Cisco Lumin Dense Platform Optical System

The Cisco® Lumin Optical Transmission Platform represents the world's first deployment of a 1310 nm dense form factor optical transmitter that incorporates hybrid optical-RF linearization technology, changing the price/performance curve for 1310 nm optics. With the Lumin dense platform optical system, you can deliver the latest broadband services to consumers across a powerful, highly scalable and reliable platform that delivers high performance at low costs.

The Lumin platform includes a Lumin Dense Fiber Chassis (DLC) 15-slot 3RU chassis and a Lumin Lite Chassis (DLL) 3-slot 1RU chassis.

The 3RU DLC chassis comes equipped with dual -48 VDC input DC/DC converters. For AC powering, a separate 1RU AC to DC shelf is available that provides complete AC power redundancy and can power multiple 3RU chassis.

Figure 1. Lumin DLC Chassis

The 1RU DLL chassis is equipped with a single standard IEC-C-13 AC input and a primary internal AC power. An optional redundant AC supply is available.

Figure 2. Lumin Lite DLL Chassis

The Cisco Lumin Optical Transmission Platform delivers 1310 nm optical linearization technology (similar to technology used in a 1550 nm transport) in a robust, low-priced 1310 nm platform.

The Lumin platform's DLT optically conditioned 1310 nm laser transmitters enable:

- Ultra-wide band optical distortion correction not limited by the effective bandwidth of RF pre-distortion.
- Use of digital DFB lasers for analog transmission – Reduces the industry's critical dependence on pricey, sorted, high-performance analog DFB diodes.
- Composite second order (CSO) control over life of the product via active feedback – Stabilizes CSO over life, not subject to the aging drift of pre-distorter-to-laser matching that exists in current RF pre-distortion technology.

Both chassis support:

- Ethernet* and serial ports for configuration and status monitoring
- LCD display and keypad for front panel configuration and control
- Local Control and Monitoring provided via the GUI based Lumin Utility
- Remote status monitoring is supported via ROSA® EM or SNMPv2 based Network Management System
- Redundant powering options
- Blind-mate, hot swappable module insertion
- Fiber routing for passing optical fiber to rear of chassis
- EIA standard 19-inch rack mounting
- Front panel LEDs to indicate status of fans, modules, and power

**Standard on 3RU, Optional on 1RU*

Lumin DLT 1310 nm Optical Transmitter Module

The Lumin DLT Optical Transmitter is an exceptionally cost-effective high-performance 1 GHz 1310 nm optical transmitter. The DLT module is designed for HFC forward path, high-density platform deployments where cost considerations are critical. The module enables economical fully segmented optical nodes (1:1 transmitter-to-node ratio) thereby providing increased targeted services bandwidth per subscriber. Measuring only 1 x 3.25 x 13 inches (25.4 x 82.55 x 330.2 mm), the compact design allows high-density deployment of up to 15 transmitter modules in the 3RU Lumin DLC Chassis.

Primary Features

- High density with up to 15 modules per chassis
- Low power consumption
- Maintains stability over temperature and time
- Increased CSO suppression at high frequency improves digital performance to 1 GHz
- 1310 nm DFB laser diode
- Active performance monitoring
- Separate RF input for narrowcasting
- Hot-swappable design
- Front panel status indicator
- Advanced on-board microprocessor control
- Manual or automatic gain controlled (MGC/AGC) modes

