APPLICANT:
Ericsson Radio Systems AB

FCC ID NO.
B5KKRC13149-15

EXHIBIT 8 - COVER SHEET

Table of Contents

2 RBS 2000 Family

Table of Contents

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.

Very Large Scale Integration (VLSI) technology is applied to achieve longer Mean Time Between Failures (MTBF)

Lower Mean Time To Repair (MTTR) is achieved through:

- User friendly Man Machine Interface (MMI) such as Light emitting diode (LED) indicators and buttons instead of man-machine language and supervision of all units and cables for fault detection and isolation.
- On site swapping and repairing thanks to a modular hardware design.

RBS supports Hierarchical Cell Structures (HCS) with up to three cell layers. The layers can be macro cells for coverage, micro cells at street level and pico cells indoors. The RBS 2000 family supports both omni directional and sector cell configurations.

RBS 2101

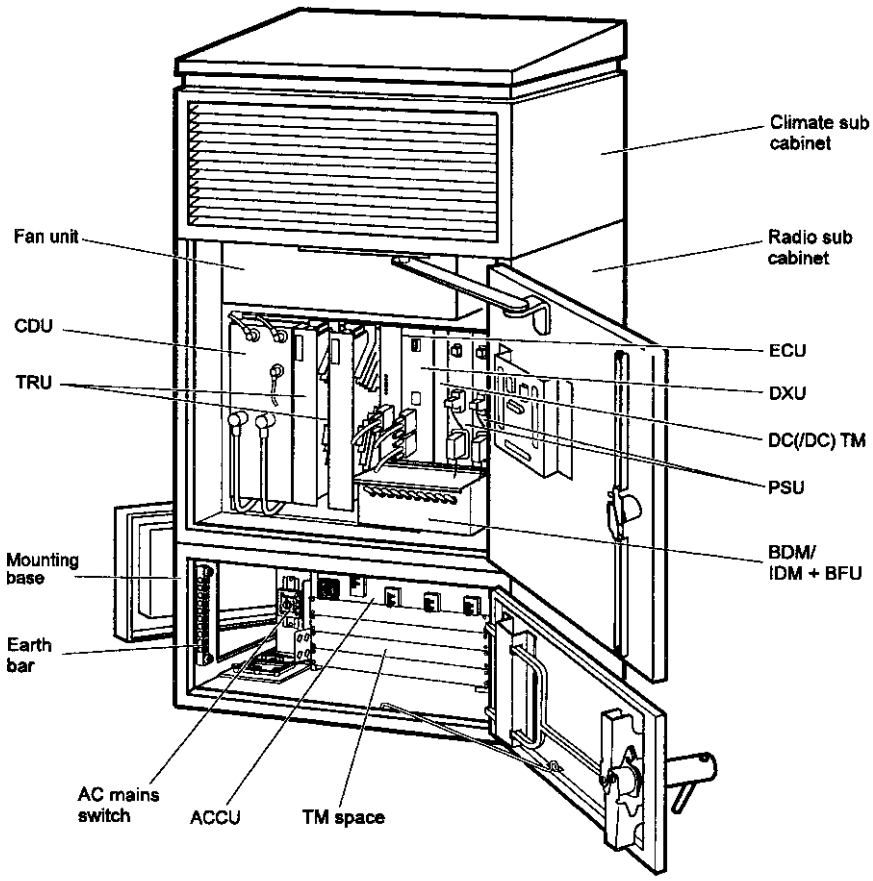

Figure 2-1 RBS 2101

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 fig 2-1.
- 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.

Technical Data

Standard size and weight for RBS parts are shown in the tables below.

	Size (mm)
Width	705
Depth	450
Total height	1285

Table 2-1 Size

Part	Weight (kg)
Climate subcabinet	48 with heat exchanger 56 with active cooler
Radio subcabinet	98 fully equipped
Mounting base	47
Total Weight	193 with heat exchanger 201 with active cooler

Table 2-2 Weight

RBS 2102

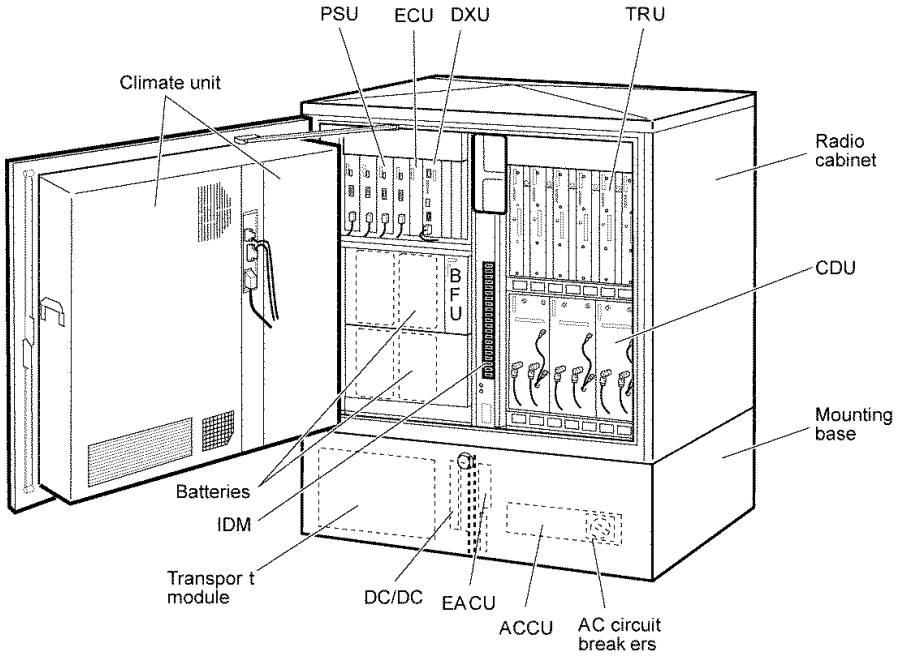

Figure 2-2 RBS 2102

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 2-3. 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.

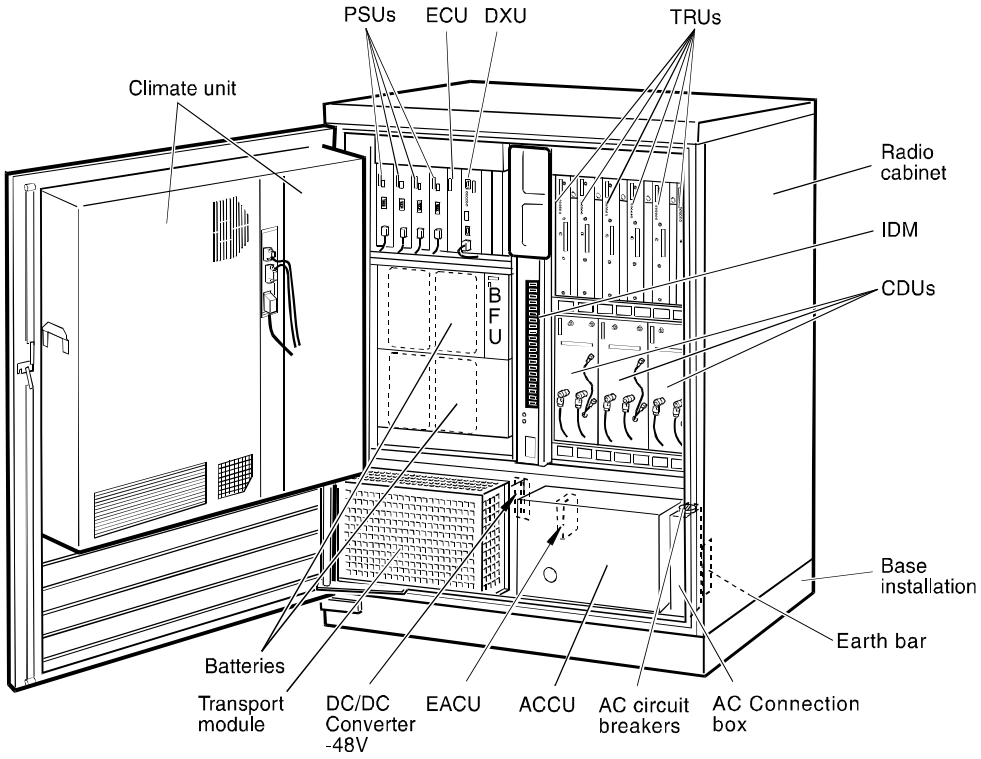

Figure 2-3 The improved RBS 2102

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 fig 2-2.
- 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.

Technical Data

Standard size and weight for RBS parts are shown in the tables below.

	Size (mm) Old	Size (mm) New
Width	1300	1300
Depth	760	710
Total height	1605	1614

Table 2-3 Size

Part	Weight (kg) Old	Weight (kg) New
Fully equipped cabinet	476 (including batteries)	550 (including batteries)
Mounting base	129	-
Total weight	605	550

Table 2-4 Weight

RBS 2103

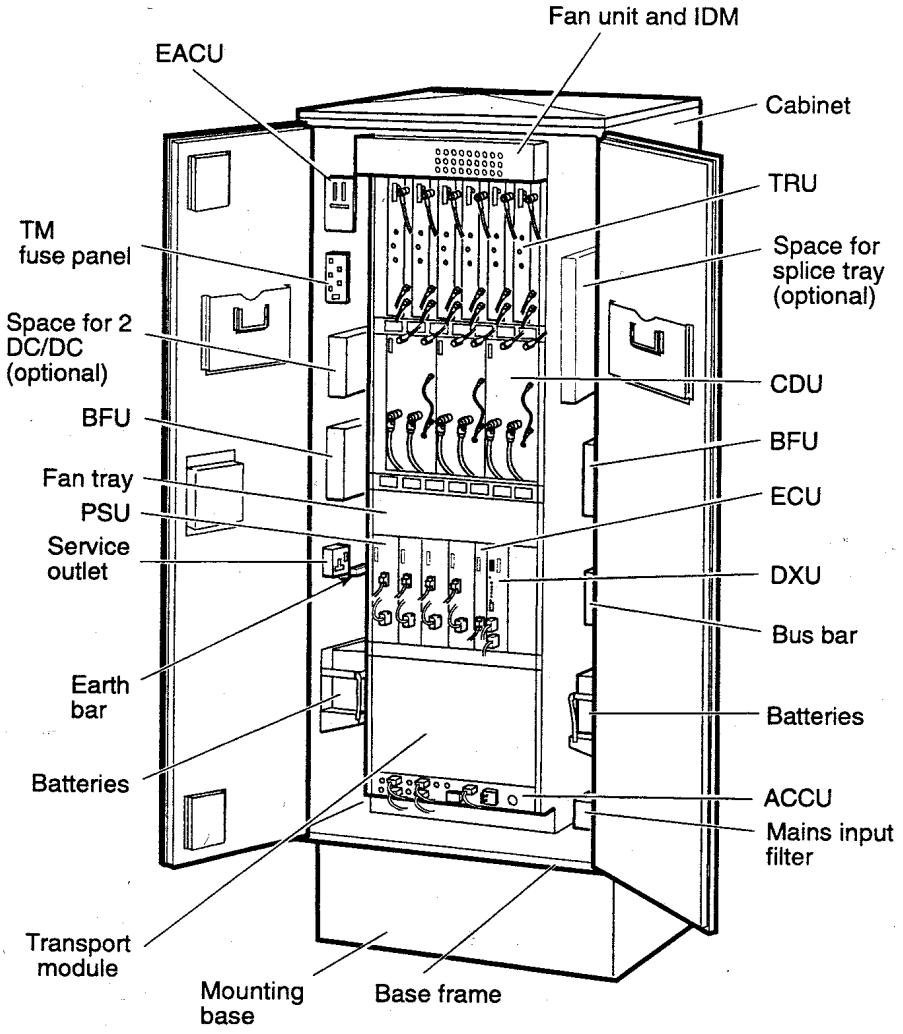

Figure 2-4 RBS 2103

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 fig 2-3.
- 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.

