

## Total Reach® DDS-R Standalone All Rate DDS Termination Unit Installation and Maintenance

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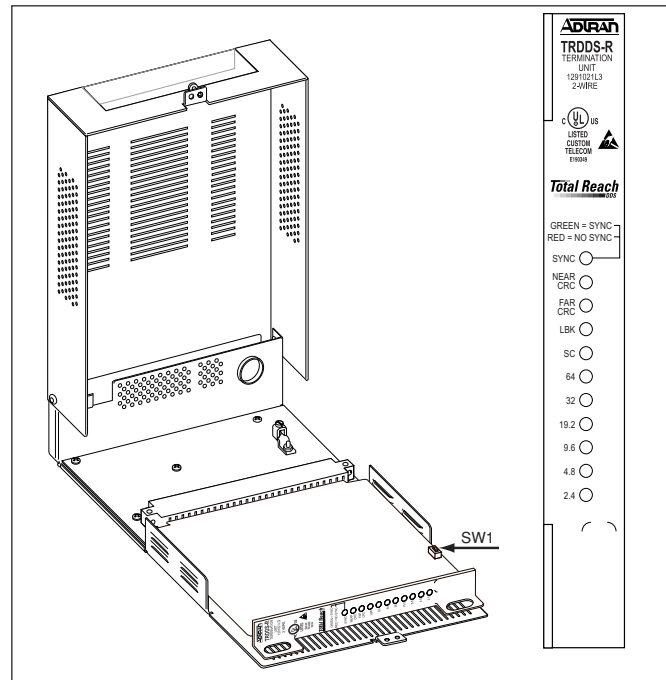
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## 1. GENERAL

This practice provides installation and maintenance procedures for the ADTRAN Total Reach® All Rate DDS Standalone Termination Unit. The ADTRAN Total Reach DDS-R Standalone includes the ADTRAN T400/T200 Single Mount Housing and the ADTRAN Total Reach DDS-R. **Figure 1** is an illustration of the ADTRAN Total Reach DDS-R Standalone (P/N 4291043SAALL).

### Revision History

This document has been reissued to include modified circuit card pinout assignments and upgrade selected text.



**Figure 1. Total Reach DDS-R Standalone**

### Description

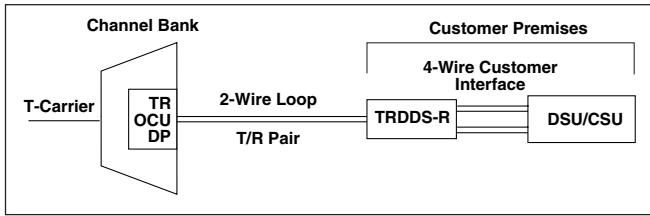
The ADTRAN Total Reach DDS-R is a span-powered termination unit designed to deliver data rates up to 64 kbps and provide testing functionality at the customer premises. Used in combination with the TROCU DP unit, the Total Reach DDS-R converts the 2-wire Total Reach signal to the traditional 4-wire DDS signal for presentation to the customer.

### NOTE

The Total Reach DDS-R unit must be used with an appropriate Total Reach TROCU DP unit.

The Total Reach DDS-R is an auto-rate adaptive digital network interface at the customer premises point-of-demarkation. In addition to terminating the 2-wire extended range signal, the Total Reach DDS-R functions as a regenerative loopback device supporting Telco-generated testing. The Total Reach DDS-R is available in the T200 mechanics and can be optioned for 0 or -10 dB output toward the customer.

The LBK option selects CSU loopback response. **Figure 2** is a diagram of the Total Reach DDS Circuit.



**Figure 2. Total Reach DDS Circuit Diagram**

### T400/T200 Housing Features

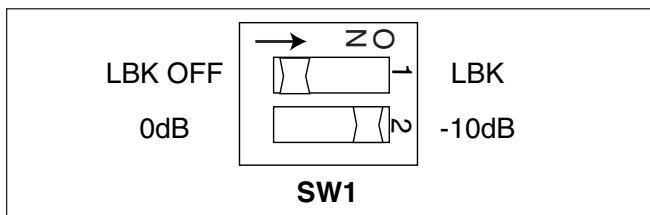
- Standalone Type-400/Type-200 housing
- Span Powered
- Network connection via terminal barrier strip
- Customer connects to RJ-48 or barrier strip
- Durable metal enclosure

