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

CONTENTS

FIGURES

TABLES

1. GENERAL

This practice provides installation and maintenance procedures for the ADTRAN Total Reach DDS-R All Rate DDS Termination Unit. **Figure 1** is an illustration of the ADTRAN Total Reach DDS-R (P/N 1292021L5).

Revision History

This document has been reissued to revise LED descriptions and loopback reference.
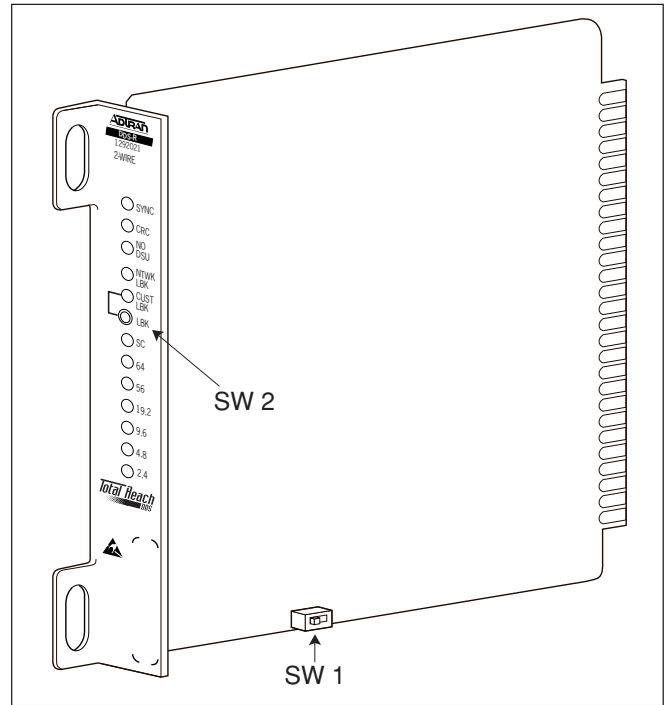
Figure 1. ADTRAN Total Reach DDS-R

Features

- 2-wire deployment.
- Repeaterless operation.
- Bridged tap tolerant.
- Span-powered.
- Protected Loopback prevents false latching loopback at 64 kbps.
- Auto-rate adaptation on subrates, 19.2 and 56 kbps rates, including secondary channel, and 64 kbps clear channel capability.
- LED indication for SYNC, CRC, DSU, Service Rate, NTWK Loopback, CUST Loopback.
- T200 mechanics.
- Signal-level indication during synchronization.
- Automatic signal cut-through during bidirectional loopbacks at the Total Reach OCU DP.

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 Total Reach OCU DP, the Total Reach DDS-R converts the 2-wire Total Reach signal to the traditional 4-wire DDS signal for presentation to the customer.

The Total Reach DDS-R is an auto-rate adaptive digital network interface located at the customer premises point of demarcation. 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 T200 mechanics, and can be optioned for 0 dB or -10 dB output toward the customer. **Figure 2** illustrates the Total Reach DDS circuit diagram.
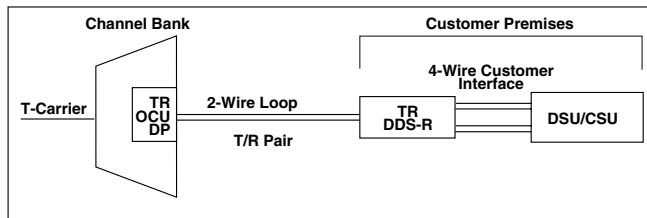

Figure 2. Total Reach DDS Circuit Diagram

NOTE

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

---

2. INSTALLATION

C A U T I O N !
SUBJECT TO ELECTROSTATIC DAMAGE
OR DECREASE IN RELIABILITY.
HANDLING PRECAUTIONS REQUIRED.

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.*

WARNING

- 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.
- Total Reach OCU DP normally provides -130 V of span-powering voltage to the Total Reach DDS-R.

CAUTION

Ensure ground continuity exists between the unit, the housing, and a known approved ground source.

