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T-BERD® 2209

Communications Analyzer

User's Manual

TTC™
A Dynatech Company

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T-BERD 2209
USER'S MANUAL

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This User's Manual applies to all T-BERD 2209 Software
Incorporating Software Level 3.4.

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Specifications, terms, and conditions are subject to change without notice.

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SECTION 1 GETTING STARTED

1.1 WELCOME TO THE T-BERD 2209

The T-BERD 2209 is the latest product offering for our TTC 2000 Test Pad platform, whose ease-of-use, flexibility, and upgradability has established the next generation in test instruments. The T-BERD 2209 combines graphical user interface technology and a touch-sensitive screen to simplify test setup and reduce test configuration time. The innovative icon-driven interface is easy to learn, and the large display screen provides ample space for displaying test results.

The T-BERD 2209 provides you the necessary test capabilities for quick, comprehensive installation and fault isolation of DS1 and DS3 transmission systems. Features include:

- Dual-receiver in-service monitoring of both the transmit and receive signals simultaneously.
- Advanced timing analysis for determining signal delays or mismatches between the switch and remote equipment.
- Isolation of physical-layer problems associated with data or other advanced service offerings for a single channel without taking unaffected channels out of service.

1.2 MANUAL OVERVIEW

This manual is organized to help you quickly become familiar with the T-BERD 2209 and its capabilities. This manual is divided into the following sections:

1. **Getting Started** — includes welcome statement, manual overview, and instrument description.
2. **Operation** — provides an explanation of the application module design, a description of the graphical user interface, and information on battery charging and replacement.
3. **Common Applications** — describes several T-BERD 2209 standard applications. Each application describes how to con-

figure the T-BERD 2209, connect to the circuit being tested and interprets the test results.

4. **Printer Operation** — presents information on connecting the T-BERD 2209 to a serial printer to provide test setup and test results printouts.

5. **Specifications** — includes the physical, environmental, and electrical specifications for the instrument.

NOTE

TTC has Application Notes and Technical Notes available upon request, or check out our Web Site at www.ttc.com for the latest information and answers to your questions.

1.3 OPTIONS

The following options are available for the T-BERD 2209.

TB2209-ASP — Advanced Stress Patterns Option

This option enables the user to transmit and receive fixed long patterns beyond the standard patterns offered in the test set. The seven T1 stress patterns that are added to the T-BERD 2209 are designed to stress test the timing recovery circuits and span-line repeater ALBO circuitry. The seven patterns include: T1-DALY, 55 octet, 2-96, 3-54, 4-120, 5-53, MIN/MAX.

TB2209-FT1 — Fractional T1 Option

This option provides fractional T1 modes for contiguous and noncontiguous, 56KxN and 64KxN, FT1 testing capabilities. This option enables complete qualification and testing of new FT1 circuits before connecting customer premises equipment. The V.54 FT1 loopcode is also added to the features list and allows for single set testing of FT1 circuits from a convenient T1 access point.

TB2209-TIM — VF PCM TIMS Option

This option provides the ability to listen to PCM encoded signals through the built-in speaker and non-intrusively monitor those signals with the two T1 receivers. In addition, it allows one to measure VF tone frequency and level as well as transmit tones (Quiet, 404 Hz, 1004 Hz, 2804 Hz, and 2713 Hz) on an individual PCM channel basis. The option allows for variable frequency/level tones to be transmitted as well. Noise measurements including SNR, C-Message, and C-Notch are also features of this option.

TB2209-SIG — Signaling Option

This option enables the user to test the ability of a switch/PBX to handle incoming calls and allows one to emulate switch-to-switch communications. The option allows one to place, receive and monitor calls over several trunk types. Features: Send/receive DTMF digits to/from switches and PBXs. Dial-up and test VF circuits. Measure inter-digit delay and digit/tone duration.

TB2209-DS3 — DS3 Analysis Option

This option adds DS3 testing to the already extensive DS1/DS0 testing capabilities of the T-BERD 2209. Without adding any size to the existing test set, this option lets one qualify DS3 circuits with BERT patterns for both M13 and C-bit framing, insert patterns on one or all DS3 channels, drop DS1 and DS0 channels from DS3 signals to test and monitor, and verify frame synchronization on DS3 lines.

TB2209-PRI — Primary Rate ISDN Option

This option adds Primary Rate ISDN testing capabilities, including the ability to place/receive multiple voice/data calls, test D-channel backup, support NFAS, and monitor via D-channel decodes. Supports AT&T 5ESS, NT DMS100 and NI-2 call controls. Supports multiple call types including voice,56K, 64K, Nx64, Nx56, and H0.

TB2209-ILE — Intelligent Line Equipment Option

This option provides the ability to loop up and loop down individual addressable office repeaters and line repeaters or to transmit maintenance switch commands. Supported equipment includes those from Westell and Teltrend.

TB2209-VT100 — VT100 Emulation Option

This option enables the user to switch the T-BERD 2209 from a BER test instrument to a VT100 terminal. Users can monitor or provision network elements such as Performance Monitoring NIUs, or HDSL terminal units via a direct RS-232 connection from the T-BERD 2209.

1.4 INSTRUMENT DESCRIPTION

The T-BERD 2209 is a hand-held test set that is designed around a powerful and flexible architecture, which includes a User Interface Module (UIM) with touch-sensitive screen (TTC 2000) that can support various Applications Modules. The modular design enables the TTC 2000 to easily convert from one test technology to another by swapping the Applications Modules.

The modular design includes two 1/4-turn screws (counterclockwise to release; Clockwise to secure) on the side of the Application Module for simple release and swapping out of modules (see Figure 1-1). The T-BERD 2209 also comes with a hand strap that can be mounted on either side of the unit (on the UIM or on the Application Module).

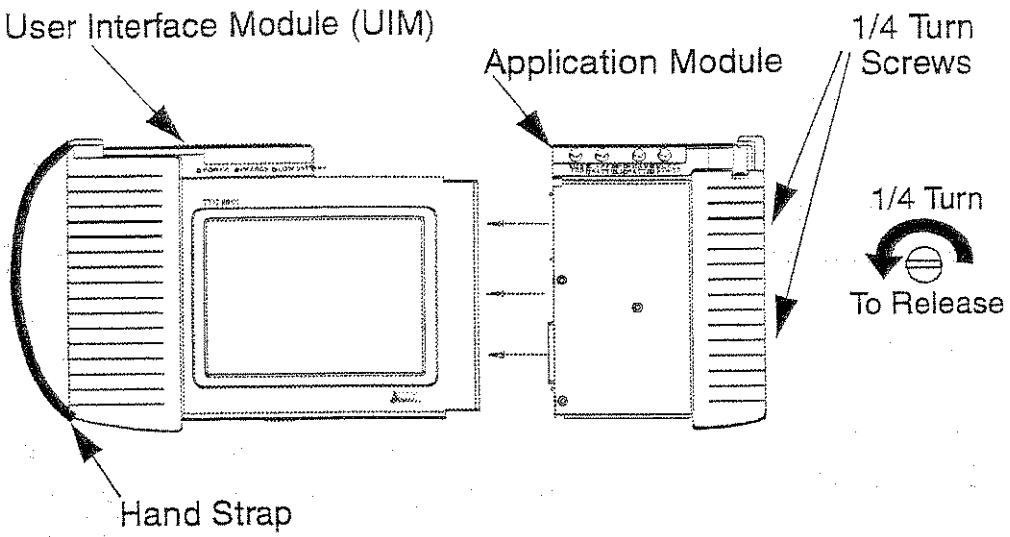


Figure 1-1. TTC 2000 UIM and T-BERD 2209 Applications Module

1.4.1 Front-Panel Features

The T-BERD 2209 provides two transmitters and receivers for T1 circuit analysis and a touch-sensitive Liquid Crystal Display (LCD) for test configuration and results selection (see Figure 1-2).

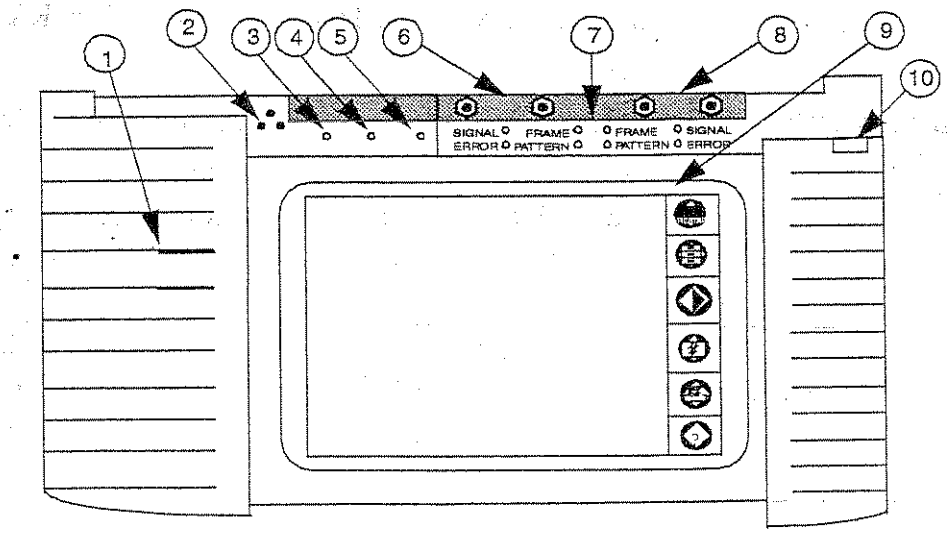


Figure 1-2. T-BERD 2209 Front Panel

Table 1-1 presents descriptions of the front-panel features.

Table 1-1. Front-Panel Features

#	Item	Description
1	Speaker Slots	The speaker slots make it easier to hear the internal speaker output.
2	Microphone	The microphone enables you to talk when a talk path is required. A "Push 2 Talk" ACTION button displays on the LCD. As an alternative, you can use a handset (supplied).
3	Power LED	This green LED illuminates when power is supplied either from the battery or the AC power adaptor.
4	Charging LED	This green LED illuminates when the battery is charging.
5	Battery Low LED	The Battery Low LED illuminates when only 25% of battery power remains. Use the AC power adaptor to recharge the battery and continue testing.
6	Primary RX & TX Jacks	The Primary RX and TX jacks are Bantam jacks that supply the T1 connection to the Primary Receiver and Transmitter. Used for most operations.
7	Status/Alarm LEDs	The Status and Alarm LEDs are divided into two sets that coincide with the Primary or Secondary RX and TX jacks. **Status LEDs** — illuminate green to indicate Signal Present, Frame Sync, and Pattern Sync. **Error LED** — illuminates red to indicate a signal problem. Go to the Summary category to view errors.
8	Secondary RX & TX Jacks	The Secondary RX and TX jacks are Bantam jacks that supply the T1 connection to the Secondary Receiver and Transmitter. Used for dual monitor and D&I (Drop and Insert) applications.

Once an out-of-warranty repair is made, the repaired part or component is warranted for 90 days. This warranty applies only to the part or component that was repaired; other parts or components are not covered under the 90-day repair warranty.

1.6 EQUIPMENT RETURN INSTRUCTIONS

Attach a tag with the following information to all equipment returned for repair.

- Owner's name and address.
- A list of the equipment being returned and the applicable serial number(s).
- A detailed description of the problem or service requested.
- The name and telephone number of the person to contact regarding questions about the repair.
- The Return Authorization (RA) number.

Leave all switches in the positions they were in when the problem occurred. This is requested so that the TTC repair group can analyze the switch positions along with a detailed description of the problem or of the service requested.

If possible, the customer should return the equipment using the original shipping container and material. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit. TTC is not liable for any damage that may occur during shipping. The customer should clearly mark the TTC-issued RA number on the outside of the package and ship it prepaid and insured to TTC.

SECTION 2 OPERATION

2.1 USER INTERFACE DESCRIPTION

When you activate the T-BERD 2209, it displays the main screen (see Figure 2-1). The main screen is used to provide setup and configuration data and to display test-specific action buttons.

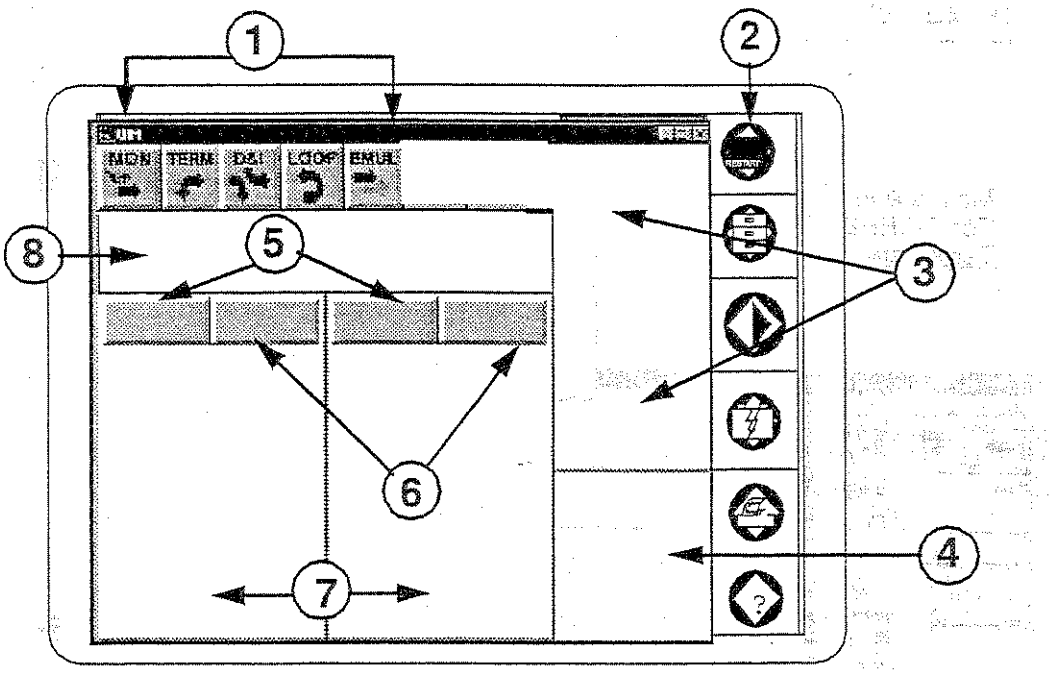


Figure 2-1. Main Screen

The Main Screen is divided into eight areas (Figure 2-1). Each area has a function, as described in the following paragraphs:

1. **Application Icon Selection** — This area displays **MON** (Monitor), **TERM** (Terminate), **D&I** (Drop and Insert), **LOOP** (Loopback), and **EMUL** (Emulate) icons used to select a test group and specific test applications within that group. Refer to Figure 2-2 to view selections (represented by their respective pull-down menus) of those application icons for test setups.

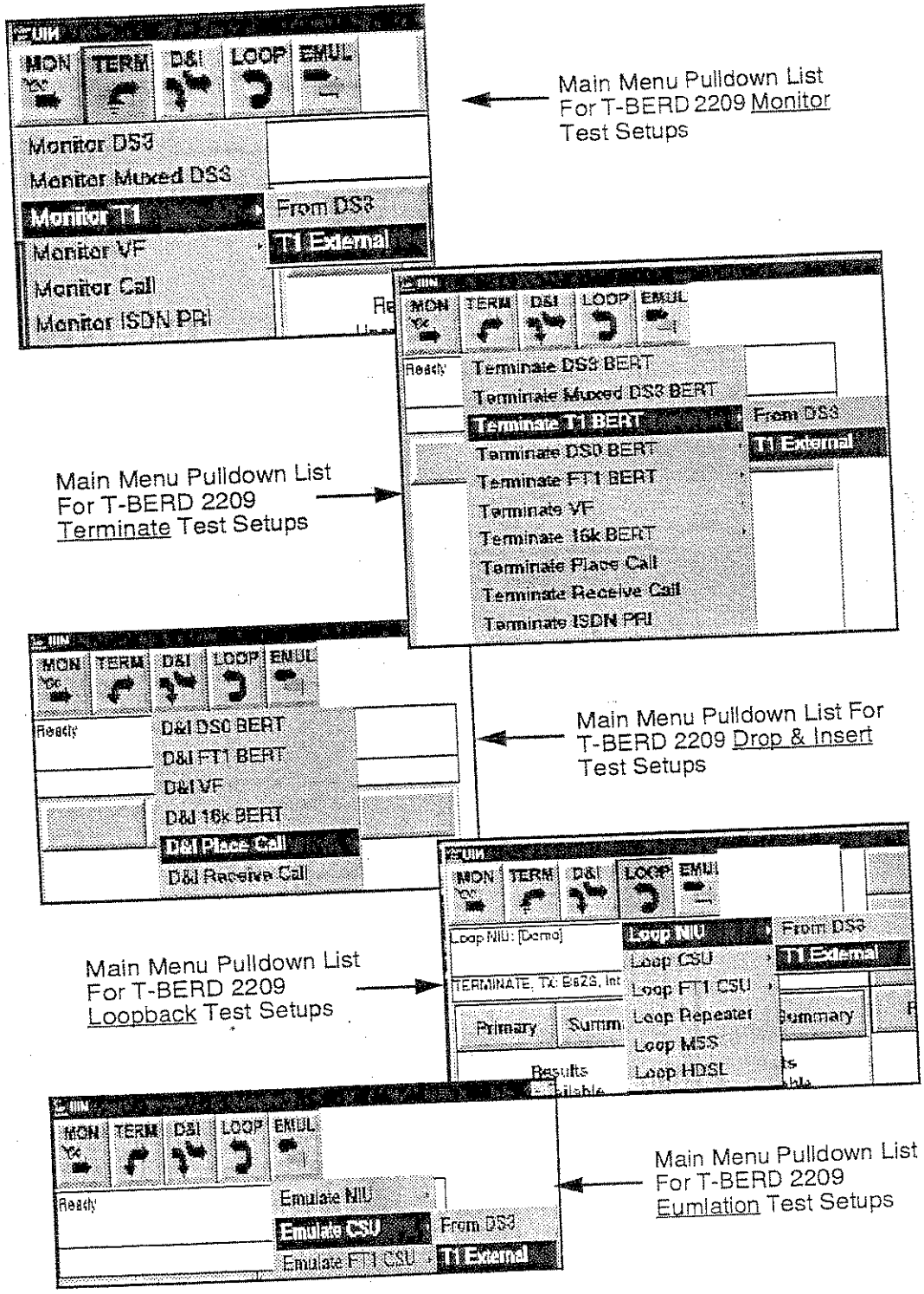


Figure 2-2. Application Icons with Pulldown Lists

2. **Permanent Softkeys** - This area includes six permanent softkeys that provide housekeeping functions for the T-BERD 2209. These keys perform as shown in Table 2-1.

Table 2-1. Permanent Softkey Icons

Icon	Description
	**RESTART** — Performs the test restart function, including resetting the current test result totals and clearing any error alarms.
	**AUX Functions** — Activates the Auxiliary Functions screen, which allows you to view the software revision level and installed options, as well as set the speaker volume, time and date, and brightness control. Accesses VT100 Emulation Option as well.
	**Screen Contrast** — Adjusts the level of detail on the screen display. Pressing the left side lightens the images, and pressing on the right side darkens the images.
	**Battery Status** — Activates the Battery Status Screen, which displays the current battery strength by bar graph and percentage value.
	**Printer Setup** — Activates the Printer Setup Screen, which enables selection of the printer interface parameters (baud rate and parity), and allows you to clear the print buffer, print results, or abort printout.
	**Help (?)** — Will provide on-line help screens to aid in test setup or T-BERD 2209 operation. Currently, this feature is disabled

3. **Quick Configuration Softkeys** — These multiple configuration buttons display based upon the type of test initiated. Only those pertaining to the specific test display (as a default), depending on the test application you have chosen. The **Setup** button allows you to change configurations. Figure 2-3 depicts real-test usage. Refer to Section 2.1.1 for information on how these buttons apply to the Property Sheets.

4. **Action Softkeys** — These action buttons are designed to take specific action during a test to initiate and measure the test (see Figure 2-1 and Figure 2-3).

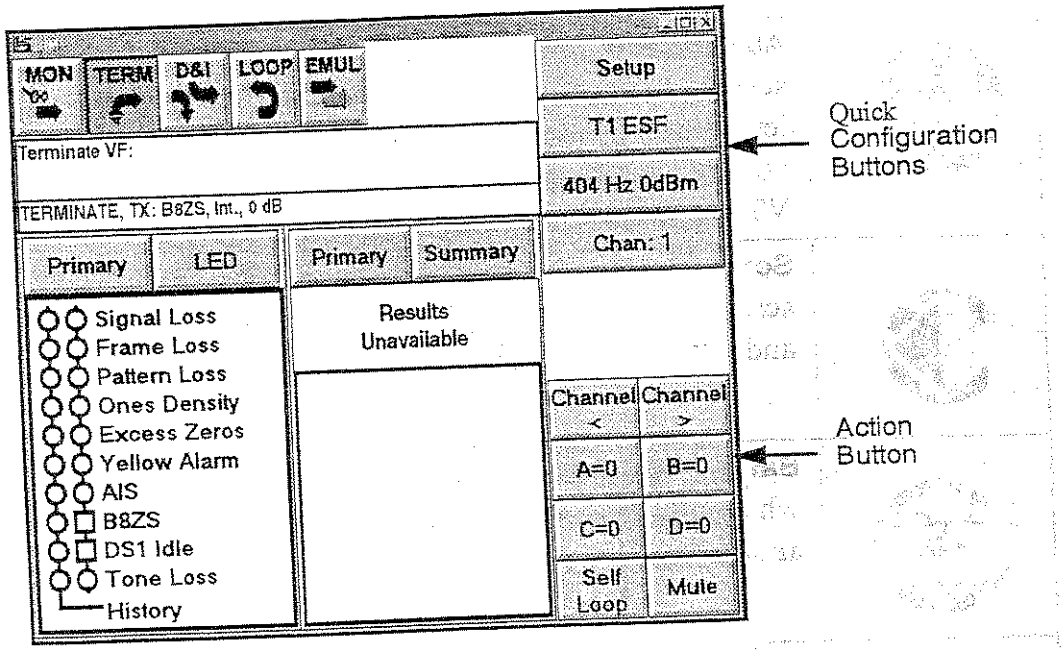


Figure 2-3. Sample Configuration/Action Buttons Usage

5. **Results GROUP Display** — The first button in this dual-results display depicts a drop-down list of the current test results, and lets you choose the *source* of results. Select Primary or Secondary receivers, choosing **Primary, Secondary, PRI Call 1** (ISDN PRI Call 1), **and PRI Call 2** (ISDN PRI Call 2) (see Figure 2-4).

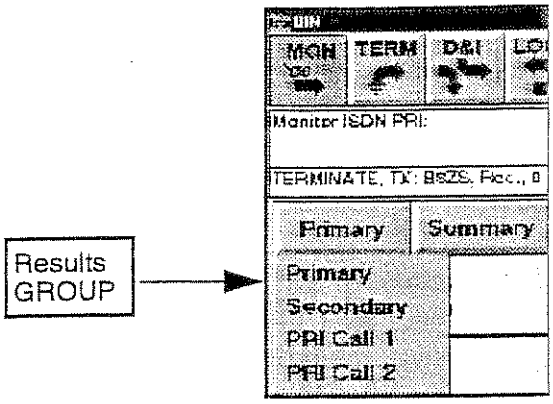


Figure 2-4. Results GROUPS Selection on Main Menu Screen

6. **Results CATEGORY Display** — The second button in this dual-feature display offers a drop-down list allowing the user to choose test results in numerous *categories*. Figure 2-5 shows some of the many selections available.

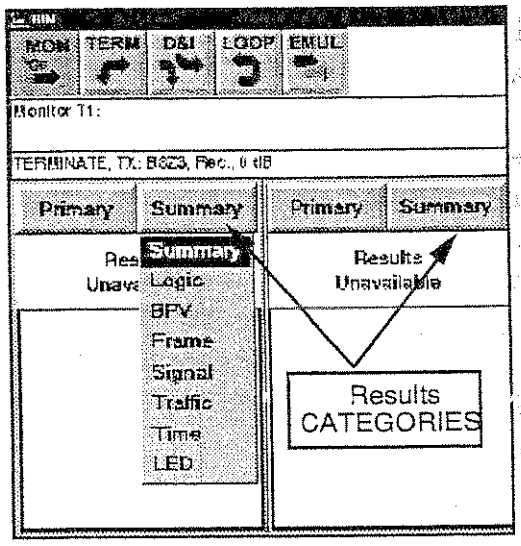


Figure 2-5. Pulldown List in Results CATEGORY

The following Result CATEGORIES are defined as follows:

Summary — This is the default category that automatically displays critical non-zero or out-of-specification results.

Logic — Logic errors are based on discrepancies between the transmitted and received bit stream. The accumulation of logic errors is dependent on frame synchronization (if in a framed mode) and pattern synchronization. When in ESF framing, the logic error inserts a CRC error. Logic errors are not available until initial pattern synchronization is obtained. During loss of frame or pattern synchronization, the accumulation of errors halts. The logic category results include pattern losses, pattern slips, bit errors, bit error rate, pattern loss seconds, error seconds, error-free seconds, and percent error-free seconds.

BPV — Bipolar Violations are caused by successive pulses with the same polarity being detected (except those pulses that are part of the B8ZS encoding). Bipolar violation results are accumulated when the signal is present. the BPV category results include BVPs, BVP error seconds, and BPV rate.

Frame — Frame errors are based on counting framing bits and identifying frame errors in the incoming signal after initial frame synchronization. The results are available whenever the receiver detects a valid framed signal, regardless of the transmitter framing mode. The frame category results include frame losses, frame errors, frame error rate, and frame error seconds.

Signal — The Signal category results include signal losses, frequency, level, and simplex current measurements.

Traffic — The Traffic category displays results for all 24 DS0 timeslot or channel signaling bits, data bits, and channel assignments.

Time — The Time category shows the elapsed time since the test started, as well as date and time.

LED — Selection of this category activates the Signal Alarm LEDs display. Two columns of LEDs reflect the current and history condition for each alarm.

When an alarm first occurs, the appropriate current LED illuminates and remains illuminated until the condition clears. If the condition clears, the History LED for that alarm illuminates and the current LED is extinguished. If the condition occurs again, the current LED illuminates and the History LED remains illuminated to show the condition also occurred in the past.

7. **Dual Test Results Display** — This area (see Figure 2-1) displays two test results windows associated with the current test application. Each window has a button for selecting the Result GROUP, a button for selecting the Result CATEGORY, a Result VALUE display window, and a Result LIST box. Figure 2-6 shows a sample depiction of the Dual Test Results Display.

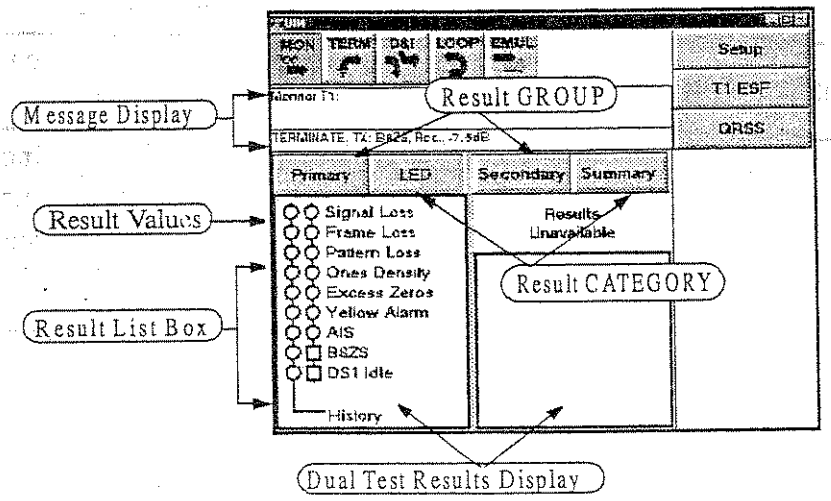


Figure 2-6. Dual Test Results Display (Labeled)

Refer to Table 2-2 for a description of test results for Logic, BPV, Frame, Signal, Traffic, and Time.

