



**STTRS DOCUMENTATION**  
**User/Maintenance Handbook**

**For**

**GETS Global Signalling L.L.C.**

**AFL Works Order Q115525**

# Table of Contents

1.	INTRODUCTION .....	2
1.1.	Scope and Purpose of Document.....	2
1.2.	Limitation of Liability Notice .....	2
2.	SAFETY CONSIDERATIONS.....	2
2.1.	Earthing of Equipment .....	2
2.2.	Electric Shock Hazard.....	2
2.3.	RF Radiation Hazard .....	2
2.4.	Lifting and other Health and Safety Recommendations.....	2
2.5.	Chemical Hazard .....	2
2.6.	Laser Safety.....	2
2.7.	Emergency Contact Numbers.....	2
3.	SYSTEM OVERVIEW ****//*** .....	2
4.	800MHZ KCRS MASTER SITE (80-330651).....	2
4.1.	800MHz KCRS MASTER SITE (80-330651) Drawings .....	2
4.1.1.	800MHz KCRS MASTER SITE (80-330651) Rack Elevation.....	2
4.1.2.	800MHz KCRS MASTER SITE (80-330651) System Diagram.....	2
4.1.3.	800MHz KCRS MASTER SITE (80-330651) Alarm Wiring Diagram .....	2
4.2.	800MHz KCRS Master Site (80-330651) Sub Components .....	2
4.2.1.	800MHz FO Master Splitter/Attenuator (55-165503).....	2
4.2.1.1.	Four Way Splitter/Combiner (05-003302) .....	2
4.2.1.2.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701) .....	2
4.2.1.3.	Dummy Load (80-007401) .....	2
4.2.2.	F/O Link Subsystem (98-800001) .....	2
4.2.3.	Optical A/B Switch FC/APC (98-700002) .....	2
4.2.4.	Fibre Optic Splitter (55-165507) .....	2
4.2.4.1.	Single Mode Optical Splitter/Coupler (98-100001).....	2
5.	700MHZ KCM MASTER SITE / PIONEER SQ (80-330652) .....	2
5.1.	700MHz KCM MASTER SITE / PIONEER SQ (80-330652) Rack Elevation.....	2
5.2.	700MHz KCM MASTER SITE / PIONEER SQ (80-330682) System Diagram .....	2
5.3.	700MHz KCM MASTER SITE / PIONEER SQ (80-330682) Alarm Wiring Diagram ****//***	2
	Approval In progresss G.D.....	2
5.4.	700MHz KCM MASTER SITE / PIONEER SQ (80-330682) Sub Components .....	2
5.4.1.	800MHz Line Amplifier (55-165703).....	2
5.4.1.1.	800MHz Line Amplifier (55-165703) Outline Drawing.....	2
5.4.1.2.	800MHz Line Amplifier (55-165703) System Diagram.....	2
5.4.1.3.	Bandpass Filter (02-007206).....	2
5.4.1.4.	Wideband Asymmetric Coupler (07-015105) .....	2
5.4.1.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
5.4.1.6.	Low Noise Amplifier (11-006702).....	2
5.4.1.7.	Power Amplifier (12-018002) .....	2
5.4.1.8.	Low Power Amplifier (12-021901).....	2
5.4.1.9.	Automatic Gain Control.....	2
5.4.1.10.	12V (Dual) Relay Board (20-001601) .....	2
5.4.1.11.	12V (Single) Relay Board (80-008901).....	2
5.4.1.12.	Dual Diode Assembly (94-100004) .....	2
5.4.1.13.	DC/DC Converter 96-200047.....	2
5.4.1.14.	12V Switch-Mode PSU (96-300052).....	2
5.4.2.	700MHz Line Amplifier (55-165704).....	2
5.4.2.1.	700MHz Line Amplifier (55-165704) Outline Drawing.....	2
5.4.2.2.	700MHz Line Amplifier (55-165704) System Diagram.....	2
5.4.2.3.	Bandpass Filter (02-007206).....	2

5.4.2.4.	Wideband Asymmetric Coupler (07-015105)	2
5.4.2.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901)	2
5.4.2.6.	Low Noise Amplifier (11-006702)	2
5.4.2.7.	Power Amplifier (12-018002)	2
5.4.2.8.	Low Power Amplifier (12-021901)	2
5.4.2.9.	Automatic Gain Control	2
5.4.2.10.	12V (Single) Relay Board (80-008901)	2
5.4.2.11.	Dual Diode Assembly (94-100004)	2
5.4.2.12.	DC/DC Converter 96-200047	2
5.4.2.13.	12V Switch-Mode PSU (96-300052)	2
5.4.3.	700MHz FO MASTER ATTENUATOR (55-165604)	2
5.4.3.1.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701)	2
5.4.4.	F/O Link Subsystem (98-800001)	2
5.4.5.	Optical AB Switch FC/APC (98-700002)	2
5.4.6.	Fibre Optic Splitter (55-165507)	2
5.4.6.1.	Single Mode Optical Splitter/Coupler (98-100001)	2
5.4.7.	PIONEER ST. SPLITTER (55-165708)	2
5.4.7.1.	2 Way Power Splitter/ Combiner 70/30 (05-009905)	2
5.4.7.2.	Wideband Asymmetric Coupler (07-015102)	2
6.	BEACON HILL STATION MASTER SITE 1 (80-330551-1)	2
6.1.	Beacon Hill Station Master Site 1 (80-330551-1) Rack Elevation	2
6.2.	Beacon Hill Station Master Site 1 (80-330551-1) System Diagram	2
	Beacon Hill Station Master Site 1 (80-330551-1) Alarm Wiring Diagram ***//*** Approval In Progress G.D.	2
6.3.	Beacon Hill Station Master Site 1 (80-330551-1) Sub Components	2
6.3.1.	800MHz FO HUB AMP (55-165501)	2
6.3.1.1.	800MHz FO HUB AMP (55-165501) Outline drawing	2
6.3.1.2.	800MHz FO HUB AMP (55-165501) System Diagram	2
6.3.1.3.	Bandpass Filter (02-007206)	2
6.3.1.4.	Wideband Asymmetric Coupler (07-015105)	2
6.3.1.5.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701)	2
6.3.1.6.	Low Noise Amplifier (11-005902)	2
6.3.1.7.	Low Noise Amplifier (11-006702)	2
6.3.1.8.	Power Amplifier (12-018002)	2
6.3.1.9.	Low Power Amplifier (12-021901)	2
6.3.1.10.	Automatic Gain Control	2
6.3.1.11.	12V (Dual) Relay Board (20-001601)	2
6.3.1.12.	12V (Single) Relay Board (80-008901)	2
6.3.1.13.	Dual Diode Assembly (94-100004)	2
6.3.1.14.	DC/DC Converter 96-200047	2
6.3.1.15.	12V Switch-Mode PSU (96-300052)	2
6.3.2.	800MHz FO HUB SPLITTER/COMB (55-165502)	2
6.3.2.1.	800MHz FO HUB SPLITTER/COMB (55-165502) Outline Drawing	2
6.3.2.2.	800MHz FO HUB SPLITTER/COMB (55-165502) System Diagram	2
6.3.2.3.	900MHz Splitter/Combiner (05-002602)	2
6.3.2.4.	Four Way Splitter/Combiner (05-003302)	2
6.3.3.	BEACON HILL SPLITTER (BDA 1 & 3) (55-165504)	2
6.3.3.1.	BEACON HILL SPLITTER (BDA 1 & 3) (55-165504) Outline Drawing	2
6.3.3.2.	BEACON HILL SPLITTER (BDA 1 & 3) (55-165504) System Diagram	2
6.3.3.3.	Four Way Splitter/Combiner (05-003302)	2
6.3.3.4.	2 Way Power Splitter/ Combiner 80/20 (05-009903)	2
6.3.3.5.	2 Way Power Splitter/ Combiner 70/30 (05-009905)	2
6.3.3.6.	Wideband Asymmetric Coupler (07-015102)	2
6.3.4.	Fibre Optic Splitter (55-165507)	2
6.4.3.1.	Single Mode Optical Splitter/Coupler (98-100001)	2
6.3.5.	Optical AB Switch FC/APC (98-700002)	2

6.3.6.	F/O Link Subsystem (98-800001) .....	2
7.	BEACON HILL STATION MASTER SITE 2 (80-330551-2) .....	2
7.1.	Beacon Hill Station Master Site 2 (80-330551-2) Rack Elevation.....	2
7.2.	Beacon Hill Station Master Site 2 (80-330551-2) System Diagram .....	2
7.3.	Beacon Hill Station Master Site 2 (80-330551-2) Alarm Wiring Diagram .....	2
7.4.	Beacon Hill Station Master Site 2 (80-330551-2) Major Sub Components.....	2
7.4.1.	800MHz FO HUB AMP (55-165501) .....	2
7.4.1.1.	800MHz FO HUB AMP (55-165501) Outline drawing .....	2
7.4.1.2.	800MHz FO HUB AMP (55-165501) System Diagram .....	2
7.4.1.3.	Bandpass Filter (02-007206).....	2
7.4.1.4.	Wideband Asymmetric Coupler (07-015105) .....	2
7.4.1.5.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701) .....	2
7.4.1.6.	Low Noise Amplifier (11-005902).....	2
7.4.1.7.	Low Noise Amplifier (11-006702).....	2
7.4.1.8.	Power Amplifier (12-018002) .....	2
7.4.1.9.	Low Power Amplifier (12-021901).....	2
7.4.1.10.	Automatic Gain Control.....	2
7.4.1.11.	12V (Dual) Relay Board (20-001601) .....	2
7.4.1.12.	12V (Single) Relay Board (80-008901).....	2
7.4.1.13.	DC/DC Converter 96-200047.....	2
7.4.1.14.	Dual Diode Assembly (94-100004) .....	2
7.4.1.15.	DC/DC Converter 96-200047.....	2
7.4.1.16.	12V Switch-Mode PSU (96-300052).....	2
7.4.2.	BEACON HILL SPLITTER (BDA 2 & 4) (55-165505).....	2
7.4.2.1.	BEACON HILL SPLITTER (BDA 2 & 4) (55-165505) Outline Drawing.....	2
7.4.2.2.	BEACON HILL SPLITTER (BDA 2 & 4) (55-165505) System Diagram .....	2
7.4.2.3.	2 Way Power Splitter/ Combiner 70/30 (05-009905) .....	2
7.4.2.4.	3 Way Power Splitter 33/33/33 (05-009906) ***//*** BSB .....	2
7.4.2.5.	3 Way Power Splitter 40/20/40 (05-009907) ***//***BSB .....	2
7.4.2.6.	Wideband Asymmetric Coupler (07-015102) .....	2
8	BEACON HILL STATION CROSS PASSAGE A (80-330591-1) .....	2
8.1.	Beacon Hill Station Cross Passage A (80-330591-1) Rack Layout ***//*** .....	2
8.2.	Beacon Hill Station Cross Passage A (80-330591-1) System Diagram .....	2
8.3.	Beacon Hill Station Cross Passage A (80-330591-1) Alarm Wiring Diagram.....	2
8.4.	Beacon Hill Station Cross Passage A (80-330591-1) Major Sub Components .....	2
8.4.1.	Wideband Asymmetric Coupler (07-015102) .....	2
8.4.2.	Power Amplifier (12-018002).....	2
8.4.3.	800MHz Line Amplifier (Ext. Amp.) (55-165401).....	2
8.4.3.1.	800MHz Line Amplifier (Ext. Amp.) (55-165401) outline drawing .....	2
8.4.3.2.	800MHz Line Amplifier (Ext. Amp.) (55-165401) system diagram .....	2
8.4.3.3.	Bandpass Filter (02-007206).....	2
8.4.3.4.	Wideband Asymmetric Coupler (07-015105) .....	2
8.4.3.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
8.4.3.6.	Low Noise Amplifier (11-006702).....	2
8.4.3.7.	Power Amplifier (12-018002) .....	2
8.4.3.8.	Low Power Amplifier (12-021901).....	2
8.4.3.9.	Automatic Gain Control.....	2
8.4.3.10.	12V (Single) Relay Board (80-008901).....	2
8.4.3.11.	Dual Diode Assembly (94-100004) .....	2
8.4.3.12.	DC/DC Converter (96-200047) .....	2
8.4.3.13.	12V Switch-Mode PSU (96-300052).....	2
9	BEACON HILL STATION CROSS PASSAGE B (80-330591-2) .....	2
9.1.	Beacon Hill Station Cross Passage B (80-330591-2) Rack layout ***//*** .....	2
9.2.	Beacon Hill Station Cross Passage B (80-330591-2) System Diagram .....	2
9.3.	Beacon Hill Station Cross Passage B (80-330591-2) Alarm Wiring Diagram.....	2
9.4.	Beacon Hill Station Cross Passage A (80-330591-1) Major Sub Components .....	2
9.4.1.	Wideband Asymmetric Coupler (07-015102) .....	2

9.4.2.	Power Amplifier (12-018002).....	2
9.4.3.	800MHz Line Amplifier (Ext. Amp.) (55-165401).....	2
9.4.3.1.	800MHz Line Amplifier (Ext. Amp.) (55-165401) outline drawing .....	2
9.4.3.2.	800MHz Line Amplifier (Ext. Amp.) (55-165401) system diagram .....	2
9.4.3.3.	Bandpass Filter (02-007206).....	2
9.4.3.4.	Wideband Asymmetric Coupler (07-015105).....	2
9.4.3.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
9.4.3.6.	Low Noise Amplifier (11-006702).....	2
9.4.3.7.	Power Amplifier (12-018002) .....	2
9.4.3.8.	Low Power Amplifier (12-021901).....	2
9.4.3.9.	Automatic Gain Control.....	2
9.4.3.10.	12V (Single) Relay Board (80-008901).....	2
9.4.3.11.	Dual Diode Assembly (94-100004).....	2
9.4.3.12.	DC/DC Converter 96-200047.....	2
9.4.3.12.	12V Switch-Mode PSU (96-300052).....	2
10.	UNIVERSITY STATION MASTER SITE 1 (80-330552-1) .....	2
10.1.	University Station Master Site 1 (80-330552-1) Rack elevation .....	2
10.2.	University Station Master Site 1 (80-330552-1) system diagram .....	2
10.3.	University Station Master Site 1 (80-330552-1) Alarm Wiring Diagram.....	2
10.4	University Station Master Site 1 (80-330552-1) Major Components .....	2
10.4.1.	800MHz FO HUB Splitter/Combiner (55-165502).....	2
10.4.1.1.	800MHz FO HUB SPLITTER/COMB (55-165502) Outline Drawing.....	2
10.4.1.2.	800MHz FO HUB SPLITTER/COMB (55-165502) System Diagram.....	2
10.4.1.3.	900MHz Splitter/Combiner (05-002602) .....	2
10.4.1.4.	Four Way Splitter/Combiner (05-003302) .....	2
10.4.2.	Fibre Optic Splitter (55-165507).....	2
10.4.2.1.	Single Mode Optical Splitter/Coupler (98-100001) .....	2
10.4.3.	800MHz FO Hub Amplifier + Filters (55-165601).....	2
10.4.3.1.	800MHz FO Hub Amplifier + Filters (55-165601) outline drawing .....	2
10.4.3.2.	800MHz FO Hub Amplifier + Filters (55-165601) system diagram .....	2
10.4.3.3.	Bandpass Filter (02-007206) .....	2
10.4.3.4.	Wideband Asymmetric Coupler (07-015105).....	2
10.4.3.5.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701) .....	2
10.4.3.6.	Low Noise Amplifier (11-005902) .....	2
10.4.3.7.	Low Noise Amplifier (11-006702) .....	2
10.4.3.8.	Power Amplifier (12-018002) .....	2
10.4.3.9.	Low Power Amplifier (12-021901).....	2
10.4.3.10.	Automatic Gain Control .....	2
10.4.3.11.	12V (Dual) Relay Board (20-001601).....	2
10.4.3.12.	12V (Single) Relay Board (80-008901) .....	2
10.4.3.13.	Dual Diode Assembly (94-100004).....	2
10.4.3.14.	DC/DC Converter 96-200047 .....	2
10.4.3.15.	12V Switch-Mode PSU (96-300052) .....	2
10.4.4.	700MHz FO Hub Amplifier (55-165602).....	2
10.4.4.1.	700MHz FO Hub Amplifier (55-165602) Outline Drawing.....	2
10.4.4.2.	700MHz FO Hub Amplifier (55-165602) system diagram .....	2
10.4.4.3.	Bandpass Filter (02-007206) .....	2
10.4.4.4.	Wideband Asymmetric Coupler (07-015105).....	2
10.4.4.5.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701) .....	2
10.4.4.6.	Low Noise Amplifier (11-005902) .....	2
10.4.4.7.	Low Noise Amplifier (11-006702) .....	2
10.4.4.8.	Power Amplifier (12-018002) .....	2
10.4.4.9.	Low Power Amplifier (12-021901).....	2
10.4.4.10.	Automatic Gain Control .....	2
10.4.4.11.	12V (Dual) Relay Board (20-001601).....	2
10.4.4.12.	12V (Single) Relay Board (80-008901) .....	2
10.4.4.13.	Dual Diode Assembly (94-100004).....	2
10.4.4.14.	DC/DC Converter 96-200047 .....	2

10.4.4.15.	12V Switch-Mode PSU (96-300052)	2
10.4.5.	University Station Splitter 1 (55-165711)	2
10.4.5.1.	University Station Splitter 1 (55-165711) outline drawing	2
10.4.5.2.	University Station Splitter 1 (55-165711) system diagram	2
10.4.5.3.	2-Way Splitter/Combiner (05-003005)	2
10.4.5.4.	Wideband Asymmetric Coupler (07-015102)	2
10.4.6.	Optical AB Switch FC/APC (98-700002)	2
10.4.7.	F/O Link Subsystem (98-800001)	2
11.	UNIVERSITY STATION MASTER SITE 2 (80-330552-2)	2
11.1.	University Station Master Site 2 (80-330552-1) Rack elevation	2
11.2.	University Station Master Site 2 (80-330552-1) system diagram	2
11.3.	University Station Master Site 2 (80-330552-1) Alarm Wiring Diagram	2
11.4.	University Station Master Site 2 (80-330552-1) Major Components	2
11.4.1.	Fibre Optic Splitter (55-165507)	2
11.4.1.1.	Single Mode Optical Splitter/Coupler (98-100001)	2
11.4.2.	800MHz FO Hub Amplifier + Filters (55-165601)	2
11.4.2.1.	800MHz FO Hub Amplifier + Filters (55-165601) outline drawing	2
11.4.2.2.	800MHz FO Hub Amplifier + Filters (55-165601) system diagram	2
11.4.2.3.	Bandpass Filter (02-007206)	2
11.4.2.4.	Wideband Asymmetric Coupler (07-015105)	2
11.4.2.5.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701)	2
11.4.2.6.	Low Noise Amplifier (11-005902)	2
11.4.2.7.	Low Noise Amplifier (11-006702)	2
11.4.2.8.	Power Amplifier (12-018002)	2
11.4.2.9.	Low Power Amplifier (12-021901)	2
11.4.2.10.	Automatic Gain Control	2
11.4.2.11.	12V (Dual) Relay Board (20-001601)	2
11.4.2.12.	12V (Single) Relay Board (80-008901)	2
11.4.2.13.	Dual Diode Assembly (94-100004)	2
11.4.2.14.	DC/DC Converter 96-200047	2
11.4.2.15.	12V Switch-Mode PSU (96-300052)	2
11.4.3.	700MHz FO Hub Amplifier (55-165602)	2
11.4.3.1.	700MHz FO Hub Amplifier (55-165602) outline drawing	2
11.4.3.2.	700MHz FO Hub Amplifier (55-165602) system diagram	2
11.4.3.3.	Bandpass Filter (02-007206)	2
11.4.3.4.	Wideband Asymmetric Coupler (07-015105)	2
11.4.3.5.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701)	2
11.4.3.6.	Low Noise Amplifier (11-005902)	2
11.4.3.7.	Low Noise Amplifier (11-006702)	2
11.4.3.8.	Power Amplifier (12-018002)	2
11.4.3.9.	Low Power Amplifier (12-021901)	2
11.4.3.10.	Automatic Gain Control	2
11.4.3.11.	12V (Dual) Relay Board (20-001601)	2
11.4.3.12.	12V (Single) Relay Board (80-008901)	2
11.4.3.13.	Dual Diode Assembly (94-100004)	2
11.4.3.14.	DC/DC Converter 96-200047	2
11.4.3.15.	12V Switch-Mode PSU (96-300052)	2
11.4.4.	700MHz FO HUB Splitter/Combiner (55-165603)	2
11.4.4.2.	Four Way Splitter/Combiner (05-003302)	2
11.4.5.	UNIVERSITY ST. SPLITTER 2 (55-165712)	2
11.4.5.1.	University Station Splitter 2 (55-165712) outline drawing	2
11.4.5.2.	University Station Splitter 2 (55-165712) system diagram	2
11.4.5.3.	Wideband Asymmetric Coupler (07-015102)	2
11.4.6.	Optical AB Switch FC/APC (98-700002)	2
11.4.7.	F/O Link Subsystem (98-800001)	2
12.	WESTLAKE STATION LINE AMPLIFIER (80-330553)	2

12.1.	Westlake Station Line Amplifier (80-330553) rack elevation .....	2
12.2.	Westlake Station Line Amplifier (80-330553) system diagram .....	2
12.3.	Westlake Station Line Amplifier (80-330553) alarm wiring diagram .....	2
12.4.	Westlake Station Line Amplifier (80-330553) Sub Components .....	2
12.4.1.	800MHz Line Amplifier (55-165703) .....	2
12.4.1.1.	800MHz Line Amplifier (55-165703) Outline Drawing .....	2
12.4.1.2.	800MHz Line Amplifier (55-165703) System Diagram .....	2
12.4.1.3.	Bandpass Filter (02-007206) .....	2
12.4.1.4.	Wideband Asymmetric Coupler (07-015105) .....	2
12.4.1.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
12.4.1.6.	Low Noise Amplifier (11-006702) .....	2
12.4.1.7.	Power Amplifier (12-018002) .....	2
12.4.1.8.	Low Power Amplifier (12-021901) .....	2
12.4.1.9.	Automatic Gain Control .....	2
12.4.1.10.	12V (Dual) Relay Board (20-001601) .....	2
12.4.1.11.	12V (Single) Relay Board (80-008901) .....	2
12.4.1.12.	Dual Diode Assembly (94-100004) .....	2
12.4.1.13.	DC/DC Converter 96-200047 .....	2
12.4.1.14.	12V Switch-Mode PSU (96-300052) .....	2
12.4.2.	700MHz Line Amplifier (55-165704) .....	2
12.4.2.1.	700MHz Line Amplifier (55-165704) Outline Drawing .....	2
12.4.2.2.	700MHz Line Amplifier (55-165704) System Diagram .....	2
12.4.2.3.	Bandpass Filter (02-007206) .....	2
12.4.2.4.	Wideband Asymmetric Coupler (07-015105) .....	2
12.4.2.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
12.4.2.6.	Low Noise Amplifier (11-006702) .....	2
12.4.2.7.	Power Amplifier (12-018002) .....	2
12.4.2.8.	Low Power Amplifier (12-021901) .....	2
12.4.2.9.	Automatic Gain Control .....	2
12.4.2.10.	12V (Single) Relay Board (80-008901) .....	2
12.4.2.11.	Dual Diode Assembly (94-100004) .....	2
12.4.2.12.	DC/DC Converter 96-200047 .....	2
12.4.2.13.	12V Switch-Mode PSU (96-300052) .....	2
12.4.3.	Westlake Station. Splitter (55-165707) .....	2
12.4.3.1.	Westlake Station. Splitter (55-165707) outline drawing .....	2
12.4.3.2.	Westlake Station. Splitter (55-165707) system diagram .....	2
12.4.3.3.	Wideband Asymmetric Coupler (07-015102) .....	2
13	ATTENUATOR SHELF (ITAC) 1 (55-165506) .....	2
13.1.	Attenuator Shelf (ITAC) 1 (55-165506) outline drawing .....	2
13.2	Attenuator Shelf (ITAC) 1 (55-165506) system diagram .....	2
13.3.	Attenuator Shelf (ITAC) 1 (55-165506) major components .....	2
13.3.1.	900MHz Splitter/Combiner (05-002602) .....	2
13.3.2.	4 Port Hybrid Coupler (05-003007) .....	2
13.3.3.	Dummy load (09-000902) .....	2
13.3.4.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
13.3.5.	Attenuator 25W, 60dB (10-002960) .....	2
14	ATTENUATOR SHELF (ITAC) 2 (55-165506) .....	2
14.1.	Attenuator Shelf (ITAC) 2 (55-165506) outline drawing .....	2
14.2	Attenuator Shelf (ITAC) 2 (55-165506) system diagram .....	2
14.3.	Attenuator Shelf (ITAC) 2 (55-165506) major components .....	2
14.3.1.	900MHz Splitter/Combiner (05-002602) .....	2
14.3.2.	4 Port Hybrid Coupler (05-003007) .....	2
14.3.3.	Dummy load 09-000902 .....	2
14.3.4.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
14.3.5.	Attenuator 25W, 60dB (10-002960) .....	2
15	ATTENUATOR SHELF (ITAC) 3 (55-165506) .....	2

15.1.	Attenuator Shelf (ITAC) 3 (55-165506) outline drawing.....	2
15.2	Attenuator Shelf (ITAC) 3 (55-165506) system diagram .....	2
15.3.	Attenuator Shelf (ITAC) 3 (55-165506) major components .....	2
15.3.1.	900MHz Splitter/Combiner (05-002602) .....	2
15.3.2.	4 Port Hybrid Coupler (05-003007) .....	2
15.3.3.	Dummy Load (09-000902) .....	2
15.3.4.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
15.3.5.	Attenuator 25W, 60dB (10-002960) .....	2
16.	CONVENTION PLACE STATION LINE AMPLIFIER (80-330556) .....	2
16.1.	Convention Place Station Line Amp. (80-330556) Rack elevation .....	2
16.2.	Convention Place Station Line Amp. (80-330556) System diagram.....	2
16.3.	Convention Place Station Line Amp. (80-330556) Alarm wiring diagram.....	2
16.4	Convention Place Station Line Amp. (80-330556) Sub Components .....	2
16.4.1.	800MHz Line Amplifier (55-165703) .....	2
16.4.1.1.	800MHz Line Amplifier (55-165703) Outline Drawing.....	2
16.4.1.2.	800MHz Line Amplifier (55-165703) System Diagram.....	2
16.4.1.3.	Bandpass Filter (02-007206) .....	2
16.4.1.4.	Wideband Asymmetric Coupler (07-015105).....	2
16.4.1.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
16.4.1.6.	Low Noise Amplifier (11-006702) .....	2
16.4.1.7.	Power Amplifier (12-018002) .....	2
16.4.1.8.	Low Power Amplifier (12-021901).....	2
16.4.1.9.	Automatic Gain Control.....	2
16.4.1.10.	12V (Dual) Relay Board (20-001601) .....	2
16.4.1.11.	12V (Single) Relay Board (80-008901) .....	2
16.4.1.12.	Dual Diode Assembly (94-100004).....	2
16.4.1.13.	DC/DC Converter 96-200047 .....	2
16.4.1.14.	12V Switch-Mode PSU (96-300052) .....	2
16.4.2	700MHz Line Amplifier (55-165704).....	2
16.4.2.1.	700MHz Line Amplifier (55-165704) Outline Drawing.....	2
16.4.2.2.	700MHz Line Amplifier (55-165704) System Diagram.....	2
16.4.2.3.	Bandpass Filter (02-007206) .....	2
16.4.2.4.	Wideband Asymmetric Coupler (07-015105).....	2
16.4.2.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
16.4.2.6.	Low Noise Amplifier (11-006702) .....	2
16.4.2.7.	Power Amplifier (12-018002) .....	2
16.4.2.8.	Low Power Amplifier (12-021901).....	2
16.4.2.9.	Automatic Gain Control.....	2
16.4.2.10.	12V (Single) Relay Board (80-008901) .....	2
16.4.2.11.	Dual Diode Assembly (94-100004).....	2
16.4.2.12.	DC/DC Converter 96-200047 .....	2
16.4.2.13.	12V Switch-Mode PSU (96-300052) .....	2
16.4.3.	Convention Place Station Splitter (55-165709).....	2
16.4.3.1.	Convention Place Station Splitter (55-165709) outline drawing .....	2
16.4.3.2.	Convention Place Station Splitter (55-165709) system diagram .....	2
16.4.3.3.	900MHz Splitter/Combiner (05-002602) .....	2
16.4.3.4.	Wideband Asymmetric Coupler (07-015102).....	2
17.	INTERNATIONAL (NO NPSPAC) LINE AMPLIFIER (80-330557) .....	2
17.1.	International (no NPSPAC) Line Amp. (80-330557) Rack elevation .....	2
17.2.	International (no NPSPAC) Line Amp. (80-330557) System diagram .....	2
17.3.	International (no NPSPAC) Line Amp. (80-330557) Alarm wiring diagram .....	2
17.4.	International (no NPSPAC) Line Amp. (80-330557) major components .....	2
17.4.1.	800MHz Line Amplifier (no NPSPAC) (55-165705) .....	2
17.4.1.1.	800MHz Line Amplifier (no NPSPAC) (55-165705) Outline Drawing .....	2
17.4.1.2.	800MHz Line Amplifier (no NPSPAC) (55-165705) System Diagram .....	2
17.4.1.3.	Bandpass Filter (02-012701) .....	2
17.4.1.4.	Bandpass Filter (02-007206) .....	2



