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Flexi Multiradio 10 BTS Transmission Description

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Summary of changes

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

This document is common for all Radio Access Technologies (RAT). You may find here information about solutions that are not available or supported in a specific SW release or RAT. Table Table 1: Releases covered by the document lists all SW releases covered by the content of this document. For features supported in your SW releases, see respective feature documentation chapter in the system library.

Table 1 Releases covered by the document

Product	Release
GSM/EDGE (BSS)	GSM 17
WCDMA RAN	WCDMA 17, WCDMA 18
Long Term Evolution	FDD-LTE 16A, FDD-LTE 17A, FDD-LTE 18, FDD-LTE 18SP
TD LTE	TD-LTE 16A, TD-LTE 17A, TD-LTE 18, TD-LTE 18SP
Single RAN	SRAN 16.10, SRAN 17A, SRAN18

Changes between issues 18 (2017-11-14) and 19 (2018-01-16)

EU compliance

Section has been updated.

Changes between issues 17 (2017-06-26) and 18 (2017-11-14)

Interfaces

- Note on 100Base-LX/BX/FX has been added.

Changes between issues 16 (2017-01-26) and 17 (2017-06-26)

Nokia 9500 Microwave Packet Radio

- Section has been added.

#unique_5/unique_5_Connect_42_v52443779

- EU Directive has been updated.

1 Overview of Flexi Multiradio 10 Base Station transmission

1.1 Outdoor System Module FSMF

Flexi Multiradio 10 BTS System Module FSMF is equipped with two integrated transport interfaces: electrical Gigabit Ethernet (GE) interface (EIF1) and optical interface (EIF2/RF/6).

The latter is SW configurable for transport purposes or for RP3-01 interface. To operate in either (transport or RP3-01), it requires a Small Form-factor Pluggable (SFP). Both Ethernet interfaces provide a physical interface to the backhaul network.

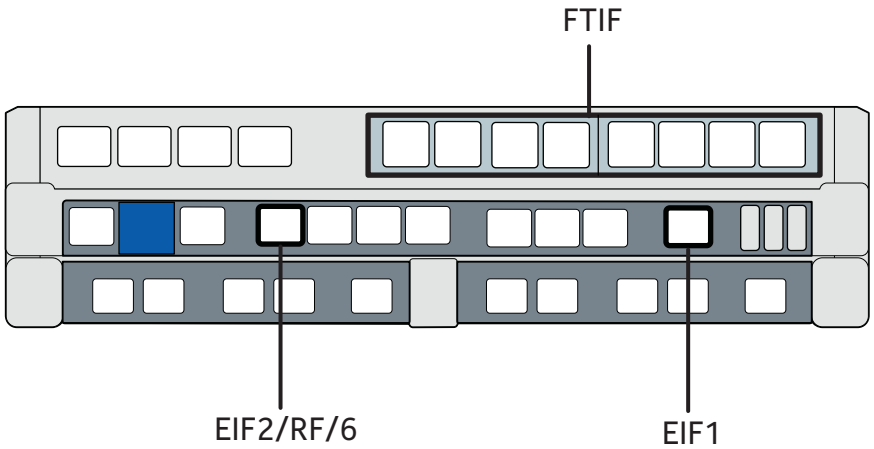
Note: In WCDMA and LTE the optical interface (EIF2/RF/6) is available as transport interface EIF2 if not used for RP3-01 connection.

Note: In GSM the optical interface (EIF2/RF/6) is available as transport interface EIF2 if the optional transmission sub-module (FTIF) is not deployed.

Flexi Multiradio 10 System Module FSMF is optimized for Ethernet Transport, and the HW supports the following integrated transport functions (without the optional transmission sub-module):

- 1 x 100/1000Base-T Ethernet port
- 1 x optional optical SFP (depends on configuration)
- Ethernet based chaining and switching across up to two interfaces
- IEEE1588-2008, Synchronous Ethernet, 1PPS and 2.048MHz[1)]
- LTE S1/X2, or WCDMA Iub/IP, or GSM Packet Abis over Ethernet backhaul interfaces

Figure 1 Flexi Multiradio 10 BTS System Module and transport interfaces



1) This function is supported from release RL35TD onwards.

Table 2 Flexi Multiradio 10 BTS System Module transmission interfaces

Interface	Capacity	Connector	Notes
TRS Interface (electrical)	1 x 100/1000 Mbit/s	RJ45	None
TRS/RP3-01 Interface EIF2/RF/6 (optical, requires SFP)	1 x 1000 Mbit/s	SFP (LC)	• Interface available if not used for RP3-01 connection. • Only 1 GE optical is supported. • For transport SFP requirements see chapter Ethernet Small Form-factor pluggable (SFP) transceivers

Note: Note that for all the technologies (GSM, WCDMA, FD-LTE and TD-LTE) there is a possibility to install an optional transmission sub-module (FTIF) to extend Flexi Multiradio 10 BTS transport capabilities.

The FTIF transmission sub-module is needed, for example: for GSM legacy Abis support and for WCDMA the support of ML-PPP or IMA over multiple TDM ports.

