

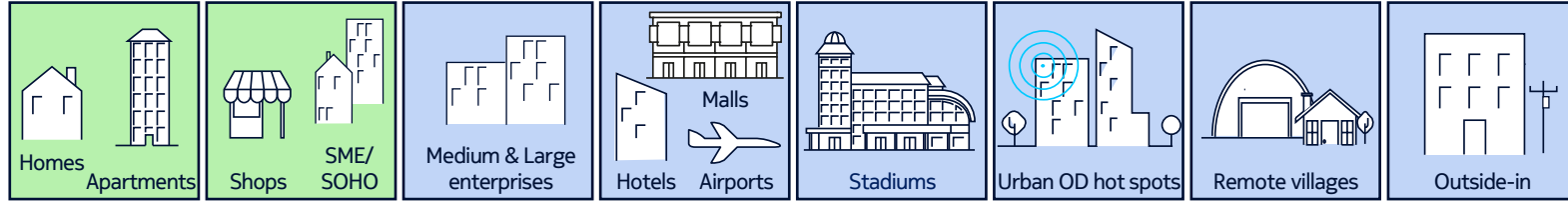
Generating Value with Nokia Small Cell Solutions

Flexi Zone (AiO) & AirScale Micro RRH



Nokia has broadest Small Cell portfolio – to address all use cases & scenarios

Use Cases



INDOOR

Femto

3G+4G

Smart Node

4G + 5G

Flexi Zone (pico/Micro/MM)

3G + 4G

*AirScale Indoor Radio (ASiR) (pRRH/S-Hub)**

2G + 3G + 4G + 5G

OUTDOOR

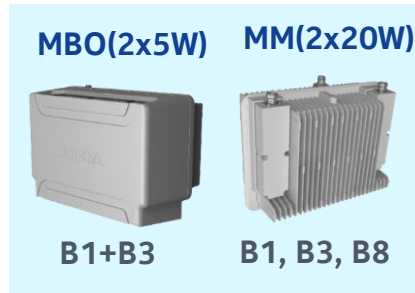
*AirScale Micro RRH**

2G + 3G + 4G + 5G

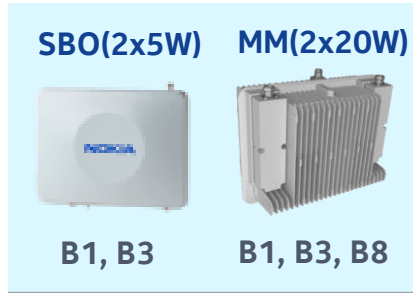
Small Cells deployment scenarios



Hot zone
capacity boost



Outdoor
coverage
/capacity
densification



Outside in
indoor perf.
boost



Indoor
coverage
/capacity
densification

Flexi Zone Indoor Pico BTS (Band 3) and Flexi Zone Indoor Pico BTS (Band 1) (WCDMA)

Specification	B3 Indoor Pico	B1 Indoor Pico
RF Output Power	50mW to 250mW per Tx Path	Configurable 50mW to 250mW per Tx Path (500 mW with VAM)
Carriers	1x 20 MHz	Upto 4X5 MHz
Bandwidth Support	5, 10, 15, 20 MHz	5 per carrier MHz
Physical Size	Dimensions: 255mm x 252mm x 53.5 mm LTE: 2.8 L / 1.9 Kg (including mounting bracket)	WCDMA: 2.8 L / 1.9 Kg WCDMA + WiFi: 2.8 L / 2.2 Kg (including wall mounting bracket)
Synchronization	RF GPS, 1588v2 (frequency, time, phase), SyncE	RF GPS, 1588v2 (frequency, time, phase), SyncE
Backhaul	(2) 100/1000 Base-T Copper	(2) 100/1000 Base-T Copper
Antenna	Configuration: 2 Tx / 2 Rx MIMO Types: Integrated Omni, External (optional)	Configuration: 2 Tx / 2 Rx MIMO Types: Integrated Omni, External (optional)
Operating Temperature	0°C to +40°C	0°C to +40°C
Input Power	PoE++ DC Input (optional) via AC adapter	PoE++ DC Input (optional) via AC adapter



Flexi Zone Multiband Indoor Small Cell Solution- FW2GEA

Specification	Details	
LTE Bands	2 RF modules supporting 3GPP band-1 + band-3	
Band Frequency	Band-1 (1 st band) UL: 1920 – 1980 MHz DL: 2110 – 2170 MHz	Band-3 (2 nd band) UL: 1710 – 1785 MHz DL: 1805 – 1880 MHz
RF Output Power	50mW to 250mW per licensed band per Tx Path	
Carriers¹	Up to 2 carriers (Max: 40MHz in DL, 40MHz in UL)	
Carrier BW	5, 10, 15, 20MHz	
Modulation	UL: up to 64QAM; DL: up to 256QAM w/0dB back-off for B1; 1dB back-off for B3	
Physical Size²	Volume: 3.4L; Weight: 6.6 lbs. Dimensions: 9.7”(w) x 9.7”(h) x 2.6”(d)	
Synch	RF GPS, 1588v2 (frequency, time, phase), SyncE	
Backhaul³	Two (2) 100/1000 Base-T Copper	
Antenna	2Tx / 2Rx for each band (Integrated Omni)	
Input Power	PoE++, DC input (optional) via AC adapter	
Power Consumption	Max: 58W @ 40°C Typ: 36W @ 25°C	
Operating Temp	0°C to +40°C (IP20)	
Regulatory	ETSI, 3GPP TS36.104 Rel-13 Local Area	

¹ Two carrier support on B66 is dependent on configuration and SW feature availability.)

² Excluding cables, antenna and mounting brackets

³ BH #1 port supporting PoE PD

Flexi Zone Multiband Indoor Pico BTS benefits

- Best performance vs. size
- High capacity
- Optional UNII unlicensed module
- Carrier-grade software quality (macro parity)
- Proven plug & play for light touch install
- Flexible backhaul, power and sync solutions
- Multi-vendor HetNet proven



FWGP-3G/4G Flexi Zone Outdoor Micro BTS, Band 1

Flexi Zone Outdoor Micro BTS WCDMA

Specification	Details
WCDMA Access	Band Class 1: 2100 MHz UL: 1920 - 1980 MHz / DL: 2110 - 2170 MHz
RF Output Power	250mW to 5W per Tx Path (10W with VAM)
WCDMA Carriers	4x 5 MHz hardware capable*
Physical Size	Dimensions: 247mm (H) x 327mm (W) x 86mm (D) Volume: 5.0 L / Mass: 5.2 Kg
Backhaul	(1) 1000Base SFP Fiber (1) 100/1000 Base-T Copper Integrated Bluetooth Access*
Antenna	Configuration: 2 Tx / 2 Rx Types: Omni Stick, Directional, External
Operating Temperature	-40 °C to +55 °C
NetAct Support	NetAct 16.8
Software Parity	Full Parity to WCDMAFZ15 Flexi Zone Indoor SW



Front



Bottom



Side

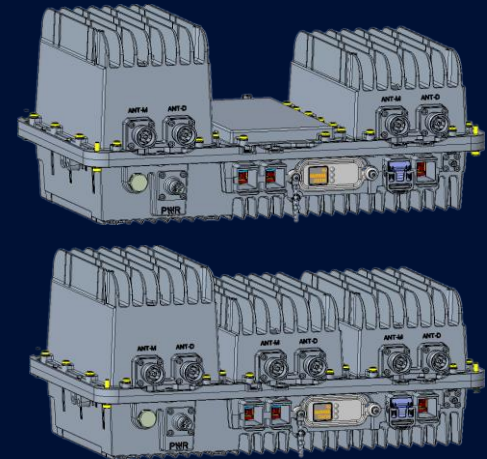
Outdoor Small Cell Solution (FW2GEB, FW2GEWB)

Flexi Zone Multiband Micro BTS: Specifications Summary

Specification	Details		
LTE access	2 RF modules + Wi-Fi module		
Band Frequency	1 st band (slot#0)	2 nd band (slot#1)	3 rd band (slot#2)
	Band Class 1: UL: 1920-1980 MHz DL: 2110-2170 MHz	Wi-Fi: 2.4GHz / 5GHz	Band Class 3: UL: 1710 - 1785 MHz DL: 1805 - 1880 MHz
RF output power ¹	250mW to 5W per Tx Path		
Carriers ²	Up to 2 carriers (Max: 40MHz in DL, 40MHz in UL)		
Carrier Bandwidth	5, 10, 15, 20MHz		
User capacity ³	Up to 840 LTE		
Physical size ⁴	Volume: 8.5L, Weight: 11.0kg		
Synchronization	RF GPS, 1588v2 (frequency, time, phase), SyncE		
Backhaul	Two (2) 100/1000 Base-T Copper; PoE Type-II support Two (2) 10Gb Fiber		
Antenna	Configuration: 2 Tx / 2 Rx Types: Directional Panel, Omni, and Remote		
Input power	90-264 VAC		
Regulatory	ETSI		

Flexi Zone Multiband Outdoor Micro BTS benefits

- High capacity
- Carrier-grade software quality (macro parity)
- Proven plug & play for light touch install
- Flexible backhaul, power and sync solutions



