1800MHz - 1900MHz ADJUSTABLE BANDWIDTH OFF-AIR REPEATERS

OR1-SBHP1-1800
OR2-SBHP1-1800
OR1-SBHP1-1900
OR2-SBHP1-1900

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TECHNICAL HANDBOOK

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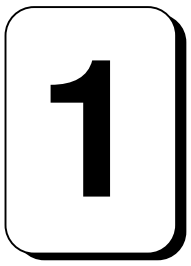
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1) SAFETY RULES

1.1 Introduction

The equipment described in this technical handbook has been designed and tested in conformity of international safety standards IEC215 / EN60215 and IEC950 / EN60950; the equipment has to be used under the responsibility of specialised personnel only. In accordance with IEC215 / EN60215, adjustment, maintenance and repair of the exposed equipment shall be carried out only by qualified personnel, who are aware of the hazards involved. The minimum qualifications are established in the standard.
Final installation of the systems must fulfil the EMF emission levels, as requested by regulations in force (recommendation n. 1999/519/EC).

WARNING: Installation Notes
Modular equipment, intended to be housed insidea rack cabinet, must be installed within a protected access area only.
This area must be opportunely protected by security system that will exclude the entry, even if accidental, to not authorized and trained personnel. Alternatively, the cabinet, in which the equipment is housed, must be closed on all sides, to allow the access to internal parts to authorized personnel only

1.2 AC Power supply

When working on the equipment always make sure that the equipment is not connected to the mains supply.

Before power up always make sure that the equipment is connected to earth by using the equipment grounding bolt.

If it is necessary to fit an AC power supply plug to power cable, the User must observe the following colour codes: LIVE terminal to BROWN lead NEUTRAL terminal to BLUE lead EARTH terminal to GREEN/YELLOW lead The User must also ensure that the protective earth wire would be the last to break, should the cable be subject to excessive strain.

1.3 Safety precautions

For the correct and safe use of the equipment it is essential that both operation personnel and services personnel follow generally accepted safety procedures (see IEC Publications 215: "Safety measures for radio transmitting equipment" and 61010-1: "Safety requirements for electrical equipment for measurement, control, and laboratory use") in addition to the safety precautions specified in this technical handbook. Specific warnings and caution statements, where applicable, can be found throughout this technical handbook. Warning and caution statements and/or symbols are marked on the equipment where is necessary. (see also ANNEX n°1).

As far as the equipment safety devices are concerned please remind that: -periodic functional check shall be carried out on protective devices; -functional check shall be carried out on protective devices, when they have operated under fault conditions; -safety devices shall not be altered or disconnected except for replacement; -safety circuit shall not be modified.

1.4 Caution and warning statements

Caution It's used to indicate the correct operation and maintenance, in order to prevent damage or destruction of equipment or other property. Warning of danger Used to indicate the potential hazard that requires correct procedures or practices in order to avoid personal injury.

1.5 Impaired safety protection

Whenever it is likely that safe operation is impaired, the apparatus must be in-operative and secured against unintended operation. The appropriate servicing staff authority must be informed.

For instance, the safety is likely to be impaired if the equipment fails to perform the prescribed measurements, or shows visible damages.

1.6 Electrostatic sensitive devices

In case of electrostatic sensitive devices (for instance all ICs and many other semiconductor devices belong to this class) it is essential to use a right protection to reduce the risk of personal injury. Careless handling, during repair, may imply life danger. When repairing, make sure that you are connected with the same potential as the ground of the equipment by means of the right devices, i.e. a GIRDLE (a wrist wrap with resistance) and a WINDING CORD to be connected to the girdle and to the relevant socket placed on the equipment.

You must also keep components and tools at this potential.

1.7 Electrolytic Capacitors

Non-solid electrolytic capacitors must not contain chemicals, which may be regarded as hazardous, if incorrectly handled. Caution is necessary, should the outer case be fractured.

1.8 Electric shock

In case of electric shock it is recommended not to touch the person before breaking the circuit by means of the power supply switch; should it be not possible to break the circuit power supply it would be advisable to try to rescue the person by means of some insulating materials: e.g. a wood stick, a nylon cord or a suitable service made of plastics, etc.

NEVER TOUCH ELECTROCUTED PEOPLE WITH YOUR HAND AS LONG AS THEIR BODIES ARE SUBJECTED TO VOLTAGE, OTHERWISE YOU TOO WOULD GET ELECTOCUTED.

Call the doctor and then immediately perform the artificial respiration as described here below:

Lay the patient on his back with his arms parallel to his body; if the patient lies on an inclined plane, please make sure that his stomach be slightly lower than his breast. Open the patient's mouth and check if there are foreign bodies. Kneel down near the patient at the same level as his head's, put one of your hands under his head and the other one under his neck. Lift the patient's neck and let his head fall backwards the most possible.

Shift your hand from the patient's neck to his chin; put your thumb between his chin and his mouth, your forefinger along his jawbone, keep your other fingers tight. By doing these operations start the self-oxygenation by means of deep breathings in standing open-mouthed. With your thumb between the patient's chin and his mouth, keep the patient's lips closed and blow into his nasal cavities.

During these operations see if the patient's breast rises. If it is not so, his nose may be obstructed; in this case, by levering on his chin with your hand, open the patient's mouth, put your lips on and blow into his oral cavity. Look at the patient's breast and see if it rises. One can use this second method instead of the first one also if the patient's nose is not obstructed, provided that his nose be occluded by squeezing his nostrils with your hand after shifting it from his head. The patient's head must be kept bent backwards the most possible.

Start with ten fast and deep expirations, then go on at the rhythm of twelve/fifteen expirations per minute. Continue as long as the patient has recovered consciousness, or a doctor has ascertained his death.

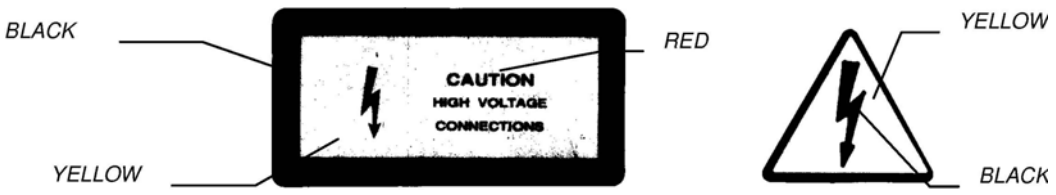
1.9 Burns

As far as burns are concerned: Don't try to take off clothes from the burnt parts; Pour some cold water on body burnt areas and ask immediately for a doctor; Don't apply ointments or oily tinctures.

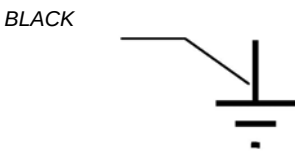
ANNEX 1

When the equipment or the modules are equipped with the labels as shown here below, it is essential to observe the warnings contained

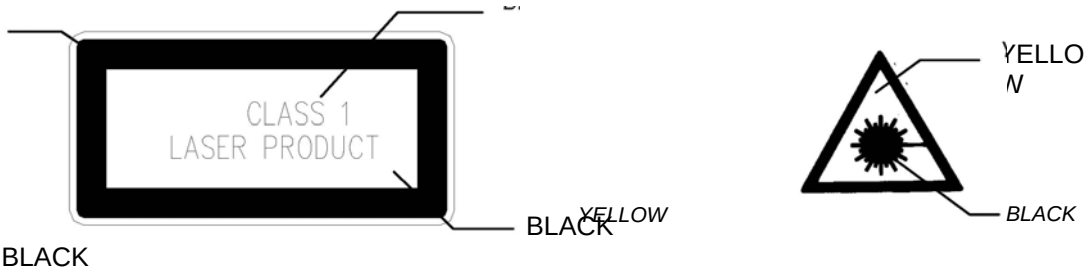
-LIVE VOLTAGE POINT



-PROTECTIVE EARTHING TERMINAL



-CLASS 1 LASER PRODUCT



BLACK

EXPLANATORY LABEL (affixed to the WARNING LABEL (affixed to the CLASS 1 product side) CLASS 1 product front)

Products which are of CLASS 1 as defined in the IEC EN 60825-1, fourth edition “Safety of laser products -Part 1: Equipment classification, requirements and user's guide”. Even if the product is of CLASS 1, please observe the following safety procedures, prescribed in the cited norm:

- **do not observe directly the laser beam,**
- **do not use observation optics (lens, microscopes, telescopes, etc.),**
- **do not expose eyes directly.**

-**DEVICES SENSITIVE TO THE ELECTROSTATICS**

WARNING: Please observe the due precautions in handling devices which are sensitive to the electrostatics.

-**NON-SOLID ELECTROLYPTIC CAPACITORS MAY CONTAIN CHEMICALS TO BE REGARDED AS HAZARDOUS, IF INCORRECTLY HANDLED.**

WARNING

THE MAXIMUM CAUTION IS REQUIRED IF THE OUTER CASE IS FRACTURED

2

2) STANDARDS

2.1. MANUFACTURE LABELS

2.1.1 BAR CODE LABEL

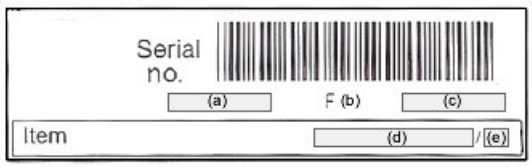


Fig. 1

Label fields (ref. Fig.1):

a) Serial number: this field contains the serial number (made up of a 7-digit sequential group) of the module or equipment.

b) F (final test tracing out): this field contains an F letter that has been barred to certify that the item has been successfully tested in the factory Final Test Dept.

c) Customer order reference.

d) Equipment acronym or manufacture part number.

e) ICS (Item Change Status): this field contains the item ICS, made up of 2 digits, starting from 01, of the manufacture part number or equipment.

Fig.2 shows an example of bar code label applied:

Fig. 2

On equipment other labels may be present, as integration of what reported in bar code label (fig.1); see following pages.

2.1.2 MANUFACTURE LABELS FOR RACK CABINETS AND EQUIPMENT

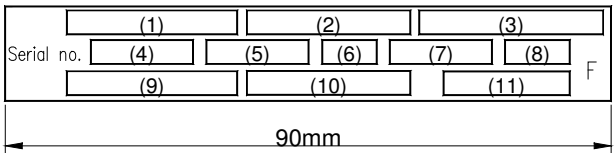


Fig. 3

Label fields (ref. Fig.3):

(1) SYSTEM (it will be filled in only if the rack cabinet or the equipment belong to a system):
this field contains the system acronym.

(2) EQUIPMENT:
This field contains the acronym of the rack cabinet or equipment.

(3) MANUFACTURE PART NUMBER:
This field contains the manufacture part number either of the rack cabinet or the equipment.

(4) SERIAL NUMBER:
This field contains the serial number (made up of a 5-digit sequential group) of the rack cabinet or equipment.
The serial number of each item comes from the manufacture orders print-out (for domestic and foreign markets).

(5) QIF (Quality Identification Factor):
FACTORY USE ONLY

(6) ICS (Item Change Status):
This field contains the item ICS, made up of 2 digits, of the rack cabinet or equipment.

(7) ORIGIN CODE:
FACTORY USE ONLY

(8) MANUFACTURE YEAR AND WEEK:
This field contains the manufacture year and week of the rack cabinet or equipment (4 digits, the first two of which indicate the year, while the last two digits indicate the relevant week) e.g. 9515: 15th week of 1995.

(9) SUPPLY VOLTAGE (from MAINS and/or from DC SOURCE)

(10) ABSORBED CURRENT

(11) MAINS FREQUENCY

F (final test tracing out):
This field contains an F letter that has been barred to certify that the item has been successfully tested in the factory Final Test Dept.

Fig.4 shows an example of manufacture label as applied to a RACK CABINET or to an EQUIPMENT.

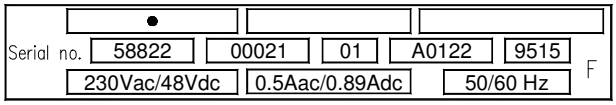


Fig. 4

(•) System acronym (if any)

For instance, you will find the manufacture label placed:

- on the upper left corner of the rack cabinet frame;
- on the rear side (or on the external right side) of the equipment rack.

2.1.3 MANUFACTURE LABELS FOR RACKS AND PLUG-IN, OR WIRING TYPE, MODULES

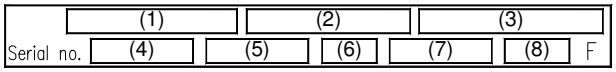


Fig. 5

Label fields (ref. Fig.5):

(1) SYSTEM (it will be filled in only if the rack or the module to be label belong to a system):
this field contains the system acronym.

(2) EQUIPMENT:
This field contains the acronym of the rack, or module.

(3) MANUFACTURE PART NUMBER:
This field contains the manufacture part number of the rack or module.

(4) SERIAL NUMBER:
This field contains the serial number (made up of a 5-digit sequential group) of the rack or module.
The serial number of each item comes from the manufacture orders print-out (for domestic and foreign markets).

(5) QIF (Quality Identification Factor)
FACTORY USE ONLY

(6) ICS (Item Change Status):
This field contains the item ICS, made up of 2 digits, of the rack or module.

(7) ORIGIN CODE:
FACTORY USE ONLY

(8) MANUFACTURE YEAR AND WEEK:
This field contains the manufacture year and week of the rack or module (4 digits, the first two of which indicate the year, while the last two digits indicate the relevant week) e.g. 9515: 15th week of 1995.

F (final test tracing out):
This field contains an F letter that has been barred to certify that the item (rack or module) has been successfully tested in the factory Final Test Dept.

Fig.6 shows an example of manufacture label as applied to a RACK or PLUG-IN, or WIRING TYPE MODULES.

