

24 Channel 800MHz & VHF Cell Enhancers

Maintenance Handbook

For

Terry Consulting

AFL Works Order Nō.: Q111353

AFL product part Nō's.: 50-078001 (800 & VHF CE's)
80-209302 (Battery Back-up)

 Aerial Facilities Limited www.AerialFacilities.com Technical Literature	800MHz & VHF Cell Enhancers Maintenance Handbook		
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AMENDMENT LIST RECORD SHEET

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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. This is a controlled release document and, as such, becomes a part of Aerial Facilities' Total Quality Management System. Alterations and modification may therefore only be performed by Aerial Facilities Ltd.

Purpose

AFL recommends that the installer of this equipment familiarise his/herself with the safety and installation procedures contained within this document before installation commences.

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 ISO 9001: 1994 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.

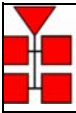
Limitation of Information Notice

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 it's 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

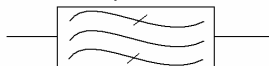
Repeater or Cell Enhancer	A Radio Frequency (RF) amplifier which can simultaneously amplify and re-broadcast Mobile Station (MS) and Base Transceiver Station (BTS) signals.
Band Selective Repeater	A Cell Enhancer designed for operation on a range of channels within a specified frequency band.
Channel Selective Repeater	A Cell Enhancer, designed for operation on specified channel(s) within a specified frequency band. Channel frequencies may be factory set, remotely set by computer, or on-site programmable.
BTS	Base Transceiver Station
C/NR	Carrier-to-Noise Ratio
Downlink (D.L.)	RF signals transmitted from the BTS and to the MS
Uplink (U.L.)	RF signals transmitted from the MS to the BTS
EMC	Electromagnetic Compatibility
GND	Ground
DC	Direct Current
AC	Alternating Current
ID	Identification Number
OIP3	Output Third Order Intercept Point = $RF_{out} + (C/I)/2$
LED	Light Emitting Diode
M.S.	Mobile Station
N/A	Not Applicable
N/C	No Connection
NF	Noise Figure
RF	Radio Frequency
Rx	Receiver
Tx	Transmitter
S/N	Serial Number

Key to AFL RF Module Drawing Symbols

Fibre Optic bulkhead connectors



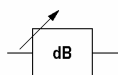
Bandpass Filter



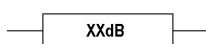
Notch Filter



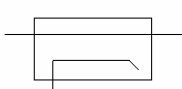
Variable (switched) Attenuator



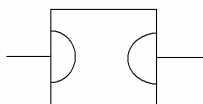
Fixed Attenuator



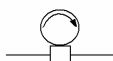
Directional Coupler



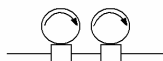
Cavity Resonator



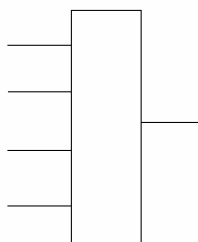
Isolator



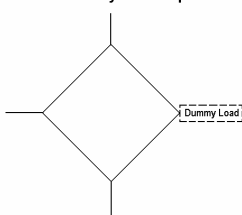
Dual Isolator



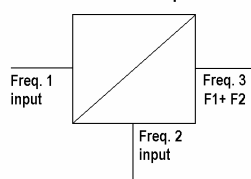
Splitter/Combiner



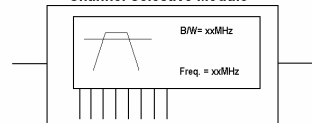
3 or 4 Port Hybrid Coupler



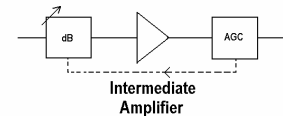
Crossband Coupler



Channel Selective Module

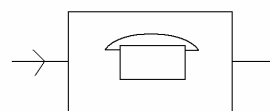


AGC Attenuator

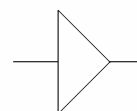


AGC Detector

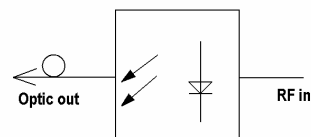
Modem



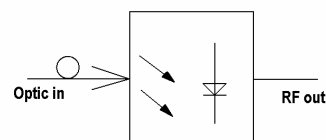
Power or Low Noise Amplifier



Fibre Optic Transmitter



Fibre Optic Receiver

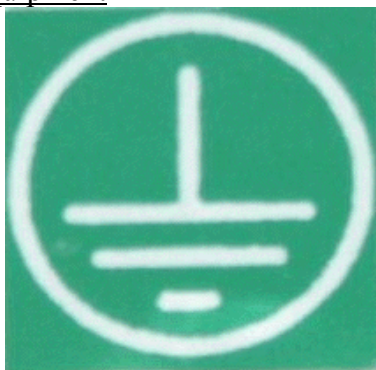


Key to AFL RF Modules

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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.

1.2 Electric Shock Hazard

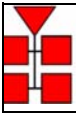


Electrical shocks due to faulty mains driven power supplies.

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

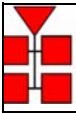


RF radiation, (especially at UHF frequencies) arising from transmitter outputs connected to AFL's equipment, must be considered a safety hazard.

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

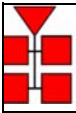
Many modules/components in AFL equipment contain P.T.F.E. as part of the RF insulation barrier.

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.

1.5 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

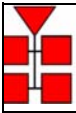
The AFL Channel and/or Band Selective Cell Enhancers are 2-way on-band repeaters. Various models are available to cover frequency bands from 50MHz to 3000MHz. The principle sphere of applications is in urban areas where the topology is such that shadows occur in the propagation pattern (for example within large buildings, conference centres, road and rail tunnels, etc.)

The frequency bands that are passed by the Cell Enhancer are set as per the specific customer requirements.

AFL manufacture a wide range of Cell Enhancers, configured for each customer's specific requirements. Two basic physical variants are available, a rack mounted version to fit in a standard 19" rack and an environmentally sealed wall mounted version which requires no further enclosure.

This system provides 800MHz Channelised (x 24) & VHF Simplex/Duplex coverage for the various concourses platforms and tunnels with a 12V battery backup service (for the 800MHz line amplifier) that will guarantee limited continued coverage in case of mains power failure.

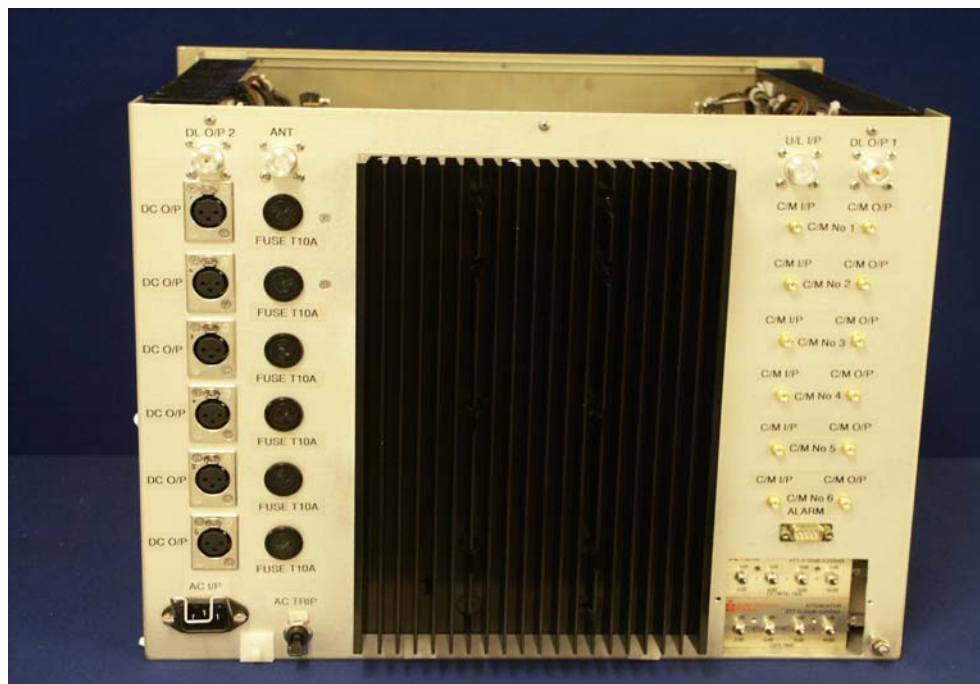
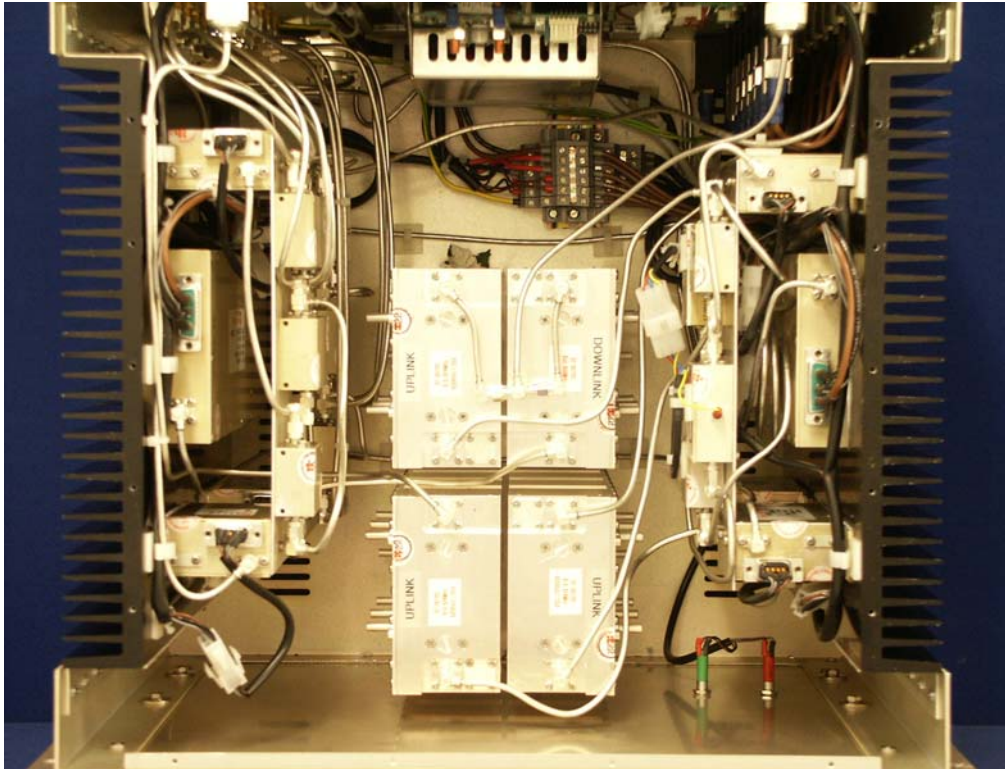
Each active module is alarm monitored with each shelf/ wall-case having a summary alarm with a visual 'alarm active' indication and a door intrusion alarm included for the wall cases. All alarms are volt-free, relay contact pairs which may be easily configured into an RS232/modem system such that automatic remote monitoring by computer may be achieved.

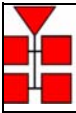
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3. SPECIFICATION

3.P Photographs

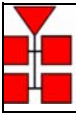
3.P.1 800MHz Air I/F Uplink Shelf 50-078002



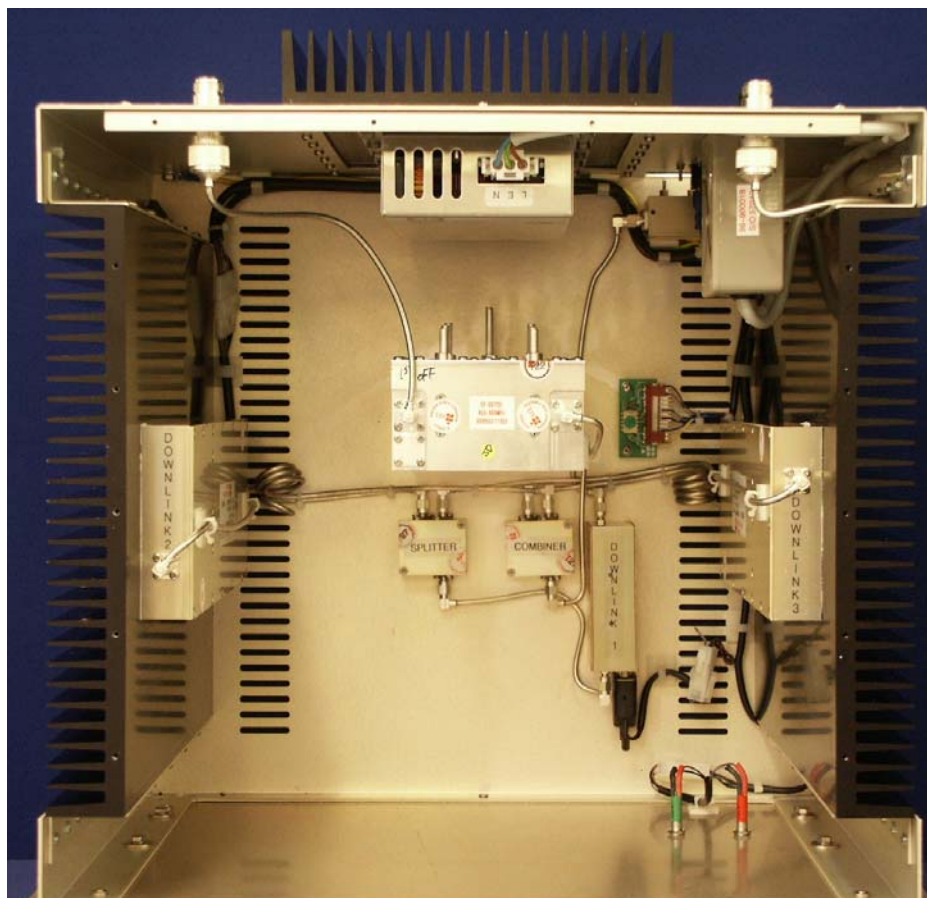
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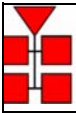
3.P.2 Eight Channel Downlink Shelf 50-078003

Photos of this shelf are unavailable

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3.P.3 Power Amplifier/Driver Shelf 50-078004



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3.P.4 800MHz In-Line Amplifier 50-078017