1.2 Indoor System Module FSIH

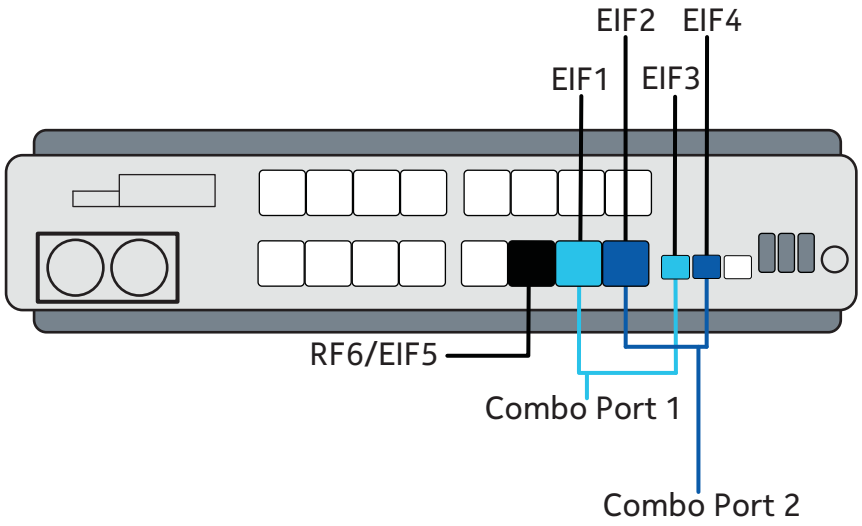
Note: Indoor System Module FSIH is supported from RL45TD release onwards.

Core module offers up to three integrated Ethernet interfaces that can be used simultaneously:

- One optical shared port
- Two Combo ports in the following combinations:
  - 2 x 100/1000Base-T, or
  - 2 x optional optical SFP, or
  - 1 x 100/1000Base-T and 1 x optional optical SFP

The optical shared port is available for transport only if it is not used for RF Module connectivity. FSIH supports Synchronous Ethernet Generation over all the integrated Ethernet interfaces.

Figure 2 FSIH System Module and transport interfaces



1.3 Nokia 9500 Microwave Packet Radio

Nokia 9500 Microwave Packet Radio solution consists of a combination of a radio unit - Microwave Packet Transceiver (MPT) and a networking unit - Microwave Service Switch (MSS). The product is supported with FSMF and AirScale System Modules.

Nokia 9500 Microwave Packet Radio (MPR) product portfolio offers a comprehensive set of microwave solutions for shorthaul, longhaul and small cell backhaul applications for telecom operators, public sectors and large enterprises. Based on a full packet architecture, it offers superior performance with its high radio density and unique multiservice link aggregation capability. This common transport of legacy TDM and Ethernet traffic positions the 9500 MPR as the ideal product family to seamlessly support backhaul transformation to full packet and provides your network the capacity to evolve.

2 FTIF transmission sub-module

2.1 Overview

FTIF transmission sub-module enhances the connectivity and transport capabilities of Flexi Multiradio 10 Base Station. The sub-module has eight PDH ports (E1/T1/JT1) with RJ48C pin-out on four physical connectors.

Flexi Multiradio 10 System Module with FTIF supports Ethernet Switching across up to three interfaces and 8x E1/T1/JT1 (twisted pair); coaxial connectivity can be provided via baluns.

The sub-module is required:

- for ATM Iub, Dual Iub, and IP Iub over ML-PPP,
- for Dynamic Abis over TDM, Dynamic Abis over IP/Ethernet (TDM pseudowire), and Packet Abis over TDM,
- if collocation (CESoPSN) or synchronization includesTDM,
- if more/other Ethernet interfaces are required than available on Flexi Multiradio 10 System Module,
- if Synchronous Ethernet Generation or PDH synchronization output is required.

Note: CESoPSN/PWE support for FSMF System Module equipped with FTIF transmission sub-module is planned to be introduced with further GSM releases.

Flexi Multiradio 10 System Module integrated Transport and FTIF build a single logical Transport node.

FTIF meets the following standards:

