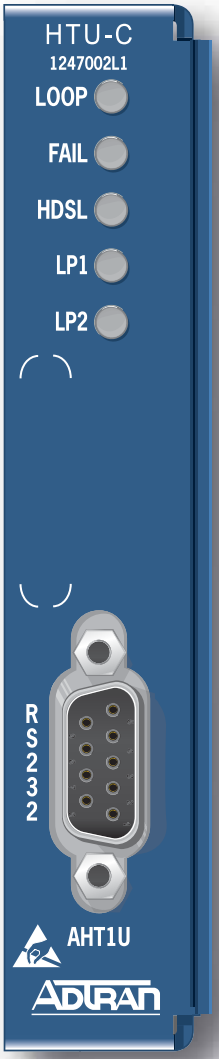

HTU-C using Narrowband/Wideband for Litespan®
Installation and Maintenance Practice

Document Number: 61247002L1-5A
CLEI: SLL7AAAA_ _
March 2008

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Revision History

Revision	Date	Description
A	March 2008	Initial release

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.

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HTU-C using Narrowband/ Wideband for Litespan

GENERAL

This practice is an installation and maintenance guide for the ADTRAN HTU-C using Narrowband/Wideband for Litespan (HTU-C NB/WB for Litespan). The HTU-C NB/WB for Litespan (P/N 1247002L1) front panel is illustrated in Figure 1.

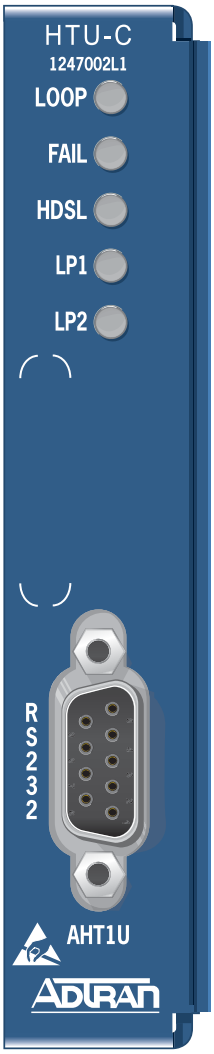

Figure 1. HTU-C NB/WB for Litespan Front Panel

DESCRIPTION

The HTU-C NB/WB for Litespan is a DS1 interface unit that provides full T1 service over 4-wire interface facilities. The HTU-C NB/WB for Litespan combines ADTRAN HDSL technology and Alcatel-Lucent Litespan technology to provide an HDSL interface to a Litespan system.

The HTU-C NB/WB for Litespan is certified by Alcatel-Lucent to safely operate in Litespan 2000 and Starspan systems. The unit is licensed under the Asynchronous High-bit-rate Digital Subscriber Line TI Interface Unit (AHT1U) channel unit type.

Features

- RS-232 maintenance port
- Lightning and power cross-protection, static discharge immunity, and local power bus fusing for line card safety and protection
- 784 kbps dual duplex 2B1Q HDSL transmission over two wire pairs
- Front panel status LEDs
- Performance monitoring and alarm reporting
- Low power consumption
- –137 volt span powering capability of up to 1 HRE and 1 HTU-R
- Corrosion-preventive sealing current over both twisted copper pairs
- Troubleshooting functionality

Asynchronous counterparts to the HTU-C NB/WB for Litespan are the asynchronous DSX-1 interface unit (ADS1U) and the asynchronous T1 interface unit (AT1U). ADTRAN provides the HTU-C NB/WB for Litespan for connection to narrowband and wideband service pairs. The List 1 provides the most flexibility for installations where the narrowband/wideband service connection is not known. It also provides flexibility of switching between narrowband and wideband services without needing a different HTU-C.

CAUTION

If the List 1 is used in applications where narrowband and wideband copper service wire pairs are connected simultaneously, only one service pair may have terminating equipment connected to the HTU-C NB/WB for Litespan. Also, copper service wire pairs not in use are considered as bridge taps to the HDSL loops in service and should be entered into the deployment calculations listed in “HDSL Deployment Guidelines” on page 27. If the bridged taps presented by the unused loop violates the CSA guidelines, the unused pair should be disconnected.

Each ADTRAN HTU-C NB/WB for Litespan provides a 1.544 Mbps data transport over two unconditioned CSA copper pairs that are in accordance with TA-NWT-001210. These CSA loops can range up to 12 kft of 24-AWG twisted pair wire. All comply with Bellcore GR1089-CORE, UL1459, FCC Class A subpart J, and Alcatel-Lucent requirements for a generic subscriber interface unit.

The HTU-C NB/WB for Litespan can be used in Litespan 2000, Litespan 2012, and Litespan ONU channel bank assembly (CBA) systems containing Litespan system software versions of 7.1.3 or higher. Each HTU-C works with the following multiple list versions of the HDSL unit remote end (HTU-R), and HDSL Range Extender (HRE):

Table 1. HDSL List Versions

Part Number	Description
1247024Lx	Locally Powered HTU-R T200
1247026Lx	Low Voltage HTU-R T200
1247041Lx	Low Voltage T200 HRE
1247045Lx	Low Voltage 239 HRE
1246026Lx	Low Voltage HTU-R T200
1246041Lx	Low Voltage T200 HRE
1246045Lx	Low Voltage 239 HRE
1245024L1	Low Voltage HTU-R T400

x = any generic number

The HTU-C NB/WB for Litespan can be deployed in circuits consisting of one HTU-C and one HTU-R. When deployment requires the HRE, which doubles the service range, the HTU-C NB/WB for Litespan can be deployed with one Low Voltage HRE and one Low Voltage HTU-R.

The HDSL local loop operates as two independent subsystems, each operating over a single twisted pair. The HTU-C NB/WB for Litespan communicates over these two twisted pairs to the HTU-R. Each subsystem carries half of the total bandwidth along with a small amount of overhead used for maintenance and performance monitoring.

Lightning and power cross-protection is provided at each twisted pair interface of the ADTRAN HTU-C NB/WB for Litespan line card. Local power bus fusing is also used to protect the Litespan channel bank backplane, Litespan bank power supplies, and neighboring Litespan line cards in the event of catastrophic line card failure.

The HTU-C NB/WB for Litespan uses a DC-to-DC converter to derive span powering voltage from the Litespan –48 VDC switched battery supply. The HTU-C NB/WB for Litespan can span power HREs and HTU-Rs as listed above.

Simplex current of 30 to 155 mA of current may be coupled onto the HDSL loop span to power the HTU-R and HRE when deployed (see Figure 2). Span powering voltages meet all requirements of Class A2 voltages as specified by Bellcore GR-1089-CORE.

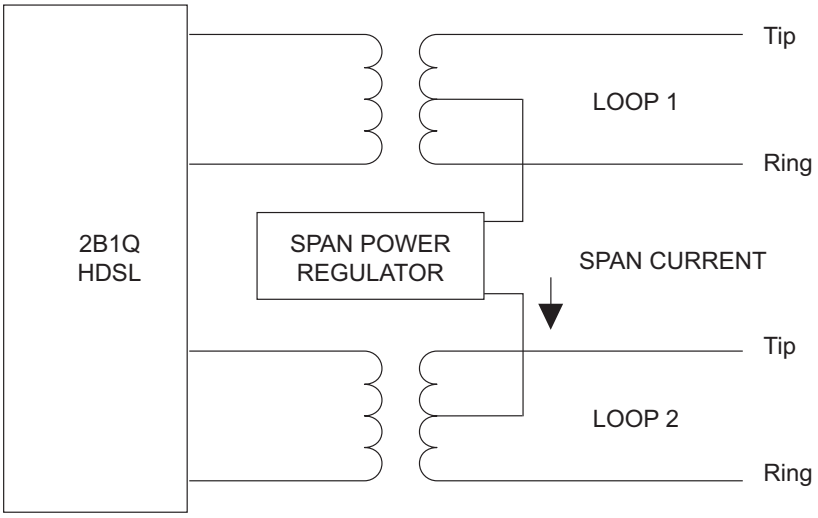

Figure 2. HTU-C Span Powering Diagram

Shipping Contents

The contents include the following items:

- HTU-C using Narrowband/Wideband for Litespan
- *HTU-C using Narrowband/ Wideband for Litespan Job Aid* (P/N 61247002L1-22)
- *HTU-C using Narrowband/ Wideband for Litespan Compliance Notice* (P/N 61247002L1-17)

Compliance

The HTU-C NB/WB for Litespan is NRTL Listed to the applicable UL standards for Continuous Use in –40°C to +50°C environmental conditions. Care should be exercised when handling equipment when temperatures at these extremes exist, as surfaces could be very cold or hot.

The HTU-C NB/WB for Litespan meets or exceeds all the applicable requirements of NEBS, Telcordia GR-63-CORE and GR-1089-CORE and is evaluated to ensure proper Operational Performance is maintained if Environmental Conditions ranging from –40°C to +71°C are encountered.

The HTU-C NB/WB for Litespan is intended for deployment in Central Office type facilities, EEEs, EECs, and locations where the NEC applies (for example, Customer Premises). Install the HTU-C NB/WB for Litespan in the appropriate chassis which is intended to be installed only in Restricted Access Locations by qualified personnel.

Table 2. Compliance Codes

Configuration Codes	Input	Output
Power Code (PC)	F	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.

