24. INTERNATIONAL STATION 700MHZ BDA (80-330558-1)

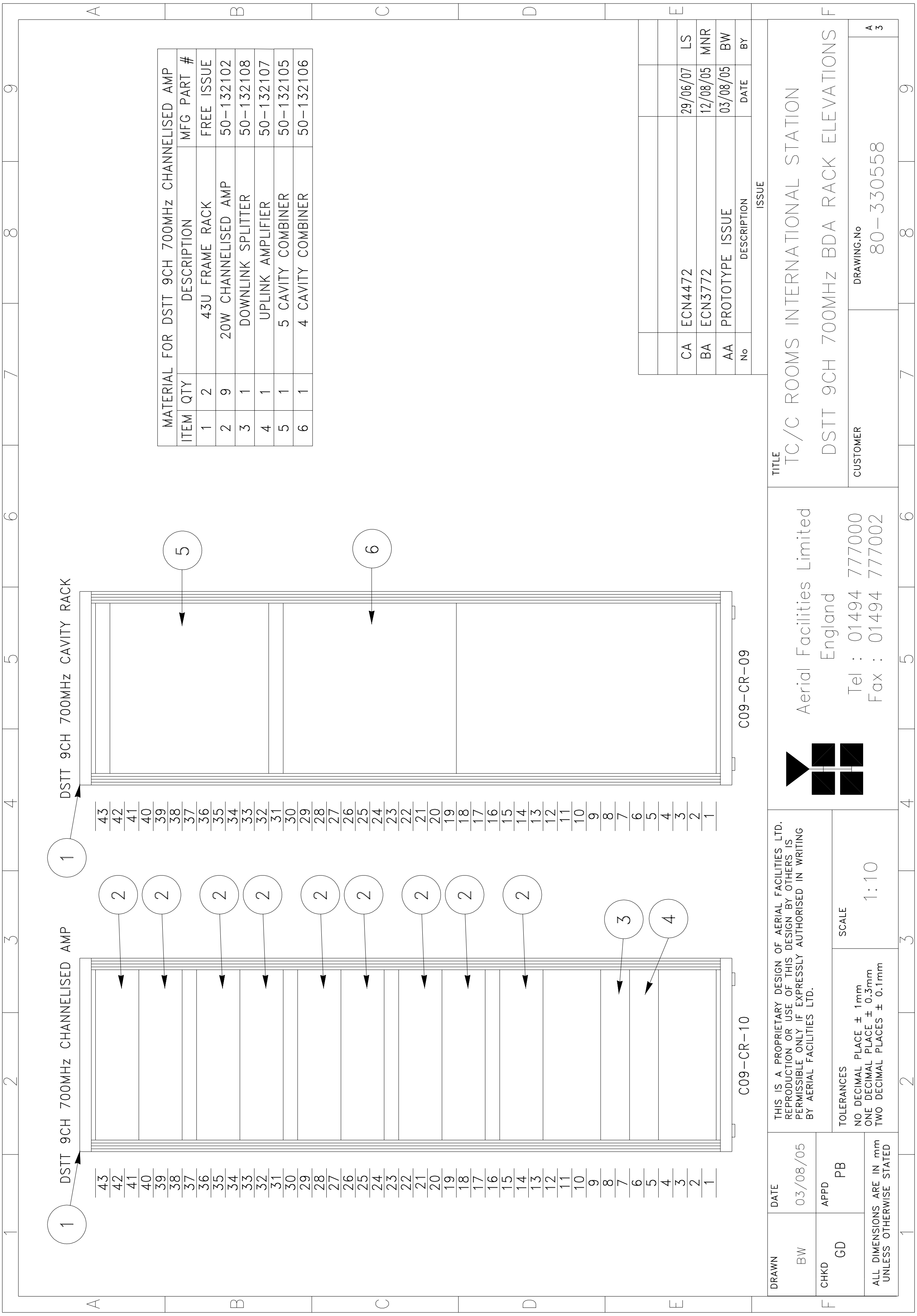
Rack number C09-CR-09

International Station 700MHz BDA (80-330558-1) List of Major Components

Section	Component Part	Component Part Description	Qty Per Assembly
24.3.1.	05-003007	4 Port Hybrid Coupler	1
24.3.2.	09-000401	Dummy Load	1
24.3.3.	50-132105	700MHz 5 Cavity Combiner System	1
24.3.4.	50-132106	700MHz 4 Cavity Combiner System	1

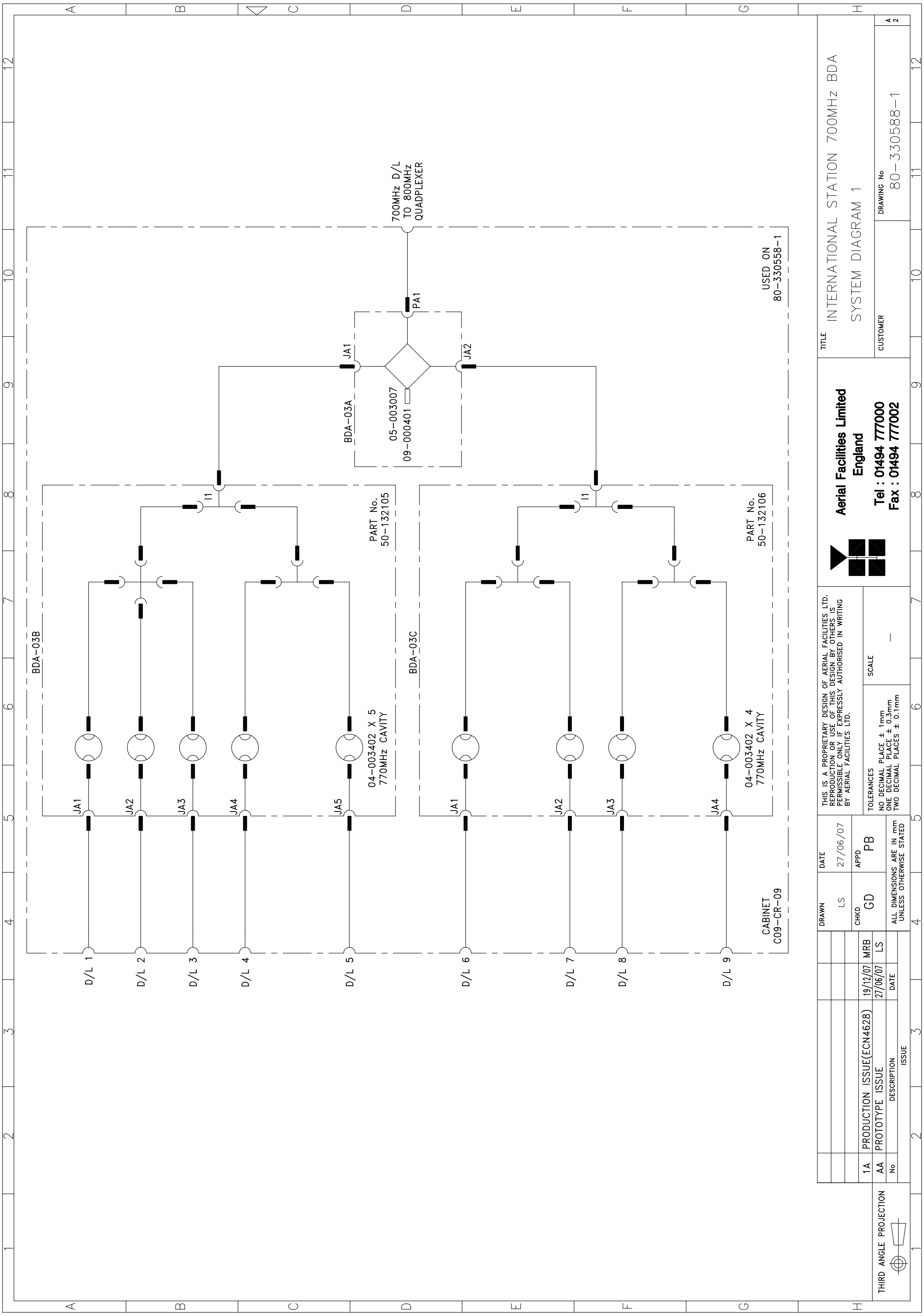
24.1. International Station 700MHz BDA (80-330558-1) Rack Drawing

Drawing number 80-330558



24.2. International Station 700MHz BDA (80-330558-1) System Diagram

Drawing number 80-330588-1



24.3. International Station 700MHz BDA (80-330558-1) Major Components

24.3.1. 4 Port Hybrid Coupler (05-003007)

This transmitter hybrid coupler 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 insertion losses are kept to a minimum. Any unused ports should be terminated with an appropriate 50Ω load. In this specific instance one port of 4 Port Hybrid Coupler (05-003007) is terminated with Dummy load 09-000401 (see below).

05-003007 Specification

PARAMETER		SPECIFICATION
Frequency range		700-900MHz
Bandwidth		200MHz
Rejection		>14dB
Insertion loss		6.5dB (in band, typical)
Connectors		SMA
Weight		<1.0kg
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C

24.3.2. Dummy Load (09-000401)

When a combiner system is used to split or combine RF signals, in many cases it is most cost effective to use a standard stock item 4, 6 or 8 port device where, in fact, only a 3 - 6 port device is needed. In this case the splitter/combiner module has one of its ports terminated (both uplink & downlink) with an appropriate load in order to preserve the correct impedance of the device over the specified frequency range. This has the advantage of allowing future expansion capability should extra channels or other functions become necessary.

