

# AR Repeaters







# User's Manual

## **AR Repeaters**

### **Channel Selective and Band Selective Repeaters**

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English

This document describes installation, commissioning and the design of the LGP Allgon AR Repeaters.

Communication between LGP Allgon AR repeaters and operators is carried out either by using LGP Allgon OMT32 (Operation and Maintenance Terminal), or LGP Allgon OMS (Operation and Maintenance System). OMT32 is described in the *OMT32, User's Manual*. OMS is described in the *Advanced Repeater OMS, User's Manual*.

Hardware and software mentioned in this document are subjected to continuous development and improvement. Consequently, there may be minor discrepancies between the information in the document and the performance and design of the product. Specifications, dimensions and other statements mentioned in this document are subject to change without notice.

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# Abbreviations

Abbreviations used in this manual, in the software, and in the repeaters:

AGC	Automatic Gain Control.
ALI	Alarm Interface board.
AMPS	Advanced Mobile Phone Service.
BCCH	Broadcast Control Channel (GSM broadcast channel time slot).
BMU	Base station Master Unit.
BA	Booster Amplifier.
BS	Base Station.
BSA	Band Selective Amplifier board.
BSel	Band Selective.
BTS	Base Transceiver Station.
CDMA	Code Division Multiple Access.
CHA	Channel Amplifier board.
CMB	Combiner unit.
CSA	CDMA/WCDMA Segment Amplifier board.
CSel	Channel Selective.
CU	Control Unit board.
CW	Continuous Wave.
DAMPS	Digital Advanced Mobile Phone Service.
DC	Directional Coupler.
DCS	Digital Communication System (same as PCN).
DIA	Distribution board.
DL	Downlink signal direction (from base station, via repeater, to mobile station).
DPX	Duplex filter.
EEPROM	Electrical Erasable Programmable Read Only Memory.
EGSM	Extended Global System for Mobile communication.
ETACS	Extended Total Access Communication System.
ETSI	European Telecommunications Standard Institute.
F2F	Fiber to Fiber Link.
FON	Fiber Optic Node board.
FOR	Fiber Optic Repeater.
FOT	Fiber Optic Transciever.
FOU	Fiber Optic Unit.
GSM	Global System for Mobile communication.
HW	Hardware.
LED	Light Emitting Diode.
LNA	Low Noise Amplifier, uplink and downlink.
MRX	Measurement Receiver board.
MS	Mobile Station.
MSC	Mobile Switching Center.
NMT	Nordic Mobile Telephone system.
OMS	Operation and Maintenance System.
OMT32	Operation and Maintenance Terminal.
OSP	Optical Splitter.
PA	Power Amplifier board.
PCN	Personal Communication Network (same as DCS).
PCS	Personal Communication System.
PSTN	Public Switched Telephone Network.
PSU	Power Supply Unit.
PTFE	Polytetrafluoro Ethylene (Teflon).
R2R	Repeater to Repeater Link.
RCC	Remote Communication Control unit.

RCU	Remote Control Unit.
RF	Radio Frequency.
RIA	Repeater to Repeater Interface Adapter board.
RMU	Repeater Master Unit.
RSSI	Received Signal Strength Indication.
RTC	Real Time Clock.
SW	Software.
TACS	Total Access Communication System.
TDMA	Time Division Multiple Access.
UL	Uplink signal direction (from mobile station via repeater to base station).
UPS	Uninterruptible Power Supply.
WCDMA	Wideband Code Division Multiple Access.
WDM	Wavelength Division Multiplexer.



# 1. Safety

In this chapter, the word 'repeater' includes all LGP Allgon repeating units, such as repeaters, hubs and radio heads.

It is necessary that any personnel involved in installation, operation or service of units included in an LGP Allgon repeater system understand and follow the below points.

- The LGP Allgon repeaters are designed to receive and amplify signals from one or more base stations and retransmit the signals to one or more mobile stations. And, also to act the other way round, that is to receive signals from one or more mobile stations, amplify and retransmit the signals to the base stations. LGP Allgon repeater systems must be used exclusively for this purpose and nothing else.
- Units supplied from the mains must be connected to grounded outlets and in conformity with the local prescriptions.
- Power supply units supplied from the mains contain dangerous voltage that can cause electric shock. Disconnect the mains prior to any work in such a unit. Local regulations are to be followed when servicing such units.



Authorized service personnel only are allowed to service units while the mains is connected.



- The repeater cover must be secured in opened position, for instance by tying it up, at outdoor repeater work. Otherwise, the cover can be closed by the wind and cause your fingers getting pinched or your head being hit.



- When working on a repeater on high ground, for instance on a mast or pole, be careful not to drop parts or the entire repeater. Falling parts can cause serious personal injury.



- All RF transmitting units, including repeaters, will generate radio signals and thereby give rise to electromagnetic fields that may be hazardous to the health of any person who is extensively exposed close to an antenna.

See the *Human Exposure of RF Radiation* section on page 1-3.



Beryllium oxide

- Beryllium oxide (BeO) may be contained in power devices, for instance in dummy loads in directional couplers (DCC), in combiner units (CMB), and in attenuators on the FON board. Beryllium oxide is poisonous if present as dust or smoke that can be inhaled.

Do not file, grind, machine, or treat these parts with acid.



Hydrogen fluoride

- Coaxial cables used in many LGP Allgon systems have the insulation made of PTFE, polytetrafluoro ethylene, that gives off small amounts of hydrogen fluoride when heated. Hydrogen fluoride is poisonous. Do not use heating tools when stripping off coaxial cable insulation.

No particular measures are to be taken in case of fire because the emitted concentration of hydrogen fluoride is very low.



- A lithium battery is permanently mounted in repeater CU units, and in FON and OCM units. Due to the risk of explosion, this battery must only be removed from the board by an LGP Allgon authorized service technician.



- NiCd batteries are mounted on the FON unit. These batteries contain environmental poisonous substances. If replaced, the old batteries should be taken care of as stated in the local prescriptions.

- The FON unit contains a class IIIb laser transmitter that emits 2 – 4mW invisible laser radiation during operation. Avoid direct exposure from unconnected laser transmitter or fiber cord as follows:

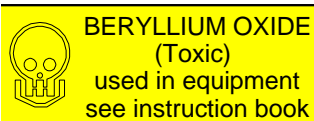
- Do not power up the FON unit if a fiber cable is not attached to the fiber output UL port, neither if a fiber cable is attached to the port but unattached in the other end.
- Never look in the end of a fiber cable. The 1310nm and 1550nm laser light is not visible, so no signal identification can be made anyway. Use always an instrument, such as a power meter to detect signaling.
- Never use any kind of magnifying devices that can focus the laser light to an unaided eye.

## Warning Signs

The following warning signs must be observed and be kept clean and readable.

### Beryllium oxide

This warning sign is applied on boards and units which contain beryllium oxide parts.



This warning sign is applied at the bottom, inside the cabinet, below the power supply unit.

The previous section details parts containing beryllium oxide and how to avoid dangerous dealing with these parts.

## Human Exposure of RF Radiation

This section contains a few words about repeater antennas and prescriptions for installation and maintenance of antenna systems. Also, it describes how to calculate safety distances needed for RF radiation at different antenna power and frequencies.

### Repeater Antennas

To be able to receive and transmit signals as described in the first bulleted paragraph on page 1-1, a repeater is connected to a donor antenna directed towards the base station, and a service antenna directed towards the coverage area. A fiber optic cable from the base station might, however, be substituted for the donor antenna.

### Installation and Maintenance of Antenna Systems

Installation and maintenance of all repeater antenna systems must be performed with respect to the radiation exposure limits for public areas.

The antenna radiation level is affected by the repeater output power, the antenna gain, and by transmission devices such as cables, connectors, splitters and feeders.

Have also in mind that the system minimum coupling loss, typical between 25dB and 35dB, is determined by a standard with the purpose to protect base stations from noise and other performance dropping effects.

## Radiation Exposure

WHO, World Health Organization, and ICNIRP, International Commission on Non-Ionising Radiation Protection, have determined recommendations for radiation exposure.

ICNIRP recommends not to exceed the following radiation power for public exposure:

Frequency	Radiation power
900MHz	4,5W/m <sup>2</sup>
1800MHz	9,0W/m <sup>2</sup>
2100MHz	10,0W/m <sup>2</sup>

For antennas larger than 20cm the maximum radiation power can be calculated by using the following formula:

$$S = \frac{P}{4 \times \pi \times r^2}$$

where

S = Radiation power in W/m<sup>2</sup>.

P = Output power in W.

r = Distance between antenna and human in meter.

To tackle the worst case successfully, the calculation does not consider system power reducing actions, such as power control and DTX.

Figure 1-1 shows the safety distance to an antenna due to the RF radiation. The distance is depending on the antenna output power and frequency, which is illustrated with two graphs in the figure.

One of the graphs applies to 4.5W/m<sup>2</sup> (900MHz) and the other to 9.0W/m<sup>2</sup> (1800MHz) or 10.0W/m<sup>2</sup> (2100MHz).

The safety distance range in Figure 1-1 is 0 to 1.4 meter that covers an antenna power range of 10dBm to 50dBm (0.01W to 100W).

## Radiation Safety Distances

This section illustrates the safety distances to the antennas for some typical repeater configurations.

### Outdoor GSM 900MHz

Repeater output power	+33dBm
Feeder loss	-5dB
Antenna gain	+17dBi
<b>EIRP</b>	<b>+45dBm</b>

The safety distance can be read to 0.75 meter in Figure 1-1 as the maximum radiation power is 4.5W/m<sup>2</sup> for 900MHz.



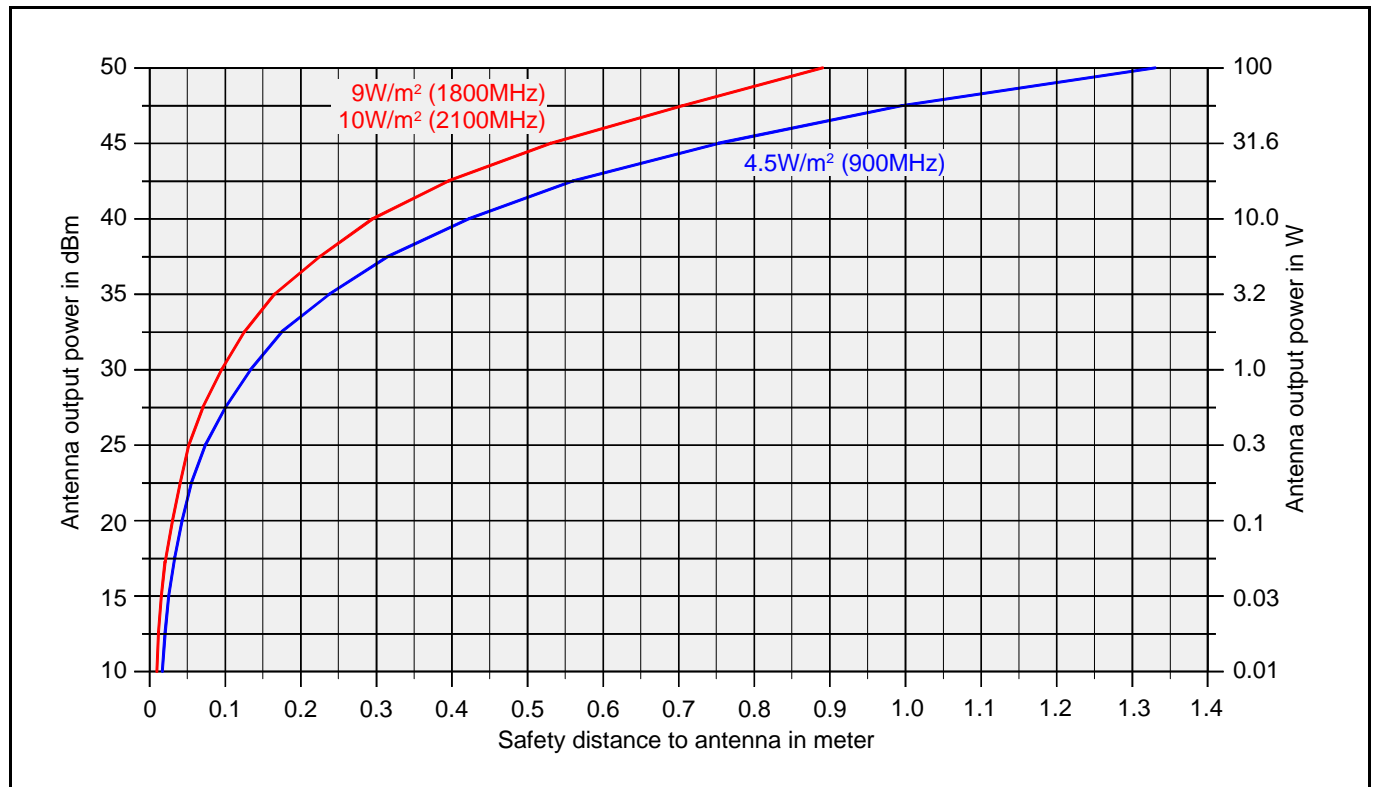


Figure 1-1. Safety distance to active antenna

### Indoor GSM 900MHz

Repeater output power	+22dBm
Feeder loss	-5dB
Antenna gain	+1dBi
<hr/> EIRP	<hr/> +18dBm

The safety distance can be read to 0.035 meter for 4.5W/m<sup>2</sup> (900MHz).

### Outdoor UMTS Standard High Power

Repeater output power	+38dBm
Feeder loss	-5dB
Antenna gain	+17dBi
<hr/> EIRP	<hr/> +50dBm

The safety distance can be read to 0.9 meter for 10W/m<sup>2</sup> (2100MHz).

### Indoor UMTS

Repeater output power	+24dBm
Feeder loss	-5dB
Antenna gain	+3dBi
<hr/> EIRP	<hr/> +22dBm

The safety distance can be read to 0.035 meter for 10W/m<sup>2</sup> (2100MHz).

## Static Electricity

Static electricity means no risk of personal injury but it can severely damage essential parts of the equipment, if not handled carefully.

Parts on the printed circuit boards as well as other parts in the equipment are sensitive to electrostatic discharge.



**Never touch the printed circuit boards or uninsulated conductor surfaces unless absolutely necessary.**

If you must handle the printed circuit boards or uninsulated conductor surfaces, use ESD protective equipment, or first touch the chassis with your hand and then do not move your feet on the floor.

Never let your clothes touch printed circuit boards or uninsulated conductor surfaces.

Always store printed circuit boards in ESD-safe bags.

## 2. Introduction



*Figure 2-1. Allgon AR Repeater*

LGP Allgon AR repeaters are used to fill out uncovered areas in cellular mobile systems, such as base station fringe areas, road tunnels, business and industrial buildings, etc.

An AR repeater receives signals from a base station, amplifies and retransmits the signals to mobile stations. Also it receives, amplifies and retransmits signals in the opposite direction. Both directions are served simultaneously.

To be able to receive and transmit signals in both directions, the repeater is connected to a donor antenna directed towards the base station and to a service antenna directed towards the area to be covered. As an alternative to the donor antenna, the repeater can be connected to the base station via an optic fiber cable.

Control of the repeaters is performed using a desktop or notebook loaded with the LGP Allgon OMT32, *Operation and Maintenance Terminal*, which can communicate with the repeaters either locally or remotely via modem. Remote operation can be performed either via PSTN or a GSM net.

To be able to control many LGP Allgon AR repeaters in common, there is an LGP Allgon OMS, *Operation and Maintenance System*.

The AR repeaters are described in this manual. OMT32 is described in the *OMT32, User's Manual*.

## Repeater Overview

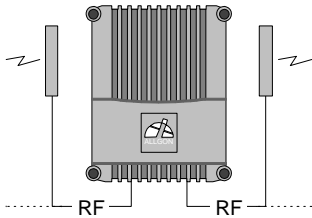
The AR repeater family includes the following main repeater types:

- Channel selective GSM repeater.
- Channel selective CDMA/WCDMA repeater.
- Channel selective high power CDMA/WCDMA repeater.
- Band selective repeater.
- Combined repeater.
- BMU, Base station Master Unit.
- RMU, Repeater Master Unit.
- FOR, Fiber Optic Repeater.

These main repeater types are briefly described below.



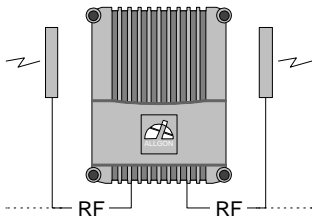
*In this document, the channel selective 900, 1800, and 1900 systems are called GSM, DCS and PCS respectively, even though these systems may have different names in other parts of the world.*



### Channel selective GSM repeater

This repeater is used for channel selective systems such as GSM, DCS, PCN and PCS.

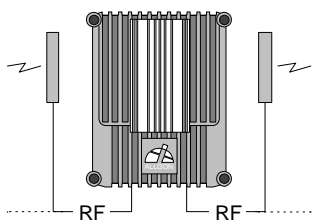
The channel selective GSM repeater has an RF port for a donor antenna (or RF cable) and an RF port for a service antenna (or RF cable).



### Channel selective CDMA/WCDMA repeaters

These repeater types are used for digital code division systems in accordance with IS-95 or J-std-008 standard, and wideband digital code division systems.

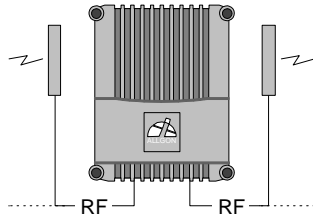
The channel selective CDMA/WCDMA repeaters have an RF port for a donor antenna (or RF cable) and an RF port for a service antenna (or RF cable).



### Channel selective high power CDMA/WCDMA repeaters

These are CDMA/WCDMA repeaters equipped with a 6dB (typically) BA (Booster Amplifier) in the downlink transmitting signal path.

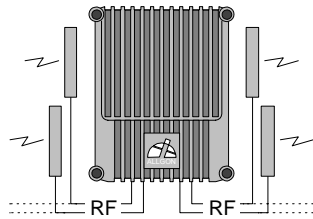
The channel selective high power CDMA/WCDMA repeaters have an RF port for a donor antenna (or RF cable) and an high power RF port for a service antenna (or RF cable).



### Band selective repeater

This repeater type is used for analog or digital systems such as NMT, GSM, TACS, ETACS, AMPS, DAMPS, CDMA and WCDMA.

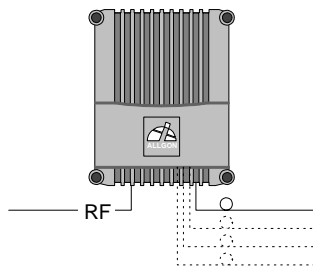
The band selective repeater has an RF port for a donor antenna (or RF cable) and an RF port for a service antenna (or RF cable).



### Combined repeater

Some of the repeater types can be combined in the same repeater chassis and be in operation in parallel.

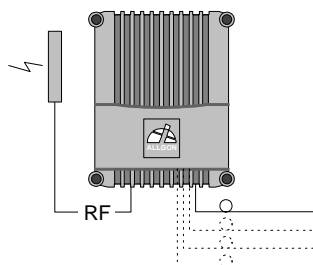
The combined repeater has normally two RF ports for donor antennas (or RF cables) and two RF ports for service antennas (or RF cables).



### BMU, Base Station Master Unit

A BMU is one of the RF repeater types equipped with a FOU (Fiber Optic Unit) that makes the repeater receive and transmit optic signals on the service side.

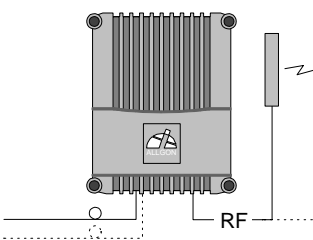
The BMU has an RF port for BTS connection and up to four fiber optic ports that can be connected to FORs.



### RMU, Repeater Master Unit

An RMU is one of the RF repeater types equipped with a FOU (Fiber Optic Unit) that makes the repeater receive and transmit optic signals on the service side.

The RMU has an RF port for a donor antenna and up to four fiber optic ports that can be connected to FORs.



### FOR, Fiber Optic Repeater

A FOR is one of the RF repeater types equipped with a FOU that makes the repeater receive and transmit optic signals on the donor side.

The FOR has a fiber optic donor port and an RF port for a service antenna (or RF cable). By equipping a FOR with a splitter, another FOR can be connected in serial.

This unit can be connected to a BMU, RMU or FOR (with splitter).

## Using Repeaters

In areas where the radio signal propagation is poor repeaters can be used to fill out those areas which are not covered by the base station.

The following scenarios are examples on this:

- Sports arenas
- Fair halls
- Large shopping centres
- Road and railway tunnels
- Indoors in buildings with metal or concrete walls

Other examples where repeaters can be used to increase the coverage are:

- Shaded areas
- Fringe coverage areas

In areas where the traffic intensity is low, it is not cost efficient to install a base station. An LGP Allgon repeater, which can be installed with a minimum of investments, is a better solution. You save installation costs as well as operational costs.

### **Examples of using repeaters**

Two examples are described in the following sections. An outdoor example in a shaded valley and an indoor example in a sports arena.

## Shaded Area

A valley is shaded by hills. There is a base station 5 kilometers away, but the lowest signal strength in the valley is less than  $-100\text{dBm}$ . A mast used for other purposes is available for a repeater installation. The mast height is 42 meter and it is located on a hill. The scenario is illustrated in Figure 2-2.

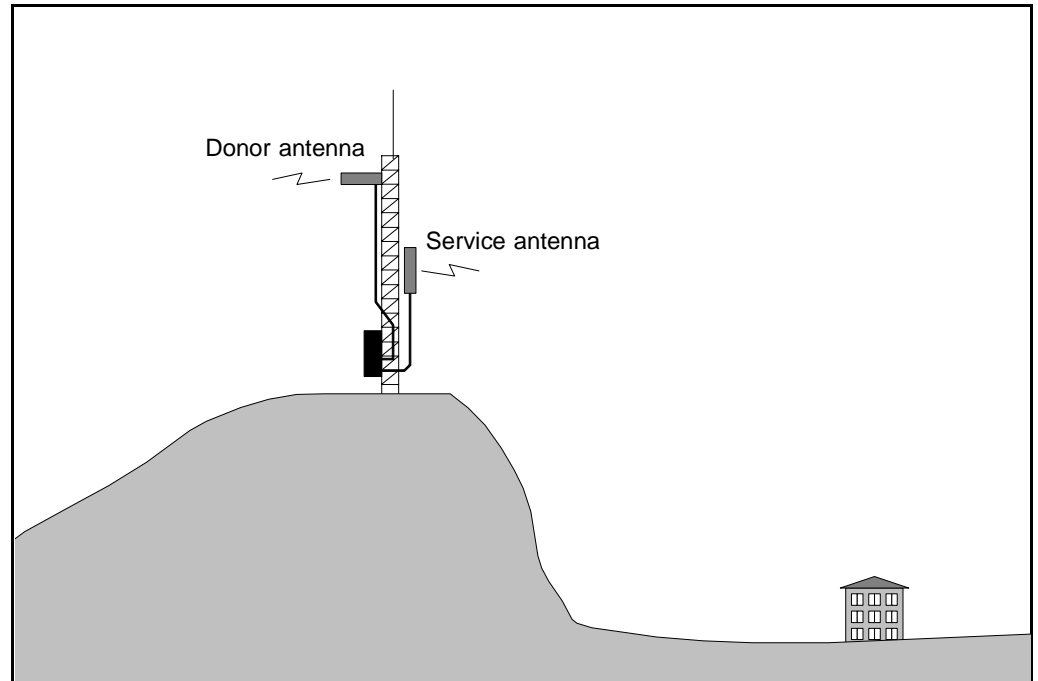


Figure 2-2. Repeater coverage of shaded area

The donor antenna of the repeater was mounted at the top of the mast and the service antenna was mounted at the half mast. The antenna isolation was measured to over 100dB. The repeater was set to 80dB gain.

Measured levels:	Received signal level	- 60.0 dBm
	Donor antenna gain	15.0 dBi
	Cable loss	- 5.0 dB
	Repeater input level	- 50.0 dBm
	<u>Adjusted repeater gain</u>	70.0 dB
	Repeater output level	20.0 dBm
	Cable loss	- 5.0 dB
	<u>Service antenna gain</u>	8.0 dBi
	Radiated output level	23.0 dBm

The measured result in the valley was better than  $-90\text{dBm}$ .

## Sports Arena

A 2000 spectators sports arena with metallic roof had an indoor signal strength too low to provide a fair service in most parts of the arena. The nearest base station was 8 kilometers away and it was equipped with one carrier only.

A donor antenna directed towards the base station was mounted on a mast outside the building and a repeater was installed inside the building with the service antenna on the arch vault. The scenario is illustrated in Figure 2-3.

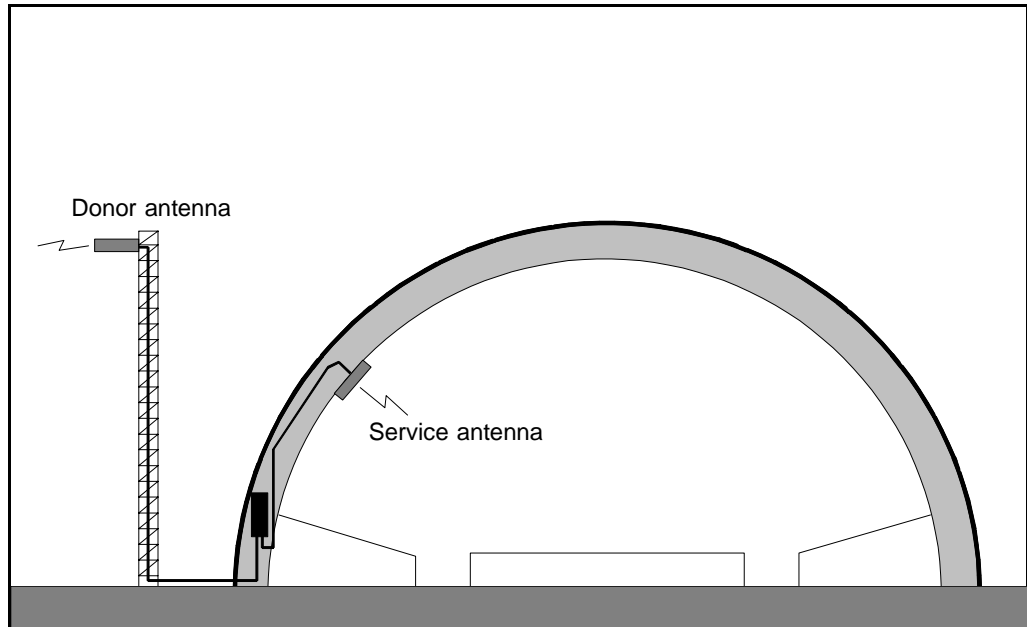


Figure 2-3. Repeater in sports arena

The antenna isolation was measured to over 85dB.

Measured levels:	Received signal level	- 80.0 dBm
	Donor antenna gain	15.0 dBi
	Cable loss	- 5.0 dB
	Repeater input level	- 70.0 dBm
	<u>Adjusted repeater gain</u>	<u>75.0 dB</u>
	Repeater output level	5.0 dBm
	Cable loss	- 2.0 dB
	<u>Service antenna gain</u>	<u>7.0 dBi</u>
	Radiated output level	10.0 dBm

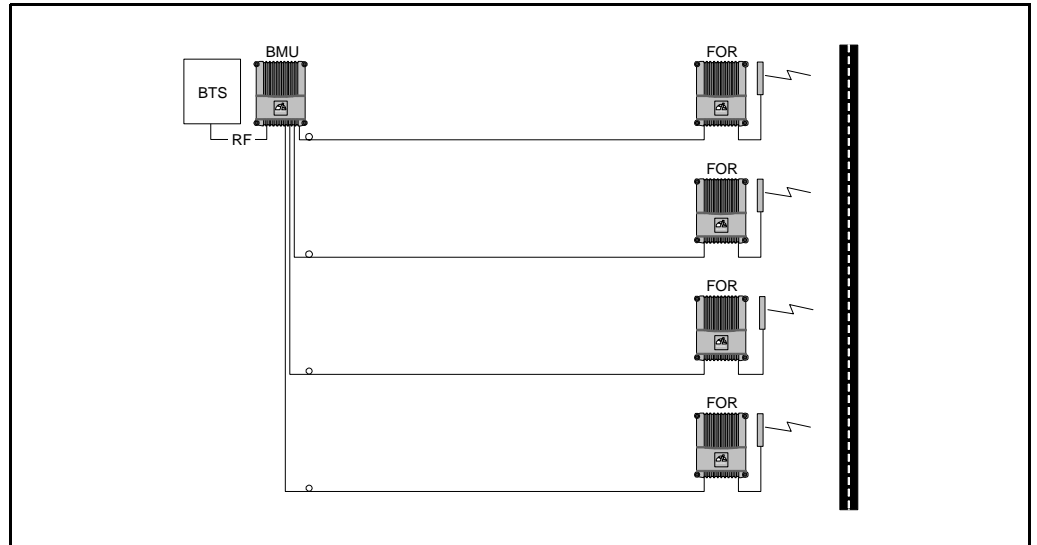
The signal strength was fair for service in the entire arena.



## Fiber Optic Distribution Net

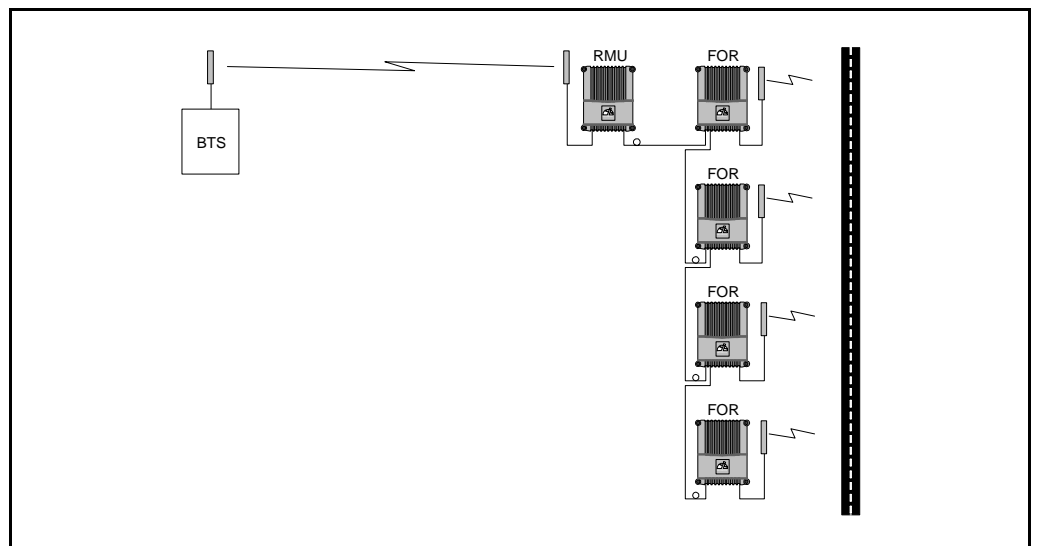
The following two examples illustrate a part of a road covered by means of a BMU or an RMU and four FORs in a fiber optic distribution net.

Figure 2-4 shows a BMU fed via an RF cable from the BTS and four fiber optic ports that feed four FORs in parallel. The BMU has to be located very close to the BTS.



*Figure 2-4. One BMU and four FORs in parallel*

Figure 2-5 shows an RMU with a donor antenna and one fiber optic port that feeds four FORs in serial.



*Figure 2-5. One RMU and four FORs in serial*

By using WDMs and OSPs in the fiber optic repeaters, the optic distribution net can be built up with a combination of serial and parallel connections with double or single fiber communication.



# 3. Installation

Before installation, read carefully Chapter 1, *Safety*.

## Siting the Repeater

LGP Allgon repeaters are designed for outdoor usage. However, humidity and temperature changes may have affect on the reliability. A preferable site for the repeater is thus indoor, in a tempered and ventilated room.

## Sunshine

If a repeater is placed outdoor and can be exposed to direct sunshine, it is essential that the air can circulate around the repeater with no obstacle.

The operating temperature must not exceed +55°C. A shelter can be used to shade the repeater from direct sunshine.

## Shelter

LGP Allgon repeaters are designed with a weather proof outdoor case that can be mounted without any kind of shelter from rain, snow or hail.

If a repeater is to be opened on the site when raining, snowing, or hailing there must be some kind of permanent or temporary shelter. This is applicable to gentle rainfall, snowfall or hail. Limitations for very bad weather is found in the next section.

LGP Allgon can provide a shelter designed for these repeaters. This shelter is shown in Figure 3-1.

## Outdoor Installation and Service Limitations

Sited outdoors, the repeater must not be opened for installation or service at bad weather, such as:

- Intense rainfall, snowfall or hail.
- Storm or high wind.
- Extremely low or high temperature.
- High humidity of the air.

## Dimensions and Weights

The dimensions of the repeater, including the mounting bracket, is shown in Figure 3-1. The repeater chassis consists of two main parts, a *cabinet* in which the circuitry is housed, and a *cover*, which can be either a low cover or a high cover (see the figure) depending on the repeater type.

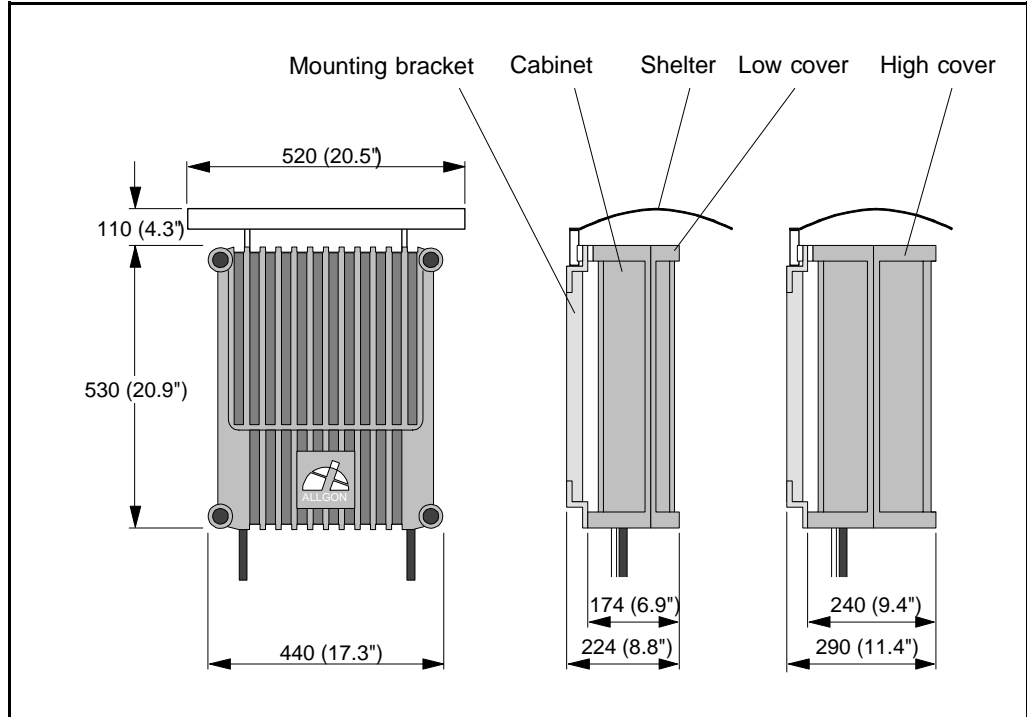


Figure 3-1. Repeater dimensions

The high power CDMA and WCDMA repeaters have an external heat sink on a high cover, see Figure 3-2.

