

Nokia AirScale Radio Description

DN09236379

Issue 49B

Approved on 2024-06-10

Test production 24r2 bts

Rel. 24R2-SR

Maintenance Documentation, Issue 03

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Table of Contents

Summary of changes	40
1 AirScale RU compliances	44
1.1 RSS-102 compliance	56
1.2 EU compliance	58
1.3 FCC Part 15 compliance	60
1.4 TEC compliance	61
1.5 Compliance with EMC, RF and safety	62
2 AirScale RU performance	68
3 AirScale RU support for BTS	72
4 List of AirScale RUs	73
5 AirScale macro FDD RUs descriptions	91
5.1 RFMs descriptions	91
5.1.1 AirScale RFM 6T6R B1/n1 480 W (ARGA)	91
5.1.2 AirScale RFM 6T6R B3/n3 480 W (AREA)	100
5.1.3 AirScale RFM 6T6R B5/n5 480 W (ARCA)	108
5.1.4 AirScale RFM 6T6R B7/n7 360 W (ARHA)	117
5.1.5 AirScale RFM 6T6R B8/n8 480 W (ARDA)	126
5.1.6 AirScale RFM 6T6R B8/n8 480 W (ARDB)	135
5.1.7 AirScale RFM 6T6R B20/n20 360 W (ARMA)	144
5.1.8 AirScale RFM 6T6R B28/n28 360 W (ARPA)	153
5.2 Single band RRHs descriptions	162
5.2.1 AirScale RRH 2T B32/B75 120 W (AHSA)	162
5.2.2 AirScale RRH 4T B32/B75 320 W (AHSB)	169
5.2.3 AirScale RRH 2T2R B3/n3 120 W (FHDL)	175
5.2.4 AirScale RRH 2T2R 900J 120 W (FHDI)	183
5.2.5 AirScale RRH 2T2R B11 120 W (FHKA)	191
5.2.6 AirScale RRH 2T2R B28/n28 120 W (FHPD)	198
5.2.7 AirScale RRH 2T2R 700 120 W (FHPG)	206
5.2.8 AirScale RRH 2T4R B1/n1 120 W (AHGA)	213
5.2.9 AirScale RRH 2T4R B1 120 W (AHGC)	221
5.2.10 AirScale RRH 2T4R B3/n3 160 W (AHEC)	229
5.2.11 AirScale RRH 2T4R B3 160 W (AHED)	237
5.2.12 AirScale RRH 2T4R B5 80 W (AHCG)	245
5.2.13 AirScale RRH 2T4R B8/n8 120 W (AHDA)	253
5.2.14 AirScale RRH 2T4R B8/n8 160 W (AHDB)	261
5.2.15 AirScale RRH 2T4R B18 60 W (AHCH)	269
5.2.16 AirScale RRH 2T4R B20/n20 120 W (AHMA)	277
5.2.17 AirScale RRH 2T4R B28 120 W (AHPC)	285
5.2.18 AirScale RRH 2T4R B28/n28 120 W (AHPD)	292
5.2.19 AirScale RRH 2T4R B28/n28 120 W (AHPE)	300
5.2.20 AirScale RRH 2T4R B28/n28 160 W (AHPJ)	308
5.2.21 AirScale RRH 2T4R B68/B28 120 W (AHPG)	315

5.2.22	AirScale RRH 2T4R B71/n71 120 W (AHOA)	322
5.2.23	AirScale RRH 4T4R B1 160 W (AHGF)	330
5.2.24	AirScale RRH 4T4R B3/n3 160 W (AHEB)	337
5.2.25	AirScale RRH 4T4R B3/n3 160 W (AHEH)	346
5.2.26	AirScale RRH 4T4R B5/n5 160 W (AHCA)	354
5.2.27	AirScale RRH 4T4R B5/B26 240 W (AHCI)	363
5.2.28	AirScale RRH 4T4R B7/n7 160 W (AHHB)	371
5.2.29	AirScale RRH 4T4R B26/n26 200 W (AHCF)	380
5.2.30	AirScale RRH 4T4R B26a 100 W (AHCC)	389
5.2.31	AirScale RRH 4T4R B28 240 W (AHPF)	396
5.2.32	AirScale RRH 4T4R B28/n28 320 W (AHPB)	403
5.2.33	AirScale RRH 4T4R B28 320 W (AHPH)	411
5.2.34	AirScale RRH 4T4R B30/n30 100 W (AHNA)	418
5.2.35	AirScale RRH 4T4R B65 160 W (AHGE)	427
5.2.36	AirScale RRH 4T4R B66/n66 160 W (FRIJ)	434
5.3	Dual band RRHs descriptions	442
5.3.1	AirScale Dual RRH 2T4R B1/B3 (n1/n3) 240 W (AHEGA)	442
5.3.2	AirScale Dual RRH 2T4R B1/B3 (n1/n3) 240 W (AHEGI)	452
5.3.3	AirScale Dual RRH 4T4R B1/B3 (n1/n3) 320 W (AHEGB)	461
5.3.4	AirScale Dual RRH 4T4R B1/B3 (n1/n3) 320 W (AHEGJ)	470
5.3.5	AirScale Dual RRH 4T4R B1/B3 (n1/n3) 400 W (AHEGC)	479
5.3.6	AirScale Dual RRH 4T4R B1/B3 (n1/n3) 400 W (AHEGF)	488
5.3.7	AirScale Dual RRH 4T4R B1/B3 480 W (AHEGG)	497
5.3.8	AirScale Dual RRH 4T4R B2/B66a (n2/n66a) 320 W (AHFIC)	506
5.3.9	AirScale Dual RRH 4T4R B5/B13 (n5) 160 W (AHBCA)	515
5.3.10	AirScale Dual RRH 4T4R B5/B13 (n5) 320 W (AHBCC)	524
5.3.11	AirScale Dual RRH 4T4R B5/B28 (n5/n28) 320 W (AHPCA)	534
5.3.12	AirScale Dual RRH 4T4R B5/B28 (n5/n28) 320 W (AHPCB)	544
5.3.13	AirScale Dual RRH 4T4R B29/n5 240 W (AHBCB)	552
5.3.14	AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDA)	562
5.3.15	AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDB)	572
5.3.16	AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDC)	581
5.3.17	AirScale Dual RRH 4T4R B12/B14 (n12/n14) 320 W (AHLBA)	590
5.3.18	AirScale Dual RRH 4T4R B12/n71 240 W (AHLOA)	600
5.3.19	AirScale Dual RRH 4T4R B13/B26 (n26) 240 W (AHBCD)	610
5.3.20	AirScale Dual RRH 4T4R B13/B71 (n71) 240 W (AHBOA)	619
5.3.21	AirScale Dual RRH 4T4R B25/B66 (n25/n66) 320 W (AHFIB)	628
5.3.22	AirScale Dual RRH 4T4R B25/B66 (n25/n66) 480 W (AHFIG)	638
5.3.23	AirScale Dual RRH 4T4R B25/B66 480 W (AHFII)	647
5.3.24	AirScale Dual RRH 4T4R B25/B66a (n25/n66a) 160 W (AHFIA)	656
5.3.25	AirScale Dual RRH 4T4R B71/B85 (n71/n85) 320 W (AHLOB)	665
5.4	Triple band RRHs descriptions	673
5.4.1	AirScale Tri RRH 2T2R B8/B20/B28 (n8/n20/n28) 240 W (AHPMDA)	673
5.4.2	AirScale RRH 2T2R B8/B20/B28 (n8/n20/n28) 240 W (AHPMDI)	682
5.4.3	AirScale Tri RRH 2T4R B5/B8/B28 (n5/n8/n28) 240 W (AHPCDB)	692
5.4.4	AirScale Tri RRH 2T4R B8/B20/B28 (n8/n20/n28) 240 W (AHPMDB)	702
5.4.5	AirScale RRH 2T4R B8/B20/B28 (n8/n20/n28) 240 W (AHPMDJ)	712

5.4.6	AirScale Tri RRH 2T4R B8/B20/B28 (n8/20/28) 320 W (AHPMDD)	721
5.4.7	AirScale Tri RRH 2T4R B8/B20/B28 320 W (AHPMDG)	730
5.4.8	AirScale Tri RRH 4T4R B1/B3/B7 (n1/n3/n7) 640 W (AHEGHA)	739
5.4.9	AirScale Tri RRH 4T4R B7/B25/B66 (n7/n25/n66) 640 W (AHFIHA)	748
5.4.10	AirScale Tri RRH 4T4R B8/B20/B28 320 W (AHPMDH)	757
5.4.11	AirScale Tri RRH 4T4R B12/B14/B29 (n12/n14/n29) 370 W (AHLBBA)	767
6	AirScale macro TDD RUs descriptions	777
6.1	AirScale RRH 2T2R B40 120 W (AZND/AZNE)	777
6.2	AirScale RRH 4T4R B40/n40 160 W (AZNA)	784
6.3	AirScale RRH 4T4R B41/n41 160 W (AZHA)	794
6.4	AirScale RRH 4T4R n77 320 W (AZQU) (eCPRI)	802
6.5	AirScale RRH 8T8R B38/n38 320 W (AZHN) (CPRI/eCPRI)	811
6.6	AirScale RRH 8T8R B40 240 W (AZNB)	820
6.7	AirScale RRH 8T8R B40/n40 240 W (AZNC)	829
6.8	AirScale RRH 8T8R n40 320 W eCPRI (AKNA)	838
6.9	AirScale RRH 8T8R n40 400 W eCPRI (AKNB)	847
6.10	AirScale RRH 8T8R B41/n41 320 W CPRI/eCPRI (AZHL)	856
6.11	AirScale RRH 8T8R n41 320 W eCPRI (AZHM)	865
6.12	AirScale RRH 8T8R n41/B41 400 W (AKHD)	874
6.13	AirScale RRH 8T8R n77 160 W (AZQO) (eCPRI)	884
6.14	AirScale RRH 8T8R n77 320 W (AKQW)	893
6.15	AirScale RRH 8T8R n77 320 W eCPRI (AZQW)	902
6.16	AirScale RRH 8T8R B42/n78 160 W CPRI/eCPRI (AZQP)	911
6.17	AirScale RRH 8T8R B42 240 W (AZQE)	920
6.18	AirScale RRH 8T8R B42/n78 240 W (AZQF)	930
6.19	AirScale RRH 8T8R n78 320 W eCPRI (AKQA)	940
6.20	AirScale RRH 8T8R n78 320 W eCPRI (AKQI)	949
6.21	AirScale RRH 8T8R n78 320 W eCPRI (AKQJ)	958
6.22	AirScale RRH 8T8R n78 320 W eCPRI (AKQZ)	967
6.23	AirScale RRH 8T8R n78 320 W eCPRI (AZQG)	976
6.24	AirScale RRH 8T8R n78 320 W CPRI/eCPRI (AZQH)	984
6.25	AirScale RRH 8T8R n78 320 W (eCPRI) (AZQI)	992
6.26	AirScale RRH 8T8R n78 320 W (eCPRI) (AZQJ)	1002
6.27	AirScale RRH 8T8R n78 320 W eCPRI (AZQL)	1012
6.28	AirScale RRH 8T8R B42/n78 320 W eCPRI (AZQS)	1020
6.29	AirScale RRH 8T8R n79 192 W eCPRI (AZTA)	1029
7	AirScale micro RRHs descriptions	1039
7.1	AirScale Micro RRH 2T B46 UNII 1+2+3 1 W (AZRB)	1039
7.2	AirScale Micro RRH 2T B46 UNII 1+2+3 1 W (AZRC)	1047
7.3	AirScale Micro RRH 2T2R B41/n41 200 W (AWHHG and AWHHH)	1053
7.4	AirScale Micro 4T4R B1 20 W (AHGB)	1060
7.5	AirScale Micro 4T4R B3 20 W (AHEJ)	1067
7.6	AirScale Micro 4T4R B5 20 W (AHCE)	1074
7.7	AirScale Micro 4T4R B7 20 W (AHHA)	1082
7.8	AirScale Micro 4T4R B13 20 W (AHBB)	1089
7.9	AirScale Micro 4T4R B14 20 W (AHBC)	1097

7.10	AirScale Micro RRH 4T4R B24/n24 8 W (AWHKB)	1105
7.11	AirScale Micro 4T4R B25/n25 20 W (AHFB)	1113
7.12	AirScale Dual-band Micro RRH 4T4R B25 + B66 160 W (AWMFIA)	1121
7.13	AirScale Micro RRH 4T4R B38/n38 80 W (AWHHI)	1130
7.14	AirScale Micro RRH 4T4R B41/n41 80 W (AWHHD)	1139
7.15	AirScale Micro RRH 4T4R B41/n41 80 W (AWHHF)	1148
7.16	AirScale Micro RRH 4T4R n78 40 W (AWHQE)	1157
7.17	AirScale Micro RRH 4T4R n78 40 W (AWHQG)	1166
7.18	AirScale Micro 4T4R B42/n78 20 W (AZQD)	1174
7.19	AirScale Micro 4T4R B43/n78 20 W (AZQR)	1182
7.20	AirScale Micro RRH 4T4R n78 40 W (AWHQF)	1190
7.21	AirScale Micro RRH 4T4R B48/n48 20 W (AWHQU)	1199
7.22	AirScale Micro 4T4R B48/n48 (CBRS) 20 W (AZQC)	1208
7.23	AirScale Micro RRH 4T4R B53 1 W (AWHNB)	1216
7.24	AirScale Micro 4T4R B66 20 W (AHIB)	1225
7.25	AirScale Micro RRH 4T4R n40 80 W (AWHNA)	1233
7.26	AirScale Micro RRH 4T4R n77 20 W (AWHQM)	1242
7.27	AirScale Micro RRH 4T4R n77 80 W (AWHQN)	1251
7.28	AirScale Micro RRH 4T4R n77 80 W (AWHQ3)	1260
7.29	AirScale Micro RRH 4T4R n78 40 W (AWHQV)	1269
7.30	AirScale Micro RRH 4T4R n78 80 W (AWHQ2)	1277
7.31	AirScale Micro RRH 4T4R n79 80 W (AWHTA)	1286
8	AirScale pico RRHs descriptions	1296
8.1	AirScale Indoor Pico RRH 4T4R B38/n38 1 W (AWPHA and AWPHB)	1296
8.2	AirScale Indoor Pico RRH 4T4R B40/n40 1 W (AWPNA and AWPNB)	1302
8.3	AirScale Indoor Pico RRH 4T4R B48/n48 1 W eCPRI (AWPQY and AWPQZ)	1308
8.4	AirScale Indoor Pico RRH 4T4R n77 1 W eCPRI (AWHQW and AWHQX)	1314
8.5	AirScale Indoor Pico RRH 4T4R n79 1 W eCPRI (AWPTC and AWPTD)	1320
9	AirScale RIUs descriptions	1326
9.1	AirScale RIU 8T8R n78 (AHQK) eCPRI	1326
10	AirScale RU sound levels	1332
10.1	Sound power levels	1332
10.2	Sound pressure levels	1334
11	AirScale RU LED indicators	1335
12	Passive intermodulation in FDD systems	1343
13	AirScale naming conventions	1344
14	Glossary	1351

List of Figures

Figure 1	CE marking (EU R&TTE Directive 1999/5/EC)	59
Figure 2	CE marking	59
Figure 3	RED Article 10.10-marking	60
Figure 4	TEC marking	62
Figure 5	Ambient temperature measurement for an exemplary radio unit without fans	70
Figure 6	Ambient temperature measurement for an exemplary fan-cooled radio unit	71
Figure 7	ARGA interfaces	93
Figure 8	ARGA functional block diagram	96
Figure 9	AREA interfaces	101
Figure 10	AREA functional block diagram	104
Figure 11	ARCA interfaces	110
Figure 12	ARCA functional block diagram	113
Figure 13	ARHA interfaces	119
Figure 14	ARHA functional block diagram	122
Figure 15	ARDA interfaces	128
Figure 16	ARDA functional block diagram	131
Figure 17	ARDB interfaces	137
Figure 18	ARDB functional block diagram	140
Figure 19	ARMA interfaces	146
Figure 20	ARMA functional block diagram	149
Figure 21	ARPA interfaces	155
Figure 22	ARPA functional block diagram	158
Figure 23	AHSA interfaces	163
Figure 24	AHSA functional block diagram	165
Figure 25	AHSB interfaces	170
Figure 26	AHSB functional block diagram	172
Figure 27	FHEL interfaces	177
Figure 28	FHEL functional block diagram	179
Figure 29	FHDI interfaces	185
Figure 30	FHDI functional block diagram	187
Figure 31	FHKA interfaces	193
Figure 32	FHKA functional block diagram	195
Figure 33	FHPD interfaces	200
Figure 34	FHPD functional block diagram	202
Figure 35	FHPG interfaces	208
Figure 36	FHPG functional block diagram	210
Figure 37	AHGA interfaces	215
Figure 38	AHGA functional block diagram	218

Figure 39	AHGC interfaces	223
Figure 40	AHGC functional block diagram	226
Figure 41	AHEC interfaces	231
Figure 42	AHEC functional block diagram	233
Figure 43	AHED interfaces	239
Figure 44	AHED functional block diagram	241
Figure 45	AHCG interfaces	247
Figure 46	AHCG functional block diagram	250
Figure 47	AHDA interfaces	255
Figure 48	AHDA functional block diagram	258
Figure 49	AHDB interfaces	263
Figure 50	AHDB functional block diagram	265
Figure 51	AHCH interfaces	271
Figure 52	AHCH functional block diagram	274
Figure 53	AHMA interfaces	279
Figure 54	AHMA functional block diagram	282
Figure 55	AHPC interfaces	287
Figure 56	AHPC functional block diagram	289
Figure 57	AHPD interfaces	294
Figure 58	AHPD functional block diagram	297
Figure 59	AHPE interfaces	302
Figure 60	AHPE functional block diagram	305
Figure 61	AHPJ interfaces	310
Figure 62	AHPJ functional block diagram	312
Figure 63	AHPG interfaces	317
Figure 64	AHPG functional block diagram	319
Figure 65	AHOA interfaces	324
Figure 66	AHOA functional block diagram	326
Figure 67	AHGF interfaces	331
Figure 68	AHGF functional block diagram	333
Figure 69	AHEB interfaces	339
Figure 70	AHEB functional block diagram	342
Figure 71	AHEH interfaces	348
Figure 72	AHEH functional block diagram	351
Figure 73	AHCA interfaces	356
Figure 74	AHCA functional block diagram	359
Figure 75	AHCI interfaces	365
Figure 76	AHCI functional block diagram	367
Figure 77	AHHB interfaces	373
Figure 78	AHHB functional block diagram	376
Figure 79	AHCF interfaces	382
Figure 80	AHCF functional block diagram	385

Figure 81	AHCC interfaces	390
Figure 82	AHCC functional block diagram	393
Figure 83	AHPF interfaces	398
Figure 84	AHPF functional block diagram	400
Figure 85	AHPB interfaces	405
Figure 86	AHPB functional block diagram	407
Figure 87	AHPH interfaces	413
Figure 88	AHPH functional block diagram	415
Figure 89	AHNA interfaces	420
Figure 90	AHNA functional block diagram	423
Figure 91	AHGE interfaces	428
Figure 92	AHGE functional block diagram	431
Figure 93	FRIJ interfaces	436
Figure 94	FRIJ functional block diagram	439
Figure 95	AHEGA interfaces	445
Figure 96	AHEGA functional block diagram	448
Figure 97	AHEGI interfaces	455
Figure 98	AHEGI functional block diagram	457
Figure 99	AHEGB interfaces	463
Figure 100	AHEGB functional block diagram	466
Figure 101	AHEGJ interfaces	473
Figure 102	AHEGJ functional block diagram	475
Figure 103	AHEGC interfaces	482
Figure 104	AHEGC functional block diagram	485
Figure 105	AHEGF interfaces	491
Figure 106	AHEGF functional block diagram	494
Figure 107	AHEGG interfaces	500
Figure 108	AHEGG functional block diagram	502
Figure 109	AHFIC interfaces	508
Figure 110	AHFIC functional block diagram	511
Figure 111	AHBCA interfaces	517
Figure 112	AHBCA functional block diagram	520
Figure 113	AHBCC interfaces	527
Figure 114	AHBCC functional block diagram	530
Figure 115	AHPCA interfaces	537
Figure 116	AHPCA functional block diagram	540
Figure 117	AHPCB interfaces	546
Figure 118	AHPCB functional block diagram	548
Figure 119	AHBCB interfaces	555
Figure 120	AHBCB functional block diagram	558
Figure 121	AHPDA interfaces	565
Figure 122	AHPDA functional block diagram	568

Figure 123	AHPDB interfaces	575
Figure 124	AHPDB functional block diagram	577
Figure 125	AHPDC interfaces	584
Figure 126	AHPDC functional block diagram	586
Figure 127	AHLBA interfaces	593
Figure 128	AHLBA functional block diagram	596
Figure 129	Style A AHLOA interfaces	603
Figure 130	Style B AHLOA interfaces	603
Figure 131	AHLOA functional block diagram	606
Figure 132	AHBCD interfaces	613
Figure 133	AHBCD functional block diagram	615
Figure 134	AHBOA interfaces	621
Figure 135	AHBOA functional block diagram	624
Figure 136	AHFIB interfaces	631
Figure 137	AHFIB functional block diagram	634
Figure 138	AHFIG interfaces	641
Figure 139	AHFIG functional block diagram	644
Figure 140	AHFII interfaces	650
Figure 141	AHFII functional block diagram	652
Figure 142	AHFIA interfaces	658
Figure 143	AHFIA functional block diagram	661
Figure 144	AHLOB interfaces	667
Figure 145	AHLOB functional block diagram	669
Figure 146	AHPMDA interfaces	675
Figure 147	AHPMDA functional block diagram	678
Figure 148	AHPMDI interfaces	685
Figure 149	AHPMDI functional block diagram	688
Figure 150	AHPCDB interfaces	695
Figure 151	AHPCDB functional block diagram	698
Figure 152	AHPMDB interfaces	705
Figure 153	AHPMDB functional block diagram	708
Figure 154	AHPMDJ interfaces	715
Figure 155	AHPMDJ functional block diagram	717
Figure 156	AHPMDD interfaces	724
Figure 157	AHPMDD functional block diagram	727
Figure 158	AHPMDG interfaces	733
Figure 159	AHPMDG functional block diagram	735
Figure 160	AHEGHA interfaces	742
Figure 161	AHEGHA functional block diagram	744
Figure 162	AHFIHA interfaces	751
Figure 163	AHFIHA functional block diagram	753
Figure 164	AHPMDH interfaces	760

Figure 165	AHPMDH functional block diagram	763
Figure 166	AHLBBA interfaces	770
Figure 167	AHLBBA functional block diagram	773
Figure 168	AZND interfaces	778
Figure 169	AZNE interfaces	779
Figure 170	AZND/AZNE functional block diagram	780
Figure 171	AZNA interfaces	786
Figure 172	AZNA (with MHA) variants A.101, A.102, all B-variants; functional block diagram	789
Figure 173	AZNA (without MHA) variants A.203 onwards; functional block diagram	790
Figure 174	AZHA interfaces	796
Figure 175	AZHA functional block diagram	798
Figure 176	AZQU interfaces	804
Figure 177	AZQU functional block diagram	807
Figure 178	AZHN interfaces	813
Figure 179	AZHN functional block diagram	816
Figure 180	AZNB interfaces	822
Figure 181	AZNB functional block diagram	825
Figure 182	AZNC interfaces	831
Figure 183	AZNC functional block diagram	834
Figure 184	AKNA interfaces	840
Figure 185	AKNA functional block diagram	843
Figure 186	AKNB interfaces	849
Figure 187	AKNB functional block diagram	852
Figure 188	AZHL interfaces	858
Figure 189	AZHL functional block diagram	861
Figure 190	AZHM interfaces	867
Figure 191	AZHM functional block diagram	870
Figure 192	AKHD interfaces	877
Figure 193	AKHD functional block diagram	880
Figure 194	AZQO interfaces	886
Figure 195	AZQO functional block diagram	889
Figure 196	AKQW interfaces	895
Figure 197	AKQW functional block diagram	898
Figure 198	AZQW interfaces	904
Figure 199	AZQW functional block diagram	907
Figure 200	AZQP interfaces	913
Figure 201	AZQP functional block diagram	916
Figure 202	AZQE carrier configuration for iBW from over 110 MHz to 140 MHz	922
Figure 203	AZQE interfaces	923
Figure 204	AZQE functional block diagram	926

Figure 205	AZQF carrier configuration for iBW from over 110 MHz to 140 MHz	932
Figure 206	AZQF interfaces	933
Figure 207	AZQF functional block diagram	936
Figure 208	AKQA interfaces	942
Figure 209	AKQA functional block diagram	945
Figure 210	AKQI interfaces	951
Figure 211	AKQI functional block diagram	954
Figure 212	AKQJ interfaces	960
Figure 213	AKQJ functional block diagram	963
Figure 214	AKQZ interfaces	969
Figure 215	AKQZ functional block diagram	972
Figure 216	AZQG interfaces	979
Figure 217	AZQH interfaces	987
Figure 218	AZQI interfaces	995
Figure 219	AZQI functional block diagram	998
Figure 220	AZQJ interfaces	1005
Figure 221	AZQJ functional block diagram	1008
Figure 222	AZQL interfaces	1015
Figure 223	AZQS interfaces	1022
Figure 224	AZQS functional block diagram	1025
Figure 225	AZTA interfaces	1031
Figure 226	AZTA functional block diagram	1034
Figure 227	AZRB interfaces and LED indicators	1041
Figure 228	AZRB functional block diagram	1043
Figure 229	AZRC interfaces and LED indicators	1048
Figure 230	AZRC functional block diagram	1050
Figure 231	AWHHG and AWHHH interfaces and LED indicators	1055
Figure 232	AWHHG and AWHHH functional block diagram	1057
Figure 233	AHGB interfaces and LED indicators	1062
Figure 234	AHGB functional block diagram	1064
Figure 235	AHEJ interfaces and LED indicators	1069
Figure 236	AHEJ functional block diagram	1071
Figure 237	AHCE interfaces and LED indicators	1076
Figure 238	AHCE functional block diagram	1078
Figure 239	AHHA interfaces and LED indicators	1084
Figure 240	AHHA functional block diagram	1086
Figure 241	AHBB interfaces and LED indicators	1091
Figure 242	AHBB functional block diagram	1093
Figure 243	AHBC interfaces and LED indicators	1099
Figure 244	AHBC functional block diagram	1101
Figure 245	AWHKB interfaces and LED indicators	1107
Figure 246	AWHKB functional block diagram	1109

Figure 247	AHFB interfaces and LED indicators	1115
Figure 248	AHFB functional block diagram	1117
Figure 249	AWMFIA interfaces and LED indicators	1124
Figure 250	AWMFIA functional block diagram	1126
Figure 251	AWHHI interfaces and LED indicators	1132
Figure 252	AWHHI functional block diagram	1135
Figure 253	AWHHD interfaces and LED indicators	1141
Figure 254	AWHHD functional block diagram	1144
Figure 255	AWHHF interfaces and LED indicators	1150
Figure 256	AWHHF functional block diagram	1153
Figure 257	AWHQE interfaces and LED indicators	1159
Figure 258	AWHQE functional block diagram	1162
Figure 259	AWHQG interfaces and LED indicators	1168
Figure 260	AWHQG functional block diagram	1170
Figure 261	AZQD interfaces and LED indicators	1176
Figure 262	AZQD functional block diagram	1178
Figure 263	AZQR interfaces and LED indicators	1184
Figure 264	AZQR functional block diagram	1186
Figure 265	AWHQF interfaces and LED indicators	1192
Figure 266	AWHQF functional block diagram	1195
Figure 267	AWHQU interfaces and LED indicators	1201
Figure 268	AWHQU functional block diagram	1204
Figure 269	AZQC interfaces and LED indicators	1210
Figure 270	AZQC functional block diagram	1212
Figure 271	AWHNB interfaces and LED indicators	1218
Figure 272	AWHNB functional block diagram	1221
Figure 273	AHIB interfaces and LED indicators	1227
Figure 274	AHIB functional block diagram	1229
Figure 275	AWHNA interfaces and LED indicators	1235
Figure 276	AWHNA functional block diagram	1238
Figure 277	AWHQM interfaces and LED indicators	1244
Figure 278	AWHQM functional block diagram	1247
Figure 279	AWHQN interfaces and LED indicators	1253
Figure 280	AWHQN functional block diagram	1256
Figure 281	AWHQ3 interfaces and LED indicators	1262
Figure 282	AWHQ3 functional block diagram	1265
Figure 283	AWHQV interfaces and LED indicators	1271
Figure 284	AWHQV functional block diagram	1273
Figure 285	AWHQ2 interfaces and LED indicators	1279
Figure 286	AWHQ2 functional block diagram	1282
Figure 287	AWHTA interfaces and LED indicators	1288
Figure 288	AWHTA functional block diagram	1291

Figure 289	AWPHA and AWP HB interfaces	1298
Figure 290	AWPHA and AWP HB functional block diagram	1300
Figure 291	AWP NA and AWP NB interfaces	1304
Figure 292	AWP NA and AWP NB functional block diagram	1306
Figure 293	AWP QY and AWP QZ interfaces	1310
Figure 294	AWP QY and AWP QZ functional block diagram	1312
Figure 295	AWH QW and AWH QX interfaces	1316
Figure 296	AWH QW and AWH QX functional block diagram	1317
Figure 297	AWPTC and AWPTD interfaces	1321
Figure 298	AWPTC and AWPTD functional block diagram	1323
Figure 299	AHQK interfaces	1328
Figure 300	AirScale 2 FDD RU (4T4R) LED interface	1335
Figure 301	Pandion 4 LED interface	1336
Figure 302	AirScale 2 FDD RU (4T4R) LED interface	1336
Figure 303	Osprey 8 LED interface	1337
Figure 304	AirScale 2 FDD RU (6T6R) LED interface	1337
Figure 305	AirScale 2 TDD RU (2T2R/4T4R/8T8R) LED interface	1338
Figure 306	Rel. 6.1 TDD RU (8T8R) LED interface	1338
Figure 307	pRRH LED indicators	1339

List of Tables

Table 1	Compliance statements for Macro FDD-LTE RUs	45
Table 2	Compliance statements for Micro RUs	51
Table 3	Compliance statements for Macro TD-LTE RUs	53
Table 4	Compliance statements for RUs for legacy releases	55
Table 5	Compliance statements and boundaries for AirScale Indoor Pico RUs	56
Table 6	RSS-102 issue 5 compliance boundaries (m) for general public levels	57
Table 7	RSS-102 issue 5 compliance boundaries (m) for occupational levels	58
Table 8	RF Modules	74
Table 9	Single band Remote Radio Heads	75
Table 10	Dual band Remote Radio Heads	79
Table 11	Triple band Remote Radio Heads	82
Table 12	TD-LTE Remote Radio Heads	84
Table 13	Micro Remote Radio Heads	87
Table 14	AirScale Indoor Pico RRH	90
Table 15	ARGA functional specification	92
Table 16	ARGA interfaces	94
Table 17	ARGA ALD support	95
Table 18	ARGA electrical specifications	97
Table 19	ARGA TX output power tolerance	97
Table 20	Recommended ARGA power back-off in 256 QAM mode	98
Table 21	ARGA dimensions and weight	99
Table 22	ARGA environmental specifications	99
Table 23	AREA functional specification	100
Table 24	AREA interfaces	102
Table 25	AREA ALD support	103
Table 26	AREA electrical specifications	105
Table 27	AREA TX output power tolerance	105
Table 28	Recommended AREA power back-off in 256 QAM	106
Table 29	AREA dimensions and weight	107
Table 30	AREA environmental specifications	108
Table 31	ARCA functional specification	109
Table 32	ARCA interfaces	111
Table 33	ARCA ALD support	112
Table 34	ARCA electrical specifications	114
Table 35	ARCA TX output power tolerance	114
Table 36	Recommended ARCA power back-off in 256 QAM mode	115
Table 37	ARCA dimensions and weight	116
Table 38	ARCA environmental specifications	117
Table 39	ARHA functional specification	118
Table 40	ARHA interfaces	120

Table 41	ARHA ALD support	121
Table 42	ARHA electrical specifications	123
Table 43	ARHA TX output power tolerance	123
Table 44	Recommended ARHA power back-off in 256 QAM mode	124
Table 45	ARHA dimensions and weight	125
Table 46	ARHA environmental specifications	125
Table 47	ARDA functional specification	127
Table 48	ARDA interfaces	129
Table 49	ARDA ALD support	130
Table 50	ARDA electrical specifications	132
Table 51	ARDA TX output power tolerance	132
Table 52	Recommended ARDA power back-off in 256 QAM mode	133
Table 53	ARDA dimensions and weight	134
Table 54	ARDA environmental specifications	135
Table 55	ARDB functional specification	136
Table 56	ARDB interfaces	138
Table 57	ARDB ALD support	139
Table 58	ARDB electrical specifications	141
Table 59	ARDB TX output power tolerance	141
Table 60	Recommended ARDB power back-off in 256 QAM mode	142
Table 61	ARDB dimensions and weight	143
Table 62	ARDB environmental specifications	144
Table 63	ARMA functional specification	145
Table 64	ARMA interfaces	147
Table 65	ARMA ALD support	148
Table 66	ARMA electrical specifications	150
Table 67	ARMA TX output power tolerance	150
Table 68	Recommended ARMA power back-off in 256 QAM mode	151
Table 69	ARMA dimensions and weight	152
Table 70	ARMA environmental specifications	153
Table 71	ARPA functional specification	154
Table 72	ARPA interfaces	156
Table 73	ARPA ALD support	157
Table 74	ARPA electrical specifications	159
Table 75	ARPA TX output power tolerance	159
Table 76	Recommended ARPA power back-off in 256 QAM mode	160
Table 77	ARPA dimensions and weight	161
Table 78	ARPA environmental specifications	161
Table 79	AHSA functional specification	162
Table 80	AHSA interfaces	164
Table 81	AHSA ALD support	165
Table 82	AHSA electrical specifications	166

Table 83	AHSA dimensions and weight	168
Table 84	AHSA environmental specifications	168
Table 85	AHSB functional specification	169
Table 86	AHSB interfaces	171
Table 87	AHSB ALD support	172
Table 88	AHSB electrical specifications	173
Table 89	AHSB power back-off in 256 QAM	173
Table 90	AHSB dimensions and weight	174
Table 91	AHSB environmental specifications	175
Table 92	FHEL functional specification	176
Table 93	FHEL interfaces	178
Table 94	FHEL ALD support	179
Table 95	FHEL electrical specifications	180
Table 96	FHEL power back-off in 256 QAM	180
Table 97	FHEL dimensions and weight	182
Table 98	FHEL environmental specifications	183
Table 99	FHDI functional specification	184
Table 100	FHDI interfaces	186
Table 101	FHDI ALD support	187
Table 102	FHDI electrical specifications	188
Table 103	FHDI dimensions and weight	190
Table 104	FHDI environmental specifications	191
Table 105	FHKA functional specification	192
Table 106	FHKA interfaces	194
Table 107	FHKA ALD support	195
Table 108	FHKA electrical specifications	196
Table 109	FHKA dimensions and weight	197
Table 110	FHKA environmental specifications	198
Table 111	FHPD functional specification	199
Table 112	FHPD interfaces	201
Table 113	FHPD ALD support	202
Table 114	FHPD electrical specifications	203
Table 115	FHPD power back-off in 256 QAM	203
Table 116	FHPD dimensions and weight	205
Table 117	FHPD environmental specifications	206
Table 118	FHPG functional specification	207
Table 119	FHPG interfaces	209
Table 120	FHPG ALD support	210
Table 121	FHPG electrical specifications	211
Table 122	FHPG dimensions and weight	212
Table 123	FHPG environmental specifications	213
Table 124	AHGA functional specification	214

Table 125	AHGA interfaces	216
Table 126	AHGA ALD support	217
Table 127	AHGA electrical specifications	218
Table 128	Recommended AHGA power back-off in 256 QAM	219
Table 129	AHGA dimensions and weight	220
Table 130	AHGA environmental specifications	221
Table 131	AHGC functional specification	222
Table 132	AHGC interfaces	224
Table 133	AHGC ALD support	225
Table 134	AHGC electrical specifications	226
Table 135	AHGC dimensions and weight	228
Table 136	AHGC environmental specifications	228
Table 137	AHEC functional specification	230
Table 138	AHEC interfaces	232
Table 139	AHEC ALD support	233
Table 140	AHEC electrical specifications	234
Table 141	AHEC dimensions and weight	236
Table 142	AHEC environmental specifications	236
Table 143	AHED functional specification	238
Table 144	AHED interfaces	240
Table 145	AHED ALD support	241
Table 146	AHED electrical specifications	242
Table 147	Recommended AHED power back-off in 256 QAM mode (carrier spacing over 100 MHz)	242
Table 148	AHED dimensions and weight	244
Table 149	AHED environmental specifications	244
Table 150	AHCG functional specification	246
Table 151	AHCG interfaces	248
Table 152	AHCG ALD support	249
Table 153	AHCG electrical specifications	250
Table 154	AHCG dimensions and weight	252
Table 155	AHCG environmental specifications	253
Table 156	AHDA functional specification	254
Table 157	AHDA interfaces	256
Table 158	AHDA ALD support	257
Table 159	AHDA electrical specifications	258
Table 160	AHDA power back-off	259
Table 161	AHDA dimensions and weight	261
Table 162	AHDA environmental specifications	261
Table 163	AHDB functional specification	262
Table 164	AHDB interfaces	264
Table 165	AHDB ALD support	265

Table 166	AHDB electrical specifications	266
Table 167	Recommended AHDB power back-off in 256 QAM mode (carrier spacing over 100 MHz)	266
Table 168	AHDB dimensions and weight	268
Table 169	AHDB environmental specifications	268
Table 170	AHCH functional specification	270
Table 171	AHCH interfaces	272
Table 172	AHCH ALD support	273
Table 173	AHCH electrical specifications	274
Table 174	AHCH dimensions and weight	276
Table 175	AHCH environmental specifications	277
Table 176	AHMA functional specification	278
Table 177	AHMA interfaces	280
Table 178	AHMA ALD support	281
Table 179	AHMA electrical specifications	282
Table 180	AHMA dimensions and weight	284
Table 181	AHMA environmental specifications	285
Table 182	AHPC functional specification	286
Table 183	AHPC interfaces	288
Table 184	AHPC ALD support	289
Table 185	AHPC electrical specifications	290
Table 186	AHPC dimensions and weight	291
Table 187	AHPC environmental specifications	292
Table 188	AHPD functional specification	293
Table 189	AHPD interfaces	295
Table 190	AHPD ALD support	296
Table 191	AHPD electrical specifications	297
Table 192	AHPD dimensions and weight	299
Table 193	AHPD environmental specifications	299
Table 194	AHPE functional specification	301
Table 195	AHPE interfaces	303
Table 196	AHPE ALD support	304
Table 197	AHPE electrical specifications	305
Table 198	AHPE power back-off in 256 QAM	306
Table 199	AHPE dimensions and weight	307
Table 200	AHPE environmental specifications	308
Table 201	AHPJ functional specification	309
Table 202	AHPJ interfaces	311
Table 203	AHPJ ALD support	312
Table 204	AHPJ electrical specifications	313
Table 205	The recommended power back-off in 256 QAM	313
Table 206	AHPJ dimensions and weight	315

Table 207	AHPJ environmental specifications	315
Table 208	AHPG functional specification	316
Table 209	AHPG interfaces	318
Table 210	AHPG ALD support	319
Table 211	AHPG electrical specifications	320
Table 212	The recommended power back-off for 256 QAM	320
Table 213	AHPG dimensions and weight	322
Table 214	AHPG environmental specifications	322
Table 215	AHOA functional specification	323
Table 216	AHOA interfaces	325
Table 217	AHOA ALD support	326
Table 218	AHOA electrical specifications	327
Table 219	The recommended power back-off in 256 QAM	327
Table 220	AHOA dimensions and weight	329
Table 221	AHOA environmental specifications	329
Table 222	AHGF functional specification	330
Table 223	AHGF interfaces	332
Table 224	AHGF ALD support	333
Table 225	AHGF electrical specifications	334
Table 226	The recommended power back-off in 256 QAM	334
Table 227	The recommended dlQam256PowerBackoffSub6 parameter value in 256 QAM	335
Table 228	AHGF dimensions and weight	336
Table 229	AHGF environmental specifications	337
Table 230	AHEB functional specification	338
Table 231	AHEB interfaces	340
Table 232	AHEB ALD support	341
Table 233	AHEB electrical specifications	342
Table 234	AHEB power back-off in 256 QAM	343
Table 235	AHEB dimensions and weight	345
Table 236	AHEB environmental specifications	345
Table 237	AHEH functional specification	347
Table 238	AHEH interfaces	349
Table 239	AHEH ALD support	350
Table 240	AHEH electrical specifications	351
Table 241	AHEH power back-off in 256 QAM	352
Table 242	AHEH dimensions and weight	354
Table 243	AHEH environmental specifications	354
Table 244	AHCA functional specification	355
Table 245	AHCA interfaces	357
Table 246	AHCA interface for ALD support	358
Table 247	AHCA electrical specifications	360

Table 248	Recommended AHCA power back-off in 256 QAM mode (carrier spacing over 100 MHz)	360
Table 249	AHCA dimensions and weight	362
Table 250	AHCA environmental specifications	362
Table 251	AHCI functional specification	364
Table 252	AHCI interfaces	366
Table 253	AHCI ALD support	367
Table 254	AHCI electrical specifications	368
Table 255	The recommended power back-off in 256 QAM	368
Table 256	AHCI dimensions and weight	370
Table 257	AHCI environmental specifications	370
Table 258	AHHB functional specification	372
Table 259	AHHB interfaces	374
Table 260	AHHB ALD support	375
Table 261	AHHB electrical specifications	376
Table 262	Recommended AHHB power back-off in 256 QAM	377
Table 263	AHHB dimensions and weight	379
Table 264	AHHB environmental specifications	379
Table 265	AHCF functional specification	381
Table 266	AHCF interfaces	383
Table 267	AHCF ALD support	384
Table 268	AHCF electrical specifications	385
Table 269	AHCF dimensions and weight	388
Table 270	AHCF environmental specifications	388
Table 271	AHCC functional specification	389
Table 272	AHCC interfaces	391
Table 273	AHCC ALD support	392
Table 274	AHCC electrical specifications	393
Table 275	AHCC power back-off in 256 QAM	394
Table 276	AHCC dimensions and weight	396
Table 277	AHCC environmental specifications	396
Table 278	AHPF functional specification	397
Table 279	AHPF interfaces	399
Table 280	AHPF ALD support	400
Table 281	AHPF electrical specifications	401
Table 282	AHPF power back-off in 256 QAM	401
Table 283	AHPF dimensions and weight	403
Table 284	AHPF environmental specifications	403
Table 285	AHPB functional specification	404
Table 286	AHPB interfaces	406
Table 287	AHPB ALD support	407
Table 288	AHPB electrical specifications	408

Table 289	AHPB power back-off in 256 QAM (carrier spacing over 100 MHz)	408
Table 290	AHPB dimensions and weight	410
Table 291	AHPB environmental specifications	411
Table 292	AHPH functional specification	412
Table 293	AHPH interfaces	414
Table 294	AHPH ALD support	415
Table 295	AHPH electrical specifications	416
Table 296	AHPH dimensions and weight	418
Table 297	AHPH environmental specifications	418
Table 298	AHNA functional specification	419
Table 299	AHNA interfaces	421
Table 300	AHNA ALD support	422
Table 301	AHNA electrical specifications	423
Table 302	AHNA power back-off in 256QAM	424
Table 303	AHNA dimensions and weight	426
Table 304	AHNA environmental specifications	426
Table 305	AHGE functional specification	427
Table 306	AHGE interfaces	429
Table 307	AHGE ALD support	430
Table 308	AHGE electrical specifications	431
Table 309	AHGE power back-off in 256 QAM	432
Table 310	AHGE dimensions and weight	433
Table 311	AHGE environmental specifications	434
Table 312	FRIJ functional specification	435
Table 313	FRIJ interfaces	437
Table 314	FRIJ ALD support	438
Table 315	FRIJ electrical specifications	439
Table 316	FRIJ power back-off in 256 QAM	440
Table 317	FRIJ dimensions and weight	441
Table 318	FRIJ environmental specifications	442
Table 319	AHEGA functional specification	443
Table 320	AHEGA interfaces	446
Table 321	AHEGA ALD support	447
Table 322	AHEGA electrical specifications	448
Table 323	Recommended AHEGA power back-off per band, in 256 QAM	449
Table 324	AHEGA dimensions and weight	451
Table 325	AHEGA environmental specifications	452
Table 326	AHEGI functional specification	453
Table 327	AHEGI interfaces	456
Table 328	AHEGI ALD support	457
Table 329	AHEGI electrical specifications	458
Table 330	Recommended power back-off values for 256 QAM	458

Table 331	AHEGI dimensions and weight	460
Table 332	AHEGI environmental specifications	461
Table 333	AHEGB functional specification	462
Table 334	AHEGB interfaces	464
Table 335	AHEGB ALD support	465
Table 336	AHEGB electrical specifications	466
Table 337	Recommended AHEGB power back-off per band, in 256 QAM	467
Table 338	AHEGB dimensions and weight	469
Table 339	AHEGB environmental specifications	470
Table 340	AHEGJ functional specification	471
Table 341	AHEGJ interfaces	474
Table 342	AHEGJ ALD support	475
Table 343	AHEGJ electrical specifications	476
Table 344	Recommended AHEGJ power back-off per band, in 256 QAM	476
Table 345	AHEGJ dimensions and weight	478
Table 346	AHEGJ environmental specifications	479
Table 347	AHEGC functional specification	480
Table 348	AHEGC interfaces	483
Table 349	AHEGC ALD support	484
Table 350	AHEGC electrical specifications	485
Table 351	Recommended AHEGC power back-off per band, in 256 QAM	486
Table 352	AHEGC dimensions and weight	487
Table 353	AHEGC environmental specifications	488
Table 354	AHEGF functional specification	489
Table 355	AHEGF interfaces	492
Table 356	AHEGF ALD support	493
Table 357	AHEGF electrical specifications	495
Table 358	Recommended AHEGF power back-off per band, in 256 QAM	495
Table 359	AHEGF dimensions and weight	496
Table 360	AHEGF environmental specifications	497
Table 361	AHEGG functional specification	498
Table 362	AHEGG interfaces	501
Table 363	AHEGG ALD support	502
Table 364	AHEGG electrical specifications	503
Table 365	Recommended power back-off values for 256 QAM	504
Table 366	AHEGG dimensions and weight	505
Table 367	AHEGG environmental specifications	506
Table 368	AHFIC functional specification	507
Table 369	AHFIC interfaces	509
Table 370	AHFIC ALD support	510
Table 371	AHFIC electrical specifications	512
Table 372	Recommended AHFIC power back-off per band, in 256 QAM	512

Table 373	AHFIC dimensions and weight	514
Table 374	AHFIC environmental specifications	515
Table 375	AHBCA functional specification	516
Table 376	AHBCA interfaces	518
Table 377	AHBCA ALD support	519
Table 378	AHBCA electrical specifications	521
Table 379	Recommended AHBCA power back-off in 256 QAM (carrier spacing over 100 MHz)	521
Table 380	AHBCA dimensions and weight	523
Table 381	AHBCA environmental specifications	524
Table 382	AHBCC functional specification	525
Table 383	AHBCC interfaces	528
Table 384	AHBCC ALD support	529
Table 385	AHBCC electrical specifications	530
Table 386	Recommended AHBCC power back-off per band, in 256 QAM (carrier spacing over 100 MHz)	531
Table 387	AHBCC dimensions and weight	533
Table 388	AHBCC environmental specifications	534
Table 389	AHPCA functional specification	535
Table 390	AHPCA interfaces	538
Table 391	AHPCA ALD support	539
Table 392	AHPCA electrical specifications	540
Table 393	Recommended AHPCA power back-off in 256 QAM	541
Table 394	AHPCA dimensions and weight	543
Table 395	AHPCA environmental specifications	544
Table 396	AHPCB functional specification	545
Table 397	AHPCB interfaces	547
Table 398	AHPCB ALD support	548
Table 399	AHPCB electrical specifications	549
Table 400	The recommended power back-off in 256 QAM	549
Table 401	AHPCB dimensions and weight	551
Table 402	AHPCB environmental specifications	552
Table 403	AHBCB functional specification	553
Table 404	AHBCB interfaces	556
Table 405	AHBCB ALD support	557
Table 406	AHBCB electrical specifications	558
Table 407	Recommended power back-off in 256 QAM (carrier spacing over 100 MHz)	559
Table 408	AHBCB dimensions and weight	561
Table 409	AHBCB environmental specifications	562
Table 410	AHPDA functional specification	563
Table 411	AHPDA interfaces	566

Table 412	AHPDA ALD support	567
Table 413	AHPDA electrical specifications	568
Table 414	Recommended AHPDA power back-off per band, in 256 QAM	569
Table 415	AHPDA dimensions and weight	571
Table 416	AHPDA environmental specifications	572
Table 417	AHPDB functional specification	573
Table 418	AHPDB interfaces	576
Table 419	AHPDB ALD support	577
Table 420	AHPDB electrical specifications	578
Table 421	The recommended power back-off in 256 QAM	578
Table 422	AHPDB dimensions and weight	580
Table 423	AHPDB environmental specifications	580
Table 424	AHPDC functional specification	582
Table 425	AHPDC interfaces	585
Table 426	AHPDC ALD support	586
Table 427	AHPDC electrical specifications	587
Table 428	The recommended power back-off in 256 QAM	587
Table 429	AHPDC dimensions and weight	589
Table 430	AHPDC environmental specifications	589
Table 431	AHLBA functional specification	591
Table 432	AHLBA interfaces	594
Table 433	AHLBA ALD support	595
Table 434	AHLBA electrical specifications	597
Table 435	Recommended AHLBA power back-off in 256 QAM (carrier spacing over 100 MHz)	597
Table 436	AHLBA dimensions and weight	599
Table 437	AHLBA environmental specifications	600
Table 438	AHLOA functional specification	601
Table 439	AHLOA interfaces	604
Table 440	AHLOA interface for ALD support	605
Table 441	AHLOA electrical specifications	607
Table 442	Recommended AHLOA power back-off in 256 QAM (carrier spacing over 100 MHz)	607
Table 443	AHLOA dimensions and weight	609
Table 444	AHLOA environmental specifications	610
Table 445	AHBCD functional specification	611
Table 446	AHBCD interfaces	614
Table 447	AHBCD ALD support	615
Table 448	AHBCD electrical specifications	616
Table 449	The recommended AHBCD power back-off in 256 QAM (carrier spacing over 100 MHz)	616
Table 450	AHBCD dimensions and weight	618

Table 451	AHBCD environmental specifications	619
Table 452	AHBOA functional specification	620
Table 453	AHBOA interfaces	622
Table 454	AHBOA ALD support	623
Table 455	AHBOA electrical specifications	625
Table 456	Recommended AHBOA power back-off in 256 QAM (carrier spacing over 100 MHz)	625
Table 457	AHBOA dimensions and weight	627
Table 458	AHBOA environmental specifications	628
Table 459	AHFIB functional specification	629
Table 460	AHFIB interfaces	632
Table 461	AHFIB interface for ALD support	633
Table 462	AHFIB electrical specifications	634
Table 463	Recommended AHFIB power back-off per band, in 256 QAM (carrier spacing over 100 MHz)	635
Table 464	AHFIB dimensions and weight	637
Table 465	AHFIB environmental specifications	638
Table 466	AHFIG functional specification	639
Table 467	AHFIG interfaces	642
Table 468	AHFIG ALD support	643
Table 469	AHFIG electrical specifications	644
Table 470	Recommended AHFIG power back-off per band, in 256 QAM	645
Table 471	AHFIG dimensions and weight	646
Table 472	AHFIG environmental specifications	647
Table 473	AHFII functional specification	648
Table 474	AHFII interfaces	651
Table 475	AHFII ALD support	652
Table 476	AHFII electrical specifications	653
Table 477	Recommended power back-off values for 256 QAM	653
Table 478	AHFII dimensions and weight	655
Table 479	AHFII environmental specifications	655
Table 480	AHFIA functional specification	657
Table 481	AHFIA interfaces	659
Table 482	AHFIA ALD support	660
Table 483	AHFIA electrical specifications	661
Table 484	Recommended AHFIA power back-off per band, in 256 QAM	662
Table 485	AHFIA dimensions and weight	664
Table 486	AHFIA environmental specifications	665
Table 487	AHLOB functional specification	666
Table 488	AHLOB interfaces	668
Table 489	AHLOB ALD support	669
Table 490	AHLOB electrical specifications	670

Table 491	Recommended power back-off values for 256 QAM	670
Table 492	AHLOB dimensions and weight	672
Table 493	AHLOB environmental specifications	672
Table 494	AHPMDA functional specification	674
Table 495	AHPMDA interfaces	676
Table 496	AHPMDA ALD support	677
Table 497	AHPMDA electrical specifications	678
Table 498	Recommended AHPMDA power back-off in 256 QAM (carrier spacing over 100 MHz)	679
Table 499	AHPMDA dimensions and weight	681
Table 500	AHPMDA environmental specifications	682
Table 501	AHPMDI functional specification	683
Table 502	AHPMDI interfaces	686
Table 503	AHPMDI ALD support	687
Table 504	AHPMDI electrical specifications	688
Table 505	The recommended power back-off in 256 QAM (carrier spacing over 100 MHz)	689
Table 506	AHPMDI dimensions and weight	691
Table 507	AHPMDI environmental specifications	691
Table 508	AHPCDB functional specification	693
Table 509	AHPCDB interfaces	696
Table 510	AHPCDB ALD support	697
Table 511	AHPCDB electrical specifications	699
Table 512	Recommended power back-off in 256 QAM (carrier spacing over 100 MHz)	699
Table 513	AHPCDB dimensions and weight	701
Table 514	AHPCDB environmental specifications	702
Table 515	AHPMDB functional specification	703
Table 516	AHPMDB interfaces	706
Table 517	AHPMDB ALD support	707
Table 518	AHPMDB electrical specifications	708
Table 519	Recommended AHPMDB power back-off per band, in 256 QAM (carrier spacing over 100 MHz)	709
Table 520	AHPMDB dimensions and weight	711
Table 521	AHPMDB environmental specifications	712
Table 522	AHPMDJ functional specification	713
Table 523	AHPMDJ interfaces	716
Table 524	AHPMDJ ALD support	717
Table 525	AHPMDJ electrical specifications	718
Table 526	The recommended power back-off in 256 QAM (carrier spacing over 100 MHz)	718
Table 527	AHPMDJ dimensions and weight	720

Table 528	AHPMDJ environmental specifications	721
Table 529	AHPMDD functional specification	722
Table 530	AHPMDD interfaces	725
Table 531	AHPMDD ALD support	726
Table 532	AHPMDD electrical specifications	727
Table 533	Recommended AHPMDD power back-off per band, in 256 QAM (carrier spacing over 100 MHz)	728
Table 534	AHPMDD dimensions and weight	729
Table 535	AHPMDD environmental specifications	730
Table 536	AHPMDG functional specification	731
Table 537	AHPMDG interfaces	734
Table 538	AHPMDG ALD support	735
Table 539	AHPMDG electrical specifications	736
Table 540	Recommended power back-off values for 256 QAM	736
Table 541	AHPMDG dimensions and weight	738
Table 542	AHPMDG environmental specifications	738
Table 543	AHEGHA functional specification	740
Table 544	AHEGHA interfaces	743
Table 545	AHEGHA ALD support	744
Table 546	AHEGHA electrical specifications	745
Table 547	Recommended power back-off values for 256 QAM	746
Table 548	AHEGHA dimensions and weight	747
Table 549	AHEGHA environmental specifications	747
Table 550	AHFIHA functional specification	749
Table 551	AHFIHA interfaces	752
Table 552	AHFIHA ALD support	753
Table 553	AHFIHA electrical specifications	754
Table 554	The recommended power back-off in 256 QAM	754
Table 555	AHFIHA dimensions and weight	756
Table 556	AHFIHA environmental specifications	756
Table 557	AHPMDH functional specification	758
Table 558	AHPMDH interfaces	761
Table 559	AHPMDH ALD support	762
Table 560	AHPMDH electrical specifications	763
Table 561	The recommended power back-off in 256 QAM (carrier spacing over 100 MHz)	764
Table 562	AHPMDH dimensions and weight	766
Table 563	AHPMDH environmental specifications	767
Table 564	AHLBBA functional specification	768
Table 565	AHLBBA interfaces	771
Table 566	AHLBBA ALD support	772
Table 567	AHLBBA electrical specifications	774

Table 568	Recommended AHLBBA power back-off in 256 QAM (carrier spacing over 100 MHz)	774
Table 569	AHLBBA dimensions and weight	776
Table 570	AHLBBA environmental specifications	776
Table 571	AZND/AZNE functional specification	777
Table 572	AZND/AZNE interfaces	779
Table 573	AZND/AZNE electrical specifications	781
Table 574	Recommended AZND/AZNE power back-off in 256 QAM	782
Table 575	AZND/AZNE dimensions and weight	783
Table 576	AZND/AZNE environmental specifications	784
Table 577	AZNA functional specification	785
Table 578	AZNA interfaces	787
Table 579	AZNA ALD support	788
Table 580	AZNA electrical specifications	790
Table 581	Recommended AZNA power back-off in 256 QAM	791
Table 582	AZNA power back-off in 5G	791
Table 583	AZNA dimensions and weight	793
Table 584	AZNA environmental specifications	794
Table 585	AZHA functional specification	795
Table 586	AZHA interfaces	797
Table 587	AZHA ALD support	798
Table 588	AZHA electrical specifications	799
Table 589	AZHA power back-off in NR	799
Table 590	AZHA dimensions and weight	801
Table 591	AZHA environmental specifications	802
Table 592	AZQU functional specification	803
Table 593	AZQU interfaces	805
Table 594	AZQU ALD support	806
Table 595	AZQU electrical specifications	808
Table 596	The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	808
Table 597	AZQU dimensions and weight	810
Table 598	AZQU environmental specifications	811
Table 599	AZHN functional specification	812
Table 600	AZHN interfaces	814
Table 601	AZHN ALD support	815
Table 602	AZHN electrical specifications	817
Table 603	The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	817
Table 604	AZHN dimensions and weight	819
Table 605	AZHN environmental specifications	820
Table 606	AZNB functional specification	821

Table 607	AZNB interfaces	823
Table 608	AZNB ALD support	824
Table 609	AZNB electrical specifications	826
Table 610	Recommended AZNB power back-off in 256 QAM	826
Table 611	AZNB dimensions and weight	828
Table 612	AZNB environmental specifications	829
Table 613	AZNC functional specification	830
Table 614	AZNC interfaces	832
Table 615	AZNC ALD support	833
Table 616	AZNC electrical specifications	835
Table 617	Recommended AZNC power back-off in 256 QAM	835
Table 618	AZNC power back-off in 5G	836
Table 619	AZNC dimensions and weight	837
Table 620	AZNC environmental specifications	838
Table 621	AKNA functional specification	839
Table 622	AKNA interfaces	841
Table 623	AKNA ALD support	842
Table 624	AKNA electrical specifications	844
Table 625	The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	845
Table 626	AKNA dimensions and weight	846
Table 627	AKNA environmental specifications	847
Table 628	AKNB functional specification	848
Table 629	AKNB interfaces	850
Table 630	AKNB ALD support	851
Table 631	AKNB electrical specifications	853
Table 632	The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	854
Table 633	AKNB dimensions and weight	855
Table 634	AKNB environmental specifications	856
Table 635	AZHL functional specification	857
Table 636	AZHL interfaces	859
Table 637	AZHL ALD support	860
Table 638	AZHL electrical specifications	862
Table 639	The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	862
Table 640	AZHL dimensions and weight	864
Table 641	AZHL environmental specifications	865
Table 642	AZHM functional specification	866
Table 643	AZHM interfaces	868
Table 644	AZHM ALD support	869
Table 645	AZHM electrical specifications	871

Table 646	The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	872
Table 647	AZHM dimensions and weight	873
Table 648	AZHM environmental specifications	874
Table 649	AKHD functional specification	875
Table 650	AKHD interfaces	878
Table 651	AKHD ALD support	879
Table 652	Table 653: AKHD electrical specifications	881
Table 653	Table 654: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	882
Table 654	Table 655: AKHD dimensions and weight	883
Table 655	Table 656: AKHD environmental specifications	884
Table 656	Table 657: AZQO functional specification	885
Table 657	Table 658: AZQO interfaces	887
Table 658	Table 659: AZQO ALD support	888
Table 659	Table 660: AZQO electrical specifications	890
Table 660	Table 661: The recommended NRCELL PDSCH power back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	890
Table 661	Table 662: AZQO dimensions and weight	892
Table 662	Table 663: AZQO environmental specifications	893
Table 663	Table 664: AKQW functional specification	894
Table 664	Table 665: AKQW interfaces	896
Table 665	Table 666: AKQW ALD support	897
Table 666	Table 667: AKQW electrical specifications	899
Table 667	Table 668: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	900
Table 668	Table 669: AKQW dimensions and weight	901
Table 669	Table 670: AKQW environmental specifications	902
Table 670	Table 671: AZQW functional specification	903
Table 671	Table 672: AZQW interfaces	905
Table 672	Table 673: AZQW ALD support	906
Table 673	Table 674: AZQW electrical specifications	908
Table 674	Table 675: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	908
Table 675	Table 676: AZQW dimensions and weight	910
Table 676	Table 677: AZQW environmental specifications	911
Table 677	Table 678: AZQP functional specification	912
Table 678	Table 679: AZQP interfaces	914
Table 679	Table 680: AZQP ALD support	915
Table 680	Table 681: AZQP electrical specifications	917
Table 681	Table 682: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	917

Table 682	Table 683: AZQP dimensions and weight	919
Table 683	Table 684: AZQP environmental specifications	920
Table 684	Table 685: AZQE functional specification	921
Table 685	Table 686: AZQE interfaces	924
Table 686	Table 687: AZQE ALD support	925
Table 687	Table 688: AZQE electrical specifications	927
Table 688	Table 689: Recommended AZQE power back-off in 256 QAM	927
Table 689	Table 690: AZQE dimensions and weight	929
Table 690	Table 691: AZQE environmental specifications	930
Table 691	Table 692: AZQF functional specification	931
Table 692	Table 693: AZQF interfaces	934
Table 693	Table 694: AZQF ALD support	935
Table 694	Table 695: AZQF electrical specifications	937
Table 695	Table 696: Recommended AZQF power back-off in 256 QAM at maximum TX power	937
Table 696	Table 697: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	938
Table 697	Table 698: AZQF dimensions and weight	939
Table 698	Table 699: AZQF environmental specifications	940
Table 699	Table 700: AKQA functional specification	941
Table 700	Table 701: AKQA interfaces	943
Table 701	Table 702: AKQA ALD support	944
Table 702	Table 703: AKQA electrical specifications	946
Table 703	Table 704: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	947
Table 704	Table 705: AKQA dimensions and weight	948
Table 705	Table 706: AKQA environmental specifications	949
Table 706	Table 707: AKQI functional specification	950
Table 707	Table 708: AKQI interfaces	952
Table 708	Table 709: AKQI ALD support	953
Table 709	Table 710: AKQI electrical specifications	955
Table 710	Table 711: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	956
Table 711	Table 712: AKQI dimensions and weight	957
Table 712	Table 713: AKQI environmental specifications	958
Table 713	Table 714: AKQJ functional specification	959
Table 714	Table 715: AKQJ interfaces	961
Table 715	Table 716: AKQJ ALD support	962
Table 716	Table 717: AKQJ electrical specifications	964
Table 717	Table 718: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	965
Table 718	Table 719: AKQJ dimensions and weight	966

Table 719	Table 720: AKQJ environmental specifications	967
Table 720	Table 721: AKQZ functional specification	968
Table 721	Table 722: AKQZ interfaces	970
Table 722	Table 723: AKQZ ALD support	971
Table 723	Table 724: AKQZ electrical specifications	973
Table 724	Table 725: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	974
Table 725	Table 726: AKQZ environmental specifications	976
Table 726	Table 727: AZQG functional specification	977
Table 727	Table 728: AZQG interfaces	980
Table 728	Table 729: AZQG interface for ALD support	981
Table 729	Table 730: AZQG electrical specifications	981
Table 730	Table 731: AZQG dimensions and weight	983
Table 731	Table 732: AZQG environmental specifications	984
Table 732	Table 733: AZQH functional specification	985
Table 733	Table 734: AZQH interfaces	988
Table 734	Table 735: AZQH interface for ALD support	989
Table 735	Table 736: AZQH electrical specifications	989
Table 736	Table 737: AZQH dimensions and weight	991
Table 737	Table 738: AZQH environmental specifications	992
Table 738	Table 739: AZQI functional specification	993
Table 739	Table 740: AZQI interfaces	996
Table 740	Table 741: AZQI ALD support	997
Table 741	Table 742: AZQI electrical specifications	999
Table 742	Table 743: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	999
Table 743	Table 744: AZQI dimensions and weight	1001
Table 744	Table 745: AZQI environmental specifications	1002
Table 745	Table 746: AZQJ functional specification	1003
Table 746	Table 747: AZQJ interfaces	1006
Table 747	Table 748: AZQJ ALD support	1007
Table 748	Table 749: AZQJ electrical specifications	1009
Table 749	Table 750: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	1009
Table 750	Table 751: AZQJ dimensions and weight	1011
Table 751	Table 752: AZQJ environmental specifications	1012
Table 752	Table 753: AZQL functional specification	1013
Table 753	Table 754: AZQL interfaces	1016
Table 754	Table 755: AZQL interface for ALD support	1017
Table 755	Table 756: AZQL electrical specifications	1017
Table 756	Table 757: AZQL dimensions and weight	1019
Table 757	Table 758: AZQL environmental specifications	1020

Table 758	Table 759: AZQS functional specification	1021
Table 759	Table 760: AZQS interfaces	1023
Table 760	Table 761: AZQS ALD support	1024
Table 761	Table 762: AZQS electrical specifications	1026
Table 762	Table 763: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	1026
Table 763	Table 764: AZQS dimensions and weight	1028
Table 764	Table 765: AZQS environmental specifications	1029
Table 765	Table 766: AZTA functional specification	1030
Table 766	Table 767: AZTA interfaces	1032
Table 767	Table 768: AZTA ALD support	1033
Table 768	Table 769: AZTA electrical specifications	1035
Table 769	Table 770: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM	1036
Table 770	Table 771: AZTA dimensions and weight	1037
Table 771	Table 772: AZTA environmental specifications	1038
Table 772	Table 773: AZRB functional specification	1040
Table 773	Table 774: AZRB interfaces	1042
Table 774	Table 775: AZRB electrical specifications	1043
Table 775	Table 776: AZRB dimensions and weight	1045
Table 776	Table 777: AZRB environmental specifications	1046
Table 777	Table 778: AZRC functional specification	1047
Table 778	Table 779: AZRC interfaces	1049
Table 779	Table 780: AZRC electrical specifications	1050
Table 780	Table 781: AZRC dimensions and weight	1052
Table 781	Table 782: AZRC environmental specifications	1053
Table 782	Table 783: AWHHG and AWHHH functional specification	1054
Table 783	Table 784: AWHHG and AWHHH interfaces	1056
Table 784	Table 785: AWHHG and AWHHH ALD support	1057
Table 785	Table 786: AWHHG and AWHHH electrical specifications	1058
Table 786	Table 787: Recommended power back-off	1058
Table 787	Table 788: AWHHG and AWHHH dimensions and weight	1059
Table 788	Table 789: AWHHG and AWHHH environmental specifications	1060
Table 789	Table 790: AHGB functional specification	1061
Table 790	Table 791: AHGB interfaces	1062
Table 791	Table 792: AHGB electrical specifications	1064
Table 792	Table 793: AHGB dimensions and weight	1066
Table 793	Table 794: AHGB environmental specifications	1067
Table 794	Table 795: AHEJ functional specification	1068
Table 795	Table 796: AHEJ interfaces	1069
Table 796	Table 797: AHEJ electrical specifications	1071
Table 797	Table 798: AHEJ dimensions and weight	1073

Table 798	Table 799: AHEJ environmental specifications	1074
Table 799	Table 800: AHCE functional specification	1075
Table 800	Table 801: AHCE interfaces	1077
Table 801	Table 802: AHCE electrical specifications	1079
Table 802	Table 803: AHCE dimensions and weight	1081
Table 803	Table 804: AHCE environmental specifications	1082
Table 804	Table 805: AHHA functional specification	1083
Table 805	Table 806: AHHA interfaces	1084
Table 806	Table 807: AHHA electrical specifications	1086
Table 807	Table 808: AHHA dimensions and weight	1088
Table 808	Table 809: AHHA environmental specifications	1089
Table 809	Table 810: AHBB functional specification	1090
Table 810	Table 811: AHBB interfaces	1092
Table 811	Table 812: AHBB electrical specifications	1094
Table 812	Table 813: AHBB dimensions and weight	1096
Table 813	Table 814: AHBB environmental specifications	1097
Table 814	Table 815: AHBC functional specification	1098
Table 815	Table 816: AHBC interfaces	1099
Table 816	Table 817: AHBC electrical specifications	1102
Table 817	Table 818: AHBC dimensions and weight	1104
Table 818	Table 819: AHBC environmental specifications	1105
Table 819	Table 820: AWHKB functional specification	1106
Table 820	Table 821: AWHKB interfaces	1108
Table 821	Table 822: AWHKB ALD support	1109
Table 822	Table 823: AWHKB electrical specifications	1110
Table 823	Table 824: The recommended power back-off in 256 QAM	1111
Table 824	Table 825: AWHKB dimensions and weight	1112
Table 825	Table 826: AWHKB environmental specifications	1113
Table 826	Table 827: AHFB functional specification	1114
Table 827	Table 828: AHFB interfaces	1116
Table 828	Table 829: AHFB electrical specifications	1118
Table 829	Table 830: AHFB dimensions and weight	1120
Table 830	Table 831: AHFB environmental specifications	1121
Table 831	Table 832: AWMFIA functional specification	1122
Table 832	Table 833: AWMFIA interfaces	1124
Table 833	Table 834: AWMFIA ALD support	1125
Table 834	Table 835: AWMFIA electrical specifications	1127
Table 835	Table 836: The recommended power back-off in 256 QAM	1127
Table 836	Table 837: AWMFIA dimensions and weight	1129
Table 837	Table 838: AWMFIA environmental specifications	1129
Table 838	Table 839: AWHHI functional specification	1131
Table 839	Table 840: AWHHI interfaces	1133

Table 840	Table 841: AWHHI ALD support	1134
Table 841	Table 842: AWHHI electrical specifications	1135
Table 842	Table 843: The recommended power back-off	1136
Table 843	Table 844: AWHHI dimensions and weight	1138
Table 844	Table 845: AWHHI environmental specifications	1139
Table 845	Table 846: AWHHD functional specification	1140
Table 846	Table 847: AWHHD interfaces	1142
Table 847	Table 848: AWHHD ALD support	1143
Table 848	Table 849: AWHHD electrical specifications	1144
Table 849	Table 850: The recommended power back-off	1145
Table 850	Table 851: AWHHD dimensions and weight	1147
Table 851	Table 852: AWHHD environmental specifications	1148
Table 852	Table 853: AWHHF functional specification	1149
Table 853	Table 854: AWHHF interfaces	1151
Table 854	Table 855: AWHHF ALD support	1152
Table 855	Table 856: AWHHF electrical specifications	1153
Table 856	Table 857: The recommended power back-off	1154
Table 857	Table 858: AWHHF environmental specifications	1157
Table 858	Table 859: AWHQE functional specification	1158
Table 859	Table 860: AWHQE interfaces	1160
Table 860	Table 861: AWHQE ALD support	1161
Table 861	Table 862: AWHQE electrical specifications	1162
Table 862	Table 863: The recommended power back-off	1163
Table 863	Table 864: AWHQE dimensions and weight	1165
Table 864	Table 865: AWHQE environmental specifications	1166
Table 865	Table 866: AWHQG functional specification	1167
Table 866	Table 867: AWHQG interfaces	1168
Table 867	Table 868: AWHQG ALD support	1169
Table 868	Table 869: AWHQG electrical specifications	1170
Table 869	Table 870: The recommended power back-off	1171
Table 870	Table 871: AWHQG dimensions and weight	1173
Table 871	Table 872: AWHQG environmental specifications	1174
Table 872	Table 873: AZQD functional specification	1175
Table 873	Table 874: AZQD interfaces	1177
Table 874	Table 875: AZQD electrical specifications	1179
Table 875	Table 876: AZQD dimensions and weight	1181
Table 876	Table 877: AZQD environmental specifications	1182
Table 877	Table 878: AZQR functional specification	1183
Table 878	Table 879: AZQR interfaces	1184
Table 879	Table 880: AZQR electrical specifications	1186
Table 880	Table 881: AZQR dimensions and weight	1189
Table 881	Table 882: AZQR environmental specifications	1190

Table 882	Table 883: AWHQF functional specification	1191
Table 883	Table 884: AWHQF interfaces	1193
Table 884	Table 885: AWHQF ALD support	1194
Table 885	Table 886: AWHQF electrical specifications	1195
Table 886	Table 887: The recommended power back-off	1196
Table 887	Table 888: AWHQF dimensions and weight	1198
Table 888	Table 889: AWHQF environmental specifications	1199
Table 889	Table 890: AWHQU functional specification	1200
Table 890	Table 891: AWHQU interfaces	1202
Table 891	Table 892: AWHQU ALD support	1203
Table 892	Table 893: AWHQU electrical specifications	1204
Table 893	Table 894: AWHQU dimensions and weight	1207
Table 894	Table 895: AWHQU environmental specifications	1208
Table 895	Table 896: AZQC functional specification	1209
Table 896	Table 897: AZQC interfaces	1211
Table 897	Table 898: AZQC electrical specifications	1213
Table 898	Table 899: AZQC dimensions and weight	1215
Table 899	Table 900: AZQC environmental specifications	1216
Table 900	Table 901: AWHNB functional specification	1217
Table 901	Table 902: AWHNB interfaces	1219
Table 902	Table 903: AWHNB ALD support	1220
Table 903	Table 904: AWHNB electrical specifications	1221
Table 904	Table 905: AWHNB dimensions and weight	1224
Table 905	Table 906: AWHNB environmental specifications	1225
Table 906	Table 907: AHIB functional specification	1226
Table 907	Table 908: AHIB interfaces	1228
Table 908	Table 909: AHIB electrical specifications	1230
Table 909	Table 910: AHIB dimensions and weight	1232
Table 910	Table 911: AHIB environmental specifications	1233
Table 911	Table 912: AWHNA functional specification	1234
Table 912	Table 913: AWHNA interfaces	1236
Table 913	Table 914: AWHNA ALD support	1237
Table 914	Table 915: AWHNA electrical specifications	1238
Table 915	Table 916: AWHNA dimensions and weight	1241
Table 916	Table 917: AWHNA environmental specifications	1242
Table 917	Table 918: AWHQM functional specification	1243
Table 918	Table 919: AWHQM interfaces	1245
Table 919	Table 920: AWHQM ALD support	1246
Table 920	Table 921: AWHQM electrical specifications	1247
Table 921	Table 922: The recommended power back-off	1248
Table 922	Table 923: AWHQM dimensions and weight	1250
Table 923	Table 924: AWHQM environmental specifications	1251

Table 924	Table 925: AWHQN functional specification	1252
Table 925	Table 926: AWHQN interfaces	1254
Table 926	Table 927: AWHQN ALD support	1255
Table 927	Table 928: AWHQN electrical specifications	1256
Table 928	Table 929: AWHQN dimensions and weight	1259
Table 929	Table 930: AWHQN environmental specifications	1260
Table 930	Table 931: AWHQ3 functional specification	1261
Table 931	Table 932: AWHQ3 interfaces	1263
Table 932	Table 933: AWHQ3 ALD support	1264
Table 933	Table 934: AWHQ3 electrical specifications	1265
Table 934	Table 935: AWHQ3 dimensions and weight	1268
Table 935	Table 936: AWHQ3 environmental specifications	1269
Table 936	Table 937: AWHQV functional specification	1270
Table 937	Table 938: AWHQV interfaces	1271
Table 938	Table 939: AWHQV ALD support	1272
Table 939	Table 940: AWHQV electrical specifications	1273
Table 940	Table 941: The recommended power back-off	1274
Table 941	Table 942: AWHQV dimensions and weight	1276
Table 942	Table 943: AWHQV environmental specifications	1277
Table 943	Table 944: AWHQ2 functional specification	1278
Table 944	Table 945: AWHQ2 interfaces	1280
Table 945	Table 946: AWHQ2 ALD support	1281
Table 946	Table 947: AWHQ2 electrical specifications	1282
Table 947	Table 948: AWHQ2 dimensions and weight	1285
Table 948	Table 949: AWHQ2 environmental specifications	1286
Table 949	Table 950: AWHTA functional specification	1287
Table 950	Table 951: AWHTA interfaces	1289
Table 951	Table 952: AWHTA ALD support	1290
Table 952	Table 953: AWHTA electrical specifications	1291
Table 953	Table 954: The recommended power back-off	1292
Table 954	Table 955: AWHTA dimensions and weight	1294
Table 955	Table 956: AWHTA environmental specifications	1295
Table 956	Table 957: AWPNA and AWPNA functional specification	1297
Table 957	Table 958: AWPNA and AWPNA interfaces	1299
Table 958	Table 959: AWPNA and AWPNA electrical specifications	1300
Table 959	Table 960: AWPNA and AWPNA dimensions and weight	1301
Table 960	Table 961: AWPNA and AWPNA environmental specifications	1302
Table 961	Table 962: AWPNA and AWPNA functional specification	1303
Table 962	Table 963: AWPNA and AWPNA interfaces	1305
Table 963	Table 964: AWPNA and AWPNA electrical specifications	1306
Table 964	Table 965: AWPNA and AWPNA dimensions and weight	1307
Table 965	Table 966: AWPNA and AWPNA environmental specifications	1308

Table 966	Table 967: AWPQY and AWPQZ functional specification	1309
Table 967	Table 968: AWPQY and AWPQZ interfaces	1311
Table 968	Table 969: AWPQY and AWPQZ electrical specifications	1312
Table 969	Table 970: AWPQY and AWPQZ dimensions and weight	1313
Table 970	Table 971: AWPQY and AWPQZ environmental specifications	1314
Table 971	Table 972: AWHQW and AWHQX functional specification	1315
Table 972	Table 973: AWHQW and AWHQX interfaces	1316
Table 973	Table 974: AWHQW and AWHQX electrical specifications	1318
Table 974	Table 975: AWHQW and AWHQX dimensions and weight	1319
Table 975	Table 976: AWHQW and AWHQX environmental specifications	1319
Table 976	Table 977: AWPTC and AWPTD functional specification	1320
Table 977	Table 978: AWPTC and AWPTD interfaces	1322
Table 978	Table 979: AWPTC and AWPTD electrical specifications	1323
Table 979	Table 980: AWPTC and AWPTD dimensions and weight	1324
Table 980	Table 981: AWPTC and AWPTD environmental specifications	1325
Table 981	Table 982: AHQK functional specification	1327
Table 982	Table 983: AHQK interfaces	1329
Table 983	Table 984: AHQK electrical specifications	1330
Table 984	Table 985: AHQK dimensions and weight	1331
Table 985	Table 986: AHQK environmental specifications	1331
Table 986	Table 987: AirScale 2 300 RRH sound power levels (measured according to ISO 3744 or ISO 3745)	1332
Table 987	Table 988: AirScale 2 600 RRH (RF5.1) sound power levels (measured according to ISO 3744 or ISO 3745)	1333
Table 988	Table 989: AirScale RF modules sound power levels (measured according to ISO 3744)	1333
Table 989	Table 990: AirScale micro RRH sound power levels (measured according to ISO 3744)	1334
Table 990	Table 991: Pandion 4 sound pressure levels	1334
Table 991	Table 992: LEDs for RF modules and RRHs	1340
Table 992	Table 993: LEDs for pico RRH	1342
Table 993	Table 994: AirScale naming convention	1345
Table 994	Table 995: Radio bands naming convention	1348

Summary of changes

A list of changes between document issues. You can navigate through the respective changed topics.

Changes between document issues are cumulative. Therefore, the latest document issue contains all changes made to previous issues.

This document is common for various radio access technologies (RATs). You may find here information about solutions that are not available or supported in a specific software release or RAT. For features supported in your software release, see respective feature documentation chapter in the system library.

Note:

For more details on Nokia AirScale compliance, see *Nokia AirScale BTS Environmental Product Declaration*.

Changes between issues 49A (2024-04-23) and 49B (2024-06-10)

General changes

The extended input voltage range has been updated for the following radio units:

- AirScale RRH 4T4R B5/n5 160 W (AHCA)
- AirScale RRH 2T4R B28/n28 160 W (AHPJ)
- AirScale RRH 2T4R B71/n71 120 W (AHOA)
- AirScale RRH 4T4R B1 160 W (AHGF)
- AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDB)
- AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDC)
- AirScale Tri RRH 4T4R B1/B3/B7 (n1/n3/n7) 640 W (AHEGHA)
- AirScale Tri RRH 4T4R B7/B25/B66 (n7/n25/n66) 640 W (AHFIHA)

The supported technologies have been updated for the following radio units:

- AirScale Dual RRH 4T4R B25/B66 (n25/n66) 320 W (AHFIB)
- AirScale Dual RRH 4T4R B25/B66 (n25/n66) 480 W (AHFIG)
- AirScale Dual RRH 4T4R B25/B66 480 W (AHFII)

- AirScale Tri RRH 4T4R B7/B25/B66 (n7/n25/n66) 640 W (AHFIHA)

AirScale RRH 8T8R B40/n40 240 W (AZNC)

- The support of NR 50, 60 and 80 MHz has been removed from the supported bandwidths.

The note regarding the default ALD port power supply has been added for the following radio units:

- AirScale Micro RRH 4T4R B48/n48 20 W (AWHQU)
- AirScale Micro RRH 4T4R B53 1 W (AWHNB)
- AirScale Micro RRH 4T4R n40 80 W (AWHNA)
- AirScale Micro RRH 4T4R n77 80 W (AWHQN)
- AirScale Micro RRH 4T4R n77 80 W (AWHQ3)
- AirScale Micro RRH 4T4R n78 80 W (AWHQ2)

AirScale Dual RRH 4T4R B71/B85 (n71/n85) 320 W (AHLOB)

- The 15 MHz has been removed from supported bandwidths for B85.

Changes between issues 49 (2024-04-15) and 49A (2024-04-23)

General changes

The *Power system characteristics* section has been removed from all radio units.

Changes between issues 48A (2024-02-09) and 49 (2024-04-15)

General changes

The following radio units have been added:

- AirScale RRH 4T4R B5/B26 240 W (AHCI)
- AirScale RRH 8T8R n41/B41 400 W (AKHD)
- AirScale Dual-band Micro RRH 4T4R B25 + B66 160 W (AWMFIA)
- AirScale Micro RRH 4T4R n40 80 W (AWHNA)
- AirScale Micro RRH 4T4R n77 80 W (AWHQ3)

The *CB011006: 50 MHz cell bandwidth - FR1-FDD* feature introduces NR carrier bandwidth 50

MHz for the following radio units:

- AirScale Tri RRH 4T4R B1/B3/B7 (n1/n3/n7) 640 W (AHEGHA)
- AirScale Dual RRH 4T4R B1/B3 480 W (AHEGG)

The *CB011173: Reefshark 6601 TDD RRH NR 10 MHz support* feature introduces NR carrier bandwidth 10 MHz for the following radio units:

- AirScale RRH 8T8R B38/n38 320 W (AZHN) (CPRI/eCPRI)
- AirScale RRH 8T8R B41/n41 320 W CPRI/eCPRI (AZHL)
- AirScale RRH 8T8R n78 320 W (eCPRI) (AZQI)
- AirScale RRH 8T8R n78 320 W (eCPRI) (AZQJ)
- AirScale RRH 8T8R B42/n78 320 W eCPRI (AZQS)

Passive intermodulation in FDD systems

- The chapter has been added to the document, replacing the *Avoiding PIM during RU operation* chapter.

AirScale RU LED indicators

- The Table: LEDs for pico RRH for pico RRH has been added.
- The note has been added.
- The Figure: pRRH LED indicators has been added.

The power back-off tables have been updated for the following groups of radio units:

- AirScale 2 FDD RU (2T4R)
- AirScale 2 FDD RU (4T4R)

AirScale RRH 4T B32/B75 320 W (AHSB)

- The power draw values have been added.

AirScale RU compliances

- The information on compliance statements has been updated and the table has been reorganized:
 - EU RoHS, CE marking, and Directive 2014/53/EU (RED) Article 10.10 columns were merged into one EU/CE column.
 - *ICES-003 compliant* column has been renamed to ISED.
 - *FCC Part 15 compliant* column has been renamed to FCC.
 - *TEC* column has been added.

TEC compliance

- TEC compliance has been added to the document.

AirScale RRH 4T4R B5/n5 160 W (AHCA)

- The SFP28 support has been removed from the connector type column in the interfaces table.

AirScale Tri RRH 4T4R B1/B3/B7 (n1/n3/n7) 640 W (AHEGHA)

- The functional block diagram has been updated.

Sound power levels

- The title of the chapter has been changed.

Sound pressure levels

- The *Sound pressure levels* chapter has been added.

AirScale RRH 4T4R B40/n40 160 W (AZNA)

- The power draw values have been updated.

1. AirScale RU compliances

RSS-102, EU, FCC, EMC, RF, and safety compliances

Table 1: Compliance statements for Macro FDD-LTE RUs

Feature ID	Release	ISED	EU/CE	FCC	TEC
CB012137 (AHPMDI)	23R4	No	Yes	No	No
CB012138 (AHPMDJ)	23R4	No	Yes	No	No
CB012139 (AHEGI)	23R4	No	Yes	No	No
CB012140 (AHEGJ)	23R4	No	Yes	No	No
CB012141 (AHPCB)	23R4	No	Yes	No	No
CB009853 (AHPDB)	23R4	No	Yes	No	No
CB010349 (AHBCC)	23R4	Yes	No	Yes	No
CB010349 (AHBCD)	23R4	Yes	No	No	No
CB010962 (AHEGHA)	23R4	No	Yes	No	No
CB008922 (AHEGG)	23R3	No	Yes	No	Yes
5GC002476 (AHCF)	23R3	No	No	Yes	No
CB007776 (AHFIB)	23R3	No	No	Yes	No
CB007776 (AHFIG)	23R3	No	No	Yes	No
CB007776 (AHFIA)	23R3	No	No	Yes	No
CB010526 (AHLOA)	23R3	Yes	No	Yes	No

Feature ID	Release	ISED	EU/CE	FCC	TEC
CB009852 (AHPDC)	23R3	No	Yes	No	No
CB009760 (AHOA)	23R3	No	Yes	No	No
CB009364 (AHGF)	23R3	No	Yes	No	No
CB006142 (AHEGHA)	23R2	No	Yes	No	No
CB009210 (AHPG)	23R2	No	Yes	No	No
CB010522 (AHPJ)	23R2	No	Yes	No	Yes
CB008229 (AHLOB)	23R2	No	No	Yes	No
CB008229 (AHFII)	23R2	Yes	No	Yes	No
CB008229 (AHFIB)	23R2	Yes	No	Yes	No
CB008229 (ARGA)	23R2	No	Yes	No	Yes
CB008229 (AHEGB)	23R2	No	Yes	No	Yes
CB008229 (AHEGC)	23R2	No	Yes	No	No
CB008229 (AHEGF)	23R2	No	Yes	No	No
CB007626 (AHCG)	23R1	No	Yes	No	Yes
CB008846 (AHPMDG)	23R1	No	Yes	No	No
CB009038 (ARHA)	23R1	No	Yes	No	No

Feature ID	Release	ISED	EU/CE	FCC	TEC
CB009038 (AHEGC)	23R1	No	Yes	No	No
CB009038 (AHHB)	23R1	No	Yes	No	No
CB009038 (AREA)	23R1	No	Yes	No	Yes
CB009038 (AHEGB)	23R1	No	Yes	No	Yes
CB006425 (AHLBBA)	22R4	Yes	No	Yes	No
CB008396 (AHLBA)	22R4	No	No	Yes	No
CB009066 (AHPMDH)	22R4	No	Yes	No	No
CB007145 (AHFII)	22R4	Yes	No	Yes	No
CB007149 (AHFIB)	22R4	Yes	No	Yes	No
CB006996 (AHGE)	22R3	No	Yes	No	No
CB007589 (AHLOB)	22R3	Yes	No	Yes	No
CB007889 (AHPG)	22R3	No	Yes	No	No
CB006079 (AHFII)	22R2	Yes	No	Yes	No
CB008447 (AHBCD)	22R2	Yes	No	Yes	No
5GC000734 (AHEC)	22R1	No	Yes	No	Yes
CB006578 (ARDB)	5G21B	No	Yes	No	Yes

Feature ID	Release	ISED	EU/CE	FCC	TEC
CB006587 (ARMA)	5G21B	No	Yes	No	No
CB007083 (AHEGF)	5G21A	No	Yes	No	No
5GC001838 (ARHA)	5G20B	No	Yes	No	No
CB005907 (AHNA)	5G20B	Yes	No	Yes	No
CB006008 (AHPMDD)	5G20B	No	Yes	No	No
5GC000729 (AHDB)	5G20A	No	Yes	Yes	No
5GC000928 (AHPMDA)	5G20A	No	Yes	No	No
5GC001099 (AHEB)	5G20A	No	Yes	No	Yes
5GC001683 (AHPMDB)	5G20A	No	Yes	No	No
5GC001694 (AREA)	5G20A	No	Yes	No	Yes
5GC001837 (ARGA)	5G20A	No	Yes	No	Yes
5GC001839 (AHHB)	5G20A	Yes	Yes	Yes	No
5GC002099 (AHFIG)	5G20A	No	No	Yes	No
5GC002227 (ARPA)	5G20A	No	Yes	No	No
5GC002304 (AHGA)	5G20A	No	Yes	No	No
5GC002311 (FRIJ)	5G20A	Yes	No	Yes	No

Feature ID	Release	ISED	EU/CE	FCC	TEC
5GC002335 (AHEGC)	5G20A	No	Yes	No	No
5GC002424 (AHBOA)	5G20A	Yes	No	No	No
5GC002429 (AHEGA)	5G20A	No	Yes	No	No
5GC002586 (AHPADB)	5G20A	No	Yes	No	No
5GC000930 (AHPB)	5G19B	No	Yes	No	Yes
5GC000934 (AHFIC)	5G19B	No	No	Yes	No
5GC001081 (AHPD)	5G19B	No	Yes	No	No
5GC001151 (AHBCA)	5G19B	Yes	No	Yes	No
5GC001441 (AHFIA)	5G19B	Yes	No	Yes	No
5GC001688 (AHEGB)	5G19B	No	Yes	No	Yes
5GC000719 (AHLOA)	5G19A	Yes	No	Yes	No
5GC000724 (AHFIB)	5G19A	Yes	No	Yes	No
5GC001150 (AHBCC)	5G19A	No	No	Yes	No
5GC001152 (AHCA)	5G19A	No	No	Yes	No
5GC002028 (AHBCB)	5G19A	No	No	Yes	No
CB007153 (AHCG)	SRAN21A	No	Yes	No	Yes

Feature ID	Release	ISED	EU/CE	FCC	TEC
SR002937 (AHGE)	SRAN21A	No	Yes	No	No
5GC002467 (AHPDA)	SRAN20A	No	Yes	No	No
SR002520 (AHPADB)	SRAN20A	No	Yes	No	No
SR002611 (ARDA)	SRAN20A	No	Yes	No	No
LTE5359 (AHPE)	SRAN19B	No	Yes	No	No
SR001667 (AHDA)	SRAN18A	No	Yes	No	No

Table 2: Compliance statements for Micro RUs

Feature ID	Release	ISED	EU/CE	FCC	TEC
CB010816 (AWHNB)	24R1	No	No	Yes	No
CB009463 (AWHQ2)	23R4	No	Yes	No	Yes
CB009365 (AWHQU)	23R4	No	No	Yes	No
CB008814 (AWHQU)	23R3	No	No	Yes	No
CB008445 (AWHKB)	22R4	No	No	Yes	No
CB005845 (AWHQN)	22R2	No	No	Yes	No
CB006657 (AWHQV)	5G21B	Yes	No	No	No
LTE4828 (AZQD)	5G21B	No	Yes	No	No
5GC001794 (AZQR)	5G20B	Yes	Yes	No	No
5GC001881 (AWHHI)	5G20B	Yes	Yes	No	No
5GC001154 (AHFB)	5G19B	Yes	No	Yes	No
5GC001189 (AHIB)	5G19B	Yes	Yes	Yes	No
5GC001483 (AHHA)	5G19B	Yes	Yes	No	No
5GC001484 (AHGB)	5G19B	No	Yes	No	Yes
5GC001485 (AHEJ)	5G19B	No	Yes	No	Yes

Feature ID	Release	ISED	EU/CE	FCC	TEC
5GC001486 (AHCE)	5G19B	Yes	No	Yes	No
5GC001157 (AWHQE)	5G19A	No	Yes	No	No
5GC001274 (AWHQF)	5G19A	No	Yes	No	No
5GC001278 (AWHQG)	5G19A	No	Yes	No	No
5GC001707 (AWHHF)	5G19A	No	Yes	Yes	No
LTE4872 (AZRC)	SRAN20A	Yes	Yes	No	No
LTE5006 (AHBC)	SRAN19	No	No	Yes	No
LTE3655 (AHBB)	SRAN18A	Yes	No	Yes	No
LTE4253 (AZRB)	SRAN18A	No	No	Yes	No
LTE3628 (AZQC)	LTE18SP	No	No	Yes	No

Table 3: Compliance statements for Macro TD-LTE RUs

Feature ID	Release	ISED	EU/CE	FCC	TEC
CB009489 (AKNB)	23R4	No	Yes	No	No
CB009489 (AKQZ)	23R4	No	Yes	No	Yes
CB008278 (AZHL)	23R3	No	Yes	Yes	No
CB007395 (AKQA)	23R2	No	Yes	No	No
CB007364 (AKNA)	23R1	No	Yes	No	No
CB007858 (AKNB)	23R1	No	Yes	No	No
CB007362 (AKQZ)	22R4	No	Yes	No	Yes
CB007363 (AKQI)	22R4	No	Yes	No	No
CB007845 (AKNB)	22R4	No	Yes	No	No
CB009083 (AZQW)	22R4	No	No	Yes	No
CB007075 (AKQJ)	22R3	No	Yes	No	No
CB007362 (AKQZ)	22R3	No	Yes	No	Yes
CB007363 (AKQI)	22R3	No	Yes	No	No
CB005965 (AZHN)	22R2	Yes	Yes	No	No
5GC001358 (AZQG)	22R2	No	Yes	No	No

Feature ID	Release	ISED	EU/CE	FCC	TEC
5GC001510 (AZQH)	22R2	No	Yes	No	No
5GC001687 (AZQL)	22R2	No	Yes	No	No
CB006986 (AZQS)	22R1	No	Yes	No	No
5GC001511 (AZQI)	5G21A	No	Yes	No	No
5GC001512 (AZQJ)	5G21A	No	Yes	No	No
5GC002270 (AZHL)	5G21A	No	Yes	Yes	No
CB005852 (AZQP)	5G21A	No	Yes	No	No
CB006061 (AZQW)	5G21A	No	No	Yes	No
CB006118 (AZQF)	5G21A	No	Yes	No	No
CB006131 (AZHN)	5G21A	Yes	Yes	No	No
5GC002305 (AZHL)	5G20B	No	Yes	Yes	No
5GC002361 (AZNA)	5G20A	No	Yes	No	Yes
5GC002400 (AZHA)	5G20A	No	Yes	No	Yes
SR002746 (AZHN)	SRAN20C	Yes	No	No	No
5GC001810 (AZQH)	5G19A	No	Yes	No	No

Table 4: Compliance statements for RUs for legacy releases

Feature ID	Release	ISED	EU/CE	FCC	TEC
SR002531 (ARDB)	FL19B	No	Yes	No	Yes
LTE4641 (ARHA)	FL19A	No	Yes	No	No
LTE5048 (AHSA)	FL19A	No	Yes	No	No
LTE4260 (AHCC)	FL19	No	No	Yes	No
LTE4615 (AHPC)	FL18A	No	Yes	No	No
LTE4637 (AHNA)	FL19	No	No	Yes	No
LTE4660 (AHPD)	FL19	No	Yes	No	No
LTE4662 (ARCA)	FL19	No	Yes	No	Yes
LTE3736 (AZQE)	TL18A	No	Yes	No	No
LTE3678 (AHDA)	FL18A	No	Yes	No	No
LTE2784 (AHEB)	FL18	No	Yes	No	Yes
LTE3515 (FHDI)	FL18	No	Yes	No	Yes
LTE4118 (AHMA)	FL18SP	No	Yes	No	No
LTE3181 (FHPD)	FL17A	No	Yes	No	No
LTE2680 (FHEL)	FL16A	No	Yes	No	No

Table 5: Compliance statements and boundaries for AirScale Indoor Pico RUs

Feature ID	Release	RF safety distance for uncontrolled (general population) exposure	RF safety distance for controlled (occupational) exposure	Compliance standard
CB007758 (AWHQW and AWHQX)	22R2	20 cm (7.87 in.)	20 cm (7.87 in.)	UK Conformity Assessed (UKCA)
CB008712 (AWPQY and AWPQZ)	23R2	28.25 cm (11.12 in.)	12.65 cm (4.98 in.)	Federal Communications Commission (FCC)
CB010204 (AWPHA and AWPBH)	24R1	18.2 cm (7.17 in.)	8.10 cm (3.19 in.)	European Union Radio Equipment Directive (RED)

1.1 RSS-102 compliance

The following are example minimum separation distances calculated to meet the limits of RSS-102, issue 5 for deployment of Nokia BTS products. These calculated distances assume a typical 16.4 dBi antenna gain. For other antenna gains the compliance boundaries should be recalculated.

Ci-dessous sont par exemple les distances minimales de séparation calculées pour respecter les limites de RSS-102, numéro 5 pour le déploiement de la station de base Nokia. Ces distances calculées supposent une antenne de gain typique 16,4 dBi. Pour d'autres gains d'antenne les limites de conformité doivent être recalculées.

Table 6: RSS-102 issue 5 compliance boundaries (m) for general public levels

Power (W)	Frequency range (MHz)			
	698 – 960		1710 – 2690	
	Limit (W/m ²)	Distance (m)	Limit (W/m ²)	Distance (m)
2	2.30	1.8	4.24	1.3
5	2.30	2.8	4.24	2.1
10	2.30	3.9	4.24	2.9
20	2.30	5.5	4.24	4.1
30	2.30	6.8	4.24	5.0
40	2.30	7.8	4.24	5.8
50	2.30	8.7	4.24	6.4
60	2.30	9.6	4.24	7.1
70	2.30	10.3	4.24	7.6
80	2.30	11.0	4.24	8.1
90	2.30	11.7	4.24	8.6

Table 7: RSS-102 issue 5 compliance boundaries (m) for occupational levels

Power (W)	Frequency range (MHz)			
	698 – 960		1710 – 2690	
	Limit (W/m²)	Distance (m)	Limit (W/m²)	Distance (m)
2	17.05	0.7	26.69	0.6
5	17.05	1.1	26.69	0.9
10	17.05	1.5	26.69	1.2
20	17.05	2.1	26.69	1.7
30	17.05	2.5	26.69	2.0
40	17.05	2.9	26.69	2.3
50	17.05	3.2	26.69	2.6
60	17.05	3.5	26.69	2.8
70	17.05	3.8	26.69	3.1
80	17.05	4.1	26.69	3.3
90	17.05	4.3	26.69	3.5

Note:

This compliance statement is not applicable to all hardware units described in this document.

1.2 EU compliance

EU RoHS statement, CE marking, Directive 2014/53/EU (RED) Article 10.10 compliance

EU RoHS statement

This equipment complies with the European Union RoHS Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment. The directive applies to the use of lead, mercury, cadmium, hexavalent chromium, Polybrominated Biphenyls (PBB), and Polybrominated Diphenyl Ethers (PBDE) in electrical and electronic equipment.

CE marking

The equipment described in this document complies with either:

- The relevant provisions of the European Union R&TTE Directive 1999/5/EC for some products shipped prior to June 30, 2017

Figure 1: CE marking (EU R&TTE Directive 1999/5/EC)



Hereby, Nokia declares that one or more of these base stations is compliant with the essential requirements and other relevant provisions of Directive: 1999/5/EC.

or

- European Union Radio Equipment Directive (RED) 2014/53/EU for some current products and all products shipped after June 30, 2017.

Figure 2: CE marking



Hereby, Nokia declares that radio equipment type Flexi Multiradio 10 BTS and Nokia AirScale BTS is compliant with Directive 2014/53/EC. For the full text of the EU declaration of conformity, see *Single RAN/Reference documentation/Declaration of Conformities (DoCs)*.

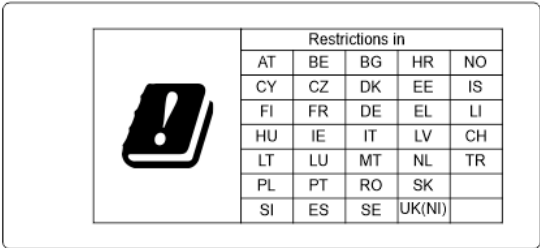
These declarations are only valid for configurations (combinations of software, firmware, and hardware) provided and/or supported by Nokia.

Directive 2014/53/EU (RED) Article 10.10 compliance

The radio frequency usage in EU is restricted and before you use the radio equipment in the commercial network you must apply for the band license from the local regulator.

As an evidence for the restriction, the packaging is to have the RED Article 10.10-marking describing the impacted countries.

Figure 3: RED Article 10.10-marking



1.3 FCC Part 15 compliance

Note:

This equipment has been tested and is compliant with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off and on, try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from the one to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Class A (not Class B) of FCC Part 15 may be met when using specific SFPs in some product configurations. For more details, see *List of Supported Nokia BTS SFPs*.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note:

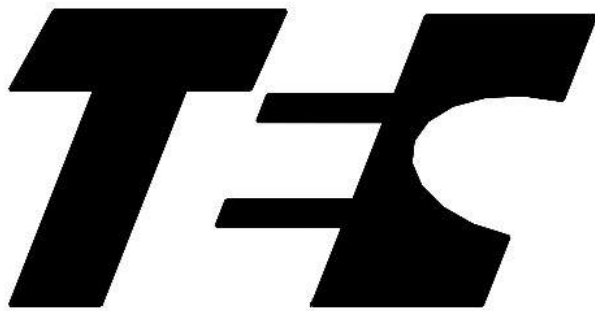
This compliance statement is not applicable to all hardware units described in this document.

1.4 TEC compliance

Notice for products in the scope of India Telecommunication Engineering Centre (TEC)

AirScale equipment is compliant with the relevant Essential Requirements of TEC, Department of Telecommunications, Ministry of Communications, Government of India, New Delhi-110001.

Figure 4: TEC marking



For the list of radio units (RUs) compliant with TEC, see [AirScale RU compliances](#).

Note:

This compliance statement is only applicable to hardware units for India, as described in this document.

1.5 Compliance with EMC, RF and safety

EMC emission, EMC immunity, RF, and safety standards for Flexi and AirScale BTS.

In Europe, this means compliance with Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC Text with EEA relevance.

In other market areas additional compliance is fulfilled according to relevant authority requirements.

EMC emission

- Common:
 - ETSI EN 301 489-1: ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU
 - ETSI EN 301 489-50: ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 50: Specific conditions for Cellular Communication Base Station (BS), repeater

and ancillary equipment; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU

- EN 55032: Electromagnetic compatibility of multimedia equipment - Emission Requirements
- ICES-003: Information Technology Equipment (ITE) – Limits and Methods of Measurement
- FCC Code of Federal Regulations (CFR) 47, Part 15 Radio Frequency Devices
- MSR:
 - 3GPP TS 37.113: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) Electromagnetic Compatibility (EMC)
- GSM/EDGE:
 - 3GPP TS 51.021: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Base Station System (BSS) equipment specification; Radio aspects - Section 8 Radiated Spurious Emissions
- UTRA:
 - 3GPP TS 25.113: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)
- E-UTRA:
 - 3GPP TS 36.113: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)
- 5G:
 - 3GPP TS 38.113: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Base Station (BS) ElectroMagnetic Compatibility (EMC)

EMC immunity

- Common:
 - ETSI EN 301 489-1: ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU
 - ETSI EN 301 489-50: ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 50: Specific conditions for Cellular Communication Base Station (BS), repeater and ancillary equipment; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
 - IEC 61000-4-8/EN 61000-4-8: Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test
 - IEC 61000-4-9 / EN 61000-4-9: Electromagnetic compatibility (EMC). Part 4-9: Testing and

measurement techniques. Pulse magnetic field immunity test

- MSR:
 - 3GPP TS 37.113: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) Electromagnetic Compatibility (EMC)
- UTRA:
 - 3GPP TS 25.113: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)
- E-UTRA:
 - 3GPP TS 36.113: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)
- 5G:
 - 3GPP TS 38.113: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Base Station (BS) ElectroMagnetic Compatibility (EMC)

RF

- Common:
 - ETSI EN 301 908-1: IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 1: Introduction and common requirements
 - FCC Code of Federal Regulations (CFR) 47, Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
 - FCC Code of Federal Regulations (CFR) 47, Part 22: Public mobile Services (2110-2130 MHz and 2160-2180 MHz)
 - FCC Code of Federal Regulations (CFR) 47, Part 24: Personal Communication Services
 - FCC Code of Federal Regulations (CFR) 47, Part 25: Satellite Communications
 - FCC Code of Federal Regulations (CFR) 47, Part 27: Miscellaneous Wireless Communications Services (758-763 MHz and 788-793 MHz) (1710-1755MHz and 2110-2155 MHz)
 - FCC Code of Federal Regulations (CFR), Part 30: Upper microwave flexible use service
 - FCC Code of Federal Regulations (CFR) 47, Part 90: Private Land Mobile Radio Services
 - RSS-Gen: General Requirements and Information for the Certification of Radio Apparatus
 - RSS-130: Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz
 - RSS-132: Cellular Telephones Employing New Technologies Operating in the Bands 824-849 MHz and 869-894 MHz
 - RSS-133: 2GHz Personal Communications Services

- RSS-139: Advanced Wireless Services Equipment Operating in the Bands 1710-1755 MHz and 2110-2155 MHz
 - RSS-140: Equipment operating in the Public Safety Broadband Frequency Bands 758-768 MHz and 788-798 MHz
 - RSS-170: Mobile Earth Stations (MESs) and Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands
 - RSS-195: Wireless Communication Service (WCS) Equipment Operating in the Bands 2305-2320 MHz and 2345-2360 MHz
 - RSS-199: Broadband Radio Service (BRS) Equipment Operating in the Band 2500-2690
- AAS:
 - 37.145-1: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network: Active Antenna System (AAS) Base Station (BS) Conformance testing; Part 1: Conducted conformance testing
 - 37.145-2: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network: Active Antenna System (AAS) Base Station (BS) Conformance testing; Part 2: Radiated Conformance testing
- MSR:
 - ETSI EN 301 908-18: IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 18: E-UTRA, UTRA and GSM/EDGE Multi-Standard Radio (MSR) Base Station (BS)
 - 3GPP TS 37.141: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing
- GSM/EDGE:
 - ETSI EN 301 502: Global System for Mobile communications (GSM); Harmonized EN for Base Station Equipment covering the essential requirements of article 3.2 of the R&TTE Directive
 - 3GPP TS 51.021: 3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Base Station System (BSS) equipment specification; Radio aspects
- UTRA:
 - ETSI EN 301 908-3: IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 3: CDMA Direct Spread (UTRA FDD) Base Stations (BS)
 - 3GPP TS 25.141: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Base Station (BS) conformance testing (FDD)
 - Telec-T112
- E-UTRA:
 - ETSI EN 301 908-14: IMT cellular networks; Harmonized EN covering the essential

requirements of article 3.2 of the R&TTE Directive; Part 14: Evolved Universal Terrestrial Radio Access (E-UTRA) Base Stations (BS)

- 3GPP TS 36.141: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing
- Telec-T139
- Telec-T146
- Telec-T156
- 5G:
 - 3GPP TS 38.141-1: 3rd Generation Partnership Project; Technical Specification Group RAN; NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing
 - 3GPP TS 38.141-2: 3rd Generation Partnership Project; Technical Specification Group RAN; NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing
 - ETSI EN 301 908-24: IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 24: New Radio (NR) Base Stations (BS)

Safety

- EN 50385: Product standard to demonstrate the compliances of base station equipment with radio frequency electromagnetic field exposure limits (110 MHz - 100 GHz), when placed on the market
- FCC 47 CFR Part 1.1310
- ISED Canada: Health Canada Safety Code 6
- Australia: ARPANSA Radiation Protection Series No.3
- EN 62232: Determination of RF field strength, power density and SAR in the vicinity of radio communication base stations for the purpose of evaluating human exposure
- either
 - IEC 60950-1/EN 60950-1/UL 60950-1/CSA C22.2 No. 60950-1: Information technology equipment – Safety – Part 1: General requirements
 or
 - IEC 62368-1/EN 62368-1/UL 62368-1/CSA C22.2 No. 62368-1-14: Audio/video, information and communication technology equipment – Part 1: Safety requirements
- IEC 60950-22/EN 60950-22/UL 60950-22/ CSA C22.2 No. 60950-22: Information technology equipment – Safety – Part 22: Equipment to be installed outdoor



Note:

This compliance statement is not applicable to all hardware units described in this document.

2. AirScale RU performance

The topic describes RF sensitivity, TX output power tolerance, received interference power, RF bandwidth terms, mean time between failures (MTBF), power draw for RRH and RFM, nominal and extended input voltage range, measuring ambient temperature, and maximum current draw.

RF sensitivity

Nokia AirScale macro radio units have superior field-proven RX sensitivity which ensures a top uplink performance without compromising the uplink coverage.

The uplink performance accuracy tests were made in compliance with 3GPP standard 36.104. The receiver sensitivity have been measured using commercial radio hardware under realistic circumstances. The top results reached -106.6 dBm and the accurate mean is -106.3 dBm.

TX output power tolerance

Nokia AirScale radio units power amplifier design brings benefits to the radio units with wide operating bandwidth and wide instantaneous bandwidth. This design produces a competitive output power tolerance which is less than ± 0.8 dB for single band radio units. Its benefit is a high maximum downlink throughput level in real operating environments.

Received interference power

Nokia AirScale macro radio units reporting accuracy complies with 3GPP standard 36.133. The reported level of Received Interference Power may slightly vary between units and different product variants. It has no impact on radio performance aspects, such as sensitivity or data throughput.

RF bandwidth terms

The descriptions of radio units contain certain BW-related information. The definitions are as follows:

RF filter bandwidth (RF BW) The 3GPP frequency range the radio operates in.
Example: Filter bandwidth of a radio unit operating in Band 41 (2496 MHz to 2690 MHz) is 194 MHz.

Instantaneous bandwidth (iBW)	A frequency range in which the radio carriers may be deployed in. Is always smaller or equal to RF BW.
Occupied bandwidth (oBW)	The HW-supported maximum sum of the deployed carriers' bandwidth. Is always smaller or equal to iBW. Example: If a radio unit oBW = 40 MHz, there might be a 2 x 20 MHz configuration deployed.

Mean time between failures

 Note:

For mean time between failures (MTBF) values, check with your local Nokia support.

Nominal input voltage range

Nominal input voltage range from -40.5 V DC to -57 V DC is defined by standard ETSI EN 300 132-2 for Europe. Within the nominal input voltage range telecom equipment should operate with no degradation of service performance.

Extended input voltage

Extended input voltage range from -36.0 V DC to -40.5 V DC and from -57.0 V DC to -60.0 V DC is defined by safety test results. Within the extended input voltage range telecom equipment should operate with no damage to the equipment during unexpected voltage surges only.

Output power, supported carriers and bandwidths, supported configurations

Note:

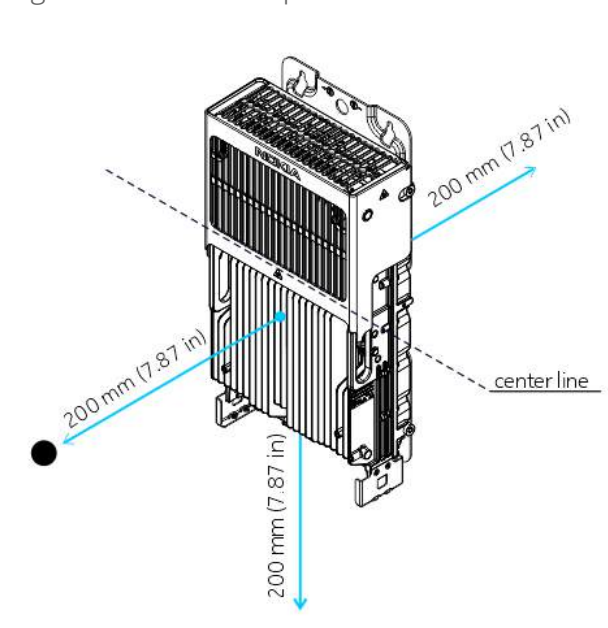
For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Ambient temperature

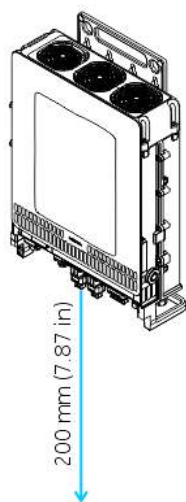
To measure ambient temperature for AirScale radio units without fans, place the thermal sensor 200 mm (7.87 in.) below the radio unit or 200 mm (7.87 in.) below the radio unit center line front or back.

Figure 5: Ambient temperature measurement for an exemplary radio unit without fans



To measure ambient temperature for fan-cooled AirScale radio units, place the thermal sensor 200 mm (7.87 in.) below the radio unit (at the air inlet).

Figure 6: Ambient temperature measurement for an exemplary fan-cooled radio unit



Maximum current draw ($I_{\max}$)

$I_{\max}$ is the calculated or measured maximum electrical current of a radio unit (RU) at its minimum operating voltage. For more information, see the *Power system dimensioning for radio units* section in *Nokia AirScale BTS Installation Site Requirements*.

3. AirScale RU support for BTS

Supported Nokia System Modules. Related documents.

Nokia AirScale radio units listed in this document are all supported by Nokia AirScale System Module. The units are also supported by either or both:

- Flexi Multiradio 10 Base Station System Module Outdoor (FSMF)
- Flexi Multiradio 10 Base Station System Module Indoor (FSIH)

To check which radio unit is compatible with the respective System Module, see one of the documents:

- *List of Features Supported in Single RAN* in Single RAN/Operating Documentation/Single RAN Features/List of Features and Documents
- *SRAN Compatibility* in Single RAN/Reference Documentation/Compatibility

For information on Flexi radio units refer to *Flexi Multiradio BTS RF Module and Remote Radio Head Description*.

For information on supported configurations, see one of the documents in Single RAN/Reference Documentation:

- *Creating Nokia AirScale BTS TD-LTE Configurations*
- *Creating Nokia AirScale BTS FDD-LTE Configurations*
- *Creating Flexi Multiradio 10 BTS FDD-LTE Configurations*
- *Creating Flexi Multiradio 10 BTS TD-LTE Configurations*
- *SBTS Supported Configurations (XLS)*

4. List of AirScale RUs

List of LTE, SRAN, and 5G releases in which the radio modules were introduced; product codes and feature numbers.

Note:

Some radio units are introduced to SRAN in LTE-only mode. They are marked with the relevant feature number:

- SRAN 18 - *SR001695: Support of Additional Dedicated LTE18 Radios in SRAN*
- SRAN 18 SP - *SR002039: Support of Dedicated LTE Radios in SRAN 18 SP*
- SRAN 18A - *SR001791: Support of Additional Dedicated LTE 18A Radios in SRAN*
- SRAN 19 - *SR002260: Support of Dedicated LTE Radios in SRAN 19*

Note:

Some radio units support 5G in various releases, see the respective 5G roadmap.

Table 8: RF Modules

RF Module name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale RFM 6T6R B1 480 W (ARGA)</u>	LTE4640 SR002273 5GC001837	474800A	LTE 19	SRAN 19	5G20A
<u>AirScale RFM 6T6R B3 480 W (AREA)</u>	LTE4208 SR001943 5GC001694	474198A	LTE 18A	SRAN 18A	5G20A
<u>AirScale RFM 6T6R B5 480 W (ARCA)</u>	LTE4662 SR002152 CB006528	474841A	LTE 19	SRAN 19	5G21B
<u>AirScale RFM 6T6R B7 360 W (ARHA)</u>	LTE4641 5GC001838	474801A	LTE 19A	-	5G20B
<u>AirScale RFM 6T6R B8 480 W (ARDA)</u>	SR002611 CB006511	474840A	SRAN 20A		5G21B
<u>AirScale RFM 6T6R B8 480 W (ARDB)</u>	SR002531 CB006578	475122A	-	SRAN 19B	5G21B
<u>AirScale RFM 6T6R B20 360 W (ARMA)</u>	LTE5070 CB006587	474803A	LTE 19A	-	5G21B
<u>AirScale RFM 6T6R B28 360 W (ARPA)</u>	LTE4663 5GC002227	474802A	LTE 19A	-	5G20A

Table 9: Single band Remote Radio Heads

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale RRH 2T B32/75 120 W (AHSA)</u>	LTE5048	475015A	LTE 19A	–	–
<u>AirScale RRH 4T B32/B75 320 W (AHSB)</u>	CB009778	476343A	–	24R1	–
<u>AirScale RRH 2T2R B3 120 W (FHEL)</u>	LTE2680 SR001121 CB006679	473475A	LTE16A	SRAN 16.10	5G21B
<u>AirScale RRH 2T2R 900J 120 W (FHDI)</u>	LTE3516 SR001451	473825A	LTE 18	SRAN 17A	–
<u>AirScale RRH 2T2R B11 120 W (FHKA)</u>	LTE3184 SR001791	473838A	LTE16A	SRAN 18A	–
<u>AirScale RRH 2T2R B28 120 W (FHPD)</u>	LTE3181 CB006680	473821A	LTE 17A	–	5G21B
<u>AirScale RRH 2T2R 700 120 W (FHPG)</u>	LTE4167 SR002260	474407A	LTE 18	SRAN 19	–
<u>AirScale RRH 2T4R B1 120 W (AHGA)</u>	LTE3764 SR001768 5GC002304	474254A	LTE 18A	SRAN 19	5G20A
<u>AirScale RRH 2T4R B1 120 W (AHGC)</u>	LTE4510 SR001791 CB010286	474586A	LTE 18A	SRAN 18A 23R3	–
<u>AirScale RRH 2T4R B3 160 W (AHEC)</u>	LTE3087 SR001389 5GC000734	473806A	LTE 18A	SRAN 18SP	5G21B

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale RRH 2T4R B3 160 W (AHED)</u>	LTE3130 SR001415	473807A	LTE 18	SRAN 18SP	–
<u>AirScale RRH 2T4R B5 80 W (AHCG)</u>	CB007153	475816A	–	SRAN 21A	–
<u>AirScale RRH 2T4R B8 120 W (AHDA)</u>	LTE3678 SR001667 CB006609	474739A	LTE 18A	SRAN 18A	5G21B
<u>AirScale RRH 2T4R B8 160 W (AHDB)</u>	LTE3837 SR001753 5GC000729	474257A	LTE 18	SRAN 18SP	5G20A
<u>AirScale RRH 2T4R B18 60 W (AHCH)</u>	CB007568	475906A	–	22R1-SR	22R1-5G
<u>AirScale RRH 2T4R B20 120 W (AHMA)</u>	LTE4118 SR002039 CB006610	474255A	LTE 18SP	SRAN 18SP	5G21B
<u>AirScale RRH 2T4R B28 120 W (AHPC)</u>	LTE4615 SR001791	474649A	LTE 18A	SRAN 18A	–
<u>AirScale RRH 2T4R B28 120 W (AHPD)</u>	LTE4660 SR002080 5GC001081	474712A	LTE 19	SRAN 19	5G19B
<u>AirScale RRH 2T4R B28 120 W (AHPE)</u>	LTE5359 5GC002170	475208A	LTE 19B	SRAN 19B	5G20B
<u>AirScale RRH 2T4R B28/n28 160 W (AHPJ)</u>	CB010522	476403A	–	23R2	–
<u>AirScale RRH 2T4R B68/28 120 W (AHPG)</u>	CB007889	475943A	–	22R2	–

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale RRH 2T4R B71/n71 120 W (AHOA)</u>	CB009760	476320A	–	23R3	–
<u>AirScale RRH 4T4R B1 160 W (AHGF)</u>	CB009364	476301A	–	23R3	–
<u>AirScale RRH 4T4R B3 160 W (AHEB)</u>	LTE2784 SR001206 5GC001099	473484A	LTE 18	SRAN 18SP	5G20A
<u>AirScale RRH 4T4R B3 160W (AHEH)</u>	LTE4686 SR002165 5GC002171	474253A	LTE 18A	SRAN 18A	5G20B
<u>AirScale RRH 4T4R B7 160 W (AHHB)</u>	LTE3137 SR002039 5GC001839	474252A	LTE 18	SRAN 18SP	5G20A
<u>AirScale RRH 4T4R B5 160 W (AHCA)</u>	LTE3399 SR002145 5GC001152 CB006640	473966A 473966B	LTE 17A	SRAN 18A	5G21B
<u>AirScale RRH 4T4R B5/B26 240 W (AHCI)</u>	CB011110	476543A	–	24R2	–
<u>AirScale RRH 4T4R B26 200 W (AHCF)</u>	SR002703 5GC002476	475313A	SRAN 20A		5G21B
<u>AirScale RRH 4T4R B26a 100 W (AHCC)</u>	LTE4260 SR002260	474469A	LTE 19	SRAN 19	–
<u>AirScale RRH 4T4R B28 240 W (AHPF)</u>	CB006896	475798A	–	–	5G21A
<u>AirScale RRH 4T4R B28 320 W (AHPB)</u>	LTE3651 SR002039 5GC000930	474119A	LTE 17ASP1	SRAN 18SP	5G19B

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale RRH 4T4R B28 320 W (AHPH)</u>	CB008748	476105A	–	22R3	–
<u>AirScale RRH 4T4R B30 100 W (AHNA)</u>	LTE4637 SR002260 CB005907	474861A	LTE 18A	SRAN 19	5G20B
<u>AirScale RRH 4T4R B65 160 W (AHGE)</u>	SR002937 CB006996	475580A	–	SRAN 21A	–
<u>AirScale RRH 4T4R B66 160 W (FRIJ)</u>	LTE2516 SR001361 5GC002311	473368A	LTE 16A	SRAN 18SP	5G20A

Table 10: Dual band Remote Radio Heads

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale Dual RRH 2T4R B1/3 240 W (AHEGA)</u>	LTE3140 SR001575 5GC002429	473995A	LTE 18	SRAN 18SP	5G20A
<u>AirScale Dual RRH 2T4R B1/B3 (n1/n3) 240 W (AHEGI)</u>	CB012139	476517A	–	23R4	–
<u>AirScale Dual RRH 4T4R B1/3 320 W (AHEGB)</u>	LTE3681 SR001668 5GC001688	474090A	LTE 18	SRAN 18SP	5G19B
<u>AirScale Dual RRH 4T4R B1/B3 (n1/n3) 320 W (AHEGJ)</u>	CB012140	476518A	–	23R4	–
<u>AirScale Dual RRH 4T4R B1/3 400 W (AHEGC)</u>	LTE4970 SR002211 5GC002335	474914A	LTE 19A	SRAN 19A	5G20A
<u>AirScale Dual RRH 4T4R B1/3 (n1/n3) 400 W (AHEGF)</u>	CB007083	475825A	–	–	5G21A
<u>AirScale Dual RRH 4T4R B1/B3 480 W (AHEGG)</u>	CB008922	476123A	–	23R3	–
<u>AirScale Dual RRH 4T4R B2/66a 320 W (AHFIC)</u>	LTE3845 SR002369 5GC000934	474239A	LTE 18	SRAN 18SP	5G19B
<u>AirScale Dual RRH 4T4R B5/13 160 W (AHBCA)</u>	LTE3848 SR002039 5GC001151	474241A	LTE 18SP	SRAN 18SP	5G19B
<u>AirScale Dual RRH 4T4R B5/13 320 W (AHBCC)</u>	LTE3849 SR002039	474341A	LTE 18	SRAN 18SP	–

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale Dual RRH 4T4R B5/28 320W (AHPCA)</u>	SR002545 5GC002593	475075A	–	SRAN 19B	5G20A
<u>AirScale Dual RRH 4T4R B5/B28 (n5/n28) 320 W (AHPCB)</u>	CB012141	476519A	–	23R4	–
<u>AirScale Dual RRH 4T4R B5/29 240 W (AHBCB)</u>	LTE3846 SR001095 5GC002028	474242A	LTE 19A Fast Delivery Mode in LTE 19	–	5G19A
<u>AirScale Dual RRH 4T4R B8/B28 480 W (AHPDA)</u>	SR002869 5GC002467	475550A	SRAN 20A		5G20A
<u>AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDB)</u>	CB009853	476357A	–	23R4	–
<u>AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDC)</u>	CB009852	476358A	–	23R3	–
<u>AirScale Dual RRH 4T4R B12/B14/n12/n14 320 W (AHLBA)</u>	LTE3847 SR002039 CB008396	474240A	LTE 18	SRAN 18SP 22R4	–
<u>AirScale Dual RRH 4T4R B12/71 240 W (AHLOA)</u>	LTE3899 SR002039 5GC000719	474331A	LTE 18	SRAN 18SP	5G19A
<u>AirScale Dual RRH 4T4R B13/26 240 W AHBCD</u>	CB008447	476021A	–	22R2	22R2
<u>AirScale Dual RRH 4T4R B13/71 240 W (AHBOA)</u>	LTE4988 SR002582 5GC002424	475250A	LTE 19B	SRAN 19B	5G20A
<u>AirScale Dual RRH 4T4R B25/66 320 W (AHFIB)</u>	LTE3789 SR001767 5GC000724	474216A	LTE 17ASP1	SRAN 18SP	5G19A

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale Dual RRH 4T4R B25/66 480 W (AHFIG)</u>	LTE5213 SR002418 5GC002099	475125A	LTE 19A	SRAN 19A	5G20A
<u>AirScale Dual RRH 4T4R B25/66 480 W (AHFII)</u>	CB006079	475656A	–	22R3	22R3
<u>AirScale Dual RRH 4T4R B25/B66a 160 W (AHFIA)</u>	LTE3421 SR002039 5GC001441	473967A	LTE 18	SRAN 18SP	5G19B
<u>AirScale Dual RRH 4T4R B71/85 320 W (AHLOB)</u>	CB007589	475910A	–	22R3	–

Table 11: Triple band Remote Radio Heads

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale Tri RRH 2T2R B8/20/28 240 W (AHPMDA)</u>	LTE3142 SR001572 5GC000928	473997A	LTE 18	SRAN 18SP	5G19A
<u>AirScale RRH 2T2R B8/B20/B28 (n8/n20/n28) 240 W (AHPMDI)</u>	CB012137	476515A	–	23R4	–
<u>AirScale Tri RRH 2T4R B5/8/28 240 W (AHPCDB)</u>	SR002520 5GC002586	475081A	SRAN 20A		5G20A
<u>AirScale Tri RRH 2T4R B8/20/28 240 W (AHPMDB)</u>	SR002368 5GC001683	475000A	–	SRAN 19B	5G20A
<u>AirScale RRH 2T4R B8/B20/B28 (n8/n20/n28) 240 W (AHPMDJ)</u>	CB012138	476516A	–	23R4	–
<u>AirScale Tri RRH 2T4R B8/B20/B28 (n8/20/28) 320 W (AHPMDD)</u>	CB006008	475707A	–	SRAN 20C	5G20B
<u>AirScale Tri RRH 2T4R B8/20/28 320 W (AHPMDG)</u>	CB008846	476122A	–	23R1	–
<u>AirScale Tri RRH 4T4R B1/B3/B7 (n1/n3/n7) 640 W (AHEGHA)</u>	CB006142	475767A	–	23R2	–
<u>AirScale Tri RRH 4T4R B7/B25/B66 (n7/n25/n66) 640 W (AHFIHA)</u>	CB007680	475964A	–	23R4	–
<u>AirScale Tri RRH 4T4R B8/20/28 320 W (AHPMDH)</u>	CB009066	476232A	–	22R4	–

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale Tri RRH</u> <u>4T4R</u> <u>B12/B14/B29/n12/</u> <u>n14/n29 370 W</u> <u>(AHLBBA)</u>	LTE5210 CB006425	475082A	LTE 19B	SRAN 19B 22R4	-

Table 12: TD-LTE Remote Radio Heads

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale RRH 2T2R B40 120 W (AZND/AZNE)</u>	LTE3961	474348A/474350A	LTE 18	–	–
<u>AirScale RRH 4T4R B40 160 W (AZNA)</u>	LTE2810 5GC002361	473914A 473914B	LTE 17A	–	5G20A
<u>AirScale RRH 4T4R B41 160 W (AZHA)</u>	LTE3329 5GC002400	473941A	LTE 17A	–	5G20A
<u>AirScale RRH 4T4R n77 320 W (AZQU) (eCPRI)</u>	CB005708	475665A	–	–	5G21A
<u>AirScale RRH 8T8R B38/n38 320 W (AZHN) (CPRI/eCPRI)</u>	SR002746 CB006131 CB005965	475547A	–	SRAN 20C 22R2	5G21A
<u>AirScale RRH 8T8R B40 240 W (AZNB)</u>	LTE3549	474051A	LTE 18SP	–	–
<u>AirScale RRH 8T8R B40 240 W (AZNC)</u>	LTE3550	474052A	LTE 18	–	–
<u>AirScale RRH 8T8R n40 320 W eCPRI (AKNA)</u>	CB007364	475945A	–	23R1	–
<u>AirScale RRH 8T8R n40 400 W eCPRI (AKNB)</u>	CB007845	475980A	–	22R4	–

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale RRH 8T8R B41/n41 320 W CPRI/eCPRI (AZHL)</u>	5GC002305 SR002812 5GC002270 SR002975	475432A	–	SRAN 20C/SRAN 21A	5G20A/5G21A
<u>AirScale RRH 8T8R n41 320 W eCPRI (AZHM)</u>	5GC002336	475546A	–	–	5G21A
<u>AirScale RRH 8T8R n41/B41 400 W (AKHD)</u>	CB011115	476461A	–	24R2	–
<u>AirScale RRH 8T8R n77 160 W eCPRI (AZQO)</u>	5GC002024	475288A	–	–	5G19B/5G21A
<u>AirScale RRH 8T8R n77 320 W (AKQW)</u>	CB007844	475979A	–	23R4	–
<u>AirScale RRH 8T8R n77 320 W eCPRI (AZQW)</u>	CB006061	475742A	–	–	5G21A
<u>AirScale RRH 8T8R B42 160 W CPRI/eCPRI (AZQP)</u>	LTE5300 CB005852	475198A	LTE 19B MP	–	5G21A
<u>AirScale RRH 8T8R B42 240 W (AZQE)</u>	LTE3736	474717A	LTE 18A	–	–
<u>AirScale RRH 8T8R B42 240 W (AZQF)</u>	LTE3737 CB006118	474188A	LTE 18	–	5G21A
<u>AirScale RRH 8T8R n78 320 W eCPRI (AKQA)</u>	CB007395	475944A	–	23R2	–

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale RRH 8T8R n78 320 W eCPRI (AKQI)</u>	CB007363	475919A	–	22R4	–
<u>AirScale RRH 8T8R n78 320 W eCPRI (AKQJ)</u>	CB007075	475824A	–	22R2	22R2
<u>AirScale RRH 8T8R n78 320 W eCPRI (AKQZ)</u>	CB007362	475918A	–	22R4	–
<u>AirScale RRH 8T8R n78 320 W eCPRI (AZQG)</u>	5GC001358	474994A	–	22R2	22R2
<u>AirScale RRH 8T8R n78 320 W CPRI/eCPRI (AZQH)</u>	5GC001810 5GC001510	475074A	–	22R2	5G19A 22R2
<u>AirScale RRH 8T8R n78 320 W eCPRI (AZQI)</u>	5GC001511	475243A	–	–	5G19B/5G21A
<u>AirScale RRH 8T8R n78 320 W eCPRI (AZQJ)</u>	5GC001512 CB007179	475244A	–	22R1-SR	5G19B/5G21A 22R1-5G
<u>AirScale RRH 8T8R n78 320 W eCPRI (AZQL)</u>	5GC001687	475130A	–	22R2	22R2
<u>AirScale RRH 8T8R n78 320 W eCPRI (AZQS)</u>	CB005777	475664A	–	–	5G21A
<u>AirScale RRH 8T8R n79 192 W eCPRI (AZTA)</u>	CB006144	475741A	–	22R1-SR	22R1-5G

Table 13: Micro Remote Radio Heads

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale Micro RRH 2T B46 UNII 1+2+3 1W (AZRB)</u>	LTE4253 SR001791	474510A	LTE 18	SRAN 18A	–
<u>AirScale Micro RRH 2T B46 UNII 1+2+3 1W (AZRC)</u>	LTE4872	474784A	SRAN 20A		–
<u>AirScale Micro RRH 2T2R n41 200 W (AWHHG/AWH HH)</u>	5GC001776	475184A 475212A	–	22R1-SR	22R1-5G
<u>AirScale Micro 4T4R B1 20 W (AHGB)</u>	LTE4269 SR002040 5GC001484	474514A	LTE 18SP	SRAN 18A	5G19B
<u>AirScale Micro 4T4R B3 20 W (AHEJ)</u>	LTE4270 SR001791 5GC001485	474513A	LTE 18SP	SRAN 18A	5G19B
<u>AirScale Micro 4T4R B5 20 W (AHCE)</u>	LTE3654 SR001791 5GC001486	474044A	LTE 18SP	SRAN 18A	5G19B
<u>AirScale Micro 4T4R B7 20 W (AHHA)</u>	LTE3713 SR002039 5GC001483	474147A	LTE 18	SRAN 18SP	5G19B
<u>AirScale Micro 4T4R B13 20 W (AHBB)</u>	LTE3655 SR001791	474042A	LTE 18SP	SRAN 18A	–
<u>AirScale Micro 4T4R B14 20 W (AHBC)</u>	LTE5006 SR002260	474948A	LTE 19	SRAN 19	–
<u>AirScale Micro 4T4R B24 8 W (AWHKB)</u>	CB008445	476086A	–	22R4	–

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>Nokia AirScale Micro 4T4R B25 20 W (AHFB)</u>	LTE3429 SR001996 5GC001154	474036A	LTE 17A	SRAN 18A	5G19B
<u>AirScale Dual- band Micro RRH 4T4R B25 + B66 160 W (AWMFIA)</u>	CB009787	476353A	–	24R2	–
<u>AirScale Micro RRH 4T4R n38 80 W (AWHHI)</u>	5GC001881	475263A	–	–	5G20A
<u>AirScale Micro RRH 4T4R B41/n41 80 W (AWHHD)</u>	LTE5161 5GC001541	475068A	LTE 19B MP	SRAN 19B MP	5G19A
<u>AirScale Micro RRH 4T4R B41/n41 80 W (AWHHF)</u>	LTE5304 5GC001707	475181A	LTE 19A	–	5G19A
<u>AirScale Micro RRH 4T4R B42/n78 40 W (AWHQE)</u>	5GC001157	474788A	–	–	5G19A
<u>AirScale Micro RRH 4T4R B42/n78 40 W (AWHQG)</u>	5GC001278	474877A	–	–	5G19A
<u>AirScale Micro 4T4R B42 20 W (AZQD)</u>	LTE4828	474798A	LTE 19	–	5G21B
<u>AirScale Micro 4T4R B43 20 W (AZQR)</u>	LTE5235 5GC001794	475148A	LTE 19A	–	5G20B

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale Micro RRH 4T4R B43/n78 40 W (AWHQF)</u>	5GC001274	474877A	–	–	5G19A
<u>AirScale Micro RRH 4T4R B48/n48 20 W (AWHQU)</u>	CB008814	476212A	–	23R3	–
<u>AirScale Micro 4T4R B48/n48 (CBRS) 20 W (AZQC)</u>	LTE3628 5GC001083	474156A	LTE 18SP	22R2	22R2
<u>AirScale Micro RRH 4T4R B53 1 W (AWHNB)</u>	CB010816	476437A	–	24R1	–
<u>AirScale Micro 4T4R B66 20 W (AHIB)</u>	LTE3431 SR002530 5GC001189	474050A	LTE 17A	SRAN 19A	5G19B
<u>AirScale Micro RRH 4T4R n40 80 W (AWHNA)</u>	CB008786	476121A	–	24R2	–
<u>AirScale Micro RRH 4T4R n77 20 W (AWHQM)</u>	5GC001832	475246A	–	–	5G19B
<u>AirScale Micro 4T4R n77 80 W (AWHQN)</u>	CB005845	475701A	–	22R2	–
<u>AirScale Micro RRH 4T4R n77 80 W (AWHQ3)</u>	CB010267	476382A	–	24R2	–
<u>AirScale Micro RRH 4T4R n78 40 W (AWHQV)</u>	CB006657	475784A	–	–	5G21B
<u>AirScale Micro RRH 4T4R n78 80 W (AWHQ2)</u>	CB009463	476314A	–	23R4	–

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale Micro RRH 4T4R n79 80 W (AWHTA)</u>	5GC001833	475245A	–	–	5G21B

Table 14: AirScale Indoor Pico RRH

RRH name	Feature ID	Product code	Introduced in LTE release	Introduced in SRAN release	Introduced in 5G release
<u>AirScale Indoor Pico RRH 4T4R B38/n38 1 W (AWPHA and AWPHB)</u>	CB010204	476363A/476364A	–	24R1	–
<u>AirScale Indoor Pico RRH 4T4R B40/n40 1 W (AWPNA and AWPNB)</u>	CB010203	476361A/476362A	–	24R1	–
<u>AirScale Indoor Pico RRH 4T4R B48/n48 1 W eCPRI (AWPQY and AWPQZ)</u>	CB008712	476099A/476101A	–	23R2	–
<u>AirScale Indoor Pico RRH 4T4R n77 (eCPRI) (AWHQW/AWHQX)</u>	CB007758	475924A/475927A	–	22R2	22R2
<u>AirScale Indoor Pico RRH 4T4R n79 (eCPRI) (AWPTC and AWPTD)</u>	CB008974	476205A/476206A	–	23R1	–

5. AirScale macro FDD RUs descriptions

Descriptions of RF modules, single band, dual band and triple band remote radio heads.

5.1 RFMs descriptions

5.1.1 AirScale RFM 6T6R B1/n1 480 W (ARGA)

ARGA (474800A) is introduced by *LTE4640* (for WCDMA and LTE), *SR002273* (for WCDMA and LTE), and *5GC001837* (for NR).

Functional description

Table 15: ARGA functional specification

Property	Value
Maximum output power	480 W
Modulation	256 QAM
Number of TXX	6T6R
Outdoor installation	Yes
Supported technologies	WCDMA, LTE, NR
RF sharing/concurrent mode	WCDMA-LTE
Duplex mode	FDD
TX frequency range	B1/n1: 2110–2170 MHz
RX frequency range	B1/n1: 1920–1980 MHz
DL filter bandwidth	60 MHz
UL filter bandwidth	60 MHz
Instantaneous bandwidth (iBW)	60 MHz
Occupied bandwidth (oBW)	60 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	5, 10, 15, 20 MHz
PIM cancellation	Yes

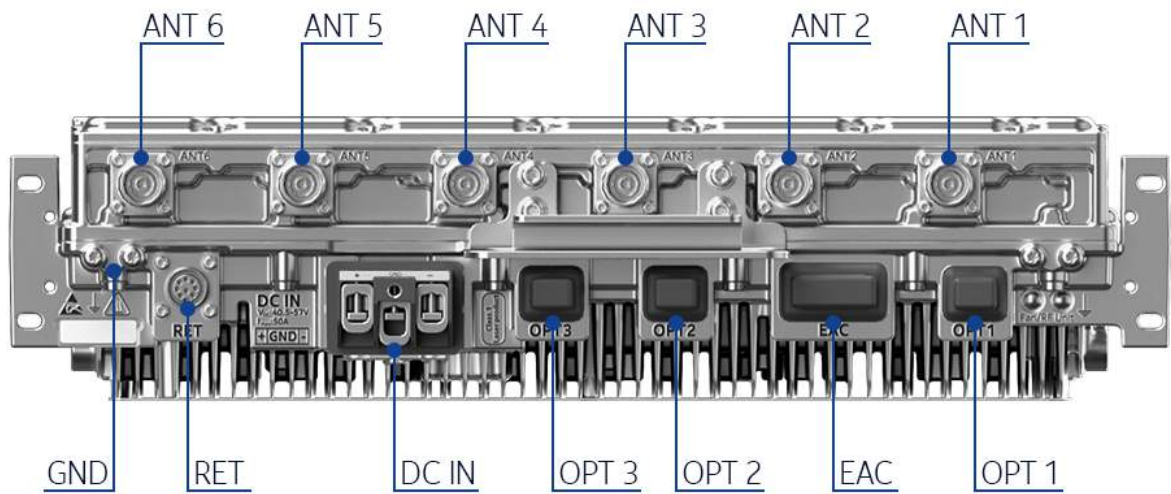
 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 7: ARGA interfaces



*EMHH Flexi 3U Casing and High Covers F&B (473187A) are required when connecting either 4.3–10 straight antenna cables or RET cables. For details, see *Nokia BTS Optional Items Description*.

Table 16: ARGA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: from 10 mm ² to 35 mm ² (7 AWG to 2 AWG)
Antenna connector	ANT	6	4.3-10	EMHH required for straight connectors*
Remote Electrical Tilt	RET	1	8-pin circular	RS-485; EMHH required*
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw	–

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 17: ARGA ALD support

ALD support	Value
AISG	ANT1, ANT3, ANT5: AISG 2.0/3.0 ANT2, ANT4, ANT6: AISG 3.0 ping receiver RET: AISG 3.0
Voltage	ANT1, ANT3, ANT5, RET: 14.5 V DC
Power per port	30 W, 45 W total

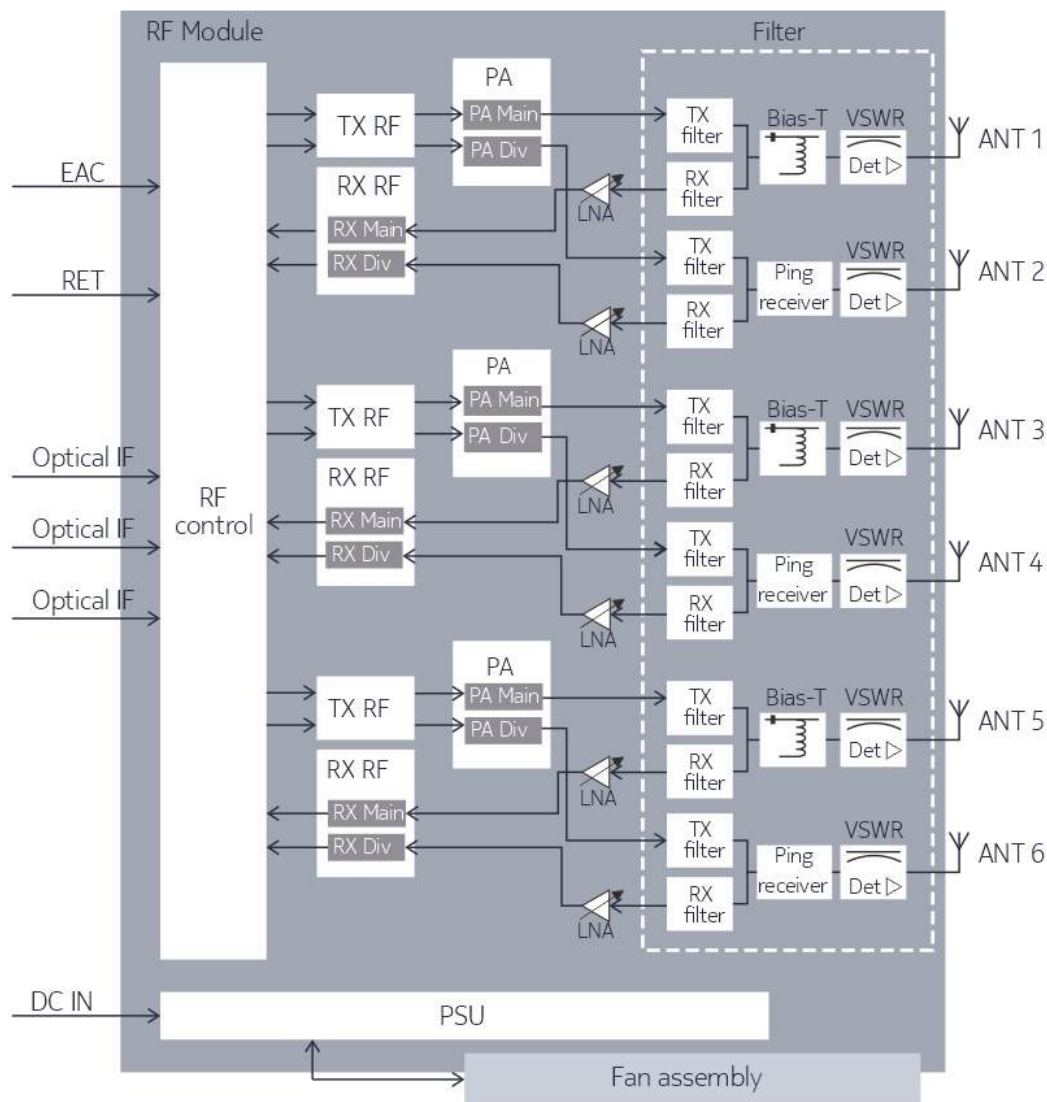


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 8: ARGA functional block diagram



Electrical specifications

Table 18: ARGA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Table 19: ARGA TX output power tolerance

Property	Value	Description
Typical power tolerance (nominal temperature)	± 0.8 dB	Over full TX RF bandwidth, nominal ambient temperature 25°C (77°F)
Typical power tolerance (extreme temperature)	± 2.0 dB	Over full TX RF bandwidth, extreme ambient temperature 55°C (131°F)

LTE power back-off

Table 20: Recommended ARGA power back-off in 256 QAM mode

Rated power [W]	Single carrier [dB]	Dual carrier [dB]
80	0.6	1.2
≤60	0	0.6

Related optional items

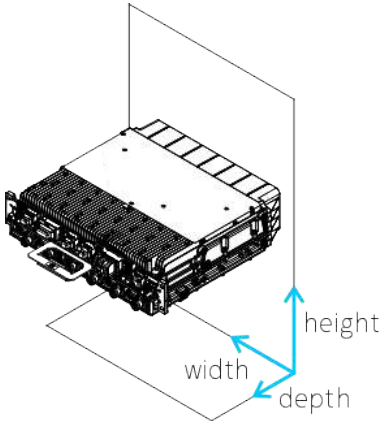
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- EMHA Flexi 3U mounting cover (470316A)
- EMHH Flexi 3U high mounting cover (473187A)
- FMAA Flexi mounting auxiliary bracket (471657A)
- FMFA Flexi mounting kit for floor, wall and pole (470149A)
- FMHA Flexi side covers (471524A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- AMRM AirScale one clip kit for RF modules (475018A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)
- FSEP Flexi system external OVP (473246A)
- FSES Flexi system external OVP (472285A)

Installation options

- *Pole (vertical)*
- *Wall (vertical)*
- *Stack*
- *Inside cabinet*
- *One-clip rail installation*

Dimensions and weight

Table 21: ARGA dimensions and weight

Property	Value	Dimensions orientation
Height	118 mm (4.65 in.)	
Width	441 mm (17.36 in.)	
Depth	402 mm (15.83 in.)	
Weight	23 kg (50.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 22: ARGA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.1.2 AirScale RFM 6T6R B3/n3 480 W (AREA)

AREA (474198A) is introduced by *LTE4208/SR001943/5GC001694*.

Functional description

Table 23: AREA functional specification

Property	Value
Maximum output power	480 W
Modulation	256 QAM
Number of TXRX	6T6R
Outdoor installation	Yes
Supported technologies	GSM, LTE, NR GSM-LTE
Duplex mode	FDD
TX frequency range	B3/n3: 1805-1880 MHz
RX frequency range	B3/n3: 1710-1785 MHz
DL filter bandwidth	75 MHz
UL filter bandwidth	75 MHz
Instantaneous bandwidth (iBW)	75 MHz
Occupied bandwidth (oBW)	75 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

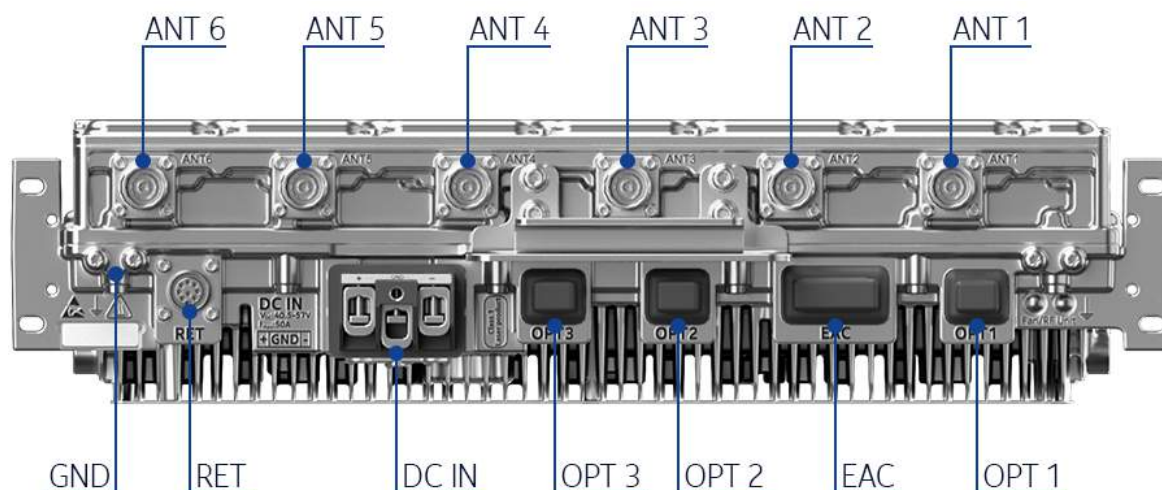
Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 9: AREA interfaces



*EMHH Flexi 3U Casing and High Covers F&B (473187A) are required when connecting either 4.3-10 straight antenna cables or RET cables. For details, see *Nokia BTS Optional Items Description*.

Table 24: AREA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 10 mm ² to 35 mm ² (7 AWG to 2 AWG)
Antenna connector	ANT	6	4.3-10	EMHH required for straight connectors*
Remote Electrical Tilt	RET	1	8-pin circular	RS-485; EMHH required*
LMI (Local Management Interface and EAC)	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw	-

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 25: AREA ALD support

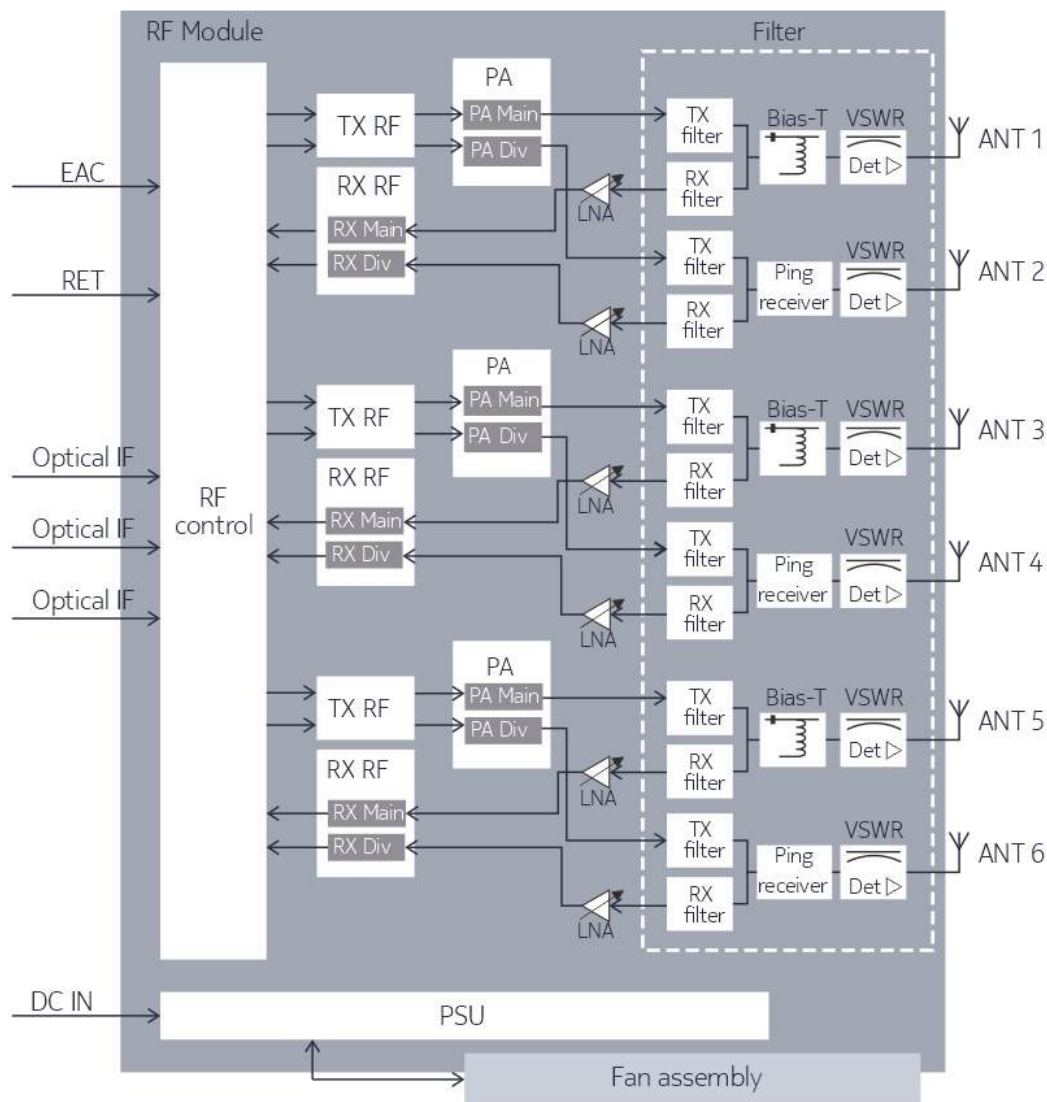
ALD support	Value
AISG	ANT1, ANT3, ANT5: AISG 2.0/3.0 ANT2, ANT4, ANT6: AISG 3.0 ping receiver RET: AISG 3.0
Voltage	ANT1, ANT3, ANT5, RET: 14.5 V DC
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 10: AREA functional block diagram



Electrical specifications

Table 26: AREA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Table 27: AREA TX output power tolerance

Property	Value	Description
Typical power tolerance (nominal temperature)	± 0.8 dB	Over full TX RF bandwidth, nominal ambient temperature 25°C (77°F)
Typical power tolerance (extreme temperature)	± 2.0 dB	Over full TX RF bandwidth, extreme ambient temperature 55°C (131°F)

LTE power back-off

Table 28: Recommended AREA power back-off in 256 QAM

Rated power [W]	Single carrier [dB]	Dual carrier [dB]
80	0.6	1.2
≤60	0	0.6

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- EMHA Flexi 3U mounting cover (470316A)
- EMHH Flexi 3U high mounting cover (473187A)
- FMAA Flexi mounting auxiliary bracket (471657A)
- FMFA Flexi mounting kit for floor, wall and pole (470149A)
- FMHA Flexi side covers (471524A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- AMRM AirScale one clip kit for RF modules (475018A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)
- FSEP Flexi system external OVP (473246A)
- FSES Flexi system external OVP (472285A)

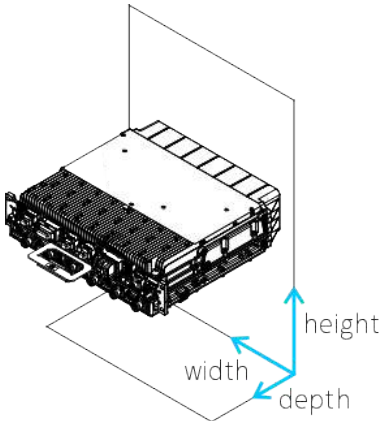
Installation options

- Pole (vertical)
- Wall (vertical)

- Stack
- Inside cabinet
- One-clip rail installation

Dimensions and weight

Table 29: AREA dimensions and weight

Property	Value	Dimensions orientation
Height	118 mm (4.65 in.)	
Width	441 mm (17.36 in.)	
Depth	402 mm (15.83 in.)	
Weight	23 kg (50.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 30: AREA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.1.3 AirScale RFM 6T6R B5/n5 480 W (ARCA)

ARCA (474841A) is introduced by LTE4662/SR002152/CB006528.

Functional description

Table 31: ARCA functional specification

Property	Value
Maximum output power	480 W
Modulation	256 QAM
Number of TXX	6T6R
Outdoor installation	Yes
Supported technologies	GSM, WCDMA, LTE, NR
RF sharing/concurrent mode	Multi-RAT operation NR, LTE, WCDMA, GSM (for concurrent part)
Duplex mode, supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B5/n5 : 869–894 MHz
RX frequency range	B5/n5 : 824–849 MHz
DL filter bandwidth	25 MHz
UL filter bandwidth	25 MHz
Instantaneous bandwidth (iBW)	25 MHz
Occupied bandwidth (oBW)	25 MHz
Number of carriers per pipe	Up to 8
Supported bandwidths	LTE: 1.4, 3, 5, 10 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

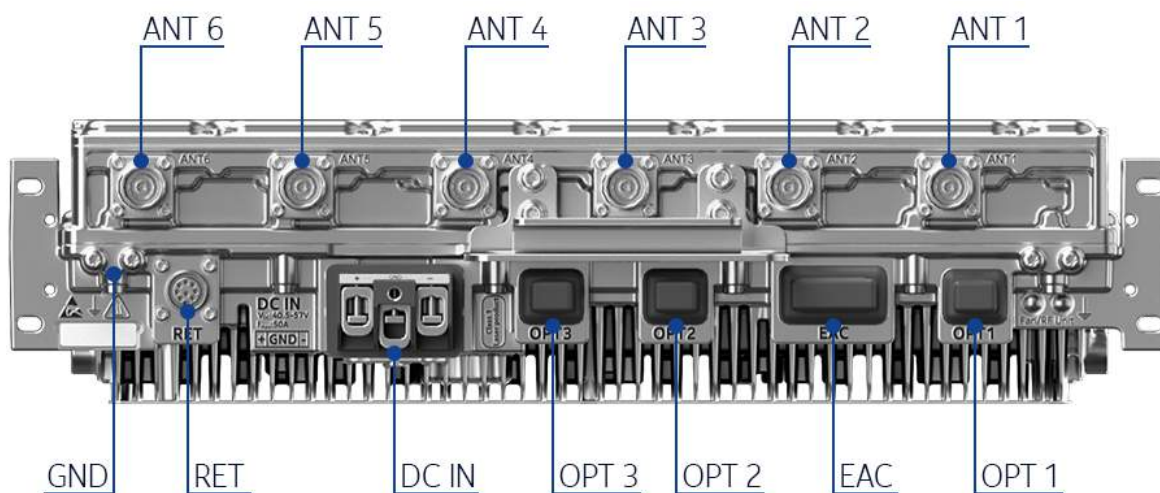
Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 11: ARCA interfaces



*EMHH Flexi 3U Casing and High Covers F&B (473187A) are required when connecting either 4.3–10 straight antenna cables or RET cables. For details, see *Nokia BTS Optional Items Description*.

Table 32: ARCA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 10 mm ² to 35 mm ² (7 AWG to 2 AWG)
Antenna connector	ANT	6	4.3-10	EMHH required for straight connectors*
Remote Electrical Tilt	RET	1	8-pin circular	RS-485; EMHH required*
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6; Nokia IP seal
Grounding (GND)		1	2 x M5 screw	–

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 33: ARCA ALD support

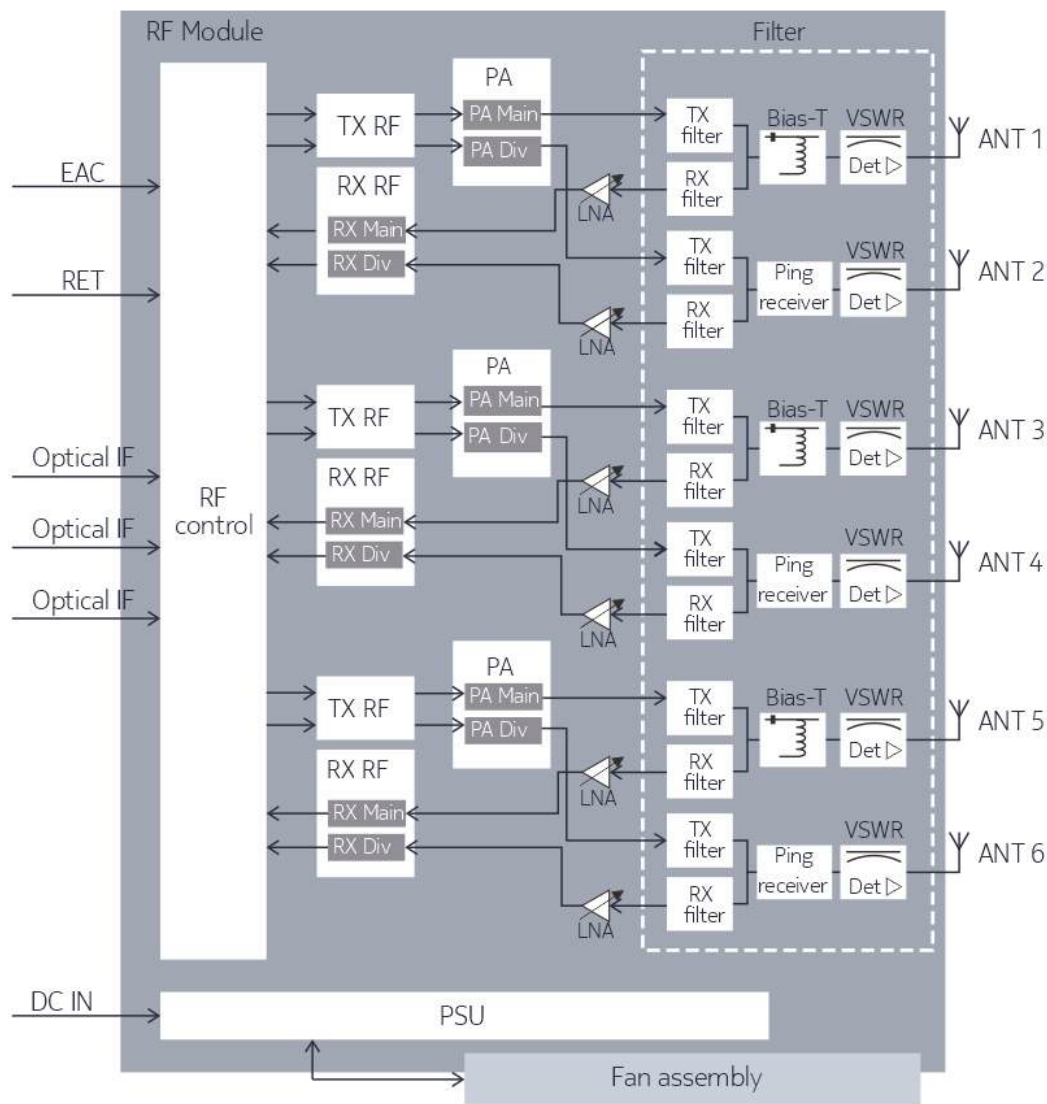
ALD support	Value
AISG	ANT1, ANT3, ANT5: AISG 2.0/3.0 ANT2, ANT4, ANT6: AISG 3.0 ping receiver RET: AISG 3.0
Voltage	ANT1, ANT3, ANT5, RET: 14.5 V DC
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 12: ARCA functional block diagram



Electrical specifications

Table 34: ARCA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Table 35: ARCA TX output power tolerance

Property	Value	Description
Typical power tolerance (nominal temperature)	± 0.8 dB	Over full TX RF bandwidth, nominal ambient temperature 25°C (77°F)
Typical power tolerance (extreme temperature)	± 2.0 dB	Over full TX RF bandwidth, extreme ambient temperature 55°C (131°F)

LTE power back-off

Table 36: Recommended ARCA power back-off in 256 QAM mode

Rated power [W]	Single carrier [dB]	Dual carrier [dB]
80	0.6	1.2
≤60	0	0.6

NR power back-off

Recommended value for `dLQam256PowerBackoffSub6` parameter is:

- 1.3 dB for 3GPP performance requirement

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- EMHA Flexi 3U mounting cover (470316A)
- EMHH Flexi 3U high mounting cover (473187A)
- FMAA Flexi mounting auxiliary bracket (471657A)
- FMFA Flexi mounting kit for floor, wall and pole (470149A)
- FMHA Flexi side covers (471524A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- AMRM AirScale one clip kit for RF modules (475018A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)
- FSEP Flexi system external OVP (473246A)

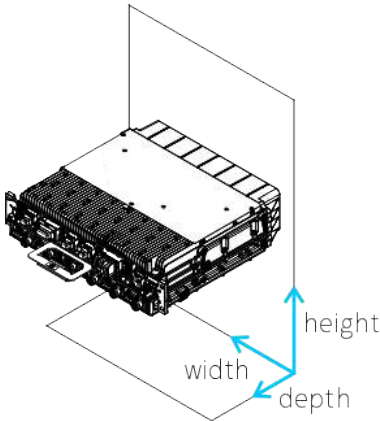
- FSES Flexi system external OVP (472285A)

Installation options

- Pole (vertical)
- Wall (vertical)
- Stack
- Inside cabinet
- One-clip rail

Dimensions and weight

Table 37: ARCA dimensions and weight

Property	Value	Dimensions orientation
Height	118 mm (4.65 in.)	
Width	441 mm (17.36 in.)	
Depth	402 mm (15.83 in.)	
Weight	23 kg (50.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 38: ARCA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.1.4 AirScale RFM 6T6R B7/n7 360 W (ARHA)

ARHA (474801A) is introduced by LTE4641 (for LTE) and 5GC001838 (for NR).

Functional description

Table 39: ARHA functional specification

Property	Value
Maximum output power	360 W
Modulation	256 QAM
Number of TXX	6T6R
Outdoor installation	Yes
Supported technologies	LTE, NR
Duplex mode - supported standard	FDD
TX frequency range	B7/n7: 2620-2690 MHz
RX frequency range	B7/n7: 2500-2570 MHz
DL filter bandwidth	70 MHz
UL filter bandwidth	70 MHz
Instantaneous bandwidth (iBW)	70 MHz
Occupied bandwidth (oBW)	70 MHz
Supported bandwidths	5, 10, 15, 20 MHz
PIM cancellation	Yes

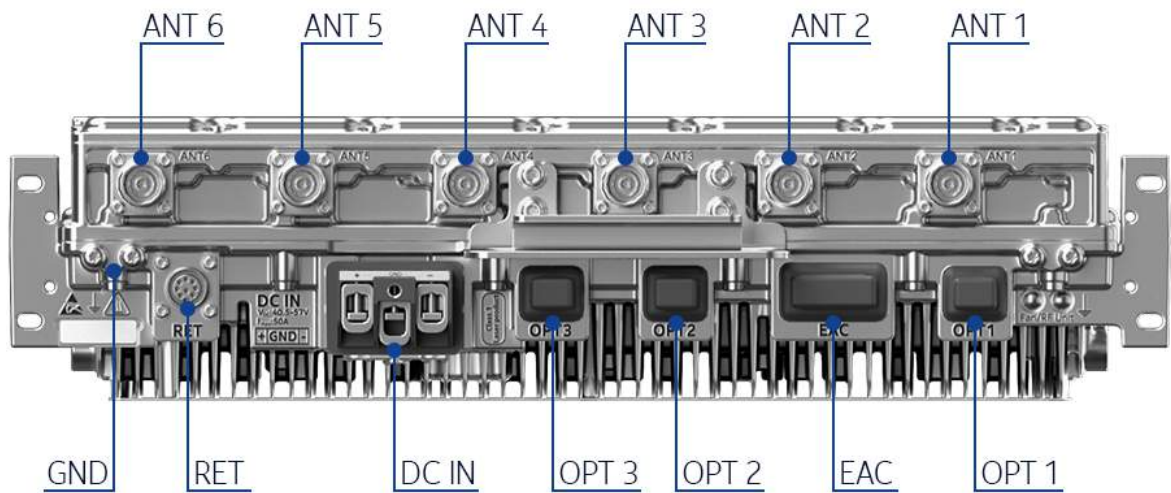
 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 13: ARHA interfaces



*EMHH Flexi 3U Casing and High Covers F&B (473187A) are required when connecting either 4.3-10 straight antenna cables or RET cables. For details, see *Nokia BTS Optional Items Description*.