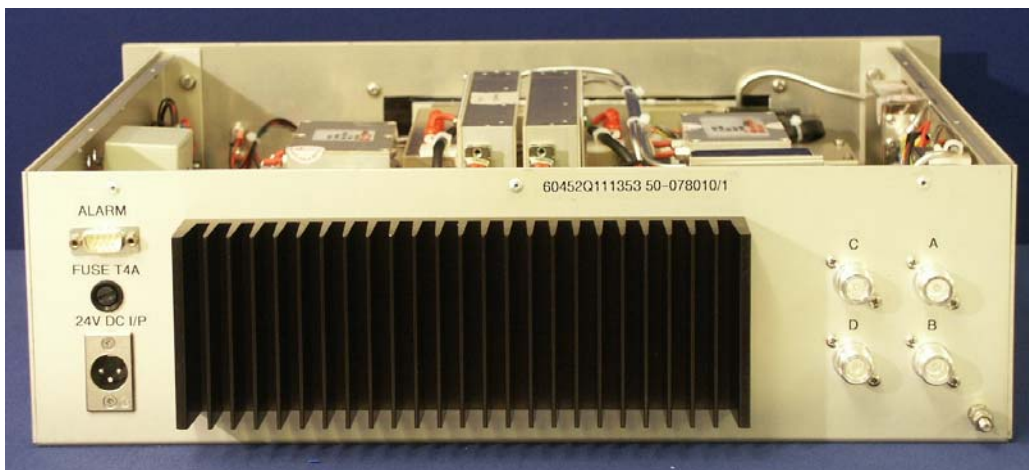
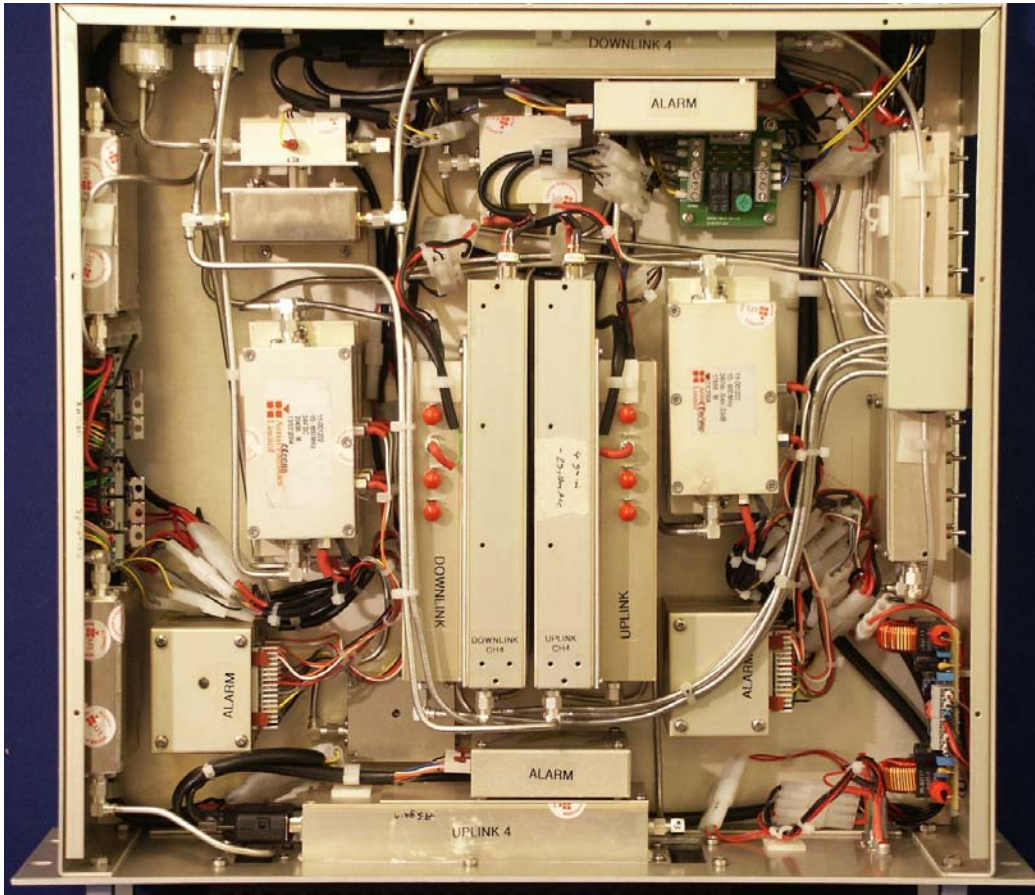
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3.P.5 VHF/800MHz Multi-Coupler Shelf 50-078015

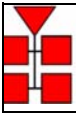
Photos of this shelf are unavailable

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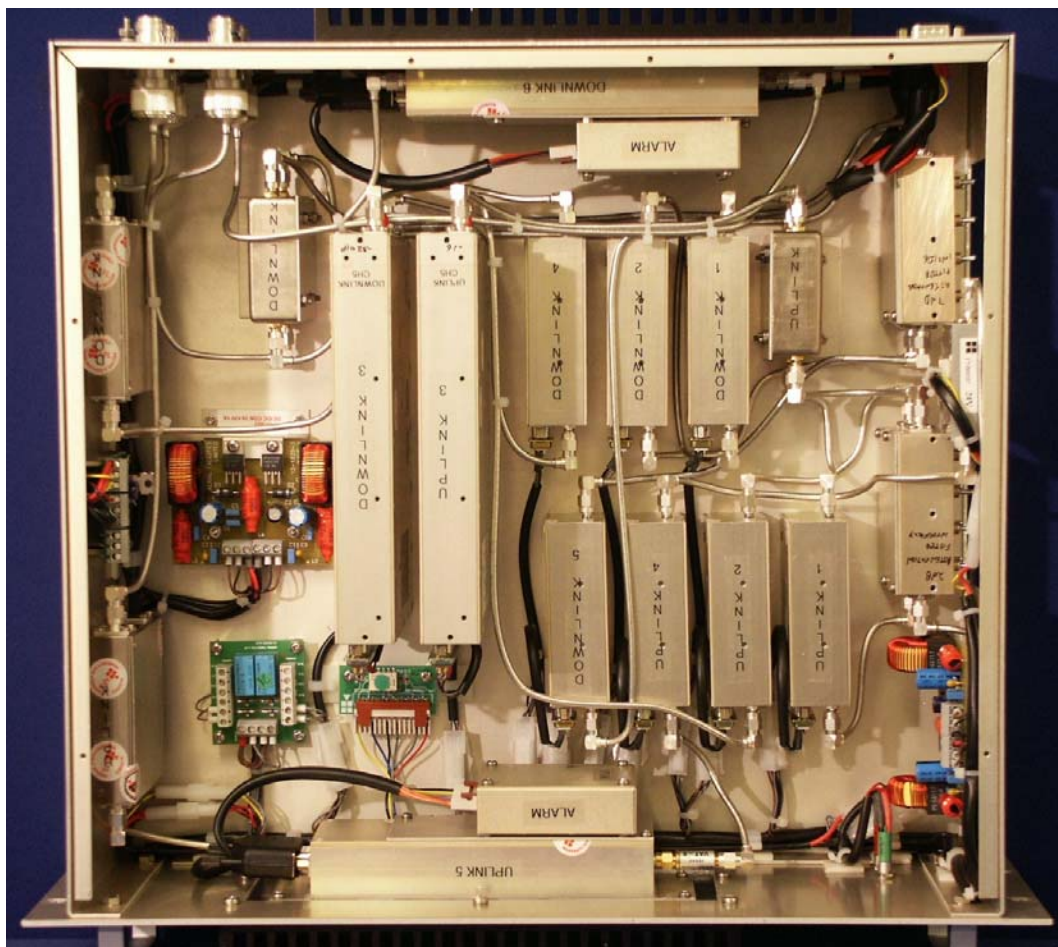
3.P.6 VHF Simplex Shelf 50-078010



There are two different types of simplex shelves 50-078010/1 & 50-078010/2, they differ only in the frequencies they process.

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3.P.7 VHF Duplex Shelf 50-078011



There are four different types of duplex shelves 50-078011/1,2,3 & 4 they differ only in the frequencies they process.

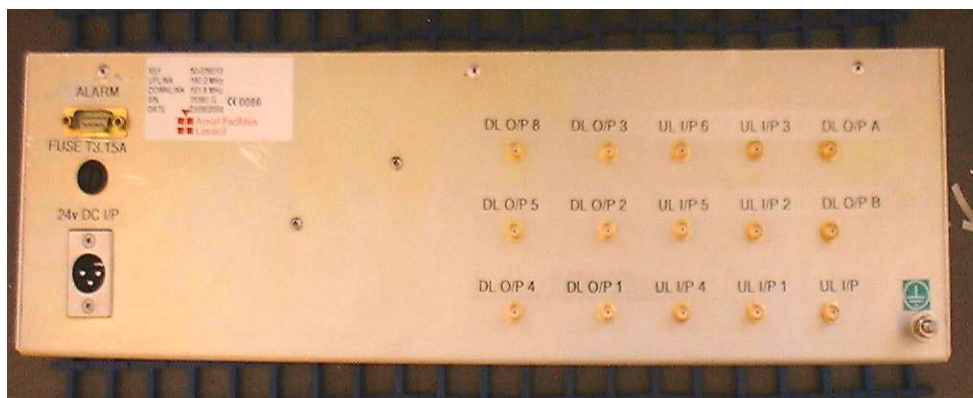
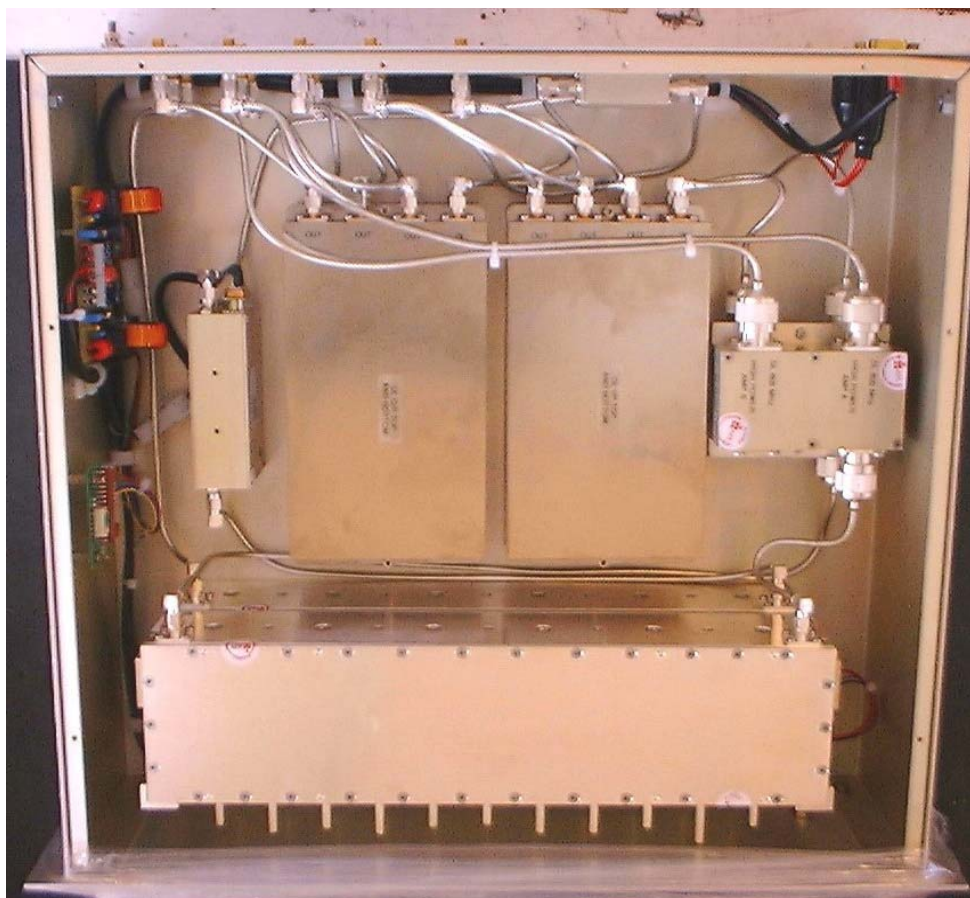
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3.P.8 VHF Air Interface Shelf 50-078012

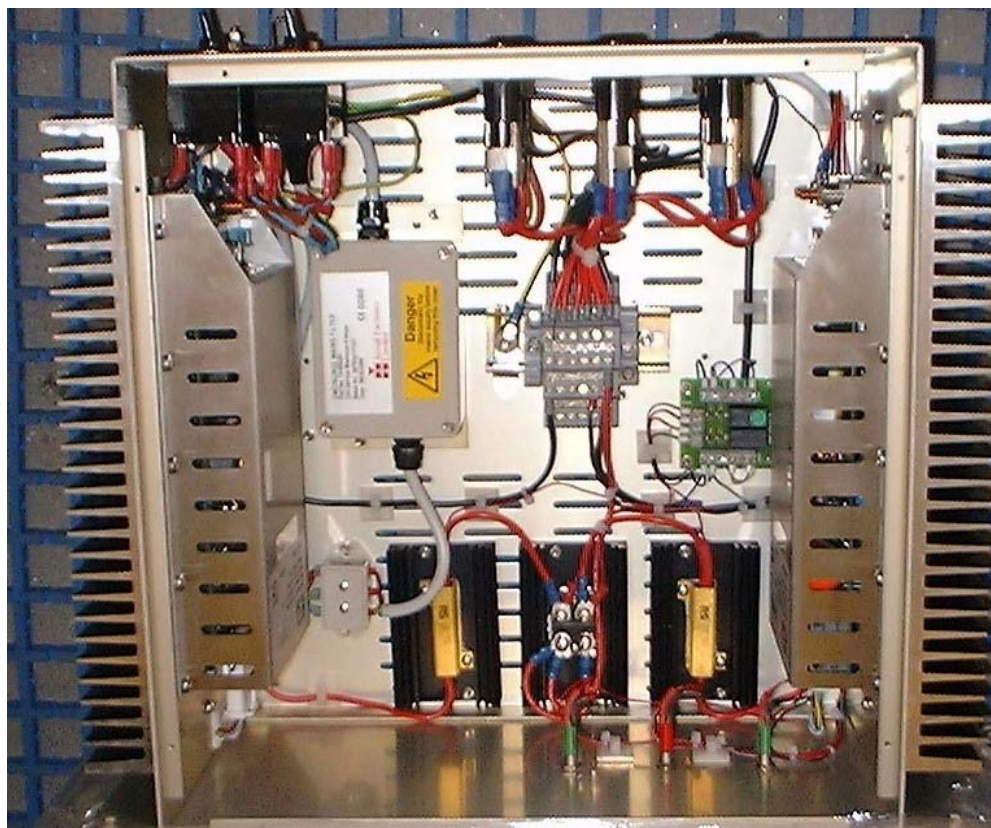
Photos of this shelf are unavailable.

