Passive RF and Optical Card Handbook

User Guide

HRG-HB-2

UK
CA

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Instrument Care and Safety Information

*Please read the whole of this section before using your **ViaLiteHD** product. It contains important safety information and will enable you to get the most from your Fibre Optic Link system.*

Electrical Safety

The **ViaLiteHD** chassis is a Safety Class 1 product (having a metal chassis directly connected to earth via the power cable). When operating the equipment note the following precautions:

- Hazardous voltages exist within the rack-mounted equipment.
- There are no user serviceable parts inside; the covers MUST NOT be removed.
- There are no user replaceable fuses in the chassis-mounted equipment or OEM modules.
- The chassis earth stud SHOULD be connected to the safety earth.
- When using a 2-pin power supply cable the chassis earth stud MUST be connected to the safety earth.
- The **ViaLiteHD** Power Supply modules do not have an isolating switch on the mains voltage inlet. For this reason, the **ViaLiteHD** chassis MUST be installed within easy reach of a clearly labelled dual pole mains isolation switch, which supplies the equipment.

ESD Precautions

Precautions for handling electro-static sensitive devices should be observed when handling all **ViaLiteHD** modules. Technicians should ensure that they use effective personal grounding (i.e. ESD wrist strap, etc.) when servicing the equipment. Any equipment or tools used should be grounded to prevent static charge build-up. Good practice should be observed at all times. For reference, see relevant standards: EN 61340-5-1, - 'Protection of Electronic Devices from Electrostatic Phenomena – General Requirements'.

Optical Safety

The **ViaLiteHD** RF Transmitter and Transceiver modules contain laser diode sources operating at nominal wavelengths of 1270 nm to 1610 nm.
These devices are rated as EN60825-1 CLASS 1 radiation emitting devices. A Class 1 laser is safe under all conditions of normal use. When operating the equipment note the following precautions:

- Never look into the end of an optical fibre, directly or by reflection, either with the naked eye or through an optical instrument.
- Never leave equipment with radiating bare fibres – always cap the connectors.
- Do not remove external equipment covers when operating.

Hot surface

The **ViaLiteHD** systems may have hot surfaces when operating under full load. The hot surfaces are not accessible when fitted in an approved chassis installation. Hot surfaces will be appropriately marked.

Suitable precaution should be taken when handling this device:
- Allow to cool for 10 minutes.
- Do not touch metallic surfaces or printed circuit board when hot.
- When handling, hold front panel and handle only.

Handling caution

The **ViaLiteHD** cards are made with folded sheet metal and care should be taken when handling due to the potential for sharp edges.

The front panel lever for retaining and removing the cards is a pinch hazard.

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1   Introduction

The **ViaLiteHD** RF Fibre Optic Links (FOLs) are a family of fibre optically coupled link systems designed for the transmission of RF analogue signals over long distances for the communications market.

ViaLiteHD is a product brand manufactured by Pulse Power and Measurement Ltd (PPM).
ViaLite Communications is a division of Pulse Power and Measurement Ltd (PPM).

The **ViaLiteHD** system offers a family of Passive RF and Optical Card modules that provide a range of functions, which can be used stand-alone or with its RF Fibre Optic Links (FOLs).

This handbook covers the following **ViaLiteHD** Passive RF and Optical rack chassis cards:

- 5 MHz to 1GHz Splitter HRG-1-AA
- L-Band Splitter HRG-1-AB
- Dual 10MHz / L-Band Diplexer HRG-S-AA
- CWDM Multiplexer HRG-7-AA.

For complete information and product familiarisation, this handbook should be read in conjunction with all other relevant handbooks for your **ViaLiteHD** system.

1.1   *ViaLiteHD* compatibility

The RF and optical interfaces are compatible with all **ViaLiteHD** Rack Cards, **ViaLiteHD** Blue OEM modules and **ViaLiteHD** black IP-rated outdoor modules.

18 laser wavelength options are available for multiplexed applications using CWDM.

Contact **ViaLite Communications** or your local **ViaLite** agent for more details.

1.2   Passive RF and Optical Card

The Passive RF and Optical Card is a carrier card for passive RF and optical devices that supports simple integration with the **ViaLiteHD** chassis in rack-mounted applications. There are many small form-factor passive devices that are often required for more complex systems and the Passive RF and Optical Card allows their use in an easy to manage way.

