

# A9110-E Micro Base Station

## Product Description



## Scope

This document gives a description of the EVOLIUM™ A9110-E Micro-BTS product range for GSM 850, GSM 900, GSM 1800, GSM 1900 and multiband digital cellular mobile radio system implementation according to GSM recommendations.

Its major purpose is

- to provide general information about the EVOLIUM™ A9110-E Micro-BTS product range,
- to give technical data for the different Micro-BTS configurations.

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## Introduction

Providing high-traffic capacity for GSM networks by economical solutions has become more and more important in the last years and will be a key issue for the near future. Alcatel recognizes the importance of capacity solutions and provides a broad range of possibilities. From the beginning Alcatel was a leader especially in the field of microcellular solutions, being first on the market with a real Micro-BTS, which is successful in commercial operation.

To answer the ongoing market demand for higher capacities, higher compactness and better performance, Alcatel offers a new Micro-BTS within the product range of EVOLIUM™ Radio Solutions. The wide flexibility of the product allows numerous applications by providing not only traditional micro-cells coverage, but also minicells, and in-building cells choices in GSM 850, GSM 900, GSM 1800 and GSM 1900 or multiband networks.

A description of the principles and characteristics of this new Alcatel A9110-E Micro Base Station is provided in the following.

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## 1. GENERAL

The EVOLIUM™ A9110-E Micro Base Station has been designed with the main goal of facilitating site acquisition and installation in a wide variety of environment, while offering cost-efficient operation and flexibility for future evolutions.

The highlights of the EVOLIUM™ A9110-E Micro-BTS are:

- *Adaptability (to optimize operator's investment)*
  - Minimum site constraints
    - Wall/pole and indoor/outdoor installation
    - Minimum volume and weight,
    - High temperature environment support with optional fan,
    - No acoustic noise emission thanks to convectional cooling concept.
  - The right number of sites
    - Different Tx power versions,
    - Dual-band concept,
    - Integrated or remote antennas.
  - Quick and efficient roll-out
    - Modular mounting concept,
    - Cabinet with integrated connection box,
    - Remote inventory,
    - Minimum installation time,
    - Autotest during commissioning.
  - Compatibility with previous A910 generation:
    - New A9110-E unit can be used as replacement of a A910
    - Site configurations can mix older A910 and new A9110-E
- *Flexibility (to minimize operator's operational expenses)*
  - Painless maintenance
    - One-module concept ('Plug & Play'),
    - No preventive maintenance (standard configurations).

- Easy network upgrades/reconfigurations
  - Online extension of modules (up to 12 TRXs),
  - Two software versions in hot standby.
- Reduced transmission and energy
  - 75-ohms or 120-ohms transmission impedance,
  - 36dB Abis receiver sensitivity for long haul lines ( up to 1,8 Km, cable dependant )
  - Low power consumption.
- Higher network reliability
  - High reliability (MTBF),
  - Several frequency synchronizations (free running, PCM).
- *Future proof (to maximize and ensure operator's revenue)*
  - Minimum capacity constraints
    - In field extension up to 12 TRXs,
    - Support of dual band.
  - All existing services supported
    - Support of full rate, half rate and enhanced full-rate codec,
    - Support of all ciphering algorithms,
    - All GSM Phase 2+ features
  - Ready for broadband data applications (release dependant)
    - Support of GPRS data services,
    - Support of EDGE.

## 2. OVERALL ARCHITECTURE

### 2.1 The EVOLIUM™ A9110-E Micro Base Station concept

An EVOLIUM™ A9110-E Micro-BTS site configuration consists of up to six A9110-E basic units. This *basic unit* is a 2TRX basis block enabling to build larger Micro-BTS site configurations, with capacities from two up to twelve TRXs in one up to six sectors.

Building or modifying site configurations is fully flexible. By only adding basic units, it is possible to adapt capacity to network development requirements.

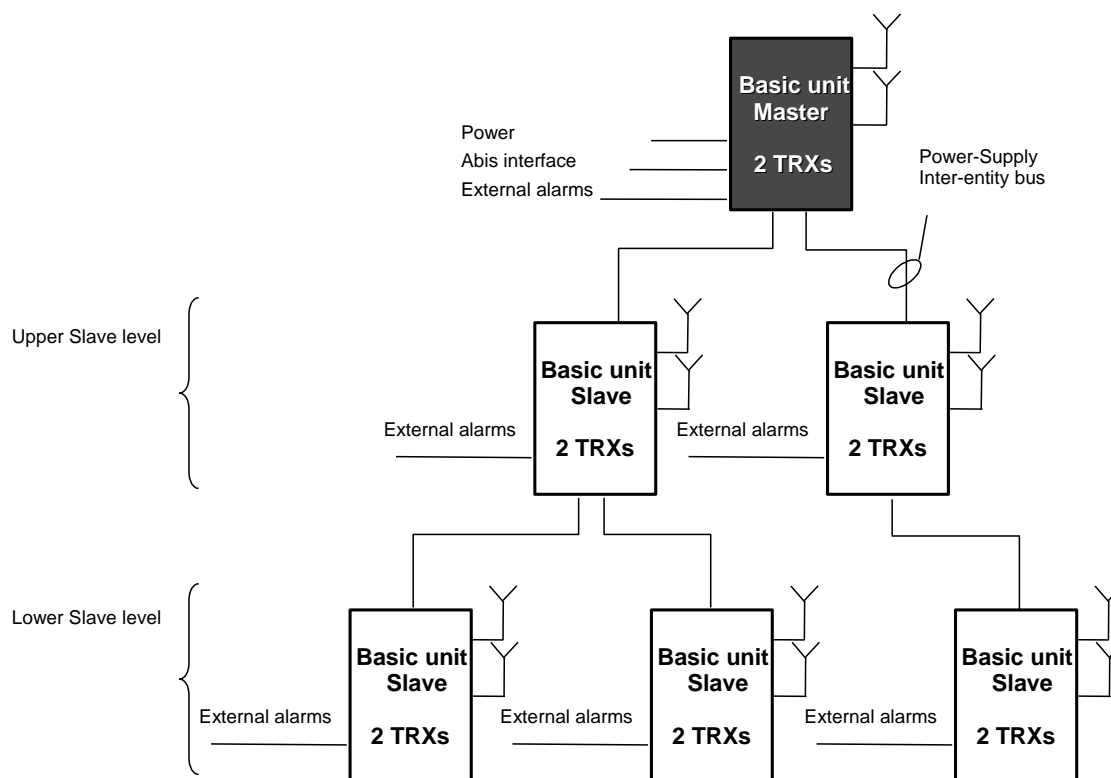


Figure 1: EVOLIUM™ A9110-E Micro-BTS site configuration principle.

