

220MHz Fibre Feed BDA Equipment

User Reference

For

Pinnacle

AFL Works Order Nō.: Q113673

AFL product part Nō.'s: 60-165801 (Fibre Fed 40W BDA)

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AMENDMENT LIST RECORD SHEET

Issue Nō.	Date	Incorporated by	Page No.'s Amended	Reason for new issue
A	19/12/05	G Dawson		Draft
AA	03/01/06	CMH		2 nd Draft
1	03/01/2006	CMH		1 st Issue
2	04/01/2006	CMH	Missing CE conformity numbers	2 nd Issue

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INTRODUCTION

Scope

This handbook is for use solely with the equipment identified by the AFL Part Number shown on the front cover. It is not to be used with any other equipment unless specifically authorised by Aerial Facilities Limited.

Purpose

The purpose of this handbook is to provide the user/maintainer with sufficient information to service and repair the equipment to the level agreed. Maintenance and adjustments to any deeper level must be performed by AFL, normally at the company's repair facility in Chesham, England.

This handbook has been prepared in accordance with BS 4884, and AFL's Quality procedures, which maintain the company's registration to BS EN ISO 9001:2000 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 to the Quality Manager.

This document fulfils the relevant requirements of Article 6 of the R&TTE Directive.

Limitation of Information Notice

This manual is written for the use of technically competent operators/service persons. No liability is accepted by AFL 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, AFL does not warrant the absolute accuracy of the information contained within this manual, or its completeness, fitness for purpose, or scope.

AFL 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.

All AFL 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.

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Glossary of Terms

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

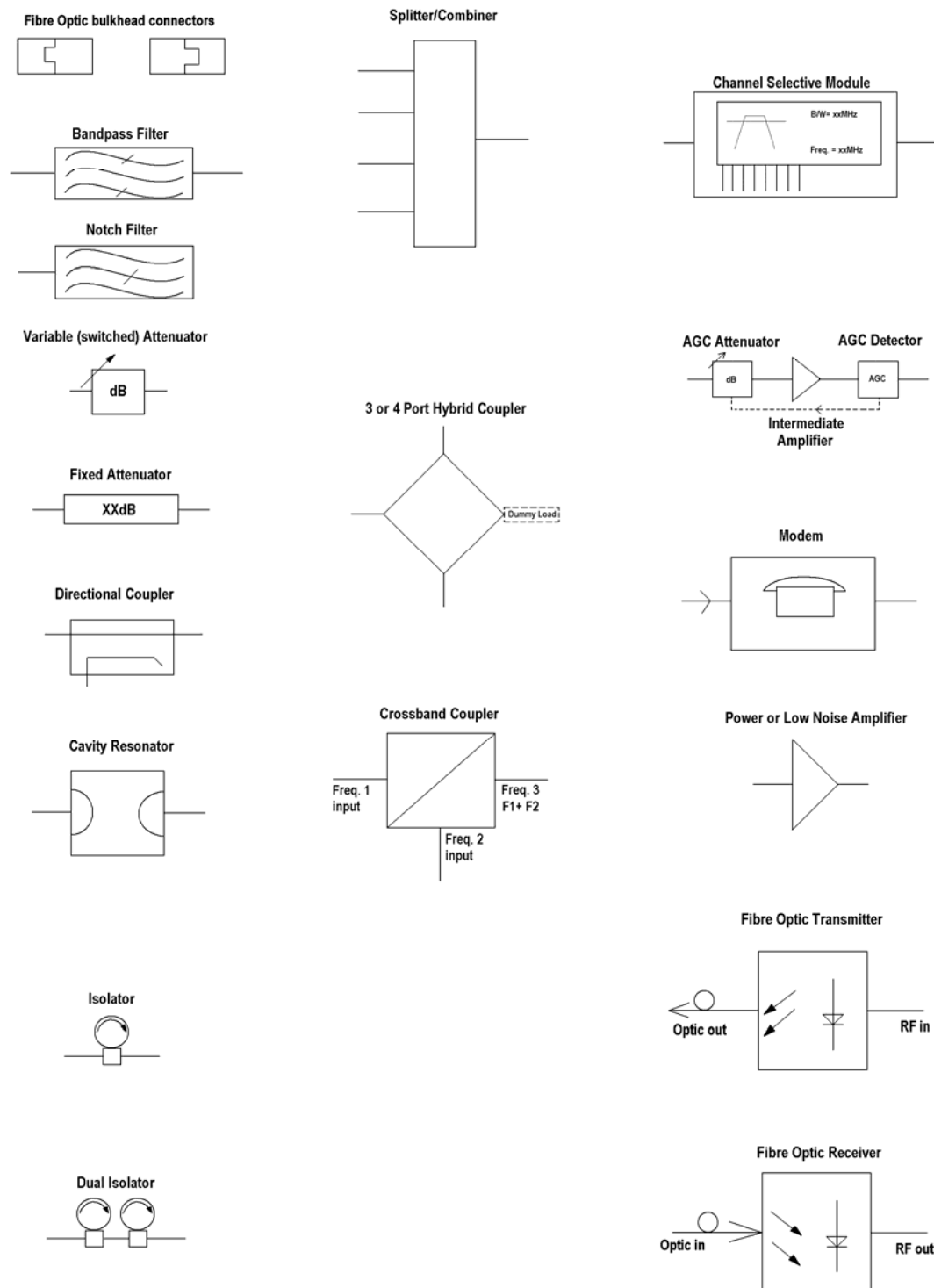
A Cell Enhancer designed for operation on a range of channels within a specified frequency band.