Table 2-2. T-BERD 2209 Test Results Description

Category	Result	Description
Logic	Pattern Losses	Loss of valid T1 pulses, where XX is a running count of signal losses since last restart.
	Bit Errors	Count of received bits that have a value opposite that of the corresponding transmitted bits after pattern synchronization.
	Bit Error Rate	Ratio of bit errors to Rx pattern data bits.
	Patt Loss Sec	Count of seconds during which pattern sync was not maintained for the entire second.
	Error Sec	Count of test seconds where one or more bit errors occurred.
	Error Free Sec	Count of seconds where pattern synch was maintained through entire second and no bit error occurred.
	%Error Free Sec	The ratio, expressed as a percentage, of error-free seconds to total number of seconds during which pattern synch is present.
Traffic	Traffic CH #	A display of signaling bits for each channel (C & D for ESF framing only).
Time	Elapsed Time	Time in HH:MM:SS format since last test restart after a signal has been detected. Time continues to increment during signal losses.
	Date	Current Date
	Time	Current Time

Table 2-2. T-BERD 2209 Test Results Description (Continued)

Category	Result	Description
Frame	Frame Losses	Count of discrete losses of frame synchronization since initialization.
	Frame Errors	Count of frame errors detected since initial frame synchronization or last test restart. For D1D and D4(Superframe), frame errors are counted if either an F_t or F_s frame bit is errored. For SLC-96 framing, frame errors are counted if F_t bits are errored. For ESF (Extended Super Frame) framing, frame errors are counted only if an error is found on the FPS bits. Frame errors are not detected on the CRC or datalink bits.
	Frame Erred Secs	Count of seconds wherein one or more frame errors occurred since the last test restart.
	Frame Error Rate	Ratio of frame errors to the number of analyzed framing bits.
	Frame Loss Secs	Count of seconds wherein frame synch was lost or not achieved since initial frame sync or last test restart. Includes seconds where signal loss causes frame synch loss
	Frame SES	Count of seconds during which 12 or more frame errors occurred (D4 framing only).
	CRC Errors	Count of CRC (Cyclic Redundancy Check) errors detected since initial frame synch or last restart. (Detected in ESF framing.)
	CRC Erred Secs	Count of seconds wherein one or more CRC errors occurred since last test restart.
	CRC Error Rate	Ratio of CRC errors to number of ESF frames received.

Table 2-2. T-BERD 2209 Test Results Description (Continued)

Category	Result	Description
Frame (cont.)	CRC SES	CRC Severely Errored Seconds; a count of seconds during which the total number of CRC errors and frame synchronization losses equaled 320 or more.
Signal	Rx Frequency	Frequency of the clock recovered from received data.
	Simplex Curr mA	Magnitude of simplex current flowing between Tx output tip-and-ring and Rx input tip-and-ring expressed in milliamperes. Simplex current displays as a number from 10 to 180. If current is less than 10mA, "<10" displays; if current exceeds 180 mA, ">180".
	Level dBdsx	Level of received dB signal, relative to standard 3-volt base-to-peak signal (DSX level).
	Level dBm	Power level of an unframed, all-ones signal (available only when AIS is detected).
	Level Vpp	Level of received signal in peak-to-peak volts. Signal level displays as volts (V) when signal level > 1 volt, or as millivolts (mV) when signal level < 1 volt.
	Timing Slips	Number of bit slips counted when primary RX jack input slips from the secondary RX jack input, used as a reference. Timing slips display as the number of bit slips, either positive or negative, dependent on whether reference clock signal is lower or higher in frequency. 193 bit slips equals a framing slip.
	Frame Slips	Number of frame slips based on frequency deviations (uncontrolled clock slips) between two input signals measured in positive or negative shifts in bits slips.

Table 2-2. T-BERD 2209 Test Results Description (Continued)

Category	Result	Description
Signal (cont.)	Slip Analysis Secs	Count of test seconds during which Timing Slip Analysis occurred.
	Signal Losses	Count of valid T1 pulse losses, due to cable removed or cessation of signal over circuit.
	Signal Loss Secs	Count of seconds where signal synch was lost or not achieved since last restart.
BPV	BPV Errors	Bipolar Violations; a count of BPV's since the start of elapsed time (excluding intentional violations found within B8ZS codes).
	BPV Erred Secs	Count of seconds wherein one or more BPV's occurred since the last test restart.
	BPV Rate	Ratio of BPV's to total bits received.

NOTE

Hierarchy information regarding prioritizing test results appearing in Summary Screen is available from TTC upon request. Just dial (800) 638-2049.

8. **Message Display** — This area (see Figure 2-1 and Figure 2-6) displays messages regarding activity associated with the current test application. The message display is comprised of:

   - **Test State/Status**: Shows the current test application. It also indicates the progression of a test, such as the transmission of loop codes and whether or not that operation was successful.
   - **Setup:** Shows a summary of the test configuration setup.

2.1.1 Application Setup Property Sheets

When any of the Quick Configuration buttons are pressed, Setup Property Sheets (which are tabulated for subsequent choices) appear on the LCD. These Setup Sheets consist of a Setup **Summary** (Figure 2-7) and Property Sheets (Figure 2-8) that provide the parameters for all test settings not determined by the default test setup.

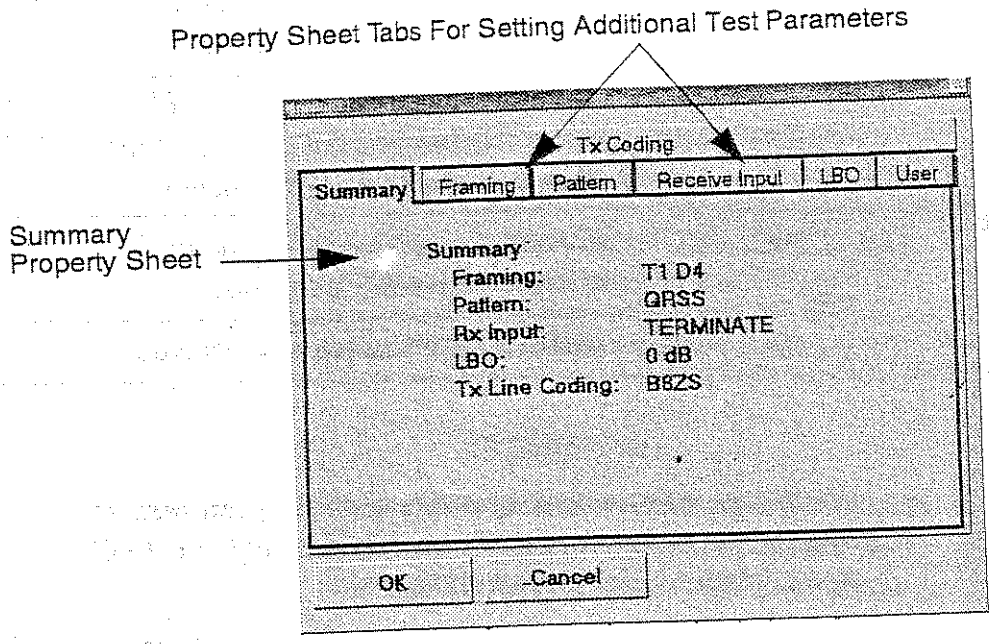
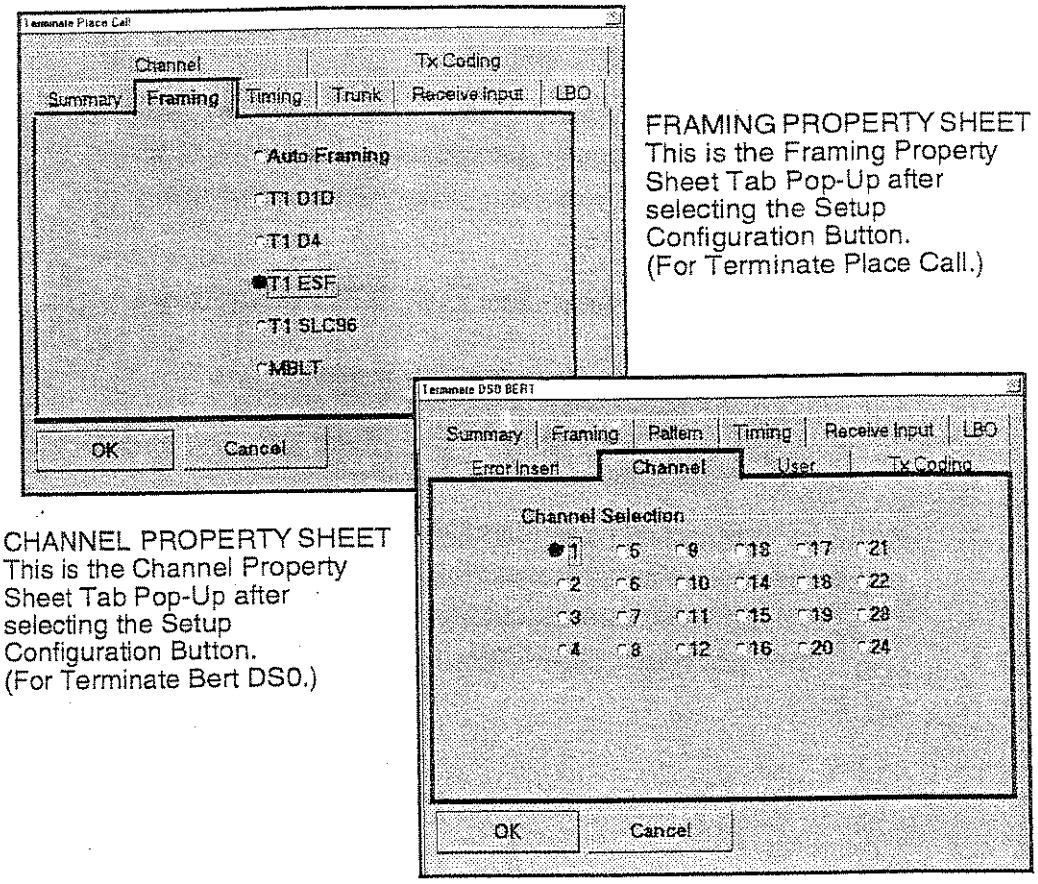


Figure 2-7. Setup Summary Property Sheet

When pressed and applicable, the **Setup** configuration key prompts a Summary Sheet that allows you to double check that you are configuring the test set for the analysis parameters you want. Behind the **Summary** Property Sheet, you see tabs of additional setup sheets that prompt you to change parameters for the test application for specific tests.

Actually, pressing any of the Quick Configuration buttons will activate the T-BERD 2209 to bring up the Property Sheets, and by pressing any of the tabs, you can immediately bring up the desired screen to set your parameters. Figure 2-8 shows a random sampling of property tabs within the Property Sheets.



FRAMING PROPERTY SHEET
This is the Framing Property Sheet Tab Pop-Up after selecting the Setup Configuration Button.
(For Terminate Place Call.)

CHANNEL PROPERTY SHEET
This is the Channel Property Sheet Tab Pop-Up after selecting the Setup Configuration Button.
(For Terminate Bert DS0.)

Figure 2-8. Property Sheet Tabs Set Test Parameters

Remember to press **OK** on the Property Sheet to set the value. You can also cancel the settings by pressing **CANCEL**.

2.2 USING THE T-BERD 2209

To operate the T-BERD 2209, you only need to turn on the test set, wait for the Main Screen to appear, then perform the following steps:

NOTE

We recommend using the stylus supplied with the T-BERD 2209 to activate functions on the touch-sensitive screen. However, any blunt device, including your finger, can be used.

1. Select an Application Icon, the FIRST STEP of any test.

2. Select an application from the list of application choices in the pulldown menu that appears when the icon is selected. The T-BERD 2209 configures a default setting for the selected test. Figure 2-9 represents choosing an application for Monitor T1 setup.

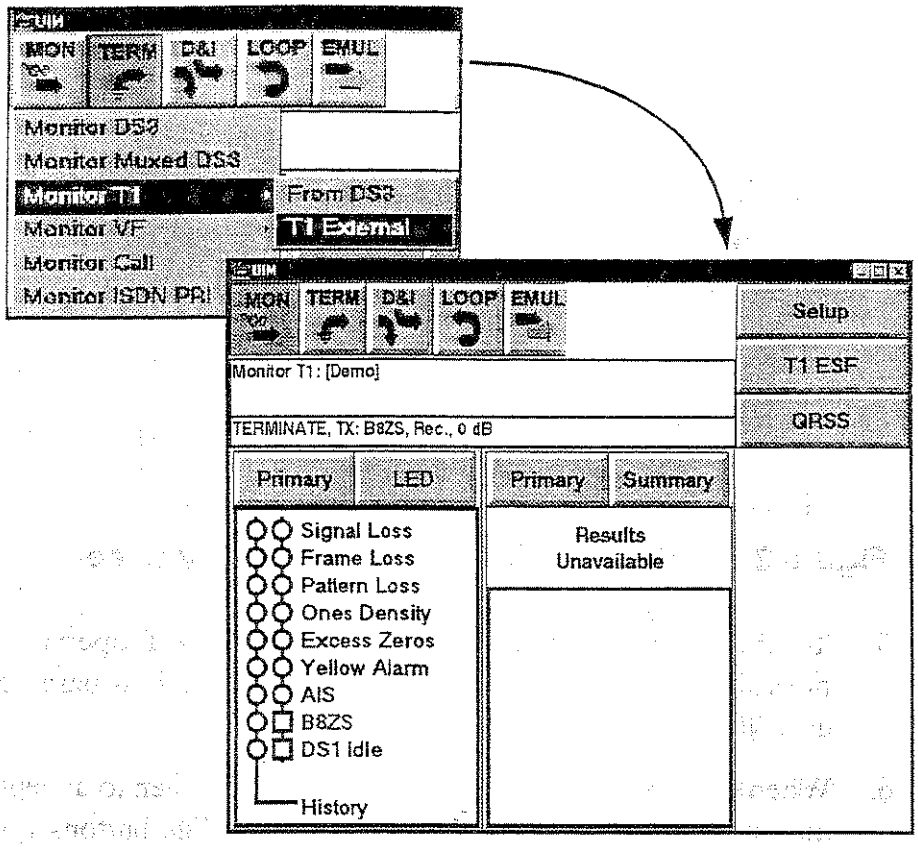


Figure 2-9. Choosing an Application

3. The buttons in the Configuration section show the current settings. To change a setting, press the appropriate button.

NOTE

As an alternative, you can use the Quick Configuration buttons (below ***Setup****) to change settings. These buttons also display current setting.*

4. To check or change the configuration, press **Setup**, which replaces the Main Screen with the Setup Screen (Figure 2-10). The Setup Screen starts with the **Summary** tab with folder tabs

set behind it for each of the parameters you may want to change from the default test setting.

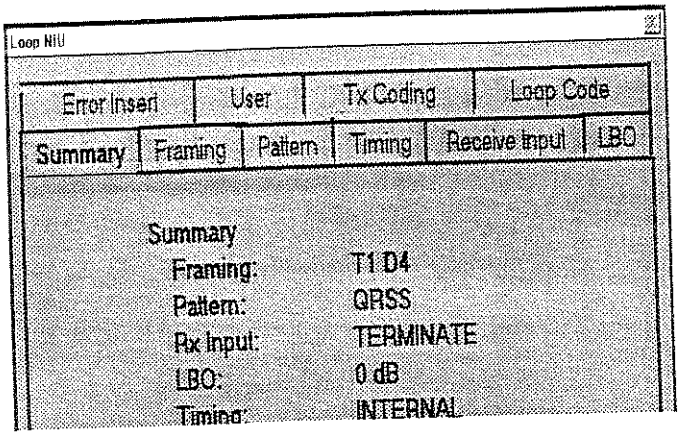


Figure 2-10. Folder Tabs Behind Summary Sheet

5. To change a parameter, press the appropriate Property Sheet tab folder to move it to the front. Set the desired parameters accordingly.

6. When done, press **OK** on the bottom of the screen to accept the new values and return to the Main Screen. The buttons reflect the new setup. Press **Cancel** to leave the values as they were and return to the Main Screen.

7. Key parameters appear as buttons immediately below the **Setup** button. Typically **Framing** and **Pattern** buttons appear here. For Loop applications, a **Loop Code** button appears with the current loop code (e.g., FAC2 for NIU Loopback). You can touch any of these buttons to go to the Setup Screen with that folder in front, ready for changes.

8. Once all parameters are correct, connect the T-BERD 2209 to the circuit using the Primary and/or Secondary TX and RX jacks. For instrument safety, we recommend connecting the cables to the RX or TX jack first, then the T1 circuit. Test results automatically begin accumulating.

9. For loopbacks and some other applications, some secondary ACTION buttons appear in the Quick Configuration area. Touch the appropriate button to perform the labeled function (e.g., **Loop Up** to send the loop up code or **Loop Down** to send the loop down code).

10. To clear alarms and begin the test, press the **RESTART** Permanent Softkey. 

11. Observe the test results in the Dual Test Results Display. All available results are listed in the Test Results List, while the currently selected result is shown in the Test Result display above the list. Touch a specific test result in the Test Results List to see it in the Test Result display.

2.3 BATTERY OPERATION

The T-BERD 2209 comes equipped with a rechargeable Nickel-Metal Hydride (NiMH) battery. A fully charged battery is good for 3 hours of continuous use. If the DS3 option is installed and in use, a fully charged battery is good for 2 hours of continuous use.

Before using your T-BERD 2209, you first need to install the battery. Fully charge the battery before first use, and check its status by reading the gauge.

2.3.1 Battery Installation and Replacement

The Nickel-Metal Hydride (NiMH) battery is easy to install and replace.

1. Turn off the T-BERD 2209.
2. Open the Battery Access Door at the bottom of the T-BERD 2209 by sliding the latch back from the edge of the test set and pulling the Battery Access Door open on its hinge.
3. Line up the battery with the terminals facing up and pointing toward the battery compartment (You should be able to read the terminal markings (-) T D C (+) at the top end of the battery.)
4. Gently slide the battery into the battery compartment until the terminals click into place. The bottom of the battery should be about a quarter of an inch inside the compartment.
5. Close the Battery Access Door and slide the latch toward the edge of the unit to secure the Battery Access Door in place.
6. Turn on the T-BERD 2209 and continue testing.

NOTE

The T-BERD 2209 battery is "hot-swappable" such that if AC power is connected, you can swap/replace the battery without affecting current test.

2.3.2 Charging the Battery

The Battery Low LED on the front panel illuminates when the battery is at 25% of full charge to indicate the battery needs to be recharged. The battery can be recharged while the T-BERD 2209 is being used for testing by connecting the AC Adaptor from the 18 VDC plug on the bottom of the test instrument to a 120 VAC power supply. This allows you to continue testing, but it lengthens the recharge time.

WARNING

Do not allow the battery to discharge completely! It is extremely important for optimal battery performance to always keep the battery charged, or to remove the battery from the unit when not in use.

To fully charge the battery quickly, turn the unit off, connect the AC Adaptor from the 18 VDC plug to a 120 VAC power supply and let the T-BERD 2209 sit for about 1 1/2 to 2 hours depending on how low the battery was.

SECTION 3 COMMON APPLICATIONS

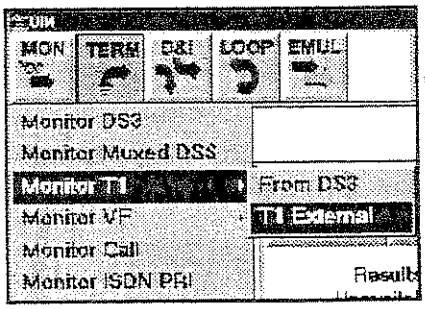
The following setup procedures are the most commonly used for the T-BERD 2209 to test T1 and DS3 circuits. *As in any test, always configure the unit before connecting to the circuit.*

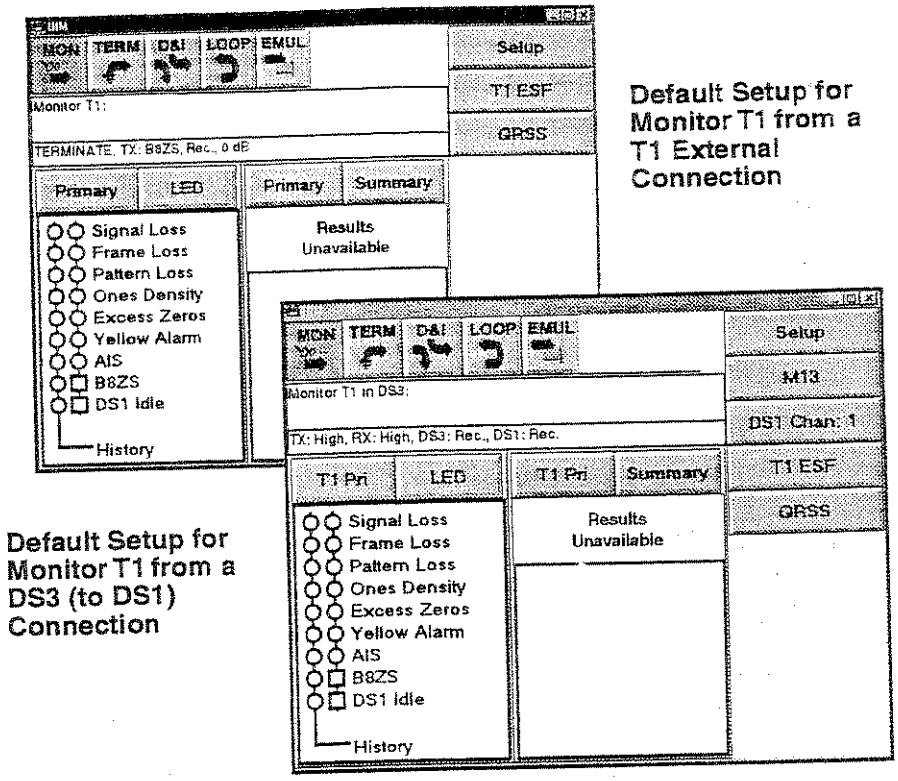
3.1 MONITORING T1 PERFORMANCE

This test allows you to:

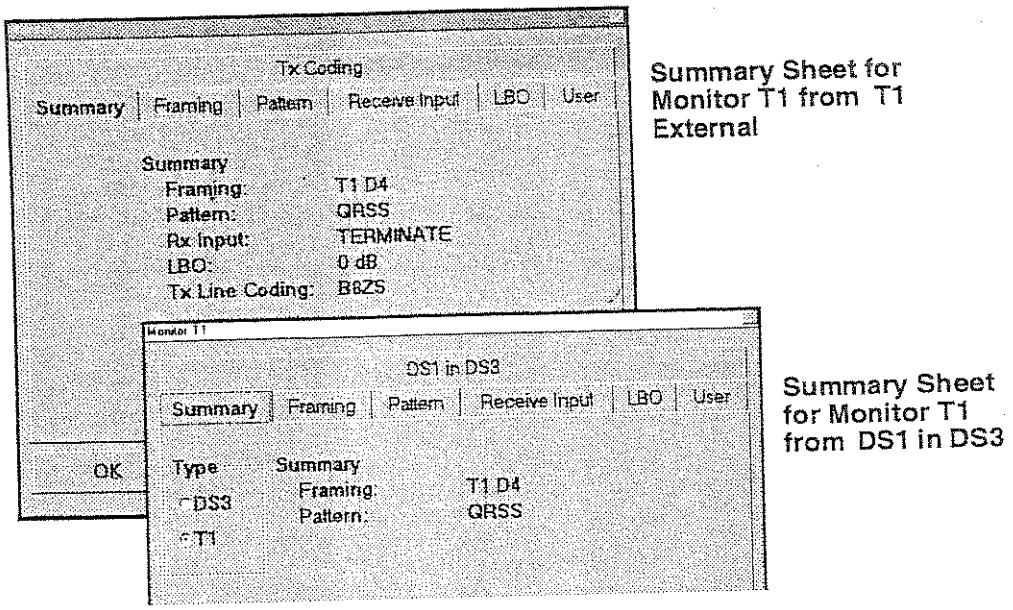
- Non-intrusively monitor the T1 facility.
- Confirm that the T1 signal is properly received by the network equipment.

1. Press **Mon**. Then, select **Monitor T1** from the pulldown menu, followed by either **From DS3** or **T1 External** (if the DS3 Option is installed). The unit automatically configures to a default setup screen.



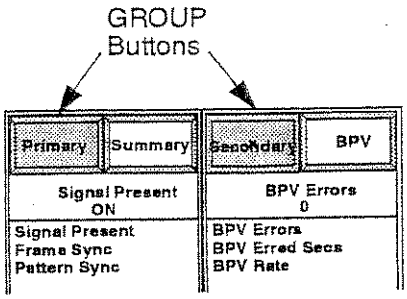


2. Press **Setup**. Ensure the characteristics shown in the Setup **Summary** Screen match the network characteristics (such as T1D4, etc.). To change settings, select the desired Property Sheet tabs in the Property Setup Sheets.

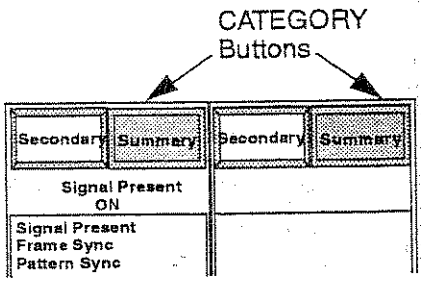


3. Exit Configuration Setup Screen by pressing **OK**.

4. Set Result GROUP buttons to **Primary** (left) and **Secondary** (right).



5. Set Result CATEGORY buttons to **Summary**.



6. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DSX-1 test access points.

7. Press the **RESTART** Permanent Softkey to clear alarms and begin the test.

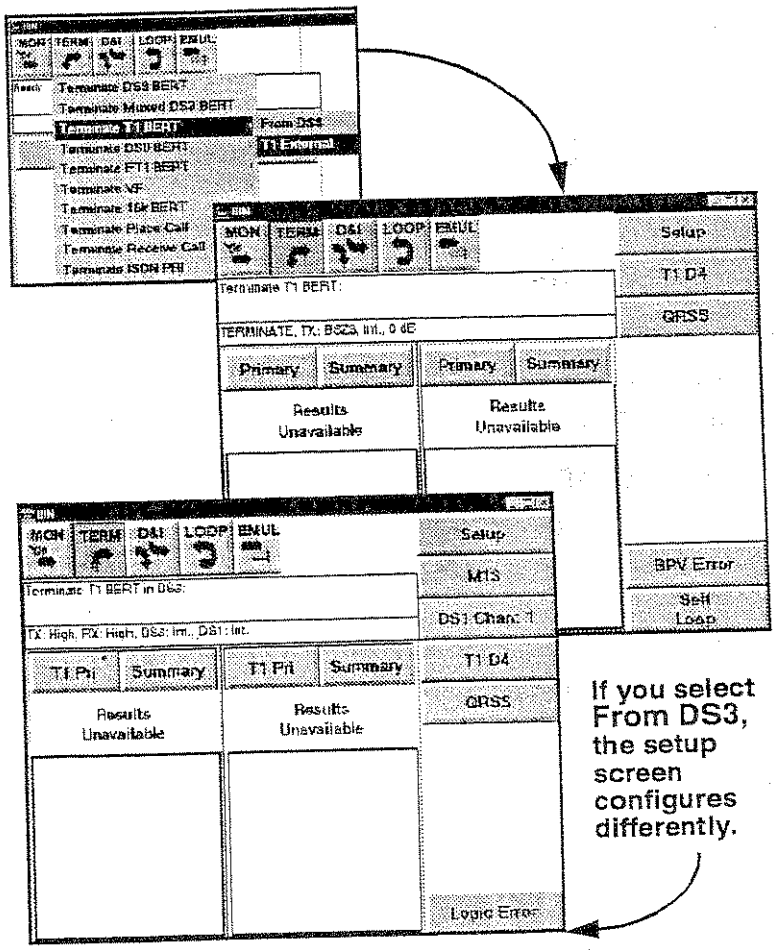
8. Verify the SIGNAL and FRAME LEDs are illuminated and the Primary and Secondary Results displays show RESULTS OK.

3.2 T1 LOOPBACK BER TEST

This test allows you to:

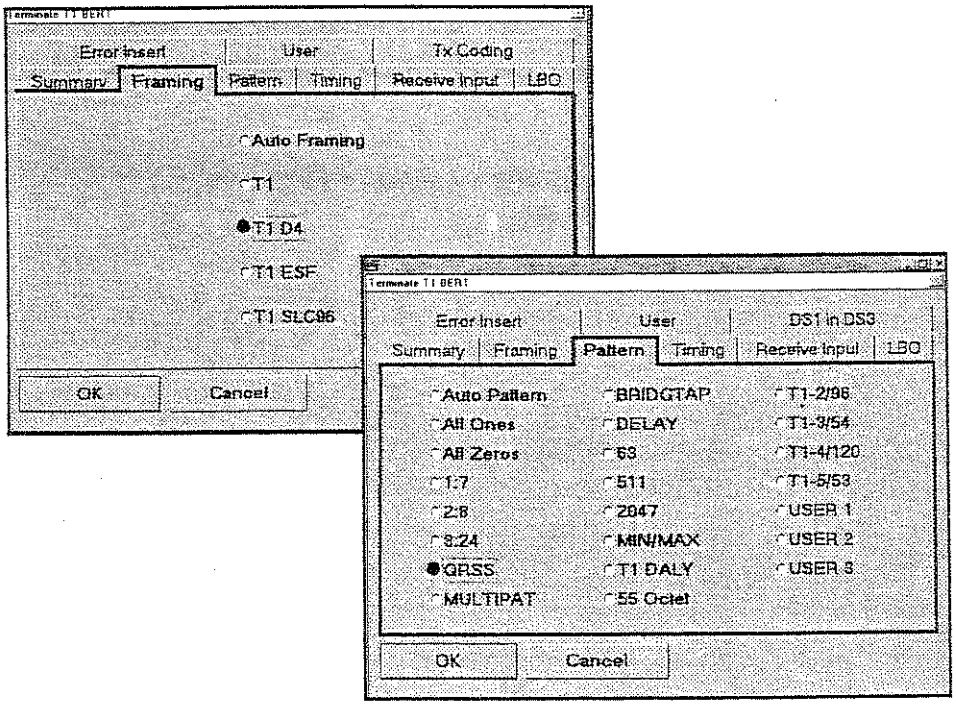
- Qualify T1 circuit error performance by testing for logic errors, BVPs, frame errors, and CRC errors (if applicable) on T1 lines.

