HST-3000

ISDN BRA 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-062501. The catalog number for an electronic guide on CD-ROM is ML-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.

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About This Guide

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 ISDN basic rate access (BRA) testing SIM. Using the option, you can place, receive, and analyze calls, test data services using BERT analysis, test voice services using a microphone/speaker audio headset, and monitor physical (layer 1), LAPD (layer 2), and Q.931 (layer 3) results.

This guide includes task-based instructions that describe how to configure and use the HST-3000 to test and troubleshoot Basic Rate ISDN circuits.

Assumptions

This guide is intended for novice, intermediate, and experienced users who want to use the HST-3000 BRA SIM efficiently and effectively. We assume that you are familiar with the ISDN communications standard and basic telecommunications safety, concepts, and terminology.

Terminology

The following terms have a specific meaning when they are used in this guide (also see "Glossary" on page 117):

– **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.

Application-oriented user guide

The *HST-3000 ISDN Basic Rate Testing User's Guide* is an application-oriented user's guide containing information about using the HST-3000 BRA SIM to perform test operations on ISDN lines with the basic rate interface. This guide includes an overview of testing features, instructions for using the HST-3000 in monitor and terminate test operations, and test result descriptions. This guide also contains testing 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 infor- mation relating to device and general functions such as using the unit with a keyboard, peripheral support, battery charging, saving and printing results, and managing files. This guide also contains technical specifications for the base unit and a description of JDSU's warranty, services, and repair informa- tion, including terms and conditions of the licensing agree- ment.

Safety and compliance information

Safety and compliance information are contained in the booklet included with the HST-3000 user documentation CD-ROM jewel case.

Technical assistance

If you need assistance or have questions related to the use of this product, use the information in Table 1 to contact JDSU's Technical Assistance Center (TAC) for customer support.

Before you contact JDSU for technical assistance, please have the serial numbers for the service interface module (SIM) and the base unit handy (see "Locating the serial number" in the *HST-3000 Base Unit User's Guide*).

Table 1   Technical assistance centers

Region	Phone Number	
Americas	1-866-ACTERNA 1-866-228-3762 301-353-1550	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 message at the TAC for your region; email the North American TAC (tac@jdsu.com); 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 **type-face**.	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 **`type-face`**.	Type: **`a:\set.exe`** in the dialog box.
Variables appear in this ***type-face***.	Type the new ***hostname***.
Book references appear in this *typeface*.	Refer to *Newton's Telecom Dictionary*

Table 3   Keyboard/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.
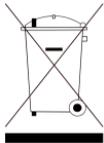
Table 5   Safety definitions

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 ISDN BRA option. Topics discussed in this chapter include the following:

About ISDN Basic Rate testing

The HST-3000 ISDN Basic Rate Access (BRA) SIM enables you to install and maintain ISDN BRA services. Using the HST with the BRA SIM, you can place, receive, and analyze calls, test data services using BERT analysis, test voice services using a microphone/speaker audio headset, and monitor physical (layer 1), LAPD (layer 2), and Q.931 (layer 3) results.

Using the ISDN BRA SIM, you can:

– Place and receive up to two calls simultaneously using the standard transmit-receive interfaces. After a call is established, you can insert voice traffic into the associated B Channel, or perform BERT analysis of the B Channel.

– Emulate central office equipment using Line Termination (LT) mode at either the S0/T0 or U interface.

– Emulate terminal equipment devices using Terminal Equipment (TE) mode at either the S0/T0 or U interface.

– Monitor and analyze ISDN BRA service at the U interface while the network is in-service.

– Isolate and locate problems by viewing D channel decode text for all captured transmitted and received frames when you monitor or terminate ISDN BRA service. After viewing the decode text, you can save the text to ISDN partner format or to a file on the HST-3000.

– BERT (IDSL) of the physical line.

– Perform BERT analysis of two B Channels simultaneously.

– Store frequently used numbers in a phone book, and then select a number from the phone book when placing a call.

– Emulate terminal equipment devices (for example, an ISDN phone or terminal adapter), and place calls using ISDN TE mode for the S/T and U interface.

- – Emulate a network termination device, and passively monitor BRA service using ISDN NT1 mode for the BRA interface (S/T and U interfaces).
- – Perform a Services Test to determine which services, or bearer capabilities, are enabled on the line.
- – Perform a Supplementary Services Test to determine whether specific supplementary services are enabled on the line.
- – Perform a B-channel test to test the provisioning of the B channels
- – Automatically answer incoming calls, when placed in Responder mode.

About BRA interfaces and the HST emulation modes

The HST ISDN BRA SIM offers six emulation modes for testing the U and S_0/T_0 interfaces. Each mode allows the HST to emulate a specific network device or devices when testing ISDN BRA service. Figure 1 illustrates the BRA interfaces.
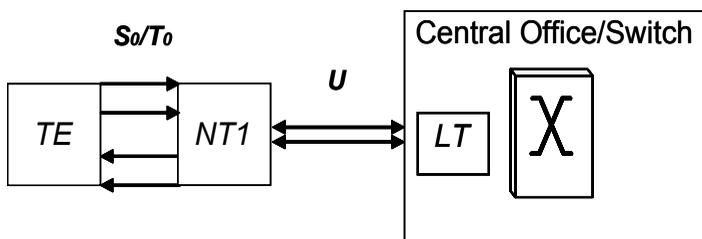
Figure 1 BRA interfaces

For details on testing ISDN BRA service using the HST, refer to Chapter 2 "Basic Rate Testing".

U interface   The U interface is the physical 2-wire echo cancelling inter-face spanning from the central office, to the local loop, and finally, to the customer premises. Each of the modes available for testing the U interface is described below.

TE-U simulation mode   The HST replaces the terminal equipment (TE) and the Network Termination (NT1) and operates on the U interface. Using this mode, you can place calls on the U interface.

LT-U simulation mode   The HST is used to replace the Line Termination (LT) device, thus emulating the switch and provides the U interface. Using this mode, you can place circuit mode calls on the U interface.

NOTE:

In the LT-U mode, the HST does not inject power. If testing against line-powered CPE, power must be injected using the optional K2512(4) accessory.

WARNING: DAMAGE TO INSTRUMENT

Injecting excessive power could damage the instrument. Use only limited current power supply. The current limit should never exceed 60 mA.

U repeater mode   In U repeater mode, the HST emulates a line repeater, allowing you to passively monitor ISDN BRA service on the U interface.

NT1 Swap-out mode   The HST is used to replace the NT1 and to transfer transparently the signalling between the S/T interface and the U interface. In that case the HST acts as an NT1.

S_0/T_0 interface The S_0/T_0 interface is the standard 4-wire (2 RX, 2 TX) interface used by ISDN terminals on the terminal side of a NT1. Each of the modes available for testing the S_0/T_0 interface is described below.

TE-S_0/T_0 simulation mode The tester is used to replace terminal equipment connected to the S/T interface

LT-S_0/T_0 simulation mode The HST replaces the Network and operates to the S/T interface.

Status LEDs

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

Table 6 Status LEDs

LED	Description
Sync	**Blinking green** — Attempting to sync on layer 1. **Solid green** — HST-3000 is synchronized with the incoming signal. **Not illuminated** — HST-3000 not synchronized.
Data	**Solid green** — TEI has been received and multi-frame (layer 2) is established. **Solid red** — TEI has not been received. **Not illuminated** — Pattern synchronization not detected on at least one active call or receiver.
Error	Used only when running a BER test. **Not illuminated** — All results OK. **Red** — Lights for one second to indicate a received error. Causes of the error appear on the Interface Results page. **Blinking amber** — Lost pattern synchronization.

Table 6 Status LEDs (Continued)

LED	Description
Alarm	Not used for Basic Rate testing.
LpBk	**Solid green** — B1, B2, B1+B2, or 2B+D channels have been looped up on the HST-3000 by a response to an EOC message, or the channels have been manually looped up. **Not illuminated** — No payload channels are currently looped.
Batt	**Not illuminated** — Battery has a useful charge. **Solid green** — AC adapter is plugged in. **Solid red** — Battery is approximately 20 percent or below of full charge. **Flashing red** — Approximately five minutes of use remains. Immediately attach AC adapter or replace battery. **Solid amber** — Battery capacity indicator ("gas gauge") needs to be reset (see the *HST-3000 Base Unit User's Guide*).

Status icons

Status icons appear in the upper right corner of the menu bar indicating the state of the phone. Table 7 describes these status icons. For descriptions of other status icons, see the *HST-3000 Base Unit User's Guide*.

Table 7   Status icons

Icon	Function
	Indicates the phone is onhook.
	Indicates the phone is ringing.
	Indicates the phone is offhook.

BRA connectors

A SIM with the BRA option has the physical interfaces needed to perform ISDN testing. The U and U mon connectors are located on the left side of the SIM. The S/T connector is on the right side. Figure 2 shows a BRA SIM with three 8-pin modular connectors.

S/T connector

U mon connector
for monitor testing

U connector for
terminate testing
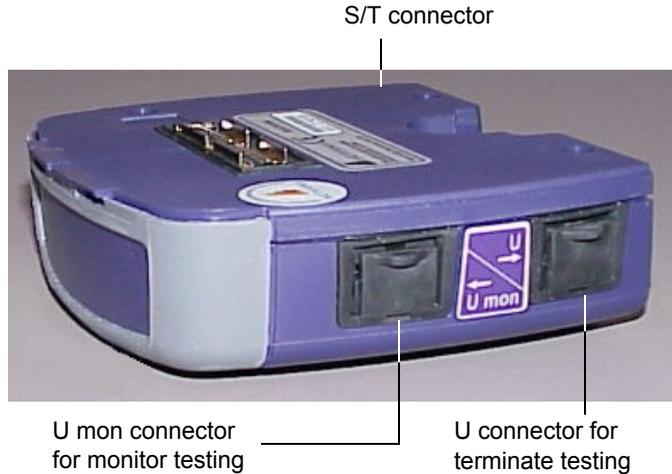
Figure 2   BRA interface connectors

DANGER: ELECTRICAL SHOCK

The S/T connector, located on the right side of the base unit when the SIM is installed, does not include a lightning protector. Connecting an outside plant line to the S/T connector during an electrical storm can result in serious injury or death. Do not connect an outside plant line to the S/T connector.

NOTE:

The BRA interface connectors are protected by flexible dust caps. The dust caps are permanent fixtures 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.

CAUTION: INSTRUMENT DAMAGE

Using a cable that is not specified for the port can damage the port. For example, using a RJ-11 connector in a RJ-45 or RJ-48 port will damage the port. Use only appropriate cables.

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*.

Basic Rate Testing

2

This chapter provides information on performing turn-up and maintenance testing using the HST-3000 BRA testing feature. Topics discussed in this chapter include the following:

Selecting a test function

To navigate to the test functions, you must first select the application, then the interface. The test functions that are available vary depending on which application you choose.

To select a test function

1 If the HST is off, press the green power button to power on the unit.

The BRA Measurements menu may take several seconds to appear.
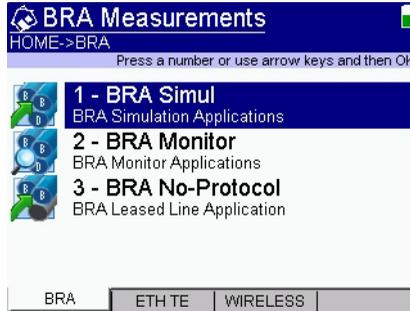
2 Select an measurement application.

To select an item, either scroll to it and then press **OK**, or press the number for the selection.

The Apps menu appears. For example, if you selected **BRA Simul** (simulate), the following screen appears.

This menu shows the interface selections. If you selected BRA Monitor, the display will have two selections: NT1 Swap and U Repeater.

3 Select an interface, for example **TE-S0/T0**.

The test function menu appears.
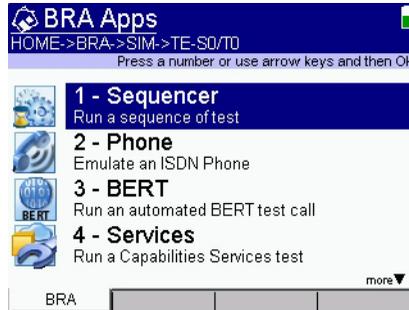
4 Select a test function.

– Sequencer (See "Running a sequence of tests" on page 35)

– Phone (See "Emulating an ISDN phone" on page 37)

– BERT (See "Running the BERT macro" on page 48)

– Services (See "Performing a capabilities service test" on page 49)

– Supplementary Services (See "Performing a supplementary services test" on page 51)

– B-Channel (See "Performing a B channel test" on page 53)

– Tracer (See "Tracing D channel messages" on page 56)

– Responder (See "Automatically responding to calls" on page 59)

The test function launches.

Specifying test settings

Before you begin testing, make sure the test settings on the HST-3000 match the settings of the line you are testing. The settings that are available vary depending on the application.

Specifying ISDN settings
When you configure the HST to place a call, you specify the settings required to activate the physical layer and initialize ISDN service over the D channel (ISDN Settings).