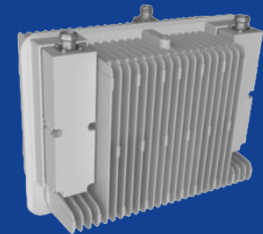
Outdoor Small Cell Solution portfolio

Flexi Zone Mini-Macro BTS: High power, high capacity
Mini-Macro (2x20W) – B3

Specification	Details
LTE access	1 high power RF module (FDD LTE or TD LTE) Many bands available
RF output power	Up to 20W per Tx path
Capacity/bandwidth	Up to 2 carriers (40MHz FDD or 40MHz TDD)
User capacity	Up to 840 LTE (depending on configuration)
Physical size	Volume: 10-12L, Weight: 10-12kg
Synchronization	RF GPS, 1588v2 (frequency, phase, time), SyncE
Backhaul	100/1000 Base-T Copper (RJ45); 1000 Base Fiber (SFP) Options for PoE out
Antenna	Configuration: 2 Tx/2 Rx MIMO Types: Integrated antennal or external
Input power	90 – 264VAC

Flexi Zone Mini-Macro benefits

- Best performance and form factor (up to 20W per Tx)
- High capacity: up to 300Mbps
- Carrier-grade software quality (macro parity)
- Proven plug & play for light touch install
- Flexible backhaul, power, and sync solutions
- Multi-vendor HetNet proven



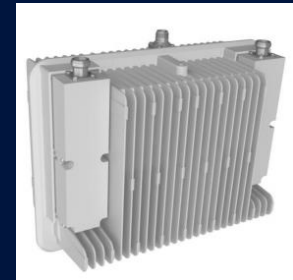
B1 FWGR (2100 MHz) Flexi Zone Outdoor Mini Macro LTE4247

AiO Outdoor High Power FDD LTE Small Cell

Specification	Details
LTE/WCDMA access	1 RF module (Band-1) Band Frequency: UL 1920 – 1980 MHz / DL 2110 - 2170 MHz
RF output power	Up to 20W per Tx path (40W total output power for B1)
Capacity/bandwidth	WCDMA :Up to 2 Carriers Capable (contiguous) WCDMA BW: 5 MHz, LTE: Up to 1 x20 MHz Carrier LTE BW: 5, 10, 15 , 20 MHz, (according to 3GPP Standards)
Physical size	Volume: ~ 14L, Weight: ~14kg 247 x 327 x 220 mm
Synchronization	RF GPS, 1588v2 (frequency, phase, time) and SyncE
Backhaul	2 x 100/1000 Base-T Copper (RJ45); 1 x 1000 Base Fiber (SFP)
Antenna	Configuration: 2Tx/2Rx MIMO (1 Radio) Types: Remote, Directional Panel, Omni Connectors: 4.3-10 Mini DIN
Operating Temperature	- 40°C to +55°C
Input power	90 - 264 VAC
3GPP Spec	TS36.104 Wide Area
Regulatory	ETSI and Telec

Flexi Zone Mini Macro BTS benefits

- Best performance and form factor
2x20W radio module
- High capacity
- Carrier-grade software quality (macro parity)
- Common OSS with macro (NetAct)
- Proven plug & play for light touch install
- Flexible backhaul, power and sync solutions

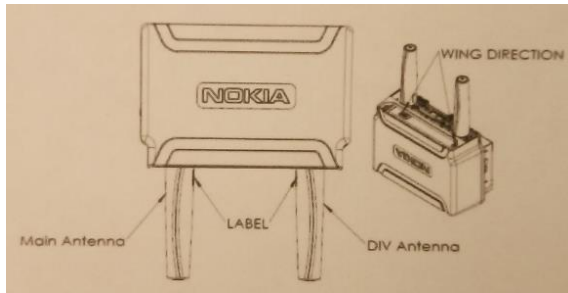


FZ Mini Macro Antenna options

2x20W LTE

We offer two options of direct connect access antennas for the MMO:

- Stacked eMIMO Omni antennas
- Integrated Multi-Band Directional antennas



eMIMO Omni antennas

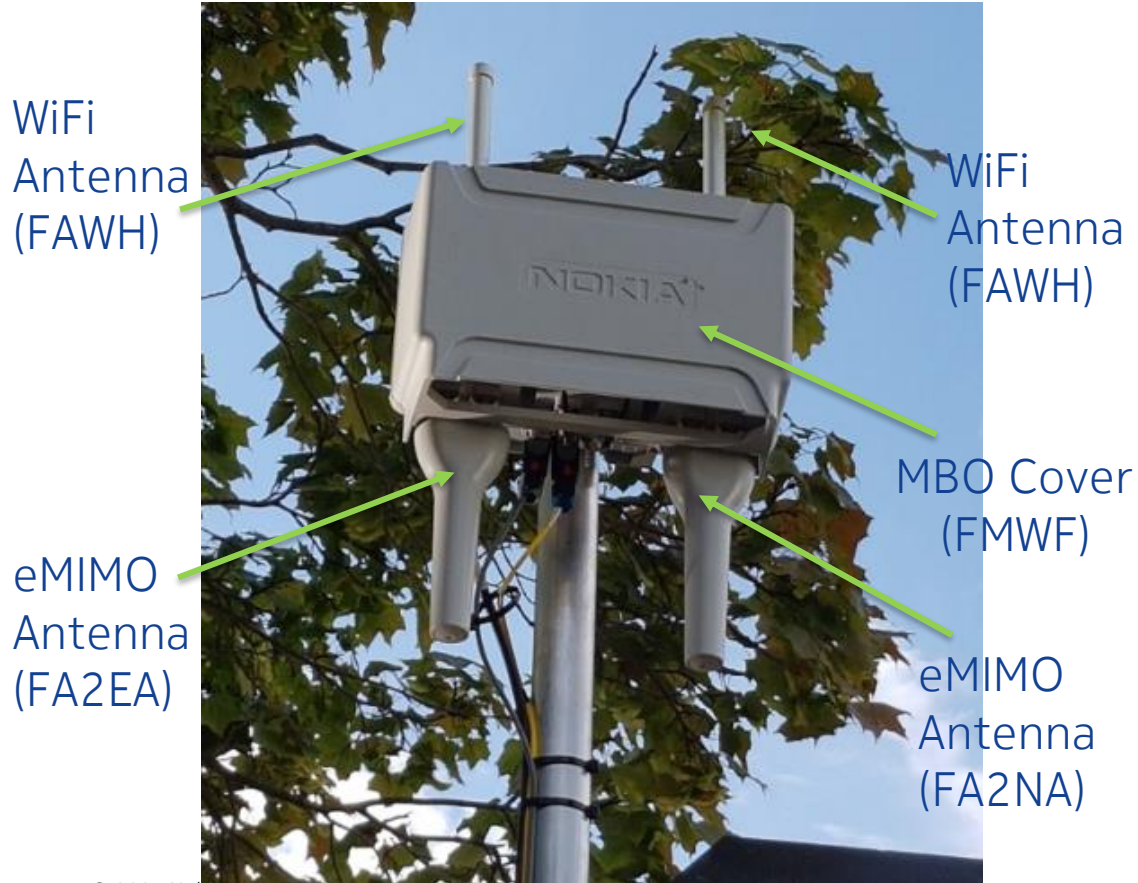
- FAWU / 474389A 2.3-2.7 GHz (4.3/10)
- FAWT / 474371A 1.7-2.1 GHz (4.3/10)



Integrated Directional antennas

- FA2HB / 474158A 1.7-2.7 GHz LTE (N-type)
- FA2EB / 474161A 1.7-2.7 GHz (4.3/10)
- FA2DA / 474159A 880-960 MHz (4.3/10)
- FA2BA / 474404A 698-803 MHz (4.3/10)

Flexi Zone MBO Small Cell field installation



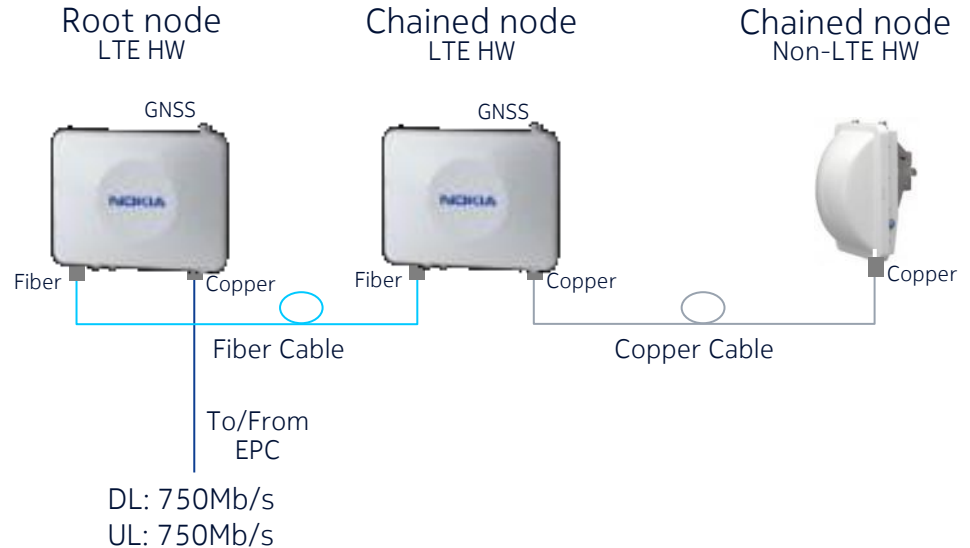
Daisy Chaining Support

Easy deployment

Lowers the transport cost by using single backhaul for multiple Small Cells

- FZM supports integrated Ethernet switching
- Daisy chaining of co-located or non co-located access points
- Chaining capacity depends on the amount of traffic on each node
- Maximum distance between the chained nodes depends on the type of physical link