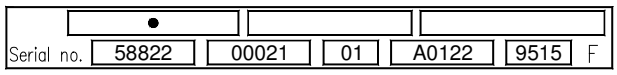


Fig. 6

(•) System acronym (if any)

For instance, you will find the manufacture label placed:

- on the topside of the plug-in module, right or left;

- on the topside of the wiring-type module.

2.1.4 SUB-MODULES MANUFACTURE LABEL

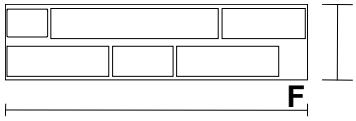


Fig. 7

Label fields (ref. Fig.7):

(3) MANUFACTURE PART NUMBER:

This field contains the sub-module manufacture part number.

(5) QIF (Quality Identification Factor)

FACTORY USE ONLY

(6) ICS (Item Change Status):

This field contains the item ICS, made up of 2 digits, of the sub-module.

(7) ORIGIN CODE:

FACTORY USE ONLY

(8) MANUFACTURE YEAR AND WEEK:
This field contains the manufacture year and week of the submodule (4 digits, the first two of which indicate the year, while the last two digits indicate the relevant week) e.g. 9542: 42nd week of 1995.

F (final test tracing out):

This field contains an F letter that has been barred to certify that the item (sub-module) has been successfully tested in the factory Final Test Dept.

Fig. 8 shows an example of manufacture label as applied to a **SUB-MODULE**.

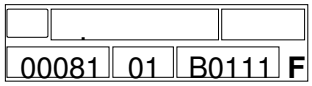


Fig. 8

You will find the manufacture label placed on the sub-module top, left, or right side.

2.2) SYMBOLS

EQUIPMENT FRONT SYMBOLS

SYMBOLS	DESCRIPTION
	Earth connection
	Ground
	Chassis ground
	AC
	DC
	Pulse current
	Battery / accumulator
	Positive connector
	Negative connector
	OFF
	ON
	STAND-BY
	ON push-button

SYMBOLS	DESCRIPTION
	Impulsive command
	Fuse
	Thermal breaker
	Failure
	Overtemperature
	Output monitoring signal
	Input monitoring signal
	Direct power monitoring socket
	Reflected power monitoring socket
	Local oscillator monitoring socket
	Gating as opening criterion
	Gating as closing criterion
	Channel / band filter

SYMBOLS	DESCRIPTION
	Band-stop filter
	Low-pass filter
	High-pass filter
	Modulator, demodulator
	Stereo
	Balance
	Amplifier
	Adjustable gain amplifier
	Loudspeaker connection
	Audio connection
	Headphone connection
	Stereo headphone
	Star connection

EQUIPMENT FRONT SYMBOLS

SYMBOLS	DESCRIPTION
	Delta connection
	High voltage
	Start push-button
	Local, manual command
	Automatic
	OFF / inhibited (function)
	ON / active (function)
	Stand-by (function)
	Output connector
	Input connector
	Clock display (operation time counter)
	Fan, blower
	Antenna
	Transmission antenna

SYMBOLS	DESCRIPTION
	Receiving antenna
	Linearization
	Limiter upper threshold
	Limiter lower threshold
	Adjusting
	Max adjusting
	Min adjusting
	Adjusting
	Frequency adjusting
	Xtal adjusting
	Freq. tuning
	Amplitude tuning
	Band tuning
	Mono

SYMBOLS	DESCRIPTION
	Dual sound

BLOCK DIAGRAM SYMBOLS

SYMBOLS	DESCRIPTION
	Linear variability
	Automatic adjustment
	Combiner general sign
	2-way power divider
	2-way power combiner
	3-way power divider
	4-way power divider
	3dB Hybrid
	White limiter
	Positive peak clipper
	Negative peak clipper
	Circulator
	Isolator
	Switch

SYMBOLS	DESCRIPTION
	2-way switch
	Voltage control electromagnetic relay
	Transformer
	Rectifier general symbol
	DC/DC converter
	Bridge rectifier
	Voltage regulator
	Zener regulator
	Constant current bias device
	Sinusoidal oscillator
	Ex-OR
	OR general symbol
	NOR general symbol
	AND general symbol

SYMBOLS	DESCRIPTION
	NAND general symbol
	NOT general symbol
	Preemphasis
	Deenphasis
	Delay line general symbol
	Coaxial type time delay limiter
	Resistive attenuator
	Pad
	Fixed phase shifter
	Thermal switch
	Band-pass filter
	Band-stop filter
	Low-pass filter
	High-pass filter

BLOCK DIAGRAM SYMBOLS

SYMBOLS	DESCRIPTION
	Divider by n
	Multiplier by n
	Mixer general symbol
	Up-converter from IF to RF
	Down-converter from RF to IF
	Voltage / frequency converter
	Directional coupler
	Double directional coupler
	Directional coupler with double detector
	Detector
	Peak detector
	To rise to cubical power
	Amplifier general symbol
	Multistage amplifier

SYMBOLS	DESCRIPTION
	DC amplifier
	Differential comparator
	Phase comparator
	Detector amplifier
	Lamped to the syncrhronizing signal peak
	Schmitt's trigger
	Amplitude linearity precorrector
	Amplitude limiter without distortion
	Equalizer general sign
	Amplitude equalizer
	Phase equalizer
	Propagation time equalizer
	Laser diode electrical-optical transmitter
	Optical-electrical receiver

SYMBOLS	DESCRIPTION
	Optical amplifier

3

3) GENERAL DESCRIPTION

Mobile phone systems have increasingly been spreading in these last years.
Besides providing reliable and good quality connections, telecommunication system services should cover as widest territory as possible.
It is well-known that connections to users' terminals are obtained on air by means of steady stations named radio bases, located through the whole territory so as to obtain a continuous covering through cells one next to another.
That allows a great number of users to enter the system using few channels.
It is important to maintain the continuity of radio-electrical coverage (and consequently, of service within each cell) in order to guarantee an acceptable level of communication.

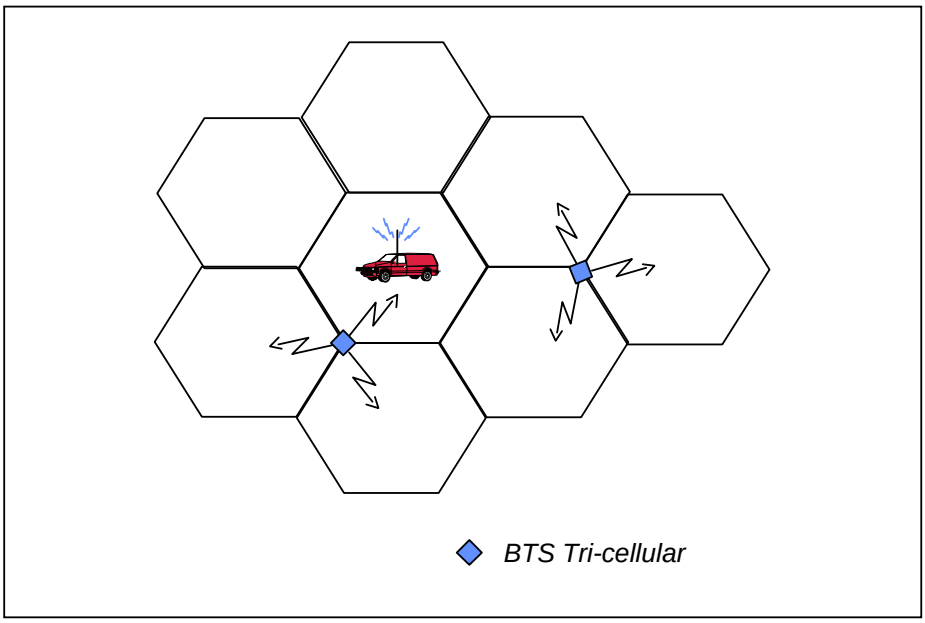


FIGURE 1 – SUBDIVISION OF THE TERRITORY IN CELLS

Off-Air Repeaters are proposed as a valid and economical solution to optimize the cell coverage of the territory and irradiate shadow area as an alternative to solutions requiring dedicated Radio-Bases (Figure 2).

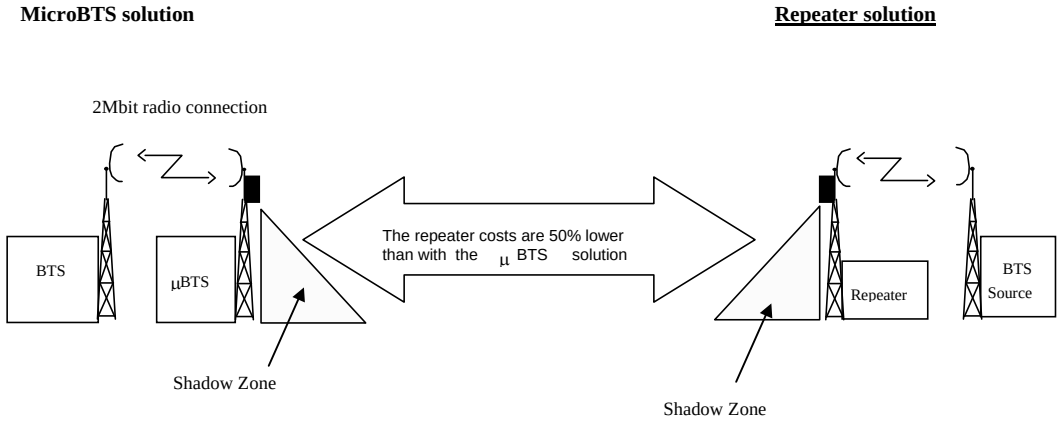


FIGURE 2 – RADIO-ELECTRICAL PROBLEMS IN CELL NETWORK COVERAGE

Off-Air Repeaters on one side receive the signals from the radio base station, amplify them and re-transmit them in the direction of the shadow area (down-link path). On the other side Off-Air Repeaters receive the signals from the mobiles (MS), amplify them and re- transmit them to the base station (up-link path).

When a single Off-Air Repeater does not provide satisfactory coverage, the repeater can be used along with other equipment. Different solutions are provided: cascade systems, based on Bi-Directional Amplifiers, and optical fibre solutions, based on Remote Units.

3.1) EXAMPLE: USE IN TUNNELS

The Off-Air Repeater interfaces directly with the BTS of the provider of the services to be extended, and can be used along with other equipment distributed inside the tunnels. Such equipment can be divided into two types, according to the radio-coverage system used:

- Bi-directional amplifiers, for cascade systems.
- Remote Units, for optical systems.

The following are a few examples of general projects for radio-electric coverage in tunnels.

- Tunnels with a length of less than 300 meters.
  In this case, one single Off-Air Repeater is sufficient. It is located at the entrance to the tunnel, equipped with an antenna which irradiates in the direction of the shadow zone (Figure 3).

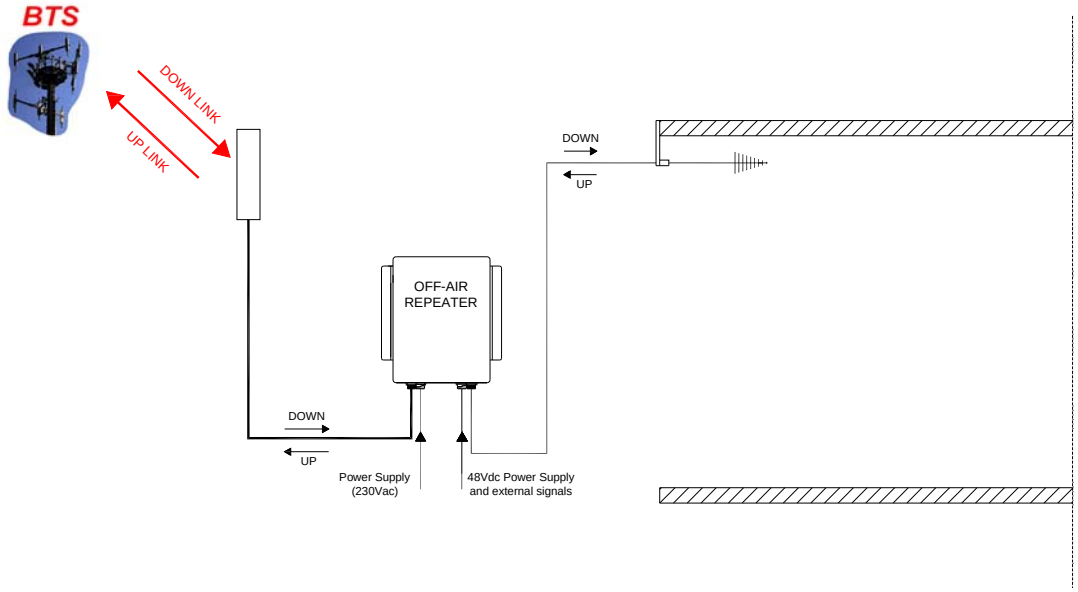


FIGURE 3

- Tunnels with a length in the 300-meter to 600-meter range.
  Also in this case, one single Off-Air Repeater is sufficient. The repeater is located at the entrance to the tunnel and equipped with a leaky cable. This cable can be combined with a directional antenna to irradiate a portion of the area in front of the tunnel exit (Figure 4).