- IEEE 802.3
- ITU-T G.703
- ITU-T G.8262
- ANSI T1.403

2.2 Interfaces

Figure 3 FTIF sub-module front panel - physical layer view

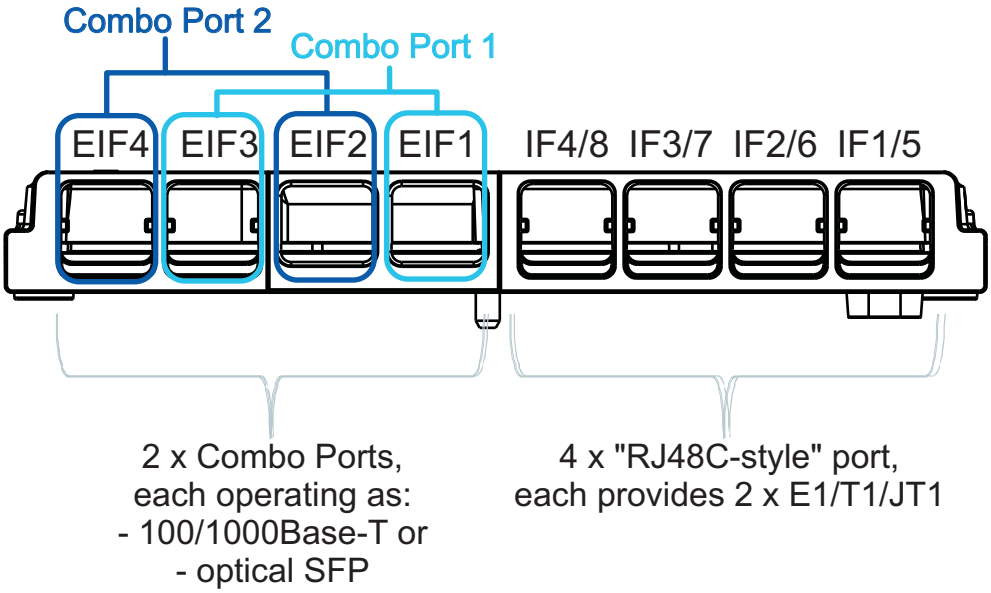
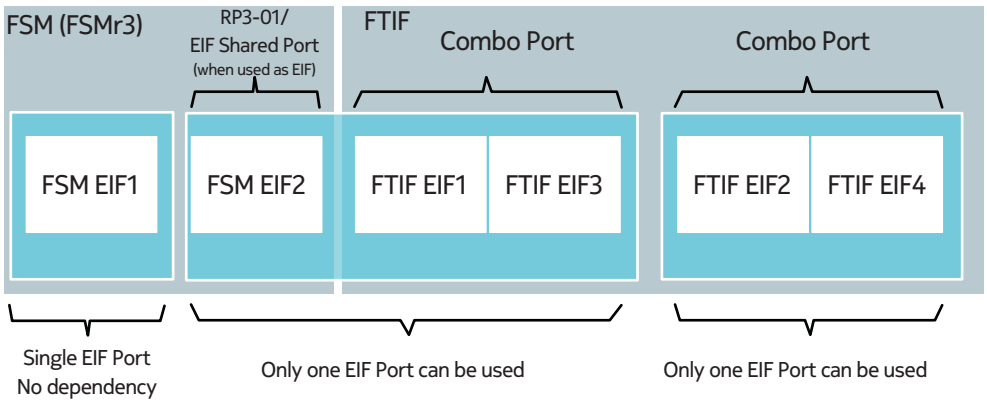


Figure 4 FTIF interfaces - logical layer view



EIF1/EIF3 and EIF2/EIF4 are paired as one combo port.

- The usage of EIF1 and EIF3 as well as EIF2 and EIF4 is mutually exclusive.
- The usage of EIF1/EIF3 on this FTIF and EIF2 on FSMF is mutually exclusive.

The supported optical SFPs 1000Base-BX/LX/SX/ZX and 100Base-FX, LX, and BX are not part of the FTIF delivery.

When using the optional transmission sub-module (FTIF), the following number of interfaces (provided by both the System Module and FTIF) is possible:

- 3 x FE/GE electrical
- 2 x FE/GE electrical + 1 x FE/GE optical
- 1 x FE/GE electrical + 2 x FE/GE optical
- 2 x FE/GE optical

Table 3 FTIF interfaces

Interfaces	Capacity	Tolerance	Connector
2 x Combo Ports; can work as: • 2 x 100/1000Base-T electrical FE/GE, or • 2 x 1000Base-BX/LX/SX/ZX optical GE, or • 2 x 100Base-LX/BX/FX optical FE, or • 1 x 100/1000Base-T + 1 x 1000Base-SX/LX/BX/ZX or 100Base-LX/BX/FX	• 2 x 100/1000 Mbit/s • 2 x 1000 Mbit/s or 2 x 100 Mbit/s • 1 x 100/1000 Mbit/s + 1 x 1000 Mbit/s or 1 x 100 Mbit/s	not relevant	• 2 x RJ45 • 2 x SFP[2)] • RJ45 + SFP
8 x E1/T1/JT1 (100/110/120 ohm, twisted pair)	8 x 2 Mbit/s (E1) 8 x 1.5 Mbit/s (T1)	± 50 ppm (E1) ± 32 ppm (T1/JT1)	4 x RJ48C

Note: FE optical interface (100Base-LX/BX/FX) is supported in the WCDMA technology only.

2.3 Physical and electrical properties

Table 4 FTIF physical and electrical properties

Property	Value
Power consumption (calculated maximum)	10 W
Height	37.5 mm (1.47 in.)
Width	244.55 mm (9.62 in.)
Depth	196.73 mm (7.74 in.)
Weight	1693 g (59.71 oz)

2.4 Contents of delivery

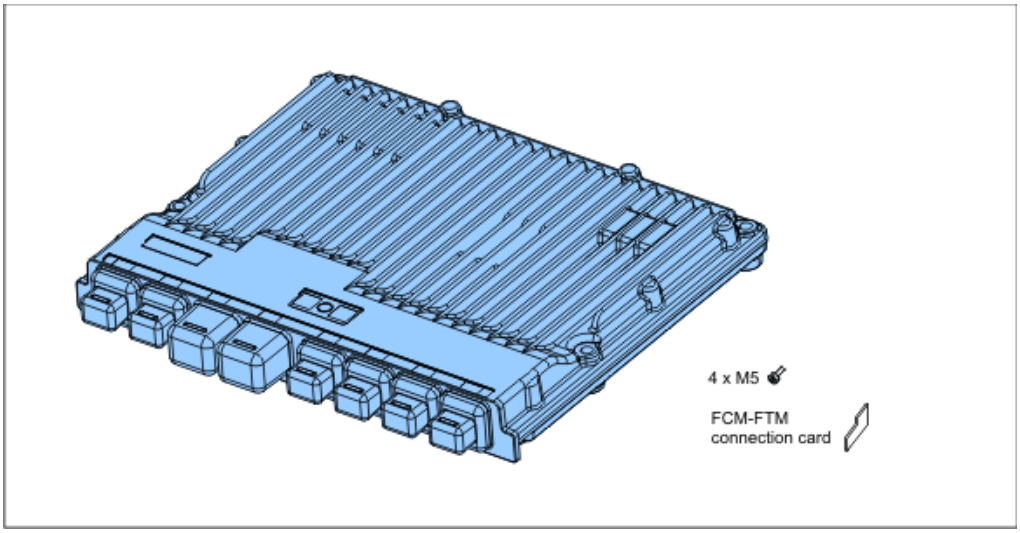
The delivery comprises the following items:

- FTIF transmission sub-module with eight rubber plugs
- 4 x M5 screw

[2)] See section Ethernet Small Form-factor Pluggable (SFP) transcievers.

- 1 x FCM-FTM connector card

Figure 5 FTIF delivery contents



3 Ethernet Small Form-factor Pluggable (SFP) transceivers

The Flexi Multiradio 10 Base Station System Module FSMF is shipped with one electrical 100/1000 Base-T Gigabit Ethernet interface (FSM EIF1). The unit has also an SFP slot (FSM EIF2) that can be either used as a transport backhaul or as an RP3-01 interface. The definition of the interface is done via configuration and the insertion of a suitable optical Small Form-factor Pluggable (SFP) transceiver.

Note: FSM EIF2 supports only optical Gigabit Ethernet SFPs. FTIF combo ports support optical Gigabit Ethernet SFPs and (in WCDMA) Fast Ethernet SFPs.

The following Gigabit Ethernet SFPs for optical backhaul can be ordered from Nokia:

Table 5 SFP variants

Product name	Sales item code	Description
FOSC Optical SFP 1000Base-LX 1310nm SM[3)]	471880A	Optical SFP transceiver, singlemode. It supports fiber length up to 10 km on 9/125 µm. Connector type: LC.
FOSD Optical SFP 1000Base-SX 850nm MM[4)]	471881A	Optical SFP transceiver, multimode. It supports fiber length up to: • 550 m on 50/125 µm • 300 m on 62.5/125 µm.
FOS1 SFP 1000Base-BX 10km, 1490nm/1310nm	473386A	Optical SFP transceiver, singlemode. It supports fiber lengths up to 10 km on 9/125 µm.
FOS2 SFP 1000Base-BX 10km, 1310nm/1490nm	473387A	Optical SFP transceiver, singlemode. It supports fiber lengths up to 10 km on 9/125 µm.
FOS3 SFP 1000Base-BX 40km, 1490nm/1310nm	473388A	Optical SFP transceiver, singlemode. It supports fiber lengths up to 40 km on 9/125 µm.
FOS4 SFP 1000Base-BX 40km, 1310nm/1490nm	473389A	Optical SFP transceiver, singlemode. It supports fiber lengths up to 40 km on 9/125 µm.

Note: Note that SFPs listed in Table 5: SFP variants are for transport only. RP3-01 connection requires different SFP types.

Note: In WCDMA 100Base-LX/BX/FX SFPs are supported on FTIF Transport Sub-module.

3) All FlexiBTS long-haul Gigabit Ethernet outdoor transmission cables are 9/125µm single mode fibers.
4) All FlexiBTS short-haul Gigabit Ethernet outdoor transmission cables are 50/125 µm multimode fibers.

If the SFP is not purchased from Nokia, the used SFP must fulfill the following requirements:

- SFP Multi-Sourcing Agreement (MSA) compliant
- Laser Class 1 compliant
- 1000Base-BX10, 1000Base-LX, 1000Base-SX, or 1000Base-ZX
  The only devices supported are those identified as LX type (SFP E²PROM Address A0h byte 6 = “02h”), SX type (“01h”), or BX type (“40h”).
- 100Base-LX, 100Base-BX10, or 100Base-FX SFPs with compliance codes for LX (SFP E²PROM Address A0h byte 6 = “10h”), BX10 type (“40h”) or FX type (“20h”) are supported in WCDMA.
- Industrial temperature range -40°C...+85°C
- LOS detection pin supported
- Extraction Bail Latch Actuator

Note: Do not use SFPs with MSA direct/standard push pull, dog leg latch actuator, with plastic pull tab, or without any extraction handle.

If the inserted SFP does not comply with the requirements listed above, an alarm (ID 61050) is raised and the laser is not switched on.

Figure 6 Supported actuator types

Note that:

- Only laser class 1 SFPs are allowed for safety reasons.
- Flexi Multiradio 10 Base Station does not support half-duplex mode.
- For the connection to be successful, the remote peers need to have a matching configuration. For example, Auto Negotiation needs to be configured in both the BTS and the remote peer.
- The same SFPs and transport cables can be used with both Flexi Multiradio Base Station and Flexi Multiradio 10 Base Station.

4 Transmission cables

This section describes layouts and pin-maps of cables used for transmission purposes in Flexi Multiradio 10 Base Station. The cable code is imprinted on each cable.