Example configuration



Flexi Zone BTS Synchronization Options

Eliminating the need for an additional HW to provide a reliable timing solutions

GPS

- Integrated GNSS Receiver with a phase accuracy of 50ns
- Support nLOS GPS reception (Urban canyons, limited in-building support)
- Detachable GPS antenna to support remote positioning
- Support of Multi-GNSS on all Indoor and enhanced Outdoor platforms

SyncE

- Ethernet Phy/MAC HW recovered clock used as frequency reference
- SW processing of Sync Status Messages (ESMC, SSM, etc.)
- SyncE mechanism is built into layer-1 transport so it provides frequency timing that is unaffected by the backhaul traffic load

1588v2

- Packet based UDP/IP PTP protocol according to IEEE1588v2
- Uses time stamped messages to synchronize Flexi Zone BTS clock to PRC traceable master clock
- Support of both frequency & time/phase clock reference

Flexi Zone Controller Integrated Grand Master Clock slashes installation complexity

- Single GPS for multiple small cells
- FZ controller distribute the timing to the small cells via Ethernet
- Allows for advanced time based interference mitigation techniques
- Daisy chained AP supported*

Flexi Zone Controller also able to pass thru 1588v2 sync signal from other time sources

Flexi Zone Bluetooth Support

Wireless connect to Flexi Zone Micro/Pico at street level for install & local site maintenance

Faster & less costly install

- After mechanical fixing & AC powering, bucket truck can move to next install
- Engineer wirelessly connects to Flexi Zone Micro/Pico via Bluetooth device to finalize initial configuration

Facilitate & reduce local maintenance time

- Wirelessly connect to Flexi Zone Micro/Pico via Bluetooth at street level from comfort of vehicle rather than outside
- No need for costly special site access equipment, authorization to block roads

Eliminates need for special site access in many cases



Bluetooth for street level site access



Field proven in multi-vendor deployment scenarios

Nokia Small Cells interoperating with other vendors' macro radio and core networks

Macro software parity enabled easy IOT of Nokia small cells with other vendor's macro radio and core networks

Country	eNB	MME	SGW
Japan	Huawei	ALU	Nokia
Japan	Nokia	Ericsson	Ericsson
China	Huawei	Nokia	Nokia
China	ZTE	Nokia	Nokia
Portugal	Huawei	Cisco	Cisco
Malaysia	Huawei	Huawei	Huawei
Korea	Nokia	Ericsson	Ericsson
Spain	Nokia	Huawei	Huawei
USA	Nokia	Nokia	Cisco
Russia	Nokia	Cisco	Cisco
USA	Ericsson	Ericsson	Ericsson
USA	Samsung	Ericsson	Ericsson
USA	Nokia	Ericsson	Ericsson
Australia	Nokia&Huawei	Ericsson	Ericsson
China	Nokia, Huawei, ZTE, Ericsson	Nokia, Huawei, ZTE, Ericsson	Nokia, Huawei, ZTE, Ericsson
Uruguay	Ericsson,ALU	Huawei	Huawei
Ecuador	Huawei,ALU	Huawei	Huawei
Brazil	Ericsson	Ericsson	Huawei
USA	ALU,Ericsson, Samsung	ALU, Ericsson, Samsung	Genband
Canada	Nokia,Huawei	Cisco	Juniper
USA	Nokia,Ericsson	Nokia	Cisco
Taiwan	Nokia,Ericsson	Nokia	Cisco

Airscale mRRH bands now available -> flexible deployment & new use cases

Micro RRH*

4x4 Micro RRH
concurrent LTE/5G

- FDD, TD, 3G, LAA
- Multi-Carrier, 4T4R
- 5G upgradable (20MHz NR)



Specification

Details

LTE/WCDMA access

FDD: Band 1, Band 3, Band 7, WCDMA optional for B1
TDD: Band 41
LAA: AZRB (FCC), AZRC (ETSI)

RF output power

4 x 5W (FDD), 4 x 10 W (TDD)

Physical size

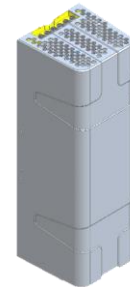
Volume: 4-6L, Weight: 4-6 kg

Interface

2 CPRI ports fronthaul (2 x 9.8Gbps)

Benefits

- Full support of 4G/5G (e.g. mix config:3x20MHz TD-LTE+1x20MHz NR)
- Best perf. to support 4X4 MIMO and 256QAM with small form factor
- Flexible installation: Wall, Pole, Strand, Enclosure, Bookshelf
- External or integrated antenna option
- Connects to Air Scale Baseband



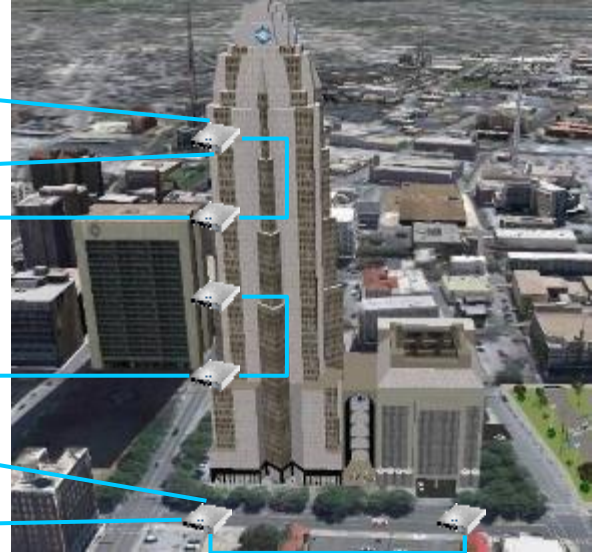
Nokia AirScale Micro RRH Use Cases



Mass Events

Stadiums/Airports/
Convention Centers

Inbuilding
Enterprise/Office
DAS Tails



Street level

Restaurants
Food Courts

Urban/Dense Urban
HotSpots, Shopping Malls
Metro, Bus, Railway stations

CPRI

23 km / 14 miles

CPRI/Dark Fiber



Nokia AirScale

CRAN BaseBand Hotel / Pool Central Office

B1 AirScale Micro RRH 4T/4R 20W (AHGB)

LTE4269

Low power remote radio head for Small Cell

Specification	Details
FDD LTE Access	Band 1: UL: 1920 – 1980 MHz / DL: 2110 – 2170 MHz
RF Output Power	Up to 4 x 5W per TX path (0.1dB steps down to 50mW)
LTE Carriers	Up to 4 carriers
Capacity	OBW up to 60MHz, IBW: 60MHz
Bandwidth Support	5, 10, 15, 20 MHz
Physical Size	DC: ~4L / ~5.5Kg; AC: ~4.5L / ~6.5Kg
Synchronization	CPRI
Interfaces	2 CPRI ports Fronthaul (2 x 9.8Gbps), 1 port for External alarm
Antenna	Configuration: 4T4R or 2T2R MIMO (Directional Panel or External)
Operating Temperature	-40 °C to +55 °C
Mounting Options	Wall, Pole, Strand, Enclosure, Bookshelf
Ingress Protection	IP65
Power Consumption	110W (Typ.); 150W (Max)
3GPP Specification	3GPP Medium Area
Input Power	DC: - 40.5V to -57V AC: 80V to 276V (via external AC/DC converter)



AHGB

B3 AirScale Micro RRH 4T/4R 20W (AHEJ)

LTE4270

Low power remote radio head for Small Cell

Specification	Details
FDD LTE Access	Band 3: UL: 1710 – 1785 MHz / DL: 1805 – 1880 MHz
RF Output Power	Up to 4 x 5W per TX path (0.1dB steps down to 50mW)
LTE Carriers	Up to 4 carriers
Capacity	OBW up to 75MHz, IBW: 75MHz
Bandwidth Support	1.4, 3, 5, 10, 15, 20 MHz
Physical Size	DC: ~4L / ~5.5Kg; AC: ~4.5L / ~6.5Kg
Synchronization	CPRI
Interfaces	2 CPRI ports Fronthaul (2 x 9.8Gbps), 1 port for External alarm
Antenna	Configuration: 4T4R or 2T2R MIMO (Directional Panel or External)
Operating Temperature	-40 °C to +55 °C
Mounting Options	Wall, Pole, Strand, Enclosure, Bookshelf
Ingress Protection	IP65
Power Consumption	110W (Typ.); 150W (Max)
3GPP Specification	3GPP Medium Area
Input Power	DC: - 40.5V to -57V AC: 80V to 276V (via external AC/DC converter)



AHEJ

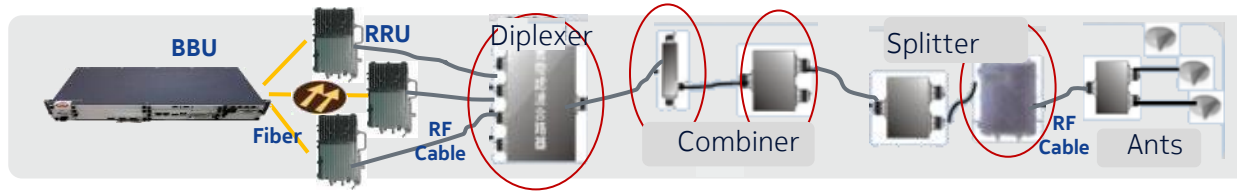
Airscale Indoor Solution (ASiR)



Difficulties to migrate traditional DAS toward 5G services

Existing network components support feasibility

- Existing Diplexer/Combiner doesn't support cmWave 3.5GHz or 4.9G frequency bands; needs new components (antennas, Diplexer/Combiners)

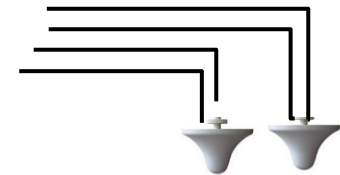


- Need higher power RRU and more Ant point to achieve same coverage, due to higher pass loss for 3.5Ghz & 4.9Ghz.

