ViaLite
SatComs
Fibre Optic Link

User Manual

LRx-L-HB- 8

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Instrument Care and Safety Information

*Please read the whole of this section before using your **ViaLite** product. It contains important safety information*

Electrical Safety

The ***ViaLite*** Power Supply Units are Safety Class 1 products (having a metal case that is directly connected to earth via the power supply cable).

When operating the equipment note the following:

- Hazardous voltages exist within the equipment. There are no user serviceable parts inside, and the covers should only be removed by suitably qualified personnel.
- The equipment does not have an isolating switch on the mains inlets. Equipment must be installed within easy reach of a clearly labelled dual pole mains isolation switch.
- Make sure that only fuses of the required rated current, and of the specified type (anti-surge, quick blow, etc.) are used for replacement.

Optical Safety

The ***ViaLite*** RF Transmitter modules contain laser diode sources operating from 1270nm to 1610nm. These devices are rated under IEC60825-1 “Safety Of Laser Products”, Part 1, First Edition, 1993 as CLASS 1 radiation emitting devices.

When operating the equipment note the following:

- 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 accessible – always cap the connectors.
- Do not remove equipment covers when operating.
- Details of optical connections to the units, compatible fibre types and care instructions can be found in the ***ViaLite*** system handbook. Please read this section before using the link.

Adjustment, maintenance and repair of the equipment should only be carried out by suitably qualified personnel. For more information on the *ViaLite* range of products, please refer to the generic *ViaLite* system handbook Lxx-HB.

TABLE OF CONTENTS

1 INTRODUCTION 5

2 SETTING UP AND UNDERSTANDING THE LINK 6

2.1 Module Operation 6

2.2 Fibre Optic Cable & Connectors 6

2.3 Using the Transmitter Module 8

2.4 Using the Receiver Module 8

2.5 LNA Feed 9

3 SYSTEM INTEGRATION 10

3.1 Link Loss Budget Calculations 10

3.2 Typical System Configuration with fixed gain modules 10

3.3 Commissioning of a Communications Link 11

3.4 Alarms & Monitoring 11

4 PART NUMBERING 14

5 TECHNICAL SPECIFICATIONS 15

6 MAINTENANCE AND FAULT-FINDING GUIDE 19

7 PRODUCT WARRANTY 20

1 Introduction

The ***ViaLite*** RF Links are a family of fibre optically coupled link systems designed for the transmission of RF analogue signals over long distances for the satellite communications market.

This handbook covers the following ***ViaLite*** RF Link part numbers:

- Transmitter units with part numbers starting
  - LRT-B-, (10-200MHz),
  - LRT-L-, (950-2150MHz)
- Receiver units with part numbers starting
  - LRR-B-, (10-200MHz),
  - LRR-L-, (950-2150MHz)
- Optical fibre interconnects with part numbers starting
  - F6- (FC/APC)
  - F7- (E2000/APC)

For complete information and product familiarisation, this handbook should be read in conjunction with the general handbook for all ViaLite systems (document Lxx-HB).

A typical system operates as follows.

The user's RF electrical signal is input to the Transmitter Module, which contains RF signal conditioning and laser control circuitry. The module modulates the intensity of a beam of light with the RF signal.

The light travels through an optical fibre to the Receiver Module. The distance between transmitter and receiver can range from 1m to 50km depending on the system specified.

The Receiver Module converts the modulated light back into an electrical signal, which is available at the output of the unit.

Care of fibre optic connectors

NB : When the fibre optic cables are not connected, it is essential that the cable and equipment connectors are protected by the Dust Caps provided with the system. Failure to do so may result in damage to the fibre ends, which are critical to the system performance. Please refer to section 2.2 for fibre optic cable handling details.

2 Setting up and Understanding the Link

This section describes the connections between your RF Fibre Optic Transmitter and Receiver Modules, and the operation of both units in a system.

Please read fully document Lxx-HB for information on installing your ***ViaLite*** equipment before commissioning your RF link system.

2.1 Module Operation

2.1.1 Plug-in Modules

The Plug-In modules are designed for use in PPM's ***ViaLite*** 19" rack case. The module is powered from the rack case backplane and all connections are on the rear panel.

To fit the module, slide it into the desired rack case position until the backplane connector mates with the connector on the back of the unit. Push fully home and tighten the two fixing screws.

2.1.2 Shielded Remote Modules

The shielded remote modules are designed for use in electrically harsh environments and can withstand high electromagnetic fields.

Modules are powered using PPM mains power supplies, of which screened and low-cost versions are available. The module is fully operational once power is applied, and hence it is recommended that RF signal and optical connections be made before the unit is powered. The module can be mounted in any orientation using the four fixing holes provided through the case.

2.1.3 OEM Modules

The small form factor OEM module allows System Integrators and Original Equipment Manufacturers an easy route to build RF/optical interfaces into their own design. Its small form factor and integrated design should allow the unit to easily be integrated into end user equipment.

2.2 Fibre Optic Cable & Connectors

2.2.1 Connector and Cable Types

All ***ViaLite*** RF modules use singlemode (9µm/125µm) cable terminated with either FC/APC or E2000/APC optical connectors. Cross-site fibre optic cables are available from PPM as either standard patch leads or heavy-duty multicore cables.

Warning!

FC/APC and E2000APC are standards for angle-polished connectors and must not be confused with standard FC/PC and E2000 connectors respectively. The two connector-types are not interchangeable and mating one with the other will damage both the cable and the module connectors.

The specification of the FC/APC and E2000APC 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 PPM. FC/APC connectors must be "narrow key width" (see technical specification).

