Alcatel 9110-E Micro-BTS Description

TRAINING MANUAL
3FL 11947 ABAA–AUB ed 3
October 2006

Safety Warning

Both lethal and dangerous voltages are present within the equipment. Do not wear conductive jewelry while working on the equipment. Always observe all safety precautions and do not work on the equipment alone.

Caution

The equipment used during this course is electrostatic sensitive. Please observe correct anti-static precautions.

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Contents

Course title:	Alcatel 9100 BTS Description
Reference:	3FL 10477 ACAA - AUP
Teaching languages:	English - French - German - Arabic - Romanian - Chinese - Portuguese

Standard duration		Training methods
i-learning c-learning or v-learning	6	Introduction of theoretical knowledge, based on the presentation of hardware.
Total duration (hrs)	6	Sequence:

Maximum number of participants: 12 (Only applicable to c-learning and v-learning)

Audience:

Personnel in charge of operating the Alcatel Base Transceiver Stations.

Objectives:

By the end of the course, participants will be able to identify the:
- Role and situation of the BTS;
- Functional subsets of the BTS;
- Hardware modules of the BTS;
- Possible hardware configurations.

Prerequisites:

- Training module “Introduction to the Alcatel GSM Network - 3FL 10471 ADAA.
- Training module “Alcatel Base Station Subsystem Description Web-based Training - 3FL 10473 ACAB” or “Alcatel Base Station Subsystem Description - 3FL 10473 ACAA”.

Course contents:

Introduction

Functional Architecture

Hardware Architecture

Configurations

Objectives

Contract number :

Course title : Alcatel 9110-E Micro-BTS Description

Client (Company, centre) :

Language : dates from : to :

Number of trainees : Location :

Surname, First name :

Did you meet the following objectives ?

Tick the corresponding box

Please, return this sheet to the trainer at the end of the training

Instructional objectives	Yes (or Globally yes)	No (or globally no)	Comments
1 Identify the role and situation of the A9110-E µ-BTS			
2 Identify the functional subsets of the A9110-E µ-BTS			
3 Identify the hardware modules of the A9110-E µ-BTS			
4 Identify the possible hardware configurations			

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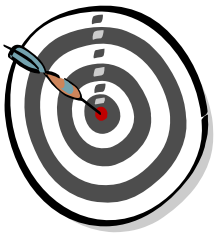
1 Introduction

Session presentation



- Objective : to be able to identify the role and situation of the A9110-E µ-BTS and to give the main characteristics and features of the A9110-E µ-BTS

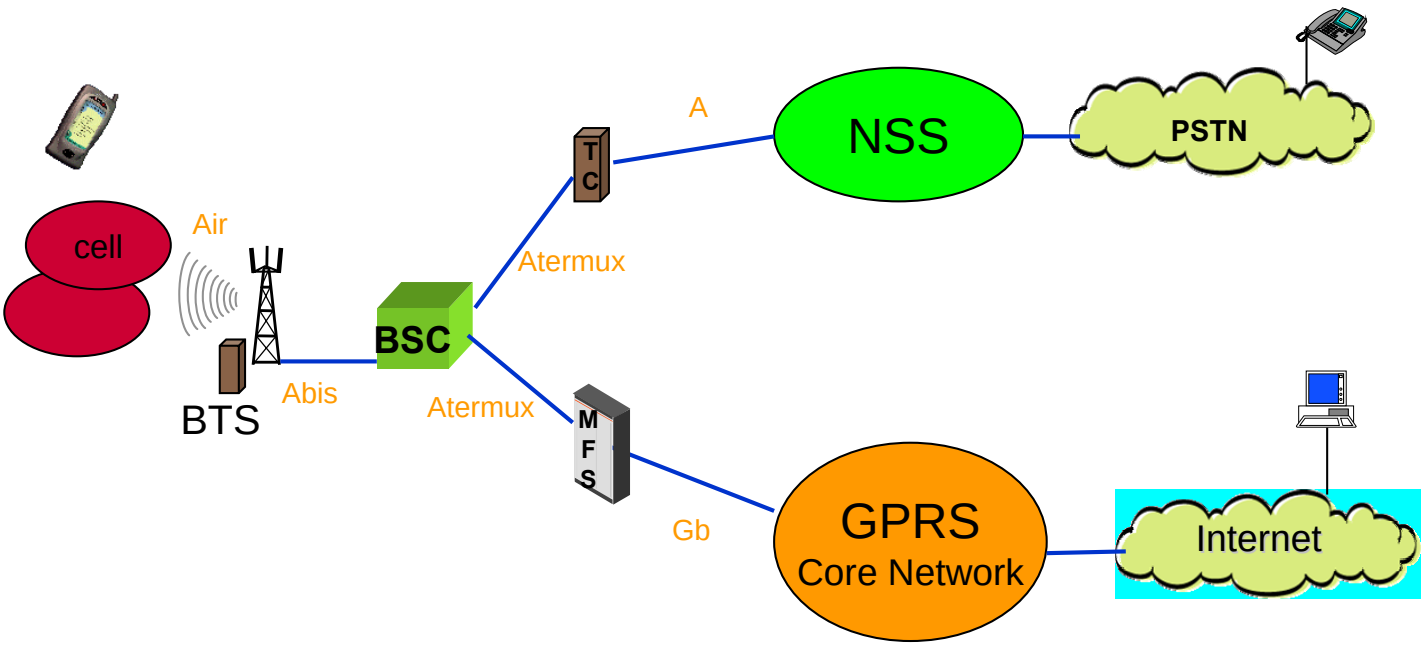
- Program :

1 Introduction

1.1 Situation of the Alcatel 9110-E µ-BTS

Situation of the Alcatel A9110-E µ-BTS

- Situation of the Alcatel A9110-E µ-BTS:



1 Introduction

1.2 Functions of the Alcatel 9110-E µ-BTS

Role of the Alcatel 9110-E µ-BTS

- Role of the Alcatel A9110-E µ-BTS:
  - The Alcatel 9110-E BTS provides two-way radio communication between the PSTN or the Internet world and mobile Stations located in a single GSM cell.
  - It provides the air interface with the mobile staions (MS) and the Abis interface with the Base Station Controller (BSC).

- The Alcatel 9110-E BTS can be considered as a radio relays between the subscriber's mobile station and the network.

1 Introduction

1.3 Main characteristics of the Alcatel 9110-E µ-BTS

Main benefits

Main benefits of the Alcatel 9110-E µ-BTS

- Adaptability :
  - Wall/pool and indoor/outdoor installation
  - Different TX power versions
  - integrated or remote antennas, ...
- Flexibility:
  - One-module concept (“Plug&Play”)
  - Online extension of modules (up to 12 TRE), ...
- Evolium BTS Architecture :
  - BTS auto identification
  - RF cabling detection
  - Remote inventory,...

- BTS auto identification:
  Auto identification is the capability of the BTS to recognise by it self:
  - For each managed module, both RIT type and RIT location,
  - The sector to which each ANC belongs to,
  - The mapping TRE/ANC
  - All the BTS HW and SW capabilities.

- RF cabling detection
  This feature allows the BTS to know how the modules in the BTS are interconnected.

  The RF cabling detection applies only to the RX cabling.The principle consists in sending, at OMU order, a low voltage DC signal to an ANx reception line, by means of the BCB (internal bus). The TRE(s) receiving this signal will then inform the OMU, specifying if the signal has been received on RXO or RX1. This detection needs to be performed at least at BTS start-up.

  The TX cabling is considered correct if the corresponding normal RX cabling is correct. This assumption is based on the usage of either bound cables (1 TX + 2 RX) and bound connectors.

- Remote inventory:
  Most of the information, mainly capabilities and module type versions are retrieved by the Remote Inventory function.
  Each RIT (replaceable item) stores inventory information (serial number, manufacturing and repair history, hardware capability...) in a flash EEPROM.
  These information are accessible from BTS terminal or from the OMC-R.

Radio performance

Radio performance 1/2:

- Frequency bands supported by the hardware:
  - GSM 850 band, Extended GSM 900
  - GSM 1800 band, GSM 1900 band
- Multiband capabilities
- Full Rate (FR) , Half Rate (HR) , Enhanced Full Rate (EFR), Adaptive MultiRate (AMR)
- Support several A5 Ciphering algorithms (A5/0, A5/1 and A5/2)
- Support for GPRS and EGPRS

- Frequency bands:
  - GSM 850: 824 MHz to 849 MHz (UL) / 869 MHz to 894 MHz (DL)
  - E-GSM 900 : 880 MHz to 915 Mhz (UL) / 925 MHz to 960 MHz (DL)
  - GSM 1800: 1710 MHz to 1785 MHz (UL) / 1805 MHz to 1880 MHz (DL)
  - GSM 1900: 1850 MHz to 1910 MHz (UL) / 1930 MHz to 1990 MHz (DL)
- Multiband capabilities
  - Multiband configurations are possible by using basic units of different bands in an Alcatel 9110-E µ-BTS. Each basic unit is a monoband one. The possible multiband operations are:
    - GSM 850 / GSM1800 , GSM 850 / GSM1900, GSM900 / GSM1800, GSM900 / GSM1900
- 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. 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.
- Support of GPRS and EGPRS.
  - GPRS with GMSK Modulation:
    On the radio interface, data can be coded according to 4 different coding schemes:
    (CS1->CS4) with CS1 offers a rate of 9.05 kbit/s and CS4 offers a rate of 21.4 Kbit/s.
  - EGPRS with both GMSK and 8-PSK Modulations:
    On the radio interface, data can be coded according to 9 different coding schemes:
    (MCS1->MCS9) with MCS1 offers a rate of 8.08 kbit/s and MCS9 offers a rate of 59.2 Kbit/s.
    GMSK modulation is used with MCS1-MCS4, 8-PSK modulation is used with MCS5->MCS9
  - GMSK modulation (frequency modulation with a constant envelope) encodes 1 bit per symbol whereas 8-PSK modulation (phase modulation with a non constant envelope) encodes 3 bits per modulated symbol.
    So 8-PSK has 3 times more capacity than GMSK.

