XTENDR®

HFC Repeater

Installation & Operation Manual

LINDSAY
BROADBAND

February 11, 2022

TABLE OF CONTENTS

1.0 PRODUCT OVERVIEW AND FEATURES

1.1 Description

Lindsay Broadband's XTENDR HFC repeater is designed for easy extensions of existing HFC networks. The XTENDR device provides a suitable migration path and cost-effective connection of customers in rural areas. It uses fiber optics without overbuilding the coaxial footprint of the HFC plant.

Customers who could not be reached before with the traditional hybrid fiber coax (HFC) network can now be served by using the XTENDR HFC repeater, in combination with Lindsay Broadband's LBON series of mini RFoG nodes at the customer premise.

The XTENDR device includes a forward optical transmitter with an optional, optical amplifier. It provides high-output power to convert downstream RF signals to optical, and reverse optical receivers to convert upstream optical signals to RF.

Up to 32 rural subscribers can be reached within a distance of 20 km (65,000 ft/12.5 mi) using this device. Many other designs can be implemented to serve up to 64 rural subscribers from a single device within 9.5 km (31680 ft/6 mi).

The return receivers in the device are DOCSIS® 3.1 capable, up to 204 MHz upstream bandwidth, wideband (1240-1620 nm; except 1540-1560 nm) multi diode receivers. Available diplex filter splits are 42/54, 85/102 or 204/258 MHz. The maximum downstream bandwidth is 1218 MHz.

The XTENDR HFC repeater can be mounted on a strand or a pole and is outdoor-rated for operation from -40°C to +60°C (-40°F to +140°F). The device comes in an IP65 outdoor-rated housing. It can be powered locally through a dedicated powering port, or remotely by combining power on the RF port with 40-90 VAC HFC power. Power consumption is less than 21 watts.

Lindsay Broadband offers end-to-end solutions to extend your existing HFC network, including designing your network using the XTENDR HFC repeater, optical passives, and RFoG CPE devices.

1.2 Features

- 1218 MHz bandwidth & a variety of diplex filter split options (42/54, 85/102, 204/258 MHz plug-in diplex filter)
- 1550 nm DFB forward transmitter with an optional built-in EDFA for high output power per port
- Multi-diode return receivers eliminate OBI

- Available in 2, 4, 8 or 16-port configurations
- Electronic adjustable slope & attenuation for upstream & downstream RF
- 40-90 VAC HFC local powering through dedicated power port, or remote powering via RF port
- Can easily connect up to 32 rural subscribers over a span of 20 km (65,000'/12.5 mi). Supports up to 64 subscribers on a single device up to 9.5 km (31680'/6 mi)
- Test point for easy setup & troubleshooting
- Perfect in combination with Lindsay's LBON series mini nodes as CPE
- IP65 outdoor enclosure & rated for outdoor temperatures -40°C to +60°C (-40°F to +140°F)
- Low power consumption
- Strand, pole or wall mounting
- High density LC/APC optical connectors

1.3 Specifications

Parameter		Specification
Downstream Optical Transmitter		
Optical Output Wavelength		1550 ± 10 nm
Without EDFA		
Optical Output Power (per port)	2 ports	4 dBm ± 0.5 dB
	4 ports	1 dBm ± 0.5 dB
	8 ports	-2 dBm ± 0.5 dB
	16 ports	-5 dBm ± 0.5 dB
With EDFA		
Optical Output Power (per port)	2 ports	12 dBm ± 0.5 dB
	4 ports	9 dBm ± 0.5 dB
	8 ports	6 dBm ± 0.5 dB
	16 ports	3 dBm ± 0.5 dB
	16 ports with dual EDFA	6 dBm ± 0.5 dB
Optical Return Loss		≤ 45 dB
RF Input Level		10-15 dBmV per channel
RF Bandwidth (1)		FH-1218 MHz
RF Return Loss		14 dB < 1000 MHz; 12 dB ≥ 1000 MHz
Flatness		± 1 dB
RF Attenuator		0-20 dB
Slope		0-20 dB
CTB (2)		> 65 dBc
CSO (2)		> 60 dBc
CNR (2)		> 50 dB
Upstream Active Combiner with Return Receiver		
Optical Input Wavelength (3)		1240-1620 nm
Optical Input Power		-9 to +3 dBm
Optical Return Loss		≤ 45 dB
Optical Receiver Diode Type		PIN
Frequency Range		12-FL MHz
RF Return Loss		16 dB
RF Output Level (4)		≥ 35 dBmV
Flatness		± 1 dB Max
Test Point for OMI Control (4)		10 dBmV ± 2 dB
Adjustable RF Attenuator		0-25 dB