WARNING

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

CAUTION

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

CAUTION

Per GR-1089-CORE Section 9, the HTU-C NB/WB for Litespan does not have an internal DC connection between battery return and frame ground. As such, it may be installed in a DC-I (isolated) or DC-C (common) installation. For installations where other cards or the host system have internal connections between battery return and frame ground, the system would be intended for deployment only in a DC-C installation.

NOTE

The HDSL port is classified as Type 1, 3, and 5, as defined in Appendix B of GR-1089-CORE Issue 4, and meets the lightning and power fault criteria with any primary protector that meets any of the voltage limits of GR-974-CORE or GR-1361-CORE (for example., carbon blocks, gas tubes, solid states, etc.).

NOTE

The HTU-C NB/WB for Litespan is designed to operate with a nominal operating voltage of –48 VDC and a minimum operating voltage of –40 VDC. The HTU-C NB/WB for Litespan is not damaged by any steady state voltage below –56.7 VDC.

NOTE

Current limiting protectors are not required.

Front Panel LEDs

LED indicators mounted on the front panel of the unit provide the status of the HDSL circuit. See Table 3 for a listing of the front panel LEDs and their indications.

Table 3. Front Panel LED Indicators

Label	Status		Description
LOOP	○	Off	Unit is not in armed or loopback state.
	●	Green	Loopback is active on this unit.
	✷	Green Flashing	Unit is in an armed state but not in loopback.
FAIL	○	Off	Unit is initialized and working properly.*
	●	Red	Unit is initializing or unable to operate.*
HDSL	○	Off	Both Loops are synchronized with no alarms at the DS1 interface
	●	Yellow	Both Loops are synchronized, but there is a yellow or red alarm at the DS1 interface
	●	Red	One or both loops are out of synchronization
LP1 /LP2	○	Off	No synchronization between HTU-C and HTU-R on loop 1/loop 2
	●	Green	Good signal quality on loop 1/loop 2
	●	Yellow	Marginal signal quality on loop 1/loop 2
	●	Red	Severely impaired signal quality on loop 1/loop 2
	☼	Flashing	Error detected on either end of loop 1/loop 2

* Illuminates upon HTU-C power up. Remains on until the HTU-C is successfully initialized. The length of time to complete this procedure is dependant on activity of the terminal control processor in the common control assembly of the Litespan system.

APPLICATIONS

The ADTRAN HDSL system provides a cost-effective alternative for deploying T1 service over metallic cable pairs. In contrast with traditional T1 service equipment, ADTRAN HDSL can be successfully deployed over two unconditioned, non-loaded, bridged-tapped copper pair CSA loops (refer to "HDSL Deployment Guidelines" on page 27).

Litespan HDSL deployment is typically made from a Litespan 2000, Litespan 2012, or Litespan ONU channel bank assembly. Figure 3 shows possible ADTRAN HDSL deployments from a Litespan channel bank assembly.

ADTRAN HDSL systems can be deployed quickly without the use of expensive T1 repeater equipment on standard CSA loops while using the existing massive copper-fed twisted line pairs in use by the industry.

ADTRAN uses negative ground-referenced span powering voltage (–137 VDC) on HDSL loop 2 while loop 1 remains at ground. This prevents corrosion associated with positive ground reference voltage while providing power for the HTU-R. HTU-R span powering can be disabled to allow locally-powered HTU-R applications, if desired.

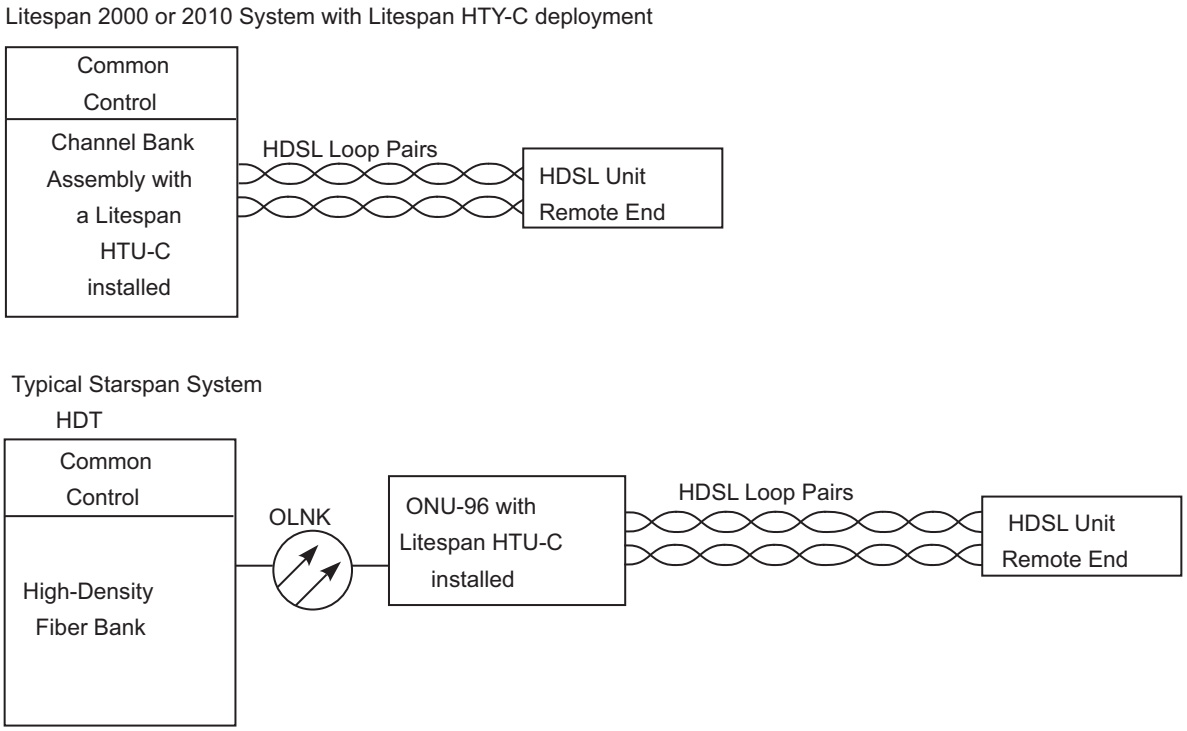

Figure 3. Deployments from a Litespan CBA

If normal CSA loops need expanding beyond the maximum range of an HTU-C/HTU-R HDSL system, a span-powered HRE can be added to effectively double the HDSL serving area. Addition of a span-powered HRE still allows span powering to be passed through to a span-powered HTU-R, providing a totally span-powered HDSL system. However, addition of an HRE adds to the total power consumption from the Litespan channel bank assembly and requires recalculation of the power budget deployment guidelines (refer to "HDSL Deployment Guidelines" on page 27). HRE deployment may limit total Litespan line card deployment.

INSTALLATION

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.

After unpacking the HTU-C NB/WB for Litespan, inspect it for damage. If damage has occurred, file a claim with the carrier, then contact ADTRAN Customer Service. If possible, keep the original shipping container for returning the unit for repair or for verification of shipping damage. Refer to "Appendix A, Warranty" for further information.

The HTU-C NB/WB for Litespan plugs directly into a Litespan channel bank assembly channel unit slot. Litespan system software must be 7.1.3 or higher. See Figure 4 for card edge connections.

Upon insertion of an HTU-C NB/WB for Litespan, the **FAIL** LED should turn on immediately. The **FAIL** LED remains on until the Litespan bank recognizes the insertion of the card and downloads the AHT1U channel unit type code into the line card. Typically, the **FAIL** LED remains on for approximately 15 to 20 seconds (time may vary). Approximately 3 to 4 seconds after the **FAIL** LED turns off, the **HDSL** LED turns red and remains so until the HTU-C NB/WB for Litespan and HTU-R units synchronize with each other over both HDSL loops.

CAUTION

Prior to installing or removing the HTU-C NB/WB for Litespan, make sure to observe the following: If the HTU-C NB/WB for Litespan is removed from a line card slot, wait at least 15 seconds before reinsertion If connected to the MTI craft interface terminal, wait until the message "AID:MJ,UEQ.." appears (where "AID" is the access identifier). This informs the Litespan common control assembly that the HTU-C NB/WB for Litespan has been removed from its slot, after which the common control assembly begins looking for the reinsertion of the line card. Reinsertion any earlier than this may temporarily lock the HTU-C into a nonfunctional state because the common control assembly will not send the AHT1U equipment type code to the HTU-C NB/WB for Litespan.

