The most important thing we build is trust

Band-Selective, Class B, Fibre-Fed Repeater User Handbook

Product Part No. BSF0060
BSF3604-406-411-115VAC

Connected – Seamless – Wireless

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1. Introduction

1.1. Scope and Purpose of Document

This handbook is for use solely with the equipment identified by the Cobham Wireless Part Number(s) shown on the front page. It is not to be used with any other equipment unless specifically authorised by Cobham Wireless. This is a controlled release document and, as such, becomes a part of the Cobham Wireless Total Quality Management System. Alterations and modification may therefore only be performed by Cobham Wireless.

Cobham Wireless recommends that the installer of this equipment familiarise themselves with all of the safety notices and any installation procedures contained within this document before installation commences.

The purpose of this handbook is to provide the user/maintainer with a general overview of the equipment and its functions along with basic fault-finding and troubleshooting procedures where appropriate. Maintenance and adjustments to any deeper level must be performed by Cobham Wireless, normally at the company's repair facility in Chesham, England.

This handbook has been prepared in accordance with Cobham Wireless' Quality procedures, which maintain the company's registration to BS EN ISO 9001:2008 and to the R&TTE Directive of the European Parliament. Copies of the relevant certificates and the company Quality Manual can be supplied on application.

1.2. Limitation of Liability Notice

This manual is written for the use of technically competent operators/service persons. No liability is accepted by Cobham Wireless for use or misuse of this manual, the information contained therein, or the consequences of any actions resulting from the use of the said information, including, but not limited to, descriptive, procedural, typographical, arithmetical, or listing errors. Furthermore, Cobham Wireless does not warrant the absolute accuracy of the information contained within this manual, or its completeness, fitness for purpose, or scope.

Cobham Wireless has made every effort to ensure that the instructions contained in this document are adequate and free of errors and omissions. The manufacturer will, if necessary, explain issues which may not be covered by this document. The manufacturer's liability for any errors in the document is limited to the correction of errors and the aforementioned advisory services.

Cobham Wireless has a policy of continuous product development and enhancement, and as such, reserves the right to amend, alter, update and generally change the contents, appearance and pertinence of this document without notice. Cobham Wireless welcomes customer comments as part of the process of continual development and improvement of the documentation in the best way possible from the user's viewpoint. Please submit your comments to the nearest Cobham Wireless sales representative.

Unless specified otherwise, all Cobham Wireless products carry a twelve month warranty from date of shipment. The warranty is expressly on a return-to-base repair or exchange basis and the warranty cover does not extend to on-site repair or complete unit exchange.

1.3. Copyright Notice

1.4. Contact Information

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Chesham, Buckinghamshire
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Registered in England and Wales: 04042808
www.cobham.com/wireless

1.5. Compliance with ISED

WARNING: This is NOT a CONSUMER device.
It is designed for installation by an installer approved by an ISED licensee. You MUST have an ISED LICENCE or the express consent of an ISED licensee to operate this device.

Under Innovation, Science and Economic Development (ISED) Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.
This equipment complies with ISED RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 2.15 m between the antenna and your body,

The installation procedure must result in the signal booster complying with ISED requirements RSS-131 Clause 6.3 and 6.4. In order to meet ISED requirements RSS-131 Clause 6.3 and 6.4, it may be necessary for the installer to reduce the UL and/or DL output power for certain installations.

Conformément à la réglementation d'Innovation, Sciences et Développement Économique (ISDE) Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

La puissance de sortie nominale indiquée par le fabricant pour cet appareil concerne son fonctionnement avec porteuse unique. Pour des appareils avec porteuses multiples, on doit réduire la valeur nominale de 3.5dB, surtout si le signal de sortie est retransmis et qu'il peut causer du brouillage aux utilisateurs de bandes adjacentes. Une telle réduction doit porter sur la puissance d'entrée ou sur le gain, et ne doit pas se faire au moyen d'un atténuateur raccordé à la sortie du dispositif.
Cet appareil est conforme aux limitations de la norme ISDE RSS-102 concernant l'exposition aux radiations dans un environnement non contrôlé. Cet appareil doit être installé et utilisé avec une distance minimale de 2.15 m entre l'antenne et le corps de l'utilisateur.

La procédure d'installation doit permettre à l'amplificateur de signal de se conformer aux exigences ISDE RSS-131 Clause 6.3 et 6.4. Afin de respecter les exigences de la norme ISDE RSS-131, paragraphes 6.3 et 6.4, il peut être nécessaire que l'installateur réduise la puissance de sortie UL et / ou DL pour certaines installations.

1.6. Compliance with FCC

Part 90 Signal Boosters	**THIS IS A 90.219 CLASS B DEVICE**

WARNING: This is **NOT** a **CONSUMER** device. This device is designed for installation by **FCC LICENCEES** and **QUALIFIED INSTALLERS**. You **MUST** have an **FCC LICENCE** or express consent of an FCC Licensee to operate this device.

You **MUST** register Class B signal boosters (as defined in 47 CFR 90.219) online at **www.fcc.gov/signal-boosters/registration**.

Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

The installation procedure must result in the signal booster complying with FCC requirements 90.219(d). In order to meet FCC requirements **90.219 (d),** it may be necessary for the installer to reduce the UL and/or DL output power for certain installations.

1.6.1. FCC Part 15

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

If not installed and used in accordance with the instructions, this equipment generates, uses and can radiate radio frequency energy. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to RF reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the Donor antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a power outlet on a circuit different from that to which the receiver is connected.

1.6.2. Unauthorized Changes to Equipment

Changes or Modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment

1.6.3. FCC RF Exposure Limits

This unit complies with FCC RF exposure limits for an uncontrolled environment. This equipment can only be installed for applications, driving passive or active DAS systems. All antennas must be operated at a minimum distance of 50 cm between the radiator and any person's body.

1.6.4. Antenna Installation

Installation of an antenna must comply with the FCC RF exposure requirements. The antenna used for this transmitter must be mounted on permanent structures.

The FCC regulations mandate that the ERP of type B signal boosters should not exceed 5W, this is equivalent to 8.2W EIRP.

Therefore the max antenna gain allowed for this type of signal booster should be limited to the values given by equation 1 (below) for the service antenna.

Equation (1) - Max SERVICE antenna gain
Max SERVICE antenna gain (dBi) = 39.1 – (37dBm - # of antennas in dB – cable losses in dB).

For example:

No. of Antennas	Cable Losses	Max Allowed Antenna Gain
4	3	39.1 - (37-6-3) =11.1dBi
1	3	39.1- (37-0-3) = 5.1dbi
10	3	39.1- (37-10-3) = 15.1dbi

1.6.5. Compliance with FCC deployment rule regarding the radiation of noise

Good engineering practice must be used in regard to the signal booster's noise radiation. Thus, the gain of the signal booster should be set so that the ERP of the output noise from the signal booster should not exceed the level of -43 dBm in 10 kHz measurement bandwidth.

In the event that the noise level measured exceeds the aforementioned value, the signal booster gain should be decreased accordingly.

In general, the ERP of noise on a spectrum more than 1 MHz outside of the pass band should not exceed -70 dBm in a 10 kHz measurement bandwidth.

The BSF0060 Repeater has a noise level of -66 dBm in 10 kHz measurement at 1 MHz spectrum outside the passband of the signal booster and an in-band noise level at around -46 dBm in a 10 kHz bandwidth. Therefore, the noise at the antenna input port should be calculated based on equation (2).

Equation (2) - Input Noise to service antenna
Input Noise to service antenna:
-66 dBm – Antenna splitter losses in dB – cable loss in dB

Example: In band Noise
Signal booster connected to 10 service antennas with a 100m long ½ inch cable.
Losses of such a cable with the connectors = ~ 12dB

Assuming 10 service antennas: antenna splitter losses = 11 dB
Based on equation (2) Input antenna noise (to the antenna) = -46-12 -11=-69 dBm ERP
The in-band input noise to the antenna should be -46 -12-11= -69dbm ERP

Example: Out of band noise
Signal booster connected to 10 service antennas with a 100m long ½ inch cable.
Losses of such a cable with the connectors = ~ 12dB

Assuming 10 service antennas: antenna splitter losses = 11 dB
Based on equation (2) Input antenna noise (to the antenna) = -66 -12 -11=-89dBm ERP
The Out of-band input noise to the antenna should be -66 -12-11= -89dbm ERP

NOTE: In this example there is no need to add an external band pass filter to attenuate the out of band noise. If fewer antennas are deployed then additional filtering may be required

Conclusion:

Good engineering practice requires that in general when the out of band noise measured at the service antenna input is more than -70 dBm per 10 kHz measurement bandwidth, an external band pass filter should be added to attenuate the out of band noise level.

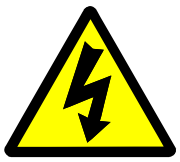
All Cobham Wireless repeaters include high selectivity duplexers and filters to attenuate the out of band noise. Should additional filtering be required, we have a comprehensive range of interference filters which can be supplied upon request.

2. Safety Notices

2.1. Earthing of Equipment

Equipment supplied from the mains must be connected to grounded outlets and earthed in conformity with appropriate local, national and international electricity supply and safety regulations.

2.2. Electric Shock Hazard



The risk of electrical shocks due to faulty mains driven power supplies whilst potentially ever present in any electrical equipment, would be minimised by adherence to good installation practice and thorough testing at the following stages:

a) Original assembly.
b) Commissioning.
c) Regular intervals, thereafter.

All test equipment must be in good working order prior to its use. High current power supplies can be dangerous because of the possibility of substantial arcing. Always switch off during disconnection and reconnection.

2.3. RF Radiation Hazard

RF radiation, (especially at UHF frequencies) arising from transmitter outputs connected to Cobham Wireless equipment, must be considered a safety hazard.

This condition might only occur in the event of cable disconnection, or because a 'spare' output has been left un-terminated. Either of these conditions would impair the system's efficiency. No investigation should be carried out until all RF power sources have been removed. This would always be a wise precaution, despite the severe mismatch between the impedance of an N type connector at 50Ω, and that of free space at 377Ω, which would severely compromise the efficient radiation of RF power. Radio frequency burns could also be a hazard, if any RF power carrying components were to be carelessly touched!

Antenna positions should be chosen to comply with requirements (both local & statutory) regarding exposure of personnel to RF radiation. When connected to an antenna, the unit is capable of producing RF field strengths, which may exceed guideline safe values especially if used with antennas having appreciable gain. In this regard the use of directional antennas with backscreens and a strict site rule that personnel must remain behind the screen while the RF power is on, is strongly recommended. Where the equipment is used near power lines or in association with temporary masts not having lightning protection, the use of a safety earth connected to the case-earthing bolt is strongly advised.

2.4. Lifting and other Health and Safety Recommendations

Certain items of Cobham Wireless equipment are heavy and care should be taken when lifting them by hand. Ensure that a suitable number of personnel, appropriate lifting apparatus and appropriate personal protective equipment is used especially when installing Equipment above ground e.g. on a mast or pole and manual handling precautions relevant to items of the weight of the equipment being worked on must be observed at all times when handling, installing or dismounting this equipment.

2.5. Chemical Hazard

Beryllium Oxide, also known as Beryllium Monoxide, or Thermalox™, is sometimes used in devices within equipment produced by Cobham Wireless. Beryllium oxide dust can be toxic if inhaled, leading to chronic respiratory problems. It is harmless if ingested or by contact.

Products that contain beryllium are load terminations (dummy loads) and some power amplifiers. These products can be identified by a yellow and black "skull and crossbones" danger symbol (shown above). They are marked as hazardous in line with international regulations, but pose no threat under normal circumstances. Only if a component containing beryllium oxide has suffered catastrophic failure, or exploded, will there be any danger of the formation of dust. Any dust that has been created will be contained within the equipment module as long as the module remains sealed. For this reason, any module carrying the yellow and black danger sign should not be opened. If the equipment is suspected of failure, or is at the end of its life-cycle, it must be returned to Cobham Wireless Ltd. for disposal.

To return such equipment, please contact the Support Desk, who will give you a Returned Materials Authorisation (RMA) number. Please quote this number on the packing documents, and on all correspondence relating to the shipment.

Polytetrafluoroethylene, (P.T.F.E.) and P.T.F.E. Composite Materials
Many modules/components in Cobham Wireless equipment contain P.T.F.E. as part of the RF insulation barrier.
This material should never be heated to the point where smoke or fumes are evolved. Any person feeling drowsy after coming into contact with P.T.F.E., especially dust or fumes should seek medical attention.