Radio performance

Radio performance 2/2:

- Radio frequency performance:
  - Reference sensitivity higher than GSM requirement (-104 dBm)
  - TX output power:
    - 3 W < GMSK<7 W (single antenna)
    - 2 W < 8-PSK < 5 W (2 antennas)
- Radio frequency hopping
- Antenna diversity
- Low loss configuration:
  - 1 sector with 2 TREs, with antenna diversity
  - 2 sectors with 1 TRE in each sector, without antenna diversity

Frequency band Nb of antennas	TX output power, **GMSK**	TX output power, **8-PSK (EDGE)**
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, **GMSK**	Reference sensitivity, **8-PSK (EDGE)**
	- 110 dBm (static and dynamic) - 112 dBm (dynamic with diversity)	< -110 dBm, (static, MCS1) -106 dBm, (static, MCS5) -96 dBm, (static, MCS9)

- The TX output power depends on the frequency band, the modulation used and the type of antenna network (1 or 2 antennas)
- Radio (synthesized) frequency hopping:
  The goal is to avoid “gap” in frequency reception for the mobile.
  The principle is to switch on frequencies predefined in a list during radio transmission.
- Two frequency hopping 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 base band RF hopping mode: A cell with N TRXs can have all its N TRXs hopping on N frequencies.
- Antenna diversity:
  The goal is to avoid fading in the frequency reception for the BTS.
  The same signal with different multi-paths is received in the Base Station where it is processed within 2 independent chains : a Discriminator then identifies the best signal.
- Low loss configuration:
  The goal is to avoid the 3dB loss by passing a combiner.

1 Introduction

1.4 Main features of the Alcatel 9110-E µ-BTS

Main features of the Evolium µ-BTS

Main features of the Evolium µ-BTS

- BTS auto-tests
- Support the BTS auto identification
- SW download (from BSC to BTS) without service interruption
- Firmware downloading
- 2 Software versions kept in flash EEPROM's in MSUM

- Auto testing
  - Upon activation of the BTS, functioning status is given (all modules active, antenna equipped) via a LED included in the connection box.
- Auto identification 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 connected in master-slave mode (more than 2-TRX configuration) appears as one BTS with four or six TRXs, which can be assigned to different sectors or to the same one.
- Firmware downloading
  - All firmware (except the boot firmware) are locally downloadable from the maintenance terminal and/or from the OMC-R.
- Two SW version in flash EEPROM in SUM
  - To facilitate the software replacement

Main features of the Evolium µ-BTS

Main features of the Evolium µ-BTS

- On line extension / reduction of Alcatel 9110-E µ-BTS slave entities
- Minimized service interruption when switching to a new software version
- RSL and OML can be multiplexed in one TS on the Abis
- OML auto detection
- Fast restart after breakdown
- Frequency hopping

- OML auto detection:
  The BTS scans 31 TSs on the Abis link to detect where is located its own OML link.
- Fast restart after breakdown:
- The service interruption is minimized at initiation or restart: The Alcatel 9110-E micro Base Station 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.
- Synthesized frequency hopping
  - 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 base band RF hopping mode: A cell with N TRXs can have all its N TRXs hopping on N frequencies

Self-Assessment on the Objectives

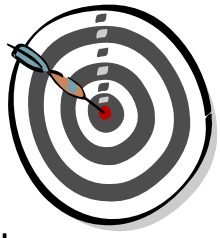
- Please be reminded to fill in the form *Self-Assessment on the Objectives* for this module
- The form can be found in the first part of this course documentation

- Objective: to be able to identify the situation and the main characteristics of the Evolium µ-BTS

-

2. Functional Architecture

Session presentation

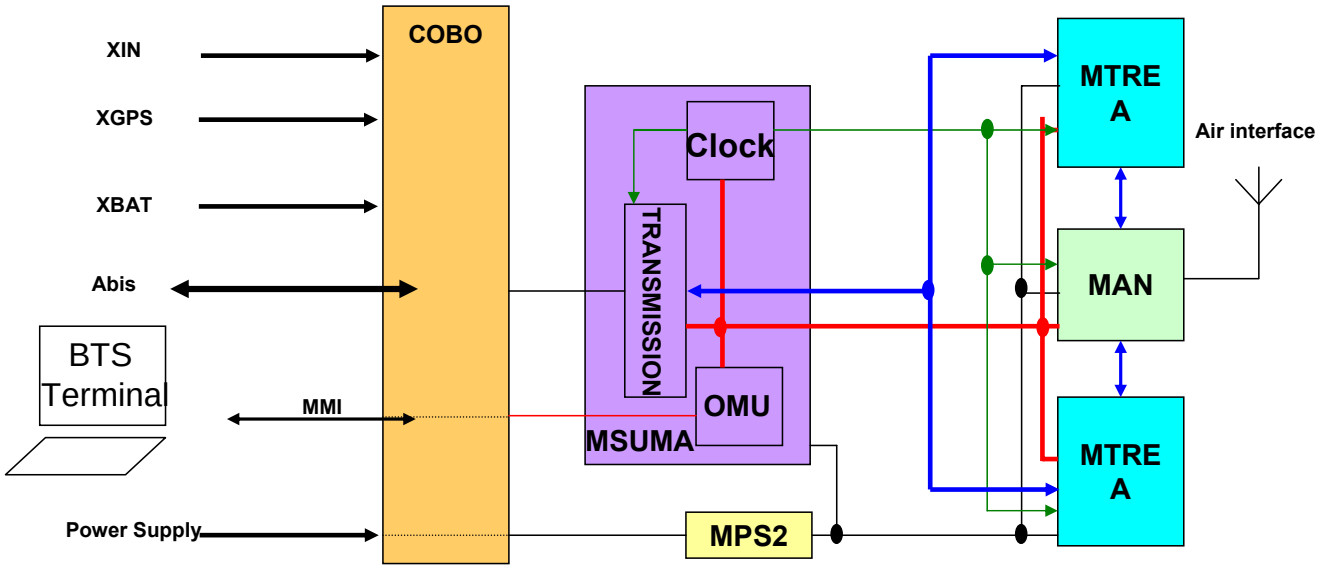


- Objective : to be able to identify the functional subsets of the A9110-E µ-BTS

- Program :

2. Functional Architecture

2.1 General functional view of A9110-E µ-BTS



COBO : Connection Box

MAN : Micro-BTS Antenna Network

MPS2 : Micro-BTS Power Supply

MSUMA : Micro-BTS Station Unit Module

MTREA : Micro-BTS Transmitter and Receiver Equipment

- Main Alcatel 9110-E Micro- BTS External Interfaces

  - Abis Provides a 2 Mbit/s link between the Alcatel 9110-E Micro-BTS and the BSC. The COBO provides two Abis Interfaces to allow connection to the BSC in a Multidrop configuration.
  - MMI Allows the connection of the BTS Terminal used for O&M configuration and telecommunications configuration.
  - XBAT Provides an asynchronous interface that is used to control an external battery backup unit.
  - XGPS Controls and supervises a GPS receiver which is used to synchronize the Alcatel 9110-E Micro-BTS. The interface also provides a 1 Hz or 10 MHz clock source that can be used in conjunction with the GPS receiver or independently.
  - XIN Provides eight alarms inputs.
  - Power Supply: The A9110-E µ-BTS supports AC (230V) or DC (300V)

2. Functional Architecture

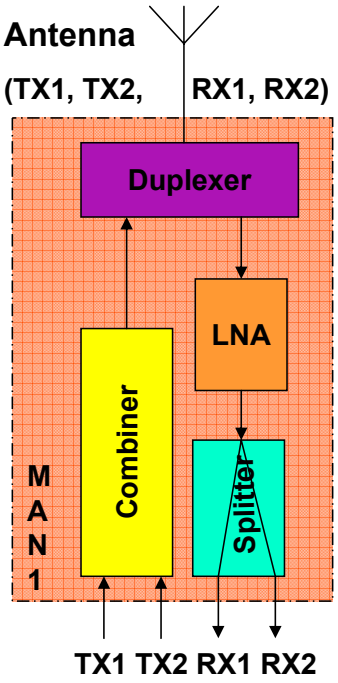
2.2 Antenna Network

Main functions

- The main functions of the MAN are:
  - in Downlink direction:
    - Isolation of the transmitters from the receivers
    - Combining the output of 2 transmitters to allow them to share a single antenna
    - Duplexing to allow transmitters and receivers to share the same antenna
  - in Uplink direction:
    - Pre-amplification to amplify the received signals and control the overall gain of the antenna network
    - Splitting to distribute the received signals to a pair of receivers.