1. Select **TERM**. Then, select **Terminate T1 BERT**, followed by **T1 External** or **From DS3** from the pulldown menu. (**Terminate DS0 BERT** and **Terminate FT1 BERT** are also T1 Termination Setups.) The unit automatically configures to a default setup screen. Access point choices are given with DS3 option.



This test assumes the testing is done from a DSX-1 patch panel where a loopback already exists at the far end.

2. Press **Setup**. Ensure the characteristics shown in the Summary setup screen match the network characteristics. To change settings, select the desired tabs in the Property Setup Sheets. *Make sure you select the* **Receive Input** *Tab and select TERM for each receiver for this test.*
3. Select proper **Framing** (T1, T1D4, T1 ESF, or T1 SLC96).
4. Select appropriate **Pattern**.



5. Set **Tx Coding** as appropriate (B8ZS or AMI).
6. Set **Timing** to INTERNAL if emulating central office equipment. Set Timing to RECOVERED (loop) if emulating customer premises equipment.
7. Set **LBO** to appropriate value (typically 0 dB).
8. Set **Receiver Input** to TERMINATE.
9. Set **Error Insert** to DS1 LOGIC.
10. Press **OK**.

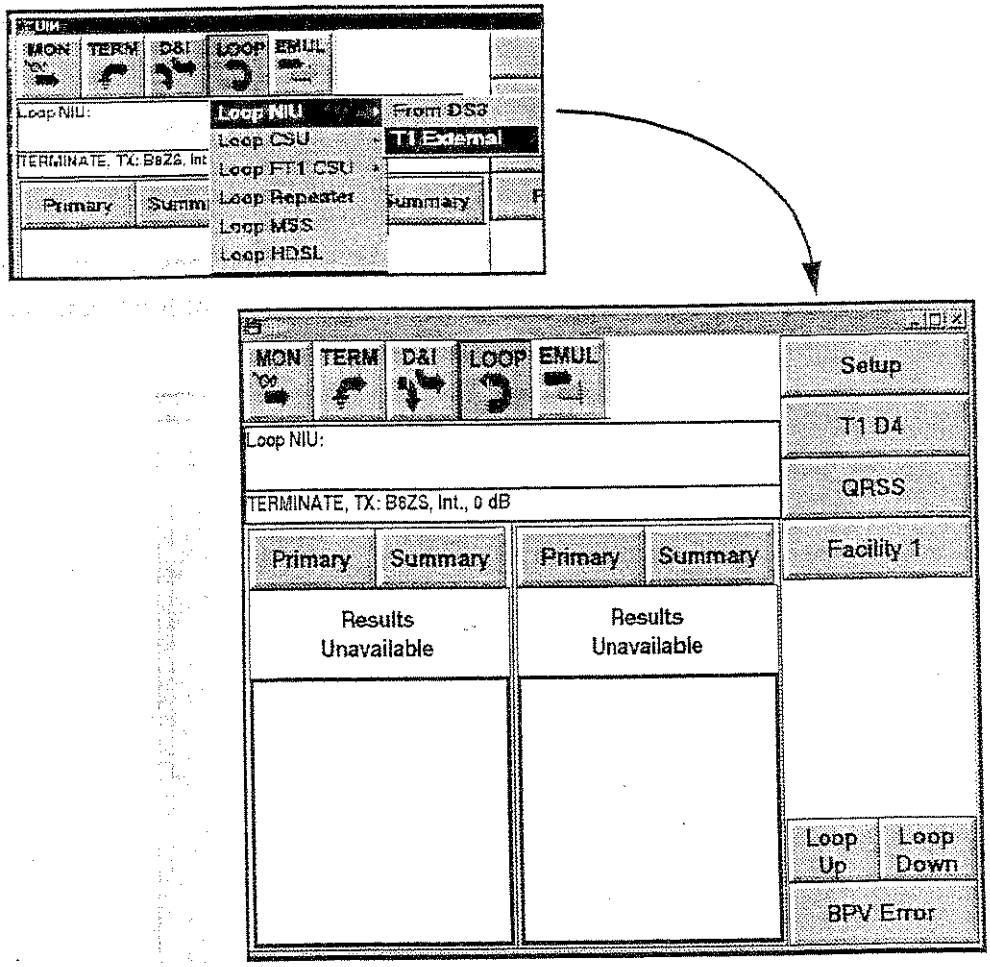
11. Connect a cable from the PRIMARY TX jack to the appropriate DSX-1 IN jack.
12. Connect a cable from the PRIMARY RX jack to the appropriate DSX-1 OUT jack.
13. Press the **RESTART** Permanent Softkey to clear alarms and begin the test.

Verify the Primary SIGNAL, FRAME, and PATTERN LEDs are illuminated and the Primary Results display shows RESULTS OK.

14. Insert one or two errors by pressing the **Logic Error** ACTION button to verify connectivity.

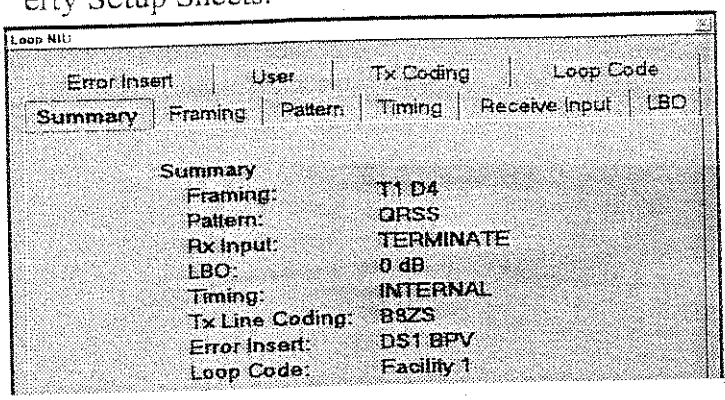
3.3 T1 LOOPBACK TEST FROM A DSX-1

1. Select **LOOP**. Then, select **Loop NIU** from the pulldown menu, followed by **T1 External** (if DS3 Option is installed).

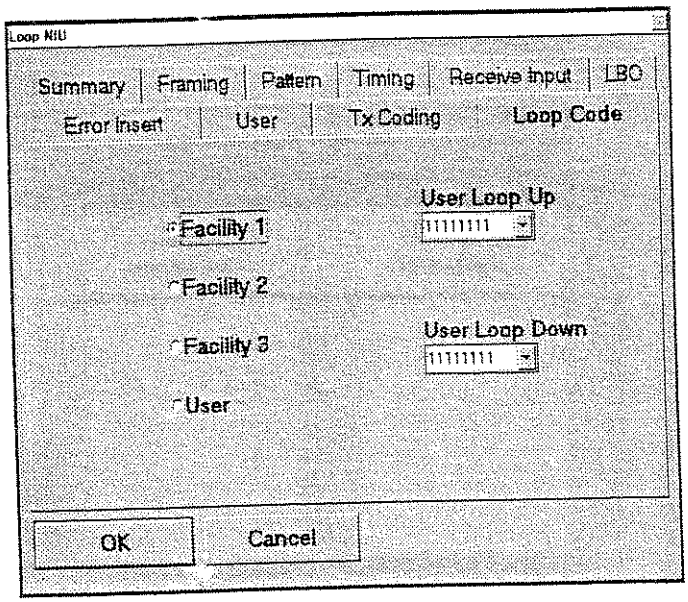


2. Touch **Setup**. Ensure characteristics shown in the **Summary** setup screen match the network characteristics.

3. To change baseline settings, select the desired tabs in the Property Setup Sheets.

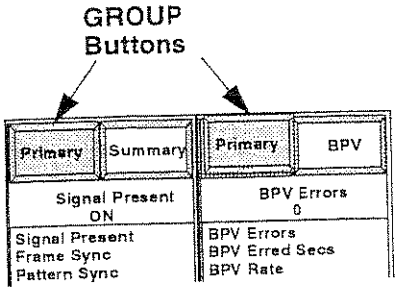


4. A **Loop Code** tab appears in the Tab Selections (as well as in the Quick Configuration area) with the current loop code (e.g., FAC2). If required, select the loop code type.

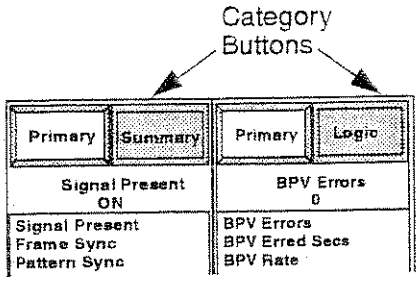


5. Press **OK**.

6. Set the Result GROUP buttons to **Primary**.

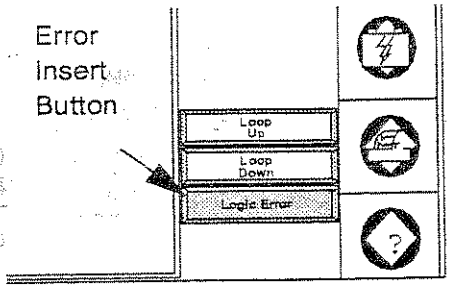


Set the left CATEGORY button to **Summary** and set the right CATEGORY button to **Logic**.



7. Press the **Loop Up** ACTION button to send the loop code. If loop up is successful, the message `LOOP UP SUCCESSSFUL` flashes.

8. Press the **Logic Error Insert** ACTION button to transmit bit errors to verify the loopback. Observe bit errors in the Primary Results display.



9. Press the **RESTART** Permanent Softkey to clear alarms.

   Verify the Primary SIGNAL, FRAME, and PATTERN LEDs are illuminated and the Primary Results display shows RESULTS OK.

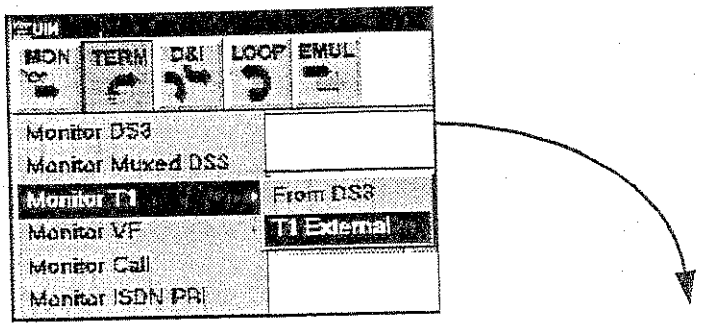
10. Perform the desired tests on the looped back circuit.

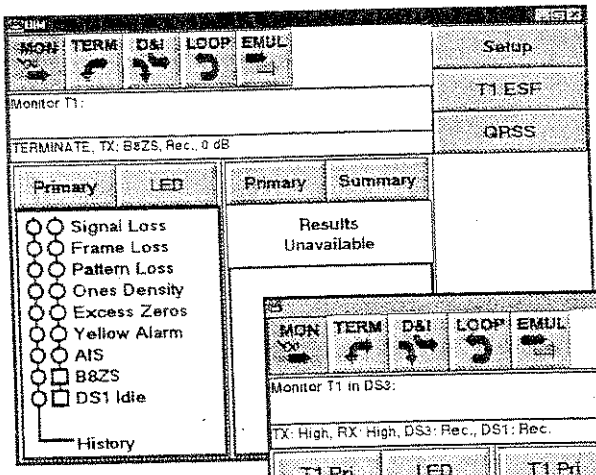
11. When testing is completed, press **Loop Down** to loop down the looped equipment. **Loop Down** remains depressed until the loop down is accomplished. If loop down is successful, the message `LOOP DOWN SUCCESSFUL` flashes and the Pattern LED goes out.

3.4 MONITORING A/B/C/D SIGNALING BITS

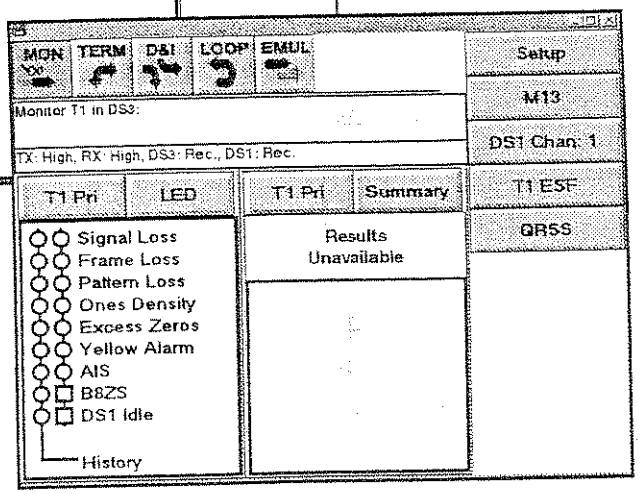
This application allows you to view the signaling bits for all of the 24 channels for both the Primary and Secondary lines, simultaneously.

1. Press **Mon**. Then, select **Monitor T1** from the pulldown menu, followed by **T1 External** (if the DS3 Option is installed). The unit automatically configures to a default setup screen.



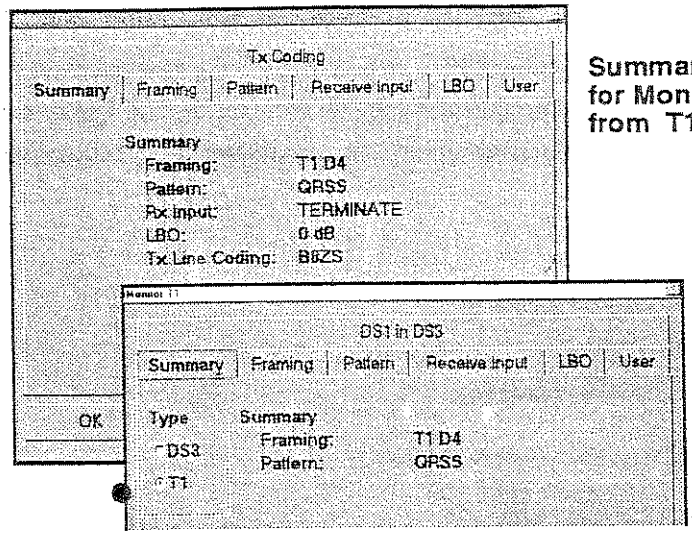


Default Setup for Monitor T1 from a T1 External Connection



(Default Setup for Monitor T1 if you select *From DS3*)

2. Press **Setup**. Ensure the characteristics shown in the Setup **Summary** Screen match the network characteristics (such as T1D4, etc.). To change settings, select the desired Property Sheet tabs in the Property Setup Sheets.

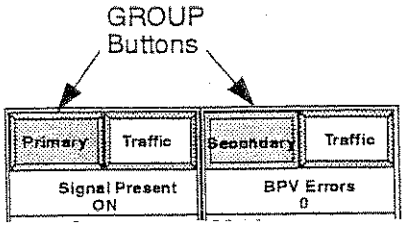


Summary Sheet for Monitor T1 from T1 External

(Summary Sheet for Monitor T1 from DS1 in DS3)

3. Exit Configuration Setup Screen by pressing **OK.**

4. Set Result GROUP buttons to **Primary** (left) and **Secondary** (right).



5. Set Result CATEGORY buttons to **Traffic.**

6. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DS1 test access point (DSX-1 patch panel).

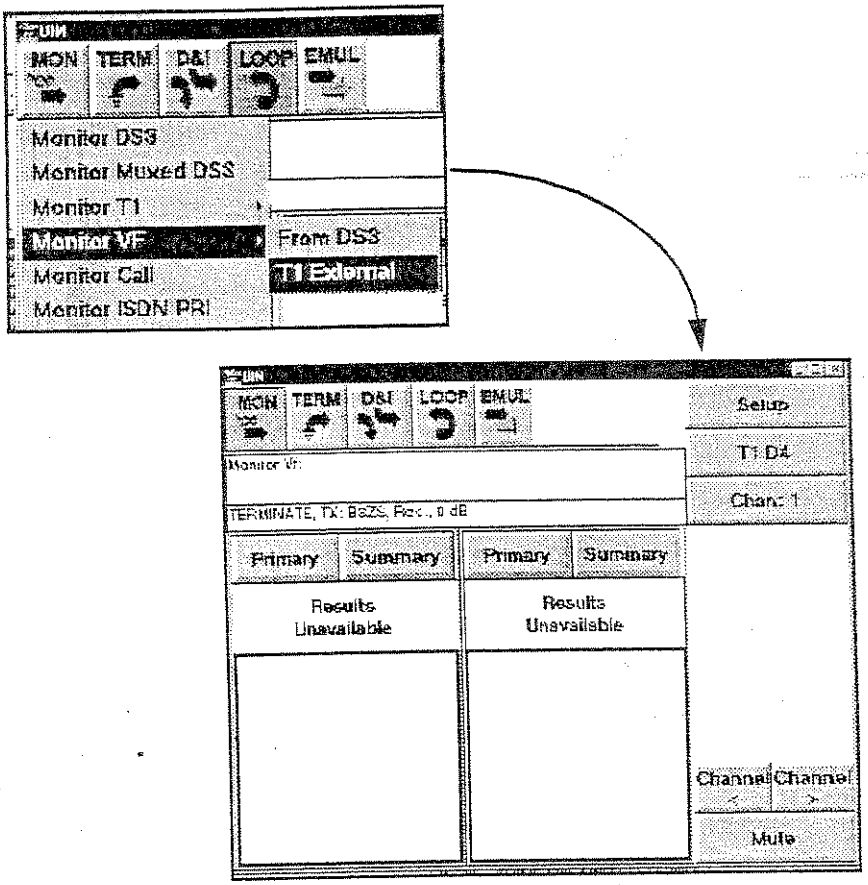
7. Press the **RESTART** Permanent Softkey to clear alarms and begin the test.

8. Verify the SIGNAL and FRAME LEDs are illuminated. Observe all 24 channels for Primary and Secondary in two groups of 12 channels each.

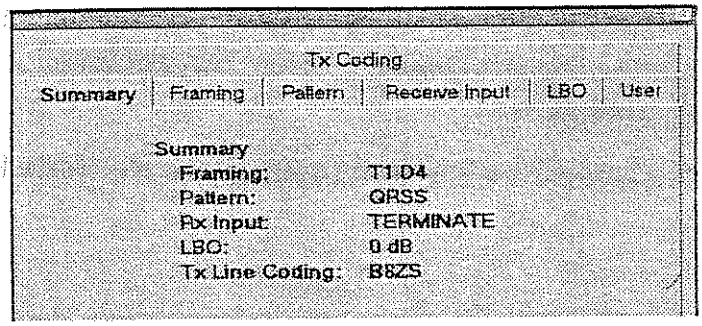
3.5 MONITORING VF

The following procedure outlines how to use the T-BERD 2209 to monitor DS0 (VF) channels out of a DS1 signal. The TB2209-TIM Option is required.

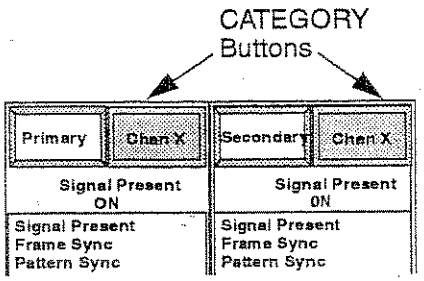
1. Press **Mon.** Select **Monitor VF** from the pulldown menu, followed by **T1 External** (or **From DS3** if the DS3 Option is installed). The unit automatically configures to a default setup screen.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** setup screen match the network characteristics (such as AMI, etc.), as well as the desired VF channel. To change the settings, select the desired property tabs in the Property Setup Sheets.



3. Press **OK**. Set Result GROUPS to **Primary** and **Secondary**.



4. Set Result CATEGORYS to **Chan X** where "X" is the VF channel selected.

5. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DS1 test access point (DSX-1 patch panel).

6. Press the **RESTART** Permanent Softkey to clear alarms and begin the test.

7. Verify the SIGNAL and FRAME LEDs are illuminated (green).

8. Observe results. Use the Channel (< >) buttons to select other channels to monitor.

3.5.1 Signal-To-Noise Ratio Measurements

Signal-to-Noise Ratio (SNR) is the ratio of the amplitude of the desired signal to the amplitude of noise signals at a given point in time, usually expressed in decibels. Its application within the T-BERD 2209 enables analysis wherein received voice frequency signals assume readable characteristics when specific tones are inserted into the transmission.

Figure 3-1 shows the hook-up for the Signal-to- Noise Ratio test.

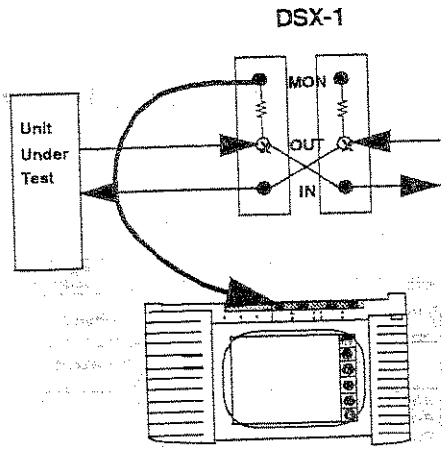


Figure 3-1. Monitoring VF Test Setup

Figure 3-2 shows the resulting Signal-to-Noise Ratio Results Screen.

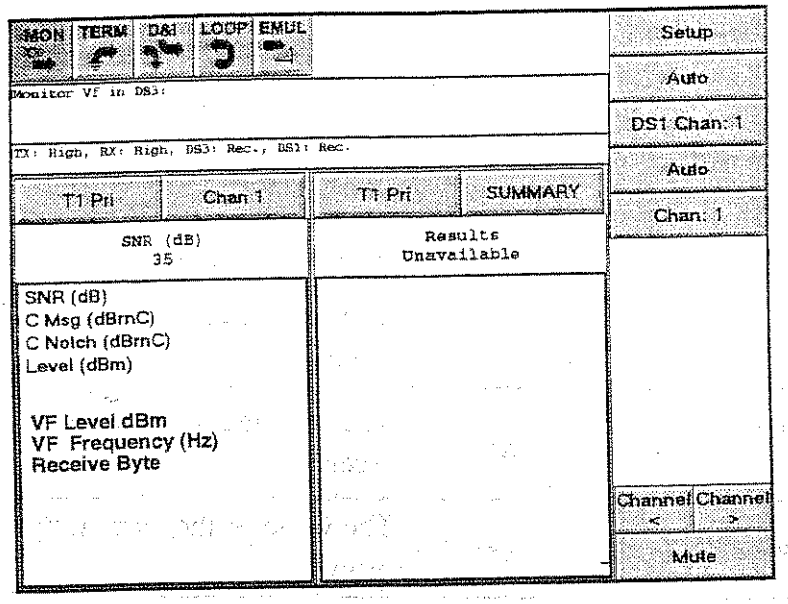


Figure 3-2. Typical Signal-to-Noise Ratio Results Screen

Refer to Table 3-1 for a description of these results.

Table 3-1. Signal-To-Noise Ratio Results

Result	Format	Description
SNR (dB)	xx.x	Signal to noise ratio of the received signal assuming an 1004Hz tone inserted from an external source
C Msg (dBrnc)	xx.x	C-Message noise of the input signal. The noise is measured using a C filter

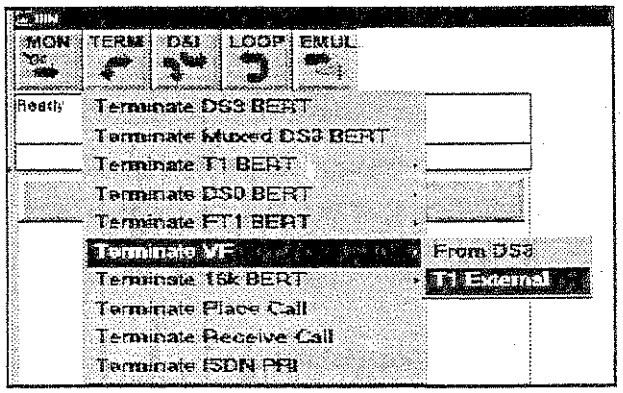
Table 3-1. Signal-To-Noise Ratio Results

Result	Format	Description
C Notch (dBrnc)	xx.x	C-Notch noise of the input signal. This assumes a 1004Hz tone inserted with an external source The tone is first eliminated with a notch filter and a C filter is used to measure the noise
Level (dBm)	-xx.x	The measured power (in dBm) of the signal
VF Frequency (Hz)	xxxx	The frequency of the tone being received
Receive Byte	xxxxxx	The value of the current byte being received

3.6 TRANSMITTING VF TONES FROM A DSX-1

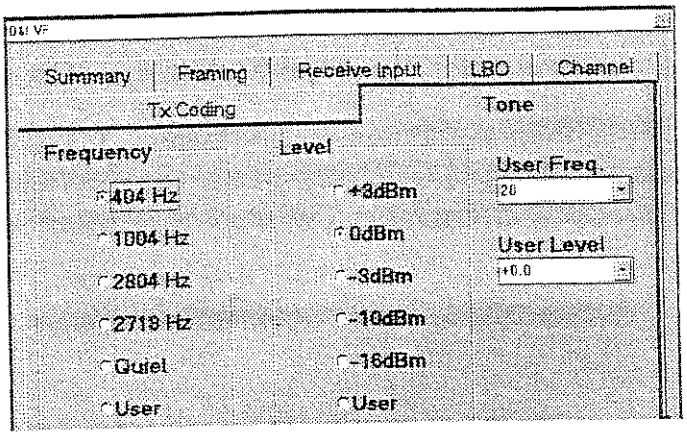
The following procedure outlines how to use the T-BERD 2209 to send test tones to help evaluate overall performance of a VF circuit from a T1 access point. The TB2209-TIM Option is required.

1. Press **TERM**. Then, select **Terminate VF** from the pulldown menu, followed by **T1 External** (if the DS3 Option is installed). The unit automatically configures to a default setup screen.



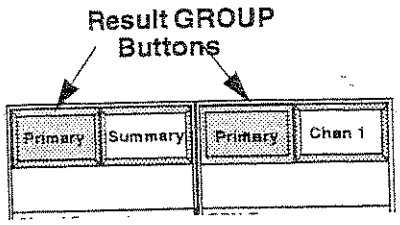
2. Press **Setup**. Ensure characteristics shown in the Setup **Summary** Screen match the network characteristics. To change settings, select the desired Property Sheet tabs in the Property Setup Sheets.
3. Select the T1 (DS0) channel on which to transmit the signal.

4. Select the desired transmit frequency and level on the Tone Property Setup Sheet. (Set to either user-specified or a pre-set tone level/frequency.) Press **OK**.



5. Press the AUX Functions permanent softkey. Set the Volume to desired level, then exit the AUX Functions screen.

6. Set both Result GROUP buttons to **Primary**.



7. Set left Result CATEGORY to Summary and right Result CATEGORY to **Chan "xx"**, where "xx" is the VF channel selected.

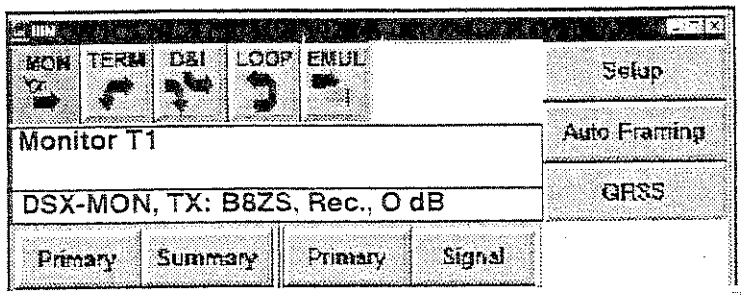
8. Observe results.

3.7 IN-SERVICE DS1 TIMING SLIPS ANALYSIS

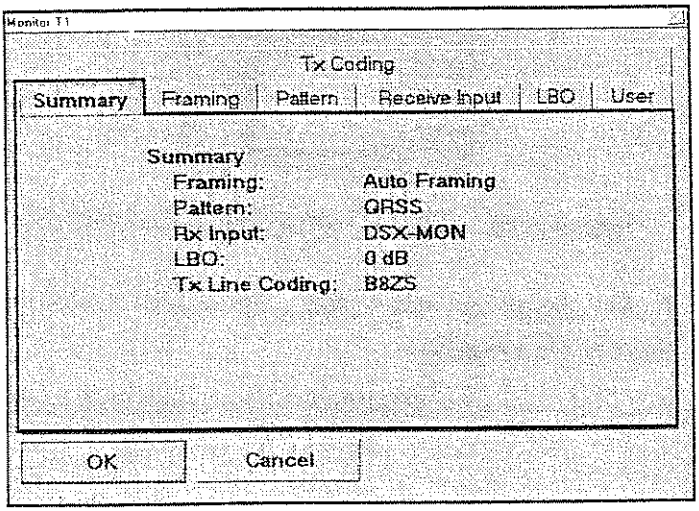
This application allows you to:

- Confirm that all the network equipment is properly synchronized.
- Verify network timing and isolate possible timing problems.

