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Flexi Zone Indoor Pico BTS Product Description

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Issue 01

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1 Summary of changes

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

Table 1 Releases covered by the document

Product	Release
Long Term Evolution	RL70, FDD-LTE 15A
TD LTE	RL55TD, TDD-LTE 15A

This is the first issue of the document.

2 Introduction to Flexi Zone Indoor Pico BTS

The Flexi Zone Indoor Pico BTS is a small cell optimized for an indoor environment. The Flexi Zone Indoor Pico BTS provides seamless mobility and enhanced user experience in enterprise and public indoor locations by cost effectively improving the coverage and capacity of the network, delivering the best subscriber mobile broadband experience.

The main application of this BTS is to deliver an improved mobile broadband experience by offloading data traffic from macro networks. Thanks to its small size and a fanless solution, the BTS can be easily and quickly deployed in strategic locations to add coverage and capacity. The Flexi Zone Indoor Pico BTS features a compact single enclosure.

The Flexi Zone Pico is a fully compliant 3GPP solution and supports standard network interfaces to other network elements, such as S1 and X2 in LTE and Iub interface towards a controller in WCDMA. It allows the use of the same software as used in macro base stations and can easily integrate into Heterogenous Networks (HetNets).

The hardware platform supports full throughput capability of 5 (only FDD), 10, 15, or 20 MHz LTE carriers with 2x2 MIMO (LTE main and diversity transmit). The WCDMA version supports 5 MHz bandwidth with 2Tx2Rx at BTS side and Virtual Antenna Mapping solution. The physical transport interface is optimized for IP-based transport solutions. Furthermore, the BTS supports varying transmit power up to 250 mW per antenna branch.

Figure 1 Flexi Zone Indoor Pico BTS



3 Benefits

Flexi Zone Pico Indoor BTS provides a vast number of benefits for the operator.

Ease of deployment

Flexi Zone Pico Indoor BTS offers new site deployment possibilities thanks to its compact size and light weight (< 3 kg (< 6.61 lb.)), which makes it easy and fast to deploy. It can be used in existing buildings using Ethernet cabling for backhaul that significantly lower the costs in comparison to traditional systems. The Flexi Zone Indoor Pico can be powered via a PoE++ based solution reducing complexity, cost of ownership and lead to faster deployments. Additionally the Flexi Zone Indoor BTS can be powered by a AC/DC power supply (optional item). Flexi Zone Pico Indoor BTS incurs lower installation cost as it can be deployed by a single person while reducing running costs due to its low power consumption yet high capacity delivery

Flexibility in installation

Flexi Zone Pico Indoor BTS is specially designed to be installed onto walls, horizontal poles, vertical poles or ceilings, which makes in the perfect BTS for indoor coverage. Refer to [Installation options](#) for more details on installation scenarios.

Macro Capacity and Full Macro Parity

Flexi Zone Indoor Pico integrates easily into Heterogenous Networks (HetNets) as the processing power allows the same software as used in macro base stations. Most features available for macro cells are also available for Flexi Zone Indoor Pico cells, including easy software upgrades to LTE-Advanced (LTE models) and support by the same NetAct Operations and Support System (OSS) as well as iSON.

Multiradio Access / Multi Technology (RAT)

Flexi Zone Indoor Pico BTS supports both LTE/WCDMA and Wi-Fi access (only variants with Wi-Fi antenna). The module is integrated within a single compact small form factor allowing for reduced number of boxes and shared devices. Additionally, Flexi Zone Indoor Pico module can be turned and angled from WCDMA to LTE via software upgrade.

Low acoustic noise

Flexi Zone Pico Indoor BTS uses passive cooling.

Easy commissioning

Flexi Zone Pico indoor BTS supports wizard-based commissioning via the BTS Site Manager. The configuration can be saved to a file which can be used later as a template.

Auto-connection is supported as in Flexi Multiradio BTS or Flexi Multiradio 10 BTS.

Software features

Flexi Zone Indoor Pico BTS enables feature parity with the Flexi Macro BTS solutions.

4 Flexi Zone Indoor Pico BTS Specifications

This topic describes Flexi Zone Indoor Pico BTS (both WCDMA and LTE) specifications, such as supported technologies, physical parameters or Wi-Fi information.

Table 2 Flexi Zone Indoor Pico BTS Specifications

Parameter	LTE and LTE + Wi-Fi variant	3G and 3G + Wi-Fi variant
3GPP RAT Support	One LTE band	One WCDMA band (software upgradable to LTE)
Bandwidth Supported	5, 10, 15, 20 MHz software selectable	HW support up to two consecutive 5 MHz carriers
3GPP RAT and Wi-Fi Antenna Configuration	Integrated 2x2 MIMO or external antennas	
Power Output	50 mW to 250 mW per Tx branch	50 mW to 250 mW per Tx path (500 mW with Virtual Antenna Mapping)
Users	Up to 400 simultaneous active subscribers	72 CE/50 HSPA users
Wi-Fi support	Via fully integrated optional Wi-Fi module	
Wi-Fi Radio/Access	5 GHz: 802.11 ac/n/a 2.4 GHz: 802.11 b/g/n	
Wi-Fi Power Output	23 dBm for 2.4 GHz 21 dBm for 5.0 GHz	
Volume / Mass	LTE (or 3G) only : Volume 2.8 L, Weight: 1.9 kg (without ceiling clip) LTE + Wi-Fi (or 3G + Wi-Fi) : Volume 2.8 L, Weight: 2.2 kg (without ceiling clip)	
Operating Temperature	0°C to 40°C (32°F to 104°F)	
Power Input	PoE++, DC input via external AC power supply adapter (optional)	
Synchronization	1588v2 / GPS (GLONASS only in LTE) / Sync-E	
Backhaul	100/1000 Base-T Copper	
Mounting	Wall / Ceiling / Pole	
Remote Local Access	Integrated Bluetooth Access	

5 Construction

Flexi Zone Indoor Pico BTS consists of the following parts:

- **Core base station module**

The core module integrates the following items into one single unit:

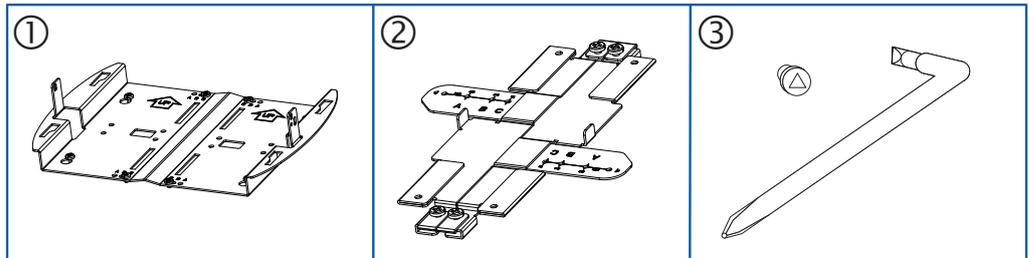
- RF
- baseband functionality
- clock and control
- external interfaces
- transmission

Some variants also contain an integrated Wi-Fi antenna that enables Flexi Zone Indoor Pico BTS to function as a wireless Access Point (AP). See [Table 6: Flexi Zone Pico Indoor BTS supported LTE bandwidth variants](#) for available models list.