Options

Rate is automatically configured from the Total Reach OCU DP. The Total Reach DDS-R has a single position, board mounted DIP switch that is provisioned as illustrated in **Figure 3**.

When 0 dB is selected on SW1, 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.
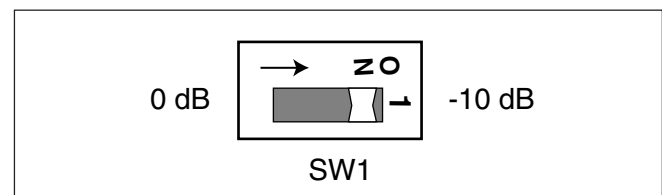
Figure 3. Option Switch

Latching Loopback

Latching loopbacks are always enabled except when temporarily disabled via the protected loopback feature.

When 64 kbps is enabled, and the protected loopback switch at the Total Reach OCU DP is OFF, the Total Reach DDS-R will respond to the legacy latching loopback sequences as described in TR62310 and ANSI T1.107. At 64 kbps, with the protected loopback switch ON, the Total Reach DDS-R will enable ADTRAN's Protected Loopback mode.

False Loopback Immunity

ADTRAN's Protected Loopback family of channel units include an algorithm compatible with SARTS, Hekimian, TPI, and other test systems that virtually eliminates false latching loopback occurrences. This algorithm is always enabled at 64 kbps. In addition, ADTRAN's Protected Loopback family features a protected loopback mode for further false latching loopback protection.

Protected Loopback

ADTRAN's protected loopback supports the proposed DDS latching loopback standard in T1E1.2/99-007R1. When protected loopback is enabled, the Total Reach DDS-R will respond to latching loopback when the idle code preamble is sent prior to the latching loopback sequence specified in TR62310 and ANSI T1.107. Protected loopback prevents false latching loopbacks when the latching loopback sequence is embedded in customer payload data. Test equipment should support T1E1.2/99-007R1 to perform testing at 64 kbps when protected loopback is enabled. See **Table 1** for the latching loopback sequence requirement when protected loopback is enabled.

Wiring

The Total Reach DDS-R can be housed in a standard T400/T200 shelf or the ADTRAN T400/T200 Single Mount Housing, part number 1212007L1 or Dual Mount Housing, part number 1212008L1. Connections are made using screwdown connectors on the terminal strip located at the rear of the housing. **Figure 4** illustrates the circuit card pinout and **Table 2** shows the wiring designations for the Total Reach DDS-R.
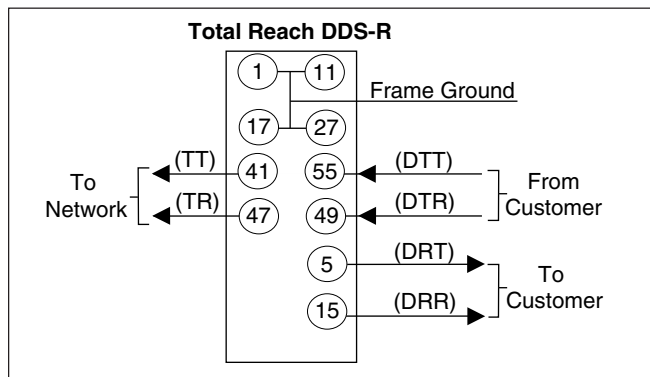

Figure 4. Circuit Card Pin Assignments

Table 1. Protected Loopback Mode Requirement T1E1.2/99-007R1 (Latching Loopback)

Sequence Function	Byte Code	# of Received Bytes
Exit Data Protocol	Idle - 11111110	Minimum of 35 Idle bytes
Clear existing loopbacks	Transition in progress (TIP) X0111010	Minimum of 35 TIP bytes
Identify device to be looped	Loopback select code (LSC) X0000101 - DS0 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		

The unit should be wired as follows:

- Network pair to terminal strip TR and TT 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

Table 2. Wiring Connections

Pair	Terminal Strip Designations	T400 Pin Number	Customer RJ48
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

No rate selection is necessary for the Total Reach DDS-R. The unit automatically adapts to the service rate of the Total Reach OCU DP in the central office.

