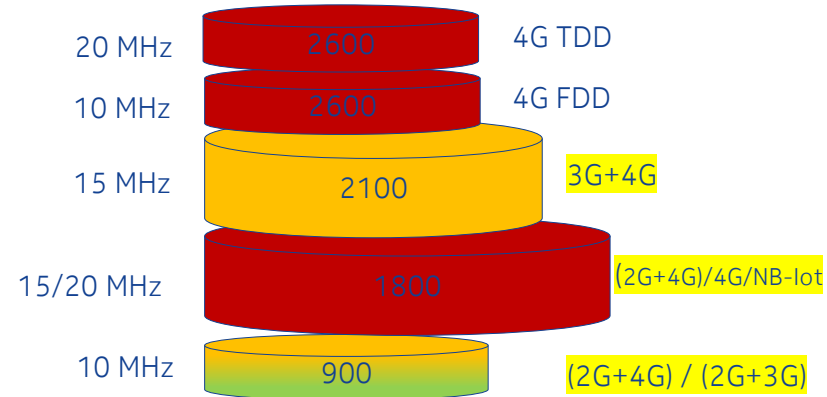
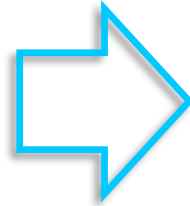
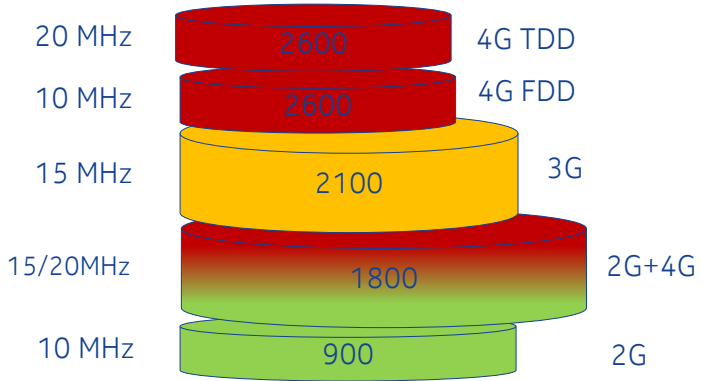
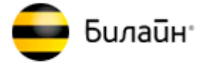


Vimpelcom South SWAP Project

AirScale HW Solution Technical Description

Rostislav Kuleshov
RSSM, East Europe

Vimpelcom South Network Technology Layers Transformation



Nokia AirScale Hardware for South SWAP project

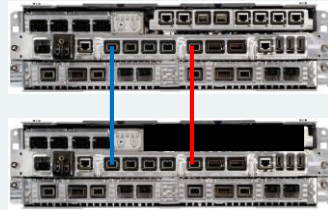
Main radio equipment : Airscale BTS product line.

- Project Scope: About 700 macro sites still to be swapped + New GF Sites.
- Support common software for technologies - 2G/3G/4G FDD/4G TDD.
- NB-IoT Support.
- Room for 5G.
- LTE Carrier Aggregation Support inside one System module.
- Baseband is built AirScale AMOB/AMIA subrack, ASIA and ABIA cards.
- Variety of radio modules : Flexi and AirScale portfolio, supporting 2T/2R, 2T/4R, 4T/4R, 6T/6R RF configurations.
- Planned starting software release - SRAN19.

AirScale System Module Hardware overview

BTS System Modules

System Module Flexi Multiradio 10



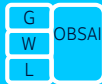
System Module AirScale



RF Sharing



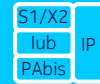
Fronthaul Sharing



System Module Sharing



Backhaul Sharing



Common BTS OAM



AirScale System Module

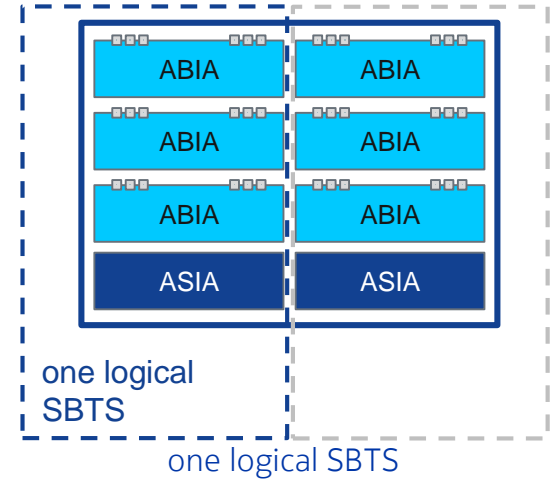
The AirScale System Module is built of:

- one subrack:
 - AMIA** (indoor) / **AMOB** (outdoor) AirScale Subrack

One sub-rack fits one or two independent logical SBTs consisting of

- one or two core modules
 - ASIA** AirScale Common
- minimum one, maximum six capacity extension modules
 - ABIA** AirScale Capacity

Each ABIA can be used for allocation of LTE or SRAN cell sets



ABIA Capacity

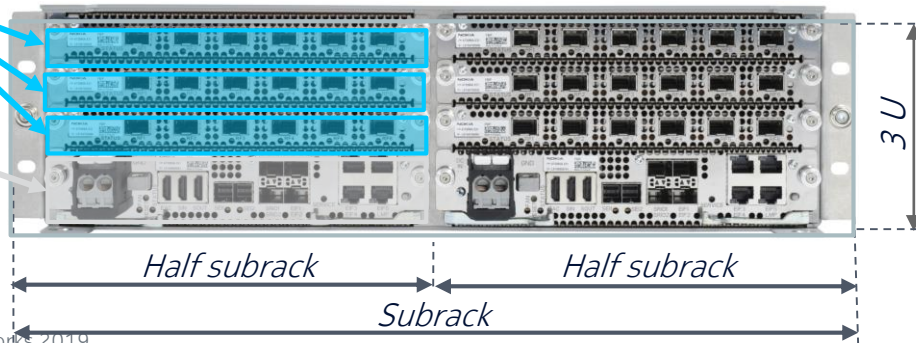
Baseband plug-in

- User Plane
- RFM connectivity

ASIA Common

Common unit

- Control Plane
- Transport connectivity



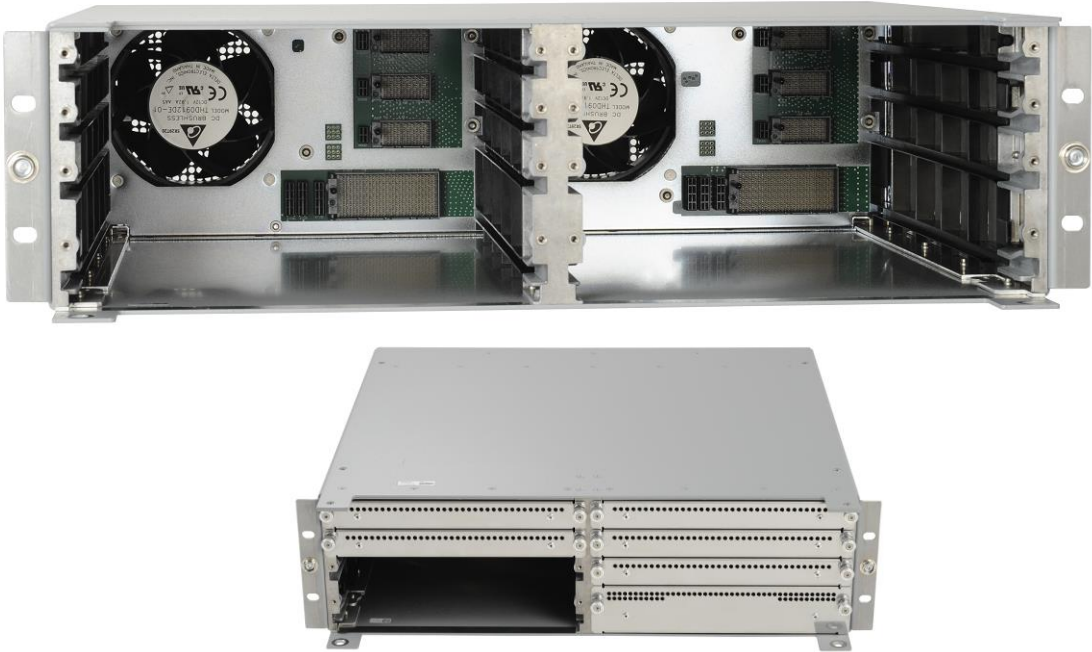
- A AirScale
- B Baseband
- I Indoor
- A
- A
- S S - Core or Common functions
- I
- A
- A
- M M - Subrack
- I
- A

AirScale System Module Indoor



AirScale System Module Indoor

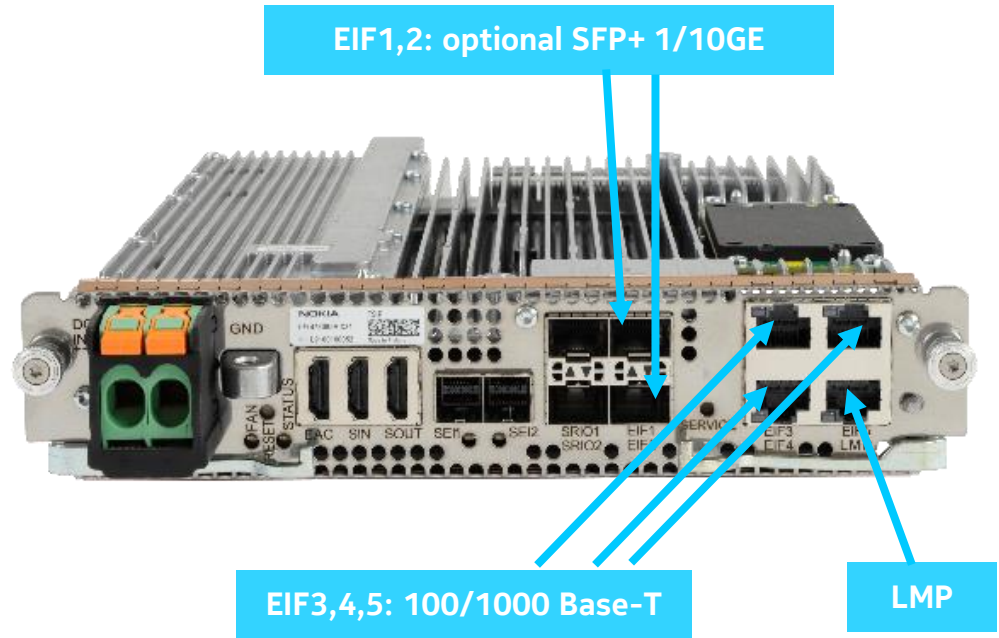
AMIA: Fans, backplane for high speed signaling and power.