Channel Selective Repeater

A Cell Enhancer, 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
AGC	Automatic Gain Control
BDA	Bi-Directional Amplifier
BTS	Base Transceiver Station
C/NR	Carrier-to-Noise Ratio
DC	Direct Current
Downlink (D/L)	RF signals Tx from the BTS to the Master Site
FO	Fibre Optic
GND	Ground
ID	Identification Number
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LPA	Low Power Amplifier
MOU	Master Optical Unit
M.S.	Mobile Station
MTBF	Mean Time Between Failures
N/A	Not Applicable
N/C	No Connection
OIP3	Output Third Order Intercept Point = $RF_{out} + (C/I)/2$
PA	Power Amplifier
RF	Radio Frequency
RSA	Receiver/Splitter Amplifier
Rx	Receiver
S/N	Serial Number
Tx	Transmitter
Uplink (U/L)	RF signals transmitted from the MS to the BTS
VSWR	Voltage Standing Wave Ratio
WDM	Wave division multiplex

Key to AFL RF Module Drawing Symbols



Key to AFL RF Modules

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EC DECLARATION OF CONFORMITY

In accordance with BS EN ISO/IEC 17050-1&-2:2004

AERIAL FACILITIES LTD
Aerial House
Asheridge Road
Chesham
Bucks HP5 2QD

C € 0086

United Kingdom

DECLARES, UNDER OUR SOLE RESPONSIBILITY THAT THE FOLLOWING PRODUCT
PRODUCT PART NO[S] **60-165801**
PRODUCT DESCRIPTION **Fibre fed BDA**
IN ACCORDANCE WITH THE FOLLOWING DIRECTIVES:

1999/5/EC The Radio & Telecommunications Terminal Equipment Directive Annex V and its amending directives

HAS BEEN DESIGNED AND MANUFACTURED TO THE FOLLOWING STANDARD[S] OR OTHER NORMATIVE DOCUMENT[S]:

BS EN 60950 Information technology equipment. Safety. General requirements

ETS EN 301 489-1 EMC standard for radio equipment and services. Part 1. Common technical requirements

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives.
SIGNED



B S BARTON
TECHNICAL DIRECTOR

DATE: 20/12/2005

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1. SAFETY CONSIDERATIONS

1.1 Earthing of Equipment



Cell Enhancers 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.

AFL recommends that all other hardware enclosures and electrically conductive metalwork within operator reach of the cell enhancer cabinet (enclosing the PSUs) be grounded to the same earth to prevent hazardous differential voltages between equipment which could result in electrocution.

This arrangement of grounding and safety earthing has always been implemented by AFL and meets good RF-engineering grounding practice, thus preventing any risk of electrocution when touching both the modules and cabinet or due to the leakage from the PSU input filter. The use of a common ground for the cabinet and AC supply input will have no detrimental affect on the overall electrical or EMC performance of the equipment.

1.2 Electric Shock Hazard



Electrical shocks due to faulty mains driven power supplies.

Whilst ever potentially present in any electrical equipment, such a condition would be minimised by quality installation practice and thorough testing at:

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

All test equipment to 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.

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1.3 RF Radiation Hazard



RF radiation, (especially at UHF frequencies) arising from transmitter outputs connected to AFL's 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 unterminated. 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 mitigate against 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.

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1.4 Chemical Hazard



Beryllium Oxide, also known as Beryllium Monoxide, or Thermalox™, is sometimes used in devices within equipment produced by Aerial Facilities Ltd. 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 Aerial Facilities Ltd for disposal.

To return such equipment, please contact the Quality Department, 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 AFL 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.

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1.5 Laser safety



General working practices adapted from EN60825-2: 2000

“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

Do not allow any dirt/foreign material ingress on the optical connector bulkheads.

The optical fibre jumper cable maximum bend radius is 3cm, any smaller radii may result in optical cable breakage or excessive transmission losses.

Caution: The FO units are NOT weather proof.

1.6 Emergency Contact Numbers

The AFL Quality Department can be contacted on:

Telephone	+44 (0)1494 777000
Fax	+44 (0)1494 777002
e-mail	qa@aerial.co.uk

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2. OVERVIEW/ SYSTEM DESCRIPTION

The system consists of a fibre optic transmitter and receiver that are co located with the existing BTS in order to convert the RF signals to optical, which can then be fed to the optical BDA remotes.