Power, Environmental & Physical		
Total Power Consumption	with EDFA	≤ 21 W
	without EDFA	≤ 15 W
Rated Operating Voltage		40-90 HFC
Operating Temperature		-40°C to +60°C (-40°F to +140°F)
IP Class		IP65
Dimensions (H x W x D)		8.6"H x 10.3"W x 4.8"D (22.0H x 26.2W x 12.2D cm)
Weight		7.0 lb (3.2 kg)

NOTES:

(1) Available options: FL = 42, 85, 204 MHz & FH = 54, 102, 258 MHz

(2) Analog channels up to 550 MHz; digital channels @ -6 dB above 550 MHz; 3.5% OMI; -1 dBm RX at ONU

(3) Except 1540-1560 nm

(4) 10% OMI per channel

1.4 Ordering Matrix

		Optical Split		Downstream IP/ Upstream OP		RF Split		Downstream Optical Amp		Optical Connector		Powering
XT	-	xx	-	RF	-	xx	-	xx	-	LA	-	xxx
		02 = 2 ports		RF		45 = 42/54 MHz		00 = No EDFA		LA = LC/APC		HFC = 40-90 VAC
		04 = 4 ports				81 = 85/102 MHz		OA = 17 dBm EDFA				
		08 = 8 ports				22 = 204/258 MHz		2OA = Dual 17 dBm EDFA (1)				
		16 = 16 ports										

NOTE:

(1) Option only with 16 ports optical split

For example, XT - 16 - RF - 45 - OA – LA – HFC
XTENDR with 16 optical ports, with RF Downstream input/upstream output, 42/54MHz RF Sub split, With 17dBm EDFA Downstream Optical Amplifier, LC/APC Connector and 40-90 Vac HFC powering.

Optional Accessories	
Part #	**Description**
XT-DF-42-54	XTENDR plug-in diplexer, 5-42/54-1218 MHz
XT-DF-85-102	XTENDR plug-in diplexer, 5-85/102-1218 MHz
XT-DF-204-258	XTENDR plug-in diplexer, 5-204/258-1218 MHz
XT-CS-xx	XTENDR cable simulator plug, 1218 MHz (xx = dB value; available values = 3,6,9,12,15)
XT-SMB	XTENDR strand mount bracket (1 pair)
XT-F-7.5	XTENDR 7.5 amp fuse
See matrix below	Optical service cables

		# of Fibers		Cable Length (meters)		Connector
XT-SC	**-**	**x**	**-**	**xx**	**-**	**LA**
		2		10 = 10 m		LA = LC/APC
		4		15 = 15 m		
		8		30 = 30 m		
				50 = 50 m		

