9 Channel, Channelised

UHF Cell Enhancer

Maintenance Handbook
For
Terry Consulting
AFL Works Order Nō.: Q10965
AFL product part Nō.: 50-025301

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AMENDMENT LIST RECORD SHEET

Issue Nō.	Date	Incorporated by	Page No.'s Amended	Reason for new issue
1	04/08/2003	CMH		1st Issue

Document Ref:-50-025301HBKM

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

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.

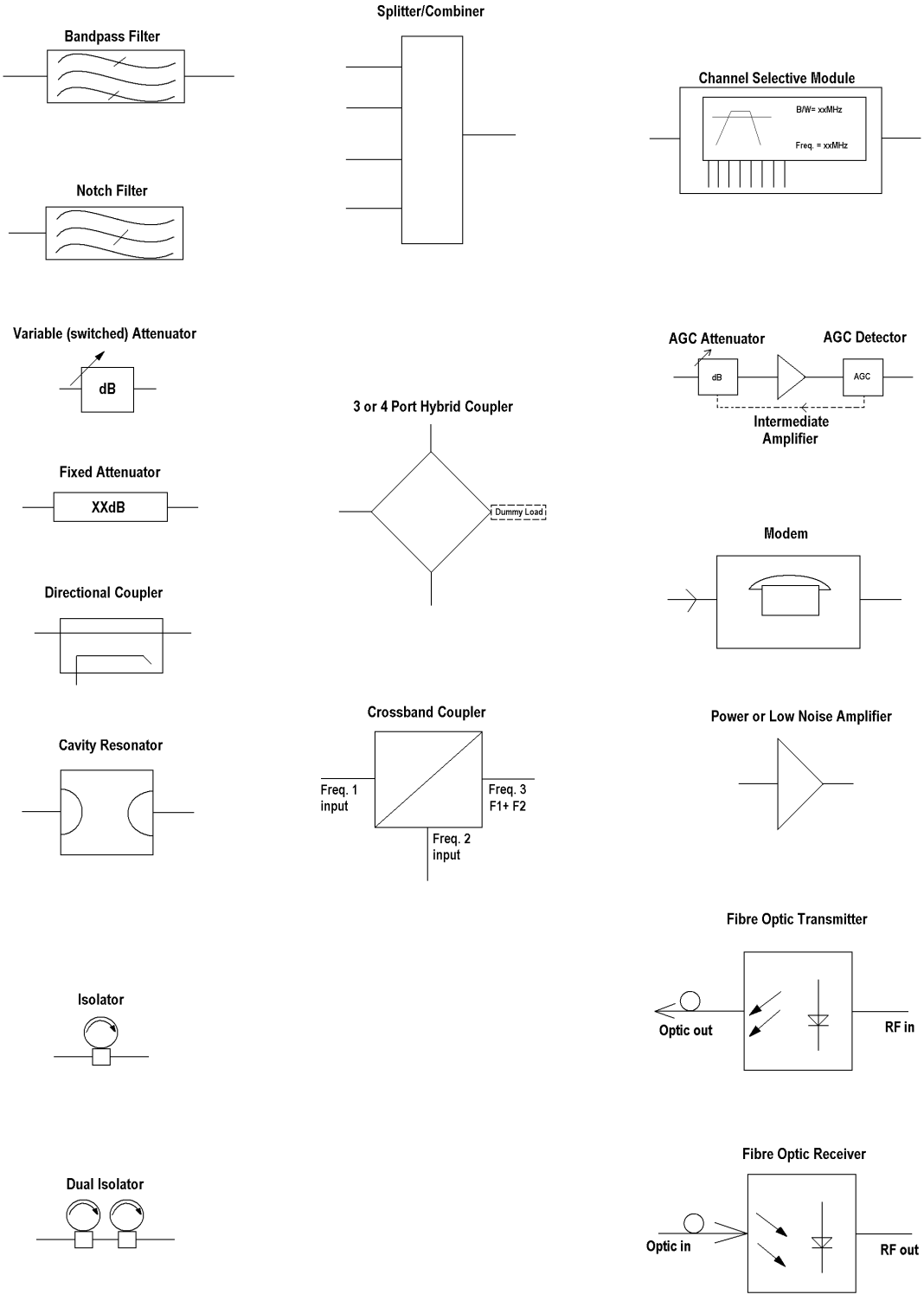
AFL has a policy of continuous product development and enhancement, and as such, reserves the right to amend, alter, update and generally change the contents, appearance and pertinence of this document without notice.

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.

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



Key to AFL RF Modules

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.

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.

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

2. OVERVIEW/SYSTEM DESCRIPTION

The AFL Channel Selective Cell Enhancer is a 2-way on-band repeater. Various models are available to cover frequency bands from 50MHz to 3000MHz. Its main 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 and tunnels, etc.,)

The Channel Selective Cell Enhancer is a 4-port device with direct connection to two antennas, a highly directional Yagi or similar aligned towards the base site (for the nine downlink channels) and a dedicated uplink antenna for the mobiles. 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.

The rack-mounted version is supplied in this instance in 5 shelf units. Each shelf/tray unit containing active modules has a ‘D.C. on’ indicator on the front panel and the PSU (in the downlink amplifier shelf) also has an ‘A.C. on’ indicator.

3. SPECIFICATION

3.1 9 Channel Channelised Cell Enhancer 50-025301 Parts Lists

AFL Part Nō.	Description	Qty.
50-025302	VTA-Downlink Duplexer Shelf	1
50-025303	VTA-Downlink Amplifier Shelf	1
50-025304	VTA-Downlink Channel Shelf	1
50-025305	VTA-Uplink Duplexer Shelf	1
50-025306	VTA-Uplink Amplifier Shelf	1

3.1.1 VTA-Downlink Duplexer Shelf 50-025302 Parts List

02-011204	6P TETRA C/L FILT (NARROW) SMA	2
02-013401	6P CL FLTR(0.5 min BW)LARGE SMA ASSY	2
19-001021	4U 19" UNIT 400 DEEP CHASSIS + BKT	1
19-001024	4U 19" UNIT FRONT PANEL FAB	1
91-020004	N JACK PANEL UT-141	6

3.1.2 VTA Downlink Amplifier Shelf 50-025303 Parts List

AFL Part Nō.	Description	Qty.
05-002603	UHF 3dB SPLITTER SMA	2
10-000701	1/4W0-30dB SWITCHED ATTENUATOR	2
11-006102	LNA 380-500MHz 1W WITH RELAY	2
11-007302	LNA. 380-500MHz 20dB (C/W RELAY) GA	1
11-007402	LNA. 380-500MHz 30dB (C/W RELAY) GA	3
12-002201	3 STAGE AMPLIFIER ALARM BOARD	2
12-002220	3 STAGE ALARM PCB COVER	2
12-004201	PWR AMP.450MHz 20W version CLASS A	2
13-001702	VOLTAGE REGULATOR Board 12V	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
80-008902	24V RELAY PCB ASSEMBLY	1
80-032320	10W PA HEATSINK (NEEDS 17-000526)	1
80-090822	C/E 8U FRONT PANEL, AFL (RAL7035)	1
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	8
91-100003	SMA PLUG ELBOW UT-141	4
91-130001	SMA ADAPT 'T' ALL FEMALE 3 GHZ	1
91-520003	POWER SWITCHD/FUSED MAINS INL.	1
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	2
91-600015	'D' 9 WAY PLUG S/B (NON FILTERED)	1
91-700017	ICD 15 WAY 0.1' CONNECTOR	5
93-540035	1K3 0.25W 1% RES MRS25 M:F	2
96-300054	24V 17A PSU 400W (XP BCC)	1
96-500005	DC INPUT FILTERS	1
96-700002	LED.GREEN 5mm SEALED IP66	1
96-700005	LED.RED 5mm SEALED IP66	1
97-400002	HANDLE TYPE H6803 4U.[ALLOY]	2

3.1.3 VTA Downlink Channel Shelf 50-025304 Parts List

05-002603	UHF 3dB SPLITTER SMA	2
05-003302	4 WAY SPLITTER GSM 900MHz	4
05-003401	4 WAY SPLITTER LOW POWER	4
17-002101	CHANNEL CONTROL MODULE	3
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
17-010601	CHAN MOD 480MHz, 15kHz B/W	9
97-000002	BLACK MODULE CAGE RUNNER	16
97-600001	SUBRACK FRONT HORIZ	4
97-600002	SUBRACK M2.5 STD TAP	4

3.1.4 VTA Uplink Duplexer Shelf 50-025305 Parts List

02-011204	6P TETRA C/L FILT (NARROW) SMA	2
02-013401	6P CL FLTR(0.5 min BW)LARGE SMA ASSY	2
19-001021	4U 19" UNIT 400 DEEP CHASSIS + BKT	1
19-001024	4U 19" UNIT FRONT PANEL FAB	1
91-020004	N JACK PANEL UT-141	6

3.1.5 VTA Uplink Amplifier Shelf 50-025306 Parts List

02-011204	6P TETRA C/L FILT (NARROW) SMA	1
02-013401	6P CL FLTR(0.5 min BW)LARGE SMA ASSY	1
10-000701	1/4W0-30dB SWITCHED ATTENUATOR	2
11-006102	LNA 380-500MHz 1W WITH RELAY	1
11-007302	LNA. 380-500MHz 20dB (C/W RELAY) GA	3
11-007402	LNA. 380-500MHz 30dB (C/W RELAY) GA	3
12-016301	PA 380-470MHz 20W CLASS A	1
13-001702	VOLTAGE REGULATOR Board 12V	2
13-003011	DC/DC CONVERTER 24-12V 8A PCB ASSY	1
17-001101	CELL ENHANCER AGC DETECTOR/AMP ASS	2
17-001201	C/E AGC UNIT ATTENUATOR ASSY	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
80-008902	24V RELAY PCB ASSEMBLY	1
80-032320	10W PA HEATSINK (NEEDS 17-000526)	1
80-090822	C/E 8U FRONT PANEL, AFL (RAL7035)	1
91-030002	N ADAPTOR PANEL FEMALE:FEMALE	4
91-100003	SMA PLUG ELBOW UT-141	4
91-130001	SMA ADAPT 'T' ALL FEMALE 3 GHZ	1
91-520003	POWER SWITCHD/FUSED MAINS INL.	1
91-600014	'D' 9 WAY SOCKET S/B (NON FILTERED)	2
91-600015	'D' 9 WAY PLUG S/B (NON FILTERED)	1
93-540035	1K3 0.25W 1% RES MRS25 M:F	2
96-300054	24V 17A PSU 400W (XP BCC)	1
96-500005	DC INPUT FILTERS	1
96-700002	LED.GREEN 5mm SEALED IP66	1
96-700005	LED.RED 5mm SEALED IP66	1
97-400002	HANDLE TYPE H6803 4U.[ALLOY]	2

3.2 Technical Specification

PARAMETER	SPECIFICATION
Downlink Frequency Range:	491.4-492.2MHz
Single Downlink Channel Frequency:	485.5875MHz
Uplink Frequency Range:	488.4-489.6MHz
Single Uplink Frequency:	485.5875MHz
Channel Bandwidth selectivity:	12.5kHz adjacent channel >20dB
	25kHz adjacent channel >80dB
Number of Channels:	9
Number of ports:	4
RF Connectors:	N type, female
Impedance:	50Ω
VSWR:	Better than 1.5:1
Sensitivity:	0.35 microvolts @ 12dB SINAD
Downlink Output Power:	40 Watts
Uplink Output Power:	20Watts
Uplink TOI:	50dBm
Downlink TOI:	50dBm
RF level per carrier:	>+23dBm
Passband ripple:	<±1.5dB
Noise figure:	<6dB (@max gain)
Gain:	96dB
Gain adjustment:	0-30dB (in 2dB steps)
In band spurious:	Better than –36dBm
Spurious up to 3GHz:	Better than –90dBc
Input AC Supply:	120V AC
Consumption:	300 Watts
Alarms: (Volt-free relay contacts)	Amplifiers
	Channel phase unlock
	PSU Failure
MTBF:	80,000 Hrs.
Housing:	19” Rack mounted

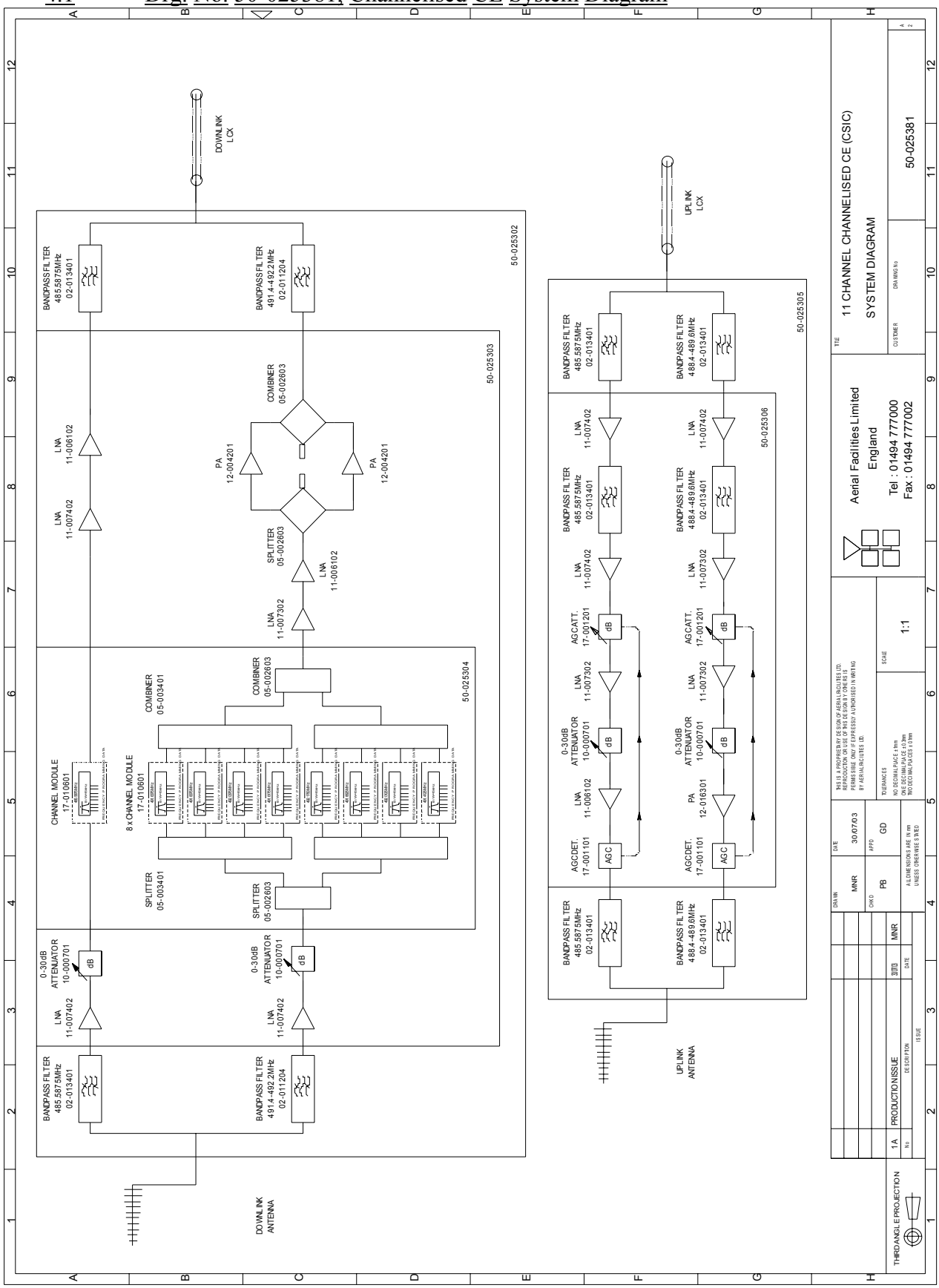
3.3 Mechanical Specification

PARAMETER		SPECIFICATION
Case Size:	Height:	Eurorack Shelves(1U=44.5mm)
	Width:	19"
	Depth:	<500mm
(excluding heatsinks, connectors, handles and feet)		
Temperature Range:	operational:	-10°C to +55°C
	storage:	-40°C to +70°C
	Weight:	<15kg*
	Humidity:	5 – 95% non-condensing
	RF Connectors:	N type female
	Environmental Protection:	IP54
Finish:	Case:	Alocrom
	Heatsinks:	Matt black
	Handles:	Alocrom
	Supply Cable:	Unit supplied with suitable supply input leads with connector and specified length of cable (where appropriate)

* Note: Individual shelf weights unspecified.