09-000401 Specification

PARAMETER	SPECIFICATION
Frequency Range	10 - 1000 MHz
Power Rating	60 watts continuous
VSWR	Better than 1.1:1
Impedance	50 Ohms
Temperature Range	-20 to +60°C
RF Connectors	N Type female
Dimension	119mm x 51mm x 51mm
Weight	485grams
Finish	Black Anodised
MTBF	>180,000 hours

24.3.3. 700MHz 5 Cavity Combiner System (50-132105)

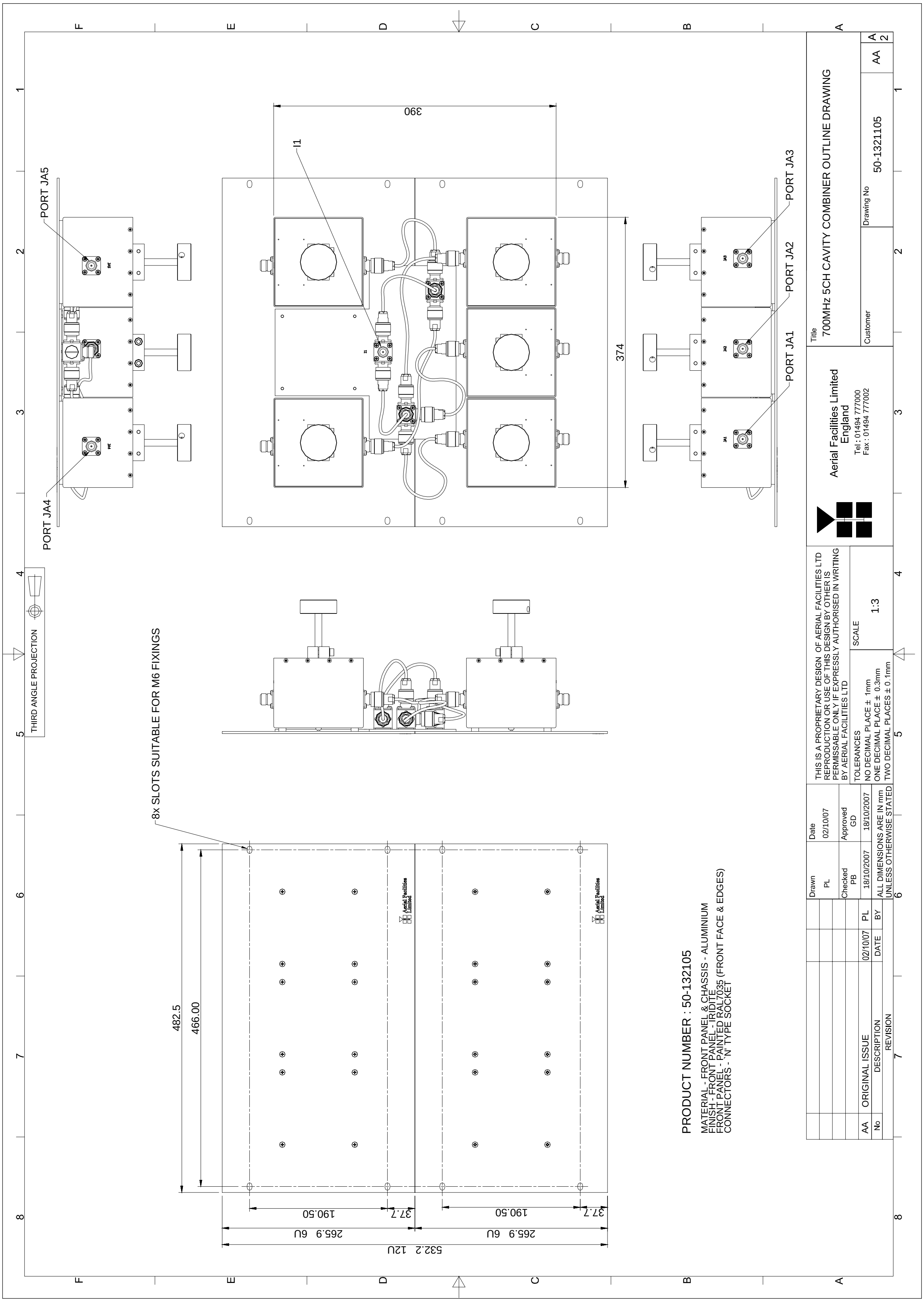
700MHz 5 Cavity Combiner System (50-132105) consists of 5 Dielectric Cavity Resonators mounted on two 3U rack mount panels, three on one panel and two on the other

700MHz 5 Cavity Combiner System (50-132105) List of Major Components

section	Component Part	Component Part Description	Qty Per Assembly
20.3.2.3.	04-003402	Dielectric Cavity Resonator	5

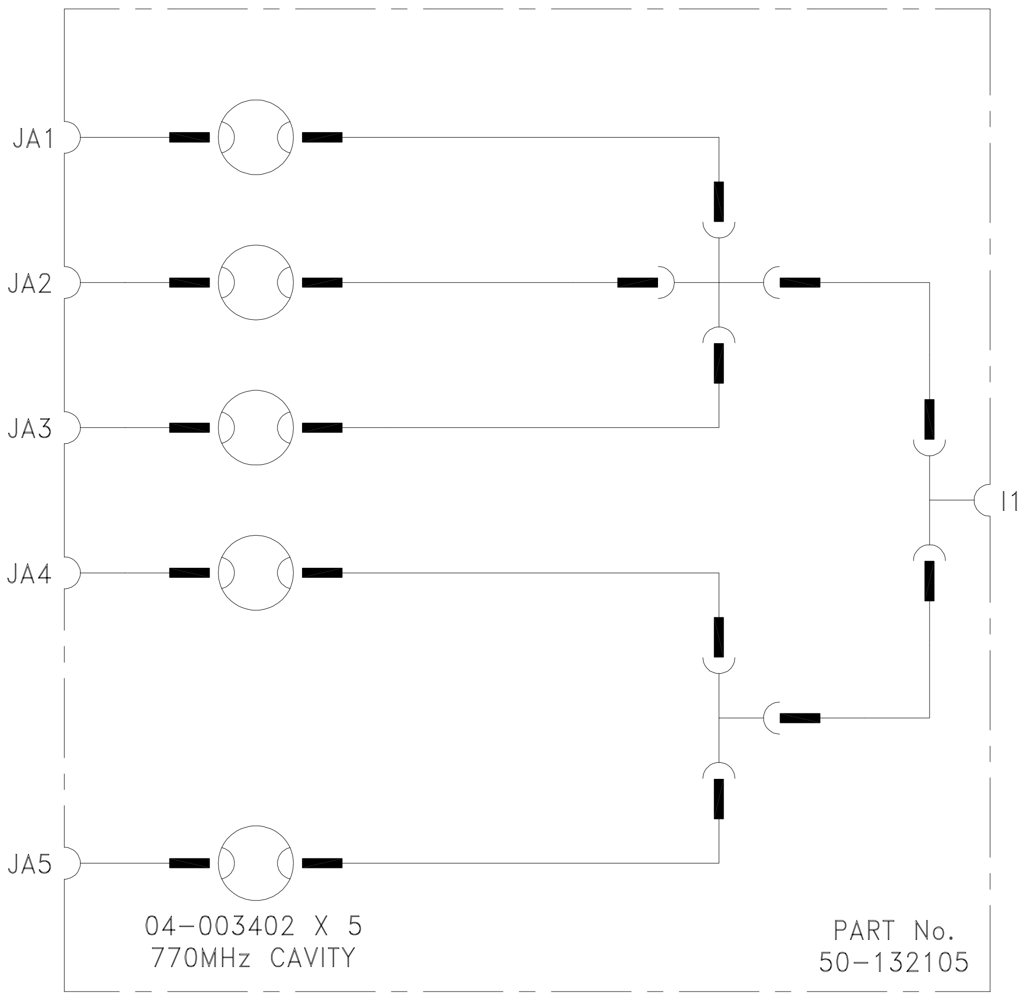
24.3.3.1. 700MHz 5 Cavity Combiner System (50-132105) Outline Drawing

Drawing number 50-1321105



24.3.3.2. 700MHz 5 Cavity Combiner System (50-132105) System Diagram

Drawing number 50-132185



AA	PROTOTYPE ISSUE	12/06/07	LS
No	DESCRIPTION	DATE	BY

ISSUE

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Aerial Facilities Limited
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

TITLE
700MHz 5CH CAVITY COMBINER SYSTEM DIAGRAM

DRAWN	DATE	CHKD	APPD	SCALE	CUSTOMER	DRAWING No	
LS	12/06/07	GD	PB	–		50–132185	A 4

24.3.3.3. Dielectric Cavity Resonator (04-003402)

Cavity resonators are used in this system for their high Q factor response and power handling characteristics. Being finely tuned items, they can be prone to being de-tuned by mechanical shock or vibration therefore these units should be handled, stored and installed with care.

Note that the cavities are coupled together using critical length harnesses. If any cable is to be changed the exact same length and type of cable should be used for replacement.

04-003402 Specification

Specification		Parameter
Frequency Range		764 to 776 MHz *
Bandwidth		25 kHz
Insertion Loss		< 1.0 dB
Return Loss		> 15 dB (at both ports)
Attenuation		> 10 dB at Fc ± 1 MHz
Power Handling (CW)		20W
Environmental		IP54
Size		124mm x 158mm x 157mm**
Weight		1.5 kg
Connectors		N female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

*Tuned to Customer's specification

**Height is dependant upon position of tuning plunger

24.3.4. 700MHz 4 Cavity Combiner System (50-132106)