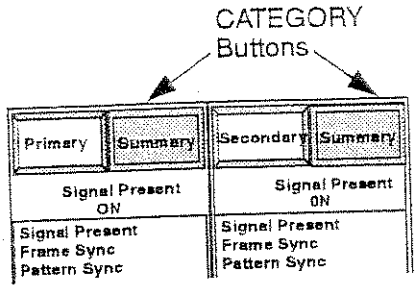
1. Press **Mon.** Select **Monitor T1** from the pulldown menu, followed by **T1 External** (or **From DS3** if the DS3 Option is installed). The unit automatically configures to a default setup screen.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** setup screen match the network characteristics (such as T1 ESF, etc.). To change the settings, select the desired property tabs in the Property Setup Sheets.



3. Press **OK**. Set Result GROUPS to **Primary** (left) and **Secondary** (right).



4. Set the Result CATEGORY buttons to **Summary**.

5. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DS1 test access point (DSX-1 patch panel).

6. Press the **RESTART** Permanent Softkey to clear old test results and begin a new test. Verify the SIGNAL and FRAME LEDs are illuminated (green).

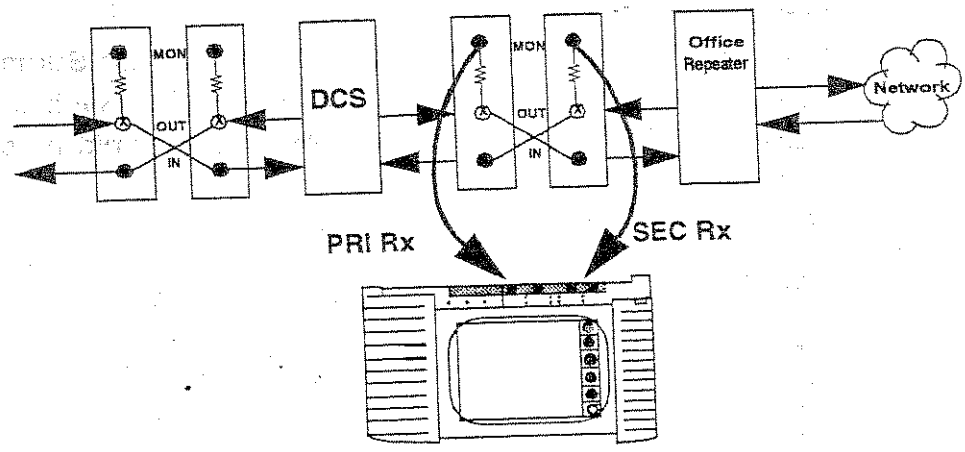


Figure 3-3. DS1 Timing Slips Analysis

7. If the signal is error free, RESULTS OK appears in both RESULTS displays.

8. Press the right CATEGORY button and select **Signal**.

9. Select **Timing Slips** and allow the test to run for at least 5 minutes. The result should be zero. If the result is not zero, the DS1 has two clock sources present on the circuit.

NOTE

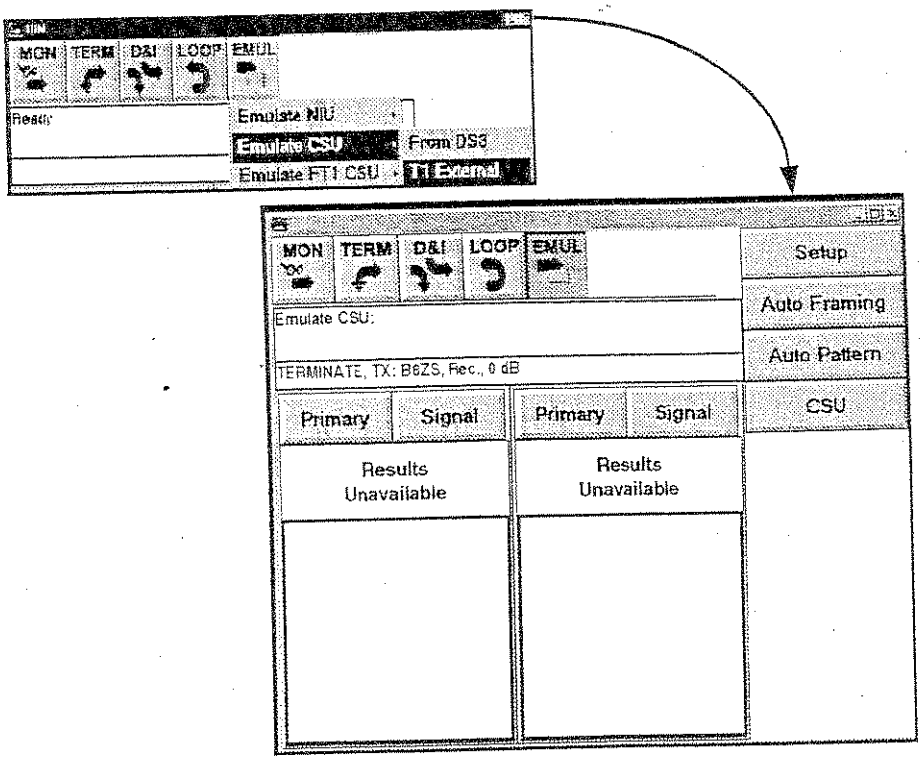
If you have timing slips, you will also have framing slips.

3.8 CSU EMULATION

NOTE

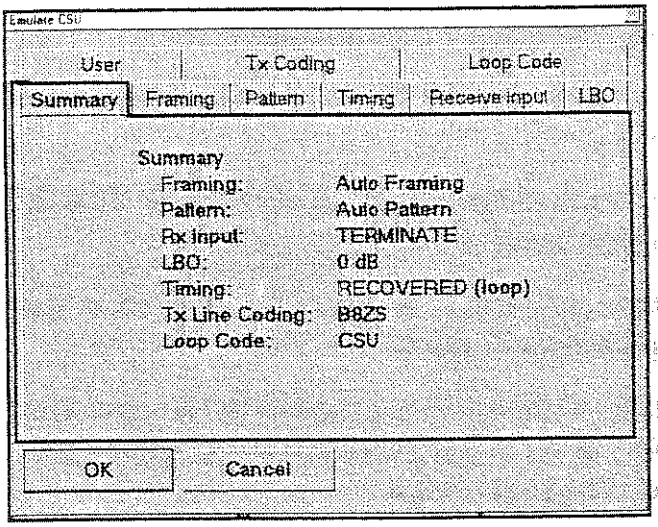
One CSU function is to complete the current path that powers the span repeaters. **HAZARDOUS VOLTAGES EXIST ON THE LINE SIDE OF THE CSU.** *Local telephone company office alarms may sound when the current path is interrupted. since telephone companies do not have a uniform policy regarding the disconnection of the CSU from the span,* ***LOCAL TELEPHONE COMPANY INTERVENTION IS STRONGLY RECOMMENDED.*** *Advanced notice should be given, so that power can be removed from the span before disconnection of the CSU.*

1. Press **EMUL**. Select **Emulate CSU** from the pulldown menu, followed by **T1 External** (if the DS3 Option is installed. The unit automatically configures to a default setup screen



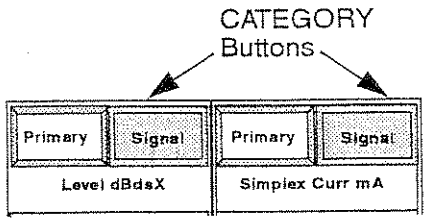
2. Press **Setup**. Ensure the characteristics shown in the **Summary** Property Setup Screen match the network characteristics (such as TX Line Coding, etc,).

   To change the settings, select the desired property tabs in the Property Setup Sheets.



3. Press **OK** to exit and save configurations:

4. Press **Primary** in the Results GROUPS window and select **Signal** in the Results CATEGORY window. Choose "Level dBdsx" for left Results window and "Simplex Curr mA" for right Results window.



5. Disconnect the Office Repeater power supply from the span being tested.

WARNING

High voltage may be encountered.

6. Once power has been removed, disconnect the CSU from the span line.
7. Connect cables from the T-BERD 2209 PRIMARY TX and RX jacks to the NIU.
8. Restore power to the span line by connecting the office repeater power supply.
9. Check the Receive Level (Level dBdsx) and select the appropriate LBO (by going back into the configuration screen — press **Setup**) as follows:

If level is -15 dBdsx and below:	set LBO to 0 dB
If level is -14 to -8 dBdsx:	set LBO to -7.5 dB
If level is -7.5 dBdsx and above:	set LBO to -15 dB

10. Send the CSU loop-up code from the central office to the T-BERD 2209. The T-BERD 2209 responds by establishing an AUTO LLB mode (See Message Display beneath applications icons). This internally loops the receiver to the transmitter. Press the **RESTART** icon to restart the test.

11. Verify that loopback was successfully established and that the SIGNAL and FRAME LEDs illuminate. Make sure there are no errors — the ERROR LED should not be illuminated.

12. Select the **Summary** Category. If errors are not detected, RESULTS OK appears. If errors are detected, observe the **Summary** category results and check the individual error results as required.

13. To disconnect the loop, send the CSU loop-down code from the central office to the T-BERD 2209. The T-BERD 2209 responds by releasing the AUTO LLB mode.

14. Disconnect the T-BERD 2209 from the span. Once done, disconnect the office repeater power supply from the span being tested.

WARNING

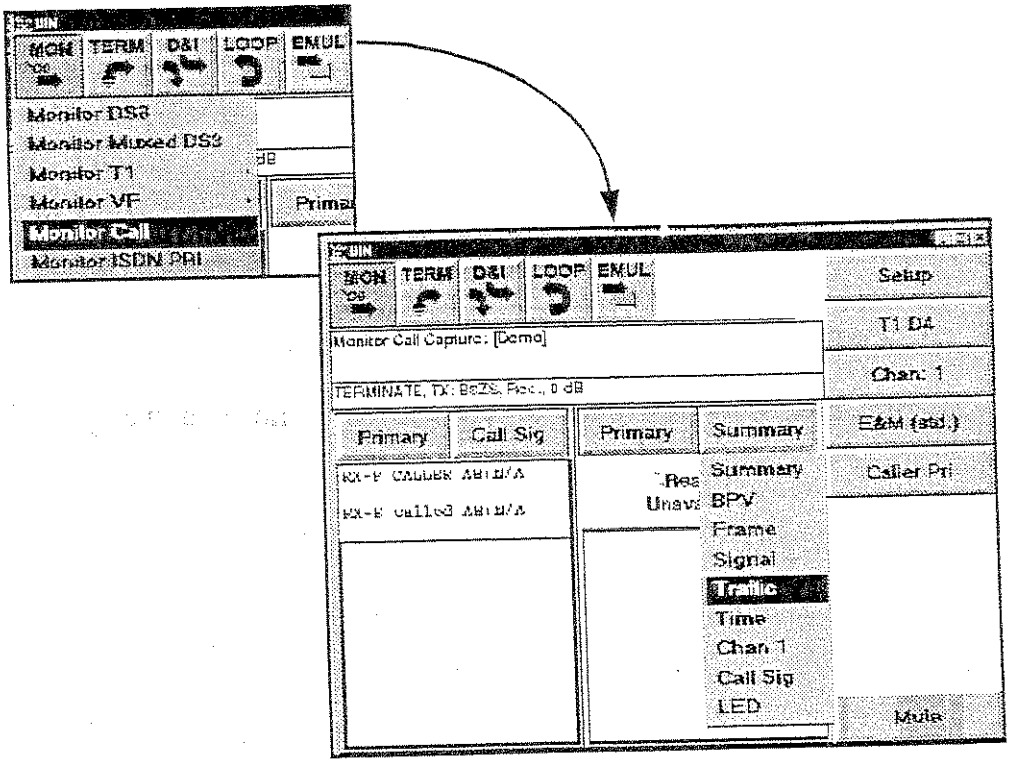
High Voltage may be encountered.

15. Reconnect the CSU and restore power to the span line.

3.9 SIGNALING MONITOR (CALL CAPTURE)

The following procedure outlines how to use the T-BERD 2209 to perform Call Capture. The TB2209-SIG Option is required.

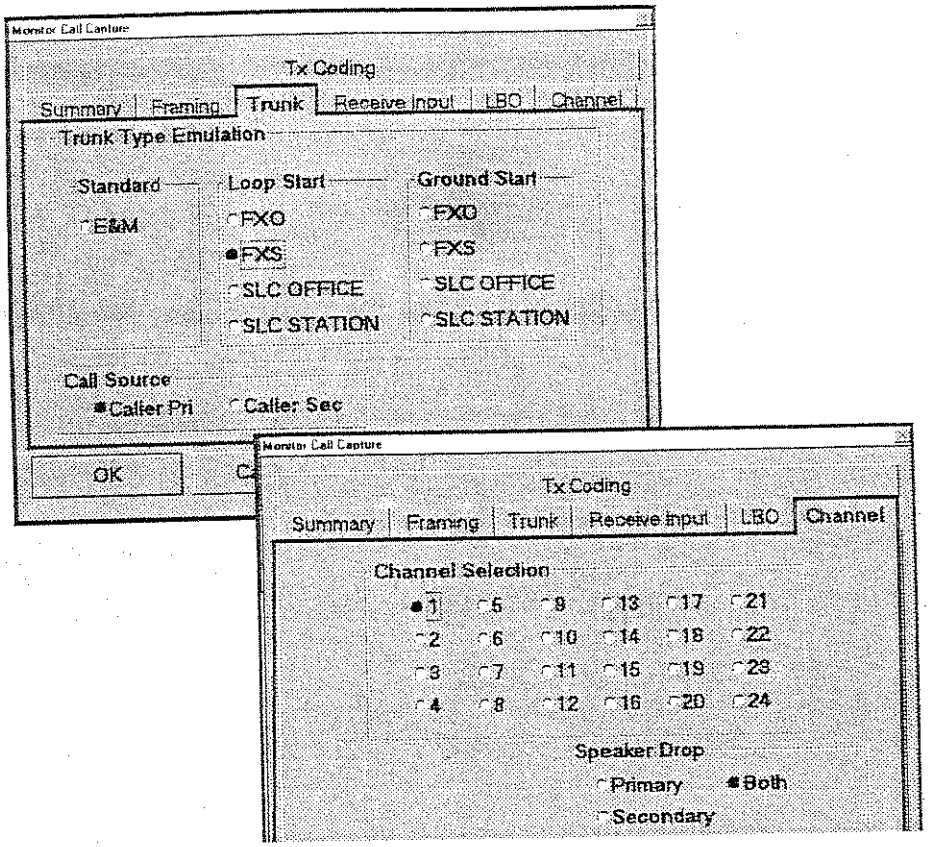
1. Touch **MON**. Select **Monitor Call** from the pulldown menu. The unit automatically configures to a default setup screen.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** Property Setup Screen match the network characteristics. To change the settings, select the desired tabs in the Property Setup Sheets.

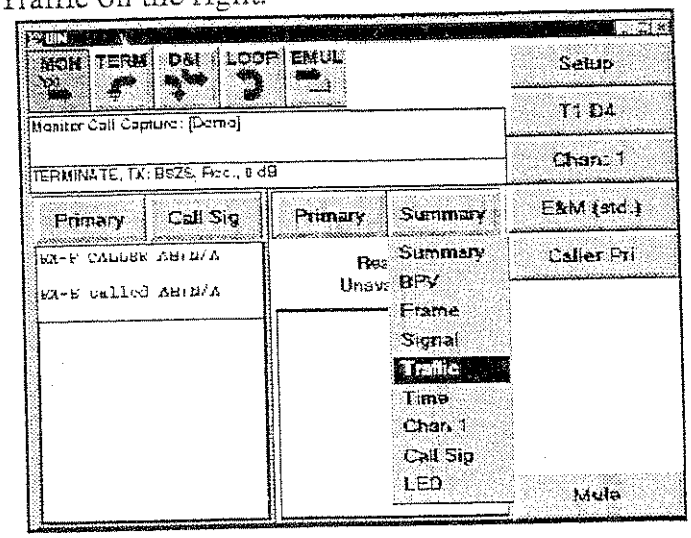
3. Select the appropriate trunk type (e.g., Loop Start, Ground Start, or E&M) using the **Trunk** tab. Select the type of circuit equipment (e.g., SLC office, SLC station, FXO, or FXS) of the source of the call. Select the side from which the call is originating using the **Call Source** button.

4. Select the **Channel** tab and use the Speaker Drop to send primary, secondary or both channels to the speaker. Press **OK**.



5. Set the Result GROUP buttons to **Primary**.

6. Set Result CATEGORY buttons to Call Sig on the left and Traffic on the right.



7. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DS1 test access point (DSX-1 patch panel).
8. Press the **RESTART** Permanent Softkey to clear alarms and begin the test.

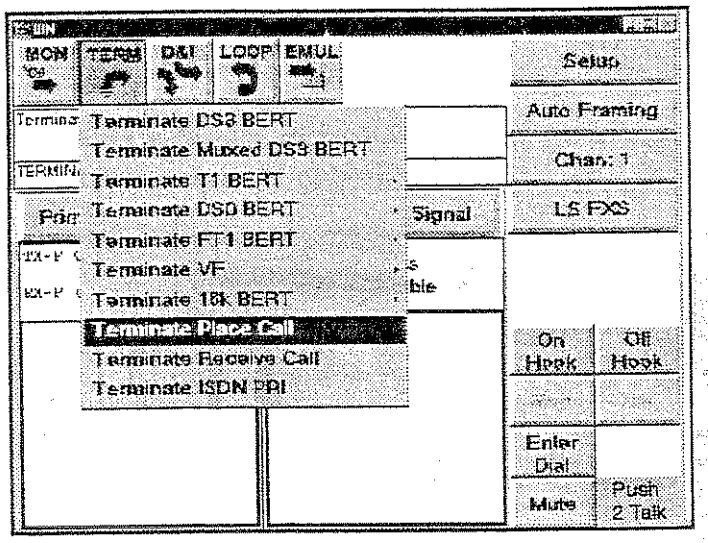
9. Verify the SIGNAL and FRAME LEDs are illuminated (green).
10. Observe the signaling activities in the results display.

3.10 PBX/SWITCH EMULATION (ORIGINATING A CALL)

The following procedure outlines how to use the T-BERD 2209 to perform Place Call. The TB2209-SIG Option is required.

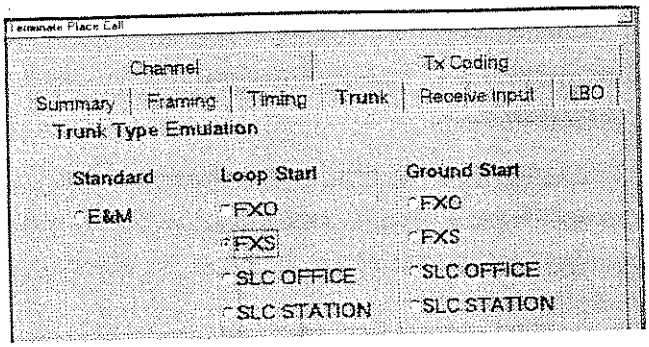
1. Press **TERM**. Then, select **Terminate Place Call** from the pull-down menu. The unit automatically configures to a default setup screen.

2. Press **Setup**. Ensure characteristics shown in the Setup **Summary** Screen match the network characteristics. To change settings, select the desired Property Sheet tabs in the Property Setup Sheets.



3. Select **Channel** tab in Property Sheet to choose the T1 channel (DS0) on which to transmit the signaling.

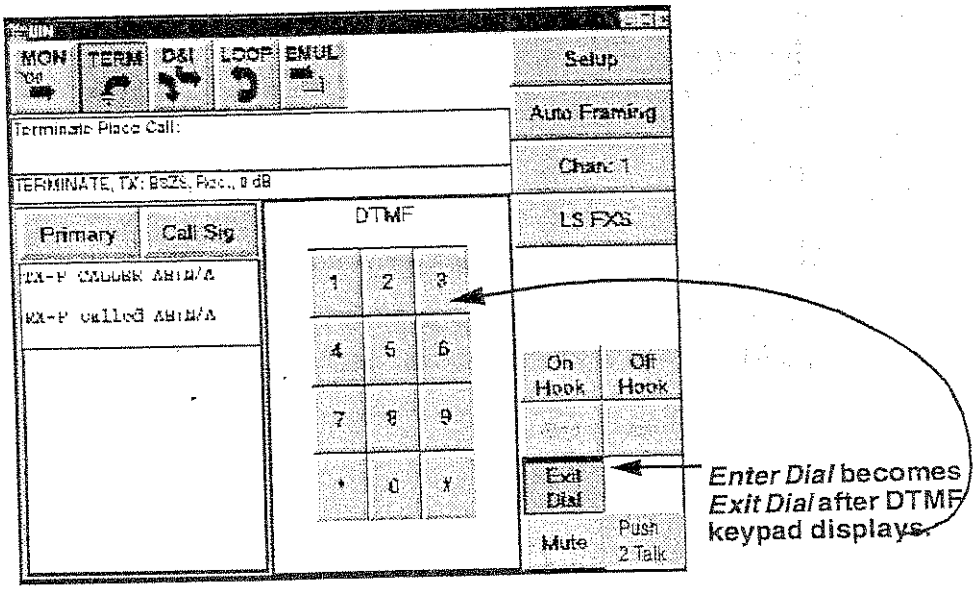
4. Select the appropriate trunk type (e.g., Loop Start, Ground Start, or Standard E&M) using the **Trunk** tab. If Loop Start or Ground Start is selected, choose FXS or SLC Station with SLC Framing as the type of card emulation. Press **OK**.



5. Connect a cable from the PRIMARY RX jack to the IN jack of the DSX-1. Connect a cable from the PRIMARY RX jack to the OUT jack of the DSX-1.

6. Press the **RESTART** Permanent Softkey to clear alarms. Verify the SIGNAL and FRAME LEDs are illuminated (green).

7. Press **Enter Dial** ACTION button to display the DTMF keypad.



8. Select **Call Sig** Results CATEGORY display beside the Primary Results GROUP selection. Verify that **On Hook** is observed in the **Call Sig** Results CATEGORY.

9. Press the **Off Hook** ACTION button. Verify that **Off Hook** appears in the Results display, followed by either a **WINK** (on standard E&M trunks) or **Dial Tone** (on Loop and Ground Start trunks).

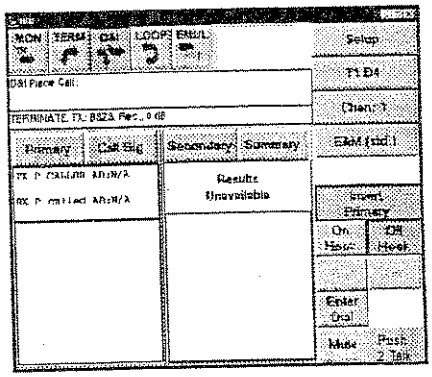
10. Dial test number on the numeric keypad.

11. Press **On Hook** to complete the call.

12. Select **Chan: X** Quick Configuration key to select another DS0 channel to test.

NOTE

If in **D&I** *mode select the* **Insert Primary** *ACTION button to start inserting on the primary T1. Use the appropriate signaling buttons to place call. Observe the signaling activity in the Call Signal window.*



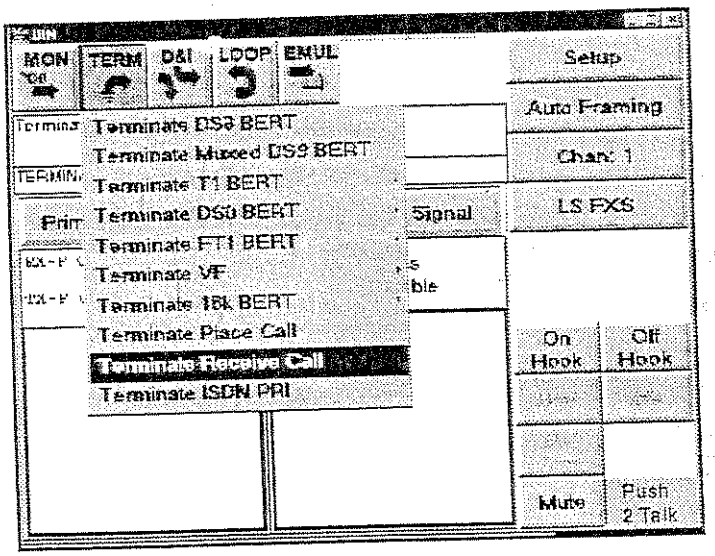
ACTION buttons enable variances in testing. Use them for ON Hook, Off Hook, Ring, Idle, access to the Keypad (Enter Dial), and Mute.

3.11 PBX/SWITCH EMULATION (TERMINATING A CALL)

The following procedure outlines how to use the T-BERD 2209 to perform Terminate Receive Call. TB2209-SIG Option is required.

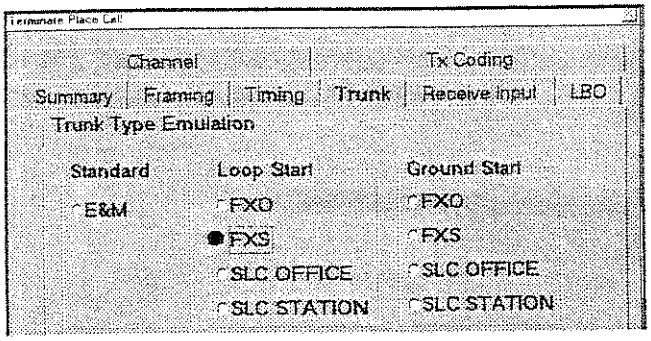
1. Press **TERM**. Then, select **Terminate Receive Call** from the pulldown menu. The unit automatically configures to a default setup screen.

2. Press **Setup**. Ensure characteristics shown in the Setup **Summary** Screen match the network characteristics. To change settings, select the desired Property Sheet tabs in the Property Setup Sheets.



3. Select **Channel** tab in Property Sheet to choose the T1 channel (DS0) on which to transmit the signaling.

4. Select the appropriate trunk type (e.g., Loop Start, Ground Start, or E&M) using the **Trunk** tab. If Loop Start or Ground Start is selected, choose FXS or SLC Station with SLC Framing as the type of card emulation. Press **OK**.



5. Connect a cable from the PRIMARY RX jack to the IN jack of the DSX-1. Connect a cable from the PRIMARY RX jack to the OUT jack of the DSX-1.

6. Press the **RESTART** Permanent Softkey to clear alarms. Verify the SIGNAL and FRAME LEDs are illuminated (green).

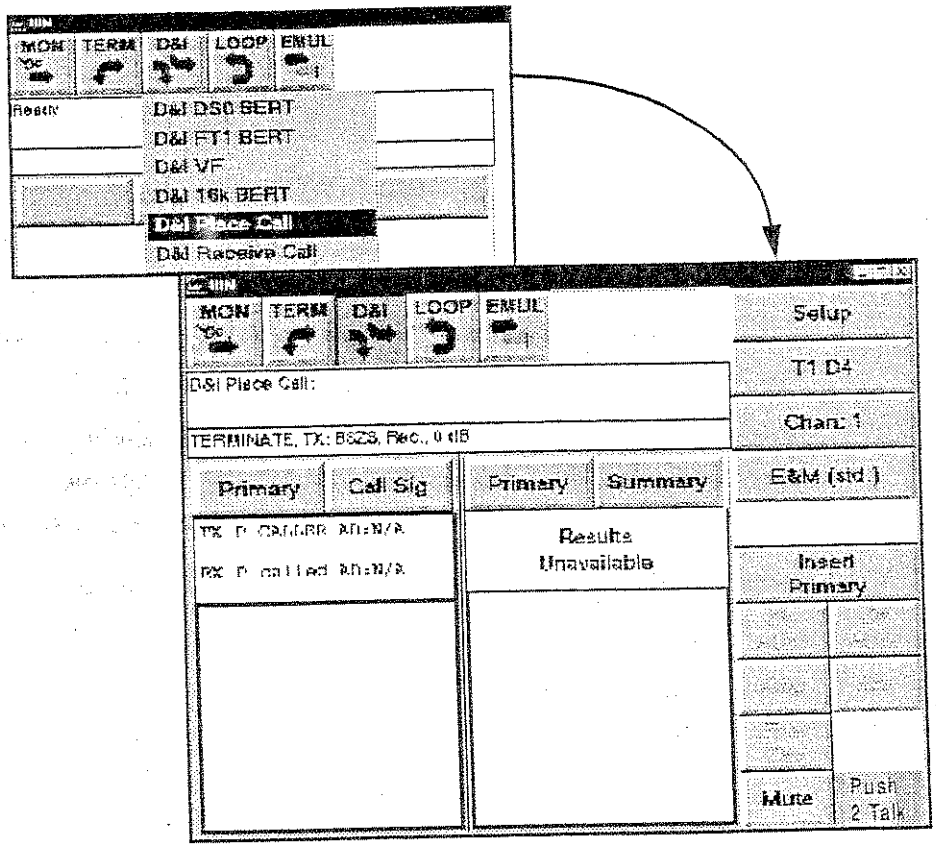
7. Select **Call Sig** Results CATEGORY display beside the Primary Results GROUP selection. Verify that **On Hook** and **Off Hook** are observed in **Call Sig** Results CATEGORY display.