AirScale System Module Cards

Nokia AirScale SM Indoor: ASIA supports the following integrated transport functions

- Packet Abis, Iub, S1/X2 over integrated Ethernet interfaces
- 3X 100/1000 Base-T Ethernet port
- 2X optional SFP+ (1/10GE optical or 1GE electrical)
- Ethernet based chaining and switching across up to 5 interfaces
- 1x 10GE connection between ASIA's via AMIA backplane
- IEEE1588v2, Synchronous Ethernet, 1PPS and 2.048MHz
- High-capacity IPsec, ASIA HW capability 10 Gbit/s DL+UL
- One transport termination per sub-rack side

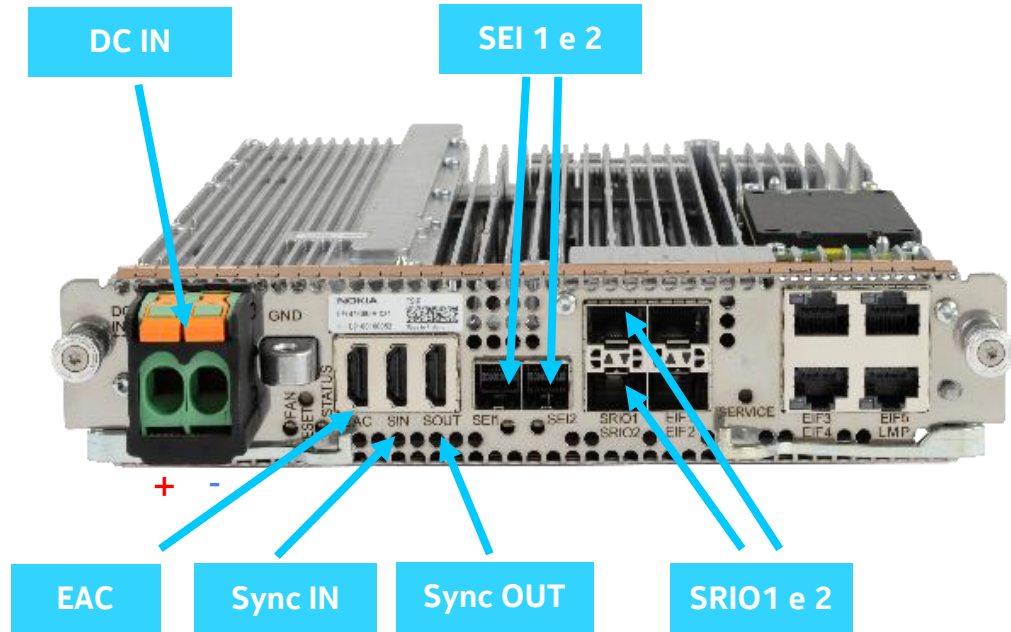


NOTE: Only SFP + Nokia transceivers are supported.

AirScale System Module Cards

ASIA :

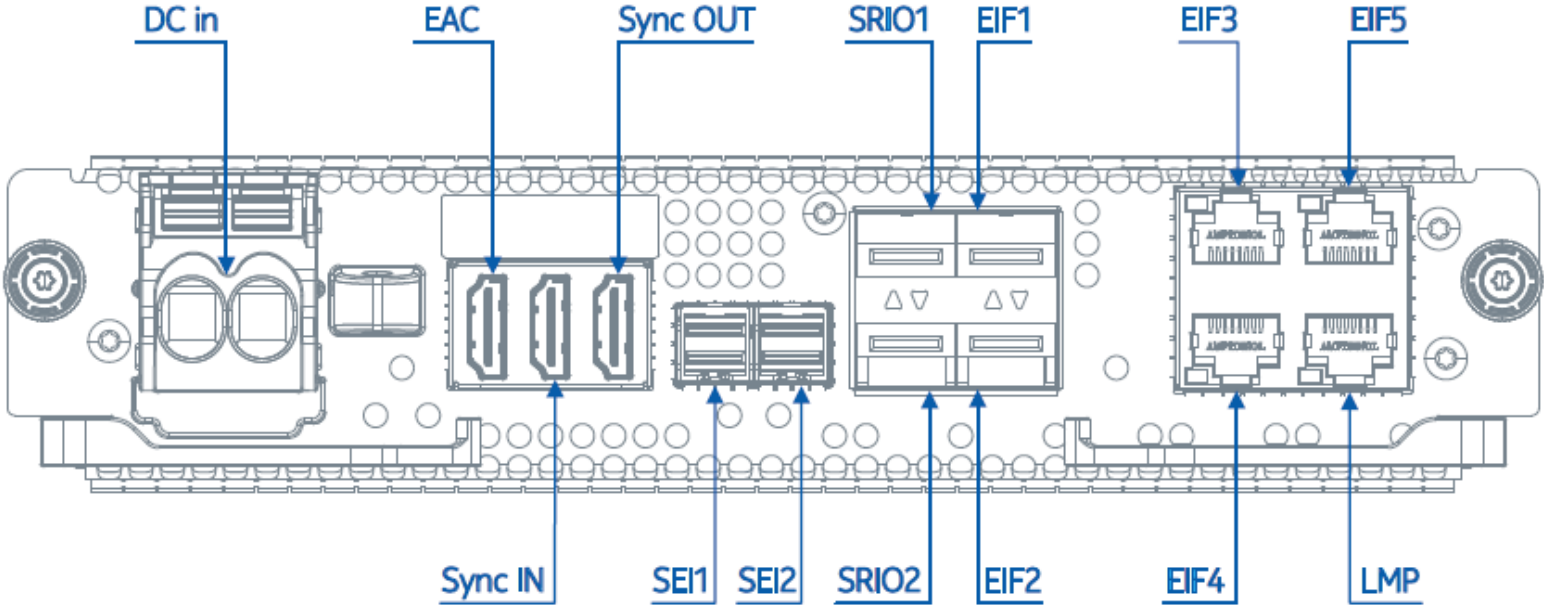
- EAC
- Sync IN
- Sync OUT
- 2 x SEI (System Extension Interface)
- 2 x SRIO (Serial Rapid Input Output)



**NOTA: Max. cable DC,
16mm².**

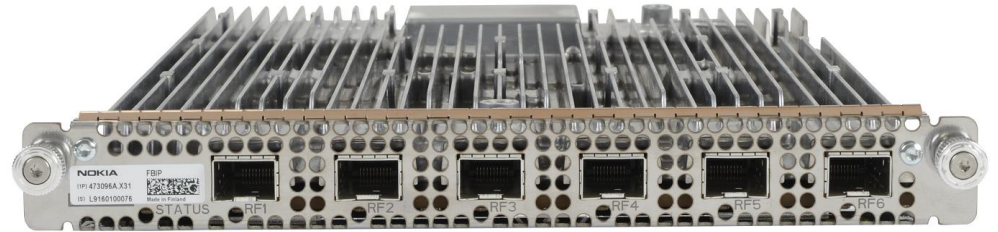
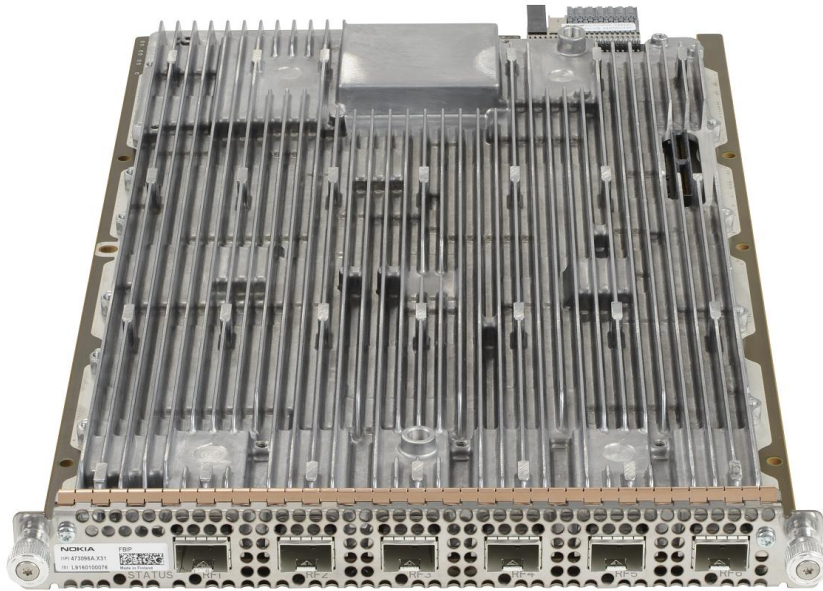
AirScale System Module Cards

ASIA



AirScale System Module Cards

ABIA: six optical interfaces for RF, 6Gbps OBSAI or 9.8Gbps CPRI.



AirScale System Module Outdoor

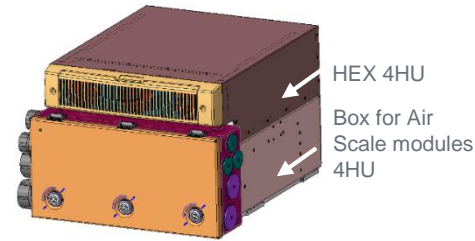


AirScale OUTDOOR Subrack AMOB

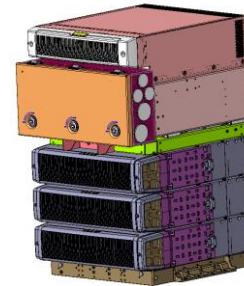
- IP55 environmental protection for AirScale indoor System Module
- Height: **8 HU** and weigh 23kg (bear subrack)
- High performance Heat Exchanger technology for thermal management
- Operating temp range -40C up to +55C without solar radiation
- Cold start from -40°C to -5°C with optional heater(s)
- Compatible with Flexi BTS mechanics stack/wall/pole/rack installation
- Possibility to install AMOB on top of the Flexi stack (3 flexi radios under AMOB in the stack for Zone 4 and 5 flexi radios for Zone 2)
- Supporting other modules above AMOB with additional stacking kit (under validation)
- Compatible with the 3rd part 19" racks and cabinets if it follow clearances and airflow requirements
- Service doors on front and rear sides
- Cable entry solution based on conduits/cable glands

Asset	Weight (Kg)	Weight (lbs)	Dimensions	mm	Inches
AMOB Cabinet	23	51			
AirScale Common Unit board (ASIA) (Core Module)	3	7	Height	354	14
ABIA (Expansion Module)	2	4	Width	487	19
½ Capacity (1 Core + 3 Expansion)	32	70	Depth	605	24
Full Capacity (2 Core + 6 Expansion)	41	90			

Stand-alone AMOB



AMOB on the pole/wall



AMOB on top of Flexi modules stack

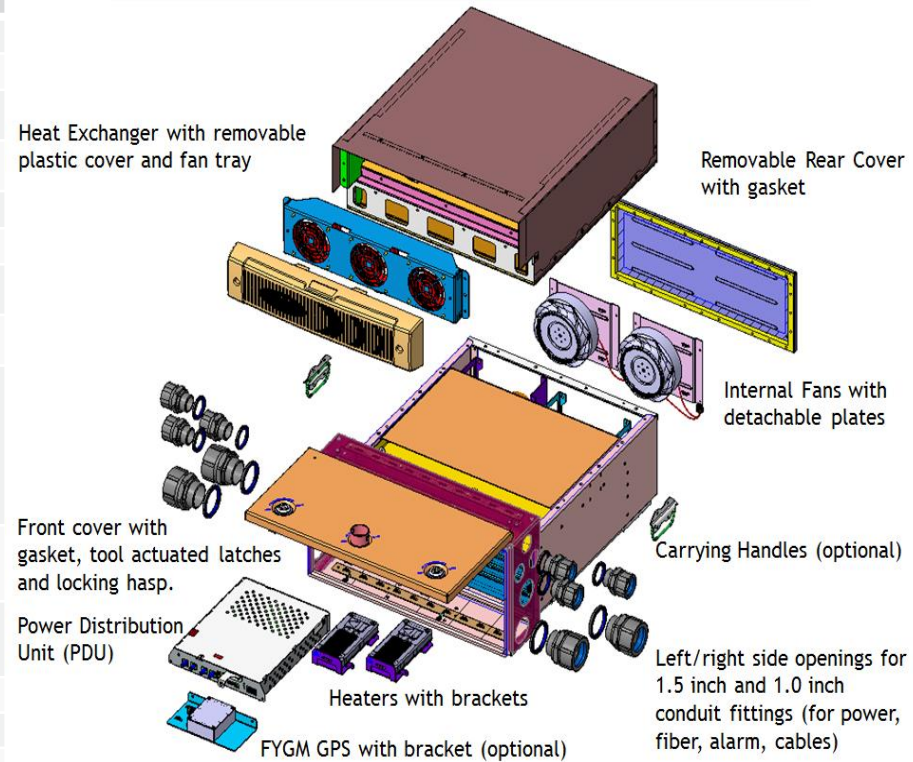


AMOB inside FCOA (3 positions possible)

