NOKIA

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Nokia AirScale System Module Product Description

DN09231912

Issue 09

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Summary of changes

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

In this summary of changes:

- Changes between issues 09 DRAFT (2019-02-20) and 09 (2019-04-05)
- Changes between issues 08 (2018-12-06) and 09 DRAFT (2019-02-20)
- Changes between issues 07 (2018-09-29) and 08 (2018-12-06)

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 SW release or RAT. For features supported in your SW 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.

Table 1   Releases covered by the document

Product	Release
Long Term Evolution	FDD-LTE 17A, FDD-LTE 18, FDD-LTE 18SP, FDD-LTE 18A, FDD-LTE 19
TD LTE	TD-LTE 17A, TD-LTE 18, TD-LTE 18SP, TD-LTE 18A, TD-LTE 19
Single RAN	SRAN 17A, SRAN 18, SRAN 18SP, SRAN 18A, SRAN 19
5G	5G 19

Changes between issues 09 DRAFT (2019-02-20) and 09 (2019-04-05)

5G and LTE content has been merged

The previous 5G-specific document version was 04C. From Issue 09 onwards the document is common for all the RATs. The list below presents the changes between Issue 09 and both LTE issue 09 DRAFT and 5G Issue 04C DRAFT.

The document has been restructured

The main changes in the structure are:

- Section List of Nokia AirScale System Module units has been added.
- The following, previously separate topics, have been moved to section Nokia AirScale System Module overview and its subsections:

- *Nokia AirScale System Module architecture*
- *Nokia AirScale System Module benefits*
- *Nokia AirScale BTS optional items*
- *AirScale System Module chaining*

- The general descriptions of each subrack have been merged to section Nokia AirScale System Module subracks description and the detailed information are included in its subsections.

- The following, previously separate topics, have been moved or merged to section Nokia AirScale System Module common plug-in units and its subsections:

  - *Transport configurations*
  - *Nokia AirScale BTS synchronization*
  - *Reset and service buttons*

Nokia AirScale SM chaining

- Information on chaining with CPRI interfaces has been added.

Nokia AirScale common plug-in units reset and service buttons

- Service and reset buttons location on ASIB has been added.

Nokia AirScale System Module environmental requirements

- Indoor and outdoor tables have been merged.

Nokia AirScale naming convention

- The following units naming has been added:

  - 5G
  - mMIMO
  - Flexi Zone and AirScale small cells
  - GNSS/GPS equipment and accessories

- Radio bands have been put in a separate table: Table 33: Radio bands naming convention
- New LTE and 5G radio bands have been added.
- *Second letter I - EDGE TRS FIFA,B ,FIQA* has been removed.

Changes between issues 08 (2018-12-06) and 09 DRAFT (2019-02-20)

ASIB Common unit and AMOD subrack have been added

- Nokia AirScale System Module common plug-in units
- *Nokia AirScale Outdoor Subrack (AMOD) description*

ASIB and AMOD information have been added across the document

- Nokia AirScale System Module overview

- Nokia AirScale SM capacity

- Nokia AirScale System Module subracks description
- *Nokia AirScale Outdoor Subrack (AMOB)*
- Nokia AirScale common plug-in units reset and service buttons
- Nokia AirScale System Module power requirements and consumption
- DC input connectors pin map
- Nokia AirScale common plug-in units grounding connectors

Operation and Maintenance Tools section has been removed

- The relevant information has been moved to Nokia AirScale System Module Indoor (AirScale SM Indoor)

RJ45 connectors pin-maps have been removed as they are standard ones

- *LMP connector pin map*
- *1000BASE-T TRS connector pin map*

Nokia AirScale System Module

- Information on the BTS element manager tools have been moved to this section from *Operation and Maintenance Tools* section.
- AMIA and AMOB figures have been removed.

Nokia AirScale System Module architecture

- *Nokia AirScale System Module architecture* figure has been updated

Main differences between Nokia AirScale and Flexi Multiradio 10 System Modules

- 5G readiness has been added.
- Information on outdoor subrack height has been removed.

Nokia AirScale Capacity and Performance

- ASIB capacity has been added.
- Multi-RAT capacity has been added.
- Section has been restructured.

Unit Replacement

- Reference to *Replacing Nokia AirScale BTS Units* has been added.

Nokia AirScale System Module sound power levels

- AMOB and AMOD sound power levels have been added.

Nokia AirScale System Module power supply solutions

- Information on AMOD power supply options have been added.
- Information on AMOB power supply options have been updated.

Nokia AirScale common plug-in units reset and service buttons

- Section has been restructured.

Nokia AirScale System Module power requirements and consumption

- ASIB and AMOB power consumption has been added.
- AMIA power consumption has been updated.

Transport Configurations

- Information on transport interfaces have been removed.

System Module chaining

- The note on chaining features has been removed.

Nokia AirScale naming convention

- Information on multi-band Radio units naming has been added.
- Information on letters O and P in the Radio units names has been added.

DC input connectors pin map

- Grounding connectors have been moved to Nokia AirScale common plug-in units grounding connectors

Changes between issues 07 (2018-09-29) and 08 (2018-12-06)

General changes

- *LTE3642: AMOC Outdoor Compact Subrack for AirScale Indoor System Module* and all the information related to AMOC have been removed throughout the document.
- The value of fan low noise has been updated in Nokia AirScale System Module sound power levels

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.

2 EU compliance

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.

2.2 CE marking

Hereby, 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 1   CE marking

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

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 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 2   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
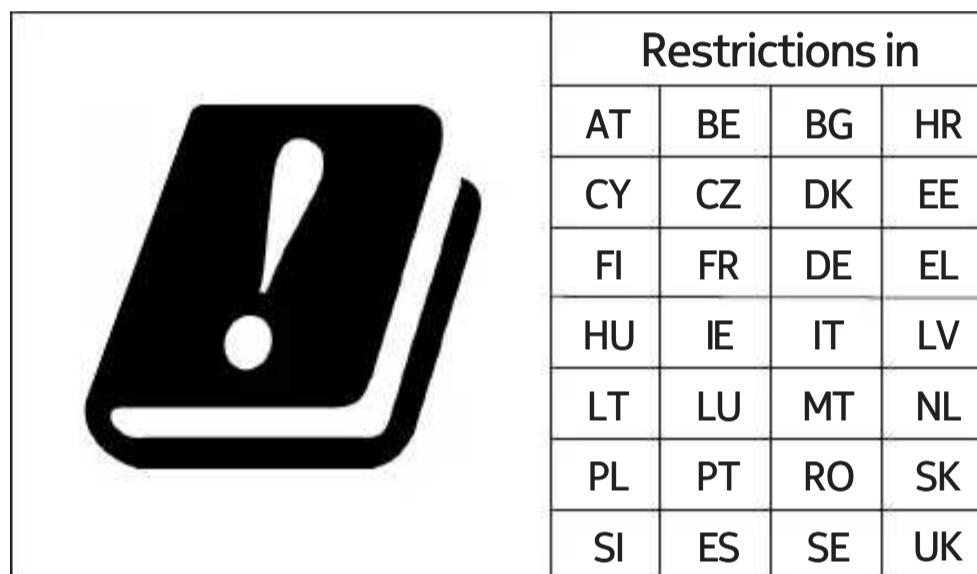
3 FCC Part 15 compliance

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.

4   List of Nokia AirScale System Module units

Contains feature numbers, product codes, supported RAT releases of the subracks and the plug-in units

Table 2   List of Nokia AirScale subracks

Name	Supported from RAT release	Feature numbers	Product code
AMIA	LTE 16A SRAN 17A 5G 19	LTE2262 SR001120, SR001160, SR001258 5GC000623	473098A
AMOB	LTE 17A SRAN 17A 5G 19	LTE3359 SR001722 5GC000418	473952A
AMOD	LTE 19 SRAN 19	LTE4525 SR002002	474930A

Table 3   List of Nokia AirScale common plug-in units

Name	Supported from RAT release	Feature numbers	Product code
ASIA	LTE 16A SRAN 17A	LTE2114 SR001120, SR001160, SR001258	473095A
ASIB	LTE 19 SRAN 19	LTE3178 SR002002	473764A
ASIK	5G 19	5GC000275	474021A

Table 4   List of Nokia AirScale capacity plug-in units

Name	Supported from RAT release	Feature numbers	Product code
ABIA	LTE 16A SRAN 17A	LTE2261 SR001120, SR001160, SR001258	473096A
ABIL	5G 19	5GC000276	474020A

5 Nokia AirScale System Module overview

> *The System Module offers high capacity, high scalability, rich fronthaul and backhaul connectivity, and optimized power consumption. It supports multiple Radio Access Technologies (RATs): 5G, LTE, Single RAN, while supporting the legacy Flexi Multiradio 10 BTS product family.*

Nokia AirScale System Module (SM) has all the needed control and baseband functions for the supported Radio Access Technologies (RATs). The basic functionalities of Nokia AirScale SM are:

- Baseband processing and decentralized control
- Transport control, integrated Ethernet ports, and IPv4/v6 and IPSec Transport
- BTS clock and timing generation and distribution
- BTS Operation and Maintenance
- Central radio interface control
- OBSAI/CPRI-compatible interfaces to radio units

Nokia AirScale SM is managed with the BTS element manager tool used in the respective technology, that is:

- LTE (up to LTE 18A) - BTS Site Manager
- LTE (from LTE 19 onwards) - Web Element Manager
- SRAN - Web Element Manager
- 5G - WebUI

Nokia AirScale System Module consists of common and capacity plug-in units inside a subrack.

Figure 3　　　　Nokia AirScale System Module architecture
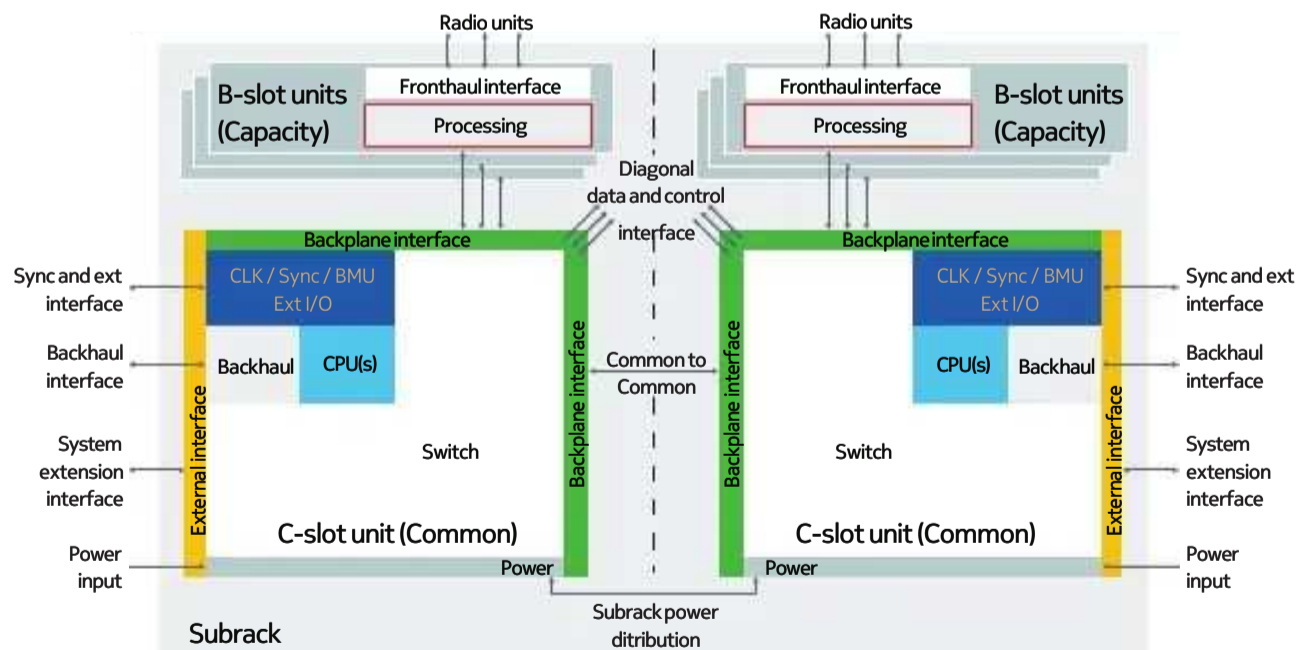
5.1 Nokia AirScale SM advantages over Flexi Multiradio 10 SM

The main advantages of AirScale SM are: greater capacity, scalability, and support of 5G.

