BSS INTEGRATION

STUDENT TEXT
EN/LZT 123 5231
R1A

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REVISION RECORD

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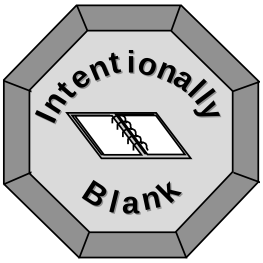
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BSS Integration

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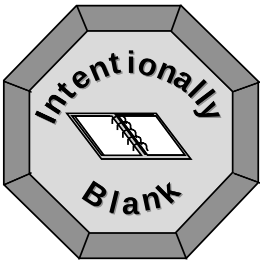
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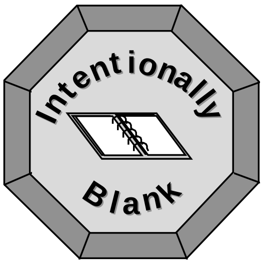
Cell Planning Process

Chapter 1

This chapter is designed to provide the student with an introduction to the cell planning and implementation processes. It also gives an explanation of the main steps in the BSS integration test.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1 Cell Planning Process

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INTRODUCTION TO BSS INTEGRATION

The BSS integration process is but a small part of the whole network realization. This chapter will give an introduction to where the BSS integration process comes in, in the whole cell planning process, and the general steps how it is performed.

The chapters following is written with the intention that the RBS field technicians shall learn how things work in the BSC side, and vice versa that the Network operation staff learn how things are done at the site.

CELL PLANNING PROCESS

Cell planning can be described briefly as all the activities involved in determining which sites will be used for the radio equipment, which equipment will be used, and how the equipment will be configured.

In order to ensure coverage and to avoid interference, every cellular network needs planning. The major activities involved in the cell planning process are depicted in Figure 1-1.

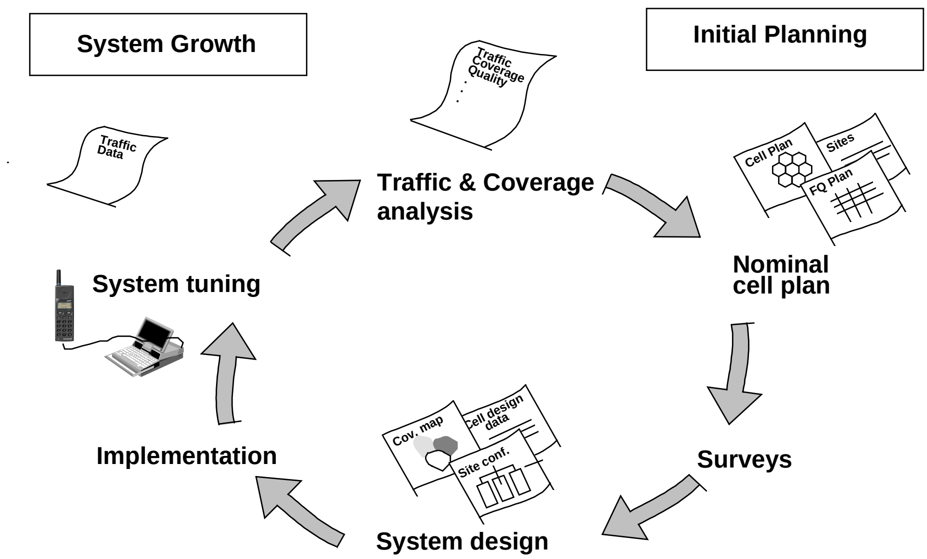

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Figure 1-1 The cell planning process

STEP 1: THE CELLPLANNING PROCESS TRAFFIC AND COVERAGE ANALYSIS (SYSTEM REQUIREMENTS)

The cell planning process starts with traffic and coverage analysis. The analysis should produce information about the geographical area and the expected need of capacity. The types of data collected are:

- Cost
- Capacity
- Coverage
- Grade of Service (GoS)
- Available frequencies
- Speech Quality Index
- System growth capability

The traffic demand (i.e. how many subscribers will join the system and how much traffic will be generated) provides the basis for cellular network engineering. Geographical distribution of traffic demand can be calculated by using demographic data such as:

- Population distribution
- Car usage distribution
- Income level distribution
- Land usage data
- Telephone usage statistics
- Other factors such as subscription charges, call charges, and price of mobile stations

STEP 2: NOMINAL CELL PLAN

Upon compilation of the data received from the traffic and coverage analysis, a nominal cell plan is produced. The nominal cell plan is a graphical representation of the network and simply looks like a cell pattern on a map. However, a lot of work lies behind it (as described previously).

Nominal cell plans are the first cell plans produced and form the basis for further planning. Quite often a nominal cell plan, together with one or two examples of coverage predictions, is included in tenders.

At this stage, coverage and interference predictions are usually started. Such planning needs computer-aided analysis tools for radio propagation studies, e.g. Ericsson's planning tool known as the Ericsson Engineering Tool (EET).

STEP 3: SURVEYS (AND RADIO MEASUREMENTS)

The nominal cell plan has been produced and the coverage and interference predictions have been roughly verified. Now it is time to visit the sites where the radio equipment will be placed and perform radio measurements. The former is important because it is necessary to assess the real environment to determine whether it is a suitable site location when planning a cellular network. The latter is very important because even better predictions can be obtained by using field measurements of the signal strengths in the actual terrain where the mobile station will be located.

STEP 4: (FINAL CELL PLAN) SYSTEM DESIGN

Once we optimize and can trust the predictions generated by the planning tool, the dimensioning of the RBS equipment, BSC, and MSC is performed. The final cell plan is then produced. As the name implies, this plan is later used during system installation. In addition, a document called Cell Design Data (CDD) containing all cell parameters for each cell is completed.

STEP 5: IMPLEMENTATION

System installation, commissioning, and testing are performed following final cell planning and system design. This step will be further explained later in this chapter.

STEP 6: SYSTEM TUNING

After the system has been installed, it is continually evaluated to determine how well it meets the demand. This is called system tuning. It involves:

- Checking that the final cell plan was implemented successfully
- Evaluating customer complaints
- Checking that the network performance is acceptable
- Changing parameters and performing other measures (if needed)

The system needs constant re-tuning because the traffic and number of subscribers increases continuously. Eventually, the system reaches a point where it must be expanded so that it can manage the increasing load and new traffic. At this point, a coverage analysis is performed and the cell planning process cycle begins again.

IMPLEMENTATION PROCESS

INSTALLATION ENGINEERING

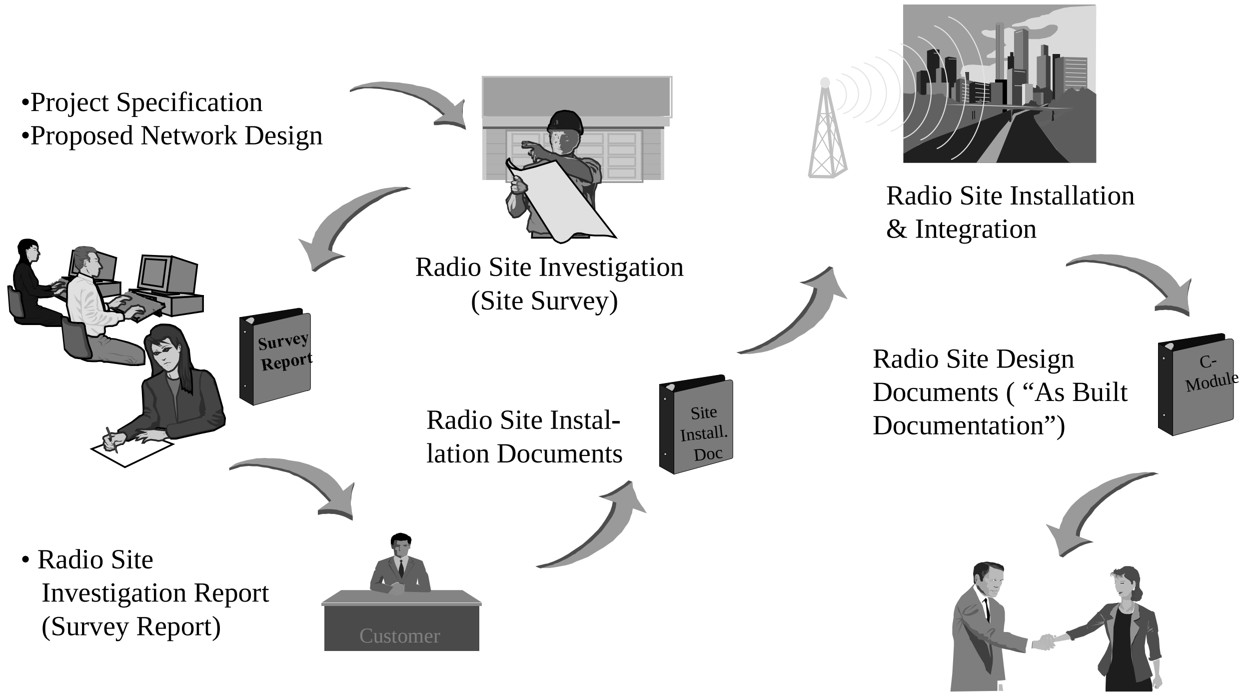

Figure 1-2 Installation engineering

Figure 1-2 shows the main steps in the implementation of a new radio site.

Output from the system design step (Step 4) in the cell planning process results in a hardware order (e.g. BSC,RBS) to the factory.

Installation engineering personnel do site investigations, which is a deeper look at the actual location where the site is going to be built. This results in the end, in a installation documentation, which is put into a binder for each site. The installation documentation contains all information needed to build the site e.g. floor plan, cable drawings, antenna arrangement drawing, earthing plan, site material list etc. The material needed to build the site is then ordered with input from the installation documents.

When all equipment has arrived the installation takes place. After all the equipment is installed it is time to see that it all works. First a test that the nodes is fully functional by them selves, installation test, and then a test that they can work together, integration test. The two tests are together called network element test an is further explained below.

All the site installation documentation is after installation and testing put into a binder, “As build documentation”, which in Ericsson world is called the C-module.

NETWORK ELEMENT TESTS

The picture below shows the main process steps in the Network element test for BSC and RBS.

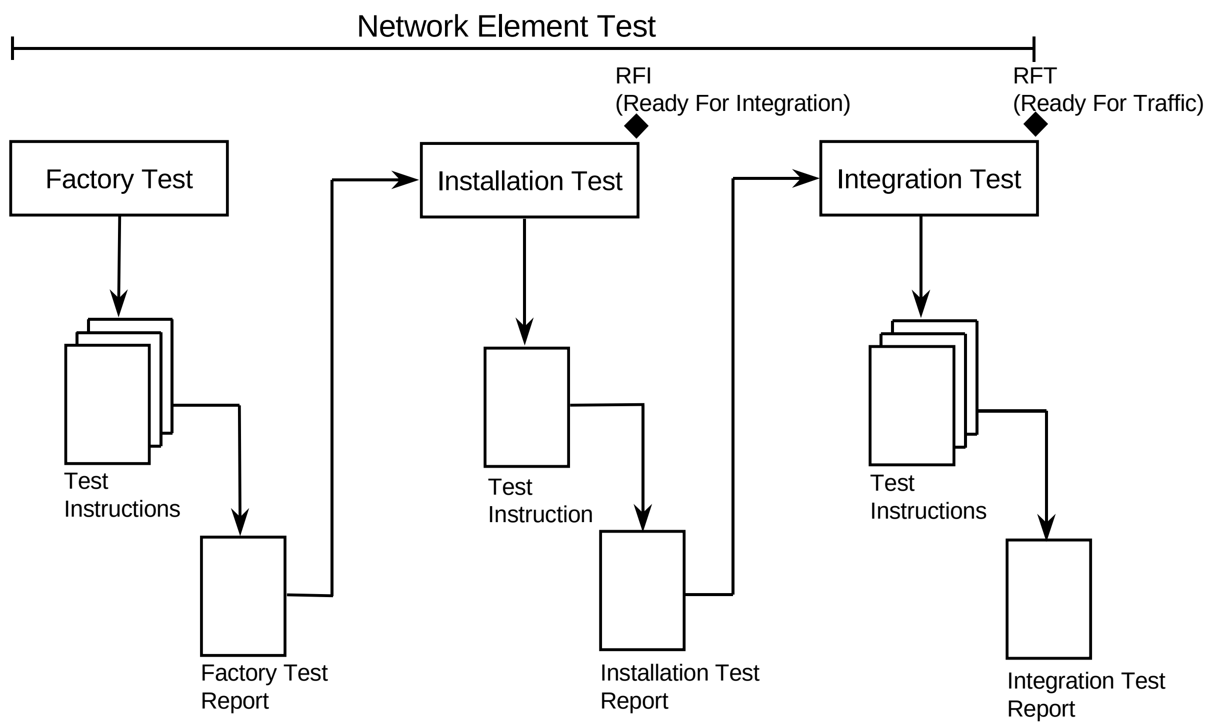

Figure 1-3 Network Element Test

BSC tests

The network element test for the BSC is described in a part of the AXE library called the H-module. The main steps are described below.

Factory Test

The purpose of this test phase is to test all hardware. The Input Output Group (IOG) is configured with the IOG exchange data and the hardware dependent exchange data is loaded.

Installation Test

The purpose of this test phase is to start up the AXE at the customer site and test all site dependent tests, such as test of alarm panel, external alarms and cabling to the Distribution Frame (DF). A final test is also performed.

After this test phase the network element is in the state Ready For Integration (RFI).

Integration Test

The purpose of this test phase is to load all network dependent exchange data and to integrate the network element into the network. Traffic tests are performed to verify the interworking function of the network element. The integration tests performed on the BSC is :

- MSC-BSS integration test
- OSS integration test
- TRI integration test (if RBS 200 is connected)
- RBS integration test (RBS 2000, RBS 200)

After this test phase the network element is in the state Ready For Traffic (RFT) and can be taken in to service.

A more thorough explanation will be given later about the steps in the Integration test part in this chapter.

RBS tests

Factory Test

The cabinets are tested before they leave the factory. This test is called Cabinet Assembly Test. The test verifies that the cabinet harware is working and that it has the right configuration. Radio meassurements are also performed on the radio parts, and the protocols for this is delivered with the cabinet.

Site Installation Test

When the cabinet is installed the Site Installation Test (SIT) is performed to verify that the RBS hardware is working as it should after the shipping of the cabinet. Parameters that is site specific e.g. External alarms, cable attenuation, alarm limits is also set during the test.

Network Integration Test

This test is done in close cooperation with the BSC personell. The test is done to verify that the RBS and BSC are interworking properly. The RBS is taken into service from the BSC and testcalls is done to see that the cell can take traffic. A more detailed explaination will be given under the next heading.

INTEGRATION TEST

This test is also referred to as the Network Integration Test in the RBS manual, EN/LZT 123 2683 Site Installation Test manual. This is the manual the Field Maintenance personnel uses. The Integration Test of RBS 2000 Series e.g.18/1538-APT 210 09 Uen B in the H-module, contains the same information, and this is what is used in from the Operations side.

Figure 1-4 shows the integration test procedure. These steps are explained in the text following.

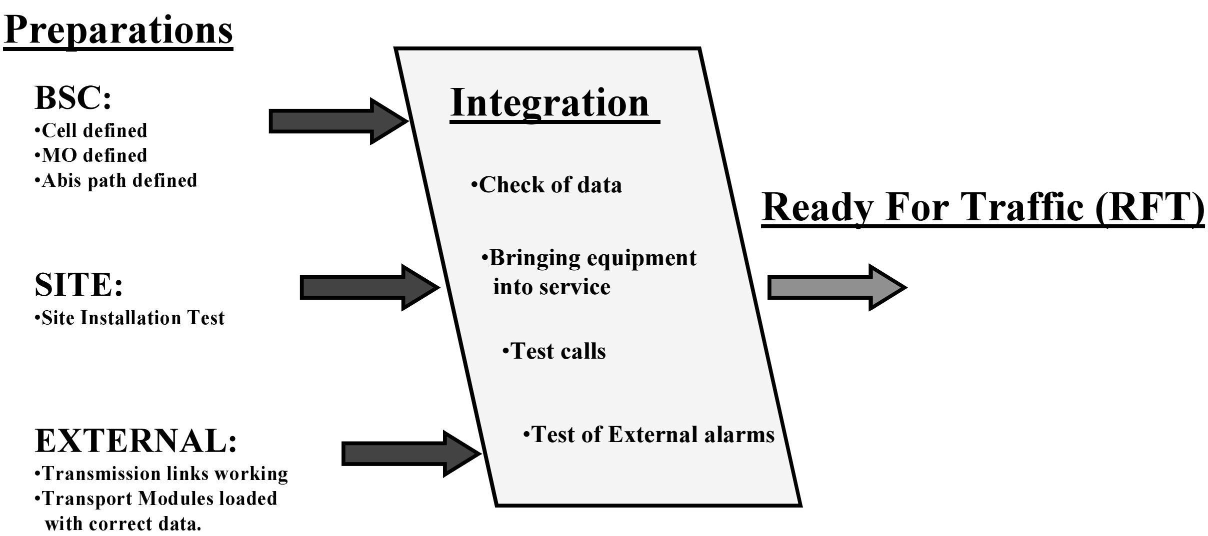

Figure 1-4 Integration test

Conditions before starting

Before the tests can be performed the following has to be fulfilled:

- The NE (network element) tests for the BSC must have been performed.
- Integration test of MSC/VLR must have been performed, e.g. it must be possible to make calls.

- The prerequisites and test preparations in the Site Installation Test manual should be fulfilled.
- Exchange data for definition of Managed Objects, Cells and Abis paths must be loaded.
- The transmission to the BTS site must be working.
- If Transport Modules (TM) are used, they must be loaded with the correct data.

Check of data

The following things are checked before the site is taken in to service.

- Check that the Transceiver group (TG) data is correct.
- Check that the PCM supervision is correctly defined.
- Check that all cell data is correctly defined.
- Check that the right BTS software is loaded in the Input Output Group (IOG).
- Check that the A-bis path is correctly defined

Bring equipment into service

The following is done to take the RBS into service.

- Bring the Managed Objects (MO) into service.
- Deblock the MOs.
- Activate the cell(s).
- Check that the RBS is correctly configured.

Call tests

When the RBS has been taken into service the commissioning staff do test calls to verify that the RBS is fully functional. The call tests are performed separately on Receiver path A and B. This is done to verify that both the antenna paths are working properly. During the test calls the BSC personnel checks that all things are working as they should in the BSC.

Test of External Alarms

This test is performed to verify that the correct external alarm string is shown in the BSC when the alarm is trigged by the RBS commissioning staff.

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BSC configuration

Chapter 2

This chapter is designed to provide the student with an overview of the main functions and concepts in the BSC and TRC nodes.

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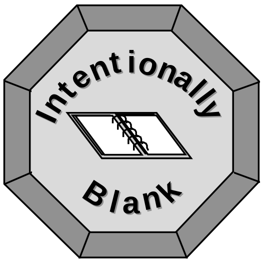
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2 BSC configuration

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BSS OVERVIEW

The Base Station Controller (BSC) controls and supervises the radio resources in the Base Tranceiver Station (BTS). Together with BTS, the BSC forms the Base Station System (BSS), responsible for the management and cell configuration data in the radio network. The main functions of the BSC are:

- administration of resources in BSS
- supervision of BTS
- connection handling of mobile stations
- locating and handover
- administration of paging
- transmission network management
- operation and maintenance of BSS

The unit that makes the speech conversion from 64 kbit/s to 13+3kbit/s (Full rate and Enhanced speech codec, FR and EFR) or 6.5+1.5 kbit/s (Halfrate speech codec,HR)per channel is called the transcoder. This function can either be put in a separate node called TRanscoder Controller (TRC) or together with the BSC which then becomes a BSC/TRC. The different types of configurations are shown in the picture below.

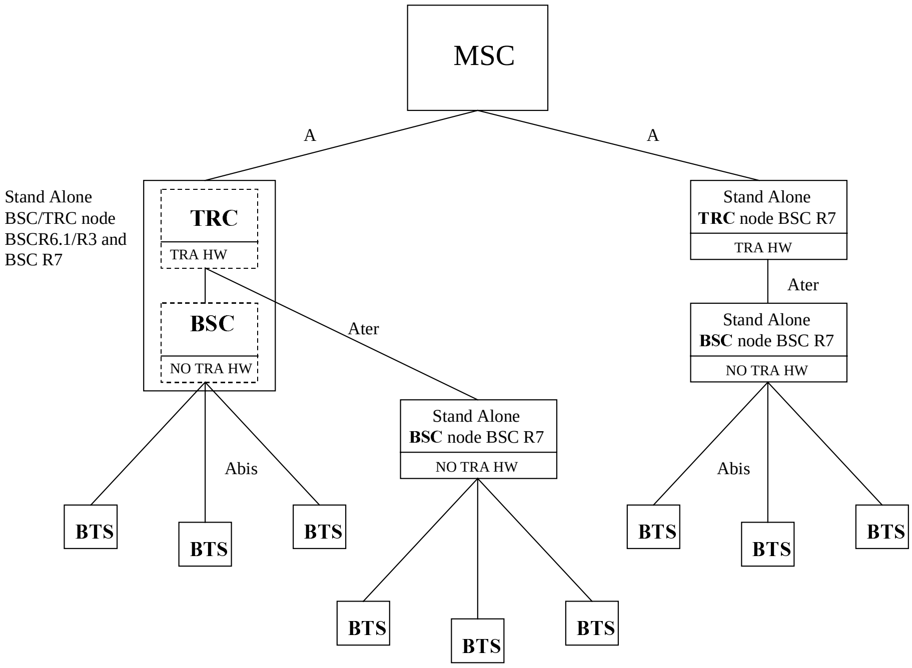

Figure 2-1 The BSS system architecture

- TRC - a Stand Alone transcoder controller node
  The TRC node allows a flexible location of the transcoder resources. Typically, the TRC is located at or near the MSC. It is controlled by the BSC. 16 BSCs can be connected to one TRC.

- BSC/TRC - a combined BSC and transcoder controller
  The BSC/TRC is suitable for medium and high capacity BSC applications, i.e. urban and suburban area networks. This node can handle up to 1020 Transceivers (TRXs). 15 stand alone BSCs can be connected to th BSC/TRC.

- BSC - a Stand Alone BSC without transcoders
  The BSC is optimized for low and medium capacity BSS networks and is a complement to the BSC/TRC especially in rural and suburban areas. For GSM 900/GSM 1800, it can handle up to 1020 TRXs.

BSC/TRC HARDWARE AND BASIC CONCEPTS

The BSC/TRC node has all the hardware that the standalone nodes TRC and BSC has, so this will be explained first. The differences will then be shown in brief later on in the chapter.

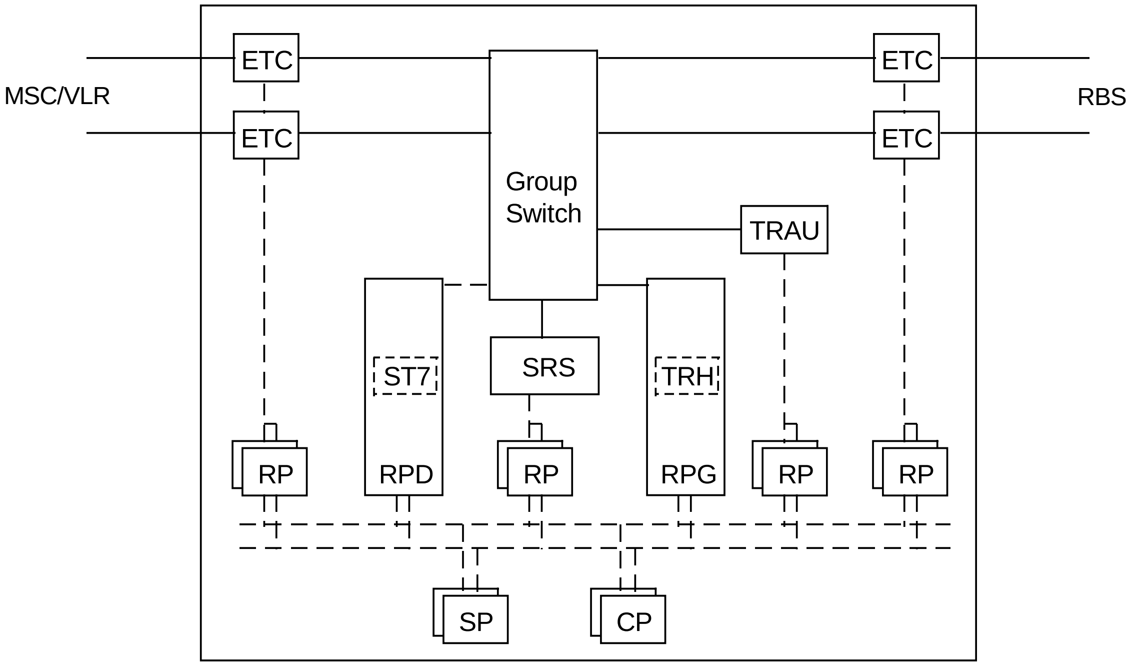

Figure 2-2 BSC/TRC hardware

GROUP SWITCH (GS)

The GS is the central part in the BSC/TRC. The GS connects an incoming channel with an outgoing channel e.g. it can connect any incoming PCM timeslot and send this out on any outgoing PCM link on any timeslot. The GS is built up by Time Switch Modules (TSM) and SPace switch Modules (SPM) and can switch down to 64 kbit/s. If switching has to be done to lower bitrates, e.g. 16 kbit/s, the SubRate Switch (SRS) must be used.

Switching Network Terminal (SNT)

All equipment connected to the group switch uses the same standardized interface, which is called Switching Network Terminal (SNT). The SNT is a software concept and represents the software connection of the physical hardware to the Group Switch. The hardware is normally referred to as device hardware. Each SNT is connected to the GS in a Switching Network Terminal Point (SNTP).

In Figure 2-2 the following device hardware are shown, which will be explained further in the chapter:

- Exchange Terminal Circuit (ETC)
- Signaling no.7 terminal (S7-ST)
- Transcoder and Rate Adaptor (TRA)
- TRansceiver Handler (TRH)
- Subrate Switch(SRS)

Device (DEV)

As mentioned before, the hardware connected to the GS is referred to as device hardware. A device is the resources that each SNT have connected to the GS. Depending on what device hardware and what software is loaded the device has different capabilities. The devives and their names will be explained under each device hardware.

EXCHANGE TERMINAL CIRCUIT (ETC)

The ETC board is the common hardware in the AXE to handle the PCM transmission links, in this case between the MSC-BSC and BSC-RBS. The links can either be 1.5 Mbit/s (T1) or 2 Mbit/s (E1) PCM links. The two types of links uses different hardware i.e. for BYB 501, which is the latest building practice, the 1.5 Mbit/s uses ETC-T1 boards and the 2 Mbit/s uses ETC5 boards. What differs though between the ETC boards towards the MSC and those towards the RBSs is that they have different software loaded. This means that the resources will have different names.

Figure 2-3 shows the different names and concepts connected with the PCM links in a E1 system.

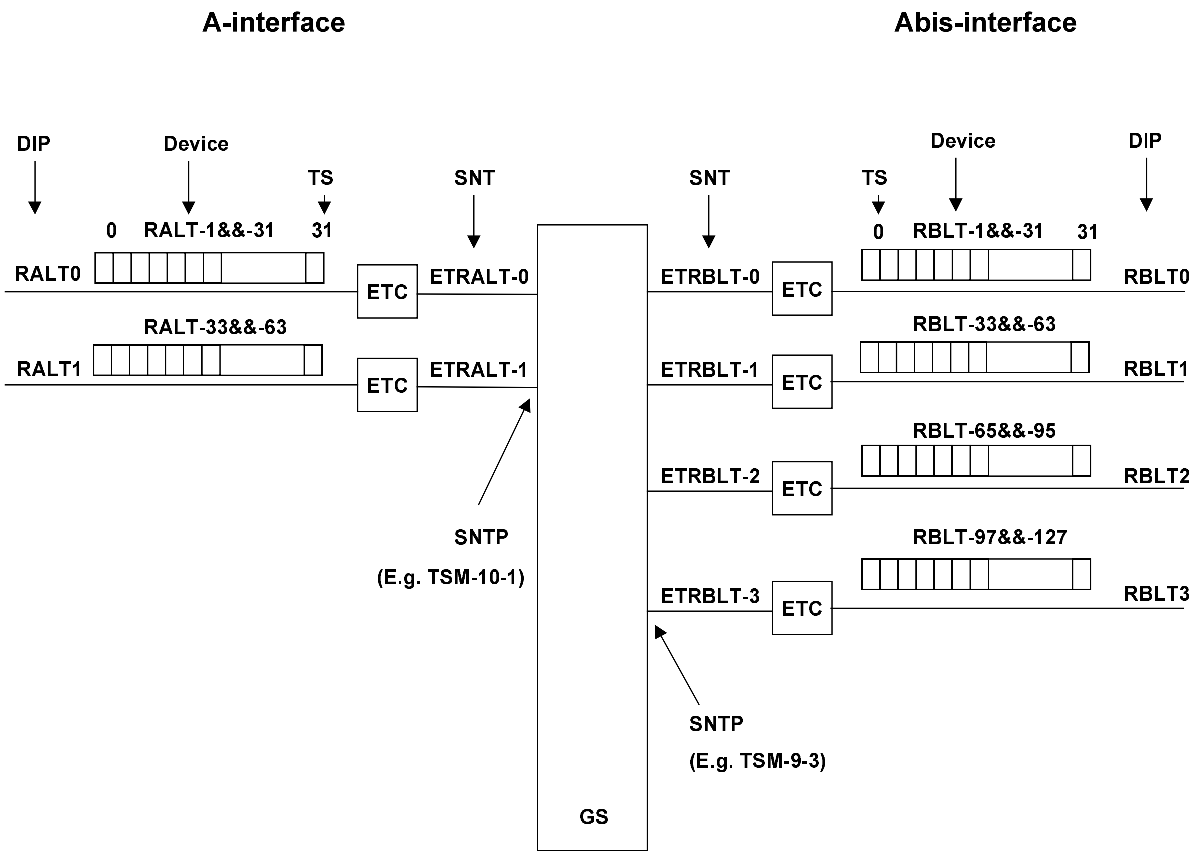

Figure 2-3 ETC related concepts

ETRBLT and ETRALT

In the Figure we have to types of SNTs the ETRBLT and the ETRALT. They are using the same type of hardware (ETC) but are loaded with different types of software. This means that they will have slightly different functions. The SNT concept supervises everything from the connection to the GS, the SNTP, and to the output from the ETC board, then the DIgital Path (DIP) takes over the supervision of the PCM link.

DIgital Path (DIP)

Digital Path (DIP) is the name of the function used for supervision of the connected PCM lines. ITU-T has issued recommendations which state how the PCM links should be supervised. All these recommendations are implemented in the DIP function and the ETC. Depending on if the PCM link goes toward the MSC or the RBS the DIP will have different names. RALT towards MSC and RBLT towards the RBSs. RBLT stands for **R**TS A-**B**is interface **L**ine **T**erminal whereas RTS stands for Radio Transmission & Transport Subsystem. RALT stands for **R**TS **A**-interface **L**ine **T**erminal.

RBLT devices

Each Time Slot (TS), which is 64 kbit/s, on the PCM link towards the RBS is called a RBLT device. The device is a resource that the BSC can put information on. In this case it is either LAPD signaling or speech towards the RBS.

The number of RBLT devices is 32 on an E1 PCM link and 24 on a T1 PCM link. Figure 2-3 shows an E1 PCM system. The numbering of the RBLT devices starts from 1 to 31 for the first DIP RBLT-0. This is written as 1&&-31 where the && is how you specify a range of numbers in an AXE command. It shall also be noted that RBLT device 0, 32, 64, 96 is not used. This is TS 0 on the PCM link, which is used for synchronization and can therefore not be used for anything else.

This is not the case in a T1 PCM link, where the synchronization is done in a other way. In the T1 system the devices are also called RBLT24 devices.

A more detailed explanation what the RBLT devices can be used for will be given in the Abis chapter.

RALT devices

Each Time Slot (TS), which is 64 kbit/s, on the PCM link towards the MSC is called a RALT device. The device is a resource that the BSC can put information on. In this case it is either C7 signaling or speech towards the MSC.

The numbering principle of the RALT devices are the same as for the RBLT devices.

TRANSCODER AND RATE ADAPTOR (TRA)

The TRA is the function responsible for the speech coding and rateadaption of incoming speech and data from the MSC and the RBS. The hardware where the function is implemented is called Transcoder and Rate Adaption Board (TRAB). It has the following basic functions:

- Transcoding of speech information. Speech at 64 kbit/s to/from the MSC is transcoded to 13 kbit/s to/from the RBS enabling four compressed channels to be multiplexed onto one 64 kbit/s channel. This is if we are using Full Rate (FR) or Enhanced Full Rate (EFR), which both has a bit rate of 13 kbit/s. For Half Rate (HR) the speech will be transcoded to 6.5 kbit/s

- Additional control information ,3 kbit/s for FR and EFR, and 1,5 kbit/s for HR, is added to the transcoded rate of 13 kbit/s towards the RBS giving a final output of 16 kbit/s or 8 kbit/s. The control information which is called in-band signaling, basicly tells what information that the 13 kbit/s or 6.5 kbit/s information contains, e.g. speech, data.
- Rate adaptation of data information. The maximum data rate supported at present in GSM is 9.6kbit/s per TS. With High Speed Circuit Switched Data (HSCSD) it is possible to have higher bit rates, since then the MS will be assigned more than one TS.
- Discontinous Transmission (DTX) functions on the up- and downlink. This will reduce the interference in the network and save batteries in the mobile.

Figure 2-4 shows in general how the TRA works.

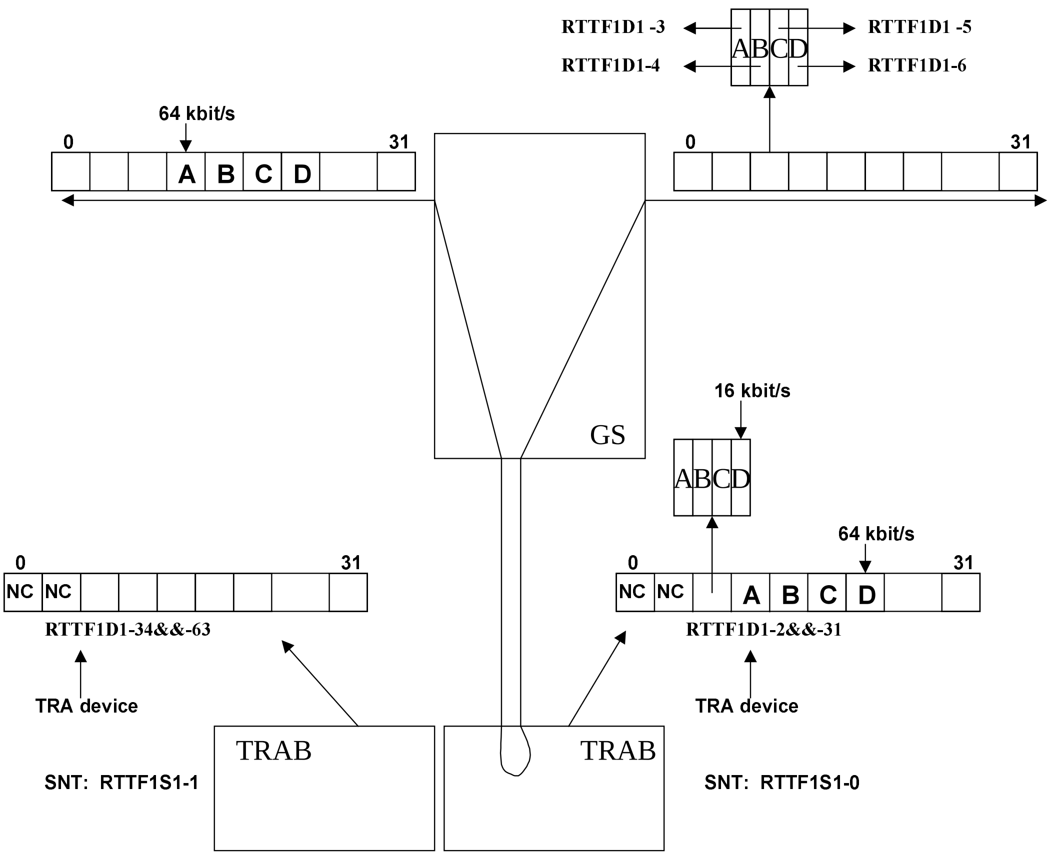

Figure 2-4 TRA function

The incoming 64 kbit/s is sent through the GS to the TRA. Four 64 kbit/s channels are transcoded to 16 kbit/s (FR and EFR) and multiplexed onto one 64 kbit/s. They are then sent out via the GS to the RBS on theAbis interface on a RBLT device.

TRA devices and SNT

Each SNT in the Figure 2-4 has 30 devices e.g. SNT: RTTF1S1-0 has devices RTTF1D1-2&&-31. From this you can read out, using the Table 1below, that this is a TRA R5 hardware, with FR speech version. The number of 64kbit/s that can be transcoded on this type of TRA is 24. They are called de-multiplexed (DEMUX) devices. The other 6 devices are called multiplexed (MUX) devices. One MUX device is 16kbit/s (FR and EFR) and a DEMUX device is 64 kbit/s.

Device Type	SNT	Speech version	TRA HW Revision
RTTRD	RTTRS	Full Rate	TRA R2&R3
RTTF1D	RTTF1S	Full Rate	TRA R4
RTTF2D	RTTF2S	Enhanced Full Rate	TRA R4
RTTH2D	RTTH2S	Half Rate	TRA R4
RTTF1D1	RTTF1S1	Full Rate	TRA R5
RTTF1D2	RTTF1S2	Enhanced Full Rate	TRA R5

Table 1 UTRA configuration names

Transcoders in pool and semi permanently connected transcoders

The transcoder devices can either be semi permanently connected or they can be in a pool. In the semi permanent connected way, the transcoder devices is always connected to the same TS in the RBS. This means that recourses is locked up for others to use even if there is no traffic going on. This means that you more or less will have to have one TRA device for each air TS, which will result in a lot of TRA boards. To put the transcoder in a pool will result that the will handle the TRA resources in another way.

Figure 2-5 shows how the TRA in pool generally works and which hardware is involved.

