Dual Band Fibre Fed BDA

User Handbook

For

General Dynamics Information Technology Inc.

AWL Works Order Q119830
AWL Product Part No. 60-232301

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1. Introduction

1.1. Scope and Purpose of Document

This handbook is for use solely with the equipment identified by the Axell Wireless Limited (AWL) Part Number shown on the front page. It is not to be used with any other equipment unless specifically authorised by AWL. This is a controlled release document and, as such, becomes a part of the Axell Wireless Total Quality Management System. Alterations and modification may therefore only be performed by Axell Wireless.

AWL 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 AWL, normally at the company's repair facility in Chesham, England.

This handbook has been prepared in accordance with BS 4884, and AWL'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 Operations Support Director (see section 2.7.).
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 AWL 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, AWL does not warrant the absolute accuracy of the information contained within this manual, or its completeness, fitness for purpose, or scope.

AWL 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.

Unless specified otherwise, all AWL 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 AWL'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 50Ω, and that of free space at 377Ω, which would severely compromise 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 AWL 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 Equipment above ground e.g. on a mast or pole and manual handling precautions relevant to items of the weight of the equipment being worked on must be observed at all times when handling, installing or dismounting this equipment.

2.5. Chemical Hazard

Beryllium Oxide, also known as Beryllium Monoxide, or Thermalox™, is sometimes used in devices within equipment produced by Axell Wireless Ltd. Beryllium oxide dust can be toxic if inhaled, leading to chronic respiratory problems. It is harmless if ingested or by contact.

Products that contain beryllium are load terminations (dummy loads) and some power amplifiers. These products can be identified by a yellow and black “skull and crossbones” danger symbol (shown above). They are marked as hazardous in line with international regulations, but pose no threat under normal circumstances. Only if a component containing beryllium oxide has suffered catastrophic failure, or exploded, will there be any danger of the formation of dust. Any dust that has been created will be contained within the equipment module as long as the module remains sealed. For this reason, any module carrying the yellow and black danger sign should not be opened. If the equipment is suspected of failure, or is at the end of its life-cycle, it must be returned to Axell Wireless Ltd. for disposal.

To return such equipment, please contact the Operations Support 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 AWL 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 fibers 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 minimum bend radius is 3cm; bending to a smaller radius may result in optical cable breakage and excessive transmission losses.
Caution: The FO units are NOT weather proof.

2.7. Emergency Contact Numbers

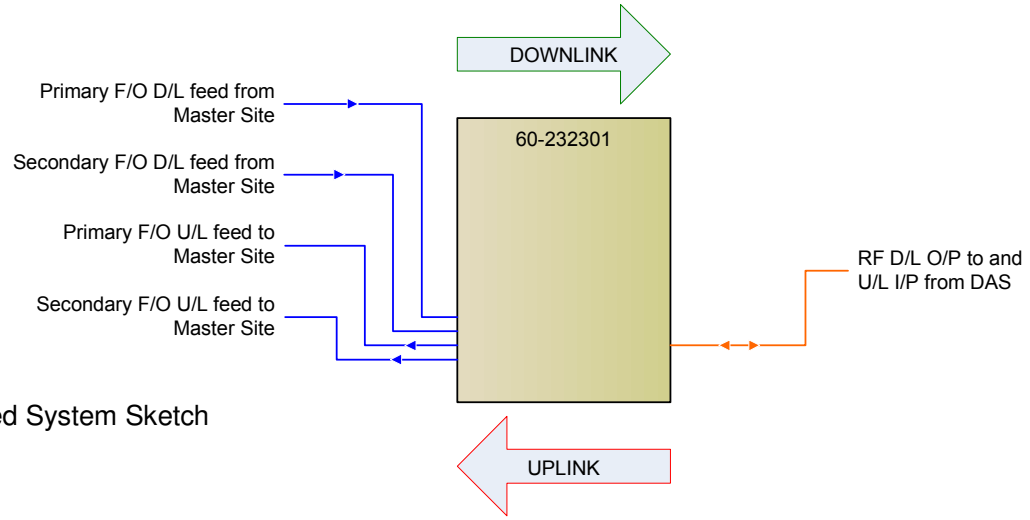
The AWL Operations Support Department can be contacted on:

Telephone	+44 (0)1494 777000
Fax.	+44 (0)1494 777002
e-mail	qa@axellwireless.com

3. Dual Band Fibre Fed BDA 60-232301

Dual Band Fibre Fed BDA 60-232301 is built into a wall-mounted, environmentally protected (IP65) aluminium alloy case; RF ports and connectors are also IP65 standard making the entire enclosure and connecting ports weatherproof. Handles are provided for carrying the unit and the door is fitted with locks. A supply isolator switch is fitted inside the unit and there are Power On and Alarm indicators on the outside of the door.

The BDA is used to filter and amplify the signal levels of two (UHF and 800MHz) Downlink and Uplink frequency bands; one RF port connects to a Distributed Antenna System facing the mobile units and four Optical Ports (primary and secondary D/L and primary and secondary U/L) receive Optical signals from (Downlink) and transmit optical signals to (Uplink) the Master Site.



Simplified System Sketch

Downlink
Downlink signals are received from the Master Site as Optical signals via Fibre Optic cables which enter the case of the BDA at the cable gland annotated “A” in section 3.5. There are two Downlink optical cables, a primary link and a secondary (redundant) link. The primary Downlink optical cable connects to the BDA at the SC/APC optical port annotated “B” in section 3.6.1.; the optical signal is demodulated to RF by the F/O Transceiver Module J1361001 annotated “A” in section 3.6.1. and the resultant RF Downlink signal passes into RF Relay Assembly 20-001507.

The secondary Downlink optical cable connects to the BDA at the SC/APC optical port annotated “C” in section 3.6.1.; the optical signal is demodulated to RF by the F/O Transceiver Module J1361001 annotated “D” in section 3.6.1. and the resultant RF Downlink signal also passes into RF Relay Assembly 20-001507 which is normally set to pass the primary signal but if the primary signal strength falls below a pre-set level then the RF relay switches to the secondary Downlink path. After leaving the RF relay the Downlink signal passes through an AGC Detector Module 17-019802 which monitors the strength of the RF signals entering the RF relay and if the primary signal falls below its pre-set threshold then the AGC Detector switches the RF relay to pass the secondary Downlink signal path.

The Downlink signal then passes through a Crossband Coupler 07-004814 (annotated “G” in sections 3.6.2. & 3.6.3.) which splits the UHF band signal from the 800MHz band signal.

UHF Downlink
The UHF branch then passes through a bandpass filter 02-010501(annotated “H” in section 3.6.2.) which is tuned to pass the UHF Downlink passband and to reject out-of-band noise and then passes through Variable Switched Attenuator 10-000901 (annotated “I” in section 3.6.2.) which can provide up to 15dB of attenuation in 1dB steps if required, the attenuation is controlled by a set of four toggle switches on the body of the attenuator; each switch is clearly marked with the attenuation it provides, and the total attenuation in-line is the sum of the values switched in.

After leaving the attenuator the UHF Downlink passes through AGC Attenuator Module 17-016401 (annotated “J” in section 3.6.2.) which is controlled by UHF Downlink AGC Detector Module 17-019802 and is capable of providing up to 15dB of signal attenuation.

The UHF Downlink then passes through two stages of amplification; the first stage is composed of two Low Noise Amplifiers 11-007402, arranged in parallel (each providing 30dB of signal gain). The signal is split into two equal paths by a 3dB Splitter/Combiner 05-002603 (annotated “K” in section 3.6.2.) and each path passes through one of the LNAs (annotated “L” and “M” in section 3.6.2.) before being recombined by a second 2 way splitter/combiner 05-002603 (annotated “N” in section 3.6.2.).

The second stage is composed of two 5W Power Amplifiers 12-021601 arranged in parallel (each providing 30dB of signal gain). The signal is split into two equal paths by a 3dB Splitter/Combiner 05-002603 (annotated “O” in section 3.6.2.) and each path passes through one of the PAs (annotated “P” and “Q” in section 3.6.2.) before being recombined by a second 2 way splitter/combiner 05-002603 (annotated “R” in section 3.6.2.).

After leaving the Power Amplifiers the UHF Downlink signal path passes through an AGC Detector Module 17-019801 (annotated “S” in section 3.6.2.) which regulates the gain level by adjusting AGC Attenuator Module 17-016401; The AGC Detector module 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 AGC Attenuator Module to limit the RF output to the (factory set) threshold. Therefore overloading of the power amplifier is avoided.

After leaving the AGC Detector Module the UHF Downlink passes through the Downlink path of Bandpass Duplexer Module 16-041402 (annotated “T” in section 3.6.2.) to further reject out-of-band noise. Upon leaving the Duplexer module the UHF Downlink signal passes into a second Crossband Coupler 07-004814 (annotated “U” in sections 3.6.2. & 3.6.3.) which combines the UHF Downlink with the 800MHz band Downlink path and the combined signal exits the BDA for the DAS via the N type port labelled “ANT. FACING MOBILES” (annotated “B” in section 3.5.)

800MHz Downlink

After passing through Crossband Coupler 07-004814 (annotated “G” in sections 3.6.2. & 3.6.3.) the 800MHz branch then passes through a bandpass filter 02-007201 (annotated “H” in section 3.6.3.) which is tuned to pass the 800MHz Downlink passband and to reject out-of-band noise and then passes through Variable Switched Attenuator 10-000901 (annotated “I” in section 3.6.3.) which can provide up to 15dB of attenuation in 1dB steps if required, the attenuation is controlled by a set of four toggle switches on the body of the attenuator; each switch is clearly marked with the attenuation it provides, and the total attenuation in-line is the sum of the values switched in.

After leaving the attenuator the 800MHz Downlink passes through AGC Attenuator Module 17-016401 (annotated “J” in section 3.6.3.) which is controlled by 800MHz Downlink AGC Detector Module 17-019802 and is capable of providing up to 15dB of signal attenuation.

The 800MHz Downlink then passes through two stages of amplification; the first stage is composed of two Low Noise Amplifiers 11-006702, arranged in parallel (each providing 30dB of signal gain). The signal is split into two equal paths by a 3dB Splitter/Combiner 05-002602 (annotated “K” in section 3.6.3.) and each path passes through one of the LNAs (annotated “L” and “M” in section 3.6.3.) before being recombined by a second 2 way splitter/combiner 05-002602 (annotated “N” in section 3.6.3.).