MAN 1

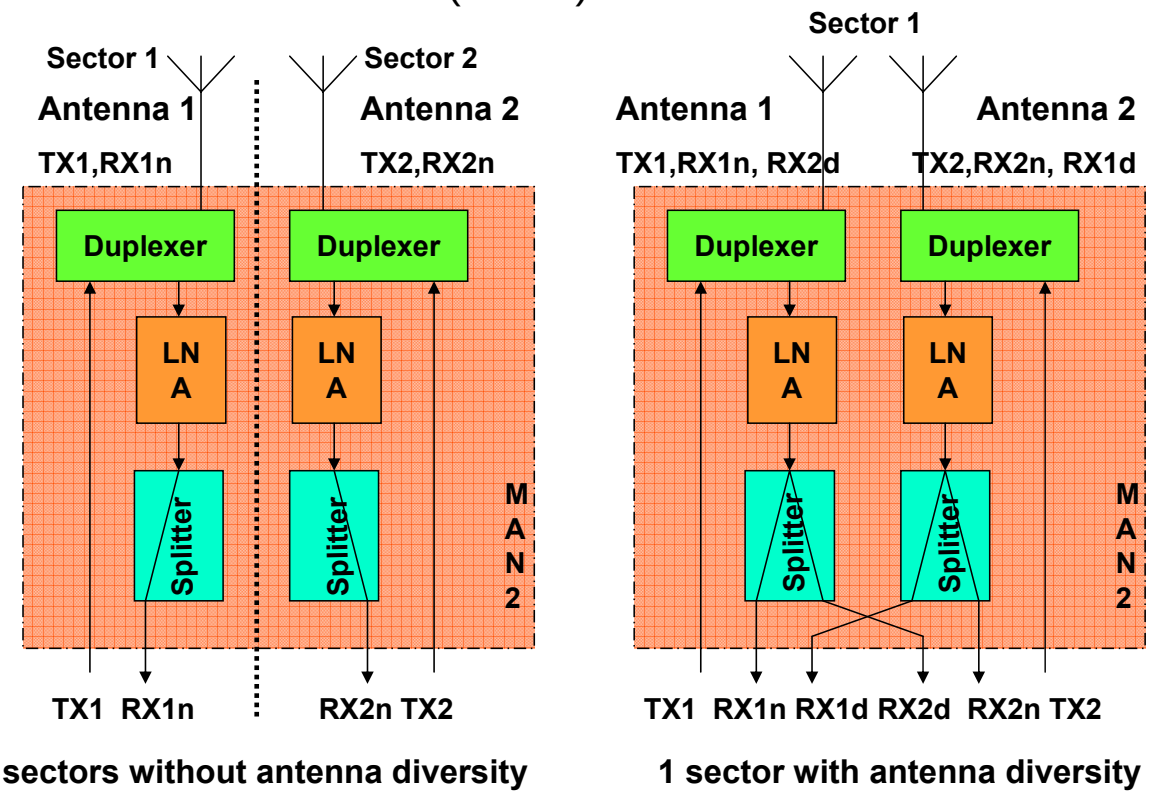
- There are two types of MAN module for the BTS Alcatel 9110-E µ-BTS.
  - Single-antenna (MAN1)



- Combiner
  - The Combiner concentrates two MTRE transmitter outputs into a single RF output, thus reducing the number of antennas required.
  - The Combiners in the MAN1 allow the outputs from two TRXs to be fed to a single antenna.
- Divider
  - The Dividers split and distribute the received RF signals from the antenna.
  - The MAN1 provides two outputs.
- Duplexer
  - The Duplexers provide the coupling function for the transmitted and received RF signals. Each duplexer provides a bi-directional signal path, allowing a single antenna to be used for the transmission and reception of uplink and downlink signals.
  - The Duplexer includes a filter unit to suppress spurious emissions and transmitter noise that could interfere with the receive frequency bandwidth.
- LNA
  - The LNA amplifies the received signals. It has a fixed nominal gain value. The LNA has an extremely low Noise Factor and good values for VSWR , compression and reliability.

MAN 2

- Low-loss architecture (MAN2)



- Splitter
  - The Dividers split and distribute the received RF signals from the antenna.
  - The MAN2 provides four outputs.
  - Rx1n for normal, Rx1d for diversity.

- Duplexer
  - The Duplexers provide the coupling function for the transmitted and received RF signals. Each duplexer provides a bi-directional signal path, allowing a single antenna to be used for the transmission and reception of uplink and downlink signals.
  - The Duplexer includes a filter unit to suppress spurious emissions and transmitter noise that could interfere with the receive frequency bandwidth.

- LNA
  - The LNA amplifies the received signals. It has a fixed nominal gain value. The LNA has an extremely low Noise Factor and good values for VSWR , compression and reliability.

2. Functional Architecture

2.3 Telecommunication

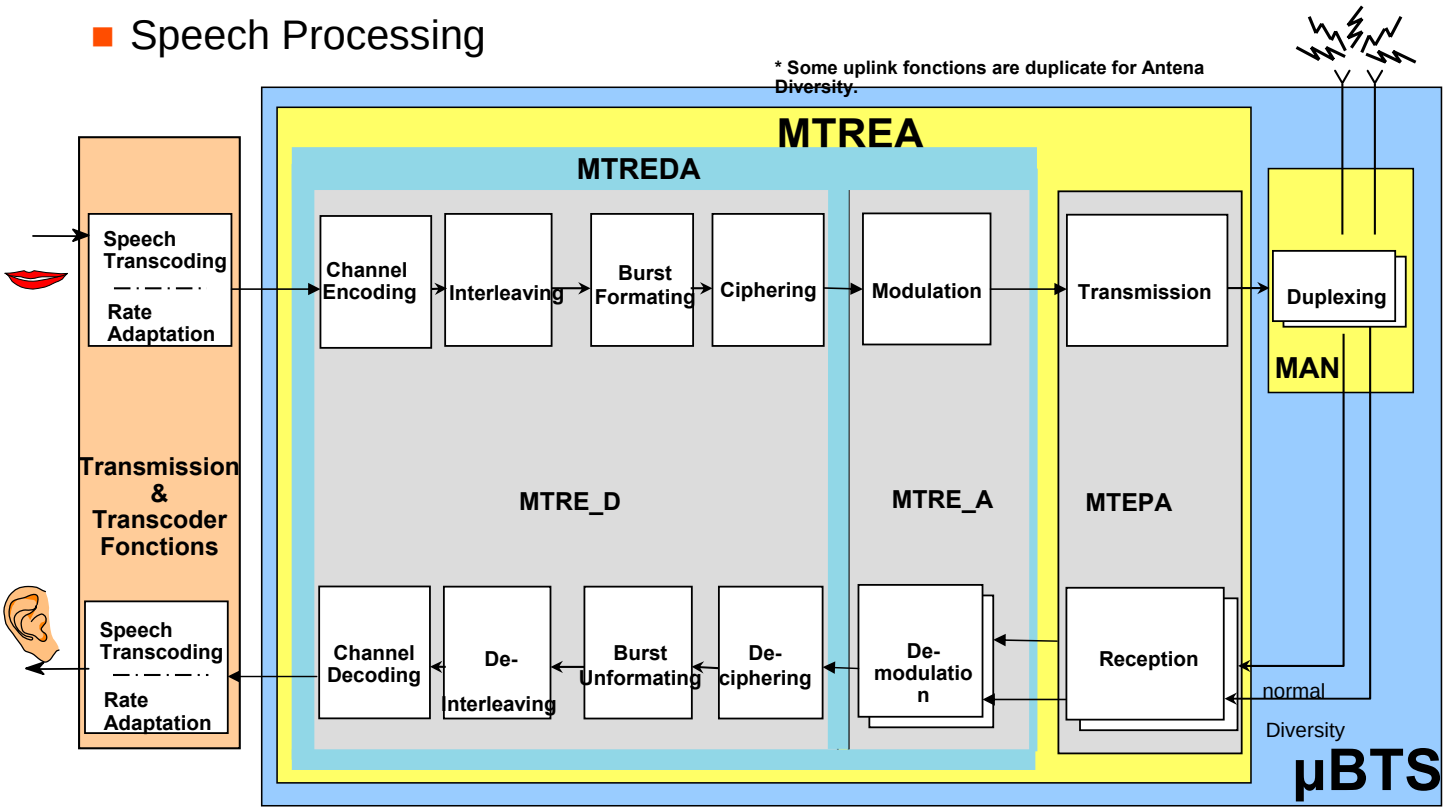
Functions

- The functions of telecommunication are divided in 2 parts :
  - Digital and analog part (MTREDA composed of MTRE_D and MTRE_A):
    - channel coding/decoding
    - interleaving/de-interleaving
    - encryption/de-encryption
    - GMSK/8-PSK modulation
    - radio frequency hopping
  - Amplification part (MTEPA)

- Digital and analog part:
  - Channel Encoding & Decoding
    - Produces a string of encoded TDMA bursts for transmission over the Air Interface
  - Interleaving / De-interleaving
    - Applied to improve the error detection rate
    - Except the burst which carries the BCCH
  - Encryption / Decryption
    - Used to protect the confidentiality of the messages on the Air Interface
    - Three options are possible in accordance with the GSM Rec. 03.20 :
      - Two algorithms A5/1or A5/2 for encryption
      - A5/0 no encryption
  - GMSK / 8-PSK modulation
    - adapts the infomation on the air interface.
    - GMSK modulation (frequency modulation with a constant envelope) encodes 1 bit per symbol.
    - 8-PSK modulation (phase modulation with a non constant envelope) encodes 3 bits per modulated symbol. So 8-PSK has 3 times more capacity than GMSK.
  - Radio frequency hopping :
    - this function is supported by 2 couples of synthesiser in RX and in TX.
    - The goal is to avoid “gap” in frequency reception for the mobile. The principle is to switch on frequencies predefined in a list during radio transmission.
- Two frequency hopping 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 base band RF hopping mode: A cell with N TRXs can have all its N TRXs hopping on N frequencies.
- Amplification part:
  - It is in charge of the power amplification of the RF from Analog part.