- **Base station contents of delivery**

1. Mounting Bracket
2. Ceiling clip with screws
3. Tamper-resistant screw and a magnetized wrench
4. Quick start guide

Figure 2 Contents of delivery



- **Base station ancillary options (not included in the box)**

- power adapter with power cable
- remote RF GPS antenna
- external antenna (only for models without internal antenna)
- PoE-++ power injector

The Flexi Zone Pico Indoor BTS is a complete BTS with Ethernet transport. The total volume of the BTS is 2.8 liters and the weight of the unit is 1.9 kg (units without Wi-Fi) or 2.2 kg (units with Wi-Fi).

5.1 Interfaces

This chapter describes interfaces of the Flexi Zone Pico module.

Flexi Zone Indoor Pico module connection panel differs between modules with and without external antenna connectors as shown in [Figure 3: Flexi Zone Indoor Pico module interfaces \(with external antenna connectors\)](#) and [Figure 4: Flexi Zone Indoor Pico module interfaces \(without external antenna connectors\)](#).

Figure 3 Flexi Zone Indoor Pico module interfaces (with external antenna connectors)

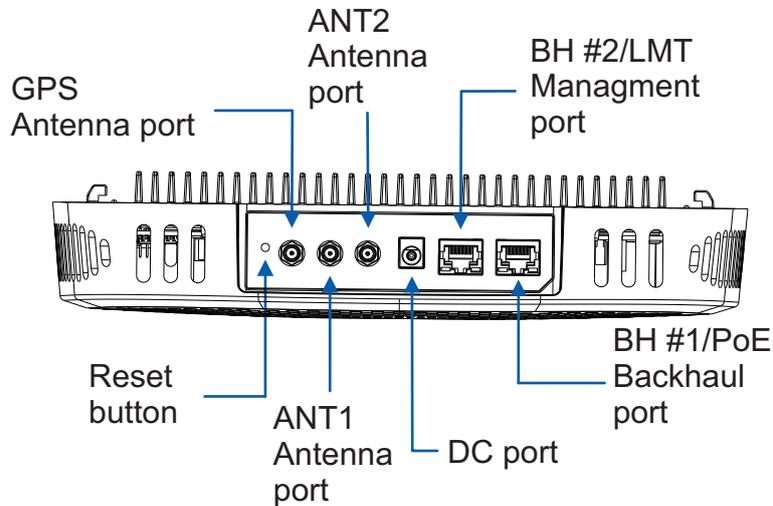
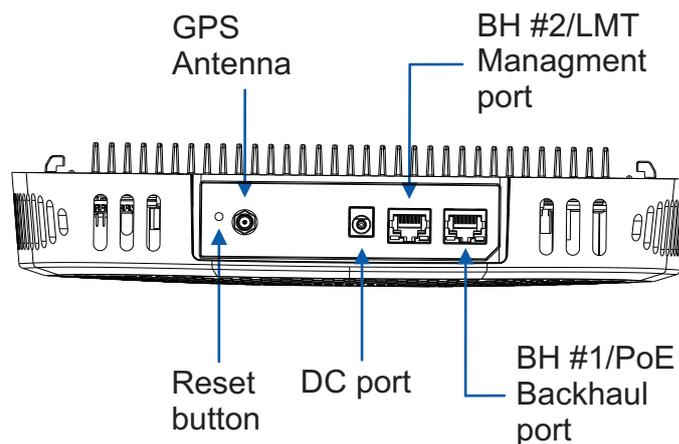


Figure 4 Flexi Zone Indoor Pico module interfaces (without external antenna connectors)



See [Table 3: Interfaces description](#) for information about differences between modules.

Table 3 Interfaces description

Interface	Connector type	Description
BH #1/PoE Backhaul port	RJ45	Ethernet connection with the core network, DC in power supply

Table 3 Interfaces description (Cont.)

Interface	Connector type	Description
BH #2/LMT Management port	RJ45	Ethernet connection with the core network or Pico Module management
5V DC port	3.5 mm barrel connector	DC in power supply
GPS antenna port	SMA	GPS antenna signal receive
ANT1 and ANT2 antenna ports	SMA	External antennas (LTE/WCDMA) signal transmit and receive

5.2 Reset button

The reset button is placed on the connection panel of the Flexi Zone Indoor Pico module. There are two functions of the reset button:

- A momentary push of the button will result in a hard reset of the device (similar to power up restart)
- Pressing and holding the button for more than 5 seconds will trigger the in factory default reset

5.3 PoE-++ solution

Flexi Zone Indoor Pico modules support Power-over-Ethernet Evolution (PoE++) technology to supply the unit with power. The PoE solution allows electrical power to pass along with data on Ethernet cabling. It offers several benefits to the user, including:

- **Cost savings** - PoE-++ significantly reduces the number of electrical wiring and outlets that have to be installed inside the building
- **Easy installation** - there is no need to search for a secure place to mount the AC/DC adapter on a wall or a ceiling
- **Flexibility** - it is easy to relocate the Pico module in order to find an optimal RF and WiFi reception

The PoE++ parameters are listed in the table [Table 4: PoE-++ specification](#).

