3998 Series 1550 nm Externally-Modulated Transmitter

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Applications

- High-Performance Supertrunking Links
- High Power Distribution Networks
- Redundant Ring Architectures
- FTTx Networks
- RFoG Applications
- SAT-IF Transport
- DWDM Node Splitting

Features

- Single or Dual Optical Outputs
- QAM Loading to 1003 MHz
- Dual Power Supplies and Fans, Redundant & Hot Swapplable
- Front Panel RF Test Point
- SNMP Control Interface
- WEB GUI
- Vacuum Fluorescent Status Display
- OMI / RF Gain Adjustment
- AGC Select: CW, Video, Manual (No AGC)
- Industry Leading Field Adjustable SBS Suppression
- Field Adjustable Electronic Dispersion Compensation (EDC)

The L-Type/D-Type/S-Type/F-Type/N-Type 3998 Series

The 3998 series is a family of state-of-the-art high-performance 1550 nm externally-modulated CATV fiber optic transmitters optimized for varying network applications. Packaged in convenient 1 RU housing, this line of optical transmitters couples high optical output powers, up to 11.0 dBm, with low optical linewidth resulting in unmatched performance. The optical modulator, combined with proprietary predistortion circuitry, provides superior CTB and CSO performance with SBS suppression levels of greater than 21 dBm. Advanced features such as built-in field adjustable SBS control and electronic dispersion compensation allow these transmitters to be quickly optimized in the field for any link or application without the need to procure specifically tuned transmitters. This affords the system designer a level of flexibility previously unknown in the CATV market place.

The L-Type series are designed as a high-performance solution for applications where the simultaneous transport of CATV and SAT-IF FM signals is required. The SAT-IF signals can be applied anywhere in the 950 to 2800 MHz band.

The D-Type series are designed as a low cost, high-performance solution for applications where the required fiber length is in the range of 20 to 50 kilometers. Advanced, high power, DFB laser technology allows these transmitters to be fielded without the use of EDFAs.

The S-Type series transmitters are designed to be the most versatile model within the 3998 series family. They can easily be configured to meet most HFC network solutions requiring link lengths in the range of 50 to 70 kilometers with one EDFA as well as links utilizing multiple EDFA's.

The F-Type series transmitters are intended for use in FTTx and RFoG architecture designs requiring high-quality transmission over varying transmission lengths and EDFA output powers. These transmitters successfully support very high optical launch powers while controlling the detrimental effects of Stimulated Brillouin Scattering (SBS), group velocity dispersion (GVD), and self phase modulation (SPM).

The N-Type series transmitters are intended for use in node-splitting architecture designs requiring cost effective DWDM transmission over medium length fiber distances.

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Optical / Electrical Characteristics

L-Type

Property	Units	Models				Comments
Performance (note 1-8)		3998-L01	3998-L02	3998-L03	3998-L04	
Specified Link Length	L (km)	25	25	25	25	
Channel Plan		NTSC 80-Ch	PAL 60-Ch	NTSC 110-ch	PAL 89-Ch	With 36 QPSK carriers from 950 to 2800 MHz
Optical Output Power	Po (dBm)	8.5/8.5	8.5/8.5	8.5/8.5	8.5/8.5	Min. 10 dBm version avail. See Chart
Noise Bandwidth	BW (MHz)	4	5	4	5	
SBS Suppression	(dBm)	15.0	15.0	15.0	15.0	Min.
CATV Carrier to Noise Ratio	CNR (dB)	51.0	51.0	49.5	49.5	Min.
CATV Composite Second Order	CSO (dBc)	-65	-65	-65	-65	Max. Port 1
CATV Composite Triple Beat	CTB (dBc)	-65	-65	-65	-65	Max. @ +25°C
CATV Composite Triple Beat	CTB (dBc)	-64	-64	-64	-64	Max. @ 0°C to 50°C
SAT-IF Carrier to Noise Ratio	CNR (dB)	27	27	27	27	Min.
SAT-IF Intermodulation Products	(dBc)	-35	-35	-35	-35	Max. Port 1
SAT-IF Spurious Products	(dBc)	-38	-38	-38	-38	Max.