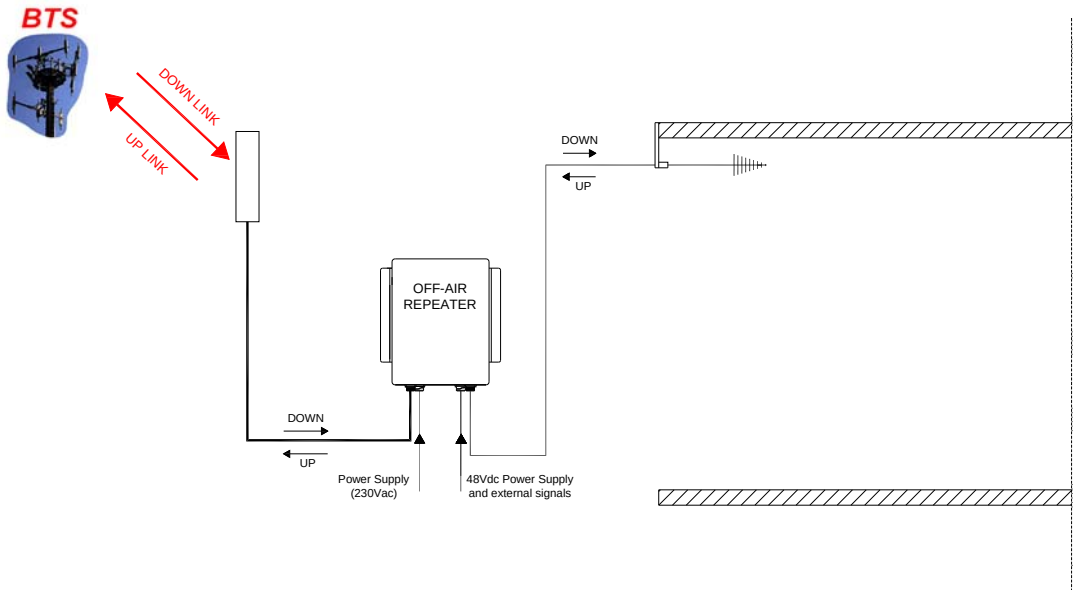


FIGURE 4

- Tunnels with a length of more than 600 meters.
  The signal can be enhanced in two ways:
  a) By an Off-Air Repeater at the entrance to the tunnel, connected to a cascade of bi-directional amplifiers inside the tunnel which re-generate the signal with amplification steps at a distance of 250mt. ÷ 400mt. from one another (Figure 5).

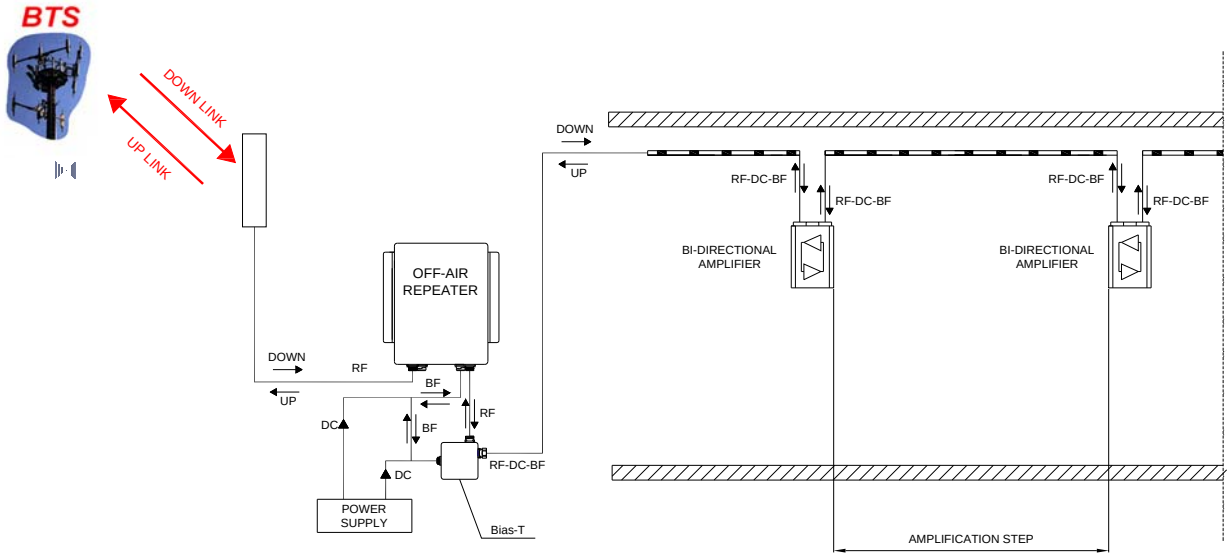


FIGURE 5

b) By an Off-Air Repeater connected to master unit and optical remote units with amplification steps of no more than 1200mt. each. The optical fiber system extends the signal through an antenna or a passive distribution system (Figure 6).

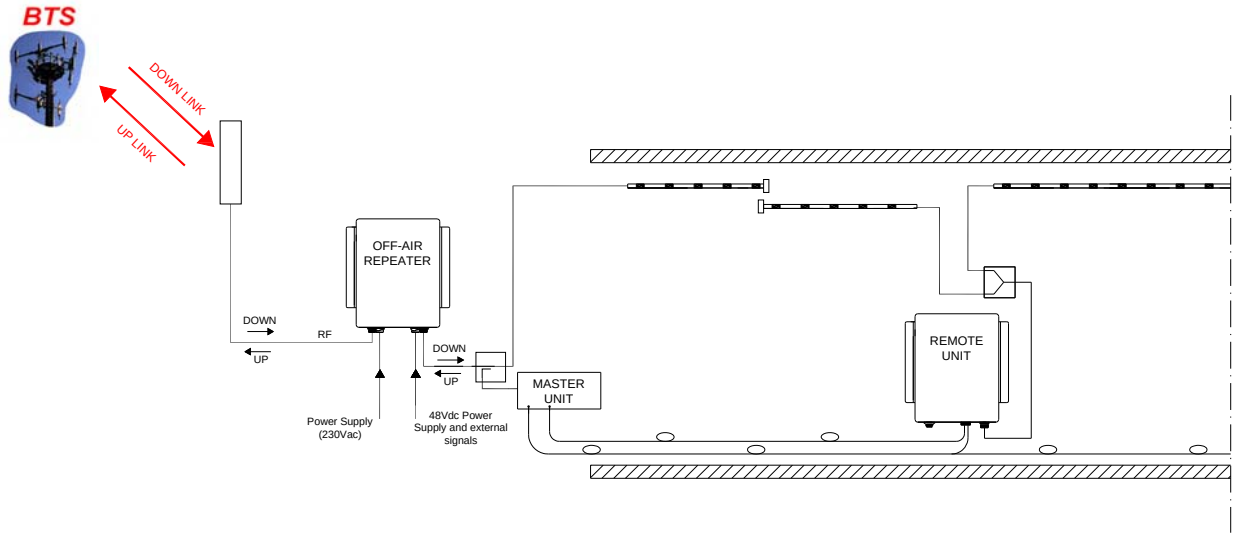


FIGURE 6

3.2) OPERATING PRINCIPLE – 1800/1900MHz ADJUSTABLE BANDWIDTH OFF-AIR REPEATERS

The repeaters described in this handbook have been developed to permit cell coverage as set forth by the DCS (Digital Cellular System) standard for cell phones operating on the 1800MHz band or by the PCS (Personal Communications Service) standard for cell phones operating on the 1900MHz band. The DC powered repeater can be power-fed by a 48Vdc power supply source only. The AC powered repeater can be power-fed from MAINS (230Vac) or from a 48Vdc power supply source or both from MAINS and from a 48Vdc source. The presence of both power supply voltages guarantees the continuity of the coverage service even in case of failure of one source. The commutation is handled automatically by the repeater.

Off-Air Repeaters are bi-directional amplifiers. The signal to be extended follows two distinct paths: the up-link path, from the mobiles to the radio base station, and the down-link path, from the radio base station towards the mobiles.

Figure 7 provides a block-diagram of the 1800/1900MHz adjustable band Off-Air Repeater.

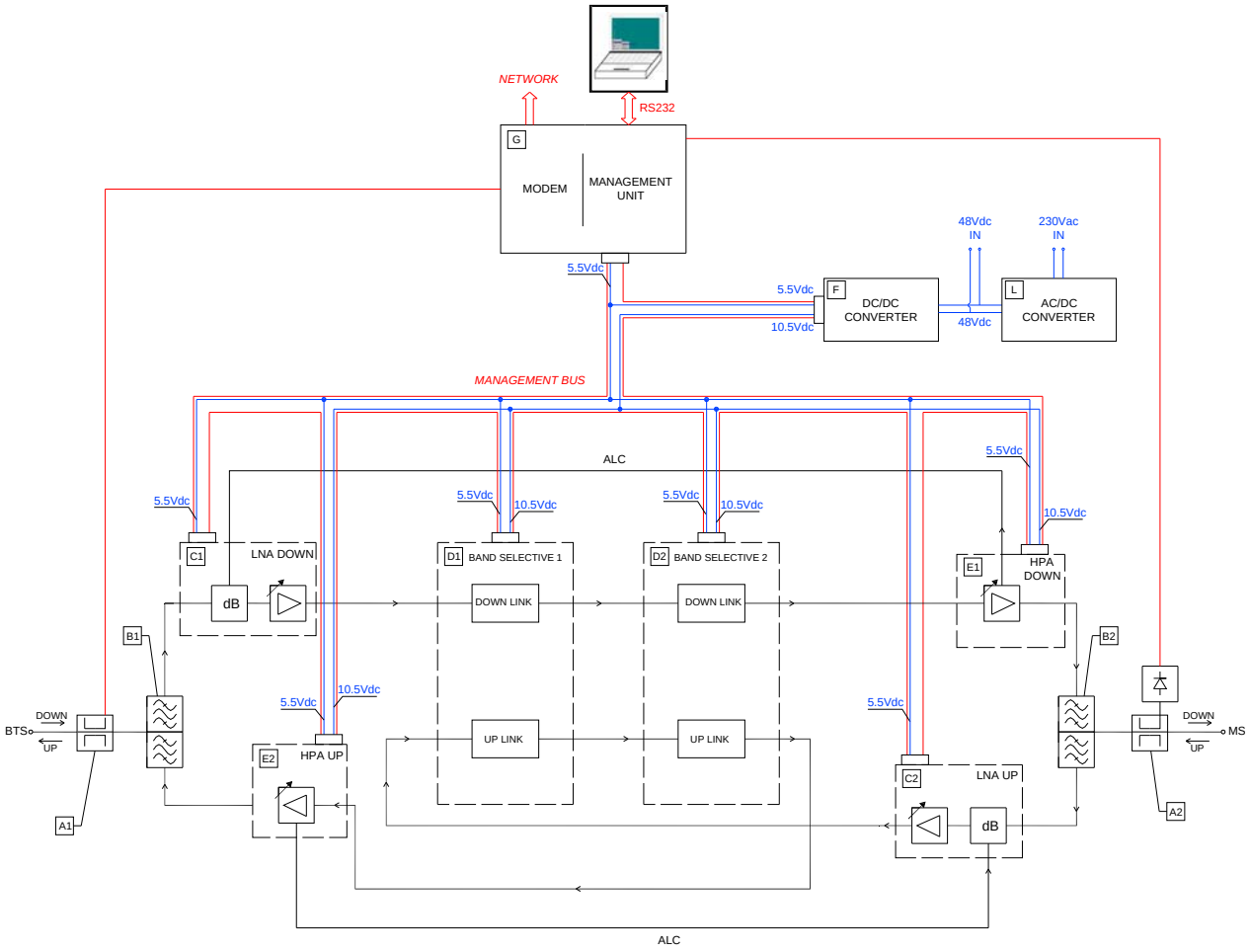


FIGURE 7 – 1800/1900MHz OFF-AIR REPEATERS BLOCK-DIAGRAM

In down-link the RF signal from the donor antenna is filtered and pre-amplified by a low-noise amplifier (LNA, **ref. C1**).

The selection of the band of frequencies to be extended is handled by two band-selective modules, **ref. D1** and **ref. D2**, which make the band-pass and frequency center programmable entities.

The band of frequencies to be extended can be managed by the user by means of the management system.

The signal is then amplified by the High power amplifier (**ref. E1**) filtered by the MS side duplexer, **ref. B2**,and transmitted by an antenna or a passive distribution system.

A VSWR detector is equipped.

The up-link path is identical to the down-link path described above.

The 48Vdc powered repeater is equipped with a DC/DC converter, **ref. F**.
The A.C. powered repeater is equipped also with an AC/DC converter, **ref. L**.

The management module, **ref. G**, makes it possible to manage the repeater in remote mode via a built-in modem, or in local mode through the RS232 connector, available on the management module.
The repeater management is performed by means of the Operation and Maintenance Terminal software, both in local mode and in remote mode (ref. Chap. 4).