2.2.2 Connecting and Disconnecting

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

2.2.2.1 FC/APC

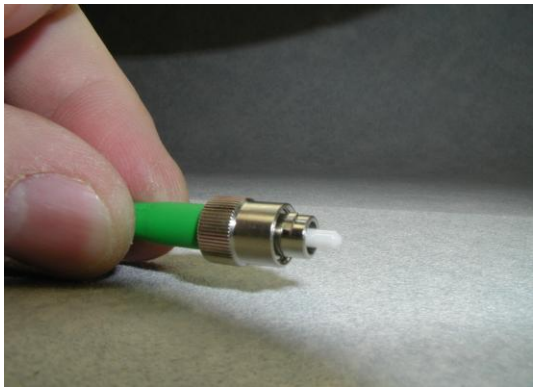
To connect FC/APC optical connectors, remove the dustcaps and align the white ceramic centre ferrule on the cable connector with the receptacle. There is a lug on the side of the ferrule, which must match the gap in the receptacle shroud. When they are aligned, gently push the plug home and finger tighten the knurled collet nut onto the threaded receptacle. See figure 1 below.

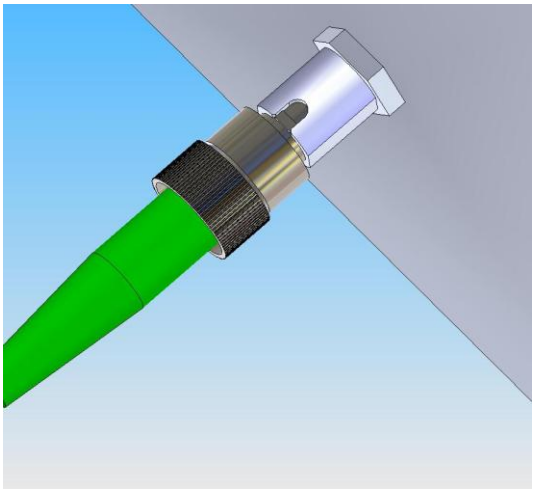
To disconnect FC/APC connectors, unscrew the knurled collet on the plug and gently withdraw the plug. Replace the dustcaps on both the receptacle and the cable plug.

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

Figure 1
(a) showing FC/APC connector with dust cap removed, (b) showing alignment of the lug on the side of the ferrule, which must match the gap in the receptacle shroud before gently pushing the plug home and finger tighten the knurled collet nut onto the threaded receptacle.


(a)


(b)

2.2.2.2 E2000/APC

To connect E2000/APC optical connectors, simply push the connector positively into the receptacle until a click is heard. The protective shutter will automatically lift as the connector is mating.

To disconnect E2000/APC connectors, depress the lever on the connector to disengage, then withdraw the connector from the receptacle. The shutter is spring-loaded and should spring back to protect the ferrule.

Care and Cleaning
The optical connectors should be cleaned **before each and every use**, even where they have been protected with dust caps.

Cleaning items required
- Lint free fibre cleaning tissues and/or cleaning sticks(normal cosmetic tissues produce dust and are not acceptable);
- Reagent grade Iso Propyl Alcohol;
- 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 polish 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 a 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 convinced that there is no optical radiation being emitted by the fibre. Remove all power sources to all modules, and completely disconnect the optical fibres.

2.2.3 Minimum Bend Radius

Because the 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.

Minimum Bend Radius of Fibre Optic Cable fitted to OEM modules is 50mm
MBR specifications for PPM fibre are given in the ***ViaLite*** System Handbook Lxx-HB.

2.3 Using the Transmitter Module

2.3.1 Connecting the Module

Connect the transmitter module to the power source, cross-site fibre optic cable and RF signal as described in section 2.1. The RF input signal applied to the signal connector should be within the maximum and minimum signal levels given in the technical specifications in section 5.

2.3.2 Front Panel Indicators

The transmitter has two front panel LEDs for indication of the state of the module. The following table shows the operation of the front panel LEDs :

	Upper LED (Power)	Lower LED (Status)
OFF	Unit Off	Unit Off
GREEN	Unit OK	Laser OK
RED	Internal Fault	Laser Failed

2.3.3 Alarms and Monitors

The transmitter module has a single alarm, which registers the status of the transmit laser. Activation of this alarm registers an internal fault and the unit should be replaced with a spare and returned to your local PPM representative. The alarm state mimics the condition of the front panel Status LED.

Since the alarm is logic HIGH (OPEN) when activated and pulled LOW (SHORT) by a transmitter module in good health, the alarm at that rack position will be activated until a working transmitter is inserted. An unused rack position registers an alarm at that position. This alarm condition can be masked if an LRK1S or LRK2S Rack Case is used. Consult System Handbook Lxx-HB for details.

On the OEM units ONLY. The forward current monitor (IFL) gives an absolute measure of the laser drive current.
V_{IFL} = 68 x Ifwd (A). e.g. Laser drive current of 40mA, produces 2.7V.
Typical room temperature range is 20 to 50mA. [Suggested thresholds: 10/80mA]

2.4 Using the Receiver Module

2.4.1 Connecting the Module

Connect the receiver to the power source, fibre optic cross-site cable and RF signal as described in sections 2.1 – 2.3

2.4.2 Front Panel Indicators

The receiver has two front panel LEDs for indication of the state of the module. The following table shows the operation of the front panel LEDs :

	Upper LED (Power)	Lower LED (Signal)
	Standard	**Standard**
OFF	Unit Off	Unit Off
GREEN	Unit OK	Link OK
RED	Internal Fault	Excessive Link Loss

2.4.3 Manual Gain Adjustment

B and L – band receivers are optionally available with a control that allows the user to alter the factory pre-set link gain by +/- 3dB adjustment of electrical signal gain. This feature is particularly beneficial where multiple links are being used in a redundant configuration, as it allows the user to accurately compensate for optical fibre loss, and thus finely equalise the gain between the individual links.

The gain is adjusted by inserting a suitable screwdriver or 'trim tool' (1.8mm straight bladed or similar) through the recess in the front panel [plug-in] or hole in the lid [OEM] receiver module. Variable gain receiver units are shipped from the factory with set to the mid point of there nominal gain (i.e. the gain adjustment is centralised and preset to 0dB offset).

2.4.4 Alarms and Monitors

The receiver module has one alarm and one analogue voltage monitor. The alarm registers the status of the input light level. When the optical power at the input of the receiver unit is above the alarm threshold (equivalent to 20dB optical loss) the alarm is activated. As soon as the received light level is restored to a value above the threshold, the alarm is reset. The alarm state mimics the condition of the front panel Status LED.