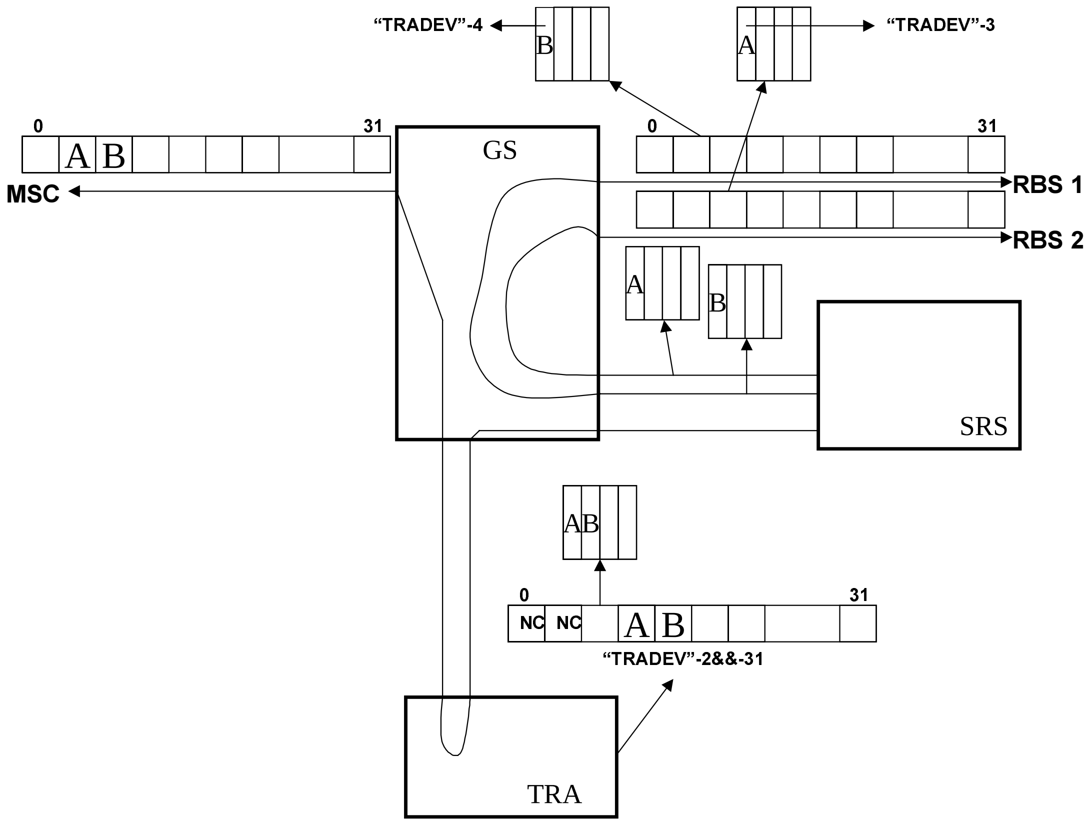

Figure 2-5 TRA-devices in pool

In the transcoder in pool solution the TRA resources are lying in "pools". In one BSC/TRC there can be different pools e.g. one pool with EFR devices, one with FR devices and one with HR devices. Depending on what MS equipment that is going to be connected the BSC/TRC can seize a device depending on what this certain MS can handle, e.g. not all MSs can handle EFR, and release the device when the call is over. This will result in less hardware, since not all people call at the same time in the whole area that the BSC controls, there will seldom be congestion due to that there is no TRA devices left in the pool.

To be handle semi permanently connected transcoders there is no need for extra hardware, however if transcoders in pool is going to be used the BSC/TRC needs to have a Subrate Switch (SRS). The reason for this is that different TRA resources, e.g. FR and EFR, will be mixed onto the same 64 kbit/s, and the GS as we said before can not switch lower than 64kbit/s. The SRS can switch down to 8 kbit/s and can then put different 16 kbit/s devices on the same 64 kbit/s. The SRS function is explained below.

TRANSCEIVER HANDLER (TRH)

The TRH performs the activities required to control the RBS and the tranceivers, and is responsible for a multitude of functions including:

- handling of signaling on the Link Access Protocol on D-channel (LAPD) link between BSC-BTS.
- handling of logical channel addressing part of signaling to/from BTS and mobile stations (MS),
- processing of measurement data from BTS and MSs,
- operation and maintenance of BTS.

Figure 2-6shows the principle of the TRH.

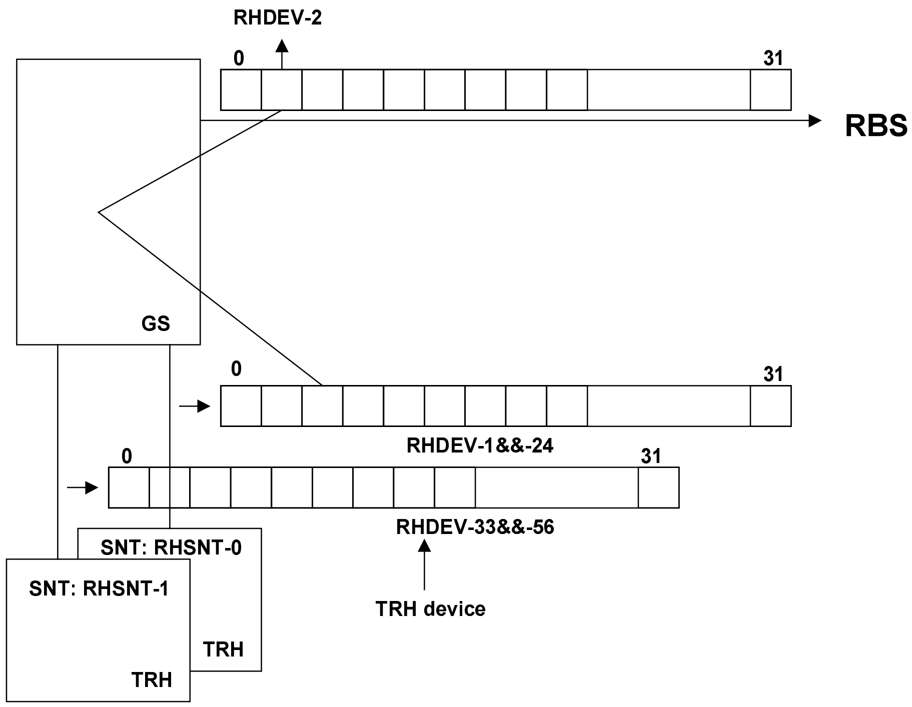

Figure 2-6 TRH function

TRH devices and SNT

Each SNT in Figure 2-6 has 32 devices. The SNT in this case is called RHSNT and it handles the TRH devices named RHDEV.

Each tranceiver in the RBS has to have a signalling connection towards the BSC. The device handling the signaling connection towards the RBS is the RHDEV. One RHDEV is semi permanently connected to one tranceiver in the RBS.

As mentioned before the RHSNT has 32 devices, but in reality only 24 of them is usable. This is due to that one TS is used for test purposes and the other go away because otherwise the TRH will be to loaded with tasks. That is why the numbering in the picture states RHDEV-1&&-24 and RHDEV-33&&-56.

The TRH that is explained above is the latest one using Regional Processor Group (RPG) hardware. The older hardware using Regional Processor Device (RPD) harware has only 8 RHDEV per board and of which only 7 can be used.

The LAPD protocol and its use will be explained further in the Abis chapter.

SUBRATE SWITCH (SRS)

Subrate switching allows connection of rates lower than 64 Kbit/s. The rates allowed are n*8 Kbit/s (where n=1..7).

An example of how the SRS can be used to switch calls to different destinations using only one TRA resource is shown in Figure 2-7 .

Four 64 Kbit/s timeslots containing speech arrive in the BSC from the MSC. The TRH controls the setup of the call and decides if the SRS shall be used, which TRA to use, call type, destination BTS etc.

The GS sets up connections to the TRA which transcodes the four 64 Kbit/s channels to four 16 Kbit/s. The 4x16 Kbit/s channels are then multiplexed to one 64 Kbit/s channel which is returned to the GS.

In this example the destination for two of the calls is BTS1, and for the other two calls, BTS2. The TRH has this information and decides that it is necessary to setup a connection towards the SRS.

The SRS switches the 16 Kbit/s subrate channels to two 64 Kbit/s channels which are returned to the GS. After this the GS can setup connections towards BTS1 and BTS2, which will contain the correct subrate channels.

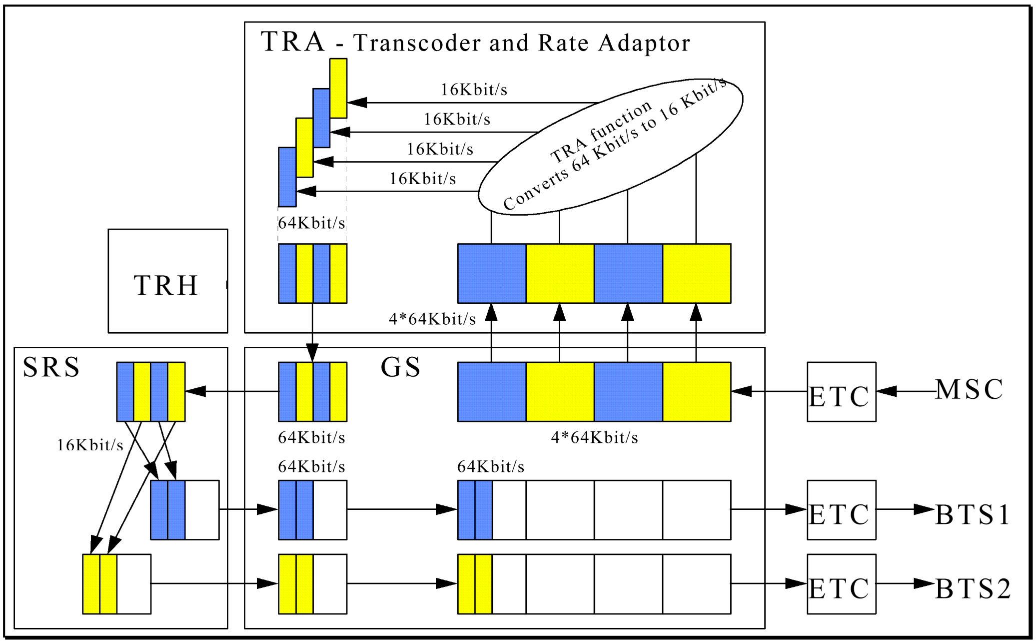

Figure 2-7 Example of switching of 16 Kbit/s subrate channels using SRS.

Except that the SRS is needed when TRA in pool is used.It is also needed when we utilize LAPD multiplexing, which is when the speech and signaling towards the RBS is multiplexed onto the same 64 kbit/s. This will be explained more in the Abis chapter.

SIGNAL TERMINAL NO.7 (ST7)

The MSC has to be able to signal with the BSC. This is done by using Signaling Terminals (ST). The signaling devices will be called e.g. C7ST2C for E1 PCM links.

The signaling between the MSC and BSC is slightly different in a T1 network since in T1 there is a separate signaling network which means that there is not a connection between the GS and the ST.

Normaly there has to be two signalling TS between the BSC and MSC, it would be enough with one but there is two for redundancy purposes.

PROCESSORS (RP AND CP)

The RPs are designed to execute simpler high-frequency functions and are mainly used for the direct control of the hardware units in the application systems. These hardware-units offer the traffic devices of the exchange e.g. ETC, TRA etc.

The CPs execute complex and data demanding tasks; while the RPs on the other hand are responsible for time consuming functions and routine scanning of hardware and filtering of signals.

There is away from ordinary RP two other types of RPs

Regional Processor Device (RPD)

In the RPD the device hardware,e.g. TRH, C7, is integrated with the RP.

Regional Processor Group (RPG)

The RPG has the same functionallity as the RPD but it has higher capacity than the RPD. The RPG, with different software loaded, can in the BSC serve as TRH or C7 teminal.

STAND ALONE TRC AND BSC

TRC

The **Transcoder Controller (TRC)** node contains the pooled transcoder resources and is a stand alone node.

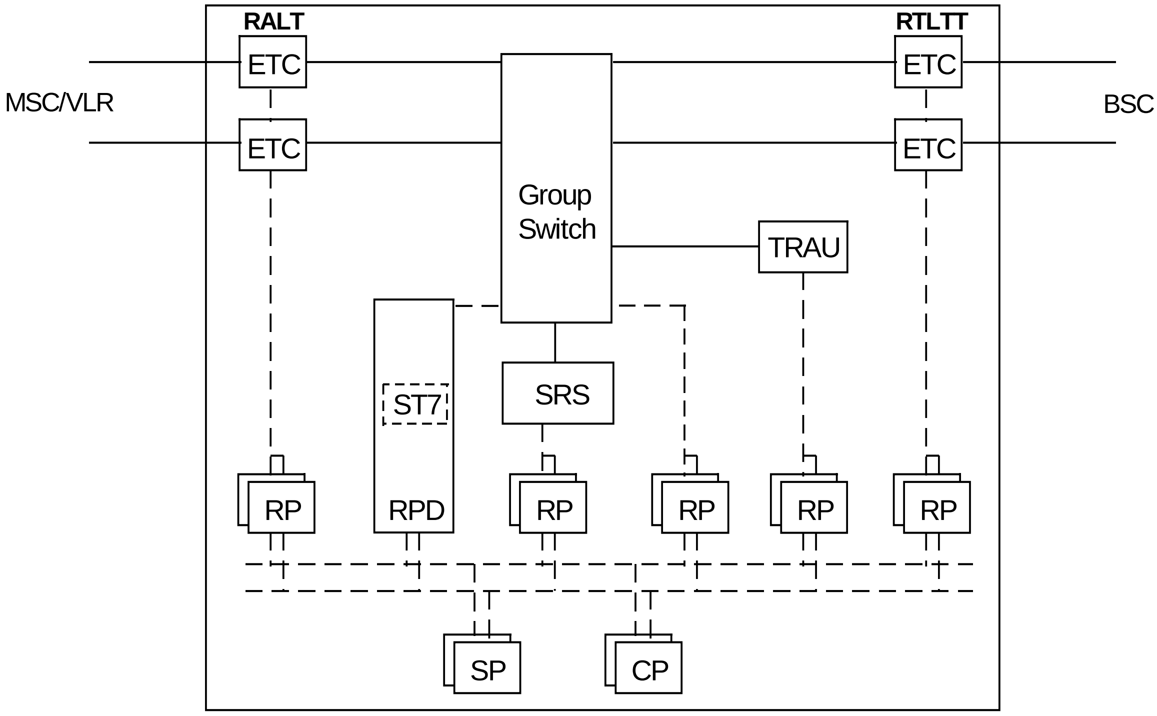

Figure 2-8 TRC Hardware

The TRC is connected to the MSC via the A-interface and to the BSC via the Ater-Interface.

The TRC node has the ability to support up to 16 BSCs over the Ater interface. The transcoders in the various TRAnscoder (TRA) pools in a TRC can be shared between all BSCs associated with the TRC. One of the connected BSCs may be residing on the same physical platform as the TRC, i.e. in a combined BSC/TRC network element.

One TRC can be connected to up to four MSCs. This makes it possible to build rather large TRCs supporting several MSCs. One BSC is still controlled by one specific MSC.

The TRC can contain several transcoder resource pools, one pool per type of transcoder resource, e.g. Full Rate, Enhanced Full Rate, Half Rate.

The A-interface signaling remains unchanged in the new system structure. For communication between the TRC and a remote BSC a C7 based Ericsson proprietary communication protocol is used. In the case of a combined BSC/TRC, internal signaling between the TRC and BSC part is used.

The TRC node handles the Ater transmission interface resources. The operation and maintenance signaling and handling of the Ater interface is similar to the current implementation on the A-interface.

At call set up, and after signaling connection set up, an assignment request is sent via the MSC to the BSC. The request is sent directly to the BSC and can pass transparently through the TRC. The BSC receives the assignment request and requests a transcoder device from the TRC also indicating the A-interface Circuit Identification (CIC) to be used for this specific call. The TRC allocates a transcoder device and the time slot on the Ater interface, which is connected to the A-interface CIC specified by the MSC. The TRC replies to the BSC, which establishes the connection to the mobile.

BSC

The BSC is developed and optimized especially for rural and suburban areas and is a complement to the BSC/TRC node in the BSC product portfolio.

The BSC contains the SRS and TRH as previously explained

The BSC does not contain any transcoders. It utilizes transcoder resources from a central BSC/TRC or from a TRC node. The BSC is connected to the BSC/TRC or TRC via the Ater interface.

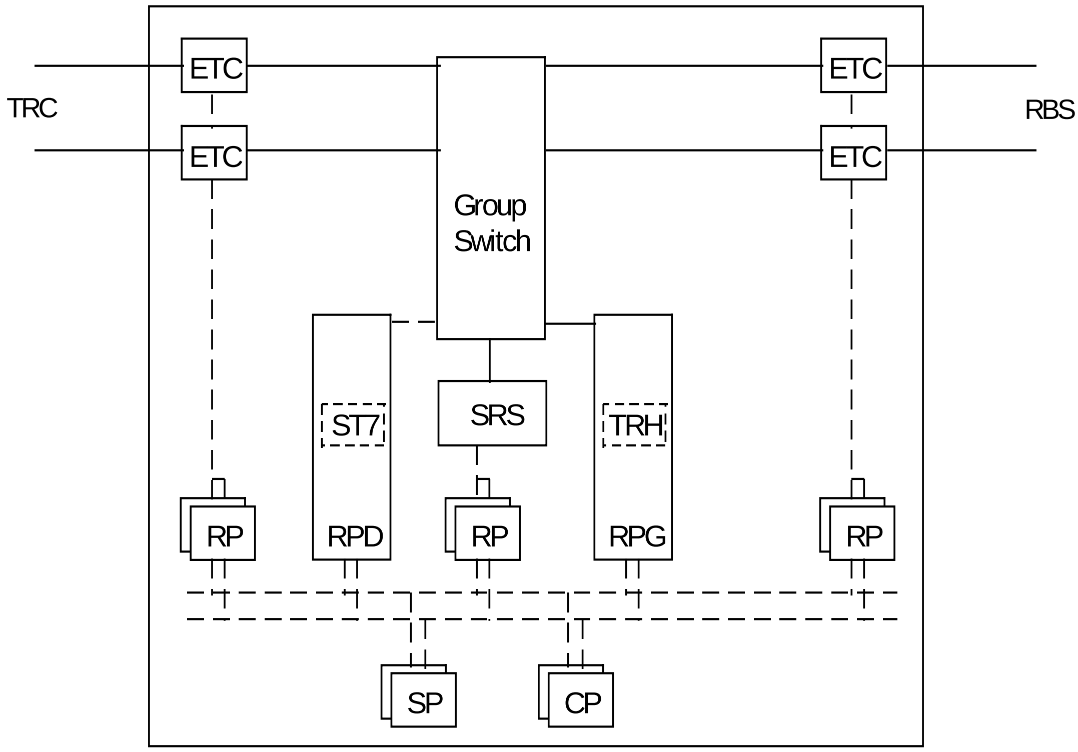

Figure 2-9 BSC hardware configuration

PCM LINK DEVICE TYPES

Figure 2-10 shows the different names of the PCM link devices in the three types of BSS implementation.

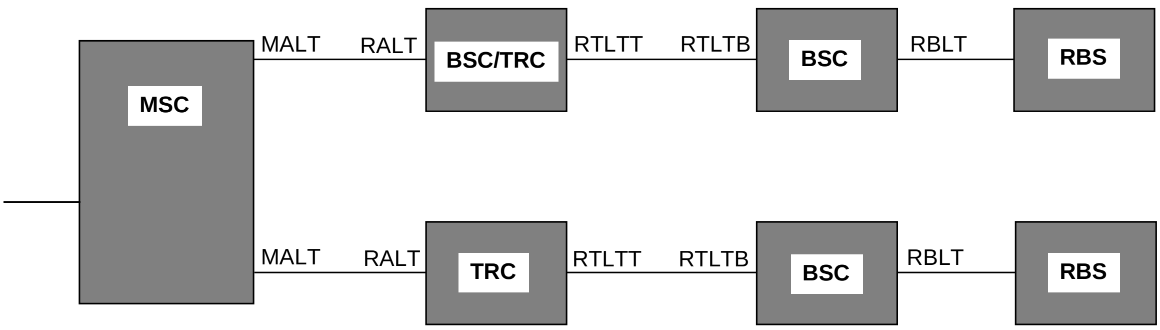

Figure 2-10 BSS PCM-link device types

RELATED COMMANDS

NTCOP - Switching Network Terminal, Connection Data, Print

NTSTP - Switching Network Terminal, State, Print

EXRPP - Exchange Data Functions RP, Print

EXEMP - Exchange Data, EM, Print

EXRUP - Exchange Data Functions, RP Software Unit Data, Print

STDEP - Device State for Devices, Print

DTDIP - Digital Path Transmission Functions, Digital Path, Print

DTSTP - Digital Path Transmission Functions, State, Print

RADEP - Radio Control Administration Device Data, Print

RRTPP - Radio Transmission Transcoder Pool, Print

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RBS 2000 Overview

Chapter 3

This chapter is designed to provide the student with an overview of the functions and hardware of the RBS 2000 family of Radio Base Stations (RBS).

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3 RBS 2000 Overview

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RADIO BASE STATION (RBS)

Radio Base Station 2000 (RBS 2000) is Ericsson's second generation of radio base stations developed to meet the GSM specification for BTSs. This document handles the indoor and outdoor versions for Ericsson's GSM System.

RBS 2000 has many advantages compared to RBS 200. The RBS 2000 product family for Ericsson's GSM System is specially designed to offer rapid and cost effective roll-outs and low total life cycle costs. It also provides simple installation with on-site testing and commissioning. This is easily achieved because the cabinets come preassembled, and software is downloaded and tested at the factory before shipment.

Flexible design means that there can be a number of configurations and expansions as the network grows. RBS can be positioned at a variety of sites including outdoor, indoor, on ground or rooftops and wall mounted.

In this Chapter the function of the Macro basestations will be shown i.e. RBS 2101,2102,2202. The micro and picobasestation i.e. RBS 2301, RBS 2302, RBS 2401, is working in the same way as the Macro basestation, but the hardware differs.

RBS 2101

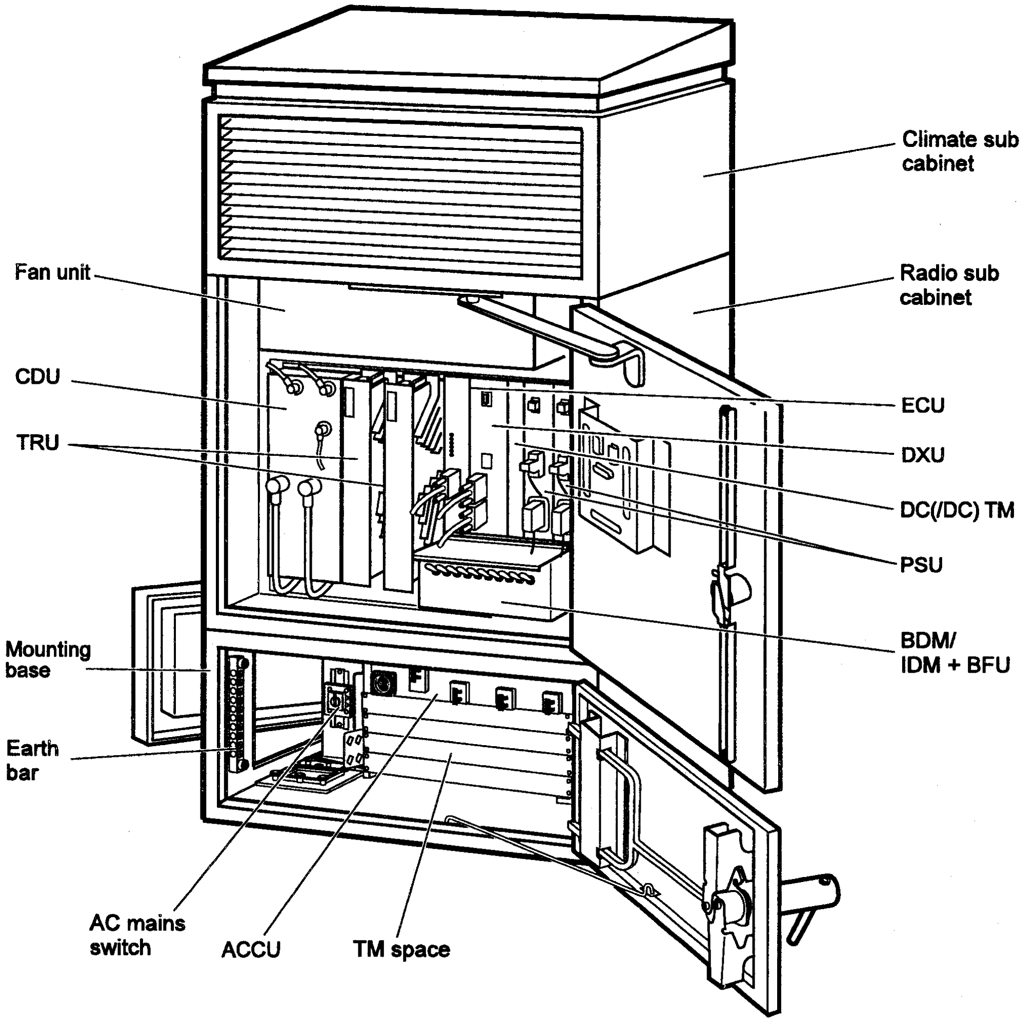


Figure 3-1 RBS 2101

General

- Is an outdoor RBS
- Can be used as a indoor RBS, without the climate sub-cabinet.
- Can support up to 2 TRUs per cabinet.
- The cabinet can be used in omni or sector configurations with more than 2 TRUs. For these configurations an extension cabinet is needed.

Cabinet

The RBS 2101 cabinet provides a durable, vandal resistant and weather proof enclosure of the RBS. The cabinet is divided into three main parts:

Climate Subcabinet:

- Supervises and maintains the internal temperature and humidity within allowed ranges for the units in the RBS.
- Can be delivered in two different versions, i.e. with heat exchanger which can handle a temperature up to +45°C or with air conditioner up to +55°C.

Radio Subcabinet:

- Houses up to 2 TRU´s and common equipment needed for serving one cell, see Figure 3-1.
- The Battery Distribution Module (BDM) contains a battery for a minimum of 3 min battery back-up.
- The optional DC/DC (+24/-48V) converter can be fitted to give power to the TM equipment.

Mounting Base:

All cables going into the cabinet enters via the mounting base that is:

- Antenna jumpers which is connected directly up to the Radio subcabinet.
- Transmission cables which are connected to the transmission equipment housed in the Transport Module (TM) space.
- Mains power cables which are connected to the AC Connection Unit (ACCU).
- External alarm cables which are connected to lightning protected inlets (max 8).

These units are then connected to the rest of the cabinet via a connector field in the mounting base ceiling.

RBS 2102

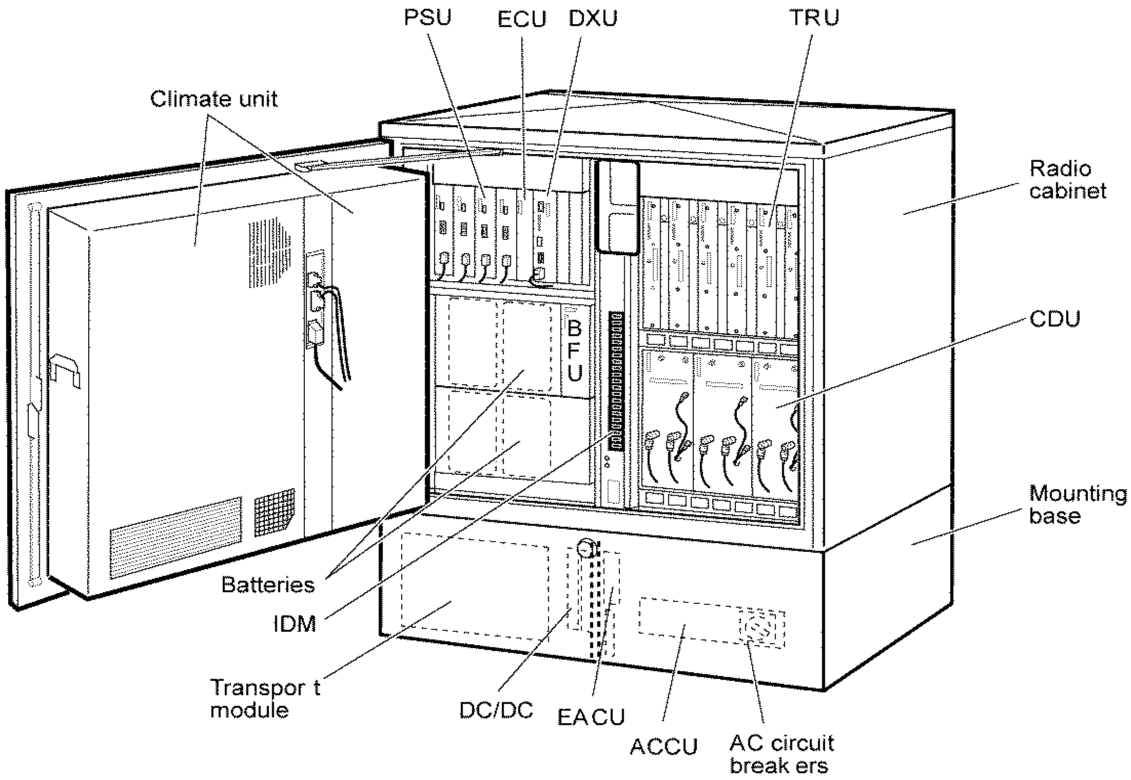


Figure 3-2 RBS 2102

General

- Is an outdoor RBS.
- Can support up to 6 TRUs per cabinet.
- Can be configured as single cell or sector configuration.
- Multicabinet configuration with two cabinets, master and extension cabinet, and 12 transceivers configured either as single cell or sector cells are supported.

Cabinet

The RBS 2102 exists in two different versions. The “old” is shown in the top picture. The new improved is shown in Figure 3-3. The main difference is that the new improved RBS 2102 does not have a mounting base. All units are mounted in the same climate protected cabinet otherwise they work in the same way and have the same configuration possibilities.

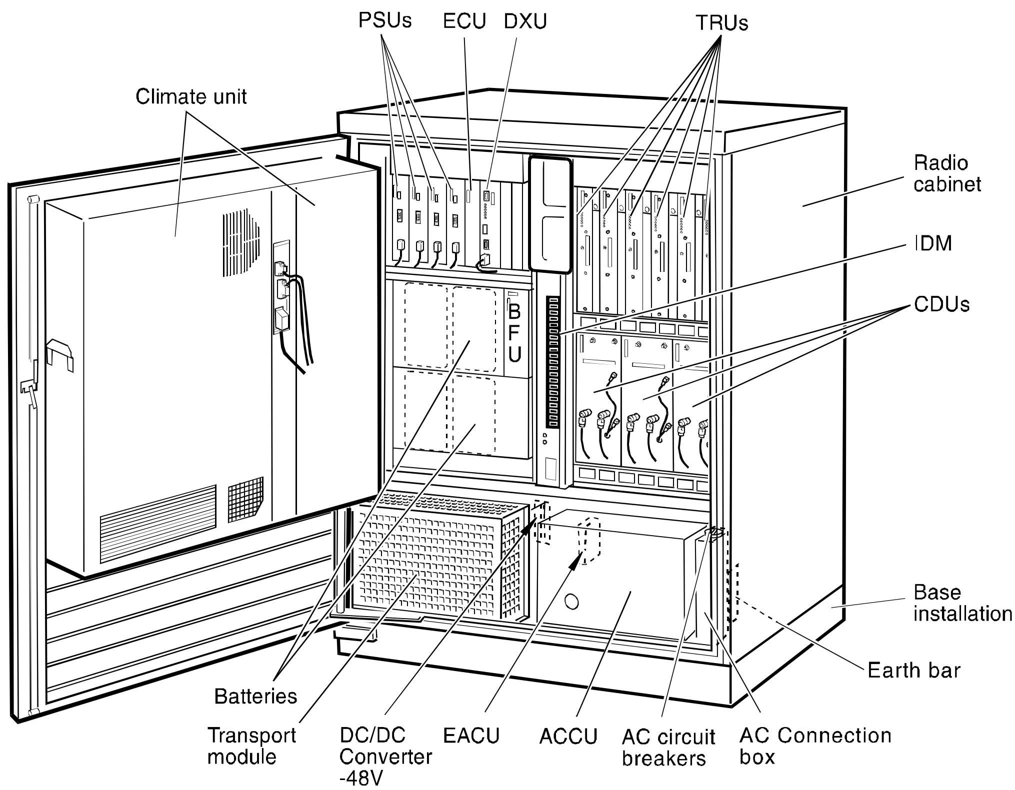


Figure 3-3 The improved RBS 2102

The RBS 2102 cabinet provides a durable, vandal resistant and weather proof enclosure of the RBS. The “old” cabinet is divided in two parts the new improved is not. Below are the items that are mounted together.

RBS cabinet:

- The RBS cabinet houses up to 6 TRUs plus common equipment needed for serving the cell configuration, see Figure 3-3.
- An optional Battery Fuse Unit(BFU) can be fitted if internal batteries are mounted, which gives a minimum of 1 hour battery back-up, if fully equipped.
- Climate Unit, which is located in the door, supervises and maintains the internal temperature and humidity within allowed ranges for the units in the RBS.

Mounting Base:

(The lower part in the new RBS 2102.)

All cables going into the cabinet enters via the mounting base, they are:

- Antenna jumpers which is connected directly up to the Radio subcabinet.
- Transmission cables which are connected to the transmission equipment housed in the Transport Module (TM) space.
- Mains power cables which are connected to the AC Connection Unit (ACCU)
- External alarm cables which are connected to the External Alarm Connection Unit (EACU).

These units are then connected to the rest of the cabinet via a connector field in the mounting base ceiling.

RBS 2103

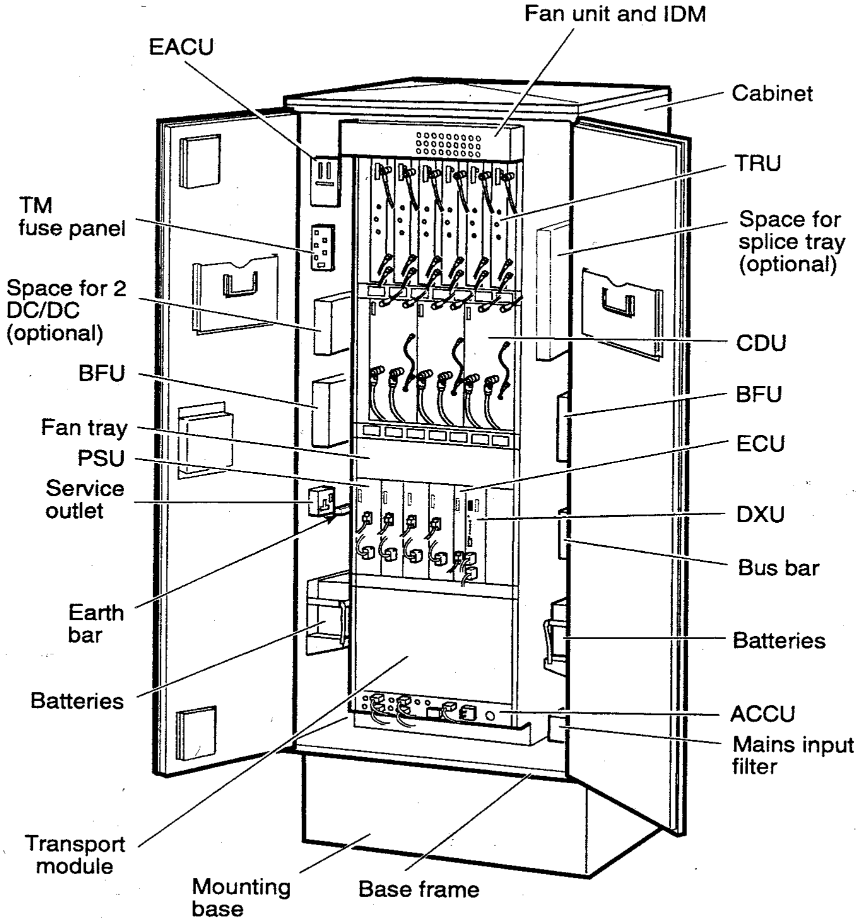


Figure 3-4 RBS 2103

General

- Is an outdoor RBS for the GSM 900 frequency band only
- Can support up to 6 TRUs per cabinet
- Can be configured as single cell or sector configuration

The RBS 2103 is currently only delivered to a specific customer.

Cabinet

The RBS 2103 cabinet provides a durable, vandal resistant and weather proof enclosure of the RBS.

- The RBS cabinet houses up to 6 TRUs plus common equipment needed for serving the cell configuration, see Figure 3-4.
- An optional Battery Fuse Unit (BFU) can be fitted if internal batteries are mounted, which gives approximately 45 minutes battery back-up.
- Cable entries for antenna feeders, transmission cables, and mains power, are concentrated on the bottom of the cabinet. The transmission equipment can be housed in the Transport Module (TM) space.
- The heat exchanger is mounted in the rear of the cabinet. Therefore, it is not possible to mount the cabinet on a wall.

RBS 2202

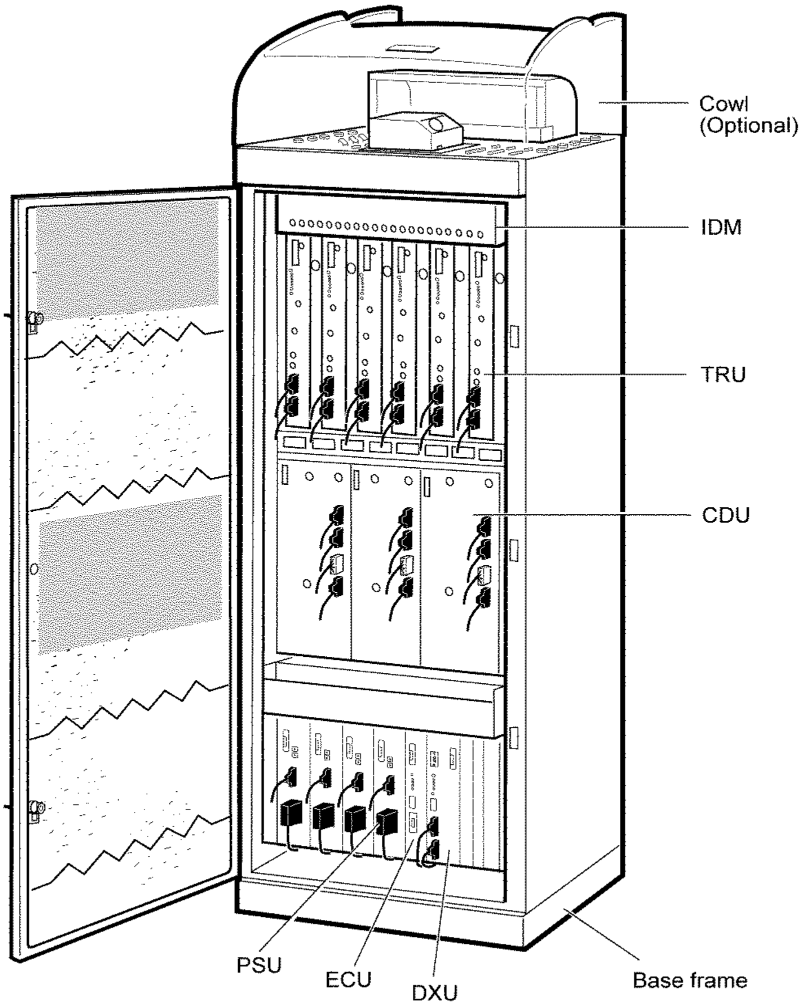


Figure 3-5 RBS 2202

General

- Is an indoor RBS.
- Can support up to 6 TRUs per cabinet.
- Can be configured as single cell or sector cell configuration.
- Multicabinet configurations with two cabinets, master and extension cabinet, and up to 12 transceivers are supported.