The second stage is composed of two 20W Power Amplifiers 12-023301 arranged in parallel (each providing 37dB of signal gain). The signal is split into two equal paths by a 3dB Splitter/Combiner 05-002602 (annotated “O” in section 3.6.3.) and each path passes through one of the PAs (annotated “P” and “Q” in section 3.6.3.) before being recombined by a second 2 way splitter/combiner 05-002602 (annotated “R” in section 3.6.3.).

After leaving the Power Amplifiers the 800MHz Downlink signal path passes through an AGC Detector Module 17-019801 (annotated “S” in section 3.6.3.) which regulates the gain level by adjusting AGC Attenuator Module 17-016401; The AGC Detector module 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 AGC Attenuator Module to limit the RF output to the (factory set) threshold. Therefore overloading of the power amplifier is avoided.

After leaving the AGC Detector Module the 800MHz Downlink passes through a second bandpass filter 02-007201 (annotated “T” in section 3.6.3.) which is tuned to pass the 800MHz Downlink passband and to further reject out-of-band noise. Upon leaving the Bandpass Filter 800MHz Downlink signal passes into a second Crossband Coupler 07-004814 (annotated “U” in sections 3.6.2. & 3.6.3.) which combines the 800MHz Downlink with the UHF band Downlink path and the combined signal exits the BDA for the DAS via the N type port labelled “ANT. FACING MOBILES” (annotated “B” in section 3.5.)

Uplink
Uplink signals are received from the DAS and enter the case of the BDA at the N type port labelled “ANT. FACING MOBILES” (annotated “B” in section 3.5.).

The Uplink signal then passes through a Crossband Coupler 07-004814 (annotated “B” in sections 3.6.4. & 3.6.5.) which splits the UHF band signal from the 800MHz band signal.

UHF Uplink
The UHF branch then passes through the Uplink path of Bandpass Duplexer Module 16-041402 (annotated “C” in section 3.6.4.) which is tuned to pass the UHF Uplink passband and to reject out-of-band noise and then passes through the first of two amplification stages.

The first stage is composed of two Low Noise Amplifiers 11-007402, arranged in parallel (each providing 30dB of signal gain). The signal is split into two equal paths by a 3dB Splitter/Combiner 05-002603 (annotated “D” in section 3.6.4.) and each path passes through one of the LNAs (annotated “E” and “F” in section 3.6.4.) before being recombined by a second 2 way splitter/combiner 05-002603 (annotated “G” in section 3.6.4.).

The UHF Uplink then passes through Variable Switched Attenuator 10-000701 (annotated “H” in section 3.6.4.) which can provide up to 30dB of attenuation in 1dB steps if required, the attenuation is controlled by a set of four toggle switches on the body of the attenuator; each switch is clearly marked with the attenuation it provides, and the total attenuation in-line is the sum of the values switched in.

After leaving the attenuator the UHF Uplink passes through AGC Attenuator Module 17-016401 (annotated “I” in section 3.6.4.) which is controlled by UHF Uplink AGC Detector Module 17-019802 and is capable of providing up to 15dB of signal attenuation.

The UHF Uplink then passes through a Bandpass Filter 02-010501 to further reject out-of-band noise and then through the second stage of amplification, the second stage is composed of two 1W Low Power Amplifiers 12-030301 arranged in parallel (each providing 33dB of signal gain). The signal is split into two equal paths by a 3dB Splitter/Combiner 05-002603 (annotated “K” in section 3.6.4.) and each path passes through one of the PAs (annotated “L” and “M” in section 3.6.4.) before being recombined by a second 2 way splitter/combiner 05-002603 (annotated “N” in section 3.6.4.).

After leaving the Low Power Amplifiers the UHF Uplink signal path passes through an AGC Detector Module 17-019802 (annotated “O” in section 3.6.4.) which regulates the gain level by adjusting AGC Attenuator Module 17-016401; The AGC Detector module 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 AGC Attenuator Module to limit the RF output to the (factory set) threshold. Therefore overloading of the power amplifier is avoided.

After leaving the AGC Detector Module the UHF Uplink passes through a second Crossband Coupler 07-004814 (annotated “P” in sections 3.6.4. & 3.6.5.) which combines the UHF Uplink with the 800MHz band Uplink path; the combined signal then passes through a 3dB Splitter/Combiner 05-002901 (annotated “Q” in sections 3.6.4. & 3.6.5.) which splits the combined Uplink signal into two equal paths.

One path is fed to the F/O Transceiver Module J1361001 (annotated “R” in sections 3.6.4. & 3.6.5.) for the primary optical link. The F/O Transceiver Module modulates the RF signal onto a laser and the primary optical uplink exits the BDA for the master site via the SC/APC optical port annotated “T” in sections 3.6.4. & 3.6.5.

The second branch of the Uplink path is fed to the F/O Transceiver Module J1361001 (annotated “S” in sections 3.6.4. & 3.6.5.) for the secondary optical link. The F/O Transceiver Module modulates the RF signal onto a laser and the secondary optical uplink exits the BDA for the master site via the SC/APC optical port annotated “U” in sections 3.6.4. & 3.6.5.

800MHz Uplink
After passing through Crossband Coupler 07-004814 (annotated “B” in sections 3.6.4. & 3.6.5.) the 800MHz branch then passes through Bandpass filter 02-007201 (annotated “C” in section 3.6.5.) which is tuned to pass the 800MHz band Uplink passband and to reject out-of-band noise and then passes through the first of two amplification stages.

The first stage is composed of two Low Noise Amplifiers 11-006702, arranged in parallel (each providing 30dB of signal gain). The signal is split into two equal paths by a 3dB Splitter/Combiner 05-002602 (annotated “D” in section 3.6.5.) and each path passes through one of the LNAs (annotated “E” and “F” in section 3.6.5.) before being recombined by a second 2 way splitter/combiner 05-002602 (annotated “G” in section 3.6.5.).

The 800MHz Uplink then passes through Variable Switched Attenuator 10-000701 (annotated “H” in section 3.6.5.) which can provide up to 30dB of attenuation in 1dB steps if required, the attenuation is controlled by a set of four toggle switches on the body of the attenuator; each switch is clearly marked with the attenuation it provides, and the total attenuation in-line is the sum of the values switched in.

After leaving the attenuator the 800MHz Uplink passes through AGC Attenuator Module 17-016401 (annotated “I” in section 3.6.5.) which is controlled by UHF Uplink AGC Detector Module 17-019802 and is capable of providing up to 15dB of signal attenuation.

The 800MHz Uplink then passes through a second Bandpass Filter 02-007201 to further reject out-of-band noise and then through the second stage of amplification, the second stage is composed of two 1W Low Power Amplifiers 12-030302 arranged in parallel (each providing 30dB of signal gain). The signal is split into two equal paths by a 3dB Splitter/Combiner 05-002602 (annotated “K” in section 3.6.5.) and each path passes through one of the PAs (annotated “L” and “M” in section 3.6.5.) before being recombined by a second 2 way splitter/combiner 05-002602 (annotated “N” in section 3.6.5.).

After leaving the Low Power Amplifiers the 800MHz Uplink signal path passes through an AGC Detector Module 17-019802 (annotated “O” in section 3.6.5.) which regulates the gain level by adjusting AGC Attenuator Module 17-016401; The AGC Detector module 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 AGC Attenuator Module to limit the RF output to the (factory set) threshold. Therefore overloading of the power amplifier is avoided.

After leaving the AGC Detector Module the 800MHz Uplink passes through a second Crossband Coupler 07-004814 (annotated “P” in sections 3.6.4. & 3.6.5.) which combines the 800MHz Uplink with the UHF band Uplink path; the combined signal then passes through a 3dB Splitter/Combiner 05-002901 (annotated “Q” in sections 3.6.4. & 3.6.5.) which splits the combined Uplink signal into two equal paths.

One path is fed to the F/O Transceiver Module J1361001 (annotated “R” in sections 3.6.4. & 3.6.5.) for the primary optical link. The F/O Transceiver Module modulates the RF signal onto a laser and the primary optical uplink exits the BDA for the master site via the SC/APC optical port annotated “T” in sections 3.6.4. & 3.6.5.

The second branch of the Uplink path is fed to the F/O Transceiver Module J1361001 (annotated “S” in sections 3.6.4. & 3.6.5.) for the secondary optical link. The F/O Transceiver Module modulates the RF signal onto a laser and the secondary optical uplink exits the BDA for the master site via the SC/APC optical port annotated “U” in sections 3.6.4. & 3.6.5.

Dual Band Fibre Fed BDA 60-232301 is powered by an AC input of 115V which drives a pair of identical 600Watt PSU modules connected via power combining diodes in a dual redundant configuration to provide a 24V DC supply which in turn is used to feed a pair of DC/DC convertors the 12V outputs of which are similarly combined via diodes. The 12V DC supply is then further modified by a multi-voltage converter to provide a range of DC voltages to power the active modules within the BDA

A comprehensive alarm system is fitted; all the amplifier, fibre optic and PSU modules carry their own voltage-free contact alarm relay outputs which are fed to and collated by a control PCB, the Generic Interface Board Assembly 17-020001 (annotated “L” in section 3.6.6.); from here alarm data is fed to the F/O Transceiver Modules and modulated onto the Uplink optical signal to be demodulated at the BTS. A summary alarm output is also present at the terminal block (terminals 7 & 8) (annotated “L” in section 3.6.1.) on the front face of the External Alarm and Battery Module J1161030 (annotated “K” in section 3.6.1.) The summary output is then fed to the 6 pole panel plug labelled “ALARM” (annotated “D” in section 3.5.) on the side of the case.

Two ports are provided where an operator may connect into the system using a laptop PC running suitable terminal-emulation software to interrogate the control PCB to gain access to alarm information and to configure the equipment. A local serial port, (a 9 way “D” panel socket annotated “J” in section 3.6.1.) and an RJ45 Ethernet port (annotated “I” in section 3.6.1.)

Control data from the BTS for the AGC system are modulated onto the optical Downlink signal and demodulated by the F/O Transceiver Modules to be fed to the control PCB.