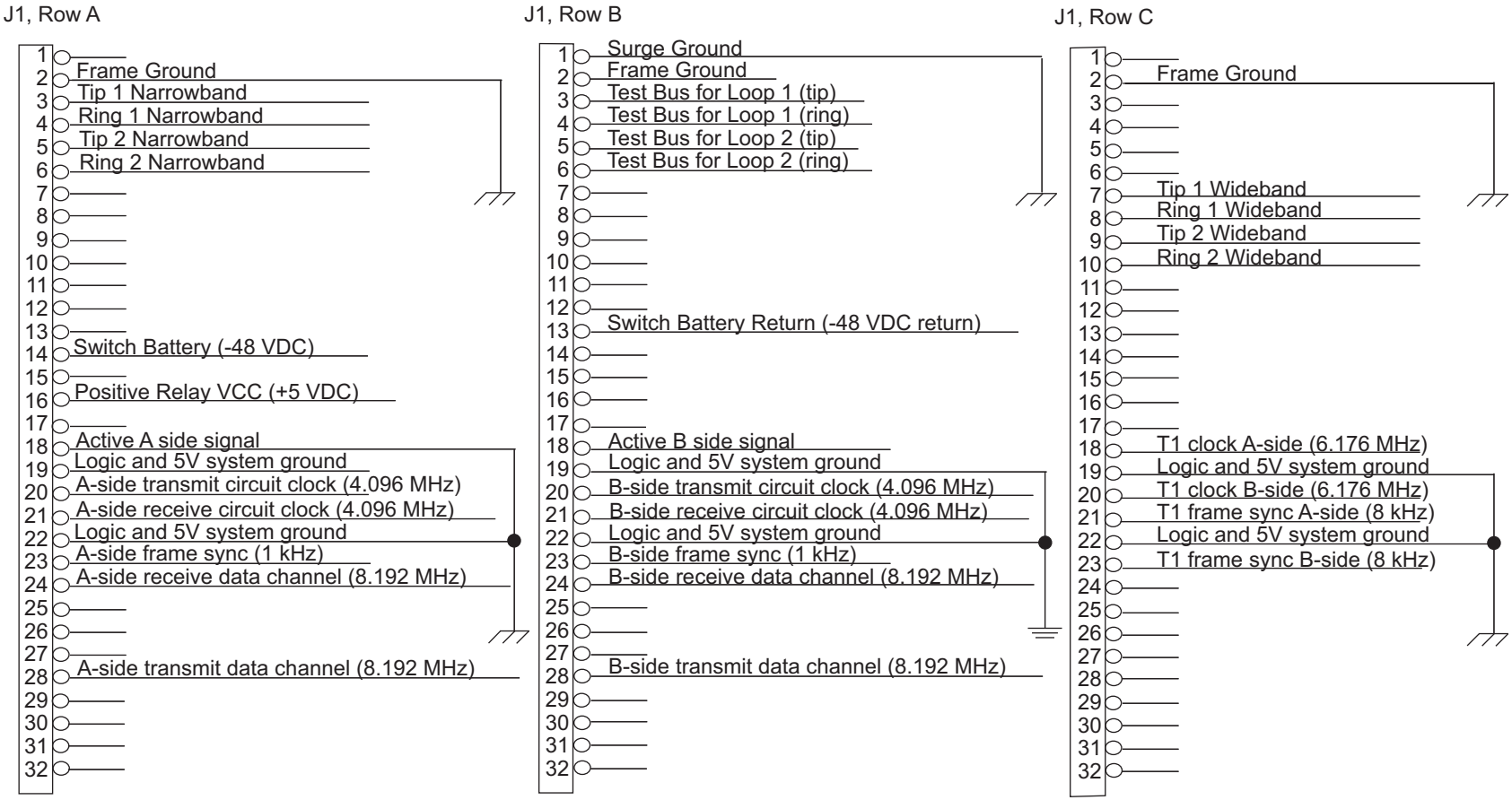

Figure 4. HTU-C Card Edge Connections

Provisioning

The HTU-C NB/WB for Litespan is provisioned in two ways:

- Local HTU-C provisioning is set using the RS-232 port. Typical T1 provisioning options are set for the HTU-C NB/WB for Litespan.
- Litespan system provisioning through a Litespan craft interface port allows a data cross-connection between the HTU-C NB/WB for Litespan and another line card in the asynchronous T1 line card class or another HTU-C NB/WB for Litespan. If the cross-connected unit is not an HTU-C, then T1 provisioning of the cross-connected unit can be accomplished through the Litespan craft interface port. If the cross-connected unit is another HTU-C NB/WB for Litespan, however, provisioning of the cross-connected unit must be performed at the front panel craft interface port.

The HTU-C NB/WB for Litespan provisioning options and defaults are listed in Table 4. For complete Litespan cross-connection provisioning information, refer to TL1 software documentation release 7.1 or higher.

Table 4. Provisioning Options

Description	Options	Default
Line Code	B8ZS; AMI	B8ZS
Framing	AUTO; ESF; SF; Unframed; FFFC (1)	AUTO
Loopback Timeout	None; 60 minutes; 120 minutes	120 minutes
DS1 Transmit Level (2)	0 dB; –15 dB	0 dB
Span Power	Enabled; Disabled	Enabled
DS1 Latching Loopback	T1; FT1(3)	T1
Customer Loss Response	AIS; CDI(4); Loopback	AIS
NIU Loopback (5)	Enabled; Disabled	Enabled
New England 1:6 Loopback (6)	Enabled; Disabled	Disabled
PRM Mode (7)	None; SPRM; NPRM	None

1. The FFFC mode sets the HTU-C to ESF and the HTU-R to SF. This mode should be used to force SF (DS1 from customer) to ESF (DSX-1 to network) conversion in the absence of network-provided ESF framing.
2. With some remote units this option is only provisionable at the HTU-R.
3. When operating in FT1 mode and during periods of T1 loss of signal, LOS, or T1 AIS from the customer CI, the HDSL system will send in the network direction from the HTU-C a Fractional DS1 idle signal consisting of a repeating 7E (HEX) byte payload within a framed/unframed T1 signal. In addition, when optioned for FT1 mode, the setting for Customer Loss Response is ignored.
4. The CDI is generated by transmitting the framing received from the network while overwriting the payload with a repeating pattern. For applications where the DS1 is Extended Superframe, the data link is overwritten with a Yellow Alarm that is interrupted once every second by a 100 millisecond code burst of 7E (HEX).
5. This option is not available if the HTU-R (P/N 1247026L7) is used in the circuit.
6. This option is only available if the HTU-R (P/N 1247026L4) is used in the circuit.
7. This option is not available if the HTU-R P/N 1247026L6 is used in the circuit.Control Port Operation

CONTROL PORT OPERATION

The HTU-C NB/WB for Litespan provides a front panel-mounted female DB-9 connector that supplies an RS-232 interface for connection to a controlling terminal. The pinout of the DB-9 is illustrated in Figure 5. The line card must be provisioned through the control port. Switches or jumpers are not provided.

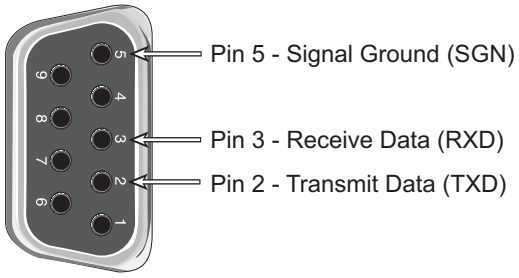

Figure 5. RS-232 (DB-9) Connector

The terminal interface operates at data rates from 1.2 kbps to 19.2 kbps. The asynchronous data format is fixed at 8 data bits, no parity and 1 stop bit. The supported terminal type is VT100 or compatible.

NOTE

Many portable personal computers use power-saving programs that are known to interfere with applications running on the personal computer. If using a portable personal computer with terminal emulation capability, communication between the computer and the HDSL unit may be periodically disrupted if power saving programs are being used on the personal computer. The symptoms may include misplaced characters appearing on the screen or the occurrence of screen time outs. These symptoms are not disruptive to the operation of the circuit and are avoidable if the power saving options are disabled or removed.

USER INTERFACE

This section provides detailed information on the following:

- Menu Structure
- Menu Navigation
- Screen Abbreviations

Menu Structure

The HTU-C NB/WB for Litespan uses a layered menu tree. Each layer of the menu tree is displayed as a menu or a screen.

Menu

A menu is a display that provides numbered selections that are used to navigate to related menus, modify provisioning information, or display information screens. A menu can contain the following objects:

- Menu Option: A menu option is indicated by a number, which when selected navigates the display to another menu layer or is used to change the option setting.
- Read-only Field: A read-only field displays information that cannot be changed. The information displayed in a read-only field can be static or can be automatically updated by the HTU-C NB/WB for Litespan.
- Read-write Field: A read-write field displays information that when selected can be modified.
- Hot Key: A hot key is a key or combination of keys that are assigned to a function. Hot keys are indicated by the required key(s) and a brief description (i.e., D - Restore factory Defaults).

Screen

A screen is a display that usually indicates the end of a menu tree path. A screen can contain the following objects:

- Read-only Field: A read-only field displays information that cannot be changed. The information displayed in a read-only field can be static or can be automatically updated by the HTU-C NB/WB for Litespan.
- Read-write Field: A read-write field displays information that when selected can be modified.
- Hot Key: A hot key is a key or combination of keys that are assigned to a function. Hot keys are indicated by the required key(s) and a brief description (i.e., D - Restore factory Defaults).

Menu Navigation

Basic menu navigation is accomplished by selecting the desired option number and then pressing ENTER. To return to the previous menu, press the escape (ESC) key. To access the System Help screen, press the question mark (?) key.

Screen Abbreviations

For abbreviations used in the screen diagrams, see Table 5.

Table 5. Screen Abbreviations

Abbreviation	Definition
ES	Errored Seconds • DSX/DS1 – SF: Second in which a BPV or frame bit error occurs – ESF: Second in which a BPV or CRC error occurs • HDSL – Second in which a CRC error occurs
SES	Severely Errored Seconds • DSX/DS1 – SF: Second in which 1544 BPVs or 8 frame bit errors occurs – ESF: Second in which 1544 BPVs or 320 CRC errors occur • HDSL – Second in which 165 CRC errors occurs
UAS	Unavailable Seconds • DSX/DS1 – Second in which there is a loss of signal or sync • HDSL – Second in which there is a loss of signal or sync
SF	Superframe Format
ESF	Extended Superframe Format
B8ZS	Binary 8 Zero Substitution
AMI	Alternate Mark Inversion
LBO	Line Build Out
BPV	Bipolar Violation • DSX/DS1 – Second in which a bipolar violation occurs
NIU	T1 Network Interface Unit
S/N	Serial Number
15M	Fifteen-minute period
24H	Twenty-four-hour period

MENU DESCRIPTIONS

The following subsections describe the HTU-C NB/WB for Litespan menu screens. Initiate a terminal session by entering multiple space bar characters, which determines the speed of the terminal. Once the speed has been determined, an Introductory menu appears.