D-Type

Property	Units	Models				Comments
Performance (note 1-7)		3998-D01	3998-D02	3998-D03	3998-D04	
Specified Link Length	L (km)	40	40	40	40	
Channel Plan		NTSC 80-Ch	PAL 60-Ch	NTSC 110-ch	PAL 89-Ch	
Optical Output Power	Po (dBm)	11.0	11.0	11.0	11.0	Min.
Noise Bandwidth	BW (MHz)	4	5	4	5	
SBS Suppression	(dBm)	> 12.0	>12.0	>12.0	>12.0	Min.
Carrier to Noise Ratio	CNR (dB)	54.0	54.0	51.0	51.0	Min.
Composite Second Order	CSO (dBc)	-65	-65	-65	-65	Max.
Composite Triple Beat	CTB (dBc)	-65	-65	-65	-65	Max. @ +25°C
Composite Triple Beat	CTB (dBc)	-64	-64	-64	-64	Max. @ 0°C to 50°C

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S-Type

Property	Units	Models					Comments
Performance (Note 1-7)		3998-SA1	3998-SA2	3998-SA3	3998-SA4	3998-SA5	
Specified Link Length	L (km)	65	65	65	65	65	
Channel Plan		NTSC 80	PAL 60	NTSC 110	PAL 89	42 CENELEC	
Optical Output Power	Po (dBm)	7.0/ 7.0	7.0/ 7.0	7.0/ 7.0	7.0/ 7.0	7.0/ 7.0	Min. - Higher Powers Available See Chart
Noise Bandwidth	BW (MHz)	4	5	4	5	5	
SBS Suppression	(dBm)	16.0	16.0	16.0	16.0	16.0	Min.
Carrier to Noise Ratio	CNR (dB)	53.0/ 53.0	53.0/ 53.0	50.0/ 50.0	50.0/ 50.0	53.0/ 53.0	Min.
Composite Second Order	CSO (dBc)	-65/ -65	-65/ -65	-65/ -65	-65/ -65	-65/ -65	Max.
Composite Triple Beat	CTB (dBc)	-65	-65	-65	-65	-65	Max. @ +25°C
Composite Triple Beat	CTB (dBc)	-64	-64	-64	-64	-64	Max. @ 0°C to 50°C

F-Type

Property	Units	Models				Comments
Performance (Note 1-7)		3998-F01	3998-F02	3998-F03	3998-F04	
Specified Link Length	L (km)	20	20	20	20	
Channel Plan		NTSC 80-Ch	PAL 60-Ch	NTSC 110-ch	PAL 89-Ch	
Optical Output Power	Po (dBm)	7.0/ 7.0	7.0/ 7.0	7.0/ 7.0	7.0/ 7.0	Min.
Noise Bandwidth	BW (MHz)	4	5	4	5	
SBS Suppression	(dBm)	21.0	21.0	21.0	21.0	Min.
Carrier to Noise Ratio	CNR (dB)	48.0	48.0	45.0	45.0	Min.
Composite Second Order	CSO (dBc)	-58	-58	-58	-58	Max.
Composite Triple Beat	CTB (dBc)	-58	-58	-58	-58	Max.

N-Type

Property	Units	Models		Comments
Performance (Note 1-7)		3998-N01	3998-N02	
Specified Link Length	L (km)	40	40	
Channel Plan		NTSC 80-Ch	PAL 60-Ch	
Optical Output Power	Po (dBm)	9.5	9.5	Min.
Noise Bandwidth	BW (MHz)	4	5	
SBS Suppression	(dBm)	13.0	13.0	Min.
Carrier to Noise Ratio	CNR (dB)	52.0	52.0	Min.
Composite Second Order	CSO (dBc)	-62	-62	Max.
Composite Triple Beat	CTB (dBc)	-62	-62	Max. @ +25°C
Composite Triple Beat	CTB (dBc)	-61	-61	Max. @ 0°C to 50°C

Notes:

1. Unless stated otherwise all specifications apply over full temperature range with no digital loading.
2. Unless stated otherwise specifications apply for nominal RF input level as defined below, after a 30 minute stabilization period.
3. Specifications separated by a slash are port1 / port 2.
4. Units are tested per the Test / Link Configuration Table
5. Noise figure for the EDFA = 4.5 ~ 5.5 dB
6. Corning SMF-28 single mode fiber
7. Receiver responsivity is 0.95 mA/mW, Equivalent noise current is 7 pA/(Hz)1/2General and Mechanical Specifications
8. With 36 QPSK modulated SAT-IF signals between 950 --- 2800 MHz, 27 MHz IF bandwidth.

