FLEXI WCDMA BASE STATION

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1. About this document

This document gives a general overview of the Flexi WCDMA Base Station (BTS).

The document includes information under the following topics:

- Flexi WCDMA BTS introduction
- Flexi WCDMA BTS features
- Flexi WCDMA BTS configurations
- Flexi WCDMA BTS management and software
- Flexi WCDMA BTS construction and modules
- Flexi WCDMA BTS technical specifications.

Flexi WCDMA BTS installation and co-siting to existing GSM/EDGE UltraSite cabinets is presented in user manual documents.

For more information on Flexi WCDMA BTS and related products, see WCDMA RAN Solution Description, Flexi BTS Solution Description, and the product overviews for Flexi Antenna System, FlexiHopper™ Microwave Radio, MetroHopper™ Radio, and MetroHub™ Transmission Node.
2. Introduction to Flexi WCDMA Base Station

Flexi WCDMA BTS is the 3G macro BTS site solution.

From a BTS site installation and hardware (HW) point of view, Flexi WCDMA BTS introduces a new revolutionary flexible way to build BTS sites using modules, without a specific BTS cabinet.

From a feature and performance point-of-view, Flexi WCDMA BTS provides on one hand a smooth evolution from UltraSite WCDMA BTSs, without compromising performance or capacity. On the other hand Flexi architecture is fully future proof and provides smooth evolution towards HSPA+ features and LTE.

Flexi WCDMA BTS provides very high radio downlink output power when using Flexi 100 W Dual Radio Module and 210 W Radio Module. Typical output power at Radio Module antenna connector is 43 W or 60W per carrier. Fewer sites are needed and High Speed Downlink Packet Access (HSDPA) services can be supported even to indoors.

Figure 1. Modular Flexi WCDMA BTS site solution

Flexi WCDMA BTS modules can be used very flexibly with different BTS configurations, AC/DC and battery backup modules, and the operator’s own site equipment, for an integrated site solution.
The Flexi WCDMA BTS standard baseline is 3GPP Release 5 FDD Node B. It is a RAS05.1 compatible BTS product.

The Flexi WCDMA BTS is fully compliant with the 3GPP Release 5 Iub standard interface.

- Optimized BTS Antenna Line.

![Antenna Line with integrated 3GPP Antenna tilt and Mast Head Amplifiers (MHAs)](image)

**Figure 2. WCDMA Antenna with integrated 3GPP Antenna tilt and Mast Head Amplifiers (MHAs)**

Antenna Line products include several antennas with optional integrated 3GPP standard down tilt control and separate Mast Head Amplifiers (MHAs).

### 2.1. Reduced OPEX

Flexi WCDMA BTS is designed as a cost efficient coverage and capacity solution to minimize BTS site CAPEX and OPEX.

Flexi WCDMA BTS provides a true modular macro site solution that integrates a high capacity BTS with all the necessary site support equipment.
Fast Site Acquisition

The Flexi WCDMA BTS is designed for easy installation, commissioning, and maintenance. Due to the modular solution, the footprint, space, weight and power feeding system of the site can be optimized. This ensures the minimum visual impact to the general public. The acquisition time, cost, and acceptance time of a new site can be minimised.

Reduced Power consumption

Flexi WCDMA BTS reduces BTS site power consumption dramatically. The electricity saving in typical configurations is up to 60 percent compared to a first generation WCDMA BTS. This saving is due to the high integration level of the Flexi WCDMA BTS, and to the new-technology power amplifiers.

Typical Flexi power consumption for 1+1+1 configuration is around 500W.

Moreover, this reduced BTS electricity consumption converts to the requirement of less battery capacity for the same backup time and less weight for the site, or to more battery backup time using the existing batteries of the site.

Minimised Rental costs

Flexi WCDMA BTS reduces BTS site rental costs because a BTS-specific cabinet is no longer needed for a WCDMA site. This means that floor space or cabinet is not necessarily required anymore. Existing site support and auxiliary cabinets can used to house Flexi WCDMA BTS modules, or modules can be installed at a wall.
The BTS floor space for a floor installation is only 470 x 600 mm (width x depth with the front and back covers installed).

**Optimised Logistics costs**

The Flexi WCDMA BTS consists of only few types of RF Module per frequency band, and one System Module. This includes baseband processing, and an alternative transmission sub-module. The logistics cost and spare part stock is minimised. The same modules are used in both indoor sites and outdoor sites.

The site power and backup system is under one Operation and Maintenance Centre (NetAct™). When the entire site status is known at the remote NetAct™ centre, maintenance visits can be planned in advance, taking into account all site equipment including the BTS, antenna line equipment, and all other Site Support equipment.

**Lower Maintenance costs**

The Flexi WCDMA BTS does not require regular maintenance. All the BTS modules can be accessed from the front, and are at least IP 55 class hermetically sealed and fresh-air-cooled.
2.2. Reduced CAPEX and Implementation Costs

**Less WCDMA BTS Sites**

Flexi WCDMA BTS provides very high radio downlink output power when using Flexi 100 W Dual RF Modules and 210 W Triple RF Modules. Total WCDMA amplifier power in one module is then 210 W. Less sites are needed and for example High Speed Downlink Packet Access (HSDPA) services can be supported even indoors.

**Reduced power system cost of the site**

Highly-reduced Flexi WCDMA BTS electricity consumption means:

- less and smaller-capacity AC-DC rectifiers (an optional AC-DC Module is available)
- smaller site power feeding cables and fuses
- smaller or no air-conditioning equipment at all for indoor sites
- no air-conditioning equipment at outdoor sites
- no need for a dedicated cabinet for the power system and auxiliary equipment.

**Installation costs**

Flexi WCDMA BTS reduces BTS installation costs, since no cabinet is needed for a WCDMA site. A single person can carry the modules and install them on the floor or on the wall. A truck is no longer needed to transport the cabinet to the site, or a crane to lift the cabinet onto the roof.

**Weight of the site**

Flexi WCDMA BTS reduces the weight of the BTS site dramatically. In a typical 2+2+2 configuration, the entire BTS weight is less than 70 kg. This makes it easier to find, acquire and build a site, especially on a rooftop.

**Optimised Antenna Line**

The Optimised Antenna Line reduces antenna line installation costs and CAPEX by removing separate Bias-Ts, jumper cables, and lightning protection units at a site. This minimises the length of the antenna line and the number of connectors, thereby optimising the site’s RF performance.
2.3. One BTS for all WCDMA network applications

Flexible site solutions

The coverage built by a Flexi WCDMA BTS provides a large service area with the minimum number of sites. The Flexi WCDMA BTS is the ideal high-capacity and large-coverage ‘one BTS only’ type for all site applications.

Site re-use by co-siting

Flexi WCDMA BTS can be used when existing BTS sites need to be expanded to provide 3G services. The Flexi WCDMA BTS can be co-sited with Talk-family and UltraSite EDGE/WCDMA BTSs. It can also be co-located with other vendors’ GSM equipment, or even with non-GSM site equipment.

Since Flexi WCDMA BTS modules can be installed on walls, even a floor-space-limited 2G equipment room and shelter can be used.

Figure 5. Flexi WCDMA BTS wall installation inside 2G site
Cost-effective future-proof site solution

The Flexi WCDMA BTS provides high network capacity with the minimum number of modules at the site. All the necessary site equipment can be integrated into one cabinet site solution, especially in an outdoor situation.

- With versatile integrated Flexi WCDMA BTS transmission alternatives the most suitable transmission media can be used at each BTS site

- With the help of an integrated Battery Back-Up, the Flexi WCDMA BTS provides several hours of uninterrupted traffic in the event of an AC power failure. The Intelligent Shut-Down feature optimises one battery backup system exploitation between BTS carriers, sectors, and the separate transmission node.

- With enough space for the operator's own site equipment (Line Terminal Equipment etc. space), there is no need for a space-consuming auxiliary cabinet on site.

- Efficient utilisation of existing antenna systems is also supported. These features make Flexi WCDMA BTS a cost-effective solution for a number of different application areas.
3. Features of Flexi WCDMA BTS

This chapter describes Flexi WCDMA BTS features in more detail.

3.1. Cost-efficient future-proof modular site

Flexi WCDMA BTS has many advanced features that make it a cost-effective site solution.

With Flexi WCDMA BTS, the same equipment can be used to build coverage and capacity. A high WCDMA carrier-capacity and wide coverage per site mean fewer sites, which makes building a WCDMA network more cost-effective. Flexi WCDMA BTS provides future-proof capacity evolution for even the densest, highest-capacity sites.

The Flexi WCDMA BTS can be installed in existing Talk-family and UltraSite GSM/EDGE/WCDMA sites for a data capability upgrade; it can utilise existing site equipment.

The actual installation of the Flexi WCDMA BTS is fast and easy because of the uniformity of the module installation, and because of the simple cabling and minimal amount of modules. In a typical configuration, the Flexi WCDMA BTS consists of only two RF Modules and one System Module.

3.1.1. Fast Installation

Due to its small weight, small size, modular design and full frontal accessibility, the Flexi WCDMA BTS is easy to install practically anywhere.

A Flexi WCDMA BTS module can be lifted, carried, and put into place by one person. The average modular BTS installation time is reduced to one third of the installation time for a traditional cabinet BTS.

The Flexi WCDMA BTS can be installed on the wall but it fits into the corresponding Talk-family and UltraSite GSM/EDGE/WCDMA BTS footprints as well. The operator does not need to alter previous plans for expansion that are based on the area. Installation locations for the Flexi WCDMA BTS can be smaller or the same as those reserved for Talk-family and UltraSite EDGE/WCDMA BTSs.
3.1.2. Low Acoustic Noise

The acoustic noise produced by the Flexi WCDMA BTS site is very low, due to highly reduced electricity consumption and an increased unit integration level. Site acceptance is easier, especially at urban outdoor sites. Fan speeds and acoustic noise are always minimised according to the BTS load and ambient temperature.

3.1.3. Easy Commissioning

The auto detection feature of Flexi WCDMA BTS makes commissioning and integrating fast and easy. The commissioning wizard guides the user step-by-step through the whole commissioning process. At the end of the process, the commissioning wizard produces a BTS Commissioning Report.

3.1.4. Scalable future-proof Transmission

Flexi WCDMA BTS System Module contains a transmission sub-module that provides the physical Iub interface to the RNC. The System Module can be configured with different variants: PDH (copper), SDH (fibre optics), microwave radios (Flexbus) and Ethernet (Fast Ethernet and Gigabit Ethernet, RAS06). All of the transmission sub module alternatives provide interfaces of a kind, for example, 8xE1/T1/JT1. In addition a hybrid PDH/Ethernet sub module is available, enabling to backhaul R’99 traffic over PDH and HSPA over Ethernet.

Please refer to chapter 6.6 for a complete list of transmission sub modules.

Flexi WCDMA BTS can be deployed in star, chain and tree topologies. The Flexi WCDMA BTS Site integrated transport modules include ATM aggregation, Ethernet switching, media conversion as well as extensive MWR hub solutions. Transmission infrastructure can be effectively shared with an existing GSM/EDGE BTS.

All of the transmission sub-modules are prepared for a future software-upgrade to enable IP transport (IP based Iub). Migrating Flexi WCDMA BTS from an ATM-based 3GPP R99/R4 to IP-based 3GPP R5 architecture does not require any hardware to be changed and can be executed remotely within minutes.
3.1.5. **Intelligent Shut-Down**

The Intelligent Shut-Down feature optimises the investment to one battery backup system on a high-capacity BTS, especially on sites that operate as important transmission hub nodes. With Intelligent Shut-Down, separate backup systems for BTS and transmission are unnecessary.

The Flexi WCDMA BTS with battery backup system supports an intelligent BTS site power shutdown procedure in the event of an AC power failure. During the commissioning of each site, the operator can define different shutdown timers and priorities for the BTS sectors and carriers.
Figure 7. Principle of Intelligent Shut-Down in the case of transmission node site

For example, a three-sector two-carrier Flexi WCDMA BTS (2+2+2) site equipped with battery backup operates as a transmission hub node towards other BTSs in a chain. The first timer can be set to shut down the second carriers of the BTS, to operate as 1+1+1 (for example) 30 minutes after an AC power failure. The second timer can be set to shut down the remaining 1+1+1 BTS (for example) one hour after the AC power failure, in order to support the transmission node for as long as possible with the existing battery capacity.

Timers can be set according to the configuration and priorities of each site. In an outdoor cabinet, a transmission node can be installed in the operator’s own Line Terminal Equipment (LTE) space of the Flexi Cabinet Site support Module (FCSA).

3.1.6. **High Reliability**

Flexi WCDMA BTS is designed to meet availability targets of the highest standard. Simplicity and speed of maintenance procedures are the prerequisites for reliable operation. Maintenance is improved by module integration and automatic fault detection procedures. Special attention has been paid to the Flexi WCDMA BTS SW start time, in order (for instance) to minimise downtime when a new SW package is taken into use.
3.2. One BTS for all WCDMA network applications

Flexi WCDMA BTS is optimised for high-capacity, wide-coverage applications. It will ensure cell ranges that meet the requirements of the coverage applications. Because of this, the number of sites required to build a good WCDMA coverage is small. A seamless voice and data coverage area can be built easily.