NOKIA

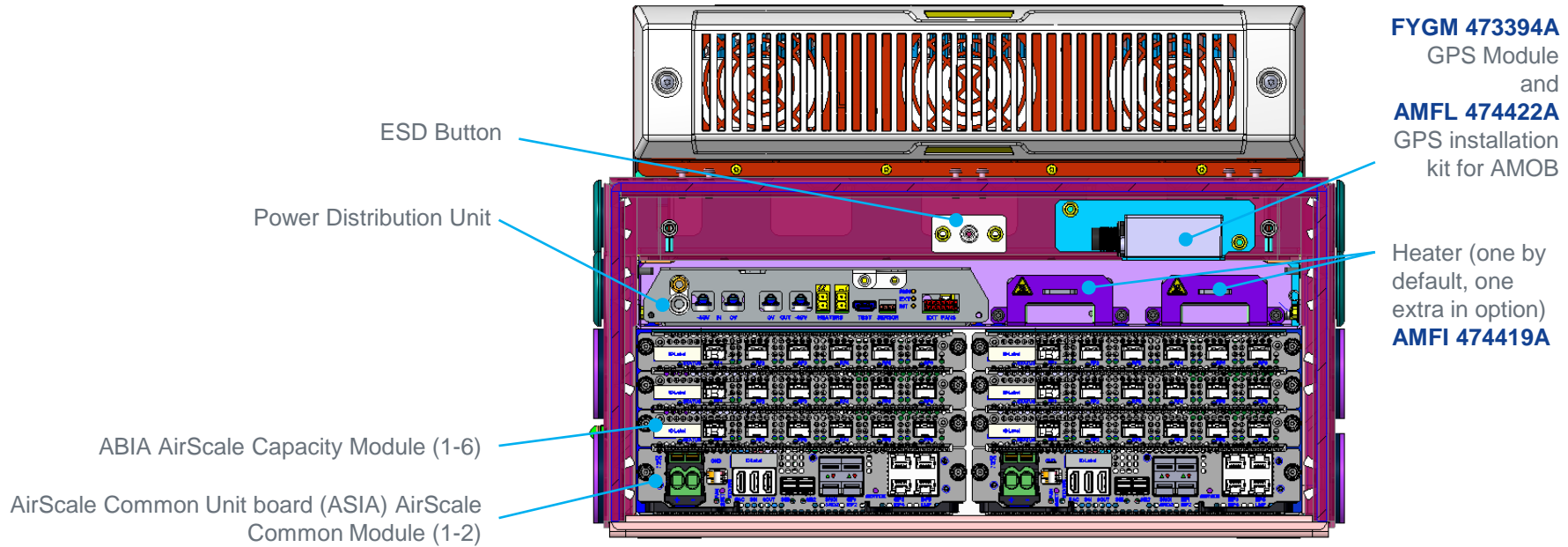
AMOB - Exploded View

Height	8U (354.8mm)
Width (front cover)	487mm
Width (cabinet)	448mm (fits into 19 inch rack) 487mm without conduits
Depth	Total 605mm 472mm from rack mounting point
Weight	23 kg (exclude ASMI plug-in modules)
Ingress Protection	IP55
Operating Temperature	-40°C up to +55°C (without solar radiation)
Installation Temperature	-20°C up to +55°C
Airflow Direction	Back to front airflow direction supported for Horizontal installation (FCOA, 19" rack, Flexi stack) Front to back airflow direction supported for Vertical installation (wall and pole mounting case)
Cold start	~2h from -40°C to -5°C *Optional 2 nd heater can be added to meet Telcordia GR requirement, cold start from -40°C to -5°C in 1 hour instead of 2 hours
Nominal supply voltage	-40.5 ... -57 V DC
Input voltage range	Extended Service Voltage Range supported -36Vdc .. -60Vdc Floating
Volume	104.5L
Mass capacity	Support Max 18Kg inside 135W @ 25°C (fans)
Power consumption	265W (with 40W tolerance) @ +55°C (all fans at highest speed) Cold start @ -40°C ~600W (1 heater ON 550W (inrush 22A) + fans at low speed) 40W @ 0°C (no heater, fans at low speed)
Conduit cable entry	2x1.5" + 3x 1" on each left and right side (6x1" and 4x1,5" in total)

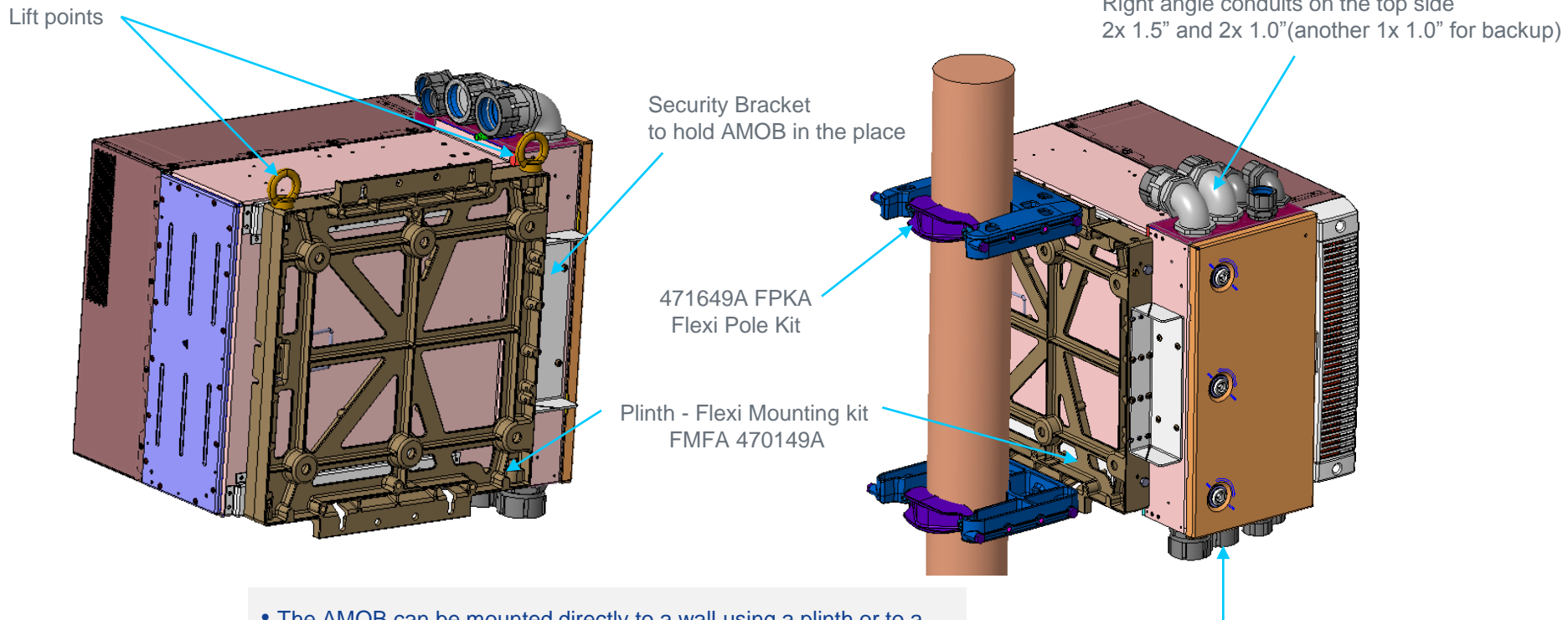


Heat Exchanger cooling contains fluorinated greenhouse gases
Hermetically sealed
Refrigerant: HFC-134a GWP value = 1430
System charge weight = 0.65Kg

AMOB – Front view, door removed



AMOB - Mounting Options – Wall & Pole



- The AMOB can be mounted directly to a wall using a plinth or to a pole using additional pole brackets
- An extra bracket is required to secure the AMOB to the plinth.

AirScale Radio Modules Hardware overview

AirScale RFM

AirScale RRH

Hardware for SWAP project

AirScale Radio Units

- **Increased Tx Power**
- **5G ready**
- **Full Band IBW**
- **CPRI Support**
- **ANT 4.3-10**

Hardware for SWAP project

AirScale Radio Units

Band	AirScale RFM				AirScale RRH			
	Model	Mode	Power per TX	IBW	Model	Mode	Power per TX	IBW
800	ARMA	6T/6R	60W	Full band	AHMA	2T/4R	60W	Full band
900	ARDA	6T/6R	80W	Full band	AHDA	2T/4R	60W	Full band
1800	AREA	6T/6R	80W	Full band	FHEL	2T/2R	60W	Full band
2100	ARGA	6T/6R	80W	Full band	AHGA	2T/4R	60W	Full band
2600	ARHA	6T/6R	60W	Full band	AHHB	4T/4R	40W	Full band
2600 TDD					FZHW	8T/8R	20W	40MHz

Note: ARMA, ARHA are available starting R20, use Flexi RFM instead.