3.3) ATTACHED DOCUMENTS

TECHNICAL CHARACTERISTICS
1800MHz 48Vdc/230Vac ADJUSTABLE BAND OFF-AIR REPEATERS

ILL DCS OFF-AIR REPEATERS (ILLUSTRATIVE DRAWINGS)
Sheet 1, equipment composition and backplane access points map
Sheet 2, modules access points map and external access points map

TECHNICAL CHARACTERISTICS
1900MHz 48Vdc/230Vac ADJUSTABLE BAND OFF-AIR REPEATERS

ILL PCS OFF-AIR REPEATERS (ILLUSTRATIVE DRAWINGS)
Sheet 1, equipment composition and backplane access points map
Sheet 2, modules access points map and external access points map

ANNEX 1

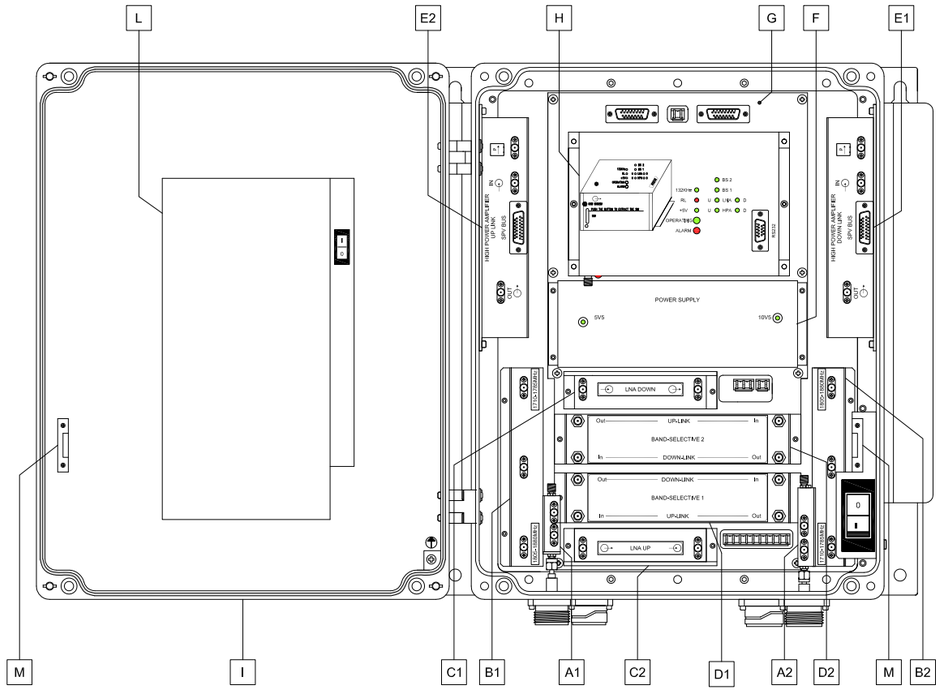
TECHNICAL CHARACTERISTICS

1800MHz 48Vdc/230Vac ADJUSTABLE BAND OFF-AIR REPEATERS

TECHNICAL CHARACTERISTICS	1800MHz OFF-AIR REPEATER 48Vdc MODEL	1800MHz OFF-AIR REPEATER 230Vac MODEL
Up Link operating frequency band	1710 ÷ 1785MHz	
Down Link operating frequency band	1805 ÷ 1880MHz	
Number of amplified bands	1	
Programmable Bandwidth / steps	From 1MHz to 16.5MHz / 10kHz step adjustable	
Output Power	28dBm (2 carriers)	
3rd Order Intercept Point (OIP3)	57dBm	
Output Power at 1dB compression point	36dBm	
Noise Figure @ max. gain	8dB	
Gain / Step	50 ÷ 80dB / 1dB step	
Ripple into operating band	± 2dB	
Total processing delay	6μs	
Return Loss	14dB	
ALC threshold (default value)	3dB over nominal output power (this value can be changed on site)	
Spurious emissions and intermodulation products	< -36dBm (in the frequency band 9kHz ÷ 1GHz) < -30dBm (in the frequency band 1GHz ÷ 12.75GHz)	
Local Control Interface	RS232	
Remote Control Interface	PSTN – GSM/DCS modem	
Power Supply	-72 ÷ -36Vdc	-72 ÷ -36Vdc 85÷265Vac (50-60Hz)
Power Consumption	110W @ 48Vdc	140VA @ 230Vac
MTBF	50 000 hours	
Operating Temperature **(*)**	-20°C up to +55°C	
Degree of protection provided by enclosure	IP65	
RF connectors	7/16 female	
Dimensions (h-w-d)	423x395x230mm (max. volume - heat sinks included)	
Weight	23Kg	

All values are typical at 25°C unless otherwise specified

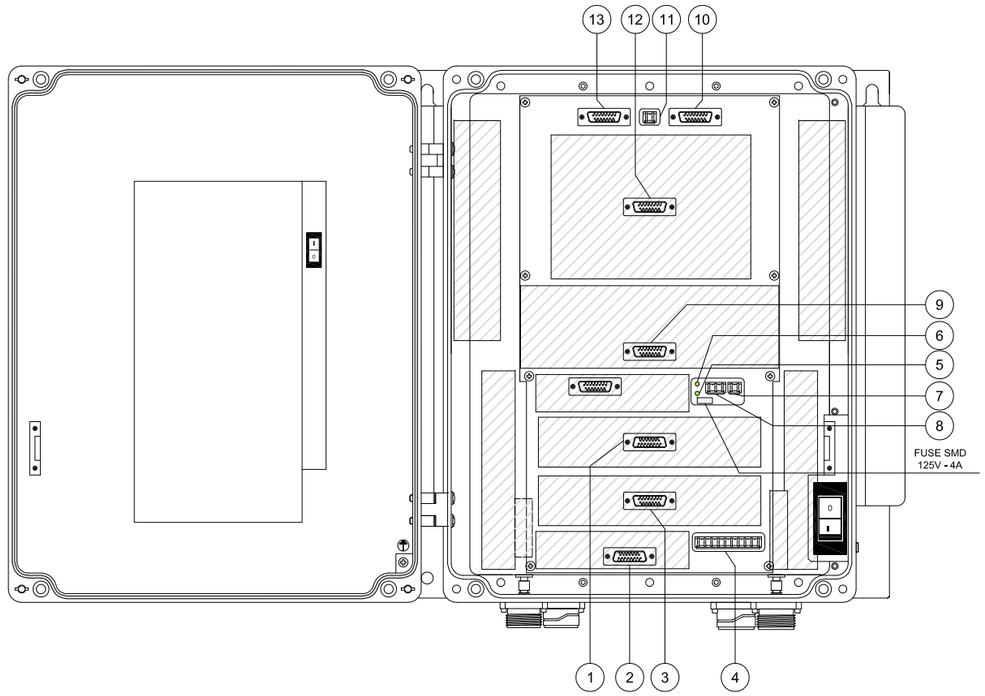
(*) Degraded performances from +50°C to +55°C



INTERNAL VIEW - EQUIPMENT COMPOSITION

EQUIPMENT COMPOSITION	
Ref.	**DESCRIPTION**
A1	DOUBLE DIRECTIONAL COUPLER
A2	DIRECTIONAL COUPLER WITH RETURN LOSS METER
B1-B2	DUPLEXER FILTER
C1	DOWN LINK LNA MODULE
C2	UP LINK LNA MODULE
D1	BAND SELECTIVE MODULE BS1
D2	BAND SELECTIVE MODULE BS2
E1	HPA 1800MHz FFWD AMPLIFIER MODULE (DOWN LINK PATH)
E2	HPA 1800MHz FFWD AMPLIFIER MODULE (UP LINK PATH)
F	DC/DC CONVERTER
G	BACKPLANE
I	REPEATER BOX
L	AC/DC CONVERTER MODULE (**230VAC MODEL ONLY**)
M	OPEN DOOR DETECTOR

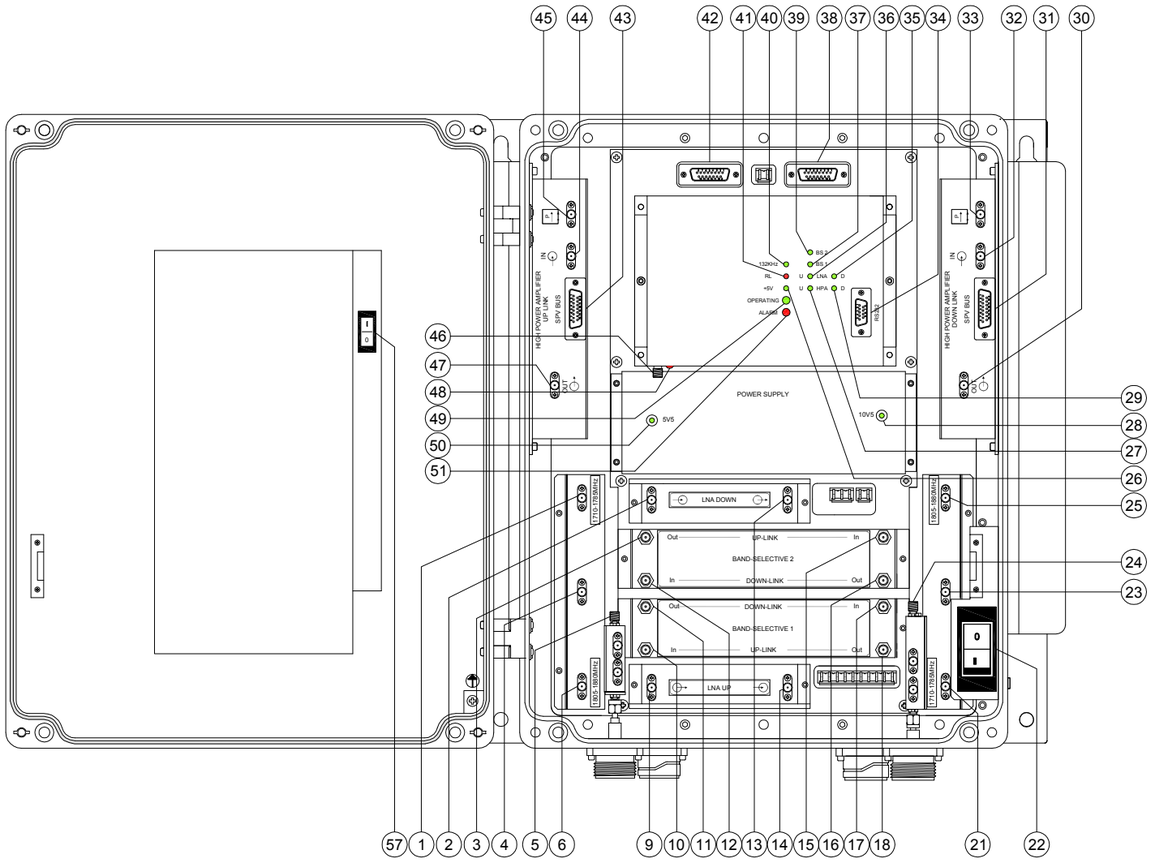
H	MANAGEMENT MODULE
	132kHz CARD (OPTION - to be equipped when the repeater is connected to bi-directional amplifiers)



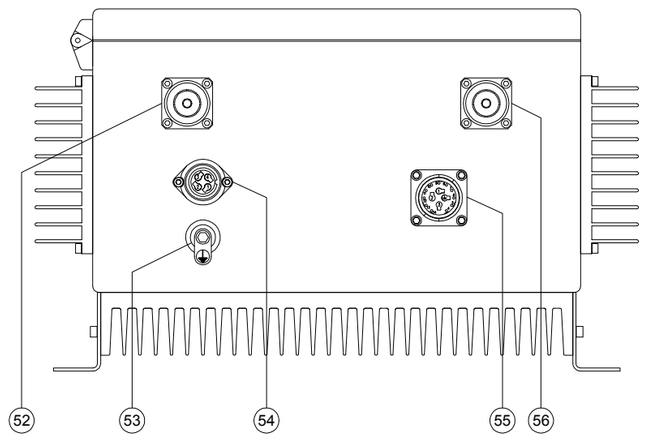
INTERNAL VIEW - BACKPLANE

BACKPLANE ACCESS POINTS MAP		
CONNECTORS		
Ref.	**Connector type**	**Connected to**
1	15-pole D-Sub female	Band selective Module 2
2	15-pole D-Sub female	LNA (Up Link path)
3	15-pole D-Sub female	Band selective Module 1
4	10-way female terminal block	External alarms and signals
7	2-way female terminal block	Open door sensor
8	3-way female terminal block	Return Loss meter
9	15-pole D-Sub female	DC/DC converter
10	15-pole D-Sub female	HPA (Down Link path)
11	2-way female terminal block **(230VAC MODEL ONLY)**	AC/DC converter (50.5Vdc backplane input)
12	15-pole D-Sub female	Management module
13	15-pole D-Sub female	HPA (Down Link path)
LEDs		
Ref.	**DESCRIPTION**	
5	GREEN LED: ON when 10.5Vdc is available	
6	GREEN LED: ON when 5.5Vdc is available	

Part Number ILL DCS OFF-AIR REPEATERS	Title 1800MHz ADJUSTABLE BAND OFF-AIR REPEATERS COMPOSITION AND BACKPLANE ACCESS POINTS MAP	Date ED. 02 31/01/2007
		Drawn by CG
		Checked by MN
Scale	Revisions ED. 01-1 29/09/2006	Approved by AV
		Sheet 1/2



