LBON500AC Series 1 GHz Customer Premise RFoG ONU with 1G/10G PON Pass Through Port

Installation & Operation Manual

LINDSAY BROADBAND
a division of technetix group

PRODUCT OVERVIEW

- Model: LBON500AC
- Bandwidth: 5-42 MHz/54-1002 MHz; 5-65 MHz/85-1002 MHz; 5-85 MHz/102-1002 MHz
- Powering: 12-15 VDC

The LBON500AC series is Lindsay Broadband's third-generation RF over glass (RFoG) premise optical network unit (ONU) with xPON pass through port. It supports the overlay of GEPON and 10G EPON with RFoG to co-exist on the same fiber network. The LBON500AC ONU incorporates the necessary filtering for proper rejection between the RFoG and 1G/10G PON wavelengths.

The LBON500AC series comes standard with Automatic Gain Control (AGC) and burst-mode return lasers (2 or 3 mW).

FEATURES

- Input Optical Wavelength: 1550 nm
- Optical AGC: -6 to +2 dBm
- Thermally stable DFB burst-mode laser
- Transmit Wavelength: 1610 nm
- Downstream Bandwidth: 54/85/102 MHz to 1002 MHz
- Upstream Bandwidth: 5 MHz to 42/65/85 MHz
- Output RF Level: 20 dBmV/CH at 1002 MHz (typ.)
- Total Input RF Level: 20-40 dBmV
- RF Bi-directional Test Point: -20 dB
- Power Supply Voltage: 12-15 VDC
- Pwr-On, Opt I/P, Opt TX LED indicators
- Optional UPS available

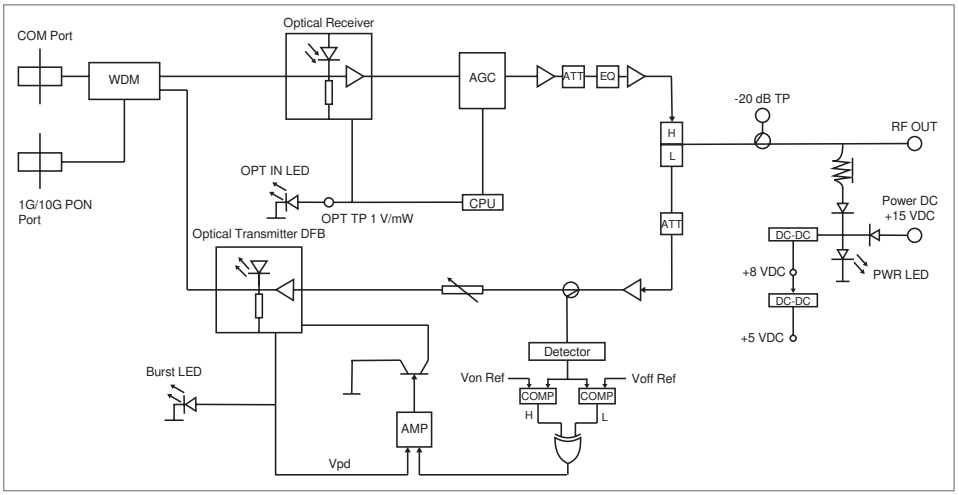
CAUTION

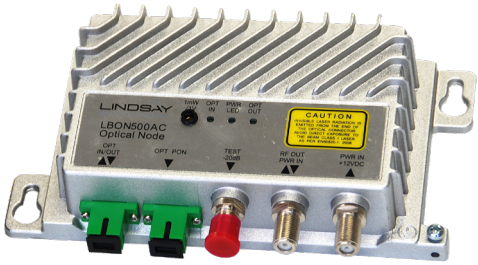
Risk of electric shock. Do not open.

Invisible laser radiation! Avoid eye injury. Never look into the optical cable or connector.

No serviceable parts inside. Refer servicing to qualified service personnel.

FUNCTIONAL SCHEMATIC





LBON500AC
(front angled view)

SPECIFICATIONS

Parameter		Specifications		
		Min	Typ	Max
Forward Receiver				
Optical Receive Wavelength		1540-1565 nm		
Monitor Voltage		1 V/mW		
Optical Input Power	Optical AGC	-6 to +2 dBm		
RFoG Path Rejection of PON Wavelengths	1260-1540 nm	≤ -30 dB		
	1565-1598 nm	≤ -30 dB		
	1625-1680 nm	≤ -30 dB		
PON Path Rejection of RFoG Wavelengths	1551/1611 nm	≤ -25 dB		

SPECIFICATIONS CONT'D.