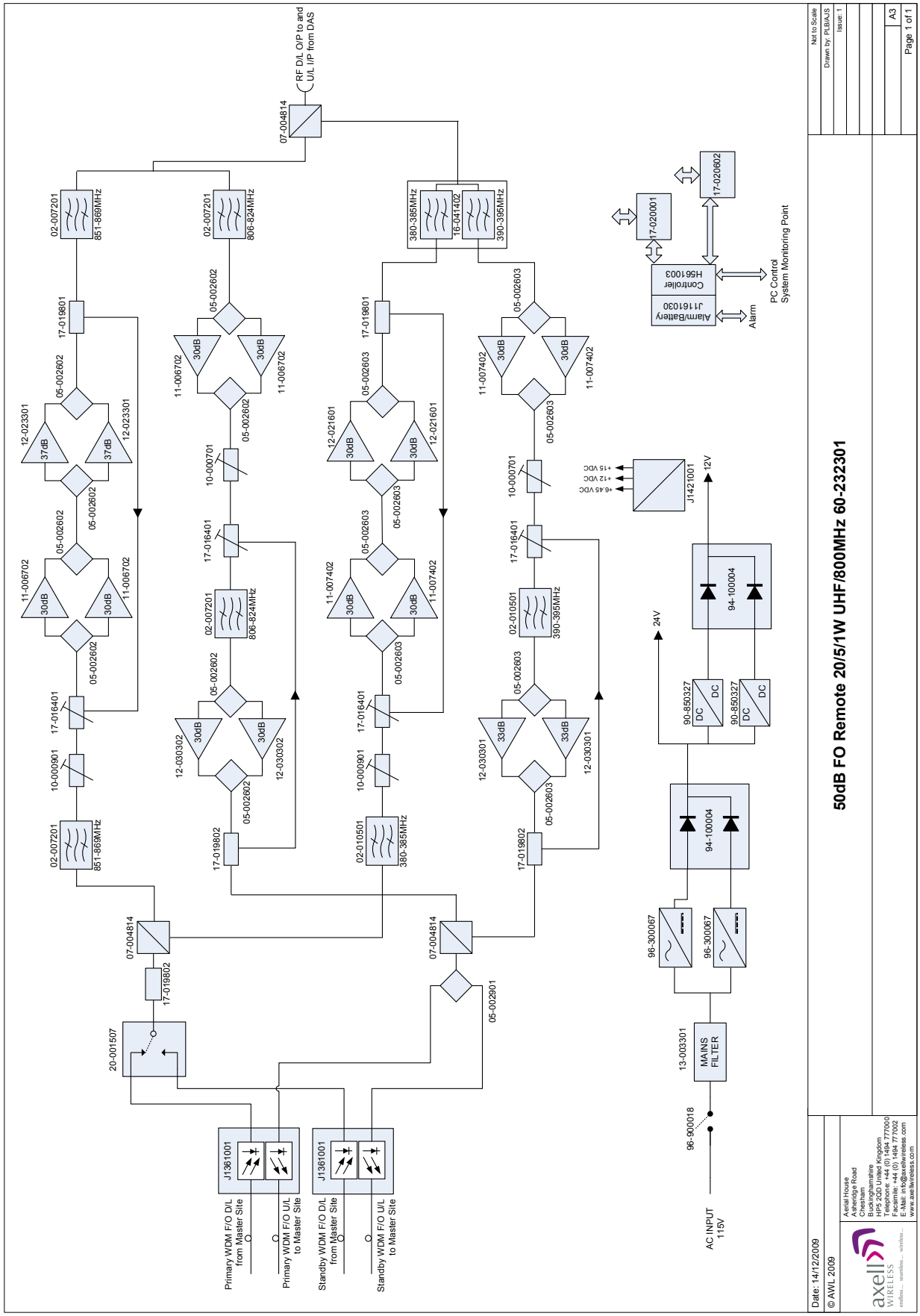
3.1. 60-232301 Specification

PARAMETER		SPECIFICATION
Optical Downlink		
Optical Input Alarm Threshold		< -9dBm at 1310nm
RF Downlink		
Passband Frequency	UHF	380-385 MHz
	800MHz	851-869 MHz
Passband Gain		50dB
Passband Ripple		<±1.5 dB
Switch Attenuator		0dB to 15dB (± 1dB) in 1dB steps
1dB Compression	UHF	+38dBm
	800MHz	+45dBm
OIP3	UHF	+50dBm
	800MHz	+63dBm
ALC setting		2dB below compression
In Band Spurious Noise (30kHz B/W)		< -13dBm @ (Max gain)
RF Uplink		
Passband Frequency	UHF	390-395 MHz
	800MHz	806-824 MHz
Passband Gain		>50 dB
Passband Ripple		<±1.5 dB
Switch Attenuator		0dB to 30dB (± 1dB) in 2dB steps
1dB Compression		+30dB
ALC Setting		0dBm (FCC -13dBm 3 Carriers)
OIP3		+40dBm
Noise Figure		<5dB (max. gain)
In Band Spurious Noise (30kHz B/W)		< -13dBm @ (Max gain)
Optical Uplink		
F/O TX Output Power		> 0dBm at 1550nm
General		
Case Size		909mm x 780mm x 275mm
Case Material		Aluminium Alloy (2mm)
Case Finish		Light Grey RAL7035 Semi-gloss
AC Supply Voltage		110V to 240V
RF Connectors		N type female
Optical Connectors		SC/APC
Alarms Fitted		UHF Downlink UHF Uplink 800MHz Downlink 800MHz Uplink F/O RX F/O TX
Temperature Range	operation	-20°C to +60°C
	storage	-40°C to +70°C
Humidity		95% RHNC

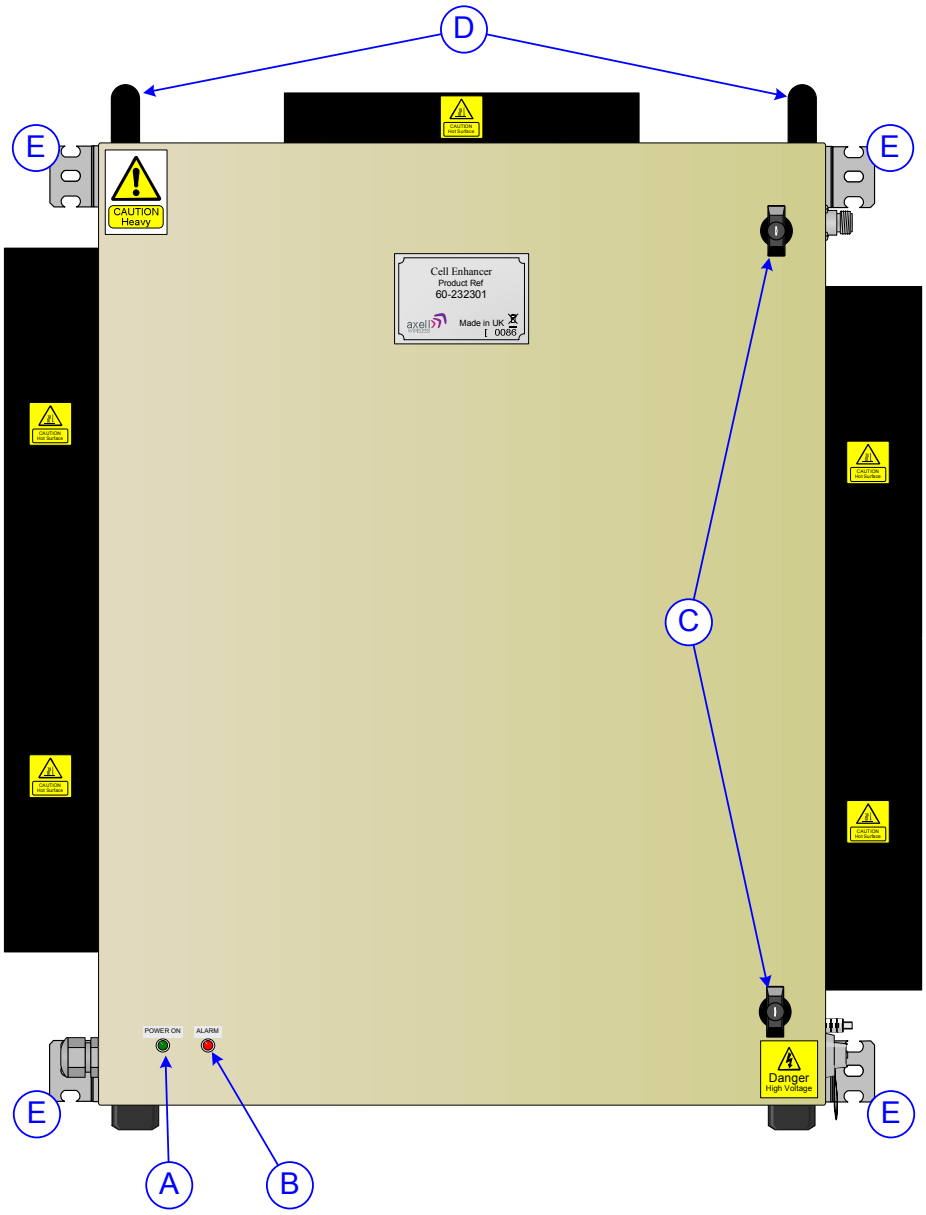
3.2. 60-232301 List of Major Sub-Components

Component Part	Part Description	Qty Per Assembly
02-007201	Bandpass Filter	4
02-010501	Bandpass Filter	2
05-002602	3dB Splitter/Combiner	8
05-002603	3dB Splitter/Combiner	8
05-002901	3dB Splitter/Combiner	1
07-004814	Crossband Coupler 500/800MHz	3
10-000701	Variable Switched Attenuator 0-30dB	2
10-000901	Variable Switched Attenuator 0-15dB	2
11-006702	Low Noise Amplifier 30dB	4
11-007402	Low Noise Amplifier 30dB	4
12-021601	5W Power Amplifier	2
12-023301	20W Power Amplifier	2
12-030301	1W Low Power Amplifier 33dB	2
12-030302	1W Low Power Amplifier 30dB	2
13-003301	Mains Filter Assembly	1
16-041402	Bandpass Duplexer Module	1
17-016401	AGC Attenuator Module	4
17-019801	AGC Detector Module (+10 to+50dBm)	2
17-019802	AGC Detector Module (-30 to+10dBm)	3
17-020001	Generic Interface Board Assembly	1
17-020602	Communications Board Module	1
20-001507	RF Relay Assembly	1
80-008901	12V Relay PCB Assembly	2
90-850327	DC/DC Converter	2
94-100004	Dual Diode Assembly	2
96-300067	600W PSU Module	2
96-900037	AC Trip Switch	1
H561003	Control Module	1
J1161030	External Alarm and Battery Module	1
J1361001	F/O Transceiver Module	2
J1421001	Multi-Voltage DC/DC Converter	1