8. Observe call sequence events as the call is established.

3.12 T1 DROP AND INSERT SETUP (PLACE CALL)

The TB2209-SIG Option is required for this D&I (drop and insert) test.

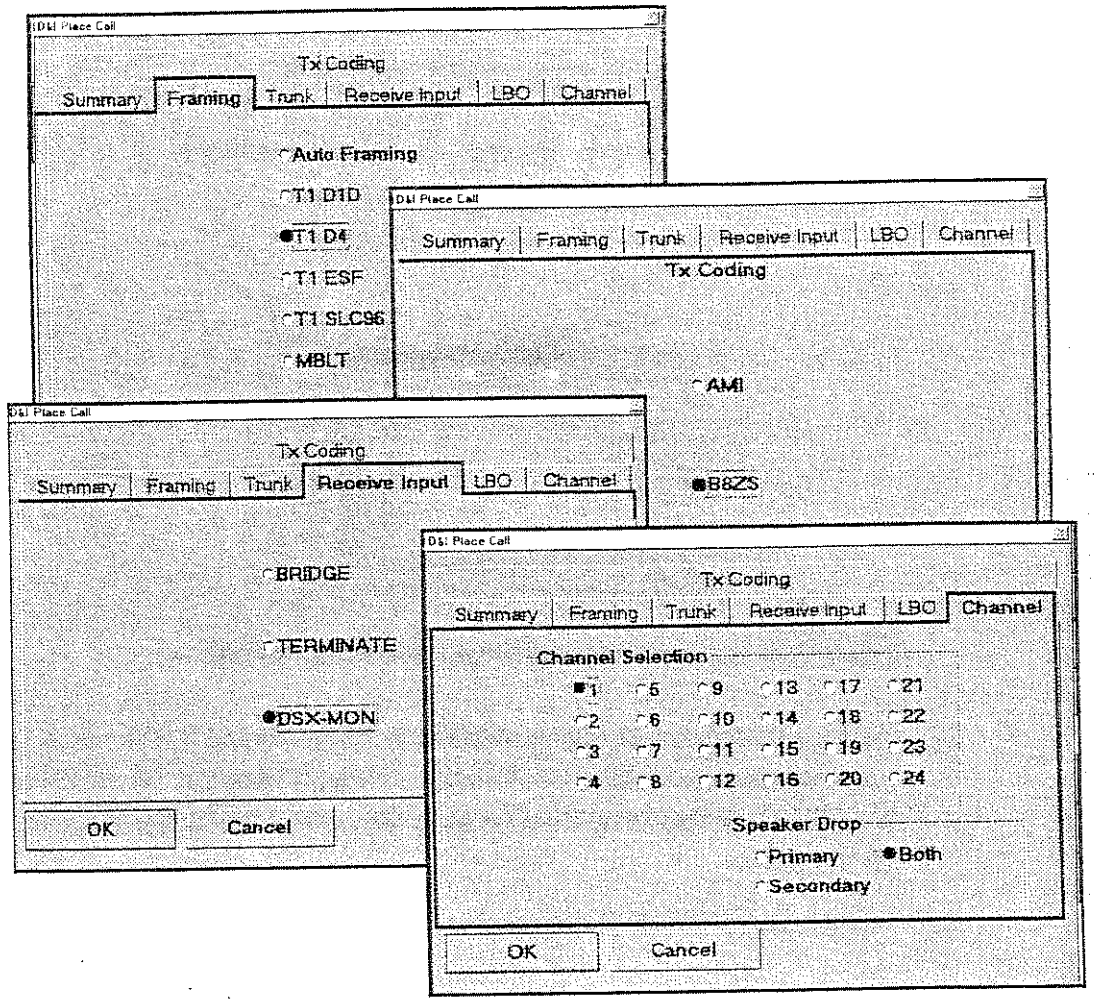
1. Select **D&I**. Then, select **D&I Place Call** from the pulldown menu. The T-BERD 2209 configures to a default setup.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** setup screen match the network characteristics.

3. To change baseline settings, select the desired Property Sheet tabs in the Property Setup sheets. Select appropriate T1 **Framing**, **Tx Coding**, **Receiver Inputs**, and **Channel** to appropriate Channel and Speaker Drop.

4. Select the appropriate trunk type (standard E&M, Loop Start, Ground Start). If Loop Start or Ground Start is selected, choose FSX or SLC (with SLC framing) as the type of card emulation. Press **OK**.



5. Connect a cable from the PRIMARY RX jack to the appropriate DSX-1 A-Side MON jack (see Figure 3-4).

NOTE

In Figure 3-4, *black cables are Primary connections, and gray cables are Secondary connections.*

6. Connect a cable from the Secondary RX jack to the appropriate DSX-1 Z-side MON jack (see Figure 3-4).

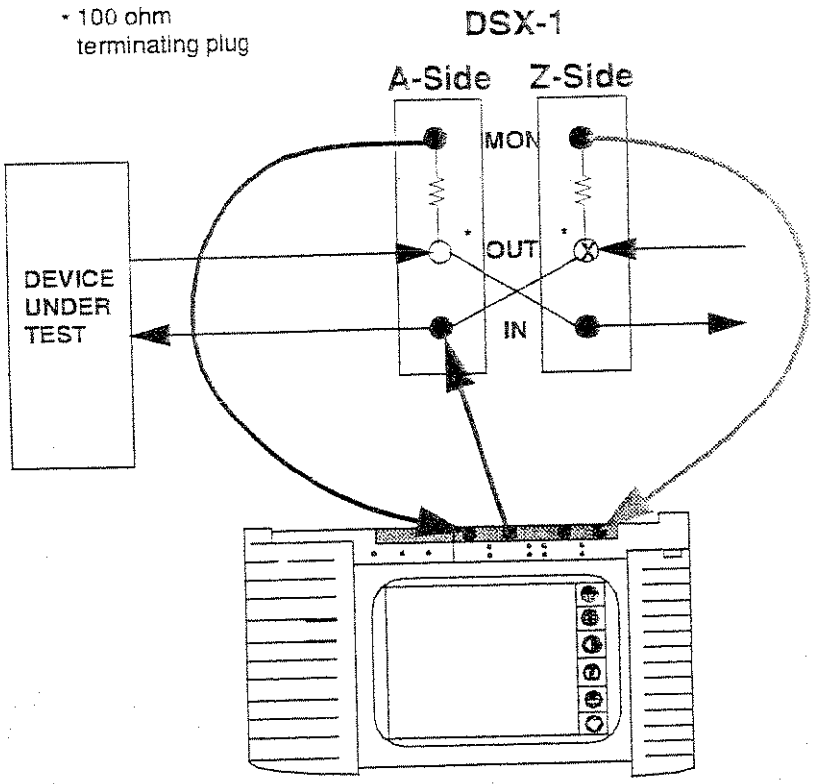


Figure 3-4. Simulation Drop and Insert Setup

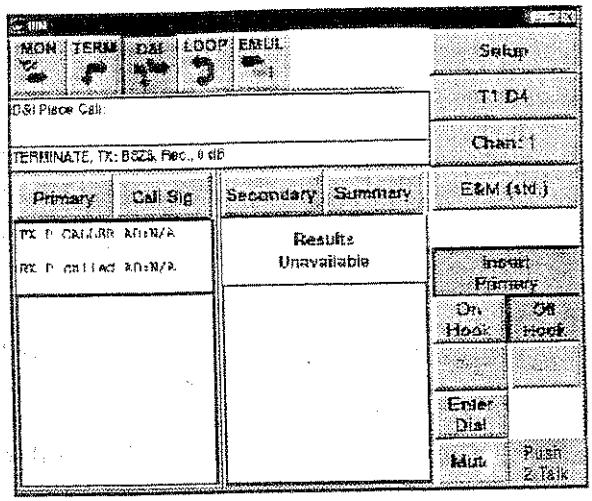
7. Simultaneously, connect a cable from the Primary TX jack to the appropriate DSX-1 A-side IN jack (Figure 3-4) while inserting a 100 ohm terminating plug into the DSX-1 Z-side OUT jack.

8. Press the **RESTART** Permanent Softkey to clear alarms.

   Verify the Primary and Secondary SIGNAL and FRAME LEDs are illuminated and the Primary and Secondary Results display shows RESULTS OK (under **Summary** CATEGORY).

9. Press the **Insert Primary** and **Enter Dial** ACTION buttons to bring up the numerical keypad.

10. Select **Call Sig** Results CATEGORY display. Verify that **ON Hook** is observed in the **Call Sig** Results CATEGORY.



ACTION buttons enable variances in testing. Use them for ON Hook, Off Hook, Ring, Idle, access to the Keypad (Enter Dial), and Mute.

11. Press the **Off Hook** ACTION button. Verify that **Off Hook** appears in the Results display, followed by either a **WINK** (on standard E&M trunks) or **Dial Tone** (on Loop and Ground Start trunks).
12. Dial test number on the numeric keypad.
13. Press **ON Hook** to complete the call.
14. Select **Chan: X** Quick Configuration key to select another DS0 channel to test.
15. Repeat procedures from Step 11 to continue testing remaining DS0 channels.
16. Disconnect from the circuit in the reverse order to prevent service disruption.

3.13 TESTING INTELLIGENT REPEATER SPANS

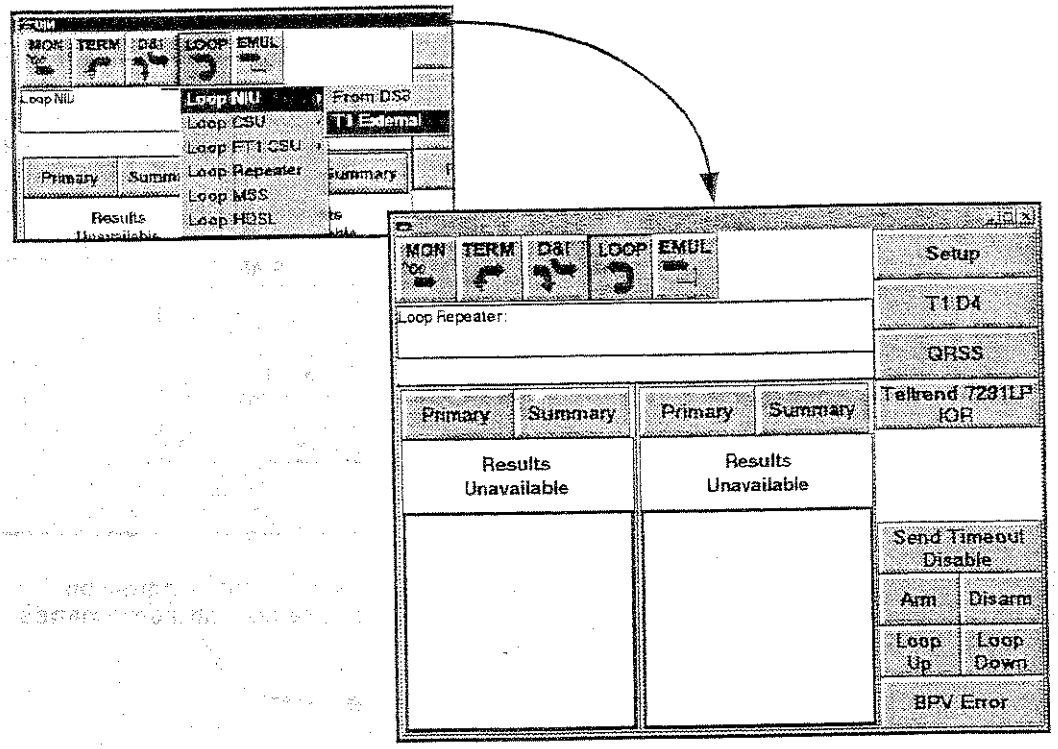
The following test application provides an example of how you can sectionalize addressable repeater spans by transmitting appropriate pre-programmed loop codes from the C.O. (central office). Testing intelligent repeater spans requires the TB2209-ILE Option.

The TB2209-ILE option provides the intelligent span equipment loop codes used to loop up and loop down individual, addressable, office repeaters and line repeaters, or to transmit maintenance switch commands.

The following devices can be armed, disarmed, queried, and looped back when the TB2209-ILE option is installed.

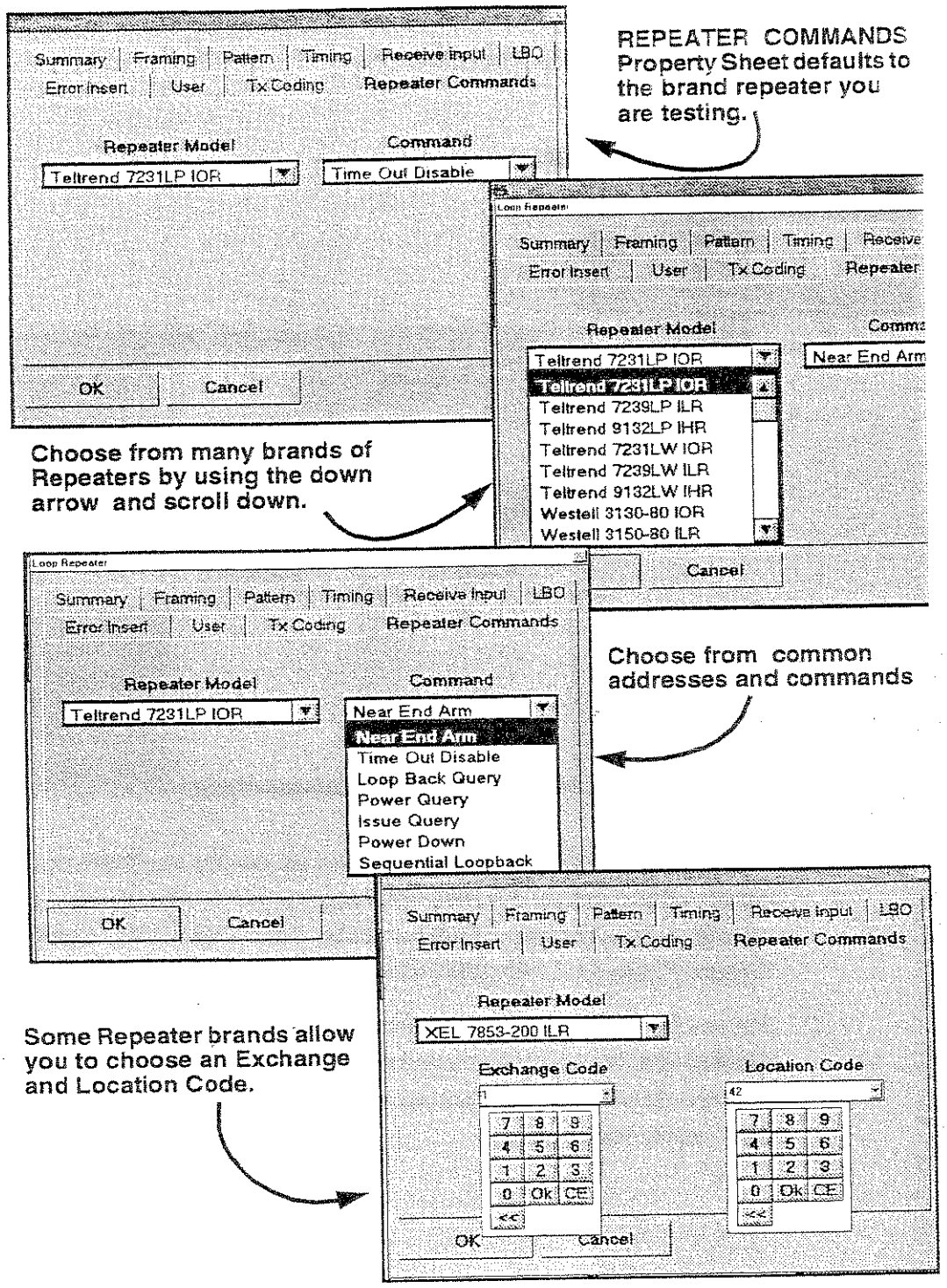
- Teltrend Model 7231LP IOR/ 7239LP ILR Intelligent Repeaters
- Teltrend Model 9132LP IHR Intelligent Repeater
- Teltrend Model 7231LW IOR / 7239LW ILR Intelligent Repeaters
- Teltrend Model 9132LW IHR Intelligent Repeater
- Westell 3130-80 IOR Intelligent Repeater
- Westell 3150-80 ILR Intelligent Repeater
- Westell 3150-81 ILR Intelligent Repeater
- Westell 3150-56 ILR Intelligent Repeater
- Westell 3151-56 ILR Intelligent Repeater
- Westell 3130-56 IOR Intelligent Repeater
- XEL 7853-200 ILR Intelligent Repeater
- Westell 3171 T1 Network Interface and Maintenance System (60 Series)

17. Press **LOOP**. Then select **Loop Repeater** from the pulldown menu. The T-BERD 2209 automatically configures to a default setup for the chosen application.

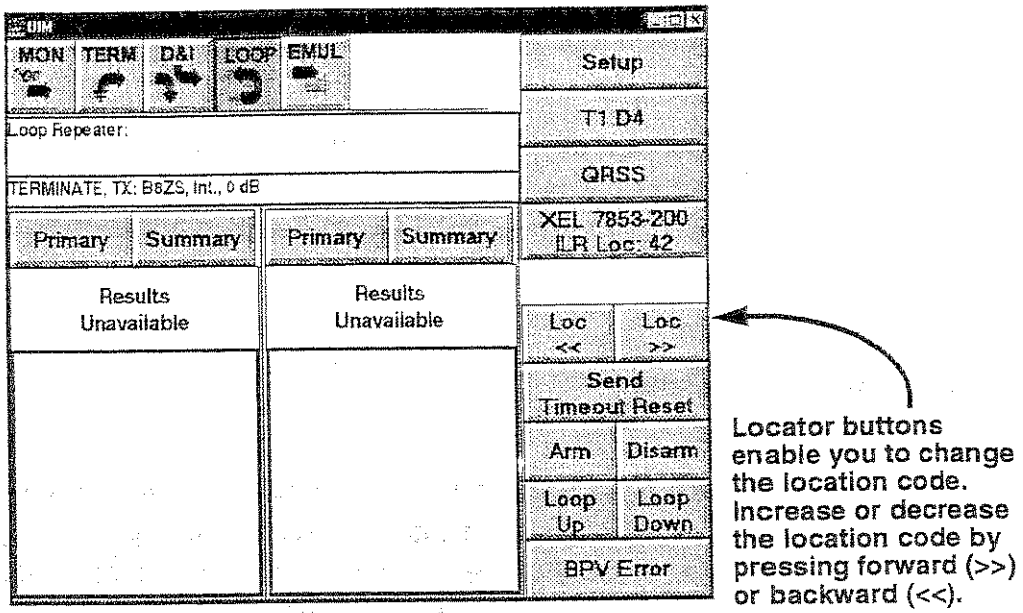


18. Press **Setup**. Ensure characteristics shown in the **Summary** setup screen match the network characteristics. To change the settings (e.g., framing, pattern, timing, etc.), select the desired Property tabs in the Property Setup sheets.

19. Select the **Repeater Command** Property Sheet tab. This tab enables you to select the appropriate model repeater type and address as well as any special commands (e.g., time out disable, power query, etc.).


REPEATER COMMANDS Property Sheet defaults to the brand repeater you are testing.
Summary
Framing
Pattern
Timing
Receive Input
LBO
Error Insert
User
Tx Coding
Repeater Commands
Repeater Model
Command
Teltrend 7231LP IOR
Time Out Disable
OK
Cancel
Choose from many brands of Repeaters by using the down arrow and scroll down.
Teltrend 7231LP IOR
Teltrend 7239LP ILR
Teltrend 9132LP IHR
Teltrend 7231LW IOR
Teltrend 7239LW ILR
Teltrend 9132LW IHR
Westell 3130-80 IOR
Westell 3150-80 ILR
Choose from common addresses and commands
Near End Arm
Time Out Disable
Loop Back Query
Power Query
Issue Query
Power Down
Sequential Loopback
Some Repeater brands allow you to choose an Exchange and Location Code.
XEL 7853-200 ILR
Exchange Code
Location Code

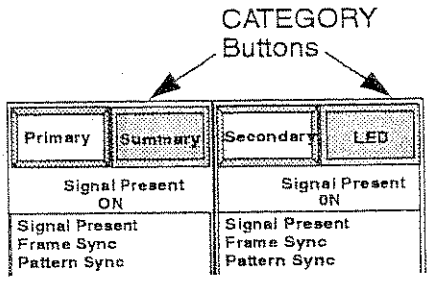
20. Press **OK.** If you chose a repeater that has **Location Code** capability, the setup screen will look similar to this:



21. Connect a cable from the PRIMARY RX jack to the span-side DSX-1 OUT jack.

22. Connect a cable from the PRIMARY TX jack to the span-side DSX-1 IN jack.

23. Set the left Result CATEGORY to **Summary** and the right Result CATEGORY to **LED.**



24. Press the **ARM** ACTION button to arm the span and provide a loopback at the NIU. The following LEDs should be illuminated (green): SIGNAL, FRAME, PATTERN. **Summary** display should show RESULTS OK. Insert a few errors by pressing the Error Insert ACTION button (e.g., **BPV**) at lower right of screen.

25. If errors are detected or the LEDs are not illuminated correctly, record the types of errors to determine symptoms of the span problem and then sectionalize the span to determine location of the fault(s).

Sectionalization Procedure:

26. Press **LOOP UP** to send the addressable repeater loop-up code to the specified mid-span repeater. Observe Message Display for messages regarding the transmission of the loop code. Verify that SIGNAL, FRAME, PATTERN LEDs are illuminated (green).

27. Press **LOOP DOWN** to send the addressable repeater loop-down code to the specified mid-span repeater. Observe Message Display for messages regarding the transmission of the loop-down code.

28. Determine new addressable repeater address (if necessary) by pressing **Addr <<** or **Addr >>**. This action increments or decrements the repeater address until it matches the selected addressable repeater.

29. Repeat steps 8-10 until the location of the problem has been isolated between two or three repeaters. Then press **LOOP DOWN**, followed by **DISARM** to end test.

Refer to Table 3-2 for definitions of Commands possible from the Repeater Commands Property Sheet.

Table 3-2. Repeater Commands for Loop Code Tests

Command	Definition
Near-End Arm	A near-end arming code is transmitted on the intelligent repeater span when testing from the NIU toward the Central Office (CO) to prepare the intelligent repeaters to loop up or loop down upon receipt of the appropriately addressed loop codes.
Time Out Disable	Disables the loopback, time-out function of the repeater. Establish the line repeater loopback first, then send **Timeout Disable**. Timeout resets when the loopback is deactivated remotely.
Loopback Query	Returns address of the repeater that is in loopback.
Power Query	Returns address of the repeater that is currently looping back the power.
Issue Query	Returns the issue (revision) of the repeater.
Sequential Loopback	Loops up/down T1 line repeaters on the span in sequence starting with the repeater nearest the T-BERD 2209, and proceeds down the span, regardless of the repeater's address. Pressing **Send Seq Loopback** transmits the sequential loopback code. The first time a repeater receives this code, it loops up and returns its address. The second time the sequential loop code is sent, the repeater loops down (or loops down and loops up the next repeater).
Power Down	Removes power from the line past the office repeater while the loop code is being transmitted (plus an additional five seconds after the loop code transmission is stopped). This function is typically used to reset the line, particularly if a repeater in loopback cannot be looped down via commands. **Warning: Do not use this function to work on the line.**

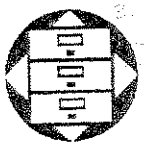
3.14 USING VT100 EMULATION

The T-BERD 2209 can be configured to perform VT-100 terminal emulation. For this function, the TB2209-VT100 option is required.

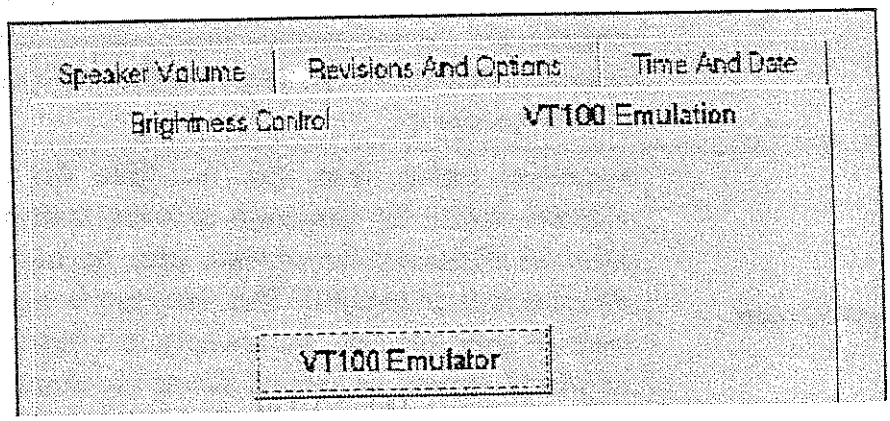
In this mode, you can locally access network components, such as HDSL units or performance monitoring devices (e.g., PMNIU or PMDNI), and provision them or obtain performance information from them. When the VT100 Option is installed in your T-BERD 2209, there is no need to carry a laptop computer to do VT100 emulation.

VT100 Setup Procedure:

1. Connect the RS-232 interconnect cable (supplied) from the printer port on the T-BERD 2209 to the network device under test (e.g., HDSL unit). If necessary, connect a "gender changer" to the DB-9 connector end.
2. Access the VT100 emulator by pressing the **Auxiliary** Permanent Softkey icon (FILE CABINET).

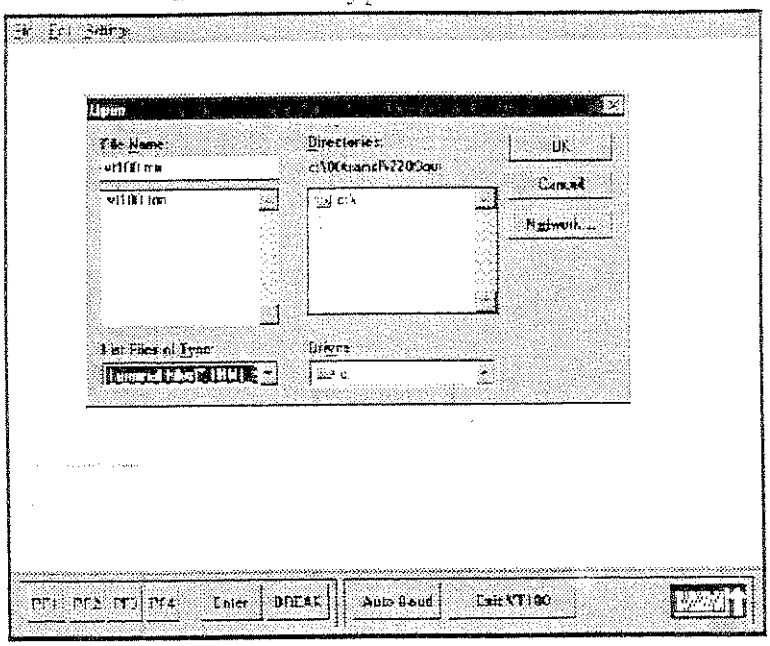


3. Press **VT100 Emulation** tab in the auxiliary functions screen, followed by **VT100 Emulator** in the middle of the screen.



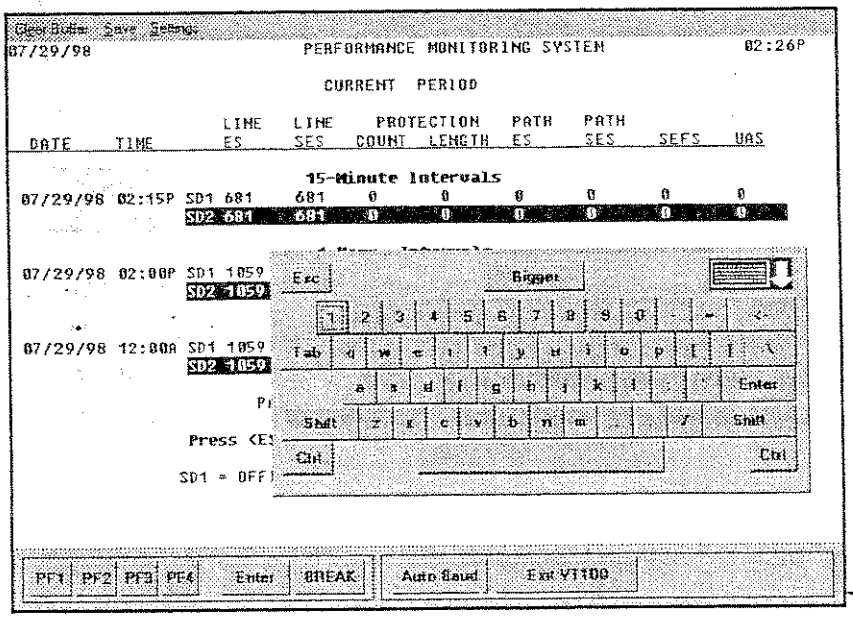
The screen turns into a VT100 terminal with a cursor blinking at the top left hand corner. Choose **File/Open** for this next screen.