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General and Mechanical Specifications

Property	Requirement	Comments
Wavelength	1555 +/-5 nm	Various Options + ITU-grid available – see Model Number Information
Channel Plan	Various – See Specification Tables	Custom channel plans available
Optical Connector	SC/APC	Other styles available
Monitoring Interfaces	100 Base-T Ethernet (SNMP) Rear Panel RS-232 interface VFD Screen Front Panel Controls	VFD- (Vacuum Fluorescent Display)
Operating Temperature	0°C to 50°C	
Storage Temperature	-20°C to 70°C	
Power Consumption	65W max	
Agency Listings	**EMI**: EN50083-2:2006 (US CATV) EN55022:2006 (US IT) EN61000-3-2 (Harmonics) EN61000-3-3 (Flicker) FCC: Part 15, Subpart B, class “A” Unintentional Radiators ICES-003 (Canada) AN/NZS 3548, Class A (Australia) VCCI, Class A (Japan)	**Safety**: FDA/CDRH Laser Safety Governed by Code of Federal Regulations Title 21, Volume 8, Part 1040 IEC 60950-1 IEC 60728-11 Laser IEC 60825-1 CB Certification
Transportation Vibration	GR-2853-CORE	In Shipping package
Transportation Shock	GR-2853-CORE	In Shipping package
Operating Humidity	20% to 85%	Non-condensing
Supply Range (VAC) (VDC)	90 to 265 VAC, 50/60 Hz +/- (36 – 72) VDC	
Dimensions	19.0”W x 15.0”D x 1.72”H	(width includes 19” front panel ears, depth includes, connectors, fans & front panel) – see drawing
Input Power Range	17 +/-1 dBmV/ch 80 NTSC channels	Manual mode
	15 +/-1 dBmV/ch 110 NTSC channels	Manual mode
	18 +/-1 dBmV/ch 60 PAL channels	Manual mode
	20 +/-1 dBmV/ch 42 CENELEC channels	Manual mode
	16 +/-1 dBmV/ch 89 PAL channels	Manual mode
	27 +/-1 dBmV/ch SAT-IF channels	Manual mode
Input Power Range	19 +/-2 dBmV/ch 80 NTSC channels	CW mode
	17 +/-2 dBmV/ch 110 NTSC channels	CW mode
	20 +/-2 dBmV/ch 60 PAL channels	CW mode
	18 +/-2 dBmV/ch 89 PAL channels	CW mode
	22 +/-2 dBmV/ch 42 CENELEC channels	CW mode
	29 +/-2 dBmV/ch SAT-IF channels	AGC mode

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General and Mechanical Specifications (continued)

Property	Requirement	Comments
Front Panel RF Gain / OMI Adjustment Range	+2 / -4 dB from nominal setting	CATV Performance can vary slightly
CATV Frequency Range	45 MHz – 1003 MHz	
CATV Flatness	+/- 0.50 dB	45 MHz – 550 MHz
	+/- 0.75 dB	45 MHz – 1003 MHz
CATV Flatness – N-Type	+/- 0.75 dB	45 MHz – 1003 MHz N-Type
CATV Input impedance	75 Ω	
CATV Input Return Loss	16 dB min	45 MHz – 1003 MHz
CATV Front Panel RF Tap	-20 +/- 1 dB down from RF input	
CATV Front Panel RF Tap Flatness	+/- 1 dB	45 MHz – 1003 MHz
SAT-IF Frequency Range	950 MHz – 2800 MHz	
SAT-IF Flatness	+/- 2 dB	
SAT-IF Input impedance	75 Ω	
SAT-IF Input Return Loss	10 dB min	950 MHz – 2800 MHz
SAT-IF Front Panel RF Tap	7 +/- 2.5 dBmV/Ch at 1% OMI/ch	
SAT-IF Front Panel RF Tap Flatness	+/- 1 dB	950 MHz – 2800 MHz