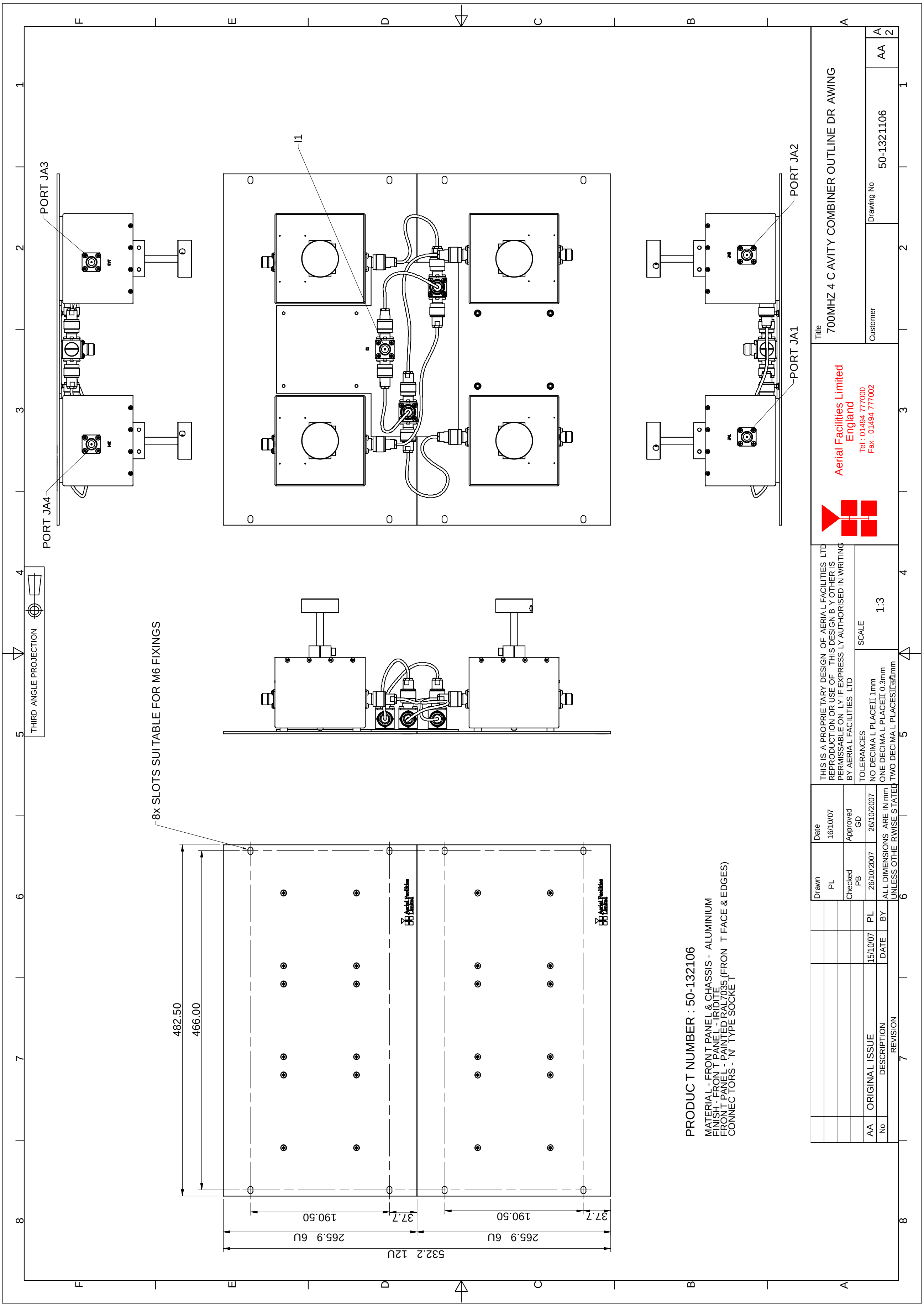
700MHz 4 Cavity Combiner System (50-132106) consists of 4 Dielectric Cavity Resonators mounted on two 3U rack mount panels, three on one panel and two on the other

700MHz 4 Cavity Combiner System (50-132106) List of Major Components

section	Component Part	Component Part Description	Qty Per Assembly
20.3.3.3.	04-003402	Dielectric Cavity Resonator	4

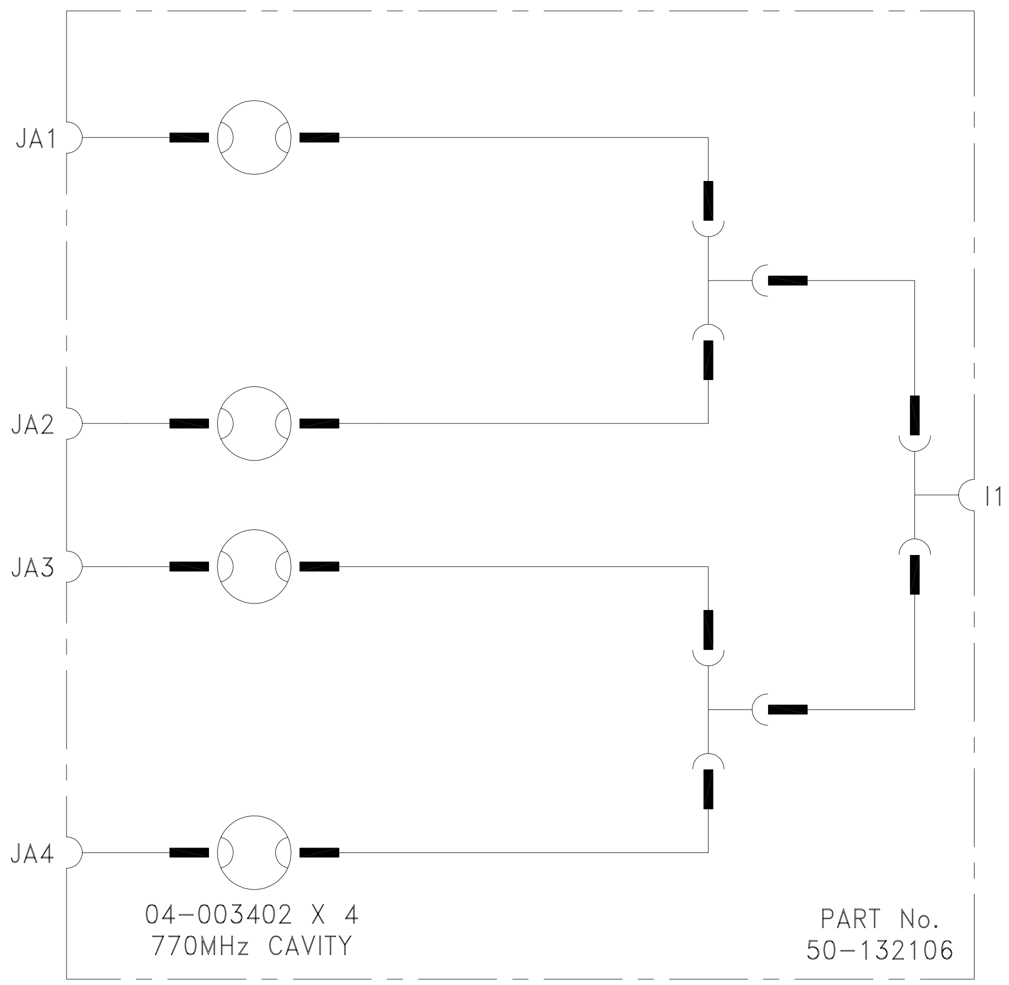
24.3.4.1. 700MHz 4 Cavity Combiner System (50-132106) Outline Drawing

Drawing number 50-1321106



24.3.4.2. 700MHz 4 Cavity Combiner System (50-132106) System Diagram

Drawing number 50-132186



No	DESCRIPTION	DATE	BY
AA	PROTOTYPE ISSUE	12/06/07	LS

ISSUE

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TOLERANCES

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

ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED

TITLE
700MHz 4CH CAVITY COMBINER SYSTEM DIAGRAM

DRAWN	DATE	CHKD	APPD	SCALE	CUSTOMER	DRAWING No	A4
LS	12/06/07	GD	PB	–		50–132186	

24.3.4.3. Dielectric Cavity Resonator (04-003402

Cavity resonators are used in this system for their high Q factor response and power handling characteristics. Being finely tuned items, they can be prone to being de-tuned by mechanical shock or vibration therefore these units should be handled, stored and installed with care.

Note that the cavities are coupled together using critical length harnesses. If any cable is to be changed the exact same length and type of cable should be used for replacement.

04-003402 Specification

Specification		Parameter
Frequency Range		764 to 776 MHz*
Bandwidth		25 kHz
Insertion Loss		< 1.0 dB
Return Loss		> 15 dB (at both ports)
Attenuation		> 10 dB at Fc ± 1 MHz
Power Handling (CW)		20W
Environmental		IP54
Size		124mm x 158mm x 157mm**
Weight		1.5 kg
Connectors		N female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

*Tuned to Customer's specification

**Height is dependant upon position of tuning plunger

25. INTERNATIONAL STATION 700MHz BDA (80-330558-2)

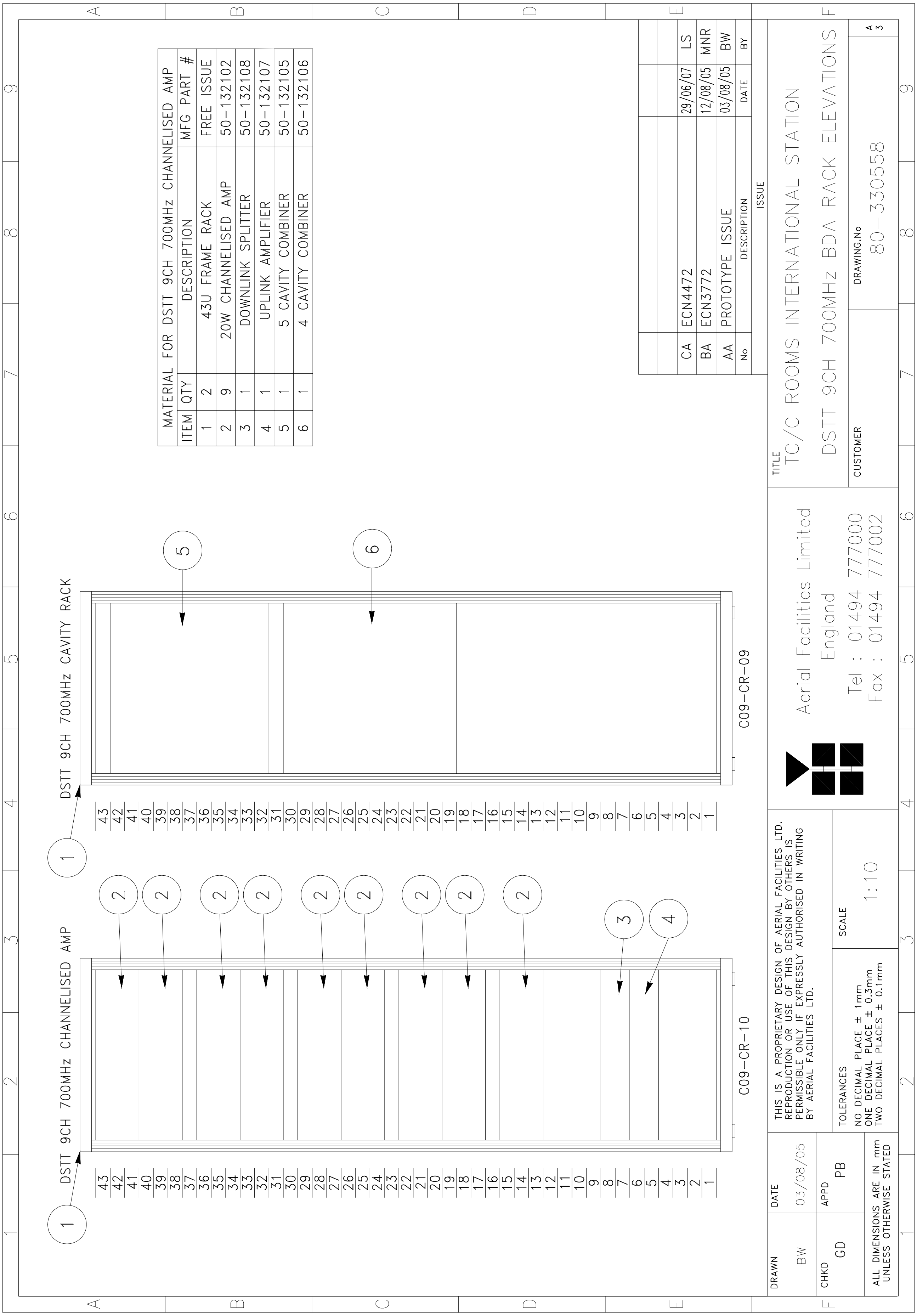
Rack number C09-CR-10

International Station 700MHz BDA (80-330558-2) List of Major Components

Section	Component Part	Component Part Description	Qty Per Assembly
25.3.1.	50-132102	700MHz Channelised Amplifier	9
25.3.2.	50-132107	700MHz Uplink Amplifier	1
25.3.3.	50-132108	700MHz Downlink Splitter	1