4. Press the keypad icon located on lower right of the screen to access the keypad.



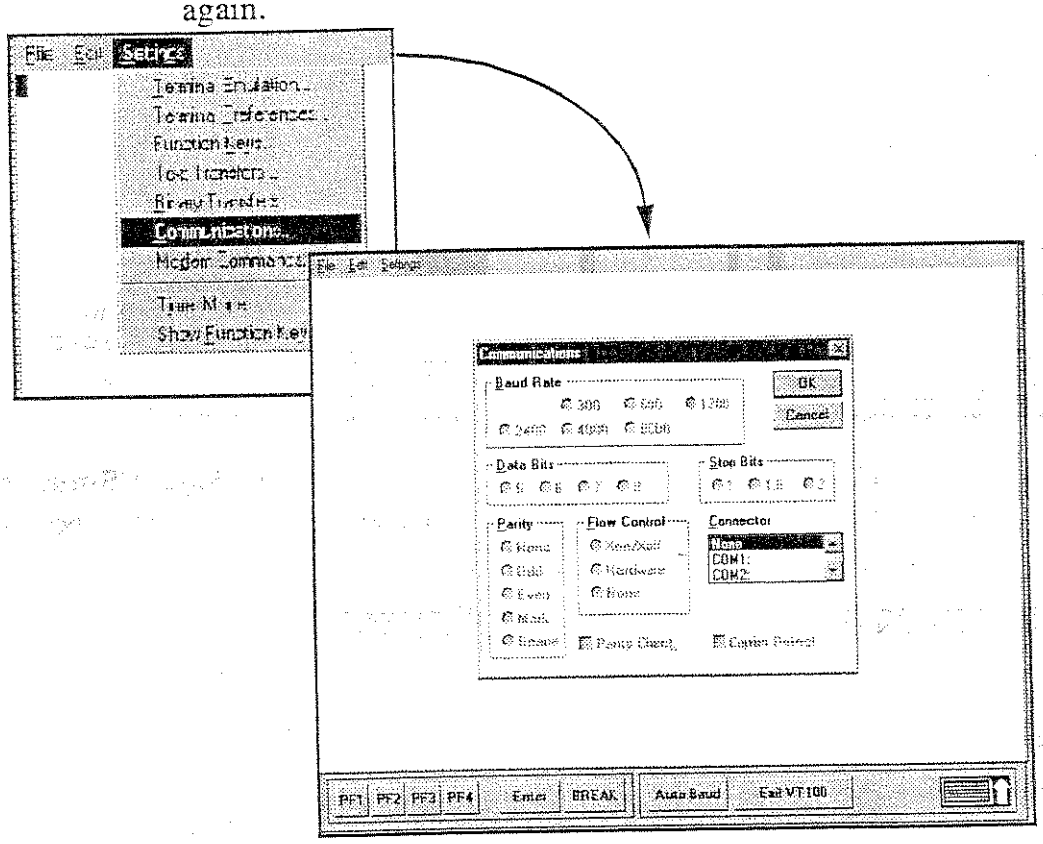
Keypad Icon becomes the VT100 keypad when depressed.

5. Change the size of the keypad by clicking the **Bigger/Smaller** button on the keyboard. You can also move/drag the keyboard to any desired location.



VT100 Keypad used during performance monitoring. Notice the Keypad Icon ha moved from status bar onto pop-up keypad.

6. To access the menu of the network unit, either wait a few seconds (e.g., Westell devices) or hit the **<ESC>** key (e.g., Teltrend devices). Often, pressing **Autobaud** works. If nothing appears on the screen after trying the above procedures, press **Settings** from the main menu bar, followed by **Communications** from the pulldown menu to ensure serial port settings are correct. If settings are incorrect, change and save the settings. Try step 6 again.



The menu for the network unit should appear and the format should be correct. If not, go back to **Settings/Terminal Preferences** and check the **CR/LF** insert. You may want to move or minimize the keypad at this time. To minimize keypad, press its icon.

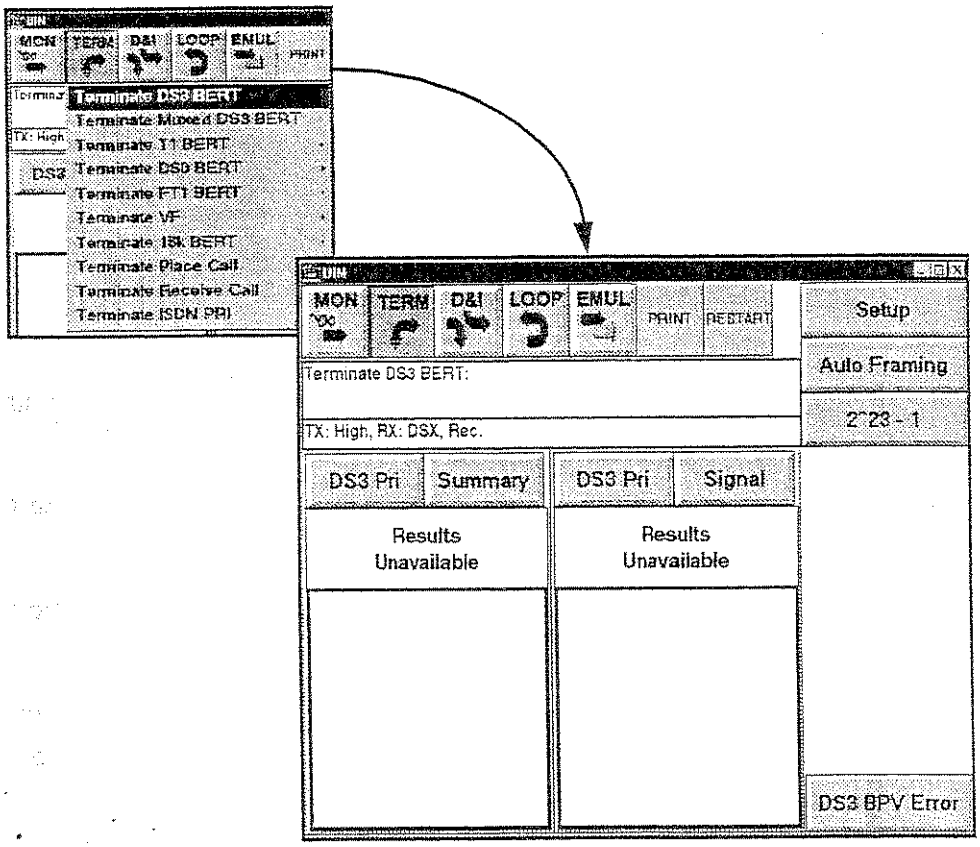
7. Perform operation(s) according to menu selections of the network device connected to the T-BERD 2209 VT100 Emulator.

8. Press **Exit VT100** to exit VT100 Emulation (*minimize keyboard, first*).

3.15 DS3 LOOPBACK BER TEST

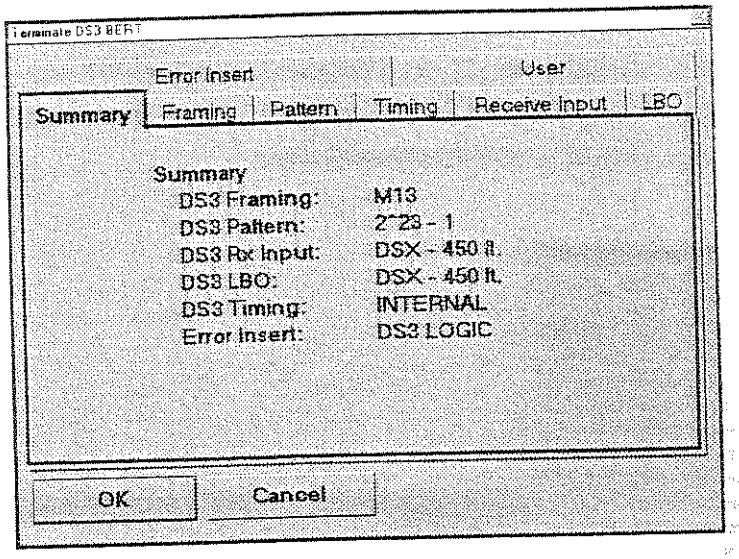
Use the following procedures to use the T-BERD 2209 to test DS3 circuits. TB2209-DS3 Option is required.

1. Press **TERM**. Select **Terminate DS3 BERT** from the pulldown menu. The T-BERD 2209 automatically configures to a default setup for the chosen application.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** Property Setup Screen match the network characteristics.
   - Select proper framing (M13 or C-Bit).
   - Select desired pattern.
   - Set Timing to INTERNAL.
   - Set LBO to DSX.

- Set Receive Input to DSX.
- Set Error Insert to DS3 LOGIC.



3. Press **OK**.
4. Loopback the far end of an out-of-service DS3 span at the DSX-3 patch panel (Figure 3-5).
5. Connect a cable from the DS3 PRIMARY RX jack to the near-end SPAN DSX-3 OUT jack.
6. Connect a cable from the DS3 PRIMARY TX jack to the near-end SPAN DSX-3 IN jack.
7. Press the RESTART Permanent Softkey to clear alarms and begin the test. Verify the SIGNAL PRESENT, FRAME SYNC, and PATTERN SYNC LEDs illuminate.
8. Press the ERROR INSERT button five times to insert five logic errors. Verify looped back span by receiving five errors in the SUMMARY display.
9. Press the RESTART Permanent Softkey to clear alarms and begin a new test.
10. Record test results if errors are detected.

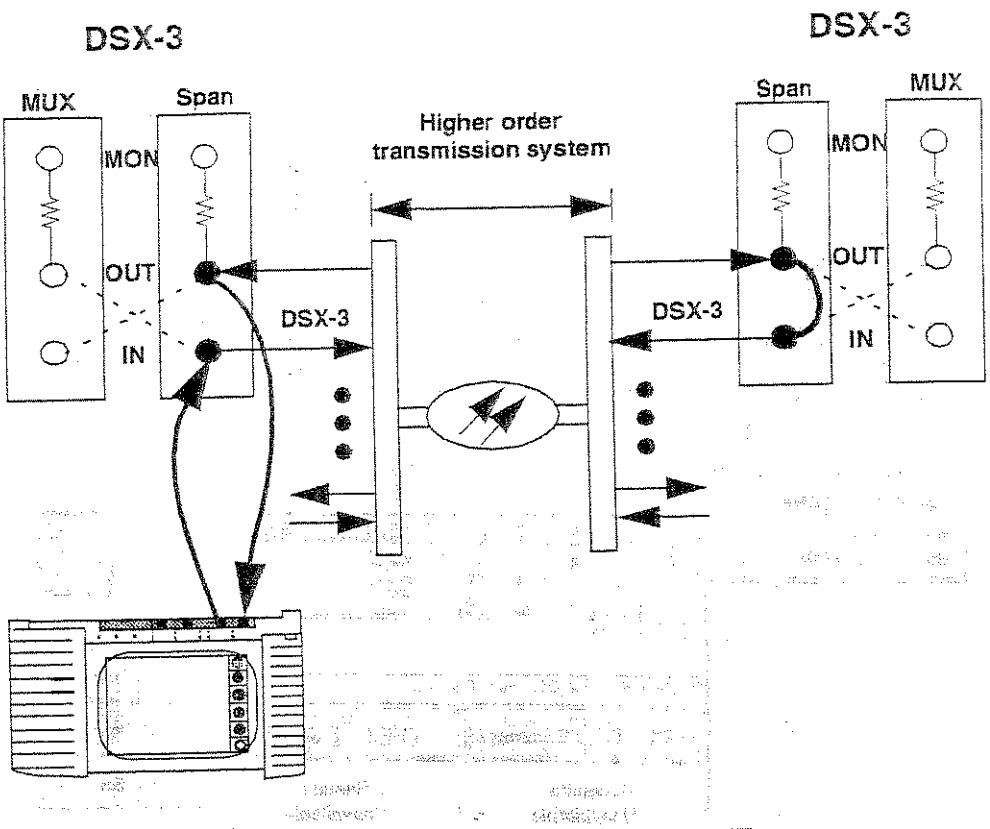
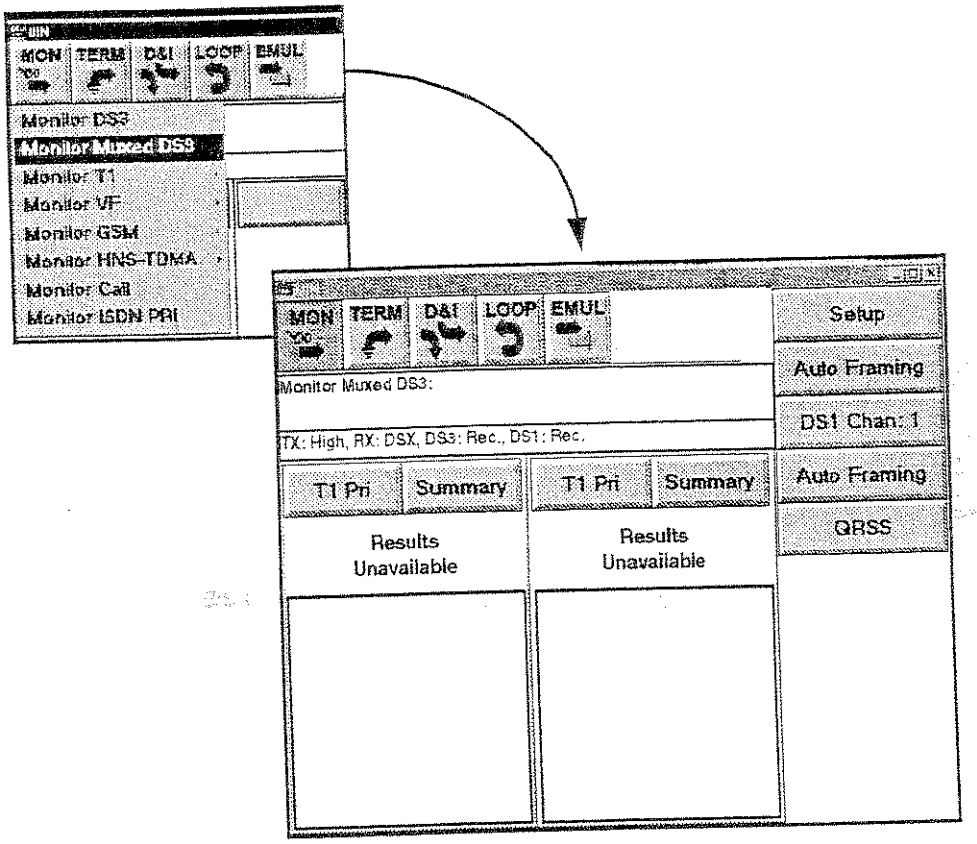


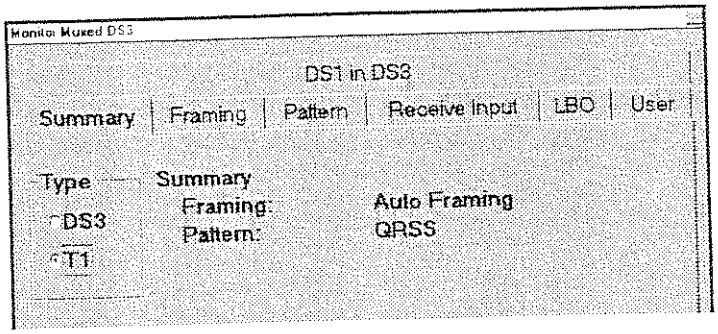
Figure 3-5. DS3 Loopback BER Test

3.16 DS1 MONITOR TEST FROM DS3

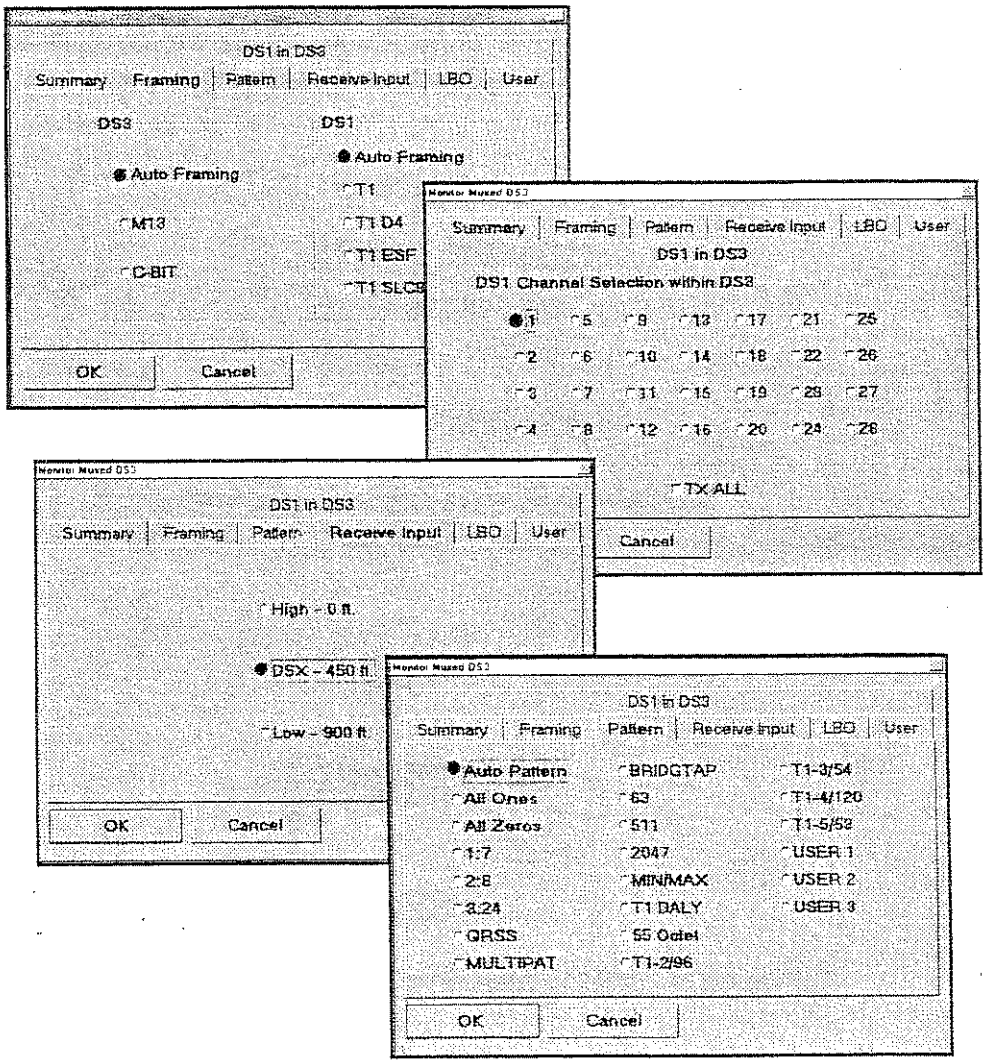
1. Press **MON**. Then, select **Monitor Muxed DS3** from the pull-down menu. The T-BERD 2209 automatically configures to a default setup for the chosen application.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** Property Setup Screen match the network characteristics.



- Set **Framing** tab to DS3/DS1 Auto Framing.
- Set **Channel** tab to desired DS1 channel to be dropped.
- Set **Receive Input** tab to DSX.
- Set **Pattern** tab to Auto Pattern.



3. Press **OK**.
4. Connect a cable from the DS3 PRIMARY RX jack to the appropriate DSX-3 monitor point (see Figure 3-6).

5. Press the RESTART Permanent Softkey to clear alarms and begin the test. Verify the DS1 SIGNAL PRESENT and FRAME SYNC LEDs illuminate. Verify the following DS3 Status LEDs are illuminated: SIGNAL and FRAME.

6. Set right Result GROUP to **DS3 Primary.**

7. Set left Result GROUP **T1 Primary.**

8. Set Result CATEGORY buttons to **Summary.** Verify RESULTS OK appears in both Category displays.

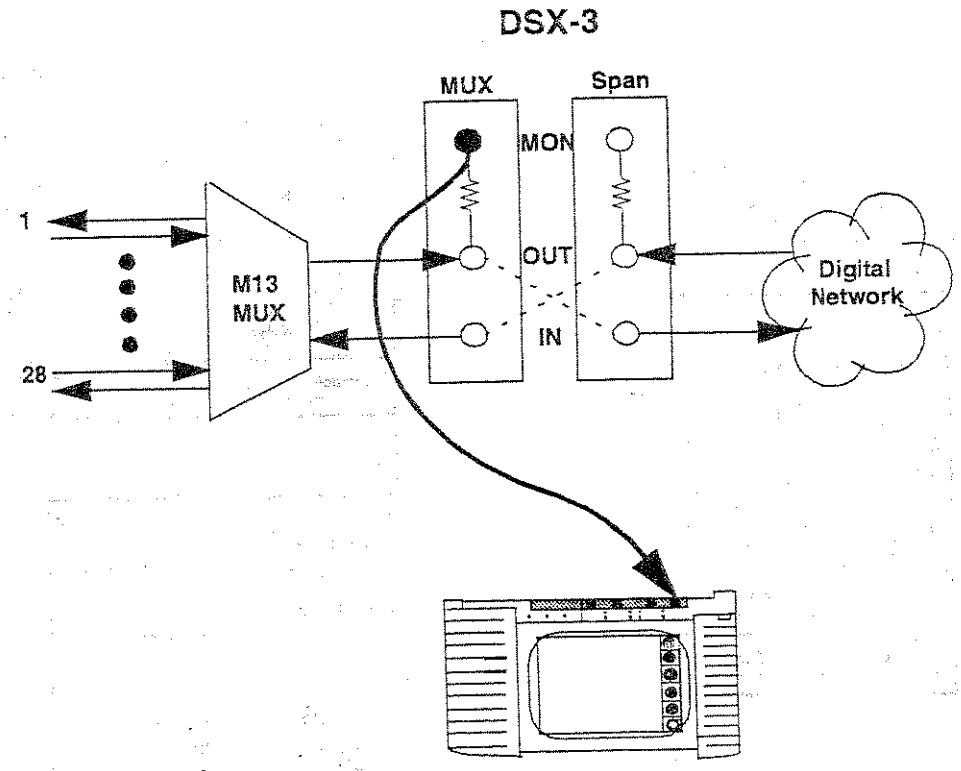


Figure 3-6. DS1 Monitor From DS3 Test

SECTION 4 ISDN PRI OPTION

4.1 INTRODUCTION

The ISDN Primary Rate Option allows the T-BERD 2209 to test the operational status of ISDN PRI links which use T1 as the physical interface. Features and capabilities of the T-BERD 2209 Primary Rate ISDN Option include:

- Provide support for LUCENT 5ESS, NT DMS 100, and National ISDN-2 Call Control specifications.
- Provide support for different call types which include voice, 56K, 64K, Nx64K, Nx56K, and H0.
- Place or receive two simultaneous voice and data calls while emulating a TE device (e.g., PBX).
- Test data services with BERT patterns or test voice services with a hands-free microphone and speaker.
- Provide history of calls that were placed and terminated, as well as, providing their corresponding cause codes.
- Monitor physical layer (T1), and provide decodes of LAPD and Q.931 messages sent on the D-Channel.
- Perform back-up D-Channel testing and ability to support NFAS.

4.2 SPECIFICATIONS

Table 4-1 lists the specifications for the Primary Rate ISDN Option.

Table 4-1. ISDN Option Specifications

Item	Specification
Connectors:	Option utilizes the T1 Interface connectors.
Line Termination (resistive):	100 ohms ±5%.
TEI Assignment:	0

4.3 FUNCTIONAL APPLICATIONS

The Primary Rate ISDN Option operates in one of two operating modes, either Monitor mode or Terminate mode. The following paragraphs discuss each mode in detail.

4.4 MONITOR MODE FOR ISDN PRI CALLS

In Monitor mode, the unit allows full duplex, non-intrusive monitoring of a single D-Channel (which enables interpreting messages going from TE to NT as well as messages going from NT to TE). In addition to providing the T1 results, the option provides full text decodes of the messages on the D-Channel.

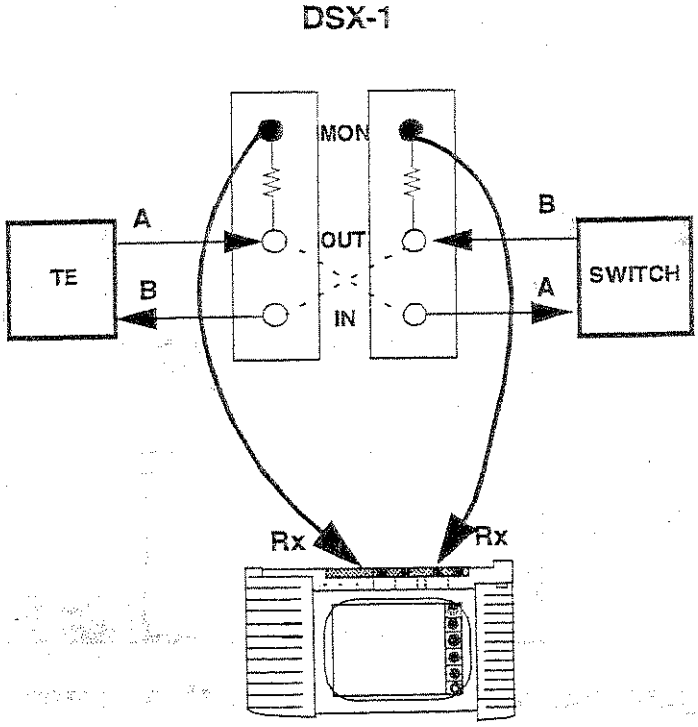


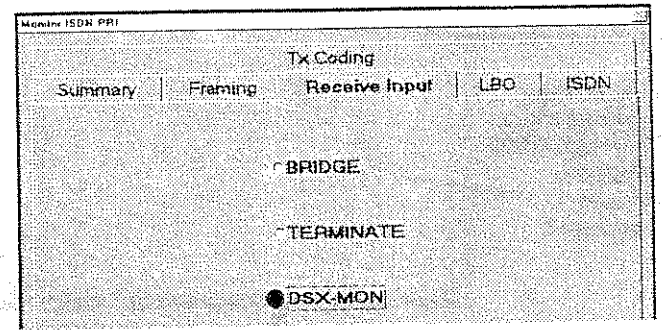
Figure 4-1. Monitor ISDN PRI Test Setup

Use the following setup procedures to prepare the T-BERD 2209 to test ISDN PRI transmissions.

1. Press **MON**. Then, select **Monitor ISDN PRI** from the pulldown menu.The T-BERD 2209 automatically configures to a default setup for the chosen application (see Figure 4-2).