3.3. 60-232301 System Diagram



3.4. 60-232301 Front View

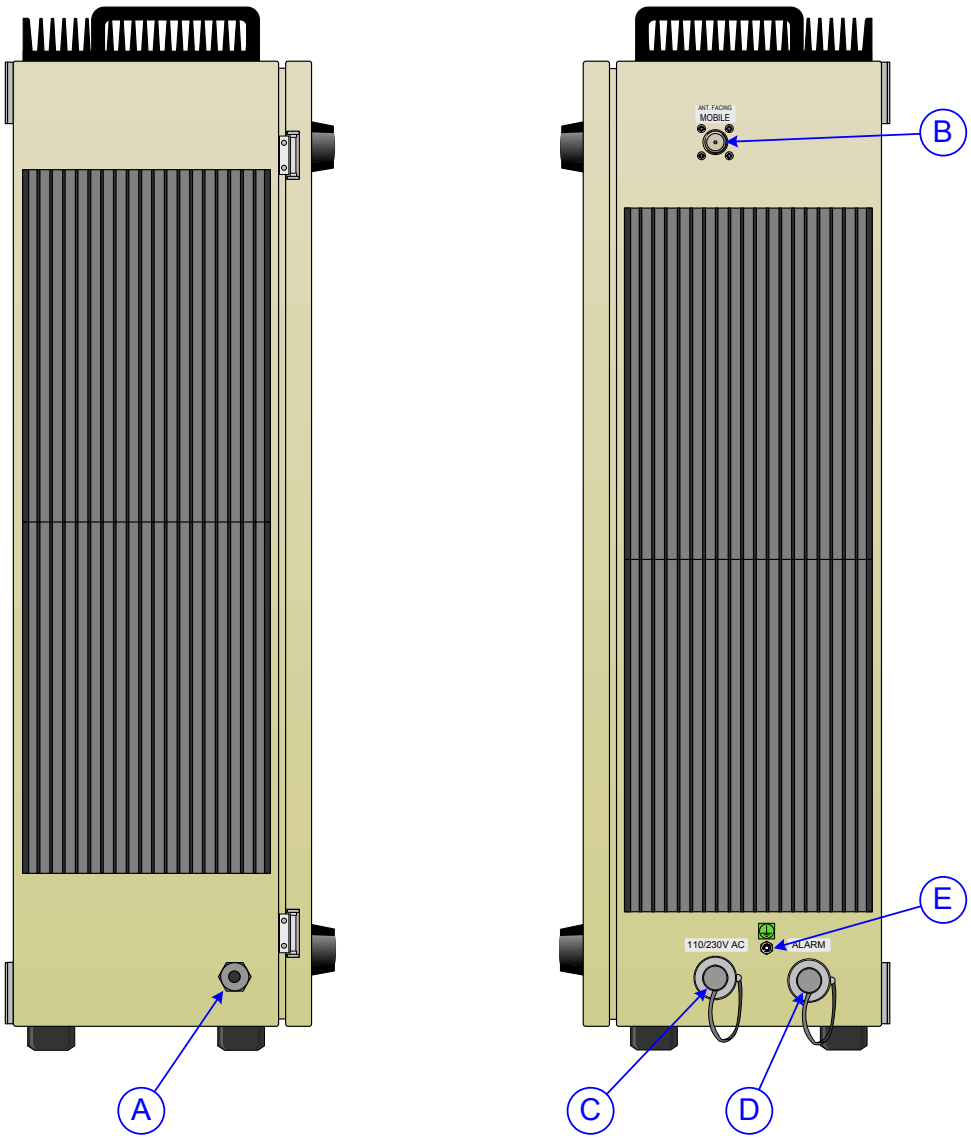


A	Green LED “POWER ON”, illuminated during normal operation
B	Red LED “ALARM”, illuminated during alarm condition
C	Lockable door handles
D	Lifting handles
E	Wall mount brackets

3.5. 60-232301 Side Views

LH Side

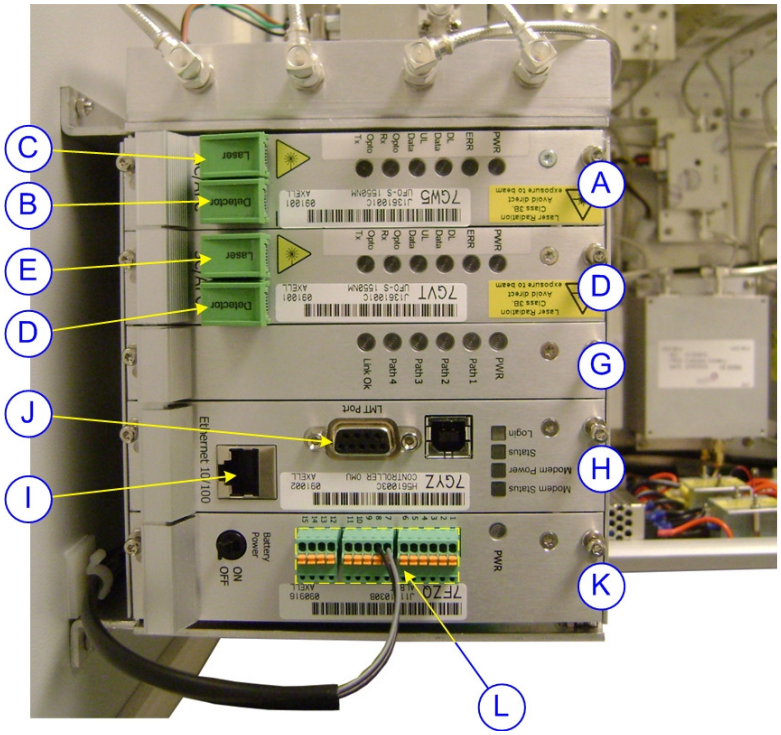
RH Side



A	Cable gland for entry of fibre optic cable link to master site
B	N type port “ANT FACING MOBILE” D/L O/P to and U/L I/P from DAS
C	3 pole panel plug “110/130V AC”, AC input
D	6 pole panel plug “ALARM”, Summary alarm output
E	Earthing connection