The base carrier card provides mechanical mounting points for various RF and optical passive devices and cables their interfaces to the rear IO panel. Any new device required of a system can be quickly added to the Passive RF and Optical Card family with minimal effort.

The base carrier card also includes an electronic ID capability to ensure compatibility with the current range of Monitoring and Control cards. This ensures that remote-managed chassis units report the location and identity of any Passive RF and Optical Cards in a system accurately.

The types of passive devices available for Passive RF and Optical Card integration are numerous, some examples are:

RF Devices	Optical Devices
Splitters	PLC Splitters
Filters	Circulators
Diplexers	Multiplexers / De-Multiplexers
Circulators	Isolators
Bias-Ts	Variable Attenuator
Isolators	Add / Drop Filters
Couplers	
Equalisers	
Transformers	

Multiple devices can also be grouped to perform a more complex function limited only by the space on the card and the IO panel capacity.

1.3 **Installation**

All **ViaLiteHD** plug-in modules are hot-swappable, so it is not necessary to power-down the chassis before inserting a Passive RF and Optical Card. All standard connectors are retained by the module, so it will be necessary to either disconnect any cables or have a sufficiently long service loop when removing modules.
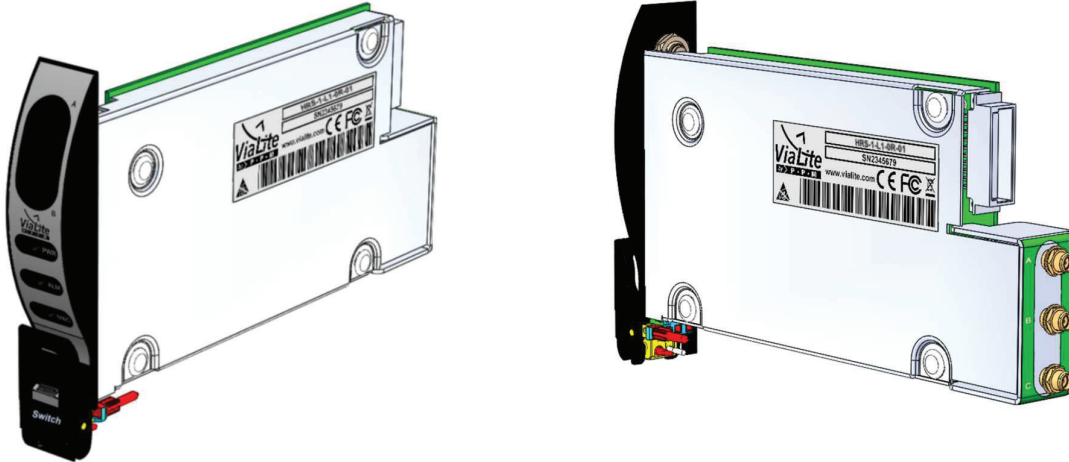
To install a 5HP Passive RF and Optical Card:

- The protective covers on the connectors may be left in place.
- Push the release button of the handle down and simultaneously pull the top of the handle towards you.
- Align the Passive RF and Optical Card upright and perpendicular to the front face of the chassis so that the PCB slides into the 'crow's feet' card guides at the top and bottom.
- Gently push the Passive RF and Optical Card down its guide, applying pressure via the handle – you may also apply pressure above the LED window on the **ViaLite** logo.
- As the Passive RF and Optical Card is fully mated, the top of the handle should snap back and lock in position.
- The pawls of the handle should be fully engaged in the matching slots.
- If power is applied to the chassis, the Passive RF and Optical Card power LED should light as soon as the module is fully inserted.
- Remove protective covers and connect any interface cables.

To remove a 5HP Passive RF and Optical Card:
- Disconnect any cables if necessary.
- Push the release button of the Passive RF and Optical Card handle down and simultaneously pull the top of the handle forwards.
- Apply pressure via the handle and gently withdraw the Passive RF and Optical Card from the chassis.