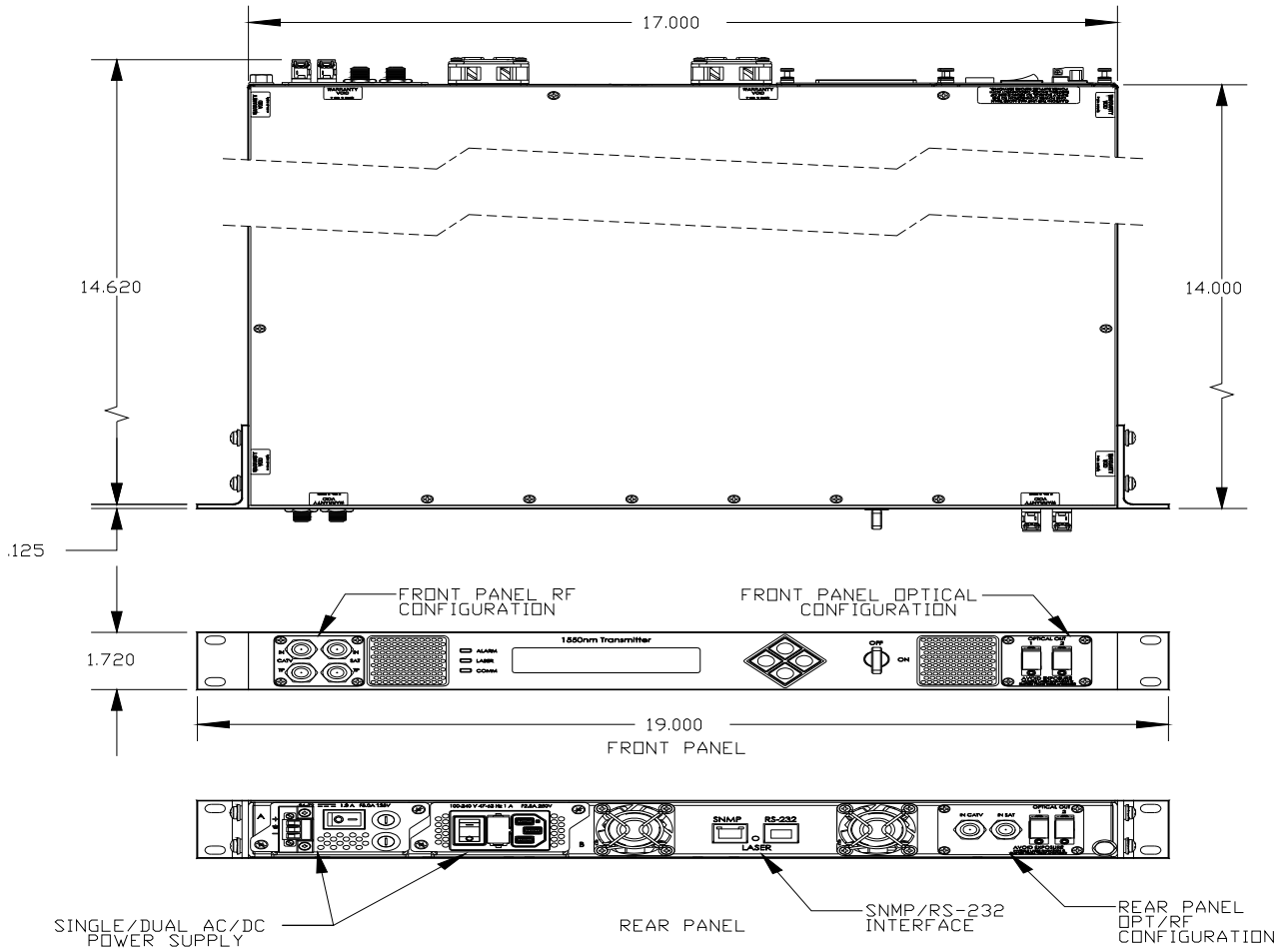
Test/Link Configuration

Property	EDFA	Link[1]	Received Power[2]
L-Type	15 dBm	25 Km	0.0 dBm at the receiver
D-Type	None	40 Km	0.0 dBm at the receiver
S-Type	16 dBm	65 Km	0.0 dBm at the receiver
F-Type	21 dBm	20 Km	-5.5 dBm at the receiver
N-Type	13 dBm	40 Km	0.0 dBm at the receiver

