



239 T1 HDSL4 Repeater (H4R) Installation and Maintenance Practice

Part Number - 61223445L1-5D



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Revision History

Revision	Date	Description of Changes
D	October 2004	Updated to add Bad Splice Detect and Fast Retrain feature descriptions

Conventions

The following typographical conventions are used in this document:

[This font](#) indicates a cross-reference link. First-time references to tables and figures are shown in **this font**.

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 silkscreen 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's product lines. ADTRAN provides a variety of training options, including customized training and course taught at our facilities or at customer sites. For more information about training, please contact us.

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239 T1 HDSL4 Repeater (H4R)

1. GENERAL

This practice is an installation and maintenance guide for the ADTRAN® 239 T1 HDSL4 Repeater (H4R) (239 H4R). **Figure 1** illustrates the 239 H4R (P/N 1223445L1) front panel.

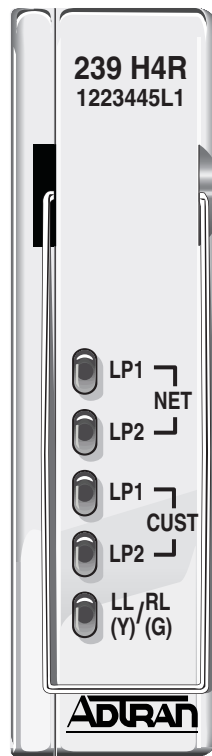


Figure 1. HDSL4 239 T1 HDSL4 Repeater (H4R)

2. DESCRIPTION

HDSL4 provides extended range T1 (DS1) transport on the telecommunications network. HDSL4 features spectral compatibility with ADSL and other transport technologies.

This 239 H4R performs signal regeneration to extend the range of the HDSL4 circuit.

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

The H4TU-C works in conjunction with the ADTRAN H4TU-R (Remote) and up to three H4Rs (Repeaters) to provide a DS1 service on the local loop.

Features

The basic features of the HDSL4 239 T1 HDSL4 Repeater (H4R), include the following:

- TC PAM line coding
- Lightning protection
- In-band loopback control
- Standard 239 form factor repeater apparatus case design
- Remote provisioning and pass-through performance monitoring
- Bad Splice Detection
- Fast Retrain

Bad Splice Detection Feature

This 239 H4R supports the Runtime TScan 2.0™ bad splice detection feature, an ADTRAN proprietary non-intrusive algorithm for detection of anomalies (bad splices) in the copper pair.

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 period of time, allowing a circuit to behave appropriately for portions of the day. However, over time the splice will oxidize and incur 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 may still be small enough to be undetected by test equipment utilized on the copper pairs. Therefore a non-intrusive method of identifying these bad splices has been developed to aid the customer in troubleshooting their distribution plant.

NOTE

The Splice Detection Feature is included with this product as an aid to troubleshooting. 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 should provide exact locations of suspect splices indicated by ADTRAN algorithms.

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

View Splice Results Screen

The Bad Splice Detection feature is accessed from the Troubleshooting screen via the craft access terminal of the H4TU-C or H4TU-R. Selecting the View Splice Results option from the Troubleshooting screen menu displays the screen illustrated in [Figure 2](#). Results will be reported in the Splice Detection Results column for each transceiver:

- NTF - Reported if the unit is active and no problems have been detected or the number of anomalies detected have not yet reached the detection count threshold, which facilitates the reporting of the result to this screen. (Eight is the present threshold.)
- LOS - Reported if the remote unit has not been detected.
- Number - Reported if an anomaly has been detected a number of times that exceeds the detection count threshold of eight. The number shown in this column represents the number of feet from the transceiver (Reference Point)

to that anomaly. This number will also reflect the highest anomaly count seen, as it is possible to have more than one bad splice per circuit. This screen will report the worst (most frequently detected) anomaly.

