



HDSL4 239 H4R Repeater Installation and Maintenance Practice

Document Number: 61223445L2-5B

CLEI: T1R6189D__

June 2009

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Revision History

Revision	Date	Description
A	July 2008	Initial release.
B	June 2009	Updated CLEI Code

Conventions

The following typographical conventions are used in this document:

[This font](#) indicates a cross-reference link.

This font indicates screen menus, fields, and parameters.

THIS FONT indicates keyboard keys (ENTER, ESC, ALT). Keys that are to be pressed simultaneously are shown with a plus sign (ALT+x indicates that the ALT key and x key should be pressed at the same time).

This font indicates references to other documentation and is also used for emphasis.

This font indicates on-screen messages and prompts.

This font indicates text to be typed exactly as shown.

This font indicates silk-screen labels or other system label items.

This font is used for strong emphasis.

NOTE

Notes inform the user of additional, but essential, information or features.

CAUTION

Cautions inform the user of potential damage, malfunction, or disruption to equipment, software, or environment.

WARNING

Warnings inform the user of potential bodily pain, injury, or death.

Training

ADTRAN offers training courses on our products. These courses include overviews on product features and functions while covering applications of ADTRAN product lines. ADTRAN provides a variety of training options, including customized training and courses taught at our facilities or at customer sites.

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HDSL4 239 H4R Repeater

INTRODUCTION

HDSL4 technology provides extended range T1 (DS1) transport on the telecommunications network, and features spectral compatibility with ADSL and other transport technologies. The ADTRAN HDSL4 239 H4R Repeater (239 H4R, P/N XXXXXXXXLX) regenerates the HDSL4 signal, extending the range of the HDSL4 circuit. The 239 H4R has enhanced troubleshooting capabilities in the presence of shorts or ground faults on the customer side of the repeater.

Figure 1 illustrates the 239 H4R (front panel).

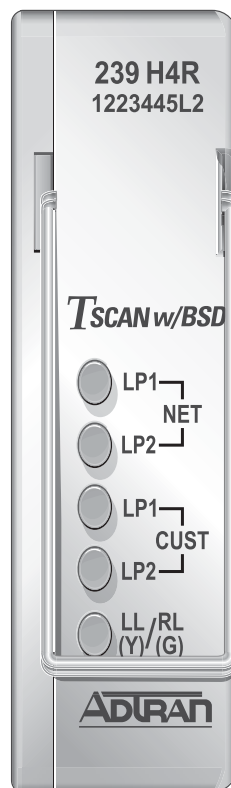


Figure 1. 239 H4R Front Panel

Description

The 239 H4R is designed for installation in pre-wired 239-sized outside plant (OSP) repeater housings and apparatus cases. Up to three 239 H4R units work in conjunction with an ADTRAN H4TU-C (HDSL4 Transceiver Unit for the Central Office) and an ADTRAN H4TU-R (T-200 HDSL4 Transceiver Unit for the Remote End) to provide DS1 service on the local loop.

The H4TU-C unit receives DSX-1 input signals from the network through the chassis. It then transports them across the HDSL4 circuit and terminates them through the H4TU-R unit, which provides a traditional DS1 to customer equipment. The H4TU-C provides testing, provisioning, and performance monitoring capabilities that address circuit status.

Features

The List 2 239 H4R has the same basic features as the List 1 239 H4R (P/N 61223445L1), and enhanced features and capabilities.

Basic Features

The basic features of the 239 H4R include the following:

- TC PAM line coding
- Lightning protection
- In-band loopback control
- Standard 239 form factor repeater apparatus case design
- Bad Splice Detection (refer to [“Bad Splice Detection”](#) on page 10)
- Fast Retrain (refer to [“Fast Retrain”](#) on page 12)
- TSCAN

Enhanced Features

Enhancements include the following:

- Fault Bridging (refer to [“Fault Bridging”](#) on page 10)
- Ground Fault Segment Identification
- Loop-to-Loop Detection
- Isolation relays in the span-powering circuitry, between the network and customer sides of the repeater.
- The ability to detect a ground fault or short on the customer side of the repeater.

Isolation Relays

Isolation relays are normally open without span powering. Once span powering is detected on the network-side, the 239 H4R monitors the customer-side to determine if a short or ground fault condition exists. If no short or ground fault is detected, the 239 H4R will close the relay, allowing span powering to pass from the network to the customer side.