Since the alarm is logic HIGH (OPEN) when activated and pulled LOW (SHORT) by a receiver with a strong optical input signal, the alarm at that rack position will be activated until a working receiver is inserted. An unused rack position registers an alarm at that position. This alarm condition can be masked if an LRK1S or LRK2S Rack Case is used. Consult System Handbook Lxx-HB for details.

There is also a Received Light Level (RLL) monitor on the backplane connector. This enables the user to measure received optical power for each channel. This can be done either manually or via a system management console (if applicable) connected to the rack case alarm connector. See document Lxx-HB for details of the Alarm Concentrator Connector.

The RLL monitor gives an absolute measure of the optical power at the receiver module. RLL Output Voltage = 7.75V at nominal system gain (0dB optical loss) and reduces by 0.25dB per dB optical loss (0.125V per dB of RF link loss). This monitor is covered in further detail in the commissioning procedure in section 0. The RLL has a linear monotonic characteristic over a minimum of 20dB optical loss (approx 2.25V to 7.75V).

2.5 LNA Feed

All information in this section refers to fibre optic transmitter modules only. LNA voltages are fed **out** through the RF **input** connector on the Tx modules.

OEM Modules
Modules in this range DO NOT offer an internally generated LNA feed voltage.
Some modules do offer an ability to route a user fed LNA voltage through PIN 13 on the 14-way header, details shown below.
When using PPM Outdoor Enclosure, external LNA feed is available via the outdoor enclosure motherboard.

Plug-In Modules
Depending on product bandwidth type there are options for internally generated 5V or 12V LNA feed, and options to route a user fed LNA voltage through PIN 14 of the rear 15-way D-sub Connector, details shown below.
It is not possible to route a user fed LNA voltage through PIN 14 of the rear 15-way D-sub Connector on any modules that have been purchased with internally generated LNA feeds.

Module Series	**Module**		
	OEM Modules	**Plug-In Modules**	
Product Name Product Series Bandwidth		**Standard & Standard Options**	**Special Options (please contact PPM when ordering, no part code exists)**
IF Link 'B' Series 10-200HMz	External +/-36V 330mA LNA feed allowed. To enable apply voltage to PIN 13 of the 14 way header connector.	No internal or external LNA feed offered	For 50ohm product only, factory option is offered for user fed +/- 36VDC at 350mA max. To enable apply voltage to PIN 14 of the rear 15-way D-sub connector on chassis or converter sleeve.
L-band Link 'L' Series 950-2150MHz	External +/-36V 330mA LNA feed allowed. To enable apply voltage to PIN 13 of the 14 way header connector.	No internal or external LNA feed offered	On 50 ohm product only a factory option is offered for user fed +/- 36VDC at 350mA max. To enable apply voltage to PIN 14 of the rear 15-way D-sub connector on chassis or converter sleeve.

3 System Integration

3.1 Link Loss Budget Calculations

The link gain (Transmitter RF input level to Receiver RF output level) depends on the following factors:

- Optical loss (due to connector insertion loss and optical fibre loss)
- Transmitter gain setting
- Receiver gain setting

The actual link gain can be determined as follows:

Link gain = Nominal Link Gain – 2 x (optical loss) [dB]

where

Optical loss = connector insertion losses + fibre losses

3.1.1 Optical Loss

The additional **electrical** insertion loss in dB resulting from **optical** losses is equal to 2 times that of the **optical** loss in dB. This is due to the physics of the optical-to-electrical conversion process in the receiver. For example, a 1dB increase in optical insertion loss will result in a 2dB decrease drop in RF signal at the output of the optical receiver.

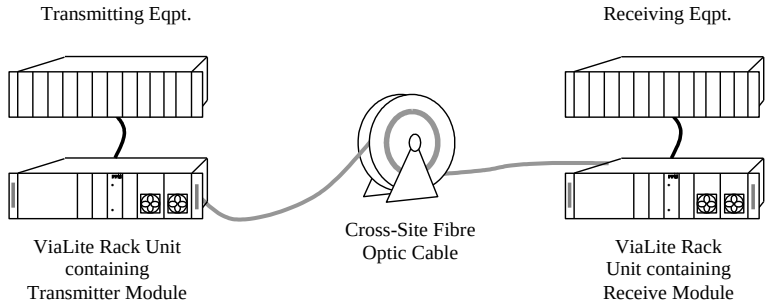
For single-mode fibre (e.g. SMF28), the **optical** loss at the 1310nm operating wavelength of the ***ViaLite*** RF Analogue links is 0.4dB/km. For 1550nm operating wavelength, the **optical** loss of the ***ViaLite*** RF Analogue link is 0.2dB/km This is increased if the fibre is under excessive tension, compression or is bent into a small radius.

For clean, new, undamaged single-mode connectors, the **optical** insertion loss is typically 0.12dB per connector. The losses at the optical connections at the Transmitter and Receiver are allowed for during manufacture of the module, and may be ignored during link gain calculations.

For short links (<250m) containing no additional optical connectors, and in which the fibre is not subject to any strain, then the optical path loss can be ignored.

3.2 Typical System Configuration with fixed gain modules

The diagram below illustrates a typical communications system configuration.



The link gain for the fixed gain systems depends solely on the loss through the optical fibre link from transmitter to receiver.