Technical Data

Standard size and weight for RBS parts are shown in the tables below.

Part	W (mm)	D (mm)	H (mm)
Cabinet	900	795	2000
Mounting base	850	650	300

Table 2-5 Size

Part	Weight (kg)
Fully equipped cabinet	480 (including batteries)

Table 2-6 Weight

RBS 2202

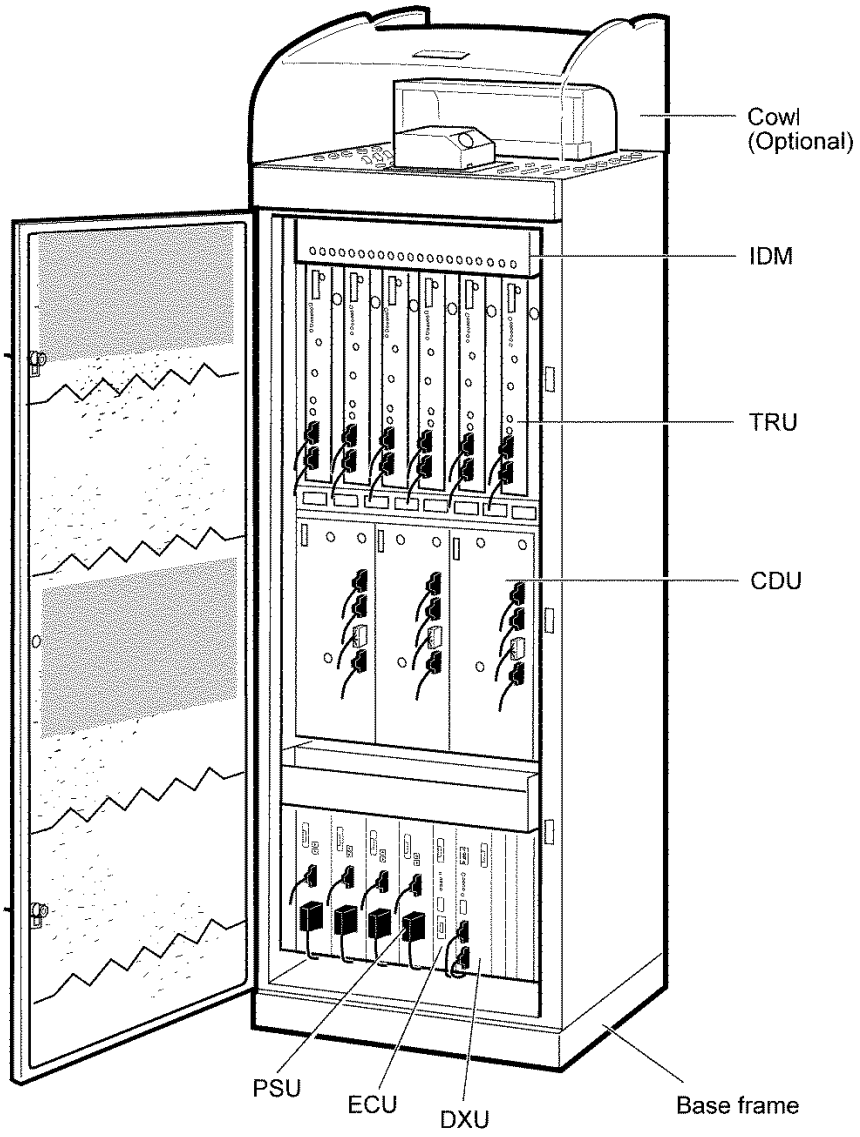

Figure 2-5 RBS 2202

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 fig 2-4.
- 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.

Technical Data

Standard size and weight for RBS parts are shown in the tables below.

	Size (mm)
Width	600
Depth	400
Height (including base frame and cowl)	1900

Table 2-7. Sizes

Part	Weight (kg)
Total weight	226 kg

Table 2-8. Weights

RBS 2301/RBS 2302

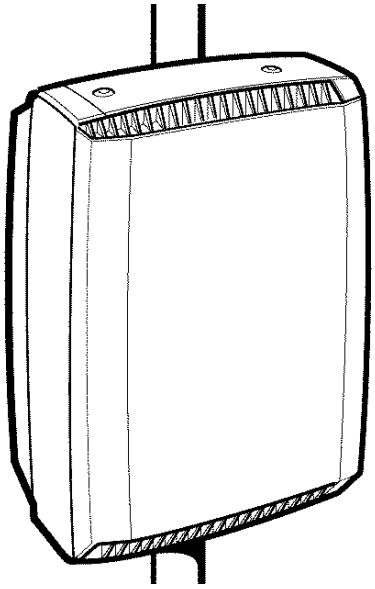

Figure 2-6 RBS 2301/2302

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.

Technical Data

Part	W (mm)	D (mm)	H (mm)
Without integral antennas	535	408	160
With sector antenna	535	408	210
With omniantenna	607	408	160

Table 2-9 Size

Part	Weight (kg)
Cabinet (including battery)	18
Mounting base (including sunshield)	6.5
Wall bracket	3
Omniantenna	0.5
Sector antenna	2
Total without internal antennas	28

Table 2-10 Weight

HARDWARE ARCHITECTURE

COMMON USED HARDWARE AND SYSTEM BUSES IN RBS 2000 MACRO

The hardware consists of a number of RUs and buses, which are briefly described in the following sections.

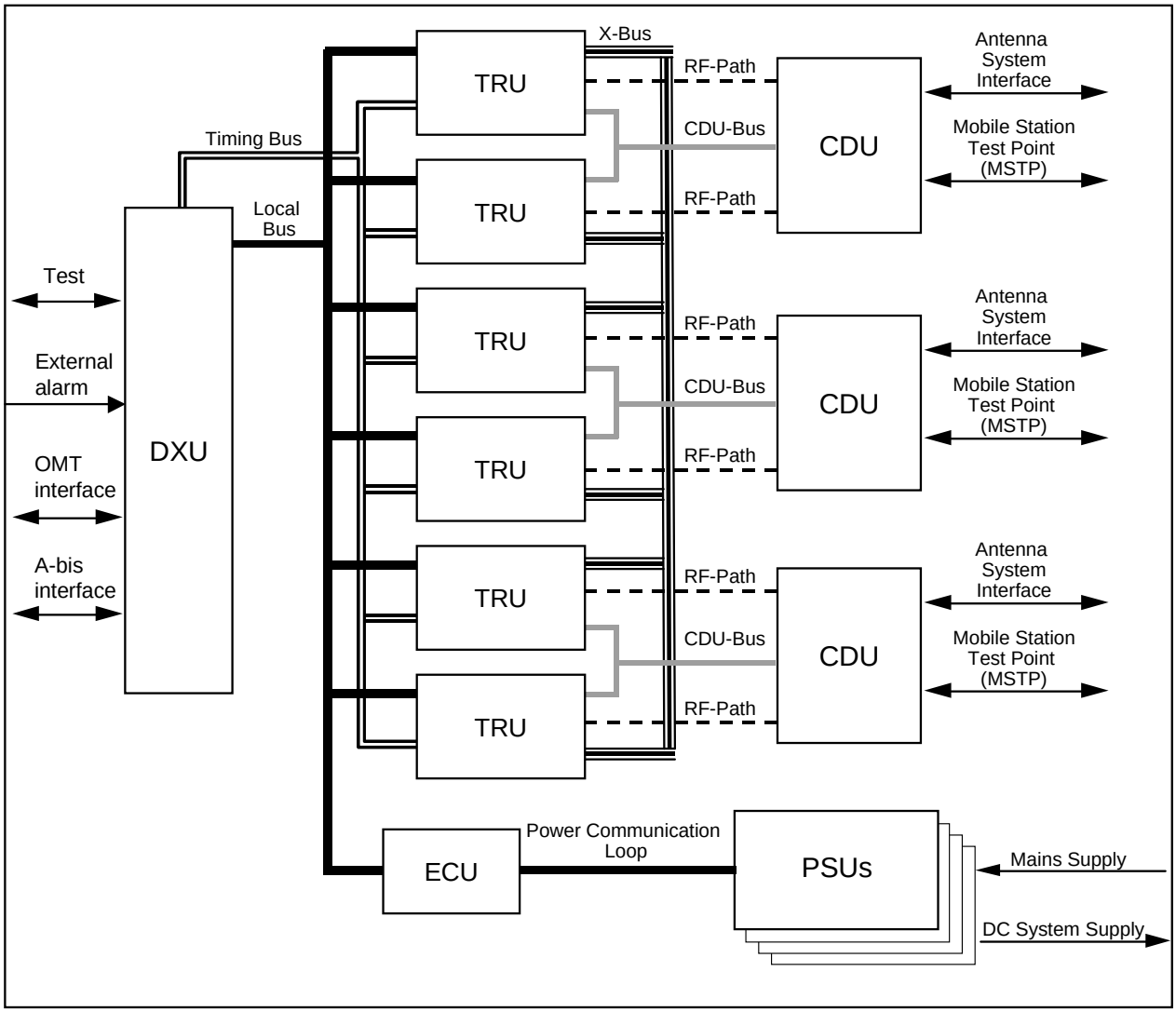

Figure 2-7 Replaceable Units (RUs) and buses in RBS 2000

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.