Table 40: ARHA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 10 mm ² to 35 mm ² (7 AWG to 2 AWG)
Antenna connector	ANT	6	4.3-10	EMHH required for straight cables*
Remote Electrical Tilt	RET	1	8-pin circular	RS-485; EMHH required*
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6; Nokia IP seal
Grounding	GND⏚	1	2 x M5 screw	–

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 41: ARHA ALD support

ALD supports	Value
AISG	ANT1, ANT3, ANT5: AISG 2.0/3.0 ANT2, ANT4, ANT6: AISG 3.0 ping receiver RET: AISG 3.0
Voltage	ANT1, ANT3, ANT5, RET: 14.5 V DC
Power per port	30 W, 45 W total

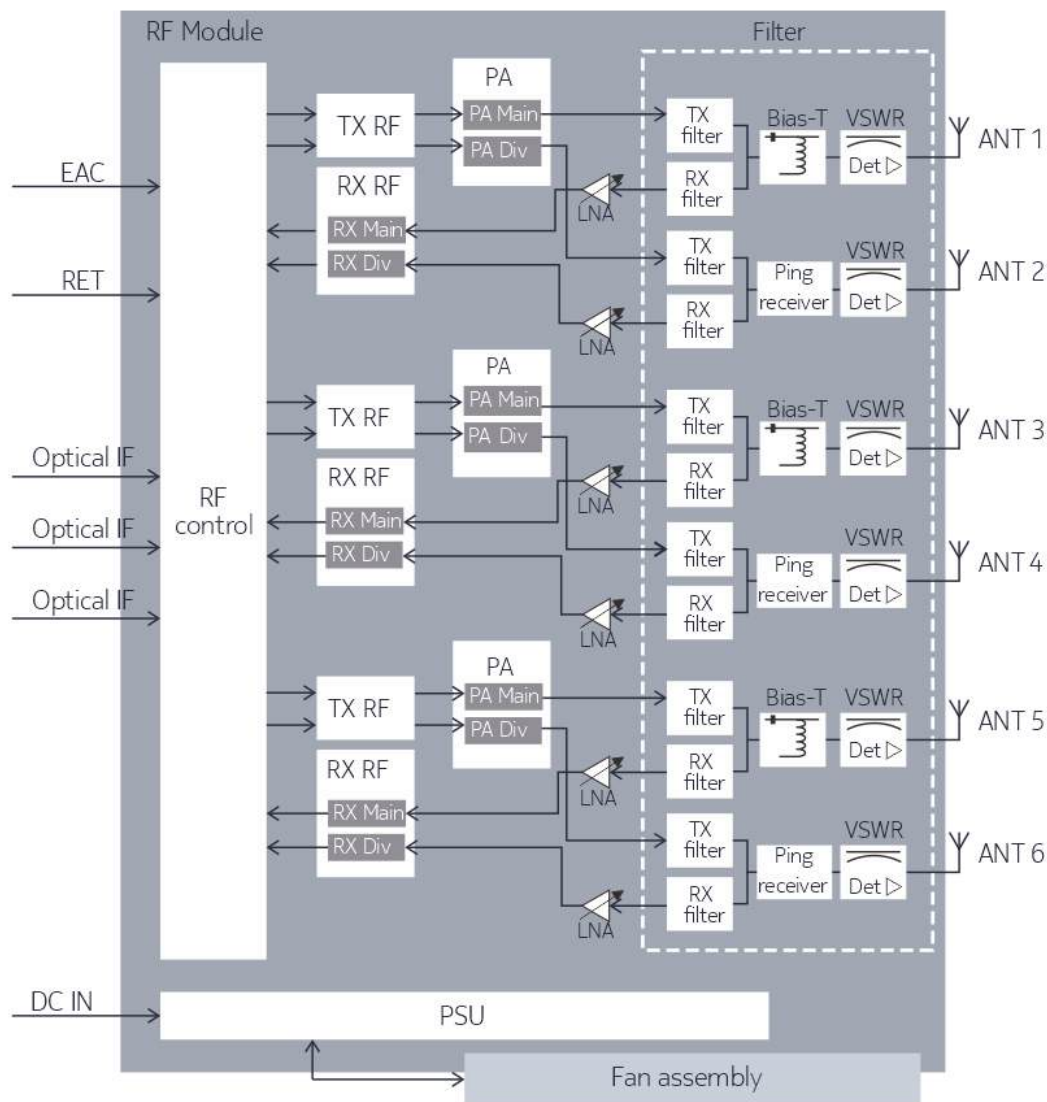


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 14: ARHA functional block diagram



Electrical specifications

Table 42: ARHA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Table 43: ARHA TX output power tolerance

Property	Value	Description
Typical power tolerance (nominal temperature)	± 0.8 dB	Over full TX RF bandwidth, nominal ambient temperature 25°C (77°F)
Typical power tolerance (extreme temperature)	± 2.0 dB	Over full TX RF bandwidth, extreme ambient temperature 55°C (131°F)

Recommended power back-off

Table 44: Recommended ARHA power back-off in 256 QAM mode

Rated power [W]	Single carrier [dB]	Dual carrier [dB]
60	0	0.6

Related optional items

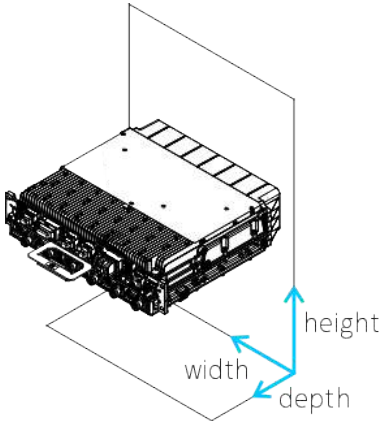
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- EMHA Flexi 3U mounting cover (470316A)
- EMHH Flexi 3U high mounting cover (473187A)
- FMAA Flexi mounting auxiliary bracket (471657A)
- FMFA Flexi mounting kit for floor, wall and pole (470149A)
- FMHA Flexi side covers (471524A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- AMRM AirScale one clip kit for RF modules (475018A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)
- FSEP Flexi system external OVP (473246A)
- FSES Flexi system external OVP (472285A)

Installation options

- *Pole (vertical)*
- *Wall (vertical)*
- *Stack*
- *Inside a cabinet*
- *One-clip rail installation*

Dimensions and weight

Table 45: ARHA dimensions and weight

Property	Value	Dimensions orientation
Height	118 mm (4.65 in.)	
Width	441 mm (17.36 in.)	
Depth	402 mm (15.83 in.)	
Weight	23 kg (50.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 46: ARHA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.1.5 AirScale RFM 6T6R B8/n8 480 W (ARDA)

ARDA (474840A) is introduced by SR002611/CB006511.

Functional description

Table 47: ARDA functional specification

Property	Value
Maximum output power	480 W
Modulation	256 QAM
Number of TXX	6T6R
Outdoor installation	Yes
Supported technologies	GSM, WCDMA, LTE, NR
RF sharing/concurrent mode	Multi-RAT operation NR, LTE, WCDMA, GSM (for concurrent part)
Duplex mode, supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B8/n8: 925-960 MHz
RX frequency range	B8/n8: 880-915 MHz
DL filter bandwidth	35 MHz
UL filter bandwidth	35 MHz
Instantaneous bandwidth (iBW)	35 MHz
Occupied bandwidth (oBW)	35 MHz
Number of carriers per pipe	Up to 8
Supported bandwidths	LTE: 1.4, 3, 5, 10 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 15: ARDA interfaces

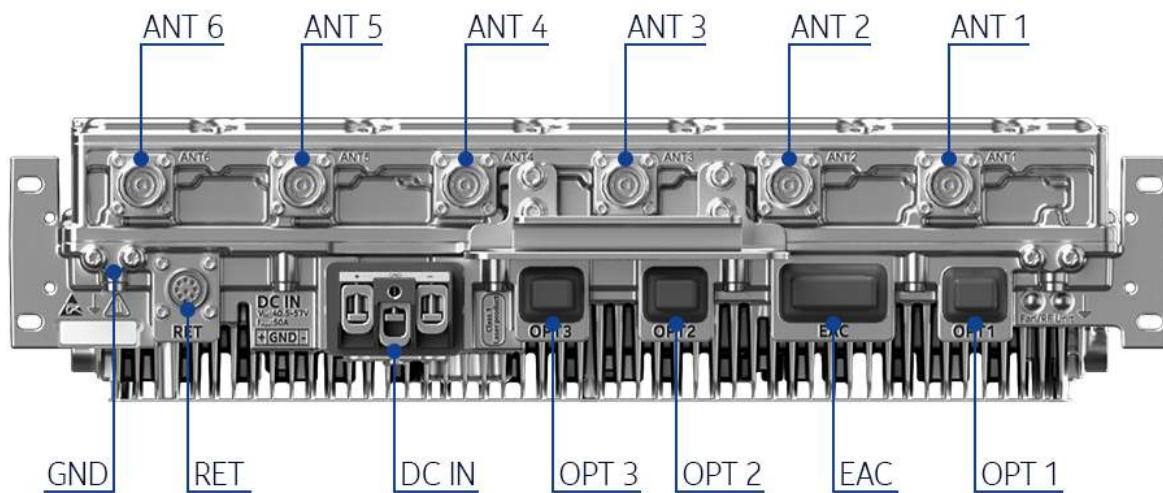


Table 48: ARDA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 10 mm ² to 35 mm ² (7 AWG to 2 AWG)
Antenna connector	ANT	6	4.3-10	EMHH required for straight connectors*
Remote Electrical Tilt	RET	1	8-pin circular	RS-485; EMHH required*
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw	–

*EMHH Flexi 3U Casing and High Covers F&B (473187A) are required when connecting either 4.3–10 straight antenna cables or RET cables. For details, see *Nokia BTS Optional Items Description*.

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 49: ARDA ALD support

Property	Value
AISG	ANT1, ANT3, ANT5: AISG 2.0/3.0 ANT2, ANT4, ANT6: AISG 3.0 ping receiver RET: AISG 3.0
Voltage	ANT1, ANT3, ANT5, RET: 14.5 V DC
Power per port	30 W, 45 W total

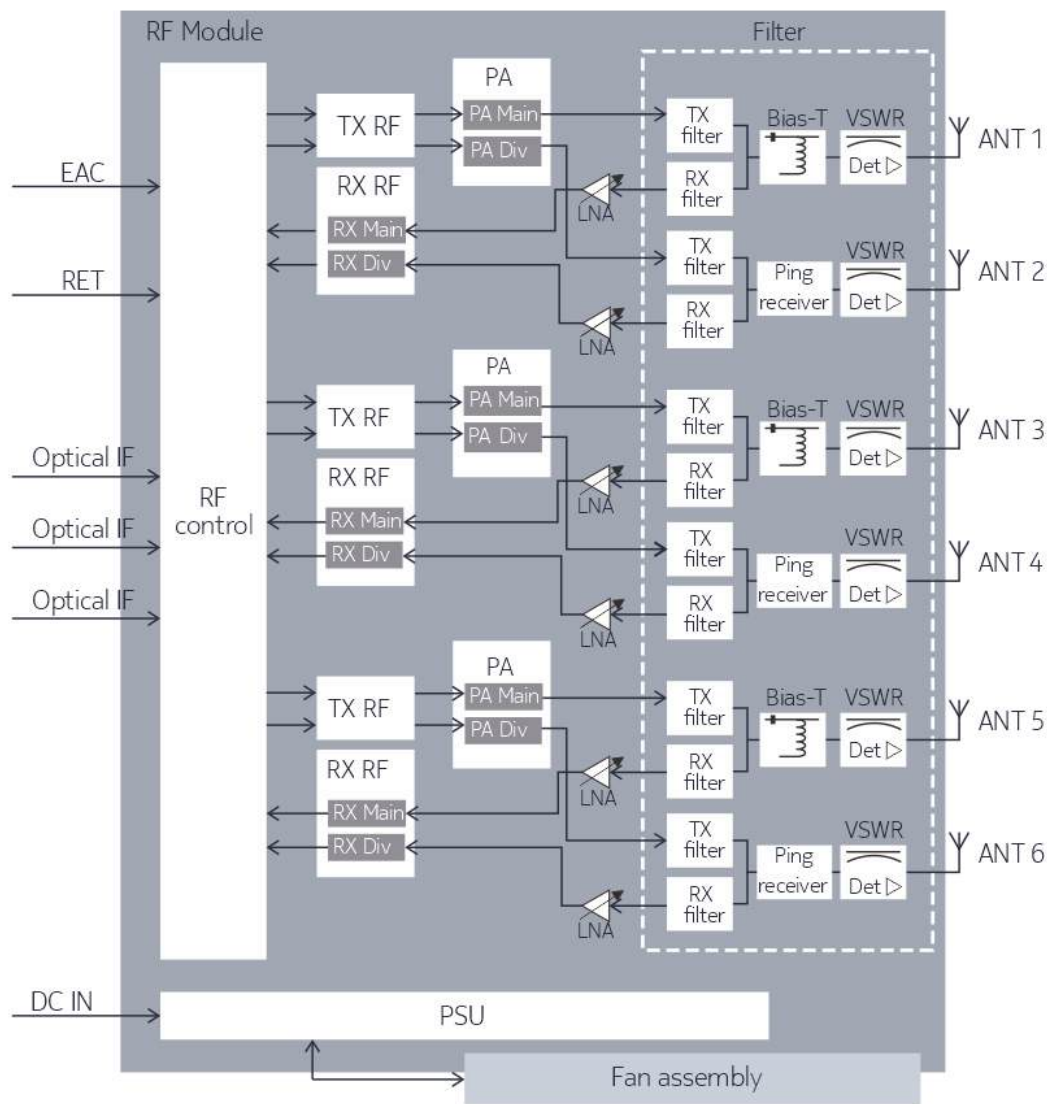


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 16: ARDA functional block diagram



Electrical specifications

Table 50: ARDA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below/beyond the extended limits, the unit might shut down.

Table 51: ARDA TX output power tolerance

Property	Value	Description
Typical power tolerance (nominal temperature)	± 0.8 dB	Over full TX RF bandwidth, nominal ambient temperature 25°C (77°F)
Typical power tolerance (extreme temperature)	± 2.0 dB	Over full TX RF bandwidth, extreme ambient temperature 55°C (131°F)

LTE power back-off

Table 52: Recommended ARDA power back-off in 256 QAM mode

Rated power [W]	Single carrier [dB]	Dual carrier [dB]
80	0.6	1.2
≤60	0	0.6

NR power back-off

Recommended value for `dLQam256PowerBackoffSub6` parameter is:

- 0.6/1.2 dB for 3GPP performance requirement
- 3.0 dB for high peak UE throughput (4x4 DL MIMO)

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- EMHA Flexi 3U mounting cover (470316A)
- EMHH Flexi 3U high mounting cover (473187A)
- FMAA Flexi mounting auxiliary bracket (471657A)
- FMFA Flexi mounting kit for floor, wall and pole (470149A)
- FMHA Flexi side covers (471524A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- AMRM AirScale one clip kit for RF modules (475018A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)

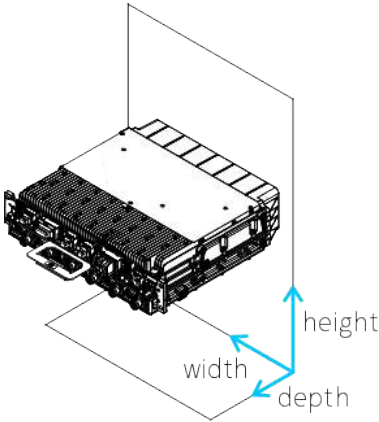
- FSEP Flexi system external OVP (473246A)
- FSES Flexi system external OVP (472285A)

Installation options

- Pole (vertical)
- Wall (vertical)
- Stack
- Inside cabinet
- One-clip rail

Dimensions and weight

Table 53: ARDA dimensions and weight

Property	Value	Dimensions orientation
Height	118 mm (4.65 in.)	
Width	441 mm (17.36 in.)	
Depth	402 mm (15.83 in.)	
Weight	23 kg (50.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 54: ARDA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.1.6 AirScale RFM 6T6R B8/n8 480 W (ARDB)

ARDB (475122A) is introduced by SR002531/CB006578.

Functional description

Table 55: ARDB functional specification

Property	Value
Maximum output power	480 W
Modulation	256 QAM
Number of TXX	6T6R
Outdoor installation	Yes
Supported technologies	GSM, WCDMA, LTE, NR
RF sharing/concurrent mode	Multi-RAT operation NR, LTE, WCDMA, GSM (for concurrent part)
Duplex mode, supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B8/n8 : 935–960 MHz
RX frequency range	B8/n8 : 890–915 MHz
DL filter bandwidth	25 MHz
UL filter bandwidth	25 MHz
Instantaneous bandwidth (iBW)	25 MHz
Occupied bandwidth (oBW)	25 MHz
Number of carriers per pipe	Up to 8
Supported bandwidths	LTE: 1.4, 3, 5, 10 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

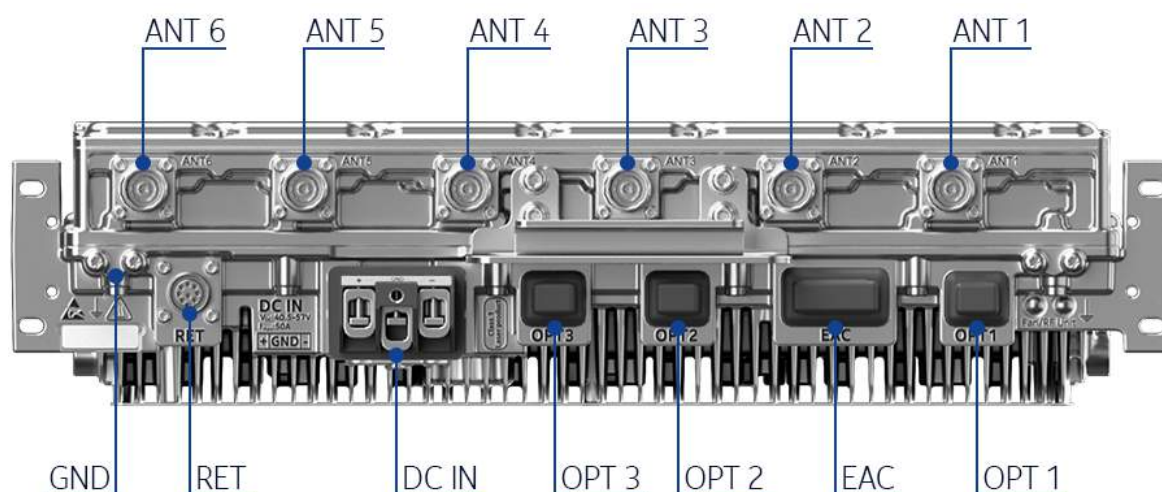
Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 17: ARDB interfaces



*EMHH Flexi 3U Casing and High Covers F&B (473187A) are required when connecting either 4.3–10 straight antenna cables or RET cables. For details, see *Nokia BTS Optional Items Description*.

Table 56: ARDB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 10 mm ² to 35 mm ² (7 AWG to 2 AWG)
Antenna connector	ANT	6	4.3-10	EMHH required for straight connectors*
Remote Electrical Tilt	RET	1	8-pin circular	RS-485; EMHH required*
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw	–

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 57: ARDB ALD support

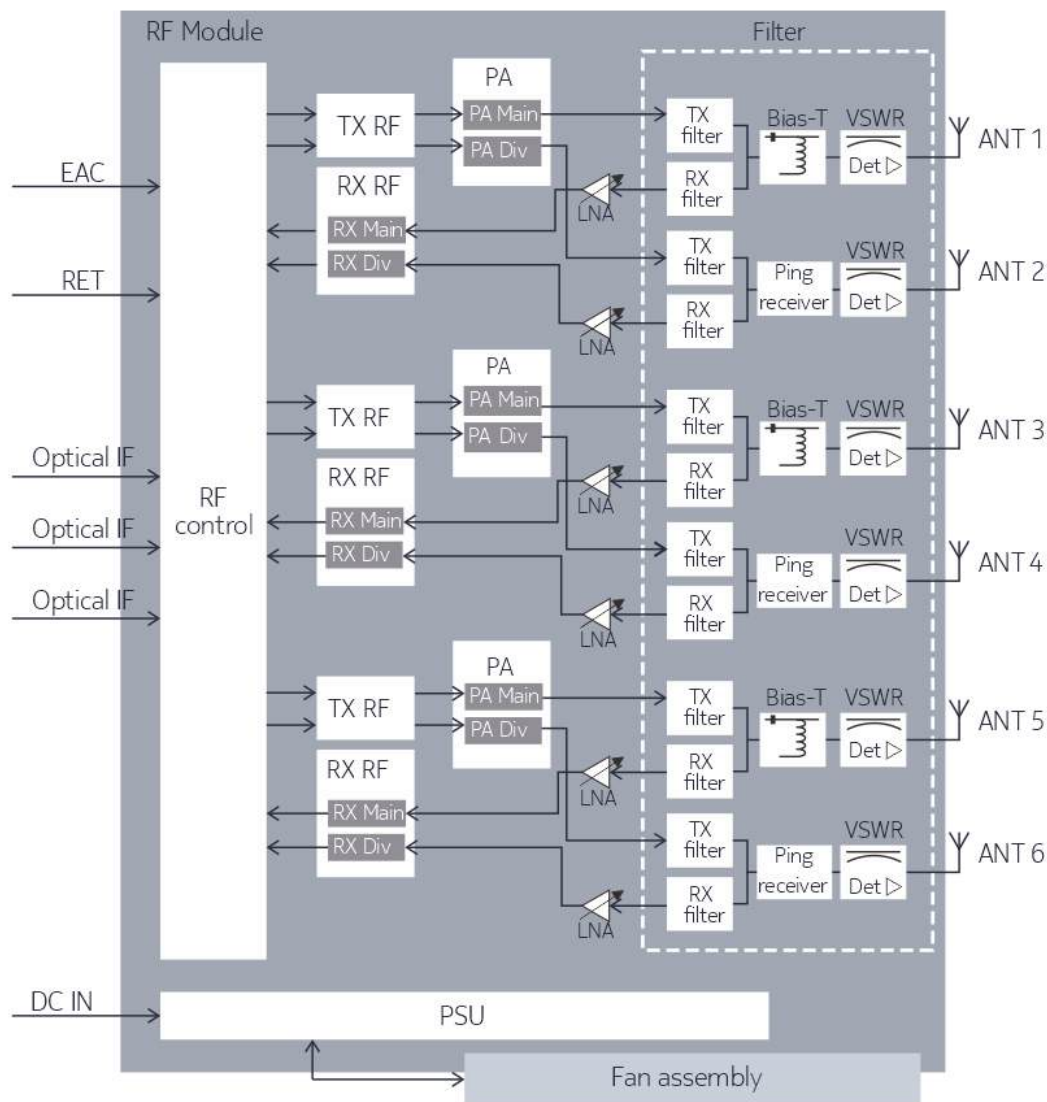
ALD support	Value
AISG	ANT1, ANT3, ANT5: AISG 2.0/3.0 ANT2, ANT4, ANT6: AISG 3.0 ping receiver RET: AISG 3.0
Voltage	ANT1, ANT3, ANT5, RET: 14.5 V DC
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 18: ARDB functional block diagram



Electrical specifications

Table 58: ARDB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Table 59: ARDB TX output power tolerance

Property	Value	Description
Typical power tolerance (nominal temperature)	± 0.8 dB	Over full TX RF bandwidth, nominal ambient temperature 25°C (77°F)
Typical power tolerance (extreme temperature)	± 2.0 dB	Over full TX RF bandwidth, extreme ambient temperature 55°C (131°F)

LTE power back-off

Table 60: Recommended ARDB power back-off in 256 QAM mode

Rated power [W]	Single carrier [dB]	Dual carrier [dB]
80	0.6	1.2
≤60	0	0.6

NR power back-off

Recommended value for `dLQam256PowerBackoffSub6` parameter is:

- 0.6/1.2 dB for 3GPP performance requirement
- 3.0 dB for high peak UE throughput (4x4 DL MIMO)

GSM cell power range

 Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- EMHA Flexi 3U mounting cover (470316A)
- EMHH Flexi 3U high mounting cover (473187A)
- FMAA Flexi mounting auxiliary bracket (471657A)
- FMFA Flexi mounting kit for floor, wall and pole (470149A)
- FMHA Flexi side covers (471524A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- AMRM AirScale one clip kit for RF modules (475018A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)

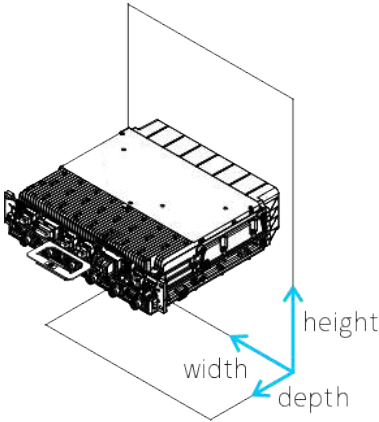
- FSEP Flexi system external OVP (473246A)
- FSES Flexi system external OVP (472285A)

Installation options

- Pole (vertical)
- Wall (vertical)
- Stack
- Inside cabinet
- One-clip rail

Dimensions and weight

Table 61: ARDB dimensions and weight

Property	Value	Dimensions orientation
Height	118 mm (4.65 in.)	
Width	441 mm (17.36 in.)	
Depth	402 mm (15.83 in.)	
Weight	23 kg (50.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 62: ARDB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.1.7 AirScale RFM 6T6R B20/n20 360 W (ARMA)

ARMA (474803A) is introduced by LTE5070/CB006587.

Functional description

Table 63: ARMA functional specification

Property	Value
Maximum output power	360 W
Modulation	256 QAM
Number of TXX	6T6R
Outdoor installation	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	Multi-RAT operation NR, LTE (for concurrent part)
Duplex mode, supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B20/n20 : 791-821 MHz
RX frequency range	B20/n20 : 832-862 MHz
DL filter bandwidth	30 MHz
UL filter bandwidth	30 MHz
Instantaneous bandwidth (iBW)	30 MHz
Occupied bandwidth (oBW)	30 MHz
Number of carriers per pipe	Up to 8
Supported bandwidths	5, 10, 15, 20 MHz
PIM cancellation	Yes

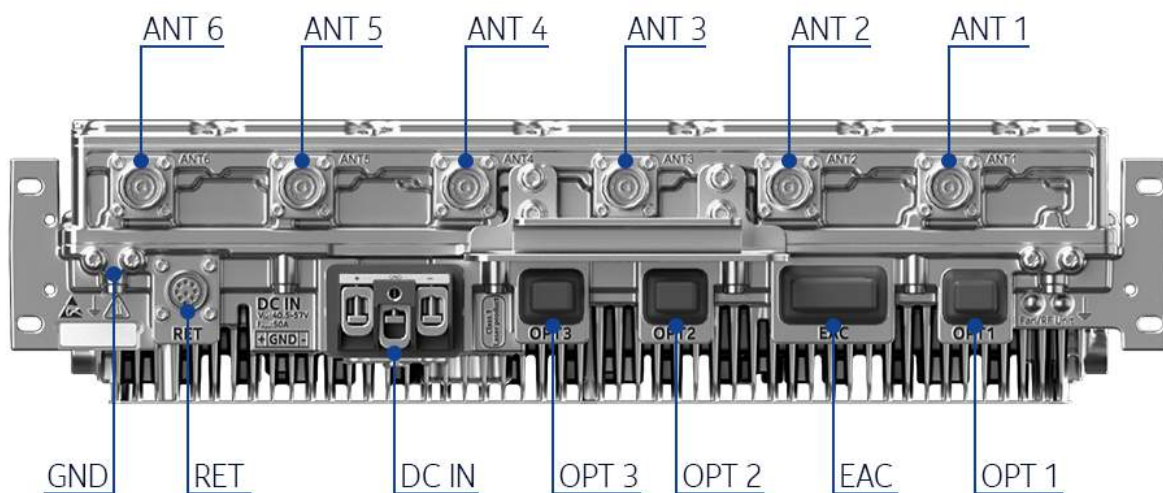
Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and 4G LTE Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 19: ARMA interfaces



*EMHH Flexi 3U Casing and High Covers F&B (473187A) are required when connecting either 4.3–10 straight antenna cables or RET cables. For details, see *Nokia BTS Optional Items Description*.

Table 64: ARMA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 10 mm ² to 35 mm ² (7 AWG to 2 AWG)
Antenna connector	ANT	6	4.3-10	EMHH required for straight cables*
Remote Electrical Tilt	RET	1	8-pin circular	RS-485; EMHH required*
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6; Nokia IP seal
Grounding	GND 	1	2 x M5 screw	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 65: ARMA ALD support

ALD support	Value
AISG	ANT1, ANT3, ANT5: AISG 2.0/3.0 ANT2, ANT4, ANT6: AISG 3.0 ping receiver RET: AISG 3.0
Voltage	ANT1, ANT3, ANT5, RET: 14.5 V DC
Power per port	30 W, 45 W total

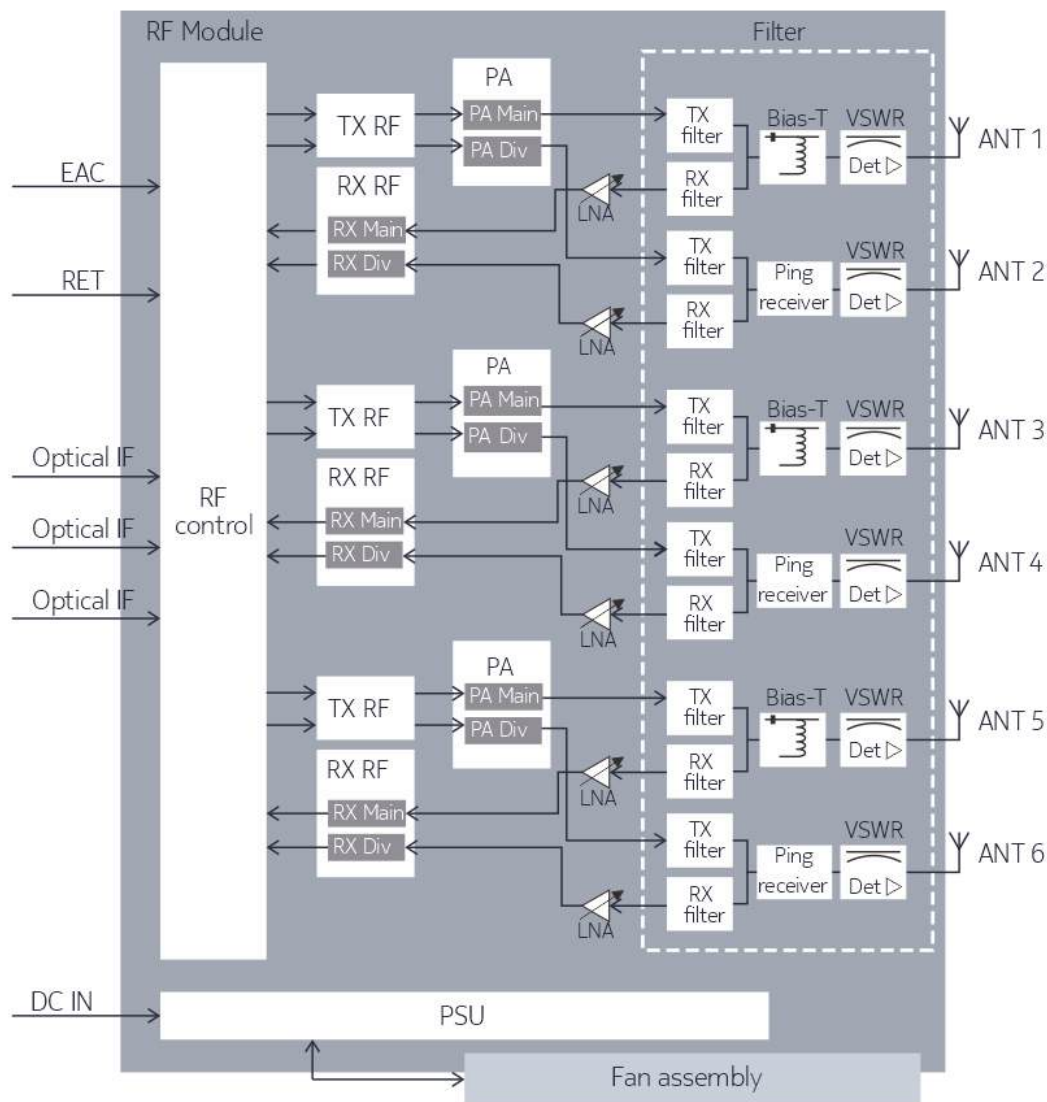


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 20: ARMA functional block diagram



Electrical specifications

Table 66: ARMA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Table 67: ARMA TX output power tolerance

Property	Value	Description
Typical power tolerance (nominal temperature)	± 0.8 dB	Over full TX RF bandwidth, nominal ambient temperature 25°C (77°F)
Typical power tolerance (extreme temperature)	± 2.0 dB	Over full TX RF bandwidth, extreme ambient temperature 55°C (131°F)

LTE power back-off

Table 68: Recommended ARMA power back-off in 256 QAM mode

Rated power [W]	Single carrier [dB]	Dual carrier [dB]
60	0	0.6

NR power back-off

Recommended value for `dLQam256PowerBackoffSub6` parameter is:

- 0.6 dB for 3GPP performance requirement

Related optional items

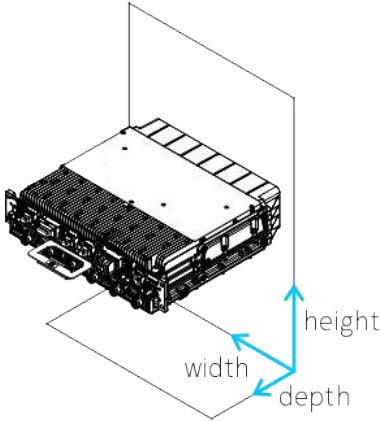
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- EMHA Flexi 3U mounting cover (470316A)
- EMHH Flexi 3U high mounting cover (473187A)
- FMAA Flexi mounting auxiliary bracket (471657A)
- FMFA Flexi mounting kit for floor, wall and pole (470149A)
- FMHA Flexi side covers (471524A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- AMRM AirScale one clip kit for RF modules (475018A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)
- FSEP Flexi system external OVP (473246A)
- FSES Flexi system external OVP (472285A)

Installation options

- *Pole (vertical)*
- *Wall (vertical)*
- *Stack*
- *Inside cabinet*
- *One-clip rail*

Dimensions and weight

Table 69: ARMA dimensions and weight

Property	Value	Dimensions orientation
Height	118 mm (4.65 in.)	
Width	441 mm (17.36 in.)	
Depth	402 mm (15.83 in.)	
Weight	23 kg (50.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 70: ARMA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.1.8 AirScale RFM 6T6R B28/n28 360 W (ARPA)

ARPA (474802A) is introduced by LTE4663/5GC002227.

Functional description

Table 71: ARPA functional specification

Property	Value
Maximum output power	360 W
Modulation	256 QAM
Number of TXX	6T6R
Outdoor installation	Yes
Supported technologies	LTE, NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B28/n28: 758-788 MHz
RX frequency range	B28/n28: 703-733 MHz
DL filter bandwidth	30 MHz
UL filter bandwidth	30 MHz
Instantaneous bandwidth (iBW)	30 MHz
Occupied bandwidth (oBW)	30 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	LTE: 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

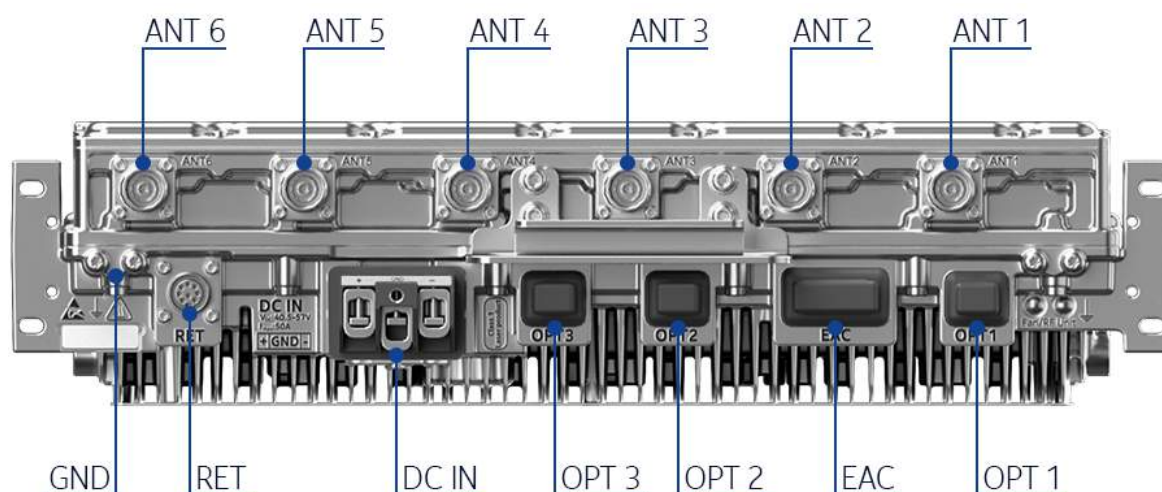
Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 21: ARPA interfaces



*EMHH Flexi 3U Casing and High Covers F&B (473187A) are required when connecting either 4.3-10 straight antenna cables or RET cables. For details, see *Nokia BTS Optional Items Description*.

Table 72: ARPA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 10 mm ² to 35 mm ² (7 AWG to 2 AWG)
Antenna connector	ANT	6	4.3-10	EMHH required for straight cables*
Remote Electrical Tilt	RET	1	8-pin circular	RS-485; EMHH required*
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6; Nokia IP seal
Grounding	GND 	1	2 x M5 screw	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 73: ARPA ALD support

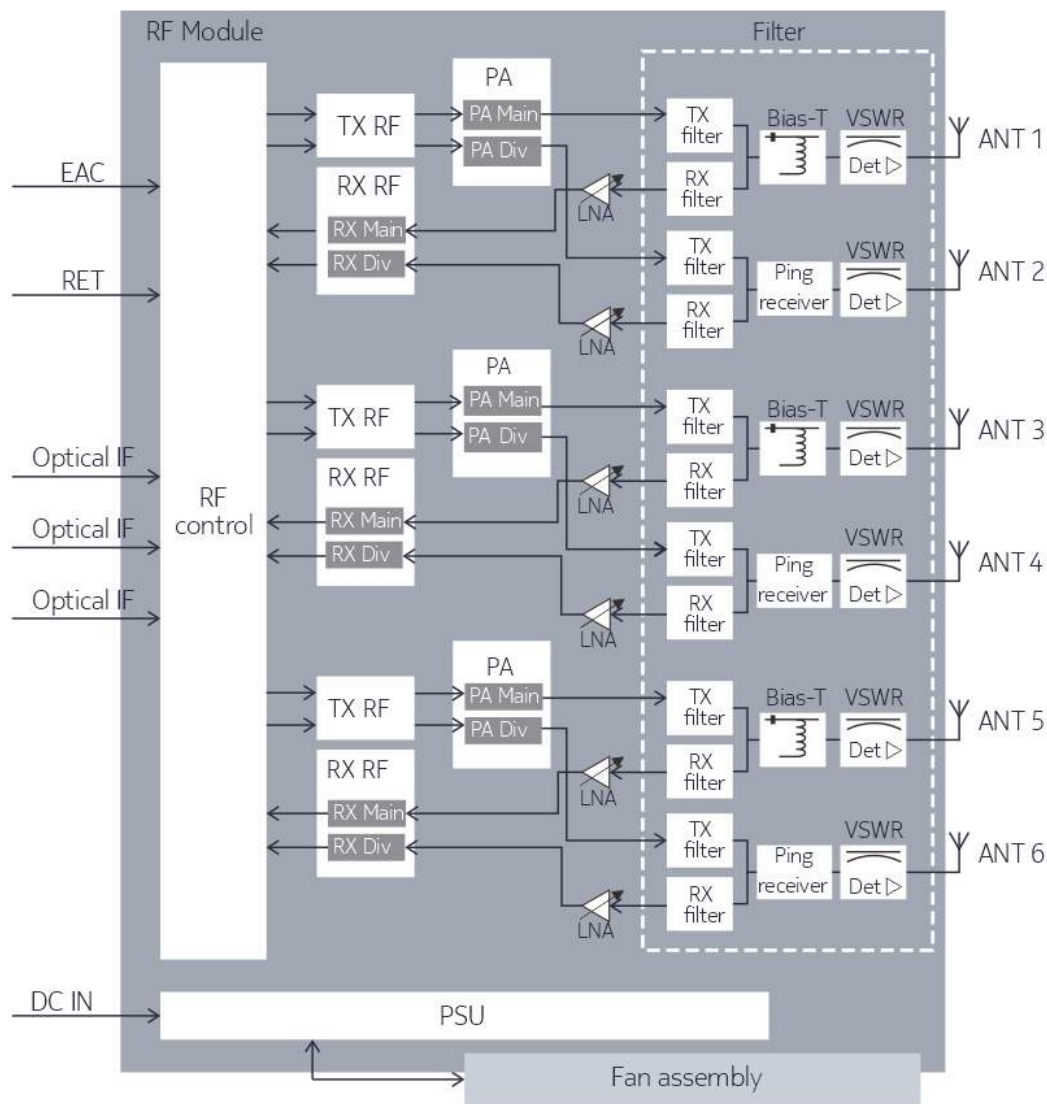
ALD support	Value
AISG	ANT1, ANT3, ANT5: AISG 2.0/3.0 ANT2, ANT4, ANT6: AISG 3.0 ping receiver RET: AISG 3.0
Voltage	ANT1, ANT3, ANT5, RET: 14.5 V DC
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 22: ARPA functional block diagram



Electrical specifications

Table 74: ARPA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Table 75: ARPA TX output power tolerance

Property	Value	Description
Typical power tolerance (nominal temperature)	± 0.8 dB	Over full TX RF bandwidth, nominal ambient temperature 25°C (77°F)
Typical power tolerance (extreme temperature)	± 2.0 dB	Over full TX RF bandwidth, extreme ambient temperature 55°C (131°F)

LTE power back-off

Table 76: Recommended ARPA power back-off in 256 QAM mode

Rated power [W]	Single carrier [dB]	Dual carrier [dB]
60	0	0.6

Related optional items

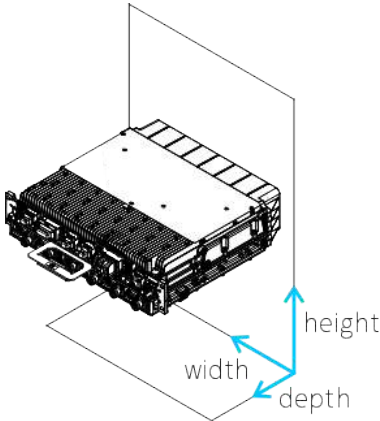
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- EMHA Flexi 3U mounting cover (470316A)
- EMHH Flexi 3U high mounting cover (473187A)
- FMAA Flexi mounting auxiliary bracket (471657A)
- FMFA Flexi mounting kit for floor, wall and pole (470149A)
- FMHA Flexi side covers (471524A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- AMRM AirScale one clip kit for RF modules (475018A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)
- FSEP Flexi system external OVP (473246A)
- FSES Flexi system external OVP (472285A)

Installation options

- *Pole (vertical)*
- *Wall (vertical)*
- *Stack*
- *Inside a cabinet*
- *One-clip rail installation*

Dimensions and weight

Table 77: ARPA dimensions and weight

Property	Value	Dimensions orientation
Height	118 mm (4.65 in.)	
Width	441 mm (17.36 in.)	
Depth	402 mm (15.83 in.)	
Weight	23 kg (50.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 78: ARPA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.2 Single band RRHs descriptions

5.2.1 AirScale RRH 2T B32/B75 120 W (AHSA)

AHSA (475015A) is introduced by LTE5048 (for LTE).

Functional description

Table 79: AHSA functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM
Number of TXRX	2T
Outdoor installation	Yes
Supported technologies	LTE
Duplex mode - supported standard	FDD
TX frequency range	B32: 1452-1496 MHz B75: 1432-1517 MHz
DL filter bandwidth	85 MHz
Instantaneous bandwidth (iBW)	B32: 44 MHz B75: 85 MHz
Occupied bandwidth (oBW)	80 MHz
Number of carriers per pipe	Up to 6
Supported bandwidths	LTE: 5, 10, 15, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 23: AHSA interfaces

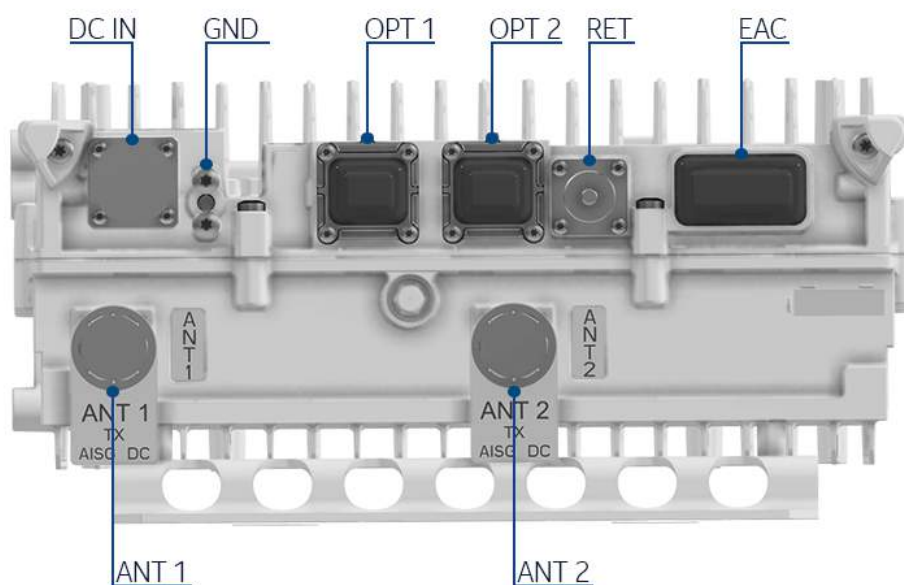


Table 80: AHSA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	2	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
External Alarm Connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 81: AHSA ALD support

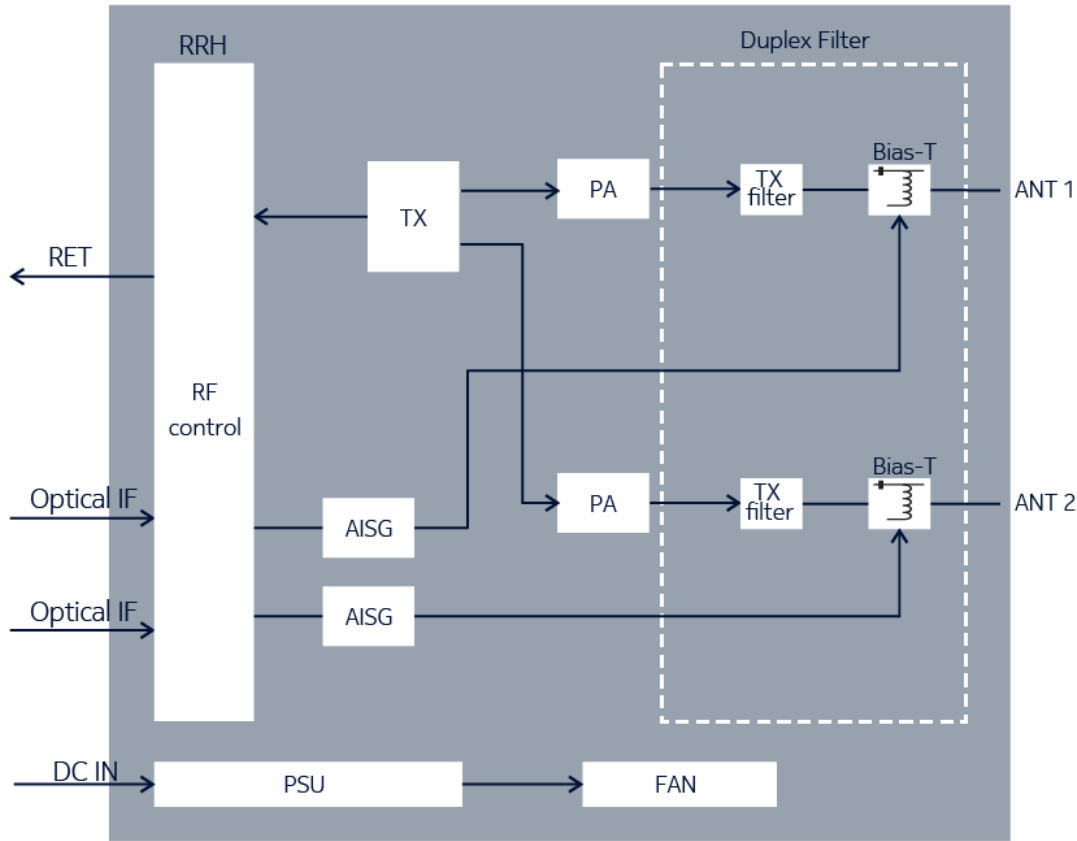
ALD support	Value
AISG	RET, ANT1, ANT2: AISG 2.0/3.0
Voltage	RET, ANT1, ANT2: 14.5 V
Power per port	30 W, 45 W total

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 24: AHSA functional block diagram



Electrical specifications

Table 82: AHSA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)

- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

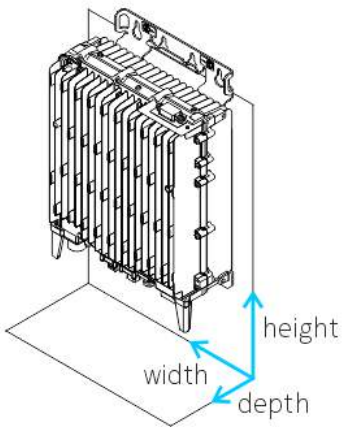
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 83: AHSA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.25 in.) With mounting brackets: 428 mm (16.87 in.)	
Width	309 mm (12.17 in.)	
Depth	Core RRH: 130 mm (5.12 in.) With mounting brackets: 153 mm (6.02 in.)	
Weight	12.0 kg (26.5 lb)	

Environmental specifications

Table 84: AHSA environmental specifications

Property	Value
Maximum operational outdoor temperature (in the shade)	55°C (131°F)
Maximum operational outdoor temperature (in the sun)	55°C (131°F)
Maximum indoor temperature	45°C (113°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.2 AirScale RRH 4T B32/B75 320 W (AHSB)

AHSB (476343A) is introduced by CB009778 (for LTE).

Functional description

Table 85: AHSB functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXRX	4T
Outdoor installation	Yes
Supported technologies	LTE
Duplex mode	FDD
TX frequency range	B32: 1452-1496 MHz B75: 1432-1517 MHz
DL filter bandwidth	85 MHz
Instantaneous bandwidth (iBW)	B32: 44 MHz B75: 85 MHz
Occupied bandwidth (oBW)	B32: 44 MHz B75: 80 MHz
Number of carriers per pipe	Up to 8 (≤10 MHz, see limitations)
Supported bandwidths	LTE: 5, 10, 15, 20 MHz
Limitations	Carrier bandwidths (cBW) of 15 and 20 MHz consume 2 carriers when planning deployments.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 25: AHSB interfaces

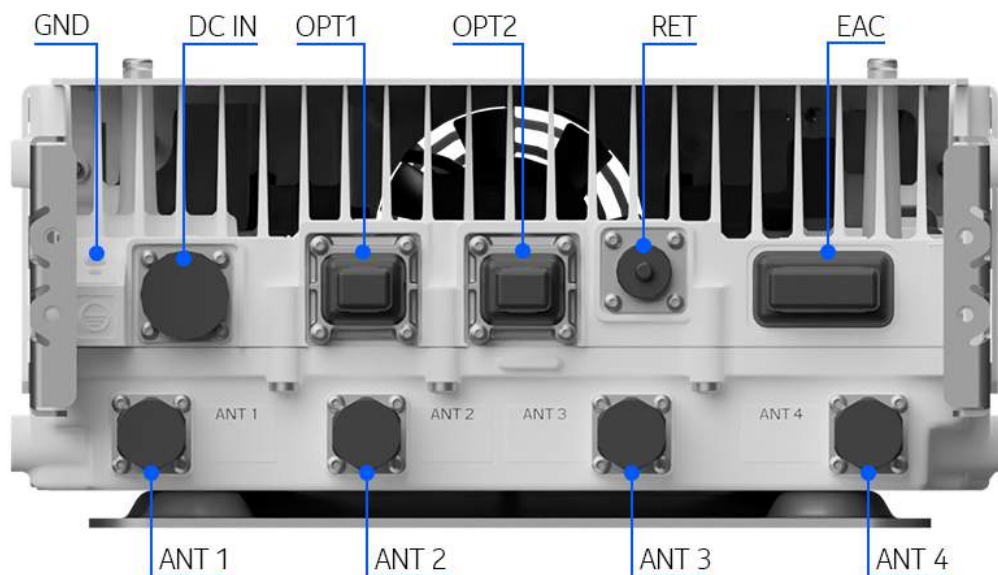


Table 86: AHSB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB or APPC
Antenna connector	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or two M5 screws	-



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

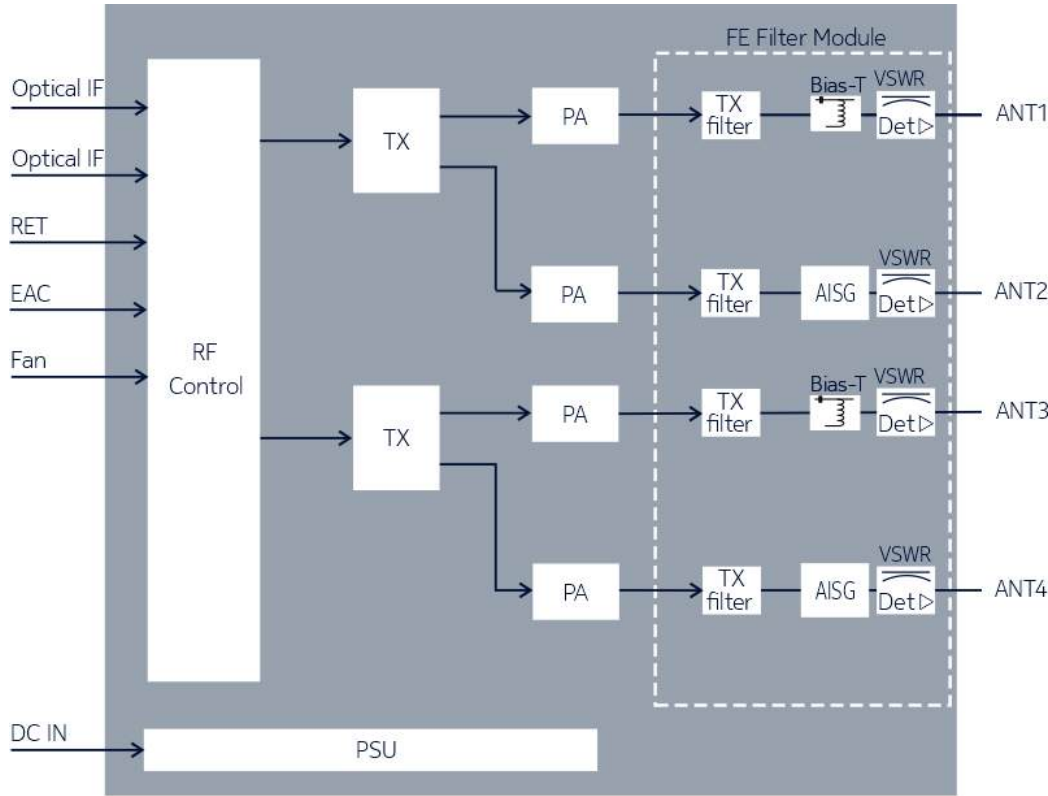
Antenna line device (ALD) support

Table 87: AHSB ALD support

Property	Value
AISG	RET, ANT1, ANT2, ANT3, ANT4: AISG 2.0/3.0
Voltage	RET, ANT1, ANT3: 14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 26: AHSB functional block diagram



Electrical specifications

Table 88: AHSB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

Table 89: AHSB power back-off in 256 QAM

RF sharing [dB]	Single carrier [dB]	Dual or triple carrier [dB]	Quad carrier [dB]
0	≤ 0.1	≤ 0.7	≤ 0.9

Related optional items

- AMBF AirScale book mount kit 126–150 (474278A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRB AirScale one clip bracket 126–200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–300 mm) (472821A)

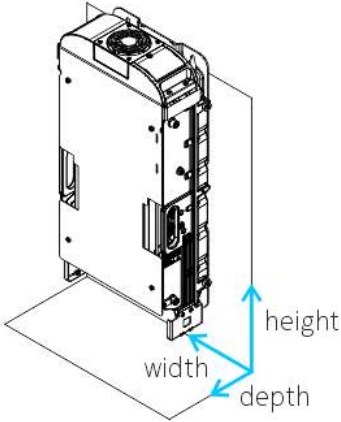
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

- Pole:
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- Wall:
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 90: AHSB dimensions and weight

Property	Value	Dimensions orientation
Height	With fan: 650 mm (25.59 in.)	
Width	Core RRH: 308 mm (12.13 in.) With side mounting bosses: 327 mm (12.87 in.)	
Depth	With mounting brackets and fan: 148 mm (5.83 in.)	
Weight	Without mounting brackets: 25.7 kg (56.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 91: AHSB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.2.3 AirScale RRH 2T2R B3/n3 120 W (FHEL)

FHEL (473475A) is introduced by LTE2680/CB006679.

Functional description

Table 92: FHEL functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	2T2R
Outdoor installation	Yes
Supported technologies	GSM, LTE, NR
RF sharing/concurrent mode	NR, LTE, GSM
Duplex mode, supported standard	FDD
TX frequency range	B3/n3: 1805-1880 MHz
RX frequency range	B3/n3: 1710-1785 MHz
DL filter bandwidth	75 MHz
UL filter bandwidth	75 MHz
Instantaneous bandwidth (iBW) (DL)	75 MHz 37.5 MHz in GSM
Instantaneous bandwidth (iBW) (UL)	75 MHz
Occupied bandwidth (oBW)	40 MHz
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 27: FHEL interfaces

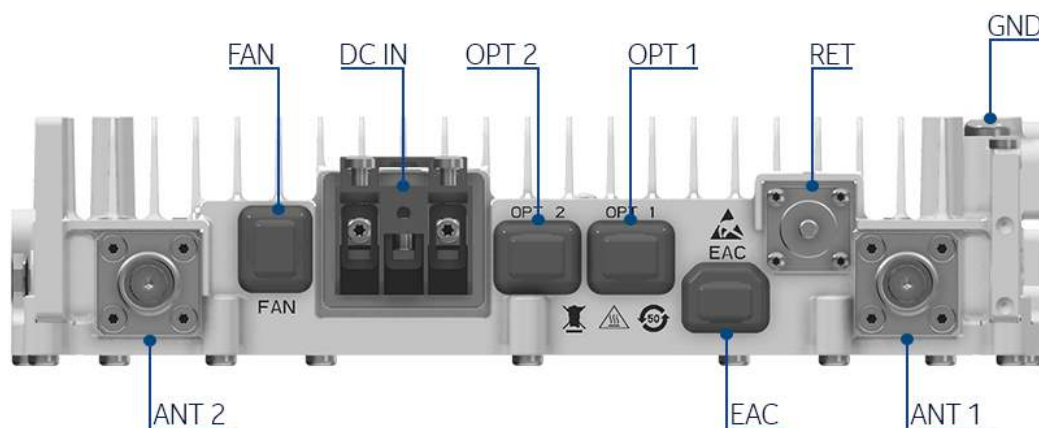


Table 93: FHEL interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 3.3 mm ² to 35 mm ² (12 AWG to 2 AWG)
Antenna connector	ANT	2	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	USB 3.0 Type-A	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	6 Gbps, OBSAI, Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	Fan	1	2-pin Micro-Fit	-



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 94: FHEL ALD support

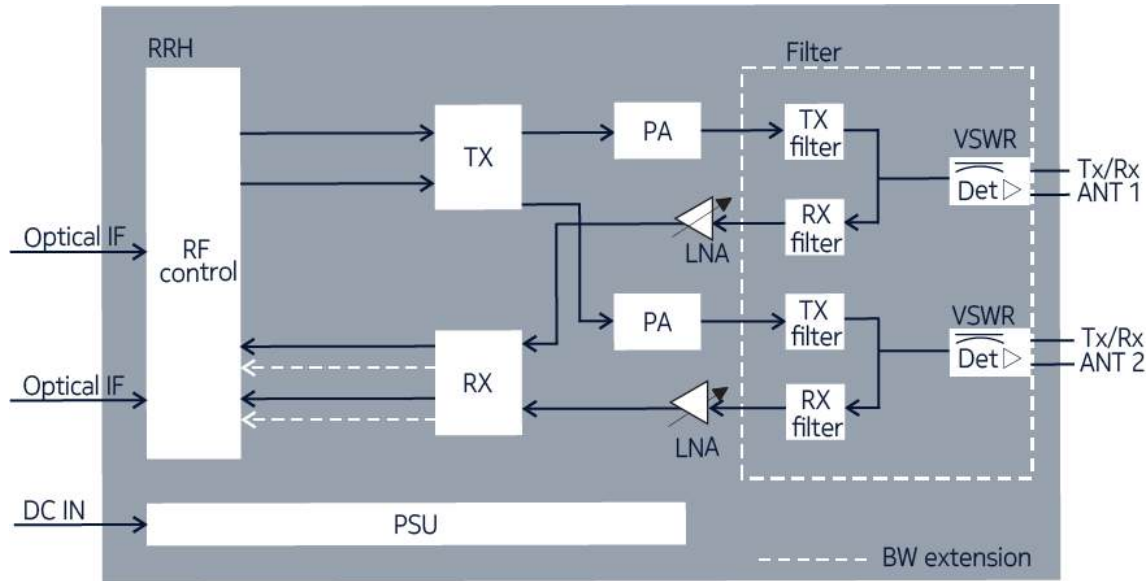
ALD support	Value
AISG	RET: 2.0
Voltage	RET: 14.5 V
Power on RET port	30 W

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 28: FHEL functional block diagram



Electrical specifications

Table 95: FHEL electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

Recommended power back-off

Table 96: FHEL power back-off in 256 QAM

Single carrier [dB]	Dual carrier [dB]
0.7	1

GSM cell power range



Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- Mandatory optional item: FMNG AirScale 1.0 small book mount kit (473980A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- FMND AirScale small fan kit (473598A)
- AMLA flat mount adapter bracket (473881A)
- FMNH AirScale ladder mount kit (474091A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)

Installation options

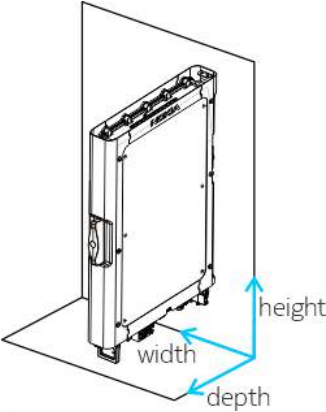
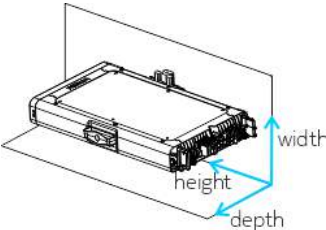
- *Wall*
 - *Flat*
 - *Vertically*
 - *Horizontally*
- *Pole*
 - *Flat*
 - *Vertically*
 - *Horizontally*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 97: FHEL dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 591.6 mm (23.29 in.) With cover, handle, and unit bracket: 600 mm (23.62 in.) With cover, handle, unit bracket, and fan kit: 630.2 mm (24.81 in.)	Dimensions orientation in vertical mount with cover 
Width	Core RRH: 77.5 mm (3.05 in.) With cover, handle, and unit bracket: 80 mm (3.15 in.) With cover, handle, unit bracket, and fan kit: 80 mm (3.15 in.) With cover, handle, unit bracket, and fan kit (unit bracket rotated 90 degrees for horizontal mounting): 143 mm (5.63 in.)	Dimensions orientation in horizontal mount with cover and fan 
Depth	Core RRH: 320 mm (12.6 in.) With cover, handle, and unit bracket: 424 mm (16.69 in.) With cover, handle, unit bracket, and fan kit: 424 mm (16.69 in.)	
Weight	Core RRH: 12.5 kg (27.5 lb) With cover, handle and unit mounting bracket: 14.4 kg (31.7 lb) With cover, handle, unit mounting bracket, and fan kit: 15.5 kg (34.2 lb)	

Environmental specifications

Table 98: FHEL environmental specifications

Property	Value
Maximum operational outdoor temperature in the shade, assuming wind speed is 3 m/s (at constant high ambient temperature, maximum output power might be limited)	55°C (131°F)
Maximum operational outdoor temperature in the sun, assuming wind speed is 3 m/s (at constant high ambient temperature, maximum output power might be limited)	50°C (122°F)
Maximum indoor temperature, assuming wind speed is 0 m/s, valid for fanless products (at constant high ambient temperature, maximum output power might be limited)	40°C (104°F)
Minimum operational temperature (including cold start)	-40°C (-40°F)
IP rating	IP65

5.2.4 AirScale RRH 2T2R 900J 120 W (FHDI)

FHDI (473825A) is introduced by LTE3516/SR001451/CB006586.

Functional description

Table 99: FHDl functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	2T2R
Outdoor installation	Yes
Supported technologies	GSM, WCDMA, LTE, NR
Duplex mode - supported standard	FDD
TX frequency range	B8: 935–960 MHz
RX frequency range	B8: 890–915 MHz
DL filter bandwidth	25 MHz
UL filter bandwidth	25 MHz
Instantaneous bandwidth (iBW)	25 MHz
Occupied bandwidth (oBW)	25 MHz
Number of carriers per pipe	Up to 5
Supported bandwidths	GSM, WCDMA, LTE: 1.4, 3, 5, 10 MHz NR: 5, 10 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 29: FHDl interfaces

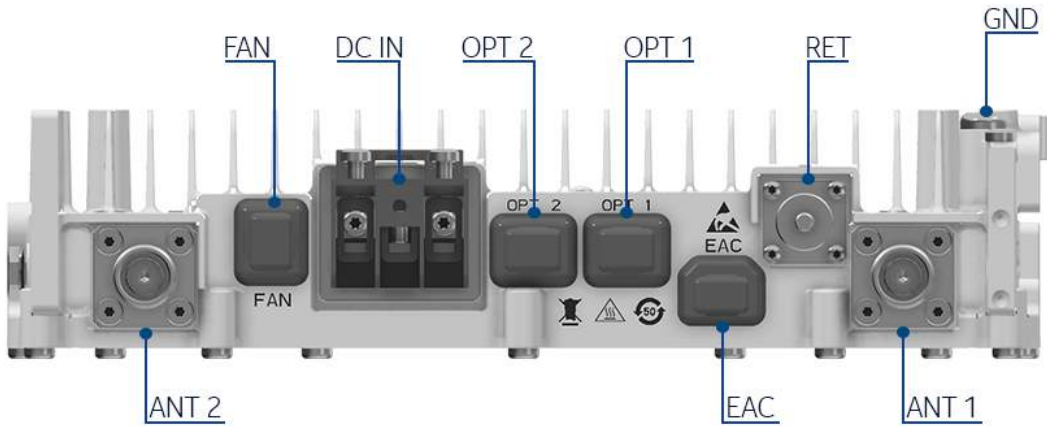


Table 100: FHDI interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	3-pole screw terminal	Allowed wire gauge: 3.3 mm ² to 35 mm ² (12 AWG to 2 AWG)
Antenna	ANT	2	4.3-10	–
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	USB 3.0 Type A	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+	6 Gbps, OBSAI, Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–
Fan	Fan	1	2-pin Micro-Fit	–



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 101: FHDl ALD support

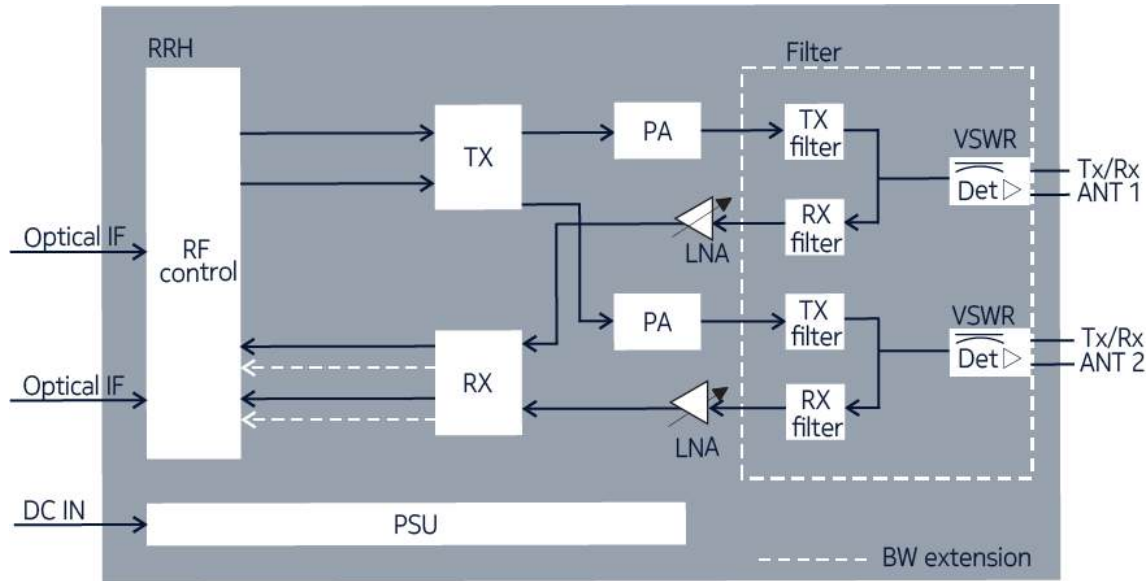
Property	Value
AISG	RET: 2.0
Voltage	RET: 14.5 V
Power per port	30 W

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 30: FHDl functional block diagram



Electrical specifications

Table 102: FHDl electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

 Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

GSM cell power range

 Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- FMNG AirScale 1.0 small book mount kit (473980A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- FMND AirScale small fan kit (473598A)
- AMLA flat mount adapter bracket (473881A)
- FMNH AirScale ladder mount kit (474091A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)

Installation options

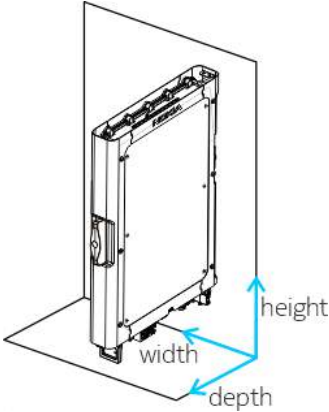
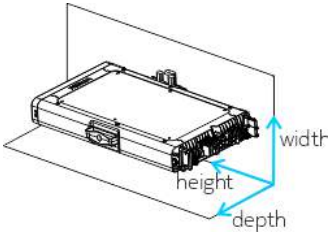
- *Wall*
 - *Flat*
 - *Vertically*
 - *Horizontally (secondary bracket rotated 90°)*
 - *Horizontally (unit bracket rotated 90°)*
- *Pole*
 - *Flat*
 - *Vertically*
 - *Horizontally*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 103: FHDl dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 591.6 mm (23.3 in.) With cover, handle, and unit bracket: 600 mm (23.6 in.) With cover, handle, unit bracket, and fan kit: 630.2 mm (24.8 in.)	Dimensions orientation in vertical mount with cover 
Width	Core RRH: 77.5 mm (3 in.) With cover, handle, and unit bracket: 80 mm (3.1 in.) With cover, handle, unit bracket, and fan kit : 80 mm (3.1 in.) With cover, handle, unit bracket, and fan kit (unit bracket rotated 90 degrees for horizontal mounting) : 143 mm (5.6 in.)	
Depth	320 mm (9.6 in.) With cover, handle, and unit bracket: 424 mm (16.7 in.) With cover, handle, unit bracket, and fan kit: 424 mm (16.7 in.)	Dimensions orientation in horizontal mount with cover and fan 
Weight	Core RRH: 12.5 kg (27.5 lb) With cover, handle and unit mounting bracket: 14.4 kg (31.7 lb) With cover, handle, unit mounting bracket, and fan kit: 15.5 kg (34.2 lb)	

Environmental specifications

Table 104: FHDl environmental specifications

Property	Value
Maximum operational outdoor temperature in the shade, assuming wind speed is 3 m/s (at a constant high ambient temperature, maximum output power might be limited)	55°C (131°F)
Maximum operational outdoor temperature in the sun, assuming wind speed is 3 m/s (at a constant high ambient temperature, maximum output power might be limited)	50°C (122°F)
Maximum indoor temperature, assuming wind speed is 0 m/s, valid for fanless products (at a constant high ambient temperature, maximum output power might be limited)	40°C (104°F)
Minimum operational temperature (including cold start)	-40°C (-40°F)
IP rating	IP65

5.2.5 AirScale RRH 2T2R B11 120 W (FHKA)

FHKA (473838A) is introduced by LTE3184.

Functional description

Table 105: FHKA functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	2T2R
Outdoor installation	Yes
Supported technologies	LTE
Duplex mode - supported standard	FDD
TX frequency range	1475.9–1495.9 MHz
RX frequency range	1427.9–1447.9 MHz
DL filter bandwidth	20 MHz
UL filter bandwidth	20 MHz
Instantaneous bandwidth (iBW)	20 MHz
Occupied bandwidth (oBW)	20 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	5, 10 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 31: FHKA interfaces

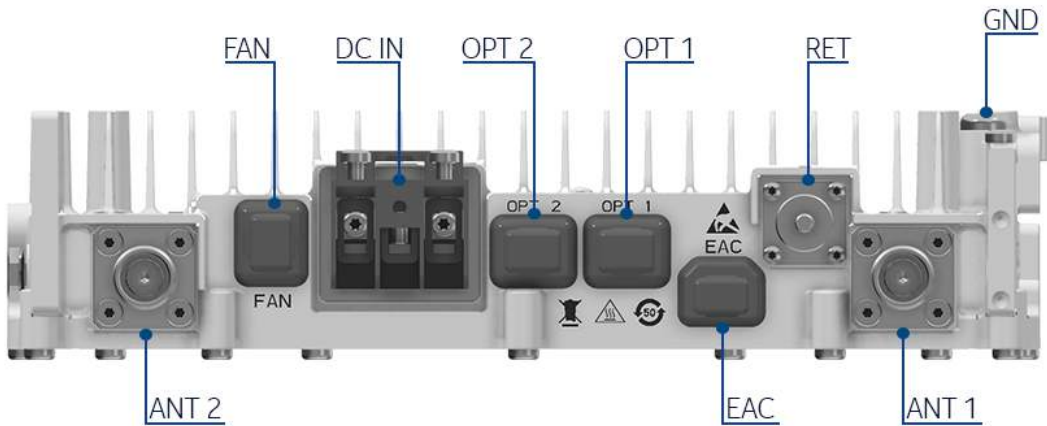


Table 106: FHKA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 3.3 mm ² to 35 mm ² (12 AWG to 2 AWG)
Antenna connector	ANT	2	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	USB 3.0 Type-A	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	6 Gbps, OBSAI, Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	Fan	1	2-pin Micro-Fit	-



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 107: FHKA ALD support

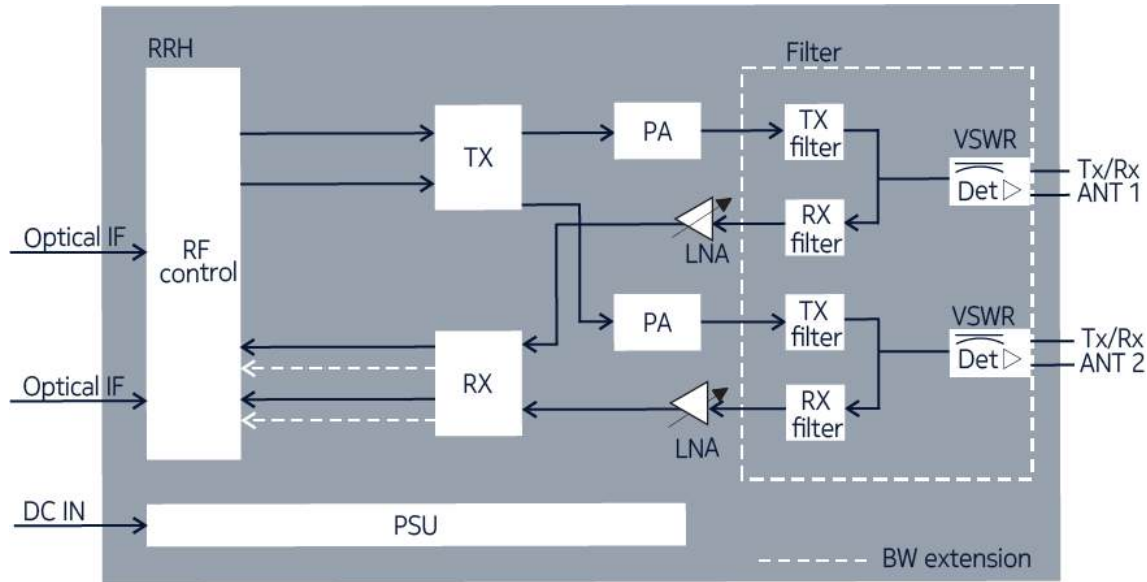
ALD support	Value
AISG	RET: 2.0
Proprietary AISG1.1	No
Voltage	RET: 14.5 V
Power on RET port	30 W

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 32: FHKA functional block diagram



Electrical specifications

Table 108: FHKA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

Related optional items

- Mandatory optional item: FMNG AirScale 1.0 small book mount kit (473980A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- FMND AirScale small fan kit (473598A)
- AMLA flat mount adapter bracket (473881A)
- FMNH AirScale ladder mount kit (474091A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)

Installation options

- *Pole:*
 - *Flat mount*
 - *Vertical*
 - *Horizontal*
- *Wall:*
 - *Flat mount*
 - *Vertical*

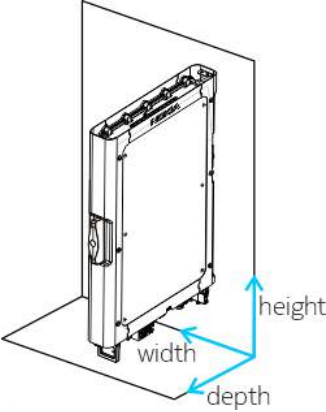
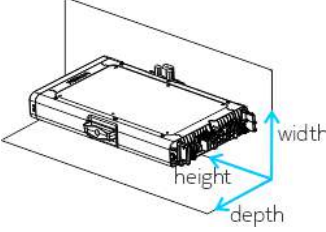
▣ Horizontal

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 109: FHKA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 591.6 mm (23.29 in.) With cover, handle, and unit bracket: 600 mm (23.62 in.) With cover, handle, unit bracket, and fan kit: 630.2 mm (24.81 in.)	Dimensions orientation in vertical mount with cover 
Width	Core RRH: 77.5 mm (3.05 in.) With cover, handle, and unit bracket: 80 mm (3.15 in.) With cover, handle, unit bracket, and fan kit: 80 mm (3.15 in.) With cover, handle, unit bracket, and fan kit (unit bracket rotated 90 degrees for horizontal mounting): 143 mm (5.63 in.)	
Depth	Core RRH: 320 mm (12.6 in.) With cover, handle, and unit bracket: 424 mm (16.69 in.) With cover, handle, unit bracket, and fan kit: 424 mm (16.69 in.)	Dimensions orientation in horizontal mount with cover and fan 
Weight	Core RRH: 12.5 kg (27.5 lb) With cover, handle and unit mounting bracket: 14.4 kg (31.7 lb) With cover, handle, unit mounting bracket, and fan kit: 15.5 kg (34.2 lb)	

Environmental specifications

Table 110: FHKA environmental specifications

Property	Value
Maximum operational outdoor temperature in the shade, assuming wind speed is 3 m/s (at constant high ambient temperature, maximum output power might be limited)	55°C (131°F)
Maximum operational outdoor temperature in the sun, assuming wind speed is 3 m/s (at constant high ambient temperature, maximum output power might be limited)	50°C (122°F)
Maximum indoor temperature, assuming wind speed is 0 m/s, valid for fanless products (at constant high ambient temperature, maximum output power might be limited)	40°C (104°F)
Minimum operational temperature (including cold start)	-40°C (-40°F)
IP rating	IP65

5.2.6 AirScale RRH 2T2R B28/n28 120 W (FHPD)

FHPD (473821A) is introduced by LTE3181/CB006680.

Functional description

Table 111: FHPD functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	2T2R
Outdoor installation	Yes
Supported technologies	NR, LTE
RF sharing/concurrent mode	NR-LTE
Duplex mode, supported standard	FDD
TX frequency range	B28/n28: 758-803 MHz
RX frequency range	B28/n28: 703-748 MHz
DL filter bandwidth	45 MHz
UL filter bandwidth	45 MHz
Instantaneous bandwidth (iBW)	45 MHz
Occupied bandwidth (oBW)	45 MHz
Supported bandwidths	LTE: 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 33: FHPD interfaces

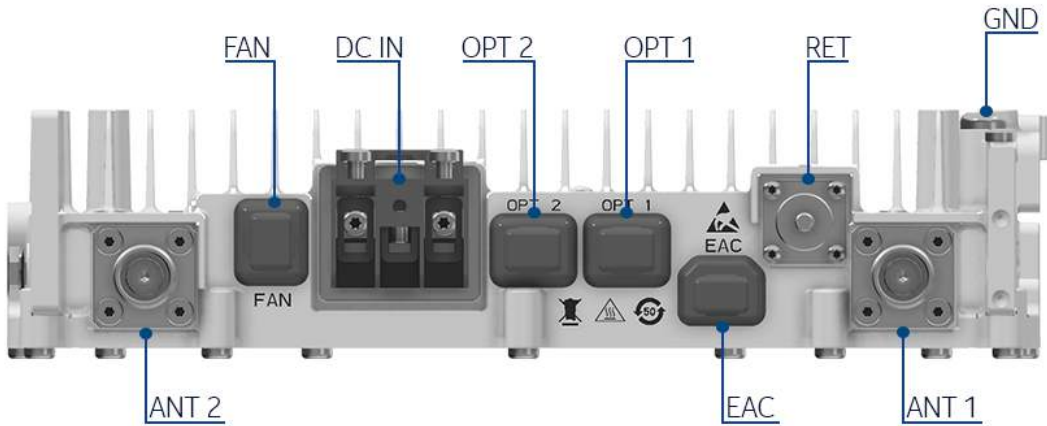


Table 112: FHPD interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 3.3 mm ² to 35 mm ² (12 AWG to 2 AWG)
Antenna connector	ANT	2	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	USB 3.0 Type-A	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	6 Gbps, OBSAI, Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	Fan	1	2-pin Micro-Fit	-

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 113: FHPD ALD support

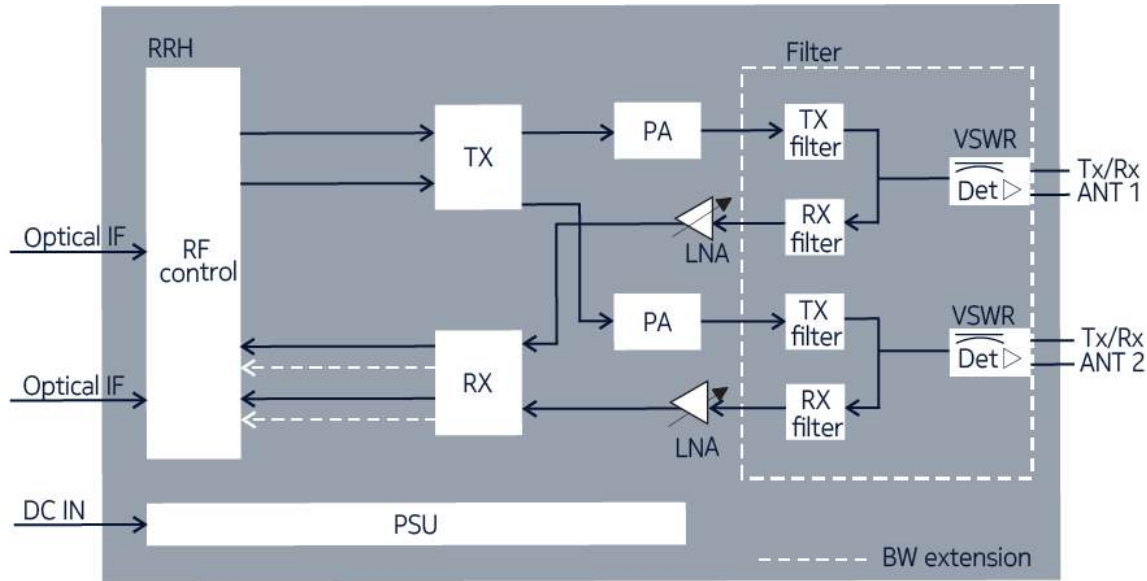
ALD support	Value
AISG	RET: 2.0
Voltage	RET: 14.5 V
Power on RET port	30 W

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 34: FHPD functional block diagram



Electrical specifications

Table 114: FHPD electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

LTE power back-off

Table 115: FHPD power back-off in 256 QAM

Single carrier [dB]	Dual carrier [dB]
0.7	0.8

Related optional items

- Mandatory optional item: FMNG AirScale 1.0 small book mount kit (473980A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- FMND AirScale small fan kit (473598A)
- AMLA flat mount adapter bracket (473881A)
- FMNH AirScale ladder mount kit (474091A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)

Installation options

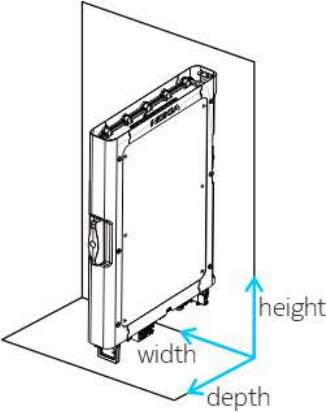
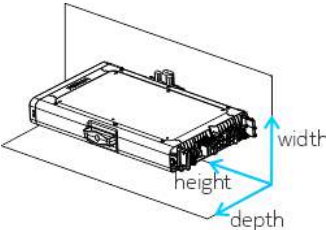
- *Pole:*
 - *Flat mount*
 - *Vertical*
 - *Horizontal*
- *Wall:*
 - *Flat mount*
 - *Vertical*
 - *Horizontal*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 116: FHPD dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 591.6 mm (23.29 in.) With cover, handle, and unit bracket: 600 mm (23.62 in.) With cover, handle, unit bracket, and fan kit: 630.2 mm (24.81 in.)	Dimensions orientation in vertical mount with cover 
Width	Core RRH: 77.5 mm (3.05 in.) With cover, handle, and unit bracket: 80 mm (3.15 in.) With cover, handle, unit bracket, and fan kit: 80 mm (3.15 in.) With cover, handle, unit bracket, and fan kit (unit bracket rotated 90 degrees for horizontal mounting): 143 mm (5.63 in.)	Dimensions orientation in horizontal mount with cover and fan 
Depth	Core RRH: 320 mm (12.6 in.) With cover, handle, and unit bracket: 424 mm (16.69 in.) With cover, handle, unit bracket, and fan kit: 424 mm (16.69 in.)	
Weight	Core RRH: 13.5 kg (29.8 lb) With cover, handle and unit mounting bracket: 15.4 kg (33.9 lb) With cover, handle, unit mounting bracket, and fan kit: 16.5 kg (36.4 lb)	

Environmental specifications

Table 117: FHPD environmental specifications

Property	Value
Maximum operational outdoor temperature in the shade, assuming wind speed is 3 m/s (at constant high ambient temperature, maximum output power might be limited)	55°C (131°F)
Maximum operational outdoor temperature in the sun, assuming wind speed is 3 m/s (at constant high ambient temperature, maximum output power might be limited)	50°C (122°F)
Maximum indoor temperature, assuming wind speed is 0 m/s, valid for fanless products (at constant high ambient temperature, maximum output power might be limited)	40°C (104°F)
Minimum operational temperature (including cold start)	-40°C (-40°F)
IP rating	IP65

5.2.7 AirScale RRH 2T2R 700 120 W (FHPG)

FHPG (474407A) is introduced by LTE4167 (for LTE).

Functional description

Table 118: FHPG functional specification

Property	Value
Maximum output power	120 W
Modulation	64/256 QAM (DL) 64/256 QAM (UL)
Number of TXRX	2T2R
Outdoor installation	Yes
Supported technologies	LTE
Duplex mode - supported standard	FDD
TX frequency range	B28: DL 773-783 MHz
RX frequency range	B28: UL 718-728 MHz
DL filter bandwidth	10 MHz
UL filter bandwidth	10 MHz
Instantaneous bandwidth (iBW)	10 MHz
Occupied bandwidth (oBW)	10 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	3, 5, 10 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 35: FHPG interfaces

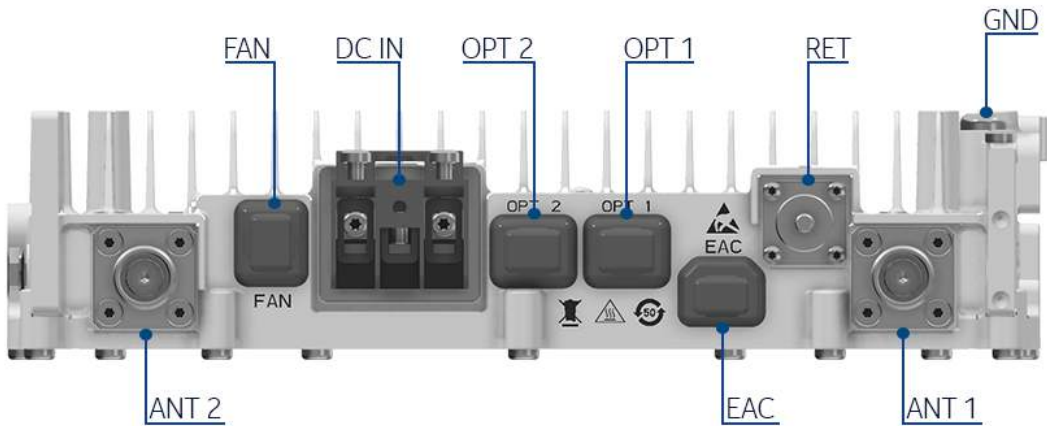


Table 119: FHPG interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: 3.3 mm ² to 35 mm ² (12 AWG to 2 AWG)
Antenna connector	ANT	2	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	USB 3.0 Type-A	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	6 Gbps, OBSAI, Nokia IP seal
Fan	Fan	1	2-pin Micro-Fit	–
Grounding	GND 	1	M8 or dual M5 screws	–



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 120: FHPG ALD support

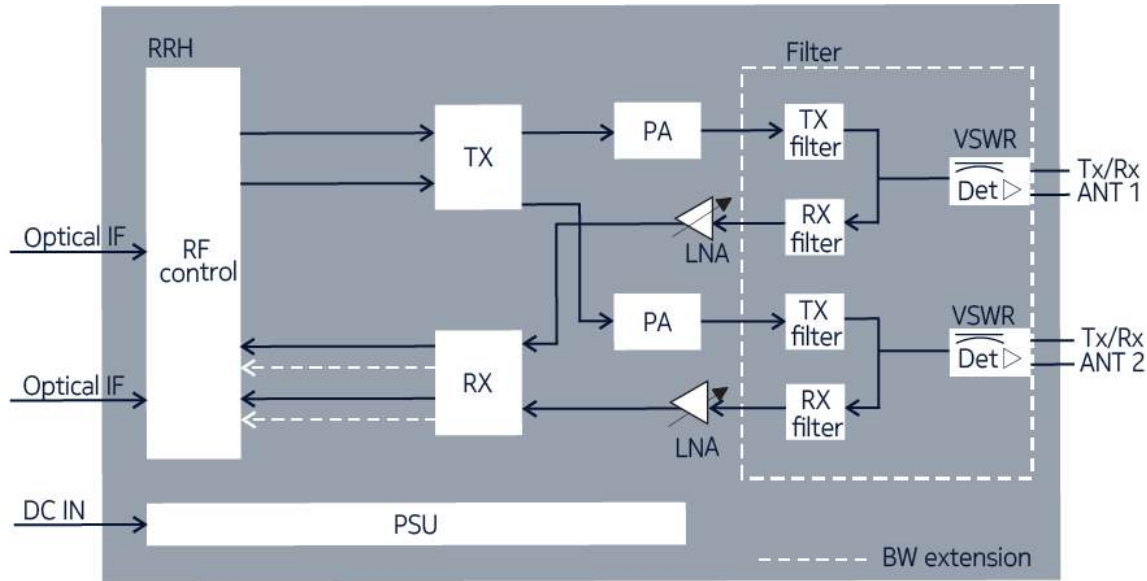
ALD support	Value
AISG	RET: 2.0
Voltage	RET 14.5V
Power per port	30 W

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 36: FHPG functional block diagram



Electrical specifications

Table 121: FHPG electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

Related optional items

- Mandatory optional item: FMNG AirScale 1.0 small book mount kit (473980A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- FMND AirScale small fan kit (473598A)
- AMLA flat mount adapter bracket (473881A)
- FMNH AirScale ladder mount kit (474091A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)

Installation options

- Wall
 - Flat
 - Vertically
 - Horizontally (secondary bracket rotated 90°)
 - Horizontally (unit bracket rotated 90°)
- Pole
 - Flat

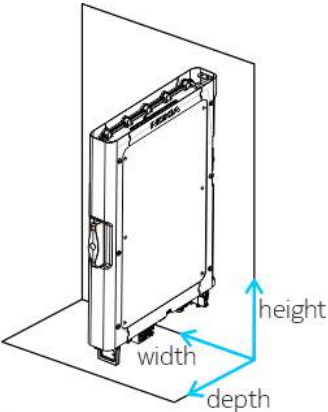
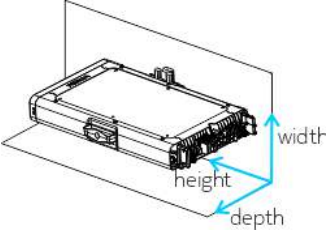
- *Vertically*
- *Horizontally*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 122: FHPG dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 591.6 mm (23.29 in.) With cover, handle, and unit bracket: 600 mm (23.62 in.) With cover, handle, unit bracket, and fan kit: 630.2 mm (24.81 in.)	Dimensions orientation in vertical mount with cover
Width	Core RRH: 77.5 mm (3.05 in.) With cover, handle, and unit bracket: 80 mm (3.15 in.) With cover, handle, unit bracket, and fan kit: 80 mm (3.15 in.) With cover, handle, unit bracket, and fan kit (unit bracket rotated 90 degrees for horizontal mounting): 143 mm (5.63 in.)	
Depth	Core RRH: 320 mm (12.6 in.) With cover, handle, and unit bracket: 424 mm (16.69 in.) With cover, handle, unit bracket, and fan kit: 424 mm (16.69 in.)	
Weight	Core RRH: 13.5 kg (29.8 lb) With cover, handle and unit mounting bracket: 15.4 kg (33.9 lb) With cover, handle, unit mounting bracket, and fan kit: 16.5 kg (36.4 lb)	

Environmental specifications

Table 123: FHPG environmental specifications

Property	Value
Maximum operational outdoor temperature (in the shade)	55°C (131°F)
Maximum operational outdoor temperature (in the sun)	55°C (131°F)
Maximum indoor temperature	45°C (113°F)
Minimum operational temperature	-40°C (-40°F)
IP rating	IP65

5.2.8 AirScale RRH 2T4R B1/n1 120 W (AHGA)

AHGA (474254A) is introduced by LTE3764/SR001768/5GC002304.

Functional description

Table 124: AHGA functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM
Number of TXX	2T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	WCDMA, LTE, NR
RF sharing/concurrent mode	LTE-WCDMA, LTE-NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B1/n1: 2110-2170 MHz
RX frequency range	B1/n1: 1920-1980 MHz
DL filter bandwidth	60 MHz
UL filter bandwidth	60 MHz
Instantaneous bandwidth (iBW)	60 MHz
Occupied bandwidth (oBW)	60 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	WCDMA: B1: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8 MHz LTE: B1: 5, 10, 15, 20 MHz NR: n1: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 37: AHGA interfaces

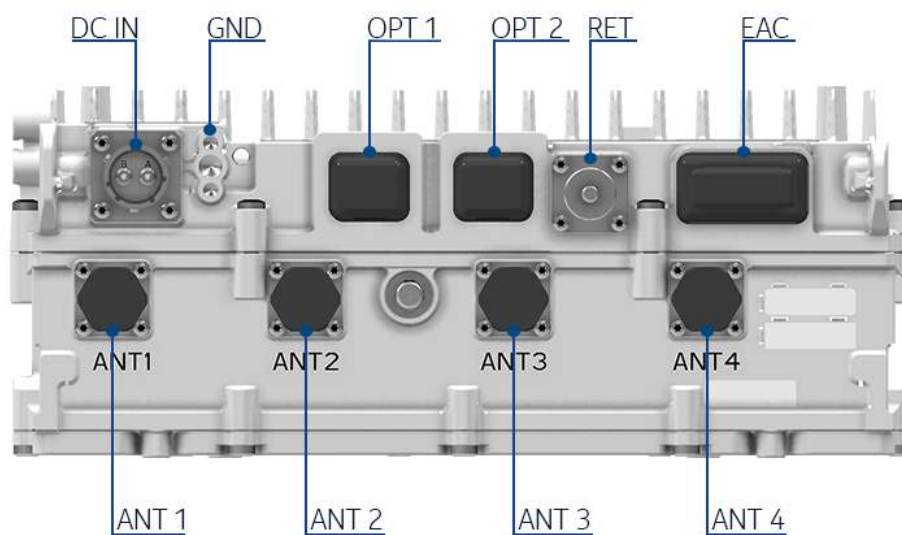


Table 125: AHGA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 126: AHGA ALD support

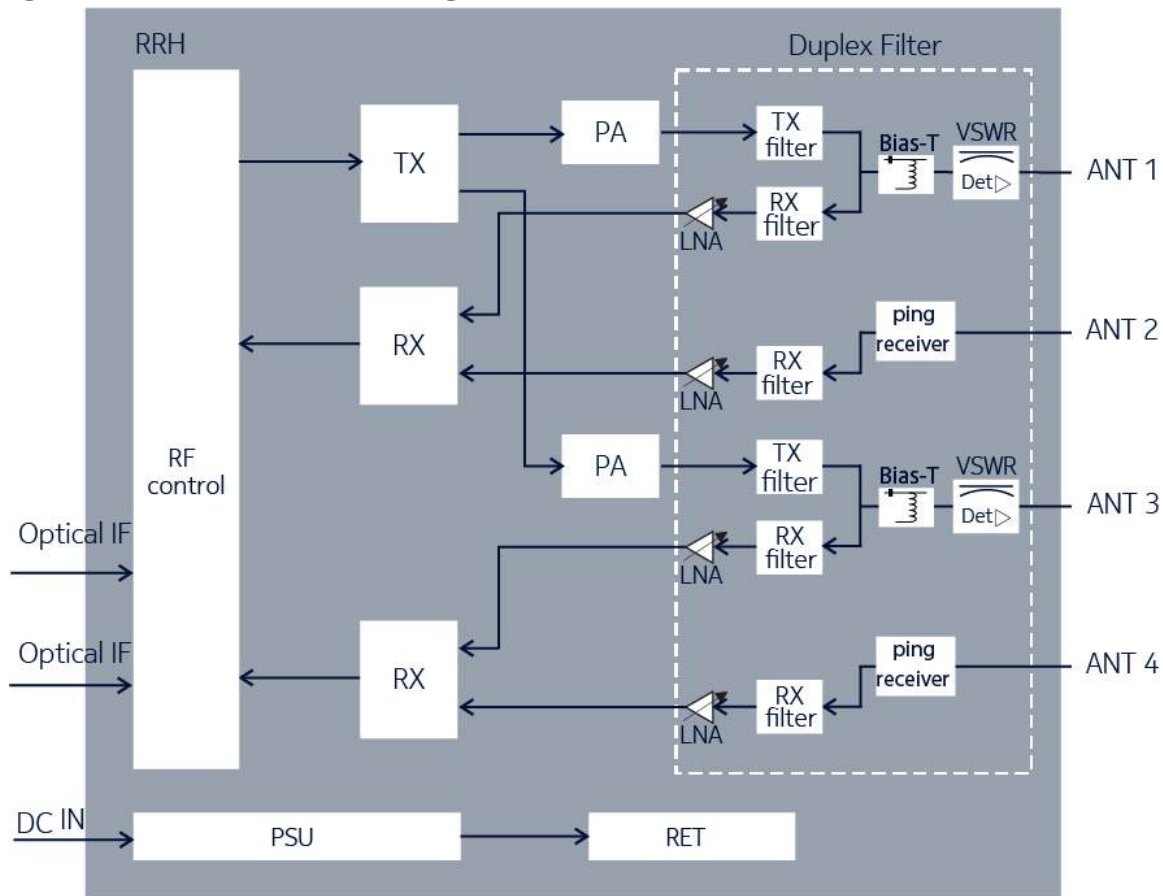
ALD support	Value
AISG	ANT1, ANT3: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 ping receiver RET: AISG 2.0/3.0
Voltage	ANT1, ANT3, RET: 14.5 V
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 38: AHGA functional block diagram



Electrical specifications

Table 127: AHGA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

LTE power back-off

Table 128: Recommended AHGA power back-off in 256 QAM

Single carrier [dB]	Dual carrier [dB]
0.6	1.2

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGC AirScale2 cover 300 x 101-125 (474269A)
- AMBD AirScale bookmount kit 76-100 (474276A) - AHGA v101 (474254A.101) use AMBD (474276A) unit bracket and AMBE (474277A) secondary bracket for bookmount installation
- AMBE AirScale bookmount kit 101-125 (474277A) - AHGA v202 (474254A.202) uses whole AMBE (474277A) bookmount kit for bookmount installation
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - Horizontal with an optional fan
 - One-clip rail
 - Book mounting

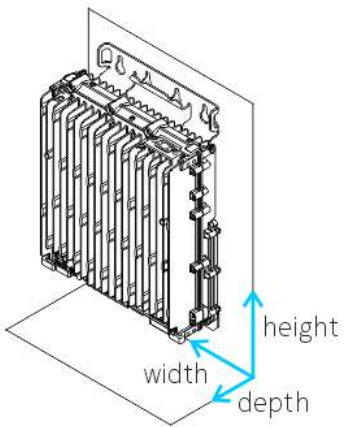


Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 129: AHGA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With upper and lower mounting brackets: 427.5 mm (16.83 in.)	
Width	295 mm (11.61 in.)	
Depth	Core RRH: 100 mm (3.94 in.) With mounting brackets: 124 mm (4.88 in.)	
Weight	11 kg (24.3 lb)	

Environmental specifications

Table 130: AHGA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.9 AirScale RRH 2T4R B1 120 W (AHGC)

AHGC (474586A) is introduced for LTE by LTE4510 and for NR by CB010286.

Functional description

Table 131: AHGC functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM
Number of TXX	2T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
Concurrent mode	LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B1: 2110-2130 MHz
RX frequency range	B1: 1920-1940 MHz
DL filter bandwidth	20 MHz
UL filter bandwidth	20 MHz
Instantaneous bandwidth (iBW)	20 MHz
Occupied bandwidth (oBW)	20 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE/NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 39: AHGC interfaces

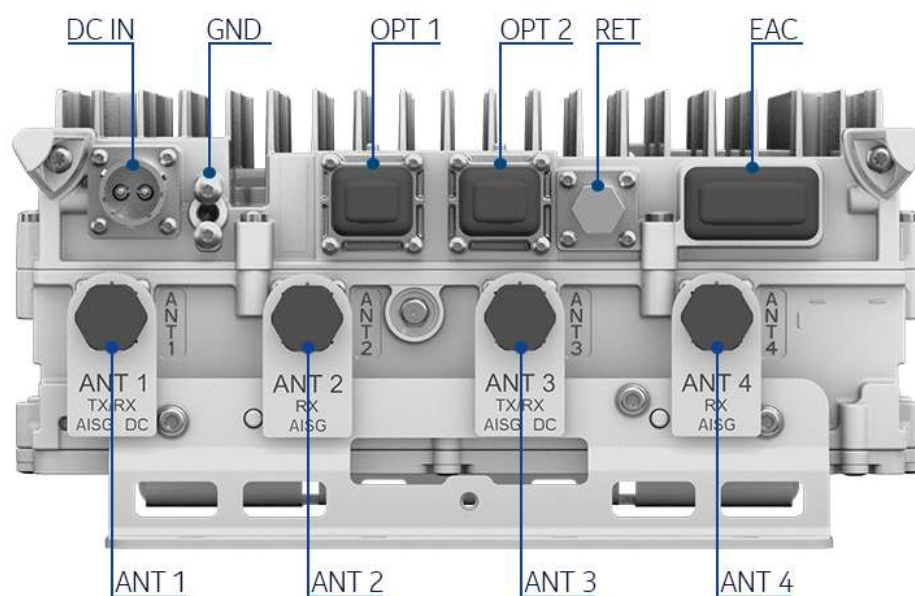


Table 132: AHGC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 133: AHGC ALD support

ALD support	Value
AISG	ANT1, ANT3: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 ping receiver RET: AISG 2.0/3.0
Voltage	ANT1, ANT3, RET: 14.5 V
Power per port	30 W, 45 W total

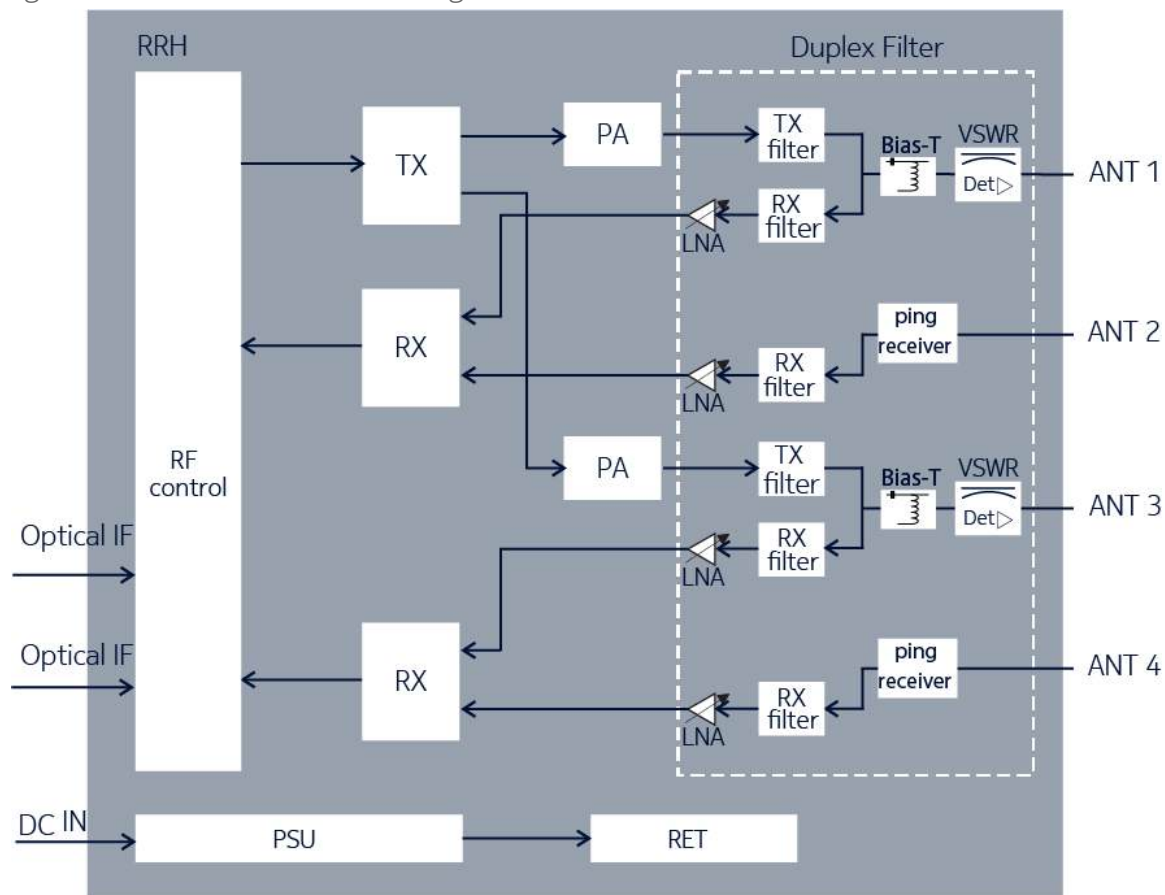


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 40: AHGC functional block diagram



Electrical specifications

Table 134: AHGC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGC AirScale2 cover 300 x 101-125 (474269A)
- AMBP AirScale book mount kit for AHGC (475324A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

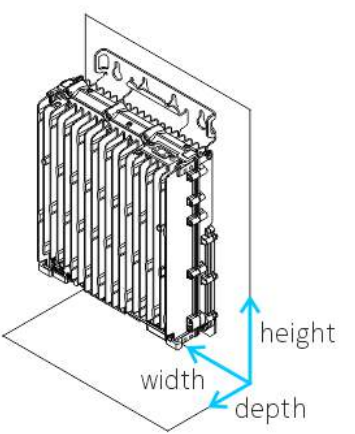
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 135: AHGC dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With upper and lower mounting brackets: 427.5 mm (16.8 in.)	
Width	295 mm (11.61 in.)	
Depth	Core RRH: 100 mm (3.94 in.) With mounting brackets: 124 mm (4.88 in.)	
Weight	11 kg (24.2 lb)	

Environmental specifications

Table 136: AHGC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.10 AirScale RRH 2T4R B3/n3 160 W (AHEC)

AHEC (473806A) is introduced by LTE3087/SR001389/5GC000734.

Functional description

Table 137: AHEC functional specification

Property	Value
Maximum output power	160 W
Modulation	256 QAM
Number of TXX	2T4R
Outdoor installation	Yes
Supported technologies	GSM, LTE, NR
RF sharing/concurrent mode	Multi-RAT operation NR, LTE, GSM (for concurrent part)
Duplex mode, supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B3: 1805–1860 MHz
RX frequency range	B3: 1710–1765 MHz
DL filter bandwidth	55 MHz
UL filter bandwidth	55 MHz
Instantaneous bandwidth (iBW)	55 MHz
Occupied bandwidth (oBW)	55 MHz
Number of carriers per pipe	Up to 6
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 41: AHEC interfaces

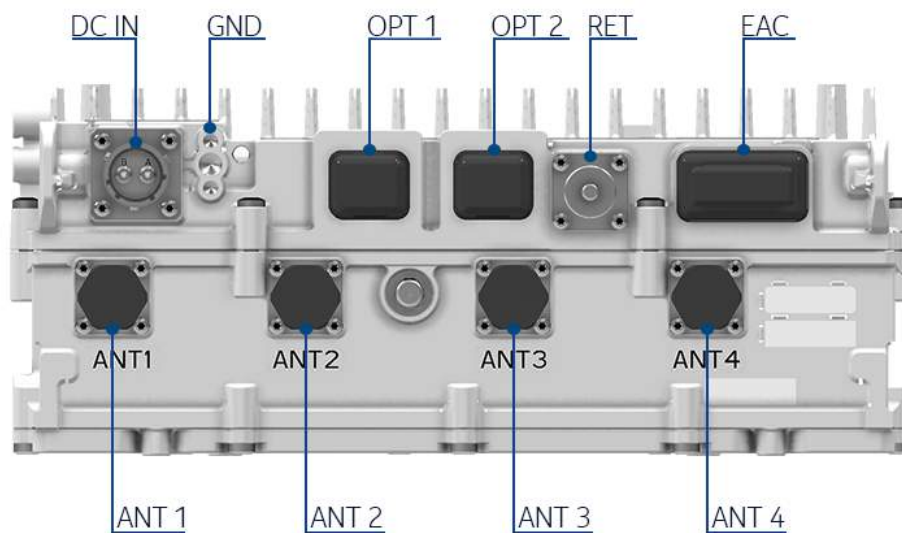


Table 138: AHEC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Grounding	GND 	1	M8 or dual M5 screws	-



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

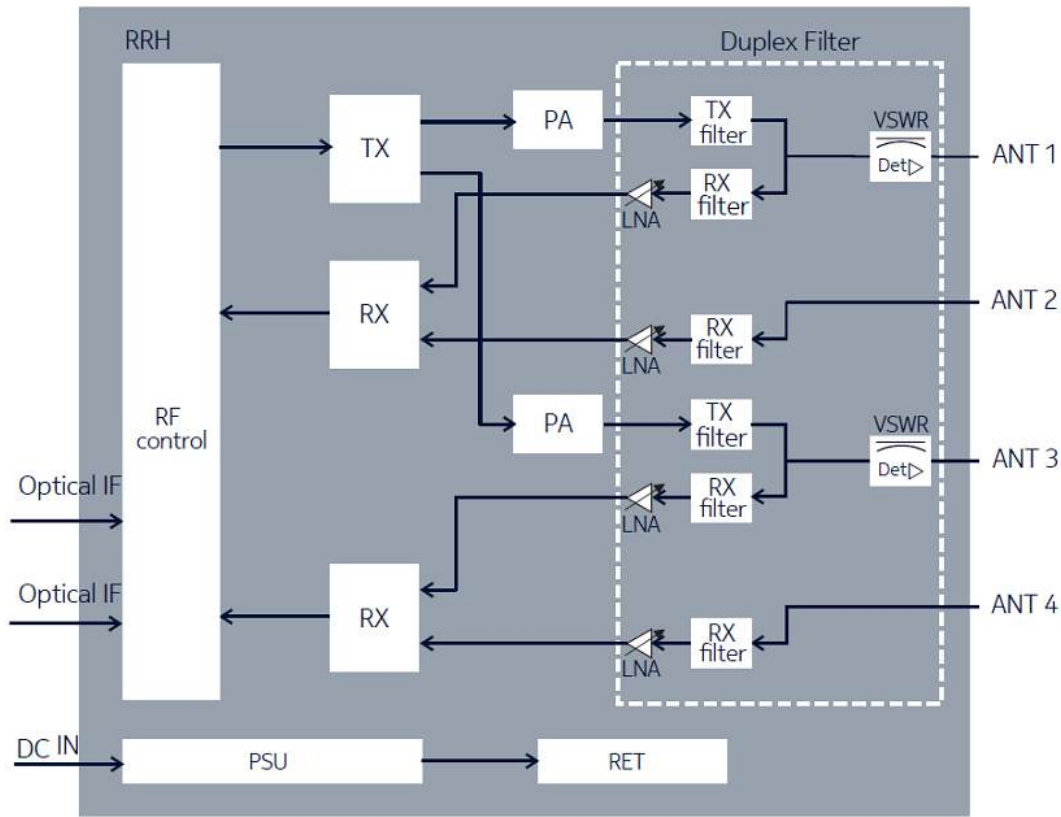
Antenna line device (ALD) support

Table 139: AHEC ALD support

ALD support through RS485/8-pin circular ports	Value
AISG	RET: AISG 2.0/3.0
Voltage	RET: 14.5 V
Power per port	40 W

Functional block diagram

Figure 42: AHEC functional block diagram



Electrical specifications

Table 140: AHEC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

NR power back-off

Recommended value for `dlQam256PowerBackoffSub6` parameter is:

- 1.5 dB for 3GPP performance requirement
- 2.5 dB for high peak UE throughput (4x4 DL MIMO)

GSM cell power range



Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ACPA AirScale 2 fiber protection (474297A)
- AMBF AirScale book mount kit 126-150 (474278A)

- AMGC AirScale 2 cover 300 x 101–125 (474269A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPA AirScale 2 26A DC plug 3.3–6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

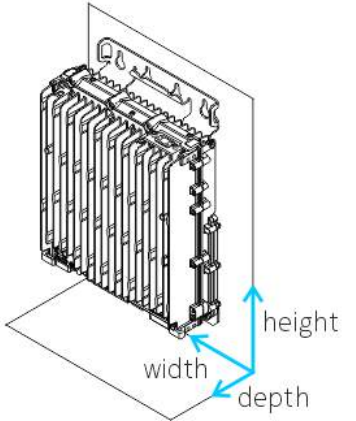
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 141: AHEC dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With upper and lower mounting brackets: 427.5 mm (16.8 in.)	
Width	308 mm (12.13 in.)	
Depth	Core RRH: 125 mm (4.92 in.) With mounting brackets: 149 mm (5.87 in.)	
Weight	Max. 12.8 kg (28.2 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 142: AHEC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

5.2.11 AirScale RRH 2T4R B3 160 W (AHED)

AHED (473807A) is introduced by LTE3130/SR001415.

Functional description

Table 143: AHED functional specification

Property	Value
Maximum output power	160 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	2T4R
Outdoor installation	Yes
Supported technologies	GSM, LTE
RF sharing/concurrent mode	GSM-LTE
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B3: 1825–1880 MHz
RX frequency range	B3: 1730–1785 MHz
DL filter bandwidth	55 MHz
UL filter bandwidth	55 MHz
Instantaneous bandwidth (iBW)	55 MHz
Occupied bandwidth (oBW)	55 MHz
Number of carriers per pipe	Up to 6
Supported bandwidths	1.4, 3, 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 43: AHED interfaces

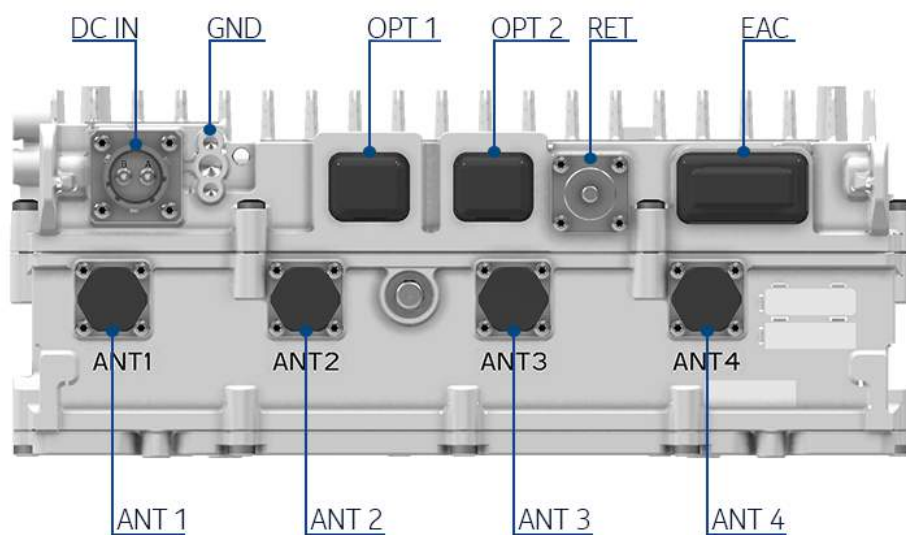


Table 144: AHED interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Grounding	GND 	1	M8 or dual M5 screws	-

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

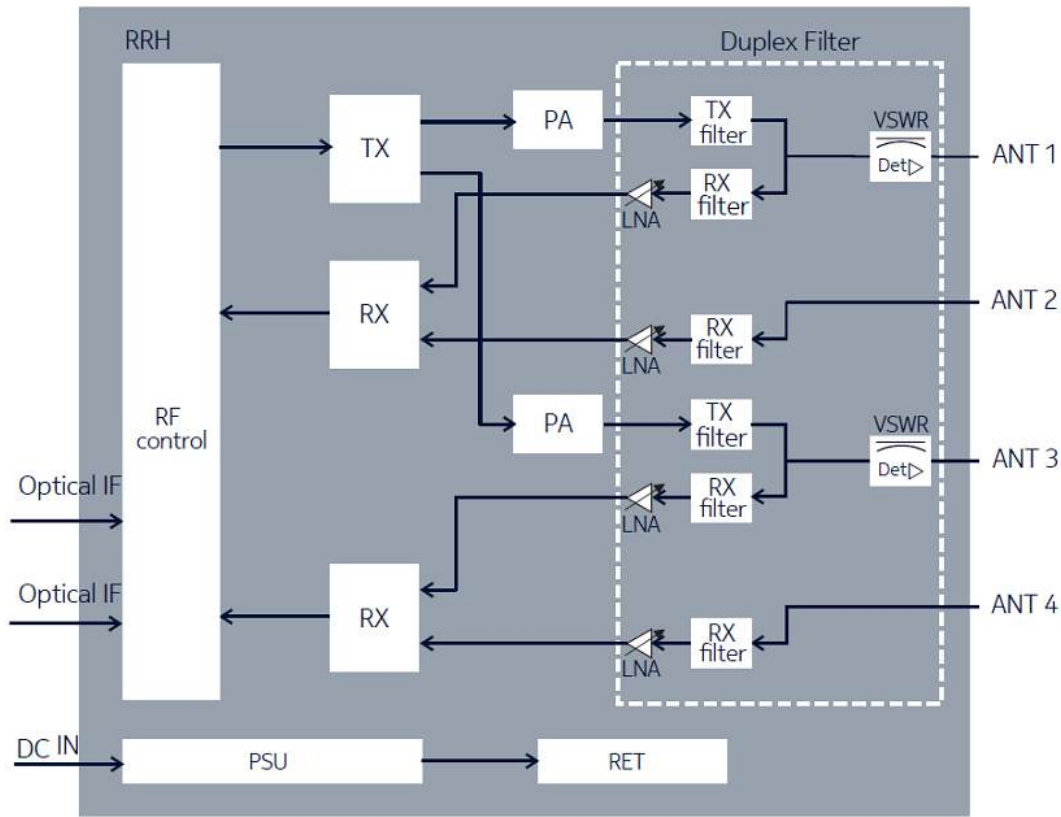
Antenna line device (ALD) support

Table 145: AHED ALD support

ALD support through RS485/8-pin circular ports	Value
AISG	RET: AISG 2.0/3.0
Voltage	RET: 14.5 V
Power per port	45 W

Functional block diagram

Figure 44: AHED functional block diagram



Electrical specifications

Table 146: AHED electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

LTE power back-off

Table 147: Recommended AHED power back-off in 256 QAM mode (carrier spacing over 100 MHz)

Single carrier [dB]	Dual carrier [dB]
0	0.8

GSM cell power range

 Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ACPA AirScale 2 fiber protection (474297A)

- AMBF AirScale book mount kit 126–150 (474278A)
- AMGC AirScale 2 cover 300 x 101–125 (474269A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPA AirScale 2 26A DC plug 3.3–6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

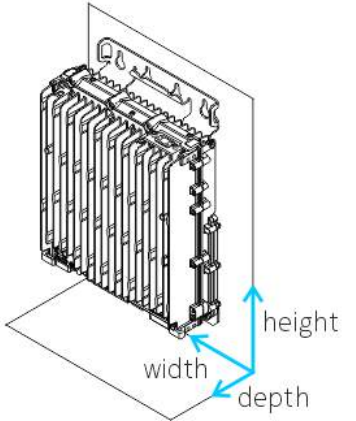


Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 148: AHED dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With upper and lower mounting brackets: 427.5 mm (16.8 in.)	
Width	308 mm (12.13 in.)	
Depth	Core RRH: 125 mm (4.92 in.) With mounting brackets: 149 mm (5.87 in.)	
Weight	max. 12.8 kg (28.2 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 149: AHED environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

5.2.12 AirScale RRH 2T4R B5 80 W (AHCG)

AHCG (475816A) is introduced by CB007153 (for LTE) and by *CB007626* (for NR).

Functional description

Table 150: AHCG functional specification

Property	Value
Maximum output power	80 W
Modulation	256 QAM
Number TXRX	2T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	869-888.4 MHz
RX frequency range	824-843.4 MHz
DL filter bandwidth	19.4 MHz
UL filter bandwidth	19.4 MHz
Instantaneous bandwidth (iBW)	19.4 MHz
Occupied bandwidth (oBW)	19.4 MHz
Number of carriers per pipe	Up to 8 (NR, LTE, NB-IoT)
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15 MHz NR: 5, 10, 15 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 45: AHCG interfaces

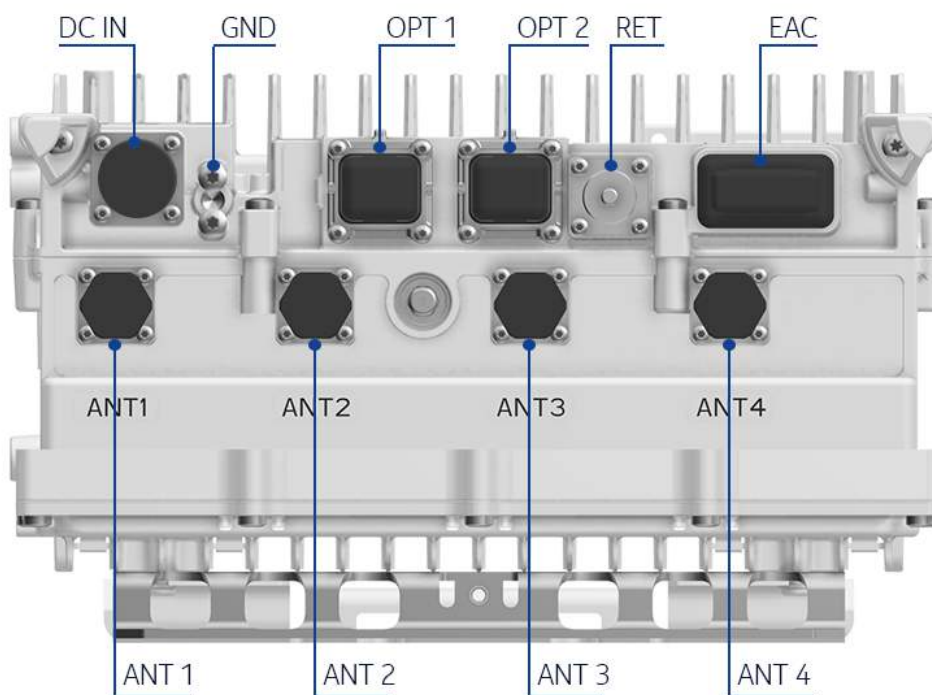


Table 151: AHCG interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna	ANT	4	4.3-10	-
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+	9.8 Gbps, CPRI; Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 152: AHCG ALD support

Property	Value
AISG	AISG 2.0/3.0 and power supply: ANT1, ANT3 PING: ANT2, ANT4
Voltage	14.5 V
Power per port	30 W, total 45 W

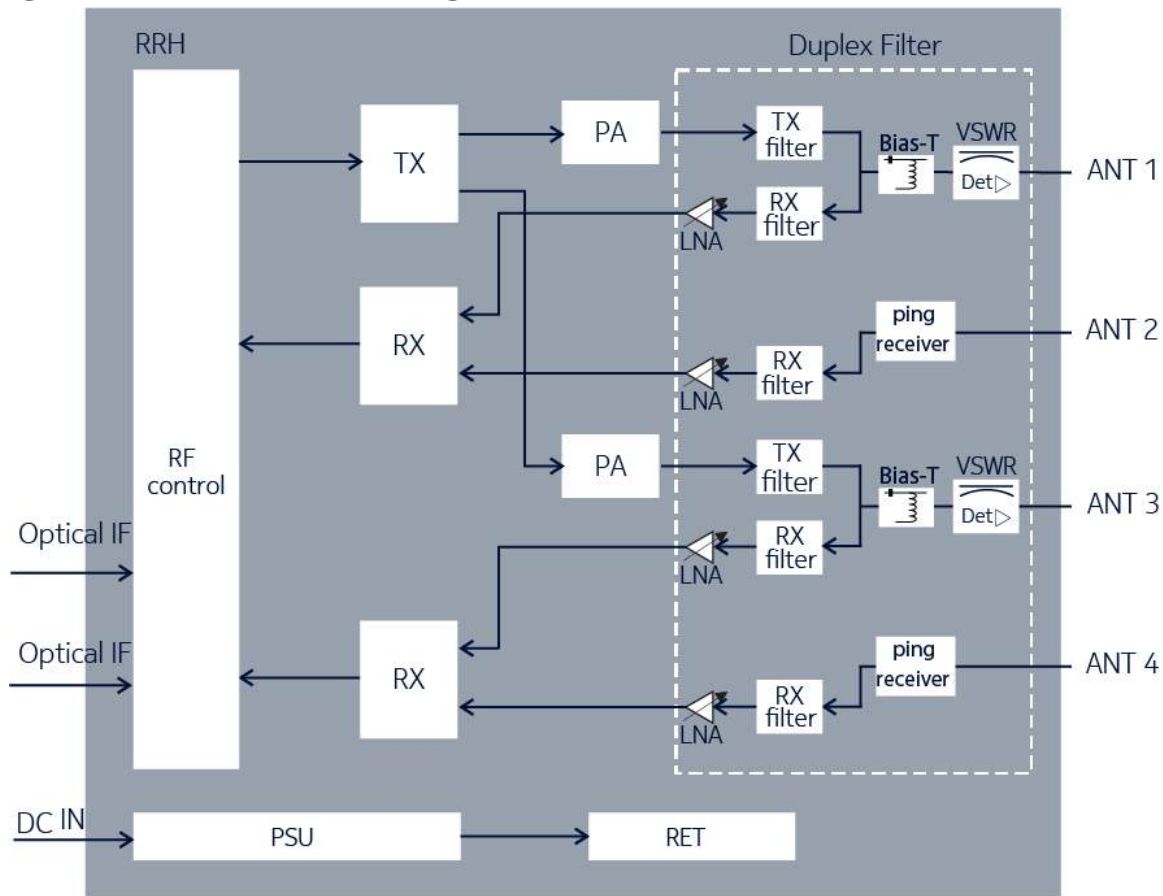


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 46: AHCG functional block diagram



Electrical specifications

Table 153: AHCG electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum startup voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

Recommended value for NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter is:

- 1.5 dB for 3GPP performance requirement
- 2.5 dB for high peak UE throughput (4x4 DL MIMO)

Related optional items

Optional elements depending on a configuration:

- ACPA AirScale 2 fiber protection (474297A)
- AMBI AirScale book mount kit for AHCA (474279A)
- AMGE AirScale 2 cover 300 x 151–185 (474271A) - factory-installed in AHCF radio variant
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAF AirScale AC-DC PSU 100–240VAC/1150 W (474676A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPA AirScale 2 26A DC plug 3.3–6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ASFA AirScale 2 fan unit 300 (473968A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

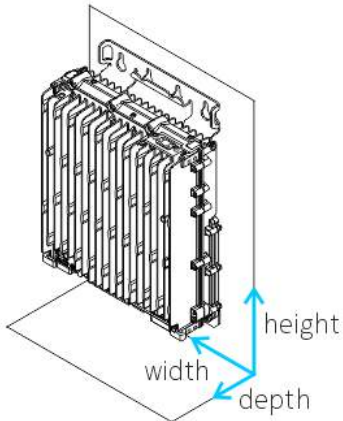
- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - Horizontal with an optional fan
 - One-clip rail
 - Book mounting

 Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 154: AHCG dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 366 mm (14.41 in.) With upper and lower mounting brackets: 447.5 mm (17.62 in.)	
Width	Core RRH: 306 mm (12.05 in.)	
Depth	Core RRH: 165 mm (6.5 in.) With upper and lower mounting brackets: 186.5 mm (7.34 in.)	
Weight	max. 17.5 kg (38.58 lb)	

Environmental specifications

Table 155: AHCG environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.13 AirScale RRH 2T4R B8/n8 120 W (AHDA)

AHDA (474739A) is introduced by LTE3678 (for GSM, WCDMA, and LTE), SR001667 (for GSM, WCDMA, and LTE), and CB006609 (for NR).

Functional description

Table 156: AHDA functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM
Number of TXX	2T4R
Outdoor installation	Yes
Supported technologies	NR, LTE, WCDMA, GSM
RF sharing/concurrent mode	NR-LTE, GSM-WCDMA, WCDMA-LTE, GSM-LTE, GSM-WCDMA-LTE
Duplex mode, supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B8/n8: 925–960 MHz
RX frequency range	B8/n8: 880–915 MHz
DL filter bandwidth	35 MHz
UL filter bandwidth	35 MHz
Instantaneous bandwidth (iBW)	35 MHz
Occupied bandwidth (oBW)	35 MHz
Number of carriers per pipe	Up to 8
Supported bandwidths	LTE: 1.4, 3, 5, 10 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 47: AHDA interfaces

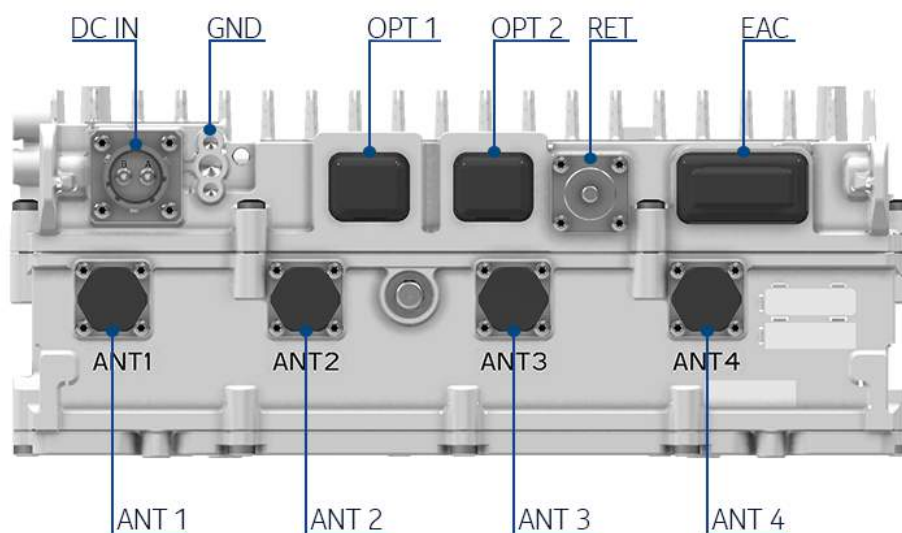


Table 157: AHDA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 158: AHDA ALD support

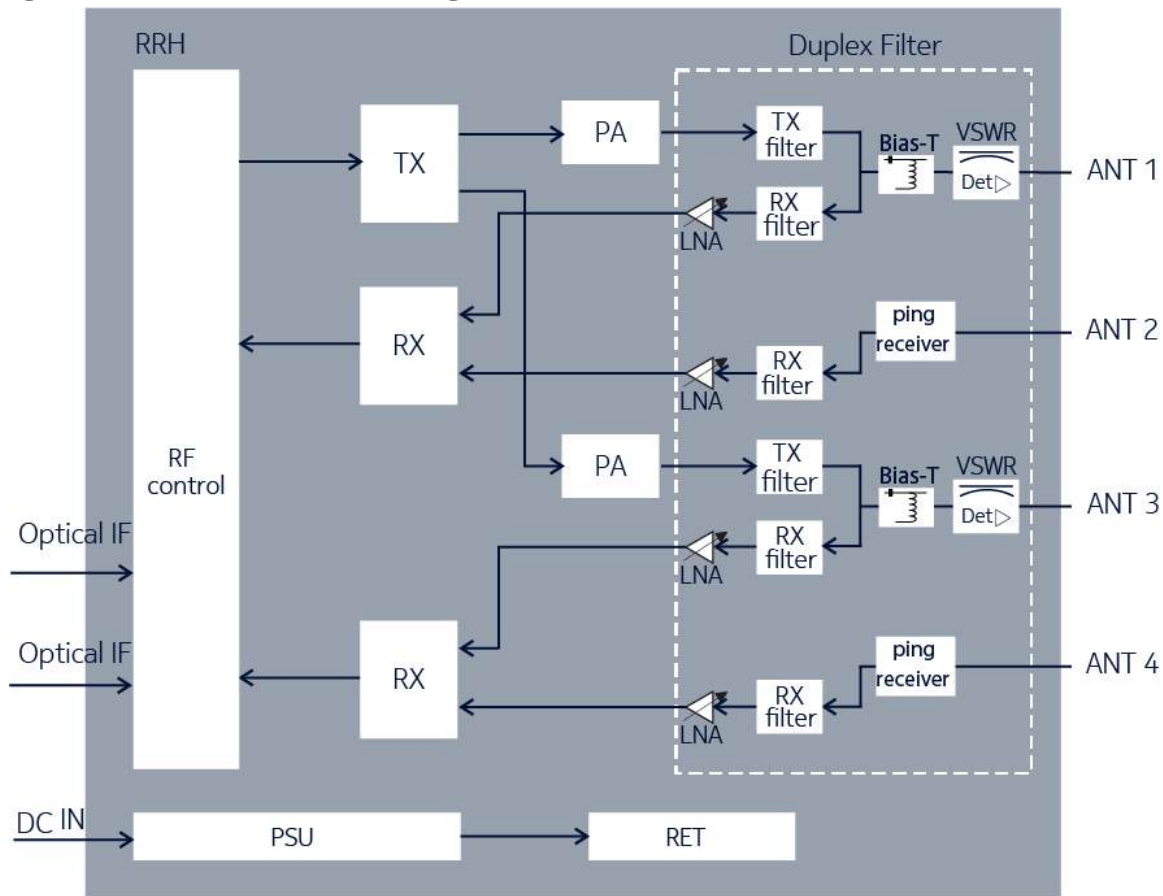
ALD support	Value
AISG	ANT1, ANT3: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 ping receiver RET: AISG 2.0/3.0
Voltage	ANT1, ANT3, RET: 14.5 V
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 48: AHDA functional block diagram



Electrical specifications

Table 159: AHDA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

LTE power back-off

Table 160: AHDA power back-off

Single carrier LTE 256 QAM [dB]	64 QAM LTE + GSM [dB]
0	0.3

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)

- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

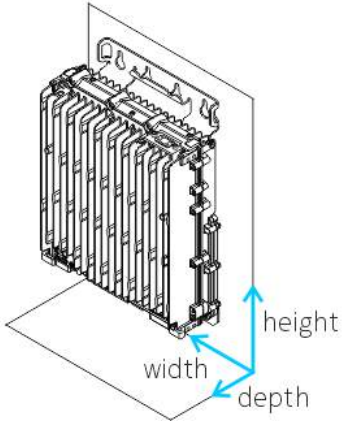
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 161: AHDA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.25 in.) With mounting brackets: 428 mm (16.87 in.)	
Width	309 mm (12.17 in.)	
Depth	Core RRH: 130 mm (5.12 in.) With mounting brackets: 153 mm (6.02 in.)	
Weight	14.0 kg (30.9 lb)	

Environmental specifications

Table 162: AHDA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.14 AirScale RRH 2T4R B8/n8 160 W (AHDB)

AHDB (474257A) is introduced by LTE3837/SR001753/5GC000729.

Functional description

Table 163: AHDB functional specification

Property	Value
Maximum output power	160 W
 Note: In the United States of America, due to the FCC certification for this product, you should not set the maximum output power per TX port above 40 W. It is the responsibility of the operator to ensure that this requirement is met.	
Modulation	256 QAM
Number of TXXR	2T4R
Outdoor installation	Yes
Supported technologies	GSM, WCDMA, LTE, NR
Duplex mode - supported standard	FDD
RF sharing/concurrent mode	GSM-WCDMA, WCDMA-LTE, GSM-LTE, GSM-WCDMA-LTE, LTE-NR
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B8/n8: 934-960 MHz
RX frequency range	B8/n8: 889-915 MHz
DL filter bandwidth	26 MHz
UL filter bandwidth	26 MHz
Instantaneous bandwidth (iBW)	26 MHz
Occupied bandwidth (oBW)	26 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	LTE: 1.4, 3, 5, 10 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 49: AHDB interfaces

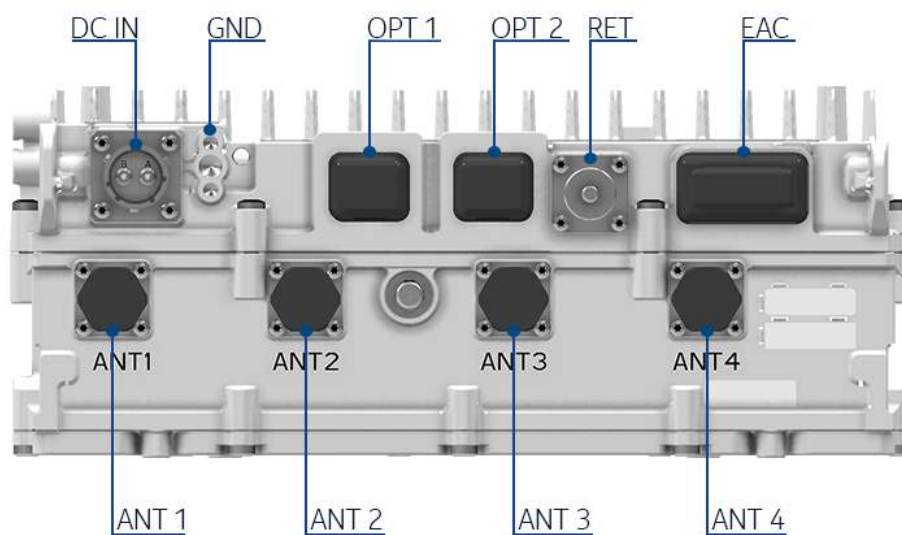


Table 164: AHDB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Grounding	GND 	1	M8 or dual M5 screws	-

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

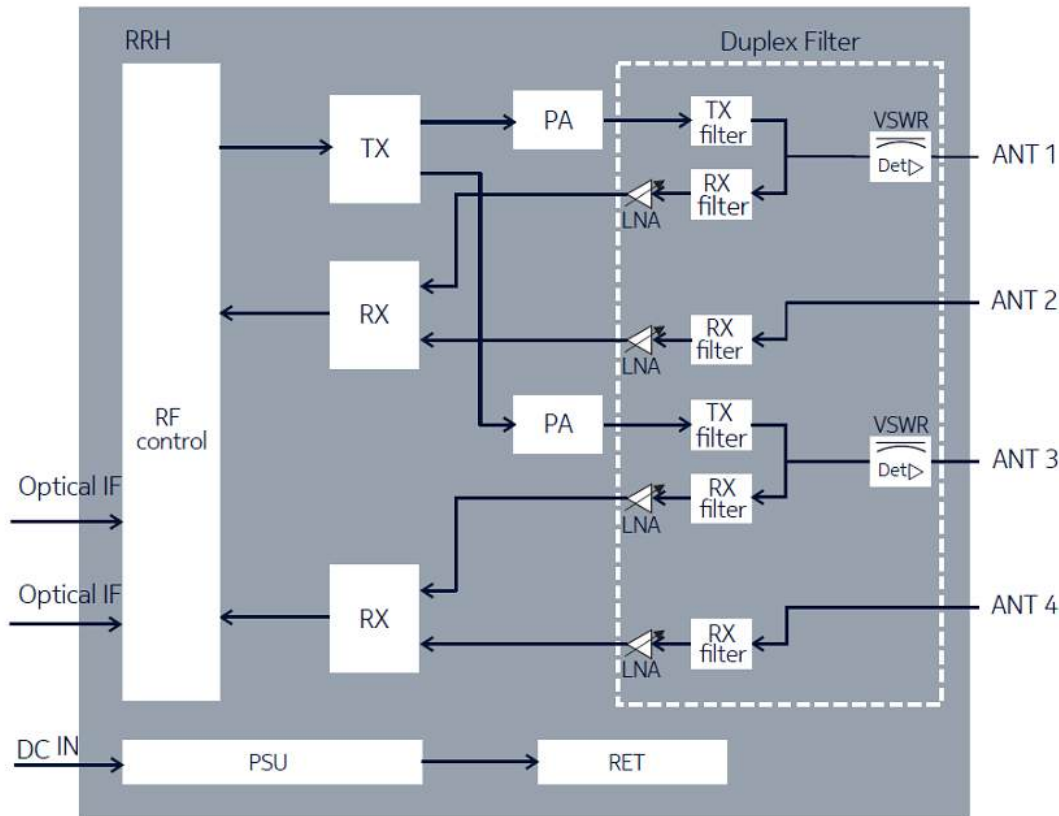
Antenna line device (ALD) support

Table 165: AHDB ALD support

ALD support through RS485/8-pin circular ports	Value
AISG	RET: 2.0/3.0
Proprietary AISG1.1	No
Voltage	RET: 14.5 V
Power per port	45 W

Functional block diagram

Figure 50: AHDB functional block diagram



Electrical specifications

Table 166: AHDB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

LTE power back-off

Table 167: Recommended AHDB power back-off in 256 QAM mode (carrier spacing over 100 MHz)

Single carrier [dB]	Dual carrier [dB]
0	0.8

GSM cell power range

 Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ACPA AirScale 2 fiber protection (474297A)
- AMBF AirScale book mount kit 126–150 (474278A)
- AMGC AirScale 2 cover 300 x 101–125 (474269A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPA AirScale 2 26A DC plug 3.3–6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

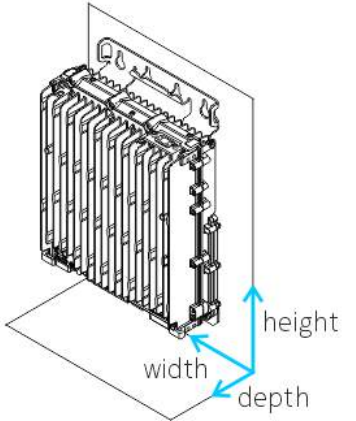
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 168: AHDB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.25 in.) With mounting brackets: 428 mm (16.87 in.)	
Width	309 mm (12.17 in.)	
Depth	Core RRH: 125 mm (4.92 in.) With mounting brackets: 149 mm (5.86 in.)	
Weight	max. 12.8 kg (28.2 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 169: AHDB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

5.2.15 AirScale RRH 2T4R B18 60 W (AHCH)

AHCH (475906A) is introduced by CB007568 (for LTE and NR).

Functional description

Table 170: AHCH functional specification

Property	Value
Maximum output power	60 W
Modulation	256 QAM
Number of TXX	2T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode-supported standard	FDD
IoT support	NB-IoT inband, guard band (upper side only)
TX frequency range	B18 (sub band 26): 860–875 MHz
RX frequency range	B18: 815–830 MHz
DL filter bandwidth	15 MHz
UL filter bandwidth	15 MHz
Instantaneous bandwidth (iBW)	15 MHz
Occupied bandwidth (oBW)	15 MHz
Number of carriers per pipe	Up to 3 in total for all supported RATs
Supported bandwidths	LTE: 5, 10, 15 MHz NR: 5, 10, 15 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 51: AHCH interfaces

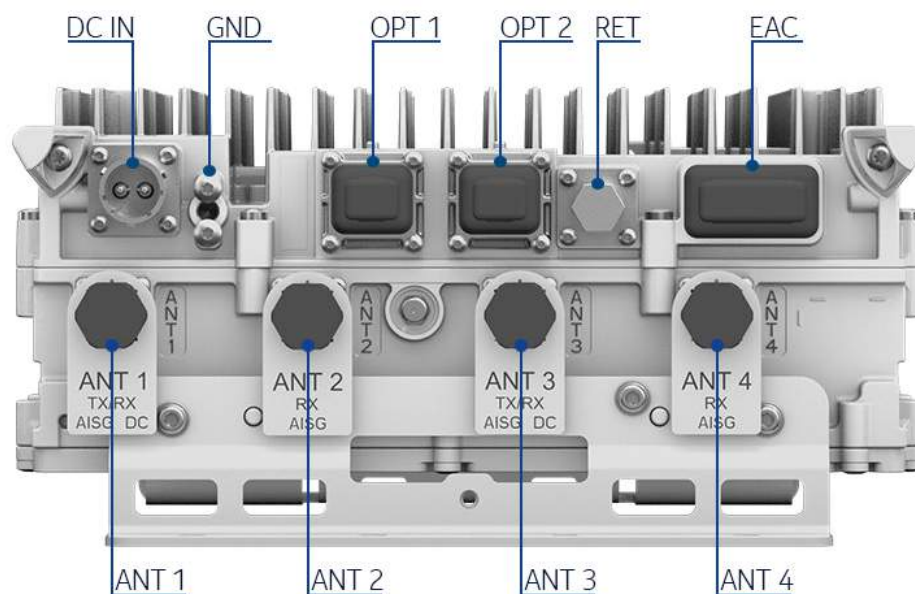


Table 171: AHCH interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	–
Antenna connector	ANT	4	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	M8 or 2 x M5 screws	–
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 172: AHCH ALD support

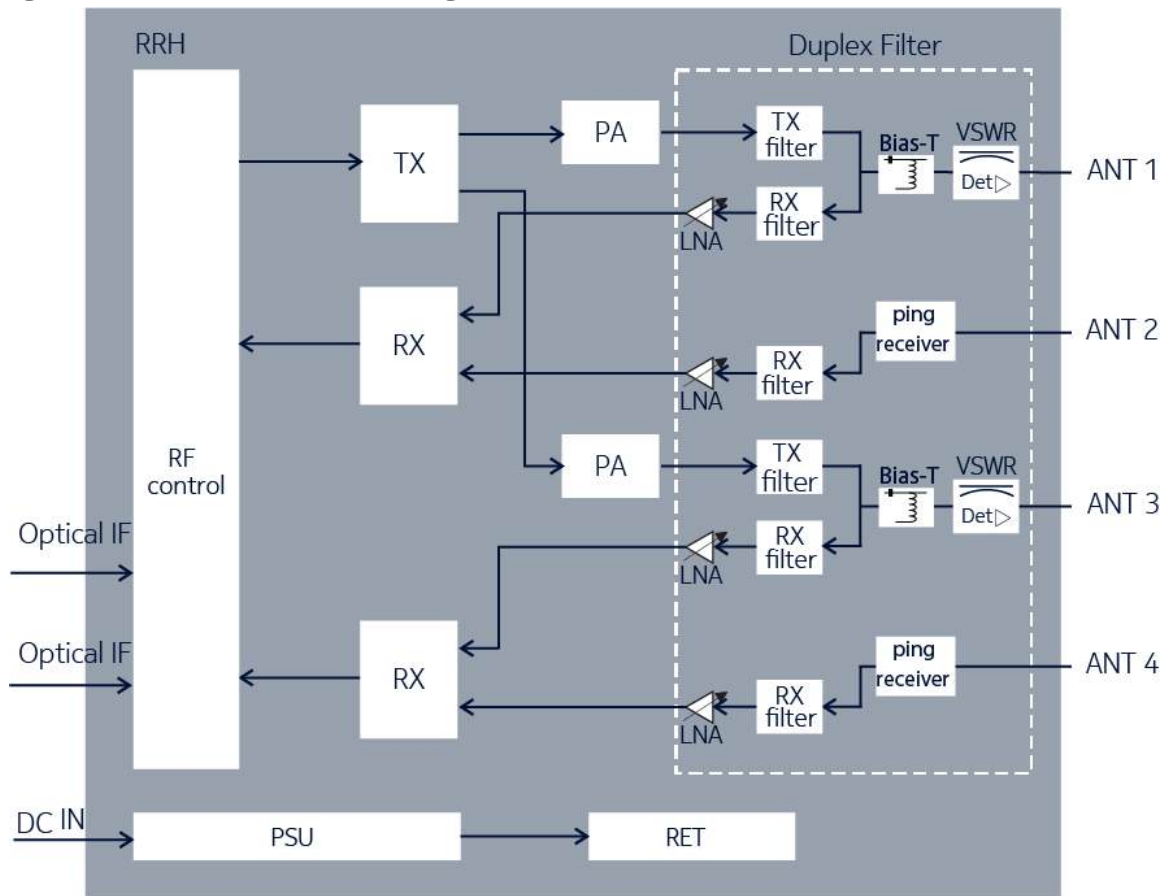
Property	Value
AISG	AISG 2.0 and 3.0: ANT 1, ANT 2, ANT 3, ANT 4 and RET Power supply: ANT 1 and ANT 3
Voltage	14.5 V
Power per port	30 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 52: AHCH functional block diagram



Electrical specifications

Table 173: AHCH electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*

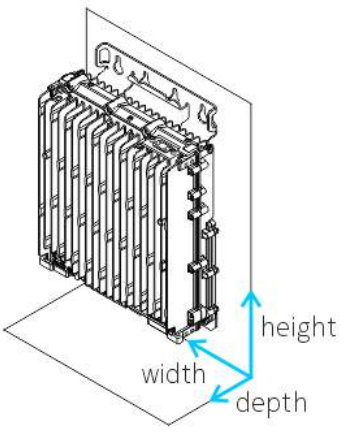
▣ Book mounting

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 174: AHCH dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With mounting brackets: 428 mm (16.85 in.)	
Width	309 mm (12.17 in.)	
Depth	Core RRH: 140 mm (5.51 in.) With mounting brackets: 163 mm (6.42 in.)	
Weight	max. 15.5 kg (34.2 lb)	

Environmental specifications

Table 175: AHCH environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.16 AirScale RRH 2T4R B20/n20 120 W (AHMA)

AHMA (474255A) is introduced by LTE4118 (for LTE) and CB006610 (for NR).

Functional description

Table 176: AHMA functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM
Number of TXRX	2T4R
Outdoor installation	Yes
Supported technologies	NR, LTE
RF sharing/concurrent mode	NR-LTE
Duplex mode, supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B20/n20: 791-821 MHz
RX frequency range	B20/n20: 832-862 MHz
DL filter bandwidth	30 MHz
UL filter bandwidth	30 MHz
Instantaneous bandwidth (iBW)	30 MHz
Occupied bandwidth (oBW)	30 MHz
Number of carriers per pipe	Up to 3
Supported bandwidths	5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 53: AHMA interfaces

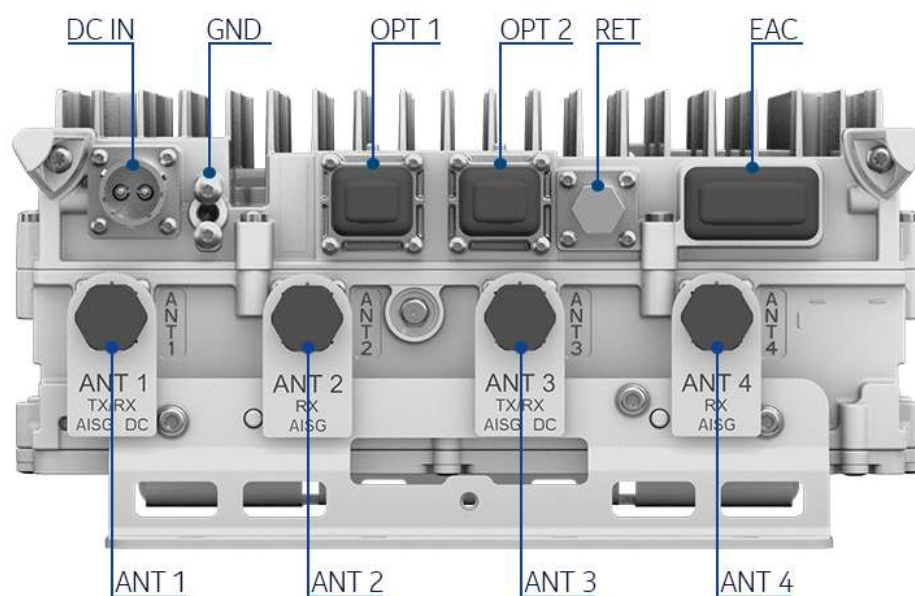


Table 177: AHMA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 178: AHMA ALD support

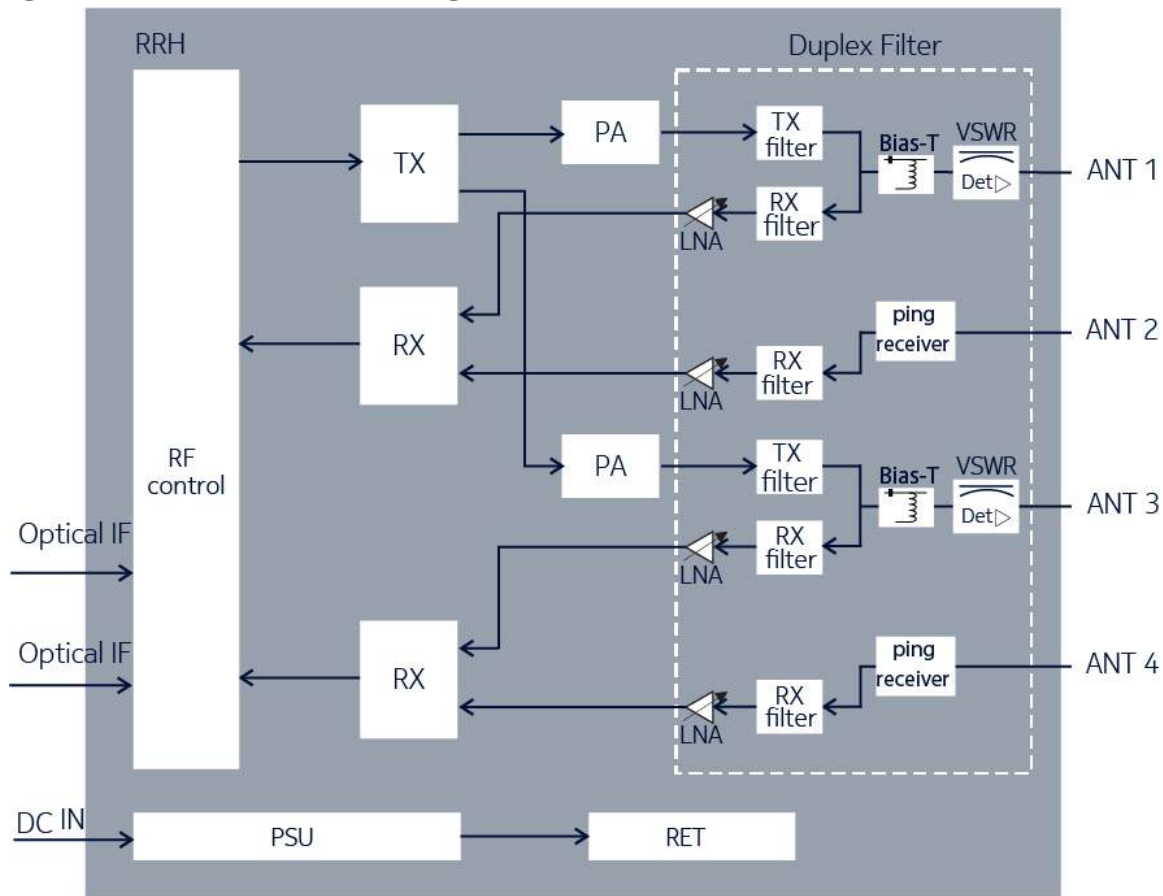
ALD support	Value
AISG	ANT1, ANT3: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 ping receiver RET: AISG 2.0/3.0
Voltage	ANT1, ANT3, RET: 14.5 V
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 54: AHMA functional block diagram



Electrical specifications

Table 179: AHMA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*

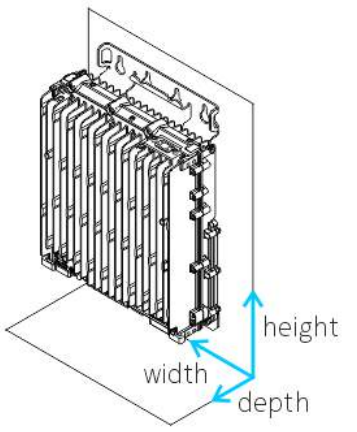
▣ Book mounting

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 180: AHMA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.25 in.) With mounting brackets: 428 mm (16.87 in.)	
Width	309 mm (12.17 in.)	
Depth	Core RRH: 130 mm (5.12 in.) With mounting brackets: 153 mm (6.02 in.)	
Weight	14 kg (30.9 lb)	

Environmental specifications

Table 181: AHMA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.17 AirScale RRH 2T4R B28 120 W (AHPC)

AHPC (474649A) is introduced by LTE4615 (for LTE).

Functional description

Table 182: AHPC functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	2T4R
Outdoor installation	Yes
Supported technologies	LTE
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	758-803 MHz
RX frequency range	703-748 MHz
DL filter bandwidth	45 MHz
UL filter bandwidth	45 MHz
Instantaneous bandwidth (iBW)	45 MHz
Occupied bandwidth (oBW)	45 MHz
Number of carriers per pipe	Up to 6
Supported bandwidths	3, 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 55: AHPC interfaces

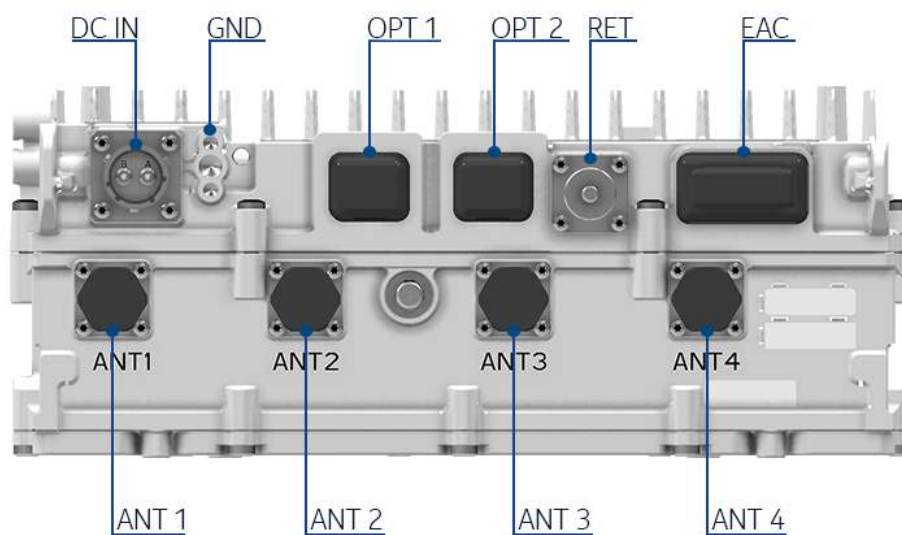


Table 183: AHPC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Grounding	GND 	1	M8 or dual M5 screws	-

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

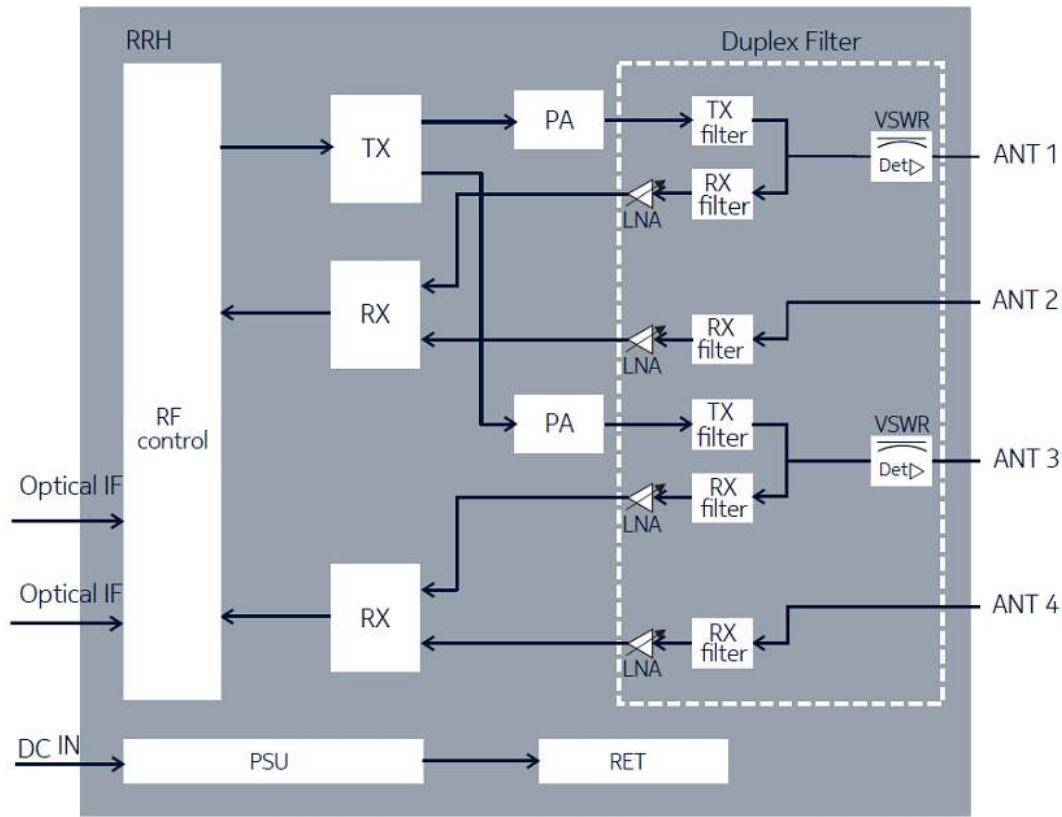
Antenna line device (ALD) support

Table 184: AHPC ALD support

ALD support through RS485/8-pin circular ports	Value
AISG	RET: AISG 2.0/3.0
Voltage	RET: 14.5 V
Power per port	30 W

Functional block diagram

Figure 56: AHPC functional block diagram



Electrical specifications

Table 185: AHPC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Related optional items

- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGC AirScale2 cover 300 x 101-125 (474269A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

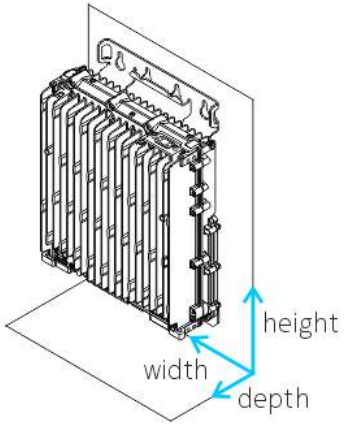
- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - One-clip rail
 - Book mounting

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 186: AHPC dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With mounting brackets: 428 mm (16.85 in.)	
Width	309 mm (12.17 in.)	
Depth	Core RRH: 125 mm (4.92 in.) With mounting brackets: 149 mm (5.87 in.)	
Weight	13.6 kg (30.0 lb)	

Environmental specifications



Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 187: AHPC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

5.2.18 AirScale RRH 2T4R B28/n28 120 W (AHPD)

AHPD (474712A) is introduced by LTE4660 (for LTE), SR002080 (for LTE), and 5GC001081 (for NR).