4. SYSTEM DRAWINGS

4.1 Drg. Nō. 50-025381, Channelised CE System Diagram



5. SUB-UNIT MODULES

5.1 VTA Downlink Duplexer Shelf 60-025302 (4U chassis)

5.1.1 Bandpass Filters (02-011204 & 02-013401)

5.1.1.1 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 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.

No adjustments should be attempted without full network sweep analysis facilities to monitor both insertion loss and VSWR simultaneously.

5.1.1.2 Technical Specification (02-011204)

PARAMETER	SPECIFICATION
Passband	491.4-492.2 MHz
Insertion Loss	1.9 dB typical
Rejection	> 485 MHz > 55 dB
	> 458-459 MHz > 60 dB
Power Rating	50 Watt
Impedance	50 ohm
VSWR	Better than 1.2:1

5.1.1.3 Technical Specification (02-013401)

Passband	485.5875MHz
Insertion Loss	1.9 dB typical
Rejection	> 492 MHz > 60 dB
	> 488-489 MHz > 55 dB
Power Rating	50 Watt
Impedance	50 ohm
VSWR	Better than 1.2:1

5.2 VTA Downlink Amplifier Shelf (50-025303, 8U Chassis)

5.2.1 UHF 3dB Splitter (05-002603)

5.2.1.1 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.

5.2.1.2 Technical Specification

PARAMETER	SPECIFICATION
Frequency Range:	400-500 MHz
Power Rating:	5 Watts
Insertion Loss:	5.2dB Typical
VSWR:	1.2:1
Impedance:	50 Ohms
Connectors:	SMA
Weight:	<0.5Kgs
Mechanical:	Drawing No. 07-003890

5.2.2 ¼Watt 0- -30dB Switched Attenuator (10-000701)

5.2.2.1 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.

5.2.2.2 Switched Attenuators

The AFL switched attenuators are available in two different types; 0 – 30dB in 2 dB steps (as in this case), 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 50Ω impedance over their operating frequency at both input and output.

5.2.3 Low Noise Amplifier (11-006102)

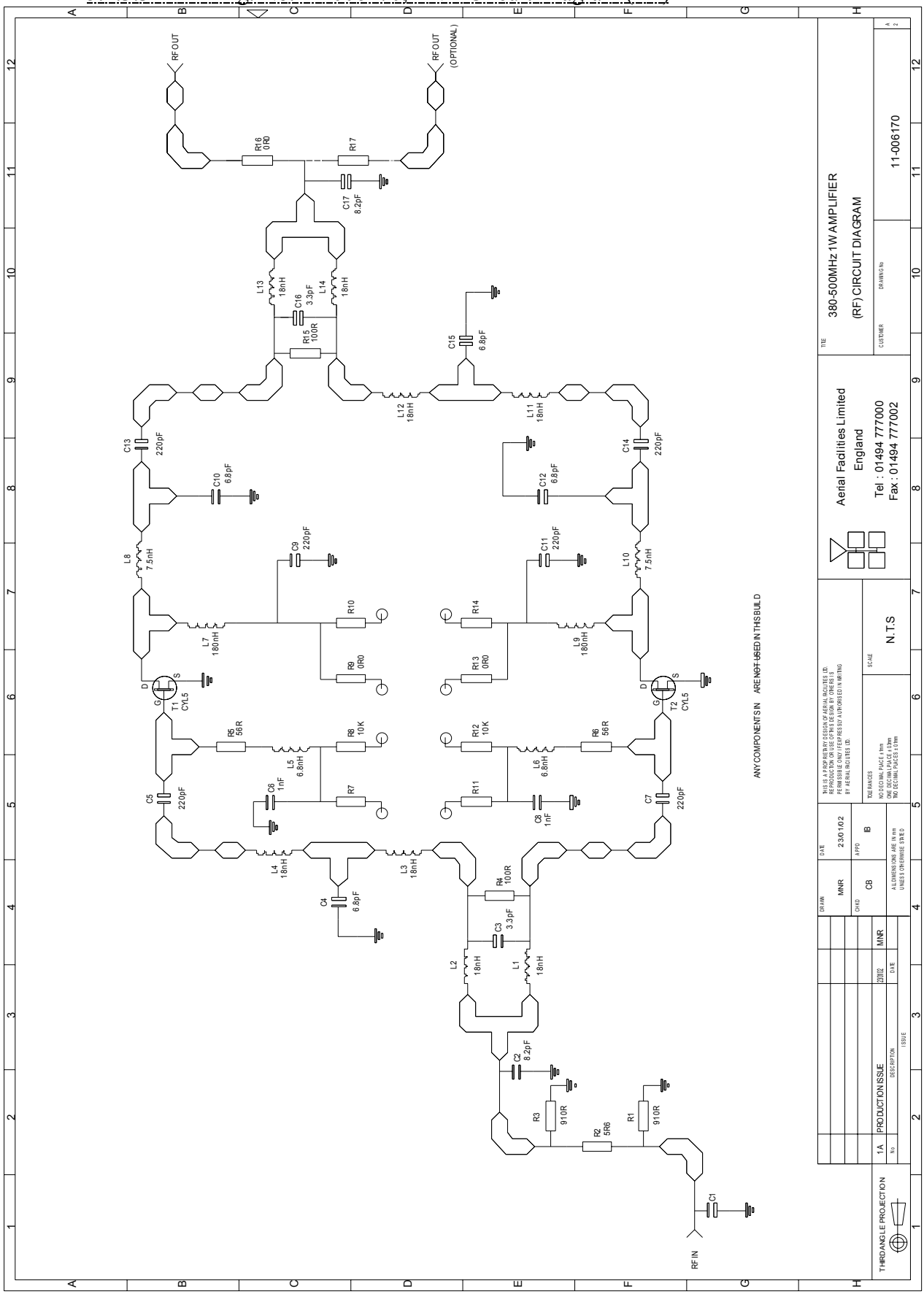
5.2.3.1 Description

The 15dB gain low noise amplifier used in the unit is a double stage solid-state low noise amplifier. Class A circuitry is used throughout the units to ensure excellent linearity 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.

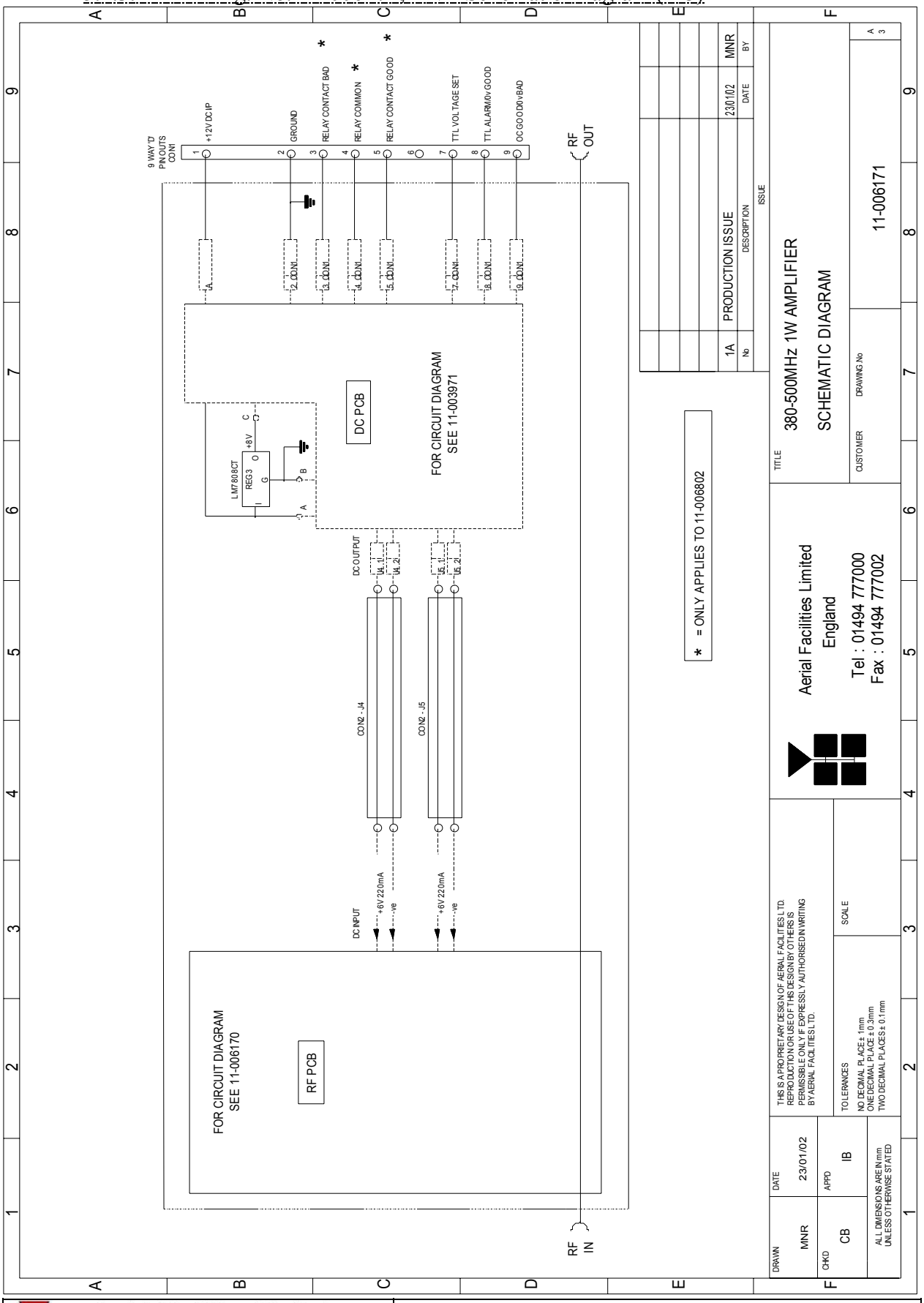
5.2.3.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency range:		380-500MHz
Bandwidth:		<150MHz
Gain:		15.5dB ±0.5dB
1dB compression point:		31dBm
IP3:		46dBm
I/O return loss:		>18dB
Noise figure:		<1.3dB
Supply requirement:		10 – 24V, DC
Consumption:		510-540mA @ (10 – 24V)
Temperature range	storage:	-20°C to +55°C
	operation:	-40°C to +70°

5.2.3.3 Drg. Nō. 11-006170, LNA Circuit Diagram (RF)



5.2.3.4 Drg. Nō. 11-006171, LNA Schematic Diagram (DC)



5.2.4 Low Noise Amplifiers (11-007302 & 11-007402)

5.2.4.1 Description

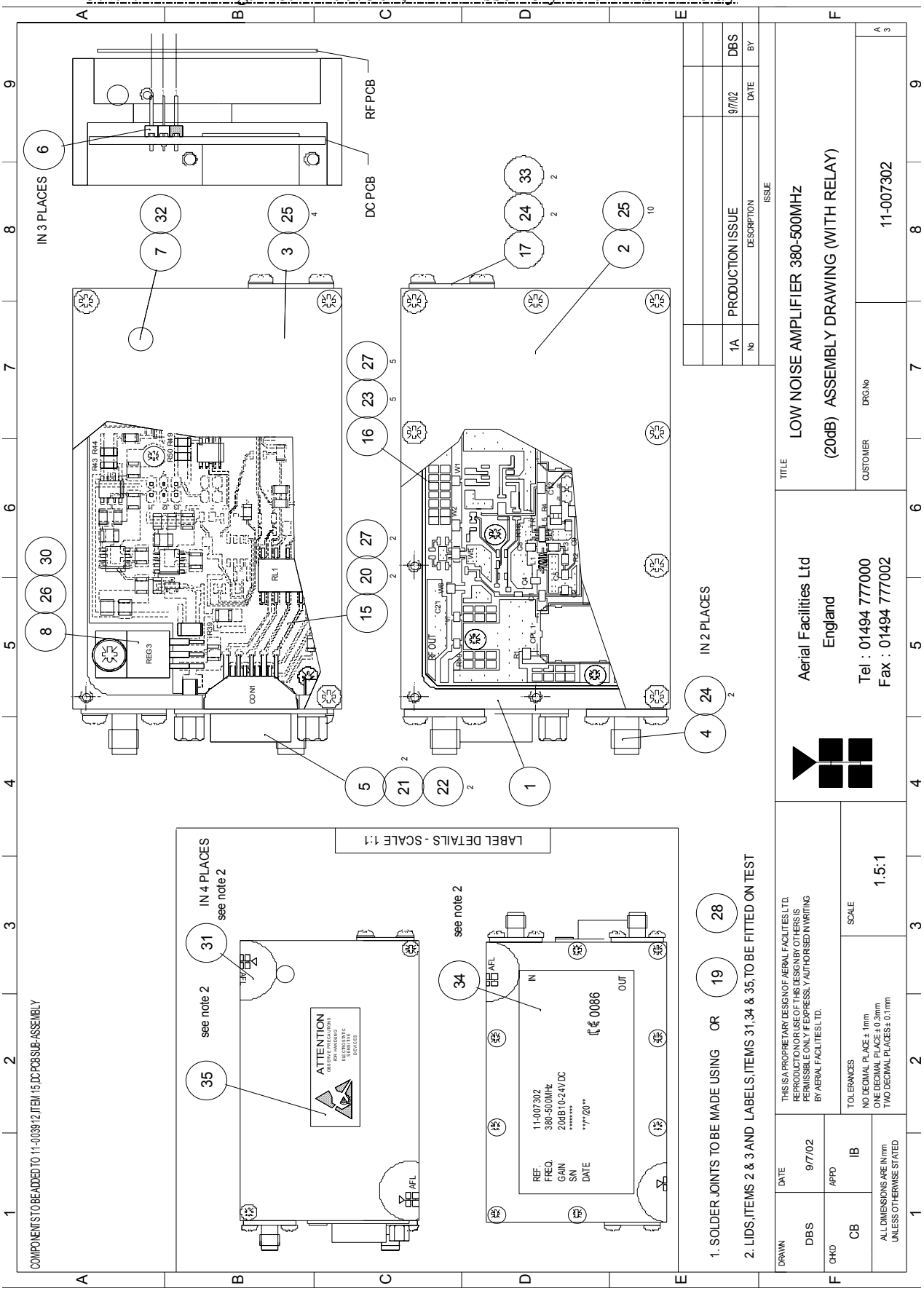
The low noise amplifiers used are double stage solid-state low-noise amplifiers. Class A circuitry is used in the units to ensure excellent linearity over a very wide dynamic range. The active devices are very moderately rated to provide a long trouble-free working life. There are no adjustments on these amplifiers, and in the unlikely event of failure then the entire amplifier should be replaced. The two amplifiers are very similar in construction, the only difference is the biasing, which changes the gain figure, see tables below.

