

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.

 Aerial Facilities Limited www.AerialFacilities.com Technical Literature	9 Way Channelised UHF Cell Enhancer Maintenance Handbook		
	H/book Number:- 50-025301HBKM	Issue No:- 1	Date:- 04/07/2003

5.2.3 Low Noise Amplifier (11-006102)

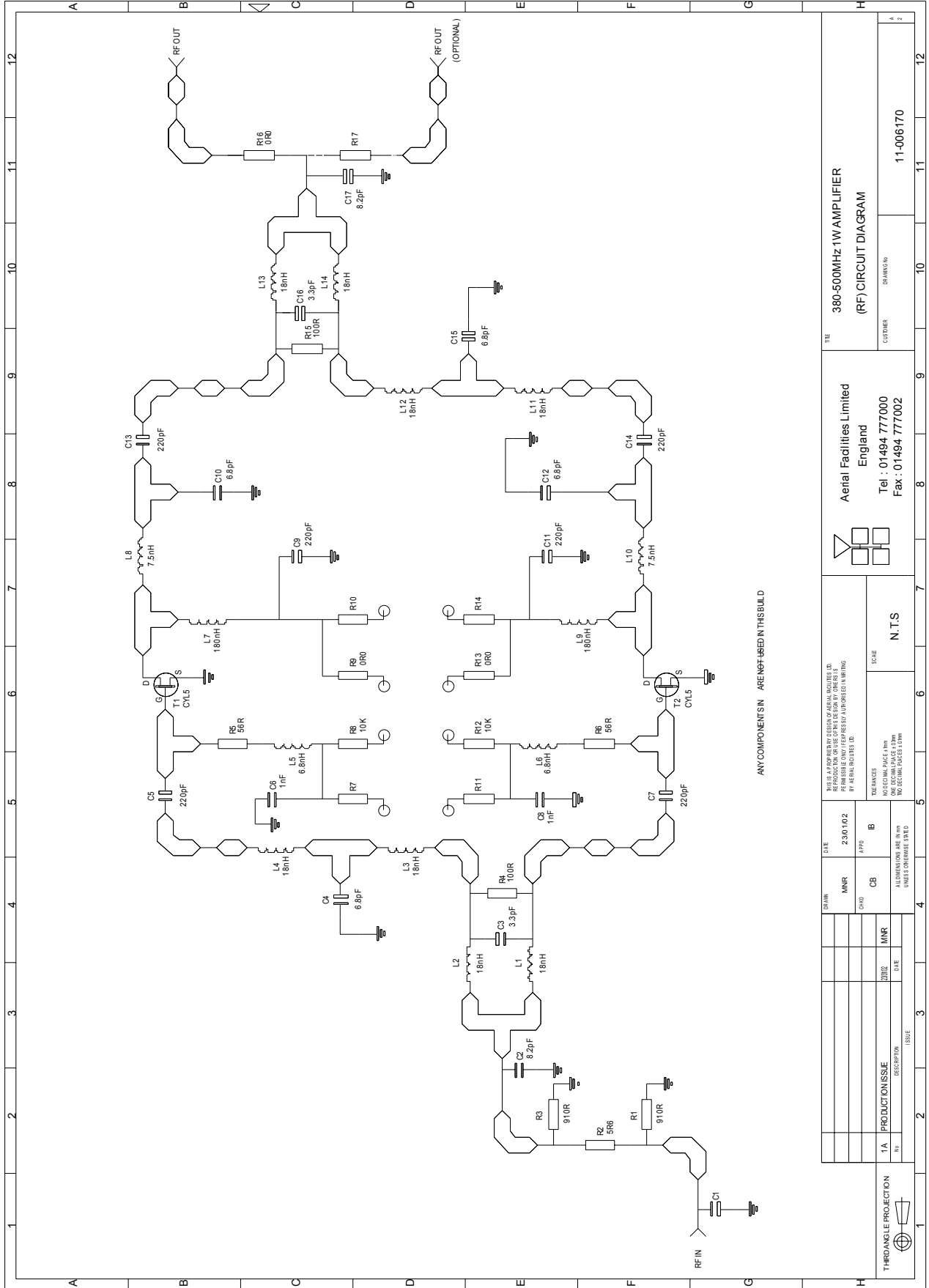
5.2.3.1 Description

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 \pm 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°

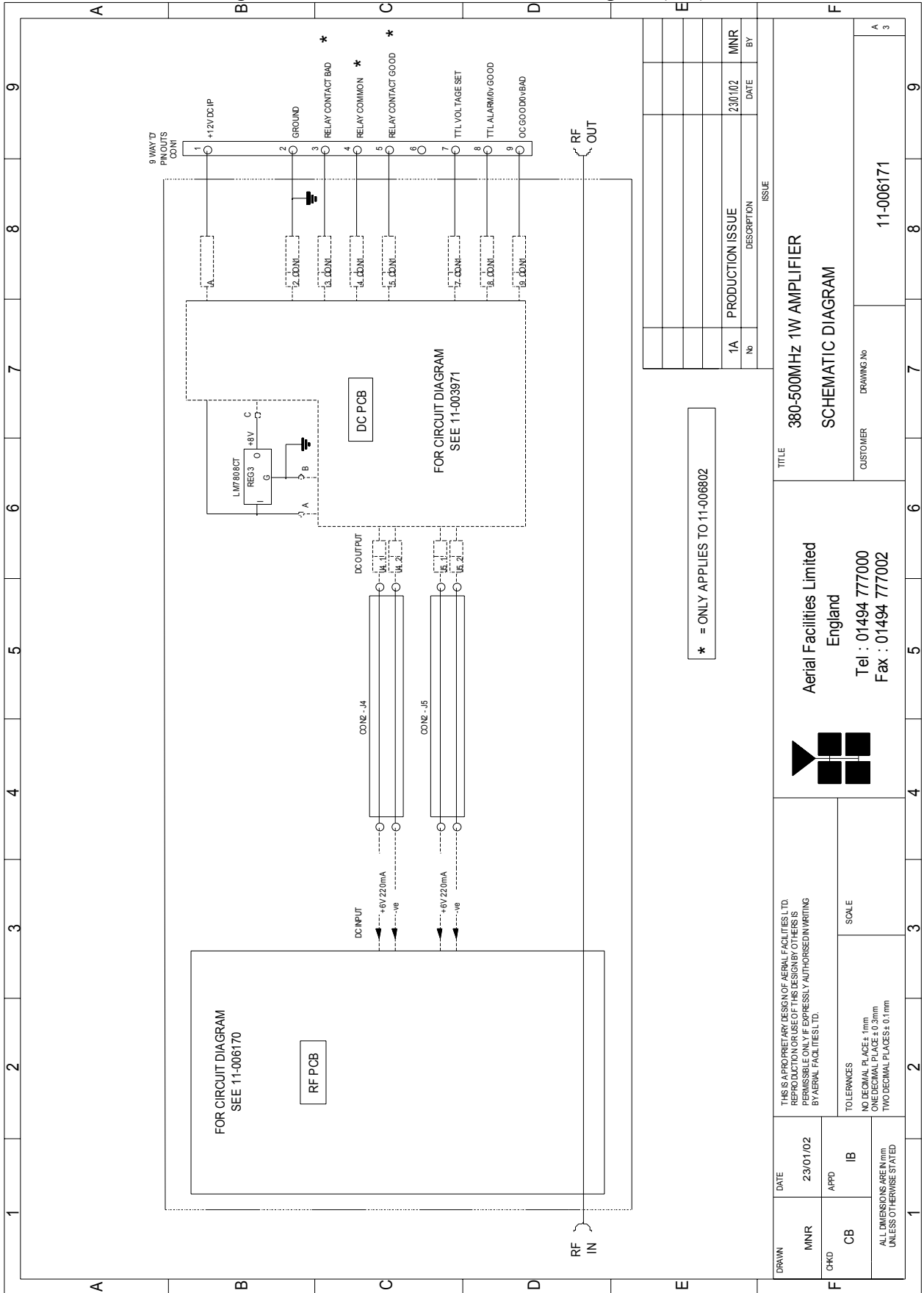
5.2.3.3 Drg. No. 11-006170, LNA Circuit Diagram (RF)



ANY COMPONENTS IN ARE NOT USED IN THIS BUILD

TITLE 380-500MHz 1W AMPLIFIER (RF) CIRCUIT DIAGRAM		CUSTOMER DRAWING NO. 11-006170	
Aerial Facilities Limited England Tel : 01494 777000 Fax : 01494 777002		SCALE N.T.S.	
DATE 23/01/02	MNR APPD	DRAWN MNR CHD	CHECKED MNR CHD
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REFERENCES NONE			
DIMENSIONS ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED			
PRODUCTION ISSUE 1A			
THROUGH ANGLE PROJECTION			

5.2.3.4 Drg. No. 11-006171, LNA Schematic Diagram (DC)



* = ONLY APPLIES TO 11-006802

No	DESCRIPTION	DATE	BY
1A	PRODUCTION ISSUE	23/01/02	MNR

TITLE		380-500MHz 1W AMPLIFIER	
SCHEMATIC DIAGRAM		SCHEMATIC DIAGRAM	
CUSTOMER	DRAWING No	11-006171	

Aerial Facilities Limited
 England
 Tel : 01494 777000
 Fax : 01494 777002

DATE	23/01/02	THIS IS A PROPRIETARY DESIGN OF AERIAL FACILITIES LTD. REPRODUCTION OR USE OF THIS DESIGN BY OTHERS IS EXPRESSLY FORBIDDEN WITHOUT THE WRITTEN PERMISSION OF AERIAL FACILITIES LTD.	
APPD	IB	TOLERANCES	SCALE
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED		NO DECIMAL PLACES ± 1mm ONE DECIMAL PLACE ± 0.1mm TWO DECIMAL PLACES ± 0.1mm	

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.