2.6. Laser Safety

General good working practices adapted from EN60825-2: 2004/ EC 60825-2:2004

Do not stare with unprotected eyes or with any unapproved optical device at the fibre ends or connector faces or point them at other people, Use only approved filtered or attenuating viewing aids.
Any single or multiple fibre end or ends found not to be terminated (for example, matched, spliced) shall be individually or collectively covered when not being worked on. They shall not be readily visible and sharp ends shall not be exposed.
When using test cords, the optical power source shall be the last connected and the first disconnected; use only approved methods for cleaning and preparing optical fibres and optical connectors.
Always keep optical connectors covered to avoid physical damage and do not allow any dirt/foreign material ingress on the optical connector bulkheads.
The optical fibre jumper cable minimum bend radius is 3cm; bending to a smaller radius may result in optical cable breakage and excessive transmission losses.
Caution: The FO units are NOT weather proof.

2.7. Emergency Contact Numbers

The Cobham Wireless Support Desk can be contacted on:

Telephone	+44 (0)1494 777747
Fax.	+44 (0)1494 777002
e-mail	cw.support@cobham.com

3. BSF3604-406-411-115VAC - BSF0060

BSF3604-406-411-115VAC part number BSF0060 is a band-selective, Class B, fibre-fed repeater built in to a dual purpose rack or wall-mounting, environmentally protected (IP65) aluminium alloy case; external ports and connectors are also IP65 standard making the entire enclosure and connecting ports weatherproof. Handles are provided for carrying the unit and the door is fitted with locks.

BSF0060 houses a fibre optic transceiver module for demodulating the Downlink optical signals to RF and modulating the Uplink RF signals to optical to be transmitted to the Master Site. BSF0060 also houses a Digital Signal Processing (DSP) module and a Downlink power amplifier to amplify channels in the bands 406-420 MHz. It is designed for FM and P25 modulations with the emission designators F1E and F3E.

The repeater houses a bandpass duplexer module connected to a common TX output/RX input port (the "Server" port) for single antenna operation. The bandpass filters in the Duplexer module are used to limit the out of band noise and prevent out-of-band signals from overloading the DSP Module.

Downlink.
BSF0060 receives a F/O feed via a WDM optical cable link from the master site. The F/O feed passes into a F/O transceiver module and is demodulated to RF.

The RF Downlink path then passes through a 30dB coaxial attenuator and into the Downlink path of the Digital Signal Processing Module which utilises SDR technology to digitally process the signals to define the required channel frequency and bandwidth; automatic gain control and signal attenuation functions are also provided.

The Downlink path then passes through a Multi-Carrier Power Amplifier; and then enters the Downlink path of the Bandpass Duplexer module which filters the signal to pass the required Downlink passband and reject out-of-band noise and then combines the Downlink and Uplink paths whilst providing isolation between the two paths. The Downlink signal then exits BSF0060 via the common TX/RX "Server" port.

Uplink.
The Uplink signal from the enters BSF0060 via the common TX/RX "Server" port and passes into the Uplink path of the Bandpass Duplexer module which splits the Uplink from the Downlink path, filters the signal to pass the required Uplink passband and reject out-of-band noise whilst providing isolation between the Uplink and Downlink paths.

The Uplink signal then enters the Uplink path of the Digital Signal Processing Module which utilises SDR technology to digitally process the signals to define the required channel frequencies and bandwidths; automatic gain control and signal attenuation functions are also provided.

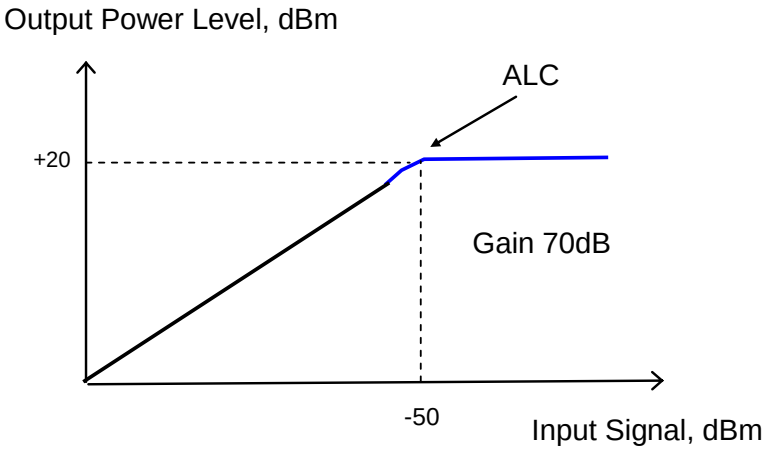
The Uplink path then passes into the F/O transceiver module where the RF signal is modulated onto a laser for onward transmission to the master site as an optical signal over the WDM fibre optic cable link

BSF0060 is powered by 115V AC which drives an internal power supply unit which provides a range of DC voltages for the internal active modules. A supply On/Standby switch is fitted inside the unit.

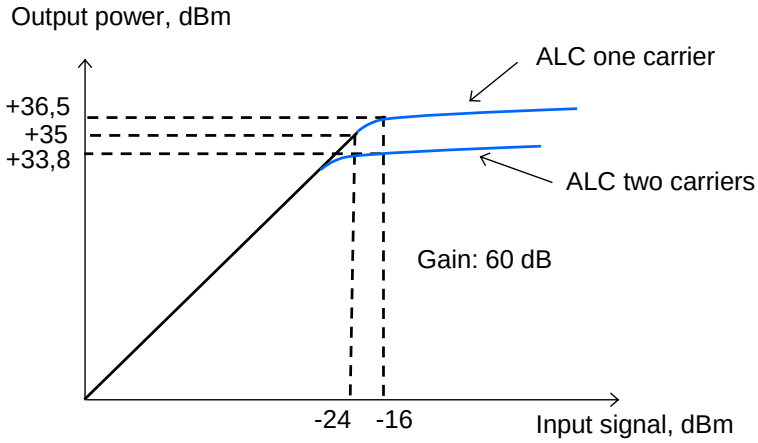
An alarm system is fitted; active modules have alarm outputs which are collated by the Control Module and modulated onto the Uplink optical signal for interrogation at the master site. The alarm data is also made available via an Ethernet link which offers the ability of remote configuration and a summary alarm, voltage-free contact relay output is made available via terminals 11 and 12 of the external interface terminal block located in the base of the repeater.

3.1. Automatic Level Control

BSF0060 is equipped with Automatic Level Control (ALC). The ALC feature enables maintaining the maximum defined output level.



The repeater has a defined maximum output level. If the input signal amplified by the gain set exceeds the set output limit, an ALC loop is activated. This ALC ensures that the amplifier does not add distortion to the radio signal. Below are examples of the ALC function for one and two carriers.



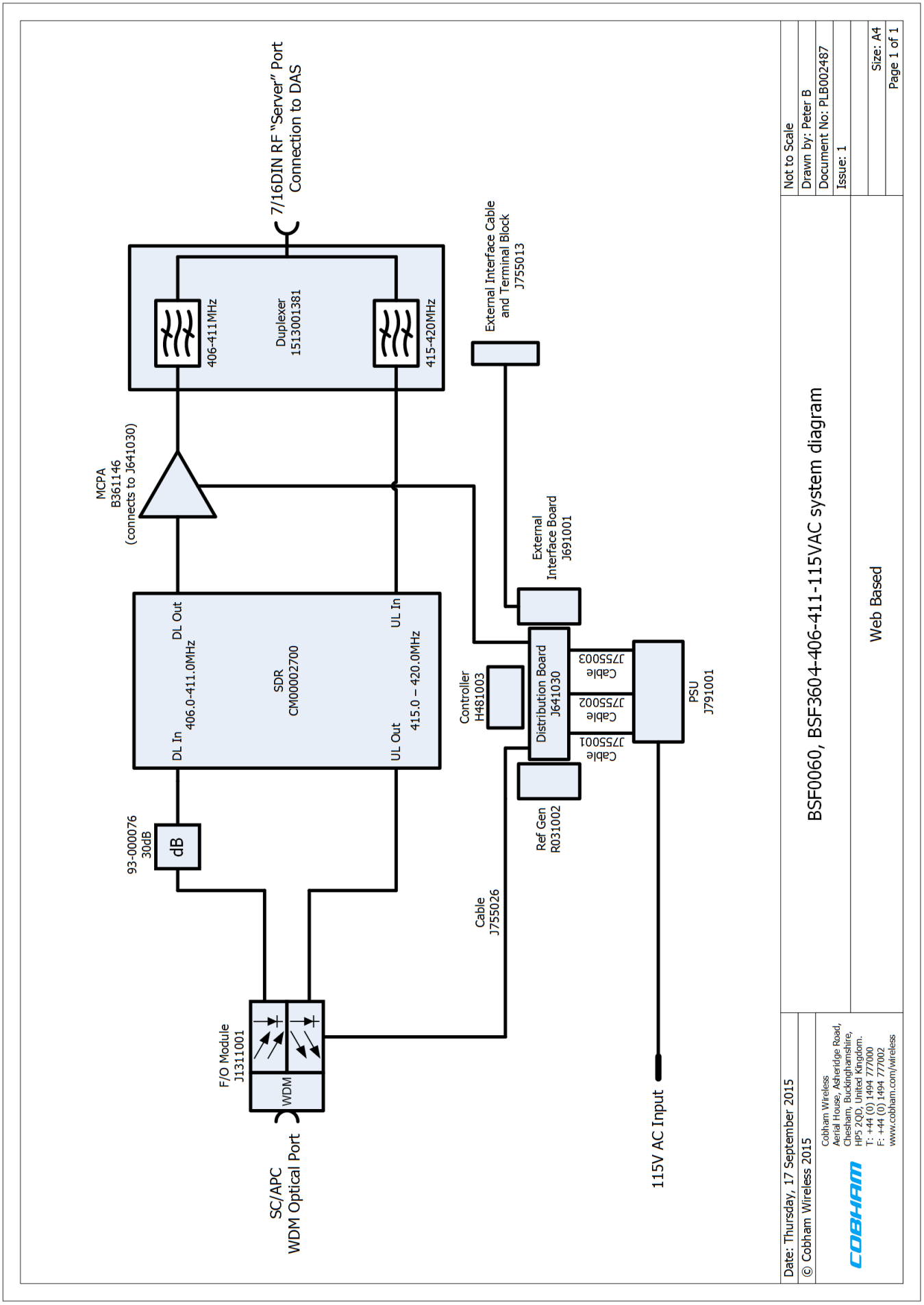
3.2. BSF0060 Major Sub Components

Component Part	Part Description	Qty. Per Assembly
J1311001	Fibre Optic Transceiver Module	2
CM00002700	Digital Signal Processing (DSP) Module	1
B361146	Multi Carrier Power Amplifier (MCPA)	2
1513001381	Duplexer Module	1
J691001	External Interface Board	1
J755013	External Interface Cable and Terminal Block	1
J791001	PSU module 115V	2
J641030	Distribution Board	1
H481003	Control Module	1
93-000076	30dB, 1W In-Line Attenuator	1
R031002	Reference Generator	1

3.3. BSF0060 Specification

Parameter		Specification
Downlink RF Measurements		
Nominal Downlink Bandwidth		5.5 MHz
Centre Frequency		408.5MHz
System net gain at 10 dB optical loss		30 dB with OMU
Gain Adjustment		0 – 30 dB in 1 dB steps
Maximum Output power		+36 dBm
Output 3rd Order Intercept Point		> +68 dBm
In-Band Spurious Noise		< -13 dBm (30 kHz B/W)
Uplink RF Measurements		
Nominal Uplink Bandwidth		5.5 MHz
Centre Frequency		417.5 MHz
System net gain at 10 dB optical loss		30 dB with OMU
Gain Adjustment		0 – 30 dB in 1 dB steps
Maximum Output power		+0 dBm
In-Band Spurious Noise		< -13 dBm (30 kHz B/W)
Noise Figure		< 6 dB
General		
Case Size (ex. mounting brackets)		538 mm x 382 mm x 198 mm
Case Material		Aluminium Alloy
Case Finish		Light Grey RAL7035
Supply Voltage		115 VAC 60Hz
Optical connector		SC/APC
RF Connector		7/16 DIN female
Impedance		50 Ω
Temperature Range	operation	-25 to +55ºC
	storage	-30 to +70ºC
Humidity		95% RHNC

