HST-3000

DDS Local Loop Testing

User's Guide

JDSU

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Ordering information

This guide is a product of JDSU's Technical Information Development Department, issued as part of the HST-3000. The catalog number for a printed user's guide is ML-060001. The catalog number for a CD-ROM containing all HST-3000 user documentation is CML-060301.

Federal Communications Commission (FCC) Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

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, and (2) This device must accept any interference received, including interference that may cause undesired operation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.
– Increase the separation between the equipment and receiver.
– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
– Consult the dealer or an experienced radio/TV technician for help.

In order to maintain compliance with the limits of a Class B digital device JDSU requires that quality interface cables be used when connecting to this equipment. Any changes or modifications not expressly approved by JDSU could void the user's authority to operate the equipment.

Industry Canada Requirements

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

WEEE Directive Compliance

JDSU has established processes in compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive, 2002/96/EC.

This product should not be disposed of as unsorted municipal waste and should be collected separately and disposed of according to your national regulations. In the European Union, all equipment purchased from JDSU after 2005-08-13 can be returned for disposal at the end of its useful life. JDSU will ensure that all waste equipment returned is reused, recycled, or disposed of in an environmentally friendly manner, and in compliance with all applicable national and international waste legislation.

It is the responsibility of the equipment owner to return the equipment to JDSU for appropriate disposal. If the equipment was imported by a reseller whose name or logo is marked on the equipment, then the owner should return the equipment directly to the reseller.

Instructions for returning waste equipment to JDSU can be found in the Environmental section of JDSU's web site at www.jdsu.com. If you have questions concerning disposal of your equipment, contact JDSU's WEEE Program Management team at WEEE.EMEA@jdsu.com.

Contents

About This Guide

This chapter provides information about the HST-3000 user documentation, including information about obtaining technical assistance and safety/compliance information. Topics discussed in this chapter include the following:

Purpose and scope

The purpose of this guide is to help you successfully use the features and capabilities of the HST-3000 with the digital data service local loop (DDS-LL) testing option.

This guide includes task-based instructions that describe how to configure and use the HST-3000 to send and receive bit error rate test (BERT) patterns via a DDS four-wire interface.

Assumptions

This guide is intended for novice, intermediate, and experienced users who want to use the HST-3000 DDS-LL testing option efficiently and effectively. We assume that you have basic computer experience and are familiar with basic telecommunications safety, concepts, and terminology.

Terminology

The following terms have a specific meaning when they are used in this guide:

– **HST-3000** — Handheld Services Tester 3000. In this user's guide, "HST-3000" is used to refer to the HST-3000 family of products or to the combination of a base unit and attached SIM. "HST" is also sometimes used to refer to the base unit/SIM combination.

– **SIM** — Service Interface Module. Sometimes referred to generically as the module. The SIM provides test application functionality.

For definitions of other terms used in this guide, see the Glossary beginning on page 47.

Application-oriented user guide

The *HST-3000 DDS Local Loop Testing User's Guide* is an application-oriented user's guide containing information about using the HST-3000 DDS Local Loop testing option to analyze the DDS four-wire local loop. This guide includes an overview of test features, instructions for using the HST-3000 to terminate or loop back traffic on a DDS line, and test result descriptions. This guide also contains specifications and contact information for JDSU's Technical Assistance Center (TAC).

This user's guide should be used in conjunction with the *HST-3000 Base Unit User's Guide*.

HST-3000 base unit user's guide

The *HST-3000 Base Unit User's Guide* contains overall information about the base unit and general functions such as instructions for charging the battery, managing files, information on peripheral support, and technical specifications for the base unit. the base unit user's guide also contains a description of Acterna's warranty, services, and repair information, including terms and conditions of the licensing agreement.

Safety and compliance information

Safety and compliance information are provided in the *HST Safety and Compliance Information* booklet included with the HST-3000 user documentation CD-ROM.

Technical assistance

If you need assistance or have questions related to the use of this product, call or e-mail JDSU's Technical Assistance Center (TAC) for customer support. Before contacting TAC, you should have the serial numbers for your HST-3000 unit. See "Locating the serial number" in the HST-3000 Base Unit User's Guide for more information.

Table 1 lists TAC information. For the latest TAC contact information, go to www.jdsu.com, or contact your local sales office for assistance. For contact information for regional sales offices, see the back cover of this guide.

Table 1 Technical assistance centers

Region	Phone Number	
Americas	1-866-ACTERNA 301-353-1550	(1-866-228-3762) tac@jdsu.com
Europe, Africa, and Mid-East	+49 (0) 7121 86 1345 (JDSU Germany)	hotline.europe@jdsu.com
Asia and the Pacific	+852 2892 0990 (Hong Kong) +8610 6833 7477 (Beijing-China)	

During off-hours, you can request assistance by doing one of the following: leave a voice mail message at the Technical Assistance number, e-mail the North American Technical Assistance Center, tac@jdsu.com, or submit your question using our online Technical Assistance Request form at www.jdsu.com.

Conventions

This guide uses naming conventions and symbols, as described in the following tables.

Table 2 Typographical conventions

Description	Example
User interface actions and buttons or switches you have to press appear in this **typeface**.	Press the **OK** key.
Code and output messages appear in this `typeface`.	`All results okay`
Text you must type exactly as shown appears in this **`typeface`**.	Type: **`a:\set.exe`** in the dialog box.
Variables appear in this ***typeface***.	Type the new ***hostname***.
Book references appear in this *typeface*.	Refer to *Newton's Telecom Dictionary*

Table 3 Keyboard and menu conventions

Description	Example
A plus sign + indicates simultaneous keystrokes.	Press **Ctrl+s**
A comma indicates consecutive key strokes.	Press **Alt+f, s**
A slanted bracket (>) indicates choosing a submenu from menu.	On the menu bar, click **Start > Program Files**.