INTERNAL VIEW - MODULES ACCESS POINTS



BOTTOM VIEW - REPEATER CASE CLOSED
EXTERNAL ACCESS POINTS

MODULES ACCESS POINTS MAP			
Ref.	**DESCRIPTION**		
1	DUPLEXER - BTS side - Up Link path SMA connector		
2	LNA - Down Link - input		
3	Band Selective 2 Up-Link path output		
4	DUPLEXER - BTS side - input/output SMA connector		
5	Directional coupler - BTS side - SMA (f) input/output connector		
6	DUPLEXER - BTS side - SMA Down Link connector		
9	LNA - Up Link path - output		
10	Band Selective 1 Up Link Input		
11	Band Selective 1 Down Link Output		
12	Band Selective 2 Down Link Input		
13	LNA - Down Link path - output		
14	LNA - Up Link path - input		
15	Band Selective 2 Up Link path input		
16	Band Selective 2 Down Link path output		
17	Band Selective 1 Down Link path Input		
18	Band Selective 1 Up Link path output		
21	DUPLEXER - MS side - Up Link path SMA connector		
22	48Vdc ONLY circuit breaker		
23	DUPLEXER - MS side - input/output SMA connector		
24	Directional coupler - MS side - SMA (f) input/output connector		
25	DUPLEXER - MS side - Down Link path SMA connector		
26	GREEN LED: +5Vdc available		
27	GREEN / RED LED HPA UP	GREEN	HPA - UP LINK - communicates with management unit
		RED	HPA - UP LINK - does not communicate with management unit
28	GREEN LED: +10.5V available		
29	GREEN / RED LED HPA DOWN	GREEN	HPA - DOWN LINK - communicates with management unit
		RED	HPA - DOWN LINK - does not communicate with management unit
30	HPA Down Link output		
31	Sub-D 15-pole management link between Down Link HPA and management unit		
32	HPA Down Link input		
33	HPA Down Link monitoring SMA connector		
34	Sub-D 9-poles RS232 connector		
35	GREEN / RED LED LNA DOWN	GREEN	LNA - DOWN LINK - communicates with management unit
		RED	LNA - DOWN - does not communicate with management unit
36	GREEN / RED LED LNA UP	GREEN	LNA - UP LINK - communicates with management unit
		RED	LNA - UP LINK - does not communicate with management unit
37	GREEN / RED LED Band Selective 1	GREEN	BS1 communicates with management unit
		RED	BS1 does not communicate with management unit
38	Sub-D 15-pole management link between Down Link HPA and management unit		
39	GREEN / RED LED Band Selective 2	GREEN	BS2 communicates with management unit
		RED	BS2 does not communicate with management unit
40	GREEN LED 132kHz: 132kHz (line amplifier management carrier) correctly operating		
41	RED LED: Return Loss alarm		
42	Sub-D 15-pole management link between Up Link HPA and management unit		
43	Sub-D 15-pole management link between Up Link HPA and management unit		
44	HPA Up Link input		
45	HPA Up Link monitoring SMA connector		
46	GSM modem RF output		
47	HPA Up Link output		
48	RED LED: modem operation	RED ON	Trying to connect to network
		BLINKING RED	Modem correctly operating
49	GREEN LED: equipment correctly operating		
50	GREEN LED: 5.5V available		
51	RED LED: equipment fault		
57 (*)	AC voltage ONLY circuit breaker		
EXTERNAL ACCESS POINTS MAP			
52	BTS side 7/16 RF connector		
53	Equipment Grounding		
54 (*)	AC voltage input (230Vac)		
55	48Vdc input / external alarms Connector		
56	MS side 7/16 RF connector		

(*) 230VAC MODEL ONLY

Part Number ILL DCS OFF-AIR REPEATERS	Title 1800MHz ADJUSTABLE BAND OFF-AIR REPEATERS MODULES ACCESS POINTS MAP AND EXTERNAL ACCESS POINTS MAP	Date ED. 02 31/01/2007
		Drawn by CG
		Checked by MN
Scale	Revisions ED. 01-1 29/09/2006	Approved by AV
		Sheet 2/2

ANNEX 2

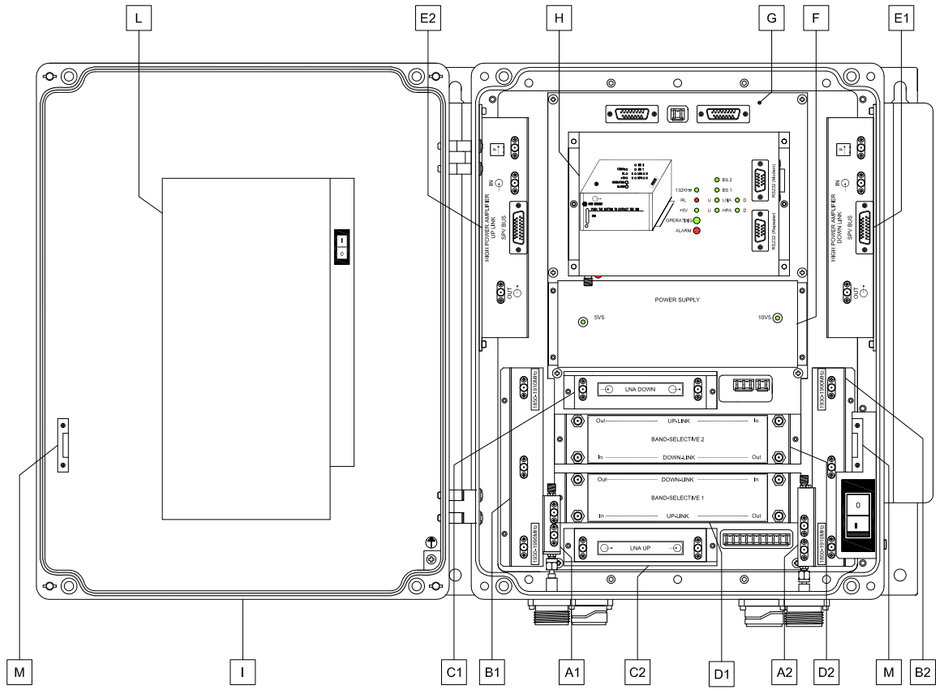
TECHNICAL CHARACTERISTICS

1900MHz 48Vdc/230Vac ADJUSTABLE BAND OFF-AIR REPEATERS

TECHNICAL CHARACTERISTICS	1900MHz OFF-AIR REPEATER 48Vdc MODEL	1900MHz OFF-AIR REPEATER 230Vac MODEL
Up Link operating frequency band	1850 ÷ 1910MHz	
Down Link operating frequency band	1930 ÷ 1990MHz	
Number of amplified bands	1	
Programmable Bandwidth / steps	From 1MHz to 16.5MHz / 10kHz step adjustable	
Output Power (GSM/TDMA)	31dBm (1 carrier) 28dBm (2 carriers) 25dBm (4 carriers)	
Output Power (CDMA)	26dBm (1 carrier) 23dBm (2 carriers) 20dBm (4 carriers)	
3rd Order Intercept Point (OIP3)	57dBm	
Output Power at 1dB compression point	36dBm	
Noise Figure @ max. gain	8dB	
Gain / Step	50 ÷ 80dB / 1dB step	
Ripple into operating band	± 2dB	
Total processing delay	6μs	
Return Loss	14dB	
ALC threshold (default value)	3dB over nominal output power (this value can be changed on site)	
Spurious emissions and intermodulation products	< -13dBm (in the frequency band 9kHz ÷ 1GHz) < -13dBm (in the frequency band 1GHz ÷ 12.75GHz)	
Local Control Interface	RS232	
Remote Control Interface	PSTN – GSM (850, 900, 1800, 1900) or CDMA (850, 1900) modem	
Power Supply	-72 ÷ -36Vdc	-72 ÷ -36Vdc 85÷265Vac (50-60Hz)
Power Consumption	110W @ 48Vdc	140VA @ 230Vac
MTBF	50 000 hours	
Operating Temperature **(*)**	-20°C up to +55°C	
Degree of protection provided by enclosure	IP65	
RF connectors	7/16 female	
Dimensions (h-w-d)	423x395x230mm (max. volume - heat sinks included)	
Weight	23Kg	

All values are typical at 25°C unless otherwise specified

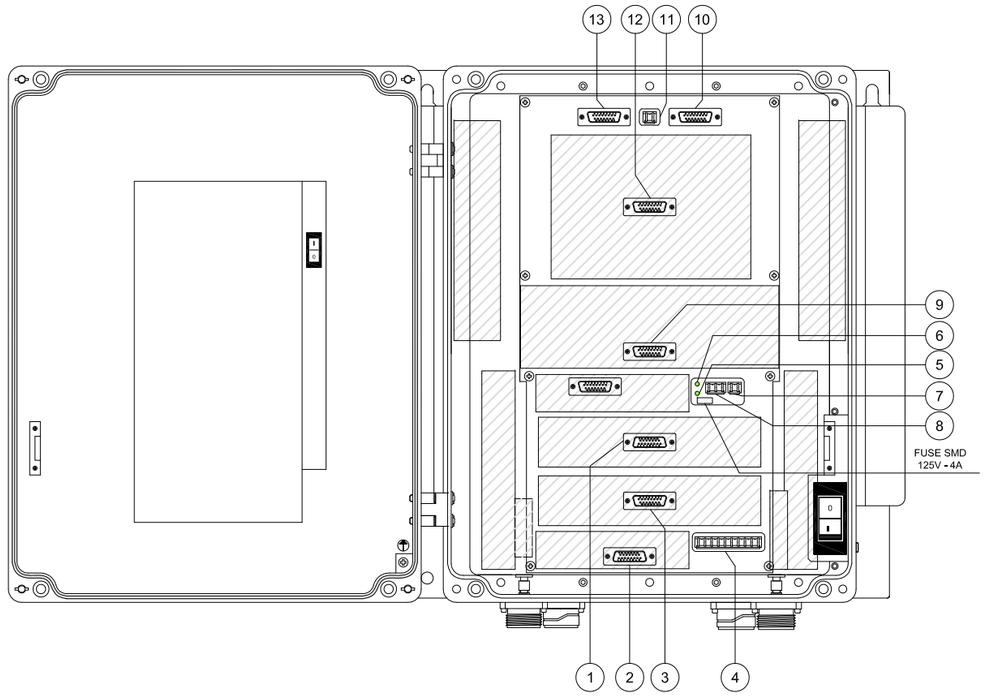
(*) Degraded performances from +50°C to +55°C



INTERNAL VIEW - EQUIPMENT COMPOSITION

EQUIPMENT COMPOSITION	
Ref.	**DESCRIPTION**
A1	DOUBLE DIRECTIONAL COUPLER
A2	DIRECTIONAL COUPLER WITH RETURN LOSS METER
B1-B2	DUPLEXER FILTER
C1	DOWN LINK LNA MODULE
C2	UP LINK LNA MODULE
D1	BAND SELECTIVE MODULE BS1
D2	BAND SELECTIVE MODULE BS2
E1	HPA 1900MHz FFWD AMPLIFIER MODULE (DOWN LINK PATH)
E2	HPA 1900MHz FFWD AMPLIFIER MODULE (UP LINK PATH)
F	DC/DC CONVERTER
G	BACKPLANE
I	REPEATER BOX
L	AC/DC CONVERTER MODULE (**230VAC MODEL ONLY**)
M	OPEN DOOR DETECTOR

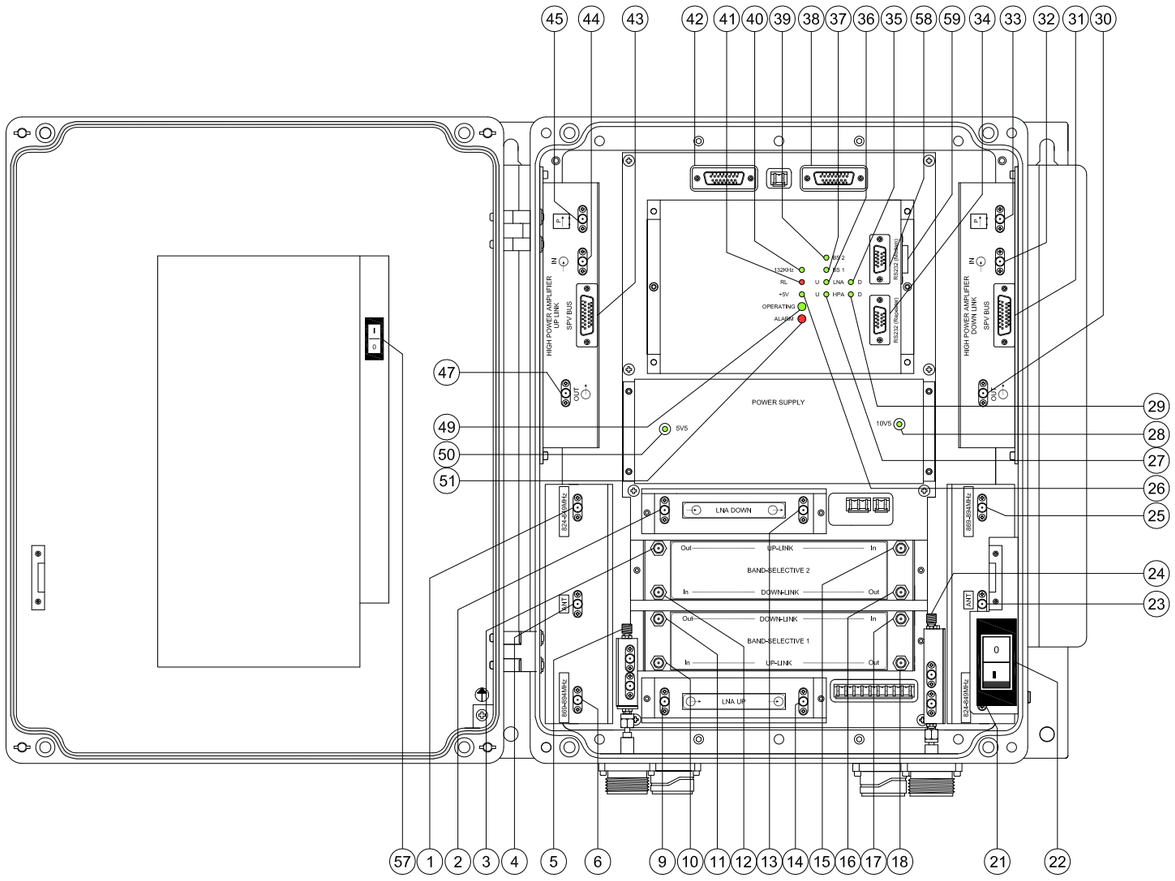
H	MANAGEMENT MODULE
	132kHz CARD (OPTION - to be equipped when the repeater is connected to bi-directional amplifiers)