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3.P.9 VHF Combiner Shelf 50-078013

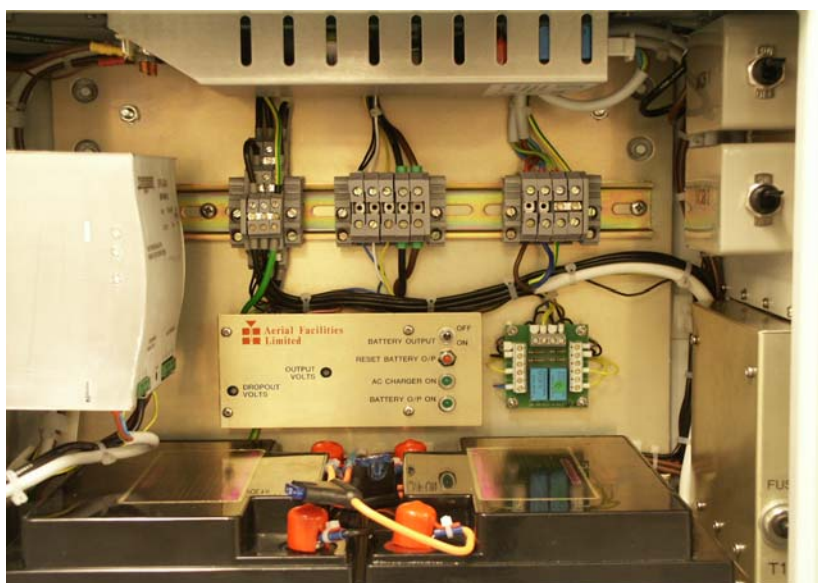
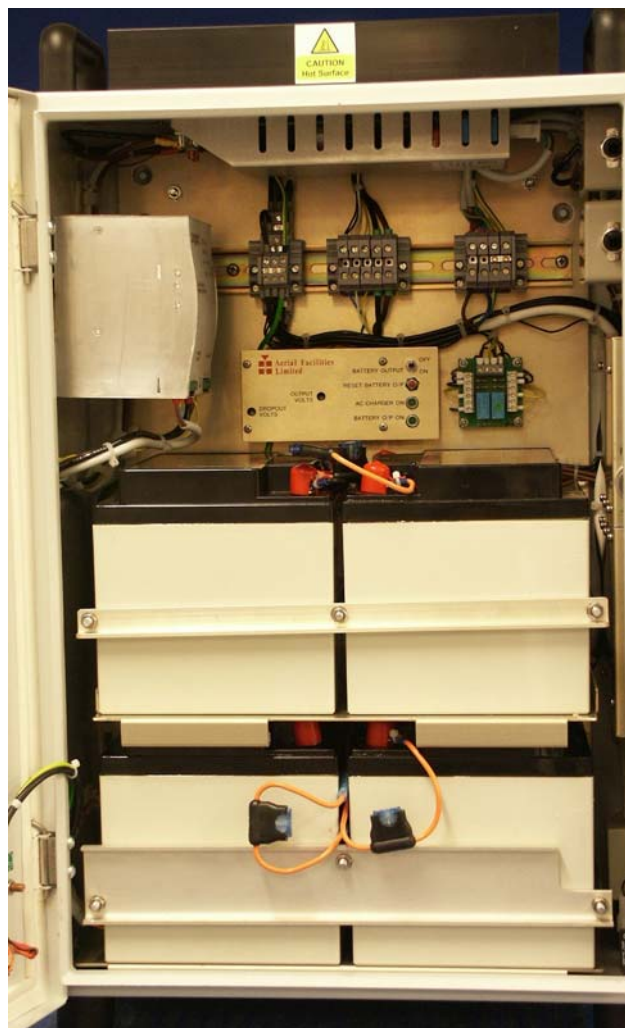


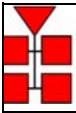
3.P.10 PSU Shelf 50-078014



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3.P.11 Battery Backup 80-209302



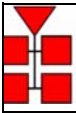
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3.P.12 Rack Photos



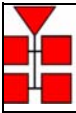
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3.1 Electrical Specification

PARAMETER		SPECIFICATION
Frequency range:		851-869MHz (Downlink)
		806-824MHz (Uplink)
Bandwidth:		160.2-161.8MHz (Simplex/Duplex)
		18MHz (UHF)
Gain:		1.6MHz (VHF)
		>100dB (Uplink)
Gain Adjustment:		>90dB (Downlink)
		0 - 30dB (in 2dB steps)
Uplink Power:		>5.0Watts (UHF)
		>5.0Watts (VHF)
Downlink Power		>40.0Watts (UHF)
		>5.0Watts (VHF)
IP3:	Uplink	+43dBm
	Downlink	+50dBm
Noise Figure:		<6dB
AGC:		-25dBm (factory set in channel module)
VSWR:		better than 1.5:1
RF Connectors:		N type, female
Temperature range	operational:	-10°C to +55°C
	storage:	-40°C to +70°C
Alarms Fitted: (non-latching, volt-free relay contacts/TTL)		1 PSU's
		2 Amplifiers
		3 Channel modules
		4 Door (Wall mount cases)

3.2 Channel Frequency Listing

Channel No.	User Group	Frequencies (MHz)		Status
		Downlink	Uplink	
1	SD Trolley	160.6650	160.9350	Duplex
2	SD Trolley	160.3800	160.9050	Duplex (Note1)
3	SD Trolley	160.7100	161.4150	Duplex
4	SD Trolley	161.2950	161.2950	Simplex
5	SD Trolley	161.5650	160.7550	Duplex
6	SD Trolley	160.5300	160.5300	Simplex
800 MHz Band				
1	SD City (PD/FD)	860.0500	815.0500	Duplex
2	SD City (PD/FD)	860.0250	815.0250	Duplex
3	SD City (PD/FD)	859.0500	814.0500	Duplex
4	SD City (PD/FD)	859.0250	814.0250	Duplex
5	SD City (PD/FD)	858.0500	813.0500	Duplex (Note 2)
6	SD City (PD/FD)	858.0250	813.0250	Duplex (Note 2)
7	SD City (PD/FD)	857.0500	812.0500	Duplex
8	SD City (PD/FD)	860.0000	815.0000	Duplex
9	SD City (PD/FD)	859.0000	814.0000	Duplex
10	SD City (PD/FD)	858.0000	813.0000	Duplex (Note 2)
11	SD City (PD/FD)	857.0250	812.0250	Duplex
12	SD City (PD/FD)	857.0000	812.0000	Duplex
13	SD City (PD/FD)	856.0500	811.0500	Duplex
14	SD City (PD/FD)	856.0250	811.0250	Duplex
15	SD City (PD/FD)	862.0500	817.0500	Duplex
16	SD City (PD/FD)	862.1000	817.1000	Duplex
17	SD City (PD/FD)	863.0500	818.0500	Duplex
18	SD City (PD/FD)	864.0500	819.0500	Duplex
19	SD City (PD/FD)	865.5000	820.0500	Duplex
20	SDSU Security	868.5750	823.5750	Duplex (Note 4)
21	SDSU Security	866.3875	821.3875	Duplex (Note 4)
22	SD City (PD/FD)	00	811.1500	Duplex (Note 3)
23	TBD	TBD	TBD	TBD
24	TBD	TBD	TBD	TBD

Note 1: Channel 2 uplink frequency was changed to 160.9050 MHz from 161.9050MHz as required by the Authority.

Note 2: Channel 4, 5 & 10 uplink frequency changed to 813.0500 MHz, 813.0250MHz, & 813.0000MHz from 816.050 MHz, 816.0250MHz & 816.000MHz respectively.

Note 3: Channel 22 is new frequency pair for SD City with 25KHz channel spacing.

Note 4: Channel 20 & 21 are analogue radio system with digital modulation (3600bps) and the donor site for these channels has azimuth of 150 degree. The Azimuth of CH 1 to Ch 19 and the new CH 22 is 40 degree.

3.3 Mechanical Specifications

3.3.1 Rack Mounted Equipment Mechanical Specifications

PARAMETER		SPECIFICATION
Rack	Height:	40U Standard Eurorack
	Width:	19" (482.6mm)
	Depth:	600mm (800 optional)
Shelves:	Height:	See parts lists
	Width:	19" (482.6mm)
	Depth:	<400mm(excluding heatsinks, connectors, handles and feet)
Temperature Range:	operational :	-10°C to +55°C
	storage:	-40°C to +70°C
Weight:		>5-15*kg
Humidity:		5 – 95% non-condensing
RF Connectors:		N type female
Environmental Protection:		IP54
Finish:	Case:	Alocrom
	Heatsinks:	Matt black
	Handles:	Alloy
	Fascias	Painted to RAL7032
Supply Cable:		Unit supplied with suitable supply input leads, connector and specified length of cable (where appropriate)
* Note: Individual shelf weight not specified.		

3.3.2 Wall Mounted Equipment (50-078017 & 80-209302)

PARAMETER		SPECIFICATION
Case size	Height:	620mm
	Width:	420mm
	Depth:	250mm
(excluding heatsinks, connectors, handles and feet)		
Fixings:		4 holes on 470(w) x 500(h) mm
Temperature Range:	operational:	-10°C to +60°C
	storage:	-40°C to +70°C
Weight:		>30kg
RF Connectors:		N type female
Environmental Protection:		IP65 (with door closed and all ports terminated)
Finish:	Case:	To RAL 7032/5
	Heatsinks:	Matt black (where fitted)
	Handles:	Black Technopolymer
Supply Cable:		Unit supplied with suitable supply input leads with connector and appropriate length of cable.

3.4 Parts Lists

3.4.1 Whole System Parts List (50-078001)

AFL Part Nö.	Part Description	Qty.
50-078002	800MHz AIR I/F + BSCE UPLINK SHELF	1
50-078003	800MHz 8CH CHANNEL MOD. SHELF	3
50-078004	800MHz 40W HPA / DRIVER SHELF	2
50-078010/1	VHF SIMPLEX SHELF	1
50-078010/2	VHF SIMPLEX SHELF	1
50-078011/1	VHF DUPLEX SHELF	1
50-078011/2	VHF DUPLEX SHELF	1
50-078011/3	VHF DUPLEX SHELF	1
50-078011/4	VHF DUPLEX SHELF	1
50-078012	VHF AIR I/F SHELF	1
50-078013	VHF COMBINER SHELF	1
50-078014	VHF PSU SHELF	1
50-078015	VHF/ 800 Tx MULTICOUPLER	1
50-078017	800MHz IN LINE AMPLIFIER	2
60-020608	40U SWING FRAME CABINET Q104362	3
80-209302	12V 160Ah BATTERY BACK UP STANDARD	2

3.4.2 800MHz AIF Uplink Shelf 50-078002 Parts List

AFL Part Nō.	Part Description	Qty.
02-007201	900MHz 8POLE 10-20MHz B/W SMA	4
05-002602	900MHz SPLITTER/COMBINER, 20W	5
05-003801	3WAY GEN.SPLIT 900MHz GEN.ASS	4
10-000701	1/4W0-30dB SWITCHED ATTENUATOR	2
11-005902	900MHz LOW NOISE AMP WITH RELAY ASS	3
11-006702	GA 800-1000MHz LNA 29dB (WITH RELAY	4
12-018001	PA 800-960MHz 10W 30dB	2
14-000225	CASE RAIL LONG R.S.A./R.F.A.	4
17-001109	CE AGC UNIT LOG DET/AMP ASSY (12v)	1
17-001201	C/E AGC UNIT ATTENUATOR ASSY	1
20-001601	12V RELAY BOARD	1
50-012820	CCE RACK MOUNTED 8U CHASSIS	1
50-012822	CCE RACK MOUNTED LID	1
50-012825	CCE RACK MOUNTED HEATSINK BRACKET	4
50-027720	RACK MTD CHAN C.E. MODIFIED HEATSIN	2
80-090822	C/E 8U FRONT PANEL, AFL (RAL7035)	1
80-310420	BCC 400W POWER SUPPLY HEATSINK	1
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	4
91-130005	SMA BULKHEAD ADAPTOR F/F	12
91-500025	3 PIN RIGHT ANGLE FREE PLUG NC-X	3
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	3
91-510004	3 PIN PNL.MOUNT SOCKET NC-X	3
91-510032	20A SOCKET CONTACT PIN	4
91-520001	PWR MAINS INL FIXED/SOLD.TERMS	1
91-520005	MAINS LEAD (KETTLE, IEC)	1
91-520010	MAINS RETAINING CLIP	1
91-600007	'D' 9 WAY BLACK SHELL	8
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	7
91-600015	'D' 9 WAY PLUG S/B (NON FILTERED)	1
91-660001	2W5 MIXED D TYPE SOCKET (7 WAY)	2
96-110034	FUSE HOLDER 16-30A, 32mm BODY	3
96-300057	15V 27A PSU 400W (XP BCC)	1
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.)	2
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2
99-200008	DANGER HIGH VOLTAGE LABEL 2x2'	1
99-200017	CAUTION HEAVY LABEL 75x55mm	2

3.4.3 800MHz 8 Channel, Channel Module Shelf 50-078003 Parts List

AFL Part Nō.	Part Description	Qty.
05-003302	4 WAY SPLITTER GSM 900MHz	4
17-002101	CHANNEL CONTROL MODULE	2
17-002103	26WAY RIBBON CABLE LEAD	8
17-003022	MODULE PATTERNED LEAVE	8
17-003023	SUBRACK SIDE PANEL	4
17-003024	SUBRACK REAR BRACKET	8
17-003025	BOTTOM MODULE GUIDE	8
17-003028	MODULE SQUARE LEAVE	8
17-003029	TOP MODULE GUIDE	8
17-009127	CHAN MOD 810-860MHz 30KHz 8p TCXO	8
91-100004	SMA PLUG ELBOW UT-85/RG405	32
91-500001	POWER PLG 3 PIN PNL.MOUNT NC-X	2
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	2
91-600007	'D' 9 WAY BLACK SHELL	4
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	2
91-600015	'D' 9 WAY PLUG S/B (NON FILTERED)	2
92-280033	Captive Screw	16
96-110001	FUSE HOLDER 20 x 5mm6.3A	2
96-110007	T 1.6A A.SURGE FUSE 20mm	4
97-000002	BLACK MODULE CAGE RUNNER	16
97-600001	SUBRACK FRONT HORIZ	4
97-600002	SUBRACK M2.5 STD TAP	4

3.4.4 800MHz 40W Amplifier Shelf 50-078004 Parts List

AFL Part Nō.	Part Description	Qty.
02-007201	900MHz 8POLE 10-20MHz B/W SMA	1
05-002602	900MHz SPLITTER/COMBINER, 20W	2
10-000901	SW. ATTENUATOR 0.25W 0-15dB	1
11-005802	900MHz DRIVER STAGE WITH RELAY	1
12-018002	PA 800-960MHz 20W CLASS A	2
14-000225	CASE RAIL LONG R.S.A./R.F.A.	2
50-012820	CCE RACK MOUNTED 8U CHASSIS	1
50-012822	CCE RACK MOUNTED LID	1
50-012825	CCE RACK MOUNTED HEATSINK BRACKET	4
50-027720	RACK MTD CHAN C.E. MODIFIED HEATSIN	2
80-090822	C/E 8U FRONT PANEL, AFL (RAL7035)	1
80-310420	BCC 400W POWER SUPPLY HEATSINK	1
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	2
91-510032	20A SOCKET CONTACT PIN	4
91-520001	PWR MAINS INL FIXED/SOLD.TERMS	1
91-520005	MAINS LEAD (KETTLE, IEC)	1
91-520010	MAINS RETAINING CLIP	1
91-600007	'D' 9 WAY BLACK SHELL	1
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	1
91-600015	'D' 9 WAY PLUG S/B (NON FILTERED)	1
91-660001	2W5 MIXED D TYPE SOCKET (7 WAY)	2
96-300057	15V 27A PSU 400W (XP BCC)	1
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
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2
99-200008	DANGER HIGH VOLTAGE LABEL 2x2'	1
99-200017	CAUTION HEAVY LABEL 75x55mm	2

3.4.5 VHF Simplex Shelf 50-078010/1

AFL Part Nō.	Part Description	Qty.
08-930002	2 PORT ISOLATOR 150-300MHz SMA	2
10-000901	SW. ATTENUATOR 0.25W 0-15dB	4
11-001202	10/600MHz LNA 24v SMA Alarm	7
12-002213	3 STAGE ALARM/SIMPLEXMUTE PCB SUB-ASS	2
12-002220	3 STAGE ALARM PCB COVER	2
12-002804	SINGLE CH. ALARM/SIMPLEX MUTE BOARD	7
12-002820	SINGLE CHANNEL ALARM COVER	7
12-004902	POWER AMP VHF 5W CLASS AB	2
13-001803	DUAL DC/DC CONVERTER 24V-12V 1A	1
13-001822	DC-DC CON 24V-5V/15V COVER	1
13-002811	SIMPLEX CONTROLLER PCB ASSEMBLY	2
17-001201	C/E AGC UNIT ATTENUATOR ASSY	4
17-002802	SIMPLEX C.E Rx/SQUELCH & AF (SMD)	2
17-009135	VHF 15Kstep CH MOD 15kHz 8p BW+IFRX	2
19-000826	2U,3U,4U 19" UNIT 400 DEEP LID	1
19-000921	3U 19" UNIT 400 DEEP CHASSIS + BKT	1
19-000924	3U 19" UNIT FRONT PANEL FAB	1
80-063920	HEATSINK 2U ASS140 (5W) MILCHBUCK	2
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	4
91-500001	POWER PLG 3 PIN PNL.MOUNT NC-X	1
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	1
91-600001	'D'TYPE 9 WAY PLUG S/B TERM	1
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	2
91-620001	'D' 25 WAY SOCKET S/B TERM	2
91-700017	ICD 15 WAY 0.1' CONNECTOR	9
93-540035	1K3 0.25W 1% RES MRS25 M:F	2
93-980109	161.295MHz CRYSTAL FILT FAN4M52500	4
96-110001	FUSE HOLDER 20 x 5mm6.3A	1
96-300014	PSU VOLTS ADJUSTER	2
96-700017	LED AMBER 5mm SEALED IP66	2
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2