Figure 3. Lumin DLT 1310 nm Optical Transmitter Module

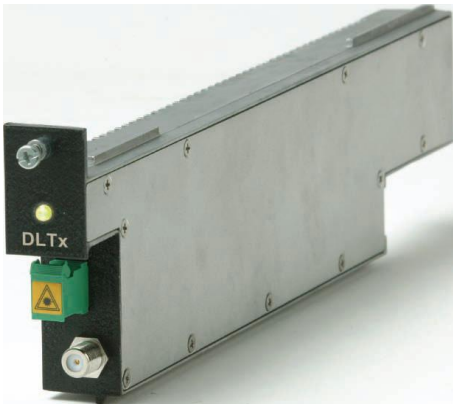

Table 1. Lumin DLT Optical Transmitter Specifications

Specification	Value	Comments
Optical		
Wavelength	1310 ±20 nm	
Output Power	4, 6, 8, 9, 10, 11, 12, 13 dBm	
Output Connector Type	SC/APC	
Electrical		
RF Bandwidth	46-1002 MHz	
Number of inputs	1 female F-type connector (broadcast) 1 female F-type connector (narrowcast)	
RF Input		
• Broadcast (BC) RF Input NTSC Required RF Input Level per NTSC Channel - 78 NTSC Channels with 450 MHz QAM (550-1002 MHz) @ -6 dB	15 dBmV	
• Narrowcast (NC) RF Input Required RF Input Level per QAM Channel - for QAM @ -6 dB relative to BC NTSC Channels	29 dBmV	
• Broadcast (BC) RF Input PAL Required RF Input Level per Channel 59 PAL D/K	18 dBmV	
• Narrowcast (NC) RF Input Required RF Input Level per QAM Channel - for QAM @ -6 dB relative to BC PAL Channel	32 dBmV	
RF Input Test Point	-20 dB	
Frequency Response 46 MHz – 1002 MHz	±0.75 dB	
RF Input Return Loss	16 dB	
Power Consumption	10.5 W DC	Note 1
Power Supply Requirements	+24 (±5) VDC	
Environmental		
Operating Temperature Range	32 to 122°F (0 to 50°C)	
Storage Temperature Range	-40 to 158°F (-40 to 70°C)	
Operating Humidity	5% to 95%, non-condensing	
Mechanical		
Dimensions (W x H x D)	1.0 x 3.25 x 13.0 in. (25.4 x 82.55 x 330.2 mm)	
Weight	1.5 lb (0.68 kg)	

Note: Power consumption spec is valid for units up to +6 dBm optical output power with higher power unit consuming slightly more.

Table 2. Lumin DLT 1310 nm Optical Transmitter - Link Carrier-to-Noise Performance

Carrier-to-Noise		78 CW NTSC with 75 QAM_{256} (550-1002 MHz) 64 CW PAL B/G or 59 CW PAL D/K with 33 QAM_{256} (600-870 MHz)									
		Total Optical Link Loss (dB)[1]									
Model #	Output Power (dBm)	3	4	5	6	7	8	9	10	11	12
DLT-4	4	52.5	51.5	50.5	49.5						
DLT-6	6			52.5	51.5	50.5	49.5				
DLT-8	8					52.5	51.5	50.5	49.5		
DLT-9	9						52.5	51.5	50.5	49.5	
DLT-10	10							52.5	51.5	50.5	49.5
DLT-11-HP	11							52.5	51.5	50.5	49.5
DLT-12-HP	12							52.5	51.5	50.5	49.5
DLT-13-HP	13							52.5	51.5	50.5	49.5

Table 3. Lumin DLT 1310 nm Optical Transmitter - Link Distortion Performance

Distortion Performance	78 CW NTSC with 75 QAM_{256} (550-1002 MHz) 64 CW PAL B/G or 59 CW PAL D/K
CTB	70
CSO	65

Table 4. Lumin DLT 1310 nm PAL Optical Transmitter - Link Carrier-to-Noise Performance

Carrier-to-Noise		59 PAL D/K, 64 CW PAL B/G[2]											
		Total Optical Link Loss (dB)[3]											
Model #	Output Power (dBm)	3	4	5	6	7	8	9	10	11	12	13	14
DLT-4	4	54	53	52	51								
DLT-6	6			54	53	52	51						
DLT-8	8					54	53	52	51				
DLT-9	9						54	53	52	51			
DLT-10-PAL	10							54	53	52	51		
DLT-11-PAL	11								54	53	52	51	
DLT-12-PAL	12									54	53	52	51

Table 5. Lumin DLT 1310 nm PAL Optical Transmitter - Link Distortion Performance

Distortion Performance	59 PAL D/K, 64 CW PAL B/G [2]
CTB	67
CSO	62

Notes:

1. Total optical link loss allows for 20 km fiber plus 3.5 dB for passive loss with balance of all fiber loss.
2. For QAM loading through 870 MHz subtract 0.5 dB from listed CNR.
3. Total optical link loss allows for 10 km fiber plus balance passive loss, for all fiber except 3.5 dB passive loss subtract 1 dB.