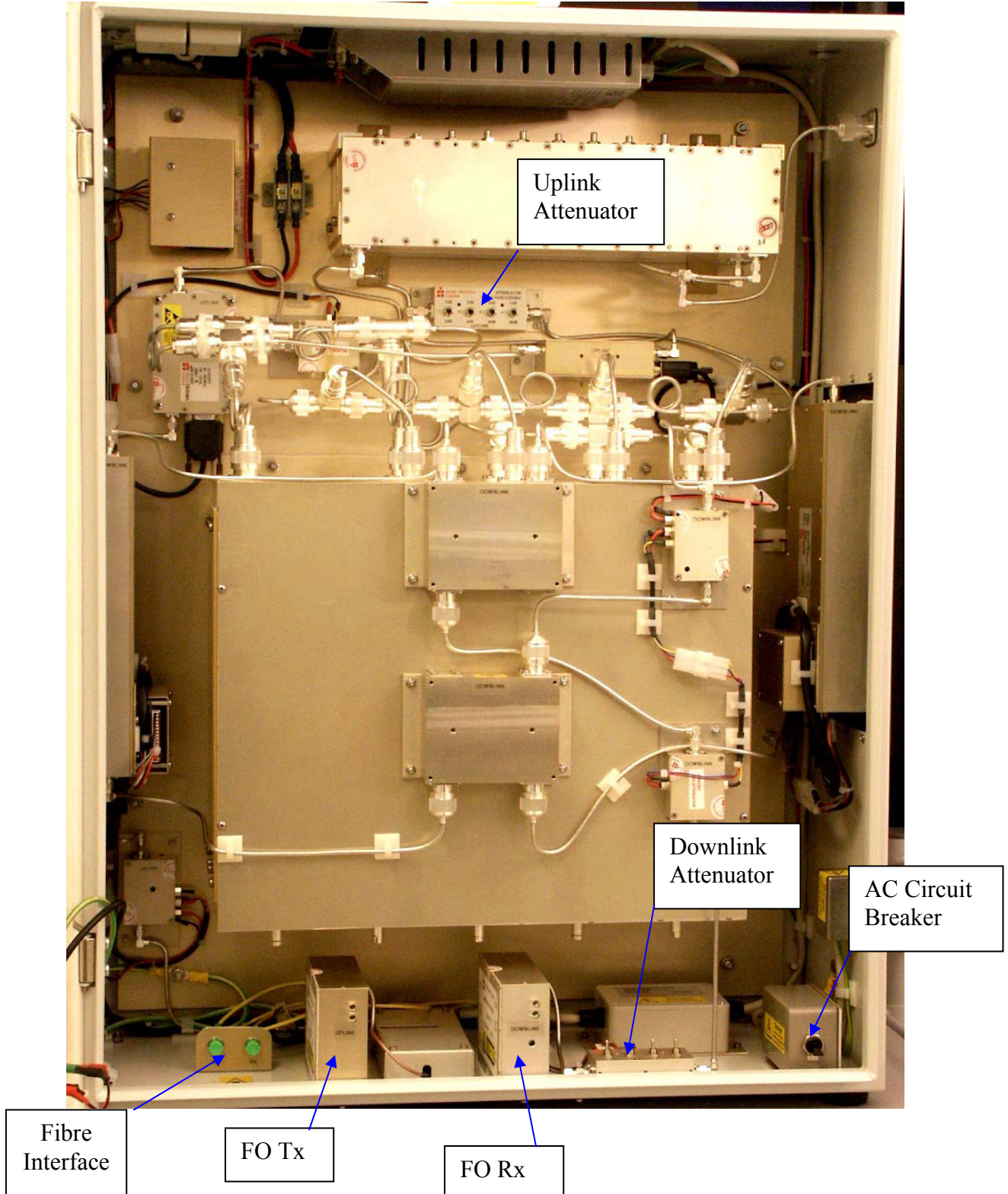
The optical fibre remote BDA's comprise of a high selectivity filter and duplexing system built into an environmentally protected enclosure to enable the high power downlink and low power uplink signals to co-exist on a common antenna port. The D/L signals from the fibre are fed via an adjustable attenuator and a pair of High Power 20Watt amplifiers coupled to provide 40Watts downlink power output. In the U/L direction, the low level signals are passed via the receive duplexer and low noise LNA, before gain adjustment to set the uplink sensitivity. The signals then pass through a further bank of filters to reduce any residual Tx carrier power before further amplification to drive the uplink fibre transmitter. The final uplink amplifier has an ALC loop to ensure that the fibre module cannot be damaged by large local signals coupled into the antenna system.

All active components in the remote BDA's have alarm monitoring with local indicators, an external panel indicator is fitted to the enclosure. The alarm loop is fed to a 21.4MHz pilot signal generator which is fed over the fibre back to the FO Mastersite.