The following procedure describes how to specify the ISDN settings.

To specify the ISDN settings

1 Press the **Configure** 🔘 navigation key.

   The test configuration soft keys appear.

2 Press the **ISDN** soft key. You may need to use the left or right arrow button to find the ISDN soft key.

   The ISDN Settings menu appears.
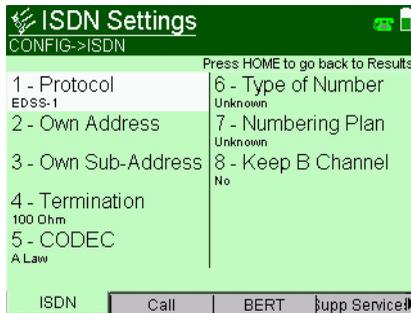
   The available selections vary depending on the protocol you choose.

3 Select **Protocol** then choose a protocol (sometimes called Call Control).

4 Select **Own Address** then enter your phone number.

5 Select **Own Sub Address** then enter your sub-address, if required.

If a sub address is required, such as a telephone and fax machine on the same line, enter the sub-address.

6 Select **Termination** then select 50 Ohm, 100 Ohm, or high termination.

7 Select **U Loss Insertion** then choose the amount of loss to insert (also called Line Build Out) on the U interface.

You can insert 0 to 6 dB loss on the U interface, in 2 db increments.

NOTE:

This selection is only available if you selected a U interface application (LT-U or TE-U).

8 Select **CODEC** then select the type of codec: mu law or A law.

9 Select **Type of Number** then specify the type of number, if required.

10 Select **Numbering Plan** then specify the numbering plan, if required.

11 Select **Keep B channel** then choose whether to keep the channel open if the call is terminated at the other end.

You are finished specifying ISDN settings.

Specifying Call settings

The following procedure describes how to specify the CALL settings.

To specify the Call settings

1 Press the **Configure** navigation key.

The test configuration soft keys appear.

2 Press the **CALL** soft key. You may need to use the left or right arrow button to find the CALL soft key.

The Call Settings menu appears.
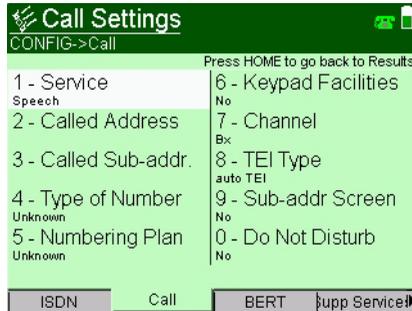
NOTE:

The call settings you specify apply to the next outgoing call you make using the HST. The settings do not impact currently active calls or incoming calls.

The available selections vary depending on the protocol you chose on the ISDN settings screen.

There may be more selections than can be displayed. Press the down arrow after the last selection to view any additional selections.

3 Select **Service** then choose the type of service.

4 Select **Called Address** then enter the number you are calling.

5 Select **Called Sub Address** then enter the sub-address, if required.

If the number you are calling requires an additional sub-address, such as a telephone and fax machine on the same line, enter the sub-address.

6 Select **Type of Number** then specify the type of number, if required.

7 Select **Numbering Plan** then specify the numbering plan, if required.

8 Select **Keypad Facilities** then specify whether keypad facilities are supported.

If supported, key presses are sent as KEYPAD information elements, rather than DTMF tones.

9 Select **Channel** then choose a B channel.

If you want the call to be placed on a specific channel, choose that channel, otherwise use Bx (meaning any B channel).

10 Select **TEI Type** then choose auto or fixed TEI.

11 If you selected fixed TEI, select **TEI Value** then enter the TEI value.

12 Select **Sub-addr Screen** and specify whether sub-address screening is used.

This selection is not available in 1TR6 protocol.

13 Select **Extension (EAZ)** and enter the extension, if required.

This selection is only available in 1TR6 protocol.

14 Select **Reject Global Call** and specify whether to globally reject all calls.

This selection is only available in 1TR6 protocol.

15 Select **Master/Slave** and select whether the HST is the Layer 2 Master or Slave.

This selection is only available in Q.SIG, Cornet-N, and Cornet-NQ protocols.

16 Select **Establish** and specify whether the layer 2 establish mode is permanent or nonpermanent.

This selection is only available in Q.SIG and SwissNet-3 protocols.

17 Select **Do Not Disturb** and specify whether the HST will ignore incoming call setup messages.

You are finished specifying Call settings.

**Specifying X.25
Call settings**
The following procedure describes how to specify the X.25
Call settings.

To specify the X.25 Call settings

1 Press the **Configure** 📝 navigation key.

The test configuration soft keys appear.

2 Press the **X.25 Call** soft key. You may need to use the left
or right arrow button to find the X.25 Call soft key.

The X.25 Call Settings menu appears.
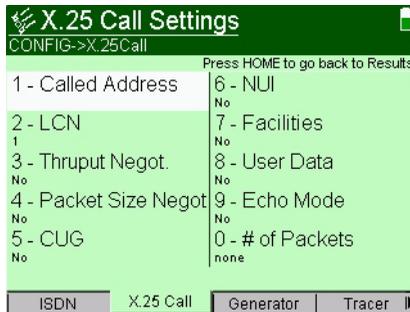
Your menu may vary, depending on the previously used
settings.

3 Select **Called Address** and then enter the number you
are calling.

4 Select **LCN** and then specify the logical channel number.

The logical channel number identifies the virtual (logical)
channel inside a transport channel.

5 Select **Throughput Negot.** and then specify whether
throughput negotiation is used, and if it is, set the bits per
second.

If this setting is enabled, the throughput class negotiation will be encoded in outgoing calls. This is an optional setting.

NOTE:

The HST-3000 ignores any fallback throughput class negotiation (for example, the remote user requests a lower throughput class).

The throughput negotiation is not accepted by all types of protocols and may cause the call setup to fail.

6 Select **Packet Size Negot.** and then specify whether packet size negotiation is used, and if it is, set the packet size.

This is an optional setting.

7 Select **CUG** and then select whether the HST-3000 will make outgoing calls from a Closed User Group.

If you select Yes, specify the **CUG Value**.

This information is included in the call setup packet.

NOTE:

An incorrect CUG value may cause the call setup to fail.

8 Select **NUI** and then specify whether a network user identification is used.

If you select Yes, specify the **NUI Value**.

If a NUI is used, this information is included in the call setup packet.

NOTE:

An incorrect NUI value may cause the call setup to fail.

9 Select **Facilities** and then specify whether facilities are included.

If you select Yes, specify the **Facilities Value**.

If Facilities are used, this information is included in the call setup packet.

> **NOTE:**
>
> An incorrect Facilities value may cause the call setup to fail.

10 Select **User Data** and then specify whether user data is included in the call setup packet.

If you select Yes, specify the **User Data Value**. Up to 40 characters can be entered.

11 Select **Echo Mode** and then specify whether the HST will send back the packets that it receives. The Echo function is generally used when accepting a call.

12 If you selected **No** for **Echo Mode**, select **# of Packets** and then specify whether you want to generate X.25 data packets when the call is established.

"None" will not generate any packets.

13 Select **Packet Length** and then specify the length of the packets (number of bytes).

This setting does not appear if you selected "None" for # of Packets.

14 Select **Check Data** and then specify whether you want to test the contents of incoming data (validate the data field).

15 Select **Throughput** and then specify the throughput, in bits per second.

You are finished specifying X.25 Call settings.

Specifying Generator settings

The following procedure describes how to specify the X.25 Generator settings. These settings are used in the X.25 Responder test.

To specify the Generator settings

1 Press the **Configure** navigation key.

The test configuration soft keys appear.

2 Press the **Generator** soft key. You may need to use the left or right arrow button to find the Generator soft key.

The X.25 Generator menu appears.
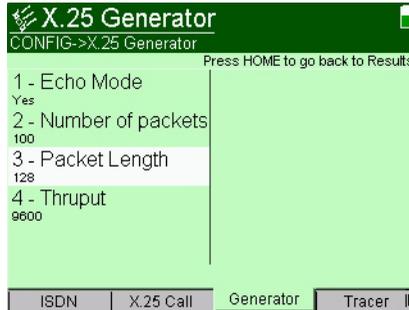
3 Select **Echo Mode** and then specify whether the HST will send back the data packets that it receives.

4 Select **Number of packets** and then specify whether you want to generate X.25 data packets when the call is established.

"None" will not generate any packets. If the value is finite, the test will stop as soon as this value has been reached.

5 Select **Packet Length** and then specify the length of the packets (number of bytes).

The contents of the packets are predefined, and are divided into three fields:

– The first field, which is defined over one byte, indicates the type of packet; it consists of one of the following letters:

B if it is the first packet sent during a test

T for subsequent packets

E for the last packet sent during a test

– The second field, which is defined over one byte, indicates the sequence number of the packet; this parameter is used to detect any loss of sequence.

– The third field consists of ASCII characters, from 20 H to 7E H.

6 Select **Check Data** and then specify whether you want to test the contents of incoming data (validate the data field).

7 Select **Throughput** and then specify the throughput, in bits per second.

You are finished specifying X.25 Generator settings.

Specifying BERT settings The BERT settings menu varies depending on the application. For example, if you are running the BERT macro, the settings are different than the phone application. The following procedure describes how to specify the BERT settings.

To specify the BERT settings

1 Press the **Configure** navigation key.

The test configuration soft keys appear.

2 Press the **BERT** soft key. You may need to use the left or right arrow button to find the BERT soft key.

The BERT Settings menu appears.
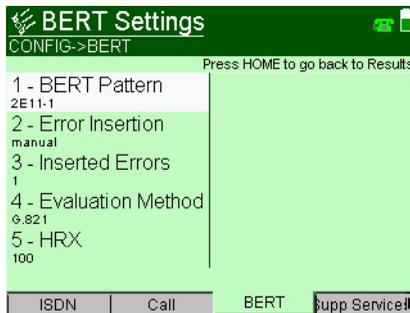
3 Select **BERT Pattern** and then choose a pattern.

The BERT patterns are described in Appendix A "Patterns and Messages".

4 Select **Error Insertion** and then select how frequently errors are inserted.

5   If you selected manual Error Insertion, select **Inserted Errors** and then enter the number of errors to be inserted.

6   Select **Evaluation Method** and then choose which method to evaluate the results: per G.821 or against a threshold.

7   Perform one of the following:

– If you selected the G.821 as the Evaluation Method, select **HRX** and enter the hypothetical reference connection.

– If you selected the Threshold Evaluation Method, select **Threshold Value** and choose the threshold value.

8   Select **Duration** and then specify the test duration.

This selection is not available in the Phone application

9   If you selected **User** as the Duration, select **hh:mm:ss** and then enter the hours, minutes, and seconds for the test.

10 Select **Repetition Factor** and then specify how many times to repeat the test when using the BERT macro.

NOTE:

This selection only applies to the BERT macro. You can repeat a BERT from the phone screen by selecting Start BERT or Stop BERT.

You are finished specifying BERT settings.

Specifying Supplementary Services settings

The following procedure describes how to specify the Supplementary Services settings.

To specify the Supplementary Services settings

1   Press the **Configure** navigation key.

The test configuration soft keys appear.

2 Press the **Supp Service** soft key. You may need to use the left or right arrow button to find the Supp Service soft key.

The Supp Service Settings menu appears.
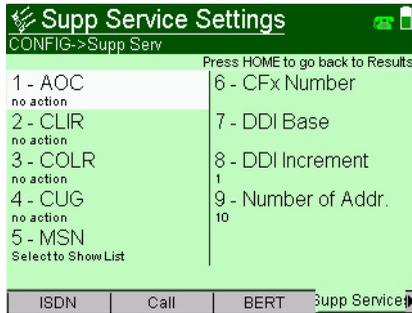
3 Select **AOC** (advice of charge) then choose the charge type.

   – no action

   – AOC-S: charge at setup

   – AOC-D: charge during call

   – AOC-E: charge at end of call

   – all

4 Select **CLIR** then choose whether calling line ID is restricted.

   – No action: encoding of the calling line ID is not implemented

   – Not allowed: calling line ID is encoded in the setup message, but will be hidden from the called party.

   – Allowed: calling line ID is encoded in the setup message and presented to the called party.

5 Select **COLR** then choose whether connecting line ID is restricted.

– No action: encoding of the connected address and connected sub-address are not implemented.

– Not allowed: connected line ID is encoded in the setup message, but will be hidden from the calling party.

– Allowed: connected line ID is encoded in the setup message and presented to the calling party.

6 Select **CUG** then select whether to make outgoing calls with the HST from a Closed User Group.

7 If you selected a specific CUG, enter the value of the closed user group.

8 Select **MSN** and then enter the multiple subscriber number (MSN) values, if needed.

9 Select **CFx Number** then enter the call forward number.

10 Select **DDI Base** then enter the Direct Dial In Base number.

Some networks may be setup to have Direct Dial In service. Usually this is a group of phone numbers, starting with a base number, then using incrementing numbers.