Table 4 Symbol conventions

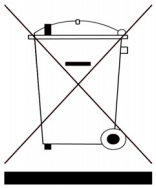
	This symbol represents a general hazard.
	This symbol represents a risk of electrical shock.
	This symbol represents a risk of explosion
	This symbol represents a Note indicating related information or tip.
	This symbol, located on the equipment or its packaging indicates that the equipment must not be disposed of in a land-fill site or as municipal waste, and should be disposed of according to your national regulations.

Table 5 Safety definitions

DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Getting started

1

This chapter provides basic information about the HST-3000 with a DDS Local Loop SIM. Topics discussed in this chapter include the following:

Overview of features

When attached to the HST-3000 base unit, the DDS Local Loop (DDS-LL) SIM lets you perform physical layer test operations necessary for provisioning transmission circuits. The DDS-LL test option includes the following features:

- BER testing on all supported rates, including end-to-end (straightaway) testing or loopback testing using another test device at the far end.
- Channel service unit/data service unit (CSU/DSU) emulation.
- A single 8-pin, RJ-48 DDS-LL interface connector. For pin assignments, see Table 7 on page 6.
- Copper testing. See the *HST-3000 Copper Testing User's Guide*.
- Frame Relay testing (optional). See the *HST-3000 Frame Relay Testing User's Guide*.

Status LEDs

Six status LEDs are located on the front of the HST-3000, above the LCD screen. Table 6 describes the LEDs.

Table 6 Status LEDs

LED	Description
Sync	A two-color LED that reports the signal status. – Green indicates a signal is present and there is frame synchronization. – Red indicates that at least one of the channels does not have signal or frame synchronization. – If the Sync LED is not illuminated, no signal has been detected.

Table 6 Status LEDs (Continued)

LED	Description
Data	A two-color LED that reports pattern synchronization status. – Green indicates pattern synchronization has been achieved on all active channels. – Red indicates that at least one of the active channels does not have pattern synchronization. – If the Data LED is not illuminated, no pattern synchronization has been detected on any active channel.
Error	An LED that reports error conditions. – Solid red indicates an error. – If the Error LED is not illuminated it means all Summary results are OK.
Alarm	This LED is not used in DDS local loop testing.
LpBk	An LED that shows when the HST is in loopback. – Green indicates that the HST has been successfully looped up. – If the LpBk LED is not illuminated, then the loopback is active.

Table 6 Status LEDs (Continued)

LED	Description
Batt	A three-color LED that indicates the battery status. – The Batt LED is off when the battery has a useful charge. – Solid or flashing amber indicates the battery capacity indicator (“gas gauge”) needs to be reset (see the *HST-3000 Base Unit User’s Guide*). – Solid green indicates a power source is plugged in. – Solid red indicates the battery is at about 20 percent or below full charge. – Flashing red indicates about five minutes of use remains. When this happens, the battery should be charged or replaced immediately. For information about recharging or changing the battery, see the *HST-3000 Base Unit User’s Guide*.

DDS-LL interface

The electrical interface for the DDS-LL testing is an eight position modular connector located on the side of the SIM (see Figure 1). Four conductors are used on the connector. For pin assignments, see Table 7 on page 6.

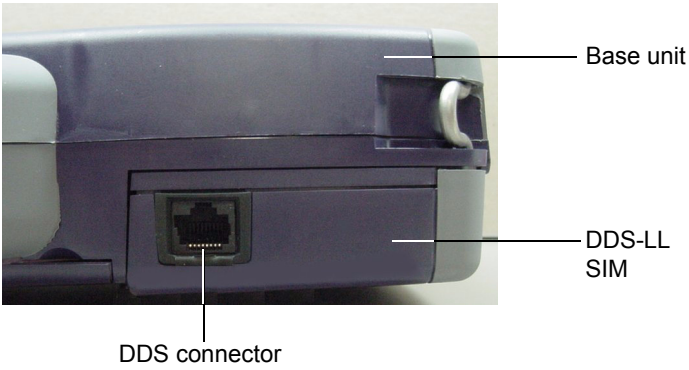


Figure 1 DDS interface connector

NOTE:

The DDS interface connector is protected by a flexible dust cap. The dust cap is a permanent fixture and should not be removed.

WARNING: ELECTRICAL SHOCK

Electrical shock may result in serious injury or death. Use care when connecting to telecommunications circuits, to be sure that you do not come in contact with exposed conductors or power mains. Connect telephone-network voltage (TNV) signals only to TNV ports.

Table 7 shows the pin assignments for the DDS-LL interface. For additional interface specifications, see "Interface specifications" on page 44.

Table 7 DDS connector pin outs (CSU/DSU Emulation)

Pin Number	Function
1	Ring Lead, Transmit data (Tx)
2	Tip Lead, Transmit Data (Tx)
3	Not Used
4	Not Used
5	Not Used
6	Not Used
7	Tip Lead, Receive Data (Rx)
8	Ring Lead, Receive Data (Rx)

Test modes

DDS-LL tests are performed in Terminate mode. In Terminate mode, the HST separates the transmit and receive sides of a DDS path. The input signal is terminated at the receive side, and a totally independent signal is generated for the output.

Options

You can order software options to add functionality to the HST-3000. For DDS-4WLL, the following option is available:

– Frame Relay — Allows you to test frame relay services. Available for E1, T1, Datacom, and DDS local loop SIMs. (Ordering number: HST3000-FR)

For information about purchasing options for the HST-3000, contact your JDSU representative or your local JDSU sales office. You can also contact JDSU through the company web site, www.jdsu.com.