3.4.6 VHF Simplex Shelf 50-078010/2 Parts List

AFL Part Nō.	Part Description	Qty.
08-930002	2 PORT ISOLATOR 150-300MHz SMA	2
10-000901	SW. ATTENUATOR 0.25W 0-15dB	4
11-001202	10/600MHz LNA 24v SMA Alarm	7
12-002213	3 STAGE ALM/SIMPLEXMUTE PCB SUB-ASS	2
12-002220	3 STAGE ALARM PCB COVER	2
12-002804	SINGLE CH. ALARM/SIMPLEX MUTE BOARD	7
12-002820	SINGLE CHANNEL ALARM COVER	7
12-004902	POWER AMP VHF 5W CLASS AB	2
13-001803	DUAL DC/DC CONVERTER 24V-12V 1A	1
13-001822	DC-DC CON 24V-5V/15V COVER	1
13-002811	SIMPLEX CONTROLLER PCB ASSEMBLY	2
17-001201	C/E AGC UNIT ATTENUATOR ASSY	4
17-002802	SIMPLEX C.E Rx/SQUELCH & AF (SMD)	2
17-009135	VHF 15Kstep CH MOD 15kHz 8p BW+IFRX	2
19-000826	2U,3U,4U 19" UNIT 400 DEEP LID	1
19-000921	3U 19" UNIT 400 DEEP CHASSIS + BKT	1
19-000924	3U 19" UNIT FRONT PANEL FAB	1
80-063920	HEATSINK 2U ASS140 (5W) MILCHBUCK	2
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	4
91-500001	POWER PLG 3 PIN PNL.MOUNT NC-X	1
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	1
91-600001	'D'TYPE 9 WAY PLUG S/B TERM	1
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	2
91-620001	'D' 25 WAY SOCKET S/B TERM	2
91-700017	ICD 15 WAY 0.1' CONNECTOR	9
93-540035	1K3 0.25W 1% RES MRS25 M:F	2
93-980112	160.530MHz CRYSTAL FILT FAN4M52500	4
96-110001	FUSE HOLDER 20 x 5mm6.3A	1
96-300014	PSU VOLTS ADJUSTER	2
96-700017	LED AMBER 5MM SEALED IP66	2
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2

3.4.7 VHF Duplex Shelf 50-078011/1 Parts List

AFL Part Nō.	Part Description	Qty.
08-930002	2 PORT ISOLATOR 150-300MHz SMA	2
10-000901	SW. ATTENUATOR 0.25W 0-15dB	4
11-006002	LNA VHF 70-500MHz WITH RELAY	7
12-002201	3 STAGE AMPLIFIER ALARM BOARD	1
12-002203	3 STAGE ALARM BOARD SIMPLEX	1
12-002220	3 STAGE ALARM PCB COVER	2
12-004902	POWER AMP VHF 5W CLASS AB	2
13-001803	DUAL DC/DC CONVERTER 24V-12V 1A	2
13-001822	DC-DC CON 24V-5V/15V COVER	1
13-002812	SWITCH VERSION OF SIMPLEX CONT.	1
17-001105	CE AGC UNIT LOG DET/AMP ASSY (24v)	1
17-009135	VHF 15Kstep CH MOD 15kHz 8p BW+IFRX	2
19-000826	2U,3U,4U 19" UNIT 400 DEEP LID	1
19-000921	3U 19" UNIT 400 DEEP CHASSIS + BKT	1
19-000924	3U 19" UNIT FRONT PANEL FAB	1
80-063920	HEATSINK 2U ASS140 (5W) MILCHBUCK	2
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	4
91-500001	POWER PLG 3 PIN PNL.MOUNT NC-X	1
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	1
91-600001	'D'TYPE 9 WAY PLUG S/B TERM	1
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	7
91-620001	'D' 25 WAY SOCKET S/B TERM	2
91-700017	ICD 15 WAY 0.1' CONNECTOR	2
93-980103	160.665MHz CRYSTAL FILT FAN4M52500	2
93-980104	160.935MHz CRYSTAL FILT FAN4M52500	2
96-110001	FUSE HOLDER 20 x 5mm6.3A	1
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2

3.4.8 VHF Duplex Shelf 50-078011/2 Parts List

AFL Part Nō.	Part Description	Qty.
08-930002	2 PORT ISOLATOR 150-300MHz SMA	2
10-000901	SW. ATTENUATOR 0.25W 0-15dB	4
11-006002	LNA VHF 70-500MHz WITH RELAY	7
12-002201	3 STAGE AMPLIFIER ALARM BOARD	1
12-002203	3 STAGE ALARM BOARD SIMPLEX	1
12-002220	3 STAGE ALARM PCB COVER	2
12-004902	POWER AMP VHF 5W CLASS AB	2
13-001803	DUAL DC/DC CONVERTER 24V-12V 1A	2
13-001822	DC-DC CON 24V-5V/15V COVER	1
13-002812	SWITCH VERSION OF SIMPLEX CONT.	1
17-001105	CE AGC UNIT LOG DET/AMP ASSY (24v)	1
17-009135	VHF 15Kstep CH MOD 15kHz 8p BW+IFRX	2
19-000826	2U,3U,4U 19" UNIT 400 DEEP LID	1
19-000921	3U 19" UNIT 400 DEEP CHASSIS + BKT	1
19-000924	3U 19" UNIT FRONT PANEL FAB	1
80-063920	HEATSINK 2U ASS140 (5W) MILCHBUCK	2
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	4
91-500001	POWER PLG 3 PIN PNL.MOUNT NC-X	1
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	1
91-600001	'D'TYPE 9 WAY PLUG S/B TERM	1
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	7
91-620001	'D' 25 WAY SOCKET S/B TERM	2
91-700017	ICD 15 WAY 0.1' CONNECTOR	2
93-980105	160.380MHz CRYSTAL FILT FAN4M52500	2
93-980106	160.905MHz CRYSTAL FILT FAN4M52500	2
96-110001	FUSE HOLDER 20 x 5mm6.3A	1
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2

3.4.9 VHF Duplex Shelf 50-078011/3 Parts List

AFL Part Nō.	Part Description	Qty.
08-930002	2 PORT ISOLATOR 150-300MHz SMA	2
10-000901	SW. ATTENUATOR 0.25W 0-15dB	4
11-006002	LNA VHF 70-500MHz WITH RELAY	7
12-002201	3 STAGE AMPLIFIER ALARM BOARD	1
12-002203	3 STAGE ALARM BOARD SIMPLEX	1
12-002220	3 STAGE ALARM PCB COVER	2
12-004902	POWER AMP VHF 5W CLASS AB	2
13-001803	DUAL DC/DC CONVERTER 24V-12V 1A	2
13-001822	DC-DC CON 24V-5V/15V COVER	1
13-002812	SWITCH VERSION OF SIMPLEX CONT.	1
17-001105	CE AGC UNIT LOG DET/AMP ASSY (24v)	1
17-009135	VHF 15Kstep CH MOD 15kHz 8p BW+IFRX	2
19-000826	2U,3U,4U 19" UNIT 400 DEEP LID	1
19-000921	3U 19" UNIT 400 DEEP CHASSIS + BKT	1
19-000924	3U 19" UNIT FRONT PANEL FAB	1
80-063920	HEATSINK 2U ASS140 (5W) MILCHBUCK	2
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	4
91-500001	POWER PLG 3 PIN PNL.MOUNT NC-X	1
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	1
91-600001	'D'TYPE 9 WAY PLUG S/B TERM	1
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	7
91-620001	'D' 25 WAY SOCKET S/B TERM	2
91-700017	ICD 15 WAY 0.1' CONNECTOR	2
93-980107	160.710MHz CRYSTAL FILT FAN4M52500	2
93-980108	161.415MHz CRYSTAL FILT FAN4M52500	2
96-110001	FUSE HOLDER 20 x 5mm6.3A	1
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2

3.4.10 VHF Duplex Shelf 50-078011/4 Parts List

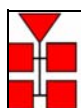
AFL Part Nō.	Part Description	Qty.
08-930002	2 PORT ISOLATOR 150-300MHz SMA	2
10-000901	SW. ATTENUATOR 0.25W 0-15dB	4
11-006002	LNA VHF 70-500MHz WITH RELAY	7
12-002201	3 STAGE AMPLIFIER ALARM BOARD	1
12-002203	3 STAGE ALARM BOARD SIMPLEX	1
12-002220	3 STAGE ALARM PCB COVER	2
12-004902	POWER AMP VHF 5W CLASS AB	2
13-001803	DUAL DC/DC CONVERTER 24V-12V 1A	2
13-001822	DC-DC CON 24V-5V/15V COVER	1
13-002812	SWITCH VERSION OF SIMPLEX CONT.	1
17-001105	CE AGC UNIT LOG DET/AMP ASSY (24v)	1
17-009135	VHF 15Kstep CH MOD 15kHz 8p BW+IFRX	2
19-000826	2U,3U,4U 19" UNIT 400 DEEP LID	1
19-000921	3U 19" UNIT 400 DEEP CHASSIS + BKT	1
19-000924	3U 19" UNIT FRONT PANEL FAB	1
80-063920	HEATSINK 2U ASS140 (5W) MILCHBUCK	2
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	4
91-500001	POWER PLG 3 PIN PNL.MOUNT NC-X	1
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	1
91-600001	'D'TYPE 9 WAY PLUG S/B TERM	1
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	7
91-620001	'D' 25 WAY SOCKET S/B TERM	2
91-700017	ICD 15 WAY 0.1' CONNECTOR	2
93-980110	161.565MHz CRYSTAL FILT FAN4M52500	2
93-980111	160.755MHz CRYSTAL FILT FAN4M52500	2
96-110001	FUSE HOLDER 20 x 5mm6.3A	1
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2

3.4.11 VHF Air Interface Shelf 50-078012 Parts List

AFL Part Nō.	Part Description	Qty.
01-002503	FILTER VHF H/B 6 SMA S 100W	2
05-002901	3dB BROADBAND SPLITTER SMA 1WATT	2
05-003401	4 WAY SPLITTER LOW POWER	1
07-005401	160-470MHz 3 WAY SPLITTER	2
11-004802	450MHz (10dB GAIN) LNA 12V.	1
12-002801	SINGLE CHANNEL ALARM BOARD STD	1
13-001803	DUAL DC/DC CONVERTER 24V-12V 1A	1
19-000826	2U,3U,4U 19" UNIT 400 DEEP LID	1
19-000921	3U 19" UNIT 400 DEEP CHASSIS + BKT	1
80-024203	TRANSMITTER HYBD COUPL.3 PORT	1
80-063627	3U FRONT PANEL FOR H/S 80-063920	1
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	15
91-500001	POWER PLG 3 PIN PNL.MOUNT NC-X	1
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	1
91-700017	ICD 15 WAY 0.1' CONNECTOR	6
93-540035	1K3 0.25W 1% RES MRS25 M:F	2
96-110001	FUSE HOLDER 20 x 5mm6.3A	1
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2

3.4.12 VHF Combiner Shelf 50-078013 Parts List

01-002503	FILTER VHF H/B 6 SMA S 100W	2
05-002901	3dB BROADBAND SPLITTER SMA 1WATT	1
07-005401	160-470MHz 3 WAY SPLITTER	4
11-006002	LNA VHF 70-500MHz WITH RELAY	1
13-001803	DUAL DC/DC CONVERTER 24V-12V 1A	1
19-000826	2U,3U,4U 19" UNIT 400 DEEP LID	1
19-000921	3U 19" UNIT 400 DEEP CHASSIS + BKT	1
80-024203	TRANSMITTER HYBD COUPL.3 PORT	2
80-063627	3U FRONT PANEL FOR H/S 80-063920	1
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	15
91-500001	POWER PLG 3 PIN PNL.MOUNT NC-X	1
91-510003	3 PIN R.ANGLE FREE SOC.NC-X.	1
93-540035	1K3 0.25W 1% RES MRS25 M:F	2
96-110001	FUSE HOLDER 20 x 5mm6.3A	1
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
97-400005	HANDLE TYPE H6802 3U [ALLOY]	2



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3.4.13 VHF PSU Shelf 50-078014 Parts List

AFL Part Nō.	Part Description	Qty.
13-003301	MAINS FILTER 8AMP ASSEMBLY	1
20-001602	24V RELAY BOARD	1
80-008920	DUAL PSU HEATSINK	2
80-008921	DUAL PSU CASE	1
80-008922	DUAL PSU LID	1
80-008925	DUAL PSU FRONT PANEL	1
80-020632	2U CHASSIS LID FIXING RAIL	4
91-500025	3 PIN RIGHT ANGLE FREE PLUG NC-X	6
91-510004	3 PIN PNL.MOUNT SOCKET NC-X	6
91-510035	3 WAY MATE N LOK PLUG HOUSING	2
91-520001	PWR MAINS INL FIXED/SOLD.TERMS	1
91-520005	MAINS LEAD (KETTLE, IEC)	1
91-520010	MAINS RETAINING CLIP	1
91-520032	MATE N LOK SOCKET CONTACT 20/14 AWG	6
91-600015	'D' 9 WAY PLUG S/B (NON FILTERED)	1
91-800014	3 WAY TERMINAL BLOCK	1
94-100004	STPS12045TV 60A DUAL DIODE	1
96-100001	20x5mm,10A FUSE HOLDER/CARRIER	6
96-300054	24V 17A PSU 400W (XP BCC)	2
96-600001	INSULATING BOOT LARGE	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	2
96-900017	AC TRIP SWITCH (3 AMP M.C.B.)	2
97-400002	HANDLE TYPE H6803 4U.[ALLOY]	2

3.4.14 VHF/800MHz Tx Multi-coupler Shelf 50-078015 Parts List

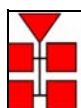
AFL Part Nō.	Part Description	Qty.
05-002602	900MHz SPLITTER/COMBINER, 20W	1
05-002901	3dB BROADBAND SPLITTER SMA 1WATT	3
05-003401	4 WAY SPLITTER LOW POWER	1
05-003801	3WAY GEN.SPLIT 900MHz GEN.ASS	1
07-004101	70-1000MHz 3dB SPLITTER/COMBINER	1
07-005401	160-470MHz 3 WAY SPLITTER	2
07-005705	CROSSBAND CPLR XC 250/380 SMA	6
07-014002	6dB 170-2200MHz DIRECTIONAL COUPLE	2
19-001122K	5U CHASSIS KIT (450mm deep)	1
80-024203	TRANSMITTER HYBD COUPL.3 PORT	1
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	15