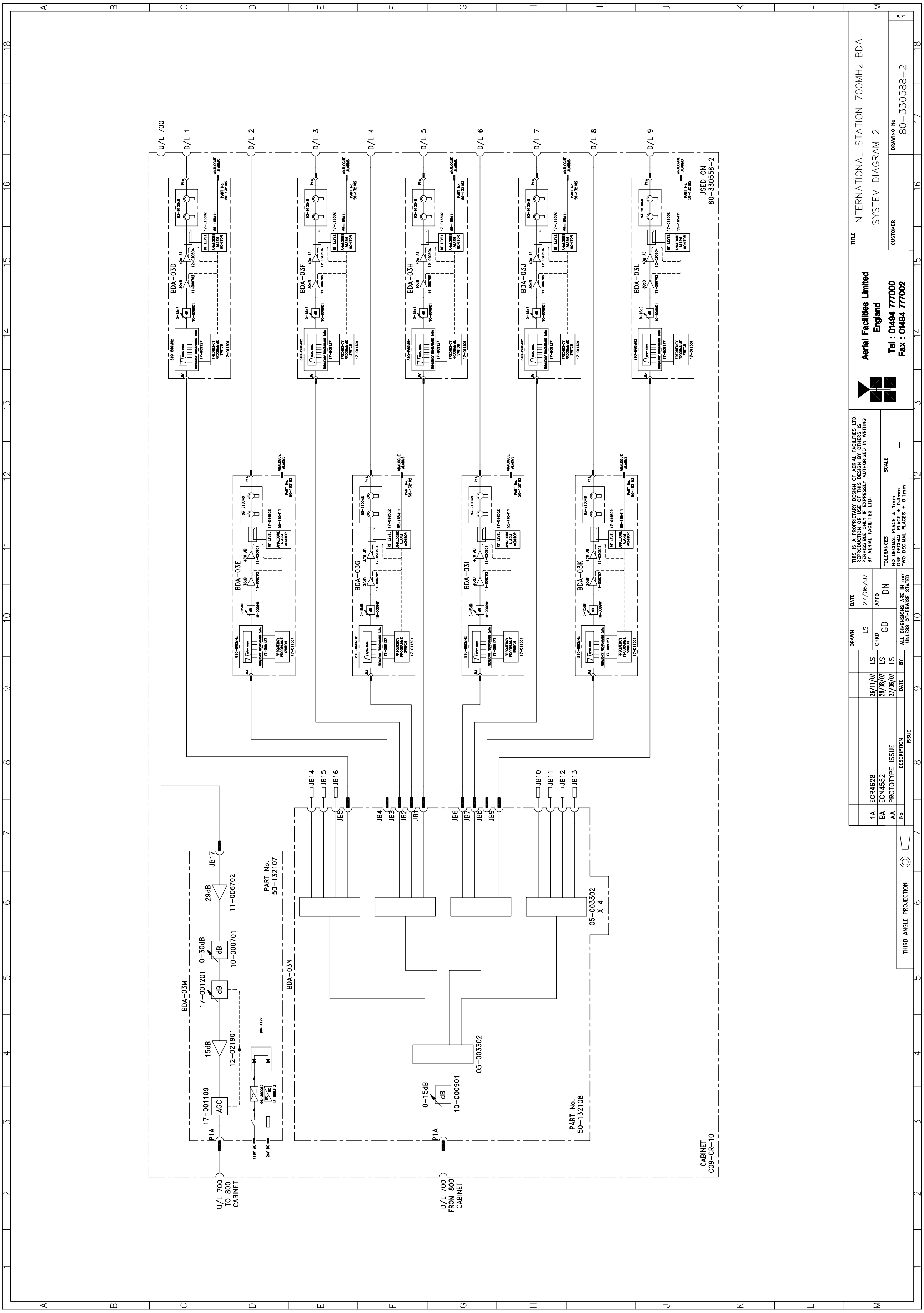
25.1. International Station 700MHz BDA (80-330558-2) Rack Drawing

Drawing number 80-330558



25.2. International Station 700MHz BDA (80-330558-2) System Diagram

Drawing number 80-330588-2



25.3. International Station 700MHz BDA (80-330558-2) Major Components

25.3.1. 700MHz Channelised Amplifier (50-132102)

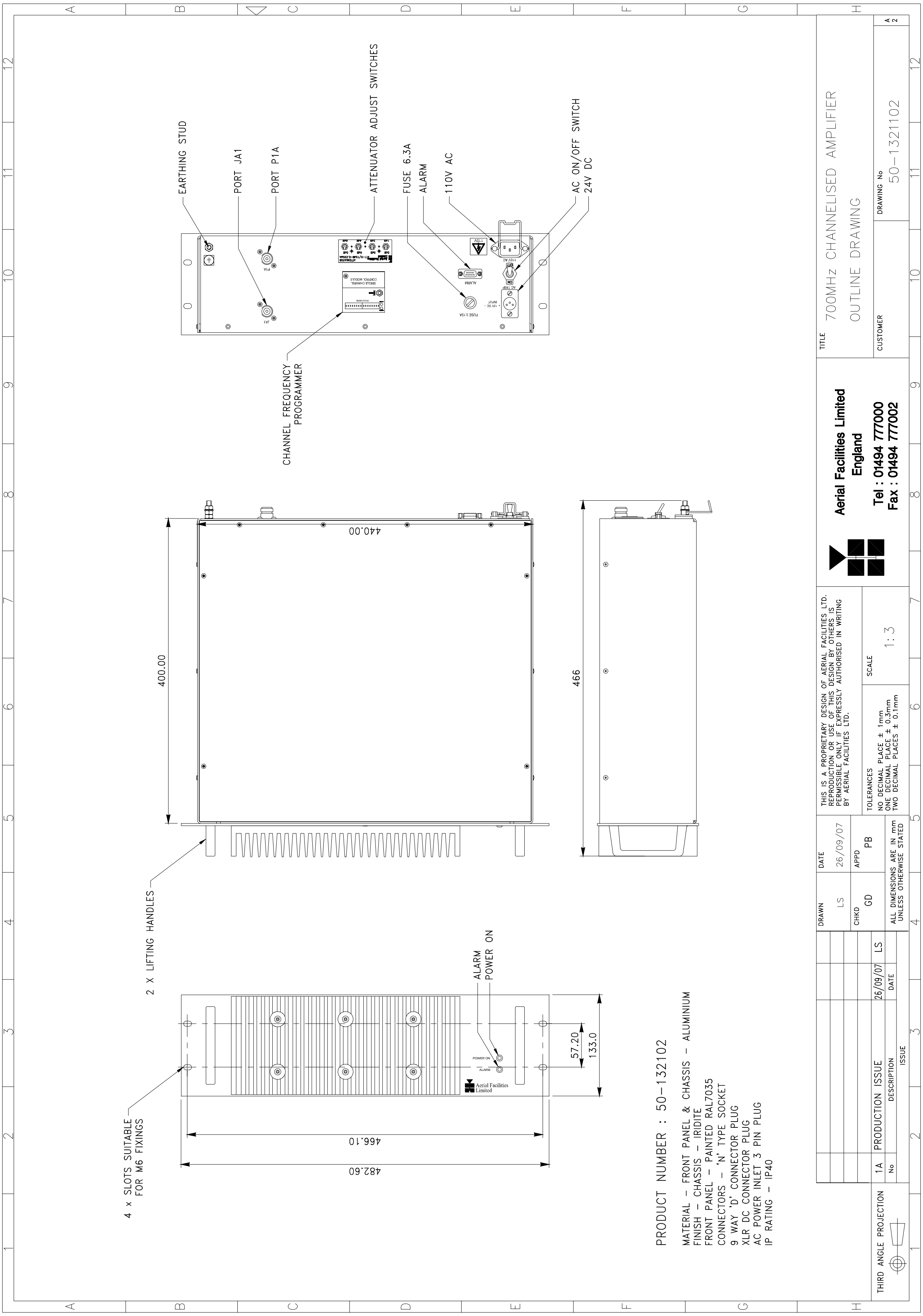
3U rack mount shelf

700MHz Channelised Amplifier (50-132102) List of major Components

Section	Component Part	Component Part Description	Qty Per Assembly
25.3.1.3.	09-000902	Dummy Load	1
25.3.1.4.	10-000901	Switched Attenuator 0.25W, 0 - 15dB	1
25.3.1.5.	11-006702	Low Noise Amplifier	1
25.3.1.6.	12-020804	Power Amplifier	1
25.3.1.7.	13-003412	DC/DC Converter	1
25.3.1.8.	17-009127	Channel Selectivity Module	1
25.3.1.9.	17-011501	Channel Control Module	1
25.3.1.10.	80-008902	24V Relay Board	1
25.3.1.11.	93-910048	Dual Isolator	1
25.3.1.12.	94-100004	Dual Diode Assembly	1
25.3.1.13.	96-300060	PSU 24V	1