### Total Reach DDS-R Features

- 2-wire deployment
- Repeaterless operation
- Auto-rate adoption on subrates, 19.2 and 56 kbps rates, including secondary channel, and 64 kbps clear channel capability
- Span-powered
- Bridged tap tolerant
- LED indicators for Power, SYNC, NEAR/FAR CRC, Service Rate, and Loopback
- Signal-level indication during synchronization
- Automatic signal cut-through upon detection of bidirectional Central Office (CO) loopback at power-up
- T200 mechanics

## 2. OPTIONS

Rate is automatically configured from the TROCU DP unit. Options are selected using circuit board DIP switch SW1 as illustrated in **Figure 3**.



**Figure 3. Total Reach DDS-R Option Switch**

When LBK (SW1-1) is selected, the unit will respond to loopback commands with a regenerative loopback toward the network. When LBK OFF is selected, the

unit will respond only to the latching loopback sequence for the Network Interface Device.

When 0 dB (SW1-2) is selected, the unit will transmit a 0 dB AMI signal across the 4-wire customer interface toward the DSU/CSU. When -10 dB is selected, the unit will transmit a -10 dB AMI signal toward the DSU/CSU.

## 3. INSTALLATION



After unpacking the unit, inspect it for damage. If damage is discovered, file a claim with the carrier, then contact ADTRAN. See *Warranty and Customer Service*.

### CAUTION

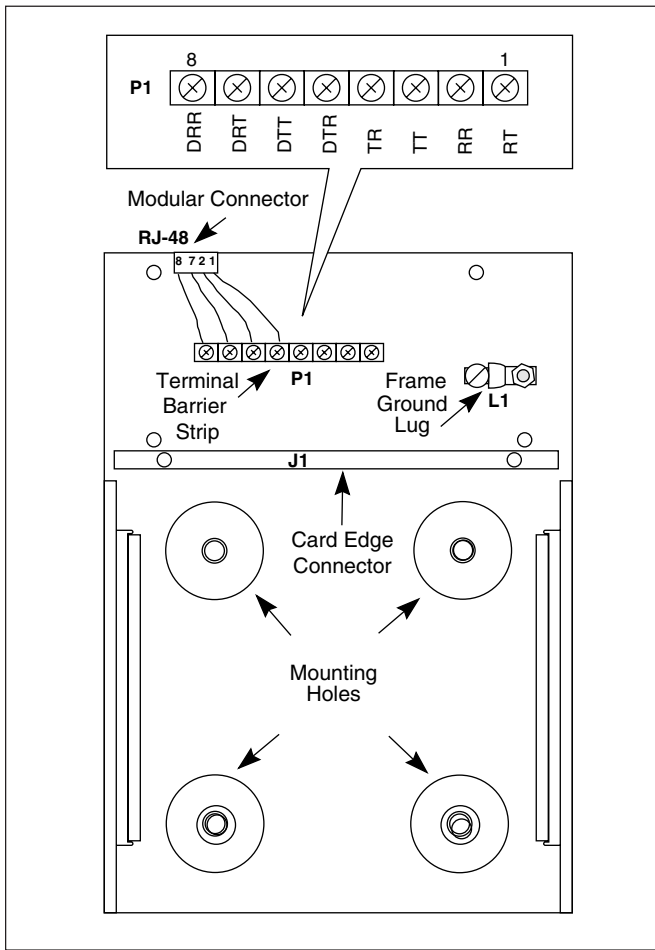
- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- TROCU-DP normally provides -130 V of span-powering voltage to the Total Reach DDS-R.

### T400/T200 Wiring

The ADTRAN T400/T200 housing is designed for either horizontal or wall mounting. If wall mounting is used:

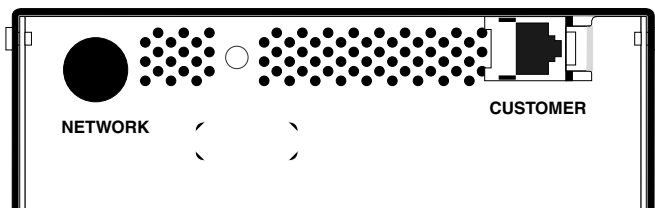
- Open the housing cover and remove the Total Reach DDS-R circuit card.
- Secure the T400/T200 housing to the wall using the mounting holes shown in **Figure 4**. Ensure clearance to completely open the cover.
- Replace the circuit card through the front of the housing until it snaps into the card edge connector (J1), shown in **Figure 4**.