Functional architecture

Speech Processing



- Speech Transcoding
  - The TC performs speech transcoding on the TCH in both directions.
  - It realizes the coding of the TCH by TCH/F or TCH/H
- Rate adaptation
  - Adapts the TC data rate to the speech frame format used on the Air Interface
  - 64 kbps to 16kbps (vice-versa).

2. Functional Architecture

2.4 Operation and maintenance

Functional architecture

- The O&M functions monitor and control the operation of the BTS.
- The O&M functions can be split in 3 parts:
  - Configuration Management
  - Fault Management
  - External Alarm Handling.
- A terminal connected via an MMI is used for local operator control of the BTS.

- The O&M functions exchange information and command messages with different parts of the BTS, and with the BSC. This allows the O&M functions to monitor and control the operation of the BTS.

Configuration Management

- The Configuration Management Function handles the following tasks:
  - Central command Control
  - Configuration / Initialisation
  - File Handling
  - Data base
  - Remote Inventory and RF Cabling Detection
  - Live Insertion and Removal of modules
  - Hardware extension / Reduction

- Central Command Control
  - GSM function-level configuration commands from the BSC or operator are translated to low-level commands for the relevant BTS modules.
- Configuration/Initialisation
  - Software initially downloaded from the BSC to the O&M functions is subsequently downloaded to the other BTS modules. The O&M functions configure each BTS modules, and report start-up test result to the BSC.
- File Handling
  - Up to two versions of the downloaded software can be stored in memory at any one time. This allows the software to be downloaded without service interruption.
- Remote Inventory & RF Cabling Detection
  - The O&M functions can interrogate the hardware to determine which modules are installed and how they are connected.
- Live Insertion and Removal of Modules
  - All modules can be inserted or removed from the BTS while power is connected.
- Hardware Extension/Reduction
  - Additional modules can be added to the existing configuration and then the BTS is reconfigured under BSC control.

Fault Management

- The Fault Management Function handles the following tasks:
  - Alarm detection and Correlation
  - Alarm Reporting
  - Alarm Translation
  - Module Power Supply Control

- Alarm Detection & Correlation
  - Detects and filters alarms to prevent the generation of multiple fault report from a single source of failure
- Alarm Reporting
  - Forwards alarms to the BSC for processing
- Alarm Translation
  - Translates alarms to a GSM function_level format, independent of hardware and software versions.
- Modules Power Supply Control
  - Module power on/off is controlled by the O&M function via the BCB Interface.

External Alarm Handling

- External Alarm Connections provide a mechanical/electrical interface between the Dedicated Alarm and Control Handling function.

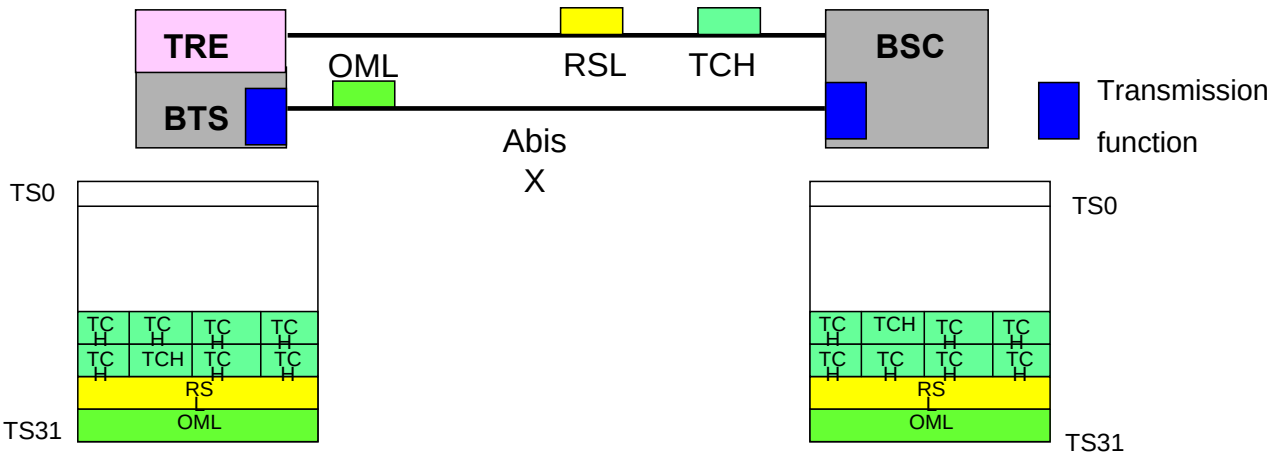
- External alarms:
  - Each basic unit provides eight external alarm inputs. The connectors are located on the connection box.
  - In a site configuration where several basic units are interconnected, it is possible to use the external alarms of the master and of the slave basic units. Then the number of external alrms inputs regarding the whole micro BTS site configuration can grow up to 48, depending on the number of basic units.

2. Functional Architecture

2.5 Transmission

Functional architecture

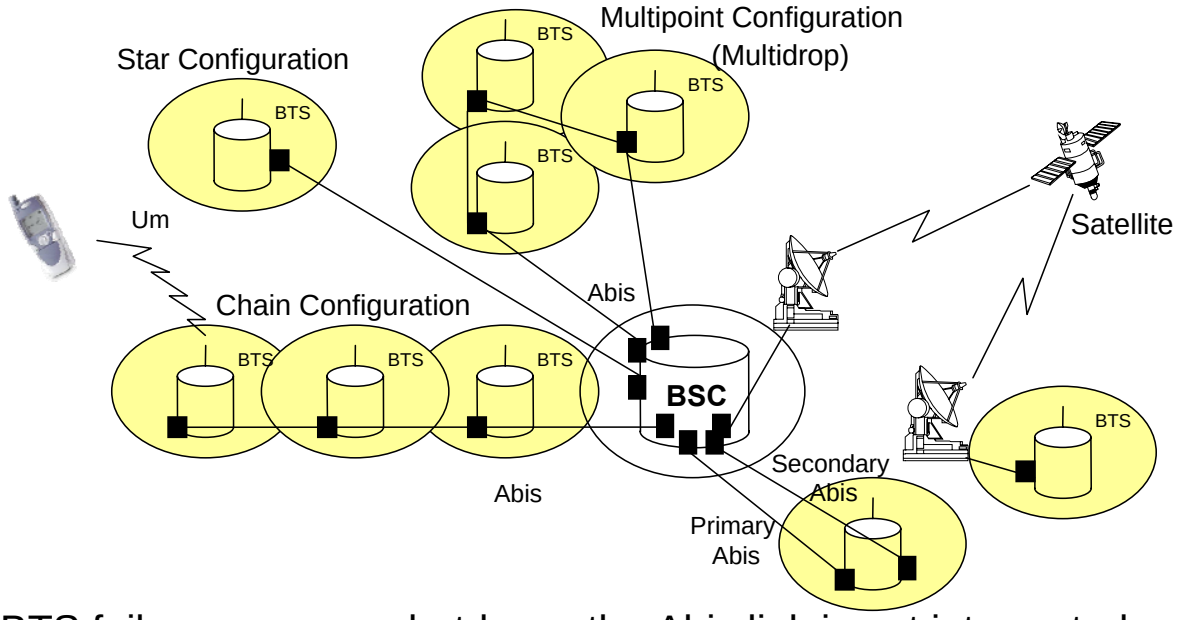
- To ensure the connection of the µ-BTS to the BSC, both are connected by an Abis interface at 2 Mbps.
  - This interface is supervised by transmission functions at BTS and BSC side
  - This interface handles the transfer of traffic and signalling data



- To minimize transmission cost, all uplink/downlink traffic and control data between the BTS and BSC is carried on a single Abis Interface.
- Within the BTS the Abis Interface uses the following links to handle the transfer of traffic and control data between the BTS transmission functions and the BTS components:
  - Data
  - LAPD RSL - for application messages
  - LAPD OML - for operation and maintenance messages
- The 2 Mbps bandwidth of the Abis Interface is used as 32 time slots, each of 64 kbps. These 32 time slots comprise one CCITT G703/704 frame.
- The transmission functions at BTS and BSC multiplexe and de-multiplexe the data onto the Abis interface

Topology

- Topology possible with the A9110-E µ-BTS



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

- STAR topology: One PCM link connects only One BTS to BSC.
- Open Multi-drop topology “CHAIN”: One PCM link connects up to 15 BTS (only 1 TRE for each BTS and using the 16 Kbps Statistic multiplexing) in serial order and the PCM is not looped back to BSC by the last BTS.
  - In chain topology, the BSC is connected with Abis link to a BTS. This one is connected to a second BTS with a second Abis link, the second BTS is at its turn connected to a third one and so on.
- Closed Multi-drop topology “RING”: One PCM link connects up to 7 BTS in serial order and the PCM is looped back to BSC by the last BTS.
  - In ring or loop topology, the last BTS of a chain is connected back to the BSC. This topology offers some security since traffic between any BTS and BSC is broadcast on the two paths, selection is based on dedicated Service bits / bytes.
- Abis via satellite : BTS on satellite Abis links have the increased timers.(from B7)
- To increase the data throughputs (GPRS and EGPRS) over radio interface some Extra TS are needed. They can be present on the primary Abis which carries the Basic Time slots, but in case of full abis, another abis called Secondary abis can be added on the BTS. (The secondary Abis carries only Extra TS).