1.5 Block diagram of the XTENDR

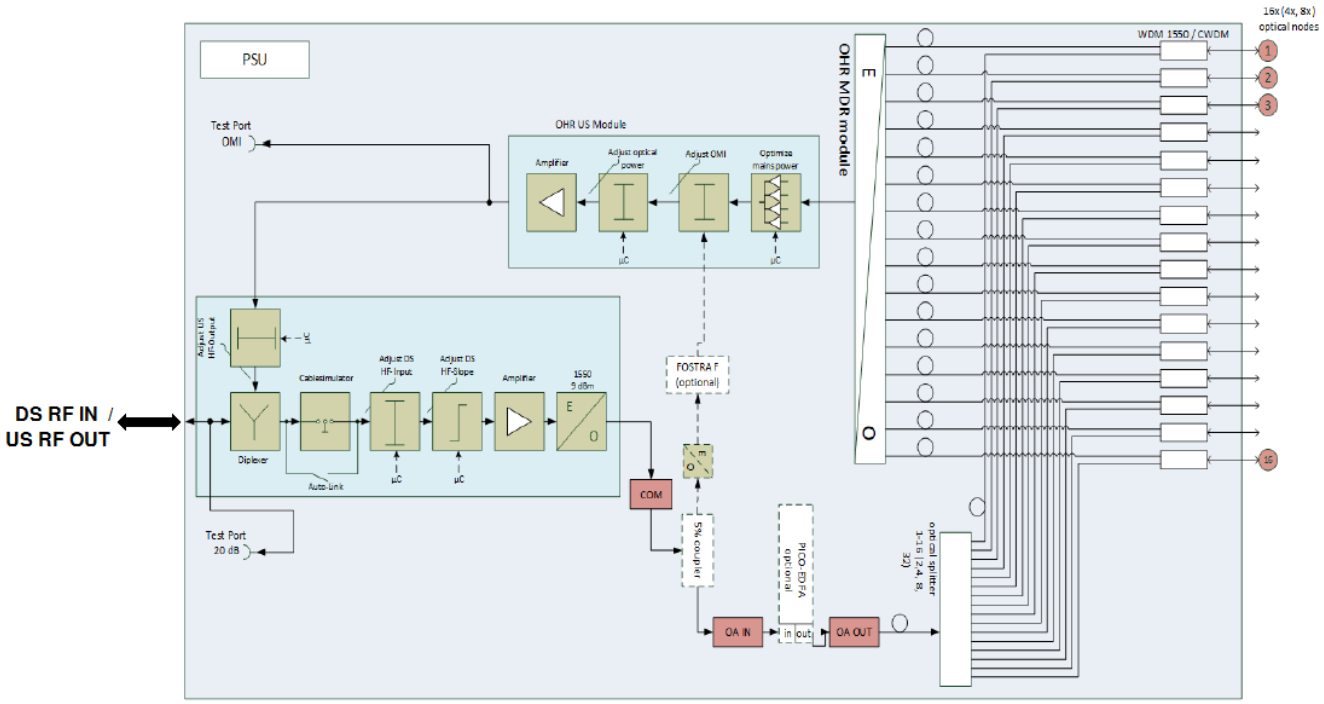

Figure 1: Block diagram of the XTENDR

2.0 SAFETY NOTES

NO SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

Failure to comply with these safety precautions and with the general or specific safety precautions described elsewhere in this series manual violates the safety standards of the design, manufacture, and intended use of the device. Lindsay Broadband Inc. assumes no liability for the customer's failure to comply with these precautions.

- The XTENDR employs an infrared laser device that emits invisible light, which can permanently damage the retina of an eye.
- Avoid direct exposure to the laser light source.
- Never stare directly into a fiber or at any mirror-like surface that could reflect light emitted from an un-terminated fiber.
- Never view an active fiber through optical instruments.

CAUTION: Do not operate the equipment outside of its maximum ratings. Doing so may result in unsatisfactory performance, unit failure, shortened unit life span, or a safety hazard.