Flexi WCDMA BTS has been developed for coverage applications. It offers, therefore:

- Very high downlink power with Flexi 100 W Dual RF Module or Flexi 210 W Triple RF Module.
- Optimum UL performance and receiver sensitivity
- Outdoor modules that can be located close to antennas, minimising antenna feeder losses
- Optimised antenna system performance, including 3GPP antenna tilting and Mast Head Amplifier support

3.2.1. Superior TX and RX performance

Very high output power using Flexi 100 W Dual RF Modules or 210 W Triple RF Modules.

For BTS receiver the minimum reference sensitivity level specified in 3GPP (3GPP TS 25.104) is -121 dBm.

The corresponding typical value for Flexi WCDMA BTS with MHA is **-129.1 dBm** in the static channel, with the following conditions:

- 0.1 % BER for 12.2 kbit/s user bit rate
- Average White Gaussian Noise (AWGN) channel type
- with 2-way RX diversity
- 2.1 GHz band (3GPP Band I)
- MHA with 12 dB gain and with typical 1.2 dB Noise Figure and 0 dB feeder loss

The typical value for Flexi WCDMA BTS without MHA is **-128.6 dBm** in the static channel, with the following conditions:

- 0.1 % BER for 12.2 kbit/s user bit rate
- Average White Gaussian Noise (AWGN) channel type
- with 2-way RX diversity
- 2.1 GHz band (3GPP Band I)
Flexi WCDMA reference typical sensitivity level without MHA and without RX diversity is **-125.6 dBm** in the static channel, with the following conditions:

- 0.1 % BER for 12.2 kbit/s user bit rate
- Average White Gaussian Noise (AWGN) channel type
- no RX diversity (as specified in 3GPP TS 25.104)
- 2.1 GHz band (3GPP Band 1)

### 3.2.2. Optimal performance with Optimised Antenna Line

Optimised Antenna line is a separate optional site solution to further optimise total BTS and antenna system site RF performance, and minimise costs.

The Flexi WCDMA BTS Optimised Antenna line includes the following optional features, enabled by SW Licence keys:

- Integrated MHA power feeding (implemented traditionally by external Bias-T units in previous BTS products) and O&M control to the RF Module of the Flexi BTS
- Antenna line supervision by Return Loss measurement
- Integrated 3GPP standard Antenna Tilt power feeding (implemented traditionally by the external Antenna Tilt unit) and 3GPP Antenna Tilt O&M control to the RF Module of the Flexi BTS

Moreover, Flexi RF Module has as a standard integrated lightning protection circuit in all antenna connectors traditionally implemented using BTS external lightning protection units.

![Optimised antenna line with MHA and 3GPP Tilt Antenna](image)

**Figure 8. Optimised antenna line with MHA and 3GPP Tilt Antenna**
The antenna connector of the Flexi WCDMA BTS is the output of the RF Module itself. No extra units, connectors, or jumper cables are necessary between the Flexi WCDMA BTS antenna connector and the antenna. This minimises the antenna line length and losses, and optimises RF performance in both the uplink and downlink direction.

### 3.2.3. High-capacity HSDPA and HSUPA BTS

The Flexi WCDMA BTS is a compact high-capacity voice and data BTS designed to support future High Speed Downlink Packet Access (HSDPA) based services and High Speed Uplink Packet Access (HSUPA) based services.

Smooth HSDPA and HSUPA support is provided through SW. RF and System Modules simultaneously support existing voice, circuit, and packet data services. They also support HSDPA and HSUPA, meaning that no special HSDPA or HSUPA modules are necessary.

The System Module supports RAS HSDPA and HSUPA with high bit rates. With all this capacity, the processing capacity of the Flexi WCDMA BTS can be configured to support the maximum capacity that the WCDMA air interface allows.

In addition to flexible traffic capacity, the Flexi WCDMA BTS also allows a free mix of traffic patterns, in order to accommodate whatever proportion of voice and data is required. As the percentage of data calls continues to grow exponentially, this feature will be particularly beneficial. Depending on network capacity requirements, the capacity installed can be matched with the capacity of the air interface.

### 3.2.4. 3GPP Iub compliant BTS

The Flexi WCDMA BTS is fully compliant with the 3GPP Release 5 Iub standard interface between the BTS and the RNC. This makes multivendor RAN possible, after 3GPP Release 5 telecom Integration and Verification in a multivendor environment has been completed.

Traffic from Flexi WCDMA BTS O&M to the NetAct™ network management system is carried in IP over ATM. Therefore, all BTS-specific O&M traffic can be transferred transparently to any RNC.

### 3.3. Flexi BTS Roadmap supported features

Current Release support for below features could be verified in the BTS roadmap

#### 3.3.1. HSDPA Code Multiplexing

Flexi supports HSDPA Code Multiplexing. Flexi HSDPA code multiplexing enables simultaneous transmission of three HSDPA users within a single cell during a single
Transmission Time Interval (TTI). Code multiplexing improves the code resource utilization and subsequently, improves the cell throughput 30-50% and beyond. Improved end user experience is acquired thanks to better cell throughput in the case of simultaneous users supporting maximum 5 codes. CAPEX and OPEX savings result from increased cell capacity.

3.3.2. Hybrid Backhaul with Pseudo Wires
Flexi makes possible to use low cost transmission media for HSPA traffic. ATM packets can be transported over Ethernet, allowing the use of more cost efficient transport media between Flexi and RNC. This feature enables the "ATM pseudowires", which are an integral part of Hybrid BTS Backhaul. With this feature more cost efficient transport medias based on packet transport (IP and Ethernet) can be used. As part of the Hybrid BTS Backhaul solution it allows to reduce the number of E1 lines used per Flexi and thus resulting Opex savings.

3.3.3. Extended Cell (180km)
Flexi Cell radius is extended up to 180 km. Flexi extended cell feature can be used to efficiently provide coverage in coastal and rural area, where big capacity or high data rates are not needed. Furthermore, new lower WCDMA frequency bands 850 MHz and 900 MHz make it possible to achieve larger cell sizes and also utilize the existing GSM cell raster. The feature is needed also with optical repeater cases (train tunnels, FlexiBTS Remote Radio Heads) to overcome the decreased cell radius caused by the delay of optical cables.

3.3.4. Flexi WCDMA BTS 3GPP antenna Tilt Support
Flexi BTS has integrated Antenna Tilt control HW in Radio module to control the 3GPP Tilt Antennas. This integrated Antenna tilt is enabled by a specific SW licence. Antenna Tilt is integrated to the RF module of Flexi BTS. It feeds DC power to the antenna and controls the antenna tilting.

3.3.5. Flexi WCDMA AISG Mast Head Amplifier Support
Flexi BTS has integrated Bias-T HW in Radio module to control Nokia Siemens Networks AISG 2.0 MHA’s. This integrated HW based SW functionality is to be enabled by a specific SW licence. Bias-T is integrated to the RF module of Flexi BTS. It feeds DC power to the MHA and controls the MHA DC power current consumption.

3.3.6. Support for Large BTS Configurations up to 12 Cells
Flexi WCDMA BTS supports 3+3+3 and 4+4+4 configurations. With this feature, it is possible to extend the BTS capacity by adding up to four carriers per sector in a three sector BTS and the required amount of baseband channel capacity. The carriers may also be in six sector configuration 2+2+2+2+2+2.
3.3.7. IP based Iub for Flexi WCDMA BTS

Flexi supports use of native IP and Ethernet transport according to 3GPP Rel-5 and Rel-6 at the Iub interface for the RNC and Flexi WCDMA BTS. With this feature the RNC and Flexi WCDMA BTS support 3GPP Rel-5 / Rel-6 compliant IP transport protocol option on the Iub interface. Dual stack operation in the RNC allows usage of ATM Iub and IP Iub simultaneously in the same RNC. With this feature, a single BTS is then connected to the RNC via IP Iub, while other BTSs may still continue using ATM Iub towards the same RNC.

3.3.8. Timing over Packet

This feature enables software support for Timing over Packet according to IEEE1588v2 allowing the synchronization of the Flexi WCDMA BTS via an Ethernet physical interface. Timing over Packet for BTS Application Software requires Flexi WCDMA FTIB. Timing over Packet solution allows the operator to take the full advantage of Ethernet/packet based BTS backhaul. In case the Ethernet/packet network is of sufficient quality, it can be used for providing synchronization to the BTS.

3.3.9. Dual IuB for Flexi WCDMA BTS

This feature enables the use of ATM protocol stack for delay critical traffic and 3GPP Rel-5 / Rel-6 compliant IP protocol stack for more delay tolerant traffic at the Iub interface. Dual IuB allows using Ethernet for HSPA traffic e.g. via Carrier Ethernet or DSL. OPEX and CAPEX savings result from more cost efficient Iub transport compared to leased E1/J1/T1s.
4. Applications and configurations

Flexi WCDMA BTS is a solution for high-capacity and large coverage sites. It is especially designed to minimise the total BTS-site CAPEX and OPEX cost by providing a modular site solution, and at the same time meeting demands for increased data and voice coverage and capacity. Flexi WCDMA BTS is very flexible and easy to expand.

Flexi WCDMA BTS is part of the Flexi Site Solution, which provides BTS sites that are fully equipped with transmission and auxiliary equipment. The following figure illustrates a Flexi Site.

![Examples of Flexi WCDMA BTS Outdoor sites](image)

Figure 9. Examples of Flexi WCDMA BTS Outdoor sites
4.1. Configurations

4.1.1. BTS configurations

The Flexi WCDMA BTS is flexible and easy to configure. Configurations are available up to 12 WCDMA carriers. The Flexi WCDMA BTS supports 2-way uplink diversity as standard.

Flexi WCDMA BTS possible HW configurations with:

- Flexi RF Module 2100 Dual 50 W (FRGC) and
- Flexi RF Module 2100 Single 50 W (FRGD)
- Flexi RF Module 2100 Triple 70 W (FRGF)

OR

- Flexi RF Module x Dual 50 W (FRxA),
- Flexi RF Module x Single 50 W (FRxB)

\[x = \text{Frequency band}\]

\[C = 850, \ D = 900, \ E = 1800, \ F = 1900, \ I = 1.7/2.1\]

OR

- Flexi Mast Head RF Module 50 W (FRGE)
- Flexi RRH 2100 Single 70W (FRGG)

Below tables present example of configurations that are supported by BTS hardware. Software support will be coming according to release roadmap.
Table 1 Example Single and Dual RF modules configurations with the licences

<table>
<thead>
<tr>
<th>Configuration</th>
<th>RF power power per carrier</th>
<th>Minimum # of Radio Modules</th>
<th>40 W SW Licence key</th>
<th>Multi Carrier SW Licence key</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 carrier omni</td>
<td>8 W</td>
<td>Single RF Module</td>
<td>8 W Lic.</td>
<td>No</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>20 W</td>
<td>Single RF Module</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>40 W</td>
<td>Single RF Module</td>
<td>1</td>
<td>no</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>20 W</td>
<td>Single RF Module</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>40 W</td>
<td>Dual RF Module</td>
<td>2</td>
<td>no</td>
</tr>
<tr>
<td>3 carrier omni</td>
<td>20 W</td>
<td>Dual RF Module</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1+1</td>
<td>8 W</td>
<td>Dual RF Module</td>
<td>2 x 8 W Lic.</td>
<td>No</td>
</tr>
<tr>
<td>1+1</td>
<td>20 W</td>
<td>Dual RF Module</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1</td>
<td>40 W</td>
<td>Dual RF Module</td>
<td>2</td>
<td>no</td>
</tr>
<tr>
<td>2+2</td>
<td>20 W</td>
<td>Dual RF Module</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2+2</td>
<td>40 W</td>
<td>2 x Dual RF Module</td>
<td>4</td>
<td>no</td>
</tr>
<tr>
<td>3+3</td>
<td>20 W</td>
<td>2 x Dual RF Module</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4+4</td>
<td>20 W</td>
<td>2 x Dual RF Module</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>1+1+1</td>
<td>20 W</td>
<td>Dual RF Module + Single RF Module</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1+1</td>
<td>40 W</td>
<td>Dual RF Module + Single RF Module</td>
<td>3</td>
<td>no</td>
</tr>
<tr>
<td>2+2+2</td>
<td>20 W</td>
<td>Dual RF Module + Single RF Module</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2+2+2</td>
<td>40 W</td>
<td>3 x Dual RF Module</td>
<td>6</td>
<td>no</td>
</tr>
<tr>
<td>3+3+3</td>
<td>20 W</td>
<td>3 x Dual RF Module</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4+4+4</td>
<td>20 W</td>
<td>3 x Dual RF Module</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Uneven conf.</td>
<td>20W or 40W</td>
<td>depends on config</td>
<td>depends on config</td>
<td>depends on config</td>
</tr>
<tr>
<td>(e.g. 2+3+4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1+1+1+1</td>
<td>20 W</td>
<td>2 x Dual RF Module</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1+1+1</td>
<td>40 W</td>
<td>2 x Dual RF Module</td>
<td>4</td>
<td>no</td>
</tr>
<tr>
<td>2+2+2+2</td>
<td>20W</td>
<td>2 x Dual RF Module</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>1+1+1+1+1+1+1</td>
<td>20 W</td>
<td>3 x Dual RF Module</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1+1+1+1+1+1</td>
<td>40 W</td>
<td>3 x Dual RF Module</td>
<td>6</td>
<td>no</td>
</tr>
<tr>
<td>2+2+2+2+2+2+2</td>
<td>20 W</td>
<td>3 x Dual RF Module</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>
Table 2 Example Triple RF module configurations with the licences