The CDU bus transfers alarms and RU specific information between the CDU and TRU.

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.

DESCRIPTION OF UNITS

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.

This unit consists of functions common to one RBS. These include:

- Interface to BSC
- Distribution switch
- Timing unit
- Local bus interface
- Concentration of the control links (LAPD signaling) to the BSC
- Collection of up to 16 external alarms
- Operation and Maintenance Terminal (OMT) interface
- Keeps the database with the cabinet configuration

With these functions the DXU establishes the connection to the BSC (the PCM link) and cross connects individual time slots to certain transceivers.

A timing reference for the RBS is generated by extracting the synchronization information from the PCM link or from an internal source.

In addition, for easy maintenance of inventory, there is a database containing information about installed hardware. This Installation Data Base (IDB) contains each RU identity, physical position, and related configuration parameters.

The BSC controls (via LAPD signaling) the configuration of the DXU. A separate 64 kbps channel is not needed.

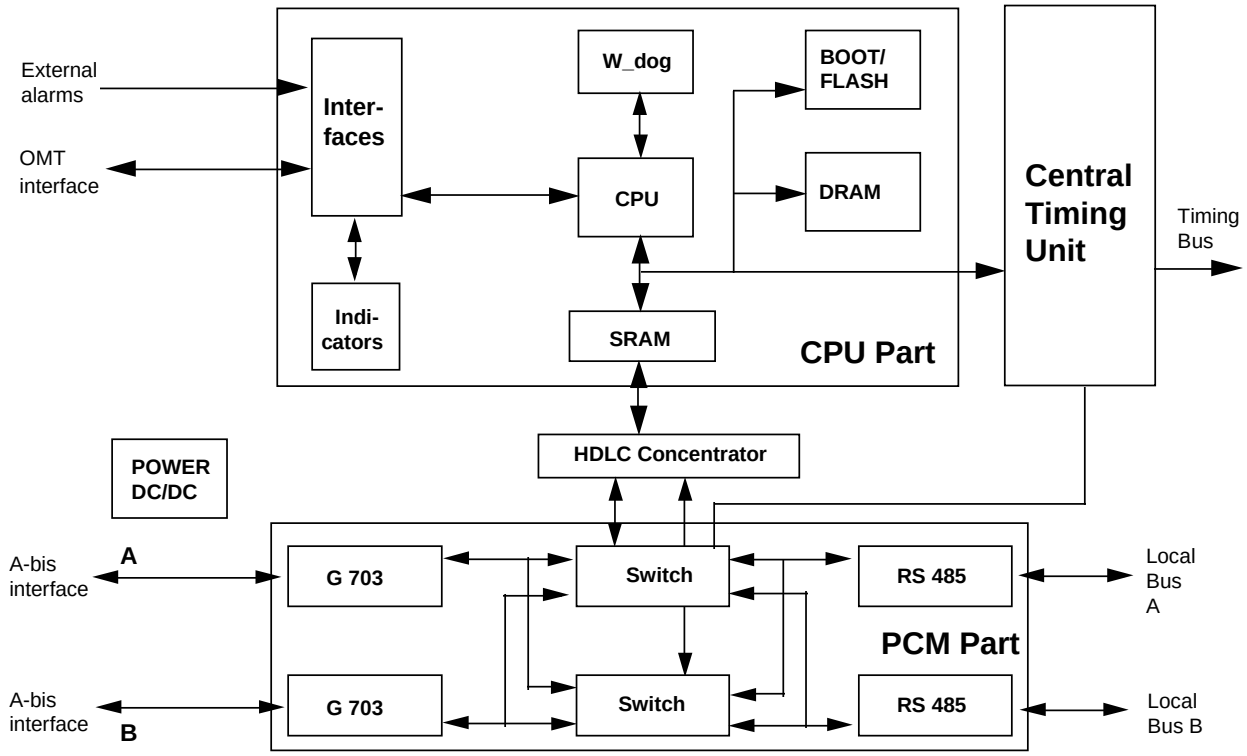

Figure 2-8 DXU Block Diagram

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

- PCM-part, Interface Switch (**IS**)
- Central Processing Unit (**CPU**)
- Central Timing Unit (**CTU**)
- High level Data Link Controller (**HDLC**) concentrator

Their main functions are:

The PCM-part **(IS)** is similar to the time switch in RBS 200. Its 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 and LAPD multiplexing. These increase the capacity of a PCM line. The HDLC concentrator reads the TRX signaling information and distributes it to the TRUs or the CPU part in the DXU accordingly.

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.

The TRU contains signal processing, radio reception, radio transmission, and power amplification. Through the use of Application Specific Integrated Circuit (ASIC) chip technology, the TRU achieves high availability, small volume, low weight, and low power consumption.

Each TRU handles 8 air time slots.

The TRU has one transmit output two receive inlets. The reason for this is to be able to receive two independent antenna signals from two antennas in the same cell. This is called diversity and is used to improve the quality of service.

The TRU has a function that performs a Radio Frequency (RF) test loop for testing transmit and receiver properties.

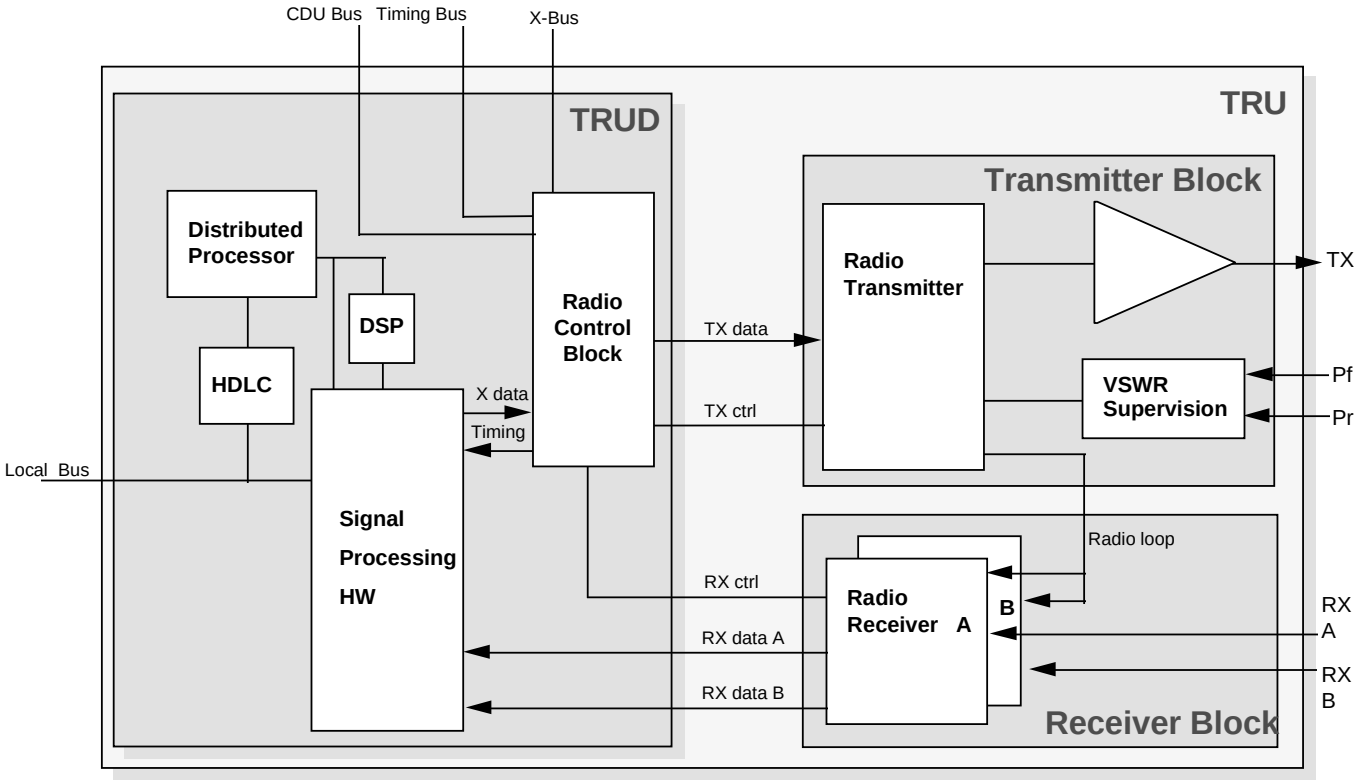

Figure 2-9 TRU Block Diagram

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)
- 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.

Compared to RBS 200, the **TRUD** has the TRXC and SPU functions.

The Transmitter Block performs the downlink signal modulation and amplification. Additionally, the Transmitter Block performs VSWR supervision.

The **transmitter block** carries out what the RTX functions did in the RBS 200.

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

The **receiver block** carries out what the RRX functions did in the RBS 200.

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)

General about Combiners and Related Units

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

Hybrid Combiner

A hybrid combiner is a broad band device allowing all frequencies in the transmit band to pass through in the forward direction. Each hybrid combiner can combine two incoming transmitter signals to one outgoing signal. This hybrid combiner has a 3 dB insertion loss. CDU-C and CDU C+ contains a hybrid combiner.

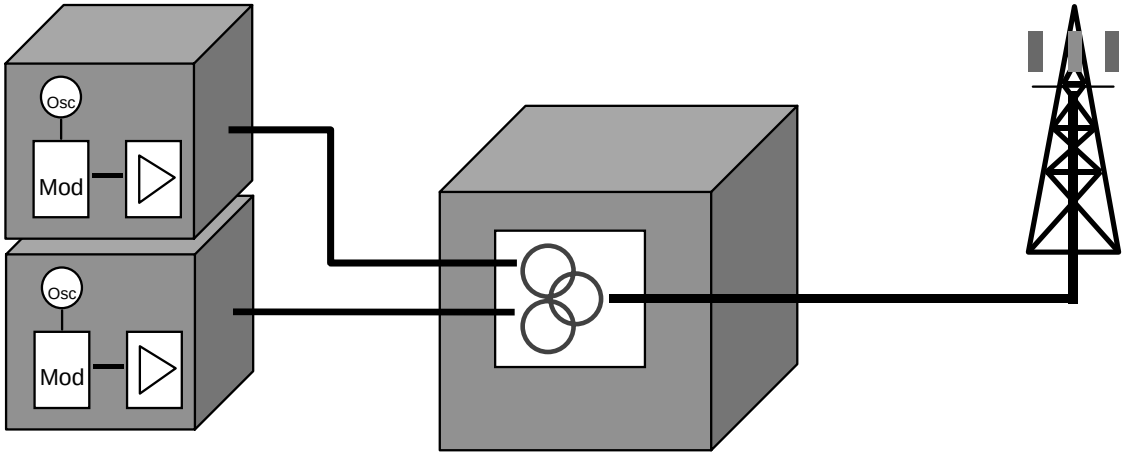

Figure 2-10 Hybrid combiner

Filter Combiners

A filter combiner is a narrow band device allowing only a selected frequency in the transmit band to pass through. The filter combiner has the same insertion loss (about 4dB) regardless of how many transmitters are in the system. CDU-D contains filter combiners.