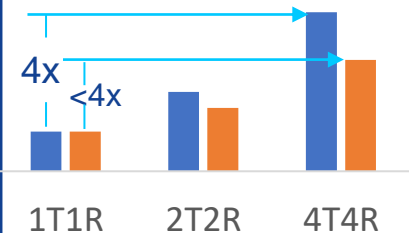
Band	Edge Perf. (dBm)	BS TX (dBm)	TX degradation (2.3G example)	Space degradation (2.3G example)	Physical link degradation
2.3G	RSRP \geq -105	CRS =12.2	0	0	0
3.5G	RSRP \geq -105	CRS =12.2	3~6	4	7-10
4.9G	RSRP \geq -105	CRS =12.2	5~9	7	12-16

High Cost

- 4T4R for indoor
 - Double NE cost
 - Complex SI
 - Uncertain performance



■ Cost ■ Performance



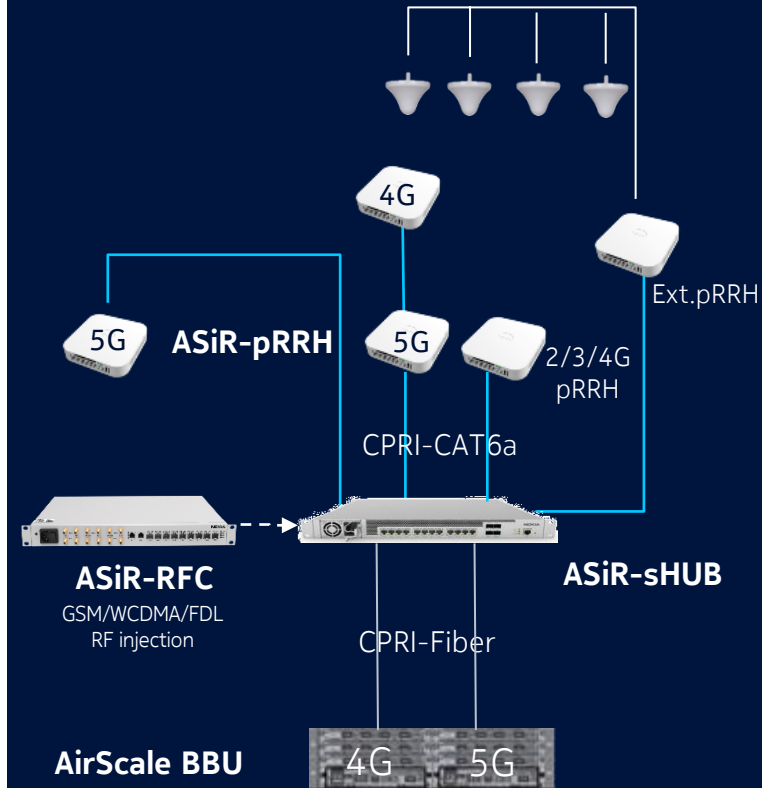
AirScale indoor Radio (ASiR)

Designed for 5G Evolution

Specification	LTE	5G
Radio access	Band 1(W+L) + Band 3/7/8(LTE) Band 40(LTE) + Band 3(G+L) Band 2(W+L)+ Band 66/7(LTE)	n78 n41
RF output power	2 x 200mW per band (40MHz OBW per band)	4 x 250mW per band (100MHz OBW)
Physical size	Volume: ~ 2L, Weight: ~2kg	
Fronthaul	1 x 10G Base-T Copper (RJ45), CPRI w/ IQC	2 x 10G Base-T Copper (RJ45), CPRI w/ IQC

Benefits

- 2G/3G/4G/5G concurrent platform
- Common Airscale BBU with macro, E2E monitoring
- High RF power pRRHs w/ integrated or external antennas
- Flexible deployment with cell combination & splitting
- Daisy Chain 5G + 4G pRRHs (power and fronthaul)
- High performance with D-MIMO, carrier aggregation



AirScale indoor Radio (ASiR)

Best Designed Multi-Technology Solution for Flexible Deployment



ASiR-pRRH

- Tri-bands support – **3 boxes into 1**
- 40MHz OBW / band , 100MHz OBW / 5G band – **Expansion flexibility**
- 200~250mW output power – **Wide coverage, high ceiling support, cost saving**
- Integrated / External antenna variants – **Extend deployment**
- 4G-5G chaining – **4G/5G co-site with just one Cat6a transmission**



ASiR-sHUB

- 12 x 10GBASE-T ports – **The highest pRRH connectivity in industry, perfect for adding 5G**
- 4 x 9.8G backhaul to BBU – Large backhaul capacity to enable **4 sHub chaining**
- 4G/5G concurrent support – **smooth upgrade to 5G**. No hardware change
- Rich feature support (SFN, Virtual 4T4R) – coverage or capacity driven



ASiR-RFC

- Multi-tech RF conversion – **GSM/WCDMA/LTE in one system**
- 3 x 4 RF ports – **Neutral Hosting for multi-vendor scenario**
- 8 x 9.8G SFP ports – Large number of connections to sHubs



NOKIA

AirScale Indoor Products

2G/4G ASi-ANT

Concurrent 2G/4G Mode

- B3/B40 FDD/TDD LTE
- 2G GSM support
- Up to 3x20MHz LTE + 2G GSM carriers
- 2x200mW per band
- ~2L / ~2kg
- Integrated omni antenna
- Ethernet fronthaul
- PoE++ input



3G/4G ASi-ANT

Tri-band 4G Support

- B1/B3/B7 FDD LTE
- 3G UMTS support
- Up to 3x20MHz LTE + 3G UMTS carriers
- 2x200mW per band
- ~2L / ~2kg
- Integrated omni antenna
- Ethernet fronthaul
- PoE++ input



5G ASi-ANT

4T4R 5G NR Small Cell

- 3.5GHz band
- Up to 100MHz carrier
- 4x250mW
- ~2.5L / ~2.5kg
- Integrated omni antenna
- Ethernet fronthaul
- PoE++ input
- Daisy chaining with 4G ASi-ANT



ASi-HUB

CPRI to 10GBASE-T conversion

- 2G/3G/4G/5G ready
- PoE++ output to ASi-ANT
- 12 10GBASE-T ports for flexible SFN configuration
- 4 fiber CPRI links for AirScale BBU interface and ASi-HUB cascading
- 19" rack mountable



RF Converter (ASi-RFC)

RF to CPRI conversion

- 1800MHz GSM & 2100MHz UMTS RF conversion
- 10MHz GSM & 20MHz UMTS
- 8 fiber CPRI links to ASi-HUB
- 19" rack mountable



AirScale Indoor Solution

- Next generation indoor solution with a centralized architecture comprising ASi-ANT, ASi-HUB, RFC and AirScale BBU
- Support 2G/3G technology via RFC which converts 2G/3G RF signals into CPRI
- 5G-ready and can be evolved into 4G+5G mixed network on the same platform