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Minimum # of Radio Modules</th>
<th>RF power per carrier</th>
<th>40 W SW Licence key</th>
<th>60 W SW Licence key</th>
<th>Multi Carrier SW Licence key</th>
<th>Branch activation in Triple RF Module Licence key</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>8</td>
<td>no</td>
<td>no</td>
<td>8W lic</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>20</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>30</td>
<td>no</td>
<td>no</td>
<td>1</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>40</td>
<td>no</td>
<td>no</td>
<td>1</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>60</td>
<td>no</td>
<td>1</td>
<td>no</td>
<td>1</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>1</td>
<td>20</td>
<td>no</td>
<td>1</td>
<td>1</td>
<td>no</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>1</td>
<td>30</td>
<td>no</td>
<td>1</td>
<td>1</td>
<td>no</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>1</td>
<td>40</td>
<td>2</td>
<td>no</td>
<td>no</td>
<td>1</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>1</td>
<td>60</td>
<td>no</td>
<td>2</td>
<td>no</td>
<td>1</td>
</tr>
<tr>
<td>3 carrier omni</td>
<td>1</td>
<td>30</td>
<td>1</td>
<td>no</td>
<td>1</td>
<td>no</td>
</tr>
<tr>
<td>1+1</td>
<td>1</td>
<td>8</td>
<td>2x8W lic</td>
<td>no</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>1+1</td>
<td>1</td>
<td>20</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>1+1</td>
<td>1</td>
<td>30</td>
<td>2</td>
<td>no</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>1+1</td>
<td>1</td>
<td>40</td>
<td>4</td>
<td>no</td>
<td>no</td>
<td>4</td>
</tr>
<tr>
<td>1+1</td>
<td>1</td>
<td>60</td>
<td>no</td>
<td>2</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>2+2</td>
<td>1</td>
<td>20</td>
<td>2</td>
<td>no</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2+2</td>
<td>1</td>
<td>30</td>
<td>no</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2+2</td>
<td>2</td>
<td>40</td>
<td>4</td>
<td>no</td>
<td>no</td>
<td>4</td>
</tr>
<tr>
<td>2+2</td>
<td>2</td>
<td>60</td>
<td>no</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1+1+1</td>
<td>1</td>
<td>20</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1+1</td>
<td>1</td>
<td>30</td>
<td>3</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1+1</td>
<td>1</td>
<td>40</td>
<td>3</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1+1</td>
<td>1</td>
<td>60</td>
<td>no</td>
<td>3</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>2+2+2</td>
<td>1</td>
<td>20</td>
<td>3</td>
<td>no</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2+2+2</td>
<td>1</td>
<td>30</td>
<td>no</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2+2+2</td>
<td>2</td>
<td>40</td>
<td>6</td>
<td>no</td>
<td>no</td>
<td>6</td>
</tr>
<tr>
<td>2+2+2</td>
<td>2</td>
<td>60</td>
<td>no</td>
<td>6</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>
Above table presents example of configurations that are supported by BTS hardware. Software support will be coming according to RAS release roadmap.
Table 3 Example RRH 2100 single 70W configurations with the licences

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Minimum # of Radio Modules</th>
<th>Rf power per carrier</th>
<th>40 W SW Licence key</th>
<th>60 W SW Licence key</th>
<th>Multi Carrier SW Licence key</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>8</td>
<td>8W lic</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>15</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>20</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>30</td>
<td>1</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>40</td>
<td>1</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1 carrier omni</td>
<td>1</td>
<td>60</td>
<td>no</td>
<td>1</td>
<td>no</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>1</td>
<td>15</td>
<td>1</td>
<td>no</td>
<td>1</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>1</td>
<td>20</td>
<td>1</td>
<td>no</td>
<td>1</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>1</td>
<td>30</td>
<td>no</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>1</td>
<td>15</td>
<td>1</td>
<td>no</td>
<td>1</td>
</tr>
<tr>
<td>2 carrier omni</td>
<td>1</td>
<td>20</td>
<td>no</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3 carrier omni</td>
<td>1</td>
<td>15</td>
<td>1</td>
<td>no</td>
<td>1</td>
</tr>
<tr>
<td>3 carrier omni</td>
<td>1</td>
<td>20</td>
<td>no</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1+1</td>
<td>2</td>
<td>15</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1</td>
<td>2</td>
<td>20</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1</td>
<td>2</td>
<td>40</td>
<td>2</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1</td>
<td>2</td>
<td>60</td>
<td>no</td>
<td>2</td>
<td>no</td>
</tr>
<tr>
<td>2+2</td>
<td>2</td>
<td>15</td>
<td>2</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>2+2</td>
<td>2</td>
<td>20</td>
<td>2</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>2+2</td>
<td>2</td>
<td>30</td>
<td>no</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1+1+1</td>
<td>3</td>
<td>15</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1+1</td>
<td>3</td>
<td>20</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>1+1+1</td>
<td>3</td>
<td>40</td>
<td>3</td>
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<td>1+1+1</td>
<td>3</td>
<td>60</td>
<td>no</td>
<td>3</td>
<td>no</td>
</tr>
<tr>
<td>2+2+2</td>
<td>3</td>
<td>15</td>
<td>3</td>
<td>no</td>
<td>3</td>
</tr>
<tr>
<td>2+2+2</td>
<td>3</td>
<td>20</td>
<td>3</td>
<td>no</td>
<td>3</td>
</tr>
<tr>
<td>2+2+2</td>
<td>3</td>
<td>30</td>
<td>no</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3+3+3</td>
<td>3</td>
<td>15</td>
<td>3</td>
<td>no</td>
<td>6</td>
</tr>
<tr>
<td>3+3+3</td>
<td>3</td>
<td>20</td>
<td>no</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4+4+4</td>
<td>3</td>
<td>15</td>
<td>no</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>
Above table presents example of configurations that are supported by BTS hardware. Software support will be coming according to release roadmap.

### 4.1.2. Dualband configurations

The two different frequency variants (e.g. 2100 MHz / 900 MHz) are supported by Flexi WCDMA BTS side by side. The dualband configurations are possible to be implemented by one System Module only.

### 4.1.3. Channel Capacity

#### Channel capacity by SW License

Flexi System Module channel capacity is designed to support flexible and cost optimized site capacity evolution. Standard Operating SW of System Module type FSMB will include support for 32 Channel Elements (CE) to be used for Common Channels. With System Module type FSMC or FSMD, Common Channels for most typical configurations are included and operator does not need take those into account in Channel Element dimensioning.

The channel capacity of the Flexi WCDMA BTS can be optimized depending on the BTS configuration and the required traffic capacity of the BTS site. More channel capacity can be allocated remotely from NetAct by sending Channel Capacity SW License to Flexi WCDMA BTS.

The minimum number of Channel Elements allocated by SW License is one (1) CE supporting both uplink and downlink. Therefore Flexi WCDMA BTS site capacity can be optimized in the step of one CE without a site visit. In traditional BTS the investment step size is typically n x 64 CE with added site visit cost.

#### Future capacity evolution

Flexi WCDMA BTS System Module is well prepared to support future capacity expansion. A second System Module can be connected to the extension connector port of the first System Module. The second System Module increases Flexi WCDMA BTS baseband (Channel Element) capacity. More information about baseband capacity in different SW releases is available in Nokia Siemens Networks roadmaps.

### 4.1.4. Transmission

Flexi WCDMA BTS provides different transmission sub-modules, which are described in chapter 6.6. These sub modules can be changed on the BTS site, for example, when topologies evolve or backhaul capacity is to be increased.
5. Management and software

Generally, the Flexi WCDMA BTS is managed from NetAct™ via the RNC, as is the whole WCDMA RAN. Due to the advanced monitoring functions of NetAct™, management tasks to be carried out on site are kept to a minimum.

NetAct™ incorporates a full range of functions, from fault, performance, and configuration management to transmission, trouble, and security management. For more information, please refer to the NetAct™ documentation.

In order to support rapid deployment, the Flexi WCDMA BTS is delivered to the customer with factory SW settings.

5.1. Local Management Tool

The element manager software is used to manage Flexi WCDMA BTS commissioning, supervision, maintenance, and testing, as well as transmission configuration.

Flexi WCDMA BTS site can be controlled remotely by opening BTS Element Manager session at remote RNC or NetAct site.

The element manager SW package includes the following:

- The Flexi WCDMA BTS Manager (see the figure below)
  - including antenna line and antenna equipment (e.g. MHA, Antenna Tilt) control and management
- The FlexiTransport Manager, for transmission management
- The Site Support Manager, for the power and battery backup system

These managers are integrated so that the physical interface (cable and connectors) is the same in all three cases, but three different applications run on the PC. The manager PC is connected to the BTS by means of an Ethernet connection.

Flexi Element Manager runs in Windows NT, 98, ME, 2000, and XP 2000 environments.
Figure 10. Flexi WCDMA BTS Manager main view

5.2. Configuration management

Once the BTS is in normal operation, a polling process is used to check possible changes in the BTS configuration. When modules are added to or removed from the BTS, the information in the HW database changes.

5.3. Software updates

The Flexi WCDMA BTS can store two SW packages in its memory. The SW can be loaded either locally, with the element manager SW, or remotely from NetAct™ (via the RNC). Site visits are unnecessary for routine O&M tasks.

Typically, local SW downloading is done only when the NetAct connection is missing, such as during commissioning. Flexi WCDMA BTS SW can be downloaded as a background.
operation without interrupting the operation of the BTS. The new SW can be activated at any time suitable for the operator.

The Flexi WCDMA BTS only uses downloadable SW. All SW can be downloaded and updated from NetAct™. This procedure is centralised, meaning that several BTSs can be upgraded with the new SW either simultaneously or one by one—whichever the operator prefers.

The Flexi WCDMA BTS keeps the current SW package and old SW package in its flash memory. Either of these SW versions can be activated at any time.

5.4. External alarms and controls

Electrically, the Flexi WCDMA BTS provides the same external alarms and controls as UltraSite WCDMA BTS.

The BTS inputs and outputs can be configured and tested locally at the BTS site, with Flexi WCDMA BTS element manager SW. Twelve user-definable external inputs and six user-controllable outputs are available, and can be freely configured to support different observation or control needs at the BTS site.

In normal operation, after they have been configured, the BTS’s external alarms and control outputs are managed from NetAct™.

5.5. SW License Key principles

Optional features that can be enabled using SW license key

- Radio carrier features with 210W Triple, 100 W Dual 50 W Single PA RF Modules and RRH 2100 Single 70W:
  - ‘40 W Power Licence Key (LK)’ enables guaranteed 40 W RF power mode at RF Module TX/RX antenna port
    - Single RF Module guaranteed 40 W requires one 40 W LK
    - To enable 40W RF power in both TX/RX antenna ports in Dual RF Module requires two 40 W LKs
    - To enable 40W RF power in all TX/RX antenna ports in Triple RF Module requires three 40 W LKs
    - To enable 40W RF power in RRH Module requires 40 W LK
  - ‘60W Power Licence key (LK)’ enables 60W RF power with Triple RF Module and RRH
    - To enable 60W RF power in all TX/RX antenna ports in Triple RF Module requires three 60 W LKs
    - To enable 60W RF power in RRH Module requires 60 W LK
  - ‘Branch activation in Triple RF Module’
    - To enable 20W RF power in TX/RX antenna connector
"Multicarrier Licence Key (LK)" enables the 2\textsuperscript{nd} RF and 3\textsuperscript{rd} carrier. Together with 40 W Licence key this means that:

- Single RF Module 2 carriers @ guaranteed 20 W requires one 40 W LK and one Multicarrier LK
- Dual RF Module 4 carriers @ guaranteed 20 W requires two 40 W LKs and two Multicarrier LKs
- RRH Single 3 carriers @ guaranteed 20 W requires 1 60 W LK and two Multicarrier LKs

- '8 W Licence key' for enabling the 8 W RF power mode for Single RF Module.

Baseband capacity
- Standard Operating SW of System Module type FSMB will include 32 Channel Elements (CE) to be used for common channel signalling
- In case of System Module type FSMC and FSMD, common channels in most typical configurations are included in standard Operating SW and operator does not need take those into account in Channel Element dimensioning.
- More baseband capacity can be allocated by Channel Capacity SW Key

HSDPA features
- 16QAM modulation
- HSDPA schedulers
- 14.4 Mbps/user

Transmission interfaces and protocols
- Standard 2 PDH ports activated, more PDH ports can be allocated by SW licence key in 2 interface increments
- Inverse Multiplexing for ATM (IMA) can be activated by SW licence per BTS
- Standard 1 Flexbus port activated, 1 additional port can be allocated by SW licence key
- ATM based Iub is a mandatory SW licence until IP based Iub becomes available in a future RAS release
- ATM over Ethernet is activated by SW licence in RAS06 to enable the Hybrid BTS backhaul feature

Optional features for Flexi optimised Antenna Line:
- MHA support (power feeding and alarm monitoring) enabled by SW Licence key
- Antenna line supervision (VSWR measurement) enabled by SW Licence key
- 3GPP Tilt Antenna support enabled by SW licence key
- AISG MHA support enabled by SW Licence key
6. Construction and units

Flexi WCDMA BTS modular architecture enables flexible evolution from initial cost-effective roll-out coverage BTS site up to a high-capacity BTS site solution. The modules are easy to install and move, and the modular structure allows the Flexi WCDMA BTS to be installed almost anywhere.