Launching an application

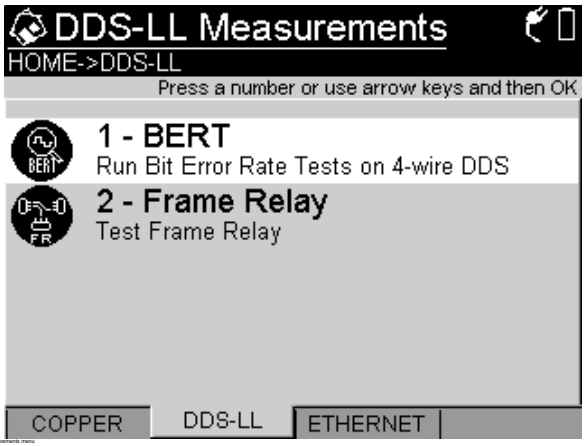
Before you can launch an application, you must have a DDS-LL SIM. Make sure the SIM is properly connected to the HST base unit before you power on the unit. For information about connecting a SIM and powering the HST, see the *HST-3000 Base Unit User's Guide*.

The following procedure describes how to launch an application.

To launch the DDS-LL application

1. Power on the HST-3000.
2. Press the **DDS-LL** soft key.

   The DDS-LL Measurements menu appears. This menu lists the available DDS-LL test applications. Menu items vary depending on the options you purchased.



T1 Measurements menu

3 Press a number key that corresponds to the application you want to launch. For example, press the 1 key to launch the BERT application. You can also use the up and down arrow keys to highlight your selection, and the press the OK key. The following table lists all currently available T1 applications.

Application	Select...
Bit error rate testing on the DDS four-wire local loop	**BERT**
Frame relay testing	**Frame Relay** For information about Frame Relay testing, see the *HST-3000 Frame Relay Testing User's Guide*.

The HST launches the application.

Accessing the test configuration menus

To configure test settings, you must access the configuration settings menus. The following procedure describes how to access the menus.

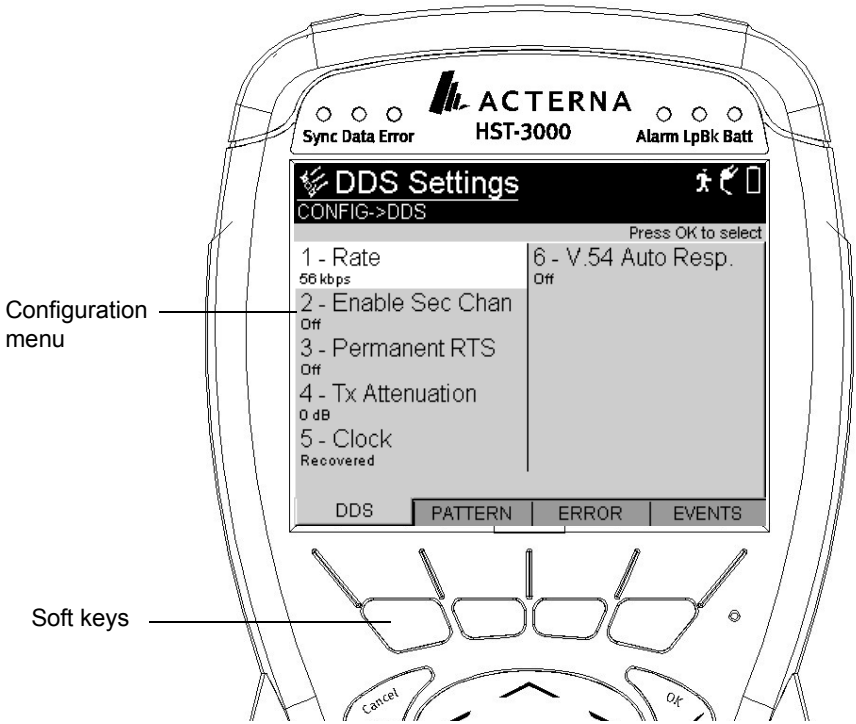
To access the test configuration menus

1 Launch the **DDS-LL** application. See "Launching an application" on page 7.

The HST launches the application and a test result screen appears.

2 Press the **Configure** navigation key.

A settings menu appears. Menus vary depending on the application you selected.



3 To view a different menu, press the corresponding soft key.

For example, to configure a test pattern, press the PATTERN soft key.

You have accessed the test configuration menus.

Instrument settings and user preferences

For information about changing instrument and preference settings, such as date and time format, port settings, sound, and screen settings, see the *HST-3000 Base Unit User's Guide*.

DDS Local Loop testing

2

This chapter provides information on circuit testing using the HST-3000 DDS Local Loop (LL) testing feature. Topics discussed in this chapter include the following:

About testing

You can use the HST-3000, with a DDS-LL SIM, to provision and maintain DDS transmission circuits. Typically this involves out-of-service testing to ensure that the physical layer is clean and there are no problems with network equipment or improper provisioning.

You can use the HST-3000 to do the following:

– Perform end-to-end bit error rate (BER) tests. Using two HST-3000 units, one at each end of the circuit, you can analyze traffic in both directions, and isolate faults on the circuit. Typically, this requires two technicians.
– Terminate a circuit, and perform BER testing to a loop back or straight away testing to another test set.
– Emulate a piece of network or CPE equipment (such as an NIU, CSU or DSU) and respond to loop backs from another tester in the network.

BER testing

In Terminate mode, the HST allows you to send DDS BERT patterns and errors (BPVs, frame errors, bit errors) through the DDS four-wire interface. The following procedure describes how to perform a BER test.

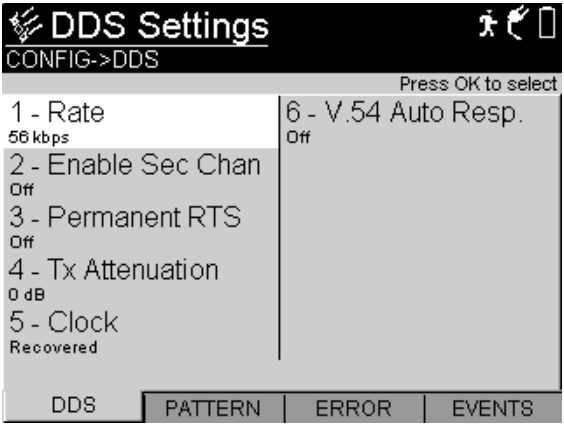
To perform a BER test

1 Launch the DDS four-wire local loop application. See “Launching an application” on page 7.

2 Access the test configuration menus. See “Accessing the test configuration menus” on page 8

3 Press the **DDS** soft key.

The DDS Settings menu appears.