17.4.1.5.	Wideband Asymmetric Coupler (07-015105).....	2
17.4.1.6.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
17.4.1.7.	Low Noise Amplifier (11-006702) .....	2
17.4.1.8.	Power Amplifier (12-018002) .....	2
17.4.1.9.	Low Power Amplifier (12-021901).....	2
7.4.1.10.	Automatic Gain Control.....	2
17.4.1.11.	12V (Single) Relay Board (80-008901) .....	2
17.4.1.12.	Dual Diode Assembly (94-100004).....	2
17.4.1.13.	DC/DC Converter 96-200047 .....	2
17.4.1.14.	12V Switch-Mode PSU (96-300052) .....	2
17.4.2.	700MHz Line Amplifier (no NPSPAC) (55-165706) .....	2
17.4.2.1.	700MHz Line Amplifier (no NPSPAC) (55-165706) Outline Drawing .....	2
17.4.2.2.	700MHz Line Amplifier (no NPSPAC) (55-165706) System Diagram .....	2
17.4.2.3.	Bandpass Filter (02-012701) .....	2
17.4.2.4.	Bandpass Filter (02-007206) .....	2
17.4.2.5.	Wideband Asymmetric Coupler (07-015105).....	2
17.4.2.6.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
17.4.2.7.	Low Noise Amplifier (11-006702) .....	2
17.4.2.8.	Power Amplifier (12-018002) .....	2
17.4.2.9.	Low Power Amplifier (12-021901).....	2
7.4.2.10.	Automatic Gain Control.....	2
17.4.2.11.	12V (Single) Relay Board (80-008901) .....	2
17.4.2.12.	Dual Diode Assembly (94-100004).....	2
17.4.2.13.	DC/DC Converter 96-200047 .....	2
17.4.2.14.	12V Switch-Mode PSU (96-300052) .....	2
17.4.3.	International Station Splitter (55-165710) .....	2
17.4.3.1.	International Station Splitter (55-165710) Outline drawing.....	2
17.4.3.2.	International Station Splitter (55-165710) System Diagram.....	2
17.4.3.3.	900MHz Splitter/Combiner (05-002602) .....	2
17.4.3.4.	05-009909 – BSB to provide spec ***//*** .....	2
17.4.3.5.	Wideband Asymmetric Coupler (07-015102).....	2
18.	UNIVERSITY STATION CROSS PASSAGE A (80-330590-1).....	2
18.1.	University Station Cross Passage A (80-330590-1) System Diagram.....	2
18.2.	University Station Cross Passage A (80-330590-1) Alarm Wiring Diagram.....	2
18.3.	University Station Cross Passage A (80-330590-1) Major Sub Components .....	2
18.3.1.	Wideband Asymmetric Coupler (07-015102) .....	2
18.3.2.	Power Amplifier (12-018002) .....	2
18.3.3.	800MHz Line Amplifier (55-165701) .....	2
18.3.3.1.	800MHz Line Amplifier (55-165701) Outline Drawing.....	2
18.3.3.2.	800MHz Line Amplifier (55-165701) System Diagram.....	2
18.3.3.3.	Bandpass Filter (02-007206) .....	2
18.3.3.4.	Wideband Asymmetric Coupler (07-015105).....	2
18.3.3.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
18.3.3.6.	Low Noise Amplifier (11-006702) .....	2
18.3.3.7.	Low Power Amplifier (12-021901).....	2
18.3.3.8.	Automatic Gain Control.....	2
18.3.3.9.	12V (Single) Relay Board (80-008901).....	2
18.3.3.10.	Dual Diode Assembly (94-100004).....	2
18.3.3.11.	DC/DC Converter 96-200047 .....	2
18.3.3.12.	12V Switch-Mode PSU (96-300052) .....	2
18.3.4.	700MHz Line Amplifier (55-165702) .....	2
18.3.4.2.	700MHz Line Amplifier (55-165702) System Diagram.....	2
18.3.4.3.	Bandpass Filter (02-007206) .....	2
18.3.4.4.	Wideband Asymmetric Coupler (07-015105).....	2
18.3.4.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
18.3.4.6.	Low Noise Amplifier (11-006702) .....	2
18.3.4.7.	Low Power Amplifier (12-021901).....	2
18.3.4.8.	Automatic Gain Control.....	2

18.3.4.9.	12V (Single) Relay Board (80-008901).....	2
18.3.4.10.	Dual Diode Assembly (94-100004).....	2
18.3.4.11.	DC/DC Converter 96-200047 .....	2
18.3.4.12.	12V Switch-Mode PSU (96-300052) .....	2
19.	UNIVERSITY STATION CROSS PASSAGE B (80-330590-2).....	2
19.1.	University Station Cross Passage B (80-330590-2) System Diagram.....	2
19.2.	University Station Cross Passage B (80-330590-2) Alarm Wiring Diagram .....	2
19.3.	University Station Cross Passage B (80-330590-2) Major Sub Components .....	2
19.3.1.	Wideband Asymmetric Coupler (07-015102) .....	2
19.3.2.	Power Amplifier (12-018002) .....	2
19.3.3.	800MHz Line Amplifier (55-165701) .....	2
19.3.3.1.	800MHz Line Amplifier (55-165701) Outline Drawing.....	2
19.3.3.2.	800MHz Line Amplifier (55-165701) System Diagram.....	2
19.3.3.3.	Bandpass Filter (02-007206) .....	2
19.3.3.4.	Wideband Asymmetric Coupler (07-015105).....	2
19.3.3.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
19.3.3.6.	Low Noise Amplifier (11-006702) .....	2
19.3.3.7.	Low Power Amplifier (12-021901).....	2
19.3.3.8.	Automatic Gain Control.....	2
19.3.3.9.	12V (Single) Relay Board (80-008901).....	2
19.3.3.10.	Dual Diode Assembly (94-100004).....	2
19.3.3.11.	DC/DC Converter 96-200047 .....	2
19.3.3.12.	12V Switch-Mode PSU (96-300052) .....	2
19.3.4.	700MHz Line Amplifier (55-165702) .....	2
19.3.4.1.	700MHz Line Amplifier (55-165702) Outline Drawing.....	2
19.3.4.2.	700MHz Line Amplifier (55-165702) System Diagram.....	2
19.3.4.3.	Bandpass Filter (02-007206) .....	2
19.3.4.4.	Wideband Asymmetric Coupler (07-015105).....	2
19.3.4.5.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
19.3.4.6.	Low Noise Amplifier (11-006702) .....	2
19.3.4.7.	Low Power Amplifier (12-021901).....	2
19.3.4.8.	Automatic Gain Control.....	2
19.3.4.9.	12V (Single) Relay Board (80-008901).....	2
19.3.4.10.	Dual Diode Assembly (94-100004).....	2
19.3.4.11.	DC/DC Converter 96-200047 .....	2
19.3.4.12.	12V Switch-Mode PSU (96-300052) .....	2
20	CONVENTION PLACE STATION 700MHZ BDA (80-330554-1).....	2
20.1	Convention Place Station 700MHz BDA (80-330554-1) Outline Drawing .....	2
20.2.	Convention Place Station 700MHz BDA (80-330554-1) System Diagram .....	2
20.3	Convention Place Station 700MHz BDA (80-330554-1) Major Components .....	2
20.3.1.	700MHz Output Duplexer/Combiner (50-132103) .....	2
20.3.1.1.	700MHz Output Duplexer/Combiner (50-132103) outline drawing.....	2
20.3.1.2.	700MHz Output Duplexer/Combiner (50-132103) system diagram.....	2
20.3.1.3.	Bandpass Filter (02-007206) .....	2
20.3.1.4.	4 Port Hybrid Coupler (05-003007).....	2
20.3.1.5.	Wideband Asymmetric Coupler (07-015105).....	2
20.3.1.6.	Dummy Load 09-000902 .....	2
20.3.2.	700MHz 5 Cavity Combiner System (50-132105).....	2
20.3.2.1.	700MHz 5 Cavity Combiner System (50-132105) Outline Drawing.....	2
20.3.2.2.	700MHz 5 Cavity Combiner System (50-132105) System Diagram.....	2
20.3.2.3.	Dielectric Cavity Resonator (04-003402).....	2
20.3.3.	700MHz 4 Cavity Combiner System (50-132106).....	2
20.3.3.1.	700MHz 4 Cavity Combiner System (50-132106) Outline Drawing.....	2
20.3.3.2.	700MHz 4 Cavity Combiner System (50-132106) System Diagram.....	2
21	CONVENTION PLACE STATION 700MHZ BDA (80-330554-2).....	2
21.1.	Convention Place Station 700MHz BDA (80-330554-2) Outline Drawing .....	2

21.2.	Convention Place Station 700MHz BDA (80-330554-2) System Diagram .....	2
21.3.	Convention Place Station 700MHz BDA (80-330554-2) Major Components .....	2
21.3.1.	700MHz Channelised Amplifier (50-132102) .....	2
21.3.1.1.	700MHz Channelised Amplifier (50-132102) Outline Drawing .....	2
21.3.1.2.	700MHz Channelised Amplifier (50-132102) System diagram .....	2
21.3.1.3.	Dummy load 09-000902.....	2
21.3.1.4.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
21.3.1.5.	Low Noise Amplifier (11-006702) .....	2
21.3.1.6.	Power Amplifier (12-020804) .....	2
21.3.1.7.	DC/DC Converter (13-003412) .....	2
21.3.1.8.	Channel Selectivity Module (17-009127) .....	2
21.3.1.9.	Channel Control Module (17-011501) .....	2
21.3.1.10.	24V Relay Board (80-008902).....	2
21.3.1.11.	Dual Isolator (770MHz) (93-910048).....	2
21.3.1.12.	Dual Diode Assembly (94-100004).....	2
21.3.1.13.	PSU 24V (96-300060) .....	2
21.3.2.	700MHz Uplink Amplifier/ Duplexer (50-132104).....	2
21.3.2.1.	700MHz Uplink Amplifier/ Duplexer (50-132104) Outline Drawing .....	2
21.3.2.2.	700MHz Uplink Amplifier/ Duplexer (50-132104) System Diagram .....	2
21.3.2.3.	Bandpass Filter (02-007206) .....	2
21.3.2.4.	Four Way Splitter/Combiner (05-003302) .....	2
21.3.2.5.	Wideband Asymmetric Coupler (07-015105).....	2
21.3.2.6.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701) .....	2
21.3.2.7.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
21.3.2.8.	Low Noise Amplifier (11-006702) .....	2
21.3.2.9.	Low Power Amplifier (12-021901).....	2
21.3.2.10.	DC/DC Converter 13-003412 .....	2
21.3.2.11.	AGC System.....	2
21.3.2.12.	Dummy Load (80-007401).....	2
21.3.2.13.	12V (Single) Relay Board (80-008901) .....	2
21.3.2.14.	Dual Diode Assembly (94-100004).....	2
21.3.2.15.	12V Switch-Mode PSU (96-300052) .....	2
22.	INTERNATIONAL STATION 800MHZ BDA (80-330555-1).....	2
22.1.	International Station 800MHz BDA (80-330555-1) Rack elevation.....	2
22.2.	International Station 800MHz BDA (80-330555-1) System diagram .....	2
22.3.	International Station 800MHz BDA (80-330555-1) Major Components.....	2
22.3.1.	800MHz Output Quadplexer/Combiner (50-132203) .....	2
22.3.1.1.	800MHz Output Quadplexer/Combiner (50-132203) Outline Drawing .....	2
22.3.1.2.	800MHz Output Quadplexer/Combiner (50-132203) System Diagram .....	2
22.3.1.3.	Bandpass Filter (02-007206) .....	2
22.3.1.4.	4 Port Hybrid Coupler (05-003007).....	2
22.3.1.5.	Wideband Asymmetric Coupler (07-015105).....	2
22.3.1.6.	Dummy load 09-000902.....	2
22.3.2.	800MHz 5 Cavity Combiner System (50-132205).....	2
22.3.2.1.	800MHz 5 Cavity Combiner System (50-132205) Outline Drawing.....	2
22.3.2.2.	800MHz 5 Cavity Combiner System (50-132205) System Diagram.....	2
22.3.2.2.	Dielectric Cavity Resonator (04-003401).....	2
23.	INTERNATIONAL STATION 800MHZ BDA.....	2
23.1.	International Station 800MHz BDA (80-330555-2) Outline Drawing.....	2
23.2.	International Station 800MHz BDA (80-330555-2) System Diagram.....	2
23.3.	International Station 800MHz BDA (80-330555-2) Major Components.....	2
23.3.1.	800MHz Channelised Amplifier (50-132202) .....	2
23.3.1.1.	800MHz Channelised Amplifier (50-132202) Outline Drawing .....	2
23.3.1.2.	800MHz Channelised Amplifier (50-132202) System Diagram .....	2
23.3.1.3.	Dummy load 09-000902.....	2
23.3.1.4.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
23.3.1.5.	Low Noise Amplifier (11-006702) .....	2

23.3.1.6.	Power Amplifier (12-020804) .....	2
23.3.1.7.	DC/DC Converter 13-003412.....	2
23.3.1.8.	Channel Selectivity Module (17-009127).....	2
23.3.1.9.	Channel Control Module (17-011501) .....	2
23.3.1.10.	24V Relay Board (80-008902).....	2
23.3.1.11	Dual Isolator (850-870MHz) (93-910045) .....	2
23.3.1.12	Dual Diode Assembly (94-100004).....	2
23.3.1.13	PSU 24V (96-300060) .....	2
23.3.2.	800MHz Uplink Amplifier/ Quadplexer (50-132204).....	2
23.3.2.1.	800MHz Uplink Amplifier/ Quadplexer (50-132204) Outline Drawing.....	2
23.3.2.2.	800MHz Uplink Amplifier/ Quadplexer (50-132204) System Diagram.....	2
23.3.2.3.	Bandpass Filter (02-007206) .....	2
23.3.2.4.	Four Way Splitter/Combiner (05-003302).....	2
23.3.2.5.	Wideband Asymmetric Coupler (07-015105).....	2
23.3.2.6.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701) .....	2
23.3.2.7.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
23.3.2.8.	Low Noise Amplifier (11-006702) .....	2
23.3.2.9.	Low Power Amplifier (12-021901).....	2
23.3.2.10.	DC/DC Converter 13-003412 .....	2
23.3.2.11.	AGC System.....	2
23.3.2.12.	Dummy Load (80-007401).....	2
23.3.2.13.	12V (Single) Relay Board (80-008901) .....	2
23.3.2.14.	Dual Diode Assembly (94-100004).....	2
23.3.2.15.	12V Switch-Mode PSU (96-300052) .....	2
24.	INTERNATIONAL STATION 700MHZ BDA (80-330558-1).....	2
24.1.	International Station 700MHz BDA (80-330558-1) Rack Drawing.....	2
24.2.	International Station 700MHz BDA (80-330558-1) System Diagram.....	2
24.3.	International Station 700MHz BDA (80-330558-1) Major Components.....	2
24.3.1.	4 Port Hybrid Coupler (05-003007) .....	2
24.3.2.	Dummy Load (09-000401) .....	2
24.3.3.	700MHz 5 Cavity Combiner System (50-132105).....	2
24.3.3.1.	700MHz 5 Cavity Combiner System (50-132105) Outline Drawing.....	2
24.3.3.2.	700MHz 5 Cavity Combiner System (50-132105) System Diagram.....	2
24.3.3.3.	Dielectric Cavity Resonator (04-003402).....	2
24.3.4.	700MHz 4 Cavity Combiner System (50-132106).....	2
24.3.4.1.	700MHz 4 Cavity Combiner System (50-132106) Outline Drawing.....	2
24.3.4.2.	700MHz 4 Cavity Combiner System (50-132106) System Diagram.....	2
25.	INTERNATIONAL STATION 700MHZ BDA (80-330558-2).....	2
25.1.	International Station 700MHz BDA (80-330558-2) Rack Drawing.....	2
25.2.	International Station 700MHz BDA (80-330558-2) System Diagram.....	2
25.3.	International Station 700MHz BDA (80-330558-2) Major Components.....	2
25.3.1.	700MHz Channelised Amplifier (50-132102) .....	2
25.3.1.1.	700MHz Channelised Amplifier (50-132102) Outline Drawing .....	2
25.3.1.2.	700MHz Channelised Amplifier (50-132102) System diagram .....	2
25.3.1.3.	Dummy load 09-000902.....	2
25.3.1.4.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
25.3.1.5.	Low Noise Amplifier (11-006702) .....	2
25.3.1.6.	Power Amplifier (12-020804) .....	2
25.3.1.7.	DC/DC Converter 13-003412.....	2
25.3.1.8.	Channel Selectivity Module (17-009127).....	2
25.3.1.9.	Channel Control Module (17-011501) .....	2
25.3.1.10.	24V Relay Board (80-008902).....	2
25.3.1.11.	Dual Isolator (770MHz) (93-910048).....	2
25.3.1.12.	Dual Diode Assembly (94-100004).....	2
25.3.1.13.	PSU 24V (96-300060) .....	2
25.3.2.	700MHz Uplink Amplifier (50-132107) .....	2
25.3.2.1.	700MHz Uplink Amplifier (50-132107) Outline Drawing .....	2

25.3.2.2.	700MHz Uplink Amplifier (50-132107) System Diagram .....	2
25.3.2.3.	Switched Attenuator 0.25Watt, 0 - 30dB (10-000701) .....	2
25.3.2.4.	Low Noise Amplifier (11-006702) .....	2
25.3.2.5.	Low Power Amplifier (12-021901).....	2
25.3.2.6.	DC/DC Converter 13-003412.....	2
25.3.2.7.	AGC System .....	2
25.3.2.8.	12V (Single) Relay Board (80-008901).....	2
25.3.2.9.	Dual Diode Assembly (94-100004).....	2
25.3.2.10.	12V Switch-Mode PSU (96-300052) .....	2
25.3.3.	700MHz Downlink Splitter (50-132108) .....	2
25.3.3.1.	700MHz Downlink Splitter (50-132108) Outline Drawing.....	2
25.3.3.2.	700MHz Downlink Splitter (50-132108) System Diagram.....	2
25.3.3.3.	Four Way Splitter/Combiner (05-003302).....	2
25.3.3.4.	Switched Attenuator 0.25W, 0 - 15dB (10-000901) .....	2
25.3.3.5.	Dummy Load (80-007401).....	2
26	2 WAY POWER SPLITTER 50/50 (05-009901) .....	2
27	2 WAY POWER SPLITTER 90/10 (05-009902) .....	2
28	2 WAY POWER SPLITTER 80/20 (05-009903) .....	2
29	2 WAY POWER SPLITTER 60/40 (05-009904) .....	2
30	2 WAY POWER SPLITTER 70/30 (05-009905) .....	2
31	***//***05-009906 .....	2
32	***//***05-009907 .....	2
33	***//***05-009908 .....	2
34	***//***05-009909 .....	2
35	***//***05-009910 .....	2
36	***//***05-009911 .....	2
37	***//***05-009912 .....	2
38	***//***80-237501 .....	2
39	***//***80-237501 .....	2
40	***//***80-237501 .....	2
41	***//***80-237501 .....	2
42	***//***80-237501 .....	2
43	***//***80-237501 .....	2
44.	SPARES PACKAGE (80-330520) .....	2
APPENDIX A .....		2
A.1.	Glossary of Terms used in this document .....	2
A.2.	Key to Drawing Symbols used in this document.....	2
A.3.	EC Declaration of Conformity .....	2
A.4.	Amendment List Record Sheet.....	2

# 1. INTRODUCTION

## 1.1. Scope and Purpose of Document

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

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

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

This handbook has been prepared in accordance with BS 4884, and AFL's Quality procedures, which maintain the company's registration to BS EN ISO 9001:2000 and to the R&TTE Directive of the European Parliament. Copies of the relevant certificates and the company Quality Manual can be supplied on application to the Quality Manager.

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

## 1.2. Limitation of Liability Notice

This manual is written for the use of technically competent operators/service persons. No liability is accepted by AFL for use or misuse of this manual, the information contained therein, or the consequences of any actions resulting from the use of the said information, including, but not limited to, descriptive, procedural, typographical, arithmetical, or listing errors.

Furthermore, AFL does not warrant the absolute accuracy of the information contained within this manual, or its completeness, fitness for purpose, or scope.

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

All AFL products carry a twelve month warranty from date of shipment. The warranty is expressly on a return to base repair or exchange basis and the warranty cover does not extend to on-site repair or complete unit exchange.

## 2. SAFETY CONSIDERATIONS

### 2.1. Earthing of Equipment



Equipment 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.

### 2.2. Electric Shock Hazard



The risk of electrical shocks due to faulty mains driven power supplies whilst potentially ever present in any electrical equipment, would be minimised by adherence to good installation practice and thorough testing at the following stages:

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

All test equipment must 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.

### 2.3. 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 un-terminated. 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  $50\Omega$ , and that of free space at  $377\Omega$ , 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.

### 2.4. Lifting and other Health and Safety Recommendations



Certain items of AFL equipment are heavy and care should be taken when lifting them by hand. Ensure that a suitable number of personnel, appropriate lifting apparatus and appropriate personal protective equipment is used especially when installing Cell Enhancers above ground e.g. on a mast or pole.

## 2.5. 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 dummy loads (load terminations) 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.

## 2.6. Laser Safety



**General good working practices adapted from EN60825-2: 2004/ EC 60825-2:2004**

Do not stare with unprotected eyes or with any unapproved optical device at the fibre ends or connector faces or point them at other people, Use only approved filtered or attenuating viewing aids.

Any single or multiple fibre end or ends found not to be terminated (for example, matched, spliced) shall be individually or collectively covered when not being worked on. They shall not be readily visible and sharp ends shall not be exposed.

When using test cords, the optical power source shall be the last connected and the first disconnected; use only approved methods for cleaning and preparing optical fibres and optical connectors.

Always keep optical connectors covered to avoid physical damage and do not allow any dirt/foreign material ingress on the optical connector bulkheads.

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

Caution: The FO units are NOT weather proof.

## 2.7. Emergency Contact Numbers



The AFL Quality Department can be contacted on:

Telephone +44 (0)1494 777000

Fax. +44 (0)1494 777002

e-mail [qa@aerialfacilities.com](mailto:qa@aerialfacilities.com)



### 3. SYSTEM OVERVIEW \*\*\*//\*\*\*

#### 4. 800MHz KCRS MASTER SITE (80-330651)

800MHz KCRS MASTER SITE (80-330651) is a 43U equipment mounting rack which houses seven rack mount trays, the trays are as follows, listed from the top of the rack

55-165503 800MHz FO Master Splitter/Attenuator

98-900001 F/O Link Subsystem

98-700002 Optical A/B Switch FC/APC

55-165507 Fibre Optic Splitter

98-900001 F/O Link Subsystem

98-700002 Optical A/B Switch FC/APC

55-165507 Fibre Optic Splitter

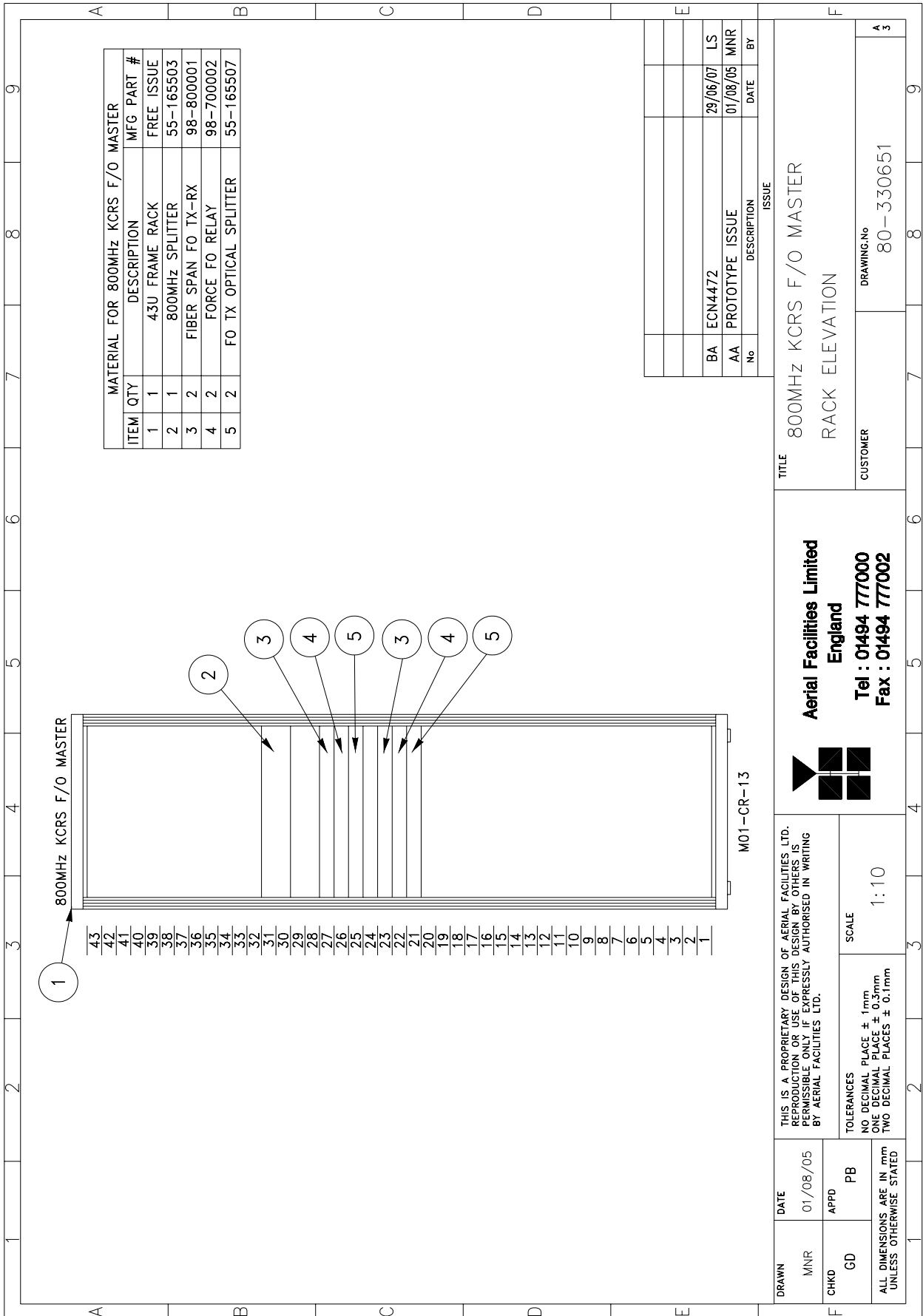
800MHz KCRS Master Site (80-330651) List of Major Sub Components

Section	Component Part	Component Part Description	Qty. Per Assembly
4.2.1.	55-165503	800MHz FO Master Splitter/Attenuator	1
4.2.2.	98-800001	F/O Link Subsystem	2
4.2.3.	98-700002	Optical A/B Switch FC/APC	2
4.2.4.	55-165507	Fibre Optic Splitter	2

# 4.1. 800MHz KCRS MASTER SITE (80-330651) Drawings

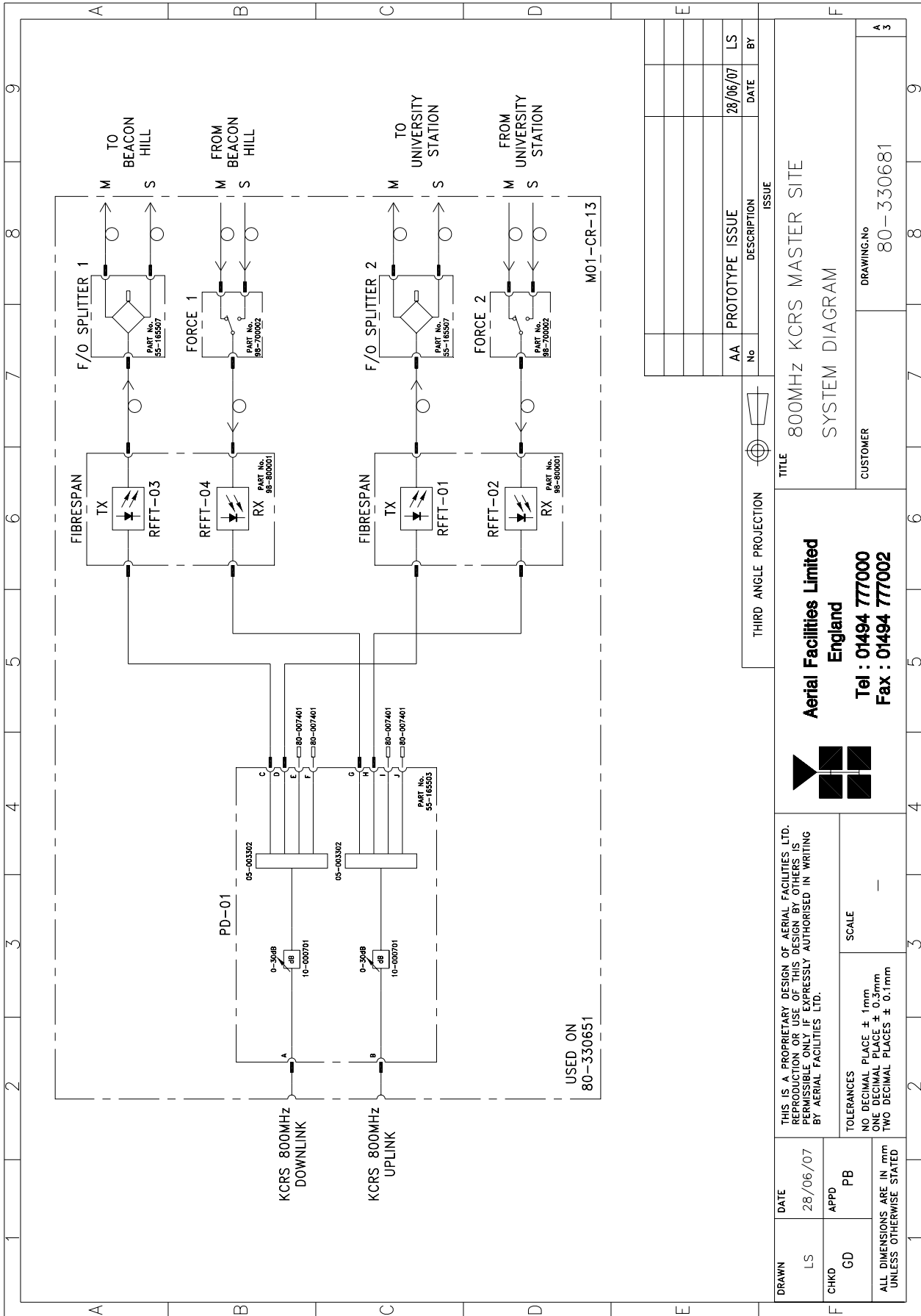
## 4.1.1. 800MHz KCRS MASTER SITE (80-330651) Rack Elevation

Drawing number 80-330651



### 4.1.2. 800MHz KCRS MASTER SITE (80-330651) System Diagram

Drawing number 80-330681



No	DESCRIPTION	DATE	BY
AA	PROTOTYPE ISSUE	28/06/07	LS

THIRD ANGLE PROJECTION	
TITLE	800MHz KCRS MASTER SITE SYSTEM DIAGRAM
CUSTOMER	80-330681

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

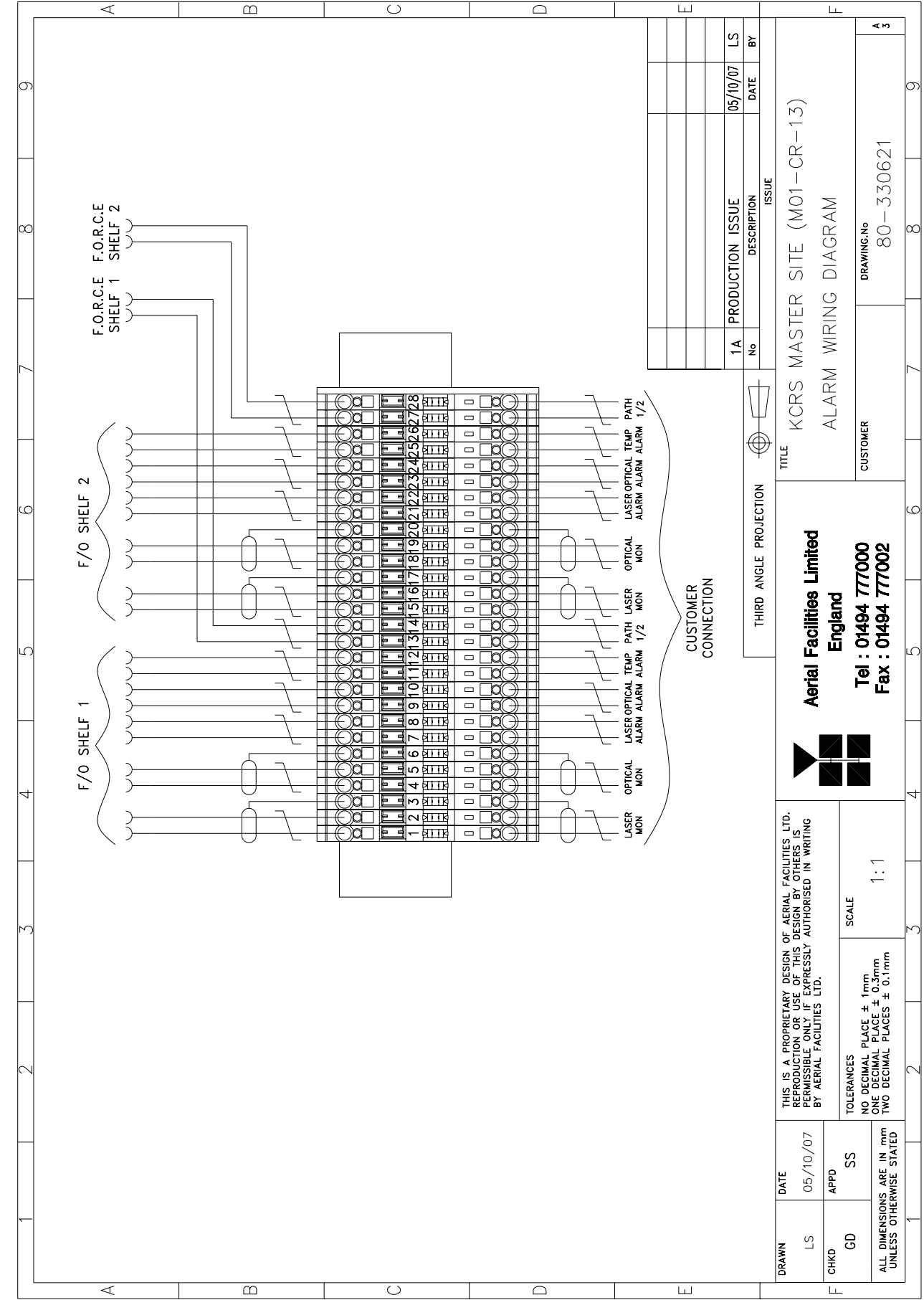
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TOLERANCES  
 NO DECIMAL PLACE ± 1mm  
 ONE DECIMAL PLACE ± 0.3mm  
 TWO DECIMAL PLACES ± 0.1mm