One basic unit is chosen as master entity. The other basic units (maximum five) serve as slave entities and are connected to the master via a master-slave connection which is composed of the *inter-entity bus* and the *power supply cables*; this connection is either a direct one, or through an intermediate slave; slave units directly connected to the master are said "upper slaves" while slaves connected to an upper slave are said "lower slaves". Two connectors are available on each basic unit toward slaves of lower level. Thus, any configuration can be derived from that presented in the above figure by removing basic units, starting from lower level.

Slave or master basic units are identical from a hardware point of view; but, all base station control functions are activated in the master unit only.



Micro-BTSs of former generation (A910 Micro-BTSs) can be part of such a configuration, the rule being that in such a mixed configuration, a A910 Micro-BTS can only be an "Upper Slave", and with no "Lower Slave" connected to it.

The A9110-E basic unit, which is made of a minimum number of modules, is a complete BTS including connection area, mounting frame, etc.. This concept, allows a simplified logistic as well as a flexible installation and reconfiguration. It fits to most applications.

## 2.2 The A9110-E basic unit

The A9110-E basic unit has a 2-TRX capacity. It is based on a three-level modular architecture, consisting of the

- Antenna coupling level,
- Transceiver (TRX) level,
- Base station Control Function (BCF) level,

for which a reduced set of very highly integrated modules was developed.

Two types of *basic units* are provided with a different antenna coupling level to connect either one or two antennas. The information flow between the Air interface and the Abis interface for both types are presented in Figure 2.

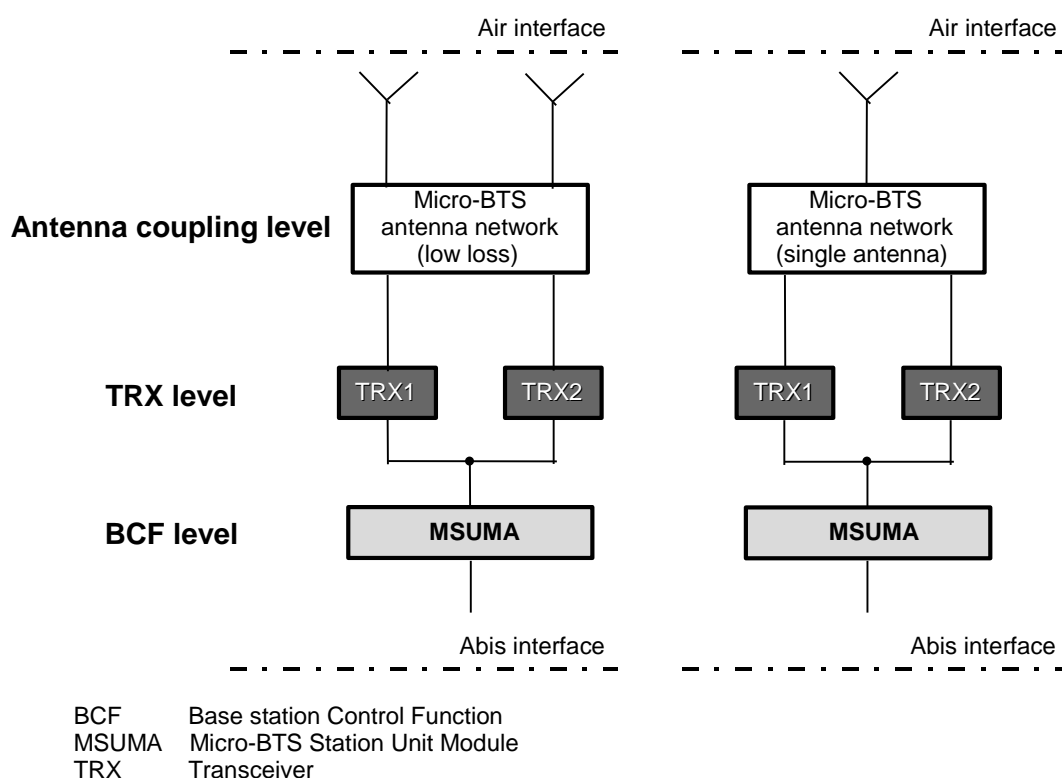


Figure 2: The two variants of the A9110-E basic unit

### 2.2.1 Antenna coupling level

The antenna coupling level is called antenna network; it is the stage between the antennas and the TRX level. The hardware of antenna coupling module is frequency band dependant.

The general functions performed at this level are:

- Duplexing transmit and receive paths onto common antennas,
- Feeding the received signals from the antenna to the receiver front end, where the signals are amplified and distributed to the different receivers (Low-Noise Amplifier (LNA) and power splitter functions);
- Providing filtering for the transmit and the receive paths,
- Hybrid combining, if necessary, output signals of two transmitters and connecting them to a single antenna.

Two different antenna network architectures are offered:

- Single-antenna architecture based on hybrid combining,
- Low-loss architecture based on air combining.

The principle and main characteristics of each architecture are presented below, one of the differences being obviously the output power that is in the range of 3 W for the single-antenna version against 7 W for the low-loss architecture (more precise values according to frequency band are given in section "RF performances" below).

#### 2.2.1.1 Single-antenna architecture

The single-antenna architecture allows to connect two TRXs to one single antenna. It combines two transmitters to one output with the hybrid-combining method. It also distributes the received signal to two receivers. Antenna diversity is not possible with this solution.

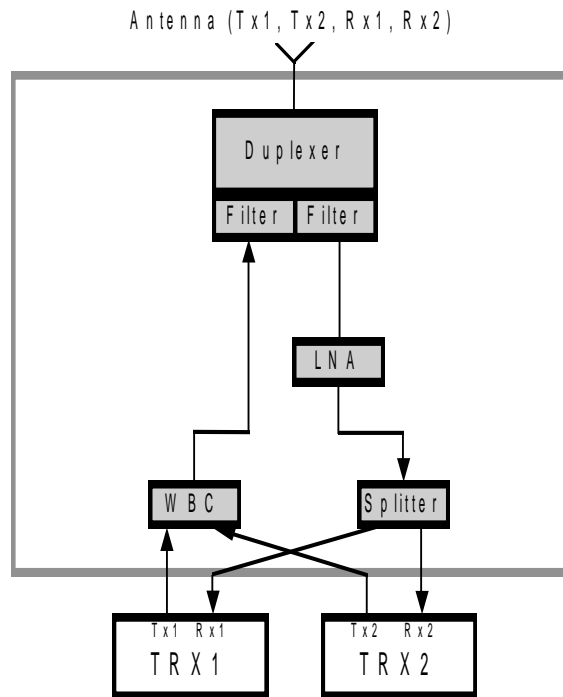


Figure 3: Single-antenna architecture

### 2.2.1.2 Low-loss architecture

Compared to the single-antenna architecture, the "low-loss" architecture contains two full chains for transmission and for reception, with for each chain a duplexer, a receiver front end (LNA) and a splitter.