AirScale RFM 6T6R B20 360W ARMA

High Power, Full band, 3-sector LTE optimized solution for EU800 MHz

Benefits for the operator

- Lean Site solution
- Reduced Opex
- High RF OP
- 1+1+1 & 2+2+2 2TX MIMO downlink with only one RF Module

Feature description

Radio Characteristics

- RF Output Power: 6x60W
- TX/RX 6TX & 6RX
- Band 20 TX 791 - 821 MHz, RX 832 - 862 MHz
- iBW & oBW Full Band
- 5G HW readiness Yes

Other Characteristics

- Supported technologies FDD-LTE
- Supported System Module: FSMF, AirScale
- Optical Interface Type: 3* 9.8 Gb/s CPRI
- Mount: Pole/Wall installation, Rooftop, Vertical Book/Stack mount, rail



Target Dimensions:

21 Liters, 23 kg

IP 65. -40°C to +55°C

AirScale RFM 6T6R B8 480W ARDA

High Power, Full band, 3-sector LTE optimized solution for 900 MHz

Benefits for the operator

- Lean Site solution
- Reduced Opex
- High RF OP
- 1+1+1 & 2+2+2 2TX MIMO downlink with only one RF Module

Feature description

Radio Characteristics

- RF Output Power: 6x80W
- TX/RX 6TX & 6RX
- Band 8 TX 925 - 960 MHz, RX 880 - 915 MHz
- iBW & oBW Full Band
- 5G HW readiness Yes

Other Characteristics

- Concurrent operation LTE, WCDMA and GSM defined by SW
- Supported System Module: FSMF, AirScale
- Optical Interface Type: 3* 9.8 Gb/s CPRI
- Mount: Pole/Wall installation, Rooftop, Vertical Book/Stack mount, rail



Target Dimensions:

21 Liters, 23 kg
IP 65. -40°C to +55°C

AREA AirScale RFM 6T6R n3 480W

5GC001694

Multi RAT capable single RFM serving 3 sectors

Benefits for the operator

- Compact size and flexible mounting options
- Prepared for built-in PIM cancellation
- Full occupied bandwidth

Radio Characteristics

Max RF Output Power	6 * 80 W
TX/RX	6T6R
Band/Frequency Range	band 3/n3
- UL(RX)	1710 - 1785 MHz
- DL(TX)	1805 - 1880 MHz
Instantaneous bandwidth (IBW)	full band
Occupied bandwidth (OBW)	full band
5G NR Carrier bandwidth	5, 10, 15, 20 MHz



Physical & Environmental

21 liters, 23 kg
IP65. -40°C to +55°C
Forced cooling

Other Characteristics

Concurrent Operation	Prepared for up to total 4 carriers LTE or NR plus up to 4 GSM TRX
External Interfaces	3 * SFP+ for CPRI 9.8, 4 * ANT 4.3-10, DC -48 V circular connector, RET 8-pin circular, ext. alarms MDR-26
Installation Options	Vertical: wall, pole; Horizontal: stack or cabinet

AirScale RFM 6T6R B1 480W ARGA

High Power, Full band, 3-sector LTE optimized solution for 2100 MHz

Benefits for the operator

- Lean Site solution
- Reduced Opex
- High RF OP
- 1+1+1 & 2+2+2 2TX MIMO downlink with only one RF Module

Feature description

Radio Characteristics

- RF Output Power: 6x80W
- TX/RX 6TX & 6RX
- Band 1 TX 2110 - 2170 MHz, RX 1920 - 1980 MHz
- iBW & oBW Full Band
- 5G HW readiness Yes

Other Characteristics

- Concurrent operation LTE, WCDMA and GSM defined by SW
- Supported System Module: FSMF, AirScale
- Optical Interface Type: 3* 9.8 Gb/s CPRI
- Mount: Pole/Wall installation, Rooftop, Vertical Book/Stack mount, rail



Target Dimensions:

21 Liters, 23 kg

IP 65. -40°C to +55°C

AirScale RFM 6T6R B7 360W ARHA

High Power, Full band, 3-sector LTE optimized solution for 2600 MHz

Benefits for the operator

- Lean Site solution
- Reduced Opex
- High RF OP
- 1+1+1 & 2+2+2 2TX MIMO downlink with only one RF Module

Feature description

Radio Characteristics

- RF Output Power: 6x60W
- TX/RX: 6TX & 6RX
- Band 7: TX 2620 - 2690 MHz, RX 2500 - 2570 MHz
- iBW & oBW: Full Band
- 5G HW readiness: Yes

Other Characteristics

- Supported technologies: FDD-LTE
- Supported System Module: FSMF, AirScale
- Optical Interface Type: 3* 9.8 Gb/s CPRI
- Mount: Pole/Wall installation, Rooftop, Vertical Book/Stack mount, rail



Target Dimensions:

21 Liters, 23 kg

IP 65. -40°C to +55°C

AirScale RRH 2T4R B20 120W AHMA

Single band AirScale RRH solution for EU800

Benefits for the operator

- Lean Site solution
- Reduced Opex
- PIM cancellation
- CPRI support
- No external filters required to handle transmitter spurious emission and blocking

Feature description

Radio Characteristics

- RF Output Power: 2x60W
- Connectors 4* 4.3-10 connectors
- TX/RX 2TX & 4RX
- Band 20 TX 791 - 821 MHz, RX 832 - 862 MHz
- iBW & oBW Full Band
- 5G HW readiness Yes

Other Characteristics

- Supported technologies FDD-LTE
- Supported System Module: FSMF, AirScale
- Optical Interface Type: 2* 9.8 Gb/s CPRI with compression
- Mount: Wall, Pole, Book, RAS, rail, horizontal with Fan



Target Dimensions

12.9 Liters, 14 kg
IP65, -40 to +55 °C

AirScale RRH 2T2R B8/20/28 240W AHPMDA

3 band (700/800/900) radio for compact site solutions

Benefits for the operator

- Lean Site solution
- Reduced Opex
- Multiband PIM cancellation
- CPRI support
- Power sharing across bands

Feature description

Radio Characteristics

- RF Output Power: RF Output Power: 2x120W. Dynamic power sharing between bands
- Connectors 4* 4.3-10 connectors
- TX/RX 2TX & 4RX for B8/20, 2TX & 4RX for B28
- Band 8 TX 925 – 960 MHz, RX 880 – 915 MHz
- Band 20 TX 791 – 821 MHz, RX 832 – 862 MHz
- Band 28 TX 758 – 788 MHz, RX 703 – 733 MHz
- iBW & oBW Full Band iBW, oWB 80 MHz per RRH
- 5G HW readiness Yes

Other Characteristics

- Supported technologies B20/28(FDD-LTE), B8(GSM/WCDMA/FDD-LTE)
- Supported System Module: FSMF, AirScale
- Optical Interface Type: 2 * 9.8 Gb/s CPRI with compression
- Mount: Pole, Wall, Bookmount, horizontal with optional fans



Target dimensions:

<21 liters, <24 kg

IP 65. -40°C to +55°C

NOKIA

AirScale RRH 2T4R B8 120W AHDA

Single band AirScale RRH solution for B8 band

Benefits for the operator

- Lean Site solution
- Reduced Opex
- PIM Cancellation
- CPRI support
- No external filters required to handle transmitter spurious emission and blocking

Feature description

Radio Characteristics

- RF Output Power: 2x60W
- Connectors: 4* 4.3-10 connectors
- TX/RX: 2TX & 4RX
- Full Band 8: TX 925 - 960 MHz, RX 880 - 915 MHz
- iBW & oBW: Full Band
- 5G HW readiness: Yes

Other Characteristics

- Concurrent operation: GSM/WCDMA/FDD-LTE
- Supported System Module: FSMF, AirScale
- Optical Interface Type: 2* 9.8 Gb/s CPRI with compression
- Mount: Wall, Pole, Book, RAS, rail, horizontal with Fan



Target Dimensions

13.6 Liters, 14 kg
IP65, -40 to +55 °C

AirScale RRH 2T4R B1 120W AHGA

Single band AirScale RRH solution for B1 band

Benefits for the operator

- Lean Site solution
- Reduced Opex
- PIM Cancellation
- CPRI support
- No external filters required to handle transmitter spurious emission and blocking

Feature description

Radio Characteristics

- RF Output Power: 2x60W
- Connectors: 4* 4.3-10 connectors
- TX/RX: 2TX & 4RX
- Band 1: TX 2110 - 2170 MHz, RX 1920 - 1980MHz
- iBW & oBW: Full Band
- 5G HW readiness: Yes

Other Characteristics

- Concurrent operation: WCDMA/FDD-LTE
- Supported System Module: FSMF, AirScale
- Optical Interface Type: 2* 9.8 Gb/s CPRI with compression
- Mount: Wall, Pole, Book, RAS, rail, horizontal with Fan



Target Dimensions

10 Liters, 11 kg

IP65, -40 to +55 °C

AirScale RRH 4T4R B7 160W AHHB

Single band AirScale RRH solution for 2600 MHz

Benefits for the operator

- Lean Site solution
- Reduced Opex
- PIM cancellation
- CPRI support

Feature description

Radio Characteristics

- RF Output Power: 4x40W
- Connectors 4* 4.3-10 connectors
- TX/RX 4TX & 4RX
- Band 7 TX 2620-2690 MHz, RX: 2500-2570 MHz
- iBW & oBW Full Band
- 5G HW readiness Yes

Other Characteristics

- Supported technologies FDD-LTE
- Supported System Module: FSMF, AirScale
- Optical Interface Type: 2* 9.8 Gb/s CPRI with compression
- Mount: Wall, Pole, Book, RAS, rail



Dimensions:

13.9 liters, 15.7 kg

IP65, -40 to +55 °C

AirScale RRH Generation 2 Installation Notes

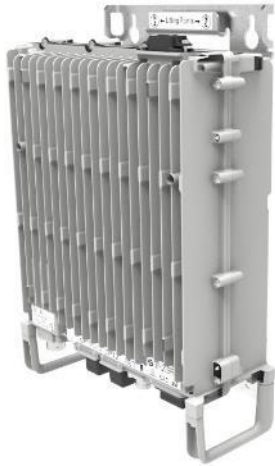
AirScale Generation 2 RRH

Installation notes.

- Two types based on vertical sizes of RRH : ~300 mm and ~600 mm
- Traditional mounting and Book mounting
- Solar shielding covers for RRH 300 family
- FPKx adaptors for combination with Flexi Radio units
- APPx connectors for DC input

AirScale 2 RRH 300 and 600

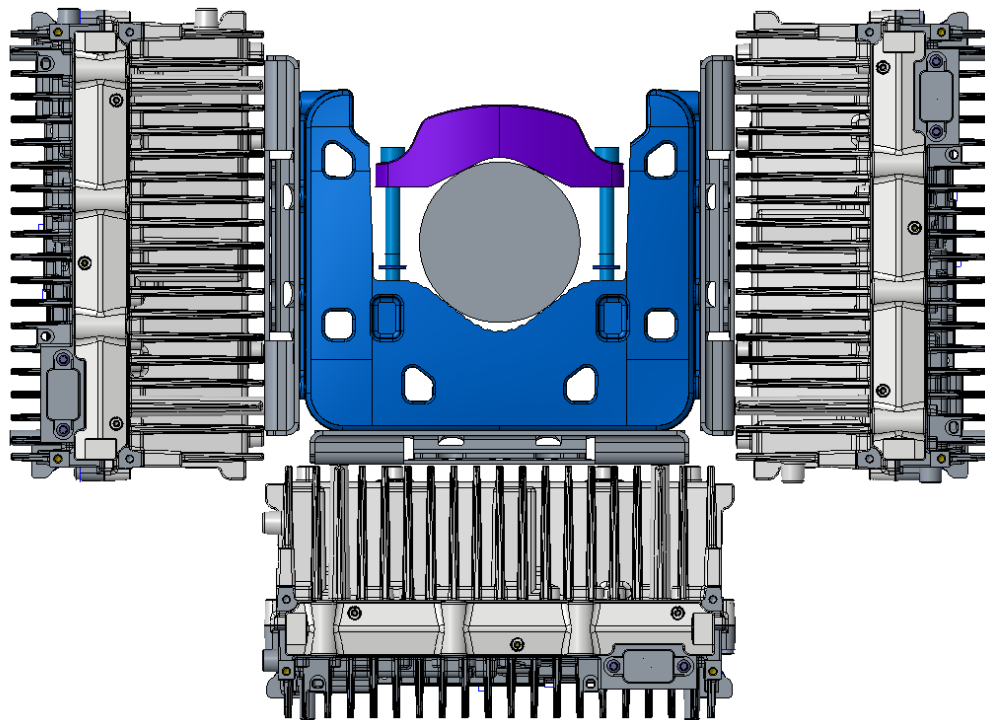
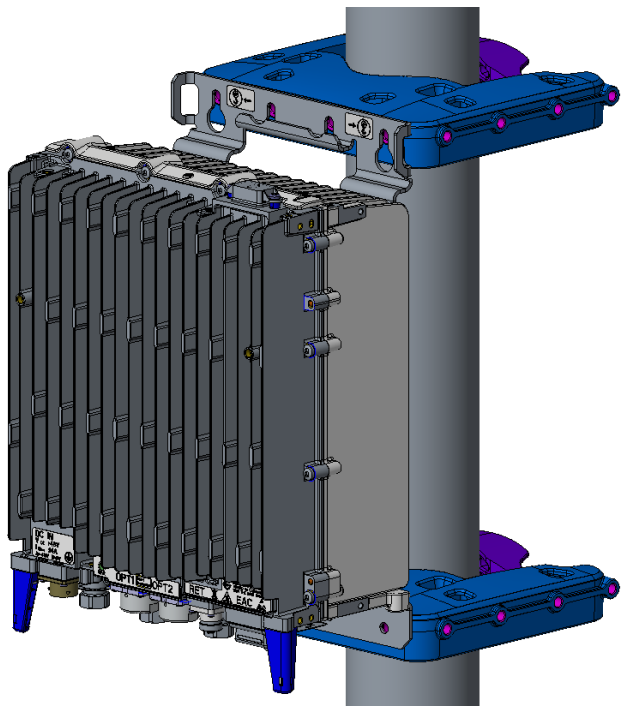
AirScale 2 RRH 300
FDD&TD LTE single band radios