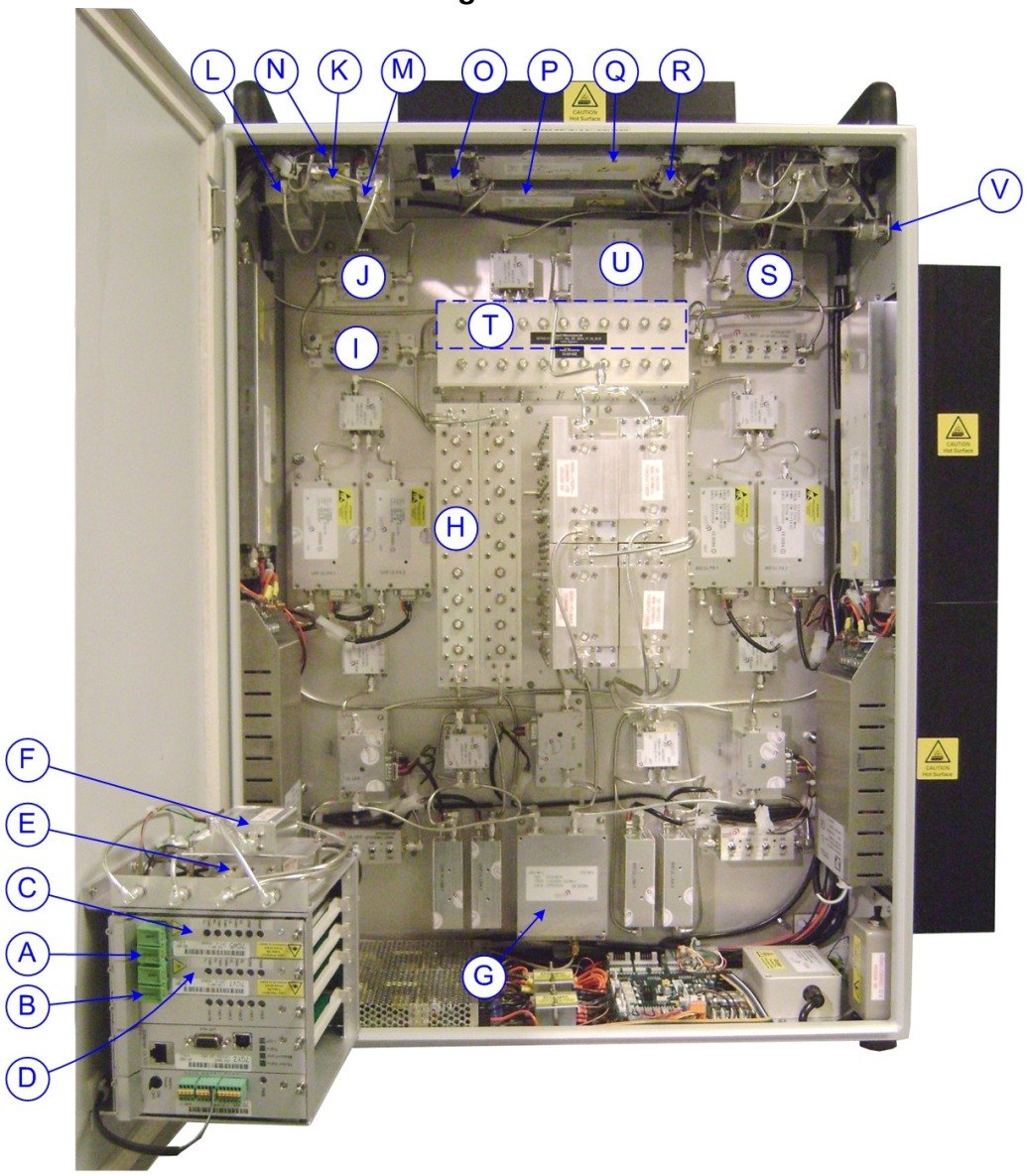
3.6. 60-232301 Interior Views

3.6.1. Interior View Showing Optical Connectors



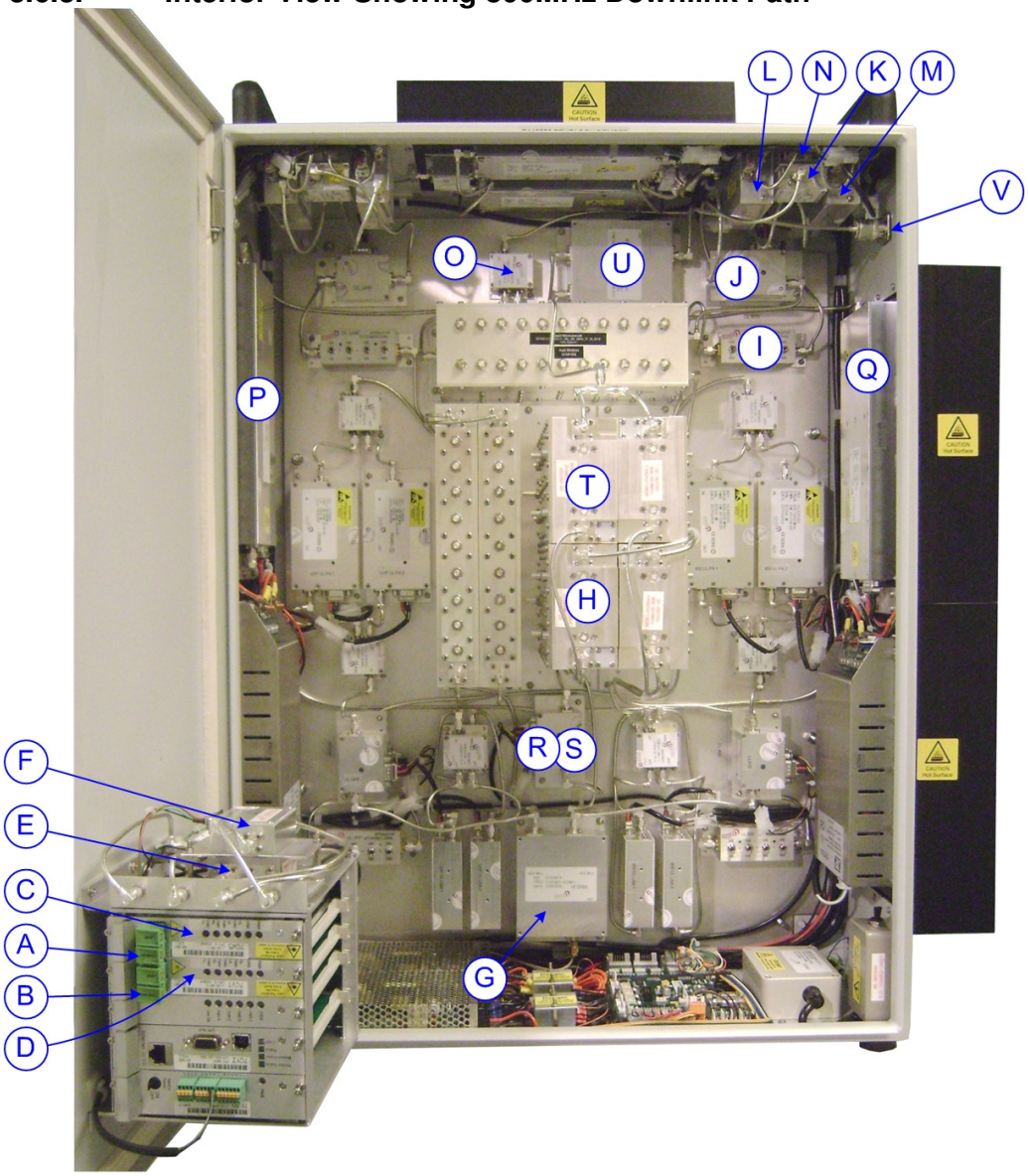
A	F/O TX/RX Module J1361001 (primary optical link)
B	SC/APC optical port – primary D/L fibre connection from master site
C	SC/APC optical port – Primary U/L fibre connection to master site
D	F/O TX/RX Module J1361001 (secondary optical link)
E	SC/APC optical port – secondary D/L fibre connection from master site
F	SC/APC optical port – secondary U/L fibre connection to master site
G	Communications Board Module 17-020602
H	Control Module H561003
I	RJ45 Ethernet socket enabling alarm/configuration by PC/laptop
J	9 pin “D” panel socket “LMT Port”, A local serial port enabling alarm/configuration by PC/laptop
K	External Alarm and Battery Module J1161030
L	Summary alarm output (terminals 7 & 8) to “ALARM” connector annotated “D” in section 3.5.

3.6.2. Interior View Showing UHF Downlink Path



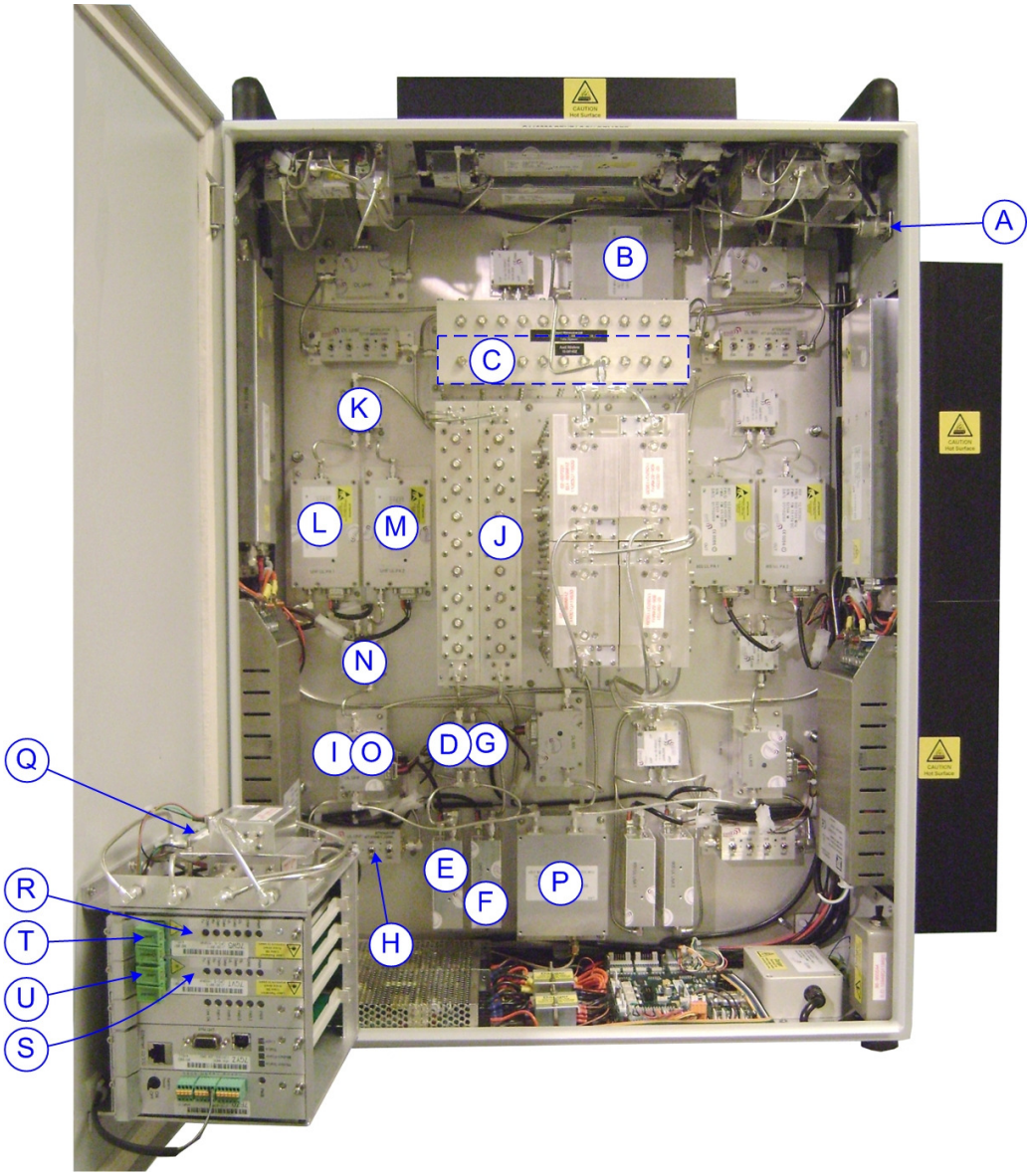
A	SC/APC optical port – primary D/L fibre connection from master site		
B	SC/APC optical port – secondary D/L fibre connection from master site		
C	F/O Transceiver Module J1361001 (primary optical link)		
D	F/O Transceiver Module J1361001 (secondary optical link)		
E	RF Relay Assembly 20-001507		
F	AGC Attenuator Module 17-016401		
G	Crossband Coupler 07-004814		
H	Bandpass Filter 02-010501		
I	Variable Switched Attenuator 0-15dB 10-000901		
J	AGC Detector Module 17-019802		
K	3dB Splitter/Combiner 05-002603 (splitting)	Q	5W Power Amplifier 12-021601 (2)
L	Low Noise Amplifier 30dB 11-007402 (1)	R	3dB Splitter/Combiner 05-002603 (combining)
M	Low Noise Amplifier 30dB 11-007402 (2)	S	AGC Detector Module (+10 to +50dBm) 17-019801
N	3dB Splitter/Combiner 05-002603 (combining)	T	Bandpass Duplexer Module 16-041402 (D/L path)
O	3dB Splitter/Combiner 05-002603 (splitting)	U	Crossband Coupler 07-004814
P	5W Power Amplifier 12-021601 (1)	V	N type port connection to DAS (D/L O/P)