NOTICE: Outdoor cables provided by Nokia are equipped with special rubber gaskets, which ensure that no water or dust gets in and damages the Flexi Multiradio 10 Base Station. Do not remove the rubber gaskets. Do not use other cables than those provided by Nokia. Improper use can lead to serious malfunctions of the system and it is not covered by the product warranty.

Note: To connect twisted pair cables to 75 ohm equipment or interfaces, baluns can be used. For details on the purchase procedure, contact Nokia sales representative.

Table 6 General information on transmission cables

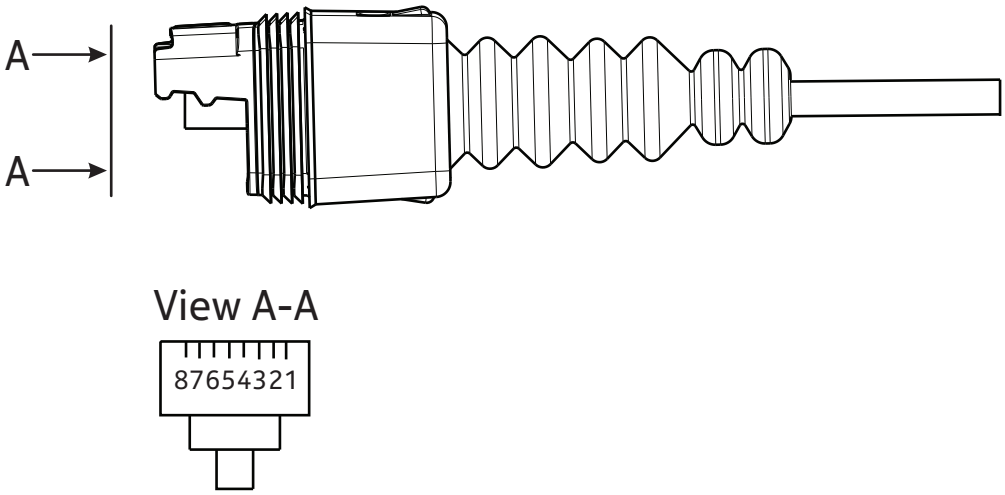
Cable name	Interface	Length [m]	Impedance [ohm]	Cable code	Sales item code
FTCB	E1/T1/JT1	15	120	994970	470309A
FTCV	E1/T1/JT1	30	120	995144	471713A
FTCX	E1/T1/JT1	50	120	995145	471714A
FTCL	E1/T1/JT1	4	120	995340	472348A
FTCY	E1	15	120	995342	472427A
FTCR	Ethernet	15	100	995094	471408A
FTCS	Ethernet	30	100	995148	471717A
FTCT	Ethernet	50	100	995149	471718A
FTCW	Ethernet	4	100	995339	472347A
FTCH	Ethernet optical	15	not relevant	994972	470311A
FTSF	Synchronization	2	not relevant	995304	472509A
FTSG	Synchronization	2	not relevant	995430	472576A
FTSK	Synchronization	2	not relevant	995530	472808A

4.1 E1/T1/JT1 Cables

4.1.1 FTCB, FTCV, FTCX

Twisted pair cable for 1 x E1. One end is equipped with an RJ48C connector and a rubber gasket.

Figure 7 View of FTCB, FTCV, or FTCX cable

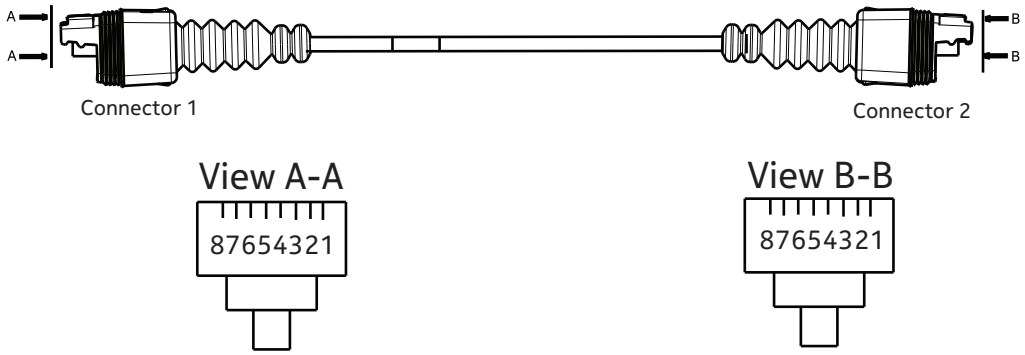


Conn. 1 Pin no.	Wire color
1	brown
2	yellow
3	
4	white
5	green
6	
7	
8	

4.1.2 FTCL

Flexi Multiradio BTS collocation cable. Twisted pair cable for 1 x E1. Both ends are equipped with RJ48C connectors and rubber gaskets.