5.2.4.2 Technical Specification, (11-007302)

PARAMETER		SPECIFICATION
Frequency range:		380-500MHz
Bandwidth:		<140MHz
Gain:		20-22dB
1dB Compression Point:		+23.5dB (typical)
3rd order intercept:		+36dB (typical)
Input/Output return loss:		>20dB
Noise figure:		<1.3dB
Connectors:		SMA female
Supply:		200-230mA @ 24V DC
Temperature range:	operational:	-10°C to +55°C
	storage:	-30°C to +70°C
Weight:		<300gms
Size:		90 x 55 x 30.2 (case only)

5.2.4.3 Technical Specification (11-007402)

PARAMETER		SPECIFICATION
Frequency range:		380-500MHz
Bandwidth:		<140MHz
Gain:		30-32dB
1dB Compression Point:		+22dBm (typical)
3rd order intercept:		+34-35dBm (typical)
Input/Output return loss:		>20dB
Noise figure:		<1.3dB
Connectors:		SMA female
Supply:		300-330mA @ 24V DC
Temperature range:	operational:	-10°C to +55°C
	storage:	-30°C to +70°C
Weight:		<300gms
Size:		90 x 55 x 30.2 (case only)


LOW NOISE AMPLIFIER 380-500MHz
(20dB) ASSEMBLY DRAWING (WITH RELAY)
11-007302
Aerial Facilities Ltd
England
Tel : 01494 777000
Fax : 01494 777002
PRODUCTION ISSUE
DESCRIPTION
ISSUE
DBS
DATE
BY
RF PCB
DC PCB
IN 3 PLACES
IN 2 PLACES
IN 4 PLACES
see note 2
see note 2
see note 2
LABEL DETAILS - SCALE 1:1
ATTENTION
REF 11-007302
FREQ. 380-500MHz
GAIN 20dB10-24V DC
S/N *******
DATE **/**/20**
0086
IN
OUT
AFL
1. SOLDER JOINTS TO BE MADE USING OR
2. LIDS,ITEMS 2 & 3 AND LABELS,ITEMS 31,34 & 35,TO BE FITTED ON TEST
COMPONENTS TO BE ADDED TO 11-003912,ITEM 15,DC PCB SUB-ASSEMBLY
DRAWN DBS 9/7/02
CHKD CB APPD IB
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED
TOLERANCES
NO DECIMAL PLACE ± 1mm
ONE DECIMAL PLACE ± 0.3mm
TWO DECIMAL PLACES ± 0.1mm
SCALE 1.5:1
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REPRODUCTION OR USE OF THIS DESIGN BY OTHERS IS
PERMISSIBLE ONLY IF EXPRESSLY AUTHORISED IN WRITING
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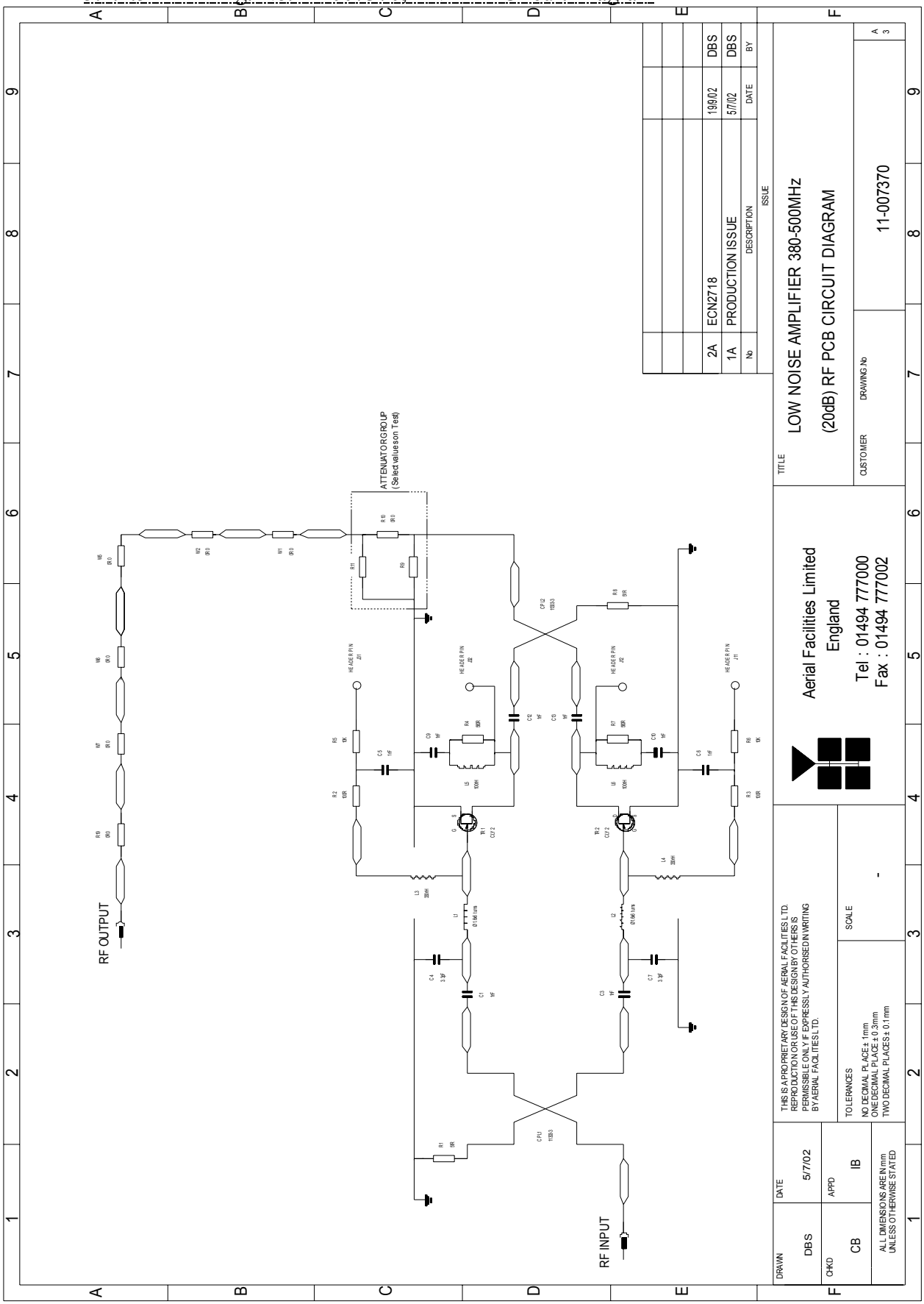
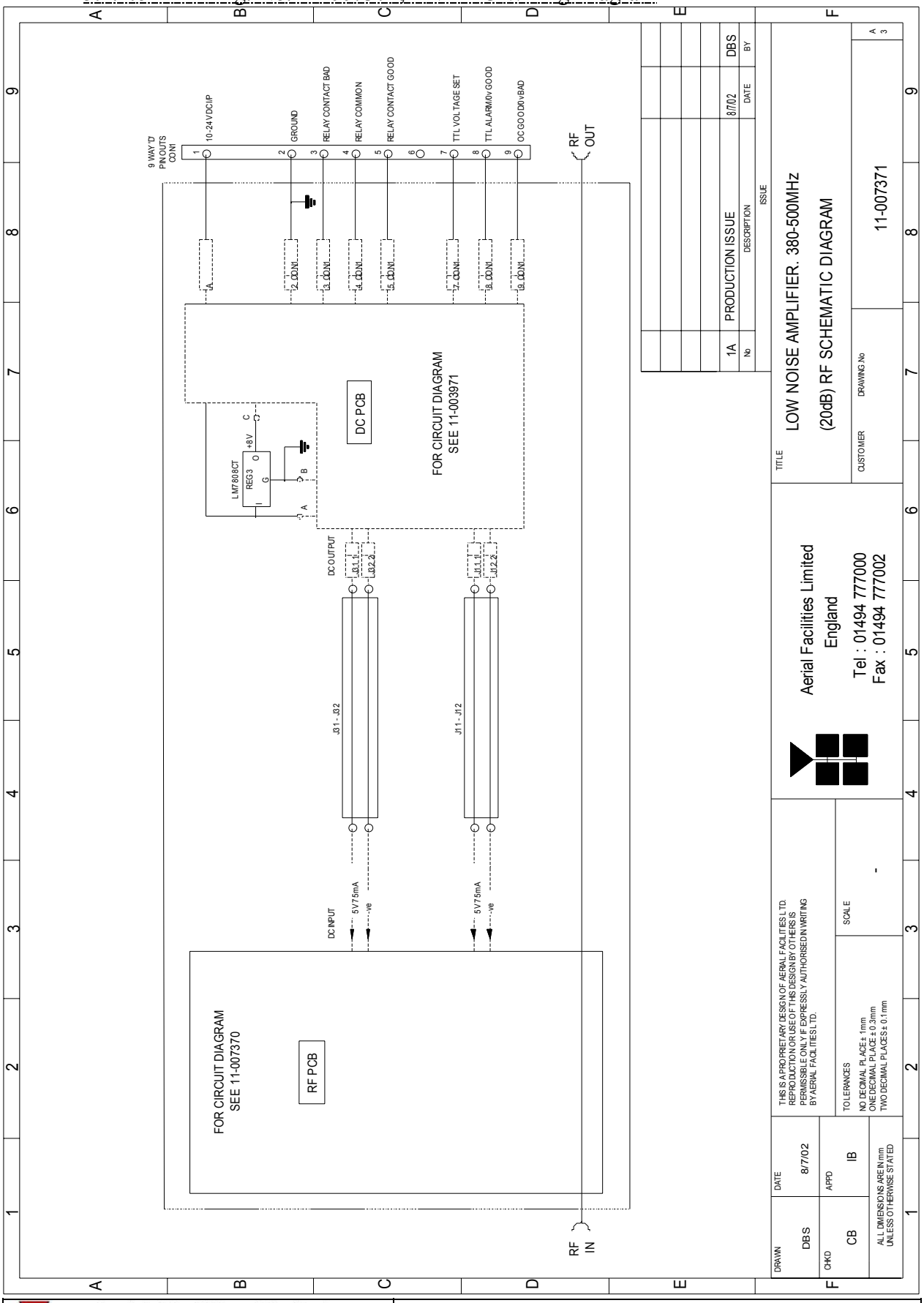
CUSTOMER
DRG.No
A3

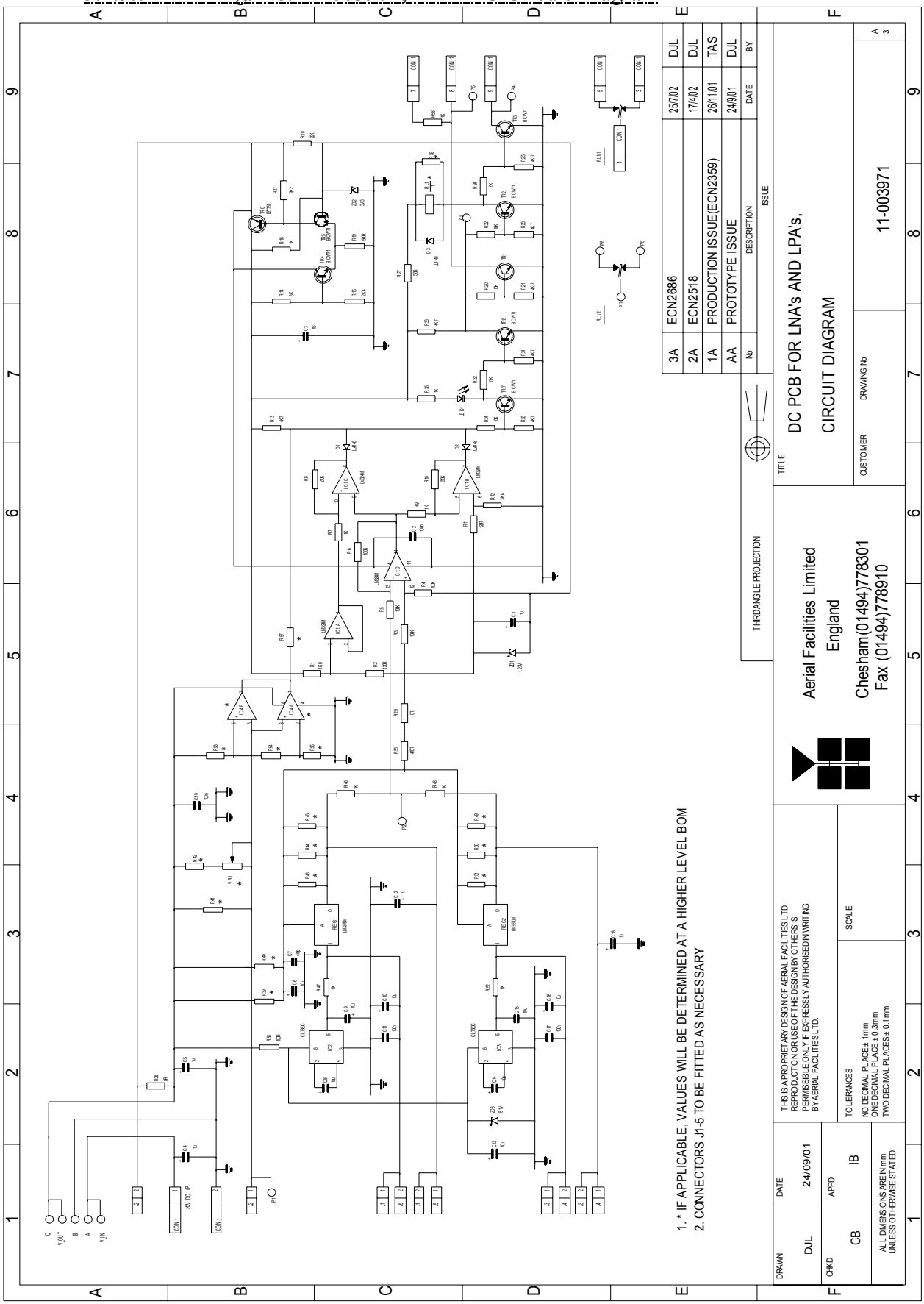
5.2.4.5 Drg. Nō. 11-007370, LNA RF Circuit Diagram



5.2.4.6 Drg. Nō. 11-007371, LNA DC Wiring Diagram



5.2.5.7 Drg. Nō. 11-003971, LNA DC Circuit Diagram



5.2.6 3 Stage Amplifier Alarm Boards (12-002201)

5.2.6.1 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.

The use of precision voltage sources and resistors has eliminated the need for initial adjustment or calibration, and the board will function correctly with a wide variation in power supply voltage (8 to 30 volts, nominal supply is 12 or 24Volts).