2 Module Types

2.1 CWDM Multiplexer – type HRG-7-AA

The HRG-7-AA is an optical CWDM multiplexer with 1 common port and 5 wavelength specific ports. The wavelengths filtered are:

- 1310 nm
- 1470 nm
- 1510 nm
- 1550 nm
- 1590 nm

The multiplexer uses free-space optics to achieve very low loss and the channel selection ensures excellent isolation between them. All connections at the rear interface are LC/APC.
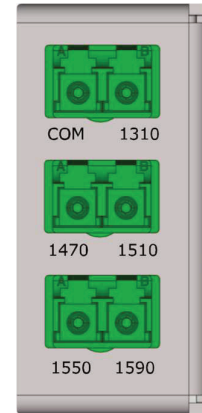
2.1.1 Specification

Parameter	Specification
Insertion loss	< 1.0dB - All wavelengths
Channel Passband	+/- 6.5 nm
Port Isolation	> 40 dB
Directivity	> 50 dB
Return loss	> 45 dB
Power Handling	300 mW
Operating temperature	-10°C to +70 °C

2.1.2 Typical performance curves

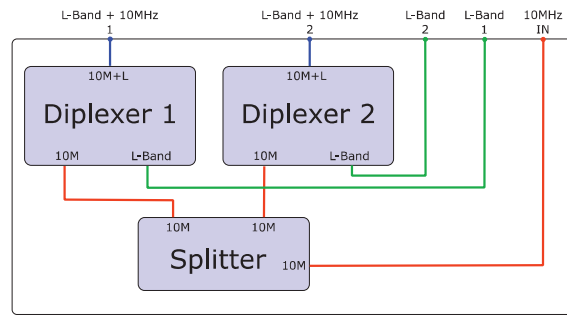CWDM MUX HRG-7-AA: Channel responses
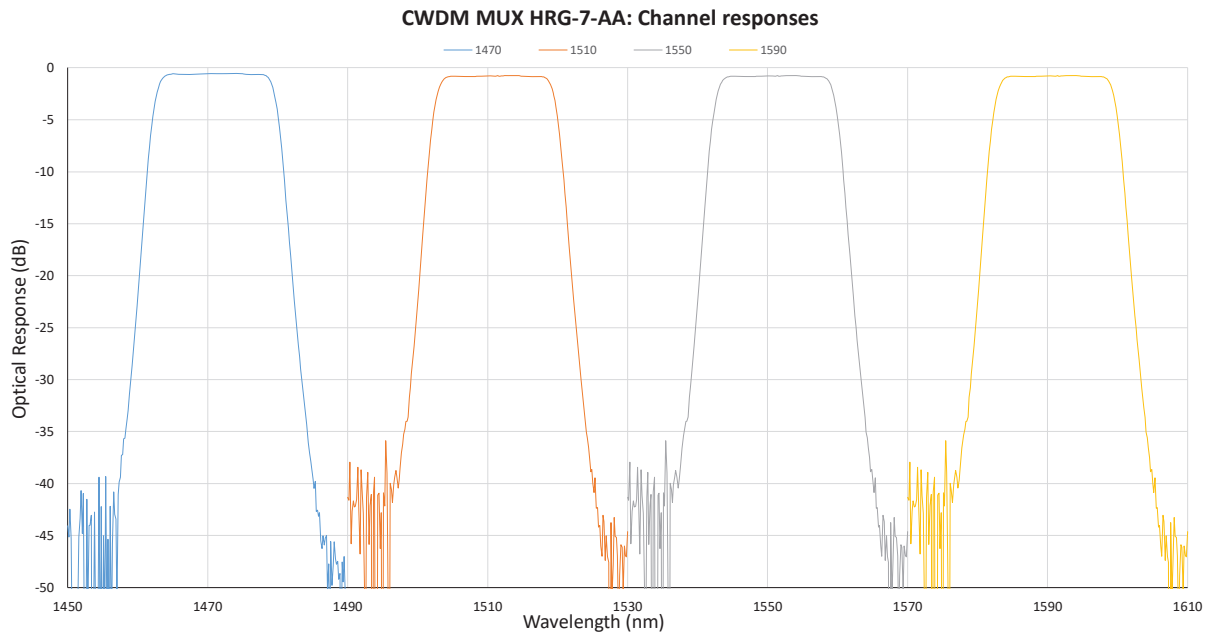
2.2   Dual Diplexer – type HRG-S-AA

The HRG-S-AA is a dual 10MHz / L-Band diplexer.

