# ADDENDUM

**to**
**EZ-TESTER DS, HD, and QJ**
**OPERATING MANUAL**

## Option 40
## Line Parametrics Testing

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**EZ-TESTER DS, HD, and QJ**
**OPERATING MANUAL**

# Option 40
# Line Parametrics Testing

*This addendum describes the operation of Option 40, Line Parametrics Testing, installed in the EZ-TESTER DS, HD, and QJ and represents an update to the procedures in manuals printed prior to July 2001.*

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**July 2001**

## TABLE OF CONTENTS



## LIST OF ILLUSTRATIONS

## 1. Line Parametrics Testing (Option 40)

The LINE PARAMETRICS test feature of the EZ-TESTER HD provides a transmission impairment measurement set (TIMS) function used for qualification of copper lines used in voice frequency or digital service applications. The tests offered by the line parametrics feature are designed to measure electrical and physical characteristics of the transmission line and to help identify and isolate potential or existing problems by detecting and displaying abnormalities that may exist. Types of tests that may be performed are:

a. Line Voltage
b. Line Analysis
c. Time Domain Reflectometry
d. Level and Frequency
e. Noise Measurement
f. Spectrum Analysis

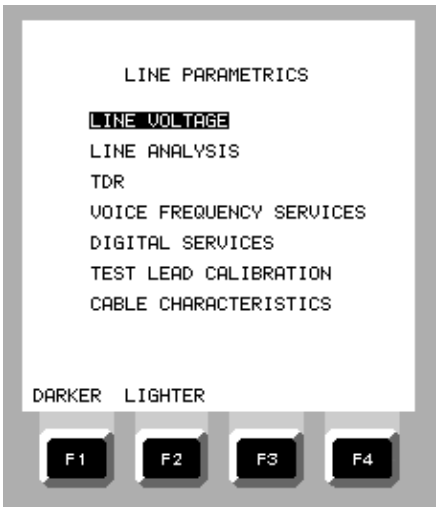


**Figure 1. LINE PARAMETRICS Menu**

Of the six test types, the last three are available under the menu headings of VOICE FREQUENCY SERVICES and DIGITAL SERVICES. If the tests are to be performed on lines set up for voice frequency service, the test set interface impedance is set to 600 ohms automatically when VOICE FREQUENCY SERVICES is selected. If testing is to be performed on lines set up for digital services, the test set interface impedance is changed to 100 ohms when DIGITAL SERVICES is selected. (Testing of lines intended for ADSL service may require a test set impedance of 135 ohms. This impedance may be ordered specially as a hardware modification.)

The test cable most frequently used for parametric testing comprises a Bantam plug, wired for tip, ring, and sleeve (ground), with alligator clips on the other end, since the line being tested is often accessible at a terminal block. Before testing a line, the conductor pairs should be disconnected from the network at both ends. If the line is left terminated at either end, or is tested in sections with intermediate devices still attached, test results will be inconclusive or confusing.

During line parametrics testing, the test set LINE 1 TX and RX jacks are used to connect the test set to the line. Depending on the test to be performed, the test cable is connected to either the TX or RX jack of the LINE 1 Bantam pair. The specific jack required for each test is shown as “TX” or RX” at the top left corner of the display after the type of test is selected from the LINE PARAMETRICS menu.

### 1.1 Test Lead Calibration

When performing parametric tests of transmission lines, the electrical characteristics of the test lead used between the test set and the line under test can significantly affect the measurements. The test lead should always be calibrated before beginning a series of tests. Failure to perform a test lead calibration may result in inconclusive results.

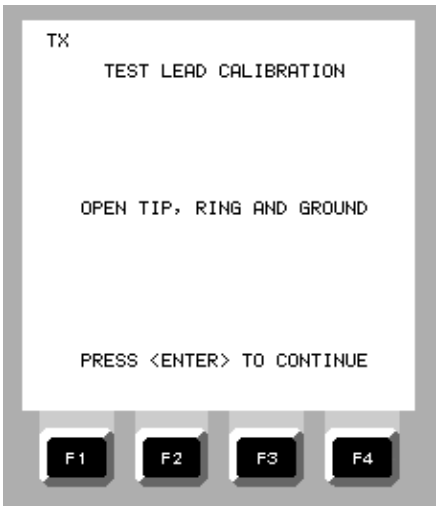


**Figure 2 . TEST LEAD CALIBRATION Screen**

Performing a Test Lead Calibration

1. On the Main Menu, move the cursor to LINE PARAMETRICS and press ENTER.

2. On the LINE PARAMETRICS menu, move the cursor to TEST LEAD CALIBRATION and press ENTER.

3. Connect the test lead to the LINE 1 TX jack on the test set.

4. Make certain the tip, ring, and ground contacts of the test lead are open and press ENTER, then wait for the test set to beep twice.

5. Short the test lead tip, ring, and ground contacts together, then press ENTER.

   When the calibration is complete, the test set will beep twice. The screen will briefly display OPERATION COMPLETE and then return to the LINE PARAMETRICS menu.

   The test lead is now calibrated for the line being tested.