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

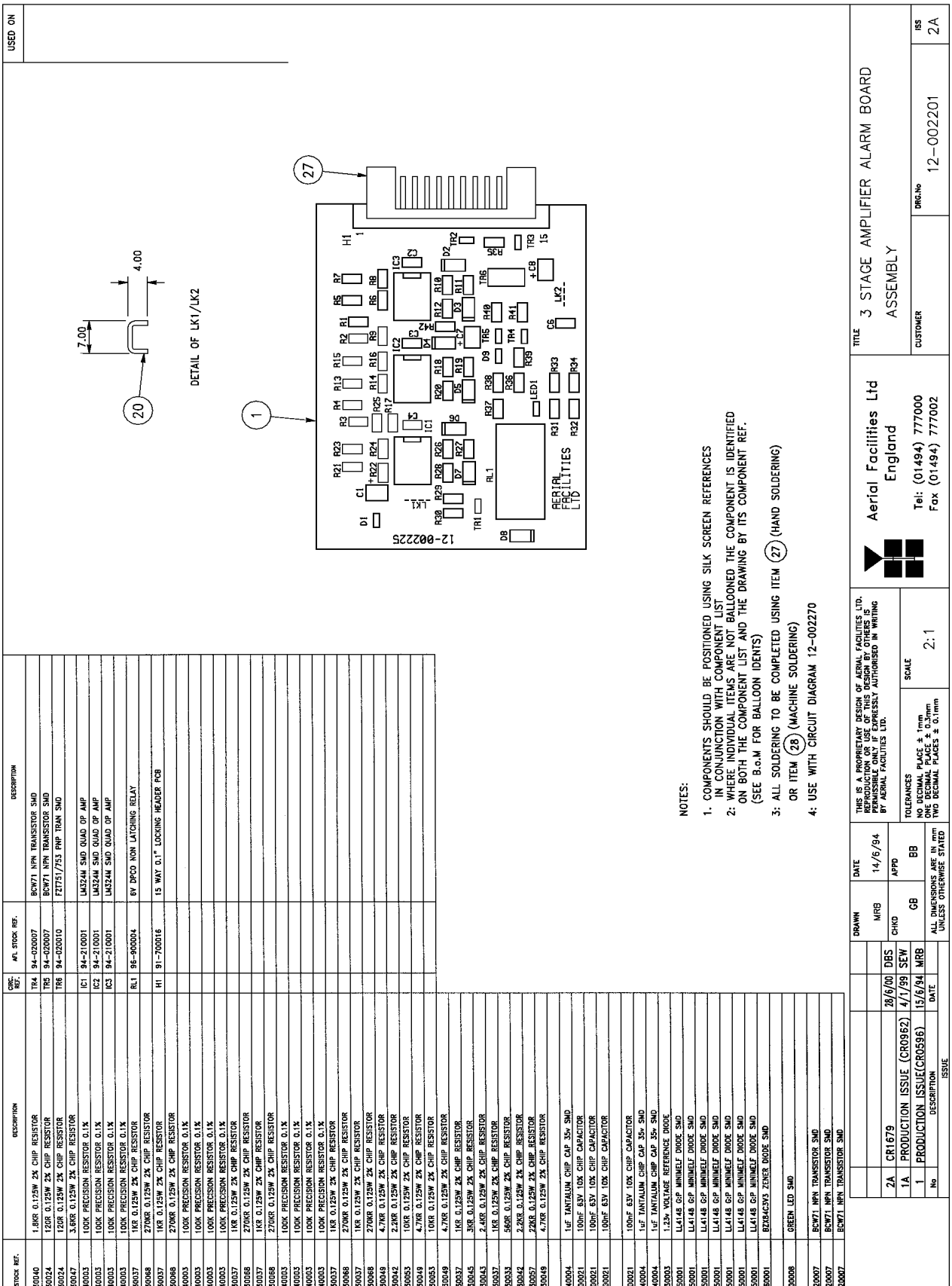
LINK1 - Removed to convert to two-way alarm board.
LINK2 - Removed to isolate 0V from chassis earth.

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

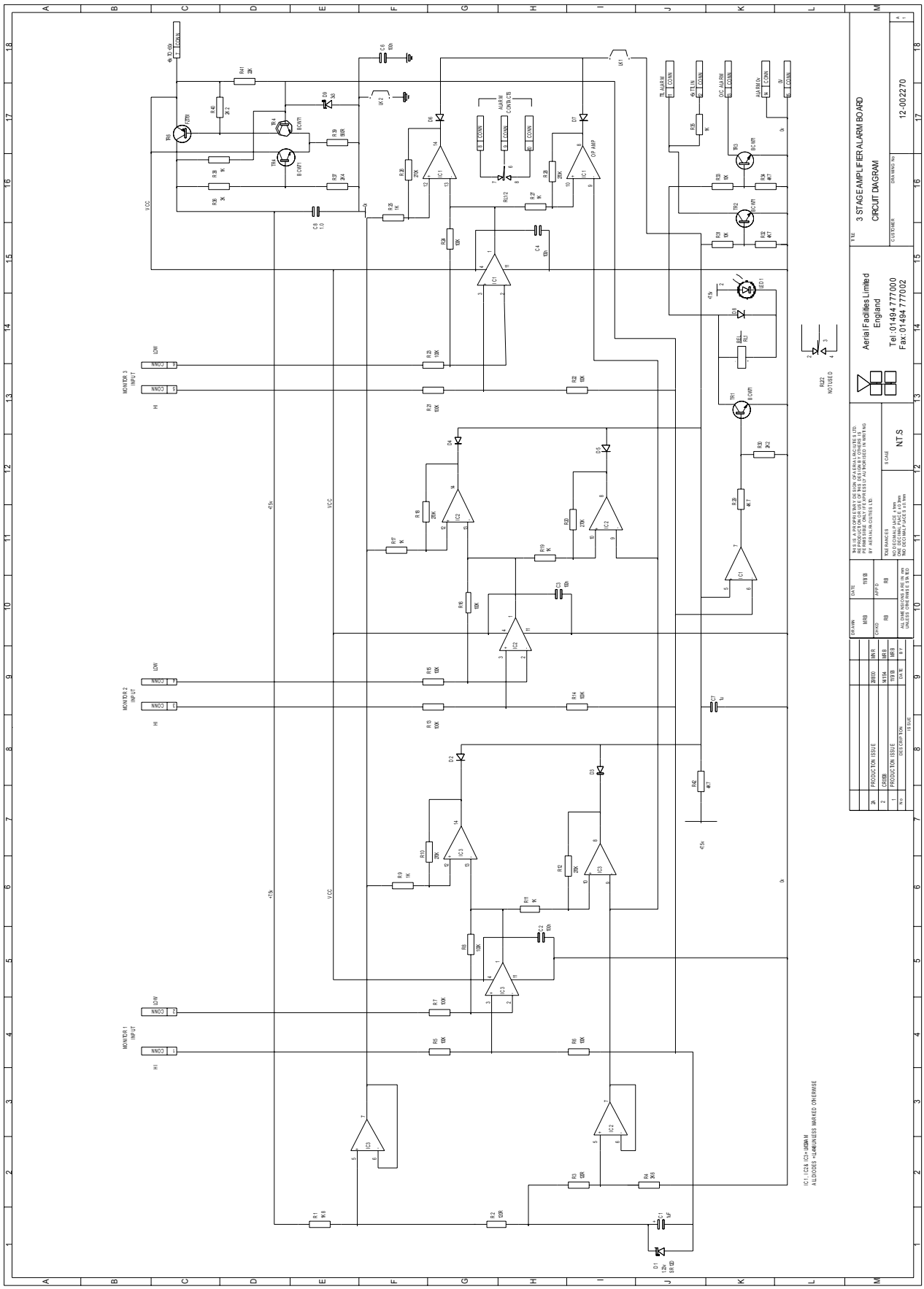
5.2.6.2 Technical Specification

PARAMETER		SPECIFICATION
Operating voltage:		8 to 30V (floating earth)
Alarm Threshold:		Vcc - 1.20 volt ±15%
Alarm output relay contacts:		
Max. switch current:		1.0Amp
Max. switch volts:		120Vdc/60VA
Max. switch power:		24W/60VA
Min. switch load:		10.0µA/10.0mV
Relay isolation:		1.5kV
Mechanical life:		>2x10^7 operations
Relay approval:		BT type 56
Connector details:		15-way 0.1" pitch
Temperature range:	operational:	-10°C to +55°C
	storage:	-40°C to +70°C
PCB Size:		74 x 56mm (3 stage)
		54 x 56mm (1 stage)

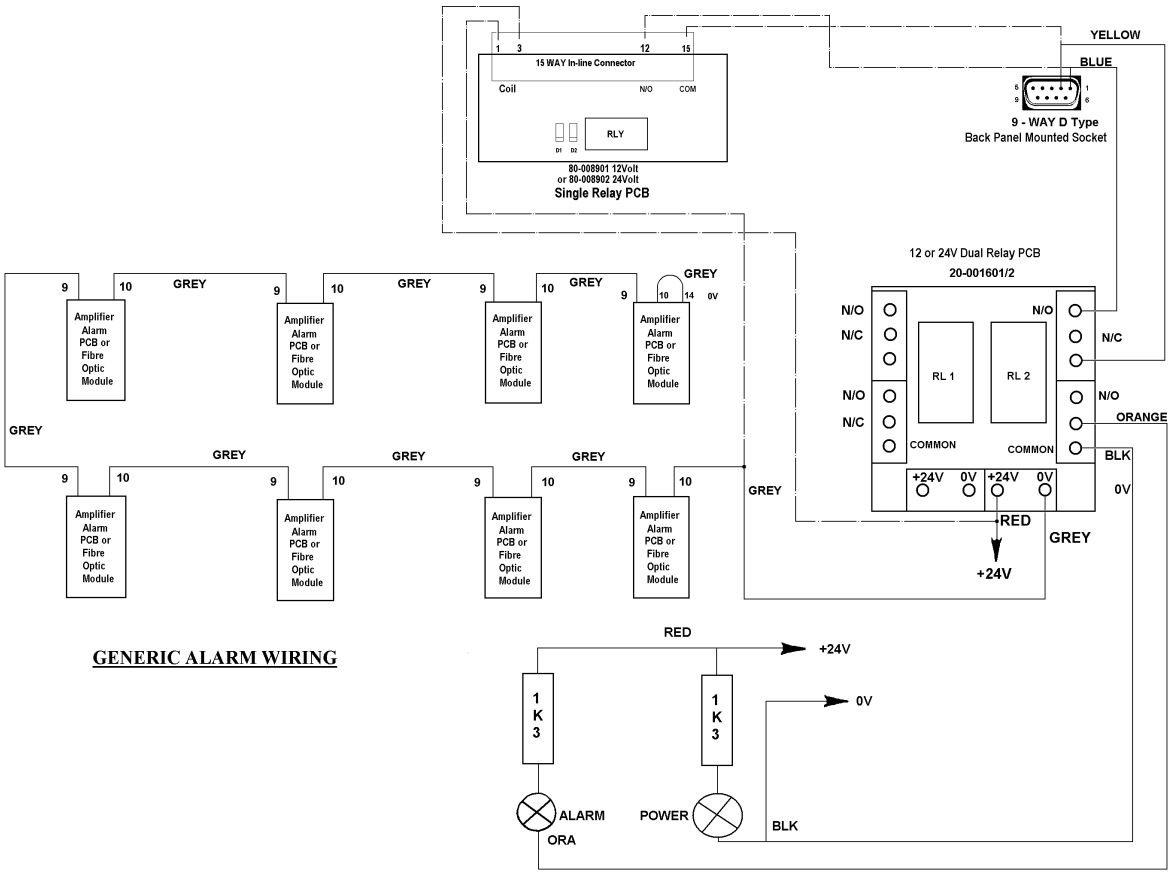
5.2.6.3 Drg. Nō. 12-002201, 3 Stage Alarm Board Assembly Drawing & Parts List



5.2.6.4 Drg. Nō. 12-002270, 3 Stage Alarm Board Circuit Diagram



5.2.6.5 Generic Rack Shelf Enclosure Alarm Wiring Sketch



GENERIC ALARM WIRING

5.2.7 450MHz 20W Power Amplifier (12-004201)

5.2.7.1 Description

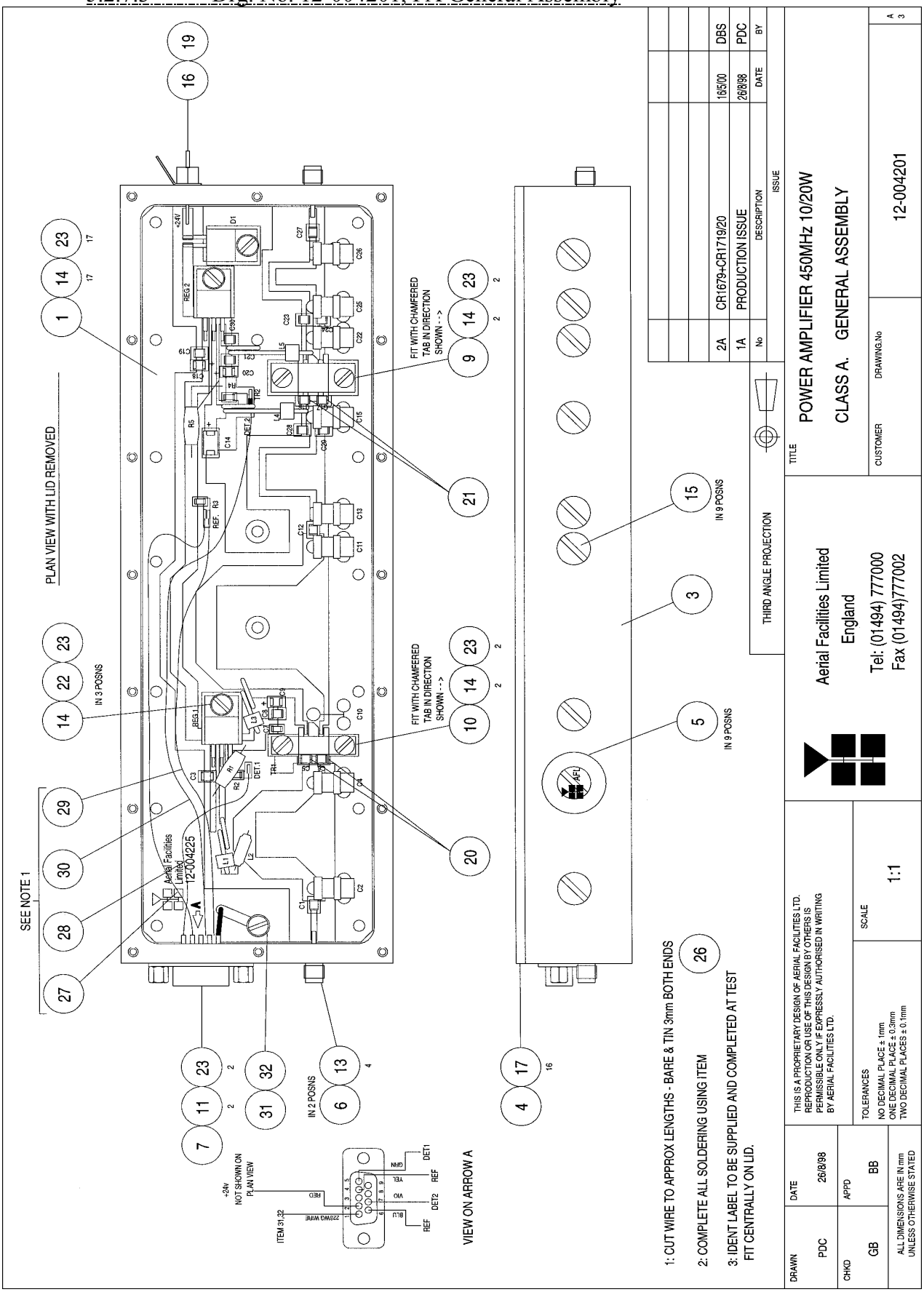
The power amplifiers fitted to this unit are multi-stage, solid state power amplifiers. Class A circuitry is employed throughout the units to ensure excellent linearity over a wide dynamic frequency range. All the semi-conductor devices are very conservatively rated to ensure low device junction temperatures and a long, trouble free working lifetime.