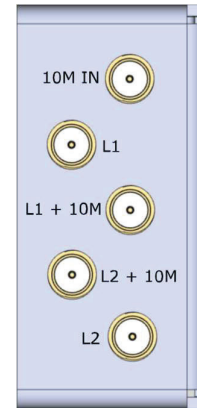The arrangement is shown in the adjacent wiring diagram.

This arrangement is often used in various Satcom configurations for applying 10MHz along with RF to a BUC and LNB.

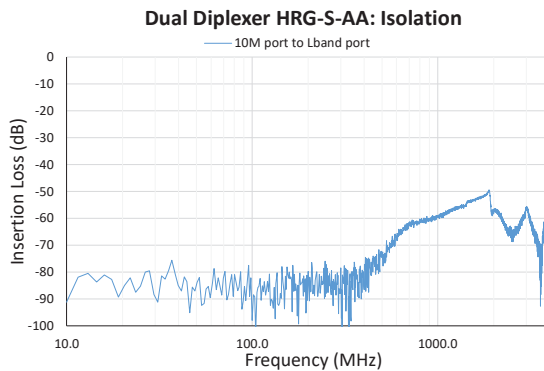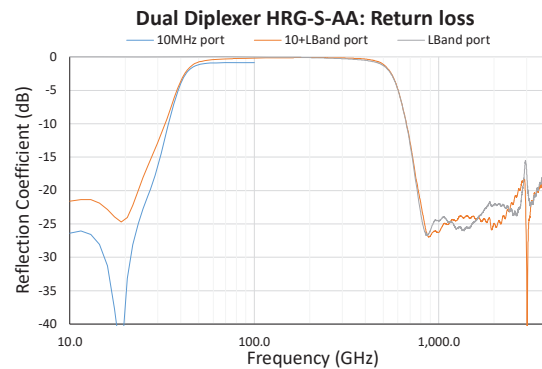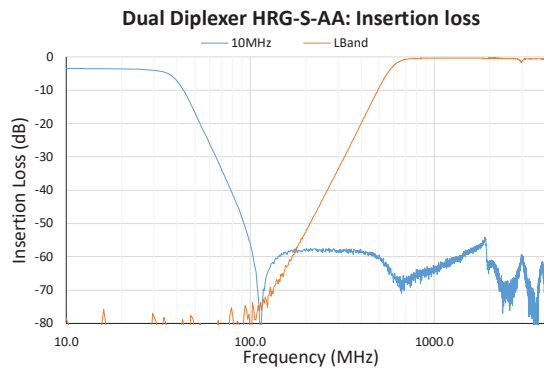The diplexer uses SMA connections for all ports.

2.2.1   Specification

Parameter	Specification
Passband (L-Band)	950 MHz to 2450 MHz
Insertion loss (L-Band)	< 1.0 dB
Insertion loss (10 MHz)	< 4.0 dB
Return loss (10 MHz)	> 18 dB
Return loss (950 MHz - 2150 MHz)	> 15 dB
Return loss (700 MHz - 2450 MHz)	> 10 dB
Power handling	1 W
Operating temperature	-40°C to +85 °C