Ground Fault or Short Detection

If a short or ground fault is detected, the 239 H4R will keep the relays open and continue to monitor the customer-side interface until the fault condition clears. During the fault condition, the network-side of that repeater can function normally, allowing for synchronization and loopback/sectionalization testing up to that repeater.

While the short or ground fault condition is present on the customer side of the repeater, the 239 H4R places a nominal -37 VDC on the customer-side, and every three seconds, will actively monitor the customer-side for the fault to clear. Once the 239 H4R detects that the condition is clear, the relays close, allowing span powering to pass to the customer side.

NOTE

The isolation process is only possible if the apparatus case is properly grounded.

Electrical Characteristics

That following table lists the electrical characteristics of all four input ports of the 239 H4R in an unpowered state.

Table 1. 239 H4R Electrical Characteristics

Subscriber Loop Test Set				Ohmmeter			
	T/R	T-GND	R-GND		T/R	T-GND	R-GND
NET 1	5	365K	365K	NET 1	5.8	14.4M	15.6M
NET 2	5	218K	217K	NET 2	5.8	16.1M	16.5M
CUST 1	7	91.9K	91.9K	CUST 1	5.7	24.4M	24.3M
CUST 2	6	61.2K	61.1K	CUST 2	5.9	24.0M	23.8M

Compliance

WARNING

Voltages up to –200 VDC with respect to ground and between individual telecommunications conductors may be present.

The HDSL4 239 H4R Repeater (P/N XXXXXXXXLX) is NRTL Listed to the applicable UL standards. The HDSL4 239 H4R Repeater (239 H4R) meets or exceeds all the applicable requirements of NEBS, Telcordia GR-63-CORE, and GR-1089-CORE. The 239 H4R is intended for deployment in 239 form factor outside plant (OSP) apparatus cases and cabinets.

Table 2 lists the compliance codes for the 239 H4R.

Table 2. Compliance Codes

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

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by ADTRAN could void the user's authority to operate this equipment.

CAUTION

Per GR-1089-CORE, the 239 H4R is designed and intended for installation as part of a Common Bonding Network (CBN). The 239 H4R is not designed nor intended for installation as part of an Isolated Bonding Network (IBN).

NOTE

The HDSL4 input and output ports are classified as Type 3 and 5, as defined in Appendix B of GR-1089-CORE Issue 4, and meets the lightning and power fault criteria with primary protectors that meet any of the voltage limits of GR-974-CORE or GR-1361-CORE (i.e., carbon blocks, gas tubes, and solid state).

NOTE

Current limiting protectors are not required.

Compatibility

The 239 H4R is used in conjunction with any T1.418-compliant, span-powering H4TU-C and H4TU-R.

Due to span power limits, the number of 239 H4R units permitted in the circuit depends on the type of H4TU-C in use. A 239 H4R provides DS1 transport on all revised resistance design (RRD) 26 AWG loops, 24 AWG loops, or both. Three 239 H4R repeaters can be added to extend the range of a loop.

The following criteria determines repeater placement:

- On single 239 H4R loops, consider the attenuation properties of the loop segment.
- For a circuit requiring two 239 H4Rs, satisfy both segment attenuation and segment DC resistance requirements.
- For a circuit requiring three 239 H4Rs, satisfy all H4TU-C and H4TU-R hardware requirements, segment attenuation, and segment DC resistance requirements.

Refer to the [“HDSL4 Deployment Guidelines”](#) on page 14 of this practice and the applicable installation and maintenance practice for the H4TU-C being deployed.

INSTALLATION



After unpacking the 239 H4R, inspect it for damage. If damage has occurred, file a claim with the carrier then contact ADTRAN Customer Service. Refer to “[Appendix A, Warranty](#)” for further information. If possible, keep the original shipping container for returning the 239 H4R for repair or for verification of shipping damage.

Shipping Contents

The contents include the following items:

- HDSL4 239 H4R Repeater (P/N 1223445L2)
- *HDSL4 239 H4R Repeater Job Aid* (P/N 61223445L2-22)
- *HDSL4 239 H4R Repeater Compliance Notice* (P/N 61223445L2-17)

CAUTION

Electrostatic discharge (ESD) can damage electronic modules. When handling modules, wear an antistatic discharge wrist strap to prevent damage to electronic components. Place modules in antistatic packing material when transporting or storing. When working on modules, always place them on an approved antistatic mat that is electrically grounded.