A step motor is used to tune the filter combiners to the selected frequency. This tuning takes approximately 5 to 7 seconds.

The tuned bandpass filter prevents power from the other transmitters to pass through this filter and destroy the transmitter.

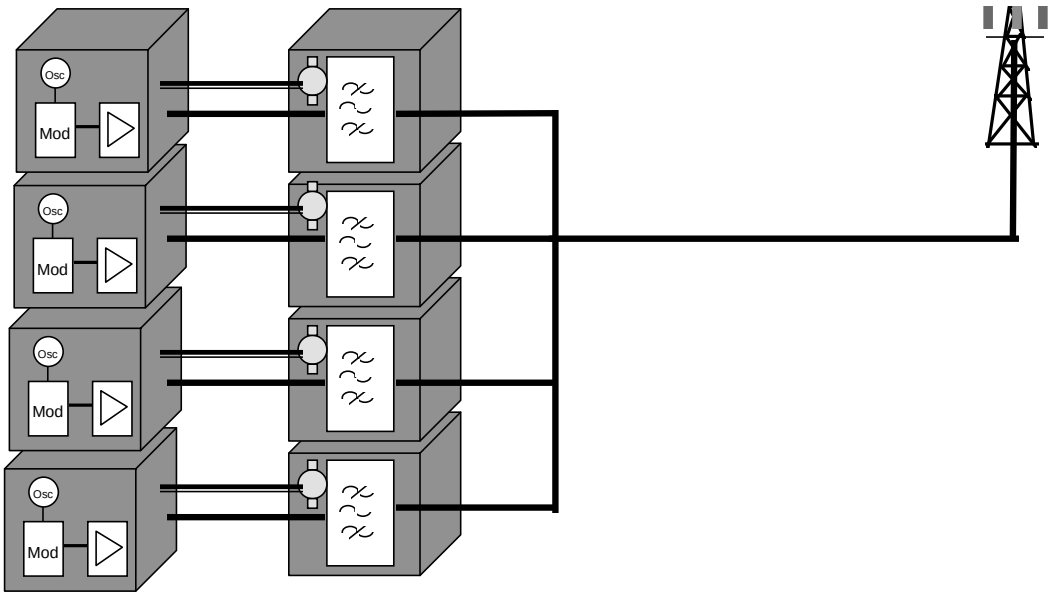

Figure 2-11 Filter combiners

Duplex Filter

To be able to use the same antenna for transmission and reception a duplex filter is used. The duplex filter can either be housed inside the CDU or can be mounted outside the base station. The outside duplex filter normally is fitted into a Tower Mounted Amplifier (TMA).

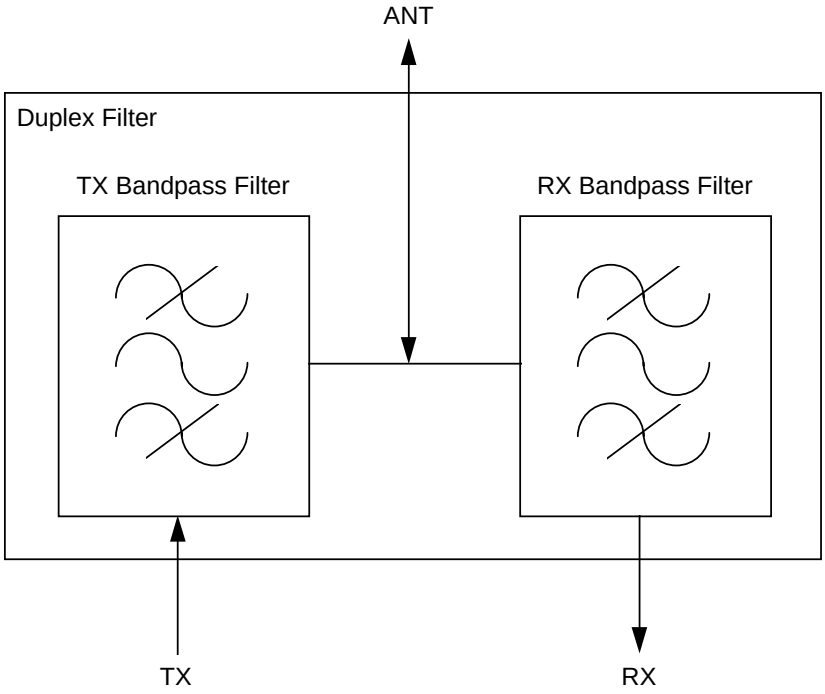

Figure 2-12 Duplex filter

A duplex filter consists of two band pass filters; one for the uplink frequency band and one for the downlink frequency band. This allows both the transmit and receive antenna paths to be connected to a common antenna because the signal from the transmitter can not pass the RX-band pass filter and the received signal from the antenna can not pass the TX-band pass filter.

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 in a 1800 or 1900 MHz system. 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.

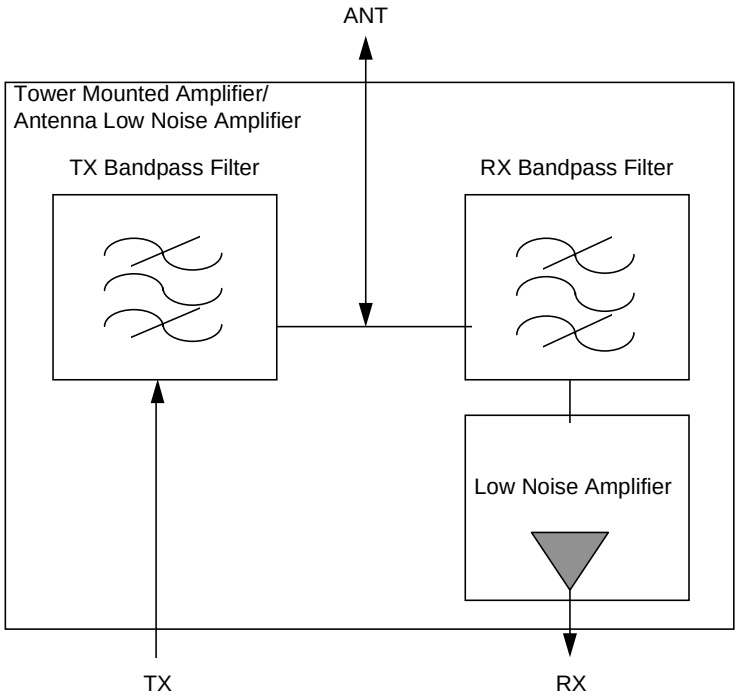

Figure 2-13 Tower Mounted Amplifier/Antenna Low Noise Amplifier

The TMA/ALNA hardware functions are:

- RX pre-amplification
- Duplex filtering

RBS 2000 Specific

A **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 within the 900 Mhz band).
- 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.

Explanation to the CDU Block Diagrams

This part is written for all the CDU types. The CDUs are not build up in exactly the same way, some of the units may not exist in some of the CDU types and some units are not explained here since they have been covered previous in the chapter.

RF Circulators or Isolators

Provides protection for the TRU from reflected RF power if something breaks in the CDU or the antenna system.

TXBP and RXBP

Transmitter Band pass filter (TXBP) and Receiver Band pass filter (RXBP), filters the transmitted RF signals to the Downlink band respectively the received RF signals to the Uplink band. This gives together with the duplex filter the wanted isolation between the TX and RX band.

Measurement Coupler Unit (MCU)

The MCU extracts forward and reflected power measurements. These measurements are routed to the TRU, via the Test Data Unit (TDU), for use in VSWR calculations. The TDU also provides the connection for hook up to a Test Mobile, Mobile Station Test Point (MSTP).

The VSWR is used to check that the antenna system is working in a proper way. If the VSWR increases over certain limits set during installation, alarms will be sent to the BSC.

Receiver Divider Amplifier (RXDA) and Receiver Divider (RXD)

The received signal is distributed to the TRUs by the RXDA or by a RXD, this depends on the CDU type. The function of the RXDA is to pre-amplify and divide the received signal. The RXD has only the function to divide.

On CDU-C, C+ and D there is High Level in (HLin) and High Level out (HLout) connection points. These can be used when a cell is split between two cabinets. E.g., the two connections make it possible to get both RxA and RxB from one CDU and it also reduces the cabling between the cabinets. On some CDU types there are even more High Level connection points to increase the flexibility of the CDU and configure the cell in a easy way.

Operation and Maintenance (O&M)

The box marked O&M in the figure symbolizes a number of Integrated Circuits dedicated to the CDU operation and maintenance functions. They communicate with the TRUs via the CDU bus. Communication consists of alarms and information from the CDU database. The database contains RU information, e.g. CDU type, serial number, etc.

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. For further reference look in the Cabinet Configuration chapter.

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.