Figure 11. Flexi WCDMA BTS modules

Flexi WCDMA BTS consists of:

- One System Module (FSMB, FSMC or FSMD), equipped with one of the following transmission sub-module alternatives:
  
  - E1/T1/JT1 transmission sub module (FTPB), or 
  - E1 (coaxial) transmission sub module (FTEB), or 
  - SDH STM-1/OC-3 transmission sub module (FTOA), or 
  - Flexbus transmission sub module (FTFA), or 
  - Hybrid E1/T1/JT1 and Ethernet transmission sub module (FTIA), or 
  - Hybrid E1 (coaxial) and Ethernet transmission sub module (FTJA).
  
  - 16 E1/T1 interfaces transmission sub module (FTHA),
  - Hybrid E1/T1/JT1 and Ethernet transmission sub module supporting Timing over Packet (FTIB),
  - One optional System Module (FSMB, FSMC or FSMD) operating in baseband extension mode.
• Flexi System extension Kit (FSKA) needed, FSKA includes optical cables with optical transceivers, DC cable and dummy transport sub-module

• One to three RF Modules
  • The FRxA and FRGC have dual Power Amplifiers, supporting one or two sectors
  • The FRxB and FRGD have single Power Amplifier, supporting one sector
  • The FRxx has triple Power Amplifier, supporting one, two or three sectors

OR

• One to six Remote Radio Head Modules
  • The FRGE, Flexi Mast Head RF Module 50W
  • The FRGG, Flexi RRH 2100 Single 70W

• One optional outdoor capable Flexi Power Module (FPMA) can house a maximum of four sub-modules;
  • One to three optional AC-DC converter sub-modules (FPAA)
  • One to three optional battery sub-modules (FPBA)

OR

• One optional long term battery back up indoor solution (MIBBU) consisting of
  • One Power Distribution unit (WPUB or WPUC)
  • One to four indoor AC/DC Power Units (WPMB or WPMC)
  • One battery package (default 62 Ah @ 48 V or optional 92 Ah)

• Module Front and Back cover kit for each module for installations without cabinet (FMCA)
  AND

• One Floor and wall Mounting plinth for installations without cabinet (FMFA)

OR

• One optional Outdoor cabinet (FCOA) with
  • One optional outdoor Cabinet site Support module (FCSA), with
  • One optional long term battery back up solution (MIBBU) consisting of
    • One Power Distribution main unit (WPUB or WPUC)
    • One to four indoor AC/DC Power Units (WPMB or WPMC)
      • One battery package (default 62 Ah @ 48 V or optional 92 Ah) with outdoor installation cable kit (FMBA)
    • One optional Cabinet Air Filter (FCFA)
    • One optional Fire Detector (FCDA)

OR

• One optional Indoor cabinet (FCIA) with
  • One optional long term battery back up solution (MIBBU) consisting of
    • One Power Distribution main unit (WPUB or WPUC)
    • One to four indoor AC/DC Power Units (WPMB or WPMC)
• One battery package (default 62 Ah @ 48 V or optional 92 Ah) with indoor installation cable kit (FMBB)
• One optional Fire Detector (FCDA)

OR
• One optional Flexi Mounting Shield (one FMSB or several FMSAs) with Flexi Mounting plinth (FMFA)
• One optional Transport Module to deploy additional transport solutions that are only required on selected sites
• An optional 24 V DC - 48 V DC Power Module (FPDA)
• One optional MHA per sector

6.1. Architecture

![General Flexi WCDMA BTS architecture](image)

Figure 12. General Flexi WCDMA BTS architecture

6.2. Mechanics

All Flexi WCDMA BTS module cores are outdoor-capable, hermetically sealed, and IP 55 class protected. The number of modules is minimised; for instance, only three modules are needed for a typical 2+2+2 configuration. Flexi WCDMA BTS modules consist of the following main parts:
Module core. The core mechanics, with installed IP55 gaskets in all of the connectors, shield the module core against water, snow, and solid foreign objects, and make the module core IP 55 weatherproof. The core mechanics also provide EMC shielding. All the connectors are at the front, and have weather-protecting gaskets. Core includes left and right cable entry & support parts.

- Module casing. This supports stacking modules on floor. The module core can be changed even if the module is at the bottom of the module stack. Casing is mandatory in all installations because it is forming air cooling tunnel.

- Fan assembly provides fresh air to cool the module. Each module controls its own fans according to temperature information, and two redundant fans enable module operation at normal temperatures even with one fan. The fan assembly can be changed in an operational module at a site where back access is provided. Fans are IP55 class.

- Flexi module cables all with IP55 protection class shields.

- Optional Front and Back covers (FCFA) for BTS site installations without a cabinet to provide extra weather protection against wind driven rain and foreign objects and to give modules uniform visual outlook.
• Optional Outdoor or Indoor Cabinet. The outdoor cabinet includes a door lock and
door alarm switch. Module covers can not be used with any cabinet.

OR

• Optional Module Shield. The shield is a mini cabinet that provides extra vandal
resistance, protection against wind driven rain and foreign objects and give BTS site
uniform visual outlook. Module covers can not be used with shield.

All modules have their own internal 48 V DC power supply.

6.3. Radio Modules and Remote Radio Heads

Nokia Siemens Networks provides radio modules and remote radio heads for different
applications. The Single and Dual RF Modules can be used in stack, pole or wall
installations in indoor or outdoor. The Triple RF module provides equal installation options
with highly integrated product. Remote Radio Heads are mainly used in poles or outdoor
installations providing silent products with no fans.

6.4. Dual Power Amplifier Radio Module (FRxA or FRGC)

![Dual RF Module Image]

Figure 14. Dual RF Module
The Dual RF Module can support one or two sectors with the following integrated components:

- Two Transceivers with TX for two carriers and RX for two carriers with diversity
- Two Linear Power Amplifiers
  - FRGC with Dual 50 W  2100
  - FRxA with Dual 50 W  C = 850
  -  D = 900
  -  E = 1800
  -  F = 1900
  -  I = 1.7/2.1
- Two RF filters for main and div branch
- A 48 V DC input power supply
- MHA and 3GPP Antenna tilt power feed and control for two sectors
- An interface to the BTS System Module.

Figure 15. Dual Power Amplifier RF Module block diagram
Flexi Dual RF Module has two TX outputs that support a maximum of four TX carriers (2 carriers/TX chain). It has four dual carrier receivers that facilitate two dual carrier receivers with 2-way uplink diversity. One Dual RF Module can support, therefore, multiple configurations with flexible upgrade paths. For example:

**Dual RF Module is configured to support one sector:**

- up to four carriers with 2-way RX diversity
  - 1 or 2 carriers @ guaranteed 20 W
  - 2 carriers @ guaranteed 40 W with two 40 W Licence Keys
  - 3 carriers @ guaranteed 20 W with one 40 W Licence Key and one Multicarrier Licence Key
  - 4 carriers @ guaranteed 20 W with two 40 W Licence Keys and two Multicarrier Licence Keys
- up to two carriers with optional 4-way RX diversity (SW Licence key required)
  - 1 or 2 carriers @ guaranteed 20 W
  - 2 carriers @ guaranteed 40 W with two 40 W Licence Keys

**Dual RF Module is configured to support two sectors:**

- up to four carriers with 2-way RX diversity
  - 1+1 carriers @ guaranteed 20 W
  - 1+1 carriers @ guaranteed 40 W with two 40 W Licence Keys
  - 2+2 carriers @ guaranteed 20 W with two 40 W Licence Keys and two Multicarrier Licence Keys

**Antenna Filter**

The Dual RF Module has two Antenna Filters. The Single RF Module has one Antenna Filter.

Antenna Filter has TX/RX duplexer filter and RX filter & Low Noise Amplifiers (LNA) with RX outputs for both antennas.

An Antenna Filter includes optional features enabled by SW Licence keys, and an integrated Bias-T’s in order to feed DC power to antenna mast equipment like an MHA and a 3GPP-compliant Tilt Antenna. Current sense circuitry is also included, to support already-existing MHAs.
The Flexi Antenna Line control system has been integrated into the Antenna Filter. The Flexi Antenna Line enables the O&M interface to the antenna line modules. As a result, MHA module alarm reporting, power feeding for the MHA and antenna tilting module and antenna tilt management can be implemented by BTS O&M via the antenna feeder.

Moreover, the Antenna Filter has integrated lightning protection circuitry. The Radio Module optimises RF performance by connecting the BTS directly to the antenna with only one feeder, thereby minimising antenna feeder length and losses caused by extra connectors and antenna jumper cables.

6.4.1. Single Power Amplifier Radio Module (FRxB or FRGD)

Flexi Single RF Module is a half-capacity variant of the Flexi Dual RF Module. It has one TX output that supports a maximum of two TX carriers (2 carriers/TX chain).

Single RF Module supports one sector:

- 1 carrier @ guaranteed 20 W
- 1 carrier @ guaranteed 40 W with one 40 W Licence Key
- 2 carriers @ guaranteed 20 W with one 40 W Licence Key and one Multicarrier Licence Key
- FRGD with Single 50 W 2100
- FRxB with Single 50 W   \( x = \) frequency band:
  \[\begin{align*}
  C &= 850 \\
  D &= 900 \\
  E &= 1800 \\
  F &= 1900 \\
  I &= 1.7/2.1
  \end{align*}\]

Single RF Module can optionally house inside its 3U casing mechanics AC/DC converter sub-module (FPAB) e.g. at Feederless and Distributed BTS sites.
The Triple RF Module can support one, two or three sectors with the following features:

- Three Transceivers with TX for two carriers and RX for two carriers with diversity
- Three Linear Power Amplifiers
  - FRGF with Triple 70 W 2100
  
  Other frequency variants availability in planning phase
- Three RF filters for main and div branch
- A 48 V DC input power supply
- MHA and 3GPP Antenna tilt power feed and control for three sectors
- An interface to the BTS System Module
- RF Module chaining support
Flexi Triple RF Module has three TX outputs that support a maximum of six TX carriers (2 carriers/TX chain). It has six dual carrier receivers that facilitate three dual carrier receivers with 2-way uplink diversity. One Triple RF Module can support, therefore, multiple configurations with flexible upgrade paths. For example:

**Triple RF Module is configured to support up to 3 sectors:**

- up to two carriers with 2-way RX diversity
  - 1 carrier @ guaranteed 60 W with 3 60 W Licence Keys and 3 Branch activation Licence Keys
  - 2 carriers @ guaranteed 30 W with 3 60 W Licence Keys, 3 Multicarrier Licence Keys and 3 Branch Activation Licence Keys

### 6.4.3. Flexi Mast Head RF Module 50W (FRGE)

FRGE Remote radio head can support one sector with the following integrated components:

- One Transceiver with TX for two carriers and RX for two carriers with diversity
- 40W output power at antenna connector
- One Linear Power Amplifier
- One RF filter for main and div branch
- A 48 V DC input power supply
- No fans
- An interface to the BTS System Module.
6.4.4. **Flexi RRH 2100 Single 70W (FRGG)**

FRGG Remote radio head can support one sector with the following integrated components:

- One Transceiver with TX from two to four carriers and RX from two to four carriers with diversity
- 60W output power at antenna connector
- Wide bandwidth support
- One Linear Power Amplifier
- One RF filter for main and div branch
- A 48 V DC input power supply
- No fans
- An OBSAI interface to the BTS System Module
Flexi RRH Module has one TX output that support a maximum of four TX carriers (4 carriers/TX chain). It has 2 four carrier receivers that facilitate 4 carrier receiver with 2-way uplink diversity. RRH can support, therefore, multiple configurations with up to 4 carriers per sector. For example:

**RRH Module is configured to support up to 4 carriers:**

- up to four carriers with 2-way RX diversity
  - 1 carrier @ guaranteed 60 W with 1 60 W Licence Keys
  - 2 carriers @ guaranteed 30 W with 1 60 W Licence Keys and 1 Multicarrier Licence Key
  - 3 carriers @ guaranteed 20 W with 1 60 W Licence Keys and 2 Multicarrier Licence Key
  - 4 carriers @ guaranteed 15 W with 1 60 W Licence Keys and 3 Multicarrier Licence Key

**6.5. System Module FSMB, FSMC and FSMD**

Please see the System Module figure in Chapter 6.8.
6.5.1. Flexi BTS System Module (FSMB)

The Flexi System Module hosts the telecom control, system operation and maintenance, baseband application, transmission, and power distribution functionality. The System Module can also act as a System Extension Module operating in a baseband extension mode.

The System Module has an integrated BTS clock that distributes the synchronization clocks to other BTS modules. The System Module hardware is HSDPA and HSUPA compliant.

The System Module uses nominal 48 V DC and distributes it on to RF and System Extension Modules. The System Module includes integrated fans.

System Module FSMB supports up to 240 CE HW.

6.5.2. Flexi BTS Multimode System Module (FSMC, FSMD)

Flexi BTS Multimode System Module is a high capacity System Module for high capacity sites, which can also be used as capacity expansion for Flexi System Module (FSMB). There are two versions of Multimode System Module:

- FSMC which supports up to 250 CE HW (180 channel elements for traffic use)
- FSMD which supports up to 500 CE HW (396 channel elements for traffic use).

Common channels do not consume total CE capacity available for traffic use in most common configurations. Flexi BTS Multimode System Module is prepared for LTE evolution with SW upgrade.