Installing the Module

The following are general installation considerations:

- To install the 239 H4R, refer to the installation and maintenance practice for the housing in use.

NOTE

There are no manual option settings for the 239 H4R.

CAUTION

Ensure that the OSP repeater housing or apparatus case is properly grounded.

- The H4TU-C provides power to the 239 H4R, independent of line impedance or wire gauge. The span power from the H4TU-C is passed through the 239 H4R and can also span-power additional H4Rs, the H4TU-R, or both. Refer to the “[HDSL4 Deployment Guidelines](#)” on page 14.
- The 239 H4R is suitable for deployment in any environmentally controlled, 239-type apparatus case. A retainer latch is available for securing the 239 H4R in the case.
- When the 239 H4R first powers up, it runs a power up self-test. Once the power up self-test is complete, the status LEDs reflect the true state of the hardware (see [Table 3](#)).

Front Panel LEDs

The 239 H4R provides front panel LEDs that display status information. [Table 3](#) lists the 239 H4R LEDs and status descriptions.

Table 3. Front Panel LEDs

Label	Status	Description
LP1/LP2 NET	○ Off	No span power is present
	● Green	Synchronized with an Signal-to-Noise Ratio (SNR) margin greater than the SNR Margin Alarm Threshold
	✱ Green, Fast Flashing	Flashing three times per second indicates attempt to synchronize with the H4TU-C
	✱ Green, Slow Flashing	Flashing once per second indicates synchronization with a SNR margin greater than the SNR Margin Alarm Threshold; attenuation is greater than the user recommended Loop Attenuation Alarm Threshold
	● Yellow	Synchronized with a SNR margin greater than 0 dB, but less than the SNR Margin Alarm Threshold
	✱ Yellow, Flashing	Synchronized with a SNR margin greater than 0 dB, but less than the SNR Margin Alarm Threshold; attenuation is greater than the Loop Attenuation Alarm Threshold
	● Red	Synchronized with a SNR margin of 0 dB
	✱ Red, Flashing	Flashing once per second indicates synchronization with a SNR margin of 0 dB; attenuation is greater than the Loop Attenuation Alarm Threshold
LP1/LP2 CUST	○ Off	No span power is present
	● Green	Synchronized with an Signal-to-Noise Ratio (SNR) margin greater than the SNR Margin Alarm Threshold
	✱ Green, Fast Flashing	Flashing three times per second indicates attempt to synchronize with the H4TU-R
	✱ Green, Slow Flashing	Flashing once per second indicates synchronization with a SNR margin greater than the SNR Margin Alarm Threshold; attenuation is greater than the Loop Attenuation Alarm Threshold
	● Yellow	Synchronized with a SNR margin greater than 0 dB, but less than the SNR Margin Alarm Threshold
	✱ Yellow, Flashing	Synchronized with a SNR margin greater than 0 dB, but less than the SNR Margin Alarm Threshold; attenuation is greater than the Loop Attenuation Alarm Threshold
	● Red	Synchronized with a SNR margin of 0 dB
	✱ Red, Flashing	Flashing once per second indicates synchronization with a SNR margin of 0 dB; attenuation is greater than the Loop Attenuation Alarm Threshold
LL/RL	● Green	A loopback is active at the H4R towards the H4TU-R
	● Yellow	A loopback is active at the H4R towards the H4TU-C
	✱ Yellow, Flashing	H4R is armed but not in loopback

FEATURE DETAILS

The 239 H4R has the following operational features:

- Fault Bridging
- Bad Splice Detection
- Fast Retrain
- TSCAN
- Ground Fault Segment Identifier
- Loop-to-Loop Detection

Fault Bridging

The Fault Bridging feature minimizes downtime due to intermittent impairments that appear on the cable pair, for example, from a Ground Fault Interrupt (GFI), short, micro-interruption, bad splice, or noise burst. This feature allows the DSL transceivers to maintain synchronization during an interruption, thus avoiding a 25 to 30-second retrain. Depending on the type of impairment, interruptions up to 200 ms can be bridged.

Bad Splice Detection

This 239 H4R supports the Runtime TScan 2.0™ Bad Splice Detection (TScan w/BSD) feature, an ADTRAN proprietary, non-intrusive algorithm for detection of anomalies (bad splices) in the copper plant. This feature monitors the cable pair during runtime for the presence of bad splices that can potentially impact service.