Nokia AirScale System Module (SM) provides the following advantages over FSMF (Flexi Multiradio 10 System Module):

- Subracks support 5G plug-in units
- Increased capacity
- Support for 9.8 Gbps CPRI
- Support for CPRI IQ data compression with three RF interfaces per ABIA unit
- Highly improved RF connectivity
- HW Capability of 10GE backhaul interfaces (SFP + slots)
- Enhanced Backhaul connectivity
- Better LTE-Advanced support through increased interconnectivity
- Improved synchronization and holdover solution
- Improved energy efficiency
- Forward compatibility through system extension interface (SEI) and new plug-in unit introduction
- Ready for full resiliency support (power, synchronization, backhaul, L3, L1, L2)

Note: The resiliency feature is dependent on software availability. Various resiliency schemes may require additional hardware (for example, a second common unit, additional capacity units, a power and synchronization cables, IQ switching equipment).

Nokia AirScale System Module (SM) no longer supports the following:

- Optional transport sub-modules, thus it does not provide PDH interfaces. Common units provide transport capacity in IP/Ethernet-based transport mode only.
- Alarm lines in the LMP interface.

5.2 Nokia AirScale SM compatibility with Flexi Multiradio 10 BTS

AirScale SM supports legacy HW, interconnectivity, and installation options.

Nokia AirScale System Module (SM) is backwards compatible with the following Flexi Multiradio 10 BTS solutions:

- SyncIn, SyncOut, SFP-SRIO, and EAC interfaces
- RF Modules and Remote Radio Heads, and related optional items
- Most of the cables and SFPs

- floor, wall, pole, rack/cabinet installation
- stacking with Flexi units

5.3 Nokia AirScale SM chaining

AirScale SM supports internal chaining within the subrack and external chaining with Flexi Multiradio 10 BTS SM

Nokia AirScale System Module (SM) capacity might be increased by chaining. Chaining is available with the following interfaces:

- OBSAI (3 Gbit/s or 6 Gbit/s) or CPRI (4.9 or 9.8 Gbit/s)
- SRIO (6.25 Gbit/s)
- 10GE System Extension Interfaces (SEI)
- Synchronization input/output (SIN, SOUT)

The following SM chaining combinations are supported:

- Nokia AirScale SM internal connections (within one subrack) between common and capacity plug-in units
- Nokia AirScale SM with Flexi Multiradio 10 BTS SM interconnection using SEI

5.4 Nokia AirScale SM capacity

Number of cells, data rates, and IPSec throughput capacity.

Table 5   AirScale hardware capacity for LTE (FDD and TDD)

Function and capabilities	ABIA	6xABIA (max. configuraiton)
Maximum cell configuration	16	96
Number of FDD-LTE cells / Capacity PIU FDD-LTE cell 2T2R	16	96
Maximum number of TDD-LTE 8T8R cells	4	24
Maximum FDD-LTE data throughput (DL + UL) [Gbps]	2.7	14.4[1]
Maximum TD-LTE data throughput [Gbps]	1.26	7.6
Maximum FDD-LTE radio processing bandwidth [MHz]	640	1280/7680
Maximum TDD-LTE radio processing bandwidth [MHz]	640	3840
CoMP & CA pool size	16/16	96/96
Maximum antenna-carriers supported FDD-LTE and TDD-LTE	32	192

[1]   This value refers to radio level throughput. eNB level throughput is dependent on backhaul capacity/dimensioning.

Table 5   AirScale hardware capacity for LTE (FDD and TDD) (Cont.)

Function and capabilities	ABIA	6xABIA (max. configuraiton)
Maximum DL data rate supported [Gbps] LTE	1.8	10.8
Maximum UL data rate supported [Gbps] LTE	0.6	3.6

Table 6   AirScale hardware capacity for Multi-RAT (GSM, WCDMA, LTE)

Function and capabilities	ASIA/ASIB	ABIA[2]	2xASIA/ASIB + 6xABIA
Number of supported RATs	3	2	3
Maximum WCDMA cell configuration[3]	24	12	48[4]
Maximum GSM configuration (number of TRXs)[5]	36	36	36/72[6]

Table 7   AirScale hardware capacity for 5G

Function and capabilities	ABIL	6xABIL
Maximum cell configuration	12	72
Cell capacity 5/10 MHz 2T2R	12	72
Cell capacity 15/20 MHz 2T2R	12	72
Cell capacity 5/10 MHz 4T4R	12	72
Cell capacity 15/20 MHz 4T4R	12	72
Cell capacity 15/20 MHz 8T8R	8	48
Cell capacity 15/20 MHz 64T64R 8x8	4	24
Cell capacity 15/20 MHz 64T64R 16x8	2	12
Cell capacity 100 MHz 64T64R 8x4	2	12
Cell capacity 100 MHz 64T64R 16x8	1	6
Maximum DL data rate supported [Gbps]	7	42
Maximum UL data rate supported [Gbps]	3.5	21

Note: Each release specifies capacity and performance requirements with specific feature sets. Please check release SW documentation for supported features and configurations.

[2]   Up-to two different RATs per each ABIA
[3]   Minimum WCDMA configuration uses ½ ABIA with scaling by ¼ ABIA steps
[4]   Up to 24 WCDMA cells per logical SBTS (48 cells with two logical SBTSs per sub-rack)
[5]   Minimum GSM configuration uses ¼ ABIA with scaling by ½ ABIA steps (max ½ ABIA)
[6]   72 TRXs when configured as separate BTS and BCF in each half sub-rack

Table 8　　　　Expected transport processing capacity

Configuration	IPsec Throughput (DL+UL) (IPv4/IPv6 with multiple SAs) [Gbps]		
	ASIA	**ASIB**	**ASIK**
1 x common unit Half-rack	5.0	7.5	7.5
2 x common unit Full-rack, one logical BTS	5.0	7.5	Not supported
2 x common unit Full-rack, two separate BTSs	10 total, 5.0 for each BTS	15 total, 7.5 for each BTS	15 total, 7.5 for each BTS

6 Nokia AirScale System Module subracks description

Indoor and outdoor subracks accommodate the plug-in units, provide interconnectivity, power distribution, and temperature management

Nokia AirScale subracks accommodate the common and capacity plug-in units and provide:

- Power distribution through the backplane
- Interconnections between the plug-in units through the backplane
- Cooling systems
- Heaters for cold start (from -40°C, outdoor Subracks only)

    - Two hours cold start time with one heater (facotry-delivered)
    - One hour cold start time with additional heater (optional)

- Ingress protection:

    - Indoor subracks: IP20

    - Outdoor subracks: IP55

Common and capacity plug-in units are accommodated in two subrack halves, in the specific slots: and in the specific order:

- C-slots accommodate common plug-in units
- B-slots accommodate capacity plug-in units

Figure 4   Subracks slot numbering

B3	B6
B2	B5
B1	B4
C1	C2

The plug-in units need to be inserted in a specific order:

1. Left half:

    a) C1
    b) B1
    c) B2
    d) B3

2. Right half:

    a) C2
    b) B4

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    c) B5

    d) B6

Depending on the given Radio Access Technology (RAT) SW, both subrack halves may be configured as a single BTS or as two separate entities, for example: LTE eNB and 5G gNB in each subrack half.

For details on the Nokia AirScale SM architecture and interfaces between the subracks and plug-in units, see Figure 3: Nokia AirScale System Module architecture.

Figure 5   AMIA overview
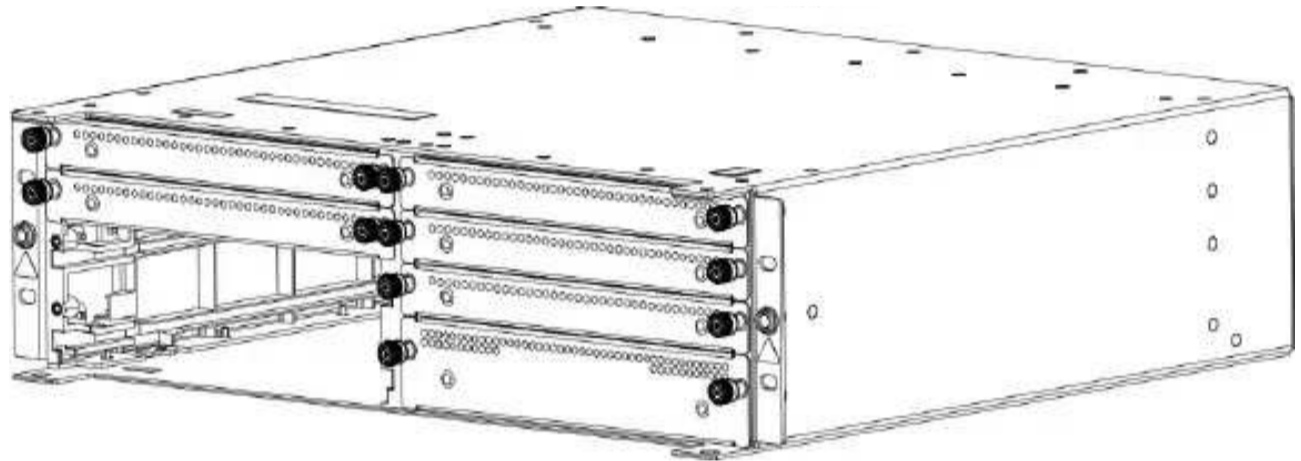
Figure 6   AMOB overview
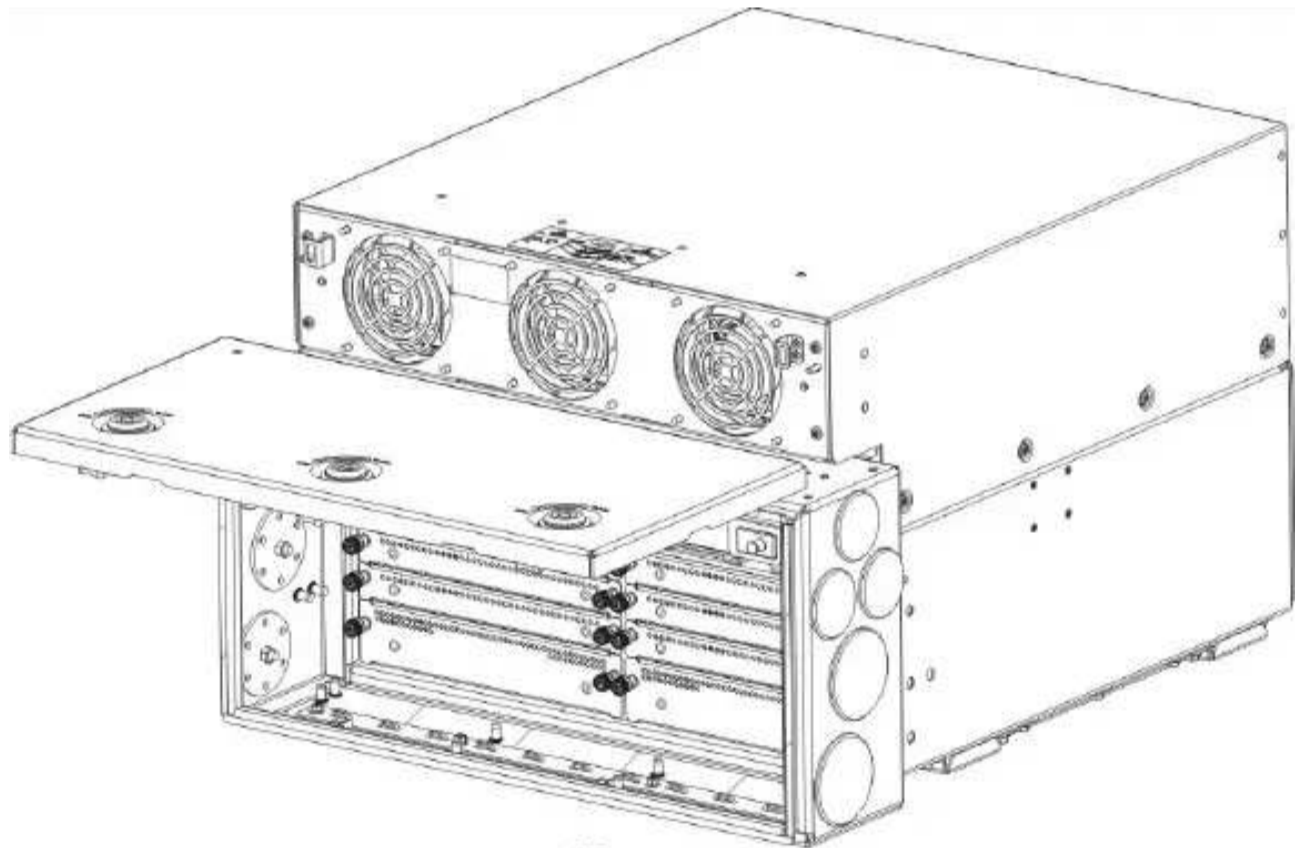
Figure 7   AMOD overview
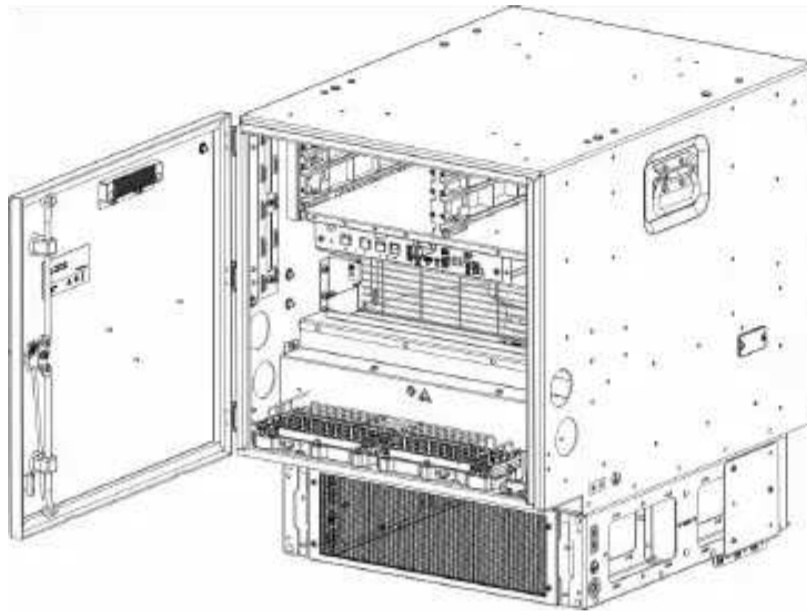
6.1   Nokia AirScale subracks specifications