4 Configure the test settings by pressing the number on the key pad that corresponds to the setting you want to configure. For example, press the **1** key to configure the primary channel data rate.

You can also use the arrow keys to highlight the option you want to configure, and then press the **OK** key. Press the **Cancel** key to exit a menu.

The following table describes the settings.

Settings	Parameters
Rate	Select the primary channel data rate (in Kbps). Options are as follows: **Auto**, **2.4**, **4.8**, **9.6**, **19.2**, **38.4**, **56** (default), or **64**.
Enable Sec Chan	Specify one of the following: – **On** — Enables the secondary channel. – **Off** — Disables the secondary channel.

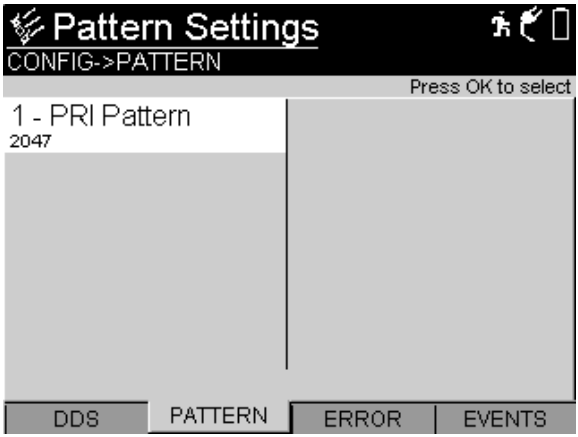
Settings	Parameters
Permanent RTS	Permanent RTS allows selection of permanent request to send. When Permanent RTS is on and the unit is not transmitting a test pattern, and the BERT pattern is not enabled, the pattern transmitted is data mode idle (11111111). When Permanent RTS is off and the unit is not transmitting a test pattern, the pattern transmitted is control mode idle (11111110). Specify one of the following options: – **On** – **Off**
Tx Attenuation	Specify the level of resistive loss (attenuation) for the transmitted signal in decibels (dB). The selected resistive loss affects the transmit data only at the connectors. Specify one of the following options: – **0** — Sets the primary output (Tx) to 0 dB attenuation. – **-3** — Attenuates the output with 3 dB of simulated resistive loss. – **-6** — Attenuates the output with 6 dB of simulated resistive loss. – **-9** — Attenuates the output with 9 dB of simulated resistive loss.

Settings	Parameters
Clock	Specify the signal timing source for the primary output (Tx): – **Internal** (or master) — Timing is derived using the internal clock/ frequency synthesizer. – **Recovered** (default) — Timing is derived from the network signal by the receiver clock and used as the transmit timing source. This option requires that signal be present on the receiver. **NOTE:** If the circuit will be physically looped back, the Clock (signal timing source) should be configured to internal timing.
V.54 Auto Resp	Specify one of the following: – **On** — Enables the HST to loop back when it receives a V.54 loop code. – **Off** — Disables the auto response feature. The HST will not respond to V.54 loop codes.

5 To specify a test pattern do the following:

a Press the **PATTERN** soft key.

The Pattern Settings menu appears.



b For the primary channel, select **PRI Pattern**, and then select a pattern.

If you select a user-programmable pattern, such as **User Bit Pattern** or **User Byte Pattern**, you must enter a pattern (see page 40).

For descriptions of the patterns available on the primary channel, and for specific information about the use of the 511QRS and 2047QRS patterns, see "BERT patterns" on page 38.

By default, the HST will transmit the selected pattern.

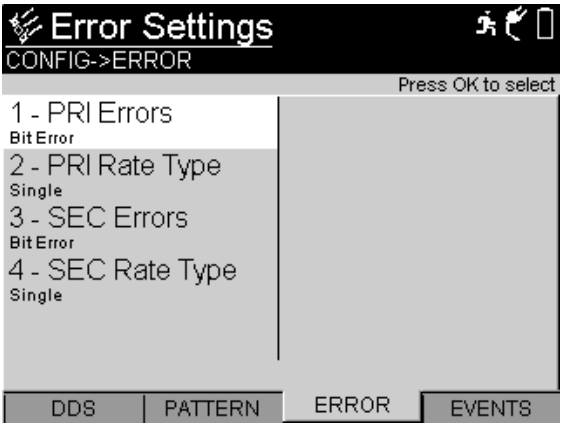
c If the secondary channel is enabled, select **SEC Pattern**, and then select a pattern.

For descriptions of patterns available on the secondary channel, see Table 16 on page 40.

6 To configure the error settings, do the following:

a Press the **ERROR** soft key.

The Error Settings menu appears.Settings for the primary (PRI) path are available. If the secondary channel is enabled, settings for the secondary (SEC) path are also available.



b Press the number key, on the keypad, that corresponds to the option you want to configure.

For example, to specify the type of error you want to insert into the primary channel, press the **1** key. The table below describes the parameters for each option.

