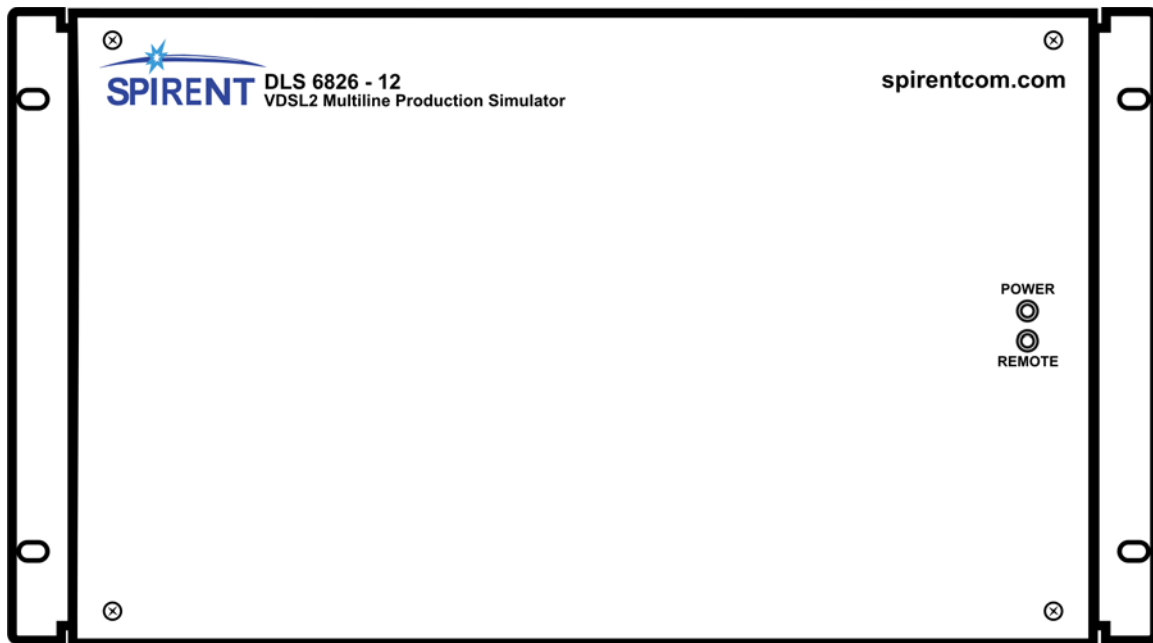




DLS 6826 Operating Manual

Multiline Wireline Simulator



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71-000103 V1.0



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1. Introduction

1.1 About the DLS 6826 Multiline Wireline Simulator

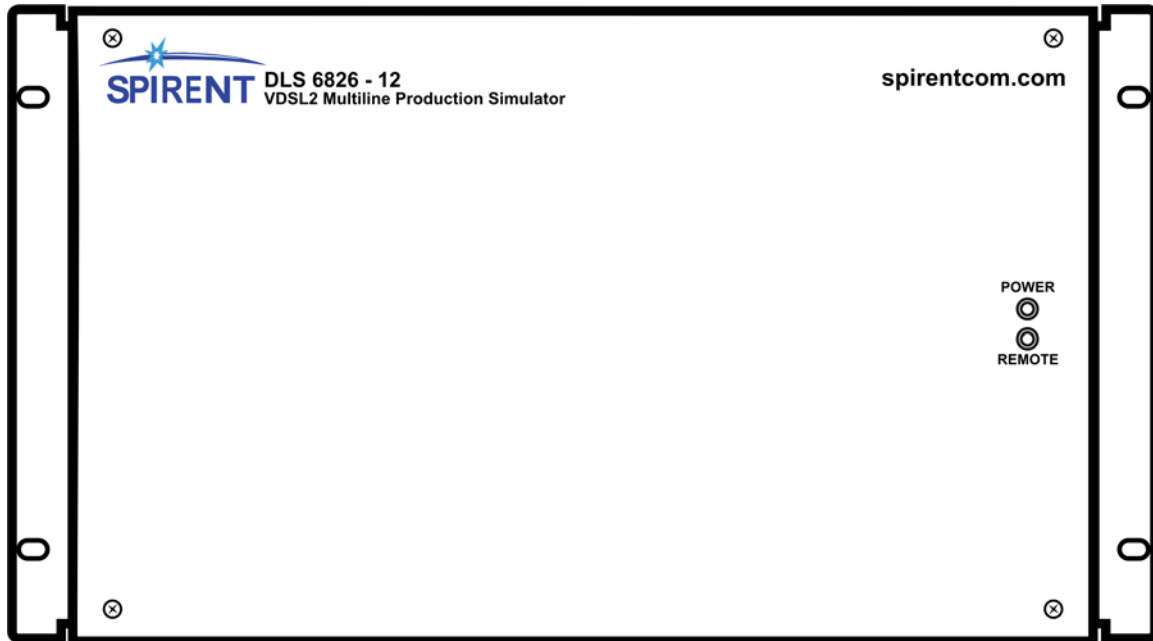


Figure 1-1 DLS 6826 Multiline Wireline Simulator

Thank you for choosing the Spirent Communications DLS 6826 Multiline Wireline Simulator.

The DLS 6826 Multiline Wireline Simulator has been designed to meet the testing needs of very high volume manufacturers of access products by emulating the insertion and return loss of a twisted copper cable, also called a wireline.

With specifications derived from North American (ANSI) standards and support for bandwidths from DC to 30 MHz, the DLS 6826 provides a complete manufacturing testing platform for most DSL technologies including VDSL2/VDSL1/ADSL2++/ADSL2+/ADSL2/ADSL and SHDSL.

Available in 8- or 12-port configurations, the 6U rack-mounted chassis can simulate loops of up to 15,000 feet. Controlled remotely via an RS-232 port, these simulated wireline lengths are fully bi-directional.