Functional description

Table 188: AHPD functional specification

Property	Value
Maximum output power	120 W
Modulation	Up to 256 QAM
Number of TXX	2T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	758-788 MHz
RX frequency range	703-733 MHz
DL filter bandwidth	30 MHz
UL filter bandwidth	30 MHz
Instantaneous bandwidth (iBW)	30 MHz
Occupied bandwidth (oBW)	30 MHz
Number of carriers per pipe	Up to 3 carriers in total for all supported RATs
Supported bandwidths	LTE: 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 57: AHPD interfaces

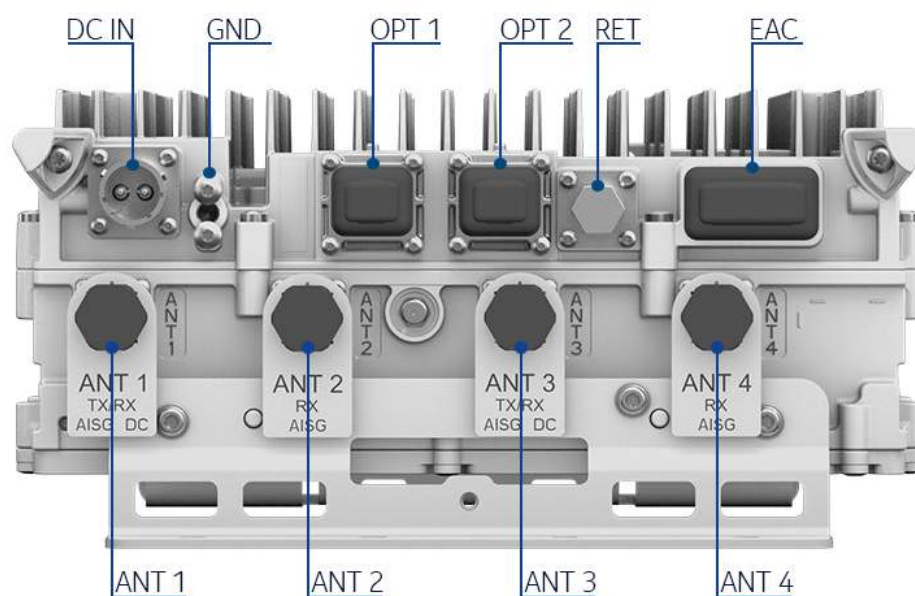


Table 189: AHPD interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 190: AHPD ALD support

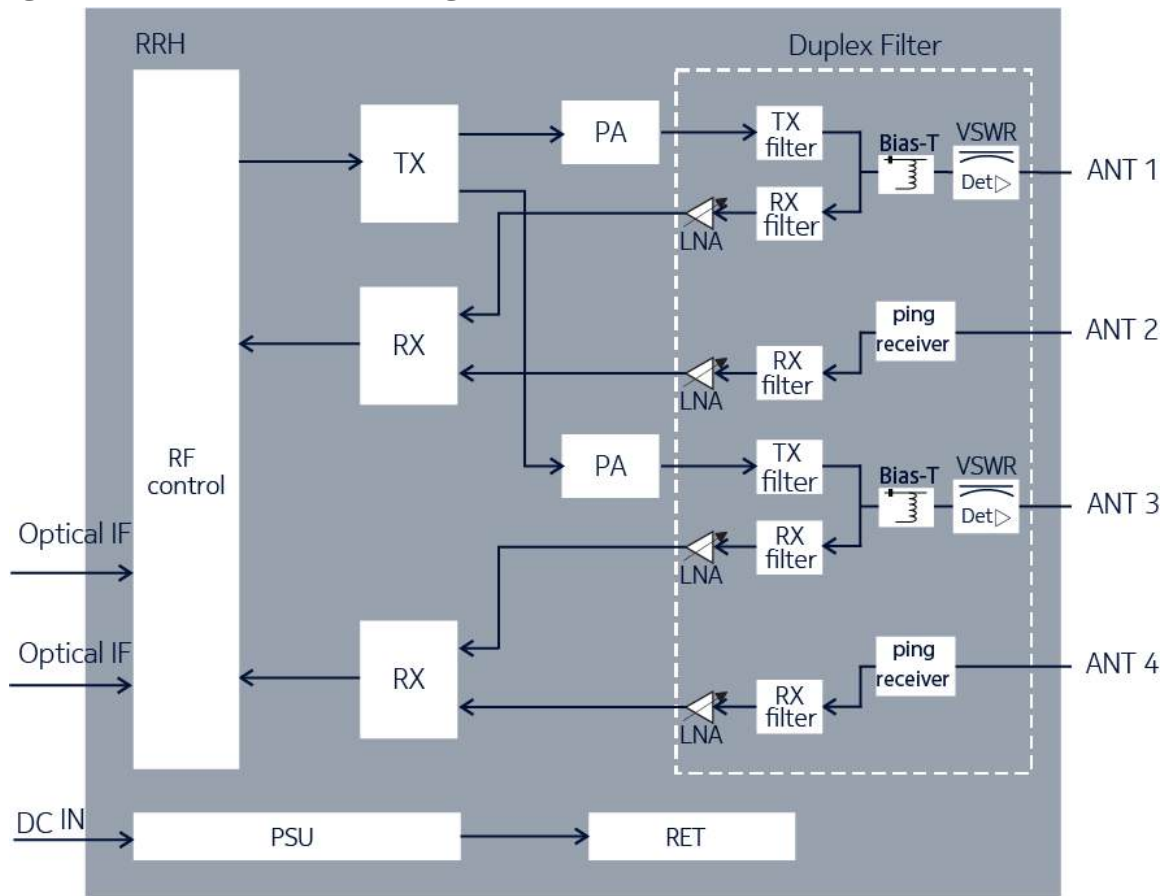
ALD support	Value
AISG	AISG 2.0 and 3.0: ANT 1, ANT 2, ANT 3, ANT 4 and RET Power supply: ANT1 and ANT3
Voltage	14.5 V
Power per port	30 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 58: AHPD functional block diagram



Electrical specifications

Table 191: AHPD electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

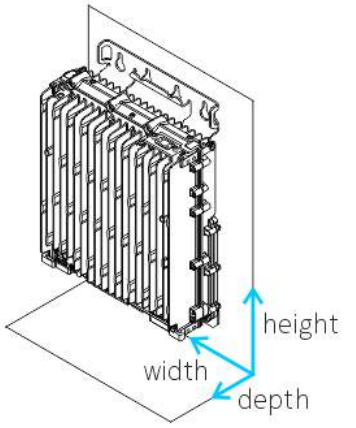
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 192: AHPD dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With mounting brackets: 428 mm (16.85 in.)	
Width	309 mm (12.17 in.)	
Depth	Core RRH: 130 mm (5.12 in.) With mounting brackets: 153 mm (6.02 in.)	
Weight	14 kg (30.9 lb)	

Environmental specifications

Table 193: AHPD environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.19 AirScale RRH 2T4R B28/n28 120 W (AHPE)

AHPE (475208A) is introduced by LTE5359 (for LTE) and 5GC002170 (for NR).

Functional description

Table 194: AHPE functional specification

Property	Value
Maximum output power	120 W
Modulation	Up to 256 QAM
Number of TXX	2T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B28/n28: 773-803 MHz
RX frequency range	B28/n28: 718-748 MHz
DL filter bandwidth	30 MHz
UL filter bandwidth	30 MHz
Instantaneous bandwidth (iBW)	30 MHz
Occupied bandwidth (oBW)	30 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 59: AHPE interfaces

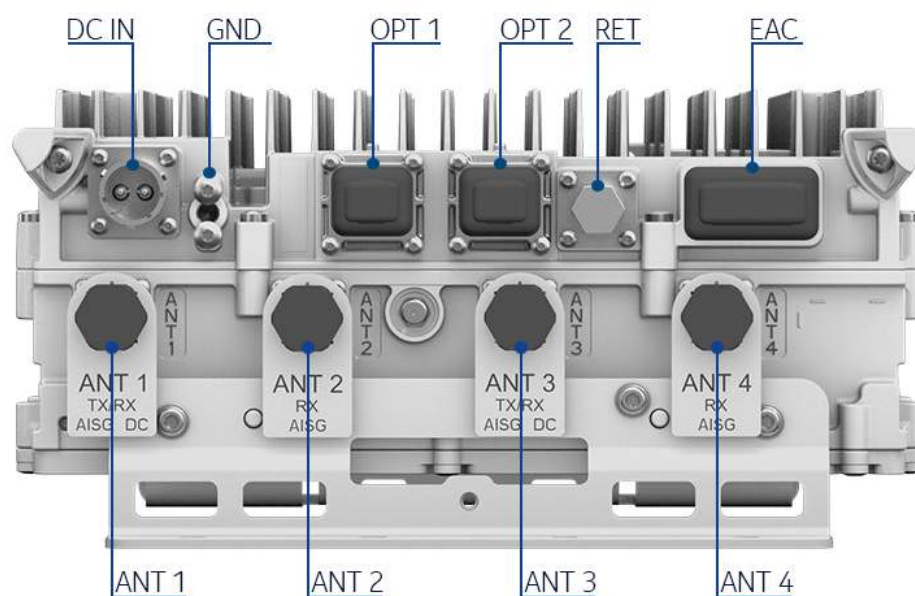


Table 195: AHPE interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 196: AHPE ALD support

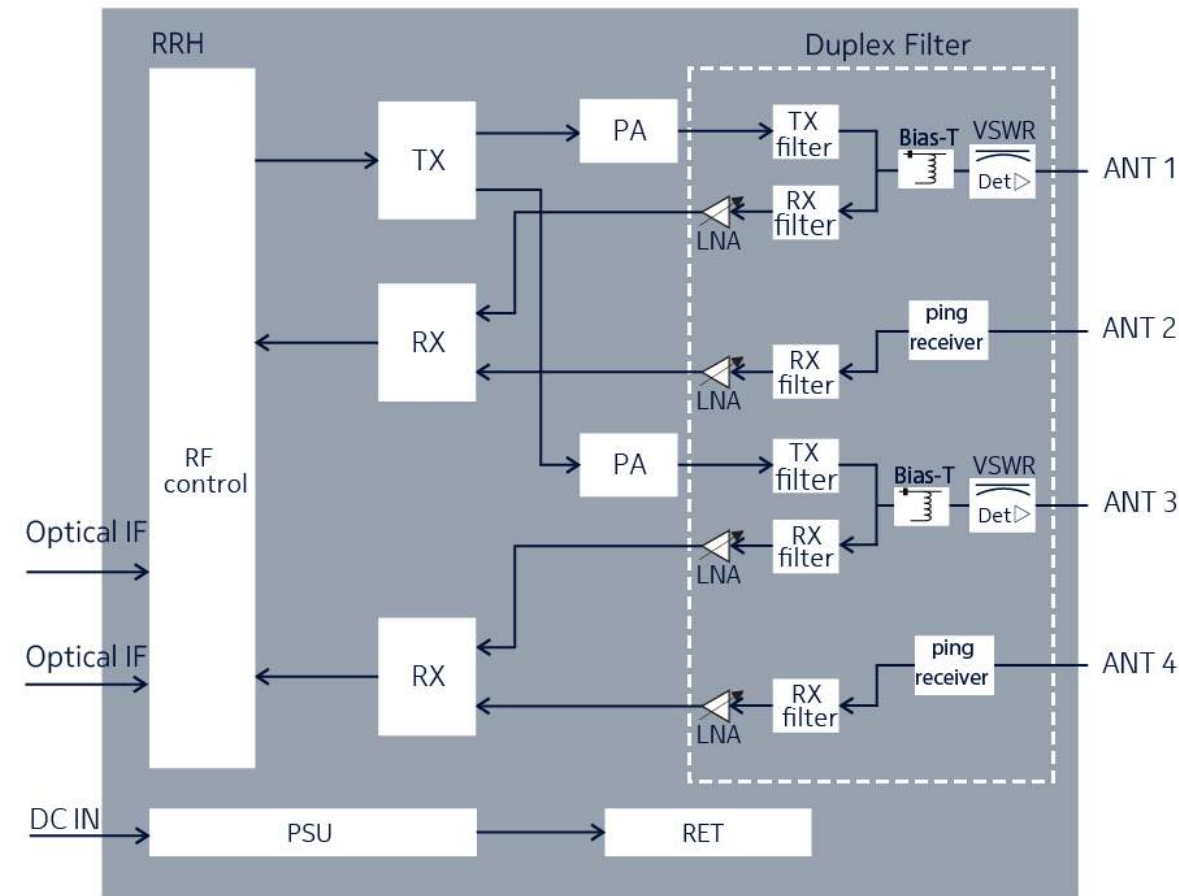
ALD support	Value
AISG	ANT1, ANT3: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 ping receiver RET: AISG 2.0/3.0
Voltage	ANT1, ANT3, RET: 14.5 V
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 60: AHPE functional block diagram



Electrical specifications

Table 197: AHPE electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA



Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Power back-off

Table 198: AHPE power back-off in 256 QAM

Single carrier [dB]	Multi-carrier [dB]
0.6	1.2

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA Pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - Horizontal with an optional fan
 - One-clip rail
 - Book mounting

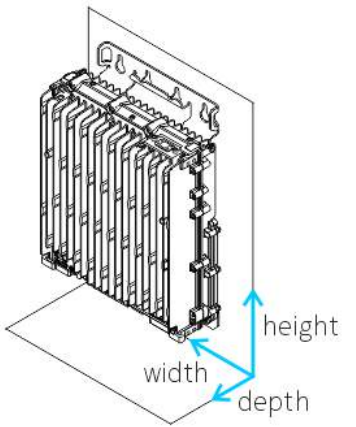


Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 199: AHPE dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.25 in.) With mounting brackets: 428 mm (16.87 in.)	
Width	309 mm (12.17 in.)	
Depth	Core RRH: 130 mm (5.12 in.) With mounting brackets: 153 mm (6.02 in.)	
Weight	14.0 kg (30.9 lb)	

Environmental specifications

Table 200: AHPE environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.20 AirScale RRH 2T4R B28/n28 160 W (AHPJ)

AHPJ (476403A) is introduced by CB010522 (for LTE and NR).

Functional description

Table 201: AHPJ functional specification

Property	Value
Maximum output power	160 W
Modulation	256 QAM
Number of TXX	2T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B28/n28: 758-803 MHz
RX frequency range	B28/n28: 703-748 MHz
DL filter bandwidth	45 MHz
UL filter bandwidth	45 MHz
Instantaneous bandwidth (iBW)	45 MHz
Occupied bandwidth (oBW)	45 MHz
Number of carriers per pipe	Up to 6
Supported bandwidths	LTE/NR: 5, 10, 15, 20 MHz
Passive intermodulation (PIM) cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 61: AHPJ interfaces

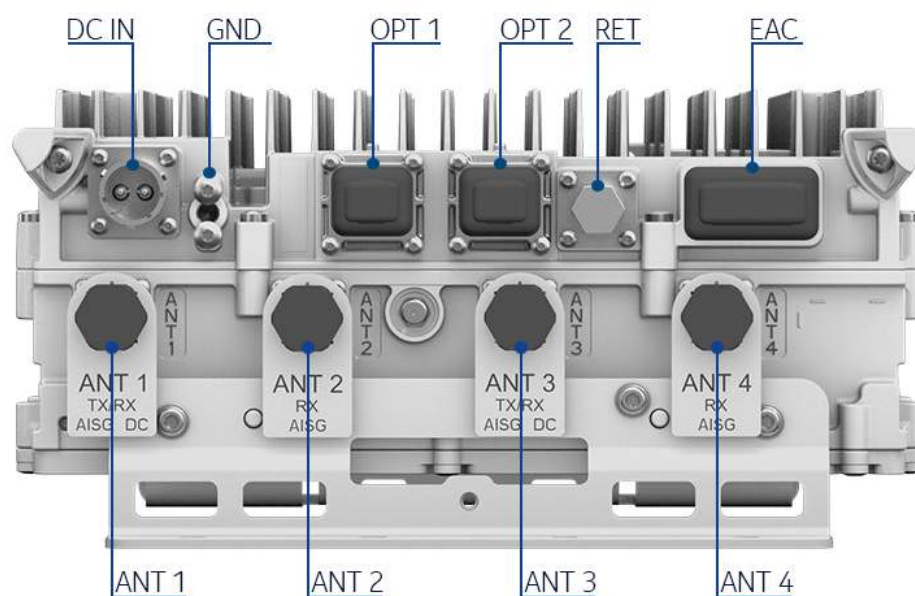


Table 202: AHPJ interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	–
Optical	OPT	2	SFP+	CPRI: 9.8 Gbps; Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–
Fan	FAN	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

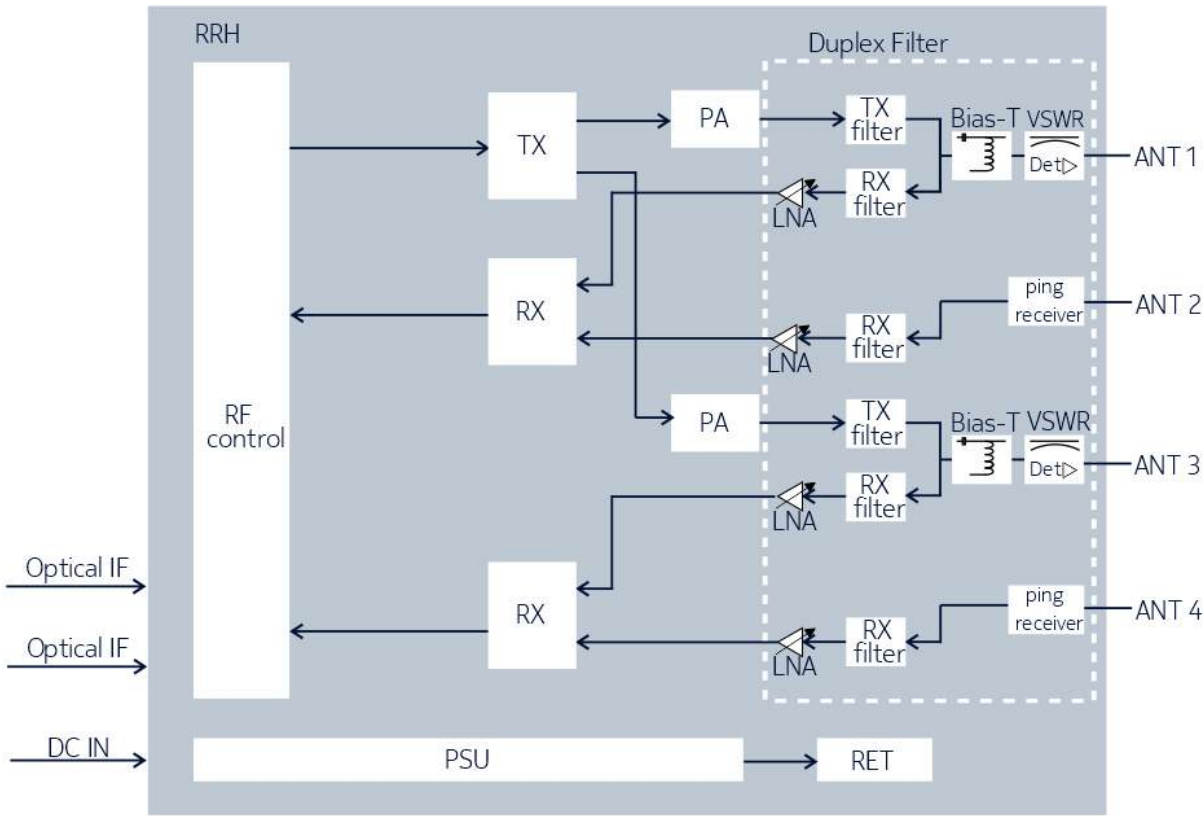
Antenna line device (ALD) support

Table 203: AHPJ ALD support

Property	Value
AISG	Version 2.0
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 62: AHPJ functional block diagram



Electrical specifications

Table 204: AHPJ electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 205: The recommended power back-off in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.6	1.2
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.6	1.2

Related optional items

- AMBF AirScale book mount kit 126-150 (474278A)

- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ASFA AirScale 2 fan unit 300 (473968A)
- ACPA AirScale 2 fiber protection (474297A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)

Installation options

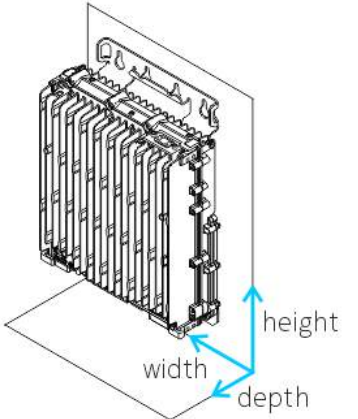
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 206: AHPJ dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 337 mm (13.27 in.) With mounting brackets: 428 mm (16.85 in.)	
Width	295 mm (11.61 in.) With mounting brackets: 324 mm (12.76 in.)	
Depth	140 mm (5.51 in.) With mounting brackets: 183 mm (7.20 in.)	
Weight	14.5 kg (32 lb)	

Environmental specifications

Table 207: AHPJ environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.21 AirScale RRH 2T4R B68/B28 120 W (AHPG)

AHPG (475943A) is introduced by CB007889 (for LTE) and CB009210 (for NR).

Functional description

Table 208: AHPG functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM
Number of TXRX	2T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band (IB), guard band (GB)
TX frequency range	B68: 753-783 MHz B28 sub-band: 758-791 MHz
RX frequency range	B68: 698-728 MHz B28 sub-band: 703-736 MHz
DL filter bandwidth	B68: 30 MHz B28 sub-band: 33 MHz
UL filter bandwidth	B68: 30 MHz B28 sub-band: 33 MHz
Instantaneous bandwidth (iBW)	B68: 30 MHz B28 sub-band: 33 MHz
Occupied bandwidth (oBW)	B68: 30 MHz B28 sub-band: 33 MHz
Number of carriers per pipe	Up to 8
Supported bandwidths	LTE: B68: 5, 10, 15 MHz B28 sub-band: 3, 5, 10, 15, 20 MHz NR: B28 sub band: 5, 10, 15, 20 MHz
Passive Inter-Modulation (PIM) cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 63: AHPG interfaces

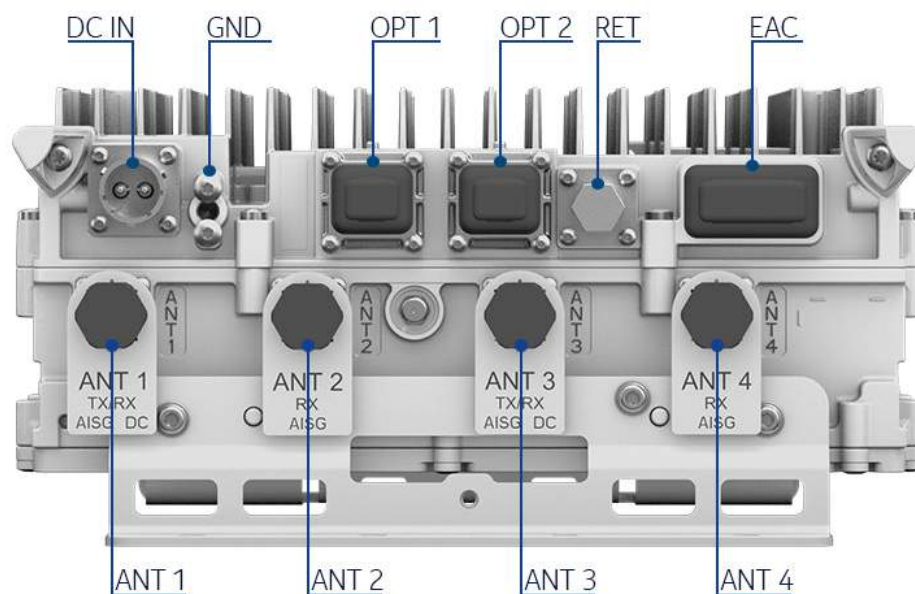


Table 209: AHPG interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	-
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	2 x M5 screw	-
Fan	Fan	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

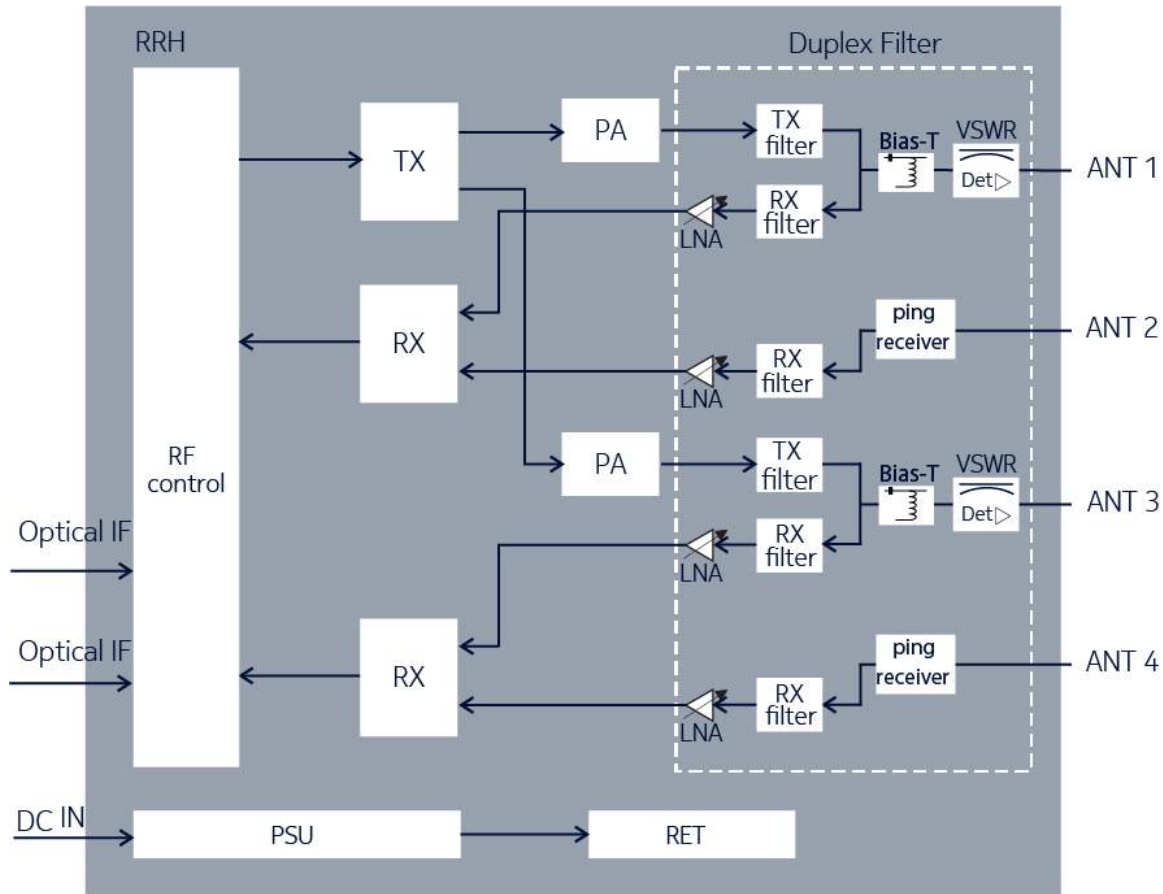
Antenna line device (ALD) support

Table 210: AHPG ALD support

Property	Value
AISG	AISG 3.0: ANT 1, ANT 2, ANT 3, ANT 4, and RET Power supply: ANT 1 and ANT 3
Voltage	14.5 V
Power per port	30 W

Functional block diagram

Figure 64: AHPG functional block diagram



Electrical specifications

Table 211: AHPG electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

Table 212: The recommended power back-off for 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Dual carrier [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.7	1.2

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)

- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

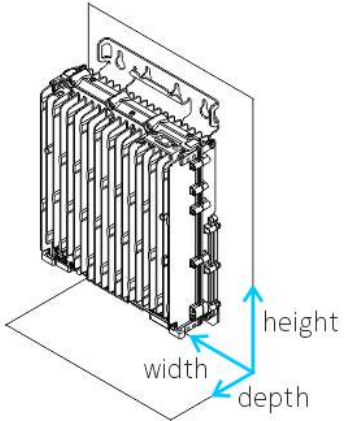
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling. Use fans for horizontal installation.

Dimensions and weight

Table 213: AHPG dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.25 in.) With mounting brackets: 428 mm (16.87 in.)	
Width	295 mm (11.61 in.)	
Depth	Core RRH: 150 mm (5.91 in.) With mounting brackets: 174 mm (6.85 in.)	
Weight	17 kg (37.5 lb)	

Environmental specifications

Table 214: AHPG environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.22 AirScale RRH 2T4R B71/n71 120 W (AHOA)

AHOA (476320A) is introduced by CB009760 (for LTE and NR).

Functional description

Table 215: AHOA functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM
Number of TXX	2T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, standalone (SA)
TX frequency range	B71/n71: 617-652 MHz
RX frequency range	B71/n71: 663-698 MHz
DL filter bandwidth	35 MHz
UL filter bandwidth	35 MHz
Instantaneous bandwidth (iBW)	35 MHz
Occupied bandwidth (oBW)	35 MHz
Number of carriers per pipe	Up to 6
Supported bandwidths	LTE/NR: 5, 10, 15, 20 MHz
Passive intermodulation (PIM) cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 65: AHOA interfaces

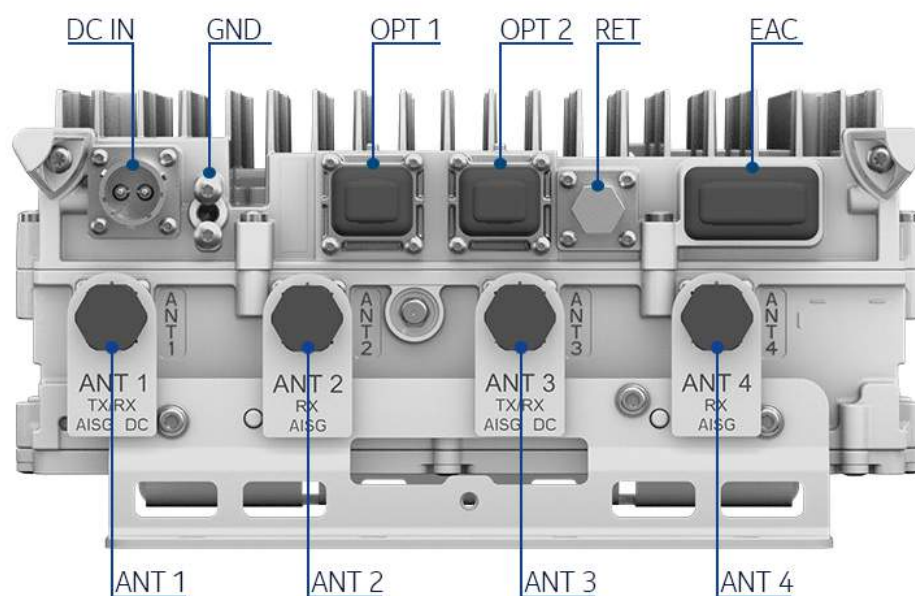


Table 216: AHOA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

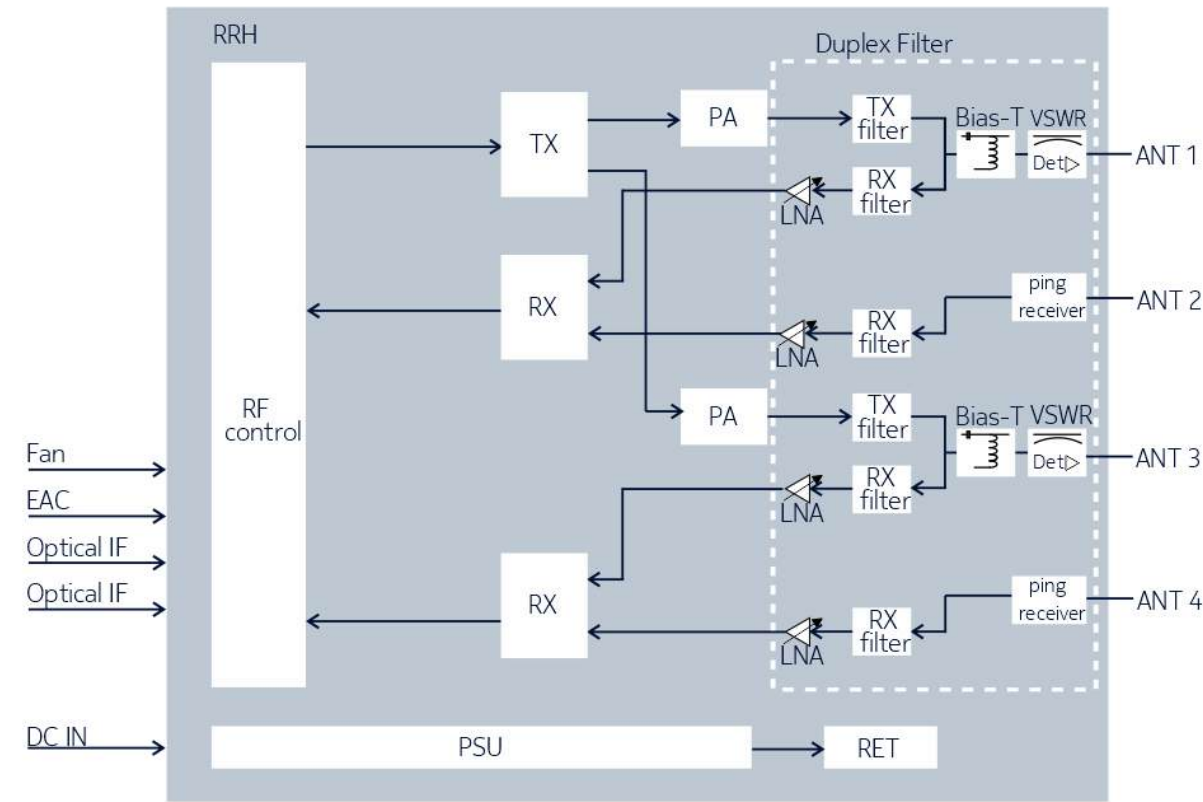
Antenna line device (ALD) support

Table 217: AHOA ALD support

Property	Value
AISG	Version 2.0
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 66: AHOA functional block diagram



Electrical specifications

Table 218: AHOA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 219: The recommended power back-off in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.6	1.2
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.7	1.3

Related optional items

- AMBF AirScale book mount kit 126-150 (474278A)

- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19-inch rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMGE AirScale 2 cover 300 x 151–175 (474271A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60– 300 mm) (472821A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAF AirScale AC/DC power supply unit (PSU) 1150 W (474676A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- ASFA AirScale 2 fan unit 300 (473968A)
- ACPA AirScale 2 fiber protection (474297A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPA AirScale 2 26A DC plug 3.3–6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)

Installation options

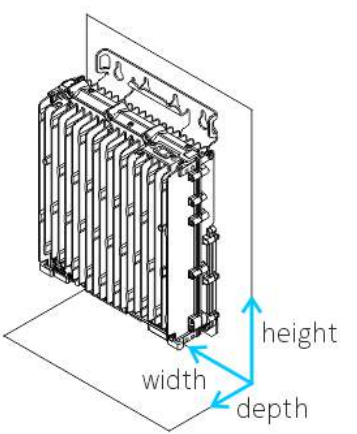
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 220: AHOA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With mounting brackets: 428 mm (16.85 in.)	
Width	295 mm (11.61 in.)	
Depth	165 mm (6.50 in.) With mounting brackets: 186.5 mm (7.34 in.)	
Weight	max. 16.7 kg (36.8 lb)	

Environmental specifications

Table 221: AHOA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.23 AirScale RRH 4T4R B1 160 W (AHGF)

AHGF (476301A) is introduced by CB009364 (for WCDMA, LTE and NR).

Functional description

Table 222: AHGF functional specification

Property	Value
Maximum output power	160 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies	WCDMA, LTE, NR
RF sharing/concurrent mode	WCDMA-LTE, LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band
TX frequency range	B1: 2110-2170 MHz
RX frequency range	B1: 1920-1980 MHz
DL filter bandwidth	60 MHz
UL filter bandwidth	60 MHz
Instantaneous bandwidth (iBW)	60 MHz
Occupied bandwidth (oBW)	60 MHz
Number of carriers per pipe	Up to 6
Supported bandwidths	WCDMA: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8 (default) MHz LTE, NR: 5, 10, 15, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 67: AHGF interfaces

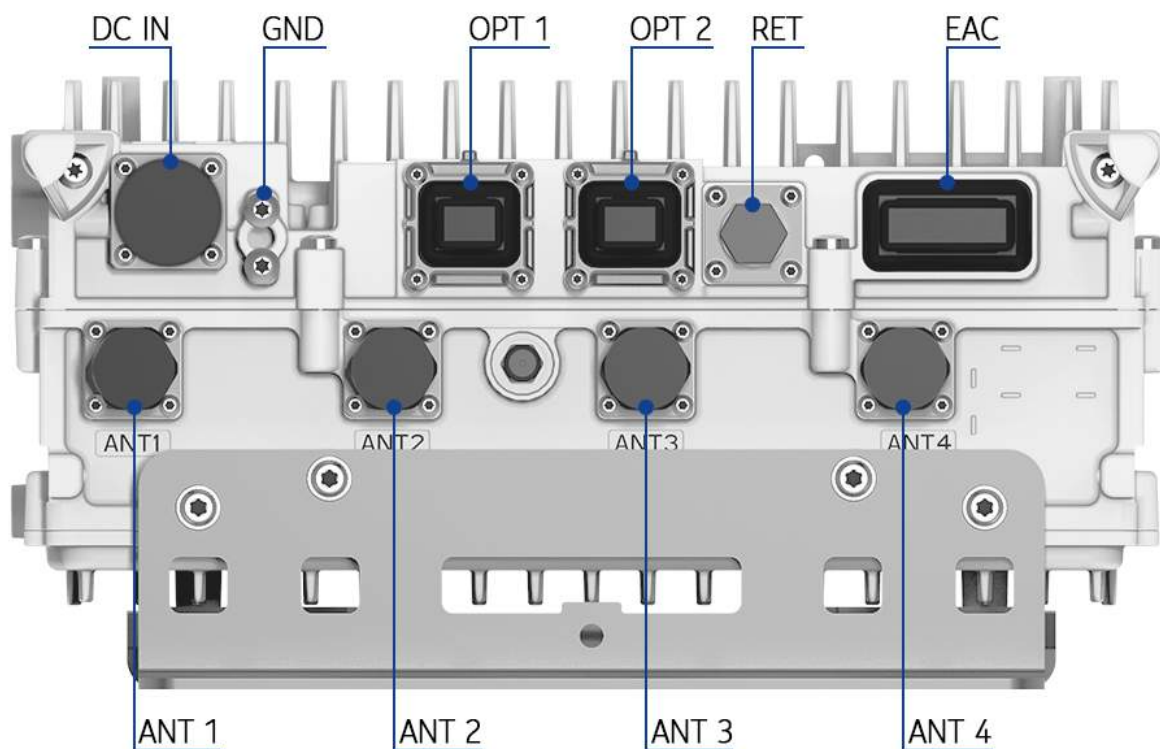


Table 223: AHGF interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPA, APPB, APPC
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3, has features that prevent damage if connecting with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	–
Optical	OPT	2	SFP+	Up to 9.8 Gbps (CPRI); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–

 WARNING!
Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

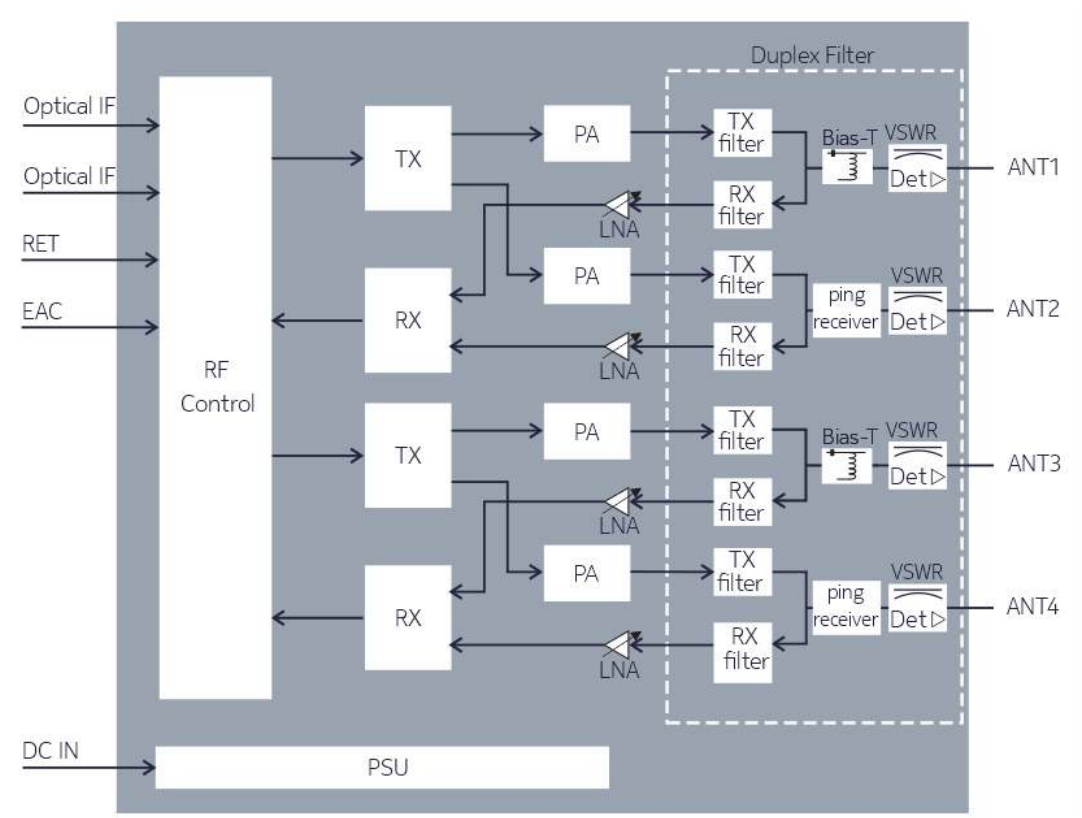
Antenna line device (ALD) support

Table 224: AHGF ALD support

Property	Value
AISG	ANT1, ANT3, RET: 2.0/3.0 ANT2, ANT4: AISG 2.0/3.0 ping receiver
Voltage	14.5 V
Power per port	ANT1, ANT3: 40 W RET: 45 W

Functional block diagram

Figure 68: AHGF functional block diagram



Electrical specifications

Table 225: AHGF electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 226: The recommended power back-off in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Dual carrier [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.7
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0	0.7

Table 227: The recommended `dLQam256PowerBackoffSub6` parameter value in 256 QAM

DL MIMO configuration	<code>dLQam256PowerBackoffSub6</code> value [dB]
Open loop MIMO	0
Close loop MIMO	1.5

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMBF AirScale book mount kit 126–150 (474278A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMGD AirScale 2 cover 300 x 126–150 (474270A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–300 mm) (472821A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- ASFA AirScale 2 fan unit 300 (473968A)
- APPA AirScale 2 26A DC plug 3.3–6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

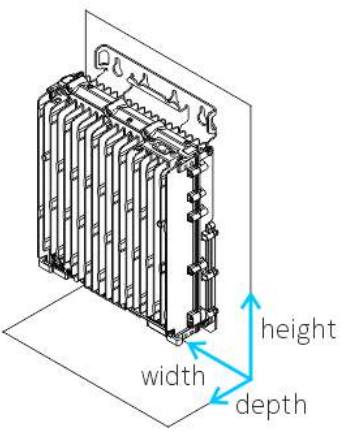
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 228: AHGF dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 337 mm (13.27 in.) With upper and lower mounting brackets: 428 mm (16.8 in.)	
Width	Core RRH: 295 mm (11.61 in.) With cover and mounting brackets: 322 mm (12.68 in.)	
Depth	Core RRH: 140 mm (5.51 in.) With mounting brackets: 165 mm (6.48 in.) With cover and mounting brackets: 184 mm (7.22 in.)	
Weight	15.2 kg (33.5 lb)	

Environmental specifications

Table 229: AHGF environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.24 AirScale RRH 4T4R B3/n3 160 W (AHEB)

AHEB (473484A) is introduced by LTE2784 (for GSM and LTE), SR001206 (for GSM and LTE), and 5GC001099 (for NR).

Functional description

Table 230: AHEB functional specification

Property	Value
Maximum output power	160 W
Modulation	Up to 256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies	GSM, LTE, NR B3: GSM
RF sharing/concurrent mode	B3: GSM-LTE
Duplex mode - supported standard	FDD
TX frequency range	B3/n3: 1805-1880 MHz
RX frequency range	B3/n3: 1710-1785 MHz
DL filter bandwidth	75 MHz
UL filter bandwidth	75 MHz
Instantaneous bandwidth (iBW)	75 MHz
Occupied bandwidth (oBW)	75 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs (including max 2 GSM TRXs)
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 69: AHEB interfaces

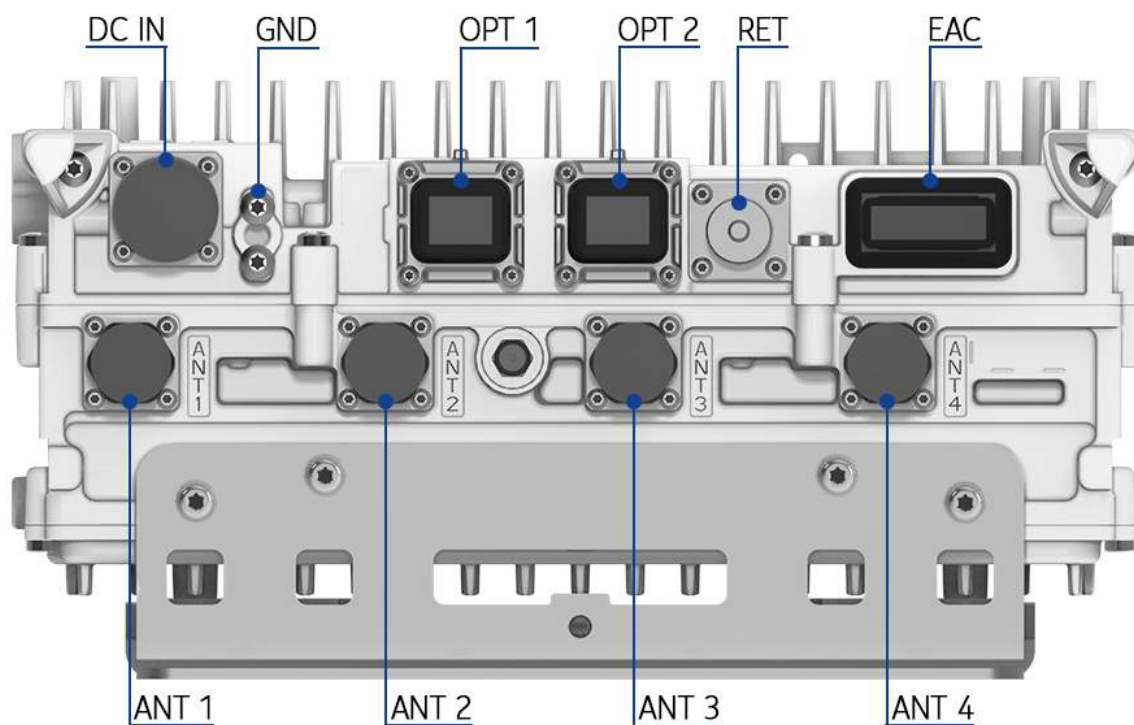


Table 231: AHEB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	Fan	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 232: AHEB ALD support

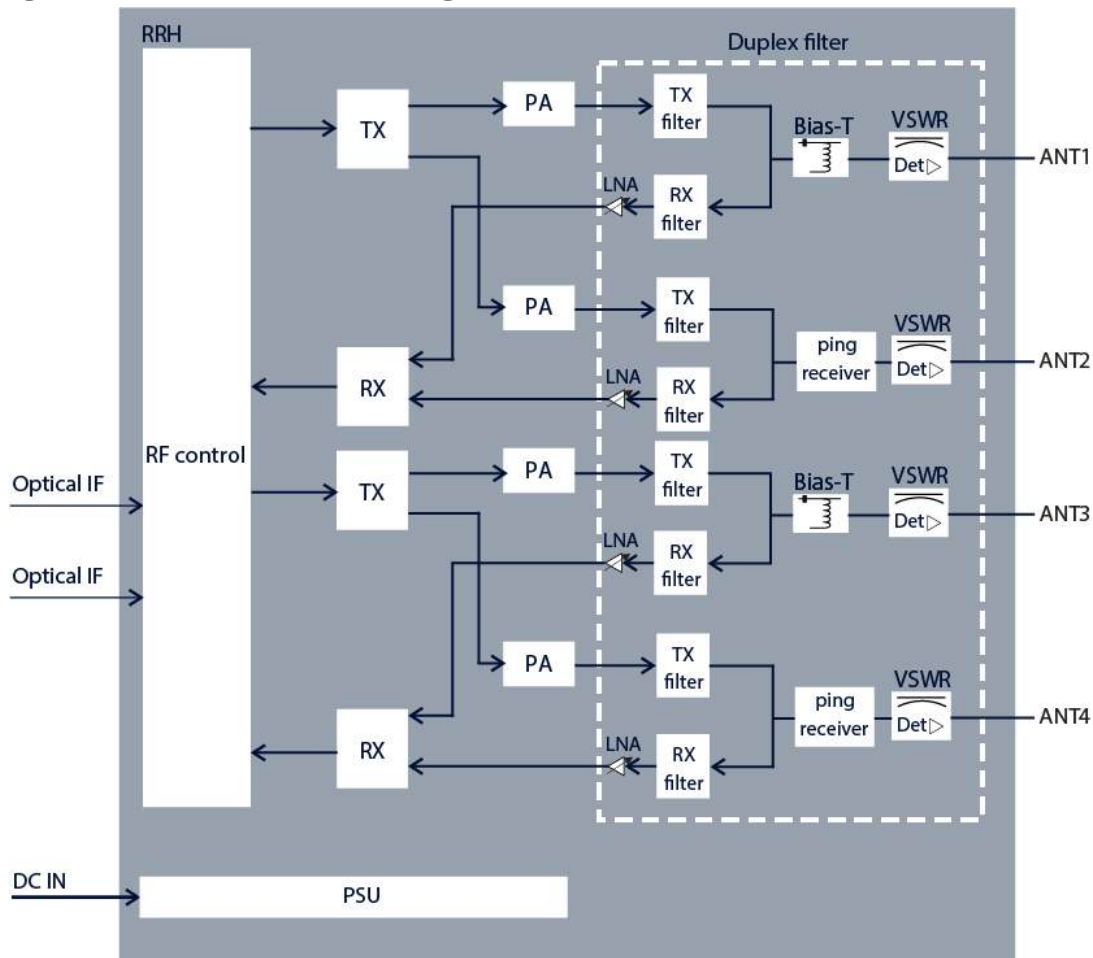
ALD support	Value
AISG	ANT1, ANT3, RET: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 Ping receiver
Voltage	ANT1, ANT3: 14.5 V RET: 14.5 V
Power per port	ANT1, ANT3: 30 W RET: 45 W
Power	45 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 70: AHEB functional block diagram



Electrical specifications

Table 233: AHEB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

Table 234: AHEB power back-off in 256 QAM

Single carrier [dB]	Dual carrier [dB]
0	0.8

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)

- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

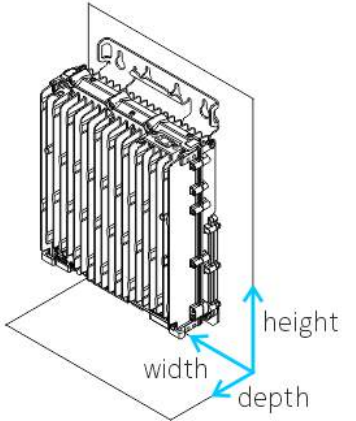
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 235: AHEB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 337 mm (13.27 in.) With upper and lower mounting brackets: 427 mm (16.81 in.)	
Width	Core RRH: 295 mm (11.61 in.) With cover and mounting brackets: 322 mm (12.68 in.)	
Depth	Core RRH: 140 mm (5.51 in.) With mounting brackets: 164.5 mm (6.48 in.) With cover and mounting brackets: 183.5 mm (7.22 in.)	
Weight	15.5 kg (34.2 lb)	

Environmental specifications

Table 236: AHEB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.25 AirScale RRH 4T4R B3/n3 160 W (AHEH)

AHEH (474253A) is introduced by LTE4686 (for LTE), SR002165 (for GSM), and 5GC002171 (for NR).

Functional description

Table 237: AHEH functional specification

Property	Value
Maximum output power	160 W
Modulation	Up to 256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies	GSM, LTE, NR
RF sharing/concurrent mode	LTE-GSM
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B3/n3: 1805-1860 MHz
RX frequency range	B3/n3: 1710-1765 MHz
DL filter bandwidth	55 MHz
UL filter bandwidth	55 MHz
Instantaneous bandwidth (iBW)	55 MHz
Occupied bandwidth (oBW)	55 MHz
Number of carriers per pipe	Up to 8
Supported bandwidths	LTE/NR: 5, 10, 15, 20 MHz
PIM Cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 71: AHEH interfaces

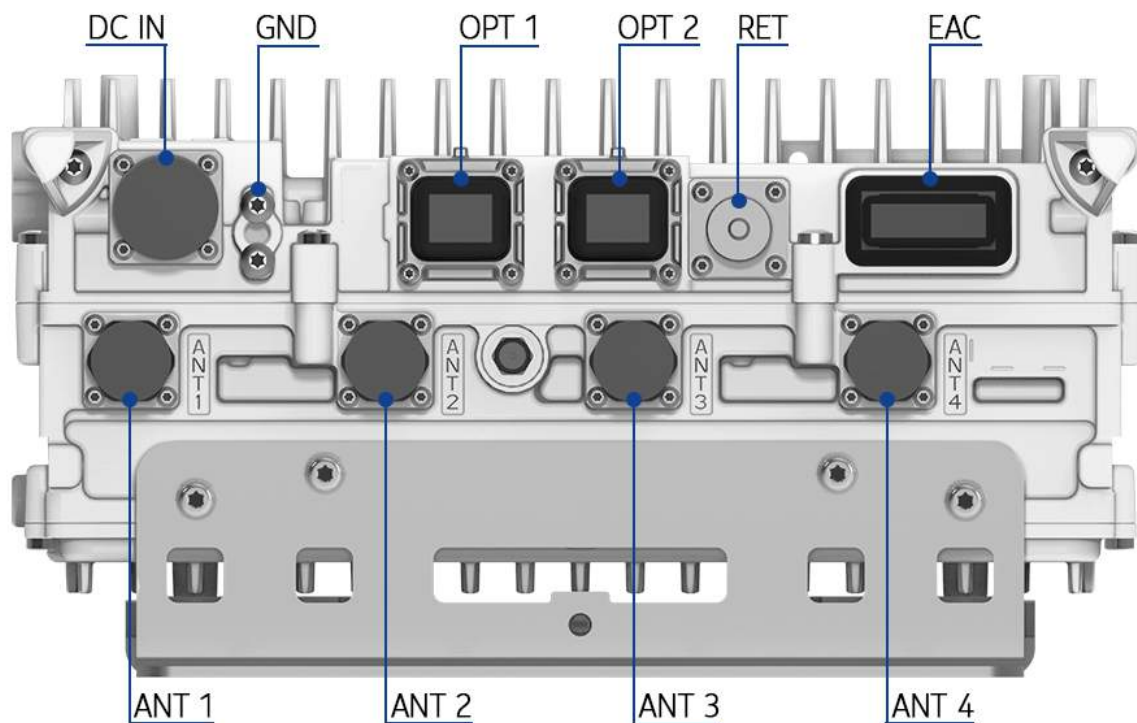


Table 238: AHEH interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	Fan	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 239: AHEH ALD support

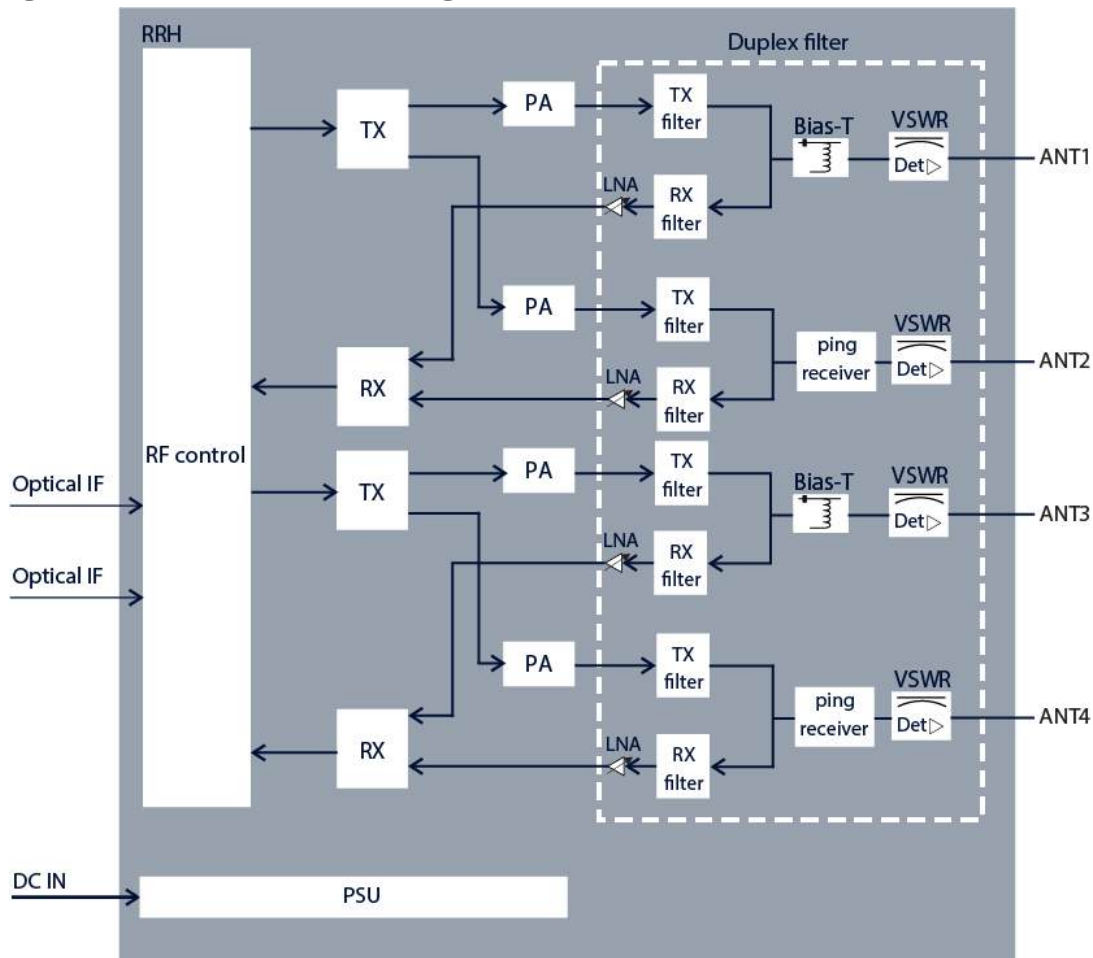
ALD support	Value
AISG	ANT1, ANT3, RET: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 Ping receiver
Voltage	ANT1, ANT3: 14.5 V RET: 14.5 V
Power per port	ANT1, ANT3: 30 W RET: 45 W
Power	45 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 72: AHEH functional block diagram



Electrical specifications

Table 240: AHEH electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

Table 241: AHEH power back-off in 256 QAM

Single carrier [dB]	Dual carrier [dB]
0	0.8

GSM cell power range



Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)

- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

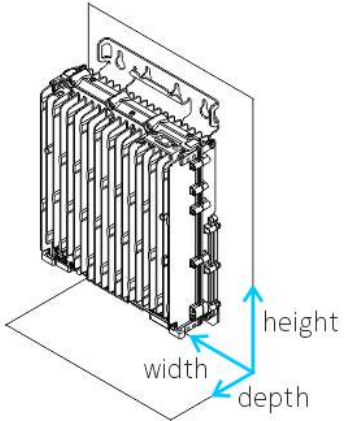
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 242: AHEH dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 337 mm (13.27 in.) With upper and lower mounting brackets: 427.5 mm (16.83 in.)	
Width	Core RRH: 295 mm (11.61 in.) With cover: 322 mm (12.68 in.)	
Depth	Core RRH: 140 mm (5.51 in.) With mounting brackets: 164.5 mm (6.48 in.) With cover and mounting brackets: 183.5 mm (7.22 in.)	
Weight	15.5 kg (34.2 lb)	

Environmental specifications

Table 243: AHEH environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	–40°C (–40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.26 AirScale RRH 4T4R B5/n5 160 W (AHCA)

AHCA (473966A /473966B) is introduced by LTE3399/SR002145/5GC001152/CB006640.

Functional description

Table 244: AHCA functional specification

Property	Value
Maximum output power	160 W
Modulation	Up to 256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	WCDMA, LTE, NR
Duplex mode - supported standard	FDD
RF sharing/concurrent mode	LTE-NR WCDMA-LTE
TX frequency range	B5/n5: 869–894 MHz
RX frequency range	B5/n5: 824–849 MHz
DL instantaneous bandwidth (iBW)	25 MHz
UL instantaneous bandwidth (iBW)	25 MHz
DL filter bandwidth	25 MHz
UL filter bandwidth	25 MHz
Number of carriers per pipe	Up to 4 carriers (LTE, NR or mixed LTE+NR)
Supported bandwidths	LTE: 1.4, 3, 5, 10 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 73: AHCA interfaces

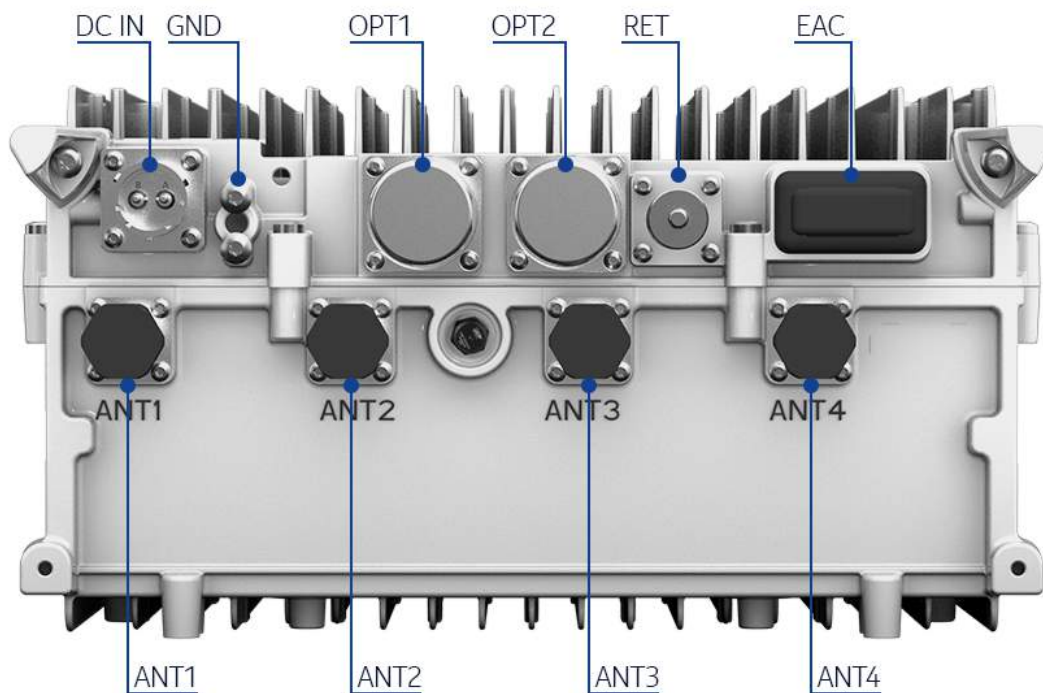


Table 245: AHCA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	ANT1 and ANT3 should be used with 2T4R and 2T2R modes.
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	Variant A (473966A): SFP+ Variant B (473966B): SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Variant A (473966A): R2CT IP seal Variant B (473966B): Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 246: AHCA interface for ALD support

ALD support via antenna ports	Value
AISG	ANT1, ANT3, RET: AISG 2.0 ANT2, ANT4: AISG 2.0 Ping receiver
Voltage	ANT1, ANT3: 14.5 V RET: 14.5 V
Power per port	ANT1, ANT3: 30 W RET: 45 W
Power	45 W

Note:

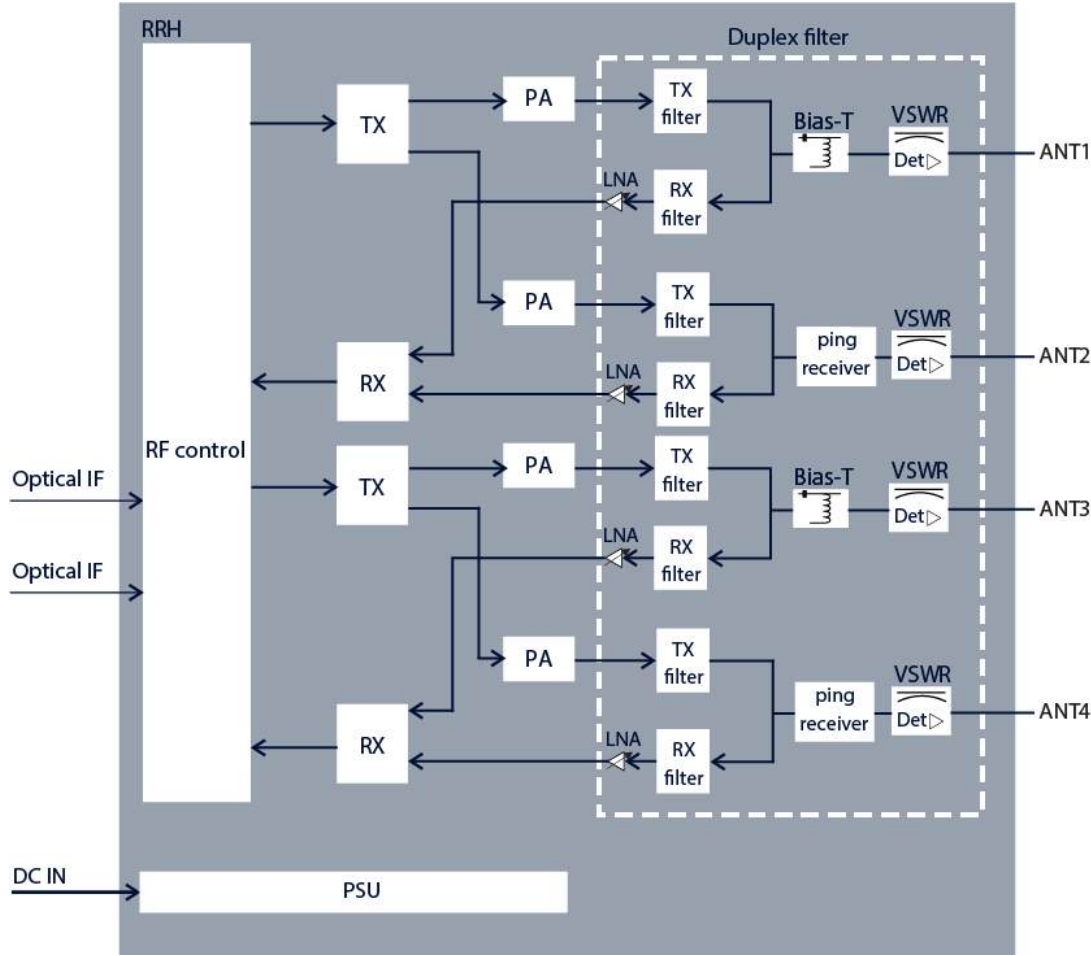
Separate software feature is required for ALD support.

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 74: AHCA functional block diagram



Electrical specifications

Table 247: AHCA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Calculated maximum input current including tolerances	18.7 A at -36 V DC (673 W) including 45 W power feed for ALD
Surge protection	Class II 5 kA

Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

LTE power back-off

Table 248: Recommended AHCA power back-off in 256 QAM mode (carrier spacing over 100 MHz)

Single carrier [dB]	Dual carrier [dB]
0	0.8

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APAF AirScale AC-DC PSU 100-240VAC/1150 W (474676A)
- AMGE AirScale 2 cover 300 x 151-175 (474271A)
- AMBI AirScale book mount kit for AHCA (474279A)

- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- ACPA AirScale 2 fiber protection (474297A) - only if R2CT is not used

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

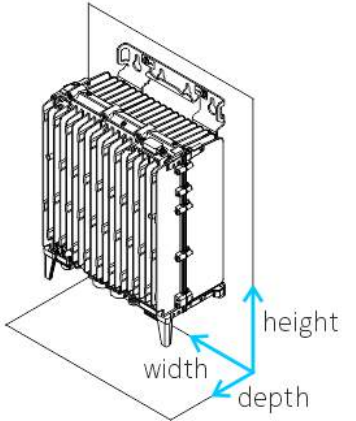


Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 249: AHCA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 386 mm (15.2 in.) With upper and lower mounting brackets: 427.5 mm (16.83 in.)	
Width	309 mm (12.17 in.) With a cover: 324 mm (12.76 in.)	
Depth	Core RRH: 165 mm (6.5 in.) With mounting brackets: 189 mm (7.44 in.) With a cover and mounting brackets: 208 mm (8.19 in.)	
Weight	16.7 kg (36.8 lb)	

Environmental specifications

Table 250: AHCA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.27 AirScale RRH 4T4R B5/B26 240 W (AHCI)

AHCI (476543A) is introduced by *CB011110* (for LTE and NR).

Functional description

Table 251: AHCI functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Operating mode	4T4R full mode 2 x 2T2R split mode
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR (max two carriers: 1 x LTE + 1 x NR)
Duplex mode	FDD
IoT support	NB-IoT standalone
TX frequency range	B5: 869–884.4 MHz B26: 868.6–884.4MHz
RX frequency range	B5: 824–839.4 MHz B26: 823.6–839.4 MHz
DL filter bandwidth	B5: 15.4 MHz B26: 15.8 MHz
UL filter bandwidth	B5: 15.4 MHz B26: 15.8 MHz
Instantaneous bandwidth (iBW)	B5: 15.4 MHz B26: 15.8 MHz
Occupied bandwidth (oBW)	B5: 15.4 MHz B26: 15.8 MHz
Number of carriers per pipe	Up to 5 (NB IoT, LTE, NR, or mixed NB IoT + LTE + NR)

Property	Value
Supported bandwidths	LTE: 5, 10 MHz NR: 5, 10, 15 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 75: AHCI interfaces

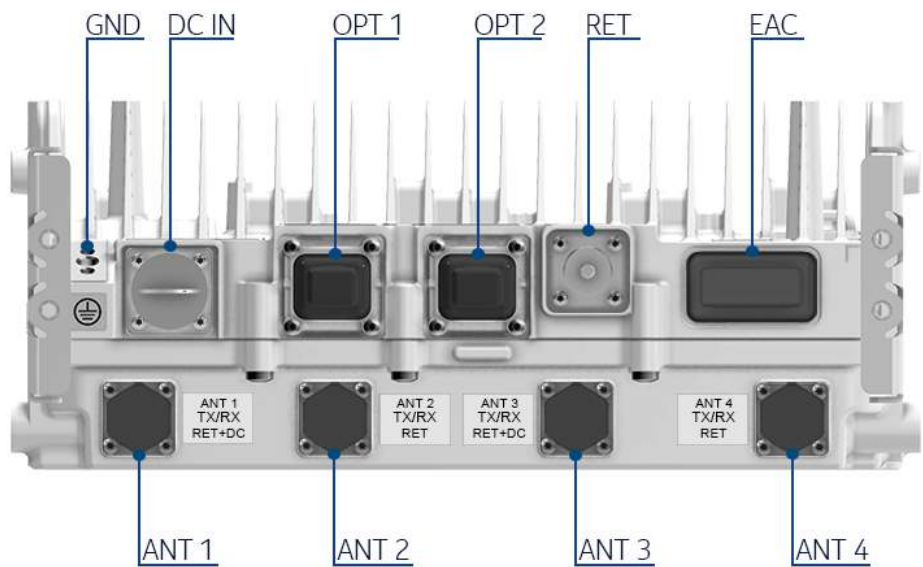


Table 252: AHCI interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	2-pole screw terminal	–
Antenna	ANT	4	4.3-10	–
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	–
Optical	OPT	2	SFP+	CPRI: 9.8 Gbps; Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

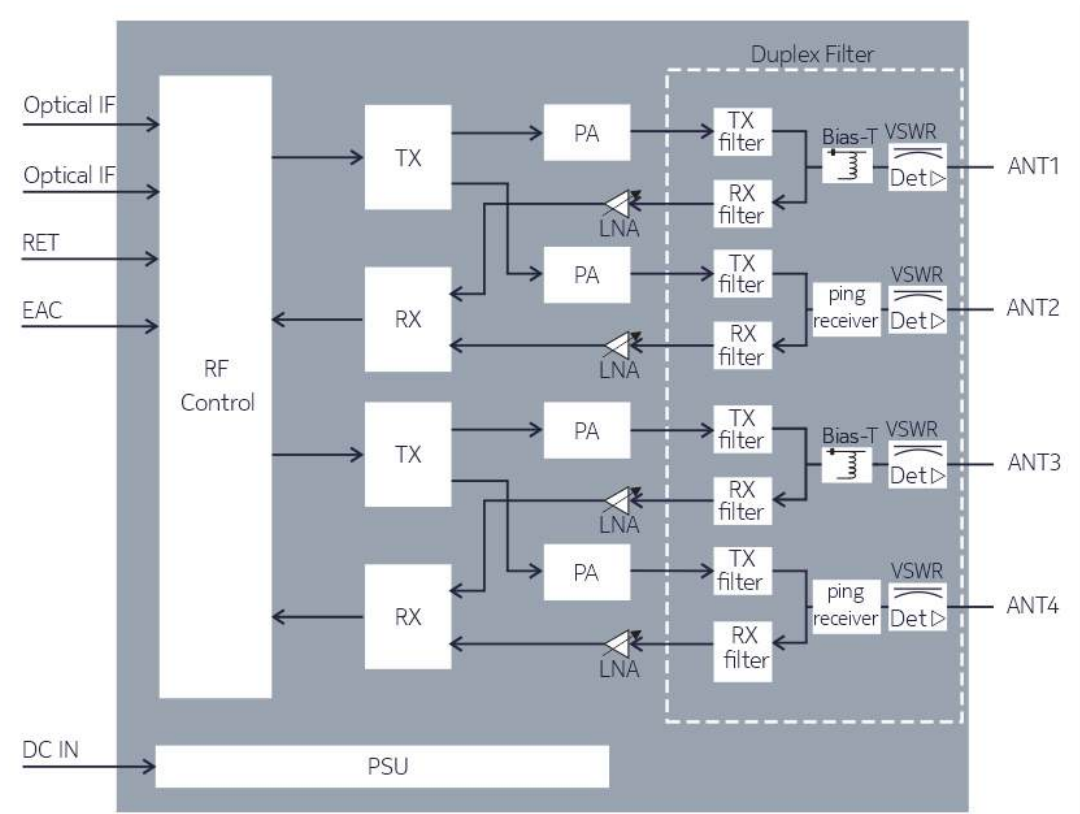
Antenna line device (ALD) support

Table 253: AHCI ALD support

Property	Value
AISG	AISG 3.0: ANT 1, ANT 2, ANT 3, ANT 4, and RET Power supply: ANT 1 and ANT 3
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 76: AHCI functional block diagram



Electrical specifications

Table 254: AHCI electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw (I_{max}) (-36 V)*	27 A
Maximum current draw (I_{max}) (-40.5 V)*	24 A

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 255: The recommended power back-off in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	1.5	1.5
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBG AirScale book mount kit 151-175 (474467A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting**
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting**

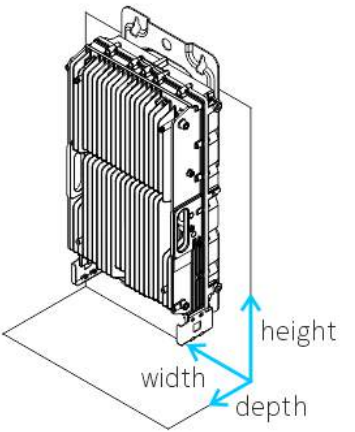
* When installing AHCI RU with other units, do not install it in the middle position, as it will overheat.

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 256: AHCI dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 512 mm (20.16 in.) With mounting bracket: 652 mm (25.67 in.)	
Width	Core RRH: 308 mm (12.13 in.) With side mounting bosses: 327 mm (12.87 in.)	
Depth	Core RRH: 155 mm (6.10 in.) With mounting bracket: 165 mm (6.50 in.)	
Weight	max. 26 kg (57.3 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 257: AHCI environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

5.2.28 AirScale RRH 4T4R B7/n7 160 W (AHHB)

AHHB (474252A) is introduced by LTE3137 (for LTE) and 5GC001839 (for NR).

Functional description

Table 258: AHHB functional specification

Property	Value
Maximum output power	160 W
Modulation	Up to 256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B7/n7: 2620-2690 MHz
RX frequency range	B7/n7: 2500-2570 MHz
DL filter bandwidth	70 MHz
UL filter bandwidth	70 MHz
Instantaneous bandwidth (iBW)	70 MHz
Occupied bandwidth (oBW)	70 MHz
Number of carriers per pipe	Up to 8
Supported bandwidths	5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 77: AHHB interfaces

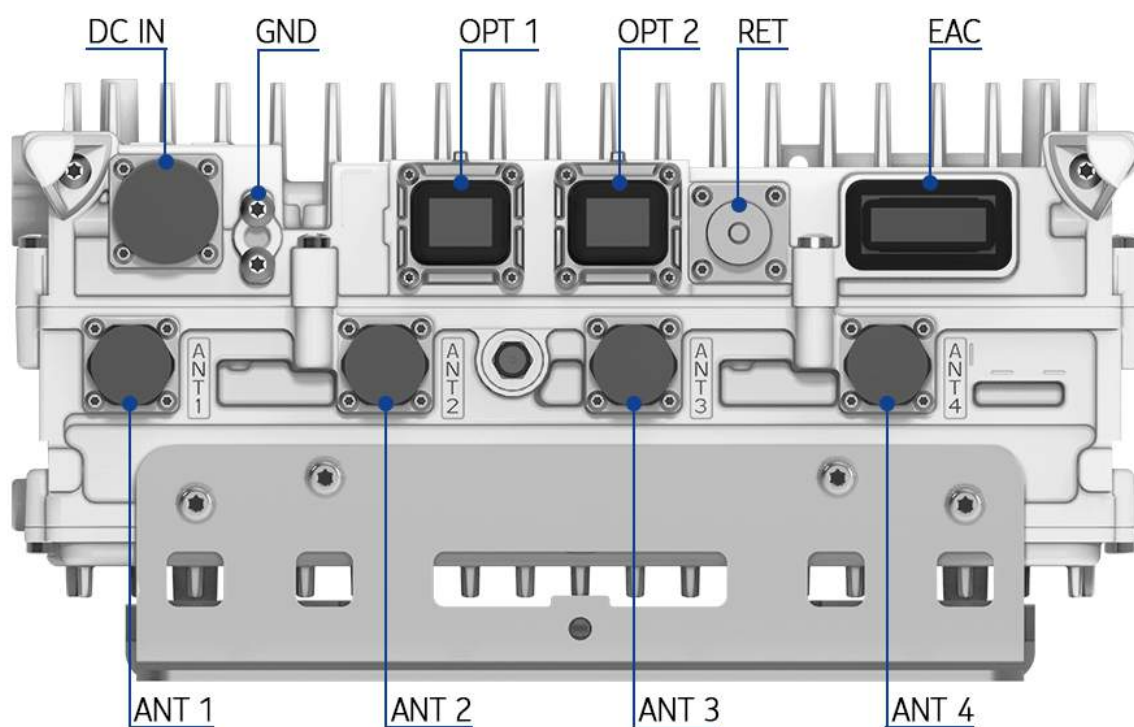


Table 259: AHHB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 260: AHHB ALD support

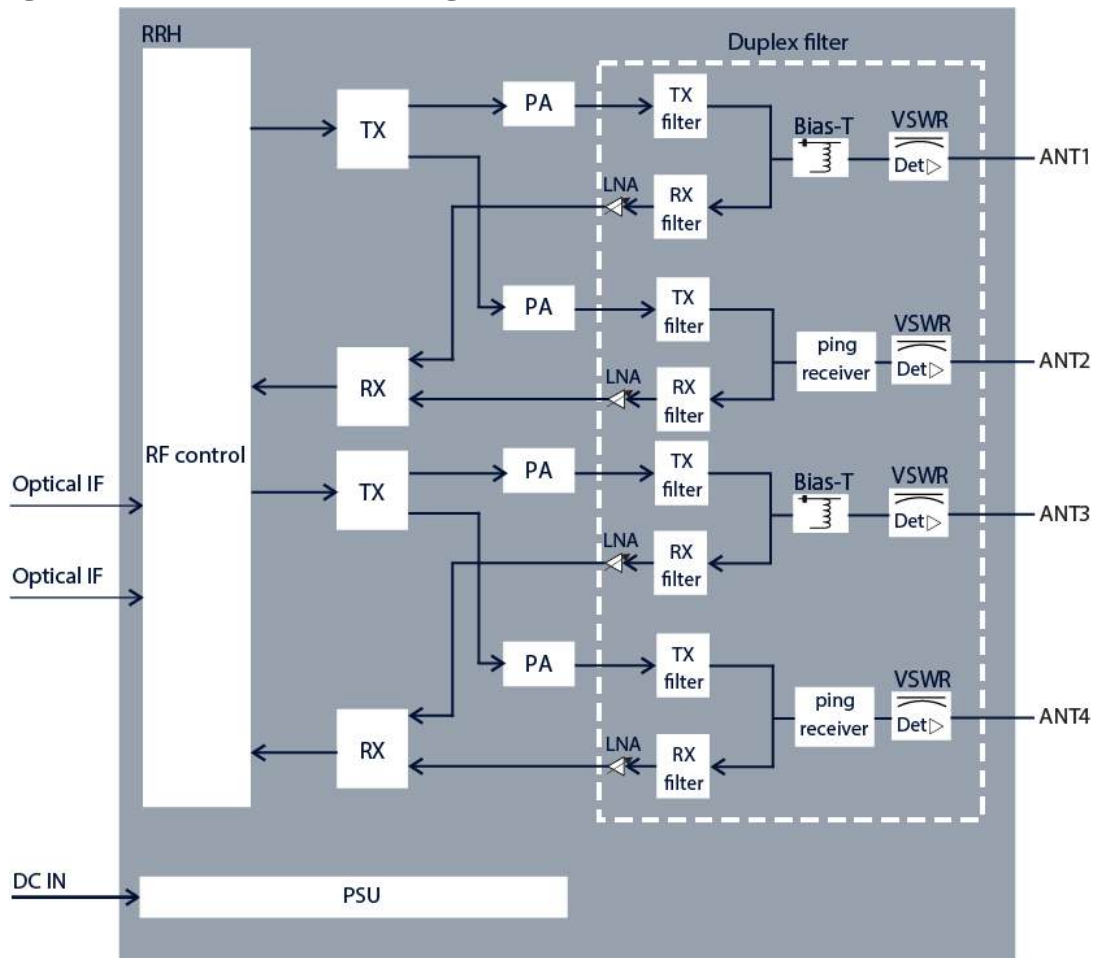
ALD support	Value
AISG	ANT1, ANT3, RET: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 Ping receiver
Voltage	ANT1, ANT3: 14.5 V RET: 14.5 V
Power per port	ANT1, ANT3: 30 W RET: 45 W
Power	45 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 78: AHHB functional block diagram



Electrical specifications

Table 261: AHHB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC



Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

LTE power back-off

Table 262: Recommended AHHB power back-off in 256 QAM

Single carrier [dB]	Dual carrier [dB]
0	0.8

NR power back-off

The recommended power back-off ($dLQam256PowerBackoffSub6$) value is 3 dB. Higher power back-off values may decrease the overall 5G coverage area for high modulation/coding scheme configurations.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)

- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

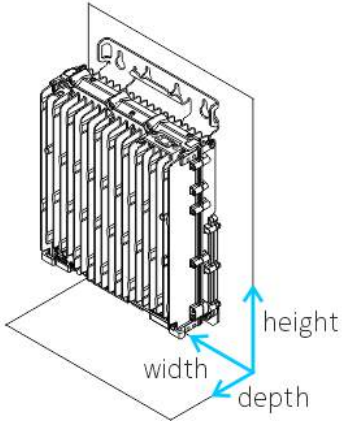
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 263: AHHB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 337 mm (13.27 in.) With upper and lower mounting brackets: 427.5 mm (16.83 in.)	
Width	Core RRH: 295 mm (11.61 in.) With cover and mounting brackets: 322 mm (12.68 in.)	
Depth	Core RRH: 140 mm (5.51 in.) With mounting brackets: 164.5 mm (6.48 in.) With cover and mounting brackets: 183.5 mm (7.22 in.)	
Weight	15.7 kg (34.6 lb)	

Environmental specifications

Table 264: AHHB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.29 AirScale RRH 4T4R B26/n26 200 W (AHCF)

AHCF (475313A) is introduced by SR002703/5GC002476.

Functional description

Table 265: AHCF functional specification

Property	Value
Maximum output power	200 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	WCDMA, LTE, NR
RF sharing/concurrent mode	B26/n26: multi-RAT operation LTE, NR B5/n5: multi-RAT operation WCDMA, LTE, NR
Duplex mode, supported standard	FDD
IoT support	NB-IoT in band, guard band (GB)
TX frequency range	B26/n26: 859–894 MHz * B5/n5: 869–894 MHz
RX frequency range	B26/n26: 814–849 MHz B5/n5: 824–849 MHz
DL filter bandwidth	35 MHz
UL filter bandwidth	35 MHz
Instantaneous bandwidth (iBW)	35 MHz
Occupied bandwidth (oBW)	35 MHz
Number of carriers per pipe	Up to 3
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

* Due to FCC requirements 1 MHz of band 26 (859–860 MHz) is reserved for a guard band. You

can allocate a carrier overlapping this area (for example 10 MHz carrier with the center frequency of 864 MHz) but in this case the overlapping PRBs need to be shut down using *LTE3145: Slim Carrier* feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 79: AHCF interfaces

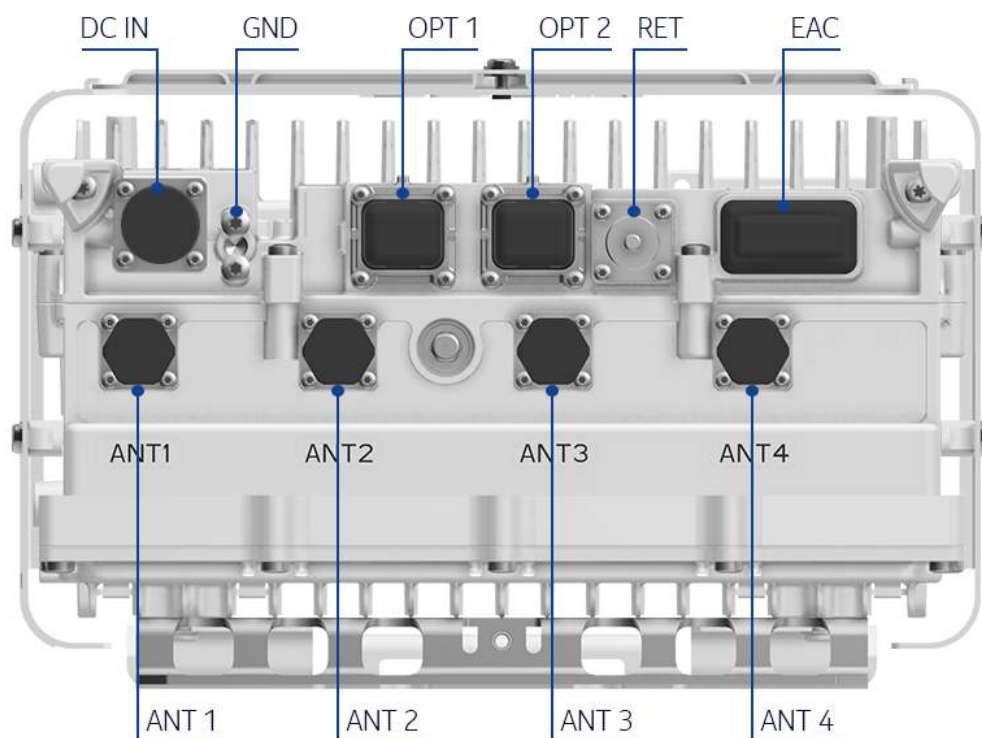


Table 266: AHCF interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 267: AHCF ALD support

ALD support	Value
AISG	AISG 2.0/3.0 and power supply: ANT1, ANT3 PING: ANT1, ANT2, ANT3, ANT4
Voltage	14.5 V
Power per port	30 W, total 45 W

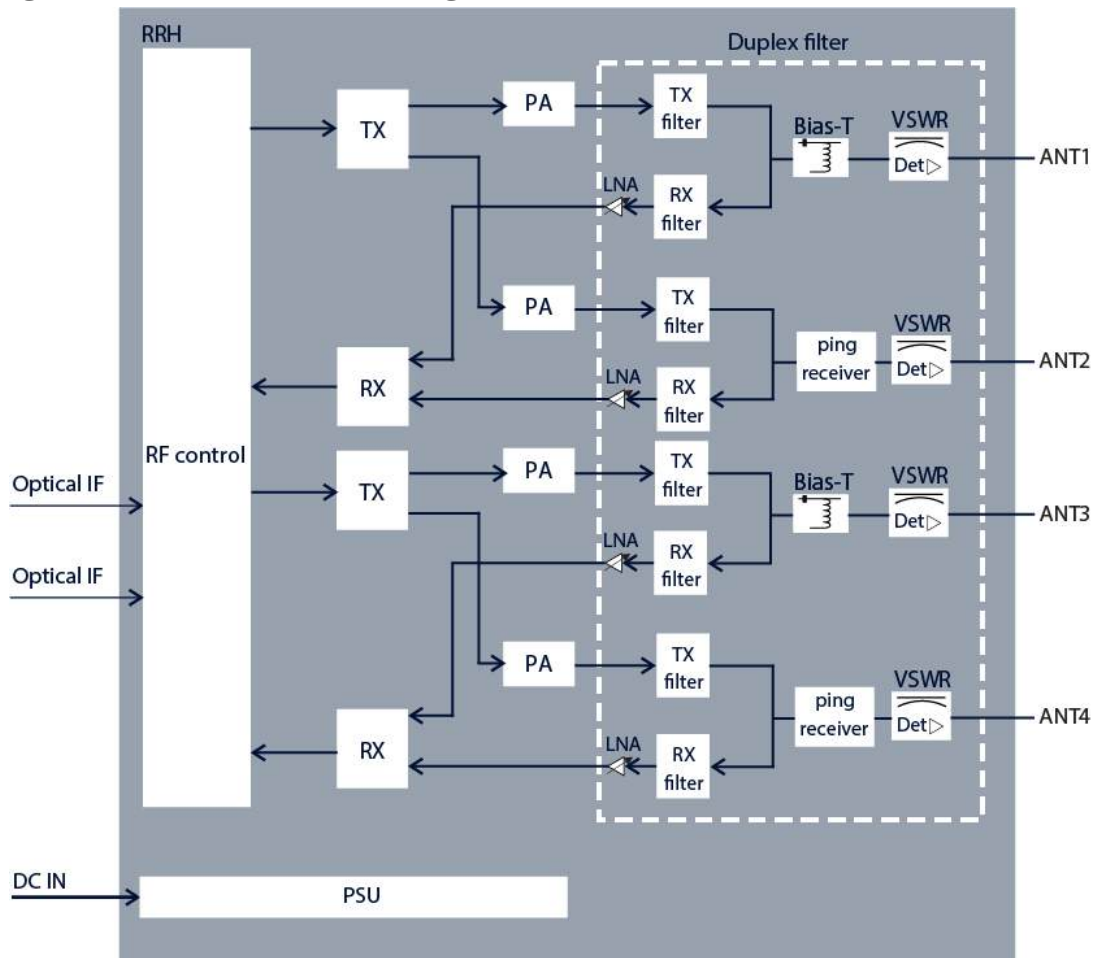


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 80: AHCF functional block diagram



Electrical specifications

Table 268: AHCF electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

NR power back-off

Recommended value for `dlQam256PowerBackoffSub6` parameter is:

- 1 dB for 3GPP performance requirement
- 2 dB for high peak UE throughput (4x4 DL MIMO)

Related optional items

- ACPA AirScale 2 fiber protection (474297A)
- AMBI AirScale book mount kit for AHCA (474279A)
- AMGE AirScale 2 cover 300 x 151–185 (474271A) - factory-installed in AHCF radio variant
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAF AirScale AC-DC PSU 100–240VAC/1150 W (474676A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPA AirScale 2 26A DC plug 3.3–6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ASFA AirScale 2 fan unit 300 (473968A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

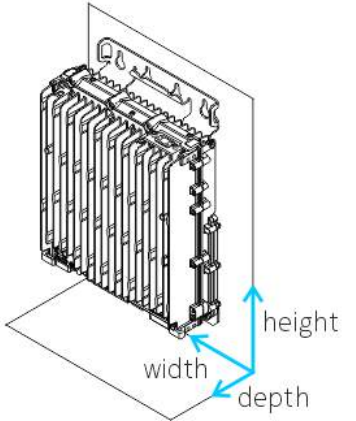
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 269: AHCF dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH with ID cover: 372.5 mm (14.67 in) With upper and lower mounting brackets: 447.5 mm (17.62 in)	
Width	Core RRH with ID cover: 317 mm (12.4 in)	
Depth	Core RRH with ID cover: 185 mm (7.28 in) With upper and lower mounting brackets: 198.5 mm (7.81 in)	
Weight	Core RRH with ID cover: 19.2 kg (42.3 lb) With upper and lower mounting brackets: 20.5 kg (45.2 lb)	

Environmental specifications

Table 270: AHCF environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.30 AirScale RRH 4T4R B26a 100 W (AHCC)

AHCC (474469A) is introduced by LTE4260 (for LTE).

Functional description

Table 271: AHCC functional specification

Property	Value
Maximum output power	100 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B26a: 862.6-869 MHz
RX frequency range	B26a: 817.6-824 MHz
DL filter bandwidth	6.4 MHz
UL filter bandwidth	6.4 MHz
Instantaneous bandwidth (iBW)	6.4 MHz
Occupied bandwidth (oBW)	6.4 MHz
Number of carriers per pipe	Up to 3
Supported bandwidths	1.4, 3, 5 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 81: AHCC interfaces

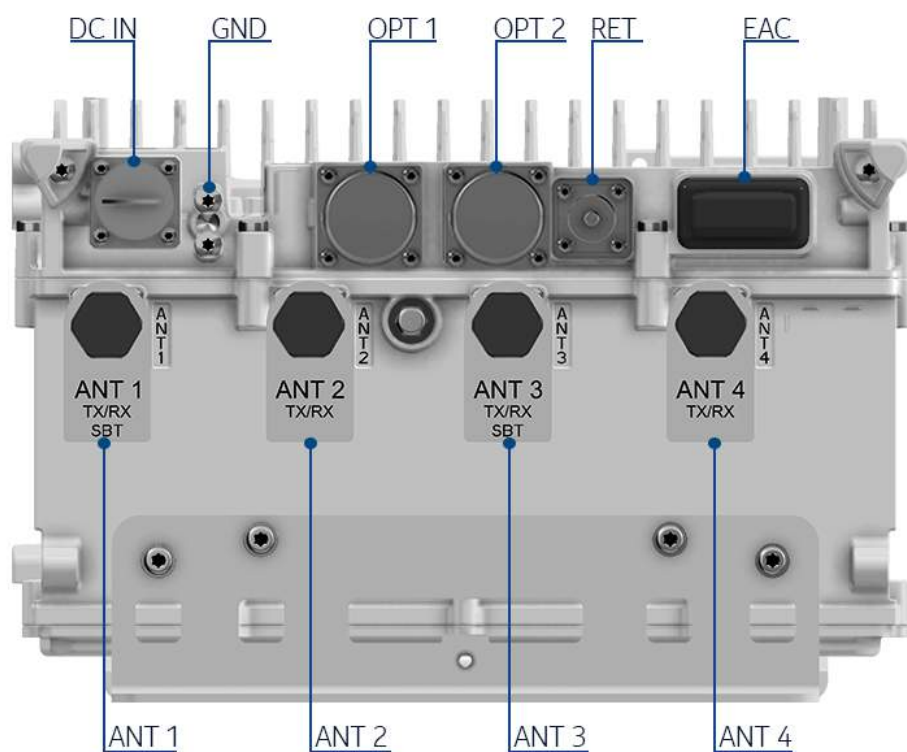


Table 272: AHCC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Two position circular connector	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10 Plus	AISG & BiasT support on ANT1 and ANT3
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); R2CT IP caps
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 273: AHCC ALD support

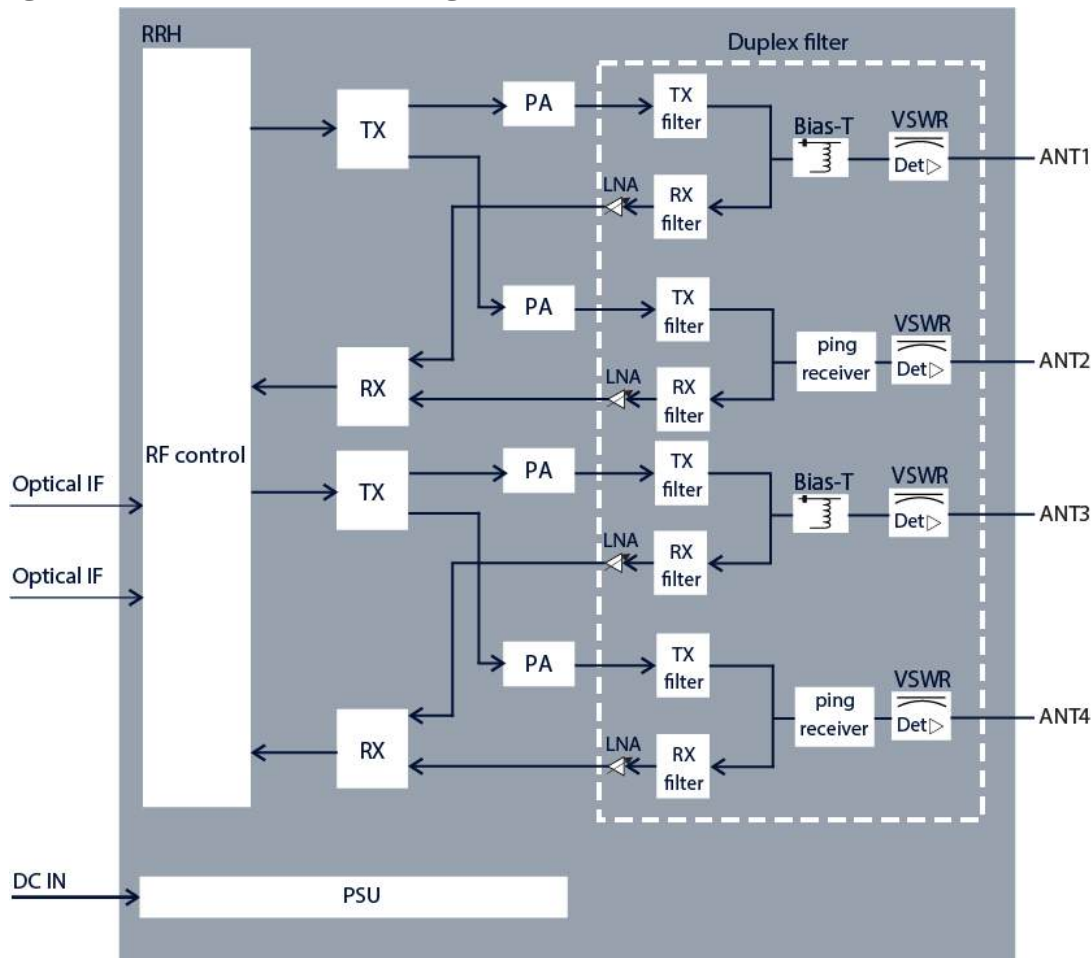
ALD support	Value
AISG	ANT1, ANT3: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 ping receiver RET: AISG 2.0/3.0
Voltage	ANT1, ANT3, RET: 14.5 V
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 82: AHCC functional block diagram



Electrical specifications

Table 274: AHCC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

Table 275: AHCC power back-off in 256 QAM

Rated power [W]	Single Carrier [dB]	Dual Carrier [dB]	Triple Carrier [dB]
40	0	0.4	0.4
25	0	0	0.4

Note:

Final values will be provided in future releases.

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGF AirScale2 cover 300 x 176-200 (474272A)
- AMBH AirScale book mount kit 176-200 (474280A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)

- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- ACPA AirScale 2 fiber protection (474297A) - only if R2CT is not used

Installation options

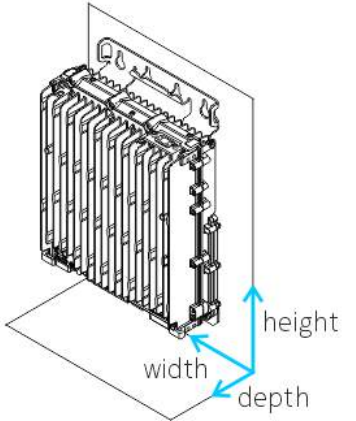
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 276: AHCC dimensions and weight

Property	Value	Dimensions orientation
Height	337 mm (13.27 in.) With upper and lower mounting bracket: 427.5 mm (16.83 in.)	
Width	295 mm (11.61 in.)	
Depth	190 mm (7.48 in.) With upper and lower mounting bracket: 206.5 mm (8.12 in.)	
Weight	21.5 kg (47.4 lb)	

Environmental specifications

Table 277: AHCC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.31 AirScale RRH 4T4R B28 240 W (AHPF)

AHPF (475798A) is introduced by CB006896 (for NR).

Functional description

Table 278: AHPF functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	NR
Duplex mode, supported standard	FDD
TX frequency range	758-788 MHz
RX frequency range	703-733 MHz
DL filter bandwidth	30 MHz
UL filter bandwidth	30 MHz
Instantaneous bandwidth (iBW)	30 MHz
Occupied bandwidth (oBW)	30 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	10, 20, 30 MHz
PIM cancellation	Yes

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 83: AHPF interfaces

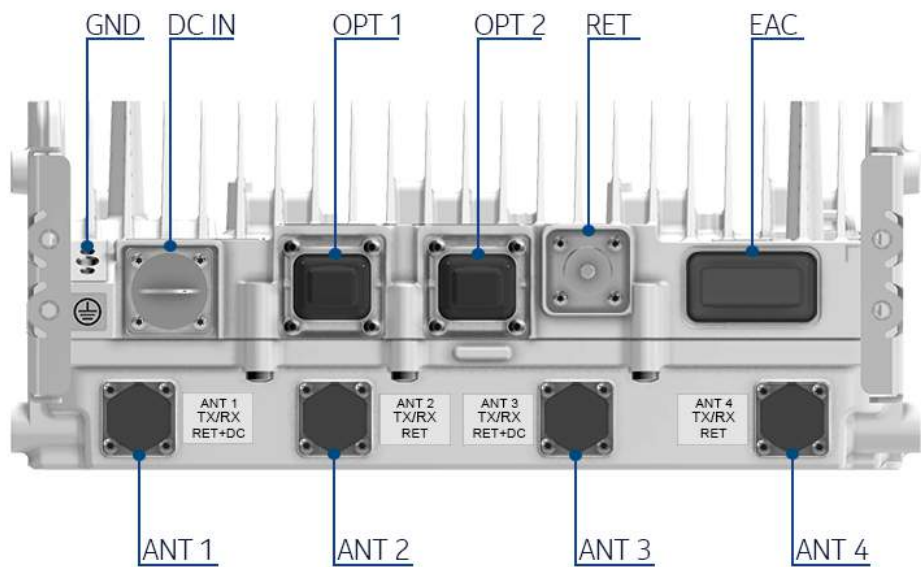


Table 279: AHPF interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	2-pole connector	APPB, APPC
Antenna connector	ANT	4	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP+	9.8 Gbit/s CPRI; Nokia IP seal
Grounding	GND 	1	2 x M5 screw	–



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 280: AHPF ALD support

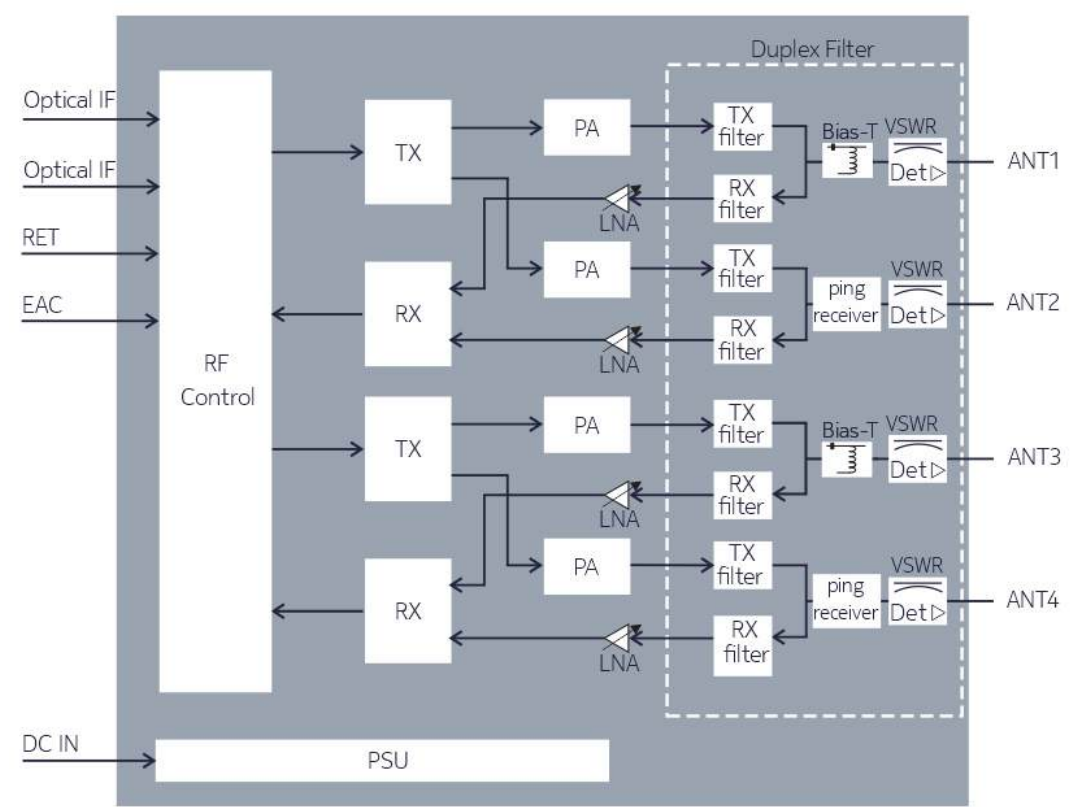
Property	Value
AISG	AISG 3.0: ANT 1, ANT 2, ANT 3, ANT 4, and RET Power supply: ANT 1 and ANT 3
Voltage	14.5 V
Power per port	30 W, 45 W total

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 84: AHPF functional block diagram



Electrical specifications

Table 281: AHPF electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

Table 282: AHPF power back-off in 256 QAM

Single Carrier [dB]	Dual Carrier [dB]
0	0

Recommend value for `dlQam256PowerBackoffSub6` parameter is:

- 0 dB for 3GPP performance requirement
- 1.5 dB for high peak UE throughput

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)

- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting*

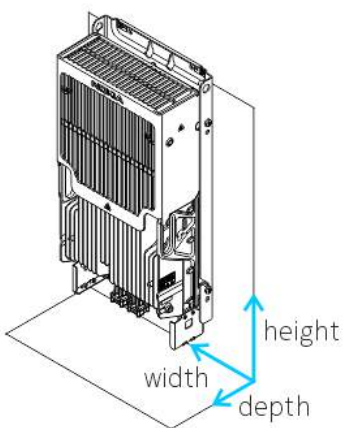


Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 283: AHPF dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 512 mm (20.16 in.) With mounting bracket: 652 mm (25.67 in.)	
Width	Core RRH: 308 mm (12.13 in.) With side mounting bosses: 327 mm (12.87 in.)	
Depth	Core RRH: 130 mm (5.12 in.) With mounting bracket: 140 mm (5.51 in.)	
Weight	22.4 kg (49.4 lb)	

Environmental specifications

Table 284: AHPF environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.32 AirScale RRH 4T4R B28/n28 320 W (AHPB)

AHPB (474119A) is introduced by LTE3651/5GC000930.

Functional description

Table 285: AHPB functional specification

Property	Value
Maximum output power	320 W
Modulation	Up to 256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE, NR
Duplex mode - supported standard	FDD
TX frequency range	758-803 MHz
RX frequency range	703-748 MHz
DL filter bandwidth	45 MHz
UL filter bandwidth	45 MHz
Instantaneous bandwidth (iBW)	45 MHz
Occupied bandwidth (oBW)	45 MHz
Number of carriers per pipe	Up to 4 carriers in total for all supported RATs
Supported bandwidths	LTE: 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 85: AHPB interfaces

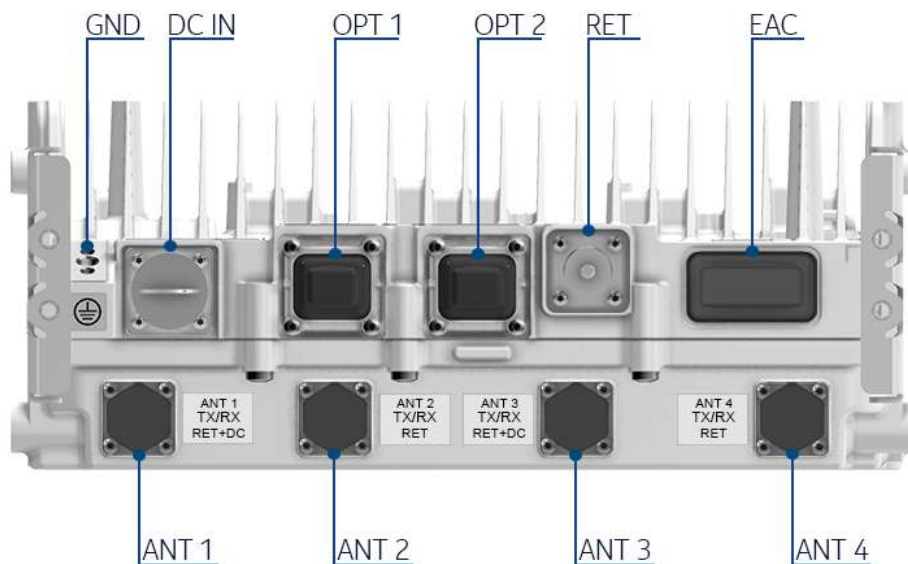


Table 286: AHPB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	high power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 287: AHPB ALD support

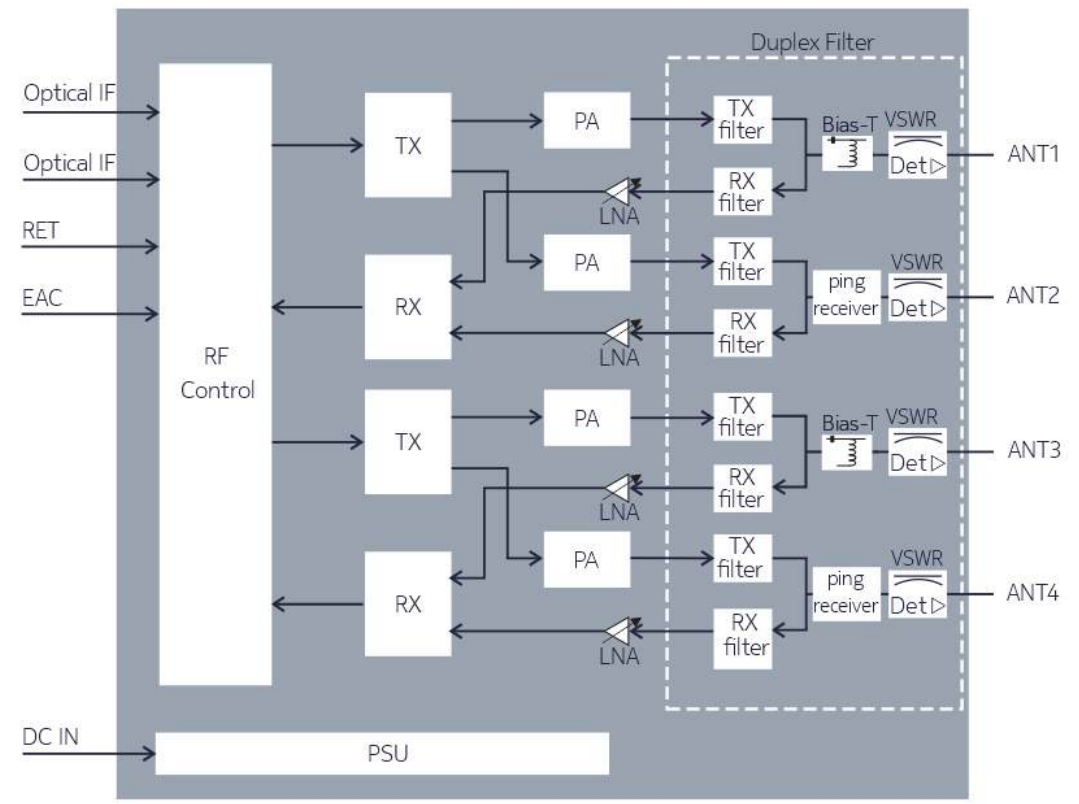
ALD support	Value
AISG	2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 86: AHPB functional block diagram



Electrical specifications

Table 288: AHPB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 289: AHPB power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.4 (two or three carriers) 1.6 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1	1.6 (two or three carriers) 1.8 (four carriers)



Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A) - recommended in AHPB v102, factory-installed in AHPB (v303)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

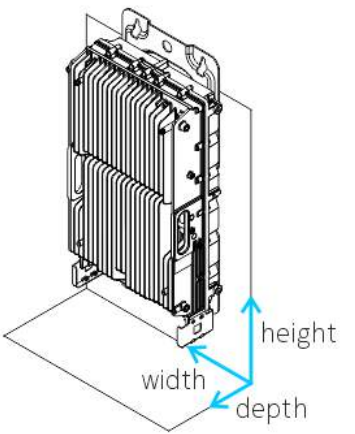
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 290: AHPB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 512 mm (20.16 in.) With mounting brackets: 630 mm (24.80 in.) With mounting brackets and fan: 650 mm (25.59 in.)	
Width	Core RRH: 308 mm (12.13 in.) With side mounting bosses: 327 mm (12.87 in.)	
Depth	Core RRH: 131 mm (5.12 in.) With mounting brackets: 143 mm (5.59 in.) With mounting bracket and heatshield or fan unit: 148 mm (5.78 in.)	
Weight	Core RRH: 24 kg (52.9 lb) With fan unit: 25 kg (55.12 lb)	

Environmental specifications

 Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 291: AHPB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	• Natural convection (fanless) or optional fan (recommended) - v102 • Forced convection (fan) - v303
IP rating	IP65

5.2.33 AirScale RRH 4T4R B28 320 W (AHPH)

AHPH (476105A) is introduced by CB008748 (for NR).

Functional description

Table 292: AHPH functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	NR
Duplex mode - supported standard	FDD
TX frequency range	B28: 758-798 MHz
RX frequency range	B28: 703-743 MHz
DL filter bandwidth	40 MHz
UL filter bandwidth	40 MHz
Instantaneous bandwidth (iBW)	40 MHz
Occupied bandwidth (oBW)	40 MHz
Number of carriers per pipe	Up to 3
Supported bandwidths	10, 30, 40 MHz
Passive Inter-Modulation (PIM) cancellation	Yes

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 87: AHPH interfaces

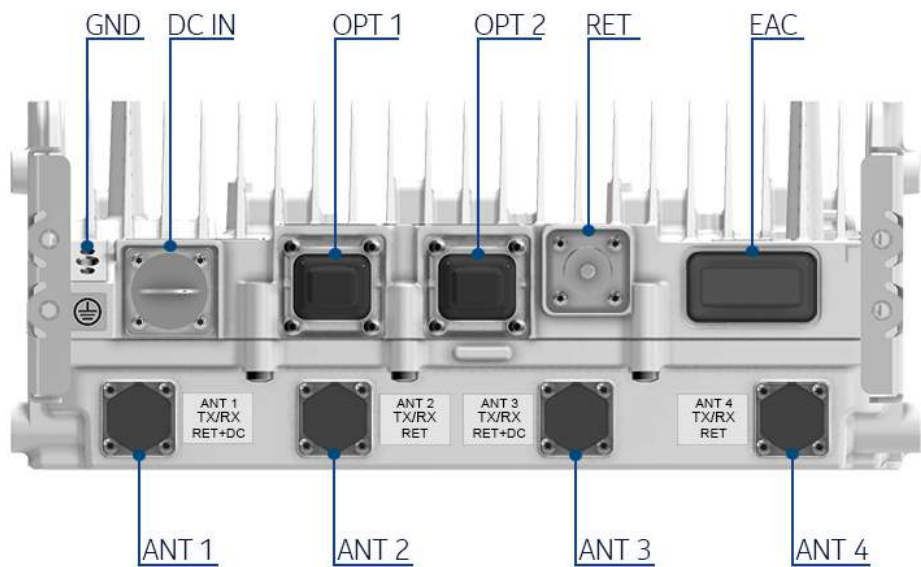


Table 293: AHPH interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	2-pole connector	–
Antenna connector	ANT	4	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP+	CPRI: 9.8 Gbps Nokia IP seal
Grounding	GND 	1	2 x M5 screw	–



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

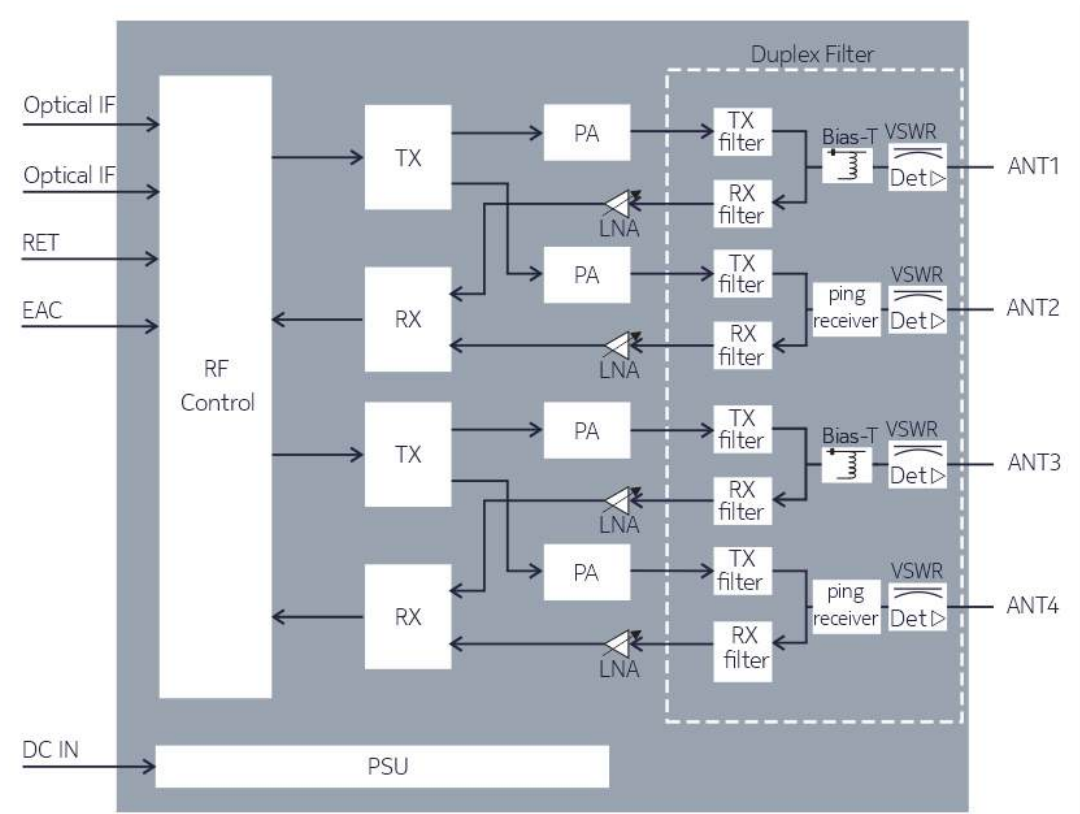
Antenna line device (ALD) support

Table 294: AHPH ALD support

Property	Value
AISG	AISG 3.0: ANT 1, ANT 2, ANT 3, ANT 4, and RET Power supply: ANT 1 and ANT 3
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 88: AHPH functional block diagram



Electrical specifications

Table 295: AHPH electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

Recommended value for the `dlQam256PowerBackoffSub6` parameter is:

- 0 dB for 3GPP performance requirement
- 1.5 dB for high-peak UE throughput (4x4 DL MIMO)

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBG AirScale book mount kit 151-175 (474467A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)

- ACPA AirScale 2 fiber protection (474297A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

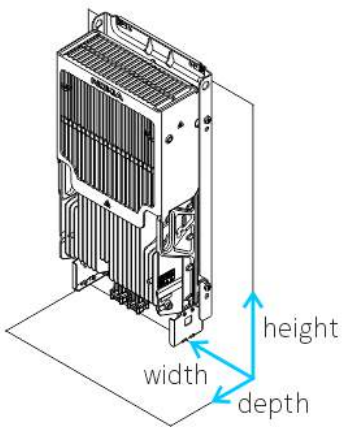
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - Vertical using *FPKA* on horizontal pole
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 296: AHPH dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 512 mm (20.16 in.) With mounting bracket: 611 mm (24.06 in.)	
Width	Core RRH: 308 mm (12.13 in.) With side mounting bosses: 327 mm (12.87 in.)	
Depth	Core RRH: 155 mm (6.1 in.) With mounting bracket: 168 mm (2.68 in.)	
Weight	max. 25.8 kg (56.9 lb)	

Environmental specifications

Table 297: AHPH environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.34 AirScale RRH 4T4R B30/n30 100 W (AHNA)

AHNA (474861A) is introduced by LTE4637 (for LTE), SR002150 (for LTE), and CB005907 (for NR).

Functional description

Table 298: AHNA functional specification

Property	Value
Maximum output power	100 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B30/n30: 2350-2360 MHz
RX frequency range	B30/n30: 2305-2315 MHz
DL filter bandwidth	10 MHz
UL filter bandwidth	10 MHz
Instantaneous bandwidth (iBW)	10 MHz
Occupied bandwidth (oBW)	10 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	5, 10 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 89: AHNA interfaces

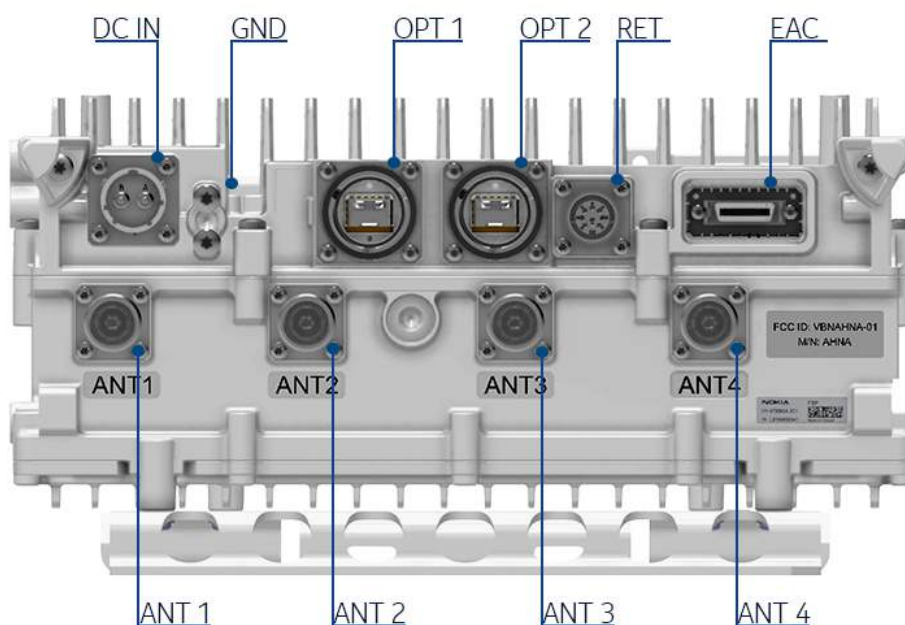


Table 299: AHNA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Low power circular	APPA, APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR 26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7), except 6.1 Gbps (CPRI6); R2CT IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 300: AHNA ALD support

ALD support	Value
AISG	ANT1, ANT3, RET: AISG 3.0 ANT2, ANT4: AISG 3.0 Ping receiver
Voltage	ANT1, ANT3, RET: 14.5 V
Power per port	ANT1, ANT3: 30 W RET: 45 W
Total maximum power	45 W

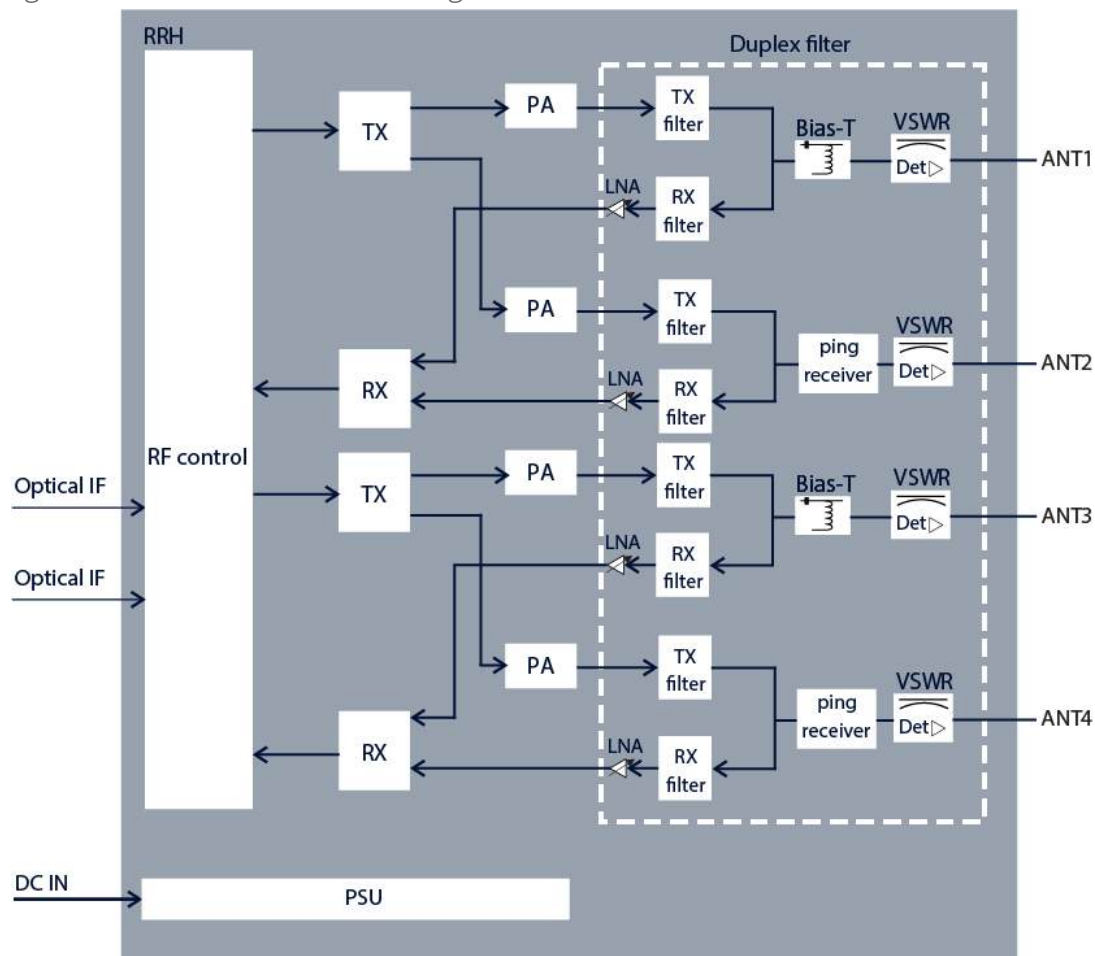


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 90: AHNA functional block diagram



Electrical specifications

Table 301: AHNA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

Table 302: AHNA power back-off in 256QAM

Single carrier [dB]	Dual carrier [dB]
0.5 dB	1 dB

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- ACPA AirScale 2 fiber protection (474297A) - only if R2CT is not used

Installation options

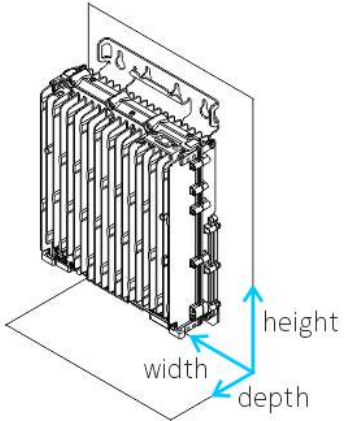
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 303: AHNA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336.5 mm (13.25 in.) With upper and lower mounting brackets 427.5 mm (16.83 in.)	
Width	Core RRH: 306 mm (12.05 in.) With cover: 324 mm (12.76 in.)	
Depth	Core RRH: 140 mm (5.51 in.) With mounting brackets: 164 mm (6.46 in.) With cover and mounting brackets: 183 mm (7.21 in.)	
Weight	Core RRH: 15.5 kg (34.2 lb) Core with brackets and cover: 17.7 kg (39.0 lb)	

Environmental specifications

Table 304: AHNA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.35 AirScale RRH 4T4R B65 160 W (AHGE)

AHGE (475580A) is introduced by CB006996 (for LTE).

Functional description

Table 305: AHGE functional specification

Property	Value
Maximum output power	160 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies	LTE
Duplex mode - supported standard	FDD
TX frequency range	B65: 2170-2200 MHz
RX frequency range	B65: 1980-2010 MHz
DL filter bandwidth	30 MHz
UL filter bandwidth	30 MHz
Instantaneous bandwidth (iBW)	30 MHz
Occupied bandwidth (oBW)	30 MHz
Number of carriers per pipe	Up to 3
Supported bandwidths	LTE: 5, 10, 15, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 91: AHGE interfaces

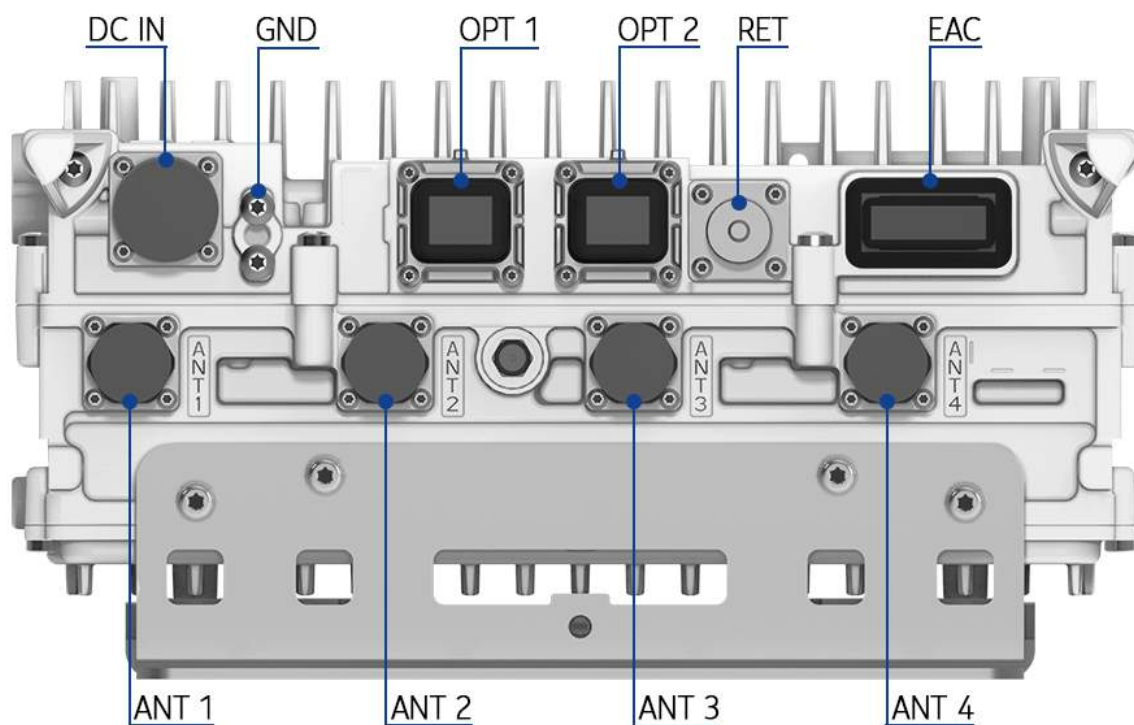


Table 306: AHGE interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 & ANT3, Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	-
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8	-

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 307: AHGE ALD support

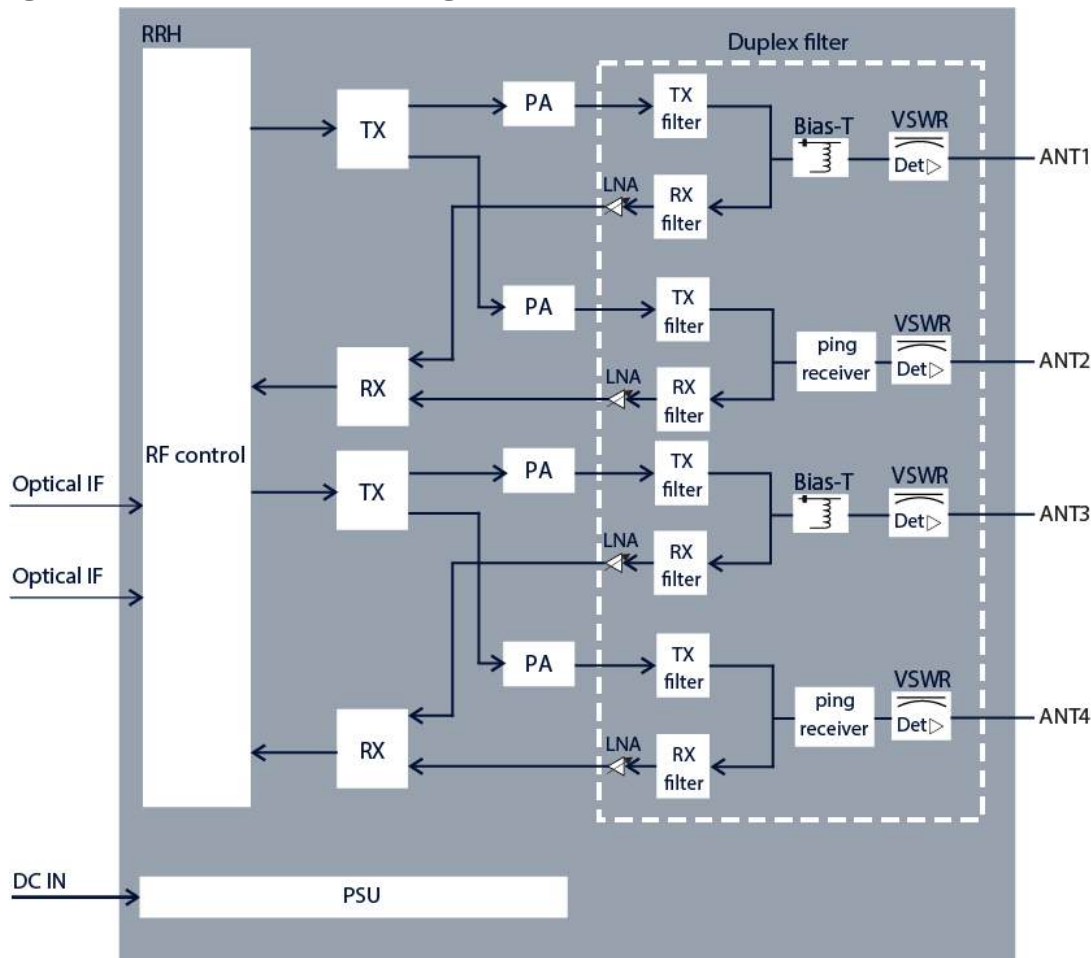
Property	Value
AISG	ANT1, ANT3, RET: 2.0/3.0 ANT2, ANT4: AISG 2.0/3.0 Ping receiver
Voltage	14.5 V
Power per port	ANT1, ANT3: 40 W RET: 45 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 92: AHGE functional block diagram



Electrical specifications

Table 308: AHGE electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC



Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

Table 309: AHGE power back-off in 256 QAM

Single Carrier [dB]	Dual Carrier [dB]
0	0.7

Related optional items

- ASFA AirScale 2 fan unit 300 (473968A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMGD AirScale 2 cover 300 x 126-150 (474270A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPA AirScale 2 26A DC plug 3.3-6 mm² (474281A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

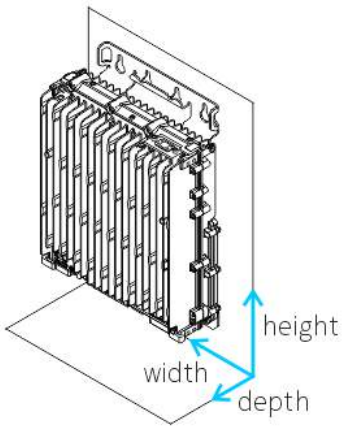
- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - Horizontal with an optional fan
 - One-clip rail
 - Book mounting

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 310: AHGE dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 337 mm (13.27 in.) With upper and lower mounting brackets: 427.5 mm (16.8 in.)	
Width	Core RRH: 295 mm (11.61 in.) With cover and mounting brackets: 322 mm (12.68 in.)	
Depth	Core RRH: 140 mm (5.51 in.) With mounting brackets: 164.5 mm (6.48 in.) With cover and mounting brackets: 183.5 mm (7.22 in.)	
Weight	15.5 kg (34.2 lb)	

Environmental specifications

Table 311: AHGE environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.2.36 AirScale RRH 4T4R B66/n66 160 W (FRIJ)

FRIJ (473368A) is introduced by LTE2516/SR001361/5GC002311.

Functional description

Table 312: FRIJ functional specification

Property	Value
Maximum output power	160 W
Modulation	Up to 64 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	WCDMA, LTE, NR
RF sharing/concurrent mode	WCDMA-LTE, LTE-NR
Duplex mode - supported standard	FDD
TX frequency range	B66/n66: 2110–2200 MHz
RX frequency range	B66/n66: 1710–1780 MHz
DL filter bandwidth	90 MHz
UL filter bandwidth	70 MHz
Instantaneous bandwidth (iBW)	DL: 90 MHz UL: 70 MHz
Occupied bandwidth (oBW)	40 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	WCDMA: 3.8, 4.2, 5 MHz LTE, NR: 5, 10, 15, 20 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 93: FRIJ interfaces

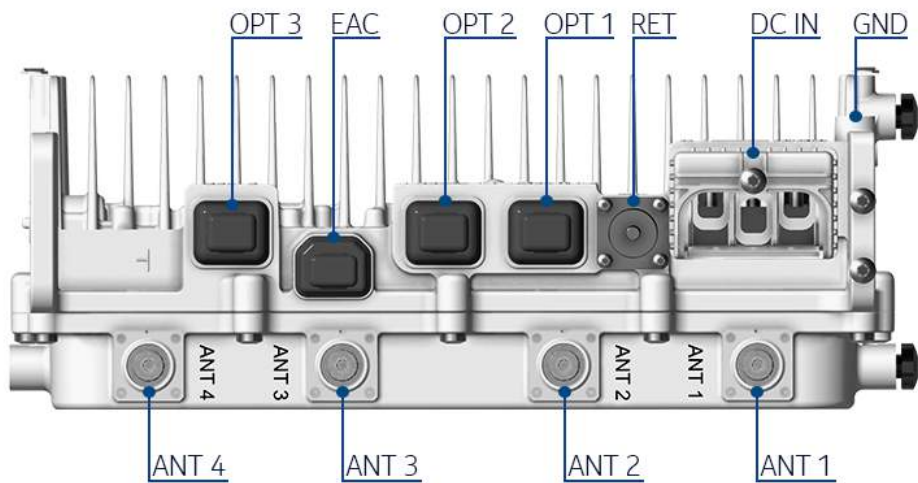


Table 313: FRIJ interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	–
Antenna connector	ANT	4	4.3-10	–
Remote Electrical Tilt	RET	1	AISG C485	8-pin circular
External Alarm Connection	EAC	1	USB 3.0 Type-A	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	6 Gbps, OBSAI, Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	–
Fan	Fan	1	2-pin Micro-Fit	Located on the side of the unit.

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 314: FRIJ ALD support

ALD support	Value
AISG	ANT1, ANT3, RET: AISG 2.0
Voltage	ANT1, ANT3: 14.5 V RET: 14.5 V
Power per port	40 W
Power	60 W

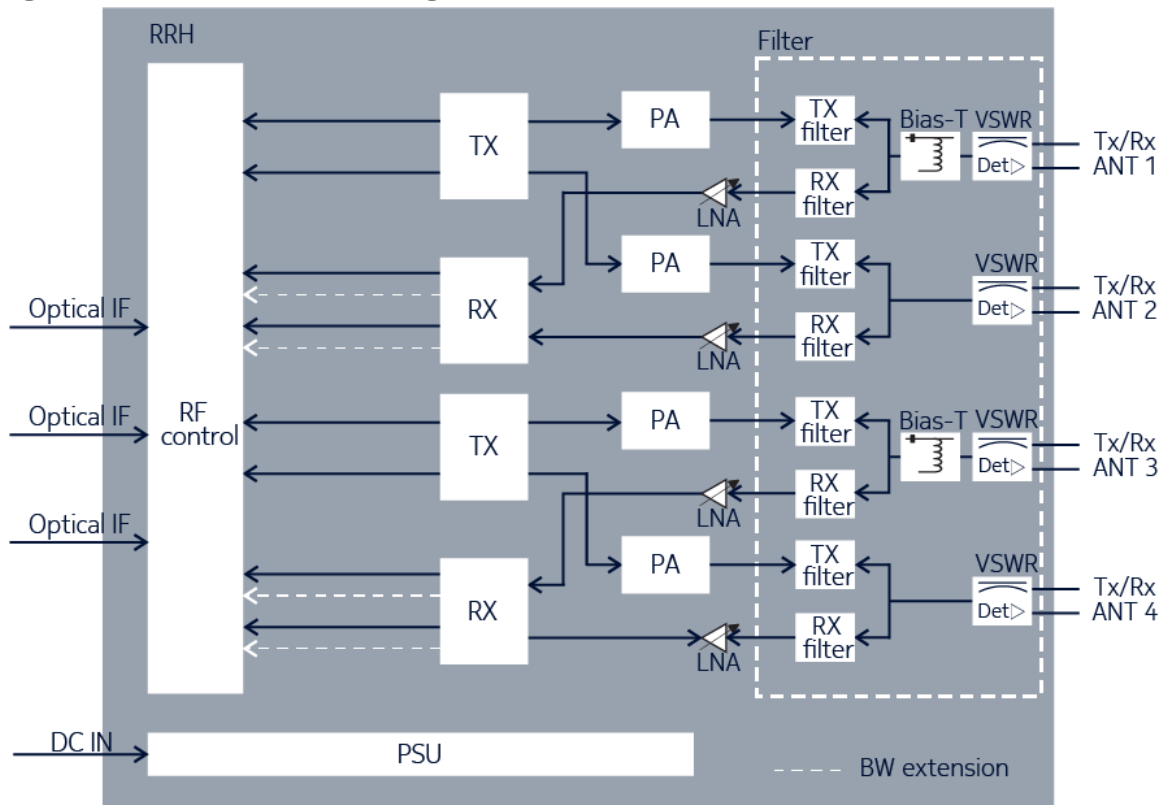


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 94: FRIJ functional block diagram



Electrical specifications

Table 315: FRIJ electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

LTE power back-off

Table 316: FRIJ power back-off in 256 QAM

Single carrier [dB]	Dual carrier [dB]
0.7	0.8

Related optional items

- Mandatory optional item: FMNF AirScale 1.0 medium book mount kit (473979A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- FMNC AirScale 1.0 medium fan kit (473597A)
- AMLA flat mount adapter bracket (473881A)
- FMNH AirScale ladder mount kit (474091A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)

Installation options

- Wall
 - Flat
 - Vertically
 - Horizontally (secondary bracket rotated 90°)
 - Horizontally (unit bracket rotated 90°)
- Pole
 - Flat
 - Vertically
 - Horizontally

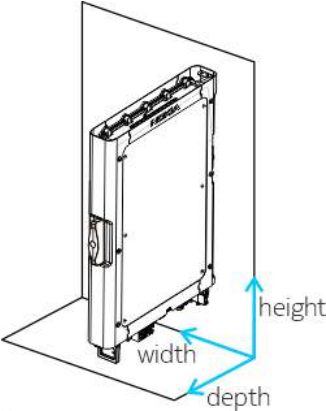
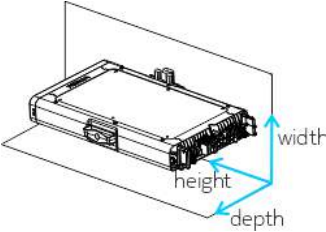


Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 317: FRIJ dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 587.2 mm (23.1 in.) With cover, handle, and unit bracket: 600 mm (23.6 in.) With cover, handle, unit bracket, and fan kit: 630.2 mm (24.8 in.)	Dimensions orientation in vertical mount with cover 
Width	Core RRH: 120 mm (4.7 in.) With cover, handle, and unit bracket: 126 mm (5.0 in.) With cover, handle, unit bracket, and fan kit: 126 mm (5.0 in.) With cover, handle, unit bracket, and fan kit (unit bracket rotated 90 degrees for horizontal mounting): 143 mm (5.6 in.)	
Depth	Core RRH: 320 mm (12.6 in.) With cover, handle, and unit bracket: 424 mm (16.7 in.) With cover, handle, unit bracket, and fan kit: 424 mm (16.7 in.)	
Weight	Core RRH: 18.5 kg (40.8 lb) With cover, handle, and unit bracket: 20.9 kg (46.1 lb) With cover, handle, unit bracket, and fan kit: 22.1 kg (48.7 lb)	Dimensions orientation in horizontal mount with cover and fan 

Environmental specifications

Table 318: FRIJ environmental specifications

Property	Value
Maximum operational outdoor temperature in the shade, assuming wind speed is 3 m/s (at constant high ambient temperature, maximum output power might be limited)	55°C (131°F)
Maximum operational outdoor temperature in the sun, assuming wind speed is 3 m/s (at constant high ambient temperature, maximum output power might be limited)	50°C (122°F)
Maximum indoor temperature, assuming wind speed is 0 m/s, valid for fanless products (at constant high ambient temperature, maximum output power might be limited)	40°C (104°F)
Minimum operational temperature (including cold start)	-40°C (-40°F)
IP rating	IP65

5.3 Dual band RRHs descriptions

5.3.1 AirScale Dual RRH 2T4R B1/B3 (n1/n3) 240 W (AHEGA)

AHEGA (473995A) is introduced by LTE3140 (for GSM, WCDMA, and LTE), SR001575 (for GSM, WCDMA, and LTE), and 5GC002429 (for NR).

Functional description

Table 319: AHEGA functional specification

Property	Value
Maximum output power	240 W
Modulation	Up to 256 QAM (DL) Up to 64 QAM (UL)
Number of TXRX	B1/n1: 2T4R B3/n3: 2T4R
Outdoor installation	Yes
Supported technologies	B1: WCDMA, LTE B3: GSM, LTE n1/n3: NR
RF sharing/concurrent mode	B1: WCDMA-LTE B3: GSM-LTE n1/n3: LTE-NR
Duplex mode	FDD
TX frequency range	B1/n1: 2110-2170 MHz B3/n3: 1805-1880 MHz
RX frequency range	B1/n1: 1920-1980 MHz B3/n3: 1710-1785MHz
DL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
UL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
Instantaneous bandwidth (iBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Occupied bandwidth (oBW)	B1/n1 2T2R: 60 MHz B1/n1 2T4R: 40 MHz (DL only) B3/n3 2T2R: 75 MHz B3/n3 2T4R: 40 MHz (DL only)

Property	Value
Number of carriers per pipe	2T4R mode: up to 4 for both bands for all supported RATs 2T2R mode: up to 8 for both bands (4 per band) for all supported RATs
Supported bandwidths	B1: 5, 10, 15, 20 MHz B3: 1.4, 3, 5, 10, 15, 20 MHz n1/n3: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes (radio unit supports Rx-sniffing on the FIR (RxCarrier) capture source. HBF (RxCombined) capture source is not supported.)
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 95: AHEGA interfaces

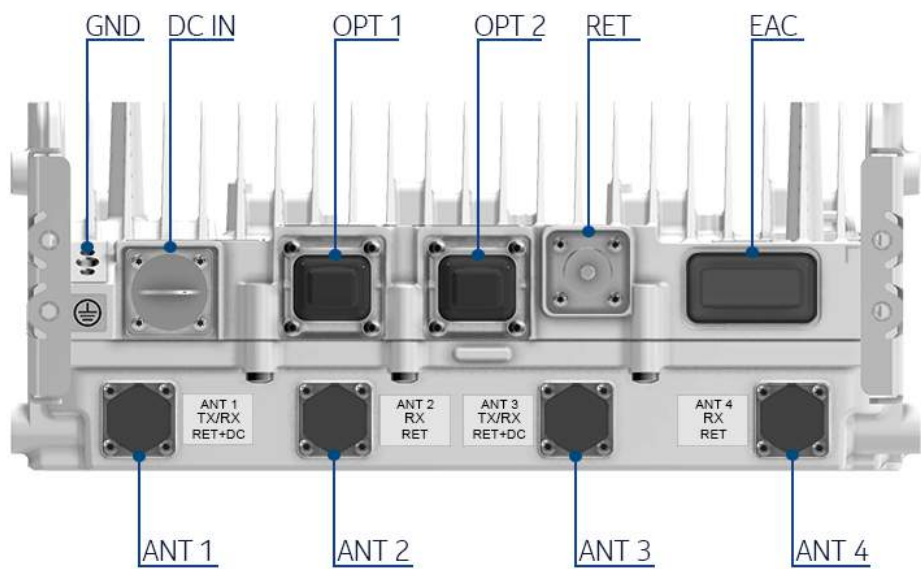


Table 320: AHEGA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	high power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on each antenna connector Has features that prevent damage when mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 321: AHEGA ALD support

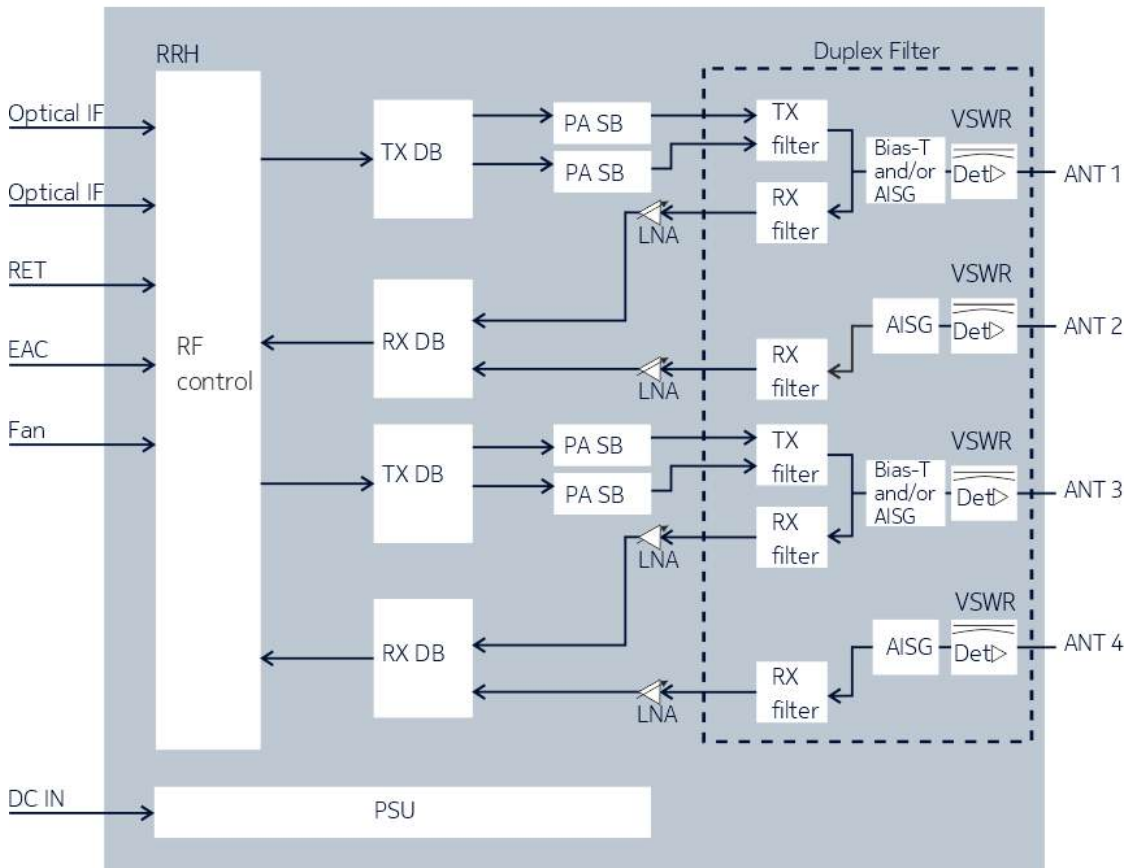
ALD support	Value
AISG	2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 96: AHEGA functional block diagram



Electrical specifications

Table 322: AHEGA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

 Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 323: Recommended AHEGA power back-off per band, in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.7 (two or three carriers) 0.9 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.2	0.9 (two or three carriers) 1.1 (four carriers)

GSM cell power range

 Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBE AirScale book mount kit 101-125 (474277A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)

- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

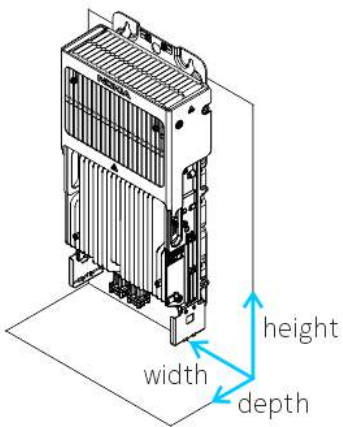
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 324: AHEGA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 512 mm (20.16 in.) With upper and lower mounting brackets: 630 mm (24.80 in.)	
Width	Core RRH: 308 mm (12.13 in.) With side mounting bosses: 321 mm (12.64 in.)	
Depth	Core RRH: 116.5 mm (4.59 in.) With mounting brackets: 128.5 mm (5.06 in.) With heat shield: 147 mm (5.79 in.)	
Weight	24 kg (52.9 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 325: AHEGA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.2 AirScale Dual RRH 2T4R B1/B3 (n1/n3) 240 W (AHEGI)

AHEGI (476517A) is introduced by CB012139 (for GSM, WCDMA, LTE, and NR).

Functional description

Table 326: AHEGI functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXRX	2T4R
Outdoor installation	Yes
Supported technologies	B1/n1: WCDMA, LTE, NR B3/n3: GSM, LTE, NR
RF sharing/concurrent mode	GSM-LTE, WCDMA-LTE, LTE-NR
Duplex mode	FDD
TX frequency range	B1/n1: 2110–2170 MHz B3/n3: 1805–1880 MHz
RX frequency range	B1/n1: 1920–1980 MHz B3/n3: 1710–1785MHz
DL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
UL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
Instantaneous bandwidth (iBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Occupied bandwidth (oBW)	B1/n1 2T2R: 60 MHz B1/n1 2T4R: 40 MHz (DL only) B3/n3 2T2R: 75 MHz B3/n3 2T4R: 40 MHz (DL only)
Number of carriers per pipe	2T4R mode: up to 4 for both bands for all supported RATs 2T2R mode: up to 8 for both bands (4 per band) for all supported RATs
Supported bandwidths	B1: 5, 10, 15, 20 MHz B3: 1.4, 3, 5, 10, 15, 20 MHz

Property	Value
Passive intermodulation (PIM) cancellation	Yes
RF scan	Yes Rx-sniffing on FIR (RxCarrier) capture source supported HBF (RxCombined) capture source not supported
PIM tests	PIM simulation
Limitations	Total number of LTE and NR carriers across both bands is limited to: • four in 4R mode. • eight in 2R mode. Dynamic spectrum sharing (DSS) requires two carriers, one for LTE and one for NR.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 97: AHEGI interfaces

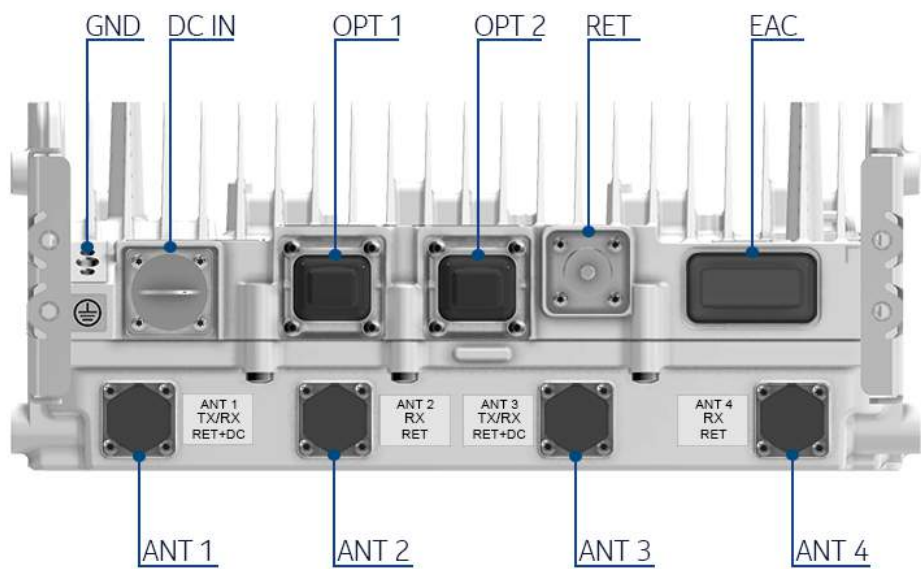


Table 327: AHEGI interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	high power circular	APPB, APPC
Antenna	ANT	4	4.3-10	• AISG on each antenna connector • Has features that prevent damage when mating with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

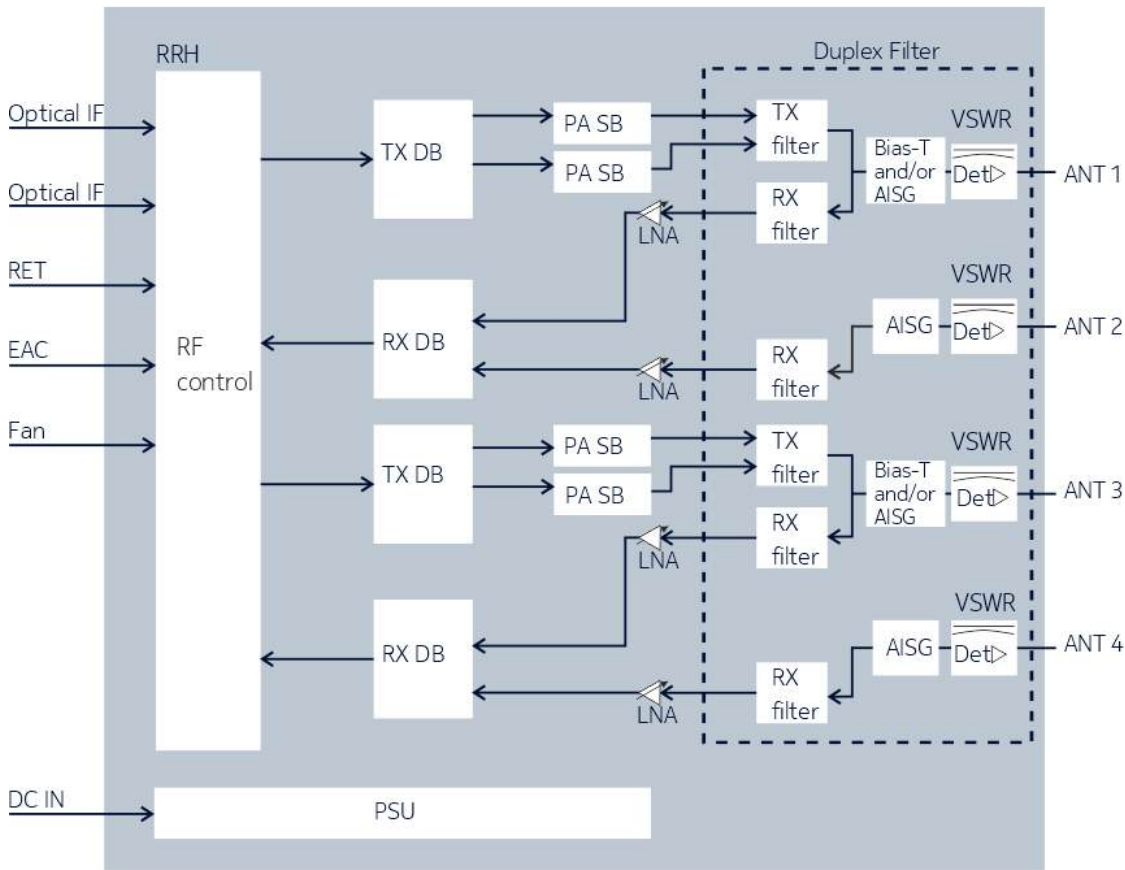
Antenna line device (ALD) support

Table 328: AHEGI ALD support

ALD support	Value
AISG	Version 2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

Functional block diagram

Figure 98: AHEGI functional block diagram



Electrical specifications

Table 329: AHEGI electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 330: Recommended power back-off values for 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.7 (two or three carriers) 0.9 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.2	0.9 (two or three carriers) 1.1 (four carriers)

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the maximum rated power. It might make the system unstable.

Related optional items

- AMBE AirScale book mount kit 101–125 (474277A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ACPA AirScale 2 fiber protection (474297A)

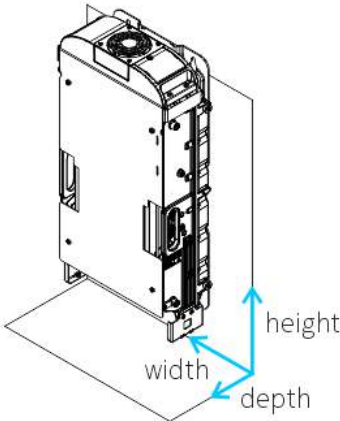
Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*

- Vertical
- Horizontal
- One-clip rail
- Book mounting

Dimensions and weight

Table 331: AHEGI dimensions and weight

Property	Value	Dimensions orientation
Height	With mounting bracket and fan unit: 673 mm (26.50 in.)	
Width	With side mounting bosses: 321 mm (12.64 in.)	
Depth	With mounting brackets and fan unit: 134 mm (5.28 in.)	
Weight	25 kg (55.1 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 332: AHEGI environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.3.3 AirScale Dual RRH 4T4R B1/B3 (n1/n3) 320 W (AHEGB)

AHEGB (474090A) is introduced by LTE3681 (for GSM, WCDMA, and LTE), SR001668 (for GSM, WCDMA, and LTE), and 5GC001688 (for NR).

Functional description

Table 333: AHEGB functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B1/n1: WCDMA, LTE, NR B3/n3: GSM, LTE, NR
RF sharing/concurrent mode	B1/n1: WCDMA-LTE-NR, WCDMA-NR, WCDMA-LTE, LTE-NR, B3/n3: GSM-LTE, GSM-NR, LTE-NR, GSM-LTE-NR
Duplex mode	FDD
TX frequency range	B1/n1: 2110-2170 MHz B3/n3: 1805-1880 MHz
RX frequency range	B1/n1: 1920-1980 MHz B3/n3: 1710-1785 MHz
DL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
UL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
Instantaneous bandwidth (iBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Occupied bandwidth (oBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	LTE B1: 5, 10, 15, 20 MHz LTE B3: 1.4, 3, 5, 10, 15, 20 MHz NR n1/n3: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Property	Value
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 99: AHEGB interfaces

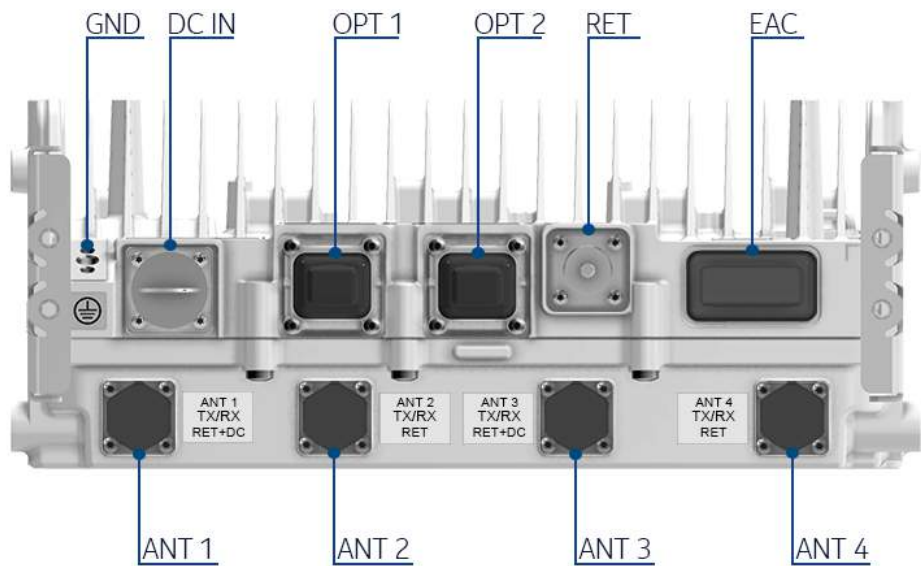


Table 334: AHEGB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3 Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	4	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 335: AHEGB ALD support

ALD support	Value
AISG	2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

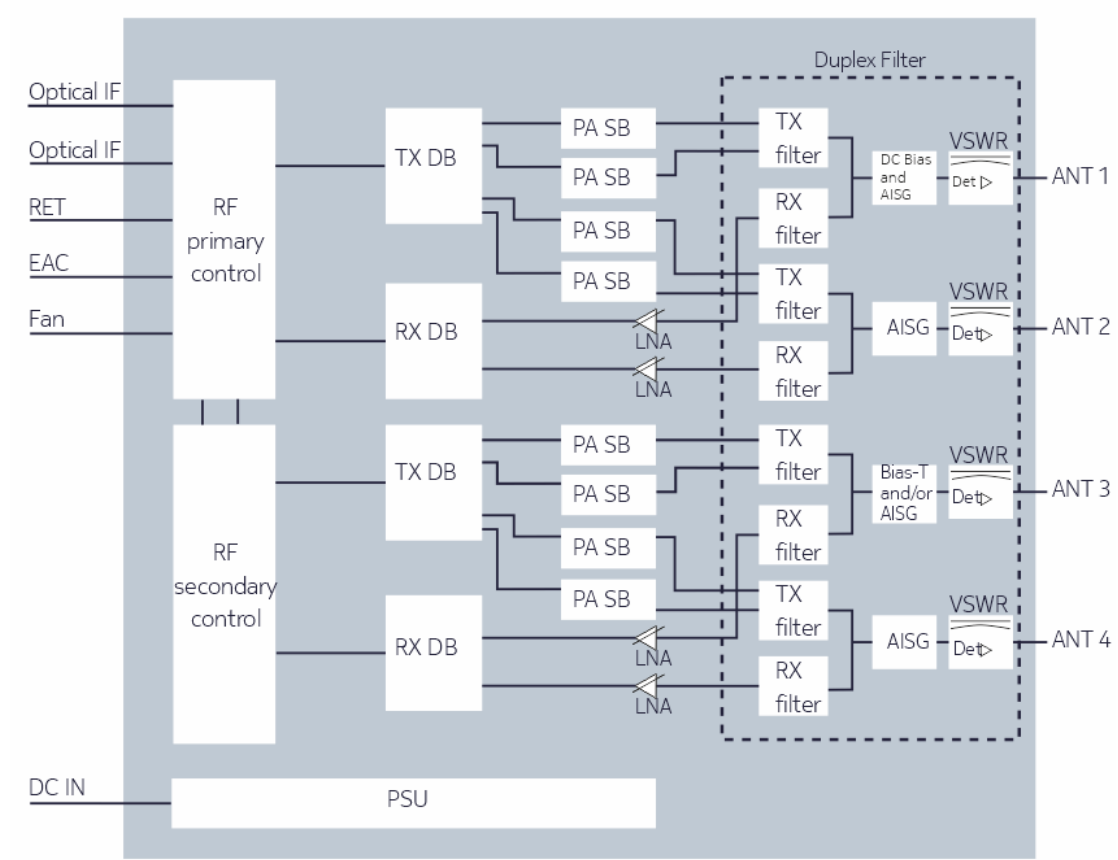


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 100: AHEGB functional block diagram



Electrical specifications

Table 336: AHEGB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

 Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 337: Recommended AHEGB power back-off per band, in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.7 (two or three carriers) 0.9 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.2	0.9 (two or three carriers) 1.1 (four carriers)

GSM cell power range

 Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)

- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

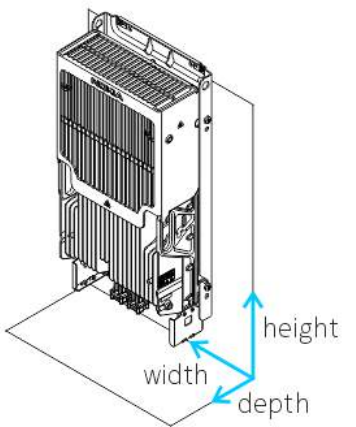
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 338: AHEGB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.05 in.) With upper and lower mounting brackets: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 149 mm (5.87 in.) With mounting brackets: 160 mm (6.3 in.)	
Weight	30 kg (66.1 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 339: AHEGB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.4 AirScale Dual RRH 4T4R B1/B3 (n1/n3) 320 W (AHEGJ)

AHEGJ (476518A) is introduced by *CB012140* (for GSM, WCDMA, LTE, and NR).