Benefit

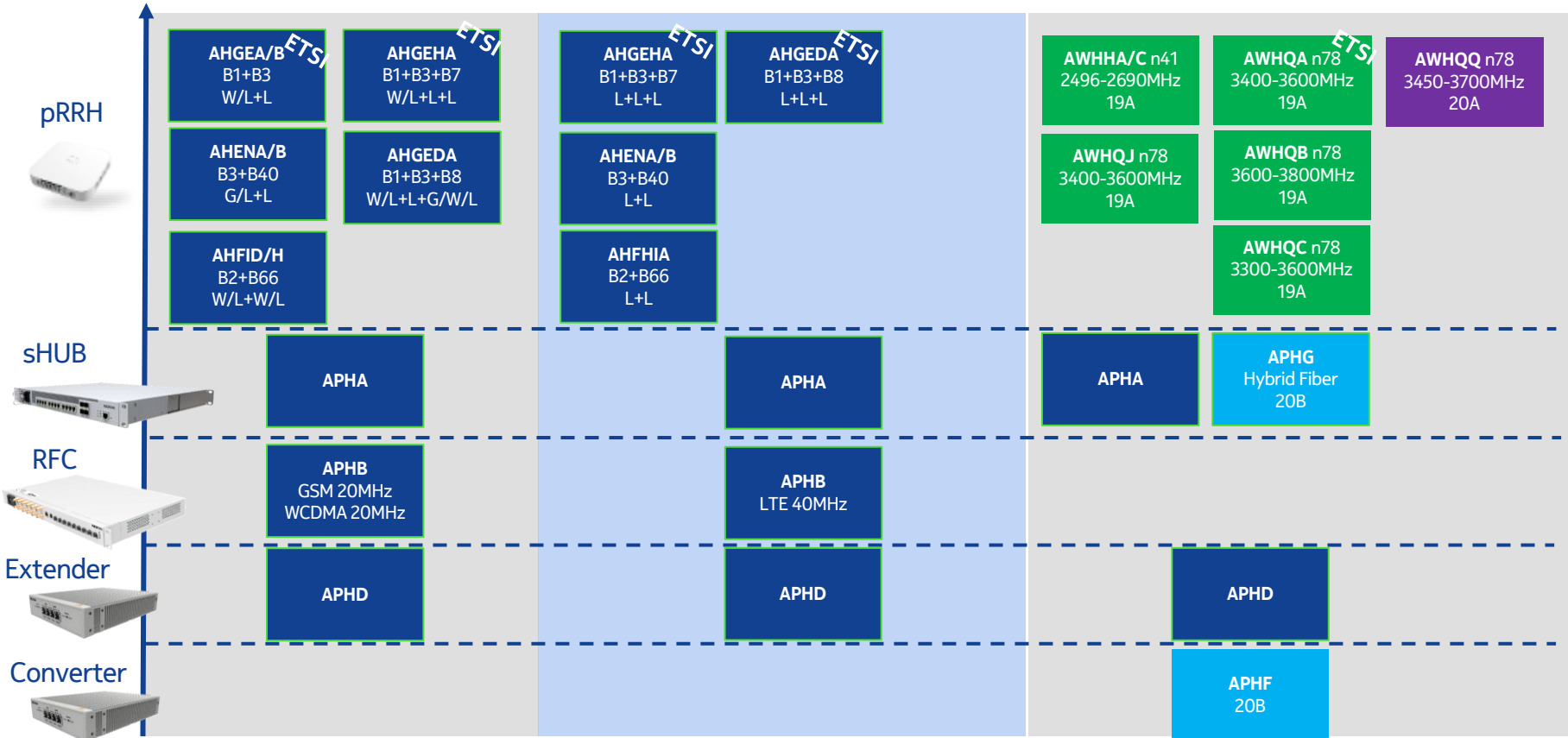
- Improved FZ SFN indoor solution
- Low cost, small form factor, macro capacity
- Architectural flexibility allowing graceful 5G insertion and easy extend to outdoor solution

Nokia AirScale Indoor solution readiness with different spectrums

2G / 3G

LTE

NR



ASiR-pRRH (pico RRH) – AHGEDA LTE B1+B3+B8

Specification	Details					
LTE Access	Band 1 + Band 3 + Band 8 (three RF bands)					
Band Frequency	1 st band		2 nd band		3 rd band	
	Band 1 (Full Band) UL: 1920–1980MHz DL: 2110–2170MHz		Band 3 (Full Band) UL: 1710–1785MHz DL: 1805–1880MHz		Band 8 (Full Band) UL: 880–915MHz DL: 925–960MHz	
RF Output Power	50 to 200mW per Tx Path		50 to 200mW per Tx Path		50 to 200mW per Tx Path ¹	
Carriers	Up to four LTE carriers per unit; Up to two carriers ² per band					
	4G LTE: Up to two 20MHz	3G UMTS: Up to one 15 MHz DAS carrier ³	4G LTE: Up to two 20MHz	No 2G/3G support	4G LTE: Up to two 10MHz	2G GSM / 3G UMTS: Up to one 15 MHz DAS carrier ³
Carrier Bandwidth	5, 10, 15, 20MHz	Up to 15MHz	5, 10, 15, 20MHz	N/A	5, 10MHz	Up to 10MHz for GSM Up to 15MHz for UMTS
Physical Size	Dimensions: 210mm x 210mm x 50mm; Volume: 2.2L, Weight: 2kg					
Synchronization	CPRI timing recovery					
Fronthaul port ⁴	One 5GBASE-T Copper (CPRI over 5GBASE-T)					
Antenna	Configuration: 2 Tx/2 Rx (per band); Types: Integrated Omni; Nominal Gain: ~0dBi					
Input Power	PoE++ (802.3bt type 3), DC input via AC adapter is not supported					
Power Consumption	Max (design): 50W @ 40°C					
Regulatory	ETSI					

1. May require Tx power back off on B8. Under study.

2. Contiguous carrier only.

3. The DC-2021-Nokia contain multiple 2G/3G carriers. 2G carrier support on this 4G ASiR-pRRH platform is only for Chinese markets.

4. here is no dedicated local maintenance port. Local maintenance will be done via console port on ASiR-SHUB.

AirScale Indoor Radio System Solution

ASiR-pRRH Benefits

- Centralized flexible architecture enabling graceful 5G insertion
- 2G/3G support via RF converter
- Best performance vs. size (up to two 2x200mW bands)
- High capacity
- 256QAM, Carrier Aggregation
- Carrier-grade software quality
- Proven plug & play for light touch install
- Enhanced scaling via SFN



AHGEDA: 475175A

ASiR-pRRH (pico RRH) – AWHQA/AWHQJ 5G n78

Specification	Details	5G 19A
5G Access	n78 (Band 42 frequency range)	
Band Frequency	UL: 3400-3600MHz DL: 3400-3600MHz	
RF Output Power	AWHQA: 50 to 250mW per Tx path; AWHQJ: 50 to 200mW per Tx path;	
RF Bandwidth	OBW: 100MHz; IBW: 100MHz	
Carriers	Up to one 5G NR carrier	
Carrier Bandwidth ¹	100MHz	
Physical Size ²	Dimensions: 210mm x 210mm x 55mm Volume: 2.3L, Weight: 2.1kg	
Synchronization	CPRI timing recovery	
Fronthaul Port ³	Two 5G/10GBASE-T Copper; Port Type: RJ45 Ethernet; (Support 9.8Gbps CPRI over 10GBASE-T with and without IQ compression.)	
Antenna	Configuration: 4 Tx/4 Rx (per band) AWHQA: integrated omni, ~0dBi nominal gain; AWHQJ: External antenna (SMA female)	
Power Supply	PoE++ (802.3bt compliant PoE interface); Type 4 as PD, Type 3 as PSE for daisy-chaining with 4G ASiR-pRRH; DC input via AC adapter is not supported	
Regulatory	AWHQA: ETSI, China MIIT/SRRC; AWHQJ: China MIIT/SRRC	
Power Consumption	Max (design): 50W @ 40°C	

1. 20, 40, 50, 60, 80MHz support is dependent on SW availability.

2. Physical size and design is subject to change during development phase.

3. There is no dedicated local maintenance port. Local maintenance will be done via console port on ASiR-SHUB.

AirScale Indoor Radio System Solution

5G ASiR-pRRH Benefits

- Centralized flexible architecture
- Best performance vs. size
- Up to 4x250mW Tx output power
- 100MHz BW carrier, 256QAM
- Carrier-grade software quality
- Proven plug & play for light touch install
- Enhanced scaling via SFN



AWHQA: 474753A

AWHQJ: 474979A

ASiR-pRRH (pico RRH)



Airscale Indoor Radio ASiR-sHUB (APHA)

Specification	Details
Type	CPRI to CPRI over 10GBASE-T converter PoE++ power injector
ASiR-pRRH interface port	Twelve 5G/10GBASE-T copper (CPRI over 10GBASE-T fronthaul)
BBU interface	Four SFP ports for 9.8Gbps CPRI interface (also used for ASiR-sHUB chaining and 2G/3G RF converter interface)
Maintenance port	One 100/1000BASE-T copper.
PoE output power	94W per ASiR-pRRH interface port
DC voltage of PoE output	57 V DC
Input power	100 to 240 VAC, 50/60Hz
Output connection	PoE++ (802.3bt type3 / type 4)
Dimensions ¹	438mm x 360mm x 43.6mm; 19" rack mountable, 1 RU height
Weight ¹	~10kg

AirScale Indoor Radio System Solution ASiR-sHUB Benefits

- 2G/3G/4G/5G CPRI ready
- CPRI to 10GBASE-T conversion
- Power injection into ASiR-pRRH via PoE++
- Twelve 10GBASE-T ports for flexible SFN configuration
- Four SFP ports allowing star/chaining topologies



APHA

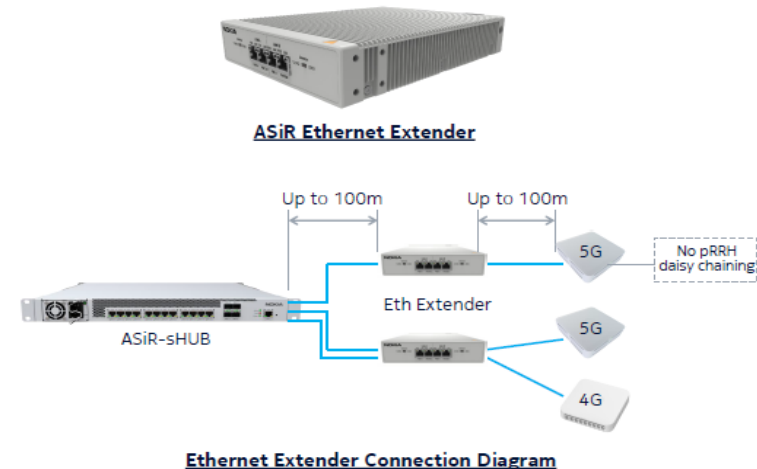
ASiR Dual-port Ethernet Extender APHD

Specification	Details
Type	PoE extender which enables PD (ASiR-pRRH/MBI/SBI) to be located up to 200m from PSE (ASiR-sHUB/PoE power injector)
PSE / PD interface port	Four RJ45 1GBASE-T/5GBASE-T/10GBASE-T copper; Two ports towards PSE (ASiR-sHUB/PoE power injector) and two ports towards PD (ASiR-pRRH/MBI/SBI)
Power level class	IEEE802.3bt Class 8 PD, IEEE802.3bt Class 6 PSE; Up to 60W passed through from PSE
PD available power	>50W with Cat.6A cable (23 AWG or better gauge) >40W with Cat.5e cable (24 AWG or better gauge) for each line at 200m from PSE.
DC voltage of PoE output	57 V DC
Input power	No external input power required. External input power port not supported.
Maintenance port	No maintenance port; Plug-and-play installation

1. Physical size and design is subject to change during development phase.
2. 4G/5G ASiR-pRRH daisy-chaining is not supported.