AirScale 2 RRH 600
Dual and 3 band radios
Very high power single band (4x80w)

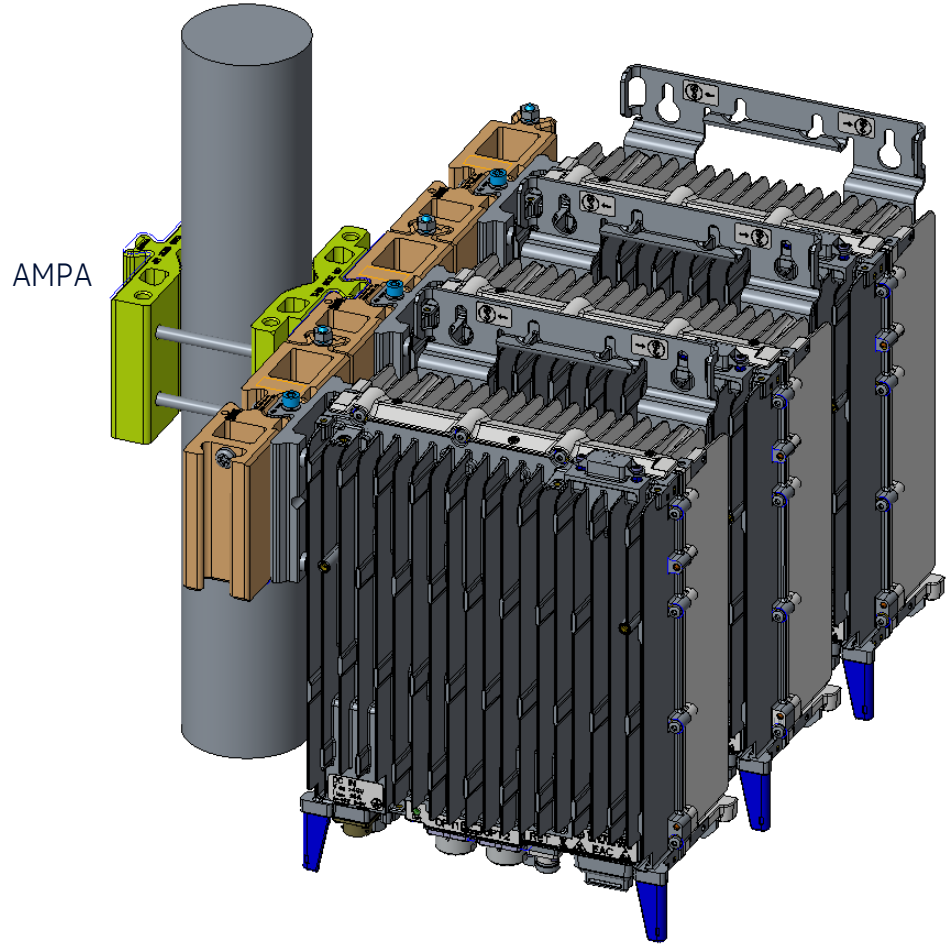


Pole fixing to legacy FPKA/C



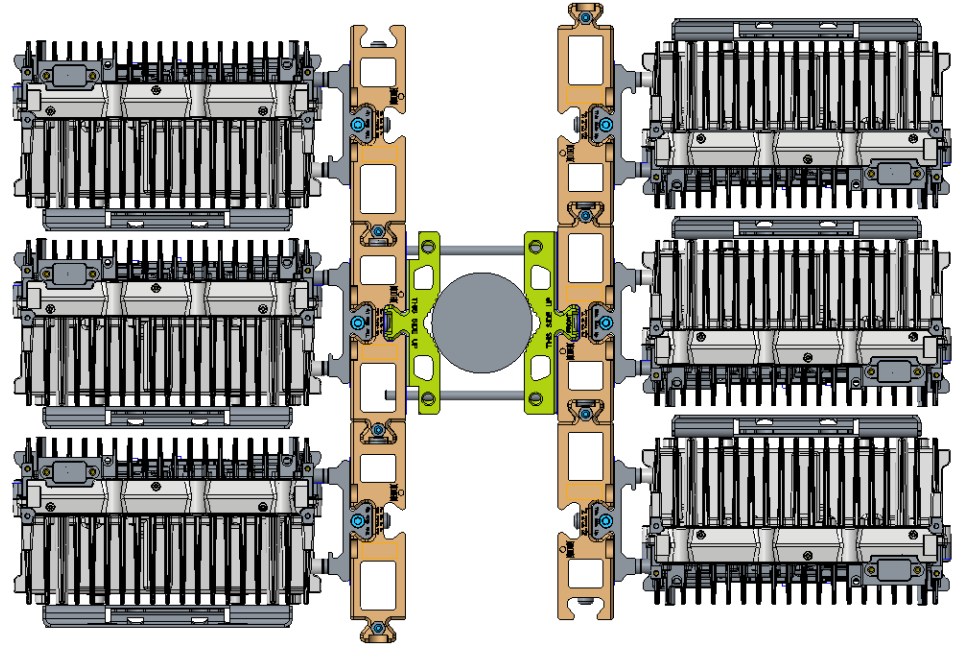
AS2 RRH bookmounting with AMPA

Code	Description	Quantity
473879A	AMPA Pole Mounting Kit (30mm to 120mm)	1
47xxxxx	AMBx AirScale bookmount kit yyy	3



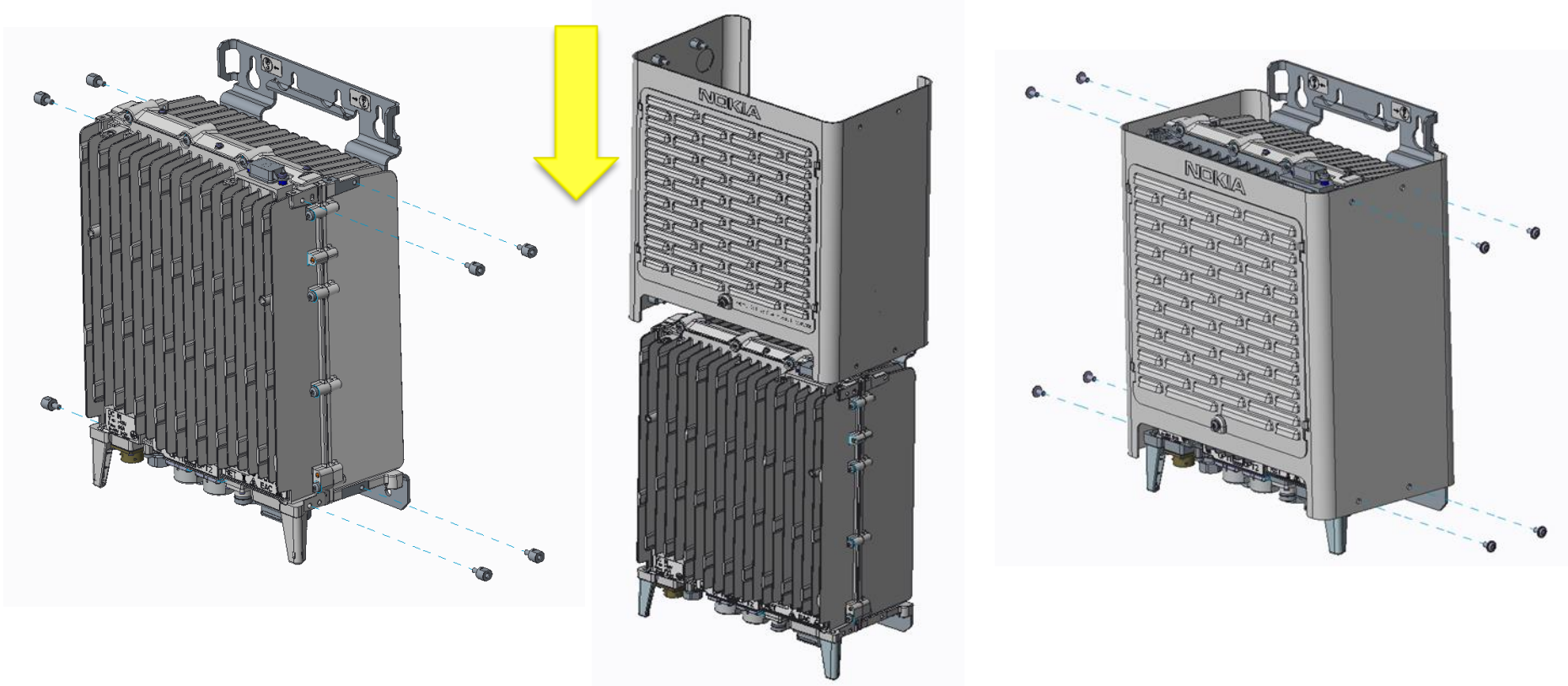
AS2 RRH bookmounting with AMPA

Code	Description	Quantity
473879A	AMPA Pole Mounting Kit (30mm to 120mm)	1
47xxxxx	AMBx AirScale bookmount kit yyy	6



AirScale 2 RRH 300 cover installation

Cover provides solar shielding for high solar load exposure.