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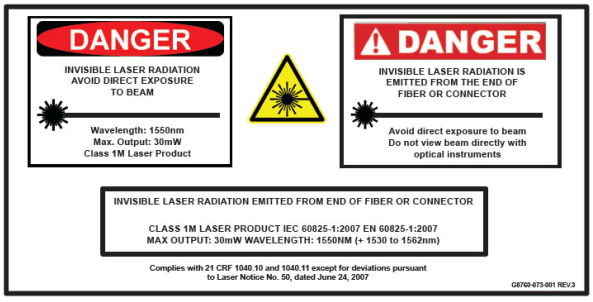
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Outline Drawing (Dimensions in inches)



Laser Safety Information

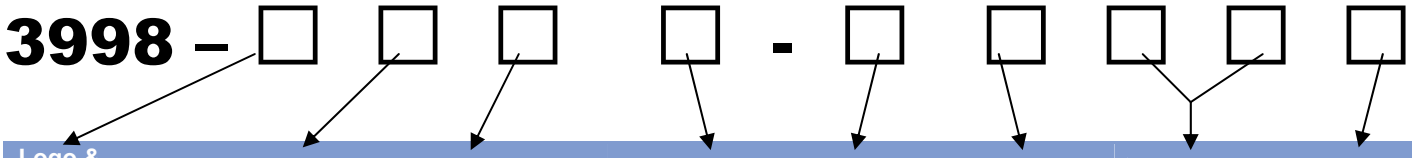
This product meets the applicable requirements of 21 CFR 1010 & 1040 and is classified as a class 1M laser product. During use as intended, the laser energy is fully contained within the fiber network such that there is no accessible laser radiation. This product has been issued accession number 0820466-001.



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Model Number Information (note 3)



Logo & Customer Specific	Link type	Pout (dBm min) Note 1	Loading Type	Optics	RF	Wavelength (nm)	Power Supply
0 – EMCORE Logo	**D** – 40 km	**0** – for D and F-Types	**1** – NTSC (80-ch)	**1** – SC/APC, Rear	**1** – RF IN Rear, TP Front	**00** –1555+/- 5.0nm	**1** – AC primary, no secondary
1 – no Logo	**S** – 65 km	**A** – 7.0/7.0 for S-Type	**2** – PAL (60-ch)	**2** – FC/APC, Rear	**2** – RF IN Front, TP Front	**01** – 1550+/- 5.0nm	**2** – DC primary, no secondary
		B – 8.0/8.0 for S-Type	**3** – NTSC (110-ch)	**3** – E2000/APC, Rear	**3** – RF IN Front, TP Rear	**xx** – ITU Channel +/- 0.1nm Note 2	**3** – AC primary, AC secondary
	F – FTTx SBS 20 dBm	**C** – 10.0 for S-Type	**4** – PAL (89-ch)	**4** – SC/APC, Front	**4** – RF IN Rear, TP Rear		**4** – AC primary, DC secondary
	L – 25 km	D- 10/10 for S & L-Type Note4	**5** – Not Used	**5** – FC/APC, Front			**5** – DC primary, DC secondary
	N – 40 km	**E** – 8.5/8.5 for L-Type	**6** – CENELEC (42-ch) Note 5	**6** -E2000/APC, Front			

Note 1: Options available for Indicated Types only.
Note 2: ITU grid wavelengths can be specified from channel 18 to 40.
Note 3: Not all configurations are available, contact factory.
Note 4: Available for S and L Links. CSO port 2 degraded by 1dB for Channel Loads 1 and 2, CSO port 2 degraded by 2dB for Channel Loads 3 and 4.
Note 5: Contact Factory for Model type availability.

Additional Kits

G3708-006-001 – Replaceable AC power supply modules
G3708-005-001 – Replaceable DC power supply modules
G7914-076-001 – Replaceable Blank power module plate
G3906-008-001 – Replaceable fans

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