



### Features

- ☑ Data Rate Applications from 125Mb/s to 3.0Gb/s
- ☑ Compliant with SONET/SDH OC-48/STM-16 Specifications
- ☑ Short Reach and Intermediate Reach
- ☑ Eye Safe (Class I Laser Safety)
- ☑ Multi-sourced 2x10 Package Style
- ☑ Duplex LC Optical Interface
- ☑ Differential Bias Monitor Voltage & Back Facet Monitor Voltage Outputs
- ☑ Receiver Power Monitor Output
- ☑ AC Coupling or DC Coupling Option to LV-PECL DATA Compatible Interface
- ☑ LV-TTL SIGNAL DETECT Output
- ☑ Single +3.3V Power Supply

### Description

The DTR-2488-SM2-LC/LS-W-G-MR SFF series of multi-rate fiber optic transceivers provide a quick and reliable interface for SONET/SDH OC-48/STM-16 short reach and intermediate reach applications. The transceivers are designed to operate from Fast Ethernet data rate (125Mb/s) to SONET/SDH OC-48/STM-16 (2.488Gb/s). They are compliant with OC-48/STM-16 SONET/SDH specifications. The short reach (SR-1) version uses a 1310nm Fabry Perot laser while the intermediate reach (IR-1) version uses a 1310nm DFB laser to achieve reaches of 2km and 15km, respectively. For intermediate reach (IR-2) version, a 1550nm DFB laser is used to obtain the reach of 15km. All modules satisfy Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-60825 standards.

The transmit and receive functions are contained in a narrow width two-row, 20-pin (2x10) package with a duplex LC optical

interface. The receptacle fits into an RJ-45 form factor outline. The 20-pin configuration is in conformance to the SFF MSA.

The transmitter design incorporates all the necessary control and driver circuitry for converting differential data to light. The receiver uses an InGaAs/InP PIN photodiode to convert the light signal into an electrical current which is amplified and regenerated into differential data outputs. AC-coupled transmit and receive DATA interface is recommended for compatibility with LV-PECL signal levels. An option for DC-coupled interface is also available. LV-TTL SIGNAL DETECT function which indicates loss of optical input is also provided.

The transceivers operate from a single +3.3V power supply over an operating case temperature range of -5°C to +70°C or -40 °C to +85 °C ("A" option). The package is made of metal for excellent EMI immunity.

### Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	$T_{st}$	- 40	+ 85	°C
Operating Case Temperature	"Blank" option	- 5.0	+ 70	°C
	"A" option	- 40	+ 85	
Supply Voltage	$V_{CC}$	0	+ 5.0	V
Input Voltage	$V_{in}$	0	$V_{CC}$	V
Output Current	$I_O$	-	50	mA
Lead Soldering Temperature & Time	-	-	260°C, 10 seconds	

# DTR-2488-SM2-LC/LS-W-G-MR

## Transmitter Performance Characteristics (over Operating Case Temperature, $V_{CC} = 3.13$ to $3.47V$ )

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate		$B$	0.125	-	3.00	Gb/s
Average Optical Output Power (coupled into single mode fiber) 50% duty cycle	L1	$P_o$	- 10.0	- 7.0	- 3.0	dBm
	L0		- 5.0	- 2.0	0	
Extinction Ratio		$P_{hi}/P_{lo}$	8.2	-	-	dB
Center Wavelength	SR-1	$\lambda_c$	1266	1310	1360	nm
	IR-1		1266	1310	1360	
	IR-2		1430	1550	1580	
Spectral Width (RMS)	SR-1	$\Delta\lambda_{RMS}$	-	-	4.0	nm
Spectral Width (-20dB)	IR-1, IR-2	$\Delta\lambda_{20}$	-	-	1.0	nm
Side Mode Suppression Ratio	IR-1, IR-2	$SMSR$	30	-	-	dB
Dispersion Penalty		-	-	-	1.0	dB
Optical Output Eye	Compliant with Telcordia GR-253-CORE and ITU-T Recommendation G.957					