Lumin DDR Optical Receiver Module

The Lumin DDR Dual-Path Optical Receiver is designed to meet CATV deployments that require high return-path receiver density. The DDR module is designed to accommodate both analog and digital formats. The receiver module has manual gain control and is designed for deployment with DLT transmitter modules in the Lumin DLC multi-module chassis accommodating up to 15 modules. The receiver module is hot-swappable allowing maximum service up-time.

Primary Features

- High density with up to 15 modules per chassis
- Two return-path receivers in a single module
- Low electronic noise and low distortion
- 1290-1620 nm wavelength operation
- Hot-swappable design
- Advanced on-board microprocessor control
- Low power consumption
- 200 MHz capable

Figure 4. Lumin DDR Optical Receiver Module

Table 6. Lumin DDR Dense Dual-Path Optical Receiver

Specification	Value	Comments
Optical		
Wavelength	1290 / 1620 nm	
Optical Input Range	-16 to 0 dBm	
Optical Input Connectors	SC/APC (2)	
Electrical		
Bandwidth	5 – 200 MHz	
RF Output Level	Use RF output level calculations	(next page)
RF Output Level – Maximum	60 dBmV (composite)	Note 1
Manual Gain Control (MGC) Range	32 dB	Note 3
Module Responsivity	300 A/W (49.5 dB)	Note 2
RF Frequency Response	±0.5 dB	
RF Output Test Point	-20 dB	
Return Loss	16 dB	
Number of RF outputs	2 (one per optical input)	
DC Power consumption	10 W DC	
Environmental		
Operating Temperature Range	32 to 122°F (0 to 50°C)	
Storage Temperature Range	-40 to 158°F (-40 to 70°C)	
Operating Humidity	5% to 95%, non-condensing	
Mechanical		
Dimensions (W x H x D)	1.0 x 3.25 x 13.0 in. (25.4 x 82.55 x 330.2 mm)	
Weight	1.1 lb (0.5 kg)	

Notes:

1. Reverse receiver (Rx) maximum output level is determined using 5 to 42 MHz noise loading, while ensuring that the noise power ratio (NPR) dynamic range for the link is not limited by the Rx. Rx RF attenuation may be needed to prevent the maximum output level from being exceeded during operation (see “Reverse Receiver RF Output Level Calculations” on next page).
2. Module responsivity measured at 1310 nm with 0 dB RF attenuation.
3. Manual gain control via Lumin chassis front panel keypad.

Reverse Receiver RF Output Level Calculations

Use this procedure to determine receiver (Rx) RF output level for design purposes.

1. **Calculate 'full link gain'** (see table below for formula).
2. **Calculate 'useable link gain'** as follows:
    a) Add the 'full link gain' to the reverse transmitter's maximum expected composite RF input (drive) level to determine the maximum expected Rx composite RF output level.
    b) Determine if the maximum expected reverse Rx composite RF output level exceeds the maximum RF output level specification (see previous page).

    If the maximum is exceeded, calculate the amount of Rx RF attenuation (level reduction in dB) required to prevent such occurrence. Then calculate the 'useable link gain' (see table below for formula).

    If the maximum is not exceeded, the 'full link gain' is equal to the 'useable link gain' (no Rx attenuation required).
3. **Calculate Receiver RF output level** (see table below for formula).

Note: Many systems design for a common Rx RF output level, which is calculated first for the link(s) with the greatest optical loss. For links with lower optical loss, Rx RF attenuation is then added (2 dB for each dB lower optical link loss) in order to achieve the common Rx RF output level.

Receiver Used	Formula for:		
	Full Link Gain [1] (dB)	Useable Link Gain (dB)	RX RF output level [2] (dBmV)
Lumin DDR Reverse Rx	84 – mpeak + (2 x Pin)	Full link gain – Rx RF attenuation	TX 'design' RF input level + Useable link gain

Notes:

1. In the full link gain formula, mpeak is the reverse transmitter single CW carrier RF input drive level in dBmV that produces 100% peak OMI, and Pin is the reverse receiver optical input power in dBm. Resultant full link gain is the gain of the link in dB from reverse transmitter RF input to reverse receiver RF output, with receiver output attenuation set to minimum (0 dB).
2. This formula yields the RF output level that can be used for reverse RF design in the headend or hub site where the receiver is located.