3.6.3. Interior View Showing 800MHz Downlink Path



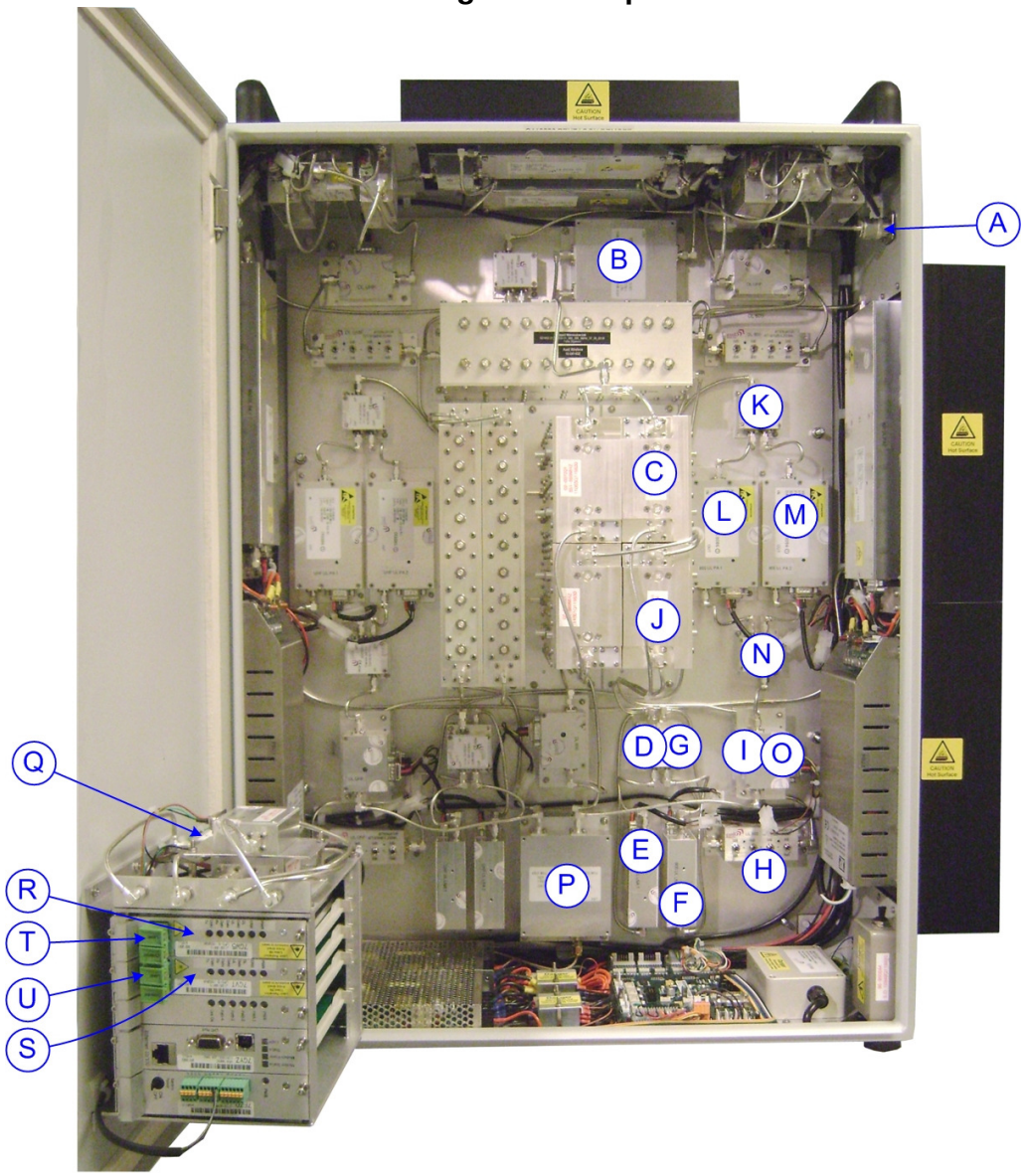
A	SC/APC optical port – primary D/L fibre connection from master site		
B	SC/APC optical port – secondary D/L fibre connection from master site		
C	F/O Transceiver Module J1361001 (primary optical link)		
D	F/O Transceiver Module J1361001 (secondary optical link)		
E	RF Relay Assembly 20-001507		
F	AGC Detector Module 17-019802		
G	Crossband Coupler 07-004814		
H	Bandpass Filter 02-007201		
I	Variable Switched Attenuator 0-15dB 10-000901		
J	AGC Attenuator Module 17-016401 (mounted below ”I” in previous section)		
K	3dB Splitter/Combiner 05-002602 (splitting)	Q	20W Power Amplifier 12-023301 (2)
L	Low Noise Amplifier 29dB 11-006702 (1)	R	3dB Splitter/Combiner 05-002602 (combining)
M	Low Noise Amplifier 29dB 11-006702 (2)	S	AGC Detector Module 17-019801 (below “Q”)
N	3dB Splitter/Combiner 05-002602 (combining)	T	Bandpass Filter 02-007201
O	3dB Splitter/Combiner 05-002602 (splitting)	U	Crossband Coupler 07-004814
P	20W Power Amplifier 12-023301 (1)	V	N type port connection to DAS (D/L O/P)

3.6.4. Interior View Showing UHF Uplink Path



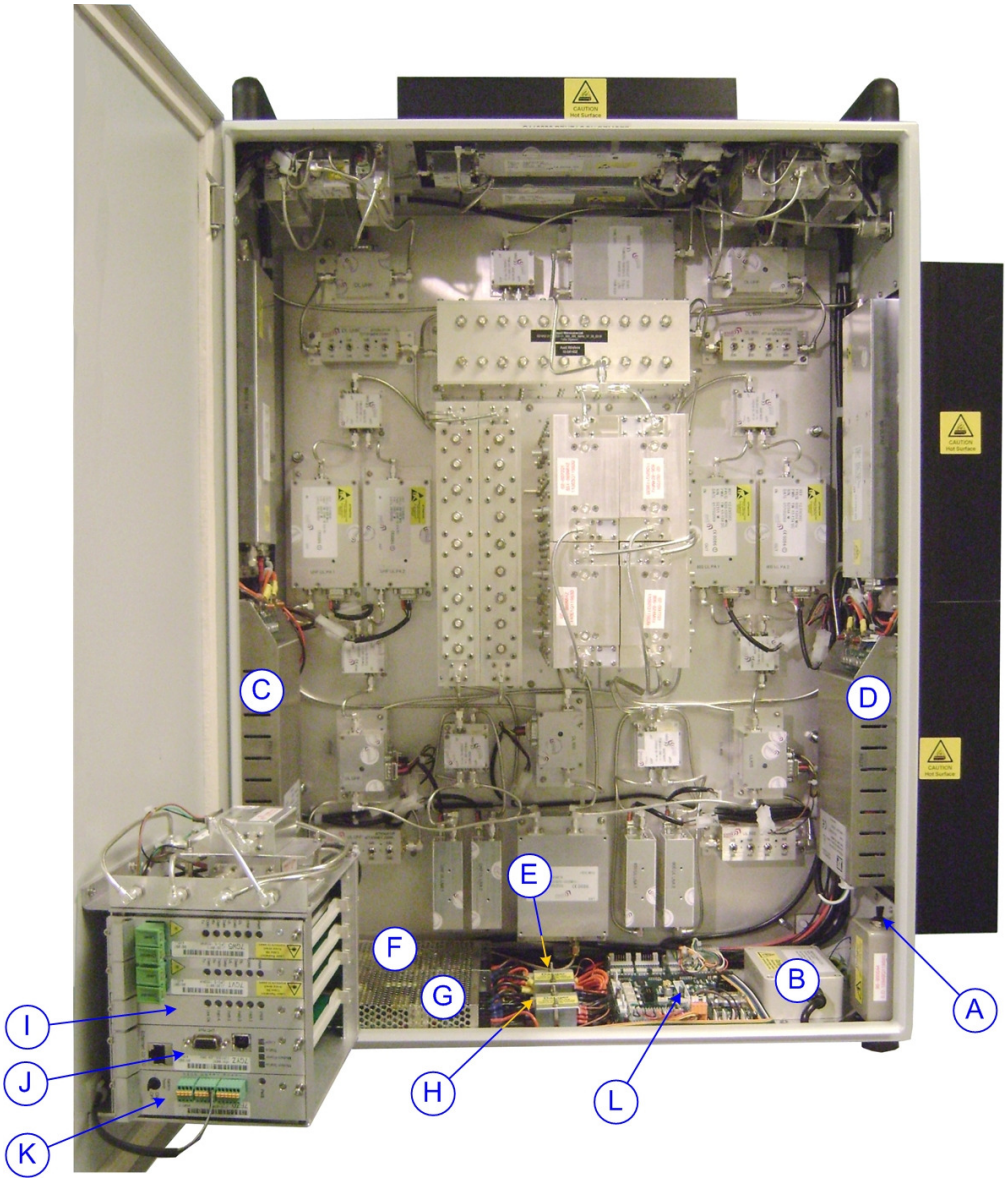
A	N type port connection to DAS (D/L O/P)	B	Crossband Coupler 07-004814
C	Bandpass Duplexer Module 16-041402 (U/L path)		
D	3dB Splitter/Combiner 05-002603 (splitting) (below “G”)		
E	Low Noise Amplifier 30dB 11-007402 (1)	F	Low Noise Amplifier 30dB 11-007402 (2)
G	3dB Splitter/Combiner 05-002603 (combining)	H	Variable Switched Attenuator 0-30dB 10-000701
I	AGC Attenuator Module 17-016401 (below “O”)	J	Bandpass Filter 02-010501
K	3dB Splitter/Combiner 05-002603 (splitting)		
L	1W Low Power Amplifier 33dB 12-030301 (1)	M	1W Low Power Amplifier 33dB 12-030301 (2)
N	3dB Splitter/Combiner 05-002603 (combining)		
O	AGC Detector Module 17-019802	P	Crossband Coupler 07-004814
Q	3dB Splitter/Combiner 05-002901		
R	F/O TX/RX Module J1361001 (primary optical link)		
S	F/O TX/RX Module J1361001 (secondary optical link)		
T	SC/APC optical port – primary fibre connection to master site		
U	SC/APC optical port – secondary fibre connection to master site		

3.6.5. Interior View Showing 800MHz Uplink Path



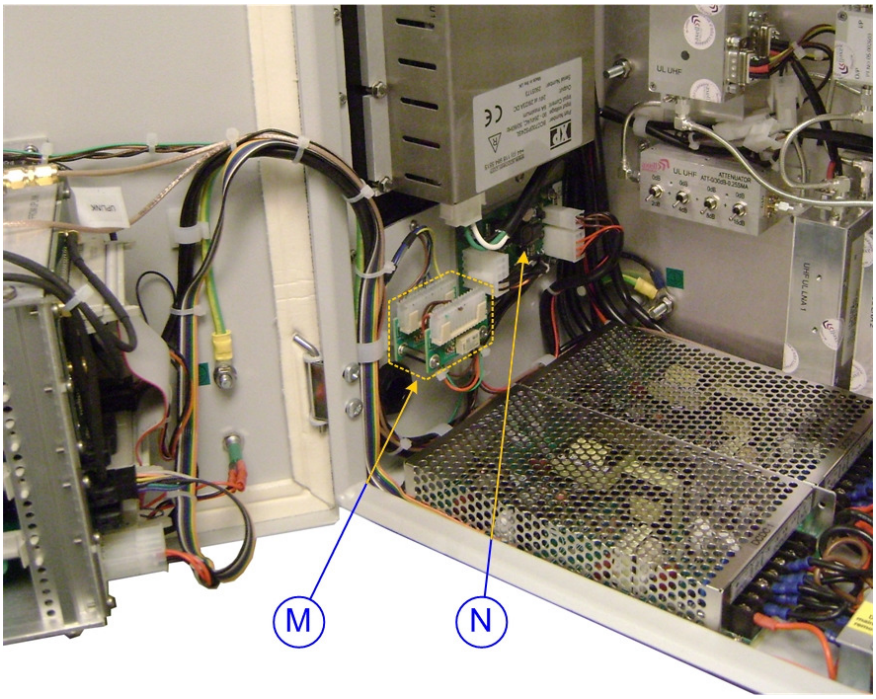
A	N type port connection to DAS (D/L O/P)	B	Crossband Coupler 07-004814
C	Bandpass Filter 02-007201		
D	3dB Splitter/Combiner 05-002602 (splitting) (below “G”)		
E	Low Noise Amplifier 29dB 11-006702 (1)	F	Low Noise Amplifier 29dB 11-006702 (2)
G	3dB Splitter/Combiner 05-002602 (combining)		
H	Variable Switched Attenuator 0-30dB 10-000701		
I	AGC Attenuator Module 17-016401 (below “O”)	J	Bandpass Filter 02-007201
K	3dB Splitter/Combiner 05-002602 (splitting)		
M	1W Low Power Amplifier 30dB 12-030302 (2)	L	1W Low Power Amplifier 30dB 12-030302 (1)
N	3dB Splitter/Combiner 05-002602 (combining)	O	AGC Detector Module 17-019802
P	Crossband Coupler 07-004814	Q	3dB Splitter/Combiner 05-002901
R	F/O TX/RX Module J1361001 (primary optical link)		
S	F/O TX/RX Module J1361001 (secondary optical link)		
T	SC/APC optical port – primary fibre connection to master site		
U	SC/APC optical port – secondary fibre connection to master site		