3.4. BSF0060 System Diagram

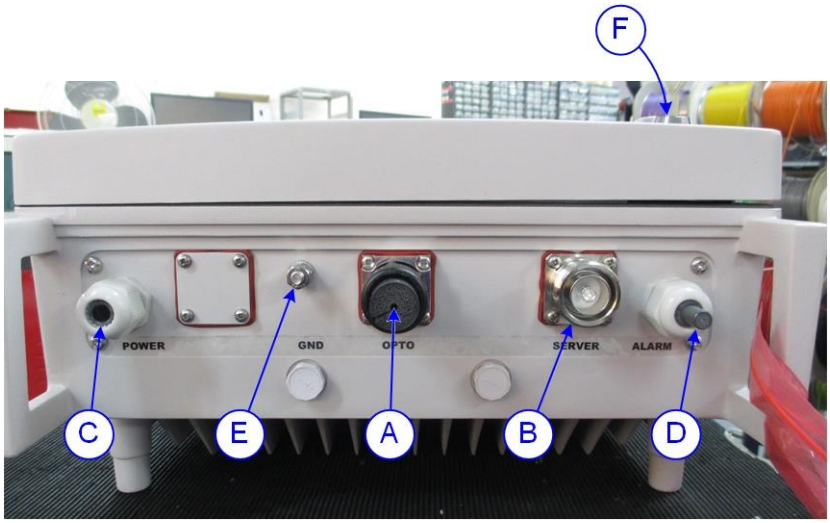


3.5. BSF0060 External and Internal Views

3.5.1. External view

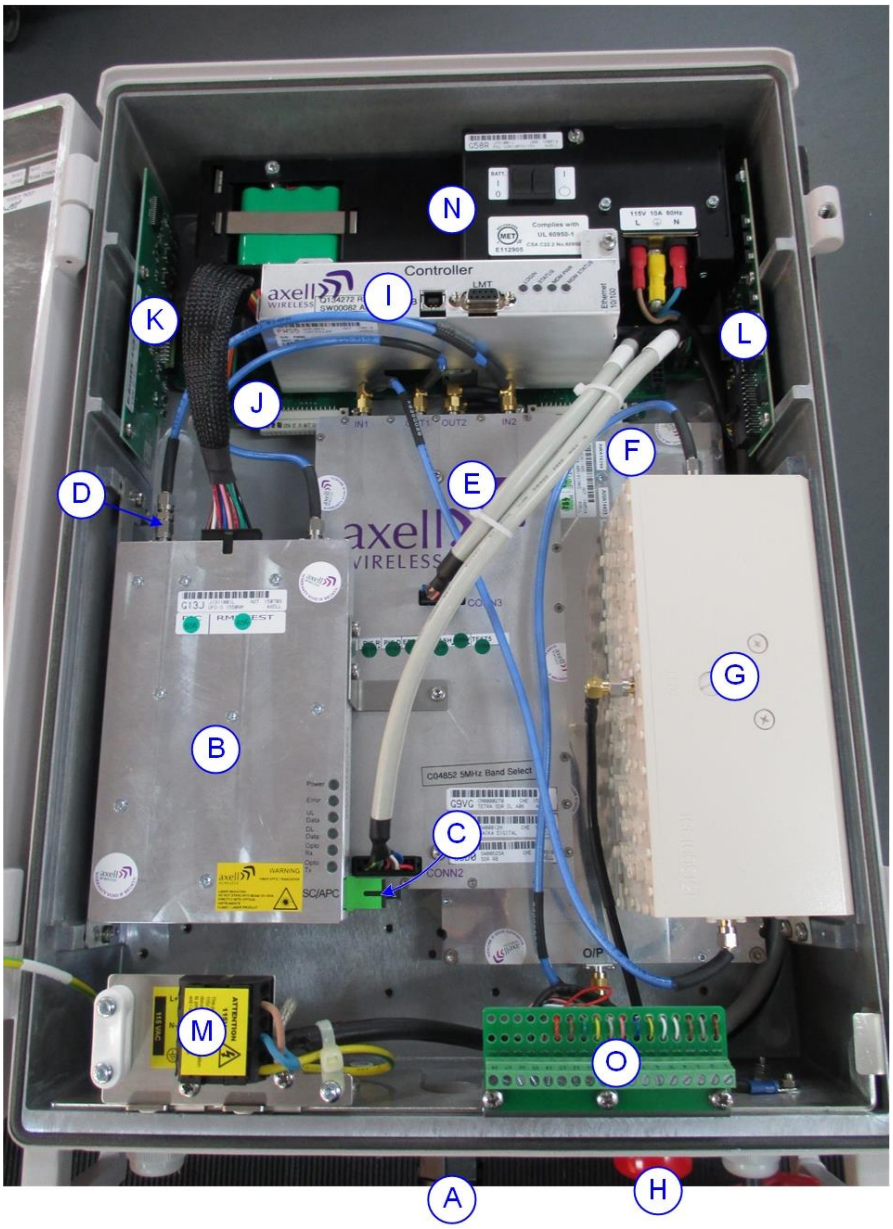
A	Position of external interfaces (see 3.5.2. below)
B	Door lock
C	Repeater lid securing screws

3.5.2. External Interfaces



A	Cable gland for fibre optic cable connections, F/O Downlink I/P and Uplink O/P
B	7/16DIN "Server" port, RF Downlink O/P and Uplink I/P
C	Cable gland for power supply cable
D	Cable gland for wired alarm output
E	Grounding connection
F	Position of door lock

3.5.3. Internal Features



A	Cable gland for fibre optic cable connections, F/O Downlink I/P and Uplink O/P
B	Fibre Optic Transceiver Module (see 3.6.2. below)
C	SC/APC F/O port
D	30dB Coaxial Attenuator
E	Digital Signal Processing Module (see 3.6.5. below)
F	Multi Carrier Power Amplifier (MCPA)
G	Duplexer Module (see 3.6.7. below)
H	7/16DIN port, RF Downlink O/P and Uplink I/P
I	Control Module (see 3.6.1. below)
J	Distribution Board (see 3.6.9. below)
K	Reference Generator Board (see 3.6.8. below)
L	External Interface Board (see 3.6.4. below)
M	Terminal block for 115V AC power connection
N	PSU module 115V (see 3.6.3. below)
O	External Interface cable and terminal block (see 3.6.4. below)

3.6. Internal Modules

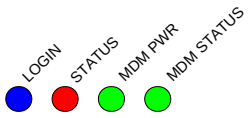
3.6.1. Control Module

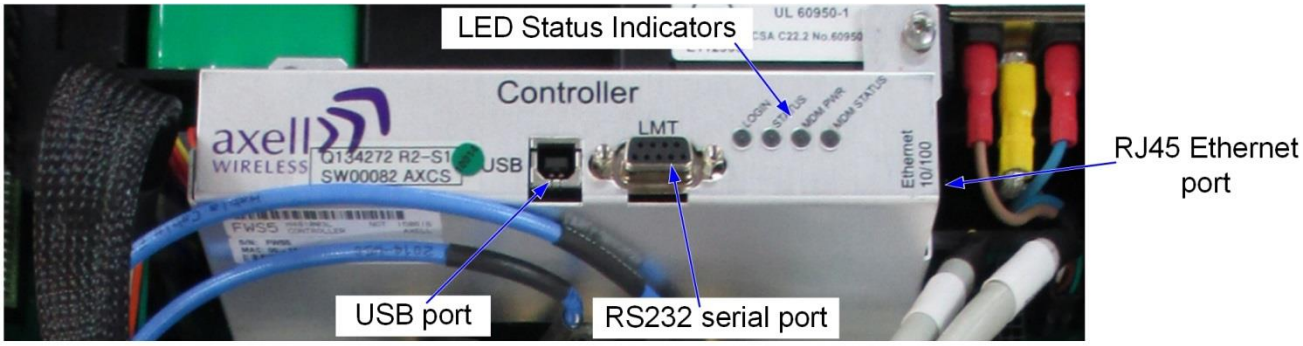
The Control Module is based upon a Linux processor and software, which is used to control and monitor the active components within the repeater. A Web browser accessed GUI allows the operator to enter the required channel frequencies and to adjust the Gain and Squelch settings.

The Control Module performs the following functions:

- Provides an RS232 and USB port for local connection enabling local interrogation of alarm data by PC/laptop.
- Provides an Ethernet port for remote reporting/interrogation of alarm data by PC/laptop.

The controller also provides a summary alarm output upon the failure of any active device and has four LEDs which give information regarding the status of the Control Module.





Blue LED - Login		
	Quick flash	Control Module switched on, someone logged in locally and/or remotely
	Off (except for a quick flash every 10th second)	Control Module switched on, no one logged in
	Off (permanent)	Control Module switched OFF

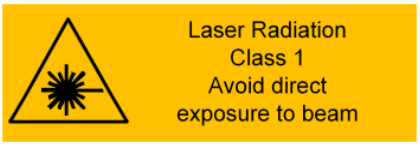
Red LED - Status		
	Quick flash	Control Module switched on, one or more errors/alarms detected
	Off (except for a quick flash every 10th second)	Control Module switched on, status OK
	Off (permanent)	Control Module switched off

As the BSF0060 repeater is not configured for Modem communication the two LEDs "Modem Power" and "Modem Status" do not fill any function and can be disregarded.

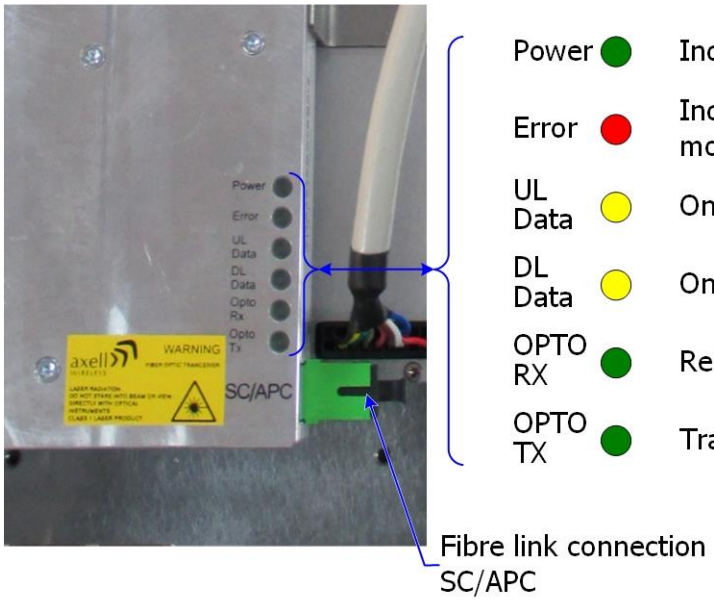
3.6.2. Fibre Optic Transceiver Module

The Fibre Optic Transceiver Module provides Optical to RF signal conversion in the Downlink direction and RF to Optical signal conversion in the Uplink direction. As downlink and uplink optical signals are combined using WDM, only one fibre link is required. The Fibre Optic Transceiver Module in the repeater works in parallel with a corresponding unit in an OMU at the master site which is linked via the optical fibre connection (SC/APC port). A pilot tone can be sent between the Fibre Optic Transceiver Module in the OMU and the repeater to define the loss in the fibre. Based on this information the repeater automatically adjusts the attenuation to compensate for the fibre loss.

Caution! Class 1 Laser Product.
Un-terminated optical receptacles may emit laser radiation.
Do not stare into the beam or view with optical instruments.



On the Fibre Optic Transceiver Module there are six LED indicators; one for power status, one for error, two for the data communication and two for the Optical signals.



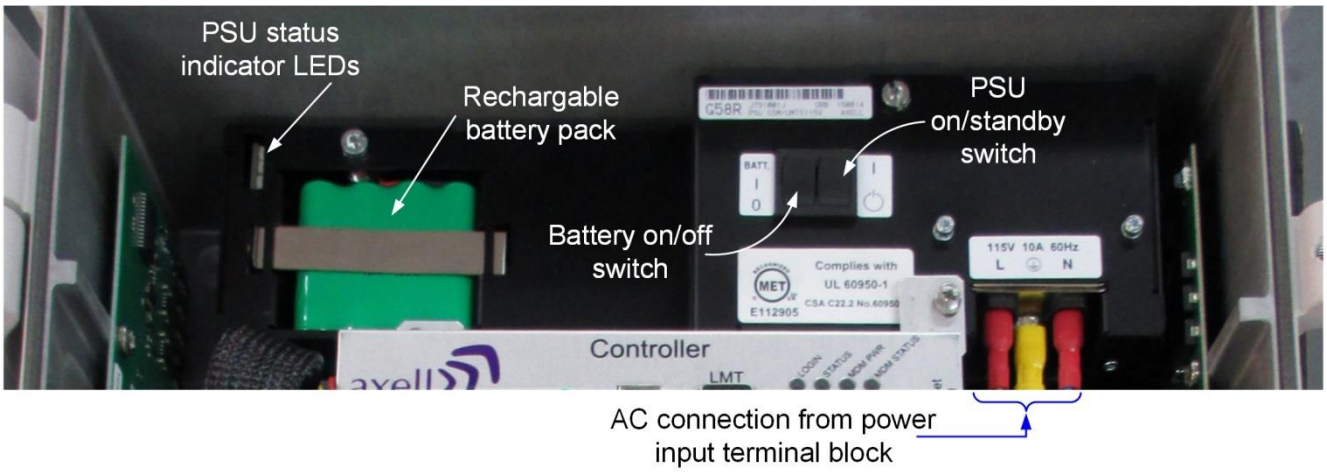
LED 1, Power, Green	
On	Unit is powered on
Off	Unit has no power
LED 2, Error, Red	
On	Error detected
Off	No error
LED 3, UL Data, Yellow	
On	Communication via the fibre optic module is ongoing in the uplink direction
Off	No communication
LED 4, DL Data, Yellow	
On	Communication via the fibre optic module is ongoing in the downlink direction
Off	No communication
LED 5, Optical RX, Green	
On	Input fibre optic level OK
Off	Input fibre optic level below threshold
LED 6, Optical TX, Green	
On	Output fibre optic level OK
Off	Output fibre optic level below threshold

3.6.3. PSU Module

The Repeater's internal PSU Module is a high efficiency 300w switched mode device that converts the 110V AC input to a range of DC voltages (28V, 15V and 6.45V) to power the internal active modules. The PSU Module has a switch which allows it to be set in the "on" or "standby" position; setting the switch to standby will disable the repeater.