Cabinet

The cabinet is to be housed in a climate protected shelter or room which gives suitable climate for the units.

- The RBS cabinet houses up to 6 TRUs plus common equipment needed for serving the cell configuration, see Figure 3-5.

- Cable entries for antenna jumpers, transmission cables, and mains power are concentrated on the roof of the cabinet.

- Power supply can be either 230 V AC, -48 V DC or +24 V DC. If 230 V AC is used, battery back-up can be provided in a separate battery back-up stand, i.e BBS 2202 which can provide up to 8 hours of battery back-up.

- A top cowl can be attached to the cabinet roof, providing acoustic damping and contributing to a clean cabinet look.

RBS 2301/RBS 2302

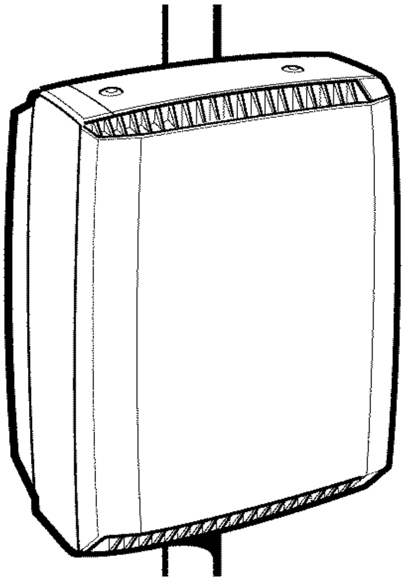


Figure 3-6 RBS 2301/2302

General

The RBS 2301 and RBS 2302 looks similar, but has some differences. The differences will be stated in the text below. If nothing is mentioned, it is valid for both RBSs.

- Designed for both indoor and outdoor applications.
- Possible to mount the cabinet on a wall or on mast pole.
- Delivered with 2 TRXs.
- Can be extended to 6 TRX solution connecting up to three cabinets together in one cell (RBS 2302).
- Supports Maxite™ (active antennas) (RBS 2302).
- Low output power makes it useful for small cells, such as: arenas, streets, and shopping malls, etc.
- Cabinet can be fitted with external antennas, internal sector- or omniantenna.
- Can be used for building picocell coverage using only one antenna feeder.

Cabinet

The size is smaller than the other base stations in the RBS 2000 family, and this is mainly thanks to the low output power. Due to this, the base station does not need so much cooling and that is why its size is smaller. The base station contains only a few replaceable parts, the main parts are:

Cabinet:

The cabinet houses up to two transceivers plus common equipment needed for serving one cell; that is power supply, distribution switch, antenna interfaces and a battery for power backup minimum 3 min.

Mounting base:

Here all incoming cables are connected, that is AC-power, transmission lines and external alarms.

Sunshields:

Are mounted around the base station to give the cabinet a cleaner look. The front sunshield can be ordered in 6 different colors for blending into the environment in a better way.

RBS 2401

Figure 3-7 RBS 2401

General

The RBS 2401 is the first dedicated indoor radio base station, designed for indoor applications. RBS 2401 is in itself a complete RBS, including transmission and integrated power supply. The product is designed for maximum efficiency in indoor situations, like office solutions and public hot spot indoor applications. This, together with flexible transmission solutions and antenna configurations, gives the most efficient and flexible indoor RBS solution available today.

Cabinet

The cabinet houses two transceivers plus common equipment needed for serving one cell. RBS 2401 convection cooling and indoor adaptations allows for a small and handy cabinet. To be able to make the RBS 2401 less visible and become a part of the background, the RBS is delivered with a front shield in a discrete colour. It is also possible to paint the front shield, as to make it easier to blend in.

HARDWARE ARCHITECTURE

COMMON USED HARDWARE AND SYSTEM BUSES IN RBS 2000 MACRO

The hardware consists of a number of Replacable Units (RUs) and buses, which are briefly described in the following sections. The RU is the smallest hardware part that can be swapped when doing repair at the site. This can be e.g. a TRanceiver Unit (TRU), cable, fan etc.

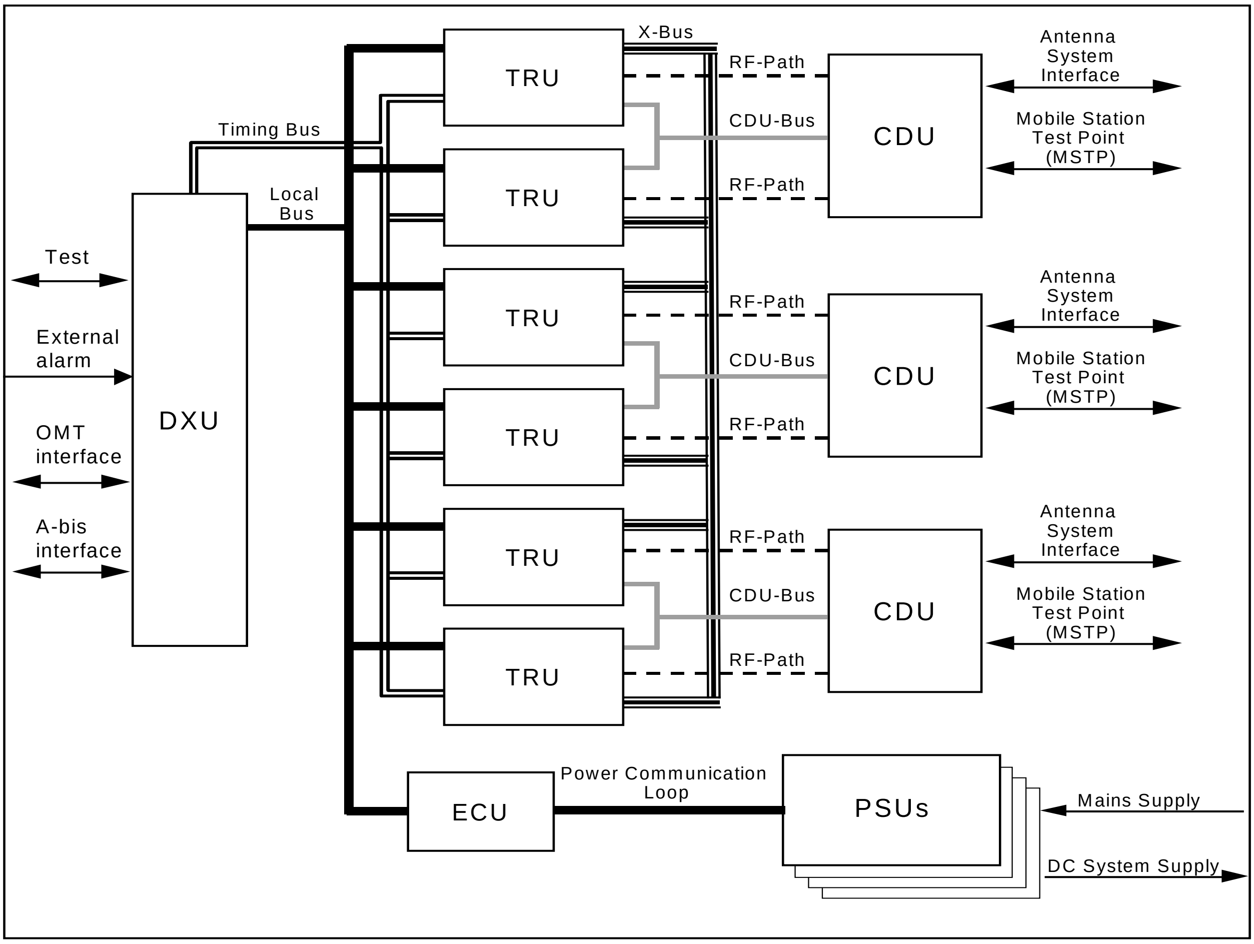


Figure 3-8 Replaceable Units (RUs) and buses in RBS 2000

DISTRIBUTION SWITCH UNIT (DXU)

The Distribution Switch Unit (DXU) is the RBS central control unit. There is one DXU per RBS. It provides a system interface by cross connecting either a 2Mbit/s or 1.5 Mbit/s transport network and individual time slots to their associated transceivers.

TRANSCEIVER UNIT (TRU)

It is a transmitter/receiver and signal processing unit which broadcasts and receives the radio frequency signals that are passed to and from the mobile station. Each TRU handles 8 air time slots.

COMBINING AND DISTRIBUTION UNIT (CDU)

A combiner is a device, at the base station, that allows connection of several transmitters to one antenna. It allows each transmitters RF energy out to the antenna, while blocking the RF energy from the other transmitters utilizing the same antenna. There are two types of combiners:

- Hybrid
- Filter

ENERGY CONTROL UNIT (ECU)

The ECU controls and supervises the power and climate equipment to regulate the power and the environmental conditions inside the cabinet to maintain system operation. It communicates with the DXU over the Local Bus. The main units in the power and climate system are:

- Power Supply Units (PSU)
- Battery and Fuse Unit (BFU) with batteries
- AC Connection Unit (ACCU)
- Climate subcabinet with Climate Control Unit (CCU), heater, active cooler and heat exchanger (outdoor cabinets only)
- Fans controlled by Fan Control Units (FCU)
- Climate sensors, i.e. temperature and humidity sensors

LOCAL BUS

The local bus offers internal communication between the DXU, TRUs and ECU. Examples of information sent on this bus are TRX Signaling, speech and data.

TIMING BUS

The timing bus carries air timing information from the DXU to the TRUs.

X-BUS

The X-bus carries speech/data on a time slot basis between the TRUs. This is used for base band frequency hopping.

CDU BUS

The CDU Bus connects the CDU to the TRUs and facilitates interface and O&M functions e.g. transfers alarms and RU specific information.

POWER COMMUNICATION LOOP

The power communication loop consists of optical-fiber cables and carries control and supervision information between the ECU, PSUs, and the BFU. E.g., the output current is regulated due to the traffic load of the RBS.

RBS 2000 FUNCTION

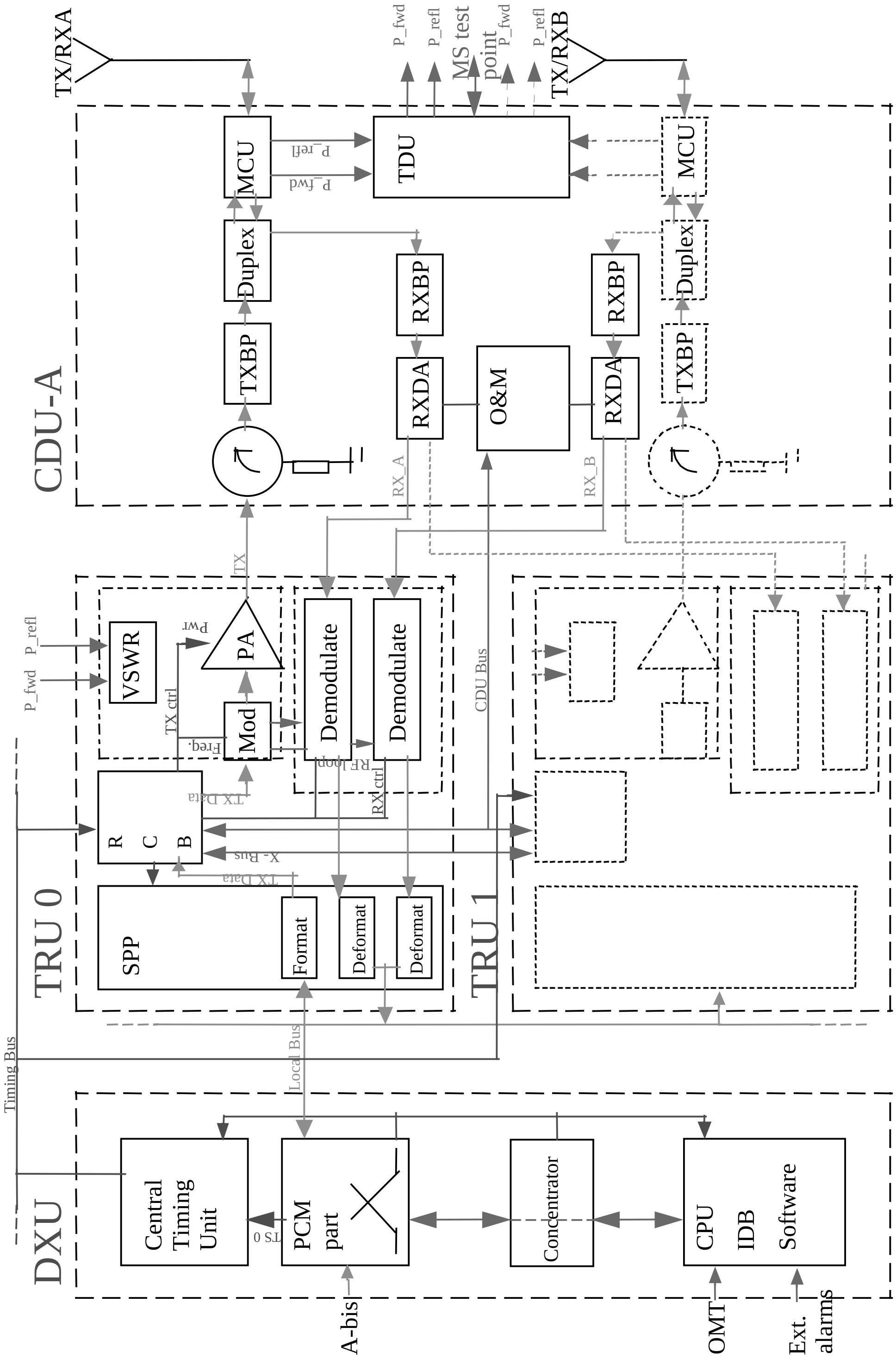


Figure 3-9 RBS 2000 Function

Figure 3-9 shows a simplified layout of the RBS RUs and the function. It will be explained in the text following.

DISTRIBUTION SWITCH UNIT (DXU)

The DXU is divided into four main sections. They are:

- PCM-part, Represents the Managed object Interface Switch (IS) and the Digital Path (DP)
- Central Processing Unit (CPU), Represents the Managed object Central Function (CF)
- Central Timing Unit (CTU), Represents the Managed object Timing Function (TF)
- High level Data Link Controller (HDLC) concentrator, Represents the Managed object Concentrator (CON).

Their main functions are:

The PCM-part (IS) purpose is to extract time slots from the A-bis link and pass them to the TRUs over the local bus. It is possible to connect two PCM lines (Port A / B) to the DXU. This is to increase the capacity or to offer redundancy on transmission links.

Secondly, the IS can drop time slots which are not used in the RBS to another destination. This is called Multi Drop (Cascading) and it enhances flexibility. Up to 5 RBSs can be interconnected on a PCM line from the BSC. The incoming time slots are connected to PCM Port A on the DXU. The outgoing time slots towards the next RBS are connected to PCM Port B. The Multi Drop functionality is activated with the OMT during installation.

The CPU carries out the resource management within the RBS. In addition, it is responsible for:

- RUs software loading and storage
- Interface to the OMT
- Operation & maintenance
- Internal and external alarms
- Extraction of LAPD signaling information

The CTU generates stable reference pulses for the TRUs. The timing unit can be synchronized from the A-bis link or from an external source like a optional sync board such as a Global Positioning System (GPS) receiver. The HDLC Concentrator enables the features LAPD concentration, that increases the capacity of a PCM line toward the RBS.

TRANSCEIVER UNIT (TRU)

The TRU includes all functions related to one radio carrier supporting eight Basic Physical Channels (BPC) on a TDMA frame. The functions include:

- Radio transmitting
- Radio receiving
- Air interface signal processing
- TRX management

TRU is divided into three main sections:

- TRansceiver Unit Digital (TRUD), represents the Managed object TRansceiver Controller (TRXC).
- Transmitter Block (TX-block)
- Receiver Block (RX-block)

Their main functions are:

The **TRUD** serves as the TRX controller. It interfaces with other RBS components via the Local Bus, CDU Bus, Timing Bus, and X Bus. The TRUD performs uplink and downlink digital signal processing such as channel coding, interleaving, ciphering, burst formatting, and Viterbi equalization.

The Transmitter Block performs the downlink signal modulation and amplification. Additionally, the Transmitter Block performs Voltage Standing Wave Ratio (VSWR) supervision. That is basicly a quote of the power sent and the power reflected back when transmitting. To supervise this, gives a indication if something has happened to the antenna system e.g. the feeder is damaged.

The Receiver Block performs the uplink signal demodulation and then routes the demodulated signal to the TRUD part.

The **radio loop** between the TX and RX makes it possible to test the TRU by generating test signals and looping them back for testing Bit Error Ratio (BER) measurements.

COMBINING AND DISTRIBUTION UNIT (CDU)

Combining and Distribution Unit(CDU) is the interface between the TRUs and the antenna system. The main purpose of the CDU is to reduce the number of antennas used in each cell/sector.

The CDUs hardware functions are:

- TX combining (not CDU-A).
- RX pre-amplification and distribution.
- Antenna system supervision support.
- RF filtering.
- Tower Mounted Amplifier (TMA) power supply and supervision (not all CDU types)
- RF Circulators inside the CDU are designed to provide the TRU with protection against reflected RF power.

The CDU combines or distributes (depending on CDU) the transmitted signals from various transceivers and distributes received signals to all transceivers. The same antennas are used for transmitting and receiving if a duplex filter is used. All signals are filtered before transmission and after reception by means of band pass filters. A measuring coupler unit is included, providing forward and reflected power measurements for Voltage Standing Wave Ratio (VSWR) calculations in the TRU.

To support different needs and configurations, a range of CDU types are developed. They are:

- Without any combiners at all (to avoid the combining loss), CDU-A.
- With hybrid combiners, CDU-C and CDU-C+.
- With filter combiners to support large configurations, CDU-D.

CDU Block Diagrams

The following block diagrams show the different CDU types for GSM 900. The main difference between these and GSM 1800 and 1900 is that the duplex filter may or may not be used. That is to be able to connect a TMA. In some CDUs there are no duplex filters inside the CDUs for those frequency bands..

Some of the CDUs might require Inter Modulaton of the 3rd order (IM3) frequency planning depending on the bandwidth used by the operator. If a bandwidth of 20 MHz or more is used, and the lowest used TX frequency is in the interval for GSM 900:935-940 MHz, for GSM 1800: 1805-1810 MHz and for GSM 1900: 1930-1935 MHz, frequency planning is recommended. Without frequency planning, sensitivity of a single receiver side could be reduced by 10-15 dB, but in practice, due to diversity, the overall reduction is 3-5 dB.

Tower Mounted Amplifier (TMA)/ Antenna Low Noise Amplifier (ALNA)

The TMA or ALNA, two different names for the same thing, is an external unit mounted in the mast, close to the antenna. It amplifies the received signal to increase the overall system sensitivity and to compensate for loss in the antenna feeder. The TMA is supplied with power from the CDU and supervised by the RBS. It also connects the transmitter and receiver path to the same antenna with a duplex filter.

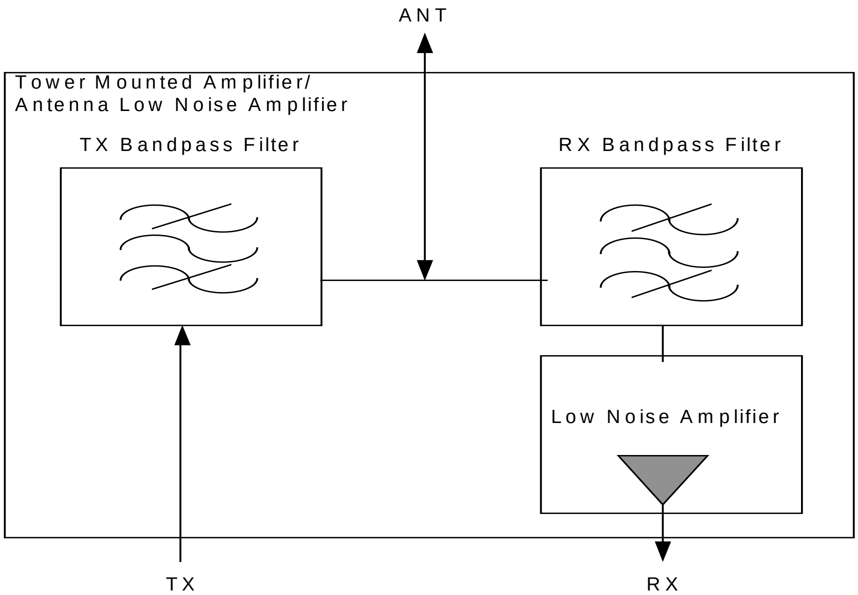


Figure 3-10 Tower Mounted Amplifier/Antenna Low Noise Amplifier

The TMA/ALNA hardware functions are:

- RX pre-amplification
- Duplex filtering

CDU-A

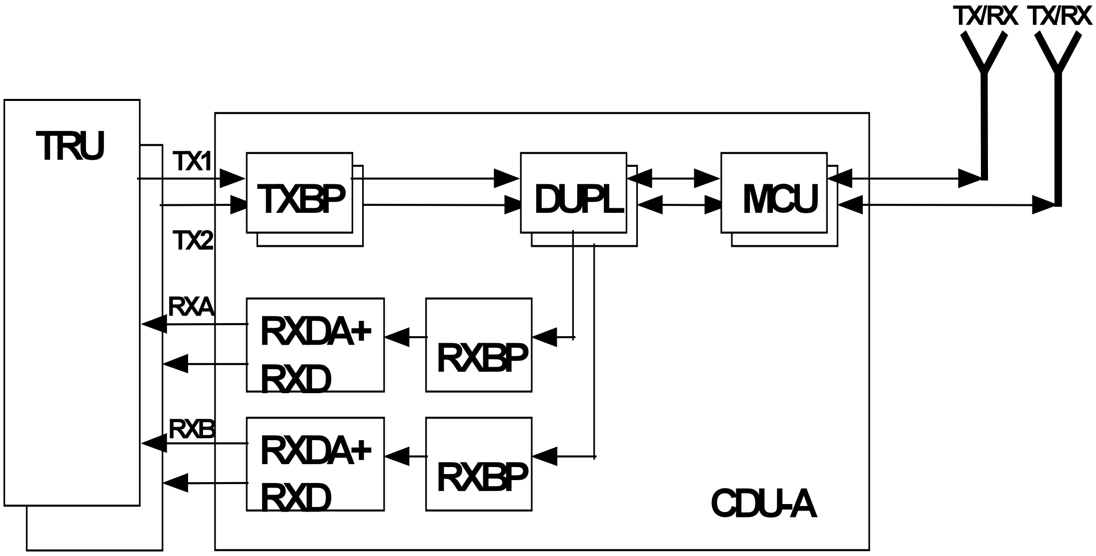


Figure 3-11 CDU-A Block Diagram

The CDU-A shall be used when optimizing cells for high coverage since the CDU is designed to maximize the output power.

Main characteristics are:

- Maximum 2 TRUs/cell (recommended not a system limit to reduce the number of antennas in the cell).
- Output power in GSM 900 is 44.5 dBm and in GSM 1800/1900 43,5 dBm.
- No limitations on frequency planning.
- Required frequency separation is 400 kHz.

CDU-C

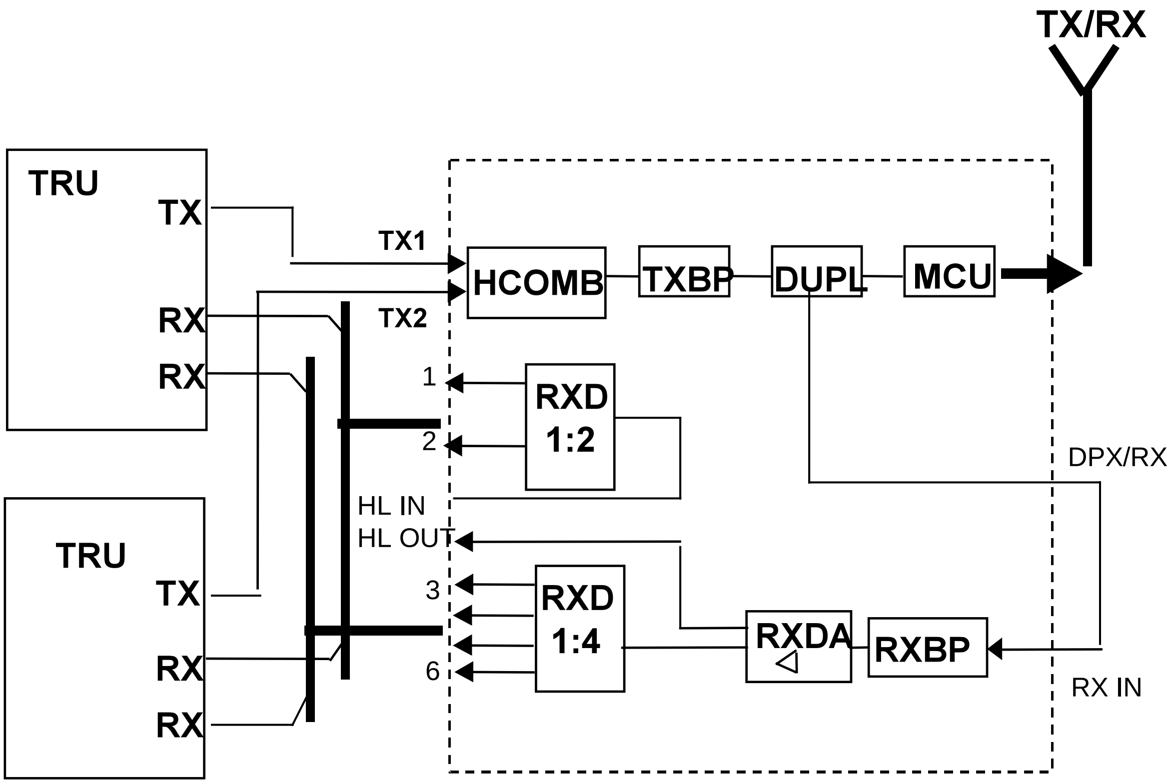


Figure 3-12 CDU-C Block Diagram

CDU-C shall be used when optimizing the cell for medium capacity, since the possible number of TRUs is higher compared to CDU-A. The output power is independent of the number of TRUs in the cell.

Main characteristics are:

- Maximum 6 TRUs/cell.
- Output power in GSM 900 is 41,0 dBm and in GSM 1800/1900 40,0 dBm. If the output from the TRU is set to maximum (900:47 dBm, 1800/1900: 45 dBm)
- IM3 limitations on frequency planning.
- Required frequency separation is 400 kHz.

CDU-C+

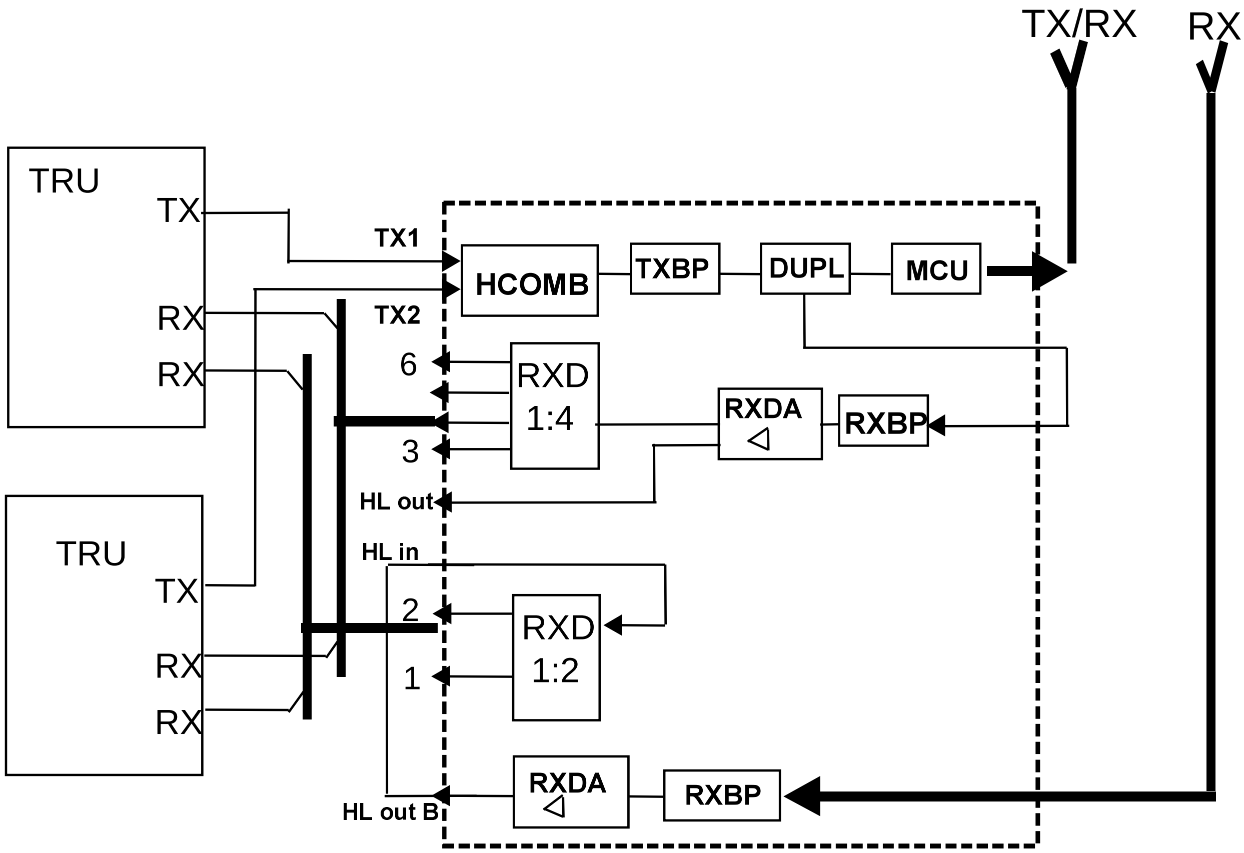


Figure 3-13 CDU-C+ without TMA

CDU-C+ shall be used when optimizing the cell for medium capacity, since the possible number of TRUs is higher compared to CDU-A. The output power is independent of the number of TRUs in the cell. The CDU-C+ replaces the CDU-C.

Main characteristics are:

- Maximum 6 TRUs/cell.
- Two receiver paths.
- Output power in GSM 900 is 41,0 dBm and in GSM 1800/1900 40,0 dBm. If the output from the TRU is set to maximum (900:47 dBm, 1800/1900: 45 dBm)
- IM3 limitations on frequency planning.
- Required frequency separation is 400 kHz.
- Versions that support E-GSM can be ordered.

CDU D

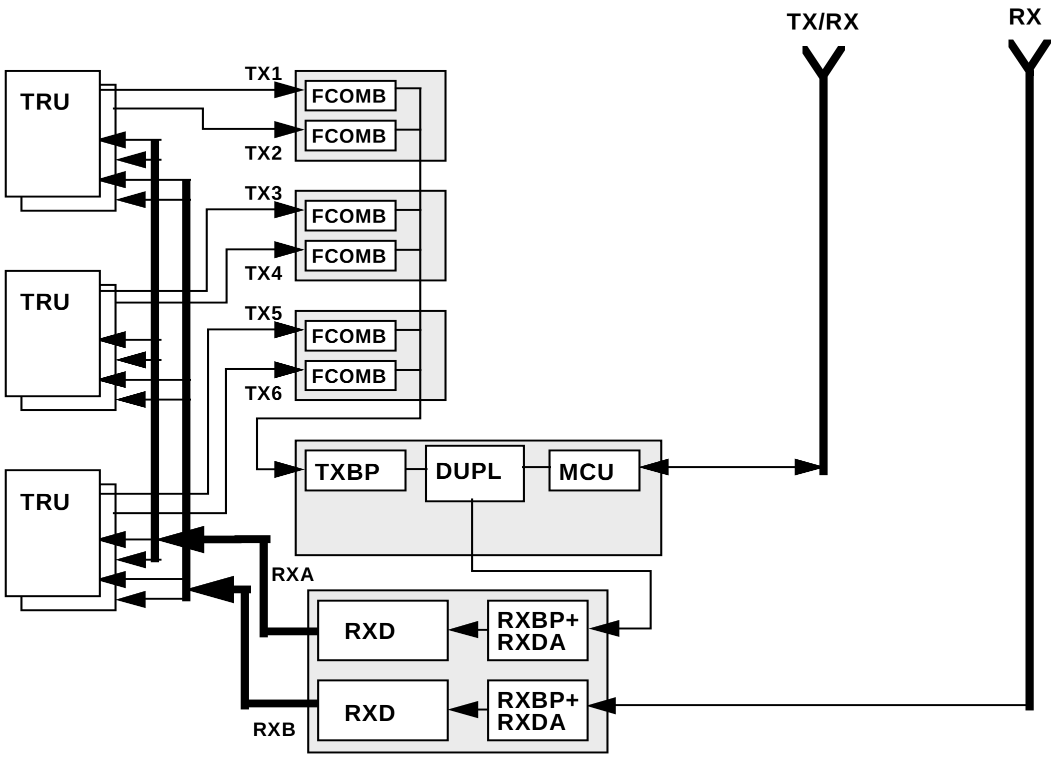


Figure 3-14 CDU-D 1x6 without TMA

CDU-D shall be used to optimize the cell for large capacity, since the possible number of TRUs is higher for this CDU compared to any other CDU-type.

Main characteristics are:

- Maximum 12 TRUs/cell.
- CDU-D has the physical size of 3 CDU-A, 3 CDU-C or 3 CDU-C+.
- Output power in GSM 900 is 41,0 dBm and in GSM 1800/1900 40,5 dBm. If the output from the TRU is set to maximum (900:47 dBm, 1800/1900: 45 dBm)
- Base band hopping must be used.
- Required frequency separation is 600 kHz for GSM 900 and 1000 kHz for GSM 1800 and GSM 1900.
- Primarily designed for RBS 2202.
- Support for E-GSM is provided. The CDU covers the E-GSM band (TX 925-960 MHz, RX 880-915 MHz).
- IM3 limitations on frequency planning.

CLIMATE AND POWERSYSTEM

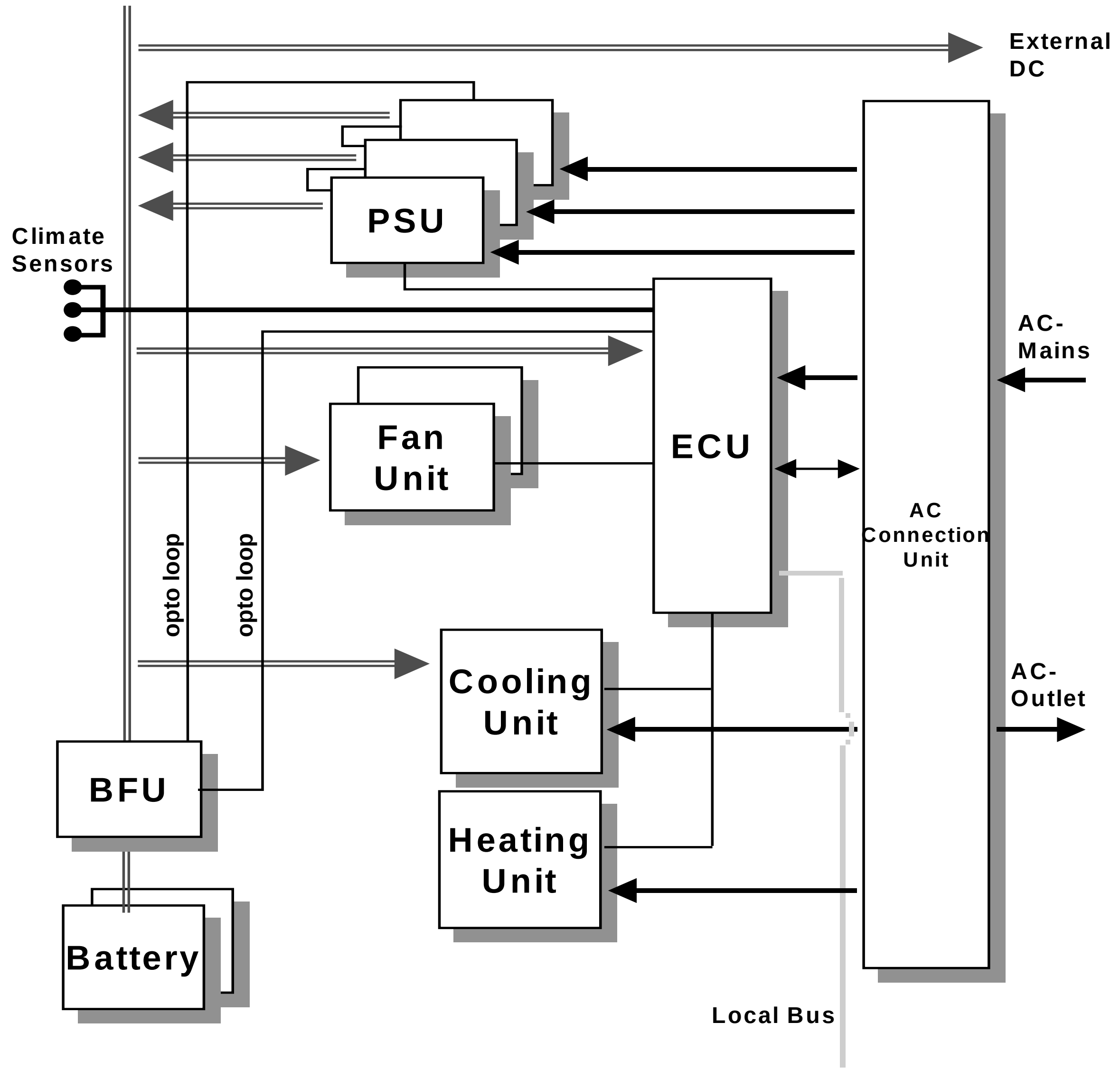


Figure 3-15 Climate and Power for an RBS 2101/2102

Figure 3-15 shows the hole climate and power system in a simplified way. The AC power for the RBS is routed through the AC Connection Unit (ACCU) and distributed to the Power Supply Units (PSU), air conditioning and heating equipment (outdoor cabinets only). In the PSUs the incoming AC is rectified to +24 DC, which is the system voltage, and then distributed to the users over the Internal Distribution Module (IDM) which provides circuit breaker protection for the base station modules. The batteries are connected to the power system via the Battery Fuse Unit (BFU) which controls the charging and discharging of the batteries. The ECU is in the center of it all and supervises and controls the power system via the optofibre loop, where information and control data is sent.

The ECU also controls and supervises the climate system. It senses the climate using temperature sensors and humidity sensors (outdoor cabinets only), for input to the climate units so that the temperature and humidity inside the cabinet is maintained between certain limits. If these limits are exceeded the units in the RBS will be shut off to prevent damage. In a simplified way the fans inside the cabinet are constantly running to circulate the internal air. The cooling and heating units, cools respectively and heats the internal airflow.