Unless otherwise noted, specifications reflect typical performance and are referenced to the ambient air temperature at the inlet to the Lumin chassis. Specifications are based upon measurements made in accordance with SCTE/ANSI standards (where applicable), using standard frequency assignments.

Lumin DLC Optical Distribution Chassis and Communications Subsystem

The Lumin DLC chassis is a compact, cost-efficient, rack-mounted optical distribution chassis and communications subsystem designed for HFC high-density platform deployments where headend or hub space is limited. The 3RU chassis accommodates a combination of up to 15 hot-swappable transmitter and/or receiver modules, resulting in one of the highest density chassis on the market today. The chassis contains an internal channel for fiber routing to the back of the rack for flexibility in installation. High-volume, ultra-efficient fans are contained in an upper tray. This tray also houses the subsystem microprocessor active monitoring services, thereby saving valuable chassis-slot space. An integrated LCD panel displays all functions and settings enabled through a front-panel control keypad. The chassis accepts dual -48 VDC inputs and features dual (redundant) DC power supplies. For AC powering, a separate 1RU power shelf is available for providing -48 VDC. This power shelf also provides redundant powering options for maximum reliability.

Figure 5. Lumin DLC Chassis

Lumin DLC Chassis Features

- Standard 19-inch, 3RU rack-mountable
- High-density, low-cost design
- High-volume, high-efficiency, fan-cooled system tray
- Microprocessor controlled subsystem service monitoring
- F-connector output
- RJ-45 and RS-232 compatible
- Remote monitoring interface
- Ethernet port for remote status monitoring
- Communication module built into fan tray
- Integrated LCD panel and control function keypad
- Blind mate (push on), DC and communications connectors
- Internal power supply has power factor correction and harmonic attenuation
- Over temperature auto-shutdown and restart circuitry
- Internal surge and short-term power dropout protection density with up to 15 modules per chassis

Table 7. Lumin DLC Chassis Specifications

Parameter	Unit/Measure	Minimum	Typical	Maximum
DC Power Requirements	VDC	-42	-48	-60
Power Consumption (fully loaded)	W			280
Operating Temperature Range (at Full Specification)	°F/°C		32 to 122 (0 to 50)	
Storage Temperature	°F/°C		-40 to 158 (-40 to +70)	
Humidity Range (Non-Condensing)	%		5 - 95	
Dimensions (3RU)	in./mm		19 x 5.25 x 13 (482.6 x 133.4 x 330.2)	
Weight	lb/kg		20 (9.1)	

Lumin DLL Chassis Features

- 19-inch rack mount in 1RU with slots for up to 3 modules
- Front panel LEDs to indicate status for fan, slots, power supply
- Front panel EIA-232 craft port on DB-9 connector is standard
- Optional Ethernet RJ-45 port for SNMP and local utility
- Holds one power supply (with option for second power supply)
- Cable tunnel to manage fiber routing from rear to front
- AC power input
- Integrated LCD panel and functional keypad with 4 buttons

Figure 6. Lumin DLL Chassis

Table 8. Lumin DLL Chassis Specifications

Parameter	Value
AC Power Requirements	90-264 VAC
Power Consumption, with three modules	40 W
Operating Temperature Range (at Full Specification)	32 to 122°F (0 to 50°C)
Storage Temperature	-40 to 158°F (-40 to 70°C)
Humidity Range (Non-Condensing)	0 to 95%
Dimensions (H x W x D)	1.66 x 16.94 x 12.04 in. (42.16 x 430.2 x 305.86 mm)
Weight, without modules	10.69 lb (4.85 kg)