Note! In the standby position the PSU module and repeater are still connected to the AC power supply but the PSU module is not operational. The PSU module on/standby switch is located on the top of the PSU module.

The PSU Module is fitted with a rechargeable battery pack which will provide the Control Module with enough capacity to send an alarm in the event of AC power failure. The PSU Module also includes charging and supervision electronics for the battery backup function. The battery can be switched on and off. The switch is placed adjacent to the PSU On/Standby switch on the top of the PSU module. At delivery the back-up battery is connected; the battery is replaced by lifting the battery pack out of its recess in the PSU module and disconnecting the cable.



LED 1: Input Power

LED 2: +6V

LED 3: +15V

LED 4: +28V

The PSU module has four LED Status Indicators, A green LED indicates that the input power to the PSU is functioning correctly.

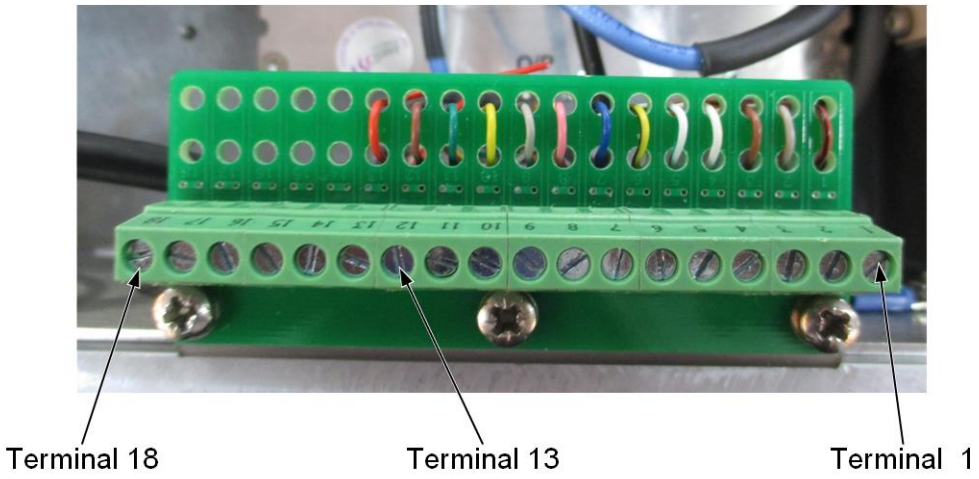
Three red LEDs indicate the health of the three output voltages supplied by the PSU.

LED 1, Input Power, Green	
Slow flash	Power supply unit operating normally
OFF	Power supply unit not operating
LED 2, +6V, Red	
Slow flash (every 10 seconds)	+6V power supply operating normally
Quick flash	+6V power supply not operating or operating with malfunction
LED 3, +15V, Red	
Slow flash (every 10 seconds)	+15V power supply operating normally
Quick flash	+15V power supply not operating or operating with malfunction
LED 4, +28V, Red	
Slow flash (every 10 seconds)	+28V power supply operating normally
Quick flash	+28V power supply not operating or operating with malfunction

3.6.4. External Interface Board, Cable and Terminal Block

The repeater is equipped with an external alarm interface board. The connector terminal block for the external alarms is located at the bottom of the repeater.

Connect the alarm cords to the terminal block according to the layout below (terminals 14 – 18 are not used).



1	External alarm 1A	10	Alarm 0V
2	External alarm 1B	11	Relay Output 1A
3	External alarm 2A	12	Relay Output 1B
4	External alarm 2B	13	GND
5	External alarm 3A	14	Not used
6	External alarm 3B	15	Not used
7	External alarm 4A	16	Not used
8	External alarm 4B	17	Not used
9	Alarm +15V	18	Not used

External Alarm:
Four external alarm sources can be connected to the repeater; the alarm operating voltage must be between 12 and 24VDC.

Alarm polarity can be configured:

- Active-low - when there is no voltage the alarm indicator will show a fault.
- Active-high - an applied voltage of between 12 and 24 V will cause the external alarm indicator will show a fault.

The repeater can supply +15 VDC to an external alarm source through terminals 9 and 10. The maximum allowed load is 100mA.

Relay Output:
The Relay Output (terminals 11 and 12) can be connected to an external device to indicate an alarm. The output can be configured to trigger on any number of internal and external alarms. The maximum current that can be supplied is 100mA.

3.6.5. Digital Signal Processing (DSP) module

The DSP module is a wideband RF module that digitises factory set segments of the full bandwidth, the setting of the segments of spectrum is performed at factory initialisation and is not field adjustable. Once the equipment leaves the factory its operating bandwidth is already set by the initialisation and the external duplexing filters used to separate and define the required Part 90 Tx and Rx frequency bands.

The DSP module provides the initial gain in the DL path and the entire gain in the UL direction. Internal ceramic filters provide UL and DL selectivity, in addition it provides attenuation control and level control in both the UL and DL directions, the overall repeater has a defined maximum output level, if the input signal amplified by the gain set exceeds the set output limit, an ALC loop is activated in the DSP module which has a range of 20dB. This ALC ensures that the amplifier does not add distortion to the radio signal.

3.6.6. Multi Carrier Power Amplifier (MCPA)

The Downlink output MCPA provides 37dB of gain and has a P1dB of 47dBm and an IP3 of 68dBm. The MCPA utilises high linearity class A techniques to minimise Intermodulation generation in the presence of multiple carriers. The amplifier output power is limited to 36dBm (4W) composite power to ensure high linearity to keep spurious products to a minimum.

3.6.7. Bandpass Duplexer Module

The bandpass duplexer module is connected to a common output/input port for single antenna operation. The purpose of the duplexer is to ensure that the equipment operating bandwidth is limited to the band of frequencies required to be amplified/repeated. The filters in the duplexer ensure that noise and any Intermodulation is limited to within the operating transmission band. The filters must prevent any noise reaching the antenna port at the receiver frequencies as any noise at this point will affect the ability to receive. The receiver input filter is used to ensure that only the required input band of frequencies is presented to the DSP module. The filter also ensures that the high level Downlink transmit output does not cause overload damage by blocking the receiver's ability to detect the wanted Uplink input frequencies.

3.6.8. Reference Generator Board

The Reference Generator is used to provide an accurate stable 10 MHz Reference signal to the DSP module to ensure that the channel selectivity is centred on the wanted channel frequency.

3.6.9. Distribution Board

The Distribution board is used to connect the DC power and the RS485 control signals between the associated modules and the PSU/Control Module.

4. Antenna and Repeater Installation Requirements

This chapter provides information on the Remote installation site requirements, on the installation requirements of the antennas, the specifications of the service antennas suitable for operation with this remote and RF and F/O cable requirements.

4.1. BSF0060 Installation Requirements

4.1.1. Safety Guidelines

Before installing the Repeater, review the following safety information:

- Follow all local safety regulations when installing the Repeater.
- Only qualified personnel are authorized to install and maintain the Repeater.
- Ground the Repeater with the grounding bolt located on the external lower side of the Repeater.
- Do not use the grounding bolt to connect external devices.
- Follow Electro-Static Discharge (ESD) precautions.
- Use low loss cables to connect the antennas to the Repeater.

Class 1 Laser
This product is equipped with class 1 lasers, as per definition in EN 60825-1.

CAUTION!	Un-terminated optical receptacles may emit laser radiation. Do not stare into the beam or view with optical instruments

4.1.2. Criteria for Repeater Installation Location

The following criteria should be considered when selecting the Repeater installation site location:

- Application type
- General surroundings
- Available installation
- Install the Repeater in a shielded, ventilated, and easy-to-reach area.
- Verify that there is a minimum of a 50 cm (20”) radius of space around the Repeater, enabling easy access to the repeater for maintenance and on-site inspection.
- Distance from antenna site - It is recommended that the installation location be as close as possible to the antenna site in order to maintain the cable loss to a minimum.
- The Repeater is convection cooled so airflow and alternation should be possible.
- Follow Electro-Static Discharge (ESD) precautions.
- Install the Repeater close to the service area to monitor the output power.
- Use low loss cables to connect the antennas to the Repeater.

4.1.3. RF Cable Installation Guidelines

Required:

- For all coaxial connections to/from the Repeater - high performance, flexible, low loss 50Ω coaxial communications cable.
- All cables shall be weather-resistant type.
- Cable length - determined by the Repeater installation plan. When calculating the cable length, take into account excess cable slack so as not to limit the insertion paths.

4.1.4. F/O Cable Installation Guidelines

Use the following over the complete link between the Remote and OMU:

- Use SC/APC connectors (8 degree angle) for all connections
- Cable length - determined by the Remote installation plan. When calculating the cable length, take into account excess cable slack so as not to limit the insertion paths.

Recommended fiber-optic cable:

- Single-mode type fiber 9/125

4.2. Service Antenna Requirements

WARNING!

a. The installer is held accountable for implementing the rules required for deployment.
b. Good engineering practice must be used to avoid interference.
c. Output power should be reduced to solve any IMD interference issues.

The Service antenna type (i.e. the antenna feeding the mobile/remote units) depends on the design of the DAS.

4.2.1. Required Antenna Information

The following antenna requirements, specifications and site considerations should be met:

- Type of installation – DAS/Radiating Cable
- Service area type and size
- Antenna type and characteristics
- Height
- Length and type of coaxial cable required for connecting the antenna to the Repeater and the attenuation.

4.2.2. Indoor Installations

4.2.2.1. Recommended Antennas

The following describes the requirements for an omnidirectional mobile used for indoor applications.

Specifications:

- One or a combination of the following antennas can be used: Ceiling Mount Patch antenna, Wall Mount Patch antenna, Corner Reflector.
- Choose an antenna with high side lobe attenuation which enables maximum isolation from other co-located antennas.

Equation (1) - Max SERVICE antenna gain

Max SERVICE antenna gain (dBi) = 39.1 – (37 dBm - # of antennas in dB – cable losses in dB).

For example:

No. of Antennas	Cable Losses	Max Allowed Antenna Gain
4	3	39.1 - (37-6-3) = 11.1 dBi
1	3	39.1- (37-0-3) = 5.1 dBi
10	3	39.1- (37-10-3) = 15.1 dBi

Typical Antenna Types:

- Indoor Dome 2.1 dBi - beam width 360°
- Indoor Panel 4.2 dBi - beam width 106°
- Radiating Cable Typically < -50 dBi

4.2.2.2. Recommended Splitters and Couplers

Axell Wireless can supply a comprehensive range of splitters and Couplers to aid the installation of the DAS system. Typical specifications as below:

Splitter Part Numbers	90-851202	90-851203	90-851204
Frequency Band	300 - 500 MHz		
Split	2 way	3 way	4 way
Max Insertion Loss	0.3 dB	0.5 dB	0.4 dB
Split Loss	3 dB	4.8 dB	6 dB

Coupler Part Number	90-852306	90-852310	90-852315	90-852320
Frequency Band	300 - 500 MHz			
Coupling	-6 dB ±1.0 dB	-10 dB ±1.0 dB	-15 dB ±1.0 dB	-20 dB ±1.0 dB
Max Mainline Loss	1.7 dB	0.8 dB	0.4 dB	0.22 dB

4.2.2.3. Installation Criteria

Determine the antenna installation configuration, according to the transmission requirements and the installation site conditions.

Installation requirements:

- An indoor antenna should be installed at a convenient location. It should be free of metallic obstruction.

Install the Service Antenna at the designated height and tune it roughly toward the Service coverage area.

4.2.2.4. Service (Mobile) Antenna Installation Criteria

Determine the antenna installation configuration, according to the transmission requirements and the installation site conditions.

Installation requirements:

- An indoor antenna should be installed at a convenient location. It should be free of metallic obstruction.
- Install the Service Antenna at the designated height and tune it roughly toward the Service coverage area.
- Installation of this antenna must provide a minimum separation distance of 50 cm from any personnel within the area to comply with FCC requirements and a minimum separation distance of 2.7 m to comply with IC requiements.