ASiR Dual-port Ethernet Extender Benefits

- Extends distance between (ASiR-sHUB) and (ASiR-pRRH) from 100m to 200m
- Simple plug-and-play deployment without external power and configuration required.
- Insures Ethernet integrity and PoE line voltage across full distance of 200m
- Supports either single line extension or dual line extension
- Applicable to ASiR/MBI/SBI

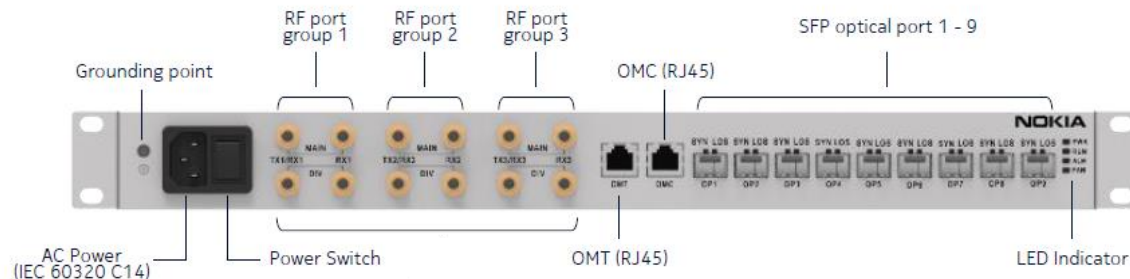


AirScale Indoor Radio – ASiR-RF Converter

Specifications¹

Details

Type	RF analog signal convert to CPRI digital data
RF signal feed port	Twelve SMA connectors in total for three RF bands – Three sets of RF feed ports, each set includes four ports: TxRx-Main/Tx-Main, Rx-Main, TxRx-Div/Tx-Div, Rx-Div. – Simplex/Duplex Tx/Rx port
ASiR-sHUB Interface Port	Eight SFP ports for 9.8Gbps CPRI interface
Maintenance port	Two 100BASE-T interface with RJ-45 connector
Bands	Multi-Band Capable (e.g., B1, B3, B7)
Bandwidth Support	GSM: 20MHz, WCDMA: 20MHz, LTE: 40MHz
Dimension	1U (445mm(W) × 260mm(D) × 44mm(H))
Weight (approx.)	7.5kg
Input power	100 - 240VAC, 50/60Hz , Power consumption: 60W max
Synchronization	CPRI timing



AirScale Indoor Radio ASiR-RFC Benefits

- Inject GSM, WCDMA and LTE signal from external BTS
- Physical connectivity with ASiR-sHUB
- CPRI interface to ASiR-sHUB
- Multi-Tech RF conversion
- Operation and Management

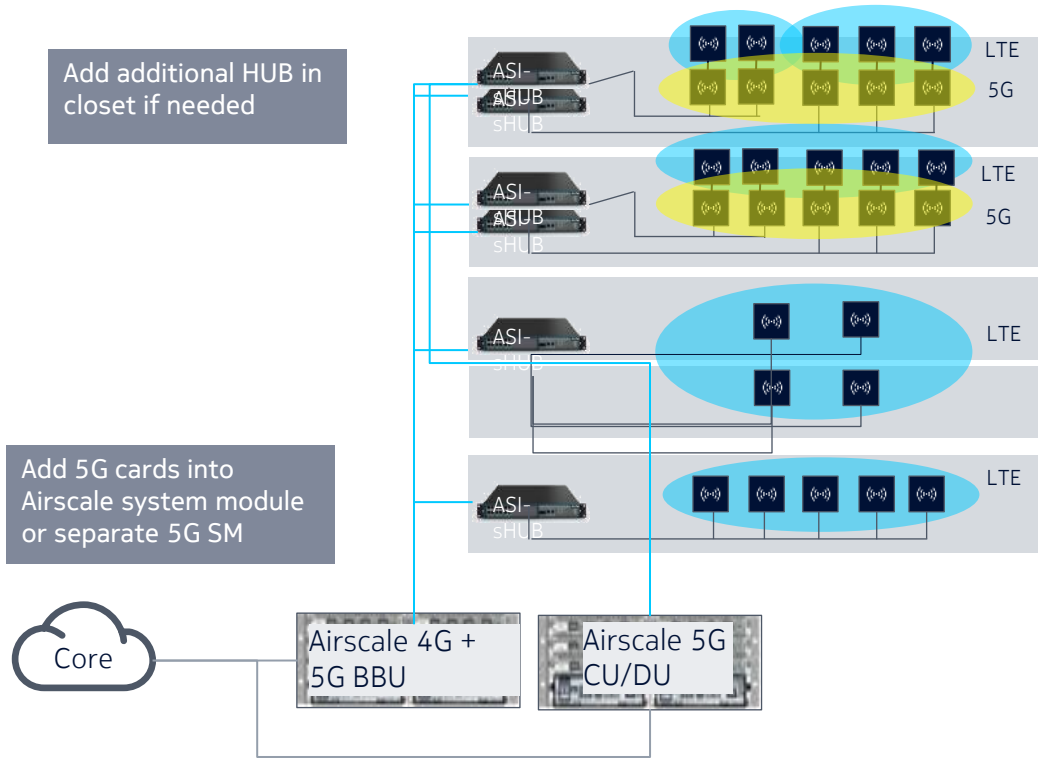
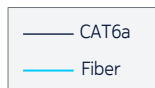


APHB

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Airscale Indoor Deployment Strategy

4G and 5G deployments



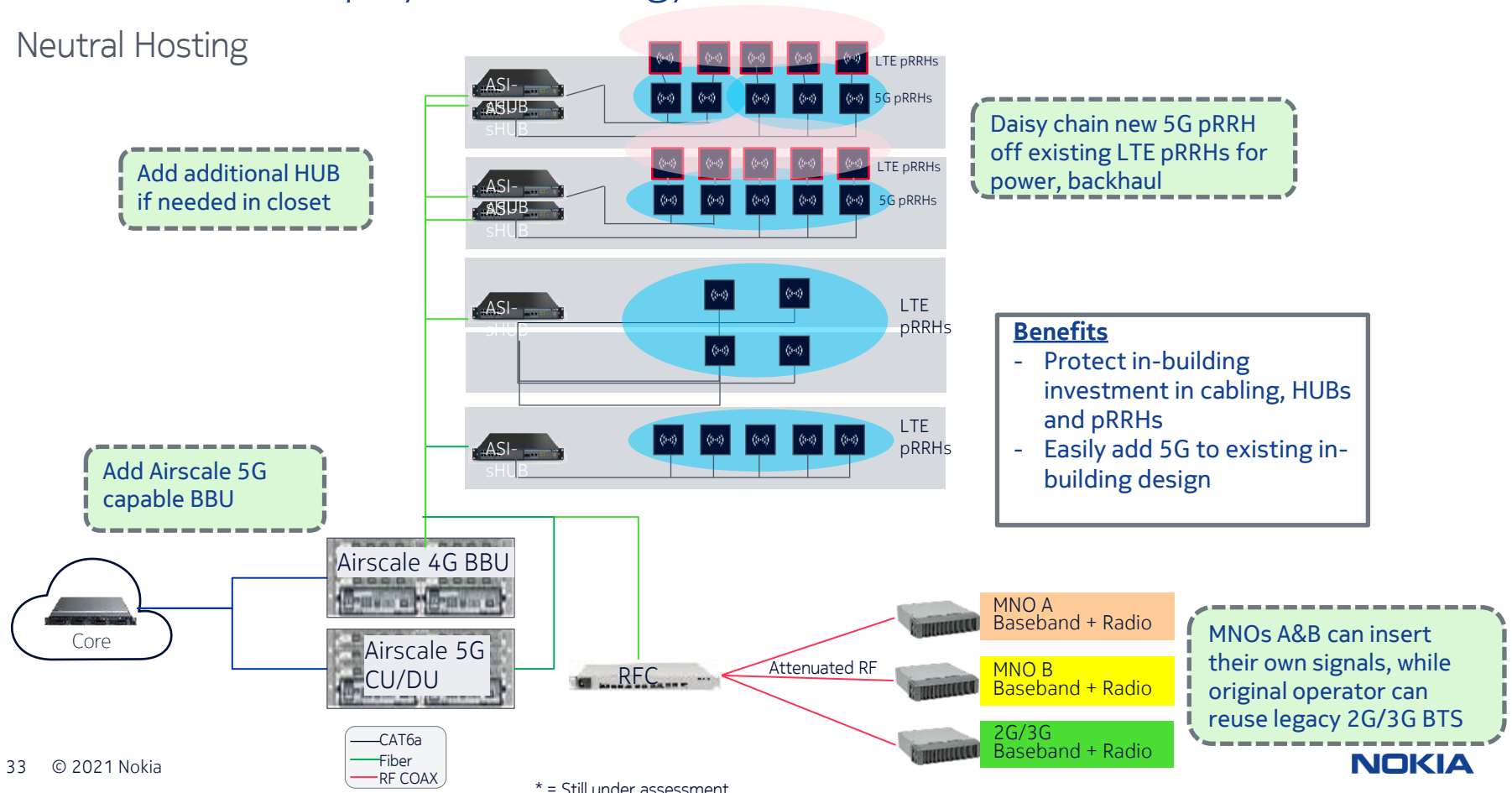
Daisy chain new 5G pRRH off existing LTE pRRHs for power and backhaul