The Total Reach DDS-R requires a frame ground connection to pin 11 of the gold finger connector. A ground lug (L1), as illustrated in **Figure 4**, is provided to connect an external frame ground wire to the unit. L1 provides Frame Ground connections for pins 11 and 27 of the plugin's gold finger card edge.



**Figure 4. T400/T200 Housing with Cover Open**

Insert the grounding wire into the housing through the Network portal of the rear panel, as illustrated in **Figure 5**.

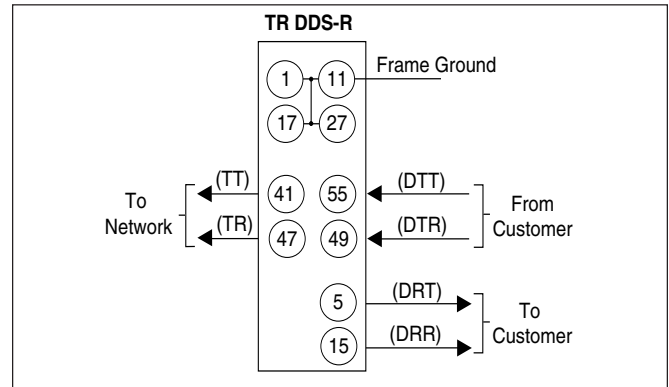


**Figure 5. T400/T200 Housing Rear Panel**

### Total Reach DDS-R Wiring

Connections are made using screwdown terminals on the barrier strip located in the rear of the housing. To connect to the barrier strip, place conductors beneath the square washer of each terminal screw and tighten.

**Figure 6** shows the circuit card pinout and **Table 1** describes the wiring connections for the Total Reach DDS-R.



**Figure 6. Circuit Card Pin Assignments**

**Table 1. Wiring Connections**

Pair	Terminal Strip Designations	T400 Pin Number	Customer RJ-48
To/From Network	TT, TR	41, 47	
To Customer (Rx)	DRT, DRR	5, 15	7, 8
From Customer (Tx)	DTR, DTT	49, 55	1, 2

The unit should be wired as follows:

- Network pair to terminal strip TT and TR positions
- To Customer and From Customer pairs through customer 8-pin modular connector  
or
- To Customer (DRT, DRR) and From Customer (DTR, DTT) to designated terminal strip positions

Rate selection is not necessary for the Total Reach DDS-R. The unit automatically adapts to the service rate of the TROCU DP in the central office.

## Compliance Codes

**Table 2** shows the Compliance Codes for the Total Reach DDS-R and the T400/T200 housing when installed together. The Total Reach DDS-R Standalone unit complies with the requirements covered under UL 1459 third edition. The Total Reach DDS-R Standalone unit is intended for installation in restricted access locations only.

**Table 2. Compliance Codes**

Code	Input	Output
Installation Code (IC)	E	–
Telecommunication Code (TC)	X	T
Power Code (PC)	C	C

### NOTE

The DDS customer port is classified as suitable for connection to intra-building or non-exposed wiring only.

## LED Indication

The Total Reach DDS-R front panel LEDs display the operating status and service rate. The LEDs are described in **Table 3**.

## Signal Meter

The Total Reach DDS-R front panel signal meter approximates the amount of dB loss on the Total Reach DDS loop at 13.3 kHz (135 Ω termination), the Nyquist frequency of Total Reach DDS. The signal meter on the Total Reach DDS-R can be used to verify that the loop loss is within Total Reach DDS deployment guidelines without the requirement of peripheral test equipment. The signal meter is activated automatically upon power-up during the Total Reach DDS training sequence and remains activated until synchronization occurs (usually 30-90 seconds after power-up). If the signal meter only illuminates the 2.4 LED, then the loop loss is too great for Total Reach DDS deployment. If the signal meter illuminates 2.4 and 4.8 (two LEDs), then the Total Reach DDS loop loss is between 50 and 56 dB and the loop is considered marginal for Total Reach DDS deployment.