NOTE

Receive Input *setting in the Property Sheet Tabs should be either DSX-MON or BRIDGE.*



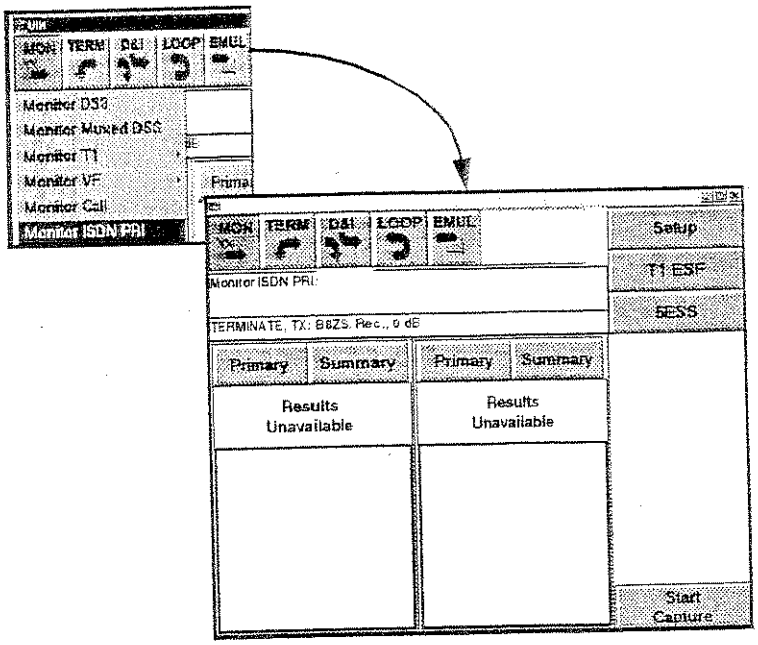
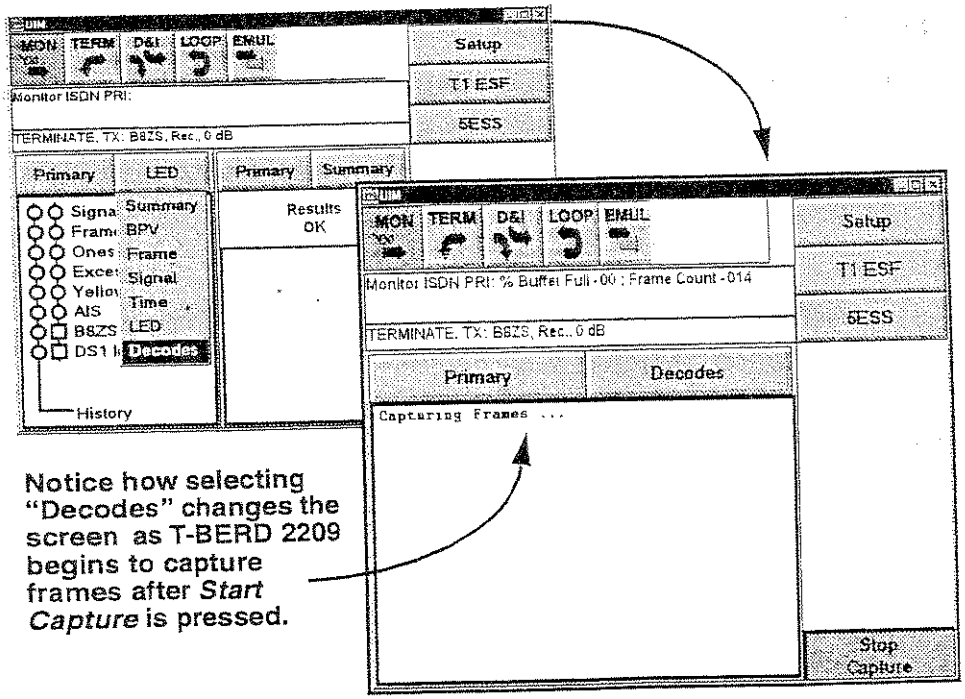
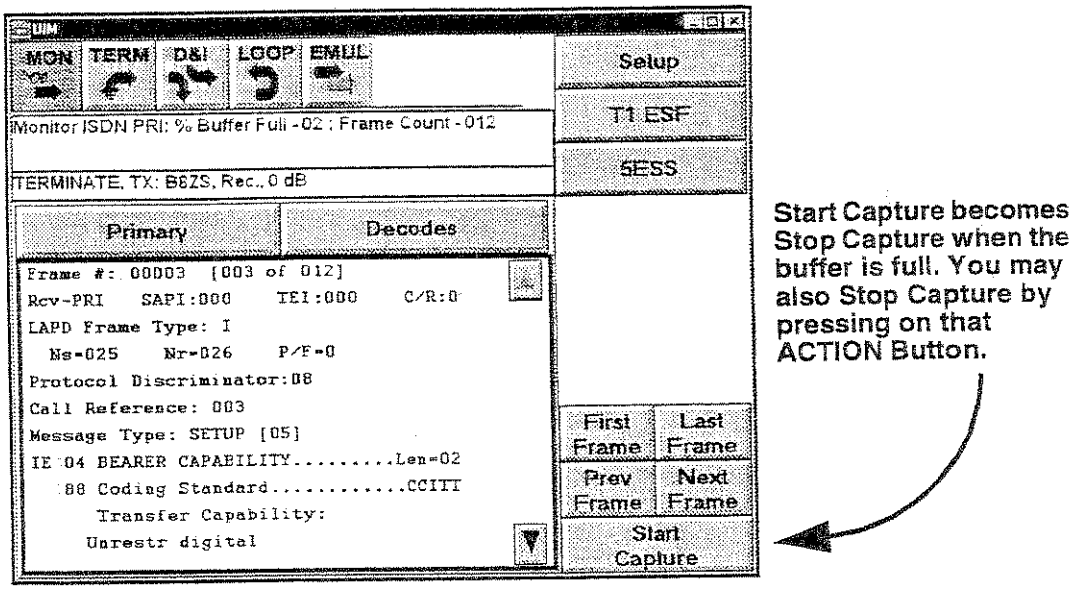


Figure 4-2. Monitor ISDN PRI Setup Screen

2. Select **Decodes** in Result CATEGORY under either Primary or Secondary Result GROUP.



3. View the B-Channel message decodes. The number of frames captured and the percent of buffer used displays in the status message window.



4. **Stop Capture** displays the last captured frame in the Display window. If no frames were captured, the text "no frames captured" displays. To traverse through the list of frames that were captured, press any of the four ACTION buttons named **First Frame**, **Last Frame**, **Prev Frame**, and **Next Frame**.

5. Observe results in the display.

4.5 TERMINATE MODE FOR ISDN PRI CALLS

The Terminate ISDN PRI test application emulates a TE (Terminal Equipment) device such as a PBX or a router. This allows the user to place a call to the network or receive a call from the network. Figure 4-3 shows the Terminate application menu.

1. Touch **TERM**. Then, select **Terminate ISDN PRI** from the pull-down menu. The T-BERD 2209 automatically configures to a default setup for the chosen application.

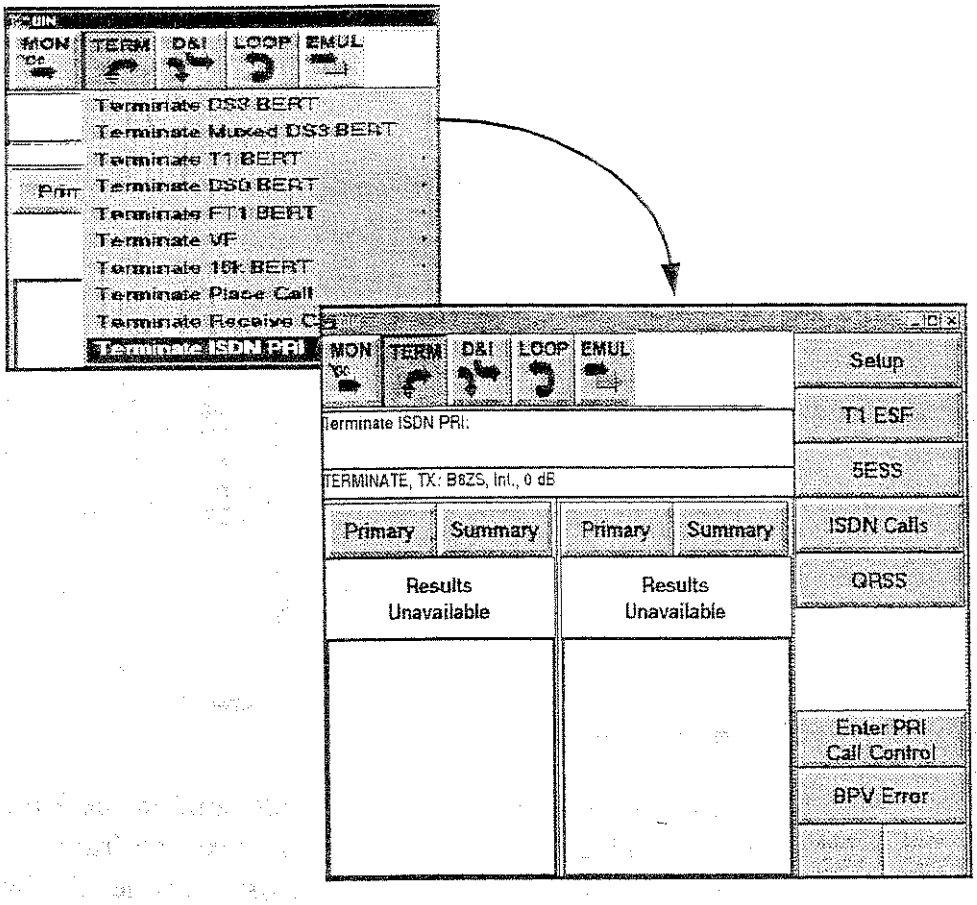
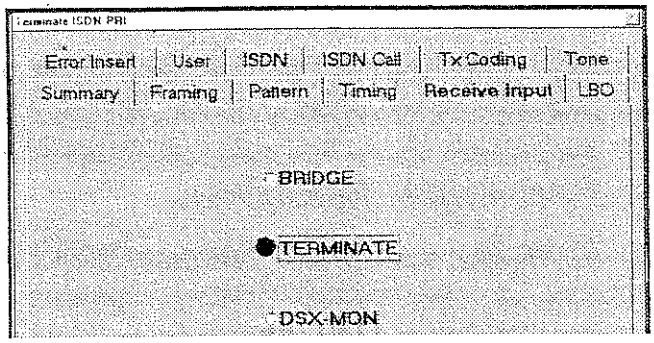


Figure 4-3. ISDN PRI Terminate Mode

NOTE

Receive Input *setting in the Property Sheet Tabs should be TERMINATE.*



When the T-BERD 2209 is configured for the correct switch type (Call Control) and the D-Channel, it establishes the data link and is ready to carry out ISDN call processing. The unit enables BERT and VF analysis of the B-channels being used, after successful call establishment. In addition to providing T1 results, the unit also provides statistics collected on the D-channel, as well as, results based on the analysis of the B-channel. The Call Controls supported in this mode include LUCENT 5ESS, NT DMS 100, and NI-2.

Supported Features of Terminate Mode PRI include:

1. **Place/Receive Call Capability**

   Enables the processing of up to two simultaneous calls—two terminating, two placing, or generating one call while terminating a second call.

   One or two calls may be placed on the same T1 or on different T1s. The following parameters must be set up to support the application:

   - Switch type: LUCENT 5ESS, NT DMS 100, or NI-2.
   - Call Control.
   - Primary D-Channel Selection.

   Each call configuration contains the following call settings:

   INTERFACE — Primary or Secondary.

   CALL TYPE — Voice or 56K, 64K, Nx56K, NX64K, H0.

   CALLED NUMBER — The number to be dialed.

   CALLING NUMBER — The number assigned to calling party (unit's assigned number).

   B-CHANNEL PREFERENCE — B-channel(s) upon which call is placed.

Table 4-2 shows the various call types supported by this option.

Table 4-2. ISDN PRI Call Specifications

Item	Specification
Voice, 56K Data, and 64K Data	Any 1 of 23 B-channels.
Nx64K Data, Nx56K Data	One or more contiguous or non-contiguous B-Channels.
H0	Limited to established channel groupings (1-6, 7-12, 13-18, 19-24). A given group of six channels is only available if there are no channel conflicts with other calls or with the D-Channel selection.

In case of *data* calls:

- A single pattern selection applies to both Data calls.

In case of *voice* calls:

- **Call 1** gets its input either from the unit microphone (press **Push 2 talk**), or the handset. **Call 2** gets its input from the tone generator (whose frequency can be changed through **Setup** Property Sheets by selecting the **Tone** Property Sheet..
- Dual mute buttons allow selective listening on each call.

To place an ISDN call from the T-BERD 2209 to the network, set the call parameters (e.g., key in the digits to place the call request to the network) in the Setup Property Sheets. Figure 4-4 shows a selection of Property Sheets typical for placing/receiving an ISDN PRI call.

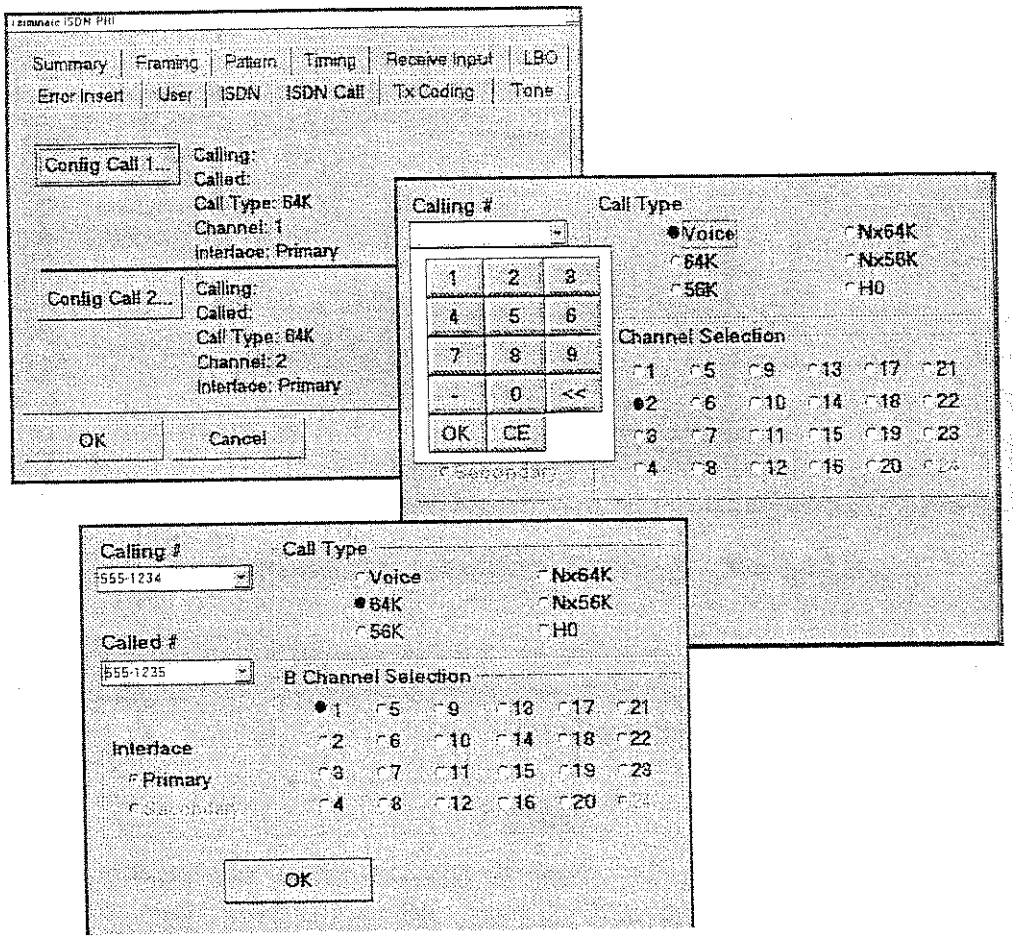


Figure 4-4. Samples of ISDN Call and Call Type Property Sheets

1. Press the **Enter PRI Call Control** ACTION button. The **PRI Call Control** Keypad pops up (Figure 4-5). Press **Conn** to place the call.

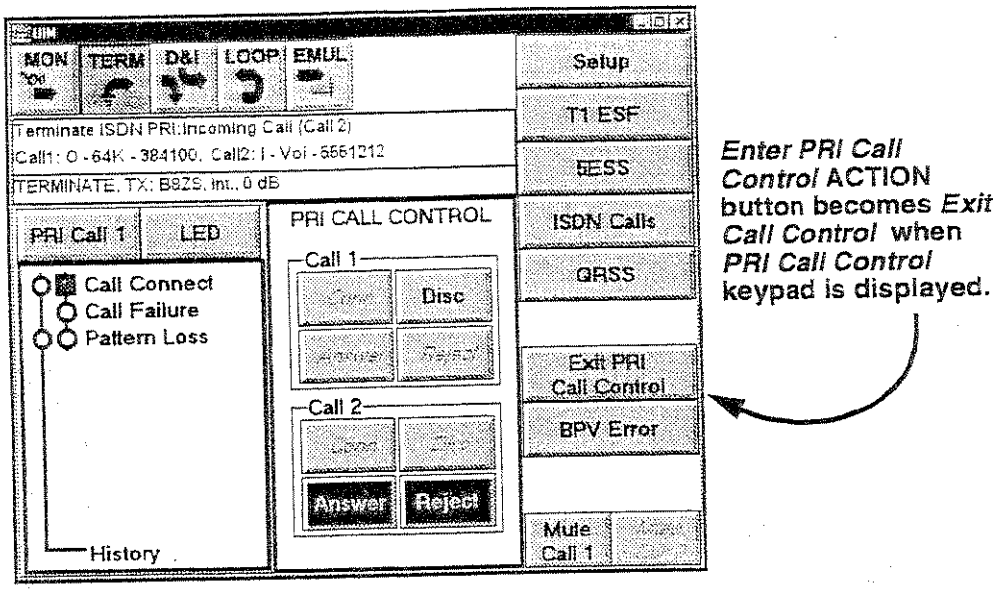


Figure 4-5. ISDN PRI Call Control Keypad

To receive an ISDN call from the network to the T-BERD 2209, you are alerted by a flashing **Enter PRI Call Control** ACTION button, and a message in the status display.

NOTE

*If the PRI Call Control Keypad is not already open, press the **Enter PRI Call Control** ACTION button to open it. Press **Answer** or **Reject** for the incoming call.*

2. **NFAS Capability**

Supports non-facility associated signaling where the signaling information for two PRI links takes place on one D-Channel. The Interface Identifiers are set to 0 for the Primary Interface and 1 for the Secondary Interface. To change the test configuration, press **Setup** and then select the **ISDN** Property Sheet tab. Select

the **NFAS/DCBU** radio button. Figure 4-6 show how this selection enables the Secondary Interface.

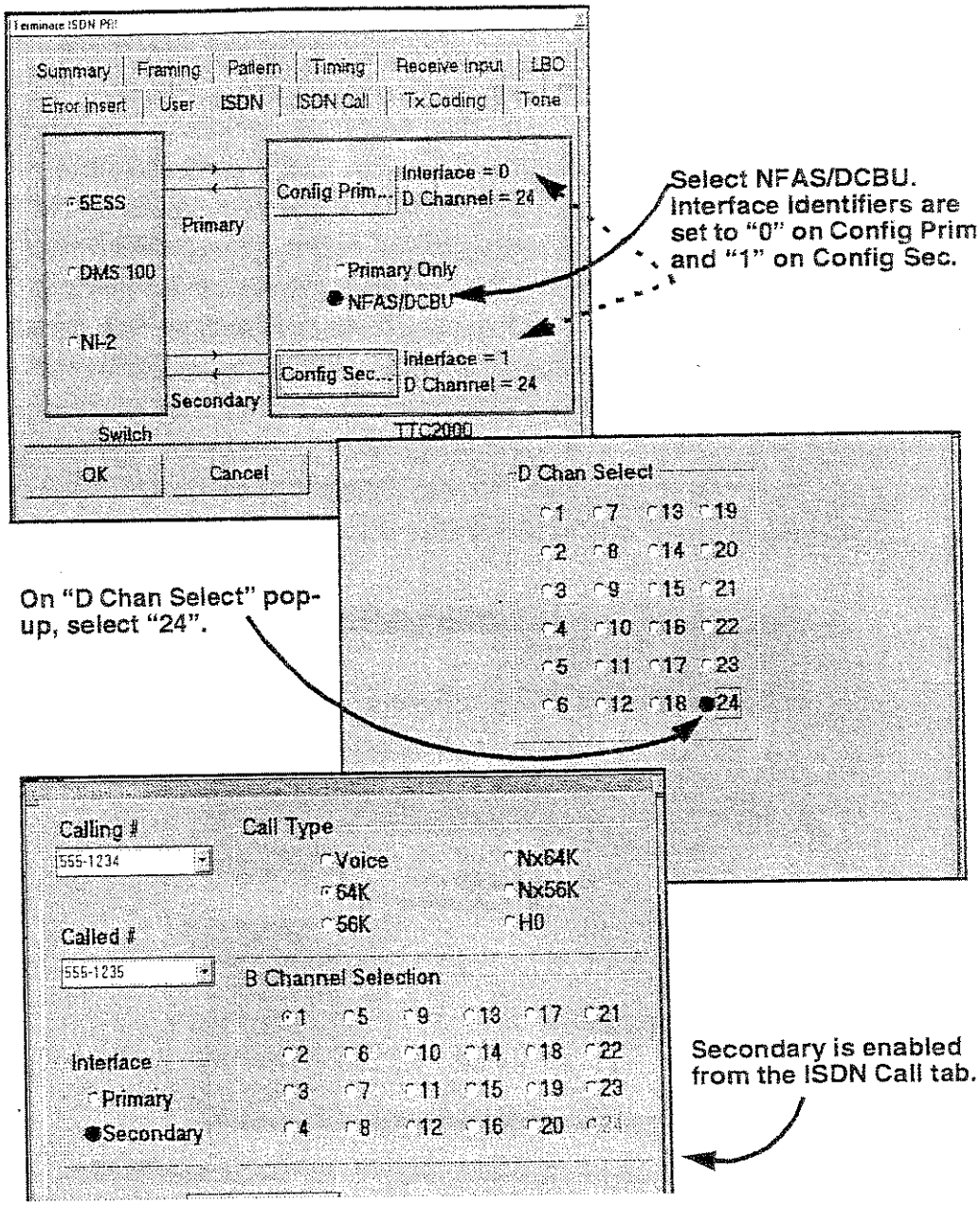


Figure 4-6. NFAS/DCBU Property Sheet Set Parameters

NOTE

NOTE: The switch must have D-Channel Backup in order to utilize the NFAS Capability.

3. D-Channel Backup Testing

The D-Channel Backup option enables all signaling information to take place on one D-Channel for both PRI interfaces (NFAS). Furthermore, there is a dedicated channel on the non-active D-Channel interface for the purpose of carrying signaling information in the case of the primary D-Channel failure. To select the DCBU/NFAS mode, press **Setup**, followed by the **ISDN** Setup Tab. Select **NFAS/DCBU**. This selection enables the Secondary Interface (see Figure 4-6). In addition, the **Config Sec.** button is activated. The **Config. Sec.** button allows the selection of which DS0 will carry signaling information. The D-Channel on each interface exists in one of several states. To check this information, select Result GROUP for the desired interface, then select **ISDN Stats** Result CATEGORY (see Figure 4-7).

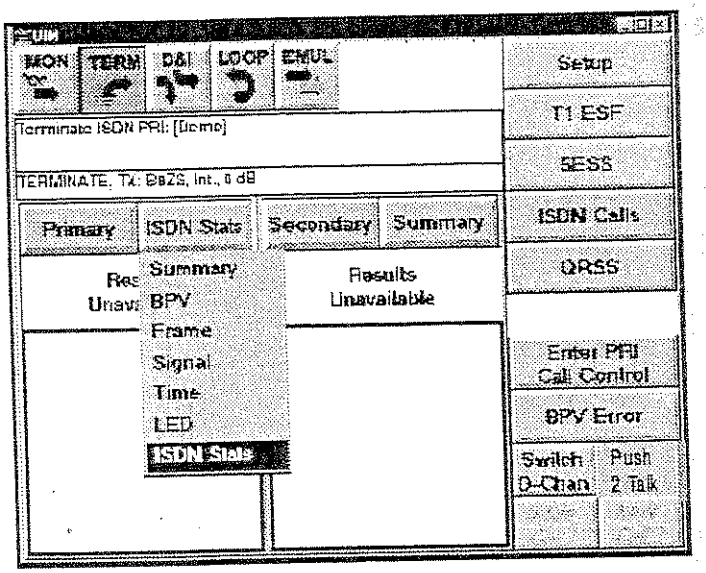


Figure 4-7. ISDN Status CATEGORY for D-Channel Test

The **Layer 2 Serv State** Result conveys which state the D-Channel is currently in. Also, a **D-Chan In Serv** LED is provided under the **LED** Result Category as a convenient means of checking for an In-Service D-Channel. The backup D-Channel feature can be used to test the switch over of a Standby D-channel to the

In-Service D-Channel. To initiate this process, disconnect the In-Service T1 or press the **Switch D-Chan** button (see Figure 4-7).

Table 4-3. D-Channel States and Descriptions

D-Channel States	Descriptions
In Service	D-Channel currently carries signaling information.
Out of Service	D-Channel is not available.
Maintenance Busy	State is entered automatically generally while state changes are taking place on the other interface
Wait	D-Channel is waiting for a response from the network in order to enter the In-Service State.
Standby	D-Channel is now prepared to transition to the In-Service State in the case of the primary D-Channel failure.

4.6 APPLICATION BUTTONS AND MENUS

4.6.1 ISDN Setup Property Menu

The ISDN Setup Screen is visible only when the **Monitor ISDN PRI** or **Terminate ISDN PRI** test applications are active. To check or change the ISDN PRI configuration, press the **Setup** button, which replaces the Main Screen with the Setup Screen (Figure 4-8).

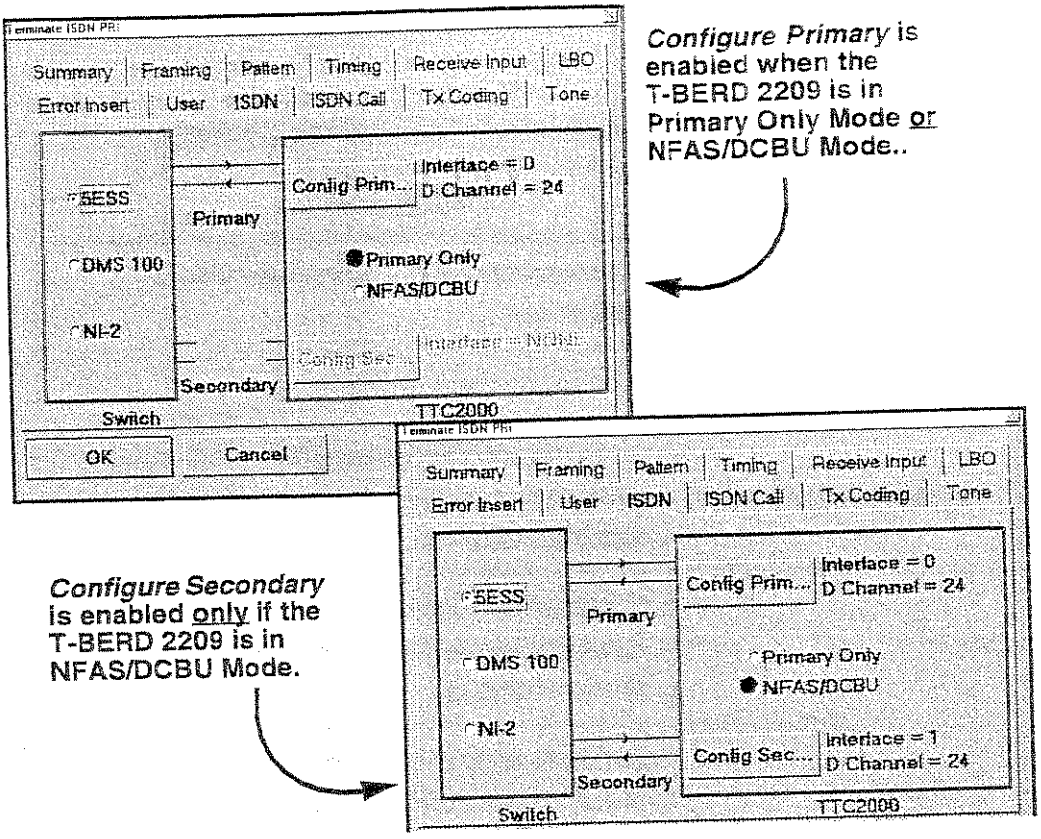


Figure 4-8. ISDN PRI Setup Screen

The ISDN Setup Screen shows a graphical summary of the test setup that matches the selected ISDN application. Press **Configure Primary** or **Configure Secondary** to select the Primary, Secondary, and D-Channel selection. Figure 4-8 shows that **Configure Secondary** is disabled while terminating a single T1,"Primary Only" mode in the ISDN Property Sheet (when setting up for testing in Terminate ISDN PRI) .

4.6.2 ISDN PRI Test Type Setup Screen Description

The Configure Primary/Secondary interface buttons set the parameters for the physical T1 interfaces of the T-BERD 2209. When either interface button is pressed, a pop-up dialog box appears which allows the user to select D-Channel selection for that interface.

Switch — Sets up termination on ISDN PRI line. Choices include:

5ESS — Selects the LUCENT 5ESS as the Call Control specification. (Also the default setting.)
DMS100 — Selects the NT DMS 100 as the Call Control specification.
NI-2 — Selects the National ISDN-2 as the Call Control specification.

Configure Primary — Sets parameter for T1 Primary interfaces.

Configure Secondary —Sets parameter for T1 Secondary interfaces.

D Chan Select — Selects the DS0 channel on which the D-Channel signaling information is to be transmitted.

4.7 ISDN PRI CALL SETTINGS MENU

The ISDN PRI Call Settings Menu (ISDN Call) is visible only when the Terminate ISDN PRI mode application is active. Parameters must be set for both **Call 1** and **Call 2** when connecting to two calls simultaneously. Press **Config Call 1** (or Config Call 2) for a pop-up dialog box to change the parameters (Figure 4-9).