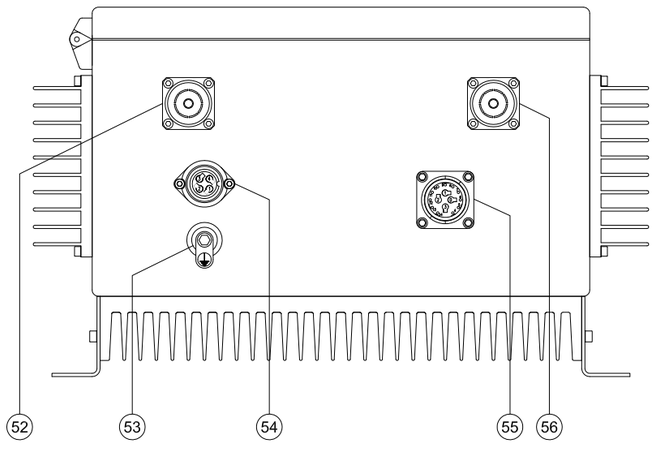
INTERNAL VIEW - BACKPLANE

BACKPLANE ACCESS POINTS MAP		
CONNECTORS		
Ref.	**Connector type**	**Connected to**
1	15-pole D-Sub female	Band selective Module 2
2	15-pole D-Sub female	LNA (Up Link path)
3	15-pole D-Sub female	Band selective Module 1
4	10-way female terminal block	External alarms and signals
7	2-way female terminal block	Open door sensor
8	3-way female terminal block	Return Loss meter
9	15-pole D-Sub female	DC/DC converter
10	15-pole D-Sub female	HPA (Down Link path)
11	2-way female terminal block **(230VAC MODEL ONLY)**	AC/DC converter (50.5Vdc backplane input)
12	15-pole D-Sub female	Management module
13	15-pole D-Sub female	HPA (Down Link path)
LEDs		
Ref.	**DESCRIPTION**	
5	GREEN LED: ON when 10.5Vdc is available	
6	GREEN LED: ON when 5.5Vdc is available	

Part Number ILL PCS OFF-AIR REPEATERS	Title 1900MHz ADJUSTABLE BAND OFF-AIR REPEATERS COMPOSITION AND BACKPLANE ACCESS POINTS MAP	Date ED. 01 08/08/2007
		Drawn by PM
	Revisions	Checked by MN
Scale		Approved by AV
		Sheet 1/2



INTERNAL VIEW - MODULES ACCESS POINTS



BOTTOM VIEW - REPEATER CASE CLOSED -
EXTERNAL ACCESS POINTS

MODULES ACCESS POINTS MAP			
Ref.	**DESCRIPTION**		
1	DUPLEXER - BTS side - Up Link path SMA connector		
2	LNA - Down Link - input		
3	Band Selective 2 Up-Link path output		
4	DUPLEXER - BTS side - input/output SMA connector		
5	Directional coupler - BTS side - SMA (f) input/output connector		
6	DUPLEXER - BTS side - SMA Down Link connector		
9	LNA - Up Link path - output		
10	Band Selective 1 Up Link Input		
11	Band Selective 1 Down Link Output		
12	Band Selective 2 Down Link Input		
13	LNA - Down Link path - output		
14	LNA - Up Link path - input		
15	Band Selective 2 Up Link path input		
16	Band Selective 2 Down Link path output		
17	Band Selective 1 Down Link path Input		
18	Band Selective 1 Up Link path output		
21	DUPLEXER - MS side - Up Link path SMA connector		
22	48Vdc ONLY circuit breaker		
23	DUPLEXER - MS side - input/output SMA connector		
24	Directional coupler - MS side - SMA (f) input/output connector		
25	DUPLEXER - MS side - Down Link path SMA connector		
26	GREEN LED: +5Vdc available		
27	GREEN / RED LED HPA UP	GREEN	HPA - UP LINK - communicates with management unit
		RED	HPA - UP LINK - does not communicate with management unit
28	GREEN LED: +10.5V available		
29	GREEN / RED LED HPA DOWN	GREEN	HPA - DOWN LINK - communicates with management unit
		RED	HPA - DOWN LINK - does not communicate with management unit
30	HPA Down Link output		
31	Sub-D 15-pole management link between Down Link HPA and management unit		
32	HPA Down Link input		
33	HPA Down Link monitoring SMA connector		
34	Sub-D 9-poles RS232 connector (Repeater)		
35	GREEN / RED LED LNA DOWN	GREEN	LNA - DOWN LINK - communicates with management unit
		RED	LNA - DOWN - does not communicate with management unit
36	GREEN / RED LED LNA UP	GREEN	LNA - UP LINK - communicates with management unit
		RED	LNA - UP LINK - does not communicate with management unit
37	GREEN / RED LED Band Selective 1	GREEN	BS1 communicates with management unit
		RED	BS1 does not communicate with management unit
38	Sub-D 15-pole management link between Down Link HPA and management unit		
39	GREEN / RED LED Band Selective 2	GREEN	BS2 communicates with management unit
		RED	BS2 does not communicate with management unit
40	GREEN LED 132kHz: 132kHz (line amplifier management carrier) correctly operating		
41	RED LED: Return Loss alarm		
42	Sub-D 15-pole management link between Up Link HPA and management unit		
43	Sub-D 15-pole management link between Up Link HPA and management unit		
44	HPA Up Link input		
45	HPA Up Link monitoring SMA connector		
47	HPA Up Link output		
49	GREEN LED: equipment correctly operating		
50	GREEN LED: 5.5V available		
51	RED LED: equipment fault		
57 (*)	AC MAINS circuit breaker		
58	Sub-D 9-poles RS232 connector (Modem)		
59	Sub-D 9-poles RS232 connector (Link))		
EXTERNAL ACCESS POINTS MAP			
52	BTS side 7/16 RF connector		
53	Equipment Grounding		
54 (*)	AC voltage input (230Vac)		
55	48Vdc input / external alarms Connector		
56	MS side 7/16 RF connector		

(*) 230VAC MODEL ONLY

Part Number ILL PCS OFF-AIR REPEATERS	TItle 1900MHz ADJUSTABLE BANDWIDTH OFF-AIR REPEATERS MODULES ACCESS POINTS MAP AND EXTERNAL ACCESS POINTS MAP	Date ED. 01 03/09/2007
		Drawn by PM
	Revisions	Checked by MN
Scale		Approved by MZ
		Sheet 2/2

4

4) INSTALLATION AND POWER-UP PROCEDURES

Ref.: ILL DCS OFF-AIR REPEATERS / ILL PCS OFF-AIR REPEATERS

WARNING:

Before installing the equipment, carefully read the safety norms herewith attached.

A correct repeater installation and setting procedure requires a good knowledge and experience in installing telecommunication equipment. These activities should be performed by skilled personnel only. Remember that if the equipment is not installed correctly, it may:

- put the donor BTS temporary out of service,
- be damaged by excessively high input or output signal levels.

4.1) INSTALLATION

1. INITIAL CHECK

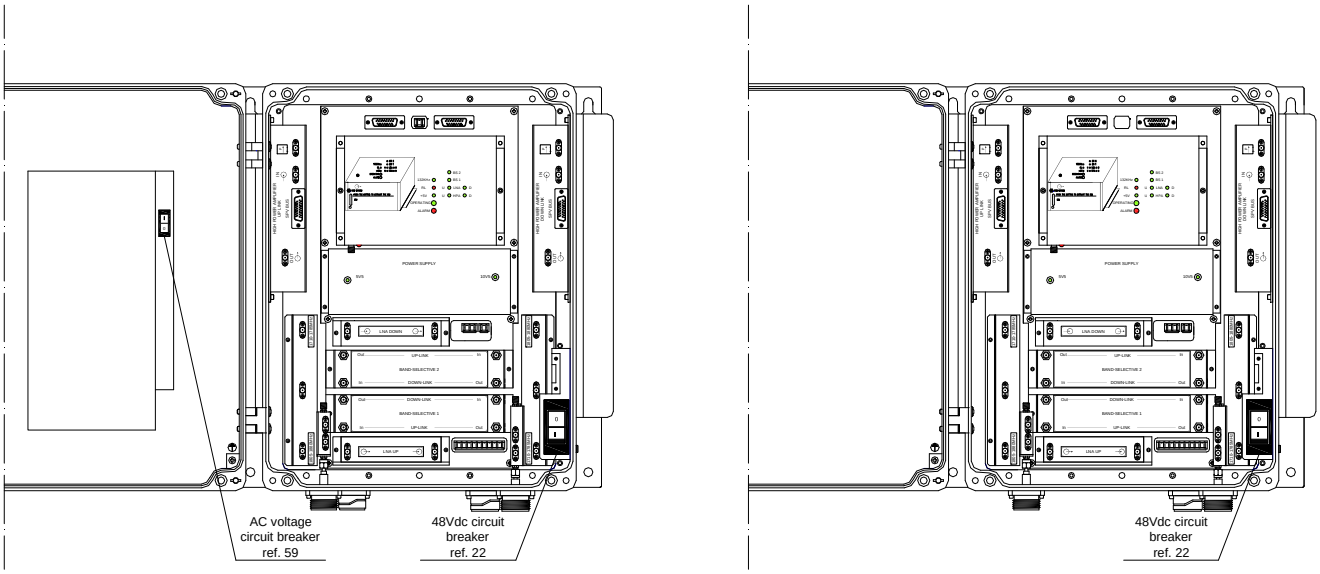
Make sure that the supply is complete and/or that the material has not been damaged during transport.
The list of the materials that make up the equipment is described in the relative PACKING LIST.
Should any parts be missing, or should some be damaged, kindly inform the Sales Dept. of RFS immediately, in order to facilitate replacing and/or repairing the parts involved.

WARNING:

Before installing the equipment, always make sure that the repeater is not powered up:

- Check that **both** ON/OFF switches located inside the alternate current powered repeater are in the OFF position (AC voltage circuit breaker, **ref. 59** and 48Vdc circuit breaker, **ref. 22** FIGURE 1a).
- Check that the ON/OFF switch (48Vdc circuit breaker, **ref. 22**, FIGURE 1b) located inside the direct current powered repeater is in the OFF position.

The LEDs inside the repeater must be turned off.



a) 230Vac MODEL
INTERNAL VIEW

b) 48Vdc MODEL
INTERNAL VIEW

FIGURE 1 – EQUIPMENT POWER SWITCHES

2. POSITIONING THE REPEATER

The Off-Air Repeater is housed inside a case which provides high-degree environmental protection (IP65). Therefore it is suitable for outdoor wall mount installation. It can also be installed inside specific cabinets equipped with UPS units.

Fix the Off-Air Repeater in vertical position on the wall, or on the vertical guides present inside the cabinet:

- Lift the equipment and fix its position with four M8 bolts, which are to be inserted in the pre-cut slots (**ref. A**, FIGURE 2).
- After checking the correct positioning of the equipment, fully tighten the bolts.

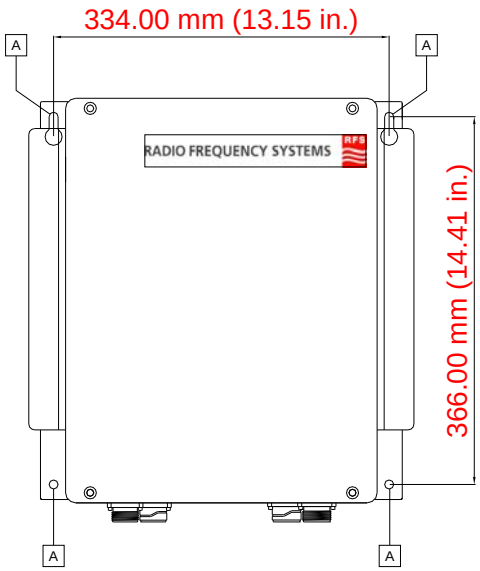
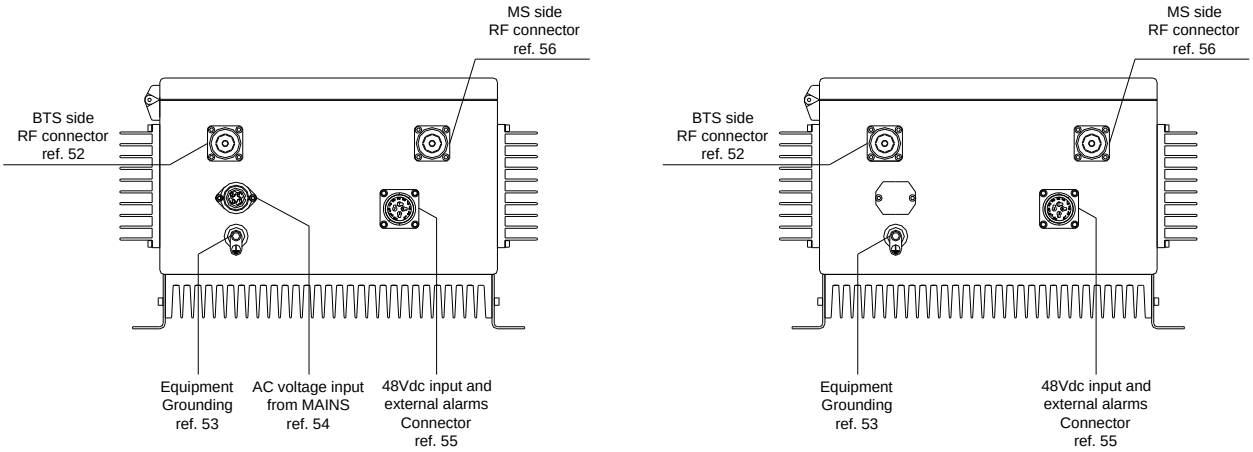


FIGURE 2 - POSITION OF THE HOLES IN THE SUPPORT BRACKETS FOR THE EQUIPMENT

3. POWER SUPPLY SOURCE CONNECTIONS AND ALARMS CONNECTIONS

- Before carrying out any other electrical connection connect the rack to the station ground, using the ground bolt on the bottom of the repeater (**ref. 53**, FIGURE 3).
- Make sure that the power supply source provides the prescribed nominal voltage.
  If so, connect the equipment to the power supply source, as described below.



a) 230Vac MODEL
BOTTOM VIEW

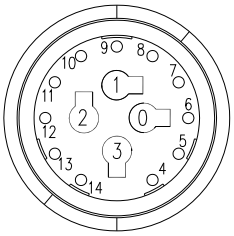
b) 48Vdc MODEL
BOTTOM VIEW

FIGURE 3 – EXTERNAL CONNECTORS

- **D.C. POWERED EQUIPMENT**

  - Connect the 15-pole (f) connector on the bottom of the repeater (**ref. 55**, FIGURE 3) to the 48Vdc/Alarm cable (supplied with the equipment).
    The cable permits D.C power supply (48Vdc) to the equipment. It also makes available the remote signals detailed into Table 1.
  - Connect the cable to the power supply source (48Vdc) and connect the external signals.