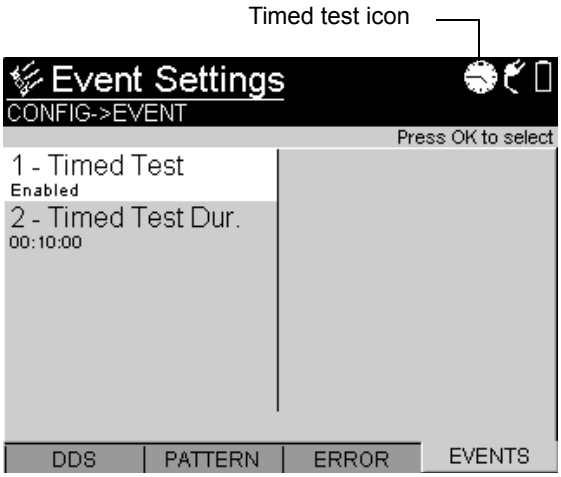
Settings	Parameters
PRI/SEC Errors	Errors available on the primary channel include: – **Bit Error** – **BPV** – **Frame Error** — This option is only available if the secondary channel is enabled or if the data rate is 64 kpbs. Errors available on the secondary channel include: – **Bit Error**

Settings	Parameters
PRI Frame Errors	Indicate the number of frame errors, either **1** or **2**. This option is only visible when the PRI Errors setting is Frame Error.
PRI/SEC Rate Type	Select **Rate Type**, and then indicate how errors will be inserted: – **Single** – **Rate** – **Multiple** The Rate Type option is only visible if the error type is Bit Error.
PRI/SEC Rate	Select **Rate**, and then indicate the insertion rate for logic errors. Available rates range from **1.0e-02** to **1.0e-07**. The Rate option is only visible if the rate type is set to Rate.
PRI/SEC Error Count	Select **Error Count**, and the number of errors to be inserted. You can select a number from **1** to **50**. The Error Count option is only visible if the rate type is Multiple.

7 To specify timed testing, do the following:

a Press the **EVENTS** soft key.

The Event Settings menu appears.



b Select **Timed Test**, and then select either **Enabled** or **Disabled**.

If you enable timed testing the clock icon appears in the upper right corner of the HST display.

c If timed testing is enabled, select **Timed Test Dur**.

d Enter the number of hours, minutes, and seconds you want the test to run, and then press the **OK** key.

8 If you are NOT connecting the HST to a multi-junction unit (MJU), you can skip this step and proceed to step 9. If you are connecting to an MJU, configure the HST to transmit an idle byte pattern before you connect the unit to the MJU. This is necessary because, by default, the HST transmits the selected BERT pattern.

To specify the idle pattern, do the following:

a Press the **Home** navigation key.

b Press the **Action** soft key, and then select **Disable BERT Pattern**.

The HST is now set to transmit the idle pattern.

9 Connect one end of the test cable to the HST's DDS interface. The HST's interface connector is located on the right side of the HST unit (see Figure 1 on page 5).

10 Connect the other end to the circuit.

If you are performing a straightaway (end-to-end) test at the customer premises, you will likely be accessing the circuit at the 66 block, NIU, or patch panel.

11 Set up a physical loop at the far end. If you are unsure of this process, contact your supervisor.

12 Press the **Home** navigation key.

13 Press the **Restart** soft key to clear all errors and begin the test.

14 By default, the HST transmits the BERT pattern. To disable the BERT pattern, press the **Action** soft key, and then select **Disable BERT Pattern**.

The HST will transmit an idle pattern.

15 Choose one or more of the following options:

Option	Do the following
To insert an error	Press the **Action** soft key, and then Select the type of error to insert. Options vary depending on the error settings you configured. Possible options include: – **Insert BPV** – **Insert Frame Error (PRI)** – **Insert Bit Errors (PRI)** or **(Sec) —** Inserts bit errors into the primary or secondary channels. – **Enable Bit Error (Pri)** or **(Sec) at *rate*** — inserts bit errors, at the specified rate, into the primary or secondary channel. If you specified an insertion rate for bit errors, the rate will appear in the option. For example: – Enable Bit Error (Pri) at 1e-3 – Enable Bit Error (Sec) at 1e-3
To send a loop up or loop down command	Press the **Action** soft key. Select **Loop Action**, and then one of the following: – **Send V.54 loop up** – **Send V.54 loop down** – **CSU/DSU loopback**

16 If the circuit is physically looped back, check to see that the inserted errors are received in the Summary test result category (see “Viewing test results” on page 22).

For physical loopbacks, the clock setting (signal timing source) should be set to internal timing.

17 If you are performing an end-to-end test, verify that the test units at each end of the circuit received the inserted errors.

NOTE:

When you send a loop command, a status message appears showing the progress of the loop operation.

The LpBk LED does not show the status of the loop operation. The LpBk LED only indicates when the HST itself is in loopback (see "Status LEDs" on page 2).

18 To stop a running test, press the **Cancel** key.

BER testing is complete.

Viewing test results

The following procedure describes how to view test results.

To view test results

1 Configure and run a test. See "BER testing" on page 12.

2 Press the **Home** navigation key.

3 Press the **Display** soft key, and then select a category.

Results for the selected category appear. For descriptions of test results, see Appendix A beginning on page 27.

4 To clear result history, press the **Results** soft key, and then select **Clear History**.

Troubleshooting

3

This chapter describes how to identify and correct problems related to DDS-LL testing with the HST-3000. Topics discussed in this chapter include the following:

Resolving problems

Table 8 describes situations that you may encounter when using the HST-3000.

Table 8 Problems and resolutions

Issue	Description	Resolution
No menu options appear on start-up	This can occur if the SIM is not properly attached to the base unit.	Power-off the unit. Unscrew the $^1/_4$-turn fastener. Carefully remove the SIM from the base unit. Carefully reconnect the SIM to the base unit. See “Attaching a SIM” in the *HST-3000 Base Unit User’s Guide*.
No signal present	This occurs when there is no valid input connected to the HST-3000.	Make sure the cables are connected to the receiver and that the signal consists of valid data.
Pattern synchronization is not achieved	This error is displayed when an input signal is detected but the incoming data pattern is different to the test pattern selected in the BERT setup.	Check the test pattern. Make sure the correct one is selected.
Bipolar violations (BPVs) detected	Excessive BPVs usually indicate the wrong rate or secondary channel mode has been incorrectly selected.	Verify that the correct rate and secondary channel mode are selected.
After connecting to the DDS four-wire interface, the LpBk LED indicates there is a CSU loopback.	The Rx and Tx connections are reversed. The LED registers a loopback because simplex current reversal (the sealing current across the Tx/Rx pair) is the mechanism that causes the CSU loopback to occur.	Check the transmit and receive connections. If they are reversed, reconnect them to the proper lines.