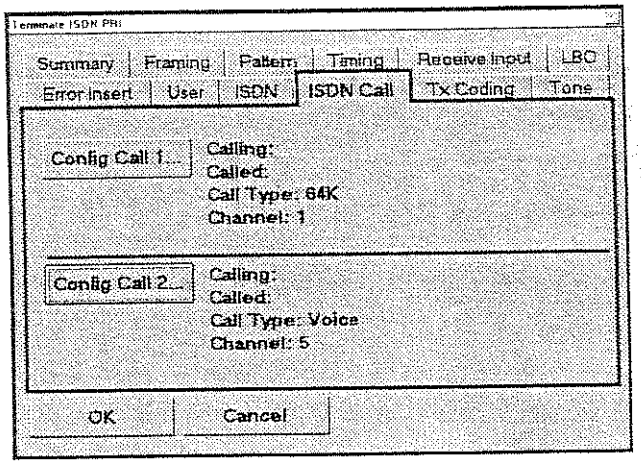


Figure 4-9. ISDN PRI Call Settings

4.7.1 ISDN PRI Call Type Screen Description

Pressing **Configure Call 1** from the **ISDN Call** Property Sheet displays the following dialog box (Figure 4-10). The following parameter choices are available:

Call Type selects the type of call to be generated and also determines the type of analysis performed on the B Channel for outgoing calls. (Default value is **VOICE**). For incoming calls, the call type is determined by the request message from the network. The choices are:

VOICE — Selects a voice type call.

64K — Selects a clear channel, unrestricted, circuit switched data connection with the full 64 kbps available for use, with no rate adaptation.

56K — Selects an unrestricted circuit switched data connection with 56 kbps CCITT I.463 rate adaptation.

Nx64K — Selects contiguous/noncontiguous 64 kbit/s timeslot operation.

Nx56K — Selects contiguous/noncontiguous 56 kbit/s timeslot operation.

H0 — Selects an **H0** type data call.

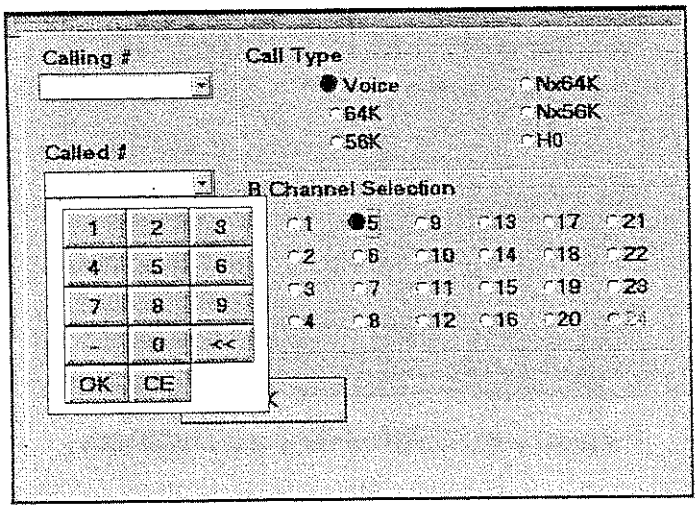


Figure 4-10. ISDN PRI Call Setting Pop-up Dialog Box

B-Channel Selection enables the user to select the B channel on which the ISDN Call is to be placed. Any number (except the D-channel) between 1 and 24 may be entered.

Interface Selection (not shown) enables the user to select either the Primary or Secondary T1 interface.

Calling Number enables entry of the caller number (directory number), up to 15 digits. A pop-up Dial pad is used to edit this field. Valid keys are **0** through **9**, the minus sign (-), the (OK) key, and the (CE) clear key.

Called Number enables entry of the number that has been called. The Edit Control pop-up keypad is used to edit this field when the down arrow key is pressed.

NOTE

The B-Channel number selection changes with the Call Type. For example, "Voice" selection is a radio button, but "Nx56k and Nx64k" is a checkbox selection. Therefore, the Call Type dynamically alters the B-Channel number selection.

4.8 CONFIGURING AN ISDN PRI CALL

1. Select **TERM**. Then, select **Terminate ISDN PRI** from the pull-down menu. The unit automatically configures to a default setup screen.
2. Press **Setup**. Ensure characteristics shown in the **Summary** setup screen match the network characteristics (Framing, Line Coding, etc.).
3. Select the **ISDN** Property Sheet tab. Configure **Call Control**, D-Channel test type (**Primary Only** or **NFAS/DCBU**), and the **D-Channel** (s) DS0s (see Figure 4-8).
4. Select the **ISDN Call** Property Sheet tab. Configure the call(s) by pressing **Config Call 1** and/or **Config Call 2** (see Figure 4-9). Refer to Table 4-4 for definitions of call configurations.
5. Press **OK**.

Table 4-4. ISDN PRI Config Call 1/2 Property Sheet

Item	Definition
Calling #	Call ID number of outgoing call.
Called #	Number you are trying to call.
Interface	Valid only when testing DCBU/NFAS, and it indicates whether the interface is Primary or Secondary on the outgoing call.
Call Type	Data (64k, 56k, Nx64K, Nx56k, H0) or Voice.
B-Channel Selection	Designated DS0s for the call.

4.9 PLACING AN ISDN PRI CALL TO TPI 560P

1. Follow procedural steps 1-6 in Section 4.8.
2. Press **Enter PRI Call Control** ACTION button (see Figure 4-5).

NOTE

If Layer 2 is in Multiframe Established state, the ***Conn*** *(Connect) button will be enabled.*

3. Press **Conn** to engage outgoing call. Setup information displays in the status window. (**Conn** button remains depressed until the TPI 560P answers the call.)
4. TPI 560P answers the call and announces the type of service, calling number, and prompts you to "hang up for call back". The **Conn** button becomes disabled, and the **Disc** (Disconnect) button enables, leaving you with an active call (see Figure 4-5).

NOTE

The audible voice announcement is only available for single, B-Channel calls.

5. Press **Disc**. The call disconnects, leaving **Conn** enabled again. TPI 560P returns the call, if connected. If the Call Control window is visible, the **Answer/Reject** buttons flash when the call is received. Otherwise, **ENTER PRI Call Control** blinks, prompting you to press it.
6. Press **Answer** or **Reject**. This action prompts the **Disc** button to enable.
7. Establish the loopback. Now BER testing can qualify the line. The T-BERD 2209 automatically inserts the configured pattern on the B-channels of the incoming or outgoing call(s).
8. Press **Disc** to disconnect the call.

4.10 ISDN PRI TEST RESULTS

Test results for the Primary Rate ISDN Option are displayed in the Terminate mode. There are two types of ISDN results:

- PHYSICAL INTERFACE (T1)-RELATIVE
- CALL-RELATIVE

The left button on the Results GROUP window controls access to these two different types of results. This button has a drop-box menu with **Primary/Secondary/Call 1/Call 2** selections. A description of the screen follows with typical Primary Rate ISDN results screens (Figure 4-11):

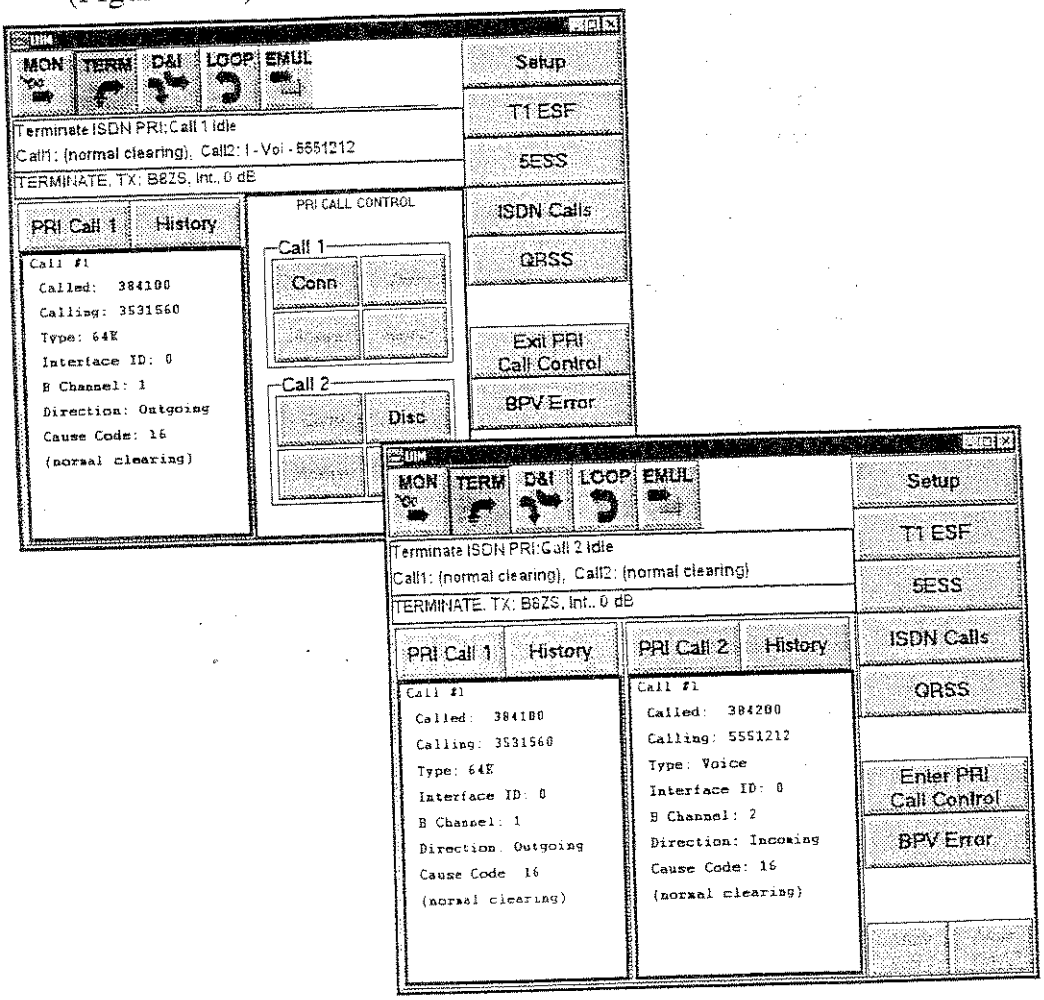


Figure 4-11. ISDN PRI Result Screens

Primary/Secondary selects the physical interface on the ISDN line. This selection allows the T1 Results CATEGORIES to be displayed (either Primary or Secondary). Additionally, the frame statistics and LAPD statistics for a D-channel which is interface-specific is present under the Primary/Secondary Result GROUPS.

Call 1 or **Call 2** Results GROUP provide call-specific results. The Results CATEGORIES include: Summary, Logic, LED, History, and Time.

Table 4-5 lists the test Results CATEGORIES for the Primary Rate ISDN Option.

Table 4-5. Test Results Categories for ISDN PRI

Category	Description
Summary Category (Primary/Secondary Result Group)	LAPD Multi-Frame Loss
	Call Fail Count
	LAPD Protocol Errors
LED Category	**D-Channel Ready** — Square LED means datalink is established and ready for call control. (Pri/Sec)
	Call Connected — Square LED means call connected for **Call 1** or **Call 2**.
	Call Failure — Round LED means **Call 1** or **Call 2** has been cleared with a cause other then "normal". Check Call History.

Table 4-5. Test Results Categories for ISDN PRI (Continued)

Category	Description
ISDN Statistics Layer 2 Category (Primary/Secondary)	**Frame Count** — Counts the total number of valid LAPD frames received.
	Errored Frames — Valid frames with one or more of the following errored conditions: undefined control fields, "S" or "U" frame with incorrect length, or "I" frame with a long information field.
	Invalid Frames — Counts the frames with FCS errors or invalid SAPI.
	Aborted Frames — Counts the aborted LAPD frames detected (excluding Out of Frame aborts).
	Reject Frames — Counts the LAPD reject frames.
	Frame Reject Frames — Counts LAPD frame reject frames.
History Category (Call 1 and Call 2)	**Call Failure** — Stores up to 12 call attempts. (including normal and abnormal call clears).

4.10.1 ISDN PRI Status Messages

The Status Message Display window (below the Application Selection buttons) shows the status of the D-channel and the progress of ISDN calls for both incoming and outgoing calls. Table 4-6 provides the list of messages and their descriptions. The second line of the status message window also provides additional information about call direction as follows:

Table 4-6. ISDN PRI Status Messages

Message	Description
I	Incoming
O	Outgoing
Call Type	64k, 56k, Voice, Nx64k, Nx56k, H0
Called Num	Outgoing calls
Calling Num	Incoming Calls

4.10.2 ISDN PRI Cause Codes

Table 4-7 provides the information between the Cause Code and the Cause Messages that are displayed in the Message/Status window. The Cause message is shown when the Call placed between the PBX and the Network fails.

Table 4-7. Cause Codes

Cause Code #	Cause Message — Q.931 Cause Codes (1988)
1	Unassigned number.
2	No route to specified transit network.
3	No route to destination.
6	Channel unacceptable.
7	Call awarded and delivered in an established channel.
16	Normal call clearing.
17	User busy.
18	No user responding.
19	No answer from user (user alerted).
21	Call rejected.
22	Number changed.

Table 4-7. Cause Codes (Continued)

Cause Code #	Cause Message — Q.931 Cause Codes (1988)
26	Non-selected user clearing.
27	Destination out of order.
28	Invalid number format.
29	Facility rejected.
30	Response to STATUS INQUIRY.
31	Normal, unspecified.
34	No circuit/channel available.
41	Temporary failure.
42	Switching equipment congestion.
43	Access information discarded.
44	Requested circuit/channel not available.
47	Resources unavailable, unspecified.
50	Requested facility not subscribed.
57	Bearer capability not presently authorized.
58	Bearer capability not available.
63	Service or option not available, unspecified.
65	Bearer capability not implemented.
69	Requested facility not implemented.
79	Service or option not implemented, unspecified.
81	Invalid call reference value.
88	Incompatible destination.
96	Mandatory information element is missing.
97	Message type non-existent or not implemented.
99	Information element non-existent or not implemented.
100	Invalid information element contents.
101	Message not compatible with call state.
102	Recovery on timer expiry.

Table 4-7. Cause Codes (Continued)

Cause Code #	Cause Message — Q.931 Cause Codes (1988)
111	Protocol error, unspecified.
127	Internetworking

Table 4-8 indicates National-specific cause values.

Table 4-8. National-Specific Cause Codes

Cause Code #	Cause Message — (Defined in TA-NWT-001268)
4	Vacant code.
8	Prefix 0 dialed in error.
9	Prefix 1 dialed in error.
10	Prefix 1 not dialed.
11	Excessive digits received, Call is proceeding.

SECTION 5 PRINTER OPERATION

5.1 INTRODUCTION

The T-BERD 2209 provides print capability for both test configuration (Controls Print) and test results (Results Print). This section describes each of the printouts and how to generate them using the Printer connector.

The T-BERD 2209 can generate a printout manually or automatically (via timed prints). When a results printout is initiated either manually or automatically, the test results are dumped to the printer or stored in nonvolatile memory (if the printer is not connected to the unit).

5.2 T-BERD 2209 PRINTER SETUP

The following connections and controls are used to set up the printer and T-BERD 2209.

5.2.1 Printer Connection

The Printer connector on the top of the mainframe is an 8-pin connector used to connect the T-BERD 2209 to a serial printer like the TTC PR-40A. The connector is configured as a Data Communications Equipment (DCE) connection, which allows you to connect the T-BERD 2209 to Data Terminal Equipment (DTE).

5.2.2 Printer Settings

The T-BERD 2209 printout generation is controlled through the Printer Screen (see Figure 5-1), which is activated by pressing the **Printer** Permanent Softkey on the right side of the Main Display.

5.2.3 Printout Controls

There are a series of buttons on the **Print Request** Property Sheet tab which are described in the following paragraphs.

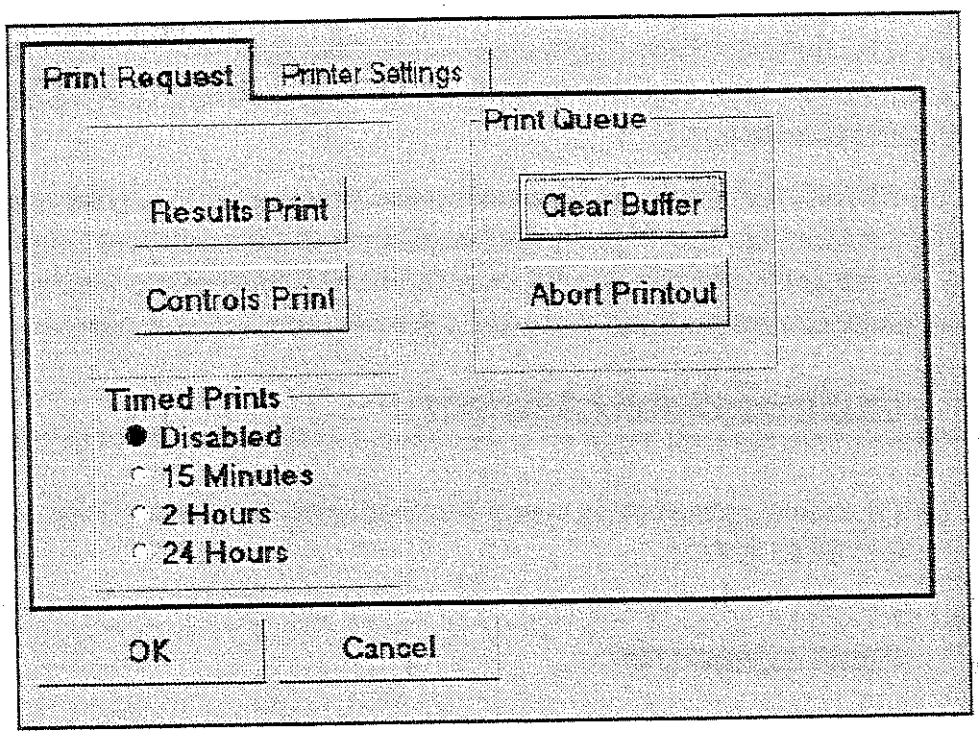


Figure 5-1. Print Request Property Sheet

5.2.3.1 Results Print

Results Print generates a date-and-time-stamped printout of current test results. Test results become available only after the T-BERD 2209 has received a valid signal.

5.2.3.2 Controls Print

Controls Print generates a date-and-time-stamped printout of the current test configuration. This printout includes the test application and parameters associated with the test setup.

5.2.3.3 Timed Prints

If you choose **Disabled**, printouts are performed manually every time you press **Results Print**. The other radio buttons specify when results are printed. Choices include results being printed every 15 minutes, every 2 hours, or every 24 hours.

5.2.3.4 Clear Buffer

Clear Buffer clears all printouts from the print buffer. The print buffer stores up to 10 Results and Controls Printouts until the T-BERD 2209 can be connected to a printer. If the print buffer is full and a printer is not connected or is off line, the first and the most recent printouts are retained while any new printouts overwrite the ones stored in the middle of the print buffer queue.

5.2.3.5 Abort Printout

Abort Printout cancels the most recent printout if the printer is connected, and it has not completed the printout.

5.2.4 Printer Settings Controls

Selecting the **Printer Settings** Property Sheet (see Figure 5-2). allows you to select the baud rate and parity for the printer interface.

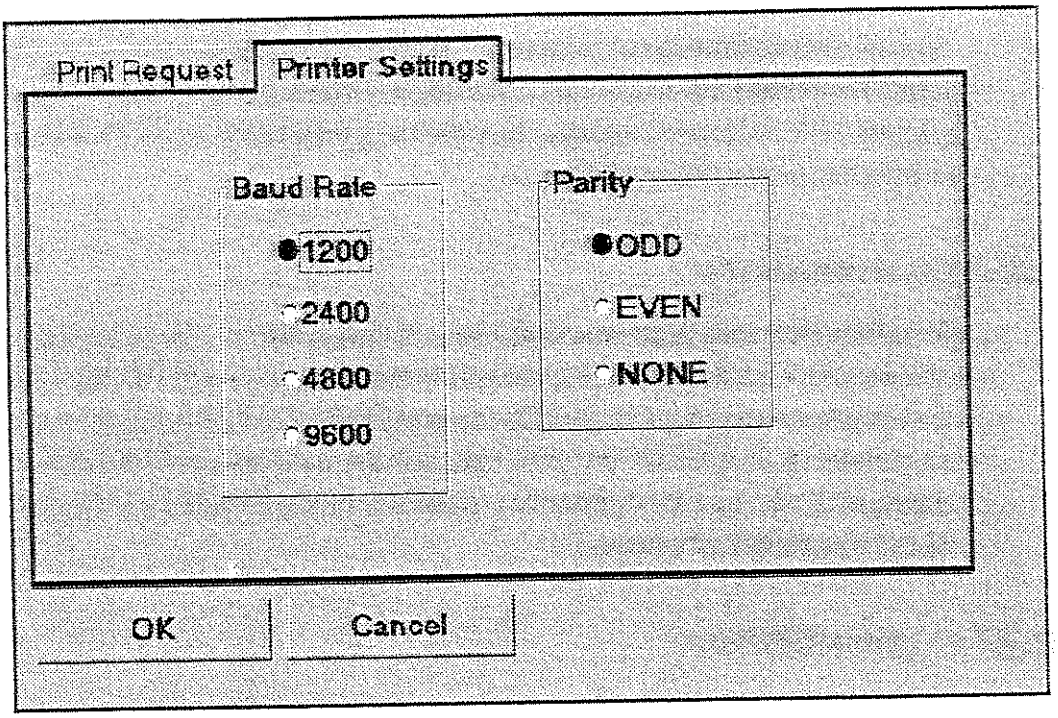


Figure 5-2. Printer Settings Property Sheet

SECTION 6 SPECIFICATIONS

6.1 GENERAL SPECIFICATIONS

Table 6-1 lists the general specifications for the T-BERD 2209.

Table 6-1. General Specifications

Specification	Value
Physical Characteristics:	
Height:	7.5" (19 cm)
Width:	11.5" (29.2 cm)
Depth:	2.25" (5.7 cm)
Weight:	4.25 lb. (1.93 kg.)
Environmental Characteristics:	
Temperature:	
Operating:	32°F to 122°F (0°C to +50°C)
Non-Operating:	-40°F to 167°F (-40°C to +75°C)
Humidity:	10% to 90% Relative Humidity, non-condensing
Electrical Characteristics:	
Battery Type:	10.8 V Nickel-Metal Hydride (NiMH)
Operating Time:	Typically provides up to three hours of continuous operation on a full charge.
Recharging Period:	Maximum of two hours from full discharge.
AC Adaptor:	120VAC to 18 VDC

6.1.1 Input Specifications

6.1.1.1 RX Jack

Connector Type:	Bantam jack.
Frequency:	1,544,000 Hz ±5000 Hz.
Impedance	
BRIDGE:	1000 ohms minimum.
TERM:	100 ohms ±5%.
DSX-MON:	100 ohms ±5%.
Range	
BRIDGE:	+6 to -35.0 dBdsx.
TERM:	+6 to -35.0 dBdsx.
DSX-MON:	+6 to -24.0 dBdsx of resistive loss.

6.1.1.2 Loop Codes Detection Criteria

In-Band:	At least 177 error-free bits of the selected repetitive pattern must be received (loop up or loop down.
Out-of-Band:	Datalink monitored every 125 ms for loop codes (loop up and loop down).

6.1.1.3 Pattern Sychronization Detection Criteria

Fixed Patterns:	30 consecutive error-free bits.
QRSS:	30 + n consecutive error-free bits for a pattern length of 2^n-1.

6.1.2 Output Specifications

6.1.2.1 TX Jack

Connector Type:	Bantam jack.
LBO Level:	Line build-out of 0, -7.5, -15.0, and -22.5 dB of cable loss at 772 Hz.

LBO Tolerance:	±1 dB at 772 kHz.
Timing:	±7 ppm internal or recovered.
Line Codes:	AMI or B8ZS.
Error Insert Type:	Logic, BPV, or Frame.
Pulse Shape:	With output terminated in 100 ohms resistive load and 0 dB line build-out selected, the T-BERD 2209 meets ITU-T Recommendation G.703; AT&T Publications CB113, CB119, CB132, CB143, and PUB62508; and AT&T PUB62411 pulse shape specifications.

6.1.2.2 *Transmitted Loop Codes*

In-Band

CSU:	Loop-up: 10000; Loop-down: 100.
Facility 1:	Loop-up: 1100; Loop-down: 1110.
Facility 2:	Loop-up: 11000; Loop-down: 11100.
Facility 3:	Loop-up:100000; Loop-down:100 (N.E.Tel.)

Out-of-Band

Line:	Loop up: 1111 1111 0111 0000 Loop down: 1111 1111 0001 1100.
Payload:	Loop up: 1111 1111 0010 1000 Loop down: 1111 1111 0100 1100.
Network:	Loop up: 1111 1111 0100 1000 Loop down: 1111 1111 0010 0100

6.1.3 Measurements Specifications

Frequency

Range:	1,544,000 ±5000 Hz.
Accuracy:	± 7 ppm.
Resolution:	1 Hz.

Received Level

Range:	+6 dBdsx to -40 dBdsx.
Accuracy:	±1.0 dB between +6 and -10 dBdsx ±2.0 dB between -10 and -20 dBdsx ±3.0 dB between -20 and -40 dBdsx.
Resolution:	0.1 dB
Vp-p Range:	60 mV to 12.0 V.
Vp-p Resolution:	0.05 V.

Simplex Current

Range:	10 mA to 180 mA.
Accuracy:	±5%.
Resolution:	1 mA.
Simplex path:	13.2 ohms (nominal).

6.1.4 Alarm Criteria

Signal Loss:	175 ±75 consecutive 0's.
Frame Loss	
D4:	2 out of 5 Ft bits in error.
ESF:	2 out of 5 frame bits in error.
SLC-96:	2 out of 5 Ft bits in error.
Pattern Loss	
	100 errors detected in 1000 or fewer bits.
Ones Density	
QRSS:	Alarm is suppressed.
Other Patterns:	Received data contains less than n ones in 8(n+1) bits, where n=1 to 23.
Excess Zeros	
AMI:	16 or more consecutive zeros.
B8ZS:	8 or more consecutive zeros.

Yellow Alarm	
D4:	Bit 2 is a 0 for 255 consecutive channels.
ESF:	256 bits ±16 bits of a repetitive (1111 1111 0000 0000) pattern received in the 4 kb/s datalink.
SLC-96:	Bit 2 is a 0 for 255 consecutive channels.
AIS:	Unframed T1 signal has 2048 consecutive ones.
Low Battery:	Battery has less than 25% energy remaining.

6.2 DS3 OPTION SPECIFICATIONS

6.2.1 DS3 Specifications

6.2.1.1 Framing Formats

- Auto
- Unframed
- M13
- Muxed M13
- C-bit
- Muxed C-bit

6.2.1.2 Pattern

- 1111
- 1100 (Idle)
- 1010 (AIS)
- 1010
- 2^{15}-1
- 2^{20}-1
- 2^{23}-1
- User (3 to 24 bit programmable)

6.2.1.3 Line Coding

- B3ZS

6.2.1.4 Connectors

- WECO 560A jack

6.2.1.5 Receiver (Single)

Frequency:	44,736 Mb/s ±300ppm
Level:	HIGH: Accepts Nominal 1.2 Vp, 0 ft. of cable from High source
	DSX: Accepts Nominal 0.6 Vp, 450 ft. of cable from High source or monitor
	LOW: Accepts Nominal 0.3 Vp, 900 ft. of cable from High source

6.2.1.6 Transmitter (Single)

Frequency:	44,736 Mb/s ±20ppm
Pulse:	HIGH: Nominal 1.2 Vp. Signal meets ANSI specification T1.102-1993 and ITU-TG.703 when subjected to 450 feet of cable loss.
	DSX: Nominal 0.91 Vp. Signal meets ANSI specification T1.102-1993 and ITU-TG.703.
	LOW: Nominal 0.31 Vp.
Timing:	Internal Clock
	Recovered Clock

6.2.2 DS3 Measurements

6.2.2.1 Summary

- Bit Errors
- Bipolar Violations
- Parity Errors

- C-bit Errors
- FEBE
- Frame Errors
- Receive Frequency
- FEAC Messages
- DS2 Frame Errors
- Pattern Slips

6.2.2.2 Logic

- Bit Errors
- Bit Error Rate
- Bit Errored Seconds
- Pattern Losses
- Pattern Slips
- Pattern Loss Seconds
- Error Free Seconds
- % Error Free Seconds

6.2.2.3 Bipolar Violations

- BPV
- BPV Rate
- BPV Errored Seconds

6.2.2.4 Frame Errors

- Frame Errors
- Frame Error Rate
- Frame Error Seconds
- Out of Frame Seconds
- C-bit Errors
- C-bit Error Rate
- FEBE

- FEBE Rate
- DS2 Frame Errors
- DS2 Frame Error Rate
- Received X-bit
- Transmit X-bit
- Frame Loss Count

6.2.2.5 Parity

- Parity Errors
- Parity Error Rate
- Parity Error Seconds

6.2.2.6 Signal

- Signal Loss
- Signal Loss Seconds
- Receive Frequency
- Receive Signal Level
- Transmit Frequency

INDEX

— Symbols —

— Numerics —

— A —

— B —

— C —

— D —

— S —

— T —

— U —

— V —

— W —

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