## Receiver Performance Characteristics (over Operating Case Temperature, $V_{CC} = 3.13$ to $3.47V$ )

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate		$B$	0.125	-	3.00	Gb/s
Receiver Sensitivity ( $10^{-10}$ BER) <sup>1</sup>		$P_{min}$	- 19.0	- 20.0	-	dBm
Maximum Input Optical Power ( $10^{-10}$ BER) <sup>1</sup>	SR-1	$P_{max}$	- 3.0	-	-	dBm
	IR-1, IR-2		0	-	-	
SIGNAL DETECT Thresholds	Increasing Light Input	$P_{sd+}$	-	-	- 19.0	dBm
	Decreasing Light Input	$P_{sd-}$	- 35.0	-	-	
SIGNAL DETECT Timing		-	3	-	100	$\mu$ s
SIGNAL DETECT Hysteresis		-	0.5	1.0	-	dB
Wavelength of Operation		$\lambda$	1100	-	1600	nm
Jitter Tolerance & Transfer Function		Compliant with ITU Recommendation G.958				

<sup>1</sup>Specified in average input optical power and measured at 125Mb/s, 155Mb/s, 622Mb/s, 1.25Gb/s and 2.488Gb/s with 2<sup>23</sup>-1 PRBS..

**Laser Safety:** All transceivers are Class I Laser products per FDA/CDRH and IEC-60825 standards. They must be operated under specified operating conditions.



**Optical Communication Products, Inc.**  
DATE OF MANUFACTURE:

MANUFACTURED IN THE USA  
This product complies with  
21 CFR 1040.10 and 1040.11

**Meets Class I Laser Safety Requirements**

# DTR-2488-SM2-LC/LS-W-G-MR

## Transmitter Electrical Interface (over Operating Case Temperature, $V_{CC} = 3.13$ to $3.47V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing between DATA+ & DATA-	$V_{INDIF}$	0.30	0.80	1.60	$V_{P-P}$
Input Impedance	$Z_{IL}$	-	50	-	$\Omega$
Transmitter Disable Voltage	$V_{DIS}$	$V_{CC} - 1.3$	-	$V_{CC}$	V
Transmitter Enable Voltage	$V_{EN}$	0	-	0.8	V
Differential Bias Monitor Voltage ( $T_a = 25^\circ C$ )	$V_{BM+} - V_{BM-}$	0.10	-	0.30	V
Differential Back Facet Monitor Voltage	$V_{FM+} - V_{FM-}$	-	250	-	mV

## Receiver Electrical Interface (over Operating Case Temperature, $V_{CC} = 3.13$ to $3.47V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output HIGH Voltage (LV-PECL) <sup>1,2</sup>	$V_{OH}$	$V_{CC} - 1.10$	-	$V_{CC} - 0.90$	V
Output LOW Voltage (LV-PECL) <sup>1,2</sup>	$V_{OL}$	$V_{CC} - 1.84$	-	$V_{CC} - 1.60$	V
Output Current	$I_O$	-	-	25	mA
Output HIGH Voltage (LV-TTL)	$V_{OH}$	2.0	-	$V_{CC}$	V
Output LOW Voltage (LV-TTL)	$V_{OL}$	0	-	0.4	V
Receiver Power Monitor Current	$V_{RPM}$	-	0.80	-	$\mu A/\mu W$

<sup>1</sup>With  $50\Omega$  terminated to  $V_{CC} - 2V$  (for DC-coupled modules).

<sup>2</sup>For AC-coupled modules, the output voltage swing into  $50\Omega$  load is  $0.3V$  minimum and  $0.8V$  maximum single-ended.

## Electrical Power Supply Characteristics (over Operating Case Temperature, $V_{CC} = 3.13$ to $3.47V$ )

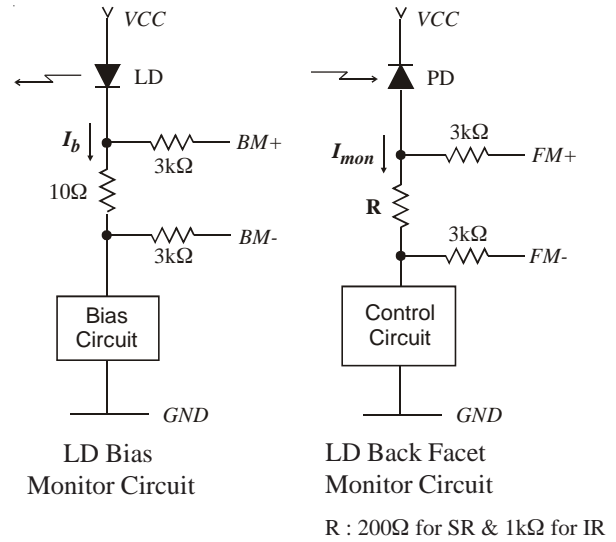
Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	$V_{CC}$	3.13	3.3	3.47	V
Supply Current <sup>1</sup>	$I_{CC}$	-	195	310	mA

<sup>1</sup>Supply current does not include termination resistor current for DC-coupled version.