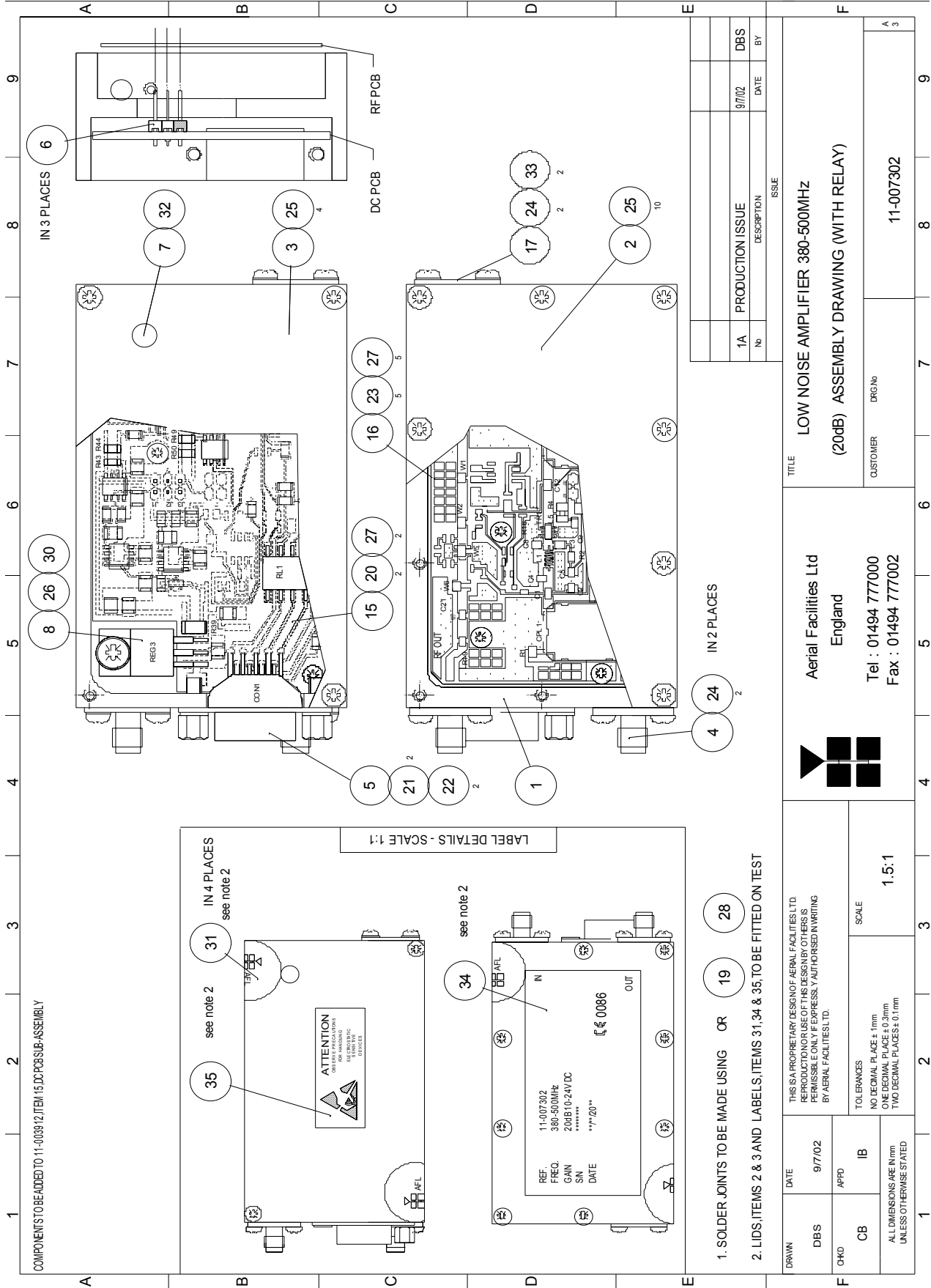
5.2.4.2 Technical Specification, (11-007302)

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)

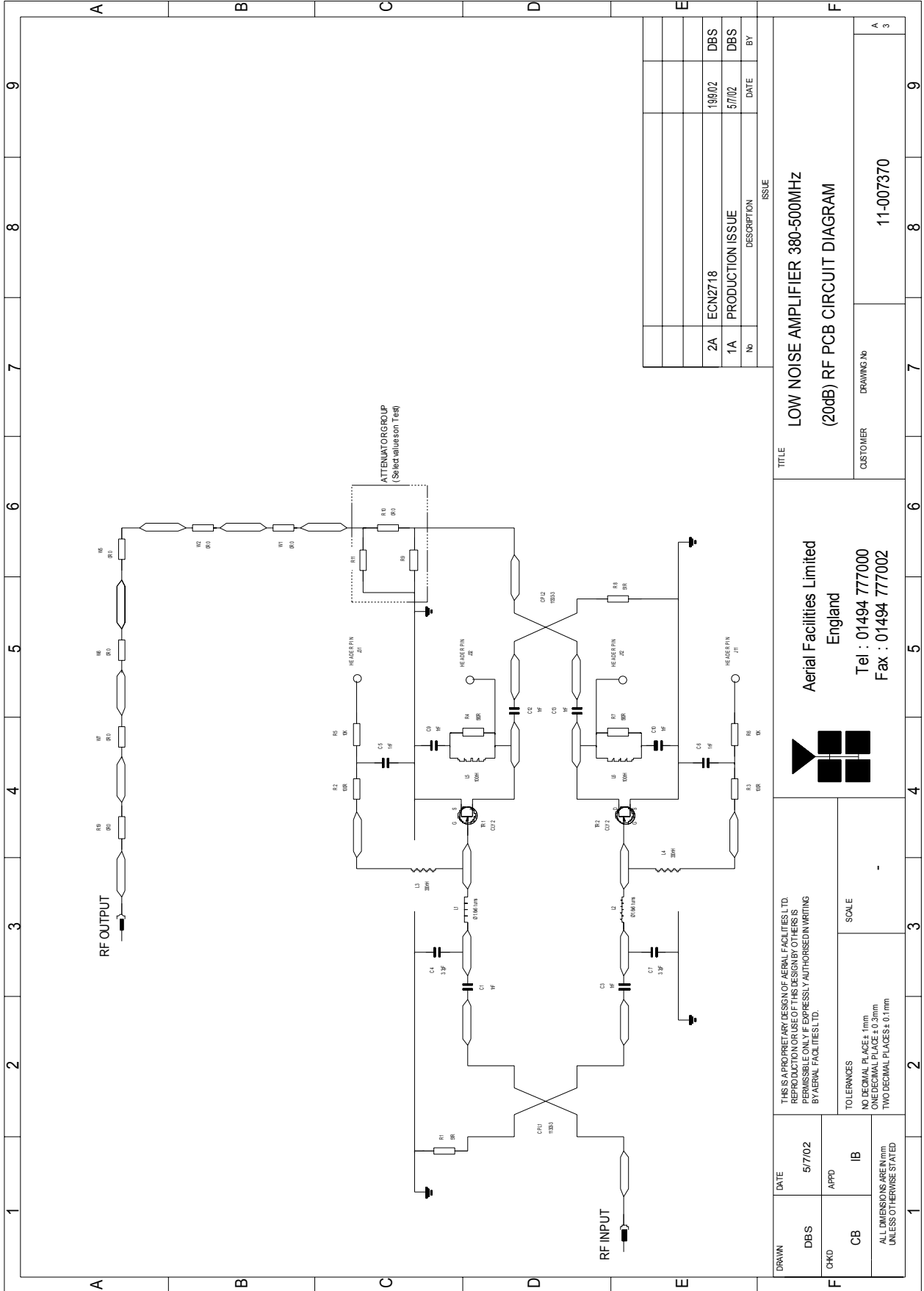
PARAMETER		SPECIFICATION
Frequency range:		380-500MHz
Bandwidth:		<140MHz
Gain:		30-32dB
1dB Compression Point:		+22dBm (typical)
3rd order intercept:		+34-35dBm (typical)
Input/Output return loss:		>20dB
Noise figure:		<1.3dB
Connectors:		SMA female
Supply:		300-330mA @ 24V DC
Temperature range:	operational: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

5.2.4.4 Drg. N^o. 11-007302, LNA Assembly With Alarm Relay



- 1. SOLDER JOINTS TO BE MADE USING OR 19 28
- 2. LIDS, ITEMS 2 & 3 AND LABELS, ITEMS 31, 34 & 35, TO BE FITTED ON TEST

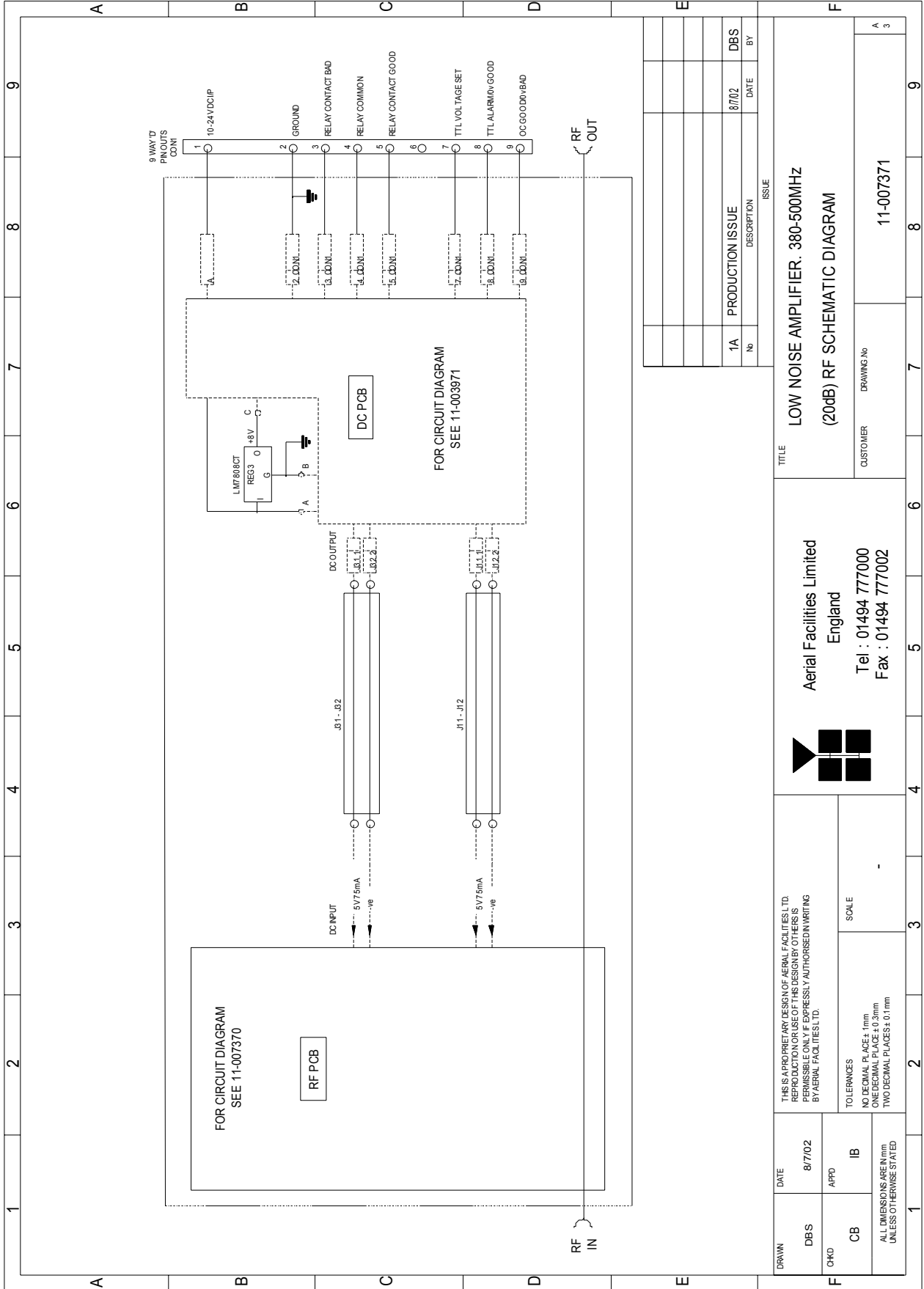
5.2.4.5 Drg. N^o. 11-007370, LNA RF Circuit Diagram