6.5.3. BTS Signal Processing

The System Module supplies the main baseband processing capacity for the WCDMA air interface. It hosts the Digital Signal Processing (DSP) processing software blocks. The System Module supports voice or data rates from 16 kbit/s up to 14.4 Mbit/s downlink with HSDPA and HSUPA.

6.5.4. Flexi BTS Control & Clock

The System Module takes care of overall BTS control. It hosts the BTS system-specific O&M and the telecom function.

The System Module has an integrated BTS clock that distributes the synchronisation clocks to other BTS modules.
6.5.5. Flexi BTS DC power distribution

The System Module includes Power Distribution sub-module (FPFA or FPFB) that has one BTS site level DC input connector and DC power distribution connectors to three RF Modules and one System Module operating in baseband extension mode.

6.5.6. Flexi BTS External Alarms and Control

The System Module performs external alarm and control functions. Twelve (12) external alarm input lines and six (6) external control output lines are available.

Besides two external alarms from optional Flexi Power Module (FPMA with FPAA and with optional battery FPBA) are connected via RJ45 cable to 2nd Ethernet port.

6.5.7. Local Ethernet HUB interfaces

The System Module has 3 integrated 10/100 BaseT Ethernet interfaces for control and monitoring of other equipment on the site. The BTS Site Element manager and Site Support System are connected to these Ethernet interfaces.

One Gigabit (1000 BaseT) Ethernet port is reserved for future enhancements.

6.6. Transmission sub-modules

Transmission sub-modules (FTxx) provide the physical Iub interface to the RNC.

Table 4 shows the transmission sub-module alternatives along with the physical interfaces. E.g. Flexbus is a single-cable interface for microwave radios. The Flexbus sub-module provides all the functionality of an indoor unit, thus the actual radio (outdoor unit) can be directly connected to it.

The Hybrid BTS backhaul units FTJA and FTIA are special cards that help the operator save OPEX especially if traditional E1/T1 leased lines are used to transport the Iub traffic. With RAS level features Route and Path selection the traffic can be separated to R’99 and HSPA paths. The HSPA traffic is then backhauled via a cheap Ethernet service while keeping the delay sensitive R’99 traffic on E1/T1 which will make the introduction of HSPA affordable,
Figure 16. Hybrid Iub

<table>
<thead>
<tr>
<th>Sub-module</th>
<th>Interface</th>
<th>No of IFs per sub-module</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTPB</td>
<td>E1/T1/JT1</td>
<td>8</td>
<td>ATM over PDH (symmetrical), IMA</td>
</tr>
<tr>
<td>FTEB</td>
<td>E1</td>
<td>8</td>
<td>ATM over PDH (asymmetrical), IMA</td>
</tr>
<tr>
<td>FTOA</td>
<td>STM-1/OC-3</td>
<td>1</td>
<td>ATM over SDH</td>
</tr>
<tr>
<td>FTFA</td>
<td>Flexbus</td>
<td>2</td>
<td>ATM over n x E1, IMA</td>
</tr>
<tr>
<td>FTIA</td>
<td>E1/T1/JT1</td>
<td>4 x E1/T1/JT1 2 x 10/100Base-TX 1 x optical Gigabit Ethernet (opt.)</td>
<td>ATM over PDH (symmetrical), IMA ATM over Ethernet Opt. GE requires SFP</td>
</tr>
<tr>
<td>FTJA</td>
<td>E1</td>
<td>4 x E1 2 x 10/100Base-TX 1 x optical Gigabit Ethernet (opt.)</td>
<td>ATM over PDH (asymmetrical), IMA ATM over Ethernet Opt. GE requires SFP</td>
</tr>
<tr>
<td>FTHA</td>
<td>E1</td>
<td>16</td>
<td>ATM over PDH (symmetrical), IMA</td>
</tr>
<tr>
<td>FTIB</td>
<td>E1/T1/JT1</td>
<td>4 x E1/T1/JT1 2 x 10/100Base-TX 1 x optical Gigabit Ethernet (opt.)</td>
<td>ATM over PDH (asymmetrical), IMA ATM over Ethernet Timing over Packet</td>
</tr>
</tbody>
</table>

Table 4: Alternative transport sub-modules and supported interfaces
6.7. Optional Modules

6.7.1. Mast-head Amplifier (WMHC)

The optional Mast Head Amplifier unit includes two identical low noise amplifiers (LNA) with the necessary filters. The power supply and O&M electronics are common to both branches. Integrated Bias-T’s at inputs and outputs for DC blocking and lightning protection are included.

MHA for 2100: **WMHC**

WMHC has a nominal gain of 12 dB, and it operates at the full 60 MHz uplink band of the 2.1 GHz UMTS band.

6.7.2. Flexi Power Module (FPMA)

The FPMA is the casing, AC and DC cable connector box, and support frame for the actual power sub-modules (FPAA and FPBA).

6.7.3. Flexi Power AC-DC Sub-Module (FPAA)

The main function of the FPAA is to provide the BTS modules with 48 V DC power from an AC current. The FPMA can house up to three AC/DC rectifiers, each of which has an output power of 1 kW 48 V DC power.

Figure 17. Flexi Power Module (FPMA) with example configuration of three AC/DC converters (FPAA) and one battery (FPBA)
6.7.4. Flexi Power Battery Sub-Module (FPBA)

The Flexi Power Battery Sub-Module (FPBA) is a separate optional sub-module used together with the AC-DC Module (FPAA). The FPMA can house up to three Battery sub-modules.

Battery Sub-Modules can provide up to one hour of battery back-up time when the AC power mains is down on a typical 1+1+1 Flexi BTS site. The FPBA, a maintenance free Lithium Ion battery, brings significant OPEX savings over its ten-year Li-Ion battery lifetime.

6.7.5. Flexi Power DC-DC Module (FPDA)

The function of the FPDA is to generate BTS internal 48 V DC power from the external 24 V DC. The FPDA is a stand alone 2 kW DC/DC module with 2 U height.

6.7.6. Flexi Cabinet Outdoor (FCOA)

The Flexi BTS multipurpose outdoor cabinet is an option for sites where cabinet is needed.

Main applications:
- module and site cables protection for vandalism and wind driven rain
- future proof multipurpose one single cabinet can house two or three separate BTSs (i.e. WCDMA and/or EDGE and/or Wimax and/or LTE)
- shared several hour battery back up in one single cabinet with one or two BTSs (WCDMA, EDGE, Wimax or LTE)
- space for operator’s own indoor IP20 class units (4 U)
- optional air filter for harsh environmental e.g. salty coastal areas
- earthquake protection for multimode BTS configurations bigger than six modules (WCDMA, EDGE, Wimax or LTE)

All Flexi module cores are IP55 weather protected. Therefore IP20 class outdoor cabinet provides extra protection for BTS modules and all site cables for wind driven rain and foreign objects and against vandalism.

The optional Outdoor Cabinet can include the following optional items:

- Outdoor Site Support Module (FCSA with optional indoor MIBBU)
  - 62 Ah or 92 Ah long term battery with outdoor installation cable kit (FMBA)
- Air filter (FCFA)
- Fire detector (FCDA)
- EAC IP55 connection box (FSEA or FSEB)
- OVP IP55 connection box (FSEC)

FSEA or FSEB is needed to connect FCDA, FCFA, FSEC and FCSA alarms. FCOA includes a lock and a door alarm switch that is connected to FSEA/B.

The cabinet dimensions are 1550 x 770 x 770 mm (H x W x D).
With optional air filter (FCFA) 1550 x 770 x 930 mm (H x W x D).
With air filter (FCFA) and wind breaker 1550 x 770 x 1020 mm (H x W x D).

FCOA has totally 40 U space (30 U horizontally and 5+5 U vertically) for flexible configurations of Flexi WCDMA, EDGE and Wimax BTS modules and Flexi common site support modules and battery back-up options.

Figure 18. Optional Flexi BTS Cabinet Outdoor (FCOA)
Figure 19. FCOA space usage with optional Site Support Module (FCSA)

Figure 20. FCOA with optional Site Support Module (FCSA)
6.7.6.1. Flexi Cabinet Site support Module (FCSA)

The Optional Flexi Cabinet Site support Module (FCSA) completes the Flexi WCDMA BTS outdoor site with a long-term battery backup solution and support for the operator's own site equipment.

The FCSA module is an IP-protected, hermetically-sealed module equipped with a Heat Exchanger (HEX).

![Diagram of Flexi Cabinet Site support module](image)

Figure 21. Optional Flexi Cabinet Site support module for an outdoor cabinet

**Flexi BTS long term battery backup solution**

At indoor sites, the Multi Integrated Battery Backup solution (MIBBU) with separate battery provides a long-term battery backup solution for the Flexi WCDMA BTS.

At outdoor sites, the FCSA, MIBBU and separate battery provide a long-term battery backup solution for the Flexi WCDMA BTS.

The MIBBU consists of a one Power Distribution Unit (WPU) with one Control Unit (CU), and one to four rectifiers Power Units (WPM). The WPU mainly distributes the input AC mains to the rectifier (WPM) units. The CU controls the WPU and monitors the alarms in the event of low supply voltage, or if the MIBBU enters the Battery backup mode in the event of an AC mains failure. The alarm generated by the CU is forwarded to the BTS O&M SW.
The WPM is a rectifier unit used to supply power to the BTS via the WPU unit. The WPM also recharges the optional batteries after discharge. WPM has output power of 1.5 kW at 48 V DC.

**Long-term battery**

The default capacity of the separate long-term battery package is 62 Ah. The battery is charged and controlled by the MIBBU. With a typical 2+2+2 configuration, the default battery can provide a battery backup time of up to three hours. By installing high capacity 92 Ah batteries, the backup time can be extended according to the requirements of each site. Battery installation and cable kit is need: F MBA for Flexi outdoor cabinet and FMBB for Flexi indoor cabinet.

In order to fulfil strict safety, type-approval, and performance requirements, and to keep the BTS warranty valid, only -tested and approved batteries can be used.

**Support for operator’s own equipment (Line Terminal Equipment LTE space)**

The FCSA provides space and support for the operator’s own indoor auxiliary site equipment, such as transmission or microwave radio equipment in an outdoor cabinet.

It includes the standard 19-inch unit space with unit mounting brackets, a 48 V DC power distribution from the FCSA, and the possibility to hard-wire alarms to the FCSA.

LTE space of FCSA:

\[
\begin{align*}
4 \text{ HU} & \times 19 \text{ inch} \times \min. \ 449 \text{ mm} \ (H \times W \times D) \\
\sim 180 \text{ mm} & \times 448 \text{ mm} \times \min. \ 449 \text{ mm} \ (H \times W \times D)
\end{align*}
\]

The Heat exchanger includes a fan that circulates the internal cooling air of the LTE space and the MIBBU power distribution unit.

6.7.7. **Flexi Cabinet Indoor (FCIA)**

The Flexi BTS multipurpose indoor cabinet is an option for indoor sites where cabinet is needed. It provides 36 U space for Flexi BTS modules (WCDMA, EDGE, Wimax modules) and for optional site support.

Main applications:
- future proof multipurpose one single cabinet can house two or three separate BTSs (i.e. WCDMA and/or EDGE and/or Wimax and/or LTE)
- shared several hour battery back up in one single cabinet with one or two BTSs (WCDMA, EDGE, Wimax or LTE)
- space for operator’s own 19 inch units
- earthquake protection for multimode BTS configurations bigger than six modules (WCDMA, EDGE, Wimax or LTE)
The optional Indoor Cabinet can include the following optional items:

- indoor long term battery back up solution (MIBBU)
  - 62 Ah or 92 Ah long term battery with indoor installation cable kit (FMBB)
- Fire Detector (FCDA)
- EAC IP55 connection box (FSEA or FSEB)
- OVP IP55 connection box (FSEC)

FSEA or FSEB is needed to connect FCDA, FSEC and MIBBU alarms.

The cabinet dimensions are 1800 x 600 x 600 mm (H x W x D).

6.7.8. Flexi Cabinet Accessories

An optional plinth (Flexi Mounting kit for Floor and Wall and Pole, FMFA) is used to fix Flexi modules to floor, wall or pole.
An optional Flexi Cabinet air Filter (FCFA) is available for the WCDMA BTS Outdoor cabinet, to filter items such as salt, dust and insects out of the fresh air through the cabinet cooling input. Cabinet filter is required on oceanic and coastal areas where salt deposition is over specified limits.

An optional Flexi Cabinet Fire Detector (FCDA) is available for the WCDMA BTS Outdoor cabinet. It is connected to one of the BTS EAC alarm lines.

### 6.7.9. Transport Module

One or more additional transmission modules can be optionally deployed outside the System Module, to increase the number of ports, mix different types of physical interfaces (media conversion) and perform ATM-layer traffic aggregation.

### 6.7.10. Flexi Mounting Shield 6U (FMSA) and 18 U (FMSB)

The Flexi Mounting Shield (FMSA) can be used at indoor and outdoor sites where extra module and cable protection is required but no space for traditional cabinet.

FMSA provides 6 U space for all Flexi BTS modules (WCDMA, EDGE, Wimax, LTE and Power modules). It can be installed on wall, pole or floor.

![Figure 23. Optional Flexi Mounting Shield 6U (FMSA)](image)
FMSB provides 18U space for all Flexi BTS modules (WCDMA, EDGE, Wimax, LTE and Power modules). It can be installed on floor.

Both FMSA and FMSB require one Flexi plinth (FMFA). Module front and back covers are not used with FMSA or FMSB.

