

EXHIBIT 8
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APPLICANT:

Ericsson Radio System AB

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EXHIBIT 8 - COVER SHEET

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RBS884 Base Station Hardware Technical Description

Abstract

This document describes the macro base station for the 800 MHz band provided by the RBS884 platform. It describes the hardware structure with focus on system level to give an overview of the fundamental parts and structures. More details can be found in supplementary documents. The document shall be used as a supplement to the description of the MBS subsystem for understanding of the RBS884 base station concept. The acronym RBS884 alone is the generic name of the macro base station for 800 MHz.

Application

Introduction of customers and Ericsson personnel to RBS884 HW.

Supplementary documents

- [1] Description of MBS, 1551-ANT 244 01
- [2] 1551-COA 109 294, Control Part
- [3] 1551-COA 109 295, Modem Par
- [4] 1551-COA 109 296, Antenna Near Part
- [5] 1551-COA 109 298, Support Part
- [6] LZB 119 722, Equipment Practice

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1 Revision Information

PB2-3 Second non-reviewed version based on Rev A and following the guidelines outlined in AR/BU-94137 rev A.

PB3->B Updated in accordance with 63/1776-5/FCP&rlb103&rlb553

B->PC1 50W added

PCx->C Updated and approved in accordance with AR/S-96:061

2 Introduction

The RBS884 base station is divided into well defined functional parts named COP, MOP, ANP and SUP. The intention is to make it possible to reuse parts of the system for developments concerning other systems and to perform independent improvements of the defined areas.

rbs884macro

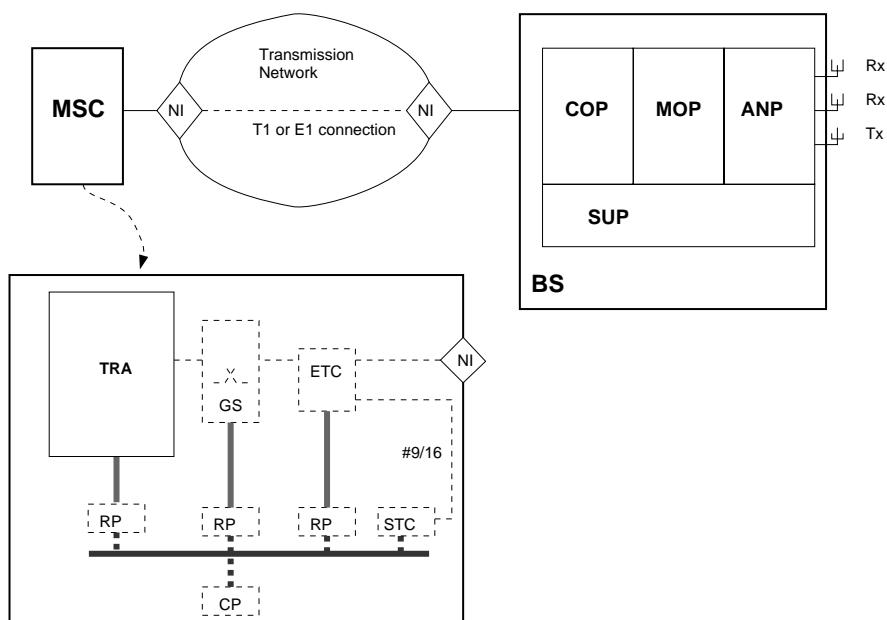


Figure 1 RBS884 HW block diagram

The RBS884 supports transcoder location in MSC only, which improves the transmission capacity by a factor three.

The RBS884 is a fully multimode i.e. has all channel functions:

- Digital Traffic Channel, DTC
- Digital VERification, DVER
- Control Channel, CC
- Analog Voice Channel, AVC
- Signal strength Receiver, SR
- Digital Control CHannel, DCCH

All carriers on a site are prepared to be TDMA frame and slot synchronized.

The RBS884 platform utilizes equipment practice BYB 401 001.

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3 Features

The RBS884 is designed for medium to high output power per carrier. 10 W transceivers or 30 W transceivers or 50 W transceivers can be selected.

The RBS884 can be configured as an omni site, a two sector site or a three sector site.

The RBS884 supports various cell patterns 7/21 and 4/12.

The RBS884 highly scalable and its physical size depends on the maximum output power per carrier, the numbers of sectors and the number of carriers per sector.

As an option the RBS884 can be equipped with a Tower Mounted Amplifier to balance the uplink RF-path and the downlink RF-path to increase coverage.

4 Limitations

The following functions and features are prepared in hardware, but will not have system support software-wise:

- Analog verification (= AVC) in dual-mode verification
- Control outputs
- SW and HW information
- Fault signal filtering
- Pin pointing of faulty unit / Error log
- RSSI calibration
- RF test loop
- Statistical supervision of DTC
- APT-alarm for faulty RFTR
- APT-alarm for faulty ALM (non-existent in this package)
- Setting of MCU attenuation value per RCG (not needed on CMS88-markets)

The RBS884 is not prepared for:

- ADPCM/PCM transcoding in analog mode
- BS power regulation dynamically (e.g. per time slot)

The RBS884 also have the following limitations:

- Cannot be used as a HUB to connect subordinated BSs to the MSC
- Cannot be cascaded
- Has no integrated power rectifiers
- Has no unit generating the Air Frame Sync (AFS)

5 Base station structure

The base station consists of the following major functional parts:

rbs884macro1

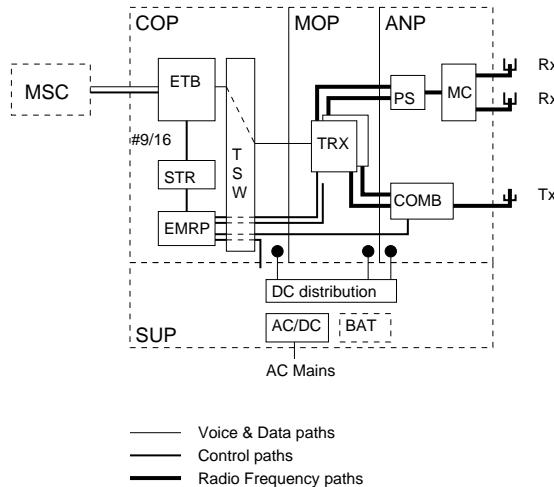


Figure 2 The RBS884 structure

COP - Control part

Handles the communication with MSC and hosts the hardware for radio traffic control, statistics and control of MOP and ANP. The COP is the SW-loadable part of the base station.

For more information refer to Supplementary Documents [2].

MOP - Modem part

Serves as the converter from speech and digital information into radio waves and vice versa. Hosts channel codec function and performs measurements on radio transmission quality. MOP consists of non-loadable HW. However, the TRX program memory can be changed from MSC by command, for correction purpose.

The transcoder, TRA, is logically part of the modem part but it is physically located in the MSC.

For more information refer to Supplementary Documents [3].

ANP - Antenna near part

Hosts the equipment associated with forward and reverse RF, such as combiners, multicouplers and power splitter. Also provides equipment for looping of radio signals, output power measurement, reflected power measurement, RSSI calibration, external alarm collection and control of external equipment. ANP consists of non-loadable HW. However, the program memory of RFTL,

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ALM and CTC can be changed from MSC by command, for correction purpose.

For more information refer to Supplementary Documents [4].

SUP - Support part

Provides DC power distribution to the base station hardware. Consists of DC distribution rails, connectors, circuit breakers and fuses.

For more information refer to Supplementary Documents [5].

Equipment Practice

All BS equipment is assembled in cabinets of uniform design and size, Width 600 mm, height 400 mm and depth 400 mm. The cabinets provides the mechanical structure and air forced cooling for the BS. The cooling capacity can be adapted to the needs for the equipment type housed in one specific cabinet.

For more information refer to Supplementary Documents [6].

6

Functional submodules and units

The functional parts, COP, MOP, ANP and SUP, are built up by functional submodules, hosted in cabinets of equal size. Each functional submodule then contains a number of different boards or units.

The functional parts, COP, MOP, ANP and SUP are built up by the functional submodules:

Control part:

* CRI

Modem part:

* TCB

Antenna near part:

* ATCC
* ANPC

Support part:

* POWD

A RBS884 BS consists of at least one functional submodule from each functional part. By appropriate number of submodules the total capacity of each functional part can be adapted to the needs of a specific BS. The figure 3 and the figure 4 gives some examples

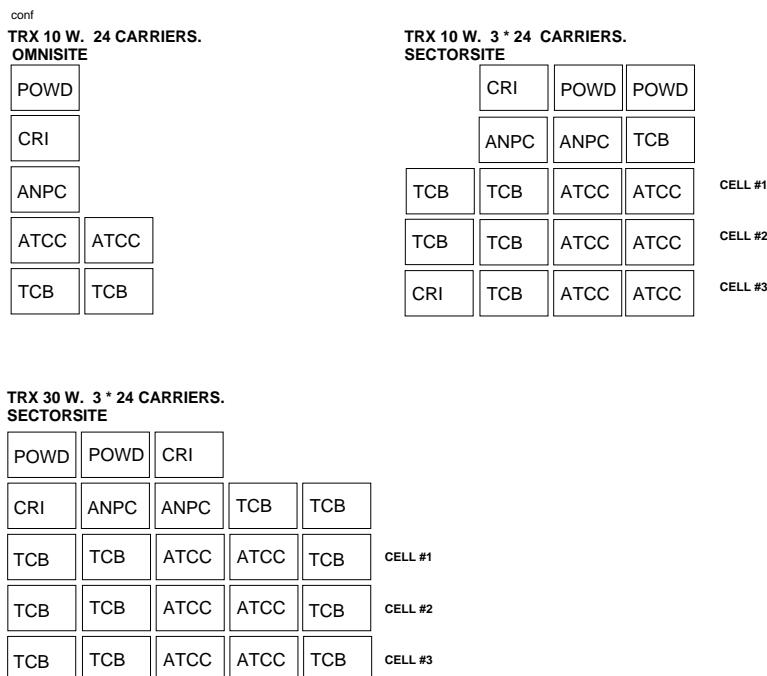


Figure 3 The RBS884 configurations, example 10 W and 30 W

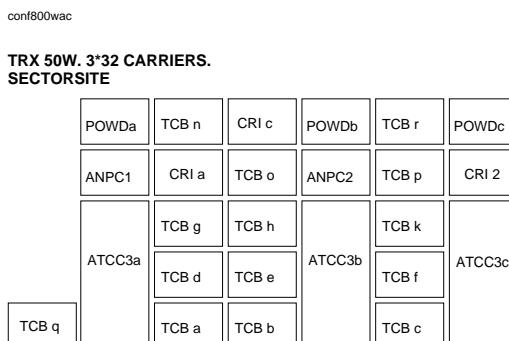


Figure 4 The RBS884 configurations, example 50 W

7 EMC and grounding principles

7.1 EMC zones

To describe the EMC concept a division into different zones is useful, reference [1]. Each zone has its own EMC characterization, as follows:

Zone 0 is the surrounding of the base station.

Zone 1: Transients from zone 0 are attenuated. Suitable to contain electronic devices with low radiation and low susceptibility.

The ground characteristics of zone 1 is that it is equipotential, which means that every part of the ground in zone 1 has the same potential to earth (zone

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0) in every moment. This is the base for protection against external transients and ESD.

The ground structure shall be made to encircle the base station. This creates a "wire shield", which is useful for protection against the fields connected to transients and conducted lightning, see ref [2].

All cables shall enter the Zone 1 via one and only one intake point.

Zone 2: Shielded from zone 1, and cables are filtered when passing the shield. The interior of zone 2 is equipotential and the shield is a part of the ground structure. The shield must be bonded to the ground structure in zone 1. Zone 2 is intended to contain unshielded electronic digital devices. These have medium emission and medium susceptibility.

Zone 3: Shielded from zone 1 and 2, and cables are filtered when passing the shield. Zone 3 is intended to contain radio equipment. Zone 3 contains circuits with high emission levels or high susceptibility, which means radio units.

7.2 Grounding principles

7.2.1

External connections and shields.

All cable shields must be terminated at the intake point. All external leads must have transient protection devices mounted close to the intake point (The Centre lead of the antenna cables are excluded). If the transient protection devices require connection to ground this shall be done at the intake point.

7.2.2

Cabinet interconnection.

All parts within the cabinet shall be grounded together. This shall preferably be done with metallic contact of the structures (called direct bond). If this is not possible, a short braided strap may be used. (Indirect bond).

7.2.3

Submodule.

Inside the submodule multipoint ground is used, and the ground planes of the boards are usually connected to both front and backplane. This is permitted but not required. The board magazine is designed according to BYB 401 001 and is covered by a shield. This shield is a part of the ground structure of the board magazine. The shield is grounded to the cabinet.

7.2.4

Fan unit.

The fan unit is grounded to the cabinet. This is required because of the RF-filters in the unit, and to reduce possible emission from the unit.



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8 Environmental and safety

The RBS884 is designed to withstand transport, storage and normal operation over a wide area of temperature, humidity, air pressure etc, see ref [3].

Also specified are ranges for safe operation and non destructive operation.

The RBS884 is designed to fulfil safety requirements defined by ref [4].

9 Basic fault handling and indications

The RBS884 supervision and fault handling is supported by hardware by a number of basic functions described below.

9.1 Cabinet numbering and board positions

Each cabinet in a site configuration has a unique number, the CID code. The number is set by a switch in each cabinet and is read by all units in the cabinet.

Within each cabinet each board has unique board position code from left to right. Each unit in the cabinet reads the board/unit position within the cabinet.

All units/boards having onboard processor unit are capable of reading the above explained information.

Detailed information in this subject is found in ref [5] and [6].

9.2 Device product info and event log

Each HW unit has the following product related information stored in HW and impossible to change during operation. The information is accessible remotely if the unit is equipped with a processor:

- * Product number
- * Revision state
- * Product Serial number

Each HW unit has the following function related information stored in HW and impossible to change during operation. The information is accessible remotely if the unit is equipped with a processor:

- * HW generation
- * Product function code
- * Revision function code
- * System function code

Each SW unit has the following product related information stored as part of the SW unit. The information is accessible remotely:

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- * Product number
- * Revision state

Each SW unit has the following function related information stored as part of the SW unit. The information is accessible remotely:

- * Program version
- * Program revision
- * Program function code

Further each exchangeable unit keeps an event log for two event categories, Alarm and Fault. The event log shall contain the following:

- * One alarm log storing the 10 latest events resulting in alarm, major failures and serious faults, sent to the MSC.
- * One fault log storing the 10 latest minor faults since the last alarm.

The information is used to ease repair, tracing of system errors and to provide information for further product improvements.

Detailed information in this subject is found in ref [7].

9.3

Error record

An error record is kept in MSC. All error messages that are sent to MSC are kept in the error record. Each message contains information about faulty unit:

- Function block name (Device type)
- Device individual # (In APZ device map)
- Fault type (Minor, major or serious)
- Fault code (1-511)
- Cabinet No
- Position No
- HW Product No
- HW REvision State
- HW Serial No
- HW generation
- Product function code
- Revision function code
- System function code
- SW Product number
- SW Revision state

9.4

LED indicators on boards/units

All boards and units have LED indications as follows.

- a** Indication LED:s are placed in the upper end of a circuit board and in the upper left corner of a HW unit.



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b The following LED:s will be found on all active units:

- a** * Power (Green)
- b** * Error (Red)

c All units containing DP or SP will also have the following LED:

- a** * Status - blocked/deblocked/traffic (Yellow)

leds

Led placement:

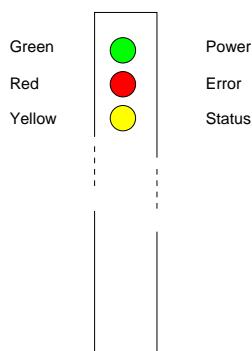


Figure 5 The LEDs location on a circuit board having a DP.

Logical description of LED:s:

Power

The power LED is always fed from the source that feeds the logic for the error LED. That is usually the +5V. This gives a safe indication of all different types of errors.

Error

The functionality will be different depending on the complexity of the product. Generally a lit LED indicates that an error is present.

However for units containing DP or SP the following is valid:

When a device is powered up and makes a selftest, the LED will flash. Depending on the result, the LED will stay in status lit/not lit. The flashing frequency is 1 Hz.

Status

The LED will be lit when the device is deblocked and not used for traffic.

The LED will be switched off when the device is blocked or in boot state.

The LED will be flashing when the device is deblocked and used for traffic or when the device is blocked and being tested.

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The flashing frequency is 15Hz. This will give a flickering impression rather than flashing.

The duty-cycle of the flashing is generally be 50%, however if the device supports traffic for more than one carrier/channel, the duty-cycle is progressive, e.g. 20%,40%,60% or 80%, depending on number of carriers/channels in traffic, if four carriers/channels are controlled.

The LED will be switched off hardware-wise by the watch dog signal and the LED status in the processor register will be reset.

Detailed information about logical descriptions, standardized LED size, exact colors and light intensity is found in ref [5].

9.5 Indications on cabinets

At front of each cabinet two indicators are found: Power-green and Error-red. The indicators are LED:s behind the small window in the front door.

The LED:s are controlled from the internal electronics in each cabinet type. The power LED will be lit when power is connected to the cabinet and the error LED will be lit by any unit/board in the cabinet that has a lit error LED on the board/unit itself.

Detailed information in this subject is found in ref [5].

10 Base station interfaces

10.1 Base station external interfaces

The following external interfaces are used by the base station hardware:

bs external iw

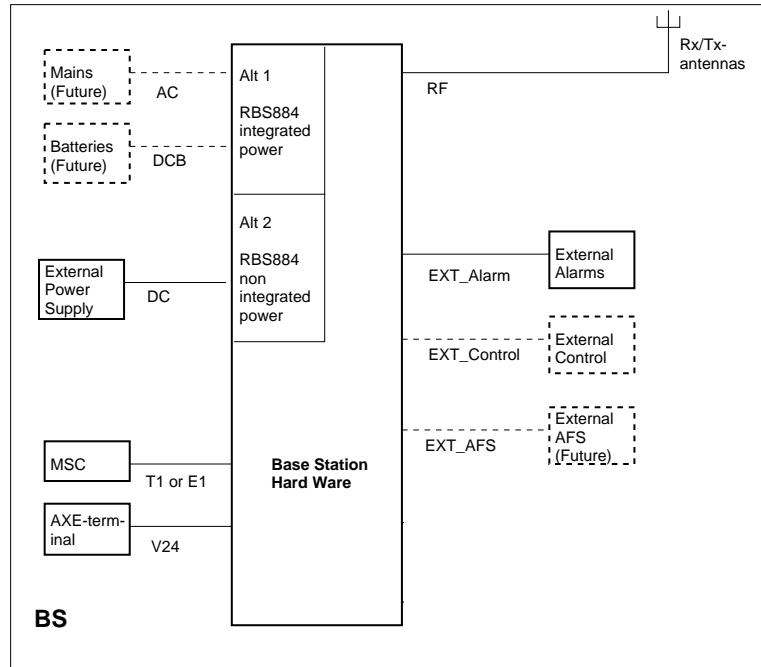


Figure 6 The RBS884 External Interface

External interfaces shown by dotted lines in the figure 6 will be added in the future.