The power amplifiers should require no maintenance over their operating lives. Under no circumstances should the cover be removed or the side adjustments disturbed unless it is certain that an amplifier has failed; since they are critically aligned during manufacture and any re-alignment will require extensive test equipment.

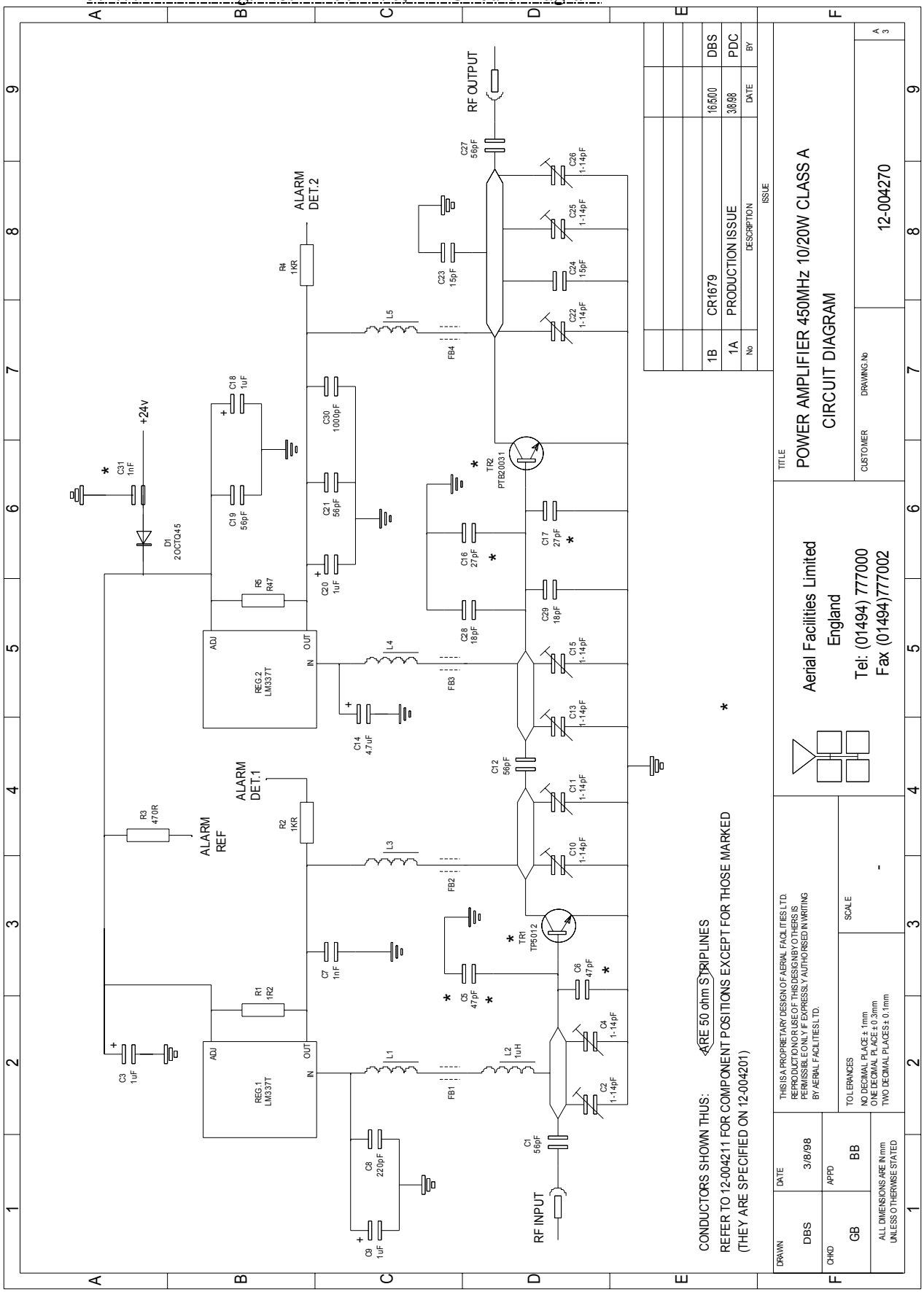
5.2.7.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency Range:		350 – 550MHz (tuned to spec.)
Bandwidth:		20MHz (tuned to spec.)
Maximum Output Power:		>20W (each)
Gain:		30dB
1dB Compression Point:		<+43dBm
3rd Order Intercept Point:		<+54dBm
VSWR:		better than 1.45:1
Connectors:		SMA female
Supply:		3.50A @ 24V DC
Size:		276 x 78 x 40mm (ex. Cons. & h'sink)
Weight:		1.5 kg (approx., excl. h'sink)
Temperature range:	operational:	-10°C to +55°C
	storage:	-40°C to +70°C

5.2.7.3 Drg. Nō. 12-004201, PA General Assembly



5.2.7.4 Drg. Nō. 12-004270, PA Circuit Diagram



5.2.7.5 Drg. Nō. 12-004270C1, PA Parts List(1)

CIRC. REF.	AFL STOCK REF.	DESCRIPTION
C1	93-200006	56pF CHIP CAP 10% TOL.(MIN)
C2	93-130023	PCB MOUNT AIR TRIMMER 1-14pF
C3	93-240003	1uF TANTALUM CHIP CAP 35V
C4	93-130023	PCB MOUNT AIR TRIMMER 1-14pF
C5	REFER TO GA 12-004201 FOR DETAILS	
C6	REFER TO GA 12-004201 FOR DETAILS	
C7	93-200020	1nF CHIP CAP 63V 10%
C8	93-200014	220pF CHIP CAP 10% TOL (MIN)
C9	93-240004	1uF TANTALUM CHIP CAP 35V
C10	NOT FITTED	NOT FITTED
C11	93-130023	PCB MOUNT AIR TRIMMER 1-14pF
C12	93-200006	56pF CHIP CAP 10% TOL.(MIN)
C13	93-130023	PCB MOUNT AIR TRIMMER 1-14pF
C14	93-240006	4.7uF TANTALUM CHIP CAP 35V
C15	93-130023	PCB MOUNT AIR TRIMMER 1-14pF
C16	REFER TO GA 12-004201 FOR DETAILS	
C17	REFER TO GA 12-004201 FOR DETAILS	
C18	93-240003	1uF TANTALUM CHIP CAP 35V
C19	93-200006	56pF CHIP CAP 10% TOL.(MIN)
C20	93-240004	1uF TANTALUM CHIP CAP 35V
C21	93-200006	56pF CHIP CAP 10% TOL.(MIN)
C22	93-130023	PCB MOUNT AIR TRIMMER 1-14pF
C23	93-200005	15pF CHIP CAP 10% TOL.(MIN)
C24	93-200005	15pF CHIP CAP 10% TOL.(MIN)
C25	93-130023	PCB MOUNT AIR TRIMMER 1-14pF
C26	93-130023	PCB MOUNT AIR TRIMMER 1-14pF
C27	93-200006	56pF CHIP CAP 10% TOL.(MIN)
C28	93-200004	18pF CHIP CAP 10% TOL.(MIN)
C29	93-200004	18pF CHIP CAP 10% TOL.(MIN)
C30	93-200016	1000pF (1nF) CHIP CAP 10% TOL.(MIN)
C31	REFER TO GA 12-004201 FOR DETAILS	

ISSUE	DATE	CHANGE No
2A	5/5/00	CR1679
1A	5/8/98	PROD. ISS.

Aerial Facilities Limited

TITLE: POWER AMPLIFIER,450MHz,10/20W
CIRCUIT COMPONENT LIST

DRAWN	DATE	CHKD	APPD	CUSTOMER	COMPONENT LIST FOR
PDC	5/8/98	GB	BB		12-004270C1

5.2.7.6 Drg. Nō. 12-004270C2, PA Parts List(2)

CIRC. REF.	AFL STOCK REF.	DESCRIPTION
TR1	REFER TO GA 12-004201 FOR DETAILS	
TR2	REFER TO GA 12-004201 FOR DETAILS	
REG1	94-300002	LM337T, VOLTAGE REGULATOR
REG2	94-300002	LM337T, VOLTAGE REGULATOR
D1	94-120006	2OTQ45 45V DUAL SCHOTTKY DIODE
R1	93-540075	1R2 2.5W RESISTOR
R2	93-630037	1KR CHIP RESISTOR
R3	93-630032	470R CHIP RESISTOR
R4	93-630037	1KR CHIP RESISTOR
R5	93-540083	47R 6W RESISTOR
L1	90-500012	1.25 ENAMELLED COPPER WIRE
	93-910001	FERRITE BEAD
L2	93-400004	1.0uH CHOKE SIGMA SC10 SERIES
L3	90-500012	1.25 ENAMELLED COPPER WIRE
	93-910001	FERRITE BEAD
L4	90-500012	1.25 ENAMELLED COPPER WIRE
	93-910001	FERRITE BEAD
L5	90-500012	1.25 ENAMELLED COPPER WIRE
	93-910001	FERRITE BEAD

ISSUE	DATE	CHANGE No
2A	5/5/00	CR1679
1A	5/8/98	PROD. ISS.

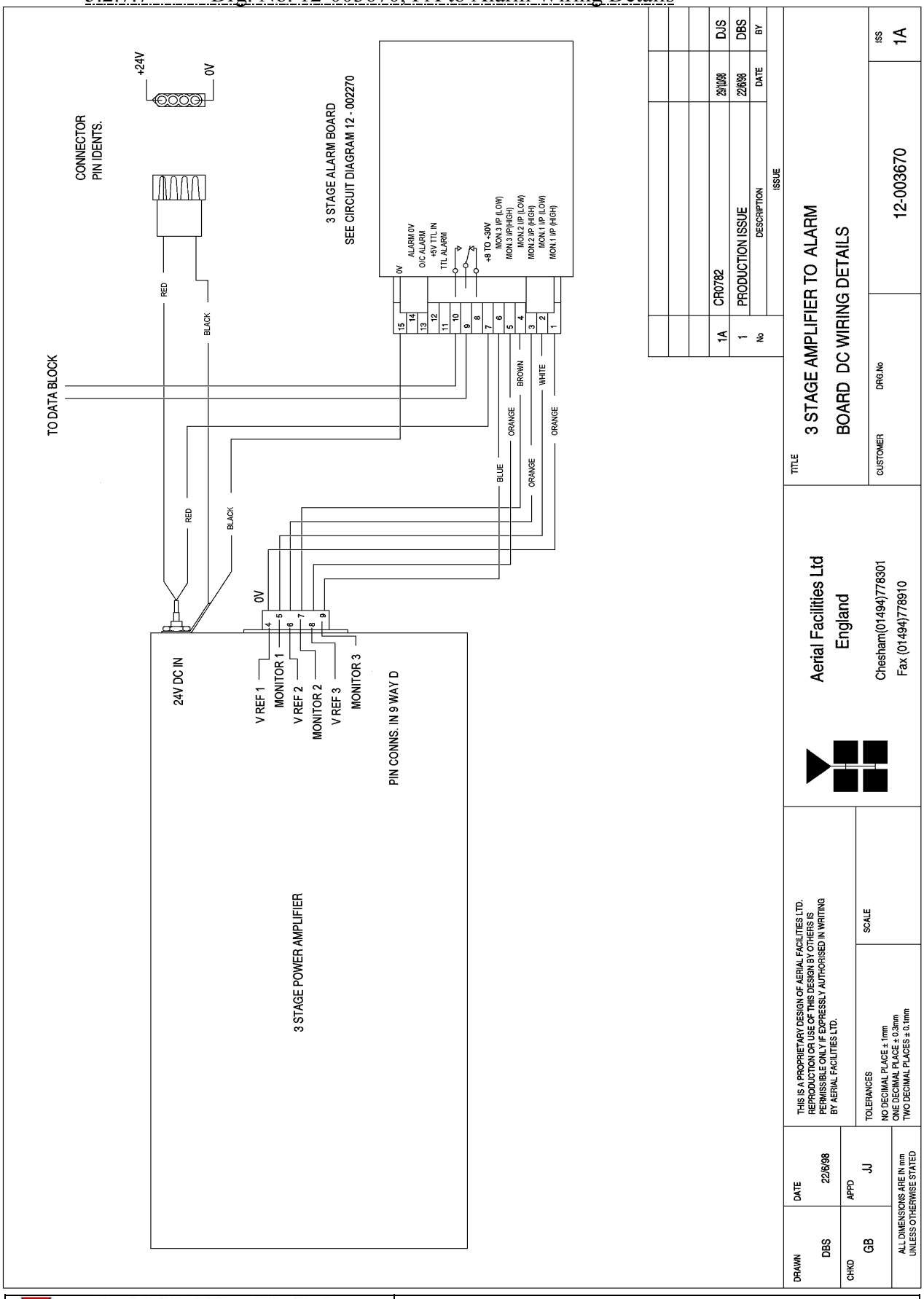
Aerial Facilities Limited

TITLE: POWER AMPLIFIER,450MHz,10\20W

CIRCUIT COMPONENT LIST

DRAWN	DATE	CHKD	APPD	CUSTOMER	COMPONENT LIST FOR
PDC	5/8/98	GB	BB		12-004270C2

5.2.7.7 Drg. Nō. 12-003670, PA to Alarm Wiring Details



5.2.8 Single DC/DC Converter (13-001702)

5.2.8.1 Description

This unit it is used to derive a fixed voltage power supply rail from some higher voltage. Typically, it is used to derive 5V, 8V, 12V or 15V from a 24V input. This particular regulator is dedicated to supply 12.8V DC.

The circuit is based upon an LM317 variable voltage regulator, which is capable of supplying a maximum of 1.5A output current. Note that at full output current the dissipation of the device must remain in 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.

The output voltage of the unit is programmed by the resistive divider which is fitted between the output terminal, the reference terminal and ground. R1 is the reference programming resistor and is fixed in all versions. R2 is fitted on 12V versions while R3, (which is in parallel with R2) is fitted on 8V and 5V versions.