PLEASE NOTE:
The 48Vdc power supply cable (also including the external alarms), provided standard with the equipment, must never be longer than 3 meters in length (connectors included).



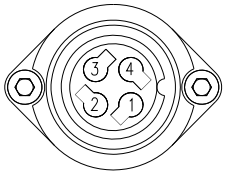
48Vdc POWER SUPPLY AND EXTERNAL ALARMS CONNECTOR

PIN	TYPE OF SIGNAL		WIRES COLOR OF 48VDC POWER SUPPLY AND EXTERNAL ALARMS CABLE
0	48Vdc POWER SUPPLY	0Vdc	RED
1		0Vdc	RED
2		- 48Vdc	BLACK
3		- 48Vdc	BLACK
4	EXTERNAL ALARMS	EXTERNAL ALARM 3	GRAY
5		EXTERNAL ALARM 4	BROWN
6		EXTERNAL ALARM 2	ORANGE
7		EXTERNAL ALARM 1	PINK
8		GROUND - GND	GREEN
9		+5Vdc EXT. ALM. COMMON	WHITE
10	NOT CONNECTED		
11	SPV CARRIER FOR BDAs (IF ANY)	132kHz	BLUE
12			VIOLET
13	NOT CONNECTED		
14	NOT CONNECTED		

TABLE 1 – 48Vdc POWER SUPPLY AND REMOTE SIGNALS CONNECTOR PIN-OUT

- **AC POWERED EQUIPMENT (ALTERNATE CURRENT)**

  - Connect the 230Vac power cable to the connector located on the bottom of the repeater (**ref. 54**, FIGURE 3). The connector pin assignments is detailed in Table 2.



230Vac POWER SUPPLY CONNECTOR

PIN	CABLE	230VAC POWER SUPPLY CABLE COLOR
1	LINE	BROWN
2	NEUTRAL	BLUE
3	GROUND (GND)	YELLOW / GREEN
4	NOT CONNECTED	

TABLE 2 – 230Vac POWER SUPPLY CONNECTOR PIN-OUT

- Connect the other end of the cable to the power supply source (230Vac).
- Also connect the 48Vdc power and alarms cable, provided standard, to the 15-pin connector located on the bottom of the equipment (**ref. 55**, FIGURE 3).
  The cable makes remote signals available. The connector pin-out is detailed into table 1.
  The cable can also be connected to a 48Vdc power supply, to feed the equipment with a D.C. voltage.

PLEASE NOTE:
The 48Vdc power supply cable (also including the external alarms), provided standard with the equipment, must never be longer than 3 meters in length (connectors included).

4.2) POWER-UP

Warning: before power up, make sure that the isolation between the donor antenna and the service antenna is at least 15dB greater than the repeater gain.

1. Connect the cable from the donor antenna to a spectrum analyzer and check input signal presence and level. After measurement disconnect the spectrum analyzer.
2. Switch on the equipment by means of the switches placed inside the repeater (FIGURE 1a and b).
3. Check the LEDs status on the management module: FIGURE 4 and Table 3 show LEDs status on the management module under normal operating conditions.

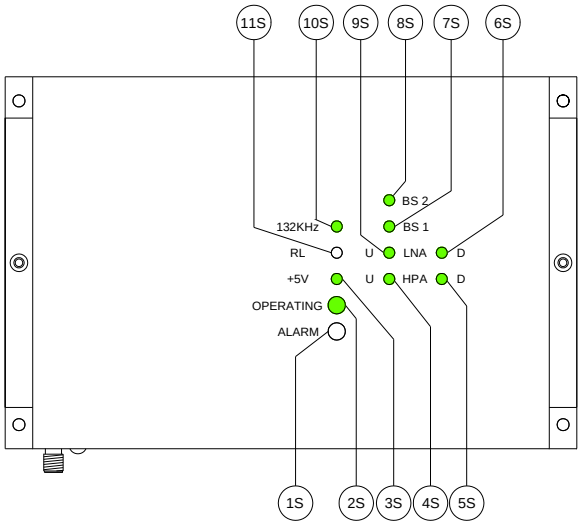


FIGURE 4 – MANAGEMENT MODULE: LEDS STATUS - CORRECT POWER UP

REF.	STATUS	MEANING
LED 1S	OFF	Equipment correctly operating
LED 2S	ON	
LED 3S	ON	Management module: +5Vdc available
LED 4S	ON, GREEN	HPA (High Power Amplifier) - UP LINK - communicates with management module
LED 5S	ON, GREEN	HPA (High Power Amplifier) - DOWN LINK - communicates with management module
LED 6S	ON, GREEN	LNA (Low Noise Amplifier) - DOWN LINK - communicates with management module
LED 7S	ON, GREEN	BS1 communicates with management module
LED 8S	ON, GREEN	BS2 communicates with management module
LED 9S	ON, GREEN	LNA (Low Noise Amplifier) - UP LINK - communicates with management module
LED 10S	ON, GREEN	132kHz correctly operating
LED 11S	OFF	**NO** Return Loss alarm

TABLE 3 - MANAGEMENT MODULE: LEDS STATUS - CORRECT POWER UP

4. Check that the green LED on the 230Vac power supply module (when equipped) is ON (**ref. 60**, ILL DCS OFF-AIR REPEATERS, sheet 2).
5. Check LEDs status on the 48Vdc power supply module: FIGURE 5 and Table 4 show LEDs status on the power supply module (DC/DC converter) under normal operating conditions.

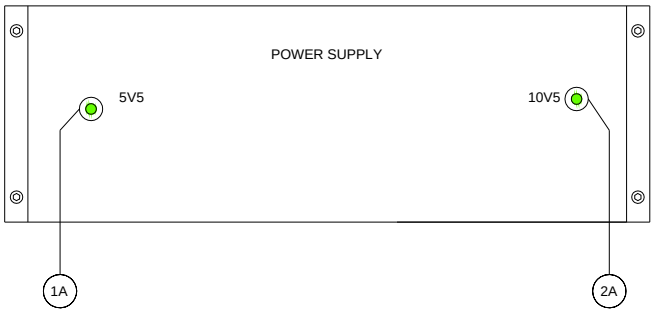


FIGURE 5 – DC/DC CONVERTER: LEDS STATUS - CORRECT POWER UP

REF.	STATUS	MEANING
LED 1A	ON	5.5Vdc from DC/DC converter available
LED 2A	ON	10.5Vdc from DC/DC converter available

TABLE 4 - DC/DC CONVERTER: LEDS STATUS - CORRECT POWER UP

6.WIRELESS MODEMS

a. Models equipped with CDMA modem

data communication between repeater (via built-in CDMA modem) and management workstation (PC where OMT/OMC management softwares have been previously installed) via PSTN and/or CDMA modem, must be established in CSD (CIRCUIT-SWITCHED DATA) mode only. All other modalities are not allowed.

As CDMA modems don't use SIMs, the network's parameters have to be set manually by using the HyperTerminal. Please contact your local Operator, communicating modem's ESN (**check the sticker at the top of the management module**), to get the needed parameters. Most common parameters are:

Typical CDMA Network Parameters

Acronyms	Full name	Network's setting / Terminal's setting	Description	Notes
MSL	Master Subsidy Lockcode	Provided by the Operator	Modem lock / unlock code	-
MDN	Mobile Data Number	Provided by the Operator	Modem phone number	MDN & MTN are synonyms
MTN	Mobile Telephone Number	Provided by the Operator	Modem phone number	MDN & MTN are synonyms
MNC	Mobile Network Code	Provided by the Operator	2 digit number that represents a sub-network in the IMSI	-
MCC	Mobile Country Code	Provided by the Operator	Predefined number that represents a Country in the IMSI	-
ESN	Electronic Serial Number	Proprietary of the modem (factory setting)	Modem internal proprietary ID (factory setting)	It can be found into the sticker at the top of the management module
MIN	Mobile Identification Number	Provided by the Operator	Subscriber's account number	-
IMSI	International Mobile Subscription Identity	Provided by the Operator	International modem ID	IMSI = MCC + MNC + MIN
(Home) SID	System ID	Provided by the Operator	ID of the sub-network where modem can operate	SID & NID are synonyms
(Home) NID	Network ID	Provided by the Operator	ID of the sub-network where modem can operate	SID & NID are synonyms
PRI	Product Release Instruction	Provided by the Operator	Carrier information	-
PRL	Preferred Roaming List	Provided by the Operator	List of NIDs/SIDs	-
PCA	Primary Channel A	Provided by the Operator	RF primary channel	-
PCB	Primary Channel B	Provided by the Operator	RF primary channel	-
SCA	Secondary Channel A	Provided by the Operator	RF secondary channel	-
SCB	Secondary Channel B	Provided by the Operator	RF secondary channel	-
A-key	Autenthification key	Provided by the Operator	Key for the autenthification	Built-in modem's one is random

Note: not all parameters could be needed

In normal operating conditions the jumper must remain connected (if removed, the remote management will be avoided). It can be temporary removed to set the Operator's parameters into the built-in modem by using the RS232 modem port. The same serial cable used for local management, can be used to set the modem. Once the modem setting is complete, reconnect the jumper to the normal operating position.

The following procedure explains how to set the modem's parameters.
Please note: AT commands, contained between the inverted commas, must be strictly typed as it follows.

1) Switch-off the repeater
2) Remove the jumper at RS232 (modem) connector
3) Connect the serial cable (supplied with repeater) with your laptop and RS232 (modem) connector
4) Switch-on the repeater and wait for the complete auto-diagnostic test
5) Run HyperTerminal software on your laptop (if you're using Microsoft XP, run HyperTerminal from start/programs/accessories/communication/HyperTerminal)
6) Type the connection's name (e.g. repeater's modem) and press OK
7) Chose the right PC's serial port (COM) and press OK
8) Set the bit-rate at "9600" baud
9) Set the number of bits at "8"
10) Set the parity at "no parity"
11) Set the bit stop at "1"
12) Set the flow control at "no flow control"
13) Press OK
14) Type "**AT**" and press ENTER (modem should reply with "OK")
15) Type "**AT+E1**" and press ENTER (modem should reply with "OK")
16) Type "**AT+CGSN**" and press ENTER to display the ESN number (if needed)
17) Type "**AT+WSPC=1,000000**" and press ENTER to get access to CDMA AT commands
18) Type "**AT+WMDN=xxx**" where xxx is the MDN number (10 to 15 digits) and press ENTER
    If needed, to get current MDN number, type "AT+WMDN?" and press ENTER
19) Type "**AT+WIMI=xxx**" where xxx is the IMSI number (15 digits) and press ENTER
    If needed, to get current IMSI number, type "AT+WIMI? and press ENTER
20) Type "**AT+WSID=, xxx, yyy**" where xxx is the SID number (1 up to 5 digits / 0 up to 32767) and yyy is the NID number (1 up to 5 digits / 0 up to 65535 – if not provided, set 65535) and press ENTER
    If needed, to get current IMSI number, type "AT+WIMI? and press ENTER
    With the this command you've set SID & NID number in first memory location. Up to 20 (0 up to 19) locations are supported. To set other SIDs & NIDs, please use the following sintax:
    Type "**AT+WSID=zz, xxx, yyy**" where zz is the location (up to 2 digits / 1 up to 19) where these SIDs & NIDs have to be stored, xxx is the SID number (1 up to 5 digits / 0 up to 32767) and yyy is the NID number (1 up to 5 digits / 0 up to 65535 – if not provided, set 65535) and press ENTER
    Please note: to set both SID & NID at 0 in location 2, type "**AT+WSID=2**"
21) Type "**AT+WPCC=xxx,yyy**" where xxx is primary channel "a" (up to 4 digits / 0 up to 2047) and yyy is primary channel "b" (up to 4 digits / 0 up to 2047) and press ENTER
    If needed, to get current primary channels, type "AT+WPCC? and press ENTER
22) Type "**AT+WSCC=xxx,yyy**" where xxx is secondary channel "a" (up to 4 digits / 0 up to 2047) and yyy is secondary channel "b" (up to 4 digits / 0 up to 2047) and press ENTER
    If needed, to get current secondary channels, type "AT+WSCC? and press ENTER
23) Type "**AT+WCMT=1**" and press ENTER to store these settings into the modem. The modem will be automatically re-start with new settings. Please wait for 10-20 seconds prior to type other commands
24) Type "**AT**" and press ENTER (modem should reply with "OK")
25) Type "**AT+E1**" and press ENTER (modem should reply with "OK")
26) Type "**AT+CICB=0**" and press ENTER to allow CSD data connections
27) Close the HyperTerminal
28) Remove the serial cable
29) Switch-off the equipment
30) Reconnect the existing jumper cable with RS232 (modem)

Please note: not all the above mentioned parameters could be necessary. For any problem, please contact our local subsidiary.

b. Models equipped with GSM modem

How to install/remove the SIM card from the built-in modem

- Open the repeater.
- Check that the switches inside the repeater are set to 0 - OFF (FIGURE 1a and b).
- Insert the SIM enabled to data transmission in not transparent mode 9600BPS (FIGURE 6)

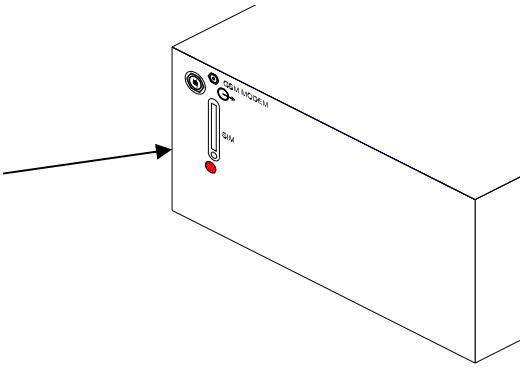


FIGURE 6 – DETAIL OF THE SIM INSERTION

- Close the Management Module
- Switch on the equipment (AC voltage circuit breaker, **ref. 57**, 48Vdc circuit breaker, **ref. 22**, FIGURE 1a-b).
- Close the repeater.