Parameter		Specifications		
		Min	Typ	Max
Forward Receiver Cont'd.				
PON Pass Through Port Loss	1G/10G	1 dB		
RF Frequency Range (1)		102-1002 MHz		
Flatness of Frequency Response	f = fmin-1002 MHz		± 1 dB	
Output Return Loss	f = fmin-1002 MHz	16 dB		
Reference Output Level (2)	@ 1000 MHz (± 2 dB)		20 dBmV	
Slope	(± 1 dB)		5 dB	
Optical Input Return Loss		45 dB		
C/N (3)		50 dB	51 dB	
CTB (3)				-65 dB
CSO (3)				-60 dB
Return Transmitter				
Optical Wavelength		1610 nm		
Optical Output Power		2 mW		3 mW
RF Input Level	Total power	20-40 dBmV		
Dynamic Input Range (4)			15 dB	
Frequency Range (1)		5 MHz		85 MHz
Flatness of Frequency Response	f = 5 MHz to fmax		± 0.75 dB	±1 dB
Input Return Loss	f = 5 MHz to fmax	16 dB		
Optical Output Return Loss		45 dB		
TX OMI (5)		35%		
Laser ON	± 1.5 dB		15 dBmV	
Laser OFF	± 1.5 dB		-4 dBmV	
Power, Environmental & Physical				
Total Power Consumption	15 VDC power pack		≤ 5.2 W	
Operating Humidity		5-95%, non-condensing		
Operating Temperature		-40°C to +65°C (-40°F to +149°F)		
Dimensions (H x W x D)		4.1"H x 6.7"W x 1.5"D (10.4H x 17.0W x 3.9D cm)		
Weight		0.3 kg (0.7 lb)		

NOTES:

(1) Other diplex splits available: 42/54 MHz & 65/85 MHz
(2) 3.5% OMI/CH
(3) -1 dBm optical input; 3.5% OMI/CH; 54-550 MHz analog channels & digital compressed channels above 550-1002 MHz at levels 6 dB below equivalent video
(4) NPR at 30 dB. Measured using a receiver with an equivalent input noise (EIN) of <2.5 pA/Hz0.5 with a link budget of 23 dB (20 km fiber + passive loss). NPR test performed with 80 MHz noise loading
(5) SCTE 174 2018 with a single 39 dBmV tone; 35% ± 1 dB

OPTICAL, RF & POWER CONNECTIONS

1. The powering port and all RF ports are standard F-type coaxial connectors. The optical connector is a SC/APC female-type.
2. The LBON500AC can be powered with 12-15 VDC. It is recommended to power the LBON500AC using a 500 mA rated power pack at 12 VDC or 15 VDC output.
3. Connect a coaxial cable from the output of the power pack to the PWR IN port on the LBON500AC.
4. The LBON500AC can also be powered from the RF OUT/PWR IN port by combining RF and power via a power inserter.
5. After connecting the coaxial cable between the power pack output and the LBON500AC, plug the power pack into the wall receptacle.
6. When the LBON500AC powers up, the PWR LED will illuminate.
7. Connect the LBON500AC chassis to physical earth (ground) by using the grounding screw on the LBON500AC.
8. The LBON500AC accepts RFoG DS optical input of 1550 ± 10 nm and optical levels from -6 dBm to +2 dBm. Using an RFoG optical power meter, make sure the optical level on the incoming fiber is within range.
9. Make sure the optical cable is matched for the proper connector (ie. SC/APC to SC/APC). After cleaning all optical connectors, connect the optical fiber to the OPT IN/OUT port on the ONU.
10. If the optical power is within range, the OPT IN LED will illuminate. Once the optical fiber is connected to the ONU, the 1 mW/1 VDC test point (TP) can be used to measure the optical input detected by the forward receiver in the ONU. Use a digital multimeter on DC voltage setting and measure between 1 mW/1V TP and the grounding screw. See table on next page for relation between measured DC voltage on 1 mW/1V TP and optical power received by the RFoG ONU.

OPTICAL, RF & POWER CONNECTIONS CONT'D.