The basic operation mode is to dedicate the two chains to two TRXs of a same sector:

- in the receive path, the output of the LNA of each chain is fed, through the splitter, to both the receiver of this chain and the receiver of the other chain, thus providing antenna diversity,
- in the transmit direction, the signal coming from each TRX is fed to its own antenna through a duplexer; air-combining is thus used instead of hybrid combining, resulting in a lower loss in the transmit path (hence the name) and an increased Tx output power compared to single-antenna architecture

An alternative operation mode is to dedicate each chain to a separate TRX of a different sector, providing two sectors of one TRX each. Switching between the two modes is obtained only through a software command. No additional hardware change is necessary.

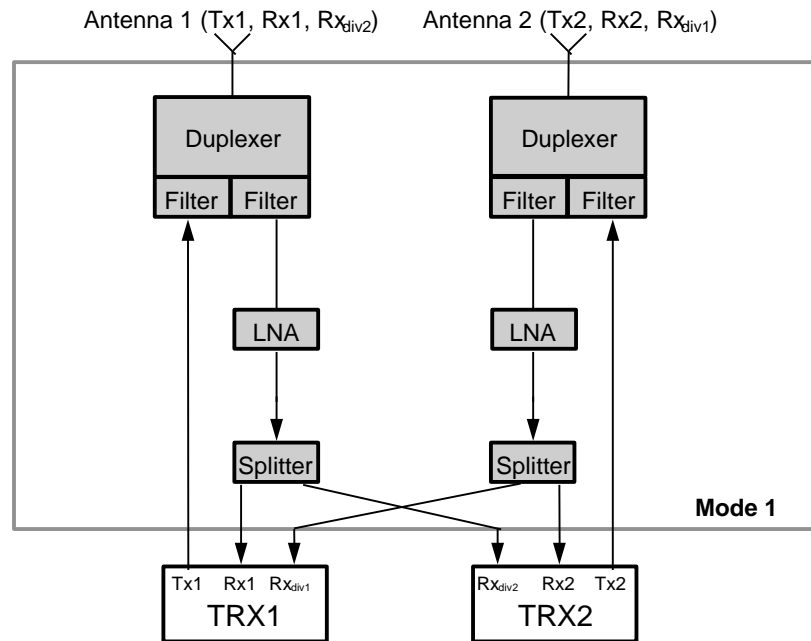


Figure 4: Low-loss architecture used for "Single sector with antenna diversity"

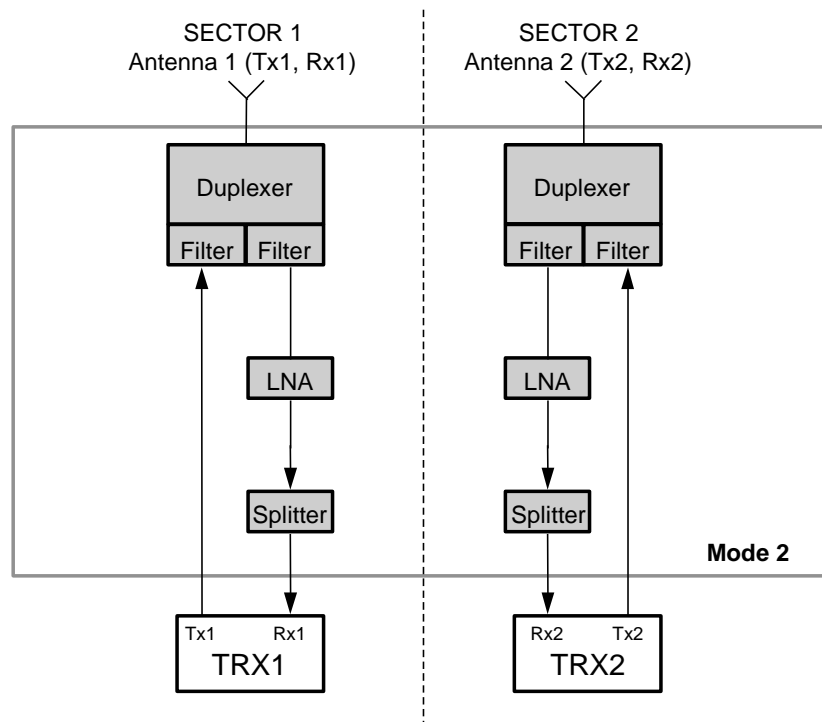


Figure 5: Low-loss architecture used for "two sectors without antenna diversity"

### 2.2.2 Transceiver (TRX) level

The transceiver (TRX) level covers GSM 850, GSM 900, GSM 1800 and GSM 1900 functionalities, including full rate, half rate, enhanced full rate, antenna diversity, radio frequency hopping (synthesized hopping) and different ciphering algorithms.

Inside each TRX module an RF loop is implemented. The loop test is performed after downloading the frequencies to the Micro-BTS as a supplement to the autotest.

The TRX module also handles the Radio Signaling Link (RSL) protocol.

### 2.2.3 Base station Control Function (BCF) level

This level is realized by the Micro-BTS Station Unit Module (MSUMA). This module is physically present in each basic unit, master or slave, of any basic unit configuration. But in the slave case main functions are disabled autonomously by MSUMA software. In fact, as only the master is physically connected to the Abis, the MSUMA detecting the Abis acts as master, and the other ones act as slaves. The station unit module of the master unit guarantees the control functions for all the basic units of the Micro-BTS.

The main base station control functions are performed by the master unit as follows:

- Generating the clocks for all other basic units; the clocks can be either synchronized to an external clock reference - e.g. Abis link - or generated in a pure free-run mode by an internal frequency generator.
- Ensuring central Micro-BTS Operation & Maintenance (O&M) application,
- Handling the Abis transmission links (2 E1 links are available),
- Handling Operation and Maintenance Link (OML) and Q1 (transmission equipment supervision) protocols.

### 3. MECHANICAL AND INSTALLATION PRINCIPLES

In addition to the high compactness (26 liters/2 TRXs for the basic unit) and the aesthetic side, the A9110-E Micro-BTS has been designed in a flexible, modular and extensible way to facilitate the installation and replacement process.

#### 3.1 Mechanical concept

##### 3.1.1 Mounting frame and connection box

A mechanical device (mounting frame) allows fast and easy installation or replacement. This mounting frame includes a connection box at the bottom which contains all the external interface cable terminations for power, transmission, alarms...

The mounting frame has to be fixed on the wall or pole. The basic unit can be simply *'plugged'* at the frame.

##### 3.1.2 Protection cover

In case of environmental or aesthetics constraints, a protection cover can be added as an option to the Micro-BTS. Please refer to Chapter 5.4 "Options" for details.