5.2.8.2 Technical Specification

PARAMETER		SPECIFICATION
Operating Voltage:		21 – 27V DC
Output Voltages:		12.4V (typical)
Output Current:		1.0A (maximum per o/p)
Connections:		Screw Terminal Block
Temperature range:	operational:	-10BC to +55BC
	storage:	-40BC to +70BC
PCB Size:		47 x 30mm

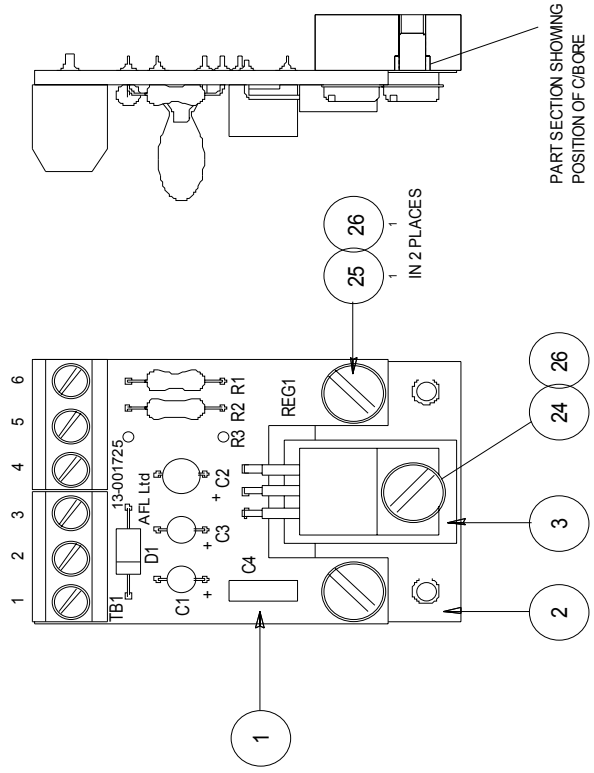
COMP. REF:	AFL STOCK REF:	DESCRIPTION
TB1	91-700003	3 WAY PRINTED CIRCUIT CON
C1	93-140002	2.2uF 35V TANT ALUM CAP
C2	93-140004	10uF 35V TANT ALUM CAP
C3	93-140002	2.2uF 35V TANT ALUM CAP
C4	93-120003	100nF 63V POL YESTER CAP FILM
D1	94-100006	DIODE 1N4003 [1N4000
R1	93-540024	240R/0.25W/1% RESMRS25 M/F
R2	93-540039	2K2 0.25W/1% RES MRS25 M/F
REG1	94-300001	LM317T NSC/MOT VOLTAGE REG

No	DESCRIPTION	DATE	BY
1A	PRODUCTION ISSUE	12/7/00	MNR

ISSUE

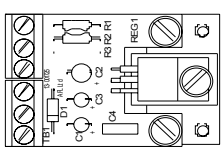
THIRD ANGLE PROJECTION

USED ON



NOTE
1: ALL SOLDERED CONNECTIONS TO BE MADE USING ITEM 23
2: WHERE INDIVIDUAL ITEMS ARE NOT BALLOONED THE COMPONENT IS IDENTIFIED ON BOTH THE COMPONENT LIST AND THE DRAWING BY ITS COMPONENT REF. (SEE B.o.M FOR BALLOON IDENTS)

ACTUAL SIZE



TITLE: 12.8v REGULATOR,ASSEMBLY

CUSTOMER | DRG No: 13-001702 | ISS: 1A | A3

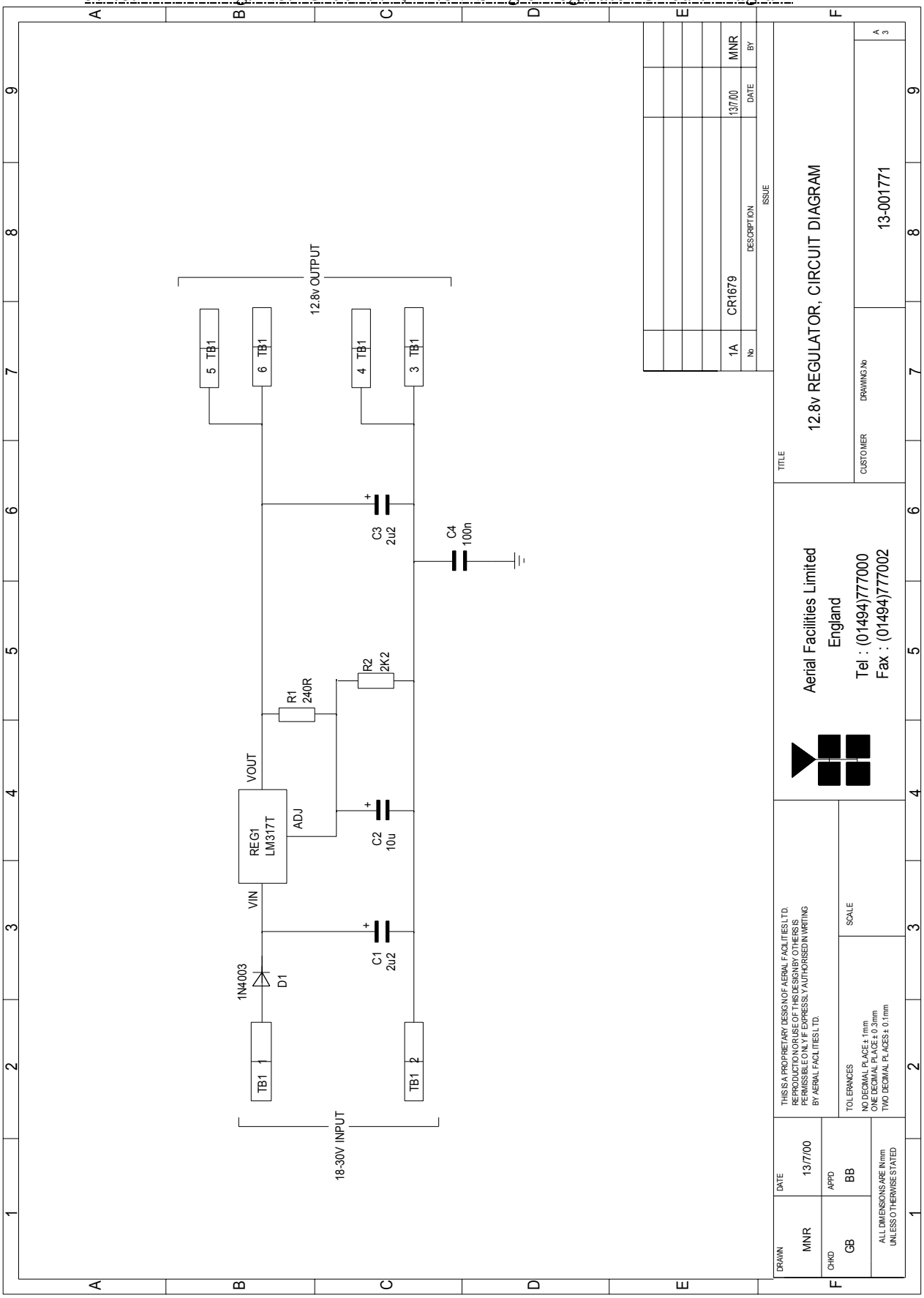
Aerial Facilities Ltd
England
Tel : (01494)777000
Fax : (01494)777002

TOLERANCES
NO DECIMAL PLACE ± 1mm
ONE DECIMAL PLACE ± 0.3mm
TWO DECIMAL PLACES ± 0.1mm

ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED

DRAWN	DATE	CHKD	APPD	SCALE
MNR	12/7/00	GB	BB	2:1

5.2.8.4 Drg. Nō. 13-001771, 12.8V Single Regulator Circuit Diagram



5.2.9 24V Single Relay Board (80-008902)

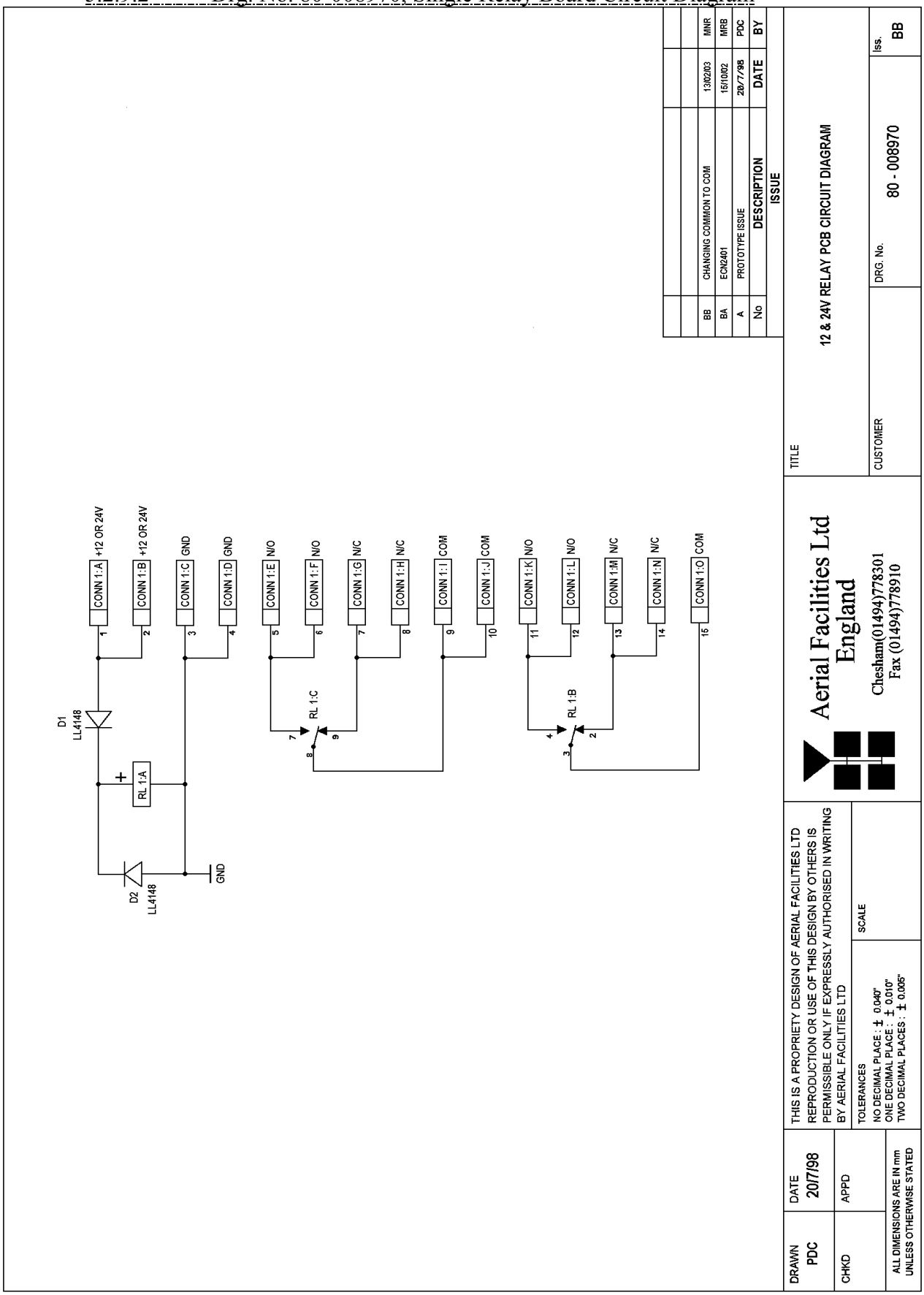
5.2.9.1 Description

The General Purpose Relay Board allows the inversion of signals and the isolation of circuits. It is equipped with a single dual pole change-over relay RL1, with completely isolated wiring, accessed via a 15 way in-line connector.

The relay is 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 relay fitted at RL1.

5.2.9.2 Drg. Nō. 80-008970, Single Relay Board Circuit Diagram



5.2.10 24V 410W Power Supply (96-300054)

5.2.10.1 Description

The power supply unit is a switched-mode type capable of supplying 24V DC at 17.0Amps continuously. Equipment of this type typically requires approximately 8.0 Amps 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 24.5V.

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. No drawings of the PSU are available.

5.2.10.2 Technical Specification

AC Input Supply:		
Voltage:		110 or 220V nominal - 90 to 132 or 180 to 264V (single phase, absolute limits)
Frequency:		47 to 63Hz
DC Output Supply:		
Voltage:		24V DC (nominal), 22 to 26V (absolute limits)
Current:		17.0A
Temperature range:	operational:	-10BC to +55BC
	storage:	-40BC to +70BC

5.3 VTA Downlink Channel Shelf (50-025304)

5.3.1 UHF 3dB Splitter (05-002603) See section 5.2.1

5.3.2 4-Way Splitter (05-003401)

5.3.2.1 Description

The Splitter/Combiners used are devices 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.

5.3.2.2 Technical Specification

PARAMETER		SPECIFICATION
Frequency range:		170 – 550MHz
Bandwidth:		280MHz
Rejection:		>14dB
Insertion loss:		6.5dB (in band, typical)
Connectors:		SMA
Weight:		<1.5Kgm
Temperature range:	operational:	-10BC to +55BC
	storage	-40BC to +70BC

5.3.3 Channel Control Module (17-002101)

5.3.3.1 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'.

5.3.3.2 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	---	---

5.3.3.3 VHF/ UHF Programming Procedure

Check that the required frequency falls within the operational frequency limits of the Cell Enhancer.

For each channel required, subtract the synthesiser offset from the required operating frequency and record the resulting local oscillator frequency.

Divide each local oscillator frequency by the channel spacing and check that the result is an integer (i.e.: 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.

Switch number	Synthesiser offset added when switch in UP position
1	+12.5kHz
2	+25kHz
3	+50kHz
4	+100kHz
5	+200kHz
6	+400kHz
7	+800kHz
8	+1.6MHz
9	+3.2MHz
10	+6.4MHz
11	+12.8MHz
12	+25.6MHz
13	+51.2MHz
14	+102.4MHz
15	+204.8MHz
16	+409.6MHz

5.3.3.4 VHF/ UHF Programming Example

Frequency required: 465.5MHz

Channel spacing: 12.5 kHz

Synthesiser offset: 21.4MHz

The Local Oscillator frequency is therefore:

$$465.4 - 21.4 = 444.0\text{MHz}$$

Dividing the LO frequency by the channel spacing of 0.0125MHz:

$$\frac{444.0}{0.0125} = 35520$$

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

Local Oscillator Frequency of 444.0MHz	Switch settings															
	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	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)

5.3.4 Channel Selectivity Module (17-010601)

5.3.4.1 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.