4.3. RF Cabling Requirements

- For all coaxial connections to/from the Repeater - high performance, flexible, low loss 50Ω coaxial communications cable.
- All cables shall be weather-resistant type.
- Cable length - determined by the Repeater installation plan. When calculating the cable length, take into account excess cable slack so as not to limit the insertion paths.
- Make sure that cable and connector are compatible. Using cables and connectors from the same manufacturer is helpful.
- All connectors must be clean and dry
- Waterproof all outdoor connections using silicone, vulcanizable tape or other suitable substance as moisture and dust can impair RF characteristics.
- Make sure enough room has been allocated for the bending radius of the cable. RF cables must not be kinked, cut or damaged in any way
- Connect the RF cable to the antenna tightly but without damaging threads
- Fasten cables tight to cable ladder or aluminum sheet
- For short length of feeder cables use ½ ", for longer feeder cables use 7/8". Chose thicker coax cables for lower attenuation. Minimize the length of the coax cables to reduce the attenuation
- Use jumper cable for easy installation. The RF Coaxial cable can be substituted at each end with a jumper cable.

5. Repeater Installation

5.1. Location Criteria

- Wall compatibility - check the suitability of the wall on which the BSF0060 is to be to be fitted.
- Plan mount - check the actual fixing centres (see below) and overall dimensions of the BSF0060 enclosure. The BSF0060 is supplied with two wall mounting brackets; when the BSF0060 is mounted on these brackets adequate ventilation is provided between the BSF0060 and the wall to which it is fixed.
- Plan connection cable clearances - the Optical, RF and power connections located on the underside of the BSF0060 will need at least 300mm vertical clearance below the BSF0060 to enable the connections to be made. The minimum bend radius for Optical and RF cables must not be less than the recommendations made by the cable manufacturer. Plan the cable runs and ensure adequate space is available.
- Allow for door opening - ensure that there is sufficient space at the front of the BSF0060 to allow the door to be fully opened and for maintenance engineers to get access to the unit with test equipment such as a spectrum analyzer. Allow an additional 500mm of space in front of the BSF0060 when the door is fully open.
- Allow for heat dispersion - Mount the repeater so that heat can be dispersed from it.
- The repeater wall mounting kit ensures an optimum airflow between the wall and the repeater.) Do not block this air channel as it will cause the MTBF of the repeater to drop dramatically, or even in the worst case cause the repeater to fail completely. If possible, use a wall in the shade to minimize the overall sun loading. If sufficient shielding cannot be obtained, an additional sun shield should be mounted.

Example of a sun shield

5.2. Unpacking

Upon receiving the BSF0060 Repeater package perform the following:

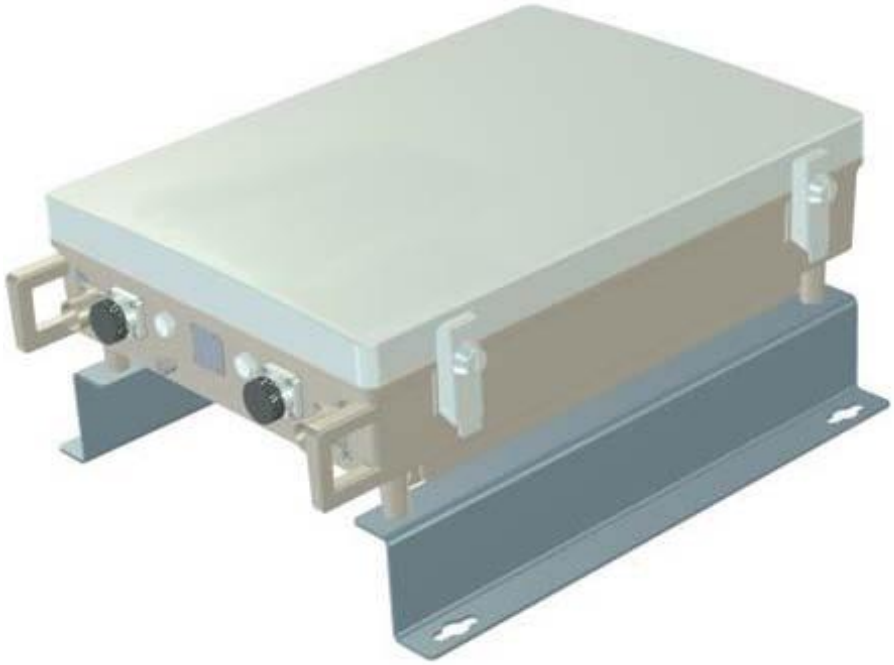
- Examine the shipping container for damage before unpacking the unit.
- Perform a visual inspection to reveal any physical damage to the equipment.
- Verify that all of the equipment (listed below) is included. Otherwise contact Cobham Wireless.

The BSF0060 Repeater package is shipped with the following equipment:

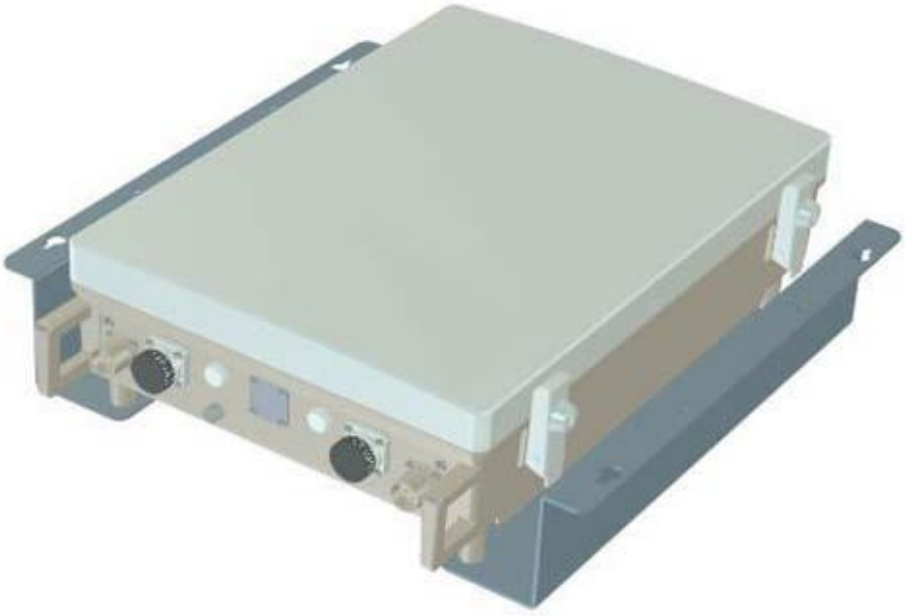
<table>
<tr><td>BSF0060 Repeater</td><td colspan="2">  </td></tr>
<tr><td>CD containing User's Manual and USB driver</td><td colspan="2">  </td></tr>
<tr><td>Mounting Brackets</td><td colspan="2">  </td></tr>
<tr><td>Cable protection KPL</td><td colspan="2">  </td></tr>
<tr><td rowspan="5">Additional (supplied) installation components:</td><td>Qty.</td><td>Description</td></tr>
<tr><td>4x</td><td>M8x12 bolts for securing the Repeater to the brackets</td></tr>
<tr><td>1x</td><td>Insex tool for bolts</td></tr>
<tr><td>1x</td><td>Fiber Conduit inlet hose fitter (may be pre-assembled)</td></tr>
<tr><td>1 x</td><td>Key</td></tr>
<tr><td>Optional equipment</td><td colspan="2">AC Cable [30 ft.] – Long cable for AC power
Alarm Cable [30 ft.] – Long cable for External Alarms Input</td></tr>
</table>

5.3. Bracket Assembly

The repeater can be mounted on the wall or in a 19 inch rack.
Using the 4 provided M8 Fixing bolts and 4 spring washers assemble the brackets as illustrated below – according to your required mounting location (wall or rack).

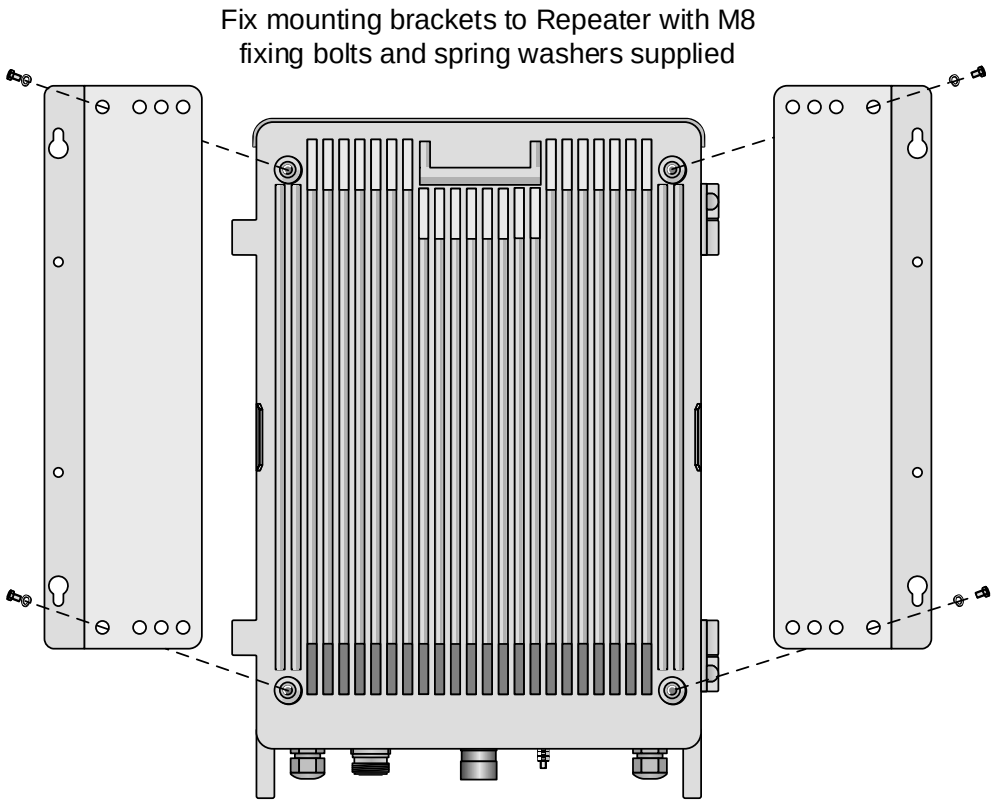


Wall mount bracket position

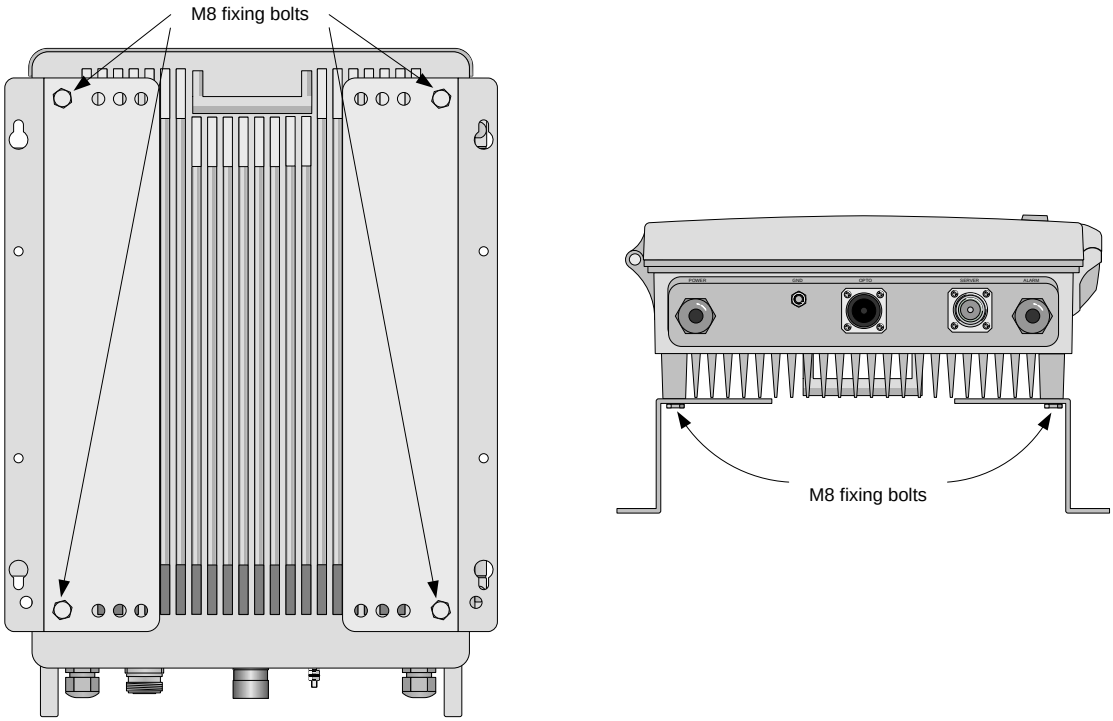


Rack-mount bracket position

Using the four M8 bolts and spring washers supplied fix mounting brackets to the Repeater