3.4.15 800Mhz In-Line Amplifier (Wall-Mount Case) 50-078017 Parts List

AFL Part Nö.	Part Description	Qty.
02-007201	900MHz 8POLE 10-20MHz B/W SMA	4
07-005705	CROSSBAND CPLR XC 250/380 SMA	4
10-000701	1/4W0-30dB SWITCHED ATTENUATOR	2
11-005902	900MHz LOW NOISE AMP WITH RELAY ASS	2
12-018002	PA 800-960MHz 20W CLASS A	1
12-018601	POWER AMPLIFIER 900MHz 5W	1
17-000126	CELL ENHANCER LABEL 6 DIGIT	1
17-000526	CE 10/20W HEATSINK THERMAL GASKET	2
17-001109	CE AGC UNIT LOG DET/AMP ASSY (12v)	1
17-001201	C/E AGC UNIT ATTENUATOR ASSY	1
17-009020	ENCLOSURE 620 x 420 x 250 (3 H/S) ALU	1
20-001601	12V RELAY BOARD	1
80-031820	20W PA HEATSINK (NEEDS 17-000526)	1
80-032320	10W PA HEATSINK (NEEDS 17-000526)	1
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	4
91-500011	PWR 3POLE PNL PLUG SEALED IP68	1
91-500015	PWR CON CAP SEALED with INT. THREAD	2
91-500016	PWR 6POLE PNL PLUG SEALED IP68	1
91-510032	20A SOCKET CONTACT PIN	4
91-600007	'D' 9 WAY BLACK SHELL	4
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	4
91-660001	2W5 MIXED D TYPE SOCKET (7 WAY)	2
96-700034	LED RED 5mm IP67 INTEGRAL RES. 24V	1
96-700035	LED GREEN 5mm IP67 INTEGRAL RES 24V	1
97-400010	BLACK PLASTIC HANDLE 50mm HIGH	2
97-900003	RUBBER FOOT 1 1/2' DIA.	4

3.4.16 12V 160Ahour Battery Back-Up 80-209302 Parts List

AFL Part N ^o .	Part Description	Qty.
17-000526	CE 10/20W HEATSINK THERMAL GASKET	2
17-004833	BATTERY BACK UP LABEL	1
20-001601	12V RELAY BOARD	1
50-046922	HEATSINK COVER (A) FOR DIODES	1
50-046923	DOOR VENT MESH	2
50-046924	BATTERY BACK UP UNIT DIODE HEATSINK	1
50-046926	BATTERY BACK UP UNIT BACK PANEL	1
50-046927	HEATSINK COVER (B) FOR DIODES	1
50-046928	COVERS A & B FIXING STRIP	1
50-046929	BATTERY BACK UP CASE	1
50-046930	BBU BATTERY REAR BRACKET	3
50-046931	BBU BATTERY CLAMPING BRACKET	1
50-046932	BBU TOP BATTERY LOCATION PLATE	1
50-046933	BBU BATTERY BASE TRAY	1
50-046934	BBU BATTERY CLAMPING STUD	6
50-046935	BBU LOWER BATTERY CLAMPING BAR	1
50-046936	BBU TOP BAT LOCATION PLATE SPACER	1
50-046937	CHARG'R AL'M INDIC'R PL'T&SILK SC'N	1
80-061003	LOW VOLTAGE 12v BATT DISC PCB PARTS	1
80-160020	AC TRIP SWITCH BOX-TWIN MTG BKT	1
80-310420	BCC 400W POWER SUPPLY HEATSINK	1
90-100003	MAINS LEAD '6 AMP'	1
90-300045	BATT.BACKUP LEADS (2	1
90-400013	CE/BBU ALARM LINK LEAD 4 CORE	1
90-600026	HEATSHRINK SLEEVE 4.8mm BLACK%	0
91-500011	PWR 3POLE PNL PLUG SEALED IP68	1
91-500015	PWR CON CAP SEALED with INT. THREAD	2
91-500016	PWR 6POLE PNL PLUG SEALED IP68	1
91-510013	PWR CON CAP SEALED with Ext. THREAD	3
91-510035	3 WAY MATE N LOK PLUG HOUSING	1
91-520032	MATE N LOK SOCKET CONTACT 20/14 AWG	3
91-800015	TRIPLE DECK TERMINAL BLOCK	3
91-800016	TRIPLE DECK TERMINAL JUMPER	3
91-800017	TRIPLE DECK TERMINAL END	1
91-800027	DIN RAIL NON-FUSED TERMINAL BLOCK	7
91-800028	DIN RAIL END-STOP	6
91-800029	DIN RAIL TERMINAL BLOCK PARTITION	4
91-800031	SYMETRIC 35x7.5mm DIN RAIL	1
91-800066	DIN RAIL END COVER	2
93-510081	0R05 50W RESISTOR ALUMINIUM CLAD	2
93-540035	1K3 0.25W 1% RES MRS25 M:F	3
94-030015	IXFN170N10 PWR MOSFET (MINI-BLOC)	1



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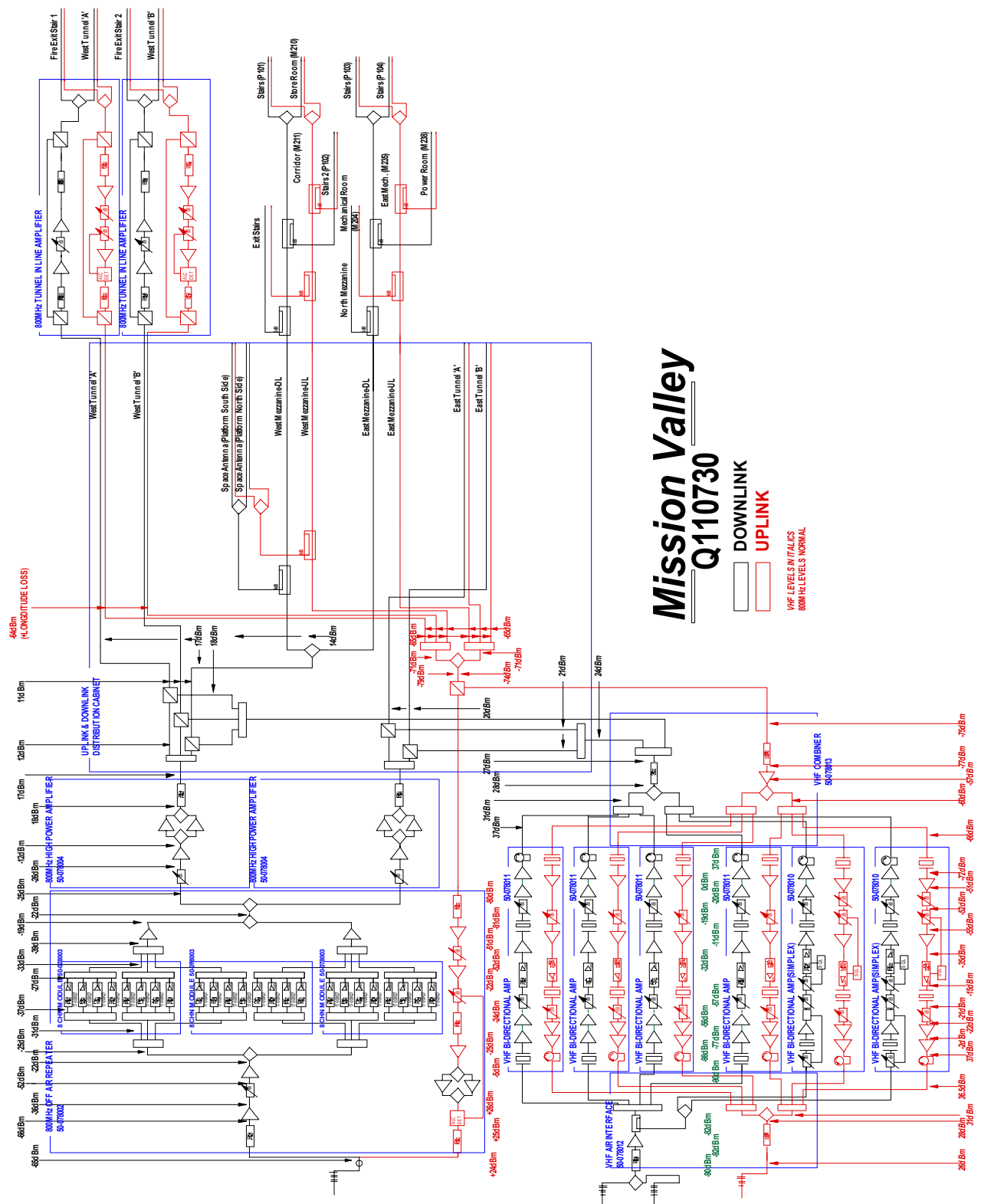
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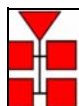
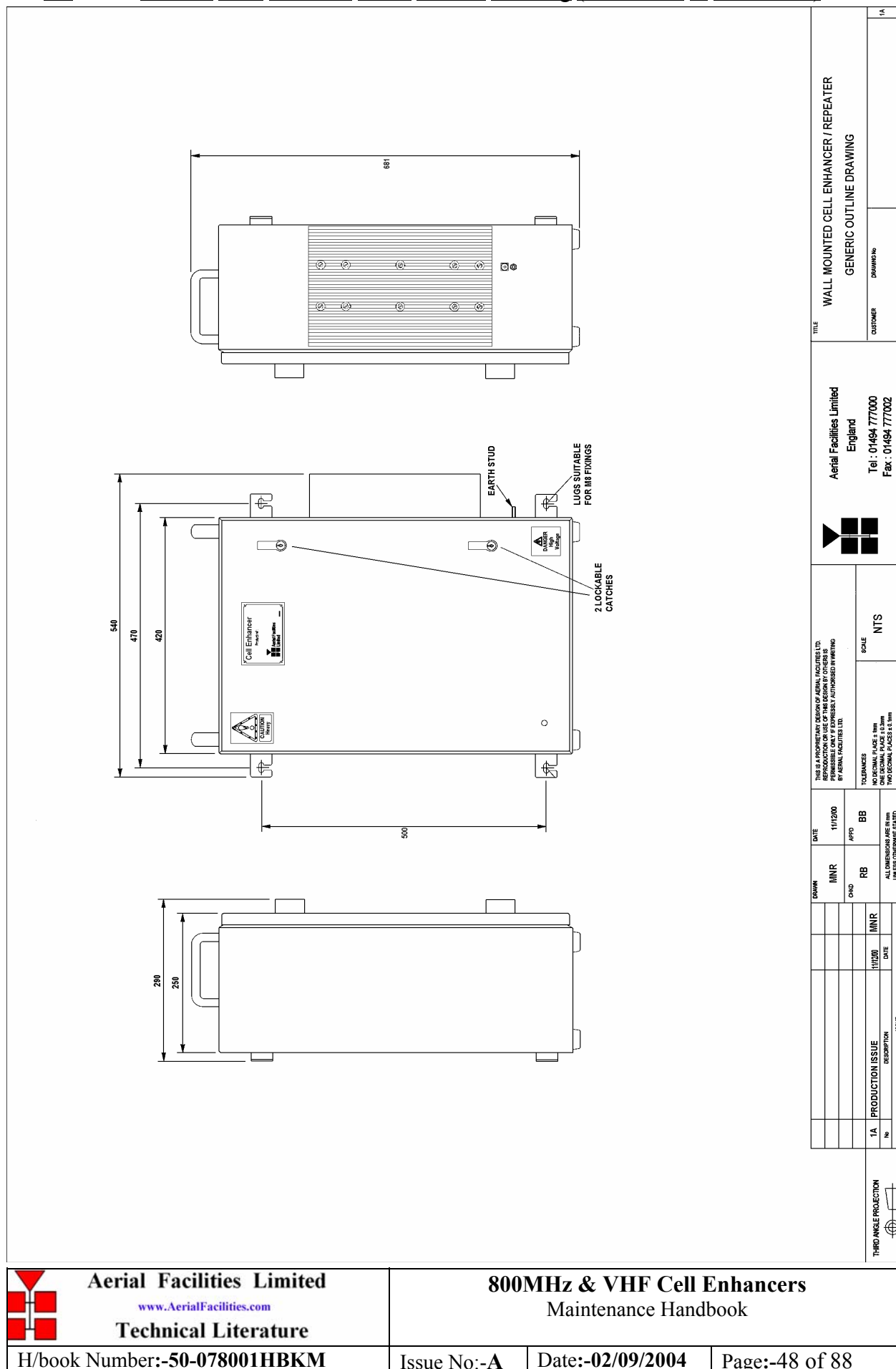
94-100004	STPS12045TV 60A DUAL DIODE	5
96-000004	38AH 12V S.L.A. BATTERY	4
96-100004	32mm 20A FUSE HOLDER	1
96-100006	FUSE HOLDER ATO IN-LINE	4
96-110015	T 15A A/SURGE FUSE 1.25'	1
96-110042	15A ATO FUSE	4
96-300057	15V 27A PSU 400W (XP BCC)	1
96-700002	LED.GREEN 5mm SEALED IP66	3
96-700005	LED.RED 5mm SEALED IP66	1
96-900018	AC TRIP SWITCH (5 AMP M.C.B.)	2
96-920002	DPDT MINI TOGGLE SWITCH	1
96-920008	PUSH BUTTON SWITCH RED (SPNO)	1
96-920011	PROXIMITY SWITCH	1
96-920012	PROXIMITY SWITCH MAGNET	1
97-100047	LOUVRE VENT PANEL 70mm RAL7035	2
97-300010	C/E SUPPLY INPUT COVER	1
97-400010	BLACK PLASTIC HANDLE 50mm HIGH	2
97-900004	RUBBER FOOT FOR CELL ENHANCERS	4
99-200003	WARNING LABELS DISCONNECT MAINS	2
99-200008	DANGER HIGH VOLTAGE LABEL 2x2'	1
99-200017	CAUTION HEAVY LABEL 75x55mm	1

4. SYSTEM DRAWINGS

4.1 24 Channel 800MHz & VHF Simplex/Duplex Cell Enhancers System Diagram



4.2 Generic Wall Mounted Cases Outline Drawing (50-078017 & 80-209302)



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5. SUB-UNIT MODULES

5.1 Bandpass Filters (02-007201 & 01-002503)

5.1.1 Description

The bandpass filters are multi-section designs with a bandwidth dependent upon the passband frequencies, (both tuned to customer requirements). The response shape is basically Chebyshev with a passband design ripple of 0.1dB. The filters are of slot coupled, folded combline design, and are carefully aligned during manufacture in order to optimise the insertion loss, VSWR and intermodulation characteristics of the unit. The tuned elements are silver-plated to reduce surface ohmic losses and maintain a good VSWR figure and 50Ω load at the input and output ports.

Being passive devices, the bandpass filters should have an extremely long operational life and require no maintenance. Should a filter be suspect, it is usually most time efficient to replace the module rather than attempt repair or re-tuning.

5.1.2 Technical Specification (02-007201)

PARAMETER		SPECIFICATION
Response Type		Chebyshev
Frequency Range:		800 - 950MHz (tuned to spec.)
Bandwidth:		10-25MHz (tuned to spec.)
Number of Sections:		8
Insertion Loss:		1.0 dB
VSWR:		better than 1.2:1
Power Handling:		100W max
Temperature range:	operation:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:		3 kg (typical)

5.1.3 Technical Specification (01-002503)

SPECIFICATION		PARAMETER
Response type:		Chebyshev
Frequency range:		135 – 250MHz
Bandwidth:		3.5MHz (tuned to spec.)
Nō. of sections:		6
Insertion loss:		1.2dB
VSWR:		Better than 1.2:1
Power Handling:		100W maximum
Temperature range:	operate:	-10°C to +60°C
	store:	-20°C to +70°C
Weight:		3 kg
Size:		384 x 82.5 x 56.4mm

5.2 900MHz Splitter/Combiner (05-002602)

5.2.1 Description

The Splitter/Combiner used is a device for accurately matching two or more RF signals to single or multiple ports, whilst maintaining an accurate 50Ω load to all inputs/outputs and ensuring that the VSWR and insertion losses are kept to a minimum. Any unused ports will be terminated with an appropriate 50Ω load.