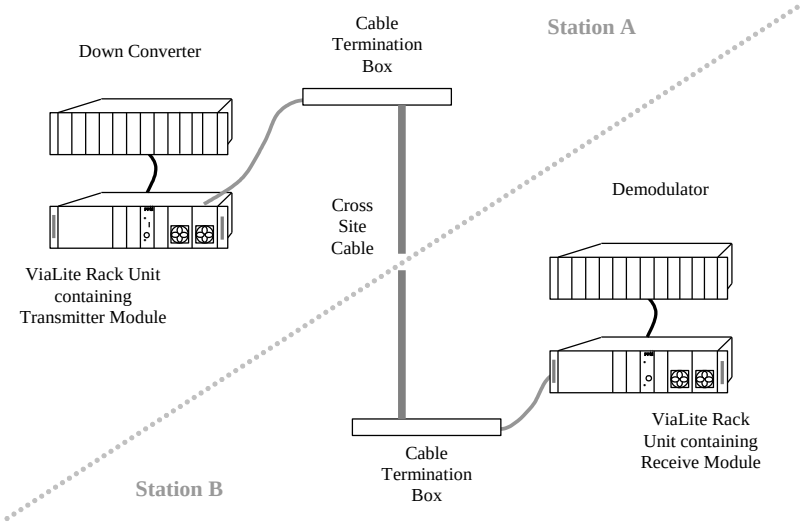
There is a Received Light Level (RLL) monitor output on the receive modules which can be used to measure the amount of laser light from the transmitter reaching the receiver during operation. This feature is only available on plug-in receiver modules.

The RLL threshold alarm (which is triggered when the RLL drops below a preset level) can be used to determine if the optical link has been damaged or degraded. This is visible as an alarm on the front panel and an open collector alarm on the alarm concentrator connector (see handbook Lxx-HB).

In the case of a system that uses receiver modules with optional manual variable gain, +/-3dB of electrical signal gain adjustment is available if necessary to compensate for fibre optic cable loss.

3.3 Commissioning of a Communications Link

This commissioning procedure illustrates the processes required to install and set up a communications link with gain control. The example describes the commissioning of a 70/140MHz interfacility link, but the technique can be applied to other module types including L-band.



We will be considering the installation of the following system. A down converter provides an output signal in the 70/140MHz IF band. The signal must be conveyed over 1500m of fibre, through a bulkhead at each station, to the demodulator. An alarm must trigger if the optical path is damaged.

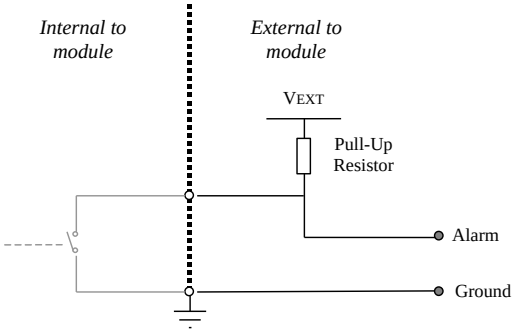
1. Install the link, connecting all optical patchcords and cross-site fibre optic cables. Clean ALL optical connectors BEFORE mating with the module.
2. Power up the equipment and allow 15 minutes to warm up.
3. Ensure that the RF power into the transmitter module is set to optimum for your system. Use a broadband RF power meter for this measurement. Typically this is the input level at which the link IMD is -40dBc. This value of input power is given in the datasheet for the link.
4. Calculate the approximate optical attenuation in the fibre path. In our case, we have two bulkhead connectors @ 0.4dB each, 1500m of optical fibre = 0.6dB, giving a total of 1.4dB of optical loss. The total RF gain of the system should be the nominal link gain minus 2x the optical loss.
5. Confirm that the RF output from the receiver is correct (to within measurement accuracy, a couple of dBs). If the loss is much higher than calculated, the most likely explanation is dirt on the optical connectors. If this is the case, clean each connection in turn until the required system gain is restored.

3.4 Alarms & Monitoring

3.4.1 Module Alarm Output

The circuit below shows how the alarm output should be configured for all types of ViaLite module. The switch (to the left of the dotted line) is internal to the module. The circuitry to the right of the dotted line is provided by the system user*.

In the presence of an alarm condition, the module will act as a high impedance node and will NOT sink current. This is a fail-safe system in that an alarm condition will be raised when a module is not present. This is an important factor when commissioning link management systems, as blank module positions will register module faults.



* This circuitry is also provided by the Redundancy Switch module and the Alarm Concentrator module. When either of these modules are used, the alarm outputs can not be considered "VOLT FREE". This is because the Redundancy Switch module and the Alarm Concentrator modules use the same module alarm outputs to detect whether a unit has failed. When these modules are used, a voltage of between 5V and 12V may be present on the 'Alarm' output line when the module is in the failed mode. When the module is working correctly, the voltage on the 'Alarm' output line will be 0V (+1.0/-0). If true "VOLT FREE" contacts are required, please consult PPM.

Maximum current = 50mA
Maximum voltage = 15V

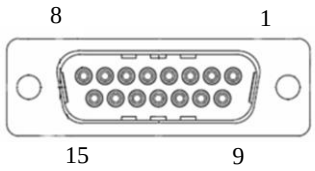
3.4.2 Module Monitor Output

All modules also provide an analogue monitor output for monitoring the condition of the Optical transmitter / receiver. Details of the monitor can be found in the technical specifications in section 5 of this document.

3.4.3 Module Alarm & Monitor Connection, Plug-in

Connection is made to the module by the 15-way D-Sub connector on the rear of the rack backplane.

Pin	Function
1	Do Not Connect
2	Do Not Connect
3	Do Not Connect
4	Do Not Connect
5	Alarm Output
6	+12V from rack supply
7	External Feed (option)
8	Ground
9	Do Not Connect
10	Do Not Connect
11	Do Not Connect
12	Do Not Connect
13	Analogue Monitor Output
14	External LNA Feed (option)
15	Ground



View looking into connector

3.4.4 Module Alarm & Monitor Connection, Shielded Remote

Connection is made to the module by the Lemo 1B 8-pole free plug on the rear of the rack backplane.

Pin Number	Function
1	Alarm Output
2	Do Not Connect
3	Do Not Connect
4	Ground
5	Vsupply
6	Do Not Connect
7	Do Not Connect
8	Analogue Monitor Output

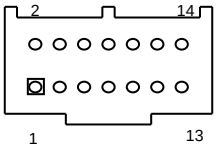
Looking into panel mount socket

Looking into Assembled plug

3.4.5 Module Alarm & Monitor Connection, OEM

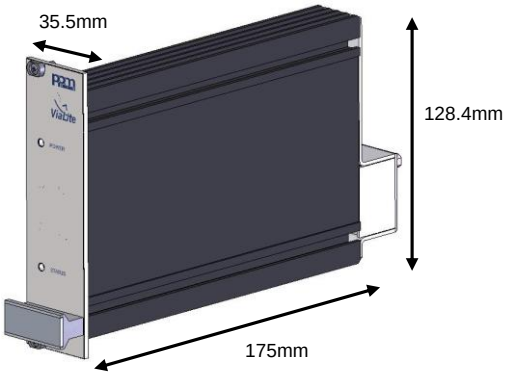
Connection is made to the module by the 14pin boxed header Molex (C-Grid III), 0.1" dual row connector. All OEM modules are supplied with a 250mm interface cable.