Signalling & traffic

- Signalling
  - Signalling frames are sent
    - via the RSL between the BSC and the baseband functions
      - One RSL is required for each BTS carrier
    - Via the OML between the BSC and the O&M functions
      - Only one OML is used by BTS
- Traffic
  - Time slots not used for signalling information are available to carry traffic. For this purpose, each 64 kbps slot is divided into four 16 kbps nibbles.
    - For TCH/F each time slot is shared between four full rate TCHs
    - For TCH/H each time slot is shared between eight half-rate TCHs

- To optimise the number of time slots on the Abis link, it 's possible to multiplex the signalling on a 64 Kbit/s.
  - No abis signalling multiplexing: each RSL has one 64 Kbits/s PCM channel.
  - The Abis static signalling multiplexing: the RSLs of 4 TRXs are submultiplexed on one 64-kbits/s PCM channel.
  - The Abis statistical signalling multiplexing on 64 Kbit/s channel: it enables the use of one to four RSLs and the OML on the same 64-kbits/s PCM channel.
  - The Abis statistical signalling multiplexing on 16 Kbits/s channel: it enables the use of one RSL and the OML on the same 16-kbits/s PCM channel.

2. Functional Architecture

2.6 Clock and power supply

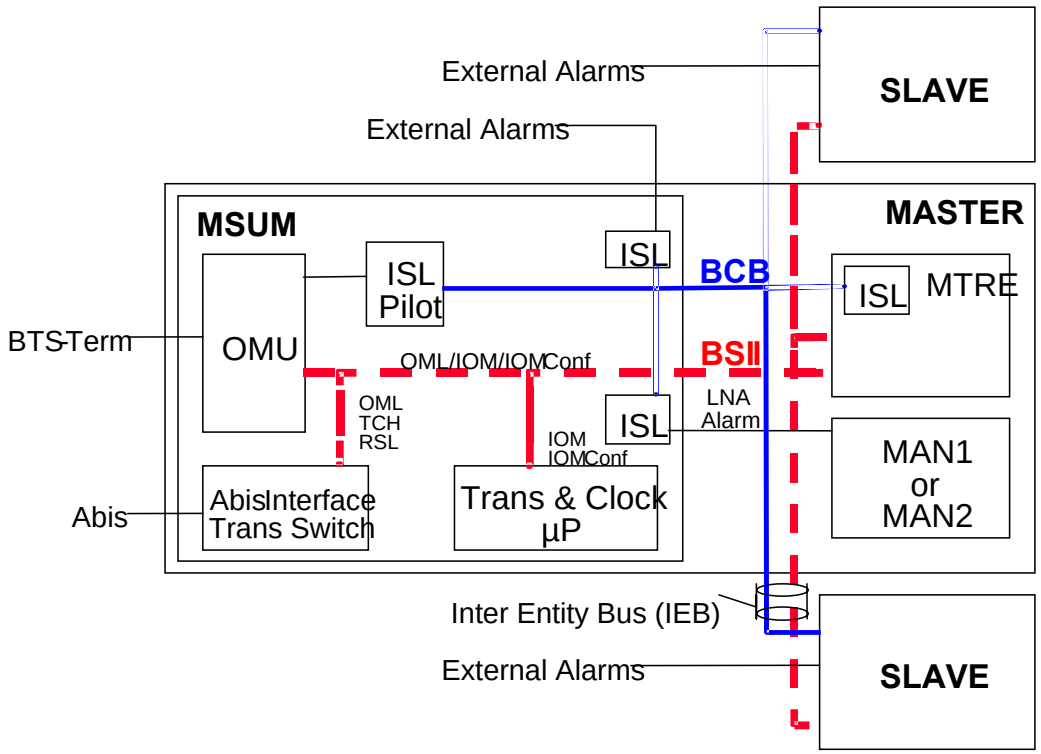
- The functions of the clock are:
  - Master clock generation
    - from an external clock
      - Abis link (PCM synchronised)
      - satellite
    - from an internal clock (free running)
  - Timing signal generation
  - Clock distribution
- The functions of the power supply are:
  - rectifying
  - power distribution

- Functions of the clock:
  - Reference clock Generation
    - The A9110-E BTS clock is derived from a 13 MHz master reference frequency. The master frequency is generated by the master frequency generator. This is a high stability oscillator.
    - The internal 13 MHz master frequency can be either free-running, or synchronized to the PCM clock on the Abis Interface. If the free-running mode is used, the BTS internal clock requires yearly calibration.
    - Additionally, an external clock synchronization signal for the BTS can be provided by the XGPS option. This signal can be used to replace the PCM synchronization from the Abis Interface.
  - Timing Signal Generation
    - From the 13 MHz reference signal, the following slower synchronization clocks are derived by a process of frequency division:
      - 2.167 MHz OBCLK
      - 216.7 Hz FCLK with Frame Number multiplexed.
  - Clock Distribution
    - The Clock Distribution function distributes the synchronization clocks in the BTS.
- Functions of the power supply:
  - The A9110-E µ-BTS supports:
    - AC : 230 V (range from 170 V to 270 V)
    - DC : 300 V (range from 240 V to 357 V)
  - The function is to rectify the voltage and distribute the power in the BTS.

2. Functional Architecture

2.7 Remote Inventory and BSII interface

Functional architecture



- Remote inventory and BSII interface
  - The remote inventory system allows to store information as :
    - Serial number, Identification, Manufacturing, commissioning and repair dates, Site and customer names, configuration ... in EEPROM placed in the different modules of the equipment.
    - These information are accessible from BTS terminal or from the OMC-R.
  - These EEPROM are managed by specific components (ISL) themselves controlled trough a BCB Bus.
  - Some alarms as External or Power supply alarms are also controlled by ISL and BCB.
  - All other useful information as traffic, signalling or control (TCH, RSL, OML, ...) use only one BSII bus.
  - In case of Master Slave configurations, Bsii and BCB are multiplexed in a specific Inter Entity Bus

Self-Assessment on the Objectives

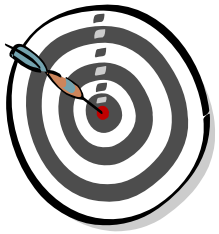
- Please be reminded to fill in the form *Self-Assessment on the Objectives* for this module
- The form can be found in the first part of this course documentation

- Objective: to be able to identify the functional subsets of the µ-BTS

-

3. Hardware Architecture

Session presentation



- Objective : to be able to identify the hardware modules of the A9110-E µ-BTS

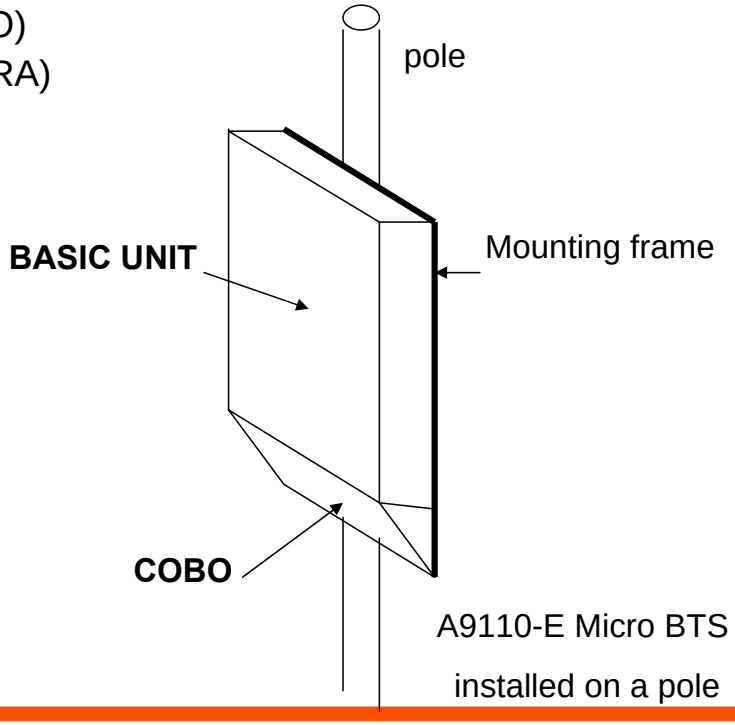
- Program :

3. Hardware Architecture

3.1 General architecture view of A9110-E µ-BTS

Hardware Architecture

- The Alcatel A9110-E µ-BTS is composed of :
  - 1 Basic unit (MB5x or DB5x)
  - 1 Connection box (COBO)
  - 1 Mounting frame (MOFRA)



- MOCO=MOFRA+COBO

3. Hardware Architecture

3.2 Basic unit

Hardware Architecture

- The Basic unit is composed of:
  - 1 MSUMA
  - 2 (MTREDA and MTEPA)
  - 1 MAN1E or 1 MAN2E
  - 1 MPS2

The Basic unit is considered as a RIT:

If one element of the board is faulty

the basic unit has to be replaced

- According the frequency band and the type of MAN, the basic unit has a specific name:

Basic unit	Description
MB5**E**	**E**GSM **900**, No Diversity
MB5**D**	GSM **1800**, No Diversity
MB5**P**	GSM **1900**, No Diversity
MB5**L**	GSM **850**, No Diversity