SCALE —

DRAWN	DATE	28/06/07
LS	APPD	PB
CHKD	GD	
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED		

### 4.1.3. 800MHz KCRS MASTER SITE (80-330651) Alarm Wiring Diagram



## 4.2. 800MHz KCRS Master Site (80-330651) Sub Components

### 4.2.1. 800MHz FO Master Splitter/Attenuator (55-165503)

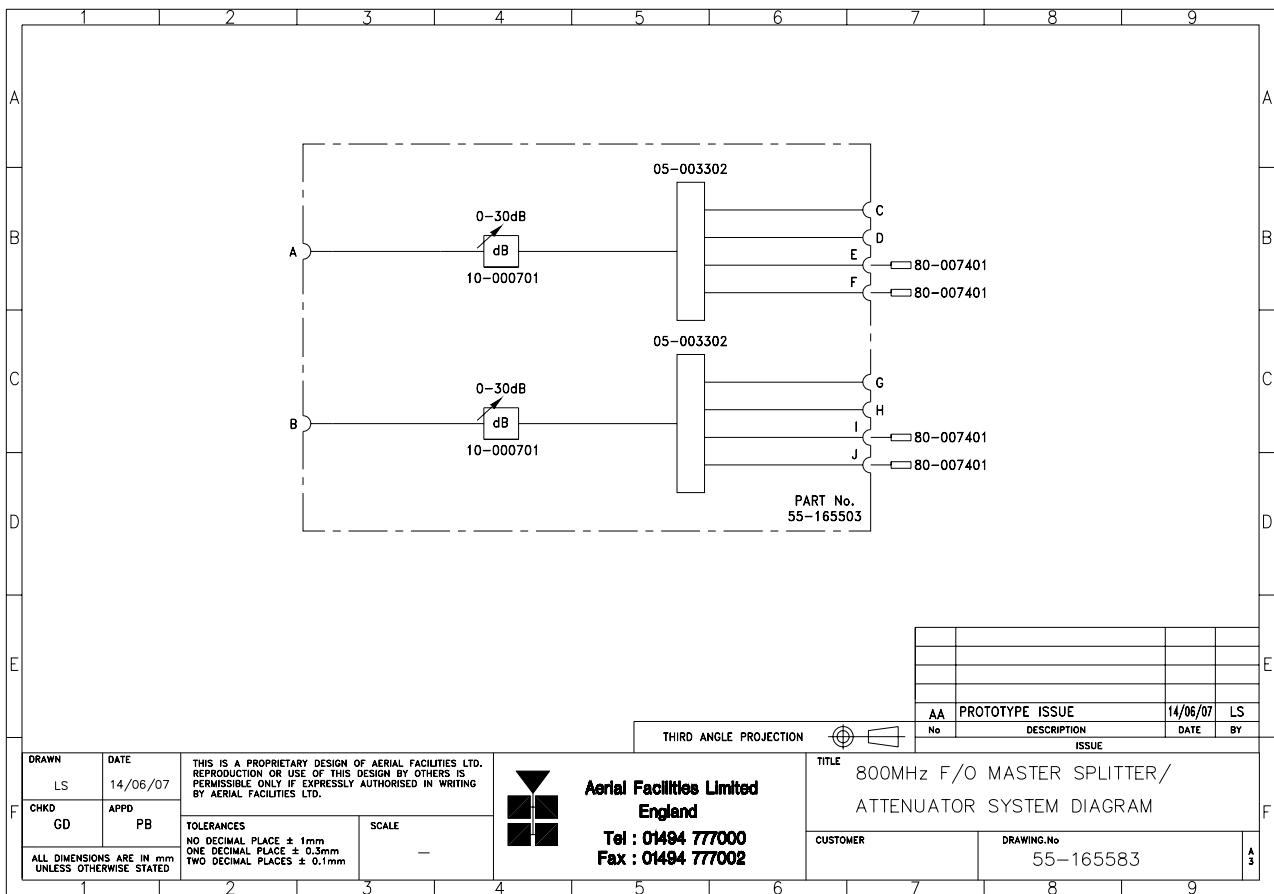
800MHz FO Master Splitter/Attenuator (55-165503) is a 2U rack mount tray which contains attenuators and splitters.

The 800MHz KCRS Downlink passes through a switched attenuator (10-000701) before entering Four Way Splitter/Combiner (05-003302) where the signal is split into two separate feeds for Beacon Hill and University Station

In the Uplink path signals from Beacon Hill and University Station are combined by a second Four Way Splitter/Combiner (05-003302) before passing through a switched attenuator (10-000701) then exiting as the 800MHz KCRS Uplink

#### 800MHz FO MASTER SPLITTER/ATTEN (55-165503) System Diagram

Drawing number 55-165583



#### 800MHz FO Master Splitter/Attenuator (55-165503) List of Major Sub components

Section	Component Part	Component Part Description	Qty. Per Assembly
4.2.1.1.	05-003302	Four Way Splitter/Combiner	2
4.2.1.2.	10-000701	Switched Attenuator 0.25Watt, 0 - 30dB	2
4.2.1.3.	80-007401	Dummy Load	4

#### 4.2.1.1. 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

#### 4.2.1.2. 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

#### 4.2.1.3. 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 the Four Way Splitters (05-003302) each have two of 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

#### 4.2.2. F/O Link Subsystem (98-800001)

F/O Link Subsystem (98-800001) is an O.E.M. sourced Optical Transceiver package containing discreet TX and RX modules and supplied as a 1U rack mount tray

Parameter	Specification
Optical Output Power	4 mW
Wavelength, peak	1310 1550 nm
Frequency Response, 50 to 2.2 GHz	± 1.5 dB
Input and Output VSWR	1.5:1
Link Gain <sup>(2)</sup>	0 dB
Output Noise Floor <sup>(1)</sup>	-137 dBm/Hz
Input 3rd Order Intercept <sup>(1)</sup>	30 dBm
Operating Temperature	-30 to +75°C
Storage Temperature	-40 to +85°C
Maximum RF Input to Transmitter	+20 dBm
Maximum Optical Input to Receiver	6 mW
A.C. Supply Voltage	90 – 265 VAC
Dimensions	483 x 457 x 44mm (19.0 x 18 x 1.72 in.)

<sup>(1)</sup> SFDR, Noise and IP3 specified with 5 dB optical loss.

<sup>(2)</sup> Link Gain specified with 1 meter fiber.

#### 4.2.3. Optical A/B Switch FC/APC (98-700002)

Optical AB Switch FC/APC (98-700002)

Optical A/B Switch FC/APC (98-700002) an O.E.M. sourced Fibre Optic relay supplied as a 1U rack mount tray. 98-700002 allows for the automatic switching between two optical inputs to provide a common optical output. Manual selection of the input is also possible via toggle switches on the front panel.



PARAMETER	SPECIFICATION
<b>Electrical Characteristics</b>	
Power Supply Voltage	100 - 240 VAC
Power Supply Frequency	50 - 60 Hz
<b>Optical Characteristics</b>	
Operating Wavelength	1200 – 1610nm
Optical Input Range	+20 dBm
Optical Insertion Loss	2.0 dB
Optical Trip Threshold/Meter Range	-35 - +20 dBm
Optical Switch Speed	15ms
Backreflection Tolerance	-50dB
<b>Environmental and Physical Characteristics</b>	
Optical Connectors	FC/APC
Operating Temp. Range	+10 to +40°C
Storage Temp. Range	-40 to +80 °C
Humidity	5 to 90 % RHNC
Weight	2.2 kg (6 lbs)
Dimensions	483 x 361 x 44mm (19.0 x 14.2 x 1.72 in.)

**4.2.4. Fibre Optic Splitter (55-165507)**

Fibre Optic Splitter (55-165507) is a 1U rack mount tray containing an optical splitter/coupler

Fibre Optic Splitter (55-165507) List of Major Sub Components

Component Part	Component Part Description	Qty. Per Assembly
98-100001	Single Mode Optical Splitter/Coupler	1

**4.2.4.1. Single Mode Optical Splitter/Coupler (98-100001)**

Single Mode Optical Splitter/Couplers are used whenever it is necessary to split or combine outputs from optical transmitters or inputs to receivers. Operators should be aware that a small insertion loss (typically 3-4dB) is common with these type of couplers.

Single Mode Optical Splitter/Coupler (98-100001) It is an O.E.M unit featuring almost negligible insertion loss to the F/O signal. Extreme caution should be exercised when handling these devices. Special attention should be shown to the connectors; repair of a broken Splitter/Coupler is not possible; replacement is the only option.

In the two Fibre Optic Splitters (55-165507) in 800MHz KCRS Master Site (80-330651), Single Mode Optical Splitter/Coupler (98-100001) is used to split the optical signal from the FO TX modules in F/O Link Subsystem (98-700001) into two equal paths.

## 5. 700MHz KCM MASTER SITE / PIONEER SQ (80-330652)

Description of 700MHz KCM MASTER SITE / PIONEER SQ (80-330652)

From the top of the rack

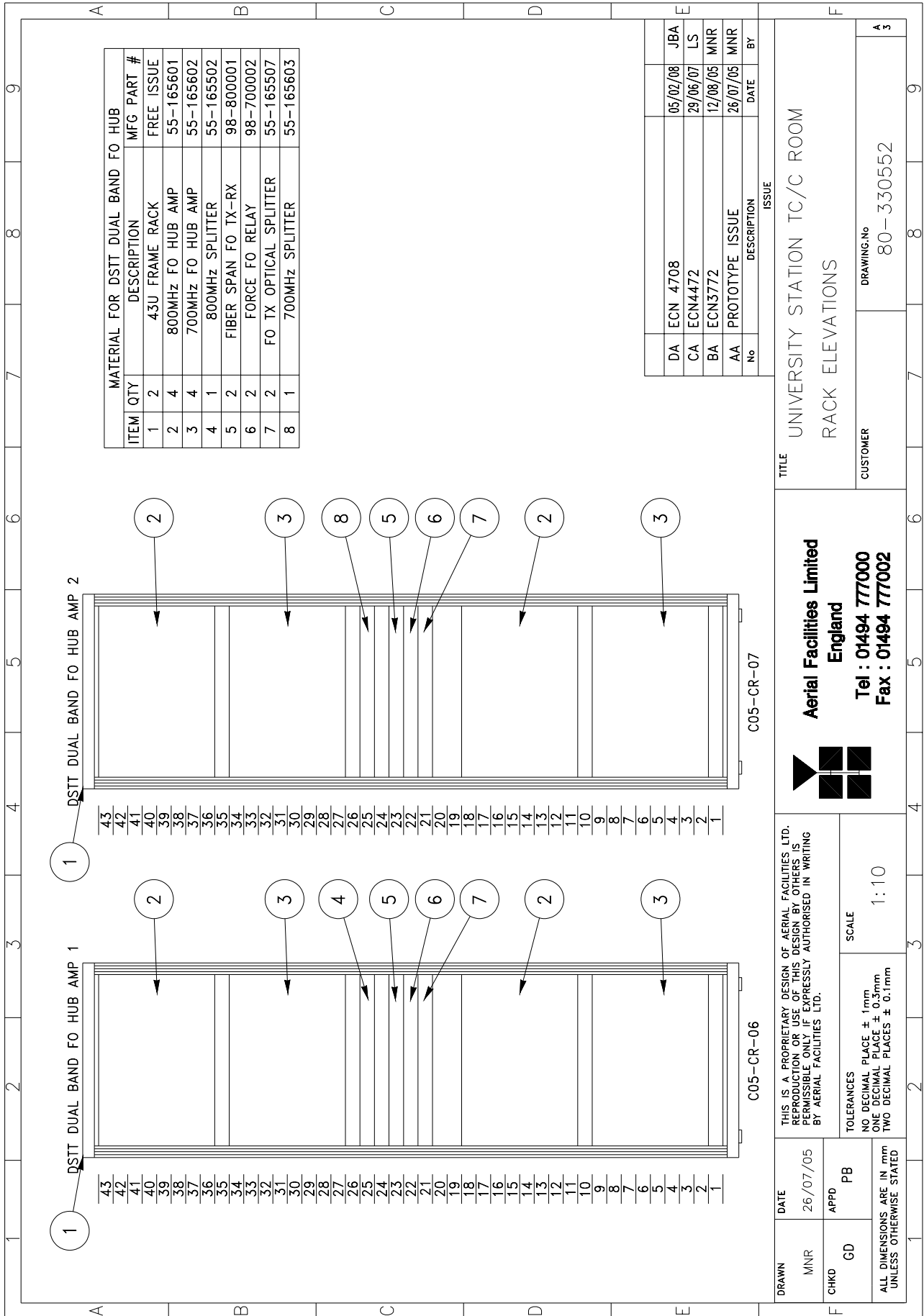
55-165703  
55-165704  
55-165703  
55-165704  
55-165604  
98-800001  
98-700002  
55-165507  
55-165708

700MHz KCM MASTER SITE / PIONEER SQ (80-330652) List of Major Sub Components

Section	Component Part	Component Part Description	Qty. Per Assembly
5.4.1.	55-165703	800MHz LINE AMP + FILTERS (INT AMP)	2
5.4.2.	55-165704	700MHz LINE AMP + FILTERS (INT AMP)	2
5.4.3.	55-165604	700MHz FO MASTER ATTENUATOR	1
5.4.4.	98-800001	2GHz 1.5um F/O LINK SUBSYSTEM	1
5.4.5.	98-700002	OPTICAL A/B SWITCH FC/APC	1
5.4.6.	55-165507	FIBRE OPTIC SPLITTER	1
5.4.7.	55-165708	PIONEER ST. SPLITTER	1

# 5.1. 700MHz KCM MASTER SITE / PIONEER SQ (80-330652) Rack Elevation

Drawing number 80-330652



No	DESCRIPTION	DATE	BY
DA	ECN 4708	05/02/08	JBA
CA	ECN4472	29/06/07	LS
BA	ECN3772	12/08/05	MNR
AA	PROTOTYPE ISSUE	26/07/05	MNR

**TITLE**  
UNIVERSITY STATION TC/C ROOM  
RACK ELEVATIONS

**CUSTOMER**  
DRAWING NO  
80-330552

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

**DRAWN** MNR DATE 26/07/05

**CHKD** GD **APPD** PB

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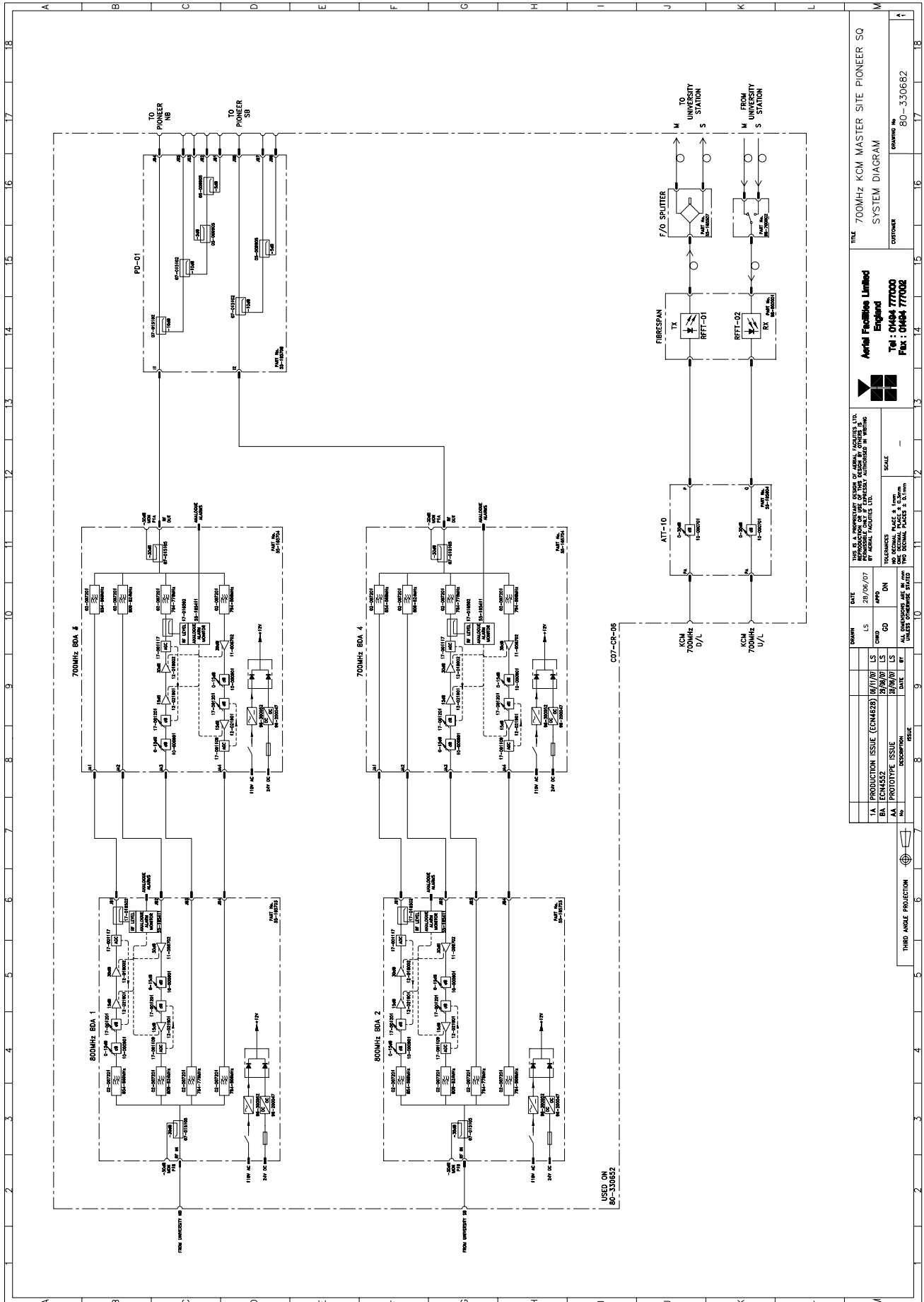
TOLERANCES  
NO DECIMAL PLACE ± 1mm  
ONE DECIMAL PLACE ± 0.1mm  
TWO DECIMAL PLACES ± 0.1mm

SCALE 1:10

ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED

# 5.2. 700MHz KCM MASTER SITE / PIONEER SQ (80-330682) System Diagram

Drawing number 80-330682



### **5.3. 700MHz KCM MASTER SITE / PIONEER SQ (80-330682) Alarm Wiring Diagram**

**\*\*\*//\*\*\* Approval In progresss G.D.**

Drawing number 80-330622

## 5.4. 700MHz KCM MASTER SITE / PIONEER SQ (80-330682) Sub Components

### 5.4.1. 800MHz Line Amplifier (55-165703)

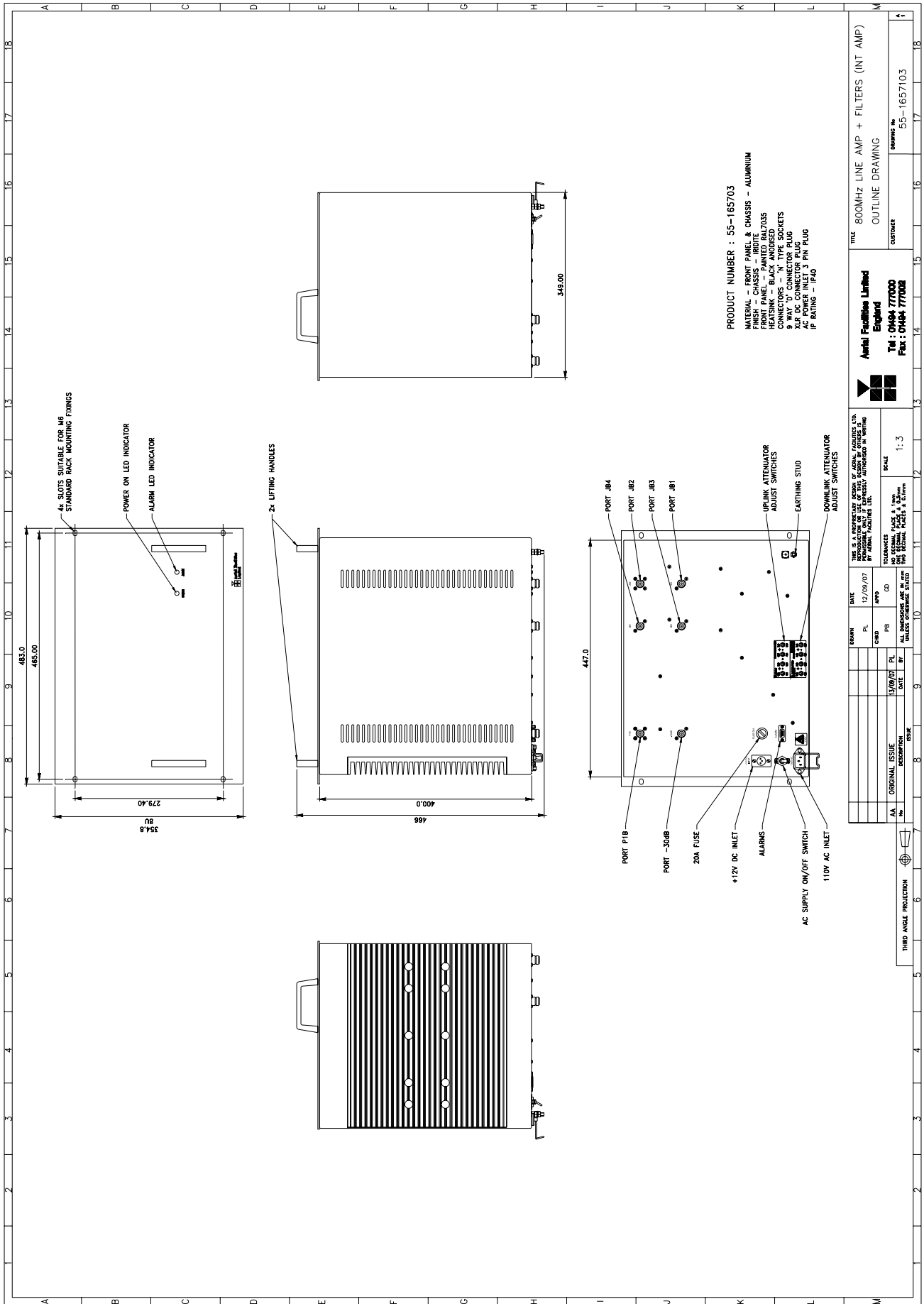
800MHz Line Amplifier (55-165703) List of Major Components

Section	Component Part	Component Part Description	Qty. Per Assembly
5.4.1.3.	02-007206	Bandpass Filter	4
5.4.1.4.	07-015105	Wideband Asymmetric Coupler	1
5.4.1.5.	10-000901	Switched Attenuator 0.25W, 0 - 15dB	2
5.4.1.6.	11-006702	Low Noise Amplifier	1
5.4.1.7.	12-018002	Power Amplifier (20W 800MHz )	1
5.4.1.8.	12-021901	Low Power Amplifier	2
5.4.1.9.	17-001109*	AGC Detector Assembly (Logarithmic)	1
	17-001117*	AGC Detector Assembly	1
	17-001201*	AGC Attenuator Assembly	2
5.4.1.10.	20-001601	12V (Dual) Relay Board	1
5.4.1.11.	80-008901	12V (Single) Relay Board	1
5.4.1.12.	94-100004	Dual Diode Assembly	1
5.4.1.13.	96-200047	DC/DC Converter	1
5.4.1.14.	96-300052	12V Switch-Mode PSU	1

\*The sub components 17-001109, 17-001117 & 17-001201 are parts of the Automatic Gain Control (AGC) system used in 800MHz Line Amplifier (55-165703); 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

# 5.4.1.1. 800MHz Line Amplifier (55-165703) Outline Drawing

Drawing number 55-1657103



PRODUCT NUMBER : 55-165703  
 MATERIAL - FRONT PANEL & CHASSIS - ALUMINIUM  
 FINISH - CHASSIS - IRIDITE  
 FRONT PANEL - PAINTED RAL7035  
 PORT P10 - 100 OHM BNC  
 PORT JB1 - 100 OHM BNC  
 CONNECTORS - 'N' TYPE SOCKETS  
 9 WAY 'D' CONNECTOR PLUG  
 XLR DC CONNECTOR PLUG  
 20A FUSE - 250V 20A 5 PIN PLUG  
 IP RATING - IP40

TITLE	800MHZ LINE AMP + FILTERS (INT AMP)
CUSTOMER	55-1657103
OUTLINE DRAWING	

**Aerial Facilities Limited**  
 England  
 Tel : 01494 77000  
 Fax : 01494 77008

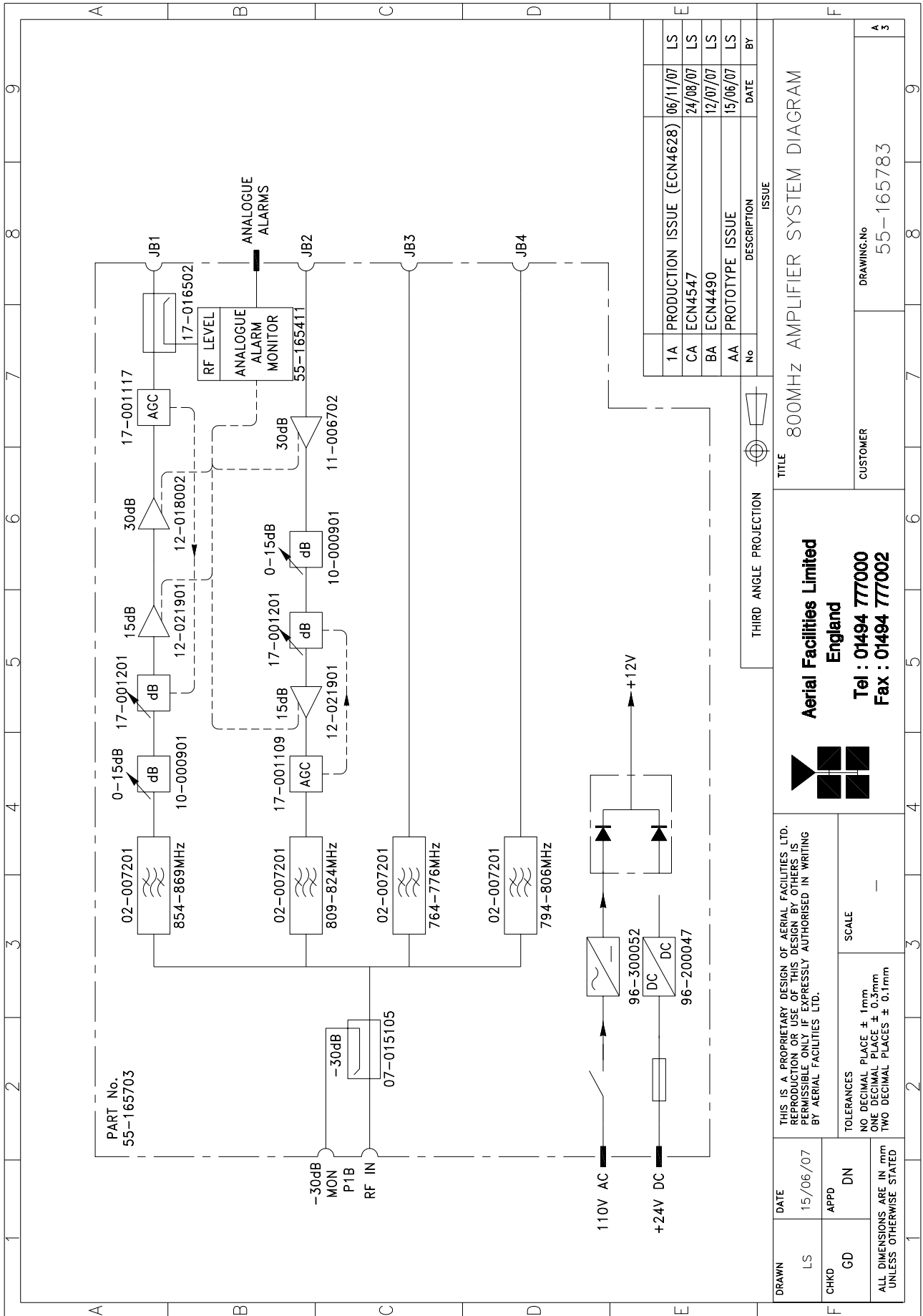
DATE	12/09/07	SCALE	1:3
ISSUE	AA ORIGINAL ISSUE	BY	
EXCEPTION		BY	

NO	DATE	BY	DESCRIPTION
AA	13/09/07	PL	ORIGINAL ISSUE

THIRD ANGLE PROJECTION

### 5.4.1.2. 800MHz Line Amplifier (55-165703) System Diagram

Drawing number 55-165783



No	DESCRIPTION	DATE	BY
1A	PRODUCTION ISSUE (ECN4628)	06/11/07	LS
CA	ECN4547	24/08/07	LS
BA	ECN4490	12/07/07	LS
AA	PROTOTYPE ISSUE	15/06/07	LS

<b>THIRD ANGLE PROJECTION</b>		<b>TITLE</b> 800MHZ AMPLIFIER SYSTEM DIAGRAM	
		<b>CUSTOMER</b> DRAWING No 55-165783	
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.		<b>SCALE</b> NO. DECIMAL PLACES ± 1mm ONE DECIMAL PLACES ± 0.3mm TWO DECIMAL PLACES ± 0.1mm	
<b>DRAWN</b> LS	<b>DATE</b> 15/06/07	<b>APPD</b> DN	<b>ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED</b>



### 5.4.1.3. Bandpass Filter (02-007206)

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

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

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

#### 02-007206 Specification

PARAMETER		SPECIFICATION
Response type		Chebyshev
Frequency range		800 - 950MHz *
Bandwidth		25MHz *
Number of sections		8
Insertion loss		1.2 dB
VSWR		better than 1.2:1
Connectors		SMA female
Power handling		100W max
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C
Weight		3 kg (typical)

\*tuned to Customer's specification

### 5.4.1.4. Wideband Asymmetric Coupler (07-015105)

The purpose of Wideband Asymmetric Coupler (07-015105) is to tap off a known portion (in this case 30dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

#### 07-015105 Specification

PARAMETER		SPECIFICATION
Construction		Inductive air gap
Frequency		800-2500MHz
Through loss		0.4dB (typical)
Coupling level		-30dB ±0.5dB
Isolation		N/A
Weight		<1.0kg
Connectors		SMA, female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

#### 5.4.1.5. 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

#### 5.4.1.6. 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.

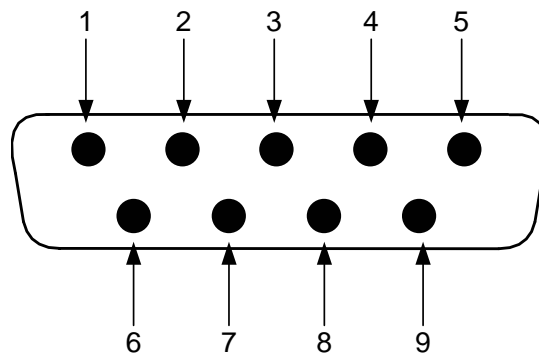
##### 11-006702 Specification

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



**5.4.1.7. Power Amplifier (12-018002)**

This amplifier is a Class A 20W power amplifier from 800-960MHz in a 1 stage balanced configuration. It demonstrates a very high linearity and a very good input/output return loss (RL). It has built in a Current Fault Alarm Function.