Table 9. Lumin Transmitter and Receiver Ordering Information

Lumin Optical Transmitters	Qty Req'd	Part Number	Notes
DLT-4, 4 dBm	Per design	4038969	
DLT-6, 6 dBm	Per design	4038970	
DLT-8, 8 dBm	Per design	4038971	
DLT-9, 9 dBm	Per design	4038972	
DLT-10, 10 dBm	Per design	4038973	
Lumin Optical Transmitters - PAL	**Qty Req'd**	**Part Number**	**Notes**
DLT-10-PAL, 10 dBm	Per design	4030633	
DLT-11-PAL, 11 dBm	Per design	4030634	
DLT-12-PAL, 12 dBm	Per design	4030635	
Lumin Optical Transmitters – High Power	**Qty Req'd**	**Part Number**	**Notes**
DLTX-11-HP	Per design	4026654	
DLTX-12-HP	Per design	4035287	
DLTX-13-HP	Per design	4035288	
Lumin Optical Receivers		**Part Number**	
DDR, Dense Dual-Path Receiver	Per design	4026656	

Table 10. Lumin DLC Ordering Information

Lumin DLC Chassis	Typical BOM Qty's per chassis	Part Number	Notes
DLC, 3RU DLC Chassis	1	4026658	(See note 1)
DLC-Blank, Blank module required to fill chassis slots	-	4023578	As req'd to fill all empty slots in chassis - 15 slots total.
Shelf, 1RU power supply, AC to -48 VDC	1	4027071	1 shelf can power up to 2 chassis - shelf is empty, power supplies sold separately.
Power supply, -48 VDC out, 450 W (for P/N 4026658)	2	4027072	Order 2 for full AC redundancy (can power up to 2 chassis).
Power supply, DC/DC converter, Lumin DLC	0	4027073	2 Included with chassis - only order if spares req'd.
Cable, DC Power to Ring Term, 1 ft. Lumin	0	4027865	Choose desired length. Order 2 fused cables per chassis (4 ft. recommended). When using existing facility -48VDC supply, use 3m DC cables. 4011730, 2 ea. (See note 2)
Cable, DC Power to Ring Term, 2 ft. Lumin	0	4027866	
Cable, DC Power to Ring Term, 4 ft. Lumin	2	4027867	
AC Power Cord, NA, 3-conductor, 15 A, 125 VAC	2	1009376	Other power cords available. Contact Applications Engineering for details.
AC Power Cord, China, 3-conductor, 10 A, 250 VAC	2	745415	Other power cords available. Contact Applications Engineering for details.
AC Power Cord, Korea, 3-conductor, 7 A, 250 VAC	2	1002366	Other power cords available. Contact Applications Engineering for details.
Alarm Signaling Cable	1	4028096	Order 1 per AC power shelf 4027071.

Notes:

1. The Lumin DLC Chassis (4026658) is factory configured with 2 DC/DC converters and a fan tray installed. All module blanks, cables, and external powering must be ordered separately.
2. Power Redundancy: DC/DC converters have independent inputs on the 3RU chassis, so 2 DC power cables are required for full DC redundancy. For AC redundancy, use two AC/-48 power supply rectifiers (4027072). In the 1RU AC shelf the rectifier -48 outputs share a common bus bar (terminal studs provided at left and right rear of shelf, but same bus). If AC redundancy is not required (not recommended), a single rectifier will still power both converters as long as 2 power cables are attached.

Table 11. Lumin DLL Ordering Information

Description	Part Number
Lumin Chassis	
Lumin 1RU DLL Chassis, single power supply, without Ethernet port	4030012
Lumin 1RU DLL Chassis, single power supply, with Ethernet port	4033114
Lumin 1RU DLL Chassis, dual power supplies, without Ethernet port	4032833
Lumin 1RU DLL Chassis, dual power supplies, with Ethernet port	4032832
Blank Front and Rear Cover	4030423
AC Power Cords	
US	3989838
UK	3989836
Japan	3993133
Italy	3993130
Europe	3989835
China	735415
Australia	1000897
Argentina	207340

Service and Support

Using the Cisco Lifecycle Services approach, Cisco and its partners provide a broad portfolio of end-to-end services and support that can help increase your network's business value and return on investment. This approach defines the minimum set of activities needed by technology and by network complexity to help you successfully deploy and operate Cisco technologies and optimize their performance throughout the lifecycle of your network.

For More Information

To learn more about the Cisco Lumin Dense Platform Optical System, contact your local account representative.

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Part Number 7013430 Rev C
May 2011