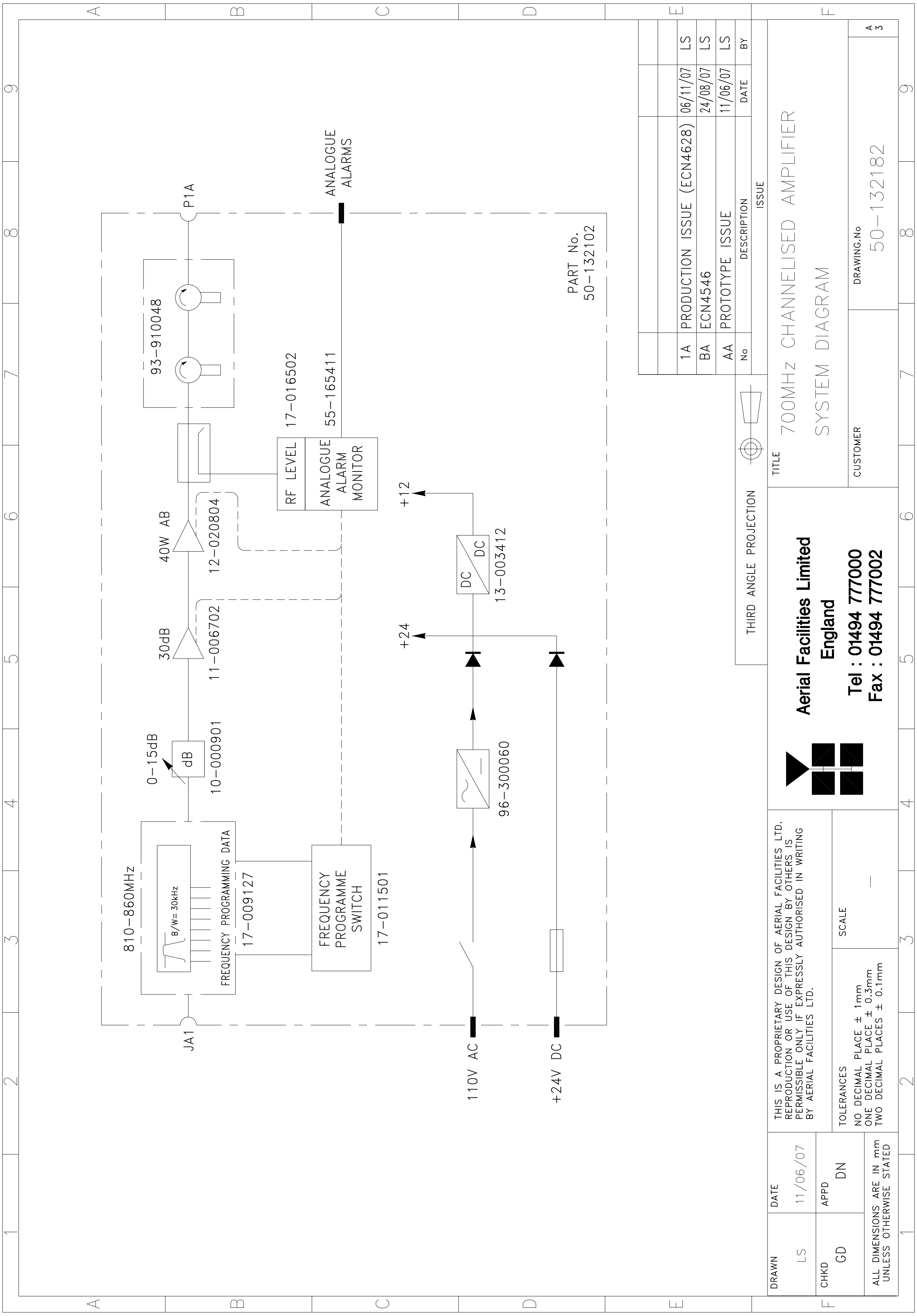
25.3.1.1. 700MHz Channelised Amplifier (50-132102) Outline Drawing

Drawing number 50-1321102



25.3.1.2. 700MHz Channelised Amplifier (50-132102) System diagram

Drawing number 50-132182



25.3.1.3. Dummy load 09-000902

Dual Isolator (770MHz) (93-910048) has one of its ports terminated with Dummy load 09-000902 in order to achieve the correct power rating to absorb the reflected power levels that can be reasonably expected within the system.

09-000902 specification

PARAMETER	SPECIFICATION
Frequency Range	0 - 2500 MHz
Power Rating	25 Watts continuous
VSWR	Better than 1.1:1
Impedance	50 Ohms
Temperature Range	-20 to +60°C
RF Connectors	N Type female
Dimension	110.3mm x 38.1mm x
Weight	485 grams
Finish	Black Anodised
RF Connector	N Type male
Environmental	IP66
MTBF	>180,000 hours

25.3.1.4. Switched Attenuator 0.25W, 0 - 15dB (10-000901)

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.

10-000901 provides attenuation from 0 - 15dB in 2 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.

10-000901 Specification

PARAMETER		**SPECIFICATION**
Attenuation Values		0-15dB
Attenuation Steps		1, 2, 4 and 8dB
Power Handling		0.25 Watt
Attenuation Accuracy		± 1.0 dB
Frequency Range		DC to 1GHz
Impedance		50Ω
Connectors		SMA
VSWR		1.3:1
Weight		0.2kg
Temperature range:	operation	-20°C to +60°C
	storage	-40°C to +70°C

25.3.1.5. Low Noise Amplifier (11-006702)

The Gallium-Arsenide low noise amplifiers used in 800MHz Line Amplifier (55-165703) are double stage, solid-state low noise amplifiers. Class A circuitry is used throughout the units to ensure excellent linearity and extremely low noise over a very wide dynamic range. The active devices are very moderately rated to provide a long trouble-free working life. There are no adjustments on these amplifiers, and in the unlikely event of a failure, then the complete amplifier should be replaced. This amplifier features its own in-built alarm system which gives a volt-free relay contact type alarm that is easily integrated into the main alarm system.

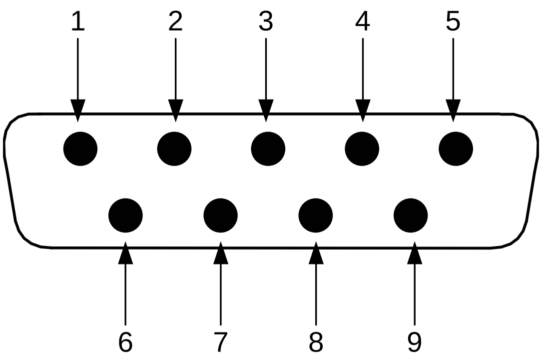
11-006702 Specification

PARAMETER		SPECIFICATION
Frequency range		800 – 1000MHz
Bandwidth		<200MHz
Gain		29dB (typical)
1dB Compression point		20dBm
OIP3		33dBm
Input/Output return loss		>18dB
Noise figure		1.3dB (typical)
Power consumption		180mA @ 24V DC
Supply voltage		10-24V DC
Connectors		SMA female
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C
Size		90 x 55 x 30.2mm
Weight		290gms (approximately)

Low Noise Amplifier (11-006702) ‘D’ Connector Pin-out details

Connector pin	Signal
1	+Ve input (10-24V)
2	GND
3	Alarm RelayO/P bad
4	Alarm Relay common
5	Alarm Relay good
6	No connection
7	TTL voltage set
8	TTL alarm/0V (good)
9	O/C good/0V bad

9-Way Pin-Out Graphical Representation



25.3.1.6 Power Amplifier (12-020804)

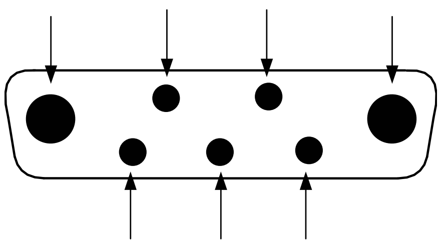
This amplifier is a Class AB 40W power amplifier from 860MHz to 960MHz in balanced configuration. The amplifier demonstrates a very good input/output return loss (RL) and it has a built-in Current Fault Alarm Function.
The unit housing is an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a D-Type connector for the power supply and the Current Fault Alarm Function.

12-020804 specification

Specification		Parameter
Frequency Range		860 - 960MHz
Gain		≥28.0 dB
Gain Flatness		1.0dB p-p Max
∆Gain vs. Temperature		2.5dB Max
Input RL		15dB Min
Output RL		15dB Min
Output Power @ P1dB		46.0dBm Min
DC Supply Voltage		24 ± 0.5Vdc
RF Input Power		25dBm
DC Supply Current	At P1dB	6000mA Max
	With no RF input (Iqc)	1700mA Max
Temperature range	operational	-40°C to +70°C
	storage	-40°C to +100°C

7-Way Connector Pin-outs

Connector Pin	Signal
A1	+24V DC
A2	GND
1	Alarm relay common
2	TTL alarm/0V good
3	Alarm relay contact (bad)
4	Alarm relay contact (good)
5	O/C good/0V bad (TTL)



25.3.1.7. DC/DC Converter 13-003412

13-003412 is based upon an O.E.M. DC/DC Converter module with a wide input range and and is used to derive a 12V fixed voltage power supply rail from a higher voltage supply, in this case 24V. In the event of failure this unit should not be repaired, only replaced.

13-003412 Specification

PARAMETER		SPECIFICATION
Operating voltage		18 – 75V DC
Output voltages		12V (typical)
Output current		5.0A (Max)
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C

25.3.1.8. Channel Selectivity Module (17-009127)

Channel Selectivity Module (17-009127) is employed when requirement dictates that very narrow bandwidths (single operating channels), must be selected from within the operating passband. One channel selectivity module is required for each channel.

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

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

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

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

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

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

25.3.1.9. Channel Control Module (17-011501)

The operating frequency for each channel in each repeater is programmed by 16 DIL (Dual In Line) switches. The programming switches are mounted in the Channel Control Module. The Channel Selectivity Modules are connected to the Channel Control Module via multi-way ribbon cables.

Adjacent to the DIL switches for each channel is a toggle switch to turn on and off individual channels as required. A green LED indicates the power status of each channel.

A red LED shows the alarm condition for each channel. An illuminated alarm LED indicates that the synthesiser has not achieved phase lock and that the module is disabled. There is a problem which requires investigation, often a frequency programmed outside the operating frequency range.

The following information is necessary before attempting the programming procedure.

7. operating frequency
8. synthesiser channel spacing (step size)
9. synthesiser offset (IF)

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. Note: the frequency of the passband will dictate the switch steps used.