Dimensions, weight, and installation options

Table 9   Nokia AirScale subracks dimensions and weight

Subrack	Dimensions		Weight	
	Height x width x depth	**U-height**	**Empty**	**Full***
AMIA	129 x 447 x 400 mm (5.08 x 17.60 x 15.75 in.)	3U	5.1 kg (11.24 lb)	24.3 kg (53.57 lb)
AMOB	355 x 487 x 605 mm (13.98 x 19.17 x 23.82 in.)	8U	23 kg (50.71 lb)	42.2 kg (93.03 lb)
AMOD	488 x 487 x 665 mm (19.21 x 19.17 x 26.18 in.)	11U	35 kg (77.16 lb)	53 kg (116.84 lb)

*With two common and six capacity plug-in units, without any optional items.

Table 10   Nokia AirScale subracks installation specification

Subrack	Installation options	Dedicated optional items	Cable entries	Airflow direction
AMIA	Pole, wall, floor, stack, 19-inch rack/cabinet	-	-	Front to back (default) Back to front

Table 10   Nokia AirScale subracks installation specification (Cont.)

Subrack	Installation options	Dedicated optional items	Cable entries	Airflow direction
AMOB	Pole, wall, floor, stack, 19-inch rack/cabinet	AMFF Blind panel assembly AMFG FCOA installation kit AMFH Stack Wall Pole installation kit AMFI Heater assembly AMFJ Conduit fittings AMFK Cable glands AMFL GPS bracket assembly AMFO Stacking kit AMFR Door sensor kit AMFS Cable gland 12x8 AMFT Front cover FYGM GPS module	Side holes (left and right): 3 x 35 mm on each side 2 x 50 mm on each side	Back to front (default) Front to back
AMOD	Pole, wall, floor, stack	AMFF Blind panel Assy for AMOB AMFV 3U plinth kit for AMOD AMFX Wall mount kit for AMOD AMFY Mufflers kit for AMOD AMHB GPS bracket assembly AYGA AirScale GPS module FYGM GPS module	Bottom entries for around 88 cables Side holes: 2 x 50 mm (in diameter) on each side	Bottom to back

6.2   Nokia AirScale subracks PDUs specifications

Outdoor subracks are equipped with a Power Distribution Unit (PDU). The PDU provides control functions and feeds the power to the plug-in units, fans, and heaters.

AMOB internal Power Distribution Unit (PDU)

Figure 8   AMOB PDU front panel
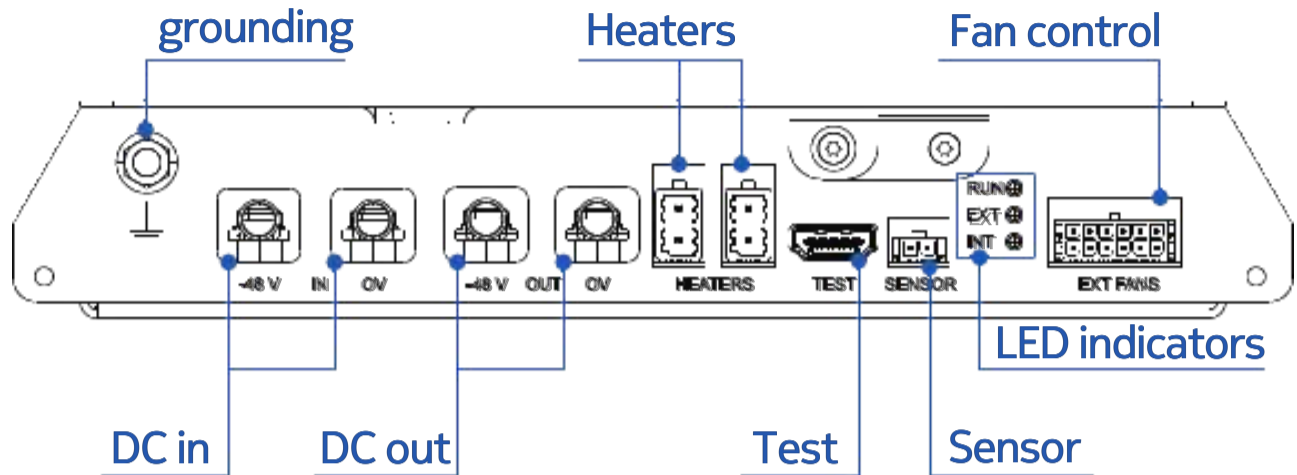
Table 11   AMOB PDU interfaces

Label	Function	Connector type
⏚	Grounding	M5 screw
IN	DC power input (50 A) with OVP	1 x 6 AWG (13.30 mm^2), positive 1 x 6 AWG, negative (13.30 mm^2)
OUT	DC power output (42 A)	1 x 7 AWG (10.55 mm^2), positive 1 x 7 AWG (10.55 mm^2), negative
HEATERS	Heater port	Nokia-specific
TEST	Test access port	HDMI
SENSOR	Temperature sensor	Nokia-specific
EXT FANS	Fan control	Nokia-specific

Table 12   AMOB PDU LED indicators

Label	LED color	
	RED	**GREEN**
RUN	PDU malfunction	PDU works correctly
EXT	External fan speed decreased at least 30%	External fan works correctly
INT	Internal fan speed decreased at least 30%	Internal fan works correctly

AMOD internal Power Distribution Unit (PDU)

Figure 9   AMOD PDU front panel
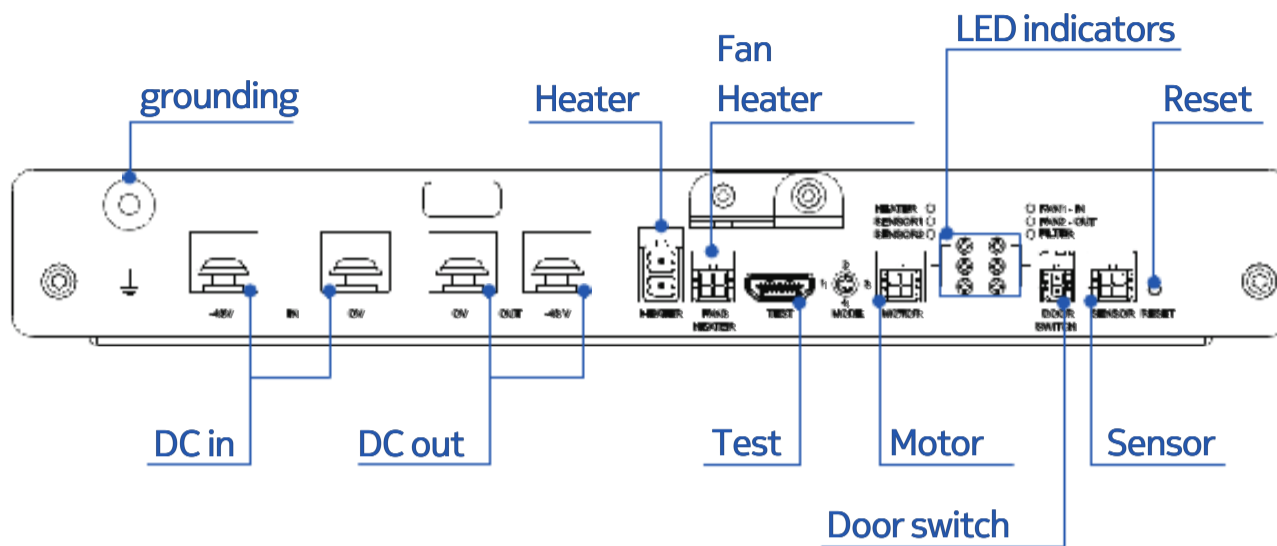
Table 13   AMOD PDU interfaces

Label	Function	Connector type
⏚	Grounding	M5 lug
IN	DC power input (80 A) with OVP	4 x M5 spacer nut
OUT	DC power output (60 A)	4 x M5 spacer nut
HEATER	Power output for the heaters	Nokia-specific
FAN3 HEATER	Power and control of the internal fan	Nokia-specific
TEST	Service port for maintenance and troubleshooting	HDMI
MOTOR	For the stepper motor	Nokia-specific
DOOR SWITCH	For controlling AMOD door	Nokia-specific
SENSOR	For temperature, humidity, and pressure sensors	Nokia-specific
RESET	Button to reset the PDU control board after maintenance activities, for example filter replacement. The System Module power is kept on during the reset, so there is no interruption of BTS service.	N/A

Table 14   AMOD PDU LED indicators

Label	LED color	
	RED	**GREEN**
HEATER	-	Heater works correctly
SENSOR 1	Temperature and humidity sensor is faulty	Temperature and humidity sensor works correctly
SENSOR 2	Pressure sensor is faulty	Pressure sensor works correctly
FAN - IN	Inlet fan is faulty or RPM is 25% higher or lower than nominal	Inlet fan works correctly

Table 14   AMOD PDU LED indicators (Cont.)

Label	LED color	
	RED	**GREEN**
FAN - OUT	Outlet fan is faulty or RPM is 25% higher or lower than nominal	Outlet fan works correctly
FILTER	Filter is clogged (pressure dropped below the threshold)	Filter works correctly

7 Nokia AirScale System Module common plug-in units

The units provide transport, central antenna data routing, and centralized control for supported Radio Access Technologies (RATs). They occupy one or two C-slots inside a subrack.

Table 15   Common plug-in units overview

Property	Value		
	ASIA	**ASIB**	**ASIK**
Nokia product code	473095A	473764A	474021A
Ingress protection class	IP 20	IP 20	IP20
Weight (without packaging)	3.1 kg (6.8 lb)	2.9 kg (6.4 lb)	3.2 kg (7.1 lb)
Introduced by feature	LTE2114: AirScale Common ASIA	LTE3178: AirScale Common ASIB and ASIBA and SR002002: AirScale Common ASIB PIU SBTS support	5GC000275: AirScale Common ASIK

ℹ **Note:** Nokia AirScale System Module common plug-in units exist in various versions. Refer to Technical Notes (part of system SW release documentation) for functionality details of each version.