Since the RBS 2202 is an indoor cabinet the climate and power system looks a little bit different. The ACCU, cooler, heater, BFU and batteries are not inside the cabinet. The PSUs are connected directly to AC voltage. The ECU is powered by DC-power only. The BFU and batteries can be mounted in an optional Battery Backup Stand, i.e. BBS 2202. Since the indoor cabinet is supposed to be placed in a climate protected housing, the cooling and heating units are not a part of the RBS 2202.

COMPARISON BETWEEN RBS 2000 AND RBS 200

Units in RBS 2000	Function	Units in RBS 200
DXU	• Interface to the 2/1.5 Mbit/s link Switches the right TS to the right TRX • Timing reference • Handling the database including all HW info in the RBS	TSW in TRI Timing units
TRU	Contains all functionality for handling 8 TS: • Single Processor • Radio receiving • Radio transmitting • Power amplifier	13 units: 8 SPP, TRXC, RRX; RTX, Power Filters, PSU (TRXC)
ECU	Controls & Supervises power & climate	PCU
CDU	• Combining transmitted signals • Distributing received signals	Combiner, RXDA, RXD

Figure 3-16 Comparison between RBS 2000 and RBS 200

SOFTWARE HANDLING

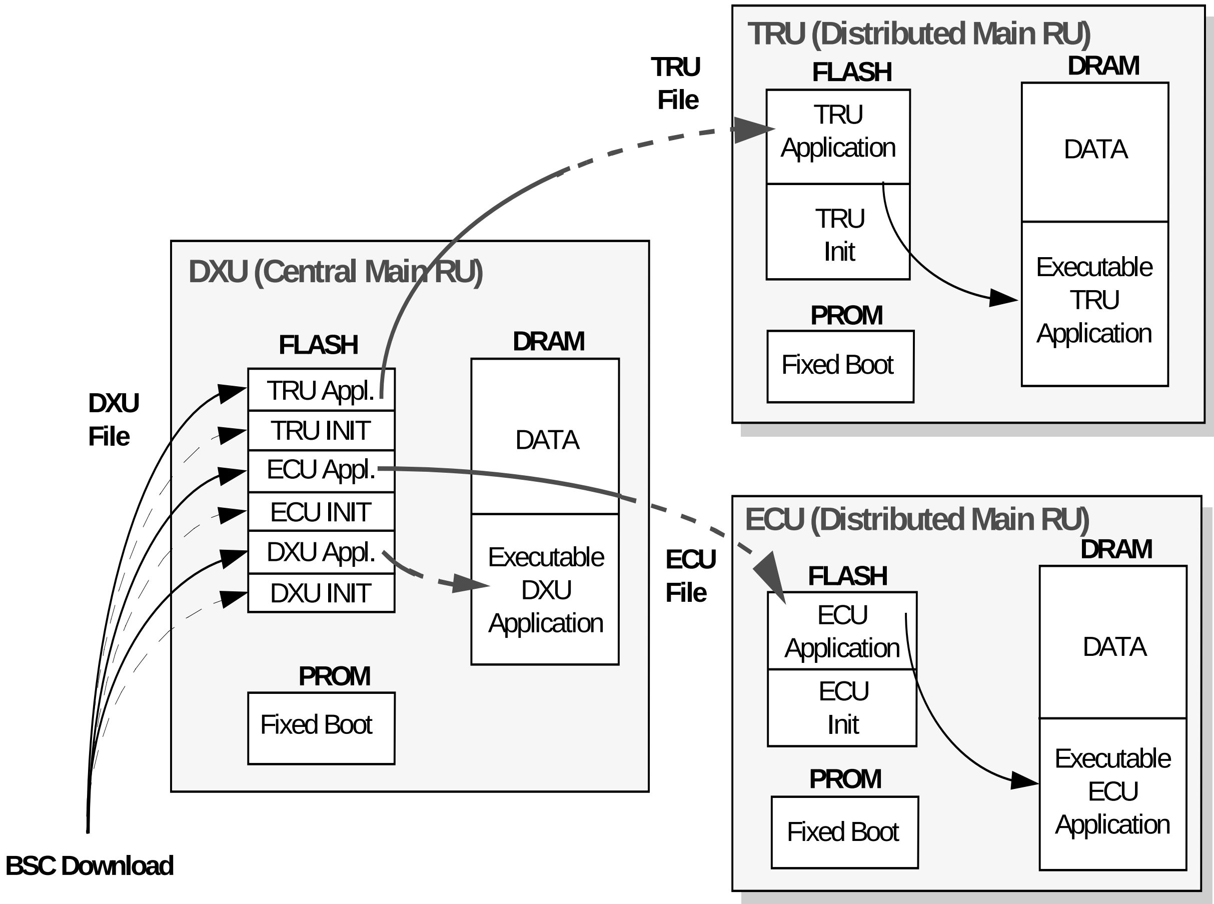


Figure 3-17. Software Handling

Software is downloaded into non-volatile memory at the factory. If it is the correct revision, the RBS can be operational immediately, otherwise the software must be downloaded from the BSC.

The BSC can download software to the non-volatile memory while the RBS carries traffic. When the software is downloaded, the RBS gets an order to change software from the BSC. The units are restarted with the new software after a down time of less than one minute.

All RBS application and initiation software programs are stored in compressed format in the non-volatile memory in the DXU module. Thus, if a TRU or ECU is changed, it does not matter if the new TRU or ECU contains old software. The DXU compares the software in the new TRU with the TRU software in the non-volatile flash memory of the DXU. If they are not the same, the DXU downloads it’s version to the TRU. The TRU and ECU also store their own compressed application software in their flash memory. This speeds up recovery from a power failure by eliminating the need to reload the software from the BSC.

During power up after a power failure, the files are decompressed and loaded into the DRAM as executable application files. The RBS then performs self tests. Once everything functions as it should, the system comes on-line.

Compressed RBS application software can be downloaded from the BSC via LAPD signaling. The DXU stores the compressed application file in the flash memory. The updated software is sent to the TRUs or ECUs, depending upon which it belongs to. There it is stored in the flash memory.

Software downloading from the BSC is executed as a background process and does not interrupt traffic.

The SW can either be downloaded to the whole TG. This is called Function change. The SW can also be downloaded to a certain MO (CF,TRXC), whis is called program load.

To initiate the SW download you first have to change the MO data of the MO to which you want to download with the RXMSC command. This is to set which SW will be the one that you are going to download. The next thing you do is giving the RXPLI command to initiate the download.

The files stored in the BSC in the IOG that are loaded are called LF 1 to LF6. Table 1 shows what it contains The XXX in the RBS SW name is the revision of the SW e.g. 082 indicates that the revision is R8/2.

LF in BSC/IOG	Type of SW	SW name in RBS
LF1	Application SW for TRU	TRLRXXX
LF2	Application SW for ECU	ECLRXXX
LF3	Application SW for DXU	DXLRXXX
LF4	Initial SW for TRU	TRBRXXX
LF5	Initial SW for ECU	ECBRXXX
LF6	Initial SW for DXU	DXBRXXX

Table 1

DUAL-BAND OPERATION

The Dual-Band solution is only valid for GSM 900/ GSM 1800.

Many of the GSM 900 operators are now also running a GSM 1800 network to increase their total network capacity. Dual-band mobile phones makes it possible to roam and do handovers between the two bands.

There is basically two ways of building a dual-band RBS site. Either you have two separate cabinets or you have dual-band RBS. Ericsson supports both of these solutions.

Two Cabinets Solution

To build a Dual-Band 3 sector site you have to use this solution. The two cabinets can share transmission if you use multidrop between the cabinets. They can also share battery backup from the same BBS. In the picture below one sector is shown in a dual-band 3-sector site. With use of diplexers the two systems can share the same antenna feeders. A diplexer is build up like a duplexer, but the filters are instead tuned to the whole 900 respectively 1800 band.

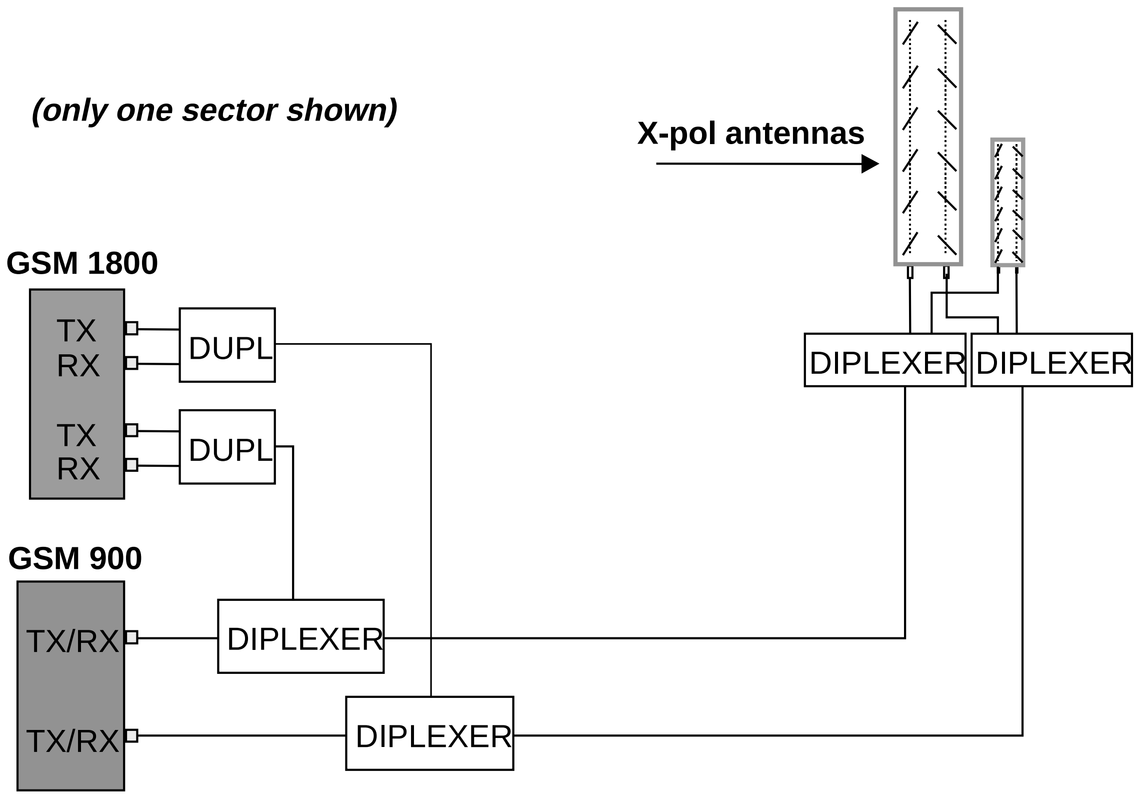


Figure 3-18 Dual-Band site

Dual-Band RBS

If smaller sites are to be implemented the Dual-Band RBS solution can be used. It can be implemented in a RBS 2102 or RBS 2202. The supported configurations are 1x2 (900) + 1x2 (1800) with CDU-A or CDU-C+ in each cell. The other is 1x4 (900) + 1x2 (1800) with CDU-C or CDU-C+ in the 900 cell and CDU-A or CDU-C+ in the 1800 cell. The picture below gives schematic picture of how it is implemented.

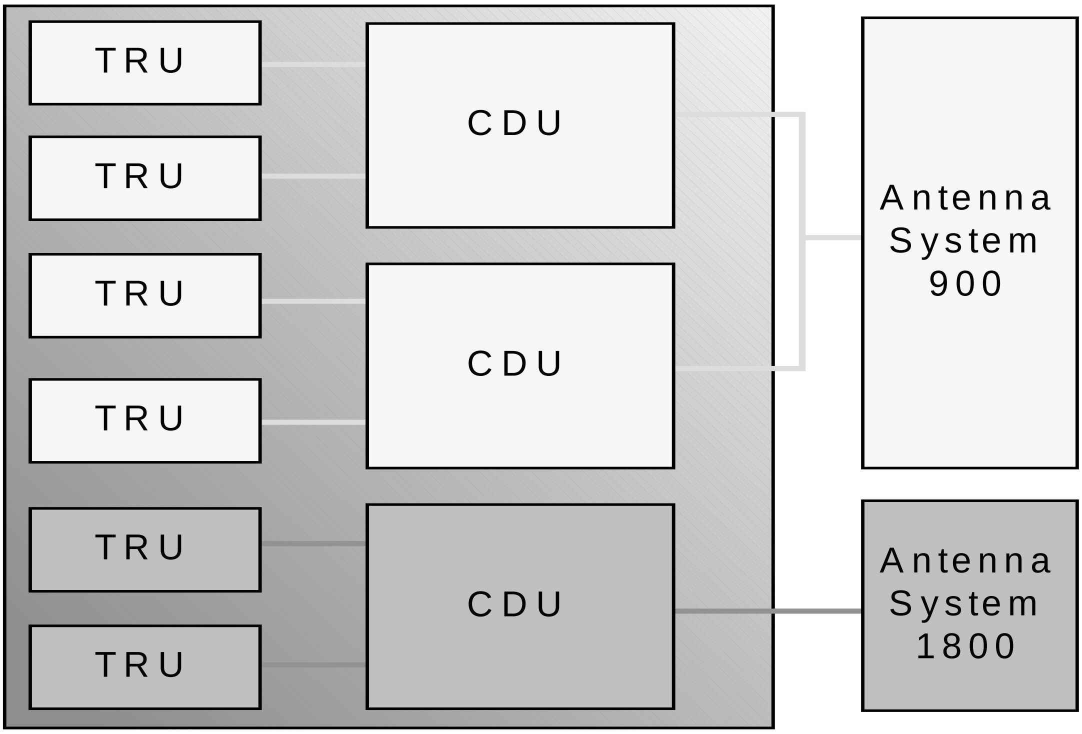


Figure 3-19 Dual-band RBS 1x4 (900) + 1x2 (1800)

RBS MAINTENANCE PROCESS

Personnel using OSS or sitting in the BSC will perform the initial fault analysis upon detecting a problem with an RBS. They will send a work order to a RBS technician who will go out to the site and perform the on-site fault analysis and corrective actions. During the fault analysis process the RBS technician will utilize the indicators on the cabinets, RUs and also the Operation and Maintenance Terminal to isolate the faulty RU. The faulty RU will be removed and replaced. The technician will then again check his indicators and OMT to confirm that the repair action was successful.

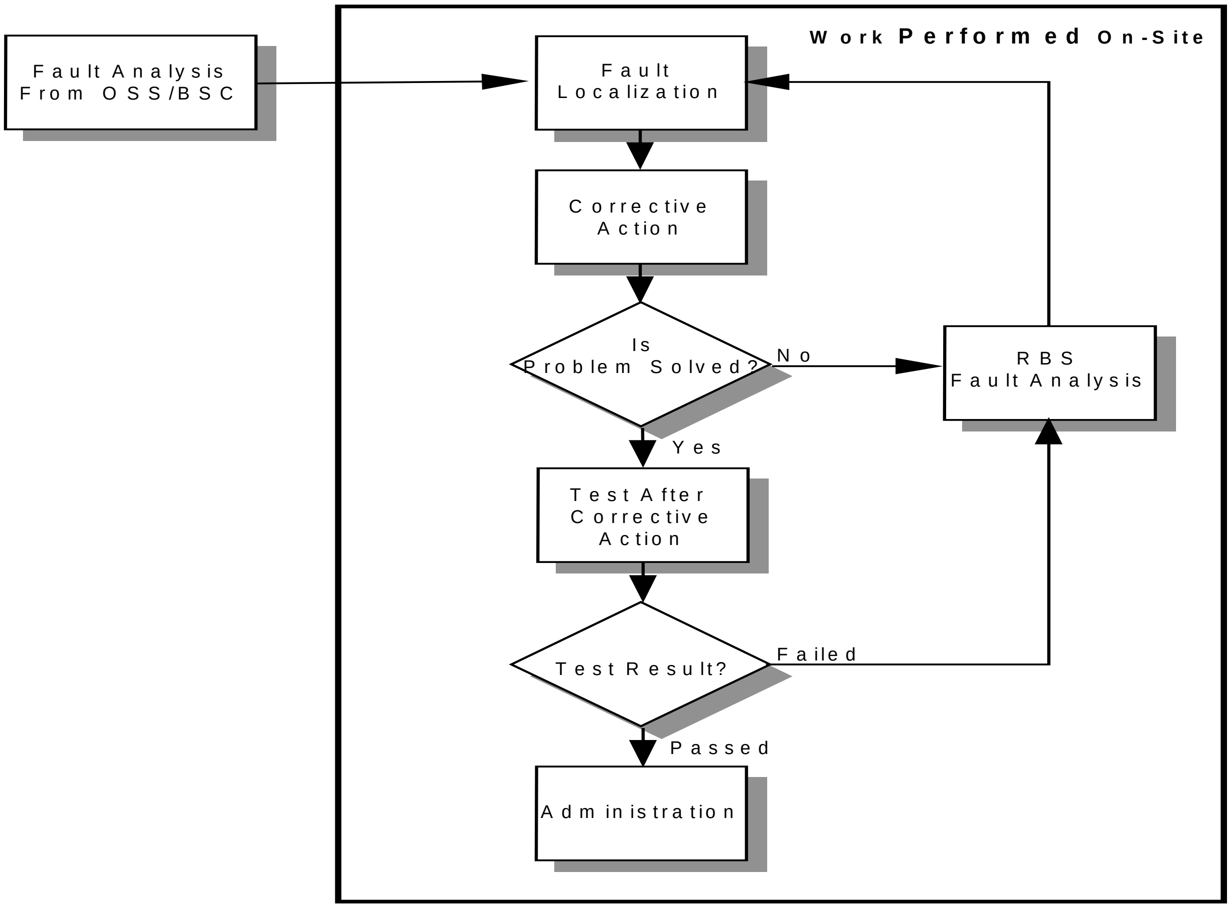


Figure 3-20 RBS Repair Process

Repair actions are quick and easy since there is no need to perform any mechanical or electrical alignment procedures, just removal and replacement of the RU as described by the maintenance manual.

RU Man Machine Interface

The Man Machine Interface (MMI), implemented in the RBS 2000, is through visual indicators (LEDs) and operation control switches.

OMT

	Central Main RU	Direct Distributed Main RU	Indirect Distributed Main RU	Sub RU
Buttons	• CPU Reset • Local/Remote	• CPU Reset • Local/Remote • Test call	• CPU Reset	
Indicators	• Fault • Operational • Local Mode	• Fault • Operational • Local Mode	• Fault • Operational	• Fault • Operational
Application Specific Indicators	• Ext. Alarms • BS Fault	• Tx not enabled • Test result	• Battery Mode • DC disconnected • AC Fault	• Battery Disconnected
	DXU	TRU	ECU	CDU, PSU, BFU

Figure 3-21 RU Man Machine Interface

The Main and Sub RUs have at least one red and one green LED indicator. The green LED indicates the RU is operational and the red LED indicates a fault has been detected in the RU. The lit red LED on the RU provides a means of recognizing the faulty RU after opening the RBS door, and can be replaced without using any specialized tools.

There are also switches for enabling *local* or *remote* operation on the Distribution Switch Unit (DXU) and Transceiver Unit (TRU). When in the local mode the RBS, or portions of it, are disconnected and isolated from the BSC, while in the remote mode the BSC has control of the RBS. Switching the DXU into LOCAL mode results in automatic blocking of the entire RBS. While switching a TRU into LOCAL mode will result in automatic blocking of only the affected TRU. This operation will not disturb any other TRUs operations.

OPERATION AND MAINTENANCE TERMINAL (OMT)

Operation and Maintenance Terminal (OMT) is a software tool specifically designed for the RBS 2000 family of base stations. It is used to perform a number of Operation and Maintenance tasks on site or remotely from the BSC. OMT is a PC program that runs under Microsoft Windows 95 or Windows NT.

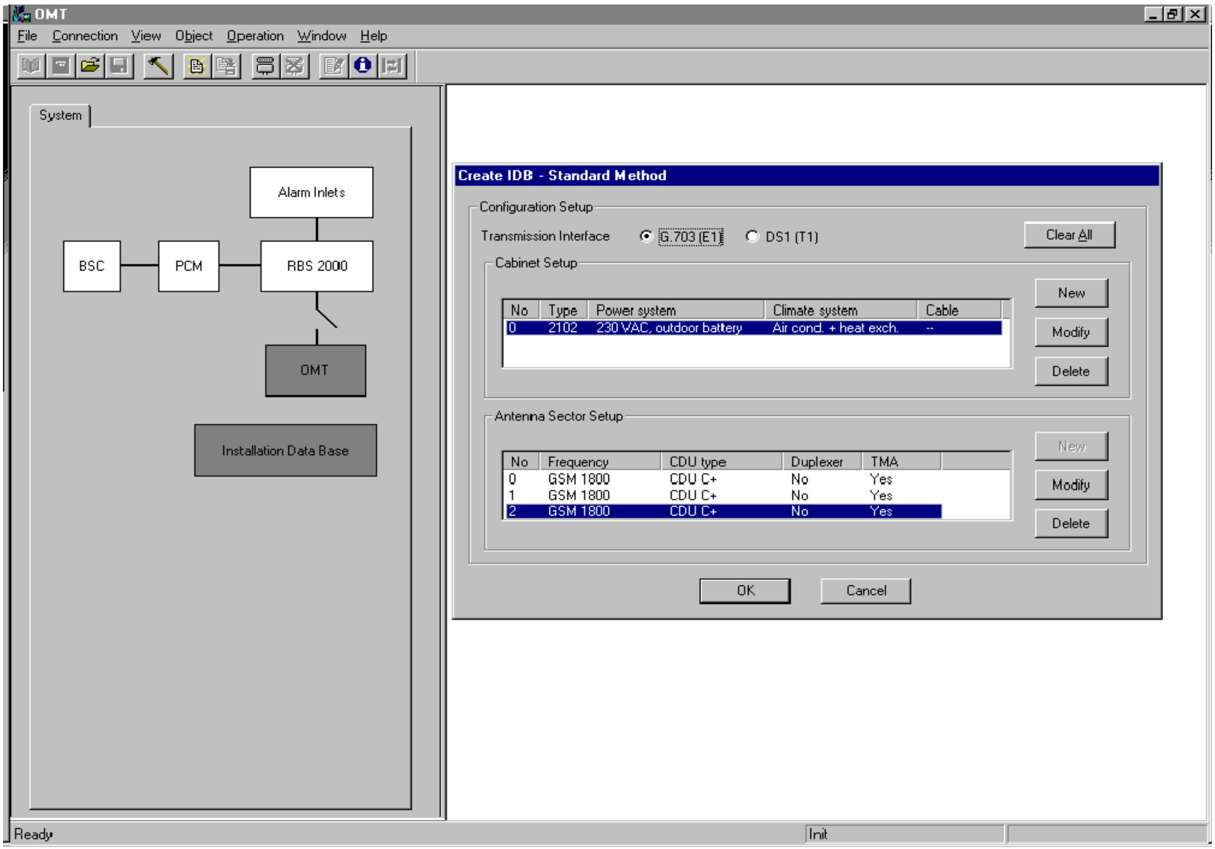


Figure 3-22 Operation and Maintenance Terminal (OMT)

OMT is used during the Radio Base Station (RBS) testing process, both in the warehouse and on-site. It is used for updating and maintaining the RBS Installation DataBase (IDB), defining RBS external alarms, and during the performance of preventive and corrective maintenance functions on the RBS 2000. The primary functions that OMT will be used to perform are; Monitoring the cabinets Internal Alarms in the troubleshooting process, performing IDB operations, defining the External Alarms and Antenna Related Auxiliary Equipment (ARAE), and monitor the hardware and configuration status of the RUs in the cabinet.

Internal Alarms

During the base station repair process the Monitor function can be used to collect information about the fault status of the RBS. This will provide the RBS technician the ability to check for faults when no MMI indications are present, and to confirm repair actions after an RU has been replaced.

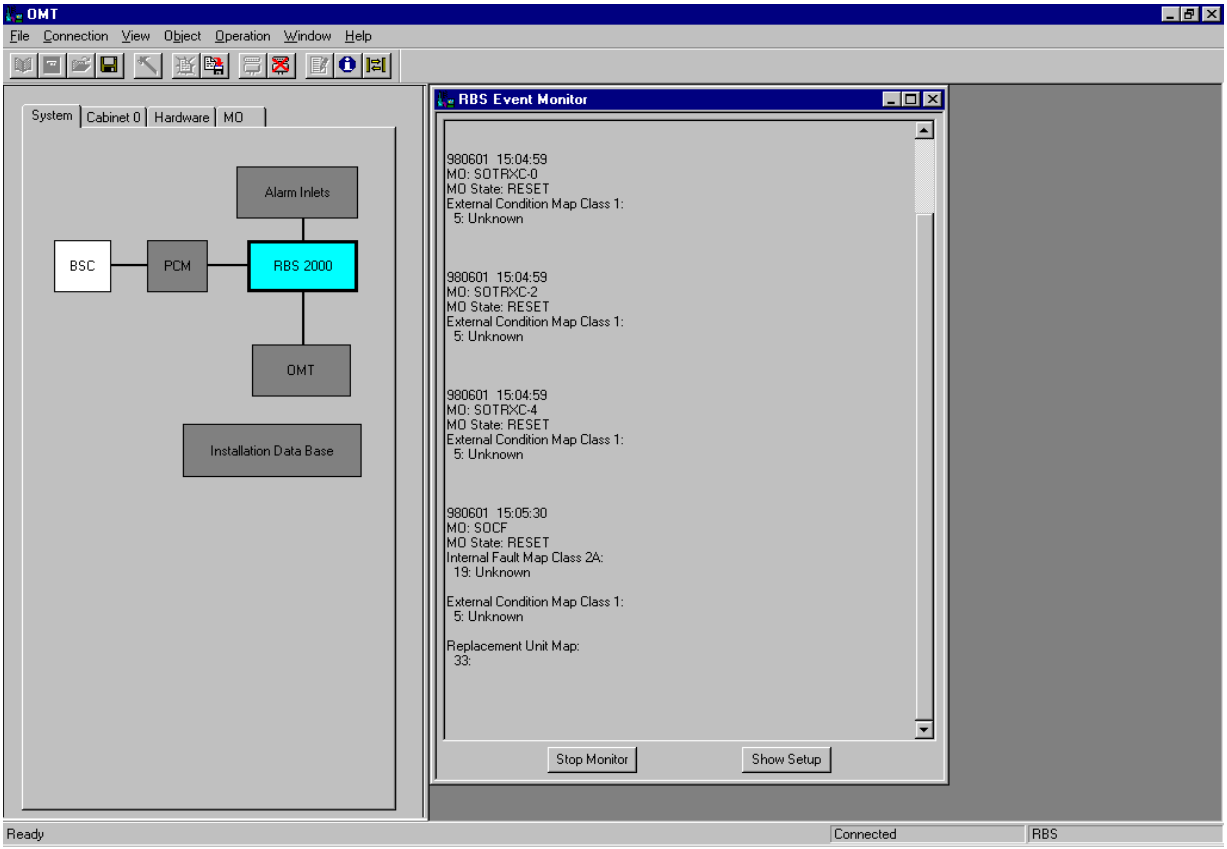


Figure 3-23 Internal Alarms

External Alarms/Antenna Related Auxiliary Equipment (ARAE)

The OMT is used to define external alarms for the base station. It is also used to define Antenna Related Auxiliary Equipment (AREA) alarms, e.g the active antenna in the Maxite. Even though they are binary alarms these alarms will be handled more like an internal alarm in the BSC.

It is important to note that during the alarm definition process the OMT must be disconnected. In order to load the newly defined alarms, the base station needs to be placed in the local mode, precluding any traffic while the new IDB is being transferred.

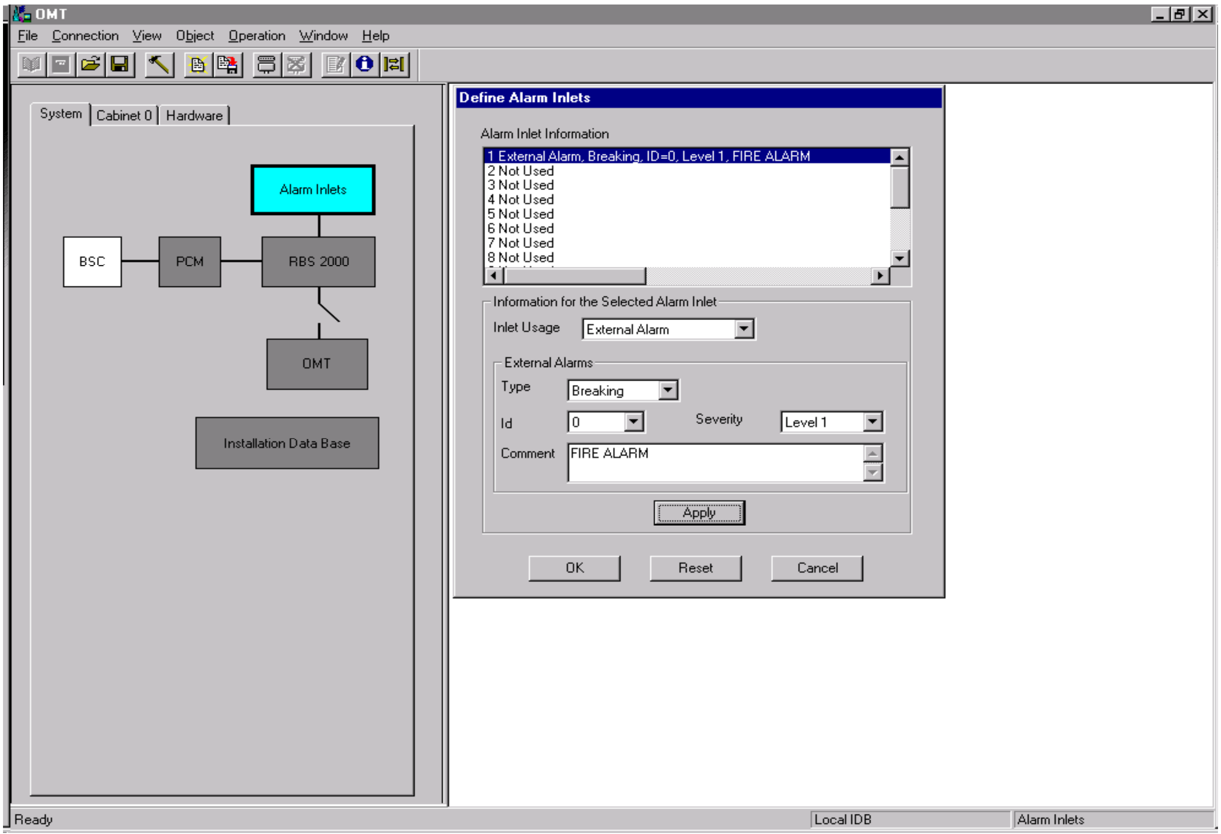


Figure 3-24 Defining External Alarms

Installation Data Base

Each RBS has a built-in Installation database where information about installed hardware is stored. This provides a way to maintain an actual inventory list of all hardware installed. The database can be accessed by the OMT. IDB information is permanently stored in the flash memory of all Main RU's and Sub RU's. IDB information pertaining to Passive RU's must be manually entered and will be retained in the DXU (Central Main RU).

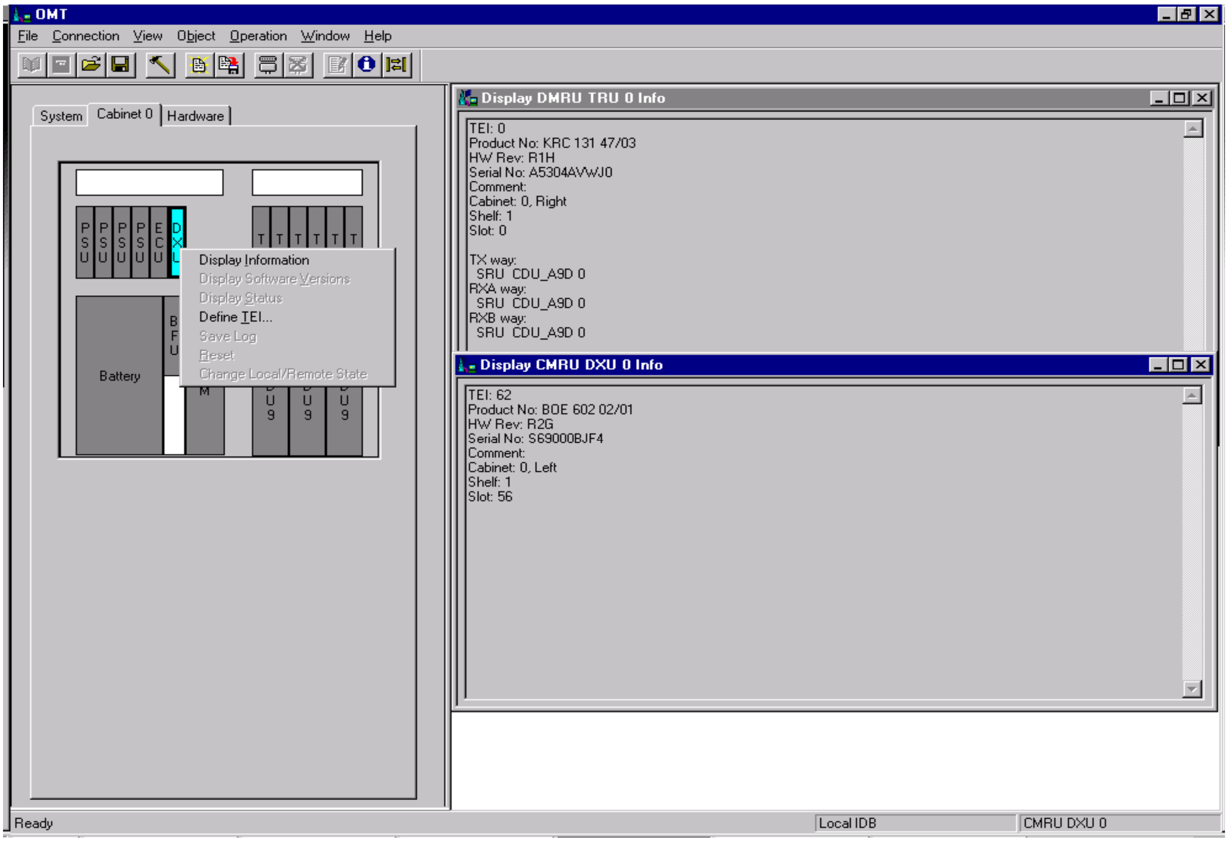


Figure 3-25 Installation Data Base (IDB)

Monitor functions

The monitor function in the OMT makes it possible to check the configuration of RUs and MOs, read sensor outputs and read faultstatus on RUs. This function belonged to OMT2 in the old SW-releases, but has now been implemented in the new OMT version.

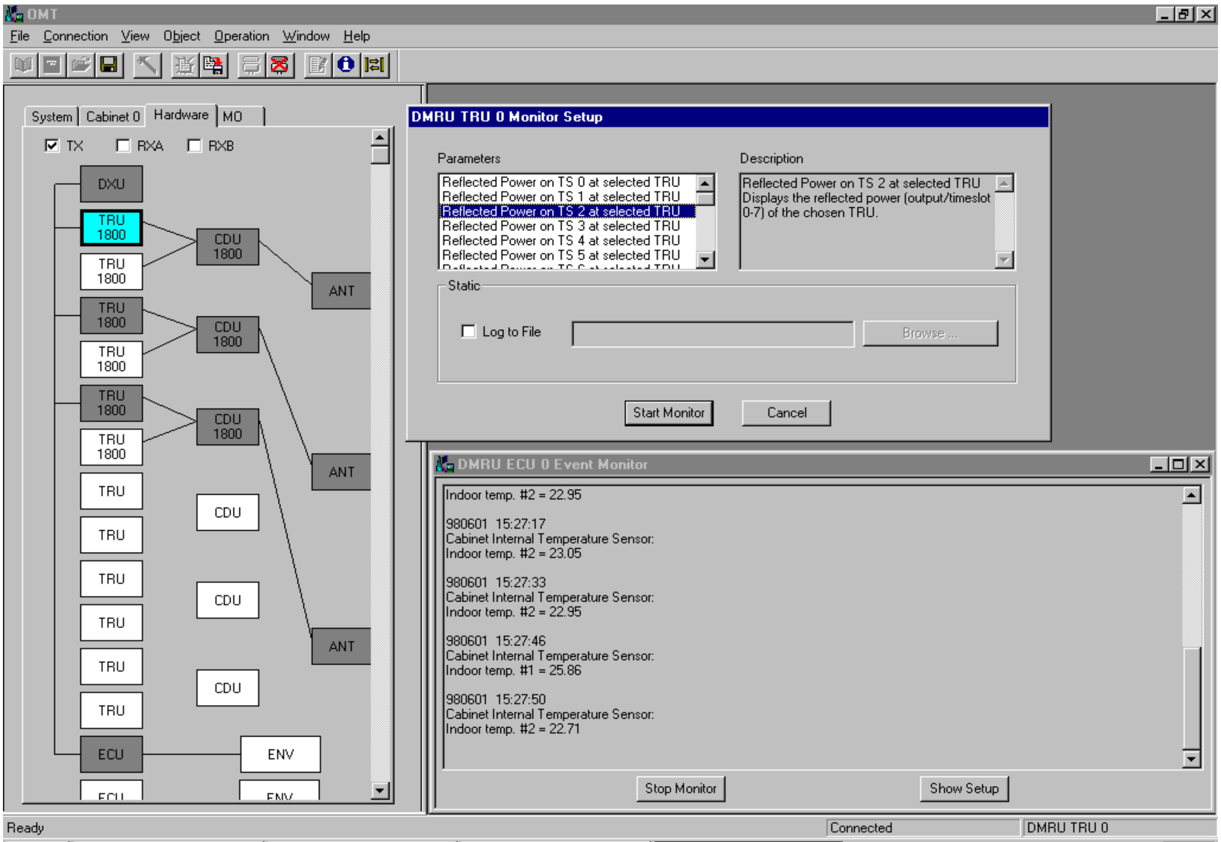
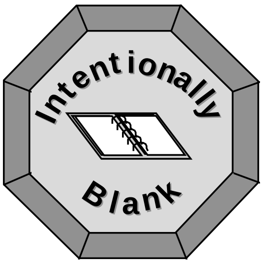


Figure 3-26 Monitor functions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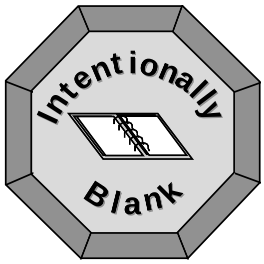
Managed Objects

Chapter 4

This chapter is designed to provide the student with an overview how the Managed Objects (MO) is structured and used.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4 Managed Objects

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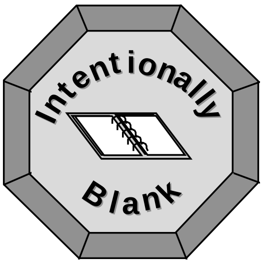
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MO CONCEPT

The hardware architecture in RBS is not visible from the BSC, so a model of the RBS has been developed which is used both in the BSC and the RBS. This model is a logical representation of the hardware and software functionality of the RBS, describing the RBS in a functional-oriented way. The model is presented as a set of Managed Objects (MOs). An MO does not necessarily have a one-to-one relation with a physical unit in the RBS. The MO comprises either both hardware and software or software only. The MOs are divided in 2 major classes:

- **Service Objects (SO)** The SOs handle functionality and are owners of specific hardware units in the cabinet.
- **Application Objects (AO)** The AOs handle functionality only and are under the administration of the SOs.