For more information refer to the Interworking Descriptions listed below

DC	86/155 19-ANT 244 01
T1	31/155 19-ANT 244 01
E1	77/155 19-ANT 244 01
V24	48/155 19-ANT 244 01 1551-ROF 131 8217 1551-CNZ 212 117
RF	4/155 19-ANT 244 01
EXT_Alarms	47/155 19-ANT 244 01
EXT_Control	47/155 19-ANT 244 01
EXT_AFS	85/155 19-ANT 244 01

10.2

Base station internal interfaces

The functional parts are connected via well defined interfaces. This will allow for independent development, functional growth and adaptation to new techniques.

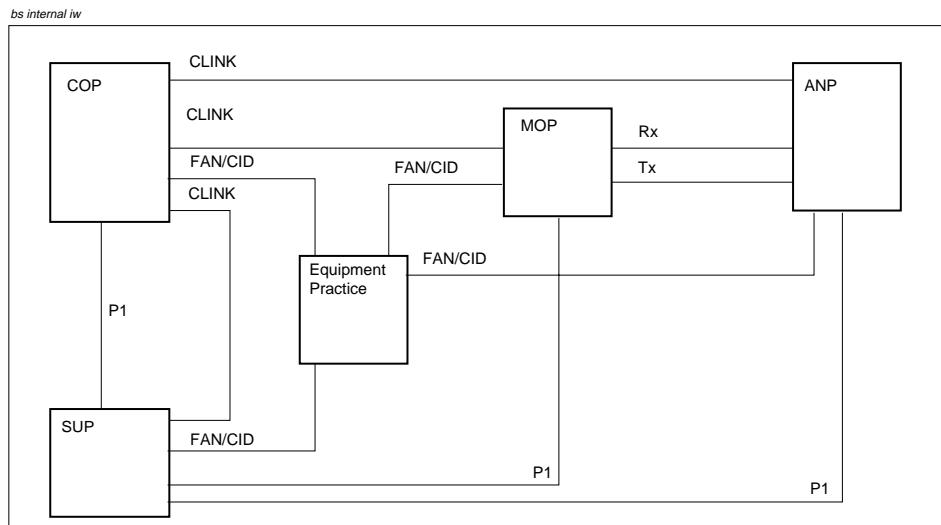


Figure 7 RBS884 Internal Interfaces, physical level.

For more information refer to the Interworking Descriptions listed below

CLINK	26/155	19-ANT	244	01
FAN/CID	1551-ROA	117	2042/1	
P1	29/155	19-ANT	244	01
Rx	83/155	19-ANT	244	01
Tx	83/155	19-ANT	244	01

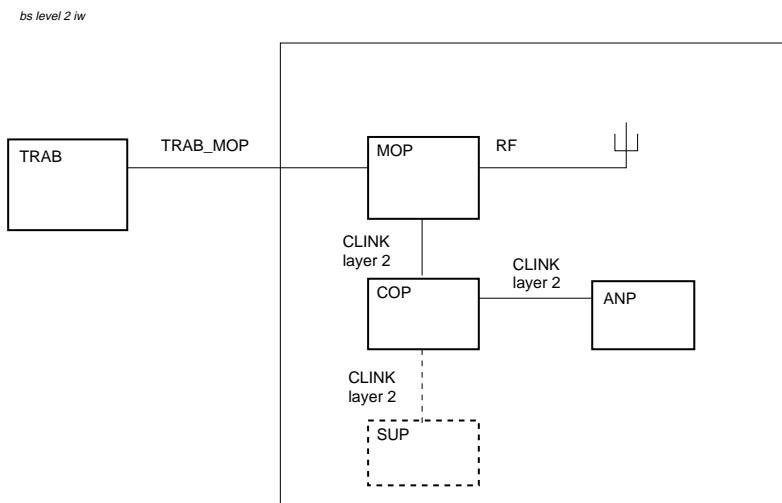


Figure 8 RBS884 Internal Interfaces, level 2. Dotted lines shows future interwork.

For more information refer to the Interworking Descriptions listed below

TRAB_MOP	74/155	19-ANT	244	01
RF	IS-136			
CLINK layer 2	27/155	19-ANT	244	01

11

The control structure

The control structure follows the CP, RP, DP hierarchy of the APZ, figure 9 a). The BS is controlled by a set of EMRPs located in the BS and connected to the CP of the MSC as a Extension Module Group, EMG. Each EMRP controls a number of devices each one having its own DP, figure 9 b).

The figure 9 c) shows the structure of the control part of the BS. The ETBs terminates PCM-links connecting the BS to the MSC. The control link for the EMG is carried on one time slot on the PCM-link and is terminated by the STR.

Devices to be controlled are connected to the RTTs via CLINKs, one CLINK to each device. A set of EMRPSs are used to control the devices on load sharing basis.

A time switch, TSW, is used to connect control paths from EMRPSs to the devices being controlled. The TSW also routes the traffic data on paths set up between a time slot on an ETB and a device connected to a RTT. The TSW is controlled by a dedicated EMRP.

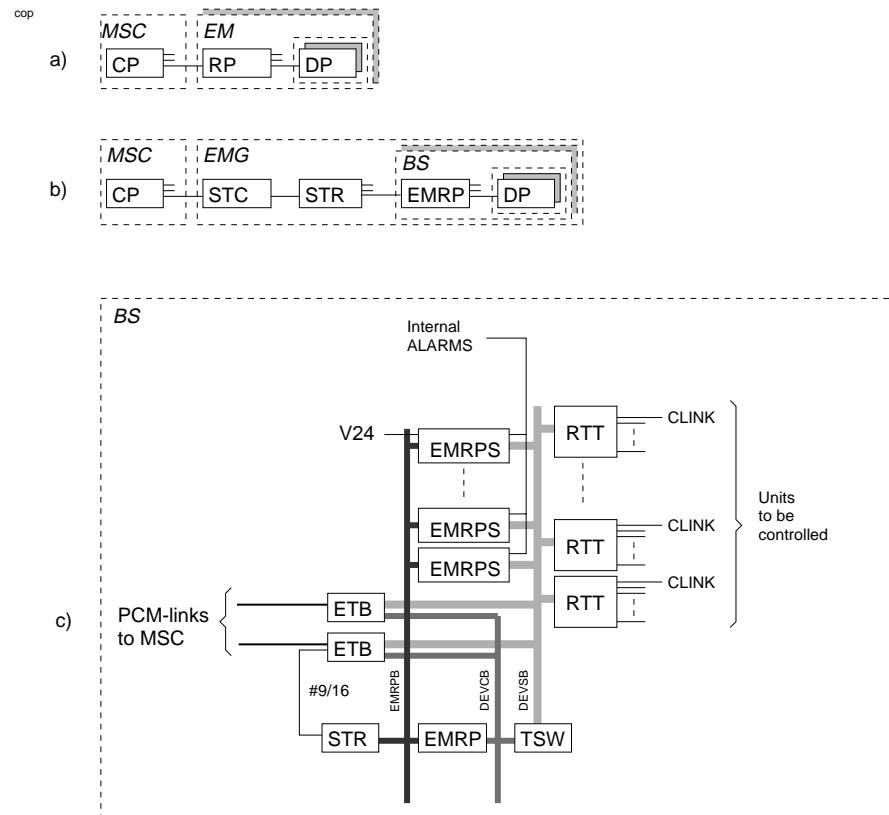


Figure 9 The Control structure.

12

The RF structure

The TRX handles uplink radio frequency signals, Rx, from the receive antenna system and transmit downlink radio frequency signals, Tx, to the transmit antenna system.

Diversity is used in the uplink direction and the receive path for each branch includes the Multi Coupler, MC, to amplify the received signal and the Power Splitters to distribute equal power level on each TRX connected to the same receive antenna.

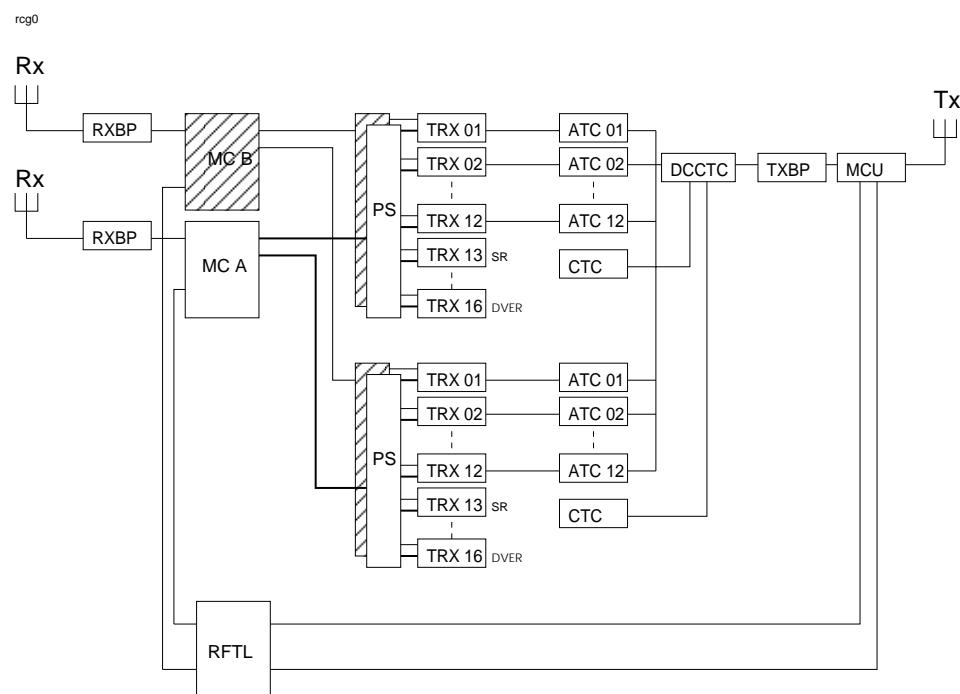


Figure 10 The RF structure.

Tower mounted amplifiers, TMA, can be added to improve the RF sensitivity in the uplink direction.

rcgtma

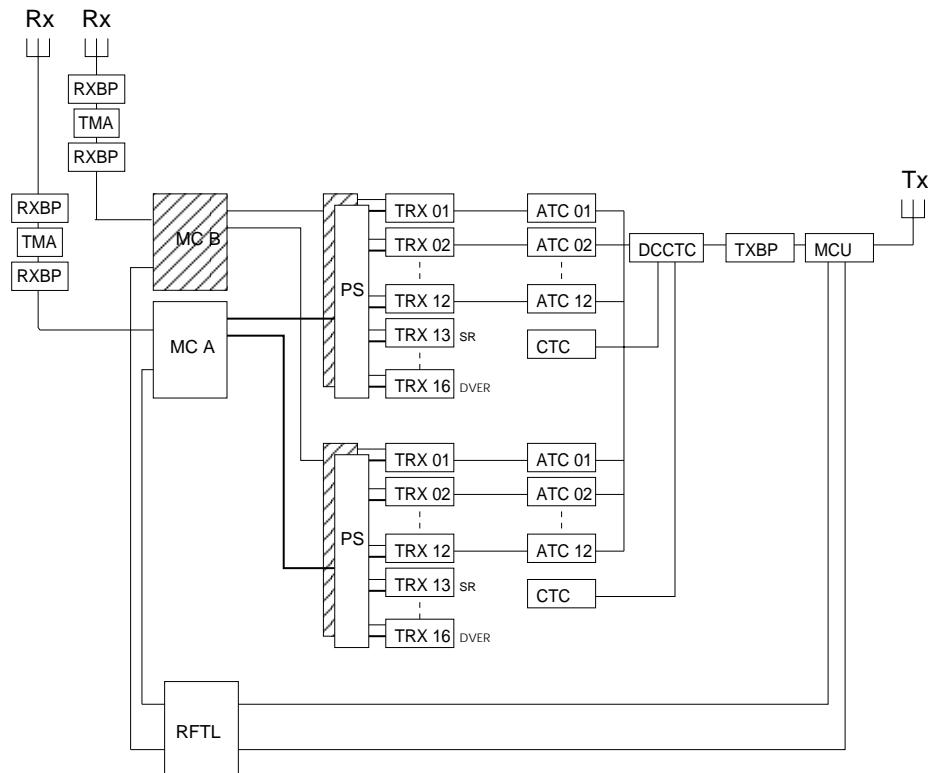


Figure 11 The RF structure including TMA.

Autotuned Filter Combiners, ATC, are used to merge the output power from the TRX:s that shall be connected to the same transmit antenna. The Combiner Tuning Controller, CTC, use the output power measured by the Directional Coupler Unit CTC, DCCTC, at the antenna feeder connection when tuning each ATC to optimum output.

All TRX:s connected to the same receiver antenna system and the same transmit antenna and bridged by one Radio Frequency Test Loop, RFTL, is forming a Radio Channel Group, RCG. The RFTL gets two output power signals from the MCU and transmit RF signal to each TRX via the two multi couplers.

13

Synchronization

The RBS884 provides Network Synchronization and Carrier Frequency Stabilization and is prepared for Air Frame Synchronization.

13.1

Network Synchronization

Network Synchronization secures error free transmission of data to and from the MCS using buffers and a stable clock. Network Synchronization is handled by the COP.

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The clock shall in normal operation be locked to a reference signal provided transparently through the transmission network from the MSC. The reference signal is normally superimposed on one traffic link connecting the BS to the MSC.

The buffer is used to equalize short term phase deviations.

13.2 Carrier Frequency Stabilization

The radio network requires very accurate carrier frequency. In RBS884 the reference signal used by the Network Synchronization also is used as a Carrier Frequency Reference.

Short term phase deviations must be removed from the reference signal. This process is called Carrier Frequency Stabilization and is handled by the COP.

To obtain the carrier frequency accuracy the reference signal must be traceable to a source of Stratum 2 level or better.

13.3 Air Frame Sync, (Future function)

AFS, when used, will synchronize all air frames transmitted from the BS. Then all frames will be transmitted phase aligned in the air.

AFS is a future function. The AFS shall be generated by the future module TIM.

The AFS will be distributed to each TRX in the backplane of each TCB. The TCB will be connected in a daisy chain fashion via the DCON board. A termination will be needed in the end of the chain.

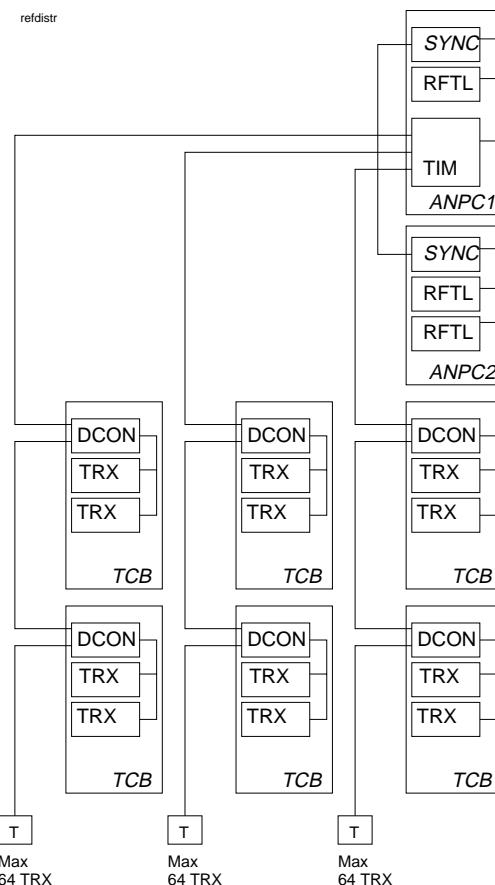


Figure 12 The Air Frame Sync distribution

The interface SYNC is part of the mechanic of the magazine and has connectors for distributing the AFS from ANPC1 to ANPC2.

14

Power supply and power distribution

The support part (SUP) provides DC of +24 Volts to all equipment on the site. The DC is produced redundantly by applying a N+1 configuration of external, internal in future, AC/DC converters that are connected in parallel.

Users are connected via fuse and low ohmic distribution. Decentralized DC/DC conversion is adopted for users. That is, generally boards and modules has internal, on board DC/DC, converters for required voltages.

Generally all parts that are vital for operation has redundant power feeding to increase availability for base station operation. The support part also hosts the optional battery backup.

14.1**RBS884 Non Integrated Power**

Non Integrated Power means AC/DC and battery equipment having other physical and mechanical structure than the RBS884 Equipment Practice and is also not an integrated part of the RBS884 control and supervision functions.

With Non Integrated Power the SUP includes only the Power Distribution sub-module, POWD, having connectors and circuit breakers for 32 P1 interfaces.

DC, +24V, must be provided to POWD from an external source.

The external source shall be supervised via external alarms.

14.2**RBS884 Integrated Power (Future)**

With Integrated Power the SUP consists of a number of Power Unit Cabinets (PUC), Battery Interconnection Cabinets (BIC) and a battery package. The first BIC has a CLINK connection to the CRI for control and alarm purpose.

The PUC includes rectifiers, a distribution part having connectors and circuit breakers for 12 users (replacing the POWD) and connection to the BIC.

The PUC:s are connected to a Battery Interconnection Cabinet (BIC). Up to 4 PUC:s can be connected to one BIC.

pow

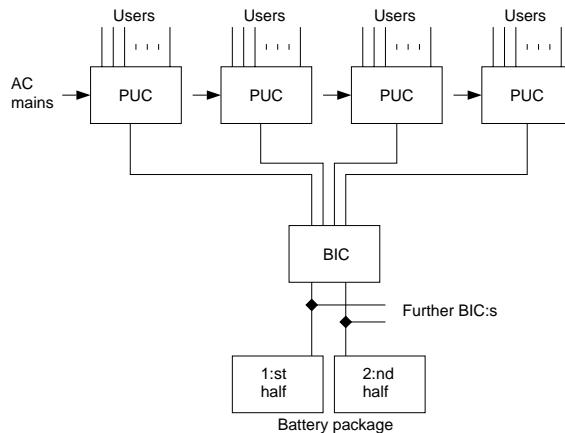


Figure 13 Integrated power

15**Redundancy structure****15.1****General**

The redundancy structure is based on duplication of vital units, N+1 redundancy and the backup functionality.

A faulty unit without redundancy will always reduce the service capability. With the backup function vital traffic functions such as CC, DCC, SR and DVER can be maintained.

The most critical part is the CRI terminating the transmission line to the MSC and the control link. The CRI is also controlling the entire BS.

15.1.1 One single CRI

In a small site, controlled by one CRI, the CRI is critical. In the figure 14 any single fault in the shaded parts can be bypassed either due to built in redundancy or by using back up unit or n+1 redundancy.

Note that the figure is a logical figure and shows the units that must be operating in order to have a control path to the TRX and in order to have a speech path to the TRX. The figure does not show the exact interconnections and order in each path.

For proper function the backup unit must be controlled by an other EMRPS and via an other RTT than the unit it will back up.

A fault in the ETB or in the TSW will stop the entire BS.