V (DC) on 1 mW/1 VDC Test Point of ONU	Optical Level Hitting the RX (mW)	Optical Level Hitting the RX (dBm)	OPT IN LED
1.58	1.58	2	
1.26	1.26	1	
1.00	1.00	0	
0.79	0.79	-1	
0.63	0.63	-2	ON (1)
0.50	0.50	-3	
0.40	0.40	-4	
0.32	0.32	-5	
0.25	0.25	-6	
0.20	0.20	-7	
0.16	0.16	-8	ON (2)
0.13	0.13	-9	
0.10	0.10	-10	
		< -10	OFF (3)

NOTES:

(1) Optical AGC
(2) No optical AGC
(3) Out of limit

11. The RFoG/PON WDM filter in the LBON500AC has significant rejection between PON and RFoG wavelengths such that they do not interfere with each other's system but can still co-exist on the same fiber. The 1G/10G PON wavelengths (DS 1490 nm/1577 nm and US 1310 nm/1270 nm) will pass through the OPT PON port after filtering. The OPT PON port has ≤ 1 dB insertion loss at PON wavelengths. The PON ONT should be connected to the OPT PON port via a fiber optic cable.
12. The F-port labelled "RF OUT" is the bi-directional RF input and output port for the LBON500AC RFoG ONU.
13. The "TEST -20 dB" port is a bi-directional -20 dB TP that can be used to test RF input and output levels. When not in use, please terminate this -20 dB TP with a 75 ohm terminator.
14. When using the -20 dB TP to measure the RF input/output levels, make sure the RF OUT port is terminated to 75 ohm. Please note the levels from -20 dB TP will be 20 dB lower than the RF OUT port.

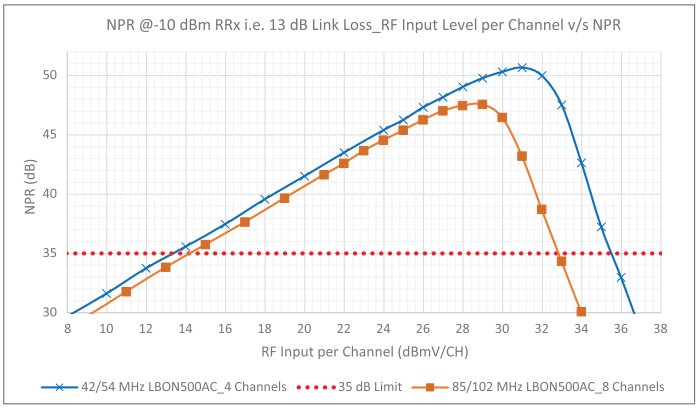
FORWARD & REVERSE SETUP GUIDELINES

1. ***Please note that there are no controls or adjustments on the LBON500AC. Do not open the lid. Opening the lid will void the warranty.***
2. For the forward path setup, make sure that the forward optical input level to the LBON500AC is within range as shown in the table in section OPTICAL, RF & POWER CONNECTIONS above. If the optical input is higher than +2 dBm, receiver overload may occur. If the optical input is < -6 dBm, the LBON500AC loses AGC tracking, RF output will not be as per specification, and the output will drop a further 2 dB with every 1 dB drop in optical input. The LBON500AC delivers optimum performance at -1 dBm optical input level.
3. The specified RF output levels are only guaranteed within optical AGC range and with OMI ≥ 3.5% on the 1550 nm downstream optical signal. To compensate for RF cable losses, there is a 5 ± 1 dB slope on the RF output of LBON500AC from low frequency to high frequency.
4. Connect a signal level meter at the RF OUT port to measure the RF output from the LBON500AC. You can also use the -20 dB TP to measure the RF output.

NOTE: The RF levels mentioned in this manual are analog channel levels, unless specified. For digital channels assume 6 dB less to that of analog channels.

5. Verify the RF output levels from the LBON500AC are as expected.
6. This completes the forward path setup for the LBON500AC RFoG ONU.
7. For the reverse path setup, make sure that the reverse input level to the LBON500AC is not too high or damage to the ONU may occur. The -20 dB TP is a bi-directional test point and can also be used to inject the upstream test carrier. Compensate 20 dB if using the test point to inject the upstream test carrier.
8. The upstream transmitter in the LBON500AC is a burst-mode transmitter and will only be activated if the RF input to the LBON500AC is within the upstream frequency range (5-42 MHz or 5-85 MHz) and is higher than 15 dBmV ± 1 dB. When the transmitter is activated, the OPT OUT LED on the LBON500AC is illuminated.
9. The upstream RF input range for the LBON500AC is 15-35 dBmV per channel (digital channel level) for the 42/54 MHz LBON500AC, and 15-33 dBmV per channel (digital channel level) for the 85/102 MHz LBON500AC. These upstream levels are assumed with the condition that a 42/54 MHz split unit will have 4 equally loaded channels in the upstream band, and the 85/102 MHz split will have 8 equally loaded channels in the upstream band. If using a different number of channels from what is mentioned above, compensate for total RF power. The total RF input level to the LBON500AC (for all channels combined) should not exceed more than 40 dBmV (digital channel level). More than 40 dBmV (digital channel level) total upstream RF input may cause laser clipping and saturation on the LBON500AC. Use the following formula to calculate total RF power: Total RF power = RF power per channel + [10* log (# of channels)].
10. Refer to the NPR plot on the next page to better understand the RF input levels to the LBON500AC.