3.0 INNER VIEW DESCRIPTION

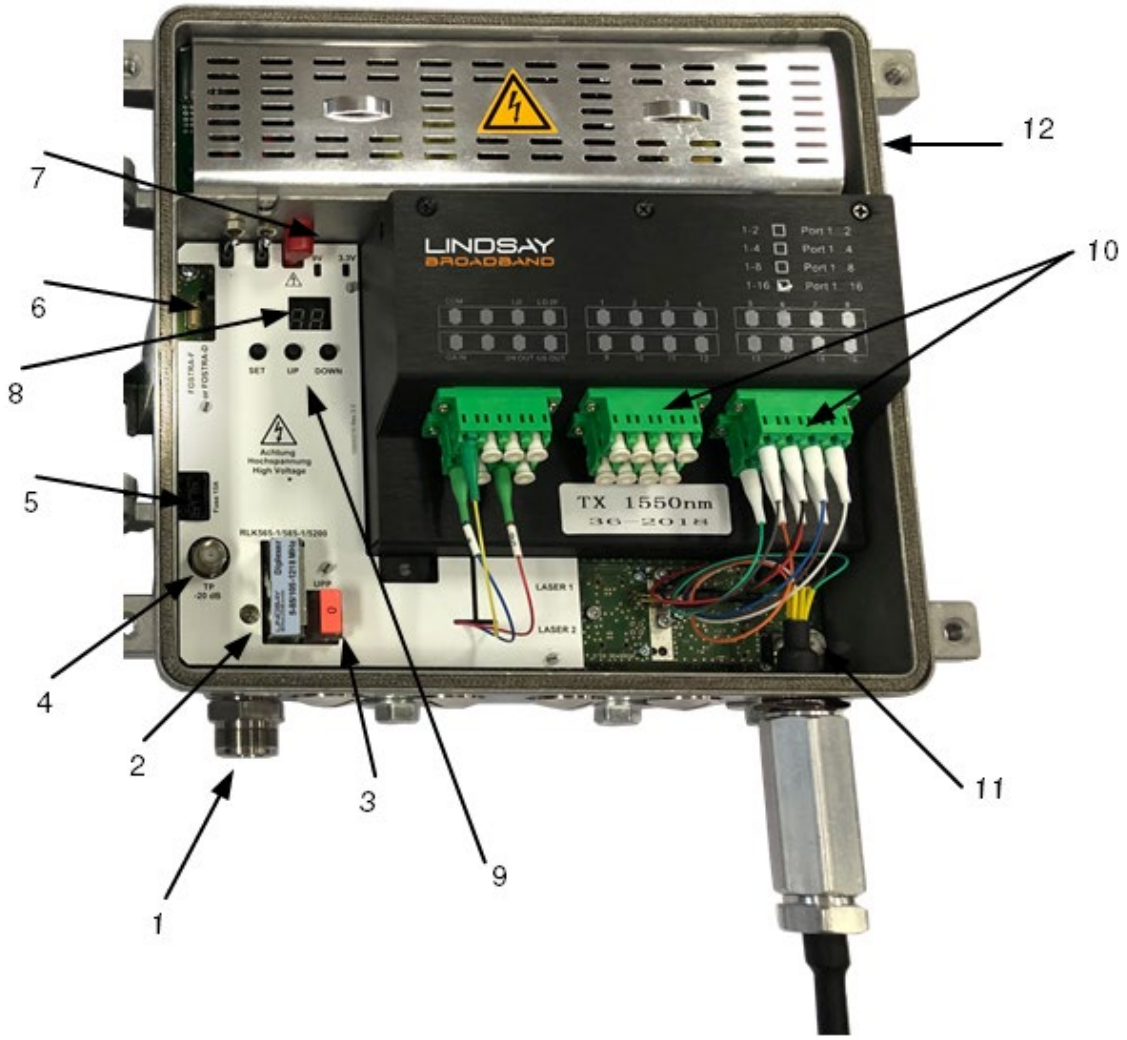

Figure 2: XTENDR Inner View

1. Downstream RF Input & Upstream RF Output. Can also combine RF and AC to power XTENDR using Power Inserter.
2. Plugin Diplex Filter (42/54MHz, 85/102MHz & 204/258MHz)
3. 1.2GHz Cable simulator
4. -20dB Bi-directional test point
5. Fuse for powering through RF port

6. Optional management module
7. Status LEDs for 9V & 3.3V internal voltage rails
8. LED Display for setup
9. Set/Up/Down push buttons for setup
10. Downstream optical output / Upstream optical input ports to connect subscribers
11. OMI Test point (for Upstream signals only)
12. Auxiliary powering port (see Figure 3). Top screw terminal is "+ve" and bottom screw terminal is ground (chassis).