Table 4 PoE-++ specification

Parameter	Value(s)
Power sourcing equipment (PSE)* output power	60 W
Power at powered device (PD)*	51 W
Voltage range at PSE*	50 - 57 VDC

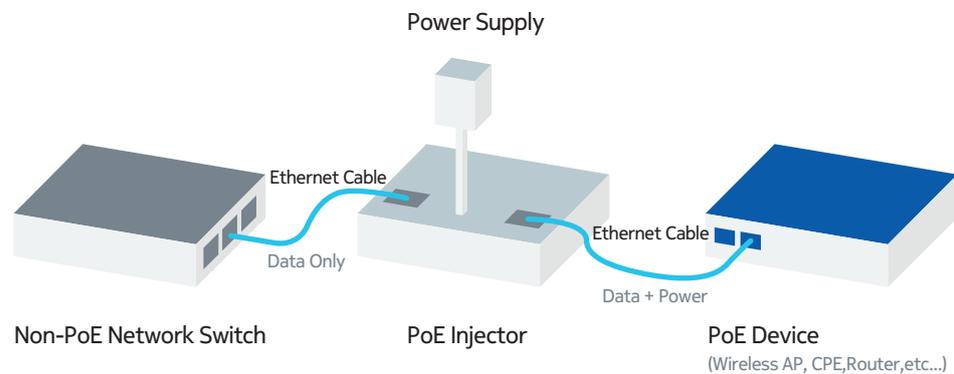
Table 4 PoE-++ specification (Cont.)

Parameter	Value(s)
Voltage range at PD*	42,5 - 57 VDC
Maximum current	1200 mA total, 300 mA/pair
Maximum cable resistance	25 Ohms per loop
CAT cable types	Cat 5e/6
Maximum cable length	100 m
Quantity of conductors used	4 pairs / 8 wires

* - PSE refers to a PoE-enabled network switch or a midspan power injector and PD means FZ Indoor Pico Module

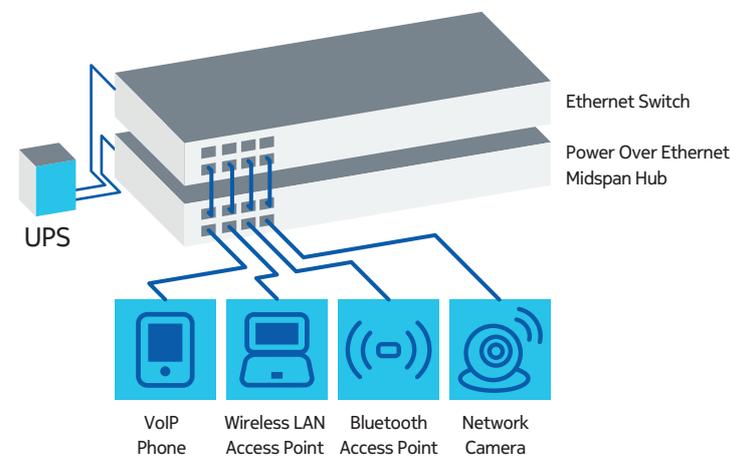
Power injectors can either be individual or multi-port, as shown in [Figure 5: One-port injector](#) and [Figure 6: Multi-port injector](#).

Figure 5 One-port injector



Individual 1 port Injector

Figure 6 Multi-port injector



Multi-Port Injector Shelf

Nokia products **require** power injectors that support a 12.5K Ohm detection resistor and provide a power output of 60W per port in a 4PPoE implementation.

Nokia recommended midspan devices are listed in the [table](#).

Table 5 Nokia recommended midspan devices

Manufacturer	Model	Number of ports
Micro-semi	PD-9606G	6
Micro-semi	PD-9612G	12
Micro-semi	PD-9501GR	1
Phihong	POE480U-4UP	4
Phihong	POE480U-8UP	8

For more information and specifications, check the manufacturers' websites.

5.4 Installation options

This chapter describes Flexi Zone Indoor Pico BTS possible installation scenarios, which are wall, pole and ceiling installations.



NOTICE: Flexi Zone Indoor Pico BTS equipment must be installed by trained and qualified service personnel in accordance with all local codes and requirements.



NOTICE: Flexi Zone Indoor Pico BTS equipment is intended for installation in restricted access location or equivalent.



NOTICE: The unit may become hot and should be installed away from any potential sources of moisture (away from heating or cooling ducts, doors/window). Ensure good airflow for the unit to allow proper heat dissipation.



NOTICE: The unit should be located away from any RF radiation sources, out of direct sun exposure, and away from a potential salt spray.



NOTICE: Avoid installing the device near windows to avoid external interference.



NOTICE: When installing the mounting bracket onto a vertical pole or a wall ensure the arrows point upwards.

For wall, pole and ceiling installation instructions refer to the *Flexi Zone Indoor Pico BTS Quick Start Guide*.

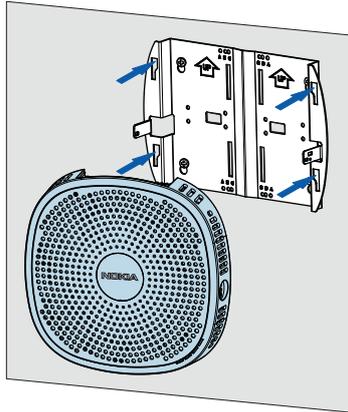
The FZ Pico Indoor module can be installed in three possible ways.

Flexi Zone Indoor Pico wall installation



Use the mounting bracket to install the Flexi Zone Indoor Pico BTS onto a wall.

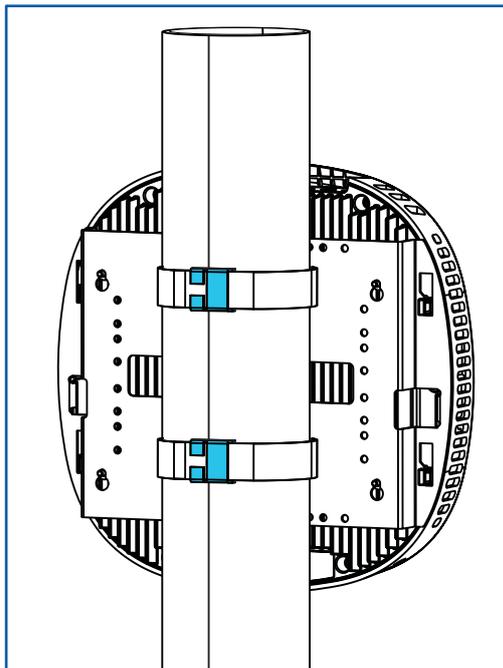
Figure 7 Mounting Flexi Zone Indoor Pico onto a wall



Flexi Zone Indoor Pico pole installation

-  Flexi Zone Indoor Pico can be mounted onto a vertical or horizontal indoor pole.
-  Use the mounting bracket delivered in the box and band straps to install the Flexi Zone Indoor Pico BTS onto a pole.
-  The band straps are not included within the package and need to be ordered separately.