### 1.2 Cable Characteristics Setup

The electrical characteristics of a cable, as well as the physical temperature of the cable being tested affect signal transmission. Before accurate test measurements can be made, specific known characteristics of the cable must be set into the test set. In many cases, when the cable type and gauge are selected in step 2 of the setup procedure, the test set will automatically set the CABLE CONSTANTS shown at the bottom of the screen. If a unique cable type is to be tested, and its type is not shown, F2 (USER) should be selected, and the CABLE CONSTANTS must be edited by the technician using information obtained from the cable manufacturer's documentation.

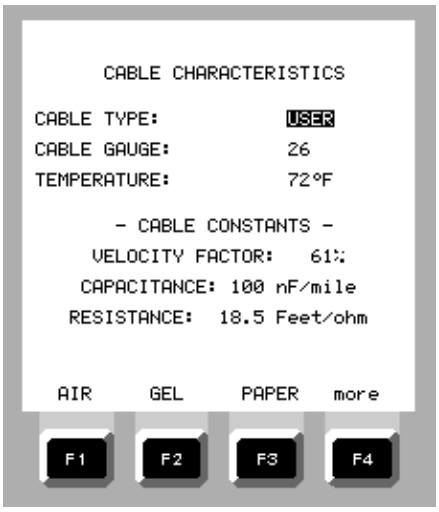


**Figure 3. CABLE CHARACTERISTICS Setup Screen**

Setting the Cable Characteristics

1. On the Main Menu, move the cursor to LINE PARAMETRICS and press ENTER.

2. On the LINE PARAMETRICS menu, move the cursor to CABLE CHARACTERISTICS and press ENTER.

3. Move the cursor to CABLE TYPE and use the F keys to enter the correct type:

   | | | | |
   |---|---|---|---|
   | F1 = AIR | F2 = GEL | F3 = PAPER | F4 = more |
   | F1 = JKT | F2 = CAT3 | F3 = CAT5 | F4 = more |
   | F1 = STATION | F2 = USER | | F4 = more |

4. Move the cursor to CABLE GAUGE and use the F keys to enter the correct gauge:

   | | | | |
   |---|---|---|---|
   | F1 = 19 | F2 = 22 | F3 = 24 | F4 = more |
   | F1 = 26 | F2 = 28 | | F4 = more |

5. Move the cursor to TEMPERATURE and press EDIT to enter the estimated cable temperature at the time of the test. Use the arrow keys and numeric keypad to enter the value.

6. IF F2 (USER) was selected in step 3, move the cursor to VELOCITY FACTOR, CAPACITANCE, and RESISTANCE and enter the values assigned by the manufacturer's documentation.

**NOTE**: When entering the figure for RESISTANCE, if the value is less than 100, be certain to enter the value preceded by a zero, ie: 099.5 Feet/ohm. When entered the test set will show 99.5 Feet/ohm.

When all steps have been completed, the test set is ready to perform parametrics testing.

### 1.3 Line Voltage Measurements

Line voltage measurements are performed to detect crossed connections, shorts due to cable damage, water intrusion, or other failures that allow voltages from adjacent conductor pairs or other sources to appear on the line being tested. When the LINE VOLTAGE test is performed, the test set will measure each voltage component detected and display their values on a single screen. The voltages measured and displayed are:

a. DC VOLTAGE
b. PEAK DC VOLTAGE
c. AC VOLTAGE
d. PEAK AC VOLTAGE

**NOTE: Whenever parametric testing is performed, the LINE VOLTAGE test should be performed before any of the remaining tests so that voltages sufficient to damage the test set or cause injury to the user may be detected.**

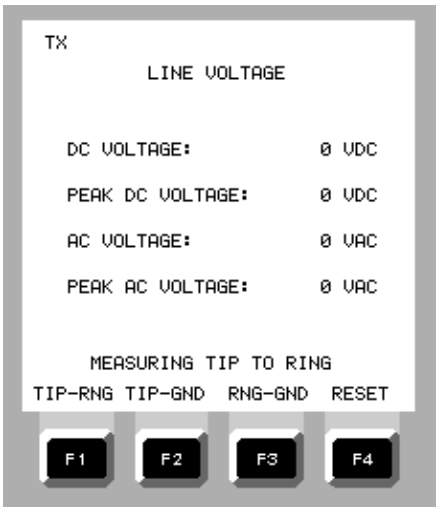


**Figure 4. Typical LINE VOLTAGE Screen**

Making a Line Voltage Measurement

1. On the MAIN MENU, move the cursor to LINE PARAMETRIC and press ENTER.

2. ON the LINE PARAMETRICS menu, move the cursor to LINE VOLTAGE and press ENTER.

3. Connect a test cable between the test set LINE 1 RX jack and the line to be tested.

4. On the LINE VOLTAGE screen, select the line conductors to be measured using the F keys.

   F1 = TIP-RNG F2 = TIP-GND F3 = RNG-GND

   The test set will display all voltage components present.