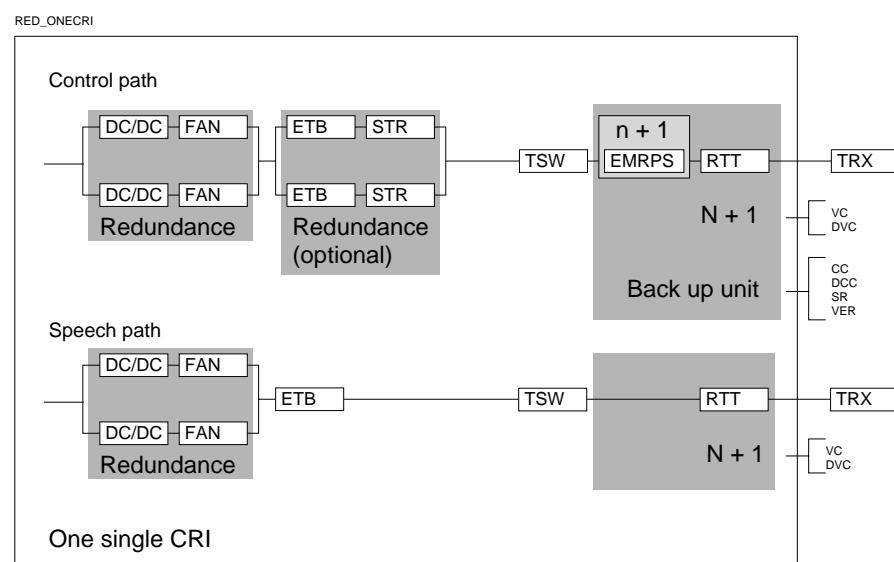


Figure 14 One CRI, system structure, logically

15.1.2 Two or more CRI

With two or more CRI all single faults can be bypassed in the control path. Vital traffic functions such as CC, DCC, SR and DVER can be maintained using the backup functionality.

In the figure 15 any single fault in the shaded parts can be bypassed either due to built in redundancy or by using back up unit or n+1 redundancy.

For proper function the backup unit must be controlled by an other CRI than the unit it will back up.

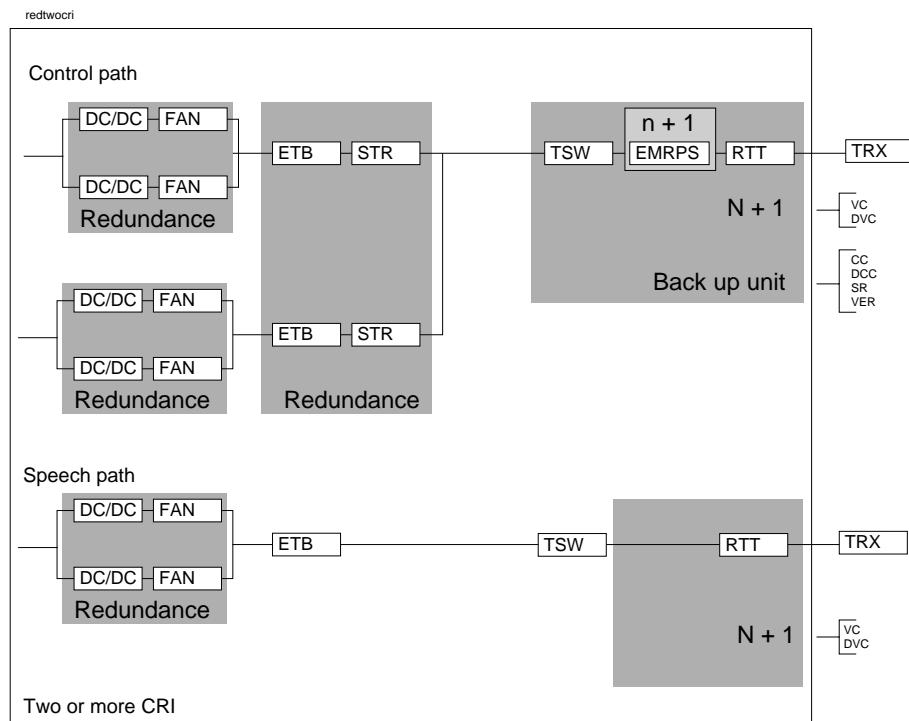


Figure 15 Two CRIs, system structure, logically

The speech path has no redundancy in the ETB and TSW. A fault in any of these will reduce the traffic capability proportional to lost traffic channels.

15.2 CRI

The CRI redundancy is based on duplication of vital units and N+1 redundancy.

The power is distributed redundantly and a single DC/DC converter failure will not affect the magazine.

The fan unit contains two fans where one fan can keep the cabinet within permitted temperature range.

The EMRPS:s can be configured in a N+1 fashion which means that if any of the active EMRPS:s fails, the stand by EMRPS can take over the task. Changing to the redundant EMRPS must be handled manually.

The redundant EMRPS is supervised by APZ. Reconfiguration has to be done manually from the MSC.

The TSW and the EMRP cannot be duplicated. The RTT cannot be duplicated.

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15.3 TCB

As each carrier can support any of the possible system frequencies, a N+1 fashion can be deployed for the TRX:s.

The multi function TRX also makes it possible to use the stand by TRX (or any of the TRX:s working as a voice channel) as backup unit for the functions ACC, DCC, DVER or SR. Device/function switching is performed automatically by the MTS in the MSC, to predefined redundant HW-unit.

The fan unit contains two fans where one fan can keep the cabinet within permitted temperature range during otherwise normal conditions.

The TRX is fed with power in groups of four, so the maximum impact of a fuse failure is on four carriers.

15.4 ATCC

The ATC:s can be configured in a N+1 fashion along with TRX, as each ATC can tune to any of the system frequencies.

The fan unit, integrated in the CTC, contains two fans where one fan can keep the cabinet within permitted temperature range.

A CTC can not be duplicated. A CTC failure will reduce the functionality. The backup function can be blocked. The ATC:s will keep their current tuning but will not be able to change frequency or compensate for temperature changes.

The ATCC cabinet is fed redundantly with respect of DC power supply.

15.5 ANPC

Each cell has diversity reception of radio signals. Hence there are two multi-couplers per cell and at a MC failure the system will continue to work with degraded performance.

An ALM failure will not affect operation but it will reduce the supervision of internal BS errors and disables all external alarm and control possibilities.

A RFTL failure will result in reduced supervision functionality for one RCG.

The ANPC is fed redundantly with respect of DC power supply.

The fan redundancy is equivalent to CRI.

15.6 Power system (Future)

With RBS884 integrated power the AC/DC rectifiers will be configured in a N+1 fashion. Fans in PUC will be redundant.

16

CO-siting

The RBS884 can be co-sited with the RBS882D. Co-sited means that the RBS884 and the RBS882D shares the Tx and Rx antennas and are controlled by the same EMG.

The antenna system will be "owned" by the RBS884. The Rx signal is forwarded from the MC of the RBS884 to the MC of the RBS882D, refer to the figure 16.

The Tx signals are joined after the combiners of each system and fed to the Tx antenna through the TxBP and MCU of the RBS884.

To share the same EMG the EMRPB of the control part of the RBS884 and the control part of the RBS882D must be connected.

The control parts of the RBS884 and the RBS882D must independent of each other get the sync reference directly from the MCS. Thus each one requires a PCM-link to the MCS.

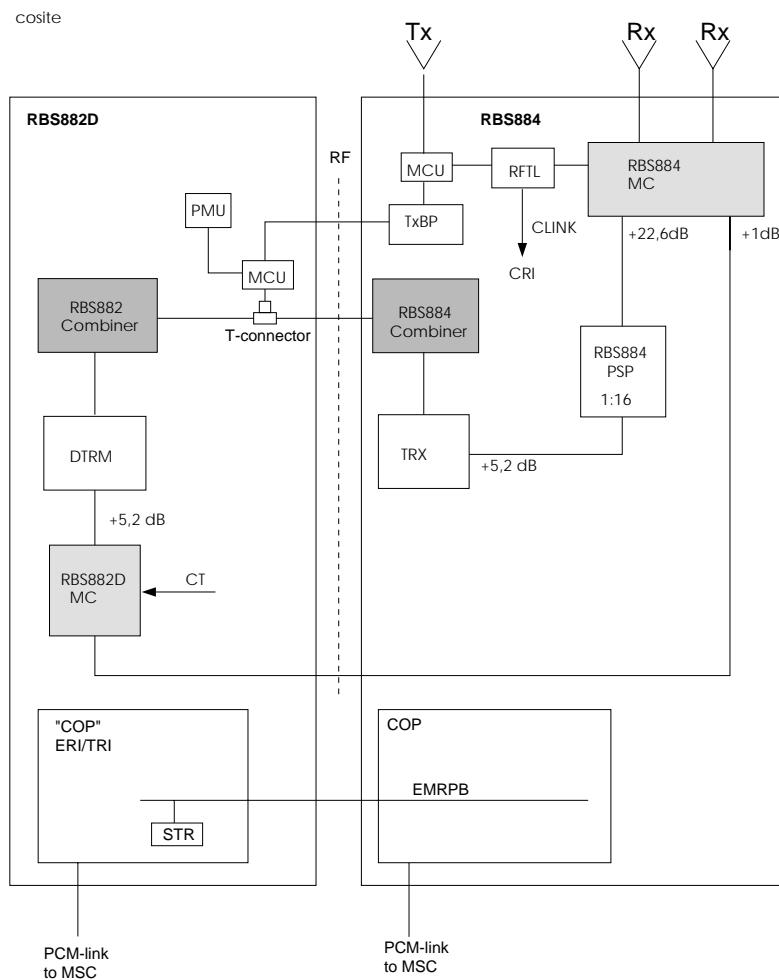


Figure 16 Co-siting of RBS884 and RBS882D

The details of the interconnection of the RF parts are described in:

RF 89/155 19-ANT 244 01 CO-siting ANP, RBS882 and RBS884

17 Capacity

17.1 The CRI

A BS can be a omni or a two or three sector site. Minimum one RCG is required for a sector. The CRI is common for all sectors.

The CRI shall have balance between EMRPS and RTT. The load on the EMRPS is mainly the control of the TRX:s. One EMRPS is assumed to control up to 4 - 5 TRXs.

Remaining equipment is in the ANP and can be spread out evenly on a number of EMRPS and adding little load to the EMRPS.

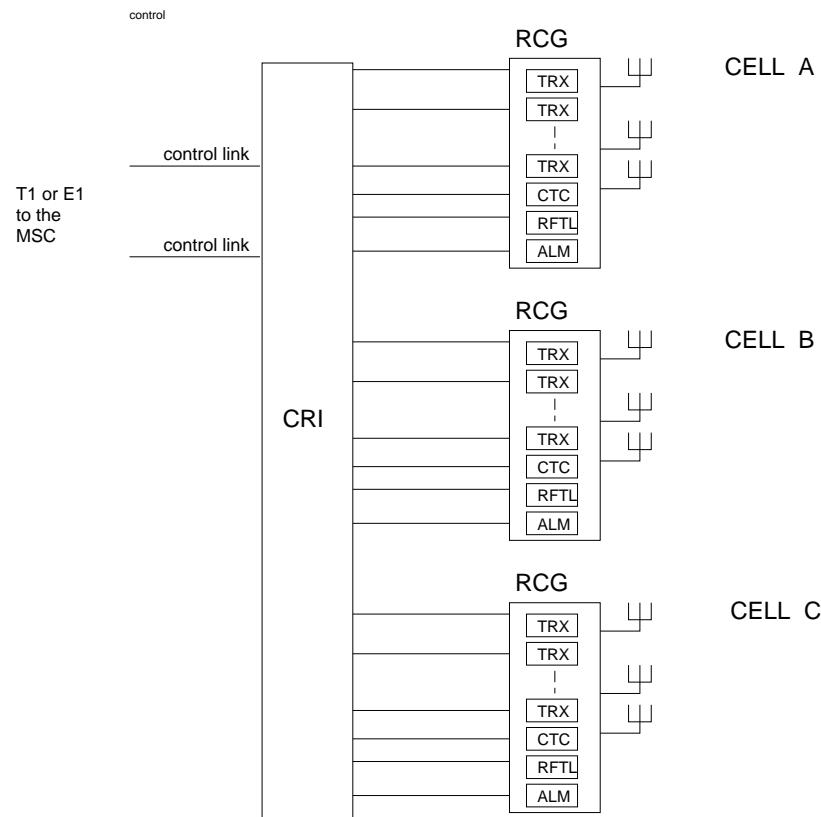


Figure 17 A three sector site

A good balance is 7 + 1 EMRPS and 6 RTT controlling from $4*7 = 28$ TRXs up to $5*7=35$ TRXs if the extra EMRPS is used as a redundant unit. If all EMRPSs are active units then from $4*8 = 32$ TRXs up to $5*8=40$ TRXs can be controlled. RTT capacity not used by TRXs will be left over to ANP equipments.

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In a three sector site, dual band, there will be at least 1 SR, 1 DVER and 1 CC per sector or totally 9 TRXs not requiring any speech path to the MSC.

With one T1 link to the MSC 23 DS0s are available and $23+9 = 32$ TRXs shall be controlled by the CRI.

With one E1 link to the MSC 30 DS0s are available and $30+9 = 39$ TRXs shall be controlled by the CRI.

In a three sector site each sector has 1 RFTL and 1 CTC for the first 11 TRXs carrying voice or data and 2 CTCs if there are more TRXs. The ANP also includes 2 ALMs. Then 8 - 11 CLINKS are required.

Then in a three sector site having up to 8 (one T1) or 10 (one E1) TRXs per sector carrying voice takes 40 and 47 out of 48 CLINKS respectively. For more capacity a second PCM-links is required. However only a small part of added DS0s can be used due to limited number of available CLINKs. In most cases 2 PCM-links means 2 CRIs. This is also good from reliable reasons too.

17.2

The RCG

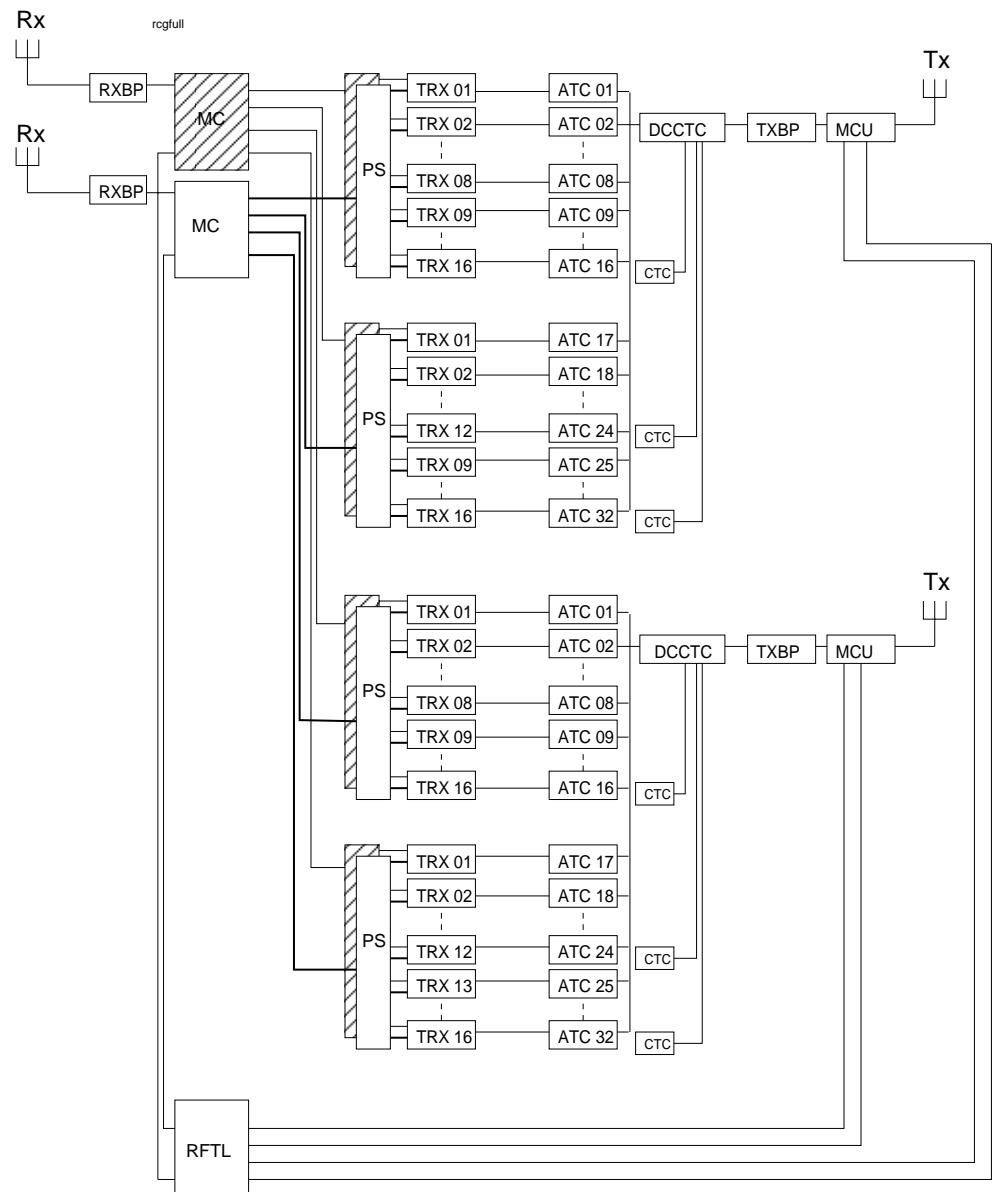


Figure 18 Maximum RCG configuration.

The RCG can be expanded to 64 TRX:s on the Rx antenna system. To match the Rx side two Tx antennas are required each one serving a group of 32 TRX:s.

A three sector site having one full RCG in each sector has totally $3 \times 64 = 192$ TRX:s.

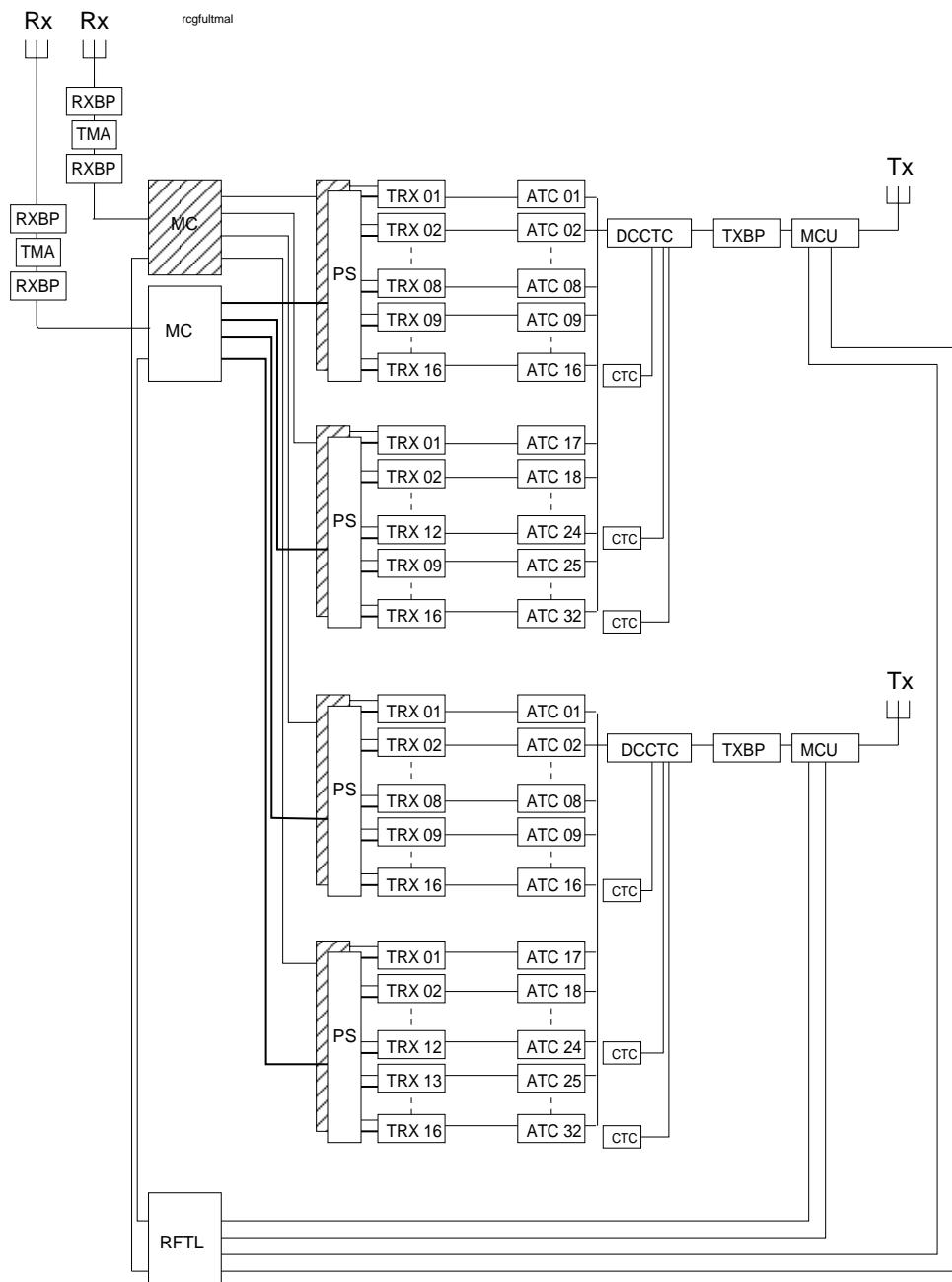


Figure 19 Maximum RCG configuration with the optional TMA.