Figure 10   ASIA interfaces
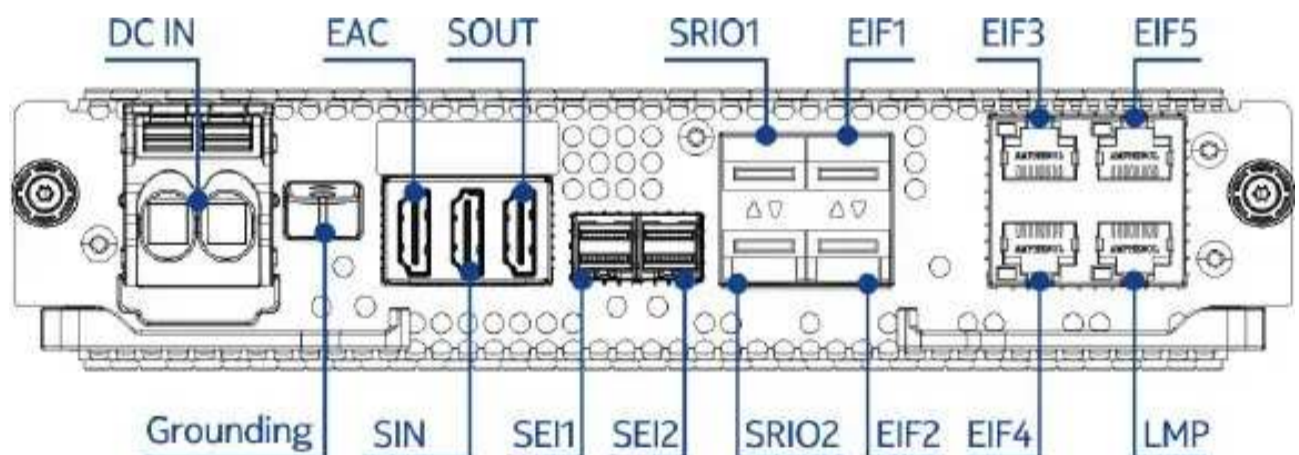
Figure 11   ASIB interfaces
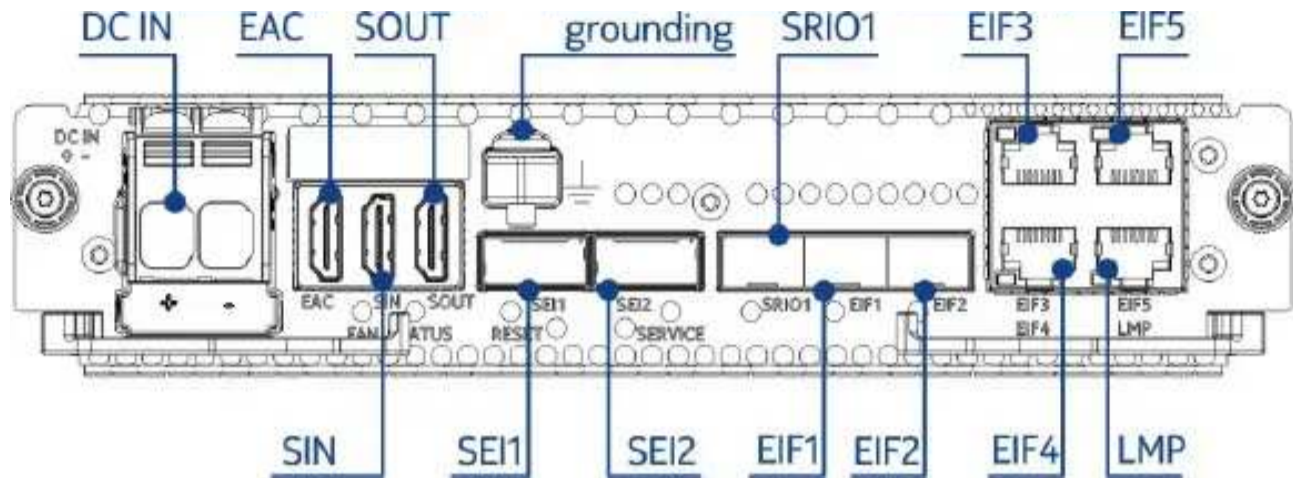
Figure 12   ASIK interfaces
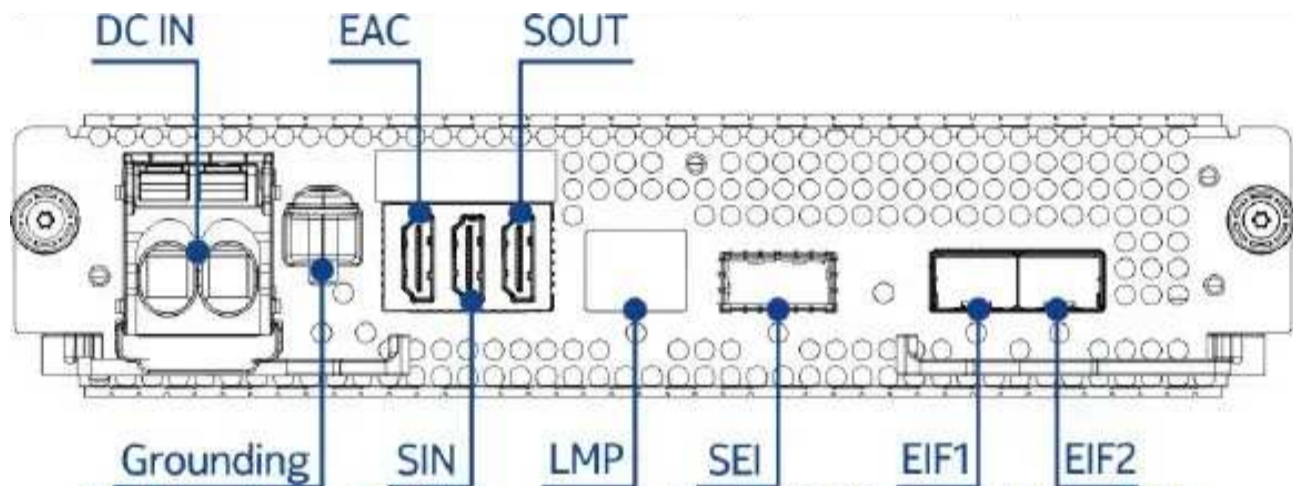
Note: The common plug-in units have a variant with a lug connector, these units are ASIAA, ASIBA, and ASIKA. All the other interfaces are the same as in ASIA, ASIB, ASIK.

Table 16   Common plug-in units interfaces

Label	Name	Function	Connector type			Additional information
			ASIA	ASIB	ASIK	
DC IN	Power Supply Interface	48 V input for the System Module	clamps			-
⏚	Grounding	Grounding	A.101: single-hole M5 A.202: dual-hole 2 x M5	dual-hole 2 x M5		-

Table 16   Common plug-in units interfaces (Cont.)

Label	Name	Function	Connector type			Additional information
			ASIA	ASIB	ASIK	
EAC	External Alarms and Control interface	A set of control and alarm signals as well as an interface for alarm extension	HDMI			Six alarm signals Six SW-assignable signals for either alarm input or control output signals FSEB compatible interface for alarm extension
SIN	Synchronization Input	External synchronization inputs, GPS equipment powering and control	HDMI			Signals in: • GNSS synchronization • GSM frame flock and frame number • ITU G.703 2.048 MHz or 10 MHz GNSS control and power supply (15 V, GND)
SOUT	Synchronization Output	An interface for external synchronization outputs	HDMI			Signals out: • GNSS synchronization • GSM frame flock and frame number • ITU G.703 2.048 MHz or 10 MHz GPS Power Supply: +15 V, GND
SEI1	System Module Extension Interface	Interface for traffic between system modules, additional synchronization source	MiniSAS-HD	QSFP+	QSFP+	2 x 10GE, MACsec 2 x SRIO, 6.25 Gbit/s Synchronization signals: SyncE, ToP (IEEE 1588v2)
SEI2	System Module Extension Interface	Interface for traffic between system modules, additional synchronization source	MiniSAS-HD	QSFP+	N/A	2 x 10GE, MACsec 2 x SRIO, 6.25 Gbit/s Synchronization signals: SyncE, ToP (IEEE 1588v2)

Table 16   Common plug-in units interfaces (Cont.)

Label	Name	Function	Connector type			Additional information
			ASIA	**ASIB**	**ASIK**	
SRIO1	Interconnection interface	Interface for Flexi Multiradio 10 BTS system modules	SFP+		N/A	-
SRIO2	Interconnection interface	Interface for Flexi Multiradio 10 BTS system modules	SFP+	N/A	N/A	-
EIF1	Transport Interface	Backhaul/higher layer fronthaul interface	1/10GE SFP/SFP+		1/10/25 GE SFP	10GBase-SR/LR, 1000Base-SX/LX/BX/ZX
EIF2	Transport Interface	Backhaul/higher layer fronthaul interface	1/10GE SFP/SFP+		1/10/25 GE SFP	10GBase-SR/LR, 1000Base-SX/LX/BX/ZX
EIF3	Transport Interface	IP/Ethernet transmission interface	1GE RJ45		N/A	100/1000Base-T
EIF4	Transport Interface	IP/Ethernet transmission interface	1GE RJ45		N/A	100/1000Base-T
EIF5	Transport Interface	IP/Ethernet transmission interface	1GE RJ45		N/A	100/1000Base-T
LMP	Local Management Port	Ethernet interface for Element Manager, SSE equipment or diagnostic	1GE RJ45			100/1000Base-T

The transport interfaces can be used for:

- Backhaul connectivity (tail sites)
- Aggregation (chain or tree sites)
- Redundancy (link load sharing, fast IP rerouting)
- Centralized RAN site solutions
- Ethernet-based chaining and switching across up to five interfaces

Note: Adding the second common plug-in unit to the right half of the subrack does not increase transport capacity. Make sure you plan the transport configuration accordingly.

7.1 Nokia AirScale System Module synchronization

Synchronization is handled by common plug-in units (ASIA, ASIB, ASIK)

To ensure proper operation, accurate synchronization within a single AirScale BTS and between different AirScale BTSs is implemented. The Control and Timing block in the BTS is responsible for implementing these functions.

The AirScale System Module has the following synchronization sources:

- Synchronous Ethernet recovered clock; through transport interface
- Timing-over-Packet (IEEE 1588v2); through transport interface
- Pulse per Second and Time of Day (1PPS & ToD)

    – Through GNSS (for example GPS)
    – From another BTS through Synchronization input (SIN)

- ITU G.703 2.048 MHz / 10 MHz through Synchronization input (SIN)
- GSM Frame Clock and Frame Number
- SM – SM synchronization (between subracks)
- SM – SM synchronization (between the common plug-in units in one subrack)
- Fronthaul interfaces on the capacity plug-in units; through RP3-01/CPRI

Synchronization Requirements can be classified into three different types:

- Frequency synchronization
- Phase synchronization
- Time synchronization

Frequency synchronization

Synchronization in the frequency domain refers to the frequency accuracy measured by comparing the actual frequency generated by the BTS in the air interface (carrier frequency) to a stable reference clock. This frequency accuracy is measured in units of ppb (parts per billion) or ppm (parts per million). 3GPP requires that the modulated carrier frequency of the BTS (all RATs) be accurate to within ±50ppb.

Frequency synchronization can be provided through Synchronous Ethernet, ToP slave (IEEE1588v2), 2 MHz, GNSS (for example GPS, Glonass).

Phase synchronization

Synchronization in the phase domain refers to the frame alignment of the radio frame transmitted into the air interface by different BTSs that are aligned to each other with the required accuracy (in the unit of microseconds or even nanoseconds). Time Duplex technology, such as LTE TDD, requires phase synchronization for its basic operation to align downlink and uplink transmission. Phase synchronization implicitly includes frequency synchronization but not the other way around.

Phase synchronization can be provided through ToP with phase sync or GNSS receiver.

Time synchronization

Synchronization in the absolute time domain means that different network elements are aligned to the required Time of Day (ToD – in the unit of years, months, days, hours, and so on). The requirements span from very mild requirements to the most stringent depending on the applications. For example, time synchronization is required for O&M purposes, such as alarm correlation. In this case, the accuracy requirement is in the range of milliseconds. On the other hand, System Frame Number (SFN) alignment on the radio interface has a very strict accuracy requirement on the level of sub microseconds. Note that SFN alignment requires phase synchronization.

7.2 Nokia AirScale System Module holdover performance

> *Nokia AirScale System Module provides internal synchronization for a limited time in case the external synchronization is lost.*

The AirScale System Module common plug-in units (ASIA, ASIB, ASIK) provide the following holdover capabilities:

- Typical holdover performance of +/- 50 ppb for 60 days.
- Typical holdover performance of +/- 3 μs for 24 hours.
- Typical holdover performance of +/- 10 μs for > 24 hours.

[i] **Note:** Conditions: The BTS has been powered on and supplied with accurate phase sync sources for a period of no less than seven days. During the overall period (including holdover), BTS has been subject to stable T conditions.

7.3 Nokia AirScale common plug-in units reset and service buttons

> *The buttons reset the BTS, the configuration, or restart the BTS in a fail safe mode*

You can use the reset and service buttons on Nokia AirScale common plug-in units in case the remote connection is not possible.

[i] **Note:** Pressing any of the buttons results in the service outage.