Table 8 Problems and resolutions (Continued)

Issue	Description	Resolution
Pattern synchronization is not achieved at the far end.	DDS local loop tests start with the unit transmitting idle codes.	You must manually enable the transmission of BERT patterns. To enable the BERT patterns, do the following: – Press the **Home** navigation key. – Press the **Action** soft key – Select **Enable BERT Pattern**.
A large number of bit errors are counted when using the 511QRS or 2047QRS BERT patterns	The QRS patterns available for primary channel BER testing meet the Telcordia/ Bellcore Operations Technology Generic Requirements (OTGR) specification's (TR-TSY-000439) definition for QRS patterns. If you are using the HST with a test set that meets the T1.510 standard for QRS, the HST will achieve pattern synchronization, but both pieces of equipment will continuously count a large number of bit errors. For additional information, see “BERT patterns” on page 38.	Select a BERT pattern other than a QRS pattern.

Test Results

A

This appendix describes the test result categories and the results within each category that are available when performing DDS local loop testing. Topics discussed in this appendix include the following:

About test results

After you start a test, the Summary result category automatically displays a large “All Summary Results OK” message if no errors or alarms have been detected. If errors are detected, the Summary results are displayed. To view test results in other categories, see “Viewing test results” on page 22. The following sections describe the test results for each of the categories.

Summary results

The Summary category automatically displays results for the primary and/or secondary channels that are non-zero, key results that are out-of-specification, or key informational results. This allows quick access to the results without having to search each category. If no errors or alarms are detected, the message, “All Summary Results OK” appears. Table 9 describes the results that can appear in the Summary category.

Table 9 Summary results

Result	Definition
BPVs	Number of bipolar violations (BPVs) detected in the received signal (that are not BPVs embedded in valid control code sequences) since start of test.
Frame Errors	Number of frame errors received since start of test.
Frame Losses	Number of times frame synchronization was lost since start of test.
Frame Sync	Indicates whether frame synchronization is detected.
Pri/Sec Pattern Losses	Number of times pattern synchronization was lost since start of test.

Table 9 Summary results (Continued)

Result	Definition
Pri/Sec Pattern Slips	Number of pattern slips detected since start of test (PRBS patterns only).
Pri/Sec Pattern Sync	Indicates whether pattern synchronization is detected.
Rx Level dB	DDS power of signal received in a test. The value will be displayed as ±xx dB in a range from +6 dB to -45 dB. A value greater than +6 dB will display `Too High` and a value less than -39.0 dB (subrates) or -45.0 dB (for all others) will display `Too Low`.
Sec Bit Errors	Number of received bits on the secondary channel with a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.
Signal Losses	Number of times the signal was lost or absent (limited to 1 loss in every 100 milliseconds).
Signal Present	Indicates whether a valid signal is present.

Signal results

The Signal category shows signal level, frequency, and loss seconds results. Results in this category accumulate after test restart. Table 10 describes the results that appear in the Signal category.

Table 10 Signal test results

Result	Description
Rx Level dB	DDS power of signal received in a test. The value will be displayed as ±xx dB in a range from +6 dB to -45 dB. A value greater than +6 dB will display `Too High` and a value less than -39.0 dB (subrates) or -45.0 dB (for all others) will display `Too Low`.
Rx Level Volts Peak	Displayed as x.x ranging from 1.0 to 3.0, and .xx Volts ranging from 0.01 to .99 Volts.
Signal Loss Seconds	Number of test seconds in which the signal was not present for any part of the second.
Signal Losses	Number of times the signal was lost or absent (limited to 1 loss in every 100 milliseconds).
Signal Present	Indicates whether a signal is present.
Simplex Current	Indicates whether the simplex current is present.

Interface (DDS-LL) results

The Interface category lists results related to framing. Table 11 describes the results that appear in the Interface category.

Table 11 Interface test results

Result	Description
BPV Err Seconds	Number of test seconds in which one or more BPVs are received.
BPV Rate	Ratio of BPVs received over total bits received.
BPVs	Number of bipolar violations (BPVs) detected in the received signal (that are not BPVs embedded in valid control codes) sequences since start of test.
Frame Error Rate	Ratio of frame errors to received framing bits since initial frame synchronization.
Frame Error Seconds	Number of seconds during which one or more frame errors occurred since initial frame synchronization.
Frame Errors	Number of frame errors detected since initial frame synchronization.
Frame Loss Seconds	Number of seconds during which one or more frame synchronization losses occurred or during which frame synchronization could not be achieved, since initial frame synchronization.
Frame Losses	Number of times frame synchronization was lost.
Frame Sync	Indicates whether frame synchronization is detected.

Table 11 Interface test results (Continued)

Result	Description
Rx Byte	Provides a sample, every second, of the data received on the line. The data byte samples are in binary form. **NOTE:** If the secondary channel is on, or the primary channel data rate is 64 Kbps, the last bit is the multiplexed secondary channel/control bit.
Rx Code	Provides a brief text description (decode), every second, for the received byte codes.

Test (BERT) results

The BERT category lists results related to the bit error rate test pattern. Table 12 describes the results that appear in the BERT category.

Table 12 Test (BERT) results

Result	Description
% Error Free Seconds	Ratio, expressed as a percentage, of seconds during which no pattern bit errors were detected, to the total number of seconds while pattern synchronization is present.
Bit Error Rate	Ratio of bit errors to received pattern data bits.
Bit Errors	Number of received bits with a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.
Error Free Seconds	Number of seconds during which no pattern bit errors are detected while pattern synchronization is present.

Table 12 Test (BERT) results (Continued)

Result	Description
Error Seconds	Number of seconds during which one or more pattern bit errors occurred since initial pattern synchronization.
Pattern Losses	Number of times the received pattern is lost relative to the expected (internally generated) test pattern.
Pattern Slips	Number of pattern slips detected since start of test (PRBS patterns only).
Pattern Sync	Indicates whether pattern synchronization is detected.