![Optional Flexi Mounting Shield 18U (FMSB)](image)

**Figure 24. Optional Flexi Mounting Shield 18U (FMSB)**

### 6.7.11. Flexi system external alarm box (FSEB)

The FSEB box is used for extending the Flexi BTS alarm connector to support up to 24 alarm interfaces. 12 alarms are supported for Flexi WCDMA BTS. Support for the fire detector is also provided. The FSEB box provides IP55 protection.

In outdoor applications, the box can be attached to the outdoor cabinet roof. There are fixing points for the FSEB in the outdoor cabinet. In indoor or stacked applications, the box is attached in the proximity of the modules, for example, on a wall.

### 6.7.12. Flexi system external OVP (FSEC)

The FSEC protects Flexi WCDMA sub-modules against surge pulse(s) in power feeding lines. The FSEC gives Class II (C, T2) protection for DC power feed and provides IP55 protection. The FSEC box is also used for altering the DC cable diameter.
6.8. Interfaces

The following figure shows the external interfaces of the Flexi WCDMA BTS System Module.

**Iub connection to RNC**

The connectors for the Iub are located on the front panel of the transmission sub-module (FTxx). The cables are routed to the side of the System Module.

The alternative Flexi Transport sub-module can be changed on site, for future Iub capacity evolution purposes.

**BTS Element Management port**

An Element Manager PCT can be connected to the management port connector at the System Module, for commissioning, operations, maintenance, and testing of the BTS. An RJ45 Ethernet connector is used.

**Antenna connectors**
The antenna feeders are connected directly to the RF Modules. With three dual power amplifier RF Modules the maximum number of antenna connections is 12. The antenna connector type is 7/16.

**Ethernet control bus**

These interfaces can be used to carry initialisation data, control data, and signalling data from the BTS to any auxiliary equipment that has an Ethernet port and an IP address.

Equipment such as an external Site Support, and microwave radio equipment can also be connected to the Flexi WCDMA BTS via these ports. The connectors are located in the Flexi WCDMA BTS System Module.

**Power feeding**

A Flexi WCDMA BTS site has one common DC input power supply that is connected to the System Module. The System Module distributes DC current to the RF Modules and second System Module operating in baseband extension mode. The AC connector is at a separate optional AC-DC Module.

**External alarms and controls (EAC)**

External alarms and control (EAC) signals are used to collect simple ON/OFF external alarms (12) from any equipment that is external to the BTS. They are also used to provide ON/OFF control signals (6) for controlling external devices.

One EAC connector is located at the System Module. A separate weather-protected EAC connector (FSEA or FSEB) box can be used to ease the connection of each physical alarm and control wire.

One optional Flexi System OVP IP55 protected box for power lines (FSEC) can be used to weather protect Over Voltage Protectors (OVP) of the DC or AC power lines of the BTS site.

**External Synchronization Input**

When using this HW connector Flexi WCDMA BTS can be optionally synchronized with an external clock signal (e.g. GPS, 2 or 10 MHz signal). This might be required e.g. in a case where Iub over Ethernet does not carry the reference clock signal.

**External Synchronization Output**

Flexi WCDMA BTS can provide clock reference signal to other co-located BTS nearby (2G, 3G and future BTS).
7. **GSM/EDGE co-siting**

When utilising an existing BTS site, compatibility of the Flexi WCDMA BTS with existing BTSs is a major issue. Flexi WCDMA BTS has been designed so that it can be installed as easily as possible on an existing site.

Compatibility has been taken into account for the following areas:

**Mechanics**

Flexi WCDMA BTS modules have much smaller space requirements than those of typical EDGE/WCDMA BTSs. Floor installations of modules can be done at the same fixing points.

**Power system**

When a Flexi WCDMA BTS is installed at an existing GSM/EDGE BTS site, the same connection types and power supply types can be used. The existing alarm connections—for example, the fire alarm and door alarm—can also be connected to the Flexi WCDMA BTS. Customer-specific alarm input and control output electrical specifications are the same; this allows for full interchangeability between connections. The UltraSite Support cabinet can support also Flexi WCDMA BTS.

**Antennas**

To minimise the work in adding WCDMA antennas to GSM BTS sites, part of the existing antenna infrastructure can be reused.

A diplexer is an attractive way to add the Flexi WCDMA BTS to the existing site, if the additional loss can be tolerated in the antenna line. Actual losses depend on the combination but in the case of GSM 900/WCDMA, the typical loss is less than 0.5 dB.
Figure 26. Principle of 2G and Flexi WCDMA BTS antenna and feeder sharing with MHAs

When co-siting with existing 2G BTS following changes need to be done:

- Bias-T at 2G BTS needs to be removed into mast below 2G MHA.
- Power (red PITA) cable needs to be routed into mast to feed DC power for 2G MHA via Bias-T. PITA cable is connected via the same connector in 2G BTS as original BTS internal Bias-T cabling.

**Transmission**

The existing transmission infrastructure can be fully utilised when the Flexi WCDMA BTS is added to GSM/EDGE BTS sites. Spare capacity can also be taken into use.

The Flexi WCDMA BTS offers a number of options for sharing transmission capacity with an existing GSM/EDGE BTS. The simplest method of Time-Division Multiplexing (TDM) sharing is to connect each BTS through dedicated E1 links.
Figure 27. Example of Flexi WCDMA and EDGE BTS transmission sharing
8. Technical specifications

The technical data related to the new items and the features in RU10 or later will be updated later on.

<table>
<thead>
<tr>
<th>Module</th>
<th>Width [mm]</th>
<th>Height [mm / U]</th>
<th>Depth [mm]</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>(with casing and fan sub-assembly)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System FSMB</td>
<td>447</td>
<td>133 / 3U</td>
<td>422 / 560 (*)</td>
<td>&lt; 18</td>
</tr>
<tr>
<td>System FSCM</td>
<td></td>
<td></td>
<td></td>
<td>&lt; 4</td>
</tr>
<tr>
<td>System FCMD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TR sub-module FTxx</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF Dual FRxx</td>
<td>447</td>
<td>133 / 3U</td>
<td>422 / 560 (*)</td>
<td>&lt; 24</td>
</tr>
<tr>
<td>RF Single FRxx</td>
<td></td>
<td></td>
<td></td>
<td>&lt; 21</td>
</tr>
<tr>
<td>RF Triple FRGF</td>
<td></td>
<td></td>
<td></td>
<td>&lt; 25</td>
</tr>
</tbody>
</table>

Table 5. Dimensions and weights for the Flexi WCDMA BTS modules
### Flexi WCDMA BTS Overview

<table>
<thead>
<tr>
<th>Component</th>
<th>Dimensions</th>
<th>Weight (kg)</th>
<th>Volume (L)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>RRH 70W FRGG</td>
<td>260 x 450</td>
<td>159</td>
<td>&lt;16.5</td>
<td></td>
</tr>
<tr>
<td>AC Power FPMA</td>
<td>447 x 72</td>
<td>133/3U 100</td>
<td>422/560(*) 380</td>
<td>&lt;11 &lt;3.2 &lt;3.8</td>
</tr>
<tr>
<td>* FPAA</td>
<td>72</td>
<td>100</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td>* FPBA</td>
<td>72</td>
<td>100</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td>24 DC Power FPDA</td>
<td>447 x 90</td>
<td>422/560(*)</td>
<td>&lt;15</td>
<td></td>
</tr>
<tr>
<td>Site Support FCSA</td>
<td>670 x 447</td>
<td>360/7.5U 178/4U 447</td>
<td>525</td>
<td>&lt;21</td>
</tr>
<tr>
<td>* LTE</td>
<td>447 &lt;110</td>
<td>133/3U 44/1U</td>
<td>-</td>
<td>&lt;20 &lt;2.8</td>
</tr>
<tr>
<td>* MIBBU (WPU)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* WMP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery space in cabinet</td>
<td>447 x 280</td>
<td>487</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Battery pcs 62 Ah</td>
<td>4 x 97 264</td>
<td>280</td>
<td>&lt;19.1</td>
<td></td>
</tr>
<tr>
<td>Battery pcs 92 Ah</td>
<td>4 x 105 264</td>
<td>395</td>
<td>&lt;28</td>
<td></td>
</tr>
<tr>
<td>Plinth (FMFA)</td>
<td>447 x 60</td>
<td>450</td>
<td>&lt;6.5</td>
<td></td>
</tr>
<tr>
<td>FlexiHub</td>
<td>447 x 2U</td>
<td>422/560(*)</td>
<td>&lt;10</td>
<td></td>
</tr>
<tr>
<td>Outdoor cabinet (FCOA) with Filter (FCFA)</td>
<td>770 x 1550</td>
<td>770</td>
<td>&lt;80</td>
<td></td>
</tr>
<tr>
<td>+ wind breaker</td>
<td>770 x 1550</td>
<td>940</td>
<td>&lt;104</td>
<td></td>
</tr>
<tr>
<td>+ wind breaker</td>
<td>770 x 1550</td>
<td>1020</td>
<td>&lt;110</td>
<td></td>
</tr>
<tr>
<td>Indoor cabinet (FCIA)</td>
<td>600 x 1800</td>
<td>600</td>
<td>&lt;60</td>
<td></td>
</tr>
<tr>
<td>Mounting Shield (FMSA)</td>
<td>350 x 600</td>
<td>600</td>
<td>&lt;12</td>
<td></td>
</tr>
<tr>
<td>Mounting Shield (FMSB)</td>
<td>600 x 910</td>
<td>600</td>
<td>&lt;20</td>
<td></td>
</tr>
</tbody>
</table>
### Table 6. Common technical specifications for the Flexi WCDMA BTS

<table>
<thead>
<tr>
<th>Property</th>
<th>System Module</th>
<th>RF Modules</th>
<th>Power Module FPMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low air temperature limit</td>
<td>-35 °C (-27 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low air start-up temperature limit</td>
<td>-35 °C (-27 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High ambient air temperature limit</td>
<td>+55°C (131°F) in shade with guaranteed minimum performance of 3GPP specification</td>
<td>+50°C (122°F) in shade with guaranteed performance (i.e. better than 3GPP)</td>
<td>+50°C (122°F) in direct sunlight with guaranteed minimum performance of 3GPP specification</td>
</tr>
<tr>
<td>Nominal DC voltage [V]</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permitted DC operating voltage fluctuation (external supply range) [V]</td>
<td>40.5 ... 57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optional Nominal DC voltage with DC-DC Module [V]</td>
<td>+24 (with FPDA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optional Permitted 24 V DC operating voltage fluctuation (external supply range) [V]</td>
<td>+ 18 ... + 32 (with FPDA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal AC voltage with optional AC Module [V]</td>
<td>240 (US 1-phase with FPMA + FPAA)</td>
<td>230 (EU 1-phase with FPMA + FPAA)</td>
<td>202 (Japan delta with FPMA + FPAA)</td>
</tr>
<tr>
<td>Optional Permitted AC operating voltage and freq. fluctuation (external supply range) [V][Hz]</td>
<td>184 ... 276 V 45 ... 66 Hz 0 ... 184 V ,10...60 minutes when using FPBA with FPAA (time depends on AC Voltage input)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 7. Tentative typical and maximum power consumptions for Flexi WCDMA BTS configurations
### Flexi WCDMA BTS Configuration, Power per Carrier

<table>
<thead>
<tr>
<th>Flexi WCDMA BTS configuration, power per carrier</th>
<th>Estimate of typical Power consumption [W] at 48 VDC input with...</th>
<th>Estimate of typical BBU time (23 °C) with typical 50 % RF load and new batteries</th>
<th>FPMA &amp; FPBA with FPAA (Note 1) [minutes]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 carrier omni @ min. 20 W (FSMB+ Single RF Module)</td>
<td><strong>10 %</strong> RF load 190, <strong>50 %</strong> RF load 250, <strong>100 %</strong> RF load 300</td>
<td><strong>92 Ah</strong> 16 h, <strong>62 Ah</strong> 11 h</td>
<td>up to 120 (3 FPBAs) ... up to 40 (1 FPBA)</td>
</tr>
<tr>
<td>1+1+1 @ min. 20 W (FSMB+ Dual + Single RF Module)</td>
<td><strong>10 %</strong> RF load 400, <strong>50 %</strong> RF load 510, <strong>100 %</strong> RF load 630</td>
<td><strong>92 Ah</strong> 7 h 30 min, <strong>62 Ah</strong> 5 h</td>
<td>up to 59 (3 FPBAs) ... up to 20 (1 FPBA)</td>
</tr>
<tr>
<td>1+1+1 @ min. 20 W (FSMC+ Triple RF Module)</td>
<td><strong>10 %</strong> RF load 375, <strong>50 %</strong> RF load 455, <strong>100 %</strong> RF load 535</td>
<td><strong>92 Ah</strong> 8 h 30 min, <strong>62 Ah</strong> 6 h</td>
<td>up to 65 (3 FPBAs) ... up to 22 (1 FPBA)</td>
</tr>
<tr>
<td>1+1+1 @ min. 20 W (FSMC+ RRH 60W)</td>
<td><strong>10 %</strong> RF load 394, <strong>50 %</strong> RF load 490, <strong>100 %</strong> RF load 568</td>
<td><strong>92 Ah</strong> 8 h 45 min, <strong>62 Ah</strong> 5 h</td>
<td>up to 60 (3 FPBAs) ... up to 20 (1 FPBA)</td>
</tr>
<tr>
<td>1+1+1 @ min. 40 W (FSMB+ Dual + Single RF Module)</td>
<td><strong>10 %</strong> RF load 490, <strong>50 %</strong> RF load 660, <strong>100 %</strong> RF load 850</td>
<td><strong>92 Ah</strong> 5 h 30 min, <strong>62 Ah</strong> 4 h</td>
<td>up to 46 (3 FPBAs) ... up to 15 (1 FPBA)</td>
</tr>
<tr>
<td>2+2+2 @ min. 20 W (FSMB+ Dual + Single RF Module)</td>
<td><strong>10 %</strong> RF load 490, <strong>50 %</strong> RF load 660, <strong>100 %</strong> RF load 850</td>
<td><strong>92 Ah</strong> 5 h 30 min, <strong>62 Ah</strong> 4 h</td>
<td>up to 46 (3 FPBAs) ... up to 15 (1 FPBA)</td>
</tr>
</tbody>
</table>
### Flexi WCDMA BTS Overview