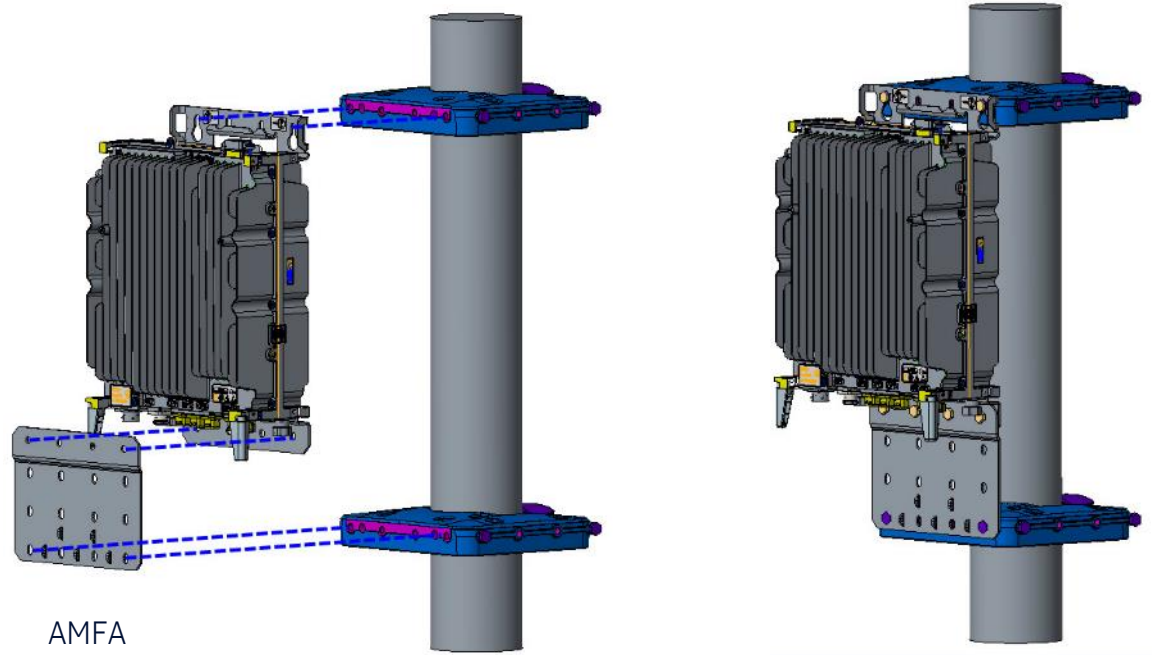
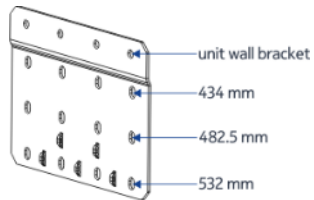
AMFA AirScale2 FPKx fixing adapter for AS2 RRH 300

AMFA Adapter is needed when a new AS 2 RRH 300 is installed into existing pole fixing of legacy RRH's/RFM's. Following heights are supported 392.5, 482.5 and 532.

AS2 RRH 300 std is 392.5mm

AS2 RRH 600 std:589 or 610 mm

Flexi RFM with plinth FMFA 482.5mm

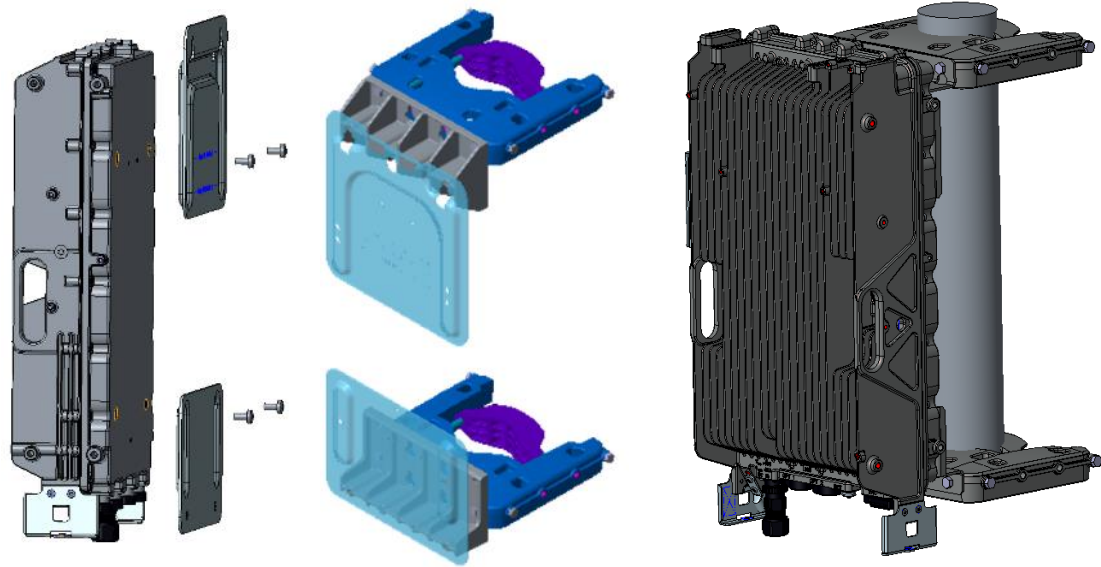


AMFD AirScale2 FPKx fixing adapter for AS2 RRH 600

AMFD Adapter is needed when a new AS 2 RRH 600 is installed into existing pole fixing of legacy RRH's/RFM's. Following heights are supported 482,5, 532 and 610.

AS2 RRH 300 std is 392.5mm

Flexi RFM with plinth FMFA 482.5mm



AHEGA

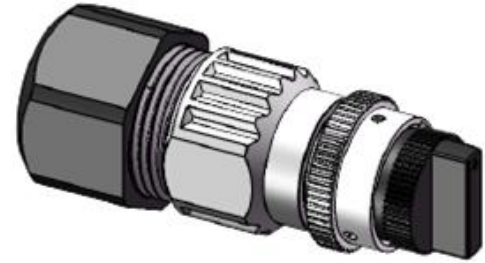
AMFD

AS2 RRH DC Power Connector

474281A	APPA AirScale2	26A	DC plug	3.3-6 mm ²
474282A	APPB AirScale2	55A	DC plug	3.3-10 mm ²
474283A	APPC AirScale2	55A	DC plug	10-16 mm ²

Features:

- UL1977 certified
- IEC 61984 and 60950-22 certified
- Zinc shell construction with tin/nickel plating
- Bayonet locking
- 26A per contact (two pole); 16A per contact (three pole)
- 360° EMI shielding
- Working temperature of -55°C to +105°C
- IP67 rated
- Receptacle with crimp contacts
- Plug with screw termination contacts for field installation
- Cable sealing range is 6-18mm OD
- UL94-V0
- ISO 21207 Method B 5 cycles for corrosion test



APPC

AirScale BTS Hardware Configurations for SWAP project

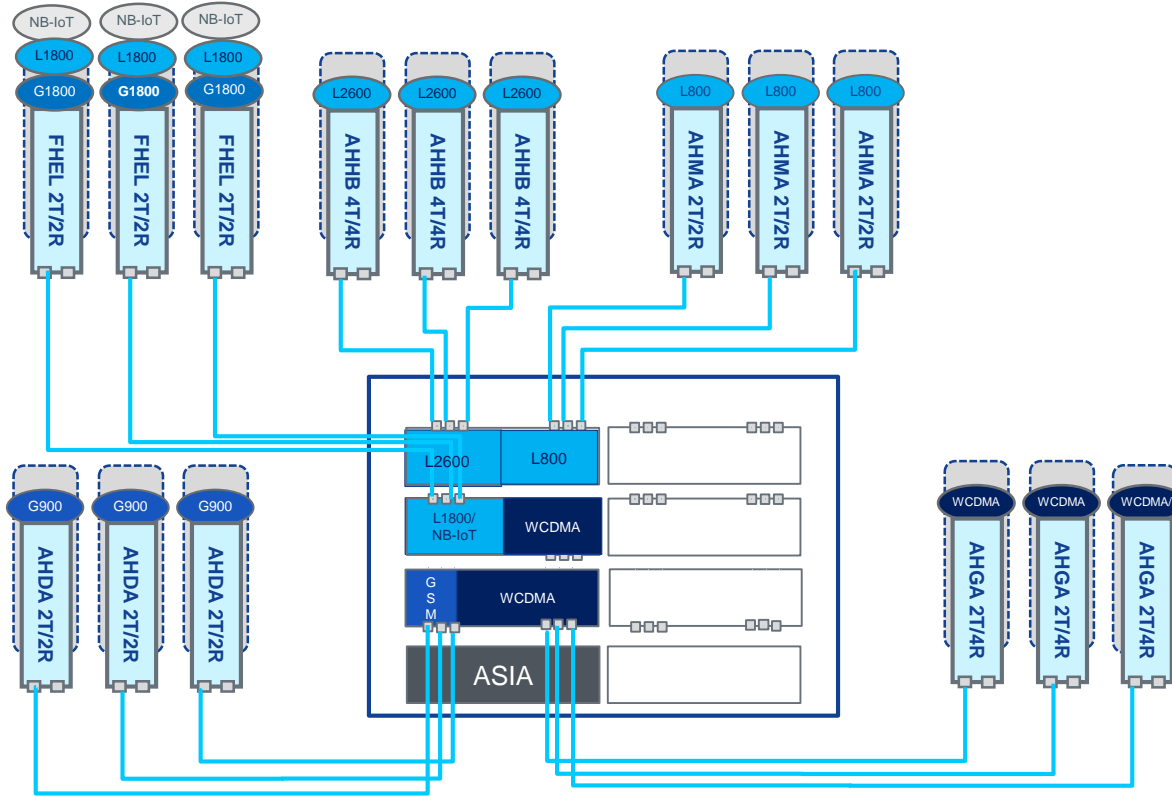
Single RAN BTS configuration – AirScale, MIMO2x2. Bands 800, 900, 2100, 1800, 2600, TD2600

Configuration notes

- LTE MIMO 2x2; .
- AMOB/AMIA Subrack, 1-2 ASIA, 1-4 ABIA
- Dual band AHPMDA AirScale RF modules can be used in both 800 and 900 bands.
- AHHB 4T4R AirScale RRH modules are used in **2T2R** mode.
- ARGA, AHDA, AHGA 2T4R AirScale RRH modules are used in **2T2R** mode.
- FHEL (AirScale generation 1) to be used as RRH for B3 band.
- FXDD to be used as RFM for band 8 until Release 20.
- FRHF to be used as RFM for band 7 until Release 20.
- 2100 is ready for LTE refarming.
- 900 is ready for LTE refarming
- L1800-L2100-L2600 FDD CA.
- LTE to be processed on ABIA hosting LTE RF Units.
- GSM/WCDMA can be processed on every ABIA using backplane capabilities.
- LTE Packed cells – increased LTE baseband capacity
- TDD LTE is supported on separate ASIA and ABIA.