Being passive devices, the splitters should have an extremely long operational life and require no maintenance. Should a unit be suspect, it is usually most time efficient to replace the whole module rather than attempt repair or re-tuning.

Being passive devices, the splitters should have an extremely long operational life and require no maintenance. Should a unit be suspect, it is usually most time efficient to replace the whole module rather than attempt repair or re-tuning.

5.2.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency Range:	Narrowband:	815 – 960MHz
	Broadband:	800 – 1200MHz
Bandwidth:	Narrowband:	145MHz
	Broadband:	400MHz
Input ports:		1
Output ports:		2
Insertion loss:	Narrowband:	3.3dB
	Broadband:	3.5dB
Return loss input & output:		1.3:1
Impedance:		50Ω
Isolation:	Narrowband:	>20dB
	Broadband:	>18dB
MTFB:		>180,000 hours
Power rating:	Splitting:	20Watts
	Combining:	0.5Watt
Connectors:		SMA female
Weight:		200g (approximately)
Size:		54 x 44 x 21mm (including connectors)

5.3 1 Watt 3dB Broadband Splitter (05-002901)

5.3.1.....Description

The 1 Watt, 3dB Splitter/Combiner used is a device for accurately matching two or more RF signals to single or multiple ports, whilst maintaining an accurate 50Ω load to all inputs/outputs and ensuring that the VSWR and insertion losses are kept to a minimum. Any unused ports will be terminated with an appropriate 50Ω load.

5.3.2 Technical Specification

PARAMETER	SPECIFICATION
Frequency Range:	100 - 520 MHz
Bandwidth:	380 MHz
Inputs:	1
Outputs:	2
Insertion Loss:	3.5 dB (typical)
Isolation:	>18 dB
Return Loss (VSWR) – Input:	Better than 1.3:1
Return Loss (VSWR) – Output:	Better than 1.3:1
Impedance:	50 Ω
Power Rating – Splitter:	20 Watts
Power Rating – Combiner:	1.0 Watt
Connectors:	SMA female
Size:	54 x 44 x 21 mm (including connectors)
Weight:	200 gm (approximately)

5.4 Four Way Splitter (05-003302)

5.4.1 Description

The Splitter/Combiner used is a device for accurately matching two or more RF signals to single or multiple ports, whilst maintaining an accurate 50Ω load to all inputs/outputs and ensuring that the VSWR and insertion losses are kept to a minimum. Any unused ports will be terminated with an appropriate 50Ω load.

5.4.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency range:		700-900MHz
Bandwidth:		200MHz
Rejection:		>14dB
Insertion loss:		7.5dB (in band, typical)
Connectors:		SMA
Weight:		<1.5kg
Temperature range:	operational	-10°C to +60°C
	storage	-20°C to +70°C

5.5 Four Way Hybrid Splitter (05-003401)

5.5.1 Description

The hybrid splitter used is a device for accurately matching one or more RF signals to single or multiple ports, whilst maintaining an accurate 50Ω load to all inputs/outputs and ensuring that the VSWR and insertion losses are kept to a minimum. Any unused ports would be terminated with an appropriate 50Ω load.

5.5.2 Technical Specification 05-003401

PARAMETER		SPECIFICATION
Frequency range:		70 – 250MHz
Bandwidth:		180MHz
Rejection:		>14dB
Insertion loss:		6.5dB (in band, typical)
Connectors:		SMA
Weight:		<1.5kg
Temperature range:	operational	-10°C to +60°C
	storage	-20°C to +70°C

5.6 3 Way Splitter/Combiner (05-003801)

5.6.1 Description

The 3 way Splitter/Combiner used is a 'Zinger' type design for accurately matching three RF signals to a single port, whilst maintaining an accurate balance between ports, and ensuring that the VSWR and insertion losses attain the best possible specification. They are specialist passive devices and must be replaced in the unlikely event of failure.

5.6.2 Technical Specification

PARAMETER	SPECIFICATION
Frequency Range:	800-1000MHz
Bandwidth:	200MHz (typical)
Inputs:	3
Outputs:	1
Insertion Loss:	5.2 dB (typical)
Isolation:	>18 dB
Return Loss (VSWR) – Input:	Better than 1.35:1
Return Loss (VSWR) – Output:	Better than 1.35:1
Impedance:	50 Ω
Power Rating – Splitter:	20 Watts
Power Rating – Combiner:	0.5 Watt
Connectors:	SMA female
Size:	54 x 44 x 21 mm (including connectors)
Weight:	200 gm (approximately)

5.7 Wideband 3dB Splitter (07-004101)

5.7.1 Description

This wideband, 2 way hybrid splitter, is an AFL stock item with many years of reliable service. The successful construction of such a device, relies largely on a pcb developed within a rigid specification, skilled assembly and testing. Insertion loss quoted is a typical figure, any unit will be within 5% of this figure.

5.7.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency Range:		70-1000MHz
Split ratio:		1:2
Insertion Loss:		3.2dB (typical)
Isolation:		>20dB
Power rating:		1.0 Watt
VSWR:		Better than 1.3:1
Available connectors:		BNC, N type, SMA
Temperature range:	operation:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:		Circa 200gms

5.8 VHF/UHF 3-Way Splitter (07-005401)

5.8.1 Description

The 3dB Splitter/Combiner used is a device for accurately matching two or more RF signals to single or multiple ports, whilst maintaining an accurate 50Ω load to all inputs/outputs and ensuring that the VSWR and insertion losses are kept to a minimum. Any unused ports will be terminated with an appropriate 50Ω load.

5.8.2 Technical Specification

PARAMETER	SPECIFICATION
Frequency Range:	160-470MHz
Bandwidth:	300MHz
Inputs:	1
Outputs:	3
Insertion Loss:	4.5 dB (typical)
Isolation:	>14 dB
Return Loss (VSWR) – Input:	Better than 1.3:1
Return Loss (VSWR) – Output:	Better than 1.3:1
Impedance:	50 Ω
Power Rating – Splitter:	20 Watts
Power Rating – Combiner:	0.5 Watt
Connectors:	SMA female
Size:	54 x 44 x 21 mm (including connectors)
Weight:	200 gm (approximately)

5.9 3 Port Tx Hybrid Coupler (80-024203)

5.9.1.....Description

The transmitter hybrid couplers provide isolation from unwanted reflected frequencies to/from the leaky feeder antennas. They are specialist narrow-band 3 port devices, designed with rejection and power handling as the main criteria. Being passive devices, the hybrid couplers should be maintenance free over their entire lifetime and have an extremely high MTBF figure. It is not recommended that the top cover be removed or any of the internal components needlessly touched, since the original factory alignment/tuning would be extremely hard to reproduce in a 'field' environment.

5.9.2 Technical Specification

PARAMETER	SPECIFICATION
Frequency Range:	140-175 MHz
Bandwidth:	$\pm 10\%$ of f_0
Insertion Loss:	3.5dB
Rejection:	-18dB
Impedance:	50 Ω
V.S.W.R:	1.2:1
Input to input isolation:	>20dB
Connectors:	Type N Standard
Dimensions:	140 x 120 x 35mm
Power rating:	50Watts
Weight:	0.5kg

5.10 Crossband Coupler (07-005705)

5.10.1 Description

The purpose of a crossband coupler is to either combine/split transmission signals from different parts of the frequency spectrum.

The crossband coupler fitted here, is the means by which the separate VHF and UHF frequency band signals are mixed to form a composite RF signal.

It basically comprises of a 3 port device, two filters, one a low pass the other a high pass, that are then mixed and fed to a common output. The couplers are built into a machined aluminium casing having a centre screening wall between the filter sections and lid secured by screws at frequent intervals over its perimeter to obtain a tight seal and to ensure linearity and stability of response.

5.10.2 Technical Specification

PARAMETER		SPECIFICATION
Passband	250MHz:	70-250MHz
	380MHz:	380-960MHz
Power Rating:		50 Watts (CW)
Number of Input ports:		2
Number of Output ports:		1
Insertion loss:		0.5 dB
Isolation:		> 50 dB 70-250MHz > 50 dB 380-960MHz (15 dB typical return loss 500-960)
Impedance:		50 Ω
Connectors:		SMA- female

5.11 6dB Power Monitor (07-014002)

5.11.1 Description

The purpose of these couplers is to tap off known portions (usually 3-30dB) of RF signal from transmission lines, either resistively or by induction, and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are formally known as *directional* couplers as they couple power from the RF mainline *in one direction only*.

Various constructional techniques are used depending on the specification required. These include microstrip, stripline, coaxial cable and capacitive types.

5.11.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency range:		170 – 2200MHz
Insertion Loss:		<0.3dB
Coupling level:		-6dB
Rejection:		N/A
Weight:		<200gms
Connectors:		N type, female
Temperature range:	operation:	-10°C to +60°C
	storage:	-20°C to +70°C

5.12 2-Port RF Isolator (08-930002)

5.12.1 Description

The purpose of fitting an isolator to the output of a transmitter in a multi-transmitter environment is such that each output is afforded a degree of isolation from every other. Were this not to be the case, two simultaneous transmissions could interfere to create intermodulation products, especially in the non-linear power amplifier output stages of the transmitters. Whilst this effect would not affect the intelligibility of the two original transmissions, a further two new transmissions would be created which could themselves cause interference to third party users.

The ferrite isolator is a ferro-magnetic device, which has directional properties. In the forward direction, RF arriving at the input is passed to the output with minimal attenuation. In the reverse direction, RF arriving at the output due to reflected power from a badly matched load, or due to coupling with another transmitter, is routed into an RF load where it is absorbed. The isolator therefore functions to prevent reflected RF energy reaching the power amplifier where it could cause intermodulation products or premature device failure.

5.12.2 Technical Specification

PARAMETER	SPECIFICATION
Frequency range:	150-300MHz
Bandwidth (% of centre frequency):	2
Isolation:	35dB (typical)
Insertion loss:	0.25dB (typical)
V.S.W.R:	1.15:1 (typical)
Maximum power:	200Watts (per carrier)
Connector:	SMA
Weight:	200gm (approximately)

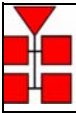
5.13 $\frac{1}{4}$ Watt 0- -30dB & 0-15dB Variable Attenuators (10-000701 & 10-000901)

5.13.1 General Application

In many practical applications for Cell Enhancers etc., the gain in each path is found to be excessive. Therefore, provision is made within the unit for the setting of attenuation in each path, to reduce the gain.

5.13.2 Switched Attenuators

The AFL switched attenuators are available in two different types; 0 – 30dB in 2 dB steps, or 0 – 15dB in 1 dB steps. The attenuation is simply set using the four miniature toggle switches on the top of each unit. Each switch is clearly marked with the attenuation it provides, and the total attenuation in line is the sum of the values switched in. They are designed to maintain an accurate 50 Ω impedance over their operating frequency at both input and output.

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5.14 LNA's (11-001202, 11-005802, 11-005902 11-006002, 11-006702 & 11-004802)

5.14.1 Description

The Gallium-Arsenide low noise amplifiers used in the unit are double stage, solid-state low noise amplifiers. Class A circuitry is used throughout the units to ensure excellent linearity and extremely low noise over a very wide dynamic range. The active devices are very moderately rated to provide a long trouble-free working life. There are no adjustments on these amplifiers, and in the unlikely event of a failure, then the complete amplifier should be replaced. This amplifier features its own in-built alarm system which gives a volt-free relay contact type alarm that is easily integrated into the main alarm system.

5.14.2 Technical Specification (11-001202)

PARAMETER	SPECIFICATION
Frequency range:	10 - 600MHz
Bandwidth:	200MHz (as required, tuneable)
1dB Compression point:	>+15 dBm
3rd order intercept:	>+25dBm
Gain:	20dB (typical)
VSWR:	better than 1.5:1
Noise figure:	3.5dB (typical)
Connectors:	SMA female
Supply:	108mA @ 24V DC
Temp. range: operational:	-10°C to +60°C
storage:	-20°C to +70°C
Weight:	0.4kg
Size:	88.9 x 50.8 x 31.75 mm (case only)

5.14.3 Technical Specification (11-004802)

PARAMETER	SPECIFICATION
Frequency Range:	350 - 550MHz
Bandwidth:	<100MHz (as required, tuneable)
1dB Compression Point:	>+29dBm
3rd Order Intercept:	>+44dBm
Gain:	>10dB (typical)
VSWR:	better than 1.5:1
Input return loss:	>14dB
Noise Figure:	<4.0dB (typical)
Connectors:	SMA female
Supply:	300mA at 24V DC
Temperature range:	operational : -10°C to +60°C
	storage: -20°C to +70°C
Size:	88 x 50 x 34mm (ex. connectors)
Weight:	0.26kg

5.14.4 Technical Specification (11-005802)

PARAMETER		SPECIFICATION
Frequency Range:		800 – 960MHz
Bandwidth:		<170MHz
Gain:		14.5±0.5dB (typical)
1dB Compression Point:		30dBm
OIP3:		46dBm
Input/Output Return Loss:		>18dB
Noise Figure:		<2.7dB
Power Consumption:		510-540mA @ 24V DC
Supply Voltage:		10-24V DC
Connectors:		SMA female
Temperature Range:	operational:	-10°C to +55°C
	storage:	-40°C to +70°C
Size:		90 x 55 x 30.2mm
Weight:		280gm (approximately)

5.14.5 Technical Specification (11-005902)

PARAMETER		SPECIFICATION
Frequency Range:		800 – 960MHz
Bandwidth:		<170MHz
Gain:		19.5dB (typical)
1dB Compression Point:		21dBm
OIP3:		33dBm
Input/Output Return Loss:		>20dB
Noise Figure:		1dB (typical)
Power Consumption:		190mA @ 24V DC
Supply Voltage:		10-24V DC
Connectors:		SMA female
Temperature Range:	operational:	-10°C to +55°C
	storage:	-40°C to +70°C

5.14.6 Technical Specification (11-006002)

PARAMETER		SPECIFICATION
Frequency range:		70 – 500MHz
Bandwidth:		<430MHz
Gain:		21dB (typical)
1dB Compression Point:		+20dB (typical)
3rd order intercept:		+33dB (typical)
Input return loss:		>14dB
Output return loss:		>20dB
VSWR:		Better than 1.5:1
Noise figure:		<2.7dB
Connectors:		SMA female
Supply:		230 - 260mA @ 10 to 24V DC
Size:		88 x 50 x 34mm (ex. connectors)
Temperature range:	operational:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:		0.26kg

5.14.7 Technical Specification (11-006702)

PARAMETER		SPECIFICATION
Frequency Range:		800 – 1000MHz
Bandwidth:		<200MHz
Gain:		29dB (typical)
1dB Compression Point:		20dBm
OIP3:		33dBm
Input/Output Return Loss:		>18dB
Noise Figure:		1.3dB (typical)
Power Consumption:		180mA @ 24V DC
Supply Voltage:		10-24V DC
Connectors:		SMA female
Temperature Range:	operational:	-10°C to +55°C
	storage:	-40°C to +70°C
Size:		90 x 55 x 30.2mm
Weight:		290gms (approximately)

5.15 5, 10 & 20W 900MHz Power Amplifiers (12-018601, 12-018001 & 12-018002)

5.15.1 Description

These Gallium-Arsenide power amplifiers are Class A 10 & 20W power amplifier from 800-960MHz in a 1 stage balanced configuration. It demonstrates a very high linearity and a very good input/output return loss. It has built in a Current Fault Alarm Function with a volt-free relay contact pair as its output.

Its housing is an aluminium case (Alocrom 1200 finish) with SMA connectors for the RF input/output and a D-Type connector for the power supply and the Current Fault Alarm Function. These amplifiers have no user adjustments and in case of failure should only be replaced.