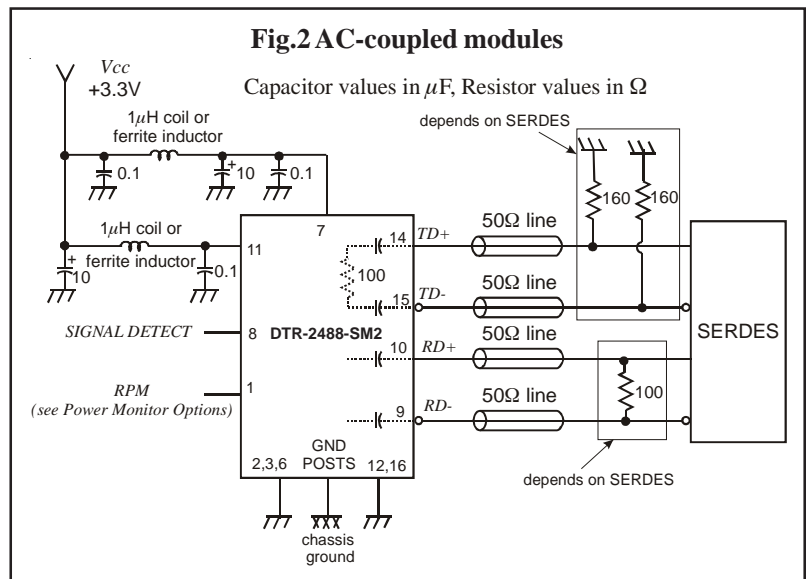
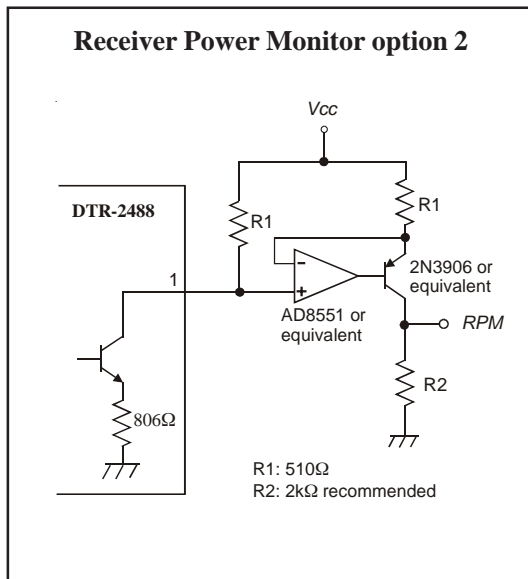
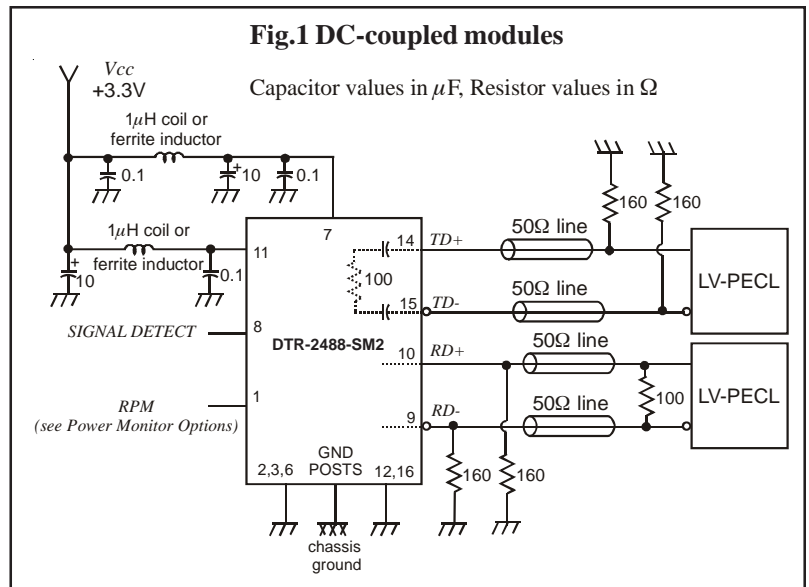
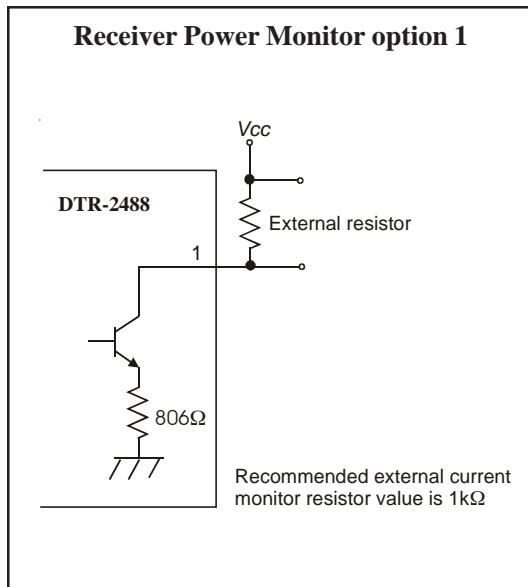
## Pin Assignments