NOTE

The screens illustrated in Figure 6 through Figure 17 are for an HDSL circuit deployed with ADTRAN HDSL technology. The circuit includes an HTU-C and an HTU-R. Other configurations are possible and their displays will vary slightly from those shown in this section.

ADTRAN HDSL Main Menu

From the Introductory menu, the Main menu can be selected. The Main menu provides access to detailed performance and configuration information, as shown in Figure 6, HDSL Main menu.

```
CIRCUIT ID:                                              MM/DD/YY hh:mm:ss


                          ADTRAN HDSL MAIN MENU


                        1) CURRENT SYSTEM STATUS
                        2) PERFORMANCE HISTORY
                        3) ADTRAN INFORMATION
                        4) LOOPBACK OPTIONS
                        5) SELF-TEST
                        6) PROVISIONING
                        7) TROUBLESHOOTING
                        H) ALARM HISTORY
                        S) SET TIME/DATE/CIRCUIT ID
                        F) DEFAULT OPTIONS
                        R) TERMINAL MODES


              Choose a screen by pressing the corresponding character.
```

Figure 6. HTU-C NB/WB for Litespan Main Menu

The Main menu options are listed in Table 6.

Table 6. HTU-C NB/WB for Litespan Main Menu

Option	Description	Function
1	Current System Status	This option displays the "Current System Status Screen" on page 16.
2	Performance History	This option displays the "Performance History Screen" on page 18.
3	Adtran Information	This option displays the "Unit Information Screen" on page 19.
4	Loopback Options	This option displays the "Loopback Options Menu" on page 19.
5	Self-test	This option displays the "Self-Test Screen" on page 20.
6	Provisioning	This option displays the "Provisioning Menu" on page 21.
7	Troubleshooting	This option displays the "Troubleshooting Display Screen" on page 22.
H	Alarm History	This option displays the "Alarm History Screen" on page 23.
S	Set Time/date/circuit Id	This option displays the "Time/Date/Circuit ID Menu" on page 25.
F	Default Options	This option displays the "Default Options Screen" on page 25.
R	Terminal Modes	This option displays the "Terminal Modes Screen" on page 26.

Current System Status Screen

The Current System Status screen, illustrated in Figure 7, provides quick access to status information for both the HTU-C and HTU-R.

```
CIRCUIT ID:                                                    MM/DD/YY hh:mm:ss
LOOP #1 <NETWORK> LOOP #2    CURRENT SYSTEM STATUS     LOOP #1 <CUSTOMER>LOOP #2
--------- HTU-C ---------                               --------- HTU-R---------
31(31) dB       30(30) dB    <-  LOSS  CUR(MAX) ->    30(30) dB        30(30) dB
   YES             YES       <-  SYNC           ->       YES              YES
000/00000       000/00000    <-  ES    15M/24H  ->    000/00000        000/00000
000/00000       000/00000    <-  SES   15M/24H  ->    000/00000        000/00000
000/00000       000/00000    <-  UAS   15M/24H  ->    000/00000        000/00000
    LOOPBACKS INACTIVE                                    LOOPBACKS INACTIVE

                          DSX-1                      DS1
  HTU-C MARGIN (dB)      ------------------------------     HTU-R MARGIN (dB)
        CUR/MIN/MAX       ESF     <-  FRAME ->     ESF           CUR/MIN/MAX
                          B8ZS    <-  CODE  ->     B8ZS
    LP1   15/15/15        N/A     <-  LBO   ->    0 dB       LP1    17/16/18
    LP2   15/15/15        N/A     <-  NIU   ->     YES       LP2    18/18/19
                          00000   <-  BPV   ->    00000
                          00000   <-  ES    ->    00000
                          00000   <-  SES   ->    00000
                          00000   <-  UAS   ->    00000
                          NONE    <- ALARMS ->     NONE
                             SEALING CURRENT PRESENT
      Press "Z" to zero registers, "X" to restart MIN/MAX, "M" for Main Menu.
```

Figure 7. Current System Status Screen

The Elapsed Time display indicates the period of time since the unit began collecting performance information. At each 15-minute interval, the performance information is transferred to the 15-minute performance data register accessed from the Performance History screen. At each 24-hour interval, the performance data is transferred into the 24-hour performance data register also accessed using the Performance History screen.

At the Current System Status screen, type "Z" to reset the performance registers to zero at both the Current System Status and Performance History screens. Figure 7 consolidates current information for the HDSL, DSX-1, and DS1 interfaces. A key to the information provided is found in the center of the screen. Arrows indicate the key applies to both the HTU-C NB/WB for Litespan and HTU-R. Table 7 gives detailed definitions of each indicator of the key.

Table 7. HDSL, DS1, and DSX-1 Key Definitions

Indicator	Definition
LOSS	Pulse attenuation measurement
SYNC	HDSL loop 1 and loop 2 sync status
ES 15M/24H	Errored seconds*
SES 15M/24H	Severely errored seconds*
UAS 15M/24H	Unavailable seconds*

* The first number is for the current 15-minute period and the second is the current 24-hour period (Loop 1 and Loop 2 numbers are displayed).

An indication of pair reversal (if present) appears at the bottom of the first key column. Status and configuration information for the DS1 and DSX-1 signals are located in the center of the screen near the bottom. Table 8 gives the definitions of the status and configuration key items.

Table 8. Status and Configuration Key Definitions

Indicator	Definition
FRAME	T1 framing format selected
CODE	T1 line coded selected
LBO	Line build-out selected (for DSX-1), Customer signal of 0 or –15 dB (for DS1)
NIU	Network interface unit enabled
BPV	Bipolar violations detected (DSX-1 and DS1)
ES	Errored seconds (DSX-1 and DS1)
SES	Severely errored seconds (DSX-1 and DS1)
UAS	Unavailable seconds (DSX-1 and DS1)
Alarms	Lists current alarm condition status

A measure of signal quality (current/minimum/maximum) for each HDSL loop is displayed on the Current System Status Screen. The noise margin is measure in dB above the 10^{-7} BER. Table 9 describes the noise margin quality levels and their indicators.

Table 9. Noise Margin Quality

Margin (in dB)	LED Color	Loop Quality
<0	Red	Poor
0–2	Yellow	Marginal
>2	Green	Good

Performance History Screen

The Performance History screen is shown in Figure 8. At each 15-minute interval, the performance information is transferred to the 15-minute performance data register accessed from the Performance History screen.

This unit supports the display of performance information in 15-minute increments for the last 24-hour period. At each 24-hour interval, the performance data is transferred into the 24-hour performance data register also accessed using the Performance History Screen. Type “H” to view the Performance History screen for HRE.

```
CIRCUIT ID:                                                  MM/DD/YY hh:mm:ss
      24 HOUR REGISTERS     PERFORMANCE HISTORY     15 MINUTE REGISTERS
     ---ES---SES---UAS--                         --ES-SES-UAS---------ES-SES-UAS--
      00000 00000 00000   <---CURRENT--->         000 000 000
09/15 ----- ----- -----   <--          -->  02:15  000 000 000  22:15 --- --- ---
09/14 ----- ----- -----     |           |    02:00 --- --- ---  22:00 --- --- ---
09/13 ----- ----- -----     |           |    01:45 --- --- ---  21:45 --- --- ---
09/12 ----- ----- -----     |           |    01:30 --- --- ---  21:30 --- --- ---
09/11 ----- ----- -----     |PREVIOUS   |    01:15 --- --- ---  21:15 --- --- ---
09/10 ----- ----- -----     |           |    01:00 --- --- ---  21:00 --- --- ---
09/09 ----- ----- -----   <--           |    00:45 --- --- ---  20:45 --- --- ---
                                        |    00:30 --- --- ---  20:30 --- --- ---
VIEW 1 : HTU-C DSX-1                    |    00:15 --- --- ---  20:15 --- --- ---
                                        |    00:00 --- --- ---  20:00 --- --- ---
1->|H|<-3-----LOOP1-----4->|H|-->      |    23:45 --- --- ---  19:45 --- --- ---
   |T|                     |T|         |    23:30 --- --- ---  19:30 --- --- ---
   |U|                     |U|         |    23:15 --- --- ---  19:15 --- --- ---
<--|C|<-5-----LOOP2-----6->|R|<-2      |    23:00 --- --- ---  19:00 --- --- ---
                                        |    22:45 --- --- ---  18:45 --- --- ---
Press view number to select view       -->  22:30 --- --- ---  18:30 --- --- ---

                                              Press “B” to go back 8 hours

                    Press “M” to return to the Main Menu
```

Figure 8. Performance History Screen

Unit Information Screen

The ADTRAN Unit Information screen is illustrated in Figure 9. The screen lists serial number, CLEI code, and manufacturing date for every unit in the HDSL circuit.

```
CIRCUIT ID:                                                    MM/DD/YY hh:mm:ss

                                  ADTRAN
                              901 Explorer Boulevard
                            Huntsville, Alabama 35806-2807

---------------------- For Information or Technical Support ---------------------
       Support Hours ( Normal 7am - 7pm CST, Emergency 7 days x 24 hours )
Phone: 800.726.8663 / 888.873.HDSL  Fax: 256.963.6217  Internet: www.adtran.com
-------------------------------------------------------------------------------
HTU-C INFORMATION                       HTU-R INFORMATION
----------------------                  --------------------
S/N : A6026223                            S/N : PA52D0891
CLEI: SLL7AAAAA                         CLEI: T1I3AAXAAA
MANF: 10/07                               MANF: 10/07









                          Press "M" to view Main Menu.
```