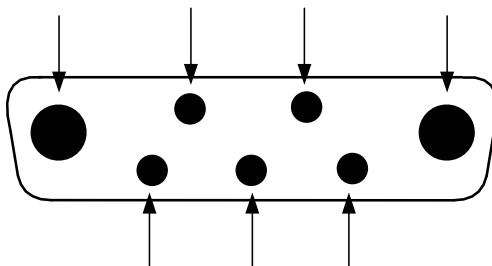
Its housing is an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a D-Type connector for the power supply and the Current Fault Alarm Function.

12-018002 Specification

PARAMETER	SPECIFICATION	
Frequency range:	800-960MHz	
Small signal gain:	30dB	
Gain flatness:	±1.2dB	
I/O Return loss:	>18dB	
1dB compression point:	42.8dBm	
OIP3:	56dBm	
Supply voltage:	24V DC	
Supply current:	5.0Amps (Typical)	
Temperature range	operational:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:	<2kg (no heatsink)	

Power Amplifier (12-018002) 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)



**5.4.1.8. 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.

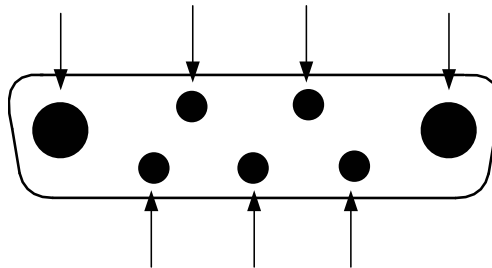
Low Power Amplifier (12-021901) Specification

PARAMETER		SPECIFICATION
Frequency range		800-960MHz*
Bandwidth		20MHz *
Maximum RF output		>1.0 Watt
Gain		15dB
1dB compression point		+30.5dBm
3 <sup>rd</sup> 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)



**5.4.1.9. Automatic Gain Control**

- 17-001109 AGC Detector Assembly (Logarithmic)
- 17-001117 AGC Detector Assembly
- 17-001201 AGC Attenuator Assembly

The sub components 17-001109, 17-001117 & 17-001201 are parts of the Automatic Gain Control (AGC) system used in 800MHz Line Amplifier (55-165703); 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

800MHz Line Amplifier (55-165703) is fitted with two differing types of Automatic Gain Control (AGC) system, one linear, and one logarithmic. The AGC with logarithmic detector (17-001117) is fitted in the uplink path and the AGC with linear detector (17-001109) is fitted in the downlink path

The AFL Automatic Gain Control system consists of two units, a detector/amplifier and an attenuator. The 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. 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

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 detector controller board.

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.

AGC Specification (both types)

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	90grams
	detector/amp	100grams

**5.4.1.10. 12V (Dual) Relay Board (20-001601)**

The General Purpose Relay Board allows the inversion of signals and the isolation of circuits. It is equipped with two dual pole change-over relays with completely isolated wiring, accessed via screw terminals. Both relays are provided with polarity protection diodes and diodes for suppressing the transients caused by "flywheel effect" which can destroy switching transistors or induce spikes on neighbouring circuits. It's common use is to amalgamate all the alarm signals into one, volts-free relay contact pair for the main alarm system.

20-001601 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 <sup>7</sup> operations
Relay approval:		BT type 56
Connector details:		Screw terminals
Temperature range	operational:	-10°C to +60°C
	storage:	-20°C to +70°C

#### 5.4.1.11. 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%
<b>Alarm output relay contacts:</b>		
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 <sup>7</sup> operations
Relay approval		BT type 56
Connector details		Screw terminals
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C

#### 5.4.1.12. 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.

#### 5.4.1.13. DC/DC Converter 96-200047

96-200047 is an O.E.M. high power device with a wide input range and 12.5 amp @ 12V (150Watts) output capability used to derive a 12V fixed voltage power supply rail from a higher voltage supply, in this case 12V. In the event of failure this unit should not be repaired, only replaced.

PARAMETER		SPECIFICATION
DC Input Voltage range		19 to 36V
DC Output voltage		12V ± 1%
Max. current load		12.5Amps
Temperature range	Operation	-10°C to +60°C
	Storage	-20°C to +85°C
Working Humidity		20 to 90% RHNC

#### 5.4.1.14. 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

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



## 5.4.2 700MHz Line Amplifier (55-165704)

Description of 700MHz Line Amplifier (55-165704)

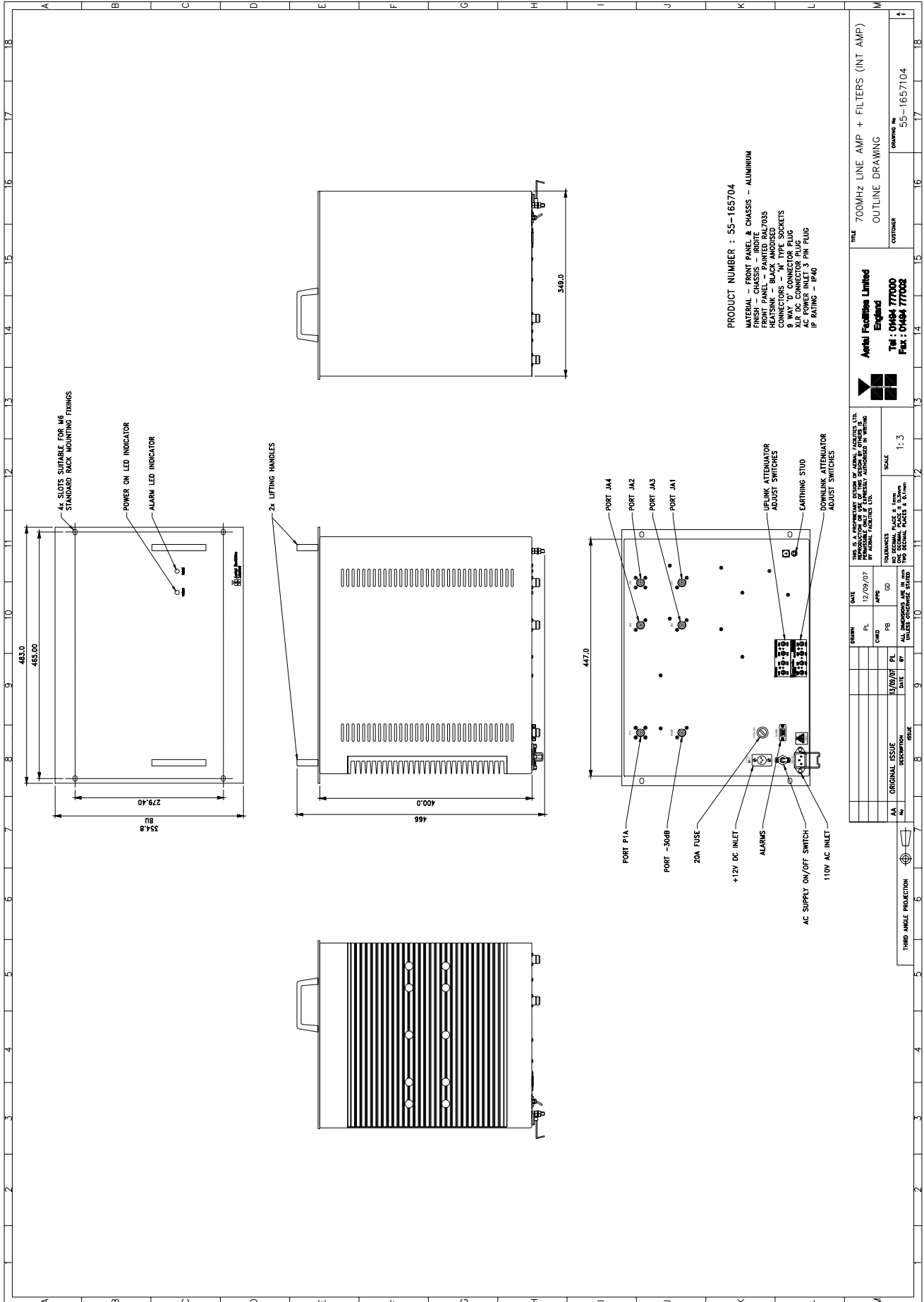
700MHz Line Amplifier (55-165704) List of Major Components

Section	Component Part	Component Part Description	Qty. Per Assembly
5.4.2.3.	02-007206	Bandpass Filter	4
5.4.2.4.	07-015105	Wideband Asymmetric Coupler	1
5.4.2.5.	10-000901	Switched Attenuator 0.25W, 0 - 15dB	2
5.4.2.6.	11-006702	Low Noise Amplifier	1
5.4.2.7.	12-018002	Power Amplifier (20W 800MHz )	1
5.4.2.8.	12-021901	Low Power Amplifier	2
5.4.2.9.	17-001109*	AGC Detector Assembly (Logarithmic)	1
	17-001117*	AGC Detector Assembly	1
	17-001201*	AGC Attenuator Assembly	2
5.4.2.10.	80-008901	12V (Single) Relay Board	1
5.4.2.11.	94-100004	Dual Diode Assembly	1
5.4.2.12.	96-200047	DC/DC Converter	1
5.4.2.13.	96-300052	12V Switch-Mode PSU	1

\*The sub components 17-001109, 17-001117 & 17-001201 are parts of the Automatic Gain Control (AGC) system used in 800MHz Line Amplifier (55-165703); 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

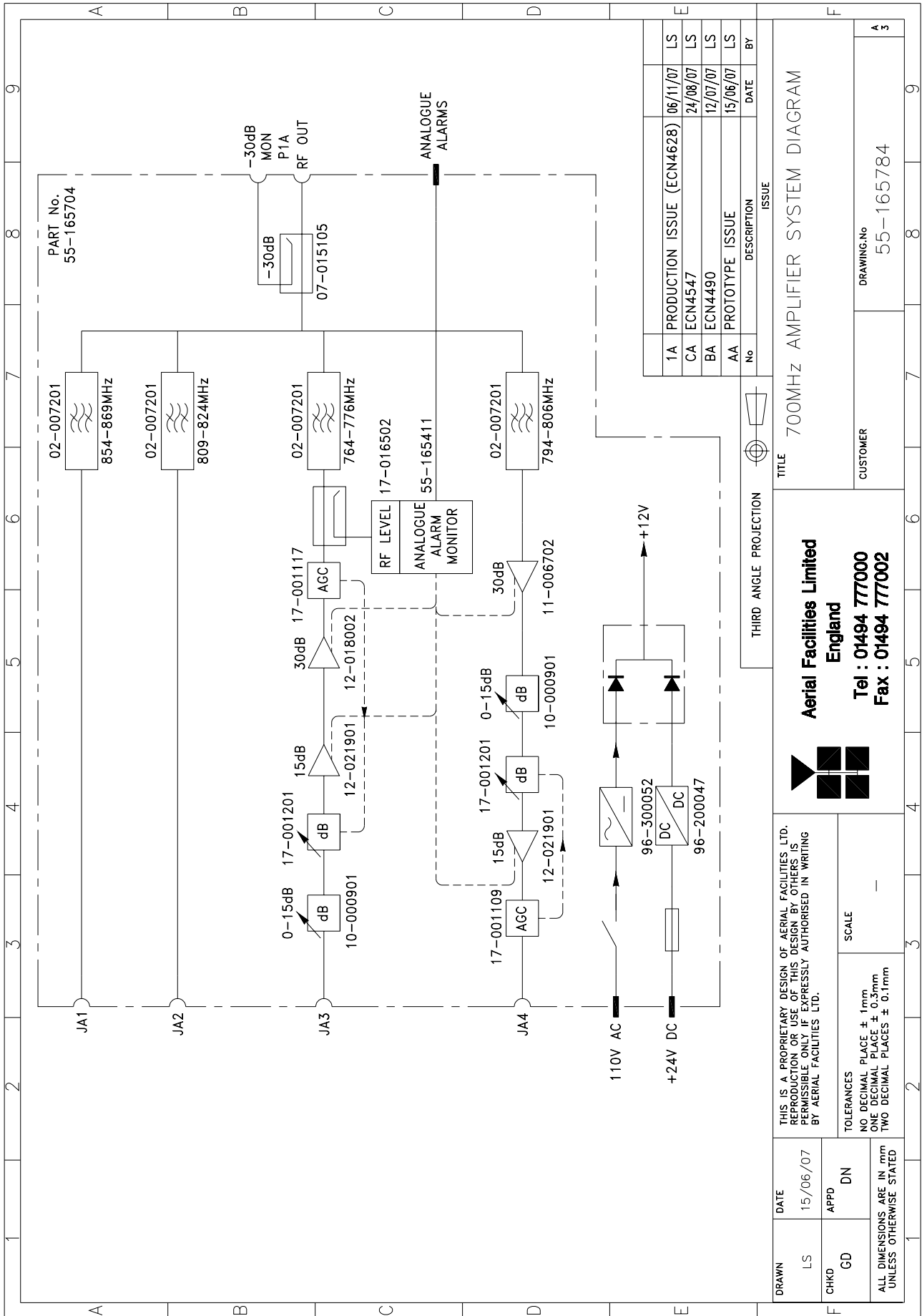
# 5.4.2.1. 700MHz Line Amplifier (55-165704) Outline Drawing

Drawing number 55-1657104



### 5.4.2.2. 700MHz Line Amplifier (55-165704) System Diagram

Drawing number 55-165784



### 5.4.2.3. Bandpass Filter (02-007206)

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

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

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

#### 02-007206 Specification

PARAMETER		SPECIFICATION
Response type		Chebyshev
Frequency range		800 - 950MHz *
Bandwidth		25MHz *
Number of sections		8
Insertion loss		1.2 dB
VSWR		better than 1.2:1
Connectors		SMA female
Power handling		100W max
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C
Weight		3 kg (typical)

\*tuned to Customer's specification

### 5.4.2.4. Wideband Asymmetric Coupler (07-015105)

The purpose of Wideband Asymmetric Coupler (07-015105) is to tap off a known portion (in this case 30dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

#### 07-015105 Specification

PARAMETER		SPECIFICATION
Construction		Inductive air gap
Frequency		800-2500MHz
Through loss		0.4dB (typical)
Coupling level		-30dB ±0.5dB
Isolation		N/A
Weight		<1.0kg
Connectors		SMA, female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

#### 5.4.2.5. 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

#### 5.4.2.6. 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.

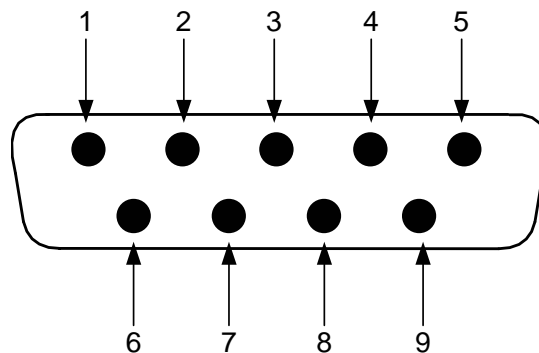
##### 11-006702 Specification

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



**5.4.2.7. Power Amplifier (12-018002)**

This amplifier is a Class A 20W power amplifier from 800-960MHz in a 1 stage balanced configuration. It demonstrates a very high linearity and a very good input/output return loss (RL). It has built in a Current Fault Alarm Function.

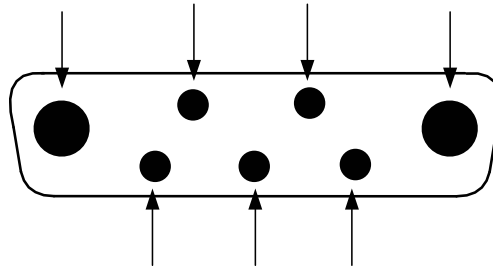
Its housing is an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a D-Type connector for the power supply and the Current Fault Alarm Function.

12-018002 Specification

PARAMETER		SPECIFICATION
Frequency range:		800-960MHz
Small signal gain:		30dB
Gain flatness:		±1.2dB
I/O Return loss:		>18dB
1dB compression point:		42.8dBm
OIP3:		56dBm
Supply voltage:		24V DC
Supply current:		5.0Amps (Typical)
Temperature range	operational:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:		<2kg (no heatsink)

Power Amplifier (12-018002) 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)



**5.4.2.8. 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.

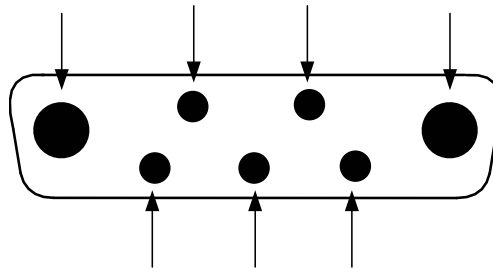
Low Power Amplifier (12-021901) Specification

PARAMETER		SPECIFICATION
Frequency range		800-960MHz*
Bandwidth		20MHz *
Maximum RF output		>1.0 Watt
Gain		15dB
1dB compression point		+30.5dBm
3 <sup>rd</sup> 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)



**5.4.2.9. Automatic Gain Control**

- 17-001109 AGC Detector Assembly (Logarithmic)
- 17-001117 AGC Detector Assembly
- 17-001201 AGC Attenuator Assembly

The sub components 17-001109, 17-001117 & 17-001201 are parts of the Automatic Gain Control (AGC) system used in 700MHz Line Amplifier (55-165704); 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

700MHz Line Amplifier (55-165704) is fitted with two differing types of Automatic Gain Control (AGC) system, one linear, and one logarithmic. The AGC with logarithmic detector (17-001117) is fitted in the uplink path and the AGC with linear detector (17-001109) is fitted in the downlink path

The AFL Automatic Gain Control system consists of two units, a detector/amplifier and an attenuator. The 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. 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

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 detector controller board.

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.

AGC Specification (both types)

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	90grams
	detector/amp	100grams

**5.4.2.10. 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%
<b>Alarm output relay contacts:</b>		
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 <sup>7</sup> operations
Relay approval		BT type 56
Connector details		Screw terminals
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C

#### 5.4.2.11. 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.

#### 5.4.2.12. DC/DC Converter 96-200047

96-200047 is an O.E.M. high power device with a wide input range and 12.5 amp @ 12V (150Watts) output capability used to derive a 12V fixed voltage power supply rail from a higher voltage supply, in this case 12V. In the event of failure this unit should not be repaired, only replaced.

PARAMETER		SPECIFICATION
DC Input Voltage range		19 to 36V
DC Output voltage		12V ± 1%
Max. current load		12.5Amps
Temperature range	Operation	-10°C to +60°C
	Storage	-20°C to +85°C
Working Humidity		20 to 90% RHNC

#### 5.4.2.13. 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

### 5.4.3. 700MHz FO MASTER ATTENUATOR (55-165604)

Description of 700MHz FO MASTER ATTENUATOR(55-165604)

700MHz FO MASTER ATTENUATOR(55-165604) List of Major Components

Component Part	Component Part Description	Qty. Per Assembly
10-000701	Switched Attenuator 0.25Watt, 0 - 30dB	2

#### 5.4.3.1. 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

#### 5.4.4. F/O Link Subsystem (98-800001)

F/O Link Subsystem (98-800001) is an O.E.M. sourced Optical Transceiver package containing discreet TX and RX modules and supplied as a 1U rack mount tray

Parameter	Specification
Optical Output Power	4 mW
Wavelength, peak	1310 1550 nm
Frequency Response, 50 to 2.2 GHz	± 1.5 dB
Input and Output VSWR	1.5:1
Link Gain <sup>(2)</sup>	0 dB
Output Noise Floor <sup>(1)</sup>	-137 dBm/Hz
Input 3rd Order Intercept <sup>(1)</sup>	30 dBm
Operating Temperature	-30 to +75°C
Storage Temperature	-40 to +85°C
Maximum RF Input to Transmitter	+20 dBm
Maximum Optical Input to Receiver	6 mW
A.C. Supply Voltage	90 – 265 VAC
Dimensions	483 x 457 x 44mm (19.0 x 18 x 1.72 in.)

<sup>(1)</sup> SFDR, Noise and IP3 specified with 5 dB optical loss.

<sup>(2)</sup> Link Gain specified with 1 meter fiber.

#### 5.4.5. Optical AB Switch FC/APC (98-700002)

Optical A/B Switch FC/APC (98-700002) an O.E.M. sourced Fibre Optic relay supplied as a 1U rack mount tray. 98-700002 allows for the automatic switching between two optical inputs to provide a common optical output. Manual selection of the input is also possible via toggle switches on the front panel.

98-700002 Specification

PARAMETER	SPECIFICATION
Electrical Characteristics	
Power Supply Voltage	100 - 240 VAC
Power Supply Frequency	50 - 60 Hz
Optical Characteristics	
Operating Wavelength	1200 – 1610nm
Optical Input Range	+20 dBm
Optical Insertion Loss	2.0 dB
Optical Trip Threshold/Meter Range	-35 - +20 dBm
Optical Switch Speed	15ms
Backreflection Tolerance	-50dB
Environmental and Physical Characteristics	
Optical Connectors	FC/APC
Operating Temp. Range	+10 to +40°C
Storage Temp. Range	-40 to +80 °C
Humidity	5 to 90 % RHNC
Weight	2.2 kg (6 lbs)
Dimensions	483 x 361 x 44mm (19.0 x 14.2 x 1.72 in.)

#### 5.4.6. Fibre Optic Splitter (55-165507)

Fibre Optic Splitter (55-165507) is a 1U rack mount tray containing an optical splitter/coupler

Fibre Optic Splitter (55-165507) List of Major Sub Components

Component Part	Component Part Description	Qty. Per Assembly
98-100001	Single Mode Optical Splitter/Coupler	1

##### 5.4.6.1. Single Mode Optical Splitter/Coupler (98-100001)

Single Mode Optical Splitter/Couplers are used whenever it is necessary to split or combine outputs from optical transmitters or inputs to receivers. Operators should be aware that a small insertion loss (typically 3-4dB) is common with these type of couplers.

Single Mode Optical Splitter/Coupler (98-100001) It is an O.E.M unit featuring almost negligible insertion loss to the F/O signal. Extreme caution should be exercised when handling these devices. Special attention should be shown to the connectors; repair of a broken Splitter/Coupler is not possible; replacement is the only option.

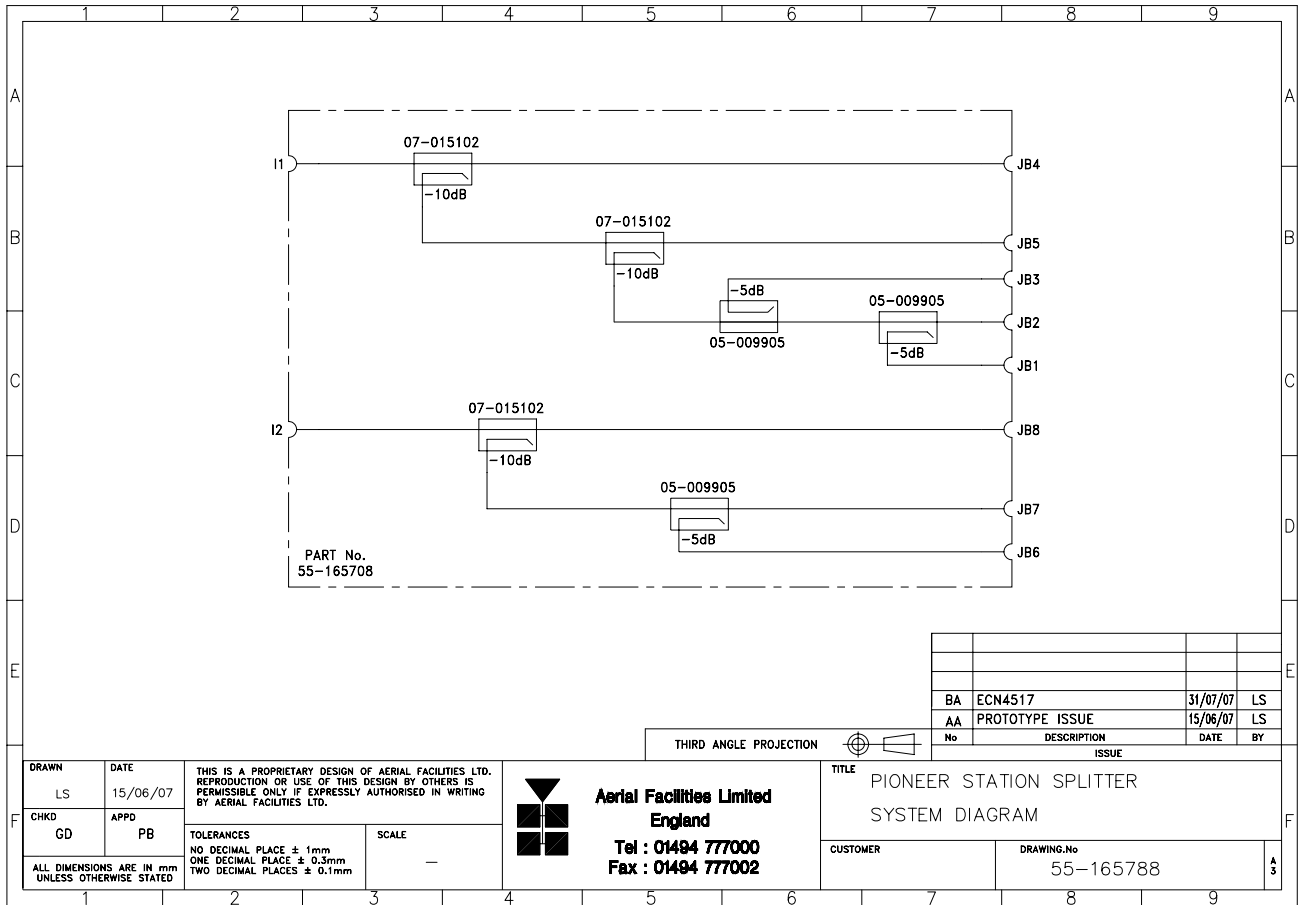
In the Fibre Optic Splitter (55-165507) in 700MHZ KCM Master Site / Pioneer Sq. (80-330652), Single Mode Optical Splitter/Coupler (98-100001) is used to split the optical signal from the FO TX module in F/O Link Subsystem (98-700001) into two equal paths.

### 5.4.7. PIONEER ST. SPLITTER (55-165708)


PIONEER ST. SPLITTER (55-165708) List of major Components

Component Part	Component Part Description	Qty. Per Assembly
05-009905	2 Way Power Splitter/Combiner 70/30	3
07-015102	Wideband Asymmetric Coupler	3

PIONEER ST. SPLITTER (55-165708) System Diagram  
Drawing number 55-165788



No	DESCRIPTION	DATE	BY
BA	ECN4517	31/07/07	LS
AA	PROTOTYPE ISSUE	15/06/07	LS

<b>DRAWN</b> LS	<b>DATE</b> 15/06/07	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.	 <b>Aerial Facilities Limited</b> <b>England</b> <b>Tel : 01494 777000</b> <b>Fax : 01494 777002</b>	<b>TITLE</b> PIONEER STATION SPLITTER SYSTEM DIAGRAM
<b>CHKD</b> GD	<b>APPD</b> PB			<b>TOLERANCES</b> NO DECIMAL PLACE ± 1mm ONE DECIMAL PLACE ± 0.3mm TWO DECIMAL PLACES ± 0.1mm
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED				<b>DRAWING.No</b> 55-165788

### 5.4.7.1. 2 Way Power Splitter/ Combiner 70/30 (05-009905)

The power Splitter/Combiner 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, return and insertion losses are kept to a minimum. Any unused ports will be terminated with an appropriate 50Ω load. Power devices such as these, typically give 10dB better output isolation than low power equivalents – (important for splitters that feed antenna systems).