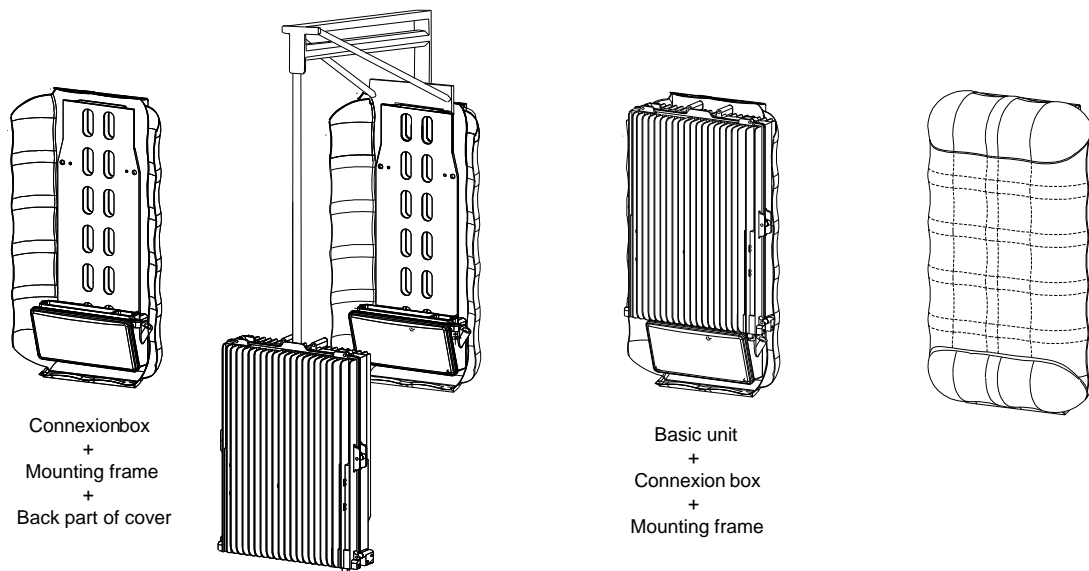
#### 3.2 Installation and commissioning

After the fixture of the mounting frame (including the connection box) on the wall or pole, a suitable lift is used to install the basic unit at the frame. This operation can be done in two ways:

- Thanks to an electrical small crane, which is put on the top of the mounting frame and connected to the connection area of the Micro-BTS for power supply. The basic unit is then lifted at the mounting frame level as represented in figure 6. One person is enough for the operation.
- Manually lifted thanks to a handwheel which is screwed at the top of the basic unit and a handle fixed at the bottom. Two persons are needed for the operation.

In case the protection cover option is chosen, the back part of the cover is fixed with the mounting frame .

Both indoor and outdoor (with protection cover) environments are possible.



**Figure 6: EVOLIUM™ A9110-E Micro Base Station - mechanical units and installation**

Basic units can be used either as *master* or *slave*. The identification is defined automatically by the cabling on dedicated connectors.

Flexible positioning of units is possible. The mechanics allows either collocated installation of master units and slave units, or delocated installation (up to five meters between the units). The adding/removing of units (but the master) can be done online during operation.

In case of hardware failure the unit is replaced completely. No on-site intervention for repair is foreseen.

Manual calibration during commissioning has not to be carried through. Thanks to the modular mounting concept, the connection box integrated in the cabinet, as well as autotest during the commissioning phase, the installation or replacement process is easy and fast.

By means of a convectional cooling the temperature range supported by the Micro-BTS is -33 °C up to +45 °C. Thanks to the optional fan mounted on top of the cover, hot-temperature conditions up to +55 °C can be reached.

As well integrated and remote antennas are possible (integrated antenna is possible in low loss and in single antenna architecture).



## 4. MAIN FEATURES AND CHARACTERISTICS

The architecture of the EVOLIUM™ A9110-E Micro-BTS is derived from that of the previous A910 family. That means basic principles and features already known from this BTS generation are also applicable for A9110-E.

### 4.1 Radio - Telecom - Transmission

#### Frequency bands

The hardware supports the GSM 850 band, *Extended GSM 900 band*, *GSM 1800 band* or the *GSM 1900 band* :

	uplink	downlink
GSM 850	824 MHz to 849 MHz	869 MHz to 894 MHz
E-GSM 900	880 MHz to 915 MHz	925 MHz to 960 MHz
GSM 1800	1710 MHz to 1785 MHz	1805 MHz to 1880 MHz
GSM 1900	1850 MHz to 1910 MHz	1930 MHz to 1990 MHz

#### Speech codecs

*Full rate*, *half rate*, *enhanced full rate* and Adaptive multirate (AMR) are supported. The same TRX hardware is prepared to support all other codec functions. The half-rate, enhanced full-rate and Adaptive multirate functioning requires that the BSS software release and the other network elements also support these codecs.

#### Ciphering algorithms

The BTS product range supports A5/1 and A5/2 ciphering algorithms; A5/0 = 'no ciphering' is always supported. Provisions are taken for A5/3 to A5/7 when defined.

#### RF performances

Radio performances in tables below are given at antenna connector (tolerance is - 0.5/+ 1 dB) :

Frequency band Nb of antennas	TX output power, <b>GMSK</b>	TX output power, <b>8-PSK (EDGE)</b>
GSM 850 / 1 antenna	3.2 W = 35.1 dBm	2.3 W = 33.6 dBm
GSM 900 (P-band) / 1 antenna	3.2 W = 35.1 dBm	2.3 W = 33.6 dBm
GSM 900 (G1-band) / 1 antenna	2.7 W = 34.45 dBm	1.3 W = 32.95 dBm
GSM 1800 / 1 antenna	3.2 W = 35.1 dBm	1.8 W = 32.6 dBm
GSM 1900 / 1 antenna	3.2 W = 35.1 dBm	1.8 W = 32.6 dBm
GSM 850 / 2 antennas	7.0 W = 38.5 dBm	5.0 W = 37.0 dBm
GSM 900 (P-band) / 2 antennas	7.0 W = 38.5 dBm	5.0 W = 37.0 dBm
GSM 900 (G1-band) / 2 antennas	6 W = 37.85 dBm	4.3W = 36.35 dBm
GSM 1800 / 2 antennas	7.0 W = 38.5 dBm	4.0 W = 36.0 dBm
GSM 1900 / 2 antennas	7.0 W = 38.5 dBm	4.0 W = 36.0 dBm

	Reference sensitivity, <b>GMSK</b>	Reference sensitivity, <b>8-PSK (EDGE)</b>
	- 110 dBm (static and dynamic) - 112 dBm (dynamic with diversity)	< -110 dBm, (static, MCS1) -106 dBm, (static, MCS5) -96 dBm, (static, MCS9)

### Multiband capabilities

Multiband configurations are possible by using basic units of different bands in an A9110-E Micro-BTS. Each basic unit is a monoband one.

The possible multiband operations are :

GSM 850 / GSM 1800,  
 GSM 850 / GSM 1900,  
 GSM 900 / GSM 1800,  
 GSM 900 / GSM 1900.

The basic units can belong to different sectors (multiband BTS without multiband cell configurations) or to the same sector (multiband BTS with multiband cell configurations).