3.6.6. Interior View Showing DC and Alarm Modules



A	AC Trip Switch 96-900037
B	Mains Filter Assembly 13-003301
C	600W PSU Module 96-300067
D	600W PSU Module 96-300067
E	Dual Diode Assembly 94-100004 (combining O/Ps from “C” and “D”
F	DC/DC Converter 90-850327
G	DC/DC Converter 90-850327
H	Dual Diode Assembly 94-100004 (combining O/Ps from “F” and “G”
I	Communications Board Module 17-020602
J	Control Module H561003
K	External Alarm and Battery Module J1161030
L	Generic Interface Board Assembly 17-020001

M	12V Relay PCB Assemblies 80-008901
N	Multi-Voltage DC/DC Converter J1421001



4. Installation – General Notes

4.1. General Remarks

When this equipment is initially commissioned, please use the equipment set-up record sheet in Appendix B. This will help both the installation personnel and Axell Wireless should these figures be needed for future reference or diagnosis.

The procedure for installing and commissioning an Axell Wireless Wall Mount BDA is generally as follows:

1. Secure the BDA in the chosen wall position.

2. Connect the optical cable to the optical port inside the BDA

3. Fix the antenna and connect its cables to the BDA antenna ports.

4. Connect a suitable mains or battery power supply to the BDA

5. Switch the equipment mains on with the small switch located inside the BDA on the lower right hand side of the case.

6. If Base Station signal is available, make test calls via the BDA to ensure correct operation, if possible monitoring the signal levels during these calls to ensure that the uplink and downlink RF levels are as anticipated.

4.2. Electrical Connections

It is recommended that the electrical mains connection is made by a qualified electrician, who must be satisfied that the supply will be the correct voltage and of sufficient capacity.

All electrical and RF connections should be completed and checked prior to power being applied for the first time.

Ensure that connections are kept clean and are fully tightened.

4.3. RF Connections

Care must be taken to ensure that the correct connections are made with particular attention made to the base station TX/RX ports. In the event that the base transmitter is connected to the RX output of the equipment, damage to the equipment will be done if the base station transmitter is then keyed.

4.4. Optical Connections

The optical input and output port is supplied with a green plastic cover, which must be removed prior to the connection of the fibre cable. Ensure that transmitter and receiver fibre cable are identified to prevent misconnection. At the master site, the fibre transmitters are in the downlink path with the receivers in the uplink. At the remote sites the fibre transmitters are in the uplink with the receivers in the downlink.
Always ensure that connections are kept clean and are fully tightened.

4.5. Commissioning

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

To commission the system the test equipment detailed in Section 5.2. will be required.
Using the system diagrams and the end-to-end test specification (supplied with the equipment), the equipment should be tested to ensure correct operation.

On initial power up the system alarm indicators on the front door of the equipment should be checked. A red LED illuminated indicates a fault that must be investigated before proceeding with the commissioning. A green LED indicates that the power supply is connected to the unit.

In the event that any part of the system does not function correctly as expected, check all connections to ensure that they are to the correct port, that the interconnecting cables are not faulty and that they are tightened. The majority of commissioning difficulties arise from problems with the interconnecting cables and connectors.

5. Maintenance – General Notes

5.1. Fault Finding

5.1.1. Quick Fault Checklist

All Axell equipment is individually tested to specification prior to despatch. Failure of this type of equipment is not common. Experience has shown that a large number of fault conditions relating to tunnel installations result from simple causes often occurring as result of transportation, unpacking and installation. Below are listed some common problems which have resulted in poor performance or an indicated non-functioning of the equipment.

- Mains power not connected or not switched on.
- External connectors not fitted or incorrectly fitted.
- Internal connectors becoming loose due to transport vibration.
- Wiring becoming detached as a result of heavy handling.
- Input signals not present due to faults in the antenna and feeder system.
- Base transmissions not present due to fault at the base station.
- Modems fitted with incorrect software configuration.
- Changes to channel frequencies and inhibiting channels.
- Hand held radio equipment not set to repeater channels.
- Hand held radio equipment not set to correct base station.

5.1.2 Fault Isolation

In the event that the performance of the system is suspect, a methodical and logical approach to the problem will reveal the cause of the difficulty. The System consists of modules fitted in enclosed shelves within a rack mounted, environmentally protected enclosure.

Transmissions from the main base stations are passed though the system to the mobile radio equipment; this could be a handheld radio or a transceiver in a vehicle. This path is referred to as the downlink. The return signal path from the mobile radio equipment to the base station is referred to as the uplink.

The first operation is to check the alarms of each of the active units and determine that the power supplies to the equipment are connected and active.
This can be achieved remotely (via CEMS, the RS232 Coverage Enhancement Management System, if fitted), or locally with the door LEDs. The green LED on the door should be illuminated, while the red alarm indicator should be off.

The individual amplifier modules within the unit have a green LED showing through a hole in their piggy-back alarm board, which is illuminated if the unit is working correctly. If an amplifier is suspect, check the DC power supply to the unit. If no other fault is apparent use a spectrum analyser to measure the incoming signal level at the input and then after reconnecting the amplifier input, measure the output level. Consult with the system diagram to determine the expected gain and compare result.

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

5.1.3 Downlink

Confirm that there is a signal at the expected frequency and strength from the base station. If this is not present then the fault may lay outside the system. To confirm this, inject a downlink frequency signal from a known source at the master site BTS input and check for output at the remote site feeder output.

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

5.1.4 Uplink

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

5.1.5 Checking service

Following the repair of any part of the system it is recommended that a full end-to-end test is carried out in accordance with the test specification and that the coverage is checked by survey.

5.1.6 Fault repair

Once a faulty component has been identified, a decision must be made on the appropriate course to carry out a repair. A competent engineer can quickly remedy typical faults such as faulty connections or cables. The exceptions to this are cable assemblies connecting bandpass filter assemblies that are manufactured to critical lengths to maintain a 50-ohm system.

Care should be taken when replacing cables or connectors to ensure that items are of the correct specification. The repair of component modules such as amplifiers and bandpass filters will not usually be possible in the field, as they frequently require specialist knowledge and test equipment to ensure correct operation. It is recommended that items of this type are replaced with a spare unit and the faulty unit returned to Axell Wireless for repair.

5.1.7 Service Support

Advice and assistance with maintaining and servicing this system are available by contacting Axell Wireless Ltd., see section 2.7.

NOTE

Individual modules are not intended to be repaired on site and attempts at repair will invalidate active warranties. Company policy is that individual modules should be repaired by replacement. Axell Wireless Ltd. maintains a level of stock of most modules which can usually be despatched at short notice to support this policy.

5.2 Tools & Test Equipment

The minimum tools and test equipment needed to successfully service this Axell Wireless product are as follows:-

Spectrum analyser	100kHz to 2GHz (Dynamic range = 90dB).
Signal Generator	30MHz to 2GHz (-120dBm to 0dBm o/p level)
Attenuator	20dB, 10W, DC-2GHz, (N male – N female)
Test Antenna	Yagi or dipole for operating frequency
Optical Power Meter	1300 – 1560nM (-40 - +10dB)
Digital multi-meter	Universal Volt-Ohm-Amp meter
Test cable x 2	N male – N male, 2M long RG214
Test cable x 2	SMA male – N male, 1m long RG223
Hand tools	Philips #1&2 tip screwdriver
	3mm flat bladed screwdriver
	SMA spanner and torque setter

5.3. Care of Modules

5.3.1. General Comments

Many of the active modules contain semiconductor devices utilising MOS technology, which can be damaged by electrostatic discharge. Correct handling of such modules is mandatory to ensure their long-term reliability.

To prevent damage to a module, it must be withdrawn and inserted with care. The module may have connectors on its underside, which might not be visible to the service operative.

5.3.2. LNA Replacement (general procedure)

The following *general* instructions should be followed to remove a module:

1) Remove power to the unit
2) Remove all visible connectors (RF, DC & alarm)
3) Release module retaining screws.
4) Slowly but firmly, pull the module straight out of its position. Take care not to twist/turn the module during withdrawal. (When the module is loose, care may be needed, as there may be concealed connections underneath).

5.3.3. Module Replacement (general procedure)

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

5.3.4. Power Amplifiers Replacement (general procedure)

1) Remove power to the unit. (Switch off at mains/battery, or remove DC in connector)

2) Remove alarm wires from alarm screw terminal block or disconnect multi-way alarm connector.

3) Carefully disconnect the RF input and output coaxial connectors (usually SMA)

If alarm board removal is not required, go to step 5.

4) There is (usually) a plate attached to the alarm board which fixes it to the amplifier, remove its retaining screws and the alarm board can be withdrawn from the amplifier in its entirety. On certain types of amplifier the alarm board is not mounted on a dedicated mounting plate; in this case it will have to firstly be removed by unscrewing it from the mounting pillars, in most cases, the pillars will not have to be removed before lifting the amplifier.

5) If the amplifier to be removed has a heatsink attached, there may be several different ways it can have been assembled. The most commonly used method, is screws through the front of the heatsink to threaded screw holes (or nuts and bolts), into the amplifier within the main case. If the heatsink is mounted on the rear of the main case (e.g., against a wall in the case of wall mounted enclosures), then the fixing method for the heatsink will be from within the case, (otherwise the enclosure would have to be removed from the wall in order to remove the heatsink).