In this example, a detection has occurred approximately 650 feet from an H4TU-C module on Loop 2 of the HDSL4 circuit.

```

Circuit ID:HTSVALHDSL4                                06/17/04 07:32:04
                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      Splice Detection Results          Version      Result Shown
Point          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. Splice Results Screen

Fast Retrain Feature

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

HDSL2 and HDSL4 transceivers normally train in approximately 25 to 30 seconds. For an initial circuit turn-up, this is not a big issue. 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, a fast retrain will be attempted. 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.

NOTE

Fast-Retrain capable units must be installed on both ends of the HDSL4 circuit for this feature to function properly. Also, if there is a failure of a fast retrain attempt, for any reason, then the traditional (25-30 second) retrain will be initiated.

Compatibility

The 239 H4R is used in conjunction with any T1.418 compliant span powering H4TU-C and H4TU-R. Compatible ADTRAN HDSL4 transceiver units are listed in [Table 1](#).

Table 1. ADTRAN Unit Compatibility

Part Number	Unit Name
118141xLy	Total Access 3000 H4TU-C
122x401Ly	220 H4TU-C
122x403Ly	DDM+ H4TU-C
122x404Ly	3192 H4TU-C
122x407Ly	Soneplex H4TU-C
122x424Ly	T200 H4TU-R, Local Power
122x426Ly	T200 H4TU-R, Span Power

x = any generic number; y = any list number

Due to span power limits, the number of H4Rs permitted in the circuit depends upon the type of H4TU-C utilized. An ADTRAN 239 H4R provides DS1 transport on all revised resistance design (RRD) 26 AWG and/or 24 AWG loops. Three ADTRAN 239 H4R repeaters may be added to extend the range of a loop.

Repeater placement is determined by the following criteria:

- On single H4R loops, only on the attenuation properties of the loop segment must be considered.
- For a circuit requiring two H4Rs, both segment attenuation as well as segment DC resistance requirements be satisfied.
- For a circuit requiring three H4Rs, H4TU-C and H4TU-R hardware requirements, segment attenuation, and segment DC resistance requirements must all be satisfied.

Refer to the [“HDSL4 Deployment Guidelines”](#) on page 6 of this practice and the Installation and Maintenance Practice for the deployed H4TU-C.

Compliance

[Table 2](#) shows the compliance codes for the 239 H4R. The 239 H4R is NRTL listed to the applicable UL standards. The 239 H4R is to be installed in a restricted access location and in a Type “B” or “E” enclosure only.

Table 2. Compliance Codes

Code	Input	Output
Power Code (PC)	C	C
Telecommunication Code (TC)		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.

3. 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:

- 239 T1 HDSL4 Repeater (H4R)
- 239 T1 HDSL4 Repeater (H4R) Job Aid

CAUTION

Electronic modules can be damaged by ESD. 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.

There are no manual option settings for the H4R.

H4R power is derived from an H4TU-C, independent of line impedance or wire gauge. The operating power from the H4TU-C may also be used to span power the H4TU-R.

The 239 H4R is designed for deployment in any environmentally controlled 239-type apparatus case.

A retainer latch is available for securing the 239 H4R in the apparatus case.

When installing the ADTRAN 239 H4R refer to the Installation and Maintenance Practice for the housing being used.

4. CONNECTIONS

All connections are made through card edge connectors.

Table 3 provides the card edge pin assignments.

CAUTION

The H4R dissipates a maximum of 5.4 watts.

NOTE

Ensure that the chassis ground is securely connected to the apparatus case. Ground pin designations are defined in [Table 3](#).

Table 3. 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

5. HDSL4 DEPLOYMENT GUIDELINES

Refer to the 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 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.

6. H4R CAPACITY GUIDELINES

The ADTRAN 239 H4R is designed for installation in a prewired apparatus case, and the capacity guidelines for deployment are defined in Table 3 and Table 4. These housing capacity numbers are based upon testing results.

Table 4. 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 5. 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

* 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).

7. FRONT PANEL LEDS

The ADTRAN 239 H4R provides front panel LEDs to display status information. See [Table 6](#) for a listing of the front panel LEDs and their indications.

Table 6. Front Panel LEDs