11 If DDI service is being used, two additional settings must be selected.

– Select **DDI Increment** then enter the Direct Dial In Increment.

– Select **Number of Addr.** then enter the number of addresses within the DDI group.

You are finished specifying Supplementary Services settings.

Specifying Tracer settings The following procedure describes how to specify the Tracer settings.

To specify the Tracer settings

1 Press the **Configure** ⬤ navigation key.

   The test configuration soft keys appear.

2 Press the **Tracer** soft key. You may need to use the left or right arrow button to find the Tracer soft key.

   The Tracer Settings menu appears.
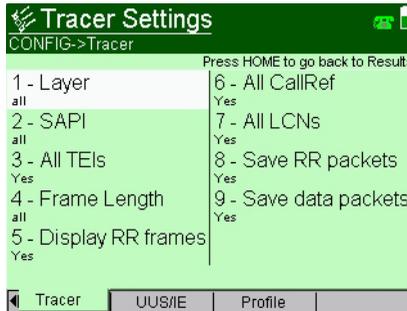
3 Select **Layer** then choose whether to filter on a specific layer.

4 Select **SAPI** then choose whether to filter on a specific SAPI.

5 Select **All TEIs** then choose whether to include all TEIs or filter on a specific TEI.

6 If you selected No for All TEIs, select **TEI Value** and specify the TEI value.

7 Select **Frame Length** then choose whether to filter on a specific frame length.

8 Select **Display RR frames** and then choose whether to display Receiver Ready frames.

9 Select **All CallRef** and then choose whether to filter on a specific call reference number. Selecting **Yes** means all call references are included (in other words, the filter is disabled).

10 If filtering on a specific call reference (you selected No for All CallRef), select **CallRef value** and specify the call reference number.

11 Select **All LCNs** and then choose whether to filter on a specific logical channel number. Selecting **Yes** means all LCNs are included (in other words, the filter is disabled).

12 If filtering on a specific LCN, select **LCN VALUE** and specify the LCN.

13 Select **Save RR packets** and then choose whether to save Receiver Ready packets.

14 Select **Save data packets** and then choose whether to save data packets.

You are finished specifying the Tracer settings.

Specifying UUS/IE settings The following procedure describes how to specify the User to User Signal (UUS) and Information Element (IE) settings.

To specify the UUS and IE settings

1 Press the **Configure** ⟨⟩ navigation key.

The test configuration soft keys appear.

2 Press the **UUS/IE** soft key. You may need to use the left or right arrow button to find the UUS/IE soft key.

The UUS/IE Settings menu appears.
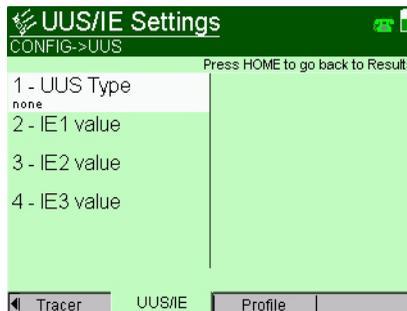
3 Select **UUS Type** then specify a UUS type.

If you selected a UUS type, the UUS Info setting appears.

4 Select **UUS Info** then select a test.

5 If you selected **Other** as the **UUS Info** test, you must specify more settings.

    a Select **UUS Pattern** then enter the user defined pattern.

    b Select **UUS Repetition** then enter the number of times to repeat the test.

6 Select **IE1 value** and enter the value of information element number 1.

This is typically a string of up to 40 characters.

7 Select **IE2 value** and enter the value of information element number 2.

This is typically a string of up to 40 characters.

8 Select **IE3 value** and enter the value of information element number 3.

This is typically a string of up to 40 characters.

You are finished specifying the UUS/IE settings.

Managing test profiles

The profile manager feature allows you to save test profiles, load saved profiles, overwrite saved profiles, and delete saved profiles.

NOTE:

Profile changes are not automatically saved to the Profile Manager. You must overwrite the profile (or create a new one) to make the change permanent.

To view the Profile Manager feature

1 Press the **Profile** soft key.

The Profile Manager menu appears.
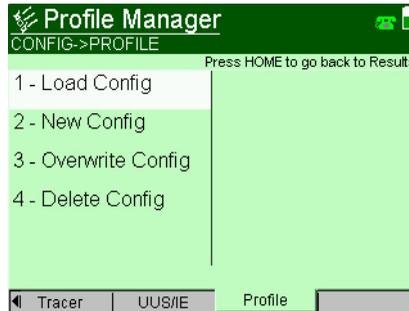
Storing test profiles After you finish specifying the HST-3000 for a particular test, you can store the test profile for future use. You can store up to 10 profiles.

To store a test profile

1 Set up the HST-3000 for the test you are performing.

2 Press the **Configure** navigation key.

3 Press the **Profile** soft key.

4 Press the **2** key.

5 Enter the file name.

6 Press the **OK** key.

The test configuration is stored.

Loading a profile After a profile is saved, you can load it. This can save time when changing settings for different circuits.

To load a test profile

1 Press the **Configure** navigation key.

2 Press the **Profile** soft key.

3 Press the **1** key.

4 Select the file name to load.

5 Press the **OK** key.

The test profile is loaded.

Overwriting a profile You can change a saved profile then overwrite the old version.

To overwrite a profile

1 Press the **Configure** navigation key.

2 Press the **Profile** soft key.

3 Press the **3** key.

4 Select the file name to overwrite.

5 Press the **OK** key.

The test profile is overwritten.

Deleting a profile If a profile is no longer needed, you can delete it.

To delete a test profile

1 Press the **Configure** navigation key.

2 Press the **Profile** soft key.

3 Press the **4** key.

4 Select the file name to delete.

5 Press the **OK** key.

The test profile is deleted.

Connecting to the line

After setting the test settings, you can connect to the line.

Your connection method will change, depending on the test application.

BRA Simulation If you are testing using a BRA Simulation function, the
connections following paragraphs describe how to connect to the line.

TE-S0/T0 If you are testing using the TE-S0/T0 application, Figure 3 shows how to connect to the line.

To connect to the line

1 Connect one end of the test cable to the **S/T** jack on the right side of the module.

2 Connect the other end of the cable to the NT1.
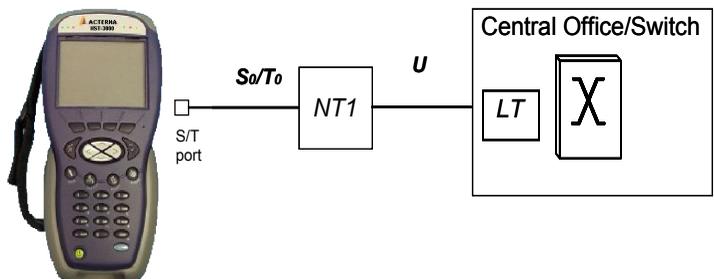
Figure 3 Connecting as a TE-S0/T0

The cables are connected.

LT-S0/T0 If you are testing using the LT-S0/T0 application, Figure 4 shows how to connect to the line.

To connect to the line

1   Connect one end of the test cable to the **S/T** jack on the right side of the module.

2   Connect the other end of the cable to the TE.
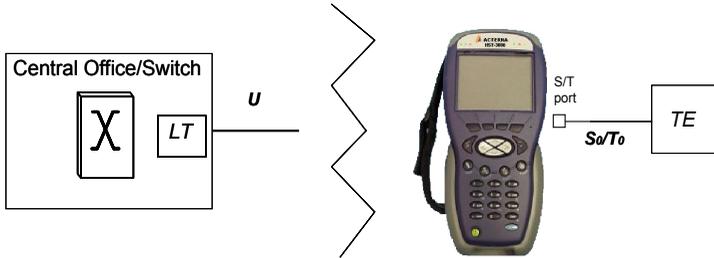
Figure 4   Connecting as a LT-S0/T0

The cables are connected.

TE-U   If you are testing using the TE-U application, Figure 5 shows how to connect to the line.

To connect to the line

1   Connect one end of the test cable to the **U** jack on the left side of the module.

2   Connect the other end of the cable into the network inter-face.

Figure 5   Connecting as a TE-U

The cables are connected.

LT-U If you are testing using the LT-U application, Figure 6 shows how to connect to the line.

To connect to the line

1 Connect one end of the test cable to the **U** jack on the left side of the module.

2 Connect the other end of the cable to the NT.

Figure 6 Connecting as a LT-U

The cables are connected.

BRA Monitor If you are testing using a BRA Monitor function, the following
connections paragraphs describe how to connect to the line.

NT1 Replacement If you are testing using the NT1 Replacement application, Figure 7 shows how to connect to the line.

To connect to the line

1 Connect one end of the test cable to the **U** jack on the left side of the module.

2 Connect the other end of the cable to the network interface.
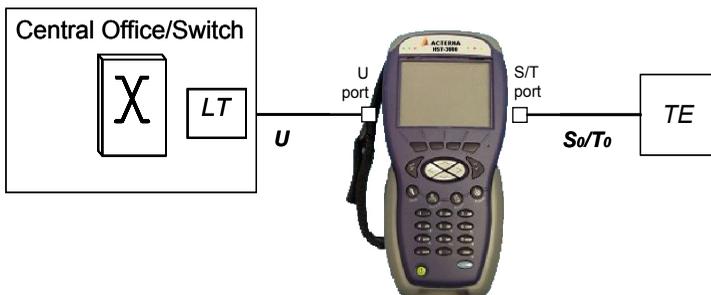
Figure 7 Connecting as a NT1 Replacement

3 Connect another cable to the **S/T** jack on the right side of the module.

4 Connect the other end of the cable to the TE.

The cables are connected.

U Monitor If you are testing using the U Monitor application, Figure 8 shows how to connect to the line.

To connect to the line

1 Connect one end of the test cable to the **U** jack on the left side of the module.

2 Connect the other end of the cable to the network inter-
face.

Figure 8 Connecting as a U Monitor

3 Connect another cable to the **U mon** jack on the left side
of the module.

4 Connect the other end of the cable to the NT1.

The cables are connected.

Running a sequence of tests

The test sequencer allows you to launch a sequence of
common tests. You can choose which tests to include in the
sequence.

The following procedure describes how to set up and run the
sequencer.

To run a test sequence

1 Select **Sequencer** from the test function screen (see
"Selecting a test function" on page 12).

The Test Sequencer screen appears.
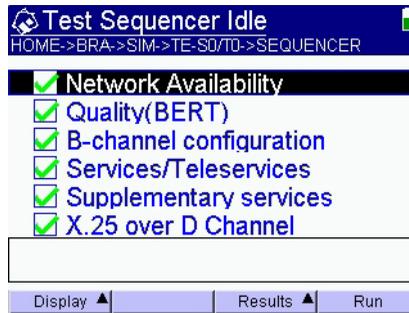
The check mark indicates that the test will be included in the test sequence.

2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31)

4 To change which tests are included, perform the following.

 a Scroll to the desired test.

 b Press the **OK** key to add or remove the checkmark.

5 Press the **Run** soft key.

The test sequence begins. As the tests run, the results appear on the screen. It may take several minutes to run the entire sequence of tests.

At the end of the test, you can view the results as text by pressing the **Display** soft key then select **Display Text Results**.

To save the results, press the **Results** soft key, then select **Save Results**.

Emulating an ISDN phone

The ISDN phone emulation function allows you to do the following:

– place or receive up to 2 calls
– transmit DTMF tones
– perform a BER test
– view D channel messages
– view layer 1 statistics
– view EOC messages

Placing calls After you specify the test settings and connect to the line, the HST establishes a data link. Once it is synchronized, it is ready to place or receive calls.

NOTE:

You will not hear a dial tone when you place voice calls from the HST using enbloc dialing. This is normal for devices placing ISDN calls.

To place a call

1 Select the **Phone** emulate test function.

The Phone screen appears.
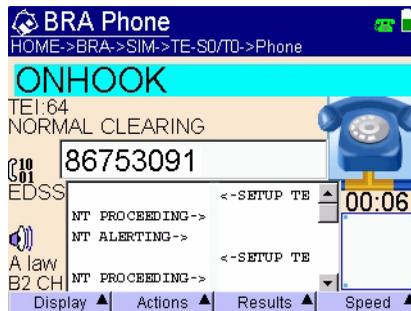
2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31)

4 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

5 Verify the link is up by doing the following:

   a Press the **Home** navigation key.

   b Press the **Display** soft key, and then select **LED**.

   c Verify the Sync LED is on.

6 Dial the number using one of the following methods:

Table 8

To dial using...	do this...
Speed dial numbers	Press the **Speed** soft key and select a number by either: – pressing the number key for the entry you want to speed dial. – using the arrow keys to highlight the entry, then press **OK** to select it. Press the **OK** key to go off hook and dial. (For more information on speed dial numbers, see "Managing speed dial numbers" on page 43.),
Enblock dialing	Enter the phone number using the keypad, then press the **OK** key to go off hook and dial.
Overlap dialing	Press the **OK** key to go off hook, wait for dialtone, then enter the phone number using the keypad. **NOTE:** You may have to clear the previous phone number by pressing the **Actions** soft key then selecting **Clear phone number**.