Compliance Codes

Table 3 shows the Compliance Codes for the Total Reach DDS-R. The Total Reach DDS-R complies with the requirements covered under UL 1950 and is intended to be installed in a type "B" or "E" enclosure in a restricted access location only.

CAUTION

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

Table 3. Compliance Codes

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

LED Indication

The Total Reach DDS-R has front panel LED indicators that display the operating status and service rate. The LEDs are described in **Table 4**.

Signal Meter

The Total Reach DDS-R contains an LED indication signal meter that 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 may be used to verify that the loop loss is actually 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 to 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 (only two LEDs), then the Total Reach DDS loop loss is between 50 dB and 56 dB and the loop is considered marginal for Total Reach DDS deployment.

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.

Table 4. LED Indicators

LED	Description
SYNC	RED indicates that there is no sync between the TR OCU DP and the TR DDS-R; check for continuity, load coils, and other abnormal line conditions. GREEN indicates loop synchronization.
CRC	ON indicates that there are errors on the 2-wire loop; check for abnormal loop conditions.
NO DSU	ON indicates the absence of the customer DSU/CSU as determined by the TR DDS-R.
NTWK LBK	ON indicates a loopback toward the network exists at the TR DDS-R. FLASHING indicates the TR DDS-R has requested a DSU/CSU loopback toward the network. This condition only occurs during Alternating Channel or Latching CSU loopbacks.
CUST LBK	ON indicates a loopback toward the customer exists at the TR DDS-R. FLASHING indicates a loopback toward the customer exists at the TR OCU DP.
SC	ON indicates the Secondary Channel is enabled.
64	ON indicates the 64 kbps data rate is enabled.
56	ON indicates the 56 kbps data rate is enabled.
19.2	ON indicates the 19.2 kbps data rate is enabled.
9.6	ON indicates the 9.6 kbps data rate is enabled.
4.8	ON indicates the 4.8 kbps data rate is enabled.
2.4	ON indicates the 2.4 kbps data rate is enabled.

See **Figure 5** 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	Signal level
9.6	○	40-50	
4.8	○	50-56	
2.4	○	>56	
Signal level indicated during synchronization			

Figure 5. Signal Loss Indication

3. 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 an NIE latching loopback command. The Total Reach DDS-R also provides a sealing current reversal when the CSU loopback command is detected. Alternating loopbacks may be performed at all rates, except 64 kbps Clear Channel. See **Table 5** for alternating loopback sequences.

Table 5. Alternating Loopback Sequences

Sequence 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 specified loopback code
X = Don't care bit	

See **Table 6** for latching loopback sequences. The Total Reach DDS-R supports testing of the 2-wire loop from the remote end when the Total Reach OCU DP is performing a bidirectional OCU loopback.

Table 6. Latching Loopback Sequences

Sequence Function	Byte Code	Number of Received Bytes
Clear existing loopbacks	Transition in progress (TIP) X0111010	Minimum of 35 TIP bytes
Identify device to be looped	Loopback select code (LSC) X0000101 - DS0 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		

LBK Button (SW2)

The Total Reach DDS-R front panel loopback button (LBK) allows loopbacks to be activated without test equipment, or centralized test coordination. Press the LBK button once to loop the Total Reach OCU DP back toward the customer. This loopback is indicated by a flashing CUST LBK LED on the Total Reach DDS-R. A loopback at the Total Reach DDS-R toward the customer's DSU/CSU may be initiated by pressing the LBK button again. A solid CUST LBK LED on the Total Reach DDS-R indicates a loopback at the Total Reach DDS-R toward the customer equipment.

Loopback LED Operation

Total Reach DDS system loopback status is indicated via the front panel NTWK LBK and CUST LBK LEDs. An active loopback occurring at the unit being viewed is always indicated via a solid loopback LED. A flashing loopback LED indicates a loopback condition at the far end unit. When a loopback toward the network is initiated, the NTWK LBK LED on the front panel of the Total Reach unit is illuminated. A loopback generated toward the customer illuminates the CUST LBK LED.