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Power Consumption</th>
<th>Duration</th>
<th>Temperature</th>
<th>FPAAs</th>
<th>FPBAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2+2+2 @ min. 20 W</td>
<td>465 640</td>
<td>800</td>
<td>6 h</td>
<td>up to 46 (3 FPBAs) ... up to 15 (1 FPBA)</td>
<td></td>
</tr>
<tr>
<td>(FSMC+ Triple RF Module)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2+2+2 @ min. 20 W</td>
<td>430 568</td>
<td>700</td>
<td>7 h</td>
<td>up to 52 (3 FPBAs) ... up to 18 (1 FPBA)</td>
<td></td>
</tr>
<tr>
<td>(FSMC+ RRH 60W)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2+2+2 @ min 40 W per carrier</td>
<td>860 1180</td>
<td>1530</td>
<td>3 h 15 min</td>
<td>up to 17 (2 FPAAs + 2 FPBAs)</td>
<td></td>
</tr>
<tr>
<td>(FSMB + 3 x Dual RF Module)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4+4+4 @ min 20 W per carrier</td>
<td>860 1170</td>
<td>1530</td>
<td>3 h 15 min</td>
<td>up to 17 (2 FPAAs + 2 FPBAs)</td>
<td></td>
</tr>
<tr>
<td>(FSMB + 3 x Dual RF Module)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4+4+4 @ min 30 W per carrier</td>
<td>870 1340</td>
<td>1780</td>
<td>3h 2h</td>
<td>up to 15 (2 FPAAs + 2 FPBAs)</td>
<td></td>
</tr>
<tr>
<td>(FSMC + 2 x Triple RF Module)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexi Outdoor cabinet Filter</td>
<td>60 100</td>
<td>180</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>(FCFA) fan</td>
<td>(clean)</td>
<td>(dirty)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexi Outdoor cabinet Site</td>
<td>34 94</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Support (FCSA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEX fans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: NA represents not applicable.*
Basic conditions:

- at room temperature (23 °C)
- System Module FSMB
  - for 2nd System Module (FSMB) add additional 100 W
- no transmission module included (typically 20W)
- no MHA power feeding included
- no antenna tilting power feeding included

Note 1:
- One FPAA can support 1 kW of 48 DC power.
- One FPBA can support 48 V DC BTS at
  - 500 W power consumption about 17 minutes, and
  - 1 kW power consumption about 8 minutes
  - at normal operational conditions with new battery.
- FPBA charging: min 5 W, typical max 55 W, absolute max 110 W (with empty FPBA)

AC site AC input power consumption:

- **FPAA or MIBBU:** rectifier AC-> DC conversion efficiency about 0.9
  - i.e. divide DC value by 0.9 for AC power consumption
- **MIBBU with battery:** add 300-500 W AC for the battery charge
- **FCSA:** the total power consumption depends on the operator’s own equipment installed in the LTE space.

Examples of the tentative typical worst-case maximum power consumption with FRGC or FRxA and FRGD or FRxB:

**Flexi BTS AC 2+2+2@ 20 W site with FPMA (2 FPAA and 2 FPBA) installed outdoors:**

\[(880 / 0.9) \text{ W} = 980 \text{ kW AC input}\]

**Flexi BTS AC 2+2+2 @ 20 W site with MIBBU and external battery**
(without the operator’s own LTE units) installed indoors:

\[(880 /0.9) + 300...500 \text{ W} = 1.3 ... 1.5 \text{ kW AC input}\]

**Flexi BTS AC 2+2+2 @ 20 W site with FCSA and MIBBU and external battery**
(without the operator’s own LTE units) installed outdoors:

\[(880 + 94) /0.9 + 300...500 \text{ W} = 1.4 ... 1.6 \text{ kW AC input}\]
Table 8. Specific technical data for the Flexi WCDMA BTS

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTS TX Frequency Range</td>
<td>2110 – 2155 MHz (FRIx, Band IV)</td>
</tr>
<tr>
<td></td>
<td>2110 - 2170 MHz (FRGx, Band I)</td>
</tr>
<tr>
<td></td>
<td>1930 – 1990 MHz (FRFx, Band II)</td>
</tr>
<tr>
<td></td>
<td>1805 –1880 MHz (FREx, Band III)</td>
</tr>
<tr>
<td></td>
<td>925 – 960 MHz (FRDx, Band VIII)</td>
</tr>
<tr>
<td></td>
<td>869 – 894 MHz (FRCx, Band V)</td>
</tr>
<tr>
<td>BTS RX Frequency Range</td>
<td>1710 – 1755 MHz (FRIx, Band IV)</td>
</tr>
<tr>
<td></td>
<td>1920 - 1980 MHz (FRGx, Band I)</td>
</tr>
<tr>
<td></td>
<td>1850 – 1910 MHz (FRFx, Band II)</td>
</tr>
<tr>
<td></td>
<td>1710 –1785 MHz (FREx, Band III)</td>
</tr>
<tr>
<td></td>
<td>880 – 915 MHz (FRDx, Band VIII)</td>
</tr>
<tr>
<td></td>
<td>824 – 849 MHz (FRCx, Band V)</td>
</tr>
<tr>
<td>Duplex separation</td>
<td>400 MHz (FRIx)</td>
</tr>
<tr>
<td></td>
<td>190 MHz (FRGx)</td>
</tr>
<tr>
<td></td>
<td>80 MHz (FRFx)</td>
</tr>
<tr>
<td></td>
<td>95 MHz (FREx)</td>
</tr>
<tr>
<td></td>
<td>45 MHz (FRDx)</td>
</tr>
<tr>
<td></td>
<td>45 MHz (FRCx)</td>
</tr>
<tr>
<td>Channel raster</td>
<td>200 kHz</td>
</tr>
<tr>
<td>Channel spacing</td>
<td>5 MHz</td>
</tr>
<tr>
<td>Guaranteed minimum TX output</td>
<td>20 ... 80 W</td>
</tr>
<tr>
<td>power per sector</td>
<td></td>
</tr>
<tr>
<td>Guaranteed minimum TX output</td>
<td>20 ... 40 W</td>
</tr>
<tr>
<td>power at antenna connector</td>
<td></td>
</tr>
</tbody>
</table>
Dynamic power control | 25 dB (50 steps in 0.5 dB increments)
---|---
Typical RX sensitivity (at 0.1% BER and 12.2 kbit/s user rate) | -129.1 dBm (feeder loss 0 dB),
with MHA | -129.0 dBm (feeder loss -1 dB),
(12 dB gain, typical 1.2 dB Noise Figure) | -128.8 dBm (feeder loss -2 dB),
with 2-way RX diversity (FRGx, Band I) | -128.7 dBm (feeder loss -3 dB),
Typical RX sensitivity (at 0.1% BER and 12.2 kbit/s user rate) without MHA | -128.5 dBm (feeder loss -4 dB),
2-way RX diversity (FRGx, Band I) | -128.2 dBm (feeder loss -5 dB),
Typical RX sensitivity (at 0.1% BER and 12.2 kbit/s user rate) without MHA | -125.6 dBm
no RX diversity (3GPP TS 25.104 ref. case) (FRGx, Band I)

Table 9. Flexi WCDMA BTS external hardware interfaces

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Connector Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna connectors</td>
<td>2..12</td>
<td>7/16 female</td>
</tr>
<tr>
<td>4 in Dual RF Module</td>
<td>2 in Single RF Module</td>
<td>( IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td>AC Input (FPMA + FPAA)</td>
<td>184 to 276 VAC</td>
<td>screw terminal (HDFK4) 4 mm² max.</td>
</tr>
<tr>
<td>AC Input (FPMA + FPAA+ FPBA)</td>
<td>0 to 276 VAC</td>
<td>screw terminal (HDFK4) 4 mm² max.</td>
</tr>
<tr>
<td>DC input (System Module)</td>
<td>40.5 to 57 V DC</td>
<td>TX25 screw terminals for 8 ... 25 mm² cable</td>
</tr>
<tr>
<td><strong>DC input</strong> to RF Module and System Module in extension mode</td>
<td>40.5 to 57 V DC</td>
<td>Multi-Beam XL ( IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td><strong>DC output</strong> from</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Grounding</td>
<td>&lt; 10 Ω</td>
<td>M6 (1 piece)</td>
</tr>
<tr>
<td>External Alarms &amp; Controls</td>
<td>12 External Alarms</td>
<td>MDR36 to EAC connector</td>
</tr>
<tr>
<td></td>
<td>6 controls</td>
<td>RJ45 to 2nd Ethernet connector</td>
</tr>
<tr>
<td></td>
<td>2 alarms</td>
<td>(IP55 cables required in outdoor installations)</td>
</tr>
<tr>
<td></td>
<td>(from FPMA/FPAA)</td>
<td></td>
</tr>
<tr>
<td>MHA power feed / VSWR alarm</td>
<td>Max 12</td>
<td>7/16 antenna feeder (Bias-T integrated to RF Module)</td>
</tr>
<tr>
<td>Local Management Tool</td>
<td>100Base-TX (System Module)</td>
<td>RJ45 (IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td>Local Ethernet (Site Support etc.)</td>
<td>2 x 100Base-TX (System Module)</td>
<td>RJ45 (IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td>Synchronization clock output</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WCDMA Combined Frame and reference clock (100/50/25/12.5 Hz with SFN0) output for clock chained WCDMA UltraSite BTS or LMU (LVDS)</td>
<td>MDR26 (IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td></td>
<td>GPS/PPS output for clock chained slave Flexi BTS or other BTS for clock and frame synchronization or for GPS receiver synchronization, RS-485.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 MHz/100MHz Test clock output, (LVTTL)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WCDMA Frame clock 100/50/25/12.5 Hz combined with SFN0 clock for test equipment</td>
<td></td>
</tr>
<tr>
<td>Synchronization clock input (optional)</td>
<td>10 MHz reference clock input LVTTL</td>
<td>MDR14 (IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td></td>
<td>2 MHz reference clock input from e.g. external transmission equipment, G.703</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GPS/PPS input from e.g. external GPS receiver or master Flexi BTS in BTS chaining, RS-485</td>
<td></td>
</tr>
<tr>
<td>E1/T1/JT1 symmetrical</td>
<td>8 x 2 Mbit/s (FTPB)</td>
<td>RJ48C, 120 Ω, balanced</td>
</tr>
<tr>
<td>Interface</td>
<td>Description</td>
<td>Notes</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>8 x 1.5 Mbit/s (FTPB)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 x 2 Mbit/s (FTIA/FTIB)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 x 1.5 Mbit/s (FTIA/FTIB)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 x 2 Mbit/s (FTHA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 x 1.5 Mbit/s (FTHA)</td>
<td></td>
<td>(IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td>E1 asymmetrical</td>
<td>8 x 2 Mbit/s (FTEB)</td>
<td>SMB, 75 Ω, unbalanced (IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td></td>
<td>4 x 2 Mbit/s (FTJA)</td>
<td></td>
</tr>
<tr>
<td>STM-1/OC-3</td>
<td>1 x 155 Mbit/s (FTOA)</td>
<td>SFP cage (SFP transceiver with LC connector included in FTOA sub-module) (IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td>Flexbus</td>
<td>2 x 16 x 2 Mbit/s (FTFA)</td>
<td>TNC (IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td>Iub over Ethernet</td>
<td>2 x 10/100Base-TX (FTIA, FTJA, FTIB)</td>
<td>RJ45 (IP55 cable required in outdoor installations)</td>
</tr>
<tr>
<td>Iub over Gigabit Ethernet</td>
<td>1 x Gigabit Ethernet (FTIA, FTJA, FTIB)</td>
<td>SFP cage (SFP transceiver with LC connector not included in sub-module delivery) (IP55 cable required in outdoor installations)</td>
</tr>
</tbody>
</table>
### Table 10. DC cable distances in Feederless Site Configurations in normal operation mode

<table>
<thead>
<tr>
<th>RF Module/cable thickness [mm²]</th>
<th>Single RF Module[m]</th>
<th>Dual RF Module[m]</th>
<th>Triple RF Module (estimated)[m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>200</td>
<td>112</td>
<td>65</td>
</tr>
<tr>
<td>10</td>
<td>200</td>
<td>189</td>
<td>110</td>
</tr>
<tr>
<td>16</td>
<td>200</td>
<td>200</td>
<td>180</td>
</tr>
<tr>
<td>25</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>35</td>
<td>-</td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>

These values are valid for the following conditions:

- System module provides power supply (48V) to RF module in normal operation
- The type of the used cables are: MCMK (max operational temperature 70°C)
- The distances above are valid for the cable temperature range -33°C - +70°C

The other DC cable length and size can be used. In all cases the minimum input voltage of the RF Module must be 36 V at DC input connector with full operating power.