Spirent Communications uses a passive components design to provide the greatest degree of accuracy and repeatability between tests.

There are two methods for controlling the wireline simulator: you can use the DLS 6800 Control Application which ships with the DLS 6826, or you can take control of your testing and benefit from the flexibility of the DLS 1200 ScriptCenter Library tool to write custom, script-based software to operate your DLS test system.

The DLS 6800 Control Application configures and controls the DLS 6826 Multiline Wireline Simulator remotely through the RS-232 interface. This application runs on any computer running a Windows™ NT 4.0 (with service pack 4.0 and up), 2000 or XP operating system.

One or more wireline simulators can be integrated into a larger test system, limited only by the number of COM ports available on the controlling computer. The configuration software that ships with the DLS 6826 can access up to 16 com ports.

Figure 1-2 illustrates an example of a typical test setup using the DLS 6826 Multiline Wireline Simulator.

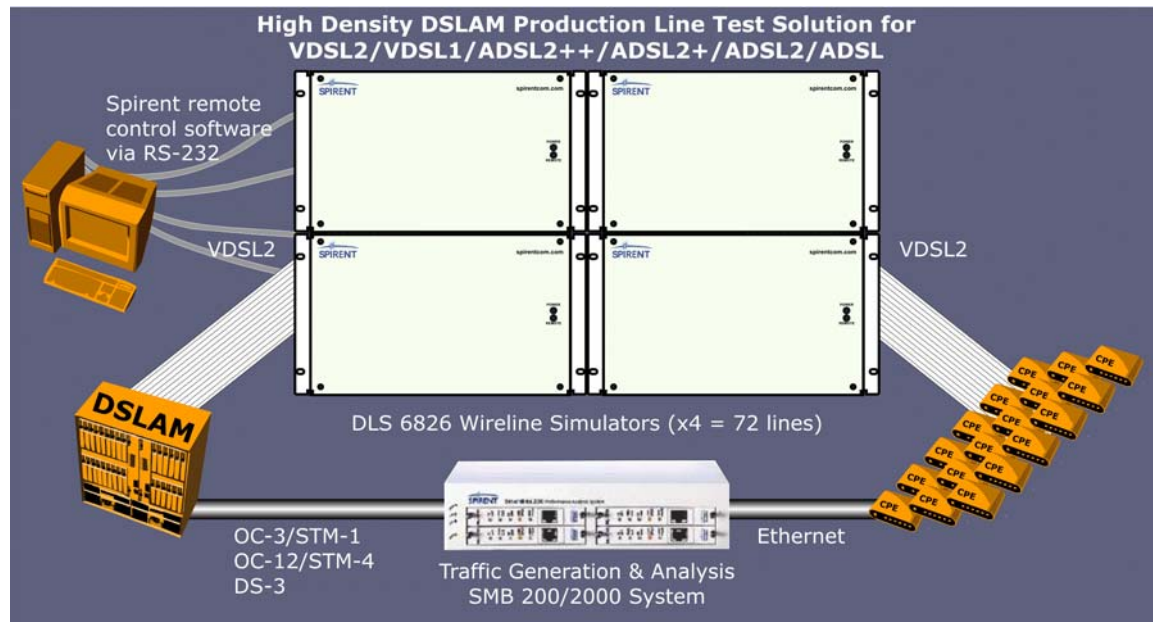


Figure 1-2 Example Test System Setup

1.2 About this Manual

Read *Chapter 2 "Getting Started"* thoroughly before powering up the DLS 6826 Multiline Wireline Simulator.