7 Verify that the call status is CONNECTED.

NOTE:

If the call status is not CONNECTED, a cause code (indicating the reason the call was not connected) displays on the Phone screen. You can also check the Interface results screen to view the layer 1 (L1) state, or check the D channel tracer for cause codes and Q.931 messages.

8 If you want to place a second call, press the **NEW CALL** soft key then repeat step 6 and step 7.

You have placed a call.

Receiving and disconnecting a call

When a call comes in, the soft keys change to allow you to accept, reject, or ignore each incoming call.

Accepting a call

You can accept up to two calls on the HST. When you accept a call, the call automatically connects to the microphone, and the payload is dropped to the speaker. If you are using a headset, the call connects to the headset, and the payload is dropped to the headset speaker. To move between calls, press the up or down arrow.

You can insert voice traffic into the B channel associated with the call by speaking into the microphone or headset or you can insert BER test patterns (see "Running a BER test" on page 40).

To accept a call when prompted

– Press the **OK** key or press the **Answer** soft key.

The HST-3000 accepts the call.

Rejecting a call When you reject a call, the HST-3000 disconnects the call.

To reject a call when prompted

– Press the **Reject** soft key.

The HST-3000 rejects the call and sends a "Call Rejected" cause message.

Ignoring a call When you ignore a call, the HST-3000 disconnects the call.

To ignore a call when prompted

– Press the **Ignore** soft key.

The HST-3000 disconnects the call and sends a "Normal Clearing" message.

Disconnecting a call **To disconnect a call**

1 Press the **OK** key to go on hook.

NOTE:

If the call status is not ON HOOK, the cause code (indicating the reason the call was not disconnected) appears on the Phone screen. See "Q.931 Cause Codes" on page 96 for descriptions of each code.

Running a BER test When you place or receive calls, you can perform BER analysis of the associated B channels. In addition to providing general ISDN results, the HST provides results based on the BER analysis of the B channels.

To run a BER test

1 With a call active, press the **Display** soft key and then select BERT.

The BERT screen appears.

2 Press the **Start BERT** soft key.

The timer will begin counting and results begin to increment.

3 *Optional.* To change the BERT pattern, press the up or down arrow.

4 *Optional.* If you have two calls active, you can BERT on either channel or both channels. Press the **Actions** soft key then select a BERT function.

Selection	Description
BERT B1	BERT on the B1 channel only
BERT B2	BERT on the B2 channel only
BERT B1 + B2	BERT on B1and B2 (bonded)
BERT B1 & B2	BERT on both channels individually (dual BERT)
BERT B1, B2, D	BERT entire interface

5 *Optional.* You can loop the channel or the entire circuit if another technician is performing the BERT, by pressing the **Actions** soft key, then select **Loop**, then choose a loopback.

Selection	Description
Loop B1	Loopback the B1 channel only
Loop B2	Loopback the B2 channel only
Loop B1 + B2 - 128 K	Loopback both B channels (but leave the D channel).
Loop 2B+D - 144 K	Loopback the entire interface (both B channels and the D channel)
Loop Off	Disable any loopbacks

6 To inject errors, press the **Actions** soft key and then select **Inject Error**.

7 To end a BERT, press the **Stop BERT** soft key

NOTE:

If you end the call while the BER test is running, the HST will lose pattern sync (and you will get errors).

8 To save your results, press the **Results** soft key then select **Save Results**.

You are finished performing a BERT test.

Transmitting DTMF tones

After a call is connected, use the keypad to insert and transmit DTMF tones. When you transmit DTMF tones, the HST temporarily disables the microphone.

To transmit DTMF tones

1 Place a call (see "Placing calls" on page 37).

2 Enter the DTMF tones using the keypad.

3 If you have two calls connected, press the up or down arrow to move to the other call.

4 Enter the DTMF tones using the keypad.

The HST transmits the tones.

NOTE:

DTMF tones are not available when tracing D channel messages.

Managing speed dial numbers You can define and store frequently used phone numbers on the HST, and then speed dial a number when placing a call.

To access the HST speed dial manager

1 Press the **Home** navigation key to return to the main Phone screen.

2 Press the **Speed** soft key then select **Manage Entries**.
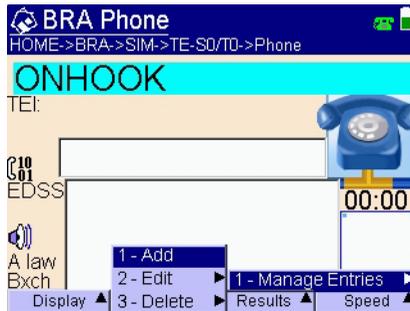
3 Select one of the following:

– Add (see "Adding or editing speed dial entries" on page 43)

– Edit (see "Adding or editing speed dial entries" on page 43)

– Delete (see "Deleting a speed dial entry" on page 44)

Adding or editing speed dial entries The following procedure describes how to add or edit speed dial entries.

To add or edit speed dial entries

1 From the Speed>Manage Entries menu, select **Add** or **Edit**.

If you selected **Edit**, select which entry to edit.

The Enter Name dialog opens.

2 Enter the name then press **OK**.

The number dialog opens.

3 Enter the phone number then press **OK**.

The new or edited entry appears in the speed dial list.

Deleting a speed The speed dial function allows you to delete a stored entry.
dial entry The following procedure describes how to delete speed dial
entries.

To delete a speed dial entry

1 From the Speed>Manage Entries menu, select **Delete**.

2 Select the entry to delete then press **OK**.

The entry is deleted.

Testing the physical layer

The HST allows you to test the physical layer without placing
a call. You can do this in two ways:

– Use the HST-3000 to perform bit error rate tests (BERT or
BER testing) of the physical line on the U interface.

– In LT mode, send EOC commands to network elements.

Performing a layer 1 BER test To verify the physical layer, you can perform a BERT test.

To test the physical layer using a BERT

1 Enter the **Phone** emulate test function.

2 Press the **Display** soft key and select **BERT**.

The BERT screen appears.

3 Press the **Activate** soft key to activate layer 1 communication.

The **Sync** LED lights when communication is established.

4 To start the BERT, press the **Actions** soft key then select **Start BERT**.
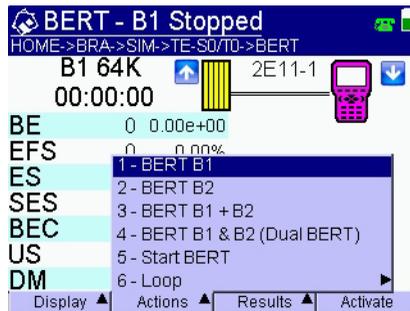
5 To change the channel or channels to BERT, press the **Actions** soft key then choose the appropriate selection.

You can also press the up or down arrow to change the pattern.

6 *Optional.* To loopback the channel or channels, press the **Actions** soft key, select **Loop**, then choose the appropriate selection.

7 To insert errors, press the **Actions** soft key and select **Insert Errors**.

This selection is only available if Error Insertion is set to manual on the BERT Settings menu.

If running a dual BERT, choose which channel on which to insert errors.

8 To end the BERT, press the **Actions** soft key then select
Stop BERT.

9 *Optional.* Press the **Results** soft key then select **Save
Results**.

NOTE:

In BERT mode, you can save results only after the BERT
ends.

Sending EOC In LT mode, the HST allows you to send EOC messages to
messages verify the physical layer.

To verify the physical layer using EOC messages

1 Select the **LT-U** application from the BRA Simulation Apps
screen.

2 Select the **Phone** emulation test function.

3 Press the **Display** soft key then select **EOC**.

The EOC Channel screen appears.

4 Press the **Activate** soft key to activate layer 1 communi-
cation.

The **Sync** LED lights when communication is established.

If any messages have been received, they are listed on
the screen.

5 To choose the message to send, press the **Actions** soft key, select **Change Message**, then choose a message:

2B+D LOOPBACK

B1 LOOPBACK

B2 LOOPBACK

REQ CRPT CRC

NOTIFY CRPT CRC

RETURN NORMAL

HOLD STATE

6 To choose the address to which to send the message, press the **Actions** soft key, select **Change Address**, then choose an address.

7 Press the **Send EOC** soft key to send the message.

If the network element responds to the message, the physical layer is verified.

NOTE:

The EOC display stops updating when the Tracer buffer is full. This is due to the fact that the EOC display is essentially a filtered version of the tracer.

8 If you selected one of the CRC messages, view the Interface results screen and check the CRC count.

Transmitting a 40 kHz tone In LT mode, the HST allows you to send a 40 kHz tone, which can be measured/verified at the other end.

To transmit a 40 kHz tone

1 Select the **LT-U** application from the BRA Simulation Apps screen.

2 Select the **Phone** emulation test function.

3 Press the **Display** soft key then select **EOC**.

The EOC Channel screen appears.

4 Press the **Actions** soft key then select **Transmit 40 kHz tone**.

The tone is transmitted at 0 dB.

5 To stop transmitting the tone, press the **Actions** soft key, then select **40 kHz off**.

Running the BERT macro

The BERT macro test function places a call then performs a BER test. The call that is placed depends on the called address in the CALL settings configuration menu. For example, you may call a loopback device, another user (who would answer the call manually), or call yourself.

To execute the BERT macro

1 Select **BERT** from the test function screen (see "Selecting a test function" on page 12).

The BERT Macro screen appears.

2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31)

4 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

5 Press the **Start** soft key.

The HST places a call then begins a BERT. Results appear on the screen.
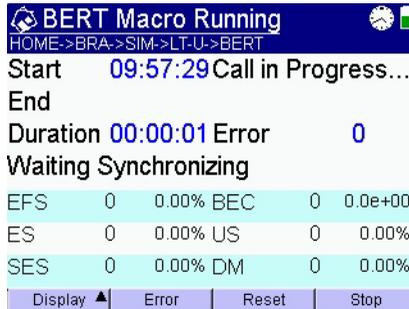
The test will run for the duration set in the BERT configuration menu.

6 *Optional.* To clear any history results, press the **Results** soft key then select **Clear Results**.

7 To change the way the results are displayed, press the **Display** soft key then select one of the following:

– Display Graphical Results (same as above)

– Display Text Results (displays the results as a text file)

8 To save your results, press the **Results** soft key then select **Save Results**.

You are finished running the BERT macro.

Performing a capabilities service test

The Services test function allows you to test the availability of services (teleservices) using an automatic test.

To run the Services test

1 Select **Services** from the test function screen (see "Selecting a test function" on page 12).

The Services screen appears.

2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31)

4 Select which services to test by performing the following:

    a Press the **Select** soft key.

    b Scroll to highlight the desired service.

    c Press the **OK** key to toggle the check mark.

    The check mark indicates that the test will be included.

NOTE:

The services available will vary depending on the protocol selection in the ISDN configuration.

    d After selecting the desired tests, press the **Accept** soft key to return to the Services screen.

    If a selection has a line through it, that service will not be tested.

5 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

6 Press the **Start** soft key.

The HST places successive calls using all the selected services. A "Running" message appears in the upper left of the screen and an arrow appears next to the service currently being tested.

7 To change the way results are displayed, press the **Display** soft key then select one of the following:

Selection	Description
Display graphical results	Results are indicated with either a check mark for pass or an "X" for fail.
Display text results	A full description of the test is displayed as text. For example, the test start and stop times are included as well as a cause code if the test failed.

8 *Optional.* To clear any history results, press the **Results** soft key then select **Clear Results**.

9 To save your results, press the **Results** soft key then select **Save Results**.

You have finished the Services test.

Performing a supplementary services test

The Supplementary Services test function allows you to test the availability of supplementary services using an automatic test.

To run the supplementary services test

1 Select **Supplementary Services** from the test function screen (see "Selecting a test function" on page 12).
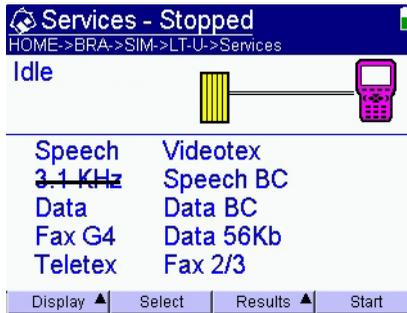
The Supp Services screen appears.

2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31)

4 Select which services to test by performing the following:

   a Press the **Select** soft key.

   b Scroll to highlight the desired service.

   c Press the **OK** key to toggle the check mark.

   The check mark indicates that the test will be included.

   d After selecting the desired tests, press the **Accept** soft key to return to the Supp Services screen.

If a selection has a line through it, that service will not be tested.

5 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

6 Press the **Start** soft key.

The HST places successive calls using all the selected services. A "Running" message appears in the upper left of the screen and an arrow appears next to the service currently being tested.

7 To change the way results are displayed, press the **Display** soft key then select one of the following:

Selection	Description
Display graphical results	Results are indicated with either a check mark for pass or an "X" for fail.