Total Reach OCU DP Bidirectional Loopback Support

The Total Reach OCU DP will execute a bidirectional loopback when performing an OCU loopback. 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 OCU DP NTWK LBK and CUST LBK indicators will illuminate during an OCU bidirectional loopback. See **Figure 6** for an illustration of the bidirectional loopback.
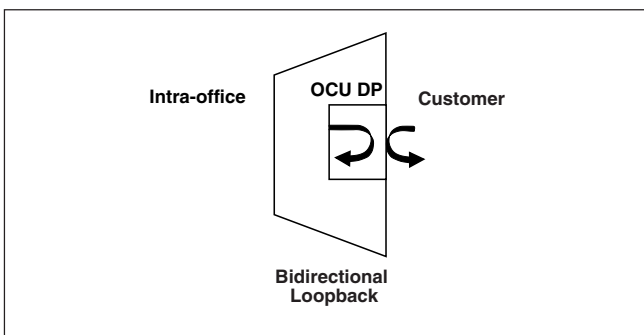
Remote End Initiated LBK Tests

The Total Reach OCU DP supports loopbacks generated from the Total Reach DDS-R which allow testing to be performed without coordination with the CO or test center. Loopbacks initiated by the Total Reach DDS-R front panel LBK pushbutton aid in system turnup testing or troubleshooting from the remote end.

The Total Reach OCU DP will respond to a loopback command initiated at the Total Reach DDS-R as follows:

- Pressing the Total Reach DDS-R LBK pushbutton once will initiate a loopback at the Total Reach OCU DP toward the customer. This allows data to be sent from the remote end to test the local loop and the Total Reach DDS-R. This loopback is indicated by a flashing CUST LBK LED on the Total Reach DDS-R and a solid CUST LED on the Total Reach OCU DP. See **Figure 7**.

- Pressing the Total Reach DDS-R LBK pushbutton a second time initiates a loopback at the Total Reach DDS-R toward the 4-wire DDS (CPE) interface. A solid CUST LBK LED on the Total Reach DDS-R indicates a loopback at the Total Reach DDS-R toward the customer equipment. See **Figure 8**.

- Pressing the LBK pushbutton a third time disables all current latching loopbacks initiated by the Total Reach DDS-R LBK pushbutton.

During a remote end initiated loopback the Total Reach system transmits ASC 9Eh toward the network, indicating an out-of-service condition generated by the remote end, as shown in Figure 7 and Figure 8.

Figure 6. OCU Bidirectional Loopback

All Total Reach system latching loopbacks, whether initiated by the LBK pushbutton, CO, or from a remote Test Center, can be disabled by sending 35 DDS loop down TIP bytes <X0111010> (Where X is a "don't care bit"). All existing latching loopbacks can also be disabled by pressing the LBK pushbutton on the CO or remote units.

Loopbacks created by either the pushbutton on the Total Reach OCU DP or the Total Reach DDS-R will automatically be released after 120 minutes, returning the system to normal operation.