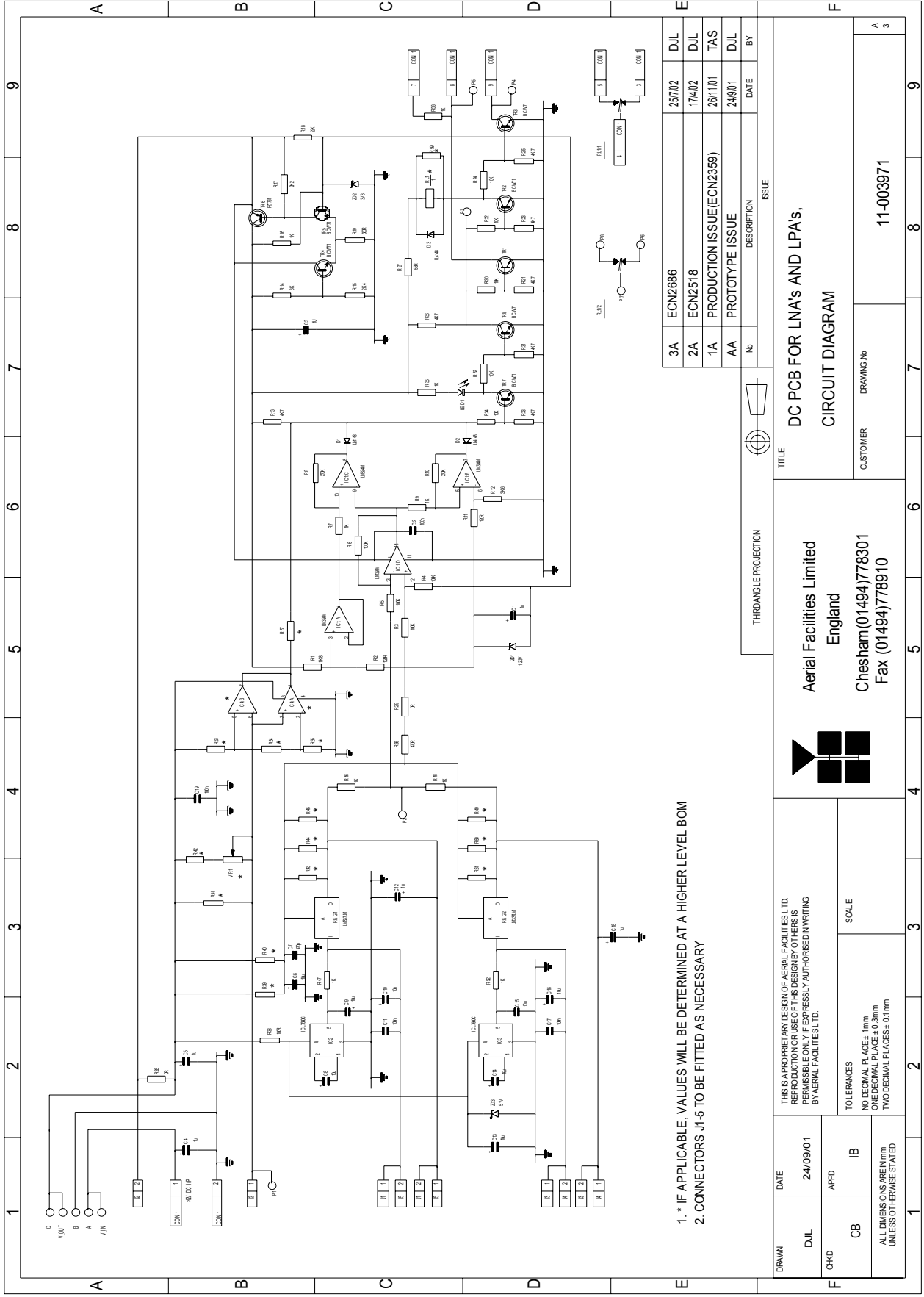
No	DESCRIPTION	DATE	BY
2A	ECN2718	19/02	DBS
1A	PRODUCTION ISSUE	5/7/02	DBS

TITLE LOW NOISE AMPLIFIER 380-500MHZ (20dB) RF PCB CIRCUIT DIAGRAM	
CUSTOMER Aerial Facilities Limited England Tel : 01494 777000 Fax : 01494 777002	DRAWING No 11-007370
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TOLERANCES NO DECIMAL PLACES - 1mm ONE DECIMAL PLACE - 0.1mm TWO DECIMAL PLACES - 0.1mm ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED	DATE 5/7/02
DBS APPD	IB

5.2.4.6 Drg. No. 11-007371, LNA DC Wiring Diagram



5.2.5.7 Drg. No. 11-003971, LNA DC Circuit Diagram



- 1. * IF APPLICABLE, VALUES WILL BE DETERMINED AT A HIGHER LEVEL BOM
- 2. CONNECTORS J1-5 TO BE FITTED AS NECESSARY

No	DESCRIPTION	DATE	BY
3A	ECN2686	25/02	DJL
2A	ECN2518	17/402	DJL
1A	PRODUCTION ISSUE(ECN2359)	26/11/01	TAS
AA	PROTOTYPE ISSUE	24/9/01	DJL

THREANGLE PROJECTION		ISSUE	
TITLE		DC PCB FOR LNA's AND LPA's,	
CUSTOMER		DRAWING NO	
Aerial Facilities Limited England Chesham(01494)778301 Fax (01494)778910		11-003971	
A		3	

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TOLERANCES NO DECIMAL PLACES - 1mm ONE DECIMAL PLACE - 0.1mm TWO DECIMAL PLACES - 0.1mm UNLESS OTHERWISE STATED		DATE	
DRAWN		24/09/01	
DUL		APPD	
CB		IB	

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.

 Aerial Facilities Limited www.AerialFacilities.com Technical Literature	9 Way Channelised UHF Cell Enhancer Maintenance Handbook		
	H/book Number:- 50-025301HBKM	Issue No:- 1	Date:- 04/07/2003

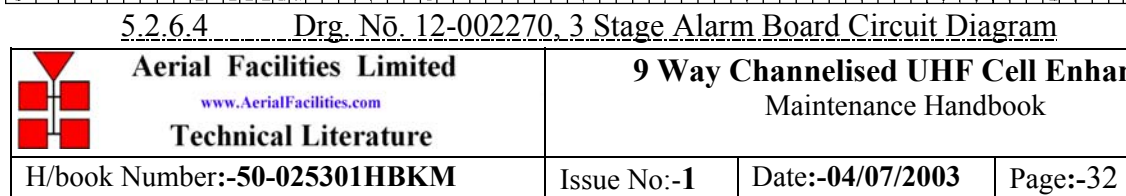
5.2.6.2 Technical Specification

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:		>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

 <p>Aerial Facilities Limited www.AerialFacilities.com Technical Literature</p>	<p>9 Way Channelised UHF Cell Enhancer Maintenance Handbook</p>		
H/book Number:- 50-025301HBKM	Issue No:- 1	Date:- 04/07/2003	Page:- 31 of 69