Fix mounting plates to Repeater



mounting plates fixed to Repeater

5.4. Mounting the Repeater onto a Wall

WARNING!	WARNING! Due to the weight of the Repeater, it is NOT recommended to fix the repeater to a hollow wall

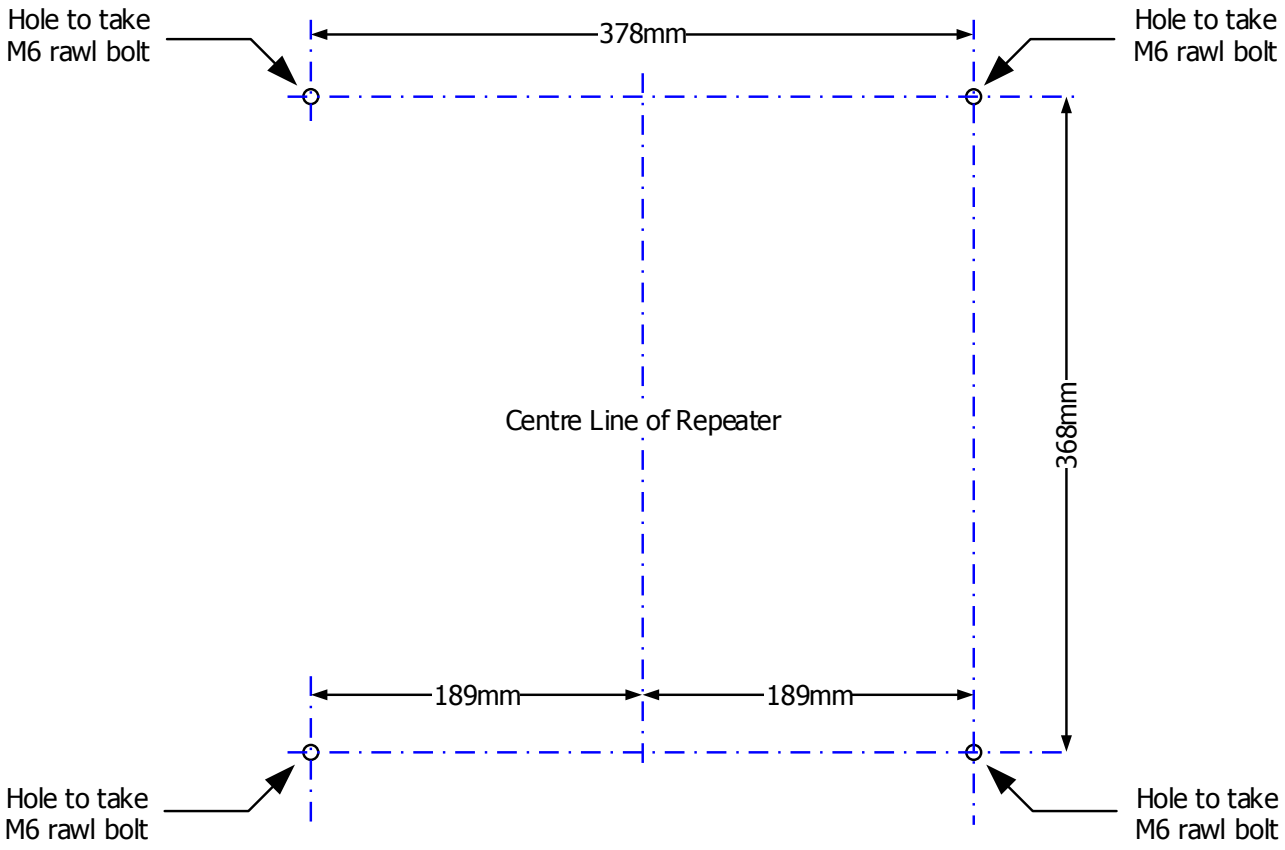
Caution: It is recommended that when lifting, two persons handle the equipment as depending upon the configuration the Repeater weighs between 20 and 33 kg

Check the suitability of the wall on which the Repeater is to be to be fitted. At this point it is recommended that the actual fixing centres (see below) and overall dimensions of the Repeater enclosure are checked. The Repeater is supplied with two wall mounting brackets; when the Repeater is mounted on these brackets adequate ventilation is provided between the Repeater and the wall to which it is fixed.

The Optical, RF and power connections located on the underside of the Repeater will need at least 300mm vertical clearance below the Repeater to enable the connections to be made. The minimum bend radius for Optical and RF cables must not be less than the recommendations made by the cable manufacturer. Plan the cable runs and ensure adequate space is available.

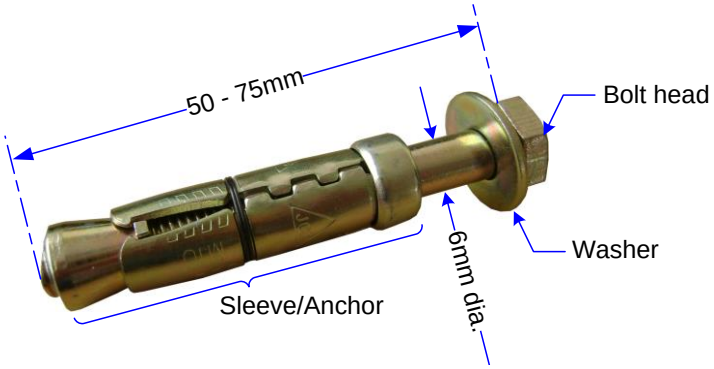
Ensure that there is sufficient space at the front of the Repeater to allow the door to be fully opened and for maintenance engineers to get access to the unit with test equipment such as a spectrum analyser. Allow an additional 500mm of space in front of the Repeater when the door is fully open.

Fix M6 Rawlbolts or similar (50 to 75mm in length) into the wall at the dimensions as illustrated in figure 1 below using equipment as specified by the fixing manufacturer. A recommended method is set out below. Care must be taken to ensure the alignment of the four fixings. A spirit level or plumb line should be used to ensure horizontal/vertical alignment.



Fixing centres

The Repeater affixed to its wall mount brackets should be fixed to a solid wall (these include brickwork, blockwork, and concrete.); due to the weight of the Repeater, fixing to a hollow wall is not recommended. Always check that there are no pipes or cables hidden in the wall beneath the area to be drilled. Various pipe and cable detectors are available to check this.

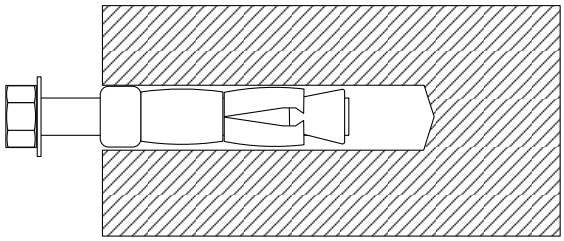


M6 rawlbolt of the type recommended to fix Repeater and mounting plates to a wall.

To provide secure fixing to a solid wall, the most common method is drilling and plugging. The size of fixing is dependent on the item to be fixed and the nature of the wall, The Repeater should be fixed with mild steel, M6 (x 50mm to 75mm) rawlbolts or similar.

First mark out on the chosen wall the fixing centres of the repeater (see above.).

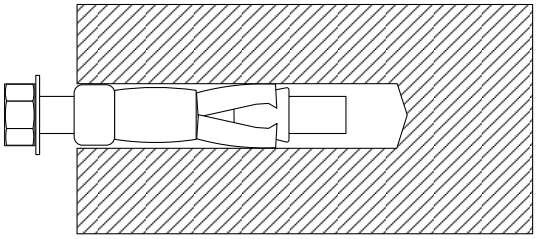
Mark and drill the wall with the correct size masonry bit as specified by the fixing manufacturer.



It is good practice to wear goggles to protect your eyes from flying debris when using power tools.

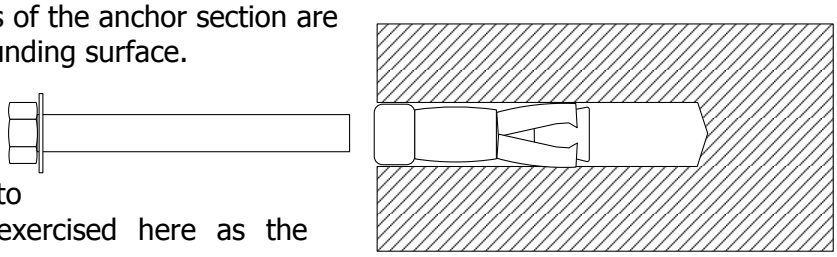
Hold the drill bit against the mark and begin drilling slowly so that the bit does not wander from the position.

The wall should be drilled to a depth which is sufficient to accommodate the full length of the fixing.



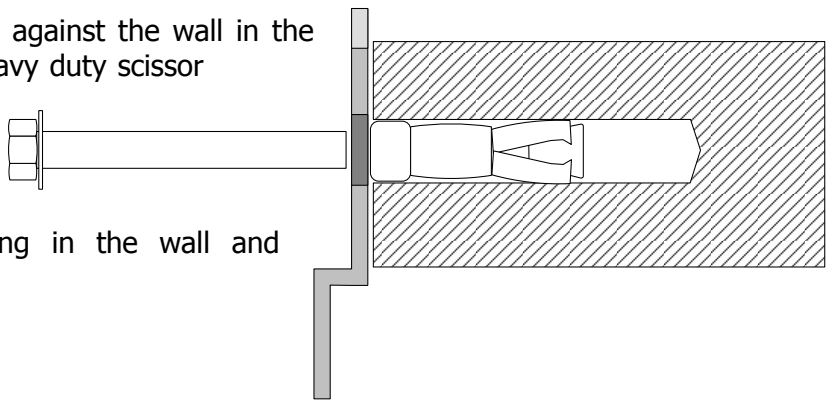
Insert the fixings so that the top of the sleeve/anchor section is level with the wall surface, gently tighten the bolt by hand so that the anchor section of the fixing expands and grips the inside of the hole.

As the bolt pulls its way in, the sides of the anchor section are forced outwards, gripping the surrounding surface.



When all four fixings are in place, carefully withdraw the bolt sections and offer up the Repeater to the wall. Great care should be exercised here as the repeater is very heavy.

When the Repeater held in position against the wall in the chosen position (a suitably rated heavy duty scissor lift table/trolley may be suitable for this operation) carefully insert the fixing bolts through the mounting lugs of the Repeater and into the sleeve/anchor sections of the fixing in the wall and tighten the bolts.



6. Initial Setup

Note! These are General instructions and the illustrations may not portray the specific repeater type.

The initial setup consists of the following procedures:

- Opening an RMC Session
- Assigning the Repeater general parameters: Name and clock
- Configuring the RF

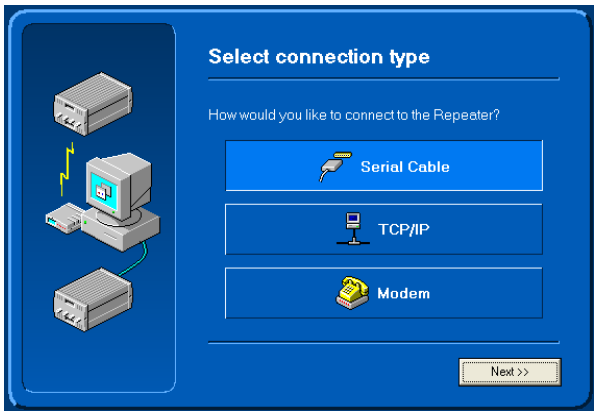
6.1. Opening an RMC Session

1. Install the RMC application supplied on the Setup CD, on the computer used to open the session to the Repeater.

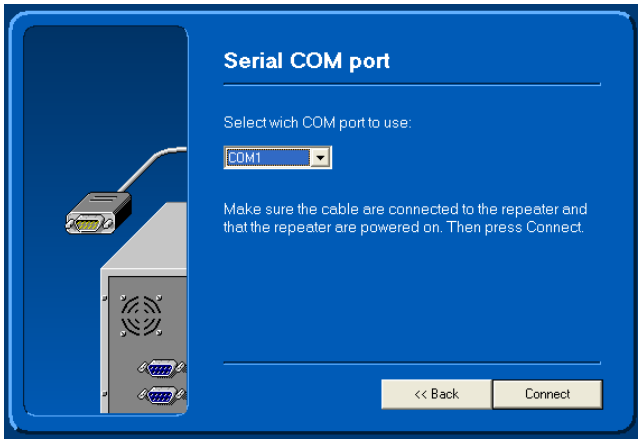
2. Connect the RS232 cable between the computer and the LMT/Ethernet port on the control module on the front panel of the repeater shelf

3. Run the application on your computer.

4. Select Serial cable Connection Type.

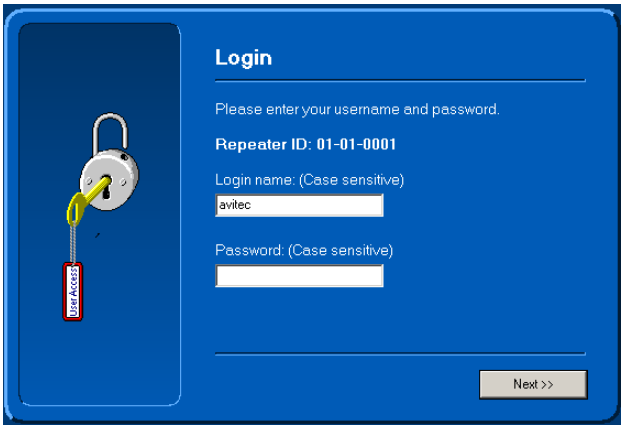


5. Click Next. The following dialog appears.



6. Select the COM port corresponding to the communication port on your computer to which the RS232 cable is connected and click Connect.