Figure 8 Mounting Flexi Zone Indoor Pico onto a pole



Flexi Zone Indoor Pico ceiling installation

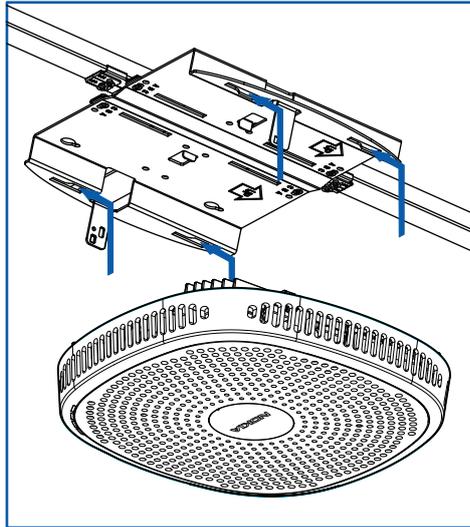


NOTICE: Ensure that the ceiling grid location is well supported.



Use the mounting bracket and the ceiling clip delivered in the box to mount the Flexi Zone Indoor Pico BTS onto a ceiling.

Figure 9 Mounting Flexi Zone Indoor Pico onto a ceiling



6 Air Interface

6.1 Air interface configuration

The BTS transceiver supports single band 2 Tx and 2 Rx antenna connections with each transmit port supporting a maximum transmission power of 250 mW per antenna branch and operates within a maximum bandwidth window of 20MHz.

6.2 Supported bandwidth

The LTE supported bandwidth is shown in [Table 6: Flexi Zone Pico Indoor BTS supported LTE bandwidth variants](#).

Table 6 Flexi Zone Pico Indoor BTS supported LTE bandwidth variants

Duplex Mode	Operating Band	Uplink (UL) operating band BTS receive UE transmit	Downlink (DL) operating band BTS transmit UE receive	Unit's name	Integrated Wi-Fi	Antenna
		$F_{UL_low} - F_{UL_high}$	$F_{DL_low} - F_{DL_high}$			
FDD	1	1920 MHz - 1980 MHz	2110 MHz - 2170 MHz	FWGI	Yes	Embedded
				FWGJ	No	Embedded
				FWGK	No	External
	2	1850 MHz - 1910 MHz	1930 MHz - 1990 MHz	FWFB	Yes	Embedded
				FWFC	No	Embedded
				FWFD	No	External
	3	1710 MHz - 1785 MHz	1805 MHz - 1880 MHz	FWEC	Yes	Embedded
				FWED	No	Embedded
				FWEE	No	External
	4	1710 MHz - 1755 MHz	2110 MHz - 2155 MHz	FWIC	Yes	Embedded
				FWID	No	Embedded
				FWIE	No	External
	7	2500 MHz - 2570 MHz	2620 MHz - 2690 MHz	FWHG	No	Embedded
				FWHI	No	External
				FWHH	Yes	Embedded
13	777 MHz - 787 MHz	746 MHz - 756 MHz	FWBC	Yes	Embedded	
			FWBD	No	Embedded	
			FWBE	No	External	

Table 6 Flexi Zone Pico Indoor BTS supported LTE bandwidth variants (Cont.)

Duplex Mode	Operating Band	Uplink (UL) operating band	Downlink (DL) operating band	Unit's name	Integrated Wi-Fi	Antenna					
		BTS receive UE transmit	BTS transmit UE receive								
		$F_{UL_low} - F_{UL_high}$	$F_{DL_low} - F_{DL_high}$								
TDD	28	703 MHz - 748 MHz	758 MHz - 803 MHz	FWPC	Yes	Embedded					
				FWPD	No	Embedded					
				FWPE	No	External					
	40	2300 MHz - 2400 MHz			FWNA	Yes	Embedded				
					FWNB	No	Embedded				
					FWNC	No	External				
					41	2496 MHz - 2690			FWHJ	Yes	Embedded
									FWHK	No	Embedded
									FWHL	No	External
42	3400 MHz - 3600 MHz			FWQB	Yes	Embedded					
				FWQC	No	Embedded					
				FWQD	No	External					

The WCDMA supported bandwidth is shown in [Table 7: Flexi Zone Pico Indoor BTS supported WCDMA bandwidth variants](#).

Table 7 Flexi Zone Pico Indoor BTS supported WCDMA bandwidth variants

Operating Band	Uplink (UL) operating band	Downlink (DL) operating band	Variant	Integrated Wi-Fi	Antenna
	BTS receive UE transmit	BTS transmit UE receive			
	$F_{UL_low} - F_{UL_high}$	$F_{DL_low} - F_{DL_high}$			
1	1920 MHz - 1980 MHz	2110 MHz - 2170 MHz	FWFE	Yes	Embedded
			FWFF	No	Embedded
			FWFG	No	External
2	1850 MHz - 1910 MHz	1930 MHz - 1990 MHz	FWGL	Yes	Embedded
			FWGM	No	Embedded
			FWGN	No	External

6.3 Diversity

2-way receiver diversity is supported. Single receiver configuration is supported by both receivers in case of failure of one of the receivers. Single transmit configuration is supported in case of failure of one of the transmitters or antennas, allowing a transmit mode configuration of Tx Diversity (SIMO).

6.4 RF Output Power

Transmit power maximum:

- 250 mW + 250mW
- 24 dBm per branch

Transmit power can be configured in different steps from the maximum down to the transmit power defined for a LTE or WCDMA Local Area class:

- 250mW + 250mW
- 24 dBm (supported commissioning values: from 17 dBm to 24 dBm, step of 1 dB)

6.5 External RF Antennas

Pico indoor variants primarily utilize internal antennas. External antennas are also supported but require additional hardware, as the Pico Indoor radio is not supplied with external antennas or antenna mounting.