CDU-A

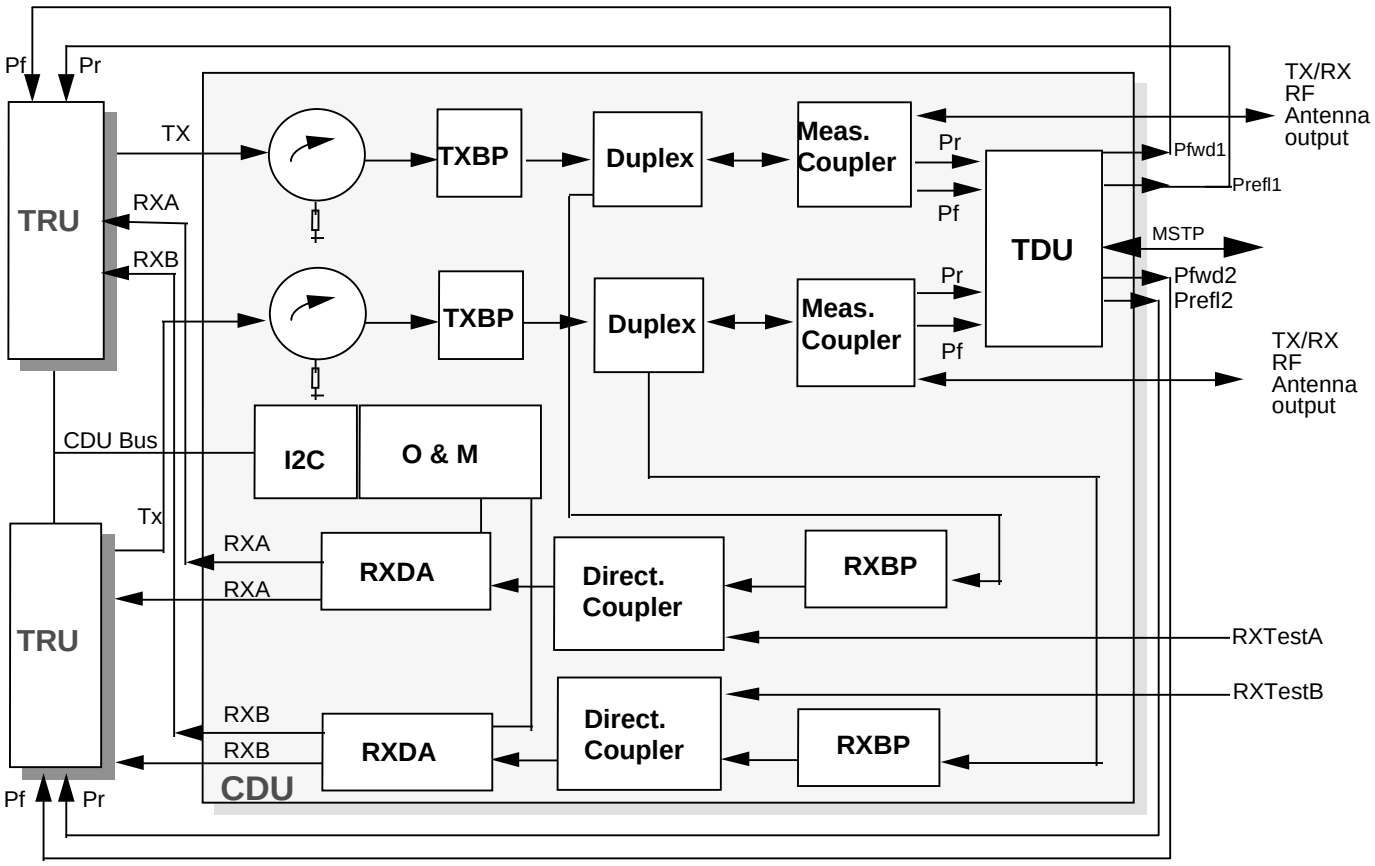

Figure 2-14 CDU-A Block Diagram

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

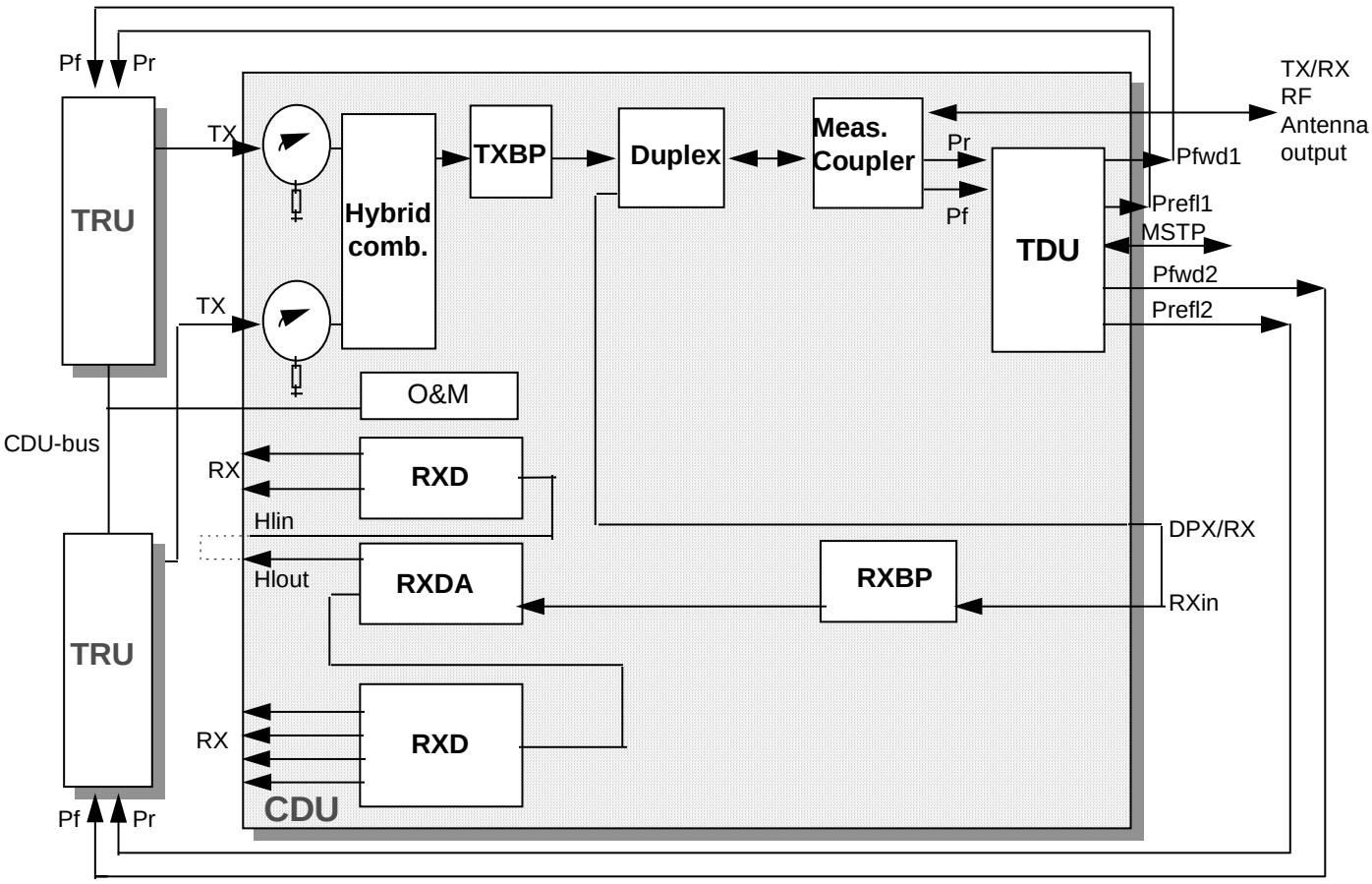

Figure 2-15 CDU-C Block Diagram

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.
- IM3 limitations on frequency planning.
- Required frequency separation is 400 kHz.

CDU-C+

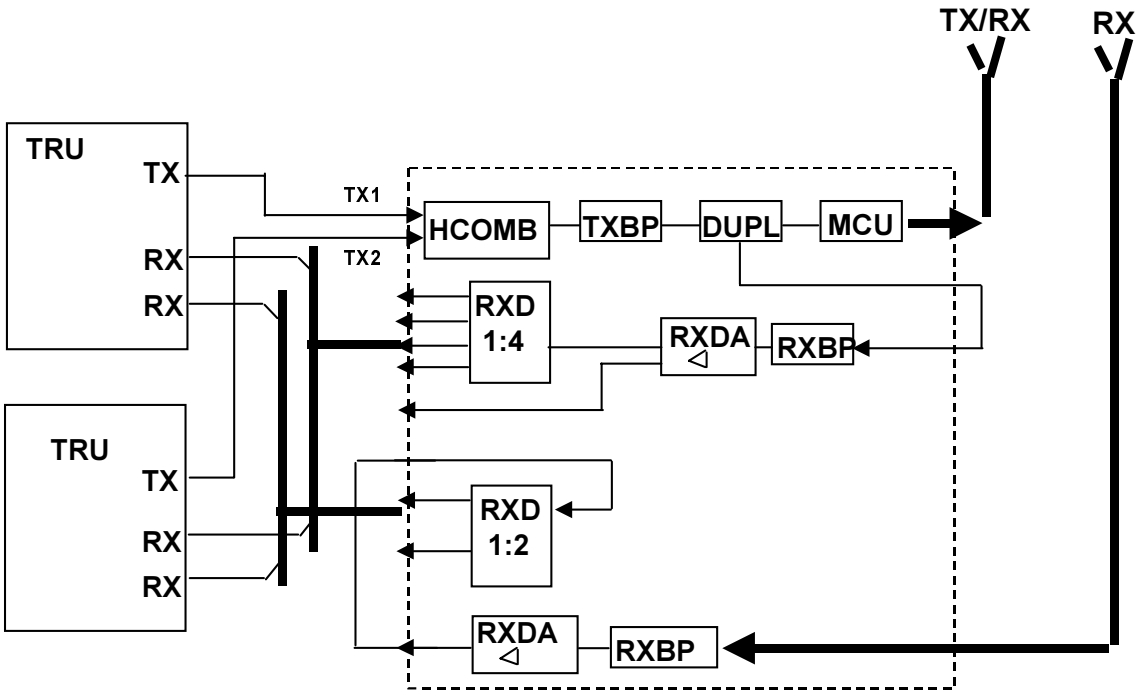

Figure 2-16 CDU-C+ without TMA

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.
- IM3 limitations on frequency planning.
- Required frequency separation is 400 kHz.