Pin Number	Name	Cable Colour	Function
1	Tx_A	Pink	Do Not Connect
2	Rx_A	Pink	Do Not Connect
3	Tx_B	Pink	Do Not Connect
4	Rx_B	Pink	Do Not Connect
5	Dig_Alm	Orange	Alarm Output
6	RTS	Pink	Do Not Connect
7	+Va	Red	+12V from supply
8	0v	Black	Ground
9	Rx_232	Pink	Do Not Connect
10	Tx_232	Purple	Do Not Connect
11	0v	Black	Ground
12	Det_Opt_Tx	Pink	Do Not Connect
13	LNA_Feed	White	External LNA Feed (option)
14	An_Alm	Green	Analogue Monitor Output

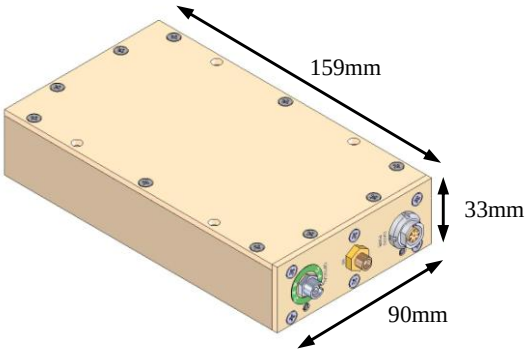


Top view, 14 pin header

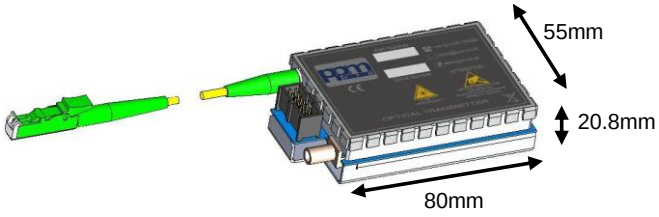
3.4.6 Mechanical Dimensions



Plug in module



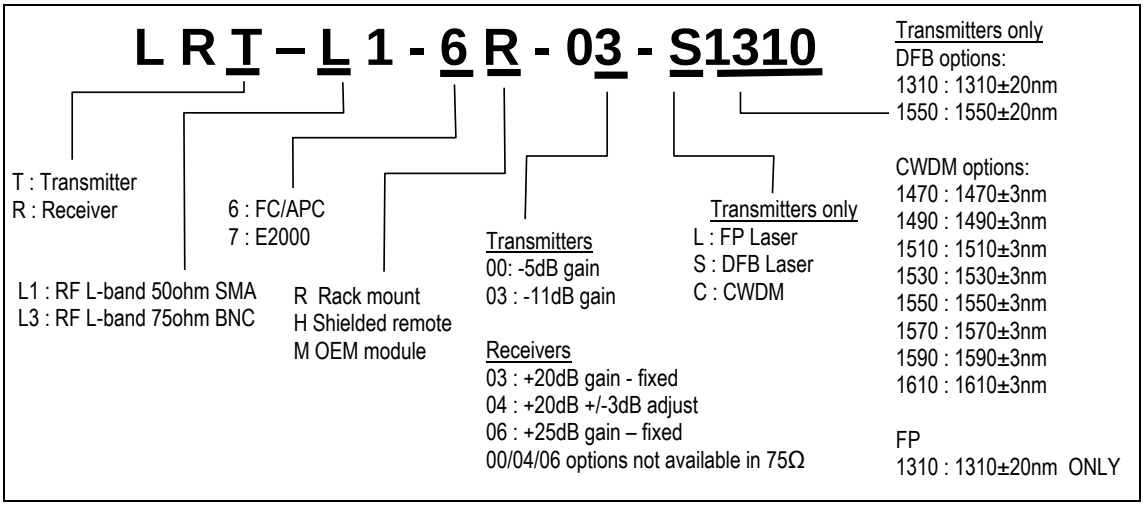
Shielded remote module

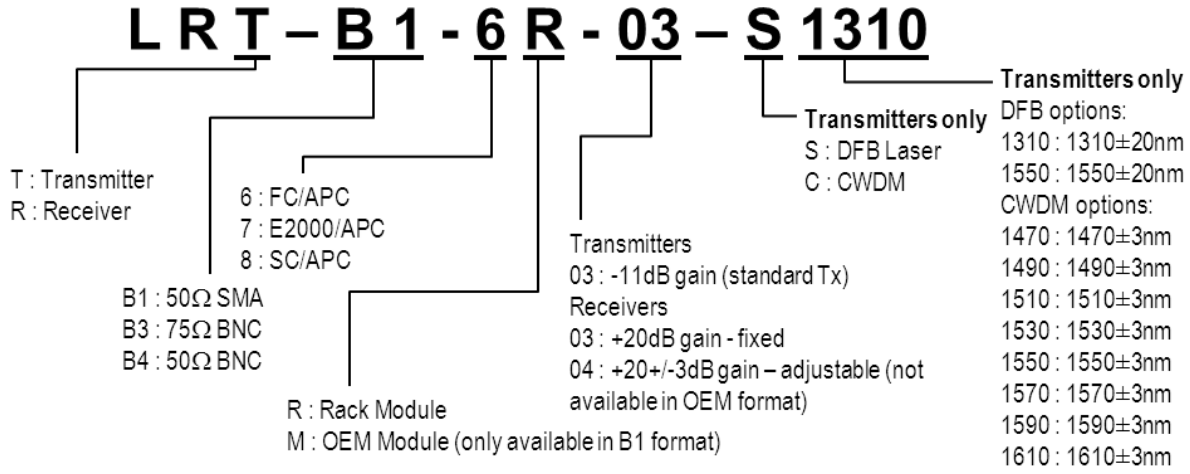


OEM module

Contact PPM for detailed dimensions

4 Part Numbering





5 Technical Specifications

	Units		Lband Rack mounted Fixed Standard Gain	Lband Rack mounted Variable Standard Gain	Lband Rack mounted Fixed Standard Gain
Transmitter			LRT-L1-6R-03-S1310	LRT-L1-6R-03-S1310	LRT-L1-6R-03-L1310
Receiver			LRR-L1-6R-03	LRR-L1-6R-04	LRR-L1-6R-03
Frequency Range	MHz		950-2150	950-2150	950-2150
Impedance	Ω		50	50	50
VSWR	(Typ)		1:1.5	1:1.5	1:1.5
Link Gain	dB (Nom)	a	9	9	9
Transmitter Gain		a	Fixed	Fixed	Fixed
Receiver Gain		a	Fixed	±3	Fixed
Flatness, Fullband	dB (Max)	a h j	±1.0	±1.25	±1.25
Flatness, Fullband	dB (Typ)	a h j	±0.4	±0.4	±0.4
Flatness, 36MHz	dB (Max)	a j	±0.35	±0.35	±0.5
Flatness, 36MHz	dB (Typ)	a j	±0.2	±0.2	±0.2
Gain Stability over temperature, Link	dB (max)	a	±3	±3	±3
Gain Stability with temperature, Tx	dB/°C (Typ)	a	0.09	0.09	0.09
Gain Stability with temperature, Rx	dB/°C (Typ)	a	0.05	0.05	0.05
Gain Stability	dB (Typ)		0.25 @ 24 hrs	0.25 @ 24 hrs	0.25 @ 24 hrs
IMD	dB (Typ)	c	-60	-60	-62
CNR	dB (Typ)	b	58	58	48
Nominal input Signal	dBm		-20	-20	-20
Nominal output Signal	dBm		-20	-20	-20
P1dB$_{input}$	dBm (Min)	a k	-5	-5	-5
P1dB$_{input}$	dBm (Typ)	a k	-1	-1	-1
IP3$_{input}$	dBm (Min)	a k	7	7	7
IP3$_{input}$	dBm (Typ)	a k	11	11	11
IP3$_{output}$	dBm (Typ)	c k	10	10	11
Noise Figure	dB (Max)	a k	22	22	22