7. INSTALL THE OPERATION AND MAINTENANCE SOFTWARE OMT REPEATER

Install on your PC the Operation and Maintenance Terminal software to set and manage the equipment (please refer to the software User's manual). The repeater can be managed in remote mode via a built-in modem, or in local mode.

8. START OMT Repeater IN LOCAL MODE

In LOCAL mode the notebook is connected to the repeater via RS232 serial cable.

- Open the repeater door (by unscrewing four screws located on the equipment front door).
  Connect your notebook to the management module (connector RS232, **ref. 34**, FIGURE 7) using the provided serial cable (null-modem type).

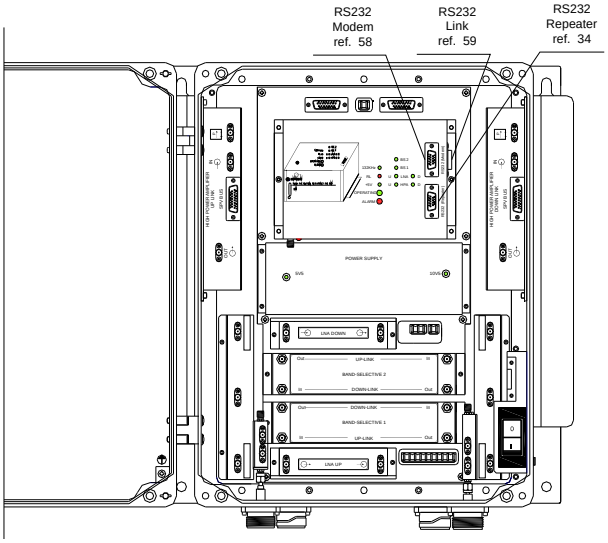


FIGURE 7 – RS232 CONNECTORS

- The connector RS232 (ref. 58,FIGURE 7) and the connector RS232 (ref. 59, FIGURE 7) are connected with a cable (only in models equipped with CDMA modem).
- Switch on your notebook and start Windows.
- To Run the program select the related folder in the Windows 'Start' menu and click.
- The 'Login panel' is displayed (FIGURE 8).

FIGURE 8 – LOGIN PANEL

- Select read/write user.

PLEASE NOTE It's not requested to insert the password the first opening of the program. It's recommended to change the password to avoid undesired accesses to the program (to change the password, please refer to the Operation and Maintenance Terminal Software User's manual).

- Click 'Ok' to start the software.
  The window 'Communication settings' is displayed: check that local 'Connection mode' is selected.
  If remote Connection mode is selected it is possible to change the Connection mode as follows:
  - select the 'Edit and save' button in the lower part of the panel to enable changes;
  - select local Connection mode;
  - press the 'Edit and save' button again to confirm.

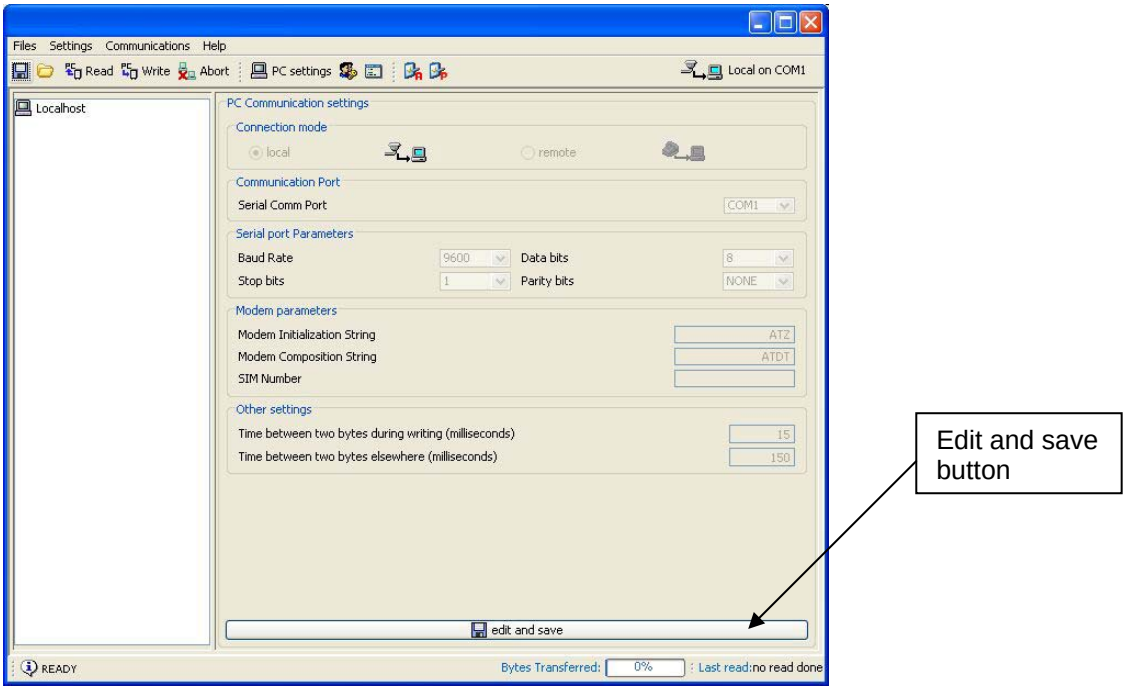


FIGURE 9 – 'COMMUNICATION SETTINGS' PANEL

9. SET THE REPEATER GAIN, FREQUENCY CENTER AND BANDWIDTH

- Select the menu entry ‘Read’ in the ‘Device’ menu, or click the ‘ Read’ button, to read the equipment configuration and status.
  The software main window is displayed.
  By means of the software set the repeater gain as described below.

NOTE

How to modify parameters:

- Click on the ‘edit and save’ button, in the lower part of the window, to enable changes to the repeater parameters.
- Click again on the ‘edit and save’ button to save changes.
- The menu entry ‘Write’, in the ‘Device’ menu, makes it possible to apply changes to the repeater. A password is required: default password is blank. To change the password please refer to the software User’s manual.

a) In the tree structure of the repeater system (FIGURE 9) select the repeater (double click on ‘Repeater’): on the right side of the window, the configuration and status panels of the repeater will be shown (Description, Spectrum, Parameters, Alarms, Communications, Advanced).

b) In the description panel, the user should select (FIGURE 10) if the system is TDMA or CDMA. This selection allows to load the right values of RF power transmitted by the HPAs (only for 1900MHz repeaters)

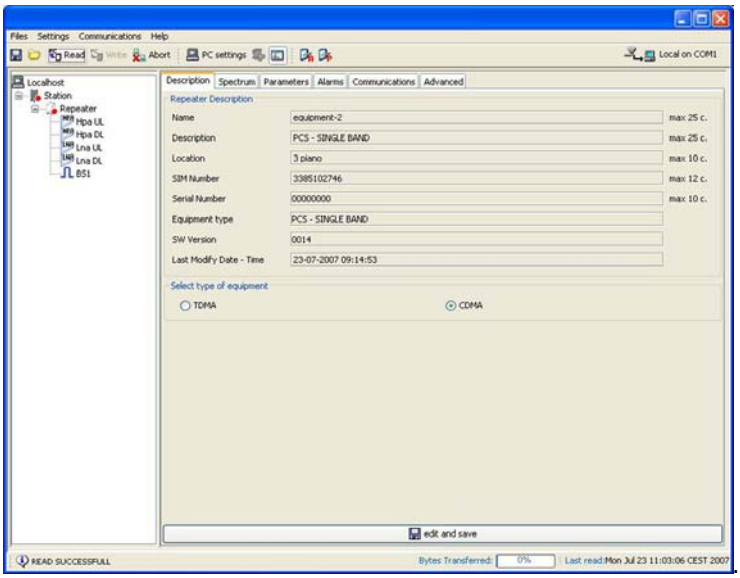


FIGURE 10 – Selection TDMA / CDMA

c) In the ‘Spectrum’ panel (FIGURE 11)set both ‘UL-attenuation’ and ‘DL-attenuation’ to 30 (dB) - maximum attenuation, i.e. minimum gain.

d) Connect the cable from the donor antenna to the BTS connector on the bottom of the repeater (**ref. 52**, FIGURE 3).

e) Connect the MS connector on the bottom of the repeater (**ref. 56**, FIGURE 3) to a spectrum analyzer.

f) In the Spectrum panel, set the Up-link frequency center and bandwidth.
In the same panel set the repeater gain (UL-Up-link- attenuation, DL-Down-link- attenuation).

PLEASE NOTE:
should it be necessary to set an attenuation greater than 15dB it is strongly recommended to connect a fixed attenuator between donor antenna and the repeater BTS side port to avoid BTS desensitisation due to excessive radiated up-link noise.

g) Check via the spectrum analyzer that the output signal level (MS side) is correct.
When the output signal level is correct, disconnect the spectrum analyzer.

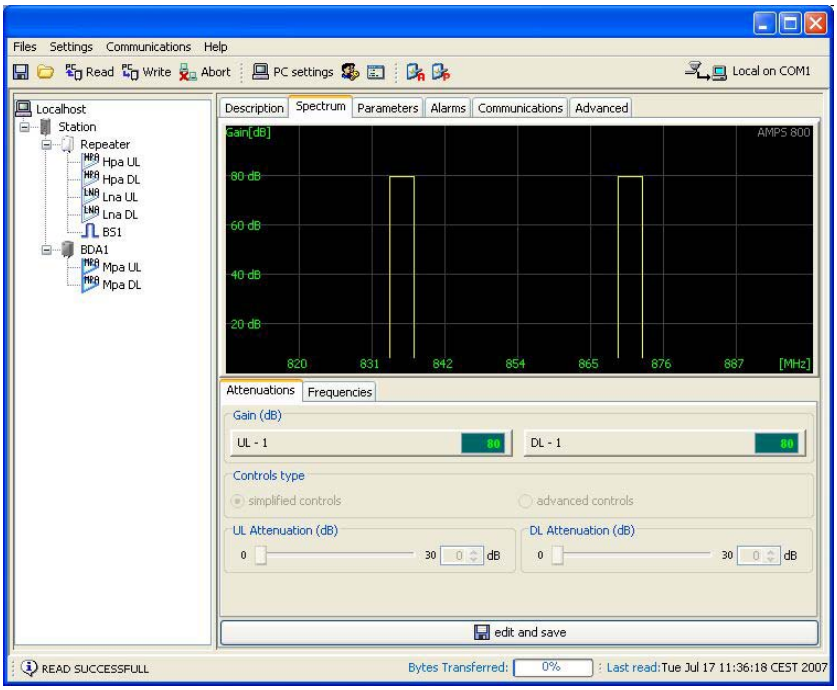


FIGURE 11 – 'SPECTRUM' PANEL

If the repeater is used in stand-alone configuration, connect the cable from the service antenna to the MS connector on the bottom of the repeater (ref. 56, FIGURE 3).
If the repeater is the head station of an optical fiber system, refer to the OPTICAL FIBER COVERAGE SOLUTIONS technical handbook to install and set Master Unit and Remote Units.
If the repeater is part of a cascade system, refer to the IN-LINE AMPLIFIERS technical handbook to install and set in-line amplifiers.

During operation the equipment can be managed, both in LOCAL and in REMOTE mode, via the software.

In REMOTE mode the equipment is managed via a modem link. On the repeater side the modem is installed within the equipment management module.
If installing /removing the SIM card from the built-in modem is necessary, please refer to the following procedure **6b** (HOW TO INSTALL/REMOVE THE SIM CARD FROM THE BUILT-IN MODEM).

For details regarding the software, please refer to the software User's manual.

4.3) ROUTINE MAINTENANCE

This equipment **does not require** any ORDINARY MAINTENANCE (or preventive maintenance) servicing.

ABBREVIATIONS AND ACRONYMS

AC	Alternating Current
ALC	Automatic Level Control
BDA	Bi-Directional Amplifier
BTS	Base Transceiver Station
DC	Direct Current
DCS	Digital Cellular System
EGSM	Enhanced Global System for Mobile Communications
EMC	Electro-Magnetic Compatibility
FET	Field-Effect Transistor
GSM	Global System for Mobile Communications
GSM-R	GSM - Railway
HPA	High Power Amplifier
IF	Intermediate Frequency
IP3	Third order Intercept Point
LNA	Low Noise Amplifier
MMIC	Monolithic Microwave Integrated Circuit
MS	Mobile Station
MTBF	Mean Time Between Failures
MU	Master Unit
NF	Noise Figure
OMC	Operation and Maintenance Center
OMT	Operation and Maintenance Terminal
PC	Personal Computer
PEP	Peak Envelope Power
PLL	Phase-Locked Loop
PSTN	Public Switched Telephone Network
RAM	Random Access Memory
RF	Radio Frequency
RL	Return Loss
RU	Remote Unit
SAW	Surface Acoustic Wave
SIM	Subscriber Identity Module
SPV	Supervision
TTL	Transistor, Transistor, Logic
UMTS	Universal Mobile Telecommunications System
UPS	Uninterruptible Power Supply
VCO	Voltage Controlled Oscillator