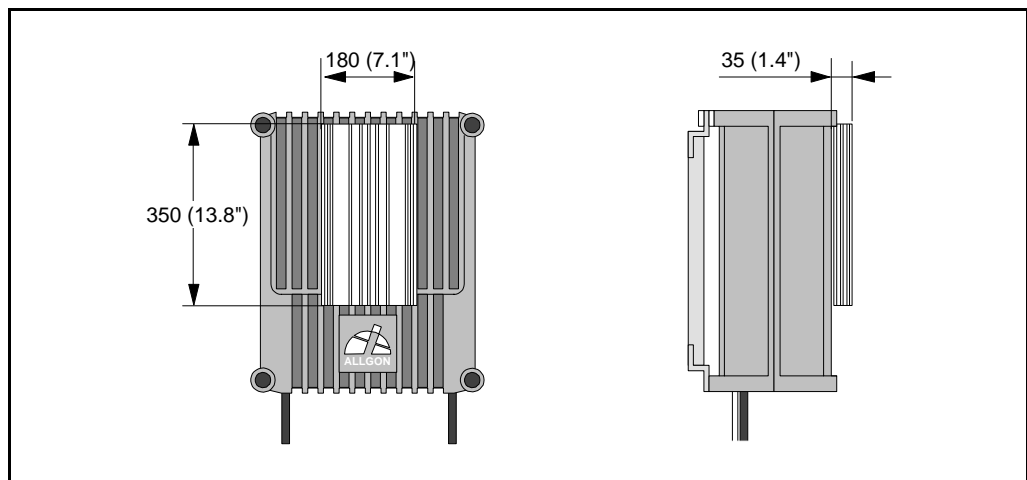


Figure 3-2. High power CDMA/WCDMA repeater

### Approximately repeater weights

Repeater with a low cover .....	21 kg (46 lbs)
Repeater with an empty high cover .....	25 kg (55 lbs)
Combined repeater with a high cover .....	30 kg (66 lbs)



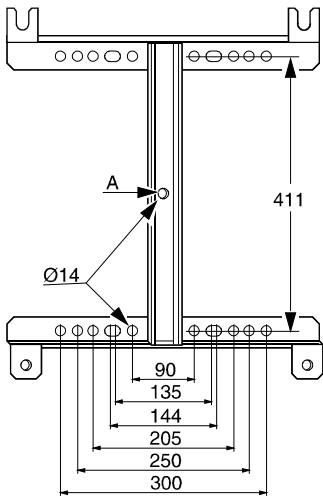
*It is not recommended to remove the cover from the cabinet at the site.*

However, if the cover, for some reason, has to be removed from the cabinet, then disconnect the interconnection cables, close the cover, remove the hinge shafts, and remove the cover.

The cabinet and cover weights are, approximately, as follows:

Empty low cover .....	6 kg (13 lbs)
Empty high cover .....	10 kg (22 lbs)
Equipped cabinet or high cover .....	15 kg (33 lbs)

## Mounting



The AR repeater is easy to mount using the provided mounting bracket, which has  $\text{Ø}14\text{mm}$  (9/16") holes for 10mm (3/8") or 12mm (1/2") fixing screws. Clamps with c-c measures of 90mm (3.5"), 135mm (5.3"), 144mm (5.7"), 205mm (8.1"), 250mm (9.8"), and 300mm (11.8") can be used as well. The vertical c-c measure for these are 411mm (16.2").

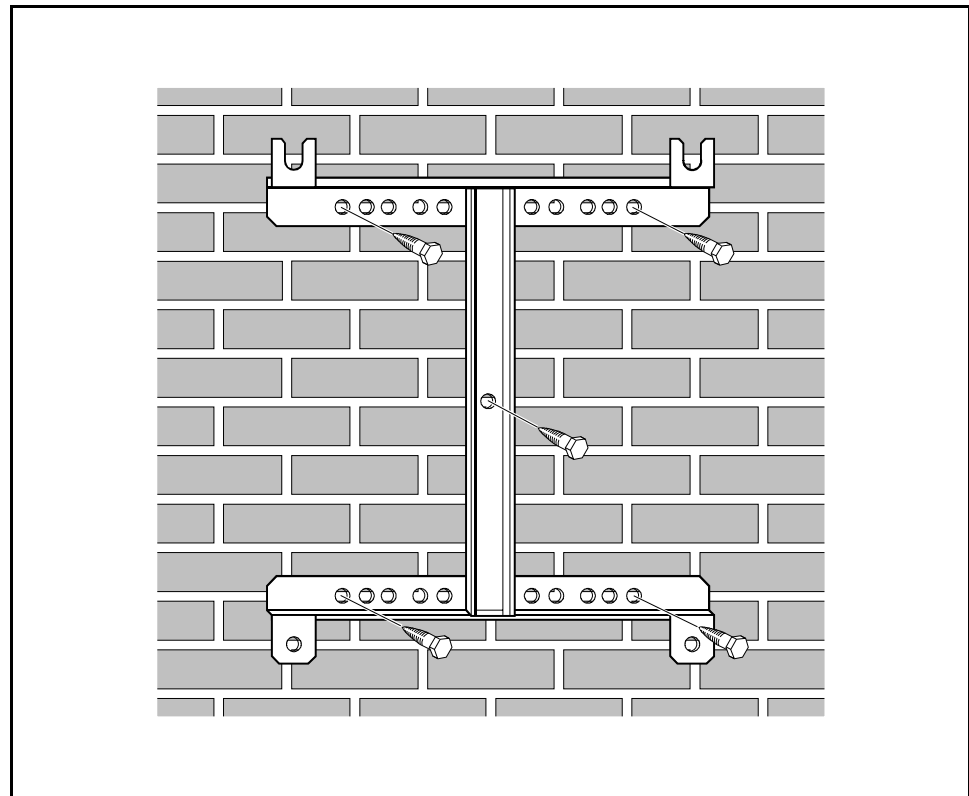
The mounting bracket is shown in the figure.

**NOTE!** There is a  $\text{Ø}14\text{mm}$  (9/16") single hole in the middle of the mounting bracket, marked 'A' in the figure, which is intended for a locking screw, i.e. a screw which cannot be removed when the repeater is put in the bracket.

Mount the repeater as follows:

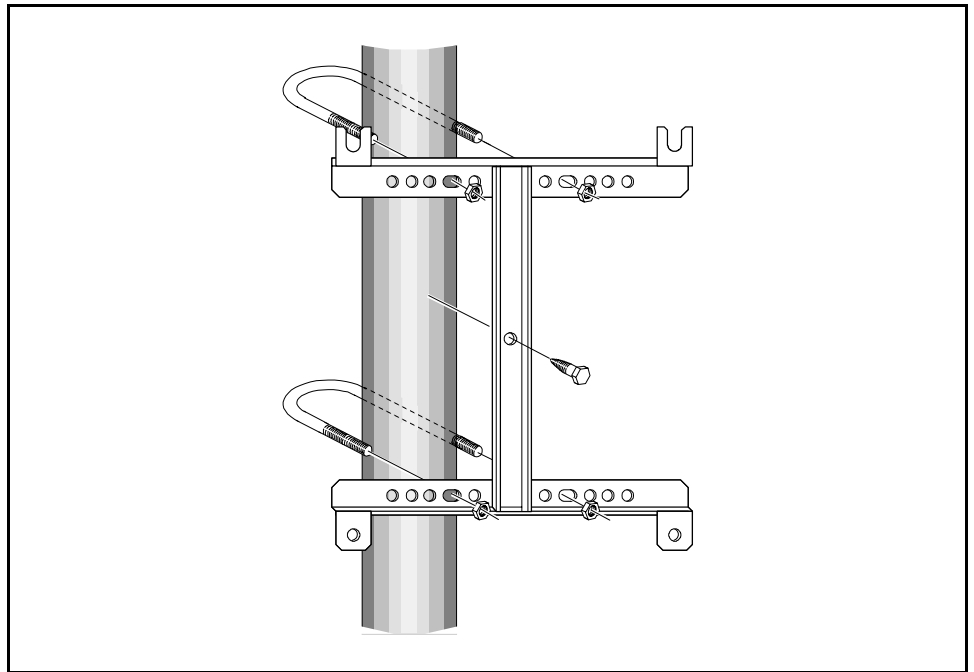
1. Mount the provided bracket.

Normally, the repeater is mounted on a wall, pole, or mast. These mounting cases are shown below.



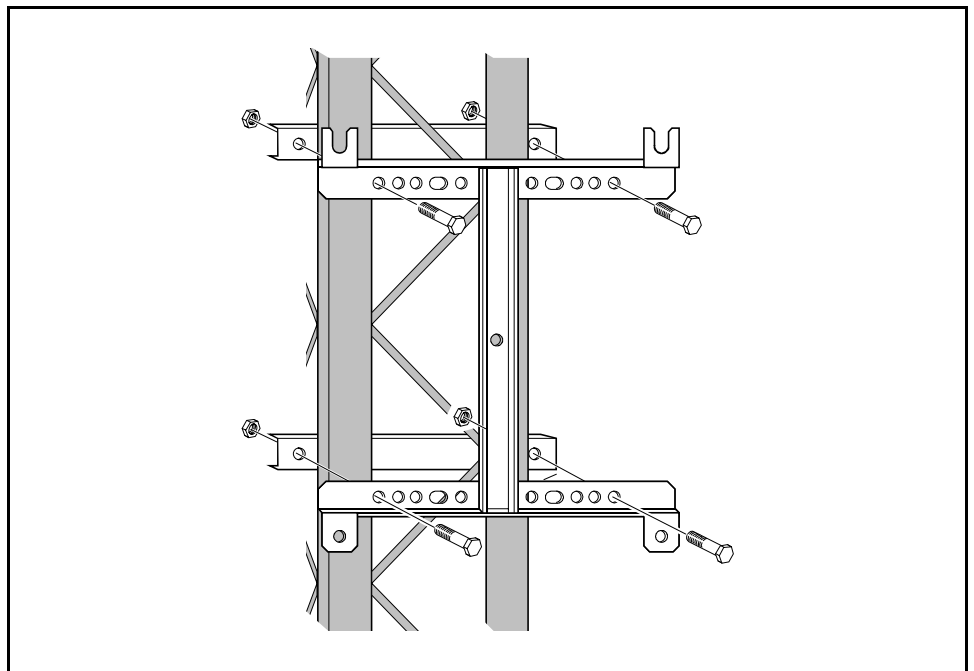
*Figure 3-3. Attaching the bracket to a wall*

Figure 3-3 shows a bracket attachment to a wall using four fixing screws and a locking screw.



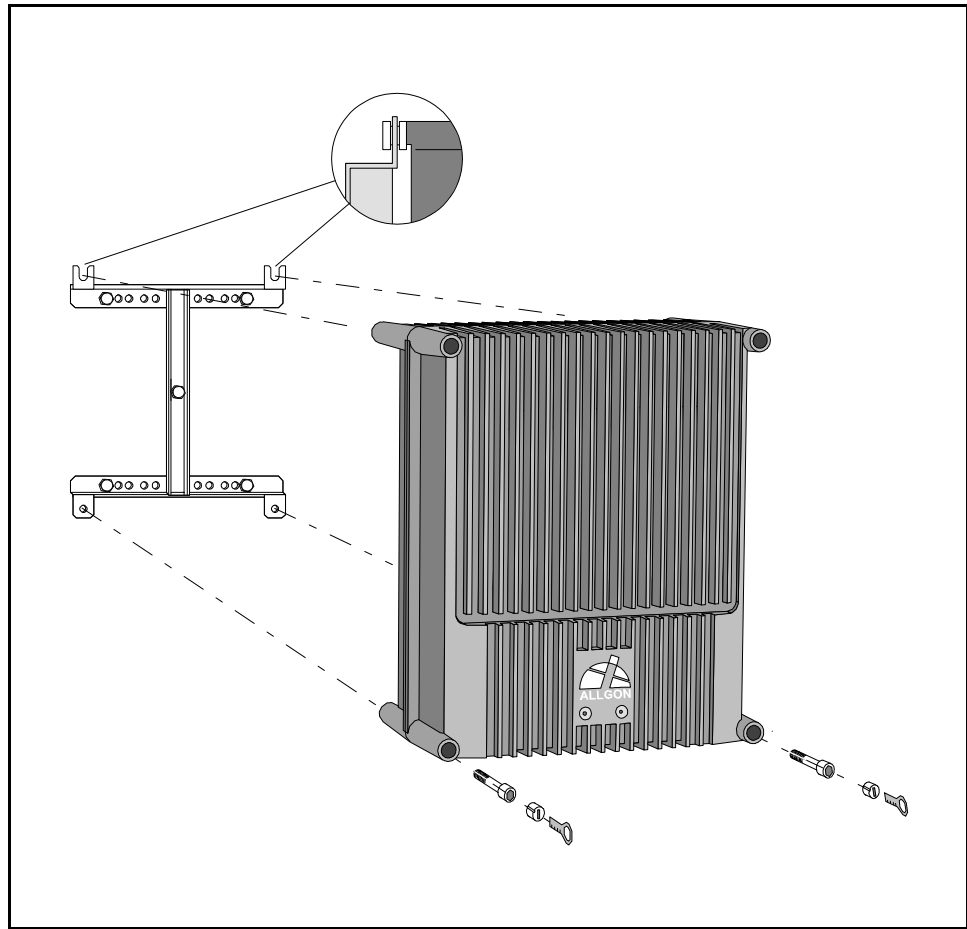
*Figure 3-4. Attaching the bracket to a pole*

Figure 3-4 shows a bracket attachment to a pole using two 144mm (5.7") U-shaped clamps and a locking screw.



*Figure 3-5. Attaching the bracket to a mast*

Figure 3-5 shows a bracket attachment to a mast using two 300mm (11.8") bar-shaped clamps and no locking screw.



*Figure 3-6. Attaching the repeater to the bracket*

2. After attaching the bracket, hang the repeater on the upper supports (see Figure 3-6) and use the screws for the lower ones. Tighten the upper and lower screws.

There are locking cylinders that can be inserted and locked with a key after the lower screws have been tightened (see Figure 3-6). These prevent unauthorized removal of the repeater.

3. Make sure the donor antenna, directed towards the base station antenna, is mounted.
4. Make sure the service antenna, directed towards the area to be covered by the repeater, is mounted.



## Connection

This section describes how to connect the input and output ports of the repeater types:

AR repeaters (except for high power CDMA/WCDMA) .....	page 3-8
High power CDMA/WCDMA .....	3-9
BMU .....	3-10
RMU .....	3-11
FOR .....	3-12

Common important instructions for the repeater types are found below.



### Station ground

There is a screw to the left in the repeater that is intended for station ground only. This screw is marked with the ground symbol.

### Mains connection

Note that local regulations are to be followed for the mains connection.



*The AR repeater is approved in accordance with EN and UL/cUL regulations. This is, however, only valid if a classified power cord is used.*

To get the repeater to meet these regulations, select one of the following classified and approved cord types:

- EN – H 05 W5 - F HMR.
- UL – AWM Style 2587.
- CSA – AWM 1 A/B 11 A/B.

For outdoor use the power cord should meet at least IP65 encapsulation requirements.



*For repeaters supplied from the mains, the mains outlet must be grounded.*

The mains connection described on the following pages means to mount the mains plug to the mains cord (if to be used) but it does not mean to connect the mains.



*Do not turn the mains on until you are commissioning the repeater (see Chapter 4, Commissioning).*

### RCU and RCC remote control units

All AR repeaters can be equipped with an RCU, Remote Control Unit. The GSM antenna for this unit is internally connected in the repeater. The RCU and its connection is described in Chapter 6, *Optionals*.

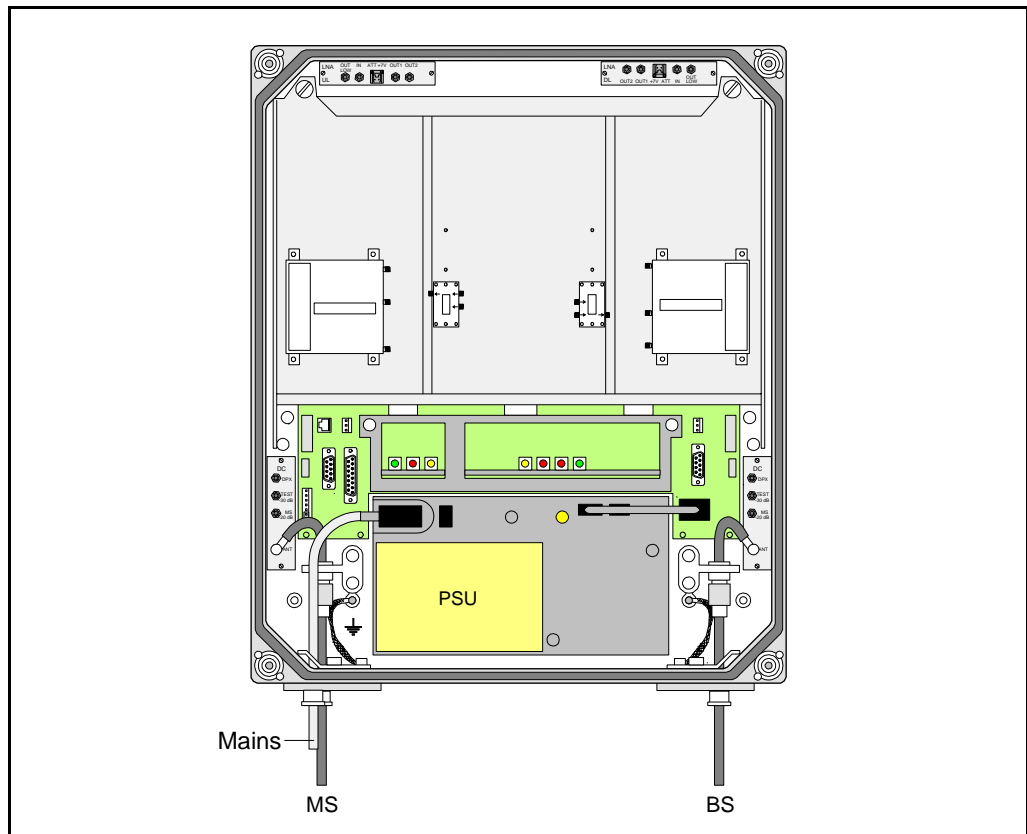


*If the RCU is removed, then the jumper between pin 2 and 3 on the P27 port must be reconnected. Do not connect the jumper to another position than between pin 2 and 3 on the P27 port.*

An RCC, Remote Communication Control unit, is required if the unit is to be connected to a FON board (the FON board does not support the RCU). A description of the RCC and its connection is found in the VD203 67/EN, *ALR Compact Repeater, User's Manual*. See also Chapter 6, *Optionals*.

## Connecting AR Repeater

This description is not applicable to a high power CDMA or WCDMA repeater.

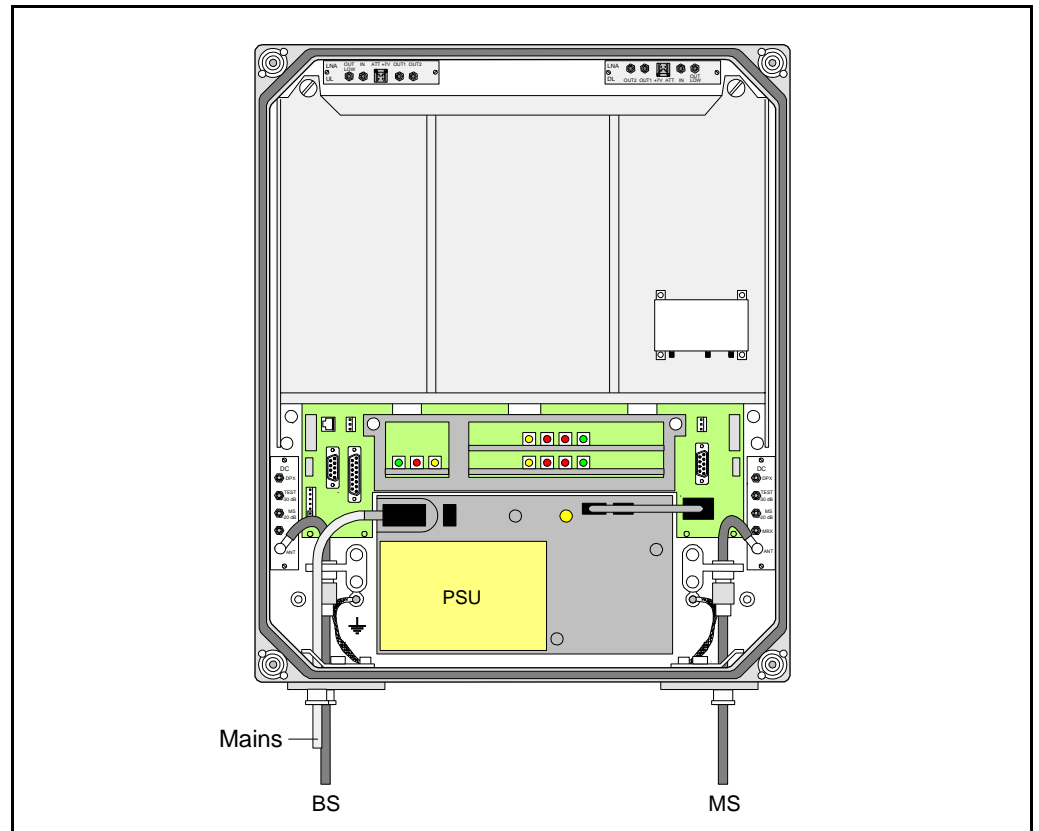


*Figure 3-7. Connecting AR repeater*

- 1.** Connect the service and donor antenna coaxial cables (or RF cable from the BTS if no donor antenna is used). Use N type male connectors.
  - The donor antenna or RF cable from the BTS is connected to the right in the cabinet ('BS' in Figure 3-7).
  - The service antenna (MS) is connected to the left in the cabinet.
- 2.** Connect station ground, if to be used (see page 3-7).
- 3.** Mount the mains plug to the mains cord (if to be used) but do not connect the mains (see page 3-7).
- 4.** Connect external alarm and optional door open alarm, if this feature is to be used. Descriptions are found on page 3-13.
- 5.** Connect the R2R cables, if this feature is to be used (see page 3-14).
- 6.** Connect a mains breakdown relay, if mains breakdown alarm is to be used (see page 3-15).

## Connecting High Power CDMA or WCDMA Repeater

This description is applicable to a high power CDMA or WCDMA repeater.



*Figure 3-8. Connecting high power CDMA/WCDMA repeater*

- 1.** Connect the service and donor antenna coaxial cables (or RF cable from the BTS if no donor antenna is used). Use N type male connectors.
  - The donor antenna or RF cable from the BTS is connected to the left in the cabinet ('BS' in Figure 3-8).
  - The service antenna (MS) is connected to the right in cabinet.
- 2.** Connect station ground, if to be used (see page 3-7).
- 3.** Mount the mains plug to the mains cord (if to be used) but do not connect the mains (see page 3-7).
- 4.** Connect external alarm and optional door open alarm, if this feature is to be used. Descriptions are found on page 3-13.
- 5.** Connect the R2R cables, if this feature is to be used (see page 3-14).
- 6.** Connect a mains breakdown relay, if mains breakdown alarm is to be used (see page 3-15).

## Connecting BMU

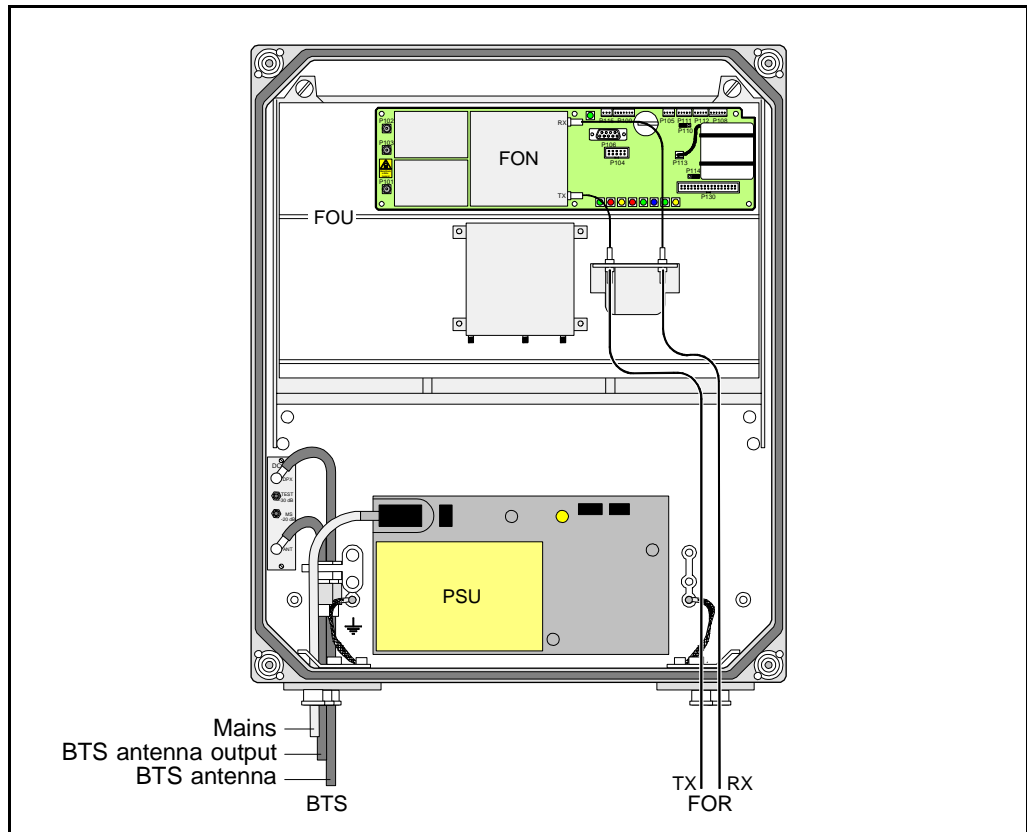


Figure 3-9. Connecting BMU

Figure 3-9 shows an BMU with separate RX/TX fiber optic cables to one FOR. By using WDMs and OSPs, up to four FORs can be fed in parallel by a BMU with double or single fiber communication. Up to eight FORs can be fed with a high cover and two FOUs.

1. Connect the BTS antenna output RF cable to the ANT port of the DC unit to the left in the cabinet. Use an N type male connector.
2. Connect an RF cable from the DPX port of the DC unit to the left in the repeater to the BTS antenna. Use an N type male connector.
3. Connect the RX and TX fiber optic cables from the FON board located in the upper part of the FOU to an FOR.
4. Connect station ground, if to be used (see page 3-7).
5. Mount the mains plug to the mains cord (if to be used) but do not connect the mains (see page 3-7).
6. Connect external alarm, if this feature is to be used. Descriptions are found on page 3-13.
7. Connect the R2R cables, if this feature is to be used (see page 3-14).
8. Connect a mains breakdown relay, if mains breakdown alarm is to be used (see page 3-15).

## Connecting RMU

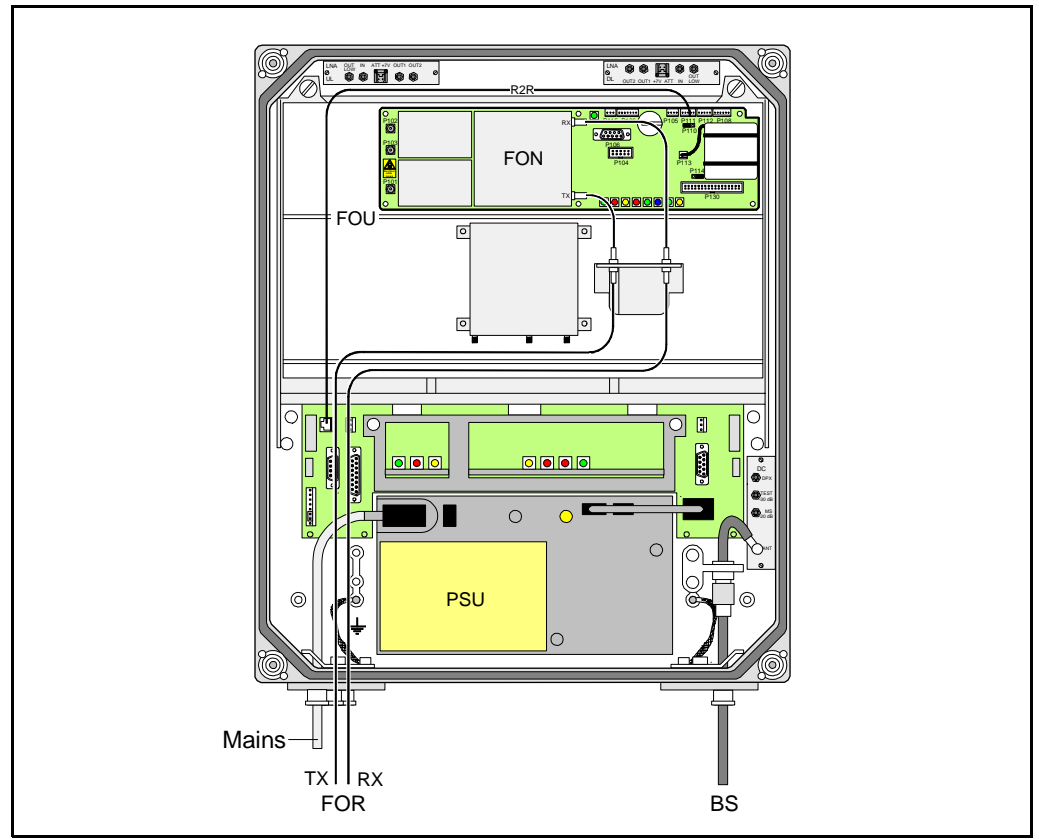


Figure 3-10. Connecting RMU

Figure 3-10 shows an RMU for donor antenna and separate RX/TX fiber optic cables to one FOR. By using WDMs and OSPs, up to four FORs can be fed in parallel by an RMU with double or single fiber communication. Up to eight FORs can be fed with a high cover and two FOUs.

1. Connect the donor antenna coaxial cable to the right in the cabinet ('BS' in Figure 3-10). Use an N type male connector.
2. Connect the RX and TX fiber optic cables from the FON board located in the upper part of the FOU to an FOR.
3. Connect station ground, if to be used (see page 3-7).
4. Mount the mains plug to the mains cord (if to be used) but do not connect the mains (see page 3-7).
5. Connect external alarm and optional door open alarm, if this feature is to be used. Descriptions are found on page 3-13.
6. Connect the R2R cables, if this feature is to be used (see page 3-14).
7. Connect a mains breakdown relay, if mains breakdown alarm is available and is to be used (see page 3-15).

## Connecting FOR

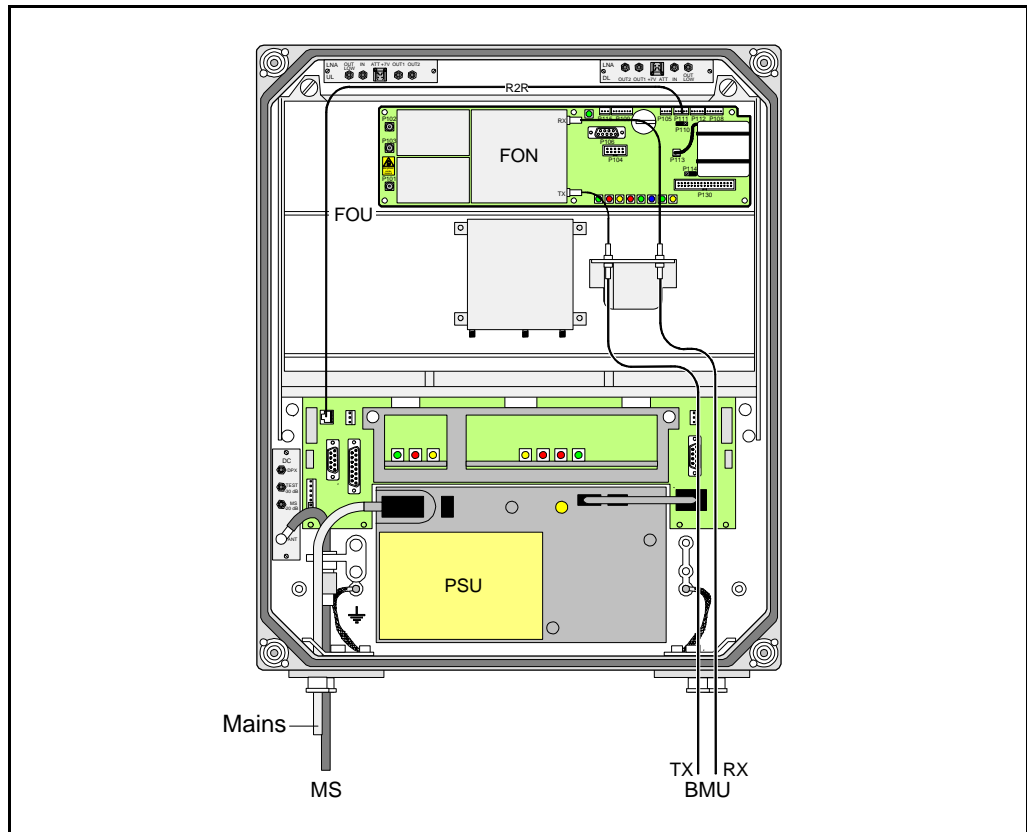


Figure 3-11. Connecting FOR

Figure 3-11 shows a FOR for service antenna and separate RX/TX fiber optic cables from a BMU. By adding WDMs and OSPs, a number of FORs can be fed by one BMU with double or single fiber communication.

1. Connect the service antenna coaxial cable to the left in the cabinet ('MS' in Figure 3-11). Use an N type male connector.
2. Connect the RX and TX fiber optic cables from the BMU to the FON board located in the upper part of the FOU.
3. Connect station ground, if to be used (see page 3-7).
4. Mount the mains plug to the mains cord (if to be used) but do not connect the mains (see page 3-7).
5. Connect external alarm and optional door open alarm, if this feature is to be used. Descriptions are found on page 3-13.
6. Connect the R2R cables, if this feature is to be used (see page 3-14).
7. Connect a mains breakdown relay, if mains breakdown alarm is to be used (see page 3-15).

## External Alarm

Burglary, fire or other external alarm can be used in the repeaters. Optical or acoustic alarm can also be connected to the repeaters.

External alarm sensors and alarm signals are connected to the P33 alarm port located to the left in the cabinet (see Figure 3-12).