When the heatsink has been removed, the amplifier may be unscrewed from the main casing by its four corner fixings and gently withdrawn.

Fitting a new power amplifier module will be the exact reverse of the above.

Note: Do not forget to apply fresh heatsink compound to the heatsink/main case joint and also between the amplifier and the main case.

5.3.5. Low Power Amplifier Replacement (general procedure)

1) Disconnect the mains power supply and disconnect the 24V dc supply connector for the LPA.
2) Disconnect the RF input and output cables from the LPA.
3) Disconnect the alarm connector.
4) Remove the alarm monitoring wires from (D type connector) pins 9 and 10.
5) Remove the LPA module by removing the four retaining screws, replace with a new LPA module and secure it with the screws.
6) Connect the RF cables to the LPA input and output connectors. Reconnect the wires to the alarm board connector pins 9 and 10.
7) Reconnect the DC supply connector and turn the mains switch on.

Note: Tighten SMA connectors using only a dedicated SMA torque spanner. If SMA connectors are over-tightened, irreparable damage will occur. Do not use adjustable pliers to loosen/tighten SMA connectors.

Also take care not to drop or knock the module as this can damage (or misalign in the case of tuned passive modules) sensitive internal components. Always store the modules in an environmentally friendly location

5.3.6. Module Transportation

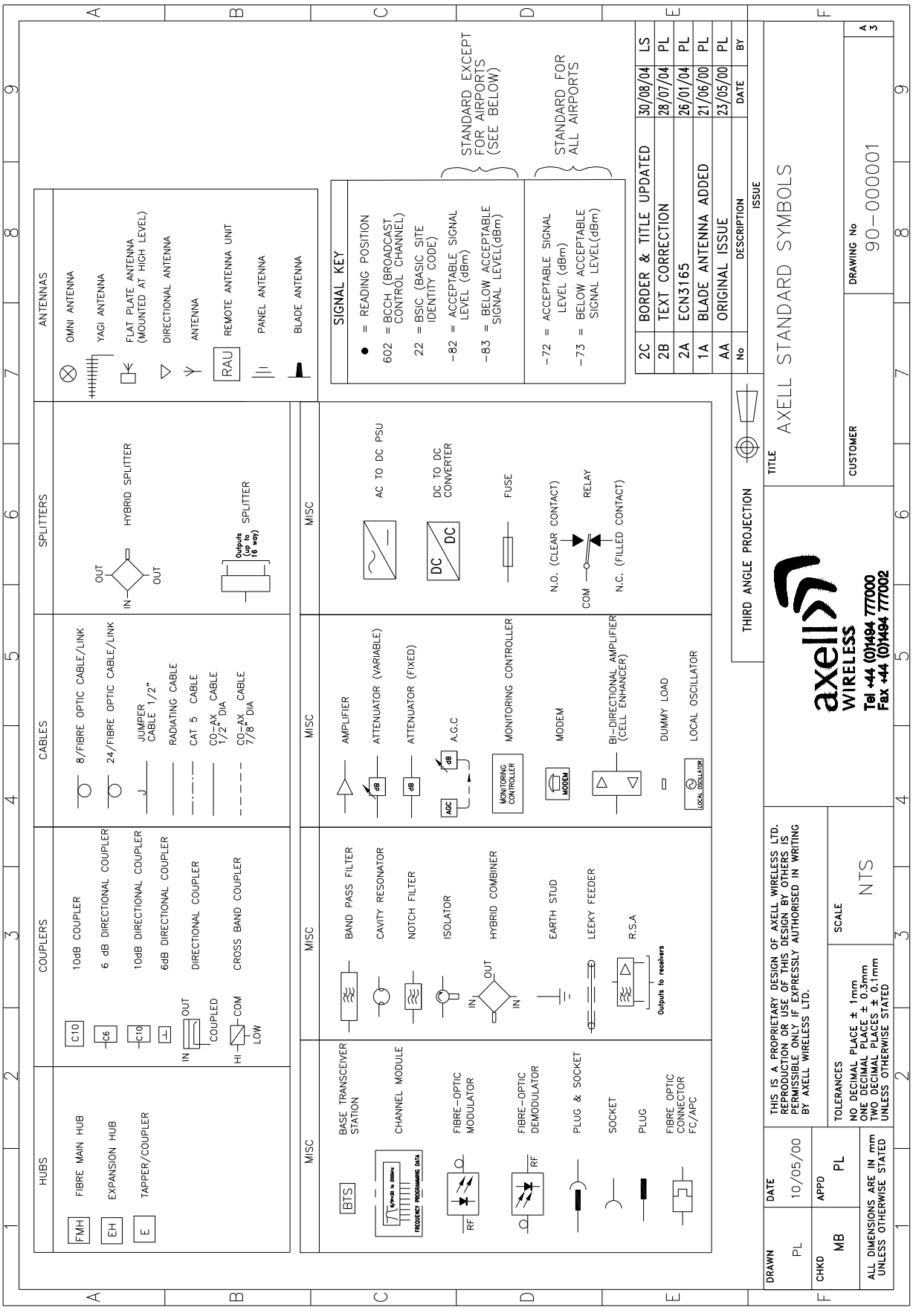
To maintain the operation, performance and reliability of any module it must be stored and transported correctly. Any module not installed in a whole system must be kept in an anti-static bag or container. These bags or containers are normally identified by being pink or black, and are often marked with an ESD label. Any module sent back to Axell Wireless for investigation/repair must be so protected. Please contact the Axell Wireless quality department before returning a module, see section 2.7.

Appendix A

A.1. Glossary of Terms used in this document

Repeater or Cell Enhancer	A Radio Frequency (RF) amplifier which can simultaneously amplify and re-broadcast Mobile Station (MS) and Base Transceiver Station (BTS) signals.
Band Selective Repeater	A Repeater designed for operation on a range of channels within a specified frequency band.
Channel Selective Repeater	A Repeater, designed for operation on specified channel(s) within a specified frequency band. Channel frequencies may be factory set or on-site programmable.
AC	Alternating Current
AGC	Automatic Gain Control
BBU	Battery Backup Unit
BDA	Bi-directional Amplifier
BTS	Base Transceiver Station (Base Station)
B/W	Bandwidth
CEMS	Coverage Enhancement Management System
C/NR	Carrier-to-Noise Ratio
DAS	Distributed Antenna System
DC	Direct Current
Downlink (D/L)	Signals transmitted from the BTS to the Mobiles
F/O	Fibre Optic
GND	Ground
ID	Identification (Number)
I/P	Input
LCX	Leaky Coaxial Cable (Leaky Feeder).
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LPA	Low Power Amplifier
Mobile(s)	Hand-portable or other “Mobile” RF Transceiver equipment
MOU	Master Optical Unit
MTBF	Mean Time Between Failures
N/A	Not Applicable
N/C (of Relays)	Normally Closed
N/O (of Relays)	Normally Open
OFR	On Frequency Repeater
OIP3	Output Third Order Intercept Point
O/P	Output
P1dB	1dB Compression Point
PA	Power Amplifier
RF	Radio Frequency
RHNC	Relative Humidity, Non Condensing
RSA	Receiver/Splitter Amplifier
RX	Receiver (Received)
SDR	Software-Defined Radio
S/N	Serial Number
TX	Transmitter (Transmitted)
Uplink (U/L)	Signals transmitted from the Mobiles to the BTS
UPS	Uninterruptible Power Supply
VSWR	Voltage Standing Wave Ratio
WDM	Wave division multiplex
Date Format	Date Format used in this document is dd/mm/yyyy

A.2. Key to Drawing Symbols used in this document



A.3. EC Declaration of Conformity

In accordance with BS EN ISO/IEC 17050-1&-2:2004

Axell Wireless Limited
Aerial House
Asheridge Road
Chesham
Buckinghamshire HP5 2QD
United Kingdom

CE 0086

Declares, under our sole responsibility that the following product:
Product Part No. 60-232301
Product Description Dual Band Fibre Fed BDA

In accordance with the following directives:

1999/5/EC The Radio & Telecommunications Terminal Equipment Directive Annex V and its amending directives

Has been designed and manufactured to the following standard[s] or other normative document[s]:

BS EN 60950 Information technology equipment. Safety. General requirements.

ETS EN 301 489-1 EMC standard for radio equipment and services. Part 1. Common technical requirements.

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives.
SIGNED

B. S. Barton
Operations Director DATE: 18/12/2009

A.4. Waste Electrical and Electronic Equipment (WEEE) Notice

The Waste Electrical and Electronic Equipment (WEEE) Directive became law in most EU countries during 2005. The directive applies to the disposal of waste electrical and electronic equipment within the member states of the European Union.

As part of the legislation, electrical and electronic equipment will feature the crossed out wheeled bin symbol (see image at left) on the product or in the documentation to show that these products must be disposed of in accordance with the WEEE Directive.

In the European Union, this label indicates that this product should not be disposed of with domestic or "ordinary" waste. It should be deposited at an appropriate facility to enable recovery and recycling.

A.5. Document Amendment Record

Issue No.	Date	Incorporated by	Section Amended	Reason for new issue
1	15/12/2009	AJS		Draft
2	22/12/2009	AJS		Issue

Appendix B

B.1 Initial Equipment Set-Up Calculations

General Information			
Site Name:		Client Name:	
Date:		AWL Equip. Model No.	

Antenna Systems				
	Model	Gain	Azimuth	Comments
A - Service Antenna				
B – Donor Antenna				
	Type	Loss	Length	Comments
C – Service Feeder				
D – Donor Feeder				

Initial Parameters	
E – CE Output Power	dBm
F – Antenna Isolation	dB
G – Input signal level from donor BTS	dBm
Operating Voltage	V

Downlink Calculations		
Parameter	Comments	Value
Input signal level (G)		dBm
CE max. o/p power (E)		dBm
Gain setting	E - G	dB
Isolation required	(Gain + 10dB)	dB
Service antenna gain (A)		dB
Service antenna feeder loss (C)		dB
Effective radiated power (ERP)	E+A-C	dBm
Attenuator setting	CE gain-gain setting	dB

If the input signal level in the uplink path is known and steady, use the following calculation table to determine the gain setting. If the CE features Automatic Gain Control the attenuator should be set to zero and if not, then the attenuation setting for both uplink and downlink should be similar.

Uplink Calculations		
Parameter	Comments	Value
Input signal level		dBm
CE max. o/p power (E)		dBm
Gain setting		dB
Required isolation		dB
Donor antenna gain (B)		dB
Donor antenna feeder loss (D)		dB
Effective radiated power (ERP)	E+B-D	dBm
Attenuator setting	(CE gain-gain setting)	dB