Selection	Description
Display text results	A full description of the test is displayed as text. For example, the test start and stop times are included as well as a cause code if the test failed.

8 *Optional.* To clear any history results, press the **Results** soft key then select **Clear Results**.

9 To save your results, press the **Results** soft key then select **Save Results**.

You have finished the Supplementary Services test.

Performing a B channel test

The B Channel test function allows you to test the provisioning of the B channels by attempting to place or receive calls.

To perform a B channel test

1 Select **B Channel** from the test function screen (see "Selecting a test function" on page 12).

The B Chan Test screen appears.

2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31)

4 Select a test mode by pressing the up or down keys.

Test	Description
Multiple Call	Determines whether the channel is available for outgoing calls. This mode places a multi-channel call. Calls are placed on open channels but any existing calls are maintained. The test is considered as Passed if a CONNECT message is received.
Sequence	Determines whether the channel is available for outgoing calls. This mode places a sequence of single-channel calls, and clears any existing calls. The test is considered as Passed if a SETUP_ACK, ALERTING or CONNECT message is received.
In/Out	Determines whether the B channels are available for incoming (IN) and outgoing (OUT) calls. This test is based on the ETSI recommendations and is performed in Selfcall mode. This test runs continuously until both an outgoing and incoming call are placed.

5 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

6 Press the **Start** soft key.

The HST places the calls.

7 To change the way results are displayed, press the
Display soft key then select one of the following:

Selection	Description
Display graphical results	Results are indicated with IN or OUT or Barred, as described in Table 9.
Display text results	A full description of the test is displayed as text. For example, the test start and stop times are included as well as a cause code if the test failed.

Table 9 describes the graphic results for the B channel tests.

Table 9 B channel graphical results

Result	Description
	Call in progress
IN	Configuration of the channel is IN.
OUT	Configuration of the channel is OUT.
IN OUT	Configuration of the channel is IN/OUT.

Table 9	B channel graphical results (Continued)

Result	Description
	Calls barred.
---	Channel not in use.

8 To save your results, press the **Results** soft key then select **Save Results**.

You have finished the B Channel test.

Tracing D channel messages

The Tracer test function allows you to trace D channel messages to troubleshoot problems with call establishment. You can view current messages or retrieve previously saved messages. For information on interpreting the messages, see "Interpreting D channel decode messages" on page 80.

NOTE:

DTMF tones are not available when tracing D channel messages.

Capturing messages

The following procedure describes how to capture D channel messages.

To capture D channel messages

1 Select **Tracer** from the test function screen (see "Selecting a test function" on page 12).

The Tracer screen appears.

2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31

4 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

The messages appear on the screen.

5 Press **Refresh** to update the list.

The messages will be filtered, based on the settings specified on the Tracer Settings menu.

6 Press the **OK** key to change the display mode:

Display mode	Description
Summary	A brief description of the message, if applicable.
Detailed	Full text decode, if applicable.
Hexadecimal	Only the HEX code

7 To save your results, press the **Results** soft key then select one of the following:

Selection	Description
Save as Trace file	Saves in binary format. You can later retrieve and view the file in Tracer. See "Retrieving saved tracer messages" on page 58.

Selection	Description
Save as Text file	Saves as decoded ASCII text file. You can then import it into a word processor or view the text file at a later time using the File Manager. For details on viewing text files on the HST, refer to the *HST-3000 Base Unit User's Guide*.
Save as ISDN Partner file	Exports the data to the format used by the ISDN Partner software.

You have finished capturing D Channel messages.

Navigating decode messages

The D-Chan Decode Results screen displays decode text messages in the order they are received on the HST.

To navigate through the messages

– Use the up and down arrows to scroll through the text of a message.

– In the Summary view, use the keypad to enter the line number for the desired message or use the arrow keys to navigate to the desired message and then press OK.

– You can easily determine how many messages have been captured by looking at the Message count at the top of the screen.

Retrieving saved tracer messages

The following procedure describes how to retrieve previously saved tracer messages.

To retrieve saved trace files

1 Select **Tracer** from the test function screen (see).

The Tracer screen appears.

2 Press the **Results** soft key.

3 Select **Load Trace file**.

A list of Trace files (files saved as binary Trace files) appears.

4 Select the trace file, then press **OK**.

The messages appear on the screen.

Clearing the message buffer The HST decode message buffer can store up to 5,000 messages. The HST captures D Channel frames and displays the associated decode text messages until the buffer becomes full. You can easily determine how full the buffer is by looking at the % Full indicator at the top of the screen. When the buffer is full, the HST stops capturing frames. You can clear the message buffer, enabling the HST to continue capturing frames.

To clear the HST message buffer

– On any results screen (for example, the D-Chan Decode Results screen), press the **Results** soft key, and then select **Clear All**.

The message buffer is cleared.

Automatically responding to calls

The Responder test function allows you to automatically accept up to two simultaneous calls.

To automatically respond to calls

1 Select **Responder** from the test function screen (see "Selecting a test function" on page 12).

2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31

4 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

5 If you want to simply connect to the call, rather than loop it back, press the **Loop Off** soft key.

Change this only if it is required.

NOTE:

This applies to the next call received.

6 Press the **Run** soft key.

The call status appears on the screen.
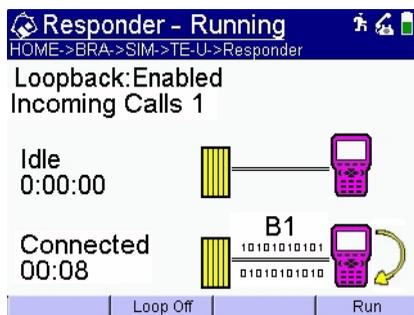
7 Press the **Break** soft key to stop the responder.

Placing and receiving X.25 calls

When operating in the TE-U or TE-S0/T0 mode, you can place and receive X.25 D channel calls.

Placing a X.25 call After you specify the test settings and connect to the line, the HST establishes a data link. Once it is synchronized, it is ready to place or receive calls.

> **NOTE:**
>
> You will not hear a dial tone when you place voice calls from the HST using enbloc dialing. This is normal for devices placing ISDN calls.

To place a X.25 call

1 Select the **X.25D** test function.

The X.25 Device screen appears.
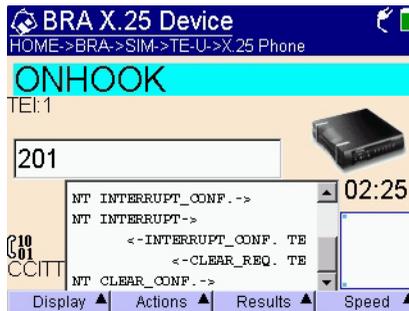
2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31)

4 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

5 Verify the link is up by doing the following:

    a Press the **Home** navigation key.

    b Press the **Display** soft key, and then select **LED**.

    c Verify the Sync LED is on.

6 Dial the number using one of the following methods:

To dial using...	do this...
Speed dial numbers	Press the **Speed** soft key and select a number by either:
	– pressing the number key for the entry you want to speed dial.
	– using the arrow keys to highlight the entry, then press **OK** to select it.
	Press the **OK** key to go off hook and dial.
	(For more information on speed dial numbers, see "Managing speed dial numbers" on page 43.),
Enblock dialing	Enter the phone number using the keypad, then press the **OK** key to go off hook and dial.

After the call is connected, the P3 statistics appear.

7 Use the left arrow to view L2 statistics.

See "X.25 results" on page 77 for information on interpreting the results.

Press the **OK** key to go on hook.

You have placed a call.

Receiving and disconnecting a call

When a call comes in, the soft keys change to allow you to accept, reject, or ignore each incoming call.

Automatically responding to calls

The X.25 Responder test function allows you to automatically accept a call and echo the packets.

To automatically respond to X.25 calls

1 Select the **X.25 - Responder** test function.

The X.25 Responder screen appears.

2 Verify your test settings. (See "Specifying test settings" on page 14)

3 Connect to the line. (See "Connecting to the line" on page 31)

4 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

5 If you want to simply connect to the call, rather than echo the packets, press the **Echo Off** soft key.

Change this only if it is required.

NOTE:

This applies to the next call received.

6 Press the **Run** soft key.

The call status appears on the screen.
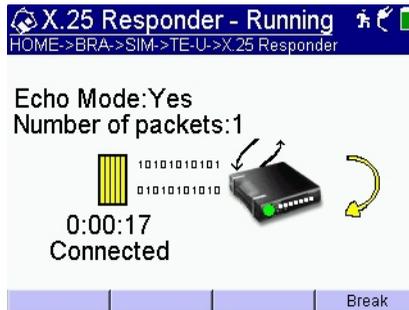
7 Press the **Break** soft key to stop the responder.

Emulating a NT1 on the BRA interface

The HST-3000 allows you to monitor and analyze BRA service from the U and S/T interface (emulates an NT1 device) while the network is in-service. To monitor BRA service from the NT1

1 If the HST is off, press the green power button to power on the unit.

The BRA Measurements menu may take several seconds to appear.

2 Select **BRA Monitor**.

The test function screen appears

3 Select **NT1 Swap**.

4 Verify your test settings. (See "Specifying test settings" on page 14)

5 Connect to the line. (See "Connecting to the line" on page 31

Once the HST achieves synchronization, the **Sync** LED on the unit will light and the Synced and Active LEDs will light on the summary screen.
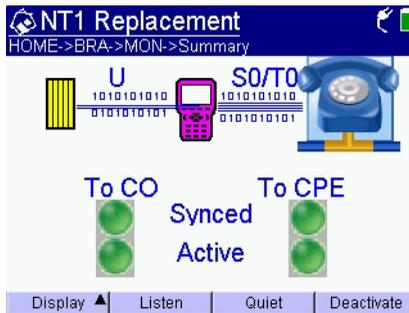
6 To listen to a channel, press the **Listen** soft key and then select the channel you wish to listen to.

NOTE:

Both sides must be synced to listen to the channel.

7 To mute your speaker, press the **Quiet** soft key.

8 Press the **Display** soft key, and then select **Interface** to display interface results for the network side (the U interface) and the customer side (the S/T interface) of the BRA interface.

9 To save your results, press the **Results** soft key then select **Save Results**.

This selection is only available on the Tracer results screen.

You have finished monitoring BRA service from the NT1.

Monitoring BRA service from the U interface

The HST-3000 allows you to monitor and analyze ISDN BRA service from the U interface while the network is in-service. During the test, the HST emulates a repeater, and monitors all D channel frames present. It decodes the received D channel information.

To monitor ISDN BRA service from the U interface

1 If the HST is off, press the green power button to power on the unit.

The BRA Measurements menu may take several seconds to appear.

2 Select **BRA Monitor**.

The test function screen appears

3 Select **U Repeater**.

4 Verify your test settings. (See "Specifying test settings" on page 14)

5 Connect to the line. (See "Connecting to the line" on page 31

Once the HST achieves synchronization, the **Sync** LED on the unit will light and the Synced and Active LEDs will light on the summary screen.
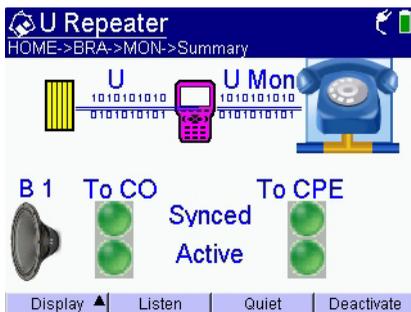
6 To monitor the audio of a call, press the **Listen** soft key and then select the channel you wish to listen to.

NOTE:

Both sides must be synced to listen to the channel.

7 To mute your speaker, press the **Quiet** soft key.

8 Press the **Display** soft key, and then select one the following:

   – **Interface** to display interface results for the network side (To CO) and the customer side (To CPE) of the BRA interface.

   – **Tracer** to display D-channel decode messages. For information about interpreting these messages, see "Interpreting D channel decode messages" on page 80.

9 To save your results, press the **Results** soft key then select **Save Results**.

   This selection is only available on the Tracer results screen.

You have finished monitoring BRA service from the U inter-
face.

━━━━━▶ **NOTE:**

When repeater power is present, the total nominal voltage
drop from the U connector to the U mon connector, and
from the U mon connector to the U connector, is 11 volts.

Monitoring the D channel with a PC

The HST-3000 allows you to monitor and analyze the
D Channel from the U and S/T interface while the network is
in-service and allows connection to a PC for in-depth analysis
of the D channel information.

To monitor the D Channel

1 If the HST is off, press the green power button to power
on the unit.

The BRA Measurements menu may take several seconds
to appear.

2 Select **BRA Monitor**, and then select an interface, for
example **U Repeater**.

The test function screen appears

3 Select **D Monitor with PC**.

4 Verify your test settings. (See "Specifying test settings" on
page 14)

5 Connect to the line. (See "Connecting to the line" on
page 31).

After the HST achieves synchronization, the **Sync** LED on
the unit will light and the Synced and Frame LEDs will
light on the summary screen.