Functional description

Table 340: AHEGJ functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	B1/n1: WCDMA, LTE, NR B3/n3: GSM, LTE, NR
RF sharing/concurrent mode	GSM-LTE-NR, WCDMA-LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, standalone
TX frequency range	B1/n1: 2110-2170 MHz B3/n3: 1805-1880 MHz
RX frequency range	B1/n1: 1920-1980 MHz B3/n3: 1710-1785 MHz
DL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
UL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
Instantaneous bandwidth (iBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Occupied bandwidth (oBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	LTE: • B1: 5, 10, 15, 20 MHz • B3: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20, 25, 30, 40 MHz

Property	Value
Passive intermodulation (PIM) cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation
Limitations	Dynamic spectrum sharing (DSS) requires two carriers, one for LTE and one for NR

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 101: AHEGJ interfaces

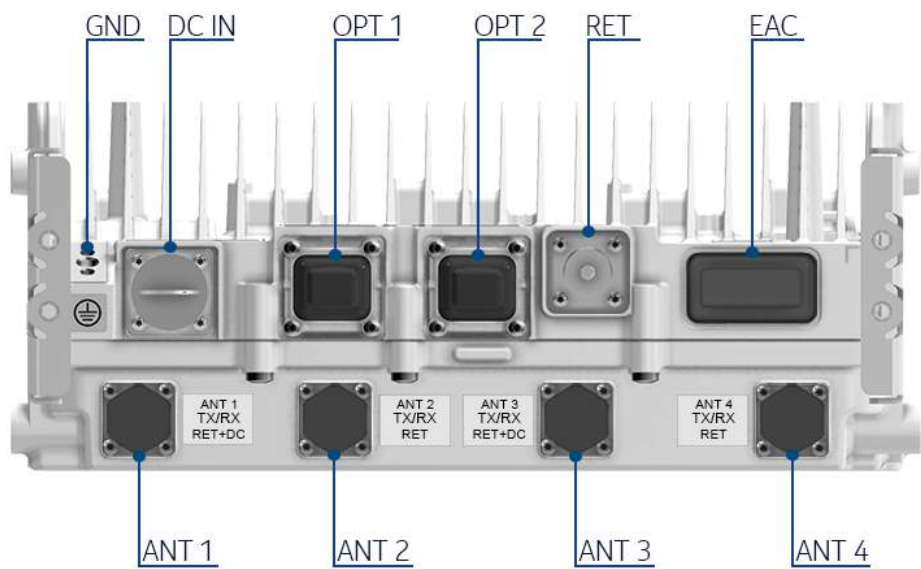


Table 341: AHEGJ interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPB, APPC
Antenna	ANT	4	4.3-10	• AISG on all ports, BiasT support on ANT1 and ANT3 • Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	4	MDR26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

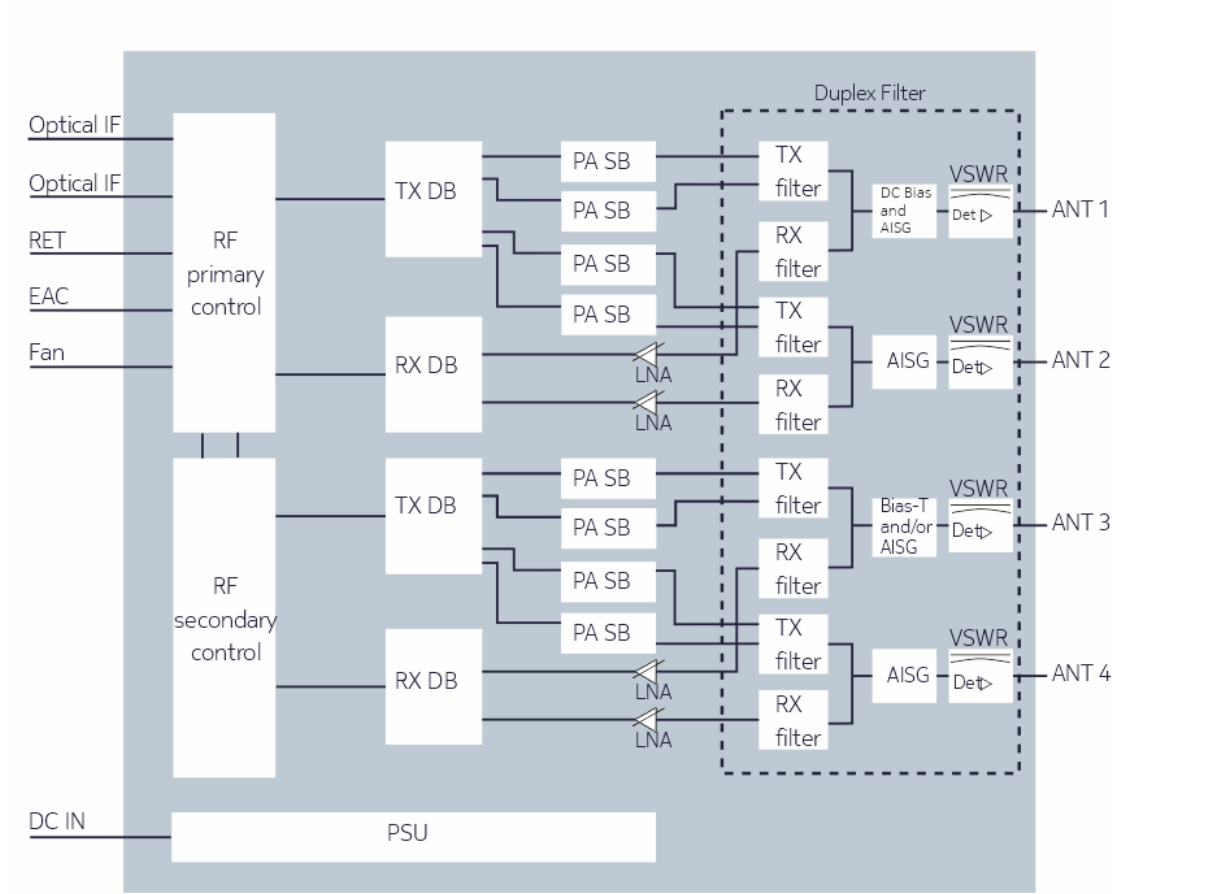
Antenna line device (ALD) support

Table 342: AHEGJ ALD support

ALD support	Value
AISG	Version 2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

Functional block diagram

Figure 102: AHEGJ functional block diagram



Electrical specifications

Table 343: AHEGJ electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 344: Recommended AHEGJ power back-off per band, in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.7 (two or three carriers) 0.9 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.2	0.9 (two or three carriers) 1.1 (four carriers)

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the maximum rated power. It might make the system unstable.

Related optional items

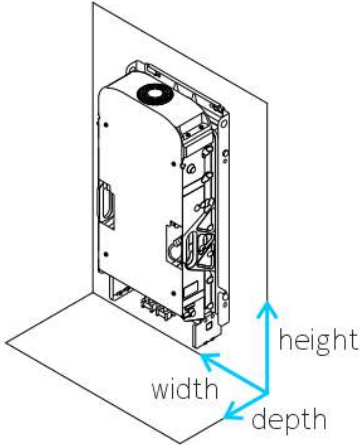
- AMBF AirScale book mount kit 126–150 (474278A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRB AirScale one clip bracket 126–200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–300 mm) (472821A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ACPA AirScale 2 fiber protection (474297A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 345: AHEGJ dimensions and weight

Property	Value	Dimensions orientation
Height	With mounting bracket and fan unit: 701 mm (27.59 in.)	
Width	With mounting bracket and fan unit: 327 mm (12.89 in.)	
Depth	With mounting bracket and fan unit: 165 mm (6.50 in.)	
Weight	With fan unit and mounting bracket: 33 kg (72.8 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 346: AHEGJ environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.3.5 AirScale Dual RRH 4T4R B1/B3 (n1/n3) 400 W (AHEGC)

AHEGC (474914A) is introduced by LTE4970 (for GSM, WCDMA, and LTE), SR002211 (for GSM, WCDMA, and LTE), and 5GC002335 (for NR).

Functional description

Table 347: AHEGC functional specification

Property	Value
Maximum output power	400 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B1: WCDMA, LTE B3: GSM, LTE n1/n3: NR
RF sharing/concurrent mode	B1: WCDMA-LTE B3: GSM-LTE n1/n3: LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B1/n1: 2110-2170 MHz B3/n3: 1805-1880 MHz
RX frequency range	B1/n1: 1920-1980 MHz B3/n3: 1710-1785 MHz
DL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
UL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
Instantaneous bandwidth (iBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Occupied bandwidth (oBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs

Property	Value
Supported bandwidths	B1: 5, 10, 15, 20 MHz B3: 1.4, 3, 5, 10, 15, 20 MHz n1/n3: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 103: AHEGC interfaces

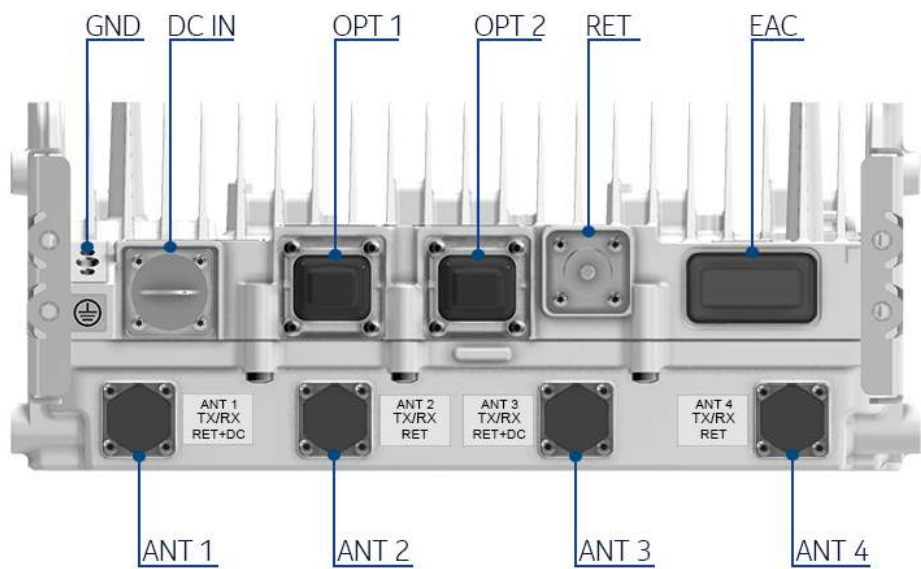


Table 348: AHEGC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 & ANT3; has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS485
External Alarm Connection	EAC	4	MDR26	4 inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 349: AHEGC ALD support

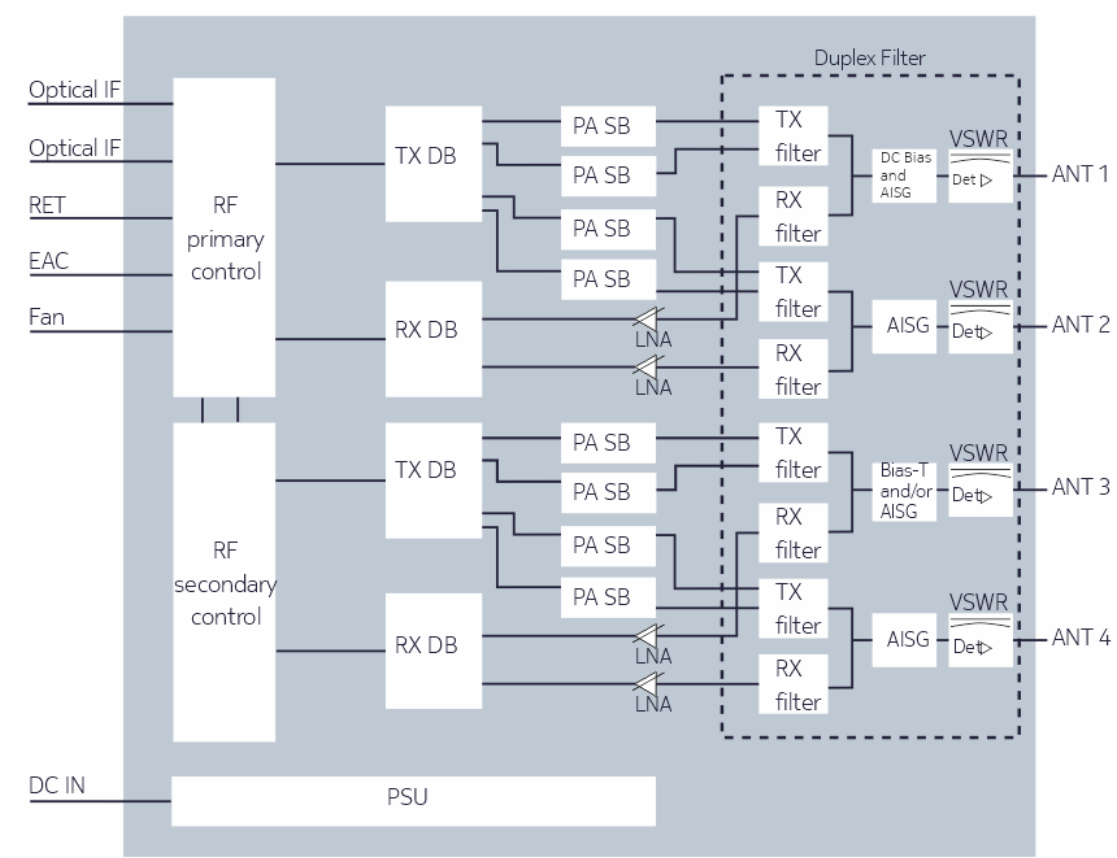
Property	Value
AISG	2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 104: AHEGC functional block diagram



Electrical specifications

Table 350: AHEGC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

LTE power back-off

Table 351: Recommended AHEGC power back-off per band, in 256 QAM

Single carrier [dB]	Dual carrier [dB]	Triple carrier [dB]	Quad carrier [dB]
0	0.7	0.7	0.9

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

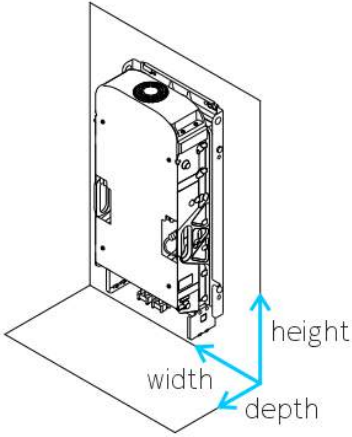
- AMBF AirScale book mount kit 126-150 (474278A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

- Pole:
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - Book mounting
- Wall:
 - Vertical
 - Horizontal
 - One-clip rail
 - Book mounting

Dimensions and weight

Table 352: AHEGC dimensions and weight

Property	Value	Dimensions orientation
Height	With fan unit: 701 mm (27.59 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting bracket: 327 mm (12.87 in.)	
Depth	Core RRH: 149 mm (5.86 in.) With mounting bracket: 160 mm (6.30 in.)	
Weight	Core RRH: 34 kg (75.0 lb)	

Environmental specifications

 Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 353: AHEGC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.3.6 AirScale Dual RRH 4T4R B1/B3 (n1/n3) 400 W (AHEGF)

AHEGF (475825A) is introduced by CB007083.

Functional description

Table 354: AHEGF functional specification

Property	Value
Maximum output power	400 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B1/n1: WCDMA, LTE, NR B3/n3: LTE, NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B1/n1: 2110-2170 MHz B3/n3: 1805-1880 MHz
RX frequency range	B1/n1: 1920-1980 MHz B3/n3: 1710-1785 MHz
DL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
UL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz
Instantaneous bandwidth (iBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Occupied bandwidth (oBW)	B1/n1: 60 MHz B3/n3: 75 MHz
Number of carriers per pipe	B1/n1: up to 8 carriers per TX/RX path in Multi-RAT case (WCDMA, LTE, NR or mix) B3/n3: up to 8 carriers per TX/RX path in Multi-RAT case (LTE, NR or mix)

Property	Value
Supported bandwidths	WCDMA: B1: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8 MHz LTE: B1: 5, 10, 15, 20 MHz B3: 1.4, 3, 5, 10, 15, 20 MHz NR: n1: 5, 10, 15, 20 MHz n3: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 105: AHEGF interfaces

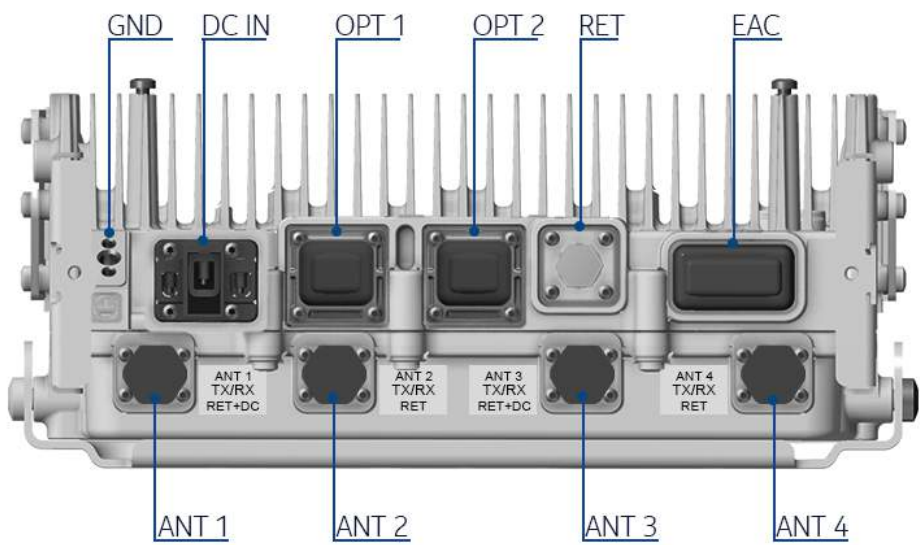


Table 355: AHEGF interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Terminal block	Max wire gauge 4 AWG with max strand diameter 7 mm (max 105 strands)
Antenna connector	ANT	4	4.3-10+	AISG on all ports and BiasT support on ANT1 and ANT3, has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	AISG RS485
External Alarm Connection	EAC	1	MDR-26	4 inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP Seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 356: AHEGF ALD support

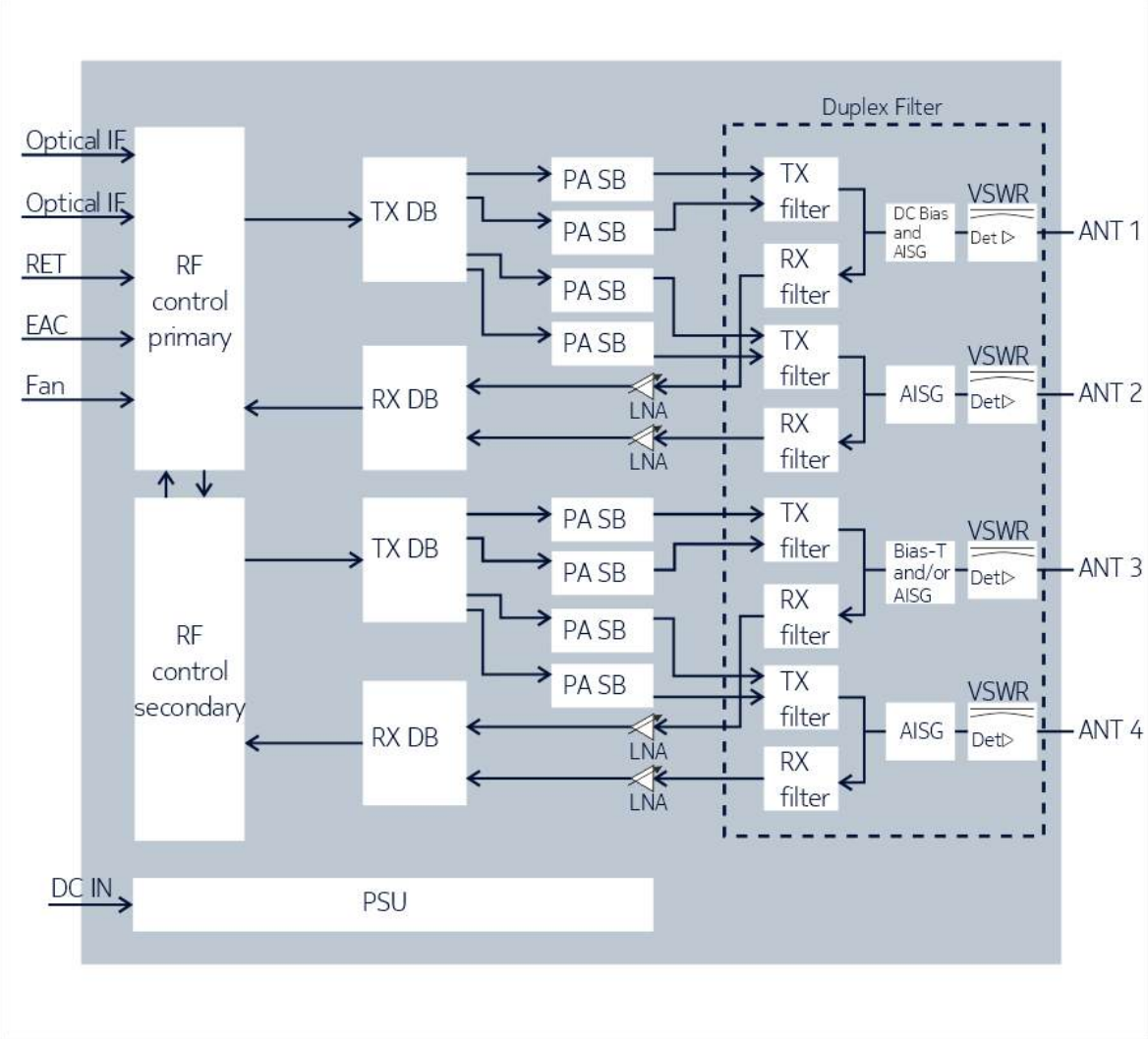
Property	Value
AISG	2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 106: AHEGF functional block diagram



Electrical specifications

Table 357: AHEGF electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -50 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

LTE power back-off

Table 358: Recommended AHEGF power back-off per band, in 256 QAM

Single carrier [dB]	Dual carrier [dB]	Triple carrier [dB]	Quad carrier [dB]
0	0.7	0.7	0.9

Related optional items

- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable (474288A)
- AMRA AirScale one clip bracket 51-125 (474580A)

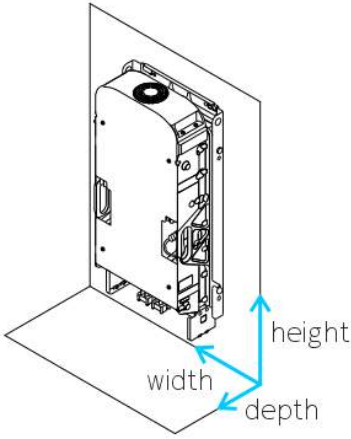
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

- Pole:
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- Wall:
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 359: AHEGF dimensions and weight

Property	Value	Dimensions orientation
Height	With fan unit: 730 mm (28.74 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting bracket: 327 mm (12.87 in.)	
Depth	Core RRH: 131 mm (5.15 in.) With mounting bracket: 142 mm (5.59 in.)	
Weight	Core RRH: 32 kg (70.6 lb)	

Environmental specifications



Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 360: AHEGF environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.3.7 AirScale Dual RRH 4T4R B1/B3 480 W (AHEGG)

AHEGG (476123A) is introduced by *CB008922* (for GSM, WCDMA, LTE, and NR).

Functional description

Table 361: AHEGG functional specification

Property	Value
Commercial name	Pandion 4
Maximum output power	480 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	B1: WCDMA, LTE, NR B3: GSM ¹⁾ , LTE, NR
RF sharing/concurrent mode	B1: WCDMA-LTE, LTE-NR B3: GSM-LTE, LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, SA
TX frequency range	B1: 2110–2170 MHz B3: 1805–1880 MHz
RX frequency range	B1: 1920–1980 MHz B3: 1710–1785 MHz
DL filter bandwidth	B1: 60 MHz B3: 75 MHz
UL filter bandwidth	B1: 60 MHz B3: 75 MHz
Instantaneous bandwidth (iBW)	B1: 60 MHz B3: 75 MHz
Occupied bandwidth (oBW)	B1: 60 MHz B3: 75 MHz
Number of carriers per pipe	Up to 8 shared for both bands

Property	Value
Supported bandwidths	WCDMA (B1 only): 3.8, 4.0, 4.2, 4.4, 4.6, 4.8 MHz LTE: • B1: 5, 10, 15, 20 MHz • B3: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20, 25, 30, 40, 50 ¹⁾ MHz
Passive intermodulation (PIM) cancellation	Yes

¹⁾NR bandwidth 50 MHz has been introduced by the *CB011006* feature.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 107: AHEGG interfaces

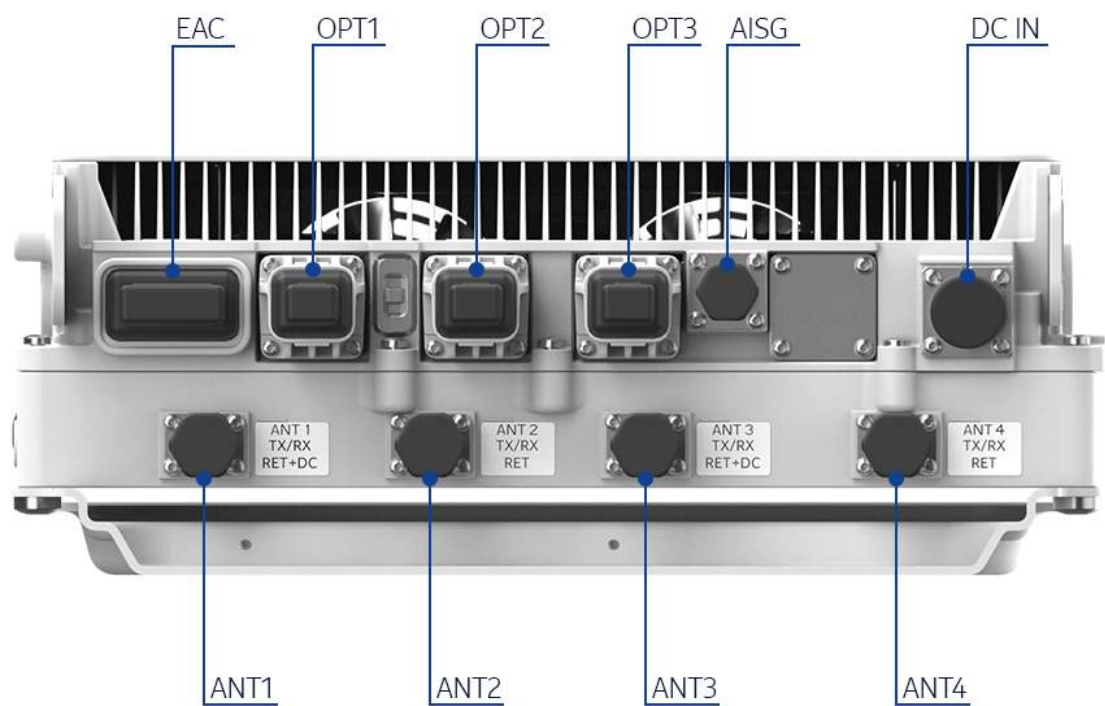


Table 362: AHEGG interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPG
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3
External alarm connection	EAC	1	MDR26	-
Optical	OPT	3	SFP28/SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Antenna Interface Standard Groups	AISG	1	8-pin circular	RS-485
Grounding	GND 	2	2 x M5 screw and 1 x M8 screw	Located on the right side of the radio unit



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

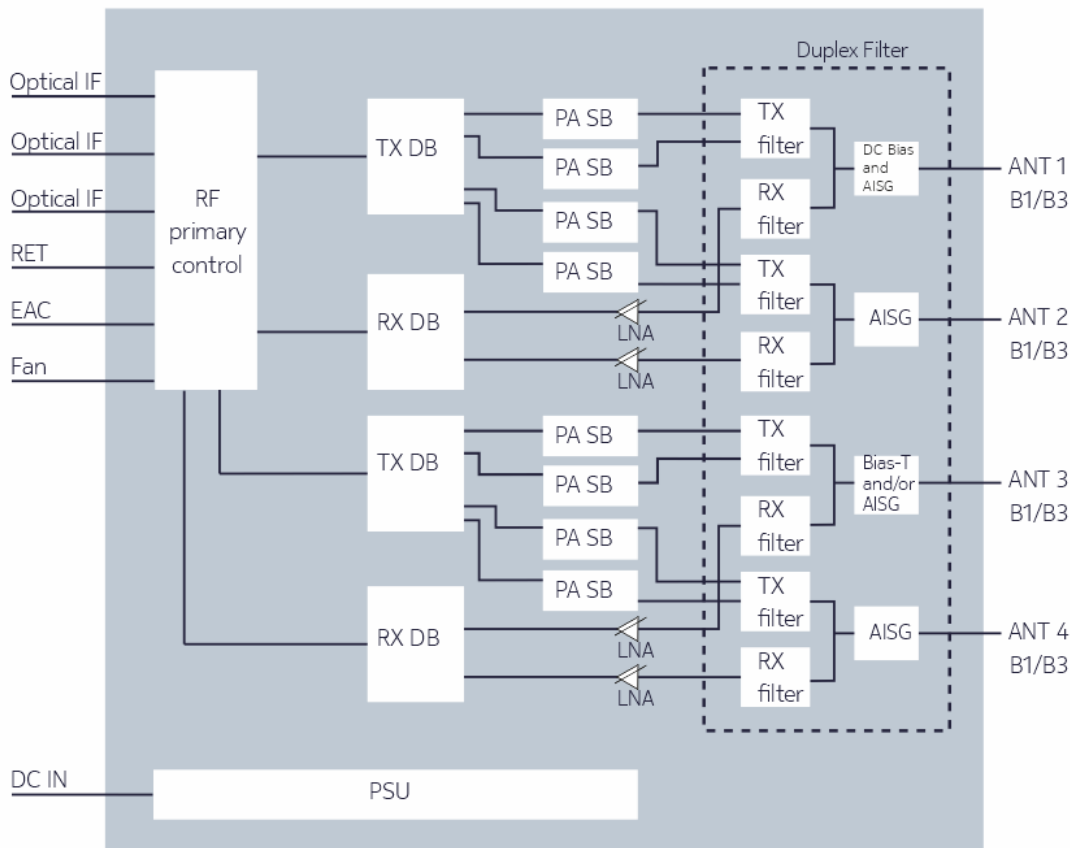
Antenna line device (ALD) support

Table 363: AHEGG ALD support

Property	Value
AISG	Version 2.0
Voltage	14.5 V
Power per port	30 W on remote electrical tilt (RET) or AISG (including 15 W limit on RET), 45 W combined

Functional block diagram

Figure 108: AHEGG functional block diagram



Electrical specifications

Table 364: AHEGG electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 365: Recommended power back-off values for 256 QAM

RAT	Feature/Parameter	Single carrier 20 MHz [dB]	Single carrier/multi carrier (contiguous) ≤ 100 MHz [dB]	Multi carrier (non-contiguous) ≤ 100 MHz [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0	0.4
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoff Sub6)	0	0.2	0.6

Note:

Transmit power back-off for 4C LTE/NR 256QAM is 1.2 dB, for 3C LTE/NR 256QAM is 1.1 dB.

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

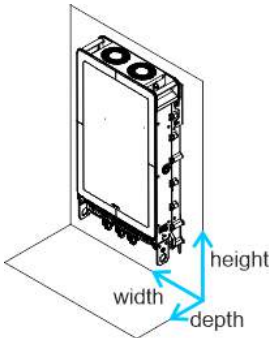
- AMBE AirScale book mount kit 101–125 (474277A)
- AMPA pole mounting kit (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60– 300 mm) (472821A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPG AirScale 2 70 A DC plug 10–16 mm² (475401A)
- ASAA AirScale 2 MDR26–open EAC 5 m cable (474288A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)

Installation options

- Pole:
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - Book mounting
- Wall:
 - Vertical
 - Horizontal
 - One-clip rail
 - Book mounting

Dimensions and weight

Table 366: AHEGG dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 640 mm (25.20 in.) With mounting bracket and fan unit: 676 mm (26.61 in.)	
Width	Core RRH: 342 mm (13.46 in.) With side mounting bosses: 369 mm (14.53 in.)	
Depth	Core RRH: 116 mm (4.57 in.) With mounting bracket: 145 mm (5.71 in.)	
Weight	max. 32 kg (70.5 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 367: AHEGG environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

¹⁾GSM requires another RAT in the same TX pipe.

5.3.8 AirScale Dual RRH 4T4R B2/B66a (n2/n66a) 320 W (AHFIC)

AHFIC (474239A) is introduced by LTE3845 (for GSM, WCDMA, and LTE), SR002039 (for GSM, WCDMA, and LTE), and 5GC000934 (for NR).

Functional description

Table 368: AHFIC functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXRX	B2/n2: 4T4R B66a/n66a: 4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B2/n2: GSM, WCDMA, LTE, NR B66a/n66a: LTE, NR
RF sharing/concurrent mode	B2/n2: GSM-LTE, GSM-WCDMA, WCDMA-LTE, GSM-WCDMA-LTE, LTE-NR B66a/n66a: LTE-NR
Duplex mode	FDD
TX frequency range	B2/n2: 1930-1990 MHz B66a/n66a: 2110-2180 MHz
RX frequency range	B2/n2: 1850-1910 MHz B66a/n66a: 1710-1780 MHz
DL filter bandwidth	B2/n2: 60 MHz B66a/n66a: 70 MHz
UL filter bandwidth	B2/n2: 60 MHz B66a/n66a: 70 MHz
Instantaneous bandwidth (iBW)	B2/n2: 60 MHz B66a/n66a: 70 MHz
Occupied bandwidth (oBW)	B2/n2: 60 MHz B66a/n66a: 70 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Property	Value
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 109: AHFIC interfaces

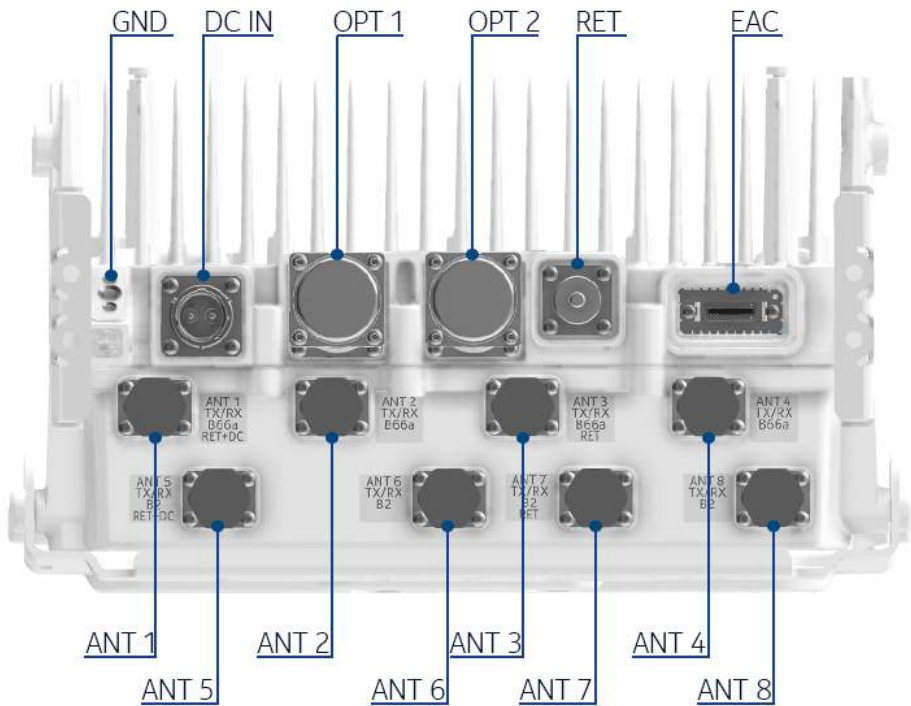


Table 369: AHFIC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT5 Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 370: AHFIC ALD support

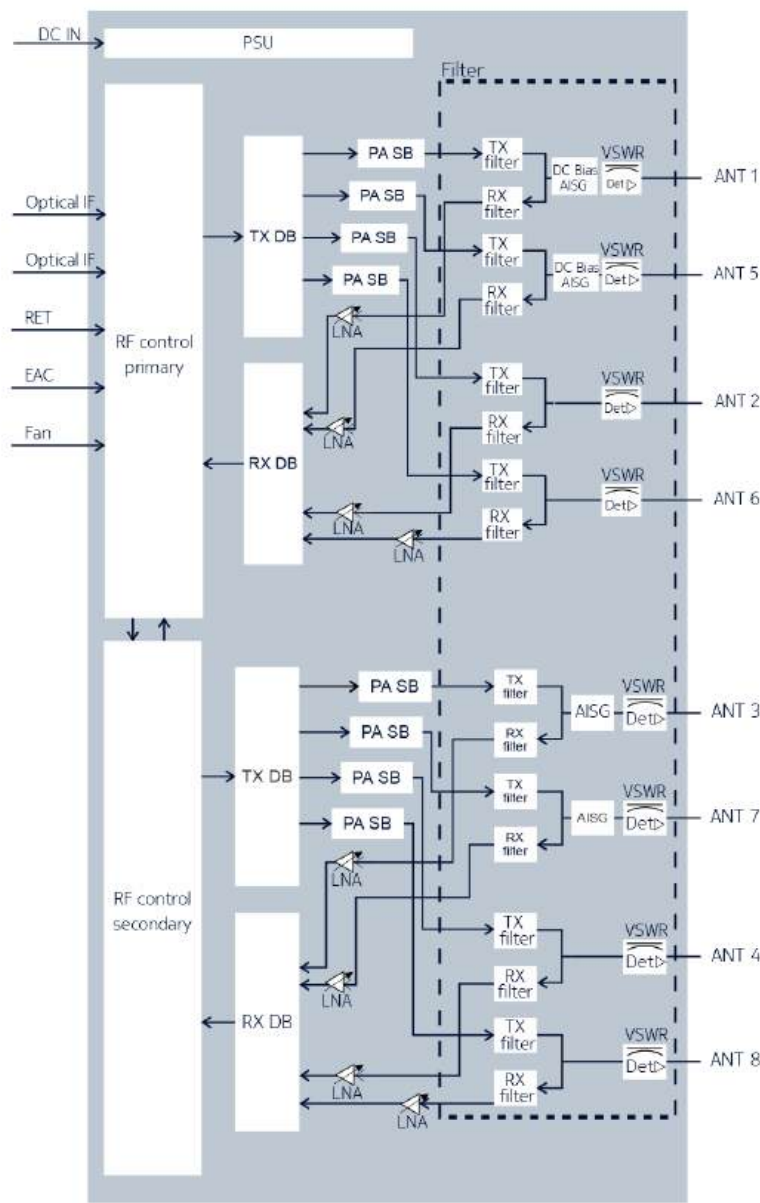
ALD support	Value
AISG	ANT1, ANT3, ANT5, ANT7: AISG 2.0/3.0
Voltage	14.5 V (ANT1 and ANT5 only)
Power per port	45 W max per ANT, 30 W max for four MHAs, 75 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 110: AHFIC functional block diagram



Electrical specifications

Table 371: AHFIC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 372: Recommended AHFIC power back-off per band, in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.7 (two or three carriers) 0.9 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffsUb6)	0.2	0.9 (two or three carriers) 1.1 (four carriers)

NR power back-off

Recommended value for `dLQam256PowerBackoffSub6` parameter is:

- 1.5 dB for 3GPP performance requirement (< 40 W)
- 3.0 dB for high peak UE throughput (4x4 DL MIMO) (60 W)

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBH AirScale book mount kit 176-200 (474280A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*

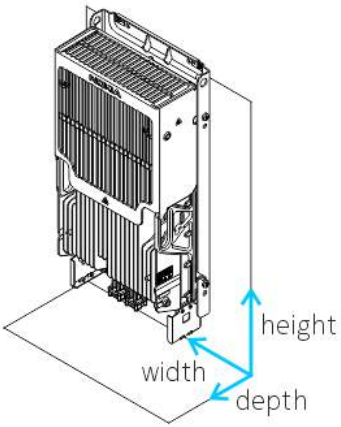
- Vertical
- Horizontal (fan is required)
- One-clip rail
- Book mounting (fan is recommended)

 Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 373: AHFIC dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.05 in.) With upper and lower mounting brackets: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 177 mm (6.97 in.) With mounting brackets: 193 mm (7.6 in.)	
Weight	35 kg (77.2 lb)	

Environmental specifications



Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 374: AHFIC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.9 AirScale Dual RRH 4T4R B5/B13 (n5) 160 W (AHBCA)

AHBCA (474241A) is introduced by LTE3848/5GC001151.

Functional description

Table 375: AHBCA functional specification

Property	Value
Maximum output power	160 W
Modulation	256 QAM
Number of TXRX	B5/n5: 4T4R B13: 4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B5, B13: LTE, n5: NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	FDD
TX frequency range	B5/n5: 869–894 MHz B13: 746–756 MHz
RX frequency range	B5/n5: 824–849 MHz B13: 777–787 MHz
DL filter bandwidth	B5/n5: 25 MHz B13: 10 MHz
UL filter bandwidth	B5/n5: 25 MHz B13: 10 MHz
Instantaneous bandwidth (iBW)	B5/n5: 25 MHz B13: 10 MHz
Occupied bandwidth (oBW)	B5/n5: 25 MHz B13: 10 MHz
Number of carriers per pipe	Up to 4 carriers in total for all supported RATs
Supported bandwidths	LTE: 1.4, 3, 5, 10 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes

Property	Value
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 111: AHBCA interfaces

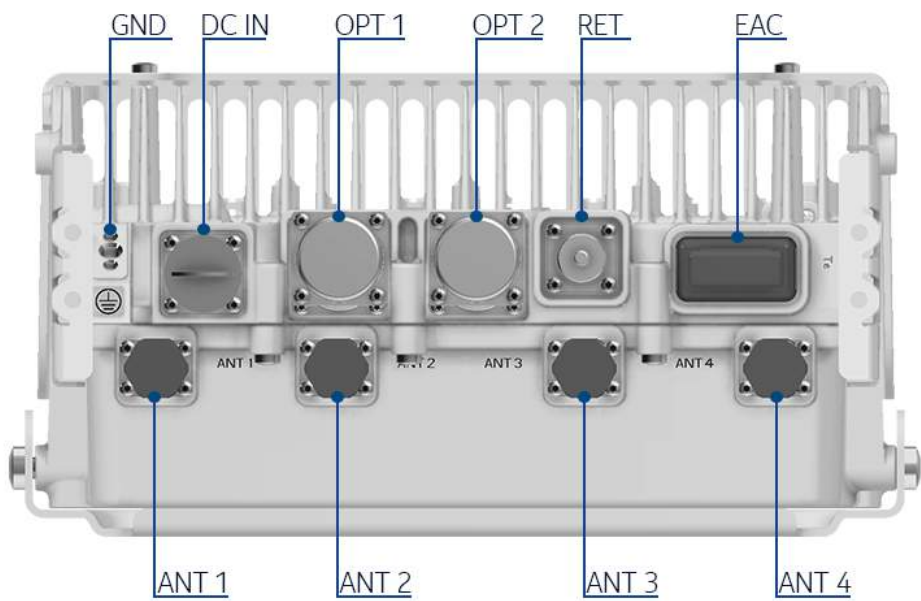


Table 376: AHBCA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	4	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 377: AHBCA ALD support

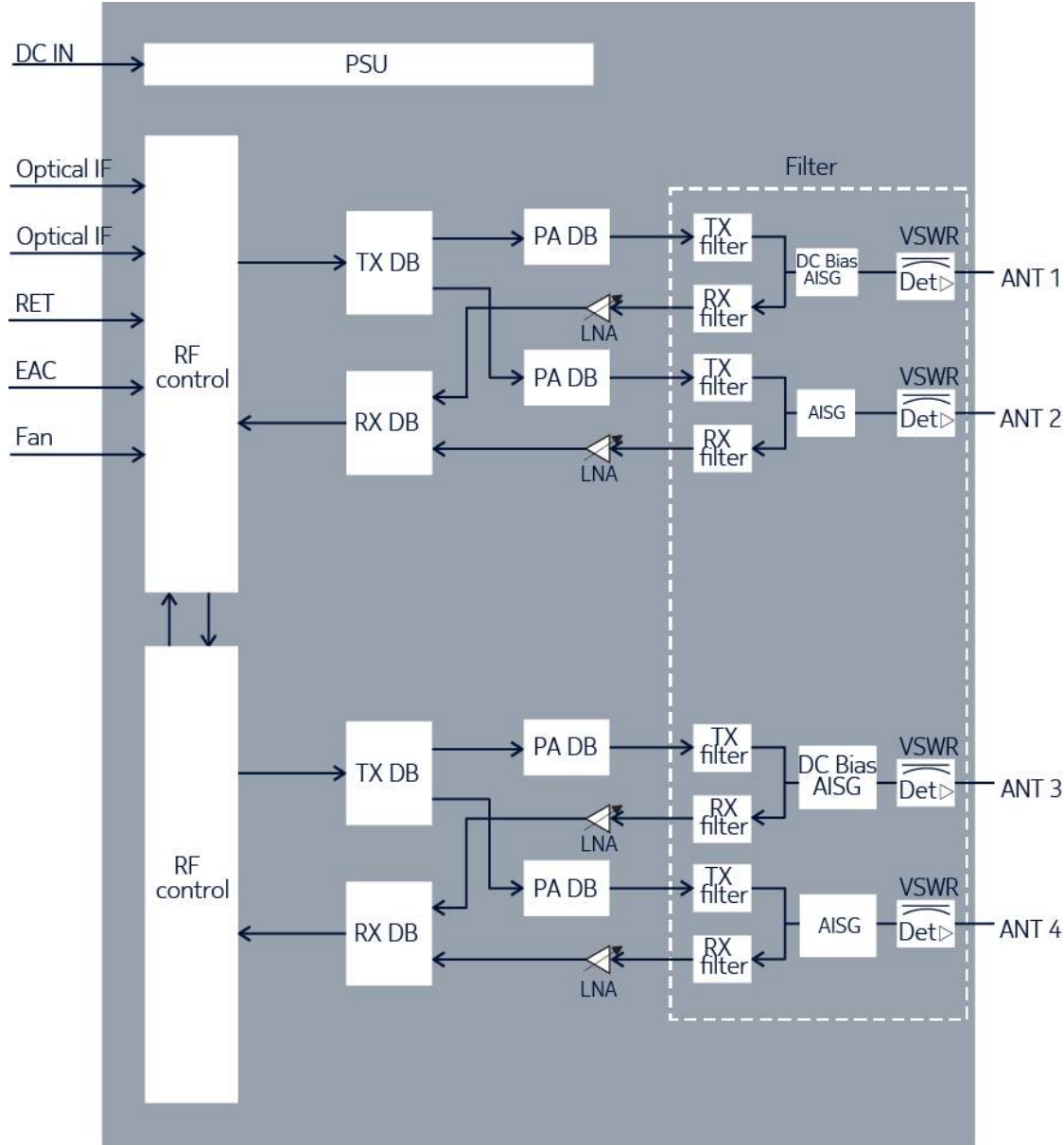
ALD support	Value
AISG	2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 112: AHBCA functional block diagram



Electrical specifications

Table 378: AHBCA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 379: Recommended AHBCA power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	0.8 (two or three carriers) 1.6 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1	1 (two or three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBG AirScale book mount kit 151-175 (474467A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

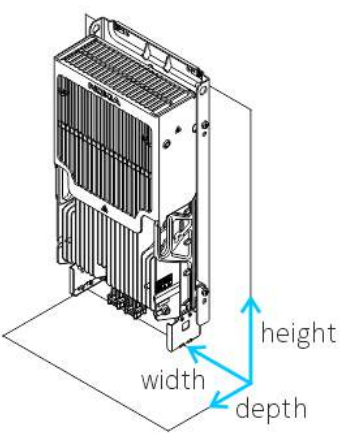
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 380: AHBCA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.05 in.) With mounting bracket: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting bracket: 327 mm (12.87 in.)	
Depth	Core RRH: 157 mm (6.18 in.) With mounting bracket: 173 mm (6.81 in.)	
Weight	34.0 kg (74.9 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 381: AHBCA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.10 AirScale Dual RRH 4T4R B5/B13 (n5) 320 W (AHBCC)

AHBCC (474341A) is introduced by LTE3849 (for WCDMA and LTE) and 5GC001150 (for NR).

Functional description

Table 382: AHBCC functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXX	B5/n5: 4T4R B13: 4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B5/n5: WCDMA, LTE, WCDMA-LTE, NR B13: LTE, NR
Duplex mode	FDD
IoT support	B5/n5: NB-IoT standalone B13: NB-IoT in band, guard band, standalone
TX frequency range	B5/n5: 869-894 MHz B13: 746-756 MHz
RX frequency range	B5/n5: 824-849 MHz B13: 777-787 MHz
DL filter bandwidth	B5/n5: 25 MHz B13: 10 MHz
UL filter bandwidth	B5/n5: 25 MHz B13: 10 MHz
Instantaneous bandwidth (iBW)	B5/n5: 25 MHz B13: 10 MHz
Occupied bandwidth (oBW)	B5/n5: 25 MHz B13: 10 MHz
Number of carriers per pipe	Up to 8

Property	Value
Supported bandwidths	LTE: • B5: 1.4, 3, 5, 10 MHz • B13: 5, 10 MHz NR: • n5: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 113: AHBCC interfaces

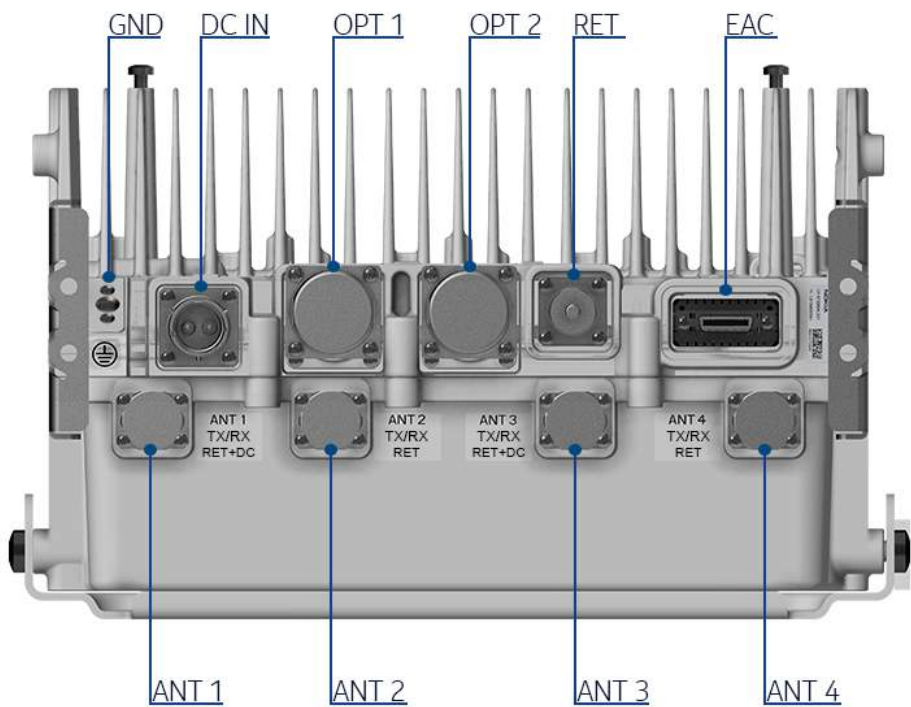


Table 383: AHBCC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3 Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M5 or dual M8 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 384: AHBCC ALD support

ALD support	Value
AISG	2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

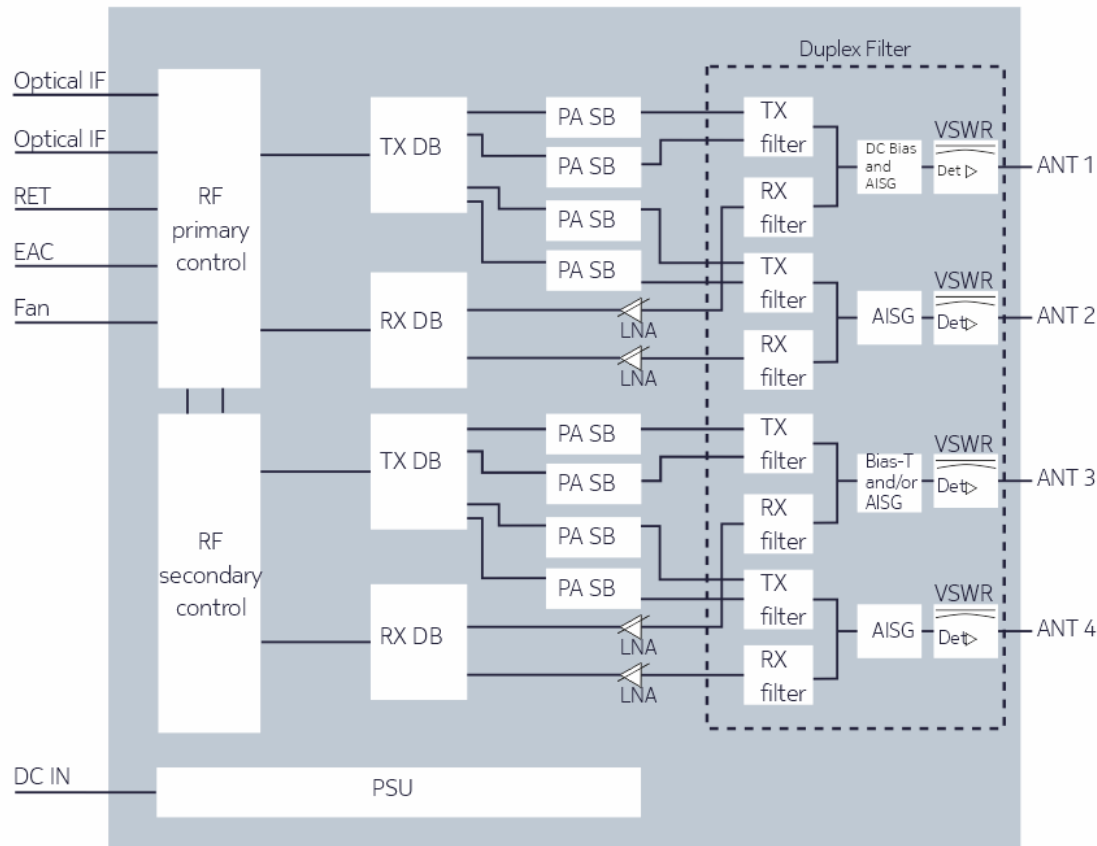


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 114: AHBCC functional block diagram



Electrical specifications

Table 385: AHBCC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

Table 386: Recommended AHBCC power back-off per band, in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.4 (two or three carriers) 1.6 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1	1.6 (two or three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBH AirScale book mount kit 176-200 (474280A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)

- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMRD AirScale one clip bracket over 200 (474582A)

Installation options

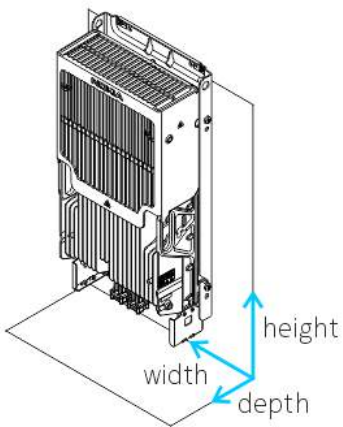
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 387: AHBCC dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.0 in.) With upper and lower mounting brackets: 675 mm (26.6 in.)	
Width	Core RRH: 308 mm (12.1 in.) With mounting brackets: 327 mm (12.9 in.)	
Depth	Core RRH: 189 mm (7.4 in.) With mounting brackets: 205 mm (8.1 in.)	
Weight	38 kg (83.8 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 388: AHBCC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.11 AirScale Dual RRH 4T4R B5/B28 (n5/n28) 320 W (AHPCA)

AHPCA (475075A) is introduced by SR002356 (for GSM, WCDMA, LTE) and 5GC002593 (for NR).

Functional description

Table 389: AHPCA functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXX	B5/n5: 4T4R B28/n28: 4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B5: GSM, WCDMA, LTE B28: LTE n5/n28: NR
RF sharing/concurrent mode	B5: GSM-WCDMA, GSM-LTE, WCDMA-LTE, GSM-WCDMA-LTE n5/n28: LTE-NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B5/n5: 869-894 MHz B28/n28: 758-803 MHz
RX frequency range	B5/n5: 824-849 MHz B28/n28: 703-748 MHz
DL filter bandwidth	B5/n5: 25 MHz B28/n28: 45 MHz
UL filter bandwidth	B5/n5: 25 MHz B28/n28: 45 MHz
Instantaneous bandwidth (iBW)	B5/n5: 25 MHz B28/n28: 45 MHz
Occupied bandwidth (oBW)	B5/n5: 25 MHz B28/n28: 45 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs

Property	Value
Supported bandwidths	B5: 1.4, 3, 5, 10 MHz B28: 3, 5, 10, 15, 20 MHz n5/n28: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 115: AHPCA interfaces

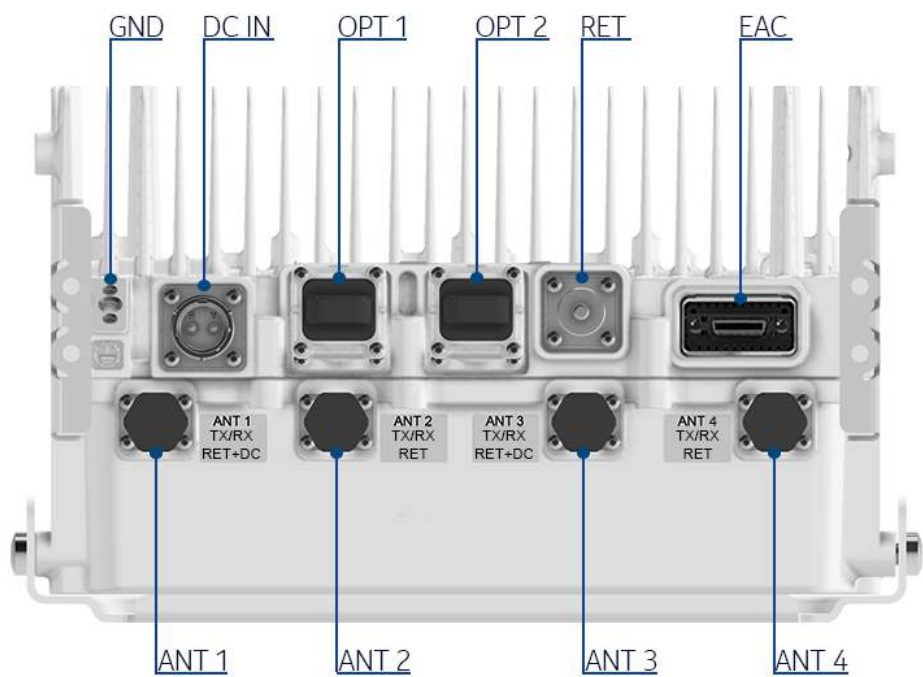


Table 390: AHPCA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on all ports and BiasT support on ANT1 and ANT3; has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 391: AHPCA ALD support

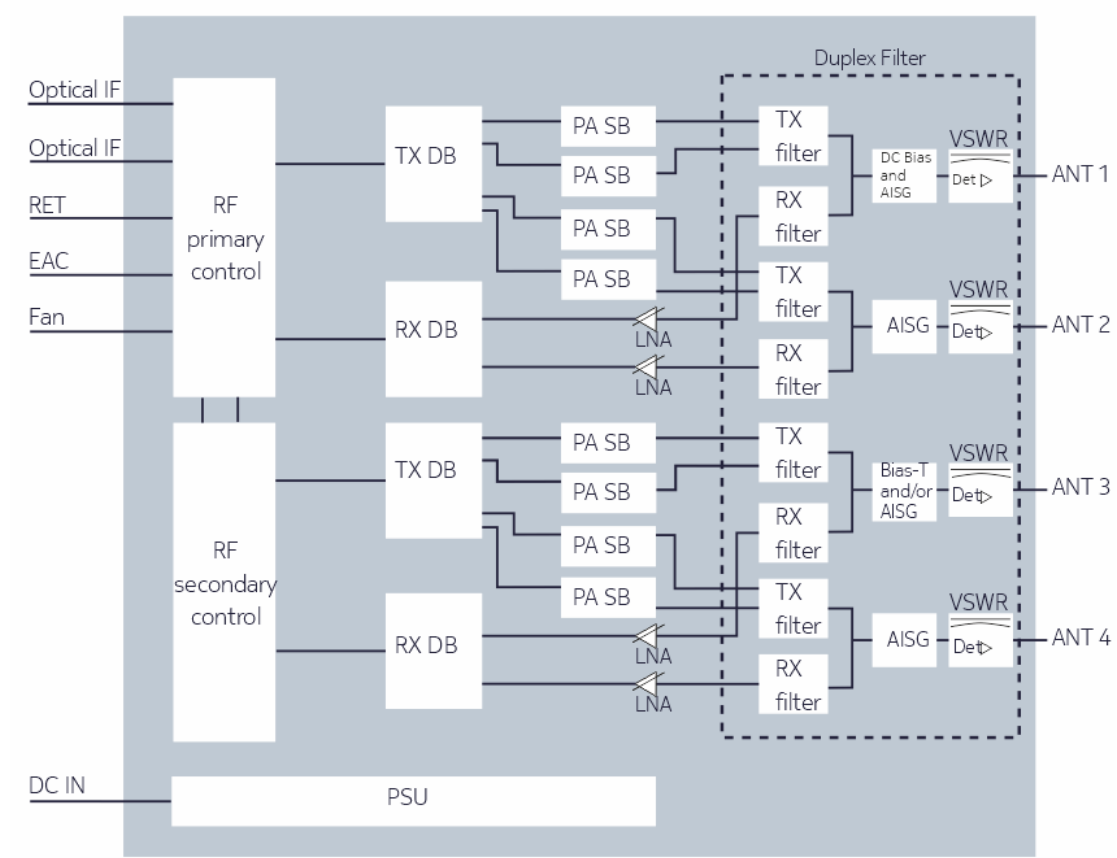
Property	Value
AISG	2.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 116: AHPCA functional block diagram



Electrical specifications

Table 392: AHPCA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

Table 393: Recommended AHPCA power back-off in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.4 (two or three carriers) 1.6 (four carriers)
NR	NRCELL_PDSCH_Power_Back-off_for_256QAM (dlQam256PowerBackoffSub6)	1	1.6 (two or three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- AMPA pole mounting kit (30-120 mm) (473879A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMBH AirScale book mount kit 176-200 (474280A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMRD AirScale one clip bracket over 200 (474582A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AOPC SFP weatherproofing boot kit (475151A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

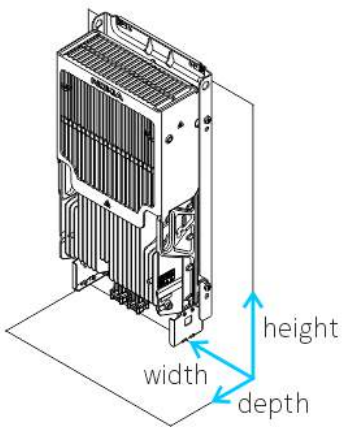


Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 394: AHPCA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.04 in.) With upper and lower mounting brackets: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 189 mm (7.44 in.) With mounting brackets: 205 mm (8.07 in.)	
Weight	Core RRH: 38 kg (83.7 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 395: AHPCA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.12 AirScale Dual RRH 4T4R B5/B28 (n5/n28) 320 W (AHPCB)

AHPCB (476519A) is introduced by *CB012141* (for GSM, WCDMA, LTE, and NR).

Functional description

Table 396: AHPCB functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	B5/n5: GSM, WCDMA, LTE, NR B28/n28: LTE, NR
RF sharing/concurrent mode	B5/n5: GSM-WCDMA, GSM-LTE, WCDMA-LTE, LTE-NR B28/n28: LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, standalone
TX frequency range	B5/n5: 869-894 MHz B28/n28: 758-803 MHz
RX frequency range	B5/n5: 824-849 MHz B28/n28: 703-748 MHz
DL filter bandwidth	B5/n5: 25 MHz B28/n28: 45 MHz
UL filter bandwidth	B5/n5: 25 MHz B28/n28: 45 MHz
Instantaneous bandwidth (iBW)	B5/n5: 25 MHz B28/n28: 45 MHz
Occupied bandwidth (oBW)	B5/n5: 25 MHz B28/n28: 45 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	B5: 1.4, 3, 5, 10 MHz B28: 3, 5, 10, 15, 20 MHz n5/n28: 5, 10, 15, 20 MHz

Property	Value
Passive intermodulation (PIM) cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 117: AHPCB interfaces

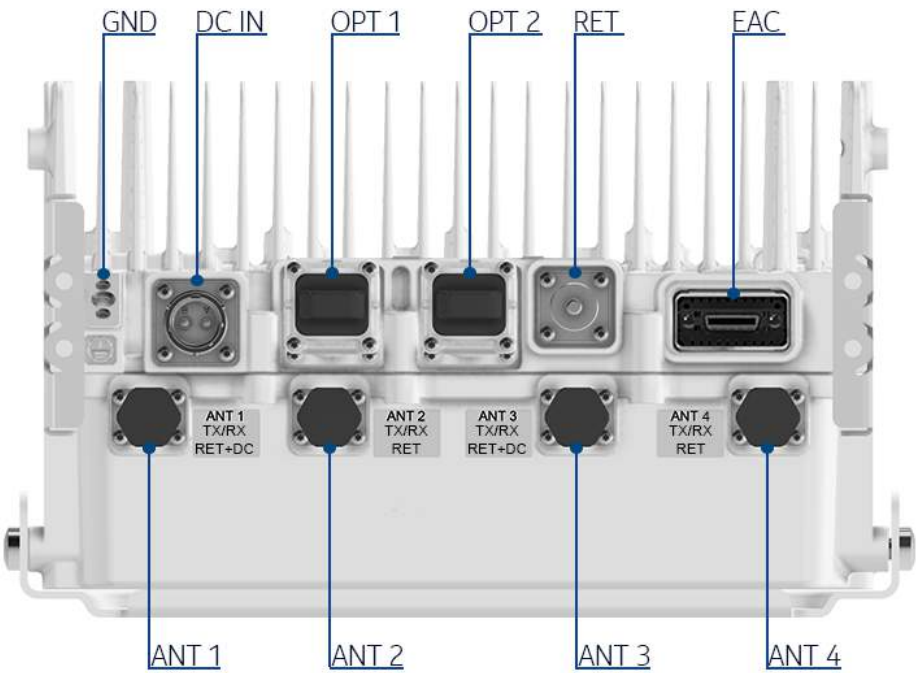


Table 397: AHPCB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on all ports and BiasT support on ANT1 and ANT3; has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR-26	Up to four external alarm inputs
Optical	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

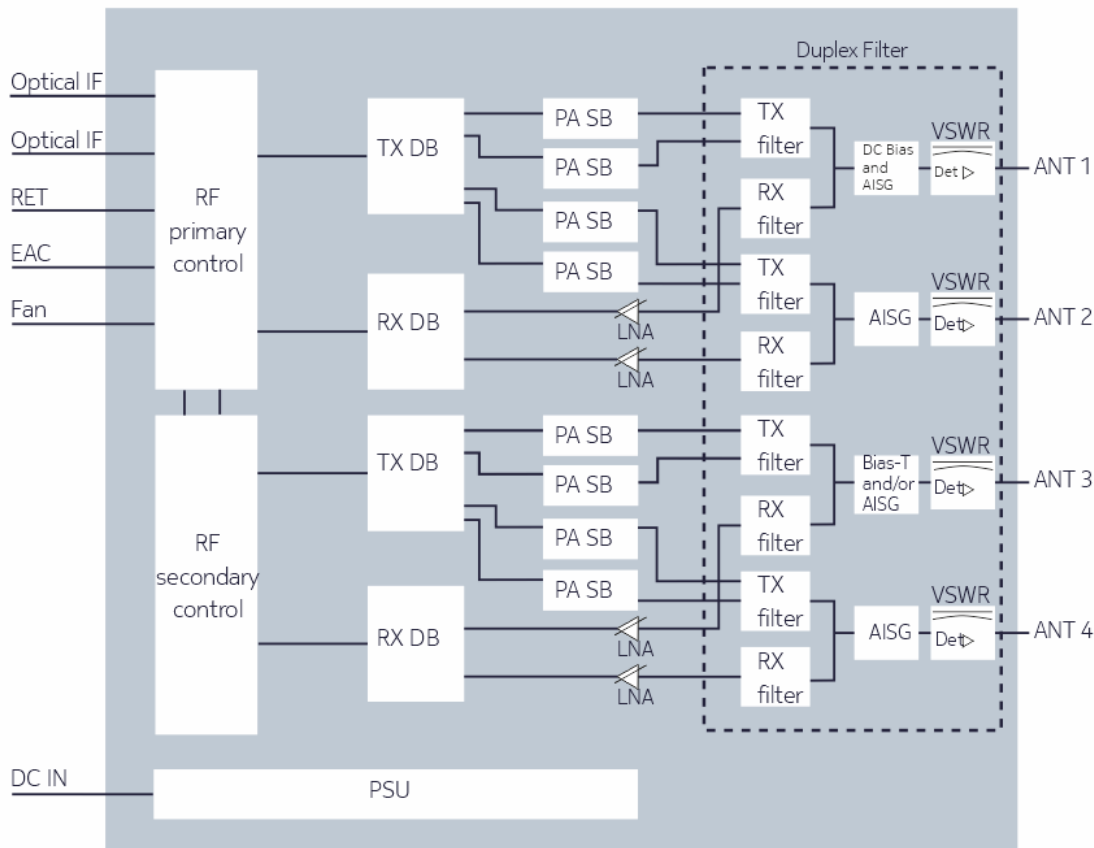
Antenna line device (ALD) support

Table 398: AHPCB ALD support

Property	Value
AISG	Version 2.0
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 118: AHPCB functional block diagram



Electrical specifications

Table 399: AHPCB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 400: The recommended power back-off in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.4 (two or three carriers) 1.6 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dLQam256PowerBackoffSub6)	1	1.6 (two or three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

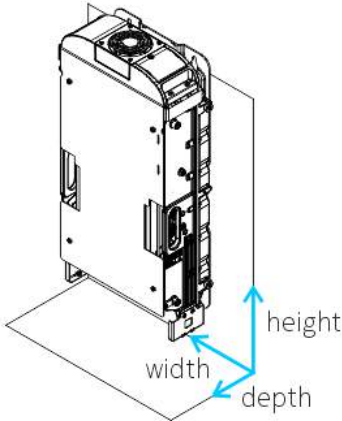
- AMBH AirScale book mount kit 176-200 (474280A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMRD AirScale one clip bracket over 200 (474582A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- ACPA AirScale 2 fiber protection (474297A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 401: AHPCB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.05 in.) With upper and lower mounting brackets and fan unit: 701 mm (27.60 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 189 mm (7.44 in.) With mounting brackets: 205 mm (8.07 in.)	
Weight	Core RRH: 37 kg (81.6 lb) With fan and mounting brackets: 41 kg (90.4 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 402: AHPCB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-35°C (-31°F)
Cooling method	Forced cooling (FAN)
IP rating	IP65

5.3.13 AirScale Dual RRH 4T4R B29/n5 240 W (AHBCB)

AHBCB (474242A) is introduced by LTE3846 (for LTE), SR001095 (for LTE), and 5GC002028 (for NR).

Functional description

Table 403: AHBCB functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXX	B5/n5: 4T4R B29: 2T
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	FDD
TX frequency range	B5/n5: 869-894 MHz B29 (LTE only): 717-728 MHz
RX frequency range	B5/n5: 824-849 MHz B29: not supported
DL filter bandwidth	B5/n5: 25 MHz B29 (LTE only): 11 MHz
UL filter bandwidth	B5/n5: 25 MHz B29: not supported
DL Instantaneous bandwidth (iBW)	B5/n5: 25 MHz B29 (LTE only): 11 MHz
UL Instantaneous bandwidth (iBW)	B5/n5: 25 MHz B29: not supported
DL Occupied bandwidth (oBW)	B5/n5: 25 MHz B29 (LTE only): 11 MHz
UL Occupied bandwidth (oBW)	B5: 25 MHz B29: not supported
Number of carriers per pipe	B5/n5: up to 4 (NR, LTE or NR+LTE) B29 (LTE only): up to 2

Property	Value
Supported bandwidths	LTE B5: 1.4, 3, 5, 10 MHz LTE B29: 5, 10 MHz NR n5: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/ SRAN Supported Configurations/ SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 119: AHBCB interfaces

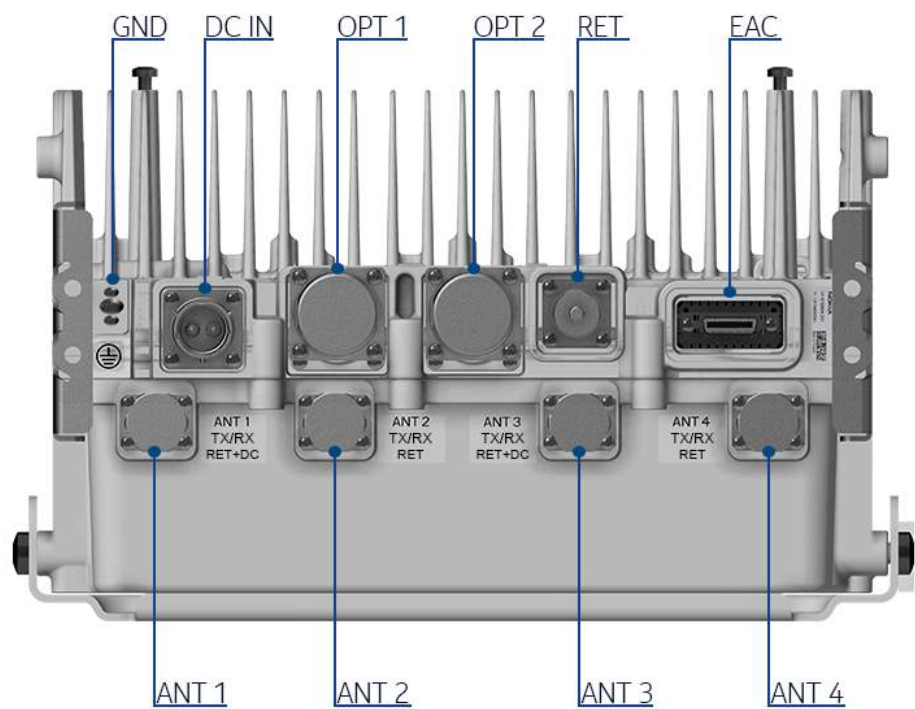


Table 404: AHBCB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC Compatible with optional AC power supply
Antenna connector	ANT	4	4.3-10+	AISG on all ports, BiasT support on ANT1 and ANT3 Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	4	MDR-26	4 inputs and 1 control output
Optical interface	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side

 Note:

ANT1 and ANT2 are used for band 29 (B29).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 405: AHBCB ALD support

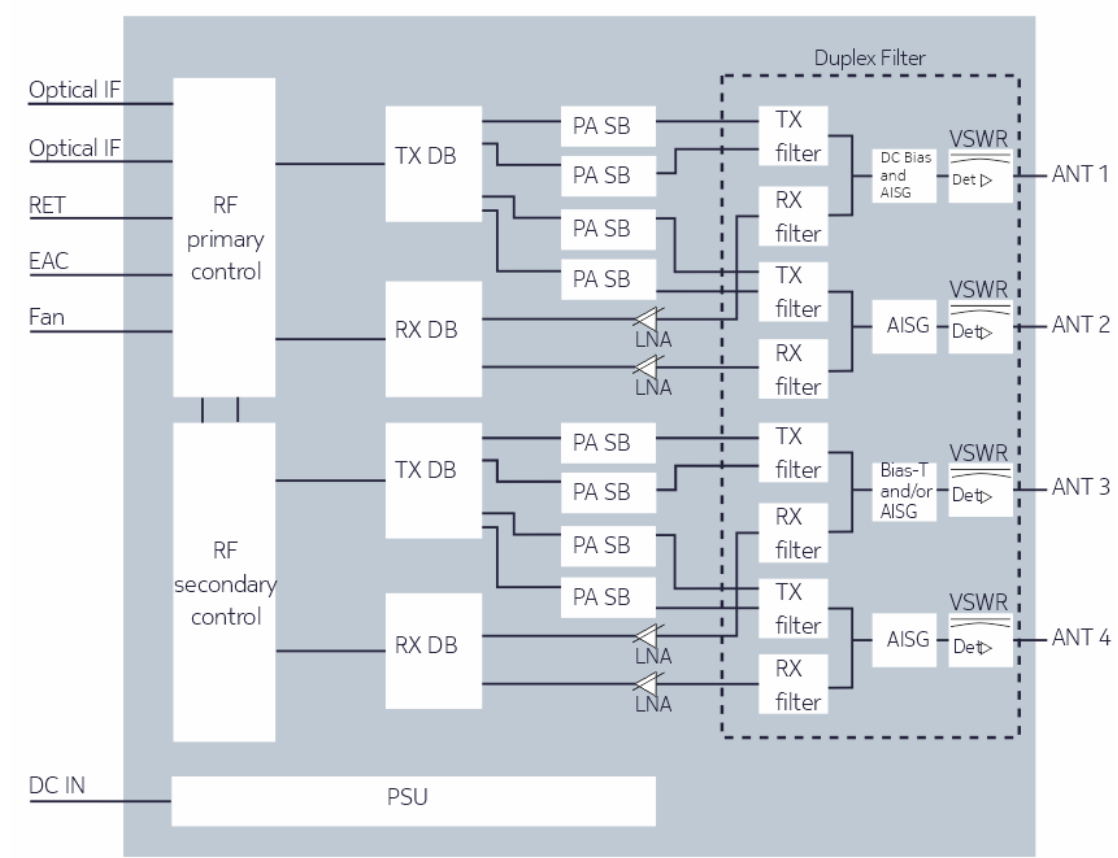
Property	Value
AISG	2.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 120: AHBCB functional block diagram



Electrical specifications

Table 406: AHBCB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 407: Recommended power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	0.8 (two or three carriers) 0.8 (four carriers)
NR	<i>NRCELL PDSCH Power Back-off for 256QAM</i> (dlQam256PowerBackoffSub6)	1	1 (two or three carriers) 1 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBH AirScale book mount kit 176-200 (474280A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)

- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMRD AirScale one clip bracket over 200 (474582A)

Installation options

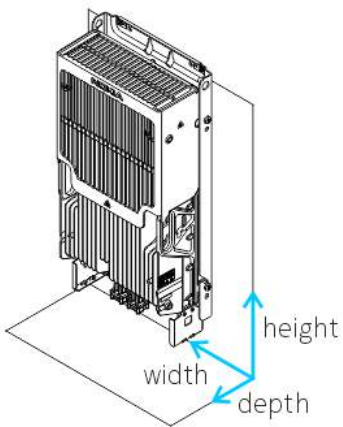
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

Notice:

To ensure convection cooling of RRHs without fans always mount the RHH vertically with the connectors facing down.

Dimensions and weight

Table 408: AHBCB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.05 in.) With upper and lower mounting brackets: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 189 mm (7.44 in.) With mounting brackets: 205 mm (8.07 in.)	
Weight	Core RRH: 38 kg (83.7 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 409: AHBCB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.14 AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDA)

AHPDA (475550A) is introduced by SR002869 (for GSM, WCDMA and LTE) and 5GC002467 (for NR).

Functional description

Table 410: AHPDA functional specification

Property	Value
Maximum output power	480 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B8: LTE, WCDMA, GSM B28: LTE n8/n28: NR
RF sharing/concurrent mode	B8: WCDMA-LTE, GSM-LTE, LTE-GSM-WCDMA n8/n28: LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B8/n8: 935-960 MHz B28/n28: 758-803 MHz
RX frequency range	B8/n8: 890-915 MHz B28/n28: 703-748 MHz
DL filter bandwidth	B8/n8: 25 MHz B28/n28: 45 MHz
UL filter bandwidth	B8/n8: 25 MHz B28/n28: 45 MHz
Instantaneous bandwidth (iBW)	B8/n8: 25 MHz B28/n28: 45 MHz
Occupied bandwidth (oBW)	B8/n8: 25 MHz B28/n28: 45 MHz
Number of carriers per pipe	B8/n8: up to 8 carriers for all supported RATs B28/n28: up to 4 carriers for all supported RATs

Property	Value
Supported bandwidths	B8: 5, 10 MHz B28: 5, 10, 15, 20 MHz n8/n28: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 121: AHPDA interfaces

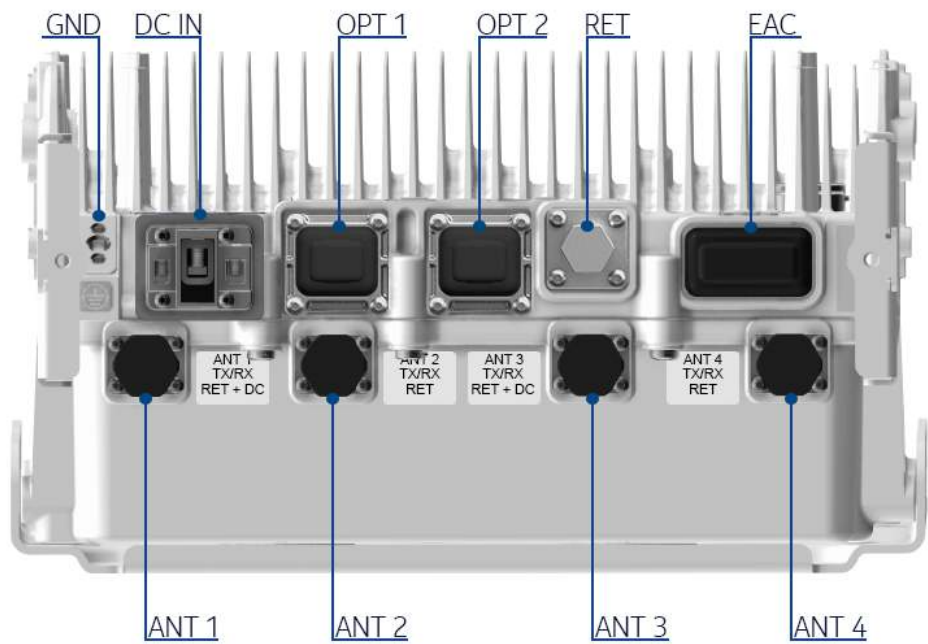


Table 411: AHPDA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	3-pole screw terminal	Allowed wire gauge: from 10 mm ² to 35 mm ² (7 AWG to 2 AW)
Antenna connector	ANT	4	4.3-10+	AISG on all ports and BiasT support on ANT1 and ANT3; has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	AISG RS485
External alarm connection	EAC	1	MDR-26	4 inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	–
Fan	FAN	1	Nokia fan	Located on the heat sink side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 412: AHPDA ALD support

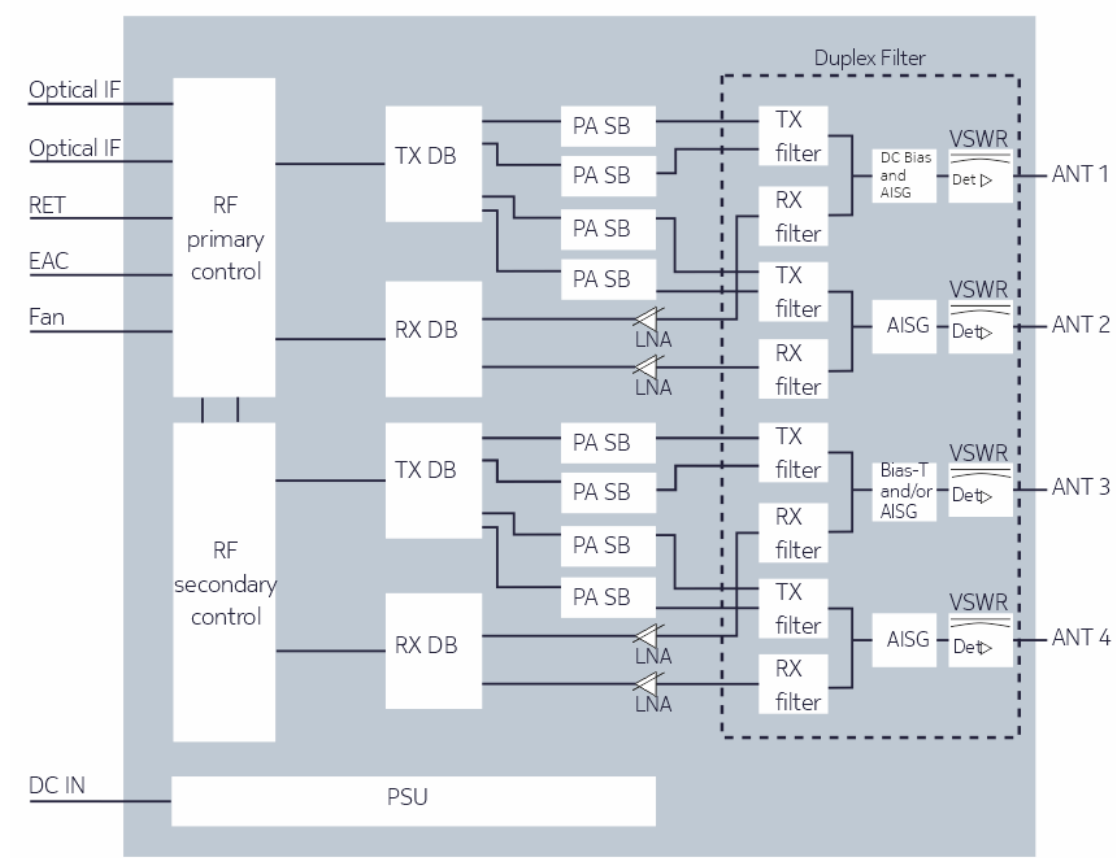
Property	Value
AISG	2.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 122: AHPDA functional block diagram



Electrical specifications

Table 413: AHPDA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 414: Recommended AHPDA power back-off per band, in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.4 (two or three carriers) 1.6 (four carriers)
NR	<i>NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)</i>	1	1.6 (two or three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

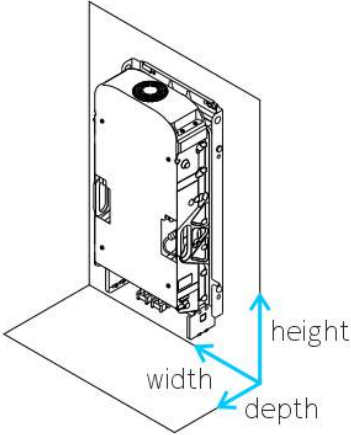
- APAM AirScale AC-DC power unit 2300 W (475766A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable (474288A)
- AHPDA v102: AMRB AirScale one clip bracket 126-200 (474581A)
- AHPDA v102: AMRC AirScale one clip rail 600 mm (474583A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*

Dimensions and weight

Table 415: AHPDA dimensions and weight

Property	Value	Dimensions orientation
Height	With fan unit: 730 mm (28.74 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting bracket: 327 mm (12.87 in.)	
Depth	Core RRH: 171 mm (6.73 in.) With mounting bracket: 182 mm (7.17 in.)	
Weight	44 kg (97.0 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 416: AHPDA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.3.15 AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDB)

AHPDB (476357A) is introduced by CB009853.

Functional description

Table 417: AHPDB functional specification

Property	Value
Commercial name	Pandion 4
Maximum output power	480 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	B8/n8: GSM, WCDMA, LTE, NR B28/n28: LTE, NR
RF sharing/concurrent mode	B8/n8: GSM-WCDMA, GSM-LTE, WCDMA-LTE, LTE-NR B28/n28: LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, standalone
TX frequency range	B8/n8: 925-960 MHz B28/n28: 758-803 MHz
RX frequency range	B8/n8: 880-915 MHz B28/n28 703-748 MHz
DL filter bandwidth	B8/n8: 35 MHz B28/n28: 45 MHz
UL filter bandwidth	B8/n8: 35 MHz B28/n28: 45 MHz
Instantaneous bandwidth (iBW)	B8/n8: 35 MHz B28/n28: 45 MHz
Occupied bandwidth (oBW)	B8/n8: 35 MHz B28/n28: 45 MHz
Number of carriers per pipe	Up to 16 (max 8 per band)

Property	Value
Supported bandwidths	WCDMA: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8 (default) MHz LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20, 25 ¹⁾ (n28 only), 30 (n28 only) MHz
Passive intermodulation (PIM) cancellation	Yes

¹⁾NR bandwidth 25 MHz has been introduced by the CB010343 feature.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 123: AHPDB interfaces

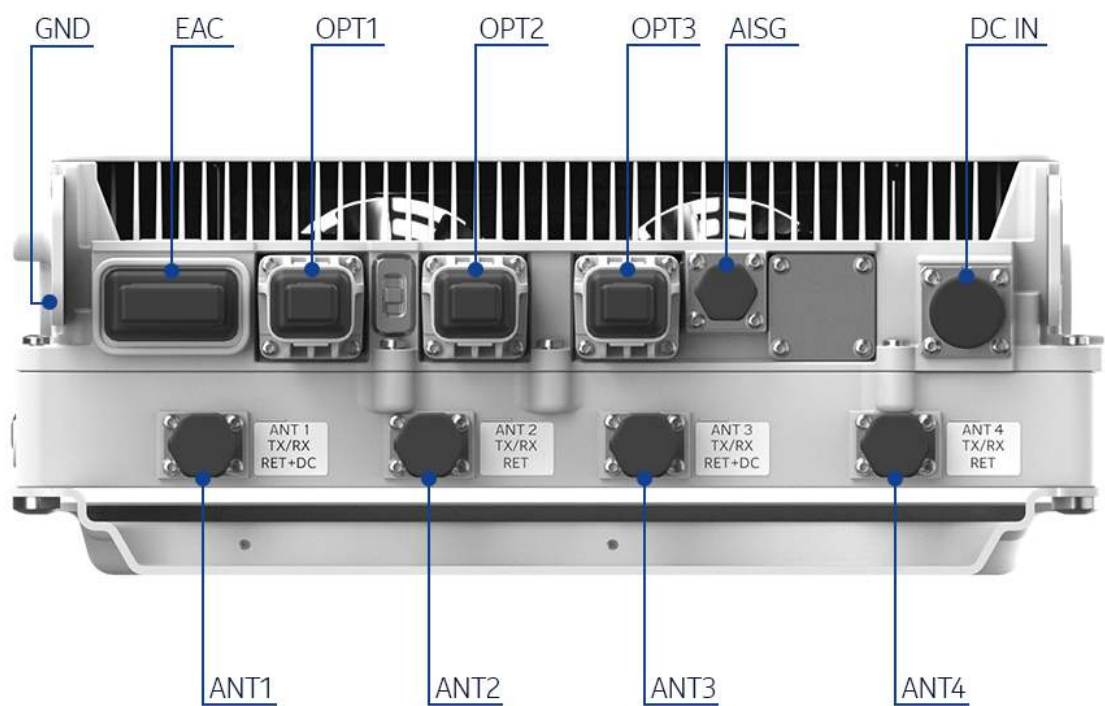


Table 418: AHPDB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPG
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3
External alarm connection	EAC	1	MDR26	-
Optical	OPT	3	SFP28, SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Antenna Interface Standard Groups	AISG	1	8-pin circular	RS-485
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

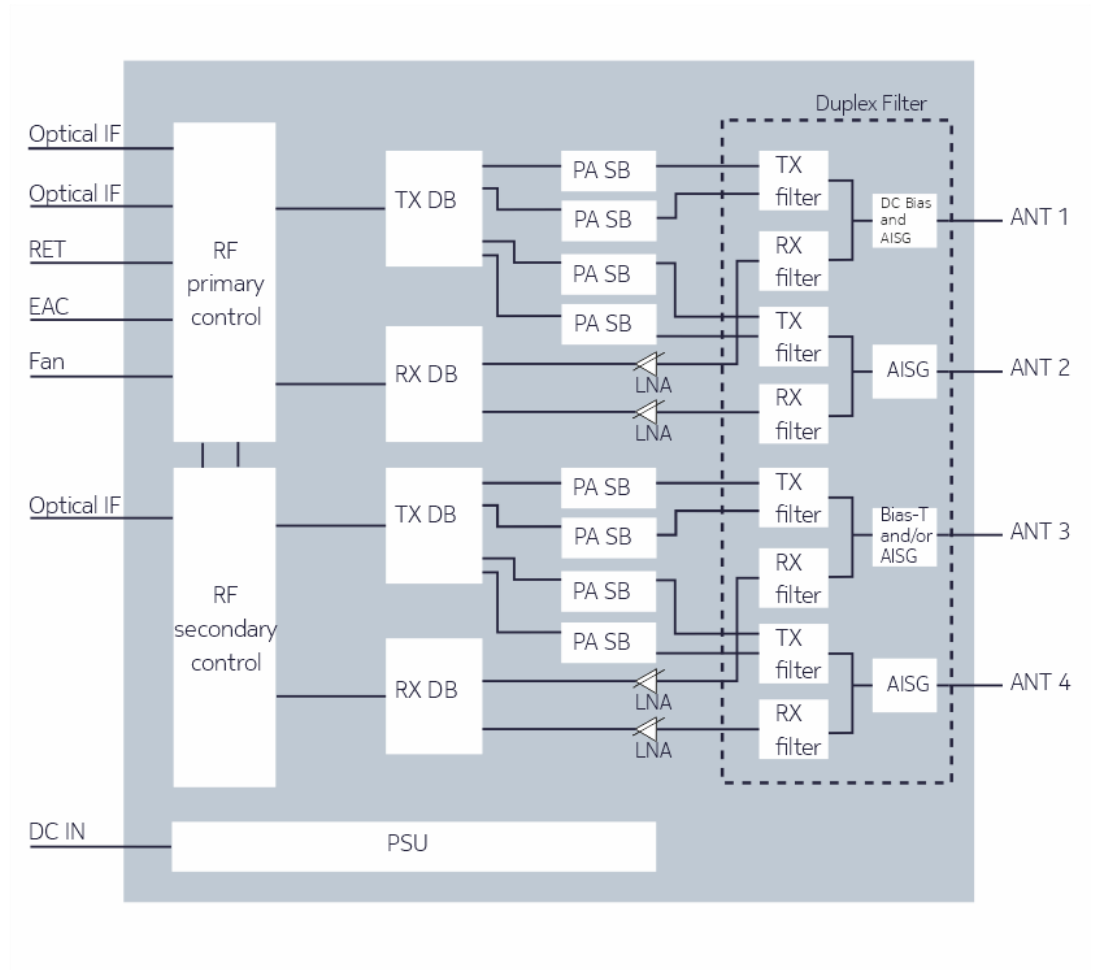
Antenna line device (ALD) support

Table 419: AHPDB ALD support

Property	Value
AISG	Version 2.0
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 124: AHPDB functional block diagram



Electrical specifications

Table 420: AHPDB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 421: The recommended power back-off in 256 QAM

RAT	Feature or Parameter	Single carrier 20 MHz [dB]	Single carrier/multi carrier (contiguous) ≤ 100 MHz [dB]	Multi-carrier (non-contiguous) ≤ 100 MHz [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0	0.4
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0	0.2	0.6

Note:

Transmit power back-off for 4C LTE/NR 256QAM is 1.2 dB, for 3C LTE/NR 256QAM is 1.1 dB.

Related optional items

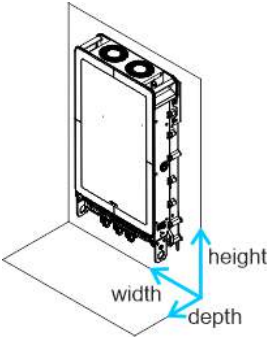
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPG AirScale 2 70 A DC plug 10-16 mm² (475401A)
- ASAA AirScale 2 MDR26-open EAC 5 m cable (474288A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*

Dimensions and weight

Table 422: AHPDB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 640 mm (25.20 in.) With mounting bracket and fan unit: 676 mm (26.61 in.)	
Width	Core RRH: 342 mm (13.46 in.) With mounting bracket and fan unit: 369 mm (14.53 in.)	
Depth	Core RRH: 156 mm (6.14 in.) With front covers: 186 mm (7.32 in.)	
Weight	max. 37 kg (81.6 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 423: AHPDB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced cooling (FAN)
IP rating	IP65

5.3.16 AirScale Dual RRH 4T4R B8/B28 (n8/n28) 480 W (AHPDC)

AHPDC (476358A) is introduced by *CB009852*.

Functional description

Table 424: AHPDC functional specification

Property	Value
Commercial name	Pandion 4
Maximum output power	480 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	B8/n8: GSM, WCDMA, LTE, NR B28/n28: LTE, NR
RF sharing/concurrent mode	B8/n8: GSM-WCDMA, GSM-LTE, WCDMA-LTE, LTE-NR B28/n28: LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, standalone
TX frequency range	B8/n8: 935-960 MHz B28/n28: 758-803 MHz
RX frequency range	B8/n8: 890-915 MHz B28/n28: 703-748 MHz
DL filter bandwidth	B8/n8: 25 MHz B28/n28: 45 MHz
UL filter bandwidth	B8/n8: 25 MHz B28/n28: 45 MHz
Instantaneous bandwidth (iBW)	B8/n8: 25 MHz B28/n28: 45 MHz
Occupied bandwidth (oBW)	B8/n8: 25 MHz B28/n28: 45 MHz
Number of carriers per pipe	Up to 16 (max 8 per band)

Property	Value
Supported bandwidths	WCDMA: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8 (default) MHz LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20, 25 ¹⁾ (n28 only), 30 (n28 only) MHz
Passive intermodulation (PIM) cancellation	Yes

¹⁾NR bandwidth 25 MHz has been introduced by the CB010343 feature.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 125: AHPDC interfaces

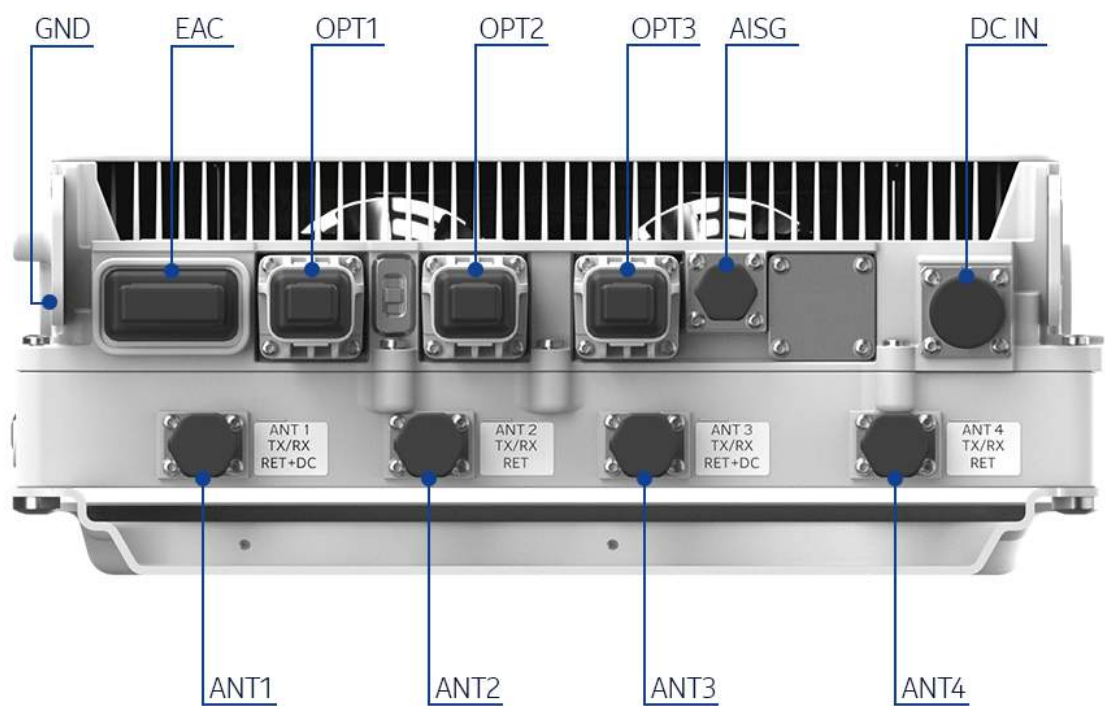


Table 425: AHPDC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPG
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3
External alarm connection	EAC	1	MDR26	-
Optical	OPT	3	SFP28, SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Antenna Interface Standard Groups	AISG	1	8-pin circular	RS-485
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

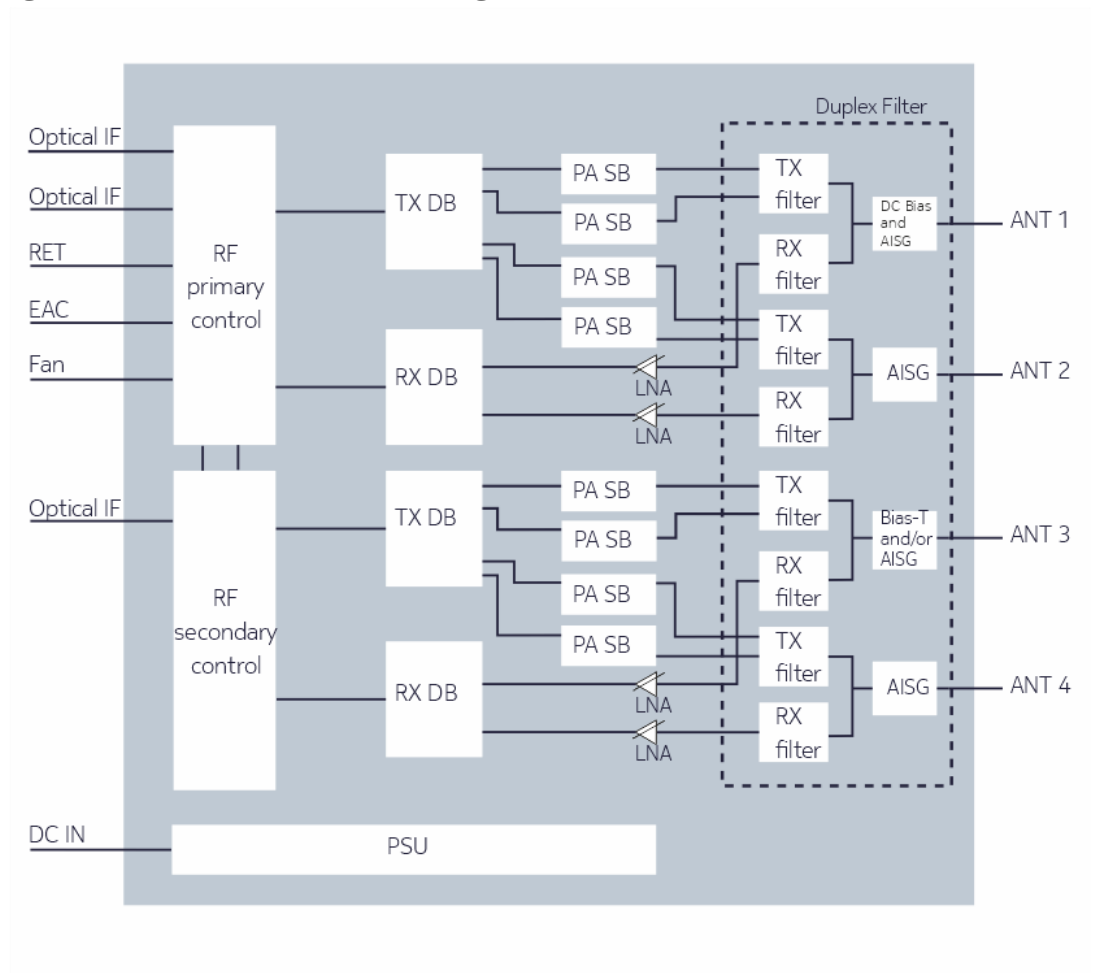
Antenna line device (ALD) support

Table 426: AHPDC ALD support

Property	Value
AISG	Version 2.0
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 126: AHPDC functional block diagram



Electrical specifications

Table 427: AHPDC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 428: The recommended power back-off in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.4
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0 0.2 for bandwidth > 20 MHz	0.6

Related optional items

- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)

- AMPA pole mounting kit (30-120 mm) (473879A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPG AirScale 2 70 A DC plug 10-16 mm² (475401A)
- ASAA AirScale 2 MDR26-open EAC 5 m cable (474288A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*

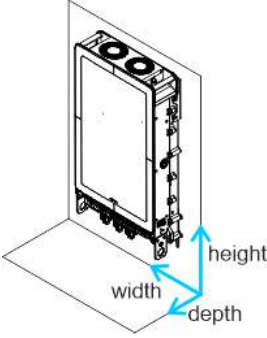


Notice:

Install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 429: AHPDC dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 640 mm (25.20 in.) With mounting bracket and fan unit: 676 mm (26.61 in.)	
Width	Core RRH: 342 mm (13.46 in.) With mounting bracket and fan unit: 369 mm (14.53 in.)	
Depth	Core RRH: 156 mm (6.14 in.) With front covers: 186 mm (7.32 in.)	
Weight	max. 37 kg (81.6 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 430: AHPDC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.3.17 AirScale Dual RRH 4T4R B12/B14 (n12/n14) 320 W (AHLBA)

AHLBA (474240A) is introduced by *LTE3847* (for LTE) and *CB008396* (for NR).

Functional description

Table 431: AHLBA functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXRX	B12 /n12 : 4T4R B14 /n14 : 4T4R
Outdoor installation	Yes
Supported technologies	LTE, NR, NB-IoT
Duplex mode - supported standard	FDD
RF sharing/concurrent mode	LTE-NR
TX frequency range	B12 /n12 : 729–745 MHz B14 /n14 : 758–768 MHz B17 (LTE only): 734–745 MHz
RX frequency range	B12 /n12 : 699–715 MHz B14 /n14 : 788–798 MHz B17 (LTE only): 704–715 MHz
DL filter bandwidth	B12 /n12 : 16 MHz B14 /n14 : 10 MHz
UL filter bandwidth	B12 /n12 : 16 MHz B14 /n14 : 10 MHz
DL instantaneous bandwidth (iBW)	B12 /n12 : 16 MHz B14 /n14 : 10 MHz B17: 11 MHz
UL instantaneous bandwidth (iBW)	B12 /n12 : 16 MHz B14 /n14 : 10 MHz B17: 11 MHz
DL occupied bandwidth (oBW)	B12 /n12 : 16 MHz B14 /n14 : 10 MHz B17: 10 MHz

Property	Value
UL occupied bandwidth (oBW)	B12 /n12 : 16 MHz B14 /n14 : 10 MHz B17: 10 MHz
Number of carriers per pipe	LTE: up to 3 NR/mixed NR+LTE: up to 8
Supported bandwidths	LTE: 5, 10 MHz NR: • n12: 5, 10, 15 MHz • n14: 5, 10 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 127: AHLBA interfaces

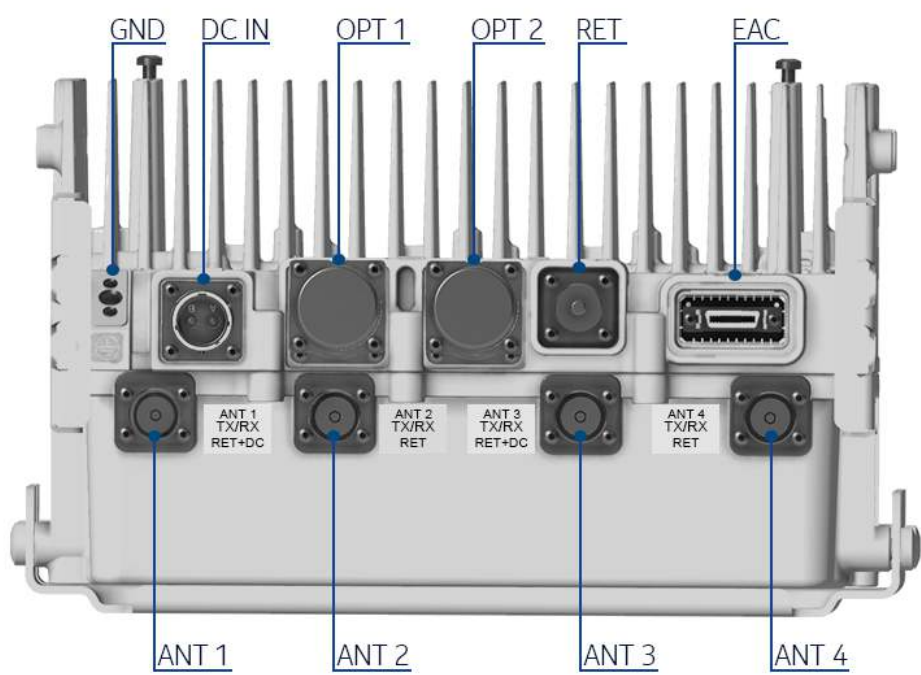


Table 432: AHLBA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPB, APPC
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT 1 and ANT 3. ANT has features that prevent damage if mating with a 4.1-9.5 connector is attempted.
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or 2 x M5 screws	–
Fan	FAN	1	Nokia fan	Located on the heat sink side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 433: AHLBA ALD support

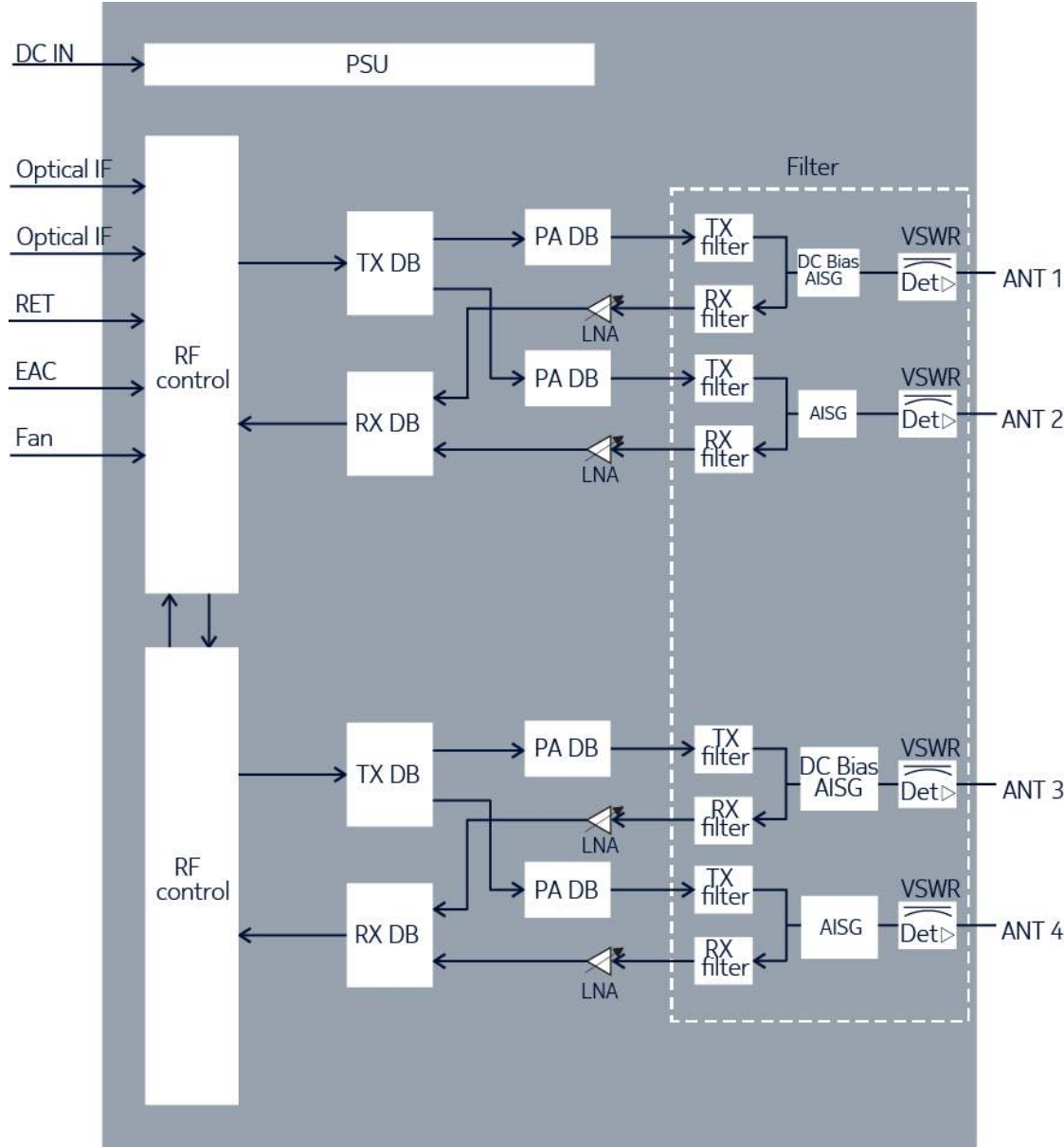
ALD support	Value
AISG	Version 2.0
Voltage	14.5 V (ANT 1 and ANT 3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 128: AHLBA functional block diagram



Electrical specifications

Table 434: AHLBA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 435: Recommended AHLBA power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.6	0.9 (two or three carriers) 1.4 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.8	1.1 (two or three carriers) 1.6 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMBH AirScale book mount kit 176-200 (474280A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- ASFC AirScale 2 fan unit 600 (474484A)

Installation options

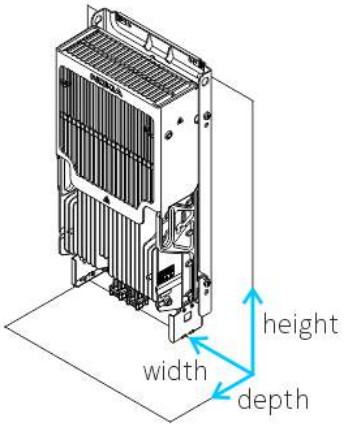
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 436: AHLBA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.0 in.) With upper and lower mounting brackets: 675 mm (26.6 in.)	
Width	Core RRH: 308 mm (12.1 in.) With mounting brackets: 327 mm (12.9 in.)	
Depth	Core RRH: 177 mm (7.0 in.) With mounting brackets: 193 mm (7.6 in.)	
Weight	35 kg (77.2 lb)	

Environmental specifications

i Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 437: AHLBA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.18 AirScale Dual RRH 4T4R B12/n71 240 W (AHLOA)

AHLOA (474331A) is introduced by LTE3899 (for LTE), 5GC000719 (for NR), and CB010526 (for LTE-NR concurrent mode).

Functional description

Table 438: AHLOA functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Software supported technologies	LTE, NR
RF sharing/Concurrent mode	LTE-NR
Duplex mode	FDD
TX frequency range	B85 (LTE only): 728–746 MHz B71/n71: 617–652 MHz B17 (LTE only): 734–746 MHz B12/n12: 729–746 MHz
RX frequency range	B85 (LTE only): 698–716 MHz B71/n71: 663–698 MHz B17 (LTE only): 704–716 MHz B12/n12: 699–716 MHz
DL instantaneous bandwidth (iBW)	B85 (LTE only): 18 MHz B71/n71: 35 MHz B17: 12 MHz B12/n12: 17 MHz
UL instantaneous bandwidth (iBW)	B85 (LTE only): 18 MHz B71: 35 MHz B17: 12 MHz B12/n12: 17 MHz
DL occupied bandwidth (oBW)	B85: 18 MHz B71/n71: 35 MHz B17: 12 MHz B12/n12: 17 MHz
UL occupied bandwidth (oBW)	53 MHz contiguous
DL filter bandwidth	B71: 35 MHz B85 (including B12, LTE only): 18 MHz

Property	Value
UL filter bandwidth	B71: 35 MHz B85 (including B12, LTE only): 18 MHz
Number of carriers per pipe	Up to 8
Supported bandwidths	LTE: • B71: 1.4, 3, 5, 10, 15, 20 MHz • B12/B85: 1.4, 3, 5, 10, 15, 20 MHz NR: • n71: 5, 10, 15, 20 MHz • n12: 5, 10, 15 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 129: Style A AHLOA interfaces

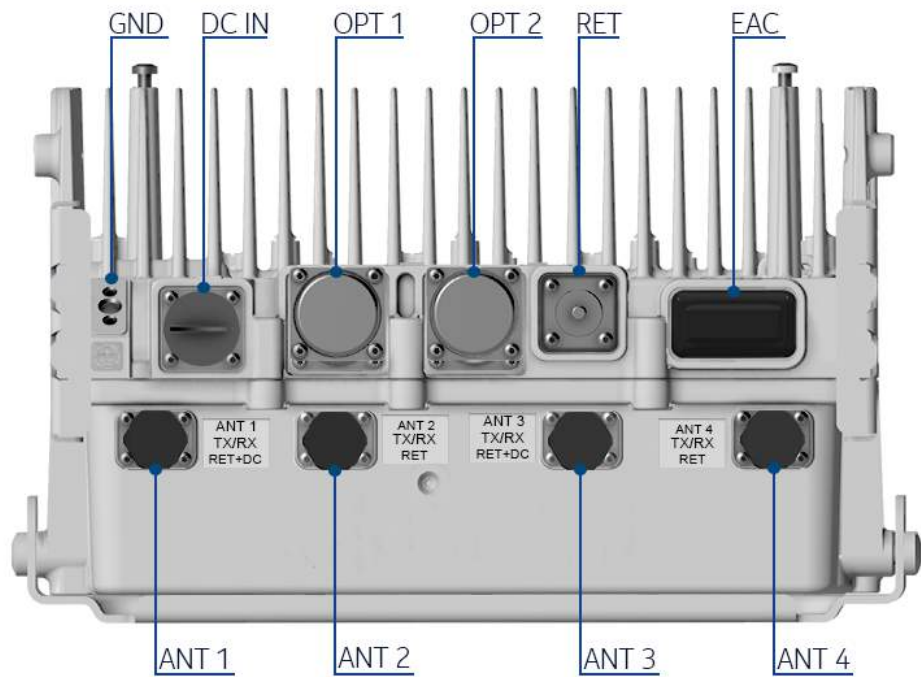


Figure 130: Style B AHLOA interfaces

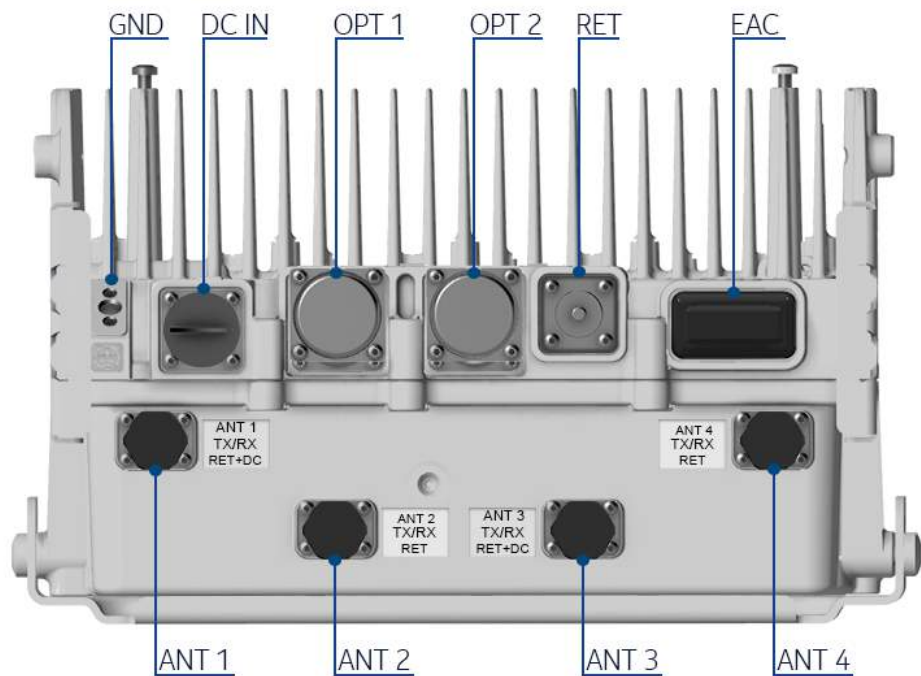


Table 439: AHLOA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	4-key high power circular connector	APPB, APPC, supports grounding for shielded cables
Antenna connector	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3 Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	AISG C485	8-pin circular
External Alarm Connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or dual M5 screws	–
Fan	FAN	1	Microfit 2x3	Located on fin side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 440: AHLOA interface for ALD support

Property	Value
AISG	2.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total



Note:

Separate software feature is required for ALD support.

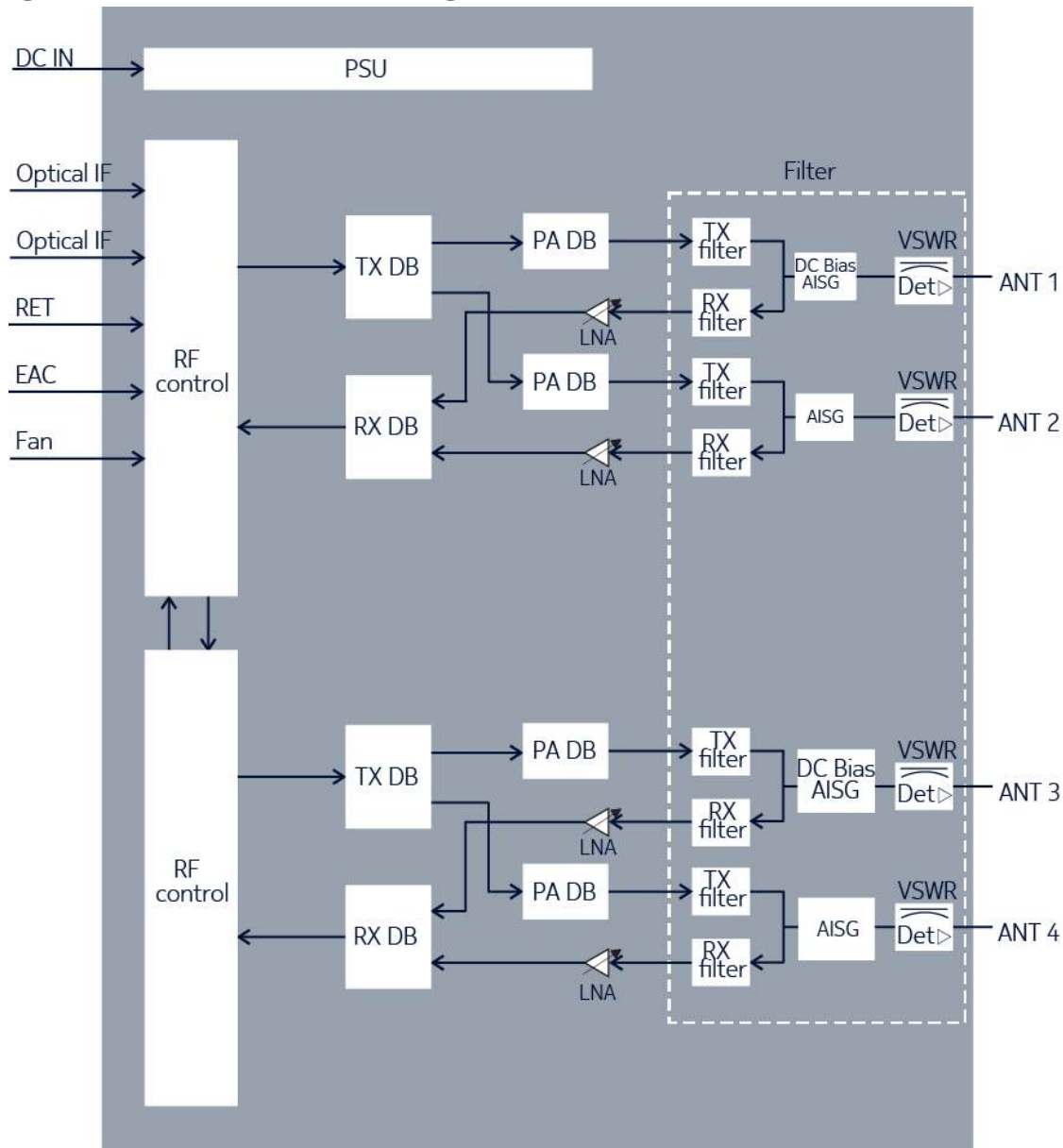


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 131: AHLOA functional block diagram



Electrical specifications

Table 441: AHLOA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 442: Recommended AHLOA power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.1 (two or three carriers) 1.2 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1	1.3 (two or three carriers) 1.4 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBH AirScale book mount kit 176-200 (474280A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMRD AirScale one clip bracket over 200 (474582A)

Installation options

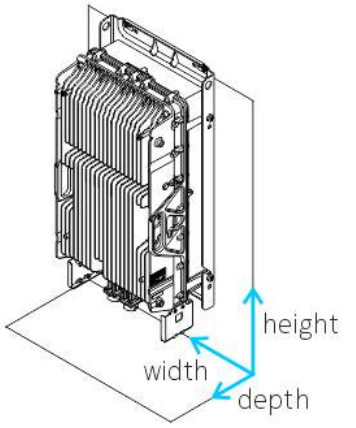
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

! Notice:

The RRH without a fan should always be mounted in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 443: AHLOA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.05 in.) With upper and lower mounting brackets: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 189 mm (7.44 in.) With mounting brackets: 205 mm (8.07 in.)	
Weight	38 kg (83.8 lb)	

Environmental specifications

i Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 444: AHLOA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.19 AirScale Dual RRH 4T4R B13/B26 (n26) 240 W (AHBCD)

AHBCD (476021A) is introduced by CB008447 (for LTE and NR).

Functional description

Table 445: AHBCD functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band (IB), guard band, standalone
TX frequency range	B5/n5: 869-894 MHz B13: 746-756 MHz B26/n26: 859-894 MHz*
RX frequency range	B5/n5: 824-849 MHz B13: 777-787 MHz B26/n26: 814-849 MHz
DL filter bandwidth	B5/n5: 25 MHz B13: 10 MHz B26/n26: 35 MHz
UL filter bandwidth	B5/n5: 25 MHz B13: 10 MHz B26/n26: 35 MHz
Instantaneous bandwidth (iBW)	B5/n5: 25 MHz B13: 10 MHz B26/n26: 35 MHz
Occupied bandwidth (oBW)	B5/n5: 25 MHz B13: 10 MHz B26/n26: 35 MHz
Number of carriers per pipe	Up to 8

Property	Value
Supported bandwidths	LTE: • B13: 5 MHz, 10 MHz • B26: 5 MHz, 10 MHz, 15 MHz • B5: 5 MHz, 10 MHz NR • n5/n26: 5 MHz, 10 MHz, 15 MHz, 20 MHz
Passive Inter-Modulation (PIM) cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

*Due to FCC requirements, 1 MHz of band 26 is reserved for the guard band (859–860 MHz). You can allocate the carrier so that it overlaps with this area, for example, a 10 MHz carrier with a center frequency of 864 MHz. However, you need to shut down the overlapping physical resource blocks (PRBs) using the *LTE3145: Slim Carrier* feature first.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 132: AHBCD interfaces

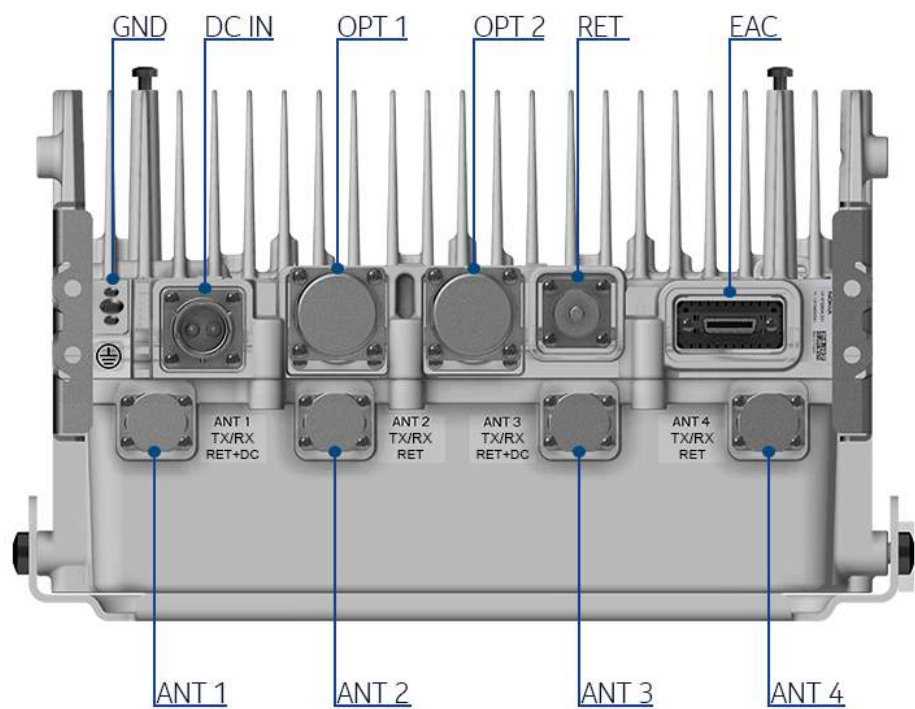


Table 446: AHBCD interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10+	AISG on all ports, BiasT support on ANT1 and ANT3. Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps; R2CT IP seal
Grounding	GND 	1	M5 or dual M8 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

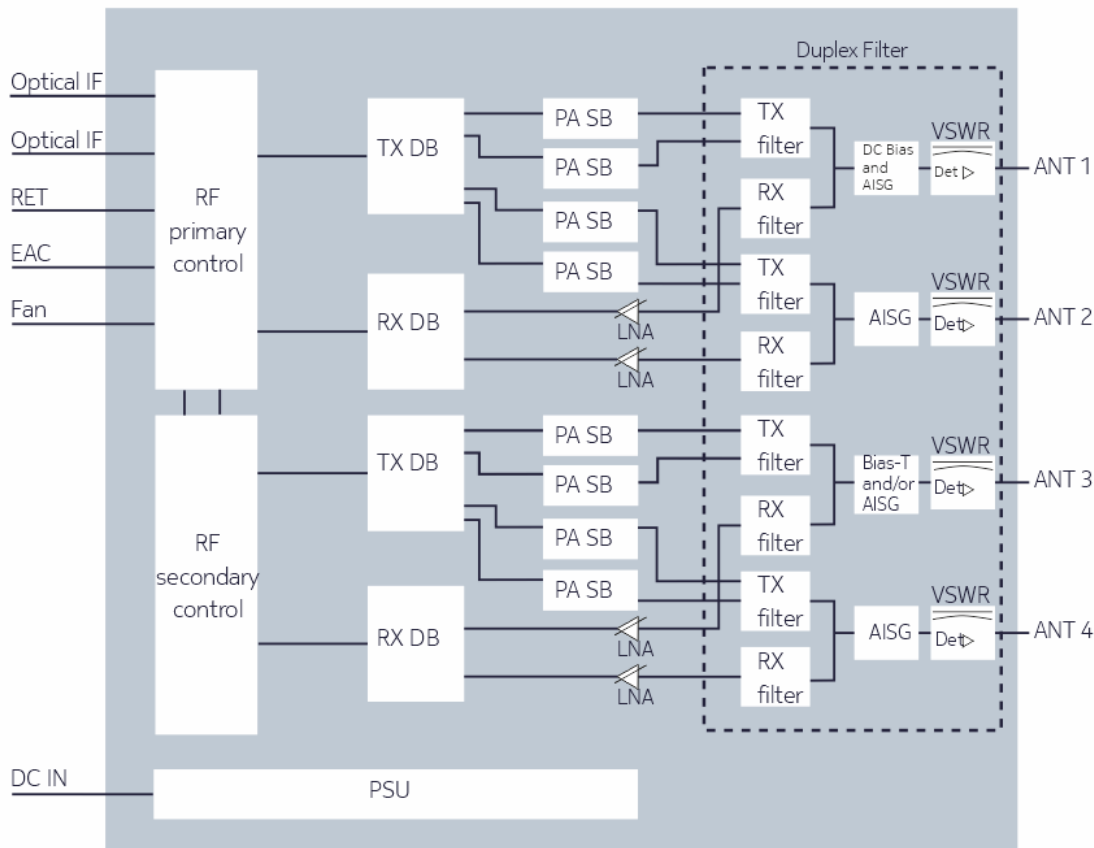
Antenna line device (ALD) support

Table 447: AHBCD ALD support

Property	Value
AISG	AISG 3.0: ANT 1, ANT 2, ANT 3, ANT 4, and RET Power supply: ANT 1 and ANT 3
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 133: AHBCD functional block diagram



Electrical specifications

Table 448: AHBCD electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 449: The recommended AHBCD power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.4 (two or three carriers) 1.6 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1	1.6 (two or three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBH AirScale book mount kit 176-200 (474280A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- ACPA AirScale 2 fiber protection (474297A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMRD AirScale one clip bracket over 200 (474582A)

Installation options

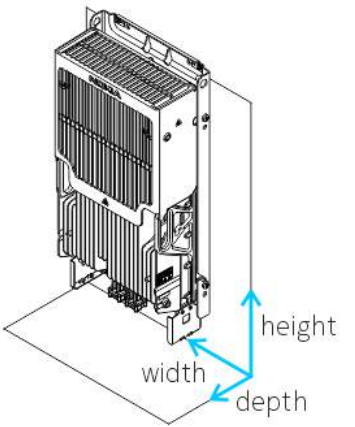
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 450: AHBCD dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.05 in.) With upper and lower mounting brackets: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 189 mm (7.44 in.) With mounting brackets: 205 mm (8.07 in.)	
Weight	38 kg (83.8 lb)	

Environmental specifications

i Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 451: AHBCD environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.20 AirScale Dual RRH 4T4R B13/B71 (n71) 240 W (AHBOA)

AHBOA (475250A) is introduced by LTE4988 (for LTE), SR002582 (for LTE), and 5GC002424 (for NR).

Functional description

Table 452: AHBOA functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	FDD
TX frequency range	B13: 746–756 MHz B71/n71: 617–652 MHz
RX frequency range	B13: 777–787 MHz B71/n71: 663–698 MHz
DL filter bandwidth	B13: 10 MHz B71/n71: 35 MHz
UL filter bandwidth	B13: 10 MHz B71/n71: 35 MHz
Instantaneous bandwidth (iBW)	B13: 10 MHz B71/n71: 35 MHz
Occupied bandwidth (oBW)	B13: 10 MHz B71/n71: 35 MHz
Number of carriers per pipe	B13: up to 2 B71/n71: up to 4 carriers in total for all supported RATs
Supported bandwidths	B13 (LTE only): 5, 10 MHz B71/n71 (LTE and NR): 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes

Property	Value
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 134: AHBOA interfaces

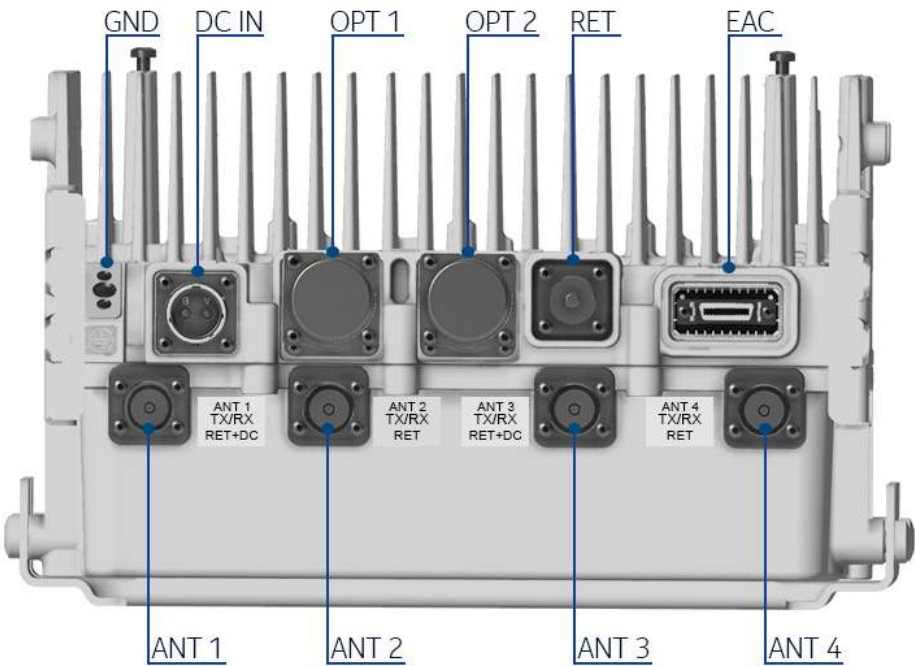


Table 453: AHBOA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10+	AISG on all ports, BiasT support on ANT1 and ANT3; has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR-26	4 inputs and 1 control output
Optical interface	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 454: AHBOA ALD support

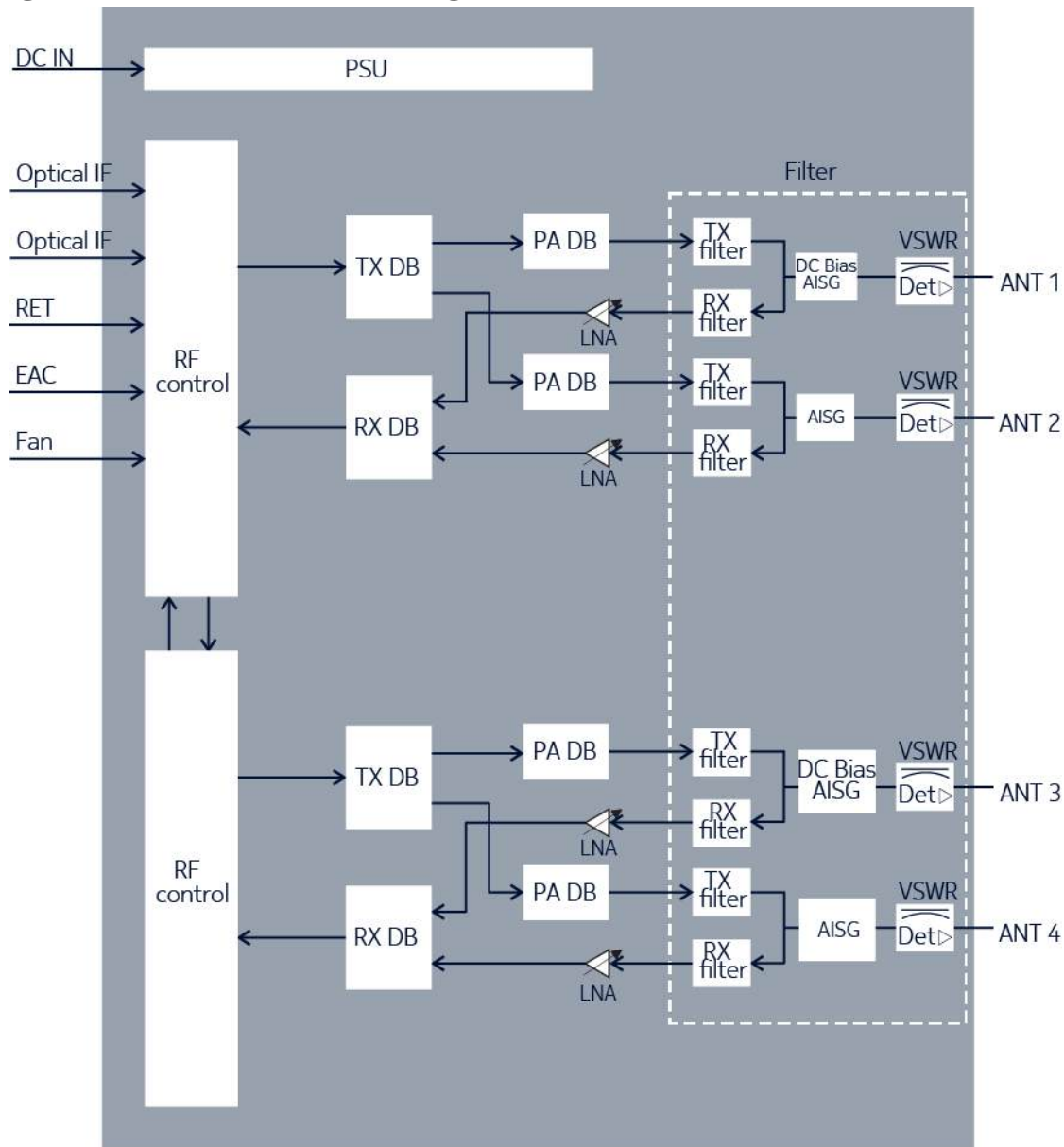
Property	Value
AISG	2.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 135: AHBOA functional block diagram



Electrical specifications

Table 455: AHBOA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 456: Recommended AHBOA power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.1 (two or three carriers) 1.2 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1	1.3 (two or three carriers) 1.4 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBH AirScale book mount kit 176-200 (474280A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMRD AirScale one clip bracket over 200 (474582A)

Installation options

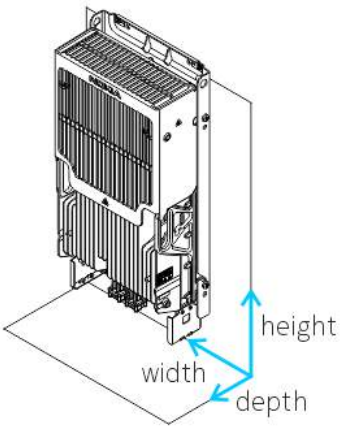
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 457: AHBOA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.04 in.) With upper and lower mounting brackets: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 189 mm (7.44 in.) With mounting brackets: 205 mm (8.07 in.)	
Weight	Core RRH: 38 kg (83.8 lb)	

Environmental specifications

i Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 458: AHBOA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.21 AirScale Dual RRH 4T4R B25/B66 (n25/n66) 320 W (AHFIB)

AHFIB (474216A) is introduced by 5GC000724/LTE3789/SR001767.

Functional description

Table 459: AHFIB functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Software supported technologies	B25: LTE, NR B2: GSM, WCDMA, LTE, NR B66: LTE, NR B10/B4: WCDMA, LTE
Duplex mode - supported standard	FDD
RF sharing/concurrent mode	B25: GSM-WCDMA-LTE, GSM-WCDMA, GSM-LTE, WCDMA-LTE B66a: WCDMA-LTE
TX frequency range	B4: 2110–2155 MHz B25/n25: 1930–1995 MHz n2: 1930–1990 MHz B66/n66: 2110–2200 MHz
RX frequency range	B4: 1710–1755 MHz B25/n25: 1850–1915 MHz n2: 1850–1910 MHz B66/n66: 1710–1780 MHz
DL instantaneous bandwidth (iBW)	B4: 45 MHz B25/n25: 65 MHz B66/n66: 90 MHz
UL instantaneous bandwidth (iBW)	B4: 45 MHz B25/n25: 65 MHz B66/n66: 70 MHz
DL filter bandwidth	B25/n25: 65 MHz B66/n66: 90 MHz
UL filter bandwidth	B25/n25: 65 MHz B66/n66: 70 MHz

Property	Value
Number of carriers per pipe	Up to 8 carriers, 4 per band, (NR, LTE or mixed NR+LTE)
Supported bandwidths	NR: 5, 10, 15, 20 MHz LTE: 1.4, 3, 5, 10, 15, 20 MHz Note: The 1.4 MHz and 3 MHz bandwidths are not supported in the upper 5 MHz of Band 25.
PIM cancellation	Yes
RF scan	Yes
PIM tests	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 136: AHFIB interfaces

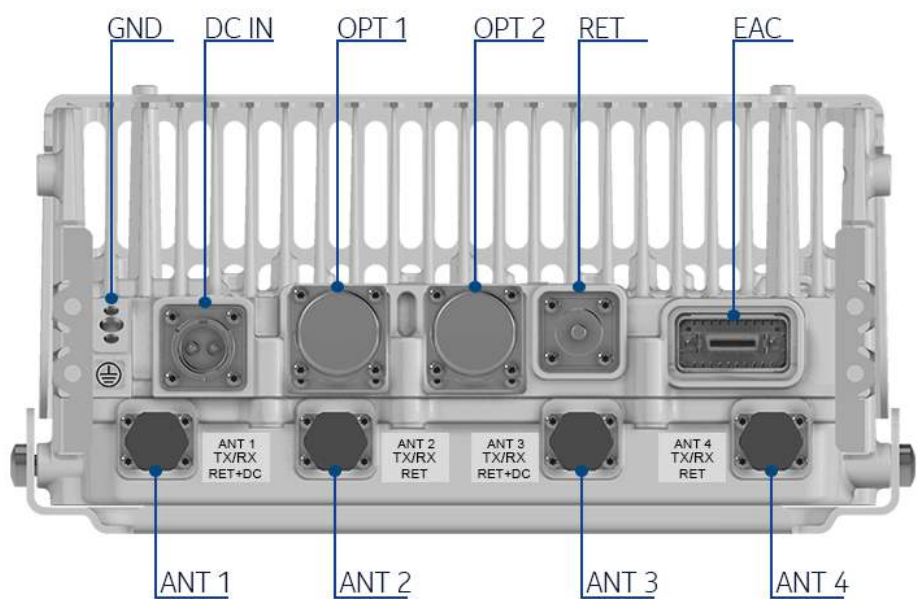


Table 460: AHFIB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3 Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 461: AHFIB interface for ALD support

Property	Value
AISG	2.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

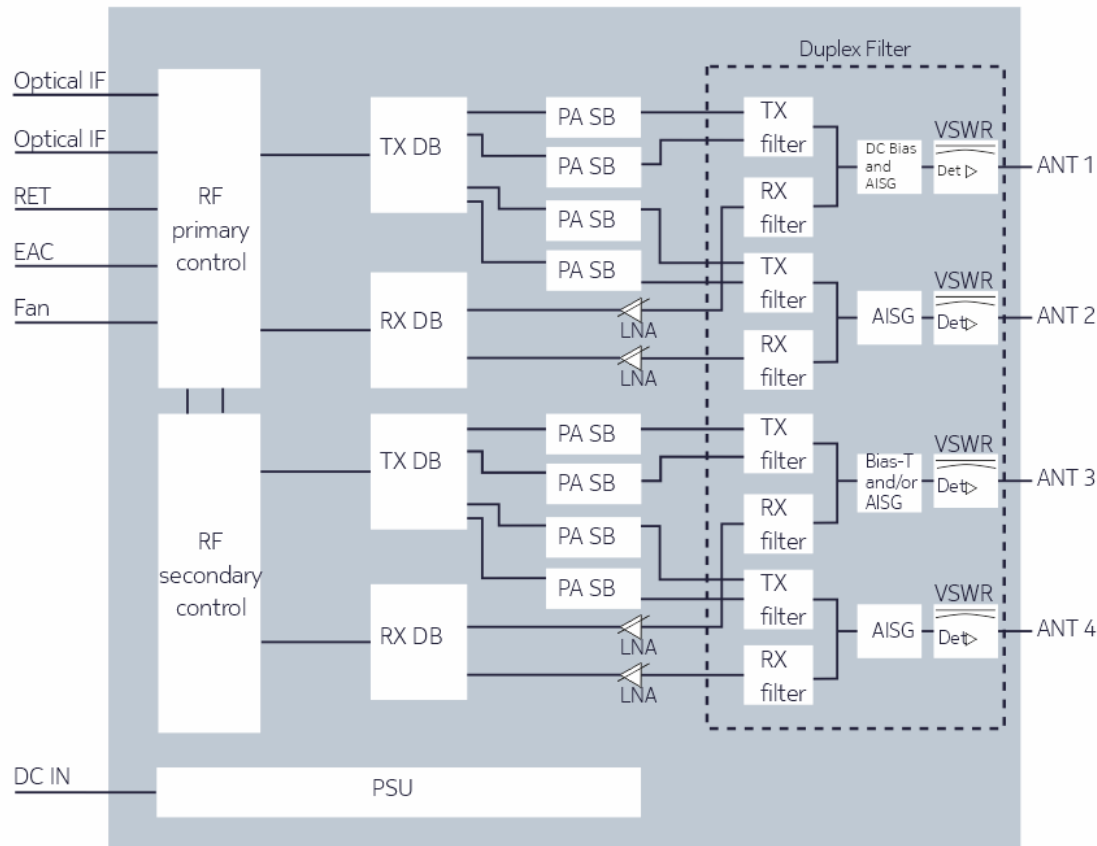
Separate software feature is required for ALD support.

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 137: AHFIB functional block diagram



Electrical specifications

Table 462: AHFIB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

 Note:

The minimum startup voltage is –40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 463: Recommended AHFIB power back-off per band, in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.7 (two or three carriers) 0.9 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.2	0.9 (two or three carriers) 1.1 (four carriers)

GSM cell power range

 Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)

- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

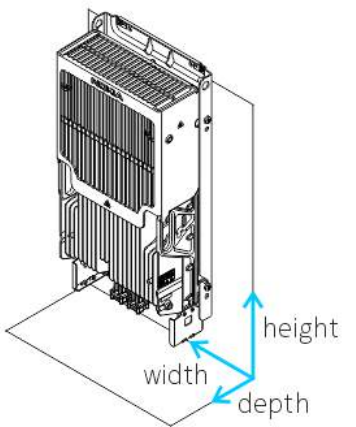
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 464: AHFIB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.05 in.) With mounting brackets: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 149 mm (5.87 in.) With mounting brackets: 165 mm (6.5 in.)	
Weight	30 kg (66.1 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 465: AHFIB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.22 AirScale Dual RRH 4T4R B25/B66 (n25/n66) 480 W (AHFIG)

AHFIG (475125A) is introduced by LTE5213 (for GSM, WCDMA, and LTE), SR002418 (for GSM, WCDMA, and LTE), and 5GC002099 (for NR).

Functional description

Table 466: AHFIG functional specification

Property	Value
Maximum output power	480 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B25: LTE, NR B2: GSM, WCDMA, LTE, NR B66: LTE, NR B10/B4: WCDMA, LTE
RF sharing/concurrent mode	B25: GSM-LTE, GSM-WCDMA, GSM-WCDMA-LTE, WCDMA-LTE, WCDMA-LTE-NR, WCDMA-NR, GSM-NR, GSM-WCDMA-NR, GSM-LTE-NR, GSM-WCDMA-LTE-NR B66: WCDMA-LTE (B4/B10) n25/n66: LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B4: 2110–2155 MHz B25/n25: 1930–1995 MHz B66/n66: 2110–2200 MHz
RX frequency range	B4: 1710–1755 MHz B25/n25: 1850–1915 MHz B66/n66: 1710–1780 MHz
DL filter bandwidth	B25/n25: 65 MHz B66/n66 (includes B4): 80 MHz
UL filter bandwidth	B25/n25: 65 MHz B66/n66 (includes B4): 80 MHz

Property	Value
Instantaneous bandwidth (iBW)	B4: 45 MHz B25/n25: 65 MHz B66/n66: 80 MHz
Occupied bandwidth (oBW)	B4: 45 MHz B25/n25: 65 MHz B66/n66: 80 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 138: AHFIG interfaces

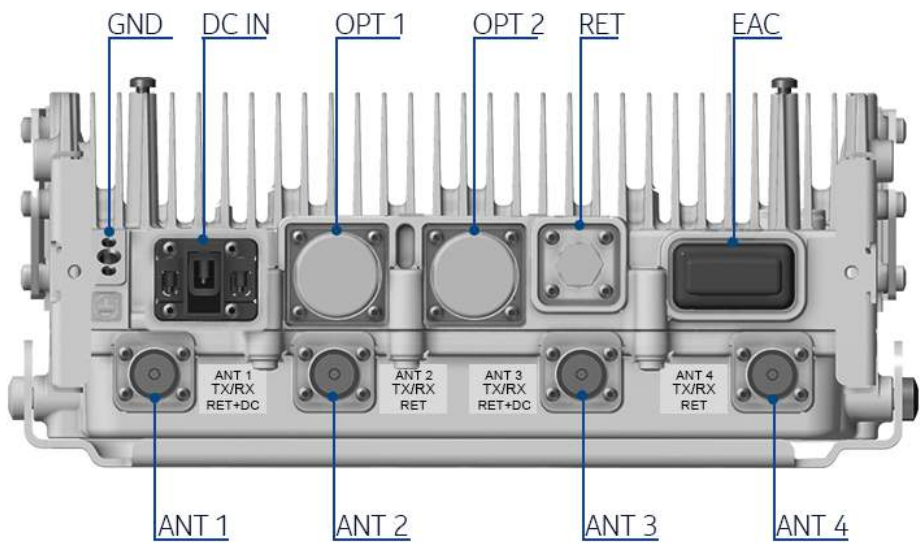


Table 467: AHFIG interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Terminal block	Max wire gauge 4 AWG with max strand diameter 7 mm (max 105 strands)
Antenna connector	ANT	4	4.3-10+	AISG on all ports and BiasT support on ANT1 & ANT3; has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	AISG RS485
External Alarm Connection	EAC	1	MDR-26	4 inputs and 1 control output
Optical interface	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or dual M5 screws	–
Fan	FAN	1	Nokia fan	Located on the heat sink side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 468: AHFIG ALD support

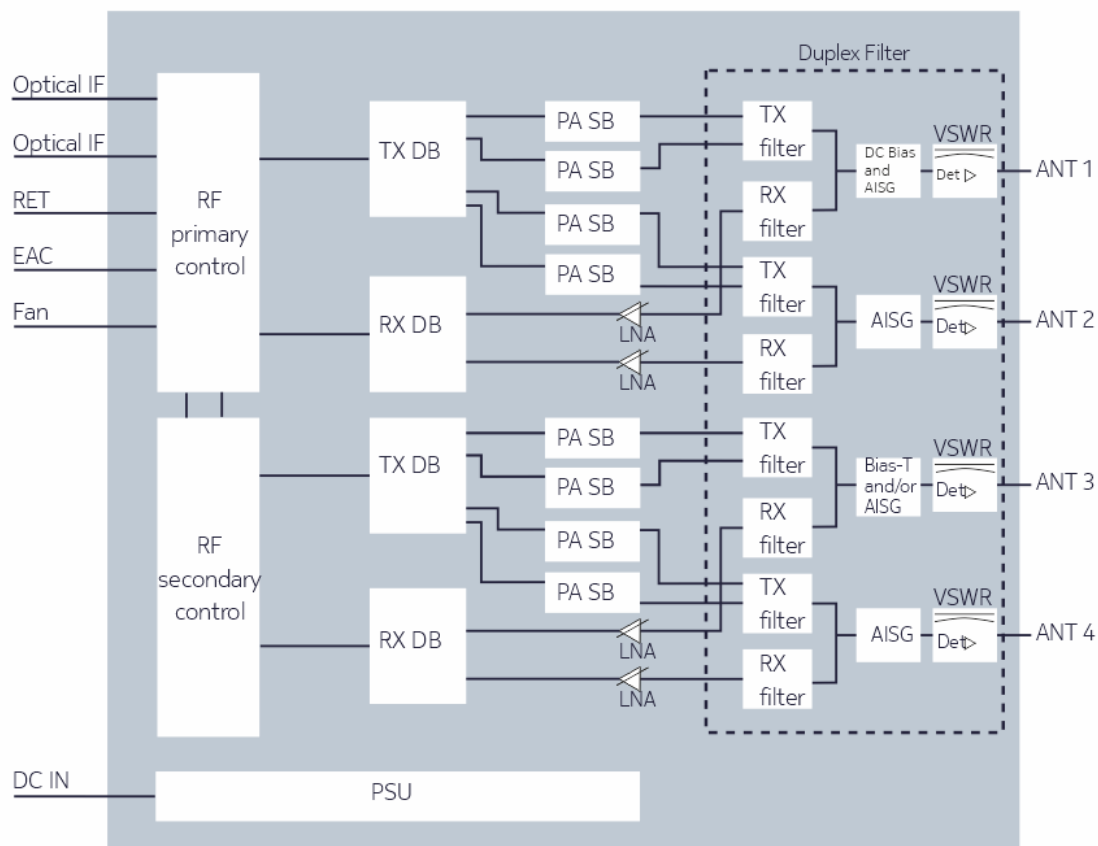
Property	Value
AISG	2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 139: AHFIG functional block diagram



Electrical specifications

Table 469: AHFIG electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -50 V DC to -60.0 V DC
Surge protection	Class II 5 kA

 Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 470: Recommended AHFIG power back-off per band, in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.7 (two or three carriers) 0.9 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.2	0.9 (two or three carriers) 1.1 (four carriers)

GSM cell power range

 Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)

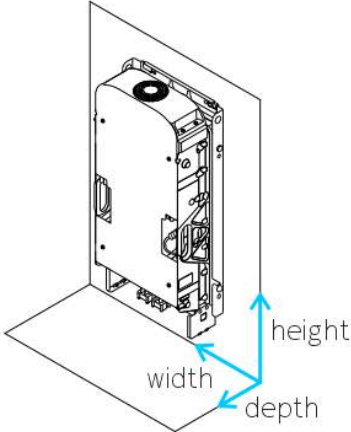
- ASAA AirScale 2 MDR26-open EAC cable (474288A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- ACPB AirScale 2 fiber connector R2CT (474384A)

Installation options

- Pole:
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- Wall:
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 471: AHFIG dimensions and weight

Property	Value	Dimensions orientation
Height	With fan unit: 730 mm (28.74 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting bracket: 327 mm (12.87 in.)	
Depth	Core RRH: 131 mm (5.15 in.) With mounting bracket: 142 mm (5.59 in.)	
Weight	Core RRH: 32 kg (70.6 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 472: AHFIG environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.3.23 AirScale Dual RRH 4T4R B25/B66 480 W (AHFII)

AHFII (475656A) is introduced by CB006079.

Functional description

Table 473: AHFII functional specification

Property	Value
Commercial name	Pandion 4
Maximum output power	480 W
Modulation	256 QAM (DL and UL)
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	B25: LTE, NR B2: WCDMA, LTE, NR B66: LTE, NR B4/B10: WCDMA, LTE
RF sharing/concurrent mode	LTE–NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B25 (includes B2): 1930–1995 MHz B66 (includes B4/10): 2110–2200 MHz
RX frequency range	B25 (includes B2): 1850–1915 MHz B66 (includes B4/10): 1710–1780 MHz
DL filter bandwidth	B25: 65 MHz B66: 90 MHz
UL filter bandwidth	B25: 65 MHz B66: 70 MHz
Instantaneous bandwidth (iBW)	DL: • B25: 65 MHz • B66: 90 MHz UL: • B25: 65 MHz • B66: 70 MHz B4: 45 MHz

Property	Value
Occupied bandwidth (oBW)	DL: • B25: 65 MHz • B66: 90 MHz UL: • B25: 65 MHz • B66: 70 MHz B4: 45 MHz
Number of carriers per pipe	Up to 8 carriers shared between bands (B25/B66)
Supported bandwidths	WCDMA: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8 (default) MHz LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20, 30, 40 MHz
Passive intermodulation (PIM) cancellation	Yes

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 140: AHFI interfaces

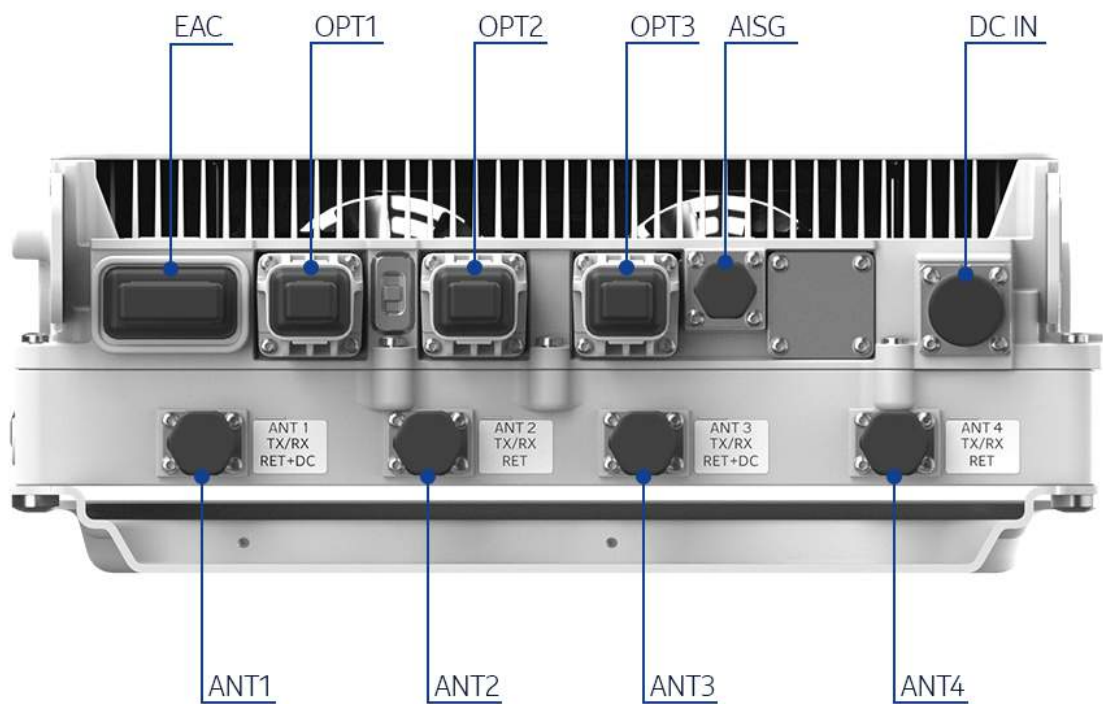


Table 474: AHFI interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPG
Antenna connector	ANT	4	4.3-10	–
External alarm connection	EAC	1	MDR26	–
Optical interface	OPT	3	SFP28	CPRI: 9.8 Gbps; Nokia IP seal
Antenna interface standards group	AISG	1	8-pin circular	RS-485
Grounding	GND 	2	2 x M5 screw and 1 x M8 screw	Located on the right side of the radio unit



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

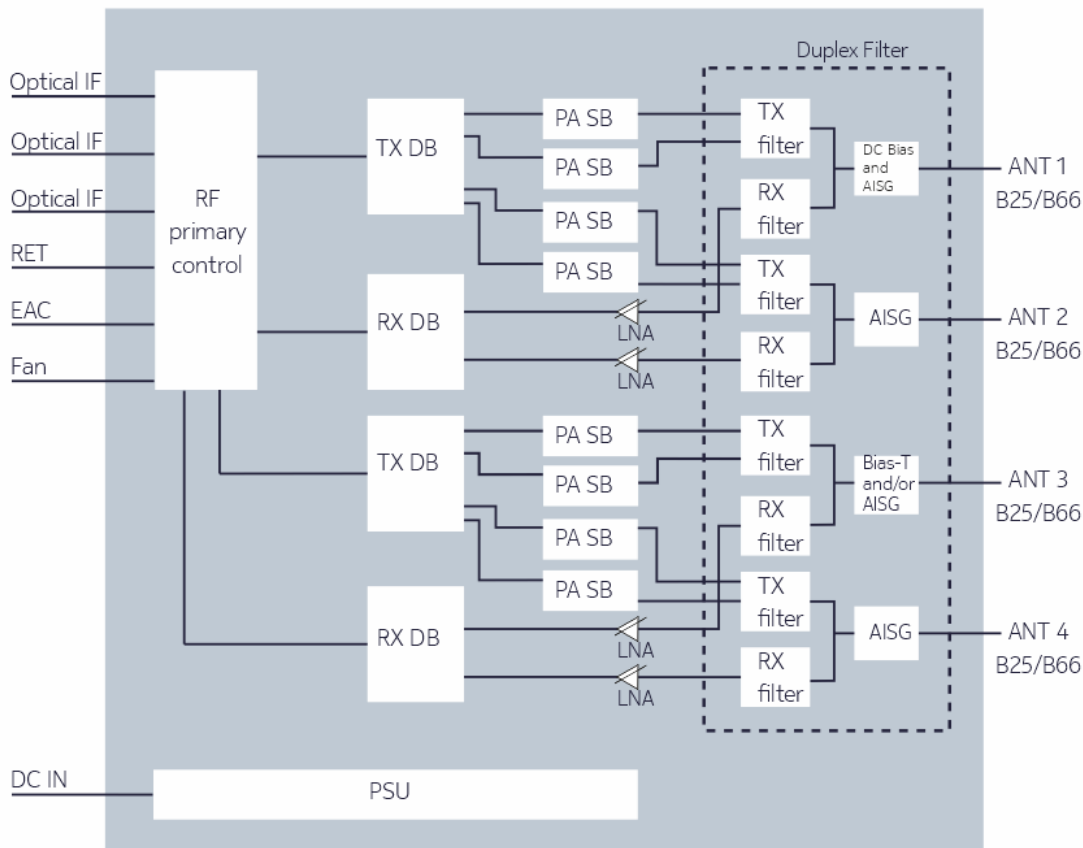
Antenna line device (ALD) support

Table 475: AHFII ALD support

Property	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	30 W on RET or AISG (including 15 W limit on RET), 45 W combined

Functional block diagram

Figure 141: AHFII functional block diagram



Electrical specifications

Table 476: AHFI electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 477: Recommended power back-off values for 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi-carrier [dB] (non-contiguous)
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.4
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0	0.6

Related optional items

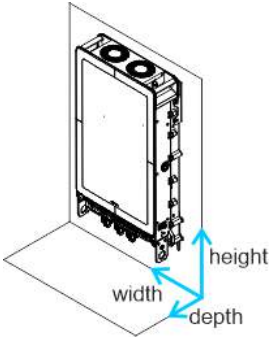
- AMBE AirScale book mount kit 101-125 (474277A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC 5 m cable (474288A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPG AirScale 2 70 A DC plug 10-16 mm² (475401A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 478: AHFII dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 640 mm (25.20 in.) With mounting bracket and fan unit: 676 mm (26.61 in.)	
Width	Core RRH: 342 mm (13.46 in.) With side mounting bosses: 369 mm (14.53 in.)	
Depth	Core RRH: 116 mm (4.57 in.) With mounting bracket: 145 mm (5.71 in.)	
Weight	max. 32 kg (70.6 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 479: AHFII environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.3.24 AirScale Dual RRH 4T4R B25/B66a (n25/n66a) 160 W (AHFIA)

AHFIA (473967A) is introduced by LTE3421/5GC001441.

Functional description

Table 480: AHFIA functional specification

Property	Value
Maximum output power	160 W
Modulation	256 QAM
Number of TXX	B25/n25: 4T4R B66a/n66a: 4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	FDD
TX frequency range	B25/n25: 1930–1995 MHz B66a/n66a: 2110–2180 MHz
RX frequency range	B25/n25: 1850–1915 MHz B66a/n66a: 1710–1780 MHz
DL filter bandwidth	B25/n25: 65 MHz B66a/n66a: 70 MHz
UL filter bandwidth	B25/n25: 65 MHz B66a/n66a: 70 MHz
Instantaneous bandwidth (iBW)	B25/n25: 65 MHz B66a/n66a: 70 MHz
Occupied bandwidth (oBW)	B25/n25: 65 MHz B66a/n66a: 70 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 142: AHFIA interfaces

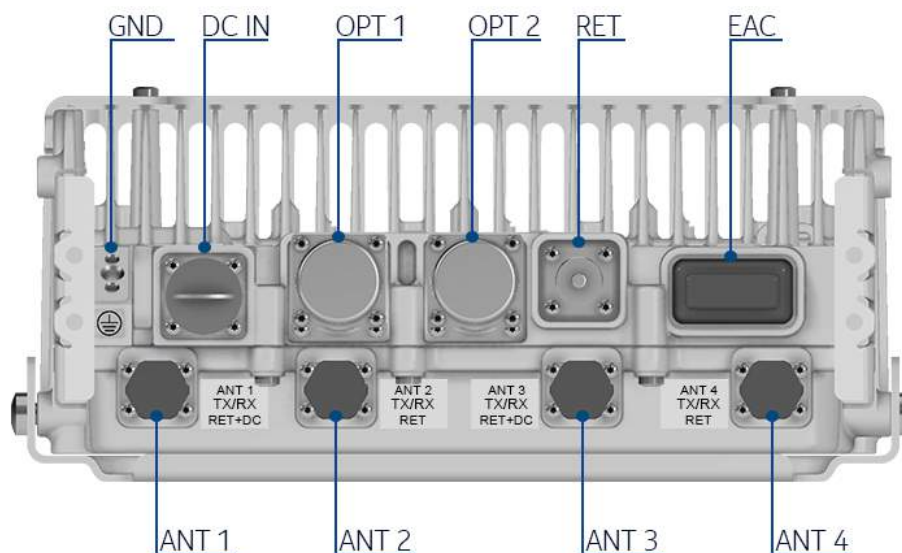


Table 481: AHFIA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3 Has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or dual M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 482: AHFIA ALD support

ALD support	Value
AISG	2.0, 3.0
Voltage	14.5 V (ANT1 and ANT3 only)
Power per port	30 W, 45 W total

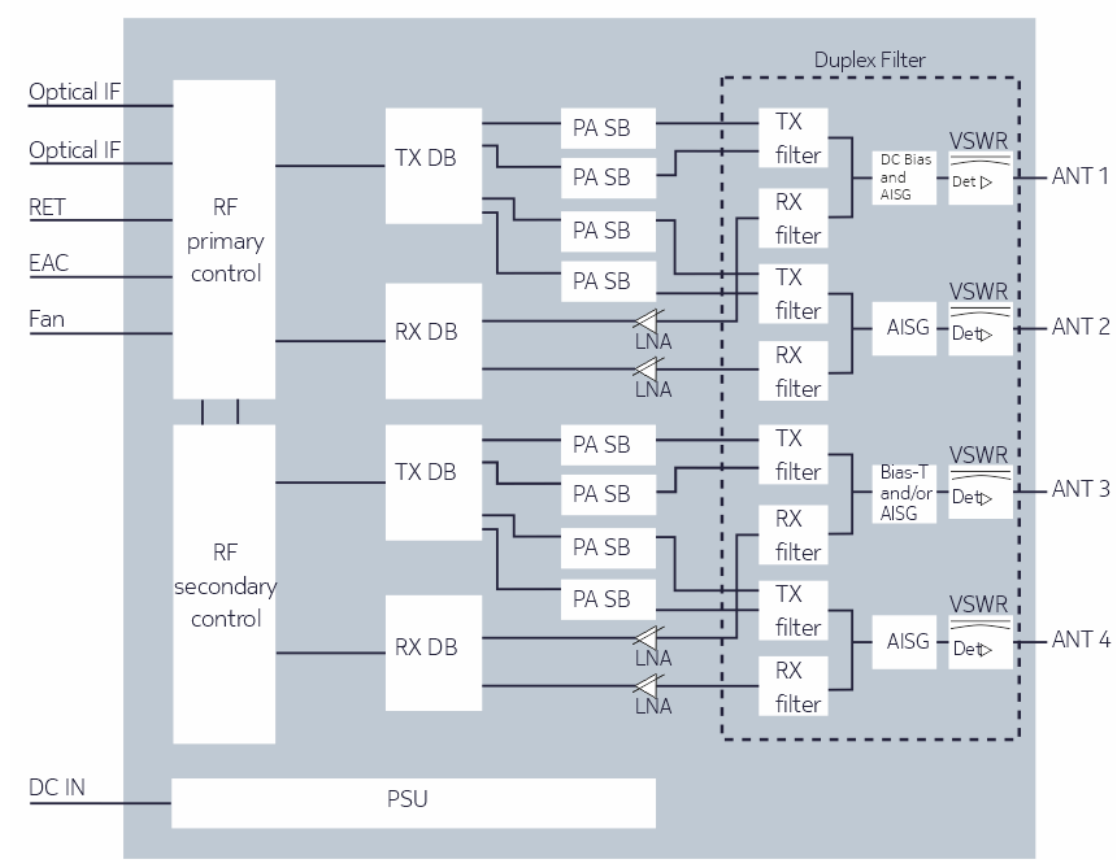


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 143: AHFIA functional block diagram



Electrical specifications

Table 483: AHFIA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 484: Recommended AHFIA power back-off per band, in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.7 (two or three carriers) 0.9 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.2	0.9 (two or three carriers) 1.1 (four carriers)

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- FPAE Flexi power AC/DC submodule 230V (472953A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)

- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

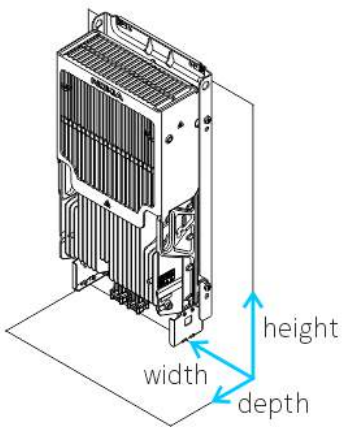
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 485: AHFIA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.05 in.) With upper and lower mounting brackets: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 129 mm (5.08 in.) With mounting brackets: 145 mm (5.71 in.)	
Weight	27 kg (59.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 486: AHFIA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.3.25 AirScale Dual RRH 4T4R B71/B85 (n71/n85) 320 W (AHLOB)

AHLOB (475910A) is introduced by CB007589 (for LTE and NR).