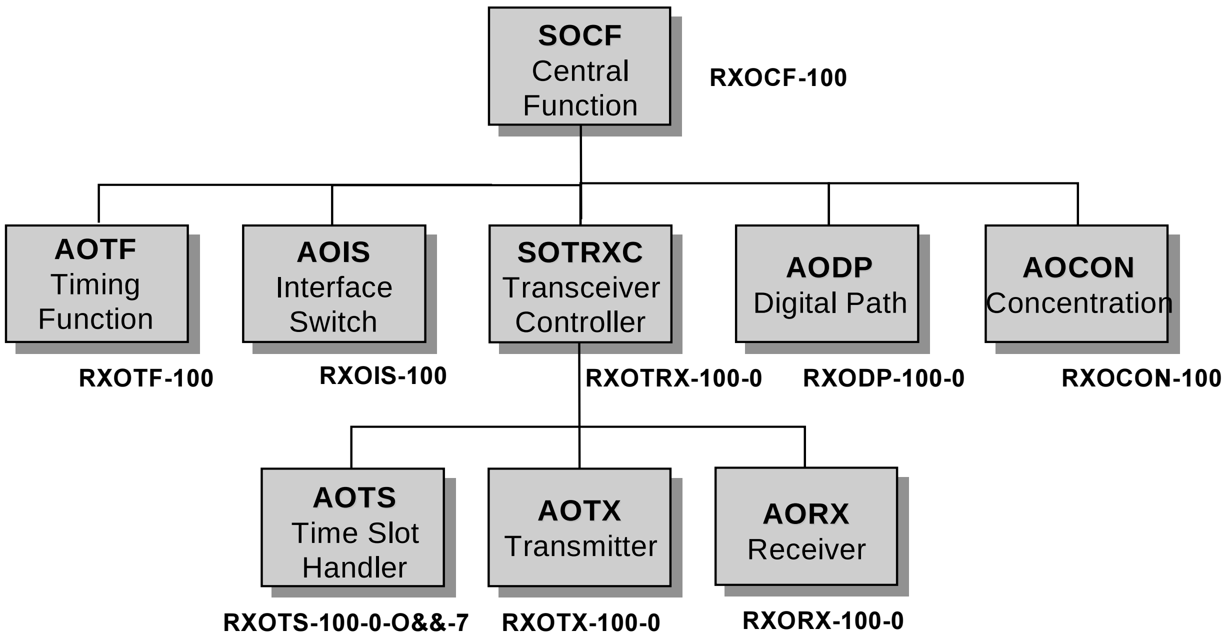


Figure 4-1 Managed Objects in RBS 2000

MANAGED OBJECT ARCHITECTURE - G12

Since all types of base stations are not build up in the same way, different models use slightly different MO models. The MO model used in and towards RBS 2000 is the MO model G12.

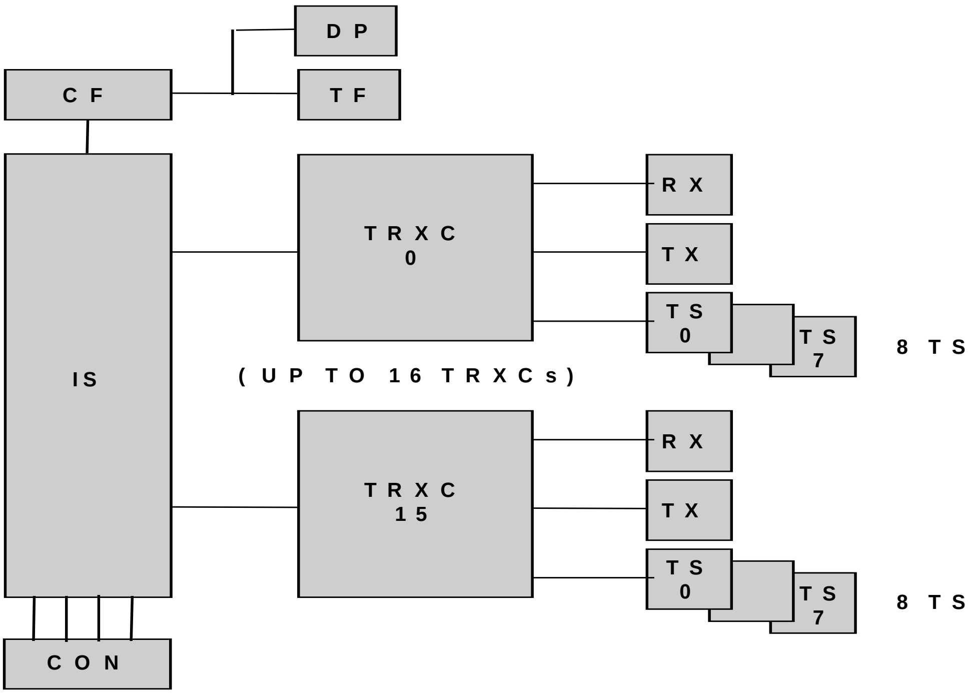


Figure 4-2 Managed Object Model G12

Figure 4-2 there is one MO not shown, that is the Transceiver Group (TG). A base transceiver station is by GSM definition the base station equipment needed to support a cell. This models implementation of the BTS functionality is named a TG. However, a TG can support a part of a cell, a cell or up to 16 cells. One TG is normally synonymous with one BTS. However, in certain applications, more than one cell can be connected to the same TG thus sharing functions in the TG (e.g. sector cells configuration 2+2+2 connected to RBS 2000 with 6 TRUs). The TF is always common to all BTSs in the same TG.

A transceiver is a part of one TG since a TG handles the functions common to a number of transceivers. For each carrier in a cell there must be a transceiver. The transceiver contains most of the equipment required to transmit and receive on the carrier. Communication between a transceiver and the BSC is provided through the DXU. A BSC can handle the following (not all system limits shown):

- 512 internal+512 external cells

- 2 subcells per cell
- 16 channel groups per cell
- 512 TGs
- 16384 traffic channels
- 32 frequencies per cell
- 256 TRHs
- 1020 transceivers

TG - HARDWARE

DXU - Distribution Switch Unit Functions

CF

Central Function, is the control part of a TG, it is a SW function, handling common control functions within a TG.

The BSC communicates with the CF using layer 2 LAPD, and is addressed by its TEI = 62, as specified for OML (GSM 08.56). However it is possible to use different than default value for TEI addressing. Corresponding value should be defined by OMT connected to RBS 2000 (or by remote OMT).

CON

LAPD Concentrator, is used by the optional feature LAPD Concentration for RBS2000.

IS

Interface Switch, provides a system interface to the PCM links and cross connects individual time slots to certain transceivers.

TF

Timing Function, extracts synchronisation information from the PCM link and generates a timing reference for the RBS.

DP

Digital Path, Layer 1 reception and transmission are not part of the BTS logical model. However, each of the PCM systems terminating in TG has an associated supervision object, the DP.

Reports on transmission faults and supervision of transmission quality are carried over the Abis O&M interface. That signaling is described using managed object DP.

TRU - Transceiver Unit functions

TRXC

Controlling all the functions for Signal processing, Radio receiving and Radio Transmitting.

Each TRX corresponds to one TRU unit. And is adressed with a TEI value (0-11), depending on the TRU physical position.

The BSC currently supports a maximum of 1020 TRXs.

TX

The MO representing the transmitter functions e.g. transmitted power and frequency on the bursts sent.

RX

The MO representing the receiver functions.

TS

All timeslots are represented by a MO TS.

ADDRESSING OF MANAGED OBJECTS

To adress a MO in MO model G12 from the BSC you have to enter RXO before the MO name. e.g. RXOTG to adress the TG in a RBS 2000 or RXOCF to adress the CF in the RBS 2000.

After the MO a instance number has to be specified e.g. RXOTG-100 to adress the TG 100.

The CFs, CONs, ISs and TFs are addressed by the same instance number as their TG. E.g. RXOCF-100, RXOIS-100.

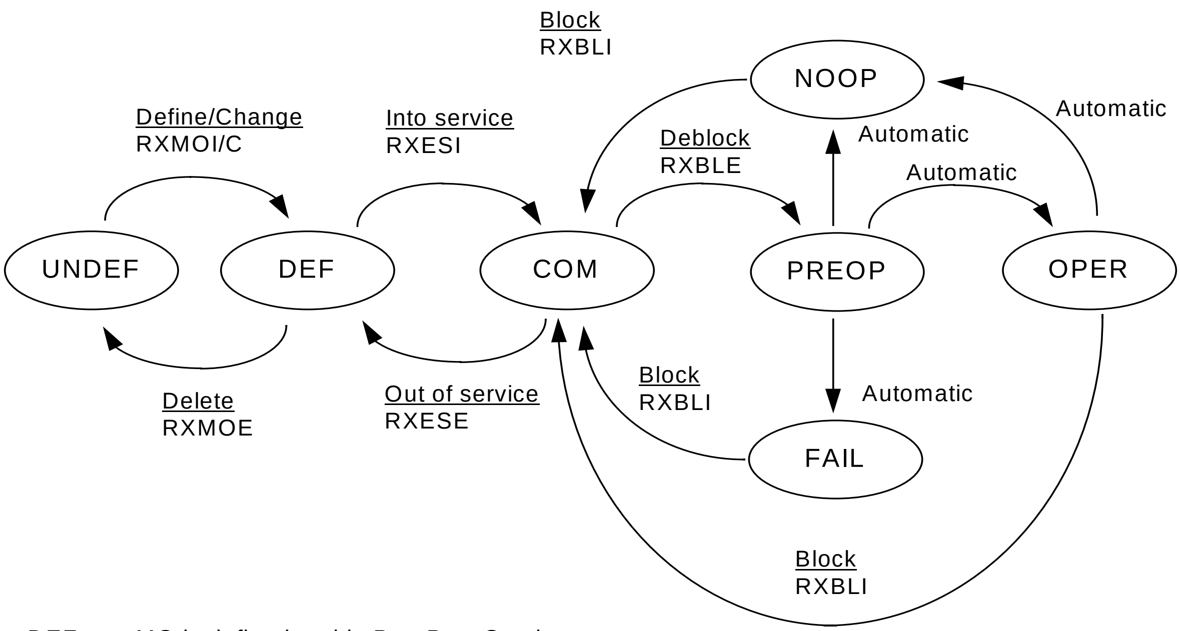
The DPs are addressed by using the same instance number as their TG and a local index within the transceiver group. Since it is possible to use both PCM lines towards RBS 2000. PCM-A corresponds to managed object RXODP-“TG #”-0, and PCM-B to RXODP-“TG #”-1.E:g. RXODP-100-0.

The TRXCs, RXs and TXs are addressed by using the same instance number as their TG and a local index within the transceiver group. The TRXC and its dedicated RX and TX are related by using the identical local indices. E.g. RXOTX-100-0.

The TSs are addressed by the same instance number as the TG, a local index for the transceiver controller (within the TG) and a local index within the TRXC.E.g. RXOTS-100-0-1 to adress timeslot 1 connected to TRXC 0 in TG 100.

MANAGED OBJECT STATES

The MOs can be in different states depending on what is currently going on in the RBS and what the BSC is doing towards the MOs at the moment. That is what Figure 4-3 is showing.



DEF MO is defined and in Pre_Post Service state
COM MO has been taken out of Pre-Post Service state
PREOP MO is being brought into operation
OPER MO is operational
NOOP MO is temporarily not operational
FAIL MO is permanently blocked because of faults

Figure 4-3 Managed Object states

The first thing that has to be done is to initiate the MO with its specific data. This is done using the RXMOI command. This command is one of many that are used to administrate the RBS. RX stands for Radio Transceiver Administration. stands for Managed Object, and I for Initiate.

If some things is not correct or has to be changed in the MO data, the RXMOC command is used. C stands for Change.

The MO is now defined. That means that the MO has all the data it needs to be able to function. However this is only a thing in the memory of the BSC. What has to be done is to bring the MO in to service. That means to load all the data into the RBS that is done using the RXESI command. ES stands for Managed Object in Service. With this command all the data is sent to the MO in the RBS.

The next thing is that the MO has to be de-blocked. The MO will then become operational, that means it can be used. The command to de-block an MO is RXBLE , where BL stands for Manual Blocking of Managed Object, and E stands for End.

The states which the MOs will be in when giving the respectively command is shown in Figure 4-3.

SOFTWARE DOWNLOAD

The HW and MO in the RBS needs to have some software (SW) to work, this SW is downloaded over the Abis interface to the RBS. How the software is structured you have to look in Chapter 3, RBS 2000 Overview. The command to initiate the SW-download is RXPLI. The command RXPLI initiates one of the following sub functions:

- The function change of software for all managed objects
- The program loading of managed object instances, specified by the command parameter.

Function change and program load of managed objects will use the software version defined to a CF, TRXC or TG.

Managed objects type CF, TRXC or TG in service will have two software versions defined.

- Actual Software version
- Replacement software version.

A command ordered software loading of a CF, TRXC or TG will always use the replacement software version, and after processing the command, the identity of its actual software version will be changed to replacement software version. To set the Replacement software version use the RXMSC command (Radio X-ceiver Administration Managed Object in-service Data, Change).

If a CF or TRXC does not have a specific software version assigned, then the software version assigned to its TG will be used .

If the command is given with parameter MOTY, this will initiate the function change of software to all manually deblocked managed objects within a BTS logical model.

Function Change is performed for a number of Transceiver Groups and its subordinate managed objects in parallel. Managed objects that are not sharing the same physical path are loaded in parallel. This allows the traffic in the rest of the system to remain unaffected.

During the function change, there will be no software loading for manually blocked managed objects. If a CF, TRXC or TG is manually blocked then its actual software version will be changed to replacement software version and this will be loaded when it is manually deblocked. Only one function change command will be allowed at any one time in the BSC.

If the command is given with parameter MO, this will load the specified managed objects.

Program loading is allowed for managed objects in service. The program loading process for a CF, TRXC or TG will be identical to its function change process. This program load command can handle up to 32 managed object instances. This function has the capability of handling up to 16commands simultaneously.

When unconditional function change or program load is requested using parameter UC, no checks are made in the BTS to verify if the defined software already exists. The software will just be loaded to the specified managed objects.

When conditional function change or program load is requested (not using parameter UC), the loading of software for managed objects will take place only if the replacement software in the BSC does not correspond to its operational software in the BTS.

In Model G12 the traffic is not terminated at file transfer, but when the BTS is started after the downloaded software has been distributed internally in the BTS, the traffic is terminated.

Before the affected channels are blocked an attempt is made to handover ongoing calls to channels in neighbouring cells or within the cell.

After the function change or program load, the pre-operational managed objects are restored to be operational. The command can only handle managed objects from the same BTS logical model.

The answer printout RADIO X-CEIVER ADMINISTRATION FUNCTION CHANGE AND PROGRAM LOAD OF MANAGED OBJECTS COMMAND RESULT will be printed, indicating whether the given command was ordered or not.

The result printout RADIO X-CEIVER ADMINISTRATION FUNCTION CHANGE AND PROGRAM LOAD OF MANAGED OBJECTS RESULT will indicate the managed objects that have been successfully loaded, list of software versions loaded, and all subordinate managed objects that have failed to load.

RELATED COMMANDS

RXMOP - Radio X-ceiver Administration Managed Object Data, Print

RXMSP - Radio X-ceiver Administration Managed Object Status, Print

RXMOI - Radio X-ceiver Administration Managed Object, Initiate

RXMOC - Radio X-ceiver Administration Managed Object Data, Change

RXESI - Radio X-ceiver Administration Managed Object in Service, Initiate

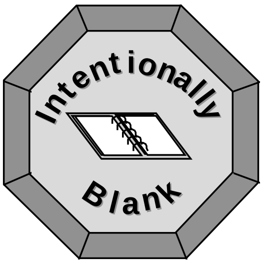
RXBLE - Radio X-ceiver Administration Manual Blocking of Managed Object, End

RXCDP - Radio X-ceiver Administration Managed Object Configuration Data, Print

RXMDP - Radio X-ceiver Administration Managed Object Device Information, Print

RXPLI – Radio X-ceiver Administration Function Change and Program Load of Managed Objects, Initiate

RXMSC - Radio X-ceiver Administration Managed Object in-service Data, Change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Abis interface

Chapter 5

This chapter is designed to provide the student with an overview of the Abis interface between the BSC and RBS.

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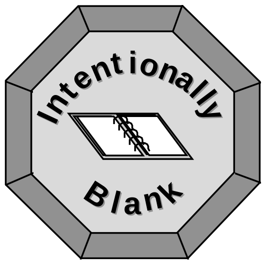
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5 Abis interface

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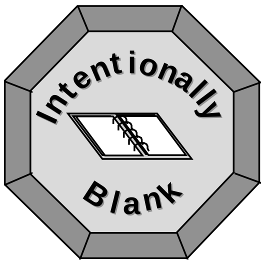
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LAPD FORMATS

INTRODUCTION

The A-bis Interface is responsible for transmitting traffic and signaling information between the BSC and the BTS. The transmission protocol used for sending signalling information on the A-bis interface is Link Access Protocol on the D-channel (LAPD).

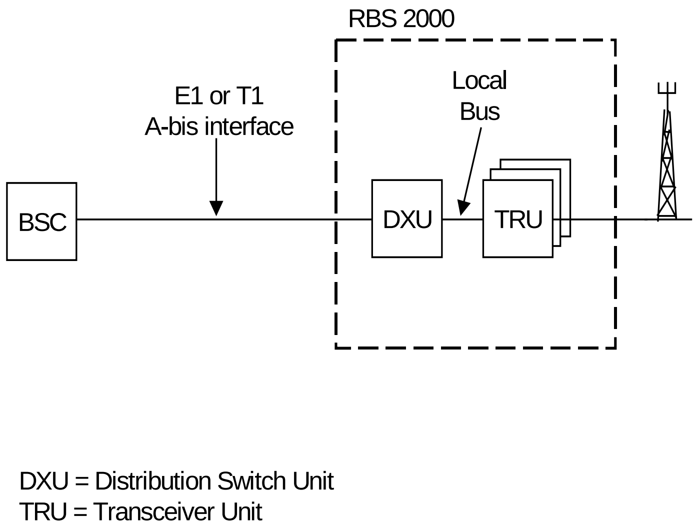


Figure 5-1 Base Station System with RBS 2000

The A-bis interface facilitates the transfer of voice and signaling information between the BSC and RBS. There is signaling to both the DXU (MO CF) and the TRU (MO TRXC). Speech is coded by the TRA in the TRC or BSC/TRC. Signaling information is handled inside the BSC by the TRH. The physical layout of the traffic and signaling to each TRU on the A-bis Interface depends on the format chosen to facilitate the transfer of information. There are three possible formats that can be designated for information transfer on the A-bis Interface:

LAPD UNCONCENTRATED

Signaling for each TRU is sent on a dedicated 64 kbit/s channel and is accompanied by two 64 kbit/s channels each carrying four 16 kbit/s submultiplexed voice/data channels. See Figure 5-2 and Figure 5-3.

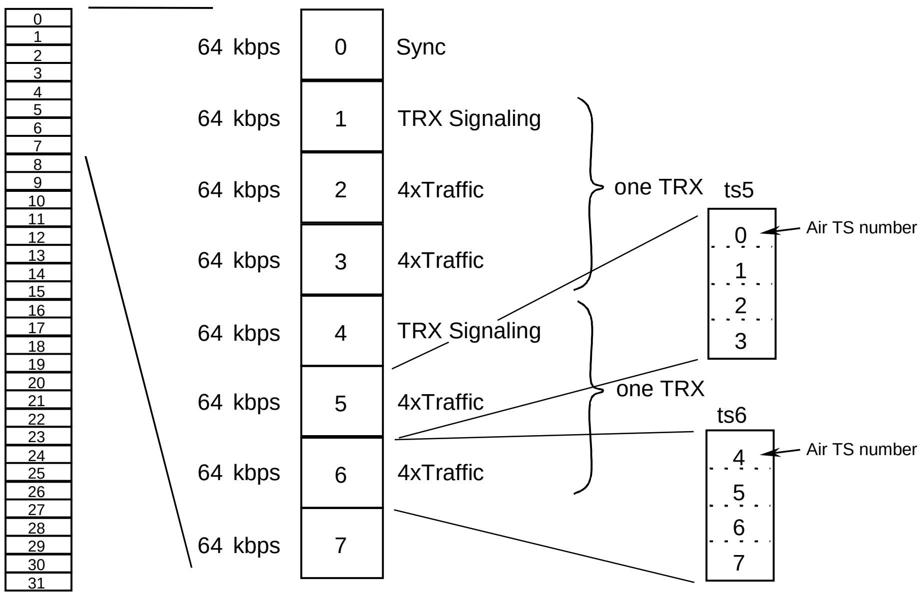


Figure 5-2 A-bis for RBS 2000 (E1)

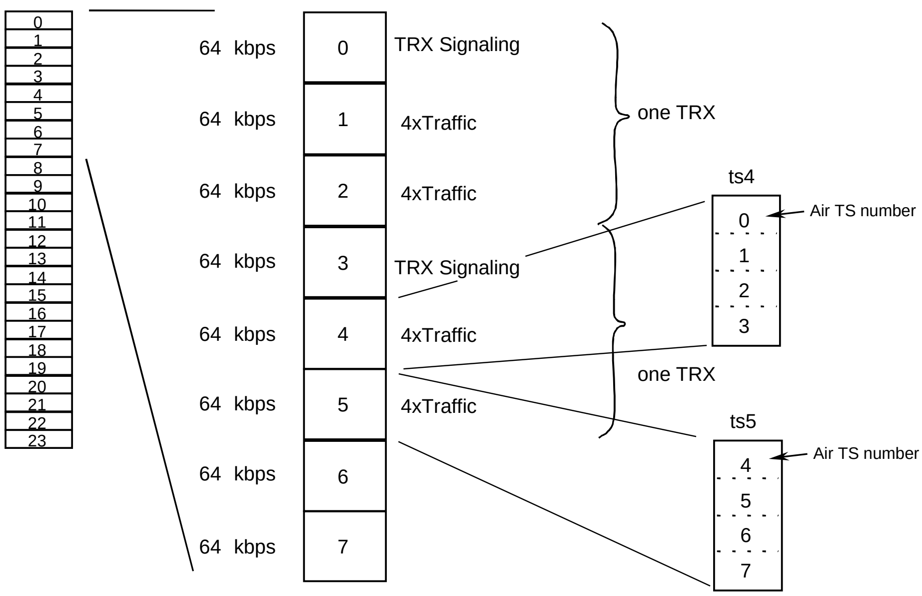


Figure 5-3 A-bis for RBS 2000 (T1)

Figure 5-4 shows an example of the devices connected to an RBS when LAPD unconcentrated is utilized. The letters ABCD etc. are only in the picture to show the function of the TRA. For questions regarding the device names refer to Chapter 2, BSC configuration.

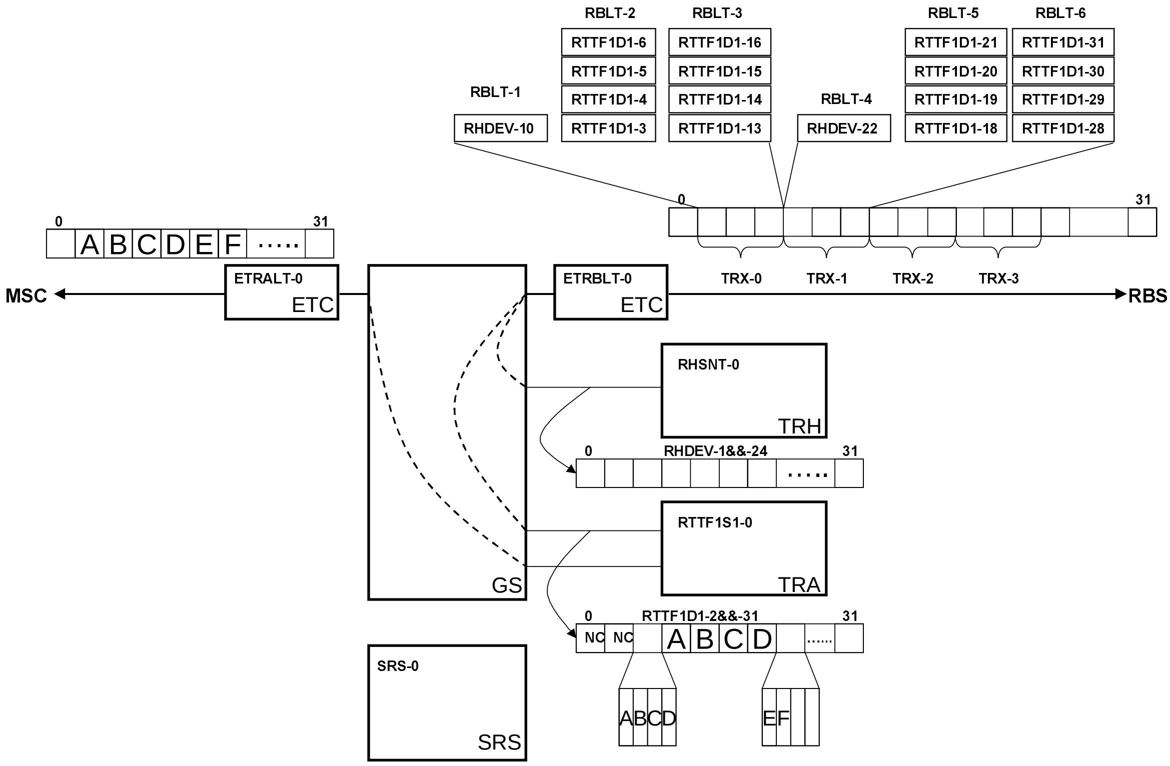


Figure 5-4 Devices used when LAPD unconcentrated is utilized.

LAPD CONCENTRATION

LAPD Concentration is recommended for all cells, but in particular those with 3 TRUs or more. (For cells with 1-2 TRUs per cell LAPD multiplexing provides the most efficient A-bis transmission). With LAPD concentration, each TRU needs 2,25 PCM time slots. It is hence possible to fit up to 13 TRUs on one 2 Mbit/s PCM line (E1), as compared to 10 TRUs without this feature. See Figure 5-5 and Figure 5-6.

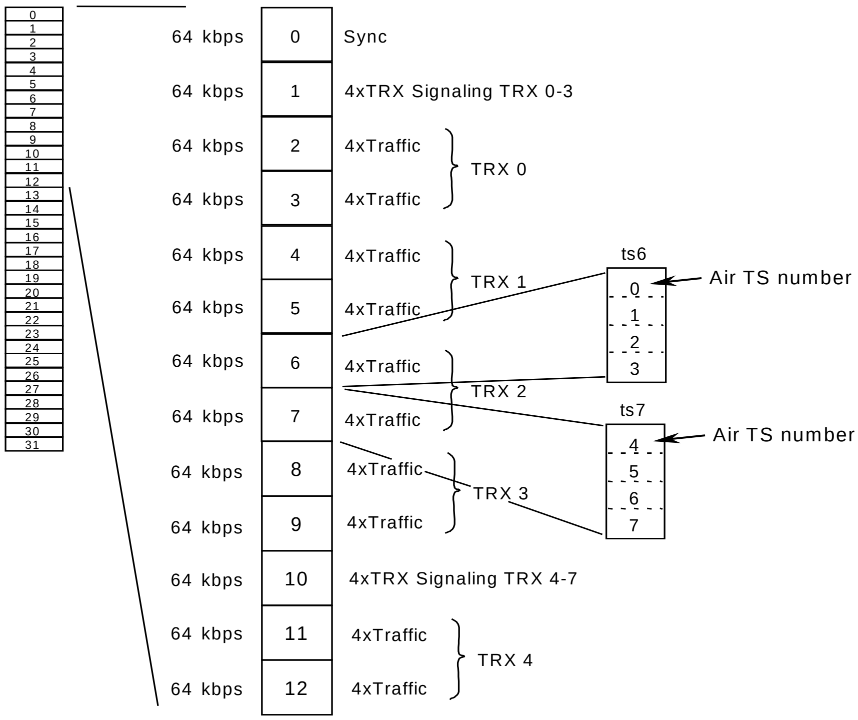


Figure 5-5 A-bis with LAPD concentration for RBS 2000 (E1)

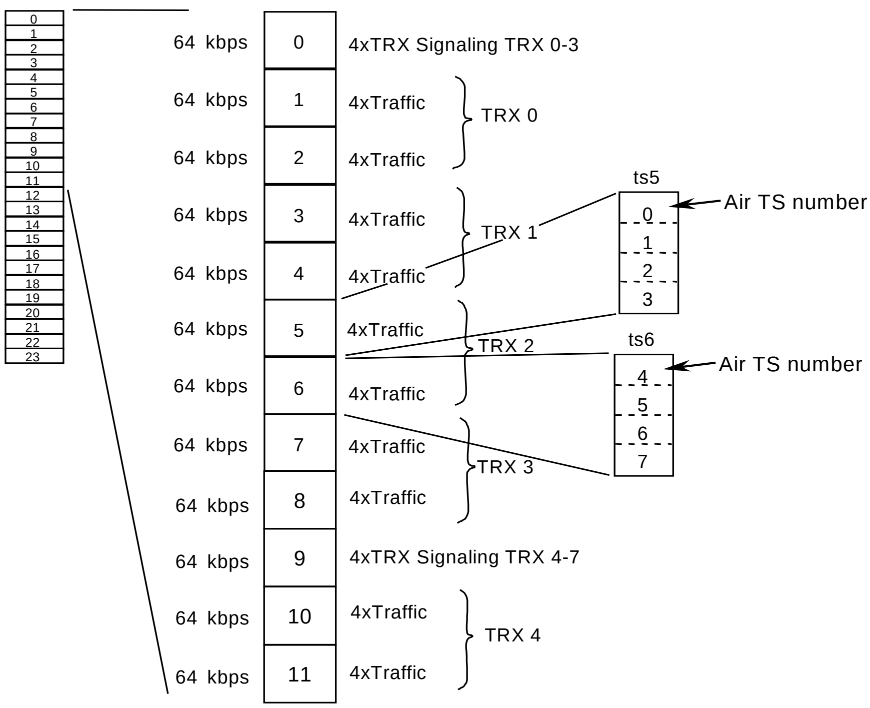


Figure 5-6 A-bis with LAPD concentration for RBS 2000 (T1)

Figure 5-7 shows an example of the devices connected to an RBS when LAPD concentration is utilized. The letters ABCD etc. is only in the picture to show the function of the TRA. Not all devices are shown in the picture. For questions regarding the device names refer to Chapter 2, BSC configuration.

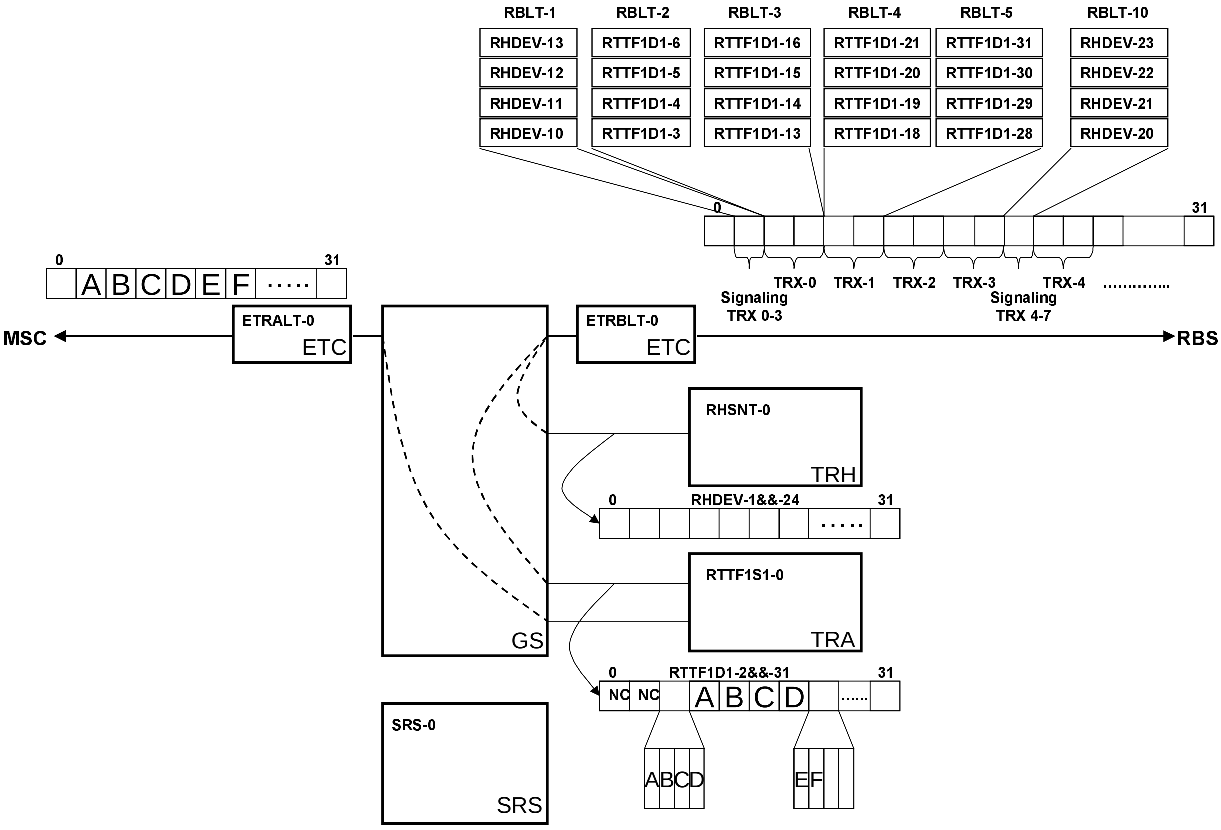


Figure 5-7 Devices used when LAPD concentration is utilized

LAPD MULTIPLEXING

LAPD Multiplexing is recommended for all small cells with 1-2 TRUs. With LAPD multiplexing, each TRU needs 2 PCM time slots. It is hence possible to fit up to 15 TRUs on one 2 Mbit/s PCM line (E1), as compared to 10 TRUs without this feature. With 2 TRUs in a cell, normally only 14 of the available channels on the air interface is used for traffic, and the remaining 2 air time slots for BCCH and SDCCH signaling. Hence there is a transmission need for approximately 14 times 16 kbit/s, i.e. 3,5 PCM time slots. The remaining half time slots is used for LAPD signaling for the two TRUs. In total 4 PCM time slots are used for 2 TRUs.

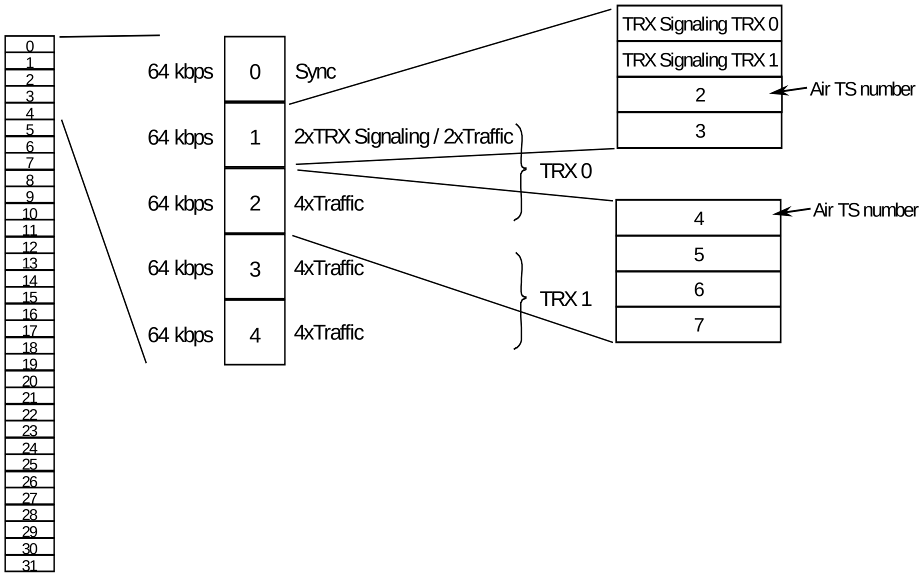


Figure 5-8 A-bis with multiplexing for RBS 2000 (E1)

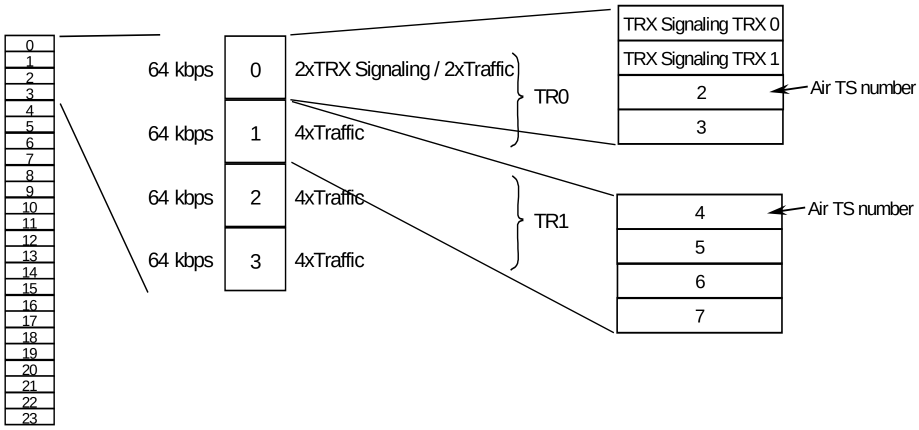


Figure 5-9 A-bis with multiplexing for RBS 2000 (T1)

The E1 networks use time slot 0 on the A-bis interface to provide a synchronization reference to the RBS. In T1 networks frame sync information extracted from the T1 link to synchronize the RBS with the network. In these systems an internal synchronization source is fitted into the DXU which gives stable and reliable synchronization.

Figure 5-10 shows an example of the devices connected to an RBS when LAPD multiplexing is utilized. The letters ABCD etc. is only in the picture to show the function of the TRA. Not all devices are shown in the picture. For questions regarding the device names refer to Chapter 2, BSC configuration.