A set of four CRI should physically address this site provided each EMRPS have capacity to control 8 TRXs.

17.3

The EMG

An EMG can address up to 32 EMRP. A CRI having 7+1 EMRPS takes 9 addresses since there is an EMRP controlling the TSW and the ETB:s.

There can be up to 4 CRI in one EMG. The total capacity of the EMG depends on the capacity of each EMRPS. To control 192 TRXs one EMRPS must control 8 TRXs.

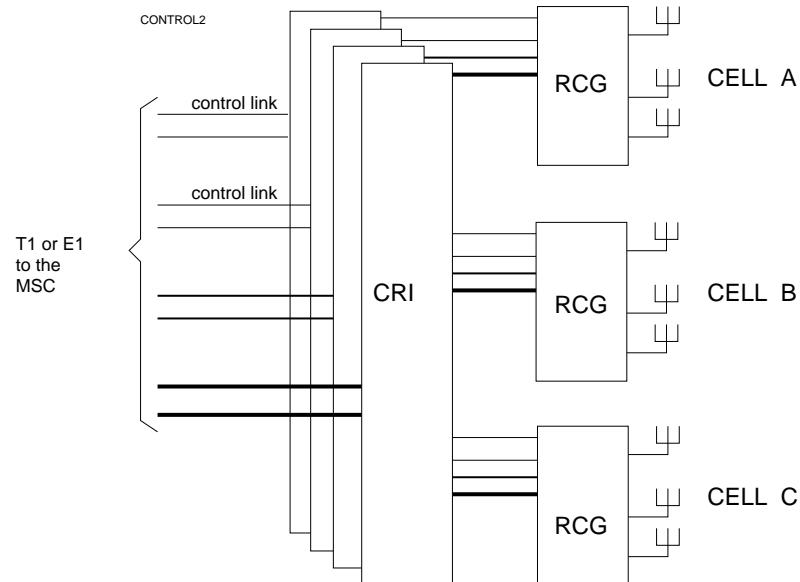


Figure 20 Maximum configuration of 1 EMG

(Note) The EMG is associated with one control link taking one DS0 of the PCM-link. The capacity is limited and will define the number of TRX:s that can be controlled by one EMG

One site can be divided on more than one EMG if the number of TRX:s exceeds the capacity of one EMG.

18

HW support for Traffic functions

There are no specific traffic functions related to the RBS884 family. Functions supported is equivalent to RBS882 and RBS882D.

The HW is designed to allow any channel function in any EMRPS or TRX, i.e. free allocation Possibilities to assign backup units is thus maximized.

The HW is not prepared for non-IS-54 characteristics like dynamic (time-slot) BS power regulation or CDMA. Some HW must be replaced to allow this.

The HW is prepared for Air Frame Sync, i.e. all TRXs can operate at the frame timing (in digital mode).

RBS884 family is designed to support CDPD modulation (with SW reload).

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HW support for Standard O&M functions

All functional descriptions in this document are limited to the HW support, primarily for functions without system support, i.e. where there is no other function documentation.

19.1

Device recovery

The recovery intends to filter out occasional, temporary, errors ("false alarm").

If a device reports a serious fault the system will respond with a blocking order. After nine minutes the system will try to reset and start the device again. If a new serious fault is received within six minutes, the device will be blocked again and no further attempts to recover will be performed.

19.2

Back-up of CC/DCCH/SR/VER

If there is a malfunction in the equipment providing the CC function, the system (meaning MTS) is automatically moving the CC function to a predefined backup equipment.

The same support is available for SR (as in earlier packages), VER and DCCH backup. All backup functions are "owned" by MTS, MBS only supports these functions. The MTS function only allows reconfiguration from the "essential" channel functions to VC/DTC.

The MBS architecture, and RBS884 HW, supports flexible allocation of backup channel to any device. This enables flexible HW upgrading, where different units may be merged, as the HW is rationalized. The backup unit should be chosen so that original and backup units share as little HW as possible, maximizing the system availability.

19.3

Test and monitoring outlets

There is only one monitoring outlet, a measurement coupler per Tx antenna connection. The coupler is the MCU to be used by RFTL.

19.4

Base Station Test Interface (BSTI)

The possibility to connect a PC to the EMRPS in order to log and insert signals for test purposes. Not to be used by customers.

19.5

CSU functions

The RBS884 requires external CSU.

19.6**Voice line characteristics**

Both analog and digital voice channels have selection of A- or u-law PCM coding, voice level adjustment (up- and downlink separately). In digital mode the TRAB makes the coding. In analog mode the TRX makes the coding.

19.7**Hot Repair**

All units are capable of being extracted/inserted in live magazines, without being damaged or other units being disturbed electrically.

Normal blocking/deblocking procedures should be used to avoid traffic disturbances.

20**HW support for Optional O&M functions****20.1****RF testloop with RFTL**

The HW supports the following function, but there is no system support yet.

The RFTL can be used to test the Tx and Rx RF-paths. A TRX is ordered to transmit a predefined modulated carrier. RFTL picks up the signal via the measuring coupler unit. The signal is mixed and transferred to the MS transmitting band and fed out on the Rx branches via the MCU. Any TRX can then be ordered to measure the signal in order to check TRX and RF-path functions.

20.2**Control outputs**

With an ALM unit installed output control, a future functionality, can be provided.

Up to 8 output control ports are available on the ALM unit.

Each output provides a closed loop when activated.

The ports are controlled by manual command

outputcontrol

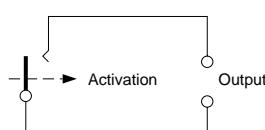


Figure 21 The output control closed loop

Refer to 47/155 19-ANT 244 01, ALM interwork description.

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20.3

SW and HW information

The HW supports the following function, but there is no system support yet.

The function provides a printout of base station equipment.

Lists can potentially be produced on MSC, site or device level.

The printout contain information about:

- SITE
- CABINET_NUMBER
- POSITION_NUMBER
- HW_PRODUCT_NUMBER
- HW_REVISION
- HW_SERIAL_NUMBER
- PRODUCT_FUNCTION_CODE
- REVISION_FUNCTION_CODE
- SYSTEM_FUNCTION_CODE
- SW_PRODUCT_NUMBER
- SW_REVISION

21

References

- [1]. 10/1056-ANT 244 01 EMC Requirements
- [2]. 1/1531-ANT 244 02 Grounding Principles
- [3]. 11/1056-ANT 244 01 Environment Requirements
- [4]. 12/1056-ANT 244 01 Safety Requirements
- [5]. 10/10260-ANT 244 01 Product characteristics
Indicators, marking and
numbering.
- [6]. 14/10260-ANT 244 01 Marking of field
exchangeable units
- [7]. 7/10260-ANT 244 01 Storage of information
in HW and SW

Product and function

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related info in HW and
SW and Event log.

22 Vocabulary

22.1 Abbreviations

ACC	Analog Control Channel
AFS	Air Frame Synchronization
ALM	Alarm Module
ANP	Antenna Near Part
ANPC	ANP complementary equipment Cabinet
ATC	Auto Tuned Combiner/Cavity
ATCC	ATC and CTC Cabinet
AVC	Analog Voice Channel
BFU	Battery Fuse Unit
BIC	Battery Interconnection Cabinet
BS	Base Station
COMB	Combiner
CID	Cabinet Identity switch
CLINK	Control LINK
COP	Control Part
CRI	Control and Radio Interface
CTC	Combiner Tuning Controller
DCC	Digital Control Channel
DC-CTC	Directional Coupler CTC
DCON	Data Connection board (In TCB)
DEVCB	DEVICE Control Bus
DEVSB	DEVICE Speech Bus
DP	Device Processor (A Device on the DEVCB or eq.)
DS0	One 64 kbit channel (time slot on a PCM connection)
DTC	Digital Traffic Channel
DVER	Digital verification function
EMG	Extension Module Group
EMRP	Extension Module Regional Processor
EMRPB	Extension Module Regional Processor Bus
EMRPS	EMRP Speech bus interface
ETB	Exchange Terminal Board
ETC	Exchange Terminal Central
GS	Group Selector
ICF	Inter Connection Fuse unit
LED	Light Emitting Diode
MBS	Mobile Base station Subsystem
MC	Multi Coupler
MOP	Modem Part
MSC	Mobile services Switching Center
NI	Network Interface
PCU	Power Control Unit

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PS	Power Splitter
PUC	Power Unit Cabinet
RBS	Radio Base Station
RCG	Radio Channel Group
RF	Radio Frequency
RFBP	RF Backplane (in TCB)
RFTL	Radio Frequency Test Loop
RP	Regional Processor
RSSI	Receive Signal Strength Indicator
RTT	Radio Transceiver Terminal
Rx	Radio Frequency receiver path
RXBP	Receiver Band Pass filter
SR	Signal strength receiver function
STC	Signaling Terminal Central
STR	Signaling Terminal Remote
SUP	Support Part
T1	American standard for 1.5 Mbit PCM lines
TCB	Transceiver Cabinet
TIM	Timing Module
TRA	Transcoder
TRX	Dual mode transceiver device
TSW	Time Switch
Tx	Radio Frequency transmitter path
TXBP	Transmitter Band Pass filter
VER	Verification Module
VSWR	Voltage Standing Wave Ratio

22.2 Terminology

AFS An Air Frame Synchronization signal used to synchronize all TRX:s in one RBS884.

CLINK The general communication interface within the RBS 884 base station. A 2.048 Mbit interface carrying 32 independent 64 kbit channels (DS0:s) which are always numbered 0-31.

CSU Customer Services Unit includes functions separating the transmission provider equipment from the customer equipment.

DSI

(Digital Signal level 1, 1.544 kb/s)

The metallic interface between a Carrier and a Customer installation. 4-Wire interface of 1.544 Mbit/s.

DS0

(Digital Signal level 0, 64 kb/s)

One 64 kbit channel on a T1 connection. (Also used as the name for a 64 kbit channel on a CLINK.)

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E1	The European standard for 2.048 Mbit PCM connection. Carries 32 independent 64 kbit channels (DS0:s) which are always numbered 0-31
EXT_AFS	An Air Frame Synchronization signal from an external air frame sync source.
HUB	Switching equipment acting as concentrator/distribution point for transmission lines to subordinated equipment.
RCG	Radio Cabinet Group
	A group of transceivers/combiners connected to the same receiver and transmitter antenna system and thus also using the same RFTL.
RBS884	RBS884 represents the Macro version of the RBS884 family.
STRATUM	Classification of clock characteristic in a hierarchy of clocks operating in a master slave relationship. Stratum 1 has the highest accuracy and performances.
T1	The American standard for 1.544 Mbit PCM connection. Carries 24 independent 64 kbit channels (DS0:s) which are always numbered 1-24.
+24V	+24 V is used in this document as a general term for the unregulated DC power distributed from the support part to all cabinets. The nominal voltage level is +27.2 V.

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DESCRIPTION RBS 884Abstract

This document contains a description of the RBS 884 Radio station. RBS 884 is commonly called the Macro base station.

Application

Introduction to RBS 884 (HRB 104 11).

Supplementary document

-

Approved

DQI status: Exited <13/0064-1/FCP 103 749 Uen>

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1

GENERAL

The Macro base station, RBS 884, is a product in the CMS 88 product family and belongs to the subsystem MBS (ANT 244 01). The Macro base station is designed to operate in cellular DAMPS(AMPS) systems. It is a configurable product with a variation of possibilities, features and options.

This document gives a short description of the products in the Macro base station (HRB 104 11).

The document is a complement to 8/1551-ANT 244 01 (ref 1). Functional information such as eg., control structure, RF structure, base station interfaces, basic fault handling, synchronization, co-siting, HW support for traffic functions etc., is found there.

Technical data of the Macro base station is given in the Product data document ref (15).

For a HW and SW introduction to MBS consult ref (2) and (3).

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2

MACRO BASE STATION PRODUCTS

2.1

CABINETS

The RBS 884 cabinets are based on the equipment practice for BYB 401 001.

A base station is built with 5 different types of cabinets, CRI, TCB, ANPC, ATCC, and POWD. With these, 12 standard configurations have been designed. Each configuration can be built in modular steps.

Common to all cabinets is that they have a CID unit. With this the position of the cabinet in the configuration can be set. A number indicates rack position and a letter indicates the row in the rack (see ref 16 to 21). The CID can be read from the MSC (exception the POWD-CID).

2.2

CONTROL PART PRODUCTS

2.2.1

CRI

The Control and Radio Interface (CRI) handles communication with the MSC. It is involved in radio traffic control and controls devices such as the TRX device, the CTC device etc. It has an interface to the transmission network (PCM), a time switch for setting up semi permanent paths, and an interface to the devices (CLINK). The clocks in the CRI are synchronized to the network. Incoming clocks are filtered from jitter and wander and are also used as reference frequency for the carriers.

Four variants of CRIs exist. BFE 401 74/1 Fully equipped CRI for T1, BFE 401 74/2 Half equipped CRI for T1, BFE 401 74/3 Fully equipped CRI for E1, and BFE 401 74/4 Half equipped CRI for E1. The fully equipped variants contain an ETB, an STR, an EMRP, a RITSW, 8 EMRPSs, 6 RTTs, 2 DC/DCs and an internal fan. The half equipped version contains 3 EMRPSs and 3 RTTs less. The configurations of the full and half cabinets are shown in ref. (16). (It is shown in all configuration descriptions (16) to 21).)

For more information about the CRI consult ref. (6) and the PCB product documentation. The control structure of a base station and more information on the synchronization is given in (1).

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2.2.2

MAGAZINE EXPANSION

The Expansion kit (1/BFE 401 74/1) contains 3 RTTs and 3 EMRPSs boards. With this kit a half equipped CRI can be expanded to a full.

2.2.3

SET OF MATERIALS

The EMRP Address plugs (from 1 to 9) are installed in the factory. When a second and a third CRI is installed at a site they must be replaced with new address plugs (10 to 18). The product number of the second set is NTM 201 702/1, and the product number of the third set is NTM 201 702/2.

2.2.4

ETB

The ETB/ETP (ROF 137 78 46/1) and ETB/24 (ROF 137 7892/1) are used to interface the transmission network. ETB/ETP is used for E1 and ETB/24 is used for T1.

In some configurations an additional ETB is necessary in the second CRI see ref. (7).

2.3

MODEM PART PRODUCTS

2.3.1

TCB

2.3.1.1

General

The Tranceiver cabinet (BFE 401 66/1) is produced equipped with radio backplane (PSPB), DCON, PFCON and internal fans. The cabinet is equipped with 10 W TRXs or 30 W TRXs and a PSP board at installation. Unused TRX positions must be equipped with RMUs (§2.3.3) to ensure proper cooling and EMC-shielding.

The Tranceiver cabinet (BFE 401 66/2) is used for 50 W base stations. It is identical to BFE 401 66/1 except that it has an other type of fan unit to provide increased cooling capacity.

The radio backplane in the TCB is fed with incoming received signals via PSPs from the multicouplers (MCA and MCB). (The type of PSP depends on the configuration, see §2.4.1.) Then the radio backplane splits these received signals and connects them to TRXs in the TCB. Incoming signals are connected in a similar pattern as the CLINK signals.

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TX signals are connected from each TRX front to the ATCC.

Power is connected from POWD to PFCON. It is distributed in 4 groups to TRXs in board positions (2, 3, 4, 5), (6, 7, 8, 9), (10, 11, 12, 13), and (14, 15, 16, 17).

Note that board position numbers are different from TRX slot numbers. TRX 1 in a 10 W configuration is positioned in board position 2, TRX 2 is positioned in board position 3, etc. The 30 W and 50 W TRXs are twice as wide as the 10 W TRXs i.e., they need two board positions in the TCB. TRX 1 in a 30 W and a 50 W configuration is positioned in board position 3, TRX 2 is positioned in board position 5, etc.

For more information on the TCB see ref. (8). For more information on the configurations consult ref. (16) to (21).

2.3.1.2 10 W configurations

CLINKs are connected from the RTT boards in the CRI to the DCON boards. In the 10 W configuration the signals are distributed to TRX slots in the following order (2, 6, 10, 14), (1, 5, 9, 13) and (3, 7, 11, 14).

In the designed configurations the TCB is equipped with 10 W TRXs in the following order (TRX slots) (2, 6, 10, 14), (1, 5, 9, 13) and (3, 7, 11, 15). The first TCB in a sector is equipped with measurement receivers (VER and SR). The measurement receivers are allocated in TRX slots 12 and 16. TRXs in slots 2 and 6 in the first TCB in a cell are allocated for ACC and DCCH. If T1 is used, slot 4 and 8 has to be equipped with RMUs. If E1 is used, even slot 4 and 8 can be equipped with TRXs. For further information about optimization of a PCM link for E1, see (30).

2.3.1.3 30 W configurations

CLINKs are connected from the RTT boards in the CRI to the DCON boards. In the 30 W configurations the signals are distributed to TRX slots in the following order (1, 3, 5, 7) and (2, 4, 6, 8).

In the designed configurations the TCB is equipped with 30 W TRXs in TRX slots in the following order, (1, 3, 5, 7) first and then (2, 4, 6, 8). The first TCB in a sector is equipped with measurement receivers (VER and SR). The measurement receivers are allocated in TRX slots 6 and 8. TRXs in slots 1 and 3 in the first TCB in

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a cell are allocated for ACC and DCCH. If T1 is used and it is a sectorized cell, not all of the TRX slots can be used (it depends on the size of the cell and the number of carriers). The unused slots has to be equipped with RMUs. If E1 is used, all slots can be equipped with TRXs. For further information about optimization of a PCM link for E1, see (30).