CIRC. REF.	AL. STOCK REF.	DESCRIPTION	CIRC. REF.	AL. STOCK REF.	DESCRIPTION
R1	95-630040	1.8K Ω 0.125W 2% CHIP RESISTOR	TR4	94-020007	BCW71 NPN TRANSISTOR SMD
R2	95-630024	120R 0.125W 2% CHIP RESISTOR	TR5	94-020007	BCW71 NPN TRANSISTOR SMD
R3	95-630024	120R 0.125W 2% CHIP RESISTOR	TR6	94-020010	FZ751/753 PNP TRIN SMD
R4	95-630024	3.6K Ω 0.125W 2% CHIP RESISTOR	IC1	94-210001	LM432M SMD QUAD OP AMP
R5	95-640003	100K PRECISION RESISTOR 0.1% 100K PRECISION RESISTOR 0.1%	IC2	94-210001	LM432M SMD QUAD OP AMP
R6	95-640003	100K PRECISION RESISTOR 0.1% 100K PRECISION RESISTOR 0.1%	IC3	94-210001	LM432M SMD QUAD OP AMP
R7	95-640003	100K PRECISION RESISTOR 0.1% 100K PRECISION RESISTOR 0.1%	RL1	95-900004	BY DPZO NON LATCHING RELAY
R8	95-630037	1K Ω 0.125W 2% CHIP RESISTOR	HI	91-700016	15 WAY D.I.T. LOCKING HEADER PCB
R9	95-630037	270K Ω 0.125W 2% CHIP RESISTOR			
R10	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R11	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R12	95-630037	270K Ω 0.125W 2% CHIP RESISTOR			
R13	95-640003	100K PRECISION RESISTOR 0.1%			
R14	95-640003	100K PRECISION RESISTOR 0.1%			
R15	95-640003	100K PRECISION RESISTOR 0.1%			
R16	95-640003	100K PRECISION RESISTOR 0.1%			
R17	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R18	95-630037	270K Ω 0.125W 2% CHIP RESISTOR			
R19	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R20	95-630037	270K Ω 0.125W 2% CHIP RESISTOR			
R21	95-640003	100K PRECISION RESISTOR 0.1%			
R22	95-640003	100K PRECISION RESISTOR 0.1%			
R23	95-640003	100K PRECISION RESISTOR 0.1%			
R24	95-640003	100K PRECISION RESISTOR 0.1%			
R25	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R26	95-630037	270K Ω 0.125W 2% CHIP RESISTOR			
R27	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R28	95-630037	270K Ω 0.125W 2% CHIP RESISTOR			
R29	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R30	95-630042	2.2K Ω 0.125W 2% CHIP RESISTOR			
R31	95-630053	10K Ω 0.125W 2% CHIP RESISTOR			
R32	95-630049	4.7K Ω 0.125W 2% CHIP RESISTOR			
R33	95-630053	10K Ω 0.125W 2% CHIP RESISTOR			
R34	95-630049	4.7K Ω 0.125W 2% CHIP RESISTOR			
R35	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R36	95-630049	4.7K Ω 0.125W 2% CHIP RESISTOR			
R37	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R38	95-630049	4.7K Ω 0.125W 2% CHIP RESISTOR			
R39	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R40	95-630042	2.2K Ω 0.125W 2% CHIP RESISTOR			
R41	95-630037	1K Ω 0.125W 2% CHIP RESISTOR			
R42	95-630049	4.7K Ω 0.125W 2% CHIP RESISTOR			
C1	95-240004	1 μ F TANTALUM CHIP CAP 35V SMD			
C2	95-240021	100nF 63V 10X CHIP CAPACITOR			
C3	95-240021	100nF 63V 10X CHIP CAPACITOR			
C4	95-240021	100nF 63V 10X CHIP CAPACITOR			
C5					
C6	95-240021	100nF 63V 10X CHIP CAPACITOR			
C7	95-240004	1 μ F TANTALUM CHIP CAP 35V SMD			
C8	95-240004	1 μ F TANTALUM CHIP CAP 35V SMD			
D1	94-130003	1.23V VOLTAGE REFERENCE DIODE			
D2	94-150001	LL4148 GP MINIMELF DIODE SMD			
D3	94-150001	LL4148 GP MINIMELF DIODE SMD			
D4	94-150001	LL4148 GP MINIMELF DIODE SMD			
D5	94-150001	LL4148 GP MINIMELF DIODE SMD			
D6	94-150001	LL4148 GP MINIMELF DIODE SMD			
D7	94-150001	LL4148 GP MINIMELF DIODE SMD			
D8	94-150001	LL4148 GP MINIMELF DIODE SMD			
D9	94-150001	LL4148 GP MINIMELF DIODE SMD			
D10	94-150001	LL4148 GP MINIMELF DIODE SMD			
LED1	96-700008	GREEN LED SMD			
TR1	94-020007	BCW71 NPN TRANSISTOR SMD			
TR2	94-020007	BCW71 NPN TRANSISTOR SMD			
TR3	94-020007	BCW71 NPN TRANSISTOR SMD			
TR4	94-020007	BCW71 NPN TRANSISTOR SMD			



5.2.6.4 Drg. No. 12-002270, 3 Stage Alarm Board Circuit Diagram

NOTES:

- COMPONENTS SHOULD BE POSITIONED USING SILK SCREEN REFERENCES
- IN CONJUNCTION WITH COMPONENT LIST
- 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 IDENT)
- ALL SOLDERING TO BE COMPLETED USING ITEM (27) (HAND SOLDERING) OR ITEM (29) (MACHINE SOLDERING)
- USE WITH CIRCUIT DIAGRAM 12-002270

Aerial Facilities Ltd
England

Tel: (01494) 777000
 Fax: (01494) 777002

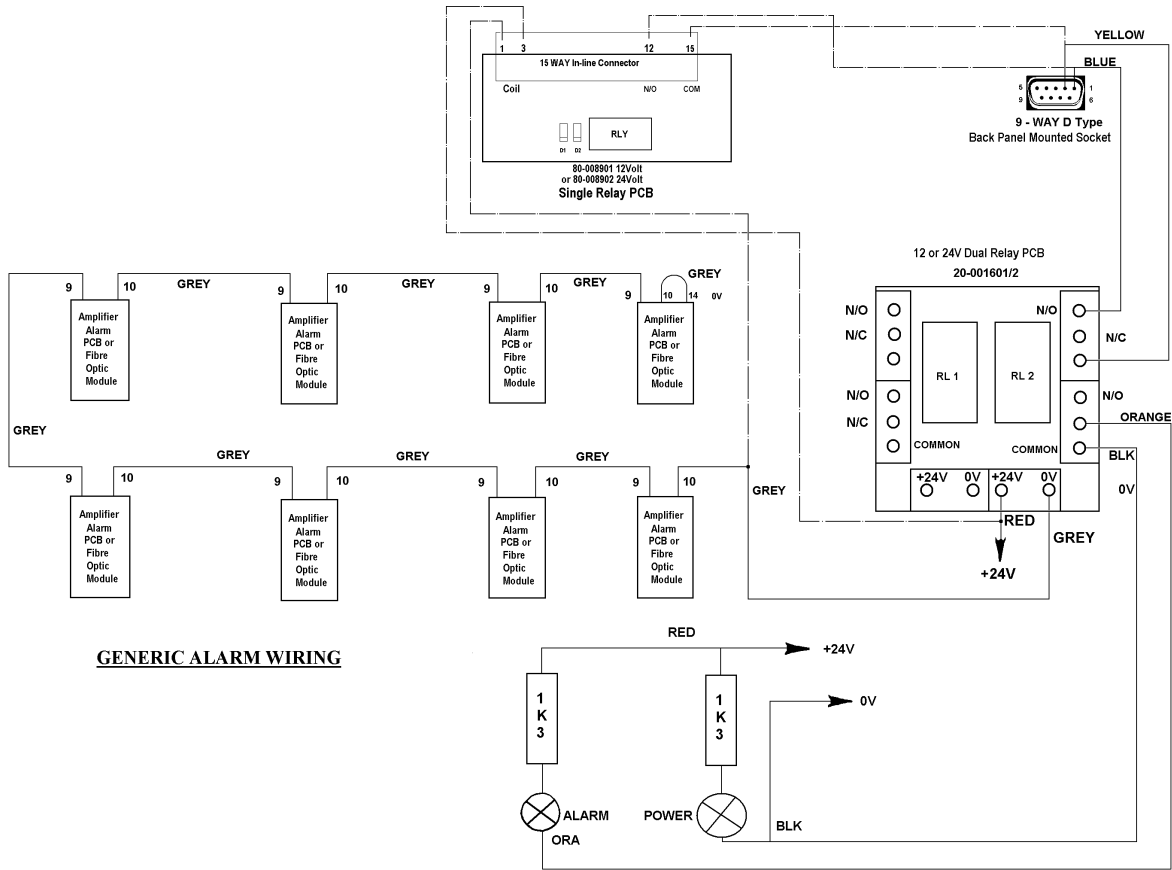
12-002270

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SCALE: 2:1

TOLERANCES:
 NO DECIMAL PLACE \pm 0.3mm
 ONE DECIMAL PLACE \pm 0.1mm
 TWO DECIMAL PLACES \pm 0.05mm

DATE	ISSUE	DESCRIPTION
14/5/94 <td>1 <td>ISSUE</td> </td>	1 <td>ISSUE</td>	ISSUE
28/6/00	2A	CR1679
4/7/99	1A	PRODUCTION ISSUE (CR0962)
15/6/94	1	PRODUCTION ISSUE (CR0596)



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Technical Literature

**9 Way Channelised UHF Cell Enhancer
Maintenance Handbook**

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

5.2.7.1 Description

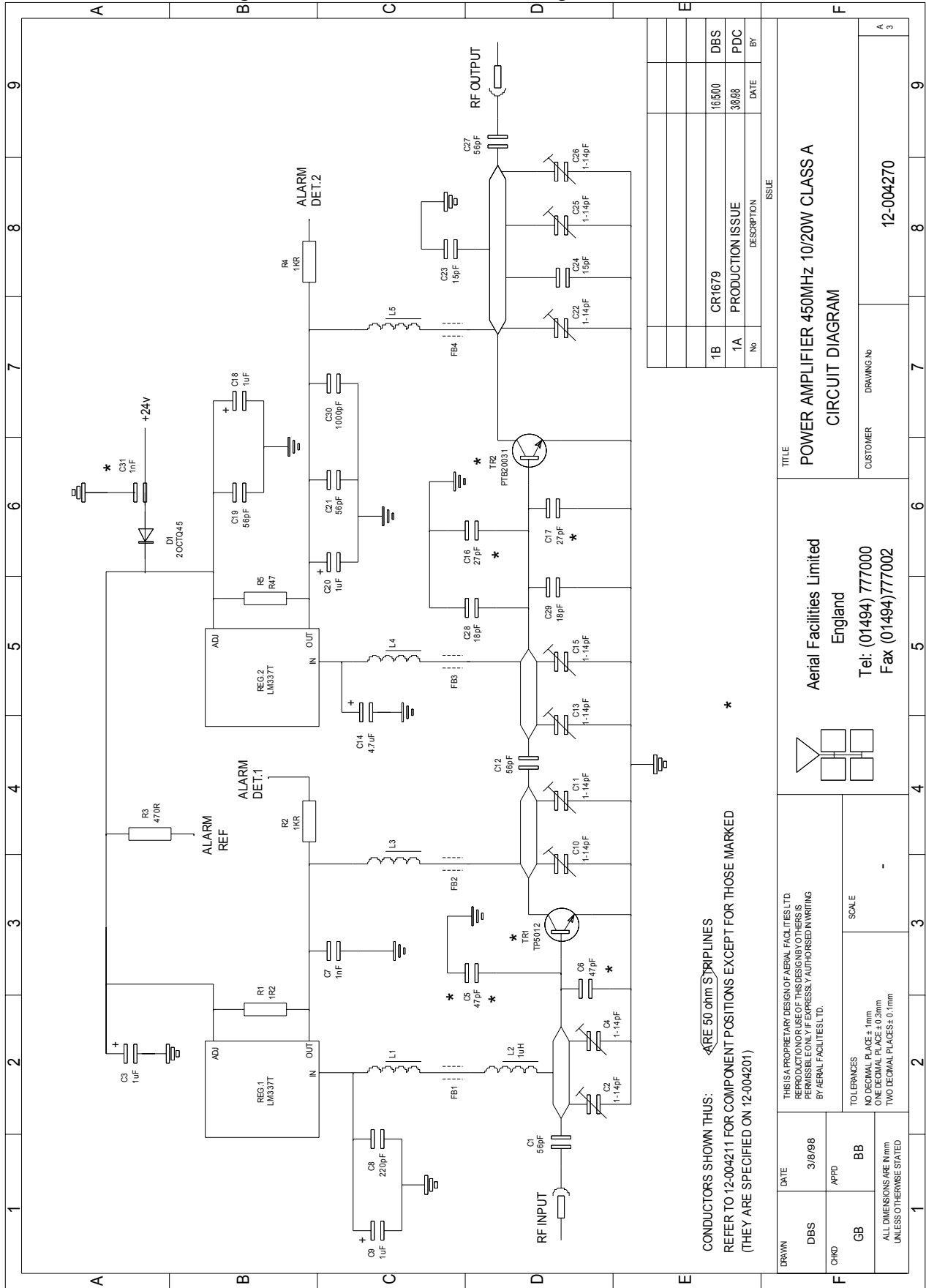
The power amplifiers fitted to this unit are multi-stage, solid state power amplifiers. Class A circuitry is employed throughout the units to ensure excellent linearity over a wide dynamic frequency range. All the semi-conductor devices are very conservatively rated to ensure low device junction temperatures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