5. To clear the display between measurements, press F4 (RESET).

### 1.4 Line Analysis

The LINE ANALYSIS test is used to establish the electrical characteristics of a line under test, determine the approximate length of the cable being tested, and to detect the presence and number of load coils on the line. When the test is run on a typical cable, disconnected at both ends, the screen displays the capacitance measured between the tip and ring, tip and ground, ring and ground, and the mutual capacitance between all three. If sufficient conductivity between conductors is present, the screen will display resistance values instead. The number of load coils detected is presented at the bottom of the screen. During the test, the test set also makes DC and AC Vrms measurements. If a value of 10 volts or more is detected, the screen will display the measured results.

During a LINE ANALYSIS test, if the line being tested is open at the far end, the length measurement shown will be the total length of all copper in the path, including unknown branches that may be present. If the length shown is unreasonably high compared to the known length of the line being tested, branches in the line may be present. If a hard short is placed at the far end, the length shown will represent the accurate distance between the test set and the short. Different lengths shown when testing the line open, and then shorted, will confirm the presence of a branch in the line.

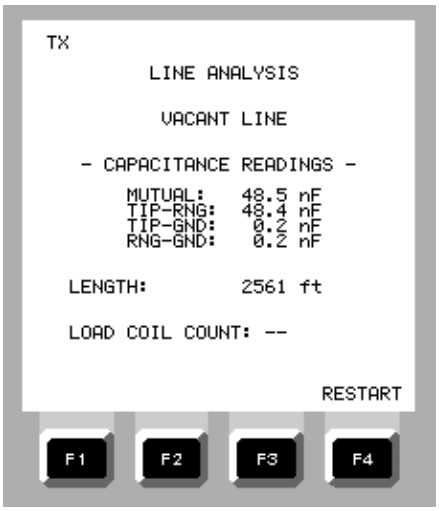


**Figure 5. Typical LINE ANALYSIS Screen**

Performing a Line Analysis

1. On the MAIN MENU, move the cursor to LINE PARAMETRIC and press ENTER.

2. (Recommended) Perform a LINE VOLTAGE measurement as described in paragraph 1.4 to confirm that voltages sufficient to cause harm to personnel or equipment are not present, then press MENU to return to the LINE PARAMETRICS menu.

3. If not already performed, run the TEST LEAD CALIBRATION and CABLE CHARACTERISTICS procedures.

4. Connect the test cable to the LINE 1 TX jack and to the conductors of the line being tested.

5. On the LINE PARAMETRICS menu, move the cursor to LINE ANALYSIS and press ENTER. The test set will perform its measurements automatically and display the results.

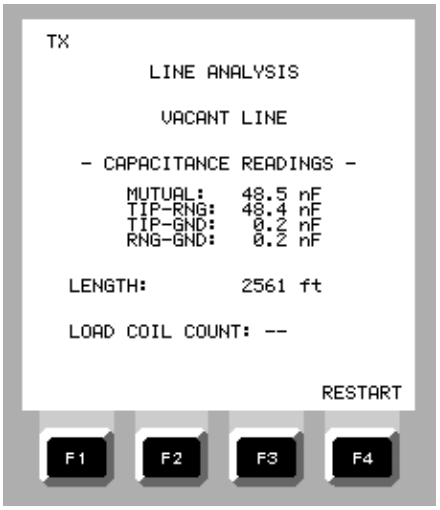


**Figure 6. LINE ANALYSIS Display Typical Vacant Line**

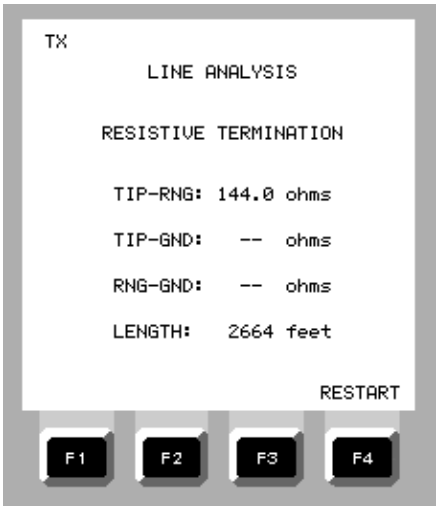


**Figure 7. LINE ANALYSIS Display Results Showing a Resistive Load**

### 1.5 Time Domain Reflectometer (TDR)

The time domain reflectometer (TDR) feature is used to detect abnormalities in the line impedance and to determine the distance from the test location to points along the transmission path where the abnormalities occur. Such abnormalities may indicate damage to the line, opens, shorts between conductors, the presence of poor quality splices, or the presence of electrical devices such as line repeaters. The effective measurement range is from 40 feet to 32,000 feet.

When TDR is selected on the LINE PARAMETRICS menu, the display presents a typical TDR screen with the horizontal axis representing distance, and the vertical axis representing impedance variations along the length of the cable. The typical trace for a normal line without connectors, splices, or electrical devices connected, is a relatively smooth flat trace beginning toward the left side of the display, with the height of the trace being determined by the impedance of the cable.