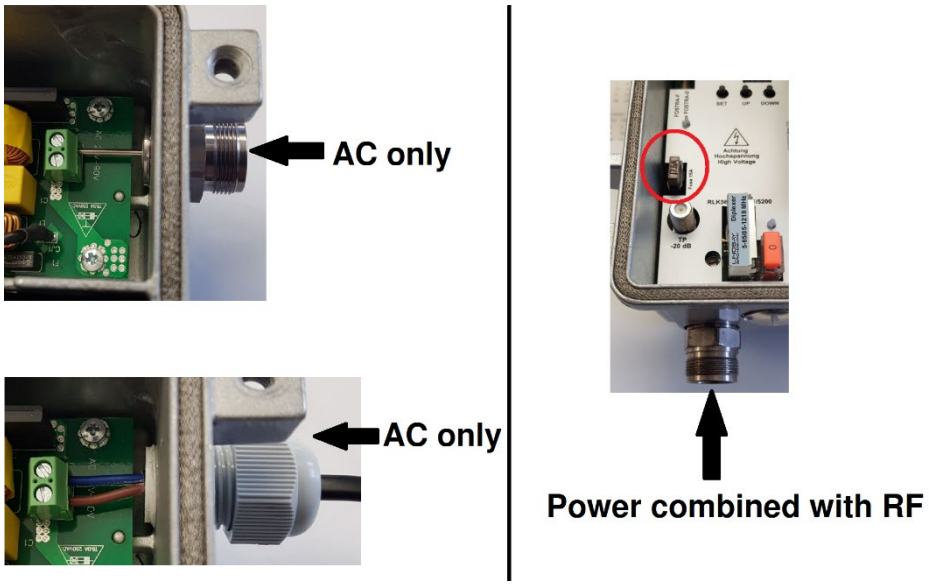

Figure 3: Powering the XTENDR

4.0 INSTALLATION & OPERATION

The XTENDR inverse node can be mounted on a pole or wall or on a strand. Use appropriate bracket for mounting.

The length of stinger center conductors used with the XT series HFC repeater is 0.9” (23.0 mm). Please use the guide below for all stingers on XT series HFC repeater. Please note this guide is not to scale.

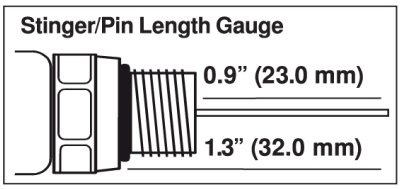

Figure 4: Stinger/Pin Length Gauge Diagram

1. Apply power to the XTENDR node as shown in Figure 3. XTENDR node can be powered with 40-90Vac HFC plant power. For powering from the RF port, plug the fuse into the socket (shown as #5 in Figure 2). XTENDR can also be powered from the auxiliary powering port. At auxiliary power input, the top screw terminal is “+ve” and bottom screw terminal is ground (chassis). No need to plug in the fuse when powering from auxiliary powering port.

2. Connect the coaxial RF from the end of your HFC network to the RF port on the XTENDR. The recommended downstream RF input to the XTENDR for analog channels is 10dBmV to 15dBmV per channel (i.e. 2.0% to 3.5% OMI per channel) or for digital channels is 4dBmV to 9dBmV per channel (i.e. 2.0% to 3.5% OMI per channel). Refer to the following table for RF input level versus OMI/Channel for setup.

Downstream RF Input Level		OMI per Channel
Digital	**Analog**	
4 dBmV	10 dBmV	2.0 %
5 dBmV	11 dBmV	2.2 %
6 dBmV	12 dBmV	2.5 %
7 dBmV	13 dBmV	2.8 %
8 dBmV	14 dBmV	3.2 %
9 dBmV	15 dBmV	3.5 %
10 dBmV	16 dBmV	4.0 %
11 dBmV	17 dBmV	4.5 %
12 dBmV	18 dBmV	5.0 %
13 dBmV	19 dBmV	5.6 %
14 dBmV	20 dBmV	6.3 %

3. Levels can be monitored on the bidirectional -20dB Test point (#4 in Figure 2). This test point is 20dB below the actual levels on the RF input/output port.

4. The “UPP” plugin on the XTENDR (#3 in Figure 2) is a 1.2GHz JXP type cable simulator. If no cable simulation is required, plug a 0dB JXP attenuator pad in the UPP plugin.

5. Press the “SET” push button on the device to access the setup menu. Press “SET” again to advance to the next parameter in the menu. Press “UP” or “DOWN” keys to change the value of the parameter. See Figure 4 for setup menu parameters and flow chart.

6. The first parameter is “FU” function parameter. Using “UP” or “DOWN” buttons to change and select device mode as “**I**” (Inverted Node) under the “FU” menu. This will set the XTENDR to operate as an inverse node.