Functional description

Table 487: AHLOB functional specification

Property	Value
Commercial name	Pandion 4
Maximum output power	320 W
Modulation	256 QAM (DL and UL)
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B71: 617-652 MHz B85: 728-746 MHz
RX frequency range	B71: 663-698 MHz B85: 698-716 MHz
DL filter bandwidth	B71: 35 MHz B85: 18 MHz
UL filter bandwidth	B71: 35 MHz B85: 18 MHz
Instantaneous bandwidth (iBW)	B71: 35 MHz B85: 18 MHz
Occupied bandwidth (oBW)	B71: 35 MHz B85: 18 MHz
Number of carriers per pipe	Up to 8 carriers shared between the bands

Property	Value
Supported bandwidths	NR: • n71: 5, 10, 15, 20, 25 MHz • n85: 5, 10, 15 MHz LTE: • B71: 5, 10, 15, 20 MHz • B85: 5, 10 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 144: AHLOB interfaces

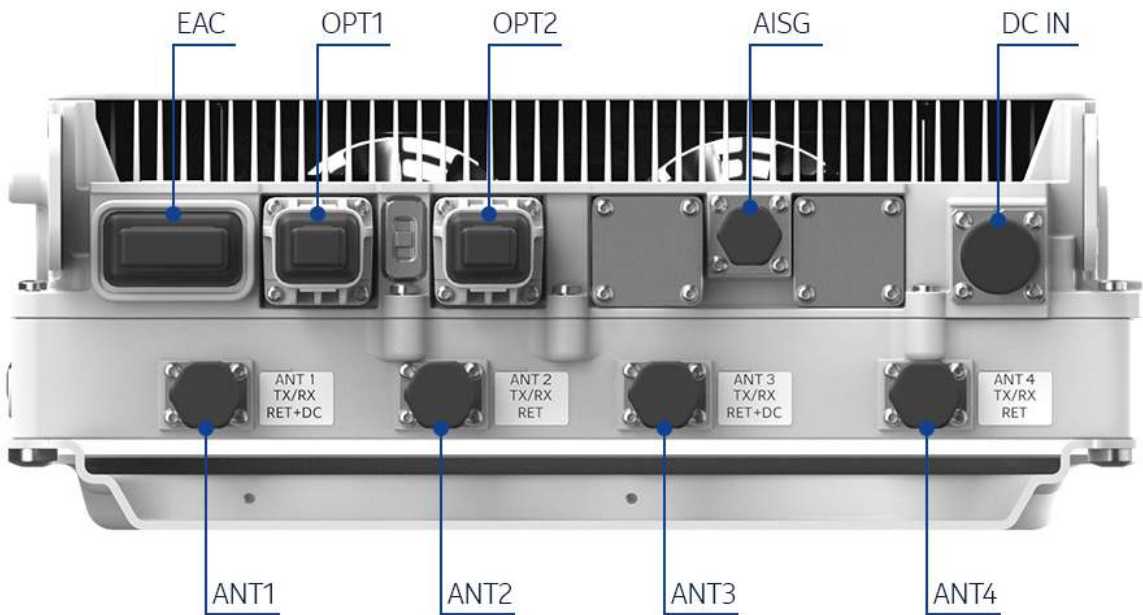


Table 488: AHLOB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPG
Antenna connector	ANT	4	4.3-10	–
External alarm connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28	CPRI: 9.8 Gbps; Nokia IP seal
Antenna interface standards group	AISG	1	8-pin circular	RS-485
Grounding	GND 	2	2 x M5 screw or 1 x M8 screw	Located on the right side of the radio unit

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

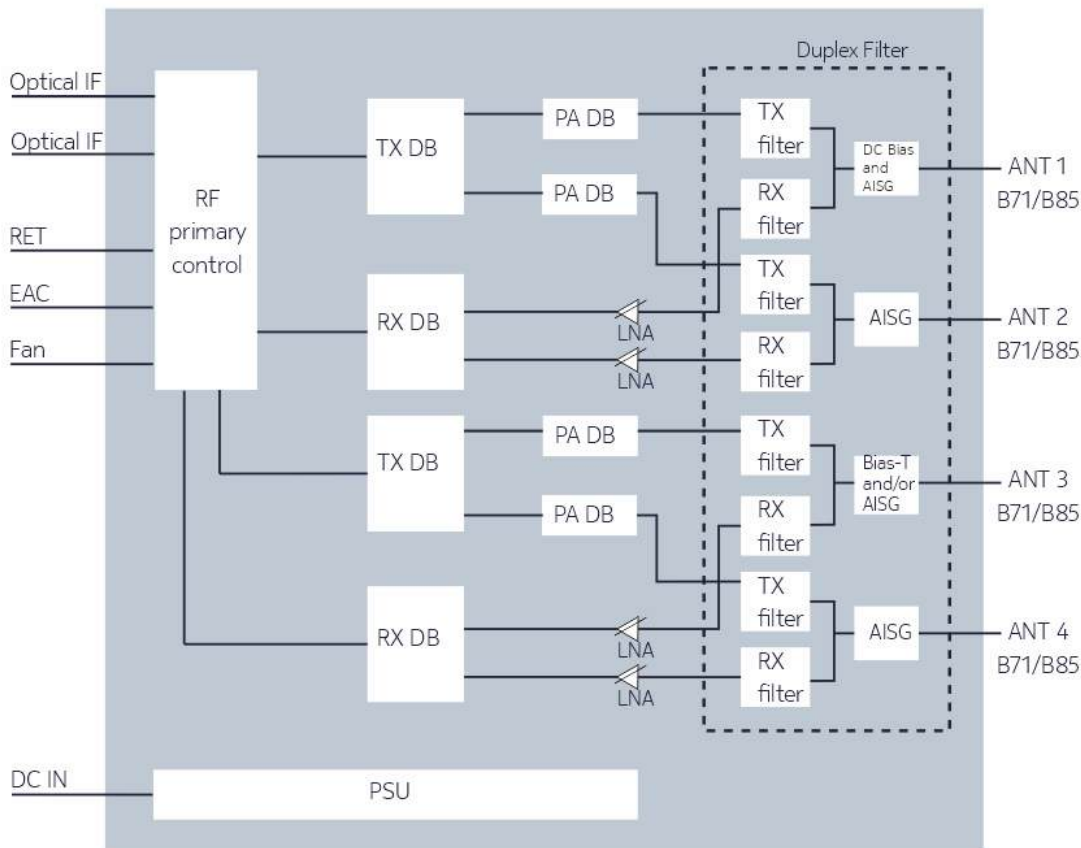
Antenna line device (ALD) support

Table 489: AHLOB ALD support

Property	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	30 W on RET or AISG (including 15 W limit on RET), 45 W combined

Functional block diagram

Figure 145: AHLOB functional block diagram



Electrical specifications

Table 490: AHLOB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 491: Recommended power back-off values for 256 QAM

RAT	Feature/parameter	Single carrier [dB]	Multi-carrier [dB] (non-contiguous)
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.4
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0	0.6

Related optional items

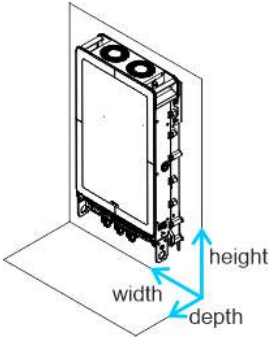
- AMBE AirScale book mount kit 101–125 (474277A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPG AirScale 2 70 A DC plug 10–16 mm² (475401A)
- ASAA AirScale 2 MDR26-open EAC 5 m cable (474288A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60– 300 mm) (472821A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 492: AHLOB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 640 mm (25.20 in.) With mounting bracket and fan unit: 676 mm (26.61 in.)	
Width	Core RRH: 342 mm (13.46 in.) With side mounting bosses: 369 mm (14.53 in.)	
Depth	Core RRH: 128 mm (5.04 in.) With mounting bracket: 158 mm (6.22 in.)	
Weight	max. 32 kg (70.6 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 493: AHLOB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.4 Triple band RRHs descriptions

5.4.1 AirScale Tri RRH 2T2R B8/B20/B28 (n8/n20/n28) 240 W (AHPMDA)

AHPMDA (473997A) is introduced by LTE3142 (for LTE), SR001572 (for GSM and WCDMA), and 5GC000928 (for NR, LTE-NR concurrent mode, and LTE-GSM-NR concurrent mode).

Functional description

Table 494: AHPMDA functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXRX	B28/n28: 2T2R B20/n20: 2T2R B8/n8: 2T2R
Outdoor installation	Yes
Supported technologies (MSR)	B20/B28 (n20/n28): LTE, NR B8/n8: GSM, WCDMA, LTE, and NR
RF sharing/concurrent mode	NR-LTE-WCDMA-GSM
TX frequency range	B28/n28: 758–788 MHz B20/n20: 791–821 MHz B8/n8: 925–960 MHz
RX frequency range	B28/n28: 703–733 MHz B20/n20: 832–862 MHz B8/n8: 880–915 MHz
DL filter bandwidth	B28/n28: 30 MHz B20/n20: 30 MHz B8/n8: 35 MHz
UL filter bandwidth	B28/n28: 30 MHz B20/n20: 30 MHz B8/n8: 35 MHz
Instantaneous bandwidth (iBW)	B28/n28: 30 MHz B20/n20: 30 MHz B8/n8: 35 MHz
Occupied bandwidth (oBW)	B28/n28: 30 MHz B20/n20: 30 MHz B8/n8: 35 MHz
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 146: AHPMDA interfaces

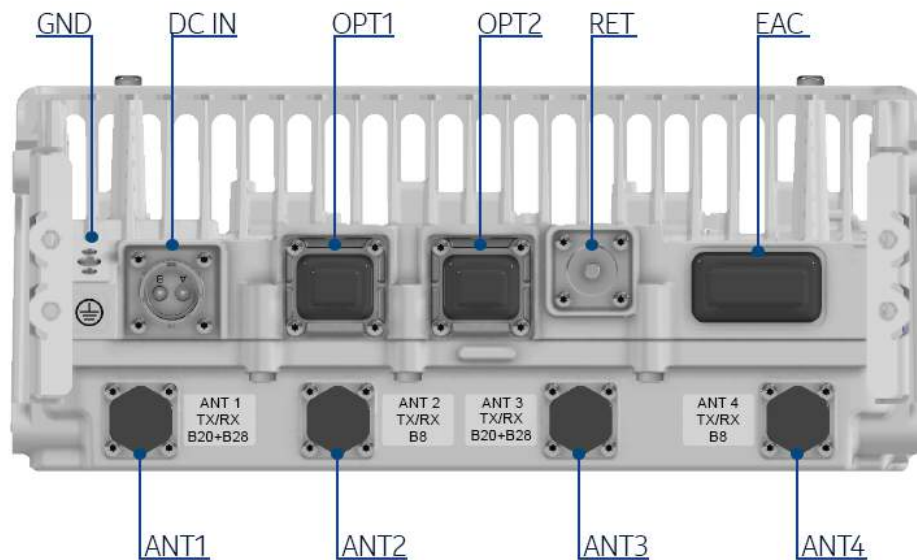


Table 495: AHPMDA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	Supports grounding for shielded cables; APPB, APPC
Antenna connector	ANT	4	4.3-10	AISG on each antenna connector Has features that prevent damage when mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or dual M5 screws	–
Fan	FAN	1	Nokia fan	Located on the heat sink side

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

 Note:

Ping receiver option enables the automatic discovery of RF cable connections between ALDs and base station radios. It also enables the operators to identify RF cables that are incorrectly connected or missing. Ping receiver ports do not provide 14.5 V DC power to ALDs.

Table 496: AHPMDA ALD support

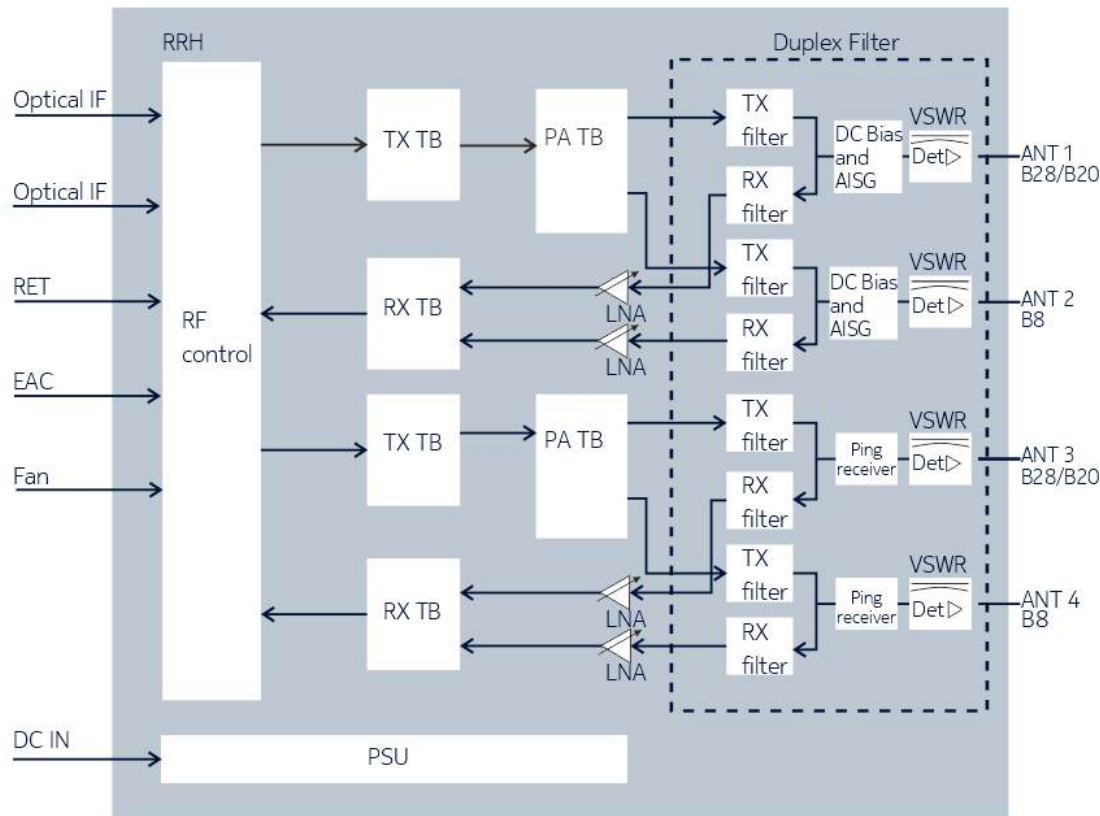
ALD support	Value
AISG	ANT1, ANT2: AISG 2.0/3.0 ANT3, ANT4: AISG 3.0 ping receiver
Voltage	14.5 V (ANT1 and ANT2 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 147: AHPMDA functional block diagram



Electrical specifications

Table 497: AHPMDA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 498: Recommended AHPMDA power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	0.8 (two carriers) 1.4 (three carriers) 1.6 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1	1 (two carriers) 1.6 (three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBF AirScale book mount kit 126-150 (474278A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AFPA rejection filter B28 703-789MHz (474704A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

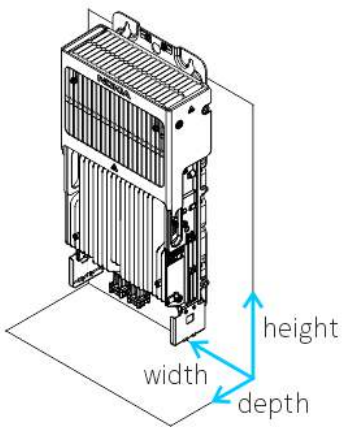
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 499: AHPMDA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 512 mm (20.16 in.) With mounting brackets: 652 mm (25.67 in.)	
Width	Core RRH: 308 mm (12.13 in.) With side mounting bosses: 327 mm (12.87 in.)	
Depth	Core RRH: 131 mm (5.12 in.) With mounting brackets: 143 mm (5.59 in.) With mounting bracket and heat shield: 148 mm (5.78 in.)	
Weight	24 kg (52.9 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 500: AHPMDA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.4.2 AirScale RRH 2T2R B8/B20/B28 (n8/n20/n28) 240 W (AHPMDI)

AHPMDI (476515A) is introduced by CB012137 (for GSM, WCDMA, LTE and NR).

Functional description

Table 501: AHPMDI functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXRX	2T2R
Outdoor installation	Yes
Supported technologies (MSR)	B8/n8: GSM, WCDMA, LTE, NR B20/n20: LTE, NR B28/n28: LTE, NR
RF sharing/concurrent mode	NR-LTE-WCDMA-GSM
Duplex mode	FDD
TX frequency range	B8/n8: 925-960 MHz B20/n20: 791-821 MHz B28/n28: 758-788 MHz
RX frequency range	B8/n8: 880-915 MHz B20/n20: 832-862 MHz B28/n28: 703-733 MHz
DL filter bandwidth	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
UL filter bandwidth	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
Instantaneous bandwidth (iBW)	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
Occupied bandwidth (oBW)	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz

Property	Value
Number of carriers per pipe	B8/n8: LTE-NR: up to 2 carriers + up to 8 GSM TRXs B20/n20: LTE-NR: up to 3 carriers B28/n28: LTE-NR: up to 3 carriers
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
Passive intermodulation (PIM) cancellation	Yes

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 148: AHPMDI interfaces

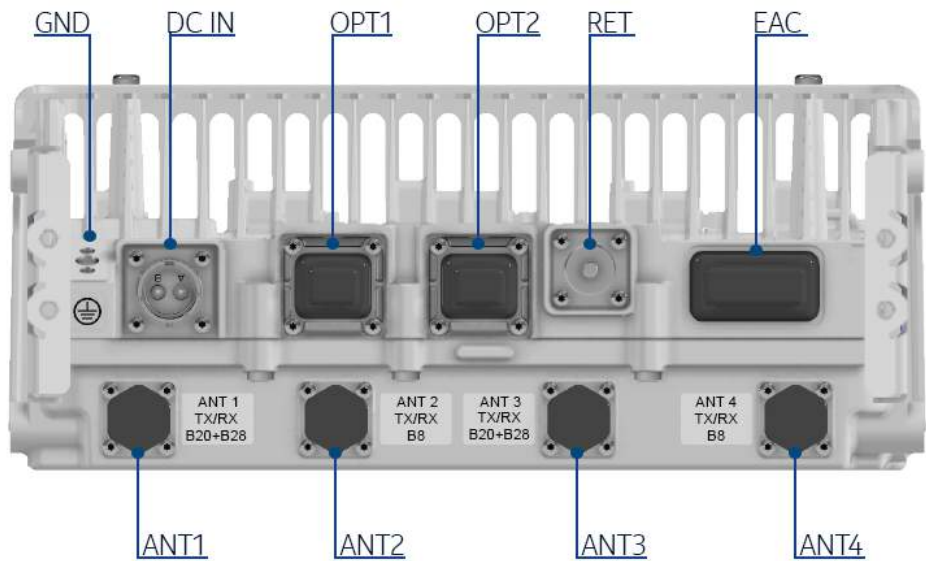


Table 502: AHPMDI interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	Supports grounding for shielded cables; APPB, APPC
Antenna	ANT	4	4.3-10	• AISG on each antenna connector • Has features that prevent damage when mating with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Note:

The ping receiver option enables automatic detection of RF cable connections between ALDs and radio units (RUs). It also enables you to identify RF cables that are incorrectly connected or missing. The ping receiver ports don't provide 14.5 V DC power to ALDs.

Table 503: AHPMDI ALD support

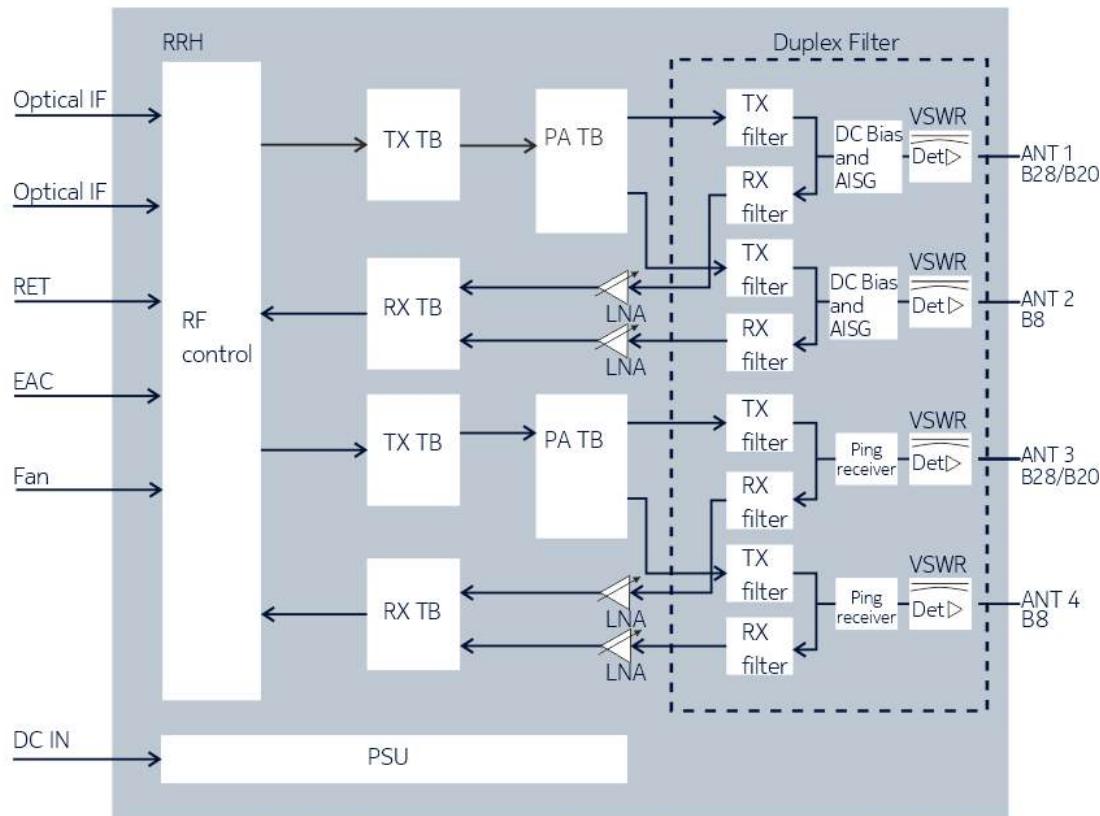
ALD support	Value
AISG	ANT1, ANT2: AISG 2.0/3.0 ANT3, ANT4: AISG 3.0 ping receiver
Voltage	14.5 V (ANT1 and ANT2 only)
Power per port	30 W, 45 W total

Note:

AirScale radio units (RUs) support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 149: AHPMDI functional block diagram



Electrical specifications

Table 504: AHPMDI electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 505: The recommended power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	0.8 (two carriers) 1.4 (three carriers) 1.6 (four carriers)
NR	<i>NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)</i>	1	1 (two carriers) 1.6 (three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the maximum rated power. It might make the system unstable.

Related optional items

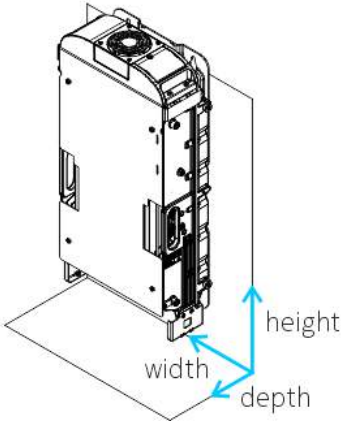
- AMBF AirScale book mount kit 126–150 (474278A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–300 mm) (472821A)
- APAF AirScale AC-DC PSU 100–240 VAC/1150 W (474676A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ACPA AirScale 2 fiber protection (474297A)
- AFPA rejection filter B28 703–789 MHz (474704A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 506: AHPMDI dimensions and weight

Property	Value	Dimensions orientation
Height	With mounting brackets and fan unit: 673 mm (26.50 in.)	
Width	With side mounting bosses: 321 mm (12.64 in.)	
Depth	With mounting brackets and fan unit: 148 mm (5.83 in.)	
Weight	With mounting brackets and fan unit: 26 kg (57.3 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 507: AHPMDI environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.4.3 AirScale Tri RRH 2T4R B5/B8/B28 (n5/n8/n28) 240 W (AHPADB)

AHPADB (475081A) is introduced by SR002520 (for WCDMA and LTE) and 5GC002586 (for NR).

Functional description

Table 508: AHPADB functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXRX	2T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	B5, B28: LTE B8: WCDMA, LTE, WCDMA-LTE n5/n8/n28: NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B5/n5: 869–880 MHz B8/n8: 940–960 MHz B28/n28: 788–803 MHz
RX frequency range	B5/n5: 824–835 MHz B8/n8: 895–915 MHz B28/n28: 733–748 MHz
DL filter bandwidth	B5/n5: 11 MHz B8/n8: 20 MHz B28/n28: 15 MHz
UL filter bandwidth	B5/n5: 11 MHz B8/n8: 20 MHz B28/n28: 15 MHz
Instantaneous bandwidth (iBW)	B5/n5: 11 MHz B8/n8: 20 MHz B28/n28: 15 MHz
Occupied bandwidth (oBW)	B5/n5: 11 MHz B8/n8: 20 MHz B28/n28: 15 MHz
Number of carriers per pipe	Up to 16 carriers in total for all supported RATs

Property	Value
Supported bandwidths	LTE B5/B8: 1.4, 3, 5, 10 MHz LTE B28: 3, 5, 10, 15 MHz NR n5/n8: 5, 10 MHz NR n28: 5, 10, 15 MHz
RF scan	Yes (radio unit supports Rx-sniffing on the FIR (RxCarrier) capture source. HBF (RxCombined) capture source is not supported.)
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 150: AHPCDB interfaces

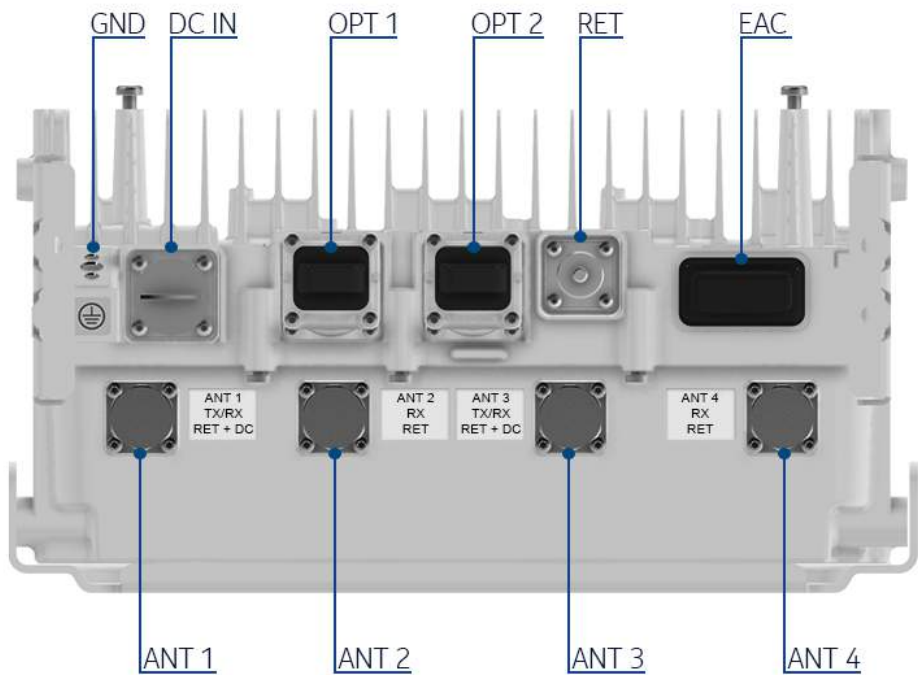


Table 509: AHPADB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	Supports grounding for shielded cables; APPB, APPC
Antenna connector	ANT	4	4.3-10+	AISG on each antenna connector Has features that prevent damage when mating with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or 2 x M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 510: AHPADB ALD support

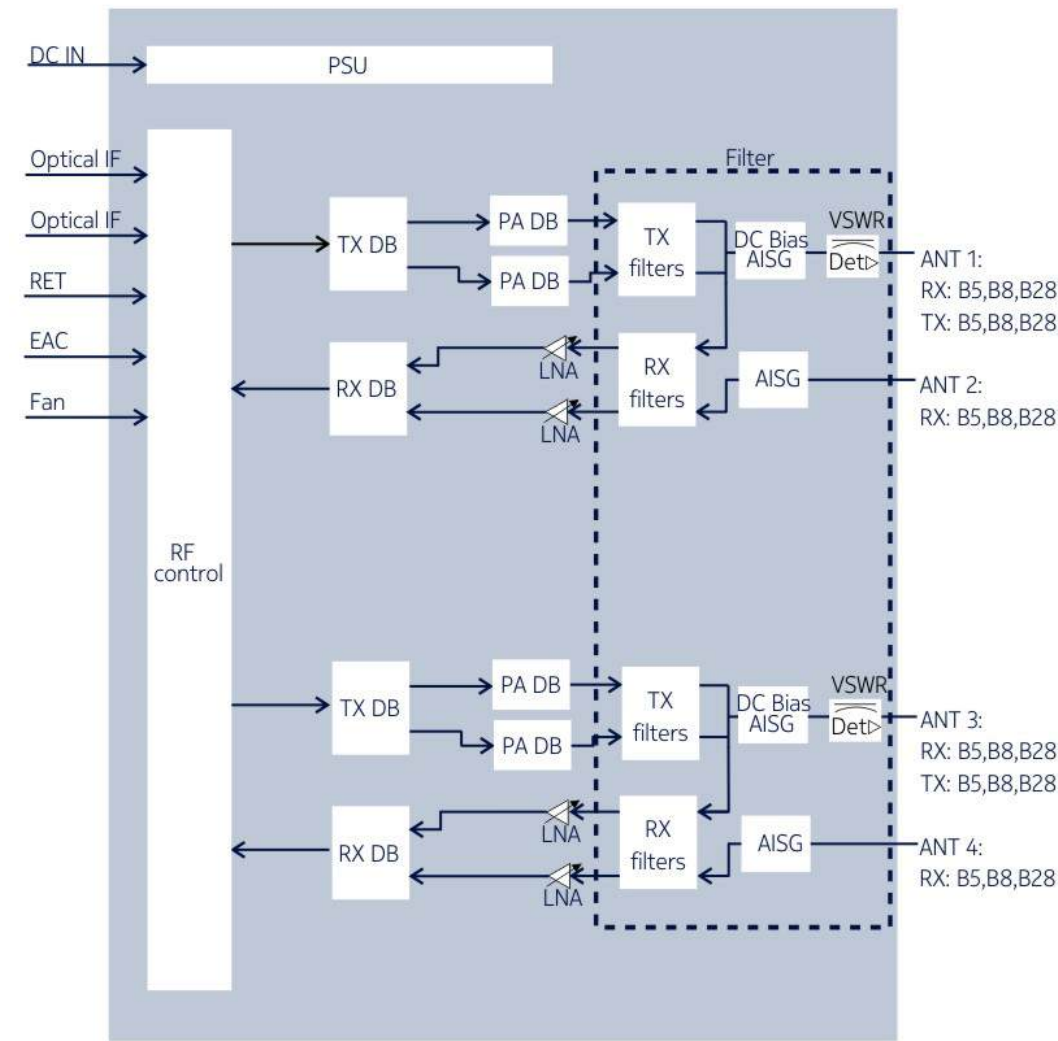
ALD support	Value
AISG	2.0
Voltage	14.5 V (ANT1 and ANT2 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 151: AHPCDB functional block diagram



Electrical specifications

Table 511: AHPADB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 512: Recommended power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.4 (two or three carriers) 1.6 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1	1.6 (two or three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBG AirScale book mount kit 151-175 (474467A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AFPA rejection filter B28 703-789 MHz (474704A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

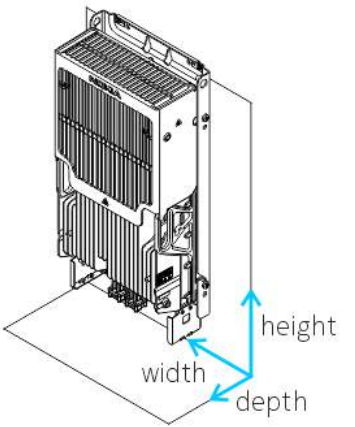
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 513: AHPADB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 512 mm (20.16 in.) With mounting bracket: 675 mm (26.57 in.)	
Width	Core RRH: 308 mm (12.13 in.) With side mounting bosses: 327 mm (12.87 in.)	
Depth	Core RRH: 165 mm (6.49 in.) With mounting bracket: 181 mm (7.13 in.)	
Weight	31 kg (68.3 lb)	

Environmental specifications

i Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 514: AHPADB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.4.4 AirScale Tri RRH 2T4R B8/B20/B28 (n8/n20/n28) 240 W (AHPADB)

AHPADB (475000A) is introduced by SR002368/5GC001683.

Functional description

Table 515: AHPMDB functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXX	B8/n8: 2T4R B20/n20: 2T4R B28/n28: 2T4R
Outdoor installation	Yes
Supported technologies (MSR)	B8/n8: GSM, WCDMA, LTE, and NR B20/B28 (n20/n28): LTE, NR
RF sharing/concurrent mode	NR-LTE-WCDMA-GSM
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B8/n8: 925-960 MHz B20/n20: 791-821 MHz B28/n28: 758-788 MHz
RX frequency range	B8/n8: 880-915 MHz B20/n20: 832-862 MHz B28/n28: 703-733 MHz
DL filter bandwidth	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
UL filter bandwidth	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
Instantaneous bandwidth (iBW)	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
Occupied bandwidth (oBW)	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz

Property	Value
Number of carriers per pipe	2T2R: Up to 16 (across all bands) for all supported RATs 2T4R: Up to 8 (across all bands) for all supported RATs
Supported bandwidths	LTE B8: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz LTE B20: 5 MHz, 10 MHz, 15 MHz, 20 MHz LTE B28: 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes
RF scan	Yes (radio unit supports Rx-sniffing on the FIR (RxCarrier) capture source. HBF (RxCombined) capture source is not supported.)
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 152: AHPMDB interfaces

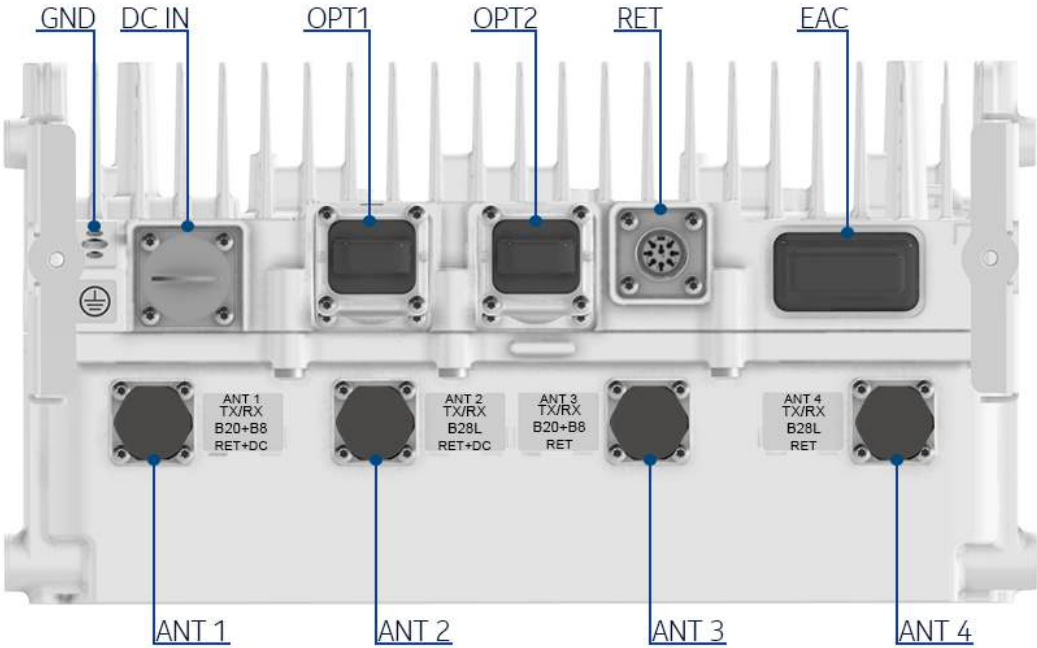


Table 516: AHPMDB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	Supports grounding for shielded cables; APPB, APPC
Antenna connector	ANT	4	4.3-10+	AISG on each antenna connector Has features that prevent damage when mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or 2 x M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 517: AHPMDB ALD support

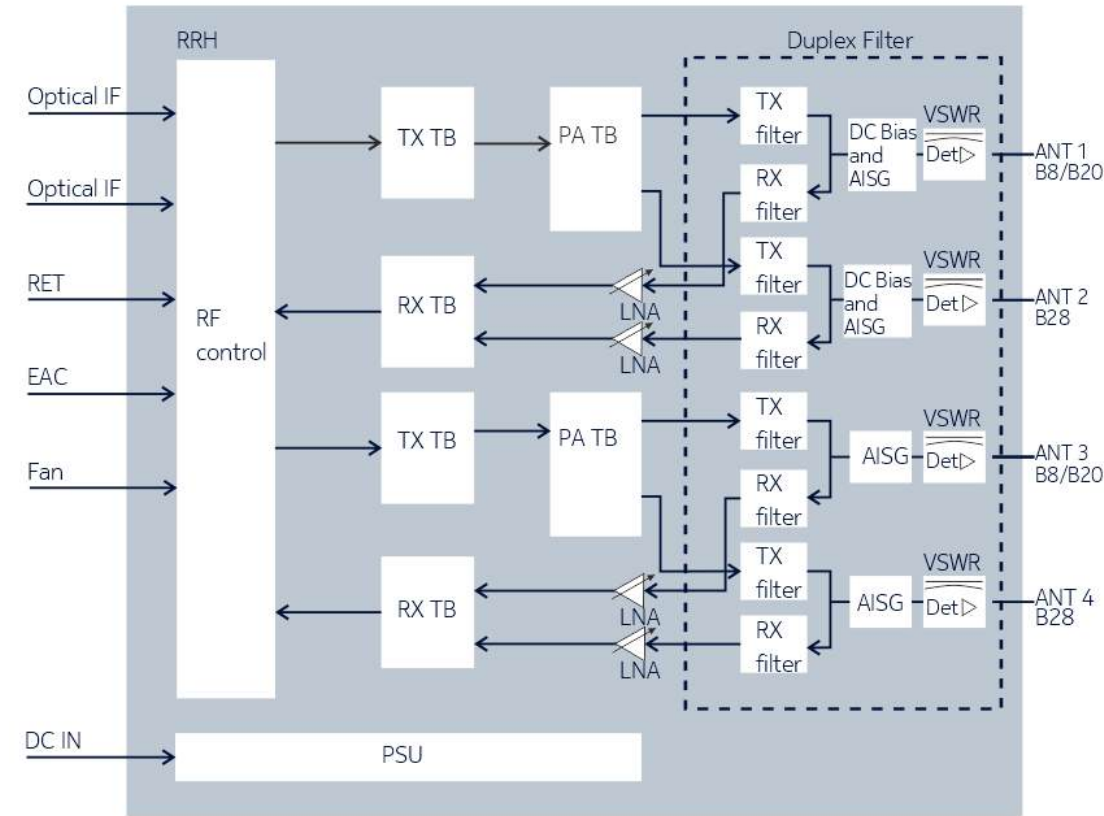
ALD support	Value
AISG	3.0
Voltage	14.5 V (RET, ANT1, ANT2 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 153: AHPMDB functional block diagram



Electrical specifications

Table 518: AHPMDB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 519: Recommended AHPMDB power back-off per band, in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	0.8 (two carriers) 1.4 (three carriers) 1.6 (four carriers)
NR	<i>NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)</i>	1	1 (two carriers) 1.6 (three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

GSM cell power range

! Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- ASFC AirScale 2 fan unit 600 (474484A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBG AirScale book mount kit 151-175 (474467A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AFPA rejection filter B28 703-789MHz (474704A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

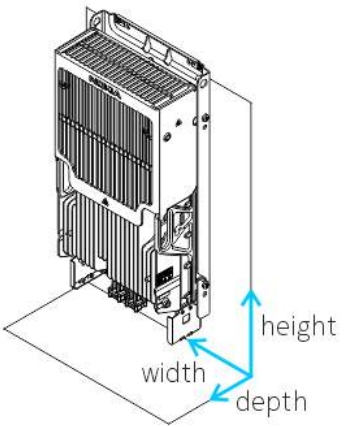
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting (fan is recommended)*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting (fan is recommended)*

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 520: AHPMDB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 512 mm (20.15 in.) With mounting bracket: 652 mm (25.66 in.)	
Width	Core RRH: 308 mm (12.13 in.) With side mounting bosses: 327 mm (12.87 in.)	
Depth	Core RRH: 169 mm (6.65 in.) With mounting bracket: 185 mm (7.28 in.)	
Weight	31 kg (68.3 lb)	

Environmental specifications

i Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 521: AHPMDB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

5.4.5 AirScale RRH 2T4R B8/B20/B28 (n8/n20/n28) 240 W (AHPMDJ)

AHPMDJ (476516A) is introduced by CB012138 (for GSM, WCDMA, LTE, and NR).

Functional description

Table 522: AHPMDJ functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM
Number of TXRX	2T4R
Outdoor installation	Yes
Supported technologies (MSR)	B8/n8: GSM, WCDMA, LTE, NR B20/B28 (n20/n28): LTE, NR
RF sharing/concurrent mode	NR-LTE-WCDMA-GSM
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, standalone
TX frequency range	B8/n8: 925-960 MHz B20/n20: 791-821 MHz B28/n28: 758-788 MHz
RX frequency range	B8/n8: 880-915 MHz B20/n20: 832-862 MHz B28/n28: 703-733 MHz
DL filter bandwidth	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
UL filter bandwidth	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
Instantaneous bandwidth (iBW)	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
Occupied bandwidth (oBW)	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz

Property	Value
Number of carriers per pipe	2T2R: Up to 16 (across all bands) for all supported RATs 2T4R: Up to 8 (across all bands) for all supported RATs
Supported bandwidths	LTE: • B8: 1.4, 3, 5, 10 MHz • B20: 5, 10, 15, 20 MHz • B28: 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
Passive intermodulation (PIM) cancellation	Yes
RF scan	Yes Rx-sniffing on FIR (RxCarrier) capture source supported HBF (RxCombined) capture source not supported
PIM tests	PIM simulation
Limitations	Dynamic spectrum sharing (DSS) requires two carriers, one for LTE and one for NR.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 154: AHPMDJ interfaces

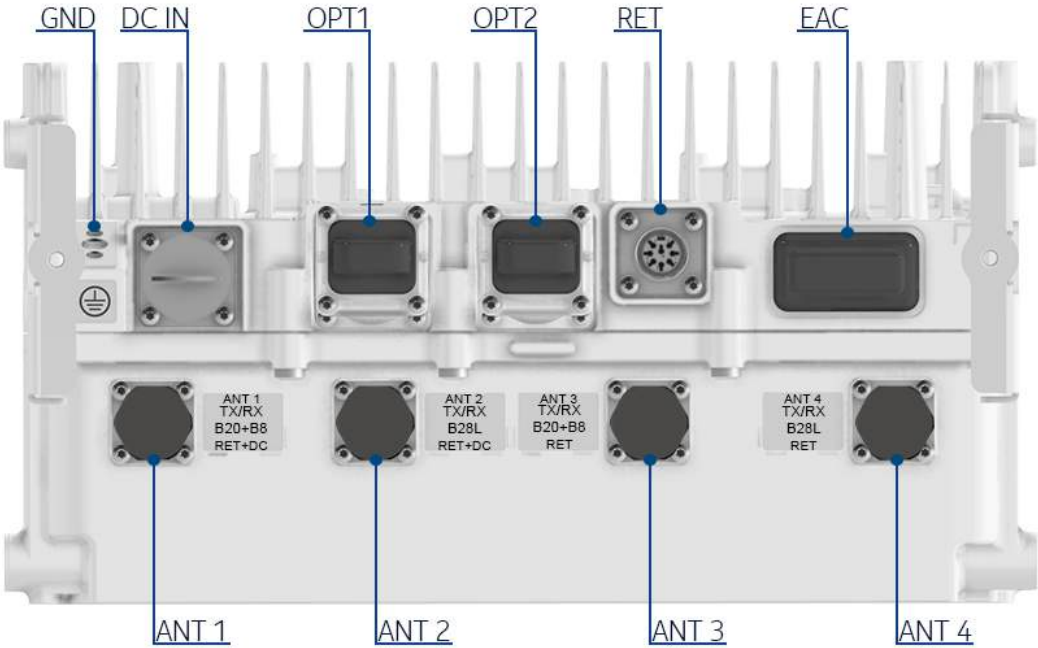


Table 523: AHPMDJ interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	Supports grounding for shielded cables; APPB, APPC
Antenna	ANT	4	4.3-10+	• AISG on each antenna connector • Has features that prevent damage when mating with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

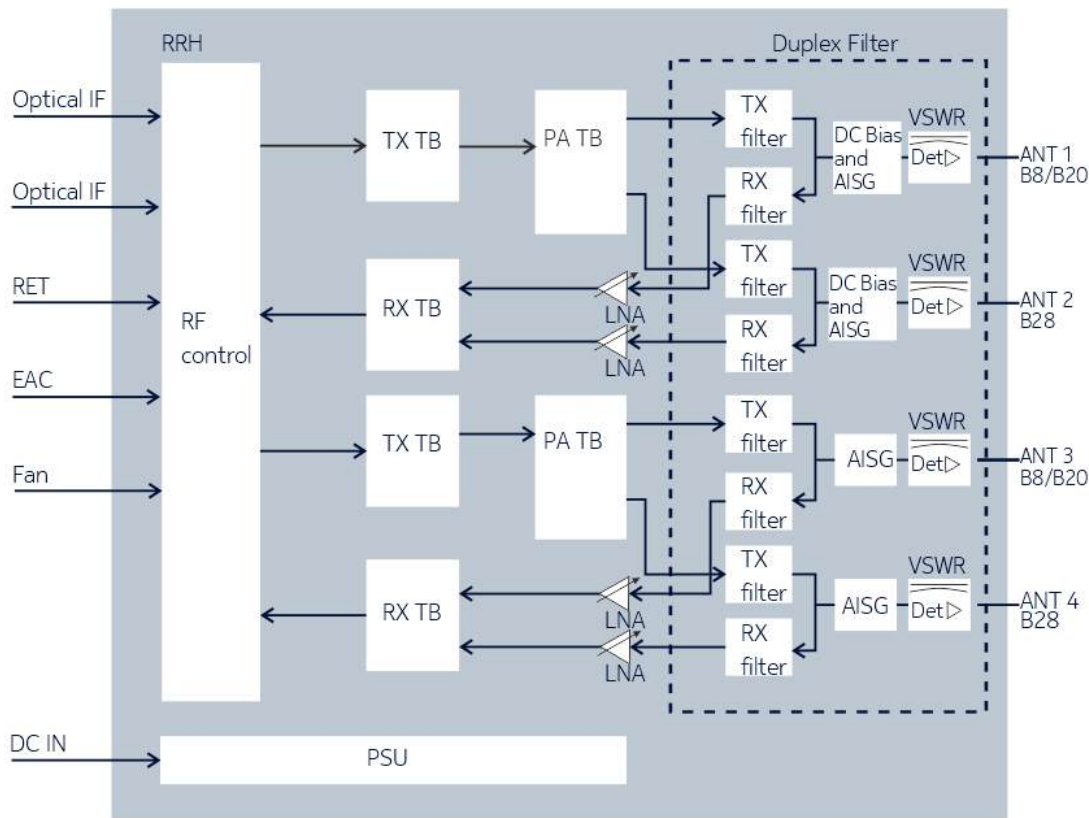
Antenna line device (ALD) support

Table 524: AHPMDJ ALD support

ALD support	Value
AISG	Version 3.0
Voltage	14.5 V (RET, ANT1, ANT2 only)
Power per port	30 W, 45 W total

Functional block diagram

Figure 155: AHPMDJ functional block diagram



Electrical specifications

Table 525: AHPMDJ electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 526: The recommended power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	0.8 (two carriers) 1.4 (three carriers) 1.6 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1	1 (two carriers) 1.6 (three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

GSM cell power range

Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the maximum rated power. It might make the system unstable.

Related optional items

- AMBG AirScale book mount kit 151–175 (474467A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRB AirScale one clip bracket 126–200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–300 mm) (472821A)
- APAF AirScale AC-DC PSU 100–240VAC/1150W (474676A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ACPA AirScale 2 fiber protection (474297A)
- AFPA rejection filter B28 703–789MHz (474704A)

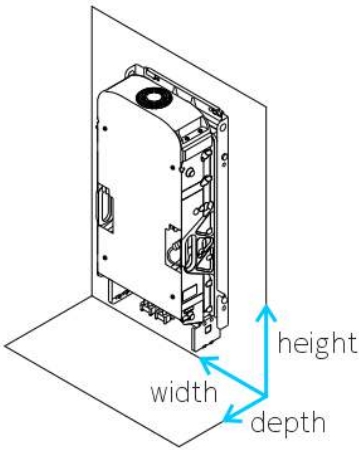
Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*

- Wall:
 - Vertical
 - Horizontal
 - One-clip rail
 - Book mounting

Dimensions and weight

Table 527: AHPMDJ dimensions and weight

Property	Value	Dimensions orientation
Height	With mounting bracket and fan unit: 673 mm (26.50 in.)	
Width	With mounting bracket and fan unit: 327 mm (12.87 in.)	
Depth	With mounting bracket and fan unit: 185 mm (7.28 in.)	
Weight	32 kg (70.5 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 528: AHPMDJ environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.4.6 AirScale Tri RRH 2T4R B8/B20/B28 (n8/20/28) 320 W (AHPMDD)

AHPMDD (475707A) is introduced by CB006008 (for GSM, WCDMA, LTE, and NR).

Functional description

Table 529: AHPMDD functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXX	B8/n8: 2T4R B20/n20: 2T4R B28/n28: 2T4R
Outdoor installation	Yes
Supported technologies (MSR)	B8/n8: GSM, WCDMA, LTE, NR B20/B28 (n20/n28): LTE, NR
RF sharing/concurrent mode	NR-LTE-WCDMA-GSM
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B8/n8: 925–960 MHz B20/n20: 791–821 MHz B28/n28: 758–788 MHz
RX frequency range	B8/n8: 880–915 MHz B20/n20: 832–862 MHz B28/n28: 703–733 MHz
DL filter bandwidth	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
UL filter bandwidth	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
Instantaneous bandwidth (iBW)	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz
Occupied bandwidth (oBW)	B8/n8: 35 MHz B20/n20: 30 MHz B28/n28: 30 MHz

Property	Value
Number of carriers per pipe	B8/n8: up to 2 B20/n20: up to 3 B28/n28: up to 3
Supported bandwidths	LTE B8: 1.4, 3, 5, 10 MHz, NB-IoT LTE B20: 5, 10, 15, 20 MHz, NB-IoT LTE B28: 3, 5, 10, 15, 20 MHz, NB-IoT NR: 5, 10, 15, 20 MHz
PIM cancellation	Yes, only on ANT1 and ANT3
RF scan	Yes Rx-sniffing on FIR (RxCarrier) capture source supported HBF (RxCombined) capture source not supported
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 156: AHPMDD interfaces

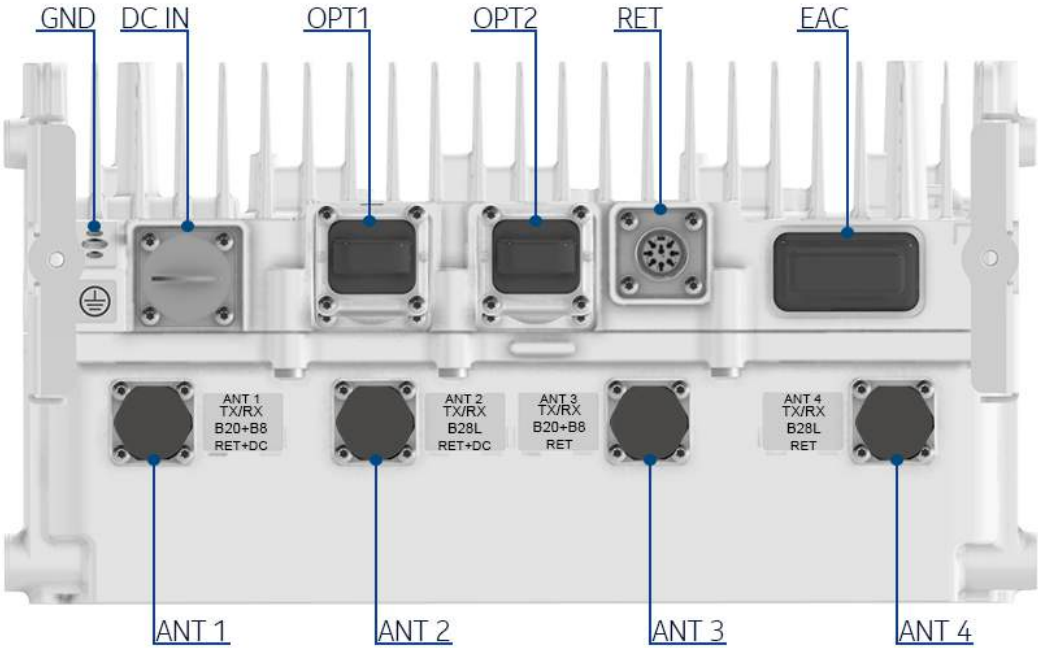


Table 530: AHPMDD interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	Supports grounding for shielded cables; APPB, APPC
Antenna connector	ANT	4	4.3-10+	AISG on each antenna connector Has features that prevent damage when mating with a 4.1-9.5 connector is attempted
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	M8 or 2 x M5 screws	-
Fan	FAN	1	Nokia fan	Located on the heat sink side



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate the RF port from the environment, and thus provide electric shock security in case RF power is accidentally turned on.

Antenna line device (ALD) support

Table 531: AHPMDD ALD support

ALD support	Value
AISG	Version 3.0
Voltage	14.5 V (RET, ANT1, ANT2 only)
Power per port	30 W, 45 W total

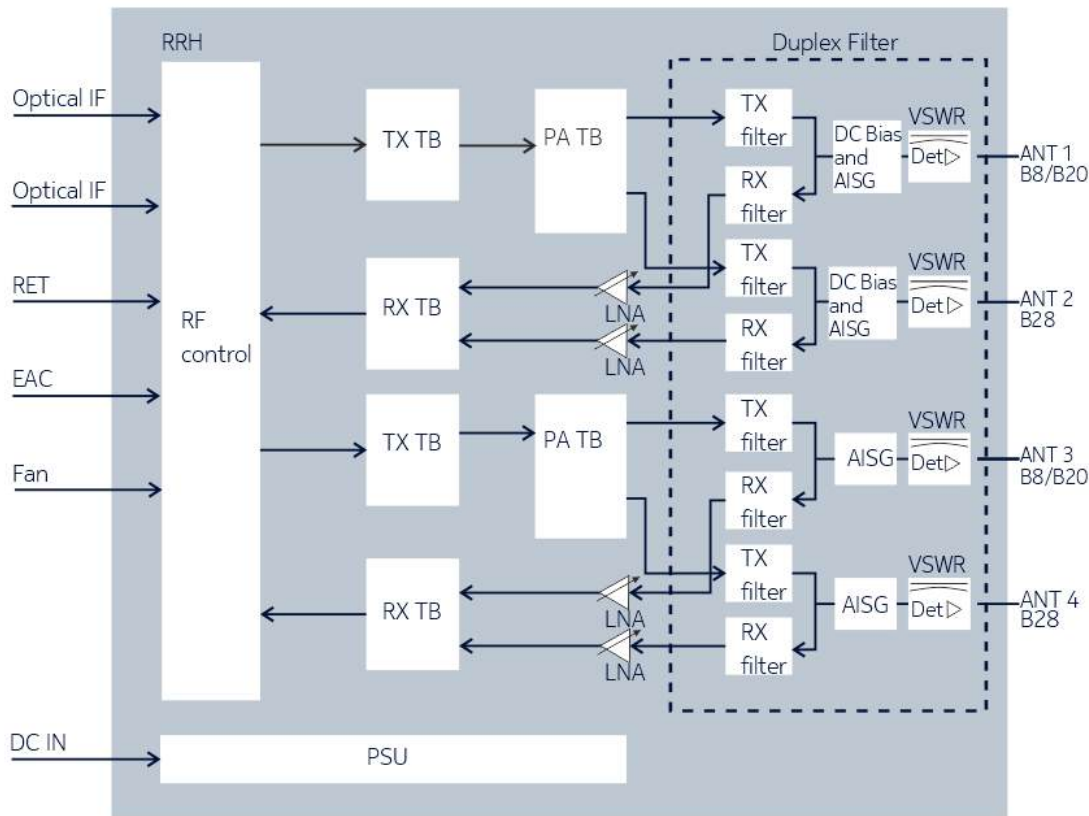


Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 157: AHPMDD functional block diagram



Electrical specifications

Table 532: AHPMDD electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond the limits, the unit might shut down.

Recommended power back-off

Table 533: Recommended AHPMDD power back-off per band, in 256 QAM (carrier spacing over 100 MHz)

Single carrier [dB]	Dual carrier [dB]	Triple carrier [dB]	Quad carrier [dB]
0.8	1.4	1.4	1.6

GSM cell power range



Notice:

Do not configure the GSM cell power below 30 dB total dynamic range from the max. rated power. It might make the system unstable.

Related optional items

- APAM AirScale AC-DC power unit 2300 W (475766A)
- AMBG AirScale book mount kit 151-175 (474467A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAF AirScale AC-DC PSU 100-240VAC/1150W (474676A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)

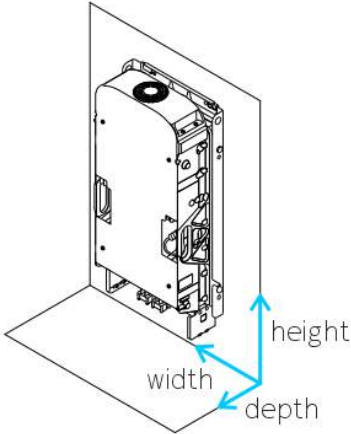
- AFPA rejection filter B28 703-789MHz (474704A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

Installation options

- Pole:
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- Wall:
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 534: AHPMDD dimensions and weight

Property	Value	Dimensions orientation
Height	With mounting bracket and fan unit: 673 mm (26.50 in.)	
Width	With side mounting bosses: 327 mm (12.87 in.)	
Depth	With mounting bracket and fan unit: 185 mm (7.28 in.)	
Weight	With mounting bracket and fan unit: 31.3 kg (69.0 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 535: AHPMDD environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.4.7 AirScale Tri RRH 2T4R B8/B20/B28 320 W (AHPMDG)

AHPMDG (476122A) is introduced by CB008846 (for GSM, WCDMA, LTE, and NR).

Functional description

Table 536: AHPMDG functional specification

Property	Value
Commercial name	Pandion 4
Maximum output power	320 W
Modulation	256 QAM (DL and UL)
Number of TXRX	2T4R
Outdoor installation	Yes
Supported technologies (MSR)	B20/B28: LTE, NR B8: GSM, WCDMA, LTE, NR
RF sharing/concurrent mode	NR-LTE-WCDMA-GSM
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band (GB), and standalone (SA)
TX frequency range	B8: 925–960 MHz B20: 791–821 MHz B28: 758–788 MHz
RX frequency range	B8: 880–915 MHz B20: 832–862 MHz B28: 703–733 MHz
DL filter bandwidth	B8: 35 MHz B20, B28: 30 MHz
UL filter bandwidth	B8: 35 MHz B20, B28: 30 MHz
Instantaneous bandwidth (iBW)	DL: • B8: 35 MHz • B20, B28: 30 MHz UL: • B8: 35 MHz • B20, B28: 30 MHz

Property	Value
Occupied bandwidth (oBW)	DL: • B8: 35 MHz • B20, B28: 30 MHz UL: • B8: 35 MHz • B20, B28: 30 MHz
Number of carriers per pipe	DL: up to 8 (for all bands and RATs) UL: up to 16 (for all bands and RATs)
Supported bandwidths	NR: • n8, n20: 5, 10, 15, 20 MHz • n28: 5, 10, 15, 20, 25¹⁾, 30 MHz LTE: • B8: 1.4, 3, 5, 10 MHz, NB-IoT in band, SA, GB • B20: 5, 10, 15, 20 MHz, NB-IoT in band, SA, GB • B28: 3, 5, 10, 15, 20 MHz, NB-IoT in band, SA, GB
Passive intermodulation (PIM) cancellation	Yes

¹⁾NR bandwidth 25 MHz has been introduced by the CB010343 feature.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 158: AHPMDG interfaces

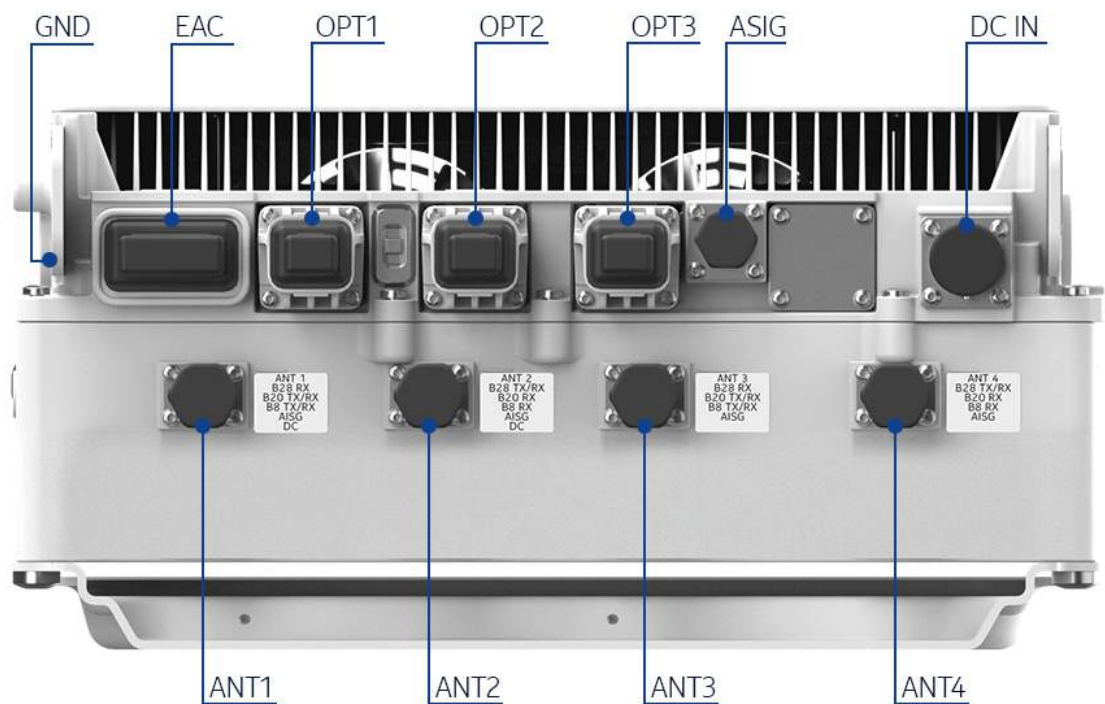


Table 537: AHPMDG interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPG
Antenna connector	ANT	4	4.3-10+	With a feature that prevents damage if mating with a 4.1-9.5 connector
External alarm connection	EAC	1	MDR26	–
Optical interface	OPT	3	SFP28	CPRI: 9.8 Gbps; Nokia IP seal
Antenna interface standards group	AISG	1	8-pin circular	RS-485
Grounding	GND 	2	2 x M5 screw and 1 x M8 screw	Located on the right side of the radio unit

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

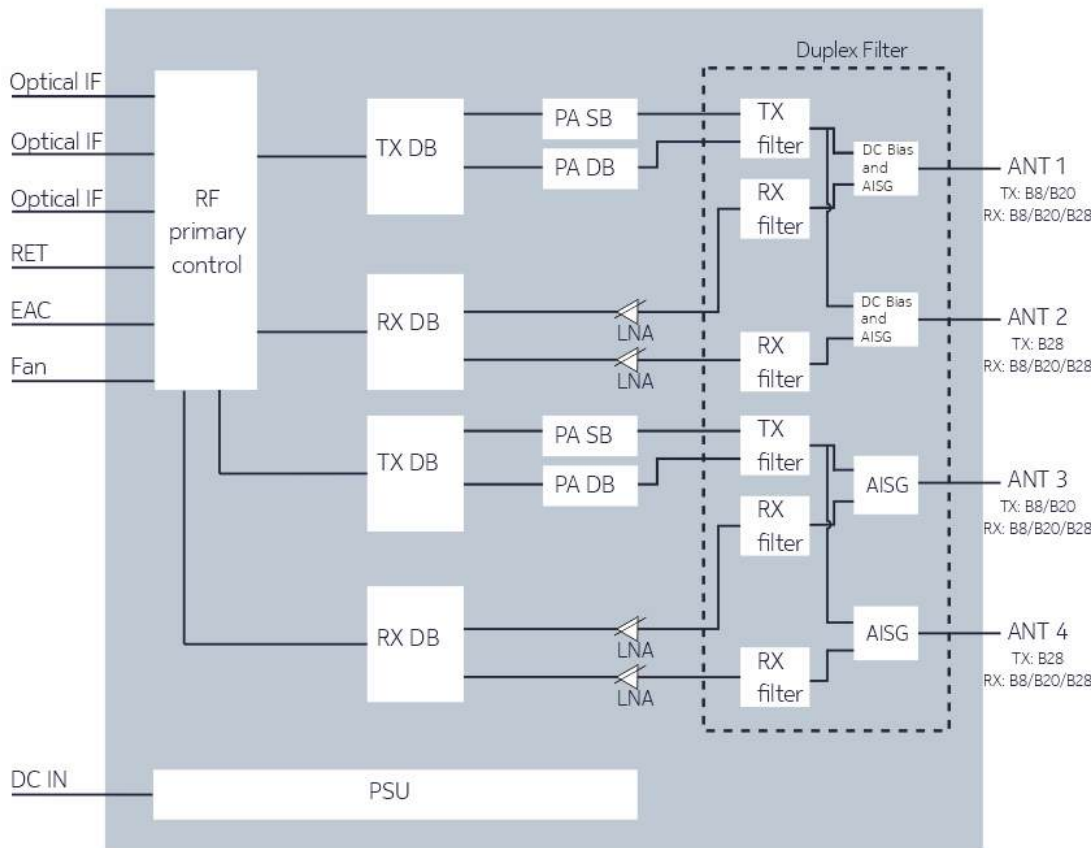
Antenna line device (ALD) support

Table 538: AHPMDG ALD support

Property	Value
AISG	Version 2.0
Voltage	14.5 V
Power per port	30 W on RET or AISG (including 15 W limit on RET), 45 W

Functional block diagram

Figure 159: AHPMDG functional block diagram



Electrical specifications

Table 539: AHPMDG electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 540: Recommended power back-off values for 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi-carrier [dB] (non-contiguous)
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0.4
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0	0.6

Related optional items

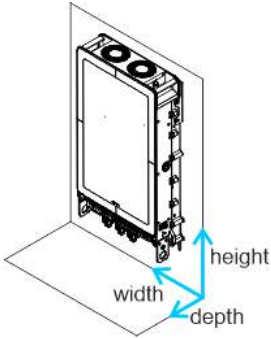
- AMBG AirScale book mount kit 151–175 (474467A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–300 mm) (472821A)
- AMPA pole mounting (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC 5 m cable (474288A)
- AMRB AirScale one clip bracket 126–200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPG AirScale 2 70 A DC plug 10–16 mm² (475401A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 541: AHPMDG dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 640 mm (25.20 in.) With mounting bracket and fan unit: 676 mm (26.61 in.)	
Width	Core RRH: 342 mm (13.46 in.) With side mounting bosses: 369 mm (14.53 in.)	
Depth	Core RRH: 157 mm (6.18 in.) With mounting bracket: 187 mm (7.36 in.)	
Weight	max. 36 kg (79.4 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 542: AHPMDG environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.4.8 AirScale Tri RRH 4T4R B1/B3/B7 (n1/n3/n7) 640 W (AHEGHA)

AHEGHA (475767A) is introduced by *CB006142* (for GSM, WCDMA, LTE, and NR).

Functional description

Table 543: AHEGHA functional specification

Property	Value
Commercial name	Pandion 4
Maximum output power	640 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	B1/n1: WCDMA, LTE, NR B3/n3: GSM, LTE, NR B7/n7: LTE, NR
RF sharing/concurrent mode	B1/n1: WCDMA-LTE, LTE-NR, WCDMA-NR, NR-LTE-WCDMA B3/n3: GSM-LTE, LTE-NR, GSM-NR, NR-LTE-GSM B7/n7: LTE-NR
Duplex mode - supported standard	FDD
IoT support	NB-IoT in band, guard band, standalone
TX frequency range	B1/n1: 2110-2170 MHz B3/n3: 1805-1880 MHz B7/n7: 2620-2690 MHz
RX frequency range	B1/n1: 1920-1980 MHz B3/n3: 1710-1785 MHz B7/n7: 2500-2570 MHz
DL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz B7/n7: 70 MHz
UL filter bandwidth	B1/n1: 60 MHz B3/n3: 75 MHz B7/n7: 70 MHz
Instantaneous bandwidth (iBW)	B1/n1: 60 MHz B3/n3: 75 MHz B7/n7: 70 MHz

Property	Value
Occupied bandwidth (oBW)	B1/n1: 60 MHz B3/n3: 75 MHz B7/n7: 70 MHz
Number of carriers per pipe	Up to 16
Supported bandwidths	WCDMA: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8 MHz LTE: 1.4 (B3 only), 3 (B3 only), 5, 10, 15, 20 MHz NR: 5, 10, 15, 20, 25 ²⁾ , 30, 40 ¹⁾ , 50 ³⁾ MHz
Passive intermodulation (PIM) cancellation	Yes

¹⁾NR bandwidth 40 MHz has been introduced by the *CB010962* feature.

²⁾NR bandwidth 25 MHz has been introduced by the *CB010343* feature.

³⁾NR bandwidth 50 MHz has been introduced by the *CB011006* feature.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 160: AHEGHA interfaces

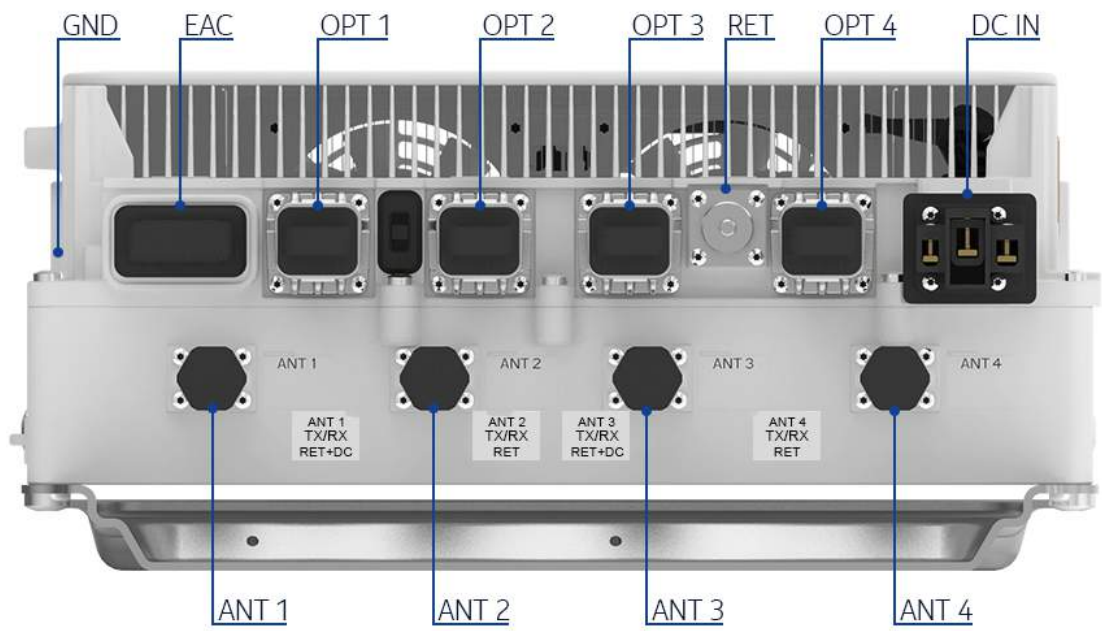


Table 544: AHEGHA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	Terminal block	Max wire gauge 4 AWG with max strand diameter 7 mm (max 105 strands)
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3
External alarm connection	EAC	1	MDR26	-
Optical	OPT	4	SFP28	CPRI: 9.8 Gbps (CPRI7); Nokia IP seal
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

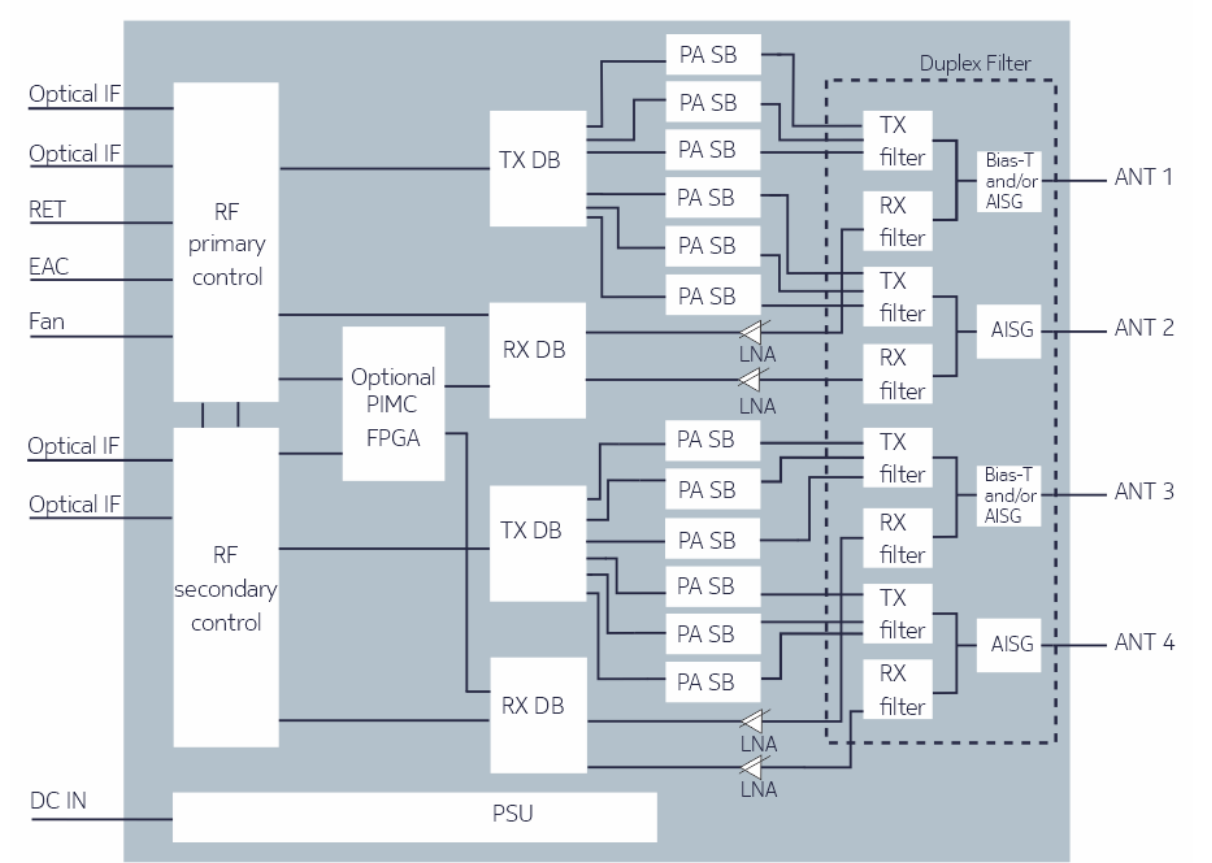
Antenna line device (ALD) support

Table 545: AHEGHA ALD support

Property	Value
AISG	Version 2.0
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 161: AHEGHA functional block diagram



Electrical specifications

Table 546: AHEGHA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA
Maximum current draw (I_{max}) (-36 V)*	80 A

*The I_{max} of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new I_{max} value. Note that the I_{max} given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 547: Recommended power back-off values for 256 QAM

RAT	Feature or Parameter	Single carrier [dB] (≤ 25 MHz)	Single wide carrier [dB] (25–100 MHz)	Multi carrier [dB] (non- contiguous)
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0	0.4
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub 6)	0	0.2	0.6

Related optional items

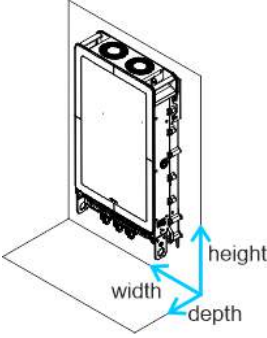
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC 5 m cable (474288A)
- AOPC SFP weatherproofing boot kit (475151A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*

Dimensions and weight

Table 548: AHEGHA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 701 mm (27.60 in.) With mounting bracket and fan unit: 736 mm (28.98 in.)	
Width	Core RRH: 342 mm (13.46 in.) With side mounting bosses: 369 mm (14.53 in.)	
Depth	Core RRH: 142 mm (5.59 in.) With mounting bracket: 171 mm (6.73 in.)	
Weight	max. 39 kg (86.0 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 549: AHEGHA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

5.4.9 AirScale Tri RRH 4T4R B7/B25/B66 (n7/n25/n66) 640 W (AHFIHA)

AHFIHA (475964A) is introduced by *CB007680*.

Functional description

Table 550: AHFIHA functional specification

Property	Value
Commercial name	Pandion 4
Maximum output power	640 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Supported technologies	B7/n7: LTE, NR B4: LTE B10: LTE B66/n66: LTE, NR B2: WCDMA, LTE, NR B25/n25: LTE, NR
RF sharing/concurrent mode	B7/n7: LTE–NR B25/n25: GSM–WCDMA, GSM–LTE, WCDMA–LTE, LTE–NR B66/n66: LTE–NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, standalone
TX frequency range	B7/n7: 2620–2690 MHz B25/n25 (includes B2): 1930–1995 MHz B66/n66 (includes B4/B10): 2110–2200 MHz
RX frequency range	B7/n7: 2500–2570 MHz B25/n25 (includes B2): 1850–1915 MHz B66/n66 (includes B4/B10): 1710–1780 MHz
DL filter bandwidth	B7/n7: 70 MHz B25/n25: 65 MHz B66/n66: 90 MHz
UL filter bandwidth	B7/n7: 70 MHz B25/n25: 65 MHz B66/n66: 70 MHz

Property	Value
Instantaneous bandwidth (iBW)	B4: 45 MHz B7/n7: 70 MHz B25/n25: 65 MHz B66/n66: 90 MHz (DL) /70 MHz (UL)
Occupied bandwidth (oBW)	B4: 45 MHz B7/n7: 70 MHz B25/n25: 65 MHz B66/n66: 90 MHz (DL) /70 MHz (UL)
Number of carriers per pipe	Up to 16
Supported bandwidths	WCDMA: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8 (default) MHz LTE: 1.4 (B2/B4/B25/B66 only), 3 (B2/B4/B25/B66 only), 5, 10, 15, 20 MHz NR: 5, 10, 15, 20, 25, 30, 40 MHz
Passive intermodulation (PIM) cancellation	Yes

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 162: AHFIHA interfaces

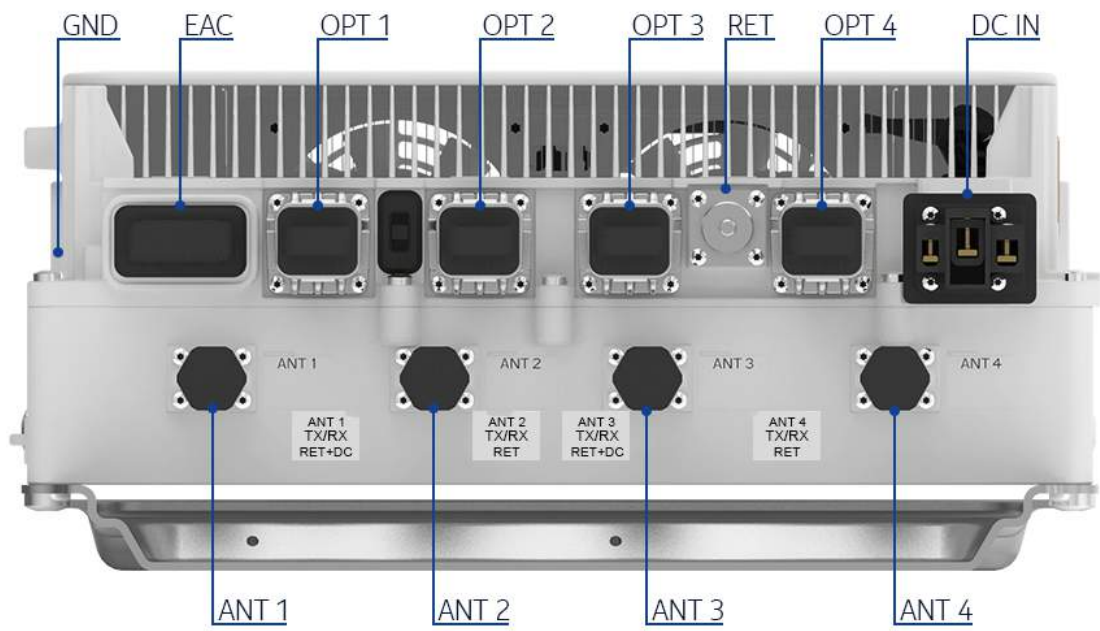


Table 551: AHFIHA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	Terminal block	Max wire gauge 4 AWG with max strand diameter 7 mm (max 105 strands)
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT1 and ANT3
External alarm connection	EAC	1	MDR26	-
Optical	OPT	4	SFP28	CPRI: 9.8 Gbps (CPRI7); Nokia IP seal
Remote electrical tilt	RET	1	8-pin circular	RS-485
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

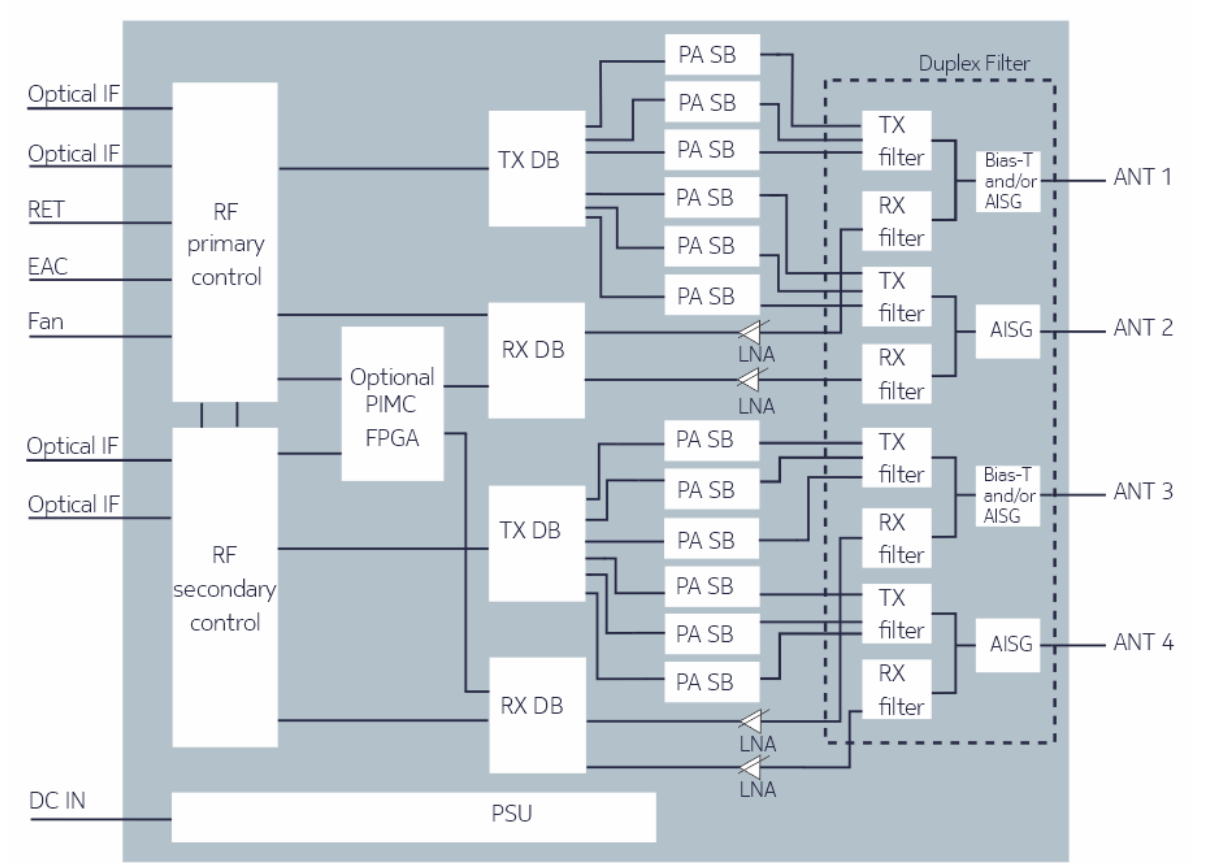
Antenna line device (ALD) support

Table 552: AHFIHA ALD support

Property	Value
AISG	Version 2.0
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 163: AHFIHA functional block diagram



Electrical specifications

Table 553: AHFIHA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 554: The recommended power back-off in 256 QAM

RAT	Feature or Parameter	Single carrier 20 MHz [dB]	Single carrier/multi carrier (contiguous) ≤ 100 MHz [dB]	Multi-carrier (non-contiguous) ≤ 100 MHz [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0	0	0.4
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0	0.2	0.6

Note:

Transmit power back-off for 4C LTE/NR 256QAM is 1.2 dB, for 3C LTE/NR 256QAM is 1.1 dB.

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

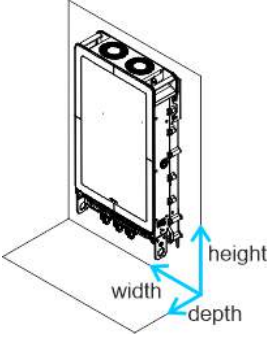
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASAA AirScale 2 MDR26-open EAC 5 m cable (474288A)
- AOPC SFP weatherproofing boot kit (475151A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
- *Wall:*
 - *Vertical*
 - *Horizontal*
 - *One-clip rail*

Dimensions and weight

Table 555: AHFIHA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 701 mm (27.60 in.) With mounting bracket and fan unit: 736 mm (28.98 in.)	
Width	Core RRH: 342 mm (13.46 in.) With side mounting bosses: 369 mm (14.53 in.)	
Depth	Core RRH: 142 mm (5.59 in.) With mounting bracket: 171 mm (6.73 in.)	
Weight	max. 39 kg (86.0 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 556: AHFIHA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced cooling (FAN)
IP rating	IP65

5.4.10 AirScale Tri RRH 4T4R B8/B20/B28 320 W (AHPMDH)

AHPMDH (476232A) is introduced by *CB009066* (for GSM, WCDMA, LTE, and NR).

Functional description

Table 557: AHPMDH functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies (MSR)	B20/B28: LTE, NR B8: GSM, WCDMA, LTE, and NR
RF sharing/concurrent mode	NR-LTE-WCDMA-GSM
Duplex mode	FDD
IoT support	NB-IoT in band, guard band (GB), standalone (SA)
TX frequency range	B8: 925–960 MHz B20: 791–821 MHz B28: 758–788 MHz
RX frequency range	B8: 880–915 MHz B20: 832–862 MHz B28: 703–733 MHz
DL filter bandwidth	B8: 35 MHz B20: 30 MHz B28: 30 MHz
UL filter bandwidth	B8: 35 MHz B20: 30 MHz B28: 30 MHz
Instantaneous bandwidth (iBW)	B8: 35 MHz B20: 30 MHz B28: 30 MHz
Occupied bandwidth (oBW)	B8: 35 MHz B20: 30 MHz B28: 30 MHz
Number of carriers per pipe	Up to 8 carriers in total for all supported RATs

Property	Value
Supported bandwidths	NR: 5, 10, 15, 20 MHz LTE: • B8: 1.4, 3, 5, 10 MHz • B20: 5, 10, 15, 20 MHz • B28: 3, 5, 10, 15, 20 MHz
Passive intermodulation (PIM) cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 164: AHPMDH interfaces

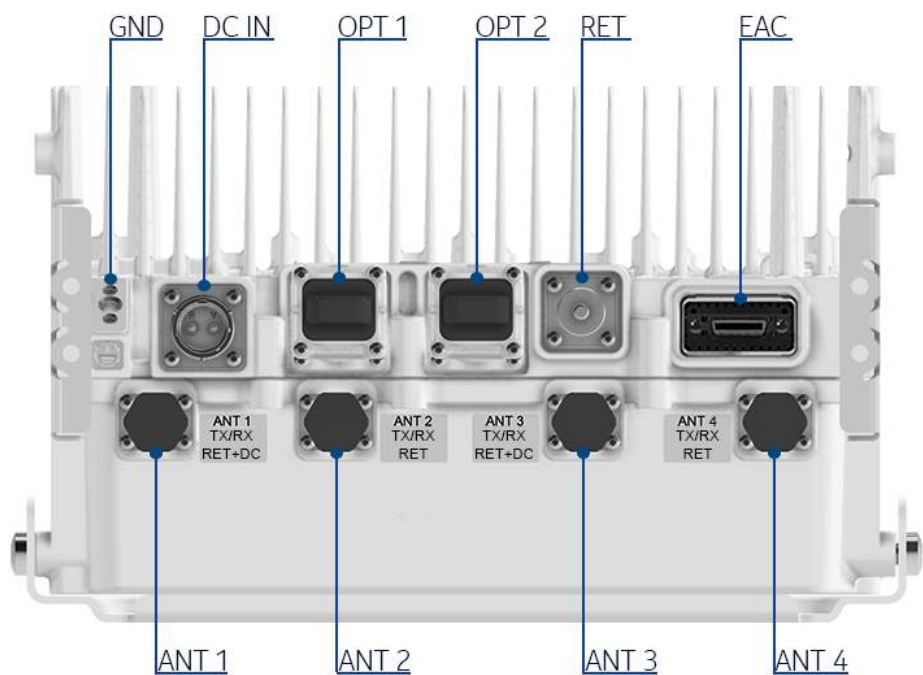


Table 558: AHPMDH interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	-
Antenna	ANT	4	4.3-10	AISG on all ports and BiasT support on ANT 1 and ANT 3. ANT has features that prevent damage if mating with a 4.1-9.5 connector is attempted.
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP	CPRI: 9.8 Gbps; Nokia IP seal
Grounding	GND 	1	M8 or 2 x M5 screws	-

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 559: AHPMDH ALD support

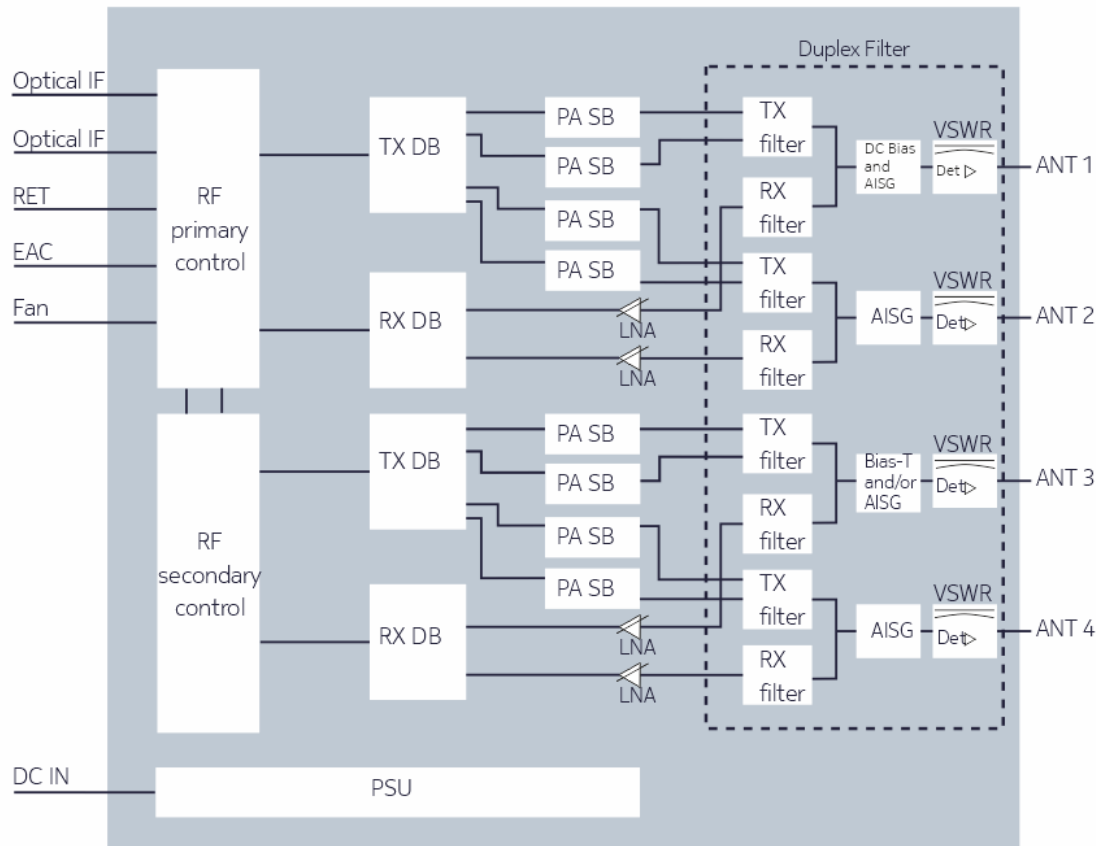
Property	Value
AISG	Version 3.0
Voltage	14.5 V (ANT 1 and ANT 3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 165: AHPMDH functional block diagram



Electrical specifications

Table 560: AHPMDH electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 561: The recommended power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.8	1.4 (two or three carriers) 1.6 (four carriers)
NR	NRCELL_PDSCH_Power_Back-off_for_256QAM (dlQam256PowerBackoffSub6)	1	1.6 (two or three carriers) 1.8 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMPA pole mounting kit (30-120 mm) (473879A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMBH AirScale book mount kit 176-200 (474280A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMRD AirScale one clip bracket over 200 (474582A)

- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- ASFC AirScale 2 fan unit 600 (474484A) - recommended in AHPMDH v101, factory-installed in AHPMDH v202
- APAM AirScale AC-DC power unit 2300 W (475766A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- AOPC SFP weatherproofing boot kit (475151A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)

Installation options

- *Pole:*
 - Vertical using *FPKA* or *FPKC*
 - One-clip rail with *FPKA* or *FPKC*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal (fan is required)*
 - *One-clip rail*
 - *Book mounting*

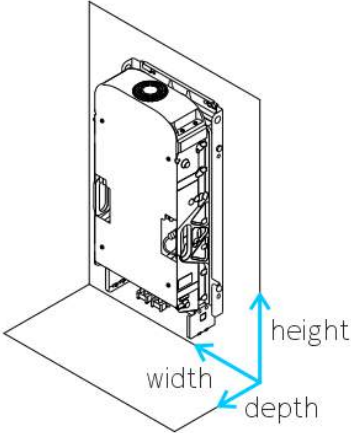


Notice:

Install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling. Use fans for horizontal installation.

Dimensions and weight

Table 562: AHPMDH dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 560 mm (22.04 in.) With upper and lower mounting brackets: 675 mm (26.57 in.) With fan unit: 701 mm (27.60 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting brackets: 327 mm (12.87 in.)	
Depth	Core RRH: 189 mm (7.44 in.) With mounting brackets: 205 mm (8.07 in.)	
Weight	Core RRH: 38 kg (83.8 lb) With fan unit: 39 kg (86.0 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 563: AHPMDH environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	• Natural convection (fanless) or optional fan (recommended) - v101 • Forced convection (fan) - v202
IP rating	IP65

5.4.11 AirScale Tri RRH 4T4R B12/B14/B29 (n12/n14/n29) 370 W (AHLBBA)

AHLBBA (475082A) is introduced by *LTE5210* (for LTE) and *CB006425* (for NR).

Functional description

Table 564: AHLBBA functional specification

Property	Value
Maximum output power	370 W
Modulation	256 QAM
Number of TXRX	B12/n12 : 4T4R B14/n14 : 4T4R B29/n29 : 2T
Outdoor installation	Yes
Supported technologies	LTE, NR
Duplex mode - supported standard	FDD
RF sharing/concurrent mode	LTE-NR
TX frequency range	B12/n12 (incl. B17): 729-745 MHz B14/n14 : 758-768 MHz B17 (LTE only): 734-745 MHz B29/n29 : 717-728 MHz¹  Note: ¹If the B29 carrier is located at the bottom edge of the band (meaning it includes down to 717 MHz), then the 3 PRBs on the far left of the spectrum should be muted.
RX frequency range	B12/n12 (incl. B17): 699-715 MHz B14/n14 : 788-798 MHz B17 (LTE only): 704-715 MHz
DL filter bandwidth	B12/n12 : 16 MHz B14/n14 : 10 MHz B29/n29 : 11 MHz
UL filter bandwidth	B12/n12 : 16 MHz B14/n14 : 10 MHz

Property	Value
Instantaneous bandwidth (iBW)	B12/n12 : 16 MHz B14/n14 : 10 MHz B17: 11 MHz B29/n29 : 11 MHz (DL only)
Occupied bandwidth (oBW)	B12/n12 : 16 MHz B14/n14 : 10 MHz B17: 11 MHz B29/n29 : 11 MHz (DL only)
Number of carriers per pipe	LTE: up to 3 NR/mixed NR+LTE: up to 7
Supported bandwidths	LTE: 5, 10 MHz NR: • n12: 5, 10, 15 MHz • n14/n29: 5, 10 MHz
PIM cancellation	Yes
RF scan	Yes
PIM tests	PIM simulation

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 166: AHLBBA interfaces

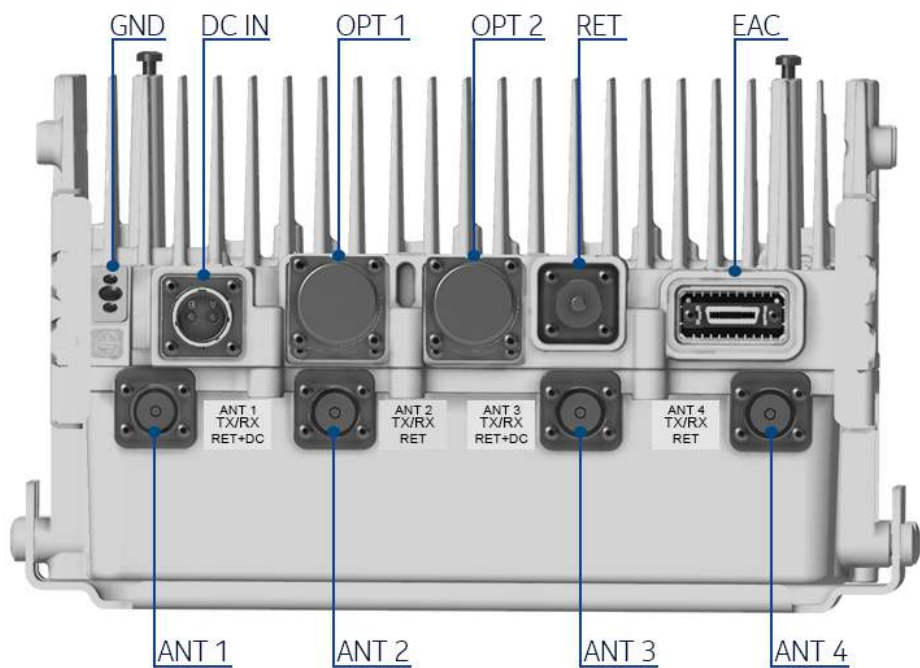


Table 565: AHLBBA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPB, APPC
Antenna	ANT	4	4.3-10	AISG on all ports, BiasT support on ANT 1 and ANT 3. ANT has features that prevent damage if mating with a 4.1-9.5 connector is attempted
Remote electrical tilt	RET	1	8-pin circular	RS-485
External alarm connection	EAC	1	MDR-26	4 alarm inputs and 1 control output
Optical	OPT	2	SFP+ (R2CT)	Up to 9.8 Gbps (CPRI7); R2CT IP seal
Grounding	GND 	1	M8 or 2 x M5 screws	-

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 566: AHLBBA ALD support

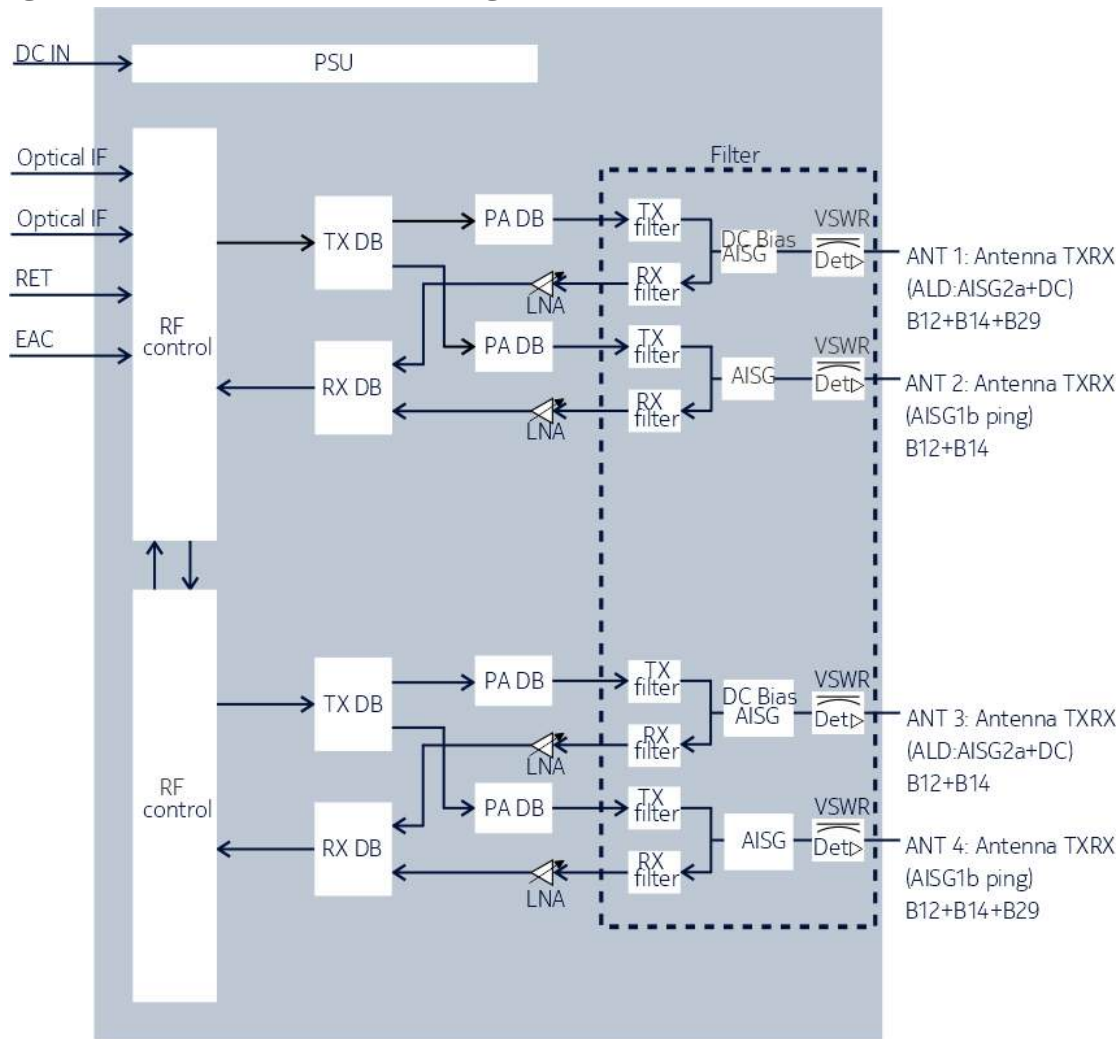
ALD support	Value
AISG	Version 2.0
Voltage	14.5 V (ANT 1 and ANT 3 only)
Power per port	30 W, 45 W total

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 167: AHLBBA functional block diagram



Electrical specifications

Table 567: AHLBBA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 568: Recommended AHLBBA power back-off in 256 QAM (carrier spacing over 100 MHz)

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	0.6	0.9 (two or three carriers) 1.4 (four carriers)
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	0.8	1.1 (two or three carriers) 1.6 (four carriers)

Note:

Add 0.7 dB to the power back-off value for RF sharing and concurrent mode.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- APAM AirScale AC-DC power unit 2300 W (475766A)
- ACPB AirScale 2 fiber connector R2CT V2 (474384A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)

Installation options

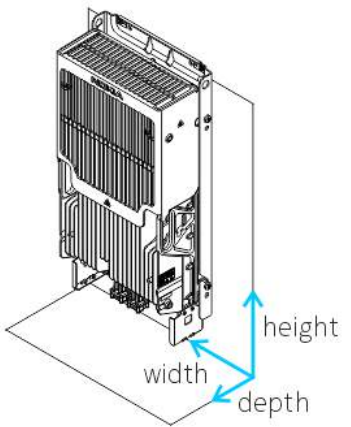
- *Pole:*
 - Vertical using *FPKA* or *FPKC*
- *Wall:*
 - *Vertical*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 569: AHLBBA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 610 mm (24.01 in.) With mounting bracket: 725 mm (28.54 in.)	
Width	Core RRH: 358 mm (14.09 in.) With mounting bracket: 377 mm (14.84 in.)	
Depth	Core RRH: 199 mm (7.83 in.) With mounting bracket: 215 mm (8.46 in.)	
Weight	46.0 kg (101.4 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 570: AHLBBA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

6. AirScale macro TDD RUs descriptions

6.1 AirScale RRH 2T2R B40 120 W (AZND/AZNE)

AZND (474348A) and AZNE (474350A) are introduced by LTE3961 (for LTE).

Functional description

Table 571: AZND/AZNE functional specification

Property	Value
Maximum output power	120 W
Modulation	256 QAM (DL)
Number of TXRX	2T2R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE
Duplex mode	TDD
Frequency range	2320-2370 MHz
Filter bandwidth	50 MHz
Instantaneous bandwidth (iBW)	50 MHz
Occupied bandwidth (oBW)	50 MHz
Number of carriers per pipe	Up to 3
Supported bandwidths	10, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 168: AZND interfaces

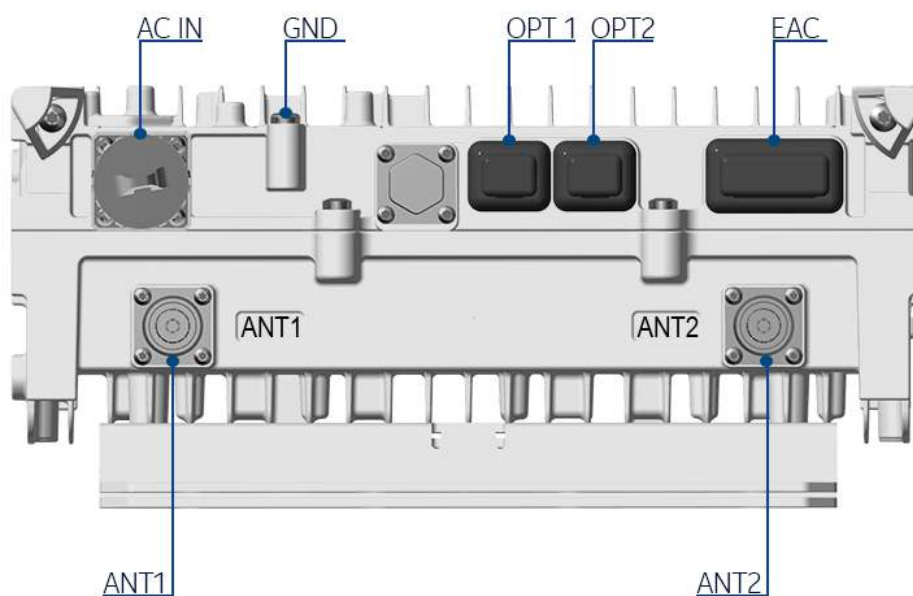


Figure 169: AZNE interfaces

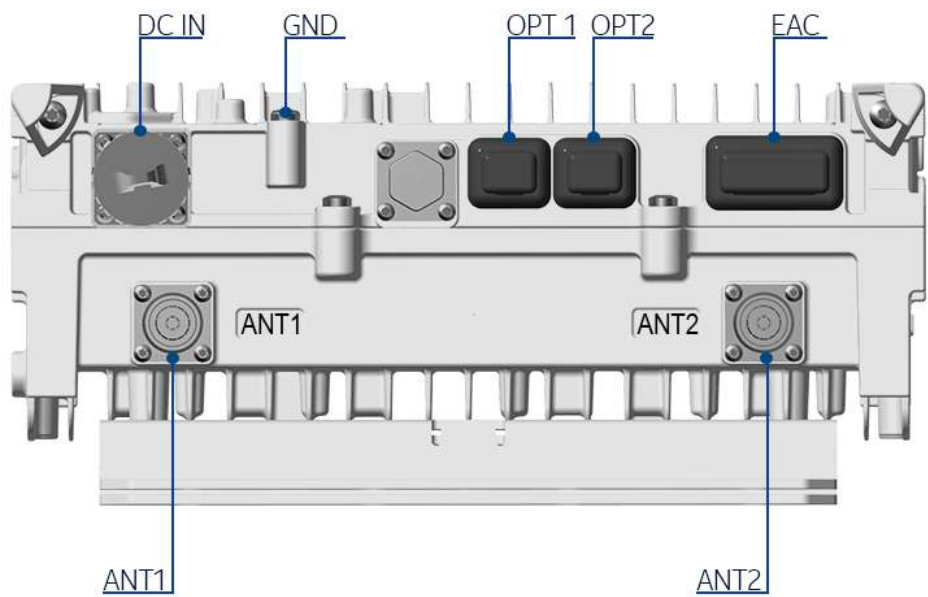


Table 572: AZND/AZNE interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	AC IN (AZND) DC IN (AZNE)	1	Circular Connector	APPF for AZND APPB for ANZE
Antenna connector	ANT	2	4.3-10	-
External Alarm Connection	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-

⚠ WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

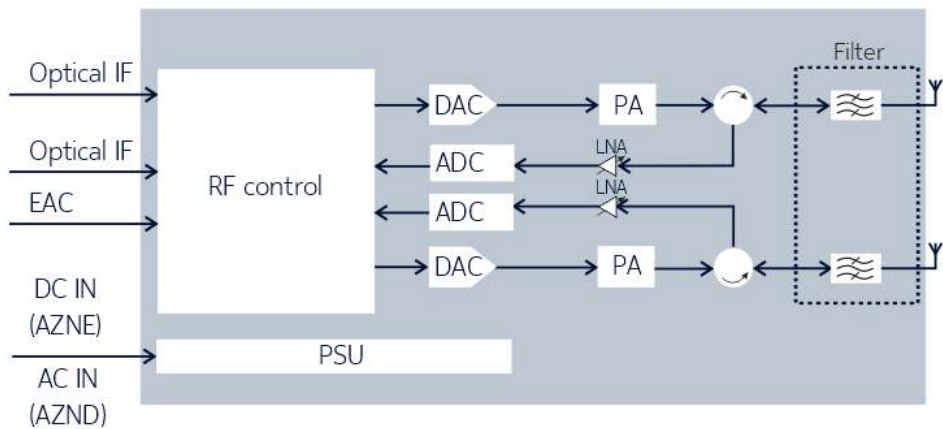
Antenna line device (ALD) support

i Note:

There is no antenna line device support for AZND/AZNE.

Functional block diagram

Figure 170: AZND/AZNE functional block diagram



Electrical specifications

Table 573: AZND/AZNE electrical specifications

Property	Value
Nominal supply voltage	AZND: 220 V AC AZNE: -48.0 V DC
Nominal input voltage range	AZND: 200 V AC to 240 V AC AZNE: -40.0 V DC to -57.0 V DC
Extended input voltage range	AZND: 140 V AC to 300 V AC AZNE: -36.0 V DC to -40.0 V DC AZNE: -57.0 V DC to -60.0 V DC
Maximum current draw (I_{max}) (-36 V)*	AZND: 4.8 A AZNE: 18 A

*The I_{max} of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new I_{max} value. Note that the I_{max} given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended power back-off

Table 574: Recommended AZND/AZNE power back-off in 256 QAM

Carrier configuration	Power reduction [dB]
Multiple carriers, continuous	0.5
Multiple carriers, non-continuous	0.5
Single carrier	0.5

Related optional items

- AMBE AirScale book mount kit 101–125 (474277A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFN AirScale 2 casing adapter RRH 300 (474664A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AZNE: APAA AirScale AC-DC power unit 760 W (473936A)
- AZNE: APAM AirScale AC-DC power unit 2300 W (475766A)
- AZNE: APPB AirScale 2 55A DC plug 3.3–10mm² (474282A)
- AZND: APPF conn 3 pole female plug AC (474893A)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Note:

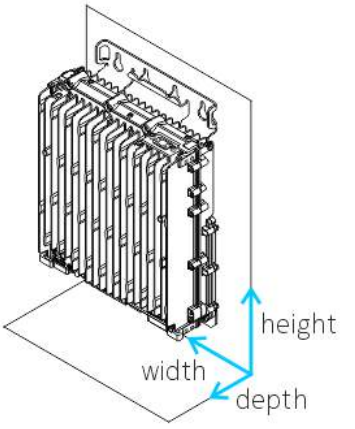
In case of mounting three modules on a wall (rail) and in bookshelf mounting, AZND/AZNE cannot be mounted as the middle unit.

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 575: AZND/AZNE dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With upper and lower mounting brackets: 430.5 mm (16.95 in.)	
Width	300 mm (11.81 in.)	
Depth	Core RRH: 110 mm (4.33 in.) With mounting brackets: 134 mm (5.28 in.)	
Weight	max. 11 kg (24.3 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 576: AZND/AZNE environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

6.2 AirScale RRH 4T4R B40/n40 160 W (AZNA)

AZNA (473914A) is introduced by *LTE2810* (for LTE) and *5GC002361* (for NR).

Functional description

 Note:

AZNA correct product code/serial number is visible in WebEM in *Parameters* tab, labelled as *Chassis product code/Chassis serial number*.

Table 577: AZNA functional specification

Property	Value
Maximum output power	160 W
Modulation	Up to 256 QAM (DL) Up to 64 QAM (UL)
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE, NR
Duplex mode	TDD
RF sharing/concurrent mode	LTE-NR
Frequency range	2300-2400 MHz
Filter bandwidth	100 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	80 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 5, 10, 15, 20 MHz NR: 20 , 30 ²⁾ , 40 ¹⁾ , 50 ²⁾ , 60 ¹⁾ , 80 ¹⁾ MHz

¹⁾ NR bandwidths 40, 60, and 80 MHz introduced by *CB007331* feature.

²⁾ NR bandwidths 30 and 50 MHz introduced by *CB009104* feature.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 171: AZNA interfaces

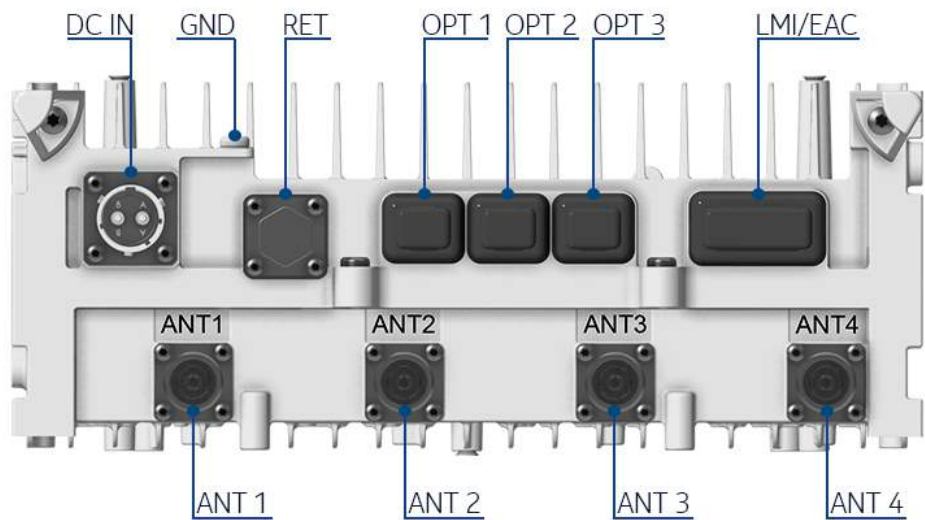


Table 578: AZNA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	-
AISG Connector	RET	1	8-pin circular	RS-485
External Alarm Connection /Local Management Interface	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal CPRI 4.9 Gbps* (LTE only); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	-
Fan	FAN	1	Nokia fan	Located on the opposite side

*Support of 4.9 Gbps CPRI introduced by the CB009390 feature.



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

*ALDs are supported on ANT ports only in versions A.101, A.102, and B.

Table 579: AZNA ALD support

ALD support	Value
AISG	ANT1, ANT3: AISG2.0/3.0* RET: AISG 2.0/3.0
Voltage	ANT1, ANT3: 14.5 V* RET: 14.5 V
Power per port	ANT1, ANT3: 45 W* RET port: 45 W

Functional block diagram

AZNA has two variants, for various ALD functions:

- Versions A.101, A.102, and all B-versions support ALD through both RET and ANT ports
- Versions A.203 and later support ALD only through RET ports

Figure 172: AZNA (with MHA) variants A.101, A.102, all B-variants; functional block diagram

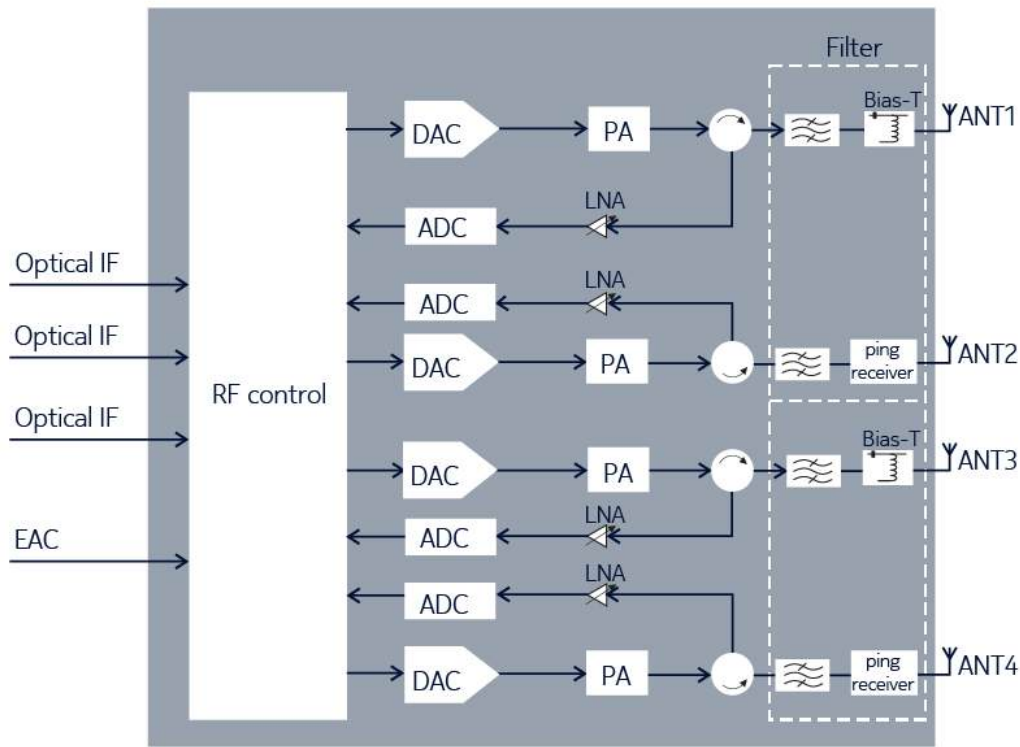
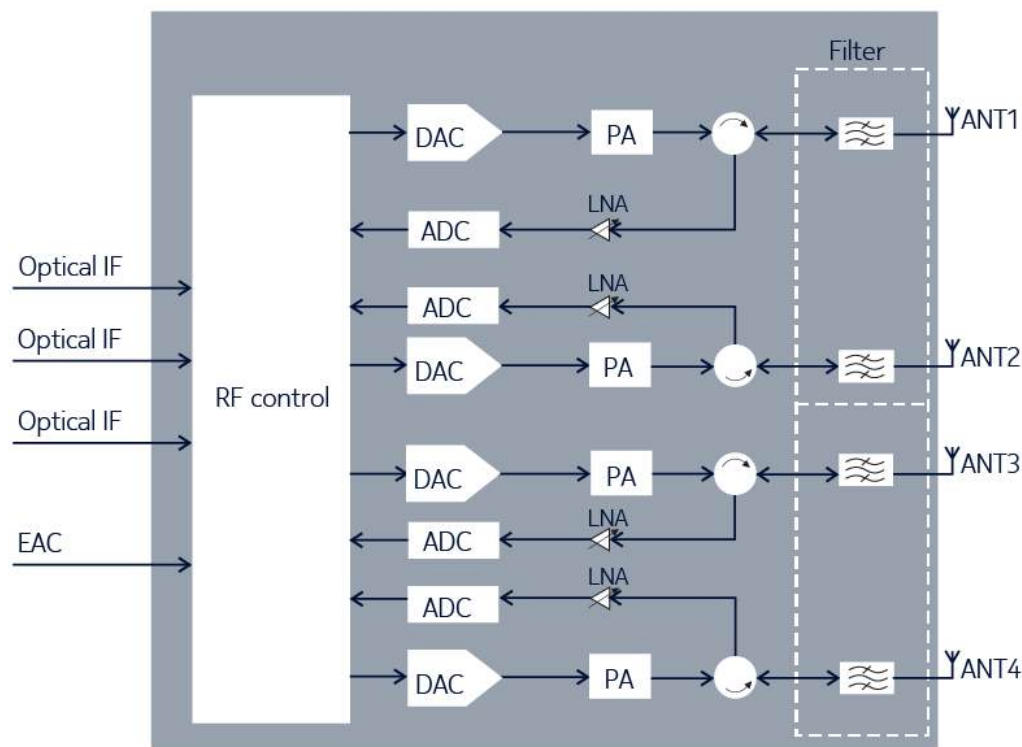


Figure 173: AZNA (without MHA) variants A.203 onwards; functional block diagram



Electrical specifications

Table 580: AZNA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw (I_{max}) (-36 V)*	18 A

*The I_{max} of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new I_{max} value. Note that the I_{max} given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale*

BTS Installation Site Requirements.

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended power back-off

Table 581: Recommended AZNA power back-off in 256 QAM

Carrier configuration	Power back-off [dB]
Multiple carriers, continuous	1.2
Multiple carriers, non-continuous	1.5
Single carrier	0.9

Table 582: AZNA power back-off in 5G

Property	Single carrier		Multi carrier (non contiguous)		
Pmax (dBm)	Pmax=35-43	Pmax=46	Pmax <43	Pmax=43	Pmax=46
Recommended back-off (dB)	1.9	2.6	2.4	3.4	Setting not allowed for single PA

Related optional items

- ASFB AirScale 2 TD RRH 4-pipe fan unit (474483A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- AMGC AirScale 2 cover 300 x 101-125 (474269A)
- AMBE AirScale book mount kit 101-125 (474277A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)

- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMRA AirScale one clip bracket 51-125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AAFGHC AirScale 4-pipe integrated antenna (474724A) or (474724B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)

Installation options

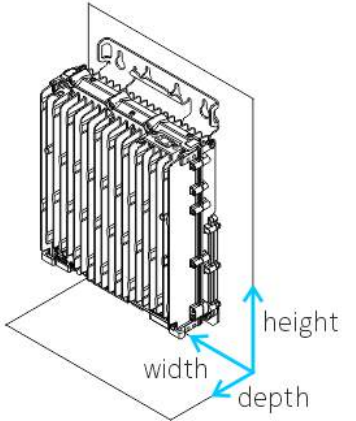
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 583: AZNA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With upper and lower mounting brackets: 427.5 mm (16.83 in.)	
Width	300 mm (11.81 in.)	
Depth	Core RRH: 120 mm (4.72 in.) With mounting brackets: 144 mm (5.67 in.)	
Weight	11 kg (24.3 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 584: AZNA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.3 AirScale RRH 4T4R B41/n41 160 W (AZHA)

AZHA (473941A) is introduced by LTE3329/5GC002400.

Functional description

Table 585: AZHA functional specification

Property	Value
Maximum output power	160 W
Modulation	Up to 256 QAM (DL) Up to 64 QAM (UL)
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE, NR
Duplex mode	TDD
RF sharing/concurrent mode	NR-SRAN
Frequency range	2496-2690 MHz
Filter bandwidth	194 MHz
Instantaneous bandwidth (iBW)	194 MHz
Occupied bandwidth (oBW)	80 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 5, 10, 15, 20 MHz NR: 20, 30 ²⁾ , 40 ¹⁾ , 50 ²⁾ , 60 ¹⁾ , 80 ¹⁾ MHz
Limitations	The maximum non-contiguous space fragment between two adjacent carriers is 100.55 MHz.

¹⁾ NR bandwidths 40, 60, and 80 MHz introduced by *CB007331* feature.

²⁾ NR bandwidths 30 and 50 MHz introduced by *CB009104* feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 174: AZHA interfaces

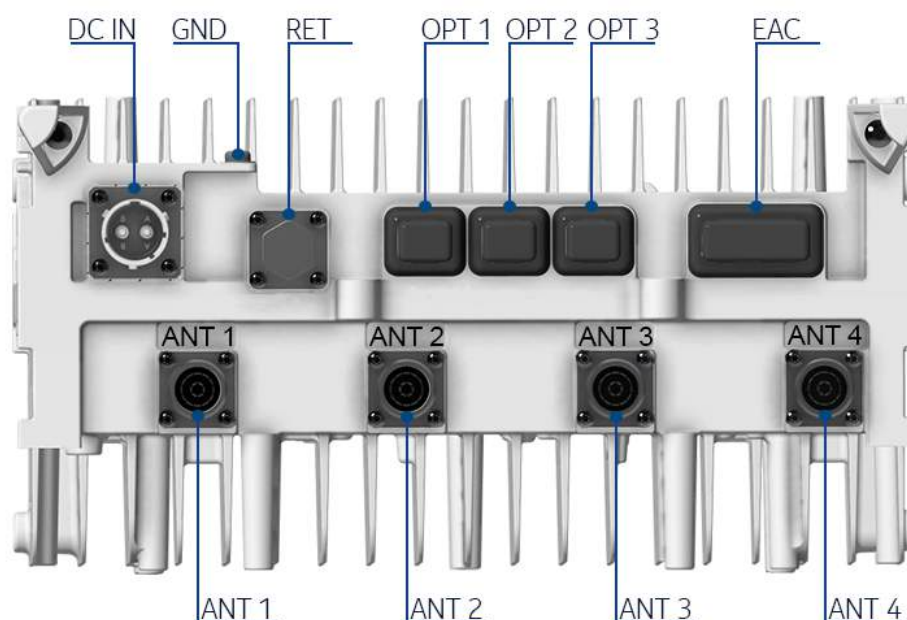


Table 586: AZHA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	4	4.3-10	–
AISG Connector	RET	1	8-pin circular	–
External Alarm Connection /Local Management Interface	EAC	1	MDR26	4 alarm inputs and 1 control output
Optical interface	OPT	3	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

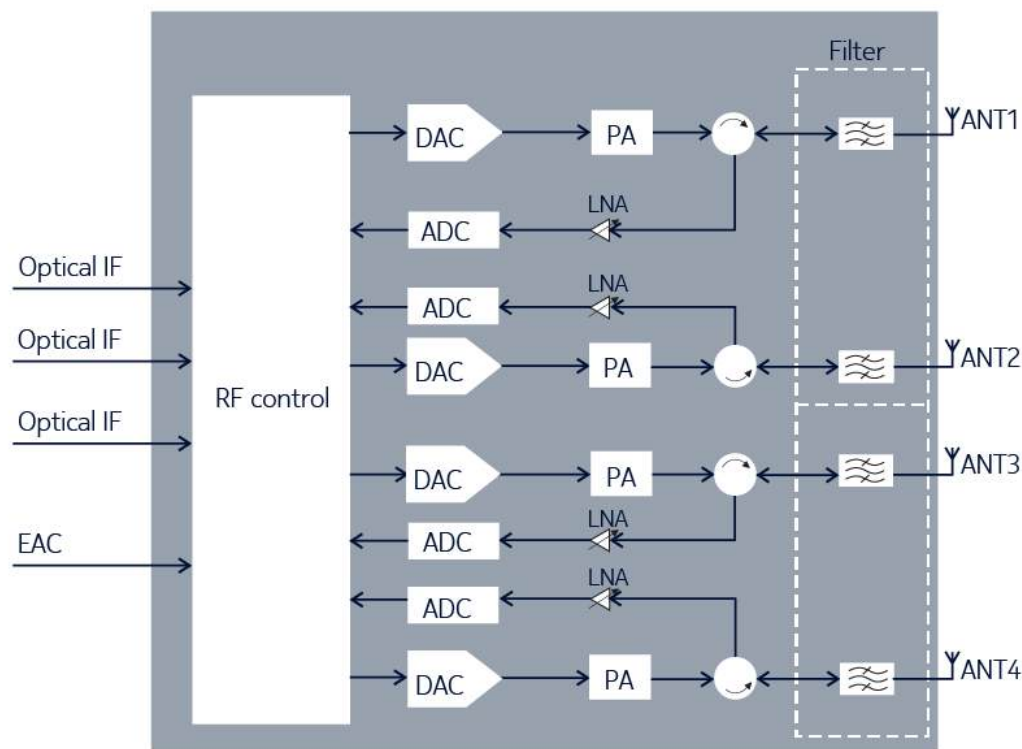
Antenna line device (ALD) support

Table 587: AZHA ALD support

ALD support through RS-485 port	Value
AISG	ANT1, ANT3, RET: AISG 2.0/3.0 ANT2, ANT4: AISG 3.0 Ping Receiver
Voltage	14.5 V
Power per port	40 W RET port: 30 W

Functional block diagram

Figure 175: AZHA functional block diagram



Electrical specifications

Table 588: AZHA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw (I_{max}) (-36 V)*	26 A

*The I_{max} of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new I_{max} value. Note that the I_{max} given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended power back-off

Table 589: AZHA power back-off in NR

Property	Single carrier		Multi carrier (non contiguous)		
Pmax (dBm)	Pmax=35-43	Pmax=46	Pmax <43	Pmax=43	Pmax=46
Recommended backoff (dB): dLQam256PowerBackoffSub6	1.9	2.6	2.4	3.4	Setting not allowed for single PA

Related optional items

- ASFB AirScale 2 TD RRH 4-pipe fan unit (474483A)
- APAA AirScale AC-DC power unit 760 W (473936A)
- AMGE AirScale 2 cover 300 x 151-175 (474271A)
- AMBG AirScale book mount kit 151-175 (474467A)
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMFC AirScale 2 19" rack fixing 300 (474291A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AAFGHC AirScale 4-pipe integrated antenna (474724A) or (474724B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)

Installation options

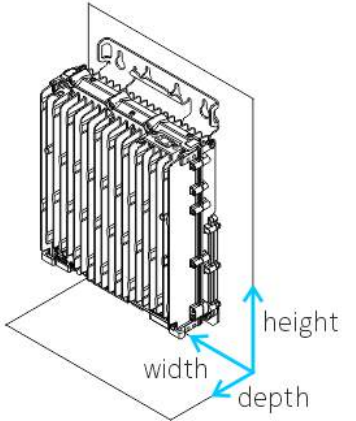
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 590: AZHA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 336 mm (13.23 in.) With upper and lower mounting brackets: 427.5 mm (16.83 in.)	
Width	300 mm (11.81 in.)	
Depth	Core RRH: 155 mm (6.1 in.) With mounting brackets: 178.7 mm (7.04 in.)	
Weight	13 kg (28.7 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 591: AZHA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.4 AirScale RRH 4T4R n77 320 W (AZQU) (eCPRI)

AZQU (475665A) is introduced by CB005708 (for NR).

Functional description

Table 592: AZQU functional specification

Property	Value
Maximum output power	320 W 4 x 40 W for 3700–3800 MHz range 4 x 40 W for 3900–4100 MHz range
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Operating modes	Non-BF mode: 4T4R for one 4-port passive antenna 2x2T2R for two 2-port passive antenna
Supported technologies	NR
Duplex mode, supported standard	TDD
TX frequency range	3700–3800 MHz and 3900–4100 MHz
RX frequency range	3700–3800 MHz and 3900–4100 MHz
DL filter bandwidth	100 + 200 MHz
UL filter bandwidth	100 + 200 MHz
Instantaneous bandwidth (iBW)	100 MHz + 200 MHz
Occupied bandwidth (oBW)	100 MHz + 200 MHz
Number of carriers per pipe	Up to 3
Maximum number of UL/DL MIMO streams	8 (4+4) • one eCPRI link: 4x200 MHz, carriers: 3700–3800 MHz and 4000–4100 MHz • one eCPRI link 4x100 MHz, carrier: 3900–4000 MHz
Supported bandwidths	20, 30, 40, 50, 60, 70, 80, 90, 100 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 176: AZQU interfaces

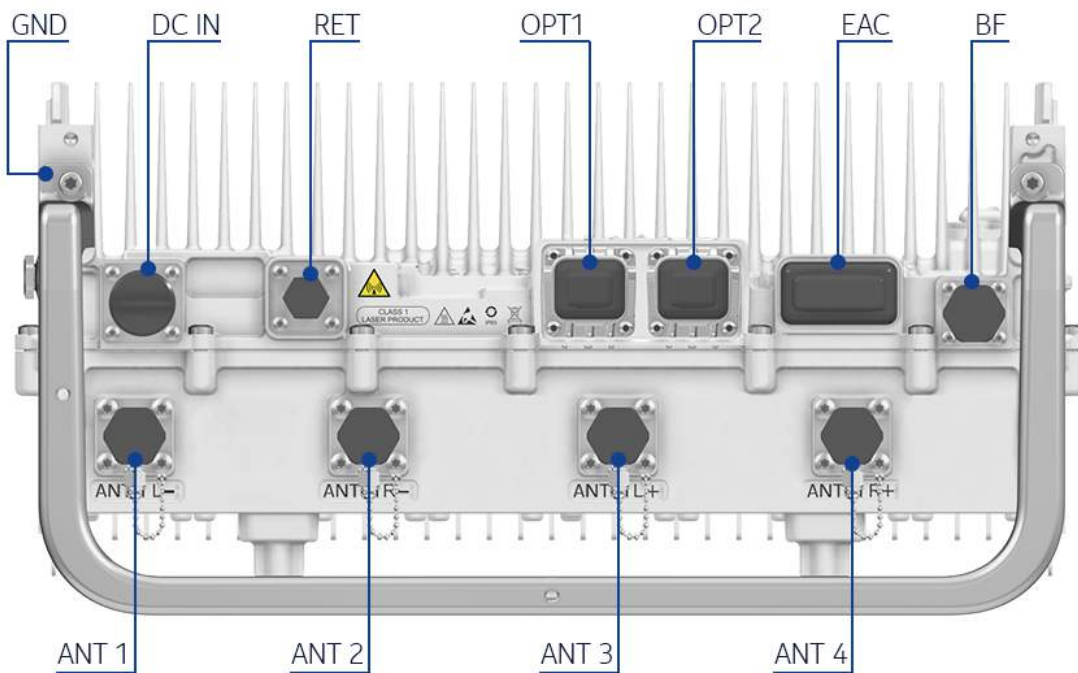


Table 593: AZQU interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	2-pole circular	APPB/APPC
Antenna connector	ANT	4	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 10 Gbps (SFP+) or 25 Gbps* (SFP28); Nokia IP seal
Beamforming	BF	1	4.3-10	AISG + Bias-T only
Grounding	GND 	1	2 x M5 screw	–

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

 Note:

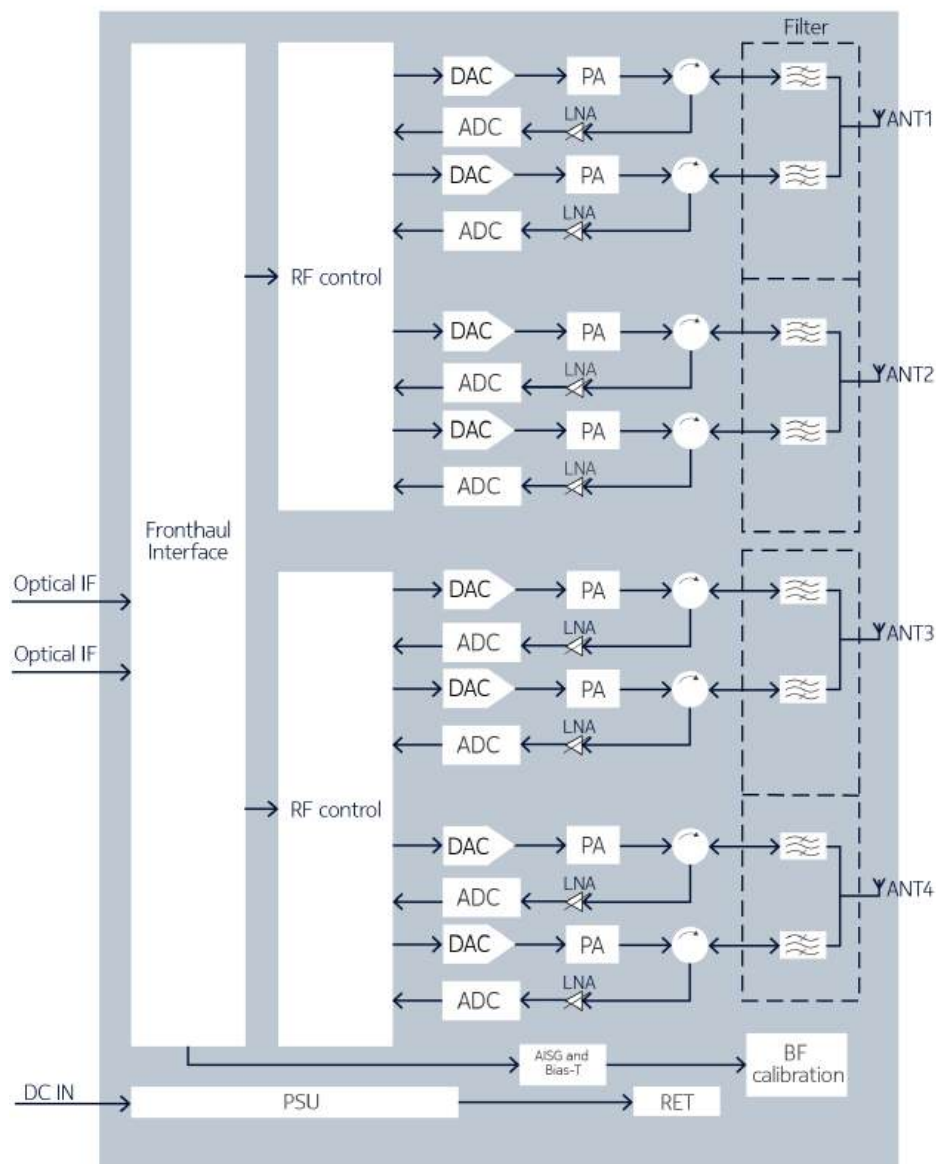
There is no AISG support on the antenna lines. AISG + DC for RETs is only available through the RET (RS-485) port.

Table 594: AZQU ALD support

ALD support through RS-485 port	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 177: AZQU functional block diagram



Electrical specifications

Table 595: AZQU electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	48 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 596: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

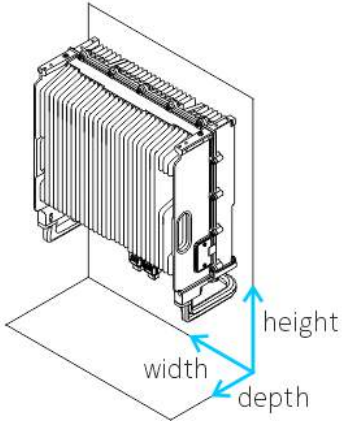
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- ASFG AirScale 8T8R TD RRH 395 mm fan unit (475796A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 597: AZQU dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 350 mm (13.78 in.)	
Width	Core RRH: 395 mm (15.55 in.)	
Depth	Core RRH: 190 mm (7.48 in.)	
Weight	Core RRH: 24.8 kg (52.0 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 598: AZQU environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.5 AirScale RRH 8T8R B38/n38 320 W (AZHN) (CPRI/eCPRI)

AZHN (475547A) is introduced by *SR002746* (for LTE CPRI), *CB006131* (for NR eCPRI), and *CB005965* (for eCPRI LTE-NR concurrent mode).

Functional description

Table 599: AZHN functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM (DL) LTE: 64 QAM (UL) NR: 256 QAM (UL)
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating mode	• 8T8R Beamforming • up to 2x 4T4R • up to 4x 2T2R • 4T4R/2T2R mix mode (non-beamforming)¹⁾
Supported technologies (standalone and MSR)	LTE, NR
Duplex mode	TDD
Concurrent mode	LTE-NR
Frequency range	n38 (n41*): 2575–2615 MHz *AZHN supports full band n38 and sub-band n41.
Instantaneous bandwidth (iBW)	40 MHz
Occupied bandwidth (oBW)	40 MHz
Number of carriers per pipe	NR: up to 2 LTE: up to 4
Supported bandwidths	LTE: 10, 15, 20 MHz NR: 10 ²⁾ , 20, 30, 40 MHz

¹⁾Operating mode introduced by *CB008970* feature.

²⁾NR bandwidth 10 MHz has been introduced by the *CB011173* feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 178: AZHN interfaces

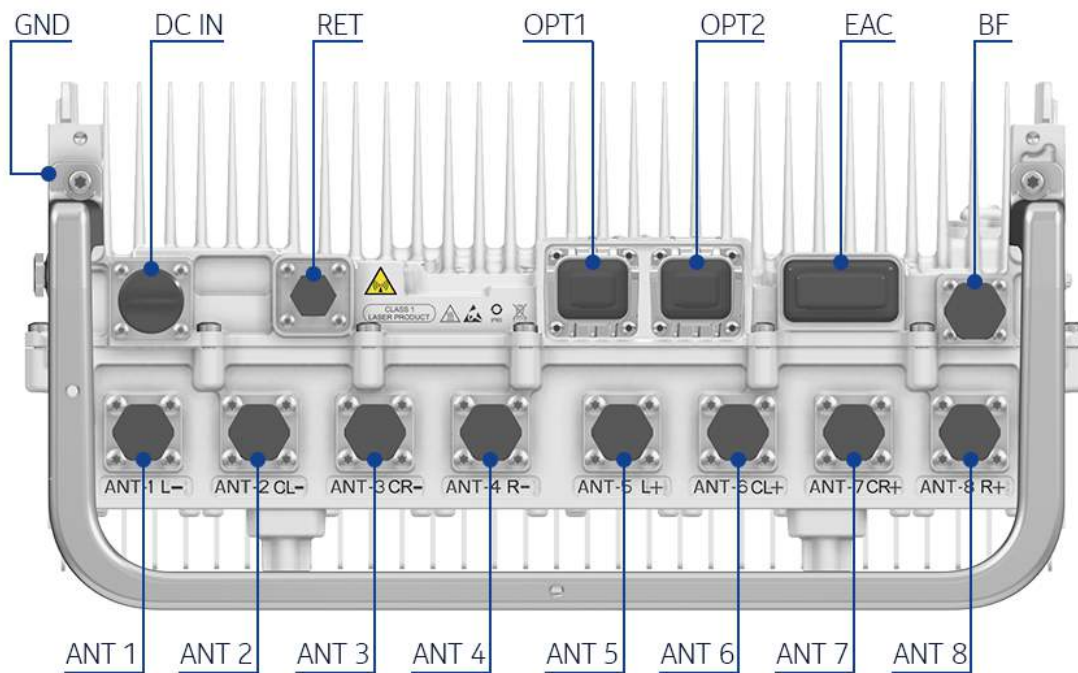


Table 600: AZHN interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	2-pole connector	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	• CPRI: 9.8 Gbps • eCPRI: 10 Gbps (SFP+) or 25 Gbps* (SFP28) • Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–
Fan	FAN	1	Nokia fan	Located in fins behind the BF connector

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Note:

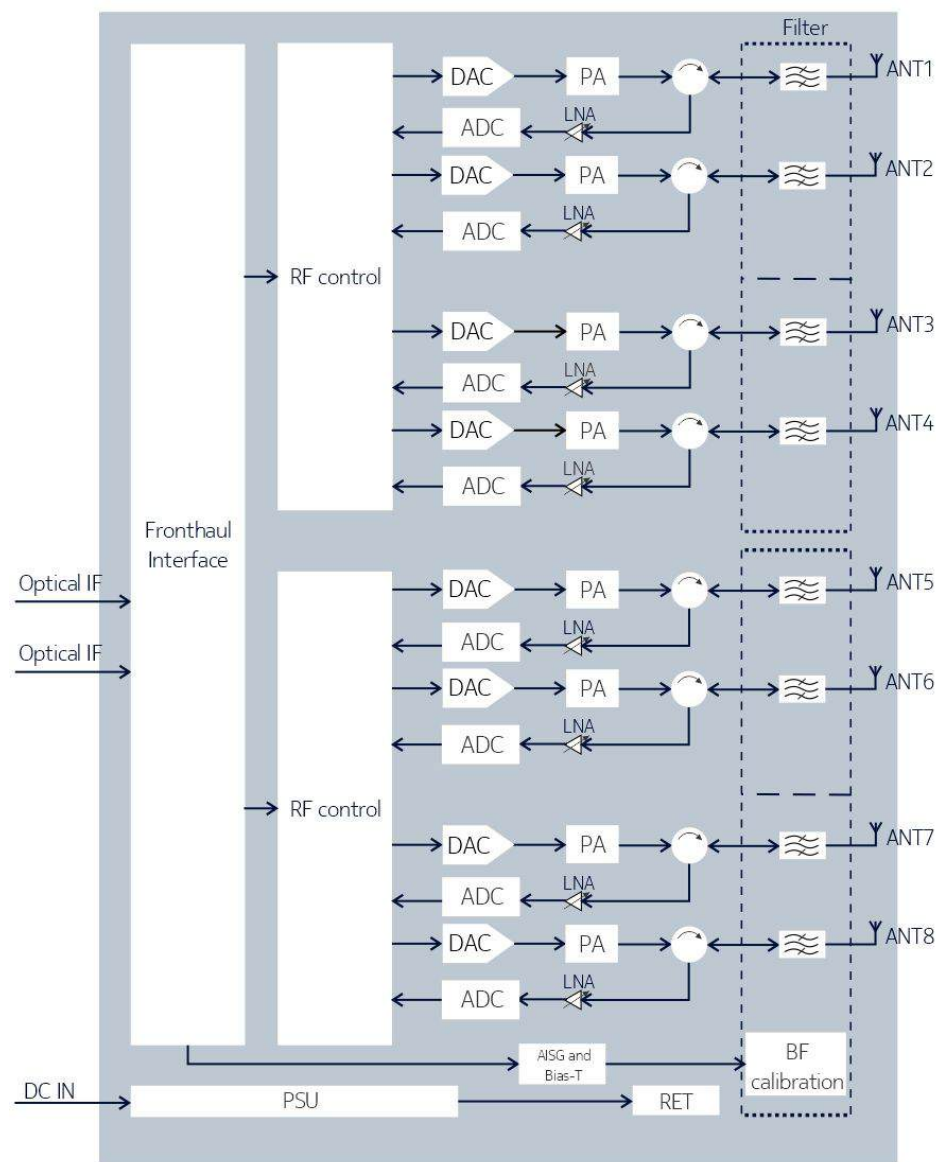
There is no AISG support on the antenna lines. AISG+DC for RETs is only available through the beamforming calibration port and the RET (RS-485) port.

Table 601: AZHN ALD support

ALD support through RS-485 port	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 179: AZHN functional block diagram



Electrical specifications

Table 602: AZHN electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw (I_{max}) (-36 V)*	48 A

*The I_{max} of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new I_{max} value. Note that the I_{max} given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 603: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

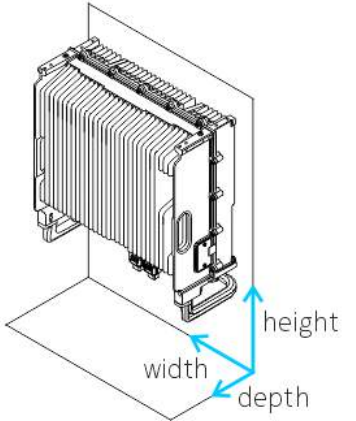
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- ASFG AirScale 8T8R TD RRH 395 mm fan unit (475796A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 604: AZHN dimensions and weight

Property	Value	Dimensions orientation
Height	350 mm (13.77 in.)	
Width	395 mm (15.55 in.)	
Depth	190 mm (7.48 in.)	
Weight	max. 24.5 kg (54.0 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 605: AZHN environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.6 AirScale RRH 8T8R B40 240 W (AZNB)

AZNB (474051A) is introduced by LTE3549 (for LTE).

Functional description

Table 606: AZNB functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Supported technologies (standalone and MSR)	LTE
Duplex mode	TDD
Frequency range	2300–2400 MHz
Filter bandwidth	100 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	80 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	10, 15, 20 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 180: AZNB interfaces

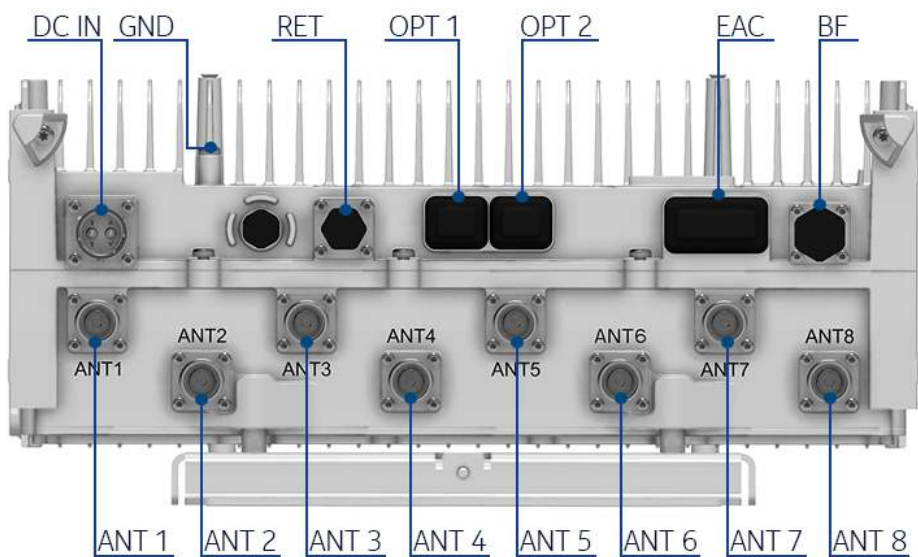


Table 607: AZNB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–
Fan	FAN	1	Nokia fan	Located on the opposite side



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

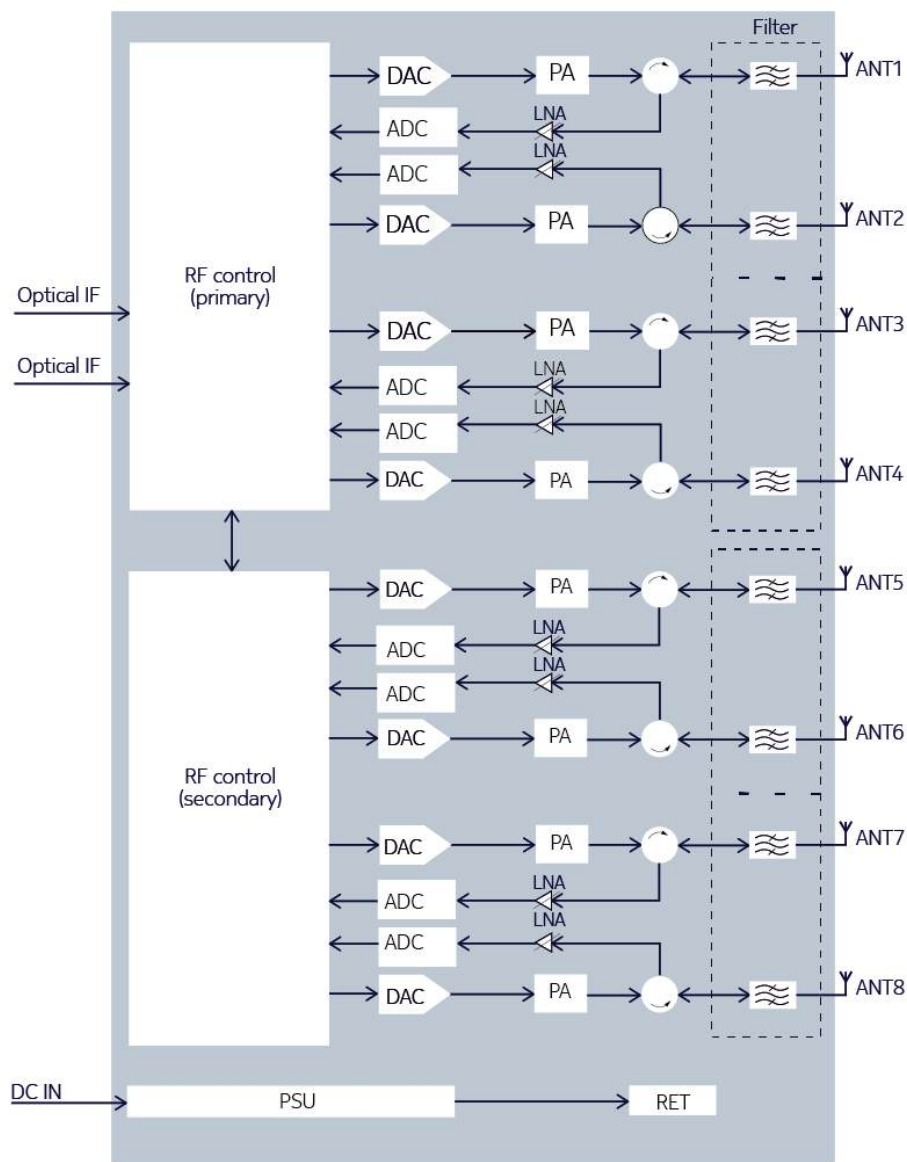
Antenna line device (ALD) support

Table 608: AZNB ALD support

ALD support through RS-485 port	Value
AISG	3.0 Main only
Voltage	14.5 V Main only
Power per port	30 W

Functional block diagram

Figure 181: AZNB functional block diagram



Electrical specifications

Table 609: AZNB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended power back-off

Table 610: Recommended AZNB power back-off in 256 QAM

Carrier configuration	Power reduction [dB]
Multiple carriers, continuous	1.5
Multiple carriers, non-continuous	2
Single carrier	1

Related optional items

- AMBG AirScale book mount kit 151-175 (474467A)
- AMGN AirScale 2 cover 395 x 150-175 (474535A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ASFD AirScale 2 TD RRH 8-pipe fan unit (474485A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

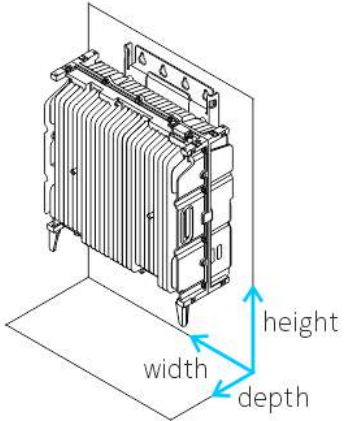
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 611: AZNB dimensions and weight

Property	Value	Dimensions orientation
Height	385 mm (15.16 in.) With upper and lower mounting brackets: 469 mm (18.46 in.)	
Width	395 mm (15.55 in.)	
Depth	160 mm (6.3 in.) With mounting brackets: 185.5 mm (7.3 in.)	
Weight	22 kg (48.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 612: AZNB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.7 AirScale RRH 8T8R B40/n40 240 W (AZNC)

AZNC (474052A) is introduced by LTE3550 (for LTE) and CB006968 (for NR).

Functional description

Table 613: AZNC functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE–NR
Duplex mode, supported standard	TDD
Frequency range	B40/n40: 2350–2390 MHz
Filter bandwidth	40 MHz
Instantaneous bandwidth (iBW)	40 MHz
Occupied bandwidth (oBW)	40 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	LTE: 10, 15, 20 MHz NR: 20, 30 ²⁾ , 40 ¹⁾ MHz

¹⁾ NR bandwidth 40 MHz introduced by *CB007331* feature.

²⁾ NR bandwidth 30 MHz introduced by *CB009104* feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 182: AZNC interfaces

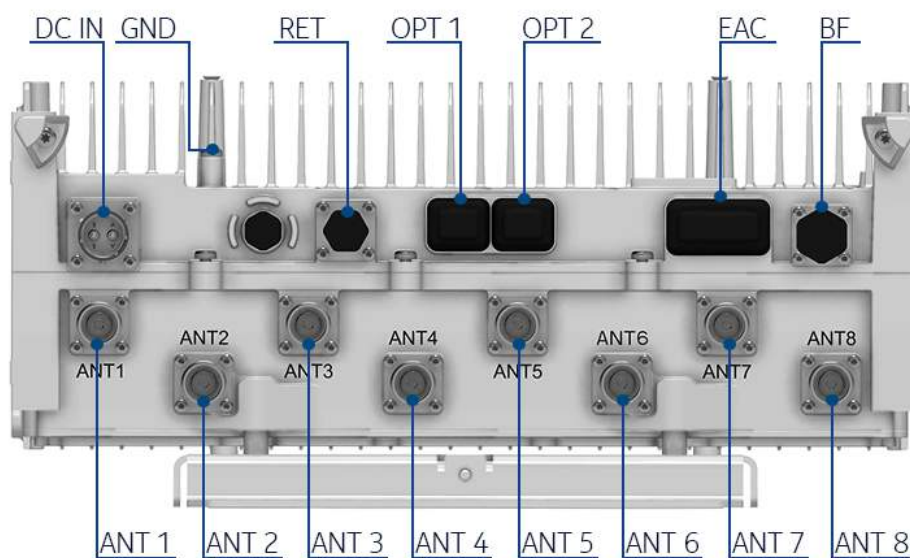


Table 614: AZNC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–
Fan	FAN	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

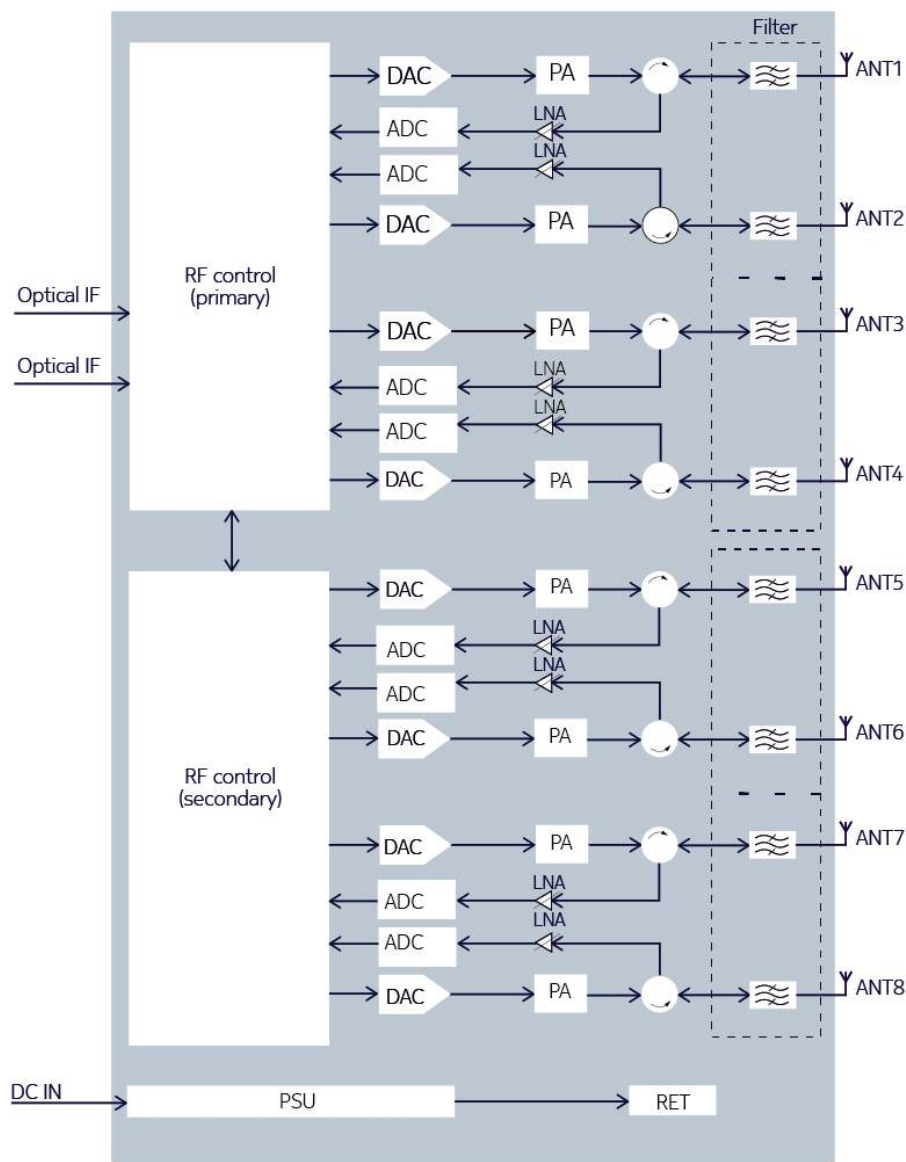
Antenna line device (ALD) support

Table 615: AZNC ALD support

ALD support through RS-485 port	Value
AISG	2.0
Voltage	14.5 V
Power per port	30 W

Functional block diagram

Figure 183: AZNC functional block diagram



Electrical specifications

Table 616: AZNC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	30 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended power back-off

Table 617: Recommended AZNC power back-off in 256 QAM

Carrier configuration	Power reduction [dB]
Continuous	1.5
Non-continuous	2

Table 618: AZNC power back-off in 5G

Property	Single carrier		Multi carrier (non contiguous)	
Pmax (dBm)	Pmax <43	Pmax=44.8	Pmax <41.8	Pmax=41.8
Recommended backoff (dB): dlQam256PowerBackoffSub6	1.5	1.7	1.5	2.1

Note:

Values in the table are valid only when the actDLLowPAPROptimizedPrecoding parameter is set to true.

Related optional items

- AMBG AirScale book mount kit 151–175 (474467A)
- AMGN AirScale 2 cover 395 x 150–175 (474535A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRB AirScale one clip bracket 126–200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26–open EAC cable 5 m (474288A)
- ASFD AirScale 2 TD RRH 8-pipe fan unit (474485A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - Horizontal with an optional fan

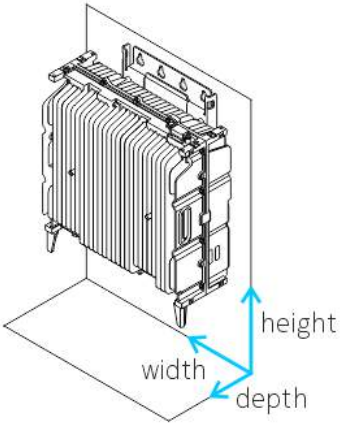
- One-clip rail
- Book mounting

! Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 619: AZNC dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 385 mm (15.16 in.) With upper and lower mounting brackets: 469 mm (18.46 in.)	
Width	395 mm (15.55 in.)	
Depth	Core RRH: 160 mm (6.3 in.) With mounting brackets: 185.5 mm (7.3 in.)	
Weight	max. 22 kg (48.5 lb)	

Environmental specifications

i Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 620: AZNC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.8 AirScale RRH 8T8R n40 320 W eCPRI (AKNA)

AKNA (475945A) is introduced by *CB007364* (for NR), *CB007858* (for LTE 1-2CC), *CB010279* (for LTE 3-4CC), and *CB009489* (for LTE-NR concurrent mode).