Poor cable splices are often undetected by normal testing methods. Often, these splices present no problem for the data transmission equipment until oxidation with the splice itself causes a rapid impedance change, which can cause errors, signal margin fluctuation, and retrain of the DSL transceivers. The splice detection feature is available from the Troubleshooting Screen through the craft access port.

Data transmission transceivers (especially echo-cancelled technologies) are subject to performance degradations and errors in the presence of bad splices. A splice may be benign for a time, allowing a circuit to behave appropriately for portions of the day. However, over time the splice oxidizes and incurs small, rapid changes in impedance. This inconsistency in behavior makes the problem difficult to locate. Additionally, an impedance change that is large enough to cause the transceiver trouble can still be small enough to be undetectable by test equipment used on the copper pairs. Therefore, a non-intrusive method of identifying these bad splices has been developed to aid the customer in troubleshooting the distribution plant.

NOTE

The Splice Detection Feature is a troubleshooting aide. Due to inconsistency in environmental conditions and their effect on telecommunications plant, ADTRAN cannot guarantee the accuracy of the measurements. Comparison to existing engineering drawings can provide exact locations of suspect splices indicated by ADTRAN algorithms.

Splices that are varying in impedance cause the HDSL data pump to see a reduced and/or fluctuating signal quality (margin). The HDSL data pump attempts to track these changes. When the changes become too severe, errors or loss of synchronization result.

View Splice Results Screen

Access to the Bad Splice Detection feature is through the Troubleshooting screen, using the craft access terminal of the H4TU-C or H4TU-R. Selecting the View Splice Results option from the Troubleshooting screen menu displays the View Splice Results screen (see [Figure 2](#)). The Splice Detection Results column lists the reported results for each transceiver:

- NTF - Indicates that the unit is active and has not detected any problems, or, the number of detected anomalies have not yet reached the detection count threshold. This threshold facilitates the reporting of the result to this screen (eight is the present threshold).
- LOS - Indicates that the unit has not detected the remote unit.
- Number - Indicates if the number of times an anomaly was detected exceeds the detection count threshold of eight. The number in this column represents the number of feet from the transceiver (Reference Point) to the anomaly. This number also reflects the highest anomaly count the unit sees, as it is possible to have more than one bad splice per circuit. This screen reports the worst (most frequently detected) anomaly.

Example

In [Figure 2](#), the View Splice Results screen example shows that a detection has occurred approximately 650 feet from an H4TU-C module on Loop 2 of the HDSL4 circuit.

```

Circuit ID:HTSVALHDSL4                               MM/DD/YY hh:mm:ss
                Press ESC to return to previous menu

* Note: Chronic Circuit Results are only valid after all other circuit *
* qualification tests have been performed and failed to show a trouble !! *

Splice Detector Version 1 Result Definitions:
-----
NTF   - No Trouble Found yet.
LOS   - Unit not in sync.
Number - Distance from Reference point (in ft.) of suspect splice.

Reference Point      Splice Detection Results      Version      Result Shown
                    Loop 1      Loop 2      Number      for date
-----
H4TUC                NTF          650          01          -----
H4TUR                NTF          NTF          01          06/17/04
H4RU1 NET            NTF          NTF          01
H4RU1 CST            NTF          NTF          01          (B)Back
  
```

Figure 2. View Splice Results Screen

Fast Retrain

Fast Retrain is an ADTRAN-proprietary feature that minimizes downtime when an intermittent, non-power related impairment (bad splice, noise burst, etc.) affects the HDSL loop and cannot be bridged.

When such an impairment occurs after achieving HDSL synchronization, Fast Retrain is invoked to restore service within 5 to 7 seconds. This short retrain time allows for reduced downtime compared to the traditional 25 to 30 second retrain duration.

NOTE

For proper functionality, install Fast Retrain capable units on both ends of the circuit. Failure of a Fast Retrain attempt initiates the traditional (25-30 second) retrain.

HDSL2 and HDSL4 transceivers normally train in approximately 25 to 30 seconds (for initial turnup, this time frame should be acceptable). However, once service has been established on the circuit, any large down-time will interrupt communications on the circuit. A loss of synchronization on the HDSL loop can cause excessive down times due not only to the 30-second HDSL retrain time, but also further delays due to the higher level protocols in the network going through re-synchronization. On the older generation HDSL2 and HDSL4 units, a 1-second loss of HDSL frame synchronization would cause the data pumps to retrain. This retrain would take approximately 25 seconds during which AIS would be sent to the terminating equipment. The reception of AIS by the terminating equipment then might trigger higher level protocol re-synchronizations.