05-009905 Specification

Specification		Parameter
Frequency Range		764 – 860MHz
Impedence		50Ω
Insertion Loss		≤ ± 0.3dB
VSWR		1.25:1
Maximum input power	Splitter	100Watts
	Combiner	5Watts
Power splitting/combining ratio		70% - 30%
RF Connectors		N Female
Dimensions		104mm x 63mm x 46mm
Temperature range	operation:	-20°C to +60°C
	storage:	-40°C to +70°C

### 5.4.7.2. Wideband Asymmetric Coupler (07-015102)

The purpose of Wideband Asymmetric Coupler (07-015102) is to tap off a known portion (in this case 10dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

07-015102 Specification

PARAMETER		SPECIFICATION
Frequency Range		800 - 2500 MHz
Coupling Value		10 dB ± 1.0 dB
Main Line Insertion Loss		<1.6 dB
VSWR		1.4:1
Directivity		>18 dB
Power Rating		200 Watts
RF Connectors		'N' female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

## 6. BEACON HILL STATION MASTER SITE 1 (80-330551-1)

Cabinet number C19-CR-05

from top of rack

55-165504

55-165501

55-165501

55-165502

98-800001

98-700002

55-165507

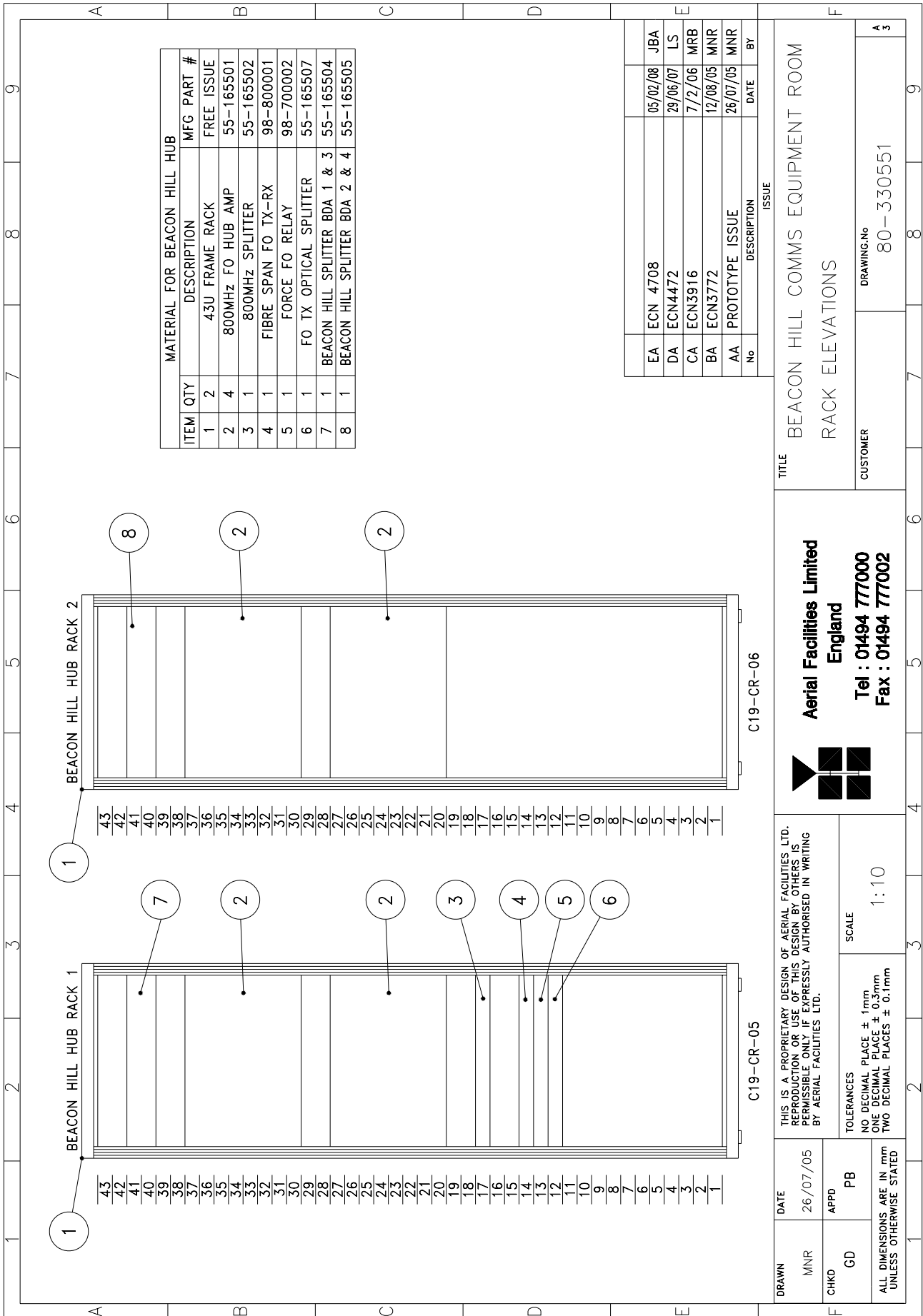
Beacon Hill Station Master Site 1 (80-330551-1) List of major Components

Section	Component Part	Component Part Description	Qty. Per Assembly
6.3.1.	55-165501	800MHz FO HUB AMP	2
6.3.2.	55-165502	800MHz FO HUB SPLITTER/COMB	1
6.3.3.	55-165504	BEACON HILL SPLITTER (BDA 1 & 3)	1
6.3.4.	55-165507	FIBRE OPTIC SPLITTER	1
6.3.5.	98-700002	OPTICAL A/B SWITCH FC/APC	1
6.3.6.	98-800001	2GHz 1.5um F/O LINK SUBSYSTEM	1



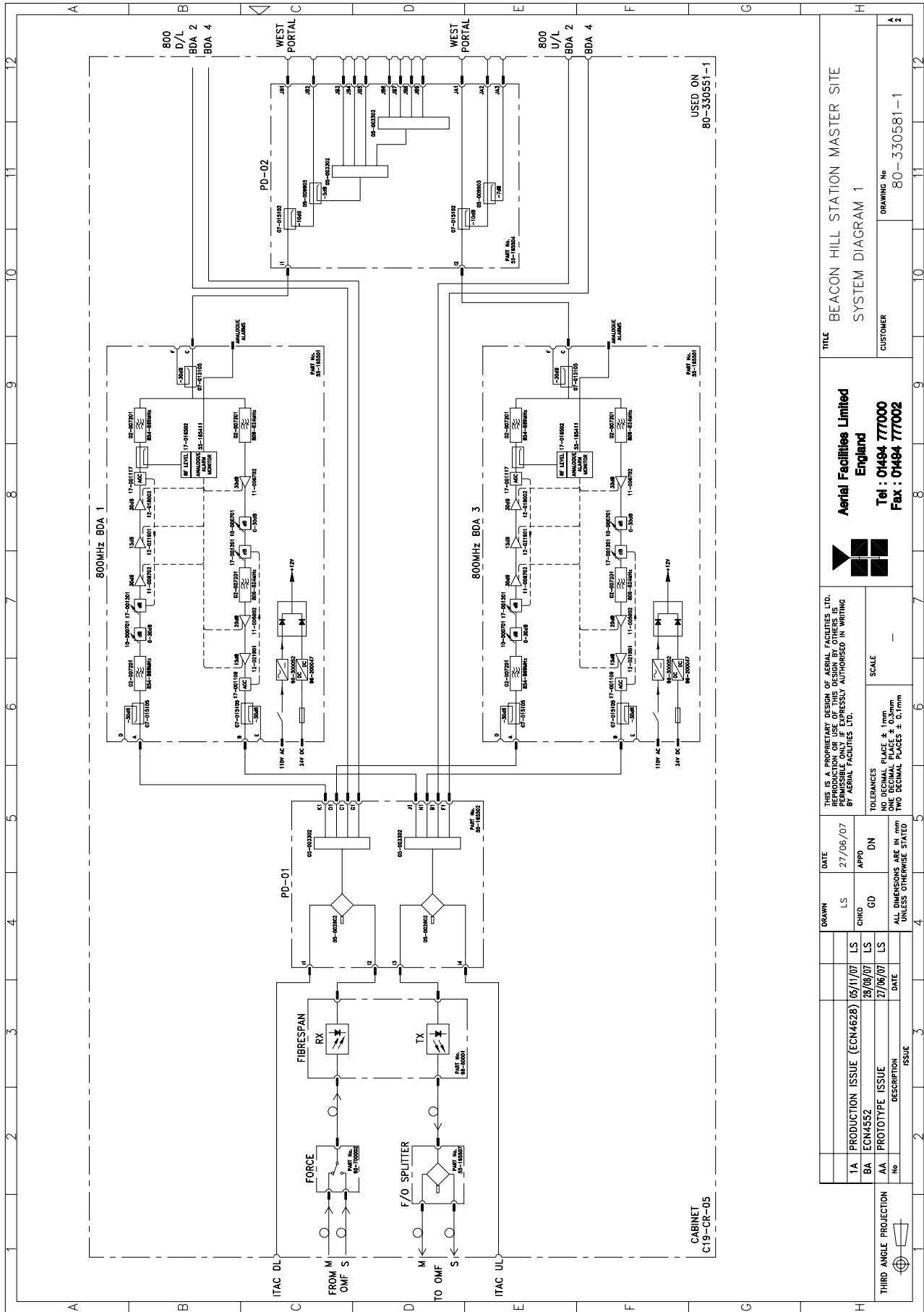
# 6.1. Beacon Hill Station Master Site 1 (80-330551-1) Rack Elevation

Drawing number 80-330551



# 6.2. Beacon Hill Station Master Site 1 (80-330551-1) System Diagram

Drawing number 80-330581-1



**Beacon Hill Station Master Site 1 (80-330551-1) Alarm Wiring Diagram \*\*\*//\*\*\***  
**Approval In Progress G.D.**  
Drawing number 80-330521-1

### 6.3. Beacon Hill Station Master Site 1 (80-330551-1) Sub Components

#### 6.3.1. 800MHz FO HUB AMP (55-165501)

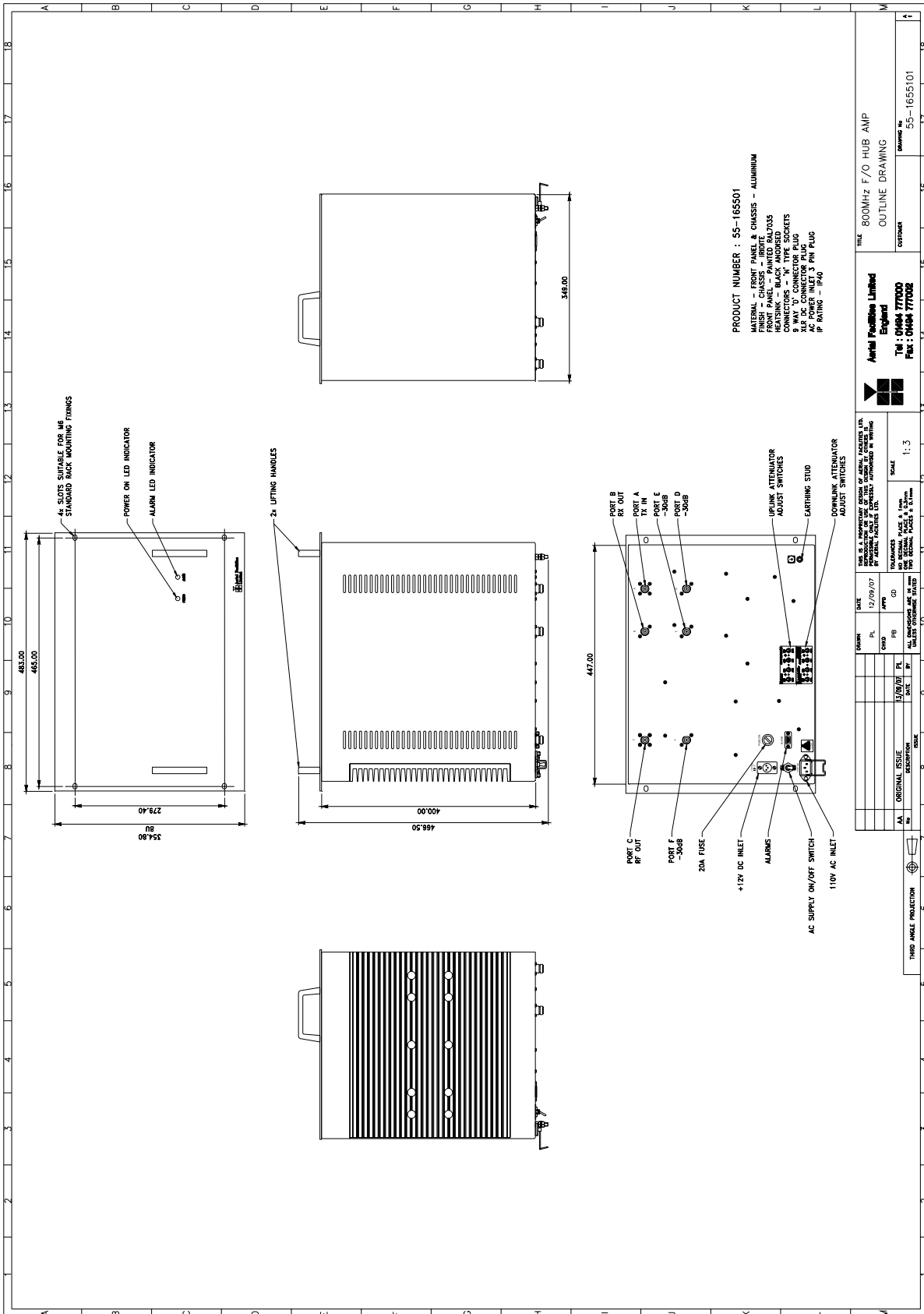
800MHz FO HUB AMP (55-165501) List of major components

Section	Component Part	Component Part Description	Qty. Per Assembly
6.3.1.3.	02-007206	Bandpass Filter	4
6.3.1.4.	07-015105	Wideband Asymmetric Coupler	3
6.3.1.5.	10-000701	Switched Attenuator 0.25Watt, 0 - 30dB	2
6.3.1.6.	11-005902	Low Noise Amplifier	1
6.3.1.7.	11-006702	Low Noise Amplifier	2
6.3.1.8.	12-018002	Power Amplifier	1
6.3.1.9.	12-021901	Low Power Amplifier	2
6.3.1.10.	17-001109*	AGC Detector Assembly (Logarithmic)	1
	17-001117*	AGC Detector Assembly	1
	17-001201*	AGC Attenuator Assembly	2
6.3.1.11.	20-001601	12V (Dual) Relay Board	1
6.3.1.12.	80-008901	12V (Single) Relay Board	1
6.3.1.13.	94-100004	Dual Diode Assembly	1
6.3.1.14.	96-200047	DC/DC Converter	
6.3.1.15.	96-300052	12V Switch-Mode PSU	1

\*The sub components 17-001109, 17-001117 & 17-001201 are parts of the Automatic Gain Control (AGC) system used in 800MHz FO HUB AMP (55-165501); 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

### 6.3.1.1. 800MHz FO HUB AMP (55-165501) Outline drawing

Drawing number 55-1655101



DATE	12/09/07	DATE	12/09/07
DESIGNER	PL	APPD	CO
CHKD	FB	CHKD	CO
DATE	12/09/07	DATE	12/09/07
SCALE	1:3	SCALE	1:3

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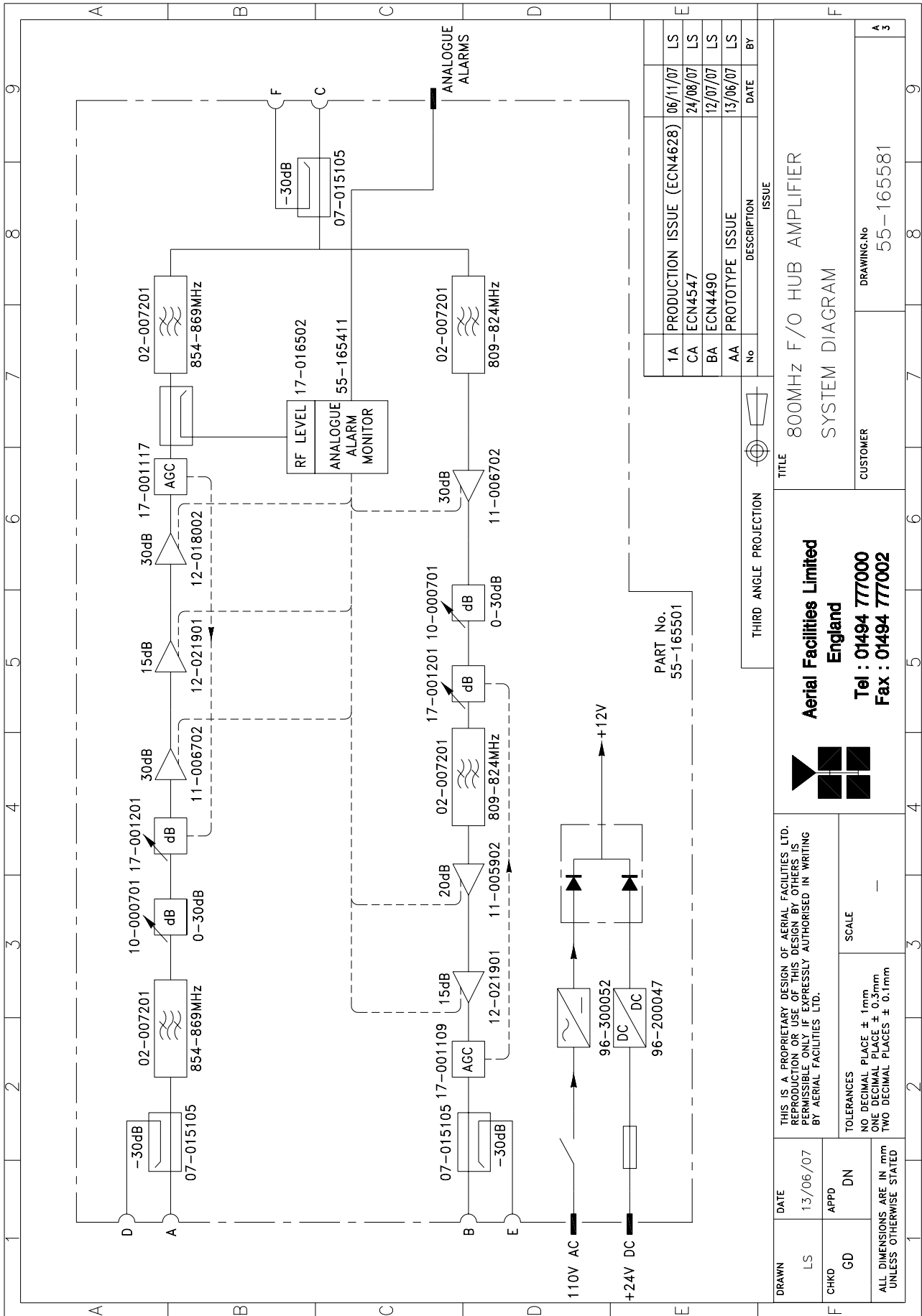
ORIGINAL ISSUE  
 DESCRIPTION  
 DATE  
 THIRD ANGLE PROJECTION

**Aerial Facilities Limited**  
 England  
 TEL : 01494 777000  
 FAX : 01494 777002

TITLE 800MHz F/O HUB AMP  
 OUTLINE DRAWING  
 DRAWING No 55-1655101

### 6.3.1.2. 800MHz FO HUB AMP (55-165501) System Diagram

Drawing number 55-165581



### 6.3.1.3. Bandpass Filter (02-007206)

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

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

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

#### 02-007206 Specification

PARAMETER		SPECIFICATION
Response type		Chebyshev
Frequency range		800 - 950MHz *
Bandwidth		25MHz *
Number of sections		8
Insertion loss		1.2 dB
VSWR		better than 1.2:1
Connectors		SMA female
Power handling		100W max
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C
Weight		3 kg (typical)

\*tuned to Customer's specification

### 6.3.1.4. Wideband Asymmetric Coupler (07-015105)

The purpose of Wideband Asymmetric Coupler (07-015105) is to tap off a known portion (in this case 30dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

#### 07-015105 Specification

PARAMETER		SPECIFICATION
Construction		Inductive air gap
Frequency		800-2500MHz
Through loss		0.4dB (typical)
Coupling level		-30dB ±0.5dB
Isolation		N/A
Weight		<1.0kg
Connectors		SMA, female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

### 6.3.1.5. 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



### 6.3.1.6. Low Noise Amplifier (11-005902)

The Gallium-Arsenide 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 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 any alarm system. There is a Current Fault Alarm Function, which indicates failure of each one or both RF transistors by a various alarm output options. The amplifier is housed in an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a 9way D-type for DC and alarm outputs.

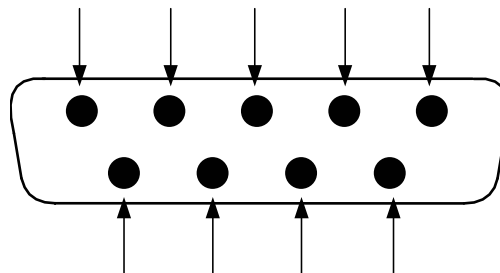
#### 11-005902 Specification

PARAMETER		SPECIFICATION
Frequency range:		800 – 960MHz *
Bandwidth:		<170MHz
Gain:		19.5dB (typical)
1dB compression point:		21dBm
OIP3:		33dBm
Input/output return loss:		>20dB
Noise figure:		1dB (typical)
Power consumption:		190mA @ 24V DC
Supply voltage:		10-24V DC
Connectors:		SMA female
Temperature range	operational:	-10°C to +60°C
	storage:	-40°C to +70°C
Size:		90 x 55 x 30.2mm
Weight:		0.28kg

\*tuned to Customer's specification

#### LNA 'D' Connector Pin-out details

Connector pin	Signal
1	+Ve input (10-24V)
2	GND
3	Alarm relay O/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



### 6.3.1.7. 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.

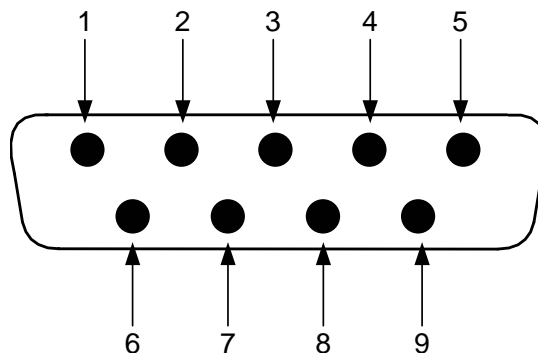
#### 11-006702 Specification

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 Relay O/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



### 6.3.1.8. Power Amplifier (12-018002)

This amplifier is a Class A 20W power amplifier from 800-960MHz in a 1 stage balanced configuration. It demonstrates a very high linearity and a very good input/output return loss (RL). It has built in a Current Fault Alarm Function.

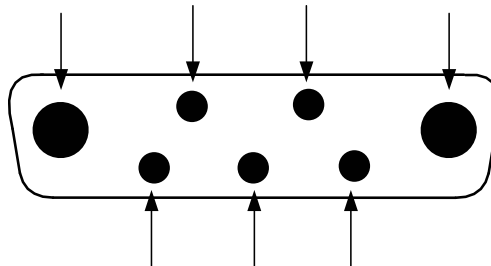
Its housing is an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a D-Type connector for the power supply and the Current Fault Alarm Function.

#### 12-018002 Specification

PARAMETER		SPECIFICATION
Frequency range		800-960MHz
Small signal gain		30dB
Gain flatness		±1.2dB
I/O Return loss		>18dB
1dB compression point		42.8dBm
OIP3		56dBm
Supply voltage		24V DC
Supply current		5.0Amps (Typical)
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C
Weight		<2kg (no heatsink)

#### Power Amplifier (12-018002) 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)



### 6.3.1.9. 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.

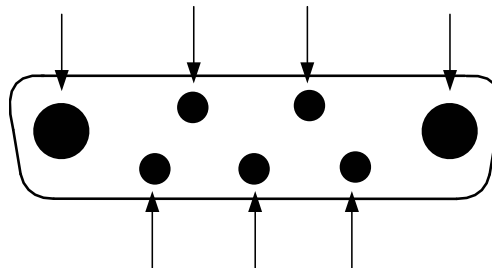
#### Low Power Amplifier (12-021901) Specification

PARAMETER		SPECIFICATION
Frequency range		800-960MHz*
Bandwidth		20MHz *
Maximum RF output		>1.0 Watt
Gain		15dB
1dB compression point		+30.5dBm
3 <sup>rd</sup> 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)



### 6.3.1.10. Automatic Gain Control

17-001109	AGC Detector Assembly (Logarithmic)
17-001117	AGC Detector Assembly
17-001201	AGC Attenuator Assembly

The sub components 17-001109, 17-001117 & 17-001201 are parts of the Automatic Gain Control (AGC) system used in 800MHz FO HUB AMP (55-165501); 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

800MHz FO HUB AMP (55-165501) is fitted with two differing types of Automatic Gain Control (AGC) system, one linear, and one logarithmic. The AGC with logarithmic detector (17-001117) is fitted in the uplink path and the AGC with linear detector (17-001109) is fitted in the downlink path

The AFL Automatic Gain Control system consists of two units, a detector/amplifier and an attenuator. The 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. 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

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 detector controller board.

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.

AGC Specification (both types)

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	90grams
	detector/amp	100grams

**6.3.1.11. 12V (Dual) Relay Board (20-001601)**

The General Purpose Relay Board allows the inversion of signals and the isolation of circuits. It is equipped with two dual pole change-over relays with completely isolated wiring, accessed via screw terminals. Both relays are provided with polarity protection diodes and diodes for suppressing the transients caused by "flywheel effect" which can destroy switching transistors or induce spikes on neighbouring circuits. It's common use is to amalgamate all the alarm signals into one, volts-free relay contact pair for the main alarm system.

20-001601 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 $\mu$ A/10.0mV
Relay isolation:		1.5kV
Mechanical life:		>2x10 <sup>7</sup> operations
Relay approval:		BT type 56
Connector details:		Screw terminals
Temperature range	operational:	-10°C to +60°C
	storage:	-20°C to +70°C

### 6.3.1.12. 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%
<b>Alarm output relay contacts:</b>		
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 <sup>7</sup> operations
Relay approval		BT type 56
Connector details		Screw terminals
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C

### 6.3.1.13. 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.

### 6.3.1.14. DC/DC Converter 96-200047

96-200047 is an O.E.M. high power device with a wide input range and 12.5 amp @ 12V (150Watts) output capability used to derive a 12V fixed voltage power supply rail from a higher voltage supply, in this case 12V. In the event of failure this unit should not be repaired, only replaced.

PARAMETER		SPECIFICATION
DC Input Voltage range		19 to 36V
DC Output voltage		12V ± 1%
Max. current load		12.5Amps
Temperature range	Operation	-10°C to +60°C
	Storage	-20°C to +85°C
Working Humidity		20 to 90% RHNC

### 6.3.1.15. 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



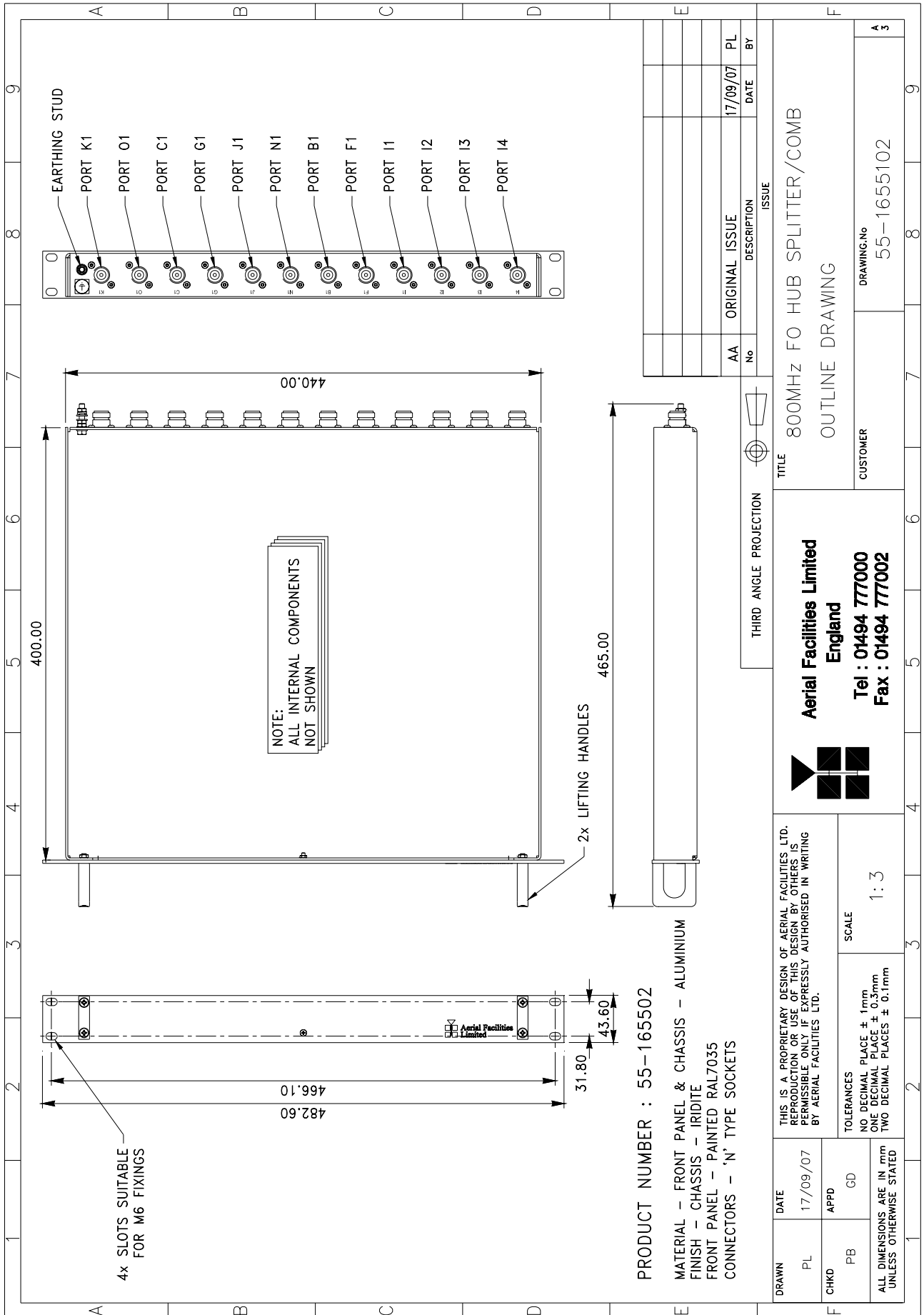
### 6.3.2. 800MHz FO HUB SPLITTER/COMB (55-165502)

800MHz FO HUB SPLITTER/COMB (55-165502) List of major components

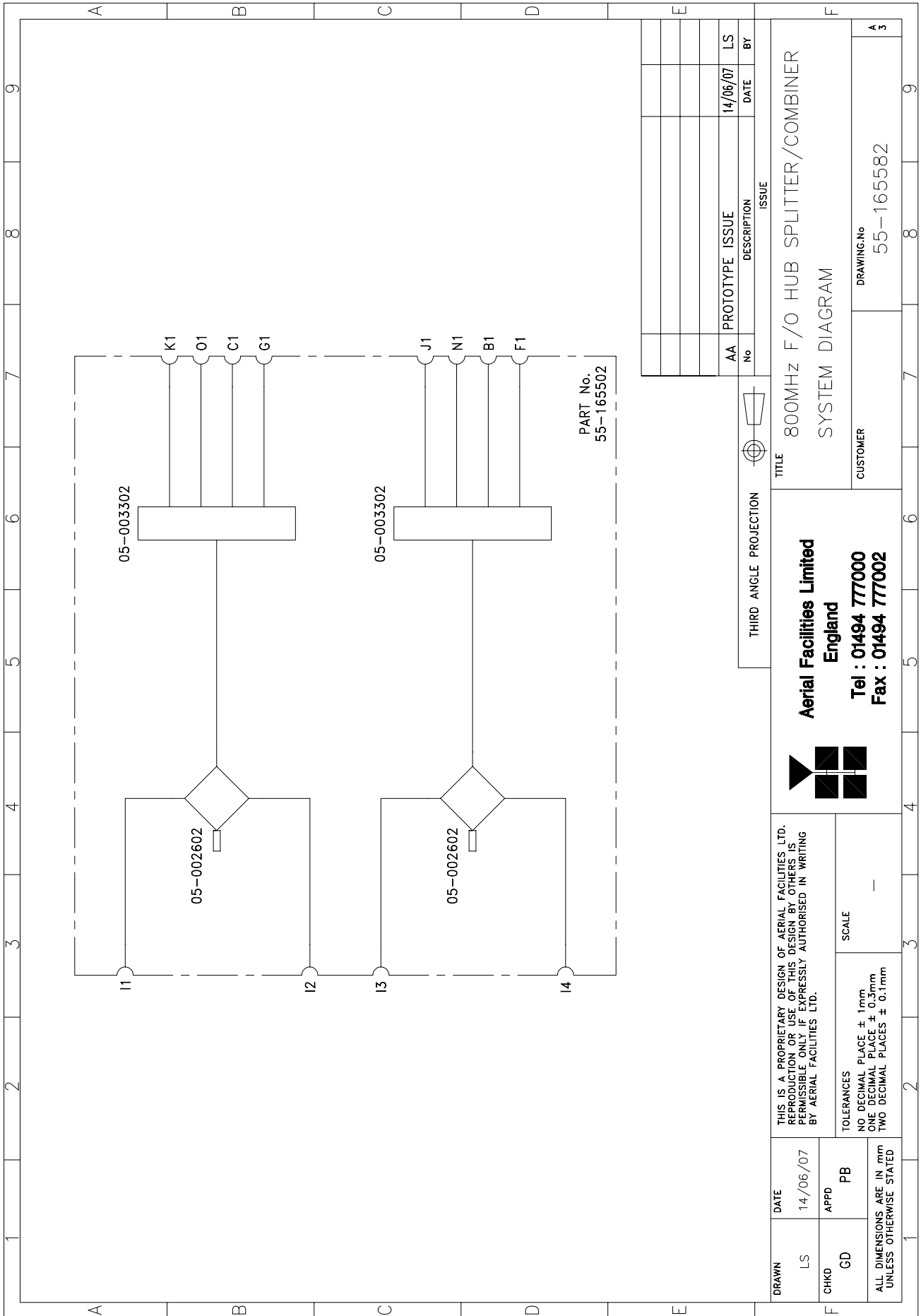
Section	Component Part	Component Part Description	Qty. Per Assembly
6.3.2.3.	05-002602	900MHZ SPLITTER/COMBINER, 20W	2
6.3.2.4.	05-003302	Four Way Splitter/Combiner	2

### 6.3.2.1. 800MHz FO HUB SPLITTER/COMB (55-165502) Outline Drawing

Drawing number 55-1655102



**6.3.2.2. 800MHz FO HUB SPLITTER/COMB (55-165502) System Diagram**  
 Drawing number 55-165582



### 6.3.2.3. 900MHz Splitter/Combiner (05-002602)

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.