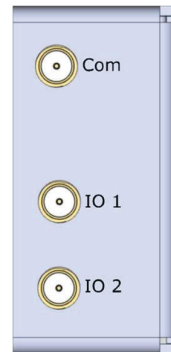### 2.2.2   Typical performance curves

Dual Diplexer HRG-S-AA: Insertion loss

Dual Diplexer HRG-S-AA: Return loss

Dual Diplexer HRG-S-AA: Isolation
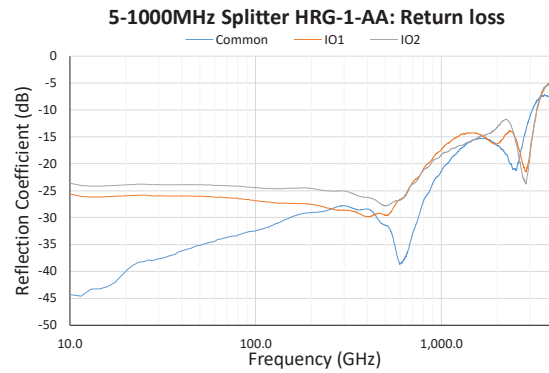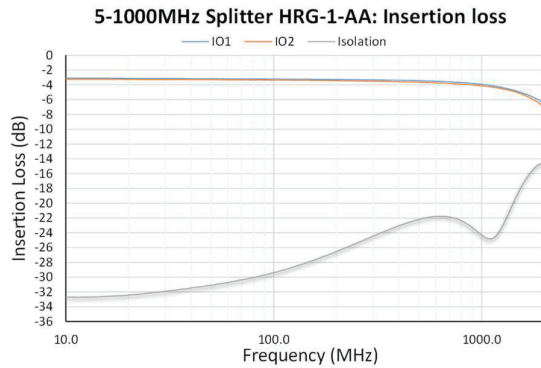
2.3   5 MHz to 1 GHz Combiner / Splitter HRG-1-AA

The HRG-1-AA is an RF 5 MHz to 1 GHz Combiner / Splitter. Signals pass between the common and IO ports. The two IO ports are isolated.

2.3.1   Specification

Parameter	Specification
Passband (L-Band)	5 MHz to 1000 MHz
Insertion loss (< 500 MHz)	< 3.9 dB
Insertion loss (< 1 GHz)	< 4.5 dB
Return loss	> 18 dB
Isolation (< 100 MHz)	> 28 dB
Isolation (< 1 GHz)	> 20 dB
Phase unbalance (< 100 MHz)	< 5 degrees
Amplitude unbalance (< 1 GHz)	< 0.5 dB
Power handling	0.5 W
Operating temperature	-40°C to +85 °C

2.3.2   Typical performance curves

5-1000MHz Splitter HRG-1-AA: Insertion loss

5-1000MHz Splitter HRG-1-AA: Return loss

2.4   L-Band Combiner Splitter HRG-1-AB

The HRG-1-AB is an extended L-Band (400-3000 MHz) Combiner / Splitter. Signals pass between the common and IO ports. The two IO ports are isolated.

2.4.1   Specification

Parameter	Specification
Passband	400 MHz to 3000 MHz
Insertion loss (700 MHz-2150 MHz)	< 4.5 dB
Insertion loss (< 3 GHz)	< 5.0 dB
Return loss	> 14 dB
Isolation	> 18 dB
Phase unbalance (700 MHz-2150 MHz)	< 5 degrees
Amplitude unbalance 700 MHz-2150 MHz)	< 0.5 dB
Power handling	0.5 W
Operating temperature	-40°C to +85 °C
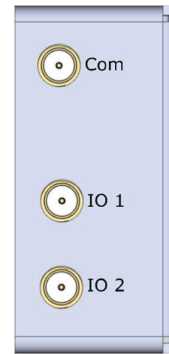
2.4.2   Typical performance curves
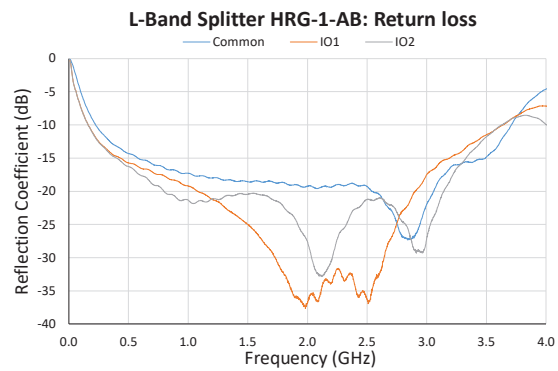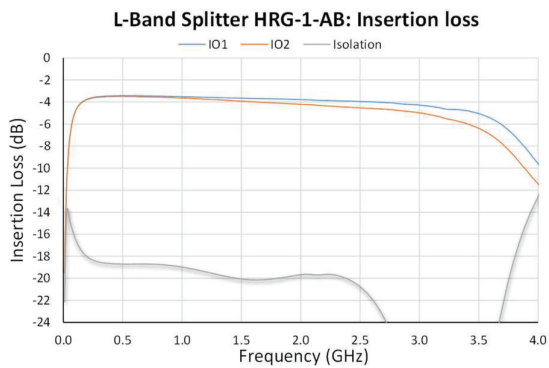
3   Monitoring and Control

The Passive RF and Optical Cards register with the chassis Monitoring and Control (M&C) module (if present) to display its presence and electronic ID information using the standard web GUI.