Figure 8 View of FTCL cable

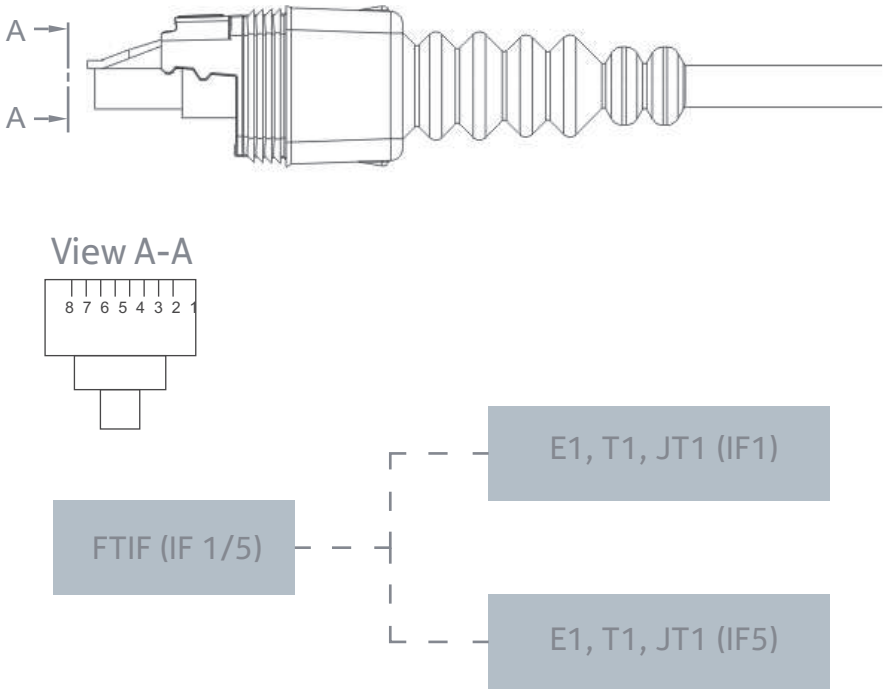


Conn. 1 Pin no.	Wire color	Conn. 2 Pin no.
1	brown	4
2	yellow	5
3		
4	white	1
5	green	2
6		
7		
8		

4.1.3 FTCY

Dual twisted pair cable for 2 x E1. One end is equipped with RJ48C and a rubber gasket. The cable is required to connect two E1 ports to one physical E1 port on FTIF.

Figure 9 View of FTCY cable



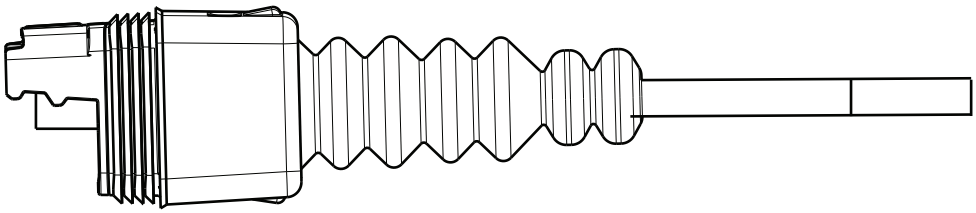
Pin No.	Connector 1 (IF1)	Connector 2 (IF5)	Pair no: color
1			2: white/orange
2	RX1_Ring		2: orange
3		TX2_Tip	3: white/green
4	TX1_Tip		1: blue
5	TX1_Ring		1: white/blue
6		TX2_Ring	3: green
7		RX2_Tip	4: white/brown
8		RX2_Ring	4: brown

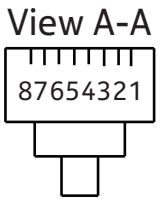
4.2 Ethernet electrical cables

4.2.1 FTCR, FTCS, FTCT

Twisted pair cable for GE. One end is equipped with an RJ45 connector and a rubber gasket.

Figure 10 View of FTCR, FTCS, or FTCT cable



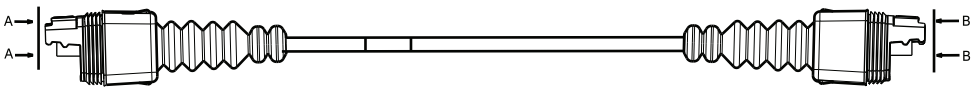


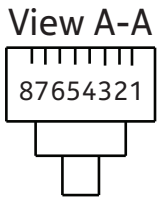
Conn. 1 Pin no.	Pair no: color
1	2: white/orange
2	2: orange
3	3: white/green
4	1: blue
5	1: white/blue
6	3: green
7	4: white/brown
8	4: brown

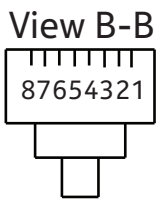
4.2.2 FTCW

Flexi Multiradio/Flexi Multiradio 10 collocation cable. Twisted pair cable for electrical Ethernet. Both ends are equipped with RJ45 connectors and rubber gaskets.

Figure 11 View of FTCW cable





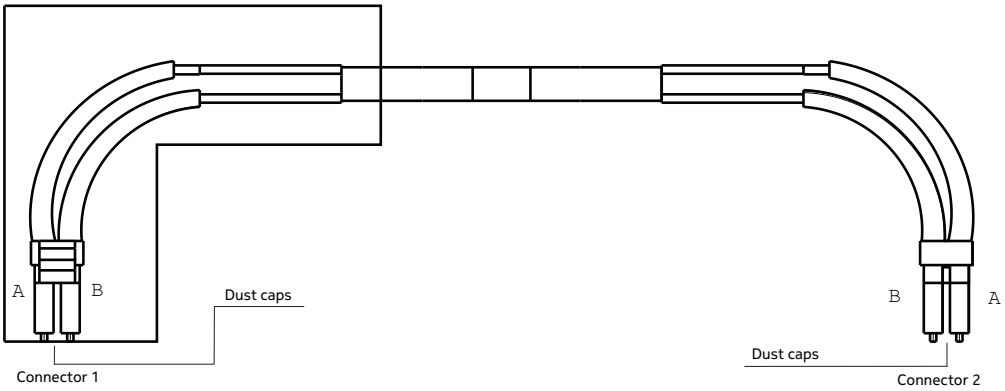


Conn. 1 Pin no.	Pair no: color	Conn. 2 Pin no.
1	2: white/orange	3
2	2: orange	6
3	3: white/green	1
4	1: blue	7
5	1: white/blue	8
6	3: green	2
7	4: white/brown	4
8	4: brown	5

4.3 Ethernet optical cable FTCH

Single mode optical fiber with 2xLC connectors and one rubber gasket.