PIN	FUNCTION	PIN	FUNCTION
1	RPM (Receiver Power Monitor)	11	$V_{CC}TX$
2	RX GND	12	TX GND
3	RX GND	13	TX DISABLE
4	N/C	14	TD+ (TX DATA IN+)
5	N/C	15	TD- (TX DATA IN-)
6	RX GND	16	TX GND
7	$V_{CC}RX$	17	BM- (BIAS MONITOR-)
8	SD (RX SIGNAL DETECT)	18	BM+ (BIAS MONITOR +)
9	RD- (RX DATA OUT-)	19	FM- (FACET MONITOR-)
10	RD+ (RX DATA OUT+)	20	FM+ (FACET MONITOR+)

## Laser Bias & Laser Back Facet Monitor Circuits



# DTR-2488-SM2-LC/LS-W-G-MR



## Application Notes

**DATA interface (DC-coupled modules):** The interface circuit for standard DC-coupled modules with direct-coupled LV-PECL interface is shown in Fig. 1. The transmitter input has internal 50Ω termination.

**DATA interface (AC-coupled modules):** For modules with AC coupling option, both transmitter and receiver interfaces have internal bias, 50Ω termination and AC coupling capacitors. The transmitter can be connected directly to the driving SERDES as shown in Fig. 2. The receiver can be connected directly to the external 50Ω loads (termination resistor of the SERDES). For best performance, both DATA+ & DATA- should be used.

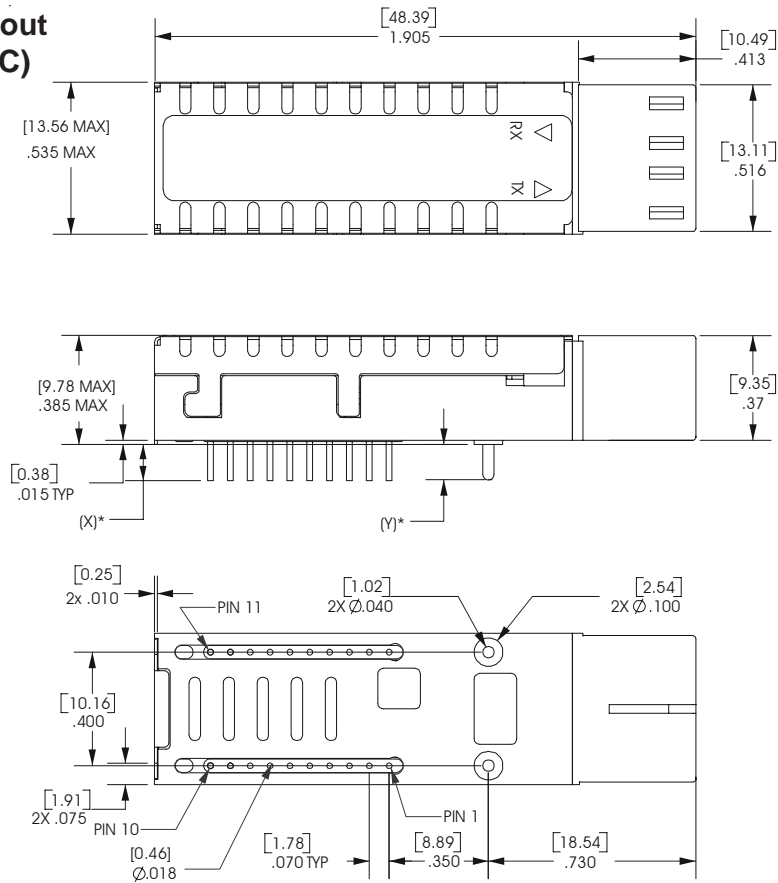
**SIGNAL DETECT:** The SIGNAL DETECT circuit monitors the incoming optical signal level and generates a logic LOW signal when an insufficient photocurrent is produced. The output is LV-TTL with no termination required.