In an effort to minimize this down time, the Fast Retrain feature has been implemented. If an impairment (bad splice, for example) causes the HDSL data pump to lose frame synchronization for 500 msec or longer, instead of retraining, the system attempts a Fast Retrain. This abbreviated train can achieve data mode in 5 to 7 seconds. A successful fast retrain should be evident by watching the Span Status screen and by reduced unavailable seconds (UAS) in the PM data for each LOS alarm recorded.

Connections

All connections take place through card edge connectors.

[Table 4](#) provides the card edge pin assignments.

CAUTION

The 239 H4R dissipates a maximum of 5.4 watts.

CAUTION

Ensure that the chassis ground is securely connected to the OSP apparatus case. [Table 4](#) lists the ground pin designations.

Table 4. 239 H4R Card Edge Pin Assignments

Pin	Designation	Description
1	GND	Ground
2	NC	No Connect
3	T1	Customer Loop 1 Tip
4	R1	Customer Loop 1 Ring
5	T1	Network Loop 1 Tip
6	R1	Network Loop 1 Ring
7	NC	No Connect
8	T	Network Loop 2 Tip
9	R	Network Loop 2 Ring
10	GND	Ground
11	T	Customer Loop 2 Tip
12	R	Customer Loop 2 Ring

HDSL4 Deployment Guidelines

Refer to the applicable H4TU-C installation and maintenance practice, HDSL4 Deployment Guidelines section, for loop parameters, including attenuation and loop resistance considerations.

NOTE

The H4TU-C with part numbers 1221401L6, 1221403L6, and 1221404L6 support only one 239 H4R in the HDSL4 circuit.

Refer to the Detailed Status Screen by accessing the menus on the H4TU-C craft terminal interface for current Signal-to-Noise Ratio Margin and Attenuation status indications for the circuit.

239 H4R Capacity Guidelines

The 239 H4R is designed for installation in a prewired apparatus case. [Table 5](#) and [Table 6](#) define the capacity guidelines for deployment. The housing capacity numbers are based on testing results.

Table 5. 239 H4R Capacity Guidelines for ADTRAN Housings

Part Number	Description	CLEI Code	Slots	Stub	H4R Capacity		Recommended Slot Assignments		Material
					Above Ground	Below Ground	Above Ground	Below Ground	
1150027L1	239/439 Housing	DDMOABA1MA	4	Air	4	4	All	All	Stainless/Polymer
1150027L2	239/439 Housing	DDMOBBA1MA	4	Gel	4	4	All	All	Stainless/Polymer
1150057L1	Universal Housing	DDMODA01RA	4	Air	4	4	All	All	Stainless Steel
1150057L1	Universal Housing	DDMODA01RA	4	Gel	4	4	All	All	Stainless Steel
1150058L1	Universal Housing	DDMOEE01RA	8	Air	8	8	All	All	Stainless Steel
1150058L2	Universal Housing	DDMOFE01RA	8	Gel	8	8	All	All	Stainless Steel

Table 6. 239 H4R Capacity Guidelines for Other Housings

Manufacturer	Description	Manufacturer's Part Number	Slots	H4R Capacity		Recommended Slot Assignments		Material
				Above Ground	Below Ground	Above Ground	Below Ground	
ADC	Radiator II	SPX-HRXC-30-AG-016GT	16	16	16	All	All	Stainless Steel
ADC	Radiator	SPX-HRXC-30-B1	8	8	8	All	All	Stainless Steel
Circa Telecom	HDSL-12A	760005	12	12	12	All	All	Stainless Steel
Circa Telecom	HDSL-12B	760006	12	12	12	All	All	Stainless Steel
Arris/ Lucent/ AT&T	Keptel® Inter Link™ 809	RF809A3-XXX or RF809B3-XXX	12	8	N/A	1, 3, 4, 6 7, 9, 10, 12	N/A	Polymer
Arris/ Lucent/ AT&T	Keptel® Inter Link™ 818/819	RF819A1 or RF819A2 RF819B1 or RF819B2	25	12	16*	Chamber 1: 1, 4, 7, 8, 11, 14 Chamber 2: 15, 17, 19, 20, 23, 25	Chamber 1: 1, 3, 5, 7, 8, 10, 12, 14 Chamber 2: 15, 16, 18, 19, 20, 22, 24, 25	Polymer
Arris	Keptel Inter Link 819 Family	AT819B1U or AT819A1U	12	8	8	2, 3, 5, 6, 8, 9, 11, 12	2, 3, 5, 6, 8, 9, 11, 12	Polymer
Arris/ Lucent/AT&T	Keptel Inter Link 820 Family	RF820AX or RF820BX	2 to 8	Full	Full	All	All	Polymer
Charles Industries	G21 Series	6212050002xx	25	12	N/A	1,2,4,6,7,8,9, 11,13,15,18,2 4	N/A	Stainless Steel
Charles Industries	G21 Series	6212040002xx	12	6	N/A	1,3,4,6,8,11	N/A	Stainless Steel