### Antenna diversity

Depending on the antenna network chosen, the A9110-E product range includes configurations with antenna diversity or without antenna diversity. Within 1 sector all units have to be configured in the same antenna diversity mode.

### Synthesizer frequency hopping

Synthesizer frequency hopping (or so-called *radio frequency hopping*) is supported by the whole BTS product range; its use is optional. Two frequency hopping modes are available:

- Standard RF-hopping mode:

A cell with N TRXs can have N-1 TRXs hopping (except the TRX carrying the BCCH), on M frequencies (M usually > N).

- Pseudo-baseband RF-hopping mode:

A cell with N TRXs can have all its N TRXs hopping on N frequencies.

### Power control

According to GSM: Dynamic 30 dB - step size 2 dB.

### Synchronization

The clocks can be

- generated in a pure free-run mode by an internal frequency generator,
- synchronized to an external clock reference:
  - Abis link (PCM-synchronized),

### Transmission

Star, chain and loop configurations are possible with the EVOLIUM™ A9110-E Micro-BTS.

In case of BTS failure or power shutdown, the Abis link is not interrupted for the following BTSs.

As for the EVOLIUM™ A910 Micro Base Station, the number of time slots on the Abis link is optimised thanks to Abis static signalling multiplexing, where the Radio Signalling Links (RSLs) of four TRXs are submultiplexed on one 64-kbits/s PCM channel.

Statistical signalling submultiplexing on a 64-kbits/s channel is also available (release dependent). It enables the use of one to four RSLs and the OML on the same 64-kbits/s time slot.

Two G.703 interfaces with a sensitivity of (36 dB) are provided for leased lines or direct cables. In a chain or loop configuration, it allows a distance of up to 1.8 km between two Micro-BTSs.

## 4.2 Operation and maintenance

### Station unit sharing

The station-unit-sharing feature is supported by the EVOLIUM™ A9110-E Micro-BTS: Whatever the number of basic units is, the configuration is seen as a single Micro-BTS with one dedicated Operation and Maintenance Link (OML).

### Autotesting

Upon activation of the BTS, functioning status is given (all modules active, antenna equipped) via a LED included in the connection box.

### Recovery

In case of interruptions on Abis or power supply or in case of exceeding the temperature range, the BTS recovers automatically when the failure has disappeared.

The service interruption is minimized at initiation or restart: The EVOLIUM™ A9110-E Micro-BTS performs a fast restart after a breakdown (BTS software files are stored in a non-volatile memory). Only the minimum necessary files are required from the BSC.

In case of a failure in the BCCH TRX, another TRX is automatically reconfigured as BCCH TRX.

## External alarms

Each basic unit provides eight external alarm inputs, four with overvoltage protection, and four without. The connectors are located on the connection box.

In a site configuration where several basic units are interconnected, it is possible to use the external alarms of the master and of the slave basic units.. Then the number of external alarm inputs regarding the whole Micro-BTS site configuration can grow up to 48, depending on the number of basic units. Physical external alarm connection can be freely mapped on each logical external alarm to be reported to OMC-R by operator. The probably causes are defined according to CCITT X.721. Nevertheless the operator is able to name each external alarm according to its special purpose. ALCATEL recommends typical external alarm connections, a simple mapping to logical alarms and a useful alarm naming convention.

## Reliability and availability

Each basic unit is considered as one module. In case of failure, the complete entity is replaced, and no on-site repair activity is foreseen.

All components have been chosen with latest technologies and high MTBF values in order to avoid a costly and not compact redundant solution.

The service availability of a cell equipped with two TRX or more, defined as the mean time between two full service interruptions due to hardware failure, is 13 years (functional MTBF with half of TRXs to survive).

## Power supply

The EVOLIUM™ A9110-E Micro Base Station supports:

- AC: 230 V (range from 170 V to 270 V)
- DC: 300 V (range from 240 V to 357 V)

The basic units are protected against short power failure of less than 200 ms.

The slave units can be remotely fed from the master unit.

## Autodetection and configuration

This feature is very important for the connection of several basic units. Any basic unit can be used either as master or slave entity. The status of a basic unit is automatically defined by its cabling.

The master is the only one which is connected to the Abis interface and downloads the necessary software to all the TRXs of the whole Micro-BTS.

From the OMC-R, a Micro-BTS site configuration in which several basic units are connected in master-slave mode (more than 2-TRX configuration) appears as one BTS with 4, 6, 8, 10 or 12 TRXs, which can be assigned to different sectors or to the same one.

### **Commissioning tests**

A set of dedicated autotests are available in order to reduce the commissioning time of less than 20 minutes (commissioning tests and configuration parameters acquisition).

### **Firmware downloading**

All firmware are locally downloadable from the maintenance terminal and/or from the OMC-R.

### **Software up-grade**

Two-software-versions storage: the EVOLIUM™ A9110-E Micro Base Station is able to store two software versions with the possibility of activating one or the other on request from the BSC. Software downloading will be performed with minimum service interruption (release-dependent).

## 5. PRODUCT RANGE

This chapter describes all possible configurations and options of the EVOLIUM™ A9110-E Micro-BTS.

The complete panel of possible configurations is derived from eight basic 2-TRX configurations by co-sitting up to six such basic configurations (12 TRXs), and if needed adding options.

These basic configurations are listed in the following table:

Description	Antenna network architecture	No. of antennas
GSM 850 2 TRXs	Single-antenna	1
GSM 850 2 TRXs	Low-loss	2
GSM 900 (E-GSM band) 2 TRXs	Single-antenna	1
GSM 900 (E-GSM band) 2 TRXs	Low-loss	2
GSM 1800 2 TRXs	Single-antenna	1
GSM 1800 2 TRXs	Low-loss	2
GSM 1900 2 TRXs	Single-antenna	1
GSM 1900 2 TRXs	Low-loss	2

Hence, the possible configurations are:

- Single-antenna,
- Low-loss with antenna diversity,
- Multiband.

### 5.1 Single-antenna

This configuration is realized with the single-antenna architecture (see chapter 2.2.1.1). The antenna network associated is called *single-antenna network*.

The characteristics are:

- One single antenna is connected to two TRXs;
- Antenna diversity is not supported;
- Up to six entities can be grouped in omni or sectored versions.



This medium-power version of A9110-E is the optimum product to serve classical microcells. These microcells will usually be implemented as clusters in a hierarchical network to provide highest capacity in dense urban areas. At the same time, coverage will be improved significantly for both outdoor as well as deep indoor from outside applications. Moreover, due to the compact and aesthetic design, the A9110-E Micro-BTS is also suited for in-building installations and coverage.