**TX DISABLE:** The transmitter is normally enabled (i.e. when the TX DISABLE control input is not connected). When the TX DISABLE control input voltage is higher than  $V_{CC} - 1.3\text{V}$ , the laser is turned off independent of the input data.

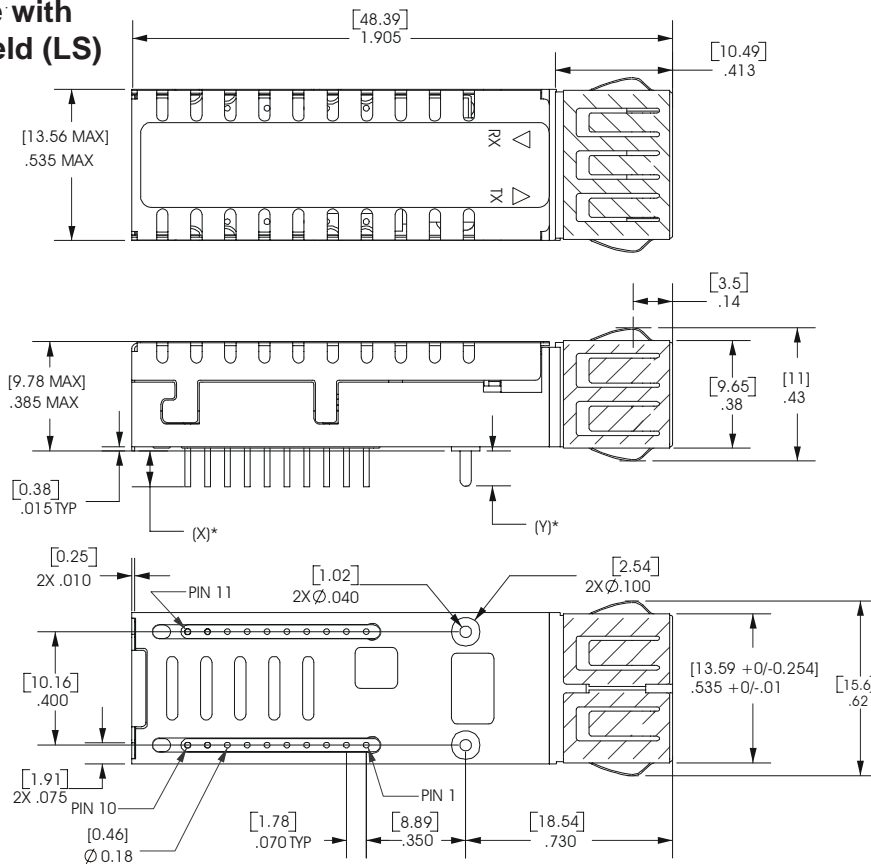
**Power supply and grounding:** The power supply line should be well-filtered. All 0.1μF power supply bypass capacitors should be as close to the DTR transceiver module as possible. The module case ground is internally AC-coupled to the circuit ground.