5.15.2 Technical Specification (12-018601, 5W)

PARAMETER		SPECIFICATION
Frequency range:		800-960MHz
Small signal gain:		30dB
Gain flatness:		± 1.2 dB
I/O Return loss:		>20dB
1dB compression point:		37dBm
OIP3:		52dBm
Supply voltage:		12V DC
Supply current:		2.0Amps (Typical)
Temperature range	operational:	-10°C to +55°C
	storage:	-30°C to +70°C
Weight:		<2kg (no heatsink)

5.15.3 Technical Specification (12-018001, 10W)

PARAMETER		SPECIFICATION
Frequency range:		800-960MHz
Small signal gain:		30dB
Gain flatness:		± 1.2 dB
I/O Return loss:		>18dB
1dB compression point:		42.8dBm
OIP3:		56dBm
Supply voltage:		24V DC
Supply current:		5.0Amps (Typical)
Temperature range	operational:	-10°C to +55°C
	storage:	-30°C to +70°C
Weight:		<2kg (no heatsink)

5.15.4 Technical Specification (12-018002, 20W)

PARAMETER		SPECIFICATION
Frequency range:		800-960MHz
Small signal gain:		30dB
Gain flatness:		±1.2dB
I/O Return loss:		>18dB
1dB compression point:		42.8dBm
OIP3:		56dBm
Supply voltage:		12V DC
Supply current:		5.0Amps (Typical)
Temperature range	operational:	-10°C to +55°C
	storage:	-30°C to +70°C
Weight:		<2kg (no heatsink)

5.16 VHF 5Watt Power Amplifier (12-004902)

5.16.1 Description

The power amplifier used is a triple stage solid-state low-noise amplifier. Class AB circuitry is used in the unit to ensure good linearity over a wide dynamic range. The three active devices are very moderately rated to provide a long trouble-free working life. There are no adjustments on this amplifier, and in the unlikely event of failure then the entire amplifier should be replaced.

5.16.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency range:		80-260MHz
Bandwidth:		20MHz (tuned to specification)
Maximum RF output:		>5.0 Watt
Gain:		40dB
1dB compression point:		+30dBm
3 rd order intercept point:		+40dBm
VSWR:		better than 1.5:1
Connectors:		SMA female
Supply:		2000mA @ 24V DC
Temperature range:	operational:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:		0.5 kg
Size:		167x52x25mm

5.17 3 Stage Alarm PCB & 3 Stage Simplex Alarm PCB(12-002201 & 12-002203)

5.17.1 Description

Amplifier Alarm Boards are fitted to monitor the bias conditions of AFL Class A amplifiers which remain constant in normal operation. Any departure from normal bias conditions is a result of device failure, excess temperature, over-driving or oscillation (excessive power).

In normal operation, the Class A bias circuit of the amplifier develops a constant voltage of 1.20V across the collector current setting resistor. The Amplifier Alarm Board is a window comparator device, which is adjusted to sense a departure from this condition. Several different alarm outputs are provided to simplify interfacing, (Relay Contact, Open Collector, and TTL Logic Levels)

The basic version of the Alarm Board (12-002801) monitors a single amplifier stage. A three-stage version (12-002201) is used on complex amplifiers where three separate comparators have their outputs logically combined to a common output stage. Failure of any one stage will activate the alarms.

Note that the alarm board has a green Light Emitting Diode located near to the centre of the printed circuit board, which is illuminated on 'Good', and extinguished on 'Alarm'. It is therefore a simple matter to identify an active module failure, by searching for an Alarm Board which has its green LED extinguished. A simple test of the alarm board is possible by shorting across the monitor inputs, pins 1 and 2, 3 and 4 or across pins 5 and 6. This last monitor input is inactive if the board has been converted to a two way alarm board. (Refer to relevant amplifier alarm wiring diagram.)

- 1) Volt-free change over relay contacts.
- 2) Open collector NPN transistor pulls low on alarm.
- 3) TTL driver.

In systems using simplex channel switching, it is necessary to be able to distinguish between a 'normal' switching operation and erroneous modes where faults in the detector circuitry may cause data errors but not necessarily fire the alarms. The simplex alarm board is designed to differentiate between normal and spurious switching signals

There are two selectable link options on the three-way board:

LINK1 - Removed to convert to two-way alarm board.

LINK2 - Removed to isolate 0V from chassis earth.

The one way alarm board only has the 0V isolation link (LINK2) fitted.

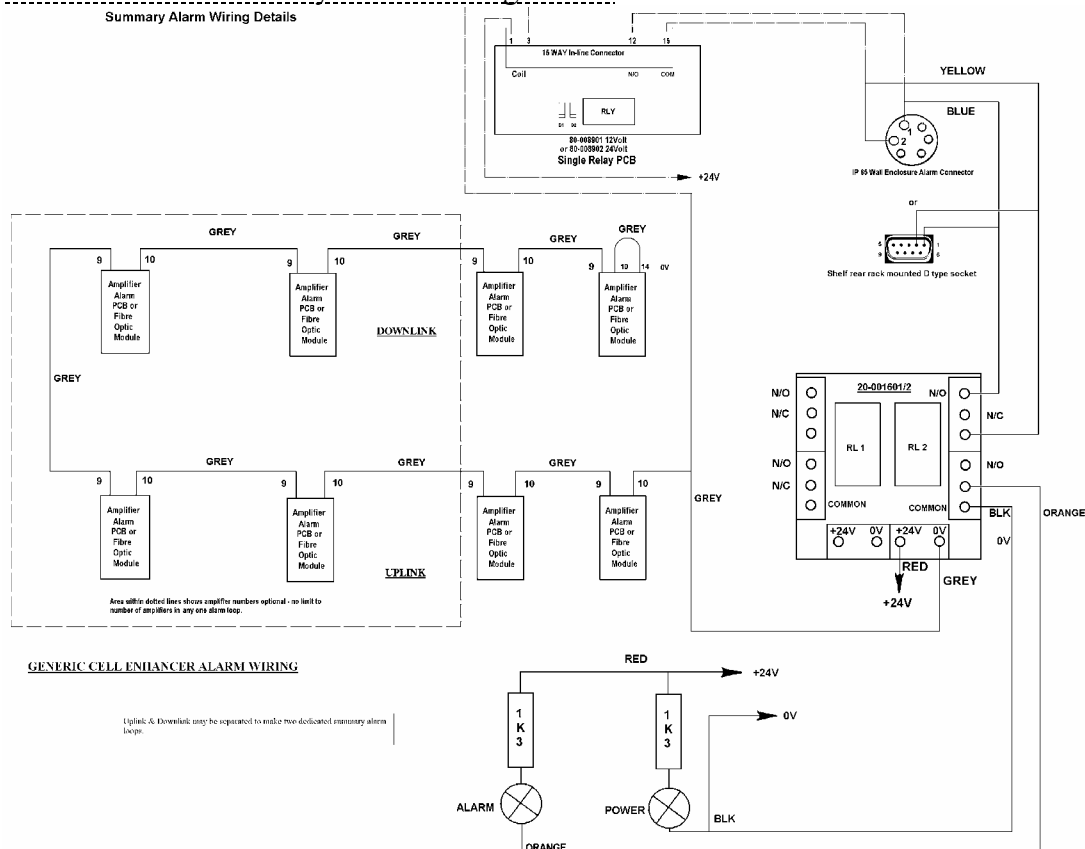
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5.17.2 Technical Specification

PARAMETER		SPECIFICATION
Operating voltage:		8 to 30V (floating earth)
Alarm Threshold:		Vcc - 1.20 volt $\pm 15\%$
Alarm output relay contacts:		
Max. switch current:		1.0Amp
Max. switch volts:		120Vdc/60VA
Max. switch power:		24W/60VA
Min. switch load:		10.0 μ A/10.0mV
Relay isolation:		1.5kV
Mechanical life:		$>2 \times 10^7$ operations
Relay approval:		BT type 56
Connector details:		15-way 0.1" pitch
Temperature range:	operational:	-10°C to +60°C
	storage:	-20°C to +70°C
PCB Size:		74 x 56mm (3 stage)
		54 x 56mm (1 stage)

5.17.3 Generic Summary Alarm Wiring Sketch

Summary Alarm Wiring Details



5.18 1 & 3 Stage Alarm/Simplex/Mute PCB (12-002804 & 12-002213)

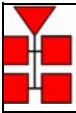
5.18.1 Description

In systems using simplex channel switching, it is necessary to be able to distinguish between a 'normal' switching operation and erroneous modes where faults in the detector circuitry may cause data errors but not necessarily fire the alarms. The simplex alarm/mute board is designed to differentiate between normal and spurious switching signals for single or multiple stage amplifiers.

5.19 Simplex Controller PCB (12-002811)

5.19.1 Description

The Simplex controller logic PCB monitors the receiver squelch output for a signal change and activates the supply switching for either the uplink or down link path accordingly. In normal operation, the low level Rx path is activated, and the associated Tx path is switched off. When a signal is detected by the Rx Squelch module, the Rx squelch output goes low (0v), which triggers the controller logic PCB. The PCB mutes the power supply to the opposite path Rx LNA's and switches on the power to the output power stage. In order to prevent the power stage noise blocking the opposite path's low level receiver, the power amplifier is normally muted.

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5.20 Dual DC/DC Converter (13-001803)

5.20.1 Description

This unit is employed where it is necessary to derive two fixed voltage power supply rails from some higher voltage. Typically it is used to derive 5, 8, 12 or 15V from a 24V input.

The circuit is based upon a pair of LM257 series variable voltage regulators (LM2576, 12 & 15V & LM2575, 5V), which are each capable of supplying an absolute maximum of 1.5A output current. Note that at full output current, the dissipation of the device must remain within design limits, bearing in mind the voltage which is being dropped across it. The maximum allowable dissipation will also depend on the efficiency of the heatsink on which the device is mounted.

5.20.1 Technical Specification

PARAMETER		SPECIFICATION
Operating Voltage:		21 – 27V DC
Output Voltage:		12V & 12V (typical)
Output Current:		1.0A (maximum per o/p)
Connections:		Screw Terminal Block
Temperature Range	operational:	-10°C to +60°C
	storage	-20°C to +70°C
PCB Size:		85 x 63mm

5.21 Simplex Squelch & AF Module (17-002802)

5.21.1 Description

The difference in signal levels between the paths means that the channel modules would latch onto any signal in the band rather than a signal at the desired channel frequency. This is achieved, in part, to having the de-sense module, (which is controlled by the Simplex Rx squelch unit), apply maximum attenuation (via an AGC attenuator unit) to the downlink path, when the uplink is active.

5.21.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency range:		80-260MHz
Bandwidth:		20MHz (tuned to spec.)
Maximum RF output:		>5.0 Watt
Gain:		40dB
1dB compression point:		+30dBm
3 rd order intercept point:		+40dBm
Noise Figure:		2.4dB
VSWR:		better than 1.5:1
Connectors:		SMA female
Supply:		1.8A @ 24V DC
Temperature range:	operational:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:		0.5 kg
Size:		167x52x25mm

5.22 Wide Dynamic Range (Log.) 12V AGC (17-001109, det. & 17-001201, atten.)

5.22.1 Description

The equipment is fitted with a wide dynamic range (logarithmic detector) Automatic Gain Control (AGC) system. This is generally fitted in the Uplink path (not usually needed in the downlink path, as the signal here is at an almost constant level), to avoid overloading the input amplifiers should a mobile be operated very close to the unit.

The AFL wide dynamic range Automatic Gain Control system consists of two units, a detector/amplifier and an attenuator. The logarithmic detector/amplifier unit is inserted in the RF path on the output of the power amplifier, and the attenuator is situated in the RF path between the 1st and 2nd stages of amplification.

Normally the attenuator is at minimum attenuation. The detector/amplifier unit monitors the RF level being delivered by the power amplifier, and when a certain threshold is reached it begins to increase the value of the attenuator to limit the RF output to the (factory set) threshold. Therefore overloading of the power amplifier is avoided.

The factory set threshold is 1dB below the Enhancer 1dB compression point. Some adjustment of this AGC threshold level is possible, a 10dB range is mostly achieved. It is not recommended under any circumstances to adjust the AGC threshold to a level greater than the 1dB compression point as system degradation will occur.

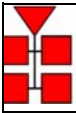
The detector comprises of a 50 Ω transmission line with a logarithmic amplifier which samples a small portion of the mainline power. The sampled signal is amplified and fed to a conventional half wave diode rectifier, the output of which is a DC voltage logarithmically proportional to the RF input signal.

This DC voltage is passed via an inverting DC amplifier with integrating characteristics, to the output, which drives the attenuation control line of the corresponding AGC attenuator. This unit is fitted at some earlier point in the RF circuit.

For small signals, below AGC onset, the output control line will be close to 12V and the AGC attenuator will have minimum attenuation. As the signal level increases the control line voltage will fall, increasing the attenuator value and keeping the system output level at a constant value.

The AGC onset level is adjusted by the choice of sampler resistor R1 and by the setting of potentiometer VR1, (factory set @ time of system test) do not adjust unless able to monitor subsequent RF levels.

The attenuator comprises a 50 Ω P.I.N diode, voltage-variable attenuator with a range of 3 to 30dB. The attenuation is controlled by a DC voltage which is derived from the associated AGC detector unit. Note that the log detector module is used with an associated controller board, in the duplex shelves for detecting the presence of signals to be muted/amplified.

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5.22.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency Range:		up to 1000MHz
Attenuation Range:		3 to 30dB
Attenuation Steps:		continuously variable
VSWR:		better than 1.2:1
RF Connectors:		SMA female
Power Handling:	attenuator:	1W
	detector/amp:	>30W (or as required)
Temperature Range:	operation:	-10°C to +60°C
	storage:	-20°C to +70°C
Size:	attenuator pcb	50 x 42 x 21mm
	detector/amp pcb	54 x 42 x 21mm
Weight:	attenuator:	90gm
	detector/amp:	100gm

5.23 Channel Control Module (17-002101)

5.23.1 Description

The purpose of the channel control modules is to change the channel selective module frequencies by means of a series of D.I.P switch banks, each switch corresponding to a different 'frequency bit'.

5.23.2 Technical Specification

Below shows the pin assignments for each switch on a channel control module.

IDC PIN	25-way Connector	Function
1	13	Freq. bit 1 (12.5kHz)
2	25	Freq. bit 2 (25kHz)
3	12	Freq. bit 3 (50kHz)
4	24	Freq. bit 4 (100kHz)
5	11	Freq. bit 5 (200kHz)
6	23	Freq. bit 6 (400kHz)
7	10	Freq. bit 7 (800kHz)
8	22	Freq. bit 8 (1.6MHz)
9	9	Freq. bit 9 (3.2MHz)
10	21	Freq. bit 10 (6.4MHz)
11	8	Freq. bit 11 (12.8MHz)
12	20	Freq. bit 12 (25.6MHz)
13	7	Freq. bit 13 (51.2MHz)
14	19	Freq. bit 14 (102.4MHz)
15	6	Freq. bit 15 (204.8MHz)
16	18	Freq. bit 16 (409.6MHz)
17	5	Module alarm
18	17	N/C
19	4	
20	16	
21	3	
22	15	+5V
23	2	0V
24	14	Switched 12V
25	1	0V
26	---	---

5.23.3 900MHz Programming Procedure

Check that the required downlink and uplink frequencies fall within the operational band limits of the Cell Enhancer.

For each Downlink and Uplink channel frequency, subtract the appropriate synthesiser offset frequency from the required operational frequency and record the resulting local oscillator frequencies.