CDU D

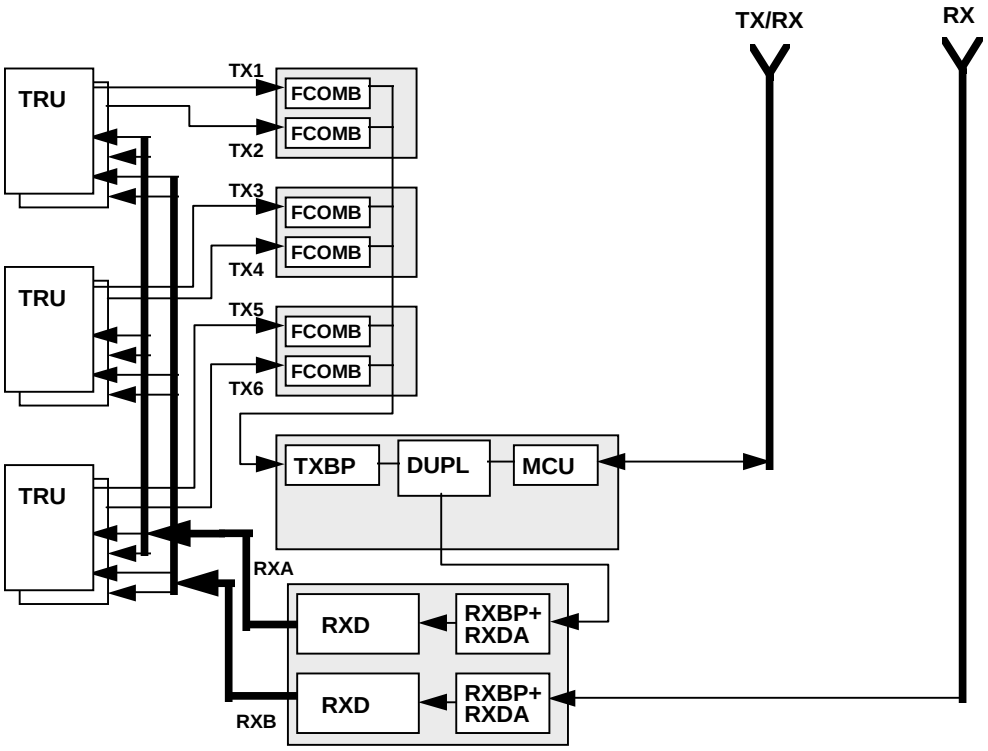

Figure 2-17 CDU-D 1x6 without TMA

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.
- 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.

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

CLIMATE AND POWERSYSTEM

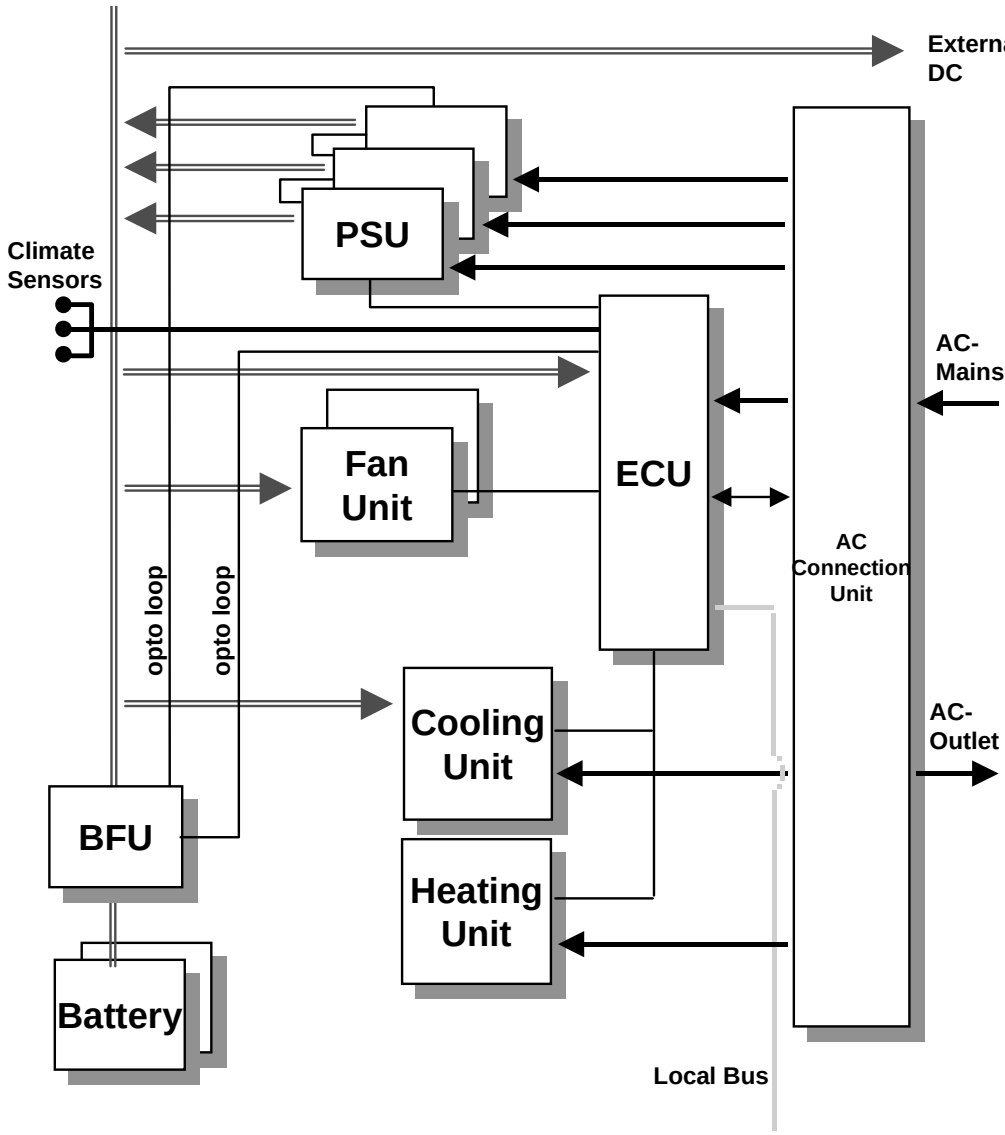

Figure 2-18 Climate and Power for an RBS 2101/2102

Figure 2-18 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 can get power in three different ways depending on the power system status, this will be explained later in the chapter. 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.

Powersystem

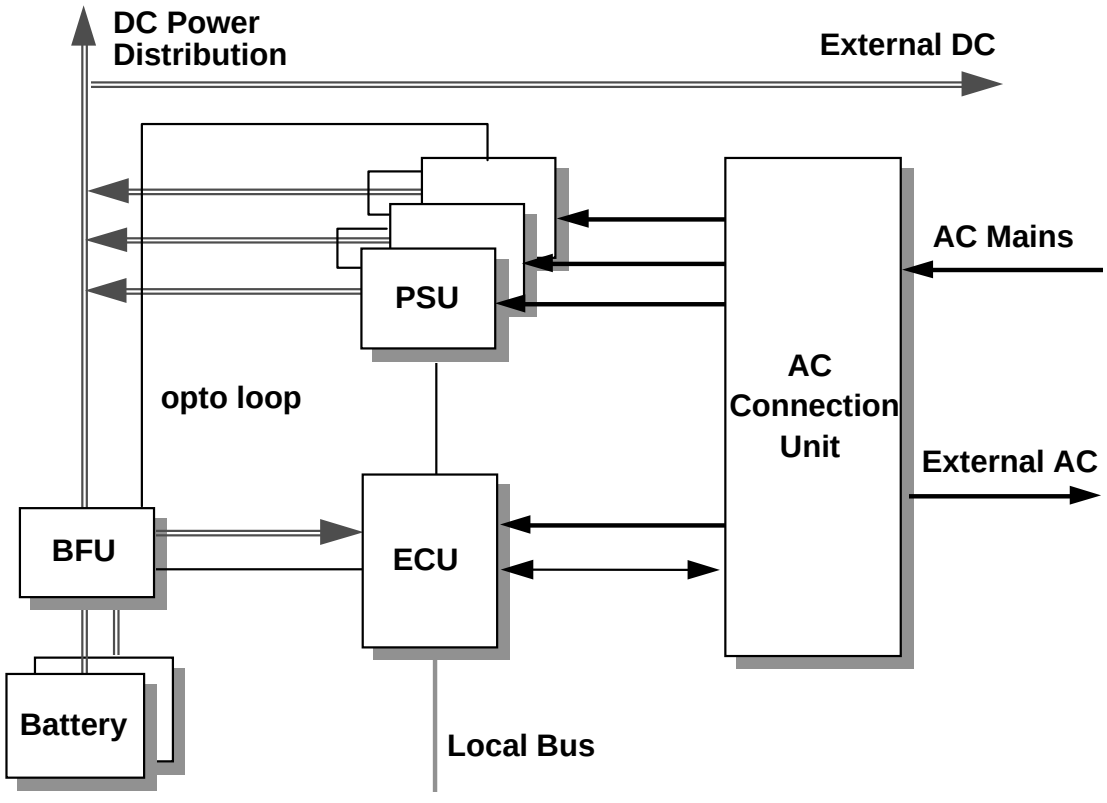

Figure 2-19 Power Supply System for an RBS 2101/2102

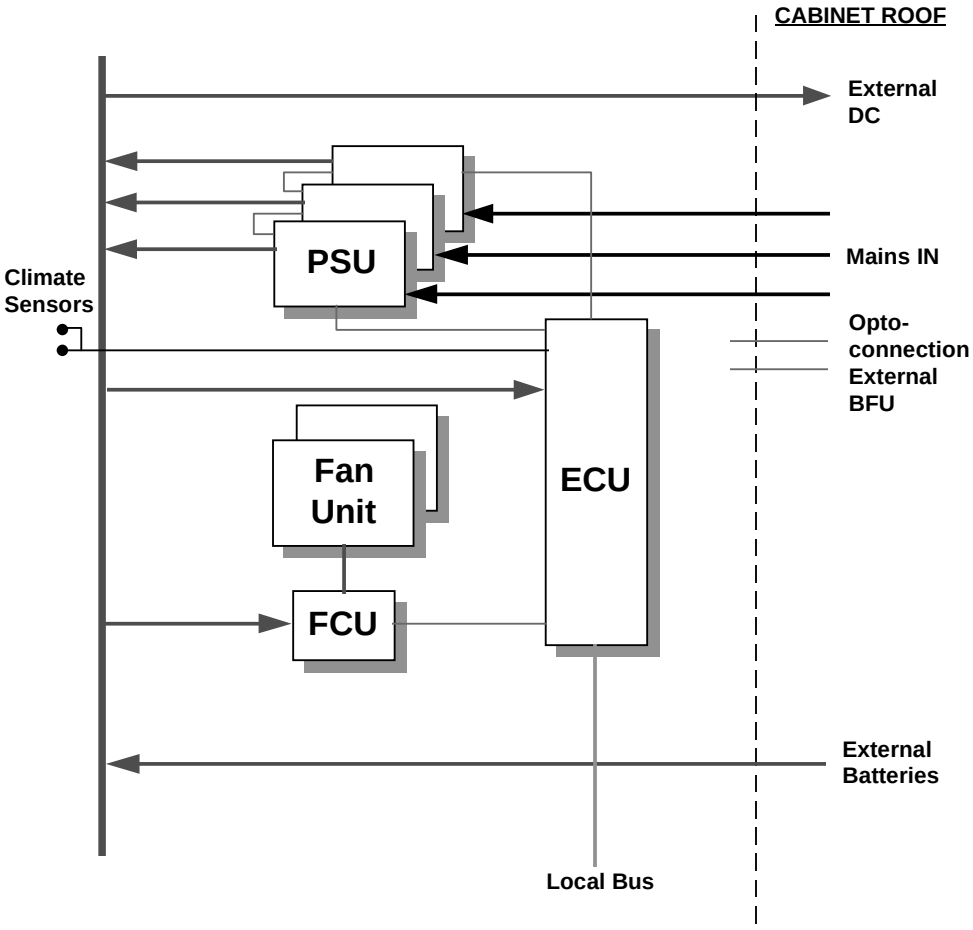

Figure 2-20 Power supply system for RBS 2202

Figure 2-19 and Figure 2-20 shows only the power system and in the following text each unit will be explained and an explanation of how the power system works will be given.