Guidelines for selecting external antennas

Table 8 Flexi Zone Pico Indoor external antenna requirements / recommendations

Parameter	Requirement / Recommendations
Type	Application specific (primarily ceiling mount is envisioned but any type can be used)
Frequency range	Operating band uplink and downlink frequencies have to be covered for the Pico model used
Polarization	Linear, cross-polarized, or vertical and horizontal
Gain	Application specific (refer to MPE/SAR section)
Beamwidth	Application specific
Return loss	>= 10 dB recommended for best performance
Input power rating	>= 2 W peak, 0.25 W average
Isolation	> 15 dB for Ant 1 and Ant 2 (main to diversity)

Maximum Personal Exposure (MPE) / Specific Absorption Rate (SAR)

MPE certification testing was performed to determine the Minimum Safe Distance using external antennas with 5dBi gain for 1700 - 2700MHz. The antenna used for this certification was Pulse DASLTE500NFMIMO. Thus, if other external antennas are used, the gain should be equal to or lower than this antenna to maintain the same minimum safe distances specified. If higher gain antennas are used, the Minimum Safe Distance is increased. Please consult your local regulatory requirements.



Please reference the actual Pico MPE/SAR reports for further details.

Cabling

Connection to the Pico SMA-F requires a SMA-M. Adapter cables are required.



For best performance direct the antenna main beam away from the Pico.



Nokia does not recommend directly attaching rubber-duck stick OMNI antennas directly to the Pico antenna outputs. This is due to the low isolation between the antennas for main and diversity that would result in degrading MIMO performance.

To insure optimal performance, high quality low loss cable should be used while keeping the cable length to a minimum. Excessive cable lengths and low quality cable cause significant performance degradation.

Lightning and surge protection

For indoor use, Flexi Zone Pico does not require surge protection. If the antennas are remotely connected outdoors, then appropriate surge protection is required per the local regulations.

Recommended antennas

Nokia does not currently supply external antennas, but some examples for recommended antennas are:

- Galtronics Pear_{TM} M4969i
- Pulse DASLTE500NFMIMO

Both are broadband antennas which requires only one antenna for MIMO.

7 Synchronization

The Flexi Zone Pico Indoor BTS supports the following synchronisation mechanisms:

- Integrated GPS/GLONASS receiver
- Synchronous Ethernet (ITU-T G.8261)
- Timing over Packet according to IEEE 1588v2

7.1 GPS / GLONASS

Instead of using the transport network for carrying the Primary Reference Clock (PRC) traceable synchronization reference, it is possible to use a distributed PRC architecture. In this case, every site in the network has a GPS-based or other synchronization source which provides a PRC traceable synchronization reference signal for RAN NEs. It is also possible to use a combination of distributed and hierarchical master-slave architecture.

In some cases, other Network Elements (for example transmission nodes) at the same site provide the synchronization reference for RAN Network Elements through external synchronization interfaces.

7.1.1 Overall GPS / GLONASS Antenna RF Requirements

Antenna Requirements

The Nokia recommended GPS / GLONASS antennas meet all quality and field performance requirements along with criteria outlined in the table below and have proven quality with good field performance. While it is possible to use other antennas, considerable care must be exercised when selecting alternatives to ensure full BTS compatibility for all conditions.

Table 9 Recommended GPS / GLONASS Antenna Specifications

	Requirement / Recommendations
Gain	+25 dB (recommended)
Noise Figure	<2.5 dB (recommended)
Operating Frequency	GPS: 1575.42 MHz with less than 3 dB attenuation at a +1.2 MHz offset from center (Required)
	GLONASS: 1602 MHz with less than 3 dB attenuation at a +8 MHz offset from center (Required)
Filtering	>40 dB attenuation at +50 MHz offset from L1 center (Recommended)
LNA Supply Voltage	Operation with a supply voltage of +4.6 VDC +/- 0.25 V (Required)
LNA Supply Current	<30 mA (Required)
Azimuth Coverage	360° (Required)
Elevation Coverage	10° to 90° (Required)

Table 9 Recommended GPS / GLONASS Antenna Specifications (Cont.)

	Requirement / Recommendations
Operating Temperature	0°C to +40°C (Recommended)

Cable length requirements

The limit on the length of the GPS cable depends on multiple factors:

- Location of the GPS antenna.
- Type of the RF GPS cable used.
- Splitters and connectors used.

Lengths vary based on the above parameters. The parameter, defining proper cable length, is the signal strength at the inputs of the Pico GPS receiver. The signal strength must meet the sensitivity requirements as shown in the table below.

Table 10 GPS sensitivity requirements

Parameter	Action type	Sensitivity
GPS Sensitivity*	Tracking	-161 dBm
	Hot Acquisition	-161 dBm
	Cold Acquisition	-147 dBm
	Reacquisition	-161 dBm

* - Values are valid at room temperature 25° C [77° F]

External GPS Antennas

Many different GPS antenna options are available for an outdoor GPS antenna. The guidelines in [Table 9: Recommended GPS / GLONASS Antenna Specifications](#) also apply to an external GPS/GLONASS receiver. The FlexiZone Micro GPS antenna (473100A) can suit this purpose. This antenna is designed to mount directly to the female N connector on the FZM so does not include a cable or mounting feature. A mounting bracket would be needed with a bulkhead female N connector then a long run of cable. If a deployment of a large number of FZPs is needed with remote GPS then the best solution would be a single GPS antenna and a distribution network. Care must be taken to insure the DC block is in place. This DC block can be a separate item or included in the distribution network.

Distribution networks

In the case of large indoor deployments of FZP units utilizing GPS/GLONASS it is better to use a single GPS antenna with a distribution network. This equipment is not supplied by Nokia as it is site specific, but can be used to overcome the losses incurred with long cable runs and multiple splits to accommodate separate feeds into each FZP. Care must be taken when selecting the proper distribution amplifier. The key requirements are as follows:

- Active GPS/GLONASS antenna bias: The amplifier must provide 5 VDC for the active antenna.
- Port Impedance: All ports (IN/OUT) must be 50 ohms.

- DC Block: All output ports must supply a DC Block to protect the FZP GPS inputs.