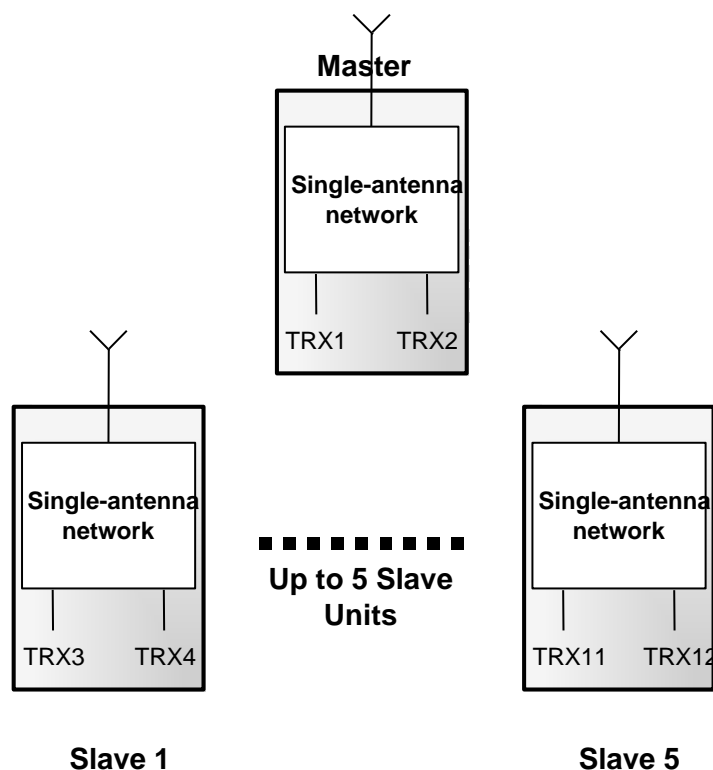


Figure 7: Single-antenna configuration

The basic unit(s) can belong to different sectors or to the same one. Hence, the following possibilities are offered: ( Example: up to six sectors configurable )

A9110-E single-antenna configurations	1 sector	2 sectors	3 sectors
No. of TRXs	Up to 12	Up to 6 TRXs/sector	Up to 4 TRXs/sector
No. of basic units per sector	Up to 6	Up to 3	Up to 2
No. of antennas	1/basic unit	1/basic unit	1/basic unit
Tx output power (W)	Deduced from basic unit choice	Deduced from basic unit choice	Deduced from basic unit choice

## 5.2 Low-loss configuration with antenna diversity

This configuration is realized with the low-loss antenna network, an antenna module associated to the low-loss architecture (see chapter 2.2.1.2). The module is configured with the antenna diversity option. The characteristics are :

- Two antennas are connected to two TRXs which belong to the same sector;
- Antenna diversity;
- Up to six entities can be grouped in omni or sectorized versions.

In case of medium to high-traffic densities, this high-power version of A9110-E is an economical solution since it allows an increased cell range. Such cells are known as minicells to be installed in hierarchical or single-layer networks. This product version can also be installed to provide an excellent coverage for shadowed area, tunnels, etc..

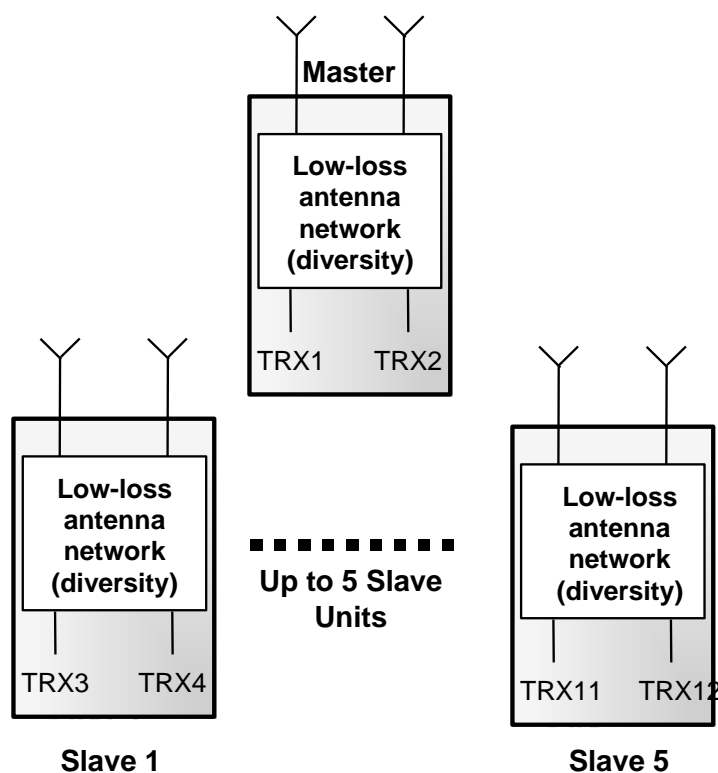


Figure 8: Low-loss configuration with antenna diversity

- Two modes for low-loss basic unit:
  - One sector with 2-TRX capacity, with antenna diversity
  - Two sectors with one TRX in each sector, without antenna diversity

with the possibility of switching from the first mode to the other one by a software command.

The basic unit(s) can belong to different sectors or to the same one. That implies the following possibilities: ( Example: up to six sectors configurable )

A9110-E low-loss configurations with antenna diversity	1 sector	2 sectors	3 sectors
No. of TRXs	Up to 12	Up to 6 TRXs/sector	Up to 4 TRXs/sector
No. of basic units per sector	Up to 6	Up to 3	Up to 2
No. of antennas *	2/basic unit	2/basic unit	2/basic unit
Tx output power (W)	Deduced from basic unit choice	Deduced from basic unit choice	Deduced from basic unit choice

\* the exact number of antenna depends on the use of panel/cross-polarized/integrated antennas.

### 5.3 Multiband configurations

The EVOLIUM™ A9110-E Micro Base Stations have been designed in such a manner that they allow multiband operation : GSM 850 and GSM 1800, GSM 850 and GSM 1900 or GSM 900 and GSM 1800. A given Micro-BTS can be composed of basic units of each band. Both bands are assigned either in different sectors (one BCCH for each band -dual BCCH) or in the same sector (one BCCH for both bands -single BCCH).

All configurations installed in a single-band infrastructure can be up-graded for multiband operation by adding a basic unit at the other band.

Both antenna network types (low loss and single antenna) are possible in multiband configurations.

**Note :** A mix of low-loss and single-antenna networks in the same configuration (same sector) is not allowed

### 5.3.1 Multiband BTS without multiband cell configurations- Dual BCCH

The possible multiband BTS without multiband cell configurations are described in the following table ( Example: up to maximum 6 sectors configurable ). Sectors may be either GSM 850, GSM 900, GSM 1800 or GSM 1900 (respecting the possible combination of frequency bands described above).

A9110-E multiband BTS configurations	3 sectors x 2 TRX in band1 3 sectors x 2 TRX in band2
No. of TRXs	Band1: 6 TRX (3x2) Band2: 6 TRX (3x2)
No. of basic units	Band1: 3 basic units Band2: 3 basic units
No. of antennas	Deduced from basic unit choice
Tx output power (W)	Deduced from basic unit choice

### 5.3.2 Multiband BTS with multiband cell configurations- Single BCCH

The possible multiband BTS with multiband cell configurations will be defined in a further step.