Alternating Current Connection Unit (ACCU)

In outdoor versions of RBS 2000, the **ACCU** distributes AC power to the PSUs, the climate unit and the service outlet. Power relays within the ACCU are used to control when the power is distributed and that it is distributed to the appropriate units. The ECU controls the power relays. The relays also provide current and phase sensing of the input power. The ACCU also provides 24 VAC to the ECU, which is used during startup, before the PSUs are providing any DC output. Also see climate protection system part later in this chapter.

Power Supply Unit (PSU)

The **PSU** converts the incoming AC power to the regulated +24 VDC required for the internal distribution system. Actually, the default output voltage from the PSUs is +27.2 VDC, the reason for this is to avoid power dips under heavy load, e.g. high traffic and recharging of the batteries at the same time. There is also a PSU-version that converts incoming -48 VDC to the internal DC-voltage. This is used in indoor cabinets installed in environments where -48 V DC is the common standard for other equipment.

The output from the PSUs are controlled and supervised by the ECU. The PSUs can work in two different modes:

- Share loading mode. Then the ECU controls the output via the optofibre loop.
- Stand alone mode. Then the ECU has no contact with the PSU over the optofibre loop and the PSU then provides the default output power.

The number of PSUs depends on the cabinet configuration, if there should be power redundancy or not, and if battery back-up is connected. The basic rules are:

- Minimum 2 PSUs independent of cabinet
- Add 1 PSU/2 TRUs
- Add 1 if there is to be redundancy or if battery back-up is connected

If the cabinet is connected directly to +24 VDC no PSUs are needed.

Internal Distribution Module (IDM)

(Not shown in Figure 2-19)The **IDM** is a panel for distributing the internal +24 VDC power to the various units within the cabinet. Each internal distribution circuit in the cabinet is fused in the IDM. The IDM also provides a grounding point to which the antistatic bracelet is connected.

Battery Fuse Unit (BFU)

If batteries are installed a **BFU** is fitted in the cabinet. The BFU contains a battery circuit breaker(100 A) for the batteries, and connects the batteries to the internal +24 Volt DC bus bar. This is not the case in RBS 2101, where the Battery Distribution Module(BDM) has that role.

The BFU, while under ECU supervision, controls the battery usage as a backup source of DC power to the base station. The BFU disconnects the batteries when the output DC voltage become seriously low (21 VDC). Temperature sensors is mounted under the batteries so the supply of DC power to the backup batteries can be regulated to avoid battery damage when the batteries are too warm or cold.

When the cabinet is running on battery-power the DC voltage to the ECU is distributed directly from the BFU over a fuse marked "Aux-fuse" on the BFU front. (This is not the case if a BBS 2202 is used.)

Batteries

Batteries are optional. They are used to provide backup power in case of mains power failure.

Battery Distribution Module (BDM) (RBS 2101 only)

The **BDM** is an IDM with a small battery of approx. 4 minutes backup and a battery supervising circuit.

DC/DC Converter

The DC/DC converter is optional. It is used when there is a need for -48 VDC supply to the Transport Module (TM). In RBS 2102, it is possible to have two DC/DC converters, one for redundancy.

Battery Backup Stand 2202 (BBS 2202)

To provide battery backup to RBS 2202 cabinets a Battery backup Stand 2202 (BBS 2202)has been developed. This will give an optional 1-8 hours battery backup to 1-3 RBSs. 1-3 battery stands is then needed. The BBS is controlled by the ECU via the optoloop.

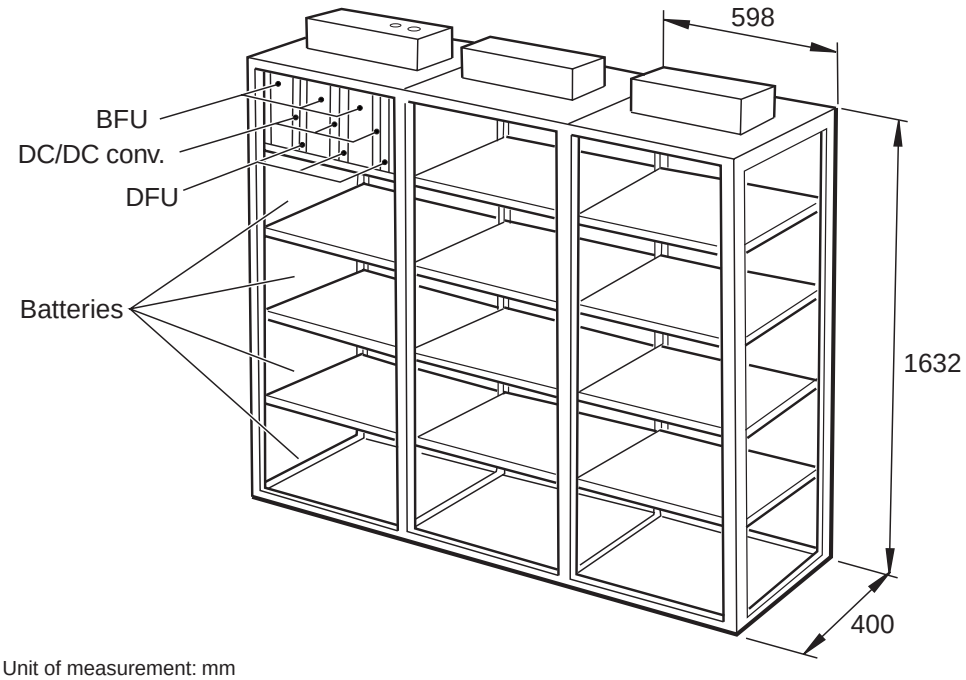

Figure 2-21 BBS 2202

In the Battery Fuse Subrack (BFS) which is the top rack. The RUs are mounted. The following units can be mounted:

- Battery Fuse Unit (BFU) which has the same role here as in the outdoor cabinets. The AUX fuse is not used in this application.

- Distribution Fuse Unit (DFU) which connects the batteries to the system voltage bar in the BBS over a 160 A circuit breaker. It also has connections on the front to external TM equipment. The TM equipment will have longer battery backup than the RBS. The DFU disconnects the TM when the battery voltage becomes to low. It exists in three different versions depending on load.

- DC/DC converter which has the same role as the outdoor cabinets.

  Thee BFUs, DFUs, DC/DC converters can be mounted in the BFS. One group is connected to one RBS. That means that up to three RBSs chares the same batteries.

  In the picture below the extended backuptime for TM equipment is shown.

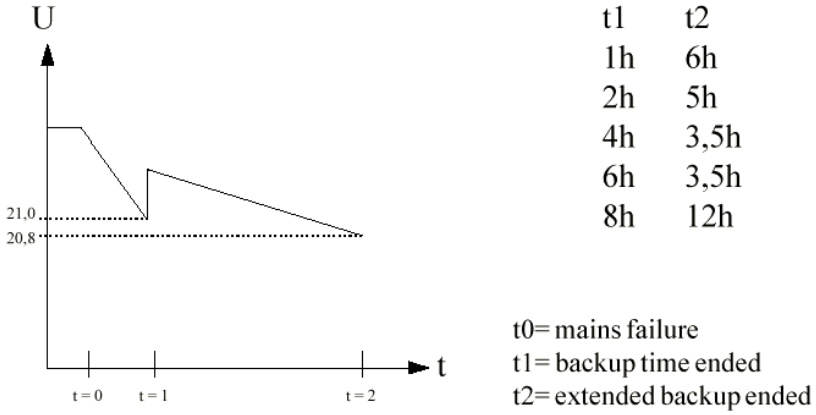

Figure 2-22 Extended battery backup for TM equipment.

AC-Power Failure

If a power failure occurs, the power is supplied from the battery backup. The ECU monitors the bus voltage and when the battery voltage goes down to 21 VDC, the ECU switches off the power supply to the users from batteries in order to prevent damage. However, when the users are disconnected, the system voltage increases a little, so the ECU is still running on DC power. That means if the AC voltage comes back when the ECU is still up and running the start-up time of the RBS will be shorter. If the AC power doesn't come back in reasonable time the ECU will discharge the batteries until the system voltage again goes down to 21 VDC and then it will be disconnected. If an external Battery Back-up Stand BBS 2202 is used, the ECU will not be connected longer than the rest of the users. Instead it is the TM equipment that will have a longer back-up time. See Figure 2-23

When the power returns, the ECU sets the bus voltage low to avoid too large currents while the batteries are recharging. It gradually increases the bus voltage to maximum, while keeping the PSUs currents within limits. Also see startup procedures in the climate protection part in this chapter.