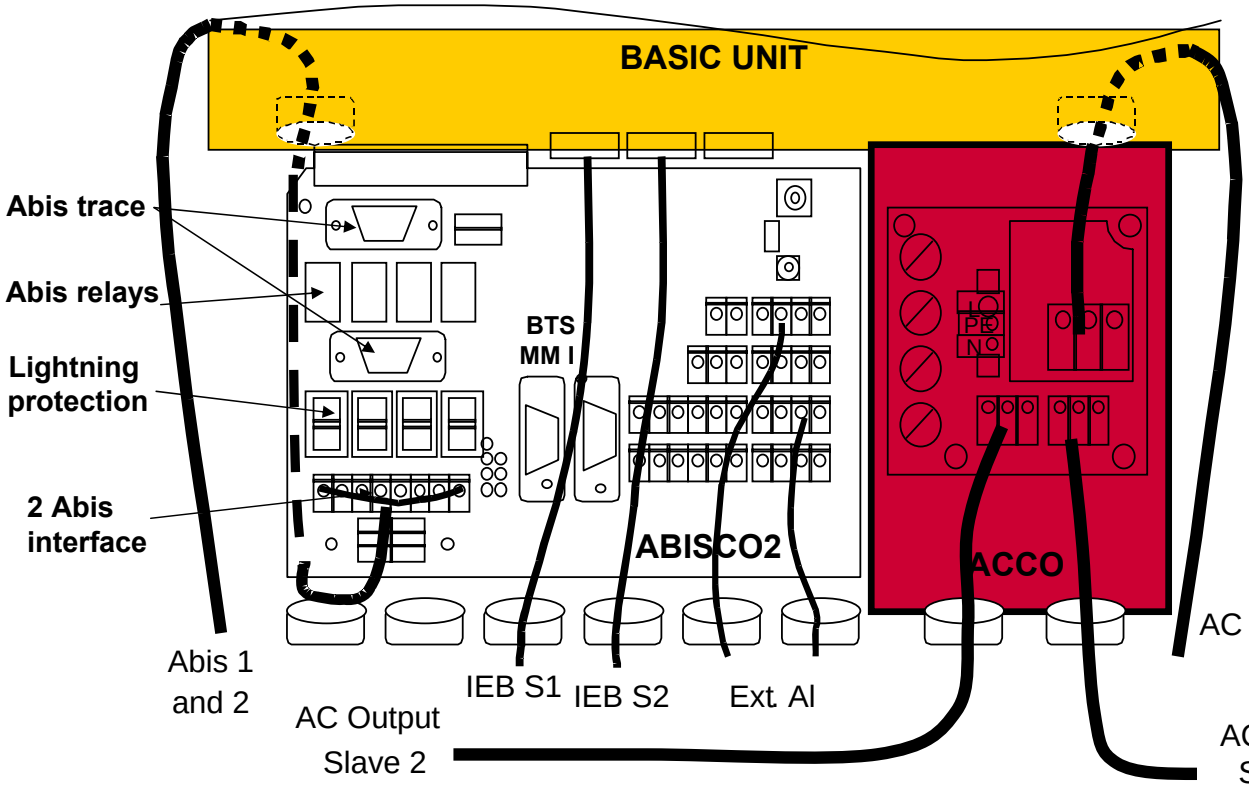
Basic unit	Description
DB5**E**	**E**GSM **900**, with Diversity
DB5**D**	GSM **1800**, with Diversity
DB5**P**	GSM **1900**, with Diversity
DB5**L**	GSM **850**, with Diversity

- RIT: Replaceable Item
- The name of the RIT is written on the side of the basic unit.
- Diversity meaning:

Frequency band Nb of antennas	TX output power, **GMSK**	TX output power, **8-PSK (EDGE)**
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

3. Hardware Architecture

3.3 Connexion box (COBO)

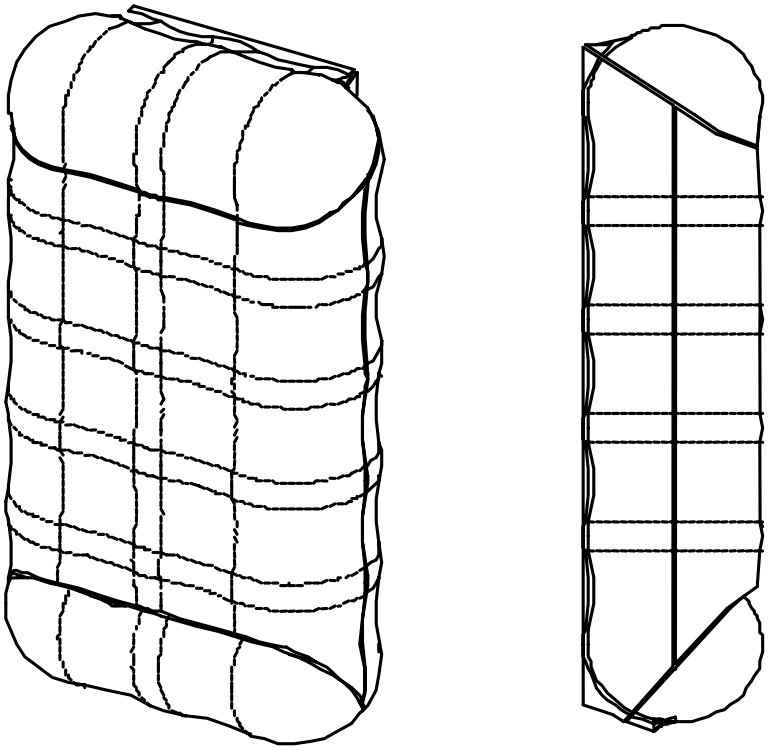


- Connexion box (COBO) :
  - The connection box is made of one waterproof area.
  - It is divided into two separate chambers.
    - One contains the ABISCO2 board which interconnect the Alcatel 9110-E to the Abis link and provides the external alarms and the test interfaces.
    - The second chamber provides the interconnection to mains (or site support cabinet for power) and distributes the power to the slave BTSs and to the external top fan. The ACCO board provides all external I/O within this chamber.
  - The COBO provides a set of clamp strips and connectors for the connexions to the outside and is linked to the MSUMA and the power supply MPS. This area can be divided into 3 subsets of connectors:
    - Power Supply AC clamp strips including protection and connector for top fan unit.
    - Access to Abis 1 and 2 and overvoltage protection.
    - Remote interfaces to provide external access to the MSUMA (external alarms, inter-entity bus, MMI, ...).
- Power supply
  - The Alcatel 9110-E Micro-BTS 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.
- Descriptions of main interfaces:
  - Abis trace: This interface is used to trace messages over the abis interface in operating mode
  - BTS MMI: This serial interface is used for O&M and transmission purposes.
  - External alarms:Eight lines are available to connect external alarms input.
  - IEB: Inter Entity Bus is used for connecting master and slaves units only.
  - External power supply: The external power supply is applied to the master unit only. Distribution to any slave unit is achieved using additional cables.

3. Hardware Architecture

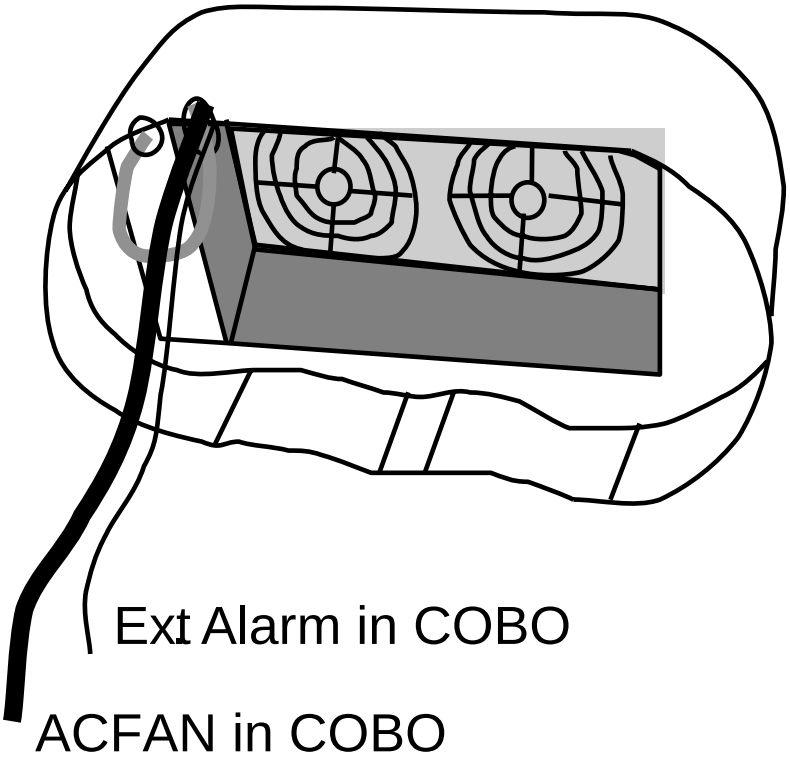
3.4 Options

Protection Cover



- 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 unauthorised access.
  - 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.