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3. FIBRE-FED BDA (60-165801)

3.1 Component Layout Photograph



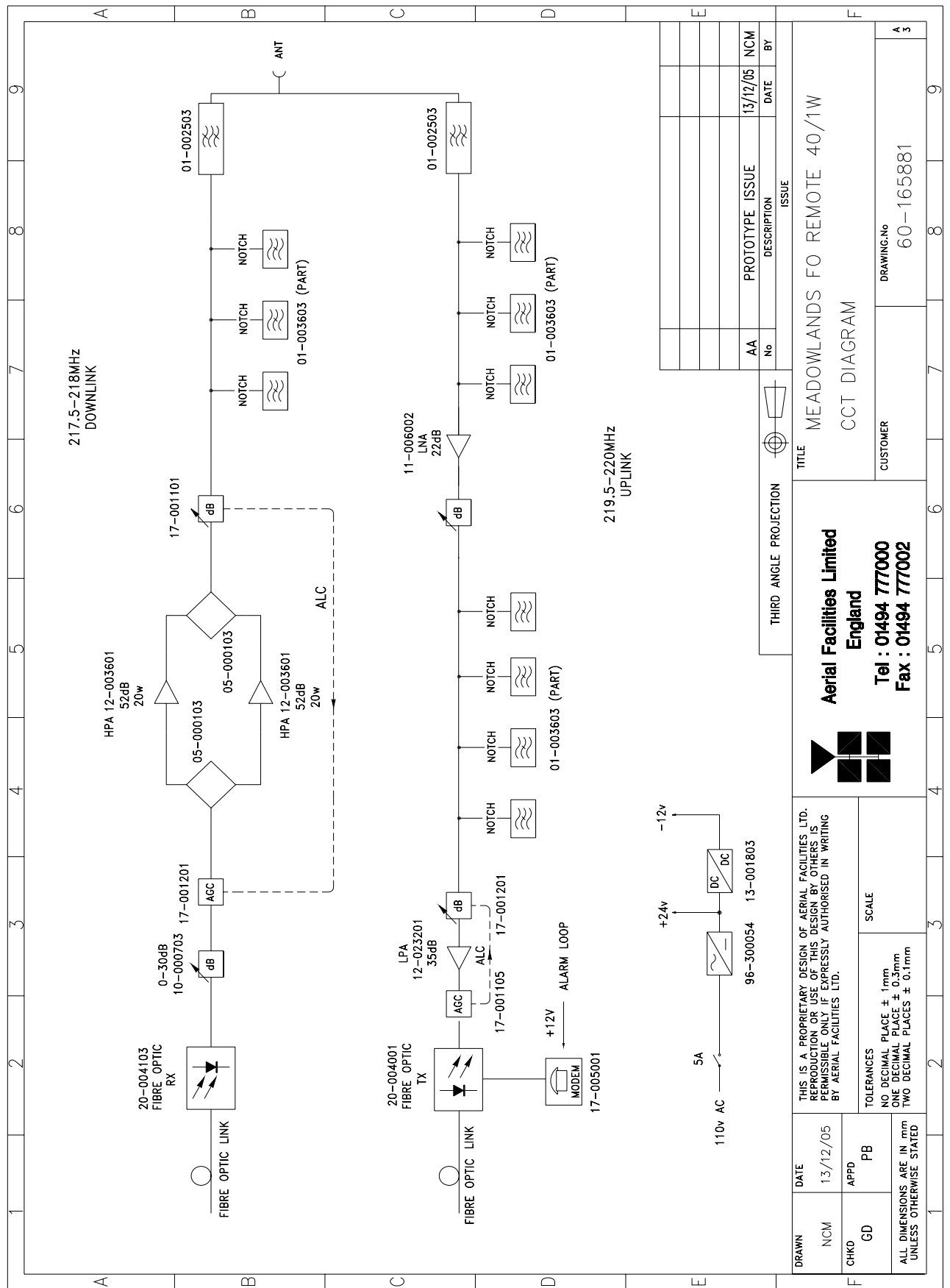
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3.2 FO BDA Electrical Specifications

PARAMETER		SPECIFICATION
Frequency range:		217.5-218.0MHz (Tx)
		219.5-220.0MHz (Rx)
Bandwidth:		0.5MHz
Gain:		0dB
Uplink Gain Adjustment:		0 - 30dB (in 2dB steps)
Downlink gain adjustment:		0-15dB (in 1dB steps)
Uplink Power:		1W
Downlink Power:		40W (20W x2)
IP3: Uplink		47dBm
IP3: Downlink		54dBm
Noise Figure:		<6dB
VSWR:		better than 1.3:1
RF Connectors:		N type, female
F/O Connectors:		FC/APC
Temperature range:	operational:	-10°C to +55°C
	storage:	-40°C to +70°C
Alarms Fitted: (volt-free contacts/TTL)	1	PSU
	2	FO Modules
	3	Amplifiers