5.2.7.4 Drg. No. 12-004270, PA Circuit Diagram



CONDUCTORS SHOWN THUS: ARE 50 ohm STRIPLINES
 REFER TO 12-004211 FOR COMPONENT POSITIONS EXCEPT FOR THOSE MARKED
 (THEY ARE SPECIFIED ON 12-004201)

No	DESCRIPTION	DATE	BY
1B	CR1679	16/500	DBS
1A	PRODUCTION ISSUE	3/8/98	PDC

TITLE		POWER AMPLIFIER 450MHz 10/20W CLASS A	
CIRCUIT DIAGRAM			
CUSTOMER	DRAWING No	12-004270	
Aerial Facilities Limited England			
Tel: (01494) 777000			
Fax: (01494) 777002			

DRWN	DATE	SCALE	
DBS	3/8/98		
CHKD	APFD		
GB	BB		
TOLERANCES			
ALL DIMENSIONS ARE IN mm			
ONE DECIMAL PLACE ± 0.3mm			
TWO DECIMAL PLACES ± 0.1mm			
UNLESS OTHERWISE STATED			

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Technical Literature

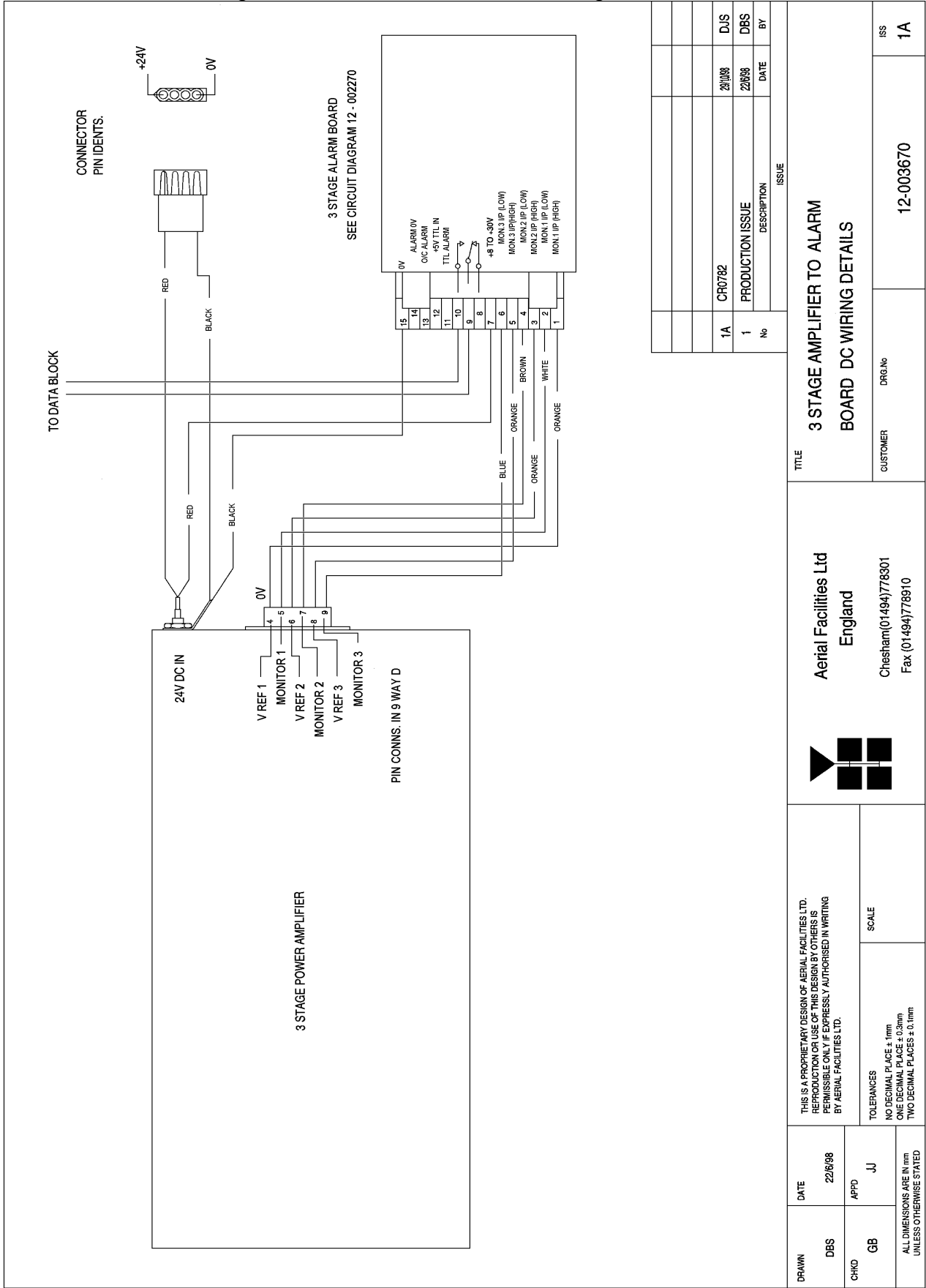
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5.2.7.5 Drg. No. 12-004270C1, PA Parts List(1)

1	2		3			4			5																																						
CIRC. REF.	AFL STOCK REF.		DESCRIPTION																																												
A	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																																													
B	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																																													
C	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																																													
D	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																																												
E	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)																																												
F	C30	93-200016	1000pF (1nF) CHIP CAP 10% TOL.(MIN)																																												
	C31	REFER TO GA 12-004201 FOR DETAILS																																													
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ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No																																				
2A	5/5/00	CR1679																																													
1A	5/8/98	PROD. ISS.																																													
G	 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																																										

5.2.7.7 Drg. No. 12-003670, PA to Alarm Wiring Details



1A	CR0782	29/10/08	DJS
1	PRODUCTION ISSUE	22/08/08	DBS
No		DATE	BY

TITLE		3 STAGE AMPLIFIER TO ALARM BOARD DC WIRING DETAILS	
CUSTOMER	DWG No	12-003670	
ISS		1A	


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CHD	GB	

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5.2.8 Single DC/DC Converter (13-001702)

5.2.8.1 Description

This unit 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

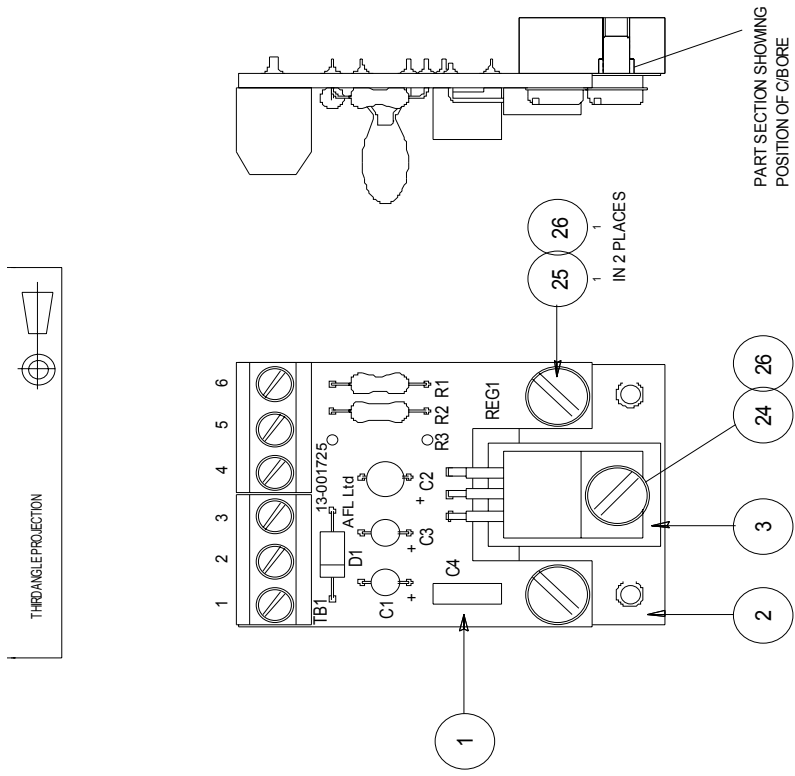
PARAMETER		SPECIFICATION
Operating Voltage:		21 – 27V DC
Output Voltages:		12.4V (typical)
Output Current:		1.0A (maximum per o/p)
Connections:		Screw Terminal Block
Temperature range:	operational:	-10BC to +55BC
	storage:	-40BC to +70BC
PCB Size:		47 x 30mm

5.2.8.3 Drg. No. 13-001702, 12.8V Regulator Assembly Drawing & Parts List

COMP. REF.	AFL STOCK REF.	DESCRIPTION
TB1	91-700003	3 WAY PRINTED CIRCUIT CON
C1	93-40002	22UF 35V TANTALUM CAP
C2	93-40004	10UF 35V TANTALUM CAP
C3	93-140002	22UF 35V TANTALUM CAP
C4	93-120003	100nF 63V POLYESTER CAP FILM
D1	94-100006	DOZE 1N4003 (1N4000
R1	93-540024	240R0.25W1% RES MRS25 M/F
R2	93-540039	2K20.25W1% RES MRS25 M/F
REG1	94-300001	LM317T NSCOMOT VOLTAGE REG