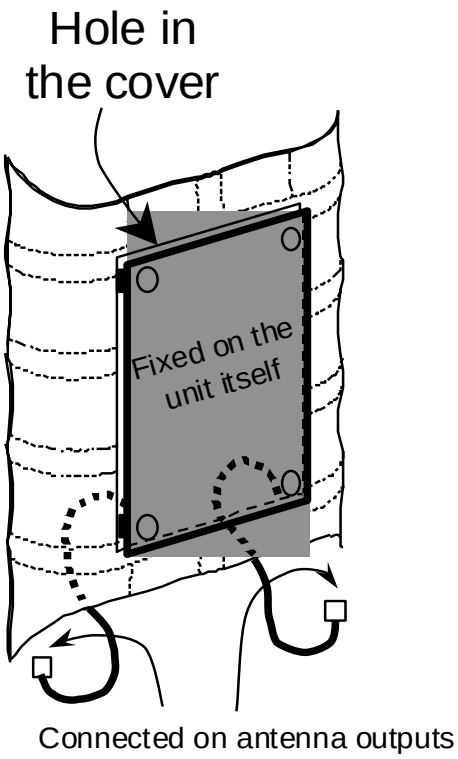
Integrated FANS



- Integrated fans

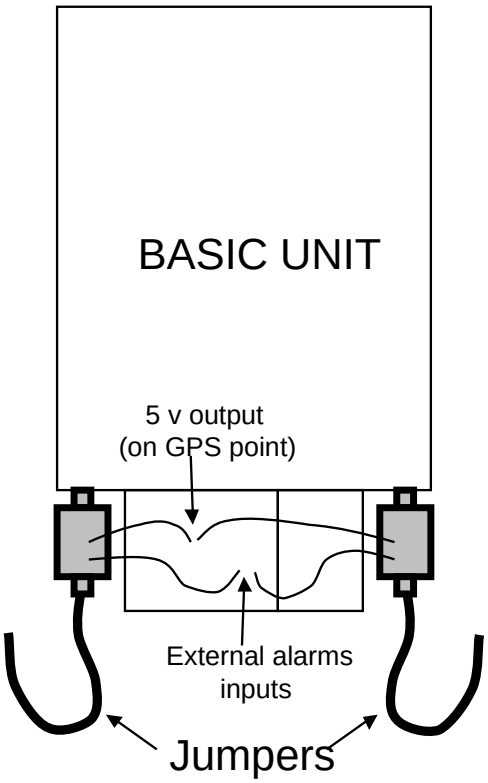
  - The standard product is designed to support temperature up to +45°C.
  - Fans are added for temperature up to +55°C.
  - This option is a special top cover including:
    - a fan cassette (with 2 fans)
    - a fan control board
    - AC and alarms cables
  - The speed of the fans is controlled depending on the temperature. In case of failure, an external alarm is sent to 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 fans.

Integrated antenna



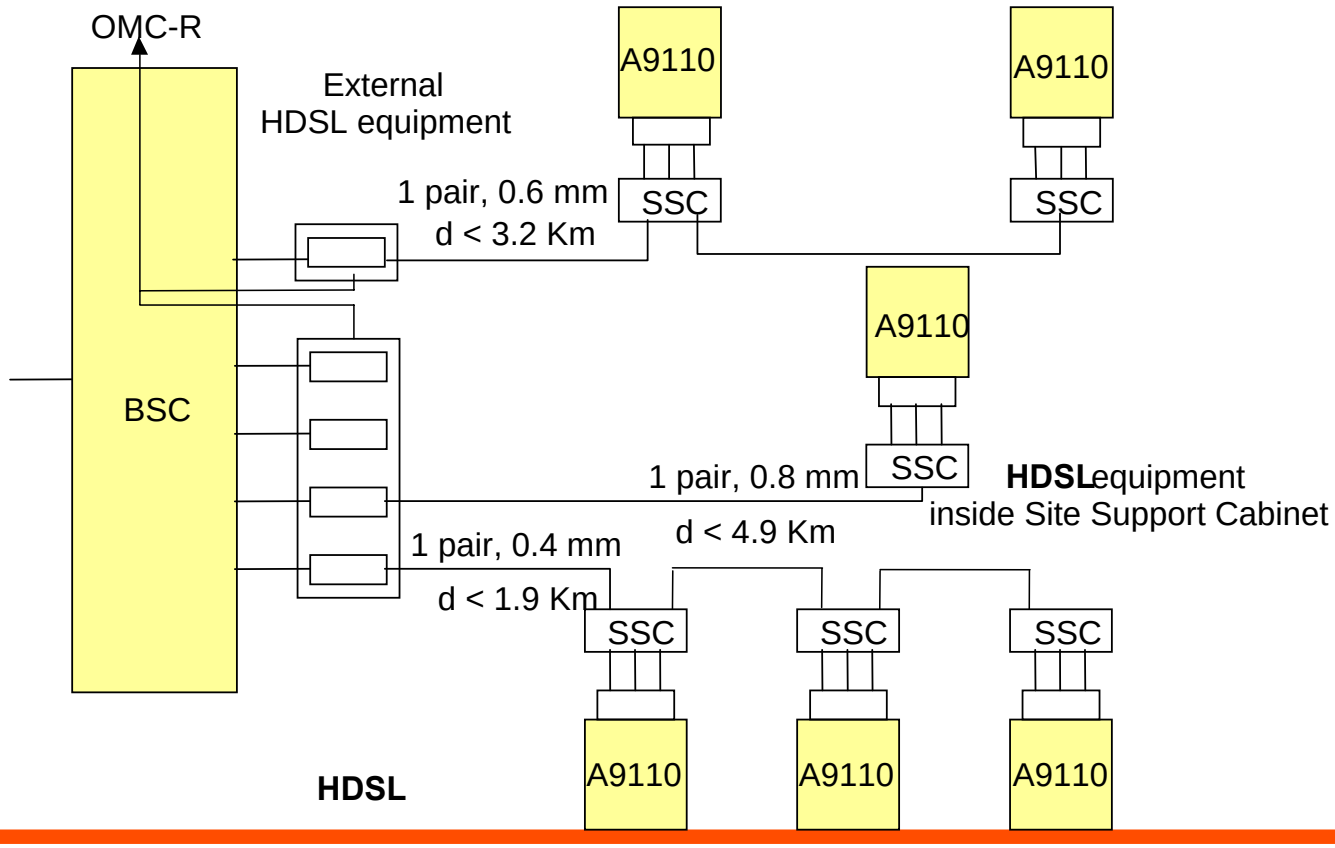
- Integrated antenna
  - The integrated antenna is possible only in low-loss configuration.
  - If a basic unit of micro BTS uses integrated antenna, then all other basics units must use integrated antenna.
  - Integrated antennas use the same connector as external antennas.
  - It’s mounted on the front face of the basic unit.
  - A special cover is required for this option.

VSWR Detectors



- VSWR(Voltage Standing Wave Ratio) Detectors
  - The return loss of the transmitted signal can be measured at the antenna connector thanks to the VSWR meter option.
  - It's a separated device which is introduced between Antenna connector and the antenna feeder therefore located inside the protection cover.
  - These detectors must be powered (GPS 5V on ABISCO) and connected to external alarms following installation procedure.
  - This option is possible and available in EGSM900. It's not possible to use it together with the integrated antenna option.

HDSL Equipment



- Site Support Cabinet (SSC):
  - The SSC is an optional unit which can be added on the micro BTS site, independently of the TRX capacity (up to 12 TRX). It consists of a separate outdoor cabinet which provides accomodation for battery backup and for external equipment.
  - HDSL is possible as an external modem within the SSC.
  - It is compatible with standard Alcatel HDSL equipment at BSC side.
  - Thanks to this transmission solution, the maximum distance between Micro-BTS and line terminal is improved. Standard one-pair copper line (0.4 mm to 0.8 mm) is used.

Self-Assessment on the Objectives

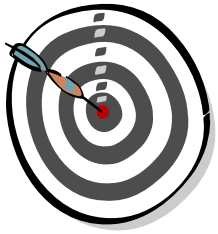
- Please be reminded to fill in the form *Self-Assessment on the Objectives* for this module
- The form can be found in the first part of this course documentation

- Objective: to be able to identify the hardware modules of the µ-BTS

-

4. Configurations

Session presentation



- Objective : to be able to identify the possible hardware configurations

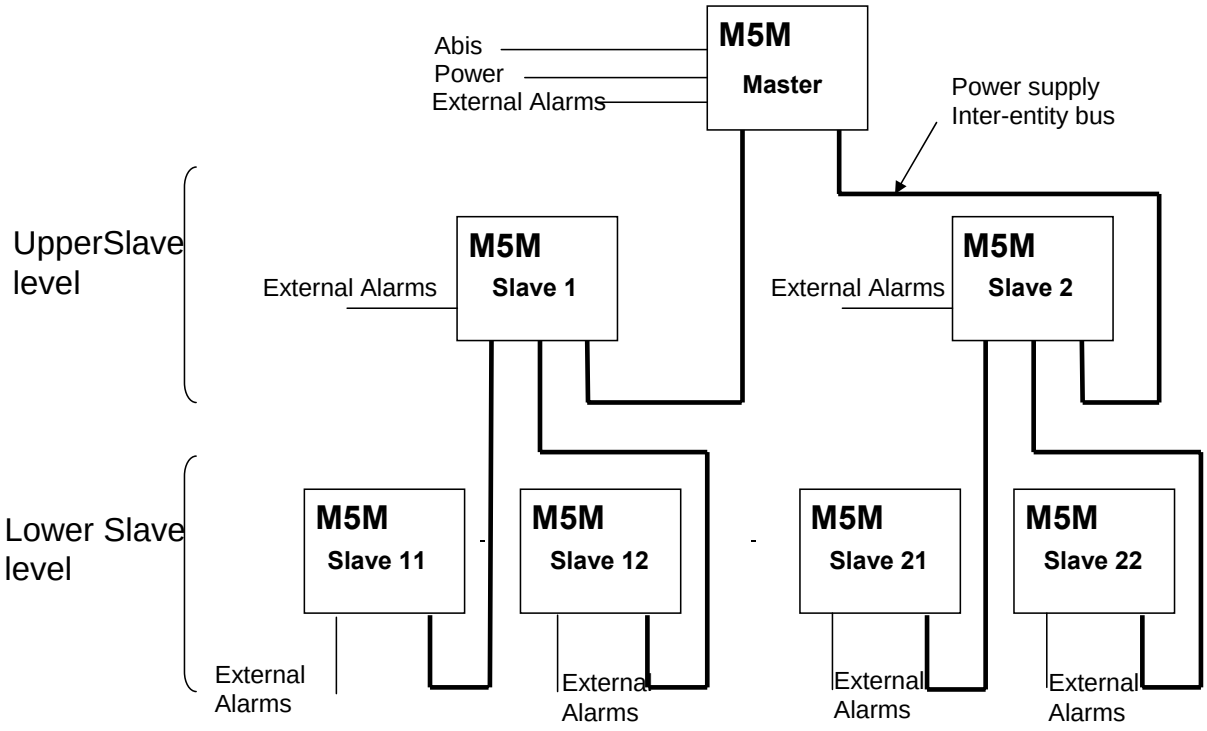
- Program :