Figure 12 View of FTCH cable



Conn. 1	Conn. 2
A	B
B	A

In principle, all prefabricated Nokia system fibers can be used for the backhaul connection. There are many variants of fibers that can be used to connect System Modules with RF Modules or Remote Radio Heads. Table 7: Multimode Flexi System Fibers presents a selection of multimode system fibers, for which the FOSD (471881A) SFP is required.

Table 7 Multimode Flexi System Fibers

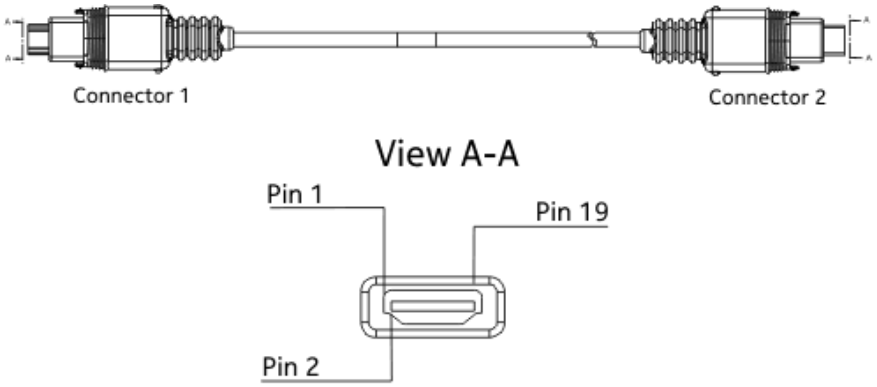
Name	Length [m]	Cable code	Sales item code
FUFBB	50	995757	473304A
FUFAY	100	995755	473302A
FUFAS	2	995741	473288A
FUFBC	10	995758	473305A
FUFBA	30	995756	473303A
FUFBB	50	995757	473304A
FUFBD	200	995759	473306A

4.4 Synchronization cables

4.4.1 FTSF Sync Cable F

2xHDMI connectors with rubber gaskets. The cable is used for connecting Sync In and Sync Out ports of collocated Flexi Multiradio 10 System Modules.

Figure 13 View of FTSF cable



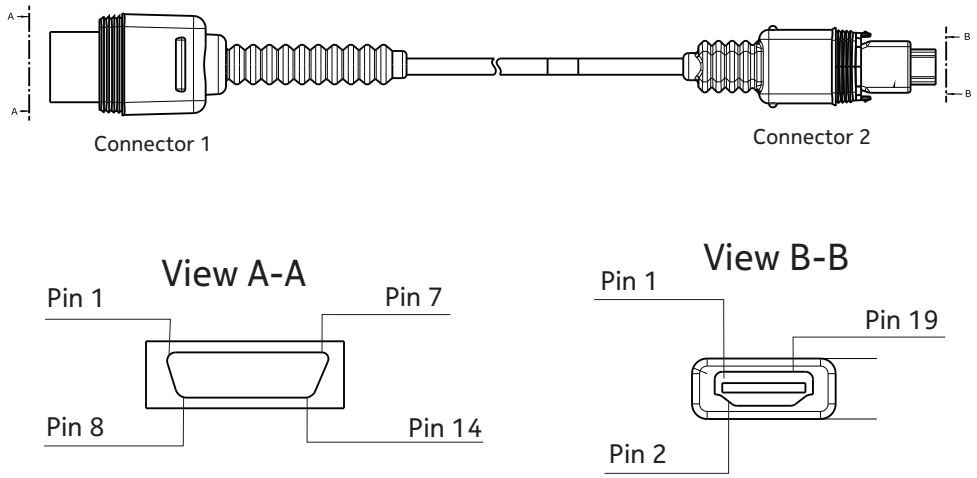
Conn. 1 Pin no.	Conn. 2 Pin no.	Pair: wire color
1: GPS_TIME_GSM_FC_OUT_H	1: GPS_TIME_GSM_FC_IN_H	TP-1: Black
3: GPS_TIME_GSM_FC_OUT_L	3: GPS_TIME_GSM_FC_IN_L	TP-1: Yellow
		TP-1G
7: PPS_OUT_H	7: GPS_PPS_GSM_FN_IN_H	TP-2: Black
9: PPS_OUT_L	9: GPS_PPS_GSM_FN_IN_L	TP-2: Green
11: GND	11: GND	TP-2G
2: SINGLE_ENDED_CLOCK_OUT1	2: SINGLE_ENDED_CLOCK_IN	TP-3: White
4: GND	4: GND	TP-3: Blue
6: GND	6: GND	TP-3G

Note: Single Ended Clock output on PIN 2 is used to provide 2.048 MHz output. For other Clock output measurements (for example, PIN 8 for 2 MHz and 10 MHz or PIN 19 for 100 Hz, 50 Hz, 25 Hz, 12.5 Hz or Sfn0) a standard HDMI cable has to be used. It is for R&D purposes only.