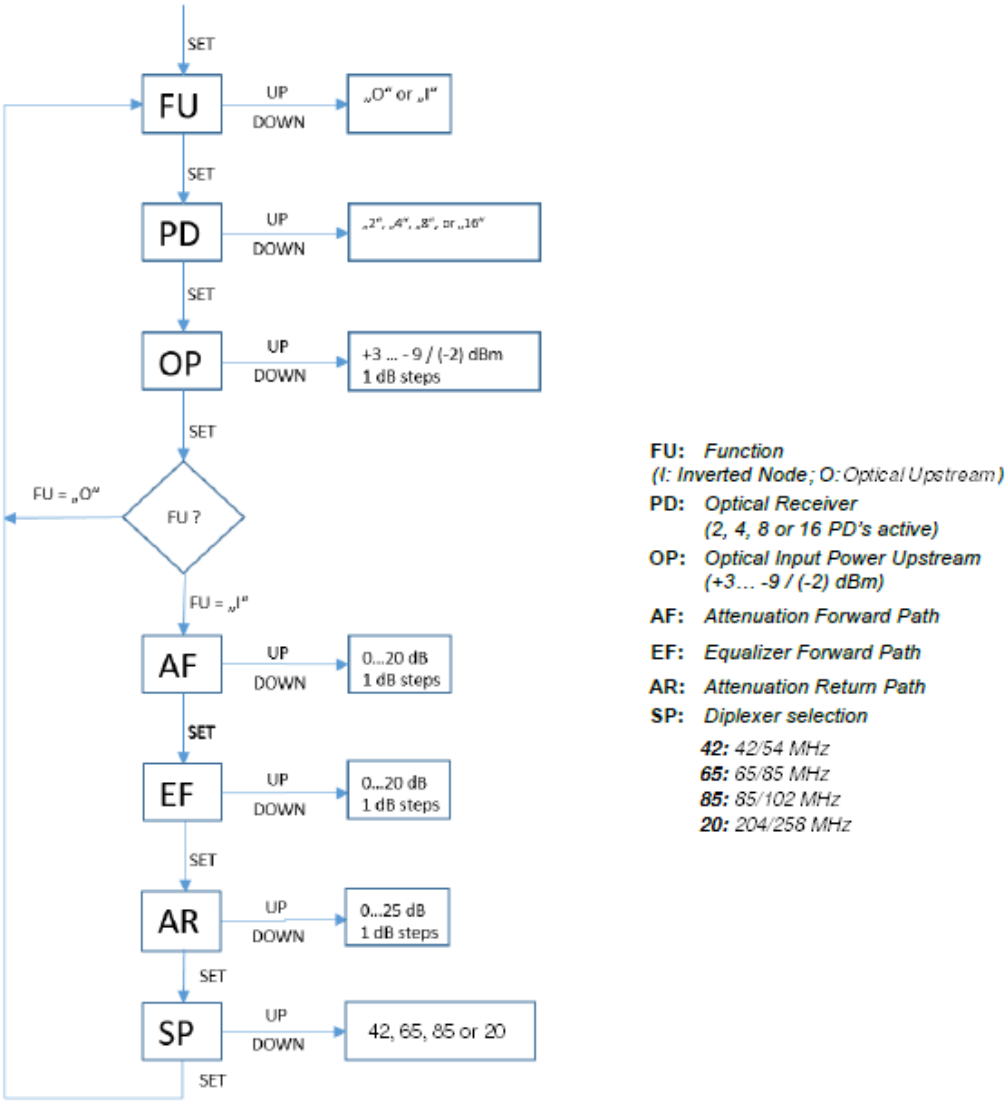

Figure 5: Local User Interface Setup

7. Connect the Optical Service Cable to the XTENDR. Connect fiber pigtails to all subscriber optical ports. Ensure all fibers/ports are clean. Use an optical power meter to verify that the downstream 1550nm optical output power level is within the specification. The XTENDR can be ordered either with or without the EDFA. Refer to the specifications for optical output power levels of your XTENDR model.

8. Adjust RF attenuation on forward path under the "AF" (Attenuation Forward Path) parameter in the setup menu if the forward RF input level to the XTENDR is high. Attenuation can be adjusted from 0dB to 20dB (by pressing "UP/DOWN" buttons) in 1dB steps.