ISSUE	
DESCRIPTION	DATE
1A	12/7/00
MNR	BY

TITLE		12.8V REGULATOR, ASSEMBLY
CUSTOMER	DRG NO	13-001702
ISS	BY	1A

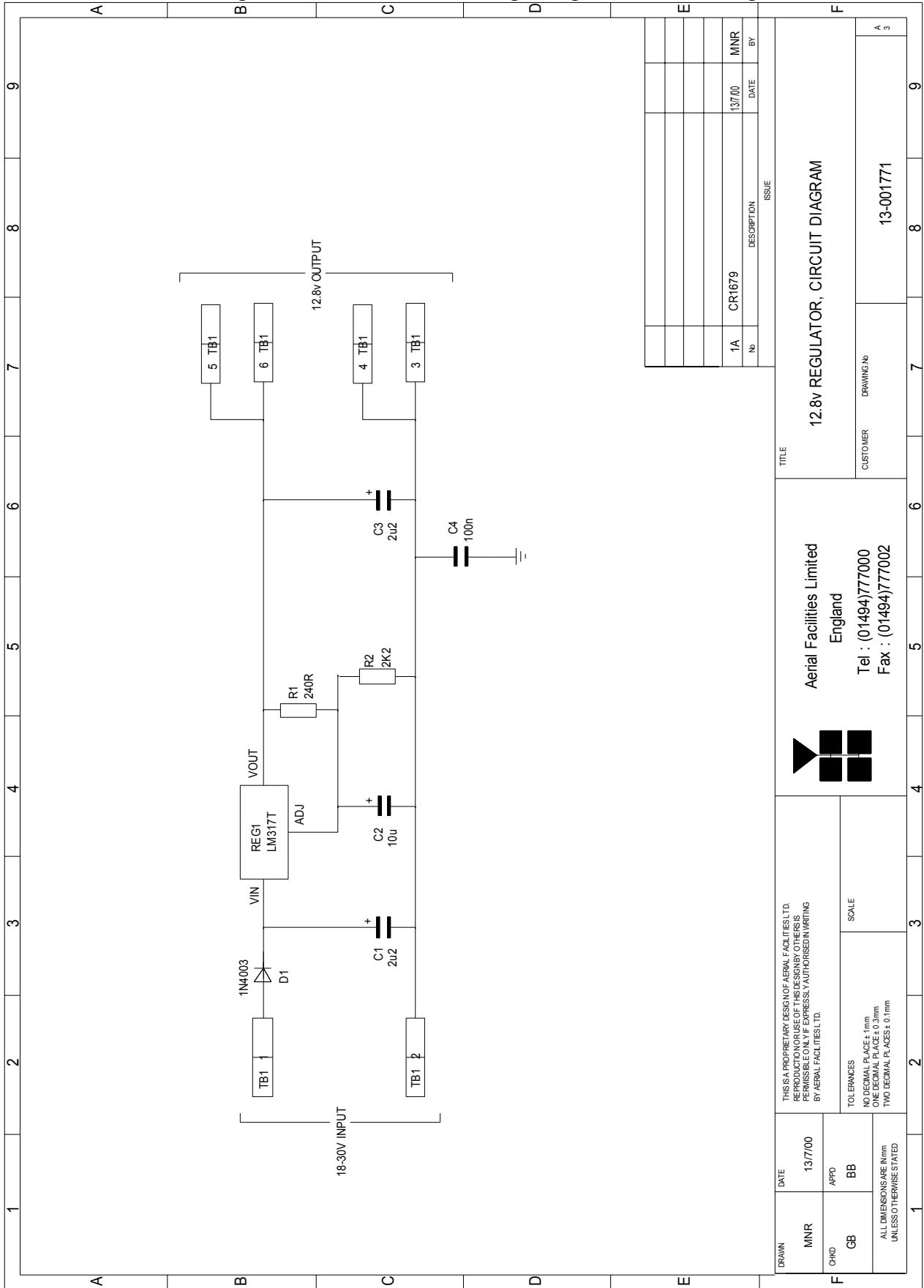


NOTE
 1: ALL SOLDERED CONNECTIONS TO BE MADE USING ITEM 23
 2: WHERE INDIVIDUAL ITEMS ARE NOT BALLOONED THE COMPONENT IS IDENTIFIED ON BOTH THE COMPONENT LIST AND THE DRAWING BY ITS COMPONENT REF. (SEE B.o.M FOR BALLOON IDENT'S)

ACTUAL SIZE	
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APPD	BB
DATE	12/7/00
BY	MNR

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5.2.8.4 Drg. No. 13-001771, 12.8V Single Regulator Circuit Diagram



No	DESCRIPTION	DATE	BY
1A	CR1679	13/7/00	MNR

TITLE		12.8v REGULATOR, CIRCUIT DIAGRAM	
CUSTOMER	DRAWING No	13-001771	
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5.2.9 24V Single Relay Board (80-008902)

5.2.9.1 Description

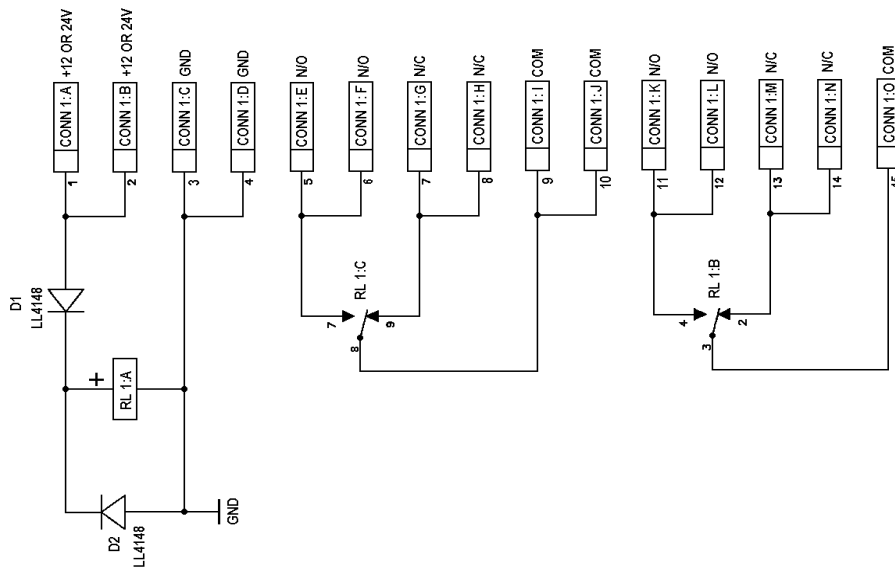
The General Purpose Relay Board allows the inversion of signals and the isolation of circuits. It is equipped with a single dual pole change-over relay RL1, with completely isolated wiring, accessed via a 15 way in-line connector.

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.

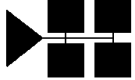
 <p>Aerial Facilities Limited www.AerialFacilities.com Technical Literature</p>	<p>9 Way Channelised UHF Cell Enhancer Maintenance Handbook</p>		
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5.2.9.2 Drg. No. 80-008970, Single Relay Board Circuit Diagram



No	DESCRIPTION	DATE	BY
BB	CHANGING COMMON TO COM	13/02/03	MMR
BA	ECH2401	16/10/02	MRB
A	PROTOTYPE ISSUE	20/7/98	PDC

TITLE		12 & 24V RELAY PCB CIRCUIT DIAGRAM	
CUSTOMER	DRG. No.	80 - 008970	Iss. BB


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DRAWN PDC	DATE 20/7/98
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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 <u>UP</u> 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 synthesised 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.

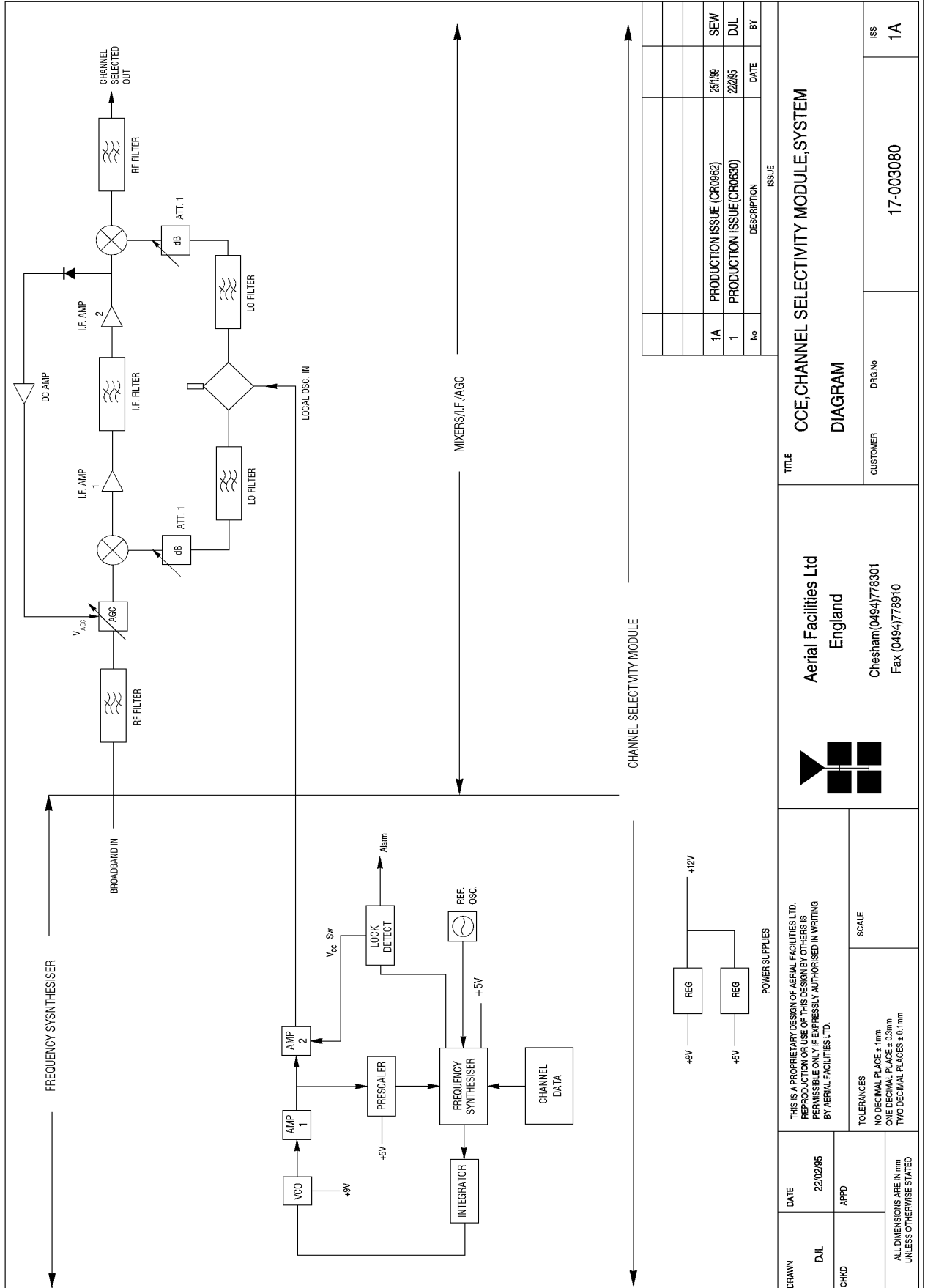
Automatic Level Control (ALC) is provided within each channel selectivity module such that the output level is held constant for high level input signals. This feature prevents saturation of the output mixer and of the associated amplifiers.