Before performing a TDR measurement, all equipment and components should be disconnected, allowing measurements to be made on the individual segments. Poor splices, cable damage, or connectors and electrical devices still connected along the pathway appear as spikes or irregularities in the normally flat trace. A movable vertical line, or marker, can be moved along the sweep trace using the left and right arrow keys until it is aligned to the leading edge of the disturbance. The position of the cursor represents the distance along the cable to the disturbance, and the measurement in feet is shown on the DISTANCE line beneath the graph. The cursor can then be moved manually to determine the distance to other irregularities.

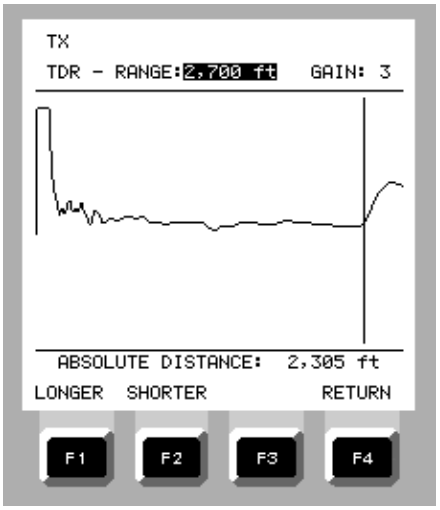


**Figure 8. Typical TDR Display**

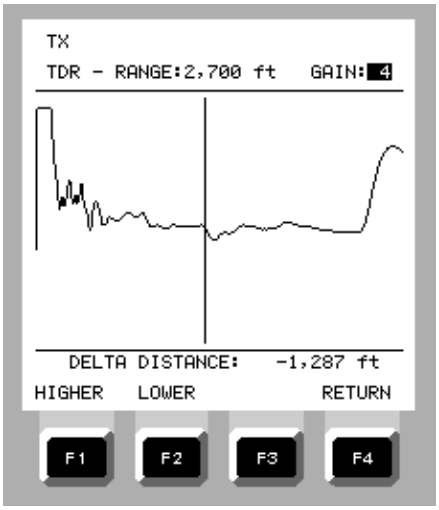


**Figure 9. TDR Delta Measurement of Same Line with Gain Increased**

Characteristics of the Trace

The TDR trace has several significant characteristics. The high, flat portion at the left edge of the trace represents the launch duration of the test pulse, which is immediately followed by an irregular or rough curve leading to the level part of the trace extending to the right edge of the screen. The irregular curve is caused by the test pulse charging the line. These two parts of the trace are referred to as the "blind area" where useful information is not presentable by the test set. The longer the range setting of the test setup, the longer the pulse duration is, generating a "blind" period. At the shortest range setting of 750 feet, the blind area is about 40 feet. At the longest range setting of 32,000 feet, the blind area is about 1,000 feet long.

After the blind area, the trace should form a relatively flat line until the pulse reaches the open connection at the far end of the line. the energy of the pulse is reflected back to the test set where the time duration is measured and the distance is computed. The open end of the line should appear as a sharp peak on the trace. A dead short at the end should appear as a sharp dip. Any other change in the impedance of the line will appear as a lesser peak or dip along the trace. Each peak or dip may represent the presence of a connector or splice along the line, physical damage due to crushing or spreading of conductor pairs, or some other feature that causes a change in the impedance of the line. The greater the irregularity of the trace, the less detectable are irregularities beyond that point. Because a TDR cannot read beyond a direct short or a complete open, or detect a smaller fault beyond a larger one, testing from both ends is recommended.

Manipulating the TDR Display

When the test set is connected to the line being tested, and TDR is first selected on the LINE PARAMETRICS menu, a trace will immediately appear on the screen. The F keys offer four ways to manipulate the TDR display or operation.

F1 = ZOOM
F2 = CURSOR
F3 = RANGE
F4 = GAIN

When F1 ( ZOOM) is selected, the F1 key changes to ZOOM IN. By pressing F1 several times, the screen will zoom in on the cursor to show more detail of the trace at that point. After zooming in, use F2 to zoom back out. F4 (RETURN) causes the display to return to the main TDR screen.

When F2 (CURSOR) is selected, the user may select between an absolute measurement from the test set to a desired point on the trace by selecting F2 (ABSOLUTE), or a difference measurement (DELTA DIFFERENCE) between the initial position of the cursor to a second point on the trace by selecting F1 (MARK). The zero point of a DELTA measurement is the starting position of the cursor. If the cursor is then moved left or right to another part of the trace, the DELTA DISTANCE will represent the distance between the starting and ending position of the cursor. F4 (RETURN) causes the display to return to the main TDR screen.

When F3 (RANGE) is selected, the user may change the distance scale of the trace. The selectable ranges are:

| | |
|---|---|
| 750 ft. | 11,000 ft. |
| 1,500 ft. | 22,000 ft. |
| 2,700 ft. | 32,000 ft. |
| 5,500 ft. | |

When TDR is first selected on the LINE PARAMETRICS menu, the range displayed will be the same as the last setting used. By pressing F3 (RANGE), the user may select F1 (LONGER) or F2 (SHORTER) to change the range of the display. The distance shown on the RANGE line at the top of the display is the distance represented by the right side of the screen and should not be confused with the DISTANCE line at the bottom of the display. F4 (RETURN) causes the display to return to the main TDR screen.