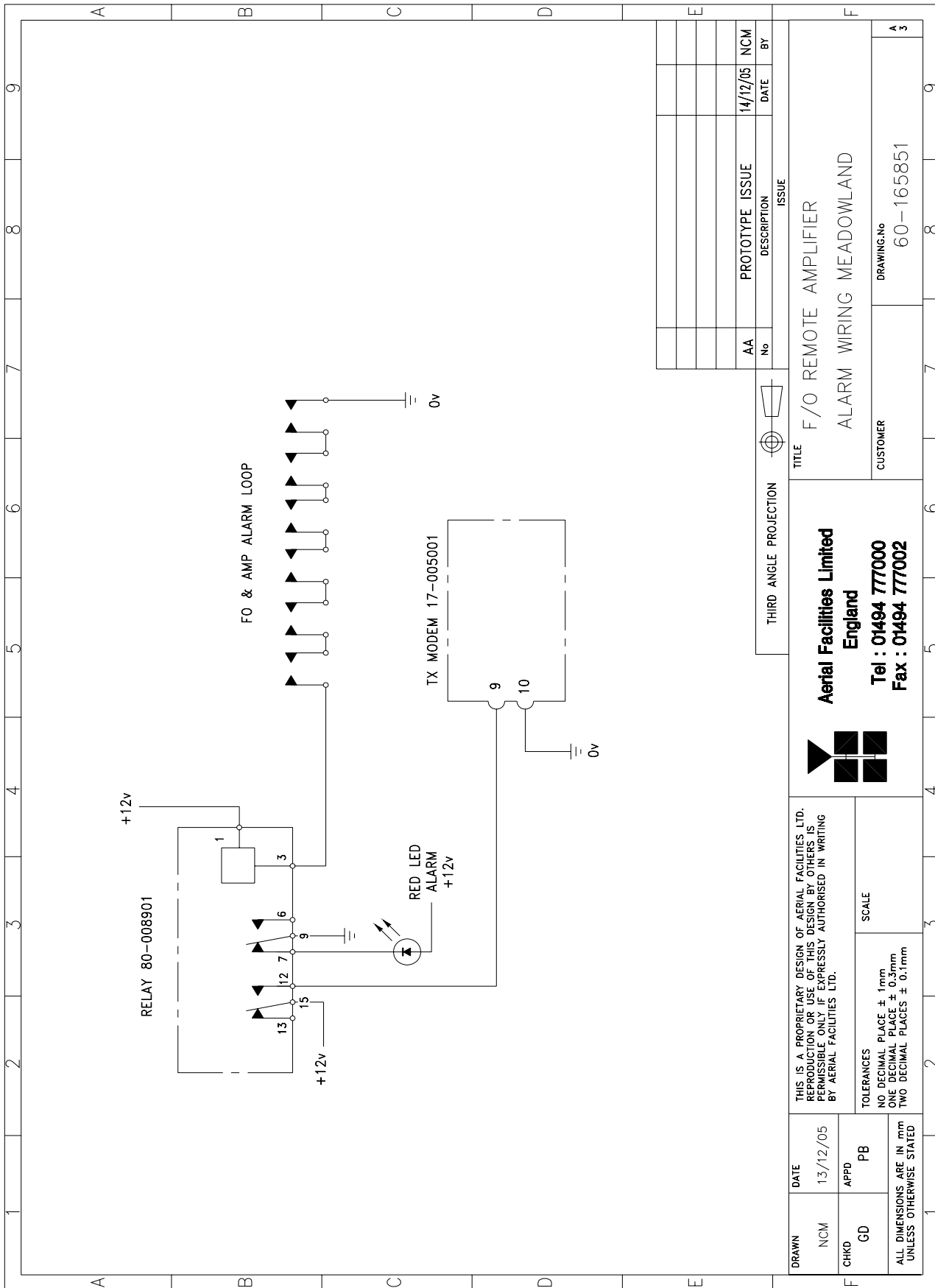
3.3

FO BDA RF Circuit Diagram, Drg. Nō. 60-165881



3.4

FO BDA Alarm Circuit Diagram, Drg. Nō. 60-165851



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3.5 FO BDA Parts List

AFL Part Nō.	Part Description	Qty.
01-002503	FILTER VHF H/B 6SMAS100W	2
01-003603	5 SEC.NOT.FIL.210-225MHz GA	2
05-000103	TX HYBRID COUPLER 3 PORT NO HTSINK	2
10-000703	1/4W0-30dB SWITCHED ATTENUATOR	2
11-006002	LNA VHF 70-500MHz WITH RELAY	1
12-002201	3 STAGE AMPLIFIER ALARM BOARD	2
12-002220	3 STAGE ALARM PCB COVER	2
12-002826	ALARM BOARD ACRYLIC LENS	2
12-003601	POWER AMP.150MHz 20W ASSEMBLY	2
12-023201	AMP. 60-250MHz 1W 35dB GAIN +12V	1
13-001803	DUAL DCDC CONVTR 24V-12V 1A	1
13-001822	DC-DC CON 24V-5V/15V COVER	1
17-001105	CE AGC UNIT LOG DET/AMP ASSY (24v)	1
17-001117	CELL ENHANCER AGC DETECTOR/AMP 12V	1
17-001201	C/E AGC UNIT ATTENUATOR ASSY	2
17-001528	GASKET 20W HEATSINK/BLANKING PLATE	3
17-005001	FIBRE OPTIC ALARM TX PCB (21.4MHz)	1
17-005020	F/O ALARM Tx/Rx PCB COVER WITH SLOT	1
17-009021K	ENCLOSURE 820x620x250 (3 x HTS) KIT	1
20-004001	FIBRE OPTIC RF TRANSMITTER (1310nm)	1
20-004103	FIBRE OPTIC RF Rx HIGH GAIN 0-1GHz	1
80-008902	24V RELAY PCB ASSEMBLY	1
80-031820	20W PA HEATSINK (NEEDS 17-001528)	2
80-310420	BCC 400W POWER SUPPLY HEATSINK	1
90-100010	MAINS LEAD '6 AMP' for USA	1
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	1
91-130001	SMA ADAPT 'T' ALL FEMALE 3 GHZ	11
91-500011	PWR 3POLE PNL PLUG SEALED IP68	1
91-500015	PWR CON CAP SEALED with INT. THREAD	1
91-510035	3 WAY MATE N LOK PLUG HOUSING	1
91-520032	MATE N LOK SOCKET CONTACT 20/14 AWG	3
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	4
91-700017	ICD 15 WAY 0.1' CONNECTOR	4
92-120009	M20 IP68 CABLE GLAND	1
92-400017	GASKET FOR N TYPE CONNECTOR	1
96-300054	24V 17A PSU 400W (XP BCC)	1
96-500005	DC INPUT FILTERS	2
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
96-900018	AC TRIP SWITCH (5 AMP M.C.B.)	1
97-300010	C/E SUPPLY INPUT COVER	1
97-900004	RUBBER FOOT FOR CELL ENHANCERS	4
98-000001	FC/APC D-HOLE ADAPTOR ADA0004	2
98-500004	FC/APC-FC/APC FIBREOPTIC CABLE 0.5M	2

4. INSTALLATION

When this equipment is initially commissioned, please use the equipment set-up record sheet in Appendix A. This will help both the installation personnel and AFL should these figures be needed for future reference or diagnosis.

4.1 General Remarks

The size and weight of the equipment racks mean that they represent a significant topple hazard unless they are bolted to the floor through the mounting holes in the base of the unit. In the interests of safety this should be done before any electrical, RF, or optical connections are made.

The equipment must be located on a flat, level surface that is made from a material suitable for bearing the weight of the rack assembly. If the installer is in any doubt about the suitability of a site it is recommended that he consult with an appropriately qualified Structural Engineer.