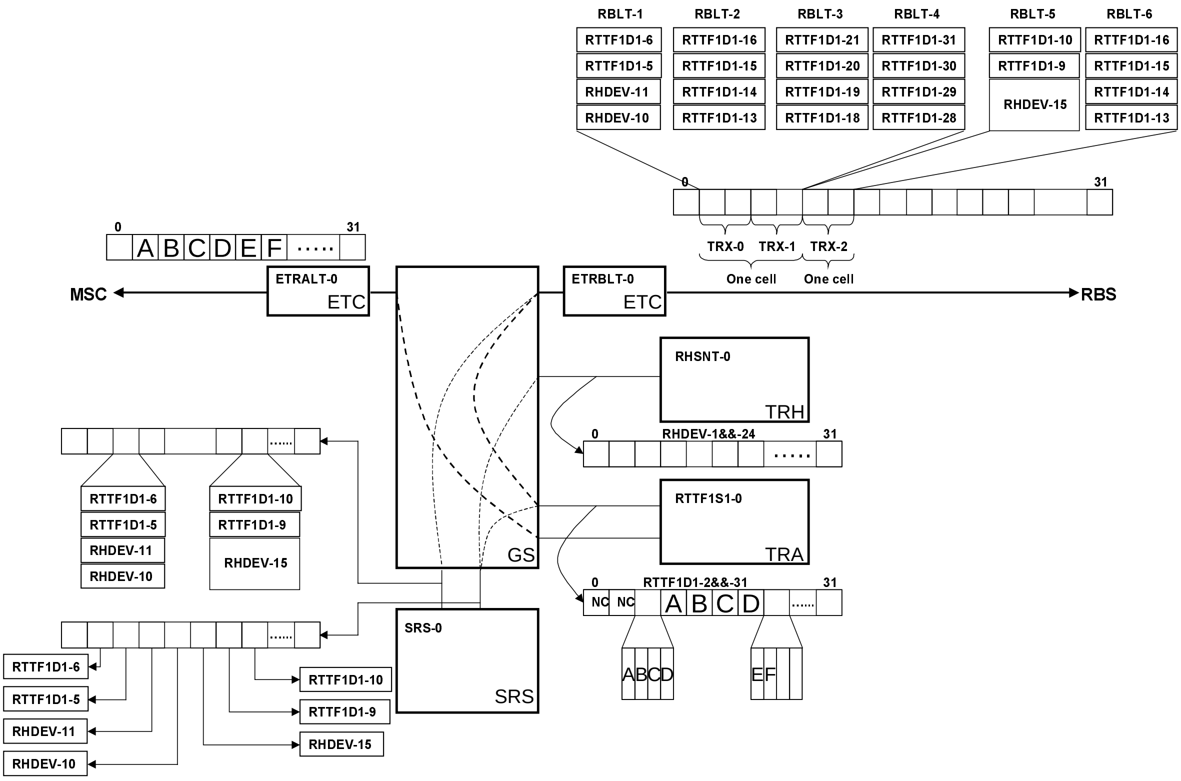


Figure 5-10 Devices used when LAPD multiplexing is utilized

ABIS CONFIGURATION

ADRESSING

TRUs in the RBS 2000 are referred to as terminal equipment. Each data link is identified by a TEI/SAPI pair unique for each physical connection.

- **Terminal Endpoint Identifier (TEI)** - signaling links over the A-bis interface are addressed to different physical entities by TEI
- **Service Access Point Identifier (SAPI)** - different functional entities within one physical entity are addressed by SAPI

Each physical connection can support a number of data links. The following links are supported and used:

- L2ML -Layer 2 Management Link, for O&M of the links.
- OML -O&M Link, for O&M of the BTS equipment.
- RSL -Radio Signalling Link, for transmission of traffic messages.

OML links are used for TRH-CF and TRH-TRXC signalling. RSL links are used for TRH-TRXC signalling to SDCCH, BCCH etc.

The TEI value for CF is default set to 62, but can be changed in the range from 12 to 63 with the OMT terminal. This has to be done if several RBSs are cascaded, and are sharing one PCM link.

The TEI value for the TRUs are in the range from 0 to 11. The TEI value is connected to the position of the TRU physical position in the cabinet. TEI 0 to 5 in the master cabinet, counted from left to right. TEI 6 to 11 in the extension cabinet.

DIGITAL CONNECTION POINTS (DCP)

Connection of the control and speech/data channels from the RBLT devices through the IS in the DXU to the TRXs is established automatically when the TRXs are taken into service (command RXESI).The connections for the units is called DCPs and represents a 64 kbit/s connection.

The things that needs to be defined:

- Which DCPs are to be connected to a particular TRU (command RXMOI).
- Which DCPs are to be connected to the CON (command RXMOI).
- Which RBLT devices are to be connected to a particular TG (command RXAPI).

In Figure 5-11 the DCP connections in the RBS 2000 can be seen.

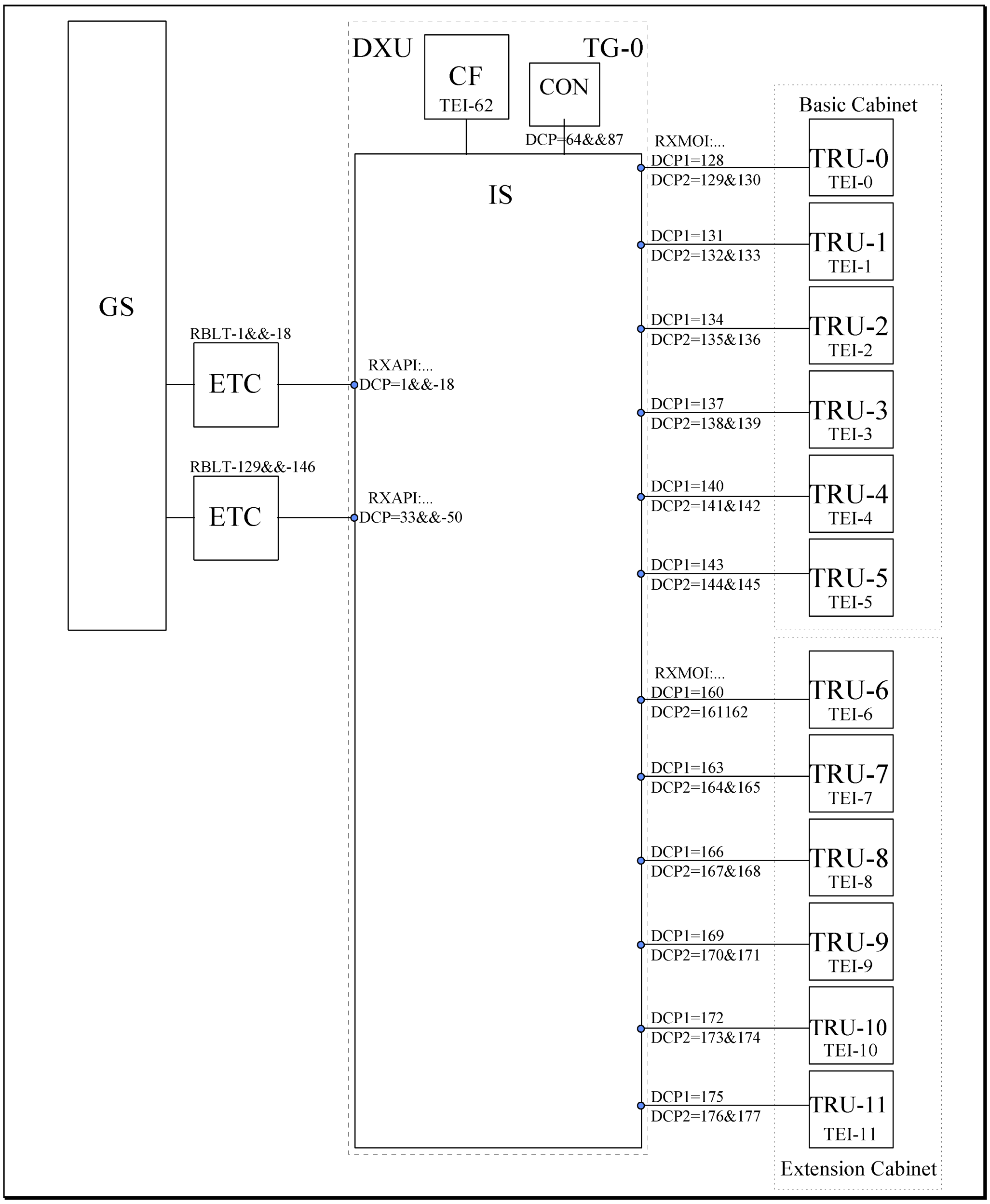


Figure 5-11 DCP connections in RBS 2000

TRU DCPs

Each TRU has three DCPs. DCP1 is the connection for signaling.Two DCP2 for traffic connections. E.g. TRU 0 has DCP1 connection 128 and DCP2 129 and 130.

CON DCPs

The concentrator is connected with 24 DCPs from 64 to 87.

RBLT device DCPs

PCM-A is connected to DCPs 1-31, and PCM-B is connected to DCPs 33-63. The connection for the synchronization timeslot TS 0 do not need to be defined for E1 PCM systems.

In a T1 PCM network the DCPs for PCM-A will be 0 to 23 and 24 to 47 for PCM-B.

LAPD UNCONCENTRATED

Figure 5-12 shows an example of the devices and connections in a RBS with four TRUs used. This means that 12 devices on the PCM link has to be used, 3 to each TRU.

RBLT devices 97 to 108, which means that the DIP is RBLT-3, are connected to DCP 1 to 12. The signaling and the speech/data is distributed to the right TRU through the IS.

The signaling for TRXC-0 and the CF are going on the same TS.

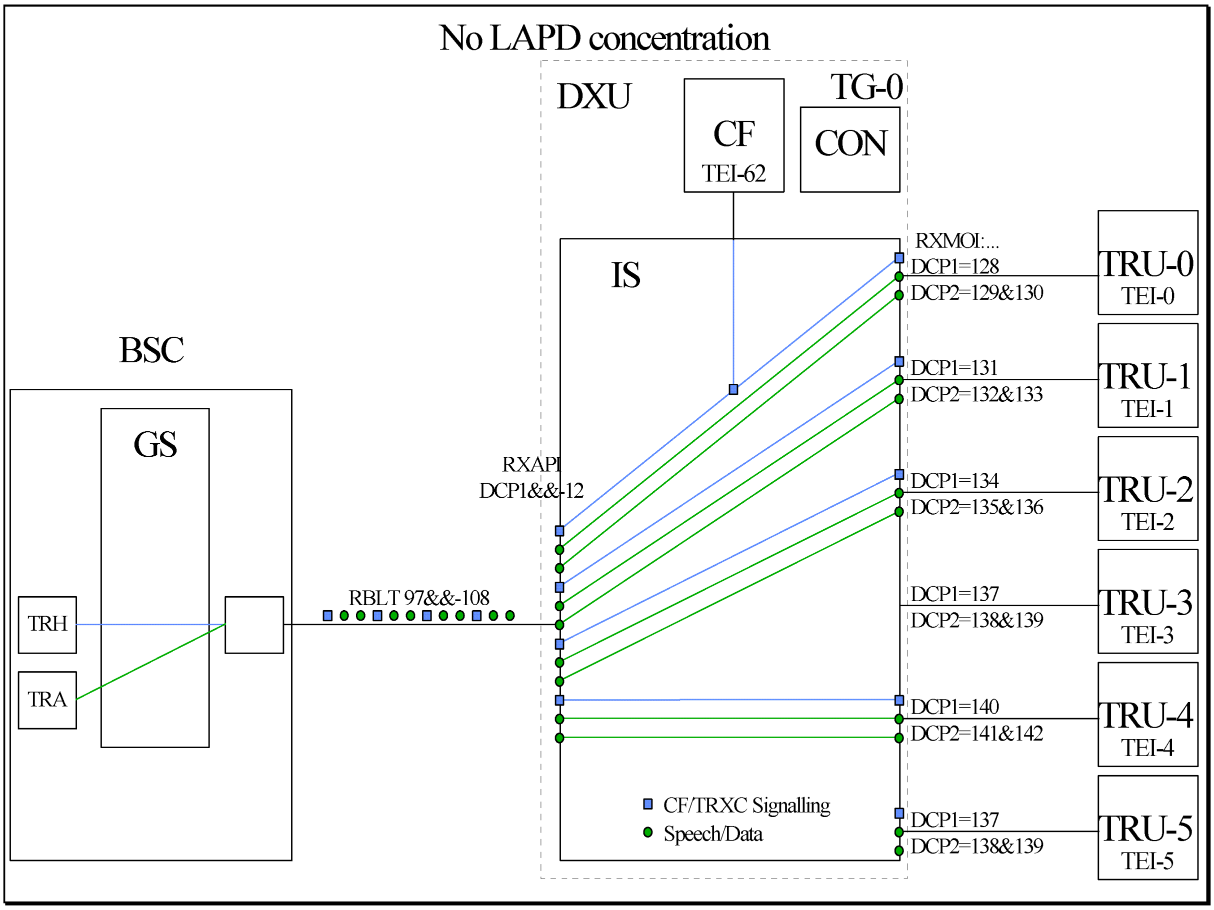


Figure 5-12 LAPD unconcentrated

LAPD CONCENTRATED

Figure 5-13 shows the case where LAPD concentration is used towards the same RBS. The concentration factor is set to 4. This means that 4 TRUs shares the same signaling TS. In this case only nine devices are needed on the PCM link to the RBS.

When LAPD concentration is used, the CON also has to be defined and connected to the IS. The concentrator then concentrates the signaling to the BSC so that four TRUs and the CF shares the same TS.

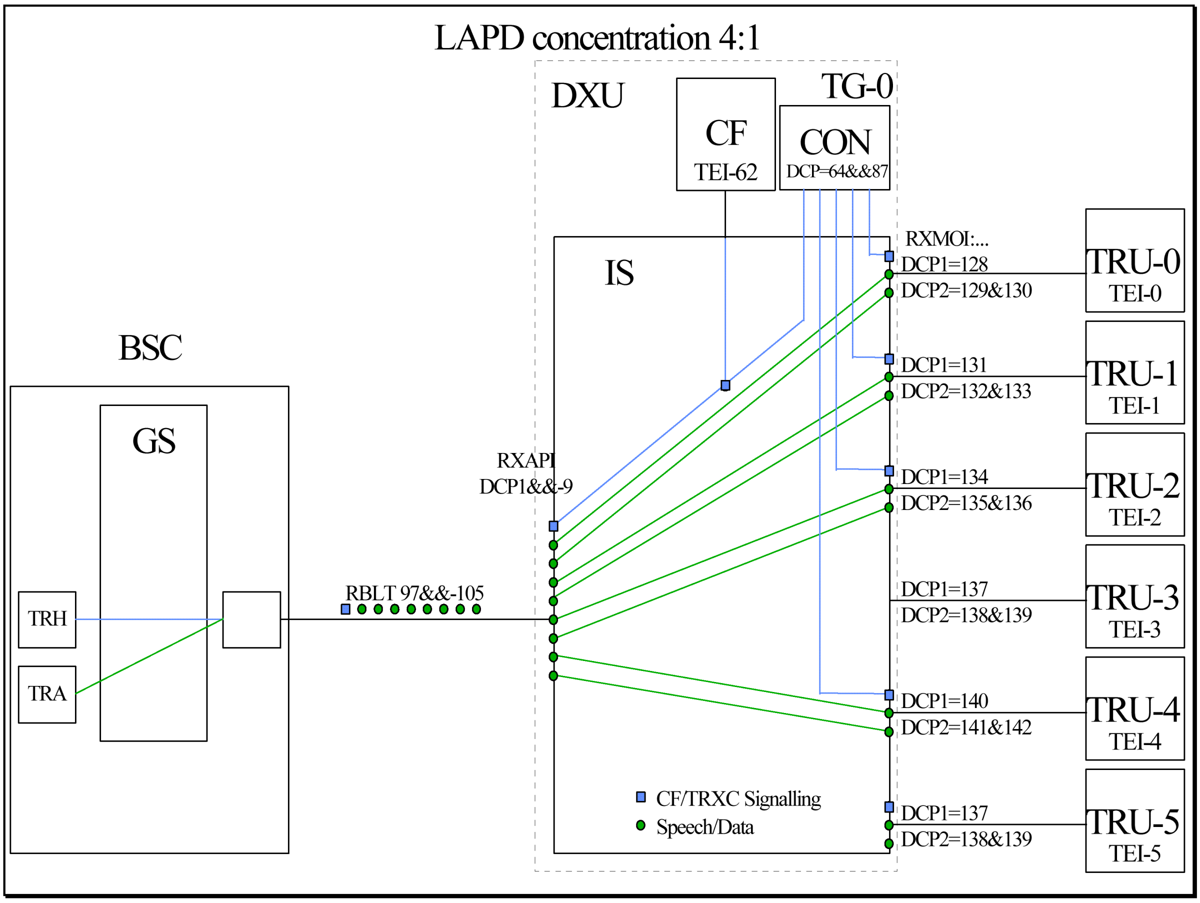


Figure 5-13 LAPD concentration

LAPD MULTIPLEXING

One TRX handles 8 TDMA timeslots on the air interface. In a cell, 2 of the 8 TDMA timeslots in one TRX are normally used for BCCH and SDCCH, the other TRXs in the cell can use all eight TS on the air interface for traffic.

In Figure 5-14 and Figure 5-15 TS 0-1 on the air interface is used for signalling (BCCH and SDCCH) and TS 2-7 is used for traffic. Since only 6 traffic channels are used, there will be spare capacity in one of the two RBLT devices used to transfer traffic channels.

In this case, the subrate channel 0-1 in RBLT-2 are not used. Figure 5-14 and Figure 5-15 show how LAPD multiplexing in one cell with one TRX can reduce the RBLT usage with one device.

Since we know that we have 2 spare subrate channels we can specify that the LAPD shall be multiplexed using 32 Kbit/s subrate physical channel for both the CF and the TRXC, which will fit in the 2 spare subrate channels (16+16 Kbit/s).The subrate switch will insert the TRXC and CF signalling in the 32 Kbit/s LAPD datalink in the spare subrate channels. The RBLT device that was previously used for LAPD signalling is free of use.

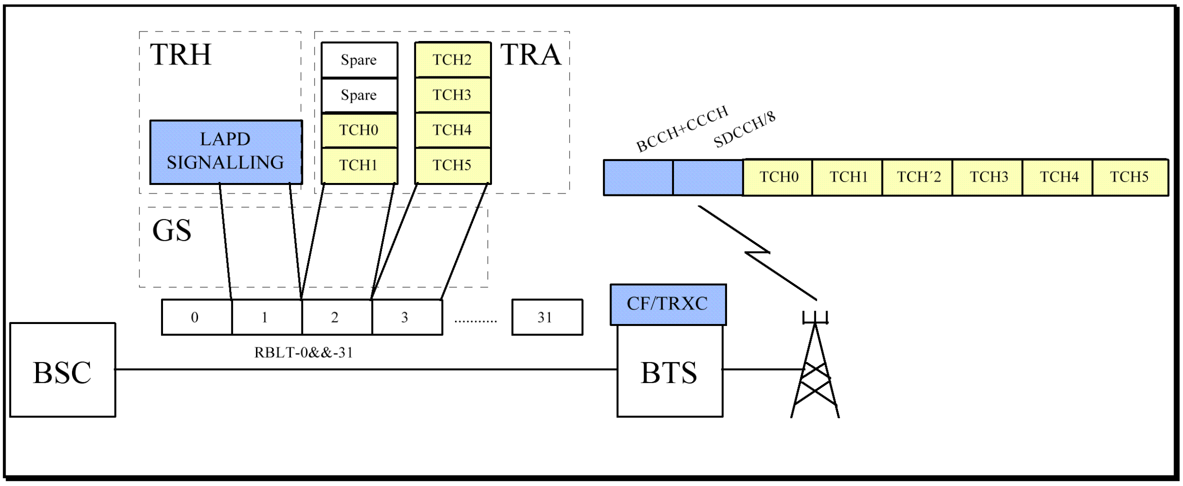


Figure 5-14 LAPD unconcentrated in a cell with one TRX

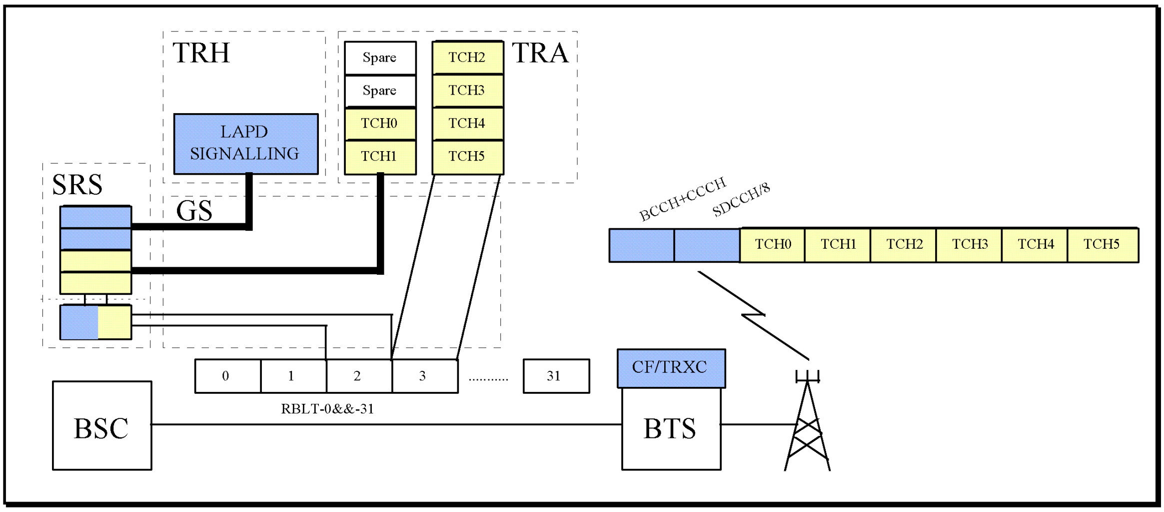


Figure 5-15 LAPD multiplexing in a cell with one TRX

BSS HARDWARE OVERVIEW

Figure 5-16 shows an example of how the BSS can be configured for two types of cells.

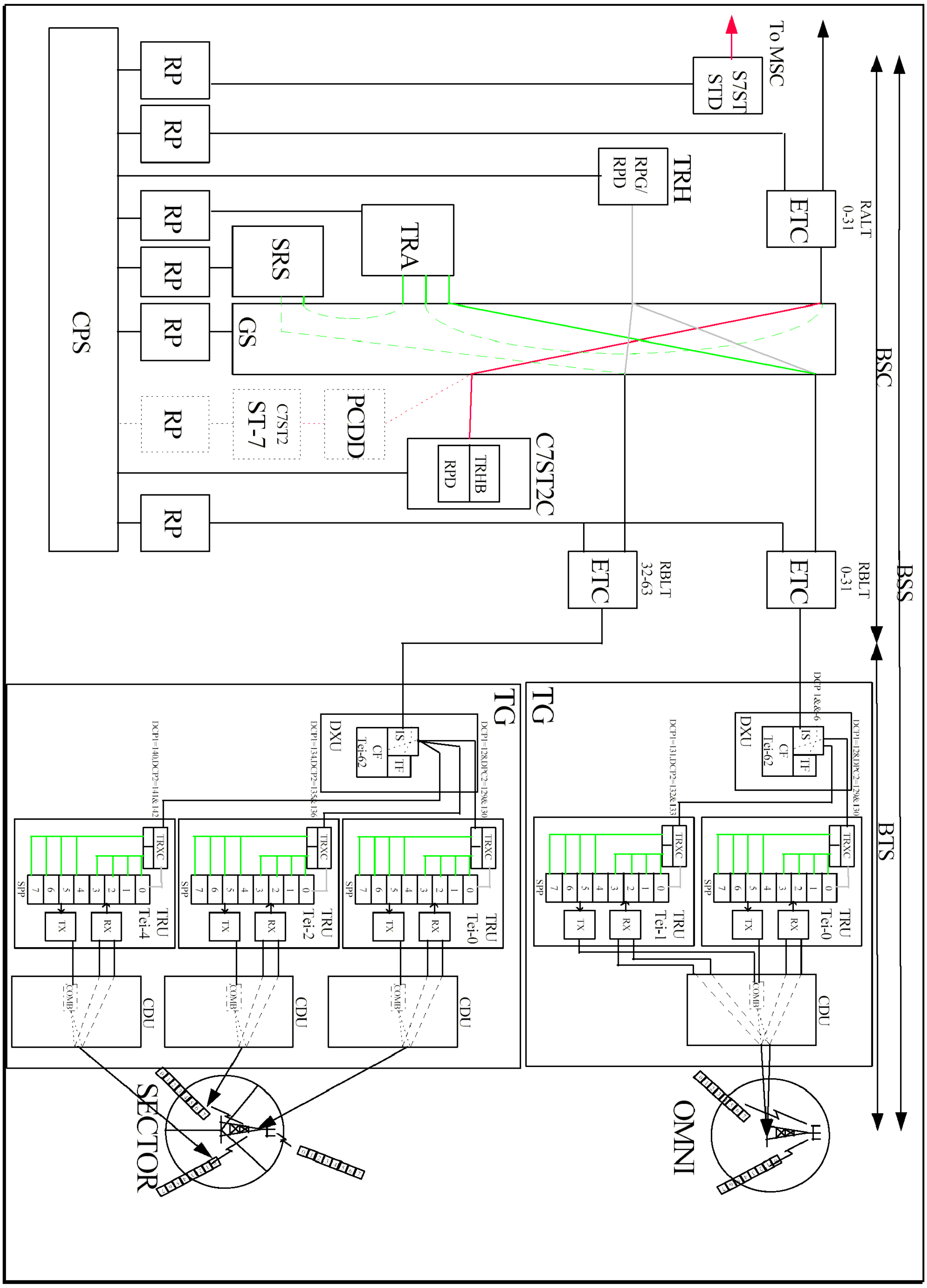


Figure 5-16 BSS Hardware Overview

RELATED COMMANDS

RXAPP - Radio X-ceiver Administration ABIS Path Status, Print

RXAPI - Radio X-ceiver Administration ABIS Path, Initiate

RXMOP - Radio X-ceiver Administration Managed Object, Print

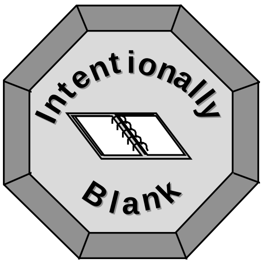
RXMOI - Radio X-ceiver Administration Managed Object, Initiate

RXMDP - Radio X-ceiver Administration Managed Object Device Information, Print

DTSTP - Digital Path Transmission Functions State, Print

DTDII - Digital Path Transmission Functions Digital Path, Initiate

DTBLE - Digital Path Transmission Functions Blocking, End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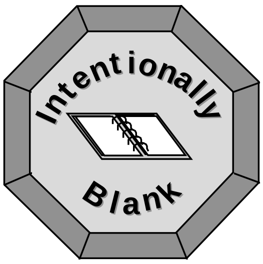
Radio Network

Chapter 6

This chapter is designed to provide the student with an overview of how the radio network is working. The main cell parameters and the connection of the cell to a Transceiver Group (TG).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6 Radio Network

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INTRODUCTION TO THE CELL

A cell is an area where a **Mobile Station (MS)** receives a signal strength which is high enough to set up a radio connection on a dedicated channel, i.e. **SDCCH** or **TCH** and maintain it. The size of a cell (or the size of area of coverage) is mainly determined by four parameters:

- The output power (**BSTXPWR**) at the antenna of the BTS: the **Effective Radiated Power (ERP)**
- The minimum received level at the MS (this is **MSRXMIN** for MS in “busy” mode)
- The minimum received level at BTS (this is **BSRXMIN**)
- The **Timing Advance (TA)**: the TA is a measure of the traveling time of the bursts between MS and BTS; the maximum value of TA in a cell is defined by the parameter **MAXTA (MAXimum Timing Advance).**

Figure 6-1 illustrates these relationships.

A second cell criterion is the existence of a BCCH. A cell must have exactly one BCCH because the BCCH carries essential information which must be known to the MS before call setup (see paragraph on System Information).

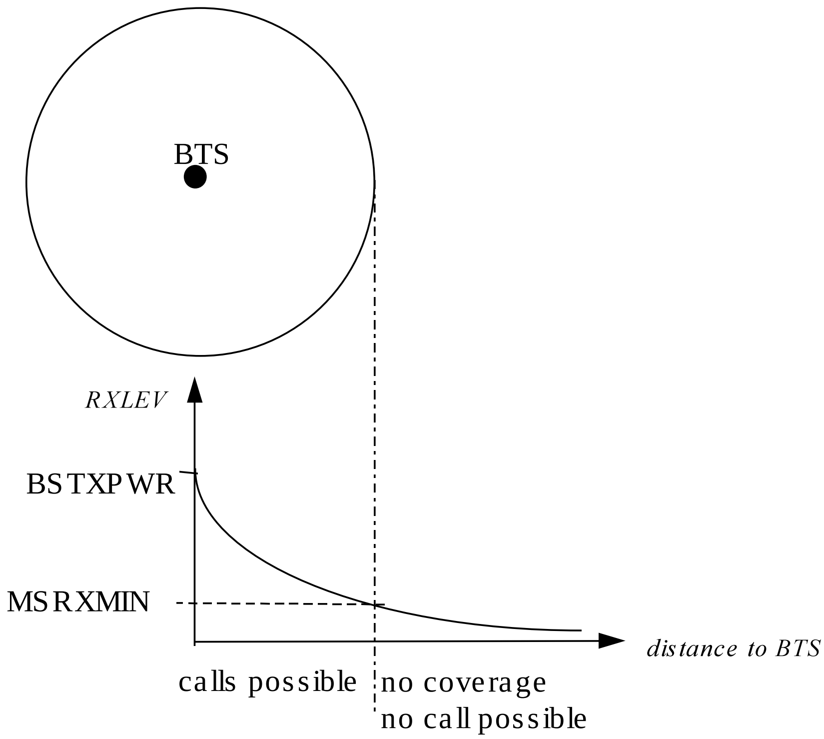


Figure 6-1 Cell size

Figure 6-1 presents a cell of circular shape which is called an omni-cell. In general, the shape of a cell depends on the antenna which is connected to the cell. The antenna can also focus its power on a certain sector of a circle. This is called a sector-cell. It is up to the cell planner to select a suitable antenna. The shape of a cell can also depend on the geographic conditions. Each sector can have its own output power assigned. The BCCH frequencies must be different in all sectors, Figure 6-2 shows two types of sector-cells:

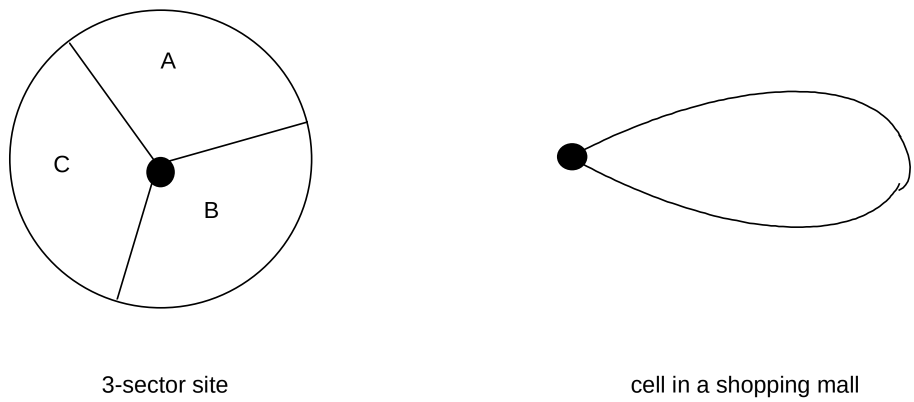


Figure 6-2 Sector Cells

THE CLUSTER

The aim of the cell planning process is to provide maximum capacity with least interference. The cell pattern and frequency plan should be designed not only for the initial network, but also for gradual growth phases. An initial network must be planned to adapt successive demands on traffic growth.

To prevent interference between cells, a cell pattern called a cluster is designed. In this cluster, a frequency will be used only once. The aim of a cluster is to have a large frequency reuse distance. Ericsson uses three types of clusters:

- 7/21 (21 frequency groups in 7 sites)
- 4/12 (12 frequency groups in 4 sites)
- 3/9 (9 frequency groups in 3 sites)

If a 4/12 cluster is used for cell planning, the number of cells consisting of different channel numbers in the network will be 12. To enable allocation of channels to cells without co–channel interference, a reuse pattern is utilized. The assignment is shown in Table 1.

Freq. group	A1	B1	C1	D1	A2	B2	C2	D2	A3	B3	C3	D3

Ch.	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
	25	26	27	28	29	30	31	32	33	34	35	36
	.	.	.	.	.	.	.	.	.	.	.	.
	121	122	123	124								

Table 1 Frequency groups in a 4/12 - cluster

These frequency groups are then placed in the cluster as shown in Figure 6-3. Groups containing adjacent frequencies, e.g. D1 and A2 or D3 and A1 should not be placed as neighboring cells.

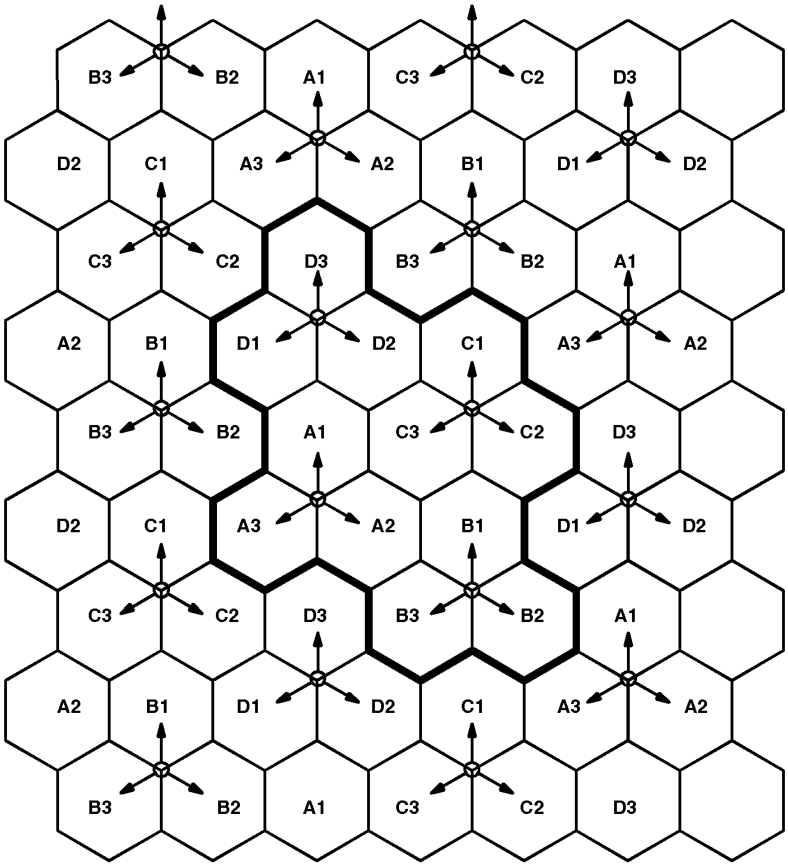


Figure 6-3 4/12 cell pattern

As a general rule, adjacent frequencies should have large geographical distances. Cells which are geographically neighbors should have a large frequency distance.

CELL DATA

The following sections on cell data describes essential cell parameters and their commands. When defining a cell, the following OPerational Instructions (OPI) must be observed:

BSC, Internal Cells, Define
BSC, Internal Cell Data, Change

CELL DEFINITION

RLDEI: CELL=cell, CSYSTYPE=csystype, EXT;

A cell can be defined in the BSC as internal or external. Internal cells are fully controlled by their own BSC while external cells are not controlled by their own BSC. However, certain data must be known in order to carry out a handover from a cell in its own BSC to a cell controlled by another BSC.

CELL: Cell designation or cell name can be a maximum of seven characters. Using the name of the site plus one more character to identify the cell within the site; 1, 2, 3 or A, B, C is recommended, alternatively, identifying the aerial direction of the cell in a sector-site.

CSYSTYPE: If the BSC global system type is mixed then CSYSTYPE must be used to define to which system the cell belongs, GSM900 and GSM1800, or GSM1900.

EXT: External cell, the cell belongs to another BSC.

Note: The global system type for the BSC is defined with command RLTYI. This command must be given before the first cell is defined.

DESCRIPTION DATA

RLDEC: CELL=cell, CGI=cgi, BSIC=bsic, BCCHNO=bcchno, NEWNAME=newname, AGBLK=agblk, MFRMS=mfrms, BCCHTYPE=bcchtype, FNOFFSET=fnoffset, XRANGE=xrange;

CGI: Cell global identity. Expressed as MCC-MNC-LAC-CI.

Cell Identity (CI): every cell is assigned a CI. This number is unique per **Location Area (LA)** and is part of the **Cell Global Identity (CGI).** The CGI uniquely identifies a cell within GSM.

The CGI is sent to the idle MSs in system information messages. The combination MCC-MNC-LAC is also known as the **Location Area Identity (LAI)**. It is important to the cellular network to know the location of a mobile since paging signals are distributed in one LA only. A record in the MSC/VLR administrates a mobile location by means of the LAI. When the MS moves from one LA to another, it sends a location updating request to the MSC/VLR.

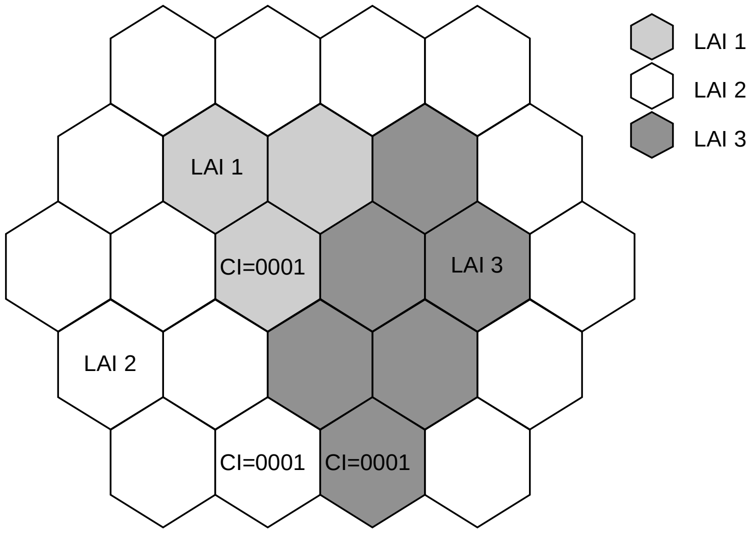


Figure 6-4 Location areas are divided into cells with their own identity

BSIC: Base Station Identity Code. It is transmitted on the SCH and is expressed as:

NCC = National Color Code of PLMN. Numeric 0 - 7.

BCC = Base Station Color code. Numeric 0 - 7.

Each operator in a country is assigned one NCC value *n* to ensure that the same NCC is not used in adjacent PLMNs. The purpose of the BSIC is to distinguish between cells with the same carrier frequency but from different clusters. It can also be used to distinguish between cells from different operators at the border between two countries. It is essential for the locating algorithm that the correct neighboring cells are evaluated.

As seen in Figure 6-5, cells which are close to country borders are given different NCC values. The MS is in active mode, using a TCH on f_{15}. The MS measures the neighboring frequencies broadcast as system information. In this example they are f_1, f_{26}, f_{29} and f_{33}. In country C, f_1 is reused too close to one of our neighbors with the same frequency. Thus, neighbor f_1 is subject to severe radio shadowing towards the MS. When the

MS tries to measure f_1, it picks up the wrong signal. However, it detects that the NCC is incorrect and the measurement is discarded.