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.

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5.3.4.2 Drg. N^o. 17-003080, Generic Channel Module Block Diagram




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TITLE		CCE, CHANNEL SELECTIVITY MODULE, SYSTEM	
CUSTOMER		Aerial Facilities Ltd England	
D.R.G. No		17-003080	
ISS		1A	

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 3 rd Order IP	55.3	55.0	dBm Min
DC Supply Voltage	24 ± 0.5		Vdc
DC Supply Current	3700 typical	3800	mA Max

5.5.2 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.

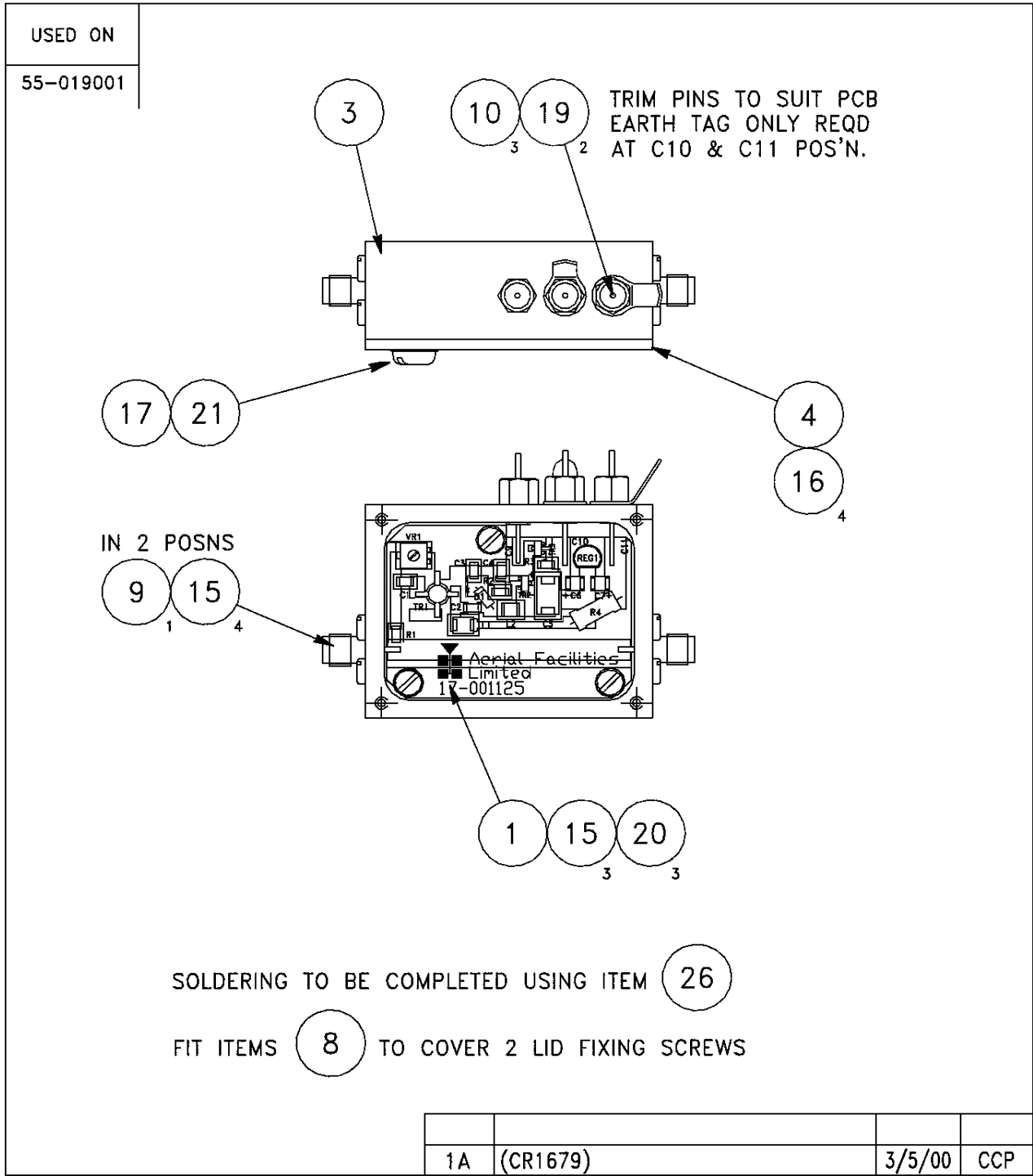
The attenuator comprises a 50Ω P.I.N diode, voltage-variable attenuator with a range of 3 to 30dB. The attenuation is controlled by a DC voltage which is derived from the associated AGC detector unit.

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5.5.2.2 Technical Specification

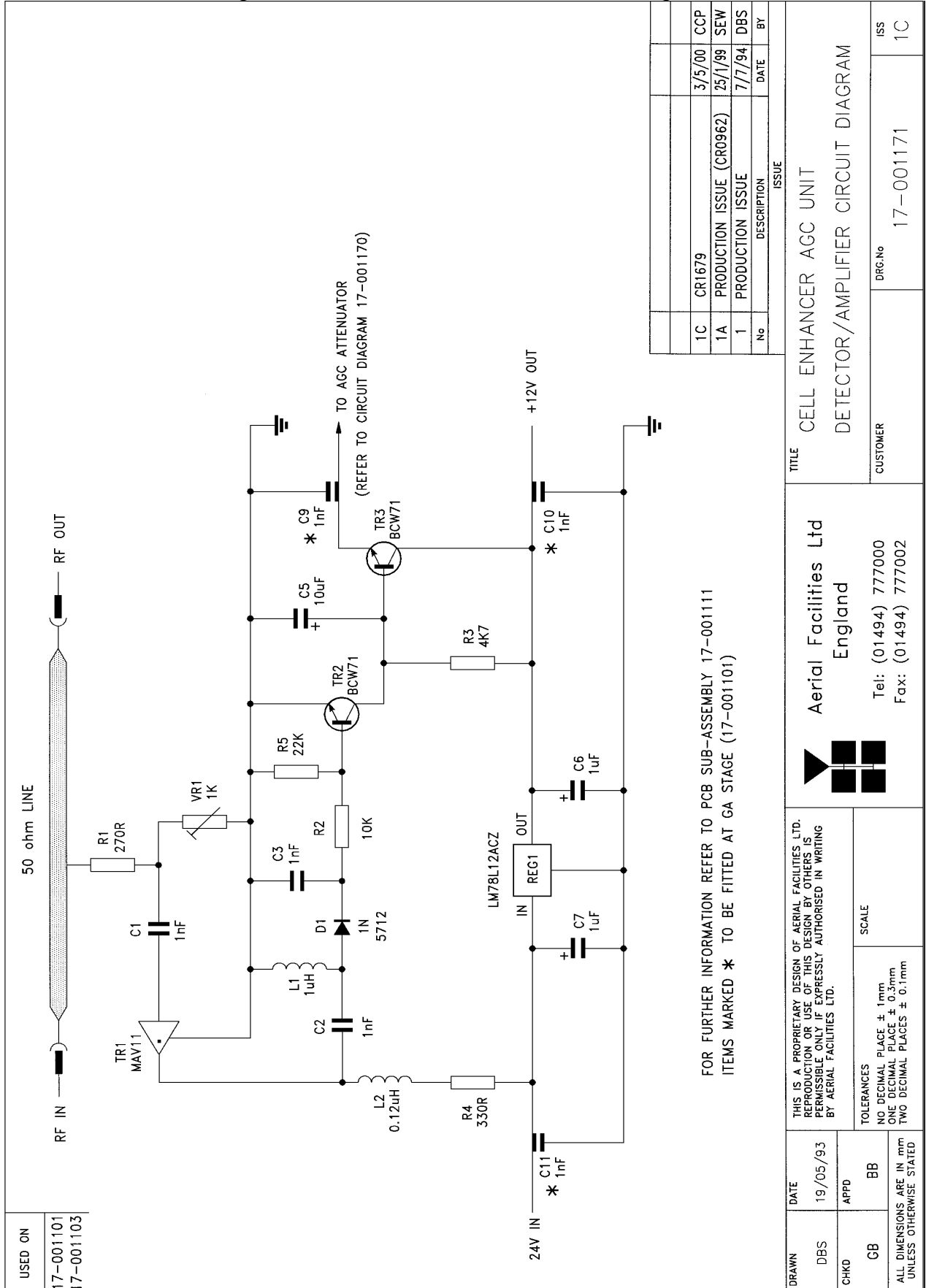
PARAMETER		SPECIFICATION
Frequency Range:		up to 1000MHz
Attenuation Range:		3 to 30dB
Attenuation Steps:		continuously variable
VSWR:		better than 1.2:1
RF Connectors:		SMA female
Power Handling:	attenuator:	1W
	detector/amp:	>30W (or as required)
Temperature Range:	operation:	-10°C to +55°C
	storage:	-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. No. 17-001101, ACG Detector Assembly



	1A	(CR1679)	3/5/00	CCP
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DRAWN CCP	DATE 3/5/00	CHKD GB	APPD BB	SCALE 1:1
CUSTOMER		DRAWING No 17-001101		ISS 1A
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5.5.2.4 Drg. Nō. 17-001171, AGC Detector Circuit Diagram