Benefits

- Protect in-building investment in cabling, HUBs and pRRHs
- Easily add 5G to existing in-building design

Airscale Indoor Deployment Strategy

Neutral Hosting

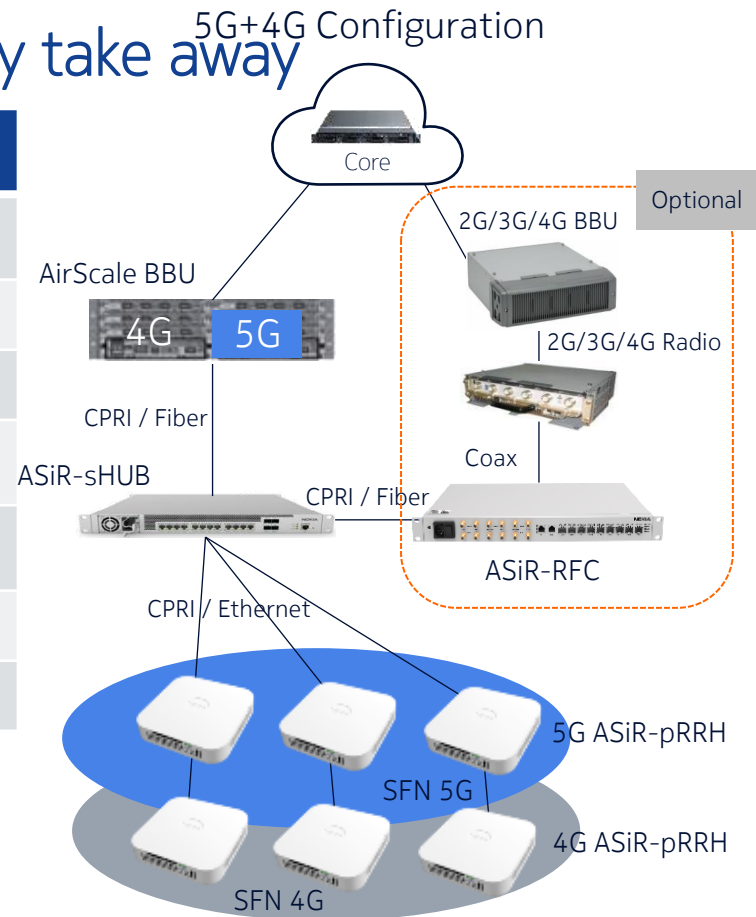


AirScale indoor Radio (ASiR) solution – Key take away ^{5G+4G Configuration}

Solution components	18A	19	19A
ASiR-pRRH B1+B3 (2100+1800)	✓		
ASiR-pRRH B3+B40 (1800+2300)	✓		
ASiR-pRRH B1+B3+B7 (2100+1800+2600)	✓		
ASiR-pRRH B1+B3+B8 (2100+1800+900)			✓
ASiR-sHUB	✓		
ASiR-RFC (2G/3G/4G RF injection)	✓		
ASiR-pRRH 5G (AWHQA/J)		✓	✓

Benefits:

- 1) Leverage existing 2G, 3G and 4G base station for multi-RAT support
- 2) 2G/3G/4G services are possible supporting with single ASiR-pRRH
- 3) 4T4R D-MIMO and 2CC/3CC CA with dual/triple bands ASiR-pRRHs
- 4) 5G ready solution architecture for in-building coverage deployments



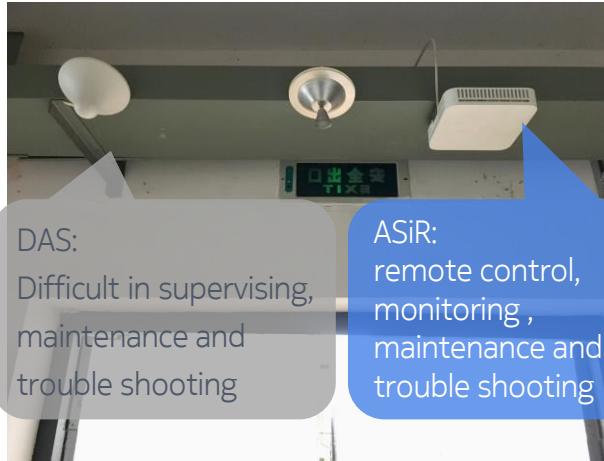
5G19A

NOKIA

ASiR vs. DAS comparisons in customer's daily operations



DAS: too many components, high maintenance cost.

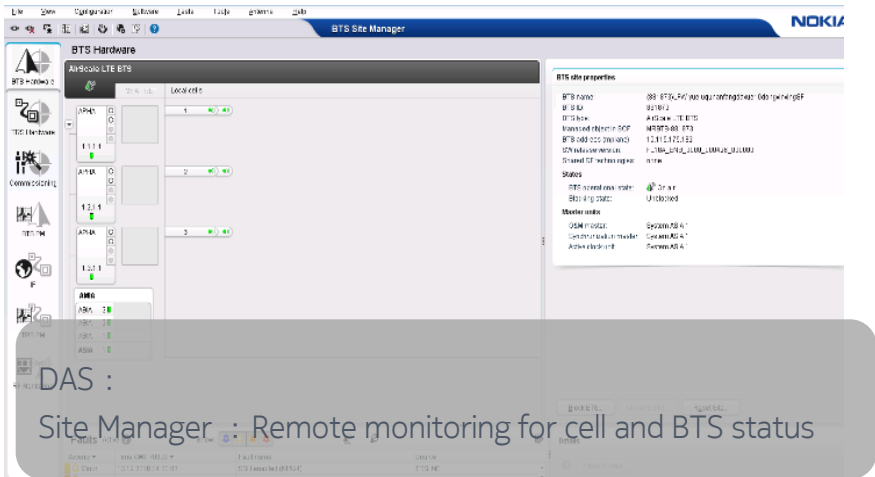


DAS:
Difficult in supervising,
maintenance and
trouble shooting

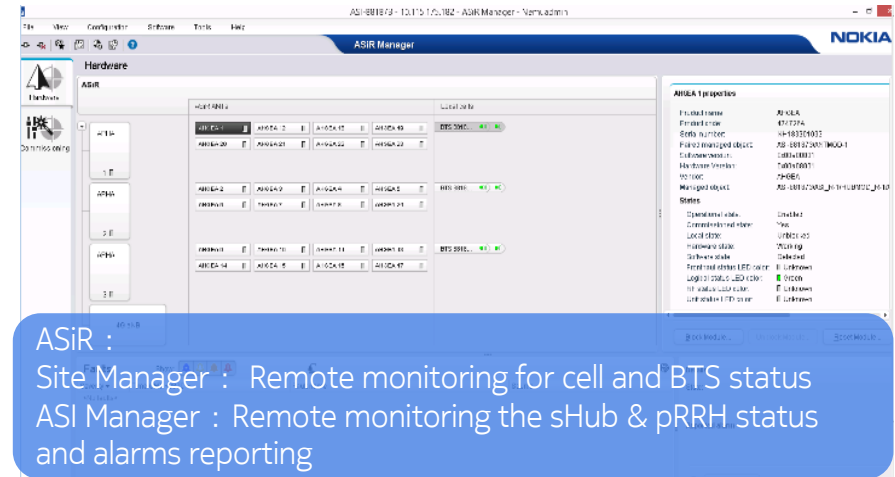
ASiR:
remote control,
monitoring,
maintenance and
trouble shooting



ASiR:
simple design, lower maintenance cost



DAS :
Site Manager : Remote monitoring for cell and BTS status



ASiR :
Site Manager : Remote monitoring for cell and BTS status
ASi Manager : Remote monitoring the sHub & pRRH status
and alarms reporting