It is important in determining the location of the rack within the room that space is allowed for access to the front and rear of the equipment. To enable maintenance to be carried out, the doors must be able to fully open.

The location must be served with a duct to allow the entry of cables into the rack.

The mains power supply is connected to the terminal strip located on the bulkhead at the rear of the equipment at floor level. It is recommended that the connection is made by a qualified electrician, who must satisfy himself that the supply will be the correct voltage and of sufficient capacity.

All electrical and RF connection should be completed and checked prior to power being applied for the first time.

4.2 RF Connections

All RF connections are made to the cable termination, located on the bulkhead at the rear of the equipment at floor level. Care must be taken to ensure that the correct connections are made with particular attention made to the base station TX/RX ports. In the event that the base transmitter is connected to the RX output of the rack, damage to the equipment will be done if the base station transmitter is then keyed.

Ensure that connections are kept clean and are fully tightened.

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4.3 Commissioning

Once all connections are made the equipment is ready for commissioning.

To commission the system the test equipment detailed in Section 6.2 will be required.

Using the system diagrams and the end-to-end test specification, the equipment should be tested to ensure correct operation. Typical RF levels that are not listed in the end-to-end specification, such as input levels to the fibre transmitters are detailed in the maintenance section of this manual.

On initial power up the system alarm indicators on the front panels of the equipment should be checked. A red LED illuminated indicates a fault in that particular tray that must be investigated before proceeding with the commissioning. A green LED on each shelf illuminates, to indicate that the power supply is connected to the shelf

In the event that any part of the system does not function correctly as expected, check all connections to ensure that they are to the correct port, that the interconnecting cables are not faulty and that they are tightened. The majority of commissioning difficulties arise from problems with the interconnecting cables and connectors.

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5. MAINTENANCE

5.1 Fault Finding

5.1.1 Quick Fault Checklist

All AFLequipment is individually tested to specification prior to despatch. Failure of this type of equipment is not common. Experience has shown that a large number of fault conditions relating to tunnel installations result from simple causes often occurring as result of transportation, unpacking and installation. Below are listed some common problems which have resulted in poor performance or an indicated non-functioning of the equipment.