**Table 3. Front Panel Indication**

LED	Status	Explanation
SYNC	ON	Unit is powered up  Synchronized with TROCU DP  Not synchronized with TROCU DP; check for continuity, load coils, and other abnormal line conditions.
	Green	
	Red	
NEAR CRC	ON	Errors occurred on the incoming data stream during the previous second; check for abnormal line conditions closer to the DDS-R.
FAR CRC	ON	Errors occurred toward the TROCU DP during the previous second; check for abnormal line conditions closer to the CO.
LBK	ON	Loopback is activated towards network or remote control link active
	Flashing	Bidirectional loopback at TROCU DP
SC	ON	Secondary Channel enabled
64	ON	64 kbps data rate enabled
56	ON	56 kbps data rate enabled
19.2	ON	19.2 kbps data rate enabled
9.6	ON	9.6 kbps data rate enabled
4.8	ON	4.8 kbps data rate enabled
2.4	ON	2.4 kbps data rate enabled

If three or more rate LEDs are illuminated during Total Reach DDS train-up, then the circuit is considered to be within Total Reach DDS deployment guidelines. See **Figure 7** for a translation of the signal meter loss ranges in dB. If the loop loss indicates a marginal loop for Total Reach DDS deployment, then a more precise loop loss measurement can be made with the appropriate test equipment.

LED	SIGNAL LOSS (dB)
SC ○	0-10
64 ○	10-20
56 ○	20-30
19.2 ○	30-40
9.6 ○	40-50
4.8 ○	50-56
2.4 ○	>56

Signal level

Signal level indicated during synchronization

**Figure 7. Signal Loss Indication**

#### 4. TESTING

##### Loopback Testing

Loopback tests can be performed from the Central Office (CO) to verify proper loop and Total Reach DDS-R operation. The Total Reach DDS-R provides a network loopback in response to a CSU latching or non-latching loopback command. The Total Reach DDS-R also provides an NIE latching loopback at all rates. Repeater loopback operation functions in accordance with TR-TSY-000476. See **Table 4** for latching loopback sequence. The Total Reach DDS-R supports testing of the 2-wire loop from the remote end when the TROCU DP is performing a bidirectional OCU loopback.

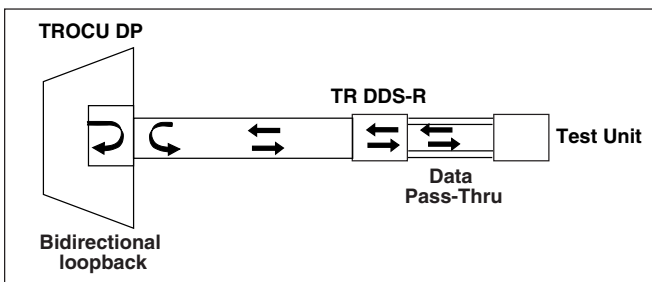
**Table 4. Latching Loopback Sequences**

Function	Byte Code	Number of Received Bytes
Clear existing loopbacks	Transistion in progress (TIP) X0111010	Minimum of 35 TIP bytes
Identifiy device to be looped	Loopback select code (LSC) X1010101 - OCU X0110001 - CSU X1000001 - NIE	Minimum of 35 LSC bytes
Prepare to loop; send MAP code after 30 bytes	Loopback enabled (LBE) X1010110	Minimum of 100 LBE bytes
Activate loopback	Far-End voice (FEV) X1011010	Minimum of 32 FEV bytes
Minimum of 35 TIP bytes required to disable established latching loopback. X = Don't Care bit		

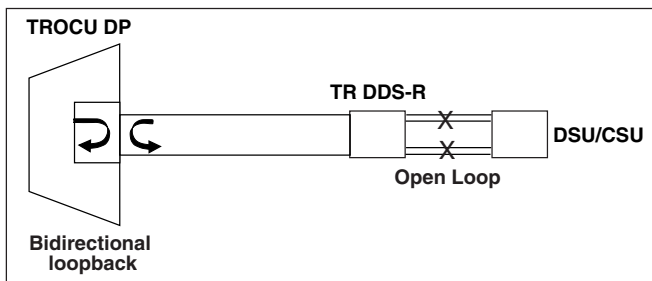
### TROCU DP Bidirectional Loopback Support

The TROCU DP will execute a bidirectional loopback when performing an OCU loopback at the TROCU DP. If the Total Reach DDS-R detects a bidirectional loopback during power-up synchronization, the Total Reach DDS-R allows data to pass on the 4-wire interface by entering into the pass-thru mode (**Figure 8**). This allows a standard portable DDS test set, connected to the 4-wire customer interface of the Total Reach DDS-R, to verify the integrity of the 2-wire loop by transmitting a test pattern and examining the returning data for synchronization and errors. The Total Reach DDS-R LBK indicator always flashes during a TROCU DP bidirectional loopback.