Noise Figure	dB (Typ)	a k	19	19	19
Noise Figure	dB (Typ)	c k	26	26	36
CNR , 1MHz BW @ -40dB IMD	dB (Typ)	a	86	86	86
CNR , 1MHz BW @ -40dB IMD	dB (Typ)	c	79	79	70
SFDR	dB/Hz? (Typ)	b	110	110	103
Maximum Input Power	dBm (Min)		15	15	15
Power Tx	W (Max)		3.2	3.2	3.2
Power Rx	W (Max)		2.7	2.7	2.7
Power Tx	W (Typ)		2.9	2.9	2.9
Power Rx	W (Typ)		2.3	2.3	2.3
RF connector			50Ω SMA	50Ω SMA	50Ω SMA
Optical Wavelength	nm	d e	1310 ± 20	1310 ± 20	1310 ± 20
Laser Type		f	DFB	DFB	FP
Optical Power Output	dBm (Typ)		4.5	4.5	4.5
Optical Connector		g	FC/APC	FC/APC	FC/APC
			FC/APC: Suhner FCPC-Z/M-A601 narrow keywidth: >60dB return loss E2000/APC: Suhner FLSH-2000-A608: >60dB return loss Use with other types may compromise system performance.		
Power LED			GREEN Indicates DC power is applied to the module		
TX status LED			GREEN: Transmitter laser functioning, RED: Transmitter laser degraded		
RX status LED			GREEN: Received light level above threshold RED: Received light level below threshold (factory set to 20dB optical)		
TX Alarm output			Open drain alarm: OPEN: okay, CURRENT SINK: Laser Degraded		
RX Alarm output			Open drain alarm: OPEN: okay, CURRENT SINK: RLL below threshold		
TX monitor output (OEM only)			None		
RX monitor output			Analogue Received Light Level (RLL) monitor. VOLTAGE = 7.75V nominal for a gain of +9dB and reduces by 0.25V per dB of loss in the optical path.		
Operating temperature range			-10°C to +50°C	-10°C to +50°C	-10°C to +50°C
Storage temperature range			-40°C to +70°C	-40°C to +70°C	-40°C to +70°C

a	nominal input power @ 0dB optical loss
b	nominal input power @ 1dB optical loss
c	nominal output power @ 5dB optical loss
d	1550nm options available
e	CWDM options available
f	DFB = Distributed feedback laser, FP = Fabry-Perot laser
g	Connector options FC/APC, E2000 available
h	Variable gain units flatness is quoted at 0dB gain offset
j	Gain variance across control range less than double that at 0dB
k	Measured at 1.2GHz
	Unless stated all test quotes @ 25°C after 15 minutes warm up