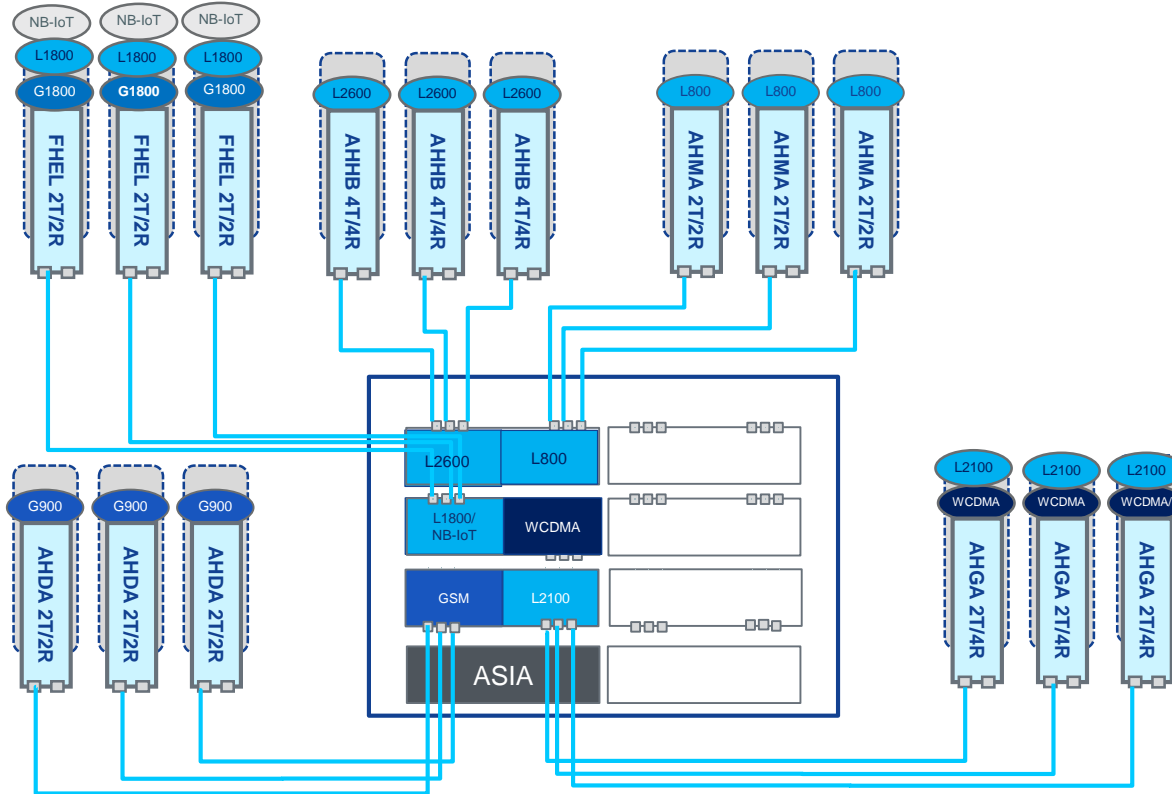
Single RAN BTS RRH configuration – AirScale, RRHs, MIMO2x2.

L800, G900, W2100, G1800/L1800/NB-IoT, L2600



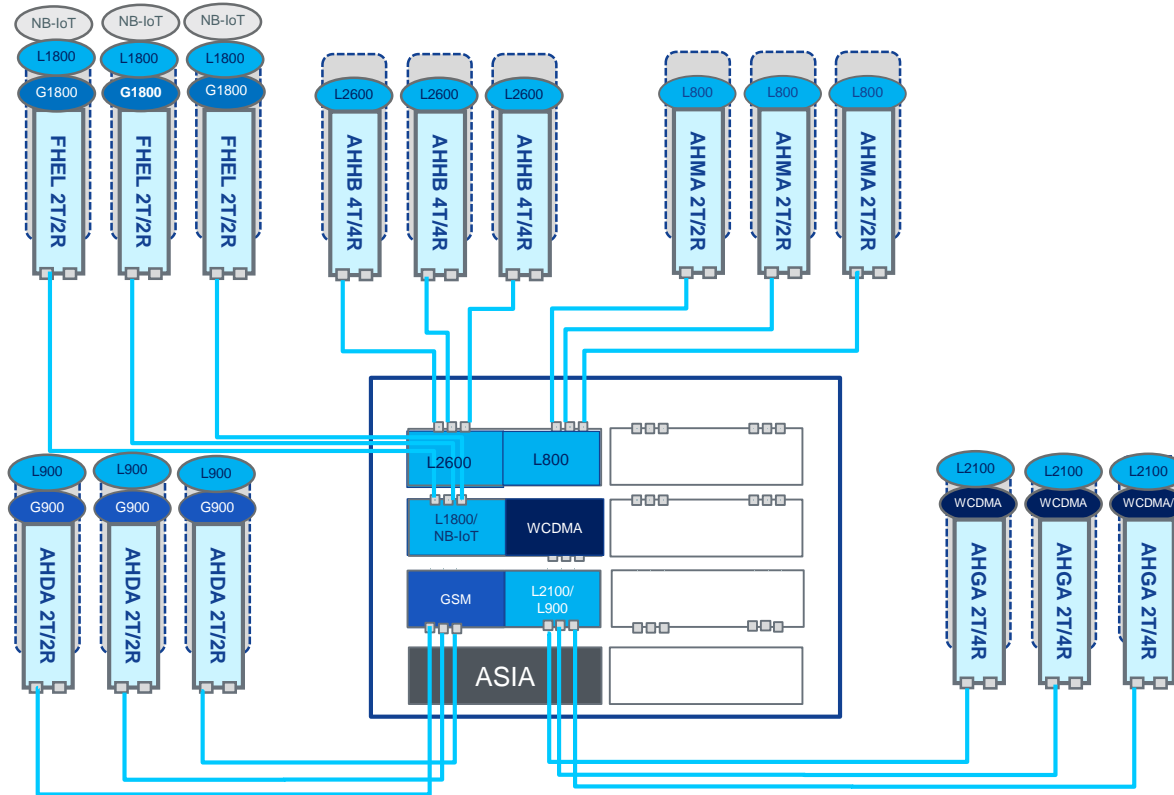
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L800, G900, W2100/L2100, G1800/L1800/NB-IoT, L2600



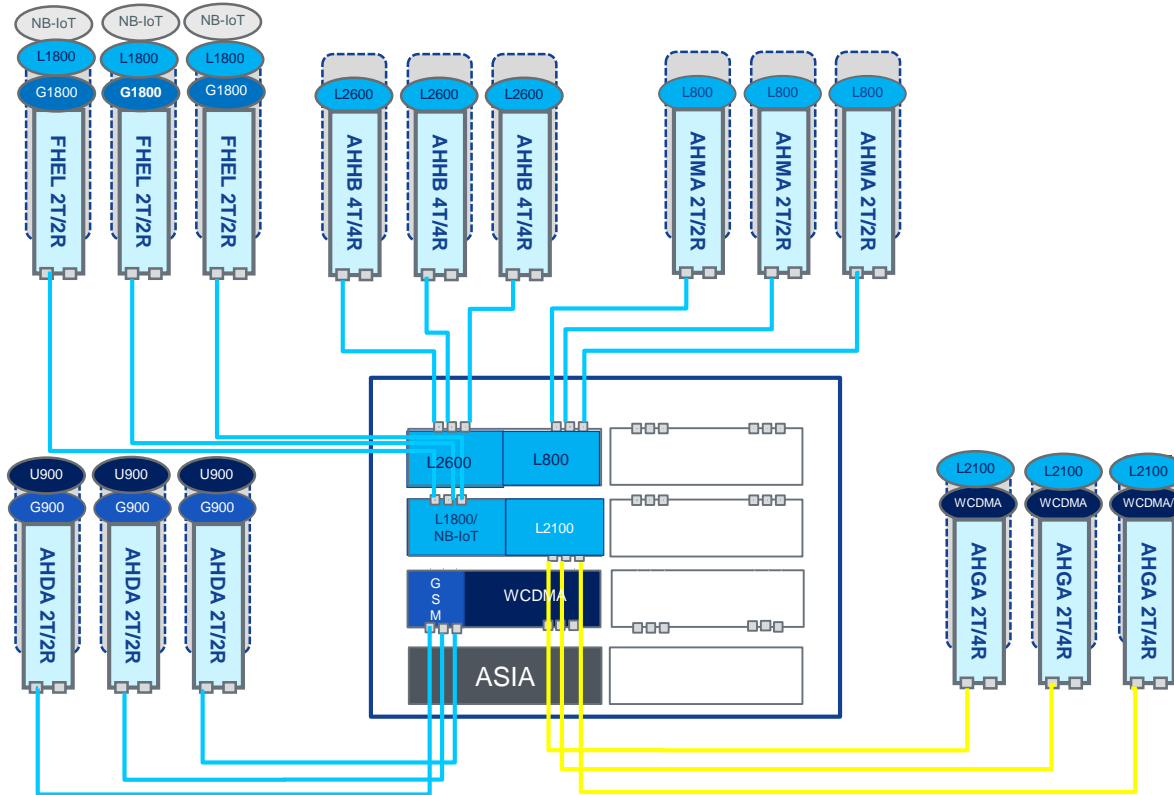
Single RAN BTS RRH configuration – AirScale, RRHs, MIMO2x2.

L800, G900/L900, W2100/L2100, G1800/L1800/NB-IoT, L2600



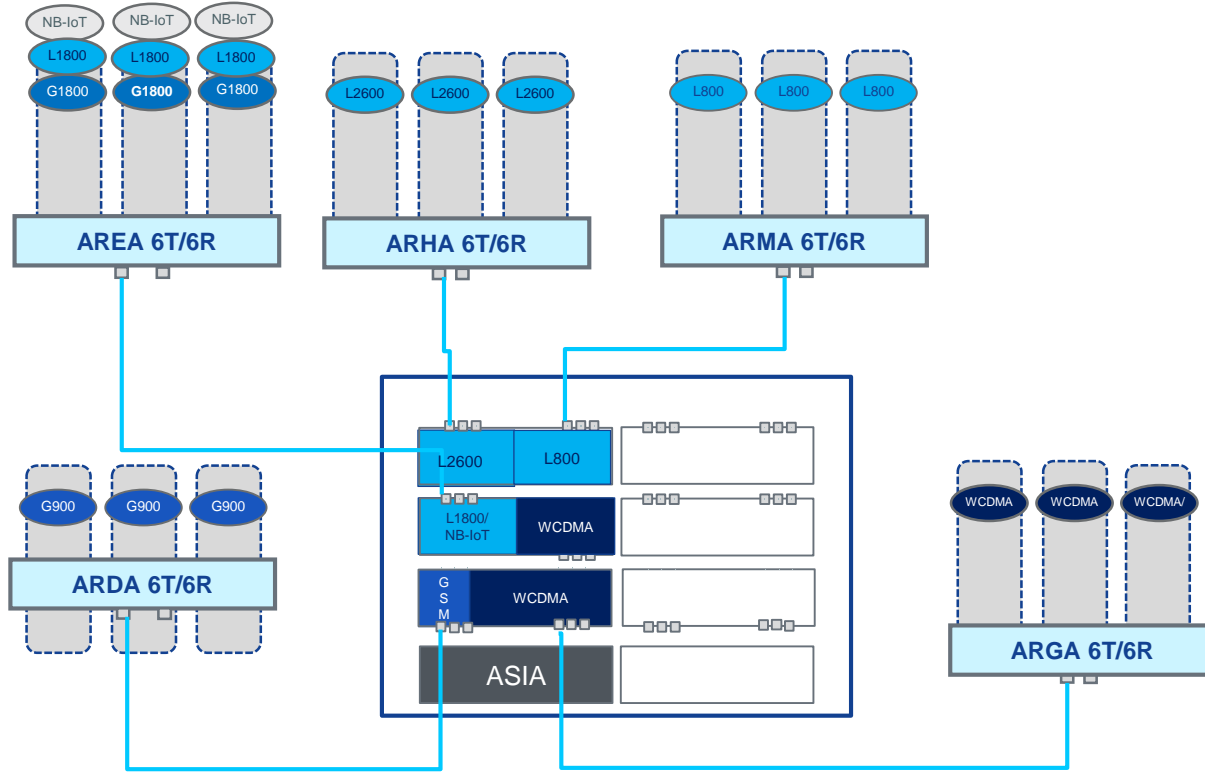
Single RAN BTS RRH configuration – AirScale, RRHs, MIMO2x2.