4.4.2 FTSG Sync Cable G

One HDMI and one MDR14 connector with rubber gaskets. The cable is used for connecting Sync In of Flexi Multiradio 10 system module to Sync Out of Flexi Multiradio System Module.

Figure 14 View of FTSG cable



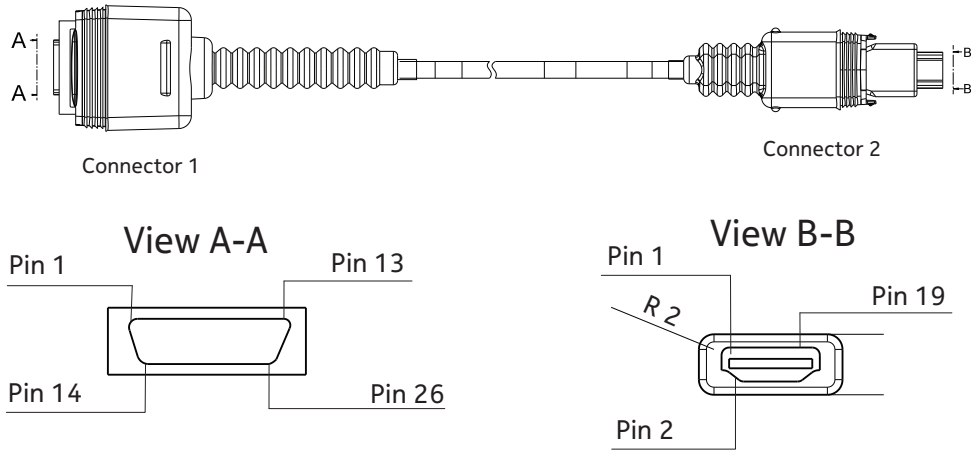
Conn. 1 MDR14 Pin no.: Signal	Conn. 2 HDMI Pin no.: Signal	Pair: wire color
1: PPS_out+	7: GPS_PPS_IN_H	TP-1: White/Blue
2: PPS_out-	9: GPS_PPS_IN_L	TP-1: Blue/White
8: GND	11: GND	TP-1G
3: GPStime_out+	1: GPS_TIME_IN_H	TP-2: White/Orange
4: GPStime_out-	3: GPS_TIME_IN_L	TP2: Orange/White
10: GND	13: GND	TP-2G
7: 2M_out	2: SingleEndedIn	TP-3: White/Green
14: GND	4: GND	TP3: Green/White
12: GND	6: GND	TP-3G

Note: Single Ended Clock output on PIN 2 is used to provide 2.048 MHz output. For other Clock output measurements (for example, PIN 8 for 2 MHz and 10 MHz or PIN 19 for 100 Hz, 50 Hz, 25 Hz, 12.5 Hz or Sfn0) a standard HDMI cable has to be used. It is for R&D purposes only.

4.4.3 FTSK Sync Cable FSMF to FSME

One HDMI and one MDR26 connector with rubber gaskets. The cable is used for connecting Sync Out of Flexi Multiradio 10 System Module to Sync In of Flexi Multiradio System Module.

Figure 15 View of FTSK cable



Conn. 1 MDR 26 Pin no.: Signal	Conn. 2 HDMI Pin no.: Signal	Pair: wire color
1: PPS_in+	7: PPS_OUT_H	TP-1: Black
2: PPS_in-	9: PPS_OUT_L	TP-1: Yellow
8: GND	11: GND	TP-1G
3: GPStime_in+	1: GPS_TIME_OUT_H	TP-2: Black
4: GPStime_in-	3: GPS_TIME_OUT_L	TP2: Green
10: GND	13: GND	TP-2G
7: REF2M_in	8: SingleEnded_clock _out_1	TP-3: White
14: GND	4: GND	TP3: Blue
16: GND	6: GND	TP-3G

5 Environment related markings

5.1 RSS-310 compliance

This equipment complies with RSS-310 of Industry Canada. Operation is subject to the condition that this device does not cause harmful interference.

5.2 EU compliance

5.2.1 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.

5.2.2 CE marking

Hereby, Nokia declares that radio equipment type Flexi Multiradio Base Station, Flexi Multiradio 10 Base Station and Nokia AirScale Base Station is in compliance with Directive 2014/53/EC. The full text of the EU declaration of conformity is available at the following internet address: **https://online.networks.nokia.com**

Figure 16 CE marking

This declaration is only valid for configurations (combinations of software, firmware, and hardware) provided and/or supported by Nokia.

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

The radio frequency usage in EU is restricted and before taking the radio equipment in use in the commercial network the operator is to apply 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 17 RED Article 10.10-marking

Restrictions in			
AT	BE	BG	HR
CY	CZ	DK	EE
FI	FR	DE	EL
HU	IE	IT	LV
LT	LU	MT	NL
PL	PT	RO	SK
SI	ES	SE	UK

5.3 FCC Part 15 compliance

This equipment has been tested and found to comply 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 commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manuals, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Changes or modifications not expressly approved by the party responsible for compliance could void the user´s authority to operate the equipment.