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

#### 05-002602 Specification

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

### 6.3.2.4. 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

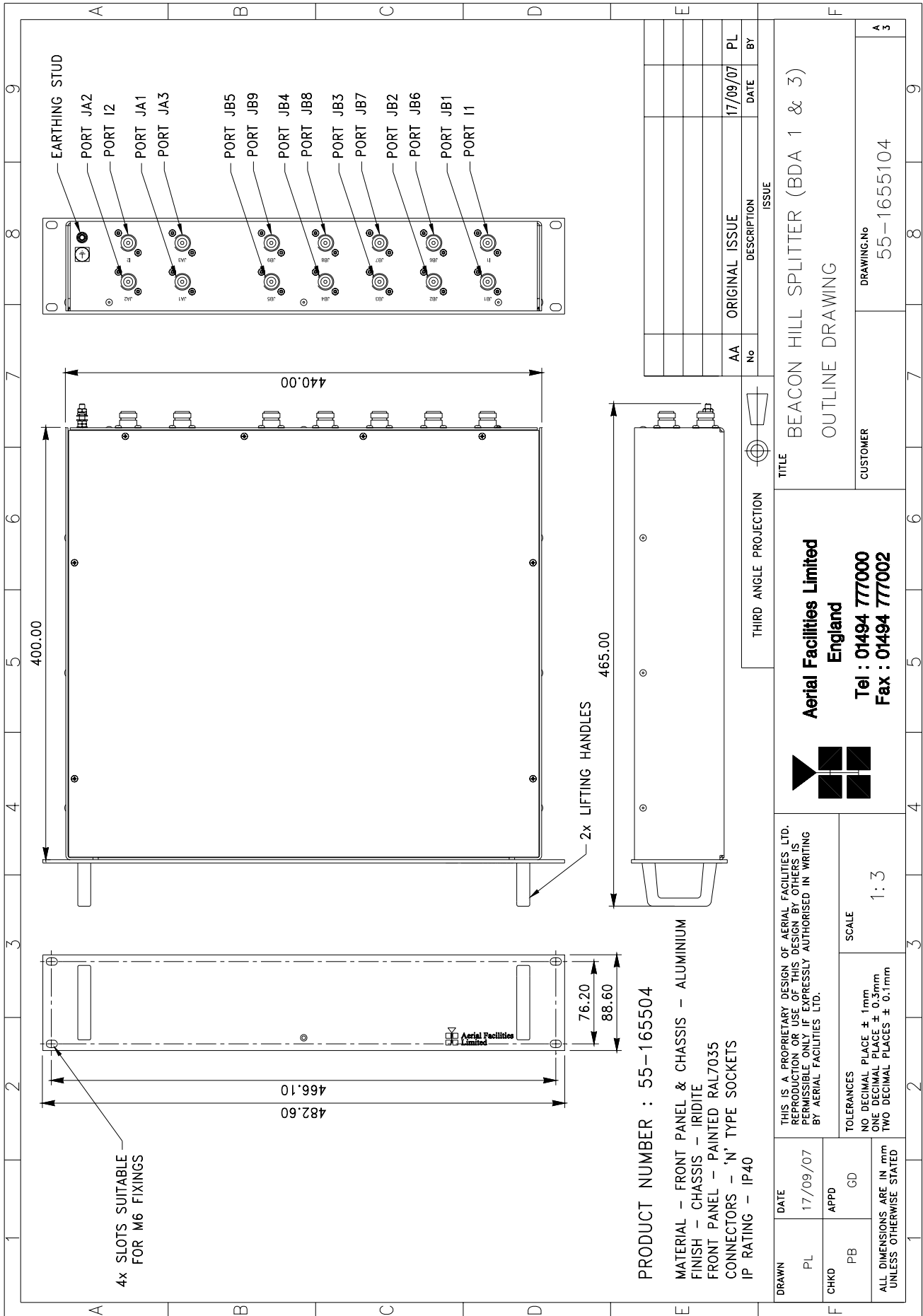
### 6.3.3. BEACON HILL SPLITTER (BDA 1 & 3) (55-165504)

BEACON HILL SPLITTER (BDA 1 & 3) (55-165504) List of major Components

Section	Component Part	Component Part Description	Qty. Per Assembly
6.3.3.3.	05-003302	Four Way Splitter/Combiner	2
6.3.3.4.	05-009903	2 Way Power Splitter/ Combiner 80/20	1
6.3.3.5.	05-009905	2 Way Power Splitter/ Combiner 70/30,	1
6.3.3.6.	07-015102	Wideband Asymmetric Coupler	2

### 6.3.3.1. BEACON HILL SPLITTER (BDA 1 & 3) (55-165504) Outline Drawing

Drawing number 55-1655104



PRODUCT NUMBER : 55-165504  
 MATERIAL - FRONT PANEL & CHASSIS - ALUMINIUM  
 FINISH - CHASSIS - IRIDITE  
 FRONT PANEL - PAINTED RAL7035  
 CONNECTORS - 'N' TYPE SOCKETS  
 IP RATING - IP40

DRAWN	DATE	17/09/07
PL		
CHKD	APPD	GD
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED		

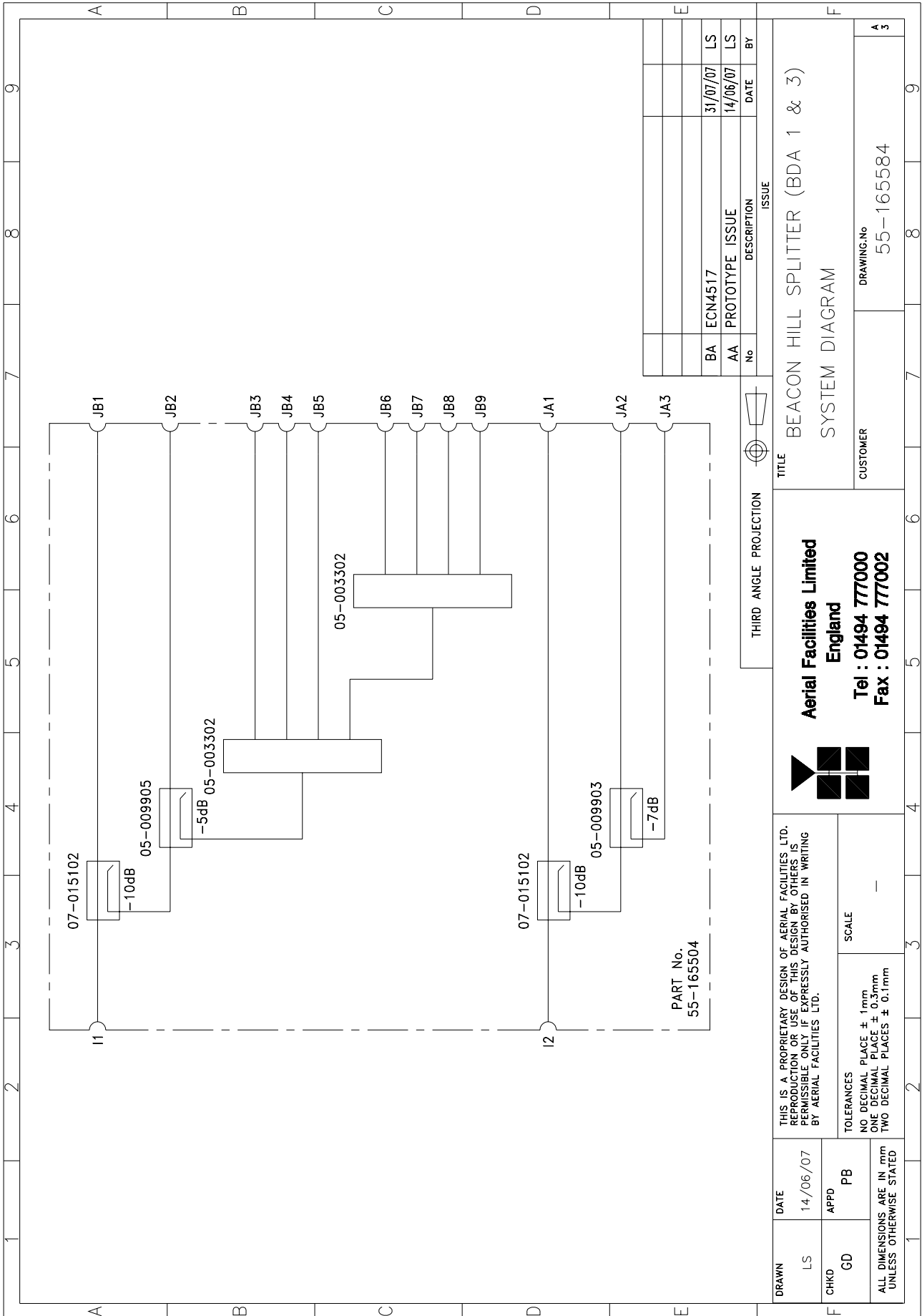
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NO. DECIMAL PLACES ± 1mm	1:3
ONE DECIMAL PLACE ± 0.3mm	
TWO DECIMAL PLACES ± 0.1mm	

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THIRD ANGLE PROJECTION	
AA No	ORIGINAL ISSUE
PL	DATE
BY	DATE
ISSUE	
TITLE	
BEACON HILL SPLITTER (BDA 1 & 3)	
OUTLINE DRAWING	
CUSTOMER	DRAWING No
	55-1655104
	A 3

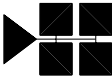
### 6.3.3.2. BEACON HILL SPLITTER (BDA 1 & 3) (55-165504) System Diagram

Drawing number 55-165584



No	DESCRIPTION	DATE	BY
BA	ECN4517	31/07/07	LS
AA	PROTOTYPE ISSUE	14/06/07	LS

<b>TITLE</b> BEACON HILL SPLITTER (BDA 1 & 3) SYSTEM DIAGRAM	
<b>CUSTOMER</b> DRAWING No 55-165584	A 3

  
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**TOLERANCES**  
 NO DECIMAL PLACE ± 1mm  
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**SCALE**  
 -

<b>DRAWN</b>	LS	<b>DATE</b>	14/06/07
<b>CHKD</b>	GD	<b>APPD</b>	PB
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED			

### 6.3.3.3. 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

### 6.3.3.4. 2 Way Power Splitter/ Combiner 80/20 (05-009903)

The power Splitter/Combiner 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, return and insertion losses are kept to a minimum. Any unused ports will be terminated with an appropriate 50Ω load. Power devices such as these, typically give 10dB better output isolation than low power equivalents – (important for splitters that feed antenna systems).

#### 05-009903 Specification

Specification		Parameter
Frequency Range		764 – 860MHz
Impedence		50Ω
Insertion Loss		≤ ± 0.3dB
VSWR		1.25:1
Maximum input power	Splitter	100Watts
	Combiner	5Watts
Power splitting/combining ratio		80% - 20%
RF Connectors		N Female
Dimensions		104mm x 63mm x 46mm
Temperature range	operation:	-20°C to +60°C
	storage:	-40°C to +70°C



### 6.3.3.5. 2 Way Power Splitter/ Combiner 70/30 (05-009905)

The power Splitter/Combiner 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, return and insertion losses are kept to a minimum. Any unused ports will be terminated with an appropriate 50Ω load. Power devices such as these, typically give 10dB better output isolation than low power equivalents – (important for splitters that feed antenna systems).

05-009905 Specification

Specification		Parameter
Frequency Range		764 – 860MHz
Impedence		50Ω
Insertion Loss		≤ ± 0.3dB
VSWR		1.25:1
Maximum input power	Splitter	100Watts
	Combiner	5Watts
Power splitting/combining ratio		70% - 30%
RF Connectors		N Female
Dimensions		104mm x 63mm x 46mm
Temperature range	operation:	-20°C to +60°C
	storage:	-40°C to +70°C

### 6.3.3.6. Wideband Asymmetric Coupler (07-015102)

The purpose of Wideband Asymmetric Coupler (07-015102) is to tap off a known portion (in this case 10dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

07-015102 Specification

PARAMETER		SPECIFICATION
Frequency Range		800 - 2500 MHz
Coupling Value		10 dB ± 1.0 dB
Main Line Insertion Loss		<1.6 dB
VSWR		1.4:1
Directivity		>18 dB
Power Rating		200 Watts
RF Connectors		'N' female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

### 6.3.4. Fibre Optic Splitter (55-165507)

Fibre Optic Splitter (55-165507) is a 1U rack mount tray containing an optical splitter/coupler

Fibre Optic Splitter (55-165507) List of Major Sub Components

Component Part	Component Part Description	Qty. Per Assembly
98-100001	Single Mode Optical Splitter/Coupler	1

#### 6.4.3.1. Single Mode Optical Splitter/Coupler (98-100001)

Single Mode Optical Splitter/Couplers are used whenever it is necessary to split or combine outputs from optical transmitters or inputs to receivers. Operators should be aware that a small insertion loss (typically 3-4dB) is common with these type of couplers.

Single Mode Optical Splitter/Coupler (98-100001) It is an O.E.M unit featuring almost negligible insertion loss to the F/O signal. Extreme caution should be exercised when handling these devices. Special attention should be shown to the connectors; repair of a broken Splitter/Coupler is not possible; replacement is the only option.

In the Fibre Optic Splitter (55-165507) in BEACON HILL STATION MASTER SITE 1 (80-330551-1), Single Mode Optical Splitter/Coupler (98-100001) is used to split the optical signal from the FO TX module in F/O Link Subsystem (98-700001) into two equal paths.

### 6.3.5. Optical AB Switch FC/APC (98-700002)

Optical A/B Switch FC/APC (98-700002) an O.E.M. sourced Fibre Optic relay supplied as a 1U rack mount tray. 98-700002 allows for the automatic switching between two optical inputs to provide a common optical output. Manual selection of the input is also possible via toggle switches on the front panel.

98-700002 Specification

PARAMETER	SPECIFICATION
Electrical Characteristics	
Power Supply Voltage	100 - 240 VAC
Power Supply Frequency	50 - 60 Hz
Optical Characteristics	
Operating Wavelength	1200 – 1610nm
Optical Input Range	+20 dBm
Optical Insertion Loss	2.0 dB
Optical Trip Threshold/Meter Range	-35 - +20 dBm
Optical Switch Speed	15ms
Backreflection Tolerance	-50dB
Environmental and Physical Characteristics	
Optical Connectors	FC/APC
Operating Temp. Range	+10 to +40°C
Storage Temp. Range	-40 to +80 °C
Humidity	5 to 90 % RHNC
Weight	2.2 kg (6 lbs)
Dimensions	483 x 361 x 44mm (19.0 x 14.2 x 1.72 in.)

### 6.3.6. F/O Link Subsystem (98-800001)

F/O Link Subsystem (98-800001) is an O.E.M. sourced Optical Transceiver package containing discreet TX and RX modules and supplied as a 1U rack mount tray

Parameter	Specification
Optical Output Power	4 mW
Wavelength, peak	1310 1550 nm
Frequency Response, 50 to 2.2 GHz	± 1.5 dB
Input and Output VSWR	1.5:1
Link Gain <sup>(2)</sup>	0 dB
Output Noise Floor <sup>(1)</sup>	-137 dBm/Hz
Input 3rd Order Intercept <sup>(1)</sup>	30 dBm
Operating Temperature	-30 to +75°C
Storage Temperature	-40 to +85°C
Maximum RF Input to Transmitter	+20 dBm
Maximum Optical Input to Receiver	6 mW
A.C. Supply Voltage	90 – 265 VAC
Dimensions	483 x 457 x 44mm (19.0 x 18 x 1.72 in.)

<sup>(1)</sup> SFDR, Noise and IP3 specified with 5 dB optical loss.

<sup>(2)</sup> Link Gain specified with 1 meter fiber.

## 7. BEACON HILL STATION MASTER SITE 2 (80-330551-2)

Cabinet number C19-CR-06

from top of rack

55-165505

55-165501

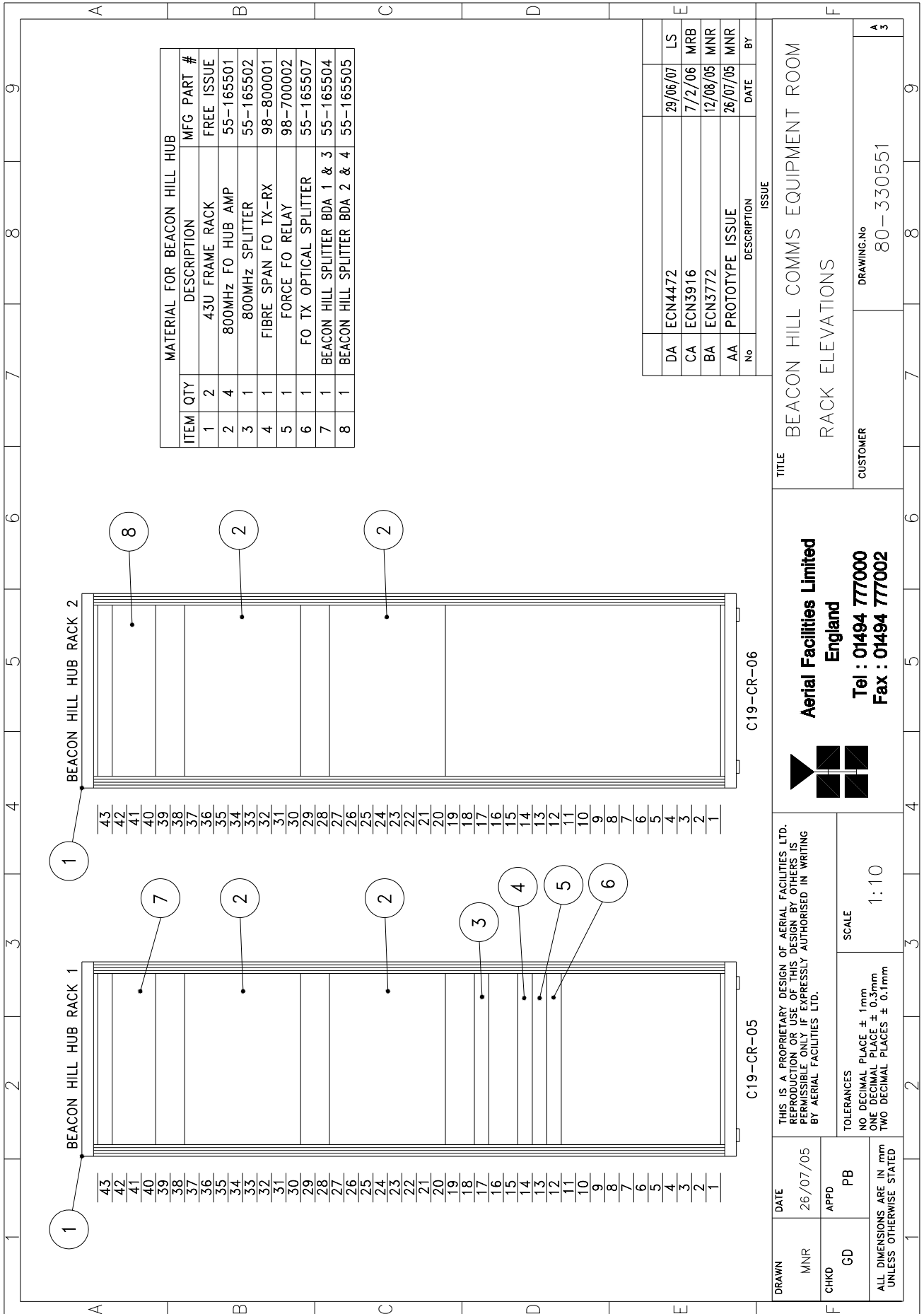
55-165501

Beacon Hill Station Master Site 2 (80-330551-2) List of major Components

section	Component Part	Component Part Description	Qty. Per Assembly
7.3.1.	55-165501	800MHz FO HUB AMP	2
7.3.2.	55-165505	BEACON HILL SPLITTER (BDA 2 & 4)	1

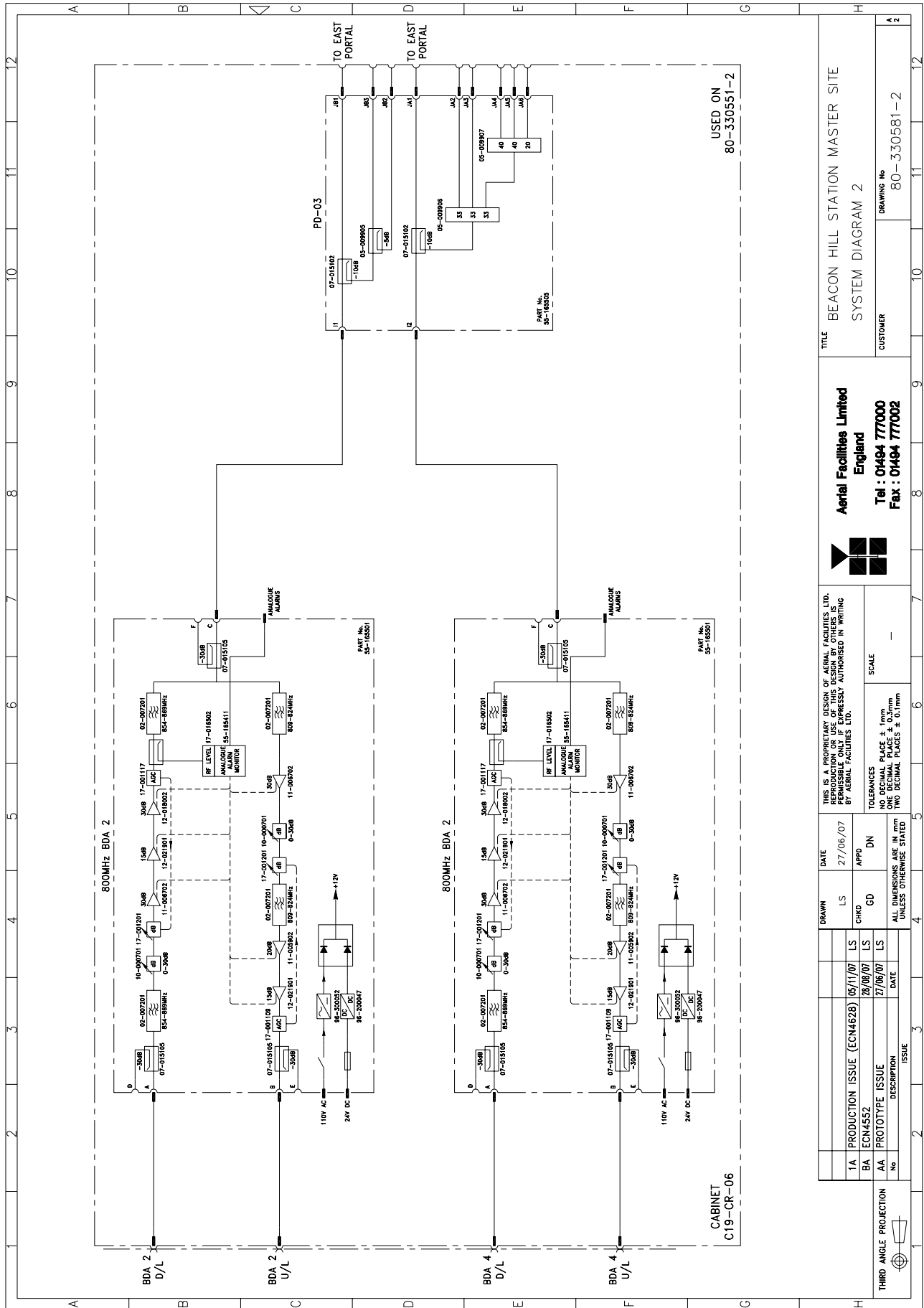
# 7.1. Beacon Hill Station Master Site 2 (80-330551-2) Rack Elevation

Drawing number 80-330551



# 7.2. Beacon Hill Station Master Site 2 (80-330551-2) System Diagram

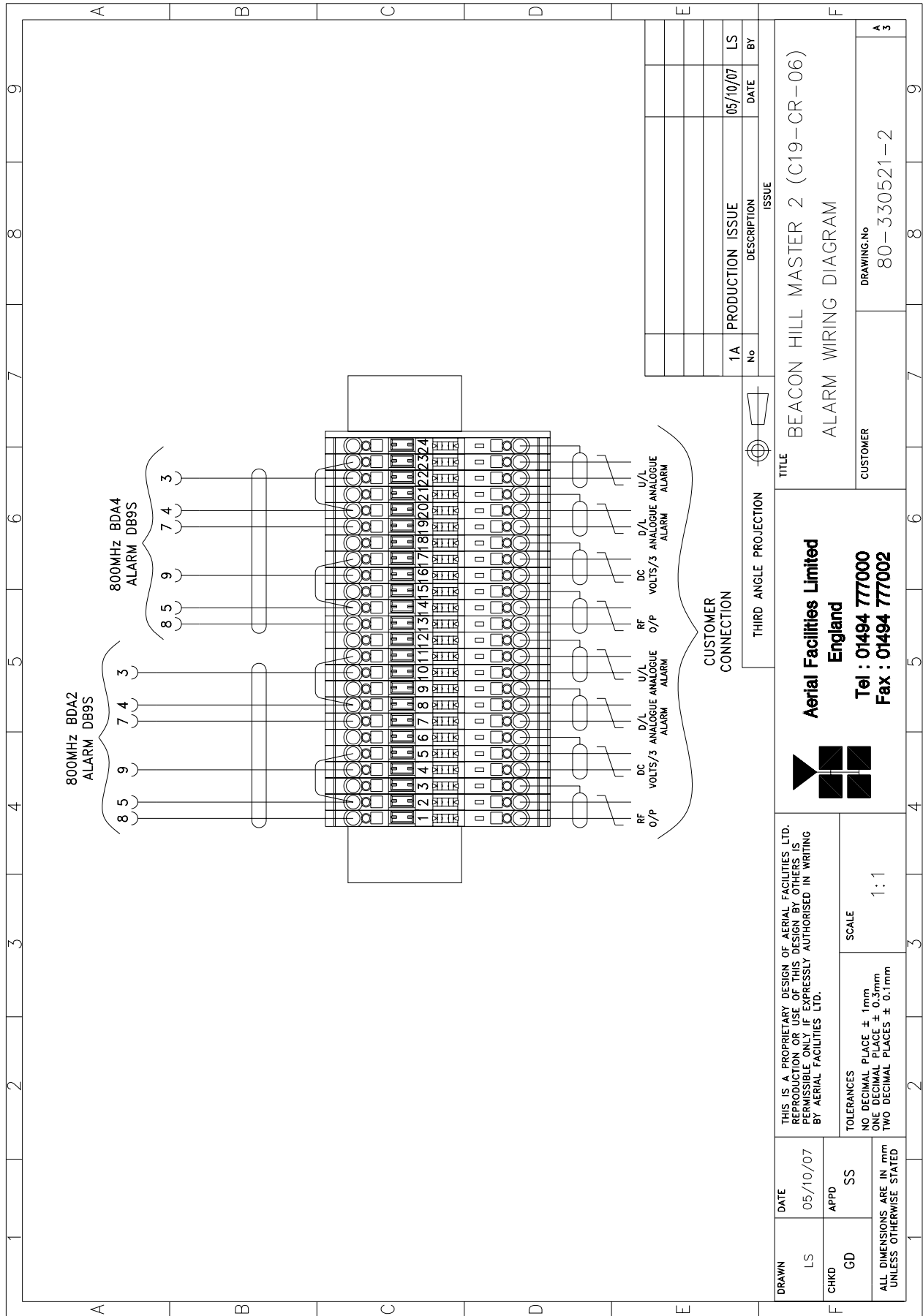
Drawing number 80-330581-2



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AA	PROTOTYPE ISSUE	CHKO	APPD	CHKO	APPD	SYSTEM DIAGRAM 2			
BA	ECN4552	GD	DN	GD	DN	CUSTOMER			
1A	PRODUCTION ISSUE (ECN4628)	ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED		SCALE		Aerial Facilities Limited			
				TOLERANCES PLACE ± 1mm ON 1 DECIMAL PLACES ± 0.1mm ON TWO DECIMAL PLACES		England			
						Tel : 01494 770000			
						Fax : 01494 770002			
						DRAWING No 80-330581-2			
						PART No. 55-168505			