## 5.4 Options

### 5.4.1 Protection cover

For each basic unit, Alcatel provides as an option, an appropriate protection cover. It will protect the BTS equipment against environmental impact (dirt, wind, sun radiation, etc.) and unauthorized access.

Moreover, thanks to its lightness, the cover is greatly adaptable to the environment.

The use of the cover is recommended for Outdoor environments, or in case of aesthetics constraints in Indoor environments (public rooms).

The cover is made up of four parts:

- the back part, fixed with the mounting frame during the installation process,
- the front part,
- the top part,
- the bottom part, which gives the access to the connection box.

It is available in two variants:

- the “standard cover”,
- the “integrated-antenna cover” where the front part is modified.

The second variant is mandatory in case of choosing integrated antenna option.

If the fan option is chosen, the top part of the cover is replaced by another one in which *fans* are integrated.

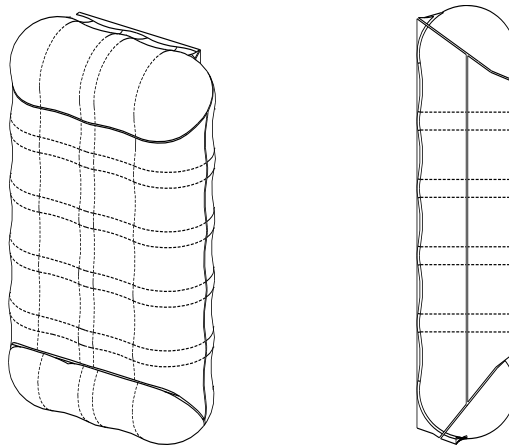


Figure 9: Protection cover

### 5.4.2 Integrated fans

The standard product is designed to support temperature up to +45°C. Fans are added for operating temperature up to +55°C.

This option is a special top cover including:

- A fan cassette (with two fans),
- A fan control board,
- AC and alarms cables.

The speed of the fans is controlled depending on the temperature. In case of failure, an external alarm is sent to the OMC-R.

The replacement from the standard top cover to the special one (including the fans) is done on field during the installation process. The protection cover is mandatory when using the fans.

### 5.4.3 Integrated antennas

For optimum RF performances, and so as to reduce the cost and installation effort, it is possible to have antennas integrated in the Micro-BTS. Therefore, no feeders nor external antennas need to be installed.

The integrated antenna is possible only in low loss configuration. If a basic unit of micro BTS uses integrated antenna, then all other basic units must use integrated antenna.

This integrated antenna is a cross-polarized +/-45° and is available in GSM900 and GSM1800, with the following characteristics:

- Isolation between antennas > 25 dB
- Gain > 5.0 dBi
- Horizontal HPBW > 78°
- Vertical HPBW > 50°

Integrated antennas use the same connector as external antennas. It is mounted on the front face of the basic unit. A special cover is required for this option (please refer to 5.4.1).

#### 5.4.4 VSWR Meter

The return loss of the transmitted signal can be measured at the antenna connector thanks to the VSWR meter option, using the Voltage Standing Wave Ratio techniques.

It is a separated device (H\*W\*D: 128\*80\*40 mm) which is introduced between the antenna connector and the antenna feeder therefore located inside the protection cover.

The VSWR meter gets 5 V DC power supply from the connection box and provides one alarm output, also connected to the connection box.

This option is available in EGSM900. It is not possible to use it together with the integrated antenna option.

#### 5.4.5 Site Support Cabinet

The Site Support Cabinet (SSC) is an optional unit which can be added on the Micro-BTS site, independently of the TRX capacity (up to 12 TRXs). It consists of a separate outdoor cabinet which provides accomodation for battery backup and for external equipment.

The characteristics of the site support cabinet are:

- Battery backup (see table below)

##### Battery backup duration in dependence of A9110-E configuration [min]

( at 25 °C ambient temperature, with cooling unit in SSC and 2 Microwave units as option ).

TRX	A9110-E w/o optionFAN w/o option Microwave	A9110-E with optionFAN w/o option Microwave	A9110-E w/o optionFAN with option Microwave	A9110-E with optionFAN with option Microwave
2	248	229	122	117
4	138	131	87	85
6	95	92	68	67
8	73	71	56	55
10	59	58	47	47
12	49	49	41	40

- Ground, wall or mast mounting,
- Size: H\*W\*D: 90\*65\*45 cm,

- Environmental:

- temperature range from -33 to + 45°C (extended to +55°C if reduced power dissipation of the options-10W) thanks to an advanced cooling system.
- lightning protection

A free space and 200W (-48V DC) power is available in the cabinet for options such as:

- Two microwave baseband units or
- Two network terminations for multidrop or
- Two HDSL modems.

This cabinet is supervised via the external alarms of the Micro-BTS.

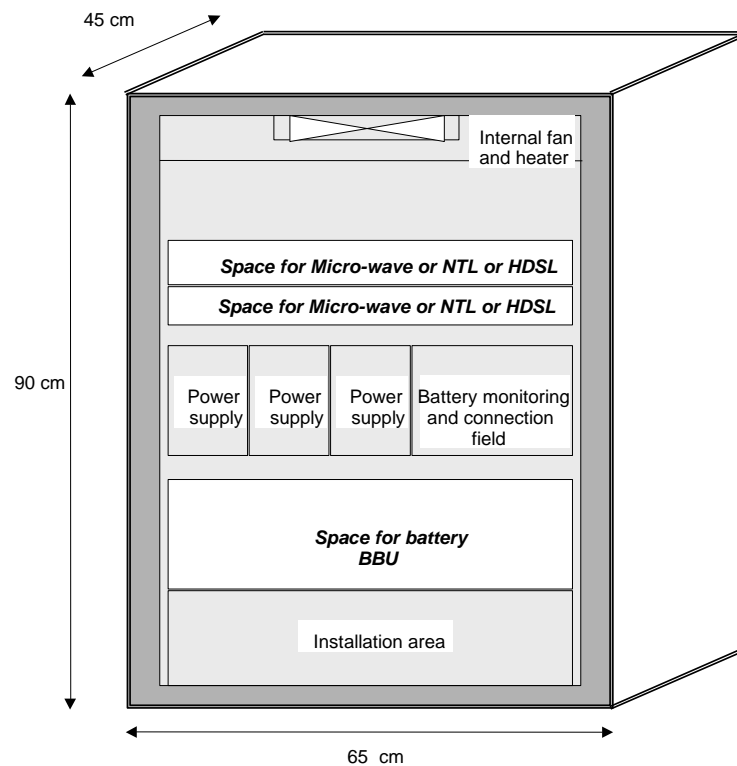


Figure 10: Site Support Cabinet



## 5.5 Overview of EVOLIUM™ A9110-E Micro Base Station main characteristics

The table below gives an overview of the main characteristics of the EVOLIUM™ A9110-E Micro Base Station.