This manual provides information about the various aspects of the DLS 6826 Multiline Wireline Simulator, such as loop configurations, remote control, warranty, specifications and contact information.

The DLS 6800 Control Application that ships with the DLS 6826 gives you full control over the characteristics of each DLS 6826 simulated loop.

We recommend that you develop your own scripts based on the type of automated testing that best suits your products. The common and device specific commands sets used to control the DLS 6826 are fully explained in *Chapter 4 "Remote Control"*.

If you have any questions after reading this manual, please contact your Spirent Communications sales representative or a member of the Customer Service team. Please find contact information in *Chapter 7 "Customer Support"* of this manual.



2. Getting Started

This chapter provides basic instructions on the setup of a DLS 6826 Multiline Wireline Simulator.

2.1 Receiving and Unpacking the Unit

Each DLS 6826 chassis is shipped in a reinforced shipping container. Please keep this container in case you need to ship the wireline simulator to another location or for repair. The DLS 6826 system contains the following:

- DLS 6826 chassis
- 1 AC to DC wall plug-in adapter
- 1 RS-232C inter-connection cable
- 1 DLS 6826 CD (software and related documents)
- 1 Operating Manual on CD

Check that you have received all the items on the list and report any discrepancies to Spirent Communications. See *Chapter 9 "Shipping The Unit"* for information.

2.2 Setup Overview

To test:

- 1) Connect the power cord on the back of the DLS 6826 chassis and switch the power on. **Important:** see instructions in *Section 2.6 "Power-up Procedure" on page 2-4*.
- 2) Connect the serial cable from the control computer to the back of the DLS 6826.
- 3) Connect digital subscriber line access multiplexer (DSLAM) equipment to the "Input" ports at the back of the DLS 6826.
- 4) Connect customer premise equipment (CPE) equipment to the corresponding "Output" ports at the back of the DLS 6826.
- 5) Start the DLS 6800 Control Application.
- 6) Connect the DLS 6800 Control Application to the DLS 6826. From the list of available serial ports on your computer (listed in the "Interfaces and Identification" panel of the main window), choose the one attached to the DLS 6826 you want to control. Click the **Start Online** button. This will open the DLS 6826 control window, allowing you to adjust the length of each wire line.
- 7) Adjust the line lengths for the test loops.
- 8) Begin testing.

2.3 Cabling Requirements

We recommend CAT5 UTP type cables.

Cables between the loop simulator and the DSLAM and CPE must be 6 feet or shorter to minimize noise coupling. Test measurements will not be affected when using such short cable lengths.

**WARNING**

When the noise levels are greater than -140 dBm/Hz, they will limit the VDSL2 performance and influence the test results.

Noise-generating devices, such as computer screens, switching power supplies (internal or external) and other electronic equipment must either be placed at least 10 feet from the test setup, or switched off.

The interconnection wiring for the “Output” and “Input” Ports should be physically separated as crosstalk can occur between cabling. Configure the cables so that they are not touching and the cables connected to the DSLAM and CPE are separated as much as possible (at least 15 cm).

2.4 Front Panel Indicators

The DLS 6826 chassis has two LEDs which indicate the power and remote status. The **Power LED** indicates when the unit is on, and doubles as an error status indicator. The **Remote LED** indicates when the DLS 6826 has received a command from the control computer.