Switch Functions		
Switch Number	Synthesiser offset added when switch in UP position	
	12.5kHz step size	25kHz step size
1	+12.5kHz	+25kHz
2	+25kHz	+50kHz
3	+50kHz	+100kHz
4	+100kHz	+200kHz
5	+200kHz	+400kHz
6	+400kHz	+800kHz
7	+800kHz	+1.6MHz
8	+1.6MHz	+3.2MHz
9	+3.2MHz	+6.4MHz
10	+6.4MHz	+12.8MHz
11	+12.8MHz	+25.6MHz
12	+25.6MHz	+51.2MHz
13	+51.2MHz	+102.4MHz
14	+102.4MHz	+204.8MHz
15	+204.8MHz	+409.6MHz
16	+409.6MHz	+819.2MHz

Programming Example

Frequency required: 454.000MHz

Channel spacing: 12.5kHz

Synthesiser offset: -21.4MHz

The Local Oscillator frequency is therefore:

454.000 – 21.4 = 432.600MHz

Dividing the Local Oscillator frequency by the channel spacing of 0.0125MHz:

$$\frac{432.600}{0.0125} = 34608$$

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

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

Switch setting: 0 = switch DOWN (ON, frequency ignored)
1 = switch UP (OFF, frequency added)

17-011501 Controller Module DIP Switch Connector Data

17-011501 Controller Module DIP Switch Connector Data			
IDC PIN	25-way Connector	Function (12.5kHz steps)	Function (25kHz steps)
1	13	Freq. bit 1 (12.5kHz)	Freq. bit 1 (25kHz)
2	25	Freq. bit 2 (25kHz)	Freq. bit 2 (50kHz)
3	12	Freq. bit 3 (50kHz)	Freq. bit 3 (100kHz)
4	24	Freq. bit 4 (100kHz)	Freq. bit 4 (200kHz)
5	11	Freq. bit 5 (200kHz)	Freq. bit 5 (400kHz)
6	23	Freq. bit 6 (400kHz)	Freq. bit 6 (800kHz)
7	10	Freq. bit 7 (800kHz)	Freq. bit 7 (1.6MHz)
8	22	Freq. bit 8 (1.6MHz)	Freq. bit 8 (3.2MHz)
9	9	Freq. bit 9 (3.2MHz)	Freq. bit 9 (6.4MHz)
10	21	Freq. bit 10 (6.4MHz)	Freq. bit 10 (12.8MHz)
11	8	Freq. bit 11 (12.8MHz)	Freq. bit 11 (25.6MHz)
12	20	Freq. bit 12 (25.6MHz)	Freq. bit 12 (51.2MHz)
13	7	Freq. bit 13 (51.2MHz)	Freq. bit 13 (102.4MHz)
14	19	Freq. bit 14 (102.4MHz)	Freq. bit 14 (204.8MHz)
15	6	Freq. bit 15 (204.8MHz)	Freq. bit 15 (409.6MHz)
16	18	Freq. bit 16 (409.6MHz)	Freq. bit 16 (819.2MHz)
17	5	Module alarm	Module alarm
18	17	Gain bit 1	Gain bit 1
19	4	Gain bit 2	Gain bit 2
20	16	Gain bit 3	Gain bit 3
21	3	Gain bit 4	Gain bit 4
22	15	(5V	(5V
23	2	0V	0V
24	14	Switched 12V	Switched 12V
25	1	0V	0V
26	---	---	---

25.3.1.10. 24V Relay Board (80-008902)

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 screw terminals.

The relay is provided with a polarity protection diode 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.

80-008902 Technical Specification

Parameter		Specification
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

25.3.1.11. Dual Isolator (770MHz) (93-910048)

The purpose of fitting an isolator to the output of a transmitter in a multi-transmitter environment is so that each output is afforded a degree of isolation from every other. Without the addition of Isolators, simultaneous transmissions could interfere to create intermodulation products and spurious transmissions would be created which would cause interference.

Dual Isolator (93-910048) is a ferro-magnetic RF device, which has directional properties. In the forward direction, RF arriving at the input is passed to the output with minimal attenuation. In the reverse direction, RF arriving at the output due to reflected power from a badly matched load, or due to coupling with another transmitter, is routed into an RF load where it is absorbed. The isolator therefore functions to prevent reflected RF energy reaching the output port of an amplifier where it could cause intermodulation products or premature device failure.

Dual Isolator (93-910048) is as its name suggests a two stage device, essentially two isolators in one casing. One isolator stage has an internal 10W load fitted, the second stage needs an external load fitted of sufficient rating to absorb the reflected power levels that can be reasonably expected within the system. In this instance Dual Isolator (93-910048) is fitted with external load 09-000902.

93-910048 Specification

Parameter	Specification
Frequency Range	760-780 MHz
Insertion Loss	0.4 dB max.
Isolation	50 dB min.
Return Loss	23 dB min.
Power Handling	10W (internally fitted load)
RF Connectors	N female

25.3.1.12. Dual Diode Assembly (94-100004)

The purpose of these dual diode assemblies is to allow two DC voltage sources to be combined, so that the main DC rail within the equipment can be sourced from either a mains driven PSU, or externally through an XLR connector or from dual mains driven PSUs . They are very heavy-duty diodes and they prevent any reverse current from flowing back to their source or the alternative supply rail. Combining diodes such as these will also be used if the equipment is to be powered from external back-up batteries.

25.3.1.13. PSU 24V (96-300060)

The power supply unit is a switched-mode type capable of supplying 24V DC at 6.25Amps continuously. Equipment of this type typically requires approximately 2-2.5Amps 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. The output voltage may be varied using a multi-turn adjustment potentiometer mounted close to the DC output terminals.

The line input voltage is sensed automatically, so no adjustment or link setting is needed by the operator.

96-300060 Specification

AC Input Supply	
Voltage	110 or 220V nominal
	90 to 132 or 180 to 264V (absolute limits)
Frequency	47 to 63Hz
DC Output Supply:	
Voltage	24V DC (nominal)
	22 to 26V (absolute limits)
Current	6.25A

25.3.2. 700MHz Uplink Amplifier (50-132107)

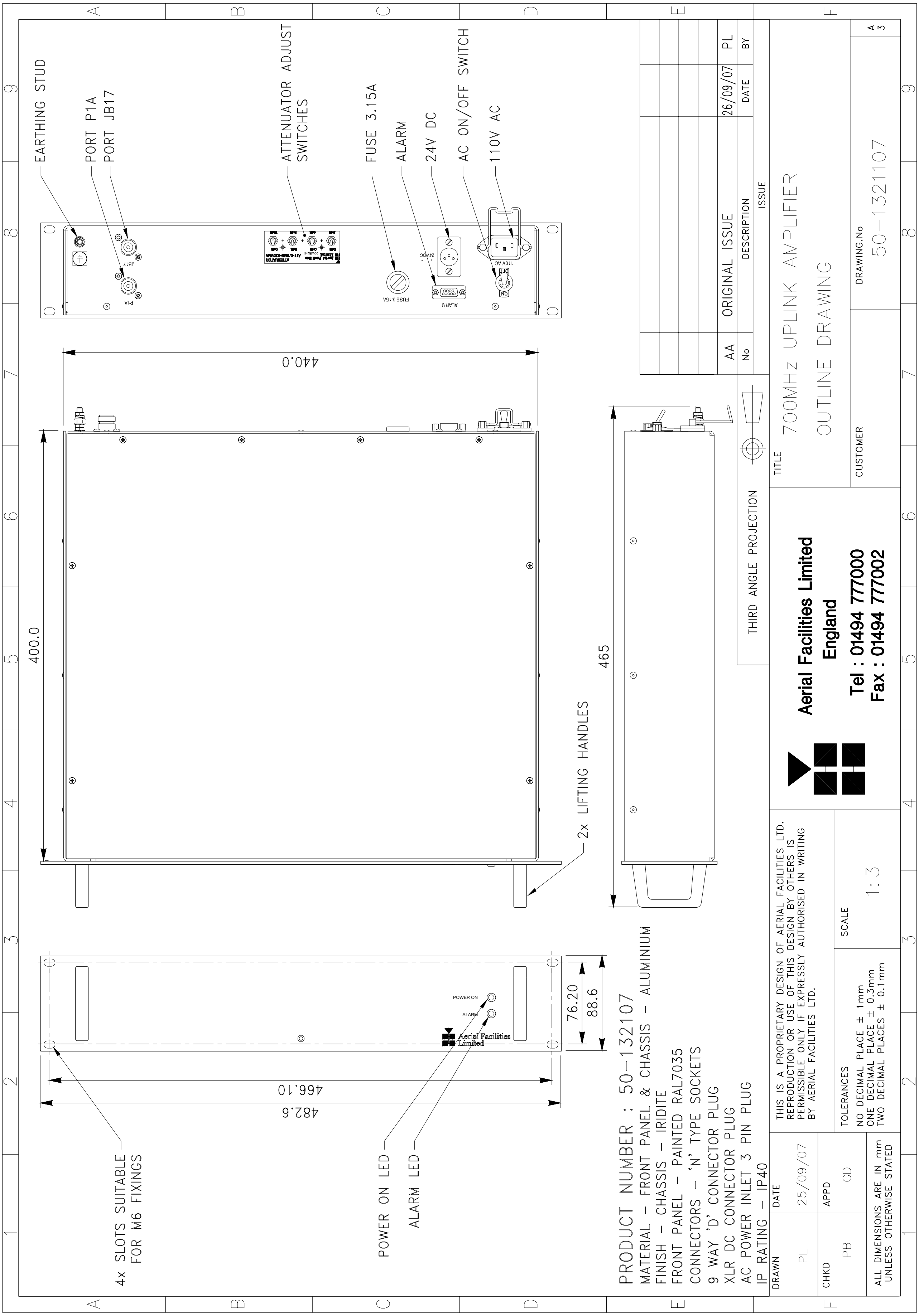
2U rack mount tray

700MHz Uplink Amplifier (50-132107) List of major Components

Section	Component Part	Component Part Description	Qty Per Assembly
25.3.2.3.	10-000701	Switched Attenuator 0.25Watt, 0 - 30dB	1
25.3.2.4.	11-006702	Low Noise Amplifier	1
25.3.2.5.	12-021901	Low Power Amplifier	1
25.3.2.6.	13-003412	DC/DC Converter	1
25.3.2.7.	17-001109	AGC Detector Assembly (Logarithmic)	1
	17-001201	AGC Detector Assembly	1
25.3.2.8.	80-008901	12V (Single) Relay Board	1
25.3.2.9.	94-100004	Dual Diode Assembly	1
25.3.2.10.	96-300052	12V Switch-Mode PSU	1