When F4 (GAIN is selected, the user can increase the vertical deflection of the trace to make less noticeable peaks and valleys easier to see. This is particularly useful to improve the detection of smaller peaks and valleys that occur before a much larger peak or valley. After F4 (GAIN) is pressed, use the F1 (HIGHER) key to increase the gain and the F2 (LOWER) key to reduce the gain. F4 (RETURN) causes the display to return to the main TDR screen.

Some Basic Rules:

- Experiment with the test set connected to good cable with known lengths, such as cable on a new spool, to become familiar with the display waveform.
- During the CABLE CHARACTERISTICS set up, enter the most accurate velocity of propagation (VOP) for the cable as possible to obtain the most accurate distance measurement.
- Always begin testing with the shortest range setting, even if the line being tested is much longer. This will improve the likelihood of detecting a fault close to the test set.
- When testing a line composed of multiple segments, isolate the fault to an individual segment and retest on that segment to improve the accuracy of the fault location.
- Test from both ends of the line or segment whenever possible. When an irregularity is detected, measuring from both ends may show the irregularity to appear at two different points along the line. Choose the midpoint between the measurements to reduce the distance error caused by an inaccurate velocity of propagation entry during setup.
- Retest the cable after each repair in case a second fault is present.

Making a Basic TDR Measurement

1. On the MAIN MENU, move the cursor to LINE PARAMETRIC and press ENTER.

2. (Recommended) Perform a LINE VOLTAGE measurement as described in paragraph 1.4 to confirm that voltages sufficient to cause harm to personnel or equipment are not present, then press MENU to return to the LINE PARAMETRICS menu.

3. If not already performed, run the TEST LEAD CALIBRATION and CABLE CHARACTERISTICS procedures. Enter the most accurate cable characteristics information possible. A correct velocity of propagation (VOP) is critical for an accurate distance measurement.

4. Connect the test cable to the LINE 1 TX jack and to the conductors of the line being tested.

5. On the LINE PARAMETRICS menu, move the cursor to TDR and press ENTER.
   The test set will perform its measurements automatically and display a trace on the screen.

6. Press F3 (RANGE) and use the F1 (LONGER) key and F2 (SHORTER) key to locate the peak on the trace representing the end of the line and stop when the peak or valley is visible as close to the right edge of the display as possible.

   If an assistant is available at the far end of the line, apply a short to the conductors and repeat the test by pressing MENU and then ENTER. The new trace should now show a dip representing the short on the line.

7. Use the right and left arrow keys to move the cursor to the midpoint between the top and bottom of the left side of the peak, if the line is open, or the dip, if it is shorted. The distance between the test set and the end of the line is shown at the bottom of the screen.

8. Move the cursor using the right and left arrow keys to make a distance measurement from the test set to any desired point along the trace.

9. Press the START key to repeat the measurement.

Manipulating the TDR Trace

The TDR trace can be manipulated using the F keys to more clearly define an irregularity in the trace that suggests a problem spot along the line.

F1 (ZOOM) Center the cursor over the irregularity in the trace to be examined, then press F1 (ZOOM). The screen will zoom in on the cursor to allow closer examination of the trace in the vicinity of the cursor. After the first zoom is performed, the F1 and F2 keys change to ZOOM-IN and ZOOM-OUT to allow further increase or decrease in the scale of the screen. Press F4 (RETURN) to return to the main TDR screen.

F2 (CURSOR) Use the F2 (CURSOR) key to change the cursor function between ABSOLUTE and MARK. In the ABSOLUTE mode, the measured distance displayed is the distance from the test set to the point on the trace being examined. When F2 (MARK) is pressed, the current position of the cursor becomes 0 feet. If the cursor is then moved to another point on the trace, the distance displayed is the distance between the first and second positions of the cursor. Press F4 (RETURN) to return to the main TDR screen.

F3 (RANGE) Use the F3 (RANGE) key to change the scale of distance shown on the screen. When F3 (RANGE) is pressed, the F1 and F2 keys change to LONGER and SHORTER. The minimum range is 750 feet. The maximum range is 32,000 feet. The current setting is displayed at the top of the screen. Press F4 (RETURN) to return to the main TDR screen.

NOTE: If a change in the range setting forces the cursor off the screen, the cursor will reappear at the highest irregularity detectable on the current trace.

F4 (GAIN) Use the F4 (GAIN) key to amplify the vertical height of irregularities seen on the screen and make them easier to see. When F4 (GAIN) is pressed, the F1 and F2 keys change to HIGHER and LOWER. Use F1 and F2 to adjust the screen as desired. Press F4 (RETURN) to return to the main TDR screen.

As an irregularity in the trace is being examined, use the four sets of controls in various combinations to improve the accuracy of the measurement. If a faint irregularity is suspected, place the cursor over it and use the RANGE feature to bring the trace to the lowest range that shows the irregularity. Use the ZOOM feature to center the irregularity and the GAIN feature to sharpen the left edge of the irregularity so its center point can be judged more accurately. Use the CURSOR feature to make distance measurements between a known point on the trace and a suspected problem.