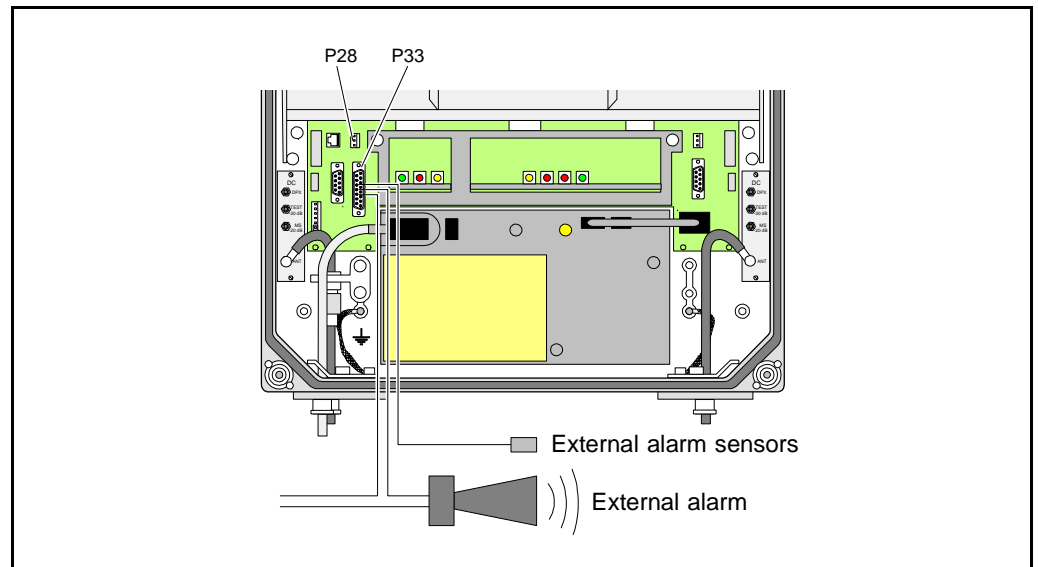


Figure 3-12. External alarm connection

The P33 alarm port is described in the *Connection Ports* section in Chapter 5.

Use a 15 pole D-sub male connector for this connection.

The cable for this installation is taken through a strain relief bushing at the bottom of the repeater.

For a repeater without a CU board, i.e. BMU, external alarm is connected to the P109 port on the FON board. The P109 port is described in the *FON - Fiber Optic Node Board* section in Chapter 5.

## Door Open Alarm

A door open alarm can be used in all repeater types that have a CU board, i.e. all types except for BMU. This is arranged with a door switch connected to the P28 port (see Figure 3-12). The P28 port and the connection is described in the *Connection Ports* section in Chapter 5.

## R2R, Repeater to Repeater Link

Connect the R2R cable, if this optional feature is to be used. See also the *F2F, Fiber to Fiber Link* section below.

The R2R net cable is connected to the P34 Repeater to Repeater Link port via the P1 terminal on the R2R connector board to the right in the repeater (see Figure 3-13).

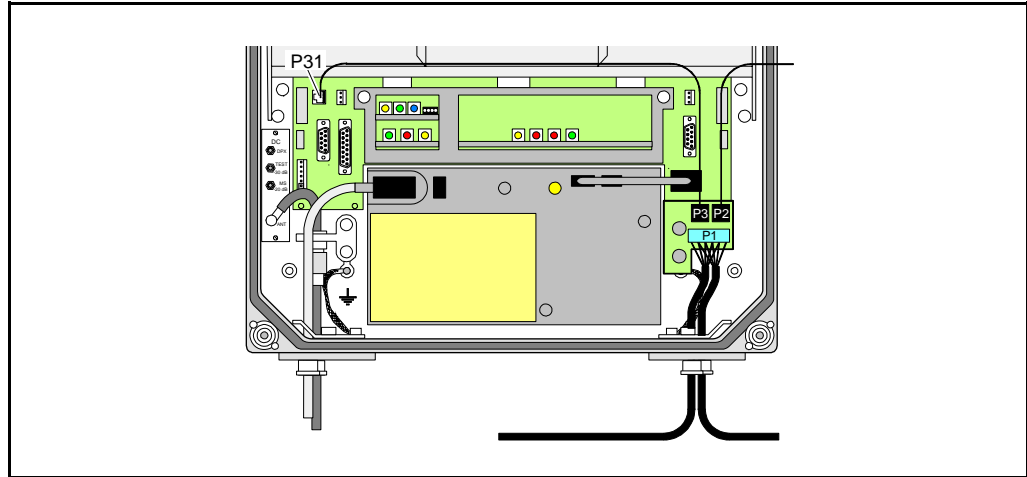


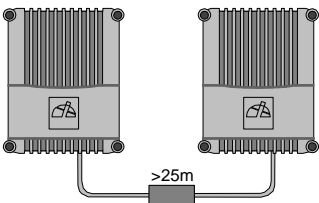
Figure 3-13. R2R connection

The P34, Repeater to Repeater Link port, is described in the *Connection Ports* section in Chapter 5.

Any cable type can be used for indoor installation.

The following cable type is recommended for outdoor installation:

Li 2YC11Y, 2x2xAWG24/222, non-halogen, Metrofunkkabel-Union.



Use a strain relief bushing or a connector at the bottom of the repeater for the external net cable.

If the link cable between two repeaters in an R2R net is longer than 25 meters, then an RS-485 repeater is required, see the figure.

Further information about the *Repeater to Repeater Link* is found in the VD202 91/EN, *R2R, Repeater to Repeater Link Kit, Installation Guide*.

## F2F, Fiber to Fiber Link

F2F is a feature that makes it possible to communicate with all repeaters that have a FON board (i.e. BMU, RMU and FOR) and are included in the same fiber optic net. By using the existing fiber optic distribution net, no wire or other communication device is required.

Communication with repeaters works also in mixed F2F and R2R net.



## Mains Breakdown Relay

To be able to distinguish PSU faults from power failure, a mains breakdown relay can be used.

The mains breakdown relay is not included in the repeater. So, it has to be mounted outside the repeater chassis. The relay intended for this purpose must fulfil the following specifications:

### Relay specification

Closing time: Max. 30 milliseconds.

Insulation coil/contact: Min. 4KV.

Mains connected relay must be in compliance with valid local regulations.

### Connection

1. Connect a currentless closed relay contact to pin AI1 and AIC on the P33 alarm connector see Figure 3-14. Alarm is initiated by short circuiting pin AI1 and AIC in the P33 connector.

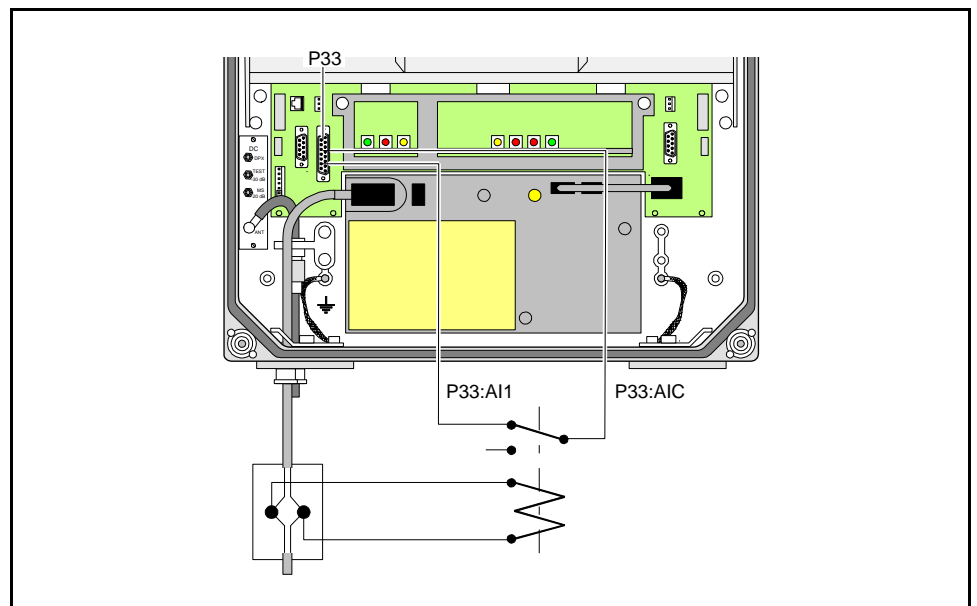


Figure 3-14. Mains breakdown relay connection

The P33 alarm port is described in the *Connection Ports* section in Chapter 5.

2. Connect the relay coil. It must be supplied from the same fuse as the repeater.
3. After commissioning, select the *Mains Breakdown* option in the alarm configuration dialog box in the OMT32 or OMS program. Refer to the *OMT32, User's Manual* or the *Advanced Repeater OMS, User's Manual*.

## Finishing the Installation

Check all connections made.

If a 24 Volt or 48 Volt power supply unit is to be used, then replace the PSU as described in the next section.

When ready with the installation, commission the repeater as described in Chapter 4, *Commissioning*.

## Installing 24V or 48V DC Power Supply Unit

The 220V AC PSU can be replaced with a 24 Volt or 48 Volt DC PSU as described below.

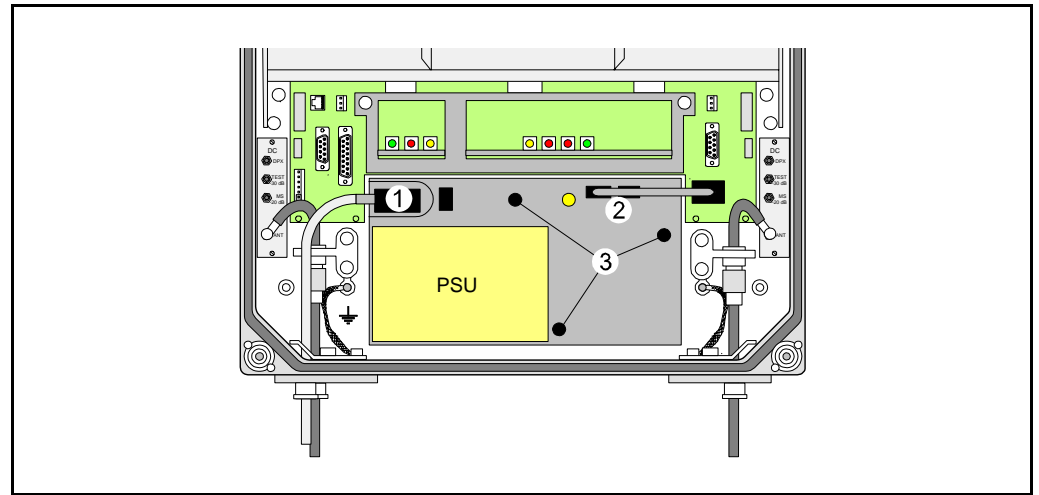
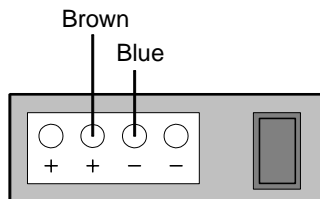


Figure 3-15. Replacing mains PSU with 24V or 48V

1. Switch the repeater off and remove the mains plug from the PSU ('1' in Figure 3-15).
2. Disconnect the two connectors (2) on the PSU.
3. Loosen the three fixing screws (3) using a 5mm Allen key.
4. Remove the PSU from the repeater.
5. Mount the 24/48 Volt DC PSU with the three fixing screws (3).
6. Connect the PSU to the DIA board (2).
7. Connect the DC power cable. The supplied cable should have a radiation limiter. The cable shall be connected as follows:



The + pole shall be connected to one of the left terminals in the PSU connector with the brown part of the DC cable.

The - pole shall be connected to one of the right terminals in the PSU connector with the blue part of the DC cable.

8. Switch the repeater on.
9. The yellow LED on the PSU shall now be lit.



*The DC Power Supply Unit must be galvanically separated from the mains supply with an equipment fulfilling the IEC65 safety requirements.*



# 4. Commissioning

Read carefully Chapter 1 *Safety* before commissioning the repeater.

Check all connections made during the installation.

To fulfill the IP65 weather protective requirements, ensure that the cable strain relief bushings are properly tightened. Also, ensure that the gaskets at the cable inlets and on the cabinet are properly fitted and not damaged.

## Preparing for setup

You can set up a repeater locally by connecting a PC loaded with the OMT32 software.

A COM port on the PC is connected to the P31 PC port (RS-232) located to the right in the cabinet (see Figure 4-1). Use the provided serial cable.

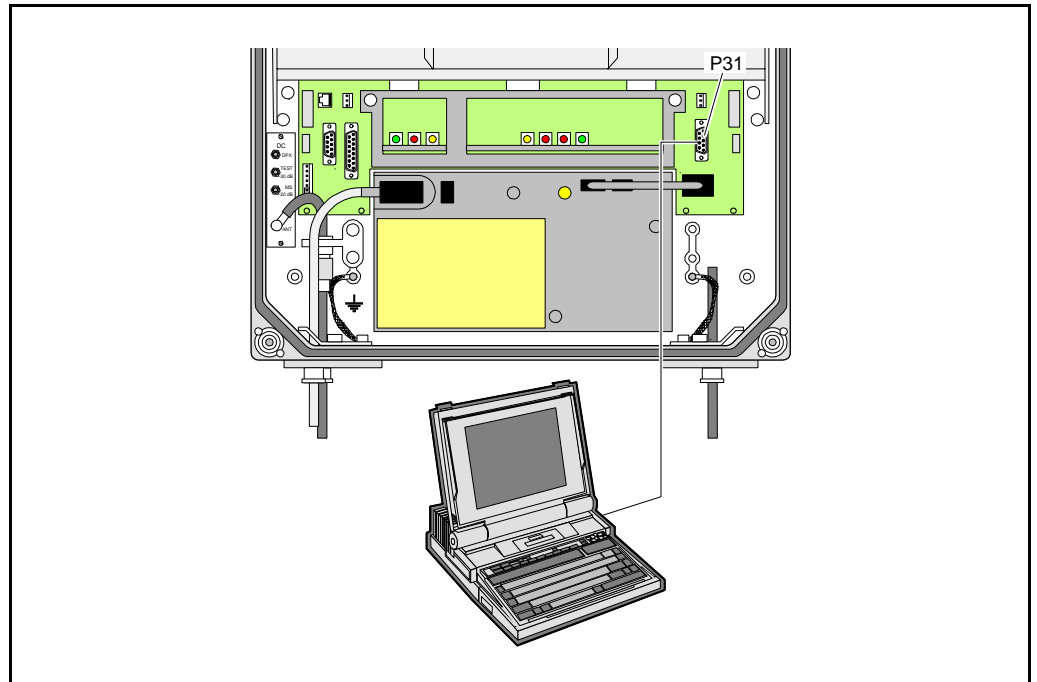


Figure 4-1. Connecting a PC for local setup

The P31 PC port is described in the *Connection Ports* section in Chapter 5.

Finally, make sure the repeater is connected to the mains.

Now, you can use OMT32 to set up and control the repeater. The OMT32 program is described in the *OMT32, User's Manual*.

For repeaters without DIA board (e.g. BMU without donor antenna) the PC is connected to the P106 port on the FON board. The P106 port is described in the *FON - Fiber Optic Node Board* section in Chapter 5.

## Starting the Repeater

1. Turn the mains switch on (marked 'S' in Figure 4-2).
2. Check the LED on the power supply unit (V). It must be lit with a steady yellow light.
3. Check the four **CU board** LEDs (see Figure 4-2). A correct power up is indicated as follows:

### **POWER**

Yellow LED that is lit with a steady light after the mains is switched on. Indicates present power.

### **BOOT**

Red LED that is lit with a steady light when the system boots, i.e. for 10 – 15 seconds after the mains is switched on. Then, it flashes for the next 5 – 10 seconds. After that, if no error is detected, the LED is off.

### **FAULT**

Red LED that flashes 15 – 20 seconds after the mains is switched on. Then, it flashes for less serious alarms (ERROR) and is lit with a steady light for fatal alarms (CRITICAL).

### **OPER**

Green LED that lights up approx. 15 seconds after the mains is switched on. It shows, with a steady light, that the unit is ready for operation.

4. Check the three **ALI board** LEDs (see Figure 4-2). The LEDs follow the alarm relays. A correct power up is indicated as follows:

### **OPER**

Green LED that has the same indication as the green LED on the CU board (see above).

### **FAULT**

Red LED that is lit with a steady light for ERROR and CRITICAL alarms.

### **POWER**

Yellow LED that has the same indication as the yellow LED on the CU board (see above).

When the indicators show operational mode, the repeater can be configured for operation by using a computer running OMT32. This is further detailed in the *OMT32, User's Manual*.

## Indicators in the Cabinet

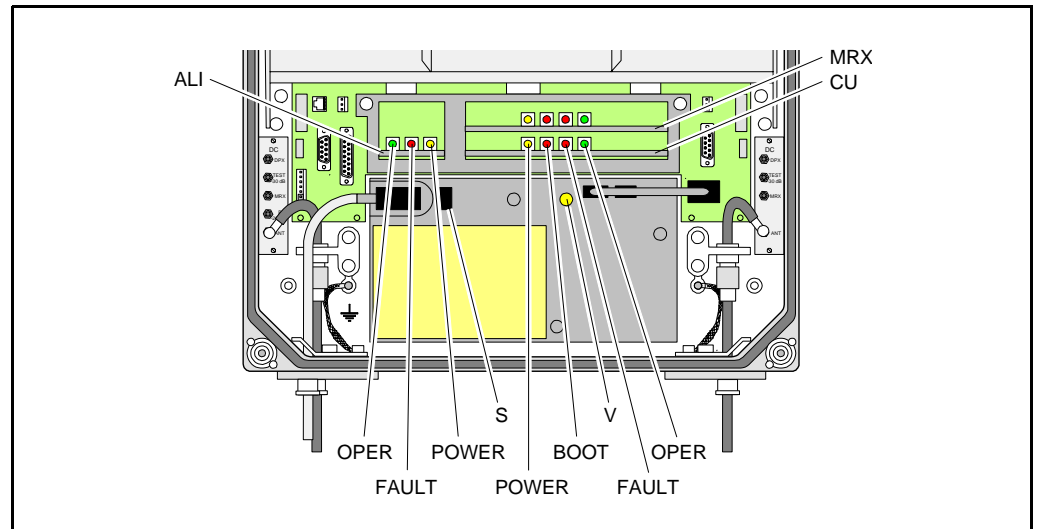


Figure 4-2. Internal indicators and mains switch

Figure 4-2 shows the repeater indicators and the mains switch in the cabinet.

Figure 4-2 is, however, not applicable to the BMU type that uses the indicators on the FON board. The FON board indicators are described in the *FON - Fiber Optic Node Board* section in Chapter 5.

### MRX indicators

An optional MRX board for CDMA repeaters has the same set of indicators as the CU board (POWER, BOOT, FAULT and OPER). The function of these MRX indicators are also the same as for the CU board (described in the previous section).

### R2R, Repeater to Repeater Link indicators

Additional indicators are found in the repeater, if equipped with the *Repeater to Repeater Link* feature. For information about these indicators, refer to the VD202 91/EN *R2R, Repeater to Repeater Link Kit, Installation Guide*.

### F2F, Fiber to Fiber Link indicator

An additional green F2F indicator is found on the FON board in the BMU, RMU and FOR types. This indicator is further described in the *FON - Fiber Optic Node Board* section in Chapter 5.

## Indicators on the Repeater Front



*Figure 4-3. External indicators*

After commissioning the repeater, the cover is closed and the following indicators on the repeater front are visible:

### **Yellow**

Operation LED that lights up approx. 15 seconds after the mains is switched on. At steady light the repeater is ready for operation.

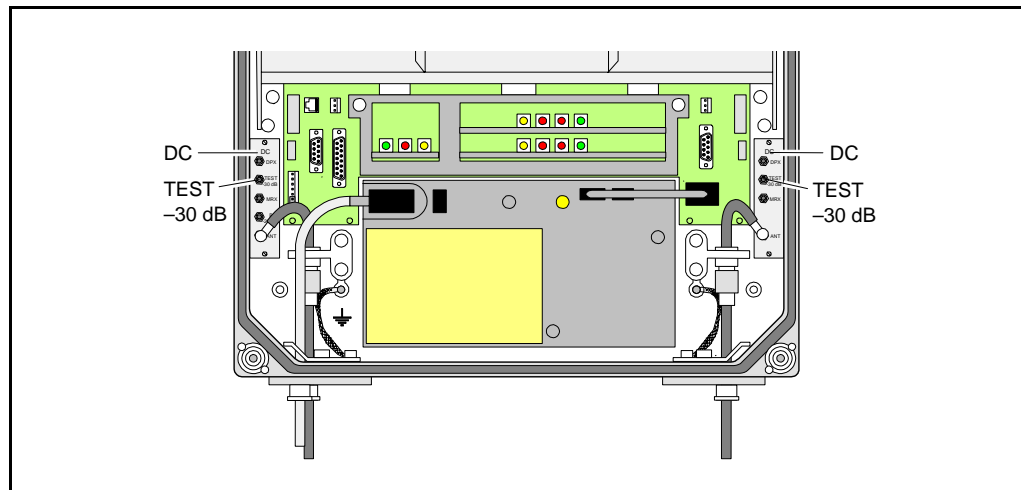
### **Red**

Alarm LED that indicates ERROR alarms with flashing light and CRITICAL alarms with steady light.



## Measuring the Output Signal Level

Uplink and downlink output signal test ports are found on the directional couplers (DC) at the MS and BS antenna connectors. These test ports are marked TEST -30dB (see Figure 4-4) and are intended for signal measuring using e.g. a spectrum analyzer.



*Figure 4-4. Measuring ports for output signal level*

The coupling is  $-30\text{dB}$  approximately. There is no directivity in these test ports, i.e. both uplink and downlink signal can be measured.

## Voltage Supply Testpoints

A number of voltage supply testpoints are available in the repeater. These testpoints are named U7A – U7F for the 7V supply voltages and U26 for the 26V or 13V supply voltage (26V or 13V depending on the repeater type).

A standard multi-meter can be used on these testpoints.

The testpoints are found on the DIA board in the repeater cabinet. The testpoint positions on the DIA board is detailed in the *Board and Unit Descriptions* section in Chapter 5.

If the repeater is equipped with a second PSU, e.g. for combined channel/band selective operation, the same set of testpoints are also found on the cover DIA board.

## Repeater Configuration

The repeater is now ready to be configured in accordance with the site conditions and system performance requirements. Pay especial attention to the antenna isolation described in the *OMT32, User's Manual*.

# 5. Functional Description

This chapter contains a short general description. After that you will find descriptions of the various repeater types on a unit level, including repeater types, design, block diagrams, board and sub unit descriptions, connection ports, and cabling.

## General Description

LGP Allgon AR repeaters work as bi-directional on-frequency amplifiers.

A repeater receives, amplifies, and retransmits signals downlink and uplink simultaneously, i.e. from the base station via the repeater to the mobile stations and from the mobile stations via the repeater to the base station.

The repeater can be connected to a BS donor antenna, directed towards the base station, and to an MS service antenna directed towards the area to be covered. These antennas are connected to the repeater with N type male connectors.

The repeaters can also be connected via RF cables or fiber optic cables instead of donor or service antennas.

To prevent instability due to poor antenna isolation, a built-in antenna isolation supervision feature reduces the gain level automatically when poor antenna isolation is detected. For channel selective CDMA repeaters, poor antenna isolation is detected and managed by means of an MRX unit (Measurement Receiver).

The LGP Allgon repeaters are controlled by powerful microprocessors.

Alarm and operational status LEDs are visible on the repeater front.

The repeater works with convection cooling without fan.

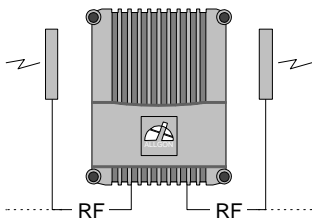
Operational parameters, such as gain, channel number, power levels, etc. are set using a desktop or notebook and LGP Allgon OMT32, which communicate, locally or remotely via modem, with the repeater. Remote operation is performed via PSTN or a GSM net.

## Repeater Types

The main repeater types are listed in Chapter 2, *Introduction*, where you also will find some examples on how to use the various repeater types to build up a fiber optic network and antennas for covering a desired area.

The main repeater types are further described in this and the following sections. As all the described repeater types can be configured differently, this description is applicable only to standard configured repeaters.

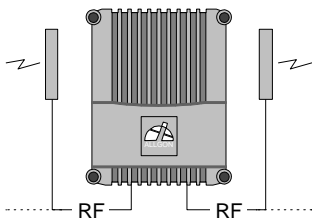
### Channel Selective GSM Repeater



A channel selective GSM repeater can be equipped with two, four, six or eight channels. This repeater type is used for channel selective systems such as GSM, DCS, PCN and PCS.

The channel selective GSM repeater has an RF port for a donor antenna (or RF cable) and an RF port for a service antenna (or RF cable).

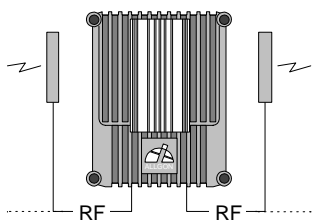
### Channel Selective CDMA/WCDMA Repeaters



A channel selective CDMA or WCDMA repeater can be equipped with one or two channels. These repeater types are used for digital code division systems in accordance with IS-95 or J-std-008 standard, and wideband digital code division systems.

The channel selective CDMA/WCDMA repeaters have an RF port for a donor antenna (or RF cable) and an RF port for a service antenna (or RF cable).

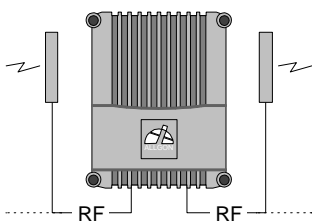
### Channel Selective High Power CDMA/WCDMA Repeaters



These are CDMA/WCDMA repeaters equipped with a 6dB (typically) BA (Booster Amplifier) in the downlink transmitting signal path.

The channel selective high power CDMA/WCDMA repeaters have an RF port for a donor antenna (or RF cable) and an high power RF port for a service antenna (or RF cable).

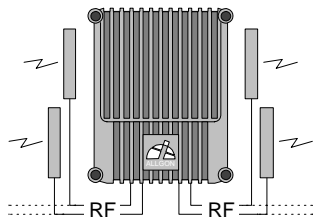
### Band Selective Repeater



The band selective repeater has an adjustable bandwidth. This repeater type is used for analog or digital systems such as NMT, GSM, TACS, ETACS, AMPS, DAMPS, CDMA and WCDMA.

The band selective repeater has an RF port for a donor antenna (or RF cable) and an RF port for a service antenna (or RF cable).

## Combined Repeater

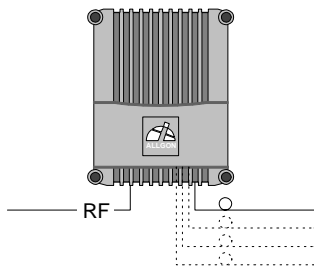


Some of the repeater types can be combined in the same repeater chassis and be in operation in parallel.

One repeater part is located in the chassis cabinet and the second repeater part is located in a high cover.

The combined repeater has normally two RF ports for donor antennas (or RF cables) and two RF ports for service antennas (or RF cables).

## BMU, Base Station Master Unit

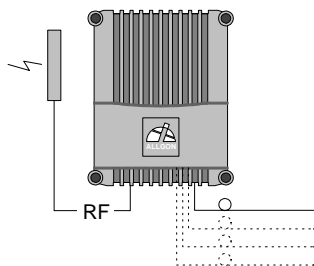


A BMU is one of the RF repeater types equipped with a FOU (Fiber Optic Unit) that makes the repeater receive and transmit optic signals on the service side.

The BMU has an RF port for BTS connection and up to four fiber optic ports that can be connected to FORs.

By using WDMs and OSPs, up to four FORs can be fed in parallel by a BMU with double or single fiber communication. Up to eight FORs can be fed with a high cover and two FOU.

## RMU, Repeater Master Unit

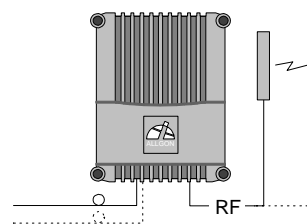


An RMU is one of the RF repeater types equipped with a FOU (Fiber Optic Unit) that makes the repeater receive and transmit optic signals on the service side.

The RMU has an RF port for a donor antenna and up to four fiber optic ports that can be connected to FORs.

By using WDMs and OSPs, up to four FORs can be fed in parallel by an RMU with double or single fiber communication. Up to eight FORs can be fed with a high cover and two FOU.

## FOR, Fiber Optic Repeater



A FOR is one of the RF repeater types equipped with a FOU that makes the repeater receive and transmit optic signals on the donor side.

The FOR has a fiber optic donor port and an RF port for a service antenna (or RF cable).

By using a splitter, another FOR can be connected in serial.

This unit can be connected to a BMU, RMU or FOR (with splitter).

## Repeater Design

The repeater is housed in a cast aluminium chassis that is waterproof, class NEMA4/IP65, for outdoor use. The chassis has a design suited for outdoor use as well as indoor use.

The chassis consists of a cabinet and a cover joined with hinges. The cabinet contains the repeater circuitry. The cover can be either a low cover or a high cover. The latter consists of another cabinet which can be used as an empty cover or be equipped as a part of the repeater or as an independent repeater unit.

Inside the repeater, a number of amplifier boards are individually shielded and located under a metal cover that can be folded out. These amplifier boards are of different types depending on the supported system.

A repeater with a high cover that is equipped as two independent repeater units (Combi) can, for example, be equipped for channel selective operation in the cabinet and band selective operation in the cover.

Functionally, all the repeater types are built up with a number of sub units. These are listed below and pointed out in the following sections.

### Sub Unit Overview

The main repeater sub units are:

#### **CHA, Channel Amplifier board**

Channel selective GSM repeaters can handle up to eight repeater channels (four if the CU part number is K103/1). For every even number of repeater channels, two CHA amplifier boards are required in the repeater, one CHA board for uplink signaling and one board for downlink signaling. Each repeater channel is allocated to a radio channel or switched off. In a GSM type TDMA system (GSM, EGSM, DCS1800 or PCS1900), one repeater channel can handle eight calls (sixteen if half-rate encoding is used).

#### **CSA, CDMA/WCDMA Segment Amplifier board**

Channel selective CDMA/WCDMA repeaters can handle two CDMA or WCDMA repeater channels. For every even number of repeater channels, two CSA amplifier boards and two PA amplifier boards are required in the repeater, one pair of CSA/PA boards for uplink signaling and one pair for downlink signaling. Each repeater channel is allocated to a radio channel or switched off.

#### **BSA, Band selective amplifier board**

Band selective repeaters can handle multi-carriers over a wide band. The bandwidth is adjustable. A band selective repeater channel requires two BSA boards and two PA amplifier boards in the repeater. One pair of BSA/PA boards for uplink signaling and one pair for downlink signaling.

**PA, Power Amplifier board**

This is a power amplifier board that can handle two repeater channels. For every even number of repeater channels, two PA amplifier boards are required in the repeater, one pair for uplink signaling and one pair for downlink signaling.

The PA board is used with CSA boards in CDMA and WCDMA repeaters, and with BSA boards in band selective repeaters.

**BA, Booster Amplifier**

CDMA and WCDMA repeaters can be equipped with a high power booster amplifier that boosts the output gain with typically 6dB. A high power CDMA or WCDMA repeater can operate with maximum two channels.

**DIA, Distribution board**

The DIA board is a distribution board on which all other boards and units are connected to.

A DIA board is found in the cabinet. Another DIA board is found in the cover, if equipped as an independent repeater.

On the DIA board, there is a shielded metal frame in which the CU, ALI and MRX boards are located.

**CU, Control Unit board**

The CU board is the control unit of the repeater.

The CU board is found in the right part of the shielded DIA board frame.

**ALI, Alarm Interface board**

The ALI board handles alarm and alarm communication.

The ALI board is found in the left part of the shielded DIA board frame.

**DC, Directional Coupler**

DC units are used as antenna signal directional couplers.

DC units are found in shielded boxes to the left and right in the cabinet (at the antenna flanges) and in some repeater types also in the cover.

**LNA, Low Noise Amplifier**

LNA amplifiers are used as uplink and downlink low noise branch amplifiers.

LNA units are found in shielded boxes in the upper part of the cabinet. In some types, they can also be found in the upper part of the cover.

**DPX, Duplex filter**

Duplex filters are found on the cover plate over the amplifier boards.

**CMB, Combiner unit**

CMB units are found on the cover plate over the amplifier boards in channel selective repeaters with more than two channels, and in combined repeaters.

**MRX, Measurement Receiver board**

Channel selective CDMA repeaters can be equipped with an MRX unit. For such a repeater, an MRX board is found in the right part of the shielded DIA board frame.

**FOU, Fiber Optic Unit**

The FOU is, in the simplest configuration, a metal plate on which a FON board (or the earlier FOT board), a duplex filter and fiber optic connectors are assembled. The FOU can, however, be configured with combiners, OSPs and WDMs to obtain a desired combination of several branches with double or single fiber communication.

The FOU is used in BMUs, RMUs and FORs.

**FON, Fiber Optic Node board**

The FON board is a unit that converts RF signals to optic signals and the other way round. Also, it supervises the RF and optical signals and generates alarm if an error occurs. Actually, it has most of the repeater functions except for channel boards.

The FON board is built up on a printed circuit board that also contains battery backup.

The FON is the main part of the FOU.

**FOT, Fiber Optic Transceiver**

The FOT unit is an earlier version of the FON board. It converts RF signals to optic signals in the same way as the FON board, but it has not as many functions as the FON board.

The FOT is the main part of the FOU.

**PSU, Power Supply Unit**

In all the repeater types, a PSU is found downmost in the cabinet. In some types, it can also be found in the cover.



**RCU, Remote Control Unit (optional)**

The RCU is an optional communication unit for remote control of the repeaters via PSTN or GSM modems.

The RCU unit is further described in Chapter 6, *Optionals*.

**RCC, Remote Communication Control unit (optional)**

The RCC is an optional communication unit for remote control of the repeaters via PSTN or RF modems.

An RCC, Remote Communication Control unit, is required if the unit is to be connected to a FON board (the FON board does not support the RCU). A description of the RCC and its connection is found in the VD203 67/EN, *ALR Compact Repeater, User's Manual*. See also Chapter 6, *Optionals*.

The RCC unit is the latest version of remote control units, also used in the Compact repeaters.

**RIA, Repeater to Repeater Interface Adapter (optional)**

If the repeater is equipped with an optional R2R feature, then a RIA board is found in the left part of the shielded DIA board frame.

For further information about the *Repeater to Repeater Link* feature, refer to the VD202 91/EN *R2R, Repeater to Repeater Link Kit, Installation Guide*.