9. Adjust the equalizer in forward path under the "EF" (Equalization Forward Path) parameter in setup menu as required to equalize the frequency dependent cable attenuation. Up to 20dB of tilt can be added to the forward path in 1dB steps.

10. Next, activate the upstream inputs by setting "**PD**" (Photo Diode Optical Receiver) value in setup menu. Using "UP" or "DOWN" buttons under "PD"; activate either 2, 4, 8 or 16 optical upstream receivers. This will activate only the number of upstream receivers as set by user under this menu and disable all other the unused receiver ports of the XTENDR. For eg: On a 16 port XTENDR, setting "4" under "PD" parameter, will activate only the first 4 (i.e. 1 to 4) upstream receivers of the multi diode receiver and turn off the extra receiver ports. This improves performance and reduces noise from inactive upstream receivers.

    NOTE: Do not select 32 receiver option under "PD" menu as this is for future purposes only & selecting 32 will change the upstream optical input range from -9 ~ +3dBm to -2 ~ +3dBm.

11. Measure the upstream optical power (1240 to 1620nm; except 1540 to 1560nm) from the subscriber ONUs at XTENDR subscriber ports using optical power meter. Ensure the upstream optical power is within -9dBm to +3dBm. Adjust the "**OP**" Optical Input Upstream Power parameter (Figure 4) for the average upstream optical input power at XTENDR. This will optimize the system for best Carrier to Noise (CNR) performance and also make sure the upstream receivers are not over driven. For e.g. If the average upstream optical input power on all ports is around -3dBm, then set "**OP**" value to "**-3**".

12. To be safe, start with an **OP** value of +3dBm. This will ensure the XT upstream path has lowest gain. Then as required, change the **OP** setting towards negative values. At -9dBm **OP** value, the XT will have maximum gain in the upstream path. It's recommended to first set **OP** values before making changes to "**AR**" parameter values in XT.

13. Next, if the Upstream RF Output from the XTENDR is too high, set the Reverse Path RF Attenuation under AR parameter in setup menu. Attenuation can be adjusted from 0 to 25dB in 1dB steps. As per the specifications, the upstream RF output levels should be ≥ 35dBmV per channel for 10% OMI per channel.

14. An upstream only test point is available for measuring OMI of the upstream receive levels (#11 in Figure 2). If the **OP** value in the setup menu is set appropriately (close to real value), the output of the test point will be as shown in the table below. If the level of RF on the OMI test point is much different from what is shown in the table below, it means that the OP setting is different from actual upstream receive level.

Upstream OMI RF Test Point Level	OMI per Channel
5 dBmV	6.3 %
6 dBmV	7.1 %
7 dBmV	7.9 %
8 dBmV	8.9 %
9 dBmV	10.0 %
10 dBmV	11.2 %
11 dBmV	12.6 %
12 dBmV	14.1 %
13 dBmV	15.8 %
14 dBmV	17.8 %
15 dBmV	20.0 %

15. Set the diplex filter parameter under "**SP**" in setup menu. For 42/54MHz diplex filter, choose **42** option, for 85/102MHz, choose **85** option and for 204/258MHz choose **20** option.

    i.e. **42** – US: 5 to 42 MHz; DS: 54 to 1218 MHz
    85 – US: 5 to 85 MHz; DS: 102 to 1218 MHz
    20 – US: 5 to 204 MHz; DS: 258 to 1218 MHz

16. This concludes the setup for XTENDR HFC Repeater.

5.0 WARRANTY AND RMA POLICY

LIMITED WARRANTY

All equipment manufactured by Lindsay Broadband Inc. ("Lindsay") is warranted to be free from defects in material and workmanship under normal use and service for a period of twelve (12) months from the date of its delivery to the Customer. During the warranty period, the Customer shall promptly notify Lindsay in writing of any claim against the warranty.

This warranty shall not apply to the following:

Any Lindsay product, which shall have been repaired or attempted to be repaired or altered outside of a Lindsay Authorized Service Depot.