6 Connect a serial cable from the HST-3000 to a PC.

7 Verify that the PC is running ISDN Partner software, and verify that the ISDN Partner version is 3.02.

The HST attempts to sync with the ISDN partner program.
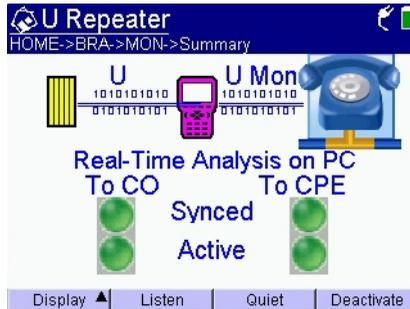
The status of the ISDN Partner synchronization is indicated on the screen. The message will be one of the following.

– Real Time Analysis on PC — The connection has never been made.

– Synchronized — The connection with the ISDN Partner software has been established.

– Connecting — A copy of ISDN partner has been detected and the test set is connecting.

– Stopped — The user or the ISDN Partner program has stopped the session.

The HST-3000 will appear as an IBT-300 when connected to the ISDN Partner software.

Use the ISDN Partner software to analyze the D Channel information. For instructions on using ISDN Partner, consult the documentation that came with the software.

You have finished monitoring the D Channel with a PC.

Test Results

3

This appendix describes the test result categories and the results within each category that are available when performing ISDN BRA tests. Topics discussed in this appendix include the following:

About test results

After you start a test, test results begin counting. Test results are separated into several categories. To view test results in other categories, press the **Display** soft key then select a category. The categories available vary depending on the application.

The following sections describe the test results for each of the categories.

Phone status

The Phone status displays information related to placing and receiving calls. This category is available when using the Phone emulate test function. Figure 9 provides an example of the Phone status screen.
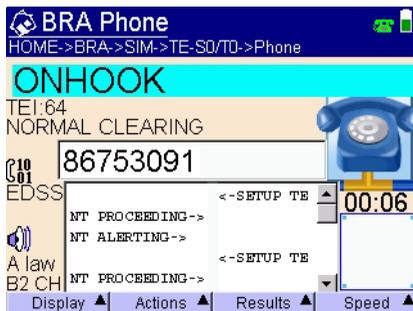
Figure 9 Phone status screen

Table 10 describes the information that appears on the Phone status screen.

Table 10 Phone status

Result	Description
Hook status	Indicates on hook or off hook, both in text and with the phone icon.
TEI	If on hook, provides the TEI of the last call. If off hook, provides the current TEI.
Cause Message	Provides a cause for call failure (for example, "NORMAL CLEARING".)
Phone number	Indicates the phone number to be dialed.
Call Control	Indicates the current call control (for example, EDSS)
Codec	Indicates the current Codec (for example, A law)
Channel	Indicates the current channel (for example, B1 CH)
Mini monitor	Displays D-channel messages
Elapsed time	Appears under the phone icon, indicates the elapsed time of the call. If the call duration continues beyond 59:59 (meaning, is more than an hour), the display changes from mm:ss to hh::mm (note the change from : to ::).
BERT status	Box in the lower right that indicates BERT status (empty in the example)

BERT results

The BERT category lists results related to bit error rate tests. This category is available in the phone emulate test function, and is the only result category for the BERT macro. Table 10 describes the results that appear in the BERT category.

Table 11 BERT results

Result	Description
BE	Bit Errors. Number of received bits that have a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.
EFS	Error Free Seconds. Seconds during which pattern synchronization was maintained through the entire second and no bit error occurred.
ES	Errored Seconds. Counts test seconds where one or more bit errors occurred.
SES	Severely Errored Seconds.
BEC	Block Error Count
US	Unavailable Seconds.
DM	Degraded Minutes.

Summary results

The Summary results provides a graphical indication of the Synced and Active LEDs in each direction: to CO and to CPE. This category is available in the NT1 Replacement and U Repeater test functions.

Interface results

The Interface category lists results related to the physical interface. This category is available in all applications, but actual results vary depending on the test function. Table 12 describes the results that appear in the Interface category and specify which modes in which they appear

> **NOTE:**
>
> When you display the category in U Repeater mode, results for the network side of the BRA interface appear in the To CO column; results for the customer side of the BRA interface appear in the To CPE column.

Table 12   Interface test results

Result	Description	Modes
Layer 1 state	Displays the current physical layer state. Its major activation states are awaiting signal, synchronized, and alerting. For the LT result, displays current J state for the LT side of line. For the NT result, displays current H state for the NT side of the line.	All
FEBE Errors	Count of Far End Bit Errors received.	TE-U, LT-U, NT1, U Mon
CRC Errors	Count of Cyclic Redundancy Check errors received.	TE-U, LT-U, NT1, U Mon
ACT DEA AIB	Value of the activation, deactivation, and alarm indication overhead bits.	TE-U, LT-U, NT1, U Mon
Rx EOC	The last EOC message received.	TE-U, LT-U, NT1, U Mon
Sealing Current	Indicates if low-voltage sealing current is present on the U interface. Appears in NT1/TE mode only.	TE-U, LT-U
Layer 2 State	The current state of layer 2.	All
TEI	The TEI assigned to the call.	All

Table 12   Interface test results (Continued)

Result	Description	Modes
Call 1	Status of call 1.	TE-U, LT-U, TE-S0/T0, LT-S0/T0
Call 2	Status of call 2.	TE-U, LT-U, TE-S0/T0, LT-S0/T0
Rx Level VPP	Current present on the S/T interface, expressed in volts peak-to-peak. Appears in TE mode for the S/T interface only.	TE-S0/T0, LT-S0/T0
BPV Errors	Count of bipolar violation errors received.	TE-S0/T0, LT-S0/T0
Framing Errors	Count of framing errors.	TE-S0/T0, LT-S0/T0
PS1	– `Normal` indicates that at least 28 volts is present on the line. – `Reversed` indicates reversed polarity of the voltage. – `Not present` indicates that less than 28 volts is present on the line. Appears in TE mode for the S/T interface or NT1 mode for the U interface only.	TE-S0/T0, LT-S0/T0 NT1
PS2	– `Normal` indicates that at least 36 volts is present on the line. – `Reversed` indicates reversed polarity of the voltage. – `Not present` indicates that less than 36 volts is present on the line. Appears in TE mode for the S/T interface or NT1 mode for the U interface only.	TE-S0/T0, LT-S0/T0 NT1

LED results

The LED category shows the current and historical status for alarms. This category is available in the Phone emulate test function.

Table 13 describes the results that appear in the LED category.

Table 13   LED results

Result	Description
Sync	Indicates synchronization with the received signal.
Active (only available in U modes)	Indicates the HST is sending an activation overhead bit.
Ready	Indicates if Layer 2 successful on TEI. If TEI Not Assigned, Awaiting TEI, Link Not Established, Awaiting Establishment, Timer Recovery, Awaiting Release, TEI Denied, Link Unknown, then Layer 2 not achieved and indicator is off.
Loop	Indicates that at least one channel is looped.
Sealing Current (only available in U modes)	Indicates if active sealing current is present on the U interface.
PS1 (only available in S/T modes)	At least 28 volts has been detected for power source 1.
PS2 (only available in S/T modes)	At least 36 volts has been detected for power source 2.

EOC results

The EOC category displays results related to the Embedded Operations Channel. This category is only available when using the LT-U test function. Table 14 describes the results that appear in the EOC category.

Table 14   EOC test results

Result	Description
Message	The last EOC message sent.
Address	The last address where a message was sent.
RX Buffer	Lists up to 20 received EOC messages.
TX	The message and address currently being sent

Tracer results

The Tracer category displays D Channel Decode messages. You can scroll through the messages using the arrow keypad. The tracer is not available in NT1 replacement mode.

For an overview on interpreting decode messages, see "Interpreting D channel decode messages" on page 80.

X.25 results

The X.25 results provide statistics on layer 2 and layer 3 (P3).

Table 15 describes the X.25 layer 3 (P3) results.

Table 15 X.25 P3 results

Result	Description
Rate	The packet rate.
Packet number	The number of packets being echoed.
Errored packets	The number of errored packets.
Errored sequence	The number of sequences that were errored.
Resets	The number of reset.
RNR	The number of RNR messages.
Window Full	The number of times the packet window was full.
Diagnostic	The number of diagnostics messages.

Table 16 describes the X.25 layer 2 (L2) results.

Table 16 X.25 L2 statistics

Result	Description
Frame number	The number of frames being echoed.
RNR	The number of RNR messages.
Reject	The number of rejected frames.
Window Full	The number of times the frame window was full.
Retries	The number of times the HST retried to send the frame.

Saving and printing results

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

Troubleshooting

4

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

Interpreting D channel decode messages

When you monitor or terminate ISDN BRA service, you can isolate and locate problems by viewing D channel decode messages for all captured transmitted and received frames.

The decode messages fall into two categories:

– Messages concerning the establishment and mainte-nance of the D channel link (layer 2 messages). These are often referred to as LAPD (Link Access Procedure D-Channel) messages.

– Messages concerning the ISDN calls, such as the reason a call is rejected, who is disconnecting a call, and the call's bearer capability (layer 3 messages). These are often referred to as Q.931 messages.

Figure 10 illustrates a sample Q.931 message indicating that a call is being setup.

```
TE->NT:C SAPI:000 TEI:0  TIME: 12:29:45.407
I   Ns =   0  Nr=  0   P=0
Call Reference 66
Protocol Discriminator.. 08
SETUP
BEARER CAPABIL. Lg =        3
 Hex. value   : 90 90 A3
 Coding stand.: CCITT coding
 Info tr.capab: 3.1 kHz audio
 Transfer mode: circuit mode
 Info tr.rate : 64 kbit/s
 Layer 1 ident.
 User info l.1: Rec.G.711 Alaw
FACILITY                        Lg =       18
 Hex. value   : 91 A1 0F 02 02 5C FF 02 01 02
 30 06 81 01 00 82 01 08
 Service discr: suppl.applica.
 COMPONENT    : Invoke
 Component LI =    15
 InvokeID(hex): 5C FF
 operation    : CUGCall
 OARequested  : FALSE
 CUGIndex(hex): 08
CALLING PTY NB. Lg =        2
 Hex. value   : 00 A0
 Type of numb.: unknown
 Number. plan : unknown
 Present.indic: restricted
 Screening ind: U.prov.nt.scre
CALLED PARTY NB Lg =        9
 Hex. value   : 80 38 36 37 35 33 30 39 31
 Type of numb.: unknown
 Number. plan : unknown
 No.digit/IA-5: 86753091
USER-USER      Lg =       21
 Hex. value   : 04 57 26 47 2D 49 42 54 3A 4C
 4F 4F 50 3B 56 30 36 2E 30 38 43
 Prot. discr. : IA5 characters
 (IA5)        : W&G-IBT:LOOP;V06.08C
```

Figure 10 Sample Q.931 message

You can easily determine the source of each message by looking at the message prefix on the first line. Messages originating from a TE device begin with `TE->NT`; messages originating from a NT device begin with `NT->TE`. The message in Figure 10 originated from a TE device.

Each call processed by the D channel is assigned a unique call reference number, which is reported on the third line of each decode message. The message in Figure 10 has a call reference number of `66`. All messages exchanged in reference to the call have the same call reference number. When viewing decode messages on a D channel processing a number of calls, it is important to verify the call reference number for each message because messages for each call are not presented as a group. A message indicating one call has been connected may be followed immediately by a message indicating a different call has been disconnected.

For details on viewing and navigating through D channel decode messages, see .

For descriptions of each individual decode message, see .

LAPD messages LAPD messages are useful when verifying the status of the D channel link. Complaints prompting you to look at LAPD messages include:

– The D channel does not go in service.
– D channel communications are lost for no known reason.
– Callers are experiencing excessive delays or timeouts when trying to place calls.

Using the LAPD messages, you can determine why a D channel link is not established, if a link is being terminated, and why a link is being terminated. Three types of frames are transmitted in LAPD: Information frames, which carry detailed call information, Unnumbered frames, which are used to

establish or terminate D channel communications, and Supervisory frames, which are used to maintain link communications after a link has been established.

LAPD Unnumbered frame messages Table 17 lists each of the LAPD unnumbered frame decode messages.

Table 17   LAPD unnumbered frame decodes

Message…	Sent to…
SABME (Set Asynchronous Balanced Mode with Extended Sequence Numbering)	Establish initial D channel communications. – An affirmative response from the link partner is a UA message. – A negative response (indicating the link partner is not ready to establish a link) is a DM message.
UA (Unnumbered Acknowledgement)	Acknowledge one of the following: – A SABME message from the device initiating D channel communications. – A DISC message from the device terminating the D channel link.
DISC (Disconnect)	Disconnect or terminate the D channel link. This message should not be confused with the Q.931 DISCONNECT message which is used to disconnect a call.