### 1.6 Voice Frequency Services and Digital Frequency Services

The VOICE FREQUENCY SERVICES and DIGITAL SERVICES selections on the LINE PARAMETRICS menu enables three additional tests:

a. LEVEL / FREQUENCY
b. NOISE
c. SPECTRUM ANALYSIS

These three tests are used to measure line loss, noise levels on the span, and to quantify the level of noise on different portions of the frequency spectrum, and are available after the user has selected VOICE FREQUENCY SERVICES or DIGITAL SERVICES on the LINE PARAMETRICS menu. Because voice frequency circuits and digital services circuits require different bandwidths for optimum performance, the test set automatically selects the required impedance when VOICE FREQUENCY SERVICES (600 ohms) or DIGITAL SERVICES (100 ohms) is selected. It is important for the user to know the type of service the line is expected to carry in order to select the appropriate menu item. Regardless of which menu item is used to access the three tests, the procedure for the selected test is identical.

#### 1.6.1 Level / Frequency Measurements

The LEVEL / FREQUENCY measurement feature is used to perform signal loss measurements at various test frequencies in three modes of operation. When operated from the VOICE FREQUENCY SERVICES menu, the test set can be used in a SEND ONLY mode or RECEIVE ONLY mode to transmit test signals to a receiver at the far end of the line, or to measure level of a signal transmitted from a source at the far end of the line. When operated from the DIGITAL SERVICES menu, It can used in

SEND ONLY, RECEIVE ONLY and FULL mode for full duplex measurements. The selectable frequencies for the SEND ONLY mode are different in the voice frequency or digital service operation. Twenty-three frequencies are available for voice frequency testing and eleven frequencies are available for digital service testing.

TX Test Frequencies for Voice Frequency Service:

| | | |
|---|---|---|
| 104 Hz | 7000 Hz | 15 kHz |
| 304 Hz | 8000 Hz | 16 kHz |
| 404 Hz | 9000 Hz | 17 kHz |
| 1004 Hz | 10 kHz | 18 kHz |
| 1804 Hz | 11 kHz | 19 kHz |
| 2317 Hz | 12 kHz | 20 kHz |
| 2804 Hz | 13 kHz | |
| 3404 Hz | 14 kHz | |

TX Test Frequencies for Digital Service - SEND ONLY:

| | | |
|---|---|---|
| 28.8 kHz | 196 kHz | 1.2 MHz |
| 48 kHz | 398.4 kHz | 1.584 MHz |
| 72 kHz | 600 kHz | 2.04 MHz |
| 120 kHz | 772.8 kHz | |

TX Test Frequencies for Digital Service - FULL:

| | | |
|---|---|---|
| 28.8 kHz | 100.8 kHz | 275.2 kHz |
| 32 kHz | 124.8 kHz | 315.2 kHz |
| 44.8 kHz | 176 kHz | 385.6 kHz |
| 56 kHz | 196 kHz | 512 kHz |
| 60.8 kHz | 206.4 kHz | 722.8 kHz |
| 68.8 kHz | 224 kHz | |
| 88 kHz | 257.6 kHz | |

Sending a Test Signal

1. On the MAIN MENU, move the cursor to LINE PARAMETRIC and press ENTER.

2. (Recommended) Perform a LINE VOLTAGE measurement as described in paragraph 2.11.3. to confirm that voltages sufficient to cause harm to personnel or equipment are not present, then press MENU to return to the LINE PARAMETRICS menu.

3. If not already performed, run the TEST LEAD CALIBRATION and CABLE CHARACTERISTICS procedures.

4. On the LINE PARAMETRICS menu, move the cursor to VOICE FREQUENCY SERVICES or DIGITAL SERVICES as required and press ENTER.

5. On the VOICE or DIGITAL SERVICES menu, move the cursor to LEVEL / FREQUENCY and press ENTER.

6. On the LEVEL / FREQUENCY menu, press F2 (SEND). The display will show MODE: SEND ONLY.

7. Move the cursor to highlight the SEND TX frequency and press the EDIT key to view the SEND FREQUENCY menu. Use the up and down arrows to move the cursor to the desired test frequency and press ENTER.

8. Move the cursor to the SEND TX level and press EDIT. Use the arrow keys to set the desired transmit level, adjustable in .1 dB increments from -10 dBm to +10 dBm, then press ENTER.

9. Connect the test cord between the test set to the LINE 1 TX jack and the line to be tested.

   The line is ready to be tested at the selected signal frequency and level by a second instrument at the far end, or by a single instrument at the near end if the line is looped back at the far end.