4. Configurations

4.1 Site configuration

Configurations

- The maximum capacity is 6 basic units for one 12 TRX



- 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.
- 4 configurations are defined for pure M5M and M4M/M5M mixed configurations:
  - Maximum 3 hierarchy levels (Master, Upper and lower slave) allowed
  - M5M must be taken as Master in M4M/M5M mixed configuration
  - M4M not possible in lower slave position
  - Each M4M as upper Slave terminates the Master-Slave-Link (inter Entity Bus - IEB)

4. Configurations

4.2 Basic configuration

Possible configurations of the Evolium A9110-E Micro BTS

- Possible configurations of the Evolium A9110-E Micro BTS

Description	Antenna network architecture	No. of Antennas
GSM 850 2TRX	Single Antenna	1
GSM 850 2TRX	Low loss	2
GSM 900 (EGSM band) 2TRX	Single Antenna	1
GSM 900 (EGSM band) 2TRX	Low loss	2
GSM 1800 2TRX	Single Antenna	1
GSM 1800 2TRX	Low loss	2
GSM 1900 2TRX	Single Antenna	1
GSM 1900 2TRX	Low loss	2

4. Configurations

4.3 Single antenna configuration

Single antenna configuration

- Single antenna configuration

A 9110-E single antenna configurations	1sector	2 sectors	3 sectors
No. of TRX	Up to 12	Up to 6 TREs per sector	Up to 4 TREs per 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	Deduced from basic unit choice	Deduced from basic unit choice	Deduced from basic unit choice

4. Configurations

4.4 Low loss configuration

Low loss configuration with antenna diversity

- Low loss configuration with antenna diversity

A 9110-E low loss configurations with antenna diversity	1sector	2 sectors	3 sectors
No. of TRX	Up to 12	Up to 6 TREs per sector	Up to 4 TREs per 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	Deduced from basic unit choice	Deduced from basic unit choice	Deduced from basic unit choice

- The exact number of antennas depends on the use of panel/ cross-polarized/integrated antennas.

4. Configurations

4.5 Multiband configuration

Multiband BTS without multiband cell configurations

- Multiband BTS without multiband cell configurations-Dual BCCH sectors may be either GSM 850, GSM 900, GSM 1800 or GSM 1900
  - Example: up to maximum 6 sectors configurable

A 9110-E multiband BTS configuration	3 sectors x 2 TRX in Band 1 3 sectors x 2 TRX in Band 2
No. of TRX	Band 1: 6 TRX (3x2) Band 2: 6 TRX (3x2)
No. of basic units per sector	Band 1: 3 basic units Band 2: 3 basic units
No. of antennas	Deduced from basic unit choice
TX output power	Deduced from basic unit choice

- A micro-BTS can be composed of basic units of each band. Both bands are assigned in different sectors (one BCCH for each band-dual BCCH) or in the same sector (one BCCH for both bands-single BCCH).

- Both antenna network types (low loss and single antenna) are possible in multiband configurations.
- A mix of low-loss and single antenna networks in the same configuration (same sector) is not allowed.
- Multiband Configurations:
  - Multiband BTS without multiband cell configurations-Dual BCCH:
    - The sectors may be either GSM 850, GSM 900, GSM1800 or GSM 1900.
  - Multiband BTS with multiband cell configurations-single BCCH:
    - The possible multiband BTS with multiband cell configurations will be defined in further step.

Self-Assessment on the Objectives

- Please be reminded to fill in the form *Self-Assessment on the Objectives* for this module
- The form can be found in the first part of this course documentation

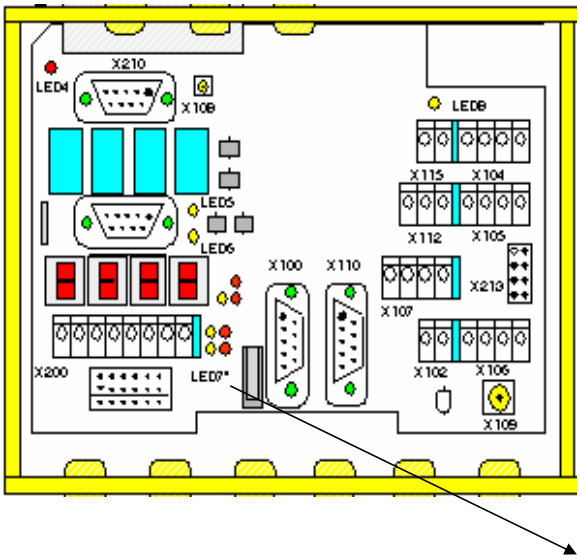
- Objective: to be able to identify the possible hardware configurations of the µ-BTS

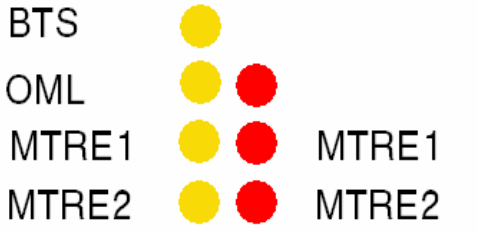
■

5. Appendix and Glossary

LEDs meaning and connector details

- Mechanical assembly of ABISCO2





LEDs meaning and connector details

LED			Available in mode		Driven by	Meaning				
No	**Name**	**Color**	**Master**	**Slave**		**Indicates**	**LED on**	**LED off**	**LED normal blinking**	**LED special blinking**
8	MPS ON	yellow	X	X	Hardware	the power status of the entity	power presence	no power presence or LED failure	-	-
4	BTS_OK	green	X	-	MSUM	the readiness of MSUM / MSUMA communicate with the BTS terminal	ready to communicate with the BTS terminal	not ready to communicate with the BTS terminal or LED failure	-	-
5	Abis 1 status	yellow	X	-	TRANS & CLOCK (of the master BTS)	the status of the considered Abis link for TRANS & CLOCK	Abis link connected	Abis link disabled by Qmux (not used) or MSUM / MSUMA deactivated (for slave BTS)	failure detected on Abis link	-
6	Abis 2 status									

LEDs meaning and connector details

LED			Available in mode		Driven by	Meaning				
No	**Name**	**Color**	**Master**	**Slave**		**Indicates**	**LED on**	**LED off**	**LED normal blinking**	**LED special blinking**
7*	OML	yellow	X	-	MSUM / MSUMA	the status of the OML link	OML connected	OML disconnected	transient state during attemp to establish the OML connection	-
	BTS	red	X	-	MSUM	the presence of alarms for the BTS	fatal alarm present	no alarm or MSUM deactivated	Non fatal alarm present	OCXO warm up (LED 3 off 0.3 s on period)
	MTRE1	yellow	X	X	MSUM of the master BTS via BSC terminals	state of the considered MTRE	MTRE powered and operational	MTRE not powered	MTRE is powered but not operational	-
	MTRE2									
	MTRE1	red				the presence of alarms for the considered MTRE (if the red LED is on, the yellow one is switched off)	fatal alarm present or module out of order	no alarm present	Non fatal alarm present	-
	MTRE2									

Glossary

A	Interface between TC and NSS			
ABIS	Interface between the BTS and The BSC			
AC	Alternating Current			
AN	Antenna Network			
Atermux	Interface between BSC and TC or MFS			
BSC	Base Station Controller			
BTS	Base Transceiver Station			
CCITT	International consultative committee on telecommunications and Telegraphy			
COBO	Connection Box			
DC	Direct Current			
DCS	Digital Cellular System			
DR	Dual Rate			
EEPROM	Electrically Erasable Programmable Read Only Memory			
EFR	Enhanced Full Rate codec			
E-PGSM	Extended-band GSM			
FR	Full Rate			
Gb	Interface between the equipment supporting the PCU function and the GPRS Core Network			
GMSK	Gaussian Minimum Shift Keying modulation			
GPRS	General Packet Radio Services			
GSM	Global System for Mobile Communication			
HDSL	High speed Digital Subscriber Loop			
HR	Half Rate			
IEB	Inter Entity BUS			
ISL	Internal Serial Link			
LNA	Low Noise Amplifier			
MAN	Micro-BTS Antenna Network			
MMI	Man Machine Interface			
MFS	Multi-BSS Fast Packet Server			
MPS2	Micro-BTS Power Supply			
MSUMA	Micro-BTS Station Unit Module			
MTRE	Micro-BTS TRansceiver Equipment			

Glossary

MS	Mobile Station
MOFRA	MOuting FRAme
NSS	Network Sub System
OML	Operation and Maintenace Link
O& M	Operation and Maintenance
OMU	Operation and Maintenance Unit
PCM	Pulse Coded Modulation
PCU	Packet Control Unit
P-GSM	Primary - band GSM
8-PSK	
PSTN	Public Switching Telephone Network
RF	Radio Frequency
RIT	Replaceable ITem
RSL	Radio Signalling Link
RX	Reception
SSC	Site Support Cabinet
SS7	Signalling system number 7
MSUMA	Micro-BTS Station Unit Module
TC	Transcoder
TCH	Traffic Channel
TCH/ F	TCH full rate
TCH/ H	TCH half rate
TRE	TRansceiver Equipment
TS	Time Slot
TX	Transmission
VSWR	Voltage Standing Wave Ratio
WBC	Wide-Band Combiner


ALCATEL


AlcatelUniversity
The smart connection