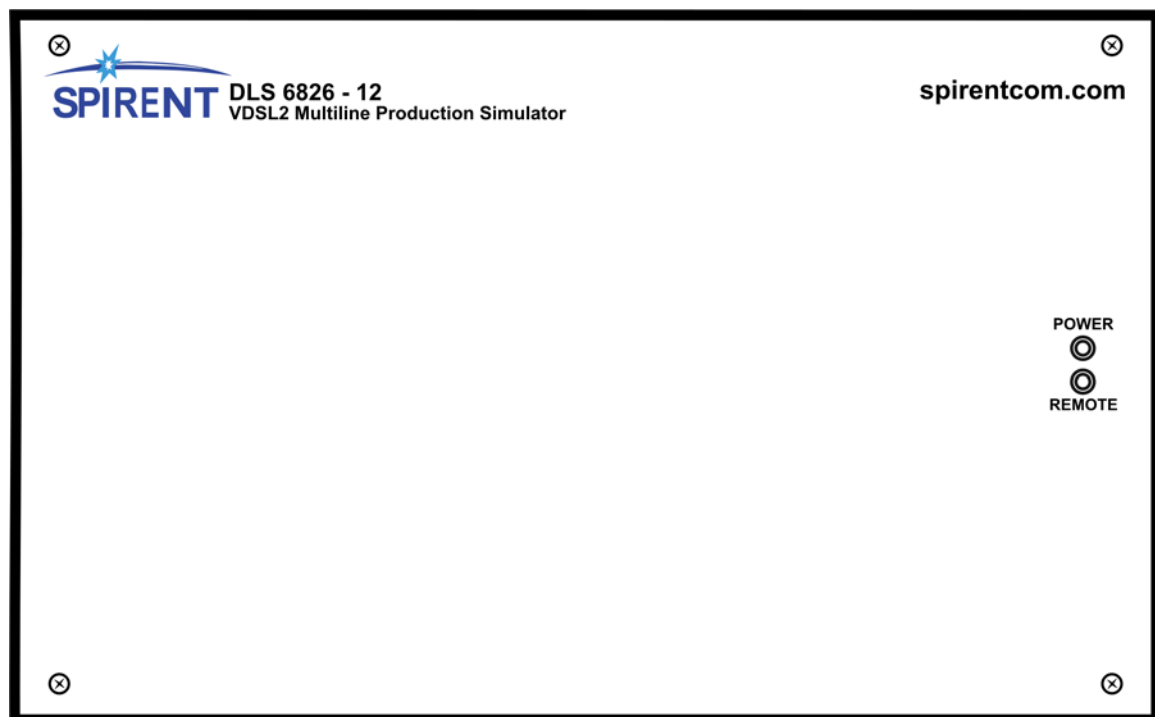


Figure 2-1 DLS 6826 Front Panel

2.4.1 Reading Remote and Power Status

The POWER LED turns green when the power is turned on.

If the DLS 6826 fails the self-test, the power LED blinks red.

If the DLS 6826 detects an internal error, the power LED turns solid red.

The REMOTE LED is off after a power-up or a reset. When the unit receives the first remote message, the REMOTE LED turns green if the command is valid or turns red if an error is detected. An invalid command or an out-of-range value will cause an error.



The REMOTE LED stays red until the error flags are cleared. When the REMOTE LED is red, the unit can still communicate as normal, but you should investigate why the error occurred. *Chapter 4 "Remote Control"* shows examples on how to read the ESR register, clear the error flags and make the REMOTE LED green once error conditions have been resolved.

2.5 Rear Panel Connections

All connectors for the DLS 6826 are located on the rear panel (see *Figure 2-2 "DLS 6826 Back Panel"*)