GPS Networking Inc. is one of the vendors that provide this type of equipment which can meet these requirements. Below are some example part numbers:

- 8-Port: AL-DCB-S1X8-N/5/110
- 16-port Rack mount: RMAL-DCB-S1X16-N/5/110
- 32-port Rack mount: RMAL-DCB-S1X32-N/5/110

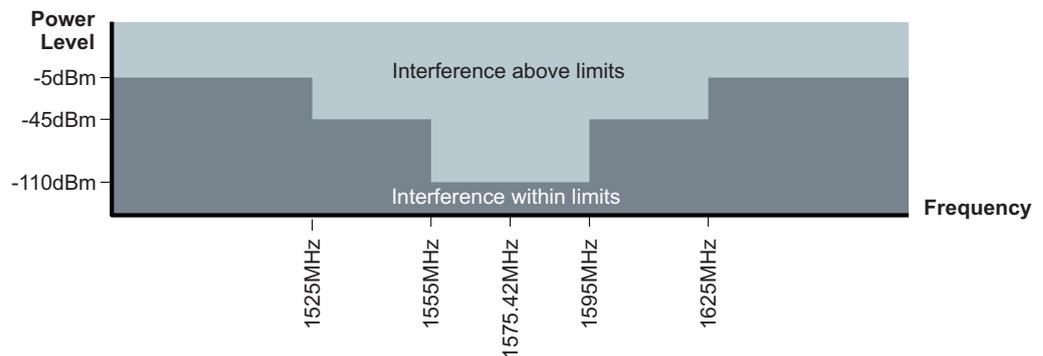
These models include the DC Block on all output ports, provide the 5 VDC for the active antenna, utilize N type connections and are powered via 110 VAC. For other AC power options the “110” in the part number above can be replaced with either “220” or “240” depending on the available local power. If utilizing a distribution network insure that all grounding and surge suppression requirements are followed.

7.1.2 RF Interference

While the BTS GPS receiver and recommended antennas provide a high level of out of band interference, rejection care needs to be taken to avoid placing the GPS antenna in the direct radiation path of cellular or other transmit antennas. To minimize interference potential the GPS antenna needs to be positioned at a different elevation and as far as possible from nearby transmit antennas. The graph presented in [Figure 10: Maximum GPS Receiver Interference Power Level vs. Frequency](#) can be used to identify the maximum interference source power levels presented at the GPS antenna surface (assuming that a Nokia recommended GPS antenna is in use and RF signal presented to the GPS receiver meets all level and noise figure requirements).

Different interference rejection performance can be experienced with other (non-Nokia recommended) GPS antenna types or when the GPS receiver is not provided with the required (minimum or maximum) RF signal levels.

Figure 10 Maximum GPS Receiver Interference Power Level vs. Frequency



7.2 Synchronous Ethernet and Synchronous Ethernet generation

According to G.8261, Synchronous Ethernet provides a SDH-like mechanism for distributing frequency information at Layer 1. The BTS receives the frequency information from the directly connected (next-hop) Ethernet switch or IP router through the Ethernet link.

SyncE provides a high quality synchronization reference for base stations, comparable to SDH synchronization. The stability of the recovered frequency is independent of the network load or network impairments like delay variations.

A co-located or another chained tail site can be synchronized with Synchronous Ethernet generation using SyncE.

Both BTS Synchronous Ethernet and Timing over Packet features can be activated simultaneously. The features can be set individually as primary and secondary synchronization sources. When both SyncE and IEEE1588 ToP are feasible in the priority configuration, the selection of ToP or SyncE as primary or secondary references is a key point in the design of the synchronization network and depends very much on the characteristics of the mobile backhaul network being used to access the BTS.

In addition, when Synchronous Ethernet Generation feature is activated, both SyncE and Timing over Packet can serve as an input for generating SyncE signal towards chained/collocated BTS.

7.3 Timing over Packet

Timing over Packet (ToP) can be also considered as an example of master-slave architecture. The ToP master sends timing packets to ToP slaves. ToP slaves recover the timing reference from the received timing packets.

The transport network between the ToP Master and the ToP Slave embedded in the BTS must fulfill certain engineering rules to guarantee proper operation of ToP as synchronization source such that the stability of the frequency for the air interface meets 3GPP requirements (+/-50ppb). These engineering rules are related to the treatment of the IEEE1588 ToP packets in the network and SLA values for Packet Loss and Packet Delay Variation.

8 Flexi Zone Pico LED states

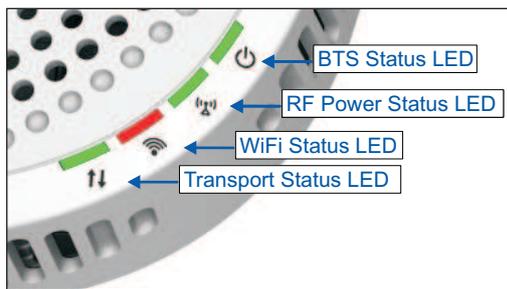
Explanation on Flexi Zone Micro and Flexi Zone Pico modules LED indications.

Additional acronyms explanation:

- TRSW - Transport Software
- POST - Power-On Self-Test
- FPGA - Field Programmable Gate Array
- BTSOM - BTS Operation and Maintenance interface

Flexi Zone Pico LED indicators are shown in the [Figure 11: LED indicators](#).

Figure 11 LED indicators



For descriptions on module LED states, see [Table 11: FZM and FZP LED indications](#).

Table 11 FZM and FZP LED indications

LED	Description	LED Control Owner *	Priority (1 is highest)	Color
Transport Status LED (Controlled by TRSW) NOTE : Transport Status LED depicts the Transport SW States	<i>Backhaul Link Status</i>			
	BTS is booting up, and the Platform SW is starting up. LED is being controlled by HW.	HW	1	OFF
	In the startup sequence, the Platform SW is up and it has taken the control of LED. This state continues until the TRSW become operational	Platform SW	1	Stable RED

Table 11 FZM and FZP LED indications (Cont.)

LED	Description	LED Control Owner *	Priority (1 is highest)	Color
	following Site Power-Up or Site Reset. Includes POST (in case of a power on scenario)			
	TRSW has taken control of Transport Status LED and is Initializing *or* Critical or Major Fault raised on TRSW	TRSW	2	Stable RED
	Critical or Major Fault raised on TRSW AND Bluetooth is ENABLED automatically	TRSW	2	Stable YELLOW
	MINOR or Degraded alarm exists on TRSW	TRSW	3	Blinking RED
	TRSW is ready (fully initialized) - No known Critical/Major/Degraded/Minor Transport faults present.	TRSW	4	Stable GREEN
RF Power Status LED (Controlled by HW)	<i>RF Transmission Status</i>			
	BTS is booting up, and the Platform SW is starting up. LED is being controlled by HW.	HW	1	OFF
	Platform SW has come up successfully.	Platform SW	1	OFF

Table 11 FZM and FZP LED indications (Cont.)