Table 17   Reset and service buttons usage effects

Button	Pressing time	Effect
Reset	Less than 5 s	Reboot to active partition SW (nominal SW), no changes in configuration
Reset	More than 5 s	Reboot to active partition SW (nominal SW), commissioning data cleared, no changes to security parameters; recommissioning is needed
Service	Single click	Reboot to fail safe SW; re-installation of the nominal SW and recommissioning are needed

Figure 13   ASIA reset and service buttons location
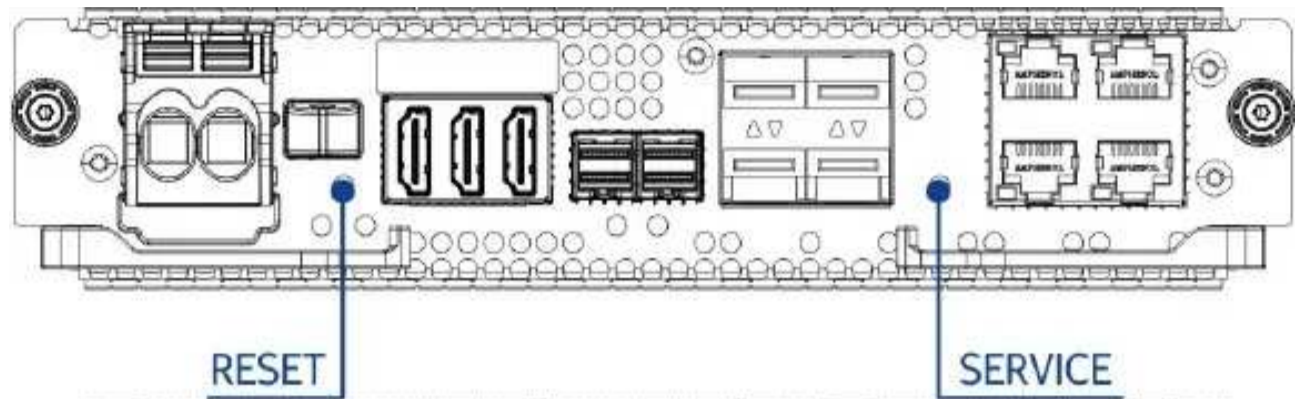
Location of those buttons on ASIAA is the same.

Figure 14   ASIB reset and service buttons location
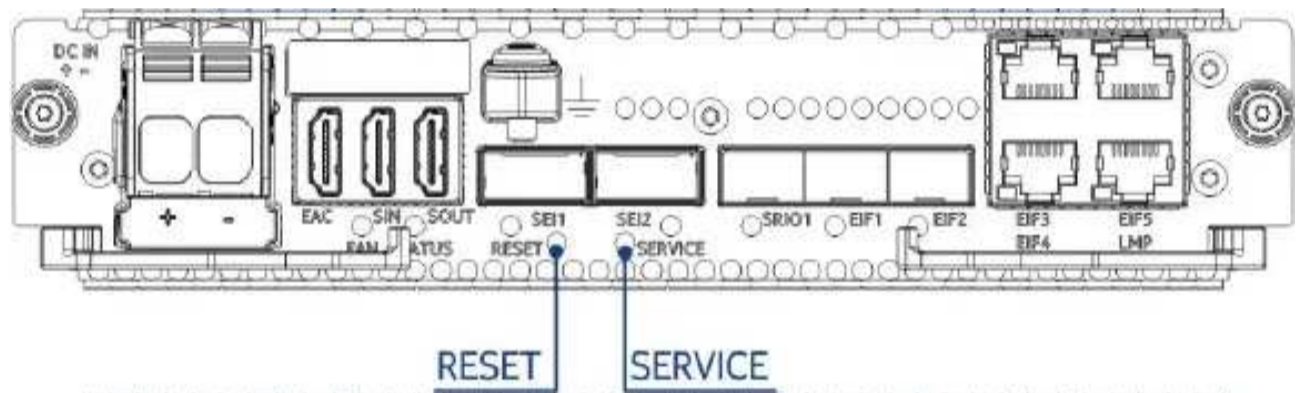
Location of those buttons on ASIBA is the same.

Figure 15   ASIK reset and service buttons locations
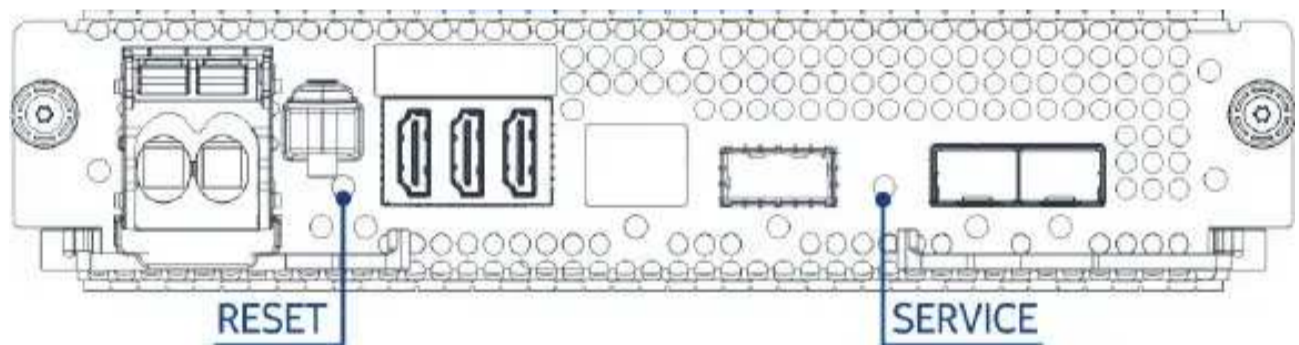
Location of those buttons on ASIKA is the same.

8   Nokia AirScale System Module capacity plug-in units

The units provide cell-specific baseband processing and optical interfaces to radio units.

Table 18   Capacity units overview

Property	Value	
	ABIA	**ABIL**
Nokia product code	473096A	474020A
Ingress protection class	IP 20	IP 20
Weight (without packaging)	2.1 kg (4.6 lb)	2.1 kg (4.6 lb)
Introduced by feature	*LTE2261: AirScale Capacity ABIA*	*5GC000276: AirScale Capacity ABIL*

Note: Nokia AirScale System Module capacity plug-in units exist in various versions. Refer to Technical Notes (part of system SW release documentation) for functionality details of each version.

Figure 16   ABIA interfaces
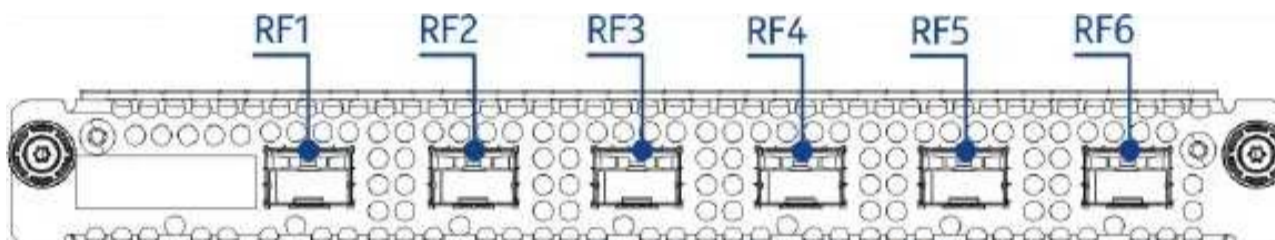
Table 19   ABIA interfaces

Label	Function	Connector type	Additional information
RF1...6	Fronthaul interface RP3-01/CPRI to radio units	SFP+	1 x OBSAI RP3-01 (3072 Mbps or 6144 Mbps) or CPRI (6 Gbps or 9.8 Gbps) Supports IQ Compression with three CPRI interfaces RF1, RF2 and RF3

Figure 17   ABIL interfaces
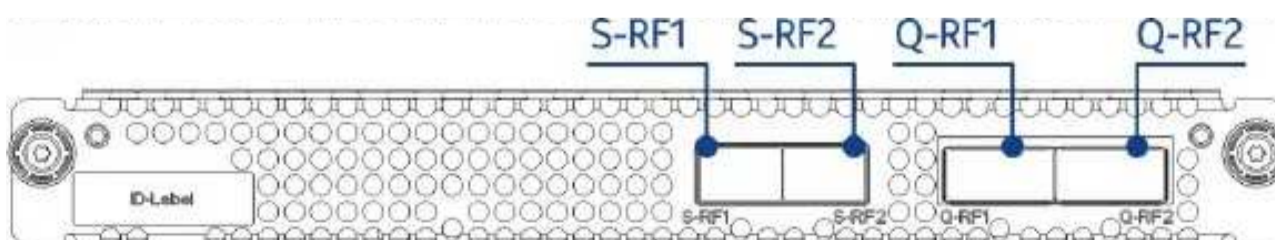
Table 20   ABIL interfaces

Label	Function	Connector type	Additional information
S-RF1, S-RF2	Fronthaul CPRI interfaces to radio units	SFP/SFP+	CPRI 9.8 Gbps or 10.1376 Gbps 10/25 GE

Table 20   ABIL interfaces (Cont.)

Label	Function	Connector type	Additional information
Q-RF1, Q-RF2	Fronthaul CPRI interfaces to radio units 10/25 GE Ethernet	QSFP	CPRI 9.8 Gbps or 10.1376 Gbps 10/25 GE

9 Nokia AirScale System Module environmental requirements and impact

9.1 Nokia AirScale System Module environmental requirements

Temperature and humidity ranges; transport, storage, and operational requirements

Table 21   Nokia AirScale SM temperature and humidity requirements

Activity	Temperature ranges		Humidity ranges
	Indoor	Outdoor	
Transportation	−40°C to 70°C (−40°F to 158°F)		Up to 95%
Storage	−33°C to 55°C (−27°F to 131°F)		10% to 100%
Installation	−20°C to 60°C (−4°F to 140°F)		Up to 93%
Operating	−5°C to 50°C (23°F to 122°F) for all 5G configurations with back to front airflow.	−35°C to 55°C (−31°F to 131°F)	
	−5°C to 55°C (23°F to 131°F) • For all LTE configurations. • For all 5G configurations with front to back airflow. • For 5G reduced configurations with back to front airflow. Contact Nokia Technical Support for details. For supported fan profiles, see Nokia AirScale System Module sound power levels.		
	−5°C to 60°C (23°F to 140°F)[7]		
Powering up[8]	−35°C to 55°C (−31°F to 131°F)		
Cold start-up	−5°C to 55°C (23°F to 131°F)	−40°C to 55°C (−40°F to 131°F)	

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[7] 60°C is only supported in LTE/SRAN, with front to back airflow inside AMIA with ASIA A.202 or ASIB, and any ABIA version.

[8] Powering on is allowed from −35°C, but AirScale System Module does not start until −5°C is reached.

Table 22　　　Required climatic conditions

Installation environment	ETSI norm required for:		
	Transportation	**Storage**	**Operation**
Indoor	ETSI EN 300 019-1-2 Class 2.3	ETSI EN 300 019-1-1 Class 1.2	ETSI EN 300 019-1-3, class 3.1E [9)]
Outdoor			ETSI EN 300 019-1-4, class 4.1

9.2　NEBS requirements for Nokia AirScale SM

A set of common technical requirements of safety, spatial and environmental design guidelines, applicable to telecommunications equipment

Network Equipment-Building System (NEBS; GR1089 criteria) installation site requirements for the Nokia AirScale System Module:

- The Nokia AirScale System Module needs to be connected to the local grounding system. All grounding system wiring must be installed by appropriately licensed personnel. Installation must be performed in accordance with national and local electrical codes, for example: National Electrical Code (NEC), National Fire Protection Association 70 (NFPA 70) in the United States.
- The Nokia AirScale System Module needs to be provided with an environmental enclosure in locations where the NEC applies for restricted access, and in outside plant locations.
- The Nokia AirScale System Module needs to be installed using thread-forming type unit mounting screws that remove any point or non-conductive coatings and establish metal-to-metal contact.
- The Nokia AirScale System Module needs to be connected to an isolated DC return (DC-I).
- The intra-building ports, such as/for example the Electrical Ethernet (EIF) interfaces and the Local Management Port (LMP) of the equipment or subassembly, are suitable for connection to intra-building, unexposed wiring, or cabling only. The intra-building ports of the equipment or subassembly must not be metallically connected to interfaces that connect to the Outside Plant (OSP) or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089) and require isolation from the exposed Outside Plant (OSP) cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

[9)] ETSI EN 300 019-1-3, class 3.1 gives general guidance on indoor installation environmental conditions. However, local conditions can change over time (day, season) and it can be impossible to verify if the indoor site requirements are unambiguously met. For example, the amount of humidity and dust can increase to a level which eventually can decrease performance and prevent the normal operation of the module over time. In such a case, when this environmental uncertainty is present, the long-term operation of BTS modules must be secured by improving the operating conditions, for example, by using proper filtering for dust and humidity. "Indoor" in this context means a controlled environment that has no direct outdoor contact or access (such as open windows or doors). For example, a roof or any other shelter against rain alone does not qualify as an indoor space. Incoming air must be filtered to remove any dust. If the outside air is hotter than the indoor space, there must not be any moisture which might condense into water. A heat exchanger or an air conditioner can be used instead of filter air cooling.