7. The Login dialog appears. Note that several users at a time can be logged on to a Repeater, for instance one locally via the RS232 interface and one remotely via modem or Ethernet.

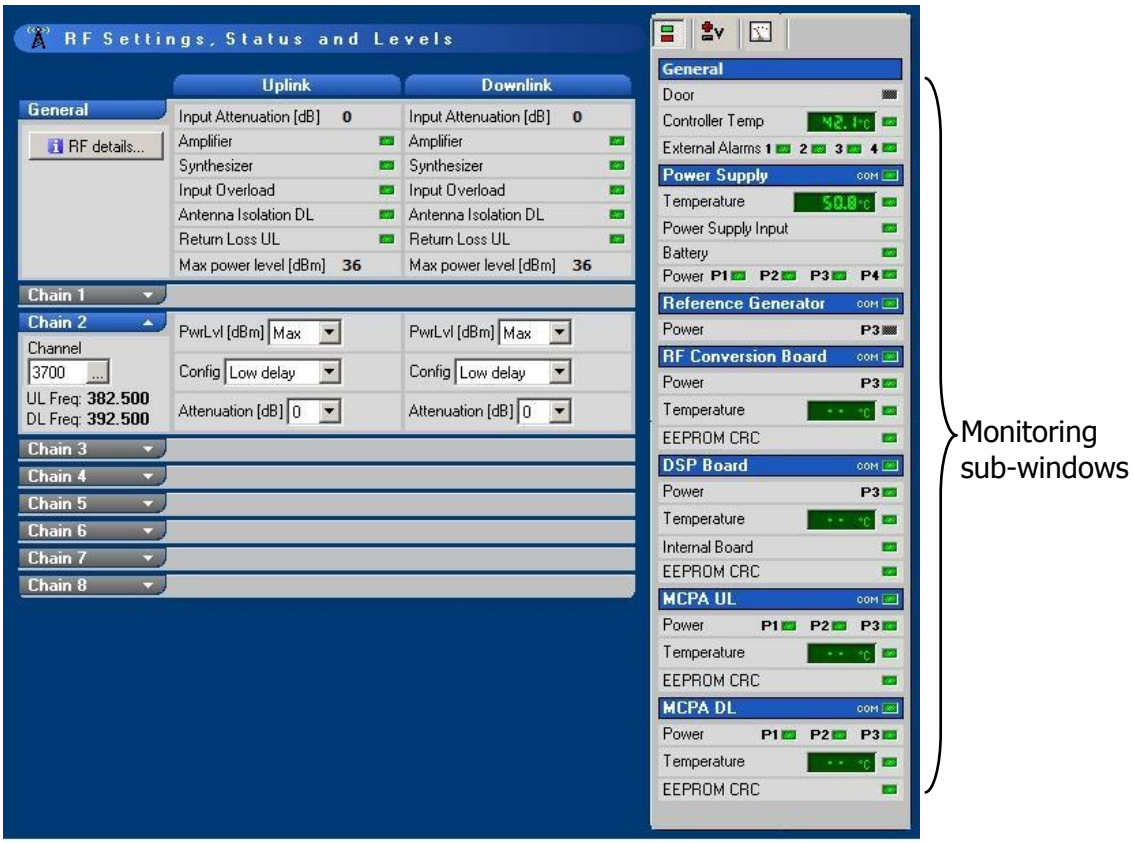


8. Enter the default login values as follows:

Login Name	Password
avitec	AvitecPasswd
case sensitive	case sensitive

Note! Do not use the number pad when entering numbers.

9. The RMC Main window appears in Console mode.



The console mode displays a large number of repeater parameters and contains a number of console pages. The viewed information and parameters displayed correspond to the connected repeater.

6.2. User Access

There is one default user name and password defined for the repeater. (More than one user at a time can be logged in).

User Name	Password
avitec	AvitecPasswd

Note: Both the user name and the password are case sensitive.

The password can be changed and new accounts be added once a logon has been made. This is made in terminal mode. Please refer to the document "CSR-CSFT438 Commands and Attributes". A user will be automatically logged out after a pre-determined period of inactivity. This time period can be defined via the RMC.

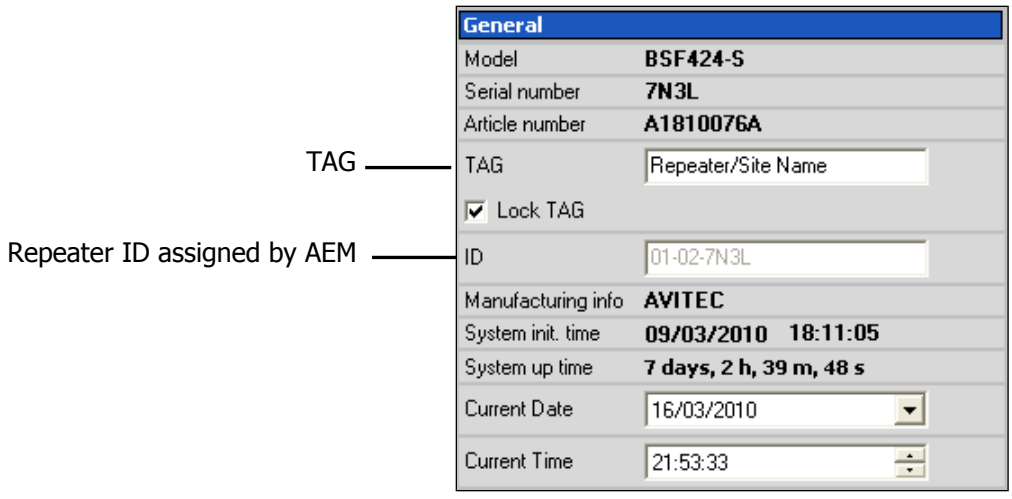
6.3. Define Repeater General Info

When the repeater is integrated into the Active Element Manager the unit is assigned a repeater ID, which is a unique identifier in the repeater network. This ID is used by the AEM to keep track of the repeaters in the AEM database.

The repeater can also be assigned a nickname (TAG) which can also be easily read by the AEM during AEM integration, providing the AEM operator a clear identification of the site.

To assign general parameters

1. In the left pane, select the Configuration window option and choose Product. The General dialog appears.



2. In the Tag field, assign the Repeater a name (up to 30 characters) that indicates the location of the Repeater.
   The repeater tag can be locked (enable Lock TAG option) so that the tag cannot be accidentally modified from the AEM side.

3. Set the Repeater Current Date and Current Time. These will be to timestamp events.

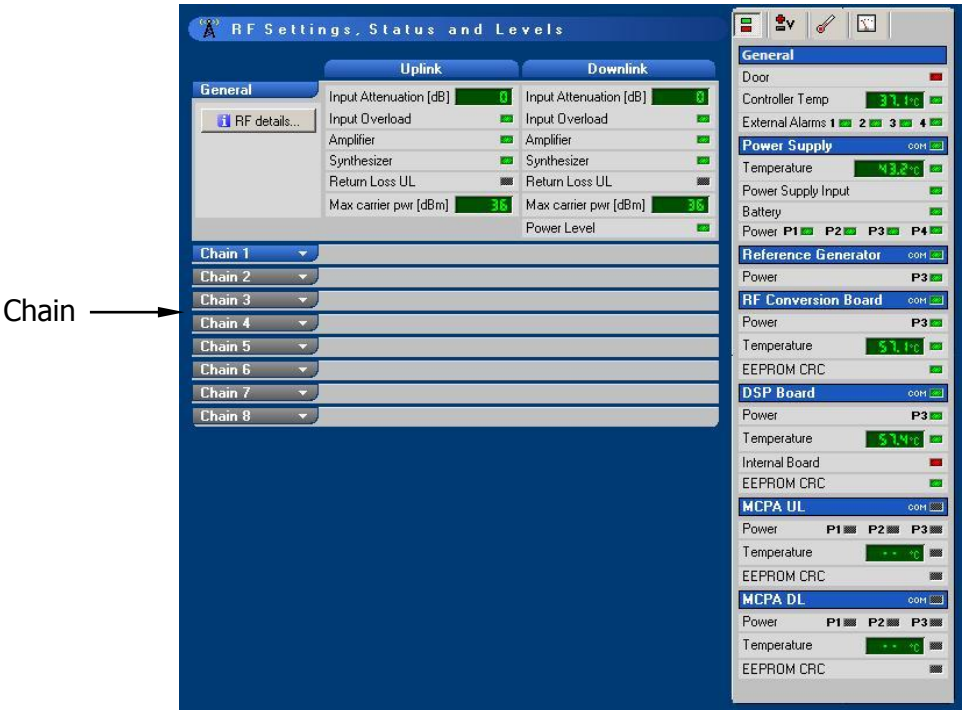
Note! Do not assign an ID.
The AEM will do this automatically when the repeater is integrated in the AEM.

6.4. Configuring RF Parameters

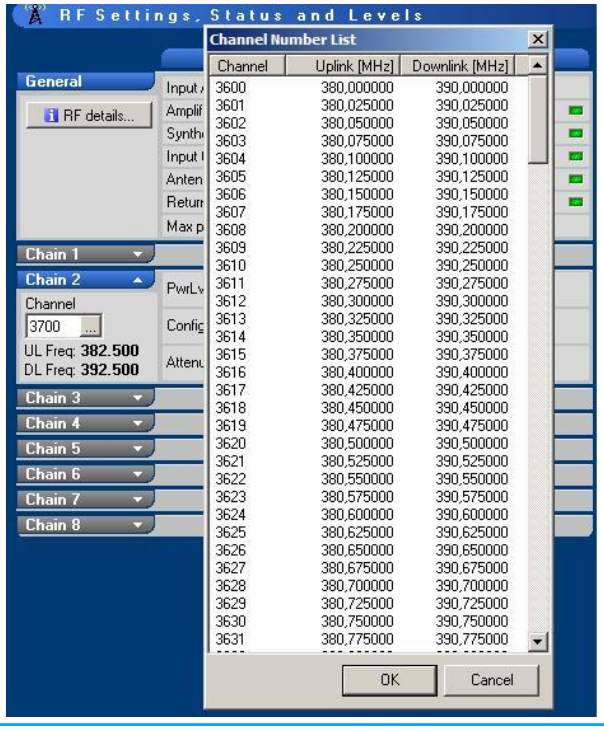
The local setup procedure consists of verifying online communication with the connected unit, defining the repeater channels and configuring attenuation levels and DL and UL chains.

To configure RF parameters

1. In the left pane, select the RF/Status window option. The RF Settings, Status and Levels pane appears.



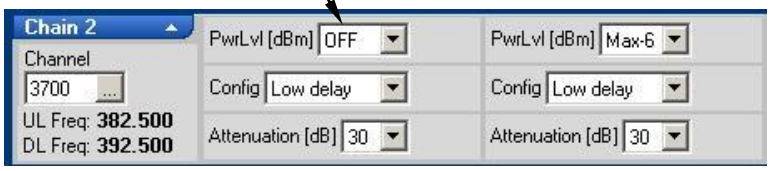
2. Define the channels to be used:
   - Select an active Chain (appears in blue).
   - Open the Channel list and select a channel and click OK.



3. Set the D/L and U/L output power levels in the corresponding fields:

- The maximum power level can be set individually for uplink and downlink of each channel.
- The level can be set in 1 dBm steps from maximum power "Max" to maximum power minus 9 dBm "Max-9".
- The Max. power level depends on the number of chains used (decreases with each additional chain).
- The power level can also be set to OFF, meaning that no output power is transmitted out in the chain.