Divide each Downlink and Uplink local oscillator frequency by the synthesiser channel spacing and check that the result is an integer (ie: no remainder).

If the synthesiser division ratio is not an integer value, check the required operational frequency and repeat the calculation checking for mistakes.

Convert the required local oscillator frequency to synthesiser programming switch state patterns according to the following table.

NOTE: Ensure that the correct column is used from the table below according to the synthesiser channel spacing of the particular channel modules fitted to the Cell Enhancer.

Switch Number	Synthesiser offset added when switch in UP position	
	25kHz channel spacing	100kHz channel spacing
1	+25kHz	+100kHz
2	+50kHz	+200kHz
3	+100kHz	+400kHz
4	+200kHz	+800kHz
5	+400kHz	+1.6MHz
6	+800kHz	+3.2MHz
7	+1.6MHz	+6.4MHz
8	+3.2MHz	+12.8MHz
9	+6.4MHz	+25.6MHz
10	+12.8MHz	+51.2MHz
11	+25.6MHz	+102.4MHz
12	+51.2MHz	+204.8MHz
13	+102.4MHz	+409.6MHz
14	+204.8MHz	+819.2MHz
15	+409.6MHz	-
16	+819.2MHz	-

5.23.4 900MHz Programming Example

Frequency required: 958.0 MHz

Channel spacing: 25 kHz

Synthesiser offset: 70 MHz

The Local Oscillator frequency is therefore:

$$958.0 - 70 = 888 \text{ MHz}$$

Dividing the LO frequency by the channel spacing of 0.025 MHz:

$$\frac{888.0}{0.025} = 35520$$

This is an integer value, therefore it is OK to proceed.

Local Oscillator Frequency	Switch settings															
	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
888.0 MHz	1	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0

Switch setting: 0 = switch DOWN (on, frequency ignored)
1 = switch UP (off, frequency added)

5.24 Channel Selective Modules (17-009127 UHF, & 17-009135 VHF)

5.24.1 Description

The channel selectivity module is employed when the Cell Enhancer requirement dictates that very narrow bandwidths (single operating channels), must be selected from within the operating passband. One channel selectivity module is required for each channel.

The Channel Selectivity Module is an Up/Down frequency converter that mixes the incoming channel frequency with a synthesised local oscillator, so that it is down-converted to an Intermediate Frequency (IF) in the upper HF range. An eight pole crystal filter in the IF amplifier provides the required selectivity to define the operating passband of the Cell Enhancer to a single PMR channel. The same local oscillator then converts the selected IF signal back to the channel frequency.

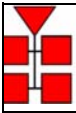
Selectivity is obtained from a fixed bandwidth block filter operating at an intermediate frequency (IF) in the low VHF range. This filter may be internal to the channel selectivity module (Crystal or SAW filter) or an externally mounted bandpass filter, (LC or Helical Resonator). Various IF bandwidths can therefore be accommodated. A synthesized Local Oscillator is employed in conjunction with high performance frequency mixers, to translate between the signal frequency and IF.

The operating frequency of each channel selectivity module is set by the programming of channel selectivity module frequencies and is achieved digitally, via hard wired links, banks of DIP switches, or via an onboard RS232 control module, providing the ability to remotely set channel frequencies.

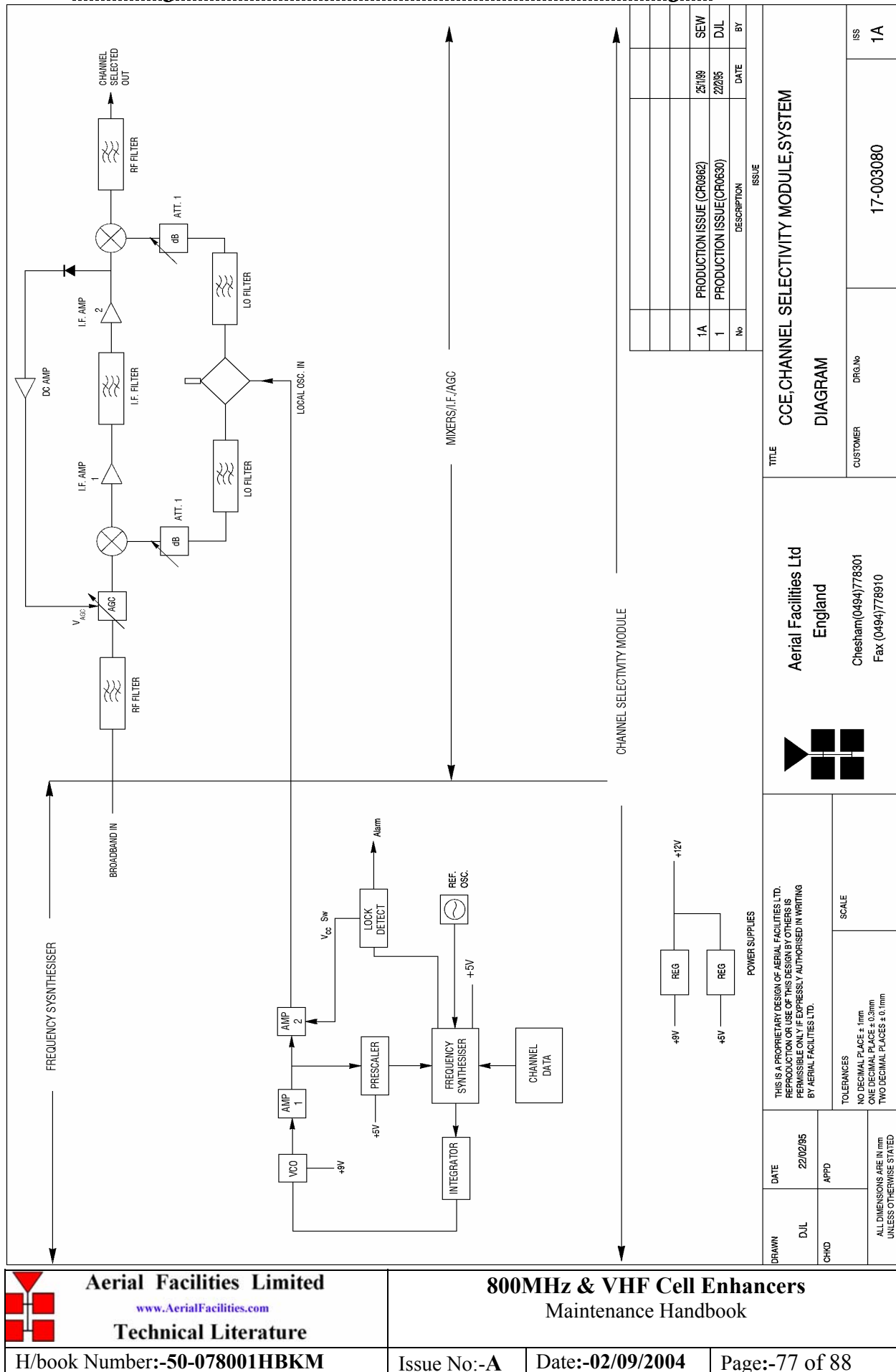
Automatic Level Control (ALC) is provided within each channel selectivity module such that the output level is held constant for high level input signals. This feature prevents saturation of the output mixer and of the associated amplifiers.

Alarms within the module inhibit the channel if the synthesised frequency is not locked. The synthesiser will not usually go out of lock unless a frequency far out of band is programmed.

The channel selectivity module is extremely complex and, with the exception of channel frequency programming within the design bandwidth, it cannot be adjusted or repaired without extensive laboratory facilities and the necessary specialised personnel. If a fault is suspected with any channel selectivity module it should be tested by substitution and the complete, suspect module should then be returned to AFL for investigation.

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5.24.2 Drg. Nō. 17-003080, Generic Channel Module Block Diagram



5.25 12 & 24V Relay Boards (20-001601 & 20-001602)

5.25.1 Description

The General Purpose Relay Board allows the inversion of signals and the isolation of circuits. It is equipped with two dual pole change-over relays RL1 and RL2, with completely isolated wiring, accessed via screw terminals.

Both relays are provided with polarity protection diodes and diodes for suppressing the transients caused by "flywheel effect" which can destroy switching transistors or induce spikes on neighbouring circuits. It's common use is to amalgamate all the alarm signals into one, volts-free relay contact pair for the main alarm system.

Note that the board is available for different voltages (12 or 24V) depending on the type of relays fitted at RL1 and RL2.

5.25.2 Technical Specification

PARAMETER		SPECIFICATION
Operating voltage:		8 to 30V (floating earth)
Alarm Threshold:		Vcc - 1.20 volt $\pm 15\%$
Alarm output relay contacts:		
Max. switch current:		1.0Amp
Max. switch volts:		120Vdc/60VA
Max. switch power:		24W/60VA
Min. switch load:		10.0 μ A/10.0mV
Relay isolation:		1.5kV
Mechanical life:		$>2 \times 10^7$ operations
Relay approval:		BT type 56
Connector details:		Screw terminals
Temperature range	operational:	-10°C to +55°C
	storage:	-40°C to +70°C

5.26 12V Low Voltage Battery Disconnect Module (80-061003)

5.26.1 Description

The low voltage disconnect module's main function is to monitor the battery voltage as the batteries discharge. When a pre-set value has been reached (usually 21.5V DC) the unit will disconnect the batteries to prevent a 'deep discharge' state which, if allowed to continue, could irreparably damage the batteries, necessitating replacement. The unit's other function is to regulate the battery voltage to the cell enhancer equipment to 23.5V when in back-up mode (the terminal voltage of fully charged batteries is likely to be higher than 27V, and therefore potentially damaging to electronics in the system).

5.26.2 Technical Specification

PARAMETER		SPECIFICATION
Operating voltage:		9-16V
Low voltage cut-off point:		10.5V (factory set)
Temperature range	operation:	-10°C to +55°C
	storage:	-20°C to +70°C
Weight:		<1kg
Size:		109.98 x 55.88mm

5.27 Crystal Filters (93-980109)

5.27.1 Description

Crystal filters are fitted at the inputs and outputs of the simplex/duplex shelves (instead of bandpass filters) in order to maximise the excellent isolation and rejection characteristics of these narrow-band devices. It is easier to achieve close channel spacing using crystal filters, however, due to the increased insertion losses, higher gain amplification is needed when they are utilised.

5.28 IXFN170N10 Power Mos-Fet Module (94-030015)

5.28.1 Description

This power module is simply a power MOS-FET transistor which is the series regulator for the main 24V DC battery output voltage rail. It is enabled/disabled from the discriminator module, (see section 5.2) has fast switch-off characteristics and a low forward volt drop. It is attached to a heatsink assembly mounted on the side of the case.

5.29 STPS12045TV 60A Dual Diode Assembly (94-100004)

5.29.1 Description

The purpose of these dual diode assemblies is to allow two (or more) DC voltage sources to be combined, so that the main 12 or 24 volt DC rail within the equipment is sourced from either the mains driven flat-pack, or externally through an XLR connector on the rear panel. The heavy-duty diodes prevent any reverse current from flowing back to their source or the alternative supply rail. Combining diodes such as these will also be used if the equipment is to be powered from external back-up batteries.

5.30 15V Switch-Mode PSU (96-300054)

5.30.1 Description

The power supply unit is a switched-mode type capable of supplying 15V DC at 27Amps continuously. The amplifiers in this unit will draw approximately 20-22Amps at 24V DC, so the PSU will be used conservatively ensuring a long operational lifetime.

No routine maintenance of the PSU is required. If a fault is suspected, then the output voltage from the power supply may be measured on its output terminals. This is typically set to 15.2V. The adjustment potentiometer will be found close to the DC output terminals.

All the PSU's used in AFL Cell Enhancers are capable of operation from either 110 or 220V nominal AC supplies. The line voltage is sensed automatically, so no adjustment or link setting is needed by the operator.

5.30.2 Technical Specification

AC Input Supply:	
Voltage:	110 or 220V nominal
	90 to 132 or 180 to 264V (absolute limits)
Frequency:	47 to 63Hz
DC Output Supply:	
Voltage:	15V DC (nominal)
	12.5-17V (absolute limits)
Current:	27.0A

6. INSTALLATION

6.1 Initial Installation Record

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.

6.1.1 Rack Mounted Equipment

Installation will be a matter of securing each shelf into its appropriate place in the rack cabinet, connecting all the cables (RF, DC and alarm) to their correct ports/connectors and system testing (at the customer's discretion) to prove the original specification. Care should be exercised when moving the 8U chassis as the weight may surprise an operator. Power should not be applied until all connections have been double-checked and verified.

6.1.2 Wall Mounted Equipment

The size and weight of the wall mounting enclosure(s) mean that they represent a significant weight hazard when fitting. In the interests of safety this should be done before any electrical, RF, or alarm connections are made.

The equipment must be located on a perpendicular, flat surface that is made from a material suitable for bearing the weight of the whole assembly with attached cables. 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 units that space is allowed for access to the front and underneath of the equipment. To enable maintenance to be carried out, the door must be able to open fully.

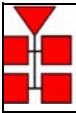
The location should be served with a duct to allow the entry of cables into the equipment.

6.1.3 Electrical Connections

The power supply is connected to the equipment via an IP65 connector located on the bottom or side surface. 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.

Ensure that connections are kept clean and are fully tightened.

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6.1.4 RF Connections

All RF connections are made to the cable termination, located on the bulkhead at the rear of the equipment at floor level (rack equipment). 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.

Again, ensure that connections are kept clean and are fully tightened.

6.2 Commissioning

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

To commission the system the test equipment detailed in Section 7.2 will be required. Using the system diagrams and the end-to-end test specification, the equipment should be tested to ensure correct operation.

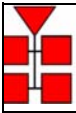
On initial power up the system alarm indicators on the front panels of the equipment should be checked. A red LED illuminated indicates a fault in an amplifier module that must be investigated before proceeding with the commissioning. A green LED on the door illuminates, to indicate that the power supply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

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.

6.3 Quick Fault Checklist

All AFL equipment 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 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/ports 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 faults at the base station.
- Modems fitted with incorrect software configuration/and or PIN Nō's.
- Changes to channel frequencies and inhibiting channels.
- Hand held radio equipment not correctly set to repeater channels.
- Hand held radio equipment not correctly set to base station.

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7. MAINTENANCE

7.1 General Procedures

7.1.1 Basic Fault Finding

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 within an 8U shelf and housed within a standard 19" rack type cabinet.

Transmissions from the main base stations are passed through 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.

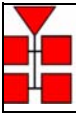
This can be achieved remotely (via CEMS, the RS232 Coverage Enhancement Management System, if fitted), or locally with the front panel LED's. The green LED on the front panel should be illuminated, while the red alarm indicator should be off.

If an Alarm is on, then that individual module must be isolated and individually tested against the original test specification.

The amplifier units within the shelf have a green LED showing through a hole in their cover, 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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7.1.2 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.

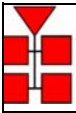
If a signal is not received at the output it will be necessary to follow the downlink path through the system to find a point at which the signal is lost. The expected downlink output for the given input can be found in the end-to-end test specification.

7.1.3 Uplink

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

7.1.4 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.

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7.1.5 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.

7.1.6 Service Support

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

7.2 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.
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.

7.3 Care of Modules

7.3.1 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.

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

The following *general* rules 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).

7.3.3 Module Replacement (general):

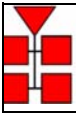
- 1 Carefully align the module into its location then slowly push the module directly straight into its position, taking care not to twist/turn it during insertion.
- 2 Reconnect all connectors, RF, alarm, power etc., (concealed connectors may have to be connected first).
- 3 Replace retaining screws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

7.3.4 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.

7.3.5 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

7.3.6 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