	Units		Lband Rack mounted Fixed High Gain	Lband OEM mounted Variable Standard Gain	Lband Rack mounted Fixed Standard Gain
Transmitter			LRT-L1-6R-00-S1310	LRT-L1-7M-03-S1310	LRT-L3-6R-03-S1310
Receiver			LRR-L1-6R-06	LRR-L1-7M-04	LRR-L3-6R-03
Frequency Range	MHz		950-2150	950-2150	950-2150
Impedance	Ω		50	50	75
VSWR	(Typ)		1:1.5	1:1.5	1:1.5
Link Gain	dB (Nom)	a	20	9	9
Transmitter Gain		a	Fixed	Fixed	Fixed
Receiver Gain		a	Fixed	±3 dB	Fixed
Flatness, Fullband	dB (Max)	a h j	±1.5	±1.25	±1.4
Flatness, Fullband	dB (Typ)	a h j	±0.6	±0.7	±0.6
Flatness, 36MHz	dB (Max)	a j	±0.5	±0.5	±0.5
Flatness, 36MHz	dB (Typ)	a j	±0.25	±0.25	±0.2
Gain Stability over temperature, Link	dB (max)	a	±3	±3	±3
Gain Stability with temperature, Tx	dB/°C (Typ)	a	0.09	0.09	0.09
Gain Stability with temperature, Rx	dB/°C (Typ)	a	0.05	0.05	0.05
Gain Stability	dB (Typ)		0.25 @ 24 hrs	0.25 @ 24 hrs	0.25 @ 24 hrs
IMD	dB (Typ)	c	-66	-62	-60
CNR	dB (Typ)	b	62	56	58
Nominal input Signal	dBm		-20	-20	-20
Nominal output Signal	dBm		-20	-20	-20
P1dB$_{input}$	dBm (Min)	a k	-12	-4	-5
P1dB$_{input}$	dBm (Typ)	a k	-8	0	-1
IP3$_{input}$	dBm (Min)	a k	0	7	7
IP3$_{input}$	dBm (Typ)	a k	4	12	11
IP3$_{output}$	dBm (Typ)	c k	14	11	10
Noise Figure	dB (Max)	a k	20	26	24
Noise Figure	dB (Typ)	a k	15	20	19
Noise Figure	dB (Typ)	c k	22	27	26
CNR , 1MHz BW @ -40dB IMD	dB (Typ)	a	83	86	85
CNR , 1MHz BW @ -40dB IMD	dB (Typ)	c	77	79	79
SFDR	dB/Hz? (Typ)	b	109	110	109
Maximum Input Power	dBm (Min)		15	15	15
Power Tx	W (Max)		3.2	2.9	3.2
Power Rx	W (Max)		2.7	2.3	2.6
Power Tx	W (Typ)		2.9	2.5	2.9
Power Rx	W (Typ)		2.3	2.1	2.3
RF connector			50Ω SMA	50Ω SMA	75Ω BNC
Optical Wavelength	nm	d e	1310 ± 20	1310 ± 20	1310 ± 20
Laser Type		f	DFB	DFB	DFB
Optical Power Output	dBm (Typ)		4.5	4.5	4.5
Optical Connector		g	FC/APC	E2000/APC	FC/APC
			FC/APC: Suhner FCPC-Z/M-A601 narrow keywidth: >60dB return loss E2000/APC: Suhner FLSH-2000-A608: >60dB return loss Use with other types may compromise system performance.		
Power LED			GREEN Indicates DC power is applied to the module		
TX status LED			GREEN: Transmitter laser functioning, RED: Transmitter laser degraded		
RX status LED			GREEN: Received light level above threshold RED: Received light level below threshold (factory set to 20dB optical)		
TX Alarm output			Open drain alarm: OPEN: okay, CURRENT SINK: Laser Degraded		
RX Alarm output			Open drain alarm: OPEN: okay, CURRENT SINK: RLL below threshold		
TX monitor output (OEM only)			Forward current monitor, measures laser drive current, VIFL = 68 x Ifwd		
RX monitor output			Analogue Received Light Level (RLL) monitor. VOLTAGE = 7.75V nominal for a gain of +9dB and reduces by 0.25V per dB of loss in the optical path.		
Operating temperature range			-10°C to +50°C	-10°C to +50°C	-10°C to +50°C
Storage temperature range			-40°C to +70°C	-40°C to +70°C	-40°C to +70°C

a	nominal input power @ 0dB optical loss
b	nominal input power @ 1dB optical loss
c	nominal output power @ 5dB optical loss
d	1550nm options available
e	CWDM options available
f	DFB = Distributed feedback laser, FP = Fabry-Perot laser
g	Connector options FC/APC, E2000 available
h	Variable gain units flatness is quoted at 0dB gain offset
j	Gain variance across control range less than double that at 0dB
k	Measured at 1.2GHz
	Unless stated all test quotes @ 25°C after 15 minutes warm up