2.3.1.4 50 W configurations

The connections of CLINKS in 50 W configurations are made in the same way as in 30 W configurations.

The TCBs in the 50 W configurations are equipped in the same way as in the 30 W configurations.

2.3.2 TRX

Three variants of tranceivers are used in the Macro base stations, TRX (KRC 121 10/2), 30 W
TRX (KRC 121 10/3) and 50 W TRX (KRC 121 04/4)

The TRX can modulate/demodulate both FM and $\pi/4$ -DQPSK RF-signals. Consequently all six IS-136 channel functions can be handled by the TRX. These functions are:

- Analog voice channel (AVC)
- Analog control channel (CC)
- Signal strength receiver (SR)
- Digital traffic channel (DTC)
- Digital control channel (DCCH)
- Verification receiver (VER)

In digital traffic the TRX carrier can convey 3 DTCs or 1 DCCH and 2 DTCs. All other channel functions require one TRX per function.

The connected CLINK (2 Mbit/s) has two duplex 64 kbit/s channels (timeslots) connected. One is for control and the other is for speech. The control of the TRX is done by the EMRPS in the CRI. For more information on the TRX see (9).

2.3.3 Radio Matching Unit (RMU)

A RMU (SXK 107 4011/1) must be mounted in not used TRX slots of the cabinet. This is to ensure cooling of the TRXs in service and EMC shielding. Two RMUs are used to cover the space of 30 W and 50 W TRXs.

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2.4 ANTENNA NEAR PART PRODUCTS

2.4.1 PSP

Four different kinds of Power splitter boards (or Antenna distributors) are used in the current configurations. These are PSP 16 (KRY 121 53/1), PSP 4 (KRY 121 53/3), PSP 8/2 (KRY 121 53/6) and PSP 2/2 (KRY 121 53/5). The PSPs are all connected to two receive branches.

PSP 16 splits each branch in 4 with an approximate attenuation of 7 dB. All four outputs are connected to the PSPB in the TCB. PSP 16 is used in 10 W configurations.

PSP 4 connects 4 signals from each branch to the PSPB with an attenuator. The attenuation is 7 dB. PSP 4 is used in 10 W, 30 W and 50 W configurations.

PSP 8/2 splits each branch in 4 with an approximate attenuation of 7 dB. Two outputs are connected to the PSPB in the TCB. The other two are connected to a PSP 2/2 in another TCB. PSP 8/2 is used in 30 W and 50 W configurations.

PSP 2/2 connects 4 signals from each branch to PSPB with an approximate attenuation of 1 dB. PSP 2/2 is used in 30 W and 50 W configurations.

2.4.2 ATCC

2.4.2.1 ATCC, GENERAL

The TRX transmitter outputs are connected to the ATCs. A single RF output from the ATCC is connected to the TXBP (and MCU), which in the 10 W and 30 W combiner versions is located in the ANPC, and then to the antenna. In the 50 W versions the RF output is connected to the TXBP (and MCU), which in this case is located in the ATCC, and then to the antenna.

The ATCs are controlled by the CTC which is controlled by the system through the CRI. A CLINK is connected from an RTT to the CTC. Forward power is measured with the DC-CTC and are used by the CTC to tune the combiners. Tuning time at a frequency change is between 2 and 3 seconds.

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2.4.2.2 ATCC 10 W and 30 W

Four versions of AutoTuned Combiner Cabinets exist for the 10 and 30 W configurations. Two of them, ATCC1 (BFE 401 017/1) and ATCC2 (BFE 401 019/1), are old versions and are not orderable any more. The two new versions are ATCC1 (BFE 401 058/1) and ATCC2 (BFE 401 059/1).

An ATCC1 is delivered with an ATC-quad, a CTC, a DC-CTC, and a fan. The ATC quad consists of 4 ceramic combiners assembled together. The combiner is designed for a maximum input power of 30 W (44.8 dBm) and a minimum channel spacing of 270 kHz. The ATCC can house 3 ATC quads. Hence two additional quads can be installed.

The ATCC2 is similar to an ATCC1 but does not contain a DC-CTC. Only one DC-CTC is used per TX antenna.

Two cabinets are connected together side by side. The combiner outputs are connected together in a T-junction before the DC-CTC in ATCC1.

For more information see ref. (10), (11), (28) and (29).

2.4.2.3 ATCC, 50 W

Three versions of Autotuned combiner cabinets exist for the 50 W configuration, ATCC1 (BFE 401 050/1), ATCC2 (BFE 401 050/2) and ATCC3 (BFE 401 052/1).

A basic ATCC1 is delivered with an ATC-quad, one CTC and a TXBP (including the MCU). The ATC-quad consists of 4 ceramic combiners assembled together. The combiner is designed for a maximum input power of 56 W (47.5 dBm) and a minimum channel spacing of 270 kHz. 8 carriers can be connected to a fully equipped ATCC1. ATCC1 contains maximum one CTCs which can control 16 combiner filters and one TXBP.

A basic ATCC2 is delivered with an ATC-quad and one CTC. 12 carriers can be connected to a fully equipped ATCC2. ATCC2 contains maximum one CTC which can control 16 combiner filters.

ATCC1 and ATCC2 are connected together side by side. The combiner outputs are connected together with a jumper before the TXBP in ATCC1.

A basic ATCC3 is delivered with one ATC-quad, one CTC and one TXBP. 32 carriers can be connected to a fully equipped ATCC3. ATCC3 contains maximum two CTCs which can control 16 combiner filters. The ATCC3 is pre-cabled for 32 carriers at delivery.

		DESCRIPTION		10
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ATCC3 is required for base stations with more than 20 carriers and recommended if the initial installation of the base station exceeds or equals 16 carriers.

For more information see ref. (23) and (24).

2.4.3 EXTENSION KIT ATCC

2.4.3.1 Extension kit 10 W and 30 W

The extension kit (BFZ 101 19/1) for the old version of the combiners consists of an ATC-quad and two short U-links. The ATC-quad is installed in the ATCC.

The extension kit (BFZ 101 32) consists of an ATC-quad and two short U-links. The ATC-quad is installed in the ATCC.

For information on installation procedures consult (12).

2.4.3.2 Extension kit 50 W

The extension kit (BFZ 101 32) consists of an ATC-quad and two short U-links. The ATC-quad is installed in the ATCC.

The extension kit (BFZ 101 31) consists of a CTC and cabling. The CTC is installed in the ATCC.

For information on installation procedures consult (12).

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2.4.4 ANPC

2.4.4.1 ANPC, GENERAL

There are five versions of the ANP complimentary equipment cabinet. For the 10 W and 30 W configurations they are ANPC1 (BFE 401 022/1), ANPC2 (BFE 401 023/1) and ANPC3 (BFE 401 022/2) and for the 50 W configuration they are ANPC1 (BFE 401 037/1) and ANPC2 (BFE 401 038/1).

2.4.4.1.1 ANPC Rx path

The Rx inputs to the ANPC are connected to the antenna feeders. The received signal is first filtered in the Receiver bandpass filter (RXBP). The RXBP filters the signal in the AMPS receive band (824 MHz to 849 MHz). Then it is amplified in the multicoupler (MCA and MCB, one for each bransch). From the multicoupler output it is connected to the PSPs in the TCB. The multicoupler has capacity to feed 4 PSPs.

The optional RFTL is connected to each multicoupler and can generate a signal to be received by each TRX. The purpose is test and calibration.

2.4.4.1.2 ANPC Tx path

The Tx input is connected from the ATCC output. The TXBP in the Tx bransch attenuates out of band emission (869-894 MHz). After this filtering the Tx signal is connected to the Measuring Coupler Unit (MCU). The output from the MCU is connected to the antenna feeder. The MCU gives the reflected and the forward power. The MCU has different outputs for 10 W (-42 dB), 30 W (-47 dB) and 50 W (-47 dB) operation. The outputs are connected to the RFTL (the optional RFTL measures the reflected and the forward power given by the MCU). An RF-instrument could possibly be connected to any of these outputs for test purposes.

TXBP and MCU are located in the ANPC only for the 10 W and 30 W configurations, in the 50 W configuration they are located in the ATCC.

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2.4.4.1.3 ANPC supervision

ANPC1, 2 and 3 are all equipped with one ALM board each. The ALM board has 16 internal alarm inputs, 32 external alarm inputs and 8 control outputs. (In the initial release of the MBS SW there is no support for the outputs.) It is controlled over the CLINK by the CRI.

ANPC1 and 3 have two reserved slots for TIM (covered with blind plates). (Synchronization with TIM will be implemented in the next release of MBS.)

2.4.4.2 ANPC, 10 W, 30 W

The ANPC for 10 W and 30 W houses units for the receive path, the transmit path, supervision of both TX and RX paths and alarm.

ANPC1 and ANPC3 *) for the 10 and 30W configurations host units for one cell, and ANPC2 hosts units for two additional cells.

Since receiver diversity is implemented in RBS 884 the ANPC1 and ANPC3 supports two Rx antennas and ANPC2 supports four Rx antennas (two Rx antennas per cell), and each receive path has one RXBP filter.

After the Rx signal has been filtered it is amplified in the Multicoupler (MCA and MCB, one for each branch) The gain is approximately 23 dB. (A 1 dB output also exists and is intended to be used when RBS 884 is cosited with RBS 882, see (1)..).

ANPC1 supports one Tx antenna, ANPC2 supports two Tx antennas (one per cell) and ANPC3 also supports two Tx antennas (but only serves one cell). Each Tx path has one TXBP filter and one MCU.

The RFTL is connected to the input of the multicouplers and to the output of the MCU, different output pairs depending on 10 W or 30 W.

The cabinet also houses a Power connection board (POC) and a fan unit.

For more information about the ANPCs for the 10 W and 30 W configurations consult (13).

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*) The ANPC3 is an ANPC1 complemented with one extra TXBP and one extra MCU to support two Tx antennas. This together with an extra ATCC and one extra ANPC cable makes it possible to support 32 carriers and to reduce the channel separation to less than 360 kHz. The ANPC3 is not included in any standard configuration.

2.4.4.3 ANPC, 50 W

The ANPC for 50 W houses units for the receive path, supervision of both TX and RX path, connection for TMA and alarm.

For the 50 W configurations there is one ANPC1 and one ANPC2 version. The ANPC1 for the 50W configuration hosts units for one cell, and ANPC2 hosts units for two additional cells.

Like in the 10 W and 30 W configurations receiver diversity is implemented, i.e. ANPC1 has two Rx antennas and ANPC2 has four Rx antennas, and each receive path has one RXBP filter.

After the Rx signal has been filtered it is amplified in the Multicoupler (MCA and MCB, one for each branch) The gain is automatically adjusted depending whether a TMA is used or not.

The optional RFTL is connected to the input of the multicoupler and to the output of the MCU located in the ATCC

The cabinet also houses a Power connection board (POC), a fan unit, a BIAS-T and a power unit (PO-ALNA) for the TMA.

For more information about the ANPCs for the 50 W configurations consult (25) and (26).

2.4.5 TMA

The TMA (Tower Mounted Amplifier) is an optional amplifier mounted in each RX-branch. The unit shall be mounted on the RX-antennas in the top of the antenna tower. The TMA amplifies the signal in the RX-chain down to the multicoupler input.

The TMA is designed for outdoor environments according to reference 4. The temperature range for normal operation is extended from -33 to +55 degrees Celsius.

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2.4.6 RFTL KIT

The RFTL kit (NTM/ROA 119 3156/2) is optional and is used for testing and calibration. The kit contains an RFTL board and cabling. The RFTL has four functions: RF signal looping, output power measurement, reflected power measurement and RF signal generation. Three functions are implemented in the system with the help of RFTL: Output power calibration, RSSI measurement and TX antenna supervision. (More functionality is implemented in the next MBS release.)

2.5 SUPPORT AND INTERCONNECT PART PRODUCTS

2.5.1 POWD

The Power distribution in a base station is done through the POWD (BMK 505 01/1). The distribution cabinet contains 32 (20 A) circuit breakers (current limitations see (7)). Nominal input voltage level from a rectifier is 27.2 V. For more information consult (14), (15) and (12).

The Power distribution in the 50 W base station is done through the POWD (BMK 505 01/3). This distribution cabinet contains 32 (30 A) circuit breakers.

2.5.2 BASE SET

The Base set (NTM 201 298) contains a base frame and a top cover. A rack of cabinets is mounted on the Base frame. The top cover is mounted on top of the top cabinet in a rack.

2.5.3 SIDE COVER KIT

The side cover kit (NTM 201 674/1) is used to cover a cabinet side. Only the cabinets at the far left and far right in a configuration are covered. In all six configurations 5 cabinets are stacked in a rack. Hence 10 covers are necessary.

2.5.4 EARTHQUAKE PROOF SET

The Earthquake proof set (NTM 201 680/1) is an option and is meant to be used in sites situated in earth quake risky areas. The kit stabilizes the rack and prevents to some extent the bolts in the base frame to be sheered off during a quake.

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2.5.5

CABLE SETS

Different standard cable sets are available to be used for the configurations of RBS 884. The main sets NTM 201 686 consists of three kits, one RF cable kit, one CLINK cable kit and one Power cable kit. If an expansion from the basic configuration is made, another RF cable kit, CLINK cable kit and Power cable kit is needed.

Following table shows how the Main cable sets fit in the different configurations.

Configuration	Suffix xxx
10 W Omni	100 to 101
10 W Two sector	200 to 202
10 W Three sector	300 to 304
30 W Omni	400 to 403
30 W Two sector	500 to 505
30 W Three sector	600 to 605
50 W Omni	700 to 707
50 W Two sector	800 to 814
50 W Three sector	900 to 915

Table 1. Product suffix numbers (NTM 201 686/xxx).

For more information about cabling consult (12).

2.6

RBS 884 MACRO USER LIBRARY

The User library (LXF 102 20) is an orderable product. Three manuals are included a Site engineering manual, an Installation and maintenance manual (ref. 12) and a Parts catalog.

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3

INTERCONNECTION BASICS

3.1

CLINK

CLINKs are used to connect device equipment such as TRXs and CTCs to the RTT boards in the CRI.

CLINKs for TCBs are grouped in 4 CLINKs per cable. In 10 W configurations 4 cables per TCB cabinet are necessary to connect all 16 positions. In 30 W configurations 2 cables per TCB are used to connect all 8 positions.

CLINK cables with one CLINK per cable are used to connect ANP parts.

Detailed information about how the CLINKs are connected in the different configurations are given in (16) to (21). For more information on the CLINK interface consult ref. (22).

3.2

RECEIVE PATH

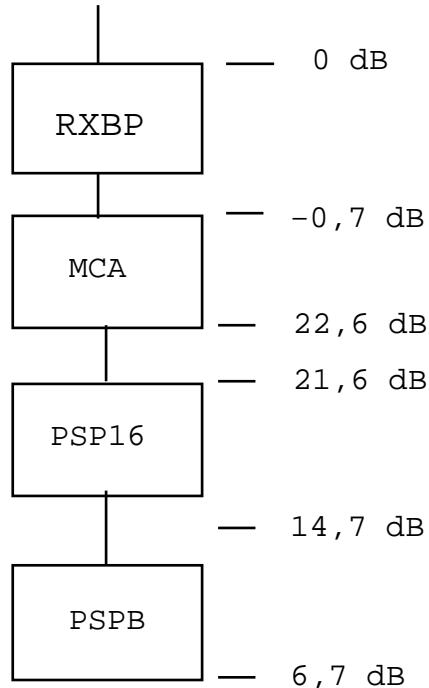
The antennas are connected to the RXBPs in the ANPC. From the RXBPs the receive path is connected to the multicoupler (MCA and MCB) inputs and then from the multicoupler outputs to PSPs in TCBs. In 30 W configurations connections between PSP 8/2 and PSP 2/2 are done. In 50 W configurations connections between PSP 8/2, PSP4 and PSP 2/2 are also done. The RX path is finally connected to the TRXs through the RF backplane (PSPB).

Nominal gain through the chain is between 5 and 7 dB. (Lower gain in TCB with PSP 2/2). The noise figure of the base station is approximately 2 dB lower than for the TRX stand alone. The intercept point is consequently also lower.

Typical RF budgets for the different types of RX paths in 10 W, 30 W and 50 W configurations are given in figure 1, 2 and 3.

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ANTENNA PORT

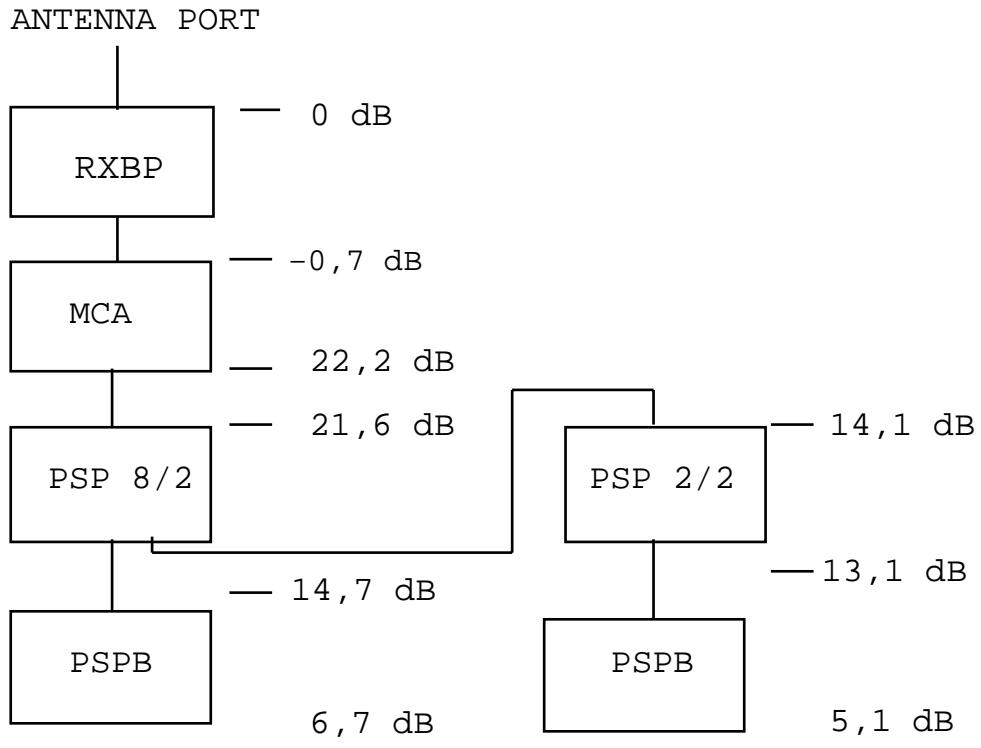


10 W CONFIGURATION (WITHOUT TMA)

Fig. 1: Typical RF level budget for 10 W configuration

(without TMA).