The Passive RF and Optical Card devices are passive and therefore no control functions are available.

Note: The alarm LED on the front panel of the card is not fitted in passive cards.

4   Fibre Optic Interfaces

4.1   Connector and cable types

All *ViaLiteHD* Passive RF and Optical Card modules use single-mode (9 µm / 125 µm) cable terminated in a range of optical connectors detailed below.

Angle polished (APC) and standard (PC) connectors must not be confused. The two connector types are not interchangeable and mating one with the other may damage both the cable and the module connectors.

Warning!

The specification of optical connector is critical to the performance of the complete Fibre Optic Link. System performance can only be guaranteed with fibre optic cables and connectors supplied by *ViaLite Communications*. When FC/APC connectors are specified they must be 'narrow key width'.

4.2   Connecting and disconnecting

Before connecting optical fibres to the module or to each other, ensure that the mating connectors are clean (see below).

4.3   Cleaning optical connectors, cleaning before every use

Optical connectors MUST be cleaned before use, even where they have been protected with dust caps.
A large percentage of performance issues can be attributed to dirty fibres.
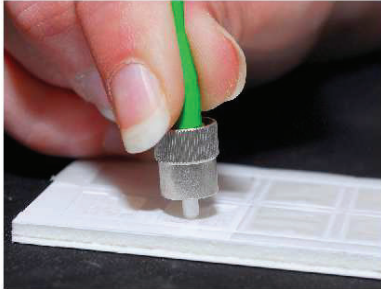
- Peel the plastic cover from an unused 'N' cleaning pad.
- Hold the connector between your thumb and forefinger.
- Clean the connector using firm pressure by swiping in a pendulum motion through each segment of the 'N' shape, following the diagram.
- Do not swipe over the same space twice.
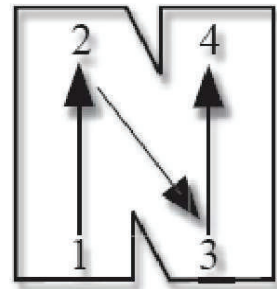
For more details, please read the cleaning instruction that accompanies the connector cleaning kit.

4.4   Cleaning optical connectors, high levels of contamination

If there are performance issues that are not resolved by basic cleaning in Section 4.3, then the following procedure should be used. If the level of contamination is high it will be necessary to repeat this procedure.

Cleaning items required:
- Lint-free fibre cleaning tissues and/or cleaning sticks (normal cosmetic tissues produce dust and are not suitable).
- Reagent grade isopropyl alcohol (IPA).
- Air duster or filtered, compressed air line.

Cable connector cleaning:
- Dampen a patch of cleaning tissue with IPA and clean all surfaces of the plug ferrule.
- Using a dry cleaning tissue, dry the ferrule and clean the end face.
- Using the air duster, blow away any residue from the end of the connector.

Module female receptacle cleaning (only recommended if problems are being experienced):
- Either use an optical cleaning stick or twist a cleaning tissue to form a stiff probe and moisten with IPA. Gently push the probe into the receptacle and twist around several times to dislodge any dirt.
- Repeat the above process with a dry tissue.
- Using the air duster, blow away any residue from the receptacle.

Important notes:
- IPA is flammable. Follow appropriate precautions / local guidelines when handling and storing.
- IPA can be harmful if spilt on skin. Use appropriate protection when handling.
- It should only be necessary to clean the female receptacles on the modules if problems are being experienced.