ADTRAN Digital System-6 Protocol

Remote access to provisioning, inventory, status, and performance information maintained in the Total Reach DDS-R is provided through a defined set of in-band DS0 byte sequences. Using a command sequence similar to the Network Interface Equipment (NIE) loopback sequence, a control link with the Total Reach DDS-R is established. Using the additional DS0 codes, information is exchanged between the control center and the Total Reach DDS-R through a command/response protocol. ADTRAN Digital System-6 (ADS-6) is supported by Hekimian React 2001 software revision 1.900 and the TPI 105. Further details of the ADTRAN Digital System-6 protocol can be found in the ADTRAN *Compatibility Bulletin for In-Band Control of Intelligent DDS Channel Equipment*, ACB-DS6-001.
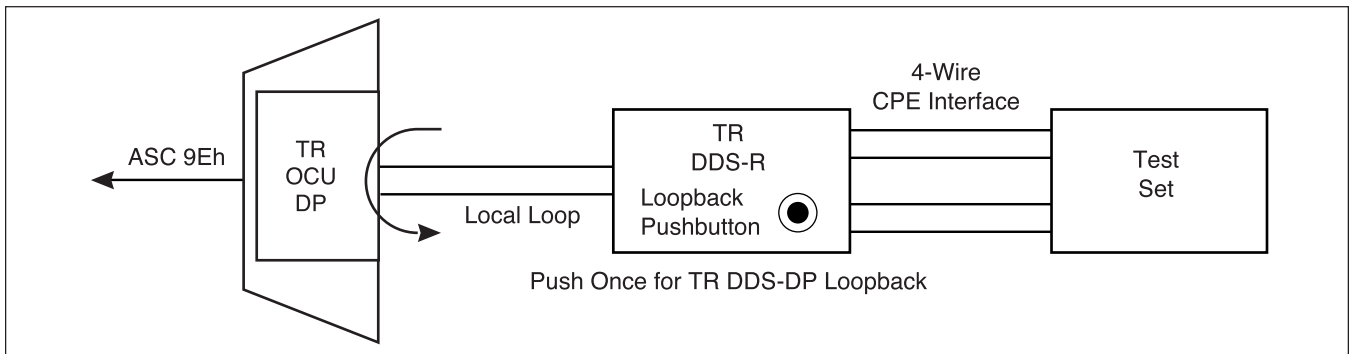

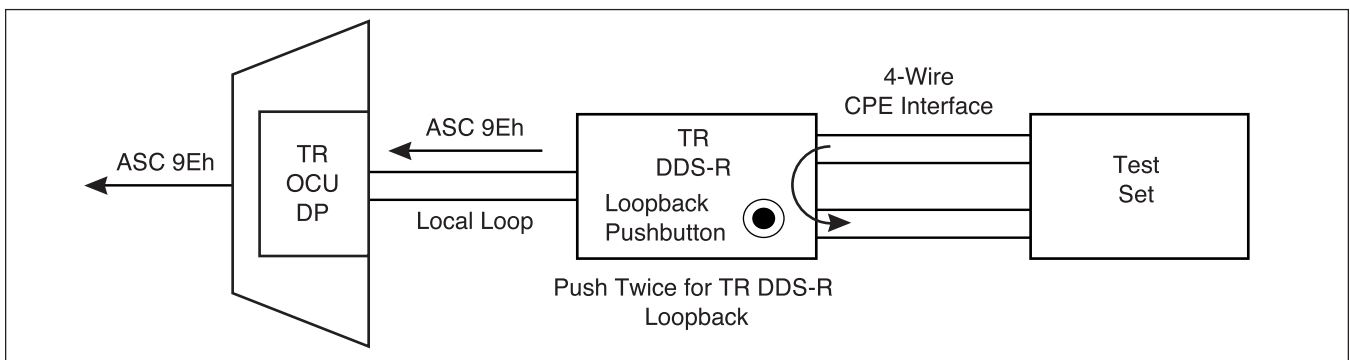**Figure 7. TR DDS-R Remote End Initiated Loopback, Local Loop**

Figure 8. TR DDS-R Remote End Initiated Loopback, Customer Loop

4. DEPLOYMENT GUIDELINES

The Total Reach OCU DP and Total Reach DDS-R use technology that eliminates 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 7** and **Table 8** for more information):

- All loops must be nonloaded.
- Actual Measured Loss (AML) should not exceed 50 dB at 13.3 kHz (135 Ω termination), the Nyquist frequency of Total Reach DDS.
- Loop length should not exceed 50 kft.
- Bridged tap tolerant to 12 kft (tests show no degradation to 18 kft).
- Background noise level should not exceed 34 dBrn.
- Impulse noise should not exceed -40 dBm (+50 dBrn).

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.

Table 7 describes cable loss for the Total Reach DDS Nyquist frequency of 13.3 kHz.

Table 8. 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

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.

---

5. MAINTENANCE

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

Table 7. 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

6. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within ten (10) years from the date of shipment if it does not meet its published specifications or fails while in service. (See *ADTRAN U.S. and Canada Carrier Networks Equipment Warranty,* 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