If the TROCU DP bidirectional loopback is invoked after the Total Reach DDS-R achieves synchronization, the Total Reach DDS-R will not pass or receive data from the CPE or DDS test set. This is consistent with current DDS testing methods and is referred to as the TROCU DP bidirectional loopback normal mode (**Figure 9**). For testing purposes, the installer may choose to initiate the Total Reach DDS-R to pass-thru mode. Once the bidirectional loopback is executed in normal mode, unseat and reseal the Total Reach DDS-R and allow the unit to train-up. Once trained, the Total Reach DDS-R will revert to pass-thru mode for further testing.



**Figure 8. TROCU DP Bidirectional Loopback Pass-Thru Mode**



**Figure 9. TROCU DP Bidirectional Loopback Normal Mode**

### Repeater Loopback (56 kbps)

A repeater loopback code transmitted from a remote or local test system causes the TROCU DP to notify the Total Reach DDS-R of a CSU loopback request. Upon detection of a CSU loopback request, the Total Reach DDS-R causes a loopback toward the network by connecting the customer-side transmit and receive together. Circuit integrity can then be verified by transmitting bit error rate (BER) data from the test system and examining the returning data for synchronization and errors.

While in loopback, the Total Reach DDS-R can detect the All-1s Repeater Release Code sequence, and upon recognition of this sequence, drops its loopback and reverses sealing current to the DSU/CSU. The All-1s Repeater Release Code sequence is the non-latching CSU loopback code alternating with an All-1s data pattern for approximately 2 seconds. See **Table 5** for alternating loopback sequences.

Some test systems and test sets support both a CSU (channel loopback) and a 56 kbps repeater loopback. If repeater loopback is available, it will only loop the Total Reach DDS-R. When CSU or channel loopback is selected, some test systems automatically send the All-1s Repeater Release Code to release loopbacks from any regenerating devices on the loop, including the Total Reach DDS-R. If the test system or test set does not support a 56 kbps repeater loopback, a CSU or channel loopback should be selected and the All-1s Repeater Release Code injected for approximately 2 seconds to release a Total Reach DDS-R loopback prior to looping the DSU/CSU.

**Table 5. Alternating Loopback Sequences**

Function	Received Bytes
Active loopback	Four consecutive bytes of specified loopback code X0101010 - OCU X0101000 - CSU X0101100 - DSU
Maintain loopback and test for bit errors	Data byte alternating with loopback code example: XDDDDDD1/X0101010
Clear loopback	Four consecutive data bytes without a specified loopback code
X = Don't care bit	

## CSU Latching Loopback

Some test systems embed All-1s Repeater Release Codes within the CSU Latching Loopback command to bypass loop repeaters and directly access the DSU/CSU. If a latching loopback at the Total Reach DDS-R is desired, see subsection *Network Interface Equipment Latching Loopback* on this page. See Table 4 for latching loopback sequences.

For test systems or test sets that do not support automatic release of CSU latching loopback from the repeaters or network interface devices, use the following procedures.

### Initiating CSU Latching Loopback to Loop DDS-R (SW1-1 LBK enabled)

- From a test system or set, send a CSU latching loopback sequence. This instructs the TROCU DP to notify the Total Reach DDS-R of a CSU loopback request.
- Send a selected test pattern and test for error-free operation.
- Upon completion of this test, advance to subsection *Terminating CSU Latching Loopback to Total Reach DDS-R or DSU/CSU* for latching loopback termination.

### Initiating CSU Latching Loopback to Loop a DSU/CSU (SW1-1 LBK enabled)

- From a test system or set, send a CSU latching loopback sequence. This instructs the TROCU DP to notify the Total Reach DDS-R of a CSU loopback request.
- To release the Total Reach DDS-R from latching loopback and reverse sealing current to the DSU/CSU, send the non-latching CSU loopback code alternating with an All-1s data pattern for approximately 2 seconds. The DSU/CSU should loop when reversed sealing current is detected.
- Send a selected test pattern and test for error-free operation.
- Upon completion of this test, advance to subsection *Terminating CSU Latching Loopback to Total Reach DDS-R or DSU/CSU* for latching loopback termination.