> ⚠️ **Never inspect an optical fibre or connector with the naked eye or an instrument unless you are certain that there is no optical radiation being emitted by the fibre. Remove all power sources to all modules and completely disconnect the optical fibres.**
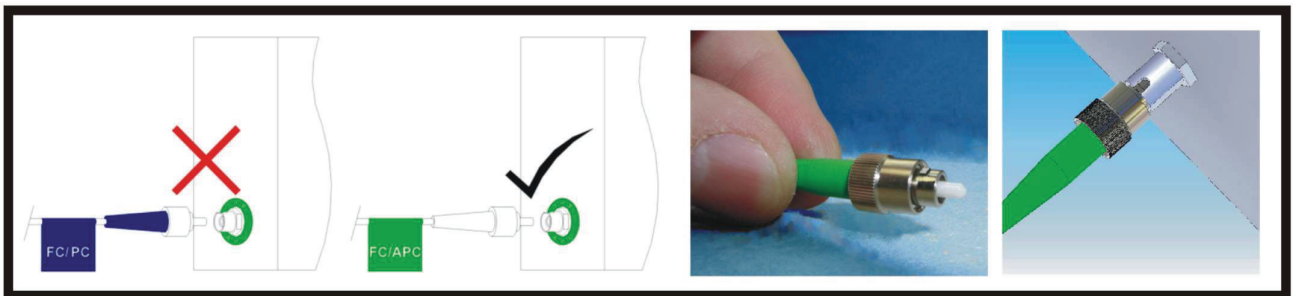
4.5 FC/APC connectors

To connect FC/APC optical connectors:
- Remove the dust caps and align the white ceramic centre ferrule on the cable connector with the mating receptacle.
- There is a key (lug) on the side of the ferrule, which must match the keyway (gap) in the receptacle shroud.
- When they are aligned, gently push the plug home.
- Finger tighten the knurled collet nut onto the threaded receptacle.

To disconnect FC/APC optical connectors:
- Using fingers, fully unscrew the knurled collet nut and gently withdraw the connector.
- Replace the dust caps on both the receptacle and the cable plug.

Warning!   It is possible to tighten the knurled collet without aligning the lug and gap. This will result in poor light transmission. Check that the lug and gap are aligned before tightening the knurled collet.
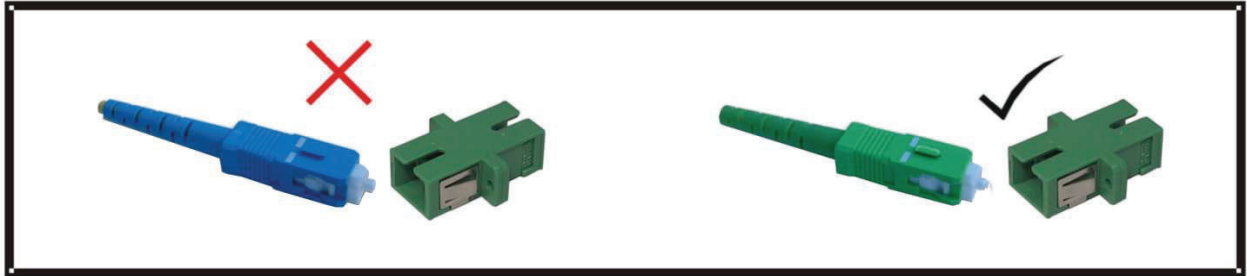
4.6   SC/APC connectors

To connect SC/APC optical connectors:
- Remove the protective plug cover.
- Align the connector keyway slot in the adaptor to the key of the plug.
- Gently push the plug into the adapter until a click is heard and the connector locks.

To disconnect SC/APC optical connectors:
- Grip the body of the plug and gently pull the plug from the adaptor, then replace the protective cover.

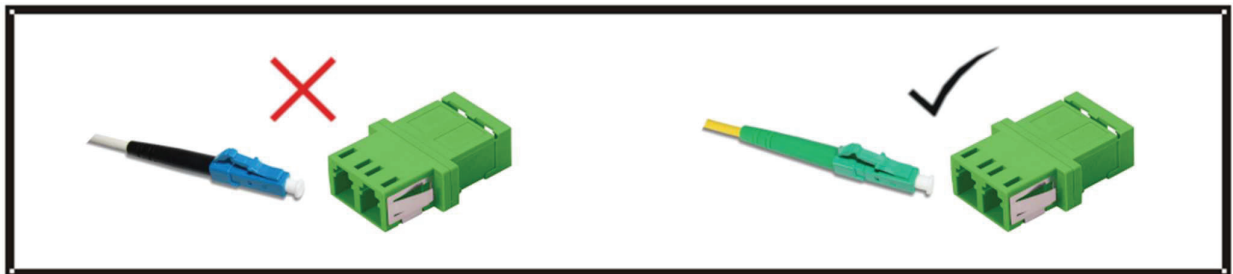Only connect SC/APC cable to SC/APC. Do not mix green and blue connections.