- Mains power not connected or not switched on.
- External connectors not fitted or incorrectly fitted.
- Internal connectors becoming loose due to transport vibration.
- Wiring becoming detached as a result of heavy handling.
- Input signals not present due to faults in the aerial and feeder system.
- Base transmissions not present due to fault at the base station.
- Modems fitted with incorrect software configuration.
- Changes to channel frequencies and inhibiting channels.
- Hand held radio equipment not set to repeater channels.
- Hand held radio equipment not set to correct base station.

5.1.2 Fault Isolation

In the event that the performance of the system is suspect, a methodical and logical approach to the problem will reveal the cause of the difficulty. The System consists of modules fitted in a wall-mounted, environmentally protected enclosure.

Transmissions from the main base stations are passed though the system to the mobile radio equipment; this could be a handheld radio or a transceiver in a vehicle. This path is referred to as the downlink. The return signal path from the mobile radio equipment to the base station is referred to as the uplink.

The first operation is to check the alarms of each of the active units and determine that the power supplies to the equipment are connected and active.

This can be achieved locally with the front panel LED's. The green LED on the front panel should be illuminated, while the red alarm indicator should be off. If an Alarm is on, then that individual module must be isolated and individually tested against the original test specification.

The individual amplifier units within the shelf have a green LED showing through a hole in their piggy-back alarm board, which is illuminated if the unit is working correctly. If an amplifier is suspect, check the DC power supply to the unit. If no other fault is apparent use a spectrum analyser to measure the incoming signal level at the input and then after reconnecting the amplifier input, measure the output level. Consult with the system diagram to determine the expected gain and compare result.

In the event that there are no alarms on and all units appear to be functioning it will be necessary to test the system in a systematic manner to confirm correct operation.

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5.1.3 Downlink

Confirm that there is a signal at the expected frequency and strength from the base station. If this is not present then the fault may lay outside the system. To confirm this, inject a downlink frequency signal from a known source at the master site BTS input and check for output at the remote site feeder output.

If a signal is not received at the output it will be necessary to follow the downlink path through the system to find a point at which the signal is lost. The expected downlink output for the given input can be found in the end-to-end test specification.

5.1.4 Uplink

Testing the uplink involves a similar procedure to the downlink except that the frequencies used are those transmitted by the mobile equipment.

5.1.5 Checking service

Following the repair of any part of the system it is recommended that a full end-to-end test is carried out in accordance with the test specification and that the coverage is checked by survey. It is important to bear in mind that the system includes a radiating cable network and base stations that may be faulty or may have been damaged.

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5.1.6 Fault repair

Once a faulty component has been identified, a decision must be made on the appropriate course to carry out a repair. A competent engineer can quickly remedy typical faults such as faulty connections or cables. The exceptions to this are cable assemblies connecting bandpass filter assemblies that are manufactured to critical lengths to maintain a 50-ohm system. Care should be taken when replacing cables or connectors to ensure that items are of the correct specification. The repair of component modules such as amplifiers and bandpass filters will not usually be possible in the field, as they frequently require specialist knowledge and test equipment to ensure correct operation. It is recommended that items of this type are replaced with a spare unit and the faulty unit returned to AFL for repair.

5.1.7 Service Support

Advice and assistance with maintaining and servicing this system are available by contacting Aerial Facilities Ltd.

NOTE

Individual modules are not intended to be repaired on site and attempts at repair will invalidate active warranties. Company policy is that individual modules should be repaired by replacement. Aerial Facilities Ltd maintains a high level of stock of most modules which can usually be despatched at short notice to support this policy.

5.2 Tools & Test Equipment

The minimum tools and test equipment needed to successfully service this AFL product are as follows:-

Spectrum analyser:	100kHz to 2GHz (Dynamic range = 90dB).
Signal Generator:	30MHz to 2GHz (-120dBm to 0dBm o/p level).
Attenuator:	20dB, 10W, DC-2GHz, (N male – N female).
Test Antenna:	Yagi or dipole for operating frequency.
Optical Power Meter:	1310 – 1550nm (-40 - +10dB)
Digital multi-meter:	Universal Volt-Ohm-Amp meter.
Test cable x 2:	N male – N male, 2M long RG214.
Test cable x 2:	SMA male – N male, 1m long RG223.
Hand tools:	Philips #1&2 tip screwdriver. 3mm flat bladed screwdriver. SMA spanner and torque setter.

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5.3 Care of Modules

5.3.1 General Comments

Many of the active modules contain semiconductor devices utilising MOS technology, which can be damaged by electrostatic discharge. Correct handling of such modules is mandatory to ensure their long-term reliability.

To prevent damage to a module, it must be withdrawn/inserted with care. The module may have connectors on its underside, which might not be visible to the service operative.

5.3.2 Module Removal (LNA's, general procedure):

The following *general* instructions should be followed to remove a module:

- 1 Remove power to the unit
- 2 Remove all visible connectors (RF, DC & alarm)
- 3 Release module retaining screws.
- 4 Slowly but firmly, pull the module straight out of its position. Take care not to twist/turn the module during withdrawal. (When the module is loose, care may be needed, as there may be concealed connections underneath).