### Terminating CSU Latching Loopback to Total Reach DDS-R or DSU/CSU

- From a test system or set, send a CSU Latching Loopback Disable command (35 TIP bytes).

## Network Interface Equipment Latching Loopback

The NIE latching loopback method can be used to loop the Total Reach DDS-R at all rates. This loopback test may require programming of the loopback select code or the complete sequence into the test system.

## 5. DEPLOYMENT GUIDELINES

The TROCU DP and Total Reach DDS-R use technology intended to eliminate the need for repeaters and concerns over impairments caused by typical noise and bridged tap. Listed below are the loop design guidelines for Total Reach DDS (see **Table 6** and **Table 7** for more information):

- All loops must be nonloaded.
- Actual Measured Loss (AML) should not exceed 50 dB at 13.3 kHz (135  $\Omega$  termination), the Nyquist frequency of Total Reach DDS.

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### NOTE

The 50 dB AML limit includes 6 dB of signal margin to account for potential near-end cross talk (NEXT) from other digital services that may be provisioned in the same binder group.

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- Loop length should not exceed 50 kft.
- Bridged tap length should not exceed 12 kft.
- Background noise level should not exceed 34 dBm.
- Impulse noise level should not exceed -40 dBm, (+50 dBm).

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### NOTE

Measure noise with 50 kbit weighting characteristic approximating a filter with a passband of 40 Hz to 30 kHz. Background noise level or impulse noise level is referenced from 56/64 kbps data rate in TR62310.

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## 6. MAINTENANCE

The Total Reach DDS-R Standalone does not require routine maintenance for normal operation.

**Table 6. Cable Type and Temperature Loss Data @ 13.3 kHz**

Plastic Cable	dB Loss/kft	Paper Cable	dB Loss/kft
19 Gauge PIC (0° F)	0.5302	19 Gauge PULP (0° F)	0.5616
19 Gauge PIC (70° F)	0.6083	19 Gauge PULP (70° F)	0.6415
19 Gauge PIC (120° F)	0.6610	19 Gauge PULP (120° F)	0.6955
22 Gauge PIC (0° F)	0.912	22 Gauge PULP (0° F)	0.9454
22 Gauge PIC (70° F)	1.0258	22 Gauge PULP (70° F)	1.0606
22 Gauge PIC (120° F)	1.1015	22 Gauge PULP (120° F)	1.1370
24 Gauge PIC (0° F)	1.2571	24 Gauge PULP (0° F)	1.2900
24 Gauge PIC (70° F)	1.3982	24 Gauge PULP (70° F)	1.4324
24 Gauge PIC (120° F)	1.4917	24 Gauge PULP (120° F)	1.5268
26 Gauge PIC (0° F)	1.6751	26 Gauge PULP (0° F)	1.6823
26 Gauge PIC (70° F)	1.8469	26 Gauge PULP (70° F)	1.8568
26 Gauge PIC (120° F)	1.9608	26 Gauge PULP (120° F)	1.9718

**Table 7. Total Reach DDS Insertion Loss Measurements**

Total Reach DDS 13.3 kHz compared to 28 kHz for traditional DDS service		
Line Configuration	@ 13.3 kHz	@ 28 kHz
27 kft 26 AWG	50.12 dB	65.35 dB
36.25 kft 24 AWG	50.00 dB	62.50 dB
50 kft 22 AWG	50.24 dB	59.33 dB

**7. WARRANTY AND CUSTOMER SERVICE**

ADTRAN will replace or repair this product within 10 years from the date of shipment if it does not meet its published specifications or fails while in service (see *ADTRAN Carrier Networks Equipment Warranty, Repair, and Return Policy and Procedure*, document 60000087-10).

Contact Customer and Product Service (CAPS) prior to returning equipment to ADTRAN.

For service, CAPS requests, or further information, contact one of the following numbers:

**ADTRAN Sales**

Pricing/Availability  
(800) 827-0807

**ADTRAN Technical Support**

Pre-sales Applications/Post-sales Technical Assistance  
(800) 726-8663

Standard hours: Monday-Friday, 7 a.m. - 7 p.m. CST  
Emergency hours: 7 days/week, 24 hours/day

**ADTRAN Repair/CAPS**

Return for Repair/Upgrade  
(256) 963-8722

**Repair and Return Address**

ADTRAN, Inc.  
CAPS  
901 Explorer Boulevard  
Huntsville, Alabama 35806-2807