## Sub Units in a Channel Selective GSM Repeater

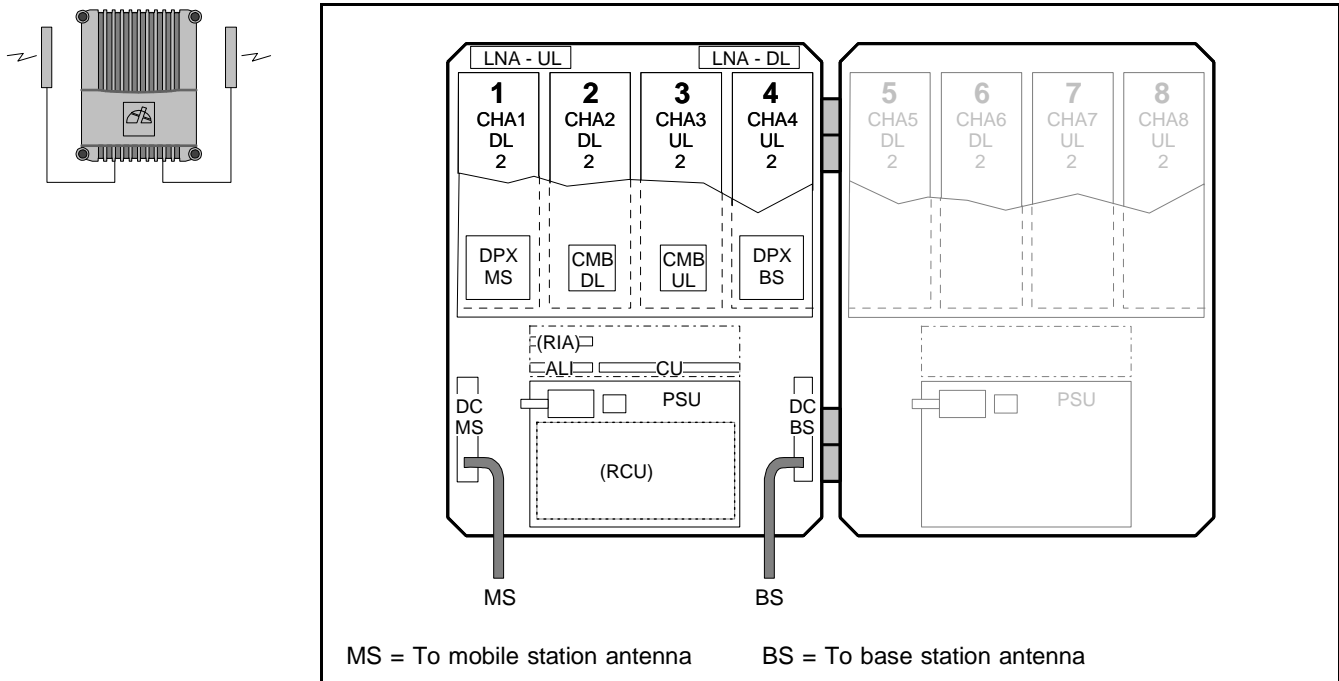


Figure 5-1. Sub units in a GSM repeater

A cabinet (the left part in Figure 5-1) for a channel selective GSM repeater can be equipped with four CHA channel boards, two downlink boards (DL) with two internal channels each and two uplink boards (UL) with two internal channels each. The described cabinet has a capacity of four bi-directional GSM channels.

The cover (the right part in Figure 5-1) can be equipped as well, which gives up to eight GSM channels. The cover board positions are shown in the figure.

Channel selective GSM repeaters are used for GSM, DCS and PCS types of TDMA systems.

### Sub units:

ALI	Alarm Interface board.
CHA	Channel Amplifier board.
CMB	Combiner unit.
CU	Control Unit board.
DC	Directional Coupler.
DPX	Duplex filter.
LNA	Low Noise Amplifier.
PSU	Power Supply Unit.
RIA	Repeater to Repeater Interface Adapter board (optional).
RCU	Remote Control Unit (optional).

## Sub Units in a Channel Selective CDMA/WCDMA Repeater

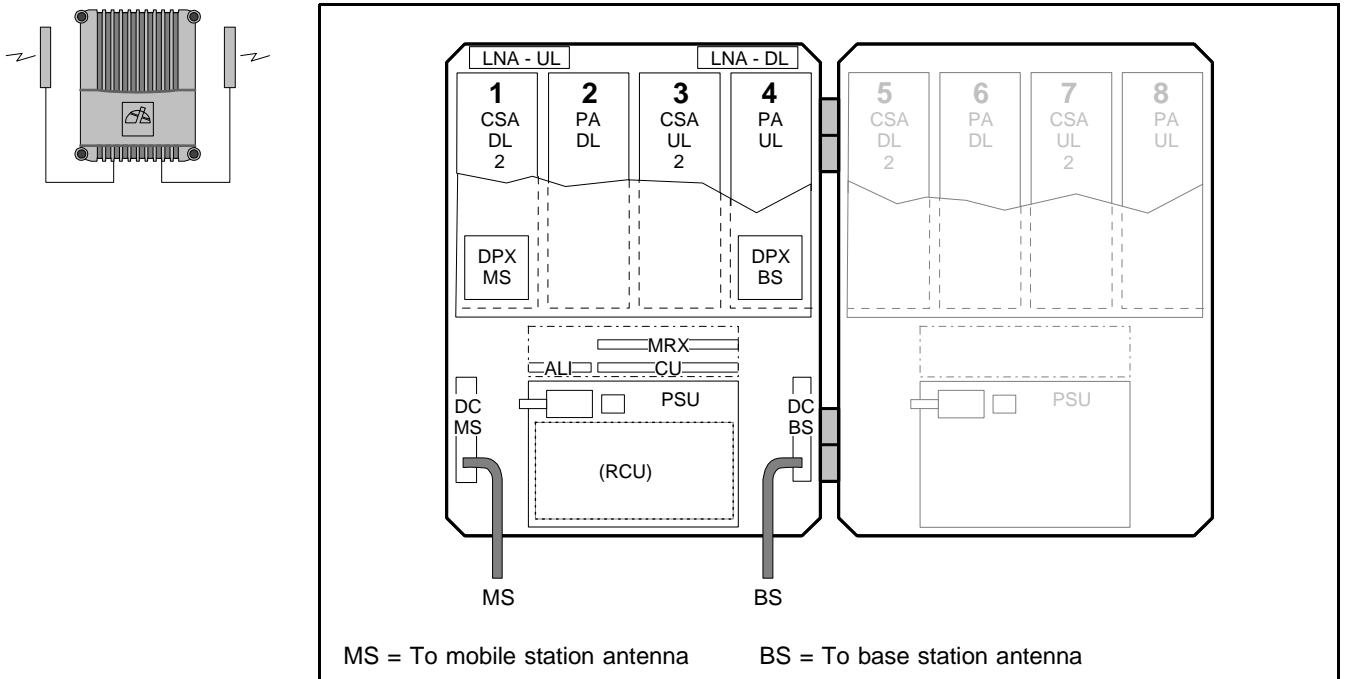


Figure 5-2. Sub units in a CDMA/WCDMA repeater

A cabinet (the left part in Figure 5-2) for a channel selective CDMA or WCDMA repeater can be equipped with two pair of CSA and PA boards, one pair for downlink (DL) and one pair for uplink (UL). The described cabinet has a capacity of two bi-directional CDMA or WCDMA carriers.

The cover (the right part in Figure 5-2) can be equipped as well, which gives up to four CDMA or WCDMA channels. The cover board positions are shown in the figure.

CSA boards are used for IS-95 or J-STD-008 types of CDMA systems and WCDMA systems.

### Sub units:

ALI	Alarm Interface board.
CSA	CDMA/WCDMA Segment Amplifier board.
CU	Control Unit board.
DC	Directional Coupler.
DPX	Duplex filter.
LNA	Low Noise Amplifier.
MRX	Measurement Receiver board (CDMA only).
PA	Power Amplifier board.
PSU	Power Supply Unit.
RCU	Remote Control Unit (optional).

## Sub Units in a Channel Selective High Power CDMA/WCDMA Repeater

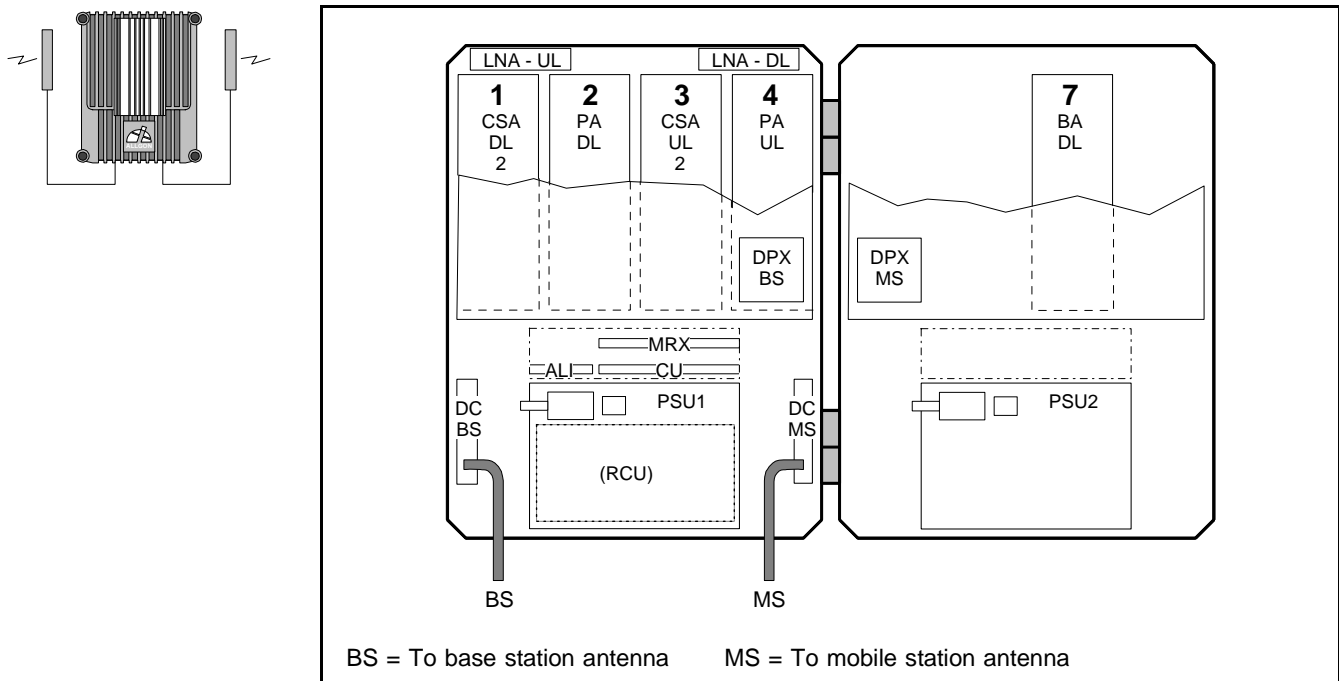



Figure 5-3. Sub units in a high power CDMA/WCDMA repeater

A cabinet (the left part in Figure 5-3) for a channel selective high power CDMA or WCDMA repeater can be equipped with two pair of CSA and PA boards, one pair for downlink (DL) and one pair for uplink (UL). The described cabinet has a capacity of two bi-directional CDMA or WCDMA carriers.

The high cover (the right part in Figure 5-3) is equipped with the BA board. There is a heat sink element on the outside of the cover.

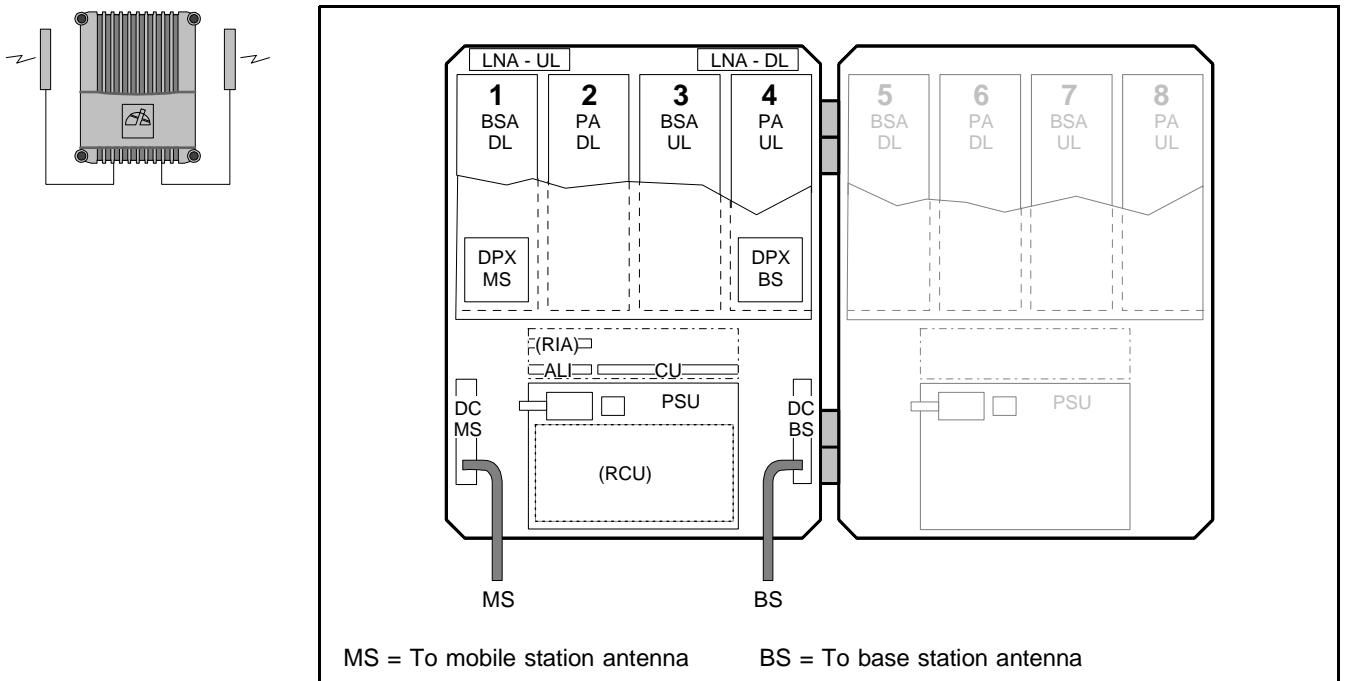
 *This repeater type has opposite positions of the BS and MS antenna inputs and DC units compared to the other repeater types.*

CSA boards are used for IS-95 or J-STD-008 types of CDMA systems and WCDMA systems.

### Sub units:

ALI	Alarm Interface board.
BA	Booster Amplifier board.
CSA	CDMA/WCDMA Segment Amplifier board.
CU	Control Unit board.
DC	Directional Coupler.
DPX	Duplex filter.
LNA	Low Noise Amplifier.
MRX	Measurement Receiver board (CDMA only).
PA	Power Amplifier board.
PSU1	Power Supply Unit.
PSU2	Special Power Supply Unit for the BA board.
RCU	Remote Control Unit (optional).

## Sub Units in a Band Selective Repeater



*Figure 5-4. Sub units in a band selective repeater*

A cabinet (the left part in Figure 5-4) for a band selective repeater is equipped with two pair of BSA and PA boards, one pair for downlink (DL) and one pair for uplink (UL). The described cabinet is equipped for bi-directional band selective operation.

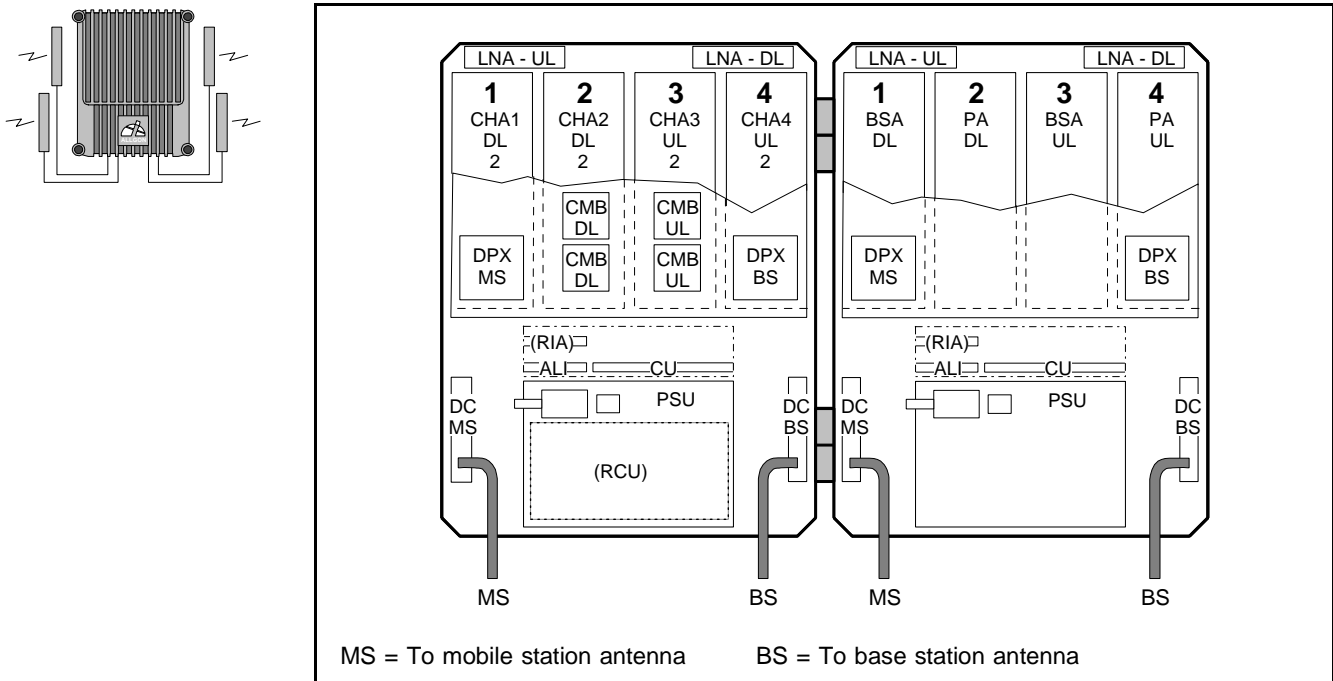
The cover (the right part in Figure 5-4) can be equipped as well. The cover board positions are shown in the figure.

BSA boards are used for band selective systems.

Sub units:

ALI	Alarm Interface board.
BSA	Band Selective Amplifier board.
CU	Control Unit board.
DC	Directional Coupler.
DPX	Duplex filter.
LNA	Low Noise Amplifier.
PA	Power Amplifier board.
PSU	Power Supply Unit.
RIA	Repeater to Repeater Interface Adapter board (optional).
RCU	Remote Control Unit (optional).

## Sub Units in a Combined Repeater



*Figure 5-5. Sub units in a combined repeater*

Figure 5-5 shows an example of a combined channel selective and band selective repeater. The channel selective part is located in the cabinet and the band selective part in the high cover.

This example has four bi-directional GSM channels and band selective operation.

Any combination of repeaters mentioned in this manual can be mixed.

### Sub units:

ALI	Alarm Interface board.
BSA	Band Selective Amplifier board.
CHA	Channel Amplifier board.
CMB	Combiner unit.
CU	Control Unit board.
DC	Directional Coupler.
DPX	Duplex filter.
LNA	Low Noise Amplifier.
PA	Power Amplifier board.
PSU	Power Supply Unit.
RIA	Repeater to Repeater Interface Adapter (optional).
RCU	Remote Control Unit (optional).

## Sub Units in a BMU

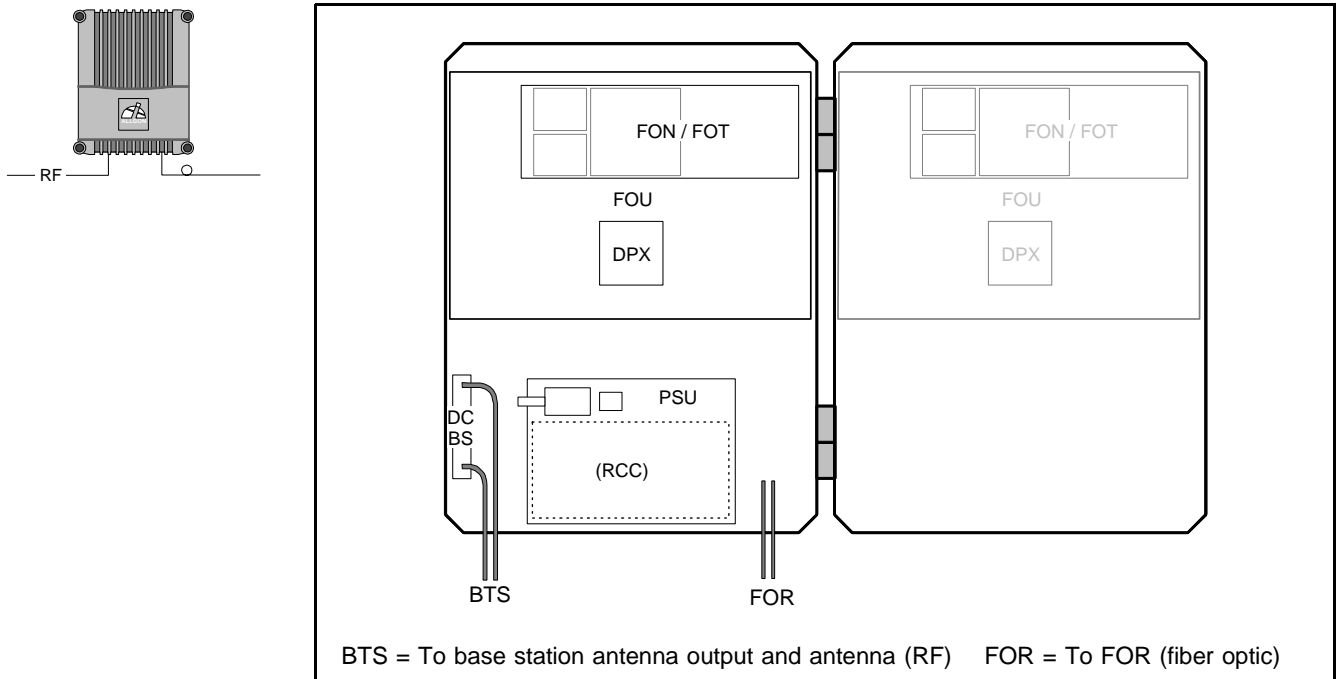


Figure 5-6. Sub units in a BMU

A cabinet (the left part in Figure 5-6) for a BMU has no control unit board and no amplifier boards but a Fiber Optic Unit (FOU) with a Fiber Optic Node board (FON) or a Fiber Optic Transceiver (FOT) and a duplex filter (DPX).

By adding WDMs and OSPs to the FOU (not shown in Figure 5-6), up to four FORs can be fed in parallel by a BMU with double or single fiber communication.

The cover (the right part in Figure 5-6) can be equipped as well, which gives up to eight fiber optic FOR ports.



*This repeater type has the opposite position of the BS connection (BTS) compared to the other repeater types.*

### Sub units:

- DC    Directional Coupler.
- DPX    Duplex filter.
- FON    Fiber Optic Node board.
- FOT    Fiber Optic Transceiver board.
- FOU    Fiber Optic Unit.
- PSU    Power Supply Unit.
- RIA    Repeater to Repeater Interface Adapter board (optional).
- RCC    Remote Communication Control unit (optional). Only if a FON board is used (the FOT board does not support the RCC unit).

The Repeater to Repeater Interface Adapter (RIA board) cannot be used in the BMU, but the FON board has the R2R and F2F functionality built-in. The FON board is described on page 5-46.

## Sub Units in an RMU

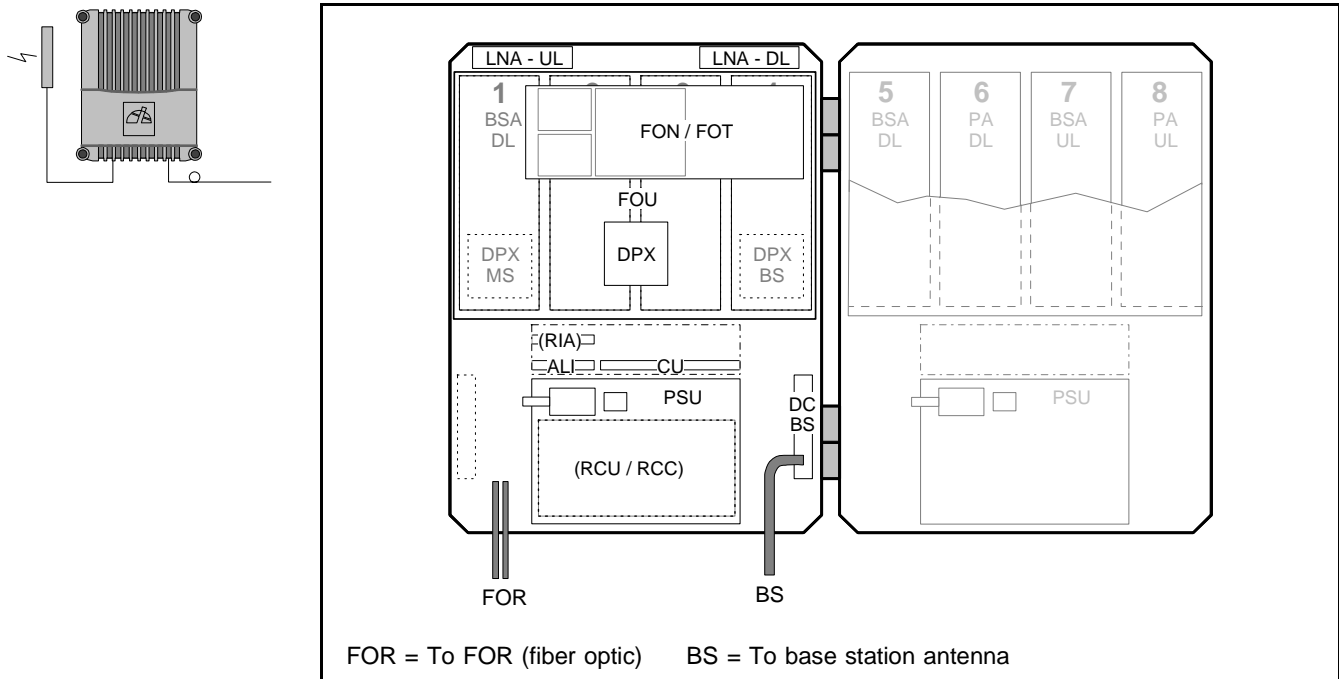


Figure 5-7. Sub units in an RMU

Figure 5-7 shows an example of an RMU for band selective operation.

This unit has the same FOU as the previous example, i.e. a Fiber Optic Node board (FON) or a Fiber Optic Transceiver (FOT) and a duplex filter (DPX). The FOU is mounted in the same band selective repeater that is described on page 5-11. Only the MS Directional Coupler (DC-MS) is omitted or not used.

Four or eight fiber optic ports can be obtained in the same way as described in the previous example.

Sub units:

ALI	Alarm Interface board.
BSA	Band Selective Amplifier board.
CU	Control Unit board.
DC	Directional Coupler.
DPX	Duplex filter.
FON	Fiber Optic Node board.
FOT	Fiber Optic Transceiver board.
FOU	Fiber Optic Unit.
LNA	Low Noise Amplifier.
PA	Power Amplifier board.
PSU	Power Supply Unit.
RIA	Repeater to Repeater Interface Adapter board (optional).
RCU or RCC	RCU Remote Control Unit (optional).
RCU or RCC	RCC Remote Communication Control unit (optional). Only if a FON board is used (the FOT board does not support the RCC unit).

The FON board has also the R2R and F2F functionality built-in. The FON board is described on page 5-46.



## Sub Units in a FOR

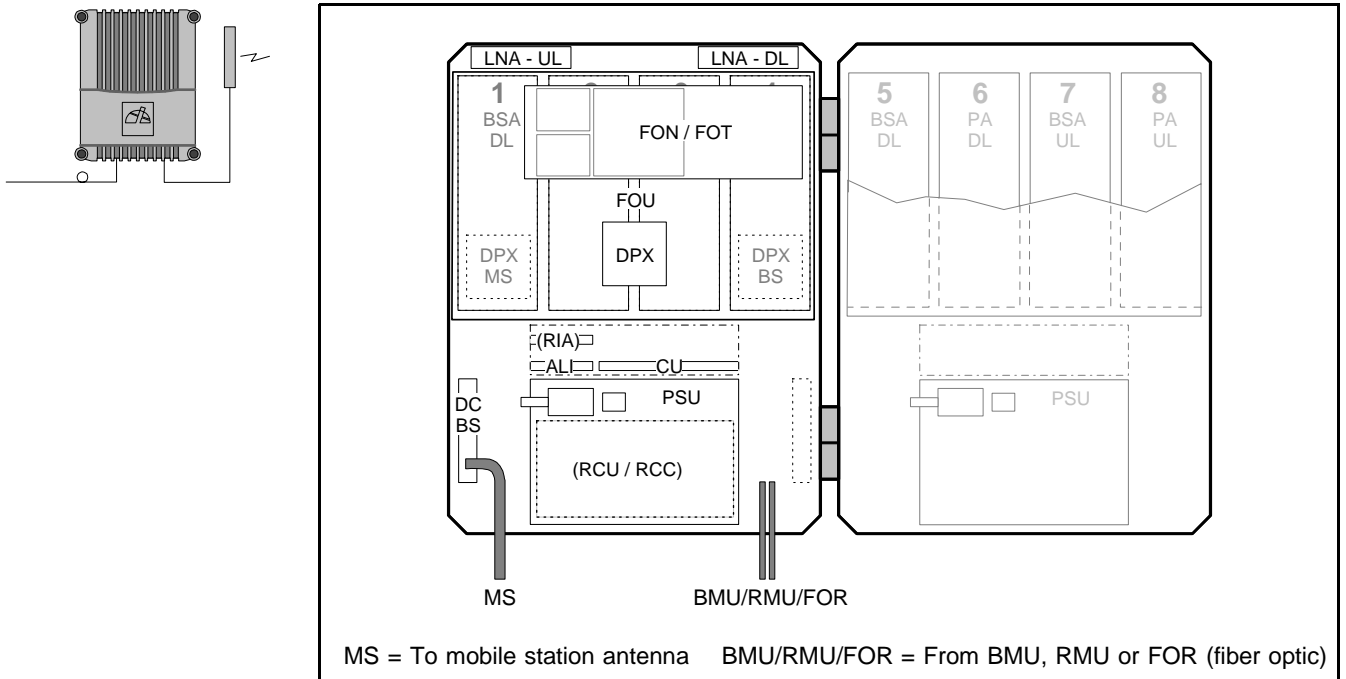


Figure 5-8. Sub units in a FOR

Figure 5-8 shows an example of a FOR for band selective operation.

This unit has the same FOU as the previous examples, i.e. a Fiber Optic Node board (FON) or a Fiber Optic Transceiver (FOT) and a duplex filter (DPX). The FOU is mounted in the same band selective repeater that is described on page 5-11. Only the BS Directional Coupler (DC-BS) is omitted or not used.

By adding WDMs and OSPs to the FOU (not shown in Figure 5-8), a fiber optic port for another FOR can be obtained with double or single fiber communication.

Sub units:

ALI	Alarm Interface board.
BSA	Band Selective Amplifier board.
CU	Control Unit board.
DC	Directional Coupler.
DPX	Duplex filter.
FON	Fiber Optic Node board.
FOU	Fiber Optic Unit.
LNA	Low Noise Amplifier.
PA	Power Amplifier board.
PSU	Power Supply Unit.
RIA	Repeater to Repeater Interface Adapter board (optional).
RCU or RCC	RCU Remote Control Unit (optional).
RCU or RCC	RCC Remote Communication Control unit (optional). Only if a FON board is used (the FOT board does not support the RCC unit).

The FON board has also the R2R and F2F functionality built-in. The FON board is described on page 5-46.

## Block Diagram

The following block diagrams are found in this section:

- Channel selective GSM repeater, page 5-18.
- Channel selective CDMA/WCDMA repeater, page 5-20.
- Band selective repeater, page 5-22.
- BMU, page 5-24.
- RMU, page 5-26.
- FOR, page 5-28.

The main signal paths for the repeater types are described in general in the next section and detailed under each block diagram.

Alarms are described on page 5-31.

Repeater setup is described on page 5-31.

## Downlink Signal Path

The downlink signal path, i.e. from the base station through the repeater to the mobile station, is described for each repeater type under the block diagrams on the following pages.

## Uplink Signal Path

The uplink signal path, i.e. from the mobile station through the repeater to the base station, is identical to the downlink path but the other way round. Only some levels and component values differ.

The high power CDMA repeater has, however, a booster amplifier in the downlink path.

# Channel Selective GSM Repeater

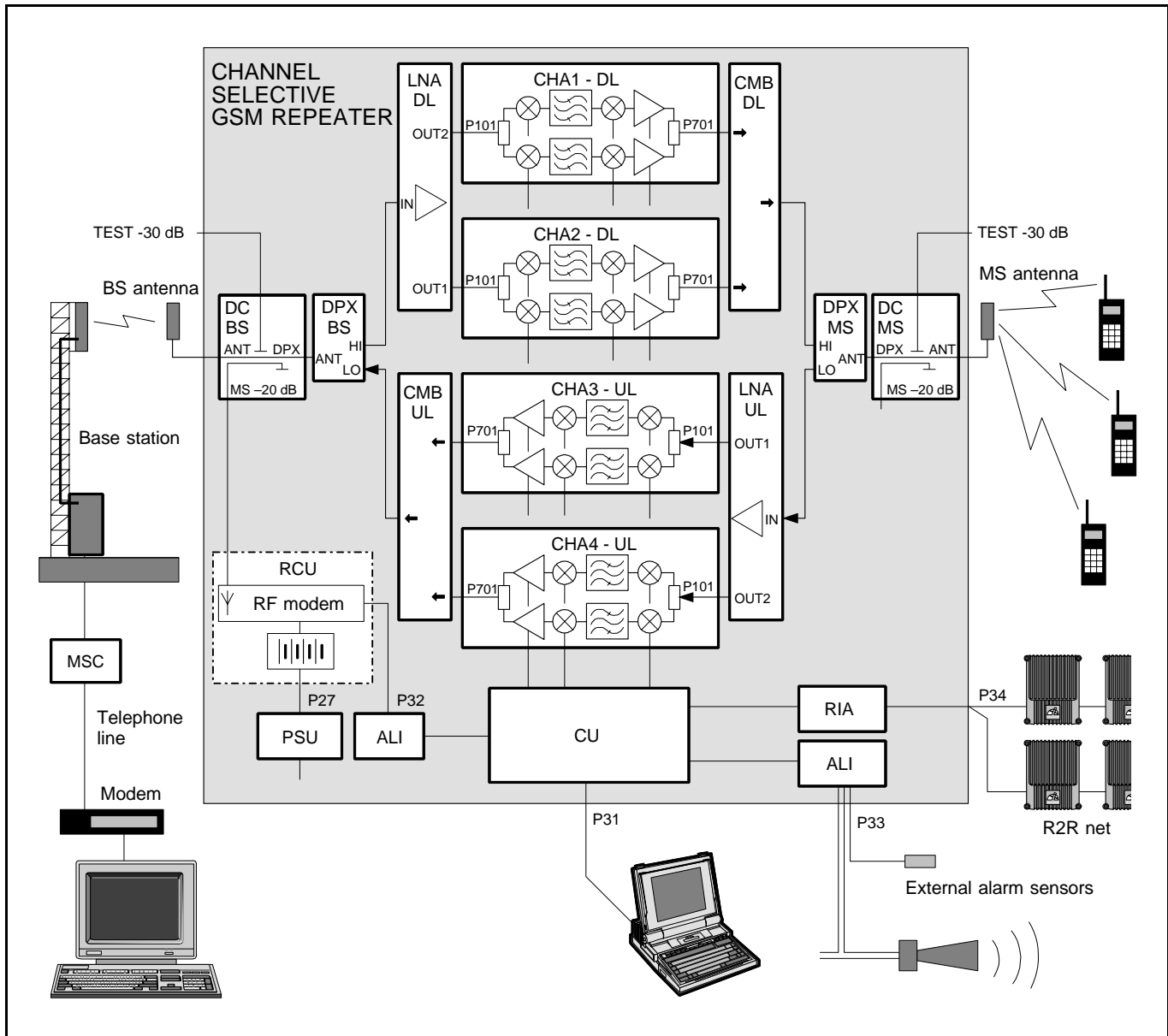


Figure 5-9. Block diagram, GSM repeater

Figure 5-9 shows a block diagram of a channel selective repeater with four bi-directional channels.