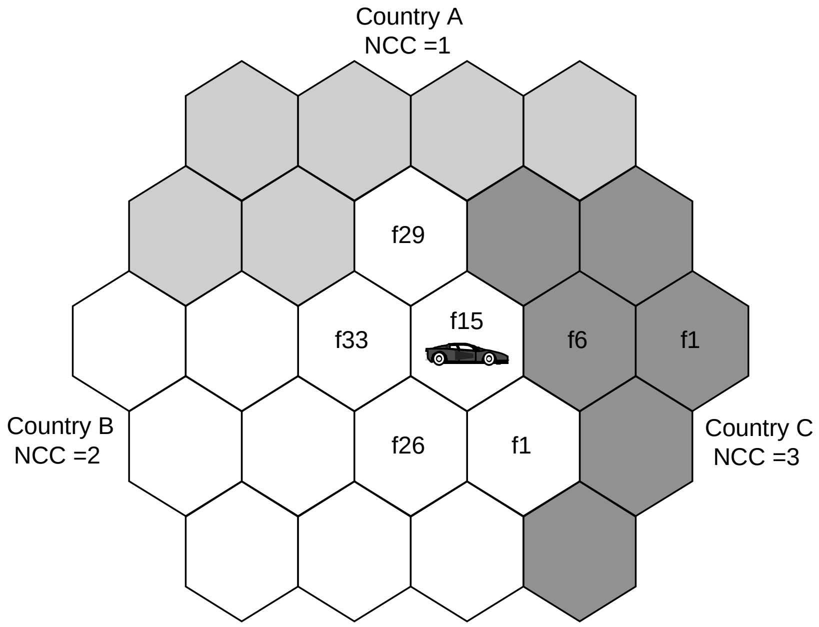


Figure 6-5 PLMN color code

In this case, the MS will not perform a call setup in another country or a different PLMN which means that the operator has saved signaling and the subscriber has saved money. This method can also be used inside a country in order to prevent signaling and handovers between different MSCs. If a call setup in another country or a different PLMN is permitted, the parameter **NCCPERM** supersedes NCC.

BCC is used as a protection against co-channel interference. For this purpose, BCC must be allocated as wisely as possible. It is recommended that all cells in a given cluster use the same BCC. In doing so the distance of a certain BCC is maximized. Suppose a MS is actively measuring neighboring cells (see Figure 6-6). Unfortunately f_{15x} is too close to neighbor f_{15y}. In some MRs the MS includes measurements from f_{15x} instead of f_{15y}. The only difference between the two is that one has BCC = 2 and the other has BCC = 3. The best result is sent to the BSC, even if the BCC is wrong. The locating algorithm in the BSC includes a filtering function which removes cells with an incorrect BCC. In this example, f_{15x} with BCC = 3 will no longer be evaluated.

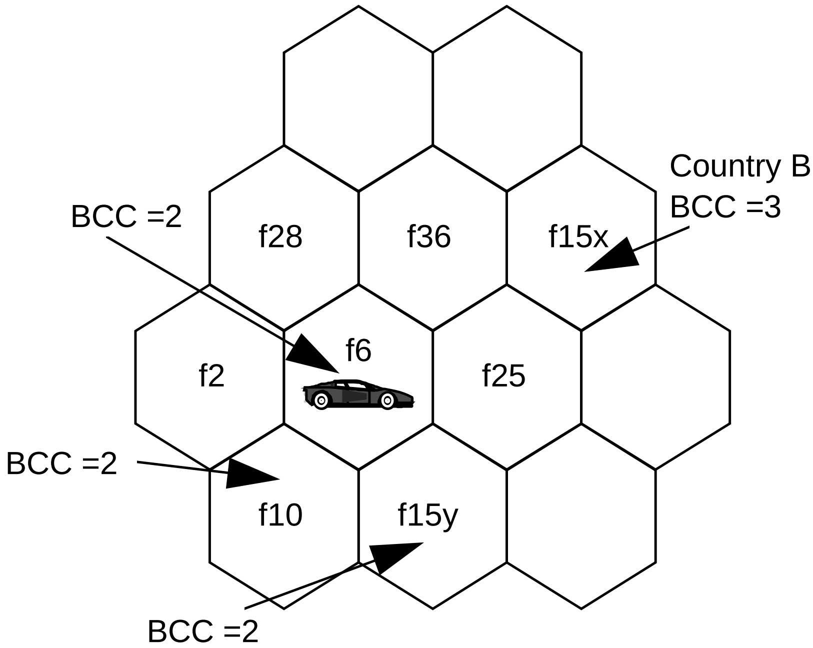


Figure 6-6 Base Station Color Code

BCCHNO: Absolute RF channel number for BCCH. Numeral 1 - 124 in GSM900, 512 - 885 in GSM1800, 512-810 in GSM1900.

NEWNAME: New cell designation. Symbolic name, maximum 7 characters.

At relocation of cells between BSCs, data must be redefined for the target cell in the target BSC and removed from the original cell in the original BSC. The cell can not have the same name in both BSCs, especially when relocating a border cell that is defined in both BSCs,

This parameter provides means to temporarily define cells and cell data in the target BSC. When the cell has been reallocated to the target BSC, it is then possible to change the name back to the original cell name used in the original BSC, in order to maintain consistency of the cell.

AGBLK: Number of reserved access grant blocks. Numeric 0 - 7. Numeric 0 - 2 for SDCCH/4.

Number of CCCH blocks reserved for the AGCH. The remaining CCCH blocks are used as PCHs. The parameter is valid only for internal cells, that is, cells belonging to the current BSC.

Within Ericsson´s GSM system, access grant messages have priority over paging messages, but if Cell Broadcast or System Information type 7&8 are to be broadcast then AGBLK must be equal to 1. During this reserved CCCH block the MS is told to listen to the cell broadcast or it will receive System Information type 7&8.

Note : Ericsson RBS 200 and RBS 2000 can only support AGBLK=0 or 1.

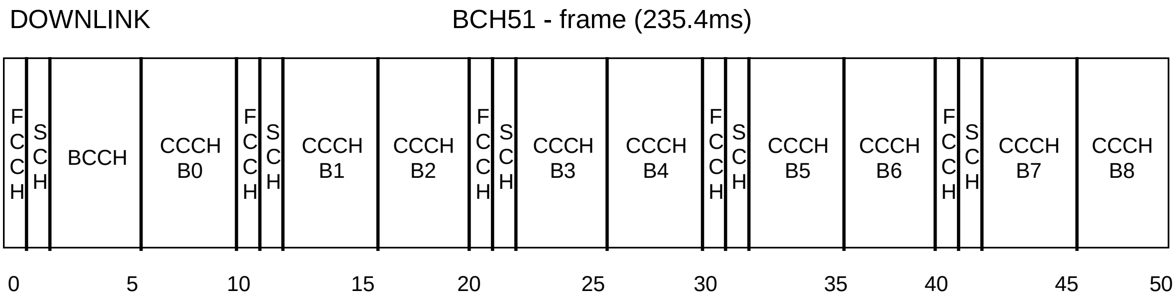


Figure 6-7 CCCH location in a multiframe

MFRMS: Multiframes period. Numeric 2 - 9. Defines the period of transmission for PAGING REQUEST messages to the same paging group. The parameter is expressed as the number of CCCH multiframes. The parameter is valid only for internal cells.

Each MS, according to its IMSI number, belongs to a specific paging group. Dependent on the IMSI-number, a MS is allocated one of the CCCH-blocks in a set of multiframe. Paging signals to this MS are then exclusively sent in this CCCH-block. The set of multiframes is determined by **MFRMS**. Since MFRMS can be set between 2 and 9, and the number of CCCH blocks within a multiframe is 9, it is possible to have 18 to 81 paging groups.

In idle mode, a MS listens to its paging group to detect a paging signal. In the gap between a certain paging group, the MS stays in a sleeping mode to minimize power consumption. If MFRMS is set to 2, the mobile listens to every 18 CCCH block which corresponds to 470.8ms (2 x 235.4ms).

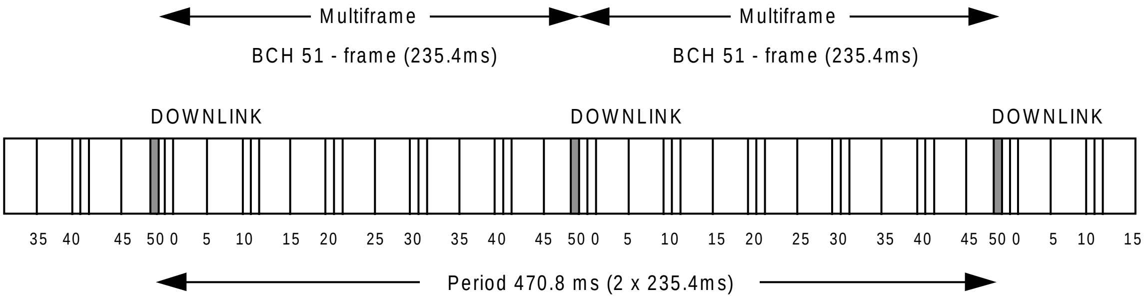


Figure 6-8 MS listening for paging request

BCCHTYPE: Identifies the type of BCCH to be used, this is only applicable for internal cells:

COMB	Indicates the cell has a combined BCCH and SDCCH/4.
COMBC	Combined with the CBCH. Indicates the cell has a combined BCCH and SDCCH/4 with a CBCH subchannel.
NCOMB	Indicates the cell does not have a combined BCCH and SDCCH/4.

FNOFFSET: Frame number offset. Numeral 0-1325. Indicates the time difference from the **Frame Number (FN)** generator in the BTS expressed as a number of TDMA frames. This prevents all cells on a site sending BCCH channels at the same time. By using FNOFFSET on a two or three sector site the time for decoding BSIC can be reduced. This parameter is valid only for internal cells.

XRANGE: Extended range cell. It can support traffic at a distance of greater than 35 km between the MS and BTS. This parameter is valid only for internal cells.

Figure 6-9 shows a printout of the Cell Description Data using the RLDEP command.

```
<RLDEP:CELL=C12301;

CELL DESCRIPTION DATA

CELL      CGI                     BSIC   BCCHNO   AGBLK   MFRMS
C12301    262-02-1-20             71        1     1       6

TYPE      BCCHTYPE                FNOFFSET        XRANGE   CSYSTYPE
INT       NCOMB                      0            NO       GSM
END

<
```

Figure 6-9 Cell Description Data

DEFINITION OF SUBCELLS

If a cell is configured with at least two frequencies, it can be split into two subcells - an overlaid subcell and an underlaid subcell. More than one frequency can be assigned to a subcell. In the BSC, subcells are denoted by the parameter **SCTYPE**. SCTYPE can be **UL** for underlaid or **OL** for overlaid subcell.

The area from the center (BTS) to the outer border is covered by the underlaid subcell. In addition, the gray area is the coverage-area of overlaid subcell.

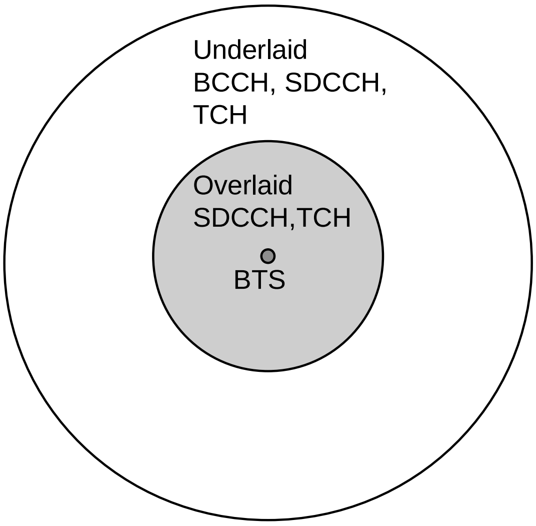


Figure 6-10 Subcell structure

The overlaid subcell depends on the underlaid subcell because it can not set up a call on its own. The overlaid subcell does not have a frequency carrying the BCCH. Call setup is performed by the underlaid subcell, but the call may then be handed over to the overlaid subcell (on the condition that the MS is in the gray area) or may be handed back from the overlaid subcell to the underlaid subcell.

The advantage of the subcell concept is that a second cluster with a smaller frequency reuse distance can be installed on top of an existing cluster, e.g. a new 3/9-cluster can be installed using overlaid subcells on top of an existing 4/12-cluster of underlaid subcells. In doing so, network capacity can be increased without adding new frequencies, but by “stealing” some frequencies from the underlaid cluster.

Another benefit is that it is not necessary to install new hardware. If a place with high traffic load must be covered, an overlaid subcell may also be used. In this case, an overlaid subcell keeps interference low. See Appendix A for more details.

Frequency administration of subcells is carried out using **CHannel GRoups (CHGR)**, e.g. the BSTXPWR must be specified separately for each subcell type, so it is done per CHGR.

CHANNEL GROUPS

RLDGI: CELL=cell, CHGR=chgr, SCTYPE=sctype;

This command is used to specify channel groups for a cell or subcell. If a subcell structure is specified with the command RLDSI, the parameter SCTYPE must be included in this command.

CHGR: Channel group. Numeral 0-15. Maximum 16 channel groups can be specified per cell.

SCTYPE: subcell type

UL= underlaid

OL= overlaid

CONFIGURATION POWER DATA FOR CELL OR SUBCELL

RLCPC: CELL=cell, SCTYPE=sctype, MSTXPWR=mstxpwr, BSPWRB=bspwrb, BSPWRT=bspwrt;

MSTXPWR: Maximum transmit power in dBm for an MS on a connection.

BSPWRB: Base Station nominal output power in dBm, for the RF channel number *which has* the BCCH.

BSPWRT: Base Station nominal output power in dBm, for the RF channels *which do not have* the BCCH.

This step is used to define or change configuration power data in a cell or a subcell. The indicated power is the nominal power of the transmitter in the BTS, not the ERP. If a subcell structure exists, the parameters MSTXPWR and BSPWRT must be specified for each subcell. If the cell is external, only parameter MSTXPWR is valid with CELL.

Figure 6-11 shows a printout of the Cell configuration power data using the RLCPP command.

```
<RLCPP:CELL=C12301;

CELL CONFIGURATION POWER DATA

CELL     TYPE BSPWRB BSPWRT MSTXPWR SCTYPE
C12301   INT  33     33     33
END
```

Figure 6-11 Cell configuration power data

FREQUENCY HOPPING DATA

RLCHC: CELL=cell, CHGR=chgr, HOP=hop, HSN=hsn;

This command is used to change the frequency hopping status and hopping sequence number for a channel group. The CHGR parameter is mandatory if channel groups other than 0 exist. The command is only valid for internal cells.

CHGR: Channel group. Numeral 0-15.

HOP: Frequency hopping status. On or off.

HSN: Hopping sequence number. Numeral 0-63.

HSN= 0 is cyclic hopping

HSN= 1-63 identifies a pseudo-random sequence

CONFIGURATION FREQUENCY DATA

RLCFI: CELL=cell, CHGR=chgr, DCHNO=dchno;

If more frequencies than the BCCHNO must be added to the cell, these frequencies are defined separately. The cell in question can be ACTIVE or HALTED. If subcells exist, new frequencies are added to the channel group (CHGR).

CHGR: Channel group. Numeral 0-15.

DCHNO: ARFCN (Absolute RF channel number). Numeric 1 - 124 in GSM900, 512 - 810 in GSM1800, 512 - 885 in GSM1900. A maximum of 16 DCHNO per channel group is allowed except for channel group 0 which allows only 15. Overall: 31 DCHNO per cell.

Figure 6-12 shows a printout of the Cell configuration frequency data using the RLCFP command.

```
<RLCFP:CELL=C12301;

CELL CONFIGURATION FREQUENCY DATA

CELL
C12301

CHGR   SCTYPE    SDCCH    SDCCHAC    TN    CCHPOS    CBCH   HSN   HOP   DCHNO
                   1         0       1     TN        NO      1    OFF     1
                                                                          5
END
```

Figure 6-12 Cell configuration frequency data

CONFIGURATION CONTROL CHANNEL DATA

RLCCC: CELL=cell, TN=tn, CHGR=chgr, SDCCH=sdcch, CBCH=cbch, CCHPOS=cchpos;

TN: Time slot Number. Numeral 0-3 for normal cell. Numeral 0 or 2 for extended range cell. System default value= 2.

CHGR: Channel group. Numeral 0-15.

SDCCH: Required number of SDCCH/8. Numeral 0-16. Numeral 0-7 when parameter CCHPOS is set to BCCH. Numeral 0-3 when parameter CCHPOS is set to BCCH and the cell is an extended range cell.

CBCH: Cell Broadcast Channel.

CBCH = YES shall be included in one of SDCCH/8 for the cell or channel group.

CBCH = NO indicates that no SDCCH/8 for the cell or channel group shall include CBCH.

Only one CBCH is allowed per cell. In case of the channel combination with CBCH (BCCHTYPE=COMBC), the CBCH is already integrated to TS0. Therefore, in control channel data, the CBCH must be set to NO (CBCH = NO).

HIERARCHICAL CELLSTRUCTURES

The relationship between cells is organized in hierarchical layers. In a network, every cell is assigned a parameter level in a 3-layer network. The level of a cell in the hierarchy determines the call setup or handover priority. Figure 6-13 shows cells in the three different layers.

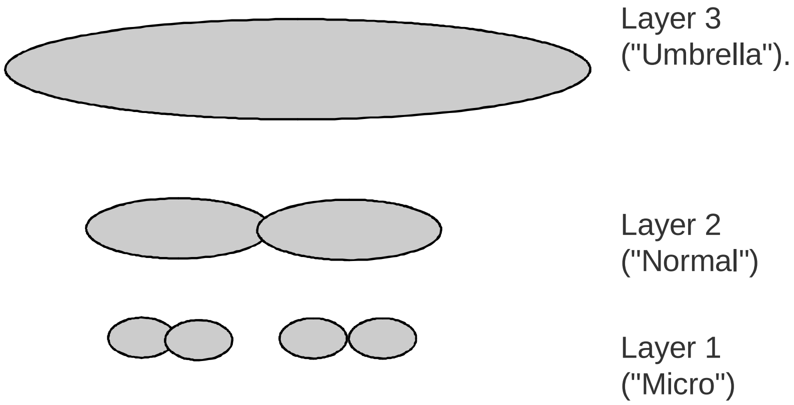


Figure 6-13 Cell Hierarchy

The layer (parameter **LEVEL**) to which a cell belongs is assigned to the cell in the definition. The following examples illustrate the advantage of hierarchical network structures. In the process of optimizing a radio network, two problems can occur:

1. There may be gaps between cells. That is, areas where there is no coverage.
2. Hot spots may occur. That is, places where there is high traffic demand.

Table 2

Layer	Priority	Name
3	low	umbrella
2	medium	normal
1	high	micro

Gaps can be covered by a large cell, that is, a BTS with a high output power and high timing advance. A cell covering these areas is called a layer 3 cell or an umbrella cell. An umbrella cell also provides coverage in the area of normal cells (See the following figure).

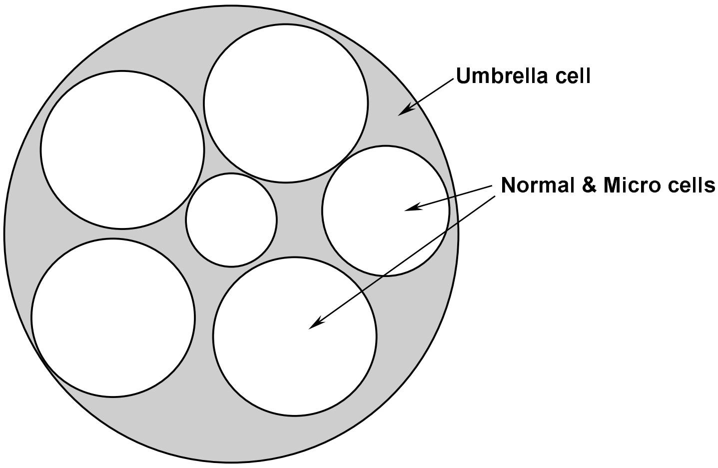


Figure 6-14 Solving the problem of Gaps

The gray area is the area which is not covered by the normal cells but covered exclusively by the layer 3 cell. Calls are now possible in the gray area. Since the layer 3 cell also provides coverage in the area of the normal cells (white area), it can also be used in the case where a normal cell is congested.

The use of layer 3 cells requires high output power and produces a high level of interference. Thus, it steals capacity from the network. It should only be used as a last resort. A layer 3 cell must not be confused with a subcell structure. A layer 3 cell can be operated from a BTS of its own. The term umbrella only indicates a low priority in cell selection.

A hot spot is a geographically small area where high capacity is required. It can be, e.g. a business center or an exhibition or fair. The best way to cover such an area is to implement a cell with a coverage area that suits the area. All calls in this geographical area should be allocated to this layer 1 or micro cell, and not to normal cells or umbrella cells. In cell selection, micro cells have highest priority.

MEASUREMENT FREQUENCIES

RLMFC:CELL=cell, MBCCHNO=mbcchno, LISTTYPE=listtype, MRNIC;

MBCCHNO: Is the **Absolute RF Channel Number (ARFCN)** for measurement on BCCH. Numeric 1 - 124 in GSM 900, 512 - 885 in GSM 1800 and 512 - 810 in GSM 1900. It represents the BCCH frequencies to be measured on by MSs in the cell.

In dual mode systems, frequencies from both systems can be used simultaneously.

LISTTYPE: Indicates if the list of measurement frequencies is to be used by the MS for measurements in idle mode or for measurements in active mode.

MRNIC: Measurement Reports Not Interpreted Correctly. If MRNIC is used, the change of frequencies is executed immediately. As a consequence, the MS delivers incorrect measurements until it has read the complete list from system information. The BSC takes this into account when evaluating the MRs. If MRNIC is skipped, the list is updated when there is a suitable point in time.

In order to measure the signal strength of neighboring cells, the MS must know the frequencies of the neighboring cell's BCCH-carriers. Up to 32 measurement frequencies can be defined in a cell. The indicated MBCCHNO must correspond to the BCCH-carriers of the cells indicated in the neighbor relationship.

If a new cell is added to the network, the new cell must know the number of the own BCCH-carrier (BCCHNO) and the BCCHNO of the neighboring cells. The neighboring cells must also know the BCCHNO of the new cell.

The BCCHNOs of these cells are transmitted to the MS via system information in the BCCH allocation list (BA-list). When the measurement frequencies are changed, the internally controlled parameter BAIND (BCCH allocation sequence number indication) toggles (see chapter 2: Channel Concept). Thus, the BSC knows if the MS has used the new or the old list of measurement frequencies. This parameter synchronizes the use of a new measurement frequencies allocation list in the mobile and the BSC.

Figure 6-15 shows a printout of the Cell meassurement frequencies using the RLMFP command.

```
<RLMFP:CELL=C12301;

CELL MEASUREMENT FREQUENCIES

CELL
C12301

LISTTYPE
IDLE

MBCCHNO
 23   45   70   93

LISTTYPE
ACTIVE

MBCCHNO
 23   45

TEST MEASUREMENT FREQUENCIES

MBCCHNO

END
```

Figure 6-15 Cell meassurement frequencies

NEIGHBOR RELATIONS

RLNRI: CELL=cell, CELLR=cellr, SINGLE;

CELLR: Related cell. Max. 7 characters.

SINGLE: Defines the relationship between the cells.

The parameter SINGLE is only given if the relation is one-way from CELL - CELLR. This means that handover can be made from CELL to CELLR. Default is mutual which means that handovers are allowed in both directions.

It is mandatory to define neighbor relationships. These relationships control the handover between cells. The type of relationship between the cells can be either mutual or one-way. Handovers in both directions are permitted when the relationship is mutual. Relationship to an external cell must be SINGLE. The handover from an internal to an external cell is initiated and controlled by its own BSC. The handover back is controlled by the other BSC. Up to 64 neighbors can be defined per cell.

Thirty-two mutual neighbors can be defined for a cell.

Figure 6-16 shows a printout of the Neighbour relation data using the RLNRP command.

```
<RLNRP:CELL=C12301,CELLR=ALL;

NEIGHBOUR RELATION DATA

CELL
C12301

CELLR    DIR      CAND     CS
C12101   MUTUAL   BOTH     NO

KHYST    KOFFSETP  KOFFSETN   LHYST    LOFFSETP  LOFFSETN
 3        0                    3        0

TRHYST   TROFFSETP TROFFSETN  AWOFFSET  BQOFFSET
 2        0                    5         3

HIHYST   LOHYST OFFSETP   OFFSETN
 5        3      0

CELLR    DIR      CAND     CS
2202B    MUTUAL   BOTH     NO

KHYST    KOFFSETP  KOFFSETN   LHYST    LOFFSETP  LOFFSETN
 3        0                    3        0

TRHYST   TROFFSETP TROFFSETN  AWOFFSET  BQOFFSET
 2        0                    5         3

HIHYST   LOHYST OFFSETP   OFFSETN
 5        3      0
END
```

Figure 6-16 Neighbour relation data

CONNECTION OF CELL TO TRANSCEIVER GROUP

RXTCI: MO=mo, CELL=cell, CHGR=chgr;

On completion of the OPI: ***BSC, Internal Cell, Define,*** the BSC knows the cell as a set of data. However, the cell does not have a connection to a BTS. No BTS is configured yet according to the parameters as defined in configuration power data, control channel data or frequency data. Therefore, the cell must be connected to a TG before it is activated. A TG is indicated to the cell as a MO and a CHGR. See Figure 6-17:

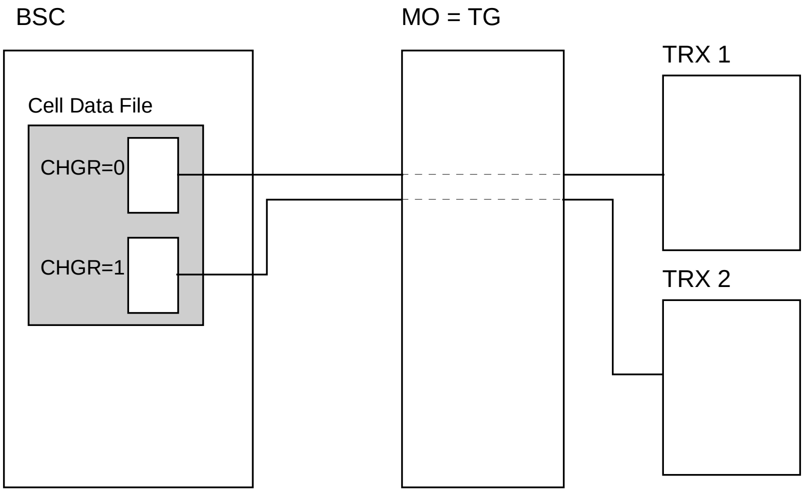


Figure 6-17 Connection of channel groups to transceiver groups

The connection is carried out via the CHGR. A normal cell (no subcell structure) is always connected via CHGR=0. In the case of subcells, the underlaid subcell is always CHGR=0 whereas the overlaid subcell is CHGR=1.

Figure 6-18 shows a printout of the TG to Channel group connection data using the RXTCP command.

```
<RXTCP:MO=RXOTG-20;

RADIO X-CEIVER ADMINISTRATION
TG TO CHANNEL GROUP CONNECTION DATA

MO                CELL                 CHGR
RXOTG-20          C12301                0

END

;
```

Figure 6-18 TG to Channel group connection data

CELL STATE

RLSTC: CELL=cell, CHGR=chgr, STATE=state;

CHGR: Channel group. Numeral 0-15

STATE: The state of the cell. Active or halted.

When defining cell data, the state of a cell is HALTED (off air). After cell data definition, the state of the cell must be changed to ACTIVE (on air). Alternatively, an individual CHGR can be activated. During cell activation, the cell data for description and configuration is downloaded to the connected TG. The purpose of the cell state is to control the input of data to the cell in order to minimize the effect on ongoing traffic. Very important data can only be changed in the HALTED state, e.g. cell description data (CGI, BCCHNO, etc.).

Cell state transition from HALTED to ACTIVE

The defined cell configuration data is used for configuration. Logical channels are created and the BCCH for the cell is activated. System information messages are distributed to the MSs.

From ACTIVE to HALTED

Ongoing calls are disconnected. All logical channels are deleted and the BCCH for the cell is deactivated.

ACTIVE	The cell is in operation
HALTED	BCCH is deactivated and no further connections are allowed. All active connections are released

Figure 6-19 shows a printout of the Cell status using the RLSTP command.

```
<RLSTP:CELL=C12301;

CELL STATUS

CELL    STATE
C12301  ACTIVE
END
```

Figure 6-19 Cell status

CONFIGURATION DATA CHECK

To check which cell recourses the cell has, use the RLCRP command. This is shown in Figure 6-20.

```
<RLCRP:CELL=C12301;

CELL RESOURCES

CELL       BCCH  CBCH  SDCCH  NOOFTCH
C12301       1     0      8       14

BPC    CHANNEL      CHRATE  SPV    STATE  ICMBAND
7994   TCH-8148     FR      1      IDLE
7997   TCH-8151     FR      1      IDLE
7996   TCH-8150     FR      1      IDLE
7995   TCH-8149     FR      1      IDLE
7998   TCH-8152     FR      1      IDLE
8000   SDCCH-34687                 IDLE
       SDCCH-34686                 IDLE
       SDCCH-34685                 IDLE
       SDCCH-34684                 IDLE
       SDCCH-34683                 IDLE
       SDCCH-34682                 IDLE
       SDCCH-34681                 IDLE
       SDCCH-34680                 IDLE
7999   TCH-8153     FR      1      IDLE
7992   TCH-8146     FR      1      IDLE
7993   TCH-8147     FR      1      IDLE
8007   TCH-8159     FR      1      IDLE
8002   TCH-8155     FR      1      IDLE
8001   TCH-8154     FR      1      IDLE
8004   TCH-8156     FR      1      IDLE
8006   TCH-8158     FR      1      IDLE
8005   TCH-8157     FR      1      IDLE
8003   BCCH-34688                  BUSY
END
```

Figure 6-20 Cell resources

To check how the TG is configured use the RXCDP command. This is shown in Figure 6-21.

```
<RXCDP:MO=RXOTG-20;
RADIO X-CEIVER ADMINISTRATION
MANAGED OBJECT CONFIGURATION DATA

MO                  RESULT    ARFCN   MISMATCH
RXORX-20-0          CONFIG    HOP     NONE
RXORX-20-1          CONFIG    HOP     NONE

MO                  RESULT    ARFCN   TXAD    TN   BPC    CHCOMB   OFFS   XRA   ICM
RXOTS-20-0-0        CONFIG        1    0       2   8004   TCH         0   NO    OFF
RXOTS-20-0-1        CONFIG        1    0       3   8005   TCH         0   NO    OFF
RXOTS-20-0-2        CONFIG        1    0       4   8006   TCH         0   NO    OFF
RXOTS-20-0-3        CONFIG        1    0       5   8007   TCH         0   NO    OFF
RXOTS-20-0-4        CONFIG        1    0       6   8002   TCH         0   NO    OFF
RXOTS-20-0-5        CONFIG        1    0       7   8001   TCH         0   NO    OFF
RXOTS-20-0-6        CONFIG        5    1       0   7992   TCH         0   NO    OFF
RXOTS-20-0-7        CONFIG        5    1       1   7993   TCH         0   NO    OFF
RXOTS-20-1-0        CONFIG        1    0       0   8003   BCCH        0   NO    OFF
RXOTS-20-1-1        CONFIG        1    0       1   8000   SDCCH8      0   NO    OFF
RXOTS-20-1-2        CONFIG        5    1       2   7994   TCH         0   NO    OFF
RXOTS-20-1-3        CONFIG        5    1       3   7995   TCH         0   NO    OFF
RXOTS-20-1-4        CONFIG        5    1       4   7996   TCH         0   NO    OFF
RXOTS-20-1-5        CONFIG        5    1       5   7997   TCH         0   NO    OFF
RXOTS-20-1-6        CONFIG        5    1       6   7998   TCH         0   NO    OFF
RXOTS-20-1-7        CONFIG        5    1       7   7999   TCH         0   NO    OFF

MO                  RESULT    ARFCN   TXAD    BSPWR   C0F   MISMATCH
RXOTX-20-0          CONFIG        1    0      33      YES   NONE
RXOTX-20-1          CONFIG    HOP      1      33      NO    NONE

MO                  RESULT    SBITS     N1    N3    N4
RXODP-20-0          CONFIG    11111           1     28

END
```

Figure 6-21 Managed Object configuration data

RELATED COMMANDS

RLLBP - Radio Control Cell BSC Locating Data, Print

RLDEP - Radio Control Cell Description Data, Print

RLCFP - Radio Control Cell Configuration Frequency Data, Print

RLCPP - Radio Control Cell Configuration Power Data, Print

RLLOP - Radio Control Cell Locating Data, Print

RLLUP - Radio Control Cell Locating Urgency Data, Print

RLLDP - Radio Control Cell Locating Disconnect Data, Print

RLLPP - Radio Control Cell Locating Penalty Data, Print

RLMFP - Radio Control Cell Measurement Frequencies, Print

RLNRP - Radio Control Cell Neighbour Relation, Print

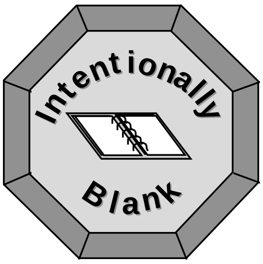
RLSTP - Radio Control Cell State, Print

RLSTC - Radio Control Cell State, Change

RXTCI – Radio X-ceiver Administration TG to Channel Group, Initiate

RXTCP - Radio X-ceiver Administration TG to Channel Group, Print

RLTYP - Radio Control Cell System Type, Print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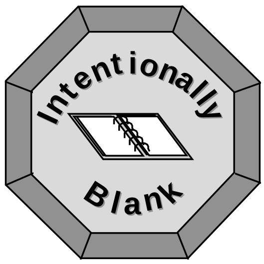
BSS Faulthandling

Chapter 7

This chapter is designed to provide the student with an overview how to handle the BTS when an alarm occurs.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7 BSS Faulthandling

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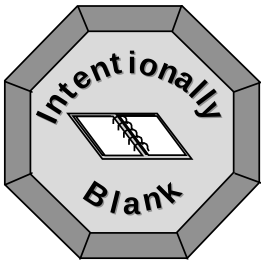
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GENERAL

If the RBS breaks down, behaves abnormally, or becomes impossible to communicate with, the BSC/OSS operator will be alerted by an alarm. In this chapter the principles of alarm handling using commands will be described.

ALARM HANDLING AND DESCRIPTIONS

Any faults that may occur at the RBS and effect the normal operation of the equipment, will be detected by RBS software and reported to the alarm handling block in the BSC. The event will be stored in two different event registers, the faulty unit list and the error log, and automatically printed out at the alarm printer, once it is detected.

All alarms that are currently active, can be printed out by using the **ALLIP** (Alarm List Printout) command.

```
A3/SW-DEV "BSC1D/CME20R7/D" 161 990517   1348   H'0041-0005
RADIO X-CEIVER ADMINISTRATION
MANAGED OBJECT FAULT

MO                                    RSITE            ALARM SITUATION
RXOTRX-300-0                          KISTA3           CLASS 2 FAULT
```

Figure 7-1 Example of an alarm printout

Alarm classes

In Figure 7-1 a Class 2 fault has occurred in TRX-0 in TG 300. The alarm class tells how severe the alarm is. The alarm classes are as follows:

Class 1A Fault: Faults reported in this class are faults that affect MO functionality. Faulty HW is part of signalling MO.

Class 1B Fault: Faults reported in this class are faults that affect MO functionality. Faulty HW is external to the signalling MO.

Class 2A Fault: Faults reported in this class are faults that do not affect MO functionality. Faulty HW is part of signalling MO.

External Class 1 Fault: Faults reported in this class are faults that do affect MO functionality. The conditions are external to the TG .

External Class 2 Fault: Faults reported in this class are faults that do not affect MO functionality. The conditions are external to the TG.

Fault information readout

The faulty unit list contains information about active alarms and the equipment that is faulty. The error log contains historical information about active and past alarm events. The information can be retrieved by the commands **RXMFP** (Radio X-eiver Administration Managed Object Fault Information, Print) and **RXELP** (Radio X-eiver Administartion Error Log, Print).

```
<RXMFP:MO=RXOTRX-300-0;

RADIO X-CEIVER ADMINISTRATION
MANAGED OBJECT FAULT INFORMATION

MO                    BTSSWVER
RXOTRX-300-0          ERA-G02-R03-V01

RU  RUREVISION                          RUSERIALNO
 0  KRC 131 47/03         R1A           A53049JYER

    RUPOSITION                          RULOGICALID
    C:0 R:C SH: 2 SL:  0                DMRU TRU     0

STATE  BLSTATE  INTERCNT  CONCNT  CONERRCNT  L3RESULT  L3REASON
OPER            00000

FAULT CODES CLASS 2A
 0

REPLACEMENT UNITS
13

END
```

Figure 7-2 Example of a faulty log printout

Figure 7-2 shows the Class 2A fault that is shown in Figure 7-1 using the RXMFP command. In this printout you can see that the Class 2A fault code is 0 and that the unit that shall be replaced is number 13. To see what the fault code means you have to check the fault code list. This can be found in RBS 2000 library e.g. the Site Installation test manual or in the Release binder. In this case fault code 0 means “RX cable disconnected” and the replaceable unit code 13 means “CDU to TRU RXB cable“.

Error log readout

In Figure 7-3 you can see the fault information stored in the error log for the fault shown in Figure 7-1 and Figure 7-2. The error log will show all faults that has occurred in this MO since the last reset of the error log. The information is presented in hexadecimal code that has to be converted into binary format and put into a matrix and converted into a decimal number. This number you then translate in the fault code list, as explained earlier in the chapter. An example of the conversion process you can see in Figure 7-4.

```
<RXELP:MO=RXOTRX-300-0;

RADIO X-CEIVER ADMINISTRATION
ERROR LOG DATA

FAULT  INFORMATION LOG

MO               BTSSWVER          DATE      TIME      REPLMAP      BTS
RXOTRX-300-0     ERA-G02-R03-V01   99-05-17  13-46-47  000000002000 STA

1AMAP            1BMAP             2AMAP          EXT1BMAP  EXT2BMAP
000000000000     000000000000      000000000001   0000      0000

END
```

Figure 7-3 Example of an error log printout

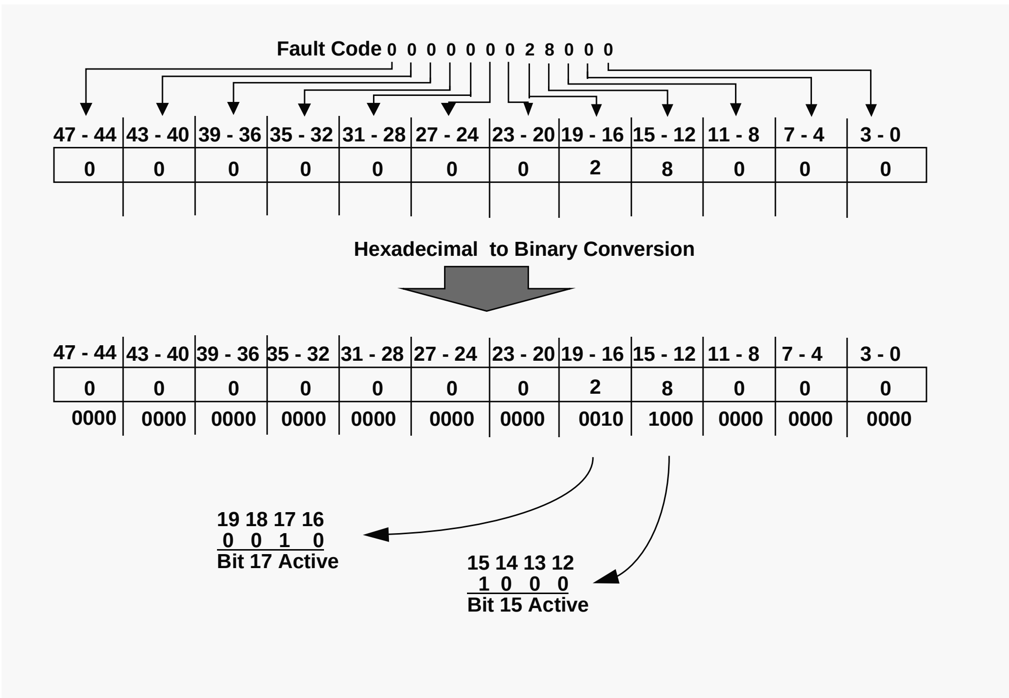


Figure 7-4 Conversion Process

Alarm handling

Whenever a RBS alarm is issued, the BSC operator determines if the fault is permanent by performing a test on the faulty equipment. The OPI ***Radio X-ceiver Administration Managed Object Fault*** is to be used as the first step in locating the cause of a fault. Which OPI that shall be use you can see in the Alarm printout header see Figure 7-1.