- Any Lindsay product, which has been subjected to misuse, damage or operated in any way other than its intended use.
- RF overload - hybrid ICs blown by excess RF level.
- Water damage caused by failure to properly close housing or failure of seal between customer installed connectors and bushing or casting at ports.
- The cost incurred by the Customer for the transportation or expedition of Lindsay products to any Lindsay Authorized Service Depot.
- Any damage to the Lindsay product, which is incurred in transit to and from any Lindsay Authorized Service Depot.
- Any Lindsay product which has been damaged by any acts of God, ie; lightning, floods, earthquakes, tornadoes and the like.
- Under the terms of this warranty, the obligation of Lindsay shall be limited to the repair or the replacement of the product at the discretion of Lindsay.

Lindsay Broadband Return Material Authorization Policy

A Return Material Authorization (RMA) Number is Required On all Product Returns (Regardless if Product is Being Returned to Repair or credit)

Product Received at the Lindsay Broadband Factory Without an RMA Number will be Returned to Sender

RMA number must be used when returning product for credit or repair. Use of RMA numbers will ensure efficient processing. When returning product to Lindsay Broadband, please follow the simple steps below (in the order that they appear):

RETURNS

1. Fill out the Product Return Authorization Form indicating product information. Repair items do not require original invoice information, but it is helpful to determine warranty eligibility.
2. Contact Lindsay Broadband Inc. Service Department in one of three ways:
   - E-mail to: contactus@lindsaybb.com (recommended method) Include all of the information from the product Authorization Form, or,
   - Fax the Product Authorization Form to 1-705-742-7669 or,
   - Call Lindsay Broadband Inc. @ 800-465-7046 Ext 235 / 261
3. After completing Steps 1 & 2, an RMA number will be assigned to you.
4. Securely pack the product and mark the box with your RMA #. If shipping multiple boxes, all boxes should be marked with the RMA #. The RMA # must be placed near your return address in large, bold print (approximately 2" in height). Please see the address label below as an example of the relative size location of the RMA #.

Sample Address label with RMA #

John Smith
ABC Company RMA 1234
123 Smith Street
Anytown, USA 00000

Lindsay Broadband Inc
2-2035 Fisher Dr.,
Peterborough, ON K9J 6X6

Send your returns to:

Lindsay Broadband Inc.
2-2035 Fisher Dr.
Peterborough, ON Canada K9J 6X6
Attn: Product Returns

All shipments are to be pre-paid by the sender. **No CODs will be accepted**.

Lindsay Broadband Return Material Authorization (RMA) Form

Service Repair Policy
Lindsay Broadband product may be returned for repair under the following condition:

1. Please contact Lindsay Broadband Service Dept. to obtain an RMA#.
2. Please supply requested information to verify 2warranty coverage.

Any shipments received by Lindsay Broadband without an RMA # will be refused.

Credit Return Policy
Lindsay Broadband products may be retuned for credit under the following conditions:

1. Products are unused and undamaged.
2. Products are accompanied by a one dollar (new purchase) for one dollar (credit return) order.
3. Products were purchased within one year from credit return date and are in a current catalog.
4. Products are subject to a 10% per RMA and $2.00 per line item.
5. Products that are custom made are subject to an additional charge for conversion of not less than 20% and not more than 50% of the FFP price.
6. Product that require factory repacking are subject to an additional charge for material and labour.
7. Please contact Lindsay Broadband Customer Service to obtain an RMA#.

Any shipments received by Lindsay Broadband without an RMA# will be refused.

Note: Products that are judged by Lindsay Broadband Inc. upon receipt as being unacceptable for credit shall be returned to sender at their expense.

SHIPPING INSTRUCTIONS

1. Make Sure to Obtain an RMA# and mark a box(s) accordingly
2. Ship Only Items Authorized
3. Enclose Packing Slip & Product Return Authorization Form
4. Ship Prepaid Only to :

Lindsay Broadband Inc
2-2035 Fisher Dr.
Peterborough, ON CANADA
K9J 6X6
Attn: Product Returns

Company	Contact Name:
Address:	City:
Prov/State:	Postal Code/Zip:
Phone: #:	Fax #:
Email address (if applicable)	
RMA # (To be supplied by Lindsay Broadband)	**Date:**
Reason for return	

Qty.	LBI Part #	Description	P.O. #	P.O. Date