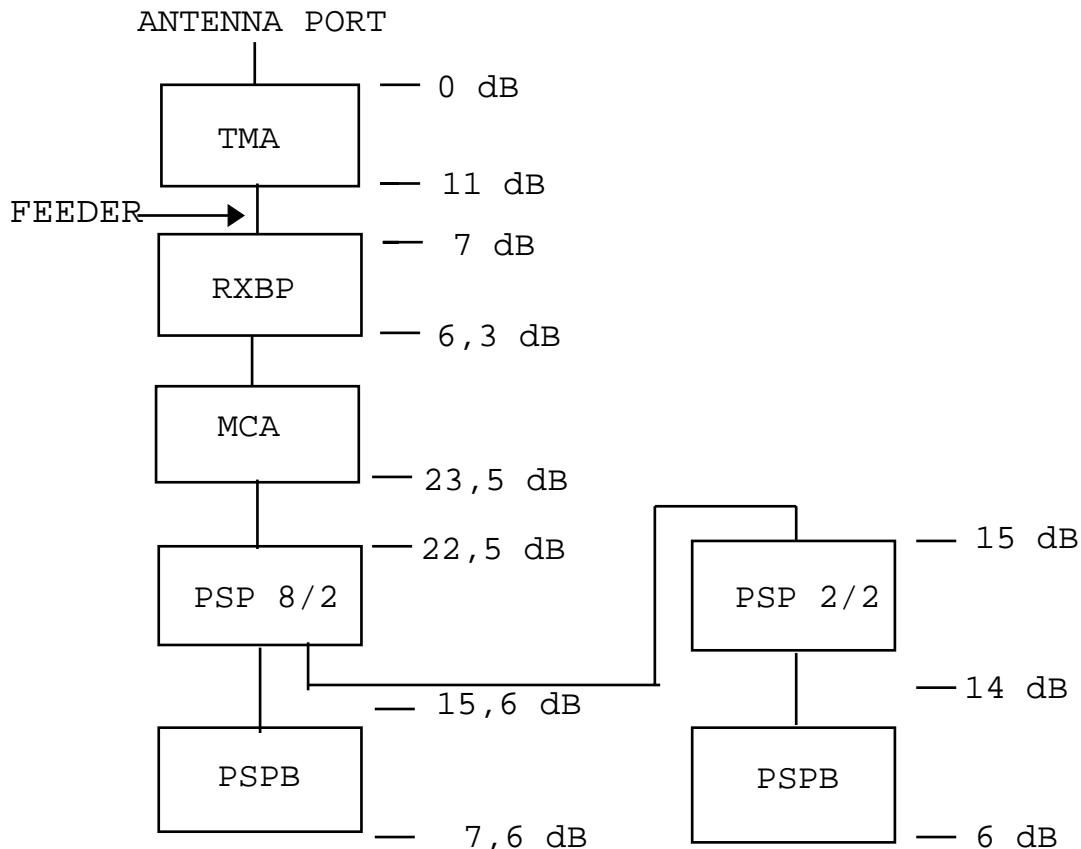
Uppgjord - Prepared ERA/AR/SK ERAAFOL	Faktaansvarig - Subject responsible	Nr - No 1551-HRB 104 11 Uen
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30 W AND 50 W (WITHOUT TMA) CONFIGURATION

Fig. 2: Typical RF level budget for 30 W and 50 W configuration (without TMA).

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50 W CONFIGURATION WITH TMA

Fig. 3: Typical RF level budget for 50 W configuration (with TMA).

3.3 TRANSMIT PATH

A transmit path is connected from the front of the TRX to a combiner in an ATCC. Each combined TX signal is connected to an ANPC that is connected to a TX antenna.

Typical attenuation from a TRX output to the antenna output in the TX path is between 3 and 5 dB. The attenuation varies with the number of TRXs connected, the combiner type and the channel frequency separation. An RF budget is given in the figure 2 below.

Uppgjord - Prepared ERA/AR/SK ERAAFOL	Faktaansvarig - Subject responsible	Nr - No 1551-HRB 104 11 Uen
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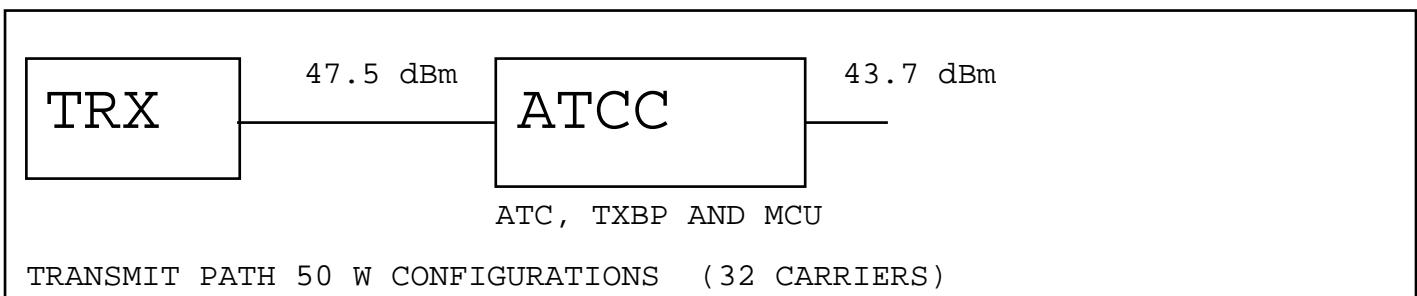
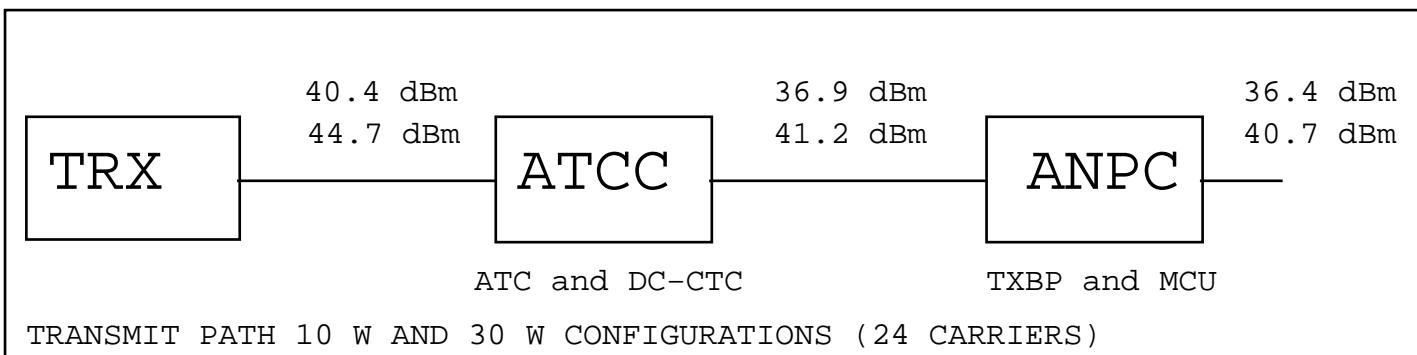


Figure 4: Typical RF budget in RBS 884.

3.4 POWER

Power is distributed from POWD. Most cabinets are connected with two cables per cabinet. An exemption is the TCB cabinet which is connected with 4 cables per cabinet. Distribution losses to cabinets are typically less than 1 V.

A rectifier is not included in HRB 104 11 but is required.

3.5 EXTERNAL INTERFACES

Consult (1).

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4

CONFIGURATIONS

Twelve types of configurations of the RBS 884 Macro base station has been designed. These are 10 W Omni site, 10 W two sector site, 10 W three sector site, ditto 30 W and ditto 50 W (with ATCC1/ATCC2 or ATCC3). All are shown in figure 5 and 6 on the next pages.

The cabinet layouts are all maximum five cabinets high. TCBs and ATCCs are to some extent located in a one-row-per-cell pattern. Only POWD and CRI are located in the top row (row E) in the configurations.

The TCB cabinet is split between two or three sectors in some locations in order to reduce the empty space as much as possible. A suitable PSP must be selected for each TCB as indicated in figure 5.

The maximum configuration can be reached in a number of expansion steps each one including 4 carriers per cell. (Expansions of less than 4 carriers is possible.) This is described in the configuration descriptions ref (16) to (21). (All these documents are not released yet. Please, consult 1095-HRB 104 11)

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TRX 10 W. 3 * 24 CARRIERS. STACKED CELLS					
POWD	POWD	POWD	POWD	POWD	POWD
CR1	CR1	CR1	CR1	CR1	CR1
ANPC1	ANPC1	ANPC1	ANPC1	ANPC1	ANPC1
ATCC	ATCC	ATCC	ATCC	ATCC	ATCC
TCB	TCB	TCB	TCB	TCB	TCB
Note: TCB a: PSP16, TCB b: PSP4					

TRX 10 W. 2 * 24 CARRIERS. STACKED CELLS					
POWD	POWD	POWD	POWD	POWD	POWD
CR1	CR1	CR1	CR1	CR1	CR1
ANPC1	ANPC1	ANPC1	ANPC1	ANPC1	ANPC1
ATCC	ATCC	ATCC	ATCC	ATCC	ATCC
TCB	TCB	TCB	TCB	TCB	TCB
Note: TCB a: PSP16, TCB b: PSP4					

TRX 30 W. 3 * 24 CARRIERS. STACKED CELLS					
POWD	POWD	POWD	POWD	POWD	POWD
CR1	CR1	CR1	CR1	CR1	CR1
ANPC1	ANPC1	ANPC1	ANPC1	ANPC1	ANPC1
ATCC	ATCC	ATCC	ATCC	ATCC	ATCC
TCB	TCB	TCB	TCB	TCB	TCB
Note: TCB a: PSP8/2, TCB b: PSP2/2					

TRX 30 W. 2 * 24 CARRIERS. OMNICELL					
POWD	POWD	POWD	POWD	POWD	POWD
CR1	TCB b	TCB c	TCB c	TCB c	TCB c
ANPC1	ANPC1	ANPC1	ANPC1	ANPC1	ANPC1
ATCC	ATCC	ATCC	ATCC	ATCC	ATCC
TCB a	TCB a	TCB a	TCB a	TCB a	TCB a
Note: TCB a: PSP8/2, TCB b: PSP2/2					

Figure 5: Cabinet layouts for 24 carriers per cell
10 W and 30 W configurations.

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TRX 50W. 1*20 carriers with ATCC1 and ATCC2.		TRX 50W. 1*32 carriers with ATCC1 and ATCC3.		TRX 50W. 2*20 carriers with ATCC1 and ATCC2.		TRX 50W. 2*32 carriers with ATCC3.	
POWD	TCBd	POWDa	CRIb	POWDa	TCB g	TCB h	POWDb
CRI	ANPC1	CRIa	TCBc	TCBe	ANPC1a	CRI a	ANPC1b
ANPC	TCBc	TCBc	ANPC1b	ANPC1a	TCBd	TCB e	TCB f
ATCC1	ATCC2	ATCC3	TCBa	ATCC1a	ATCC2a	TCB c	ATCC3b
TCBa	TCBb	TCBa	TCBb	ATCC1b	ATCC2b	TCB a	TCB b
TCBc	TCBe	TCBa	TCBb	TCBf	TCB k	TCB b	TCB n

TRX 50W. 3*20 carriers with ATCC1 and ATCC2.		TRX 50W. 3*32 carriers with ATCC3.	
POWDa	CRI a	POWDb	CRI c
ANPC1	ANPC2	CRI b	POWDa
TCB a	ATCCa	ATCC2a	TCB n
TCB e	ATCC b	ATCC1b	TCB h
TCB d	TCB c	ATCC1c	ATCC2c
		TCB f	TCB g
		TCB a	TCB b
		TCB q	TCB k
			TCB e
			TCB d
			TCB f
			ATCC3b
			ATCC3c
			ATCC3b
			TCB f
			TCB c

Figure 6: Cabinet layouts for 50 W TRX, 32 carriers per cell

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5

ACRONYMS AND ABBREVIATIONS

AMPS	Advanced mobile phone system
ANP	Antenna near part
ANPC	ANP complimentary equipment cabinet
AVC	Analog voice channel
ATCC	Autotuned combiner cabinet
CC	Control channel (IS-54)
CID	Cabinet (position) identity switch
CLINK	Control link
CRI	Control and radio interface
CSU	Customer service unit
CTC	Combiner tuning controller
DAMPS	Digital AMPS
DC-CTC	Direction coupler for the CTC
DCCH	Digital control channel
DCON	CLINK connection board (TCB)
DTC	Digital traffic channel
$\pi/4$ -DQPSK	Differential quadrature phase shift keying
E1	32 channel PCM
EMC	Electromagnetic compatibility
EMRP	Extension module regional processor
EMRPS	EMRP with DEVSB
ETB	Exchange terminal board
FM	Frequency modulation
MBS	Subsystem Mobile base station (ANT 244 01)
MCA	Multicoupler (branch A)
MCB	Multicoupler (branch B)
MCU	Measuring coupler unit
MSC	Mobile services switching center
PCB	Printed circuit board
PCM	Pulse code modulation
PFCON	Power connection board (TCB)
PO-ALNA	Power connection board, TMA
POC	Power connection board (ANPC)
POWD	Power distribution
PSP	Power splitter
PSPB	Power splitter (radio) backplane
RITSW	Radio interface time switch
RFTL	Radio frequency test loop
RMU	Radio Matching Unit (dummy)
RTT	Radio transceiver terminal
RXBP	Receive band pass filter
SR	Signal strength receiver
STR	Signaling terminal regional
SW	Software
T1	24 channel PCM
TCB	Tranceiver cabinet
TIM	Timing module
TMA	Tower Mounted Amplifier
TRX	Transceiver
TXBP	Transmit bandpass filter
VER	MS verification receiver

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REVISION INFORMATION

A --> B: <ERAAFOL>

This revision is updated for the 50 W RBS 884 after technical review, ref. (27). Some of the major changes follow below.

- §2.3.1 Updated the TRX allocations in the TCBs.
- §2.4.2 Updated the ATCC information.
- §2.4.4 Updated the ANPC information and added information about ANPC3.
- §3.2 Updated figure 2 and 3.
- §3.3 Updated figure 4.

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LIB - LINE INTERFACE BOARD

ROF 137 8406

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1**GENERAL**

The Line Interface Board, LIB, interfaces between 8 analogue subscriber lines and a digital switching network.

The LIB is a part of the AXE subsystem SSS
(Subscriber Switching Subsystem)

LIB implements the following functions for 8 subscribers:

- Current feed of the subscriber line (2x300 ohms and 2x400 ohms).
- Off- and onhook detection.
- Polarity reversal of current feed.
- Ring signal sending.
- Ring trip.
- Subscriber line and line circuit test possibility.
- Overvoltage protection.
- 2/4 wire conversion.
- A/D and D/A conversion including filtering.
- Common control bus interface.
- Common speech bus interface.

1.1**Indexes**

The index of a board defines the relative sending and receiving levels, the current feeding resistance and the input impedance.

Table 1 shows the relation between index, levels, current feeding and input impedance.

Table 1: Index of LIB8

Variant	Transmit level (dBr)	Receive level (dBr)	Current feed. resistance	Input impedance
ROF 137 8406/1	0	-7.0	2 x 400 ohms	600 ohms
ROF 137 8406/2	0	-6.0	2 x 400 ohms	600 ohms
ROF 137 8406/3	0	-4.0	2 x 400 ohms	600 ohms
ROF 137 8406/11	0	-7.0	2 x 300 ohms	600 ohms
ROF 137 8406/12	0	-6.0	2 x 300 ohms	600 ohms
ROF 137 8406/13	0	-4.0	2 x 300 ohms	600 ohms
ROF 137 8406/21	0	-7.0	2 x 300 ohms	900 ohms

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2 FUNCTIONAL DESCRIPTION

2.1 Current feed

At nominal battery voltage i.e. -48 V, the LIB8 could be used for lines with loop resistance up to about 1800 ohms if decadic impulsing (60/40 ms), is used.

(A cable of 0.4 mm diameter, twisted pair, has a nominal loop resistance of 278 ohms/km)

If tone signalling (DTMF) is used, the line lenght could be somewhat extended.

As a rule, the loop resistance should not exceed 2500 ohms.

The maximum loop resistance could however be limited for other reasons, e.g. by the type of telephone set used or particular requirements on the line current specified by the local administration.

2.2 Signalling

The LIB performs the following signalling functions:

DC-signalling:

- Loop detection
- Reception of digits with decadic impulsing
- Polarity reversal

Ring signalling:

- Ring signal superimposed on battery, -48V
- Ringtrip detection

Tone signalling:

- Transmission and reception of DTMF-signals.

2.3 Transmission

Relative level:

The relative levels in transmit and receive direction are defined by the index of a board. Table 1 shows the relation between index and levels.

Input impedance:

The input impedance is for index .../1,2,3,11,12,13 600 ohms resistive. For index .../21 the input impedance is 900 ohms resistive.

Balance impedance:

The balance impedance is a complex three element circuit. The impedance is shown in figure 4.

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2.4 Testing

With a test relay, the line circuit and the subscriber line can be connected to central testing equipment through a test bus.

2.5 Overvoltage protection

The LIB's are protected by means of PTC-resistors (Positive Temperature-Coefficient), VDR's (Voltage Dependent Resistor) and zener-diodes.

The zener-diodes protect the low voltage part of the circuit against transients, mainly caused by lightning.

The VDR lowers the strain on the transformer and the components behind the transformer, in case of transversal (metallic) overvoltages, especially of transient nature.

The PTC's act as resettable fuses that increase their resistance strongly when heated up by an overcurrent. The power dissipation on the board is thereby limited to a safe level.

When the overcurrent has disappeared, the PTC will cool down and return to its normal low-ohmic state. Thus no manual intervention is necessary to restore the line, as would be the case in a fuse-protected system.

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3

REALISATION

A block diagram of the LIB is shown in figure 1.

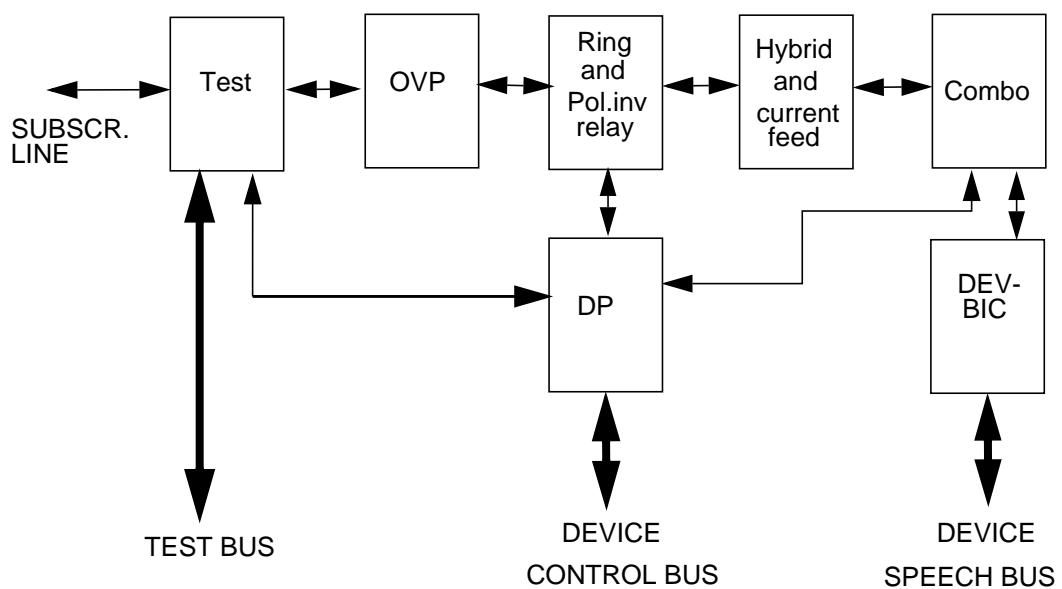


Figure 1. Block diagram (only one of two DP and DEVBIC are shown)

Description of the different blocks in fig 1:

OVP:

Overvoltage protection network is shown in fig 2

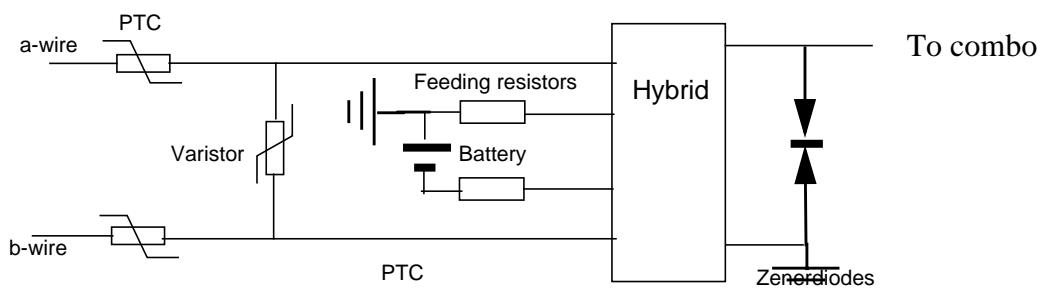


Figure 2. Overvoltage protection

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RELAYS:

- Test relay for connection to test bus.
- Ring relay for connection to ring generator.
- Polarity inversion of battery.