FORWARD & REVERSE SETUP GUIDELINES CONT'D.



11. For optimum performance in the upstream direction, make sure the LBON500AC is operated with RF input levels to the left side of the NPR peak. Operating at RF input levels to the left side of the NPR peak will provide the best MER/BER performance while assuring the laser saturation and clipping does not occur on the RFoG ONU transmitter.
12. This completes the reverse path setup for the LBON500AC RFoG ONU.
13. If you have any more questions regarding the LBON500AC setup, please contact Lindsay Broadband for support.

COMPLETING THE INSTALLATION

1. Record the input and output levels for the station in both upstream and downstream for reference.
2. Make sure the cables are routed properly and all connections are secured.
3. Ensure the optical fiber cable is not pinched and does not have sharp bends.

TROUBLESHOOTING GUIDELINES

1. No Power on the LBON500AC ONU.
   - **a.** Check the powering coaxial cable and connections for intermittent connections.
   - **b.** Check the output of the power adapter for proper DC voltage (12-15 VDC). It is normal for a linear power pack to have more than 15 VDC output when unloaded. It should not be more than 20 VDC when unloaded. When the LBON500AC is connected to this unloaded power pack, the output voltage will drop within 12-15 VDC specification.
   - **c.** Check with a different 12 VDC or 15 VDC power pack that is at least rated for more than 500 mA.
   - **d.** Try powering via the RF OUT/PWR IN port using a power inserter.
2. Low or no downstream RF output level.
   - **a.** Verify the optical receive level on the LBON500AC is within range (-6 dBm to +2 dBm, 3.5% OMI level and 1540-1565 nm).
   - **b.** Using a fiber inspection scope, check the optical connector and adapter. Make sure the optical connection is clean.
   - **c.** If the optical input is within range, the OPT IN LED will be illuminated. Verify that the OPT IN LED is illuminated. Use a DC voltage meter to measure the 1 mW/ 1V TP on the ONU. Refer to step #10 and table under the OPTICAL, RF & POWER CONNECTIONS section of this manual.
   - **d.** Check for intermittent connections or pinched fibers.
3. Low or no upstream transmit level.
   - **a.** Verify the upstream RF input level is within the LBON500AC upstream frequency range (5-42 MHz or 5-85 MHz) and higher than 15 dBmV ± 1 dB.
   - **b.** Use a CW carrier for injection to keep the transmit laser ON.
   - **c.** Inject either from the RF OUT port or using the bi-directional -20 dB TP. Make sure to compensate 20 dB if using the -20 dB TP to inject carrier.
   - **d.** If the upstream RF input is within RF input range, then the OPT OUT LED will illuminate. Verify the OPT OUT LED is ON.
   - **e.** When the OPT OUT LED is ON, connect an optical power meter to the OPT IN/OUT port. Using the optical power meter at the 1610 nm wavelength, verify the optical output of the LBON500AC directly from OPT IN/OUT port is ≥ 2.7 dBm.
   - **f.** Check for intermittent connections.
4. If the problem is still not solved, replace, and try with another ONU.
5. If the problem still exists, contact Lindsay Broadband for support. Do not open the LBON500AC as it will void the warranty.

ORDERING INFORMATION

		Fwd Output Level		Total Return Input Power		Laser Type		TX Power		Common Connector		PON Connector		TX Wavelength		Sub-Split		Power Adaptor
LBON500AC	-	xx	-	xx	-	D	-	x	-	xx	-	xx	-	xx	-	xx	-	xx
		20 = 20 dBmV		25 = 25 dBmV		D = DFB		2 = 2 mW		SA = SC/APC		SA = SC/APC		61 = 1610 nm		45 = 42/54		00 = None
		36 = 36 dBmV		30 = 30 dBmV				3 = 3 mW		SU = SC/UPC		SU = SC/UPC				68 = 65/85		01 = N. America
																81 = 85/102		02 = Europe

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