L800, G900/U900, W2100/L2100, G1800/L1800/NB-IoT, L2600. CPRI Reconnection



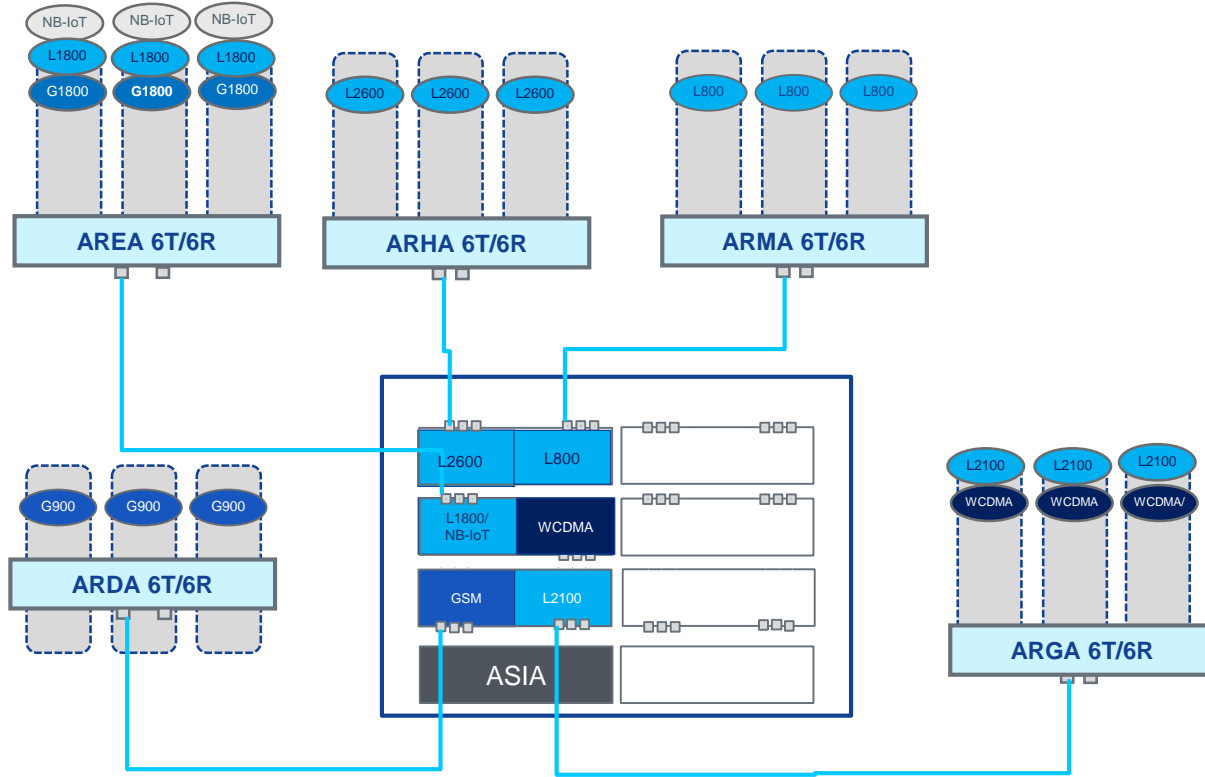
Single RAN BTS RRH configuration – AirScale, RFMs, MIMO2x2.

L800, G900, W2100, G1800/L1800/NB-IoT, L2600

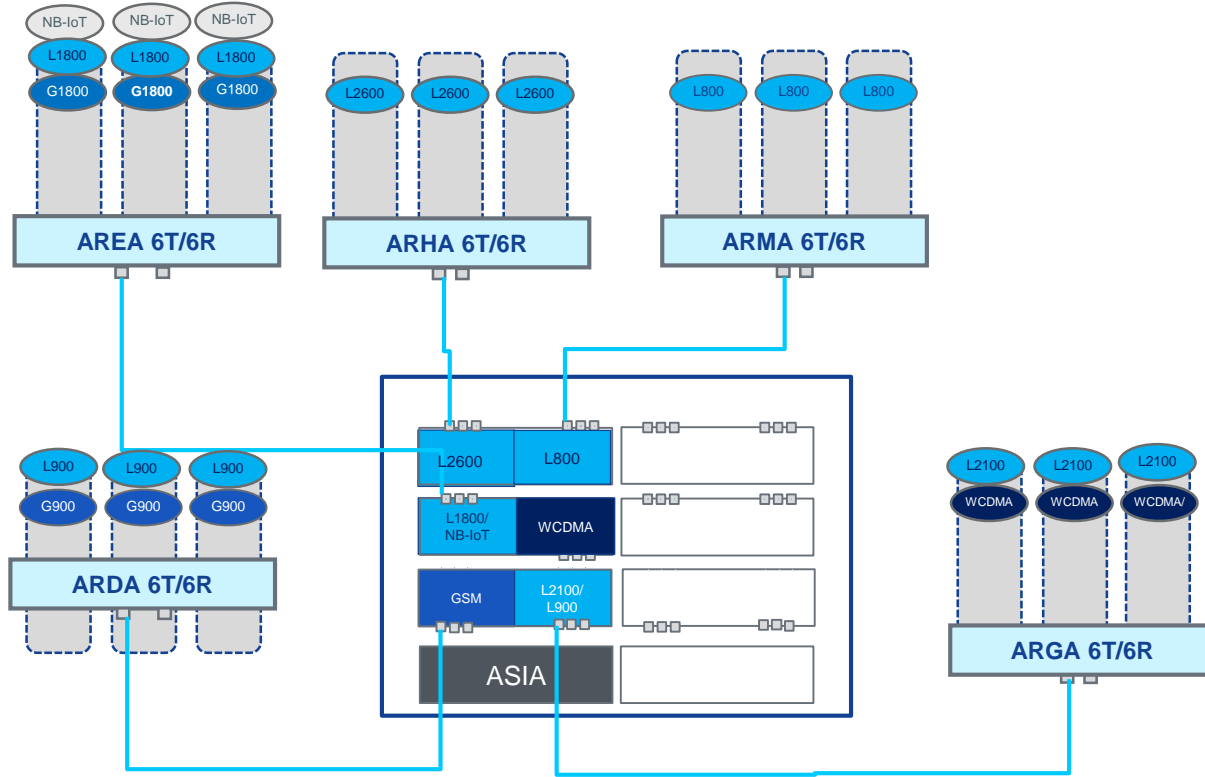


Single RAN BTS RRH configuration – AirScale, RFMs, MIMO2x2.

L800, G900, **W2100/L2100**, G1800/L1800/NB-IoT, L2600

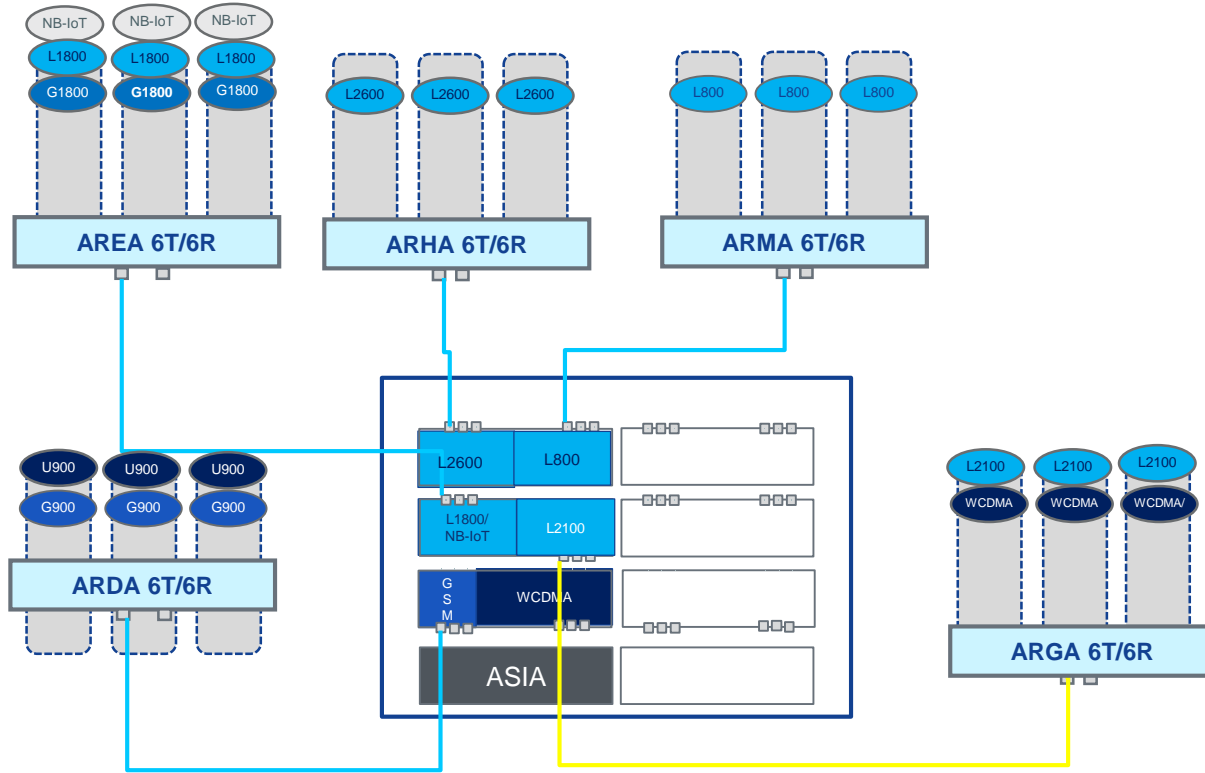


Single RAN BTS RRH configuration – AirScale, RFMs, MIMO2x2.
L800, G900/L900, W2100/L2100, G1800/L1800/NB-IoT, L2600



Single RAN BTS RRH configuration – AirScale, RFMs, MIMO2x2.

L800, G900/U900, W2100/L2100, G1800/L1800/NB-IoT, L2600. CPRI reconnection



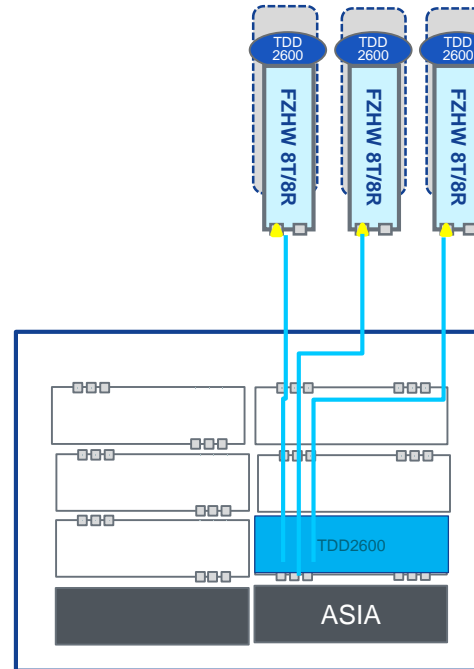
TDD BTS Hardware

LTE TDD BTS configuration – AirScale, TDD2600, FZHW, MIMO 4x4, 20MHz

Configuration notes

- TD LTE 4x4, 1 cell per sector, each cell 4x20W 20 MHz.
- Dedicated ASIA ABIA (half rack), Available TDD Configuration starting from Release 17A.
- FZHW 8T/8R RRH 2600 TDD.

TDD BTS RRH configuration – AirScale, FZHW, MIMO4x4, Band 38, TDD2600



NOKIA