Unit	Label	Indication	Description
	LP1/LP2 NET	<ul style="list-style-type: none"> ○ Off ● Solid Green ✱ Fast Flashing Green ✱ Slow Flashing Green ● Solid Yellow ✱ Flashing Yellow ● Solid Red ✱ Flashing Red 	<p>No span power is present</p> <p>Synchronized with an Signal to Noise Ratio (SNR) margin greater than the recommended SNR Margin Alarm Threshold</p> <p>(Flashing 3 times per second) Attempting to synchronize with the H4TU-C</p> <p>(Flashing once per second) Synchronized with a SNR margin greater than the recommended SNR Margin Alarm Threshold, and the attenuation is greater than the user recommended Loop Attenuation Alarm Threshold</p> <p>Synchronized with a SNR margin greater than 0 dB but less than the recommended SNR Margin Alarm Threshold</p> <p>Synchronized with a SNR margin greater than 0 dB but less than the recommended SNR Margin Alarm Threshold, and the attenuation is greater than the user recommended Loop Attenuation Alarm Threshold</p> <p>Synchronized with a SNR margin of 0 dB</p> <p>(Flashing once per second) Synchronized with a SNR margin of 0 dB, and the attenuation is greater than the recommended Loop Attenuation Alarm Threshold</p>
	LP1/LP2 CUST	<ul style="list-style-type: none"> ○ Off ● Solid Green ✱ Fast Flashing Green ✱ Slow Flashing Green ● Solid Yellow ✱ Flashing Yellow ● Solid Red ✱ Flashing Red 	<p>No span power is present</p> <p>Synchronized with an Signal to Noise Ratio (SNR) margin greater than the recommended SNR Margin Alarm Threshold</p> <p>(Flashing 3 times per second) Attempting to synchronize with the H4TU-R</p> <p>(Flashing once per second) Synchronized with a SNR margin greater than the recommended SNR Margin Alarm Threshold, and the attenuation is greater than the user recommended Loop Attenuation Alarm Threshold</p> <p>Synchronized with a SNR margin greater than 0 dB but less than the recommended SNR Margin Alarm Threshold</p> <p>Synchronized with a SNR margin greater than 0 dB but less than the recommended SNR Margin Alarm Threshold, and the attenuation is greater than the user recommended Loop Attenuation Alarm Threshold</p> <p>Synchronized with a SNR margin of 0 dB</p> <p>(Flashing once per second) Synchronized with a SNR margin of 0 dB, and the attenuation is greater than the recommended Loop Attenuation Alarm Threshold</p>
	LL/RL	<ul style="list-style-type: none"> ● Solid Yellow ✱ Flashing Yellow ● Solid Green 	<p>Indicates that a loopback is active at the H4R towards the H4TU-C</p> <p>H4R is armed but not in loopback</p> <p>Indicates that a loopback is active at the H4R towards the H4TU-R</p>

8. MAINTENANCE

The HDSL4 239 T1 HDSL4 Repeater (H4R) requires no routine maintenance for normal operation. In case of equipment malfunction, perform an in-band loopback from the Central Office. If a malfunction is confirmed, replace the unit.

The ADTRAN 239 H4R has looping capability through the channel allowing digital loopback in fault isolation. The loopback is activated remotely. The type of loopbacks the H4R supports will be dependent upon the loopback capabilities of the transceiver units utilized on the circuit. Refer to the 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 H4R, refer to the housing Installation and Maintenance Practice for the entry and pressurization control, the replace the faulty unit.

ADTRAN does not recommend that repairs be attempted in the field. Repair services may be obtained by returning the defective unit to ADTRAN. Refer to [“Appendix A, Warranty”](#) for further information.

9. SPECIFICATIONS

Specifications for the HDSL4 239 T1 HDSL4 Repeater (H4R) are detailed in [Table 7](#).

Table 7. 239 T1 HDSL4 Repeater (H4R) Specifications

Specification	Description
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 6.
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 6.
Return Loss:	12 dB (50 kHz to 200 kHz)
Power <i>Tested with the ADTRAN H4TU-R (P/N 1223426L1) and H4R (P/N 1223445L1)</i>	
H4R Input Power	5.0 watts (span powered by H4TU-C)
Clock	
Clock Sources:	DSX-1 Derived (with HDSL4 frame bit stuffing)
Internal Clock Accuracy:	±25 ppm (Exceeds Stratum 4), Meets T1.101 Timing Requirements
Tests	
Diagnostics:	Loopback initiated with in-band codes or from H4TU-C or H4TU-R craft interface
Physical	
239 Repeater, Apparatus Shelf-Mounted, Weight:	< 11b.
Environment	
Standard Operating Temperature:	-40°C to +70°C
:Storage Temperature:	-40°C to +85°C
Compliance	
UL 60950 NEBS Level 3 (SR-3580) FCC 47CFR Part 15, Class A	
Part Number	
239 T1 HDSL4 Repeater (H4R):	1223445L1

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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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