LED	Description	LED Control Owner *	Priority (1 is highest)	Color
	FPGA has taken control of the RF LED in the startup sequence	FPGA	1	Blinking GREEN
	RF Transmission OFF	FPGA	1	Blinking GREEN
	RF Transmission ON	FPGA	2	Stable GREEN
BTS Status LED (Controlled by BTSOM)	<i>BTS Status</i>			
	While BTS is booting up and Status LED is being controlled by HW	HW	1	Stable RED
	In startup sequence, Platform SW is up and is now controlling the Status LED. Includes POST (in case of a power on scenario)	Platform SW	1	Blinking YELLOW
	Startup: Indicates BTSOM has taken control of the BTS Status LED and is performing site initialization related activities with the iOMS (SW version inquiry, SW download, SCF download, HW Configuration upload, Alarm sync, etc).	BTSOM SW	2	Blinking YELLOW

Table 11 FZM and FZP LED indications (Cont.)

LED	Description	LED Control Owner *	Priority (1 is highest)	Color
	Indicates BTS and/or all CELLS are Blocked/Locked	BTSOM SW	3	Stable YELLOW
	Indicates BTS is Faulty: It signifies that at-least one Critical Fault is currently present on BTS. Note: Includes any type of BTS faults including Transport, U-Plane, and C-Plane faults.	BTSOM SW	4	Stable RED
	Indicates BTS is degraded: At least one Major Fault is currently active on BTS (while no Critical Faults are active) Note: Includes any type of BTS faults including Transport, U-Plane, and C-Plane faults.	BTSOM SW	5	Blinking RED
	Indicates a SW download is in progress during runtime operation (i.e. SW download is occurring outside of startup)	BTSOM SW	6	Blinking GREEN
	Indicates a Critical Failure occurred during Auto Connection (AutoConnection State is "Disconnected").	BTSOM SW	7	Stable RED

Table 11 FZM and FZP LED indications (Cont.)

LED	Description	LED Control Owner *	Priority (1 is highest)	Color
	<p>If failure is due to an iOMS rejection (unsuccessful AutoConnectionEstablishedReply message was received), condition will persist for 5 min until the Auto-Connection process is automatically retried.</p> <p>Note: If failure is due to iOMS connectivity being down (detected by Supervision on iOMS link), a Critical Fault will be active (SET).</p>			
	<p>Indicates Auto-Connection is in Progress (Until connection to Final iOMS is achieved)</p>	BTSOM SW	8	Blinking YELLOW
	<p>Indicates BTS is Uncommissioned</p> <p>Note: A "4030: EFaultId_NoCommDataAl" will be SET resulting in generation of a "7652 BASE STATION NOTIFICATION" alarm.</p>	BTSOM SW	9	Stable YELLOW
	<p>BTS in Test Dedicated State</p>	BTSOM SW	10	Blinking GREEN

Table 11 FZM and FZP LED indications (Cont.)

LED	Description	LED Control Owner *	Priority (1 is highest)	Color
	Indicates either 1) a stable condition where at least one CELL is OnAir (indicated in conjunction with "RF Power Status" LED being Stable GREEN), or 2) a transitory condition where the BTS is fully configured and nothing is preventing a CELL from transitioning to onAir (indicated in conjunction with "RF Power Status" LED being Blinking GREEN).	BTSOM SW	10	Stable GREEN

For descriptions on Pico module WiFi LED states, see [Table 12: Flexi Zone Pico WiFi LED states](#).

Table 12 Flexi Zone Pico WiFi LED states

WiFi LED state	Description
Off	WiFi module not present
Blinking red	WiFi module boot in progress
Stable red	2.4 GHz and 5 GHz fault
Blinking green	2.4 GHz or 5 GHz fault
Stable green	2.4 GHz and 5 GHz on

9 Transport

Transport protocol

Flexi Zone Pico Indoor BTS uses IP/Ethernet as a standard transport protocol. A copper or wireline Ethernet is the standard interface in BTS units.

When external transport solutions (such as wireless backhaul, GPON, etc.) are used, they communicate through the Ethernet connection on the BTS and the technology used is transparent to the BTS.

Flexi Zone Pico Indoor versions supports the following network interfaces depending on the technology:

- LTE
 - eNodeB to MME and Serving SAE Gateway with S1 interface
 - eNodeB to eNodeB with X2 interface
- WCDMA
 - IUB (100/1000 BASE-T)
 - RJ45 (the physical transport interface configuration)

The physical transport interface configuration available is RJ45.

Wireline Ethernet

Flexi Zone Pico Indoor BTS Base Module RJ45 socket supports 2 Gigabit Ethernet copper interfaces 100/1000 Base-T according IEEE802.3 clause 40.

10 Wi-Fi coverage

This chapter describes optimal mounting location for a maximum Wi -Fi coverage.

The location and orientation that you choose for the FZ Indoor Pico play a critical role in the performance of your wireless network. In general, it is recommended to install the module away from obstructions and sources of interference.

Due to the design tradeoffs required to produce a small, low-cost product, a minor amount of sensitivity degradation is expected from the WiFi Tx under certain conditions and LTE/WiFi band combinations. Care should be taken during deployment to configure the WiFi network to use channels with as much frequency separation from the LTE band as possible.

Care should also be taken to maximize the distance between WiFi and other unlicensed devices to the FZP in order to minimize the opportunity for interference and performance degradation. If interference is observed or suspected from other RF devices, Nokia recommends increasing the distance between the FZP and interfering device as much as possible to preserve FZP performance.

Figures below show recommended [ceiling location](#), [wall location](#) and [corridor location](#).