Functional description

Table 621: AKNA functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating mode	8T8R full mode 2x 4T4R or 4x 2T2R split mode (non-beamforming) 4T4R/2T2R mix mode (non-beamforming)*
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	TDD
Frequency range	n40: 2350-2390 MHz
Instantaneous bandwidth (iBW)	40 MHz
Occupied bandwidth (oBW)	40 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 10, 15, 20 MHz NR: 20, 30, 40 MHz

*Operating mode introduced by CB008970 feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 184: AKNA interfaces

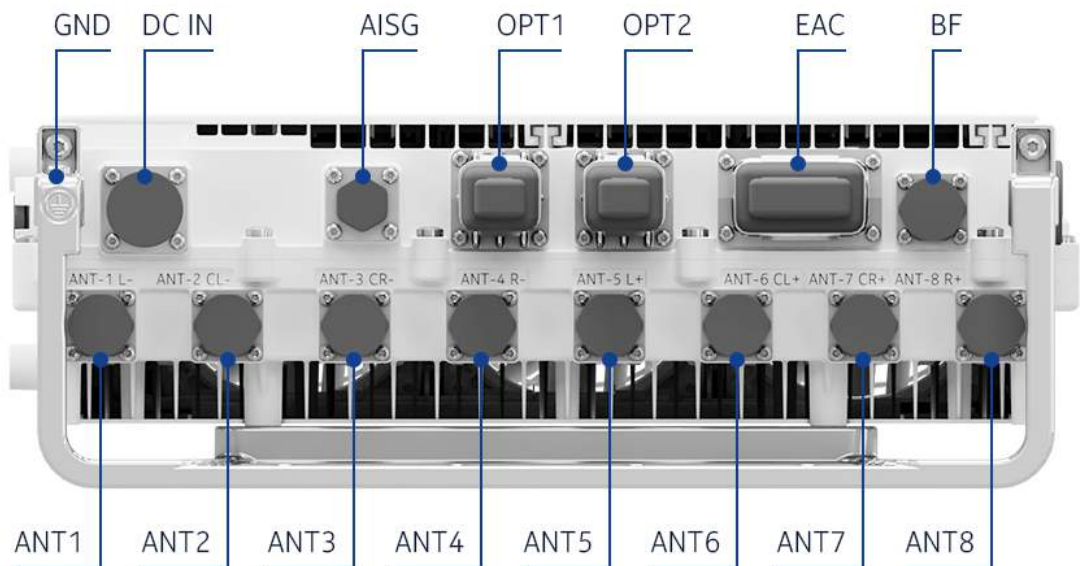


Table 622: AKNA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPC
Antenna	ANT	8	4.3-10	–
Antenna Interface Standards Group	AISG	1	8-pin circular	–
External alarm connection	EAC	1	MDR26	–
Optical	OPT	2	SFP28, SFP+	eCPRI: 25 Gbps (SFP28) and 10 Gbps (SFP+); Nokia IP seal; Support of self-tunable DWDM* SFP introduced by the <i>CB006519: SFP Controlled Fronthaul DWDM Auto-tuning</i> feature.
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–

*DWDM – dense wavelength division multiplexing



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

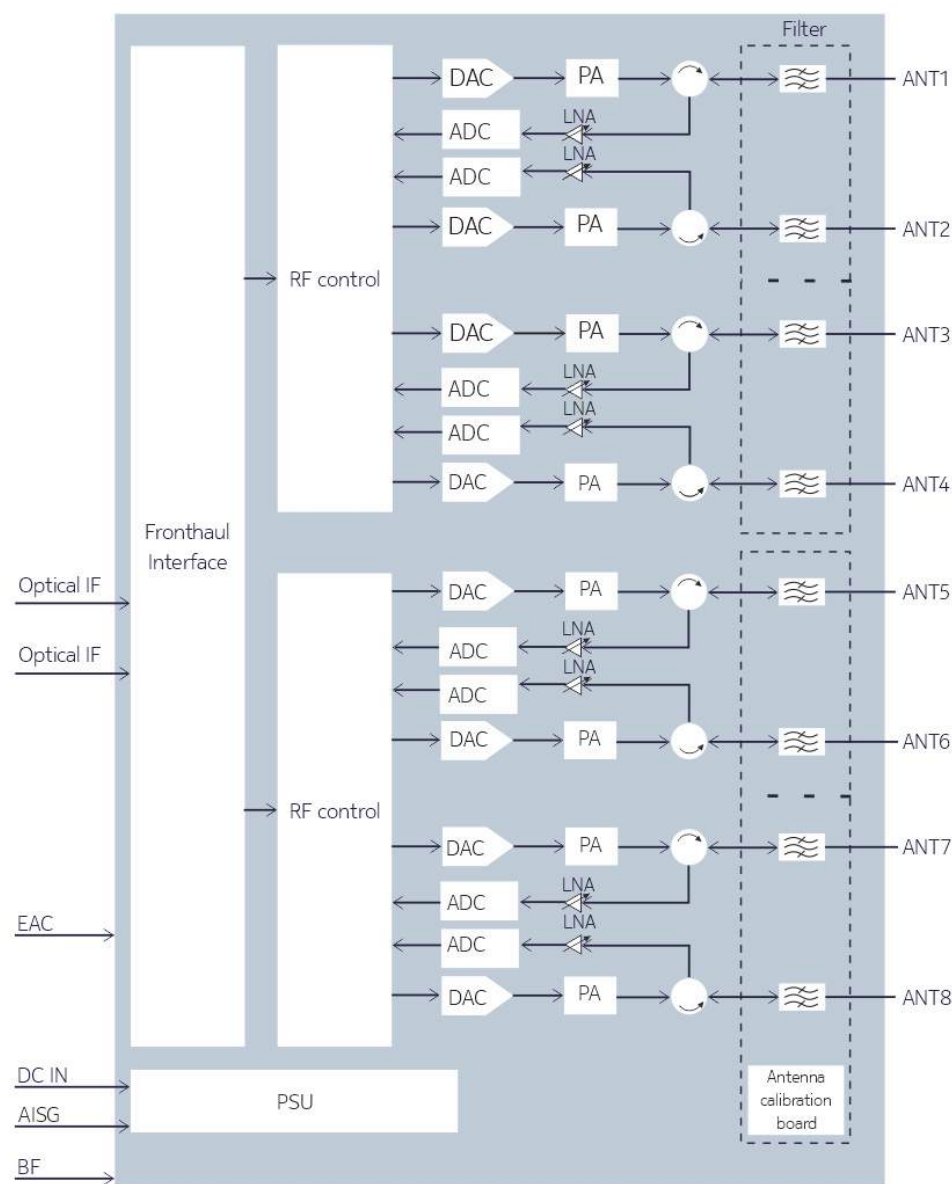
Antenna line device (ALD) support

Table 623: AKNA ALD support

Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	25 W

Functional block diagram

Figure 185: AKNA functional block diagram



Electrical specifications

Table 624: AKNA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw ($I_{\max}$) (-36 V)*	55 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 625: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMBE AirScale book mount kit 101–125 (474277A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAD AirScale MDR26-open EAC cable 5 m (475570A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–300 mm) (472821A)

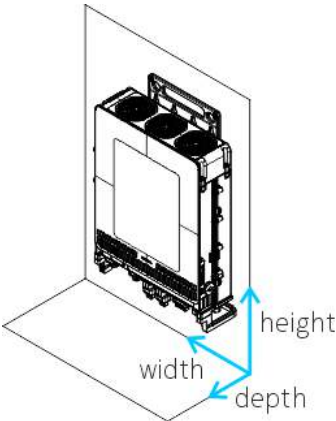
Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - One-clip rail

- Book mounting

Dimensions and weight

Table 626: AKNA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 445 mm (17.52 in.)	
Width	Core RRH: 360 mm (14.17 in.)	
Depth	Core RRH: 110 mm (4.33 in.)	
Weight	Core RRH: 15.6 kg (34.39 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 627: AKNA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

6.9 AirScale RRH 8T8R n40 400 W eCPRI (AKNB)

AKNB (475980A) is introduced by *CB007845* (for NR), *CB007858* (for LTE 1-2CC), *CB010279* (for LTE 3-4CC), and *CB009489* (for LTE-NR concurrent mode).

Functional description

Table 628: AKNB functional specification

Property	Value
Maximum output power	400 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating mode	8T8R full mode 2x 4T4R or 4x 2T2R split mode (non-beamforming) 4T4R/2T2R mix mode (non-beamforming)*
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	TDD
Frequency range	n40: 2300-2400 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 4
Maximum number of UL/DL MIMO streams	Up to 8
Supported bandwidths	LTE: 10, 15, 20 MHz NR: 20, 30, 40, 50, 60, 80, 90, 100 MHz

*Operating mode introduced by CB008970 feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 186: AKNB interfaces

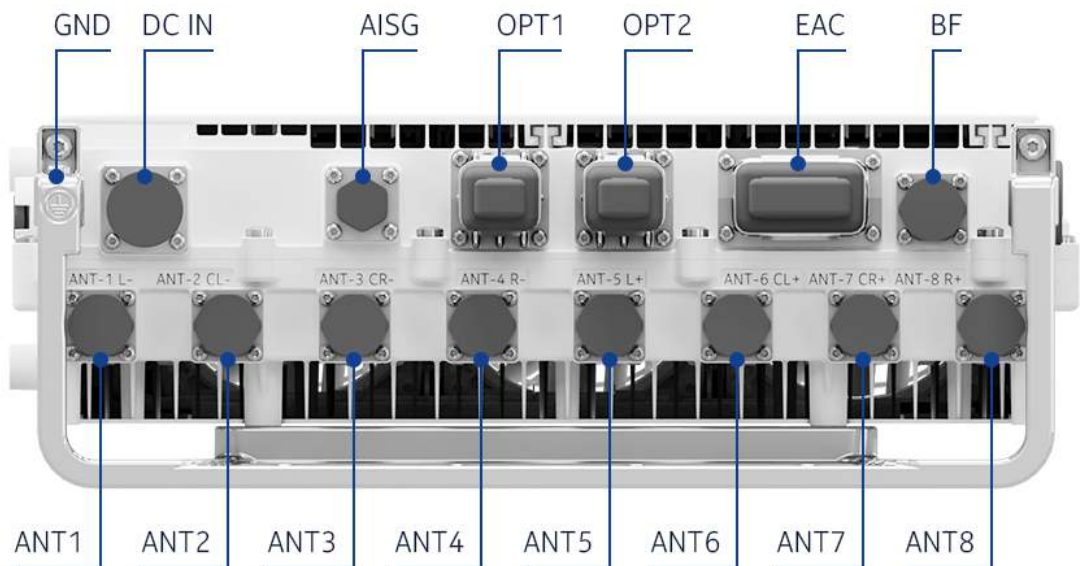


Table 629: AKNB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPC
Antenna	ANT	8	4.3-10	–
Antenna Interface Standards Group	AISG	1	8-pin circular	–
External alarm connection	EAC	1	MDR26	–
Optical	OPT	2	SFP28, SFP+	eCPRI: 25 Gbps (SFP28) and 10 Gbps (SFP+); Nokia IP seal; Support of self-tunable DWDM* SFP introduced by the <i>CB006519: SFP Controlled Fronthaul DWDM Auto-tuning feature.</i>
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–

*DWDM – dense wavelength division multiplexing

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

 WARNING!

Risk of low-noise amplifier (LNA) damage

If output power of any port of AKNB radio unit is set to more than 40 W (46 dBm), before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not meet, there is a high risk that the LNA will be damaged in case RF power is accidentally on.

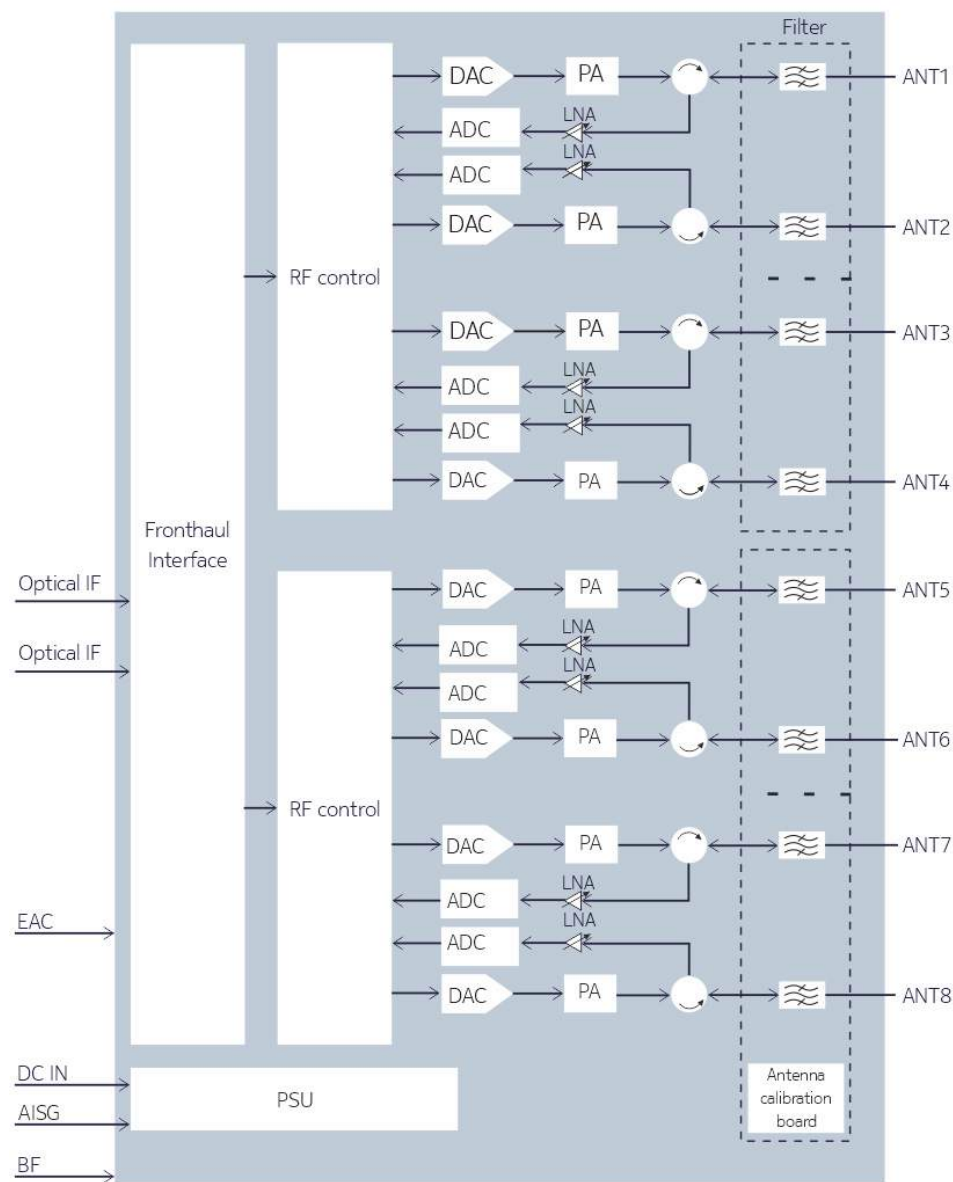
Antenna line device (ALD) support

Table 630: AKNB ALD support

Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	25 W

Functional block diagram

Figure 187: AKNB functional block diagram



Electrical specifications

Table 631: AKNB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw ($I_{\max}$) (-36 V)*	55 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 632: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMBE AirScale book mount kit 101–125 (474277A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAD AirScale MDR26-open EAC cable 5 m (475570A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–295 mm) (472821A)

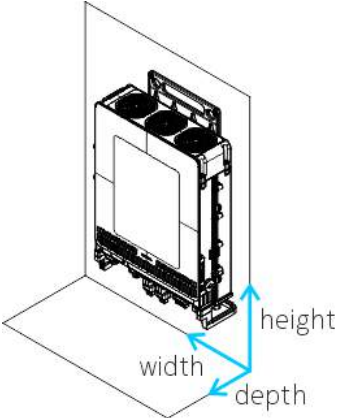
Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - One-clip rail

- Book mounting

Dimensions and weight

Table 633: AKNB dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 445 mm (17.52 in.)	
Width	Core RRH: 360 mm (14.17 in.)	
Depth	Core RRH: 110 mm (4.33 in.)	
Weight	Core RRH: 15.4 kg (33.95 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 634: AKNB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

6.10 AirScale RRH 8T8R B41/n41 320 W CPRI/eCPRI (AZHL)

AZHL (475432A) is introduced by SR002812 (for LTE CPRI), 5GC002305 (for NR CPRI), SR002975 (for LTE eCPRI and LTE-NR concurrent mode), and 5GC002270 (for NR eCPRI and LTE-NR concurrent mode).

Functional description

Table 635: AZHL functional specification

Property	Value
Maximum output power	320 W
Modulation	Up to 256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating modes	• 8T8R • (1-2)²⁾ x 4T4R (non-beamforming) • (1-4)²⁾ x 2T2R (non-beamforming) • 1 x 4T4R/2 x 2T2R mix mode (non-beamforming)¹⁾  Note: Beamforming (BF) is available only in 8T8R mode.
Supported technologies	LTE, NR
Concurrent mode	LTE-NR (eCPRI only)
Duplex mode, supported standard	TDD
Frequency range	2496-2690 MHz
Instantaneous bandwidth (iBW)	194 MHz
Occupied bandwidth (oBW)	190 MHz
Number of carriers per pipe	NR: up to 3 ²⁾ LTE: up to 4
Maximum number of UL/DL MIMO streams	8
Supported bandwidths	NR: 10 ³⁾ , 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz LTE: 10, 15, 20 MHz

¹⁾Operating mode introduced by CB008970 feature.

²⁾Change introduced by CB009085 feature.

³⁾NR bandwidth 10 MHz has been introduced by the CB011173 feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 188: AZHL interfaces

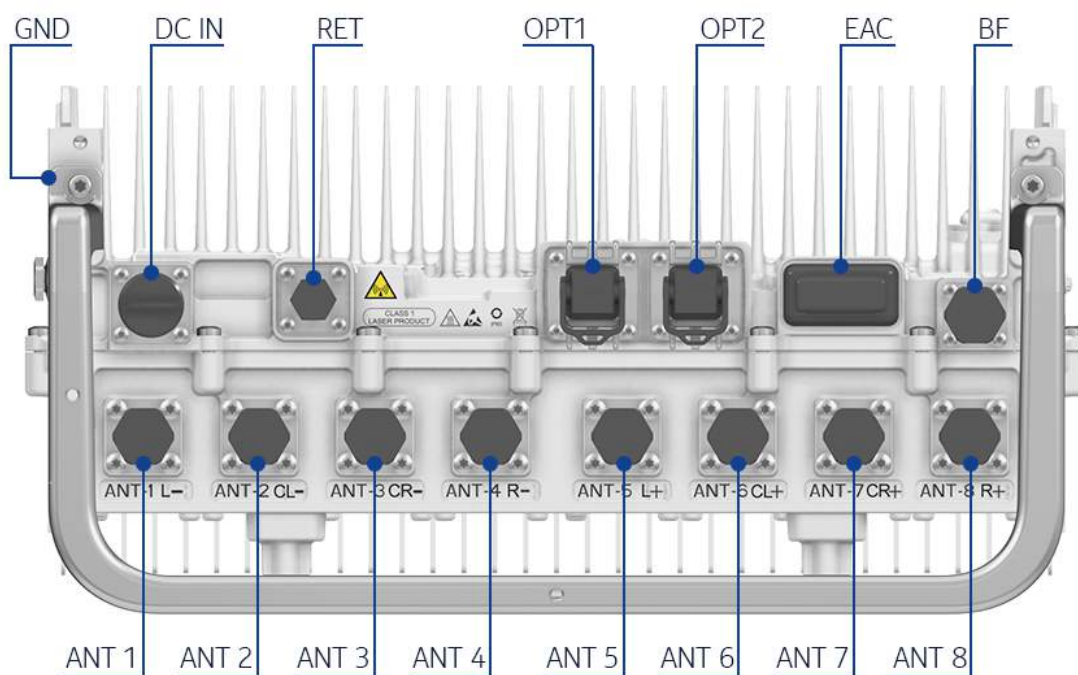


Table 636: AZHL interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	CPRI: 9.8 Gbps, eCPRI: 10 Gbps (SFP+) or 25 Gbps* (SFP28); OCTIS universal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–
Fan	FAN	1	Nokia fan	Located in the fins behind the BF connector

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Note:

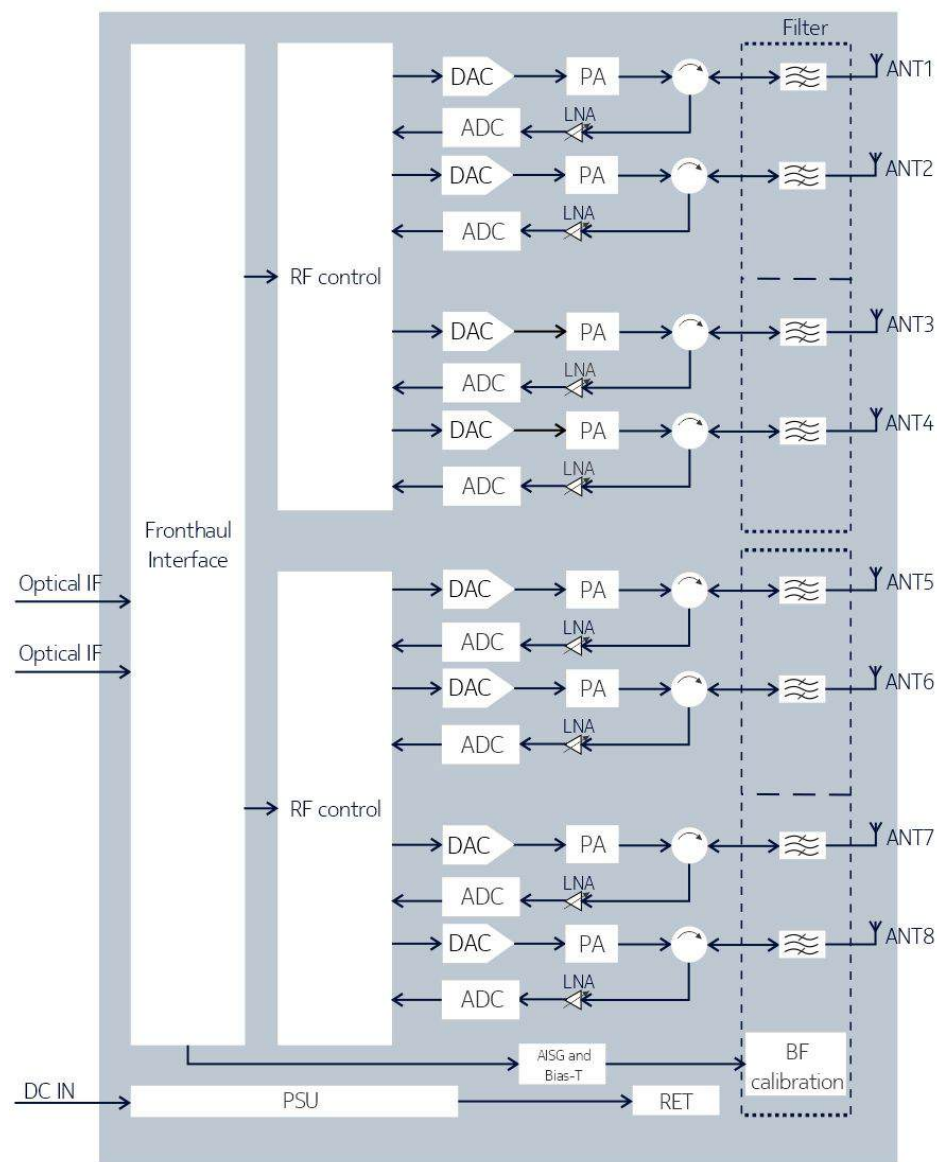
Recommended value for VSWR major and minor alarm threshold is 3.5.

Table 637: AZHL ALD support

ALD support through RS-485 port	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 189: AZHL functional block diagram



Electrical specifications

Table 638: AZHL electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	48 A

* The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 639: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

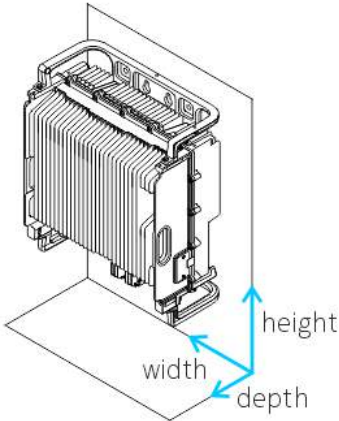
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- ASFG AirScale 8T8R TD RRH 395 mm fan unit (475796A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- AOPE OCTIS universal plug kit (475153A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 640: AZHL dimensions and weight

Property	Value	Dimensions orientation
Height	350 mm (13.77 in.)	
Width	395 mm (15.55 in.)	
Depth	190 mm (7.48 in.)	
Weight	max. 23.7 kg (52.2 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 641: AZHL environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.11 AirScale RRH 8T8R n41 320 W eCPRI (AZHM)

AZHM (475546A) is introduced by 5GC002336 (for NR) and CB006124 (for LTE and LTE-NR concurrent mode).

Functional description

Table 642: AZHM functional specification

Property	Value
Maximum output power	320 W
Modulation	Up to 256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating modes	Beamforming mode: • One or two cells 8T8R with 8-port calibrated BF antenna Non beamforming mode: • Up to four cells 2T2R or two cells 4T4R with uncalibrated TRX antenna • 4T4R/2T2R mix mode (non-beamforming)*
Concurrent mode	LTE-NR
Supported technologies	NR, LTE
Duplex mode, supported standard	TDD
Frequency range	2515-2675 MHz
Instantaneous bandwidth (iBW)	NR: 160 MHz LTE: 160 MHz
Occupied bandwidth (oBW)	NR: 160 MHz LTE: 80 MHz
Number of carriers per pipe	NR: Up to 2 LTE: Up to 4
Maximum number of UL/DL MIMO streams	Up to 8
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz LTE: 10, 15, 20 MHz

*Operating mode introduced by CB008970 feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 190: AZHM interfaces

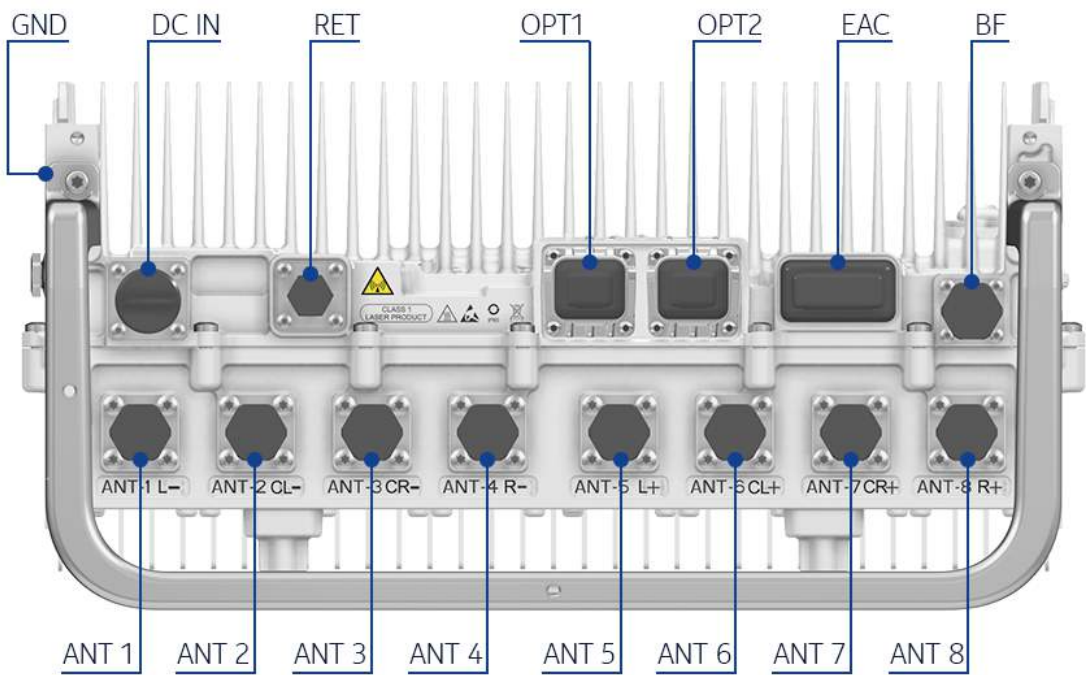


Table 643: AZHM interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 10 Gbps (SFP+) and 25 Gbps* (SFP28); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–
RF monitor	–	8	SMA, female	Located under each antenna connector

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

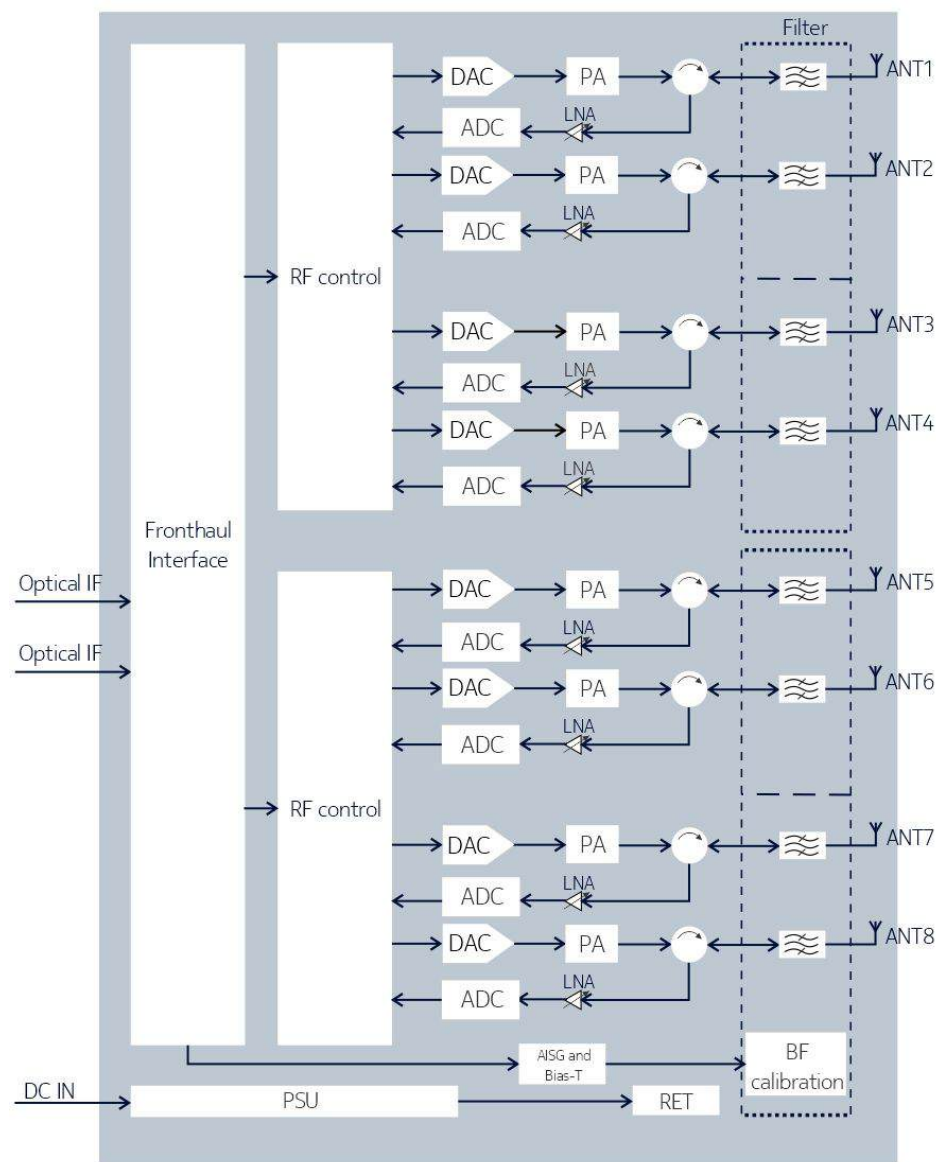
Antenna line device (ALD) support

Table 644: AZHM ALD support

Property	Value
AISG	2.0
Voltage	14.5 V
Power per port	30 W, 45 W total

Functional block diagram

Figure 191: AZHM functional block diagram



Electrical specifications

Table 645: AZHM electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw (I_{max}) (-36 V)*	48 A

*The I_{max} of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new I_{max} value. Note that the I_{max} given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 646: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

 Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- ASFG AirScale 8T8R TD RRH 395 mm fan unit (475796A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

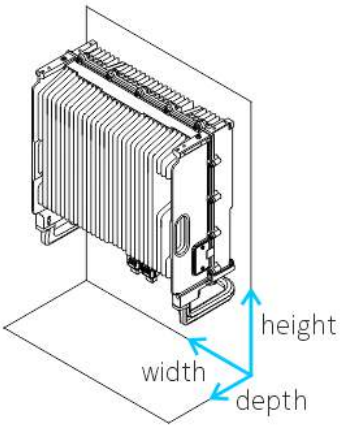
Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical

- One-clip rail
- Book mounting

Dimensions and weight

Table 647: AZHM dimensions and weight

Property	Value	Dimensions orientation
Height	350 mm (13.78 in.)	
Width	395 mm (15.55 in.)	
Depth	190 mm (7.48 in.)	
Weight	max. 23.0 kg (50.7 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 648: AZHM environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.12 AirScale RRH 8T8R n41/B41 400 W (AKHD)

AKHD (476461A) is introduced by *CB011115* (for LTE, NR, and LTE-NR concurrent mode).

Functional description

Table 649: AKHD functional specification

Property	Value
Maximum output power	400 W
Modulation	256 QAM
Number of TXX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating mode	• 8T8R full mode (beamforming) • 2x 4T4R or 4x 2T2R split mode (non-beamforming) • 2x 2T2R + 4T4R mix mode (non-beamforming)
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	TDD
Frequency range	n41/B41: 2496–2690 MHz
Instantaneous bandwidth (iBW)	194 MHz
Occupied bandwidth (oBW)	190 MHz
Number of carriers per pipe	NR: up to 2 LTE: up to 4
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz LTE: 10, 15, 20 MHz

Property	Value
Limitations	• When switching from LTE or NR dedicated mode to concurrent mode, you need to manually reset the radio unit (RU). You don't need to reset the RU when switching from concurrent mode to dedicated mode. • In NR 2CC concurrent mode, you can't set long PRACH and short PRACH in two different NR cells. In NR dedicated, LTE concurrent, and LTE dedicated modes, you can set PRACH freely. • For NR ≥ 60 MHz, the total concurrent mode carrier number is decreased from 4CC to 3CC. • PSD between LTE or NR carriers must be the same. • Maximum carrier number is: - 8CC for NR (non-beamforming). - 16CC for LTE and LTE-NR. • In LTE-NR concurrent mode, carrier configuration is divided into two blocks in the iBW per pipe. The sum of all carrier channel bandwidths in each block is ≤ 100 MHz and ≥ 20 MHz (only continuous carriers are allowed in each block). • In LTE-NR concurrent mode (non-beamforming), the following configurations are supported: 1CC (NR) + 3CC (LTE), and 2CC (NR) + 2CC (LTE). You can mix them in the different sectors.

- PRACH - physical random access channel
- PSD - power spectral density

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 192: AKHD interfaces

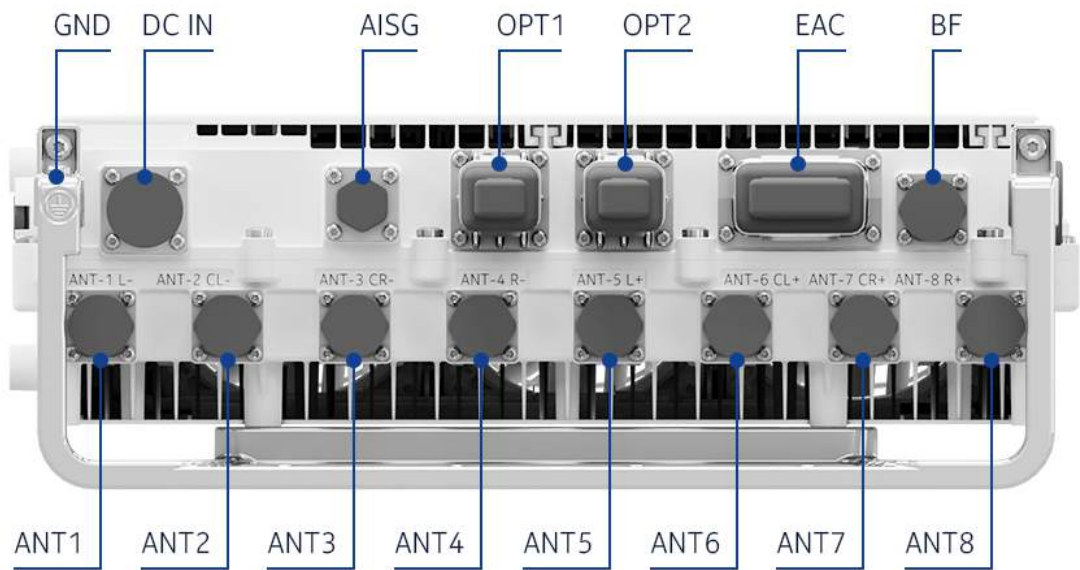


Table 650: AKHD interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPC
Antenna connector	ANT	8	4.3-10	–
Antenna Interface Standards Group	AISG	1	8-pin circular	–
External alarm connector	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 25 Gbps (SFP28) and 10 Gbps (SFP+); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

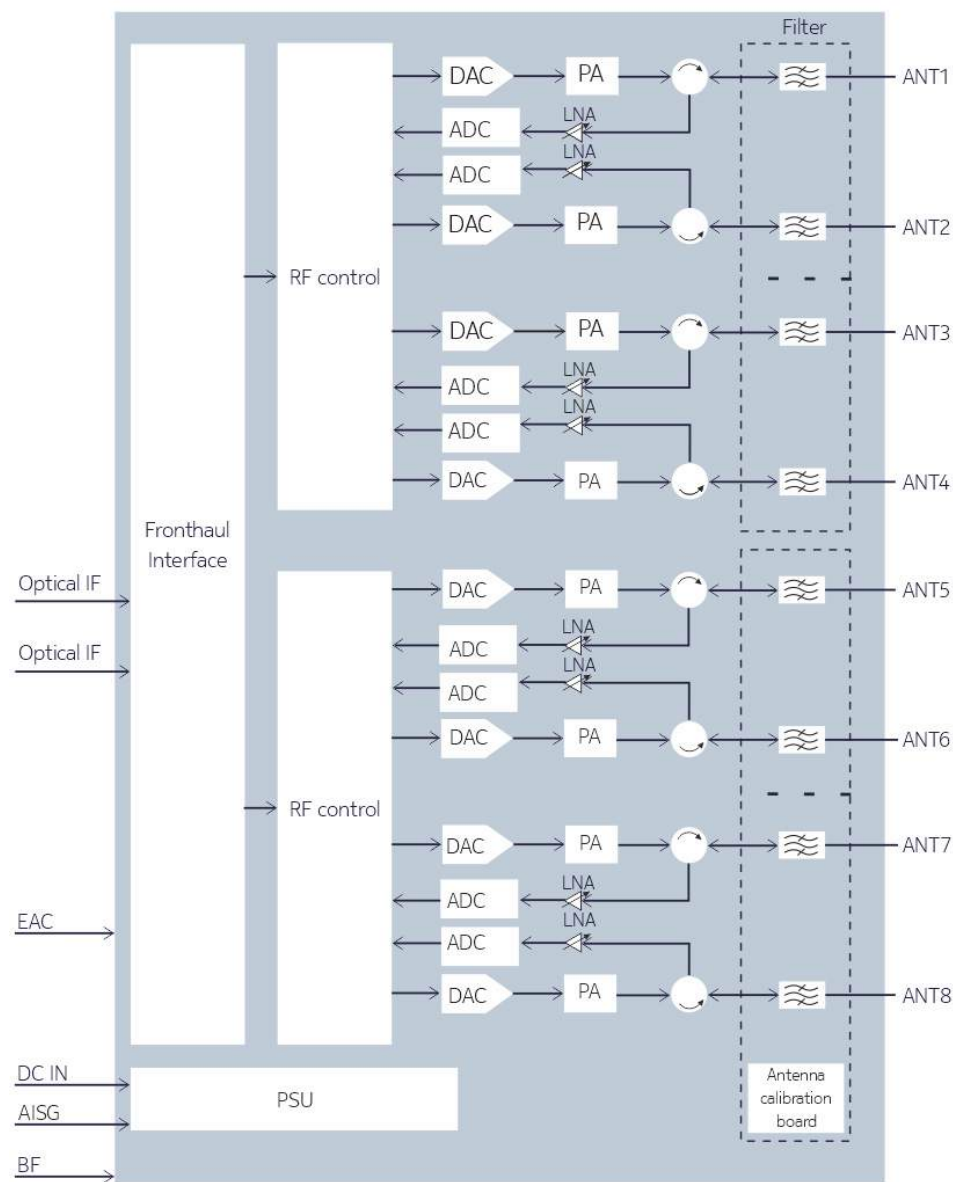
Antenna line device (ALD) support

Table 651: AKHD ALD support

Property	Value
AISG	Version 2.0 or 3.0
Voltage	24 V
Power per port	25 W total

Functional block diagram

Figure 193: AKHD functional block diagram



Electrical specifications

Table 653: AKHD electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw ($I_{\max}$) (-36 V)*	55 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 654: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60– 300 mm) (472821A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBE AirScale book mount kit 101–125 (474277A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- AOPC SFP weatherproofing boot kit (475151A)
- ASAD AirScale MDR26-open EAC cable 5 m (475570A)

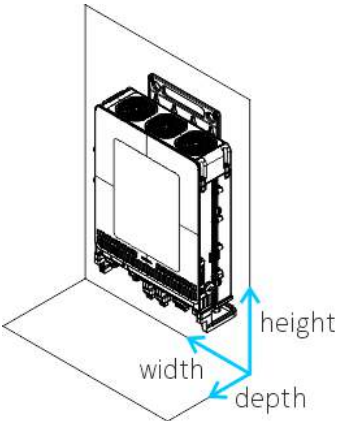
Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - One-clip rail

- Book mounting

Dimensions and weight

Table 655: AKHD dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 445 mm (17.52 in.)	
Width	Core RRH: 360 mm (14.17 in.)	
Depth	Core RRH: 110 mm (4.33 in.)	
Weight	Core RRH: 15.3 kg (33.7 lb.)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 656: AKHD environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

6.13 AirScale RRH 8T8R n77 160 W (AZQO) (eCPRI)

AZQO (475288A) is introduced by 5GC002024 (for NR eCPRI).

Functional description

Table 657: AZQO functional specification

Property	Value
Maximum output power	160 W
Modulation	Up to 256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating modes	BF mode: • One cell 8T8R with 8-port calibrated BF antenna (one sector, one carrier, 4 antennas/ports per polarization) Non BF mode: • 2T2R for 2-port passive antennas (up to two sectors, one carrier) • 4T4R for 4-port passive antennas (one sector, one carrier) • 2x4T4R sub-sectors for 4-port passive antennas (one sector, one carrier) • 4x2T2R sub-sectors for 2-port passive antennas (one sector, one carrier) • 4T4R/2T2R mix mode (non-beamforming)*
Software supported technologies	NR
Duplex mode, supported standard	TDD
Frequency range	n77: 3900–4100 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 1
Maximum number of UL/DL MIMO streams	8 (with 1x25 GE or 2x10 GE)
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, and 100 MHz

*Operating mode introduced by CB008970 feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 194: AZQO interfaces

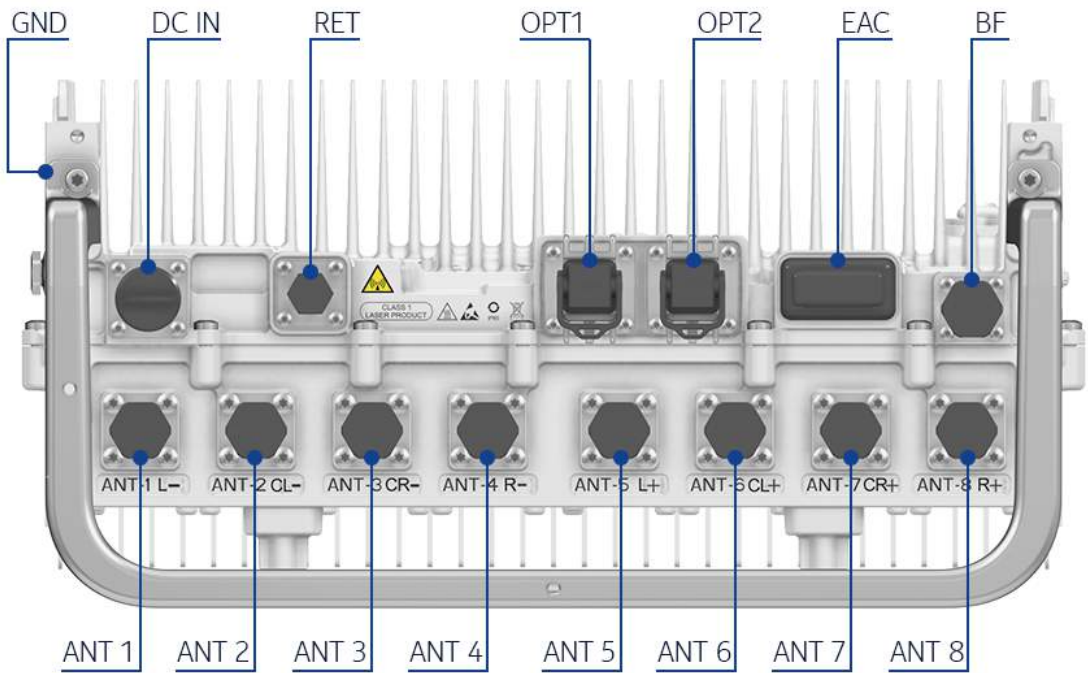


Table 658: AZQO interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 10 Gbps (SFP+) and 25 Gbps* (SFP28); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–
RF Monitor	–	8	SMA, female	–

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Note:

There is no AISG support on the antenna lines. AISG+DC for RETs is only available through the beamforming calibration port and the RET (RS-485) port.

Note:

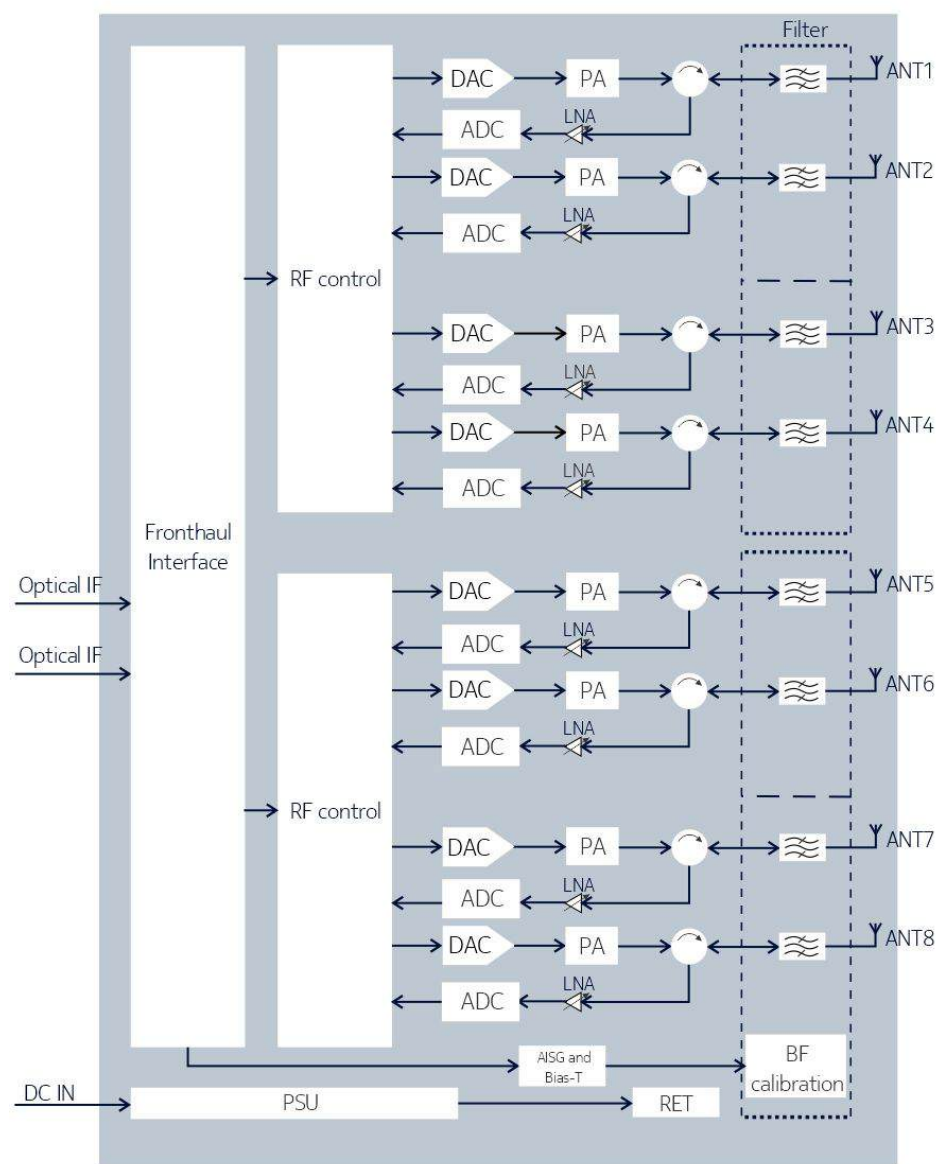
Recommended value for VSWR major and minor alarm threshold is 3.5.

Table 659: AZQO ALD support

ALD support through RS-485 port	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 195: AZQO functional block diagram



Electrical specifications

Table 660: AZQO electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	31 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.



Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 661: The recommended NRCELL PDSCH power back-off for 256 QAM (dLQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dLQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

Installation options

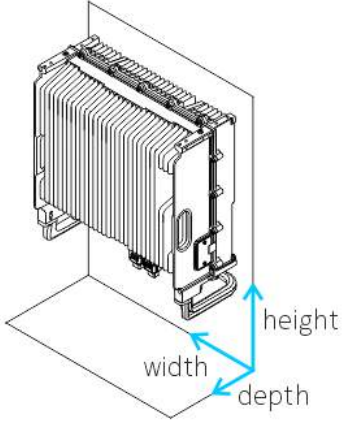
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Notice:

To ensure convection cooling of RRHs without fans always mount the RRH vertically with the connectors facing down.

Dimensions and weight

Table 662: AZQO dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 350 mm (13.78 in.)	
Width	Core RRH: 395 mm (15.55 in.)	
Depth	Core RRH: 165 mm (6.50 in.)	
Weight	Core RRH: 23 kg (50.7 lb)	

Note:

Dimensions and weight provided for core RRH, without heat shield, fan and mounting brackets.

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 663: AZQO environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

6.14 AirScale RRH 8T8R n77 320 W (AKQW)

AKQW (475979A) is introduced by CB007844 (for NR).

Functional description

Table 664: AKQW functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM (DL and UL)
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating mode	8T8R full mode 2x 4T4R or 4x 2T2R split mode (non-beamforming) 4T4R/2T2R mix mode (non-beamforming)
Supported technologies	NR
Duplex mode	TDD
TX frequency range	n77: 3700–3980 MHz
RX frequency range	n77: 3700–3980 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	200 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	20, 30, 40, 50, 60, 70, 80, 90, 100 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 196: AKQW interfaces

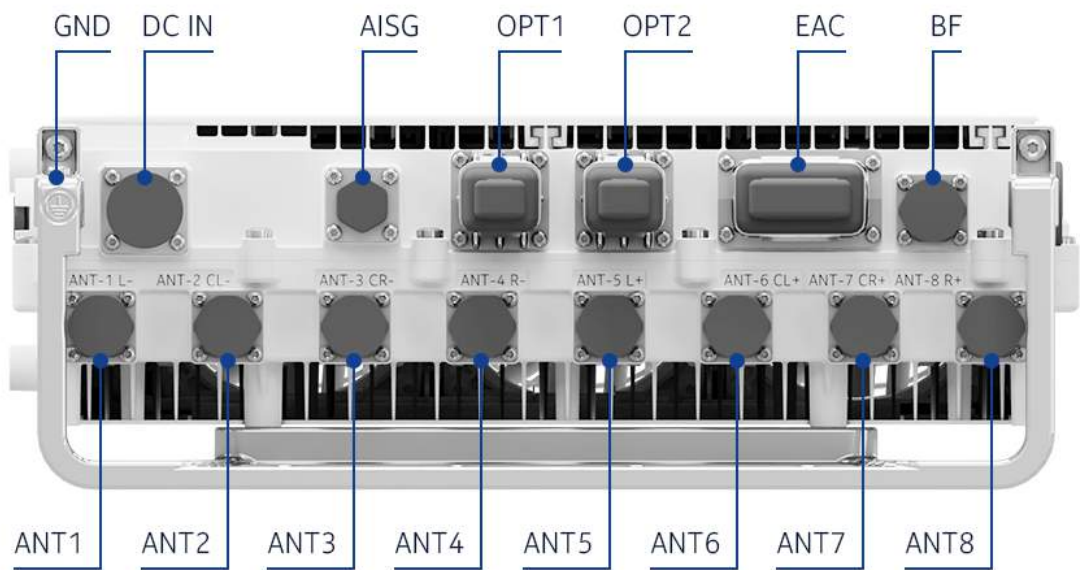


Table 665: AKQW interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPB, APPC
Antenna	ANT	8	4.3-10	–
External alarm connection	EAC	1	MDR26	–
Optical	OPT	2	SFP28, SFP+	eCPRI: 25 Gbps (SFP28) or 10 Gbps (SFP+), Nokia IP seal; Support of self-tunable DWDM* SFP introduced by the CB006519: <i>SFP Controlled Fronthaul DWDM Auto-tuning</i> feature.
Beamforming	BF	1	4.3-10	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–

*DWDM – dense wavelength division multiplexing



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

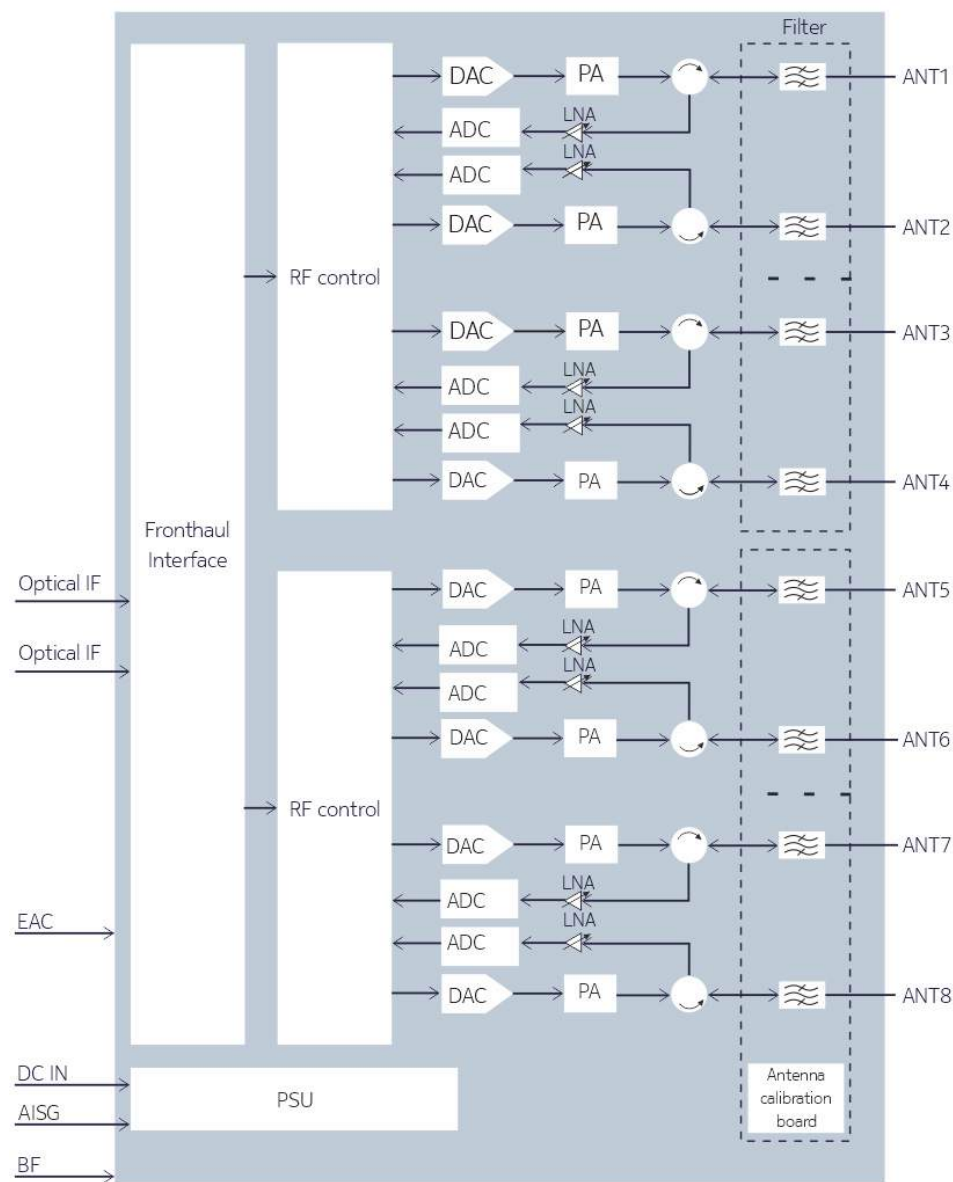
Antenna line device (ALD) support

Table 666: AKQW ALD support

Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	25 W

Functional block diagram

Figure 197: AKQW functional block diagram



Electrical specifications

Table 667: AKQW electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw ($I_{\max}$) (-36 V)*	55 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 668: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMBE AirScale book mount kit 101–125 (474277A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60– 300 mm) (472821A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- AOPC SFP weatherproofing boot kit (475151A)
- ASAD AirScale MDR26-open EAC cable 5 m (475570A)

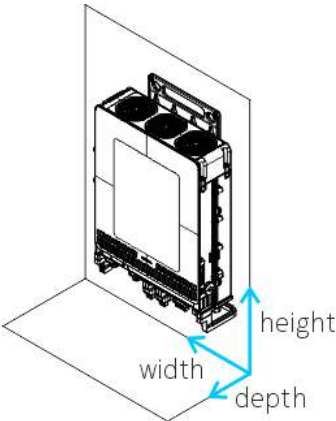
Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - One-clip rail

- Book mounting

Dimensions and weight

Table 669: AKQW dimensions and weight

Property	Value	Dimensions orientation
Height	445 mm (17.52 in.)	
Width	360 mm (14.17 in.)	
Depth	110 mm (4.33 in.)	
Weight	15.5 kg (34.2 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 670: AKQW environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

6.15 AirScale RRH 8T8R n77 320 W eCPRI (AZQW)

AZQW (475742A) is introduced by CB006061 (for NR).

Functional description

Table 671: AZQW functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating modes	• 8T8R Note: Beamforming (BF) is available only in 8T8R mode. • 2 x 4T4R Note: AZQW supports dual sub-band mode in 2 x 4T4R - ANT1, 2, 5, 6 transmit on one set of frequencies and ANT 3, 4,7, 8 transmit on another set of frequencies.
Supported technology	NR
Duplex mode, supported standard	TDD
Frequency range	3700–3980 MHz
Instantaneous bandwidth (iBW)	140 MHz with contiguous and non-contiguous carriers (frequency gap cannot exceed 80 MHz)
Occupied bandwidth (oBW)	140 MHz in 8T8R mode 280 MHz in 2 x 4T4R split mode
Number of carriers per pipe	One
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and 4G LTE Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 198: AZQW interfaces

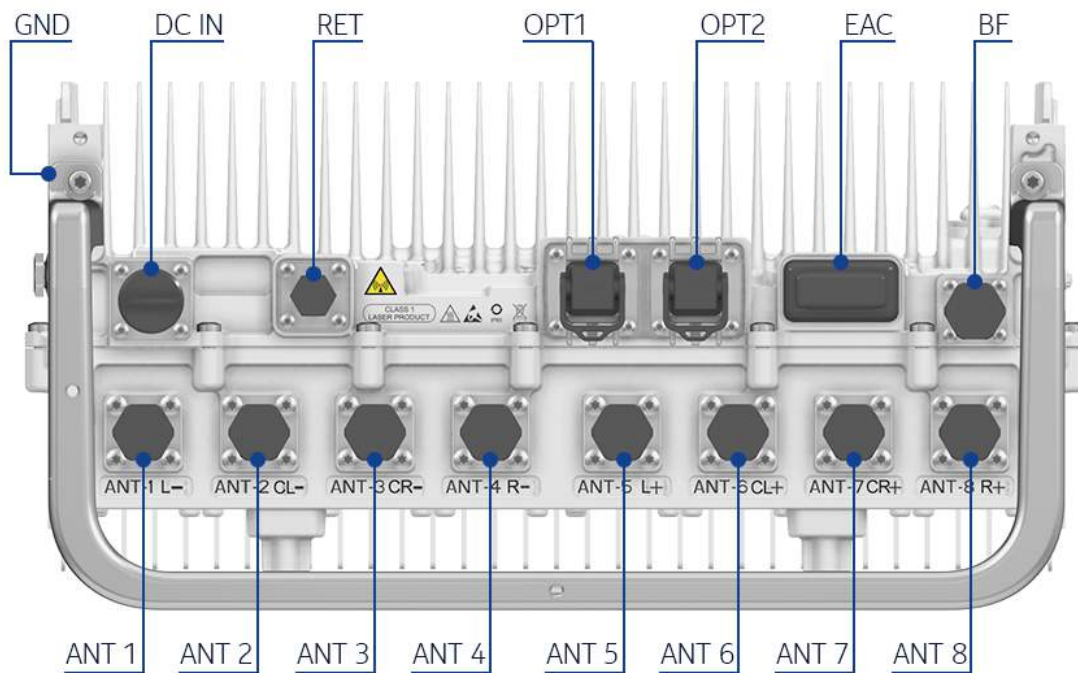


Table 672: AZQW interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	10 Gbps (SFP+) and 25 Gbps* (SFP28) eCPRI; OCTIS universal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–
Fan	FAN	1	Nokia fan	Located in the fins behind the BF connector

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Note:

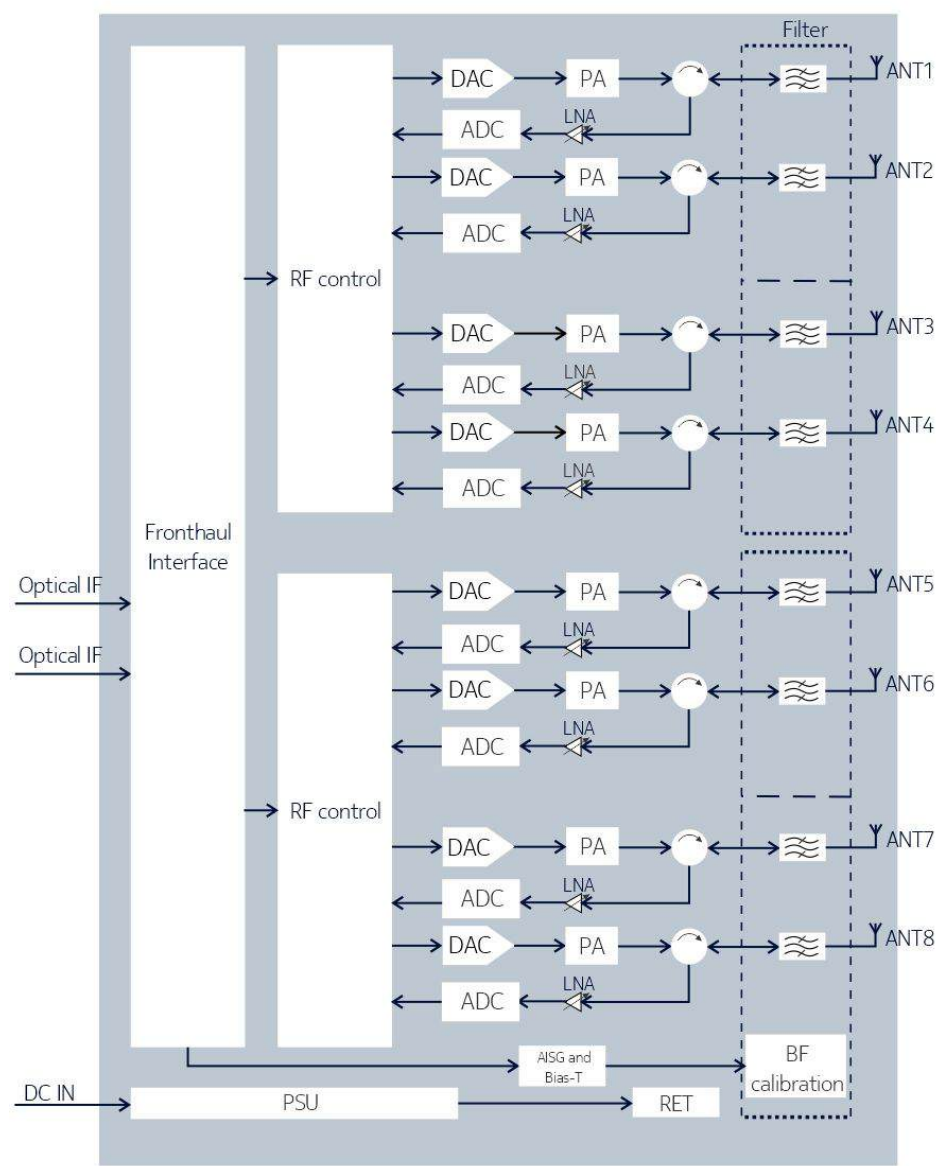
Recommended value for VSWR major and minor alarm threshold is 3.5.

Table 673: AZQW ALD support

Property	Value
AISG	2.0/3.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 199: AZQW functional block diagram



Electrical specifications

Table 674: AZQW electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	48 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 675: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

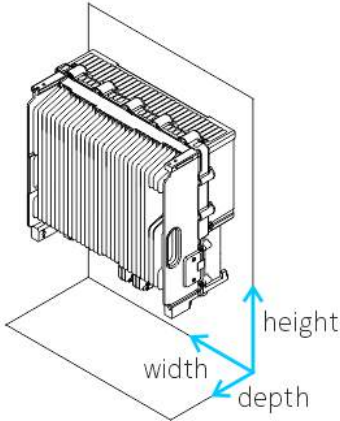
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- ASFG AirScale 8T8R TD RRH 395 mm fan unit (475796A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- AOPE OCTIS universal plug kit (475153A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 676: AZQW dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 354.2 mm (13.94 in.)	
Width	Core RRH: 406.3 mm (16 in.)	
Depth	Core RRH: 193 mm (7.6 in.)	
Weight	Core RRH: 24 kg (52.9 lb)	

Note:

Dimensions and weight provided for core RRH, without heat shield, fan and mounting brackets.

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 677: AZQW environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.16 AirScale RRH 8T8R B42/n78 160 W CPRI/eCPRI (AZQP)

AZQP (475198A) is introduced by LTE5300 (for LTE CPRI) and CB005852 (for NR eCPRI).

Functional description

Table 678: AZQP functional specification

Property	Value
Maximum output power	160 W
Modulation	UL: Up to 64 QAM DL: Up to 256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating modes	• 8T8R • 2 x 4T4R • 4 x 2T2R • 4T4R/2T2R mix mode (non-beamforming)*  Note: Beamforming (BF) is available only in 8T8R mode.
Supported technologies (standalone and MSR)	LTE, NR
Concurrent mode	LTE-NR (eCPRI only)
Duplex mode, supported standard	TDD
Frequency range	3400–3600 MHz
Instantaneous bandwidth (iBW)	NR/LTE: 200 MHz
Occupied bandwidth (oBW)	LTE: 80 MHz (CPRI), 160 MHz (eCPRI) NR: 200 MHz (eCPRI)
Number of carriers per pipe	LTE: up to 4 NR: up to 2
Supported bandwidths	LTE: 10, 15, 20 MHz NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz

*Operating mode introduced by CB008970 feature.

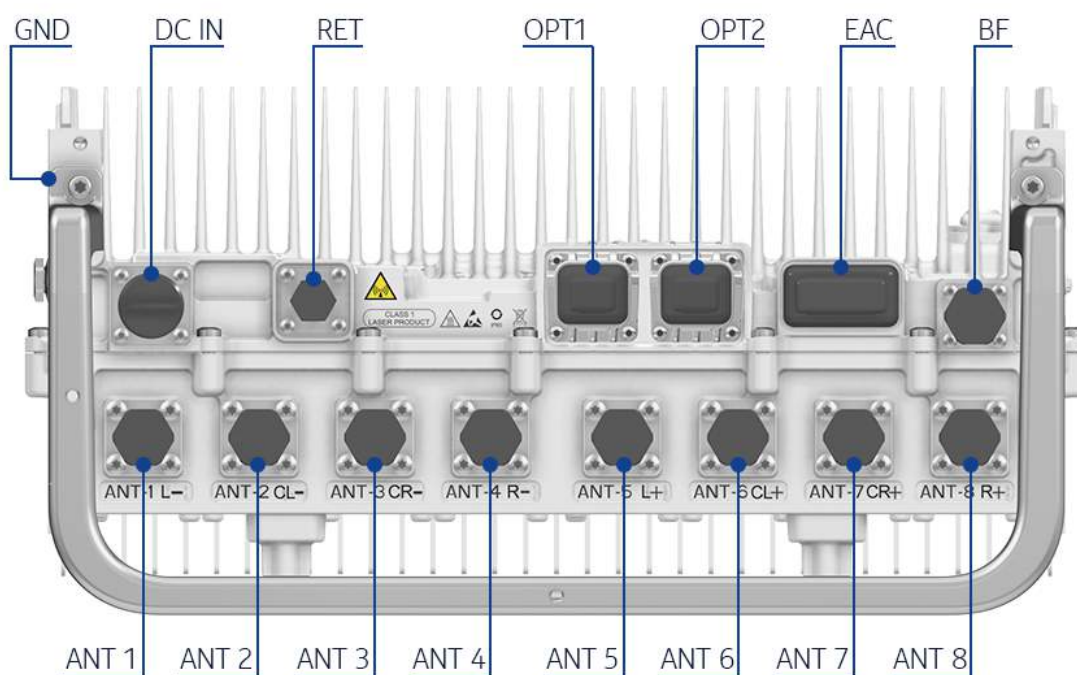
Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 200: AZQP interfaces

**Note:**

AZQP has SMA Rx monitoring ports.

Table 679: AZQP interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	CPRI: 9.8 Gbps, eCPRI: 10 Gbps (SFP+) or 25 Gbps* (SFP28); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–
RF monitor	–	8	SMA, female	Located under each antenna connector

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.

WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Note:

There is no AISG support on the antenna lines. AISG+DC for RETs is only available through the beamforming calibration port and the RET (RS-485) port.

Note:

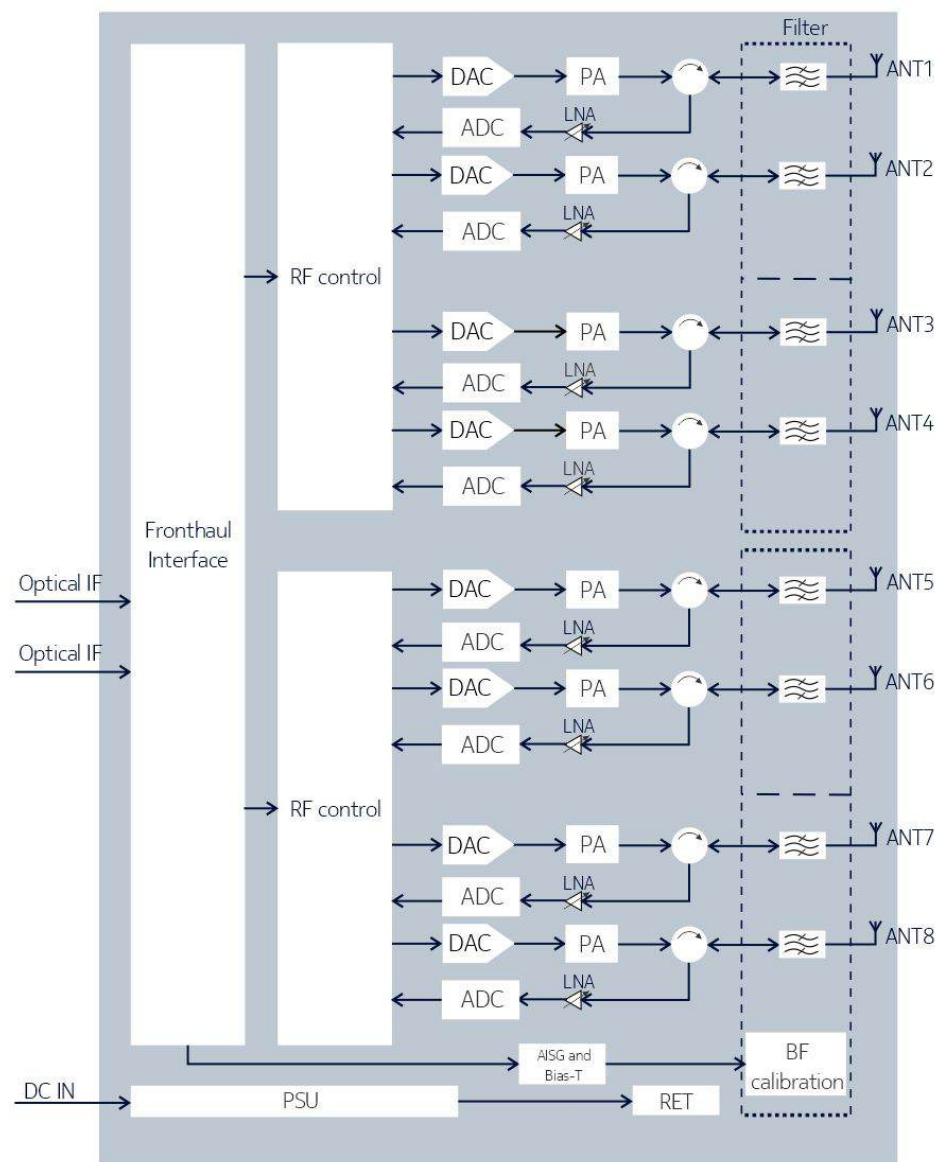
Recommended value for SRAN 20C AZQP VSWR major and minor alarm threshold is 3.5.

Table 680: AZQP ALD support

ALD support through RS-485 port	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 201: AZQP functional block diagram



Electrical specifications

Table 681: AZQP electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	31 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 682: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

Installation options

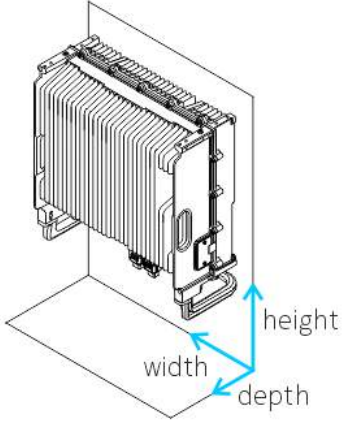
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 683: AZQP dimensions and weight

Property	Value	Dimensions orientation
Height	350 mm (13.78 in.)	
Width	395 mm (15.55 in.)	
Depth	165 mm (6.50 in.)	
Weight	Core RRH: 23 kg (50.7 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 684: AZQP environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

6.17 AirScale RRH 8T8R B42 240 W (AZQE)

AZQE (474717A) is introduced by LTE3736 (for LTE).

Functional description

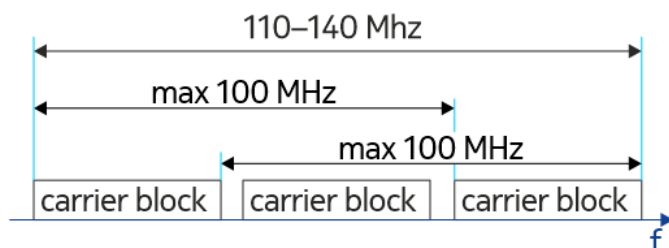
Table 685: AZQE functional specification

Property	Value
Maximum output power	240 W
Modulation	256 QAM (DL) 64 QAM (UL)
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Supported technologies (standalone and MSR)	LTE
Duplex mode	TDD
Frequency range	3400–3600 MHz
Filter bandwidth	200 MHz
Instantaneous bandwidth (iBW)	140 MHz*
Occupied bandwidth (oBW)	80 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	10, 15, 20 MHz

*Carrier configuration depends on the iBW used:

- For iBW up to 110 MHz - any carrier configuration
- For iBW over 110 MHz and up to 140 MHz the following requirements for carrier blocks must be fulfilled. A carrier block is a set of consecutive carriers.
 - The frequency distance between the lower edge of the lowest carrier block and the lower edge of the highest carrier block must be max 100 MHz
 - The frequency distance between the lower edge of the lowest carrier block and the lower edge of the highest carrier block must be max 100 MHz

Figure 202: AZQE carrier configuration for iBW from over 110 MHz to 140 MHz



Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 203: AZQE interfaces

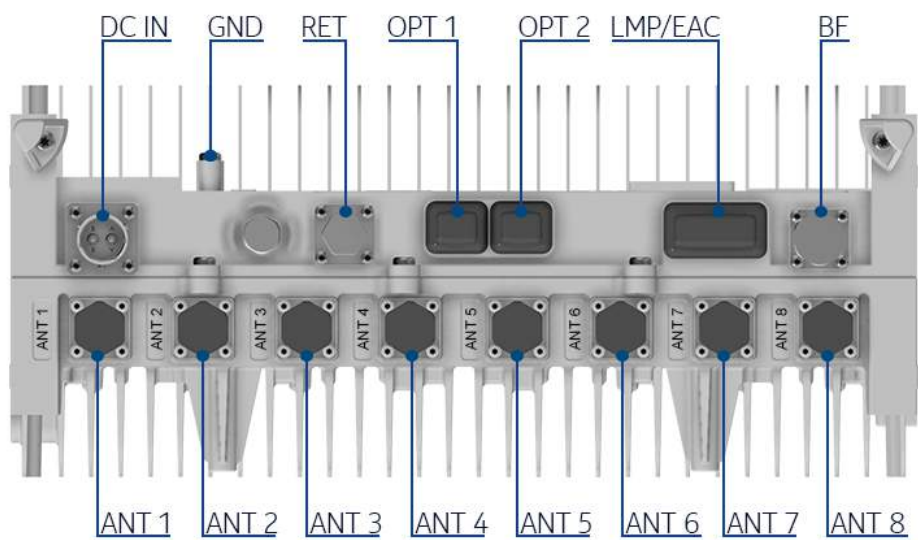


Table 686: AZQE interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	LMP/EAC	1	MDR26	–
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	M8 or dual M5 screws	–
Fan	FAN	1	Nokia fan	Located on the opposite side

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

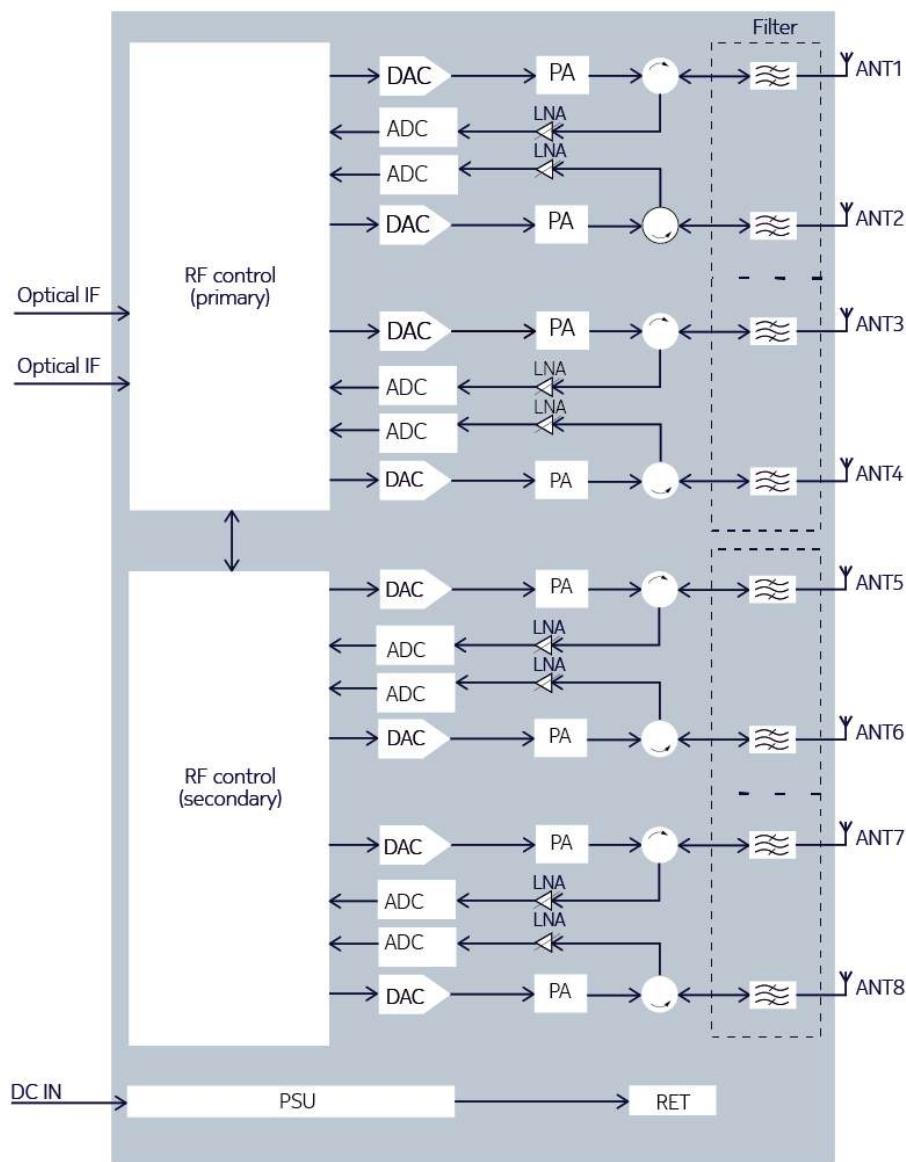
Antenna line device (ALD) support

Table 687: AZQE ALD support

ALD support through RS-485 port	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	30 W

Functional block diagram

Figure 204: AZQE functional block diagram



Electrical specifications

Table 688: AZQE electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended power back-off

Table 689: Recommended AZQE power back-off in 256 QAM

Carrier configuration	Power back-off [dB]
Multiple carriers, continuous	1
Multiple carriers, non-continuous	1.4
Single carrier	1

Related optional items

- AMBG AirScale book mount kit 151-175 (474467A)
- AMGN AirScale 2 cover 395 x 150-175 (474535A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)

- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26-open EAC cable 5 m (474288A)
- ASFD AirScale 2 TD RRH 8-pipe fan unit (474485A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

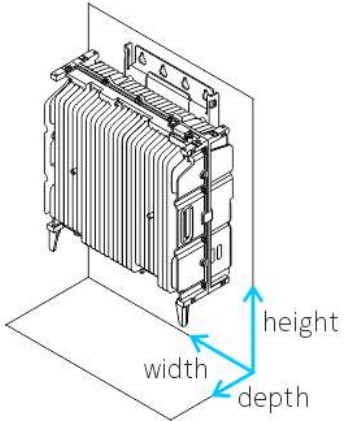
- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *Horizontal with an optional fan*
 - *One-clip rail*
 - *Book mounting*

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 690: AZQE dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 385 mm (15.16 in.) With upper and lower mounting brackets: 469 mm (18.46 in.)	
Width	395 mm (15.55 in.)	
Depth	Core RRH: 170 mm (6.69 in.) With mounting brackets: 190.5 mm (7.5 in.)	
Weight	24.0 kg (52.0 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 691: AZQE environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.18 AirScale RRH 8T8R B42/n78 240 W (AZQF)

AZQF (474188A) is introduced by LTE3737 (for LTE) and CB006118 (for NR).

Functional description

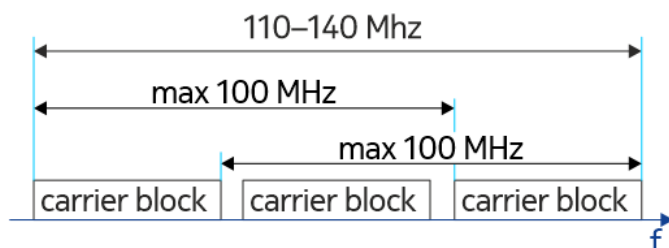
Table 692: AZQF functional specification

Property	Value
Maximum output power	240 W
Modulation	Up to 256 QAM (DL) LTE: up to 64 QAM (UL) NR: up to 256 QAM (UL)
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes (LTE only)
Supported technologies (standalone and MSR)	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	TDD
Frequency range	3410–3590 MHz
Filter bandwidth	180 MHz
Instantaneous bandwidth (iBW)	140 MHz ¹⁾
Occupied bandwidth (oBW)	80 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 10, 20 MHz NR: 20 , 30 ³⁾ , 40 ²⁾ , 50 ³⁾ , 60 ²⁾ , 80 ²⁾ MHz

¹⁾Carrier configuration depends on the iBW used:

- For iBW up to 110 MHz - any carrier configuration
- For iBW over 110 MHz and up to 140 MHz it is required that the frequency distance between the lower edge of the lowest carrier block (set of consecutive carriers) and the lower edge of the highest carrier block be max 100 MHz

Figure 205: AZQF carrier configuration for iBW from over 110 MHz to 140 MHz



²⁾ NR bandwidths 40, 60, and 80 MHz introduced by *CB007331* feature.

³⁾ NR bandwidths 30 and 50 MHz introduced by *CB009104* feature.

Note:

For 8T8R radio units, 80 MHz can only be supported when the ANT 1, ANT 2, ANT 3, and ANT 4 ports are in use.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/5G NR and gNB Supported Configurations* and see:

- *5G NR Supported Configurations*
- *5G NR Supported Configurations - Rules and Examples*

Interfaces

Figure 206: AZQF interfaces

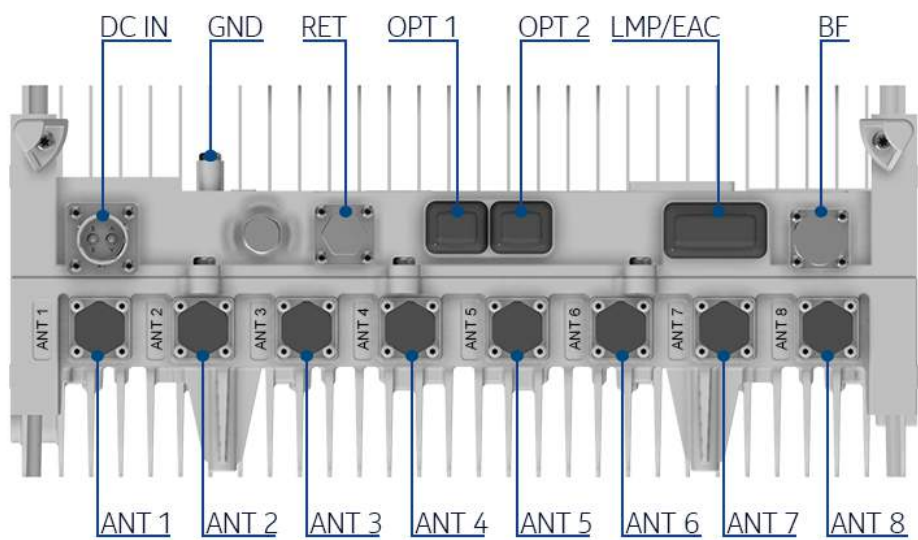


Table 693: AZQF interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP+	Up to 9.8 Gbps (CPRI7); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

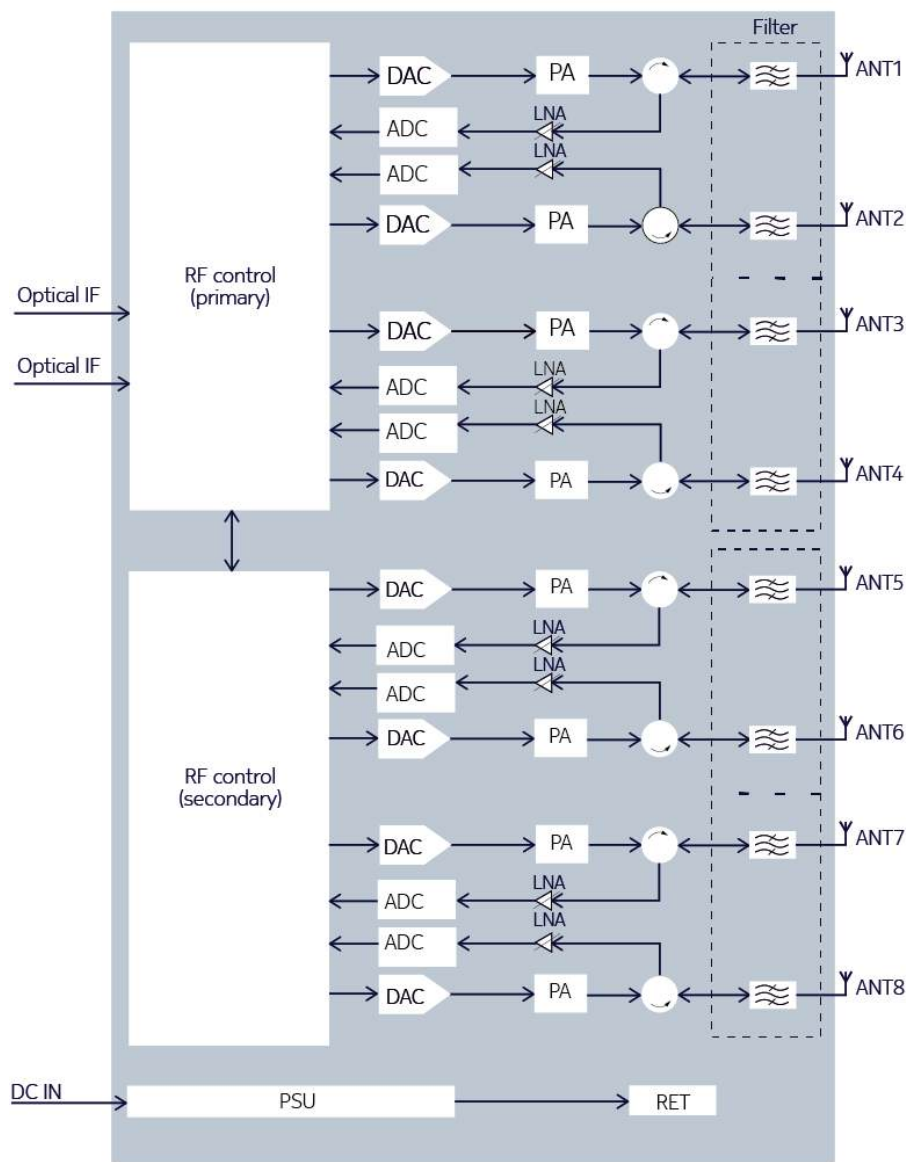
Antenna line device (ALD) support

Table 694: AZQF ALD support

ALD support through RS-485 port	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	30 W

Functional block diagram

Figure 207: AZQF functional block diagram



Electrical specifications

Table 695: AZQF electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	33 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, unit might shut down.

Recommended LTE power back-off

Table 696: Recommended AZQF power back-off in 256 QAM at maximum TX power

Carrier configuration	Power back-off [dB]
Multiple carriers, continuous	1.3
Multiple carriers, non-continuous	1.7
Single carrier	1

Recommended NR power back-off

Table 697: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Related optional items

- AMBG AirScale book mount kit 151–175 (474467A)
- AMGN AirScale 2 cover 395 x 150–175 (474535A)
- AMFA AirScale 2 FPKx fixing adapter (474289A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRB AirScale one clip bracket 126–200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAA AirScale 2 MDR26–open EAC cable 5 m (474288A)
- ASFD AirScale 2 TD RRH 8-pipe fan unit (474485A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (v101: 60–295 mm, v202: 60–300 mm) (472821A)

Installation options

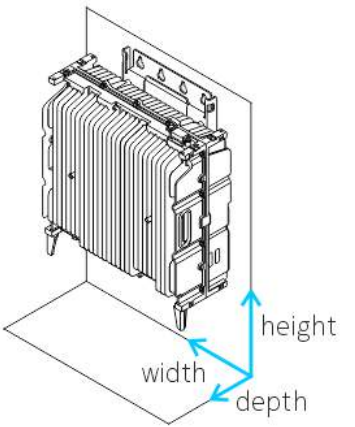
- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - Horizontal with an optional fan
 - One-clip rail
 - Book mounting

Notice:

Install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling. For horizontal installation fans are required.

Dimensions and weight

Table 698: AZQF dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 385 mm (15.16 in.) With upper and lower mounting brackets: 469 mm (18.46 in.)	
Width	395 mm (15.55 in.)	
Depth	Core RRH: 170 mm (6.69 in.) With mounting brackets: 190.5 mm (7.5 in.)	
Weight	22.5 kg (49.6 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 699: AZQF environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.19 AirScale RRH 8T8R n78 320 W eCPRI (AKQA)

AKQA (475944A) is introduced by CB007395 (for NR) and CB009489 (for LTE-NR concurrent mode).

Functional description

Table 700: AKQA functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating mode	8T8R full mode 2 x 4T4R or 4 x 2T2R split mode (non-beamforming) 4T4R/2T2R mix mode (non-beamforming)
Supported technologies	NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	TDD
Frequency range	n78: 3300-3700 MHz
Instantaneous bandwidth (iBW)	300 MHz
Occupied bandwidth (oBW)	200 MHz in 8T8R full mode 2 x 200 MHz in 2 x 4T4R split mode
Number of carriers per pipe	Up to 3
Maximum number of UL/DL MIMO streams	8
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz LTE: 10, 15, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 208: AKQA interfaces

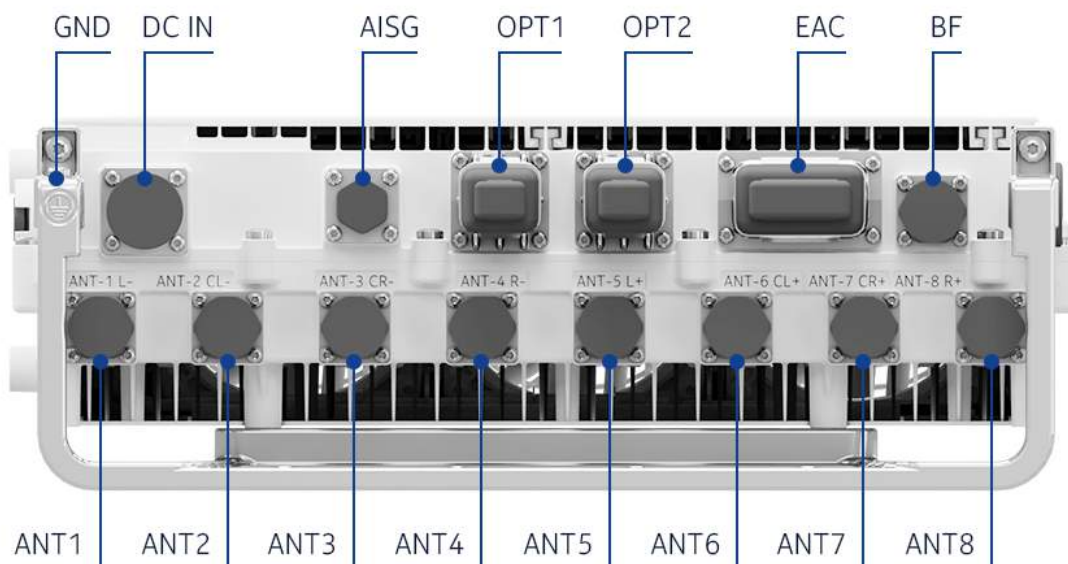


Table 701: AKQA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPC
Antenna	ANT	8	4.3-10	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–
External alarm connection	EAC	1	MDR26	–
Optical	OPT	2	SFP28, SFP+	eCPRI: 25 Gbps (SFP28) or 10 Gbps (SFP+), Nokia IP seal; Support of self-tunable DWDM* SFP introduced by the <i>CB006519: SFP Controlled Fronthaul DWDM Auto-tuning</i> feature.
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–

*DWDM – dense wavelength division multiplexing



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

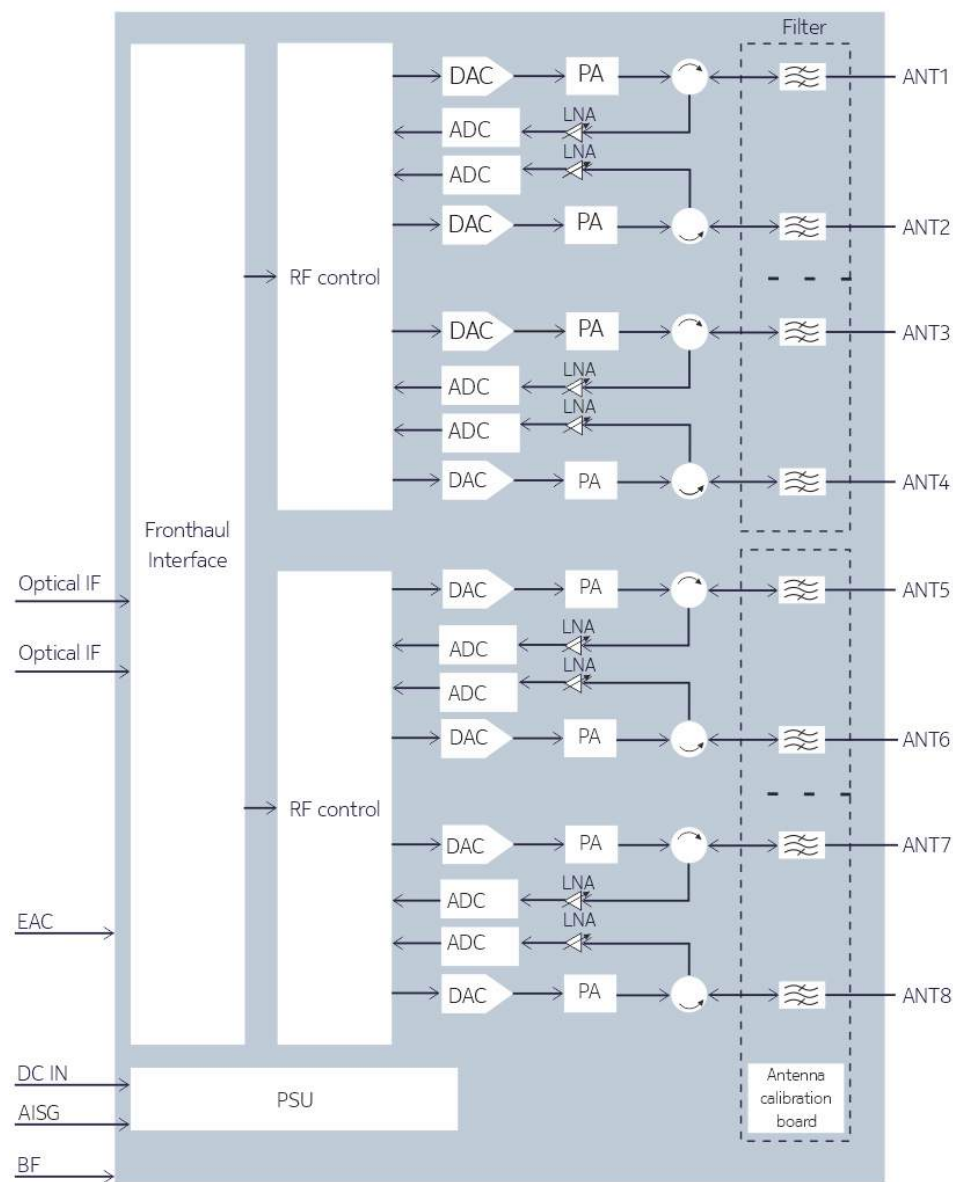
Antenna line device (ALD) support

Table 702: AKQA ALD support

Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	25 W

Functional block diagram

Figure 209: AKQA functional block diagram



Electrical specifications

Table 703: AKQA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw ($I_{\max}$) (-36 V)*	55 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 704: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the CB007657: Low PAPR Optimized Precoding feature.

Related optional items

- AMBE AirScale book mount kit 101–125 (474277A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–300 mm) (472821A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPB AirScale 2 55A DC plug 3.3–10 mm²(474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAD AirScale MDR26-open EAC cable 5 m (475570A)

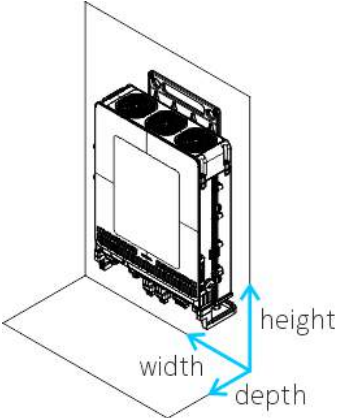
Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - One-clip rail

- Book mounting

Dimensions and weight

Table 705: AKQA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 445 mm (17.52 in.)	
Width	Core RRH: 360 mm (14.17 in.)	
Depth	Core RRH: 110 mm (4.33 in.)	
Weight	Core RRH: 15.8 kg (34.8 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 706: AKQA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

6.20 AirScale RRH 8T8R n78 320 W eCPRI (AKQI)

AKQI (475919A) is introduced by *CB007363* (for NR) and *CB009489* (for LTE-NR concurrent mode).

Functional description

Table 707: AKQI functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating mode	8T8R full mode 2 x 4T4R or 4 x 2T2R split mode (non-beamforming) 4T4R/2T2R mix mode (non-beamforming)*
Supported technologies	NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	TDD
Frequency range	n78: 3410-3800 MHz
Instantaneous bandwidth (iBW)	300 MHz
Occupied bandwidth (oBW)	200 MHz in 8T8R full mode 390 MHz in 2x4T4R split mode
Number of carriers per pipe	Up to 3
Maximum number of UL/DL MIMO streams	Up to 8
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz LTE: 10, 15, 20 MHz

*Operating mode introduced by CB008970 feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 210: AKQI interfaces

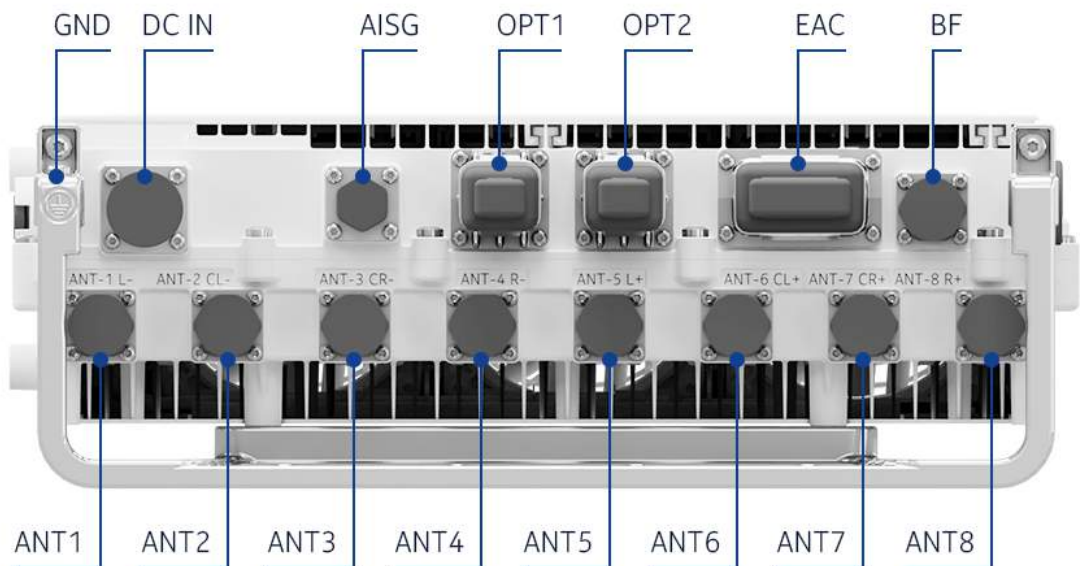


Table 708: AKQI interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	High power circular	APPC
Antenna	ANT	8	4.3-10	–
Antenna Interface Standards Group	AISG	1	8-pin circular	–
External alarm connection	EAC	1	MDR26	–
Optical	OPT	2	SFP28, SFP+	eCPRI: 25 Gbps (SFP28) and 10 Gbps (SFP+); Nokia IP seal; Support of self-tunable DWDM* SFP introduced by the <i>CB006519: SFP Controlled Fronthaul DWDM Auto-tuning feature.</i>
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–

*DWDM – dense wavelength division multiplexing



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

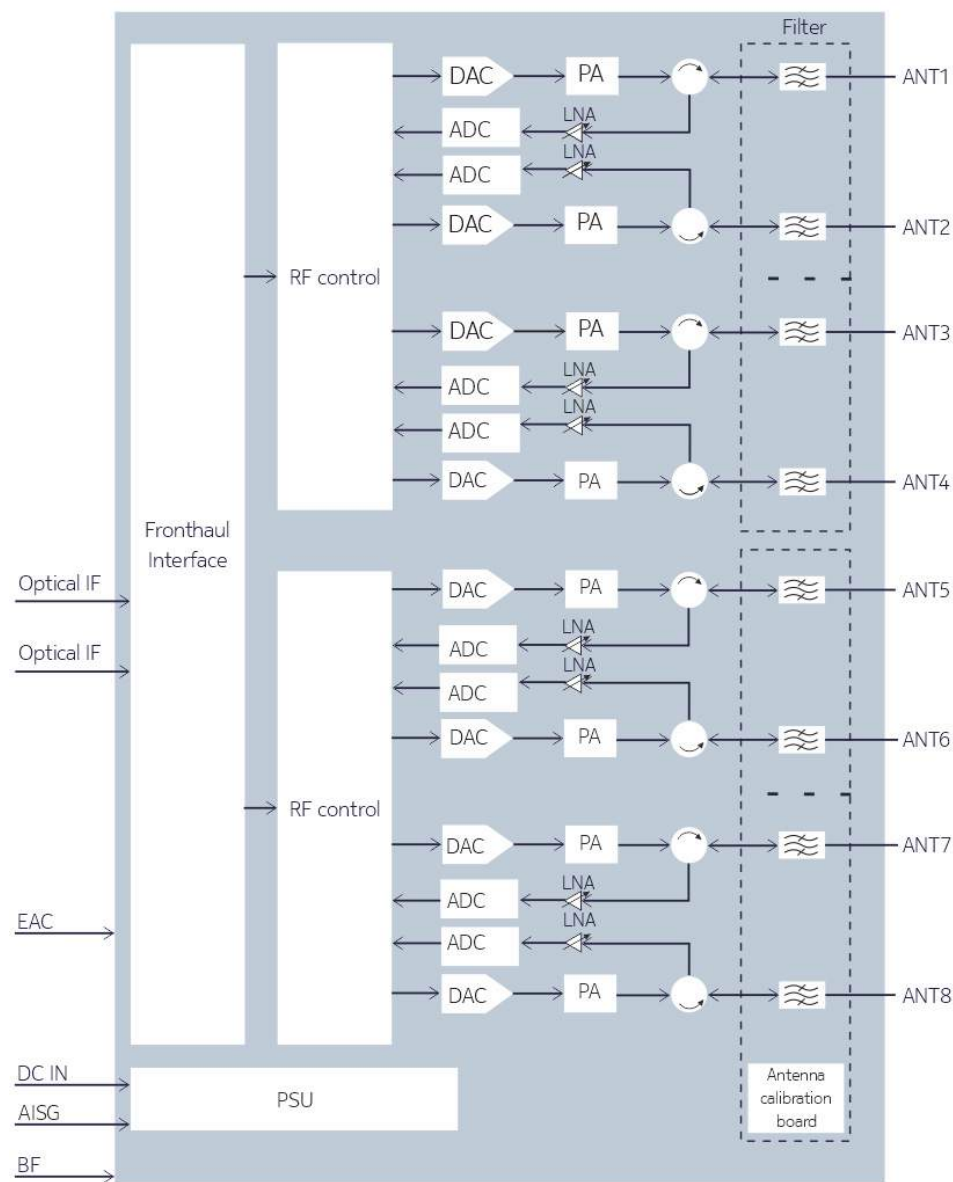
Antenna line device (ALD) support

Table 709: AKQI ALD support

Property	Value
AISG	3.0
Voltage	24 V
Power per port	25 W

Functional block diagram

Figure 211: AKQI functional block diagram



Electrical specifications

Table 710: AKQI electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw ($I_{\max}$) (-36 V)*	55 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 711: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the CB007657: Low PAPR Optimized Precoding feature.

Related optional items

- AMBE AirScale book mount kit 101–125 (474277A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60– 300 mm) (472821A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- AOPC SFP weatherproofing boot kit (475151A)
- ASAD AirScale MDR26-open EAC cable 5 m (475570A)

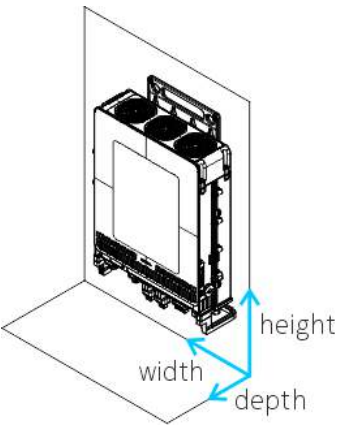
Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - One-clip rail

- Book mounting

Dimensions and weight

Table 712: AKQI dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 445 mm (17.52 in.)	
Width	Core RRH: 360 mm (14.17 in.)	
Depth	Core RRH: 110 mm (4.33 in.)	
Weight	Core RRH: 15.3 kg (33.7 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 713: AKQI environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

6.21 AirScale RRH 8T8R n78 320 W eCPRI (AKQJ)

AKQJ (475824A) is introduced by CB007075 (for NR) and CB009489 (for LTE-NR concurrent mode).

Functional description

Table 714: AKQJ functional specification

Property	Value
Maximum output power	320 W
Maximum modulation	256 QAM
Number of TXX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating mode	8T8R full mode 2x 4T4R or 4x 2T2R split mode (non-beamforming) 4T4R/2T2R mix mode (non-beamforming)*
Supported technology	NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	TDD
Frequency range	n78: 3420-3800 MHz
Instantaneous bandwidth (iBW)	300 MHz
Occupied bandwidth (oBW)	200 MHz in 8T8R full mode 380 MHz in 2x4T4R split mode
Number of carriers per pipe	Up to 3
Maximum number of UL/DL MIMO streams	8
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz LTE: 10, 15, 20 MHz

*Operating mode introduced by CB008970 feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 212: AKQJ interfaces

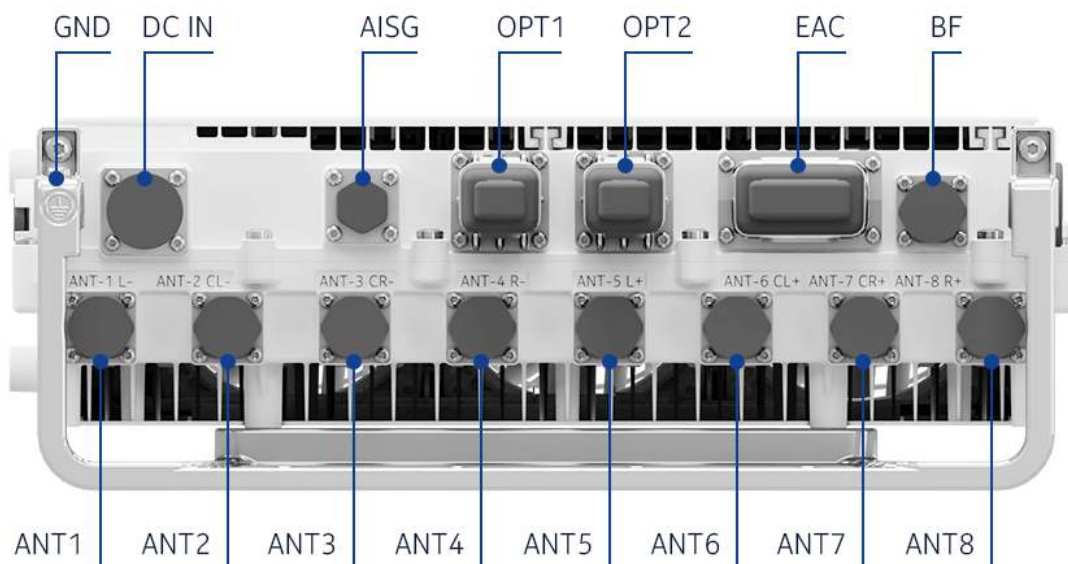


Table 715: AKQJ interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPC
Antenna connector	ANT	8	4.3-10	–
Antenna Interface Standards Group	AISG	1	8-pin circular	–
External alarm connector	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 25 Gbps (SFP28) and 10 Gbps (SFP+); Nokia IP seal; Support of self-tunable DWDM* SFP introduced by the <i>CB006519: SFP Controlled Fronthaul DWDM Auto-tuning feature.</i>
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–

*DWDM – dense wavelength division multiplexing



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

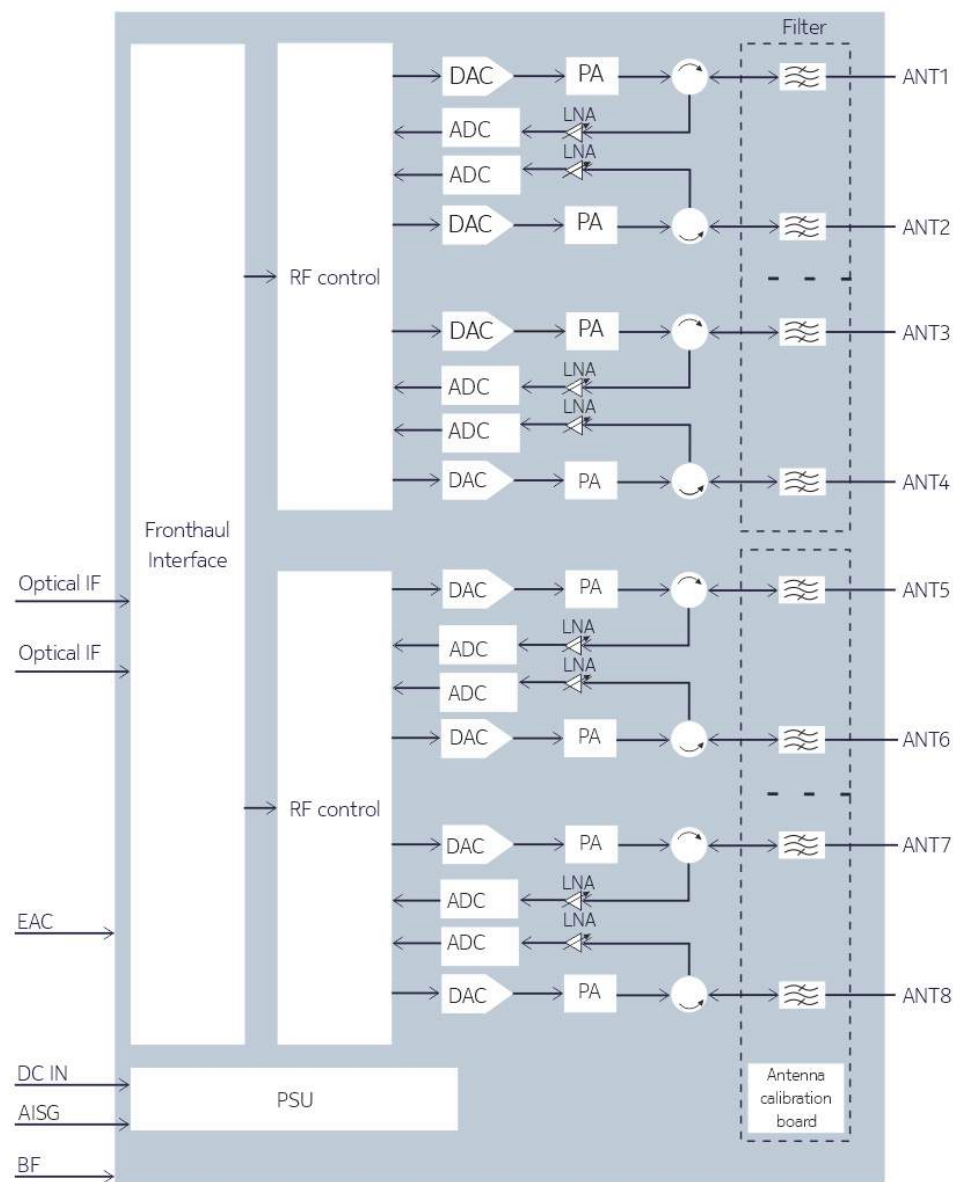
Antenna line device (ALD) support

Table 716: AKQJ ALD support

Property	Value
AISG	3.0
Voltage	24 V
Power per port	25 W

Functional block diagram

Figure 213: AKQJ functional block diagram



Electrical specifications

Table 717: AKQJ electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw ($I_{\max}$) (-36 V)*	55 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 718: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

 Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60– 300 mm) (472821A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBE AirScale book mount kit 101–125 (474277A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- AOPC SFP weatherproofing boot kit (475151A)
- ASAD AirScale MDR26-open EAC cable 5 m (475570A)

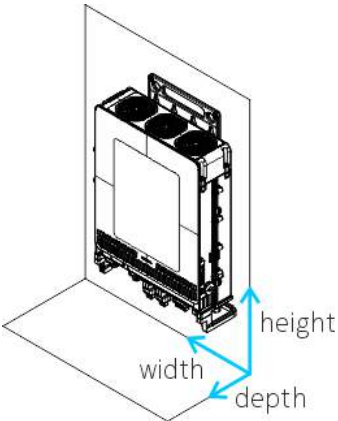
Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - One-clip rail

- Book mounting

Dimensions and weight

Table 719: AKQJ dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 445 mm (17.52 in.)	
Width	Core RRH: 360 mm (14.17 in.)	
Depth	Core RRH: 110 mm (4.33 in.)	
Weight	Core RRH: 15.3 kg (33.73 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 720: AKQJ environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

6.22 AirScale RRH 8T8R n78 320 W eCPRI (AKQZ)

AKQZ (475918A) is introduced by CB007362 (for NR) and CB009489 (for LTE-NR concurrent mode).

Functional description

Table 721: AKQZ functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM (DL and UL)
Number of TXX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating mode	8T8R full mode 2x 4T4R or 4x 2T2R split mode (non-beamforming) 4T4R/2T2R mix mode (non-beamforming)
Supported technology	NR
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	TDD
Frequency range	n78: 3300-3670 MHz
Instantaneous bandwidth (iBW)	300 MHz
Occupied bandwidth (oBW)	200 MHz in 8T8R full mode 300 MHz in 2x4T4R split mode
Number of carriers per pipe	Up to 3
Maximum number of UL/DL MIMO streams	8
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz LTE: 10, 15, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 214: AKQZ interfaces

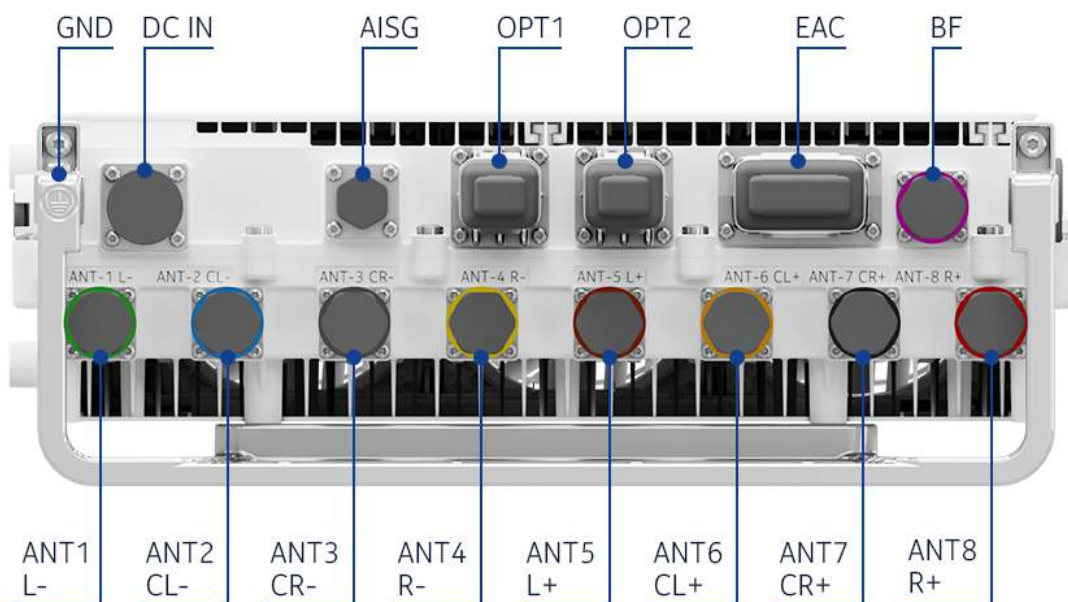


Table 722: AKQZ interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPC
Antenna connector	ANT	8	4.3-10	–
Antenna Interface Standards Group	AISG	1	8-pin circular	–
External alarm connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 25 Gbps (SFP28) and 10 Gbps (SFP+); Nokia IP seal; Support of self-tunable DWDM* SFP introduced by the <i>CB006519: SFP Controlled Fronthaul DWDM Auto-tuning</i> feature.
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–

*DWDM – dense wavelength division multiplexing



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

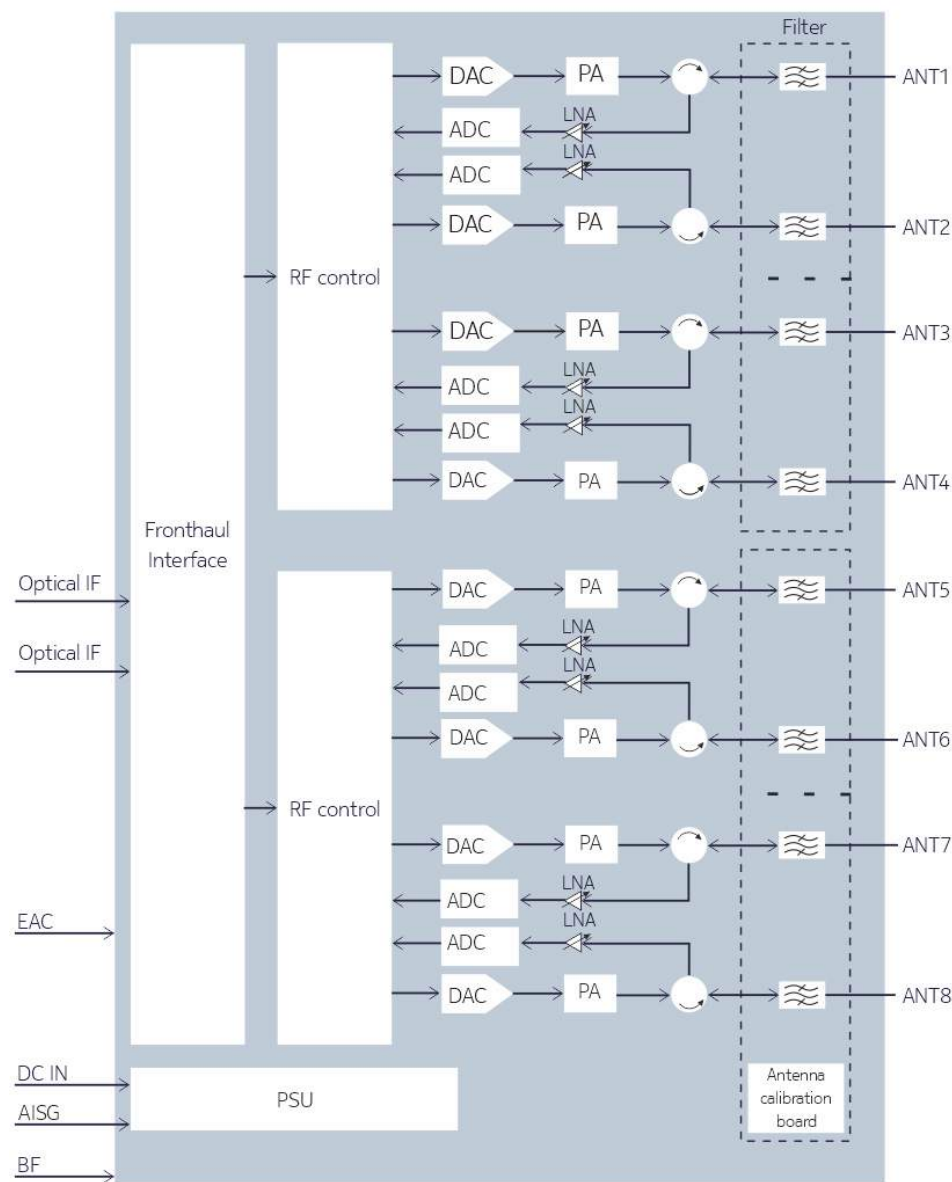
Antenna line device (ALD) support

Table 723: AKQZ ALD support

Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	25 W

Functional block diagram

Figure 215: AKQZ functional block diagram



Electrical specifications

Table 724: AKQZ electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw ($I_{\max}$) (-36 V)*	55 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 725: The recommended NRCELL PDSCH Power Back-off for 256 QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

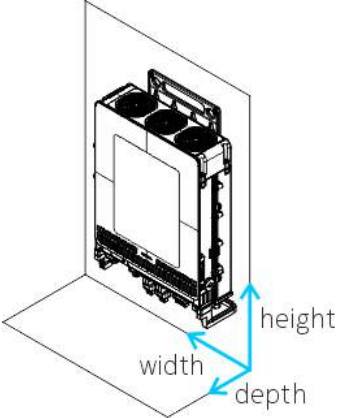
- AMBE AirScale book mount kit 101–125 (474277A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30–120 mm) (473879A)
- AMRA AirScale one clip bracket 51–125 (474580A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AOPC SFP weatherproofing boot kit (475151A)
- APPB AirScale 2 55A DC plug 3.3–10 mm² (474282A/474282B)
- APPC AirScale 2 55A DC plug 10–16 mm² (474283A/474283B)
- ASAD AirScale MDR26-open EAC cable 5 m (475570A)
- FPKA Flexi pole mounting kit (30–120 mm) (471649A)
- FPKC Flexi pole mounting kit (60–295 mm) (472821A)

Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical
 - One-clip rail

- Book mounting

Dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 445 mm (17.52 in.)	
Width	Core RRH: 360 mm (14.17 in.)	
Depth	Core RRH: 110 mm (4.33 in.)	
Weight	Core RRH: 15.5 kg (34.17 lb)	

Environmental specifications

Note:

There is no need to reduce power or limit the carried traffic load if you follow site installation guidelines. Only when operating at a constant high traffic load in very high ambient temperature conditions may this become temporarily necessary to protect the unit from overheating.

Table 726: AKQZ environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Forced convection (fan)
IP rating	IP65

6.23 AirScale RRH 8T8R n78 320 W eCPRI (AZQG)

AZQG (474994A) is introduced by 5GC001358 (for NR eCPRI).

Functional description

Table 727: AZQG functional specification

Property	Value
Maximum output power	320 W
Modulation	Up to 256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming (BF)	Yes
Operating mode ¹	BF mode: • 1 sector, 1 carrier, 8T8R with 8-port calibrated antenna. Supported antenna types defined by 5GC001849 and 5GC001866. For more information, see 5GC002142 and 5GC001849 feature description. Non-BF mode: • 1 or 2 sectors, 1 carrier, 2T2R for 2-port passive antennas • 1 sector, 1 carrier, 4T4R for 4-port passive antenna • 1 sector, 1 carrier, 2x4T4R subsectors for 4-port passive antennas • 1 sector, 1 carrier, 4x2T2R subsectors for 2-port passive antennas
Software supported technologies	NR
Duplex mode, supported standard	TDD
Frequency range	n78: 3400–3600 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	1
Maximum number of UL/DL MIMO streams	Up to 8
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz

Note:

¹You can select only one operating mode for one radio unit. All cells must have the same carrier bandwidth and carrier frequency.

Note:

The radio unit is utilizing digital predistortion (DPD) method for improving the transmitter linearity. A single DPD iteration round of all antenna pipes may take up to one minute. During that time performance is not optimal and you may not yet reach higher modulation and coding scheme (MCS) ranks.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 216: AZQG interfaces

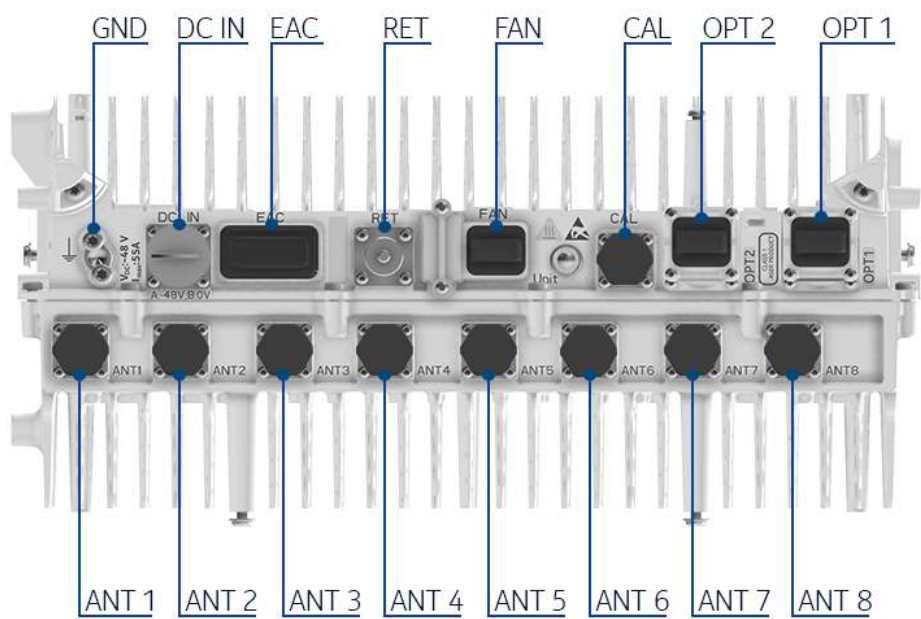


Table 728: AZQG interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	OBTS	APPB or APPC plug
Optical interface	OPT 1-2	2	SFP28, SFP+	eCPRI: 10 Gbps (SFP+) or 25 Gbps (SFP28); Nokia IP seal AOPC
External Alarm and Control	EAC	1	MDR26	6 alarm inputs and 1 control output
Remote Electrical Tilt	RET	1	AISG C485	–
Antenna connector	ANT 1-8	8	4.3-10 female	–
Calibration	CAL	1	4.3-10 female	–
Grounding	GND 	1	M8 or 2 x M5 screw	–



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 729: AZQG interface for ALD support

Property	Value
AISG	RAE: 2.0
Voltage	10-30 V
Power per port	-

Electrical specifications

Table 730: AZQG electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

Recommend value for `dLQam256PowerBackoffSub6` parameter is:

- 1.5 dB for 3GPP performance requirement.
- 3 dB for high peak UE throughput (4x4 DL MIMO).

Related optional items

- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60-300 mm) (472821A)
- AMG V AirScale 417 mm 19 rack/stack fixing (475397A)
- AMBO AirScale book mount kit 201-225 (475396A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- ASFF AirScale 8T8R fan unit (475567A)
- APPB AirScale2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection kit (474297A)

Installation options

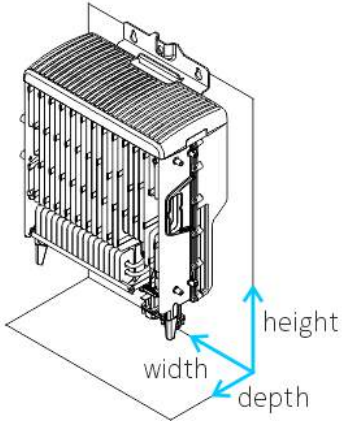
- *Pole*
- *Wall*
- One-clip mounting with AMRC (on *wall*, pole with *FPKA* or *FPKC*)
- *Stack with AMG V* (ASFF fan required)
- *19" rack with AMG V* (ASFF fan required)

Notice:

The RRH without a fan should always be mounted in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 731: AZQG dimensions and weight

Parameter	Details	Dimension orientation
Height	435 mm (17.13 in.) With mounting brackets: 561 mm (22.09 in.)	
Width	400 mm (15.74 in.)	
Depth	192 mm (7.56 in.) With mounting brackets: 217 mm (8.54 in.)	
Weight	25.5 kg (56.2 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 732: AZQG environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.24 AirScale RRH 8T8R n78 320 W CPRI/eCPRI (AZQH)

AZQH (475074A) is introduced by 5GC001810 (for NR CPRI) and 5GC001510 (for NR eCPRI).

Functional description

Table 733: AZQH functional specification

Property	Value
Maximum output power	320 W
Modulation	Up to 256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming (BF)	Yes
Operating mode ¹	BF mode: • 1 sector, 1 carrier, 8T8R with 8-port calibrated antenna. Supported antenna types defined by 5GC001849 and 5GC001866. For more information, see 5GC002142 and 5GC001849 feature description. Non-BF mode: • 1 or 2 sectors, 1 carrier, 2T2R for 2-port passive antennas • 1 sector, 1 carrier, 4T4R for 4-port passive antenna • 1 sector, 1 carrier, 2x4T4R subsectors for 4-port passive antennas • 1 sector, 1 carrier, 4x2T2R subsectors for 2-port passive antennas
Software supported technologies	NR
Duplex mode, supported standard	TDD
Frequency range	n78: 3600–3800 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 1
Maximum number of UL/DL MIMO streams	Up to 8
Supported bandwidths	20, 30, 40, 50, 60, 70, 80, 90, 100 MHz

i Note:

¹You can select only one operating mode for one radio unit. All cells must have the same carrier bandwidth and carrier frequency.

i Note:

The radio unit is utilizing digital predistortion (DPD) method for improving the transmitter linearity. A single DPD iteration round of all antenna pipes may take up to one minute. During that time performance is not optimal and you may not yet reach higher modulation and coding scheme (MCS) ranks.

i Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 217: AZQH interfaces

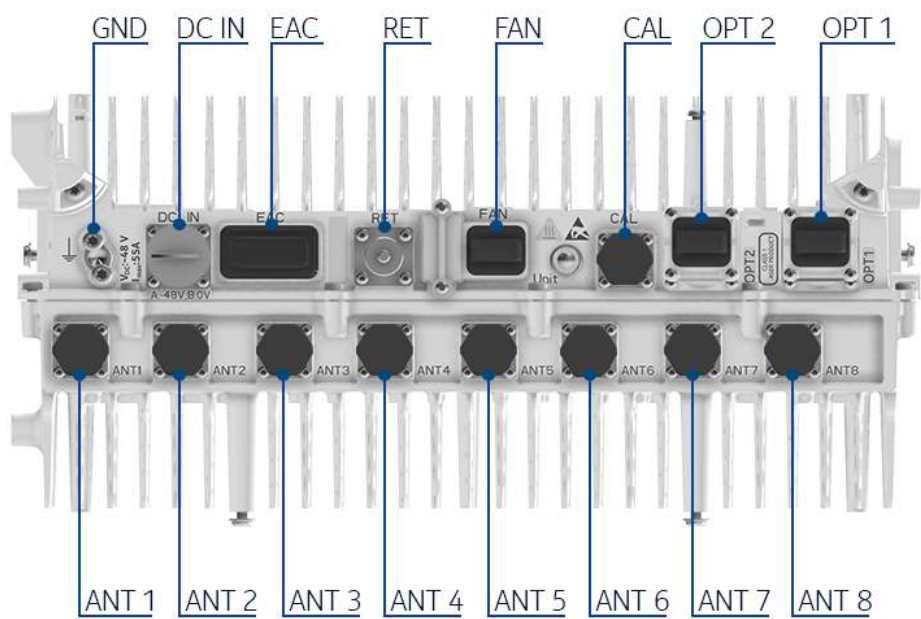


Table 734: AZQH interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	OBTS	APPB or APPC plug
Optical interface	OPT 1-2	2	SFP28, SFP+	CPRI: 9.8 Gbps, eCPRI: 10 Gbps (SFP+) or 25 Gbps (SFP28); Nokia IP seal AOPC
External Alarm and Control	EAC	1	MDR26	6 alarm inputs and 1 control output
Remote Electrical Tilt	RET	1	AISG C485	-
Antenna connector	ANT 1-8	8	4.3-10 female	-
Calibration	CAL	1	4.3-10 female	-
Grounding	GND 	1	M8 or 2 x M5 screw	-

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 735: AZQH interface for ALD support

Property	Value
AISG	RAE: 2.0
Voltage	10-30 V
Power per port	-

Electrical specifications

Table 736: AZQH electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended parameter values

Recommend value for dLQam256PowerBackoffSub6 parameter is:

- 1.5 dB for 3GPP performance requirement.
- 3 dB for high peak UE throughput (4x4 DL MIMO).

Related optional items

- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMG V AirScale 417mm 19 rack/stack fixing (475397A)
- AMBO AirScale book mount kit 201-225 (475396A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- ASFF AirScale 8T8R fan unit (475567A)
- APPB AirScale2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection kit (474297A)

Installation options

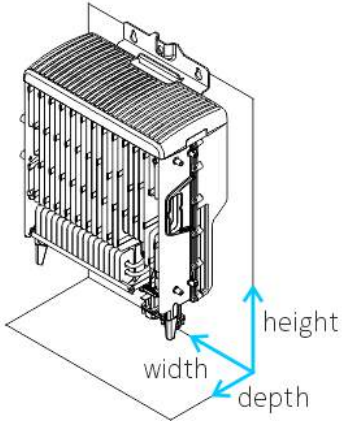
- *Pole*
- *Wall*
- One-clip mounting with AMRC (on *wall*, pole with *FPKA* or *FPKC*)
- *Stack with AMG V* (ASFF fan required)
- *19" rack with AMG V* (ASFF fan required)

Notice:

The RRH without a fan should always be mounted in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 737: AZQH dimensions and weight

Parameter	Details	Dimension orientation
Height	435 mm (17.13 in.) With mounting brackets: 561 mm (22.09 in.)	
Width	400 mm (15.74 in.)	
Depth	192 mm (7.56 in.) With mounting brackets: 217 mm (8.54 in.)	
Weight	25.5 kg (56.2 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 738: AZQH environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.25 AirScale RRH 8T8R n78 320 W (eCPRI) (AZQI)

AZQI (475243A) is introduced by 5GC001511 (for NR eCPRI).

Functional description

Table 739: AZQI functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating modes	BF mode (one sector, up to two NR carriers): • One cell 8T8R with 8-port calibrated BF antenna (4 antennas/ports per polarization) Non BF mode: • 2T2R for 2-port passive antennas (up to two sectors, up to two NR carriers) • 4T4R for 4-port passive antennas (one sector, up to two NR carriers) • 2x4T4R sub-sectors for 4-port passive antennas (one sector, up to two NR carriers) • 4x2T2R sub-sectors for 2-port passive antennas (one sector, up to two NR carriers) • 4T4R/2T2R mix mode (non-beamforming)¹⁾  Note: There can be only one carrier configuration, i.e. all sectors and sub-sectors in one radio shall have the same (single or dual) carrier bandwidth and the same carrier frequency (or frequencies).
Software supported technologies	NR
Duplex mode, supported standard	TDD
Frequency range	n78: 3410–3700 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	200 MHz (160 MHz for TD-CPRI)

Property	Value
Number of carriers per pipe	Up to 2
Maximum number of UL/DL MIMO streams	Up to 8 (with 2x25 GE)
Supported bandwidths	10 ²⁾ , 20, 30, 40, 50, 60, 70, 80, 90 and 100 MHz single carriers (20 MHz and 40 MHz with optimized sampling rates)
Limitations	When AZQI is commissioned to have 10 or 20 MHz NR carriers, the maximum iBW is limited to ≤180 MHz. If iBW ≥ 160 W, back-off is limited to 0.8 dB.

¹⁾Operating mode introduced by CB008970 feature.

²⁾NR bandwidth 10 MHz has been introduced by the CB011173 feature.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 218: AZQI interfaces

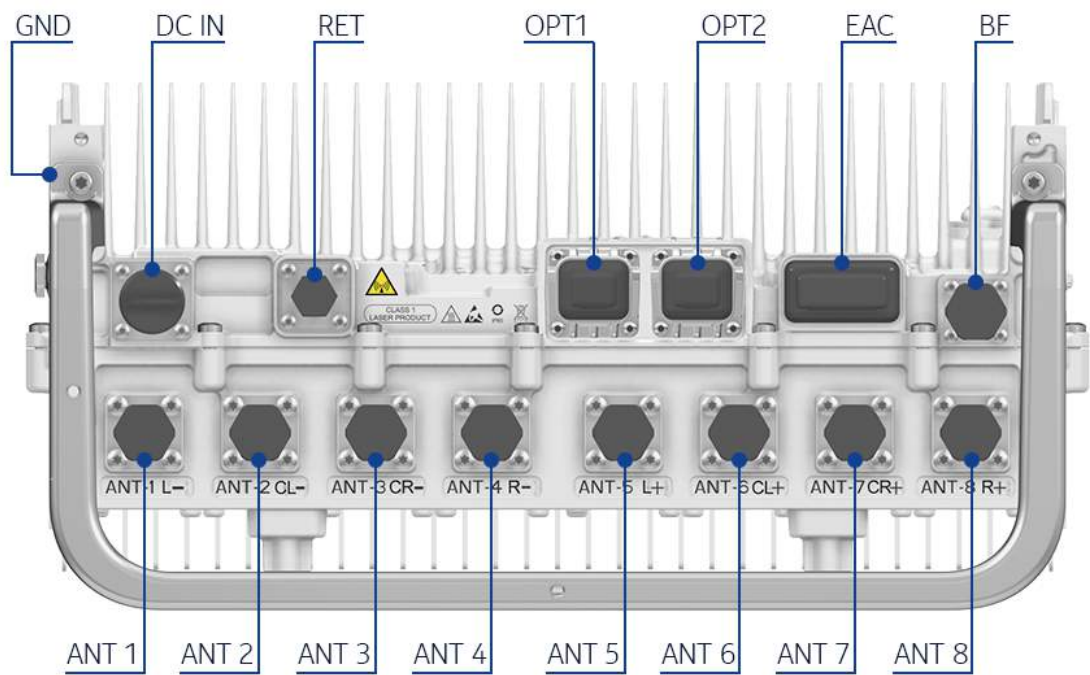


Table 740: AZQI interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 10 Gbps (SFP+) or 25 Gbps* (SFP28); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw	–
Fan	FAN	1	Nokia fan	Located in fins behind the BF connector

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Note:

There is no AISG support on the antenna lines. AISG + DC for RETs is only available through the beamforming calibration port and the RET (RS-485) port.

Note:

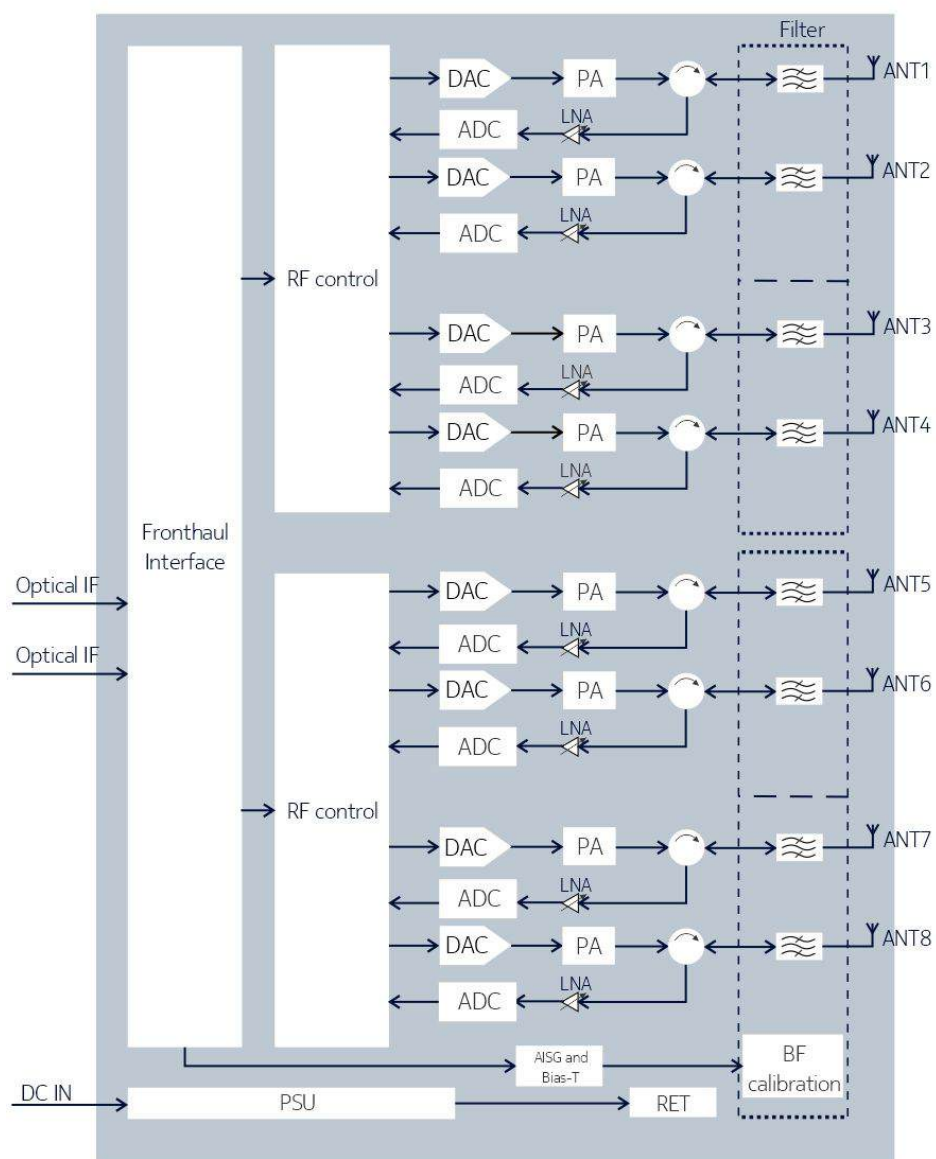
Recommended value for VSWR major and minor alarm threshold is 3.5.

Table 741: AZQI ALD support

ALD support through RS-485 port	Value
AISG	2.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 219: AZQI functional block diagram



Electrical specifications

Table 742: AZQI electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	48 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.



Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 743: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

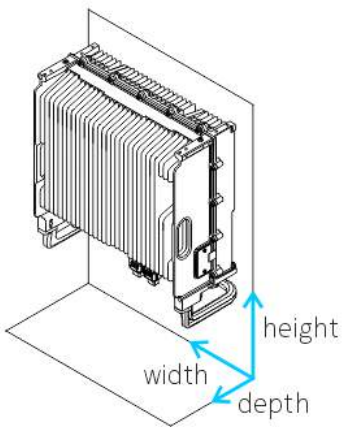
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- ASFG AirScale 8T8R TD RRH 395 mm fan unit (475796A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 744: AZQI dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 350 mm (13.78 in.)	
Width	Core RRH: 395 mm (15.55 in.)	
Depth	Core RRH: 190 mm (7.48 in.)	
Weight	Core RRH: 24 kg (52.9 lb)	

Note:

Dimensions and weight provided for core RRH, without heat shield, fan and mounting brackets.

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 745: AZQI environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.26 AirScale RRH 8T8R n78 320 W (eCPRI) (AZQJ)

AZQJ (475244A) is introduced by 5GC001512 (for NR eCPRI) and CB007179 (for LTE eCPRI) .

Functional description

Table 746: AZQJ functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating modes	BF mode (one sector, up to two NR carriers): • One cell 8T8R with 8-port calibrated BF antenna (4 antennas/ports per polarization) Non BF mode: • 2T2R for 2-port passive antennas (up to two sectors, up to two NR carriers) • 4T4R for 4-port passive antennas (one sector, up to two NR carriers) • 2x4T4R sub-sectors for 4-port passive antennas (one sector, up to two NR carriers) • 4x2T2R sub-sectors for 2-port passive antennas (one sector, up to two NR carriers) • 4T4R/2T2R mix mode (non-beamforming)¹⁾  Note: There can be only one carrier configuration, i.e. all sectors and sub-sectors in one radio shall have the same (single or dual) carrier bandwidth and the same carrier frequency (or frequencies).
Software supported technologies	LTE, NR
Concurrent mode	LTE-NR (eCPRI only)
Duplex mode, supported standard	TDD
Frequency range	n78: 3480-3800 MHz
Instantaneous bandwidth (iBW)	LTE/NR: 200 MHz

Property	Value
Occupied bandwidth (oBW)	NR: 200 MHz (160 MHz for TD-CPRI) LTE: 80 MHz
Number of carriers per pipe	NR: up to 2 LTE: up to 4
Maximum number of UL/DL MIMO streams	8 (with 2x25 GE)
Supported bandwidths	NR: 10 ²⁾ , 20, 30, 40, 50, 60, 70, 80, 90 and 100 MHz single carriers (20 MHz and 40 MHz with optimized sampling rates) LTE: 10, 15, 20 MHz
Limitations	When AZQJ is commissioned to have 10 or 20 MHz NR carriers, the maximum iBW is limited to ≤180 MHz. If iBW ≥ 160 W, set back-off to 0.8 dB.

¹⁾Operating mode introduced by CB008970 feature.

²⁾NR bandwidth 10 MHz has been introduced by the CB011173 feature.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 220: AZQJ interfaces

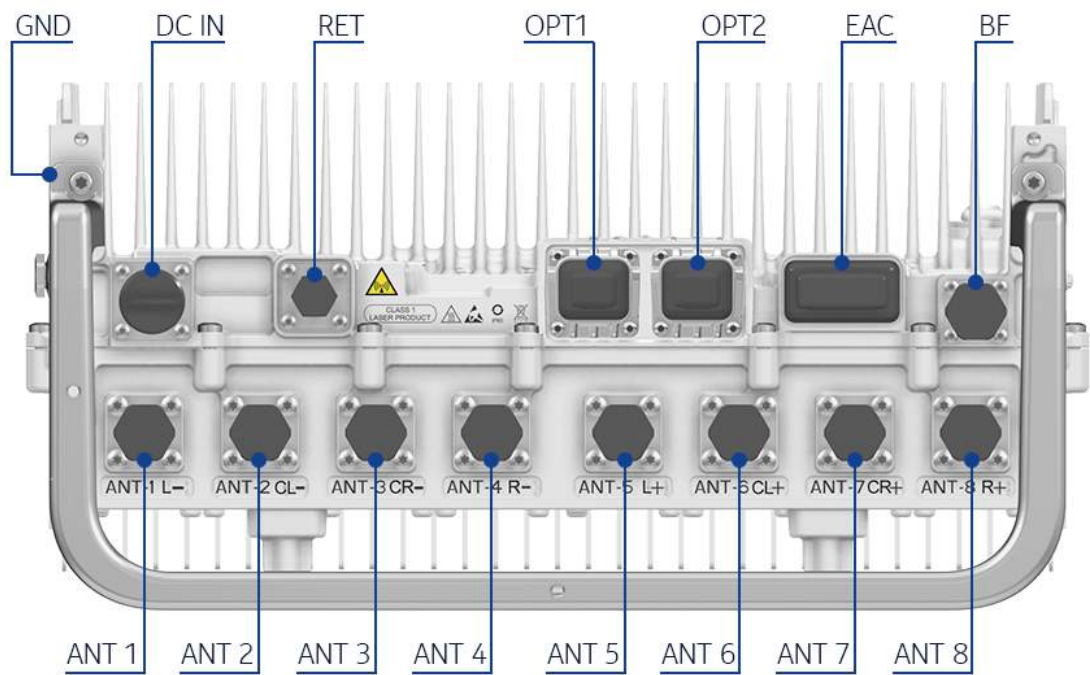


Table 747: AZQJ interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	-
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	-
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 10 Gbps (SFP+) or 25 Gbps* (SFP28); Nokia IP seal
Beamforming	BF	1	4.3-10	-
Grounding	GND 	1	2 x M5 screw	-
Fan	FAN	1	Nokia fan	Located in fins behind the BF connector

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Note:

There is no AISG support on the antenna lines. AISG + DC for RETs is only available through the beamforming calibration port and the RET (RS-485) port.

Note:

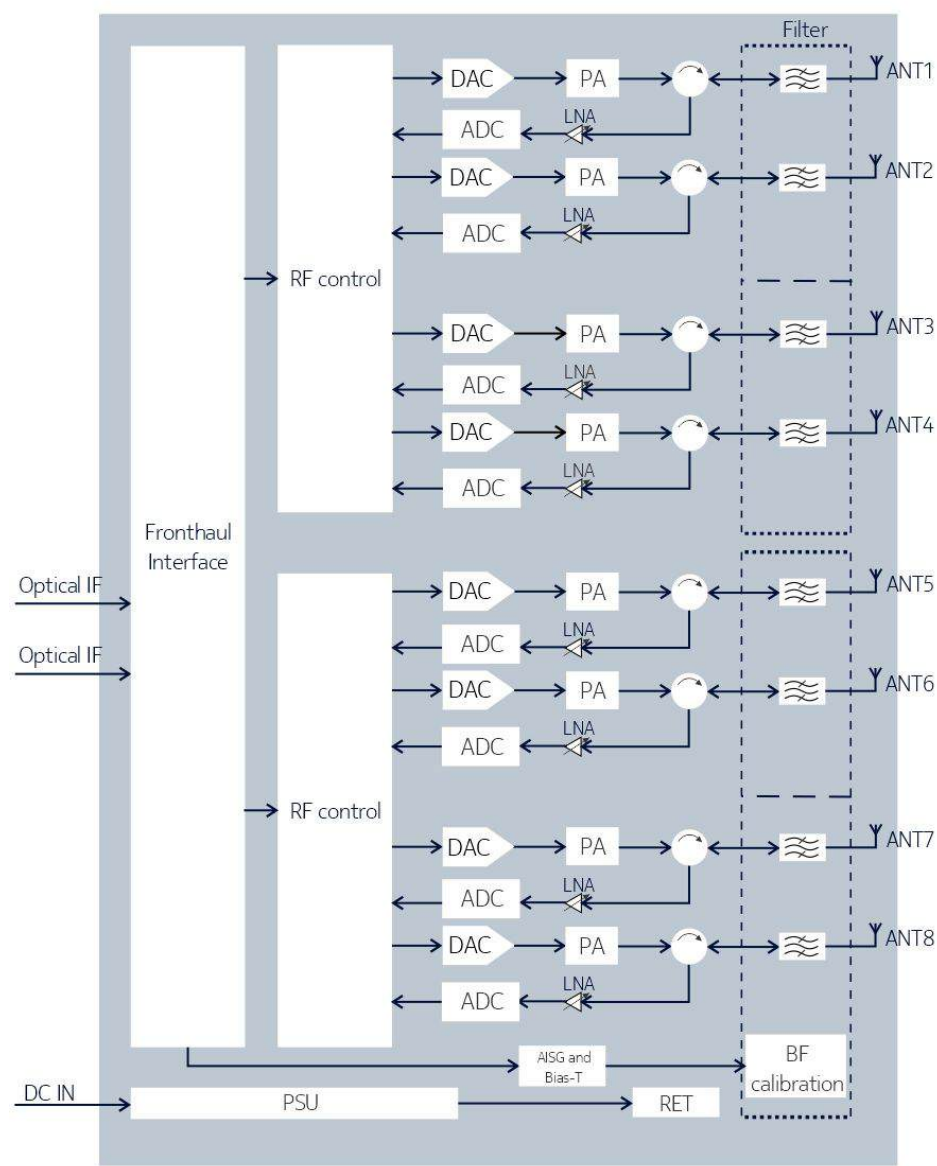
Recommended value for VSWR major and minor alarm threshold is 3.5.

Table 748: AZQJ ALD support

ALD support through RS-485 port	Value
AISG	2.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 221: AZQJ functional block diagram



Electrical specifications

Table 749: AZQJ electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	48 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.



Note:

The minimum startup voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 750: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

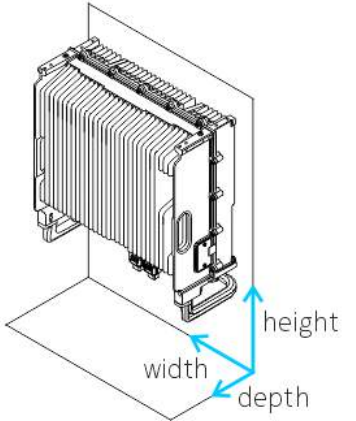
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- ASFG AirScale 8T8R TD RRH 395 mm fan unit (475796A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 Fiber Protection (474297A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 751: AZQJ dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 350 mm (13.78 in.)	
Width	Core RRH: 395 mm (15.55 in.)	
Depth	Core RRH: 190 mm (7.48 in.)	
Weight	Core RRH: 24 kg (52.9 lb)	

Note:

Dimensions and weight provided for core RRH, without heat shield, fan and mounting brackets.

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 752: AZQJ environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.27 AirScale RRH 8T8R n78 320 W eCPRI (AZQL)

AZQL (475130A) is introduced by 5GC001687 (for NR eCPRI).

Functional description

Table 753: AZQL functional specification

Property	Value
Maximum output power	320 W
Modulation	Up to 256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming (BF)	Yes
Operating mode ¹	BF mode: • 1 sector, 1 carrier, 8T8R with 8-port calibrated antenna. Supported antenna types defined by 5GC001849 and 5GC001866. For more information, see 5GC002142 and 5GC001849 feature description. Non-BF mode: • 1 or 2 sectors, 1 carrier, 2T2R for 2-port passive antennas • 1 sector, 1 carrier, 4T4R for 4-port passive antenna • 1 sector, 1 carrier, 2x4T4R subsectors for 4-port passive antennas • 1 sector, 1 carrier, 4x2T2R subsectors for 2-port passive antennas
Software supported technologies	NR
Duplex mode, supported standard	TDD
Frequency range	n78: 3480–3700 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 1
Maximum number of UL/DL MIMO streams	Up to 8
Supported bandwidths	NR: 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz

Note:

¹You can select only one operating mode for one radio unit. All cells must have the same carrier bandwidth and carrier frequency.

Note:

The radio unit is utilizing digital predistortion (DPD) method for improving the transmitter linearity. A single DPD iteration round of all antenna pipes may take up to one minute. During that time performance is not optimal and you may not yet reach higher modulation and coding scheme (MCS) ranks.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 222: AZQL interfaces

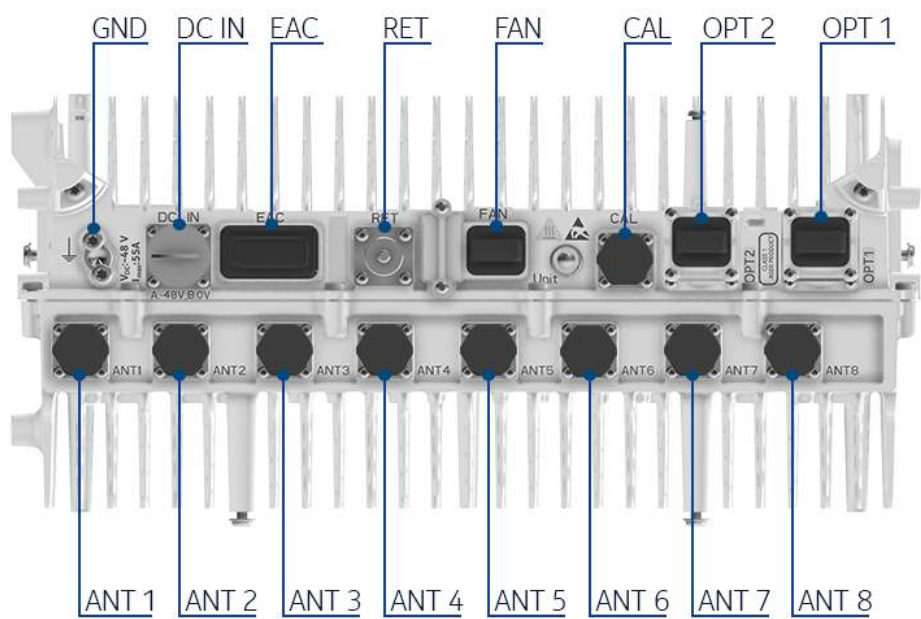


Table 754: AZQL interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	OBTS	APPB or APPC plug
Optical interface	OPT 1-2	2	SFP28, SFP+	eCPRI: 10 Gbps (SFP+) or 25 Gbps (SFP28); Nokia IP seal AOPC
External Alarm and Control	EAC	1	MDR26	6 alarm inputs and 1 control output
Remote Electrical Tilt	RET	1	AISG C485	–
Antenna connector	ANT 1-8	8	4.3-10 female	–
Calibration	CAL	1	4.3-10 female	–
Grounding	GND 	1	M8 or 2 x M5 screw	–



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF power from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 755: AZQL interface for ALD support

Property	Value
AISG	RAE: 2.0
Voltage	10-30 V
Power per port	-

Electrical specifications

Table 756: AZQL electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended parameter values

Recommend value for `dLQam256PowerBackoffSub6` parameter is:

- 1.5 dB for 3GPP performance requirement.
- 3 dB for high peak UE throughput (4x4 DL MIMO).

Related optional items

- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- AMGV AirScale 417mm 19 rack/stack fixing (475397A)
- AMBO AirScale book mount kit 201-225 (475396A)
- AMRB AirScale one clip bracket 126-200 (474581A)
- AMRC AirScale one clip rail 600 mm (474583A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- ASFF AirScale 8T8R fan unit (475567A)
- APPB AirScale2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection kit (474297A)

Installation options

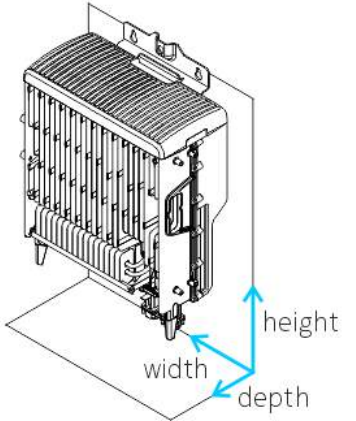
- *Pole*
- *Wall*
- One-clip mounting with AMRC (on *wall*, pole with *FPKA* or *FPKC*)
- *Stack with AMGV* (ASFF fan required)
- *19" rack with AMGV* (ASFF fan required)

Notice:

The RRH without a fan should always be mounted in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 757: AZQL dimensions and weight

Parameter	Details	Dimension orientation
Height	435 mm (17.13 in.) With mounting brackets: 561 mm (22.09 in.)	
Width	400 mm (15.74 in.)	
Depth	192 mm (7.56 in.) With mounting brackets: 217 mm (8.54 in.)	
Weight	25.5 kg (56.2 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 758: AZQL environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.28 AirScale RRH 8T8R B42/n78 320 W eCPRI (AZQS)

AZQS (475664A) is introduced by CB005777 (for LTE and NR).

Functional description

Table 759: AZQS functional specification

Property	Value
Maximum output power	320 W
Modulation	256 QAM
Number of TXX	8T8R
Outdoor installation	Yes
Beamforming	Yes (in 8T8R mode only)
Operating modes	• 8T8R • 2 x 4T4R • 4 x 2T2R • 4T4R/2T2R mix mode (non-beamforming)¹⁾
Supported technologies (standalone and MSR)	LTE, NR
Concurrent mode	LTE-NR
Duplex mode, supported standard	TDD
Frequency range	3400–3600 MHz
Instantaneous bandwidth (iBW)	LTE/NR: 200 MHz
Occupied bandwidth (oBW)	NR: 200 MHz LTE: 80 MHz
Number of carriers per pipe	NR: up to 3 LTE: up to 4
Supported bandwidths	NR: 10 ²⁾ , 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz LTE: 10, 15, 20 MHz

¹⁾Operating mode introduced by *CB008970* feature.

²⁾NR bandwidth 10 MHz has been introduced by the *CB011173* feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 223: AZQS interfaces

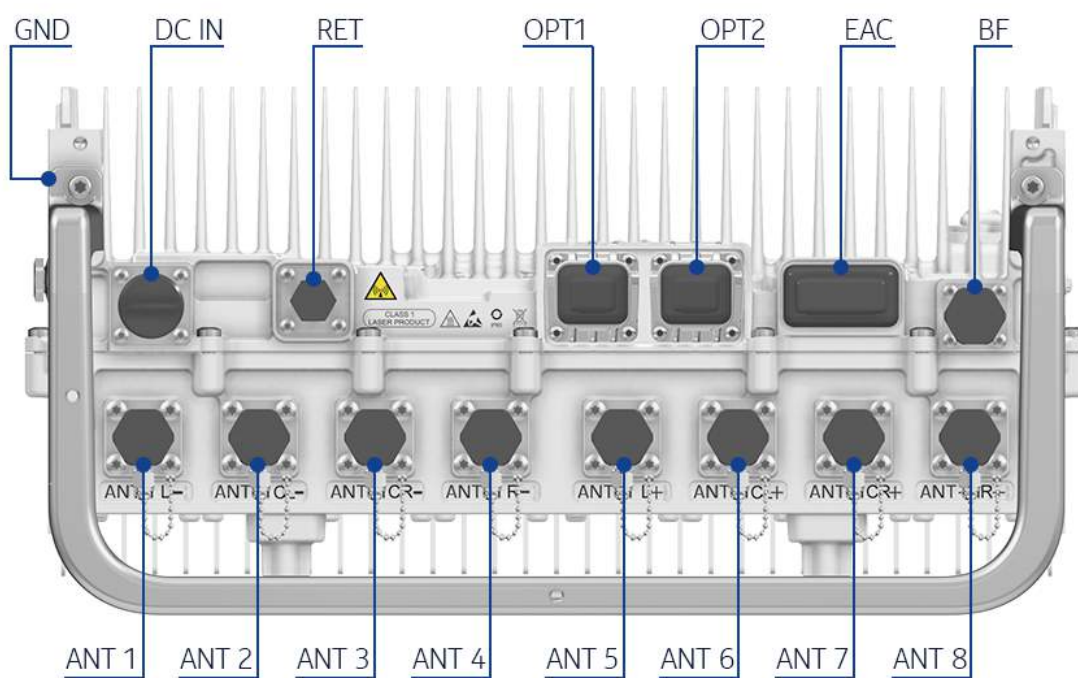


Table 760: AZQS interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	RF monitor SMA female connectors located under each antenna connector.
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 10 Gbps (SFP+) or 25 Gbps* (SFP28); Nokia IP seal
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw or M8 screw	–
Fan	FAN	1	Nokia fan	Located in the fins behind the BF connector

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

 Note:

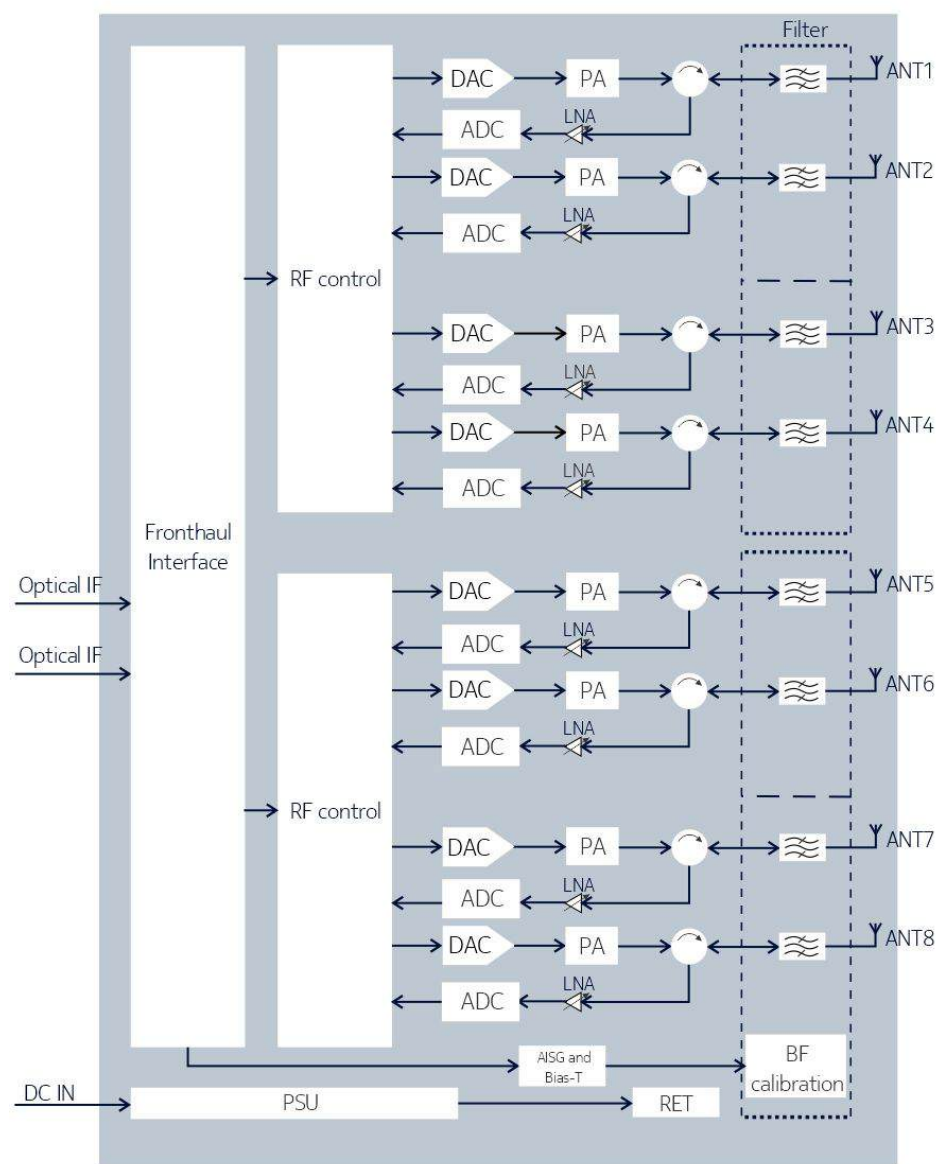
There is no antenna interface standards group (AISG) support on the antenna lines. AISG+DC for RETs is only available through the beamforming calibration port and the RET (RS-485) port.

Table 761: AZQS ALD support

ALD support through RS-485 port	Value
AISG	2.0, 3.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 224: AZQS functional block diagram



Electrical specifications

Table 762: AZQS electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Maximum current draw ($I_{\max}$) (-36 V)*	48 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond the extended limits, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 763: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

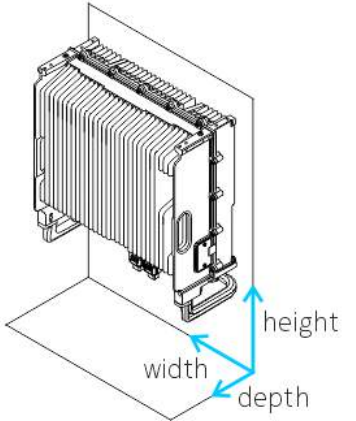
- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- ASFG AirScale 8T8R TD RRH 395 mm fan unit (475796A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

Installation options

- *Pole:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*
- *Wall:*
 - *Vertical*
 - *One-clip rail*
 - *Book mounting*

Dimensions and weight

Table 764: AZQS dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 350 mm (13.78 in.)	
Width	Core RRH: 395 mm (15.55 in.)	
Depth	Core RRH: 190 mm (7.48 in.)	
Weight	Core RRH: 24.8 kg (54.7 lb)	

Note:

Dimensions and weight provided for core RRH, without heat shield, fan, and mounting brackets.

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 765: AZQS environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

6.29 AirScale RRH 8T8R n79 192 W eCPRI (AZTA)

AZTA (475741A) is introduced by CB006144 (for NR).