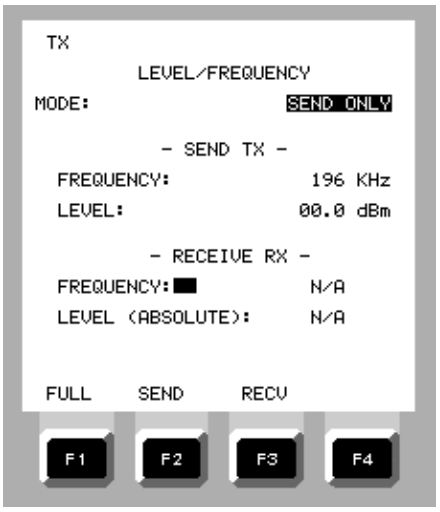


**Figure 10. LEVEL / FREQUENCY Measurement SEND Mode**

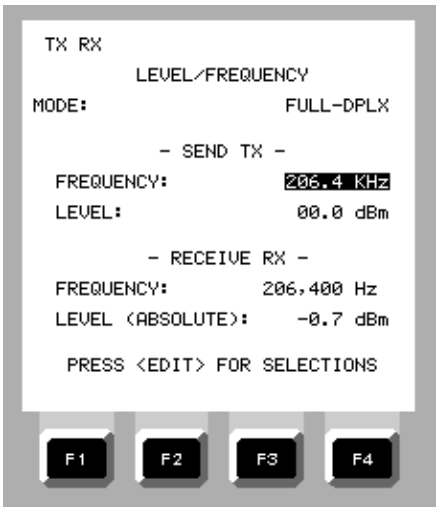


**Figure 11. LEVEL / FREQUENCY Measurement FULL Mode**

Measuring the Frequency and Level of a Received Test Signal

1. On the MAIN MENU, move the cursor to LINE PARAMETRIC and press ENTER.

2. (Recommended) Perform a LINE VOLTAGE measurement as described in paragraph 1.4 to confirm that voltages sufficient to cause harm to personnel or equipment are not present, then press MENU to return to the LINE PARAMETRICS menu.

3. If not already performed, run the TEST LEAD CALIBRATION and CABLE CHARACTERISTICS procedures.

4. On the LINE PARAMETRICS menu, move the cursor to VOICE FREQUENCY SERVICES or DIGITAL SERVICES as required and press ENTER.

5. With the test cable connected between the test set LINE 1 RX jack and the line to be tested, move the cursor to LEVEL / FREQUENCY and press ENTER.

6. On the LEVEL / FREQUENCY menu, press F3 (RECV). The display will show MODE: RECV ONLY.

The frequency of a signal present on the line will be shown on the bottom portion of the screen under the line - RECEIVE RX -.

The signal level will be displayed on the next line as an (ABSOLUTE) or (RELATIVE) measurement.

Making an Absolute Level Measurement

Absolute level measurements are measurements that compare the signal or noise level to a reference of 1 milliwatt, and are displayed in units of dBm. These measurements may be used to insure the input or output level of a device is sufficient to meet operating specifications. Measurements may be made at different points along a line and may not require knowledge of levels at any other point. Each measurement is independent.

7. With the test set connected and set up as in steps 1 through 6, press the F4 key once or twice until LEVEL (ABSOLUTE) appears. Within five to six seconds, the LEVEL line will present the measurement in dBM.

Making a Relative Level Measurement

Relative level measurements are measurements that compare a signal level on one part of the line to a signal level at another location, and are displayed in units of dB. A typical measurement would be a loss measurement comparing the signal level at the output of one device to the level of the signal when it reaches the next device in the circuit.

8. With the tester set up as in steps 1 through 6, connect the test cable to the point along the line that will be used as the reference point, and press the F4 key once or twice until the LEVEL line reads LEVEL (RELATIVE). The level shown will change to 0.0 dB. This is now the reference level.

9. Move the test set to the next test point without making any changes to the test set. Within a few seconds of making connection, the test set will display the signal level in dB.

### 1.6.2 Noise Measurements

The NOISE MEASUREMENT feature provides a simple, rapid indication of line noise levels using eight different measurement types divided into two groups dependent upon the type of line service selected on the LINE PARAMETRICS menu. Each group of tests is performed automatically, providing an indication of general noise levels present as well as noise is specific frequency bands most likely to interfere with particular circuit formats.

Noise Measurements for Voice Frequency Service

| | |
|---|---|
| C-Message | D-Filter |
| C-Message / Notch | Notch |

C-MESSAGE - Readings greater than 20 dBrnc may indicate presence of electromagnetically induced noise such as cross-talk or power line harmonics.

C-MESSAGE / NOTCH - Requires a 1010 Hz signal be applied to the line, generally from the far end. Readings greater than 20 dBrnc may indicate signal distortion due to presence of faulty equipment attached to line such as lightening protectors and ringers.

D-FILTER - Readings greater than 20 dBrnc may indicate presence of induced lower frequency noise that may affect operation of devices such as analog modems and fax machines.

NOTCH - Requires a 1010 Hz signal be applied to the line, generally the far end. Readings greater than 30 dBrnc indicate distortion caused by devices attached to the line.

Noise Measurements for Digital Service Lines

| | |
|---|---|
| 772 KHz Flat | F-Filter (HDSL) |
| E-Filter (ISDN) | G-Filter (ADSL) |

772 kHz FLAT - This reading represents the amount of noise measured at the 772 kHz point, critical during an idle condition (all 1's) when the highest pulse density would be encountered on the line.