Figure 9. Unit Information Screen

Loopback Options Menu

The HDSL loopback options menu is illustrated in Figure 10. The user can terminate or evoke loopbacks using these screens. Refer to "Appendix A, HDSL Loopbacks" for detailed HDSL loopback information.

```
CIRCUIT ID:                                                    MM/DD/YY hh:mm:ss
                                LOOPBACK OPTIONS

                 _____                                  _____
                |HTU-C|                                |HTU-R|
                |     |                 LP1            |     |
           ---->|-----|<==============================>|-----|<---
                |     |                                |     |
           NET  |     |                                |     |  CUST
                |     |                 LP2            |     |
           <----|-----|<==============================>|-----|--->
                |     |                                |     |
                |_____|                                |_____|

                    1) LOOPBACK TO NETWORK  AT HTU-C = INACTIVE
                    2) LOOPBACK TO CUSTOMER AT HTU-C = INACTIVE
                    3) LOOPBACK TO NETWORK  AT HTU-R = INACTIVE
                    4) LOOPBACK TO CUSTOMER AT HTU-R = INACTIVE









               Press corresponding number to toggle loopback option.
                       Press "M" to return to the Main Menu
```

Figure 10. Loopback Options Menu

Self-Test Screen

The Self-Test screen is illustrated in Figure 11. On this screen, press "S" to initiate a self-test, and press "M" to return the Main Menu.

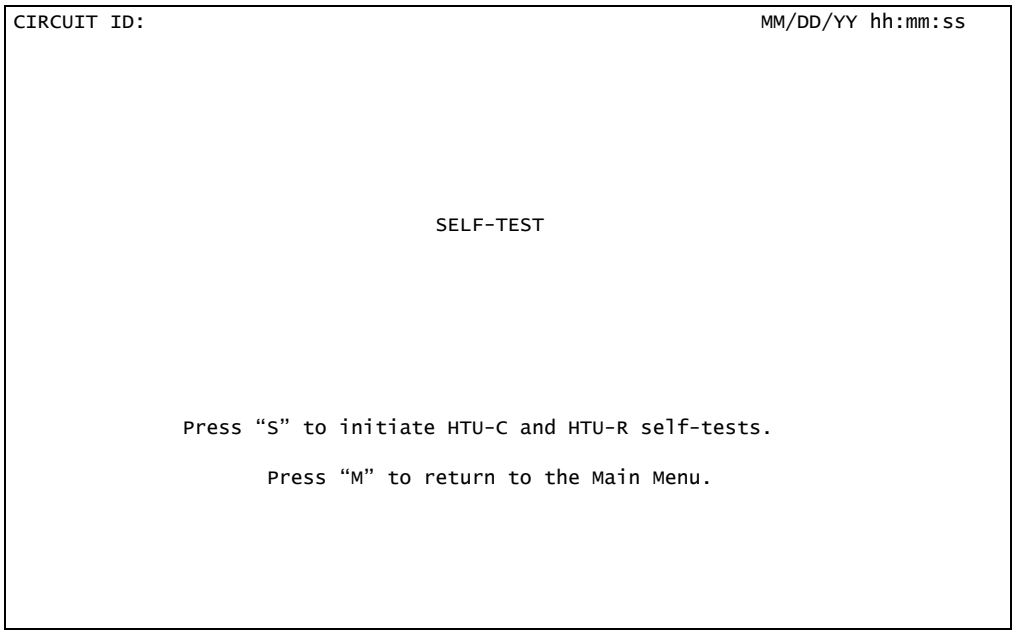

Figure 11. Self-Test Screen

Provisioning Menu

The Provisioning menu is illustrated in Figure 12. This screen displays the current system configuration and allows for changing this configuration. Depending upon the HTU-R installed, making provisioning changes from the HTU-R may not be allowed.

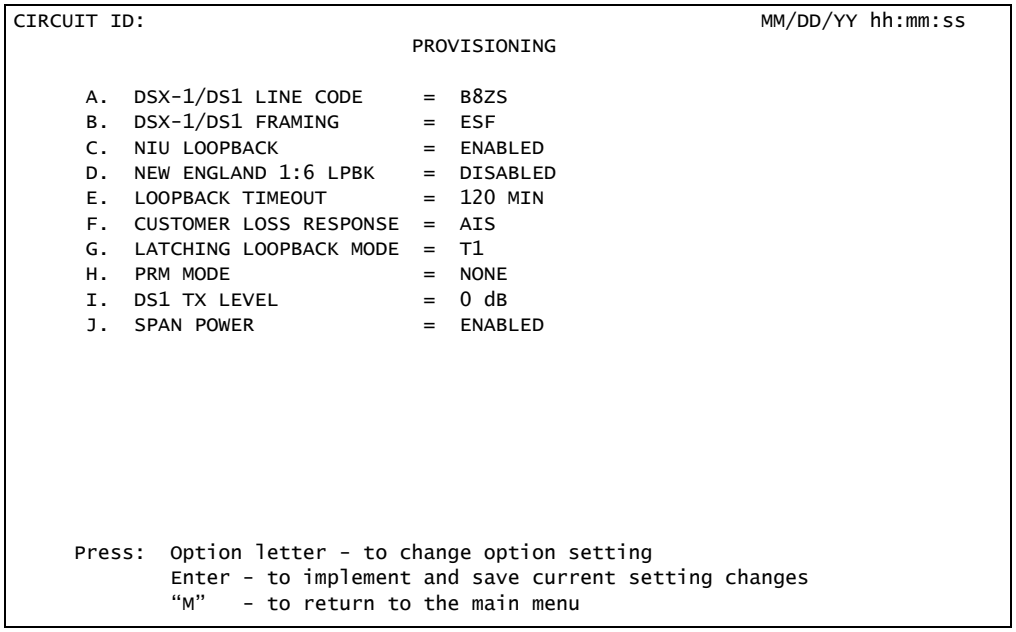

Figure 12. Provisioning Menu

The HTU-C NB/WB for Litespan stores its provisioning information in an EEPROM so that it remembers the past provisioning changes to determine its operating mode in the event of power loss to the HTU-C NB/WB for Litespan.

Some provisioning options will not appear on certain HTU-Rs provisioning screen, and the alarm setting provision on the HTU-R provisioning screen is meaningless in a Litespan environment and should be ignored.

DSX-1 in the HDSL screens actually refers to a virtual DS1 channel provided by the time slot interchanger unit (TSI) of the Litespan CBA to the Litespan line card (see Alcatel-Lucent Litespan documentation for more detail). The actual DSX-1 monitoring point is at the T1 framer onboard the HTU-C NB/WB for Litespan.

This monitoring point receives the DS1 cross-connected data recovered from the DS1 virtual tributary presented to the line card.

The asynchronous DS1 gate array on the HTU-C NB/WB for Litespan is responsible for providing the DS1 cross-connected data that is recovered from the DS1 virtual tributary.

Provisioning options are summarized in Table 4 on page 10. Each option may be changed to any one of the listed settings. Some options and settings may not be applicable depending on which HTU-R is in the circuit.

Troubleshooting Display Screen

The Troubleshooting Display screen, illustrated in Figure 13, graphically depicts an HDSL circuit. The unit reviews red, yellow, and blue alarm conditions in the circuit to automatically predict where a fault is located. Once a fault location is suspected, the corresponding portion of the circuit on the screen is highlighted and a message describing the failure appears.

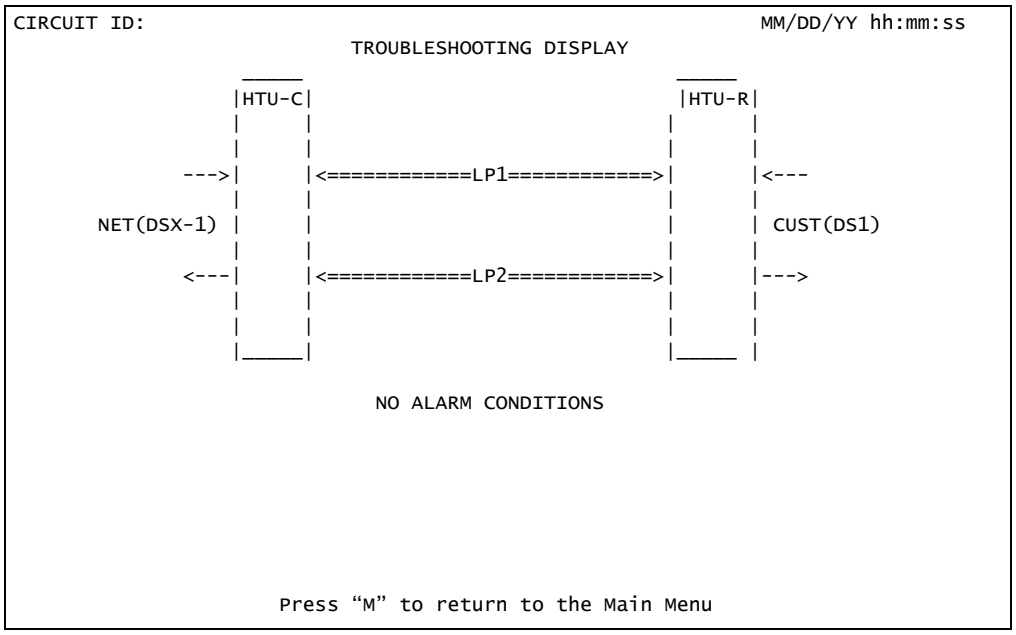

Figure 13. Troubleshooting Display Screen

Alarm History Screen

Alarms are indicated by the HTU-C NB/WB for Litespan in the following ways:

- HTU-C DB-9 control port Alarm History screen (Figure 14)
- Front Panel LEDs
- Standing alarms (through direct access to the Litespan, or remote access through a modem)

```
CIRCUIT ID:                                                    MM/DD/YY hh:mm:ss
                                T1 Alarm History
LOCATION    ALARM       FIRST                LAST                CURRENT    COUNT
-------------------------------------------------------------------------------
HTU-C       RED(LOS)                                             OK          000
 (DSX-1)    YELLOW                                               OK          000
            BLUE(AIS)                                            OK          000

HTU-R       RED(LOS)                                             OK          000
 (DS1)      YELLOW                                               OK          000
            BLUE(AIS)                                            OK          000
                               HDSL Span History
-------------------------------------------------------------------------------
SPAN 1      LP1 HLOS                                             OK          000
            LP2 HLOS                                             OK          000

HTU-C       LP1 MRGN                                             OK          000
            LP2 MRGN                                             OK          000

HTU-R       LP1 MRGN                                             OK          000
            LP2 MRGN                                             OK          000


                  Press: C to clear history : M for main menu
```

Figure 14. Alarm History Screen

The HTU-C NB/WB for Litespan DB-9 control port screen alarms are presented on the following screens:

- Alarm History Screen
- Current System Status Screen
- Troubleshooting Display Screen

Red, yellow, and blue alarms at both DSX-1 and DS1 interfaces plus HDSL loop synchronization loss conditions are reported.

TL1 provides alarm support through TL1 retrieval of standing alarms from the Litespan database. Table 10 defines the TL1 alarm conditions.

Table 10. TL1 Alarm Conditions

T L1 Alarm	T L1 Alarm Description	Implications
AID,T1:MJ,LOS,SA *	The access identifier (CBA slot) has a major service-affecting alarm because of a loss of sync condition on the HDSL loops or loss of signal at the HTU-R DS1.	There is an HDSL loss of sync in any HDSL leg, or DS1 loss of signal at the HTU-R DS1 interface. The HTU-C is in startup ,or a problem exists on the local loop or customer interface.
AID,EQPT:MJ,UEQ,SA	The access identifier (CBA slot) has a major service-affecting alarm because no channel unit is installed in an equipped CBA slot.	No channel unit is installed in a slot which should be equipped. The HTU-C is not inserted properly in the correct slot, or the unit is defective.
AID,EQPT:MJ,FAIL,SA	The access identifier (CBA slot) has a major service-affecting alarm because of equipment type mismatch.	The equipment installed in the channel bank slot differs from the equipment type reserved in the software record of the Litespan database. To clear the alarm delete the equipment record (for example, dlt-eqpt::cot-1-15 with TL1) and reinsert the card, or equip the slot with the currently reserved equipment type.
AID,EQPT:MJ,FAIL,SA	The access identifier (CBA slot) has a major service-affecting equipment failure.	The HTU-C NB/WB for Litespan is unable to operate normally or has failed a diagnostic test. Refer to the "Troubleshooting" section of this practice.

* AID is the access identifier (for example, cot-1-15)

Time/Date/Circuit ID Menu

Use the Time/Date/Circuit ID menu in Figure 15 to set the time, date, and circuit ID.

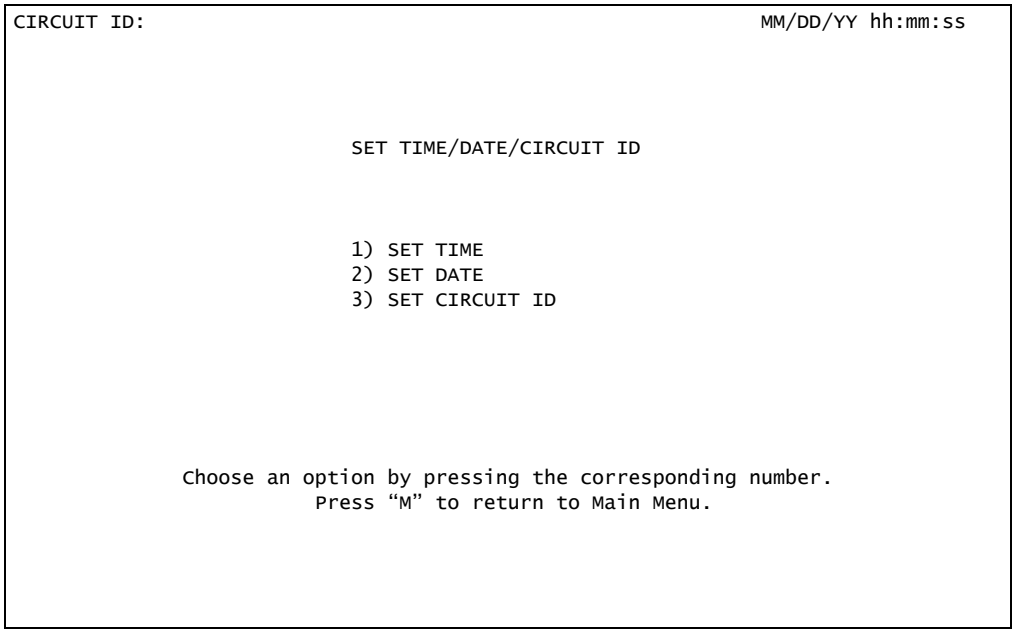

Figure 15. Time/Date/Circuit ID Screen

Default Options Screen

The Default Options screen in Figure 16 allows the user to reset all of the provisioning options to the original factory default values.

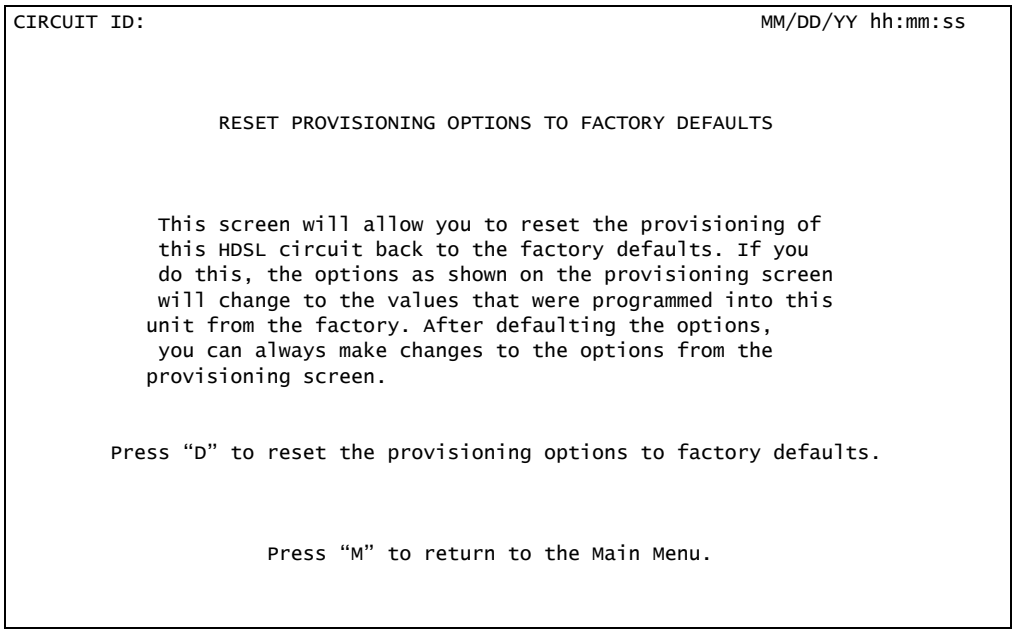

Figure 16. Default Options Screen

Terminal Modes Screen

The Terminal Modes screen in Figure 17 defines the two different terminal modes, Manual Update and Real Time Update. Press “T” to toggle between the two terminal modes.

```
CIRCUIT ID:                                                    MM/DD/YY hh:mm:ss

                              TERMINAL MODES MENU

    MANUAL UPDATE MODE:

    * You can print or log screens
    * No text is highlighted
    * “3 SPACES TO UPDATE” appears at the top of each screen,
       reminding you to press 3 spacebars to update the screen
    * There is a delay between screen changes & updates
    * After 30 min. of no interaction, a new baud rate search is begun
    * Ignores input until screen is finished printing.

    REAL-TIME UPDATE MODE:

     * Faster of the two modes
    * You cannot print screens to a log file
     * Highlighting is enabled
    * Recommended for daily operation


                   Press “T” to toggle between the terminal modes.
                       Press “M” to return to the main menu.
```

Figure 17. Terminal Modes Screen

HDSL DEPLOYMENT GUIDELINES

The ADTRAN HDSL system is designed to provide DS1-based services over loops designed to comply with carrier service area (CSA) guidelines. CSA deployment guidelines are given below.