Table 17   LAPD unnumbered frame decodes (Continued)

Message…	Sent to…
DM (Disconnect Mode)	Indicate one of the following: – The link partner is not ready to establish a D channel link with the device sending a SABME message. – The link partner cannot terminate the link (in response to a DISC message), typically because communications have already been disconnected.
FRMR (Frame Reject)	Indicate that an unrecoverable link-level problem has occurred. This message is transmitted when re-transmitting a frame will not correct the problem, and indicates a potential high level protocol issue between the link partners.
UI (Unnumbered Information)	Request an exchange of information between the link partners.

LAPD Supervisory frame messages

Table 18 lists each of the LAPD supervisory frame decode messages. For an overview of LAPD messages, see "LAPD messages" on page 82.

Table 18 LAPD supervisory frame decodes

Message…	Sent to…
RR (Receiver Ready)	Keep the signal alive between the link partners, and acknowledge receipt of frames. RR messages are the most common messages observed in D channel decodes. When there are no call-related messages to send, the link partners transmit RR frames to make sure the link stays in service. **NOTE:** When you are viewing a large number of decode messages to troubleshoot call processing, you can typically ignore the RR messages since they are simply used to keep the D channel signal alive.
RNR (Receiver Not Ready)	Indicate that a link partner is experiencing difficulty (such as buffer depletion), and cannot accept any additional information frames (call related messages) at this time. RNR messages should occur rarely, and should be investigated immediately when they occur.
REJ (Reject)	Force re-transmission of bad frames. Frequent REJ frames indicate miscommunication on the D channel, typically due to errored frames during transmission.

Q.931 messages
Q.931 messages are useful for observing the call setup process, and identifying key information about each call, such as the called party number, transfer capability (which indicates whether the call is a voice or data call), and the channel selection (the B channel carrying the call).

Each Q.931 message begins with a message prefix on the first line which indicates where the message originated. Messages originating from a TE device begin with TE->NT; messages originating from a NT device begin with NT->TE. The call reference number for the message appears on the fourth line. The fifth line indicates the type of message being sent (for example, SETUP or CONNECT).

Finally, information elements pertaining to the call are listed. For SETUP messages, the elements roughly correspond to the settings required to place a call from the HST, such as the ISDN and Call settings listed in . Additional call settings are also listed in the SETUP messages.

For DISCONNECT messages, the cause or reason for the call being disconnected is reported. For example, if the call is disconnected simply because one of the users hangs up the phone, the cause is reported as a Normal Clearing.

If a call cannot be connected, and as a result a RELEASE message is issued in response to a SETUP request, the RELEASE message reports the cause for the disconnection.

Q.931 decodes
lists each of the Q.931 decode messages. For an overview of Q.931 messages, see .

Table 19 Q.931 decodes

Message…	Sent to…
SETUP	Originate a call.

Table 19 Q.931 decodes (Continued)

Message…	Sent to…
CALL PROCEEDING	Indicate that a SETUP message has been received, and that the device is attempting to process the call.
ALERTING	Indicate that a SETUP message has been received, and that the device is attempting to process the call.
CONNECT	Indicate that the call has been completed and that the calling party is connected with the called party.
CONNECT ACK	Acknowledge that the CONNECT message has been received.
DISCONNECT	Disconnect the call. Can be sent from the calling device or the called device. **NOTE:** DISCONNECT messages report the cause for the disconnection.
RELEASE	Release the call in response to a DISCONNECT message, or because a call cannot be connected. **NOTE:** If a call cannot be connected, and as a result a RELEASE message is issued in response to a SETUP request, the RELEASE message will report the cause for the disconnection.
RELEASE COMPLETE	Acknowledge that a RELEASE message has been received, and disconnect the call. **NOTE:** A call is not disconnected until the RELEASE COMPLETE message is observed.

Cause Codes

Table 20 lists and explains the most commonly encountered cause codes for ISDN BRA calls.

Table 20   Common Q.931 Cause Codes

Cause Code	D Channel Decode Description	Typically Indicates
16	Normal clearing	No fault is detected; the call is finished.
18	No user responding	The receiving equipment did not respond to the call attempt within the allowed time.
28	Invalid number format	The receiving equipment considers the number to be incomplete or in an incorrect format. For example, numbers sent as a subscriber plan are expected to be 7 digits or less; numbers sent as national dialing plans are expected to be more than 7 digits.
31	Normal unspecified	Any number of unspecified conditions, but may indicate the call is terminating into a "fast busy" (all trunks are busy).

Table 20 Common Q.931 Cause Codes (Continued)

Cause Code	D Channel Decode Description	Typically Indicates
57	Bearer capability not authorized	The calling party has requested a call type (bearer capability) or service that is not implemented on the receiving equipment for the line. Often seen when trying to place voice calls on data only lines or data calls on voice only lines.
88	Incompatible destination	The destination device is not capable of supporting the type of call requested. Usually seen when trying to place data calls to a voice phone.
100	Invalid information element contents	A protocol problem where the receiving equipment does not understand one of the fields inside of the call setup message. If you receive this message, do the following: – Verify that the call control is correct for the call. – Contact a Tier 2 or Tier 3 technician or switch vendor to isolate and resolve the problem.
102	Recovery on timer expiry	No response received to generated messages. Often seen when B channels are not active.

Resolving problems

Table 21 describes situations that you may encounter when using the HST-3000 to test ISDN BRA service, and then helps you resolve the situation.

Table 21 Issues and resolutions

Issue	Description	Resolution
No dial tone detected on HST	You will not hear a dial tone when you place voice calls from the HST using enbloc dialing or if you place data calls. This is normal for devices placing ISDN calls.	N/A.
Is my call connected?	When placing or receiving a call on the HST, you want to verify that the call is connected.	Check the call status on the Phone screen or the Interface screen.
Call will not connect	Calls may not connect because the HST is not configured properly for the outgoing call, or for a variety of other reasons, such as an invalid bearer capability ("Call Service" on the Call settings page).	Verify the following: – Make sure you specified the number you want to call as the **Called address** (under Call Settings); not your Own Address (under ISDN settings). – Make sure you specified the correct call control protocol (under ISDN Settings). – If the HST is configured correctly for the call, check the cause code on the Phone screen.

Table 21   Issues and resolutions (Continued)

Issue	Description	Resolution
Decode messages are not captured.	The HST stops capturing decode messages when the message buffer is full.	Clear the message buffer (see "Clearing the message buffer" on page 59).
	The HST is filtering messages.	Check the Tracer settings to verify that the desired filters are being used.
HST-3000 does not synchronize to ISDN line.	Sync LED does not illuminate solid green when attached to the ISDN line.	– Verify the correct mode is selected for what the HST-3000 is trying to emulate (NT, TE, LT). – Verify the test cord is plugged into the jack on the BRA SIM corresponding to the selected mode. Most CPE turn-up testing is performed with the HST-3000 configured as an NT1/TE with the test cord in the U interface jack.

Patterns and Messages

A

This appendix describes the BERT patterns, EOC messages, and Cause messages for Basic Rate testing. Topics discussed in this appendix include the following:

- "BERT patterns" on page 94
- "Call status messages" on page 95
- "Q.931 Cause Codes" on page 96

BERT patterns

Table 22 shows the BERT patterns available for ISDN Basic
Rate testing.

Table 22   ISDN BERT patterns

Pattern	Description
2E11-1	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.
2E15-1	Selects the 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential 0s and 15 sequential 1s. Simulates live data for 56 kbps to 2Mbps circuits.
16 bit word	User defined. **NOTE:** It is recommended that this pattern is used only when testing from one HST to another or from a HST to a loopback.
2E11-1 inverted	Selects the inverted 2^{11} -1 Pseudorandom pattern, which generates a maximum of 10 sequential 0s and 11 sequential 1s.
2E15-1 inverted	Selects the inverted 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential 1s and 15 sequential 0s.

Call status messages

The progression of incoming and outgoing calls is reported using call states. The states are displayed on the phone screen.

Table 23 lists the valid call states that may appear for a call as a Call Status result.

Table 23   Call states

State	Indicates
Ringing	An outgoing call has been routed to the destination ISDN device or phone, and is in the process of ringing. **NOTE:** Some ISDN devices do not literally ring.
Connected	An incoming or outgoing call is established.
Dial Tone	LT device is ready to accept overlap dialing.
On hook	The HST is ready to place or receive the call.
Ringing	An incoming call is waiting to be accepted, rejected, or ignored.
Enblock or Overlap Dialing	The HST is in the process of initializing an outgoing call.
Proceeding	A switch has recognized and is processing the outgoing call.
Releasing	The HST is in the process of releasing the call.

Q.931 Cause Codes

Cause codes indicating the reason a call is disconnected are displayed on the phone screen.

For each disconnected call, the D Channel Decode Results screen displays the following cause value information in either the DISCONNECT or RELEASE message:

– A location code, indicating where the disconnect originated (for example, on a private network or a transit network).

– A class code, indicating the type of disconnect (for example, due to a protocol error).

– The cause value issued by the ISDN Network. This value corresponds to a Q.931 cause code (see the cause codes listed in Table 24 on page 97).

– An abbreviated description indicating the reason the call was disconnected.

The Phone screen simply provides the cause value and an abbreviated description of the cause of the disconnect.

NOTE:

The cause codes listed in Table 24 on page 97 do not appear on the D Channel Decode Results or Phone screens. The codes correspond to those listed in the International Telecommunications Union (ITU) Q.931 standards.

Table 24 lists the cause codes for ISDN BRA calls. For brief
explanations of common cause codes, see Table 20 on
page 88.

Table 24   Cause Codes

Cause Code	Cause Message	Description
0	UNKNOWN CAUSE VALUE	
1	UNASSIGNED NUM	Unassigned Number
2	NO ROUTE TO NETWORK	No route to specified network
3	NO ROUTE TO DESTINATION	No route to destination
6	CHAN UNACCEPTABLE	Channel unacceptable
7	CALL AWARDED	Call awarded delivered in est. ch.
16	NORMAL CLEARING	Normal Clearing
17	USER BUSY	User busy
18	NO USER RESPONSE	No User Response
19	ALERTING NO ANSWER	User alerting no answer
21	CALL REJECTED	Call Rejected
22	NUMBER CHANGED	Number changed
26	NON SELECTED CLR	Non-selected user clearing
27	DEST OUT OF ORDER	Destination out of order
28	INVALID NUMBER FORMAT	Invalid Number Format
29	REQ FACILITY REJ	Requested facility rejected
30	RSP TO STAT ENQ	Response to STATUS ENQuiry
31	NORM UNSPECIFIED	Normal Unspecified
34	NO CHAN AVAILABLE	No channel available
35	QUEUED	Queued
38	NETWORK OUT OF ORDER	Network out of order

Table 24   Cause Codes (Continued)

Cause Code	Cause Message	Description
41	TEMPORARY FAILURE	Temporary failure
42	NETWORK CONGESTED	Network congested
43	INFO DISCARDED	Access information discarded
44	CHAN NOT AVAILABLE	Requested channel not available
47	RESOURCE UNAVAILABLE	Resources unavailable/unspecified
49	QUAL SVC UNAVAILABLE	Quality of service unavailable
50	FAC NOT SUBSCRIBED	Requested facility not subscribed
52	OUT CALLS BARRED	Outgoing calls barred
54	IN CALLS BARRED	Incoming calls barred
57	BEARCAP NOT AUTHORIZED	Bearer capability not authorized
58	BEARCAP NOT AVAILABLE	Bearer capability not presently available
63	SERVC NOT AVAILABLE	Service or option not available
65	BEARSVC NOT IMPLEMENTED	Bearer service not implemented
66	CHNTYPE NOT IMPLEMENTED	Channel type not implemented
69	REQ FAC NOT IMPLEMENTED	Requested facility not implemented
70	RES DIGITAL ONLY	Only restricted dig. info. bearer
79	SERVICE NOT IMPLEMENTED	Service/option not implemented unspecified
81	INVALID CALL REF	Invalid Call Reference value
82	CHAN NOT EXIST	Identified channel does not exist
83	NO CALL ID	No call ID
84	CALL ID IN USE	Call ID in use
85	NO CALL SUSPEND	No call suspend

Table 24   Cause Codes (Continued)

Cause Code	Cause Message	Description
86	CALL CLEARED	Call cleared
88	INCOMPAT DEST	Incompatible destination
91	NET NOT EXIST	Transit network does not exist
95	INVALID MSG	Invalid message unspecified
96	INFOELEMENT MISS	Mandatory information element missing
97	MSG TYPE NON-EXIST	Message type nonexistent or not implemented
98	MSG NOT COMPAT	Message not compatible with call state
99	ELEMENT NONEXIST	Info element nonexistent or not implemented
100	INVAL INFO	Info element not valid
101	MSG NOT COMPAT	Message not compatible with call state
102	RECOV ON TMR EXP	Recover on timer expire
111	PROTOCOL ERROR	Protocol error unspecified
127	INTERWORKING	Interworking unspecified
200	LAYER 1 NOT ACTIVE	Layer 1 not active
201	TEI ERROR	TEI Error
202	LAYER 2 NOT ACTIVE	Layer 2 not active
203	NO RESP SABME	No response to SABME
204	DM RECEIVED	Received a DM
205	DISC RECEIVED	Disconnect received
206	NO RESPONSE TO SETUP	No response to setup

Call acceptance rules

This appendix lists the call acceptance or call rejection rules according to the protocol selected. Topics listed in this appendix include the following:

–
–

1TR6 and TN-1R6 protocol

Table 25 provides the call acceptance rules for the 1TR6 and TN-1R6 protocols.