LED results

The LED category shows the current and historical status for alarms. Table 13 describes the results that appear in the LED category.

Table 13 LED results

Result	Description
Pri Pattern Sync	Indicates pattern synchronization on the primary channel is detected.
CSU LpBk	Indicates CSU loopback is detected.
DSU Alternating LpBk	Indicates DSU alternating loopback is detected.
DSU Latching LpBk	Indicates DSU latching loopback is detected.
Frame Sync	Indicates frame synchronization is detected.
Frame Sync History	Indicates frame synchronization was detected and then later lost.

Table 13 LED results (Continued)

Result	Description
Pri Pattern Sync History	Indicates pattern synchronization was detected and then later lost on the primary channel.
Sec Pattern Sync	Indicates pattern synchronization on the secondary channel is detected.
Sec Pattern Sync History	Indicates pattern synchronization was detected and then later lost on the secondary channel.
Signal Present	Indicates a signal is present on the line.
Signal Present History	Indicates a signal was detected and then later lost.
V.54 LpBk	Indicates the unit is responding to a V.54 loopback request.

Time results

The time category lists the current date, time, and the amount of elapsed time since test restart. Table 14 describes the results that appear in the Time category.

Table 14 Time test results

Result	Description
Date	Current day and month.
Elapsed Time	Amount time in hours, minutes, and seconds (hh:mm:ss) since the last test restart.
Time	Current time of day in hours, minutes, and seconds (hh:mm:ss).

Table 14 Time test results (Continued)

Result	Description
Time Remaining	Amount of time remaining until the test is complete.

Saving and printing results

For information about saving and printing test results, see the *HST-3000 Base Unit User's Guide*.

BERT Patterns and Errors

B

This appendix describes the patterns available for BER testing. Topics discussed in this appendix include the following:

BERT patterns

The 511QRS and 2047QRS patterns, available on the HST for primary channel BERT, meet the Telcordia/Bellcore Operations Technology Generic Requirements (OTGR) specification's (TR-TSY -000439) definition for QRS patterns. The TPI Model 82 and Model 105 also meet the Telcordia/OTGR specification for the 56 kbps primary data rate when the secondary channel is enabled.

Other JDSU products, such as the FIREBERD 6000 and the T-BERD 950, meet the ANSI T1.510 specification for QRS. Additionally, all DS0 DDS equipment (including the HST-3000 T1 DDS option) conforms to the T1.510 standard.

Because of the different QRS standards, the HST-3000 will achieve pattern synchronization with test equipment meeting the T1.510 standard, but both pieces of equipment will continuously count a large number of bit errors. In such a situation, JDSU recommends using a pattern other than a QRS pattern.

Table 15 describes the BERT patterns available for DDS local loop testing using the primary channel. Table 16 on page 40 describes the patterns available on the secondary channel.

Table 15 Primary DDS channel patterns

Pattern	Description
Auto	Allows the HST to automatically detect the pattern on the received signal.
All Ones	Provides a fixed test pattern of all ones. Generally this pattern is used to stress span repeater current regulator circuits. It can also be used as a keep alive signal or an idle code.
All Zeros	Provides a fixed test pattern of all zeros.
2^6-1(63)	Selects the 2^6 -1 Pseudorandom pattern, which generates a maximum of 5 sequential 0s and 6 sequential 1s. Simulates live data for circuits less than 9.6 kbps.

Table 15 Primary DDS channel patterns (Continued)

Pattern	Description
511	Selects the 2^9 -1 Pseudorandom pattern, which generates a maximum of 8 sequential 0s and 9 sequential 1s. Simulates live data for circuits less than 9.6 kbps.
511QRS	Selects the 2^9 -1 Pseudorandom pattern, which generates a maximum of 6 sequential 0s and 9 sequential 1s.
2047	A pseudorandom pattern based on an 11-bit shift register. Selects the 2^{11} -1 Pseudorandom pattern, which generates a maximum of 10 sequential 0s and 11 sequential 1s. Simulates live data for circuits 56 kbps and lower. (Used for DDS and ISDN.)
2047QRS	Selects the 2^{11} -1 Pseudorandom pattern, which generates a maximum of 6 sequential 0s and 11 sequential 1s.
2^15-1	Selects the 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential 0s and 15 sequential 1s.
2^20-1	Selects the 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential 0s and 20 sequential 1s.
2^23-1	Selects the 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential 0s and 23 sequential 1s.
DDS1	Selects a pattern consisting of 100 octets of 0xFF, followed by 100 octets of 0x00, transmitted right to left. Stresses a DDS circuit's minimum and maximum power recovery.
DDS2	Selects a pattern consisting of 100 octets of 0x7E, followed by 100 octets of 0x00, transmitted right to left. Ensures a DDS circuit can properly pass the signal. Provides a minimum ones density and simulates bit-oriented protocol flags.
DDS3	Selects a fixed pattern consisting of F0011 0010 [0x32], transmitted right to left. Used to simulate a signal transmitted over the DDS circuit. Medium stress for a DDS circuit. DDS3 (32 hex) is the EBCDIC Sync Idle Character
DDS3R	Selects a fixed pattern the reverse of DDS3.
DDS4	Selects a fixed pattern consisting of F0100 0000 [0x40], transmitted right to left. Moderately stresses the DDS clock recovery circuitry. DDS4 (40 hex) is the EBCDIC space character.

Table 15 Primary DDS channel patterns (Continued)

Pattern	Description
DDS5	Selects a rotating pattern consisting of DDS patterns 1-4.
DDS6	Selects a fixed pattern consisting of seven octets of 0x7F, followed by one octet of 0xFF, transmitted right to left. Simulates a DDS signal transition from idle mode to data mode. Detects marginal equipment in multipoint applications.
User Bit Pattern	A user-programmable pattern that is 3 to 32 bits in length.
User Byte Pattern	A user-programmable pattern that is 1 to 64 bytes in length.