• The intra-building ports of the equipment or subassembly must use shielded intra-building cabling/wiring that is grounded at both ends.

9.3 Nokia AirScale System Module sound power levels

Maximum acoustic noise levels emitted by Nokia AirScale System Module subracks, measured according to ISO 3744

Table 23 Subracks' sound power levels dependency on temperature (measured according to ISO 3744)

Temperature	Maximum noise level in full configuration with low noise fan profile (dBA)		
	AMIA	AMOB	AMOD
15°C (59°F)	54	57	Will be provided in the future releases
23°C (73.4°F)	62	57	Will be provided in the future releases
45°C (113°F)	68	76	Will be provided in the future releases

Table 24 Subracks' sound power levels dependency on fan profile at 23°C (measured according to ISO 3744)

Fan profile	Maximum noise level (dBA)		
	AMIA	AMOB	AMOD
Low noise	62	57	Will be provided in the future releases
Optimized	82	83	70
Optimized with muffler	Not applicable	Not applicable	64
Linear	70	72*	At 25°C: 64 At 45°C: 70
Linear with muffler	Not applicable	Not applicable	At 25°C: 58 At 45°C: 64

*In horizontal position. Vertical may be louder.

Note: The optimized fan profile does not conform with NEBS acoustic emission limits.

NOTICE: Do not use the low noise fan profile with back to front airflow direction inside AMIA with ABIL. Use the linear (default) or the optimized fan profile.

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10 Nokia AirScale System Module power supply solutions

> *You may provide power to the subrack halves separately, redundantly, or the power may be bridged*

Table 25   Power supply options support by subracks

Power supply option	AMIA	AMOB	AMOD
Option 1	yes	yes	yes
Option 2	yes	no	no
Option 3	yes	no	yes*

*requires two power feeding lines:

- one to the PDU and from the PDU to the left side common plug-in unit
- one with a third party overvoltage protection (OVP) to the right side common plug-in unit

Note: A separate grounding cable is needed for each connected DC feed.

Option 1: A single power supply for the whole AirScale System Module

In this option, there is one DC feed from either left or right subrack half's DC input.

Figure 18   Power option 1

Primary DC

Primary DC
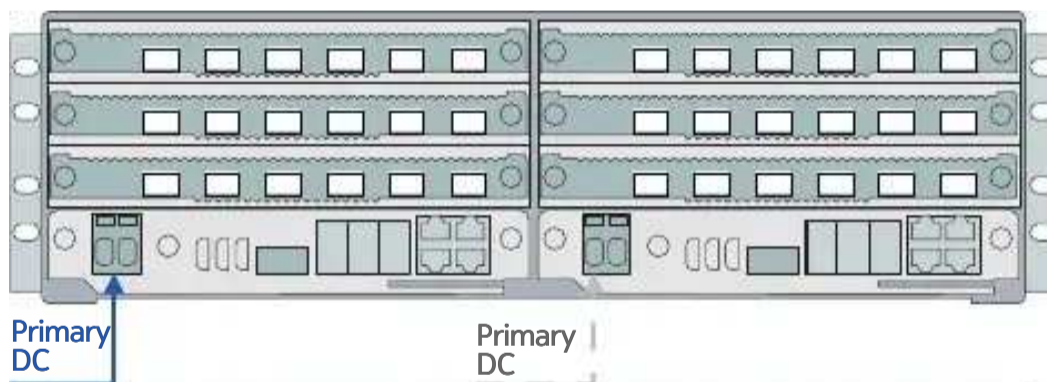
Option 2: Two power supplies, supplying power independently to two BTSs

In this option, the DC bridge in the subrack's rear is removed. Both inputs feed their own subrack half.

Figure 19   Power option 2

Primary DC

Primary DC
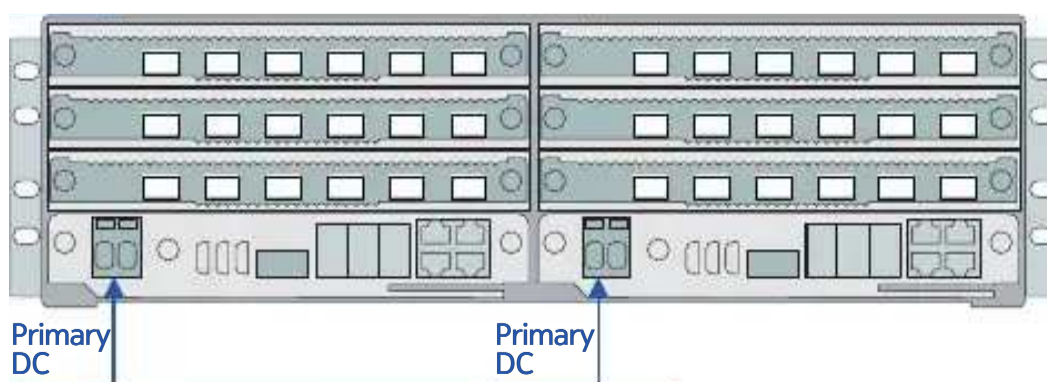
Option 3: Redundant for one BTS

This option provides load balancing between the two inputs through a DC bridge in the subrack's rear.

Figure 20   Power option 3

Primary DC

Secondary DC
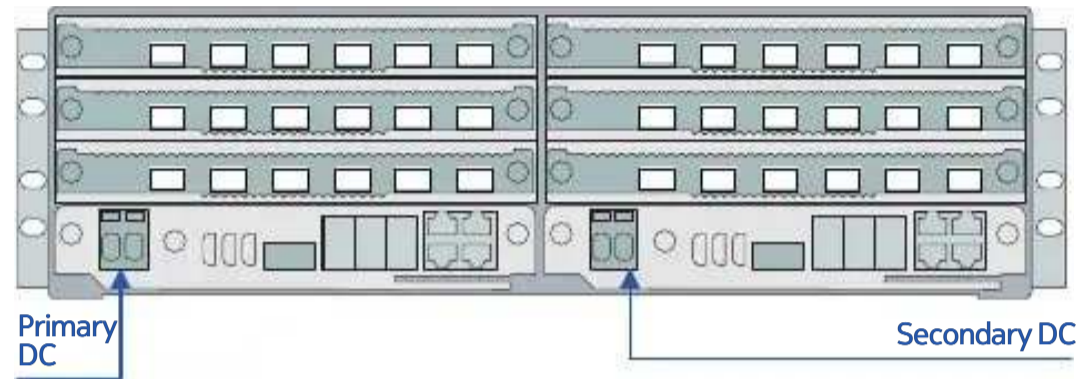
11 Nokia AirScale System Module power requirements and consumption

Supply voltage range; power consumption of plug-in units and subracks

Note: For DC-feed and fuse rating details, see *Nokia AirScale BTS Installation Site Requirements*

Table 26 Input voltage of the Nokia AirScale System Module Indoor

Property	Value
Nominal supply voltage	-48 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
Minimum startup voltage	40.5 V DC

*If the input voltage exceeds the extended range, the unit may shut down.

Table 27 Power consumption of the Nokia AirScale System Module subunits and configurations

Unit/subrack	Typical power consumption (at 25°) Measured according to ETSI ES 202 706	Maximum power consumption (at 55°/60°)	Cold start power consumption AMOB, AMOD: at -40°C Plug-in units, AMIA: at -5°C
ASIA	80 W	129 W	will be provided in future release
ASIB	80 W	will be provided in future release	will be provided in future release
ASIK*	115 W*	180 W*	will be provided in future release
ABIA	80 W	158 W	will be provided in future release
ABIL*	132 W*	199 W*	will be provided in future release
AMIA	20 W to 40 W, depending on the configuration	40 W	will be provided in future release
AMIA minimum configuration (1 ASIA + 1 ABIA)	160 W	210 W	< 160 W

Table 27 Power consumption of the Nokia AirScale System Module subunits and configurations (Cont.)

Unit/subrack	Typical power consumption (at 25°) Measured according to ETSI ES 202 706	Maximum power consumption (at 55°/60°)	Cold start power consumption AMOB, AMOD: at -40°C Plug-in units, AMIA: at -5°C
AMIA maximum configuration (2 ASIA + 6 ABIA)	702 W	1248 W	< 702 W
AMIA 5G half equipped* (1 ASIK + 3 ABIL)	573 W*	will be provided in future release	will be provided in future release
AMOB	15 W	225 W	570 W (with one heater) 1100 W (with two heaters)
AMOB minimum configuration (1 ASIA + 1 ABIA)	172 W	287 W	will be provided in future release
AMOB maximum configuration (2 ASIA + 6 ABIA)	741 W	1003 W	will be provided in future release
AMOD	54 W	130 W	625 W (with one heater) 1225 W (with two heaters)

*The values for 5G units are preliminary; the exact values will be provided in the future releases.

12 Nokia AirScale System Module LED indicators

Each plug-in unit's LEDs indicate status of specific ports, fans, plug-in units, or the whole System Module

LEDs indicate operation of the plug-in units (or the whole system module) as follows:

- Unit (system module) status LED
- All SFP/QSFP and RJ45 interfaces status LED
- FAN status LED
- SEI interfaces link status LED (common plug-in units)
- All LEDs are 3-color (red, green, yellow) and have three possible states when lit: stable, blinking, or alternating colors

12.1 5G common plug-in unit LED indicators

Figure 21   ASIK LED indicator locations
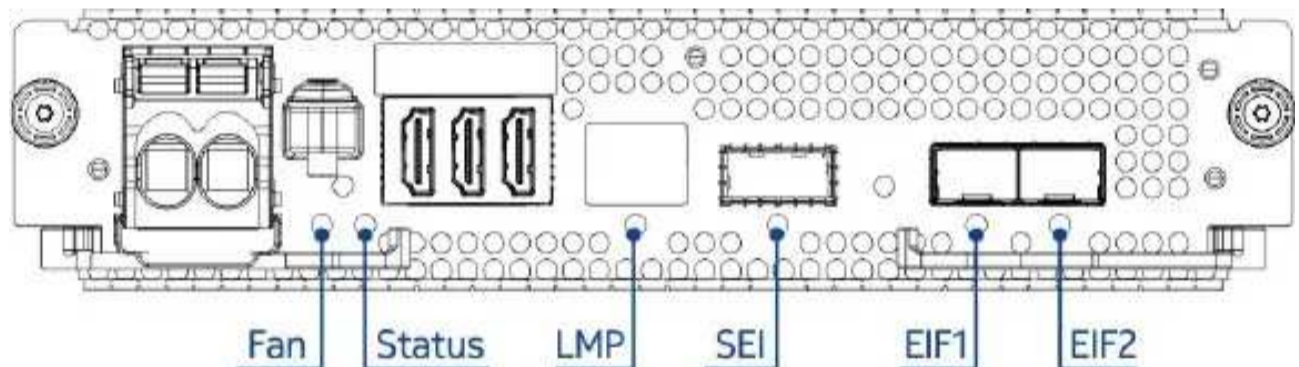
ASIKA LED indicators are located in the same locations.

Table 28   ASIK LED indicators (5G)

LED name	LED description	LED status
FAN	Operational status of FAN	Stable GREEN: all fans working Stable YELLOW: some fans faulty Stable RED: all fans faulty OFF: not in use
STATUS	Operational status of the whole System Module	Stable GREEN: HW online or commissioning configured Blinking GREEN: SW downloading or commissioning configuring (in runtime) Stable YELLOW: commissioning not configured[10]

---

[10] Commissioned data was not uploaded to a BTS.

Table 28   ASIK LED indicators (5G) (Cont.)