This diagram is applicable to repeaters for the GSM, DCS, PCN and GSM 1900 (PCS) systems.

### **Downlink signal path**

The signal from the base station is received via the repeater BS antenna and is then forwarded through a directional coupler (DC). The signal passes a duplex filter (DPX), is amplified in a low noise amplifier (LNA), and enters the channel boards (CHA), which have two parallel channels each.

The first mixer stage on the CHA amplifier board, which is controlled by a synthesizer, converts the received frequency down to the IF frequency. The signal is then filtered by SAW bandpass filters and, not shown in the figure, amplified before it is fed to the second mixer stage for conversion back to the original frequency.

The output signal from the mixer is then amplified in the power amplifier and fed to a combiner, which combines the signals from the two channels on the channel board.

The output signal passes a combiner (CMB), a duplex filter (DPX), and a directional coupler (DC), before it is fed to the repeater MS antenna.

RCU is described on page 5-30.

R2R is described on page 5-30.

# Channel Selective CDMA/WCDMA Repeater

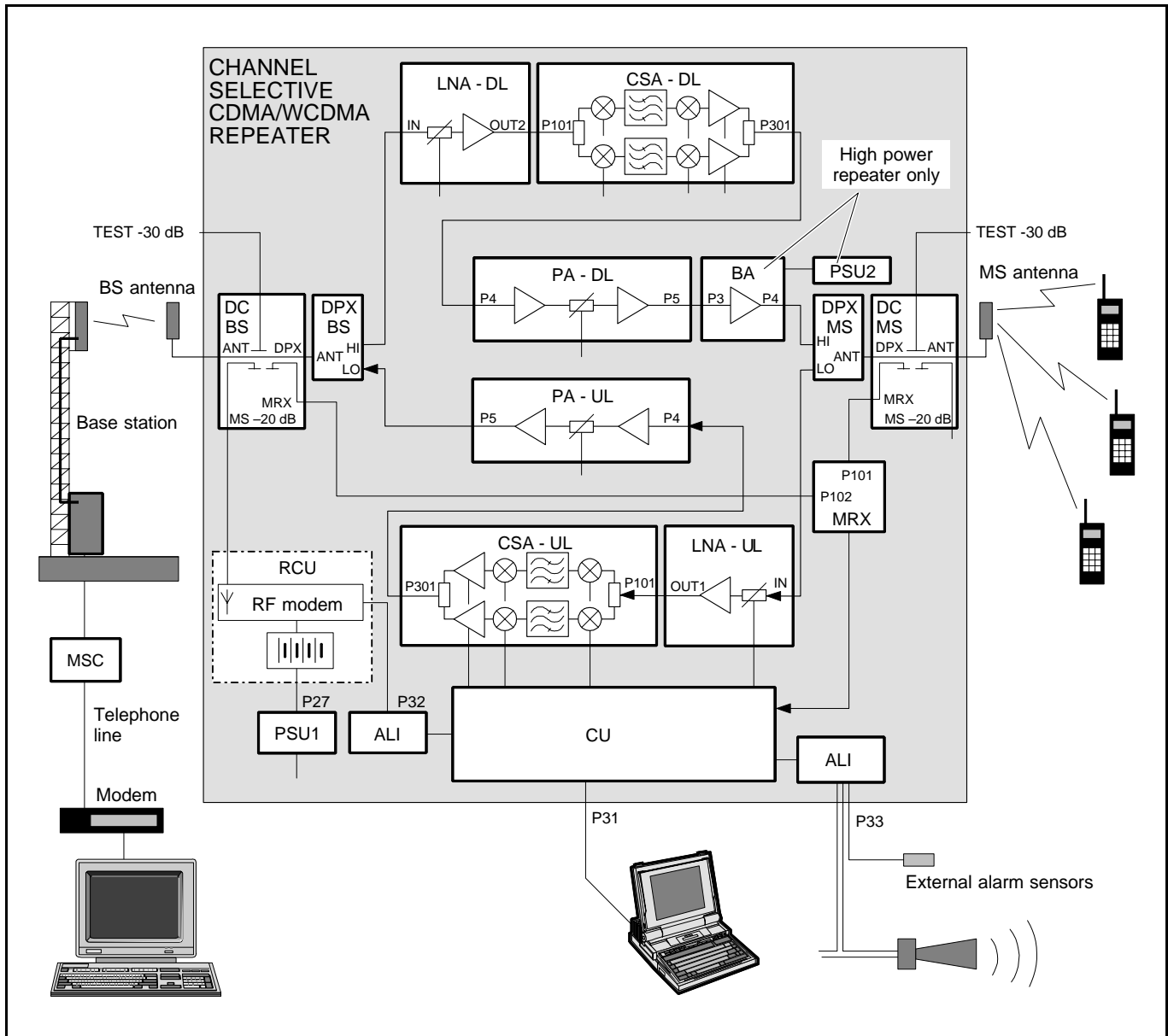


Figure 5-10. Block diagram, CDMA/WCDMA repeater

Figure 5-10 shows a block diagram of a channel selective CDMA or WCDMA repeater.

## Downlink signal path

The signal from the base station is received via the repeater BS antenna and is then forwarded through a directional coupler (DC). The signal passes a duplex filter (DPX), is amplified in a low noise amplifier (LNA), and enters the channel board (CSA), which has two parallel channels.

The first mixer stage on the CSA amplifier board, which is controlled by a synthesizer, converts the received frequency down to the IF frequency. The signal is then filtered by SAW bandpass filters and, not shown in the figure, amplified before it is fed to the second mixer stage for conversion back to the original frequency.

The following amplifier on the CSA board is controlled by the CU unit. The output gain can be reduced to avoid instability due to poor antenna isolation by means of the gain control in the MRX unit. The MRX gain control affects also other amplification stages.

The output signal from the amplifier is fed to a combiner that combines the signals from the two channels on the CSA board.

The signal from the CSA board is amplified on the PA board and then fed to a duplex filter (DPX) or, in high power CDMA repeaters, to a booster amplifier board (BA).

The amplified output signal passes the duplex filter (DPX) and a directional coupler (DC) before it is fed to the repeater MS antenna.

## High power CDMA/WCDMA repeaters

In high power CDMA or WCDMA repeaters, a booster amplifier (BA) boosts the output downlink signal from the PA board by typically 6dB. The amplified signal is fed to the duplex filter (DPX).

Only the downlink path in high power CDMA repeaters has a BA booster amplifier.

The BA amplifier is powered by a separate power supply unit (PSU2).

## CDMA repeaters with MRX

In CDMA repeaters, the output and input signals are measured at the MS and BS directional couplers (DC) by means of the MRX unit. The MRX unit continuously supervises the signal levels and controls the output gain levels via the CU unit to avoid self oscillation due to permanently or temporarily decreased antenna isolation.

The MRX unit offers also spectrum analyzis features further described in the *OMT32, User's Manual*.

RCU is described on page 5-30.

# Band Selective Repeater

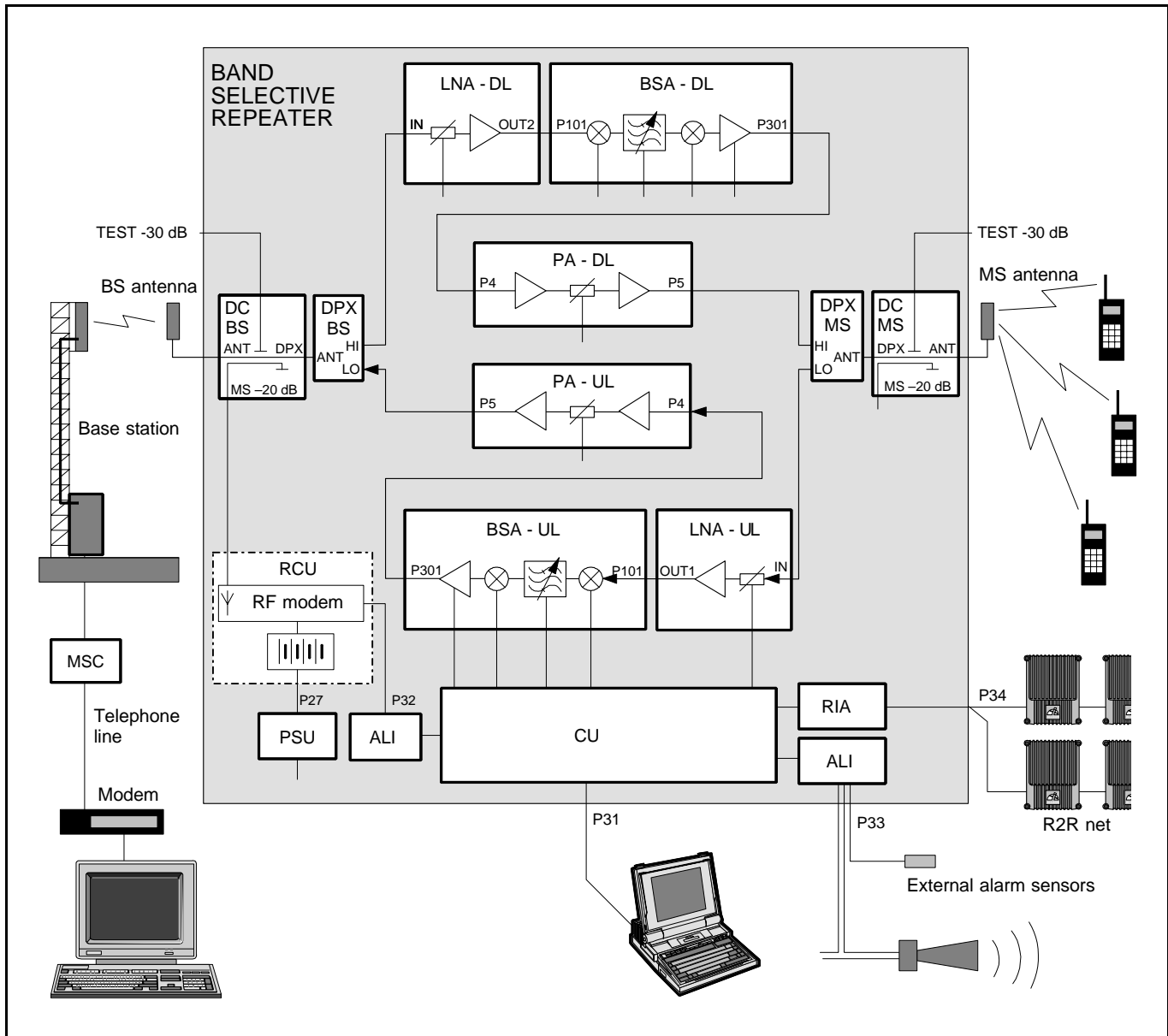


Figure 5-11. Block diagram, band selective repeater

Figure 5-11 shows a block diagram of a band selective repeater.

This diagram is applicable to repeaters for e.g. NMT, GSM, TACS, ETACS, AMPS, DAMPS, CDMA and WCDMA systems.



## Downlink signal path

The signal from the base station is received via the repeater BS antenna and is then forwarded through a directional coupler (DC). The signal passes a duplex filter (DPX), is amplified in a low noise amplifier (LNA), and enters the band selective amplifier board (BSA).

The first mixer stage on the BSA amplifier board, which is controlled by a synthesizer, converts the received frequency down to the IF frequency. The signal is then filtered by SAW bandpass filters and, not shown in the figure, amplified before it is fed to the second mixer stage for conversion back to the original frequency.

The BSA board has adjustable bandwidth and the SAW filter combination can be software changed from OMT32 (or OMS).

The following power amplifier is controlled by the CU unit. The amplifier gain will be reduced to avoid instability due to poor antenna isolation.

A detector on the PA board measures continuously the output level. The signal from this detector is used by the automatic gain control, AGC, to supervise and, if necessary, reduce the output power to keep it under a maximum level. The AGC gain control affects also other amplification stages.

The output signal passes duplex filter (DPX) and a directional coupler (DC) before it is fed to the repeater MS antenna.

RCU is described on page 5-30.

R2R is described on page 5-30.

## BMU

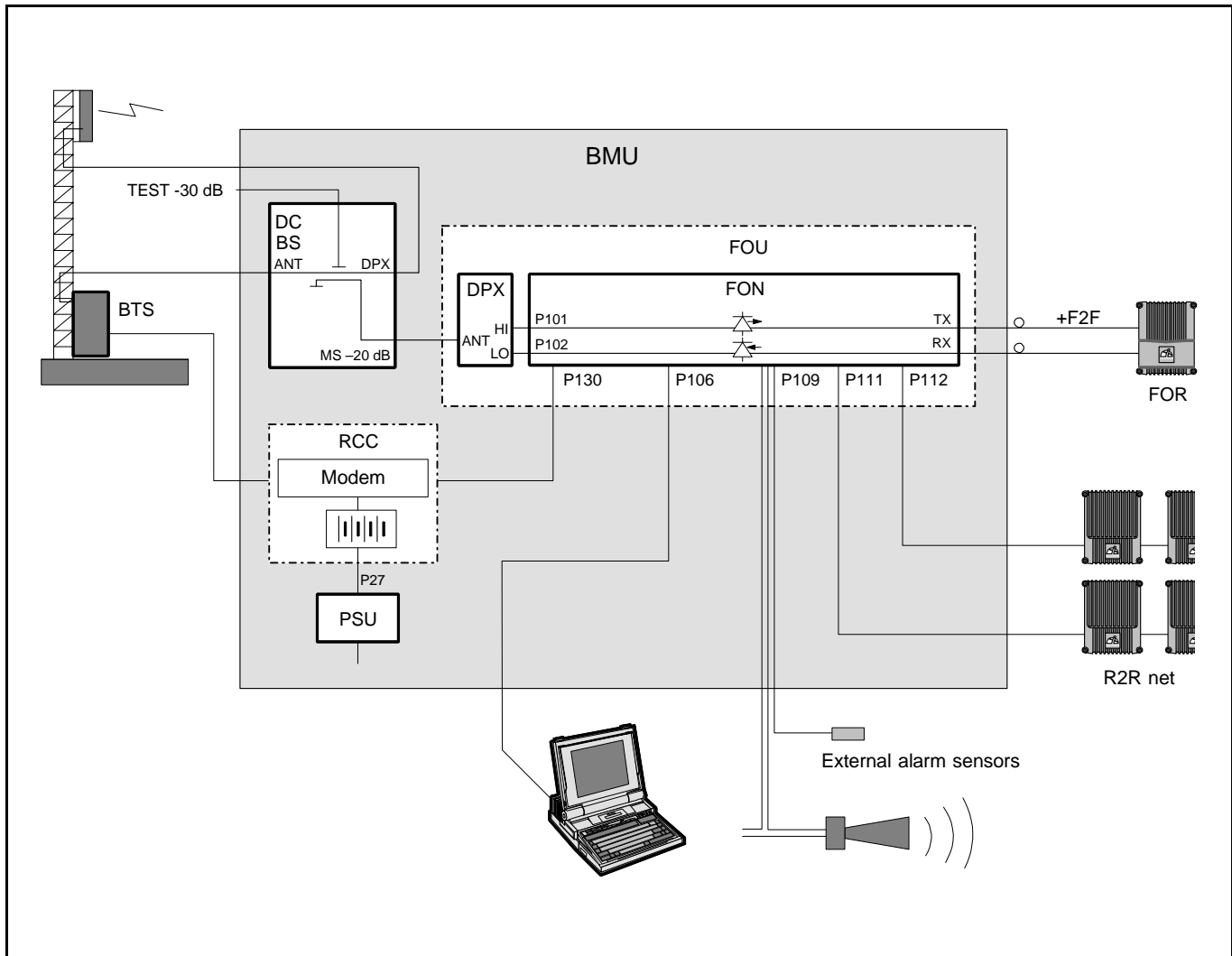


Figure 5-12. Block diagram, BMU

Figure 5-12 shows a block diagram of a BMU.

The BMU has to be located adjacent to the BTS as the base station antenna signal passes through the BMU.

Features controlled by the CU, ALI and RIA boards in standard repeaters are here controlled by the FON board that has the required functionality built-in. It also has the F2F function built-in (+F2F in Figure 5-12).

The FON board is described on page 5-46.

A FOT board can be used instead of a FON board, but the RCC, external alarm and R2R net functions are not supported by the FOT board.

The FON board is described below.

**Downlink signal path**

The base station antenna signal is fed through a directional coupler (DC) inside the BMU. The signal from the MS -20dB port enters the FOU by passing a duplex filter (DPX).

The downlink path (HI) is then fed to the FON board that converts the RF signal to an optic signal.

The optic signal from the TX output is sent via fiber optic cables to a FOR.

RCC is described on page 5-30.

R2R is described on page 5-30.

F2F is described on page 5-31.

## RMU

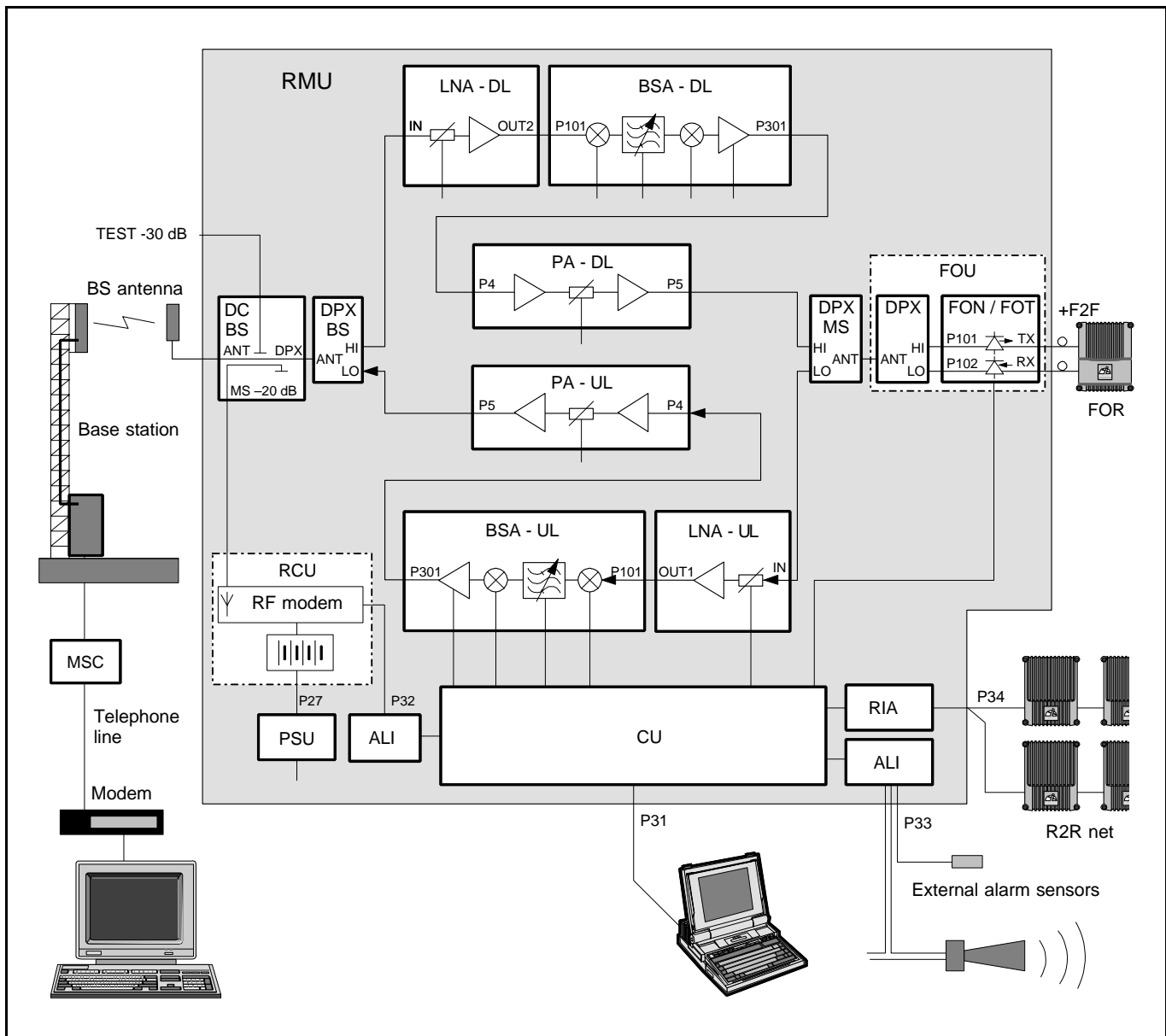


Figure 5-13. Block diagram, RMU

Figure 5-13 shows a block diagram of an RMU for band selective operation.

This diagram is identical to the block diagram of the band selective repeater on page 5-22, except for the FOU and the fiber optic connection to the FOR.

A FOT board can be used instead of the FON board, but the F2F function is not supported by the FOT board (+F2F in Figure 5-13).

An RCC unit can be used instead of the RCU shown in Figure 5-13, provided a FON board is used. The RCC is then connected to the FON board. The FOT board does not support the RCC unit.

**Downlink signal path**

The signal from the duplex filter (DPX-MS) enters the FOU by passing a duplex filter (DPX).

The downlink path (HI) is then fed to the FON board that converts the RF signal to an optic signal.

The FON board supervises the signaling and reports errors to the CU.

The optic signal from the TX output is sent via a fiber optic cable to a FOR.

RCU is described on page 5-30.

RCC is described on page 5-30.

R2R is described on page 5-30.

F2F is described on page 5-31.

## FOR

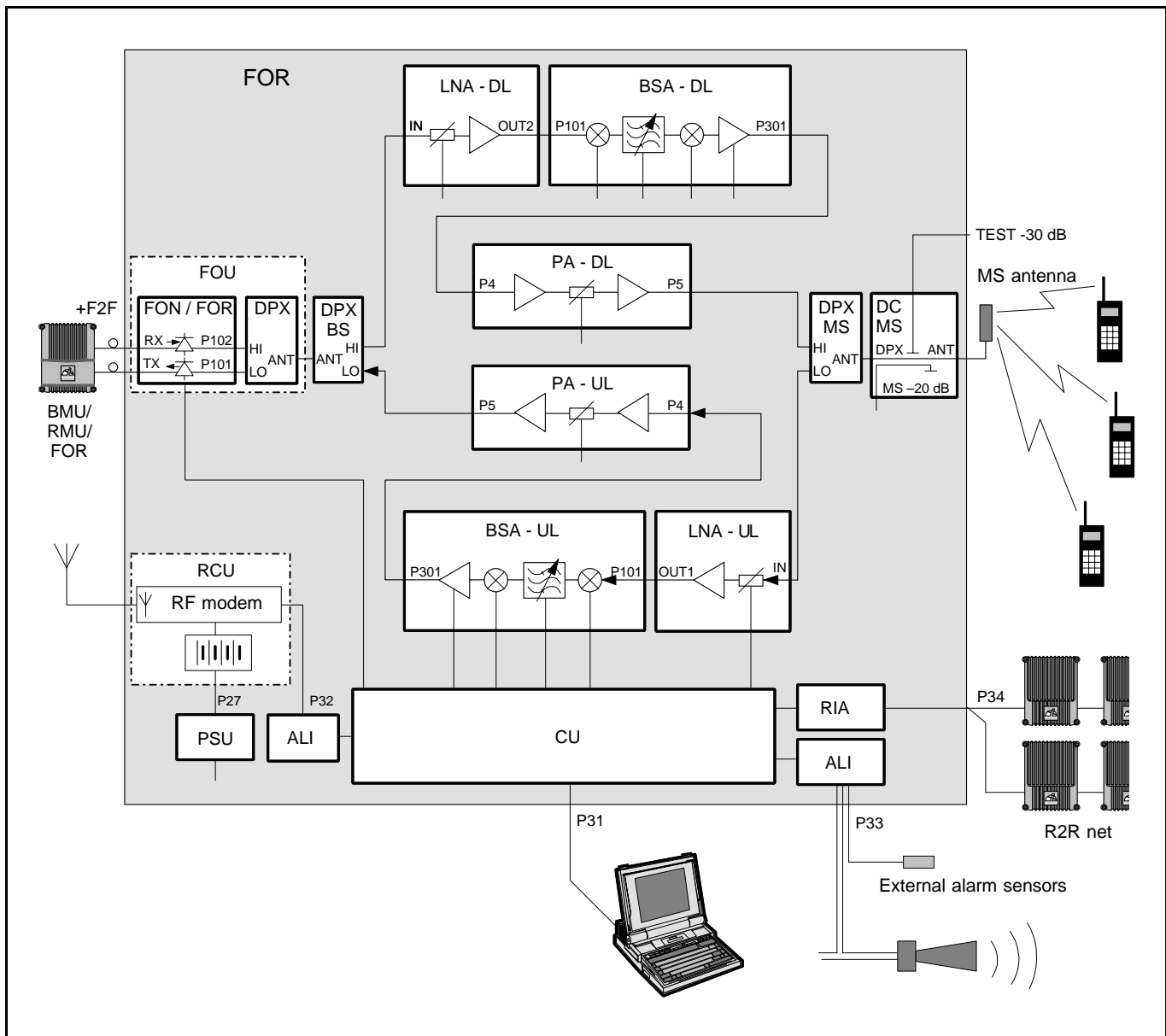


Figure 5-14. Block diagram, FOR

Figure 5-14 shows a block diagram of a FOR with band selective operation.

The diagram is identical to the block diagram of the band selective repeater on page 5-22, except for the FOU and the fiber optic connection to the BMU, RMU or FOR.

A FOT board can be used instead of the FON board, but the F2F function is not supported by the FOT board (+F2F in Figure 5-14).

An RCC unit can be used instead of the RCU shown in Figure 5-13, provided a FON board is used. The RCC is then connected to the FON board. The FOT board does not support the RCC unit.

**Downlink signal path**

The signal from a BMU, RMU or FOR is received via a fiber optic cable and is fed to the FON board on the FOU.

The FON board converts the optic signal to an RF signal.

The FON board supervises also the signaling and reports errors to the CU.

The RF signal passes first a duplex filter (DPX) and then the standard duplex filter (DPX-BS) in the band selective repeater.

RCU is described on page 5-30.

RCC is described on page 5-30.

R2R is described on page 5-30.

F2F is described on page 5-31.

## RCU

The optional RCU Remote Control Unit is located inside the repeater (described in Chapter 6, *Optionals*).

Communication with the repeater is performed by means of a GSM modem that has the antenna connected to the BS directional coupler (DC) or has a separate antenna. Data is transferred between the repeater and the RCU via the P32 modem port.

The RCU unit is powered via the P27 auxiliary port and the unit has a battery with a capacity enough for sending a number of alarms if a mains power failure occurs.

## RCC

The optional RCC Remote Communication Control unit is an alternative to the RCU, provided the repeater has a FON board. The RCC unit is also used in the Compact repeaters.

An RCC unit is required if the communication unit has to be connected to a FON board, e.g. in the BMU (the FON board does not support the RCU).

Communication with the repeater is performed by means of a PSTN or RF modem that has the antenna connected to the BS directional coupler (DC) or has a separate antenna. Data is transferred between the repeater and the RCC unit via the P130 port on the FON board.

The RCC unit is also powered via the P130 port and the unit has a battery with capacity enough for sending a number of alarms if a mains power failure occurs.

A description of the RCC and its connection is found in the VD203 67/EN, *ALR Compact Repeater, User's Manual*.

## R2R

The optional R2R Repeater to Repeater Link feature makes it possible to communicate with a number of repeaters via one RCU unit in one of the repeaters in an R2R net. Several RCU units can also be used in the same net.

The repeaters in the R2R net are connected to the P34 port.

The R2R feature is described in Chapter 6, *Optionals*.



## F2F

The F2F feature makes it possible to communicate with all repeaters that have a FON board (i.e. BMU, RMU and FOR) and are included in the same fiber optic net. By using the existing fiber optic distribution net, no wire or other communication device is required.

Communication with repeaters in a mixed F2F and R2R net is possible.

## Alarm

Alarm signals from external sensors are received by the ALI board, which forwards the alarm signals to the CU board.

The software on the CU board is able to activate acoustic or visual alarm or direct the alarm to the P33 alarm port to be forwarded, via the RCU unit, to OMT32 (or OMS) located in an operation and maintenance central.

Alarms can also be handled by the FON board in fiber optic units, e.g. the BMU that has no CU board or ALI board.

Alarms can be configured from OMT32 (or OMS).

## Repeater Setup

The repeater parameters can be set locally by means of a desktop or notebook running OMT32.

The PC is connected to the CU via the P31 PC port. See the block diagrams (e.g. Figure 5-9 on page 5-18).

If the repeater has no CU unit but a FON board (e.g. the BMU), then the desktop or notebook is connected to the P106 port on the FON board (see Figure 5-12 on page 5-24).

If the repeater has an RCU or RCC, then the repeater parameters can be set remotely by means of a desktop or notebook running OMT32 or OMS and a modem.

## Board and Unit Descriptions

This section describes the main boards and units in the AR repeaters.

Information about cabling between boards and units is found on page 5-57.

The following amplifier boards and units are described in this section:

- CHA – Channel Amplifier board, page 5-33.
- CSA & PA – Channel Selective CDMA/WCDMA boards, page 5-34.
- BA – Booster Amplifier board for high power CDMA/WCDMA, page 5-35.
- BSA & PA – Band Selective boards, page 5-36.
- DIA – Distribution board, page 5-37.
- CU – Control Unit board, page 5-39.
- MRX – Measurement Receiver board, page 5-40.
- DC – Directional Coupler, page 5-42.
- LNA – Low Noise Amplifier, page 5-43.
- DPX – Duplex filter, page 5-44.
- FOU – Fiber Optic Unit, page 5-45.
- FON – Fiber Optic Node board, page 5-46.
- FOT – Fiber Optic Transceiver board, page 5-50.

## CHA – Channel Amplifier Board

The cabinet can be equipped with four CHA Channel Amplifier boards. These are numbered from left to right: CHA1 – CHA4. The board positions CHA1 – CHA2 are used for downlink and CHA3 – CHA4 for uplink (see Figure 5-1 on page 5-8). If the repeater is equipped with two channels only, the board positions 1 and 3 are used.

The two internal channels on each CHA board are located to the left and to the right on the board.

If a board is to be removed, the RFI filter at the board connector and the two coaxial connectors must be removed prior to the board removal. No heat compound is used on the heat sink body or on the chassis.

Coaxial connector P101 is the input of the CHA board (fed by LNA).

Coaxial connector P701 is the output of the board. The output signal is fed to the duplex filter, either directly or via a CMB combiner, depending on the repeater configuration.

### Connection

CHA1/DL (board #1 from left).

Port	Connected to
P101	OUT2 on the LNA/DL low noise amplifier.
P701	4 channels: Input on the CMB/DL combiner. 2 channels: HI on the DPX/MS duplex filter.

CHA2/DL (board #2 from left).

Port	Connected to
P101	OUT1 on the LNA/DL low noise amplifier.
P701	Input on the CMB/DL combiner.

CHA3/UL (board #3 from left).

Port	Connected to
P101	OUT1 on the LNA/UL low noise amplifier.
P701	4 channels: Input on the CMB/UL combiner. 2 channels: LO on the DPX/BS duplex filter.

CHA4/UL (board #4 from left).

Port	Connected to
P101	OUT2 on the LNA/UL low noise amplifier.
P701	Input on the CMB/UL combiner.

### Caution

The CHA Channel Amplifier board power transistors may contain beryllium oxide (BeO) that is poisonous. See Chapter 1, *Safety*.



BERYLLIUM OXIDE

## CSA & PA – Channel Selective CDMA/WCDMA Boards

For channel selective CDMA or WCDMA operation, the cabinet is normally equipped with two CSA and two PA boards. These are numbered from left to right. Board position 1 is used for CSA downlink board, position 2 for PA downlink board, position 3 for CSA uplink board, and position 4 for PA uplink board (see Figure 5-2 on page 5-9).

If a board is to be removed, the RFI filter at the board connector, the two coaxial connectors, and the flat conductor cable between the CSA board and the PA board must be removed prior to the board removal. No heat compound is used on the heat sink body or on the chassis.

Coaxial connector P101 is the input of the CSA board (fed by LNA).

Coaxial connector P301 is the output of the CSA board. The signal from this output is fed to the PA board input P4. The PA board output P5 is fed to the duplex filter of the same signal direction.

### Connection

CSA/DL (board #1 from left).

Port	Connected to
P101	OUT1 on the LNA/DL low noise amplifier.
P301	P4 on the PA/DL board.

PA/DL (board #2 from left).

Port	Connected to
P4	P301 on the CSA/DL board.
P5	<i>Channel selective high power CDMA/WCDMA repeater:</i> P3 on the BA/DL board in the cover.  <i>All other types:</i> HI on the DPX/MS duplex filter.

CSA/UL (board #3 from left).

Port	Connected to
P101	OUT1 on the LNA/UL low noise amplifier.
P301	P4 on the PA/UL board.

PA/UL (board #4 from left).

Port	Connected to
P4	P301 on the CSA/UL board.
P5	LO on the DPX/BS duplex filter.

### Caution

The PA Power Amplifier board power transistors may contain beryllium oxide (BeO) that is poisonous. See Chapter 1, *Safety*.



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## BA – Booster Amplifier for High Power CDMA/WCDMA

For CDMA and WCDMA repeaters, a BA (Booster Amplifier) can be added in the downlink path to increase the output power with typically 6dB.

A high power CDMA or WCDMA repeater with a BA board can operate with maximum 2 channels.

The BA board is shown in the block diagram on page 5-20. It occupies board position 7 in the cover (see the repeater units on page 5-10).

A second power supply unit (PSU2), located in the repeater cover, is required for the BA board. This PSU is a special PSU for the BA board.

The BA booster amplifier requires a heat sink applied on the front of the repeater.

If the BA board is to be removed, the RFI filter at the board connector and the two coaxial connectors must be removed prior to the board removal. No heat compound is used on the heat sink body or on the chassis.

Coaxial connector P3 is the amplifier input (fed by the downlink PA board).

Coaxial connector P4 is the amplifier output. The signal from this output is fed, via the downlink duplex filter and directional coupler, to the downlink antenna.