HYBRID AND CURRENT FEEDING:

The 2/4 - wire hybrid consists of an E-type iron core transformer.

A simplified circuit diagram of the hybrid is shown in figure 3.

The balance network (transformed to the line-side of the transformer) is shown in figure 4.

Resistors are used to feed the subscriber line through the hybrid transformer.

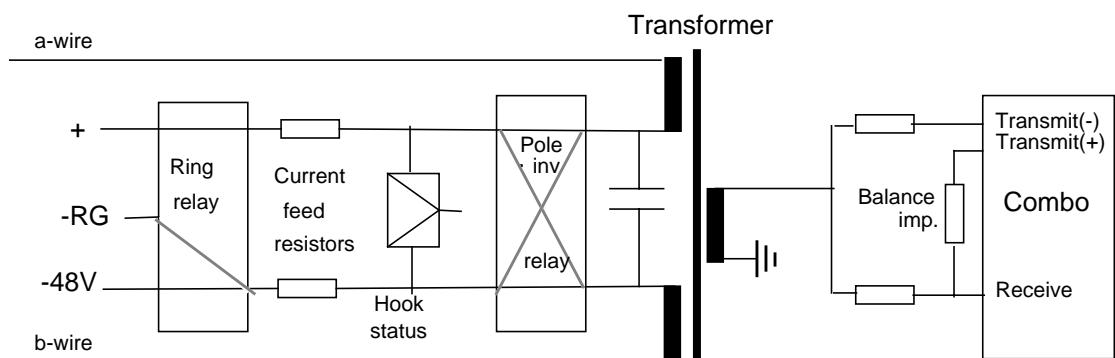


Figure 3. Transformer SLIC, simplified diagram.

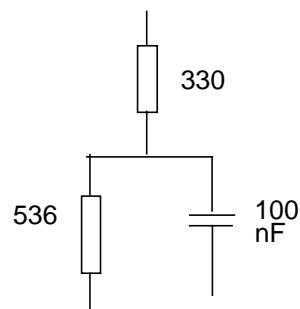


Figure 4. Balance network (standardized values at the transformers line-side)

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COMBO:

The combo performs the A/D and D/A conversion and filtering for the speech signal.

It also codes the speech signal to A-law, PCM-code.

The input and output relative levels are set by gain setting resistors at the analog input and output of the combo.

DEVBIC:

The Device Bus Interface Circuit links the low speed PCM speech bus (2Mb/s) on the board to the high speed speech bus, DEVSB (12Mb/s), in the magazine.

The board is equipped with two DEVBIC circuits, each connecting four lines to the DEVSB.

DP:

The board is equipped with two Device Processors.

Each processor controls and supervises four lines on the board and communicates with master software via the Device Control Bus DEVCB. The subscriber hook states, including dial pulses, are detected by the DP through precision resistor networks and comparators.

The hook states during ringing are detected the same way by software integration and filtering of the comparator outputs.

Ring tripping is done autonomously.

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4**TECHNICAL DATA****4.1****Current feed**

The current feed of LIB8 is 2x400 ohms (indexes 1-3) or 2x300 ohms (indexes 11-13 and 21) resistive as shown in figure 3.

The characteristic is linear, but if the current exceeds 100 mA e.g. due to a short circuit close to the MDF, the PTC resistors start to limit the current. This will keep the heat generation on a safe level.

4.2**Signalling**

Subscriber loop signalling is performed according to:

1/1914 - ANS 13101

2/1914 - ANS 13101

1/1914 - ANS 13301

2/1914 - ANS 13301

4.2.1**DC signalling**

Loop detection:

The threshold for detecting a transition on hook -> off hook, is a loop resistance < 4200 ohms, and a transition off hook -> on hook, a loop resistance > 4200 ohms for indexes 1-3.

For indexes 11-13 and 21 the threshold is 4000 ohms.

The line current for which the transition occurs is about 10 mA for all indexes. However, if the loop resistance should be close to the thresholds, the detector would be sensitive to disturbances on the line and therefore the maximum loop resistance should not exceed 2500 ohms.

The loop detector output is filtered in the device processor before the changes are reported to the EMRP (Extension Module Regional Processor).

The filter time is programmable. Default is 5 ms.

Decadic impulsing:

No digit analysis is done by the device processor during decadic impulsing. Only changes in hookstate, filtered as described above, are reported to EMRP. The performance for decadic impulsing depends upon the subscriber equipment, the characteristic of the subscriber line and the filtering time. As a rule, the decadic impulsing could be used in subscriber loops with a loop resistance < 1800 ohms.

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Polarity reversal:

Polarity reversal of the current feed is done by means of a relay, controlled by the device processor.

4.2.2

Ring signalling

The ring signal is received from a central ring generator which, via the ring relay and feeding resistors, feeds the subscriber line with ring signal superimposed on the battery voltage -48V.

The ring voltage and frequency are determined by the ring generator, commonly 70V - 105V rms, 25 Hz.

The ring cadence is determined by the central software.

The hook status during ringing is supervised by the loop detector of which the output is oscillating at the frequency of the ring voltage.

The time ratio, output high/output low, is dependent of the hook status and by time measurements in the device processor an hook off will be detected.

The ring trip is performed autonomously when the conditions are fulfilled.

To avoid false ring trip, the detector output is filtered i.e. after a change, it must be stable for a certain time, before the change is recognized.

The filtering time as well as the time ratio are programmable i.e. set by central software. Default values are:

Ringtrip time high 20.5 ms

Ringtrip time low 20.0 ms

Testpoint filtering time 5.0 ms

See 4.2.4 Signalling between EMRP and LIB for more details.

4.2.3

Tone signalling

DTMF signalling:

The LIB board does not generate or detect DTMF signals.

The tones are sent through the normal transmission path.

Generation and detection of DTMF must be done in central equipment.

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4.2.4 Signalling between EMRP and LIB

EMRP -> DP:

SIGNAL NO.	NAME	DATA
DEC	HEX	
0	00	DEVPIDREQUACK
1	01	ECHO
1	01	ECHO1
2	02	SUBCON
3	03	SUBDECON
4	04	UPDATE
5	05	IDLELI
6	06	RINGON
7	07	RINGOFF
8	08	POLINVON
9	09	POLINVOFF
10	0A	TESTACCON
11	0B	TESTACCOFF
12	0C	COMBOON
13	0D	COMBOOFF
//	//	GO AHEAD
		80+id

id = DP no.

00 - 7F

0i = ind no.

00 - 03

cs = checksum

d1 = ring relay

00 = released

01 = operated

d2 = polinv. relay

00 = released

01 = operated

d3 = test relay

00 = released

01 = operated

d4 = test point (tp)

00 = on hook

01 = off hook

d5 = order code (tp value)

00 = send off

01 = send on

d6 = combo status

00 = power off

01 = power on

d7 = ringtrip time high

in 0.5 ms step

d8 = ringtrip time low

in 0.5 ms step

d9 = tp filtering time

in 0.5 ms step

Description of DATA (Byte 1-4) :

Byte 1 = (id) Device processor number

Byte 2 = Number of bytes in message

Byte 3 = Signal number

Byte 4 = Individual (circuit) number

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DP -> EMRP:

SIGNAL NO.		NAME	DATA
DEC	HEX		
1	01	ECHOR	id,07,01,0i,d1,d2,cs
2	02	ONHOOK	id,06,02,0i,d3,cs
3	03	OFFHOOK	id,06,03,0i,d3,cs
41	29	ECHOR1	id,09,29,0i,d1,d2,d4,d5,cs
65	41	DEVPIDREQ	FF,05,41,00,46

id = DP no. 00 - 7F

0i = ind no. 00 - 03

cs = checksum

d1 = no. of checksum faults

d_2 = no. of identity faults

d3 = time for change

d4 = type of line card LIB-5, LIB-7 and LIB8= 00

d5 = value of testpoint according to:

d5 MSB 0 0 0 0 b₃ b₂ b₁ b₀ LSB

$b_i = 0$ Channel no. (i) in state HOOK ON

$b_i = 1$ Channel no. (i) in state HOOK OFF

Description of DATA (Byte 1-4):

Byte 1 = (id) Device processor num

Byte 2 = Number of bytes in message

Byte 3 = Signal number

Byte 4 = Individual (circ)

4.3

Transmission

This section describes the typical transmission performance for signals passing through the analogue 2 wire interface and the digital 4 wire interface of the LIB board.

This is defined as the Z-interface in the ITU-T Rec Q.551.

The performance is described by measurements on half-channels, using the terms input and output connection, as defined in ITU-T Rec Q.551.

The performance for connections through an exchange involving two analogue interfaces can be determined by suitably combining the values for the various parameters.

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4.3.1

Levels

The nominal input and output relative level of the LIB8 is defined by its index.

Table 1 shows the relation between index and relative levels.

4.3.1.1

Tolerances of relative levels

The difference between the actual relative level and the nominal assigned relative level, which arises from design tolerances, adjustment increments, cabling etc. should lie within the following limits:

Input connection	-0.3 to +0.7 dB
Output connection	-0.7 to +0.3 dB

4.3.1.2

Short-term variation of loss with time

When a sine-wave signal at a reference frequency of 1020, +2 Hz -7 Hz and at a level of -10 dBm0 is applied to the 2-wire analogue interface of any input connection, or a digitally simulated sine-wave signal of the same characteristic is applied to the exchange test point T_i of any output connection, the level at the corresponding exchange test point T_o and the 2-wire analogue interface respectively should not vary by more than +/- 0.2 dB during any 10-minute interval of typical operation under the permitted variations in the power supply voltage and temperature.

4.3.1.3

Receive cut off

In order to reduce the risk of instability during those periods when the line circuit is not effectively terminated by the subscriber, the 4-wire loop is set to 6 dB attenuation in the output connection of the line interface during that same period.

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4.3.1.4 Variation of gain with input level

With a sine-wave signal at a frequency of 1014 Hz applied to the port of any channel at a level between -55 to +3 dBmO, the gain variation of that channel relative to the gain at an input level of -10 dBmO, lies within the limits shown in Figure 5.

Input as well as output connection.

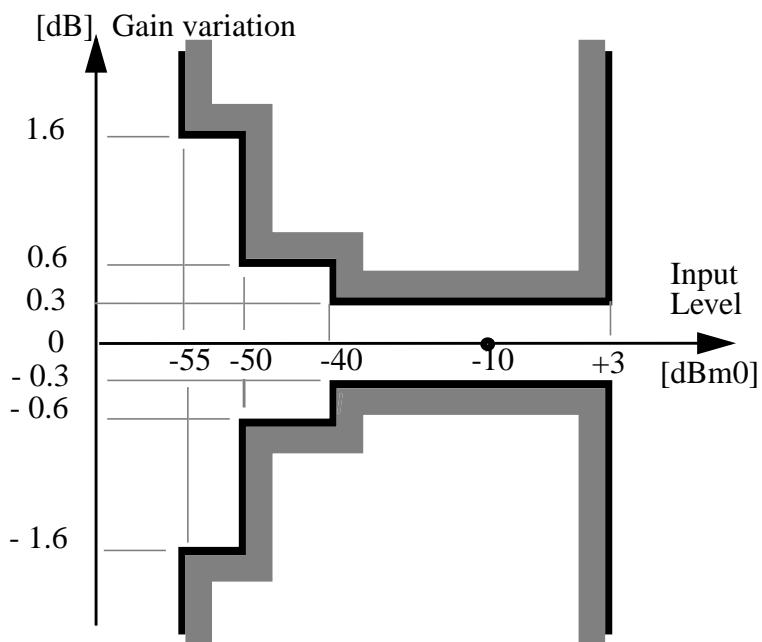


Figure 5. Variation of gain with input level.

4.3.1.5 Loss distortion with frequency

The loss distortion is expressed in terms of the loss at a specified frequency, relative to the loss at 1014 Hz, for the nominal frequency band 200 Hz to 3400 Hz.

At a nominal input level of -10 dBmO the distortion lies within the limits shown in Figure 6 for input connection and Figure 7 for output connection.

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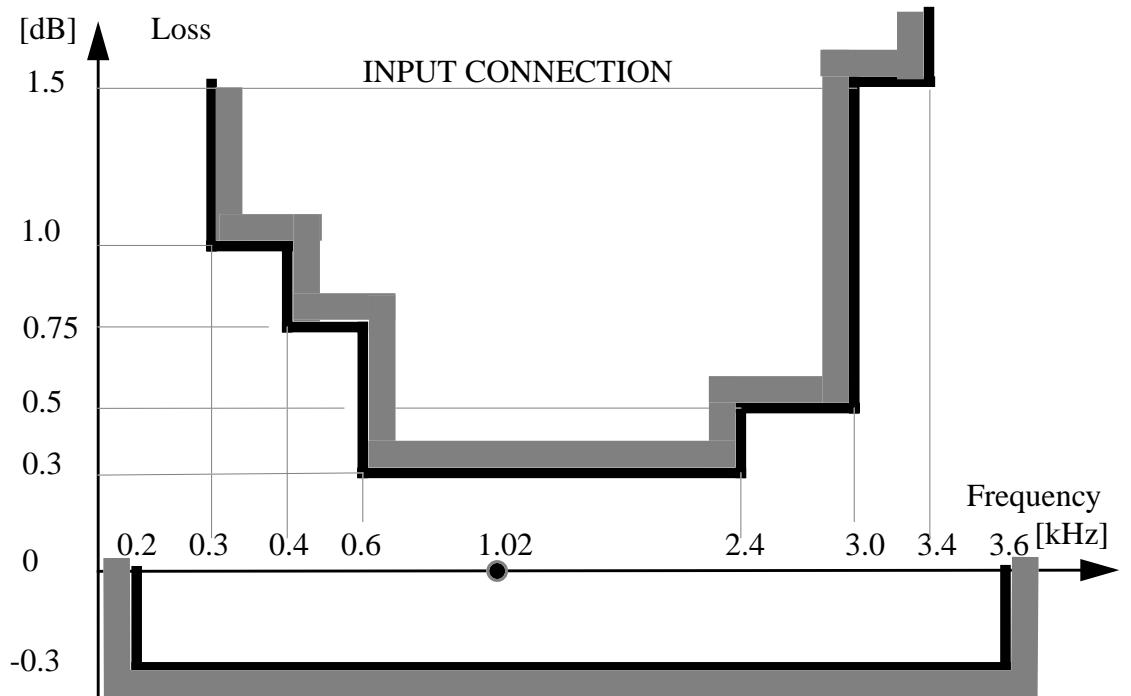


Figure 6. Loss distortion with frequency, input connection

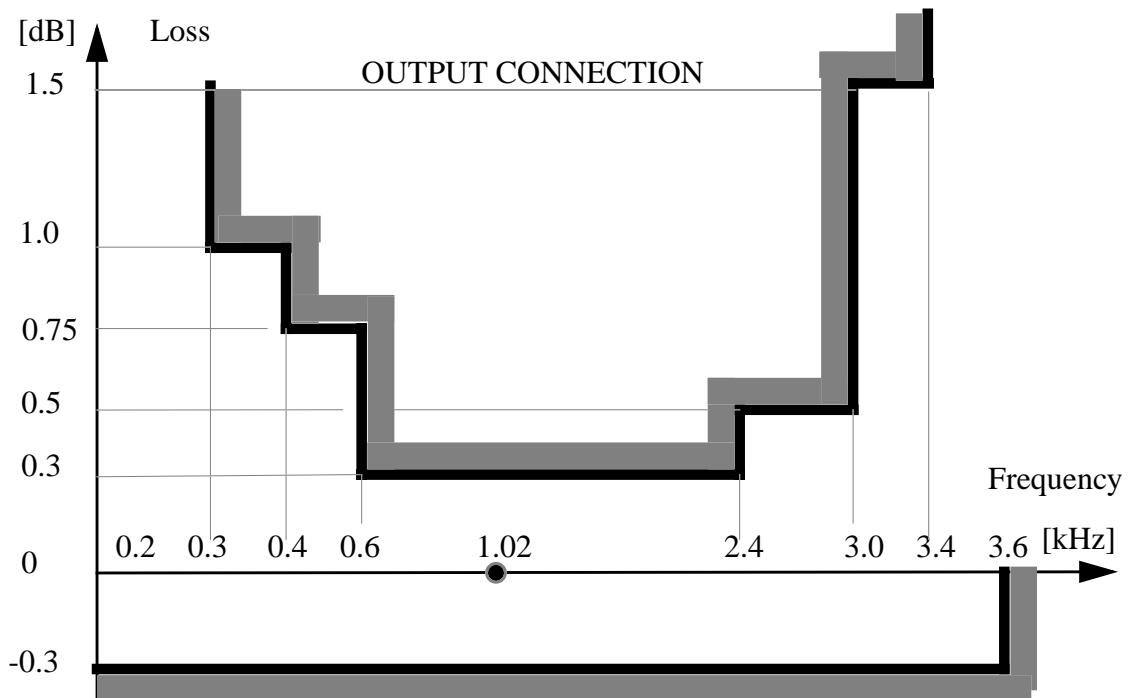


Figure 7. Loss distortion with frequency, output connection

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4.3.1.6

Group delay

The values given in this part do not include any delays due to frame aligners and time stages in the switching matrix, which will be present in a complete connection.

Absolute group delay:

The absolute group delay is defined as the group delay measured at the frequency where it has its minimum value in the band 500 to 2500 Hz. This value is below 700 us for a connection set up through one pair of line circuits.

Group delay distortion:

The group delay distortion is measured relative to the absolute group delay in the frequency band 500 to 2800 Hz.

The distortion lies within the limits shown in Figure 8.

The mask is valid for both input and output connection.