FOR FURTHER INFORMATION REFER TO PCB SUB-ASSEMBLY 17-001111
ITEMS MARKED * TO BE FITTED AT GA STAGE (17-001101)

1C	CR1679	3/5/00	CCP
1A	PRODUCTION ISSUE (CR0962)	25/1/99	SEW
1	PRODUCTION ISSUE	7/7/94	DBS
No		DATE	BY

DRAWN	DATE	ISSUE	
DBS	19/05/93	CELL ENHANCER AGC UNIT	
CHKD	APPD	DETECTOR/AMPLIFIER CIRCUIT DIAGRAM	
GB	BB	CUSTOMER	ISS
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED		17-001171	1C
TOLERANCES		Aerial Facilities Ltd	
NO DECIMAL PLACE ± 1mm		England	
ONE DECIMAL PLACE ± 0.3mm		Tel: (01494) 777000	
TWO DECIMAL PLACES ± 0.1mm		Fax: (01494) 777002	


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Technical Literature


9 Way Channelised UHF Cell Enhancer
Maintenance Handbook

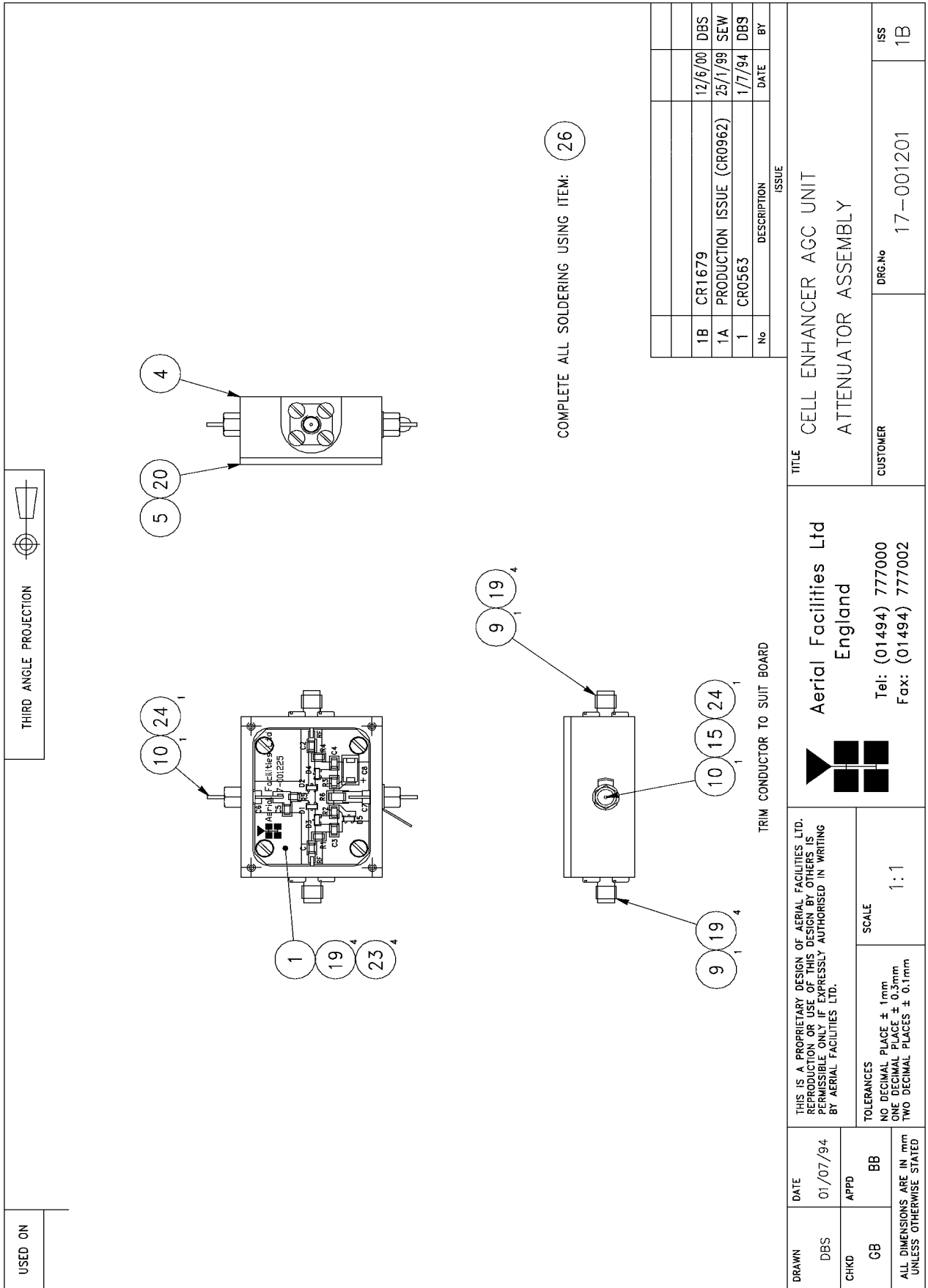
5.5.2.5 Drg. Nō. 17-001171C, AGC Detector Parts List

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	

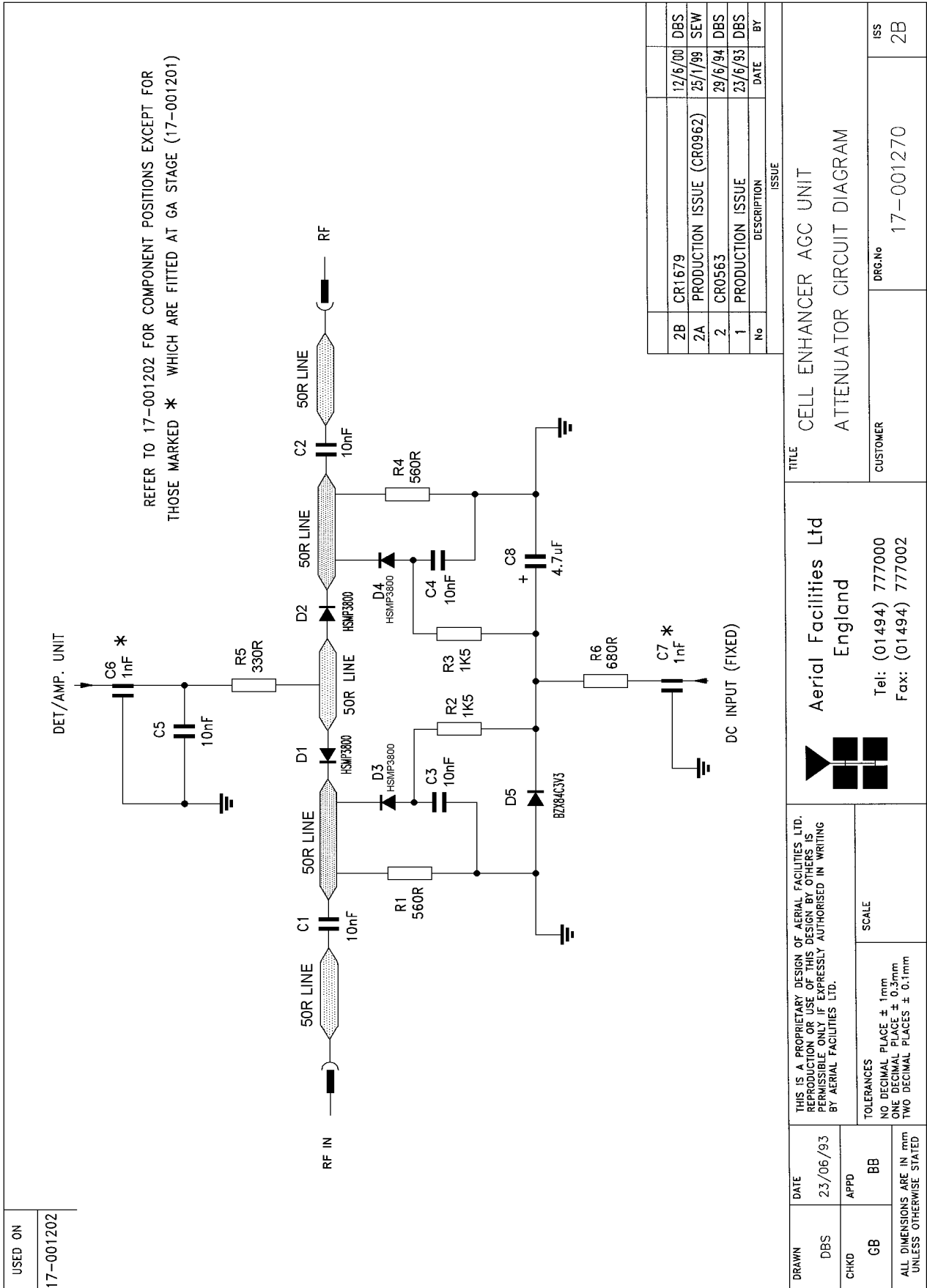
2A	3/5/00	CR1679										
1A	2/2/99	CR0962										
1	7/7/94	Prod.Issue										
ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No	ISSUE	DATE	CHANGE No	ISSUE

 Aerial Facilities Limited				TITLE CELL ENHANCER AGC UNIT DETECTOR/AMP.CIRCUIT COMP.LIST								
DRAWN DBS	DATE 19/05/93	CHKD GB	APPD BB	CUSTOMER			COMPONENT LIST FOR 17-001171C			ISS 2A		

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5.5.2.7 Drg. No. 17-001270, AGC Attenuator Circuit Diagram



USED ON
17-001202

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			DATE
			BY

DRAWN DBS CHKD GB	DATE 23/06/93 APPD BB	THIS IS A PROPRIETARY DESIGN OF AERIAL FACILITIES LTD. REPRODUCTION OR USE OF THIS DESIGN BY OTHERS IS PERMISSIBLE ONLY IF EXPRESSLY AUTHORISED IN WRITING BY AERIAL FACILITIES LTD.	TITLE CELL ENHANCER AGC UNIT ATTENUATOR CIRCUIT DIAGRAM
TOLERANCES NO DECIMAL PLACE ± 1mm ONE DECIMAL PLACE ± 0.3mm TWO DECIMAL PLACES ± 0.1mm	SCALE	CUSTOMER Aerial Facilities Ltd England Tel: (01494) 777000 Fax: (01494) 777002	ISS 2B