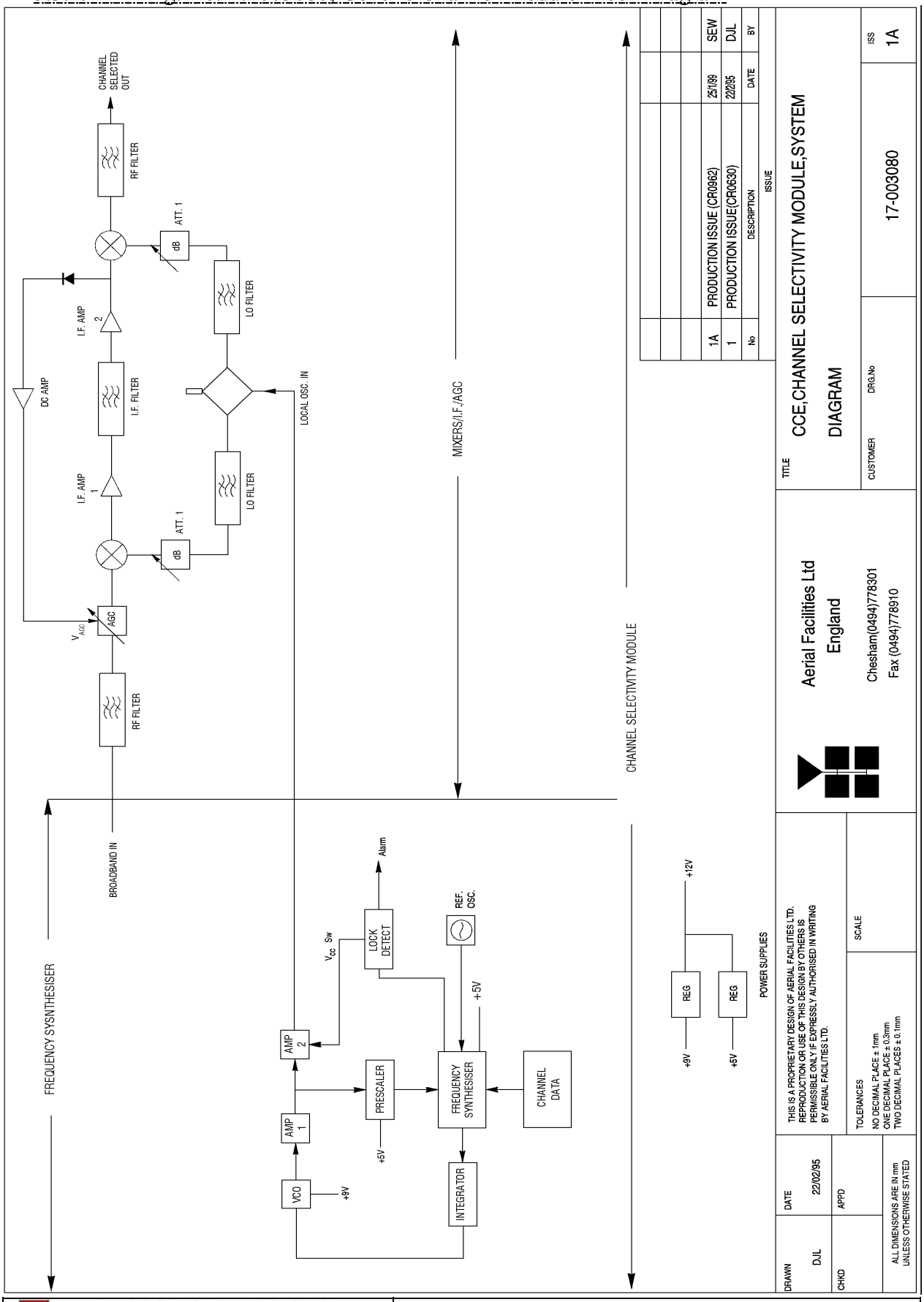
The operating frequency of each channel selectivity module is set by the programming of channel selectivity module frequencies and is achieved digitally, via hard wired links, banks of DIP switches (see section 5.3.3), or via an onboard RS232 control module, providing the ability to remotely set channel 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.

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



5.4 VTA Uplink Duplexer Shelf (50-025305, 4U Chassis)

5.4.1 Bandpass Filters (02-011204 & 02-013401) See section 5.1.1

5.5 VTA Uplink Amplifier Shelf (50-025306, 8U Chassis)

5.5.1 20Watt Class A Power Amplifier (12-016301)

5.5.1.1 Description

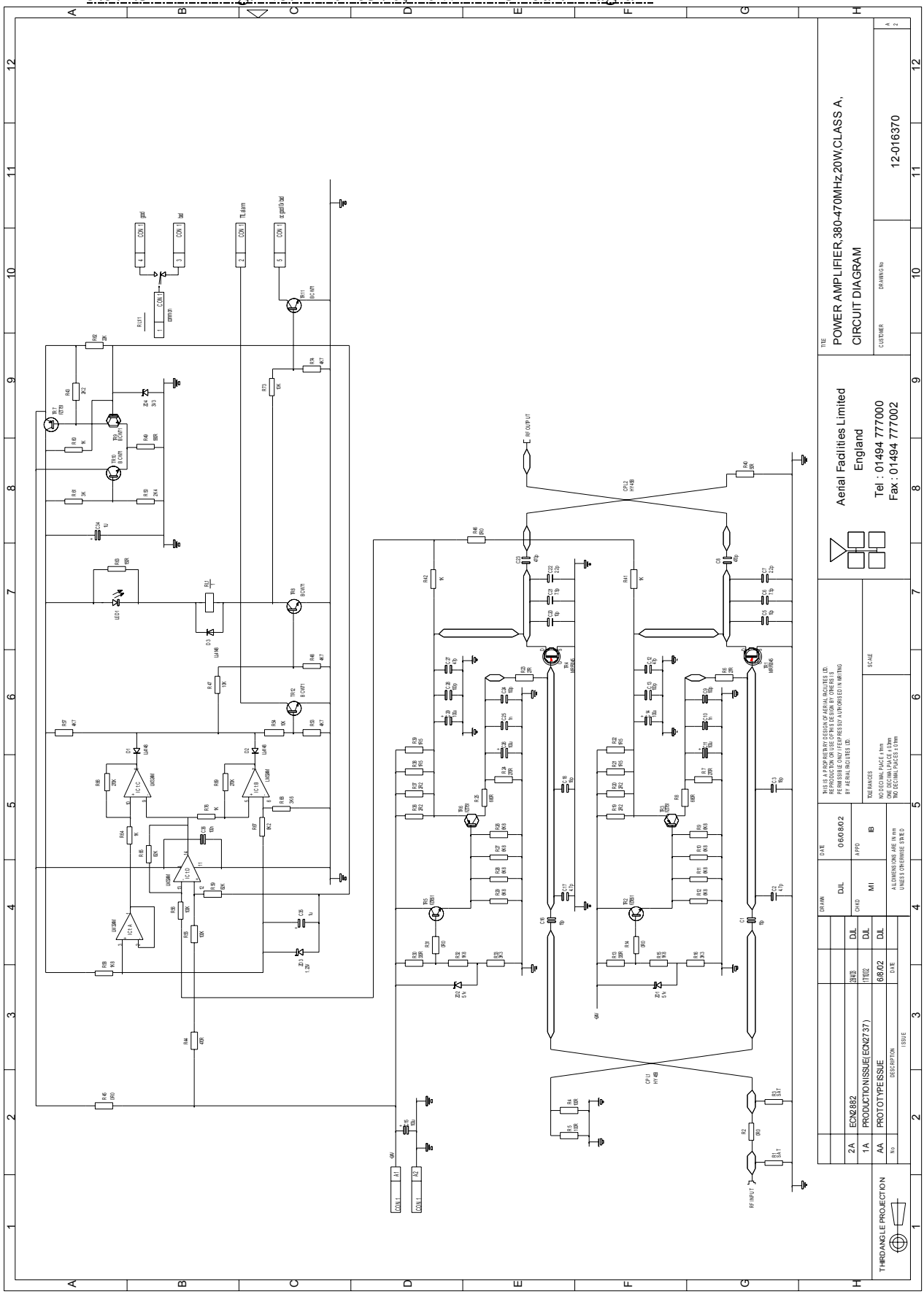
This amplifier is a Class A 20W power amplifier with a frequency range from 380MHz to 470MHz in a 1 stage balanced configuration. It demonstrates a very high linearity and a very good input/output return loss (RL). It has built in a Current Fault Alarm Function.

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.

5.5.1.2 Technical Specification

Parameters	Guaranteed	Guaranteed	Units
Temperature	+25	-10 to +60	°C
Frequency Range	380 - 470		MHz
Small Signal Gain	≥23.0		dB
Gain Flatness	1.5	1.7	dB p-p Max
ΔGain vs. Temperature		1.0	dB Max
In/Out RL	18	18	dB Min
Output Power @ 1dB Compression Point	43.2	43.0	dBm Min
Output 3rd Order IP	55.3	55.0	dBm Min
DC Supply Voltage	24 ± 0.5		Vdc
DC Supply Current	3700 typical	3800	mA Max

5.5.1.3 Drg. Nō. 12-016370, 20W PA Circuit Diagram



5.5.2 Automatic Gain Control (17-001101, Det. & 17-001201, Atten.)

5.5.2.1 Description

The equipment is fitted with an 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 amplifiers (with the associated performance degradation) should a mobile be operated very close to the unit.

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 50Ω transmission line with a resistive tap 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 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.

The unit contains a 12V DC regulator in the detector module, which supplies stabilised voltage to the DC amplifier and via an external cableform to the AGC attenuator.

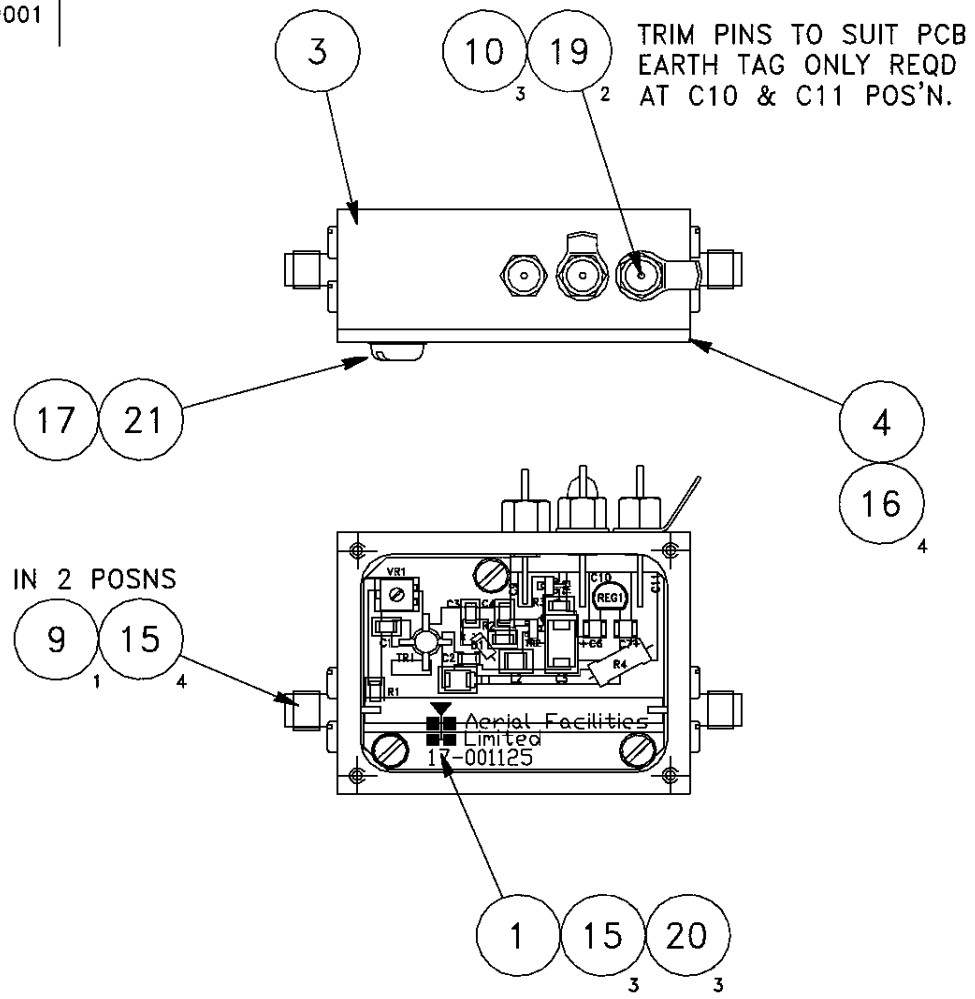
For small signals, below AGC onset, the output control line will be close to 12V and the AGC attenuator will have minimum attenuation. As the signal level increases the control line voltage will fall, increasing the attenuator value and keeping the system output level at a constant value.
The AGC onset level is adjusted by the choice of sampler resistor R1 and by the setting of potentiometer VR1.
The attenuator comprises a 50Ω 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.

5.5.2.2 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 +55°C
	storage:	-40°C to +70°C
Size:	attenuator pcb	50 x 42 x 21mm
	detector/amp pcb	54 x 42 x 21mm
Weight:	attenuator:	90g
	detector/amp:	100g

5.5.2.3 Drg. Nō. 17-001101, ACG Detector Assembly

USED ON
55-019001



SOLDERING TO BE COMPLETED USING ITEM 26

FIT ITEMS 8 TO COVER 2 LID FIXING SCREWS

No	DESCRIPTION	DATE	BY
1A	(CR1679)	3/5/00	CCP

ISSUE

THIRD ANGLE PROJECTION

Aerial Facilities Limited

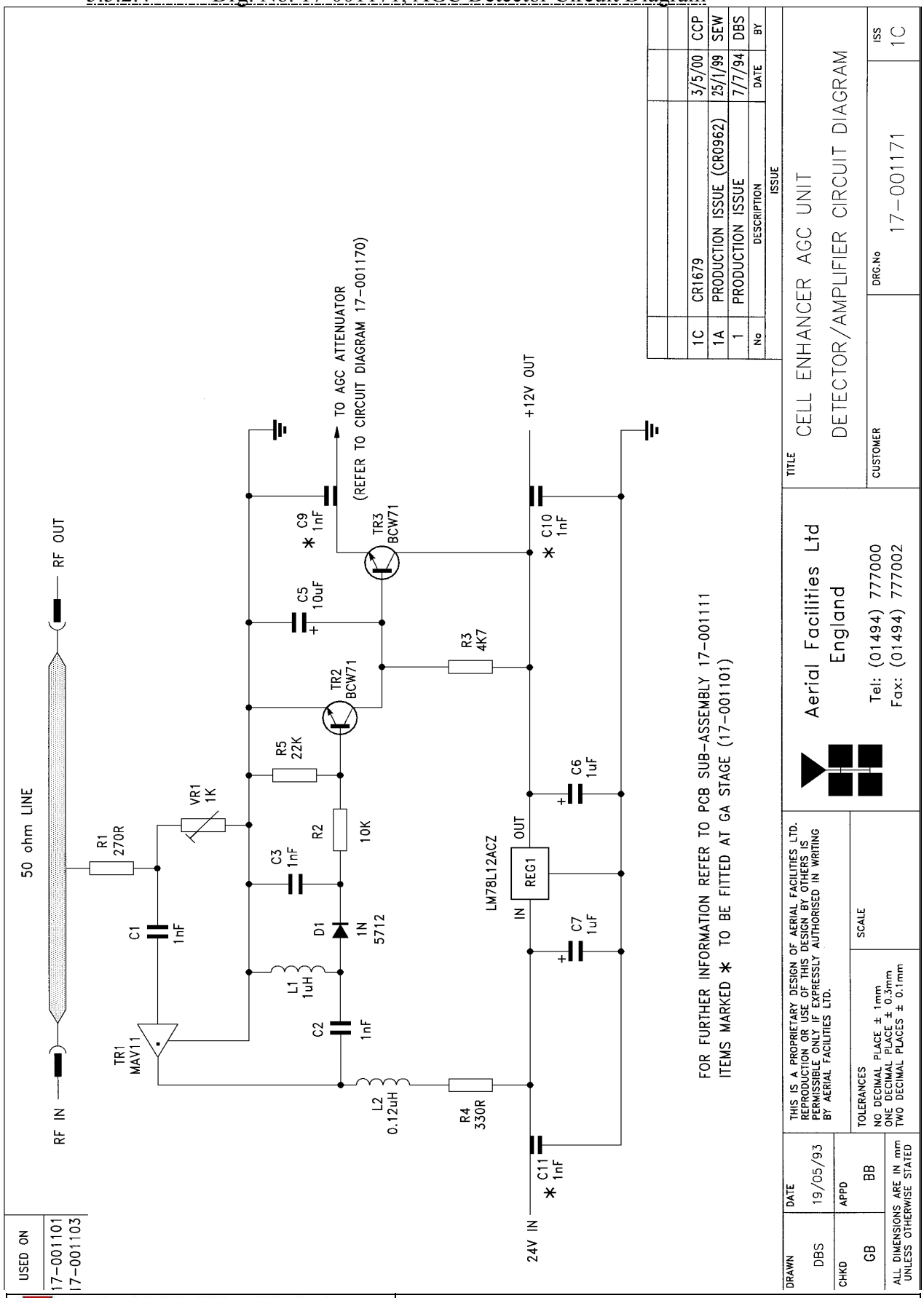
TOLERANCES
NO DECIMAL PLACE ± 1mm
ONE DECIMAL PLACE ± 0.3mm
TWO DECIMAL PLACES ± 0.1mm

ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED

TITLE
CELL ENHANCER AGC UNIT
DETECTOR/AMP. ASSEMBLY

DRAWN	DATE	CHKD	APPD	SCALE	CUSTOMER	DRAWING No	ISS
CCP	3/5/00	GB	BB	1:1		17-001101	1A

5.5.2.4 Drg. Nō. 17-001171, AGC Detector Circuit Diagram



5.5.2.5 Drg. Nō. 17-001171C, AGC Detector Parts List

USED ON	CIRC. REF.	AFL STOCK REF.	DESCRIPTION
17-001103	C1	93-200020	1nF 63V 10% CHIP CAPACITOR
	C2	93-200020	1nF 63V 10% CHIP CAPACITOR
	C3	93-200020	1nF 63V 10% CHIP CAPACITOR
	C5	93-240007	10uF 25V TANTALUM CHIP CAPACITOR SMD
	C6	93-240004	1uF 35V TANTALUM CHIP CAPACITOR SMD
	C7	93-240004	1uF 35V TANTALUM CHIP CAPACITOR SMD
	C9	93-150001	1nF FEED THROUGH CAPACITOR
	C10	93-150001	1nF FEED THROUGH CAPACITOR
	C11	93-150001	1nF FEED THROUGH CAPACITOR
	D1	94-120004	1N 5712 SCHOTTKY BARRIER DIODE
	L1	93-400018	1.0uH INDUCTOR 3613 SERIES SMD
	L2	93-400019	0.12uH SMD INDUCTOR
	R1	93-6300037	1KR 0.125W 2% CHIP RESISTOR
	R2	93-6300053	10KR 0.125W 2% CHIP RESISTOR
	R3	93-6300049	4.7KR 0.125W 2% CHIP RESISTOR
	R4	93-510050	330R 1.6W % H:P PR37 RESISTOR
	R5	93-630057	22KR 0.125W 2% CHIP RESISTOR
	REG1	94-300006	LM78L12ACZ VOLTAGE REGULATOR
	TR1	94-200007	MONOLITHIC AMP. MAV 11.
	TR2	94-020007	BCW71 TRANSISTOR SMD
	TR3	94-020007	BCW71 TRANSISTOR SMD
	VR1	93-610002	1KR 0.25W SMD POT 4mm

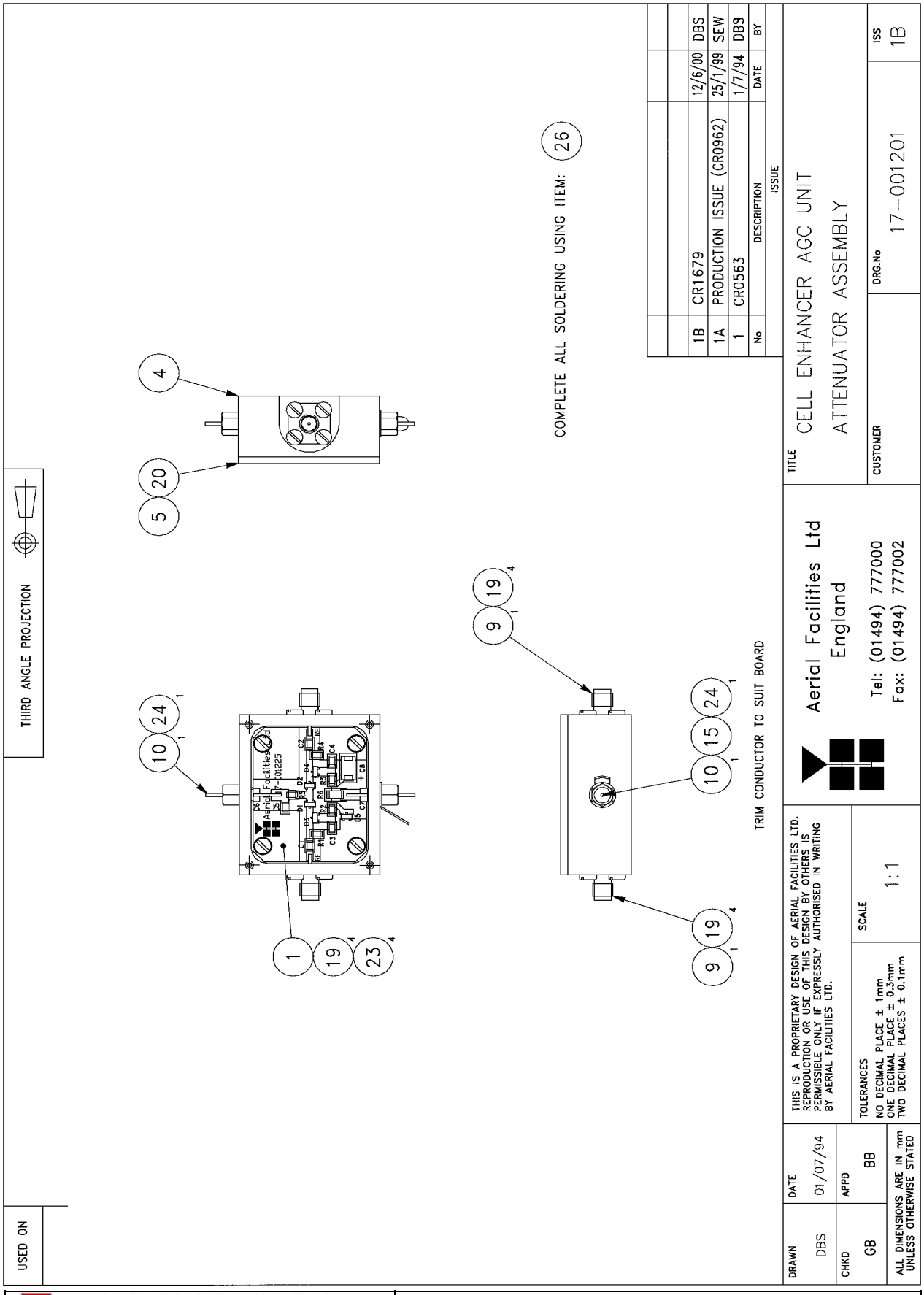
ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No
2A	3/5/00	CR1679									
1A	2/2/99	CR0962									
1	7/7/94	Prod.Issue									

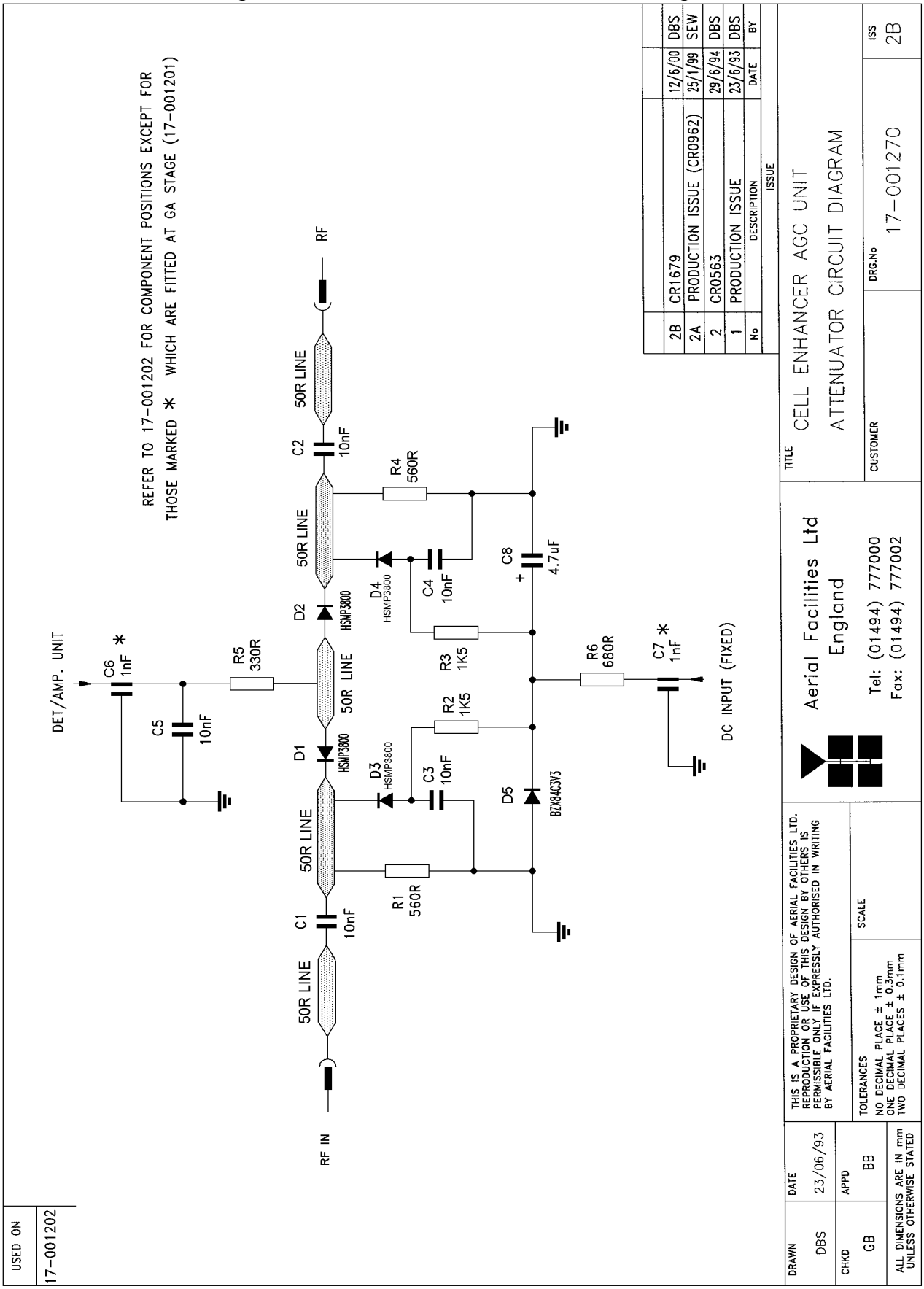
Aerial Facilities Limited

TITLE: CELL ENHANCER AGC UNIT
DETECTOR/AMP.CIRCUIT COMP.LIST

DRAWN	DATE	CHKD	APPD	CUSTOMER	COMPONENT LIST FOR	ISS
DBS	19/05/93	GB	BB		17-001171C	2A

5.5.2.6 Drg. Nō. 17-001201, AGC Attenuator Assembly Drawing




REFER TO 17-001202 FOR COMPONENT POSITIONS EXCEPT FOR THOSE MARKED * WHICH ARE FITTED AT GA STAGE (17-001201)
DET/AMP. UNIT
C6 * 1nF
C5 10nF
R5 330R
50R LINE
C1 10nF
C2 10nF
C3 10nF
C4 10nF
R1 560R
R2 1K5
R3 1K5
R4 560R
R6 680R
C7 * 1nF
C8 + 4.7uF
D1 HSMP3800
D2 HSMP3800
D3 HSMP3800
D4 HSMP3800
D5 BZX84C3V3
RF IN
RF
DC INPUT (FIXED)
2B CR1679 12/6/00 DBS
2A PRODUCTION ISSUE (CR0962) 25/1/99 SEW
2 CR0563 29/6/94 DBS
1 PRODUCTION ISSUE 23/6/93 DBS
No DESCRIPTION DATE BY
ISSUE
TITLE CELL ENHANCER AGC UNIT
ATTENUATOR CIRCUIT DIAGRAM
CUSTOMER
DRG.No 17-001270
ISS 2B
Aerial Facilities Ltd
England
Tel: (01494) 777000
Fax: (01494) 777002
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SCALE
TOLERANCES
NO DECIMAL PLACE ± 1mm
ONE DECIMAL PLACE ± 0.3mm
TWO DECIMAL PLACES ± 0.1mm
DRAWN DBS DATE 23/06/93
CHKD GB APPD BB
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED
USED ON 17-001202

5.5.2.8 Drg. Nō. 17-001270C, AGC Attenuator Parts List

USED ON	CIRC. REF.	AFL STOCK REF.	DESCRIPTION
17-001201	C1	93-200019	10nF 63V 10% CHIP CAPACITOR
	C2	93-200019	10nF 63V 10% CHIP CAPACITOR
	C3	93-200019	10nF 63V 10% CHIP CAPACITOR
	C4	93-200019	10nF 63V 10% CHIP CAPACITOR
	C5	93-200019	10nF 63V 10% CHIP CAPACITOR
	C6	93-150001	1nF FEED THROUGH CAPACITOR
	C7	93-150001	1nF FEED THROUGH CAPACITOR
	C8	93-240006	4.7uF 35V TANTALUM CHIP CAPACITOR
	D1	94-190001	PIN DIODE HSMP 3800 SMD
	D2	94-190001	PIN DIODE HSMP 3800 SMD
	D3	94-190001	PIN DIODE HSMP 3800 SMD
	D4	94-190001	PIN DIODE HSMP 3800 SMD
	D5	94-160001	BZX84C3V3 ZENDER DIODE SMD
	R1	93-630033	560R 0.125W 2% CHIP RESISTOR
	R2	93-630039	1.5KR 0.125W 2% CHIP RESISTOR
	R3	93-630039	1.5KR 0.125W 2% CHIP RESISTOR
	R4	93-630033	560R 0.125W 2% CHIP RESISTOR
	R5	93-630030	330R 0.125W 2% CHIP RESISTOR
	R6	93-650013	680R 0.75W 2% CHIP RESISTOR

ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No
1B	2/5/00	CR1679									
1A	3/2/99	CR0962									
1	29/6/94	CR0563									

Aerial Facilities Limited

TITLE
CELL ENHANCER AGC UNIT
ATTENUATOR CIRCUIT DIAGRAM

DRAWN	DATE	CHKD	APPD	CUSTOMER	COMPONENT LIST FOR	ISS
DBS	29/06/94				17-001270C	1B

All other modules in this shelf are described elsewhere in this document.

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.

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

Refer to the system drawing(s) in section 4. for cabling details.

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 shelves or trays and all housed within a standard 19" rack type cabinet.
Transmissions from the main base stations are passed though the system (via air interface antennas) 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 Cell Enhancer Management System, if fitted), or locally with the front panel LED's. The green LED on the front panels of shelves containing active components should be illuminated, while the red alarm indicator should be off.

If an Alarm is on, then that individual shelf must be individually tested against the original test specification.
The individual amplifier units within the shelf have a green LED showing through a hole in their piggy-back alarm board, which is illuminated if the unit is working correctly.

If an amplifier is suspect, check the DC power supply to the unit. If no other fault is apparent use a spectrum analyser to measure the incoming signal level at the input and then after reconnecting the amplifier input, measure the output level. Consult with the system diagram to determine the expected gain and compare result.

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

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.

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 not have to be removed before lifting the amplifier.

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.

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