# DTR-2488-SM2-LC/LS-W-G-MR

## Package without EMI Shield (LC)

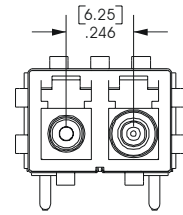
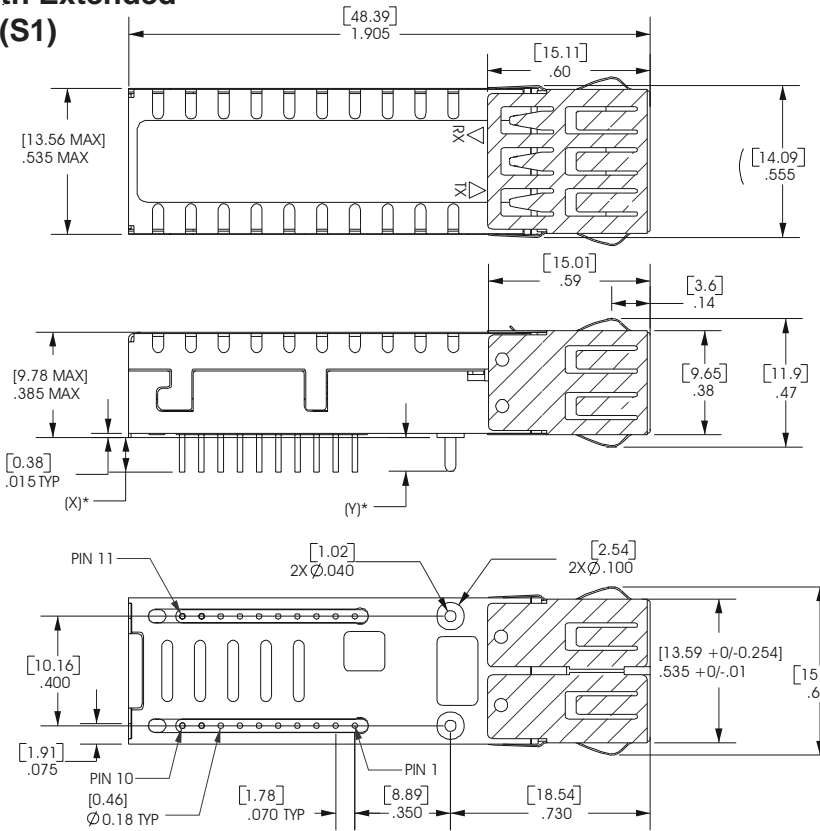


## Package with EMI Shield (LS)



# DTR-2488-SM2-LC/LS-W-G-MR

## Package with Extended EMI Shield (S1)



\*(x) & (y): See Pin Length Option Table in Ordering Information

Dimensions in inches [mm]  
Default tolerances:  
.xxx = ± .005", .xx = ± .01"

## Ordering Information

DTR - 2488 - SM2 - Lx - T - Ln - DR - XX - Wp - G - MR - S1

**Connector**  
LC : w/o EMI Shield  
LS : w/ EMI Shield  
or w/ Extended S1 Shield

**Temperature Range**  
"Blank" : -5°C to +70°C  
"A" : -40°C to +85°C

**Light Output Option**  
L1 : -10 to -3dBm (SR-1)  
L0 : -5 to 0dBm (IR-1 & IR-2)

**Extended Shield**  
"Blank" : None  
"S1" : Extended EMI Shield

see Pin Length Option Table

**Receiver Coupling Option**  
"Blank" : DC Coupling  
"AC" : AC Coupling

**Distance Option (see Note)**  
SR : SR-1/I-16 (12/2km)  
IR1 : IR-1/S-16.1 (21/15km)  
IR2 : IR-2/S-16.2 (42/15km)

### Pin Length Option Table

Options (p)	Pin Length (x)		Post Length (y)	
	Inches	Millimeters	Inches	Millimeters
"blank"	0.140 ± 0.010	3.56 ± 0.250	0.125 + 0.010 - 0.005	3.17 + 0.250 - 0.125
5	0.155 ± 0.010	3.94 ± 0.250	0.155 + 0.010 - 0.005	3.94 + 0.250 - 0.125
8	0.180 ± 0.010	4.57 ± 0.250	0.180 + 0.010 - 0.005	4.57 + 0.250 - 0.125

Note: These are target distances to be used for classification and not for specification, per Telcordia GR-253-CORE/ITU-T Recommendation G.957.

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