China International Import Expo, Nov. 2019

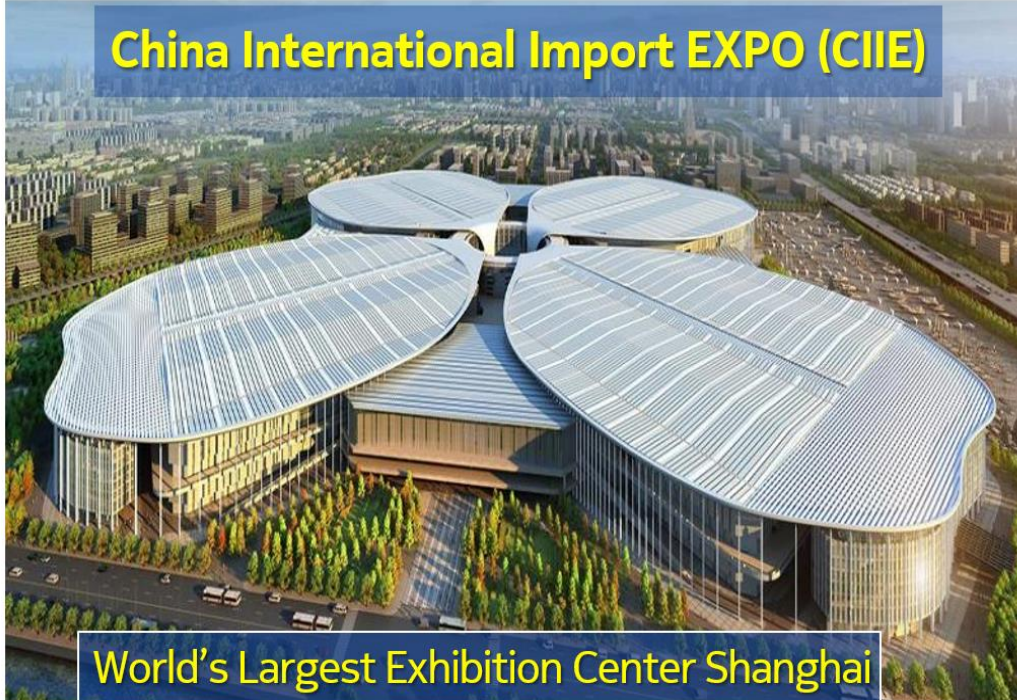
World's largest Exhibition Center in Shanghai

China Mobile

Expo Center

4G+5G

China International Import EXPO (CIIE)

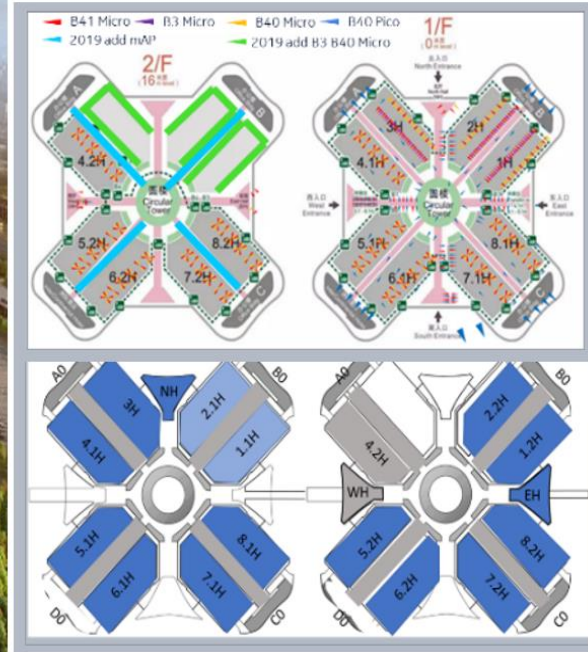


World's Largest Exhibition Center Shanghai

Total area (m²)
1.72M

Daily peak visitors
227k

6 days traffic UL+DL
54TB



FlexiZone
Micro+Pico
845

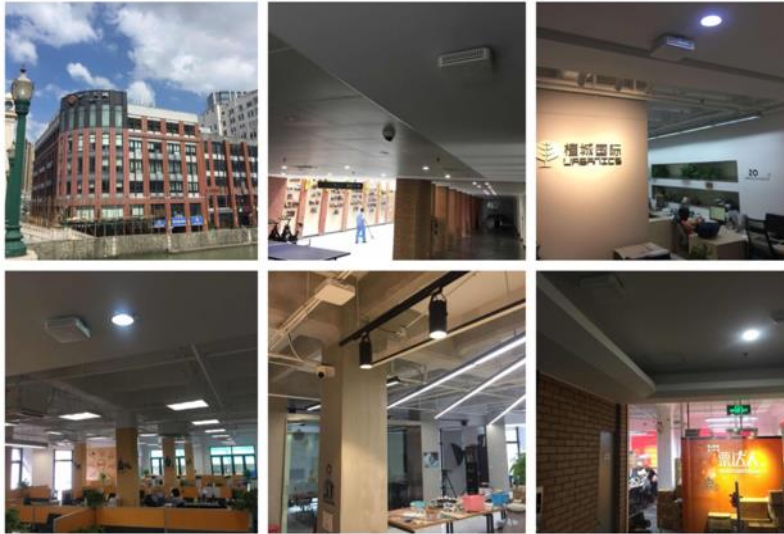
5G SC's:
ASiR 456
sHUB 61
mRRH 27

- | Small halls/Offices/Aisles | New halls |
|----------------------------|------------------------|
| • 295.000m ² | • 56.000m ² |
| • ASiR pRRH: 456 pcs | • AS mRRH: 27 pcs |
| • height: 5-10m | • height: ≥15m |

AirScale indoor Radio (ASiR) references

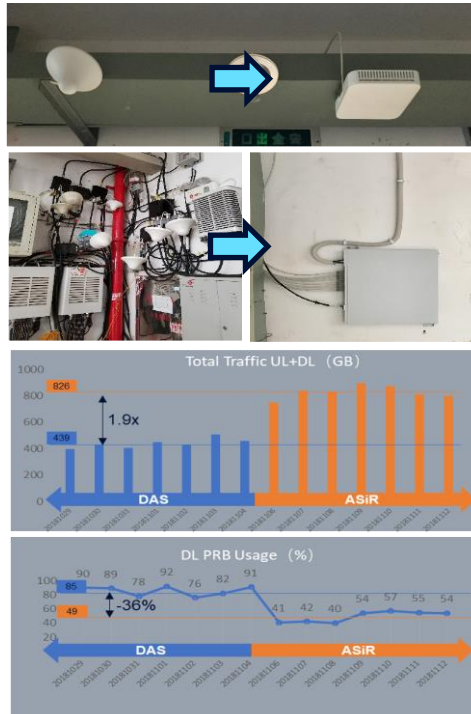
5G ready indoor solution

Shanghai China for office (FDD)



- 54x B1+B3 ASiR-pRRHs deployed in the office building
- Fast Deployment and integration with existing network
- >20K pRRHs will be deployed in Shanghai before Jun 2019

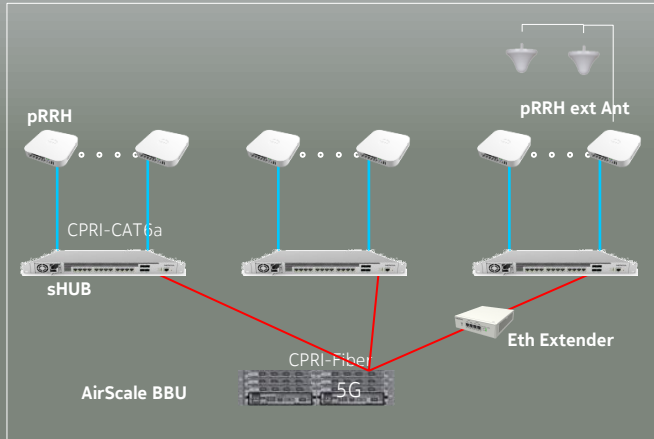
Hunan, China for DAS replacement



- China Unicom is using the ASiR to replace high traffic area DAS system
- The replacement will provide:
 - Capacity boosting
 - Easy maintenance
 - Low OPEX
- In Hunan, China, 3 sHubs + 24 pRRHs (6*20Mhz) are used for one of the high traffic dormitory university building
- Data throughput increase 90% after replacement: DL 130% and Uplink 30%. DL PRB usage lower 36%

AirScale Indoor Radio - Stunning 5G Indoor performance

Shanghai Mobile CIIE 5G Indoor Enhancement



NR Carrier: 1x100MHz @n41 (4layers 256QAM)

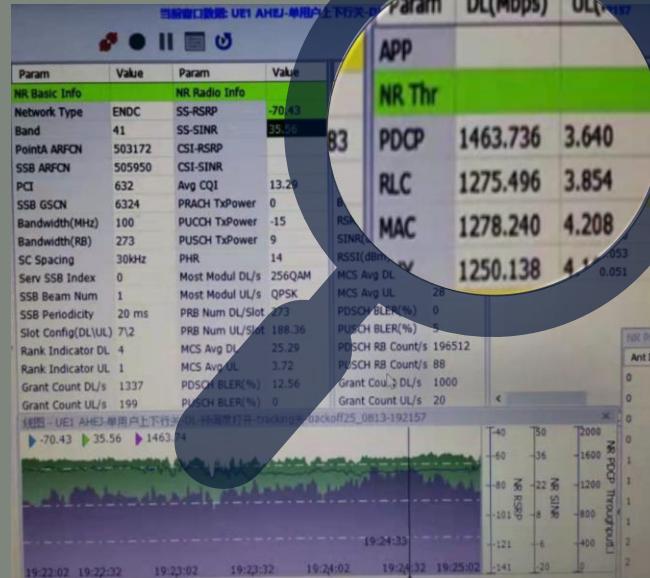
LTE Anchor Carrier: 1x20MHz @B3 (AHEJ 2layers 256QAM)

1463Mbps

FTP Max DL Speed

1257Mbps

SPEEDTEST Max DL



5G ASiR deployment plan

- n41 pRRH 501 pcs
- n41 pRRH ext antenna 88 pcs
- ASiR SmartHUB 61 pcs
- Ethernet extender 29 pcs

NSA architecture

NOKIA