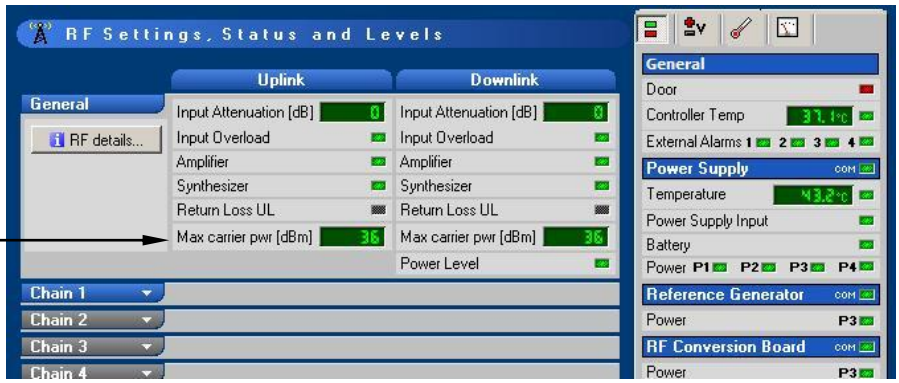
Output power level



Note! Verify that the power levels for the inactive chains are set to **OFF**.

The current value can be read in the top part of this screen (36 dBm in example below).

Current measured power level (depends on no. of chains used)

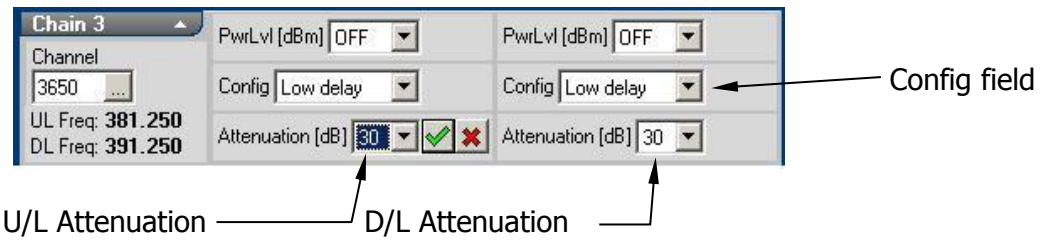


4. In Config field, select Low Delay or High Selectivity for the U/L and D/L frequencies.

5. In the Downlink:

- Verify that the Return Loss is approximately 10dB, indicating the antenna is installed correctly. (The Return Loss measures the reflected signal on the Server Antenna port of the repeater. If the value is approximately 3dB, either the port is open or check the antenna installation.).
- Set attenuation to maximum value.

Note! The values shown in the figure below are for example only.



- Lower the Attenuation level step by step until the desired output power level is reached. In this example +30 dBm. (Zero attenuation = maximum gain).

6. In the Uplink, set the Attenuation 2dB higher than in the downlink path.
Since the base station is more sensitive than a mobile unit there may be less signal gain from the mobile unit in to the base station (U/L) than in the opposite direction. The uplink attenuation can be adjusted more accurately later on, once the drive test signal measurements have been completed.

6.5. Configuring External Alarms and Relay

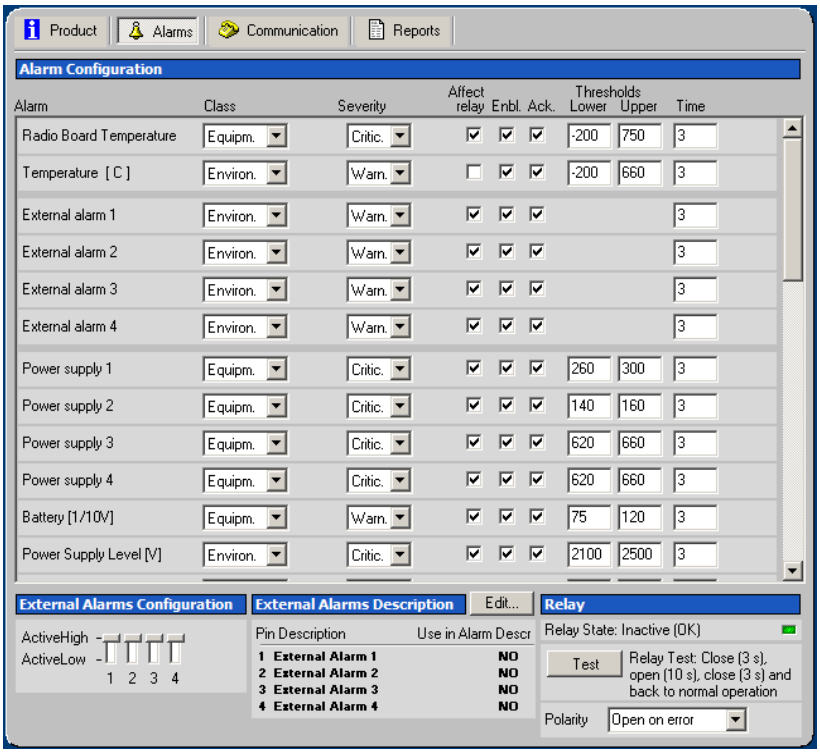
This section describes how to define set the external alarms to "active high" or "active low." You can also set the delay time (in seconds) in which a fault can be detected before an alarm is generated.

6.5.1. Configuring External Alarms

To configure the external alarms

1. In the RMC Main window, select the Configuration window option and click on Alarms. The External Alarms configuration options are located at the bottom of the screen.

External alarms



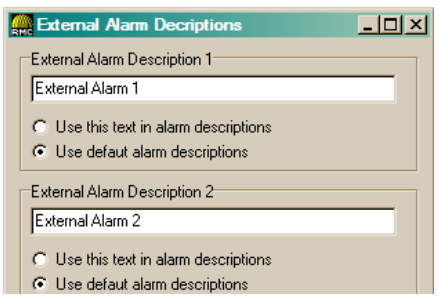
1. In the External Alarms Configuration area, set the levels of each alarm:

- Active High – voltage triggers alarm
- Active Low – no voltage triggers alarm

2. Assign a description to each relevant alarm:

In the External Alarms Description area, click Edit.

Assign a description to each relevant alarm (up to 19 characters).



6.5.2. Configuring and Testing the Relay

This section describes how to set the relay activation and how to test the Relay function.

Note! The relay status is not affected by the login / logout alarm parameters.

For installation testing purposes, it is possible to test the open / close function of the relay. This test procedure makes sure the relay is closed for 3 seconds, then opens for 10 seconds, and finally closes for 3 seconds before going back to original state.

1. In the RMC Main window, select the Configuration window option. The Relay configuration options are located at the bottom of the screen.

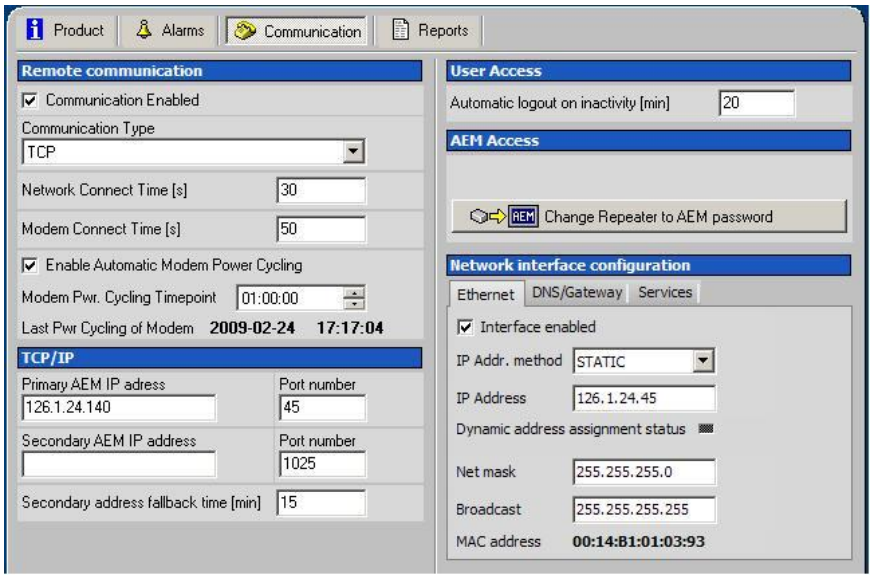
2. The relay can be set to close or open to indicate an alarm. This can be changed by changing the polarity.

6.6. TCP/IP Communication Configuration – for Remote Monitoring

A TCP/IP communication is run over a company's network. Therefore each company needs to define the details regarding the configuration, IP addresses, etc.

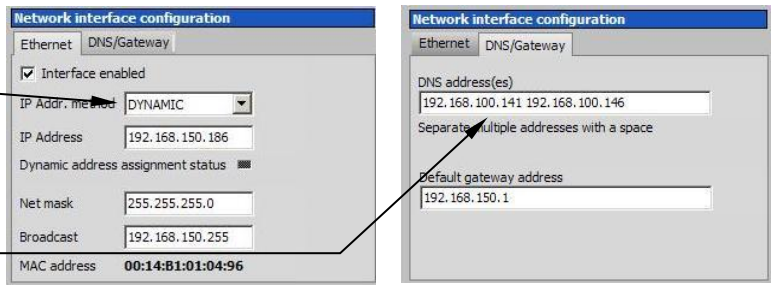
Note! For more information please refer to the document "Common Commands and Attributes", (available from Cobham Wireless) section 12, Network and USB Configurations.

1. Select Configuration and choose Communication. The following window appears.



2 Set the IP Address method as either Dynamic or Static.

3. Set the DNS or Gateway address.



6.7. Integration into the AEM

When the repeater has been installed at site and the remote communication has been enabled, the repeater can be integrated to the Active Element Manager. This is done by the operator of the AEM. After entering the telephone number to the repeater, the AEM dials up the repeater, downloads all the repeater parameters and statuses into a database. When all parameters have been downloaded, the AEM configures the repeater with the telephone number where alarms and reports should be sent, and optionally with a secondary telephone number where the repeater can dial in case connection to primary number fails.

When heartbeat reports and alarms are sent from the repeater to the AEM also the latest information about the status and RF-configuration is included. This means that the AEM operator always has information about the current status in the AEM database (and do not need to call the repeater to find this out).

Note! Once the repeater is integrated to the AEM, all changes to the repeater should preferably be done from the Active Element Manager in order to ensure that the database always contains correct information.

Appendix

A.1. Glossary of Terms used in this document

Repeater or Cell Enhancer	A Radio Frequency (RF) amplifier which can simultaneously amplify and re-broadcast Mobile Station (MS) and Base Transceiver Station (BTS) signals.
Band Selective Repeater	A Repeater designed for operation on a range of channels within a specified frequency band.
Channel Selective Repeater	A Repeater, designed for operation on specified channel(s) within a specified frequency band. Channel frequencies may be factory set or on-site programmable.
AC	Alternating Current
AEM	Active Element Manager (Network control and monitoring software)
AGC	Automatic Gain Control
BBU	Battery Backup Unit
BDA	Bi-directional Amplifier
BTS	Base Transceiver Station (Base Station)
B/W	Bandwidth
C/NR	Carrier-to-Noise Ratio
COMMUX	Communications Multiplexer
Critical Harness	A coaxial cable harness with components of a critical length used to minimise phase discrepancies when joining signal paths of differing frequencies.
DAS	Distributed Antenna System
DC	Direct Current
Downlink (D/L)	Signals transmitted from the BTS to the Mobiles
DSP	Digital Signal Processing
F/O	Fibre Optic
GND	Ground
ID	Identification (Number)
I/P	Input
LCX	Leaky Coaxial Cable (Leaky Feeder).
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LPA	Low Power Amplifier
Mobile(s)	Hand-portable or other "Mobile" RF Transceiver equipment
MOU	Master Optical Unit
MTBF	Mean Time Between Failures
N/A	Not Applicable
N/C (of Relays)	Normally Closed
N/O (of Relays)	Normally Open
OFR	On Frequency Repeater
OIP3	Output Third Order Intercept Point
O/P	Output
P1dB	1dB Compression Point
PA	Power Amplifier
RF	Radio Frequency
RHNC	Relative Humidity, Non Condensing
RMC	Repeater Maintenance Console (a GUI based Repeater management application)
RSA	Receiver/Splitter Amplifier
RX	Receiver (Received)
SDR	Software-Defined Radio
S/N	Serial Number
TX	Transmitter (Transmitted)
Uplink (U/L)	Signals transmitted from the Mobiles to the BTS
UPS	Uninterruptible Power Supply
VSWR	Voltage Standing Wave Ratio
WDM	Wave division multiplex
Date Format	Date Format used in this document is dd/mm/yyyy

A.2. Document Amendment Record

Issue No.	Date	Incorporated by	Section Amended	Reason for new issue
1	24/11/2015	AJS		Draft
2	22/01/2016	AJS		Issue
3	19/09/2016	AJS		Bandwidth revision
4	12/12/2016	AJS		Gain figures revision
5	14/05/2018	AJS		ISED compliance statement.