- All loops are nonloaded only.
- For loops with 26-AWG cable, the maximum loop length including bridged tap lengths is 9 kft.
- For loops with 24-AWG cable, the maximum loop length including bridged tap lengths is 12 kft.
- Any single bridged tap is limited to 2 kft.
- Total bridged tap length is limited to 2.5 kft.
- The total length of multigauge cable containing 26-AWG cable must not exceed the following:

  $12 - \{(3*L_{26})/9\} - L_{BTAP}$ (in kft)

  Where:

  L_{26} = total length of 26-AWG cable excluding bridged taps (in kft)

  L_{BTAP} = total length of all bridged taps (in kft)

This deployment criteria is summarized in the chart shown in Figure 18.

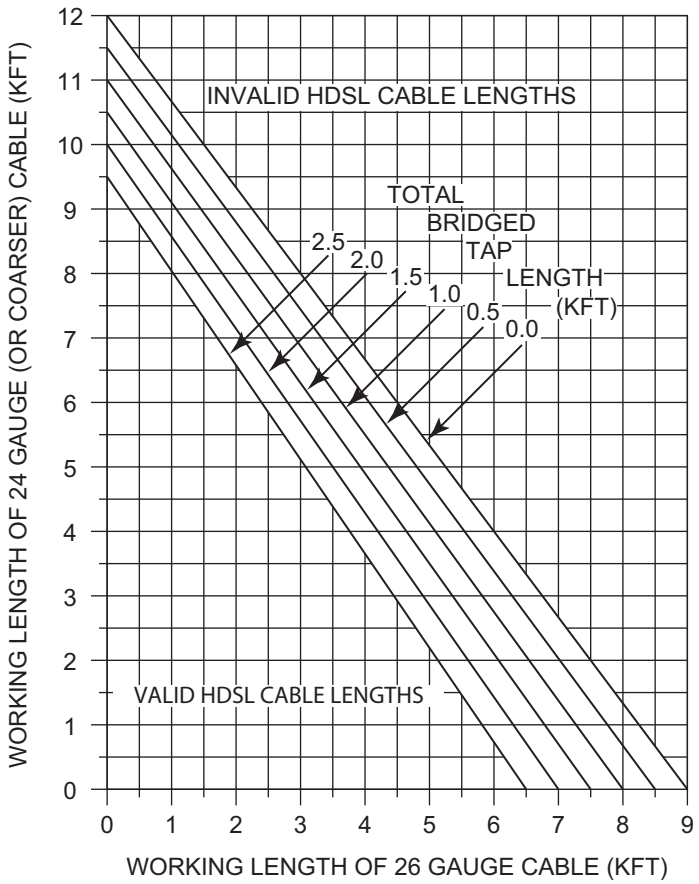

Figure 18. HDSL Deployment Guidelines

Loop loss per kft for other wire is summarized in Table 11.

Table 11. HDSL Loss Values

Cable Gauge	Cable Type	Loop Loss per kft.		
		68°	90°	120°
26	PIC	3.902	4.051	4.253
26	Pulp	4.030	4.179	4.381
24	PIC	2.863	2.957	3.083
24	Pulp	3.159	3.257	3.391
22	PIC	2.198	2.255	2.333
22	Pulp	2.483	2.45	2.629
19	PIC	1.551	1.587	1.634
19	Pulp	1.817	1.856	1.909

Recommended maximum local loop loss information for PIC cable at 70°F, 135 Ω, resistive termination is provided in Table 12.

Table 12. Loop Insertion Loss Data

Frequency (Hz)	Maximum Loss (db)
3,000	12.0
10,000	15.0
50,000	25.5
100,000	30.0
150,000	32.75
196,000	35.00
200,000	35.25

An approximation for the maximum amount of wideband noise on an HDSL local loop as measured by a 50 kbps filter is ≤ 31 dBrn.

An approximation for the maximum level of impulse noise as measured using a 50 kbps filter on an HDSL loop is ≤ 50 dBrn.

NOTE

These approximations are to be used as guidelines only and may vary slightly on different loops. Adhering to the guidelines should produce performance in excess of 10^{-7} BER.

When deploying any of the HTU-C NB/WB for Litespans, the power requirements for the application should also be considered for product mix calculations and maximum number of HTU-C NB/WB for Litespans within a channel bank assembly. Use Worksheet PW-1 in the Engineering and planning section of Alcatel-Lucent practice, OSP TL1 software documentation release 7.1, or higher to determine whether a particular combination of channel units is within power-drain specifications. When using the ADTRAN HTU-C NB/WB for Litespan, use the replacement factors listed in Table 13 instead of the ones listed in Worksheet PW-1.

Table 13. Worksheet PW-1 Replacements

Configuration	A Column Factor	B Column Factor	D Column Factor
Original Worksheet PW-1 values for AHT1U with no repeater and a span-powered HTU-R.	0.430	0.076	0.200
ADTRAN HTU-C NB/WB for Litespan and an HTU -R, (P/N 1247027Lx).	0	0	0.135
ADTRAN HTU-C NB/WB for Litespan with an HRE (P/N 1247041Lx) or (P/N 1247045Lx), and an HTU-R (P/N 1247026Lx).	0	0	0.255

Note: Do not use original worksheet values with ADTRAN products.

The power parameters shown in Table 14 are for the configurations listed in Table 13. These values are derived from an HDSL system with worst-case power measurements.

Table 14. Power Parameters for Replacements to Worksheet PW-1

Power Bus	ADTRAN HTU-C NB/WB for Litespan and an HTU-R	ADTRAN HTU-C NB/WB for Litespan with an HRE and an HTU-R
+5 V	0 mA	0 mA
–5 V	0 mA	0 mA
–48 V switch battery	135 mA	255 mA
–48 V talk battery	0 mA	0 mA
Power Consumption	6.48 watts	12.24 watts
Power Dissipation	3.65 watts	4.24 watts

Note: All worst-case HDSL loop power measurements

TROUBLESHOOTING

Table 15 is a troubleshooting guide for the HTU-C NB/WB for Litespan.

Table 15. Troubleshooting Guide

Condition	Solution
At power up, all front panel indicators are off.	1. Verify that the channel bank or ONU BPS power LEDs are on. 2. Make sure that the unit is fully and correctly inserted into the channel bank or ONU. 3. If step 1 fails, contact Alcatel-Lucent customer service (refer to "Appendix B, Warranty"). If step 1 passes, but step 2 fails, replace the HTU-C.
The FAIL LED remains on.	1. Verify that the channel bank or ONU BPS FAIL LEDs are off. 2. Verify that the equipment type for the HTU-C NB/WB for Litespan slot is AHT1U. Using TL1, equipment type is shown with the command rtrv-eqpt::AID, where AID is the access identifier (i.e., cot-1-15). 3. If step 1 fails, contact Alcatel-Lucent customer service (refer to "Appendix B, Warranty"). If step 1 and step 2 pass, replace the HTU-C. If step 1 passes but step 2 fails, delete the equipment record (i.e., dlt-eqpt::cot-1-15 with TL1) and reinsert the card, or equip the slot with the currently reserved equipment type.
The FAIL LED is off, but the HDSL LED remains red.	1. Check that neither HDSL loop is open. 2. Check that neither or both HDSL loops are shorted. 3. Verify the loop conforms to CSA guidelines and is not too long. Loop loss at 200 kHz should be less than 35.25 dB. 4. Verify that both HDSL loops have acceptable noise limits (refer to "HDSL Deployment Guidelines"). 5. Verify that tip and ring of each HDSL loop belongs to the same twisted pair. 6. If steps 1 through 5 pass, but the HDSL LED remains red, replace the HTU-C. 7. If step 6 fails, replace the HTU-R and the HRE.
The FAIL LED is off, but the HDSL LED remains yellow.	1. Check that the framing and line coding are set appropriately for T1 data at the HTU-R and for cross-connected T1 data coming to the HTU-C. 2. Check that the DS1 LED at the HTU-R is green. 3. If step 1 fails, change the appropriate framing and line coding (refer to "Provisioning"). If step 1 passes, but step 2 fails, a problem may exist at the HTU-R T1 interface. If the problem does not exist at the T1 interface, replace the HTU-C.

MAINTENANCE

The HTU-C NB/WB for Litespan requires no routine maintenance for normal operation. 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 the"Appendix B, Warranty" section for further information.

PRODUCT SPECIFICATIONS

Product specifications are listed in Table 16.