Climate System

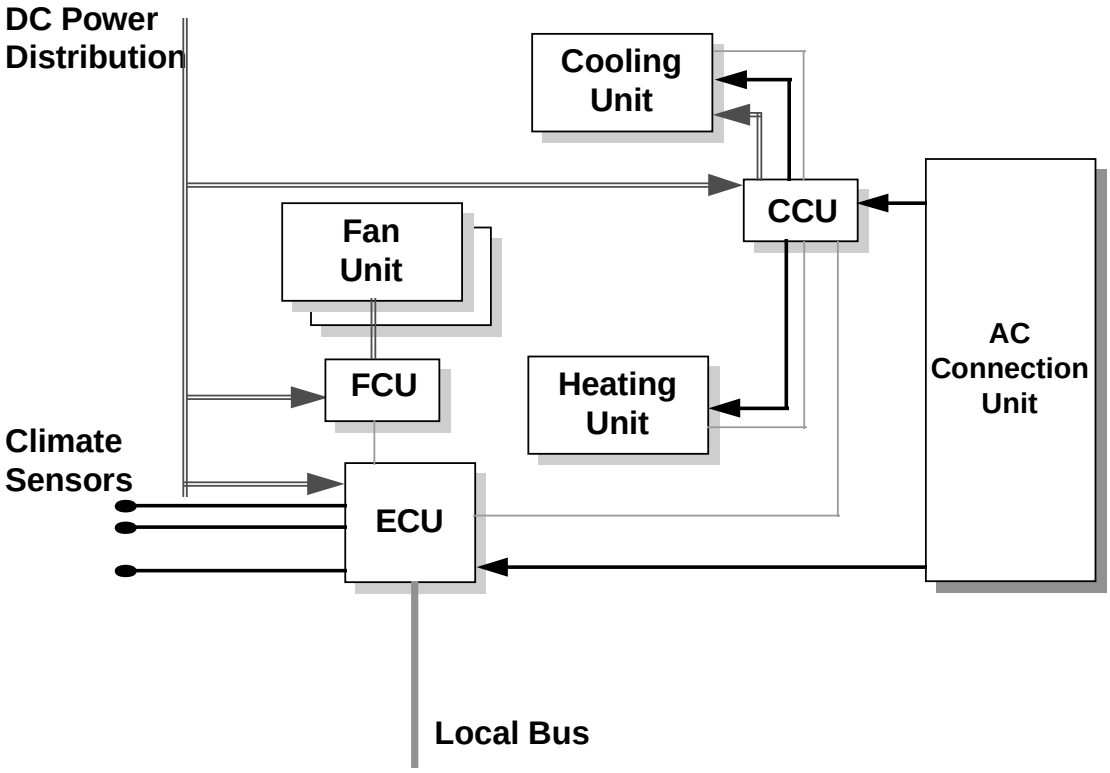

Figure 2-23 Climate System for RBS 2101/2102

During operation and when a cabinet is starting up, it is important not to damage the units. Normal operation temperature range for the units is between +5°C - +45°C. The ECU is in charge of the climate protection system and always monitors the climate inside the cabinet by using the temperature sensors and the humidity sensor, and tries to maintain a suitable climate inside the cabinet for the units.

The fans inside the cabinet are always running to circulate the air. The ECU controls the fans via the Fan Control Units (FCUs). One FCU handles two fans. To be able to change the temperature of the circulating air, there is a climate unit, consisting of a heating unit and a cooling unit. The cooling unit is either a heat exchanger or an active cooler, or both depending on the cabinet type. The climate unit is controlled by the Climate Control Unit (CCU), which then is controlled by the ECU.

When the cabinet is in normal operation the ECU maintains the climate inside the cabinet by changing the speed of the fans and turning on and off the cooling and heating units to regulate the internal air temperature. The climate unit takes air from the

outside to cool down the internal air, but the external and internal airflow never mix.

When a cabinet is powered on, the ECU will always start up first. It will start running on 24 VAC provided by the ACCU. First of all it will check the temperature inside the cabinet. If it is to cold, that is below +5°C, the heater will be started to heat up the cabinet until it is above +5°C then it turns on the AC power to the PSUs by maneuvering the relays in the ACCU. The heater runs on AC power distributed from the ACCU via the CCU. Directly when the PSUs are distributing DC-voltage, the rest of the users will start up.

If a cabinet is powered on and the temperature is above +5°C - +45°C, the start-up procedure is the same as stated above except that the ECU will sense that the temperature is suitable for the units, the power to the PSUs are then connected directly.

When starting up a cabinet that is warmer than +45°C the same procedures are used as stated above. Even if the temperature inside the cabinet is above the upper limit for normal operation the units will start up in the cabinet. The cooling equipment will try to decrease the cabinet temperature. If it is to warm for the units, which have individual safe function ranges, they will shut down their selves. They will start up when the temperature goes down below the safe function of the unit itself. E.g. a TRU will operate up to +55°C but with reduced output power. When its above +55°C it will shut down.

All figures above are not valid for all cabinet types and all climate units. Exact figures and data can be found in the Reference Manual EN/LZT 123 2769.

Unit Description, TRU

The Transceiver Unit (TRU) is a transmitter/receiver and signal processing unit which transmits and receives the radio frequency signals that are passed to and from the mobile station. There are different versions of TRU depending on the frequency band.

One TRU can serve eight full rate duplex channels or 16 half rate channels.

The TRU has one transmit antenna terminal and two receive terminals. The TRU supports diversity reception.

Diversity is used to improve the receiver performance. It is achieved by having two independent receiver paths. The signals are combined in the signal processing in the Digital Block.

Block Diagram

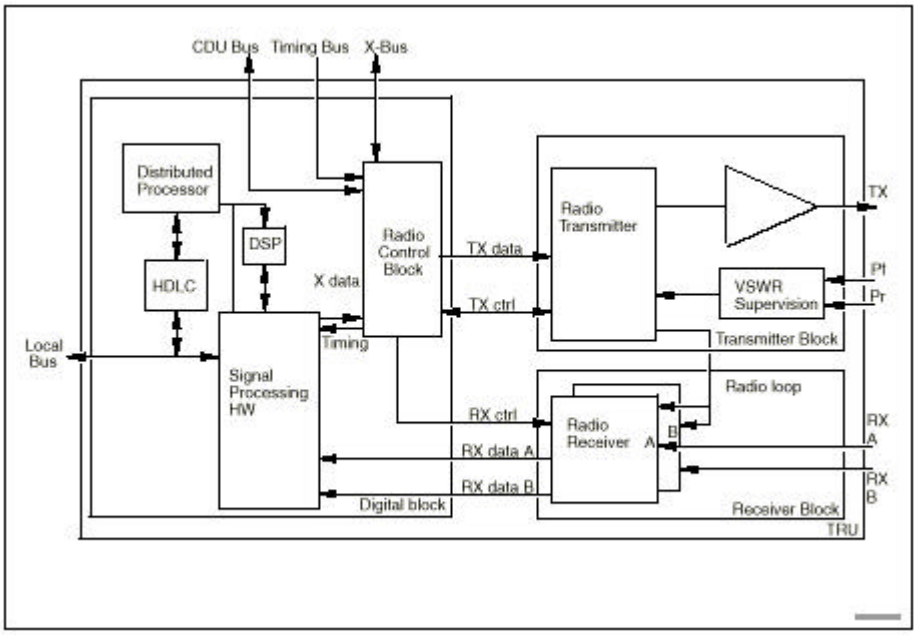

Figure 45 TRU, block diagram

The TRU consists of three main blocks.

- Digital Block
- Transmitter Block (TX-block)
- Receiver Block (RX-Block)

Digital Block

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

Transmitter Block (TX-block)

The transmitter block carries out the Transmitter (TX) functions including GMSK modulation, RF generation and power amplification. When baseband hopping is employed each TX transmits on the same frequency and the physical channel data will be sent from different TXs with each burst. With synthesiser hopping the physical channel data will be sent from the same TX all the time but will use a new frequency with every burst.

Receiver Block (RX-block)

The receiver block carries out the Receiver (RX) functions for reception and demodulation. There are two RX per TRU. The receiver is capable of frequency hopping.

The radio loop between the TX and RX makes it possible to test the entire TRU by generating test signals.

Functions

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:
  - GMSK modulation
  - RF generation
  - Power amplification
- Radio receiving
  - Basebands hopping/synthesizer hopping
  - Diversity
- Air interface signal processing
- TRX management

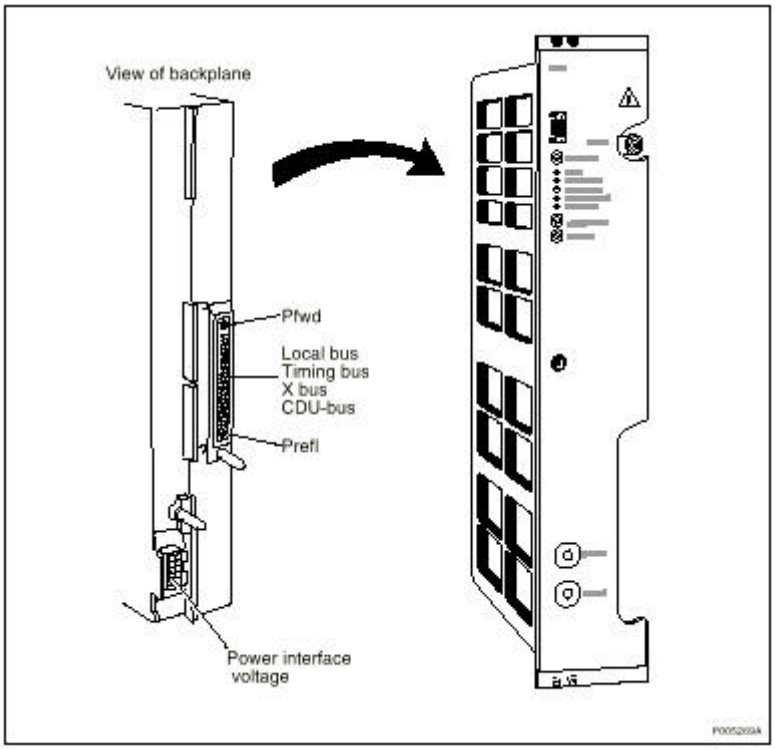

Figure 47 New TRU, front panel and backplane

The TRU has the following external interfaces:

- Local bus (backplane)
- Timing bus (backplane)
- X-bus (backplane)
- TX (front)
- RX 2 (front)
- Pfwd (backplane)
- Pre (backplane)
- CDU-Bus (backplane)

Indicators and Buttons

On the front panel there are five indicators (see following grid) and three push buttons for RESET, LOCAL/REMOTE and TEST CALL.

Indicator	**Colour**
Fault	Red
Operational	Green
Local mode	Yellow
Tx not enabled	Yellow
Test result	Yellow

The Backplane

The local bus, timing bus, X-bus, CDU bus, System voltage, Pfwd and Pre connectors are located on the backplane. See Figure 46 on page 175.

Dimensions and Weight

Height	400 mm (9 TE x 44.45 mm)
Width	71 mm (14 TE x 5.08 mm)
Depth	270 mm
Weight	5 kg
Max. Power Consumption	233 W
MAx. Heat Generation	198 W