If the last number is compatible with the installed EAZ (extension) and the condition for global call rejection (see the following section), the incoming call is accepted. It is assumed that the address of the incoming call is compatible with the installed address. (The validity of the received address is not checked.)

Table 25   Call acceptance rules for 1TR6 and TN-1R6 protocols

RejGlob	EAZ	Last number of the received address	Call management
Don't care	Don't care	= EAZ	Call accepted
Don't care	# 0	# EAZ and # 0	Call rejected
No	# 0	= 0	Call accepted
Yes	# 0	= 0	Call rejected
No	= 0	# 0	Call accepted
Yes	= 0	# 0	Call rejected

Other protocols

The following tables provide examples of accepted and rejected call scenarios for protocols other than 1TR6 and TN-1R6.

The field "Sub-add call screening" (on the Call Settings configuration menu) allows the user to test the called address and sub-address on incoming calls. If this field is set to "Yes," the called address and sub-address are tested before accepting the call.

Table 26 lists examples of accepted calls.

Table 26 Accepted call examples

Sub-add call screening	Own address	Received address	Own sub-address	Received sub-address	Call management
No	Indifferent	Indifferent	Indifferent	Indifferent	Call accepted
Yes	Empty	Indifferent	Empty	Indifferent	Call accepted
Yes	X	X	A	A	Call accepted
Yes	X	X	Empty	Indifferent	Call accepted
Yes	Empty	Indifferent	A	A	Call accepted

Table 27 lists examples of rejected calls due to the address.

Table 27 Call rejection due to the address

Sub-add call screening	Own address	Received address	Own sub-address	Received sub-address	Call management
Yes	X	Empty	Indifferent	Indifferent	Call rejected
Yes	X	Y (not equal to X)	Indifferent	Indifferent	Call rejected

Table 28 lists examples of rejected calls due to the sub-address.

Table 28   Call rejection due to the sub-address

Sub-add call screening	Own address	Received address	Own sub-address	Received sub-address	Call management
Yes	Indifferent	Indifferent	A	B (not equal to A)	Call rejected
Yes	Indifferent	Indifferent	A	Empty	Call rejected

Protocol Services

C

This appendix lists the services offered according to the protocol selected. Services listed in this appendix include the following:

Q.931, EDSS-1, Q.SIG, TPH1962, Telenokia, Televerket, NTT, and CorNet

Table 29 lists the services available for the Q.931, EDSS-1, Q.SIG, TPH1962, Telenokia, Televerket, NTT, CorNet-T®, and CorNet-NQ® protocols.

Table 29   Q.931, EDSS-1, Q.SIG, TPH1962, Telenokia, Televerket, NTT, and CorNet services

Service	Bearer Capability (BC)	Low Layer Compatibility (LLC)	High Layer Compatibility (HLC)
Speech	0x80, 0x90, 0xA3	-	0x91, 0x81
3.1 KHz	0x90, 0x90; 0xA3	-	0x91, 0x81
Data	0x88, 0x90	-	0x91, 0xC1
Fax G4	0x88, 0X90	-	0x91, 0xA1
Teletex	0x88, 0X90	-	0x91, 0xB1
Videotex	0x88, 0X90	-	0x91, 0xB2
Speech BC	0x80, 0x90, 0xA3	-	-
Data BC	0x88, 0x90	-	-
Data 56Kb	0x88, 0x90; 0x21; 0x8F	-	-
Fax 2/3	0x90, 0X90, 0xA3	-	0x91, 0x84

VN3

Table 30 lists the services available for the VN3 protocol.

Table 30 VN3 services

Service	BC	LLC	HLC
Speech	0x80, 0x90, 0xA3	-	0x91, 0x81
3.1 kHz	0x90, 0x90; 0xA3	-	0x91, 0x81
Data	0x88, 0x90	-	0xC1, 0xFF
Fax G4	0x88, 0X90	-	0x91, 0xA1
Teletex	0x88, 0X90	-	0x91, 0xB1
Videotex	0x88, 0X90	-	0x91, 0xB2
Speech BC	0x80, 0x90, 0xA3	-	-
Data BC	0x88, 0x90	-	-
Data 56Kb	0x88, 0x90; 0x21; 0x8F	-	-

VN4

Table 31 lists the services available for the VN4 protocol.

Table 31 VN4 services

Service	BC	LLC	HLC
Speech	0x80, 0x90, 0xA3	-	0x91, 0x81
3.1 KHz	0x90, 0x90; 0xA3	-	0x91, 0x81
Data	0x88, 0x90	-	
Fax G4	0x88, 0X90	-	0x91, 0xA1
Teletex	0x88, 0X90	-	0x91, 0xB1
Videotex	0x88, 0X90	-	0x91, 0xB2

Table 31   VN4 services (Continued)

Service	BC	LLC	HLC
Speech BC	0x80, 0x90, 0xA3	-	-
Data 56Kb	0x88, 0x90; 0x21; 0x8F	-	-

VN6

Table 32 lists the services available for the VN6 protocol.

Table 32   VN6 services

Service	BC	LLC	HLC
Speech BC	0x80 0x90 0xA3	-	-
3.1 KHz BC	0x90 0x90 0xA3	-	-
7 K Audio	0x91 0x90 0xA5 (H.221, H.242)	-	-
Data BC	0x88 0x90	-	-
Speech	0x80 0x90 0xA3	-	0x91 0x81
Fax G3	0x90 0x90 0xA3	-	0x91 0x84
Fax G4	0x88 0x90	-	0x91 0xA1
Teletex	0x88 0x90	-	0x91 0xB1
Videotex	0x88 0x90	-	0x91 0xB2
Video conference	0x88 0x90	-	0x91 0xE1

SwissNet-3

Table 33 lists the services available for the SwissNet-3 protocol.

Table 33   SwissNet-3 services

Service	BC	LLC	HLC
Speech	0x80, 0x90, 0xA3	-	0x91, 0x81
3.1 KHz	0x90, 0x90; 0xA3	-	0x91, 0x81
Data	0x88, 0x90	-	0x91, 0xC1
Fax G3	0x90, 0x90; 0xA3	-	0x91, 0x84
Fax G4	0x88, 0x90	-	0x91, 0xA1
Teletex	0x88, 0X90	-	0x91, 0xB1
Videotex	0x88, 0X90	-	0x91, 0xB2
Speech BC	0x80, 0x90, 0xA3	-	-
Data BC	0x88, 0x90	-	-
Data 56Kb	0x88, 0x90; 0x21; 0x8F	-	-
7 kHz NFB	0x91, 0x90, 0xA5	-	0x91, 0x81
Vtel NFB	0x91, 0x90, 0xA5	-	0x91, 0x60, 0x81
3.1 KHz PI	0x90, 0x90; 0xA3	-	-

1TR6 and TN-1R6

Table 34 lists the services available for the 1TR6 and TN-1R6 protocols.

Table 34   1TR6 and TN-1R6 services

Service	Service byte (hex)[1]	Additional info byte (hex)[1]
Speech	01	02
3.1 KHz	01	01
Data	07	00
Ton 3.1 KHz	10	01
Fax G3	02	02
Fax G4	04	00
Teletex	09	00
Btx	05	00
X21 Uc 19	03	0C
X25 Uc 13	08	05
Mixed	0A	00
Remote	0D	00
Graph	E0	00
Bild	10	03

1. The service byte and additional info byte combine to form the service indicator (SIN)

1TR67

Table 35 lists the services available for the 1TR67 protocol.

Table 35   1TR67 services

Service	BC	LLC	HLC
3.1 K tel	0x80, 0x90; 0xA3	-	0x91, 0x81
Speech	0x80, 0x90, 0xA3	-	-
D 64K	0x88, 0x90;	-	-
3.1k aud	0x90, 0x90, 0xA3	-	-
7k audio	0x91, 0x90; 0xA5	-	-
X.25B-K	0x88, 0xC0; 0xC6, 0xE6	-	-
7k tele	0x91, 0x90; 0xA5	-	0x91, 0x81
Fax 2/3	0x90, 0x90; 0xA3	-	0x91, 0x84
Fax 4	0x88, 0x90	0x88, 0x90; 0xD1, 0xE7	0x91, 0xA1
Btx 64k	0x88, 0x90	0x88, 0x90; 0xD1, 0xEA	-
Btx neu	0x88, 0x90	0x88, 0x90; 0xD1, 0xE7	91, B2
X.21 Uc19	0x88, 0x90	0x88, 0x90; 0x21, 0x90	0x91, 0xB1
Tele 64	0x88, 0x90	0x88, 0x90; 0xD1, 0xE7	0x91, 0xB1
Bild 3.1	0x91, 0x90, 0xA5	-	0x91, 0x60, 0x81
Bild	0x88, 0x90, 0xA5		0x91, 0x60, 0x82

Specifications

D

This appendix contains specifications for the BRA option. Topics discussed in this appendix include the following:

Interfaces

This section describes interface specifications.

U interface Table 36 describes the U interface.

Table 36 U interface specifications

Parameter	Specification
Number of transmitters	1
Number of receivers	2
Connector	RJ-45 (ISO 10173)
Line code	2B1Q

S/T interface Table 37 describes the S/T interface.

Table 37 S/T interface specifications

Parameter	Specification
Number of transmitters	1
Number of receivers	1
Connector	RJ-45 (ISO 10173)
Impedance	100 Ω or Hi-Z
Line code	AMI

Connector pin designations

This section provides the pin designations for the connectors.

U interface Table 38 lists the pin designations for the U interface connectors.

Table 38   U interface pin designations
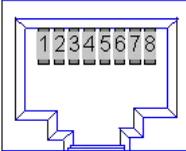
	Pin	Designation
	1	Not Used
	2	Not Used
	3	Not Used
	4	Signal Tx/Rx
	5	Signal Tx/Rx
	6	Not Used
	7	Not Used
	8	Not Used

S/T interface Table 39 provides the pin designations for the S/T connector.

Table 39 S/T connector pin designations

	pin	TE-S/T Simulation	LT-S/T Simulation	Power
	1	Not Used	External power	Not Used
	2	Not Used	External power	Not Used
	3	TX (+)	RX (+)	
	4	RX (+)	TX (+)	PS1
	5	RX (-)	TX (-)	
	6	TX (-)	RX (-)	
	7	Not Used	Not Used	PS2
	8	Not Used	Not Used	
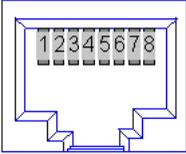
Glossary

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.

B-Channel — Bearer Channel. Portion of the BRA interface that typically carries information. *See* Circuit mode calls.

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.

BRA — Basic Rate Access. An ISDN configuration which consists of two B-channels that can carry voice or data at rate of 64Kbps, and one D-channel, which carries call-control information.

C

Cause Code — Reason an ISDN call was disconnected.

CRC — Cyclic Redundancy Check. A code word used to confirm that a bit stream contains valid data.

D

D-Channel — Portion of BRA interface that provides signaling. May also be used to carry packet calls for data transfers.

E

EOC — Embedded Operations Channel. A portion of the ISDN signal that contains instructions for a network device.

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

F

FEBE — Far End Block Error. A block error detected at a device on the customer premises.

Frame Check Sequence —
Bits added to the end of a frame for error detection.

I

ISDN — Integrated Services Digital Network. A set of communications standards allowing a single wire or optical fiber to carry voice, digital network services and video.

L

LAPD — Link Access Procedure-D. A protocol for ISDN connections.

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

Loopback — Instructing a network device to return a received signal.

LT — Line Termination. A mode in which the HST-3000 simulates a line termination device, such as a central office switch.

M

MSN — (Multiple subscriber number.

N

NT1 — Network Termination type 1. A mode in which the HST-3000 simulates the ISDN device responsible for the termination of the ISDN transmission facility at the customer premises.

P

Pattern — A fixed or pseudo-random string of ones and zeroes used to perform a BER test. ISDN signals must have certain patterns to achieve synchronization between two devices.

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

Q.931 — A message-oriented protocol used on ISDN networks.

S

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

S/T interface — The standard 4-wire (2 RX, 2 TX) ISDN interface used by ISDN terminals on the terminal side of a NT1.

T

TE — Terminal Equipment. A mode in which the HST-3000 simulates a a termination device, such as an ISDN telephone.

TEI — Terminal Endpoint Identifier. The ID of an ISDN device on the customer premises.

U

U interface — The physical 2-wire echo cancelling interface spanning the local loop and the customer premises.

U Loss Pad Insertion — An optional attenuation which can be applied to the output signal to simulate long lengths of cable.

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