* For 16 slot use, the ambient air temperature measured 1 foot away and parallel to the housing should not exceed 115°F (46.1°C).

MAINTENANCE

The 239 H4R requires no routine maintenance for normal operation. Do not attempt repairs in the field. Repair services may be obtained by returning the defective unit to ADTRAN. Refer to the “[Appendix A, Warranty](#)” for further information.

In case of equipment malfunction, perform an in-band loopback from the Central Office. If a malfunction is confirmed, replace the unit.

The 239 H4R has looping capability through the channel allowing digital loopback in fault isolation. The loopback is activated remotely. The type of loopbacks the 239 H4R supports are dependent on the loopback capabilities of the transceiver units in use on the circuit. Refer to the applicable installation and maintenance practice of the specific H4TU-C or H4TU-R for a list of loopback codes.

Performance monitoring, diagnostics, and loopbacks are also available from the craft interface at the H4TU-C or H4TU-R.

CAUTION

When testing indicates a faulty 239 H4R, refer to the housing installation and maintenance practice for the entry and pressurization control, then replace the faulty unit.

SPECIFICATIONS

Table 7 lists the specifications for the 239 H4R.

Table 7. 239 H4R Specifications

Specification	Description
Environmental	
Operating Temperature:	-40°C to 70°C
Storage Temperature:	-40°C to 85°C
Relative Humidity:	95 percent maximum at 50°C, noncondensing
Maximum Current Draw:	0.025 A maximum at -48VDC
Maximum Heat Dissipation:	1.21 watts
Physical	
Dimensions:	Height: 3.125 inches Width: 1.14 inches Depth: 10.1 inches
Weight:	< 11 pounds
Power	
239 H4R Input Power	5.0 watts (span powered by H4TU-C)
Loop Interface	
Modulation Type:	16 TC PAM
Mode:	Full Duplex, Partially overlapped echo canceling
Number of Pairs:	2
Line Rate:	1.552 Mbps
Baud Rate:	261.333 k baud
Loop Loss:	Refer to “ HDSL4 Deployment Guidelines ” on page 14.
Bridged Taps:	Single Taps < 2000 ft., Total Taps < 2500 ft.
Performance:	Compliant with T1.418-2000 (HDSL4 Standard, Issue 2)
H4TU-C Transmit Power (Data) Level:	14.1 ±0.5 dBm (0 to 400 kHz)
H4TU-C Transmit Power (Activation) Level:	14.1 ±0.5 dBm (0 to 307 kHz)
Input Impedance:	135 ohms
Maximum Loop Resistance:	Refer to “ HDSL4 Deployment Guidelines ” on page 14.
Return Loss:	12 dB (50 kHz to 200 kHz)
Clock	
Clock Sources:	DSX-1 Derived (with HDSL4 frame bit stuffing)
Internal Clock Accuracy:	±25 ppm (Exceeds Stratum 4), Meets T1.101 Timing Requirements

Table 7. 239 H4R Specifications

Specification	Description
Tests	
Diagnostics:	Loopback initiated with in-band codes or from H4TU-C or H4TU-R craft interface
Compliance	
	UL 60950
	GR-63-CORE
	GR-1089-CORE
	NEBS Level 3 (SR-3580)
	FCC 47CFR Part 15, Class A
Part Number	
HDSL4 239 H4R Repeater:	XXXXXXXXLX

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Appendix A

Warranty

WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within the warranty period if it does not meet its published specifications or fails while in service. Warranty information can be found at www.adtran.com/warranty.

Refer to the following subsections for sales, support, Customer and Product Service (CAPS) requests, or further information.

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

Contact CAPS prior to returning equipment to ADTRAN.

ADTRAN, Inc.

CAPS Department

901 Explorer Boulevard

Huntsville, Alabama 35806-2807



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