The following is an example of a class 1A fault.

1. Compare fault indication with the recorded information in the error log. If a specific fault has occurred several times before in the same BTS, it could possibly be a hardware fault. If the fault occurs throughout the system and no particular HW fault is found, then a trouble report should be issued.

   RXELP:MO=mo

2. Print MO fault information.

   RXMFP:MO=mo

3. Manually block the faulty equipment.

   RXBLI:MO=mo

4. Test the faulty MO.

   RXTEI:MO=mo

If the test indicates a fault in the MO, the MO must be repaired according to the Maintenance manual for the RBS by a field technichian. The test result must be used as an input to the fault analysis.

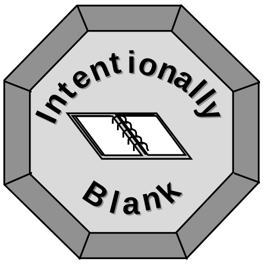
5. If the test does not indicate any faults, the MO can be deblocked.

   RXBLE:MO=mo

OSS overview

Chapter 8

This chapter is designed to provide the student with an overview of the Ericsson OSS system, and an introduction to the main OSS applications used in the BSS integration process i.e. Cellular Network Administration (CNA), BTS Management (BSM) and Command Handling Application (CHA).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8 OSS overview

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OSS INTRODUCTION

ERICSSON'S OMC AND NMC IMPLEMENTATION

Operation and Support System (OSS) is Ericsson's product to support the activities performed in an OMC and/or NMC. The network operator monitors and controls the network through OSS which offers cost effective support for centralized, regional and local operations and maintenance activities. OSS is based on Ericsson's Telecommunications Management and Operations Support (TMOS) platform.

OSS is designed as a complete network management system which can be used to control all the main network elements such as MSC/VLRs, HLRs, ILRs, TRCs, BSCs, EIRs, AUCs and Mobile Intelligent Network (MIN) nodes OSS can also control BTSs through the BSCs.

OSS uses a Graphical User Interface (GUI) enabling easier system use and network management.

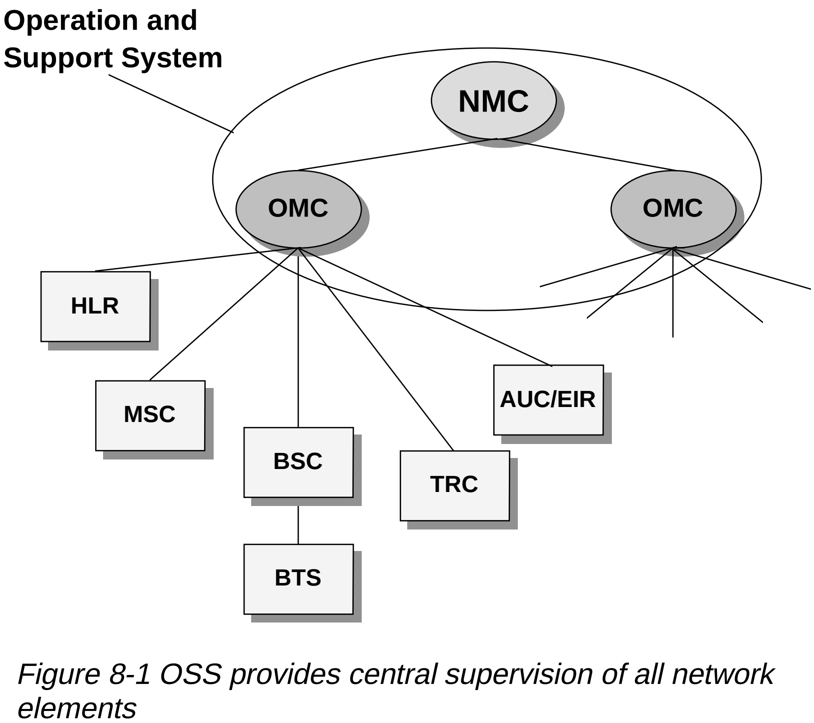


Figure 8-1 OSS provides central supervision of all network elements

Telecommunication Management Network (TMN)

OSS and TMOS are based on the international Telecommunication Management Network (TMN) standard. TMN is a model for the management of telecommunication networks. The most important areas of network management identified by TMN are:

- Configuration Management
- Fault Management
- Performance Management

Configuration Management

In OSS, the cellular network can be displayed on screen using a Graphical Cell Configuration (GCC). GCC gives a graphical view of the entire network and allows the operation and maintenance staff to zoom in on specific regions of the network to get a more detailed picture of particular cells.

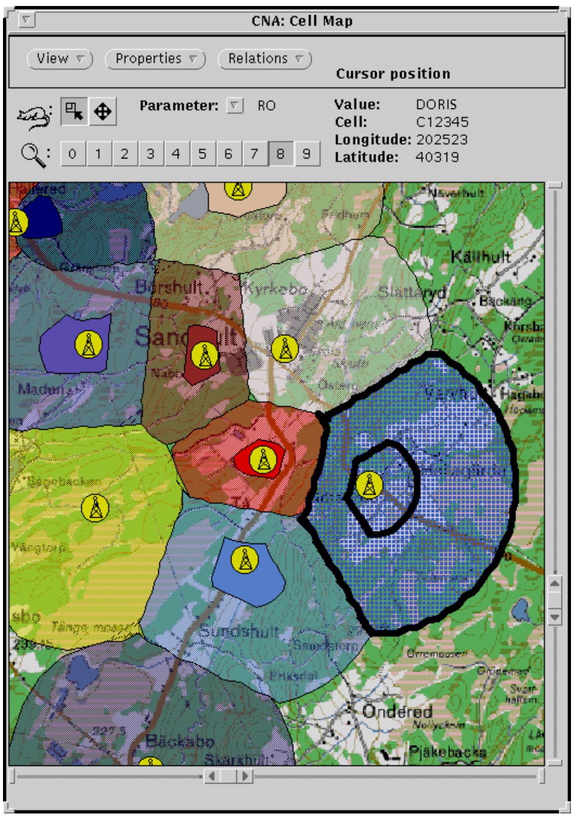


Figure 8-2 Graphical Cell Configuration

Fault Management

The operator can monitor the status of the network by using Network Status Presentation. If a failure occurs in the network, one or more alarms are activated and forwarded to the OMC.

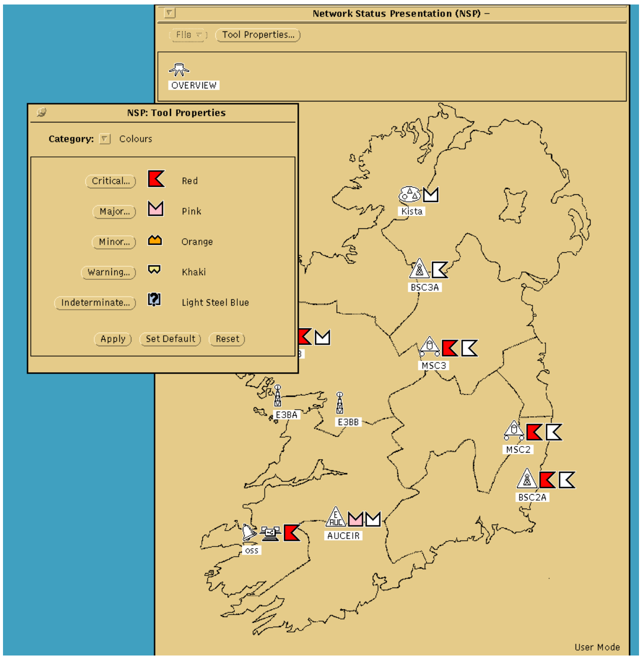


Figure 8-3 Network Status Presentation map showing icons for different types of alarms

Performance Management

In order to plan for future use of the cellular network, each operator must check the performance of the network. With performance management it is possible for an operator to collect and receive statistics based on both short-term and long-term measurements.

OSS APPLICATIONS

OSS includes applications for the supervision, configuration and performance management in a cellular network. In addition to the applications for handling a cellular network, OSS also provides basic functions, e.g. for alarm handling and file transfer. The picture below shows most of the OSS applications.

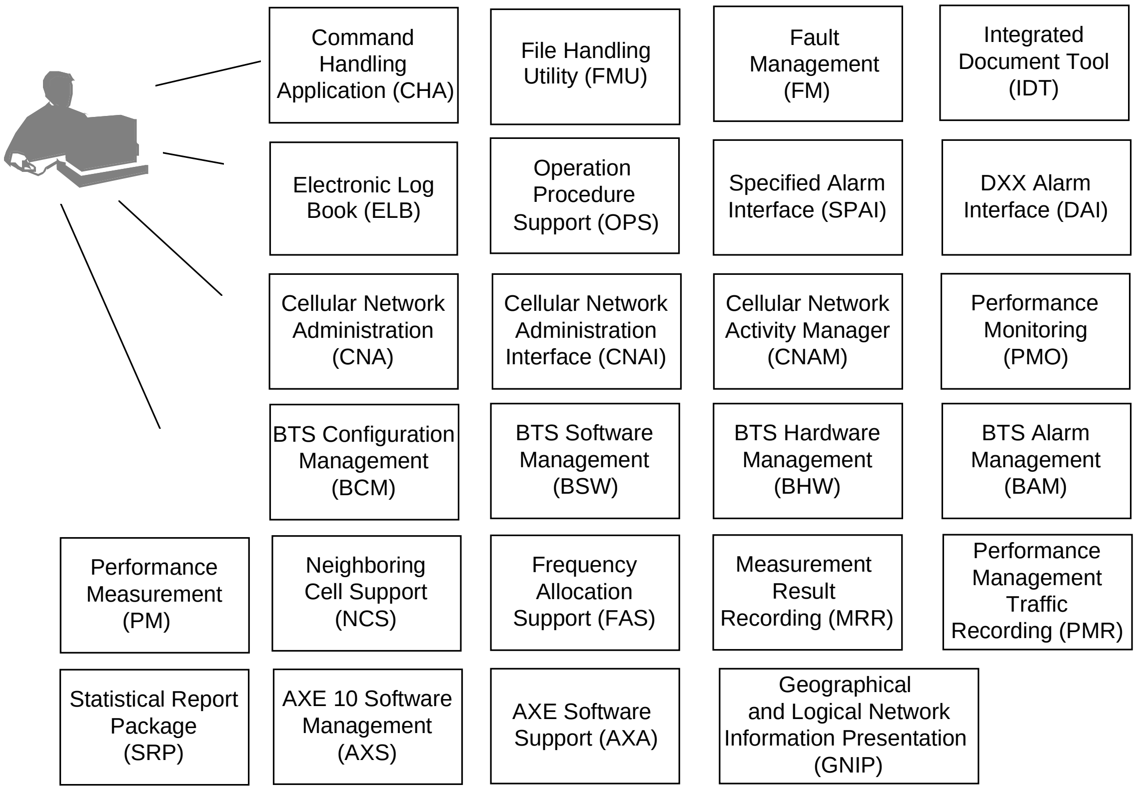


Figure 8-4 The OSS applications

CONFIGURATION MANAGEMENT IN OSS

INTRODUCTION TO CONFIGURATION MANAGEMENT

A cellular network consists of several nodes with certain functions in the network. To achieve and maintain high performance, the network has to be adapted all the time. New subscribers must be added, new cells must be introduced, the software of certain NEs must be updated, etc. Adaptations like these are achieved by configuration management.

OSS supports configuration management in a user-friendly way through its concept. OSS provides a network view, which means the user can see how changes in one NE have impacted on other NEs. So OSS is the best solution for configuration management in a network.

Configuration management in OSS can be divided into three areas:

- Configuration management for cells
- Configuration management for Base Transceiver Stations (BTSs)
- Configuration management for AXE-10 software

In this chapter only the first two will be explained more in detail.

CONFIGURATION MANAGEMENT FOR CELLS

To handle the cells and related parameters, that is changing cellparameters in already defined cells or putting in new cells there are two applications in the OSS to handle this. They are :

- Cellular Network Administration (CNA)
- Cellular Network Administration Interface (CNAI)

The Cellular Network Administration (CNA) function is used to retrieve information, view and plan the structure of a cellular network which will be explained further in the chapter.

The CNA Interface (CNAI) application is a file interface that enables data transfer between an external system and the database of the Cellular Network Administration (CNA).

CNAI allows the users to export and import cell data from CNA and to transfer data between different OMCs. This will not be explained further in the chapter.

CELLULAR NETWORK ADMINISTRATION (CNA)

CNA provides an easy and user-friendly way to retrieve information and adjust the parameters in the cellular network.

CNA Network Model

A model of the real cellular network is stored in the OSS database. This model consists of data (parameters) structured as objects in hierarchical levels reflecting the real cellular network. The user may create, delete, and change new objects and display parameter data in the CNA Model without interfering with the existing NEs.

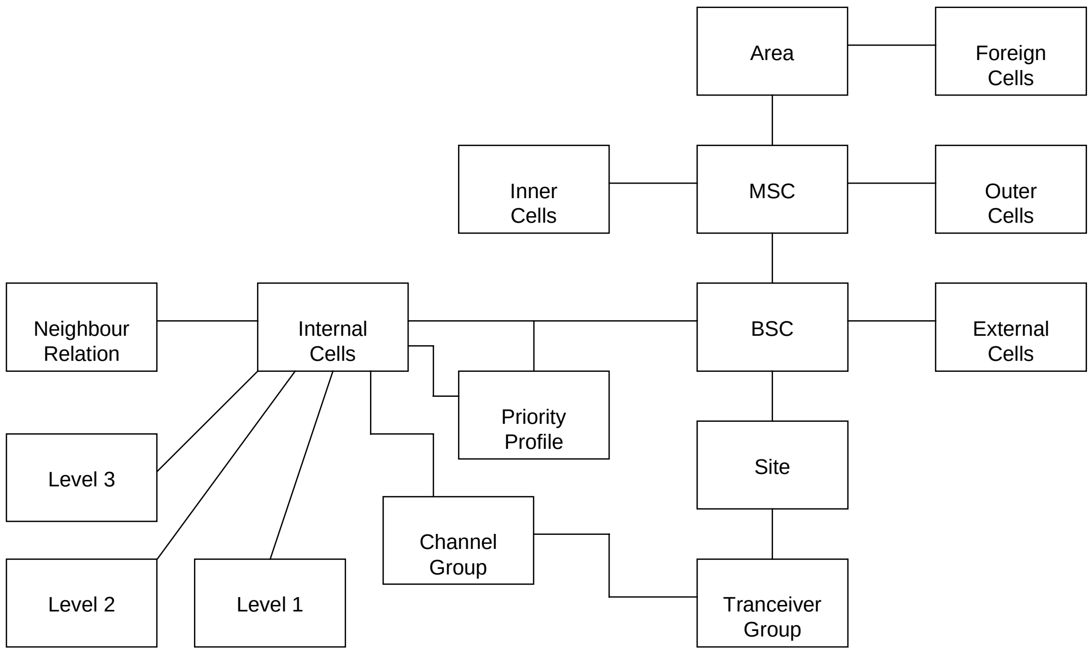


Figure 8-5 CNA Network model

The concepts used in Figure 8-5 is explained below.

Foreign Cell

A Foreign Cell is a cell managed by another OMC and is a neighbour to one or more cells managed by the OMC in question.

Inner Cell

Inner Cells contain MSC data associated with the cell which belongs to this MSC.

Outer Cell

Outer Cells are cells that belong to any other MSC in the PLMN to which a handover can be made from one or more cells in the selected MSC. An Outer Cell is only needed in order to create a Neighbour Relation to a cell belonging to another MSC.

Internal Cell

Internal Cells contain BSC data associated with a cell controlled by the BSC to which the Internal Cell belongs. The only exception is data associated with Neighbour Relations within a BSC or between cells in different BSCs. If the cell has a subcell structure the Internal Cell contains the Underlaid Subcell data together with the data common to both the Underlaid Subcell and the Overlaid Subcell. It can also be set to be a Level 1, 2, or 3 Cell. The Level 1 and Level 3 Type Cell parameters can be used in combination with a subcell structure

External Cell

External Cells are cells that belong to any other BSC in the PLMN and to which a handover can be made from one or more cells in the BSC in question.

An External Cell is only needed in order to create a Neighbour Relation to a cell belonging to another BSC.

External Cells can be a Level 1 Type Cell, a Level 2 Type Cell, or a Level 3 Type Cell, depending of which type of Internal Cell they represent.

Neighbour Relation

The BSC holds data which defines the Neighbour Relations between cells in order to handle handover from the ServingCell to other cells.

Channel Group

A Channel Group is a set of radio frequencies. Each cell and subcell belonging to a BSC must have one or more Channel Groups which are connected to a Transceiver Group. The set of radio frequencies can be configured for frequency hopping.

CNA Area concept

CNA handles different areas when managing the real Network. The areas are shown in Figure 8-6.

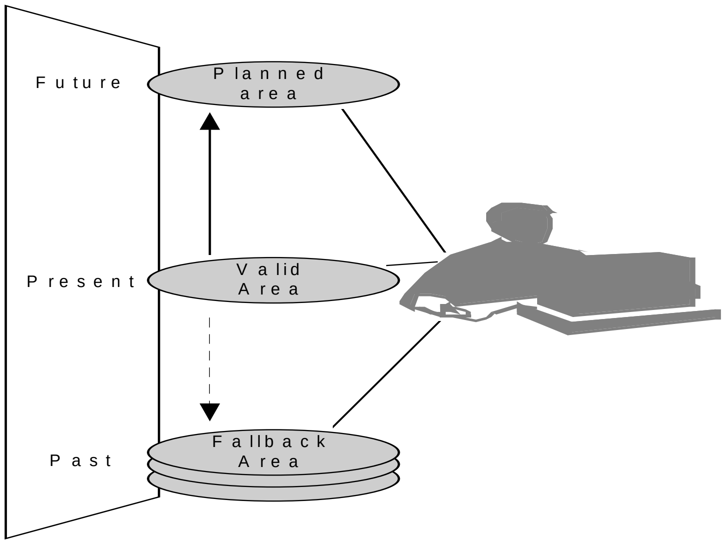


Figure 8-6 The Area Concept in CNA

Actions are performed on the areas defined as follows:

Valid Area

The Valid Area is the model of the real Network. This area makes it possible to retrieve information from the Network without interfering with it. The Adjust function is used to get the accurate data from the Network into the Valid Area. When the Network is updated with a Planned Area, the Valid Area is automatically updated as well.

Planned Area

A Planned Area is an area in which the user can make changes, create, and delete objects etc. without interfering with the real Network. It is then possible to update the Network with these changes.

Fallback Area

A Fallback Area is a complete copy of the Valid Area at the moment the Fallback Area was created. It is used as a backup for the Valid Area. The Valid Area and the Network may be restored by creating a Planned Area from the Fallback Area, and start an Update Job from this Planned Area.

CNA concepts

Adjust

Adjustment Jobs are used to adjust the Valid Area with data from the Network. When a job starts, the Valid Area and the Network are compared. The Valid Area is then adjusted with the differences found and thus becomes a true copy of the Network.

Adjustment Jobs can be created for the entire Valid Area, but they can also be performed on MSC, BSC, or Cell level.

Consistency check

Consistency Checks are performed to check the consistency of the parameters. The Consistency Checks issue warnings when rules defining the parameter values, their limit values, and their relations are violated. This is a toolpreventing the user from entering inconsistent data in the Planned Area and subsequently in the Valid Area, and thus helps to avoid problems when the Network is updated. The user can select to ignore the warnings and thus enter inconsistencies into the Network.

A Consistency Check can also be performed after the completion of an Adjustment Job with the Valid Area to check the consistency in the Network.

Consistency Checks can be carried out when the current selection is:

- the Valid Area or a Planned Area
- an MSC, a BSC, or an Internal Cell in the Valid Area
- an MSC, a BSC, or an Internal Cell in a Planned Area.

Update

Update Jobs are used to update the cellular network with data from a Planned Area. When a job starts, the Network and the Valid Area are updated with the differences existing between the Planned and the Valid Areas. The Planned Area and the affected BSCs and MSCs of the Valid Area are locked during the Update process.

Update Jobs may be run:

- on Area level
- on NE level
- on Foreign Cells

An Update Job on the Area level is automatically subdivided into the required number of subjobs. The subjobs are automatically run in parallel, as many as the system resources allow. One job is created for each NE which contains changed objects or is changed itself, plus one job handling changes in the Foreign Cells.

On NE level, two or more Update Jobs may be manually scheduled to run in parallel, as long as they do not affect the same NE. The jobs may be run from the same or from different areas.

Many changes in a Planned Area are distributed to other NEs. For example, changing the CGI in an Internal Cell will affect the corresponding Inner, Outer, and External Cells in other NEs, and changing the BCCHNO in a cell will affect the ACTIVE and IDLE lists in all cells which can perform a handover to that cell.

CNA workflow

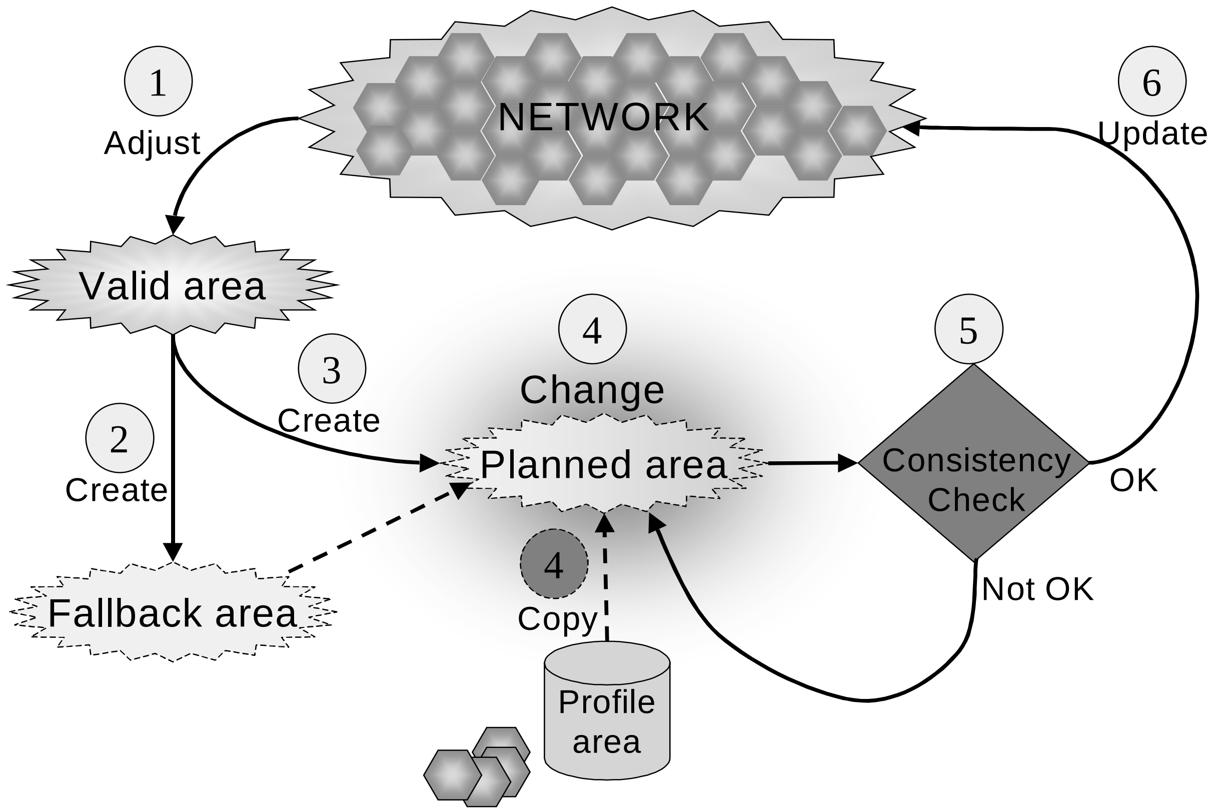


Figure 8-7 The CNA workflow

The steps shown in Figure 8-7 are explained below.

1. An Adjustment job is performed to update the Valid area with the network data.

2. A Fallback area can be created if the changes that are being put into the network are not working as was thought. An update can then be done using this area data.

3. From the Valid area a Planned area is created. Here all changes that are going to be made to the network are done. Cell data can be copied from already defined cells to make it easier.

4. To check that the changes made in the Planned area are working correctly, before updating the network with them, a Consistency check can be done to verify this.

5. To put in the changes made in the Planned area an Update job is performed.

CONFIGURATION MANAGEMENT FOR BASE TRANSCEIVER STATIONS

OSS provides four applications for the BTS handling These applications support the Ericsson RBS 200 and RBS 2000.See Figure 8-8.

- BTS Configuration Management (BCM)
- BTS Hardware Management (BHW)
- BTS Alarm Management (BAM)
- BTS Software Management (BSW)

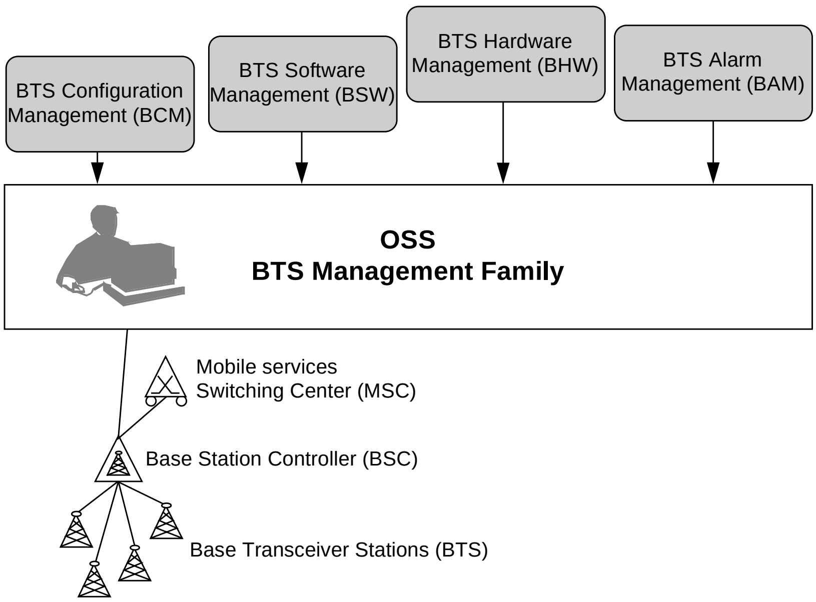


Figure 8-8 The BTS Management family

For BCM, BHW and BAM a common user interface is used, called BTS Management (BSM). The BSW is started as a separate application from the OSS menu.

The purpose of the Base Station Configuration Management (BCM) application is to enable the user to handle the base station configuration in the mobile network. This will be explained more in detail later in the chapter.

With BHW, the user can retrieve and display - in a graphical user interface all relevant information on installed hardware related to Managed Objects (MOs) in a base station. The user can easily identify a Replaceable Unit (RU) as well as its revision, vendor, and logical model. For an RBS 2000, it is also possible to retrieve the logical-ID, serial number, and physical position of an RU. It is only possible to retrieve information from the network underlying the BHW application but not to perform any changes to the network. A search facility allows network-wide search for specific hardware equipment. This will not be explained further in the chapter.

BAM introduces a consistent and user-friendly way of handling and configuring the base station's alarm coordination and the External Alarm Objects (EXALOs). The alarm coordination feature allows reduction of the amount of reported alarms which enables the user to concentrate on the important ones. (Note that the alarms are not received by BAM but by Fault Management.) One of the advantages of using BAM is that it provides the user with a more efficient fault-finding process by interpreting the fault and status information presented on the Managed Objects (MOs) which makes base station alarm handling smooth and continuous. This will not be explained further in the chapter.

The purpose of the BTS Software Management (BSW) application is to enable the user to handle and down-load BTS software (SW) in a centralized way. This will not be explained further in the chapter.

BTS CONFIGURATION MANAGEMENT (BCM)

BCM provides functions for planning of parameter changes to the network. This planning include introduction of new base stations as well as modification of existing ones. All planning is made off-line in the database without interfering with the network and is made by using the BTS Wizard.

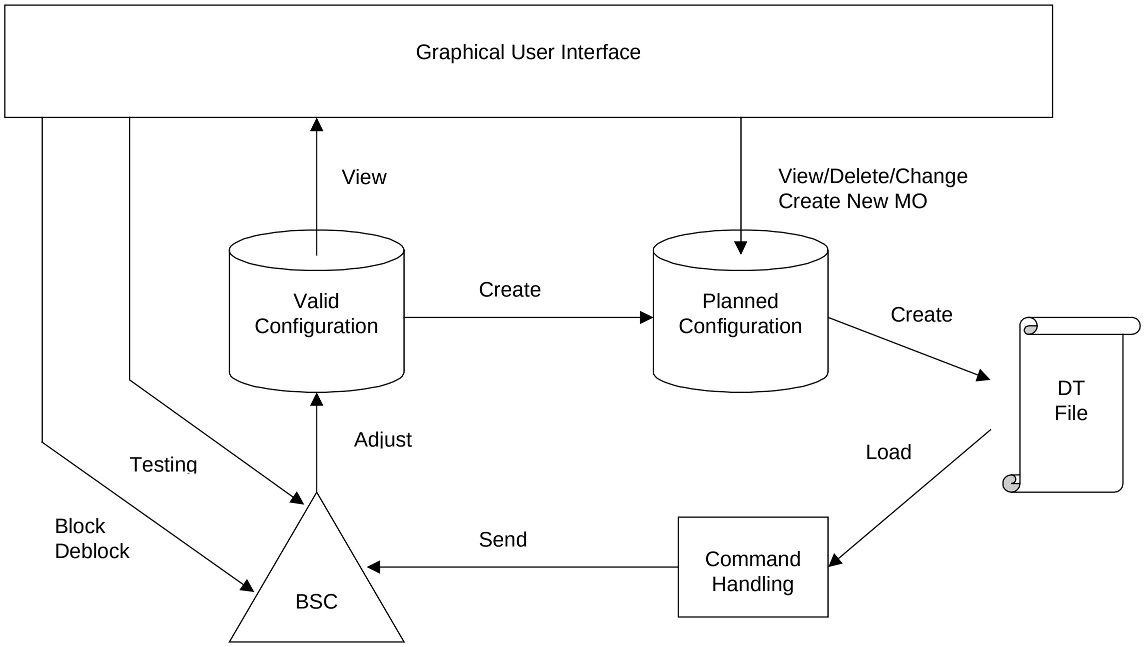


Figure 8-9 BSM/BCM Architecture and workflow

Figure 8-9 shows the main things that can be done using the BCM. These concepts and the workflow are explained below. The concept is similar to the one used in CNA.

Adjust

BCM stores data about the network (MOs and their attributes) in the BSM database. When an MO is selected in the MO-browser, the appropriate data is fetched from the database and displayed in the attribute pane for the MO.BSM differentiates two types of data stored in the BSM database:

Non-Volatile Data: Non-volatile data is information which does not change very often. Non-volatile data comprise the attribute categories Alarm, Definition, and Hardware as well as MO-instances (MO names) data. (Note that the attribute-category Alarm is BAM-specific and that the attribute-category Hardware is BHW-specific.)

Volatile Data : Volatile data is data which is controlled by the BSC and is likely to change often and without user control. Volatile data comprise the attribute categories Configuration, Faultmap, and State.

The information in the BSM database can be updated (to reflect the data in the actual network) in the following ways:

- Scheduled adjust of non-volatile data
- Refresh of volatile data

Valid configuration

The valid configuration is a model of the network at the time of the latest adjustment. The valid configuration needs to be regularly adjusted with the latest data from the real network in order to display up-to-date information. This is done with the adjust function.

When the network is changed, the valid configuration is not updated automatically, so a new adjustment job must be run in order to do this.

Planned configuration

A planned configuration is a copy of another configuration (valid or another planned configuration) which the user can edit without interfering with the network. Planned configurations can be saved and loaded under a name. If a planned configuration is edited by a user, it is automatically locked for the other users.

Editing (that is, changing the planned configuration) is made by using the BTS Wizard, or in some limited cases, by free editing in the BSM base window. The BTSWizard supports the user by offering step-by-step guidance through the configuration planning process Free editing in BSM means creating objects and changing attribute values. For the BCM application, free editing means that you can, for planning purposes, create the SITE object in the planned configuration. The BSM applications BHW and BAM allow some editing (of application-related MOs and attributes) directly in the attribute pane

The planned configuration is created as a shine-through configuration meaning that changes on the valid configuration will be available in all planned configurations.A planned configuration contains all MO instances but not the attributes for the MOs. When an MO is selected, the attributes from the valid configuration for this MO are shown. An attribute is not saved in a planned configuration until the attribute is actually changed. This means that only the delta (the difference) between the valid and the planned configuration is stored in the database.

DT file

To update the network with planned changes of the RBS configuration, the user creates a Data Transcript (DT). The DT is generated out of a planned configuration for the affected BSC and is a file which contains the sequence of MML commands needed to update the network with the planned data.

In some cases information might be missing in the DT file. The header of the DT file describes how missing information is marked in the file. The user can further edit this file and use it to update the network using, for example, CHA.

When the network is updated and an adjustment is performed afterwards, the BSM database (and the valid configuration) will reflect the new state of the network.

Blocking /deblocking and testing

The effort to change the state of base stations can be reduced by using the state changing functions in BCM. The functions works on different MO levels and includes commands and scripts for blocking/deblocking as well as for in service/out of service operations.

BCM also offers a set of different tests on base station objects as an aid in problem identification. The tests are achieved by sending standard MML commands to the BSCs and presenting the result in the common Report window.

CREATE A NEW CELL AND SITE WORKFLOW

To introduce a new RBS and connect the cells and bring it into service using the two applications CNA and BSM is made easier if you follow the workflow in Figure 8-10. There are other ways to perform it.

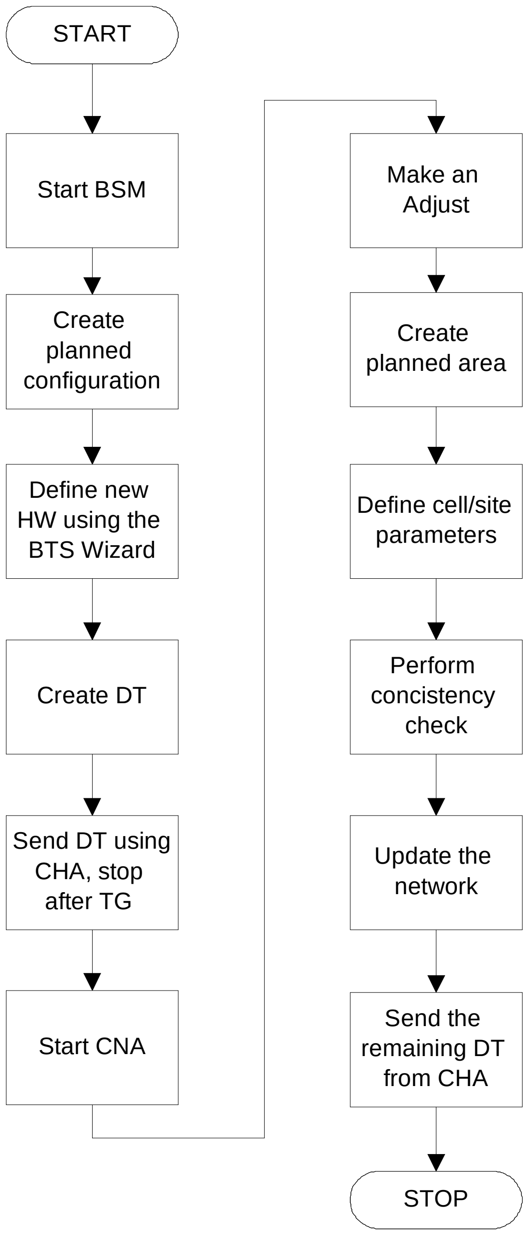


Figure 8-10 Create new cell/site workflow

COMMAND HANDLING APPLICATION (CHA)

CHA is an application which allows the user to send MML commands and to receive printouts from different NE's. The following NE's are supported:

- Mobile service Switching Center (MSC)
- Home Location Register (HLR)
- Base Station Controller (BSC)
- Message System (MXE)

The CHA base window consist of two area's, the response area and the input area. Immediate and delayed responses are presented in the response area. The input area displays a history of current manually entered MML commands. The entered MML commands can be edited and saved as command files and reloaded for later use. There are several input areas available, which can be used for the execution of different command files. The commands within a command file can be sent one by one or as a block to the NE.

CHA can be used without a mouse. For this, hot keys are available to control the different functions of the CHA

Other applications can be started from the CHA main window. The following 3 applications are included in the CHA:

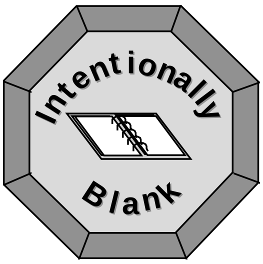
- Spontaneous Report Manager
- Activity Manager
- Command Log Search

Further applications can be included by the system administrator.

Spontaneous Reports, e.g. system restart messages, are not displayed in the response area of the CHA. For the presentation of Spontaneous Reports, the Spontaneous Report Manager is available which allows subscription to different Spontaneous Reports.

The Activity Manager gives the possibility to schedule the execution of command files and system command files. This can be useful for standard maintenance procedures, which must be performed during the night.

All commands, responses, and reports are logged in the Telecommunication Application-Data Base (TAP-DB). The Command Log Search application provides the functions for searching and retrieving information from the TAP-DB.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