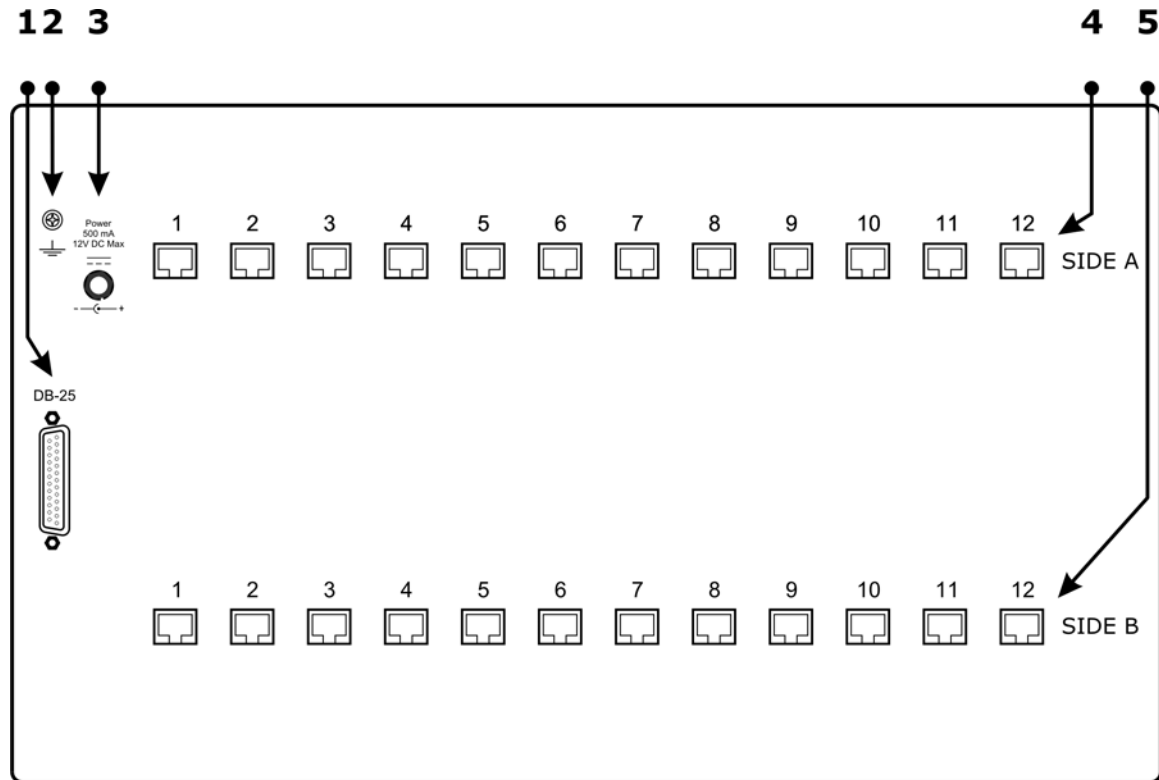


Figure 2-2 DLS 6826 Back Panel

- 1) **RS-232 (DCE) Serial Connector:** Connect to a computer for remote control.
- 2) **Ground Connection:** Connect to earth ground (optional).
- 3) **Power Input:** Connect to the AC-DC wall adapter power source.
- 4) **RJ - 45 SIDE A:** (8 or 12, depending on model) Connect to DUT (usually CPE devices).
- 5) **RJ - 45 SIDE B:** (8 or 12, depending on model) Connect to DUT (usually a DSLAM).

2.5.1 Connecting the DLS 6826 to a DUT

In a typical setup the customer site equipment is connected to a "Side A" port, and the Telephone Exchange (Central Office) equipment is connected to the corresponding "Side B" port of the DLS 6826 Multiline Wireline Simulator. The pinout of the RJ-45 female connector is shown in *Figure 2-3*.

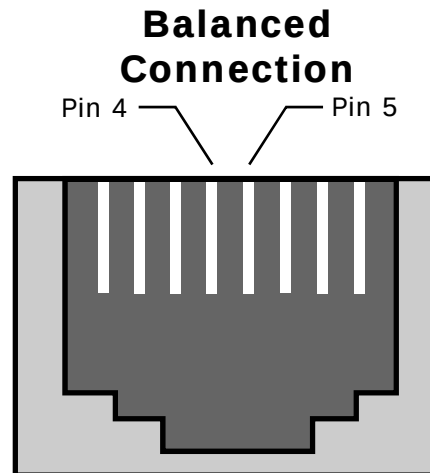


Figure 2-3 RJ-45 Female Connector

The two center pins of the RJ-45 connector (pin 4, Tip; and pin 5, Ring) carry the signal.

These connections are balanced.

NOTE

We recommend that these leads be shorter than 15 cm if you are using frequencies up to 30 MHz. It is possible to use longer leads as the frequency decreases.

WARNING

The maximum input to any DLS 6826 port must not exceed +/-200 V or 100 mA between Tip and Ring. Exceeding these limits could damage the unit.

2.6 Power-up Procedure

The following procedure *must* be followed when connecting and powering up the DLS 6826:

- Step 1:** If the power supply has a switch, turn it off.
- Step 2:** Connect the DC power cord from the AC/DC power adapter to the *Power Input* connector at the back of the DLS 6826.
- Step 3:** Connect the AC power cord (provided) from the AC/DC power adapter to an AC outlet.
- Step 4:** If the AC-DC power adapter has power switch, turn it on.

The power LED turns on when power is supplied to the DLS 6826.

Always power-up and power-down the DLS 6826 at the AC side of the power adapter, never the DC side.

WARNING

Do not plug or unplug the DC input while the Power Supply is connected to a live AC outlet.

**WARNING**

Before operating the unit, please refer to *Section 11.1.5 "Connections to a Power Supply"*, to ensure that the correct AC/DC adapter is used.