LED name	LED description	LED status
		Blinking YELLOW: SW downloading or commissioning configuring (in start-up)
		Stable RED: HW resetting or HW failed or commissioning not configured [11]
		Blinking RED: HW degraded
		Alternating RED/YELLOW: Autoconnection state: Rejected or registered NOK
		Alternating GREEN/RED: Autoconnection state: Registered
		Alternating GREEN/YELLOW: Autoconnetion state: Completed
SEI	Link status of System Extension interface SEI1	Available in a future release [12]
EIF1	Link status of 10GE/25GE SFP28 TRS interface EIF1	Stable GREEN: EIF link working
		Stable YELLOW: EIF port has a faulty or non-compliant SFP module
EIF2	Link status of 10GE/25GE SFP28 TRS interface EIF2	OFF: in start-up OAM configures both EIF ports as default or SFP plug-in module is missing from EIF port or EIF has a correct SFP module but link is not working
LMP	Link status of Local Management Port	Stable GREEN: LMP connected
		OFF: LMP disabled

12.2   5G capacity plug-in unit LED indicators

Figure 22   ABIL LED indicator locations
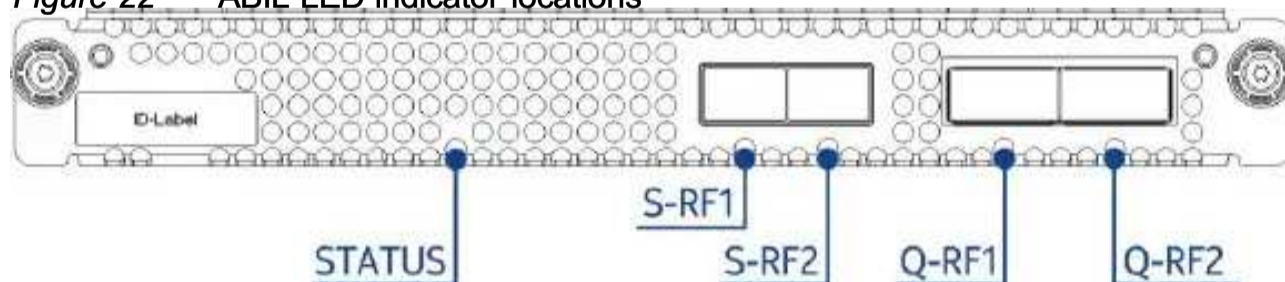
Table 29   ABIL LED indicators (5G)

LED name	LED description	LED status
STATUS	Operational status of the ABIL plug-in unit	Stable GREEN: HW online or commissioning configured

11) Commissioned data was uploaded to a BTS, but it is missing/corrupted.

12) SEI connector is used only to connect two ASIKs within one gNB-DU (in one AMIA subrack). Currently such configuration is not supported. Two ASIKs can be placed in one AMIA subrack, but they belong to different gNB-DUs so there is no SEI connection between them.

Table 29   ABIL LED indicators (5G) (Cont.)

LED name	LED description	LED status
		Blinking YELLOW: SW downloading or commissioning configuring (in start-up) Stable RED: HW failed Blinking RED: HW degraded
S-RF1	Link status of RF SFP+/SFP28 interface S-RF1	Stable GREEN: link established Stable YELLOW: missing SFP module or SFP module HW error
S-RF2	Link status of RF SFP+/SFP28 interface S-RF2	Stable RED: link broken OFF: M-plane is not initialized or the port is not commissioned
Q-RF1	Link status of RF QSFP+/QSFP28 interface Q-RF1	Stable GREEN: all commissioned links established Stable YELLOW: missing QSFP module or QSFP module HW error Stable RED: all commissioned links broken
Q-RF2	Link status of RF QSFP+/QSFP28 interface Q-RF2	Alternating RED/GREEN: some commissioned links broken OFF: M-plane is not initialized or the port is not commissioned

12.3   LTE/SRAN common plug-in units LED indicators

Figure 23   ASIA LED indicators location
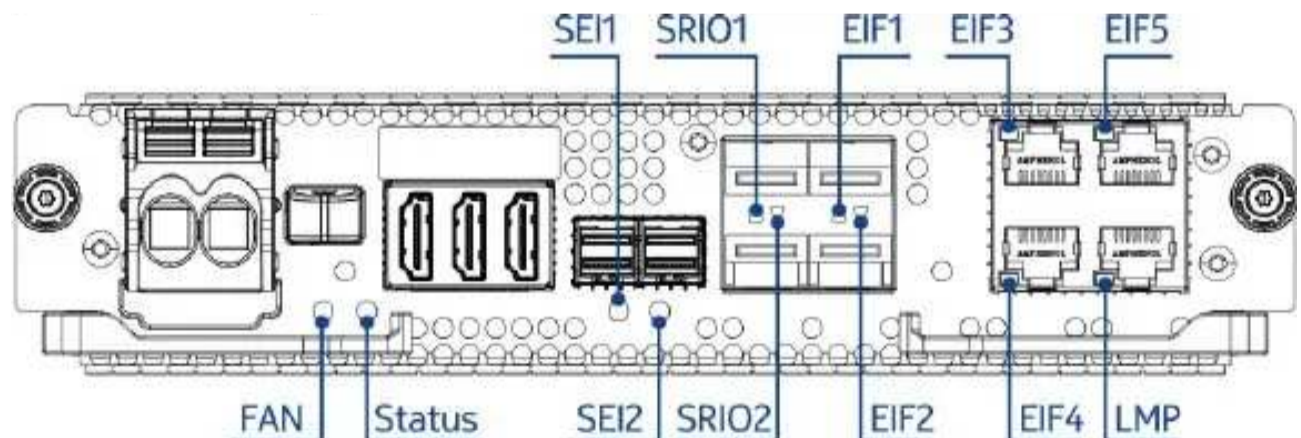
ASIAA LED indicators are located in the same locations.

Figure 24   ASIB LED indicators location
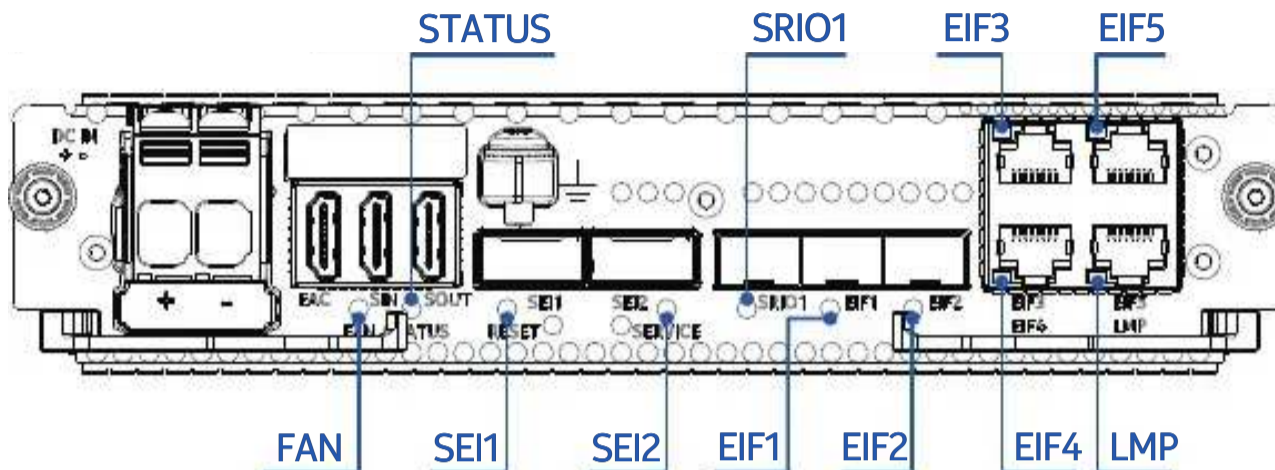
ASIBA LED indicators are located in the same locations.

Table 30   ASIA and ASIB LED indicators (LTE, SRAN)

LED name	LED description	LED status
FAN	Operational status of FAN	Stable GREEN: all fans working Stable YELLOW: some fans faulty Stable RED: all fans faulty
STATUS	Operational status of the whole System Module	Stable GREEN: HW online or commissioning configured Blinking GREEN: commissioning Internal SW download while configured Stable YELLOW: HW blocked or HW detected or commissioning unconfigured Blinking YELLOW: commissioning preparing or commissioning configuring or commissioning prepared Stable RED: HW resetting or HW failed Blinking RED: HW degraded
SEI1	Link status of System Extension interface SEI1	Available in a future release
SEI2	Link status of System Extension interface SEI2	Available in a future release
SRIO1	Link status of SRIO SFP+ interface SRIO1	Stable GREEN: SRIO port online Stable YELLOW: SRIO port connecting Stable RED: SRIO port degraded Off: SRIO port failed or not used
SRIO2 (ASIA only)	Link status of SRIO SFP+ interface SRIO2	
EIF1	Link status of 1/10GE SFP/SFP+ TRS interface EIF1	Stable GREEN: EIF online Stable Yellow: SFP disconnected Stable RED: no link detected Stable RED: EIF failed
EIF2	Link status of 1/10GE SFP/SFP+ TRS interface EIF2	

Table 30   ASIA and ASIB LED indicators (LTE, SRAN) (Cont.)

LED name	LED description	LED status
EIF3	Link status of 100/1000Base-T TRS interface EIF5	Blinking RED: EIF degraded Off: EIF port not used
EIF4	Link status of 100/1000Base-T TRS interface EIF6	
EIF5	Link status of 100/1000Base-T TRS interface EIF7	
LMP	Link status of Local Management Port	Stable GREEN: LMP port online Stable YELLOW: LMP port offline (LTE) Off: LMP port not used (LTE) Off: LMP port offline or not used (Single RAN)

12.4 LTE/SRAN capacity plug-in unit LED indicators

Figure 25   ABIA LED indicators location

Table 31   ABIA LED indicators (LTE, SRAN)

LED name	LED description	LED status
STATUS	Operational status of the ABIA plug-in unit	Stable GREEN: HW online or commissioning configured Blinking GREEN: Commissioning Internal SW download while configured Stable YELLOW: HW blocked or HW detected or commissioning unconfigured Blinking YELLOW: commissioning preparing or commissioning configuring or commissioning prepared Stable RED: HW resetting or HW failed Blinking RED: HW degraded
RF1	Link status of RF SFP+ interface RF1	Stable GREEN: optical cable online Stable YELLOW: optical cable disconnected Stable RED: optical cable failed Blinking RED: optical cable degraded
RF2	Link status of RF SFP+ interface RF2	
RF3	Link status of RF SFP+ interface RF3	

Table 31   ABIA LED indicators (LTE, SRAN) (Cont.)

LED name	LED description	LED status
RF4	Link status of RF SFP+ interface RF4	Off: optical cable not used
RF5	Link status of RF SFP+ interface RF5	
RF6	Link status of RF SFP+ interface RF6	

13 Nokia AirScale naming convention

Explanation on what the consecutive letters of a Nokia AirScale BTS modules mean

Table 32 Nokia AirScale naming convention

Letter	Description
First letter A _ _ _	Nokia AirScale product family
First letter F _ _ _	First generation Nokia AirScale RRH, Flexi Multiradio 10 BTS product family
Second letter _ A _ _	Antenna equipment, same band combiner, TD-LTE mMIMO
Second letter _ B _ _	Capacity plug-in unit
Second letter _ C _ _	Cabinet and cabinet accessories
Second letter _ D _ _	Diplexers
Second letter _ E _ _	5G and LTE mMIMO
Second letter _ H _ _	Nokia AirScale Remote Radio Heads (RRHs)
Second letter _ J _ _	5G radio access points (RAP)
Second letter _ L _ _	Low noise mast head amplifier (MHA)
Second letter _ M _ _	Subracks
Second letter _ N _ _	Compact active antenna (CAA) solution
Second letter _ O _ _	SFPs
Second letter	Power supply modules

Table 32   Nokia AirScale naming convention (Cont.)

Letter	Description
_P _ _	
Second letter _R _ _	RF Modules
Second letter _S _ _	System Modules (Flexi Multiradio 10 BTS) Common plug-in units (Nokia AirScale BTS)
Second letter _T _ _	Transport Modules, Submodules, and Cables
Second letter _Z _ _	Nokia AirScale TD-LTE RF Modules (RFMs)
Third letter _ _ I _	Indoor usage
Third letter _ _ O _	Outdoor usage
Third letter _ _ W _	Flexi Zone and AirScale small cells
Third letter _ _ Y _	GNSS/GPS equipment and accessories
Fourth letter _ _ _ A	Hardware version - A is the first, B - the second, and so on.
Fifth (and consecutive) letter _ _ _ _ A	In case of multi-band Radio units, there may be five or more letters, depending on the number of supported bands. The fifth letter is also added in some special cases, then it denotes a market-specific or customer-specific variant. For example ASIAA is the same as ASIA, but it has a different DC input connector.

For the following radio units, the second letter indicates the unit type:

- AA - Nokia Airscale TD-LTE mMIMO
- AE - Nokia AirScale 5G mMIMO
- AH - Nokia AirScale Remote Radio Heads
- AR - Nokia AirScale RF Modules
- AZ - Nokia AirScale TD-LTE and 5G RRH
- FH - first generation Nokia AirScale RRH

The third letter in those cases tells the operating 3GPP band for the respective technology (LTE or 5G) as in the table below. If the Radio unit supports more than one frequency band, the respective letters are given one after another. For example AHPMDA is a triple-band RRH, where the letters PMD describe the bands it supports - Bands 28, 20, and 8.