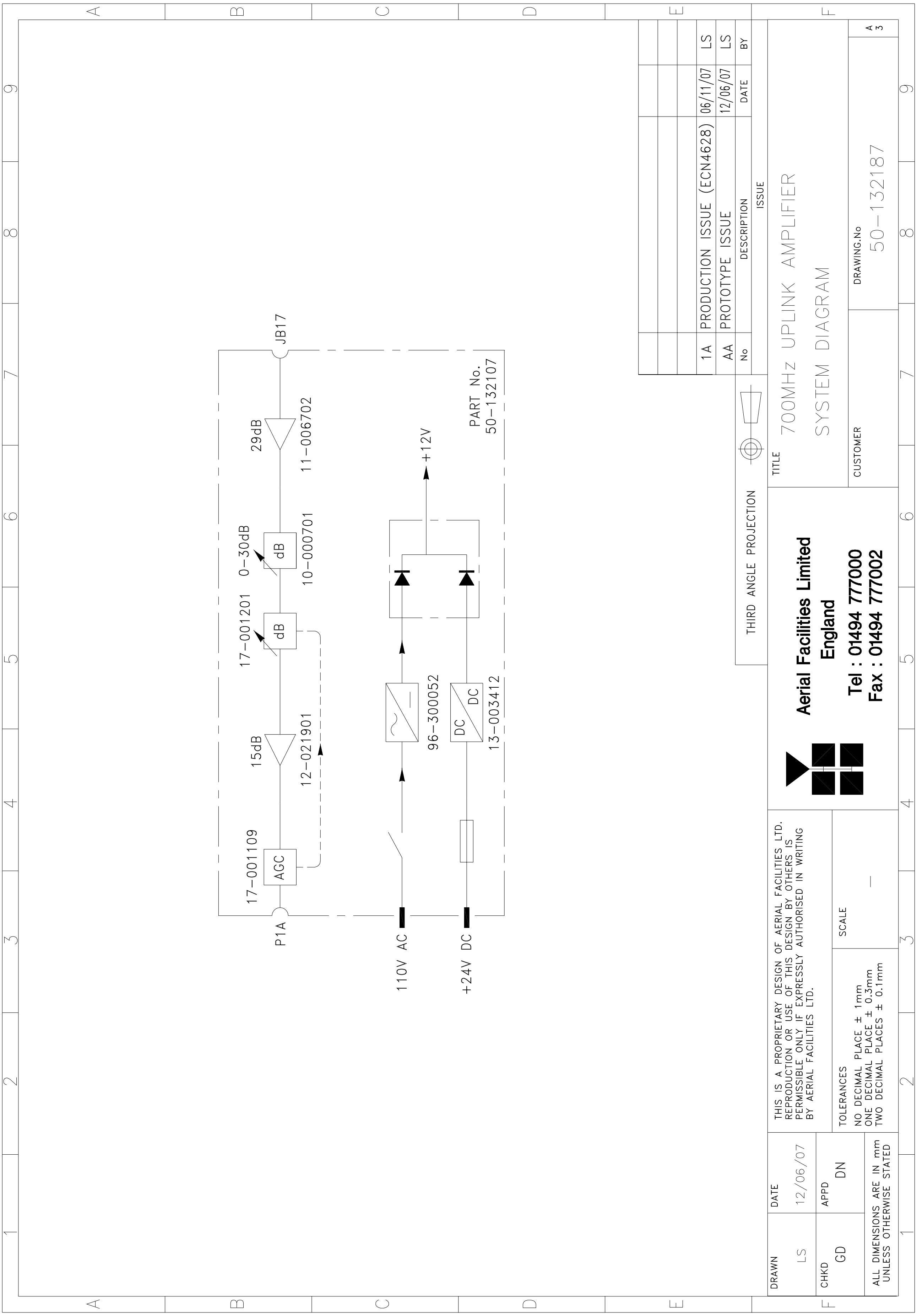
25.3.2.1. 700MHz Uplink Amplifier (50-132107) Outline Drawing

Drawing number 50-1321107



25.3.2.2. 700MHz Uplink Amplifier (50-132107) System Diagram

Drawing number 50-132187



25.3.2.3. Switched Attenuator 0.25Watt, 0 - 30dB (10-000701)

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.

Switched Attenuator 10-000701 provides attenuation from 0 to 30dB in 2 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.

10-000701 Specification

PARAMETER		SPECIFICATION
Attenuation Values		0-30dB
Attenuation Steps		2, 4, 8 and 16dB
Power Handling		0.25 Watt
Attenuation Accuracy		± 1.0 dB
Frequency Range		DC to 1GHz
Impedance		50Ω
Connectors		SMA
VSWR		1.3:1
Weight		0.2kg
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

25.3.2.4. Low Noise Amplifier (11-006702)

The Gallium-Arsenide low noise amplifiers used in 700MHz Line Amplifier (55-165704) are double stage, solid-state low noise amplifiers. Class A circuitry is used throughout the units to ensure excellent linearity and extremely low noise over a very wide dynamic range. The active devices are very moderately rated to provide a long trouble-free working life. There are no adjustments on these amplifiers, and in the unlikely event of a failure, then the complete amplifier should be replaced. This amplifier features its own in-built alarm system which gives a volt-free relay contact type alarm that is easily integrated into the main alarm system.

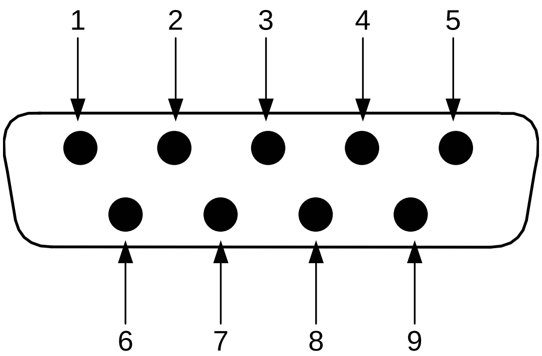
11-006702 Specification

PARAMETER		SPECIFICATION
Frequency range		800 - 1000MHz
Bandwidth		<200MHz
Gain		29dB (typical)
1dB Compression point		20dBm
OIP3		33dBm
Input/Output return loss		>18dB
Noise figure		1.3dB (typical)
Power consumption		180mA @ 24V DC
Supply voltage		10-24V DC
Connectors		SMA female
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C
Size		90 x 55 x 30.2mm
Weight		290gms (approximately)

Low Noise Amplifier (11-006702) ‘D’ Connector Pin-out details

Connector pin	Signal
1	+Ve input (10-24V)
2	GND
3	Alarm RelayO/P bad
4	Alarm Relay common
5	Alarm Relay good
6	No connection
7	TTL voltage set
8	TTL alarm/0V (good)
9	O/C good/0V bad

9-Way Pin-Out Graphical Representation



25.3.2.5. Low Power Amplifier (12-021901)

The low power amplifier used is a triple stage solid-state low-noise amplifier. Class A circuitry is used in the unit to ensure excellent linearity over a very wide dynamic range. The three active devices are very moderately rated to provide a long trouble-free working life.
Its housing is an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a D-Type connector for the power supply and the Current Fault Alarm Function.
There are no adjustments on this amplifier, and in the unlikely event of failure then the entire amplifier should be replaced.

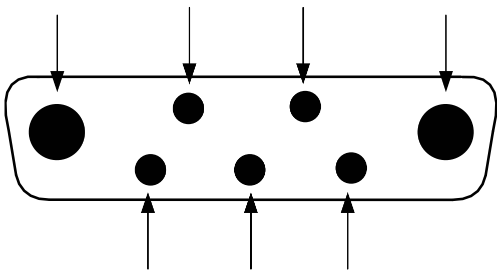
Low Power Amplifier (12-021901) Specification

PARAMETER		SPECIFICATION
Frequency range		800-960MHz*
Bandwidth		20MHz *
Maximum RF output		>1.0 Watt
Gain		15dB
1dB compression point		+30.5dBm
3rd order intercept point		+43dBm
Noise Figure		<6dB
VSWR		better than 1.5:1
Connectors		SMA female
Supply		500mA @ 10-15V DC
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C
Weight		0.5 kg
Size		167x52x25mm

* Tuned to Customer’s specification

Low Power Amplifier (12-021901) 7-Way Connector Pin-outs

Connector Pin	Signal
A1 (large pin)	+24V DC
A2 (large pin)	GND
1	Alarm relay common
2	TTL alarm/0V good
3	Alarm relay contact (bad)
4	Alarm relay contact (good)
5	O/C good/0V bad (TTL)



25.3.2.6. DC/DC Converter 13-003412

13-003412 is based upon an O.E.M. DC/DC Converter module with a wide input range and and is used to derive a 12V fixed voltage power supply rail from a higher voltage supply, in this case 24V. In the event of failure this unit should not be repaired, only replaced.

13-003412 Specification

PARAMETER		SPECIFICATION
Operating voltage		18 – 75V DC
Output voltages		12V (typical)
Output current		5.0A (Max)
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C

25.3.2.7. AGC System

AGC Detector Unit (17-001109)
AGC Attenuator Unit (17-001201)

Equipment 700MHz Uplink Amplifier (50-132107) is fitted with a wide dynamic range Automatic Gain Control (AGC) system. This is fitted in the Uplink path to avoid overloading the amplifiers (with the associated performance degradation) should a mobile be operated very close to the unit.

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

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

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

The detector comprises of a 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.

For small signals, below AGC onset, the output control line will be close to 12V and the AGC attenuator will have minimum attenuation. As the signal level increases the control line voltage will fall, increasing the attenuator value and keeping the system output level at a constant value.
The AGC onset level is adjusted by the choice of sampler resistor R1 and by the setting of potentiometer VR1, (factory set at the time of system test) do not adjust unless able to monitor subsequent RF levels. 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.

Wide Dynamic Range AGC Specification

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

25.3.2.8. 12V (Single) Relay Board (80-008901)

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.

80-008901 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		Screw terminals
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C

25.3.2.9. Dual Diode Assembly (94-100004)

The purpose of these dual diode assemblies is to allow two DC voltage sources to be combined, so that the main DC rail within the equipment can be sourced from either a mains driven PSU, or externally through an XLR connector or from dual mains driven PSUs . They are very heavy-duty diodes and they prevent any reverse current from flowing back to their source or the alternative supply rail. Combining diodes such as these will also be used if the equipment is to be powered from external back-up batteries.

25.3.2.10. 12V Switch-Mode PSU (96-300052)

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 12.2V. The adjustment potentiometer will be found close to the DC output terminals.