E-FILTER (ISDN) - Reading indicates the amount of noise in the ISDN frequency band of 1000 Hz to 50kHz

F-FILTER (HDSL) - Reading indicates the amount of noise measured in the HDSL bandwidth of 4.9 kHz to 245 kHz.

G-FILTER (ADSL) - Reading indicates the noise measured in the ADSL bandwidth of 20 kHz to 1.1 MHz.

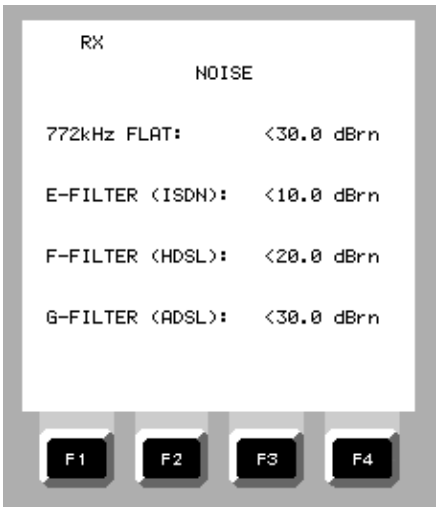


**Figure 12. Typical NOISE Measurement Display**

Performing Noise Measurement Tests

1. On the MAIN MENU, move the cursor to LINE PARAMETRIC and press ENTER.

2. (Recommended) Perform a LINE VOLTAGE measurement as described in paragraph 1.4 to confirm that voltages sufficient to cause harm to personnel or equipment are not present, then press MENU to return to the LINE PARAMETRICS menu.
3. If not already performed, run the TEST LEAD CALIBRATION and CABLE CHARACTERISTICS procedures.

4. On the LINE PARAMETRICS menu, move the cursor to VOICE FREQUENCY SERVICES or DIGITAL SERVICES as required and press ENTER.

5. With the test cable connected between the LINE 1 RX jack and the line to be tested, move the curser to NOISE and press ENTER. The test set will measure the received signal level and display the result within a few seconds of the time of connection.

### 1.6.3 Spectrum Analysis

The SPECTRUM ANALYSIS feature is used to detect the presence of noise on the span, to determine the portions of the frequency spectrum of the line bandwidth most affected, and to provide an indication of the level of interference at specific points within the frequency band. During a SPECTRUM ANALYSIS operation, the test set display presents a graph with the horizontal axis representing the frequency spectrum from 0 to 25 kHz (VOICE FREQUENCY SERVICES) or 0 to 2.5 MHz (DIGITAL SERVICES), and the vertical axis representing the power level in ten dB increments. When a test is initiated, narrow peaks representing noise appear along the frequency axis. The two highest peaks are marked by triangular pointers, the black representing the highest level and the plain one representing the second highest. The noise level in dBm for each pointer is shown immediately below the graph. Figure 13 illustrates a typical spectrum analysis display.

The SPECTRUM ANALYSIS feature is available under the menu titles VOICE FREQUENCY SERVICES and DIGITAL SERVICES. If the tests are to be performed on lines set up for voice frequency service, the test set interface impedance is set to 600 ohms automatically when VOICE FREQUENCY SERVICES is selected. If testing is to be performed on lines set up for digital services, the test set interface impedance is changed to 100 ohms when DIGITAL SERVICES is selected.

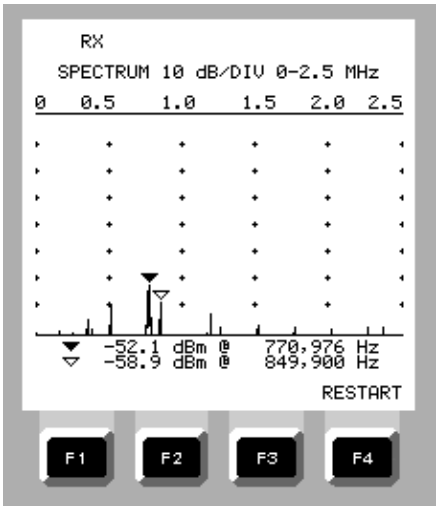


**Figure 2-13. Typical Spectrum Analysis Display**

Performing a Spectrum Analysis

1. On the MAIN MENU, move the cursor to LINE PARAMETRIC and press ENTER.

2. (Recommended) Perform a LINE VOLTAGE measurement as described in paragraph 1.4 to confirm that voltages sufficient to cause harm to personnel or equipment are not present, then press MENU to return to the LINE PARAMETRICS menu.

3. If not already performed, run the TEST LEAD CALIBRATION and CABLE CHARACTERISTICS procedures.

4. On the LINE PARAMETRICS menu, move the cursor to VOICE FREQUENCY SERVICES or DIGITAL SERVICES as required and press ENTER.

5. With the test cable connected between the LINE 1 RX jack and the line to be tested, move the curser to SPECTRUM ANALYSIS and press ENTER. The test set will detect and display spikes representing noise peaks on the line.

6. Press F4 (RESTART) to begin a new test. If suspected noise sources can be turned off or if shielding can be improved, re-run the test to determine the effectiveness of the action.

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