Figure 12 Recommended ceiling location

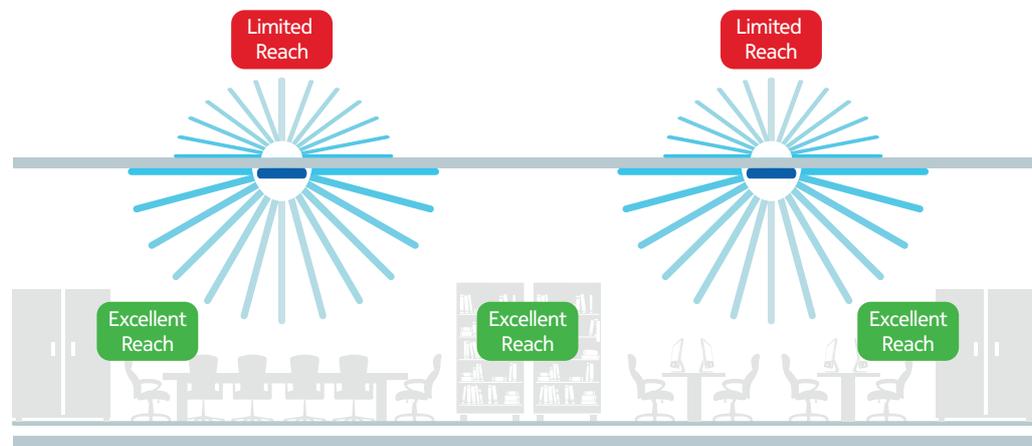


Figure 13 Recommended wall location

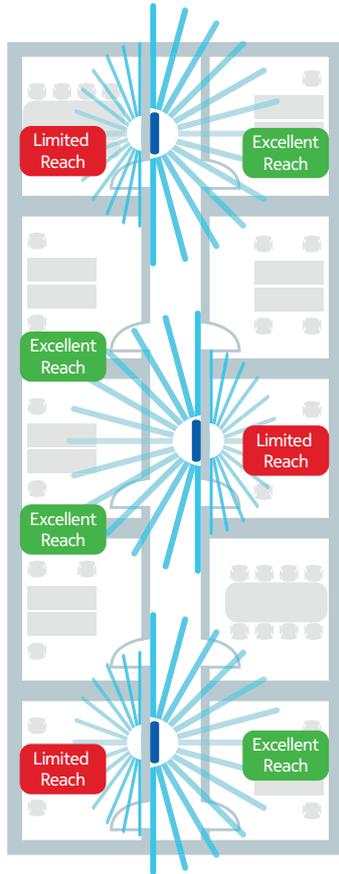
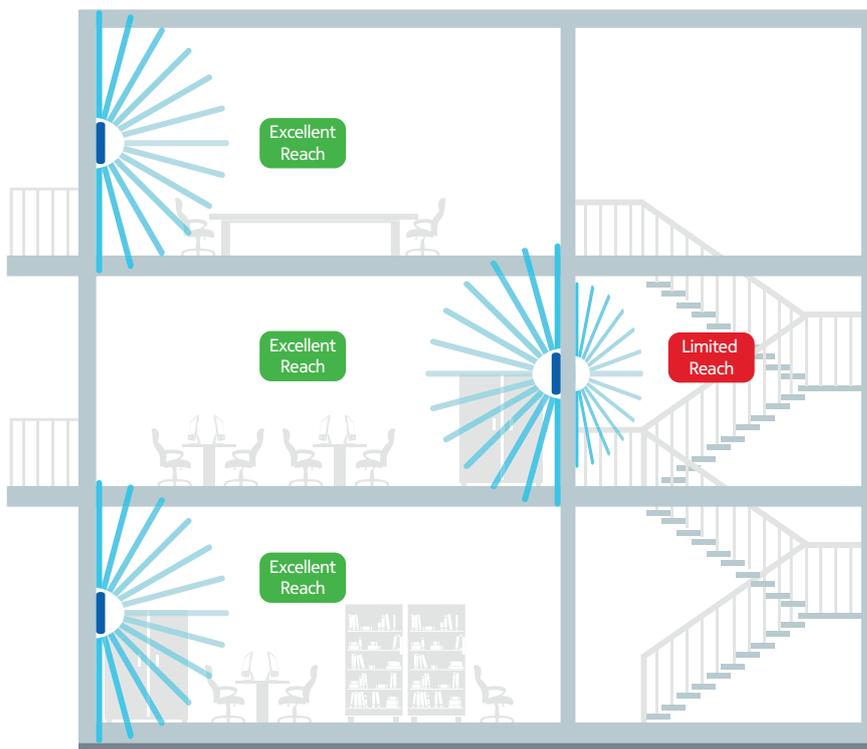


Figure 14 Recommended corridor location



11 Management and software

The Flexi Zone Indoor Pico BTS can be managed remotely via NetAct. Auto-connection and auto-configuration start automatically when the Flexi Zone Indoor Pico BTS starts. Please make sure the backhaul connection to the Core Network is in place for this to succeed.

It can also be managed locally through the RJ45 port or through a Bluetooth connection. The Bluetooth connection eliminates the need for a wired connection to the Flexi Zone Indoor Pico BTS when it is installed in a difficult to reach location. NetAct can be used to manage the Flexi Zone Indoor Pico BTS remotely.

The Pico Indoor BTS utilizes an internal Bluetooth antenna. The useful range for Bluetooth is influenced by the installation and environment of the surroundings. If multiple WiFi Access Points are operating nearby, the range can be reduced as 2.4GHz WiFi operates in the same frequency spectrum. For maximum Bluetooth range a Class 1 dongle is required.

Flexi Zone Indoor Pico BTS features an internal Bluetooth module which consists of an on-board Bluetooth transceiver. The transceiver provides a 78 channel EDR 2.1 compliant Bluetooth interface used for remote MMI and maintenance operations. All required SW is loaded and installed onto the Flexi Zone Indoor Pico BTS Bluetooth Module as part of the overall Flexi Zone Indoor Pico BTS product software. Contact Nokia for additional details.

The BTS automatically detects the SW version number, HW product code, version number and serial number during the start-up. This data can be retrieved remotely. The BTS controls its internal operation, ensuring that any malfunctions or loss-of-service is detected and reported to the network management.

Software updates

New SW versions can be downloaded while the BTS is in operation. Software can be uploaded to BTS either locally, with the BTS Site Manager, or remotely from NetAct. Site visits are therefore unnecessary for routine operation and maintenance (O&M) tasks.

Typically, a local software download is done only when the NetAct connection is missing, for example, during the commissioning process. Software downloads can be run in the background of the BTS operation. The new software can be activated at any time. A reboot is required in order to activate the software.

The BTS only uses downloadable software. All software can be downloaded and updated from NetAct. As the procedure is centralized, upgrading SW for several BTSs can be performed simultaneously or individually.

The BTS keeps the current and previous software packages in its flash memory and can be updated at any moment. Updated software (current and previous) in the BTS can be seen through BTS Site Manager/NetAct.