4.7   LC/APC connectors

To connect LC/APC optical connectors:
- Remove the protective plug cover.
- Align the plug retaining clip with the socket key.
- Gently push the plug into the socket until a click is heard and the connector locks.

To disconnect LC/APC optical connectors:
- Grip the body of the plug and whilst depressing the retaining clip, gently pull the plug from the socket. Replace the protective cover.

Only connect LC/APC cable to LC/APC. Do not mix green and blue connections.

4.8   Minimum bend radius

Because optical fibre is made of glass, it is important not to subject it to excessive stress. For this reason, each type of cable has a minimum bend radius (MBR) specification, beyond which the cable cannot be bent without permanent damage occurring.

The minimum bend radius (MBR) of fibre optic cable fitted to *ViaLite* modules is 50 mm. MBR specifications for *ViaLite Communications* supplied fibre optic cables are given in the *ViaLiteHD* System Handbook Hxx-HB.

5   RF Interface

5.1   SMA connections

The high frequency RF converters are fitted with SMA connectors. SMA connectors offer excellent performance but must be clean, free of dust/contaminants and tightened to the correct torque. Please ensure that an SMA torque spanner set to 1.0 Nm is used to make the connections. An example torque wrench is shown below (Huber Suhner 74_Z-0-0-21) 1 Nm, 8 mm / 0.315 inch.


Over tightening an SMA with a standard 8 mm spanner will risk twisting of the connection behind the bulkhead and may result in damage that impacts the performance of the link. Always use a 1 Nm torque wrench.

Connect and tighten RF connectors to present the correct termination impedance before applying power to the modules.

6   Mechanical Dimensions

6.1   Passive RF and Optical Card - dimensions
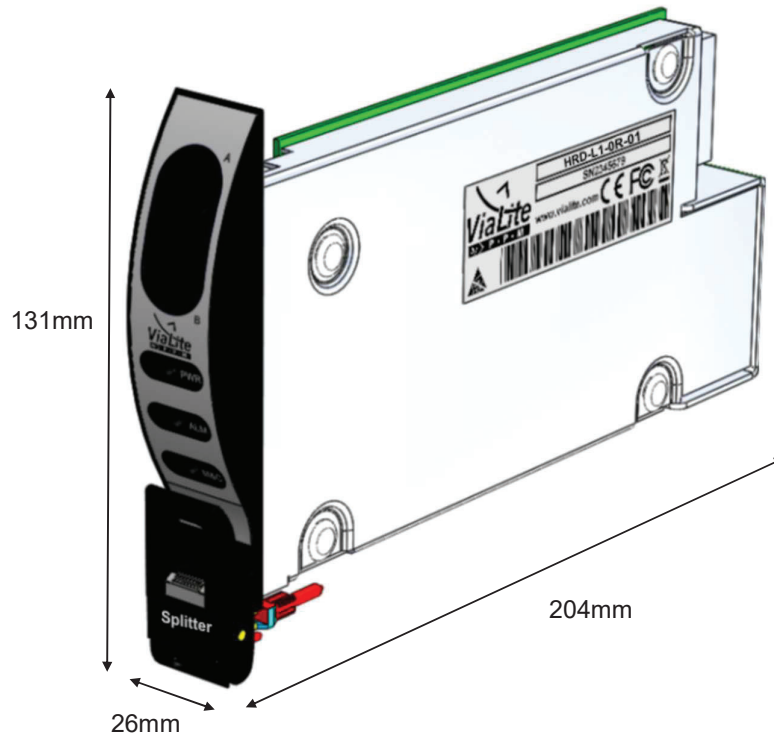
Weight: 220 g typical
       300 g maximum

7   <u>Product Warranty</u>

The guarantee / warranty period, unless otherwise agreed in writing, shall be as stated in document 'F292 - PPM Manufactured Product – Warranty', which is available at: https://ppm.co.uk/warranty-periods/. Extended warranty options are available at the time of purchase.

Prior to returning any goods for warranty or non-warranty repairs, please contact PPM / *ViaLite Communications* for a returns reference.