EVOLIUM™ A9110-E Micro Base Station	without cover option		with cover option	
	Low-loss	Single-antenna	Low-loss	Single-antenna
Typical power consumption without heating elements	140 W per 2 TRXs		140 W per 2 TRXs	
Typical power consumption with fan	155 W per 2 TRXs		155 W per 2 TRXs	
Typical power consumption including heating elements	210 W per 2 TRXs (at 0 °C)		210 W per 2 TRXs (at 0 °C)	
Lightening protection	Antenna, PCM, AC input and 4 external alarms		Antenna, PCM, AC input and 4 external alarms	
Temperature range	-33 °C to + 45 °C		-33 °C to + 45 °C (+55 °C with fan option)	
Height	750 mm		818 mm / 940 mm with fan	
Width	384 mm (max)		450 mm (max)	
Depth	137 mm (max)		190 mm (max)	
Weight	27 kg	26 kg	32.5 kg	31.5 kg
Volume	34 l *)		54 l *)	
Optional fan	No	No	Yes	Yes
Environmental protection level	IP 55		IP 55	

### Main characteristics of the EVOLIUM™ A9110-E Micro Base Station

\*) The cabinet volume includes TRXs, mounting mechanics, connection box including Abis relays, lightning protection, external alarms, as well as provisions for extension, provisions for optional fan.

## 6. ENVIRONMENTAL AND EMC CONDITIONS

### 6.1 Environmental conditions

The environmental conditions define the limits (temperature, humidity, etc.) for BTS cabinets in operation, transportation, and storage conditions as specified in the following classes:

EVOLIUM™ A9110-E Micro Base Station	Outdoor
Operation	ETS 300 019-1-4 class 4.1
Transportation	ETS 300 019-1-2 class 2.3
Storage	ETS 300 019-1-1 class 1.3

### 6.2 ElectroMagnetic Compatibility (EMC)

All EVOLIUM™ A9110-E Micro Base Stations fulfill the requirements of the following standards:

- *European Directive 89/336/EEC according to ETSI ETS 301 489 -1 and 8.*

### 6.3 Acoustic noise and ultrasonic

The emitted sound power level does not exceed 30 dB<sub>A</sub> without fan and 54 dB<sub>A</sub> with fan in one meter distance (sound power measured according to ISO 3743).

## 6.4 Operation of EVOLIUM™ A9110-E outdoor Micro Base Stations

Climatic conditions for environmental class 4.1 (stationary use at non-weather protected locations):

Environmental parameter	Unit	Class 4.1
Low air temperature	°C	-33
High air temperature	°C	+40 (Note 1)
Low relative humidity	%	15
High relative humidity	%	100
Low absolute humidity	g/m <sup>3</sup>	0.26
High absolute humidity	g/m <sup>3</sup>	25
Rain intensity	mm/min	6
Rate of change of temperature	°C/min	0.5
Low air pressure	kPa	70
High air pressure	kPa	106
Sun radiation	W/m <sup>2</sup>	1120 (Note2)
Heat radiation	W/m <sup>2</sup>	Negligible
Movement of the surrounding air	m/s	50
Conditions of condensation	None	Yes
Conditions of precipitation (rain snow, hail)	None	Yes
Low rain temperature	°C	5
Conditions of water from sources other than rain	None	Splashing water
Conditions of icing and frosting	None	Yes
Salt fog cycle	3 x 24 h (IEC68-2-52: Salt-fog environment)	

Note 1: The high temperature supported by the EVOLIUM™ A9110-E Micro Base Station is extended to +45 °C (+55 °C with optional fans)

Note 2: The sun radiation condition is fulfilled only with the optional cover

## 6.5 Transportation of EVOLIUM™ A9110-E outdoor Micro Base Stations

Climatic conditions for environmental class 2.3 (transportation):

Environmental parameter	Unit	Class 2.3
Low air temperature	°C	-40
High temperature, air in unventilated enclosures	°C	+70
High temperature, air in ventilated enclosures or outdoor air	°C	+40
Change of temperature air/air	°C	-40/+30
Change of temperature air/water	°C	+40/+5
Relative humidity, not combined with rapid temperature changes	% °C	95 +45
Relative humidity, combined with rapid temperature changes air/air at high relative humidity	% °C	95 -40/+30
Absolute humidity, combined with rapid temperature changes air/air at high water content	g/m <sup>3</sup> °C	60 +70/+15
Low air pressure	kPa	70
Change of air pressure	kPa/min	no
Movement of the surrounding medium, air	m/s	20
Precipitation, rain	mm/min	6
Radiation, solar	W/ m <sup>2</sup>	1120
Radiation, heat	W/ m <sup>2</sup>	600
Water from sources other than rain	m/s	1
Wetness	None	Conditions of wet surface

## 6.6 Storage of EVOLIUM™ A9110-E outdoor Micro Base Stations

Climatic conditions for environmental class 1.3 (non-weather protected storage locations):

Environmental parameter	Unit	Class 1.3
Low air temperature	°C	-33
High air temperature	°C	+40
Low relative humidity	%	15
High relative humidity	%	100
Low absolute humidity	g/m <sup>3</sup>	0.26
High absolute humidity	g/m <sup>3</sup>	25
Rain intensity	mm/min	6
Rate of change of temperature	°C/min	0.5
Low air pressure	kPa	70
High air pressure	kPa	106
Sun radiation	W/m <sup>2</sup>	1120
Heat radiation	W/m <sup>2</sup>	Negligible
Movement of the surrounding air	m/s	50
Conditions of condensation	None	Yes
Conditions of precipitation (rain snow, hail)	None	Yes
Low rain temperature	°C	5
Conditions of water from sources other than rain	None	Splashing water
Conditions of icing and frosting	None	Yes

## 7. GLOSSARY

AD	Antenna Diversity
AMR	Adaptive Multi-Rate
BBU	Battery Backup Unit
BCF	Base station Control Function
DR	Dual Rate
E-GSM	Extended-band GSM
EFR	Enhanced Full Rate
GPRS	General Packet Radio Service
GPS	Global Positioning System
HDSL	High-bit-rate Digital Subscriber Line
HR	Half Rate
HSCSD	High-Speed Circuit Switched Data
LNA	Low-Noise Amplifier
MTBF	Mean Time Between Failures
NTL	Network Termination Link
OML	Operation and Maintenance Link
PCM	Pulse Code Modulation
P-GSM	Primary-band GSM
RFE	Receiver Front End
RFH	Radio Frequency Hopping
RSL	Radio Signalling Link
MSUM	Micro-BTS Station Unit Module
U	Unit used in mechanic design for the height of modules: 1U = 1.75" = 44.45 mm
VSWR	Voltage Standing Wave Ratio
WBC	Wide-Band Combiner

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