	Units	IF Rack mounted Fixed Standard Gain	IF Rack mounted Variable Standard Gain	IF OEM mounted Fixed Standard Gain	IF Rack mounted Variable Gain
Transmitter		LRT-B1-6R-03-S1310	LRT-B1-6R-03-S1310	LRT-B1-7M-03-S1310	LRT-B3-6R-03-S1310
Receiver		LRR-B1-6R-03	LRR-B1-6R-04	LRR-B1-7M-03	LRR-B3-6R-04
Frequency Range	MHz	70-140	70-140	70-140	70-140
Impedance	Ω	50	50	50	75
VSWR	(Typ)	1:1.5	1:1.5	1:1.5	1:1.5
Link Gain	dB (Nom) [a]	9	9	9	9
Transmitter Gain	[a]	Fixed	Fixed	Fixed	Fixed
Receiver Gain	[a]	Fixed	±3 dB	Fixed	±3 dB
Flatness, Fullband	dB (Max) [a h j]	±0.5	±0.5	±0.5	±0.75
Flatness, Fullband	dB (Typ) [a h j]	±0.2	±0.2	±0.2	±0.3
Flatness, 36MHz	dB (Max) [a j]	±0.25	±0.25	±0.25	±0.25
Flatness, 36MHz	dB (Typ) [a j]	±0.1	±0.1	±0.1	±0.1
Gain Stability over temperature, Link	dB (max) [a]	±3	±3	±3	±3
Gain Stability with temperature, Tx	dB/°C (Typ) [a]	0.09	0.09	0.09	0.09
Gain Stability with temperature, Rx	dB/°C (Typ) [a]	0.05	0.05	0.05	0.05
Gain Stability	dB (Typ)	0.25 @ 24 hrs	0.25 @ 24 hrs	0.25 @ 24 hrs	0.25 @ 24 hrs
IMD	dB (Typ) [c]	-58	-58	-58	-57
CNR	dB (Typ) [b]	58	58	58	59
Nominal input Signal	dBm	-20	-20	-20	-20
Nominal output Signal	dBm	-20	-20	-20	-20
P1dB$_{input}$	dBm (Min) [a k]	-6	-6	-6	-6
P1dB$_{input}$	dBm (Typ) [a k]	-2	-2	-2	-3
IP3$_{input}$	dBm (Min) [a k]	6	6	6	6
IP3$_{input}$	dBm (Typ) [a k]	10	10	10	10
IP3$_{output}$	dBm (Typ) [c k]	8	8	8	8
Noise Figure	dB (Max) [a k]	23	23	23	25
Noise Figure	dB (Typ) [a k]	20	20	20	19
Noise Figure	dB (Typ) [c k]	26	26	26	25
CNR , 1MHz BW @ -40dB IMD	dB (Typ) [a]	85	85	85	85
CNR , 1MHz BW @ -40dB IMD	dB (Typ) [c]	78	78	78	78
SFDR	dB/Hz? (Typ) [b]	109	109	110	109
Maximum Input Power	dBm (Min)	15	15	15	15
Power Tx	W (Max)	3.4	3.4	3.4	3.2
Power Rx	W (Max)	2.9	2.9	2.9	3
Power Tx	W (Typ)	2.9	2.9	2.9	2.9
Power Rx	W (Typ)	2.3	2.3	2.3	2.3
RF connector		50Ω SMA	50Ω SMA	50Ω SMA	75Ω BNC
Optical Wavelength	nm [d e]	1310 ± 20	1310 ± 20	1310 ± 20	1310 ± 20
Laser Type	[f]	DFB	DFB	DFB	DFB
Optical Power Output	dBm (Typ)	4.5	4.5	4.5	4.5
Optical Connector	[g]	FC/APC	FC/APC	E2000/APC	FC/APC
		FC/APC: Suhner FCPC-Z/M-A601 narrow keywidth: >60dB return loss E2000/APC: Suhner FLSH-2000-A608: >60dB return loss Use with other types may compromise system performance.			
Power LED		GREEN Indicates DC power is applied to the module			
TX status LED		GREEN: Transmitter laser functioning, RED: Transmitter laser degraded			
RX status LED		GREEN: Received light level above threshold RED: Received light level below threshold (factory set to 20dB optical)			
TX Alarm output		Open drain alarm: OPEN: okay, CURRENT SINK: Laser Degraded			
RX Alarm output		Open drain alarm: OPEN: okay, CURRENT SINK: RLL below threshold			
TX monitor output (OEM only)		None			
RX monitor output		Analogue Received Light Level (RLL) monitor. VOLTAGE = 7.75V nominal for a gain of +9dB and reduces by 0.25V per dB of loss in the optical path.			
Operating temperature range		-10°C to +50°C	-10°C to +50°C	-10°C to +50°C	-10°C to +50°C
Storage temperature range		-40°C to +70°C	-40°C to +70°C	-40°C to +70°C	-40°C to +70°C

[a] nominal input power @ 0dB optical loss
[b] nominal input power @ 1dB optical loss
[c] nominal output power @ 5dB optical loss
[d] 1550nm options available
[e] CWDM options available
[f] DFB = Distributed feedback laser
[g] Connector options FC/APC, E2000 available
[h] Variable gain units flatness is quoted at 0dB gain offset
[j] Gain variance across control range less than double that at 0dB
[k] Measured at 1.2GHz
Unless stated all test quotes @ 25°C after 15 minutes warm up

5.1.1 Module Specifications

RX Level threshold	Set to 20dB±3dB optical (or 40dB±6dB electrical loss)
Supply Voltage **Rack plug-in module** **OEM module**	 12VDC ± 0.5VDC 12VDC ± 0.5VDC
MTBF–Ground, fixed environment **50°C, MIL-HDBK-217**	Rx - 300,000 Hours incl. contribution from housing Tx – 60,000 Hours incl. contribution from housing

Operating Conditions

Gain Stability over Temperature **Tx** **Rx**	< +/-3dB over operating range <0.05dB/°C below 40°C typ., <0.08dB/°C above 40°C typ. <0.03dB/°C typ.
Operating Temperature **Rack plug-in module** **Shielded remote module** **OEM module**	 -10°C to +50°C -20°C to +50°C -10°C to +50°C convection cooling in free air
Storage Temperature **All types**	 -40°C to +70°C

6 Maintenance and Fault-Finding Guide

Refer to the following table that gives a list of commonly encountered problems and suggested solutions.

Fault	Possible Causes	Solution
"+12V" LED is not illuminated on the Plug-In PSU.	Power is not attached to the PSU. Fuse has blown in PSU.	Connect mains power to the PSU. Replace fuse.
Power LED does not light on Shielded Remote Module.	Power source not connected.	Connect power source.
Power LED lights up RED.	External Feed is in current limit.	Check external load.
Status LED lights up RED but RF signal is present.	Laser degraded.	Return to local PPM office.
Status LED lights up RED and no RF signal is present.	Low optical level at receiver.	Check optical link for breaks / kinks
Status LED lights up GREEN but no RF signal is present.	Gain adjustment set too low. RF feed not connected.	Increase gain setting. Check RF connections.

The ***ViaLite*** range of RF Transmit and Receive Modules are precision engineered and calibrated for optimum performance and accuracy before dispatch.

However, in the event of any problems or queries arising about the equipment, please contact PPM or your local agent.

7 Product Warranty

The Company guarantees its products, and will maintain them for a period of three years from the date of shipment and at no cost to the customer. Extended warranty options are available at the time of purchase.

Please note that the customer is responsible for shipping costs to return the unit to PPM.

The Company or its agents will maintain its products in full working order and make all necessary adjustments and parts replacements during the Company's normal working hours provided that the Customer will pay at the rates currently charged by the Company for any replacements made necessary by accident, misuse, neglect, wilful act or default or any cause other than normal use.

Claims must be made promptly, and during the guarantee period.

IMPORTANT: -

Please contact both your selling agent and PPM prior to returning any goods for Warranty or Non-Warranty repairs. Goods will not be accepted without a valid Goods Return Number (GRN)

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