### Connection

#### BA/DL

Port	Connected to
P3	P5 on the PA/DL board.
P4	HI on the DPX/MS duplex filter.

## BSA & PA – Band Selective Boards

For band selective operation, the cabinet is equipped with two BSA and two PA boards. These are numbered from left to right. Board position 1 is used for BSA downlink board, position 2 for PA downlink board, position 3 for BSA uplink board, and position 4 for PA downlink board (see Figure 5-4 on page 5-11).

If a board is to be removed, the RFI filter at the board connector, the two coaxial connectors, and the flat conductor cable between the BSA board and the PA board must be removed prior to the board removal. No heat compound is used on the heat sink body or on the chassis.

Coaxial connector P101 is the input of the BSA board (fed by LNA).

Coaxial connector P301 is the output of the BSA board. The signal from this output is fed to the PA board input P4. The PA board output P5 is fed to the duplex filter of the same signal direction.

### Connection

BSA/DL (board #1 from left).

Port	Connected to
P101	OUT1 on the LNA/DL low noise amplifier.
P301	P4 on the PA/DL board.

PA/DL (board #2 from left).

Port	Connected to
P4	P301 on the BSA/DL board.
P5	HI on the DPX/MS duplex filter.

BSA/UL (board #3 from left).

Port	Connected to
P101	OUT1 on the LNA/UL low noise amplifier.
P301	P4 on the PA/UL board.

PA/UL (board #4 from left).

Port	Connected to
P4	P301 on the BSA/UL board.
P5	LO on the DPX/BS duplex filter.

### Caution

The PA Power Amplifier board power transistors may contain beryllium oxide (BeO) that is poisonous. See Chapter 1, *Safety*.



BERYLLIUM OXIDE

## DIA – Distribution Board

DIA is a distribution board for most of the boards, units and ports. The DIA board is exclusively equipped with connectors. The connector types are chosen to prevent unintentional mixing up.

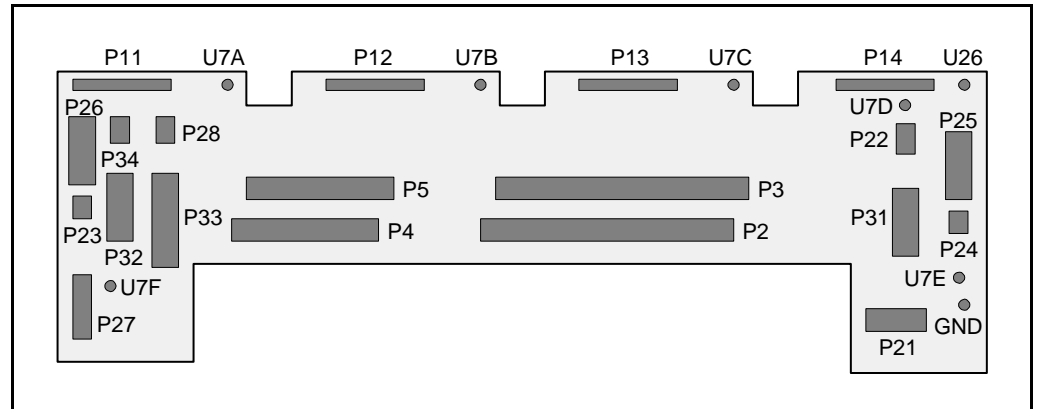


Figure 5-15. DIA board connectors and testpoints

### Connection and connector types

Port	Connected to	Connector type
P2	CU board.	
P3	Not used.	
P4	ALI board.	
P5	Not used.	
P11	CHA1/DL or CSA/DL or BSA/DL.	16 pole 1 line female.
P12	CHA2/DL or PA/DL.	16 pole 1 line female.
P13	CHA3/UL or CSA/UL or BSA/UL.	16 pole 1 line female.
P14	CHA4/UL or PA/UL.	16 pole 1 line female.
P21	PSU - Power Supply Unit.	10 pole 2 line male.
P22	LED board in the cover.	4 pole 1 line male.
P23	LNA/UL	2 pole 1 line male.
P24	LNA/DL	2 pole 1 line male.
P25	Expansion output port to cover circuitry if any. Only in cabinets.	16 pole 2 line male.
P26	Expansion input port from the cabinet. Used in equipped high covers only.	16 pole 2 line male.
*P27	AUX1 auxiliary connector.	8 pole 1 line male.
P28	Door switch (internal alarm).	3 pole 1 line male.
P31	PC (serial RS-232).	9 pole D-sub female.
P32	Modem (serial RS-232).	9 pole D-sub male.
P33	External alarm.	15 pole D-sub female.
P34	Repeater to Repeater Link.	8 pole RJ45 modular female.

\*Pin 2 and 3 on the P27 connector must be interconnected with a jumper if the connector is not used.

## Testpoints

The following testpoints are found on the DIA board (see Figure 5-15).

Testpoint	Voltage	Purpose
U7A	+7V DC	CHA1/DL or CSA/DL or BSA/DL downlink board supply voltage.
U7B	+7V DC	CHA2/DL or PA/DL downlink board supply voltage.
U7C	+7V DC	CHA3/UL or CSA/UL or BSA/UL downlink board supply voltage.
U7D	+7V DC	CHA4/UL or PA/UL downlink board supply voltage.
U7E	+7V DC	LNA/UL and LNA/DL and P27 auxiliary port supply voltage.
U7F	+7V DC	CU board and ALI board and RCU supply voltage via the P27 auxiliary port jumper.
U26	+26V DC or +13V DC	Power amplifiers and P27 auxiliary port supply voltage (26V or 13V depending on the repeater type).
GND	0	Ground

## DIA board part # and version

The DIA board part # is K105/1. Version R2A or higher (containing the P34 connector) is required to use the optional R2R feature.



## CU – Control Unit Board

The CU board is the central board in the repeater, located in the repeater cabinet (see Figure 5-1 to Figure 5-5). The CU board contains a microprocessor, main memory, flash memory for the CU software, EEPROM memory for parameters, memory for the event log and statistics, a REFO reference oscillator, ports for local and remote communication, battery powered real-time clock, etc.

The CU board is used to supervise and control operational parameters such as gain control, channel handling, etc. The CU takes care of alarms and the event log, password and logon, and many other procedures.

The CU is also a control interface when using OMT32, locally or remotely via modem, or OMS.

The CU software can be downloaded from OMT32, either locally or remotely, or from OMS.

The real-time clock on the CU board is used for alarm and for the event log.

There are currently two CU board variants: K103/1 and K103/2.

### CU board and CU software part #s

K103/1 CU board (old) CU board K103/1 can be run with the SA102 01/2 CU software. This board can store one version of CU software. The repeater will always boot on this software version.

K103/2 CU board (current) CU board K103/2 can be run with either the old SA102 01/2 CU software or the current SA102 02/1 or SA102 02/2 CU software. This board can store two versions of CU software, located in segment 1 and segment 2 of the flash memory as *Application 1* and *Application 2*. The repeater will boot on that software which is set as *Primary* (description of *Primary* application is found in the *OMT32, User's Manual*).

Compatibility for CU boards and CU software is detailed on page 5-67.

### Connection

The CU board is connected to the DIA board via the P2 port.

### Caution

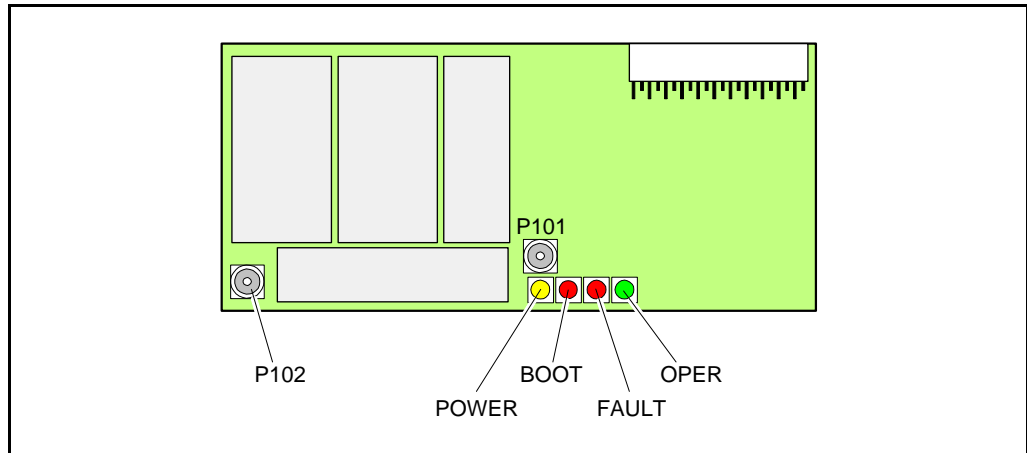


A lithium battery is permanently mounted on the CU board. Due to the risk of explosion, this battery must not be removed from the board. In case of battery malfunction, replace the CU board. The old CU board can be sent to LGP Allgon for repair.

## MRX – Measurement Receiver Board

Channel selective CDMA repeaters are equipped with an MRX (Measurement Receiver) that continuously supervises the signal levels and controls the output gain levels via the CU unit to avoid self oscillation due to permanently or temporarily decreased antenna isolation.

The MRX board is shown in Figure 5-16.



*Figure 5-16. MRX Measurement Receiver board*

The four LEDs (POWER, BOOT, FAULT and OPER) have the same function as the CU unit, described in Chapter 4.

The MRX board is located in the frame on the DIA board, see the repeater units on page 5-9 and page 5-10.

The MRX unit is also shown in the CDMA block diagram on page 5-20.

### Connection

#### MRX

Port	Connected to
P101	MRX on the DC/MS directional coupler.
P102	MRX on the DC/BS directional coupler.

### MRX function

The main task of the MRX unit is to supervise the channel spectrum of active CDMA channels in a channel selective CDMA 800/1900 repeater in order to maximize gain and output power, and to minimize problems as low antenna isolation and poor antenna matching.

The MRX unit also offers spectrum monitoring and return loss measurement.

### Antenna isolation

The MRX unit automatically supervises the antenna isolation. The system will detect both the margins to instability and full self-oscillation.

Two different alarm types (*Warning* and *Ceasing*) can be sent by the MRX unit due to poor antenna isolation:

- If a low margin to instability is detected, then a *Warning* alarm is sent and the gain is reduced gradually to a preset value.
- If the MRX unit detects self-oscillation, then a *Warning* alarm is sent and the gain is reduced to the same preset value.
- When the MRX unit no longer senses any isolation problems a *Ceasing* signal is sent and the gain is increased to the level set by the operator.

### Return loss (VSWR)

The MRX unit will automatically and continuously supervise both the donor and the service antennas. The operator can, however, also manually start a measurement of a desired antenna simply by selecting a CDMA antenna, which will then be used for the measurement.

A *Warning* alarm is sent when the return loss is below an alarm threshold that is set by the operator. When the return loss is above the same threshold again, a *Ceasing* signal is sent.

### Spectrum monitoring

This feature allows the operator to perform spectrum analysis in local or remote mode. This is further described in the *OMT32, User's Manual*.

## DC – Directional Coupler

The directional couplers are located at the left and right side in the lower part of the repeater cabinet (see Figure 5-1 to Figure 5-5). The MS and BS directional couplers are shown in Figure 5-17.

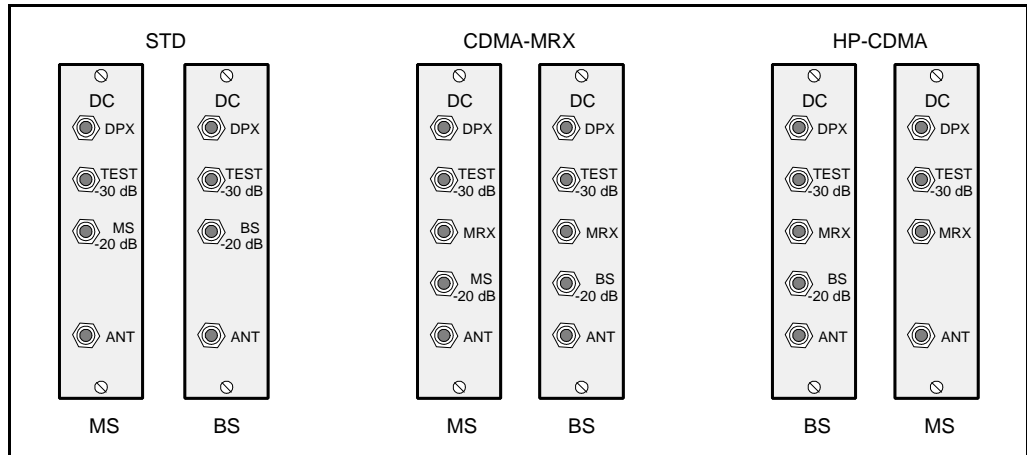


Figure 5-17. MS and BS directional couplers

The following types are depicted in Figure 5-17:

- STD Couplers for standard repeaters.
- CDMA-MRX Couplers for CDMA repeaters with MRX.
- HP-CDMA Couplers for high power CDMA/WCDMA repeaters.

### Connection

#### DC/MS

Port	Connected to
DPX	ANT on the DPX/MS duplex filter.
TEST -30dB	Test port for the downlink output signal (no directivity).
MS -20dB	Not used.
MRX	P101 on the MRX unit.
ANT	MS antenna (or RF service cable).

#### DC/BS

Port	Connected to
DPX	<i>BMU</i> : BTS antenna (see page 5-64). <i>All other types</i> : ANT on the DPX/BS duplex filter.
TEST -30dB	Test port for the uplink output signal (no directivity).
BS -20dB	<i>BMU</i> : ANT on the FOU/DPX duplex filter. <i>All other types</i> : Antenna connection for remote control RF modem. This port has at least 20dB directivity towards the antenna.
MRX	P102 on the MRX unit.
ANT	<i>BMU</i> : BTS antenna output port (see page 5-64). <i>All other types</i> : BS antenna (or RF cable to BTS).

## LNA – Low Noise Amplifier

The LNA low noise amplifiers are located at the top of the cabinet and the high cover, if equipped (see Figure 5-1 to Figure 5-5). LNA/UL (uplink) is located to the left and LNA/DL (downlink) to the right. All coaxial connectors are of SMA type.

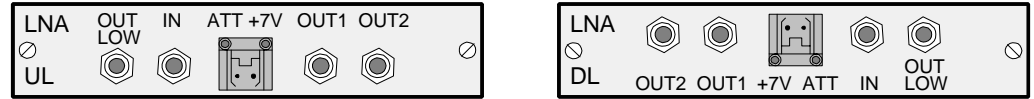


Figure 5-18. LNA low noise amplifier

Signals from the duplex filter output are fed to the LNA input connector IN. Output OUT1 and OUT2 feed the CHA, CSA or BSA boards of the same signal direction. The signal level in these connectors are +20dB referred to the antenna input. Another output, OUT LOW, is an expansion output for an additional LNA amplifier, if the repeater is equipped in the cover part of the chassis. The gain to this connector is +2dB.

The +7V input is used for 7V supply from the DIA board.

ATT is a control signal for a controllable attenuator in the LNA.

### Connection

LNA/UL (to the left in the cabinet or cover).

Port	Connected to
OUT LOW	IN on the LNA/UL in the cover, if equipped.
IN	LO on the DPX/MS duplex filter.
ATT +7V	P23 on the DIA board.
OUT1	P101 on the CHA3/UL or CSA/UL or BSA/UL board.
OUT2	P101 on the CHA4/UL channel board.

LNA/DL (to the right in the cabinet or cover).

Port	Connected to
OUT LOW	IN on the LNA/DL in the cover, if equipped.
IN	HI on the DPX/BS duplex filter.
ATT +7V	P24 on the DIA board.
OUT1	P101 on the CHA2/DL or CSA/DL, or BSA/DL board.
OUT2	P101 on the CHA1/DL channel board.

Not used outputs do not need to be terminated.

## DPX – Duplex Filter

The DPX duplex filters are located on the metal cover sheet in the upper part of the repeater cabinet (see Figure 5-1 to Figure 5-5). MS and BS duplex filters are identical.

### Connection

#### DPX/MS

Port	Connected to
ANT	<i>RMU:</i> ANT on the FOU/DPX duplex filter. <i>All other types:</i> DPX on the DC/MS directional coupler.
HI	<i>Channel selective GSM repeater:</i> 4 channels: Output on the CMB/DL combiner. 2 channels: P701 on the CHA1/DL channel board.  <i>Channel selective CDMA/WCDMA repeater:</i> P5 on the PA/DL board.  <i>Channel selective high power CDMA/WCDMA repeater:</i> P4 on the BA/DL board in the cover.  <i>Band selective repeater:</i> P5 on the PA/DL board.
LO	IN on the LNA/UL low noise amplifier.

#### DPX/BS

Port	Connected to
ANT	<i>FOR:</i> ANT on the FOU/DPX duplex filter. <i>All other types:</i> DPX on the DC/BS directional coupler.
HI	IN on the LNA/DL low noise amplifier.
LO	<i>Channel selective GSM repeater:</i> 4 channels: Output on the CMB/UL combiner. 2 channels: P701 on the CHA3/UL channel board.  <i>Channel selective CDMA/WCDMA repeater:</i> P5 on the PA/UL board.  <i>Channel selective high power CDMA/WCDMA repeater:</i> P5 on the PA/UL board.  <i>Band selective repeater:</i> P5 on the PA/UL board.

A DPX duplex filter is also included in the FOU, see Figure 5-6 to Figure 5-8. This filter can be connected to various ports depending on the repeater type, see the block diagrams in Figure 5-12 to Figure 5-14.

## FOU – Fiber Optic Unit

FOU is an add on unit for the various repeater types. In the simplest form, the FOU is a metal plate on which a FON board, a duplex filter (DPX) and fiber optic connectors are assembled. This form of the FOU is shown in Figure 5-19.

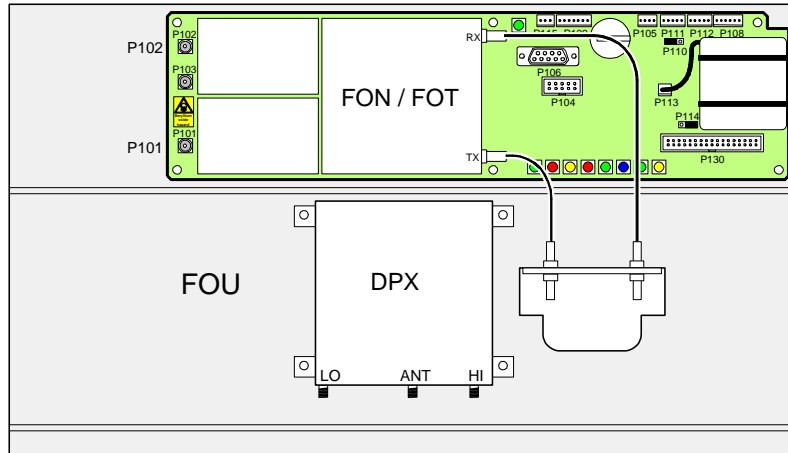


Figure 5-19. FOU, Fiber Optic Unit

The FOU can, however, be configured with a FOT board instead of the FON board, combiners, OSPs and WDMs to obtain a desired combination of several branches with double or single fiber communication.

The add on FOU is used in the BMUs, RMUs and FORs and it is mounted on top of the cover plate in the upper part of the repeaters.

The FON board is described on page 5-46, the FOT board on page 5-50.

### Connection

The connection is depending on the repeater type and if the FOU is connected at the BS or MS side of the repeater. The RF connection for the FOU is shown in the following tables. The FON control ports are described in the next section (page 5-46).

DPX connection with the FOU on the BS side (e.g. FOR).

Port	Connected to
ANT	ANT on the DPX/BS duplex filter.
HI	P102 on the FON board. P301 on the FOT board.
LOI	P101 on the FON board. P101 on the FOT board.

DPX connection with the FOU on the MS side (e.g. BMU and RMU).

Port	Connected to
ANT	<i>BMU</i> : BS –20dB on the DC/BS Directional Coupler. <i>All other types</i> : ANT on the DPX/MS duplex filter
HI	P101 on the FON board. P101 on the FOT board.
LO	P102 on the FON board. P301 on the FOT board.

## FON – Fiber Optic Node Board

The FON board converts RF signals to optic signals and the other way round. Also, it contains very much of the repeater control features, such as:

- Supervision of the RF and optical signaling.
- Internal and external alarm handling.
- RS232 interface port for local PC control.
- Interface port for RCC.
- Functionality and interface port for R2R Repeater to Repeater Link.
- Functionality and interface port for F2F Fiber to Fiber Link.
- Battery backup with charger.

The FON board is built up on a printed circuit board that also contains the battery backup. The FON board is shown in Figure 5-20.

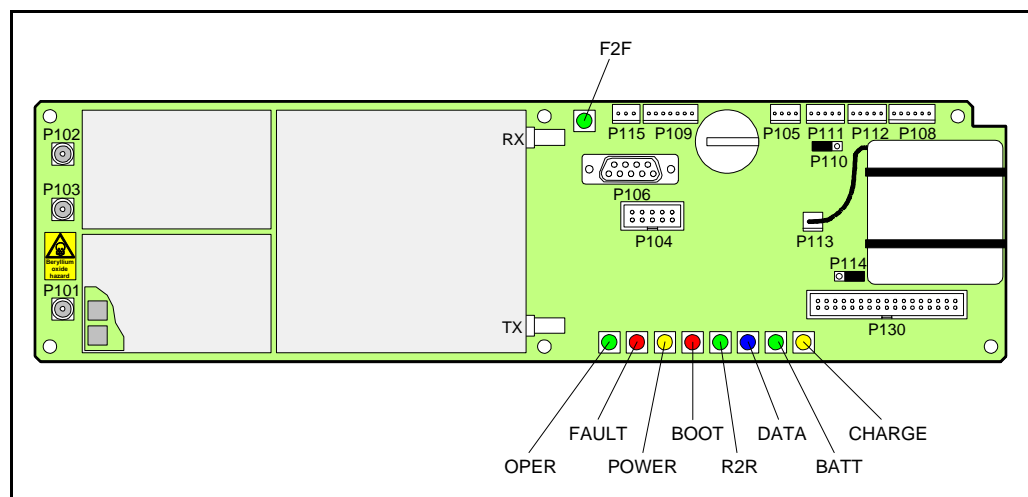


Figure 5-20. FON, Fiber Optic Node board

### RF and optical ports

Port	Description
P101	RF input signal (converts to optical TX).
P102	RF output signal (converted from optical RX).
P103	RF low power output signal (15dBm below the P102 signal).
RX	Optical reception (to RF output port P102 and P103).
TX	Optical transmission (from RF input port P101).

P101 and P102 are connected to the DPX as described on page 5-45.

### Caution

There are two attenuators at the P101 port on the FON board that may contain beryllium oxide (BeO), which is poisonous. The attenuators are found inside the shield. See Chapter 1, *Safety*.



Beryllium oxide



## Indicators

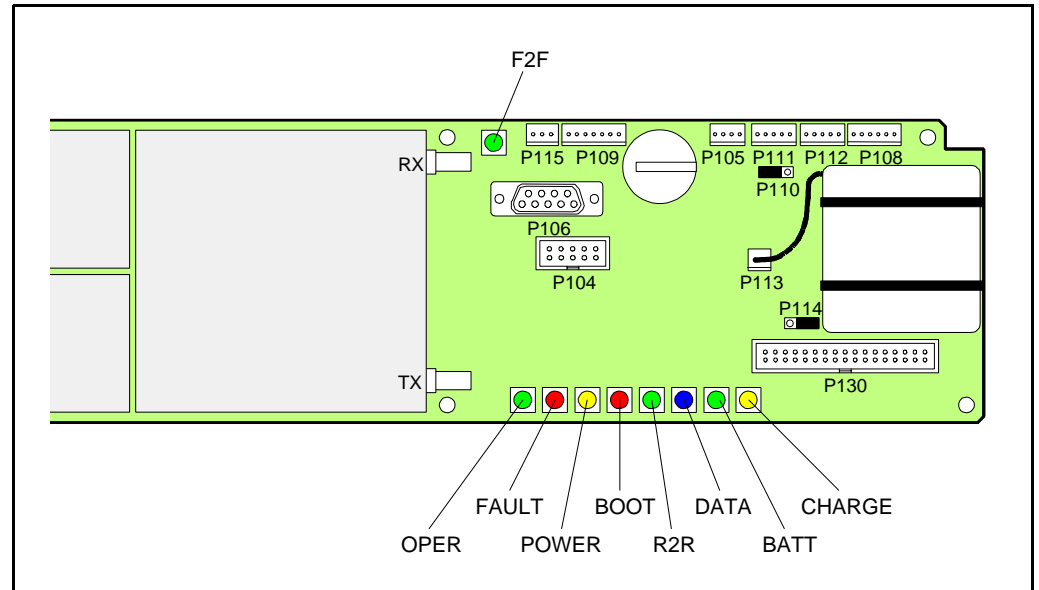


Figure 5-21. FON indicators and ports

The FON board contains the following LED indicators:

### F2F

Green LED that indicates, with a flashing light, that the repeater currently is a F2F Control Station. A steady light indicates that the repeater is not currently a Control Station, or there is no more repeater in the net. Only one repeater in an F2F net can show a flashing green LED at the same time.

### OPER

Green LED that lights up approx. 15 seconds after the mains is switched on. It shows, with a steady light, that the unit is ready for operation.

### FAULT

Red LED that flashes 15 – 20 seconds after the mains is switched on. Then, it flashes for less serious alarms (ERROR) and is lit with a steady light for fatal alarms (CRITICAL).

### POWER

Yellow LED that is lit with a steady light after the mains is switched on. Indicates present power.

### BOOT

Red LED that is lit with a steady light when the system boots, i.e. for 10 – 15 seconds after the mains is switched on. Then, it flashes for the next 5 – 10 seconds. After that, if no error is detected, the LED is off.

### R2R

Green LED that indicates, with a flashing light, that the repeater currently is a R2R Control Station. A steady light indicates that the repeater is not currently a Control Station, or there is no more repeater in the net. Only one repeater in an R2R net can show a flashing green LED at the same time.

**DATA**

Blue LED that indicates data transmission in the R2R or F2F net.

**BATT**

Green LED that indicates, with a steady light, that the batteries currently are used as power source.

**CHARGE**

Yellow LED that indicates battery charge with a steady light.

**Connection ports**

Except for the RF and optic ports, the FON board contains the following connection ports:

**P104 – Debug**

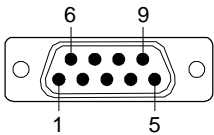
This port is only used for development and debugging.

**P105 – Front LED indicators**

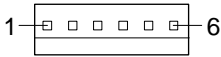
P105 is a 4 pole male connector used for the yellow and red LED indicators on the front.

**P106 – PC port**

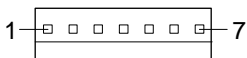
P106 is a 9 pole D-sub female RS-232 port used for local PC communication. This port is identical to the P31 PC port, see the description on page 5-53.

**P108 – Power**

P108 is a 6 pole male connector used for providing the FON board with power. This connector is not used in Compact repeaters (information for Compact repeater manual reference).

**P109 – Alarm**

P109 is a 7 pole male alarm connector used for external alarm sensors and alarm equipment.



This port is the same port as the P33 alarm port described on page 5-54, but P109 has the following pinning:

Pin 1 AIC Ground

Pin 2 AIC Ground

Pin 3 AI1 External alarm input 1 – EAL1.

Pin 4 AI2 External alarm input 2 – EAL2.

Pin 5 AI3 External alarm input 3 – EAL3.

Pin 6 AI4 External alarm input 4 – EAL4.

Pin 7 Not used

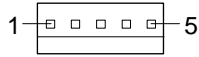
**P110**

This jumper is used to terminate an R2R link. It has to be set in the parking state for all repeaters, except for the last repeaters in an R2R net.



Parking state is shown in the figure (the pins closest to the battery pack interconnected).

The opposite state terminates the R2R net.



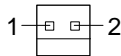
**P111, P112 – R2R ports**

P111 and P112 are 5 pole male connectors used for the *Repeater to Repeater Link* feature (R2R net).

P111 and P112 are identical and connected in series. One of the connectors are intended to be used from the previous repeater in the net chain, and the other connector to the next repeater in the net chain. Either of P111 or P112 can be used for the first and the last repeater in the net chain.

Use straight connection between P111 and P112 connectors.

No termination is required for the outermost repeaters in an R2R net.



**P113 – Batteries**

P113 is a 2 pole male connector used for the backup batteries.



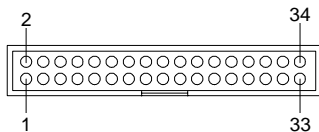
**P114 – Repeater type**

This jumper has to be OFF for all the AR repeater types, i.e. all the repeaters mentioned in this manual. ON state is used for Compact repeaters only. The OFF state is shown in the figure (the pins closest to the battery pack interconnected).



**P115 – Future port**

P115 is a 3 pole male connector intended for future use (not used for the time being).



**P130 – RCU port**

P130 is a 34 pole 2 line male connector used for connecting an RCC, Remote Communication Control unit.

The P130 connector contains modem connection, RCC power supply, etc.

## FOT – Fiber Optic Transceiver Board

The FOT board converts RF signals to optic signals and the other way round. It also contains a simple supervision functionality consisting of a signal monitoring and error signaling if the fiber optic signal is no longer active.

The FOT board is built up on a printed circuit board. The FOT board is shown in Figure 5-22.

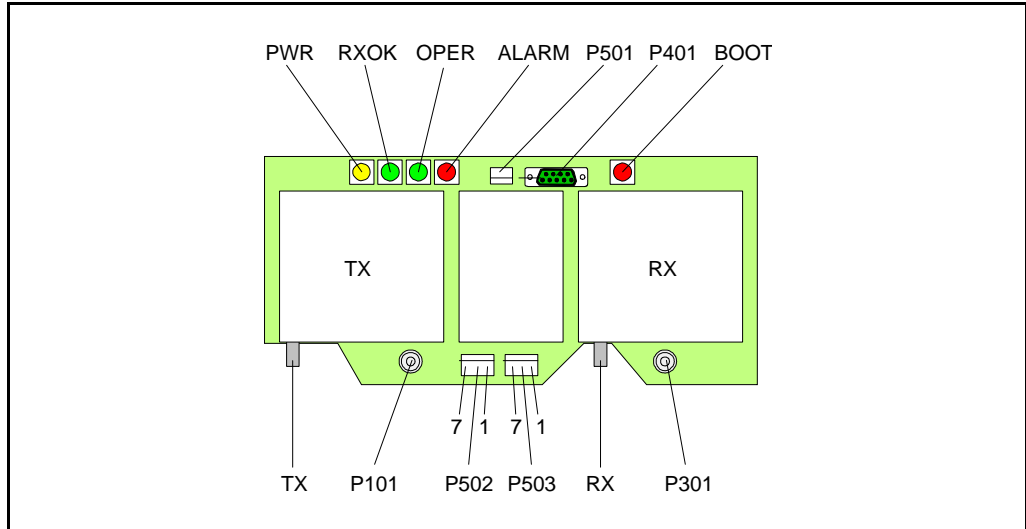


Figure 5-22. FOT indicators and ports

### RF and optical ports

Port	Description
P101	RF input signal (converts to optical TX). SMA connector.
P301	RF output signal (converted from optical RX). SMA connector.
RX	Optical reception (to RF output port P301).
TX	Optical transmission (from RF input port P101).

P101 to P301 are connected to the DPX as described on page 5-45.

## Indicators

The FON board contains the following LED indicators:

### PWR

Yellow LED that is lit with a steady light after the mains is switched on. Indicates present power.

### RXOK

Green LED that indicates that the unit is ready to receive optic signals.

### OPER

Green LED that lights up approx. 15 seconds after the mains is switched on. It shows, with a steady light, that the unit is ready for operation.

### ALARM

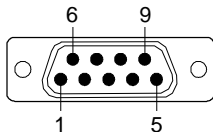
Red LED that flashes 15 – 20 seconds after the mains is switched on. Then, it flashes for less serious alarms (ERROR) and is lit with a steady light for fatal alarms (CRITICAL).

### BOOT

Red LED that is lit with a steady light when the system boots, i.e. for 10 – 15 seconds after the mains is switched on. Then, it flashes for the next 5 – 10 seconds. After that, if no error is detected, the LED is off.

## Connection ports

Except for the RF and optic ports, the FOT board contains the following connection ports:



### P401 – PC port

P401 is a 9 pole D-sub female RS-232 port used for local PC communication. This port is identical to the P31 PC port, see the description on page 5-53.

### P501 – Master unit

Connector for master unit.

### P502 and P503 – Power

Power and alarm port for the FOT board.

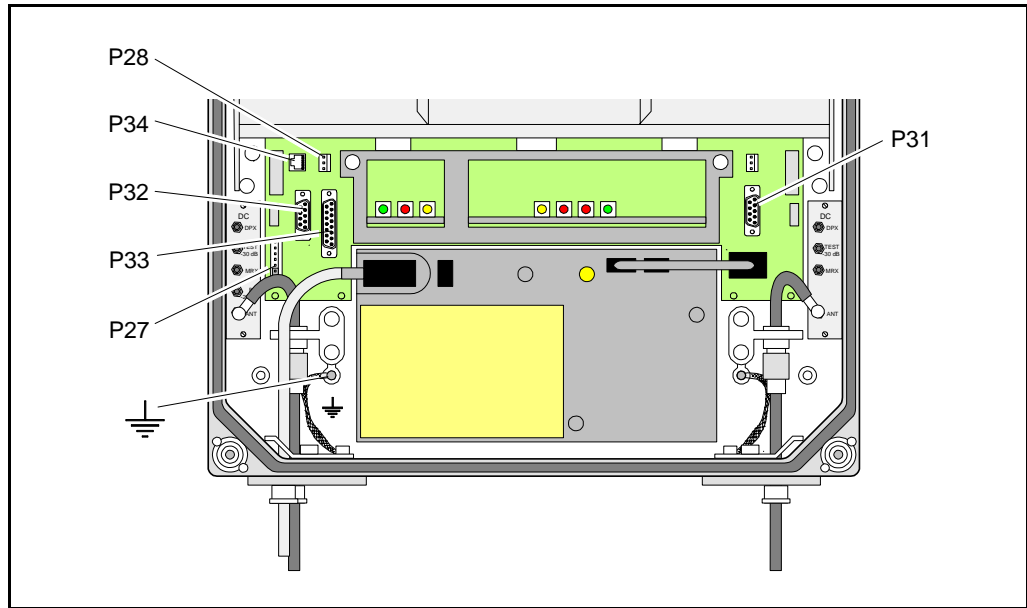
P502 and P503 have the following pinning:

Pin 1	+7V
Pin 2	+7V
Pin 3	Alarm
Pin 4	GND
Pin 5	Shut down.
Pin 6	GND

# Connection Ports

The DIA distribution board provides most of the internal connection between the repeater units, and to external ports. Connectors involved in the installation are also located on the DIA board. These connectors are described below. A complete DIA board connector list is found on page 5-37.

Figure 5-23 shows the location of the connection ports.