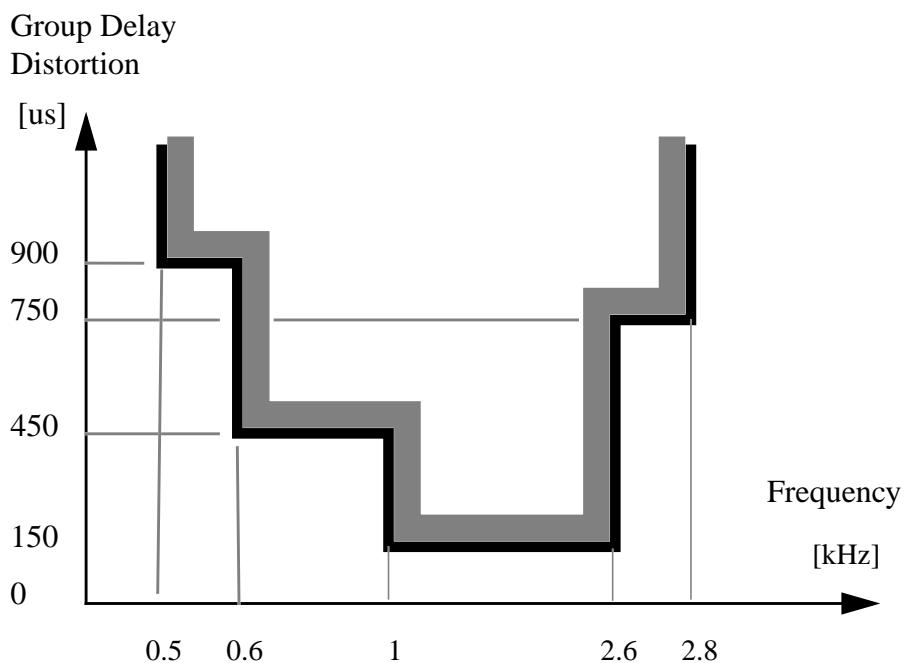


Figure 8. Group delay distortion with frequency

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4.3.2 Impedances

4.3.2.1 Input impedance

The nominal input impedance is 600 ohms for index .../1,2,3,11,12,13 and 900 ohms for index .../21.

Return loss for index 1,2,3,11,12 and 13 measured against a 600 ohms resistor is:

- > 16 dB in the frequency band 300 to 600 Hz
- > 20 dB in the frequency band 600 to 3400 Hz

For index 21, the return loss measured against a 900 ohms resistor is:

- > 14 dB in the frequency band 300 to 500 Hz
- > 18 dB in the frequency band 300 to 600 Hz
- > 14 dB in the frequency band 2000 to 3400 Hz

4.3.2.2 Impedance unbalance about earth

The longitudinal conversion loss (LCL), defined in ITU-T Rec G.117, § 4.1.3, exceeds the following minimum values, with the equipment under test in normal talking state:

Index 1,2,3,11,12,13:

- > 46 dB in the frequency band 300 to 600 Hz
- > 52 dB in the frequency band 600 to 3400 Hz

Index 21:

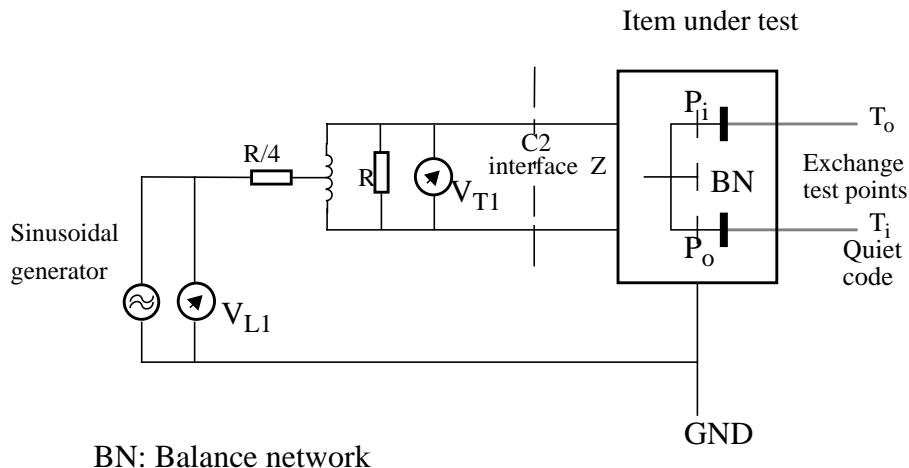
- > 40 dB in the frequency band 300 to 600 Hz
- > 46 dB in the frequency band 600 to 3400 Hz

Test method:

Longitudinal conversion loss should be measured in accordance with the principles given in Recommendation 0.121, paragraph 2.1 and 3. figure 9 shows an example of the basic measuring arrangement for digital exchanges.

Measurements of the longitudinal and transversal voltages should preferably be done with frequency-selective level meter.

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BN: Balance network

R should be in the range of 600 - 900 ohms

$$\text{Longitudinal conversion loss (LCL)} = 20 \log_{10} \left| \frac{V_{L1}}{V_{T1}} \right| \text{ dB}$$

Figure 9. Arrangement for measuring LCL

4.3.2.3

Terminal balance return loss (TBRL)

The TBRL is related to the loss a_{io} between the exchange test points T_i and T_o (see Figure 10) of a half connection as follows:

$$TBRL = a_{io}(f) - (a_o + a_i)$$

where a_o and a_i are the losses 2-wire port to T_i and T_o to 2-wire port, measured at 1020 Hz.

The balance network is shown in Figure 5.

Using an sinusoidal test signals the measured TBRL exceeds the limits shown in Figure 10 towards the actual balance test network.

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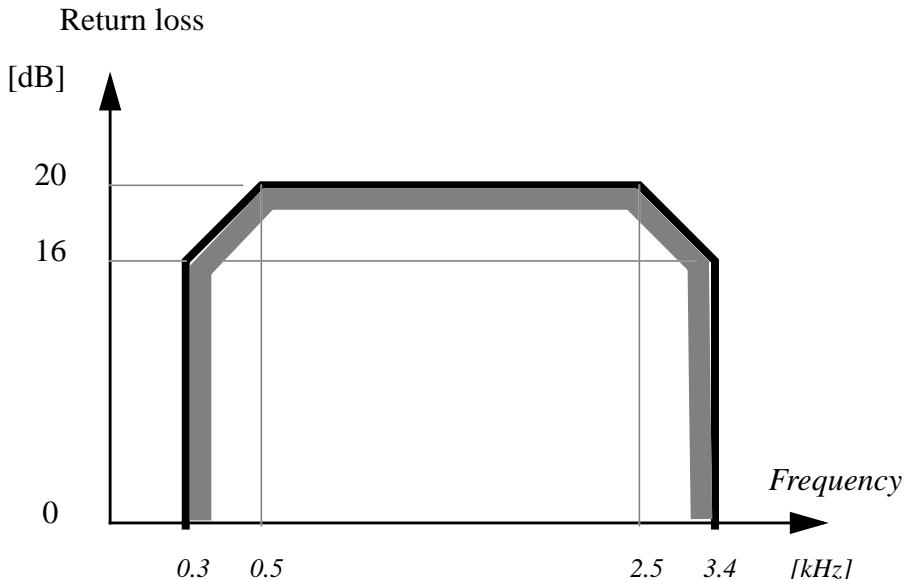


Figure 10. Limits for TBRL

4.3.3 Noise

4.3.3.1 Weighted noise

With a maximum noise level on the battery voltage of 2 mVp (psophometric weighted), in the frequency range 25Hz - 5kHz, the weighted noise (idle channel noise) is less than :

-64 dBm0p input connection

-67 dBm0p output connection

measured with an instrument in accordance with ITU-T Rec. O.41.

4.3.3.2 Unweighted noise

The level of total unweighted noise power, measured with an O.41 instrument in a 30 Hz to 3 kHz band, flat weighting, is less than -55 dBm0.

4.3.3.3 Single frequency noise

The level of any single frequency, e.g. the sampling frequency and its multiples, measured selectively is less than -50 dBm0.

4.3.3.4 Impulsive noise

With the input terminated in its nominal input impedance at the far end of a subscriber cable, the impulsive noise is less than 5 counts in 5 minutes at a threshold level of -35dBm0 as specified in ITU-T Rec. Q.45. These limits apply to the send path and the receive path separately.

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The impulsive noise counter is described in ITU-T Rec. 0.71 .

4.3.3.5

Crosstalk

For crosstalk measurement the following auxiliary signals are injected:

The quiet code into the decode input

The activation signal into the analogue side of the channel under test.

Input crosstalk:

A sine-wave test signal at the reference frequency of 1020 Hz and at a level of 0 dBm0, applied to an analogue 2-wire interface, should not produce a level in any other half connection exceeding -73 dBm0 for near-end crosstalk (NEXT) and -70 dBm0 for far-end crosstalk (FEXT).

Typical measured value -84 dBm0.

The measurement shall be carried out in accordance with ITU-T Rec. Q.552, figure 8/Q.552.

Output crosstalk:

A digitally simulated sine-wave test signal at the reference frequency of 1020 Hz, +2Hz -7Hz applied at a level of 0 dBm0 to an exchange test point T_i , should not produce a level in any other half connection exceeding

-70 dBm0 for near-end crosstalk (NEXT) and -73 dBm0 for far-end crosstalk (FEXT).

Typical measured value -84 dBm0

The measurement shall be carried out in accordance with ITU-T Rec. Q.552, figure 9/Q.552

4.3.4

Spurious effects at OUTPUT in presence of input signal

4.3.4.1

Total distortion including quantizing distortion

With a sine-wave test signal at the reference frequency of 1020 Hz (see ITU-T Recommendation 0.132) applied to the 2-wire interface of an input connection, or with a digitally simulated sine-wave signal of the same characteristic applied to the exchange test point of an output connection, the signal-to-total distortion ratio, measured at the corresponding outputs of the half connection with a proper noise weighting (see Table 4 of G.223) should lie above the limits shown in figure 11 and figure 12

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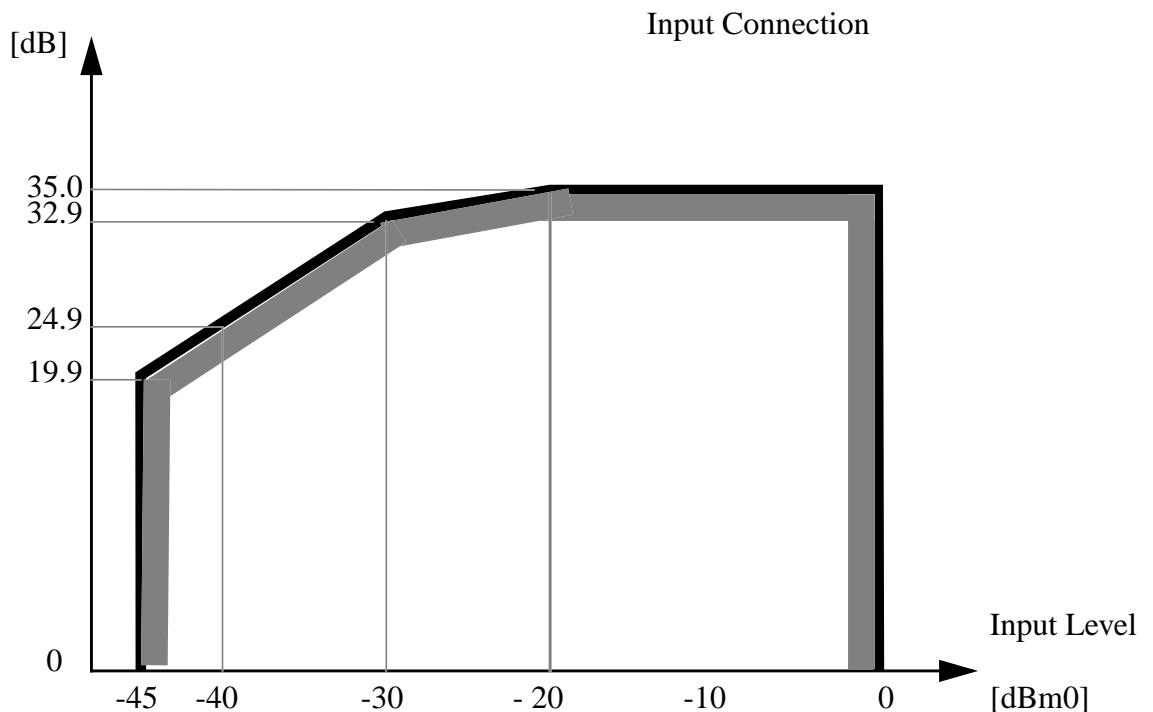


Figure 11. Limits for signal to total distortion ratio as a function of input level. Sine wave method.
Input relative level, $L_i = 0 \text{ dB}$

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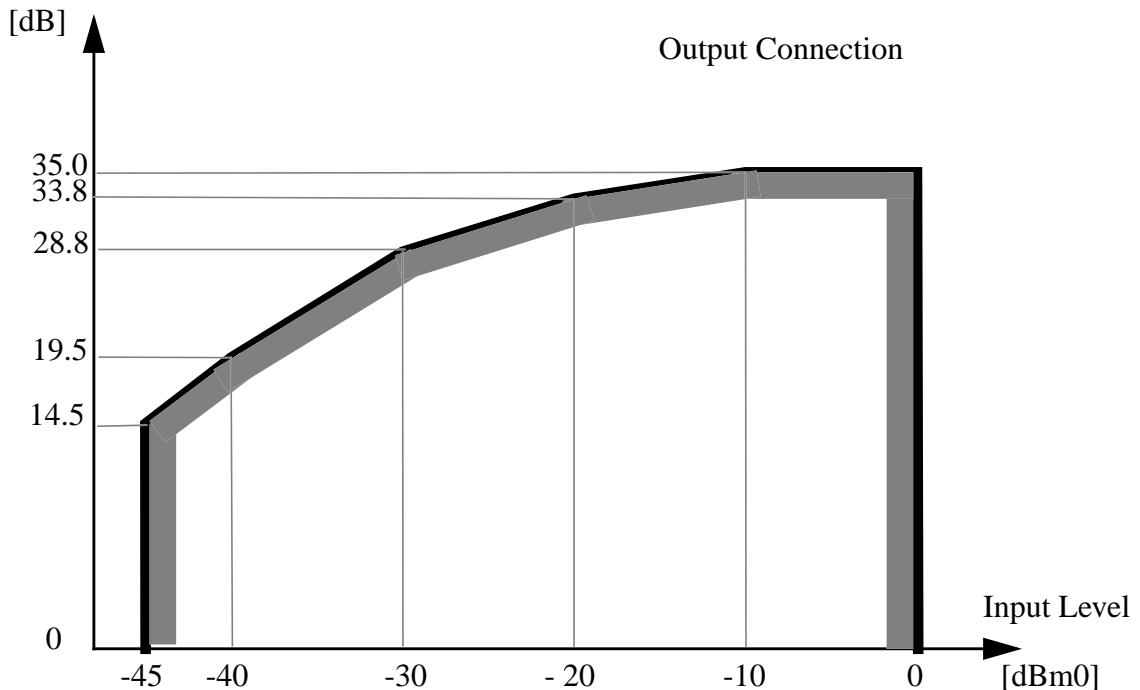


Figure 12. Limits for signal to total distortion ratio as a function of input level. Sine wave method.
Output relative level, $Lo = -7 \text{ dBr}$

4.3.4.2 Rejection of spurious signals

With a digitally generated sine wave in the frequency range 300 - 3400 Hz, and at a level of 0 dBm0, applied to the exchange test point T_i of a half connection, the level of spurious out-of-band image signals measured selectively at the 2-wire interface, is less than -25 dBm0.

4.3.4.3 Rejection of out-of-band signals

With a sine-wave signal in the range from 4.6 kHz to 72 kHz applied to the 2-wire interface of an input connection at a level of -25 dBm0, the level of any image frequency produced in the time slot corresponding to the input connection will be at least 25 dB below the level of the test signal.

4.4 Power supply

The LIB8 must be supplied with -48V, +5V, -5V and +12V.

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4.5**Clock signals**

The LIB8 must be supplied with 4.000 MHz and 12.288 MHz clock signals.

4.6**Mechanical data**

Size of PCB	178 mm x 221 mm
Mounting height	max 13.5 mm
Weight	0.5 kg

4.7**Power consumption**

The total power consumption is the sum of the power dissipation on the board and the power fed to the subscriber line.

The power consumption varies between the different generations and also between the revision states within each generation. It is also heavily dependent on the length of the subscriber line and the traffic intensity.

For that reason, the power consumption is specified for a board without traffic i.e. HOOK ON and the combos in POWER OFF, and for a board with traffic on all channels with a loop resistance of 600 ohms each channel.

The dissipation for each supply voltage and total dissipation per board is specified in the tables below.

Without traffic:

Board	Power consumption (W)					Total
	+12V	+5V	-5V	-48V		
ROF 137 8406/all indexes	0.02	0.53	0.03	0.66	1.2 W	

With traffic on all eight channels (600 ohms loop resistance):

ROF 137 8406/1,2,3	0.02	0.8	0.2	14.2	15.2 W
ROF 137 8406/11,12,13,21	0.02	0.8	0.2	16.6	17.6 W

The traffic dependent power consumption per channel can be calculated according to the equations below:

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$$P_{\text{traffic}} = \frac{U_{\text{battery}}^2}{R_{\text{feed}} + R_{\text{line}}} + \Delta P_{\text{channel}} \quad (\text{Watt/channel})$$

where

R_{feed} = feeding resistance according to table1, page 2

R_{line} = the subscriber line loop resistance

$\Delta P_{\text{channel}}$ = traffic dependent power **per channel** drawn from the +12V, +5V and -5V supply voltages and is about **0.1 W**

U_{battery} = station battery voltage

Example:

~~Calculate~~ the total power dissipation on a board with **two channels**, battery voltage **-48V**, loop resistance **600 ohms**.

The feeding resistance is **2x400 ohms** i.e. index 1, 2 or 3 (see table 1)

The power dissipation without traffic is **1.2 W** as shown above.

$$P_{\text{traffic}} = \frac{48^2}{800 + 600} + 0.1 = \underline{1.7 \text{ Watt / channel}}$$

$$P_{\text{total}} = 2 \times P_{\text{traffic}} + 1.2 = \underline{4.6 \text{ Watt}}$$

and the part dissipated in the lines:

$$P_{\text{line}} = 2 \times \left(\frac{U_{\text{battery}}^2}{800 + R_{\text{line}}} \right)^2 \times R_{\text{line}} = \underline{1.4 \text{ Watt}}$$

and hence the power dissipated on the board:

$$P_{\text{board}} = P_{\text{total}} - P_{\text{line}} = 4.6 - 1.4 = \underline{3.2 \text{ Watt}}$$

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5 ENVIRONMENTAL PERFORMANCE

5.1 Climatic

The board is designed to work in environment class S8 (indoor premises with regulated temperature), as defined in ST 1025-201 (Standard Technical Instruction).

5.2 Overvoltage

The LIB8 is basically designed to comply with the ITU-T Rec. K20. In some respects, the LIB8 exceeds the K20.

For instance, the board will withstand an overvoltage of 240V rms, between the a-wire and b-wire, and between a + b-wire and ground, for at least 24 hours, without any permanent damage.

The tests according to ITU-T K20, table 2/K.20 (exposed environments) have been performed with gas discharge tube as primary protection as specified in ITU-T, K12.