Table 16. HTU-C NB/WB for Litespan Specifications

Specification	Description
Loop Interface	
Modulation Type:	2B1Q
Mode:	Full Duplex, Echo Cancelling
Number of Pairs:	Two, with connections to narrowband and wideband
Bit Rate:	784 kbps per pair
Baud Rate:	392 baud per pair
Service Range:	Defined by CSA guidelines
Loop Loss:	35 dB maximum at 200 kHz
Bridged Taps:	Single Taps < 2 kft; Total Taps < 2.5 kft
Performance:	Compliant with Bellcore TA-NWT-001210
HDSL Tx Signal Level:	13.5 dBm
Input Impedance:	135 ohms
Return Loss:	20 dB (40 kHz to 200 kHz)
Power *Tested with the ADTRAN Low-Voltage HRE (P/N 1247045L1) and the ADTRAN Low Voltage HTU-R (1247026L4).*	
Total Power:	–48 VDC at 135 mA with HTU-R –48 VDC at 255 mA with HTU-R and HRE
HTU-C Power Dissipation:	3.65 watts with HTU-R 4.24 watts with HRE and HTU-R
Span Power:	–137 VDC for voltage and current limit at 160 mA ±5% (Internally Generated)
Fusing:	1.00 A (not field-replaceable)
Clock	
Clock Sources:	Internal, DSX-1 Derived
Internal Clock Accuracy:	±25 ppm (exceeds Stratum 4). Meets T1.101 timing requirements.
Tests	
Diagnostics:	Local Loopback (HTU-C), Remote Loopback (HTU-R), HRE Loopback, Self-Test

Table 16. HTU-C NB/WB for Litespan Specifications (Continued)

Specification	Description
Physical	
Mounting:	Litespan 2000 CBA, Litespan 2012 CBA, or an ONU CBA
Dimensions:	4.42 in. high × 0.84 in. wide × 10.4 in. deep (11.22 cm × 2.13 cm × 26.4 cm)
Weight:	Less than one pound
Environment	
Temperature:	Operating (Standard): –40°C to +70°C; Storage: –40°C to +85°C
Humidity:	Up to 95% noncondensing
Electrical/Safety Protection:	Complies with Bellcore GR1089-CORE, UL1459, FCC Class A subpart J, and Alcatel-Lucent requirements for a generic subscriber interface unit.
Control Port	
Interface:	RS-232 (DB-9)
Terminal Type:	VT100 or compatible
Async Speed:	1.2 kbps to 19.2 kbps
Data Format:	8 data bits, no parity, 1 stop bit
Part Number	
HTU-C NB/WB for Litespan (AHT1U):	1247002L1

Appendix A
HDSL Loopbacks

HDSL MAINTENANCE MODES

This Appendix describes operation of the HDSL system with regard to detection of in-band and ESF facility data link loopback codes.

Upon deactivation of a loopback, the HDSL system will synchronize automatically. Note that the synchronization process of the HDSL system upon deactivation of the HRE loopback could take up to 15 seconds, ensuring all system elements are synchronized.

Loopback Process Description

In general, the loopback process for the HDSL system elements is modeled on the corresponding DS1 system process. Specifically, the HTU-C loopback is similar to an Intelligent Office Repeater loopback and the HTU-R loopbacks are similar to an inline T1 Repeater loopback.

In-band control code sequences are transmitted over the DS1 link by either the unframed or overwrite method. The HDSL elements respond to either method.

The unframed method produces periodic control sequences, and the normal DS1 framing bit is omitted.

The overwrite method produces periodic control sequences. However, once per frame, the framing bit overwrites one of the bits in the control sequence.

The unit can detect the loopback activation or deactivation code sequence only if an error rate of 1E-03 or better is present.

DDS Latching Loopback Operation

If the unit is optioned for FT1 mode, then DDS Latching Loopback operation is supported as described in Bellcore TA-TSY-000077, Issue 3, Section 5.1.3. The HTU-C and any HRE units which are in the HDSL circuit are treated as Identical Tandem Data ports and the HTU-R is treated as a Different Tandem Data port. The HTU-R will establish a network loopback upon detection of standard DDS NI-NEI/RPTR loopback sequence. When using HRE(s) in the circuit, each HRE will respond as a down stream DS0 DP tandem element and provide a network loopback.

Loopback Control Codes

A summary of control sequences is given in Table A-1 and Table A-2.

NOTE

In all control code sequences presented, the in-band codes are shown left-most bit transmitted first, and the ESF data link codes with right-most bit transmitted first.

Table A-1. HDSL Loopback Control Codes

Source (1)	Code (Hex / Binary) (2,3)	Name
	Abbreviated	
Network	3 in 7 (1110000) (binary)	Loopback data from network toward network in the HTU-R
Network	4 in 7 (1111000) (binary)	Loopback data from network toward network in the HTU-C
Network	2 in 6 (110000) (binary)	Loopback data from network toward network in first HRE
Network	3 in 6 (111000) (binary)	Loopback data from network toward network in second HRE
Customer	6 in 7 (1111110) (binary)	Loopback data from customer toward customer in HTU-C
Customer	5 in 7 (1111100) (binary)	Loopback data from customer toward customer in HTU-R
Customer	4 in 6 (111100) (binary)	Loopback data from customer toward customer in first HRE
Customer	5 in 6 (111110) (binary)	Loopback data from customer toward customer in second HRE
	Wescom	
Network	FF1E/ 1111 1111 0001 1110	Loopback data from network toward network at HTU-C
Customer	3F1E/ 0011 1111 0001 1110	Loopback data from customer toward customer at HTU-C
Network	FF04/ 1111 1111 0000 0100	Loopback data from network toward network at HRE 1
Network	FF06/ 1111 1111 0000 0110	Loopback data from network toward network at HRE 2
Customer	3F04/ 0011 1111 0000 0100	Loopback data from customer toward customer at HRE 1

Table A-1. HDSL Loopback Control Codes (Continued)

Source (1)	Code (Hex / Binary) (2,3)	Name
		Wescom (Continued)
Customer	3F06/ 0011 1111 0000 0110	Loopback data from customer toward customer at HRE 2
Network	FF02/ 1111 1111 0000 0010	Loopback data from network toward network at HTU-R
Customer	3F02/ 0011 1111 0000 0010	Loopback data from customer toward customer at HTU-R
Customer	FF48 (ESF-DL)/ 1111 1111 0100 1000	Loopback data from customer toward customer at HTU-R
Network	1 in 6 (100000)/ (binary)	Loopback data from network toward network at HTU-R
Network	FF48 (ESF-DL)/ 1111 1111 0100 1000	Loopback data from network toward network at HTU-R
Network/ Customer	1 in 3 (100) (binary)	Loop down everything
Network/ Customer	FF24 (ESF-DL)/ 1111 1111 0010 0100	Loop down everything

1. The Source column indicates from which side of the interface the control codes are sent. For example, an (N) indicates a network sourced code, while a (C) indicates a customer sourced code.
2. All codes are in-band unless labeled ESF-DL.
3. All codes listed above must be sent for a minimum of 5 seconds in order for them to be detected and acted upon.

Table A-2. In-Band Addressable Loopback Codes

Function	Code (Hex / Binary)	Response [1]
Arm (also known as a 2-in-5 pattern)	11000 (binary)	The HTU-R will loop up toward the network. No AIS or errors will be sent as a result of this loopback. The HTU-C and HRE will arm.
Disarm (also known as a 3-in-5 pattern)	11100 (binary)	The HTU-C and HRE are removed from the armed state. If any of the units are in loopback when the 11100 pattern is received, they will loop down. The LBK LEDs will turn off on all units.
HTU-C Network Loop Up [2]	D3D3/ 1101 0011 1101 0011	If the units have been armed and no units are in loopback, the HTU-C will loop up toward the network, 2 seconds of AIS (all 1s) will be sent, 5 seconds of data will pass, and 231 bit errors will be injected into the DSX-1 signal. As long as the pattern continues to be sent, 231 errors will be injected every 20 seconds. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 231 bit errors will resume at 20-second intervals.
HRE Network Loop Up	C741/ 1100 0111 0100 0001	If an HRE is present, the units have been armed, the HRE will loop up toward the network, 2 seconds of AIS (all 1s) will be sent, 5 seconds of data will pass, and 10 bit errors will be injected into the DSX-1 signal. As long as the pattern continues to be sent, 10 errors will be injected every 20 seconds. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 10 bit errors will resume at 20-second intervals.
HRE2 Network Loop Up	C754/ 1100 0111 0101 0100	If a second HRE is present, the units have been armed, the HRE will loop up toward the network, 2 seconds of AIS (all 1s) will be sent, 5 seconds of data will pass, and 200 bit errors will be injected into the DSX-1 signal. As long as the pattern continues to be sent, 200 errors will be injected every 20 seconds. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 200 bit errors will resume at 20-second intervals.
Loop Down	9393/ 1001 0011 1001 0011	Any HTU-C and HRE units currently in loopback toward the network will loop down and will retain the armed state.

Table A-2. In-Band Addressable Loopback Codes (Continued)

Function	Code (Hex / Binary)	Response (1)
Query Loopback	D5D5/ 1101 0101 1101 0101	If the units are armed and the HTU-C, HRE, or HTU-R are in network loopback, errors are injected into the DSX-1 signal upon detection of the query loopback pattern. As long as the pattern continues to be sent, errors are injected again every 20 seconds. The number of errors injected each time depends on which unit is in loopback. If the HTU-C is in network loopback, 231 errors are injected, 20 at a time if the HTU-R is in network loopback, 10 at a time if HRE #1 is in network loopback, and 200 at a time if HRE #2 is in network loopback.
Loopback Time Out Override	D5D6/ 1101 0101 1101 0110	If the units are armed and this pattern is sent, the loopback time out will be disabled. The time out option will be updated on the Provisioning menu of the HTU-R (viewable through the RS-232 port) to None. As long as the units remain armed, the time out will remain disabled. When the units are disarmed, the loopback time out returns to the value it had before the D5D6 code was sent.
Span Power Disable	6767/ 0110 0111 0110 0111	If the units are armed and this pattern is sent, the HTU-C will deactivate its span power supply, turning off the HTU-R and HRE (if present). As long as the pattern continues to be sent, the span power supply will remain disabled. When the pattern is no longer being sent, the HTU-C will reactivate its span power supply, turning the remote unit(s) on. All units retrain and return to the disarmed and unlooped state.

1. All codes listed above must be sent for a minimum of 5 seconds in order for them to be detected and acted upon.
2. If NIU is enabled, then the HTU-R can be in network loopback when the HTU-C or HRE loop up codes are sent.

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Appendix B
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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Huntsville, AL 35806