All the PSUs 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.

96-300052 Specification

AC Input Supply	
Voltage	110 or 220V nominal
	85 - 265V AC (absolute limits)
Frequency	47 to 63Hz
DC Output Supply	
Voltage	12V DC (nominal)
	10.5-13.8V (absolute limits)
Current	12.5A

25.3.3. 700MHz Downlink Splitter (50-132108)

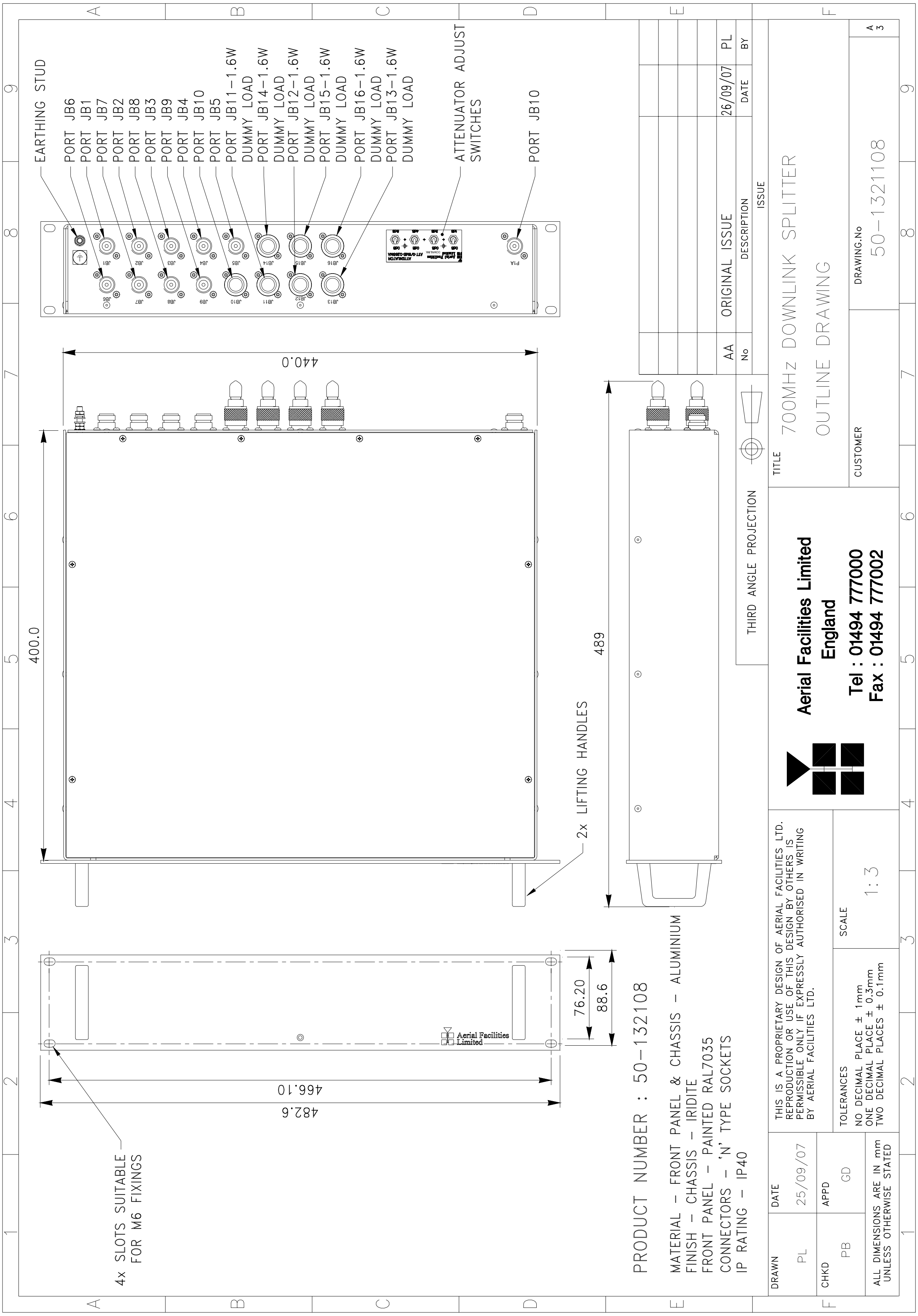
2U rack mount tray

700MHz Downlink Splitter (50-132108) List of Major Components

Section	Component Part	Component Part Description	Qty Per Assembly
25.3.3.3.	05-003302	Four Way Splitter/Combiner	5
25.3.3.4.	10-000901	Switched Attenuator 0.25W, 0 - 15dB	1
25.3.3.5.	80-007401	Dummy Load	7

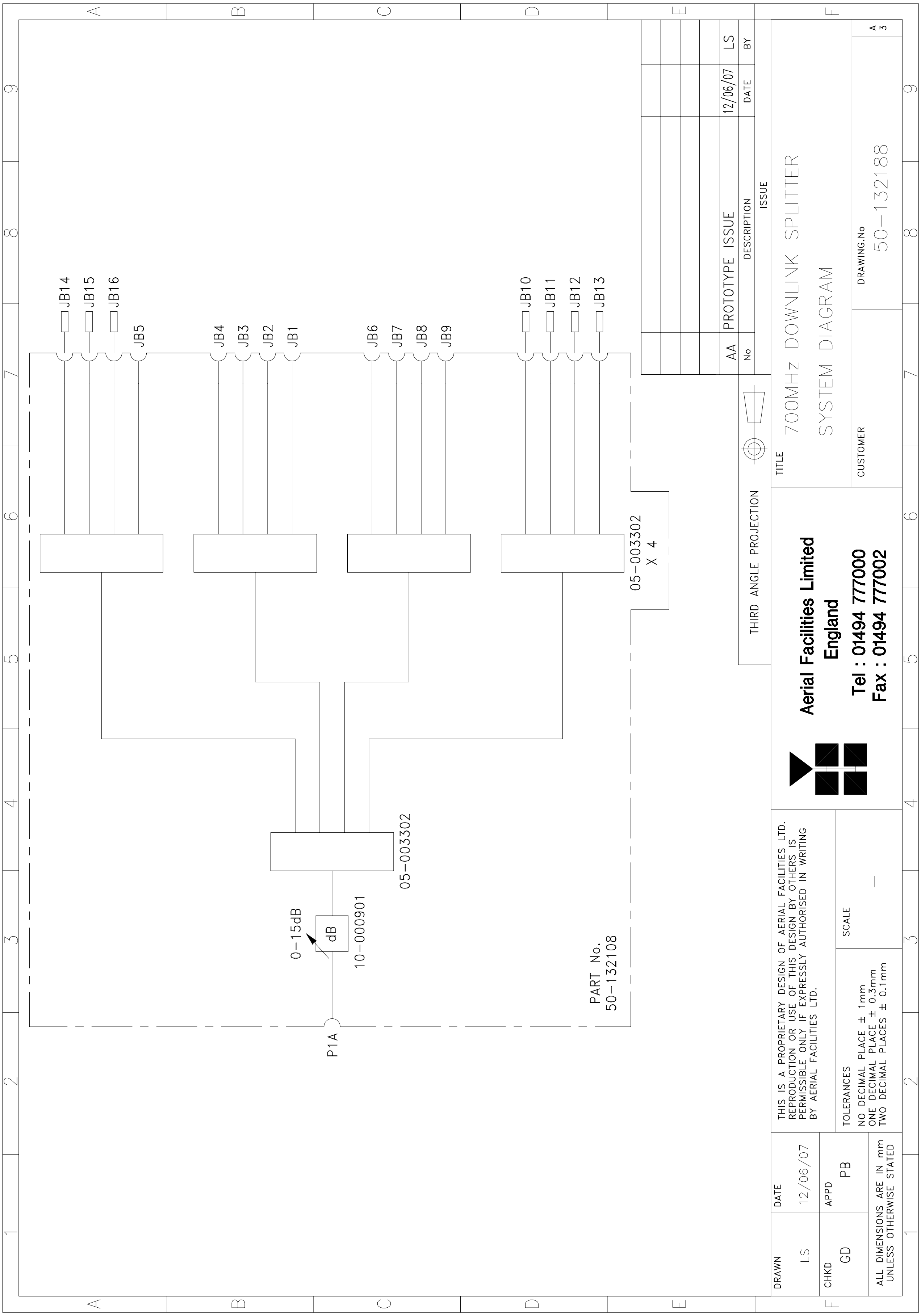
25.3.3.1. 700MHz Downlink Splitter (50-132108) Outline Drawing

Drawing number 50-1321108



25.3.3.2. 700MHz Downlink Splitter (50-132108) System Diagram

Drawing number 50-132188



25.3.3.3. Four Way Splitter/Combiner (05-003302)

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

Four Way Splitter (05-003302) Specification

PARAMETER		SPECIFICATION
Frequency range:		700-980MHz
Bandwidth:		180MHz
Rejection:		>14dB
Insertion loss:		<7.0dB (in band)
Connectors:		N type, female
Weight:		<1.5kg
Temperature range:	operational :	-20°C to +60°C
	storage	-40°C to +70°C

25.3.3.4. Switched Attenuator 0.25W, 0 - 15dB (10-000901)

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.

10-000901 provides attenuation from 0 - 15dB in 2 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.

10-000901 Specification

PARAMETER		SPECIFICATION
Attenuation Values		0-15dB
Attenuation Steps		1, 2, 4 and 8dB
Power Handling		0.25 Watt
Attenuation Accuracy		± 1.0 dB
Frequency Range		DC to 1GHz
Impedance		50Ω
Connectors		SMA
VSWR		1.3:1
Weigh		0.2kg
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

25.3.3.5. Dummy Load (80-007401)

When a combiner system is used to split or combine RF signals, in many cases it is most cost effective to use a standard stock item 4, 6 or 8 port device where, in fact, only a 3 or 6 port device is needed. In this case seven of the outputs from the Four Way Splitter/Combiner (05-003302) have their ports terminated with Dummy Load (80-007401) in order to preserve the correct impedance of the devices over the specified frequency range. This also has the advantage of allowing future expansion capability should extra channels or other functions become necessary.

Dummy Load (80-007401) Specification

Parameter		Specification
Frequency Range		0 to 1000MHz
Power Rating		1.6 Watts
VSWR (Max)	0-500MHz	1.2:1
	500-1000MHz	1.3:1
Temperature		-20 to +55°C
Connector		'N' type Male
Nominal Impedance		50 Ohms