### 7.3. Beacon Hill Station Master Site 2 (80-330551-2) Alarm Wiring Diagram

Drawing number 80-330521-2



## 7.4. Beacon Hill Station Master Site 2 (80-330551-2) Major Sub Components

### 7.4.1. 800MHz FO HUB AMP (55-165501)

800MHz FO HUB AMP (55-165501) List of major components

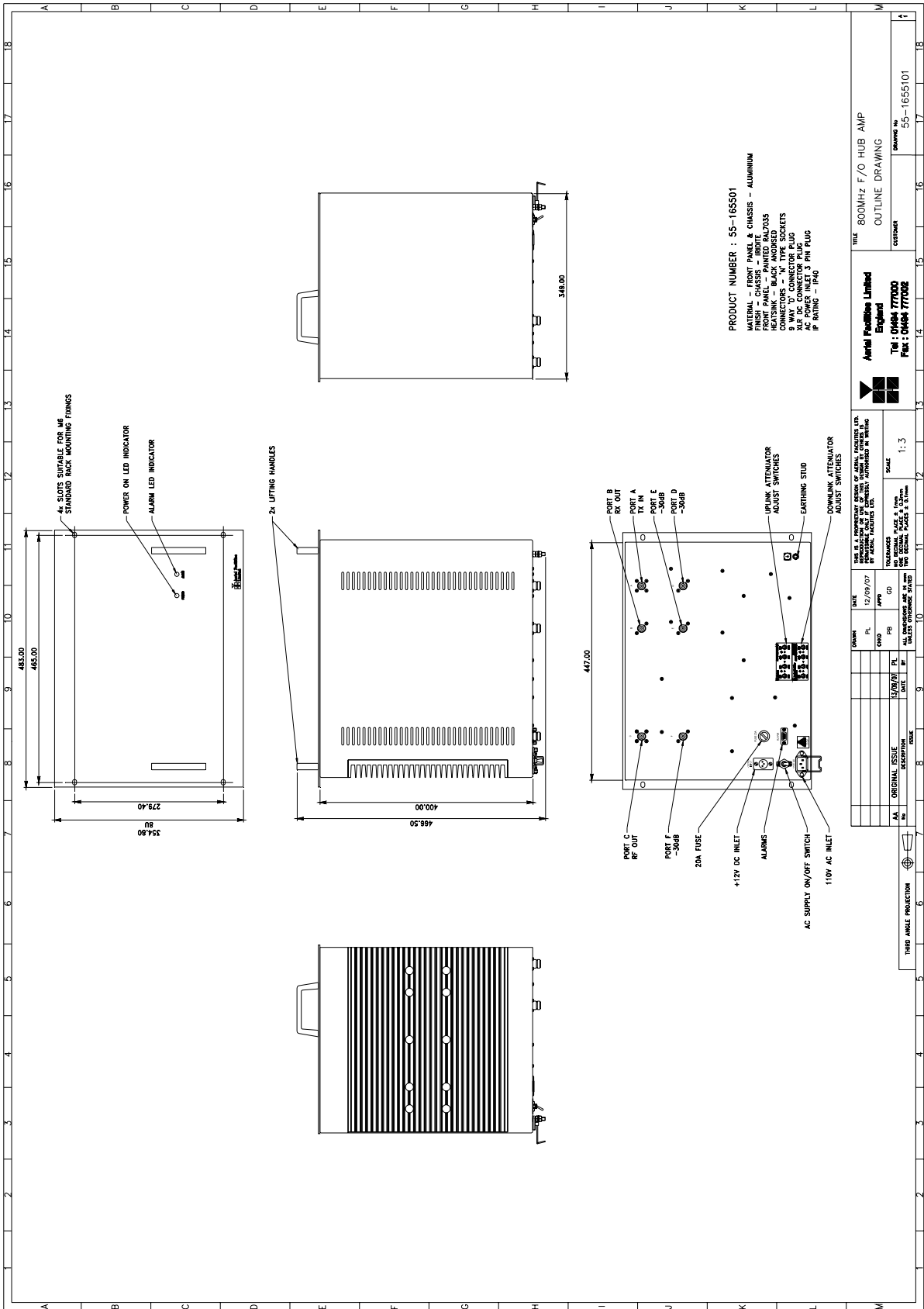
section	Component Part	Component Part Description	Qty. Per Assembly
7.4.1.3.	02-007206	Bandpass Filter	4
7.4.1.4.	07-015105	Wideband Asymmetric Coupler	3
7.4.1.5.	10-000701	Switched Attenuator 0.25Watt, 0 - 30dB	2
7.4.1.6.	11-005902	Low Noise Amplifier	1
7.4.1.7.	11-006702	Low Noise Amplifier	2
7.4.1.8.	12-018002	Power Amplifier	1
7.4.1.9.	12-021901	Low Power Amplifier	2
7.4.1.10.	17-001109*	AGC Detector Assembly (Logarithmic)	1
	17-001117*	AGC Detector Assembly	1
	17-001201*	AGC Attenuator Assembly	2
7.4.1.11.	20-001601	12V (Dual) Relay Board	1
7.4.1.12.	80-008901	12V (Single) Relay Board	1
7.4.1.13.	96-200047	DC/DC Converter	
7.4.1.14.	94-100004	Dual Diode Assembly	1
7.4.1.15.	96-200047	DC/DC Converter	1
7.4.1.16.	96-300052	12V Switch-Mode PSU	1

\*The sub components 17-001109, 17-001117 & 17-001201 are parts of the Automatic Gain Control (AGC) system used in 800MHz FO HUB AMP (55-165501); 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink



# 7.4.1.1. 800MHz FO HUB AMP (55-165501) Outline drawing

Drawing number 55-1655101

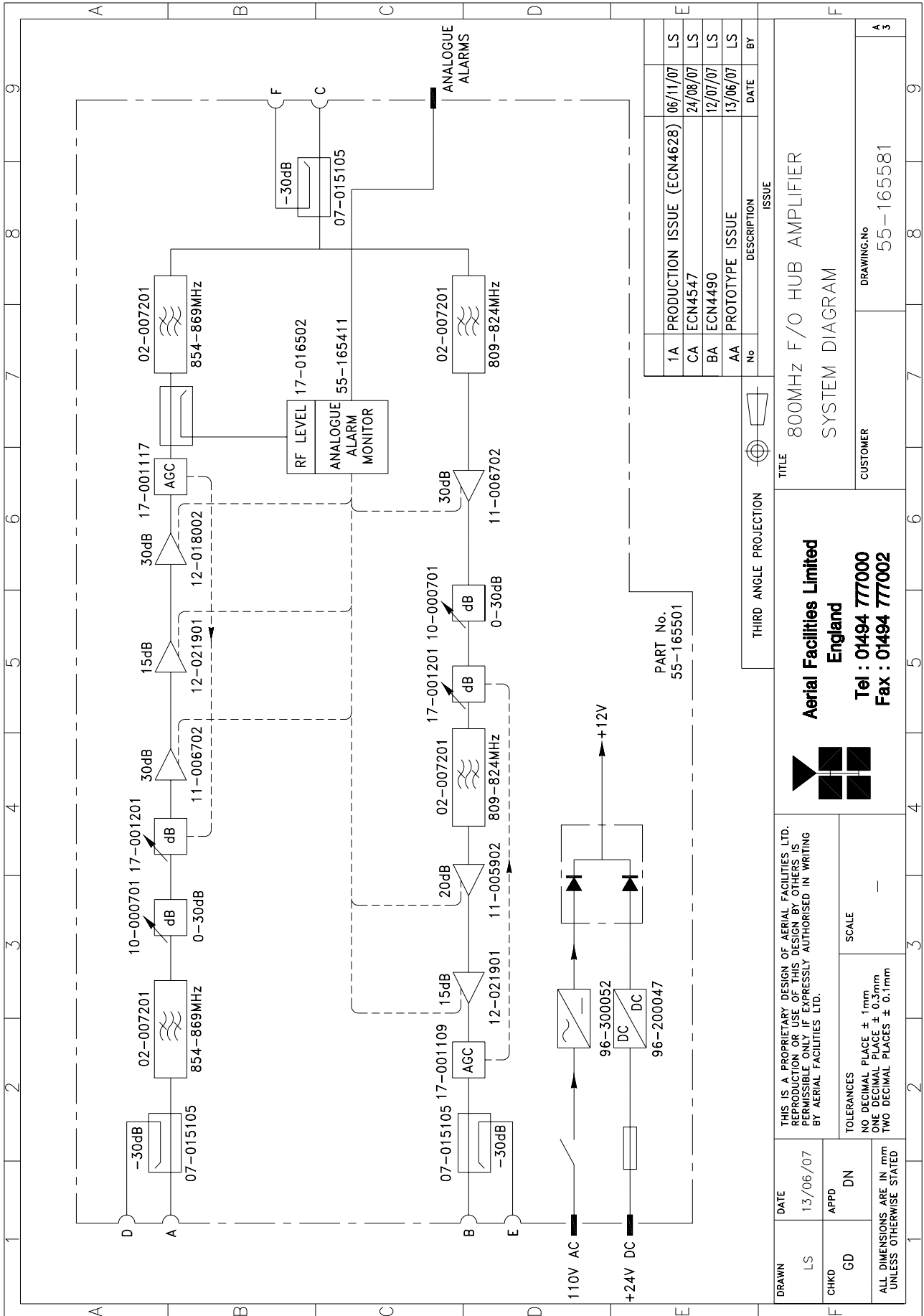


DATE	12/09/07	DATE	12/09/07
DESIGNER	PL	APPD	CO
CHECKED	FB	DATE	12/09/07
SCALE	1:3	DESCRIPTION	THIRD ANGLE PROJECTION
ISSUED AS A SUPPLEMENTARY DESIGN OF ORIGINAL DRAWING NO. 55-165501	FOR THE PURPOSES OF THE PROJECT ONLY. NOT TO BE USED FOR ANY OTHER PURPOSES WITHOUT THE WRITTEN APPROVAL OF THE PROJECT MANAGER.		

AWAL Facilities Limited England	Tel : 0494 77000 Fax : 0494 77002
TITLE : 800MHz F/O HUB AMP OUTLINE DRAWING	
DRAWING NO : 55-1655101	

### 7.4.1.2. 800MHz FO HUB AMP (55-165501) System Diagram

Drawing number 55-165581



### 7.4.1.3. Bandpass Filter (02-007206)

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

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

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

#### 02-007206 Specification

PARAMETER		SPECIFICATION
Response type		Chebyshev
Frequency range		800 - 950MHz *
Bandwidth		25MHz *
Number of sections		8
Insertion loss		1.2 dB
VSWR		better than 1.2:1
Connectors		SMA female
Power handling		100W max
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C
Weight		3 kg (typical)

\*tuned to Customer's specification

### 7.4.1.4. Wideband Asymmetric Coupler (07-015105)

The purpose of Wideband Asymmetric Coupler (07-015105) is to tap off a known portion (in this case 30dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

#### 07-015105 Specification

PARAMETER		SPECIFICATION
Construction		Inductive air gap
Frequency		800-2500MHz
Through loss		0.4dB (typical)
Coupling level		-30dB ±0.5dB
Isolation		N/A
Weight		<1.0kg
Connectors		SMA, female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

#### 7.4.1.5. 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

### 7.4.1.6. Low Noise Amplifier (11-005902)

The Gallium-Arsenide 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 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 any alarm system. There is a Current Fault Alarm Function, which indicates failure of each one or both RF transistors by a various alarm output options. The amplifier is housed in an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a 9way D-type for DC and alarm outputs.

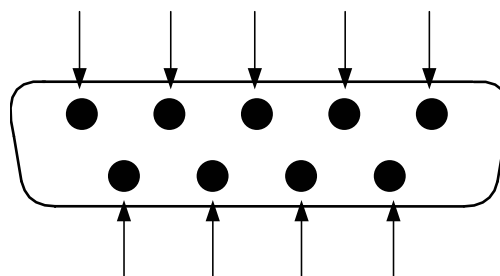
#### 11-005902 Specification

PARAMETER		SPECIFICATION
Frequency range:		800 – 960MHz *
Bandwidth:		<170MHz
Gain:		19.5dB (typical)
1dB compression point:		21dBm
OIP3:		33dBm
Input/output return loss:		>20dB
Noise figure:		1dB (typical)
Power consumption:		190mA @ 24V DC
Supply voltage:		10-24V DC
Connectors:		SMA female
Temperature range	operational:	-10°C to +60°C
	storage:	-40°C to +70°C
Size:		90 x 55 x 30.2mm
Weight:		0.28kg

\*tuned to Customer's specification

#### LNA 'D' Connector Pin-out details

Connector pin	Signal
1	+Ve input (10-24V)
2	GND
3	Alarm relay O/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



### 7.4.1.7. 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.

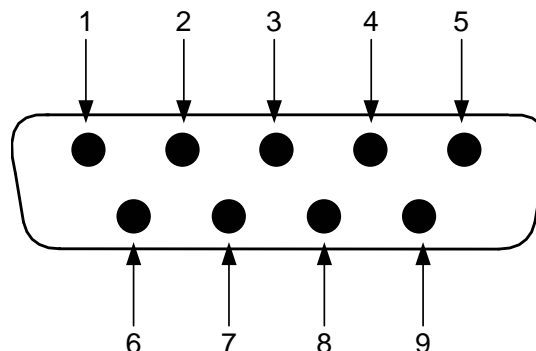
#### 11-006702 Specification

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 Relay O/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



### 7.4.1.8. Power Amplifier (12-018002)

This amplifier is a Class A 20W power amplifier from 800-960MHz in a 1 stage balanced configuration. It demonstrates a very high linearity and a very good input/output return loss (RL). It has built in a Current Fault Alarm Function.

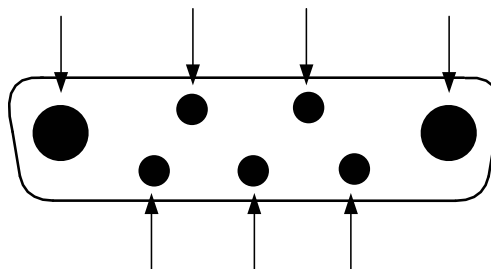
Its housing is an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a D-Type connector for the power supply and the Current Fault Alarm Function.

#### 12-018002 Specification

PARAMETER		SPECIFICATION
Frequency range:		800-960MHz
Small signal gain:		30dB
Gain flatness:		±1.2dB
I/O Return loss:		>18dB
1dB compression point:		42.8dBm
OIP3:		56dBm
Supply voltage:		24V DC
Supply current:		5.0Amps (Typical)
Temperature range	operational:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:		<2kg (no heatsink)

#### Power Amplifier (12-018002) 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)



### 7.4.1.9. 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.

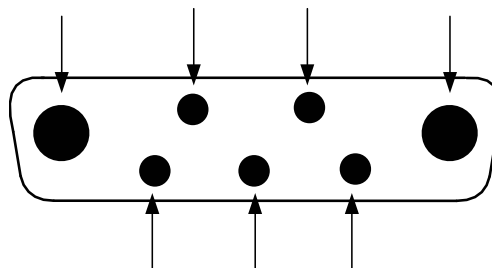
#### Low Power Amplifier (12-021901) Specification

PARAMETER		SPECIFICATION
Frequency range		800-960MHz*
Bandwidth		20MHz *
Maximum RF output		>1.0 Watt
Gain		15dB
1dB compression point		+30.5dBm
3 <sup>rd</sup> 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)





#### 7.4.1.10. Automatic Gain Control

17-001109	AGC Detector Assembly (Logarithmic)
17-001117	AGC Detector Assembly
17-001201	AGC Attenuator Assembly

The sub components 17-001109, 17-001117 & 17-001201 are parts of the Automatic Gain Control (AGC) system used in 800MHz FO HUB AMP (55-165501); 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

800MHz FO HUB AMP (55-165501) is fitted with two differing types of Automatic Gain Control (AGC) system, one linear, and one logarithmic. The AGC with logarithmic detector (17-001117) is fitted in the uplink path and the AGC with linear detector (17-001109) is fitted in the downlink path

The AFL Automatic Gain Control system consists of two units, a detector/amplifier and an attenuator. The 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. 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

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 detector controller board.

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.

AGC Specification (both types)

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	90grams
	detector/amp	100grams

**7.4.1.11. 12V (Dual) Relay Board (20-001601)**

The General Purpose Relay Board allows the inversion of signals and the isolation of circuits. It is equipped with two dual pole change-over relays with completely isolated wiring, accessed via screw terminals. Both relays are provided with polarity protection diodes and diodes for suppressing the transients caused by "flywheel effect" which can destroy switching transistors or induce spikes on neighbouring circuits. It's common use is to amalgamate all the alarm signals into one, volts-free relay contact pair for the main alarm system.

20-001601 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 $\mu$ A/10.0mV
Relay isolation:		1.5kV
Mechanical life:		>2x10 <sup>7</sup> operations
Relay approval:		BT type 56
Connector details:		Screw terminals
Temperature range	operational:	-10°C to +60°C
	storage:	-20°C to +70°C

#### 7.4.1.12. 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%
<b>Alarm output relay contacts:</b>		
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 <sup>7</sup> operations
Relay approval		BT type 56
Connector details		Screw terminals
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C

#### 7.4.1.13. DC/DC Converter 96-200047

96-200047 is an O.E.M. high power device with a wide input range and 12.5 amp @ 12V (150Watts) output capability 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.

PARAMETER		SPECIFICATION
DC Input Voltage range		19 to 36V
DC Output voltage		12V ± 1%
Max. current load		12.5Amps
Temperature range	Operation	-10°C to +60°C
	Storage	-20°C to +85°C
Working Humidity		20 to 90% RHNC

#### 7.4.1.14. 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.

#### 7.4.1.15. DC/DC Converter 96-200047

96-200047 is an O.E.M. high power device with a wide input range and 12.5 amp @ 12V (150Watts) output capability used to derive a 12V fixed voltage power supply rail from a higher voltage supply, in this case 12V. In the event of failure this unit should not be repaired, only replaced.

96-200047 Specification

PARAMETER		SPECIFICATION
DC Input Voltage range		19 to 36V
DC Output voltage		12V ± 1%
Max. current load		12.5Amps
Temperature range	Operation	-10°C to +60°C
	Storage	-20°C to +85°C
Working Humidity		20 to 90% RHNC

#### 7.4.1.16. 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

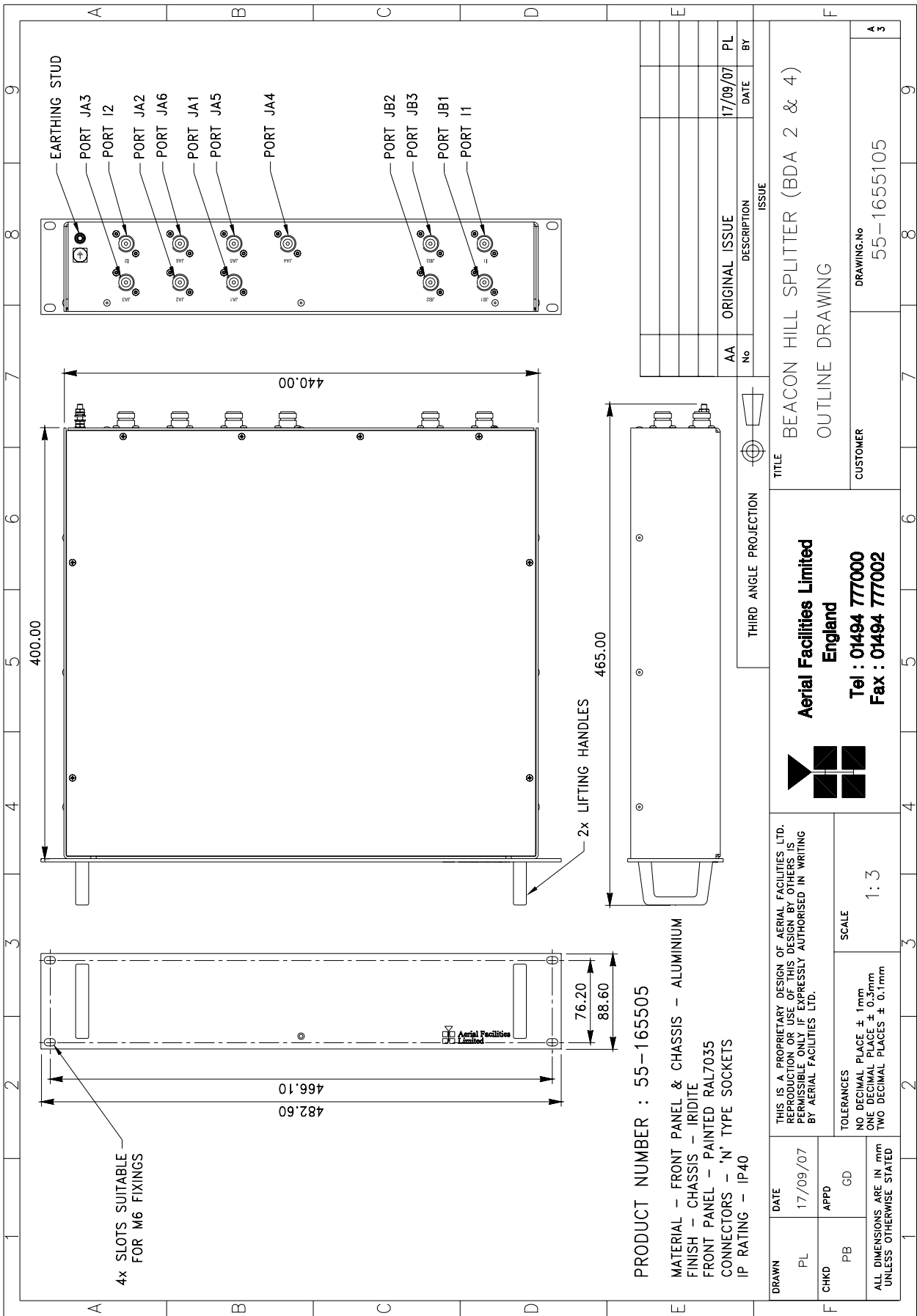
#### 7.4.2. BEACON HILL SPLITTER (BDA 2 & 4) (55-165505)

BEACON HILL SPLITTER (BDA 2 & 4) (55-165505) List of Major Components

Section	Component Part	Component Part Description	Qty. Per Assembly
7.3.2.3.	05-009905	2 Way Power Splitter/ Combiner 70/30	1
7.3.2.4.	05-009906	3 Way Power Splitter 33/33/33	1
7.3.2.5.	05-009907	3 Way Power Splitter 40/20/40	1
7.3.2.6.	07-015102	Wideband Asymmetric Coupler	2

### 7.4.2.1. BEACON HILL SPLITTER (BDA 2 & 4) (55-165505) Outline Drawing

Drawing Number 55-1655105



PRODUCT NUMBER : 55-165505

MATERIAL - FRONT PANEL & CHASSIS - ALUMINIUM  
 FINISH - CHASSIS - IRIDITE  
 FRONT PANEL - PAINTED RAL7035  
 CONNECTORS - 'N' TYPE SOCKETS  
 IP RATING - IP40

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

SCALE  
 1:3

DRAWN	DATE	17/09/07
PL	APPD	GD
CHKD	PB	GD
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED		

AA	ORIGINAL ISSUE	17/09/07	PL
No	DESCRIPTION	DATE	BY
ISSUE			

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

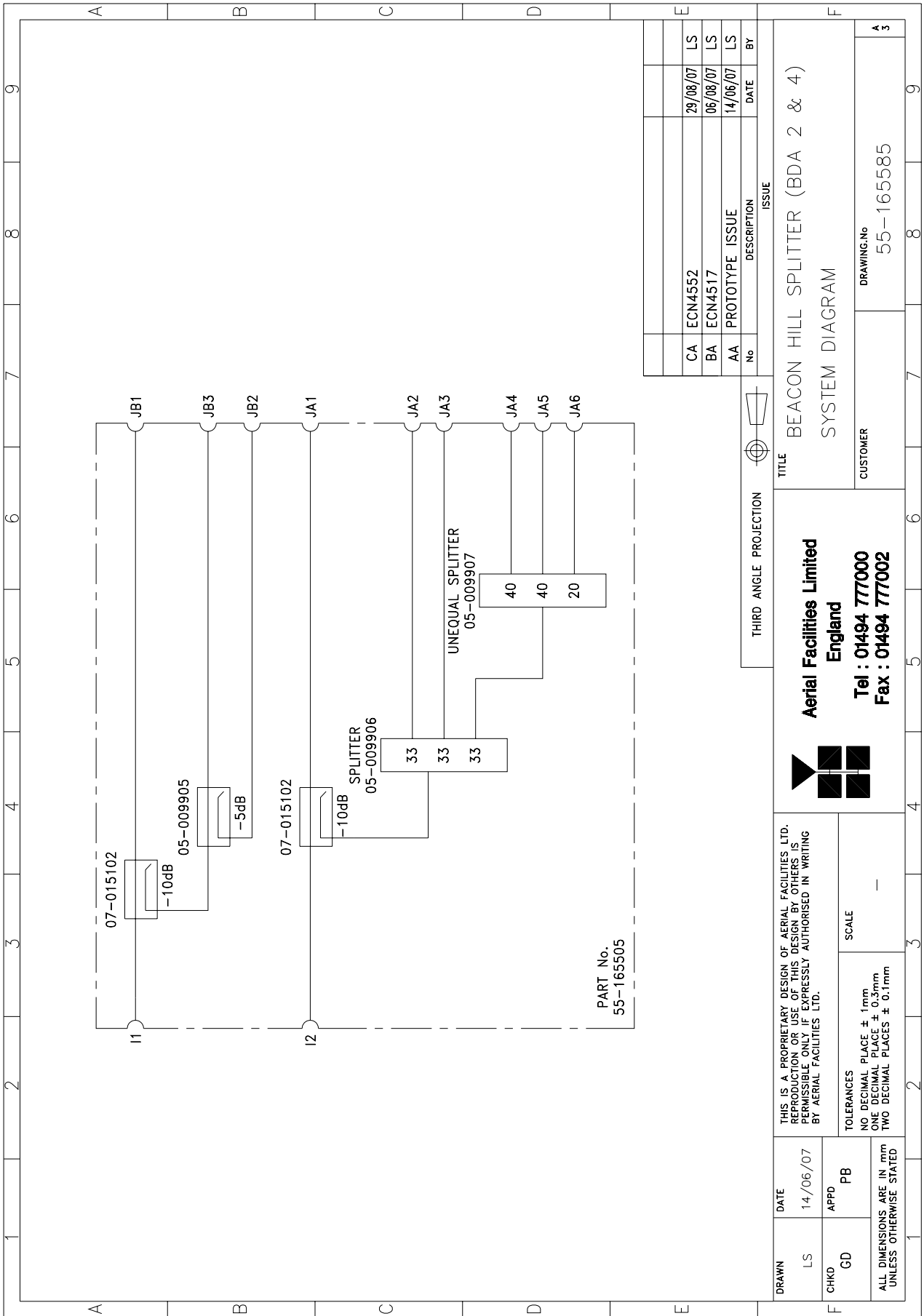
THIRD ANGLE PROJECTION

TITLE  
 BEACON HILL SPLITTER (BDA 2 & 4)  
 OUTLINE DRAWING

CUSTOMER  
 DRAWING.No  
 55-1655105

### 7.4.2.2. BEACON HILL SPLITTER (BDA 2 & 4) (55-165505) System Diagram

Drawing Number 55-165585

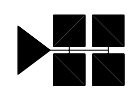


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CA	ECN4552	29/08/07	LS
BA	ECN4517	06/08/07	LS
AA	PROTOTYPE ISSUE	14/06/07	LS

THIRD ANGLE PROJECTION

TITLE: BEACON HILL SPLITTER (BDA 2 & 4)  
 SYSTEM DIAGRAM

CUSTOMER: DRAWING No. 55-165585



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LS	14/06/07	TOLERANCES	SCALE
CHKD	APPD	NO DECIMAL PLACE $\pm$ 1mm	—
GD	PB	ONE DECIMAL PLACE $\pm$ 0.5mm	
		TWO DECIMAL PLACES $\pm$ 0.1mm	
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED			

### 7.4.2.3. 2 Way Power Splitter/ Combiner 70/30 (05-009905)

The power Splitter/Combiner 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, return and insertion losses are kept to a minimum. Any unused ports will be terminated with an appropriate 50Ω load. Power devices such as these, typically give 10dB better output isolation than low power equivalents – (important for splitters that feed antenna systems).

05-009905 Specification

Specification		Parameter
Frequency Range		764 – 860MHz
Impedence		50Ω
Insertion Loss		≤ ± 0.3dB
VSWR		1.25:1
Maximum input power	Splitter	100Watts
	Combiner	5Watts
Power splitting/combining ratio		70% - 30%
RF Connectors		N Female
Dimensions		104mm x 63mm x 46mm
Temperature range	operation:	-20°C to +60°C
	storage:	-40°C to +70°C

### 7.4.2.4. 3 Way Power Splitter 33/33/33 (05-009906) \*\*\*//\*\*\* BSB

### 7.4.2.5. 3 Way Power Splitter 40/20/40 (05-009907) \*\*\*//\*\*\* BSB

### 7.4.2.6. Wideband Asymmetric Coupler (07-015102)

The purpose of Wideband Asymmetric Coupler (07-015102) is to tap off a known portion (in this case 10dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

07-015102 Specification

PARAMETER		SPECIFICATION
Frequency Range		800 - 2500 MHz
Coupling Value		10 dB ± 1.0 dB
Main Line Insertion Loss		<1.6 dB
VSWR		1.4:1
Directivity		>18 dB
Power Rating		200 Watts
RF Connectors		'N' female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

## 8 BEACON HILL STATION CROSS PASSAGE A (80-330591-1)

Cabinet C18-CR-01

Beacon Hill Station Cross Passage A (80-330591-1) List of major Components

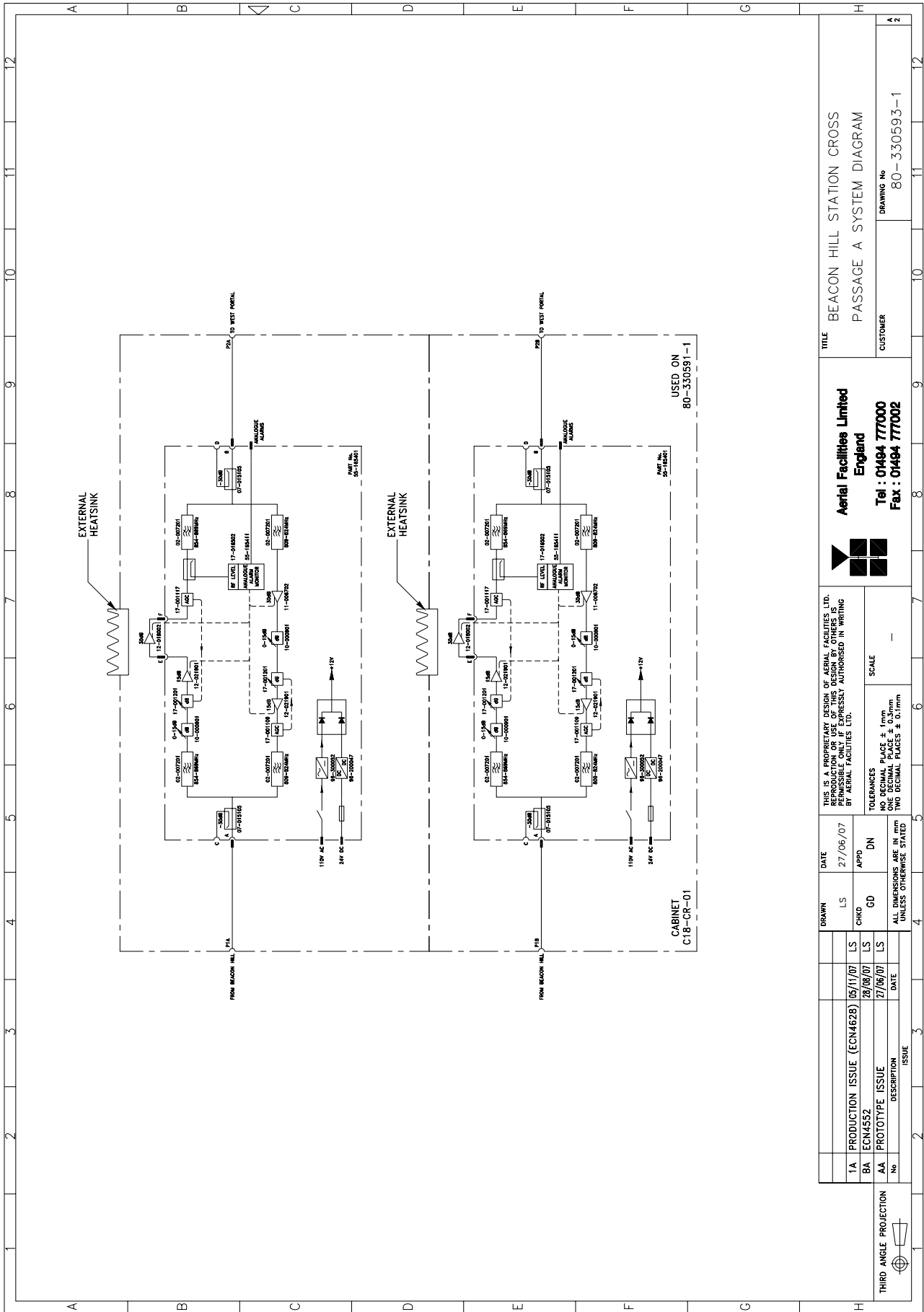
	Component Part	Component Part Description	Qty. Per Assembly
8.4.1.	07-015102	Wideband Asymmetric Coupler	1
8.4.2.	12-018002	Power Amplifier	2
8.4.3.	55-165401	800MHz Line Amplifier (Ext. Amp.)	2