General issues to be considered when installing the DC cables of the feederless site:

- In the case of power break BTS functions with batteries. The output voltage of the batteries starts to decrease in time.
- The batteries should be installed in the proximity of the system module to minimise additional voltage drop before RF Module.
- If the cables are under protective cover the temperature of the cables can increase. This increases the resistance of the cables and voltage drop is bigger between the system module and RF module.
- The power dissipation of the DC cable adds power consumption of the site. E.g. Power dissipation with Dual RF module (with max load 2*40W) of the 100m DC cable is ~50 W when used 16 mm² and ~130 W when used 6 mm². E.g. Power dissipation with Triple RF module (with max load 3*60W) of the 100m DC cable is ~100 W when used 25 mm² and ~160W when used 16 mm².
## Table 11. DC cable distances in Feederless Site Configurations according to ETSI EN300132

<table>
<thead>
<tr>
<th>RF Module/cable thickness [mm²]</th>
<th>Single RF Module [m]</th>
<th>Dual RF Module [m]</th>
<th>Triple RF Module (estimated) [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>77</td>
<td>42</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>130</td>
<td>71</td>
<td>40</td>
</tr>
<tr>
<td>16</td>
<td>200</td>
<td>112</td>
<td>65</td>
</tr>
<tr>
<td>25</td>
<td>200</td>
<td>178</td>
<td>105</td>
</tr>
<tr>
<td>35</td>
<td>-</td>
<td></td>
<td>145</td>
</tr>
</tbody>
</table>

These values are valid for the following conditions:

- The input of the BTS DC voltage is 40.5V
- The type of the used cables are: MCMK (max operational temperature 70°C)
- The distances above are valid for the cable temperature range -33°C to +70°C

The other DC cable length and size can be used. In all cases the minimum input voltage of the RF Module must be 36 V at DC input connector with full operating power.

General issues to be considered when installing the DC cables of the feederless site:

- If the cables are under protective cover the temperature of the cables can increase. This increases the resistance of the cables and voltage drop is bigger between the system module and RF module.
- The power dissipation of the DC cable adds power consumption of the site. E.g., Power dissipation (with Dual RF module) of the 100m DC cable is ~47 W when used 16 mm² and ~126 W when used 6 mm².
Table 12. Environmental specifications and requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Flexi Modules with front and back covers</th>
<th>Modules with Outdoor Cabinet</th>
<th>Modules with Outdoor Cabinet and Air Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>ETSI 300 019-1-2, Class 2.3, climate conditions according to class 2.3</td>
<td>ETSI 300 019-1-1, Class 1.2, IEC class 1M4</td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>ETSI 300 019-1-1, Class 1.2, IEC class 1M4</td>
<td>ETSI 300 019-1-4, class 4.1 and IEC class 4M5</td>
<td></td>
</tr>
<tr>
<td>Wind Driven rain</td>
<td>GR-487-CORE MIL-STD 810E method 506.3 for Rainfall rate 15 cm/hr and Wind velocity 33 m/s</td>
<td>GR-487-CORE MIL-STD 810E method 506.3 for Rainfall rate 15 cm/hr. Wind load 67 m/s</td>
<td>GR-487-CORE MIL-STD 810E method 506.3 for Rainfall rate 15 cm/hr. Wind load 67 m/s</td>
</tr>
<tr>
<td>Salt fog and dust</td>
<td>IEC 721-2-5 IEC 68-2-52/Kb, Stress level 1 with 0.44% salt solution by weight. This corresponds to IEC 721-2-5 Humid costal and inland (moderate) environment with up to 8mg/ (m²day) salt deposition for outdoor BTS w/o optional air filter.</td>
<td>IEC 721-2-5 IEC 68-2-52/Kb, Stress level 1 with 5% salt solution by weight.</td>
<td></td>
</tr>
<tr>
<td>Noise power, night time</td>
<td>54 dB(A) 54 dB(A) 55 dB(A)</td>
<td>54 dB(A) 54 dB(A) 55 dB(A)</td>
<td></td>
</tr>
<tr>
<td>(1+1+1 in +15 °C, according ISO 3744)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise power, day time</td>
<td>58 dB(A) 58 dB(A) 59 dB(A)</td>
<td>58 dB(A) 58 dB(A) 59 dB(A)</td>
<td></td>
</tr>
<tr>
<td>(1+1+1 in +23 °C according ISO 3744)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise power, extreme</td>
<td>63 dB(A) 63 dB(A) 64 dB(A)</td>
<td>63 dB(A) 63 dB(A) 64 dB(A)</td>
<td></td>
</tr>
<tr>
<td>(1+1+1 in +45 °C, according ISO 3744)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ingress</td>
<td>IP55 IP55 IP55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.1. EMC compatibility

The Flexi WCDMA Base Station is EMC compatible according to the following specifications:


**EMC emission**

- ETSI EN 301 489-1: ‘Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services - Part 1: Common technical requirements’.
- EN55022: "Limits and methods of measurement of radio disturbance characteristics of information technology equipment".
- 3GPP TS25.113

**EMC immunity**

- ETSI EN 301 489-1: ‘Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services - Part 1: Common technical requirements’.
- ETSI EN 301 489-23: ‘Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services - Part 23: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) Base Station (BS) radio, repeater and ancillary equipment’.
- IEC 1000-4-9: Pulse magnetic field immunity test.
• IEC 1000-4-8: "Electromagnetic Compatibility (EMC) Part 4. Testing and measurement techniques Section 8: Power frequency magnetic field immunity test, Basic EMC Publication".
• 3GPP TS25.113
• GR-1089-CORE
9. Abbreviations

2G  2nd generation (BTS site, e.g. GSM, TDMA or PDC)
3GPP 3rd Generation Partnership Project
AC  Alternating Current
AISG Antenna Interface Standards Group
AMR Adaptive Multi-rate speech
ATM Asynchronous Transfer Mode
BBU Battery Backup
BTS Base Station, Node B in 3GPP
CAPEX Capital Expenditure
CE Baseband processing capability to support max. 16 kbit/s user data in both uplink and downlink, e.g. one AMR speech channel
CES Circuit Emulation Service
DC Direct Current
DSP Digital Signal Processing
E1 European Digital Signal 1
EM BTS Element Manager SW
EMC Electromagnetic Compatibility
ETSI European Telecommunications Standards Institute
FB Flexbus
FB CC Flexbus cross-connect
FCDA optional Flexi Cabinet Fire Detector
FCFA optional Flexi Cabinet air Filter
FCIA optional Flexi Cabinet Indoor
FCOA optional Flexi Cabinet Outdoor
FCSA optional Flexi Cabinet Site support module,
FMBA Flexi Mounting kit for Batteries with FCOA and FCSA
FMCA optional Flexi Mounting Covers for back and front, 3U high
FMCB optional Flexi Mounting Covers for back and front, 2U high
FMFA optional Flexi Mounting kit for Floor and Wall and Pole
FMBA Flexi Mounting kit for Batteries for FCOA outdoor cabinet
FMBB Flexi Mounting kit for Batteries for FCIA indoor cabinet
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMSA</td>
<td>Flexi Mounting Shield 6U for pole and wall (and floor)</td>
</tr>
<tr>
<td>FMSB</td>
<td>Flexi Mounting Shield 18U for floor</td>
</tr>
<tr>
<td>FMUA</td>
<td>Flexi Mounting kit for UltraSite EDGE BTS cabinet vertical</td>
</tr>
<tr>
<td>FMUB</td>
<td>Flexi Mounting kit for UltraSite EDGE BTS cabinet horizontal</td>
</tr>
<tr>
<td>FPAA</td>
<td>optional Flexi Power AC/DC Sub-Module 230 V for FPMA</td>
</tr>
<tr>
<td>FPAB</td>
<td>optional Flexi Power AC/DC Sub-Module 230 V for 1 sector RF Module (FRxB or FRGD)</td>
</tr>
<tr>
<td>FPBA</td>
<td>optional Flexi Power Battery Sub-module for FPMA</td>
</tr>
<tr>
<td>FPDA</td>
<td>optional Flexi Power DC/DC Module 24 V</td>
</tr>
<tr>
<td>FPFA</td>
<td>Power Distribution Sub-module for System Module</td>
</tr>
<tr>
<td>FPMA</td>
<td>optional Flexi Power Module, version A</td>
</tr>
<tr>
<td>FRGC</td>
<td>Flexi RF Module 2.1 GHz Dual 50 W</td>
</tr>
<tr>
<td>FRGD</td>
<td>Flexi RF Module 2.1 GHz Single 50 W</td>
</tr>
<tr>
<td>FRxA</td>
<td>Flexi RF Module x Hz Dual 50 W, x = frequency band:</td>
</tr>
<tr>
<td>C</td>
<td>850 MHz</td>
</tr>
<tr>
<td>D</td>
<td>900 MHz</td>
</tr>
<tr>
<td>E</td>
<td>1700 &amp; 1800 MHz</td>
</tr>
<tr>
<td>F</td>
<td>1900 MHz</td>
</tr>
<tr>
<td>I</td>
<td>1700/2100 MHz</td>
</tr>
<tr>
<td>FRxB</td>
<td>Flexi RF Module x Hz Single 50 W</td>
</tr>
<tr>
<td>FRGE</td>
<td>Flexi Mast Head RF Module 50W</td>
</tr>
<tr>
<td>FRGF</td>
<td>Flexi RF Module 2.1 GHz Triple 70W</td>
</tr>
<tr>
<td>FRGG</td>
<td>Flexi RRH 2100 Single 70W</td>
</tr>
<tr>
<td>FSMB</td>
<td>Flexi System Module (240 CE HW capacity)</td>
</tr>
<tr>
<td>FSMC</td>
<td>Flexi System Module (250 CE HW capacity)</td>
</tr>
<tr>
<td>FSMD</td>
<td>Flexi System Module (500 CE HW capacity)</td>
</tr>
<tr>
<td>FSEA/B</td>
<td>optional Flexi System External Alarm IP55 protected connection box</td>
</tr>
<tr>
<td>FSEC</td>
<td>optional Flexi System OVP IP55 protected box for power lines</td>
</tr>
<tr>
<td>FSFB</td>
<td>Flexi System Fibre 50 m for Feederless site</td>
</tr>
<tr>
<td>FSFC</td>
<td>Flexi System Fibre 100 m for Feederless site</td>
</tr>
<tr>
<td>FSKA</td>
<td>Flexi System extension kit for 2nd System Module</td>
</tr>
<tr>
<td>FTxx</td>
<td>Alternative transmission sub-modules</td>
</tr>
<tr>
<td>FTEB</td>
<td>E1 (asymmetric) transmission sub-module</td>
</tr>
<tr>
<td>FTFA</td>
<td>Flexbus transmission sub-module</td>
</tr>
</tbody>
</table>
FTHA: 16xE1/T1 Transport Sub-module
FTIA: Hybrid E1/T1/JT1 (symmetric) and Ethernet transmission sub-module,
FTIB: Hybrid E1/T1/JT1 and Ethernet transmission sub-module with TOP,
FTJA: Hybrid E1 (asymmetric) and Ethernet transmission sub-module
FTOA: Optical STM-1/OC-3 transmission sub-module
FTPB: E1/T1/JT1 (symmetric) transmission sub-module
FTCx Flexi Transport Cable outdoor (x= length and type varies)
HEX Heat Exchanger in FCSA
HSDPA High Speed Downlink Packet Access
HSUPA High Speed Uplink Packet Access
HW Hardware
ID Identifier
IMA Inverse Multiplexing on ATM
IP Internet Protocol
IP55 Ingress Protection class for outdoor equipment
IP20 Ingress Protection class for indoor equipment
LNA Low Noise Amplifier
LMP Local Management connector Port for Element Manager (EM) PC
LTE Line Terminal Equipment (space) in FCSA
LTE Long Term Evolution, future Node-B and mobile network
MHA Mast Head Amplifier
MIBBU optional indoor Multi Integrated Battery Backup solution
MIBBU = WPU + 1...4 WPM + 62 Ah or 92 Ah battery
OPEX Operating Expense
OVP Over Voltage Protector for AC or DC power lines
PC Personal Computer
PDH Plesiochronous Digital Hierarchy
RAN Radio Access Network
RNC Radio Network Controller
RTT Roundtrip Time
SDH Synchronous Digital Hierarchy
TDM Time-Division Multiplexing
TTI Transmission Time Interval
TOP Timing over Packet
### Flexi WCDMA BTS Overview

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>Software</td>
</tr>
<tr>
<td>UE</td>
<td>User Equipment</td>
</tr>
<tr>
<td>VSWR</td>
<td>Voltage Standing Wave Ratio</td>
</tr>
<tr>
<td>WMHC</td>
<td>optional dual Wideband Mast Head Amplifier, 2.1 GHz&lt;br&gt;The same MHA is used with UltraSite WCDMA BTSs</td>
</tr>
<tr>
<td>WPU</td>
<td>optional Wideband Power Distribution unit, indoor</td>
</tr>
<tr>
<td>WPM</td>
<td>optional Wideband Power unit, AC/DC indoor rectifier inside WPU</td>
</tr>
</tbody>
</table>