Functional description

Table 766: AZTA functional specification

Property	Value
Maximum output power	192 W
Modulation	256 QAM
Number of TXRX	8T8R
Outdoor installation	Yes
Beamforming	Yes
Operating modes	• 8T8R • 2 x 4T4R  Note: Beamforming (BF) is available only in 8T8R mode.
Supported technologies	NR
Duplex mode - supported standard	TDD
Frequency range	n79: 4500–4600 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	NR: Up to 2
Maximum number of UL/DL MIMO streams	Up to 8
Supported bandwidths	NR: 100 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 225: AZTA interfaces

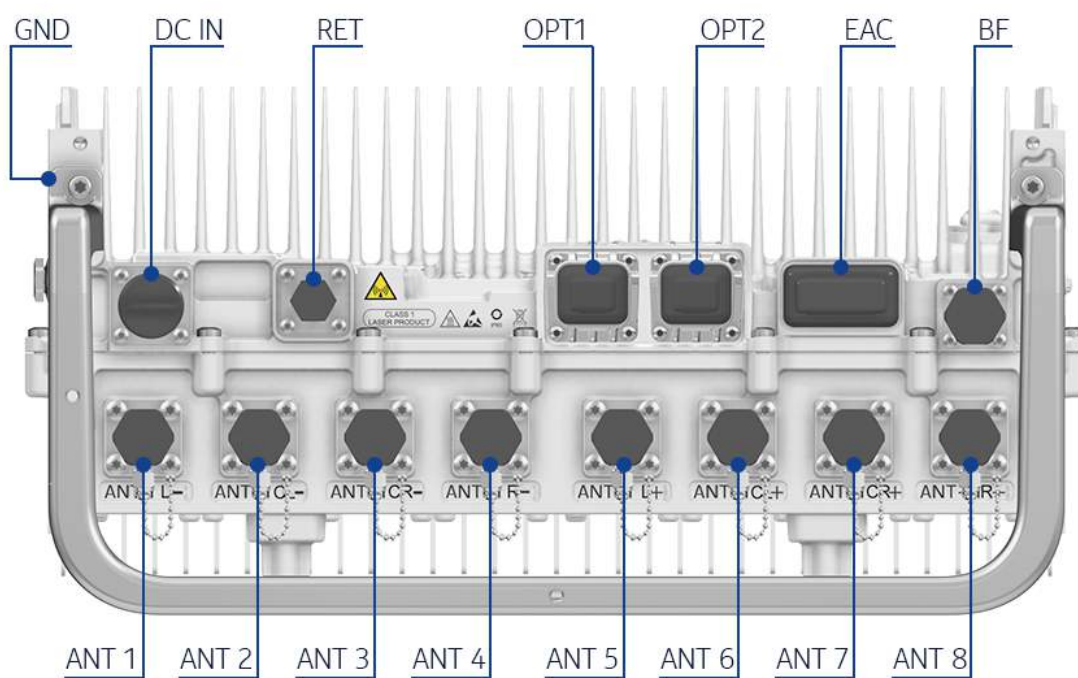


Table 767: AZTA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	High power circular	APPB, APPC
Antenna connector	ANT	8	4.3-10	–
Remote Electrical Tilt	RET	1	8-pin circular	RS-485
External Alarm Connection	EAC	1	MDR26	–
Optical interface	OPT	2	SFP28, SFP+	eCPRI: 10 Gbps (SFP+) or 25 Gbps* (SFP28); Nokia IP seal AOPC
Beamforming	BF	1	4.3-10	–
Grounding	GND 	1	2 x M5 screw or 1 x M8 screw	–
Fan	FAN	1	Nokia fan	Located in fins behind the BF connector
RF monitor	–	8	SMA, female	Located under each antenna connector

*Maximum link utilization is 72% DL and 90% UL for 25 Gbps.



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support



Note:

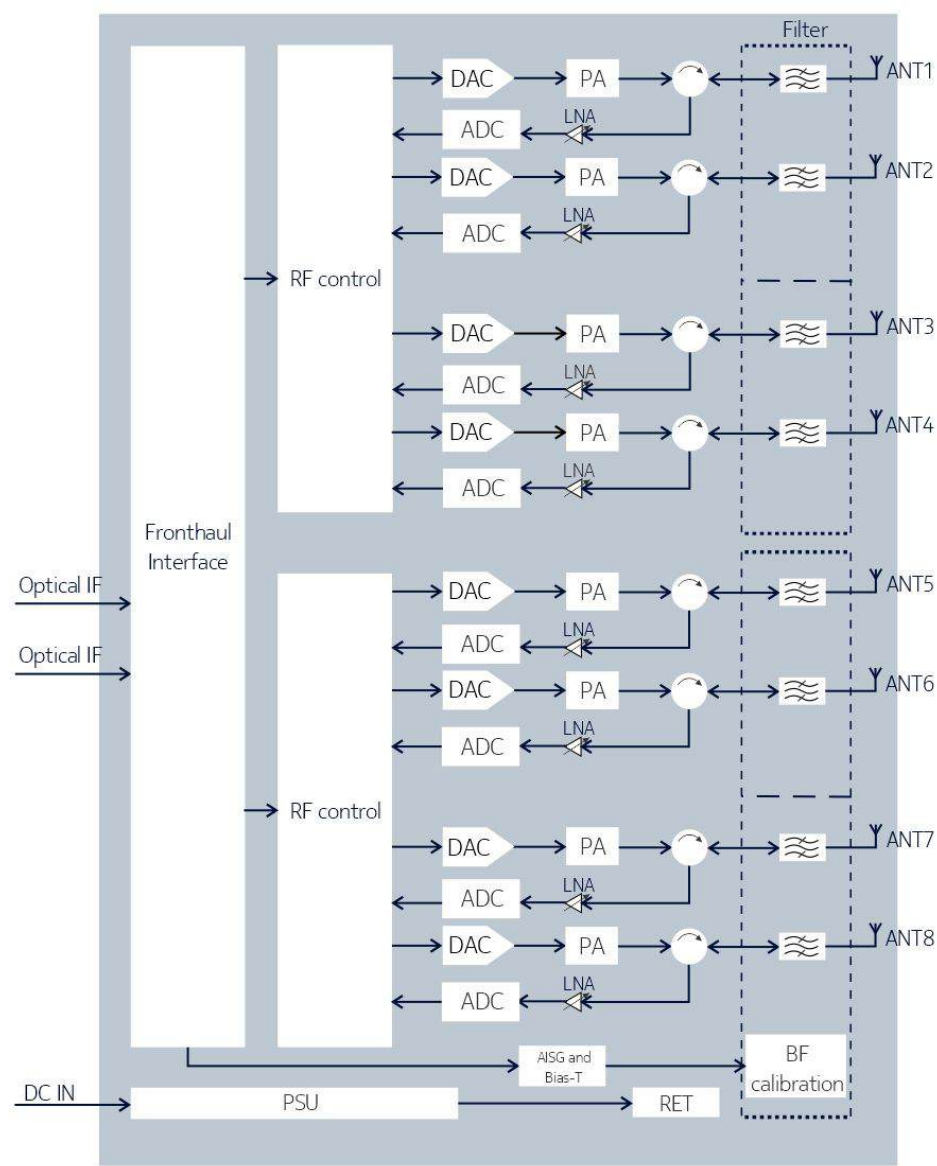
There is no AISG support on the antenna lines. AISG + DC for RETs is only available through the beamforming calibration port and the RET (RS-485) port.

Table 768: AZTA ALD support

ALD support through RS-485 port	Value
Antenna Interface Standards Group (AISG)	Version 2.0
Voltage	14.5 V
Power per port	15 W total per unit (2 W ALD modem + 13 W RET)

Functional block diagram

Figure 226: AZTA functional block diagram



Electrical specifications

Table 769: AZTA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 20 kA
Maximum current draw ($I_{\max}$) (-36 V)*	48 A

*The $I_{\max}$ of the RU is given at an operating voltage of -36 V. For higher input voltages, you need to calculate a new $I_{\max}$ value. Note that the $I_{\max}$ given in the table might not be reached in actual use cases. For more information, see the guidance for power system dimensioning in *Nokia AirScale BTS Installation Site Requirements*.

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 770: The recommended NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter value in 256 QAM

DL MIMO configuration	dlQam256PowerBackoffSub6 value [dB]
Open loop MIMO	1.5
Close loop MIMO	3

 Note:

To achieve lower power back-off values you may need to enable the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- FPKA Flexi pole mounting kit (30-120 mm) (471649A)
- FPKC Flexi pole mounting kit (60- 300 mm) (472821A)
- ASFG AirScale 8T8R TD RRH 395 mm fan unit (475796A)
- AMPA pole mounting kit (30-120 mm) (473879A)
- AMFD AirScale 2 FPKx fixing adapter 600 (474293A)
- AMBQ book mounting kit (475591A)
- AMRB AirScale one clip bracket 126-200 (474581A) - version 102
- AMRC AirScale one clip rail 600 mm (474583A)
- APPB AirScale 2 55A DC plug 3.3-10 mm² (474282A)
- APPC AirScale 2 55A DC plug 10-16 mm² (474283A/474283B)
- ACPA AirScale 2 fiber protection (474297A)
- ASAD AirScale MDR26-open EAC cable 5m (475570A)

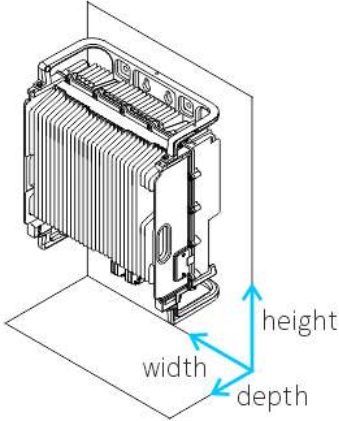
Installation options

- Pole:
 - Vertical
 - One-clip rail
 - Book mounting
- Wall:
 - Vertical

- One-clip rail
- Book mounting

Dimensions and weight

Table 771: AZTA dimensions and weight

Property	Value	Dimensions orientation
Height	Core RRH: 350 mm (13.78 in.) With heat shield: 354 mm (13.94 in.)	
Width	Core RRH: 395 mm (15.55 in.) With heat shield: 406 mm (15.98 in.)	
Depth	Core RRH: 190 mm (7.48 in.) With heat shield: 193 mm (7.6 in.)	
Weight	Core RRH: 24.0 kg (52.9 lb) With heat shield: 24.8 kg (54.7 lb)	

Note:

Dimensions and weight are provided without fan and mounting brackets.

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 772: AZTA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan
IP rating	IP65

7. AirScale micro RRHs descriptions

7.1 AirScale Micro RRH 2T B46 UNII 1+2+3 1 W (AZRB)

AZRB (474510A) is introduced by *LTE4253* (for LTE).

Functional description

Table 773: AZRB functional specification

Property	Value
Maximum output power	1 W ¹
Modulation	256 QAM
Number of TXRX	2T
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE
Duplex mode	FDD
TX frequency range	UNII-1: 5170-5250 MHz UNII-2: 5250-5330 MHz ² UNII-2: 5490-5725 MHz UNII-3: 5735-5835 MHz
Filter bandwidth	UNII-1: 80 MHz UNII-2: 80 MHz (not permitted yet) UNII-2: 235 MHz (not permitted yet) UNII-3: 100 MHz
Instantaneous bandwidth (iBW)	80 MHz
Occupied bandwidth (oBW)	60 MHz (80 MHz with <i>LTE4224</i>)
Number of carriers per pipe	Up to 3
Supported bandwidths	20 MHz
PIM cancellation	No

¹Due to low power and high-quality antenna connectors, AZRB doesn't support VSWR alarm reporting.

²Due to the type approval of the *LTE4216: DFS Support for LAA* feature, using UNII-2 channels with AZRB is available from SW version FL18A 3.0 onward.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 227: AZRB interfaces and LED indicators

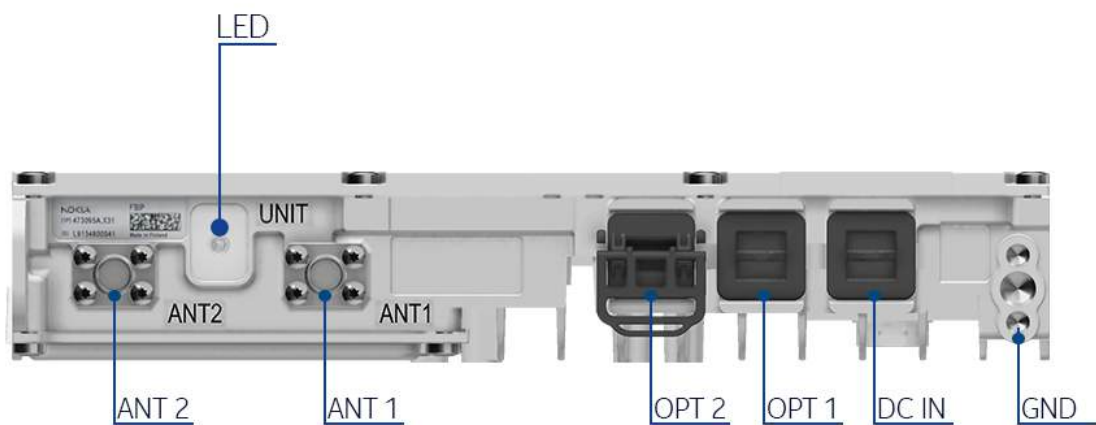


Table 774: AZRB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	OCTIS Plug Kit DC Power	Hot insert not supported
Antenna connector	ANT	2	NEX 10	-
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6;
Grounding	GND 	1	M8 or dual M5 screws	-

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

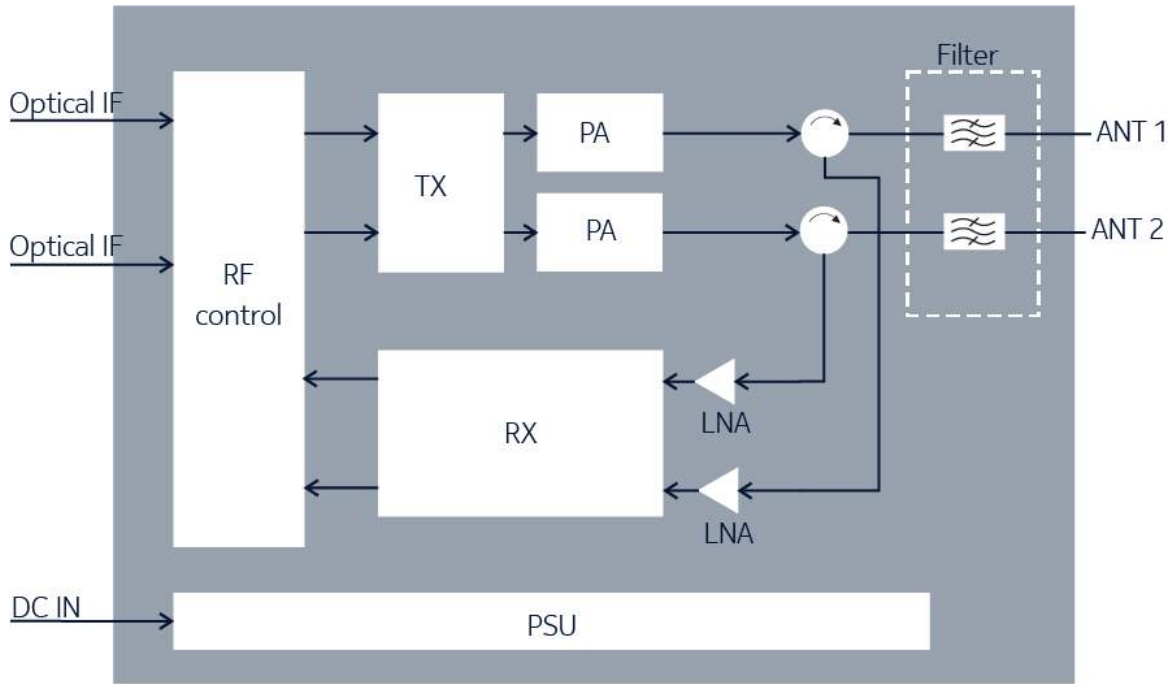
Antenna line device (ALD) support

 Note:

AZRB doesn't support ALD systems.

Functional block diagram

Figure 228: AZRB functional block diagram



Electrical specifications

Table 775: AZRB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36 V to -40.5 V and -57 V to -60 V (DC)

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

! Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBM AirScale micro horizontal strand mount bracket (474956A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- FMWM AirScale micro RRH enclosure (474431A)
- FMWV AirScale micro RRH enclosure (475185A)

i Note:

Whether installation in FMWV or FMWM is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAB AirScale micro AC PSU (474130A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AARC AirScale micro integrated antenna (474618A)

i Note:

Refer to *Cabling Nokia AirScale Micro Remote Radio Heads* section in the *Installing and Cabling Nokia AirScale Micro Remote Radio Heads* document for a list of currently approved antennas for AZRB B46.

Installation options

- Pole:
 - *Fixed orientation*

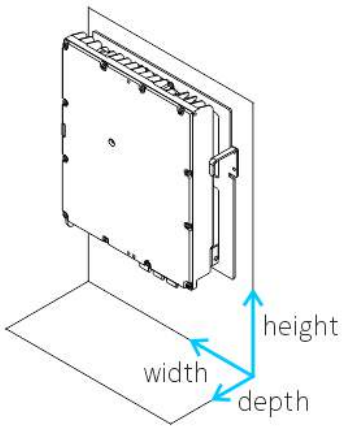
- Tilt mounting
- Multi-directional tilt mounting
- Bookshelf mounting
- Wall:
 - Fixed orientation
 - Tilt mounting
 - Multi-directional tilt mounting
 - Bookshelf mounting
- Strand
- Enclosure FMWM or FMWV

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 776: AZRB dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	245 mm (9.65 in.) core unit (DC version) 270 mm (10.63 in.) with AC adapter (AC version)	
Depth	45 mm (1.77 in.) core unit (DC version) 55 mm (2.17 in.) with AC adapter (AC version)	
Weight	5.0 kg (11.0 lb) core unit (DC version) 5.8 kg (12.8 lb) with AC adapter (AC version)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 777: AZRB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

Warnings, cautions or notes related to the product

Note:

In accordance with KDB 353028 D01 Antennas Part 15 Transmitters and KDB 178919 D01 Permissive Change Policy v06, for B46 unlicensed band antennas, AZRB may not be substituted for models used during the type approval process without prior consultation with your local Nokia account team. Additional regulatory approvals may be required.

7.2 AirScale Micro RRH 2T B46 UNII 1+2+3 1 W (AZRC)

AZRC (474784A) is introduced by *LTE4872* (for LTE).

Functional description

Table 778: AZRC functional specification

Property	Value
Maximum output power	1 W
Modulation	256 QAM
Number of TXRX	2T
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE
Duplex mode	FDD
TX frequency range	UNII-1: 5170-5250 MHz UNII-2A: 5250-5330 MHz ¹ UNII-2C: 5490-5725 MHz ² UNII-3: 5735-5835 MHz ³
Filter bandwidth	UNII-1: 80 MHz UNII-2A: 80 MHz UNII-2C: 235 MHz UNII-3: 100 MHz
Instantaneous bandwidth (iBW)	80 MHz
Occupied bandwidth (oBW)	60 MHz (80 MHz with <i>LTE4224</i>)
Number of carriers per pipe	Up to 3
Supported bandwidths	20 MHz
PIM cancellation	No

¹UNII-2 channels can't be used until full type approval for the *LTE4788: ETSI and IC DFS Support for LAA* feature is available.

²UNII-2C channels are supported by IC and ETSI regulatory domains.

³UNII-3 channels are supported by IC regulatory domain only.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 229: AZRC interfaces and LED indicators

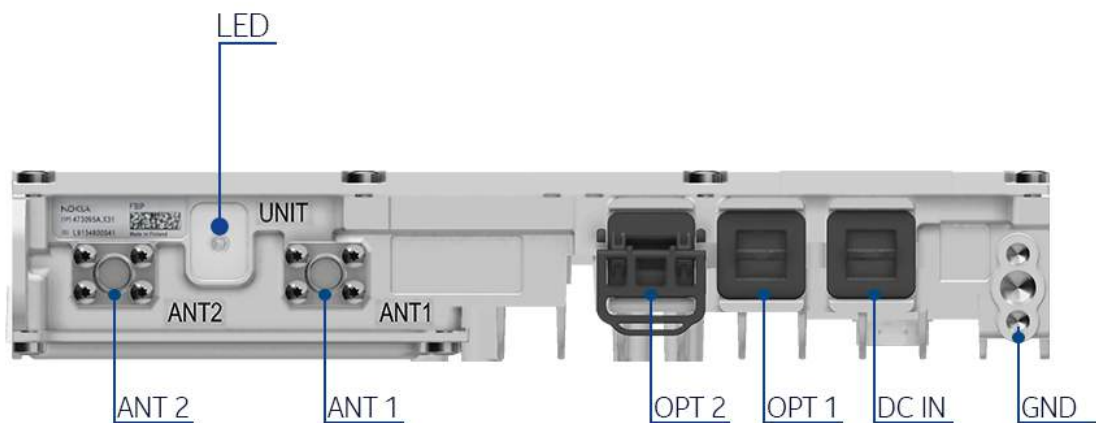


Table 779: AZRC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	OCTIS Plug Kit DC Power	Hot insert not supported
Antenna connector	ANT	2	NEX 10	–
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6;
Grounding	GND 	1	M8 or dual M5 screws	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

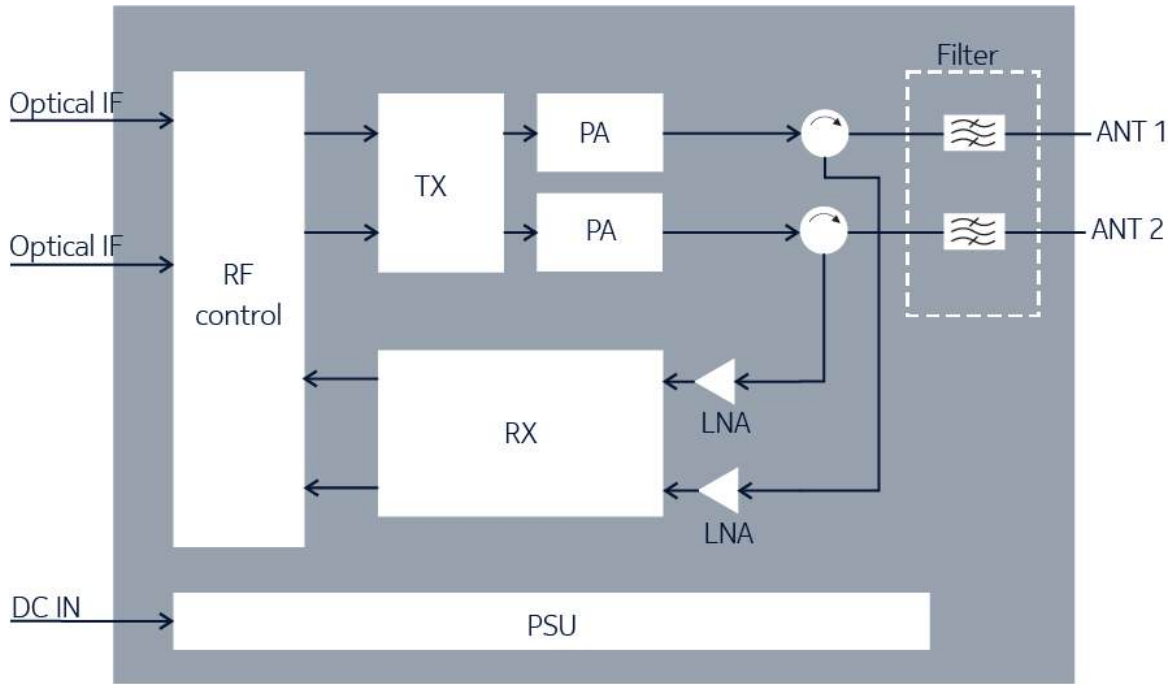
Antenna line device (ALD) support

 Note:

AZRC doesn't support ALD systems.

Functional block diagram

Figure 230: AZRC functional block diagram



Electrical specifications

Table 780: AZRC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

! Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBM AirScale micro horizontal strand mount bracket (474956A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- FMWM AirScale micro RRH enclosure (474431A)
- FMWV AirScale micro RRH enclosure (475185A)

i Note:

Whether installation in FMWV or FMWM is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAB AirScale micro AC PSU (474130A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AARC AirScale micro integrated antenna (474618A)

Installation options

- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*
 - *Tilt mounting*

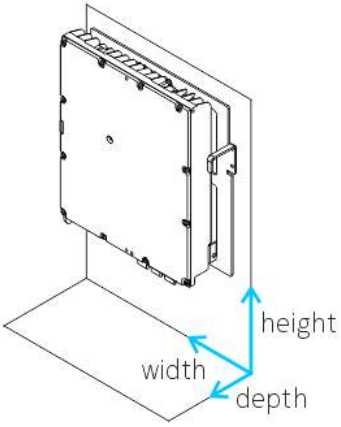
- Multi-directional tilt mounting
- Bookshelf mounting
- Strand
- Enclosure

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 781: AZRC dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	Core RRH (DC version): 245 mm (9.65 in.) RRH with an AC adapter (AC version): 270 mm (10.63 in.)	
Depth	Core RRH (DC version): 45 mm (1.77 in.) RRH with an AC adapter (AC version): 55 mm (2.17 in.)	
Weight	Core RRH (DC version): 5.0 kg (11.0 lb) RRH with an AC adapter (AC version): 5.8 kg (12.8 lb)	

Environmental specifications



Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 782: AZRC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	–40°C (–40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

7.3 AirScale Micro RRH 2T2R B41/n41 200 W (AWHHG and AWHHH)

AWHHG (475184A) and AWHHH (475212A) are introduced by 5GC001776 (for NR). AWHHH is an AC powered variant of AWHHG, which is natively DC powered.

Functional description

Table 783: AWHHG and AWHHH functional specification

Property	Value
Maximum output power	200 W
Modulation	256 QAM
Number of TXX	2T2R
Outdoor installation	Yes
Beamforming	No
Supported technology	LTE, NR
Duplex mode	TDD
Frequency range	B41/n41: 2515-2675 MHz
Instantaneous bandwidth (iBW)	160 MHz
Occupied bandwidth (oBW)	160 MHz
Number of carriers per pipe	LTE: up to 3 NR: up to 2 LTE + NR: up to 4
Supported bandwidths	LTE: 20 MHz NR: 60, 100 MHz
Limitations	Activating the 5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μ DTx usage.

Interfaces

Figure 231: AWHHG and AWHHH interfaces and LED indicators

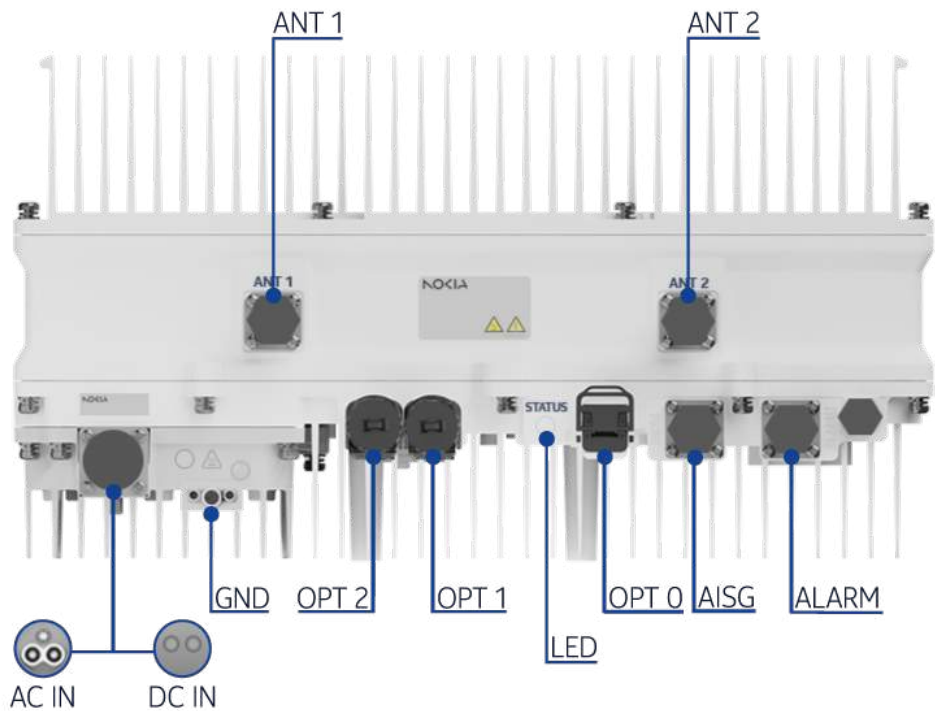


Table 784: AWHHG and AWHHH interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	–	1	DC version: 2-pin circular connector AC version: 3-pin circular connector	Hot insert not supported
Antenna connector	ANT	2	N-type	–
External Alarm Connection	ALARM	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	CPRI: 9.8 Gbps, OCTIS IP seal
Grounding	GND⏚	1	M8 or 2 x M5 screw	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

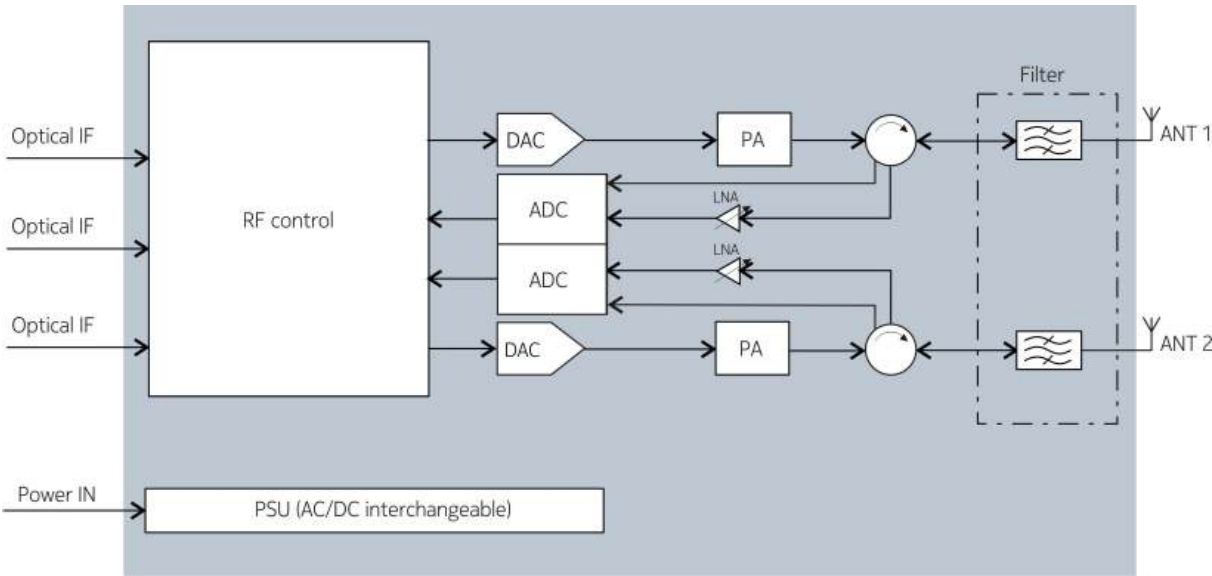
Antenna line device (ALD) support

Table 785: AWHHG and AWHHH ALD support

Property	Value
AISG	2.0
Voltage	24 V
Power per port	30 W

Functional block diagram

Figure 232: AWHHG and AWHHH functional block diagram



Electrical specifications

Table 786: AWHHG and AWHHH electrical specifications

Property	Value
Nominal supply voltage	DC version: -48 V DC AC version: 220 V AC
Nominal input voltage range	DC version: -40.5 to -57 V DC
Extended input voltage range	DC version: -36 to -40.5 V and -57 to -60 V DC AC version: 140 to 300 V AC

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

Table 787: Recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
NR	NRCELL PDSCH power back-off for 256 QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMEB AirScale strap mount pole kit (474923A)

Note:

The AMEB bracket (474923A) is no longer available for purchase. It has been replaced by the AMED bracket (475736A).

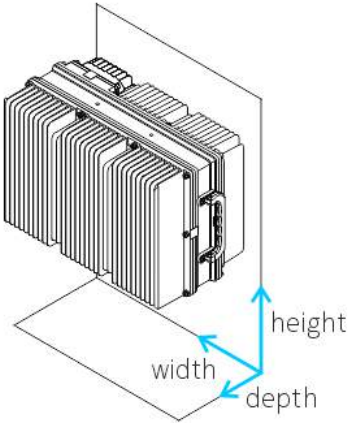
- AMED 20 deg tilt pole mount kit (475736A)
- APPB AirScale 2 55 A DC plug 3.3-10 mm² – OD 8-15 mm (474282A)
- APPF conn 3 pole female AC plug 1.5-6 mm² – OD 8-15 mm (474893A)
- OCTIS plug kit SFP 2 (475756A)

Installation options

- Pole
- Wall

Dimensions and weight

Table 788: AWHHG and AWHHH dimensions and weight

Property	Value	Dimensions orientation
Height	270 mm (10.63 in.)	
Width	410 mm (16.14 in.)	
Depth	225 mm (8.86 in.)	
Weight	21.0 kg (46.3 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 789: AWHHG and AWHHH environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

7.4 AirScale Micro 4T4R B1 20 W (AHGB)

AHGB (474514A) is introduced by LTE4269 (for WCDMA and LTE), SR002040 (for WCDMA and LTE), and 5GC001484 (for NR).

Functional description

Table 790: AHGB functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies	WCDMA, LTE, NR
RF sharing/concurrent mode	WCDMA-LTE, LTE-NR
Duplex mode	FDD
TX frequency range	2110–2170 MHz
RX frequency range	1920–1980 MHz
DL filter bandwidth	60 MHz
UL filter bandwidth	60 MHz
Instantaneous bandwidth (iBW)	60 MHz
Occupied bandwidth (oBW)	60 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	WCDMA: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8, 5 MHz LTE: 5, 10, 15, 20 MHz NR: 20 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

**WARNING!****Risk of electric shock**

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

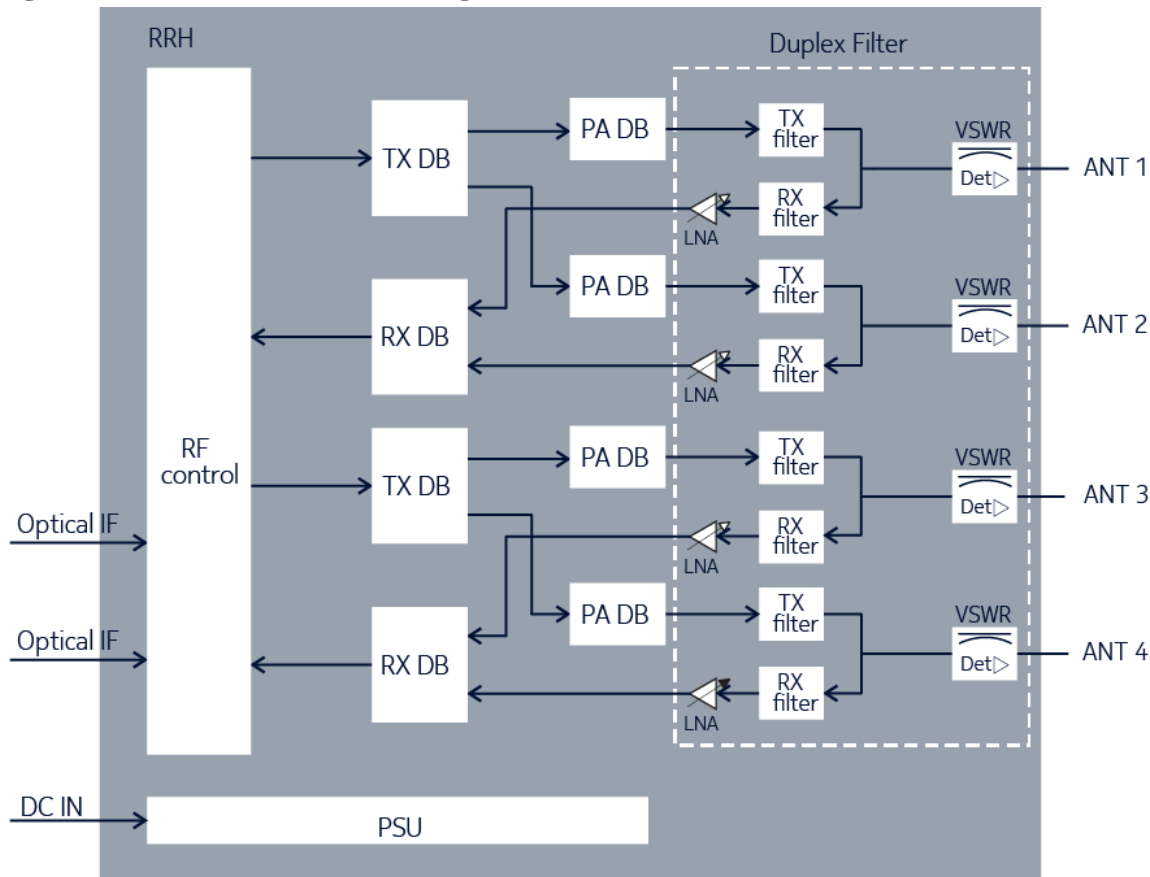
Antenna line device (ALD) support

Note:

There is no Antenna Line Device support for AHGB.

Functional block diagram

Figure 234: AHGB functional block diagram



Electrical specifications

Table 792: AHGB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36 V to -40.5 V and -57 V to -60 V (DC)

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

! Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AMBL AirScale micro horizontal strand mount bracket (474849A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)²⁾
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- FMWM AirScale micro RRH enclosure (474431A)

i Note:

Whether installation in FMWM is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAB AirScale micro AC PSU (474130A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AAFA AirScale micro integrated antenna (474185A)

Installation options

- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*

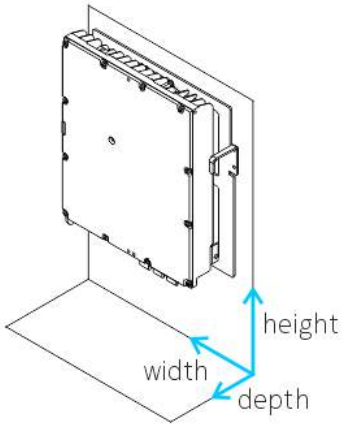
- Tilt mounting
- Multi-directional tilt mounting
- Bookshelf mounting
- Strand
- Enclosure

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 793: AHGB dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.6 in.)	
Width	245 mm (9.6 in.)	
Depth	55 mm (2.2 in.)	
Weight	5.4 kg (11.7 lb) core unit (DC version) 6.1 kg (13.4 lb) with AC adapter (AC version)	

Environmental specifications



Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 794: AHGB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

²⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.5 AirScale Micro 4T4R B3 20 W (AHEJ)

AHEJ (474513A) is introduced by LTE4270 (for LTE) and 5GC001485(for NR).

Functional description

Table 795: AHEJ functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	FDD
TX frequency range	1805-1880 MHz
RX frequency range	1710-1785 MHz
DL filter bandwidth	75 MHz
UL filter bandwidth	75 MHz
Instantaneous bandwidth (iBW)	75 MHz
Occupied bandwidth (oBW)	75 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 20 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 235: AHEJ interfaces and LED indicators

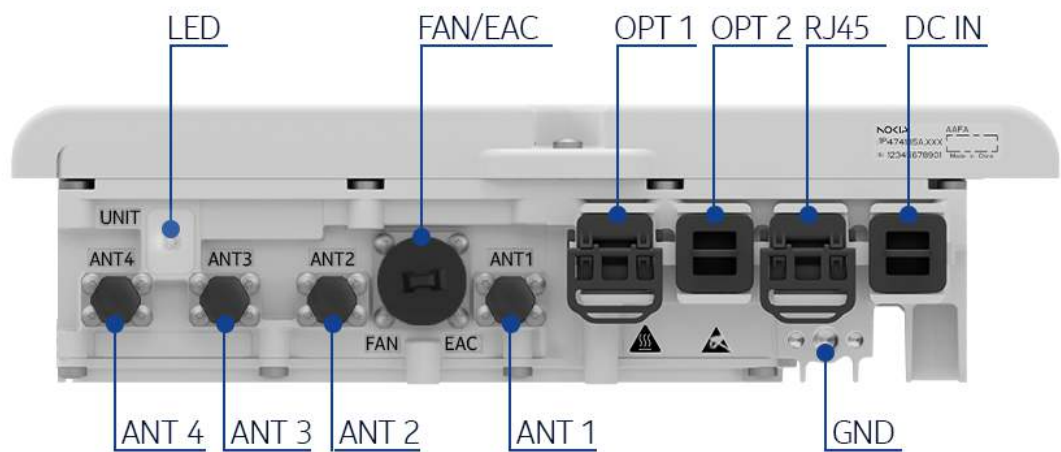


Table 796: AHEJ interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC Octis Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
External Alarm Connection/Fan	EAC/FAN	1	CIRC 8F IP67 Flange	–
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6;
Ethernet	RJ	1	RJ45	Separate feature required to enable this interface
Grounding	GND 	1	M8 or dual M5 screws	–

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

**WARNING!****Risk of electric shock**

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

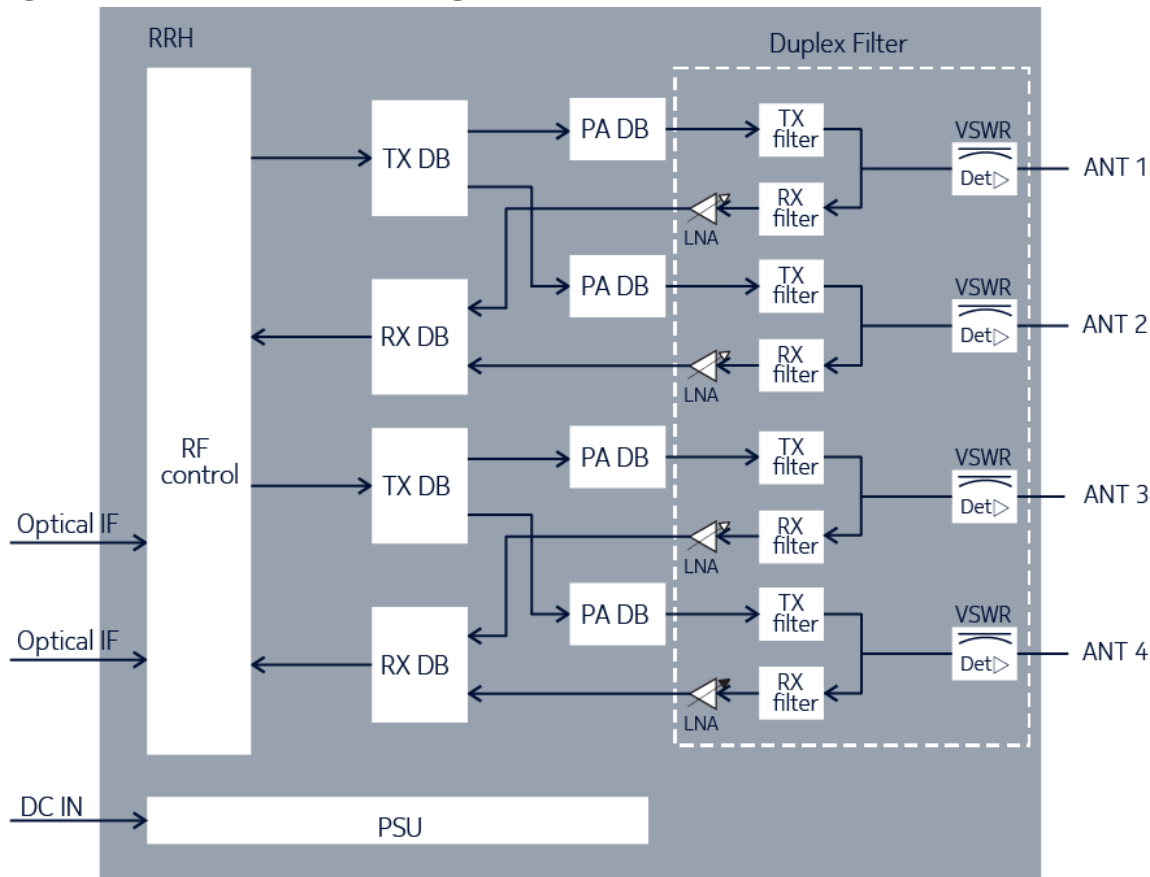
Antenna line device (ALD) support

Note:

There is no Antenna Line Device support for AHEJ.

Functional block diagram

Figure 236: AHEJ functional block diagram



Electrical specifications

Table 797: AHEJ electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36 V to -40.5 V and -57 V to -60 V (DC)

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

! Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AMBL AirScale micro horizontal strand mount bracket (474849A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)³⁾
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- FMWM AirScale micro RRH enclosure (474431A)

i Note:

Whether installation in FMWM is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAB AirScale micro AC PSU (474130A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AAFA AirScale micro integrated antenna (474185A)

Installation options

- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*

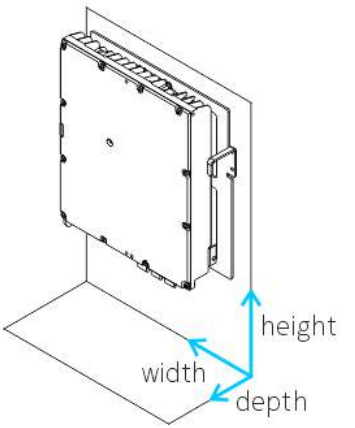
- Tilt mounting
- Multi-directional tilt mounting
- Bookshelf mounting
- Strand
- Enclosure

! Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 798: AHEJ dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	245 mm (9.65 in.)	
Depth	55 mm (2.17 in.)	
Weight	5.4 kg (11.7 lb) core unit (DC version) 6.1 kg (13.4 lb) with AC adapter (AC version)	

Environmental specifications



Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 799: AHEJ environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

³⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.6 AirScale Micro 4T4R B5 20 W (AHCE)

AHCE (474044A) is introduced by LTE3654 (for LTE) and 5GC001486 (for NR).

Functional description

Table 800: AHCE functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, standalone
TX frequency range	869-894 MHz
RX frequency range	824-849 MHz
DL filter bandwidth	25 MHz
UL filter bandwidth	25 MHz
Instantaneous bandwidth (iBW)	25 MHz
Occupied bandwidth (oBW)	25 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 1.4, 3, 5, 10 MHz including NB-IoT (in band and guard band) NR: 5, 10, 15, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 237: AHCE interfaces and LED indicators

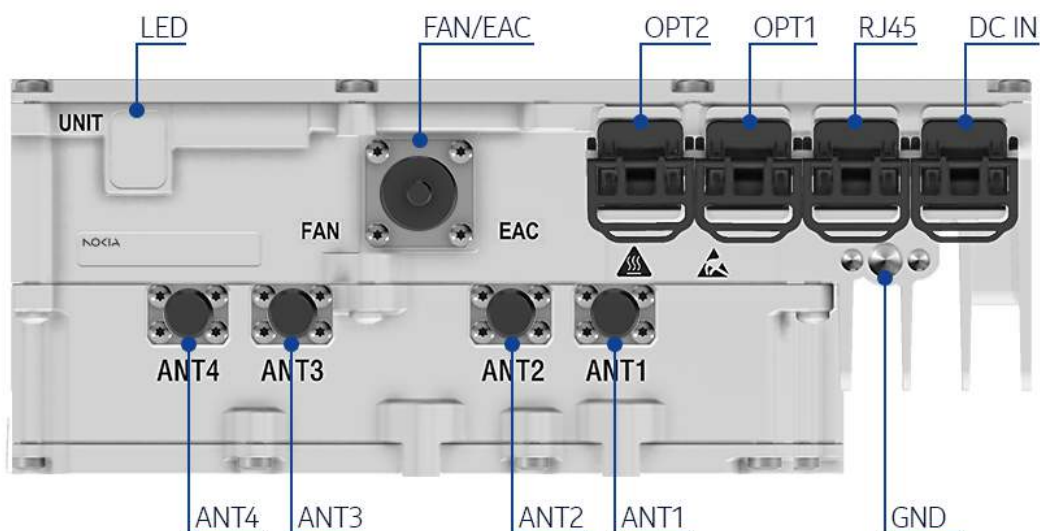


Table 801: AHCE interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	–
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6;
Ethernet	RJ	1	RJ45	Separate feature required to enable this interface
Grounding	GND 	1	M8 or dual M5 screws	–



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

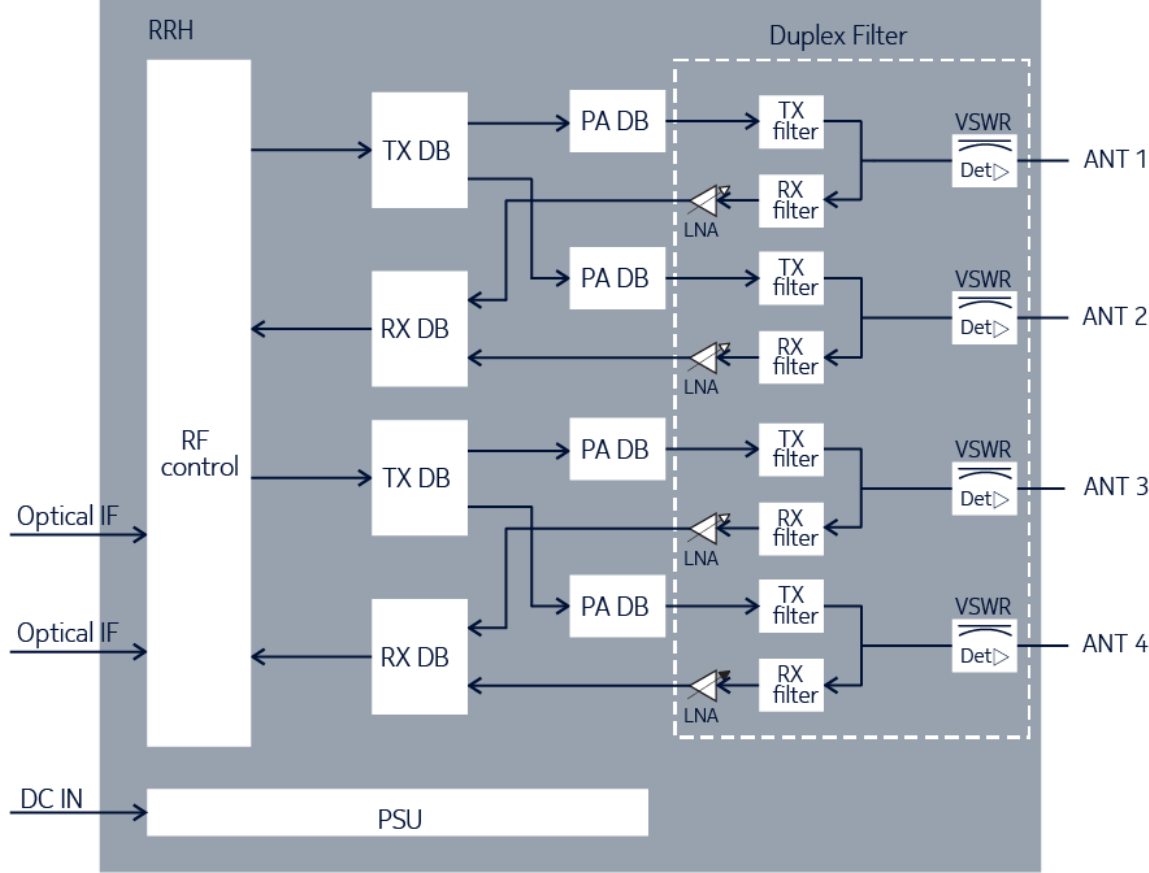
Antenna line device (ALD) support

Note:

There is no Antenna Line Device support for AHCE.

Functional block diagram

Figure 238: AHCE functional block diagram



Electrical specifications

Table 802: AHCE electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36 V DC to -40.5 V DC -57 V DC to -60 V DC

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

 Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AACA AirScale micro integrated antenna (474227A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AMBL AirScale micro horizontal strand mount bracket (474849A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)⁽⁴⁾
- FMWM AirScale micro RRH enclosure (474431A)
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV or FMWM is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- APAB AirScale micro AC PSU (474130A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)

Installation options

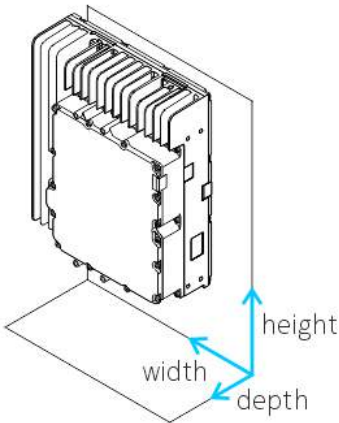
- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Strand
- Enclosure FMWM or FMWV

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 803: AHCE dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	245 mm (9.55 in.)	
Depth	95 mm (3.74 in.)	
Weight	8.0 kg (17.6 lb) core unit (DC version) 8.7 kg (19.2 lb) with AC adapter (AC version)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 804: AHCE environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

⁴⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.7 AirScale Micro 4T4R B7 20 W (AHHA)

AHHA (474147A) is introduced by LTE3713 (for LTE) and 5GC001483 (for NR).

Functional description

Table 805: AHHA functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	FDD
TX frequency range	2620–2690 MHz
RX frequency range	2500–2570 MHz
DL filter bandwidth	70 MHz
UL filter bandwidth	70 MHz
Instantaneous bandwidth (iBW)	70 MHz
Occupied bandwidth (oBW)	70 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 5, 10, 15, 20 MHz NR: 20 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 239: AHHA interfaces and LED indicators

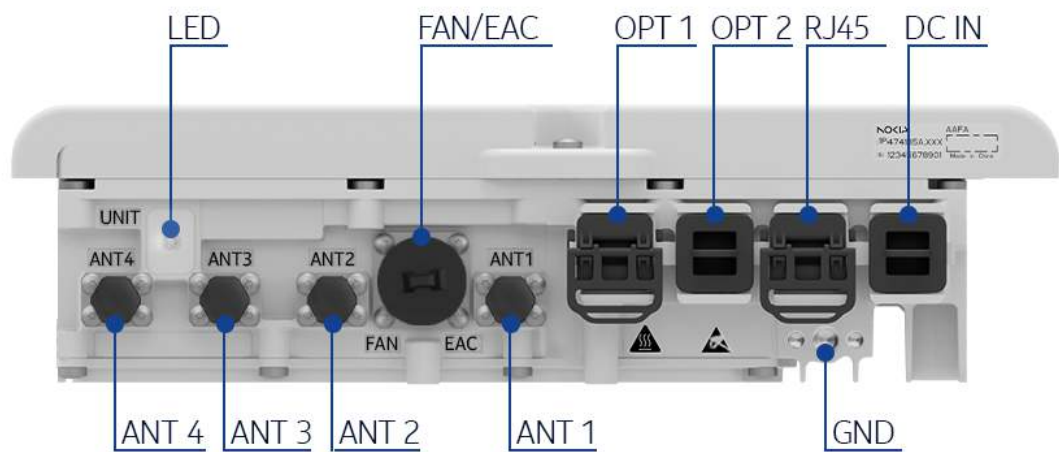


Table 806: AHHA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC Octis Plug Kit	–
Antenna connector	ANT	4	Nex10	–
External Alarm Connection/Fan	FAN/EAC	1	CIRC 8F IP67 Flange	–
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6;
Grounding	GND 	1	M8 or dual M5 screws	–



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!**Risk of electric shock**

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

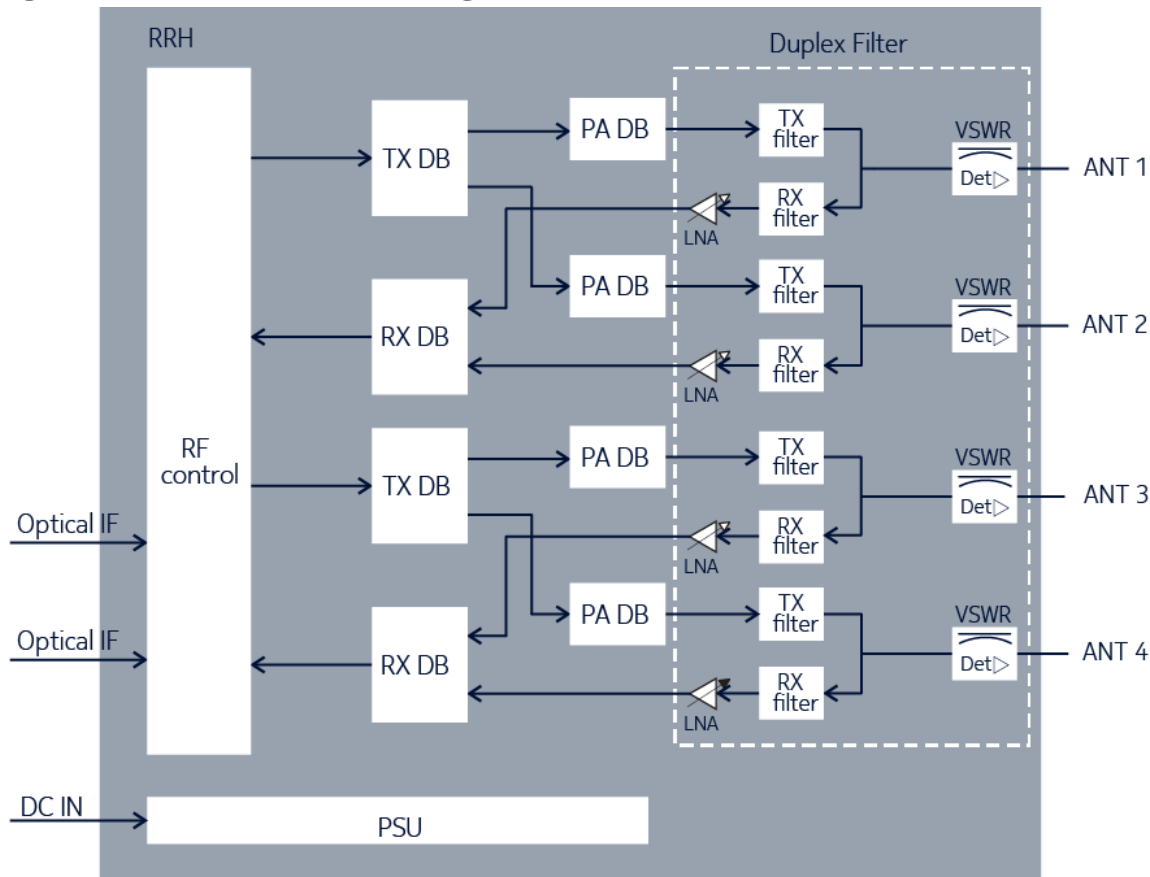
Antenna line device (ALD) support

 Note:

There is no Antenna Line Device support for AHHA

Functional block diagram

Figure 240: AHHA functional block diagram



Electrical specifications

Table 807: AHHA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36 V DC to -40.5 V DC -57 V DC to -60 V DC

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

! Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AML AirScale micro horizontal strand mount bracket (474849A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)⁵⁾
- FMWM AirScale micro RRH enclosure (474431A)
- FMWV AirScale micro RRH enclosure (475185A)

i Note:

Whether installation in FMWV or FMWM is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAE AirScale micro AC PSU (474518A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AAHG AirScale micro integrated antenna (474584A)

Installation options

- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*

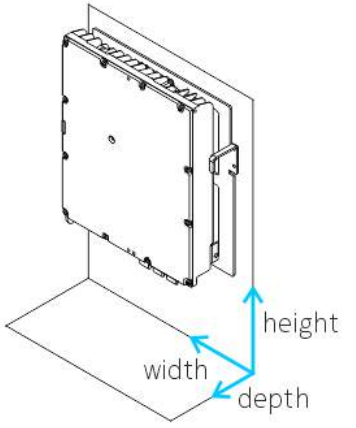
- Wall:
 - Fixed orientation
 - Tilt mounting
 - Multi-directional tilt mounting
 - Bookshelf mounting
- Strand
- Enclosure FMWM or FMWV

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 808: AHHA dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.1 in.)	
Width	245 mm (9.6 in) core unit (DC version) 270 mm (10.6 in.) with AC adapter (AC version)	
Depth	65 mm (2.6 in.) core unit (DC version) 65 mm (2.6 in.) with AC adapter (AC version)	
Weight	Max. 5.0 kg (11.0 lb) core unit (DC version) 5.8 kg (12.8 lb) with AC adapter (AC version)	

Environmental specifications



Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 809: AHHA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

⁵⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.8 AirScale Micro 4T4R B13 20 W (AHBB)

AHBB (474042A) is introduced by LTE3655 (for LTE).

Functional description

Table 810: AHBB functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE
Duplex mode	FDD
IoT support	NB-IoT in band, guard band
TX frequency range	746-756 MHz
RX frequency range	777-787 MHz
DL filter bandwidth	10 MHz
UL filter bandwidth	10 MHz
Instantaneous bandwidth (iBW)	10 MHz
Occupied bandwidth (oBW)	10 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	5, 10 MHz including NB-IoT (in band and guard band)

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 241: AHBB interfaces and LED indicators

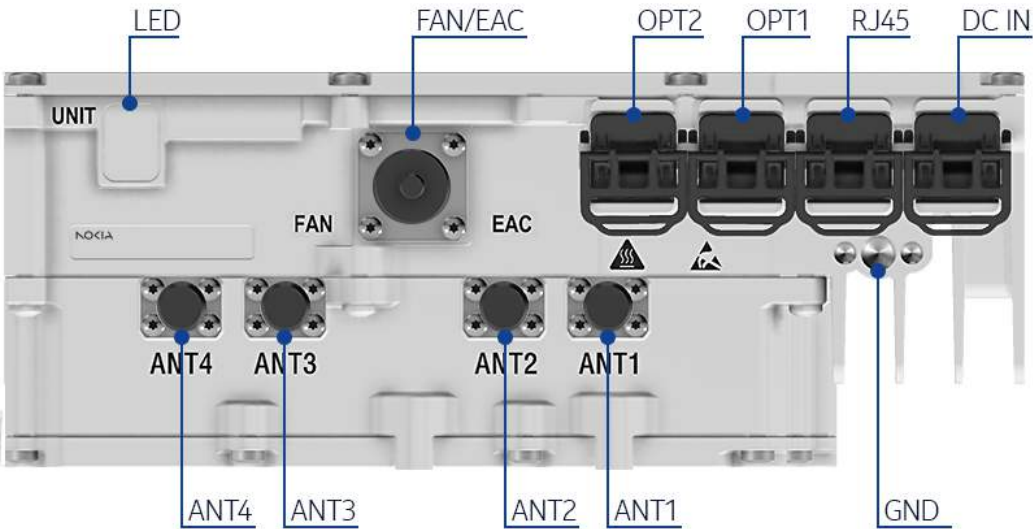


Table 811: AHBB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC Octis Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
External Alarm Connection/Fan	EAC/FAN	1	CIRC 8F IP67 Flange	–
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6;
Ethernet	RJ	1	RJ45	Separate feature required to enable this interface
Grounding	GND 	1	M8 or dual M5 screws	–



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

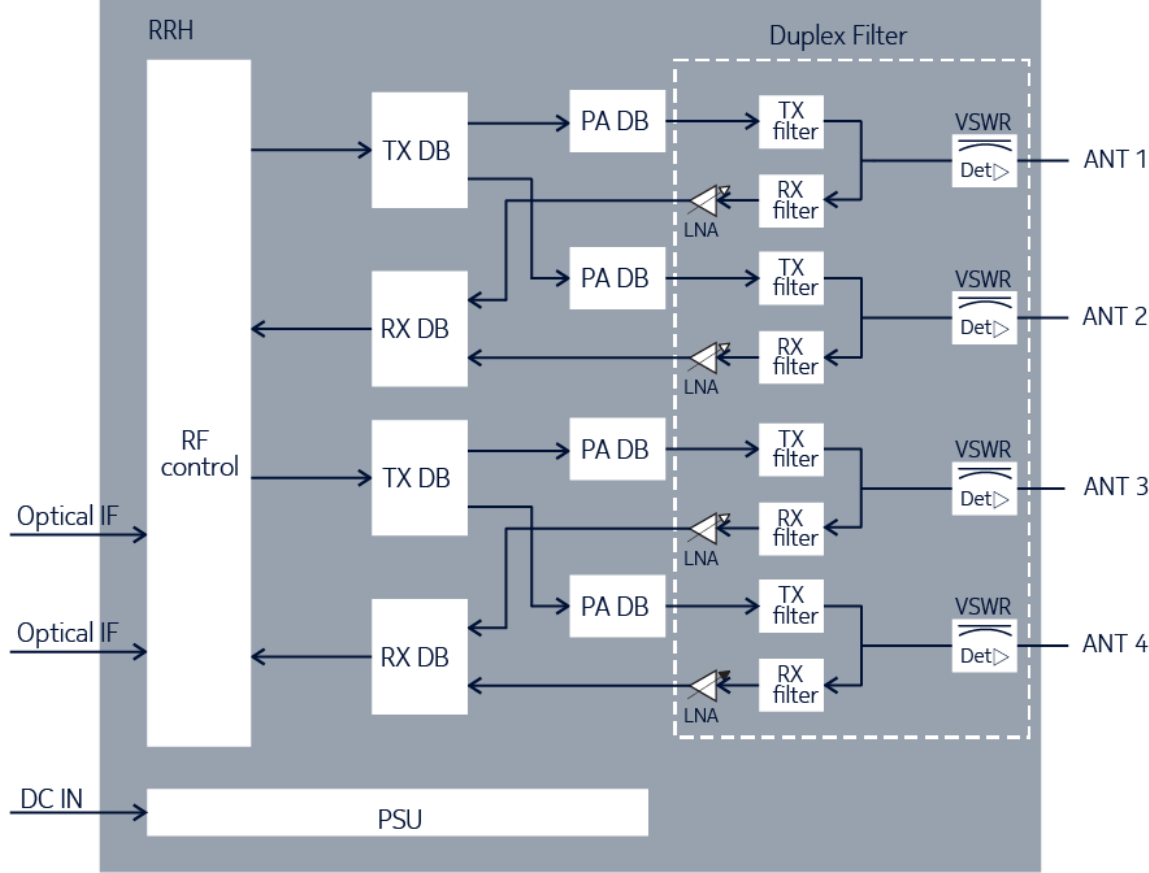
Antenna line device (ALD) support

Note:

AHBB doesn't support ALD systems.

Functional block diagram

Figure 242: AHBB functional block diagram



Electrical specifications

Table 812: AHBB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36 V to -40.5 V and -57 V to -60 V (DC)

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AMBL AirScale micro horizontal strand mount bracket (474849A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAB AirScale micro AC PSU (474130A)

- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AABA AirScale micro integrated antenna (474230A)

Installation options

- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- *Strand*
- *Enclosure*

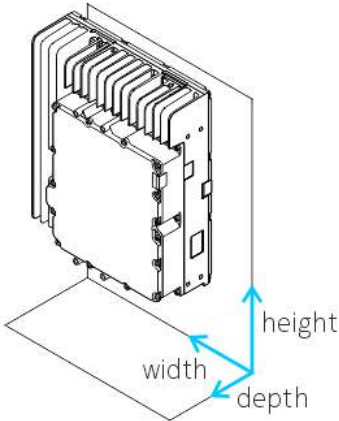


Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 813: AHBB dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.6 in.)	
Width	245 mm (9.6 in.)	
Depth	95 mm (3.74 in.)	
Weight	7.8 kg (17.2 lb) core unit (DC version) 8.5 kg (18.7 lb) with AC adapter (AC version)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 814: AHBB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

7.9 AirScale Micro 4T4R B14 20 W (AHBC)

AHBC (474948A) is introduced by LTE5006 (for LTE).

Functional description

Table 815: AHBC functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR)	LTE
Duplex mode	FDD
TX frequency range	758-768 MHz
RX frequency range	788-798 MHz
DL filter bandwidth	10 MHz
UL filter bandwidth	10 MHz
Instantaneous bandwidth (iBW)	10 MHz
Occupied bandwidth (oBW)	10 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	5, 10 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 243: AHBC interfaces and LED indicators

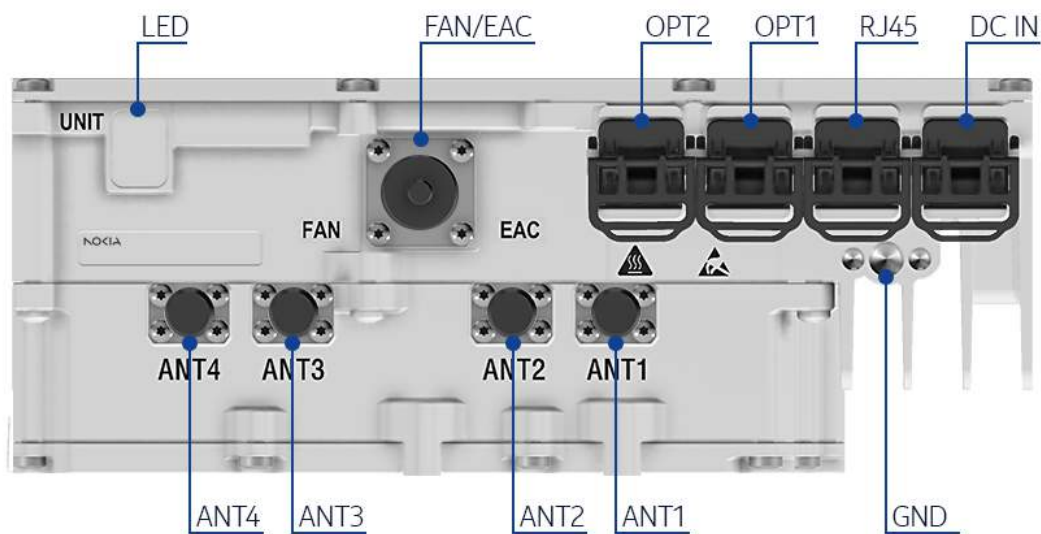


Table 816: AHBC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
External Alarm Connection/Fan	EAC/FAN	1	CIRC 8F IP67 Flange	–
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6;
Ethernet	RJ	1	RJ45	–
Grounding	GND 	1	M8 or two M5 screws	–

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

**WARNING!****Risk of electric shock**

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

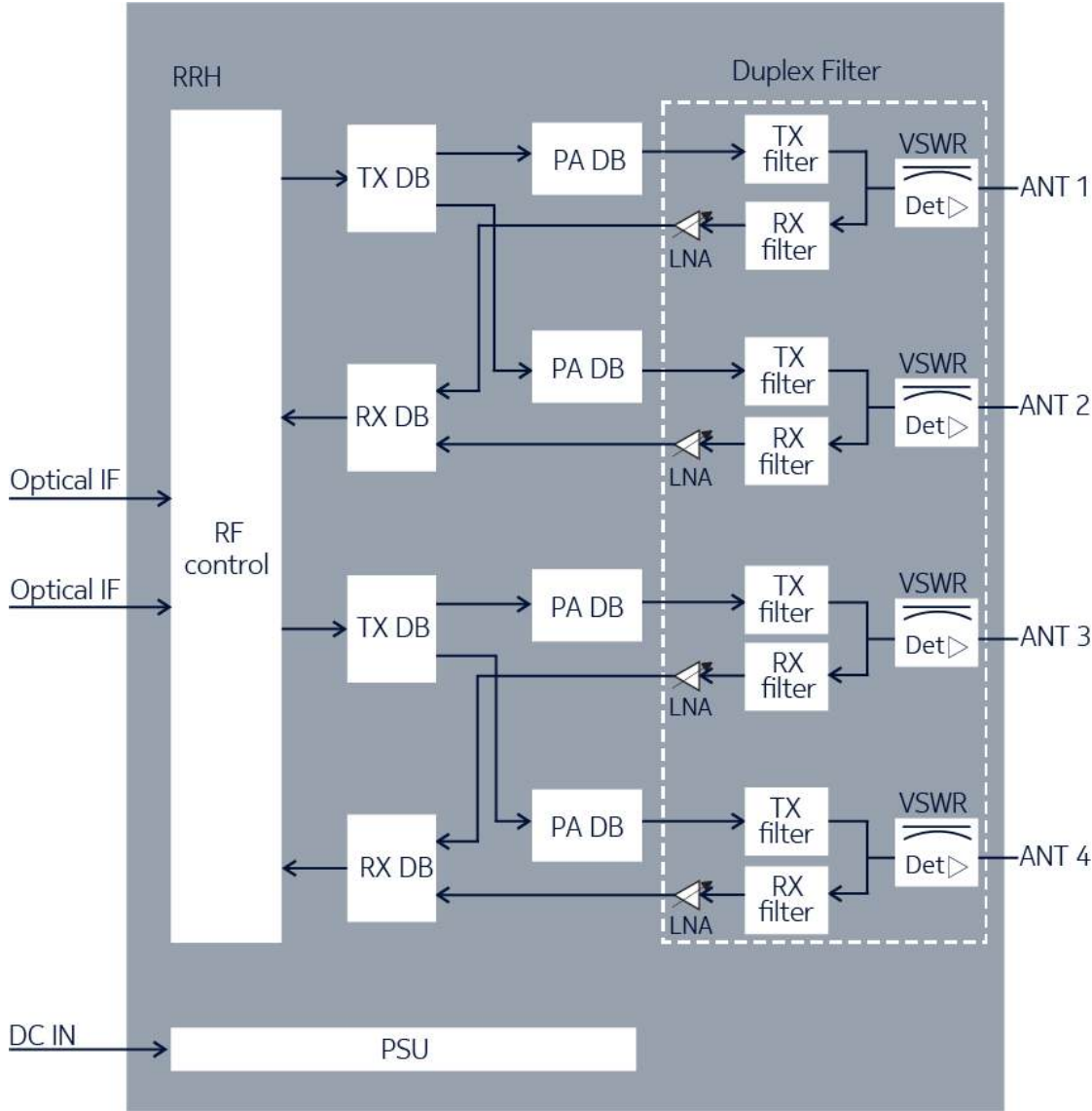
Antenna line device (ALD) support

Note:

AHBC doesn't support ALD systems.

Functional block diagram

Figure 244: AHBC functional block diagram



Electrical specifications

Table 817: AHBC electrical specifications

Property	Value
Nominal supply voltage	-48 V DC
Nominal input voltage range	-40.5 V DC to -57 V DC AC: 80 V to 288 V (through external AC/DC converter)
Extended input voltage range	-36 V DC to -40.5 V DC -57 V DC to -60 V DC

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

 Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AMBL AirScale micro horizontal strand mount bracket (474849A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAB AirScale micro AC PSU (474130A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AABA AirScale micro integrated antenna (474230A)

Installation options

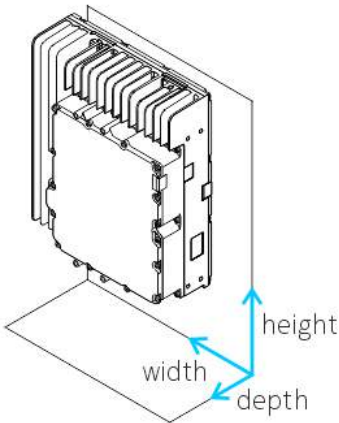
- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- *Strand*
- Enclosure *FMWM* or *FMWV*

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 818: AHBC dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Depth	95 mm (3.74 in.)	
Width	245 mm (9.65 in.) core unit (DC version) 270 mm (10.63 in.) with AC adapter (AC version)	
Weight	8.1 kg (17.9 lb) core unit (DC version) 8.8 kg (19.4 lb) with AC adapter (AC version)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 819: AHBC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

7.10 AirScale Micro RRH 4T4R B24/n24 8 W (AWHKB)

AWHKB (476086A) is introduced by CB008445 (for LTE and NR).

Functional description

Table 820: AWHKB functional specification

Property	Value
Maximum output power	8 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE, NR
RF sharing/concurrent mode	NR-LTE
Duplex mode - supported standard	FDD
TX frequency range	B24/n24: 1526–1536 MHz
RX frequency range	B24/n24: 1627.5–1637.5 MHz, 1646.5–1656.5 MHz
DL filter bandwidth	10 MHz
UL filter bandwidth	10+10 MHz
Instantaneous bandwidth (iBW)	10 MHz
Occupied bandwidth (oBW)	10 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	LTE, NR: 5, 10 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 245: AWHKB interfaces and LED indicators

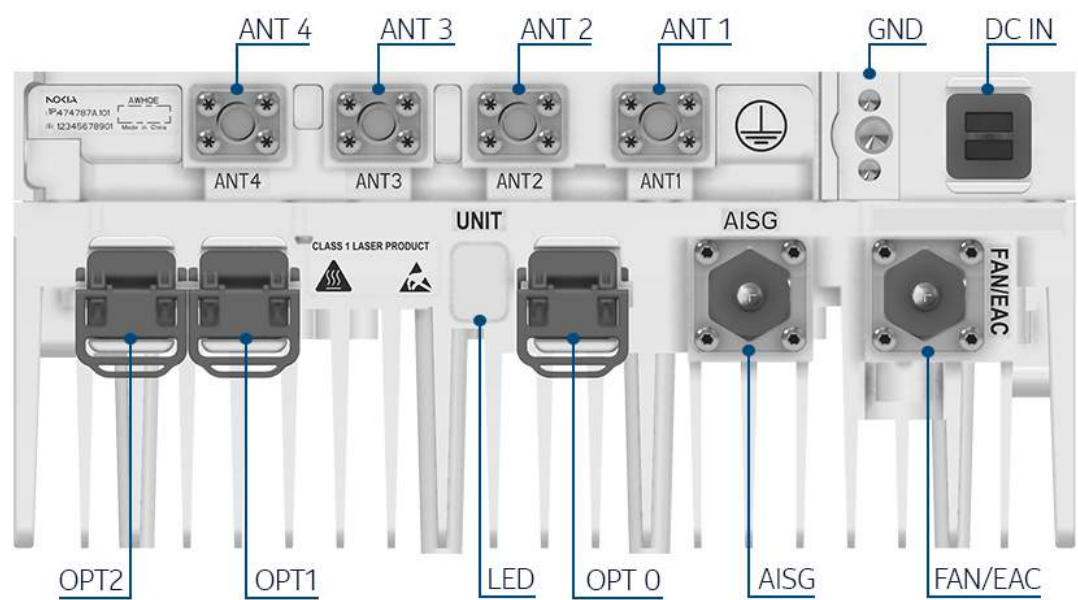


Table 821: AWHKB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna	ANT	4	NEX 10	-
Fan/external alarm connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical	OPT	3	OCTIS Plug Kit SFP+	9.8 Gbps, CPRI
Grounding	GND⏚	1	M8 or 2x M5 screw	-
Antenna Interface Standards Group	AISG	1	8-pin circular	-

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF ports from the environment, and thus provide electric shock security in case RF power is accidentally on.

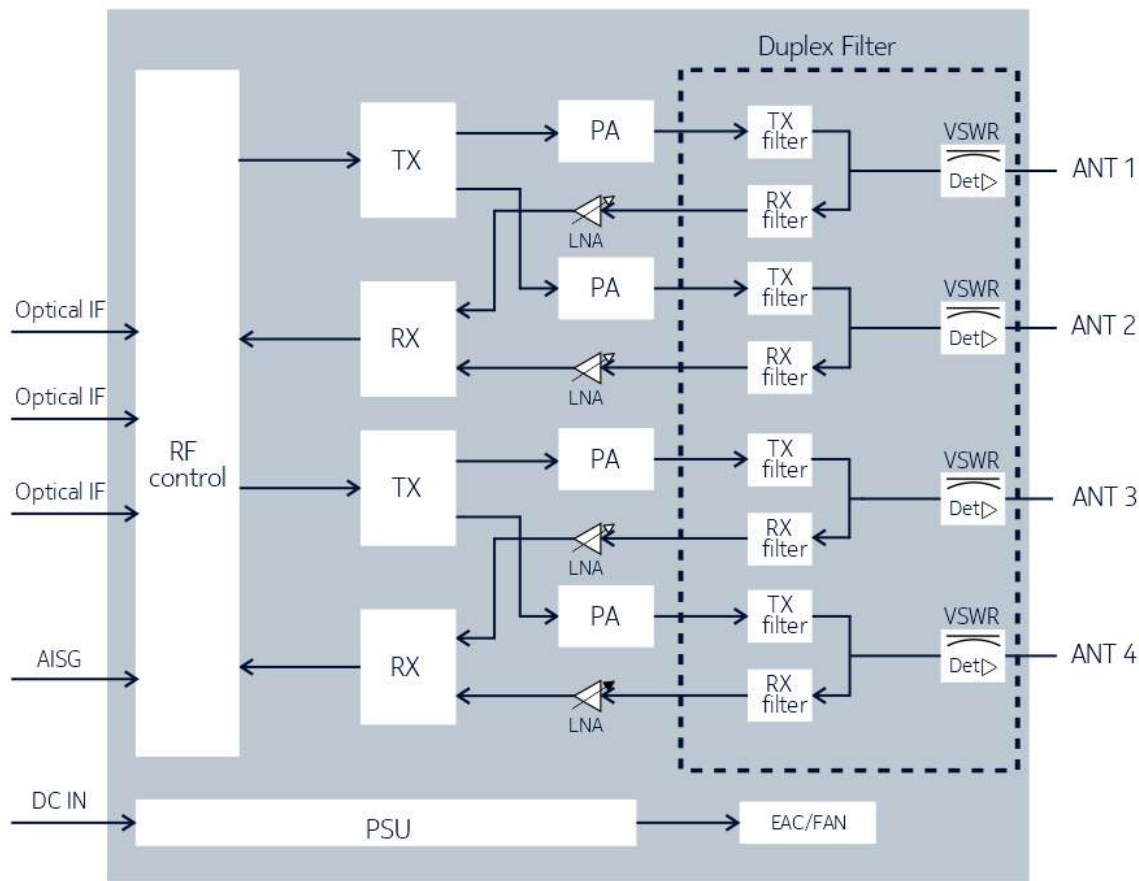
Antenna line device (ALD) support

Table 822: AWHKB ALD support

Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	30 W

Functional block diagram

Figure 246: AWHKB functional block diagram



Electrical specifications

Table 823: AWHKB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 76 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

 Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Recommended power back-off

The recommended power back-off values are defined as follows. High back-off values may cause radio outages.

Table 824: The recommended power back-off in 256 QAM

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	1.5	1.5
NR	NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- APAE AirScale micro 210 W AC PSU (474518A)
- AMJK piggyback mounting kit (476408A)
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)

Installation options

- Pole:
 - On the back of the unit
 - Sideways
 - Tilt mounting
- Wall
 - On the back of the unit
 - Sideways
 - Tilt mounting

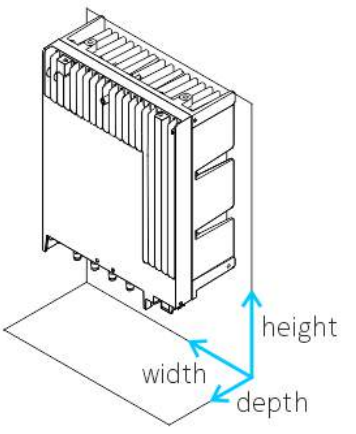
- Enclosure *FMWM* or *FMWV*

! Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 825: AWHKB dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	Core RRH (DC version): 245 mm (9.65 in.) RRH with an AC adapter (AC version): 270 mm (10.63 in.)	
Depth	95 mm (3.74 in.)	
Weight	Core RRH (DC version): 7.5 kg (16.5 lb) RRH with an AC adapter (AC version): 8.5 kg (18.7 lb)	

Environmental specifications

i Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 826: AWHKB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

7.11 AirScale Micro 4T4R B25/n25 20 W (AHFB)

AHFB (474036A) is introduced by LTE3429 (for WCDMA and LTE), SR001996 (for WCDMA and LTE), and 5GC001154 (for NR).

Functional description

Table 827: AHFB functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies	WCDMA, LTE, NR
RF sharing/concurrent mode	WCDMA-LTE*, LTE-NR
Duplex mode	FDD
TX frequency range	1930–1995 MHz
RX frequency range	1850–1915 MHz
DL filter bandwidth	65 MHz
UL filter bandwidth	65 MHz
Instantaneous bandwidth (iBW)	65 MHz
Occupied bandwidth (oBW)	65 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	WCDMA: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8, 5 MHz LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
Dynamic spectrum sharing (DSS) support	LTE-NR: 10, 15, 20 MHz

*WCDMA and LTE can be transmitted simultaneously with any number of carriers, but the combined bandwidth can't exceed 55 MHz.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 247: AHFB interfaces and LED indicators

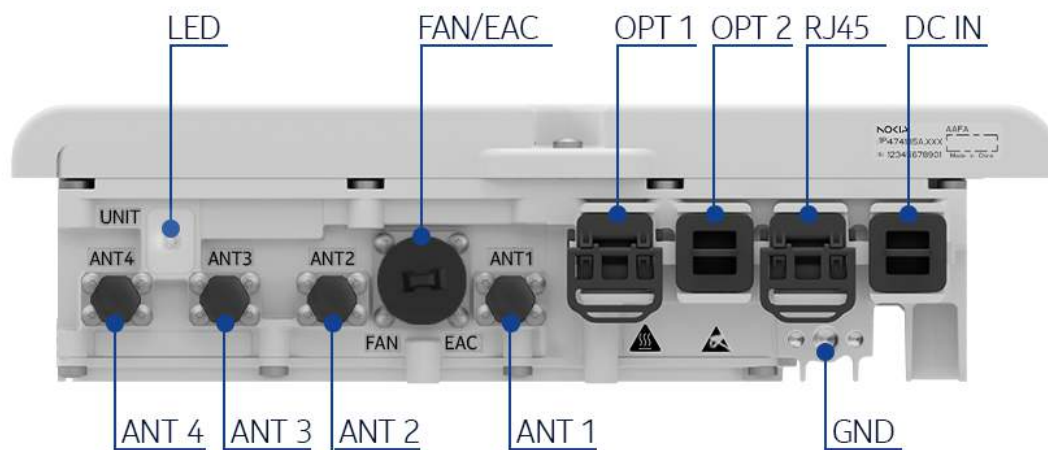


Table 828: AHFB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
External Alarm Connection/Fan	FAN/EAC	1	CIRC 8F IP67 Flange	Hot insert not supported
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6
Ethernet	RJ	1	RJ45	Separate feature required to enable this interface
Grounding	GND 	1	M8 or dual M5 screws	–



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

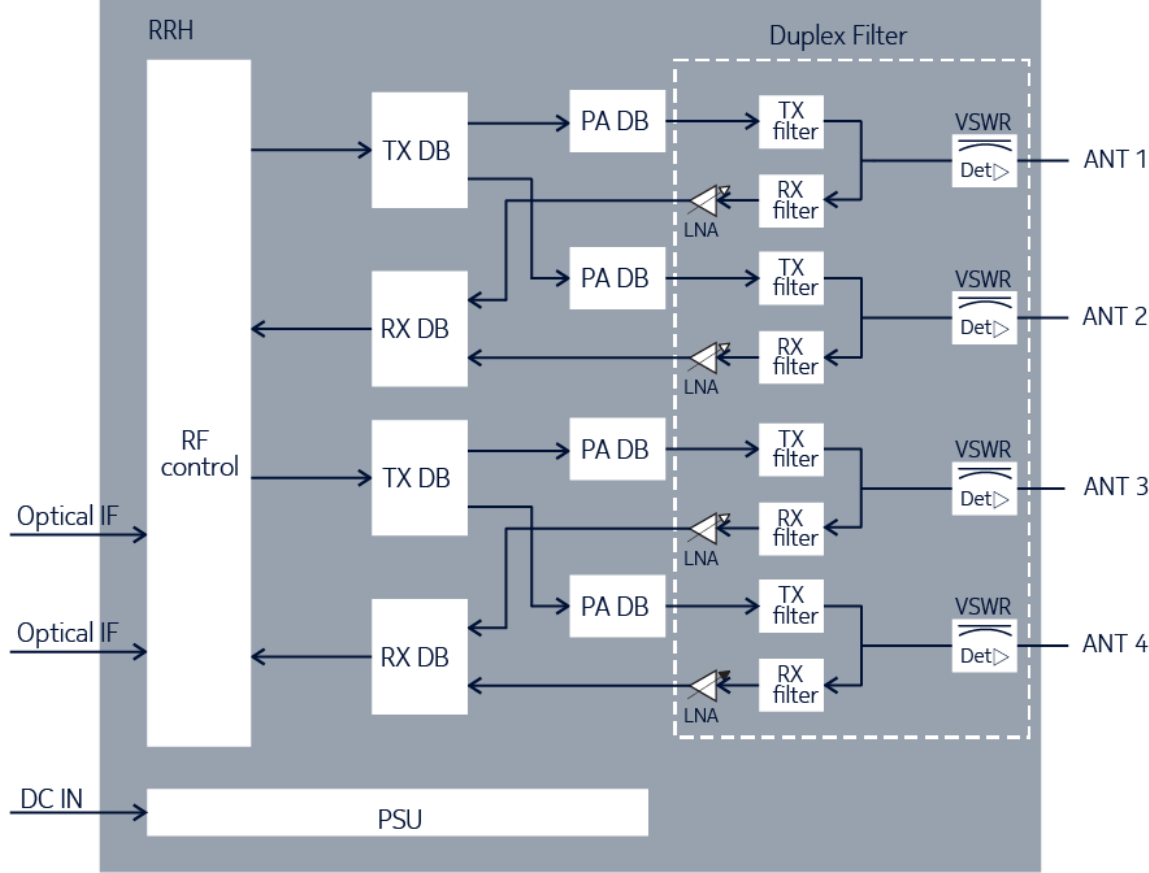
Antenna line device (ALD) support

Note:

There is no Antenna Line Device support for AHFB.

Functional block diagram

Figure 248: AHFB functional block diagram



Electrical specifications

Table 829: AHFB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36 V DC to -40.5 V DC -57 V DC to -60 V DC
Surge protection	Class II 5 kA

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

 Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

Optional elements dependent on the configuration:

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AML AirScale micro horizontal strand mount bracket (474849A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)⁶⁾
- FMWM AirScale micro RRH enclosure (474431A)
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV or FMWM is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAB AirScale micro AC PSU (474130A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AAFA AirScale micro integrated antenna (474185A)

Installation options

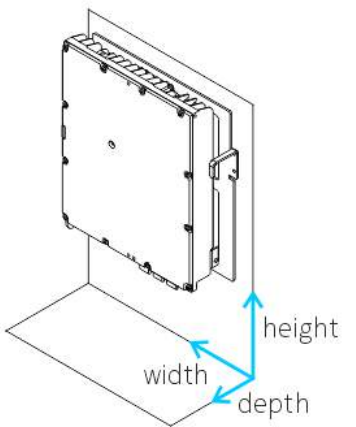
- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- *Strand*
- Enclosure *FMWM* or *FMWV*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 830: AHFB dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	245 mm (9.65 in.) core unit (DC version) 270 mm (10.63 in.) with AC adapter (AC version)	
Depth	55 mm (2.17 in.)	
Weight	5.4 kg (11.9 lb) core unit (DC version) 6.1 kg (13.4 lb) with AC adapter (AC version)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 831: AHFB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

⁶⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.12 AirScale Dual-band Micro RRH 4T4R B25 + B66 160 W (AWMFIA)

AWMFIA (476353A) is introduced by CB009787 (for LTE, NR, and LTE-NR concurrent mode).

Functional description

Table 832: AWMFIA functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	160 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Operating mode	4T4R full mode 2 x 2T2R split mode
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	FDD
IoT support	NB-IoT in band, guard band, standalone (in LTE mode)
UL frequency range	B25: 1850-1915 MHz B66: 1710-1780 MHz
DL frequency range	B25: 1930-1995 MHz B66: 2110-2200 MHz
UL filter bandwidth	B25: 65 MHz B66: 70 MHz
DL filter bandwidth	B25: 65 MHz B66: 90 MHz
Instantaneous bandwidth (iBW)	B25: 65 MHz B66: 90 MHz
Occupied bandwidth (oBW)	B25: 65 MHz B66: 90 MHz

Property	Value
Number of carriers per pipe	B25: up to 4 B66: up to 4 B25+B66: Up to 8 NR 30 and 40 MHz carrier bandwidths count as 2 x 20 MHz each and use two carriers. Only standalone IoT carriers are included in total carrier count.
Supported bandwidths	LTE: 1.4 (ABIA only), 3 (ABIA only), 5, 10, 15, 20 MHz NR: 5, 10, 15, 20, 25, 30, 35, 40 MHz
Passive intermodulation (PIM) cancellation	Yes (LTE and NR)
RF sniffing	Yes (LTE only)
Limitations	IQ compression is supported only for the following bandwidths: • LTE: 15 and 20 MHz • NR: 15, 20, and 40 MHz Dynamic spectrum sharing (DSS) requires carriers of the same bandwidths for both LTE and NR in LTE-NR concurrent mode.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 249: AWMFIA interfaces and LED indicators

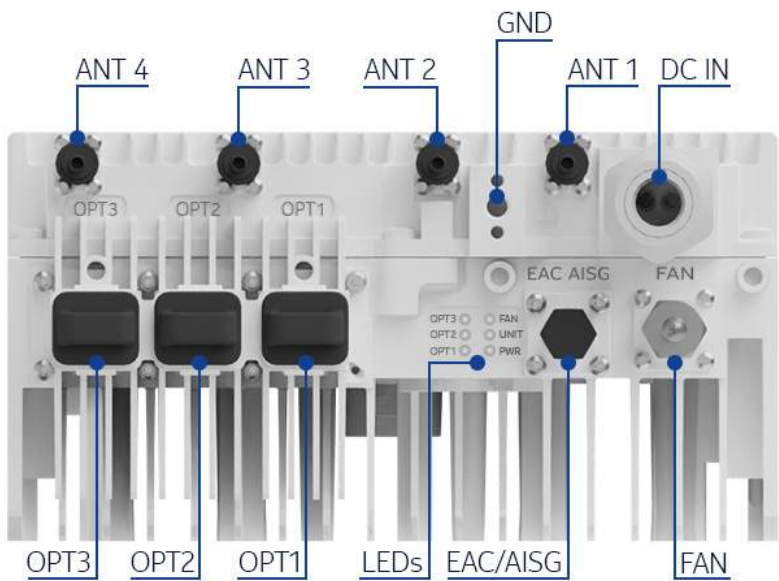


Table 833: AWMFIA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	APPB/APPC APPF for APAI PSU	APPB – DC input APPF – AC input for APAI PSU
Antenna	ANT	4	NEX 10	–
External alarm connection /Antenna Interface Standards Group	EAC/AISG	1	4 + 9 pin circular	Four external alarms supported
Optical	OPT	3	SFP+/SFP28	CPRI: 9.8 Gbps; Nokia IP seal
Grounding	⏏	1	1 x M8 or 2 x M5 screw	–



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

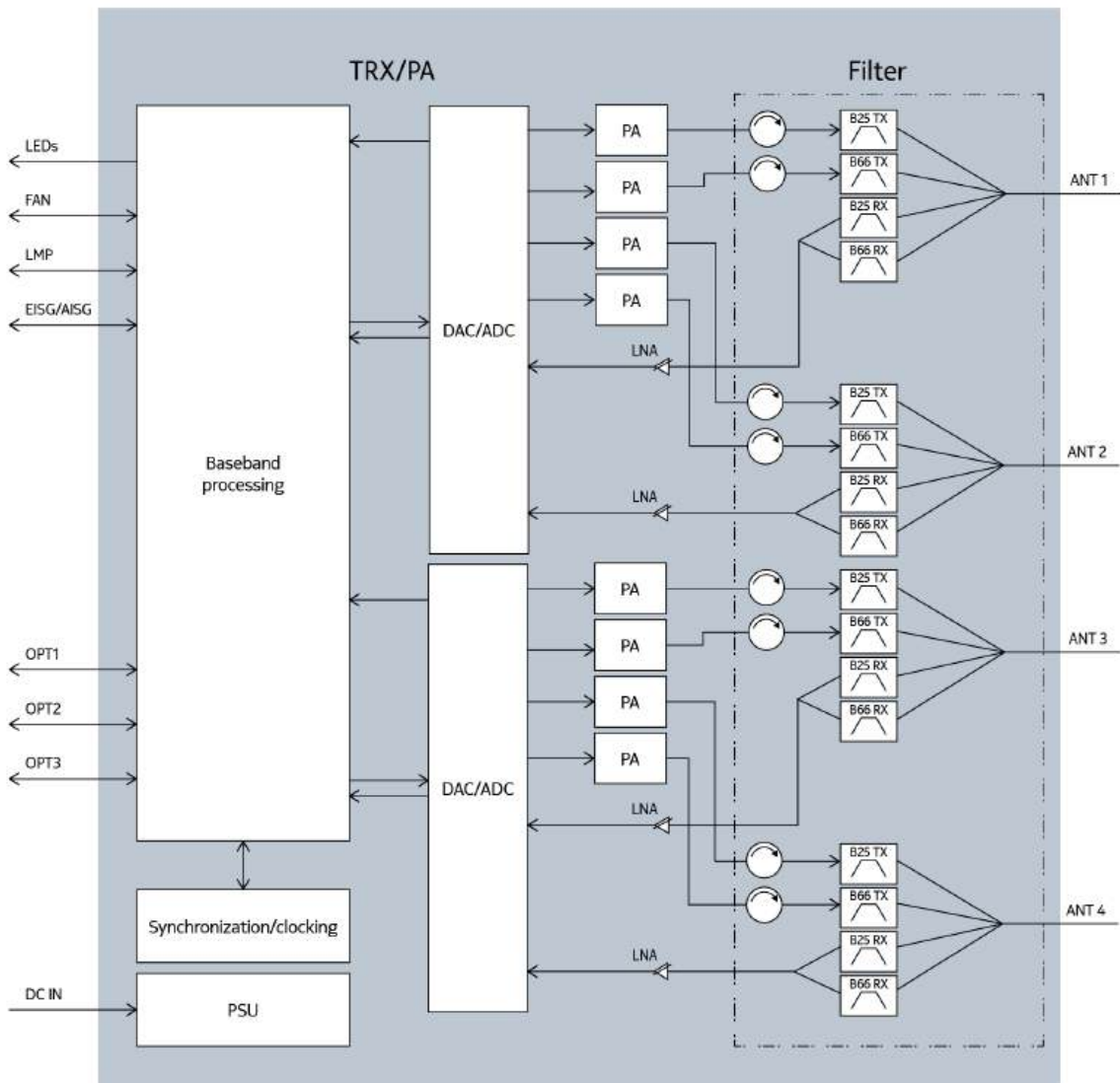
Antenna line device (ALD) support

Table 834: AWMFIA ALD support

Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	30 W

Functional block diagram

Figure 250: AWMFIA functional block diagram



Electrical specifications

Table 835: AWMFIA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 85 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	20 kA

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

Table 836: The recommended power back-off in 256 QAM

RAT	Single carrier 20 MHz [dB]	Single carrier or contiguous multi carrier ≤ 100 MHz [dB]	Non-contiguous multi carrier [dB]	Dual cluster contiguous multi carrier [dB]
LTE ¹	0.0		0.6	1.0
NR ²	0.0	0.2	0.6	1.2

¹LTE4054: LTE Dynamic Back-off

²NRCELL PDSCH Power Back-off for 256QAM

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMED 20 deg tilt pole mount kit (475736A)
- AMJL piggyback bracket for ASOF (476439A)
- APAI AirScale micro AC power supply unit (PSU) (476433A)
- APPB AirScale 2 55A DC plug 3.3-10 mm2 (474282A)
- AOPC SFP weatherproofing boot kit (475151A)
- AAFC AirScale micro integrated directional panel antenna (476490A)

Installation options

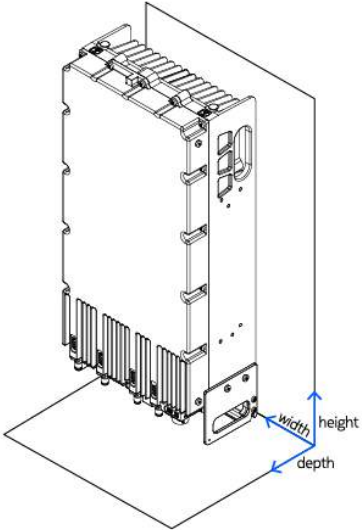
- Pole:
 - *With the AMED bracket (can be tilted)*
 - *With the AMBA bracket (can't be tilted)*
 - *With the ASOF core unit*
- Wall:
 - *With the AMED bracket (can be tilted)*
 - *With the AMBA bracket (can't be tilted)*
 - *With the ASOF core unit*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 837: AWMFIA dimensions and weight

Property	Value	Dimensions orientation
Height	547 mm (21.54 in.)	
Width	245 mm (9.65 in.)	
Depth	130 mm (5.12 in.) 158 mm (6.22 in.) with an external antenna	
Weight	17 kg (37.5 lb.) 18.5 kg (40.8 lb.) with an external antenna	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating.

Table 838: AWMFIA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless)
IP rating	IP65

7.13 AirScale Micro RRH 4T4R B38/n38 80 W (AWHHI)

AWHHI (475263A) is introduced by 5GC001881 (for NR) and *CB009464* (for LTE and LTE-NR concurrent mode).

Functional description

Table 839: AWHHI functional specification

Property	Value
Maximum output power	80 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE, NR
Operating mode	4T4R full mode 2x 2T2R split mode
RF sharing/concurrent mode	LTE-NR
Duplex mode	TDD
Frequency range	2575-2615 MHz
Filter bandwidth	40 MHz
Instantaneous bandwidth (iBW)	40 MHz
Occupied bandwidth (oBW)	40 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 10, 20 MHz NR: 10, 20, 40 MHz
Limitations	• LTE-NR concurrent mode supported only with dedicated fronthaul • ABIN supported only for LTE • Activating the <i>5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency</i> feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μDTx usage.

Interfaces

Figure 251: AWHHI interfaces and LED indicators

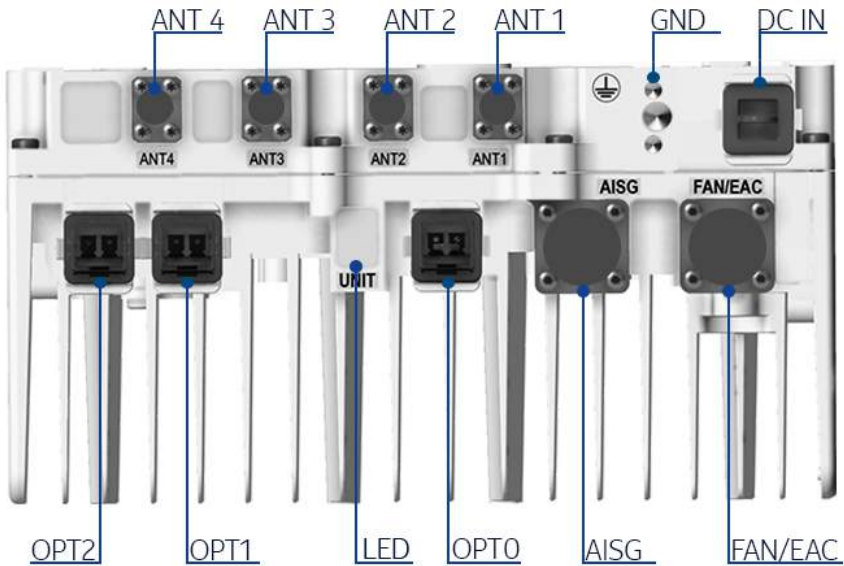


Table 840: AWHHI interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
Fan/External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	9.8 Gbps, CPRI
Grounding	GND 	1	M8 or 2 x M5 screw	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 841: AWHHI ALD support

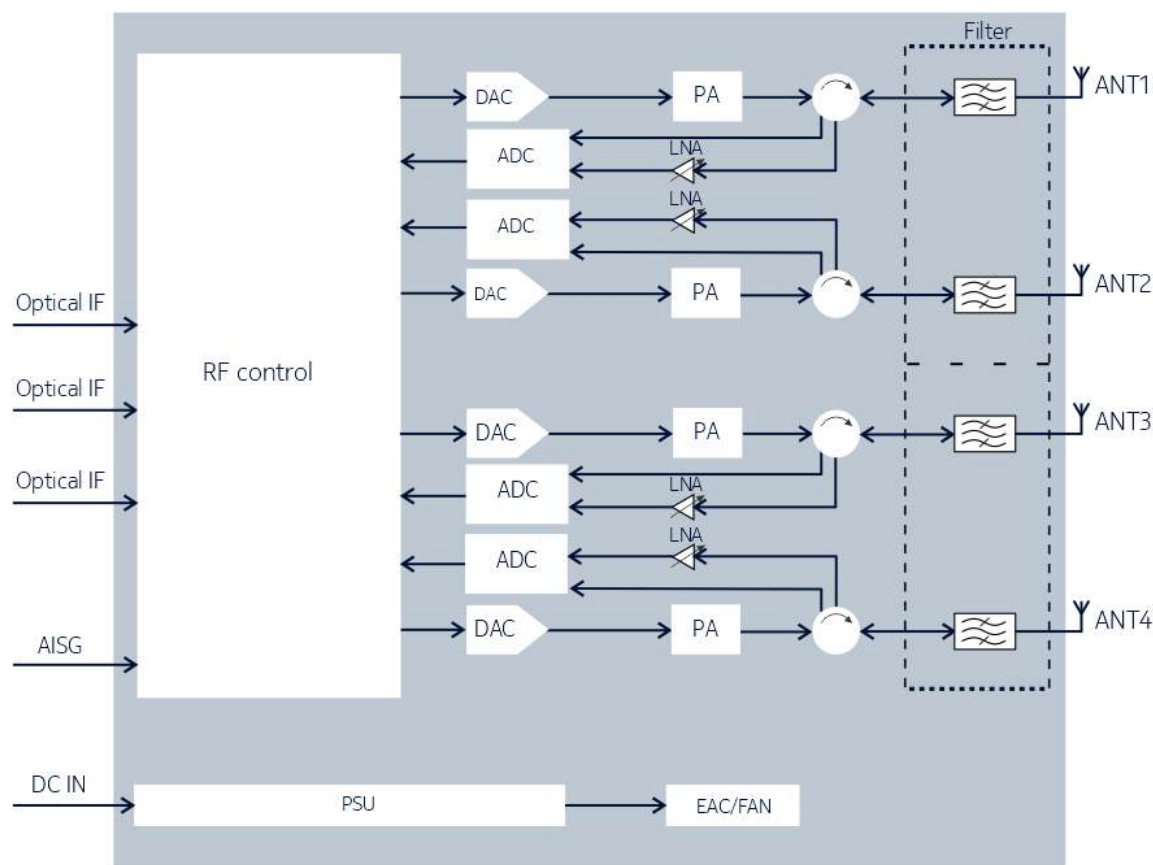
Property	Value
AISG	2.0
Voltage	24 V
Power per port	30 W

 Note:

AirScale RRHs support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 252: AWHHI functional block diagram



Electrical specifications

Table 842: AWHHI electrical specifications

Property	Value
Nominal supply voltage	-48 V DC
Nominal input voltage range	-40.5 to -57 V DC 85 to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36 to -40.5 V and -57 to -60 V DC

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Recommended power back-off

Table 843: The recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
NR	NRCELL_PDSCH power back-off for 256 QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)⁷⁾
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAH AirScale micro AC PSU (475043A)
- OCTIS plug kit AC power (474244A)

- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAHM AirScale micro integrated antenna (475211A)

Installation options

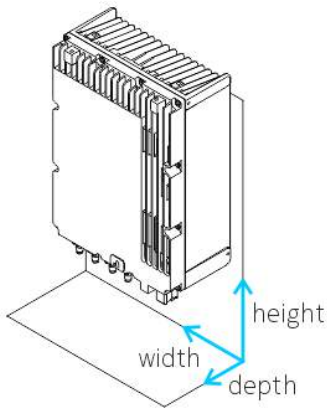
- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure *FMWM* or *FMWV*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 844: AWHHL dimensions and weight

Property	Value	Dimensions orientation
Height	345 mm (13.58 in.)	
Width	• Without antenna: - DC version: 245 mm (9.65 in.) - AC version (with an external AC adapter): 270 mm (10.63 in.) • With antenna: 270 mm (10.63 in.)	
Depth	• Without antenna: 130 mm (5.12 in.) • With antenna: 155 mm (6.10 in.)	
Weight	• Without antenna: - DC version: ~11.0 kg (24.3 lb) - AC version (with an external AC adapter): ~12.8 kg (28.2 lb) • With antenna: - DC version: ~12.5 kg (27.6 lb) - AC version (with an external AC adapter) ~14.3 kg (31.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 845: AWHHl environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

⁷⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.14 AirScale Micro RRH 4T4R B41/n41 80 W (AWHHD)

AWHHD (475184A) is introduced by LTE5161 (for LTE) and 5GC001541 (for NR).

Functional description

Table 846: AWHHD functional specification

Property	Value
Maximum output power	80 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies (standalone and MSR)	LTE, NR
Duplex mode	TDD
Frequency range	B41/n41: 2515-2675 MHz
Filter bandwidth	160 MHz
Instantaneous bandwidth (iBW)	160 MHz
Occupied bandwidth (oBW)	160 MHz
Number of carriers per pipe	LTE: up to 3 NR: up to 2 LTE + NR: up to 4
Supported bandwidths	LTE: 10, 20 MHz NR: 20, 40, 50, 60, 80, 100 MHz
Limitations	Activating the 5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μ DTx usage.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 253: AWHHD interfaces and LED indicators

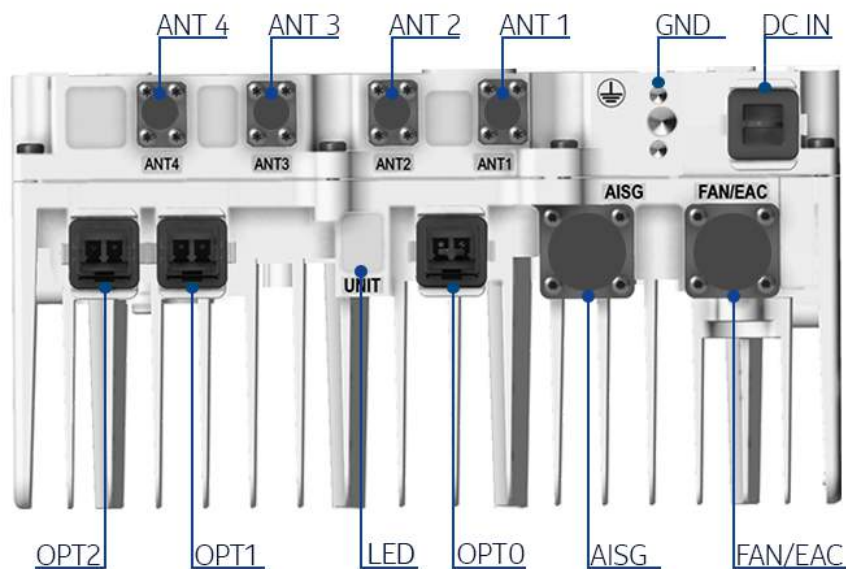


Table 847: AWHHD interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
Fan/External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	9.8 Gbps, CPRI
Grounding	GND 	1	M8 or 2 x M5 screw	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 848: AWHHD ALD support

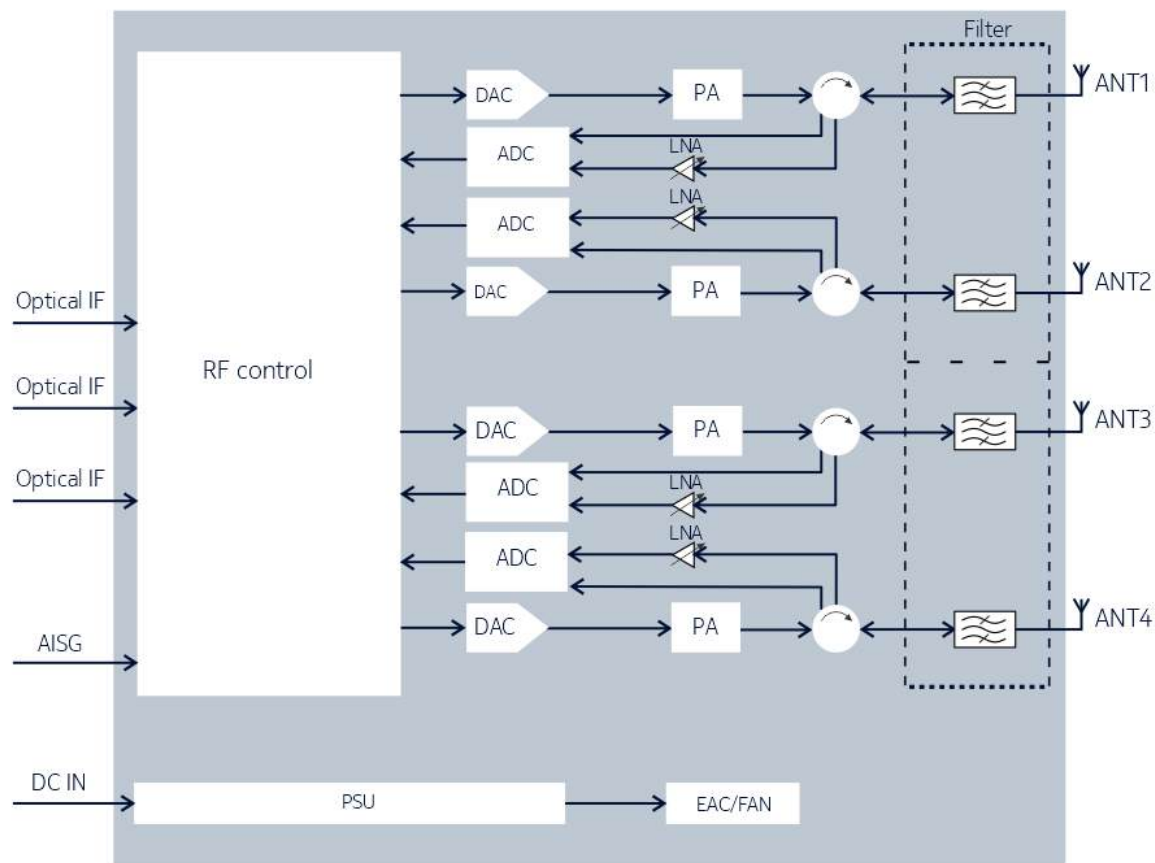
Property	Value
AISG	2.0
Voltage	24 V
Power per port	30 W

 Note:

AirScale radio units (RUs) support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 254: AWHHD functional block diagram



Electrical specifications

Table 849: AWHHD electrical specifications

Property	Value
Nominal supply voltage	-48 V DC
Nominal input voltage range	-40.5 to -57 V DC 85 to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36 to -40.5 V and -57 to -60 V DC

 Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

 Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Recommended power back-off

Table 850: The recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	1.5	1.5
NR	NRCELL_PDSCH power back-off for 256 QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)⁸⁾
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAH AirScale micro AC PSU (475043A)

- OCTIS plug kit AC power (474244A)
- OCTIS plug kit for SFP 2 (475756A)
- OCTIS plug kit DC power (474184A)
- AAHL AirScale micro integrated antenna (475160A)

 Note:

AAHL is supported only in shroud installations with an additional adapter.

- AAHM AirScale micro integrated antenna (475211A)

Installation options

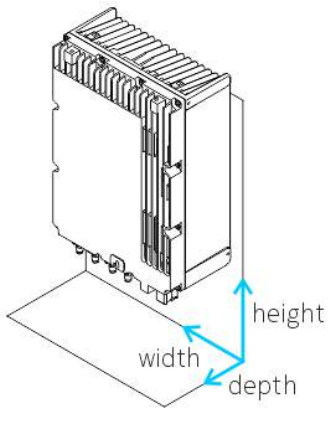
- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure *FMWM* or *FMWV*

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 851: AWHHD dimensions and weight

Property	Value	Dimensions orientation
Height	345 mm (13.58 in.)	
Width	• Without antenna: - DC version: 245 mm (9.65 in.) - AC version (with an external AC adapter): 270 mm (10.63 in.) • With antenna: 270 mm (10.63 in.)	
Depth	• Without antenna: 130 mm (5.12 in.) • With antenna: 155 mm (6.10 in.)	
Weight	• Without antenna: - DC version: ~11.0 kg (24.3 lb) - AC version (with an external AC adapter): ~12.8 kg (28.2 lb) • With antenna: - DC version: ~12.5 kg (27.6 lb) - AC version (with an external AC adapter) ~14.3 kg (31.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 852: AWHHD environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

⁸⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.15 AirScale Micro RRH 4T4R B41/n41 80 W (AWHHF)

AWHHF (475181A) is introduced by *LTE5304* (for LTE) and *5GC001707* (for NR).

Functional description

Table 853: AWHHF functional specification

Property	Value
Maximum output power	80 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE, NR
RF sharing/concurrent mode	LTE-NR
Duplex mode	TDD
Frequency range	B41/n41: 2496-2690 MHz
Filter bandwidth	194 MHz
Instantaneous bandwidth (iBW)	194 MHz
Occupied bandwidth (oBW)	160 MHz
Number of carriers per pipe	LTE: up to 3 NR: up to 2 LTE + NR: up to 4
Supported bandwidths	LTE: 10, 20 MHz NR: 10, 20, 30, 40, 50, 60, 70*, 80, 90, 100 MHz
Limitations	Activating the 5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μ DTx usage.

*With the CB009336 feature, if you have a 70 MHz cell configured and want to add a cell with a lower bandwidth, the newly created cell won't be operational, and a site reset will be required to make it operational. If you create the cells in the order of 10, 20, and 70 MHz or all at once, this issue doesn't occur. This limitation applies only when IQ compression is used.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 255: AWHHF interfaces and LED indicators

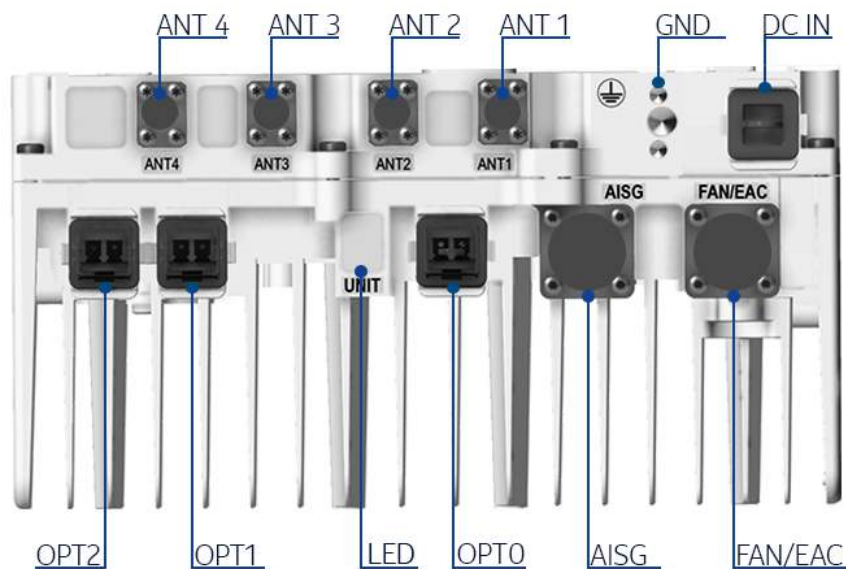


Table 854: AWHHF interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
Fan/External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	9.8 Gbps, CPRI
Grounding	GND 	1	M8 or 2 x M5 screw	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 855: AWHHF ALD support

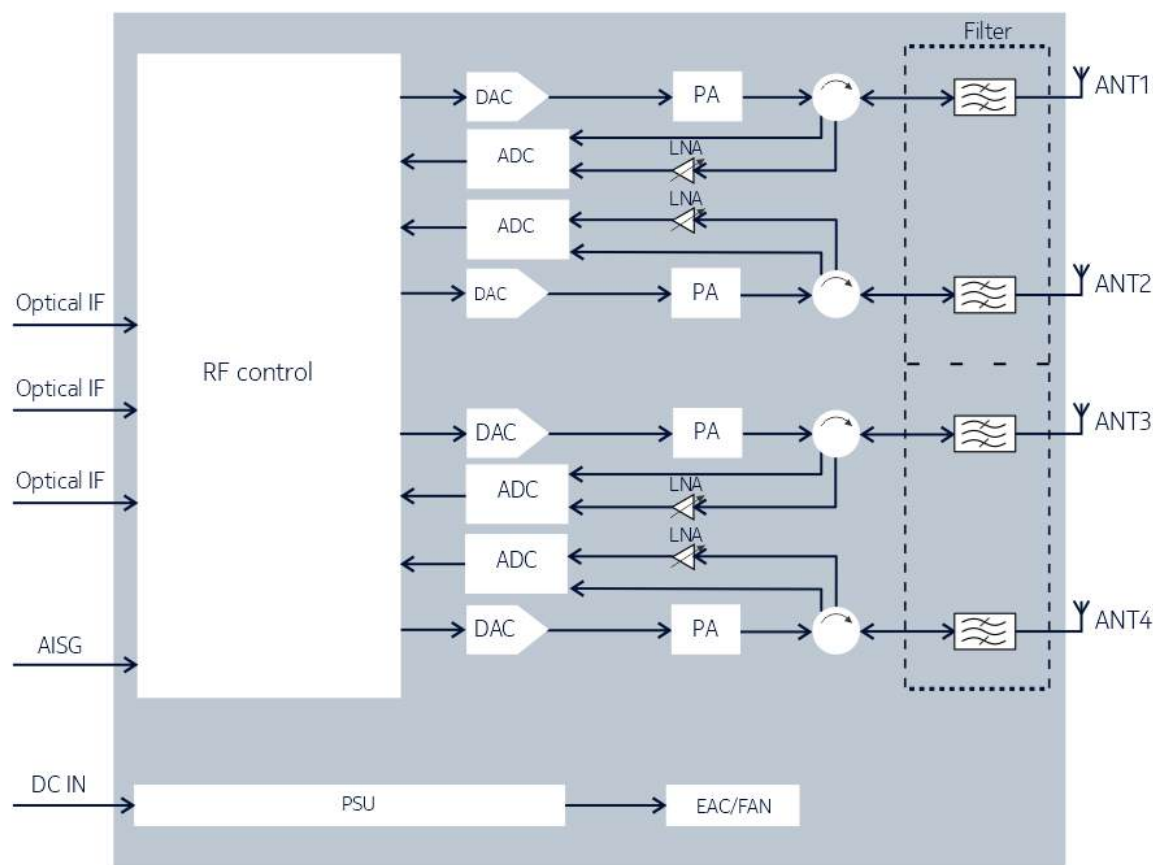
Property	Value
AISG	2.0
Voltage	24 V
Power per port	30 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 256: AWHHF functional block diagram



Electrical specifications

Table 856: AWHHF electrical specifications

Property	Value
Nominal supply voltage	-48 V DC
Nominal input voltage range	-40.5 to -57 V DC 85 to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36 to -40.5 V and -57 to -60 V DC

 Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

 Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Recommended power back-off

Table 857: The recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
LTE	<i>LTE4054: LTE Dynamic Back-off</i>	1.5	1.5
NR	NRCELL PDSCH power back-off for 256 QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)⁹⁾
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAH AirScale micro AC PSU (475043A)

- OCTIS plug kit ACpower (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAHM AirScale micro integrated antenna (475211A)

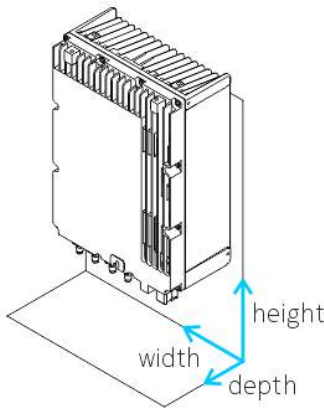
Installation options

- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Enclosure*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Property	Value	Dimensions orientation
Height	345 mm (13.58 in.)	
Width	• Without antenna: - DC version: 245 mm (9.65 in.) - AC version (with an external AC adapter): 270 mm (10.63 in.) • With antenna: 270 mm (10.63 in.)	
Depth	• Without antenna: 130 mm (5.12 in.) • With antenna: 155 mm (6.10 in.)	
Weight	• Without antenna: - DC version: ~11.0 kg (24.3 lb) - AC version (with an external AC adapter): ~12.8 kg (28.2 lb) • With antenna: - DC version: ~12.5 kg (27.6 lb) - AC version (with an external AC adapter) ~14.3 kg (31.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 858: AWHHF environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

⁹⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.16 AirScale Micro RRH 4T4R n78 40 W (AWHQE)

AWHQE (474788A) is introduced by 5GC001157 (for NR).

Functional description

Table 859: AWHQE functional specification

Property	Value
Maximum output power	40 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technology	NR
Duplex mode, supported standard	TDD
Frequency range	3400-3600 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	20, 30, 40, 50, 60, 80, 90, 100 MHz
Limitations	Activating the <i>5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency</i> feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μ DTx usage.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 257: AWHQE interfaces and LED indicators

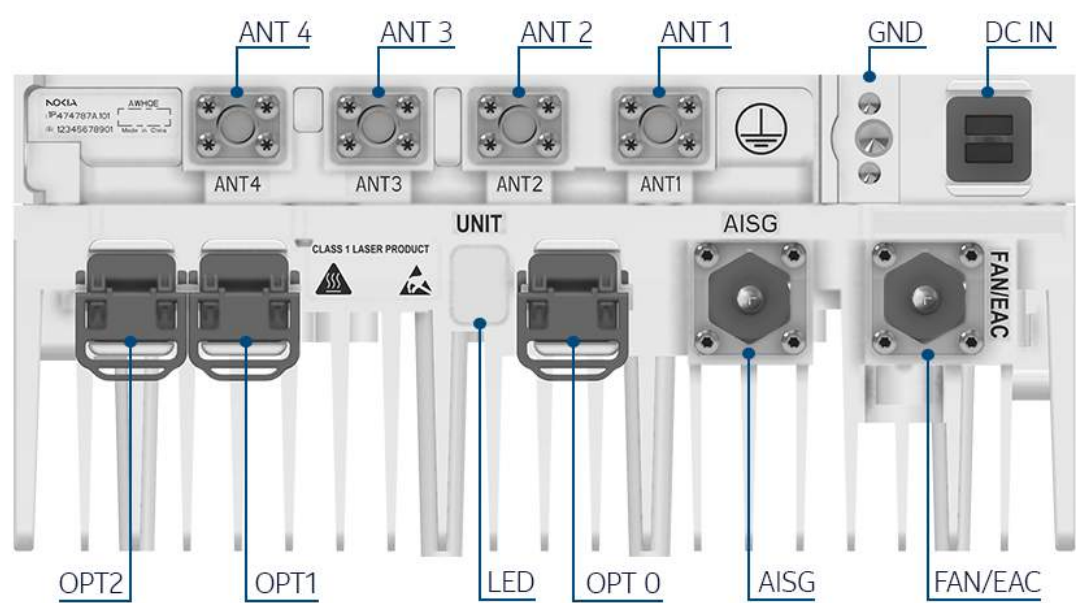


Table 860: AWHQE interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
Fan/External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	9.8 Gbps, CPRI
Grounding	GND 	1	M8 or 2 x M5 screw	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 861: AWHQE ALD support

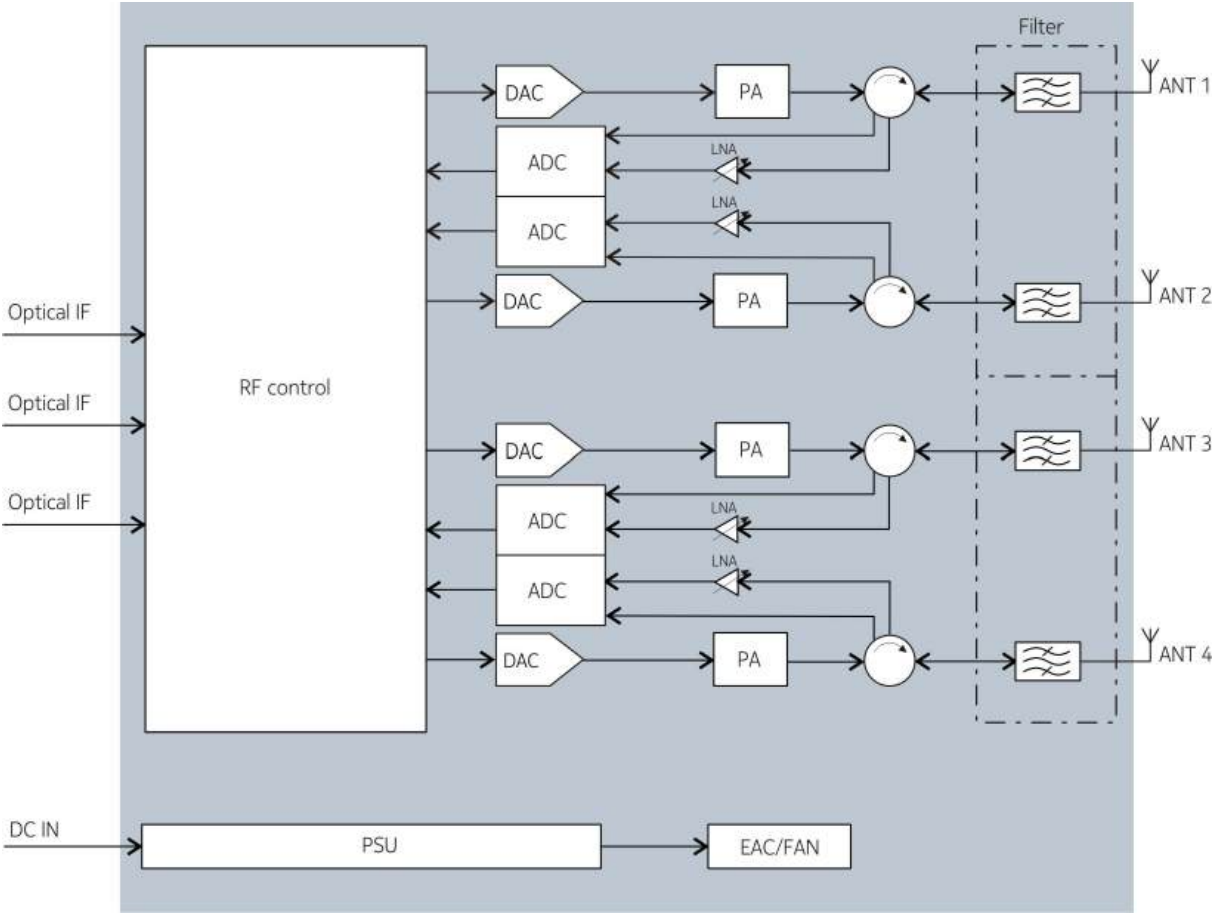
Property	Value
AISG	2.0
Voltage	24 V
Power per port	30 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 258: AWHQE functional block diagram



Electrical specifications

Table 862: AWHQE electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 76 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36 V DC to -40.5 V DC -57 V DC to -60 V DC

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Recommended power back-off

Table 863: The recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
NR	NRCELL_PDSCH power back-off for 256 QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹⁰⁾
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAG AirScale micro AC PSU (474866A)
- OCTIS plug kit AC power (474244A)

- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAQA AirScale micro integrated antenna (474520A)

Installation options

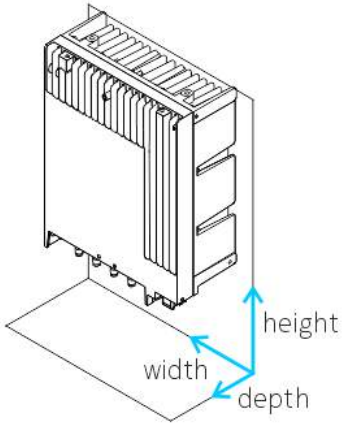
- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure *FMWM* or *FMWV*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 864: AWHQE dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	• DC version: 245 mm (9.65 in.) • AC version (with an external AC adapter): 270 mm (10.63 in.)	
Depth	110 mm (4.33 in.)	
Weight	• DC version: ~9 kg (19.8 lb) • AC version: ~10 kg (22.0 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 865: AWHQE environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹⁰⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.17 AirScale Micro RRH 4T4R n78 40 W (AWHQG)

AWHQG (474877A) is introduced by 5GC001278 (for NR).

Functional description

Table 866: AWHQG functional specification

Property	Value
Maximum output power	40 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Software supported technology	NR
Duplex mode, supported standard	TDD
Frequency range	3460-3580 MHz
Instantaneous bandwidth (iBW)	120 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	20, 40, 50, 60, 80, 100 MHz
Limitations	Activating the <i>5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency</i> feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μ DTx usage.

Interfaces

Figure 259: AWHQG interfaces and LED indicators

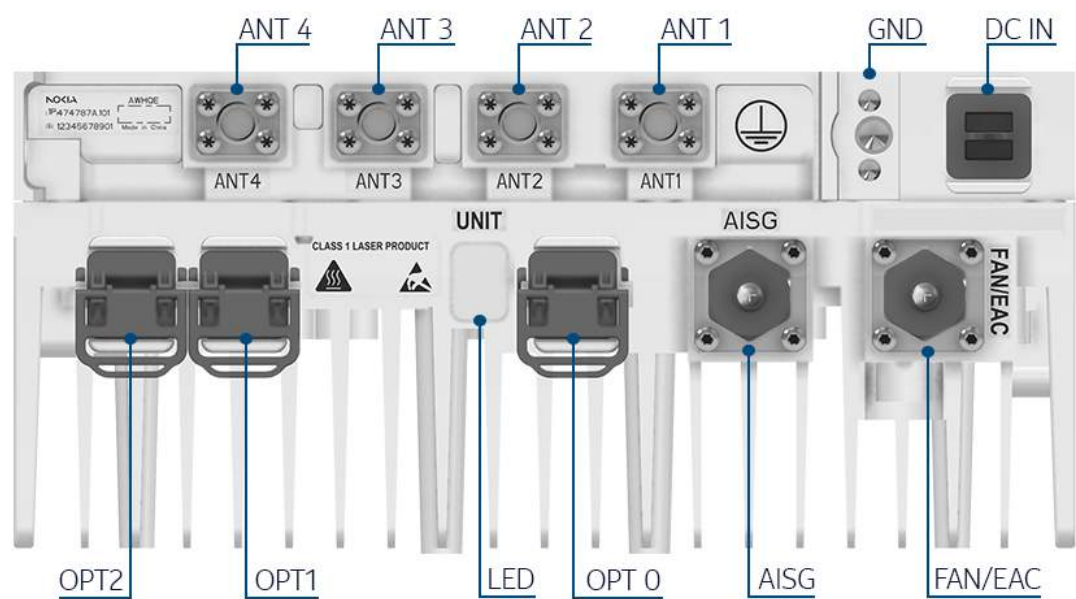


Table 867: AWHQG interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	-
Fan/External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	9.8 Gbps, CPRI
Grounding	GND 	1	M8 or 2 x M5 screw	-
AISG connector	AISG	1	8-pin circular	-

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 868: AWHQG ALD support

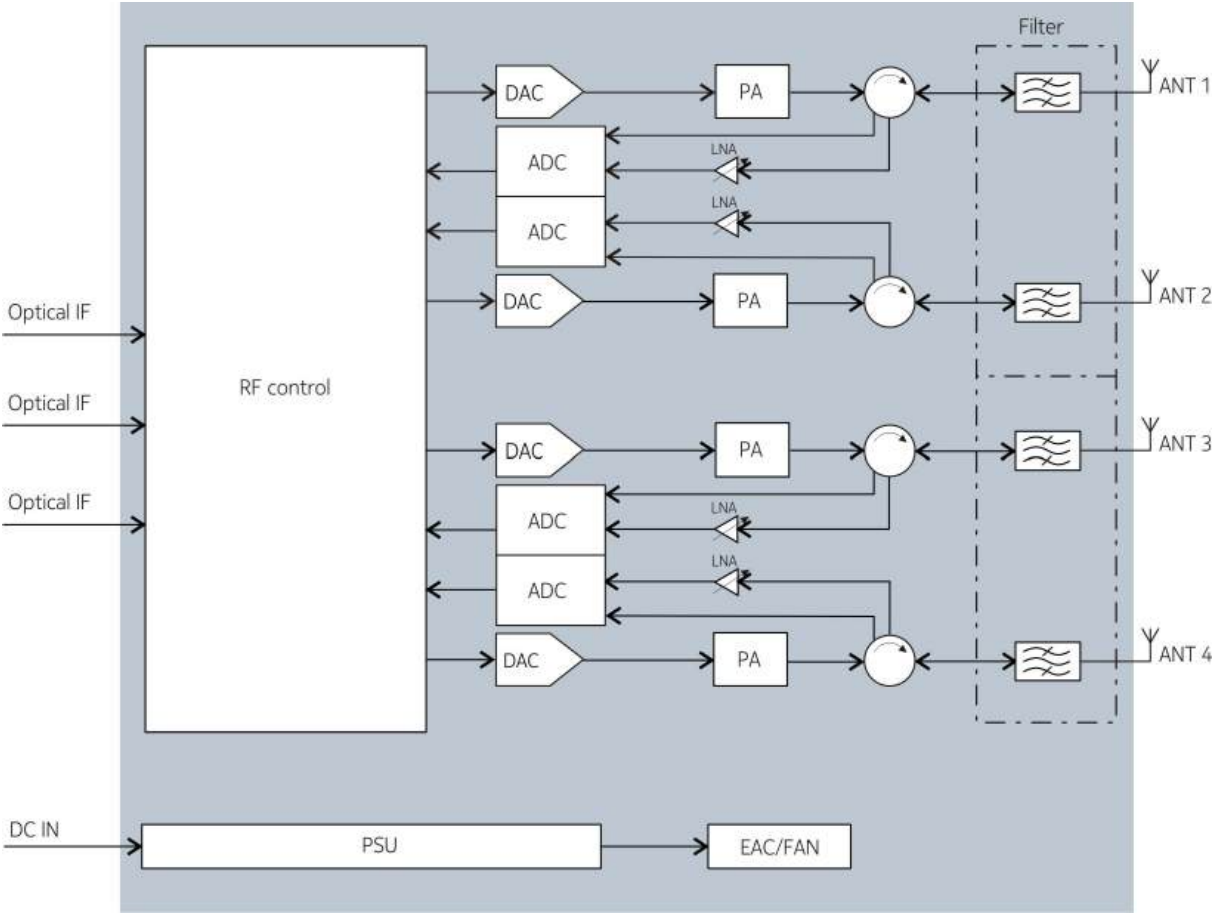
Property	Value
AISG	2.0
Voltage	24 V
Power per port	30 W

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 260: AWHQG functional block diagram



Electrical specifications

Table 869: AWHQG electrical specifications

Property	Value
Nominal supply voltage	DC: -48 V
Nominal input voltage range	DC: -40.5 V to -57 V AC: 76 V to 288 V (through an external AC/DC converter)
Extended input voltage range	-36 V to -40.5 V DC -57 V to -60 V DC

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Recommended power back-off

Table 870: The recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
NR	NRCELL PDSCH power back-off for 256 QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹¹⁾
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAG AirScale micro AC PSU (474866A)
- OCTIS plug kit AC power (474244A)

- OCTIS plug kit DC power (474184A)
- OCTIS plug kit for SFP 2 (475756A)
- AAQA AirScale micro integrated antenna (474520A)

Installation options

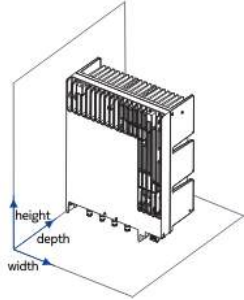
- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
 - Enclosure *FMWM* or *FMWV*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 871: AWHQG dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	Core RRH (DC version): 245 mm (9.65 in.) RRH with an AC adapter (AC version): 270 mm (10.63 in.)	
Depth	110 mm (4.33 in.)	
Weight	Core RRH (DC version): 9.0 kg (19.8 lb) RRH with an AC adapter (AC version): 10.5 kg (23.2 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 872: AWHQG environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹¹⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.18 AirScale Micro 4T4R B42/n78 20 W (AZQD)

AZQD (474798A) is introduced by LTE4828 (for LTE) and 5GC001489 (for NR).

Functional description

Table 873: AZQD functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE, NR
Operating modes	• LTE mode: - Up to four 10, 15 or 20 MHz LTE carriers • NR mode: - Up to two 20 MHz NR carriers • Concurrent mode: - One NR 20 MHz carrier with one LTE 10/20 MHz carrier or three 20 MHz carriers - Two NR 20 MHz carriers with two LTE 20 MHz carriers • Concurrent split mode LTE+NR: - One NR 2T2R 20 MHz carrier with one LTE 2T2R 10/20 MHz carrier or three 20 MHz carriers - Two NR 2T2R 20 MHz carriers with two LTE 2T2R 20 MHz carriers - One NR 2T2R 20 MHz carrier with one LTE 2T2R 20 MHz carrier
RF sharing/concurrent mode	NR-LTE
Duplex mode, supported standard	TDD
Filter bandwidth	200 MHz
Frequency range	3400–3600 MHz
Instantaneous bandwidth (iBW)	80 MHz
Occupied bandwidth (oBW)	80 MHz
Number of carriers per pipe	Up to 4

Property	Value
Supported bandwidths	LTE: 10, 15, 20 MHz NR: 20 MHz
Limitations	For any two adjacent carriers, the distance from the center of the first carrier to the farther edge of the second carrier can't exceed 110 MHz.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 261: AZQD interfaces and LED indicators

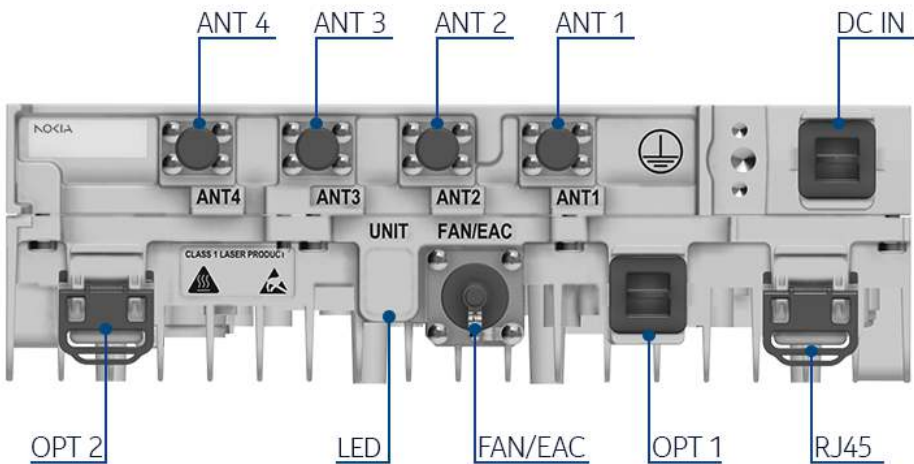


Table 874: AZQD interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
External Alarm Connection/Fan	EAC/FAN	1	CIRC 8F IP67 Flange	Hot insert not supported
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7)
Ethernet	RJ	1	RJ45	–
Grounding	GND 	1	M8 or two M5 screws	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

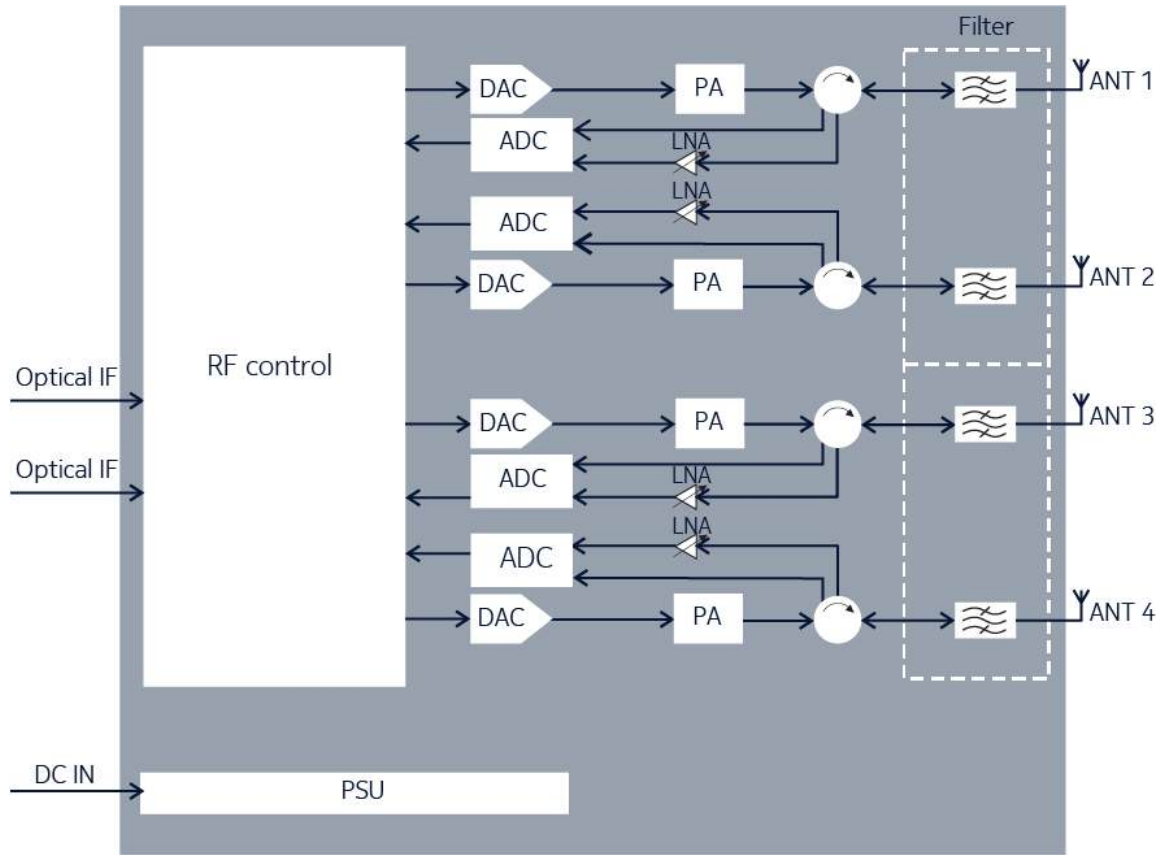
Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

There is no ALD support for AZQD.

Functional block diagram

Figure 262: AZQD functional block diagram



Electrical specifications

Table 875: AZQD electrical specifications

Property	Value
Nominal supply voltage	DC: -48 V AC: 220 V
Nominal input voltage range	DC: -40.5 V to -57.0 V AC: 80 V to 276 V (through external AC/DC converter), 45 Hz to 65 Hz
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

 Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

 Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

5G power back-off

To reach maximum 256 QAM DL throughput it might be necessary to adjust `dLQam256PowerBackoffSub6` value. Optimal value depends on used P_{max} value and radio unit variant. As an example, `dLQam256PowerBackoffSub6` value 2-2.5 dB gives the best DL throughput with AZQD radio when P_{max} is set to 37 dBm.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)

- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AMBL AirScale micro horizontal strand mount bracket (474849A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹²⁾
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAE AirScale micro AC PSU (474518A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AAQA AirScale micro integrated antenna (474520A)

Installation options

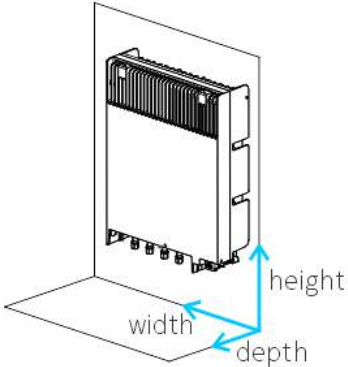
- *Pole*
- *Wall*
- *Tilt mounting*
- *Bookshelf mounting*
- *Strand*
- Enclosure *FMWM* or *FMWV*

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 876: AZQD dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	245 mm (9.65 in.) core unit (DC version) 270 mm (10.63 in.) with AC adapter (AC version)	
Depth	75 mm (2.95 in.)	
Weight	6.5 kg (14.3 lb) core unit (DC version) 7.4 kg (16.3 lb) with AC adapter (AC version)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 877: AZQD environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹²⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.19 AirScale Micro 4T4R B43/n78 20 W (AZQR)

AZQR (475148A) is introduced by LTE5235 (for LTE) and 5GC001794 (for NR).

Functional description

Table 878: AZQR functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies (standalone and MSR)	LTE, NR
Duplex mode	TDD
Frequency range	3600–3800 MHz
Filter bandwidth	200 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	80 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	LTE: 10, 15, 20 MHz NR: 20 MHz
Limitations	For any two adjacent carriers, the distance from the center of the first carrier to the farther edge of the second carrier can't exceed 110 MHz.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 263: AZQR interfaces and LED indicators

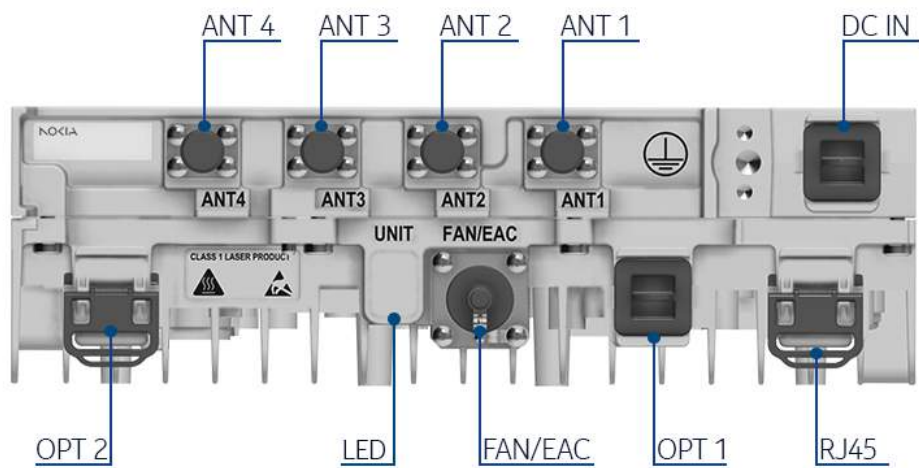


Table 879: AZQR interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
External Alarm Connection/Fan	EAC/FAN	1	CIRC 8F IP67 Flange	Hot insert not supported
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7);
Ethernet	RJ	1	RJ45	–
Grounding	GND 	1	M8 or two M5 screws	–

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

**WARNING!****Risk of electric shock**

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

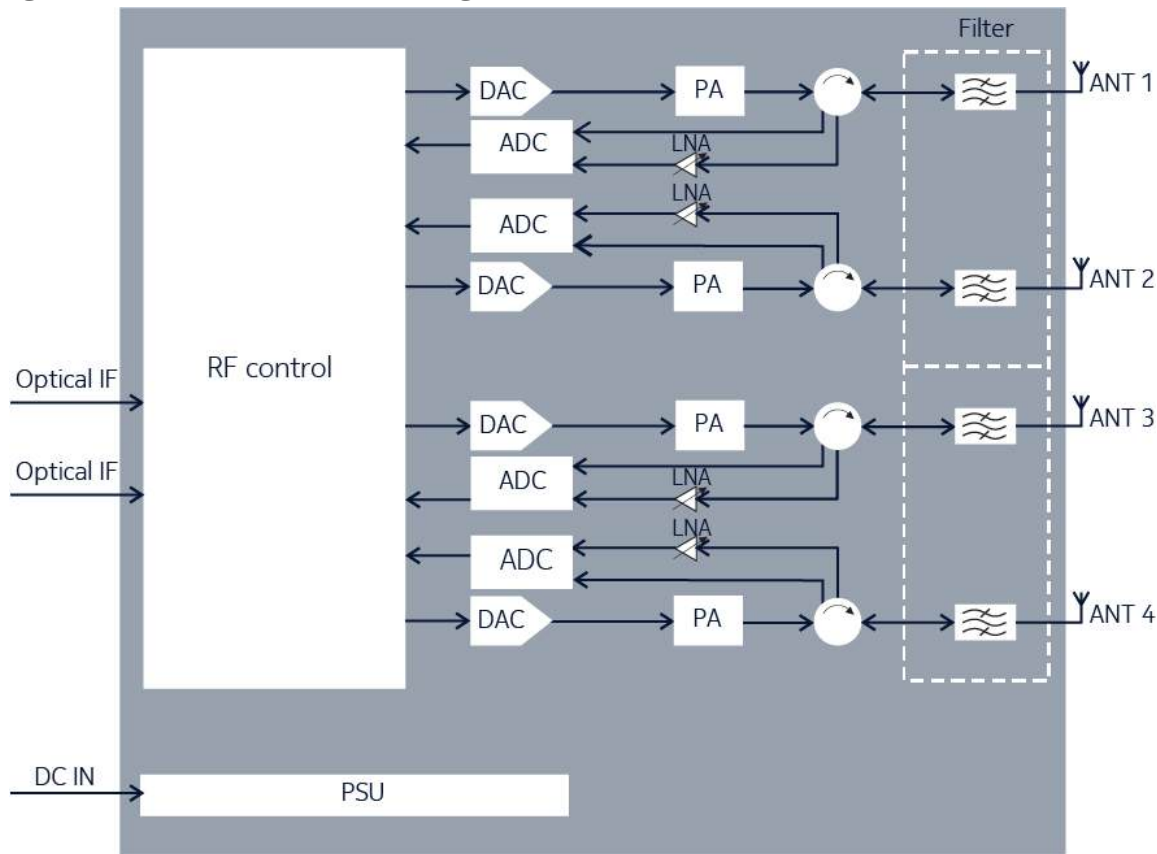
Antenna line device (ALD) support

Note:

AZQR doesn't support ALD systems.

Functional block diagram

Figure 264: AZQR functional block diagram



Electrical specifications

Table 880: AZQR electrical specifications

Property	Value
Nominal supply voltage	DC: -48 V AC: 220 V
Nominal input voltage range	DC: -40.5 V to -57 V AC: 80 V to 276 V (through external AC/DC converter), 45 Hz to 65 Hz
Extended input voltage range	DC: -36 V to -40.5 V DC: -57 V to -60 V

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

NR power back-off

Note:

To reach maximum 256 QAM DL throughput it might be necessary to adjust `dlQam256PowerBackoffSub6` value. Optimal value depends on used $P_{\max}$ value and radio unit variant. As an example, `dlQam256PowerBackoffSub6` value 2-2.5 dB gives the best DL throughput with AZQR radio when $P_{\max}$ is set to 37 dBm.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AMBL AirScale micro horizontal strand mount bracket (474849A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹³⁾
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- FMWG AirScale micro wall/pole mount kit for single radio (474013A)

- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- APAE AirScale micro AC PSU (474518A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AAQA AirScale micro integrated antenna (474520A)

Installation options

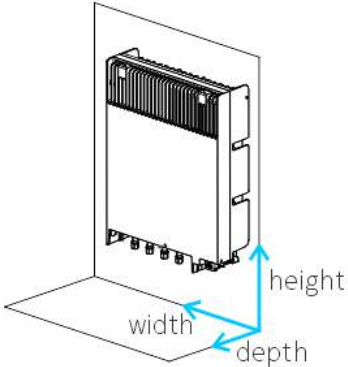
- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- *Strand*
- Enclosure *FMWM* or *FMWV*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 881: AZQR dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	Core RRH (DC version): 245 mm (9.65 in.) RRH with an AC adapter (AC version): 270 mm (10.63 in.)	
Depth	75 mm (2.95 in.)	
Weight	Core RRH (DC version): 6.5 kg (14.3 lb) RRH with an AC adapter (AC version): 7.4 kg (16.3 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 882: AZQR environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹³⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.20 AirScale Micro RRH 4T4R n78 40 W (AWHQF)

AWHQF (474877A) is introduced by 5GC001274 (for NR).

Functional description

Table 883: AWHQF functional specification

Property	Value
Maximum output power	40 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Software supported technology	NR
Duplex mode, supported standard	TDD
Frequency range	3600–3800 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	20, 40, 50, 60, 80, 90, 100 MHz
Limitations	Activating the <i>5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency</i> feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μ DTx usage.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 265: AWHQF interfaces and LED indicators

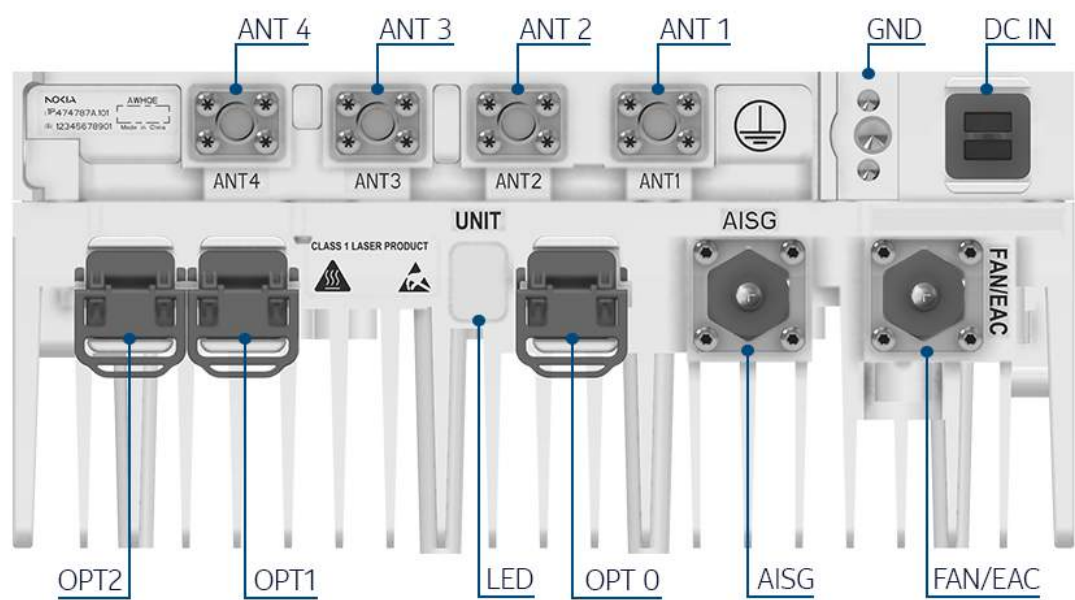


Table 884: AWHQF interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	-
Fan/External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	9.8 Gbps, CPRI
Grounding	GND 	1	M8 or 2 x M5 screw	-
Antenna Interface Standard Groups	AISG	1	8-pin circular	-

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 885: AWHQF ALD support

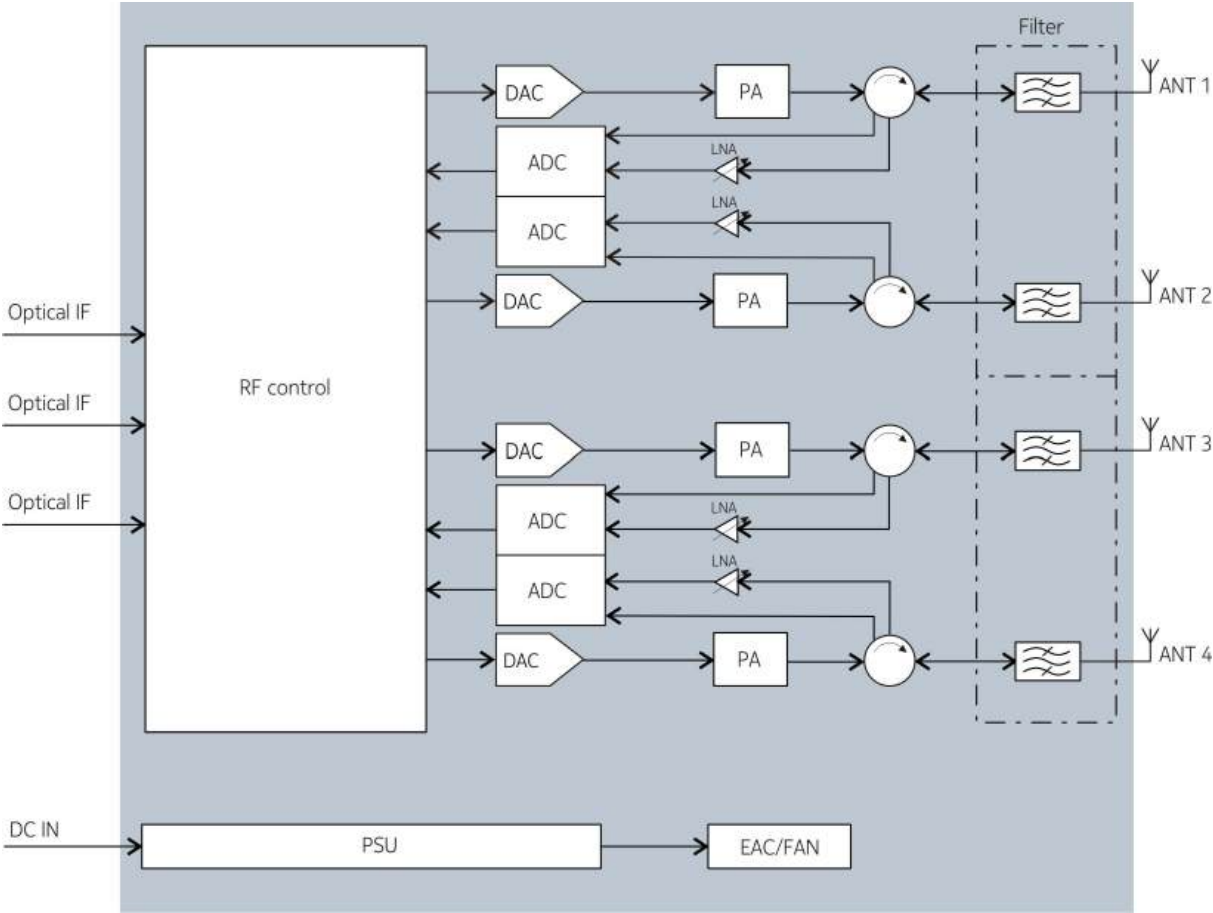
Property	Value
AISG	2.0
Voltage	24 V
Power per port	30 W

 Note:

AirScale radio units (RUs) support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 266: AWHQF functional block diagram



Electrical specifications

Table 886: AWHQF electrical specifications

Property	Value
Nominal supply voltage	DC: -48 V
Nominal input voltage range	DC: -40.5 V to -57 V AC: 76 V to 288 V (through an external AC/DC converter)
Extended input voltage range	-36 V to -40.5 V DC -57 V to -60 V DC

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Recommended power back-off

Table 887: The recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
NR	NRCELL PDSCH power back-off for 256 QAM (d1Qam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹⁴⁾
- APAG AirScale micro AC PSU (474866A)
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- OCTIS plug kit AC power (474244A)

- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAQA AirScale micro integrated antenna (474520A)

Installation options

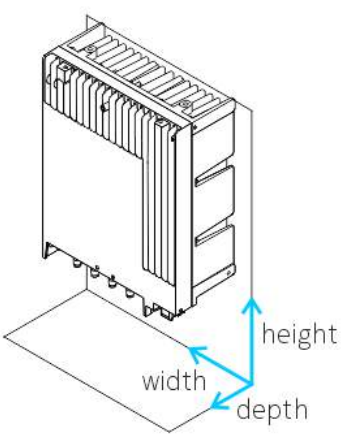
- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure *FMWM* or *FMWV*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 888: AWHQF dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	• DC version: 245 mm (9.65 in.) • AC version (with an external AC adapter): 270 mm (10.63 in.)	
Depth	110 mm (4.33 in.)	
Weight	• DC version: ~9 kg (19.8 lb) • AC version: ~10 kg (22.0 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 889: AWHQF environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹⁴⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.21 AirScale Micro RRH 4T4R B48/n48 20 W (AWHQU)

AWHQU (476212A) is introduced by *CB008814* (for NR) and *CB009365* (for LTE and LTE-NR concurrent mode).

Functional description

Table 890: AWHQU functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	20 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE, NR
Operating mode	4T4R full mode 2x 2T2R split mode In 2x 2T2R split mode, RF sharing on the same sector antenna isn't supported.
RF sharing/concurrent mode	LTE-NR
Duplex mode	TDD
Frequency range	B48/n48: 3550–3700 MHz
Filter bandwidth	150 MHz
Instantaneous bandwidth (iBW)	150 MHz
Occupied bandwidth (oBW)	150 MHz
Number of carriers per pipe	LTE: up to 4 NR: up to 3 LTE + NR: up to 7
Supported bandwidths	LTE: 10, 20 MHz NR: 10, 20, 30, 40, 50, 60, 70, 80 MHz*
Limitations	Activating the 5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and µDTx usage.

*NR bandwidths 50, 60, 70, and 80 MHz have been added due to the CB009509 feature.

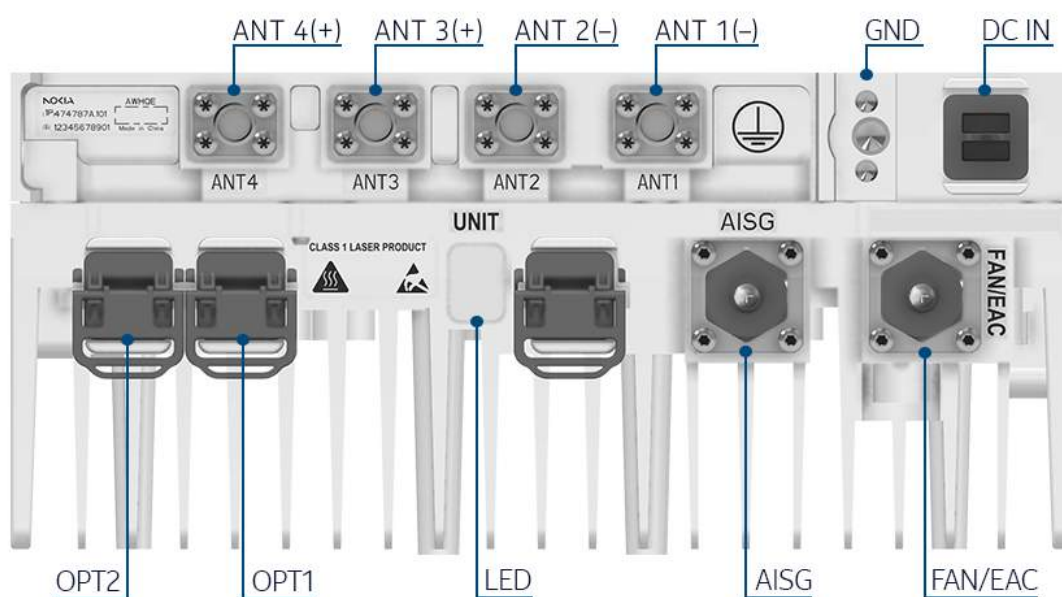
Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 267: AWHQU interfaces and LED indicators



Note:

Only SFP ports OPT1 and OPT2 (marked in the figure above) are operational and supported by software.

Table 891: AWHQU interfaces

Interface	Label	Number of interfaces	Connector type	Additional info
Power	DC IN	1	DC OCTIS Plug Kit	-
Antenna	ANT	4	NEX 10	-
Fan/external alarm connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical	OPT1, OPT2	2	SFP+/SFP28 (10GE/25GE)	eCPRI: 10 or 25 Gbps
Grounding	GND 	1	1 x M8 or 2 x M5 screw	-
Antenna Interface Standard Groups	AISG	1	8-pin circular	Voltage: 24 V Max power: 30 W

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock.

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 892: AWHQU ALD support

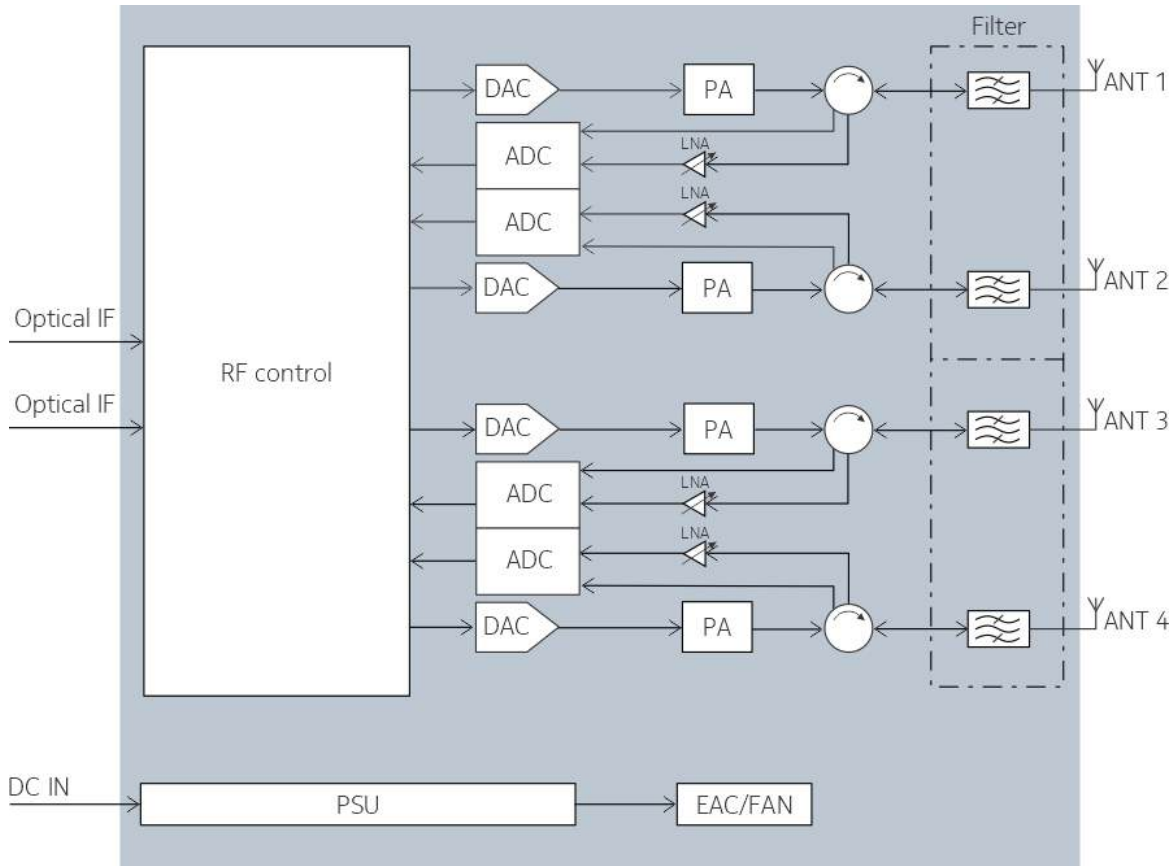
Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	30 W

 Note:

By default, the ALD port is powered when at least one carrier is configured and activated. If no carriers are configured and activated, the ALD port will remain unpowered and ALD devices won't be able to operate.