5.3.3 Module Replacement (general):

- 1 Carefully align the module into its location then slowly push the module directly straight into its position, taking care not to twist/turn it during insertion.
- 2 Reconnect all connectors, RF, alarm, power etc., (concealed connectors may have to be connected first).
- 3 Replace retaining screws (if any).
- 4 Double-check all connections before applying power.

5.3.4 Power Amplifiers

- 1) Remove power to the unit. (Switch off @ mains/battery, or remove DC in connector)
- 2) Remove alarm wires from alarm screw terminal block or disconnect multi-way alarm connector.
- 3) Carefully disconnect the RF input and output coaxial connectors (usually SMA)

If alarm board removal is not required, go to step 5.

- 4) There is (usually) a plate attached to the alarm board which fixes it to the amplifier, remove its retaining screws and the alarm board can be withdrawn from the amplifier in its entirety. On certain types of amplifier the alarm board is not mounted on a dedicated mounting plate; in this case it will have to firstly be removed by unscrewing it from the mounting pillars, in most cases, the pillars will not have to be removed before lifting the amplifier.

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- 5) If the amplifier to be removed has a heatsink attached, there may be several different ways it can have been assembled. The most commonly used method, is screws through the front of the heatsink to threaded screw holes (or nuts and bolts), into the amplifier within the main case. If the heatsink is mounted on the rear of the main case (e.g., against a wall in the case of wall mounted enclosures), then the fixing method for the heatsink will be from within the case, (otherwise the enclosure would have to be removed from the wall in order to remove the heatsink).

When the heatsink has been removed, the amplifier may be unscrewed from the main casing by its four corner fixings and gently withdrawn.

Fitting a new power amplifier module will be the exact reverse of the above.

Note: Do not forget to apply fresh heatsink compound to the heatsink/main case joint and also between the amplifier and the main case.

5.3.5 Low Power Amplifier Replacement

- 1 Disconnect the mains power supply and disconnect the 24V dc supply connector for the LPA.
- 2 Disconnect the RF input and output cables from the LPA.
- 3 Disconnect the alarm connector.
- 4 Remove the alarm monitoring wires from (D type connector) pins 9 and 10.
- 5 Remove the LPA module by removing the four retaining screws, replace with a new LPA module and secure it with the screws.
- 6 Connect the RF cables to the LPA input and output connectors. Reconnect the wires to the alarm board connector pins 9 and 10.
- 7 Reconnect the DC supply connector and turn the mains switch on.

Note: Tighten SMA connectors using only a dedicated SMA torque spanner. If SMA connectors are over-tightened, irreparable damage will occur. . Do not use adjustable pliers to loosen/tighten SMA connectors.

Also take care not to drop or knock the module as this can damage (or misalign in the case of tuned passive modules) sensitive internal components. Always store the modules in an environmentally friendly location

5.3.6 Module Transportation:

To maintain the operation, performance and reliability of any module it must be stored and transported correctly. Any module not installed in a whole system must be kept in an anti-static bag or container. These bags or containers are normally identified by being pink or black, and are often marked with an ESD label. Any module sent back to AFL for investigation/repair must be so protected. Please contact AFL's quality department before returning a module.

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APPENDIX A INITIAL EQUIPMENT SET-UP CALCULATIONS

GENERAL INFORMATION			
Site Name:		Client Name:	
Date:		AFL Equip. Model Nō.	

ANTENNA SYSTEMS				
	Model	Gain	Azimuth	Comments
A - Service Antenna				
B - Donor Antenna				
	Type	Loss	Length	Comments
C - Service Feeder				
D - Donor Feeder				

INITIAL PARAMETERS	
E - CE Output Power	dBm
F - Antenna Isolation	dB
G - Input signal level from donor BTS	dBm
Operating Voltage	V

DOWNLINK CALCULATIONS		
Parameter	Comments	Value
Input signal level (G)		dBm
CE max. o/p power (E)		dBm
Gain setting	E - G	dB
Isolation required	(Gain + 10dB)	dB
Service antenna gain (A)		dB
Service antenna feeder loss (C)		dB
Effective radiated power (ERP)	E+A-C	dBm
Attenuator setting	CE gain-gain setting	dB

If the input signal level in the uplink path is known and steady, use the following calculation table to determine the gain setting. If the CE features Automatic Gain Control the attenuator should be set to zero and if not, then the attenuation setting for both uplink and downlink should be similar.

UPLINK CALCULATIONS		
Parameter	Comments	Value
Input signal level		dBm
CE max. o/p power (E)		dBm
Gain setting		dB
Required isolation		dB
Donor antenna gain (B)		dB
Donor antenna feeder loss (D)		dB
Effective radiated power (ERP)	E+B-D	dBm
Attenuator setting	(CE gain-gain setting)	dB