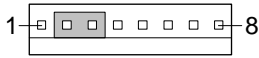
*Figure 5-23. Connection ports and station ground*

Station ground is also shown in Figure 5-23 (at the ground symbol).

The port descriptions are found on the following pages:

P27 Auxiliary Port .....	page 5-53
P28 Door switch alarm input port .....	5-55
P31 PC Port .....	5-53
P32 Modem Port .....	5-54
P33 Alarm Port .....	5-54
P34 Repeater to Repeater Link Port .....	5-56

## P27 Auxiliary Port



Auxiliary port P27 is used to power the RCU, Remote Control Unit, for communication with the repeater.

The connector is found on the DIA board to the left in the cabinet.

P27 is an 8 pole, 1 line male connector.

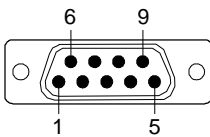


*Pin 2 and 3 of the P27 port must always be interconnected to provide the CU and ALI boards with voltage supply. If there is no cable connected to the P27 port, pin 2 and 3 must be interconnected with a jumper.*

### P27 auxiliary connector pinning

Pin 1	+7V DC.
Pin 2	+7V DC.
Pin 3	CU and ALI power supply from pin 2.
Pin 4	GND
Pin 5	+26V DC or +13V DC depending on the repeater type.
Pin 6	Not used.
Pin 7	Output 200KHz reference.
Pin 8	GND

## P31 PC Port



PC port P31 is a RS-232 port used for local PC communication.

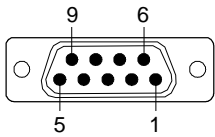
The connector is found on the DIA board to the right in the cabinet.

P31 is a 9 pole D-sub female connector.

### P31 PC connector pinning

Pin 1	Not used.
Pin 2	Data from repeater to OMT32.
Pin 3	Data from OMT32 to repeater.
Pin 4	DTR from OMT32 to repeater.
Pin 5	GND
Pin 6	DSR from repeater to OMT32.
Pin 7	RTS from OMT32 to repeater.
Pin 8	CTS from repeater to OMT32.
Pin 9	Not used.

## P32 Modem Port



Modem port P32 is a RS-232 port with V.24 interface used for the RCU, Remote Control Unit.

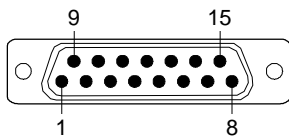
The connector is found on the DIA board to the left in the cabinet.

P32 is a 9 pole D-sub male connector.

### P32 modem connector pinning

Pin 1	DCD
Pin 2	RXD
Pin 3	TXD
Pin 4	DTR
Pin 5	GND
Pin 6	DSR
Pin 7	RTS
Pin 8	RFS
Pin 9	RI

## P33 Alarm Port



Alarm port P33 is used for external alarm sensors and alarm equipment.

The connector is found on the DIA board to the left in the cabinet.

P33 is a 15 pole D-sub female connector.

The port has four alarm inputs, EAL1 - EAL4, and two alarm outputs.

### Four alarm inputs

The inputs are low-level inputs with common ground (AIC).

Use insulated switch or relay to initiate alarms (open switches in normal operating mode, closed switches cause alarm).

The alarm switch connection can be toggled between being active open or active closed. This is further described in the *OMT32, User's Manual* and in the *Advanced Repeater OMS, User's Manual*.

The alarm input voltage ratings, related to ground (AIC), are:

$$\begin{aligned} V_{in_{max}} &= 5.5V \\ V_{in_{min}} &= -0.5V \end{aligned}$$

### P33 alarm connector pinning

Pin 14	AI1	External alarm input 1 - EAL1.
Pin 15	AI2	External alarm input 2 - EAL2.
Pin 7	AI3	External alarm input 3 - EAL3.
Pin 8	AI4	External alarm input 4 - EAL4.
Pin 6	AIC	Ground.





### P28 - AI4 door switch alarm input

Normally, alarm input AI4 is used for repeater cover opening alarm EAL4, which is arranged using a door switch (optional). Because of that, AI4 and AIC are available also in the P28 connector, to which the door switch is connected.

The connector is found on the DIA board to the left in the cabinet.

The EAL4 door switch alarm is activated 10 – 30 seconds after the cover has been opened.

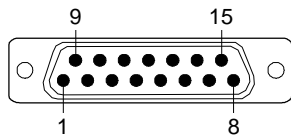
### Two alarm outputs

Both the alarm outputs are 1 pole closing and 1 pole opening relay outputs insulated from each other.

Maximum ratings, related to ground or any other alarm terminal, are 50VAC/60VDC.

The alarm outputs are defined as follows:

- Pin 9-1 AO1 – AO8 Closed when operating, otherwise open.
- Pin 10-2 AO6 – AO7 Open when operating, otherwise closed.
- Pin 11-3 AO2 – AO5 Closed at alarm state, otherwise open.
- Pin 12-4 AO3 – AO4 Open at alarm state, otherwise closed.



### P33 alarm connector pinning

- Pin 1 AO8
- Pin 2 AO7
- Pin 3 AO5
- Pin 4 AO4
- Pin 5 Not used.
- Pin 6 AIC
- Pin 7 AI3
- Pin 8 AI4
- Pin 9 AO1
- Pin 10 AO6
- Pin 11 AO2
- Pin 12 AO3
- Pin 13 Not used.
- Pin 14 AI1
- Pin 15 AI2

## P34 Repeater to Repeater Link Port



The P34 port is used for the R2R, *Repeater to Repeater Link*, which is an optional feature for the AR repeaters. This port is also used to interconnect the F2F, *Fiber to Fiber Link* feature, to the R2R net.

The connector is found on the DIA board to the left in the cabinet.

P34 is an 8 pole RJ45 modular female connector.

By interconnecting the P111 or P112 on the FON board to this port, the F2F net is included in the R2R net and all repeaters in both the nets are accessible.

### **P34 Repeater to Repeater Link connector pinning**

Pin 1	C/S
Pin 2	GND
Pin 3	D-
Pin 4	D+
Pin 5	D+
Pin 6	D-
Pin 7	GND
Pin 8	C/S

For further information about the *Repeater to Repeater Link* installation, refer to the VD202 91/EN *R2R, Repeater to Repeater Link Kit, Installation Guide*.

## Cabling

On the following pages, you will find cabling information for the various repeater types:

- Channel selective GSM repeater, two channels, page 5-58.
- Channel selective GSM repeater, four channels, page 5-59.
- Channel selective CDMA with MRX, two channels, page 5-60.
- Channel selective WCDMA, two channels, page 5-61.
- Channel selective high power CDMA/WCDMA, two channels, page 5-62.
- Band selective repeater, page 5-63.
- BMU, page 5-64.
- RMU, page 5-65.
- FOR, page 5-66.

# Channel Selective GSM Repeater, Two Channels

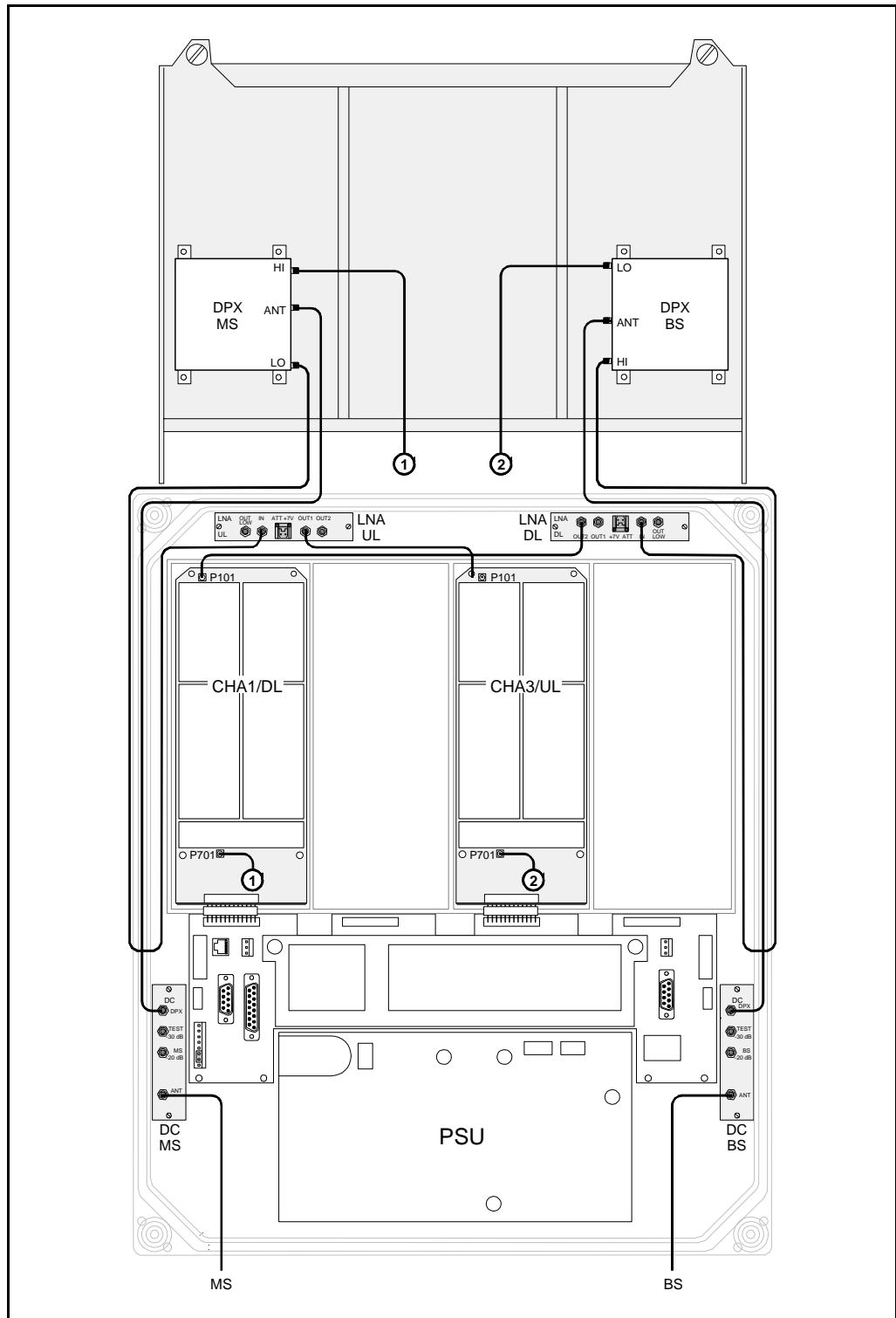


Figure 5-24. Cabling, 2 channel GSM repeater

Figure 5-24 shows a repeater equipped with the CHA1/DL and CHA3/UL channel boards for two bi-directional GSM channels.

# Channel Selective GSM Repeater, Four Channels

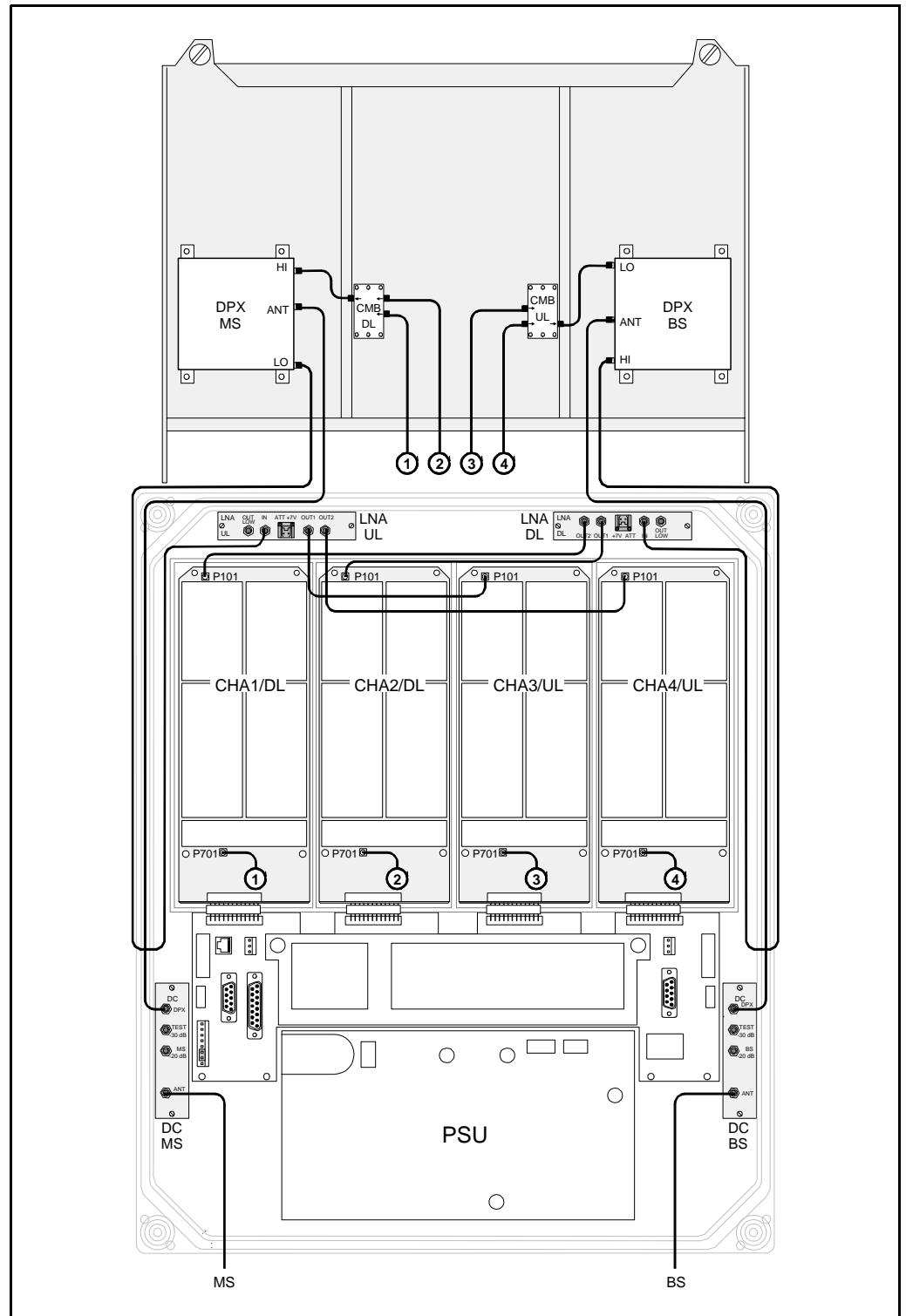
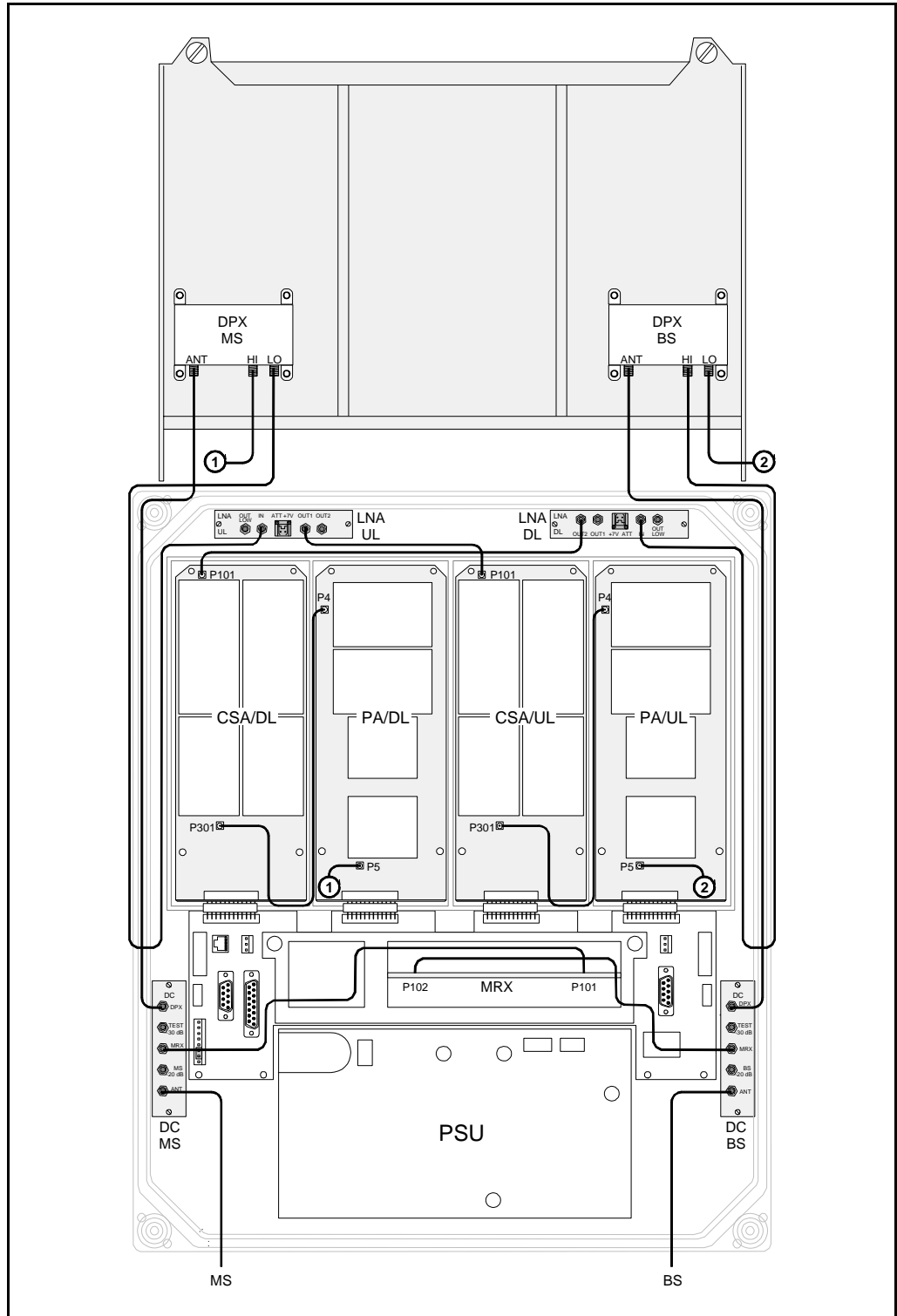


Figure 5-25. Cabling, 4 channel GSM repeater

Figure 5-25 shows a channel selective repeater equipped with the CHA1/DL, CHA2/DL, CHA3/UL, and CHA4/UL channel boards for four bi-directional GSM channels.

# Channel Selective CDMA Repeater With MRX, Two Channels



*Figure 5-26. Cabling, 2 channel CDMA repeater with MRX*

Figure 5-26 shows a channel selective high power CDMA repeater equipped with two CSA boards, two PA boards, a BA board (in the cover) and an MRX unit.

### Channel Selective WCDMA Repeater, Two Channels

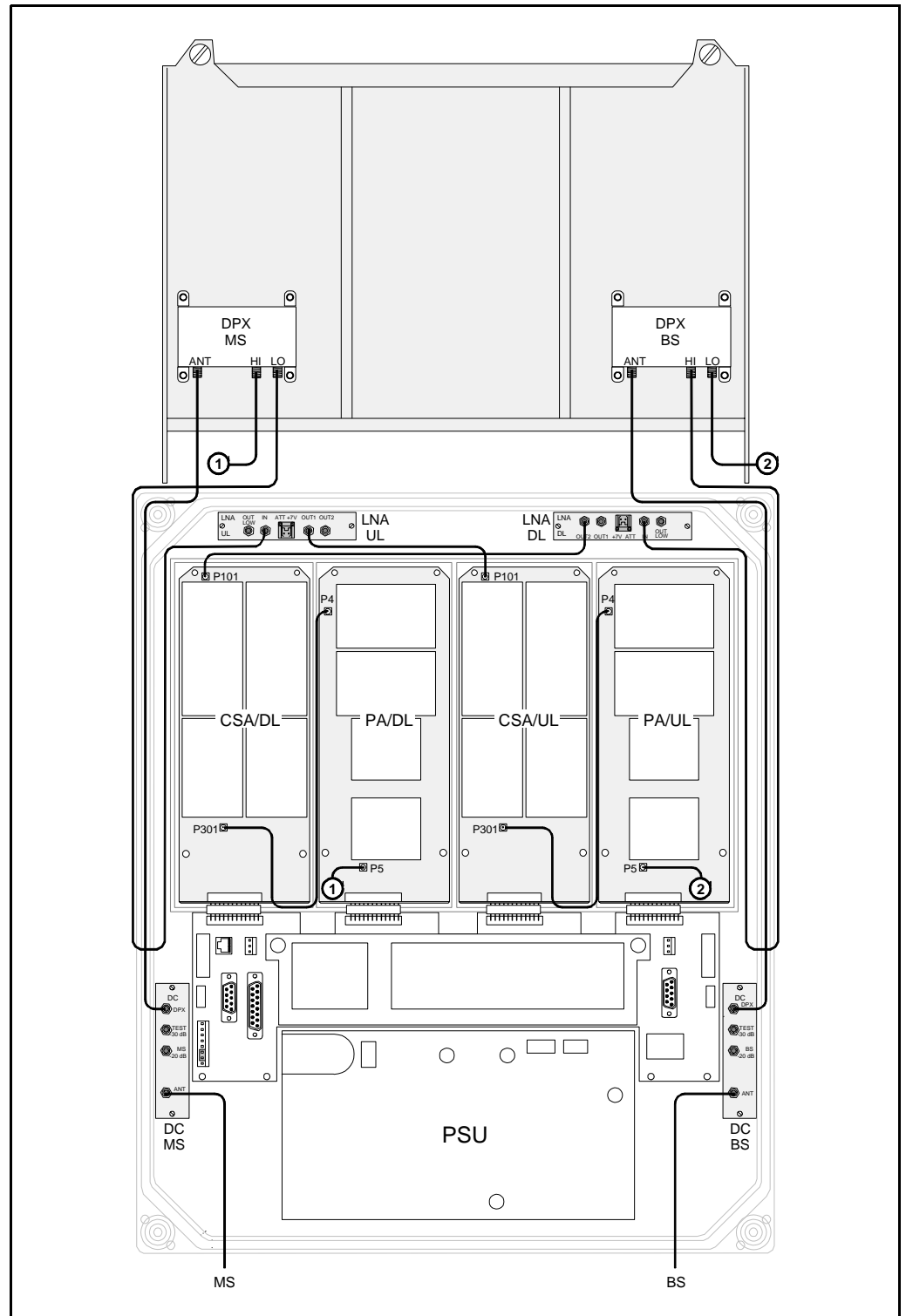


Figure 5-27. Cabling, 2 channel WCDMA repeater

Figure 5-27 shows a channel selective WCDMA repeater equipped with two CSA boards and two PA boards.

# Channel Selective High Power CDMA/WCDMA Repeater, Two Channels

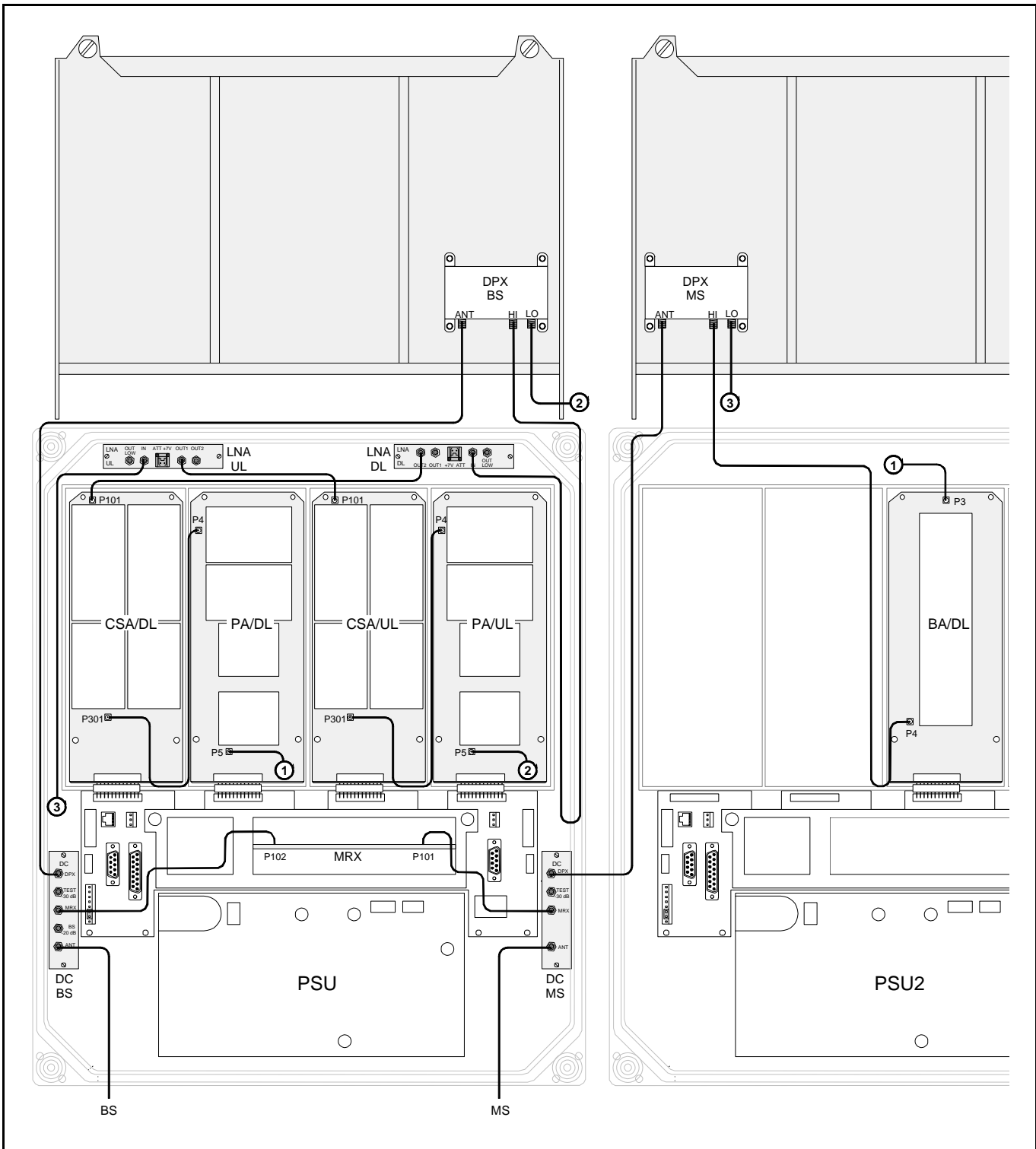


Figure 5-28. Cabling, 2 channel high power CDMA/WCDMA

Figure 5-28 shows a channel selective high power CDMA repeater equipped with two CSA boards, two PA boards and a BA board (in the cover). The high power CDMA repeater is available for two channels only.



### Band Selective Repeater

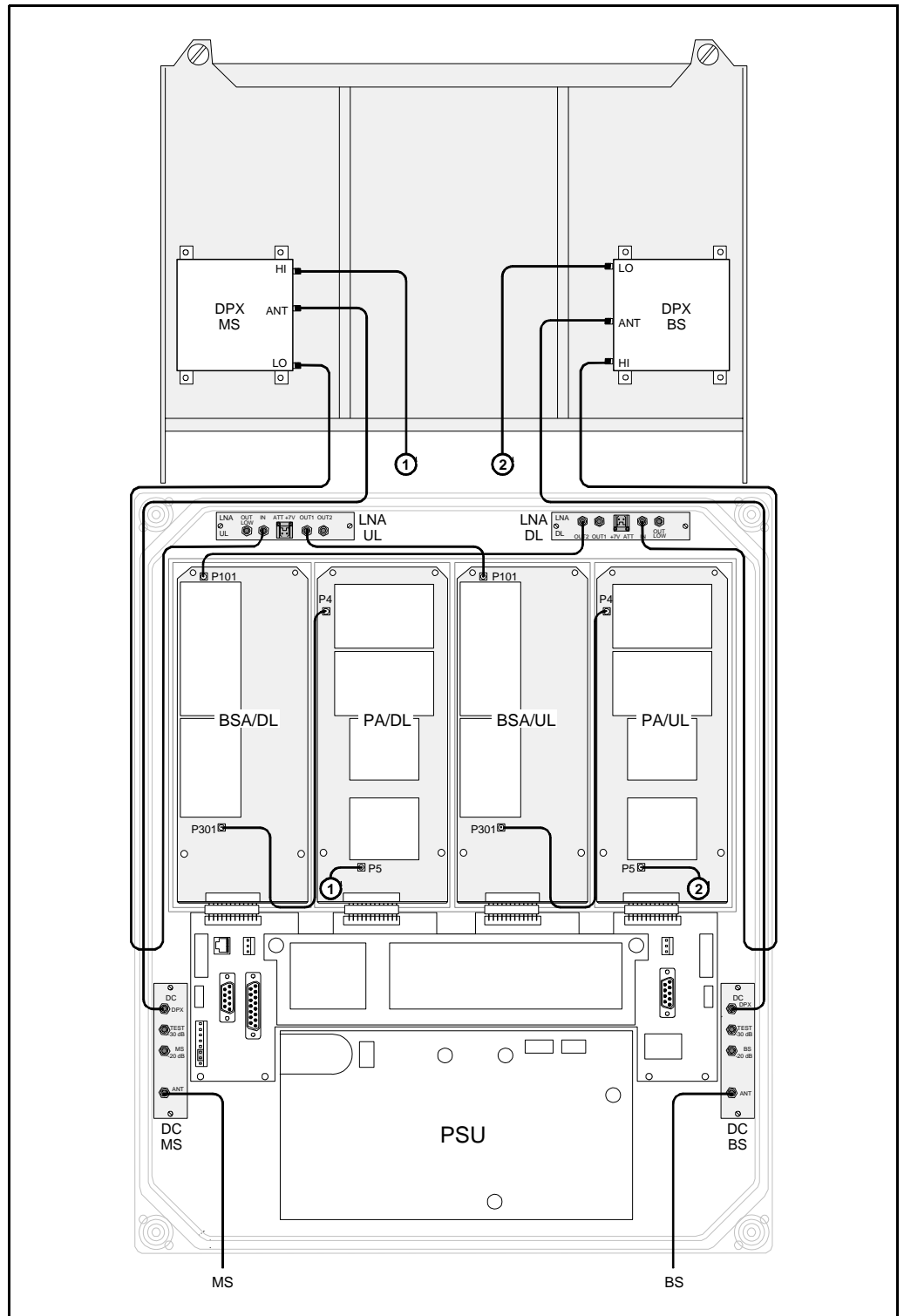


Figure 5-29. Cabling, band selective repeater

Figure 5-29 shows a band selective repeater equipped with two BSA boards and two PA boards.

BMU

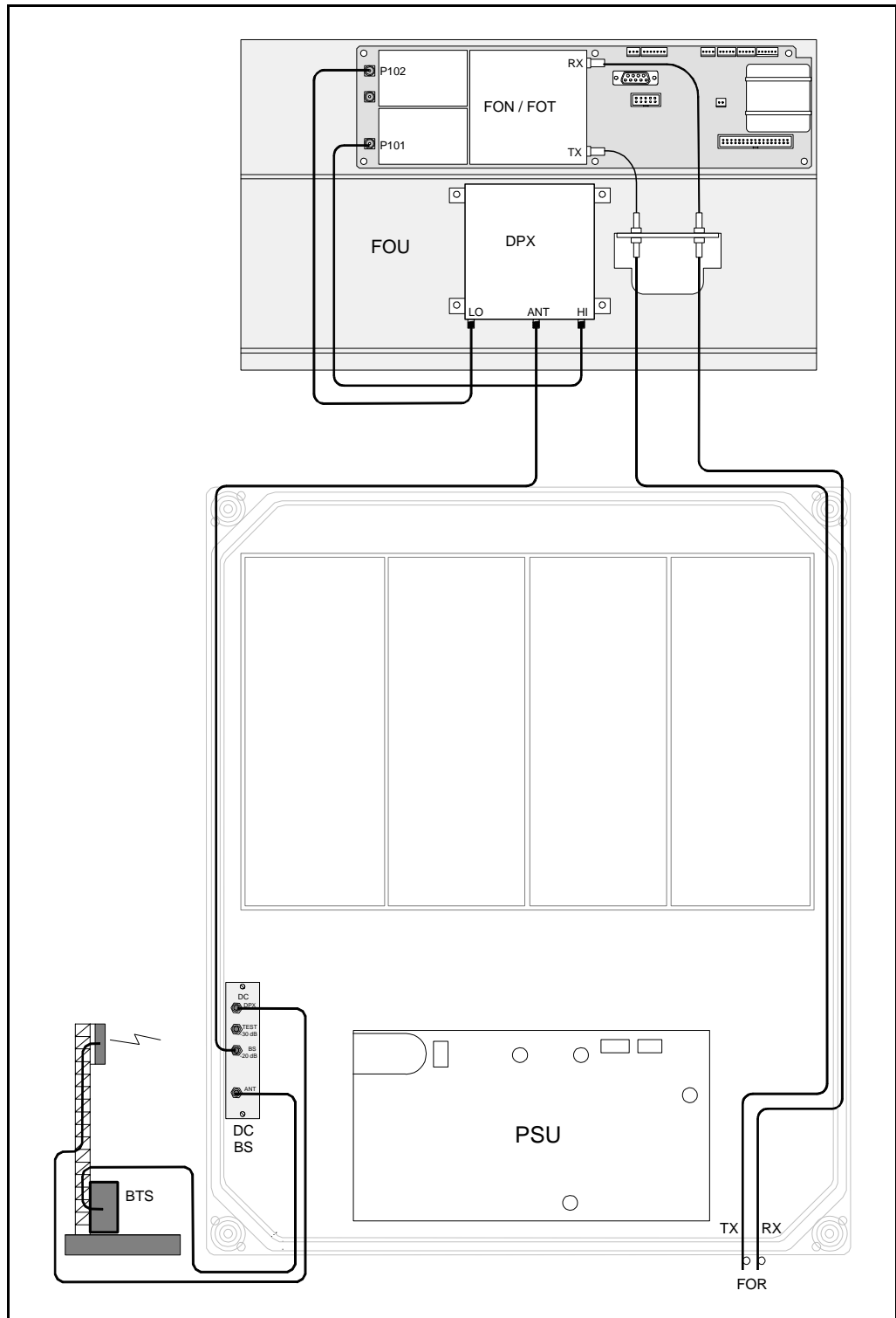


Figure 5-30. Cabling, BMU

Figure 5-30 shows a BMU with a FON board. In this type, the BTS antenna signal is passing through the Directional Coupler (DC-BS). The service side has a fiber optic connection port for a FOR.