Functional block diagram

Figure 268: AWHQU functional block diagram



Electrical specifications

Table 893: AWHQU electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 76 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

! Notice:

Always connect de-energized power cables to the remote radio head (RRH) and turn the power supply on afterward. Connecting energized power cables can damage the RRH.

i Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

For AWHQU, Nokia recommends 1.5 dB power back-off value for both LTE and NR. To set the power back-off value, configure:

- the *LTE4054: LTE Dynamic Back-off* feature for LTE.
- the *NRCELL PDSCH Power Back-off for 256QAM* (`dlQam256PowerBackoffSub6`) parameter for NR.

High back-off values may cause radio outages.

i Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹⁵⁾
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAH AirScale micro AC PSU (475043A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAHO AirScale micro integrated antenna (475920A)

Installation options

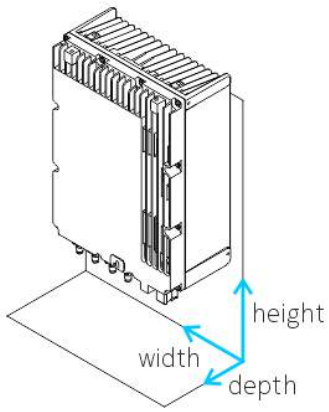
- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 894: AWHQU dimensions and weight

Property	Value	Dimensions orientation
Height	345 mm (13.58 in.)	
Width	• Without antenna: - DC version: 245 mm (9.65 in.) - AC version (with an external AC adapter): 270 mm (10.63 in.) • With antenna: 270 mm (10.63 in.)	
Depth	• Without antenna: 130 mm (5.12 in.) • With antenna: 155 mm (6.10 in.)	
Weight	• Without antenna: - DC version: ~11.0 kg (24.3 lb) - AC version (with an external AC adapter): ~12.8 kg (28.2 lb) • With antenna: - DC version: ~12.5 kg (27.6 lb) - AC version (with an external AC adapter) ~14.3 kg (31.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 895: AWHQU environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹⁵⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.22 AirScale Micro 4T4R B48/n48 (CBRS) 20 W (AZQC)

AZQC (474156A) is introduced by LTE3628 (for LTE) and 5GC001083 (for NR).

Functional description

Table 896: AZQC functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	TD-LTE, NR
Operating modes	LTE mode: up to four 10 or 20 MHz carriers NR mode: two 20 MHz carriers Concurrent mode: one 20 MHz NR carrier with up to three LTE carriers (10 or 20 MHz)
Duplex mode – supported standard	TDD
Frequency range	3550–3700 MHz
Filter bandwidth	150 MHz
Instantaneous bandwidth (iBW)	150 MHz*
Occupied bandwidth (oBW)	80 MHz
Number of carriers per pipe	LTE: up to 4 NR: 2
Supported bandwidths	LTE: 10, 20 MHz NR: 20 MHz

*150 MHz support is conditional and may be limited by any two adjacent carriers. The distance between the first carrier center and the second carrier further edge can’t exceed 110 MHz.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 269: AZQC interfaces and LED indicators

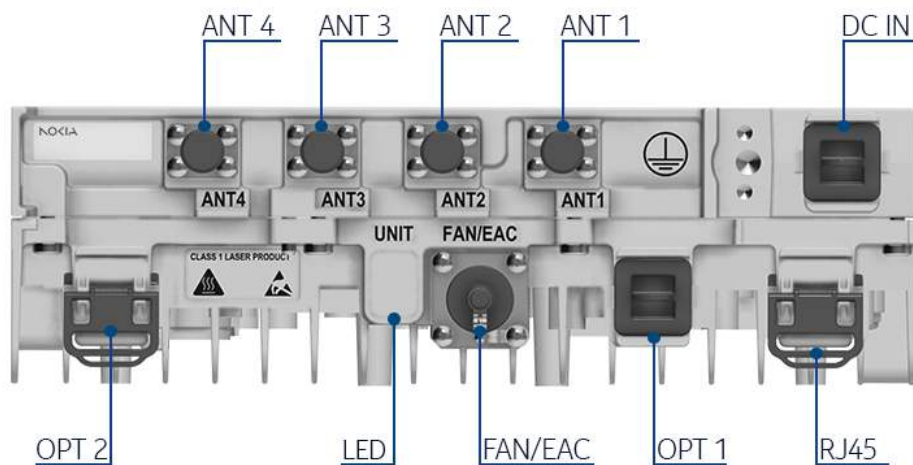


Table 897: AZQC interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
External alarm connection/fan	EAC/FAN	1	CIRC 8F IP67 Flange	Hot insert not support
LED	UNIT	1	–	–
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7)
Ethernet	RJ	1	RJ45	Separate feature required to enable this interface
Grounding (GND)		1	M8 or dual M5 screws	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

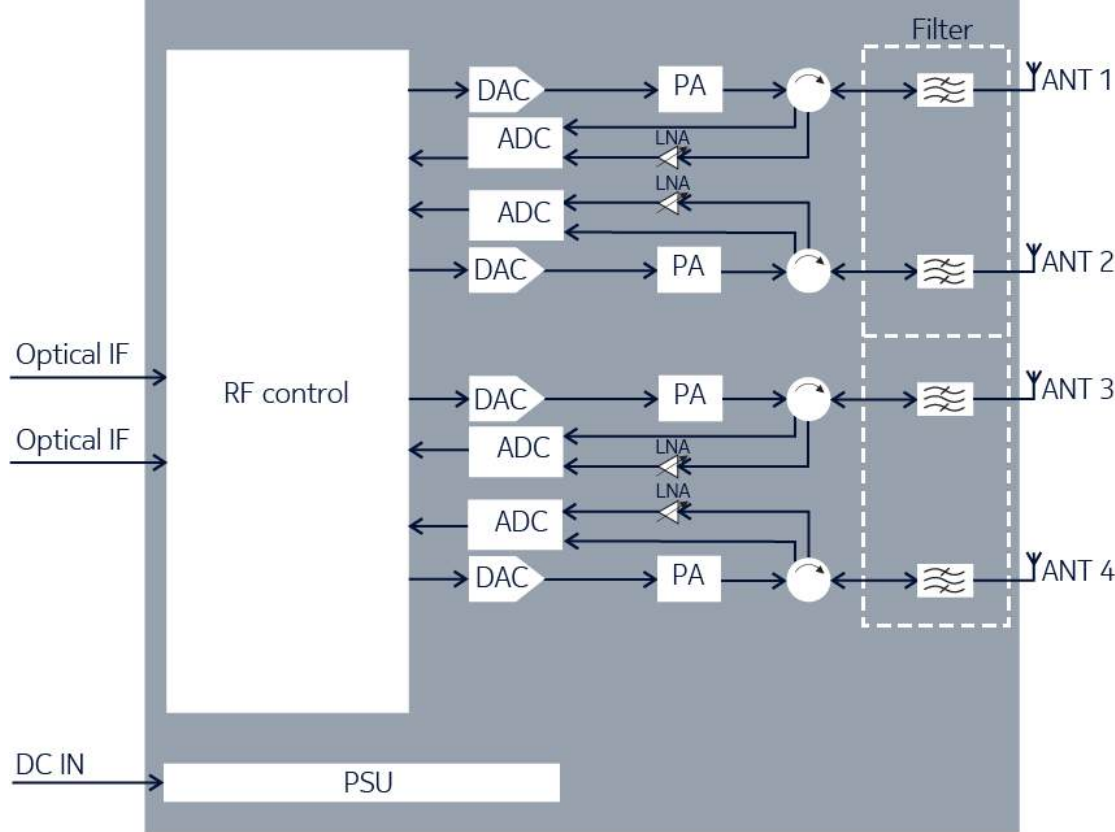
Antenna line device (ALD) support

Note:

There is no ALD support for AZQC.

Functional block diagram

Figure 270: AZQC functional block diagram



Electrical specifications

Table 898: AZQC electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 80 V AC to 276 V AC (through an external AC/DC converter)
Extended input voltage range	-36 V to -40.5 V and -57 V to -60 V (DC)
Surge protection	Class II 5 kA



Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.



Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMGP AirScale micro cover 245 x 288 (474705A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹⁶⁾
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAE AirScale micro 210 W AC PSU (474518A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)
- AAQA AirScale micro integrated antenna 3.5G (474520A)

Installation options

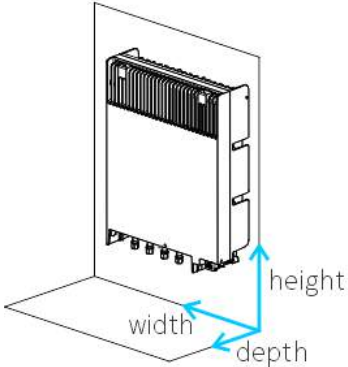
- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Strand
- Enclosure

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 899: AZQC dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	245 mm (9.65 in.) core unit (DC version) 270 mm (10.63 in.) with AC adapter (AC version)	
Depth	75 mm (2.95 in.)	
Weight	6.5 kg (14.3 lb) core unit (DC version) 7.4 kg (16.3 lb) with AC adapter (AC version)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 900: AZQC environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹⁶⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.23 AirScale Micro RRH 4T4R B53 1 W (AWHNB)

AWHNB (476437A) is introduced by CB010816 (for LTE).

Functional description

Table 901: AWHNB functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	1 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	LTE
Operating mode	4T4R full mode 2x 2T2R split mode
Duplex mode	TDD
Frequency range	B53 : 2483.5–2495 MHz
Filter bandwidth	11.5 MHz
Instantaneous bandwidth (iBW)	10 MHz
Occupied bandwidth (oBW)	10 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	LTE: 10 MHz
Limitations	AWHNB: • supports only PRACH¹ format 0. • doesn't support RTWP² measurement.

¹PRACH – physical random access channel

²RTWP – received total wideband power

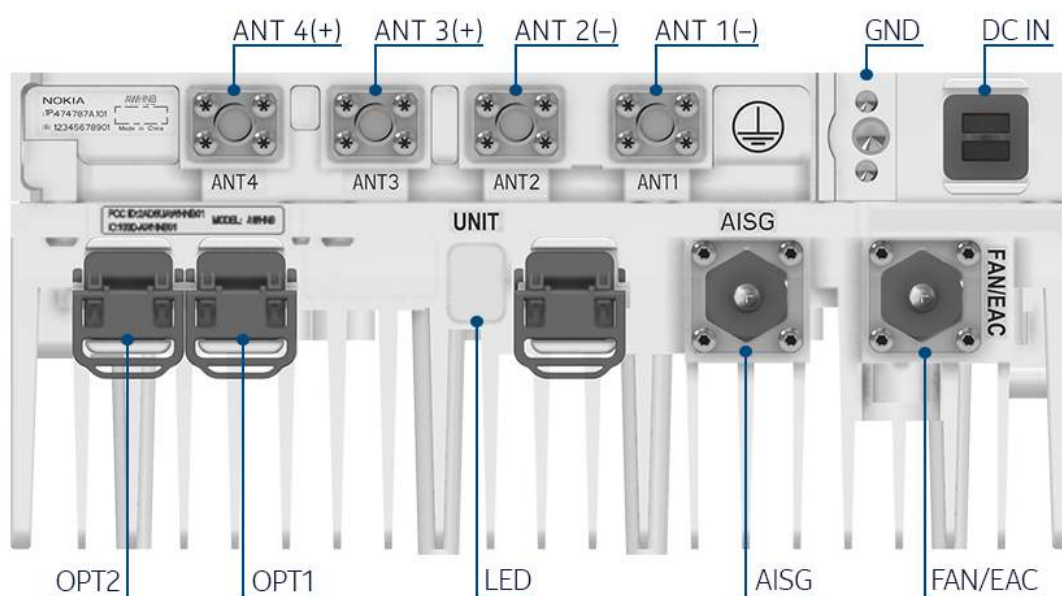
Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 271: AWHNB interfaces and LED indicators

**Note:**

Only small form-factor pluggable (SFP) ports OPT1 and OPT2 (marked in the figure above) are operational and supported by software.

Table 902: AWHNB interfaces

Interface	Label	Number of interfaces	Connector type	Additional info
Power	DC IN	1	DC OCTIS Plug Kit	-
Antenna	ANT	4	NEX 10	-
Fan/external alarm connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical	OPT1, OPT2	2	SFP+/SFP28 (10GE/25GE)	eCPRI: 10 or 25 Gbps
Grounding	GND 	1	1 x M8 or 2 x M5 screw	-
Antenna Interface Standard Groups	AISG	1	8-pin circular	Voltage: 24 V Max power: 30 W

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock.

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 903: AWHNB ALD support

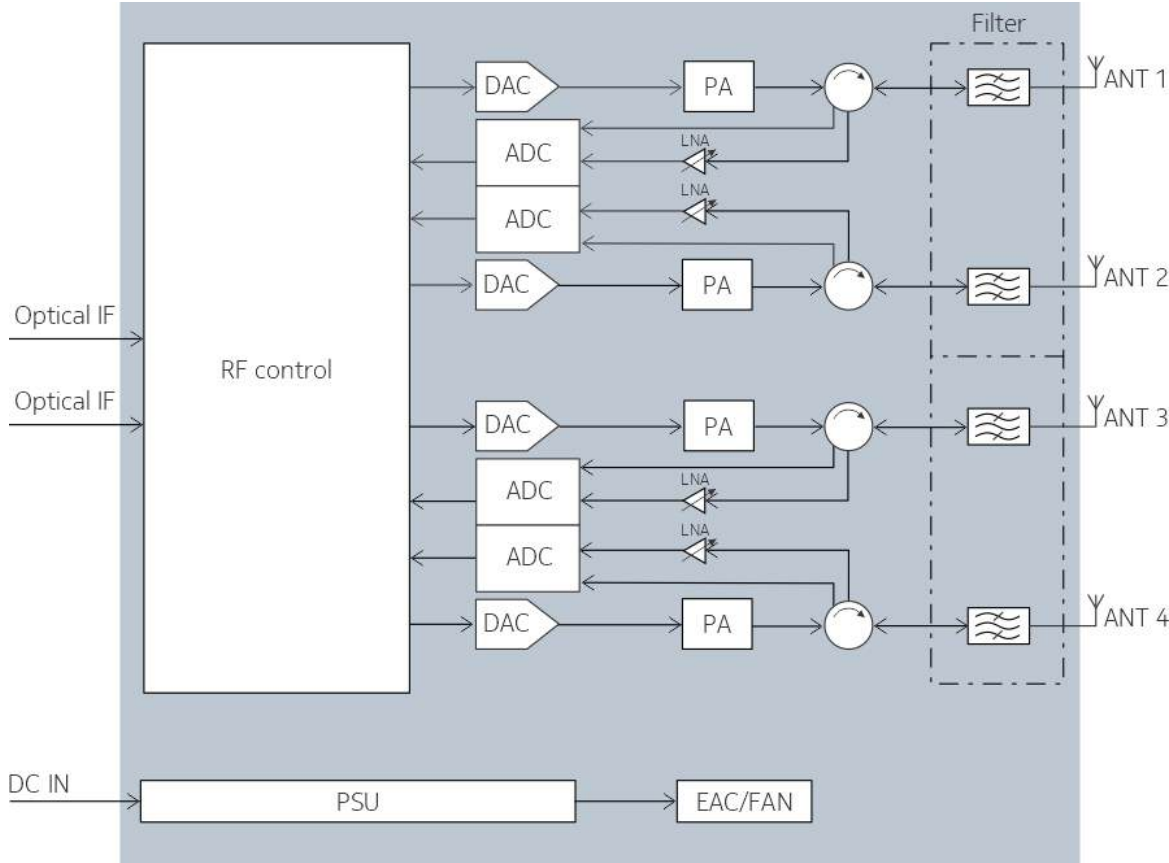
Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	30 W

 Note:

By default, the ALD port is powered when at least one carrier is configured and activated. If no carriers are configured and activated, the ALD port will remain unpowered and ALD devices won't be able to operate.

Functional block diagram

Figure 272: AWHNB functional block diagram



Electrical specifications

Table 904: AWHNB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 76 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

! Notice:

Always connect de-energized power cables to the remote radio head (RRH) and turn the power supply on afterward. Connecting energized power cables can damage the RRH.

i Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

For AWHNB, Nokia recommends 1.5 dB power back-off value for 256 QAM in LTE and NR. To set the power back-off value, configure:

- the *LTE4054: LTE Dynamic Back-off* feature for LTE.
- the *NRCELL PDSCH Power Back-off for 256QAM* (`dlQam256PowerBackoffSub6`) parameter for NR.

High back-off values may cause radio outages.

i Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole tilt mounting kit (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹
- FMWV AirScale micro RRH enclosure (475185A)²
- APAE AirScale micro AC PSU (474518A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)

Installation options

- **Pole:**
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- **Wall:**
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- **Enclosure²**

**Notice:**

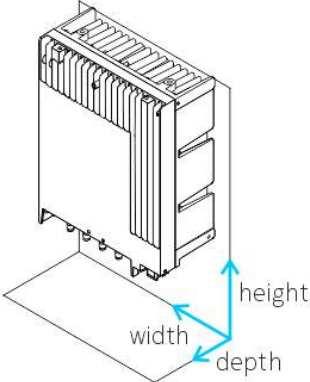
Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

¹AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

²Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

Dimensions and weight

Table 905: AWHNB dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	• DC version: 245 mm (9.65 in.) • AC version (with an external AC adapter): 270 mm (10.63 in.)	
Depth	110 mm (4.33 in.)	
Weight	• DC version: ~9 kg (19.8 lb) • AC version: ~10 kg (22.0 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 906: AWHNB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

7.24 AirScale Micro 4T4R B66 20 W (AHIB)

AHIB (474050A) is introduced by LTE3431 (for WCDMA and LTE), SR002530 (for WCDMA and LTE), and5GC001189 (for NR).

Functional description

Table 907: AHIB functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Supported technologies (standalone and MSR/concurrent operation)	LTE, WCDMA-LTE, NR, NR-SRAN
Duplex mode	FDD
TX frequency range	2110-2200 MHz
RX frequency range	1710-1780 MHz
DL filter bandwidth	90 MHz
UL filter bandwidth	70 MHz
Instantaneous bandwidth (iBW)	70 MHz
Occupied bandwidth (oBW)	70 MHz
Number of carriers per pipe	Up to 4
Supported bandwidths	WCDMA: 3.8, 4.0, 4.2, 4.4, 4.6, 4.8, 5 MHz LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20 MHz
Dynamic spectrum sharing (DSS) support	LTE-NR: 10, 15, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 273: AHIB interfaces and LED indicators

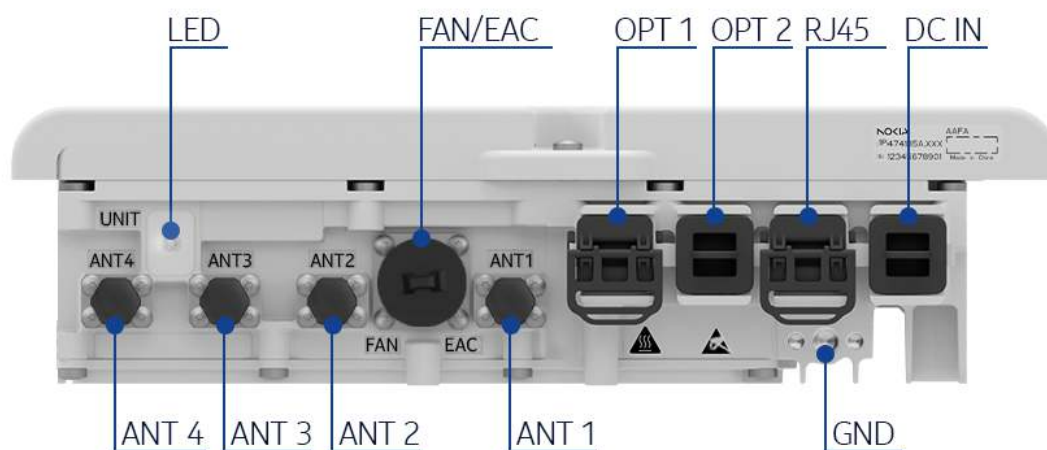


Table 908: AHIB interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX10	–
External Alarm Connection /Fan	FAN/EAC	1	CIRC 8F IP67 Flange	Hot insert not supported
Optical interface	OPT	2	OCTIS Plug Kit SFP/SFP+	Up to 9.8 Gbps (CPRI7), except CPRI6;
Ethernet	RJ	1	RJ45	Separate feature required to enable this interface
Grounding	GND 	1	M8 or dual M5 screws	–



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

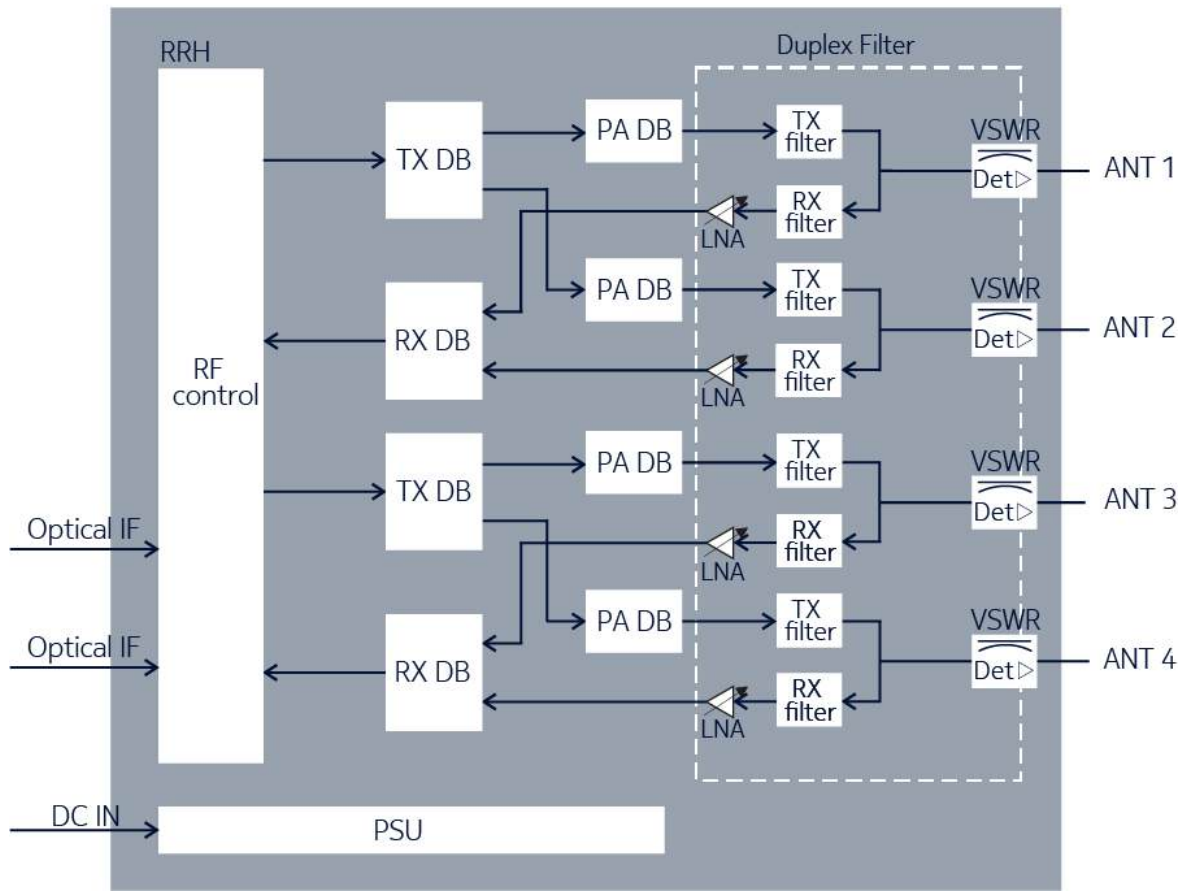
Antenna line device (ALD) support

Note:

There is no ALD support for AHIB.

Functional block diagram

Figure 274: AHIB functional block diagram



Electrical specifications

Table 909: AHIB electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC
Extended input voltage range	-36 V DC to -40.5 V DC -57 V DC to -60 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is -40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AAFA AirScale micro integrated antenna (474185A)
- AMBC AirScale micro tilt mount kit (474332A)
- AMBK AirScale micro horizontal strand mount bracket (474630A)
- AMBL AirScale micro horizontal strand mount bracket (474849A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹⁷⁾
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWH AirScale micro wall/pole mount kit for dual radios (474312A)
- FMWM AirScale micro RRH enclosure (474431A)
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV or FMWM is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAB AirScale micro AC PSU (474130A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP (474183A)

Installation options

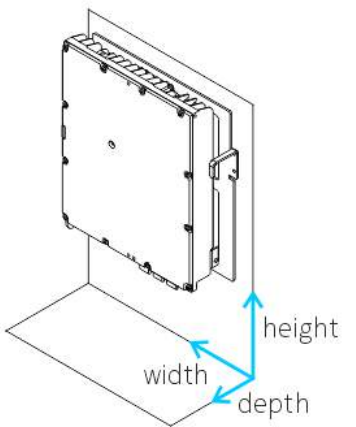
- Pole:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- Wall:
 - *Fixed orientation*
 - *Tilt mounting*
 - *Multi-directional tilt mounting*
 - *Bookshelf mounting*
- *Strand*
- Enclosure *FMWM* or *FMWV*

 Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 910: AHIB dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	245 mm (9.65 in.) core unit (DC version) 270 mm (10.63 in.) with AC adapter (AC version)	
Depth	55 mm (2.17 in.)	
Weight	5.4 kg (11.9 lb) core unit (DC version) 6.1 kg (13.4 lb) with AC adapter (AC version)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 911: AHIB environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹⁷⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.25 AirScale Micro RRH 4T4R n40 80 W (AWHNA)

AWHNA (476121A) is introduced by CB008786 (for NR).

Functional description

Table 912: AWHNA functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	80 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Operating mode	4T4R full mode 2 x 2T2R split mode
Supported technologies	NR
Duplex mode	TDD
Frequency range	n40: 2300-2400 MHz
Filter bandwidth	100 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	10, 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz
Limitations	Support of 90 MHz and 100 MHz bandwidths on band n40 is only available for UEs with newer chipsets (such as Qualcomm X65 onward) and might be disabled by default. For older UEs that don't support these bandwidths, it may lead to repetitive radio access attempts. Contact the UE vendor for more details.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 275: AWHNA interfaces and LED indicators

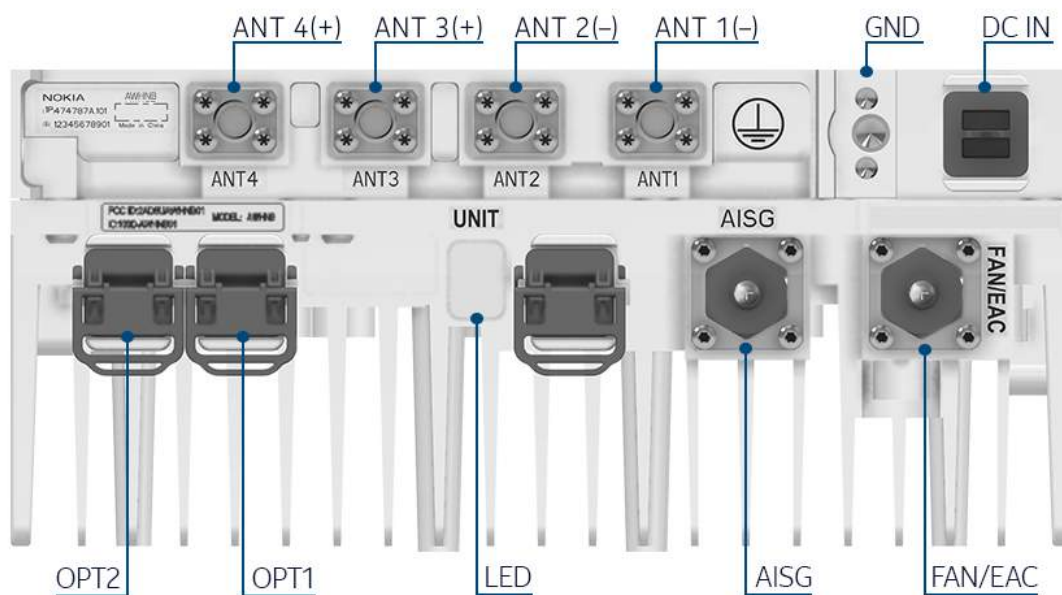


Table 913: AWHNA interfaces

Interface	Label	Number of interfaces	Connector type	Additional info
Power	DC IN	1	DC OCTIS Plug Kit	-
Antenna	ANT	4	NEX 10	-
Fan/external alarm connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical	OPT1, OPT2	2	SFP+/SFP28 (10GE/25GE)	eCPRI: 10 or 25 Gbps
Grounding		1	1 x M8 or 2 x M5 screw	-
Antenna Interface Standard Groups	AISG	1	8-pin circular	Voltage: 24 V Max power: 30 W

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 914: AWHNA ALD support

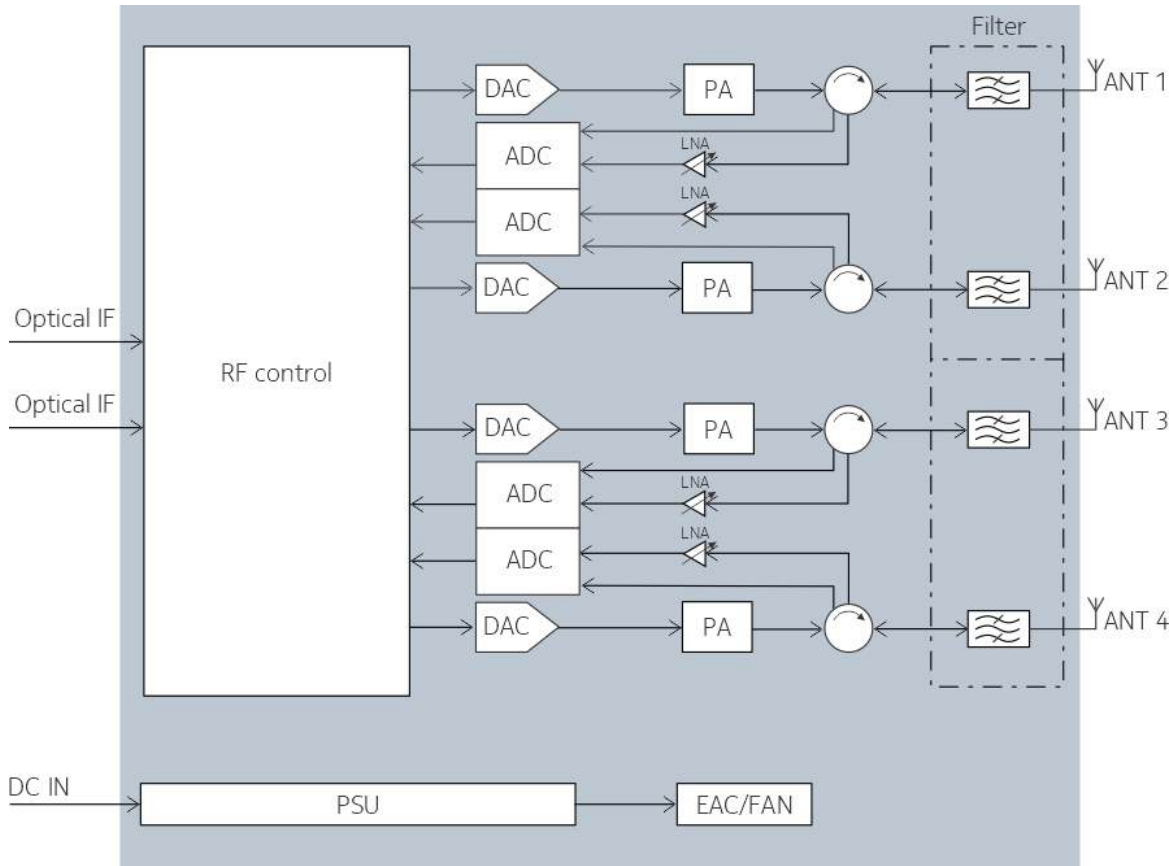
Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	30 W

 Note:

By default, the ALD port is powered when at least one carrier is configured and activated. If no carriers are configured and activated, the ALD port will remain unpowered and ALD devices won't be able to operate.

Functional block diagram

Figure 276: AWHNA functional block diagram



Electrical specifications

Table 915: AWHNA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 85 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

For AWHNA, Nokia recommends 1.5 dB power back-off value for 256 QAM. To set the power back-off value, configure the `NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)` parameter for NR. High back-off values may cause radio outages.

Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole tilt mounting kit (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A) ¹
- FMWV AirScale micro RRH enclosure (475185A) ²
- APAH AirScale micro AC PSU (475043A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAHM AirScale micro integrated antenna (475211A)

Installation options

- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*

- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure²

**Notice:**

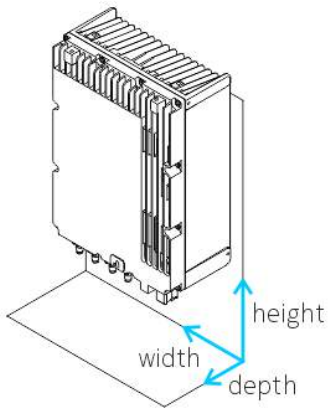
Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

¹AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

²Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

Dimensions and weight

Table 916: AWHNA dimensions and weight

Property	Value	Dimensions orientation
Height	345 mm (13.58 in.)	
Width	• Without an antenna: - DC version: 245 mm (9.65 in.) - AC version (with an external AC adapter): 270 mm (10.63 in.) • With an antenna: 270 mm (10.63 in.)	
Depth	• Without an antenna: 130 mm (5.12 in.) • With an antenna: 155 mm (6.10 in.)	
Weight	• Without an antenna: - DC version: ~11.0 kg (24.3 lb) - AC version (with an external AC adapter): ~12.8 kg (28.2 lb) • With an antenna: - DC version: ~12.5 kg (27.6 lb) - AC version (with an external AC adapter) ~14.3 kg (31.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 917: AWHNA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

7.26 AirScale Micro RRH 4T4R n77 20 W (AWHQM)

AWHQM (475246A) is introduced by 5GC001832 (for NR).

Functional description

Table 918: AWHQM functional specification

Property	Value
Maximum output power	20 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies (standalone and MSR)	NR
Duplex mode, supported standard	TDD
Frequency range	3800-4100 MHz
Filter bandwidth	300 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 5
Supported bandwidths	20, 40, 50, 60, 80, 100 MHz
Limitations	Activating the 5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μ DTx usage.

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 277: AWHQM interfaces and LED indicators

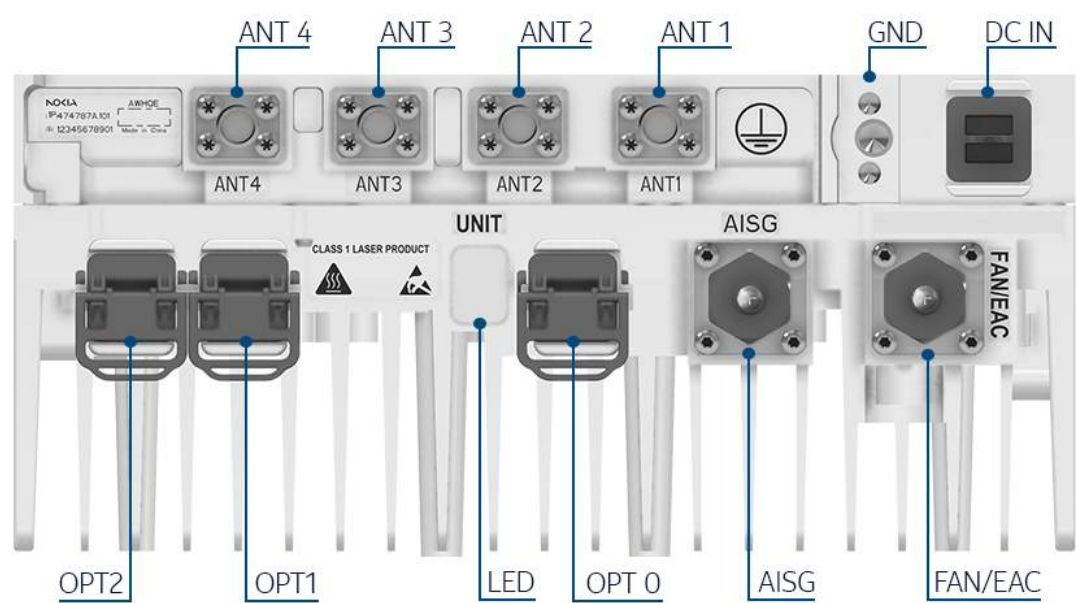


Table 919: AWHQM interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
Fan/External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	9.8 Gbps, CPRI
Grounding	GND 	1	M8 or 2 x M5 screw	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 920: AWHQM ALD support

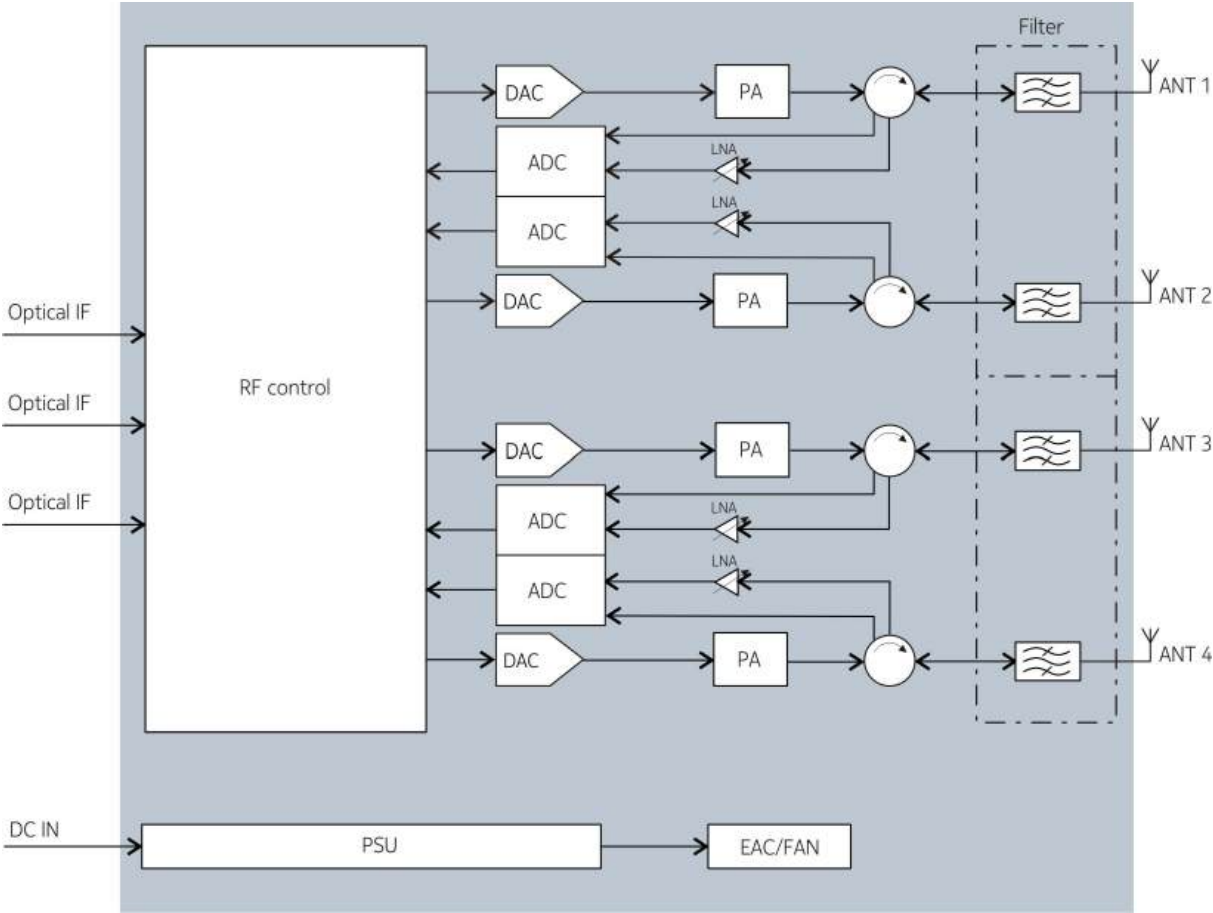
Property	Value
AISG	2.0
Voltage	24 V
Power per port	30 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 278: AWHQM functional block diagram



Electrical specifications

Table 921: AWHQM electrical specifications

Property	Value
Nominal supply voltage	DC: -48 V
Nominal input voltage range	DC: -40.5 V to -57 V AC: 76 V to 288 V (through an external AC/DC converter)
Extended input voltage range	-36 V to -40.5 V DC -57 V to -60 V DC

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

Recommended power back-off

Table 922: The recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
NR	NRCELL PDSCH power back-off for 256 QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹⁸⁾
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAG AirScale micro AC PSU (474866A)
- OCTIS plug kit AC power (474244A)

- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAHN AirScale micro integrated antenna (475539A)

Installation options

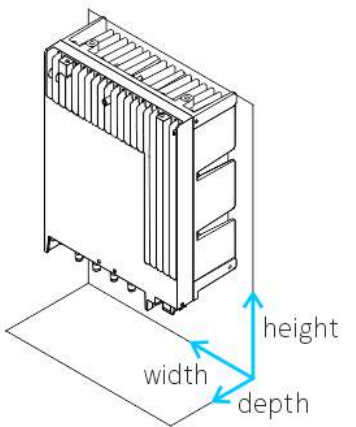
- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure *FMWM* or *FMWV*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 923: AWHQM dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	Core RRH (DC version): 245 mm (9.65 in.) RRH with an AC adapter (AC version): 270 mm (10.63 in.)	
Depth	110 mm (4.33 in.)	
Weight	Core RRH (DC version): 9.0 kg (19.8 lb) RRH with an AC adapter (AC version): 10.2 kg (22.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 924: AWHQM environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹⁸⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.27 AirScale Micro RRH 4T4R n77 80 W (AWHQN)

AWHQN (475701A) is introduced by CB005845 (for NR).

Functional description

Table 925: AWHQN functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	80 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	NR
Operating mode	4T4R full mode 2x 2T2R split mode ¹
Duplex mode	TDD
Frequency range	B5: 3700–3980 MHz
Filter bandwidth	280 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	200 MHz
Number of carriers per pipe	Up to 2 ²
Supported bandwidths	10, 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz ³
Limitations	Activating the 5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μDTx usage.

¹Split mode has been added due to the CB009509 feature.

²The number of carriers has been changed to two due to the CB009509 feature.

³NR bandwidths 10, 20, 30, 50, 60, 70, and 90 MHz have been added due to the CB009509

feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 279: AWHQN interfaces and LED indicators

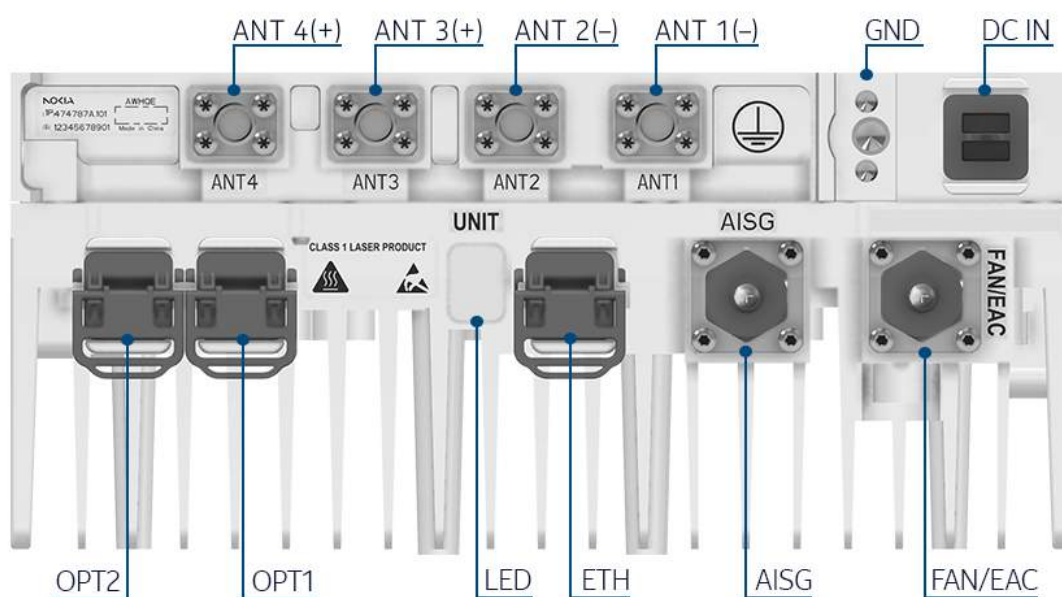


Table 926: AWHQN interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
Fan/external alarm connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	2	OCTIS Plug Kit SFP+/SFP28	10 or 25 Gbps, eCPRI
Ethernet	ETH	1	OCTIS Plug Kit SFP+/SFP28	This port is hardware ready only. The SFP/RJ45 adapter needed to use RJ45 will be provided in future releases.
Grounding	GND 	1	M8 or 2 x M5 screw	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 927: AWHQN ALD support

Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	30 W

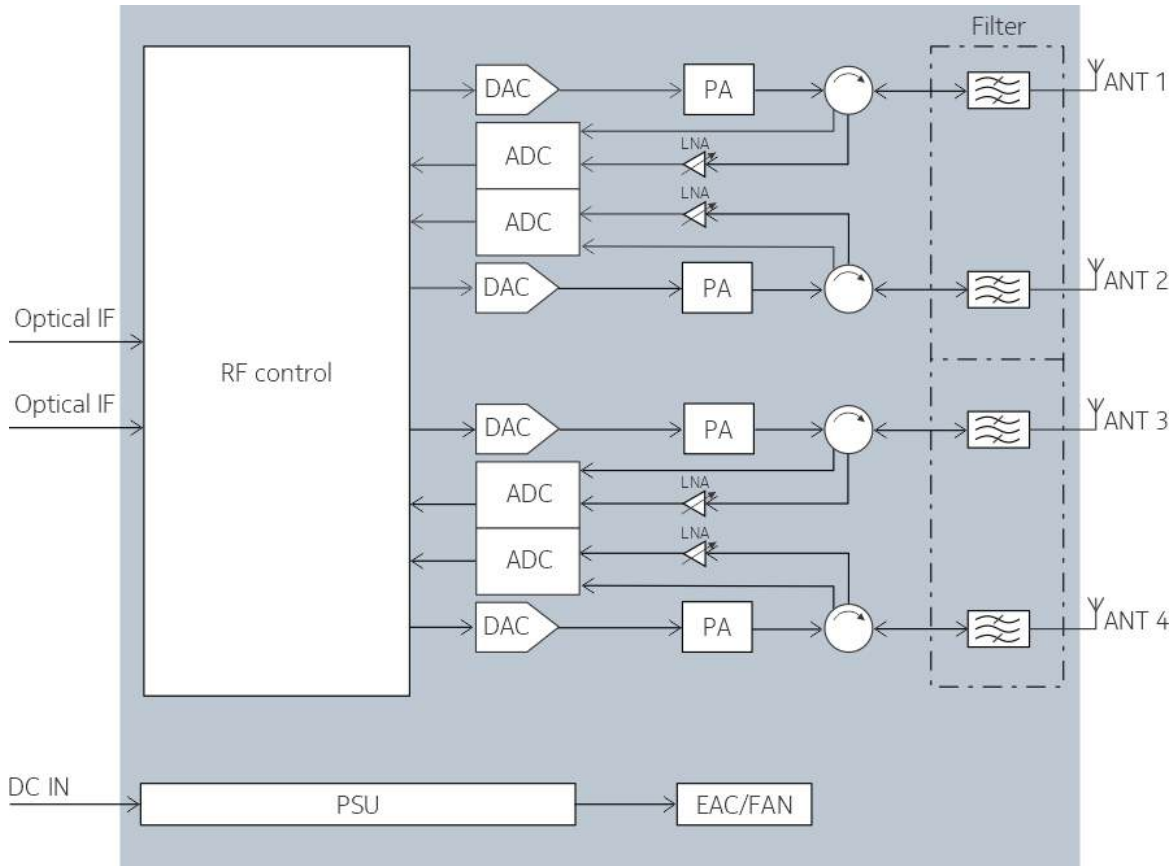


Note:

By default, the ALD port is powered when at least one carrier is configured and activated. If no carriers are configured and activated, the ALD port will remain unpowered and ALD devices won't be able to operate.

Functional block diagram

Figure 280: AWHQN functional block diagram



Electrical specifications

Table 928: AWHQN electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 76 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterwards. Connecting energized power cables can damage the RRH.

NR power back-off

The recommended value for the `dlQam256PowerBackoffSub6` parameter is:

- 1.5 dB for 3GPP performance requirement
- 3 dB for high-peak UE throughput (4x4 DL MIMO)

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)¹⁹⁾
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAH AirScale micro AC PSU (475043A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAHO AirScale micro integrated antenna (475920A)

Installation options

- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure *FMWM* or *FMWV*

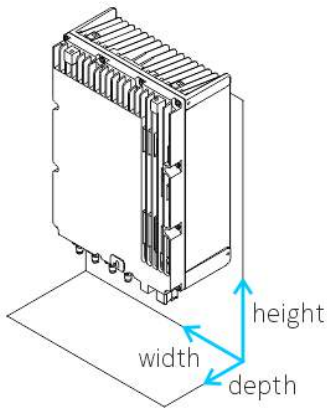


Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 929: AWHQN dimensions and weight

Property	Value	Dimensions orientation
Height	345 mm (13.58 in.)	
Width	• Without antenna: - DC version: 245 mm (9.65 in.) - AC version (with an external AC adapter): 270 mm (10.63 in.) • With antenna: 270 mm (10.63 in.)	
Depth	• Without antenna: 130 mm (5.12 in.) • With antenna: 155 mm (6.10 in.)	
Weight	• Without antenna: - DC version: ~11.0 kg (24.3 lb) - AC version (with an external AC adapter): ~12.8 kg (28.2 lb) • With antenna: - DC version: ~12.5 kg (27.6 lb) - AC version (with an external AC adapter) ~14.3 kg (31.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 930: AWHQN environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

¹⁹⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.28 AirScale Micro RRH 4T4R n77 80 W (AWHQ3)

AWHQ3 (476382A) is introduced by CB010267 (for NR).

Functional description

Table 931: AWHQ3 functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	80 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	NR
Operating mode	4T4R full mode 2 x 2T2R split mode
Duplex mode	TDD
Frequency range	n77: 3800-4200 MHz
Filter bandwidth	400 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	200 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	10, 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 281: AWHQ3 interfaces and LED indicators

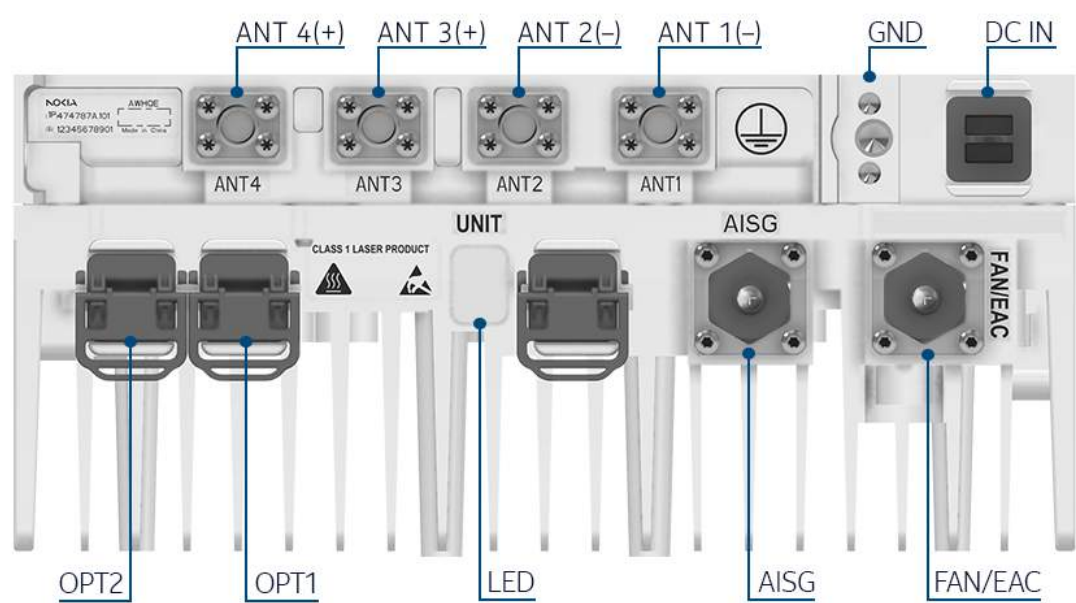


Table 932: AWHQ3 interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power	DC IN	1	DC OCTIS Plug Kit	-
Antenna	ANT	4	NEX 10	-
Fan /external alarm connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical	OPT	2	SFP+/SFP28 (10GE/25GE)	eCPRI: 10 or 25 Gbps
Grounding		1	1 x M8 or 2 x M5 screw	-
Antenna Interface Standard Groups	AISG	1	8-pin circular	Voltage: 24 V Max power: 30 W

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 933: AWHQ3 ALD support

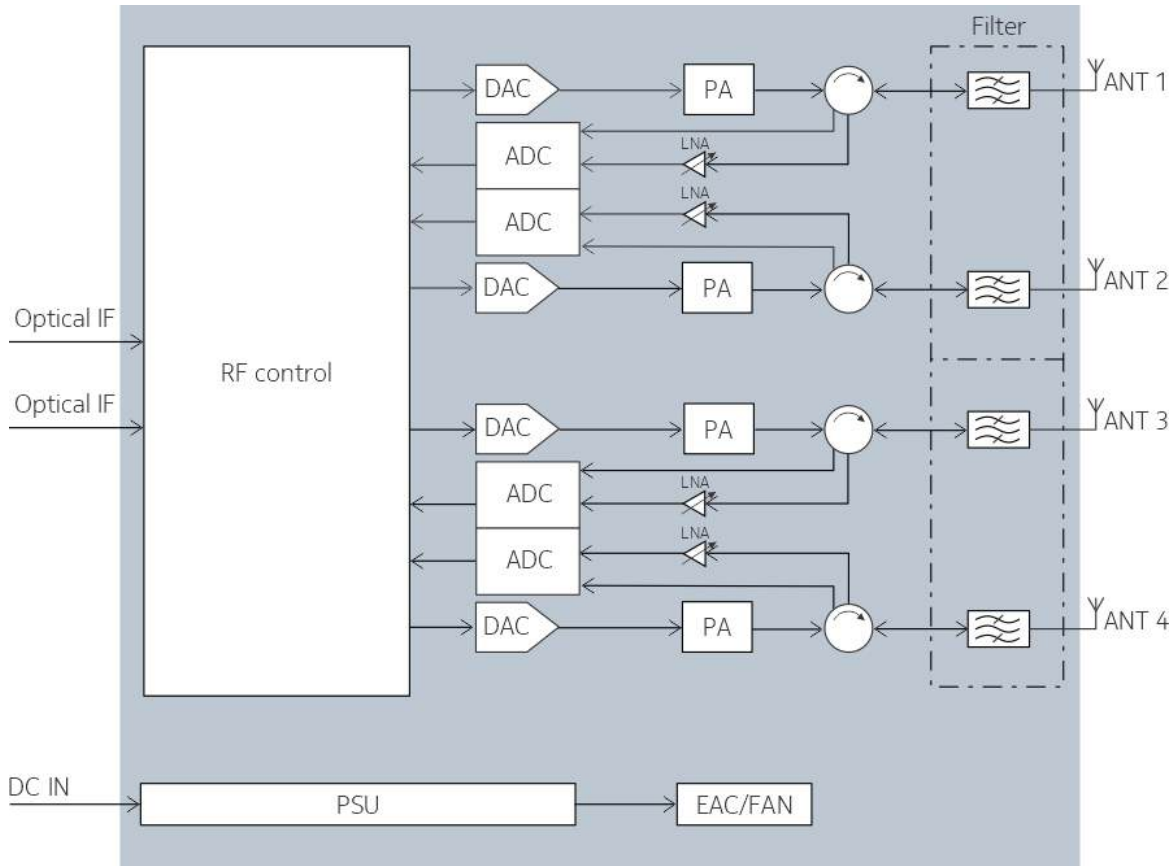
Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	30 W

 Note:

By default, the ALD port is powered when at least one carrier is configured and activated. If no carriers are configured and activated, the ALD port will remain unpowered and ALD devices won't be able to operate.

Functional block diagram

Figure 282: AWHQ3 functional block diagram



Electrical specifications

Table 934: AWHQ3 electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 85 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

! Notice:

Always connect de-energized power cables to the remote radio head (RRH) and turn the power supply on afterward. Connecting energized power cables can damage the RRH.

i Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Recommended power back-off

For AWHQ3, Nokia recommends 1.5 dB power back-off value for 256 QAM. To set the power back-off value, configure the `NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6)` parameter for NR. High back-off values may cause radio outages.

i Note:

You can further optimize the power back-off value by enabling the *CB007657: Low PAPR Optimized Precoding* feature.

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole tilt mounting kit (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A) ¹
- FMWV AirScale micro RRH enclosure (475185A) ²
- APAH AirScale micro AC PSU (475043A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAHO AirScale micro integrated antenna (475920A)

Installation options

- Pole:
 - On the back of the unit
 - Sideways
 - Tilt mounting
- Wall:
 - On the back of the unit
 - Sideways
 - Tilt mounting
- Enclosure²

Notice:

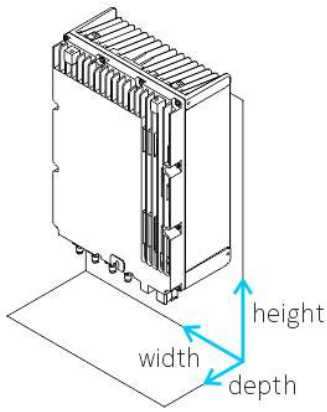
Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

¹AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

²Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

Dimensions and weight

Table 935: AWHQ3 dimensions and weight

Property	Value	Dimensions orientation
Height	345 mm (13.58 in.)	
Width	• Without an antenna: - DC version: 245 mm (9.65 in.) - AC version (with an external AC adapter): 270 mm (10.63 in.) • With an antenna: 270 mm (10.63 in.)	
Depth	• Without an antenna: 130 mm (5.12 in.) • With an antenna: 155 mm (6.10 in.)	
Weight	• Without an antenna: - DC version: ~11.0 kg (24.3 lb) - AC version (with an external AC adapter): ~12.8 kg (28.2 lb) • With an antenna: - DC version: ~12.5 kg (27.6 lb) - AC version (with an external AC adapter) ~14.3 kg (31.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 936: AWHQ3 environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

7.29 AirScale Micro RRH 4T4R n78 40 W (AWHQV)

AWHQV (475784A) is introduced by CB006657 (for NR).

Functional description

Table 937: AWHQV functional specification

Property	Value
Maximum output power	40 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	NR
Duplex mode - supported standard	TDD
Frequency range	3450–3650 MHz
Filter bandwidth	200 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths*	20, 30, 40, 50, 60, 70, 80, 90, 100 MHz
Limitations	Activating the 5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μ DTx usage.

*Bandwidths 40, 70, 80, 90, and 100 MHz have been introduced by the CB009394 feature.

Interfaces

Figure 283: AWHQV interfaces and LED indicators

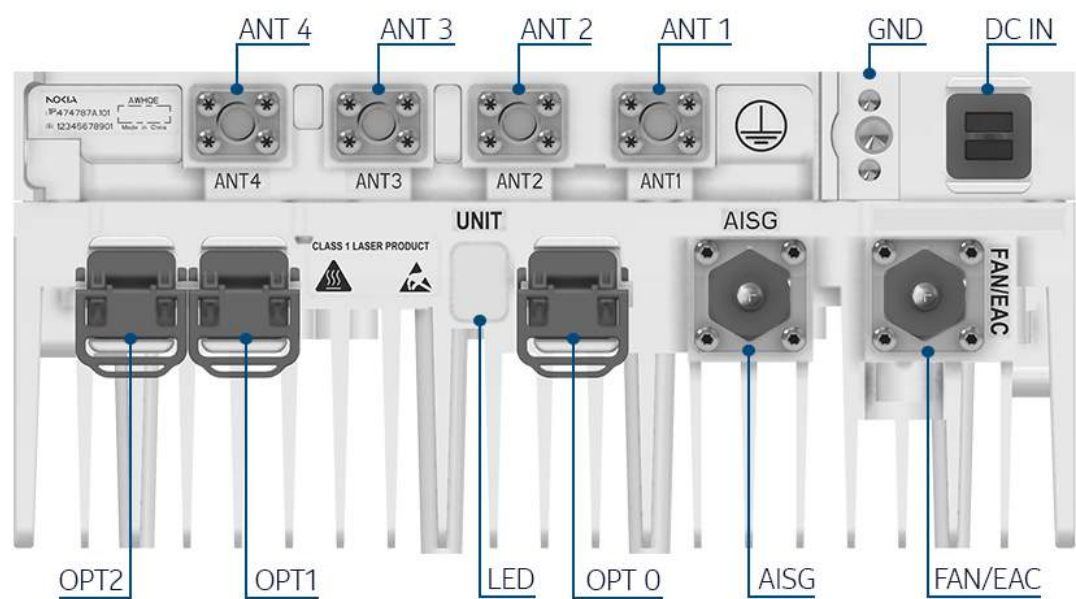


Table 938: AWHQV interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	-
Fan/External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	9.8 Gbps, CPRI
Grounding	GND 	1	M8 or 2 x M5 screw	-
AISG connector	AISG	1	8-pin circular	-

Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

WARNING!

Risk of electric shock

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 939: AWHQV ALD support

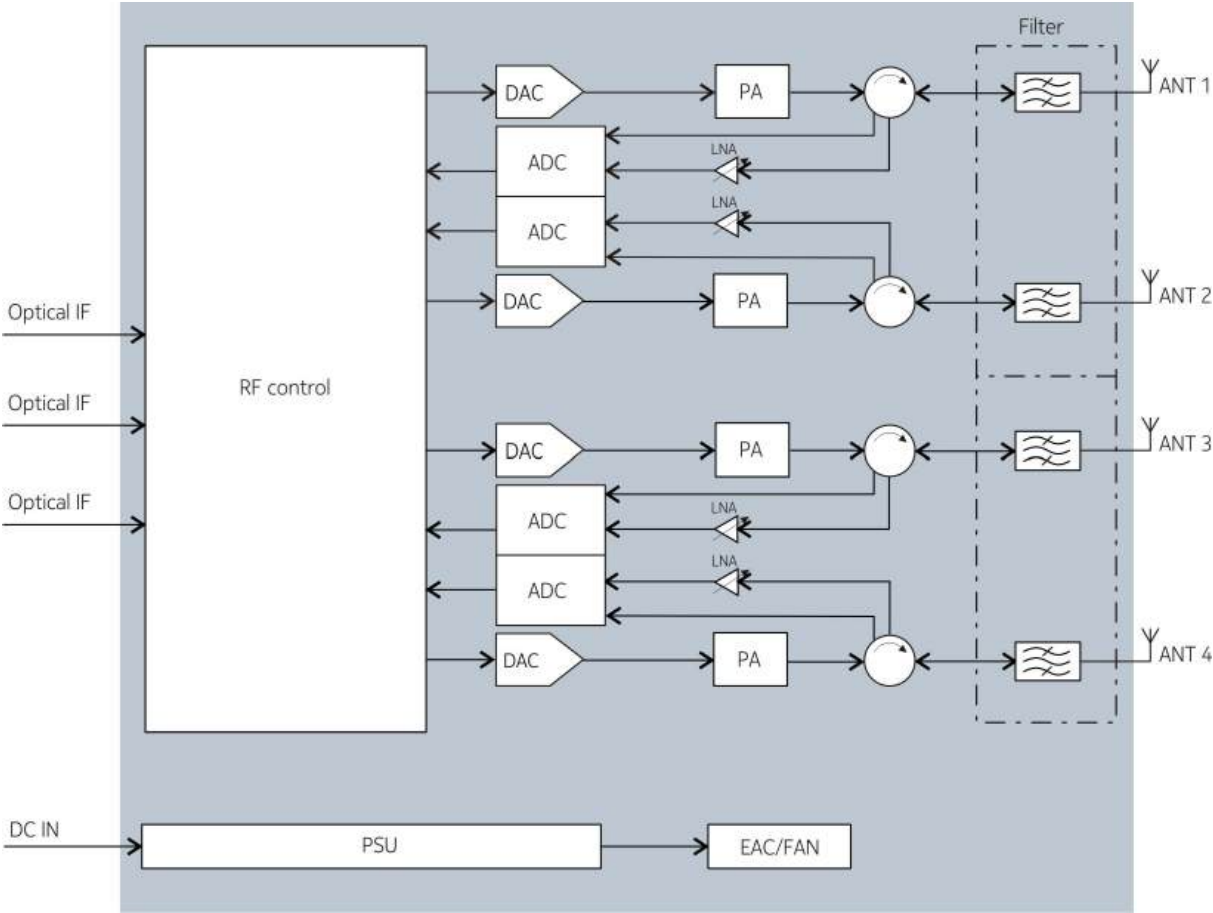
Property	Value
AISG version	2.0
Voltage	24 V
Power per port	30 W

Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 284: AWHQV functional block diagram



Electrical specifications

Table 940: AWHQV electrical specifications

Property	Value
Nominal supply voltage	DC: -48 V
Nominal input voltage range	DC: -40.5 V to -57 V AC: 76 V to 288 V (through an external AC/DC converter)
Extended input voltage range	-36 V to -40.5 V DC -57 V to -60 V DC
Surge protection	Class II 5 kA

 Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above extended limits, the unit might shut down.

 Notice:

Do not connect an energized power cable to the RRH. Always connect de-energized power cables to the RRH and turn the power supply on afterward. Connecting energized power cables can damage the RRH.

Recommended power back-off

Table 941: The recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
NR	NRCELL PDSCH power back-off for 256 QAM (d1Qam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)²⁰⁾
- FMWV AirScale micro RRH enclosure (475185A)

 Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAG AirScale micro AC PSU (474866A)

- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAQA AirScale micro integrated antenna (474520A)

Installation options

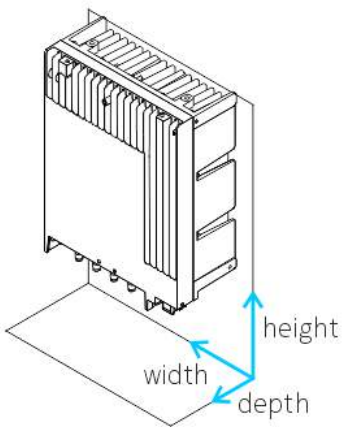
- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure *FMWM* or *FMWV*

Notice:

Always install the RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 942: AWHQV dimensions and weight

Property	Value	Dimensions orientation
Height	295 mm (11.61 in.)	
Width	Core RRH (DC version): 245 mm (9.65 in.) RRH with an AC adapter (AC version): 270 mm (10.63 in.)	
Depth	110 mm (4.33 in.)	
Weight	Core RRH (DC version): 9.0 kg (19.8 lb) RRH with an AC adapter (AC version): 10.2 kg (22.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 943: AWHQV environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

²⁰⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.30 AirScale Micro RRH 4T4R n78 80 W (AWHQ2)

AWHQ2 (476314A) is introduced by CB009463 (for NR).

Functional description

Table 944: AWHQ2 functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	80 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	NR
Operating mode	4T4R full mode 2x 2T2R split mode
Duplex mode	TDD
Frequency range	n78: 3300-3670 MHz
Filter bandwidth	370 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	200 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	10, 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz*
Limitations	Activating the 5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μ DTx usage.

*NR bandwidths 60, 70, 80, and 90 MHz have been added due to the CB009509 feature.

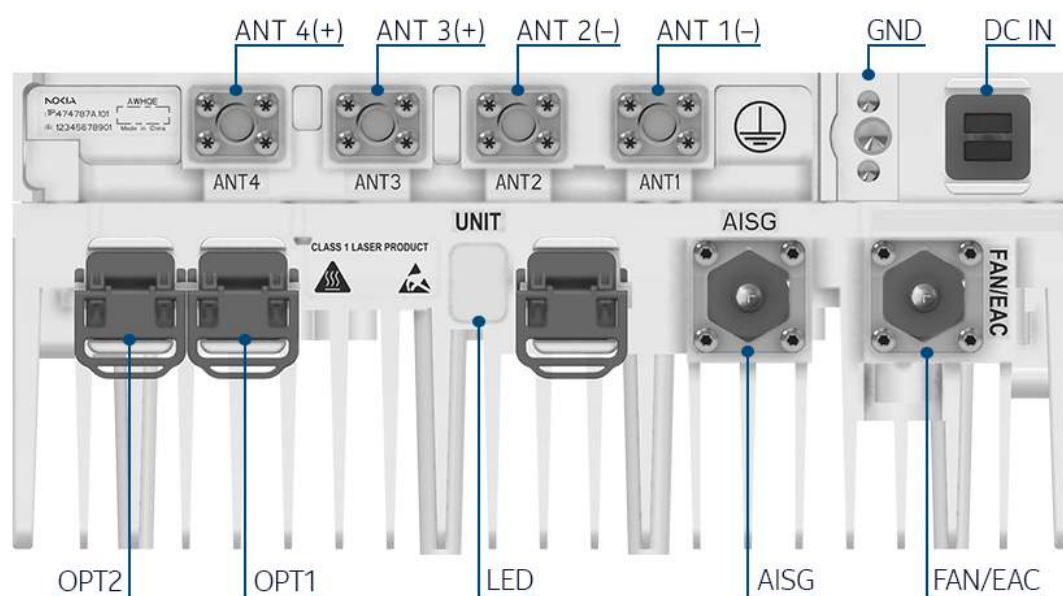
Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 285: AWHQ2 interfaces and LED indicators

**Note:**

Only small form-factor pluggable (SFP) ports OPT1 and OPT2 (marked in the figure above) are operational and supported by software.

Table 945: AWHQ2 interfaces

Interface	Label	Number of interfaces	Connector type	Additional info
Power	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna	ANT	4	NEX 10	–
Fan/external alarm connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical	OPT1, OPT2	2	SFP+/SFP28 (10GE/25GE)	eCPRI: 10 or 25 Gbps OCTIS IP seal
Grounding	GND 	1	1 x M8 or 2 x M5 screw	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	Voltage: 24 V Max power: 30 W



Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).



WARNING!

Risk of electric shock.

Before turning the RF power on, terminate all RF ports with a nominal 50 Ω load (for example, a feeder with an antenna). If you can't do it, do not remove the plastic caps from the unused RF ports. The plastic caps isolate the RF ports from the environment and protect from electric shock in case the RF power is accidentally turned on.

Antenna line device (ALD) support

Table 946: AWHQ2 ALD support

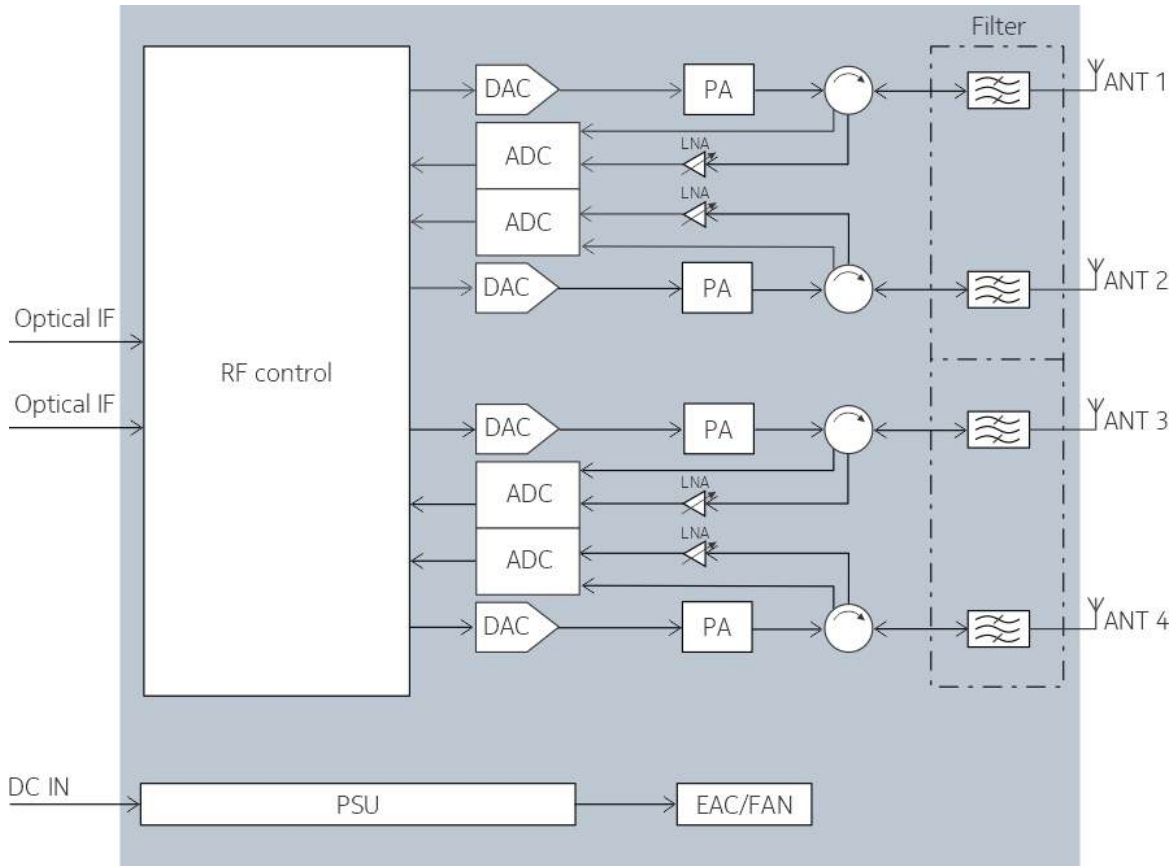
Property	Value
AISG	Version 2.0
Voltage	24 V
Power per port	30 W

 Note:

By default, the ALD port is powered when at least one carrier is configured and activated. If no carriers are configured and activated, the ALD port will remain unpowered and ALD devices won't be able to operate.

Functional block diagram

Figure 286: AWHQ2 functional block diagram



Electrical specifications

Table 947: AWHQ2 electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 85 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended input voltage range, the unit might shut down.

Notice:

Always connect de-energized power cables to the remote radio head (RRH) and turn the power supply on afterward. Connecting energized power cables can damage the RRH.

Recommended power back-off

The recommended value for the NRCELL PDSCH Power Back-off for 256QAM (dlQam256PowerBackoffSub6) parameter:

- 1.5 dB for 3GPP performance requirement
- 3 dB for high-peak UE throughput (4x4 DL MIMO)

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)²¹⁾
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAH AirScale micro AC PSU (475043A)
- OCTIS plug kit AC power (474244A)
- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAHO AirScale micro integrated antenna (475920A)

Installation options

- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure *FMWM* or *FMWV*

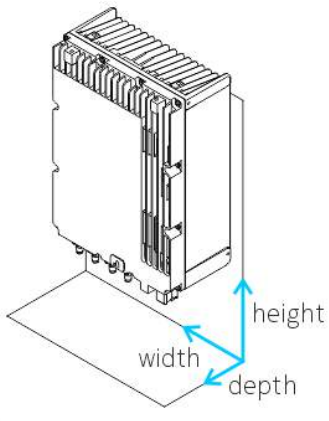


Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side to ensure convection cooling.

Dimensions and weight

Table 948: AWHQ2 dimensions and weight

Property	Value	Dimensions orientation
Height	345 mm (13.58 in.)	
Width	• Without antenna: - DC version: 245 mm (9.65 in.) - AC version (with an external AC adapter): 270 mm (10.63 in.) • With antenna: 270 mm (10.63 in.)	
Depth	• Without antenna: 130 mm (5.12 in.) • With antenna: 155 mm (6.10 in.)	
Weight	• Without antenna: - DC version: ~11.0 kg (24.3 lb) - AC version (with an external AC adapter): ~12.8 kg (28.2 lb) • With antenna: - DC version: ~12.5 kg (27.6 lb) - AC version (with an external AC adapter) ~14.3 kg (31.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 949: AWHQ2 environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	-40°C (-40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

²¹⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

7.31 AirScale Micro RRH 4T4R n79 80 W (AWHTA)

AWHTA (475245A) is introduced by 5GC001833 (for NR).

Functional description

Table 950: AWHTA functional specification

Property	Value
Maximum output power	80 W
Modulation	256 QAM
Number of TXX	4T4R
Outdoor installation	Yes
Beamforming	No
Supported technologies	NR
Duplex mode, supported standard	TDD
Frequency range	4600-4900 MHz
Filter bandwidth	300 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	200 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths *	40, 50, 100 MHz
Limitations	• AWHTA only supports carrier configurations from band 1 (4600-4800 MHz) or band 2 (4700-4900 MHz). • Activating the <i>5GC000431: Cell Switch-Off (Component Carrier) for Energy Efficiency</i> feature may not always reduce power draw for this RU, depending on factors such as the number of carriers and μDTx usage.

*Bandwidths 40 and 50 MHz have been introduced by the CB009394 feature.

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 287: AWHTA interfaces and LED indicators

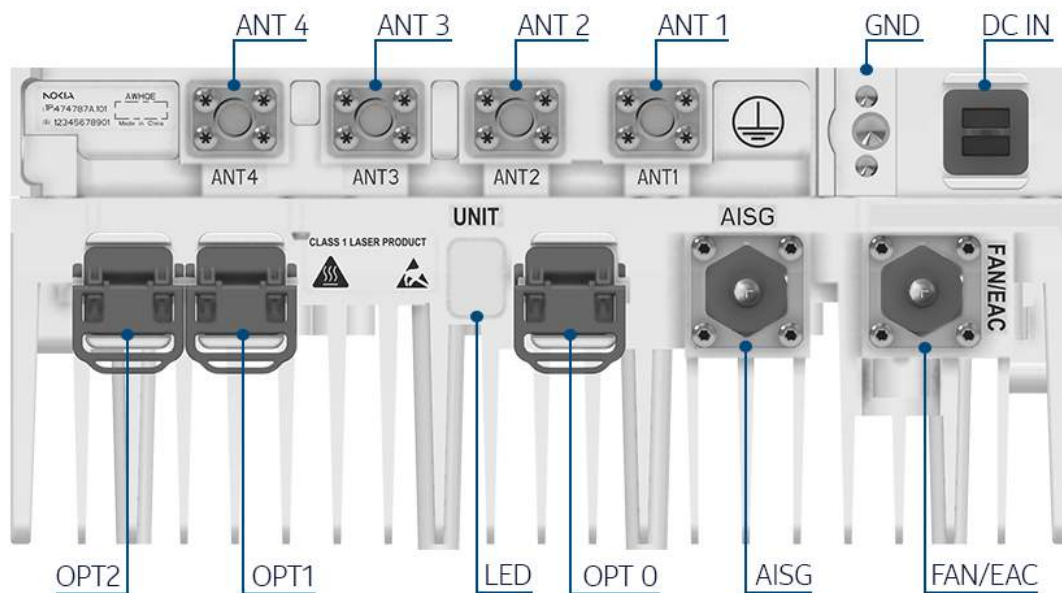


Table 951: AWHTA interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	DC OCTIS Plug Kit	Hot insert not supported
Antenna connector	ANT	4	NEX 10	–
Fan/External Alarm Connection	FAN/EAC	1	CIRC 8F IP67 Flange	Two external alarms supported
Optical interface	OPT	3	OCTIS Plug Kit SFP/SFP+	9.8 Gbps, CPRI
Grounding	GND 	1	M8 or 2 x M5 screw	–
Antenna Interface Standard Groups	AISG	1	8-pin circular	–

 Note:

To check the meaning of the LED indicators, see [AirScale RU LED indicators](#).

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Antenna line device (ALD) support

Table 952: AWHTA ALD support

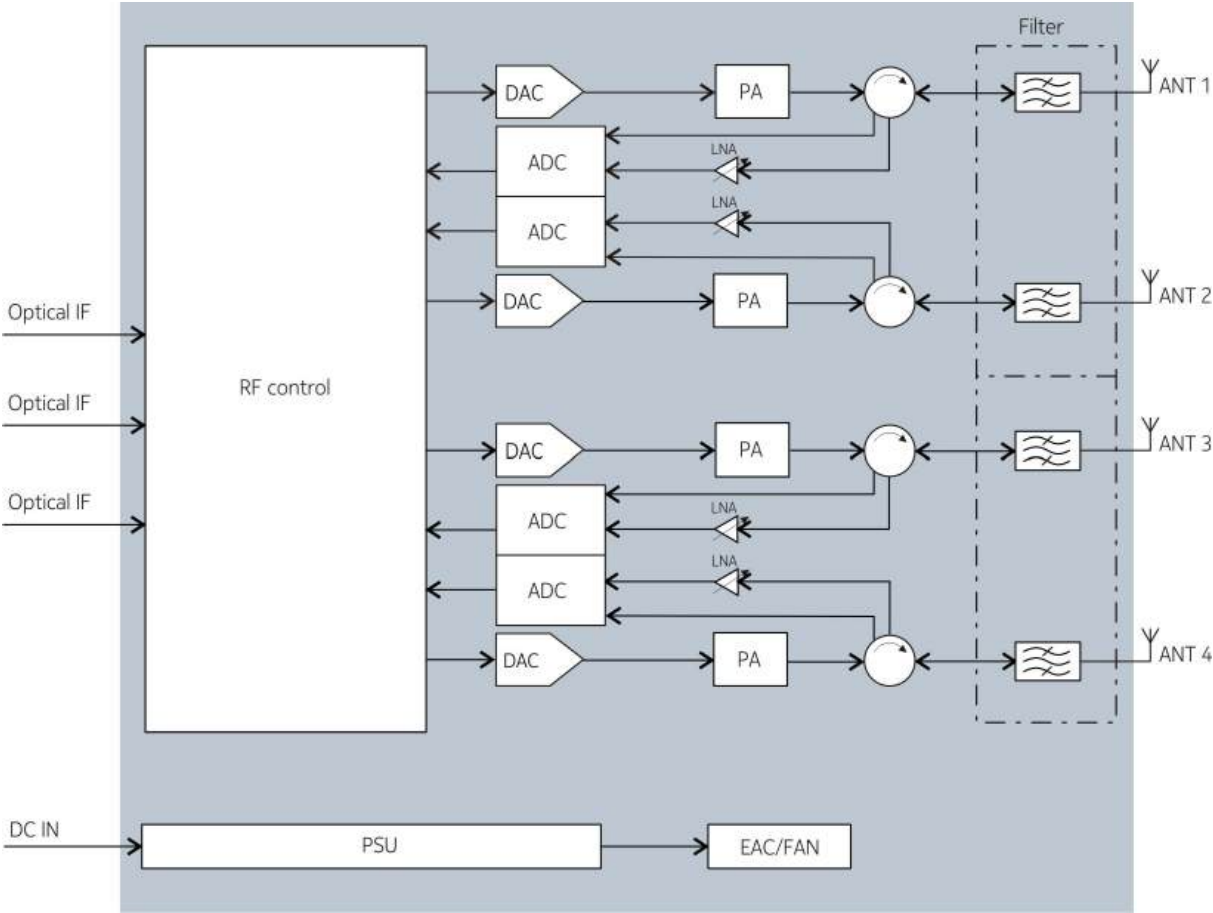
Property	Value
ALSG version	2.0
Voltage	24 V
Power per port	30 W

 Note:

AirScale radio units support masthead amplifiers (MHAs) with 12 dB gain only.

Functional block diagram

Figure 288: AWHTA functional block diagram



Electrical specifications

Table 953: AWHTA electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC
Nominal input voltage range	-40.5 V DC to -57.0 V DC 85 V AC to 288 V AC (through an external AC/DC converter)
Extended input voltage range	-36.0 V DC to -40.5 V DC -57.0 V DC to -60.0 V DC
Surge protection	Class II 5 kA

Note:

The minimum start-up voltage is –40.5 V DC. If the input voltage is below or above the extended limits, the unit might shut down.

Notice:

Always connect de-energized power cables to the RRH and turn the power supply on afterward. Connecting energized power cables can damage the RRH.

Recommended power back-off

Table 954: The recommended power back-off

RAT	Feature/Parameter	Single carrier [dB]	Multi carrier (non-contiguous) [dB]
NR	NRCELL_PDSCH power back-off for 256 QAM (dlQam256PowerBackoffSub6)	1.5	1.5

Related optional items

- AMBA AirScale micro bracket assembly kit (474182A)
- FMWG AirScale micro wall/pole mount kit for single radio (474013A)
- AMJK piggyback mounting kit (476408A)
- AMJL piggyback bracket for ASOF (476439A)²²⁾
- FMWV AirScale micro RRH enclosure (475185A)

Note:

Whether installation in FMWV is supported depends on the intended RRH configuration in the enclosure. For more information, contact your Nokia customer team.

- APAH AirScale micro AC PSU (475043A)
- OCTIS plug kit AC power (474244A)

- OCTIS plug kit DC power (474184A)
- OCTIS plug kit SFP 2 (475756A)
- AAHO AirScale micro integrated antenna (475920A)

Installation options

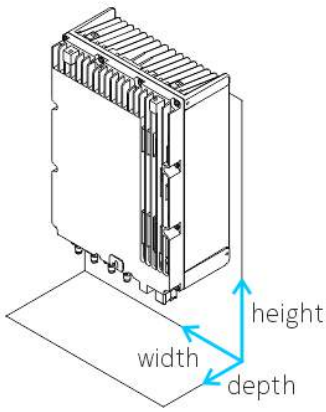
- *Pole:*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- *Wall*
 - *On the back of the unit*
 - *Sideways*
 - *Tilt mounting*
- Enclosure *FMWM* or *FMWV*

Notice:

Always install this RRH in a vertical orientation with connectors on the bottom side, to ensure convection cooling.

Dimensions and weight

Table 955: AWHTA dimensions and weight

Property	Value	Dimensions orientation
Height	345 mm (13.58 in.)	
Width	• Without antenna: - DC version: 245 mm (9.65 in.) - AC version (with an external AC adapter): 270 mm (10.63 in.) • With antenna: 270 mm (10.63 in.)	
Depth	• Without antenna: 130 mm (5.12 in.) • With antenna: 155 mm (6.10 in.)	
Weight	• Without antenna: - DC version: ~11.0 kg (24.3 lb) - AC version (with an external AC adapter): ~12.8 kg (28.2 lb) • With antenna: - DC version: ~12.5 kg (27.6 lb) - AC version (with an external AC adapter) ~14.3 kg (31.5 lb)	

Environmental specifications

Note:

Ambient conditions, such as solar radiation and natural airflow, as well as the configuration and location of the installation, might affect the maximum power output. When operating with a constant high traffic load at high temperatures, you might have to temporarily reduce power or limit the carrier traffic load to protect the unit from overheating. If the ambient temperature regularly reaches over 45°C (113°F) or TX output power exceeds 75% of the maximum TX output power, Nokia recommends using an optional fan.

Table 956: AWHTA environmental specifications

Property	Value
Maximum operational temperature	55°C (131°F)
Minimum operational temperature	−40°C (−40°F)
Cooling method	Natural convection (fanless) or optional fan (only in shroud installations)
IP rating	IP65

²²⁾AMJL compatibility depends on your configuration. For more information, see the *AMJL piggyback bracket compatibility list* section in *Installing and Cabling Nokia AirScale Core Unit ASOF*.

8. AirScale pico RRHs descriptions

8.1 AirScale Indoor Pico RRH 4T4R B38/n38 1 W (AWPHA and AWP HB)

AWPHA (476363A) and AWP HB (476364A) are introduced by *CB010204* (for LTE and NR).

Functional description

Table 957: AWPHA and AWPBH functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	1 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	No
Beamforming	No
Supported technologies	LTE, NR
Operating mode	4T4R full mode 2x 2T2R split mode
RF sharing/concurrent mode	LTE-NR
Duplex mode	TDD
Frequency range	B38 or n38: 2570-2620 MHz
Filter bandwidth	50 MHz
Instantaneous bandwidth (iBW)	50 MHz
Occupied bandwidth (oBW)	50 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	LTE: 10, 15, 20 MHz NR: 20, 30, 40 MHz
Limitations	AWPHA and AWPBH: • support only direct connection with a capacity plug-in unit. • don't support ASIR_* and ASIR-sHUB configurations. • support LTE-NR concurrent mode with shared eCPRI fronthaul on the same ABIO or ASOE.

*ASiR - AirScale Indoor Radio

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 289: AWPHA and AWPHB interfaces

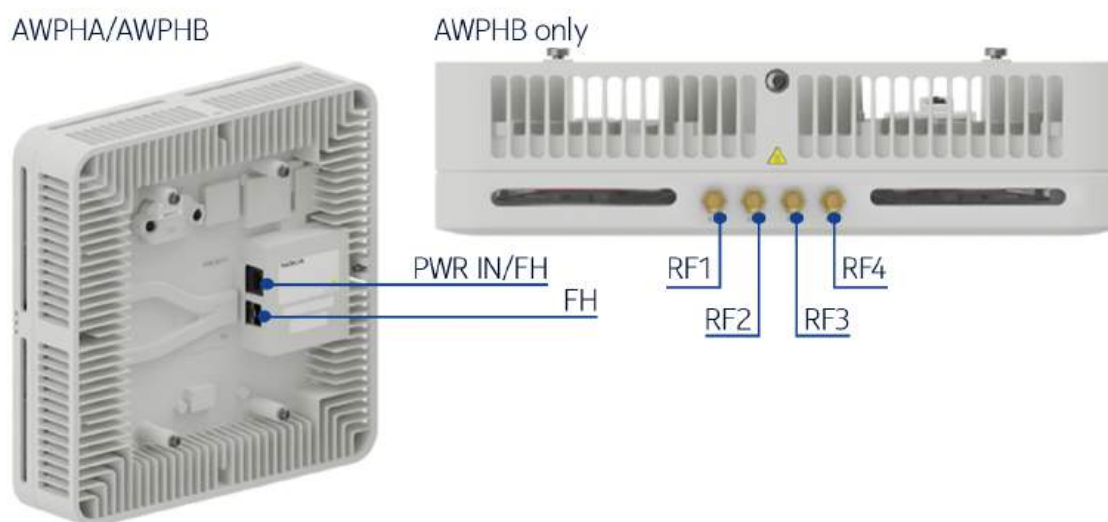


Table 958: AWPHA and AWPHB interfaces

Interface	Label on hardware	Number of interfaces	Connector type	Additional information
Ethernet connector	PWR IN/FH	1	RJ45	PoE input
Antenna connector	RF	4	SMA female	Only AWPHB (integrated antenna in AWPHA)
Optical	FH	1	SFP28	eCPRI: 10 or 25 Gbps, Nokia IP seal

- eCPRI – Enhanced Common Public Radio Interface
- PoE – Power over Ethernet
- SFP – small form-factor pluggable

 WARNING!

The intra-building port (RJ45) is suitable for connection to intra-building or unexposed wiring or cabling only. Do not metalically connect this port to interfaces that connect to an outside plant (OSP) or its wiring. These interfaces are designed as intra-building only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from exposed OSP cabling. The addition of primary protectors isn't sufficient protection to connect these interfaces metalically to OSP wiring.

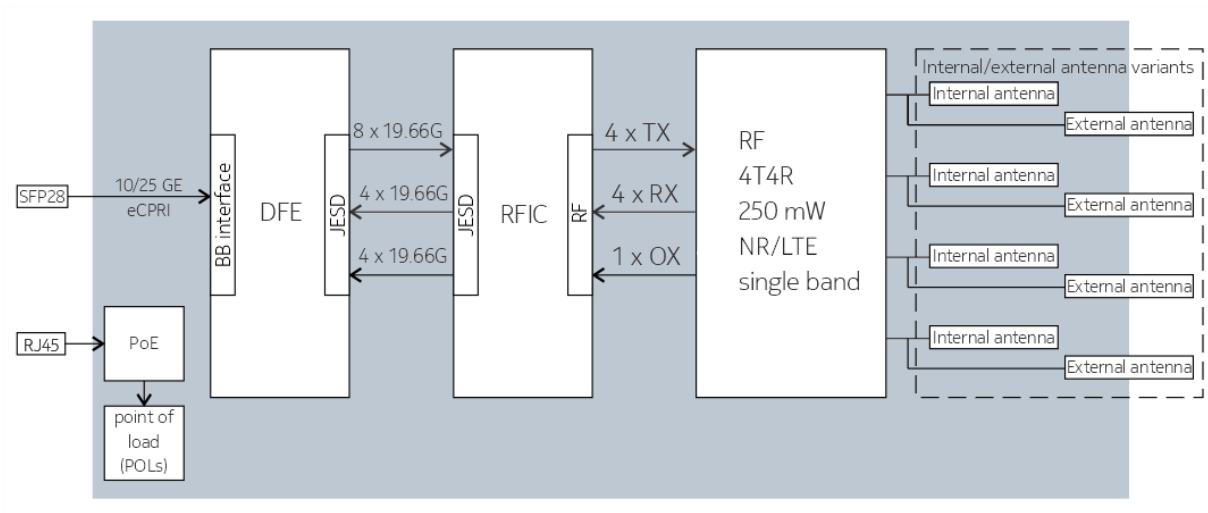
Antenna line device (ALD) support

 Note:

AWPHA and AWPHB don't support ALD systems.

Functional block diagram

Figure 290: AWPHA and AWPBH functional block diagram



Electrical specifications

Table 959: AWPHA and AWPBH electrical specifications

Property	Value
Input voltage range	43–57 V DC
Power input standard	PoE++ (IEEE 802.3bt compliant interface) Type 4 powered device (PD)
Power input options	• DC input from an external AC adapter • DC input from a hybrid fiber cable • PoE input from an Ethernet cable

Note:

The AC-powered PoE supply complies with the GR-1089-CORE Port Type 7 lightning criteria for primary surge protection when it's installed with an external surge protection device.

Related optional items

- FPW35 ASiR power adapter EU (475896A)
- APHI 1-Port Indoor PoE++ (GC) (476549A)
- APHT 1-Port Indoor PoE++ (GC) (476278A)

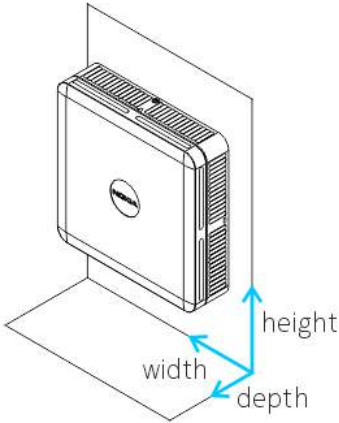
- APHU 6-Port Indoor PoE++ (GC) (476279A)
- APHV 12-Port Indoor PoE++ (GC) (476280A)

Installation options

- Wall
- Ceiling

Dimensions and weight

Table 960: AWPHA and AWPHB dimensions and weight

Property	Value	Dimensions orientation
Height	250 mm (9.84 in.)	
Width	250 mm (9.84 in.)	
Depth	63.2 mm (2.49 in.)	
Weight	3.1 kg (6.8 lb)	

Environmental specifications

Note:

Use AWPHA and AWPHB only in a controlled environment.

Table 961: AWPNA and AWPNA environmental specifications

Property	Value
Maximum operational temperature	40°C (104°F)
Minimum operational temperature	-20°C (-4°F)
Cooling method	Natural convection (fanless)
IP rating	IP20

8.2 AirScale Indoor Pico RRH 4T4R B40/n40 1 W (AWPNA and AWPNA)

AWPNA (476361A) and AWPNA (476362A) are introduced by CB010203 (for LTE and NR).

Functional description

Table 962: AWPNA and AWPNB functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	1 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	No
Beamforming	No
Supported technologies	LTE, NR
Operating mode	4T4R full mode 2x 2T2R split mode
RF sharing/concurrent mode	LTE-NR
Duplex mode	TDD
Frequency range	B40 or n40: 2300-2400 MHz
Filter bandwidth	100 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	LTE: 10, 15, 20 MHz NR: 20, 40, 50, 60, 80, 100 MHz
Limitations	AWPNA and AWPNB: • support only direct connection with a capacity plug-in unit. • don't support ASIR_* and ASiR-sHUB configurations. • support LTE-NR concurrent mode with shared eCPRI fronthaul on the same ABIO or ASOE.

*ASiR - AirScale Indoor Radio

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 291: AWPNA and AWPNB interfaces

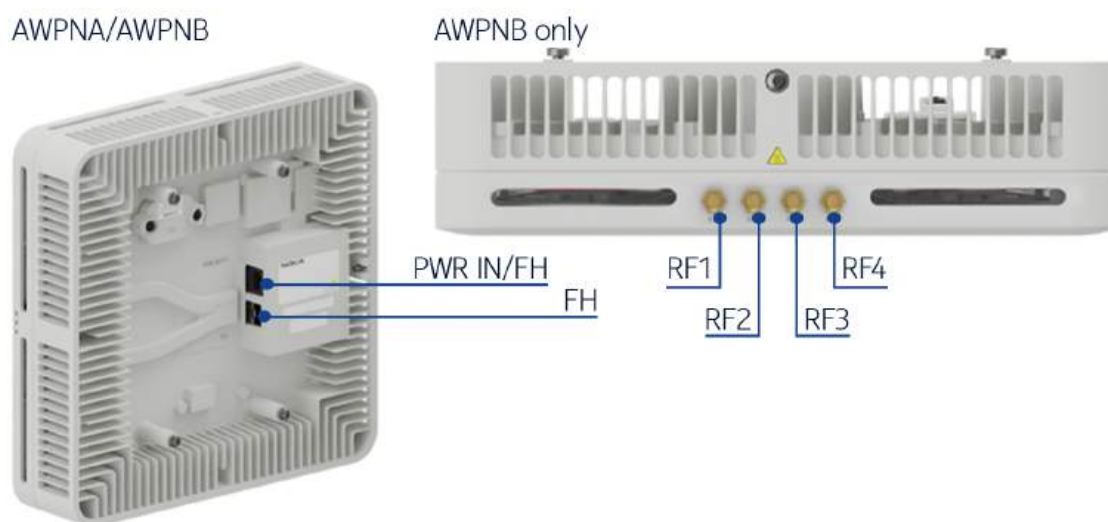


Table 963: AWPNA and AWPNB interfaces

Interface	Label on hardware	Number of interfaces	Connector type	Additional information
Ethernet connector	PWR IN/FH	1	RJ45	PoE input
Antenna connector	RF	4	SMA female	Only AWPNB (integrated antenna in AWPNA)
Optical	FH	1	SFP28	eCPRI: 10 or 25 Gbps, Nokia IP seal

- eCPRI – Enhanced Common Public Radio Interface
- PoE – Power over Ethernet
- SFP – small form-factor pluggable



WARNING!

The intra-building port (RJ45) is suitable for connection to intra-building or unexposed wiring or cabling only. Do not metalically connect this port to interfaces that connect to an outside plant (OSP) or its wiring. These interfaces are designed as intra-building only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from exposed OSP cabling. The addition of primary protectors isn't sufficient protection to connect these interfaces metalically to OSP wiring.

Antenna line device (ALD) support

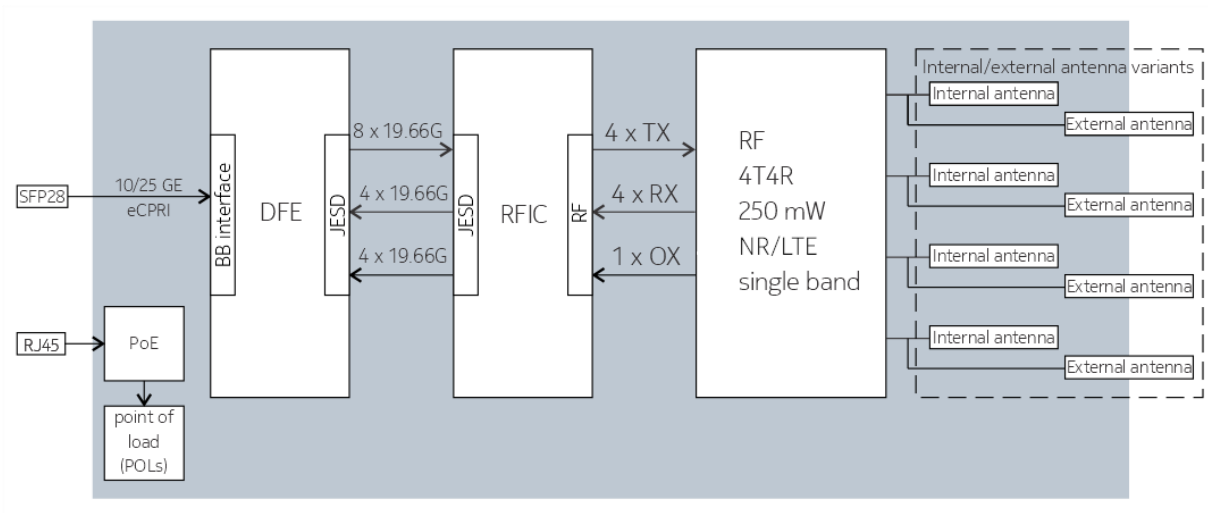


Note:

AWPNA and AWPNB don't support ALD systems.

Functional block diagram

Figure 292: AWPNA and AWPNB functional block diagram



Electrical specifications

Table 964: AWPNA and AWPNB electrical specifications

Property	Value
Input voltage range	43–57 V DC
Power input standard	PoE++ (IEEE 802.3bt compliant interface) Type 4 powered device (PD)
Power input options	• DC input from an external AC adapter • DC input from a hybrid fiber cable • PoE input from an Ethernet cable

Note:

The AC-powered PoE supply complies with the GR-1089-CORE Port Type 7 lightning criteria for primary surge protection when it's installed with an external surge protection device.

Related optional items

- FPW35 ASiR power adapter EU (475896A)
- APHI 1-Port Indoor PoE++ (GC) (476549A)
- APHT 1-Port Indoor PoE++ (GC) (476278A)

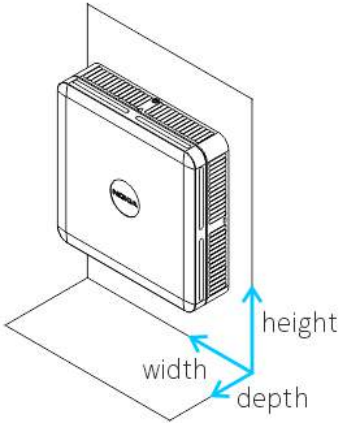
- APHU 6-Port Indoor PoE++ (GC) (476279A)
- APHV 12-Port Indoor PoE++ (GC) (476280A)

Installation options

- Wall
- Ceiling

Dimensions and weight

Table 965: AWPNA and AWPNB dimensions and weight

Property	Value	Dimensions orientation
Height	250 mm (9.84 in.)	
Width	250 mm (9.84 in.)	
Depth	63.2 mm (2.49 in.)	
Weight	3.1 kg (6.8 lb)	

Environmental specifications

Note:

Use AWPNA and AWPNB only in a controlled environment.

Table 966: AWPNA and AWPNB environmental specifications

Property	Value
Maximum operational temperature	40°C (104°F)
Minimum operational temperature	-20°C (-4°F)
Cooling method	Natural convection (fanless)
IP rating	IP20

8.3 AirScale Indoor Pico RRH 4T4R B48/n48 1 W eCPRI (AWPQY and AWPQZ)

AWPQY (476099A) and AWPQZ (476101A) are introduced by CB008712 (for LTE and NR) and CB009323 (for LTE-NR concurrent mode).

Functional description

Table 967: AWPQY and AWPQZ functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	1 W
Modulation	256 QAM (in DL and UL)
Number of TXRX	4T4R
Outdoor installation	No
Beamforming	No
Supported technologies	LTE, NR
Operating mode	4T4R full mode 2x 2T2R split mode
RF sharing/concurrent mode	LTE-NR
Duplex mode - supported standard	TDD
Frequency range	B48 or n48: 3550–3700 MHz
Filter bandwidth	150 MHz
Instantaneous bandwidth (iBW)	150 MHz
Occupied bandwidth (oBW)	150 MHz
Number of carriers per pipe	• LTE or NR: up to 4 • LTE + NR: up to 7 (4 LTE and 3 NR)
Supported bandwidths	n48: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 MHz B48: 10, 20 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 293: AWPQY and AWPQZ interfaces

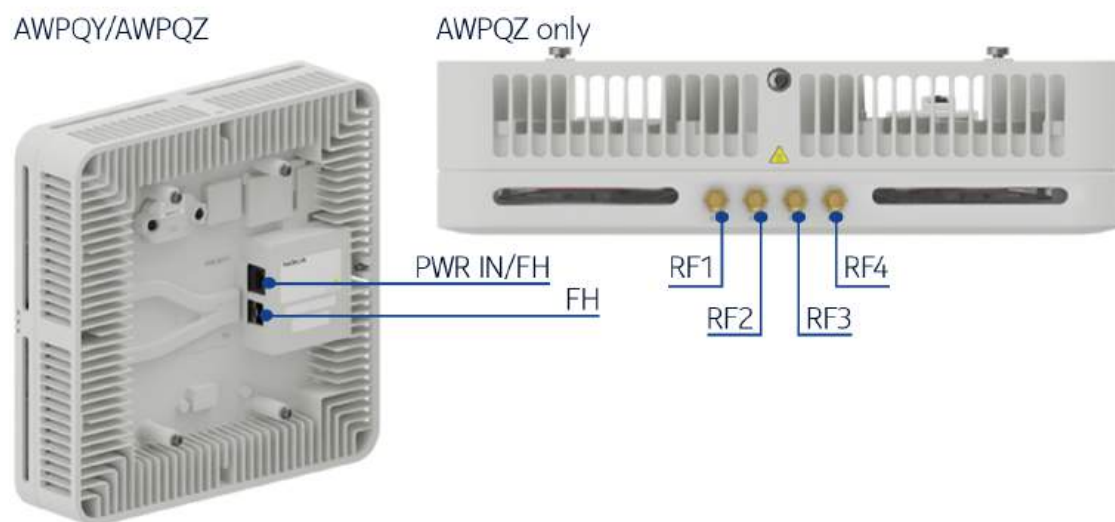


Table 968: AWPQY and AWPQZ interfaces

Interface	Label on hardware	Number of interfaces	Connector type	Additional information
Ethernet connector	PWR IN/FH	1	RJ45	PoE input
Antenna connector	RF	4	SMA female	Only AWPQZ (integrated antenna in AWPQY)
Optical	FH	1	SFP28	eCPRI: 10 or 25 Gbps, Nokia IP seal

- eCPRI – Enhanced Common Public Radio Interface
- PoE – Power over Ethernet
- SFP – small form-factor pluggable

 WARNING!

The intra-building port (RJ45) is suitable for connection to intra-building or unexposed wiring or cabling only. Do not metalically connect this port to interfaces that connect to an outside plant (OSP) or its wiring. These interfaces are designed as intra-building only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from exposed OSP cabling. The addition of primary protectors isn't sufficient protection to connect these interfaces metalically to OSP wiring.

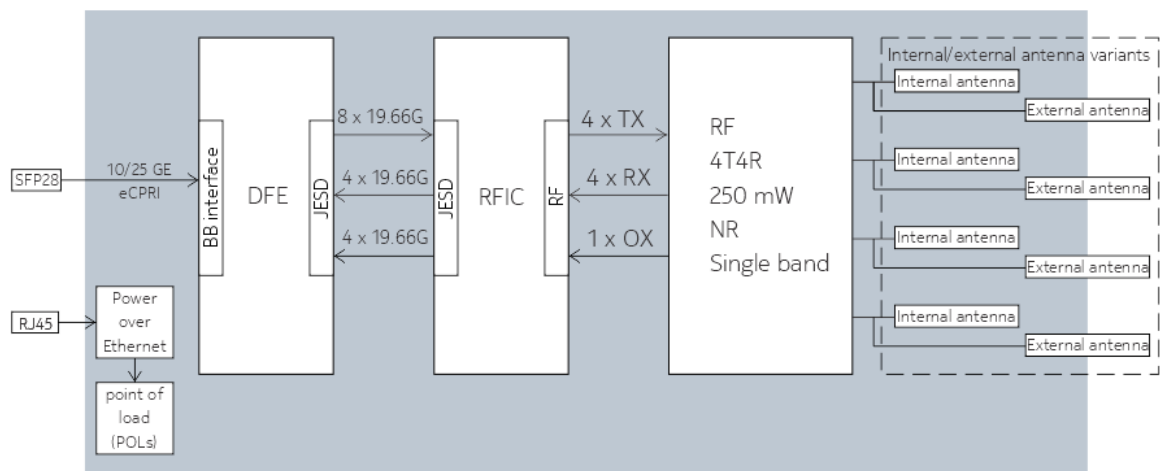
Antenna line device (ALD) support

 Note:

AWPQY and AWPQZ don't support ALD systems.

Functional block diagram

Figure 294: AWPQY and AWPQZ functional block diagram



Electrical specifications

Table 969: AWPQY and AWPQZ electrical specifications

Property	Value
Input voltage range	43–57 V DC
Power input standard	PoE++ (IEEE 802.3bt compliant interface) Type 4 powered device (PD)
Power input options	• DC input from an external AC adapter • DC input from a hybrid fiber cable • PoE input from an Ethernet cable

Note:

The AC-powered PoE supply complies with the GR-1089-CORE Port Type 7 lightning criteria for primary surge protection when it's installed with an external surge protection device.

Related optional items

- FPW36 ASiR power adapter US (475897A)
- APHT 1-port indoor PoE++ injector (476278A)
- APHU 6-port indoor PoE++ injector (476279A)

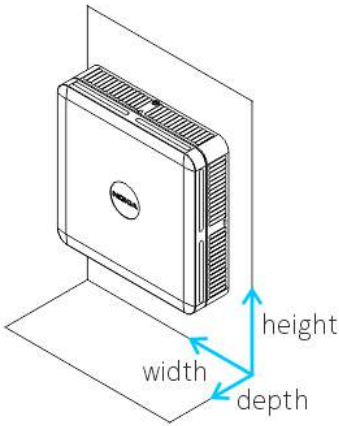
- APHV 12-port indoor PoE++ injector (476280A)

Installation options

- Wall
- Ceiling

Dimensions and weight

Table 970: AWPQY and AWPQZ dimensions and weight

Property	Value	Dimensions orientation
Height	250 mm (9.84 in.)	
Width	250 mm (9.84 in.)	
Depth	63.2 mm (2.49 in.)	
Weight	3.1 kg (6.8 lb)	

Environmental specifications

Note:

Use AWPQY and AWPQZ only in a controlled environment.

Table 971: AWPQY and AWPQZ environmental specifications

Property	Value
Maximum operational temperature	40°C (104°F)
Minimum operational temperature	-20°C (-4°F)
Cooling method	Natural convection (fanless)
IP rating	IP20

8.4 AirScale Indoor Pico RRH 4T4R n77 1 W eCPRI (AWHQW and AWHQX)

AWHQW (475924A) and AWHQX (475927A) are introduced by CB007758.

Functional description

Table 972: AWHQW and AWHQX functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	1 W
Modulation	Up to 256 QAM (in DL and UL)
Number of TXRX	4T4R
Outdoor installation	No
Beamforming	No
Supported technology	NR
Duplex mode – supported standard	TDD
Frequency range	n77: 3800–4200 MHz
Filter bandwidth	400 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	200 MHz
Number of carriers per pipe	2
Supported bandwidths	20, 30, 40, 50, 60, 80, 100 MHz

 Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/5G NR Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 295: AWHQW and AWHQX interfaces

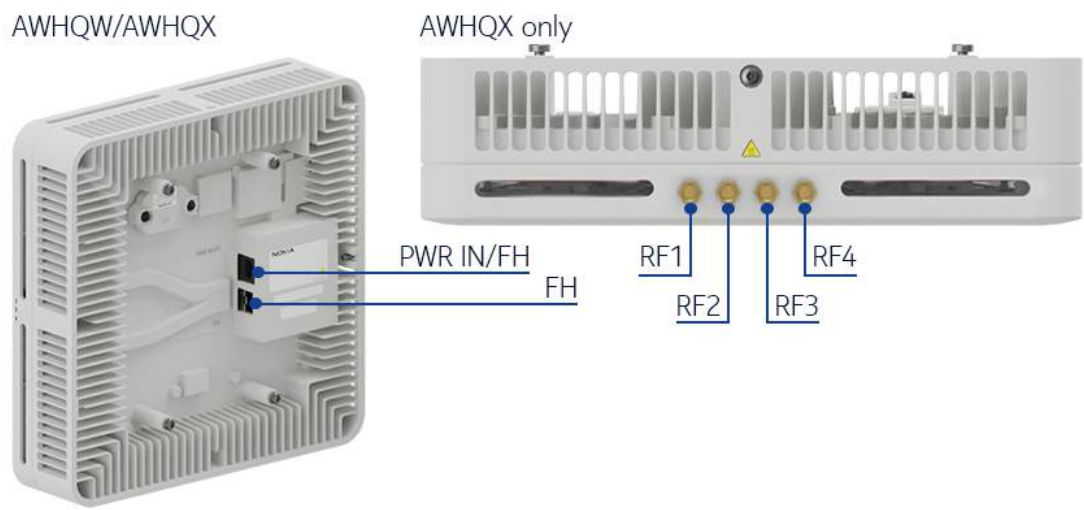


Table 973: AWHQW and AWHQX interfaces

Interface	Label on hardware	Number of interfaces	Connector type	Additional information
Ethernet connector	PWR IN/FH	1	RJ45	PoE input
Antenna connector	RF	4	SMA female	Only AWHQX (integrated antenna in AWHQW)
Optical	FH	1	SFP28	eCPRI: 10 or 25 Gbps, Nokia IP seal

- eCPRI – Enhanced Common Public Radio Interface
- PoE – Power over Ethernet
- SFP – small form-factor pluggable

WARNING!

The intra-building port (RJ45) is suitable for connection to intra-building or unexposed wiring or cabling only. Do not metalically connect this port to interfaces that connect to an outside plant (OSP) or its wiring. These interfaces are designed as intra-building only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from exposed OSP cabling. The addition of primary protectors isn't sufficient protection to connect these interfaces metalically to OSP wiring.

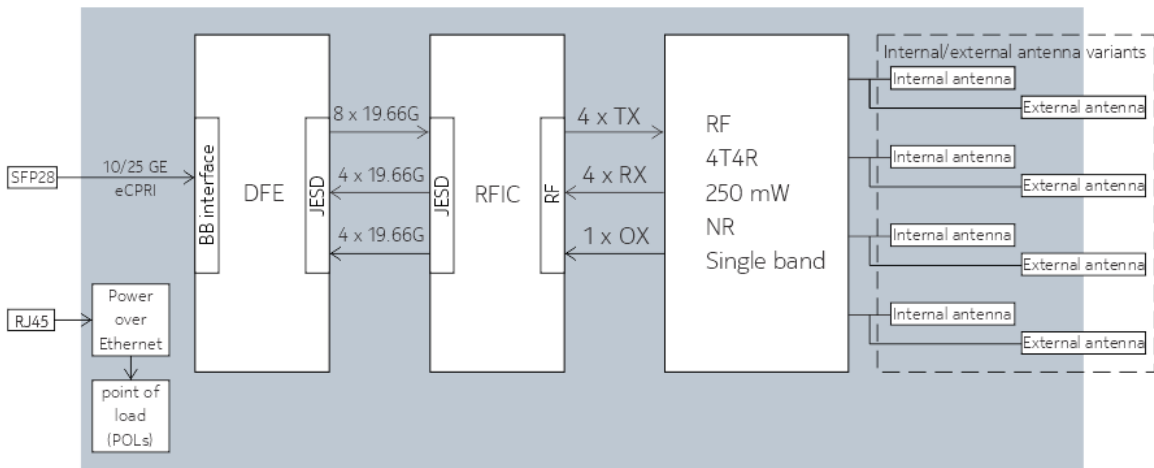
Antenna line device (ALD) support

Note:

AWHQW and AWHQX don't support ALD systems.

Functional block diagram

Figure 296: AWHQW and AWHQX functional block diagram



Electrical specifications

Table 974: AWHQW and AWHQX electrical specifications

Property	Value
Input voltage range	43-57 V DC
Power input standard	PoE++ (IEEE 802.3bt compliant interface) Type 4 powered device (PD)

 Note:

The AC-powered PoE supply complies with the GR-1089-CORE Port Type 7 lightning criteria for primary surge protection when it's installed with an external surge protection device.

Related optional items

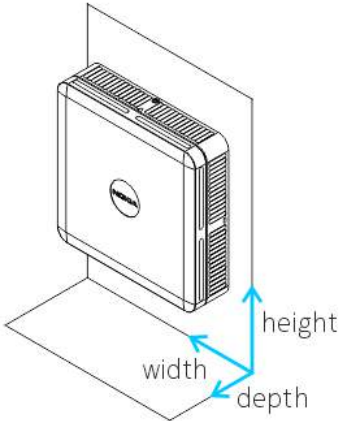
- FPW35 ASiR power adapter EU (475896A)
- FPW36 ASiR power adapter US (475897A)
- FPW37 ASiR power adapter UK (475898A)
- APHT 1-port indoor PoE++ injector (476278A)
- APHU 6-port indoor PoE++ injector (476279A)
- APHV 12-port indoor PoE++ injector (476280A)

Installation options

- *Wall*
- *Ceiling*

Dimensions and weight

Table 975: AWHQW and AWHQX dimensions and weight

Property	Value	Dimensions orientation
Height	250 mm (9.84 in.)	
Width	250 mm (9.84 in.)	
Depth	63.2 mm (2.49 in.)	
Weight	3.1 kg (6.8 lb)	

Environmental specifications

Note:

Use AWHQW and AWHQX only in a controlled environment.

Table 976: AWHQW and AWHQX environmental specifications

Property	Value
Maximum operational temperature	40°C (104°F)
Minimum operational temperature	-20°C (-4°F)
Cooling method	Natural convection (fanless)
IP rating	IP20

8.5 AirScale Indoor Pico RRH 4T4R n79 1 W eCPRI (AWPTC and AWPTD)

AWPTC (476205A) and AWPTD (476206A) are introduced by CB008974 (for NR).

Functional description

Table 977: AWPTC and AWPTD functional specification

Property	Value
Commercial name	Shikra 4
Maximum output power	1 W
Modulation	256 QAM
Number of TXRX	4T4R
Outdoor installation	No
Beamforming	No
Supported technologies	NR
Duplex mode - supported standard	TDD
Frequency range	n79: 4600-5000 MHz
Filter bandwidth	400 MHz
Instantaneous bandwidth (iBW)	200 MHz
Occupied bandwidth (oBW)	200 MHz
Number of carriers per pipe	Up to 2
Supported bandwidths	40, 50, 100 MHz

Note:

For more information on output power, supported carriers and bandwidths, and supported configurations, go to *Reference Documentation/SRAN Supported Configurations/SBTS and gNB Supported Configurations* and see:

- *SBTS Supported Configurations*
- *SBTS Supported Configurations - Rules and Examples*

Interfaces

Figure 297: AWPTC and AWPTD interfaces

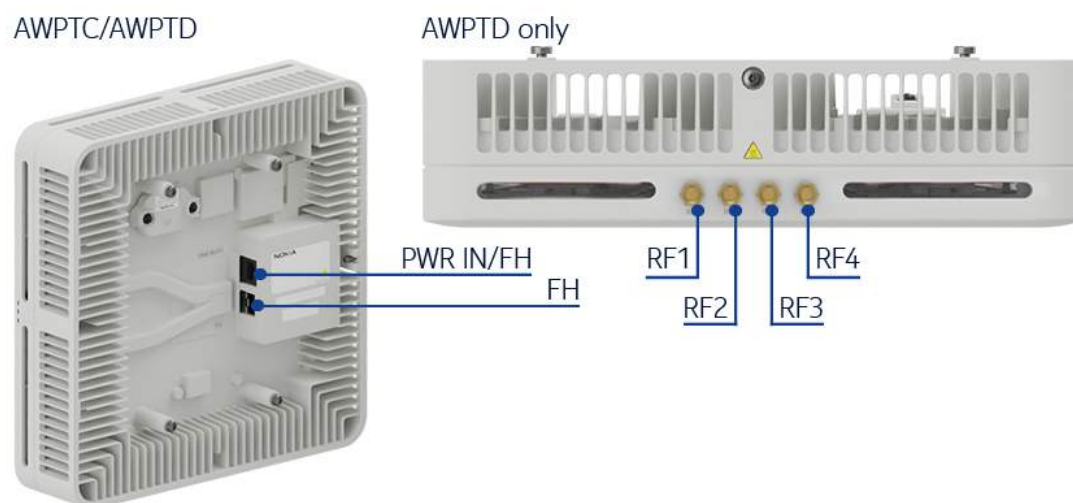


Table 978: AWPTC and AWPTD interfaces

Interface	Label on hardware	Number of interfaces	Connector type	Additional information
Ethernet connector	PWR IN/FH	1	RJ45	PoE input
Antenna connector	RF	4	SMA female	Only AWPTD (integrated antenna in AWPTC)
Optical	FH	1	SFP28	eCPRI: 10 or 25 Gbps, Nokia IP seal

- eCPRI – Enhanced Common Public Radio Interface
- PoE – Power over Ethernet

 WARNING!

The intra-building port (RJ45) is suitable for connection to intra-building or unexposed wiring or cabling only. Do not metalically connect this port to interfaces that connect to an outside plant (OSP) or its wiring. These interfaces are designed as intra-building only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from exposed OSP cabling. The addition of primary protectors isn't sufficient protection to connect these interfaces metalically to OSP wiring.

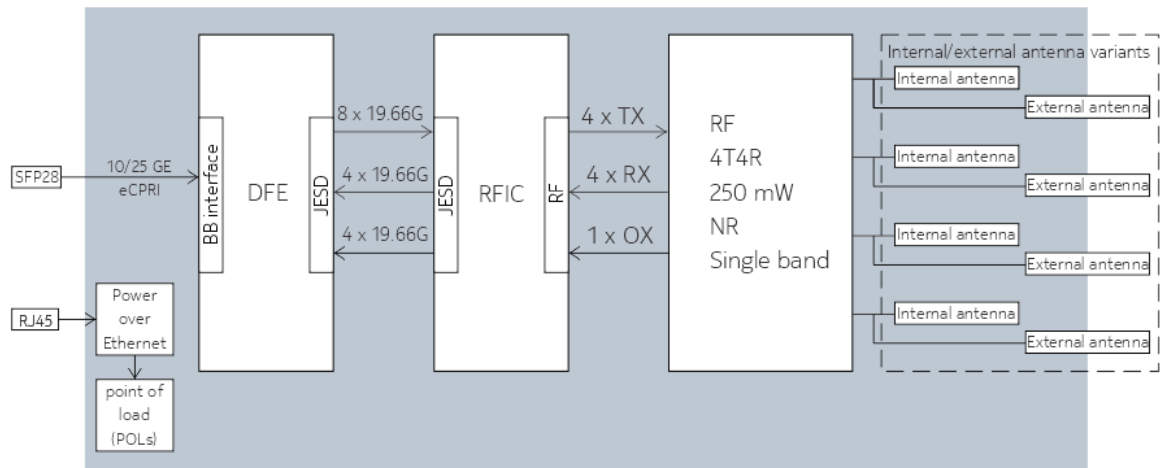
Antenna line device (ALD) support

 Note:

AWPTC and AWPTD don't support ALD systems.

Functional block diagram

Figure 298: AWPTC and AWPTD functional block diagram



Electrical specifications

Table 979: AWPTC and AWPTD electrical specifications

Property	Value
Input voltage range	43–57 V DC
Power input standard	PoE++ (IEEE 802.3bt compliant interface) Type 4 powered device (PD)
Power input options	• DC input from an external AC adapter • DC input from a hybrid fiber cable • PoE input from an Ethernet cable

Note:

The AC-powered PoE supply complies with the GR-1089-CORE Port Type 7 lightning criteria for primary surge protection when it's installed with an external surge protection device.

Related optional items

- FPW35 ASiR power adapter EU (475896A)
- FPW36 ASiR power adapter US (475897A)
- FPW37 ASiR power adapter UK (475898A)

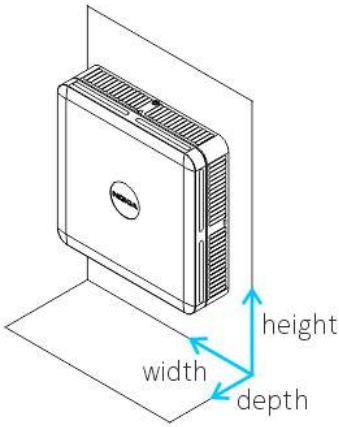
- FPW38 ASiR power adapter JP (475899A)
- APHT 1-port indoor PoE++ injector (476278A)
- APHU 6-port indoor PoE++ injector (476279A)
- APHV 12-port indoor PoE++ injector (476280A)

Installation options

- *Wall*
- *Ceiling*

Dimensions and weight

Table 980: AWPTC and AWPTD dimensions and weight

Property	Value	Dimensions orientation
Height	250 mm (9.84 in.)	
Width	250 mm (9.84 in.)	
Depth	63.2 mm (2.49 in.)	
Weight	3.1 kg (6.8 lb)	

Environmental specifications

Note:

Use AWPTC and AWPTD only in a controlled environment.

Table 981: AWPTC and AWPTD environmental specifications

Property	Value
Maximum operational temperature	40°C (104°F)
Minimum operational temperature	-20°C (-4°F)
Cooling method	Natural convection (fanless)
IP rating	IP20

9. AirScale RIUs descriptions

9.1 AirScale RIU 8T8R n78 (AHQK) eCPRI

Repeater Interface Unit (AHQK) (474919A) is introduced by 5GC001342 (for NR).

Functional description

Table 982: AHQK functional specification

Property	Value
Modulation	256 QAM (UL/DL)
Number of TXX	8T8R
Outdoor installation	No
Beamforming	No
Operating mode	4x4 MIMO, one cell 2x2 MIMO, one or two cells
Software supported technologies	NR
Duplex mode, supported standard	TDD
Frequency range	UL: 122.88 MHz DL: 368.64 MHz
Instantaneous bandwidth (iBW)	100 MHz
Occupied bandwidth (oBW)	100 MHz
Number of carriers per pipe	1
Maximum number of UL/DL MIMO streams	UL: 4 DL: 2
Supported bandwidths	80, 100 MHz

Interfaces

Figure 299: AHQK interfaces

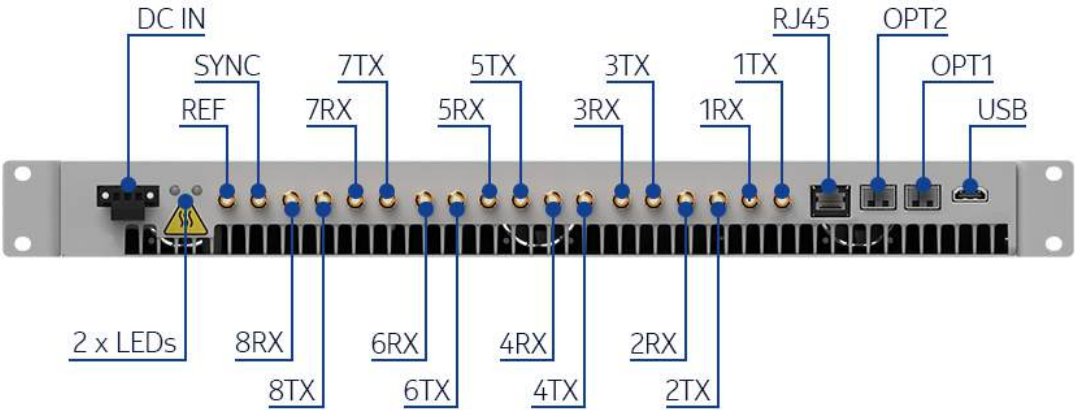


Table 983: AHQK interfaces

Interface	Label on the hardware	Number of interfaces	Connector type	Additional info
Power connector	DC IN	1	5.08 mm, EURO HEADER, RA PCB PIH	–
 Note: Power draw is less or equal 177 W (75% duty cycle).				
10 MHz reference	REF	1	SMA	Sine wave
TDD synchronization	SYNC	1	SMA	LVTTTL 3.3V, DL period: High, else: Low
IF I/F	TX/RX	16	SMA	–
Operational state visual indication (2 pcs) unit and TX status	ACT/ALM	2	–	Showing status of a unit and fan/TX
Control and maintenance	RJ45	1	C&M	Ethernet, control and maintenance operation using NATP protocol
Optical interface	OPT	2	SFP28	Up to 9.8 Gbps, eCPRI
USB interface	USB	1	–	–
Grounding	GND 	1	2x M5 screw or 1x M8 screw	–
Fan	FAN	1	1X4M P3 mm 5A ANG SMD	Located inside the unit

 WARNING!

Risk of electric shock

Before turning RF power on, RF ports have to be terminated by nominal 50 Ω load (for example, feeder with antenna). If these conditions are not met, do not remove the plastic caps that are delivered within the unused RF ports. The plastic caps isolate RF port from the environment, and thus provide electric shock security in case RF power is accidentally on.

Electrical specifications

Table 984: AHQK electrical specifications

Property	Value
Nominal supply voltage	-48.0 V DC

 Note:

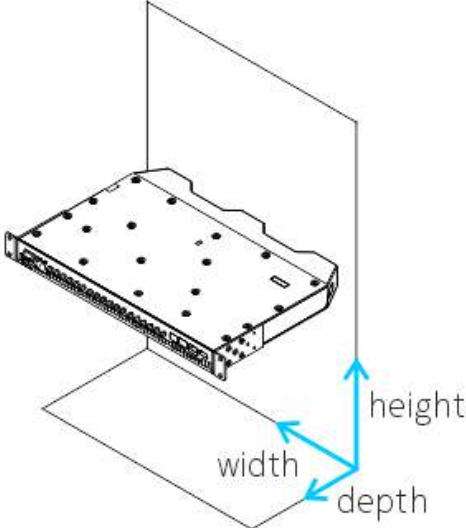
The minimum start-up voltage is -40.5 V DC. If the input voltage is below or beyond extended limits, the unit might shut down.

Installation option

19" rack

Dimensions and weight

Table 985: AHQK dimensions and weight

Property	Value	Dimensions orientation
Height	44 mm (1.73 in.)	
Width	442 mm (17.4 in.) without brackets 495 mm (19.49 in.) with brackets	
Depth	350 mm (13.78 in.)	
Weight	5.7 kg (12.57 lb)	

Environmental specifications

Table 986: AHQK environmental specifications

Property	Value
Maximum indoor temperature	50°C (122°F)
Minimum operational temperature	0°C (32°F)
Cooling method	Forced convection (fan)
IP rating	IP20

10. AirScale RU sound levels

10.1 Sound power levels

Sound power levels measured according to ISO 3744 or ISO 3745

Table 987: AirScale 2 300 RRH sound power levels (measured according to ISO 3744 or ISO 3745)

Configuration	Typical without optional fans*	With optional fans
Single module at 15°C (59°F)	≤ 35 dBA	≤ 54 dBA
Single module at 23°C (73.4°F)	≤ 35 dBA	≤ 58 dBA
Single module at 45°C (113°F)	≤ 35 dBA	≤ 63 dBA

*Sound power levels can vary between radio units and be ≤45 dBa if maximum capacity is configured.

Table 988: AirScale 2 600 RRH (RF5.1) sound power levels (measured according to ISO 3744 or ISO 3745)

Configuration	Typical without optional fans*	With optional or mandatory fans
Single module at 15°C (59°F)	≤ 35 dBA	≤ 57 dBA for 160 W radio units
	≤ 35 dBA	≤ 59 dBA for 240 W radio units
	≤ 35 dBA	≤ 60 dBA for 320 W and 480 W radio units
Single module at 23°C (73.4°F)	≤ 35 dBA	≤ 61 dBA for all radio units
Single module at 50°C (122°F)	≤ 35 dBA	≤ 66 dBA for 160 W radio units
	≤ 35 dBA	≤ 67 dBA for 240 W, 320 W and 480 W radio units

*Sound power levels can vary between radio units and be ≤45 dBA if maximum capacity is configured.

Table 989: AirScale RF modules sound power levels (measured according to ISO 3744)

Configuration	Maximum
Single module at 15°C (59°F)	58 dBA
Single module at 23°C (73.4°F)	61 dBA
Single module at 50°C (122°F)	71 dBA

Table 990: AirScale micro RRH sound power levels (measured according to ISO 3744)

Configuration	Without fans
Single module at 15°C (59°F)	≤ 35 dBA
Single module at 23°C (73.4°F)	≤ 35 dBA
Single module at 50°C (122°F)	≤ 35 dBA

10.2 Sound pressure levels

Sound pressure levels measured according to ISO 3744 and scaled to 3 m (9.84 ft) distance.

Table 991: Pandion 4 sound pressure levels

Configuration	Maximum sound pressure level at 3 m (9.84 ft)
Single module at 15°C (59°F)	≤ 35 dBA for 320 W and 480 W radio units
	≤ 40 dBA for 640 W radio units
Single module at 25°C (77°F)	≤ 40 dBA for 320 W and 480 W radio units
	≤ 41 dBA for 640 W radio units
Single module at 45°C (113°F)	≤ 50 dBA for 320 W and 480 W radio units
	≤ 50.6 dBA for 640 W radio units

 Note:

Sound power levels for Pandion 4 are the same as AirScale 2 600 (RF5.1) at the same output power levels.

11. AirScale RU LED indicators

You can control LED indicators 180 seconds after powering on the radio unit.

RF modules and RRHs may be equipped with the following LEDs:

- RF Unit LED
- SFP/QSFP and RJ45 interfaces LEDs
- FAN status LED

All LEDs are three-color (red, green, yellow) and have three possible states when lit:

- Stable
- Blinking
- Alternating colors

Note:

Due to component variances the color of yellow may have an orange or green tone.

Figure 300: AirScale 2 FDD RU (4T4R) LED interface

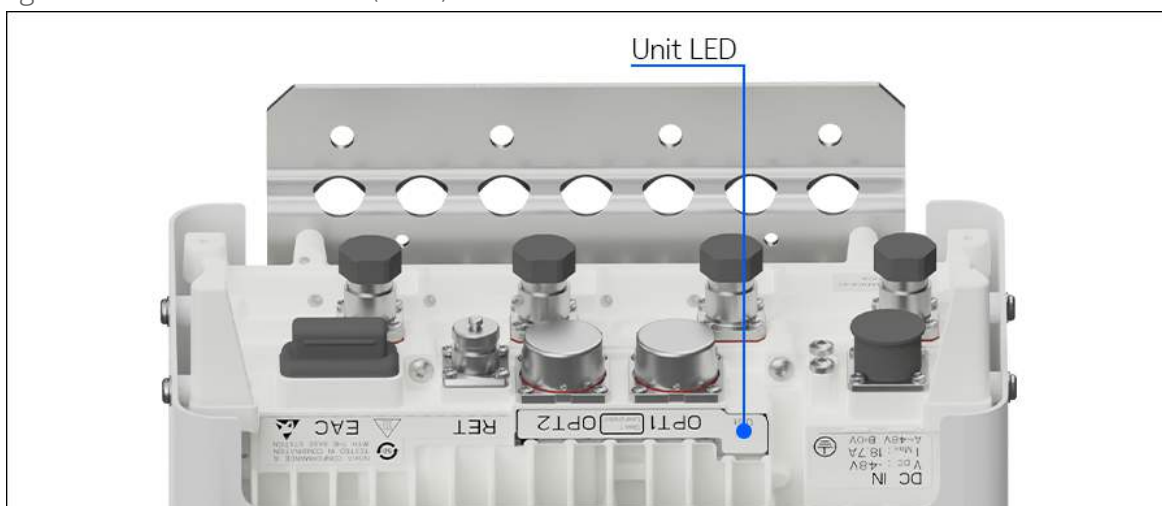


Figure 301: Pandion 4 LED interface

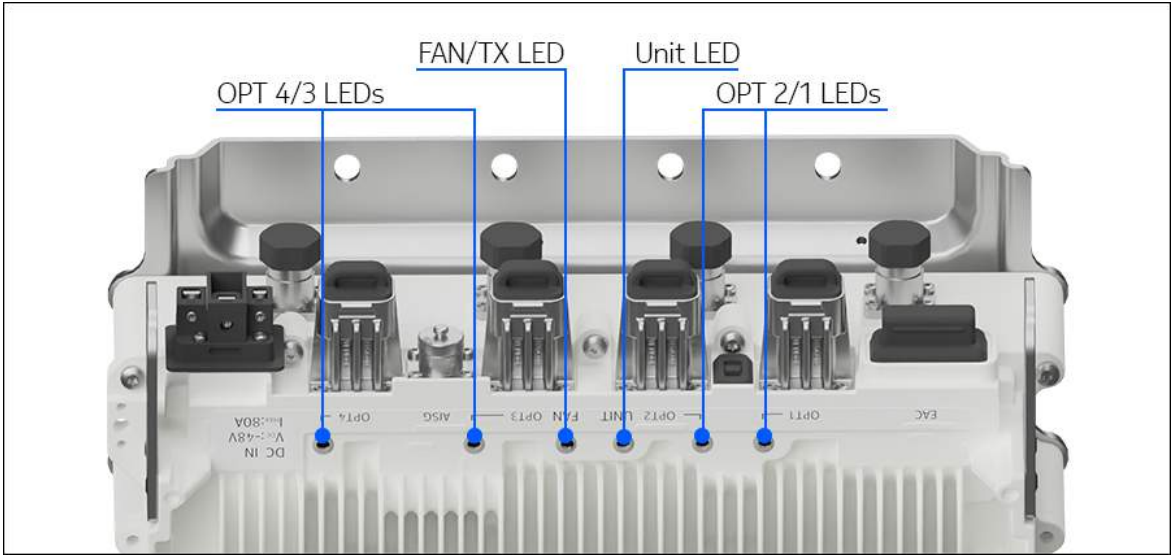


Figure 302: AirScale 2 FDD RU (4T4R) LED interface

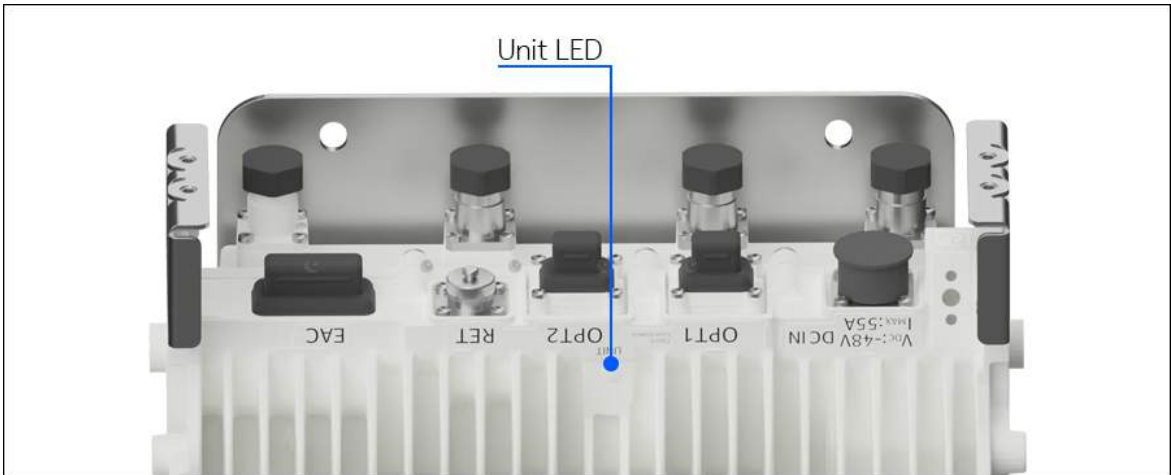


Figure 303: Osprey 8 LED interface

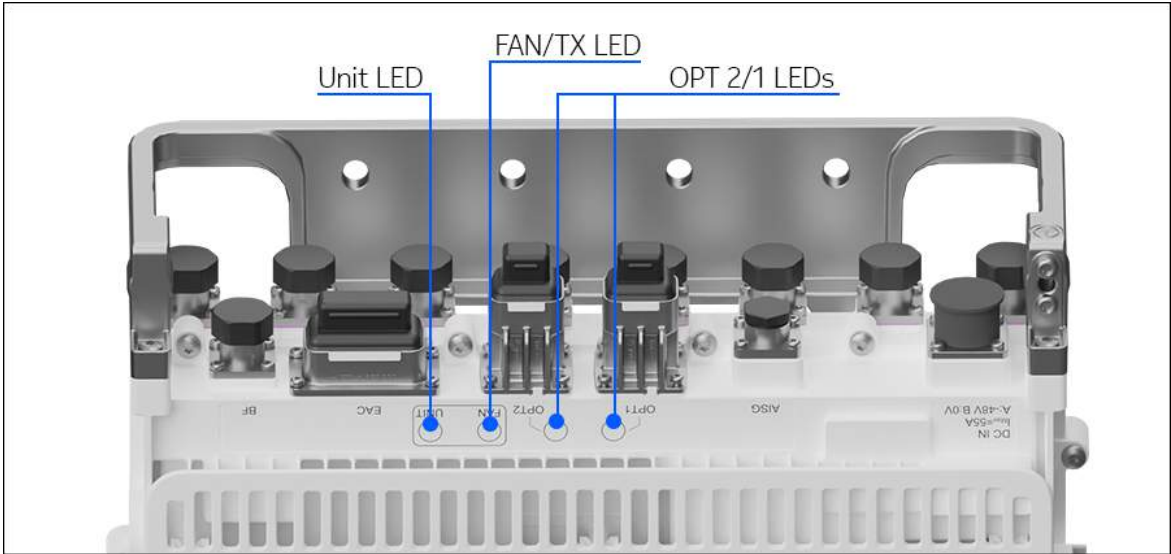


Figure 304: AirScale 2 FDD RU (6T6R) LED interface

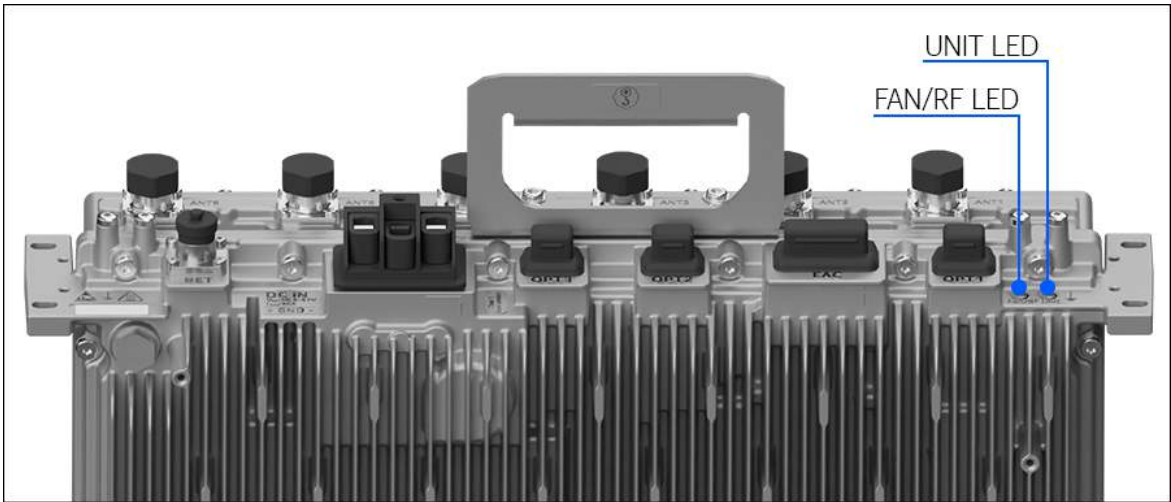


Figure 305: AirScale 2 TDD RU (2T2R/4T4R/8T8R) LED interface



Figure 306: Rel. 6.1 TDD RU (8T8R) LED interface

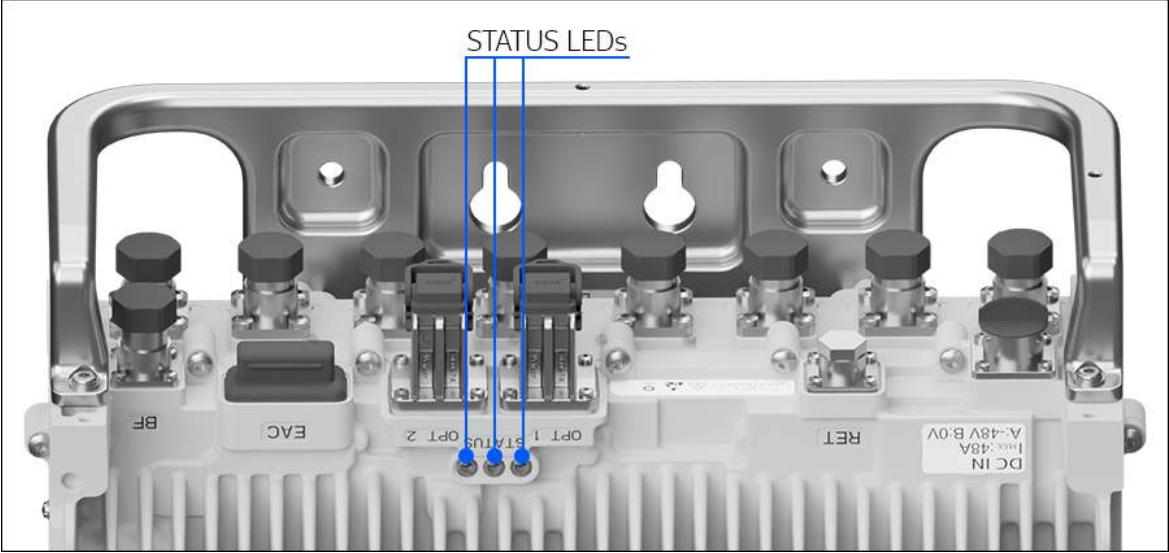


Figure 307: pRRH LED indicators

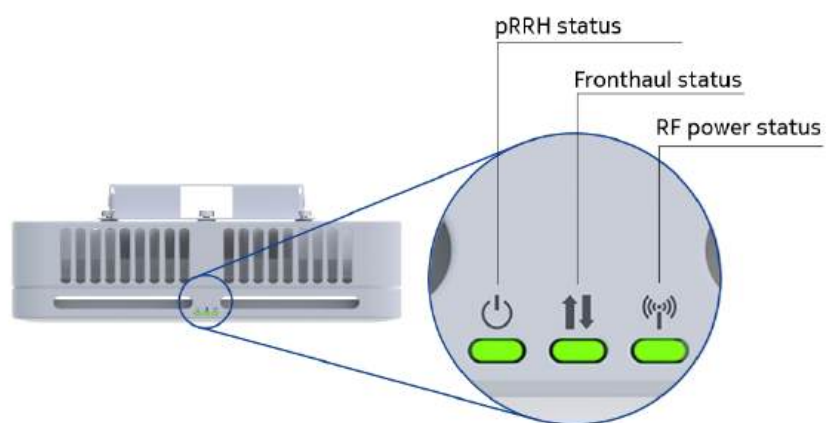


Table 992: LEDs for RF modules and RRHs

LED name	LED description	LED status
RF UNIT	Critical alarm affecting the whole radio unit or all antenna carriers	Stable RED: fault
RF UNIT	Operation degraded - Major alarm affecting the whole radio unit - Major/Critical alarm affecting a module subcomponent or antenna carrier - Critical alarm affecting fans	Blinking RED: major/critical alarm
RF UNIT	- The carriers blocked from BTS - No connection to any system module	Stable YELLOW: no alarm
RF UNIT	- Software download in progress - Configuration in progress: RF resources are being setup, but not yet activated	Blinking YELLOW: no alarm
RF UNIT	- Software configuration complete or supervisory: RF resources activated and transmission possible - Working normally, no alarm on the radio unit	Stable GREEN: no alarm
RF UNIT	Software activation	Blinking GREEN: no alarm
RF UNIT	Switched ON, but the next conditions are not reached yet	Stable RED for less than 5 second and changes to stable YELLOW: no alarm
RF UNIT	The module in the process of resetting	Stable RED for less than 5 seconds: no alarm* *For some RUs it may take 30 seconds or more.
RF UNIT	Antenna line faulty/degraded due to external factors (for example, VSWR minor/major values exceeded, Antenna line device faulty/degraded)	Periodic RED and GREEN: alarm
RF UNIT	Module highlighting (Flexi BTS SM functionality that can help identifying faulty module)	Blinking colors (RED, YELLOW, and GREEN), each color stable for 0.5 second: no alarm
FAN	At least one fan faulty or degraded	RED: no alarm

LED name	LED description	LED status
FAN	All fans working	GREEN: no alarm
FAN	RF transmission ON	Stable, color set according to fan status: no alarm
FAN	RF transmission OFF	Blinking color set according to fan status: no alarm
OPT (eCPRI/O-RAN)	SFP absent	OFF
OPT (eCPRI/O-RAN)	Self-tunable SFP in self-tuning	Blinking: GREEN
OPT (eCPRI/O-RAN)	SFP present but TX_FAULT or RX_LOS reported	Stable: RED
OPT (eCPRI/O-RAN)	SFP present and no TX_FAULT nor RX_LOS but no ETH LINK	Blinking: RED
OPT (eCPRI/O-RAN)	SFP present and ETH LINK working	Stable: GREEN
OPT (CPRI)	SFP absent	OFF
OPT (CPRI)	Self-tunable SFP in self-tuning	Blinking: GREEN
OPT (CPRI)	TX_FAULT or RX_LOS reported	Stable: RED
OPT (CPRI)	no TX_FAULT nor RX_LOS	Stable: GREEN

Note:

FHEL, FRIJ, FHDI, FHPD, and FHKA radio units do not support critical alarm affecting fans LED.

Table 993: LEDs for pico RRH

pRRH LED status	Fronthaul LED status	RF power LED status	Description
Stable: YELLOW	OFF	OFF	Power up
Stable: YELLOW	Blinking: RED	OFF	SFP present, no ETH LINK
Stable: YELLOW	Stable: GREEN	OFF	SFP present, ETH LINK working correctly
Stable: YELLOW	Stable: GREEN	Blinking: GREEN	Start-up ongoing
Blinking: YELLOW	Stable: GREEN	Blinking: GREEN	Configuration in progress: RF resources setting up
Stable: GREEN	Stable: GREEN	Blinking: GREEN	• Software configuration complete • RF transmission ON
Stable: GREEN	Stable: GREEN	Stable: GREEN	RF transmission ON

 Note:

The LED indicators of pRRHs are generally consistent with those on macro RRHs.

The differences are:

- Before the transmission is on, the green LED of the pRRH is blinking.
- LED layout:
 - macro RRH › pRRH
 - unit/module/power status › pRRH status
 - RF/TX/FAN status › RF power status

12. Passive intermodulation in FDD systems

Passive intermodulation (PIM) is an ever-increasing problem in mobile networks using FDD radio units (RUs).

It can create interference on Rx (uplink) carriers and, therefore, increase received total wideband power (RTWP), cause Rx signal level alarms, reduce Rx sensitivity, or even block Rx. PIM is an RF phenomenon seen in FDD systems—it isn't Nokia- or RAT-specific.

PIM issues can arise when:

- new frequency bands or carriers are activated.
- Tx power levels are increased.
- carrier bandwidths are expanded.
- new equipment is installed.
- one BTS vendor is swapped to another.
- the equipment is installed by untrained and unqualified personnel.
- new structures are erected near the existing BTS antennas.
- the existing equipment ages.

PIM is a particular issue whenever old antenna systems (feeder and jumper lines, antennas, and other antenna system components) are re-used during swap project.

To mitigate PIM, pay attention also to the following factors:

- Plan frequency and Tx allocations in feeder lines to avoid PIM-susceptible carrier combinations.
- Measure antenna line PIM performance.
- Only use RF components with good PIM performance.
- Before re-using old antenna systems, test their PIM performance to ensure it's sufficient for a swap procedure.
- Remember that antenna lines that have good PIM performance today may not last for years.

13. AirScale naming conventions

Explanation of abbreviations in AirScale hardware product names

Abbreviated product names

Table 994: AirScale naming convention

Letter	Description
First letter A _ _ _	AirScale product family
First letter F _ _ _	Flexi Multiradio 10 BTS product family, first generation of AirScale remote radio heads (RRHs), or ASMR extension modules
First letter P _ _ _	IPAA+ Platform Antennas (PFAs)
Second letter _ A _ _	Antenna equipment, band combiner, or macro massive MIMO adaptive antennas (MAAs)
Second letter _ B _ _	Capacity plug-in units
Second letter _ C _ _	Cabinet or cabinet accessories
Second letter _ D _ _	Diplexers or fronthaul switches
Second letter _ E _ _	Macro or small cells TDD MAAs
Second letter _ F _ _	Interference cancellation or IPAA+ PFAs
Second letter _ H _ _	Macro or micro FDD RRHs or repeater interface units (RIUs)
Second letter _ J _ _	NR radio access points (RAPs)
Second letter _ K _ _	Macro TDD RRHs
Second letter _ L _ _	Low-noise mast head amplifiers (MHAs)
Second letter _ M _ _	Subracks or mounting kits

Letter	Description
Second letter _ N _ _	Compact active antenna (CAA) solution
Second letter _ O _ _	Small form-factor pluggables (SFPs)
Second letter _ P _ _	Power supply units (PSUs)
Second letter _ Q _ _	Macro TDD MAAs
Second letter _ R _ _	Macro FDD radio units (RUs)
Second letter _ S _ _	Control plug-in units, core units, fan units, or external alarm modules
Second letter _ T _ _	Transport modules, submodules, or cables
Second letter _ V _ _	Macro TDD MAAs
Second letter _ W _ _	AirScale mmWave Radios (ASMRs) or micro or pico RRHs
Second letter _ Y _ _	GNSS equipment and accessories
Second letter _ Z _ _	Macro or micro RRHs
Third letter _ _ I _	Indoor usage (system module or cabinet)
Third letter _ _ O _	Outdoor usage (system module or cabinet)
Third (and consecutive) letter _ _ x _	In the case of single-band RUs, it's the number of the supported band. In the case of multi-band RUs, there may be more letters, depending on the number of supported bands (for example, _ _ xx_). For the letter corresponding to the supported band, see Table: Radio bands naming convention .

Letter	Description
Fifth letter ____A	In some special cases, the fifth letter in system modules may be added to denote a market- or customer-specific variant. For example, ASIAA is the same as ASIA but it has a different DC input connector.
Fifth letter _____I	Specific for AEQx: IPAA version of MAA with interleaved mMIMO and passive low-band antenna arrays shown with "_I", for example, AEQE_I.
Fifth letter AB__L AM__L AS__L	Liquid-cooled variant of system module (capacity plug-in unit/subrack/control plug-in unit)
Last letter (fourth or higher) ____A	Hardware variant: A - the first, B - the second, and so on

For the following RUs, the second letter indicates the unit type:

- AA - AirScale FDD/TDD MAAs
- AE - AirScale TDD MAAs
- AH - AirScale FDD RRHs or RIUs
- AK - AirScale TDD RRHs
- AQ - AirScale TDD MAAs
- AR - AirScale FDD RUs
- AV - AirScale TDD MAAs
- AW - AirScale ASMR or FDD/TDD micro/pico RRHs
- AZ - AirScale TDD RRHs or FDD/TDD micro RRHs
- FH, FR - Flexi and AirScale RRHs

The third letter for single-band RUs, the third and consecutive letters for multi-band RUs (except the last one), and the fourth letter for AWHxx micro RRHs indicate the operating 3GPP band for the respective technology (LTE or NR), as in the table below. If an RU supports more than one frequency band, the respective letters are given one after another. For example, AHPMDA is a triple-band RRH for NR and LTE, where the letters PMD describe the bands it supports—LTE B8/B20/B28 and NR n8/n20/n28.

Table 995: Radio bands naming convention

Letter	Band
B	B13, B14, n14 (above 700 MHz)
C	B5, B18, B26, n5, n18, n26 (850 MHz)
D	B8, n8 (900 MHz)
E	B3, n3 (1700 MHz and 1800 MHz)
F	B2, B25, n2, n25 (1900 MHz)
G	B1, B65, n1, n65 (2100 MHz)
H	B7, B38, B41, n7, n38, n41 (2600 MHz)
I	B66, n66 (1700 and 2100 MHz)
K	B11, B24, B50, B54, n24, n50 (1500 MHz)
L	B12, B17, B29, B85, n12, n29 (below 700 MHz)
M	B20, n20 (800 MHz EU)

Letter	Band
N	B30, B40, n30, n40 (2300 MHz)
O	B71, n71 (600 MHz US)
P	B28, B68, n28 (700 MHz)
Q	B42, B43, B48, n42, n48, n77, n78 (3500 MHz – 4200 MHz)
R	B46 (5000 MHz – 6000 MHz)
S	B32, B75 (SDL* 1400 MHz)
T	n79 (4400 MHz – 5000 MHz)
U	n257, n258, n261 (24 GHz – 28 GHz)
W	n260 (39 GHz)

*SDL - supplemental downlink

Commercial product names

Nokia introduced product names for AirScale plug-in, core, and radio units. The names, featuring names of winds and birds, are used in marketing materials and initial interactions. The use of product-specific identification codes continues in operating and release documentation as well as for ordering purposes.

Control and capacity plug-in units are named after a wind, for example:

- Chinook – ASIL control plug-in unit
- Fremantle – ABIO capacity plug-in unit
- Levante – ABIP capacity plug-in unit
- Lodos – ABIQ capacity plug-in unit
- Ostro – ABIN capacity plug-in unit
- Ponente – ASIM control plug-in unit

Core units are named after a wind, for example:

- Tuuli 12 – ASOE
- Tuuli 6 – ASOF

Radio units (RUs) and Massive MIMO Adaptive Antennas (MAAs) are named after a bird of prey, for

example:

- Osprey 8 – 8T8R RRH

For example: AirScale RRH 8T8R n78 320 W AKQZ

- Osprey 32 – 32T32R MAA

For example: AirScale MAA 32T32R 128 AE n78 240 W AQQQ

- Osprey 64 – 64T64R MAA

For example: AirScale MAA 64T64R 192 AE n78 320 W AQQE

- Pandion 4 – 4T4R FDD RRH

For example: AirScale Dual RRH 4T4R B25/66 480 W AHFII

- Habrok 64 – 64T64R MAA

For example: AirScale MAA 64T64R 192 AE n78 320 W AVQL

 Note:

- RUs from release 5.1 are renamed to AirScale 2 RUs.
- Release 6.1 refers to RUs based on Reefshark 6601 SoC.

14. Glossary

List of terms appearing in the Nokia AirScale Radio Description document

ambient temperature	temperature of the air surrounding a particular piece of equipment
American wire gauge (AWG)	standard classification for measuring non-ferrous wire conductor sizes Note: The higher the gauge number, the smaller the diameter and the thinner the wire. Telephone wire is usually 22, 24, or 26 AWG. Since thicker wires have less electrical resistance and carry more current, they're better for longer distances.
Antenna Interface Standards Group (AISG)	standards group that has been established to create an open specification for the control interface of third-generation antenna line products. In some MAA (Massive MIMO Adaptive Antenna) units, AISG and external alarm connection (EAC) ports are combined into a single port
Antenna Line Device (ALD)	variety of tower-top equipment that may be connected to the radio unit (RU), for example, remote electrical tilt (RET) or masthead amplifier (MHA)
bandwidth (BW)	quantitative difference between the limiting frequencies of a frequency band that indicates the width of a communication channel
beamforming (BF)	energy-efficient signal processing technique which shapes radio frequency beams to transmit a directional signal to users
bias tee (bias-T, biasT)	unit that provides power to the masthead amplifier (MHA) and can also provide fault monitoring of the antenna line voltage standing-wave ratio (VSWR) and MHA
Common Public Radio Interface (CPRI)	standard defining the interface between the radio unit (RU) and radio access unit (RAU)

concurrent mode	operational mode of a software-defined radio unit (RU) in which it can operate on two or more radio technologies simultaneously
Enhanced Common Public Radio Interface (eCPRI)	standard that defines the connection between eCPRI Radio Equipment Control (eREC) and eCPRI Radio Equipment (eRE) through the fronthaul transport network. It's used in NR systems, LTE-Advanced, and LTE-Advanced Pro
extended input voltage	voltage range from -36.0 V DC to -40.5 V DC and from -57.0 V DC to -60.0 V DC, defined by safety test results. As long as the equipment is operating within the extended input voltage range, it shouldn't be damaged during unexpected voltage surges. When the input voltage level is too high or too low, an over-voltage or under-voltage alarm is raised, respectively
external alarm connection (EAC)	connection for external alarms from any equipment that's external to the BTS. In some Massive MIMO Adaptive Antenna (MAA) units, Antenna Interface Standards Group (AISG) and EAC ports are combined into a single port
finite impulse response (FIR)	digital filter of finite duration used for signal processing
frequency division duplex (FDD)	duplex mode where uplink and downlink transmissions use two separate radio frequencies
full mode (or full panel mode)	configuration in which all the antenna elements are utilized as one logical antenna panel for one RAT
grounding (GND)	electrical connection between a given point in the equipment and the ground
guard band	unused frequency band that lies between two transmission frequency bands. This frequency band is used in all broadband networks, and in mobile communications radio bands, for channel separation to prevent interference between channels
Half Power Beam Width (HPBW)	measured in degrees, angular width of the major lobe of an antenna at which the amplitude drops to half of the peak value (-3 dB)

Hybrid Beamforming (HBF)	type of beamforming that uses both analog and digital beamforming to send a signal
ingress protection (IP)	protection of electronic components inside a network element against the ingress of rain, snow, and dust. The IP rating is a standard used to describe the level of protection of electrical equipment, which uses a two-digit code. The first digit describes the level of protection against solid particles, whereas the second digit refers to the level of protection against liquid ingress. The higher the number, the better the protection
instantaneous bandwidth (iBW)	frequency range in which the radio carriers may be deployed; iBW is always smaller or equal to RF bandwidth
Internet of Things (IoT)	technology that interconnects devices and enables an exchange of data between them. These devices can be machines, parts of machines, smart meters, or sensors. A machine-to-machine communication is needed to support the IoT
Local Management Port (LMP)	dedicated Ethernet port in the BTS used for connecting to the management interface of the equipment
masthead amplifier (MHA)	low-noise amplifier (LNA) that is used to compensate the cable loss between the antenna connector and BTS input connector
Maximum current draw ($I_{\max}$)	calculated or measured maximum electrical current of a radio unit (RU) at its minimum operating voltage
mean time between failures (MTBF)	expected operating time between two consecutive system failures of a unit
Multiple Input Multiple Output (MIMO)	antenna technology for wireless communications in which multiple antennas are used at both the source (transmitter) and the destination (receiver). It's a key ingredient of the LTE air interface, supporting requirements for throughput and spectral efficiency. The MIMO technology provides an increase in the radio link capacity by using more than one transmitting and receiving antenna working on the same frequency. Data sent with this technology is divided into separate streams and transmitted simultaneously by a number of antennas over the same air interfaces

Multi-Standard Radio (MSR) base station	BTS characterized by the ability of its receiver and transmitter to process two or more carriers in common active RF components simultaneously in a declared RF bandwidth, where at least one carrier is of a different RAT than the other carriers.
narrowband Internet of Things (NB-IoT)	implementation of IoT in LTE network, which uses a 200 kHz carrier (either in-band, standalone, or LTE guard band), suitable for stationary devices requiring very little data (tens of kb)
nominal input voltage range	voltage range from -40.5 V DC to -57 V DC, defined by standard ETSI EN 300 132-2 for Europe. Within the nominal input voltage range, the equipment should operate with no degradation of service performance
non-standalone (NSA)	type of a network configuration which uses LTE infrastructure for NR deployment
OBSAI RP3-01 interface (RP3-01)	optical interface for connecting the radio unit (RU) to the system module (SM) Note: For example, a three-branch radio unit (RU) has three OBSAI RP3-01 interfaces. OBSAI stands for Open Base Station Architecture Initiative. RP stands for reference point.
occupied bandwidth (oBW)	hardware-supported maximum sum of the bandwidths of the deployed carriers. It's always smaller or equal to iBW. For example: If a radio unit oBW = 40 MHz, there might be a 2x20 MHz configuration deployed
Open Base Station Architecture Initiative (OBSAI)	standard defining the architecture, functions, and minimum requirements for integrating components and modules from various vendors into a BTS
optical interface (OPT)	in fiber-optic communication, an interface over which an optical signal passes from one equipment or medium to another, without being converted to an electrical signal
output power	mean power of one carrier of the UE, delivered to a load with resistance equal to the nominal load impedance of the transmitter

over voltage protection (OVP)	protection against the average voltage raising above the upper design limit
passive intermodulation (PIM)	unwanted signal generated in a passive (or non-linear) device, such as a connector or a cable. It's generated by the non-linear mixing of two or more frequencies
power distribution unit (PDU)	in a network element, a unit that distributes AC mains to the rectifiers and then distributes DC output from the rectifiers to the intended loads
power over Ethernet (PoE)	system capable of passing electrical power safely, along with data, on Ethernet cabling. PoE technology is based on the IEEE 802.3af standard
power supply unit (PSU)	device or system that supplies electrical or other types of energy to an output load or group of loads
quad small form-factor pluggable (QSFP)	four channel physically compact connector design that consists of a housing fitted on a host board and a pluggable transceiver. It's developed for use in high-speed data transfer, including both copper-based and fiber-optic systems. QSFP28 is an industry format of transceivers, allowing the highest data rate of 4x25 Gbps used for 100 Gbps links
quadrature amplitude modulation (QAM)	modulation system which increases the amount of information that can be carried within a given bandwidth. It provides an increased number of bits per symbol: For 16 QAM - 4 bits/symbol; For 64 QAM - 6 bits/symbol; For 256 QAM - 8 bits/symbol
radio access technology (RAT)	connection method used to connect different terminals and applications to telecommunication networks by using RF signals
radio frequency module (RFM, RF Module)	radio unit (RU) responsible for transmitting and receiving RF signal. In transmission path (TX), the RFM receives the signal from the system module (SM), transforms it into an RF signal, and sends it to the antennas. In reception path (RX), it goes the other way around. RFM is fitted for co-located sites. Its counterpart fitted for distributed sites is a remote radio head (RRH). Usually, RFMs can be installed in a rack, on a stack, on a wall, or on a pole

radio unit (RU)	radio part of a radio access point (RAP) hosting the RF functionality and beamforming processing of the BTS
remote electrical tilt (RET)	system that allows the operator to adjust the down tilt of each antenna remotely Note: RET can be used locally at the BTS, or remotely at a regional operation and maintenance center or network operations center. It reduces the cost of the downtime of the BTS.
remote radio head (RRH)	radio unit (RU) that is separated from the BTS and connected to it through a fiber optic cable. It's usually mounted on a tower or rooftop to provide optimal coverage
RF filter bandwidth (RF BW)	3GPP frequency range the radio operates in. For example, filter bandwidth of a radio unit (RU) operating in Band 41 (2496 MHz to 2690 MHz) is 194 MHz
small form-factor pluggable (SFP)	physically compact connector design that consists of a housing fitted on a host board and a pluggable transceiver, developed for use in high-speed data transfers including both copper-based and fiber-optic systems. SFP+ supports 10 Gbps; SFP28 supports 25 Gbps; SFP56 supports 56 Gbps
sniffing	recording the traffic flowing through the network Note: Sniffing can be used to attack the IP network. If data or commands are sent unencrypted, sniffing can be used for eavesdropping. It can also be used for stealing user identities and passwords, which can be used for the impersonation.
split mode	configuration in which antenna elements are divided into two separate logical antenna panels. The division is done in vertical dimension, for example, NR is allocated in the left side and LTE in the right side of the antenna panel. The split panel mode serves separate carriers with each half of the antenna elements

standalone (SA)	in NR, a configuration independent from LTE, which uses NR core network and NR radio network
time division duplex (TDD)	duplex mode in which several signals are interleaved in time for transmission over a common frequency channel  Note: In TDD, the same frequency channel can be used for transmission in both directions. Both ends of a bidirectional connection alternate between transmitting and receiving bursts of data.
TX output power tolerance	expressed in percentages, the acceptable amount of variation in the power output of a transmitter (TX) in relation to its specified power output
voltage standing wave ratio (VSWR)	ratio of maximum to minimum voltage in the standing wave pattern that appears along a transmission line. It's used as a measure of impedance mismatch between the transmission line and its load