Table 33   Radio bands naming convention

Letter	Band
A	400 MHz
B	Bands 12, 13, 14, 17, 29 (700 MHz)
C	Band 5 (850 MHz)
D	Band 8 (900 MHz)
E	Band 3 (1700/1800 MHz)
F	Band 25 (1900 MHz)
G	Band 1 (2100 MHz)
H	Band 7 (2600 MHz)
I	Band 66 (1700/2100 MHz)
K	Band 11 (1500 MHz)
L	Band 12 (700 MHz)
M	Band 20 (800 MHz EU)
N	Band 30 (2300 MHz)
O	Band 71 (600 MHz US)
P	Band 28 (700 MHz)
Q	Bands 42, 43 5G NR Bands n77, n78 (3500 MHZ - 4200 MHz)
U	5G NR Bands n257, n258 (24 GHz – 28 GHz)
W	5G NR Band n260 (39 GHz)

14 Appendix: Nokia AirScale System Module connectors pin maps

Pin maps of Nokia-specific connectors

14.1 DC input connectors pin map

Figure 26   DC input (ASIA, ASIB, ASIK)
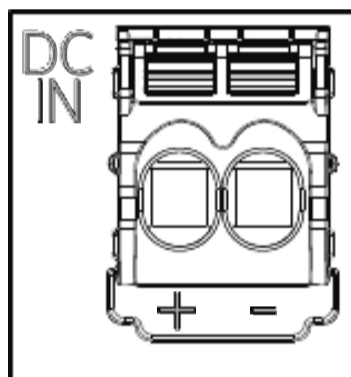
Figure 27   DC input (ASIAA, ASIBA, ASIKA)
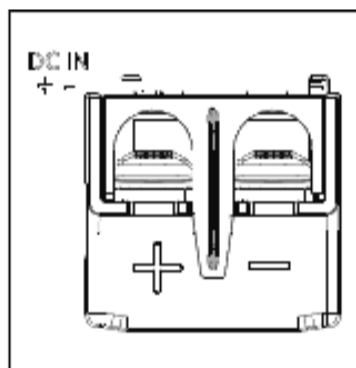
Table 34   Common modules DC input connectors

Pin	Signal (-48 V DC)
Left (+)	V48RTN (+)
Right (-)	V48N (-)

14.2 Nokia AirScale common plug-in units grounding connectors

Figure 28   ASIA A.101 grounding connector

Figure 29   ASIA A.202, ASIAA, ASIB, ASIBA, ASIK, ASIKA grounding connector

Table 35   Common units grounding connectors

Common unit	Grounding connector
ASIA A.101	one M5 screw hole
ASIA A.202, ASIAA, ASIB, ASIBA, ASIK, ASIKA	two M5 screw holes

14.3 External Alarm Control (EAC) connector pin map

The connector is marked EAC on the common plug-in unit.

Figure 30   EAC HDMI connector pins order
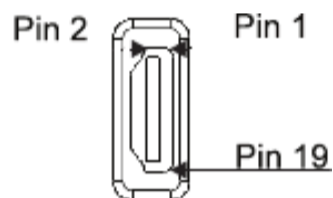
Table 36   EAC connector (HDMI)

Pin	Signal
case	ground / chassis ground
1	EXT_AL0
2	EXT_AL1
3	EXT_AL2
4	EXT_AL3
5	EXT_AL4
6	EXT_AL5
7	EXT_CTRL0_EXT_AL6
8	EXT_CTRL1_EXT_AL7
9	EXT_CTRL2_EXT_AL8
10	EXT_CTRL3_EXT_AL9
11	EXT_CTRL4_EXT_AL10
12	EXT_CTRL5_EXT_AL11
13	P5V_EAC
14	P5V_EAC
15	PROT_CAN_H_P5V_EAC
16	GND

Table 36   EAC connector (HDMI) (Cont.)

Pin	Signal
17	PROT_CAN_H_P5V_EAC
18	GND
19	GND

14.4   External synchronization input connector pin map

The connector is marked SIN on the common plug-in unit.

Figure 31   SIN HDMI connector pins order
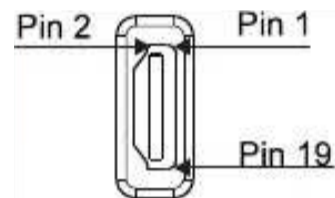
Table 37   External synchronization input interface connector (HDMI)

Pin	Signal	Pin	Signal
1	GPS_TIME_IN_H GSM_FC_IN_H	2	SingleEndedIn
3	GPS_TIME_IN_L GSM_FC_IN_L	4	GND
5	NC	6	GND
7	GPS_PPS_IN_H GSM_FN_IN_H	8	NC
9	GPS_PPS_IN_L GSM_FN_IN_L	10	GPS_CONTROL_H
11	GND	12	GPS_CONTROL_L
13	GND	14	NC
15	GPS_PWR_RET	16	GND
17	GND	18	GPS_PWR
19	NC	-	-

Signal descriptions:

- GPS_TIME_IN_H, GSM_FC_IN_H, GPS_TIME_IN_L, GSM_FC_IN_L: serial data from GPS to CPU or GSM Frame Clock input; RS422/485 differential.
- SingleEndedIn: REF2M_IN REF10M_IN Accepts TTL/CMOS and SINE from -6 to +13 dBm. Input impedance is approximately 75 Ohm.
- NC: No Connection.
- GPS_PPS_IN_H, GSM_FN_IN_H, GPS_PPS_IN_L, GSM_FN_IN_L: PPS pulse from GPS or GSM Frame Number input; RS422/485 differential.
- GPS_CONTROL_H, GPS_CONTROL_L: Serial data form CPU to GPS; RS422/485 differential.
- GPS_PWR, GPS_PWR_RET: GPS power supply: 50 mA at 15 to >35 V.
- GPS_PWR_N is tied to GND.

14.5 External synchronization output connector pin map

The connector is marked SOUT on the common plug-in unit.

*Figure 32*   SOUT HDMI connector pins order
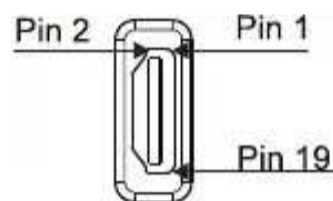
Table 38   External synchronization output interface connector (HDMI)

Pin	Signal	Pin	Signal
1	GPS_TIME_OUT_H GSM_FC_OUT_H	2	SingleEndedClockOut 1
3	GPS_TIME_OUT_L GSM_FC_OUT_L	4	GND
5	NC	6	GND
7	PPS_OUT_H	8	SingleEndedClockOut 2
9	PPS_OUT_L	10	DiffClockOut_H or GSM_FN_OUT_H
11	GND	12	DiffClockOut_L or GSM_FN_OUT_L
13	GND	14	NC
15	-	16	GND
17	GND	18	NC

Table 38   External synchronization output interface connector (HDMI) (Cont.)

Pin	Signal	Pin	Signal
19	TESTCLK_GSM_FN_OUT_H	-	-

Signal descriptions:

- GPS_TIME_OUT_H, GSM_FC_OUT_H, GPS_TIME_OUT_L, GSM_FC_OUT_L: Copy of the serial data from GPS to CPU. The collocated BTS is only interested in the NMEA contents of this data stream or GSM Frame Clock output; RS422/485 differential or frame clock out.

- SingleEndedClockOut1: LVTTL. Can have 11 sources: 2.048 MHz (from SingleEndedIn), 10 MHz (from SingleEndedIn), 10 MHz (FPGA internally generated), FCLK_IN 250 Hz, SYNC_WFCLK 30.72 MHz, SYNC_SFCLK 100 Hz, SYNC_SFCLK/2 50 Hz, SYNC_SFCLK/4 25 Hz, SYNC_SFCLK/8 12.5 Hz, SFNO 30.72 MHz pulse per 10 ms, Internal PPS_int 1 Hz.

- PPS_OUT_H, PPS_OUT_L: PPS_OUT RS422/485 differential.

- SingleEndedClockOut2: LVTTL. Can have two sources: 2.048 MHz (from SingleEndedIn), 10 MHz (from SingleEndedIn).

- DiffClockOut_H or GSM_FN_OUT_H, DiffClockOut_L or GSM_FN_OUT_L: Has 12 potential clock sources: 2.048 MHz (from SingleEndedIn), 10 MHz (from SingleEndedIn), 10 MHz (FPGA internally generated), FCLK_IN 250 Hz, SYNC_WFCLK 30.72 MHz, SYNC_SFCLK 100 Hz, SYNC_SFCLK/2 50 Hz, SYNC_SFCLK/4 25 Hz, SYNC_SFCLK/8 12.5 Hz, SFNO 30.72 MHz pulse per 10 ms, Internal PPS_int 1 Hz, GSM FRAME number.

- TESTCLK_GSM_FN_OUT_H: Single ended copy of pins 10/12.

15 Appendix: Documentation related to Nokia AirScale BTS

References to other Operating Documents which include information on Nokia AirScale BTS

15.1 5G documentation related to Nokia AirScale BTS

BTS Descriptions

- *3D View of Nokia AirScale System Module 5G (html)*
- *3D View of Nokia AirScale System Module 5G (pdf)*
- *Nokia AirScale Radio Units Description*
- *Nokia AirScale System Module Product Description*

Install and Commission

- *Nokia AirScale System Module — AMIA Installing and Cabling Manual*
- *Nokia AirScale System Module — AMOB Installing and Cabling Manual*
- *Installing and Cabling Nokia AirScale Radio Units*
- *Factory Delivery Software and Diagnostic And Recovery Software Description*
- *Deployment, Commissioning and Integrating gNB*

Integrate and Configure

- *Configuring Security in gNB*

Reference

- *5G BTS Alarms and Faults*
- *5G BTS Performance Measurements*
- *5G BTS Parameters*

Legal, Safety, and Environmental Information

- *Nokia AirScale Cloud BTS - 5G Personal Data Inventory*

15.2 LTE/SRAN documentation related to Nokia AirScale BTS

Nokia AirScale BTS

- **Nokia AirScale BTS Descriptions**
  - *Nokia AirScale Radio Description*
  - *Nokia AirScale BTS Transmission Description*
  - *Nokia AirScale BTS Optional Items Description*

- – *Nokia BTS Cables and SFPs Description*

- **Installing Nokia AirScale System Modules**

  - – *Nokia AirScale System Module — AMIA Installing and Cabling Manual*
  - – *Nokia AirScale System Module — AMOB Installing and Cabling Manual*
  - – *Nokia AirScale System Module — AMOD Installing and Cabling Manual*
  - – *Nokia BTS Installation Site Requirements*
  - – *Installing Nokia AirScale System Module for Stack and Wall Configurations*
  - – *Cabling Nokia AirScale System Module*
  - – *Expanding Nokia AirScale BTS*
  - – *Creating Nokia AirScale BTS FDD-LTE Configurations*
  - – *Creating Nokia AirScale BTS TD-LTE Configurations*

- **Installing Nokia AirScale Radios**

  - – *Nokia AirScale Radio Quick Guide*
  - – *Installing and Cabling Nokia AirScale RF Modules*
  - – *Installing and Cabling Nokia AirScale Remote Radio Heads*
  - – *Installing and Cabling Nokia AirScale 2 Remote Radio Heads 300*
  - – *Installing and Cabling Nokia AirScale 2 Remote Radio Heads 600*
  - – *Installing and Cabling Nokia AirScale Micro Remote Radio Heads*

- **Troubleshooting Nokia AirScale BTS**

  - – *Replacing Nokia AirScale BTS Units*
  - – *Maintaining Nokia BTS Hardware*

- **Legal, Safety and Environmental Information**

  - – *Nokia AirScale BTS Environmental Product Declaration*

Flexi Multiradio 10 BTS

- **Installing Flexi Multiradio 10 BTS Optional Items**

  - – *Installing Optional Flexi System Units*
  - – *Installing Optional Flexi Power Units*
  - – *Installing Optional Flexi Installation Kits*
  - – *Installing Optional Global Navigation Satellite System Units*

Nokia Cabinets

- *Nokia Cabinets Description*
- *Installing Nokia BTS Modules in Cabinets*

BTS Reference Data

- *LTE BTS Alarms and Faults*
- *LTE BTS Parameters*
- *FDD-LTE BTS Configurations*
- *TD-LTE BTS Configurations*

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