RMU

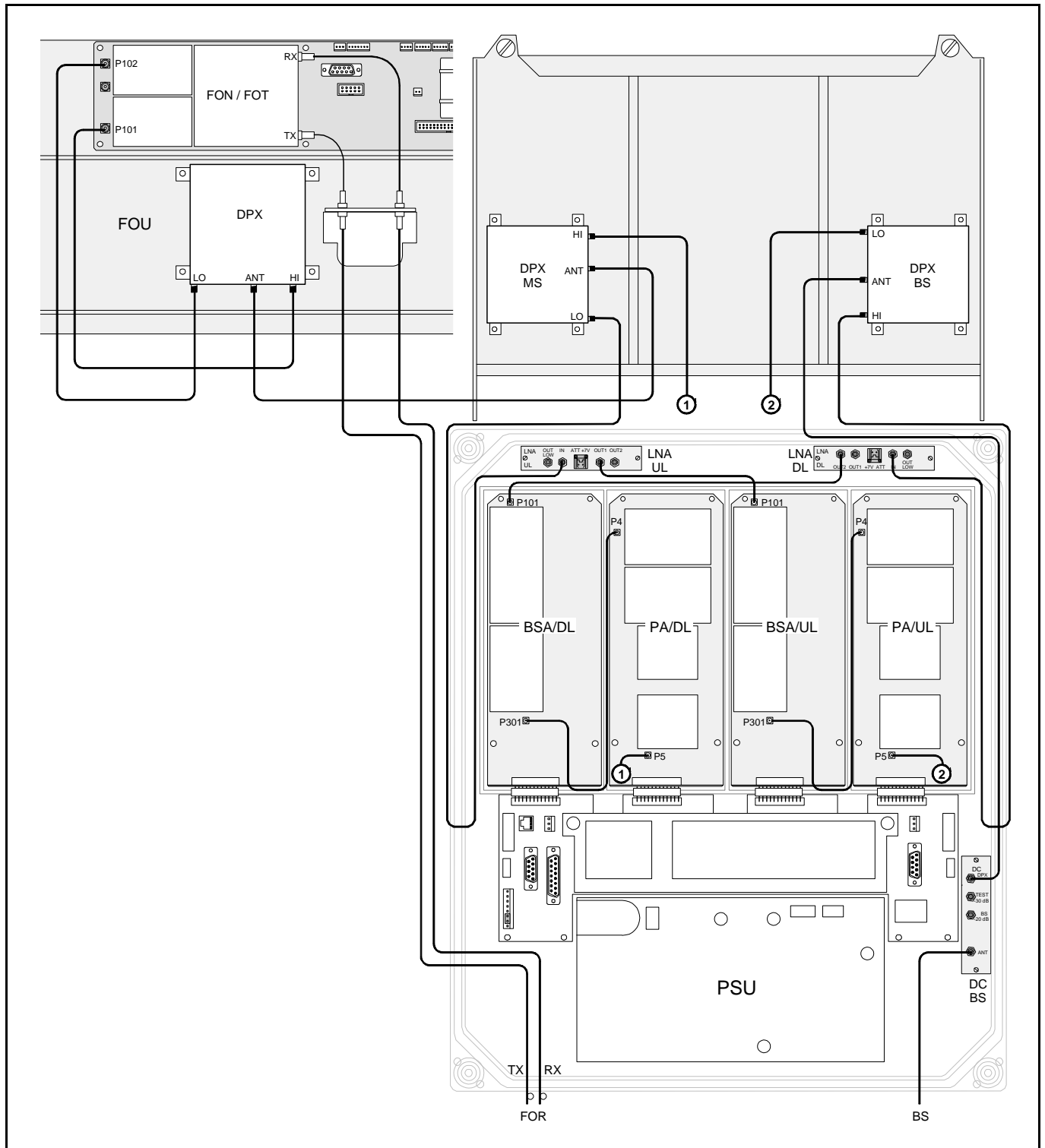


Figure 5-31. Cabling, RMU

Figure 5-31 shows an RMU for band selective operation equipped with a FON board, two BSA boards and two PA boards. The MS side has a fiber optic connection port for a FOR.

FOR

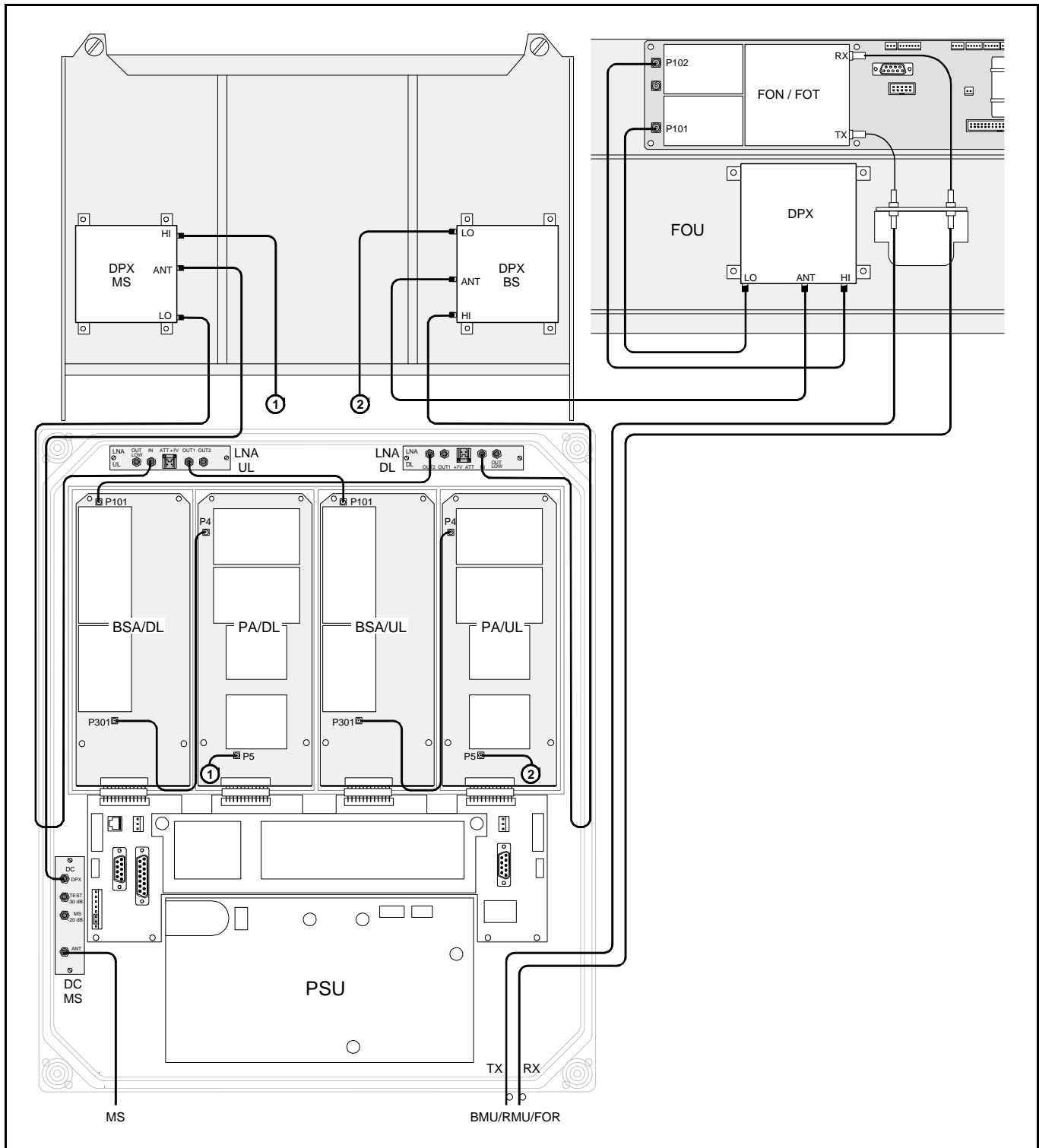


Figure 5-32. Cabling, FOR

Figure 5-32 shows a FOR for band selective operation equipped with a FON board, two BSA boards and two PA boards. The BS side has a fiber optic connection port for a BMU, RMU or another FOR.

## Repeater Software and Hardware Compatibility

There are different versions of repeater CU software, which can be combined with boards of various revisions. These have unique part numbers and revision information. Below, you will find a table of repeater software currently available in combination with CU board revisions.

CU Board Part #	CU Software		Comments
	Part #	Latest revision	
K103/1 or K103/2	SA102 01/2	R2E	For GSM channel selective $\leq 4$ channels, band selective 800-900MHz fixed bandwidth only, and combi (800/900MHz). No traffic statistics.
K103/2	SA102 02/1	R3A	For GSM, EGSM, DCS, PCS channel selective $\leq 8$ channels, band selective 800-900MHz fixed or adjustable bandwidth, band selective 1800MHz or 1900MHz and combi. Supports R2R link.
		R3C	Supports stacked channels.
K103/2	SA102 02/2	R1A	For 800/1900MHz CDMA $\leq 4$ channels. Supports MRX
		R2A	Supports R2R.

This information is updated 2001-06-28.

As new versions of hardware and software are released without prior noticing, contact your LGP Allgon sales representative if in doubt about the latest revision status.

For detailed information, refer to the release notes for the CU software to be downloaded (normally found in the *readme.txt* file provided with the program files).



# 6. Optionals

This chapter describes the following optional accessories available for the LGP Allgon repeaters:

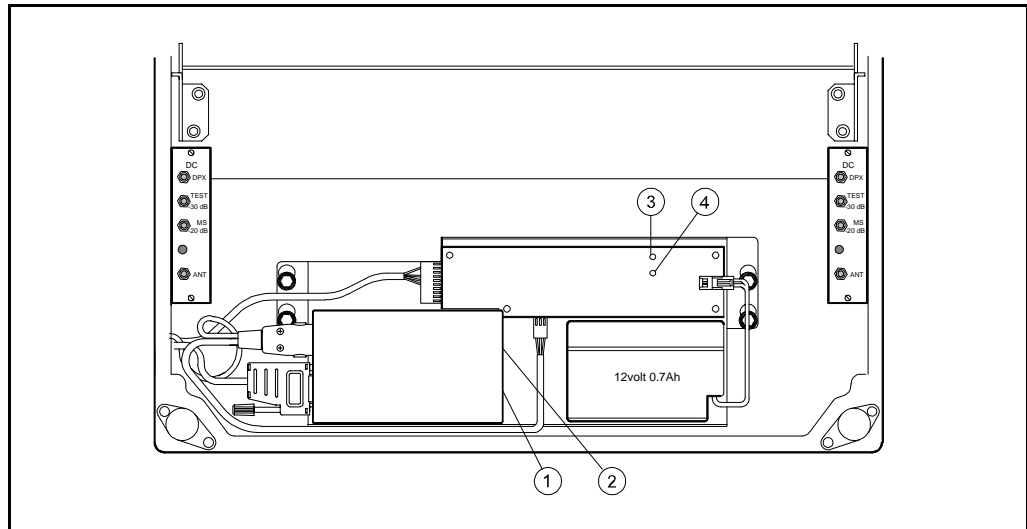
- RCU, Remote Control Unit for GSM 900/1800/1900, page 6-2.
- RCU, Remote Control Unit with PCMCIA Modem, page 6-4.
- RCC, Remote Communication Control unit, page 6-6.
- R2R, Repeater To Repeater Link, page 6-7.
- Traffic Statistics, page 6-9.
- Battery Backup, page 6-9.
- 7/16" Antenna Cable Connectors, page 6-9.
- OMS, Operation and Maintenance System, page 6-9.

## RCU, Remote Control Unit for GSM 900/1800/1900

*As the mobile phone technology is developing very fast, this RCU may be modified after issuing this manual. New types may also have been added. For the latest details, please contact your local LGP Allgon representative.*

For remote control of LGP Allgon repeaters in the GSM 900 system an RCU Remote Control Unit is available as a kit. This kit contains an integrated mobile phone/modem, power supply and power supply backup. A detailed installation guide is also included in the RCU kit.

The RCU for the GSM system is mounted inside the repeater cabinet, in front of the PSU (see Figure 6-1).



*Figure 6-1. RCU - GSM 900 type*

The RCU is connected to the P27, P32, and MS -20dB ports.



## RCU kit items

The item numbers refer to the numbers in Figure 6-1.

1. The GSM board. Press a pencil or similar object on the small button adjacent to the SIM board to release it.
2. LED indicator on the M1 phone/modem unit which shows three operational modes:  
Out: The unit is off  
Slow flashing: Stand by  
Fast flashing: Connection in progress
3. Green LED on the battery charger which is lit with a steady light when the power supply is OK, either from the mains or from the battery.
4. Yellow LED on the battery charger which is lit with a steady light during battery charge from the mains.



*Do not forget to put a jumper between pin 2 and 3 on the P27 connector if you disconnect the RCU.*

## GSM subscriber conditions

- Data transmission, 9600 bps (baud)
- Transparent mode
- If the PIN code have to be disabled, use another phone.

If you get problems with the PIN code, please contact LGP Allgon Technical Support.

## Power supply backup

If a power failure occurs, the backup battery has capacity to supply the CU, ALI and phone/modem for 30 minutes at room temperature and a limited number of call attempts.

The battery life is 1 – 2 years at normal indoor temperature. If the operational temperature is higher, the battery life is shortened.

## Power supply battery type

12V, 0.7A/20h, lead, sealed, including cable and JST VHR-2N connector.

Part #	LGP Allgon:	PM291 09/1
	Hitachi:	HP0.7-12P (VHR-2N)
	Yuasa:	NP0.8-12

## RCU, Remote Control Unit with PCMCIA Modem

*As the mobile phone technology is developing very fast, this RCU may be modified after issuing this manual. New types may also have been added. For the latest details, please contact your local LGP Allgon representative.*

For remote control of LGP Allgon repeaters in various systems the following PCMCIA modem based RCU Remote Control Units is available as a kit:

- RCU Kit for PCMCIA – Fixed Wire Line Connection.

This RCU does not include accessories for a mobile phone.

Detailed installation guide is included in the RCU kit.

### **RCU Kit for PCMCIA – Fixed Wire Line Connection**

This kit contains a PCMCIA card host, power supply, and power supply backup.

Most Hayes compatible PCMCIA card modems (not included in the kit) can be used.

### **Power supply backup**

If a power failure occurs, the included backup battery has capacity to supply the CU, ALI and the modem. For the Wireless Connection type, this is applicable provided the specified configuration of mobile phone and PCMCIA modem is used.

The battery life is 1 – 2 years at normal indoor temperature. If the operational temperature is higher, the battery life is shortened.

## RCU for Fixed Wire Line Connection

The RCU for Fixed Wire Line Connection is mounted inside the repeater cabinet, in front of the PSU (see Figure 6-2).

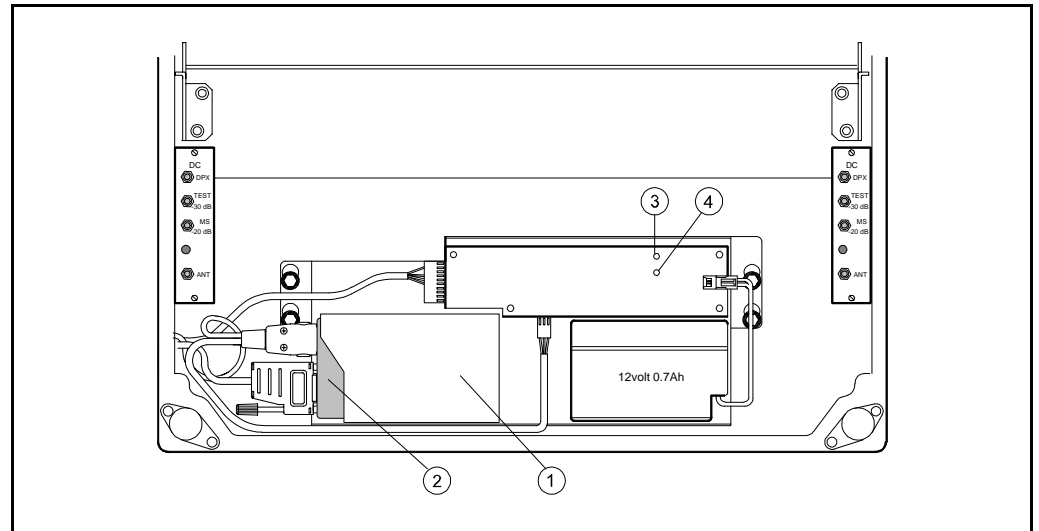


Figure 6-2. RCU - Fixed Wire Line PCMCIA type

The RCU is connected to the P27 and P32 ports.

A free strain relief bushing at the bottom of the repeater is used for the external telephone line cable.

### RCU kit items

The item numbers refer to the numbers in Figure 6-2.

1. PCMCIA modem card host.
2. PCMCIA modem card (not included in the kit).
3. Green LED on the battery charger which is lit with a steady light when the power supply is OK, either from the mains or from the battery.
4. Yellow LED on the battery charger which is lit with a steady light during battery charge from the mains.



*Do not forget to put a jumper between pin 2 and 3 on the P27 connector if you disconnect the RCU.*

## RCC, Remote Communication Control Unit

The optional RCC Remote Communication Control unit is an alternative to the RCU, provided the repeater has a FON board. The RCC unit is also used in the Compact repeaters.

An RCC unit is required if the communication unit has to be connected to a FON board, e.g. in the BMU (the FON board does not support the RCU).

Communication with the repeater is performed by means of a PSTN or RF modem that has the antenna connected to the BS directional coupler (DC) or has a separate antenna. Data is transferred between the repeater and the RCC unit via the P130 modem port on the FON board.

The RCC unit is also powered via the same port and the unit has a battery with capacity enough for sending a number of alarms if a mains power failure occurs.

A description of the RCC and its connection is found in the VD203 67/EN, *ALR Compact Repeater, User's Manual*.

## R2R, Repeater To Repeater Link

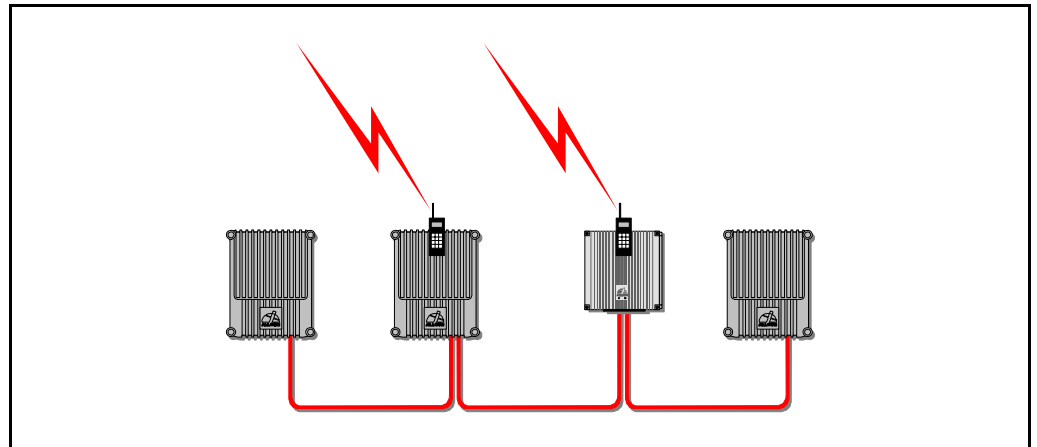


Figure 6-3. Repeater to Repeater Link

The LGP Allgon *Repeater to Repeater Link* can be used in order to establish a repeater network with up to 13 repeaters, one or several of which can contain a phone line for communication with an OMT32 or an OMS.

All LGP Allgon repeaters can be included in a R2R net (see Figure 6-3). Channel selective repeaters, band selective repeaters, and Compact repeaters can be mixed in the same net. For Compact repeaters, the R2R *Repeater to Repeater Link* feature is standard and requires no extra hardware or software.

AR Repeaters can either be equipped with this feature at the delivery from LGP Allgon, or be completed with a *Repeater to Repeater Link Kit*, provided the repeaters meet the below requirements.

### R2R Requirements

To be able to use the *Repeater to Repeater Link* feature, the following DIA board, CU board and CU software are required:

- DIA board K105/1 version R2A or higher.
- CU board K103/2 version R1A or higher.
- CU software SA102 02/1 version R3A or higher.

The version of the RIA board can be detected remotely by means of the OMT32, see the *OMT32, User's Manual*.

Further information and requirements are found in the R2R installation document, *R2R, Repeater to Repeater Link Kit, Installation Guide* (part # VD202 91/EN).

## Installation

The R2R, *Repeater to Repeater Link*, is installed as described in the *R2R, Repeater to Repeater Link Kit, Installation Guide*.

At least one RCU unit (or telephone line with modem) is required for remote communication.

## Configuration

Configuration is described in the *OMT32, User's Manual*.

## F2F Access

Communication with repeaters in a mixed F2F and R2R net is possible.

By interconnecting a F2F net with an R2R net, all repeaters in both the nets are accessible. FON boards are, however, required for the repeaters included in the F2F net (the FOT board does not support the F2F feature).

## Traffic Statistics

Traffic statistics is available for channel selective GSM 900, GSM 1900 and DCS/PCN 1800 repeaters, provided that the repeaters have the latest CU software versions, the latest CU and CHA boards, and that an OMS is used to poll and view the statistics.

## Battery Backup

Battery backup can be arranged by completing the repeater with an LGP Allgon UPS (Uninterruptible Power Supply). The LGP Allgon UPS has an exterior similar to the repeater which means that it can preferably be mounted adjacent to the repeater.

## 7/16" Antenna Cable Connectors

A 7/16" antenna cable kit is available for all the LGP Allgon repeaters. This kit includes 7/16" antenna connectors for uplink and downlink antennas mounted on two repeater cable inlet flanges, and cables and connectors for connection to the DC directional couplers inside the repeater.

## OMS, Operation and Maintenance System

The *OMS, Operation and Maintenance System* is an LGP Allgon software package for controlling a large repeater fleet by using computers with Windows NT in networks with a common database.

The OMS is capable of operating a large number of repeaters. Multiple modems can be used for several incoming and outgoing parallel activities, such as polling, radio parameter configuration, software downloading, etc.

OMS is an improved OMC, *Operation and Maintenance Center*. The latter is replaced by the OMS and is no longer subject to further development.





# 7. Repeater Alarms

This chapter contains a list of those alarms which are initiated in the repeater.

*Critical, Error* and *Warning* alarms can be sent automatically from a repeater to an OMT32 and OMS and then be stored. These alarms can then be viewed.

The alarm handling is described in the following manuals:

- *OMT32, User's Manual*
- *Advanced Repeater OMS, User's Manual*

The table starting on the following page contains those alarms that can be generated by an AR repeater.

## Alarm Reference List

The following table contains the internal repeater alarms which can occur and be shown in the OMT32 and OMS alarm window (additional alarms may have been added to the system after issuing this manual).

Alarm Text	Alarm Unit	Alarm Level	Description
<i>Antenna isolation</i>	BSA # Channel # UL/DL	<i>Warning</i>	Antenna isolation is below the gain set. The gain is reduced 10 – 13dB below oscillation point.  Suggested remedy: Decrease the gain or increase the antenna isolation.
		<i>Error</i>	The gain is reduced as much as possible but the oscillation continues. The amplifier is turned off.  Suggested remedy: Decrease the gain or increase the antenna isolation.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Antenna SWR</i>	Donor or service antenna	<i>Error</i>	Antenna SWR above preset limit.  Suggested remedy: Check antenna, connector and cables.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Alarm reset</i>	CU	<i>None</i>	Manual alarm reset. Alarm criteria is re-evaluated and reported if still active.
<i>BA HW error</i>	BA #	<i>Error</i>	BA-BA link does not work properly.  Suggested remedy: Check cables between BA units.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Bad table found</i>	CU	<i>Error</i>	Incorrect information detected in a table.  Suggested remedy: Replace the unit for calibration.
<i>Battery backup fault</i>	External	Configurable	Battery backup fault (provided the external alarm 2 is configured to display this alarm).
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Battery fault</i>	RCC unit, FON charger	<i>Error</i>	The backup battery on the RCC unit or the FON board does not work properly.  Suggested remedy: Check cables or replace battery.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>CU battery fault</i>	CU	<i>Warning</i>	CU RAM battery fault.  Suggested remedy: Make sure the P3 jumper is connected on the CU board.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Door open alarm</i> <sup>1)</sup>	External	Configurable	Door open more than 30 seconds.
		<i>Ceasing</i>	Door closed more than 30 seconds or the alarm is disabled.
<i>EEPROM error</i>	CU	<i>Error</i>	EEPROM read or write error.
<i>Err in AD-converter</i>	CU	<i>Warning</i>	Unreliable value from the analog-to-digital converter.
<i>Ext REFO error</i>	CU	<i>Warning</i>	An external reference is lost (e.g. GPS reference).  Suggested remedy: Check reference source and cables.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>External alarm 1</i>	External	Configurable	External alarm input 1 active more than 1 second.
		<i>Ceasing</i>	External alarm input 1 no longer active.
<i>External alarm 2</i>	External	Configurable	External alarm input 2 active more than 1 second.
		<i>Ceasing</i>	External alarm input 2 no longer active.
<i>External alarm 3</i>	External	Configurable	External alarm input 3 active more than 1 second.
		<i>Ceasing</i>	External alarm input 3 no longer active.

Alarm Text	Alarm Unit	Alarm Level	Description
<i>External alarm 4</i>	External	Configurable	External alarm input 4 active more than 1 second.
		<i>Ceasing</i>	External alarm input 4 no longer active.
<i>Fiberoptical error</i>	FOT	Configurable	Fiber optic error (provided the external alarm 3 is configured to display this alarm).
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>FON Laser RX Fault</i>	FON	<i>Error</i>	The received optical level is below the allowed limit set to generate <i>Error</i> alarm.  Suggested remedy: Check the fiber optic cord.
		<i>Warning</i>	The received optical level is below the allowed limit set to generate <i>Warning</i> alarm.  Suggested remedy: Check the fiber optic cord.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>FON Laser TX Fault</i>	FON	<i>Error</i>	The laser transmitter control loop voltage is out of range.  Suggested remedy: Replace the FON board.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>FON Power Fault</i>	FON	<i>Error</i>	A FON board DC power supply voltage is out of range.  Suggested remedy: Replace the FON board.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>FON RxStable alarm</i>	FON	<i>Warning</i>	Laser receiver input signal below preset warning limit.  Suggested remedy: Check FON board cables and connectors.
		<i>Error</i>	Laser receiver input signal below preset error limit.  Suggested remedy: Check FON board cables and connectors.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>FON SPI Error</i>	FON	<i>Error</i>	The SPI bus connection to the RF modem does not work properly.  Suggested remedy: Replace the FON board.
<i>FON TxStable alarm</i>	FON	<i>Error</i>	Unstable laser transmitter control loop, probably due to a faulty laser.  Suggested remedy: Replace the FON board.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Gain reduction</i>	Channel # UL/DL	<i>Warning</i>	The gain is reduced below the limit.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>High PSU voltage</i>	BA # BSA # CSA #	<i>Critical</i>	Too high PA supply voltage.  Suggested remedy: Make sure the right PSU is used.
<i>High temperature</i>	BA # BSA # CHA # CSA # PA #	<i>Error</i>	Board temperature higher than 95°C.
		<i>Warning</i>	Board temperature higher than 85°C.
		<i>Ceasing</i>	Board temperature below 70°C.
	CU	<i>Warning</i>	CU board temperature higher than 90°C.
		<i>Ceasing</i>	CU board temperature below 90°C.
<i>Inst. unit lost</i>	CU	<i>Error</i>	Missing HW since last power on.
<i>Local bus error</i>	BA #	<i>Error</i>	Communication bus error on BA board.
	BSA #	<i>Error</i>	Communication bus error on BSA board.
	CHA #	<i>Error</i>	Communication bus error on CHA board.
	CSA #	<i>Error</i>	Communication bus error on CSA board.
<i>Log cleared</i>	CU	<i>None</i>	Log memory has been cleared.

<b>Alarm Text</b>	<b>Alarm Unit</b>	<b>Alarm Level</b>	<b>Description</b>
<i>Log memory fault</i>	CU	<i>Error</i>	Log memory fault.
<i>Login failed</i>	CU	<i>None</i>	Invalid repeater password.
<i>Low stability margin</i>	Channel # UL/DL	<i>Warning</i>	MRX has detected that antenna isolation is below the gain set. The gain is reduced 10 – 13dB below oscillation point.  Suggested remedy: Decrease the gain or increase the antenna isolation.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Low traffic activity</i>	RSSI Statistics	<i>Warning</i>	No signal strength was above the limit set.  Suggested remedy: Check the antennas and that a phone works in the covered area.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Mains bkd w backup</i>	External	<i>Error</i>	Mains breakdown – power from battery backup.  Suggested remedy: Check the mains power.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Mains breakdown <sup>2)</sup></i>	External	<i>Critical</i>	Power failure.
		<i>Ceasing</i>	Mains power is up again.
<i>Modem init failed</i>	Remote ctrl	<i>None</i>	Initiation string to modem not accepted.  Suggested remedy: Check the modem by using the modem debugger in OMT32 or OMS.
<i>New unit detected</i>	CU	<i>None</i>	Additional HW since last power on.
<i>No BCCH detected</i>	RSSI Statistics	<i>Warning</i>	Signal strength on the BCCH channel below the limit set.  Suggested remedy: Make sure the repeater is configured to the BCCH channel, and that the BTS signal is proper.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>No connection</i>	Remote ctrl	<i>None</i>	No connection at callback.
		<i>Warning</i>	No connection at alarm calling.
<i>No modem found</i>	Remote ctrl	<i>None</i>	No modem is found.
<i>No phone detected</i>	Remote ctrl	<i>Warning</i>	When using a PC-card modem together with the MS this alarm indicates contact with the PC-card modem but not with the MS. The MS may be turned off.  Note that a Nokia MS does not power up after power failure.  Suggested remedy: Make sure the phone is connected.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Not In Allowed Area</i>	CU	<i>None</i>	Repeater is moved from the operating area and the RF HW is switched on or off.
<i>Overpower alarm</i>	Channel # UL/DL	<i>Warning</i>	Input power too high, output power above maximum limit.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>PA fault</i>	BA # BSA # CHA # CSA #	<i>Error</i>	PA has not enough output power for the RSSI and gain set.
<i>PA Undervoltage alarm</i>	PA # BA #	<i>Error</i>	PA voltage level below alarm limit.  Suggested remedy: Check the PSU.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Param. R/W error</i>	BA #	<i>Error</i>	EEPROM failure on BA board.
	BSA #	<i>Error</i>	EEPROM failure on BSA board.
	CHA #	<i>Error</i>	EEPROM failure on CHA board.
	CSA #	<i>Error</i>	EEPROM failure on CSA board.

Alarm Text	Alarm Unit	Alarm Level	Description
<i>PIN code failed</i>	Remote ctrl	<i>Warning</i>	The PIN code sent to MS is incorrect.  Suggested remedy: Unlock the MS/SIM card by using the PUK code.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>Power supply</i>	PSU1	<i>Critical</i>	Power failure in PSU1 (in the cabinet).
		<i>Ceasing</i>	PSU1 works properly again.
	PSU2	<i>Critical</i>	Power failure in PSU2 (in the cover).
		<i>Ceasing</i>	PSU2 works properly again.
	FON Charger	<i>Error</i>	The FON 10 Volt charger voltage below limit.  Suggested remedy: Replace the FON board.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>R2R HW error</i>	RIA, FON	<i>Error</i>	R2R HW is faulty.  Suggested remedy: Replace the RIA board or the FON board.
<i>R2R node lost</i>	CU	<i>None</i>	An R2R node is lost.  Suggested remedy: Check if the node is connected and still in operation.
<i>R2R queue full</i>	CU	<i>None</i>	R2R transmit queue is full, messages are lost.  Suggested remedy: Check R2R configuration and cables.
<i>REFO error</i>	CU	<i>Error</i>	Significant REFO drift or error detected by CU.
<i>Remote connection</i>	Remote ctrl	<i>None</i>	Remote connection to OMT32 via modem.
<i>Remote timeout</i>	Remote ctrl	<i>Warning</i>	A 20 minute time limit exceeded without extending timer.
<i>Repeater restart</i>	CU	<i>None</i>	Powering up by user or after power failure.
		<i>Warning</i>	Software restart error 1 <sup>st</sup> - 7 <sup>th</sup> time.
		<i>Error</i>	Software restart error 8 <sup>th</sup> - 10 <sup>th</sup> time.
<i>RF blocking</i>	Channel # UL	<i>Error</i>	CW signal constantly >27dBm in more than 10 seconds. PA off.
		<i>Ceasing</i>	The cause of the alarm has ceased.
<i>RTC error</i>	CU	<i>Error</i>	RTC does not operate properly.  Suggested remedy: Replace the CU board.
<i>RTC restarted</i>	CU	<i>None</i>	The time is changed by the operator.
		<i>Warning</i>	Date set to 1994-01-01.  Suggested remedy: Make sure the P3 jumper is connected on the CU board.
<i>Startup error</i>	BA #	<i>Error</i>	Hardware error on BA board.
	BSA #	<i>Error</i>	Hardware error on BSA board.
	CHA #	<i>Error</i>	Hardware error on CHA board.
	CSA #	<i>Error</i>	Hardware error on CSA board.
<i>SW incompatibility</i>	MRX	<i>Error</i>	MRX not compatible with CU software. Suggested remedy: Replace the bad CU software version.
<i>SW load error</i>	CU	<i>Error</i>	Software load error.  Suggested remedy: Check the repeater SW by using the SW manager in OMT32. Do not restart the repeater.
<i>Synthesizer fault</i>	BA #	<i>Error</i>	Synthesizer unlocked on BA board.
	BSA #	<i>Error</i>	Synthesizer unlocked on BSA board.
	CHA #	<i>Error</i>	Synthesizer unlocked on CHA board.
	CSA #	<i>Error</i>	Synthesizer unlocked on CSA board.

<b>Alarm Text</b>	<b>Alarm Unit</b>	<b>Alarm Level</b>	<b>Description</b>
<i>Table database err</i>	CU	<i>Error</i>	A table database is not found (calibration error).
<i>Table not found</i>	CU	<i>Error</i>	A SW table is not found (SW or calibration error).
<i>Unsupported PA type</i>	BA #	<i>Error</i>	The PA board ID is not expected by the BA board. Suggested remedy: Make sure the right PA board is used.
	BSA #	<i>Error</i>	The PA board ID is not expected by the BSA board. Suggested remedy: Make sure the right PA board is used.
	CSA #	<i>Error</i>	The PA board ID is not expected by the CSA board. Suggested remedy: Make sure the right PA board is used.
<i>Volt Reg. fault</i>	BA #	<i>Error</i>	Missing DC voltage on BA board.
	BSA #	<i>Error</i>	Missing DC voltage on BSA board.
	CHA #	<i>Error</i>	Missing DC voltage on CHA board.
	CSA #	<i>Error</i>	Missing DC voltage on CSA board.

## Remarks

- 1) The *Door open alarm* requires an optional door switch described in the *P33 Alarm Port* section in Chapter 5.
- 2) The *Mains breakdown* alarm requires a relay not included in the repeater (see *Mains Breakdown Relay* in Chapter 3).

Channel #, UL/DL Repeater channel number (1-4) at channel selective operation, uplink or downlink.

BSEL #, UL/DL Repeater channel number at band selective operation, uplink or downlink.

BA # BA board number for high power operation.

BSA # BSA board number for band selective operation.

CHA # CHA board number for channel selective operation.

CSA # CSA board number for channel selective CDMA operation.

FON FON board for fiber optic communication.

PA PA board for channel selective or band selective operation.

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