Table 16 shows the BERT patterns available for DDS local loop testing using the primary channel.

Table 16 Secondary DDS channel patterns

Pattern	Description
Auto	Allows the HST to automatically detect the pattern on the received signal.
Idle	Provides a fixed test pattern of all ones. Generally this pattern is used to stress span repeater current regulator circuits. It can also be used as a keep alive signal or an idle code.
511	Selects the 2^{9} -1 Pseudorandom pattern, which generates a maximum of 8 sequential 0s and 9 sequential 1s. Simulates live data for circuits less than 9.6 kbps.
2047	A pseudorandom pattern based on an 11-bit shift register. Selects the 2^{11} -1 Pseudorandom pattern, which generates a maximum of 10 sequential 0s and 11 sequential 1s. Simulates live data for circuits 56 kbps and lower. (Used for DDS and ISDN.)

Errors

Table 17 lists the errors you can insert.

Table 17 Errors

Error	Description
BPV	Bipolar violation
Frame Error	Frame Error or FAS
Bit Error	Payload bit error

Error/alarm criteria

Table 18 shows the criteria that will cause an error or alarm to register on the HST-3000.

Table 18 Error/alarm criteria

Error/Alarm	Criteria
Signal Loss	32 consecutive zeros or sudden signal strength loss of more than 6 dB.
Frame Loss	Caused when five consecutive framing patterns contain one or more errors. The framing pattern is 101100. If any one or more bits is errored 5 consecutive times, frame loss is declared and the HST begins searching for the framing pattern.

Specifications

C

This appendix contains specifications for the DDS-LL testing option. Topics discussed in this appendix include the following:

Interface specifications

The HST-3000 with the DDS-LL testing option supports a DDS four-wire Local Loop interface. Table 19 shows the DDS-LL interface connector specifications. For additional information about the interface connector, see "DDS-LL interface" on page 5.

Table 19 DDS interface specifications

Feature/Function	Specification
Supported Emulation	CSU/DSU emulation
Supported test modes	Terminate
Nominal Tx Amplitude	For 9.6 Kbps: 0.75 Vp ±10% All other rates: 1.5 Vp ±10%
Termination Impedance (Rx)	135 Ohms ±5% measured from 100 Hz to 144 Khz
Data Format Support	Standard DDS (Primary Channel and Out-of-Band Control Codes) DDS with Secondary Channel (Primary, Secondary, In-band Control)
Primary Channel Data Rate Support	2.4, 4.8, 9.6, 19.2, 38.4, 56, and 64 Kbps
Secondary Channel Data Support	IDLE insertion, 511, 2047 BERT
Clock Source	Internal or Recovered from network (user selectable)
Receive Signal Range	For 56 and 64 kbps rates: +6.0 dB to -45 dB For all other data rates: +6.0 dB to -40 dB

Table 19 DDS interface specifications (Continued)

Feature/Function	Specification
Transmitter Output Levels	0, -3, -6, and -9 dB with accuracy ±1 dB from the level at 0 dB. **NOTE:** this is resistive attenuation and should not be considered LBO.
Internal Timing Accuracy	±50 ppm

Glossary

A

AMI — Alternate Mark Inversion. A line code which inverts the polarity of alternate 1s.

B

Base Unit — The HST-3000 base unit houses the keypad, display screen, battery, and some connectors. Service interface modules (SIMs) connect to the base unit to provide testing functionality.

BERT — Bit Error Rate Test. A known pattern of bits is transmitted, and errors received are counted to figure the BER. The Bit Error Rate test is used to measure transmission quality.

BPV — Bipolar Violation. A BPV is a violation that occurs when two consecutive non-zero elements of the same polarity occur in a bipolar signal.

C

CO — Central Office.

CPE — Customer Premise Equipment.

CSU — Channel Service Unit. A device that terminates a digital channel on a customer's premises.

D

DDS — Dataphone Digital Servers, also called Digital Data System. A private line digital service, typically with rates at 24, 48, 96, and 56Kbps.

DS1 — An interface providing a framed or unframed 1.544 Mb/s bit stream.

DSU — Data Service Unit. A device that connects data terminal equipment, such as a PC or LAN, to a digital phone line to allow fully digital communication.

E

ES — Errored Second. A second during which at least one error or alarm occurred.

F

Frame Loss — Criteria is as follows: D4D - 2 out of 5 Ft bits in error; ESF - 2 out of 5 frame bits in error.

H

HST — Handheld Services Tester. The HST-3000 is JDSU's portable, modular test set that combines copper and service testing capabilities in a rugged, battery operated unit.

L

LBO — Line Build Out. An optional attenuation which can be applied to the output signal to simulate long lengths of cable.

Local Loop — The physical connection from the subscriber's premises to the carrier's point of presence.

LOF — Loss of Frame. A condition indicating that the receiving equipment has lost frame delineation.

LOS — Loss Of Signal. A condition when no pulses of positive or negative polarity are received for more than 175 pulse counts.

N

NIU — Network Interface Unit. Electronic device at the point of interconnection between the service provider communications facilities and terminal equipment at a subscriber's premises.

P

Pattern sync — The condition when the received test pattern matches the transmitted test pattern. In order to detect pattern sync the instrument must be transmitting a known

test pattern in at least one channel (if framed) or continuously (if unframed).

Q

QRSS — Quasi-Random Signal Sequence.

R

Rx — Receiver or input.

S

SES — Severely Errored Seconds.

SIM — Service Interface Module. SIMs connect to the HST-3000 base unit to provide testing functionality.

T

TNV — Telephone-network voltage.

Tx — Transmitter or output.

V

V.54 — ITU-T standard for loop test devices in modems, data communications equipment (DCE), and data terminal equipment (DTE). The v.54 standard defines local and remote loopbacks.

Index

I

L

P

Q

R

S

T

U

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