**8.1. Beacon Hill Station Cross Passage A (80-330591-1) Rack Layout \*\*\*//\*\*\***  
Drawing number

## 8.2. Beacon Hill Station Cross Passage A (80-330591-1) System Diagram

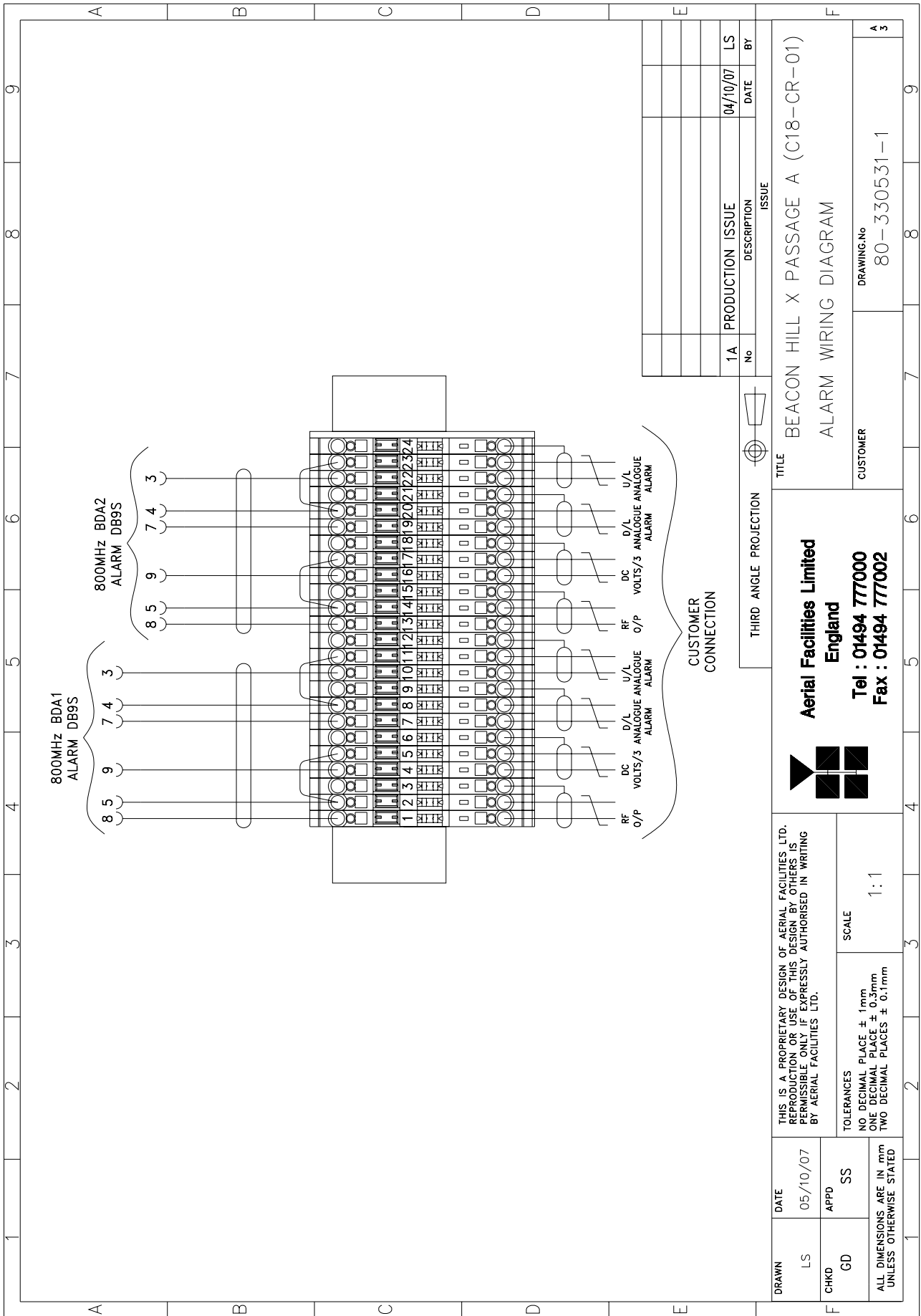
Drawing number 80-330593-1



DRAWN		DATE	TITLE	
LS	27/06/07	BEACON HILL STATION CROSS		
CHKO	APPO	PASSAGE A SYSTEM DIAGRAM		
LS	DN	CUSTOMER		
LS	ISSUE	DRAWING No 80-330593-1		
LS	DESCRIPTION	Aerial Facilities Limited		
No	ISSUE	England		
THIRD ANGLE PROJECTION		Tel : 01494 77000		
		Fax : 01494 77002		
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### 8.3. Beacon Hill Station Cross Passage A (80-330591-1) Alarm Wiring Diagram

Drawing number 80-330531-1



## 8.4. Beacon Hill Station Cross Passage A (80-330591-1) Major Sub Components

### 8.4.1. Wideband Asymmetric Coupler (07-015102)

The purpose of Wideband Asymmetric Coupler (07-015102) is to tap off a known portion (in this case 10dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

#### 07-015102 Specification

PARAMETER		SPECIFICATION
Frequency Range		800 - 2500 MHz
Coupling Value		10 dB ± 1.0 dB
Main Line Insertion Loss		<1.6 dB
VSWR		1.4:1
Directivity		>18 dB
Power Rating		200 Watts
RF Connectors		'N' female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

### 8.4.2. Power Amplifier (12-018002)

This amplifier is a Class A 20W power amplifier from 800-960MHz in a 1 stage balanced configuration. It demonstrates a very high linearity and a very good input/output return loss (RL). It has built in a Current Fault Alarm Function.

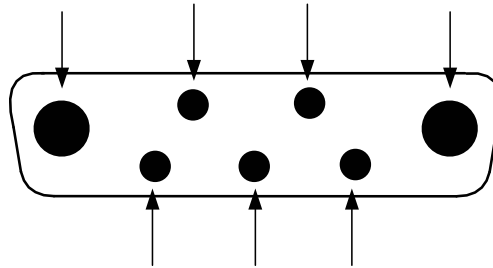
Its housing is an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a D-Type connector for the power supply and the Current Fault Alarm Function.

#### 12-018002 Specification

PARAMETER		SPECIFICATION
Frequency range		800-960MHz
Small signal gain		30dB
Gain flatness		±1.2dB
I/O Return loss		>18dB
1dB compression point		42.8dBm
OIP3		56dBm
Supply voltage		24V DC
Supply current		5.0Amps (Typical)
Temperature range	operational	-10°C to +60°C
	storage	-20°C to +70°C
Weight		<2kg (no heatsink)

Power Amplifier (12-018002) 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)



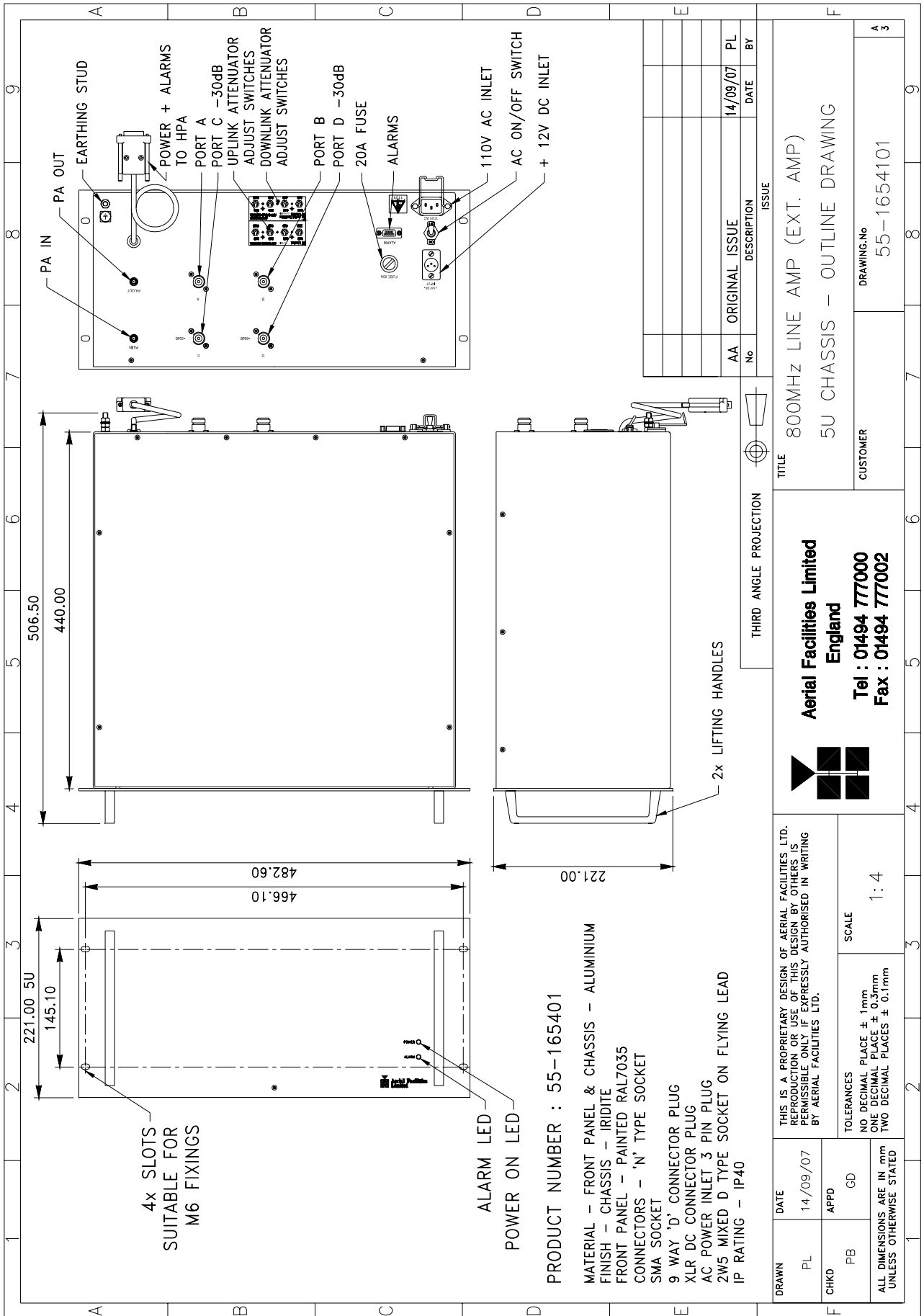
### 8.4.3. 800MHz Line Amplifier (Ext. Amp.) (55-165401)

800MHz Line Amplifier (Ext. Amp.) (55-165401) list of major components

section	Component Part	Component Part Description	Qty. Per Assembly
8.4.3.3.	02-007206	Bandpass Filter	4
8.4.3.4.	07-015105	Wideband Asymmetric Coupler	2
8.4.3.5.	10-000901	Switched Attenuator 0.25W, 0 - 15dB	2
8.4.3.6.	11-006702	Low Noise Amplifier	1
8.4.3.7.	12-018002K	Power Amplifier	1
8.4.3.8.	12-021901	Low Power Amplifier	2
8.4.3.9.	17-001109	AGC Detector Assembly (Logarithmic)	1
	17-001117	AGC Detector Assembly	1
	17-001201	AGC Attenuator Assembly	2
8.4.3.10.	80-008901	12V (Single) Relay Board	1
8.4.3.11.	94-100004	Dual Diode Assembly	1
8.4.3.12.	96-200047	DC/DC Converter	
8.4.3.14.	96-300052	12V Switch-Mode PSU	1

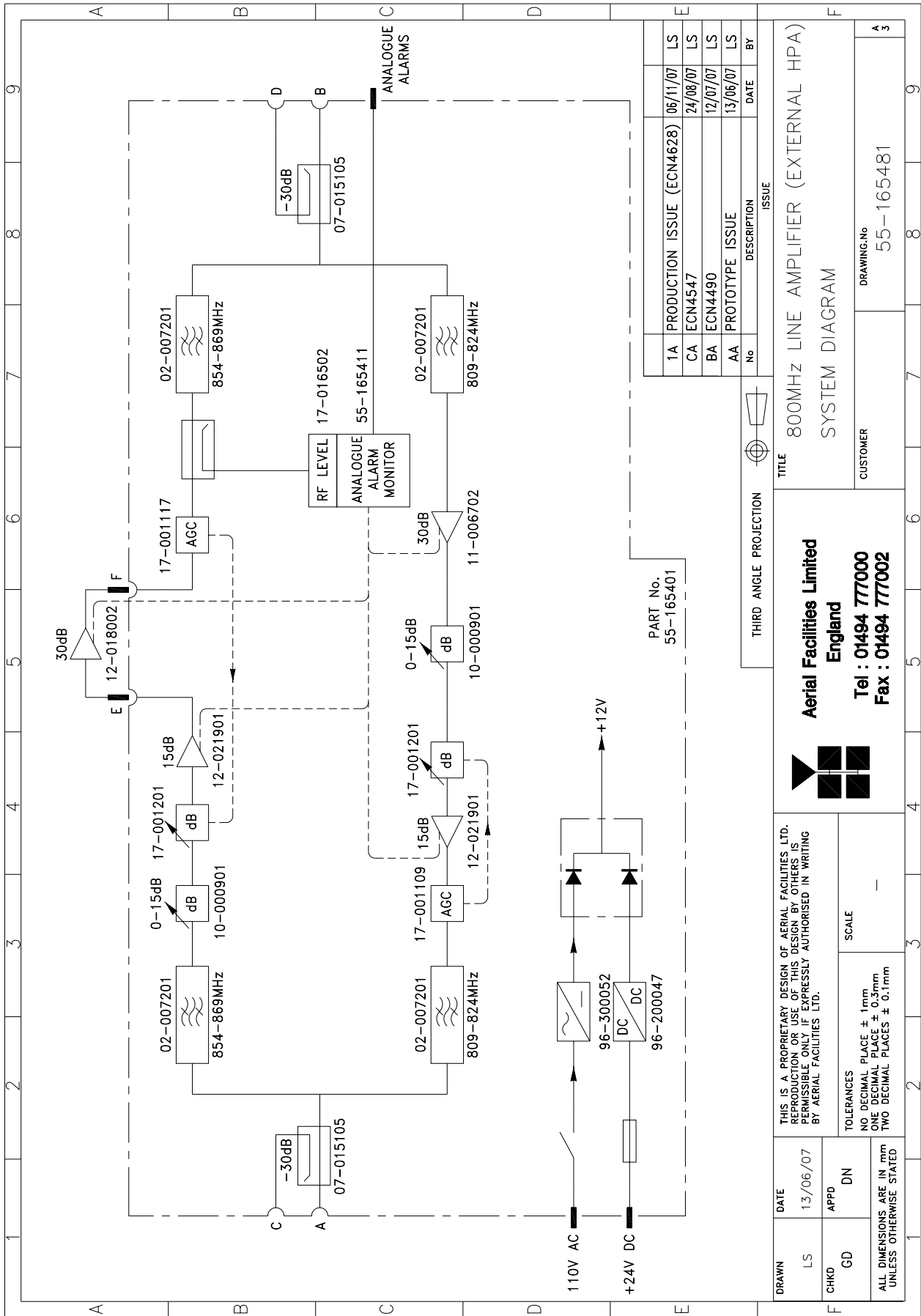
### 8.4.3.1. 800MHz Line Amplifier (Ext. Amp.) (55-165401) outline drawing

Drawing number 55-1654101



### 8.4.3.2. 800MHz Line Amplifier (Ext. Amp.) (55-165401) system diagram

Drawing number 55-165481





### 8.4.3.3. Bandpass Filter (02-007206)

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

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

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

#### 02-007206 Specification

PARAMETER		SPECIFICATION
Response type		Chebyshev
Frequency range		800 - 950MHz *
Bandwidth		25MHz *
Number of sections		8
Insertion loss		1.2 dB
VSWR		better than 1.2:1
Connectors		SMA female
Power handling		100W max
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C
Weight		3 kg (typical)

\*tuned to Customer's specification

### 8.4.3.4. Wideband Asymmetric Coupler (07-015105)

The purpose of Wideband Asymmetric Coupler (07-015105) is to tap off a known portion (in this case 30dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

#### 07-015105 Specification

PARAMETER		SPECIFICATION
Construction		Inductive air gap
Frequency		800-2500MHz
Through loss		0.4dB (typical)
Coupling level		-30dB ±0.5dB
Isolation		N/A
Weight		<1.0kg
Connectors		SMA, female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

### 8.4.3.5. 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

### 8.4.3.6. 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.

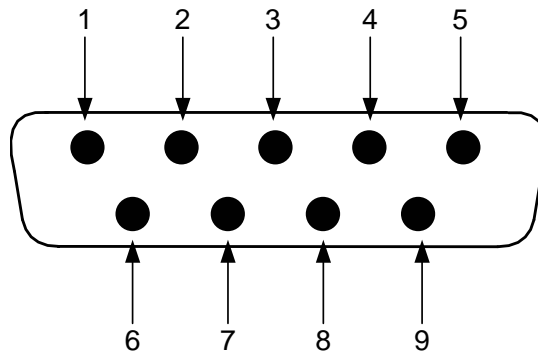
#### 11-006702 Specification

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 Relay O/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



**8.4.3.7. Power Amplifier (12-018002)**

This amplifier is a Class A 20W power amplifier from 800-960MHz in a 1 stage balanced configuration. It demonstrates a very high linearity and a very good input/output return loss (RL). It has built in a Current Fault Alarm Function.

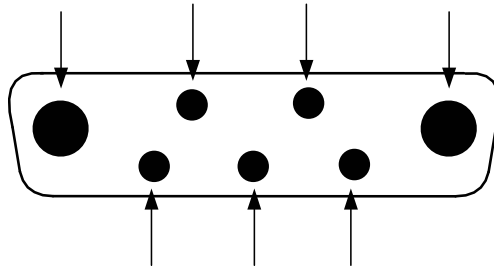
Its housing is an aluminium case (Iridite NCP finish) with SMA connectors for the RF input/output and a D-Type connector for the power supply and the Current Fault Alarm Function.

12-018002 Specification

PARAMETER	SPECIFICATION	
Frequency range:	800-960MHz	
Small signal gain:	30dB	
Gain flatness:	±1.2dB	
I/O Return loss:	>18dB	
1dB compression point:	42.8dBm	
OIP3:	56dBm	
Supply voltage:	24V DC	
Supply current:	5.0Amps (Typical)	
Temperature range	operational:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:	<2kg (no heatsink)	

Power Amplifier (12-018002) 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)



**8.4.3.8. 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.

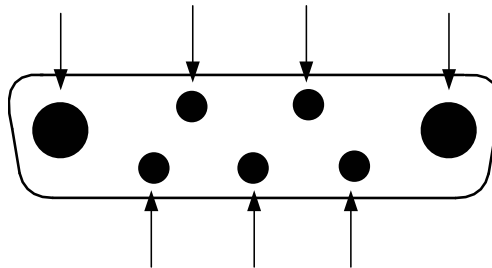
Low Power Amplifier (12-021901) Specification

PARAMETER		SPECIFICATION
Frequency range		800-960MHz*
Bandwidth		20MHz *
Maximum RF output		>1.0 Watt
Gain		15dB
1dB compression point		+30.5dBm
3 <sup>rd</sup> 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)



#### 8.4.3.9. Automatic Gain Control

- 17-001109 AGC Detector Assembly (Logarithmic)
- 17-001117 AGC Detector Assembly
- 17-001201 AGC Attenuator Assembly

The sub components 17-001109, 17-001117 & 17-001201 are parts of the Automatic Gain Control (AGC) system used in 800MHz Line Amplifier (Ext. Amp.) (55-165401); 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

800MHz Line Amplifier (Ext. Amp.) (55-165401) is fitted with two differing types of Automatic Gain Control (AGC) system, one linear, and one logarithmic. The AGC with logarithmic detector (17-001117) is fitted in the uplink path and the AGC with linear detector (17-001109) is fitted in the downlink path

The AFL Automatic Gain Control system consists of two units, a detector/amplifier and an attenuator. The 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. 17-001117 and 17-001201 are paired for use in the uplink and 17-001109 and 17-001201 are paired for use in the downlink

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 detector controller board.

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.

AGC Specification (both types)

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	90grams
	detector/amp	100grams

#### 8.4.3.10. 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%
<b>Alarm output relay contacts:</b>		
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 <sup>7</sup> operations
Relay approval		BT type 56
Connector details		Screw terminals
Temperature range	operation:	-10°C to +60°C
	storage	-20°C to +70°C

### 8.4.3.11. 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.

### 8.4.3.12. DC/DC Converter (96-200047)

DC/DC Converter 96-200047

96-200047 is an O.E.M. high power device with a wide input range and 12.5 amp @ 12V (150Watts) output capability 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.

PARAMETER		SPECIFICATION
DC Input Voltage range		19 to 36V
DC Output voltage		12V ± 1%
Max. current load		12.5Amps
Temperature range	Operation	-10°C to +60°C
	Storage	-20°C to +85°C
Working Humidity		20 to 90% RHNC

### 8.4.3.13. 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

## 9 BEACON HILL STATION CROSS PASSAGE B (80-330591-2)

Cabinet C20-CR-01

Beacon Hill Station Cross Passage B (80-330591-2) List of major Components

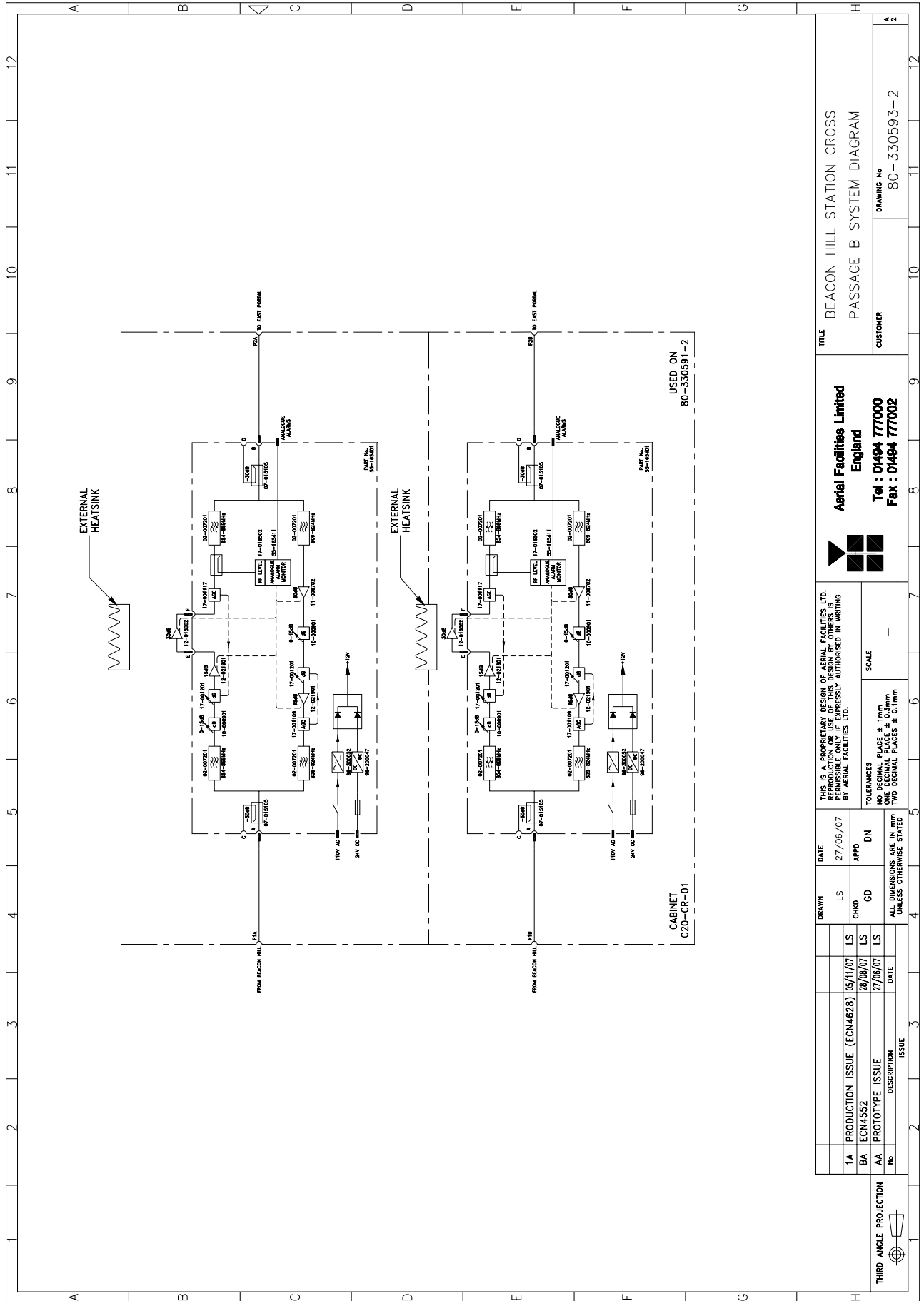
	Component Part	Component Part Description	Qty. Per Assembly
9.4.1.	07-015102	Wideband Asymmetric Coupler	1
9.4.2.	12-018002	Power Amplifier	2
9.4.3.	55-165401	800MHz Line Amplifier (Ext. Amp.)	2



**9.1. Beacon Hill Station Cross Passage B (80-330591-2) Rack layout \*\*\*//\*\*\***  
Drawing number

## 9.2. Beacon Hill Station Cross Passage B (80-330591-2) System Diagram

Drawing number 80-330593-2



TITLE		BEACON HILL STATION CROSS PASSAGE B SYSTEM DIAGRAM	
CUSTOMER		DRAWING No 80-330593-2	

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**England**  
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 TWO DECIMAL PLACES ± 0.1mm  
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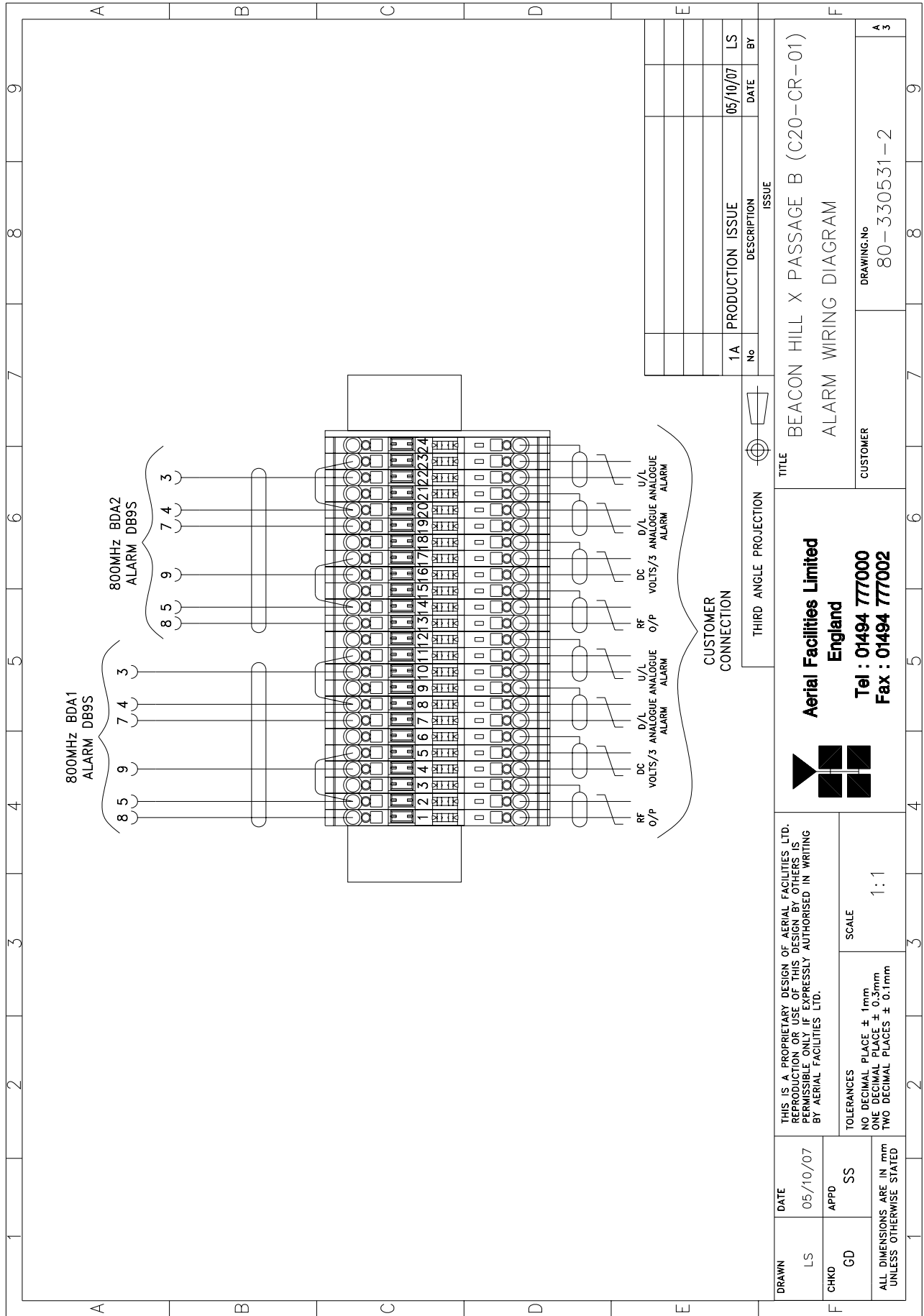
SCALE  
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DRAWN	DATE	LS	APPD	DN
1A	27/06/07	LS		
BA	05/11/07	LS		
AA	28/08/07	LS		
	27/06/07	LS		
No	ISSUE			

THIRD ANGLE PROJECTION

### 9.3. Beacon Hill Station Cross Passage B (80-330591-2) Alarm Wiring Diagram

Drawing number 80-330531-2



## 9.4. Beacon Hill Station Cross Passage A (80-330591-1) Major Sub Components

### 9.4.1. Wideband Asymmetric Coupler (07-015102)

The purpose of Wideband Asymmetric Coupler (07-015102) is to tap off a known portion (in this case 10dB) of RF signal from transmission lines and to combine them, for example through splitter units for different purposes (alarms/monitoring etc.), whilst maintaining an accurate 50Ω load to all ports/interfaces throughout the specified frequency range. They are known formally as directional couplers as they couple power from the RF mainline in one direction only.

#### 07-015102 Specification

PARAMETER		SPECIFICATION
Frequency Range		800 - 2500 MHz
Coupling Value		10 dB ± 1.0 dB
Main Line Insertion Loss		<1.6 dB
VSWR		1.4:1
Directivity		>18 dB
Power Rating		200 Watts
RF Connectors		'N' female
Temperature range	operation	-20°C to +60°C
	storage	-40°C to +70°C

### 9.4.2. Power Amplifier (12-018002)

This amplifier is a Class A 20W power amplifier from 800-960MHz in a 1 stage balanced configuration. It demonstrates a very high linearity and a very good input/output return loss (RL). It has built in a Current Fault Alarm Function.

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.

#### 12-018002 Specification

PARAMETER		SPECIFICATION
Frequency range:		800-960MHz
Small signal gain:		30dB
Gain flatness:		±1.2dB
I/O Return loss:		>18dB
1dB compression point:		42.8dBm
OIP3:		56dBm
Supply voltage:		24V DC
Supply current:		5.0Amps (Typical)
Temperature range	operational:	-10°C to +60°C
	storage:	-20°C to +70°C
Weight:		<2kg (no heatsink)

Power Amplifier (12-018002) 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)