NOTE

Please refer to *Chapter 11 "Safety"* for more details.

2.7 DLS 6826 Remote Control

The DLS 6826 Multiline Wireline Simulator is configured through its RS-232 serial port. The reach (length) of each simulated wireline can be adjusted remotely using configuration software.

You can use the included DLS 6800 Control Application to configure the DLS 6826; or you can develop your own custom configuration software using the DLS 6826 command set. The command set is covered in *Chapter 4 "Remote Control"*.

2.7.1 Connecting the Computer via the Serial Port

Connect one end of an RS-232 serial cable to the RS-232 connector located on the back panel of the DLS 6826 chassis and the other end to a serial COM port connector on the computer.

See *Section 3.2.1 "Connect to a Chassis" on page 3-2* for additional information about COM ports.





3. The DLS 6800 Control Application

3.1 Control Application

The DLS 6800 Control Application provides you with an interactive interface to control the DLS 6826.

NOTE

This application runs on any computer running a Windows™ NT 4.0 (with service pack 4.0 and up), 2000 or XP operating system.

3.1.1 Installation

To install the software, insert the installation CD into the CD drive of the control computer. The installation program normally runs automatically.

If the installation program does not start automatically, run SETUP.EXE from the installation CD.

Follow the on-screen instructions to complete the installation process.

3.1.2 Starting the DLS 6800 Control Application

To start the DLS 6800 Control Application, click the **Start** button in Windows, then select **Programs >> Spirent Communications >> DLS 6800**. The program starts and the communications window appears (*Figure 3-1*).

3.2 Communications Interface Selection

This section discusses how to connect the control application to a chassis, and how to correlate a control application session with a chassis.



3.2.1 Connect to a Chassis

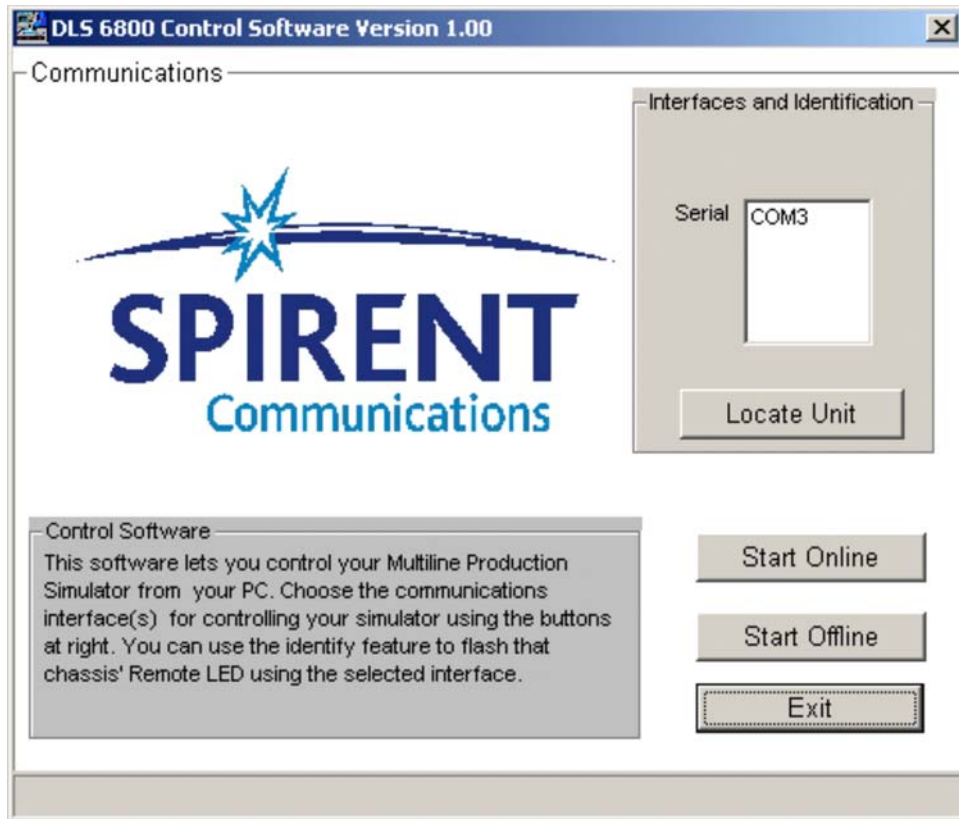


Figure 3-1 DLS 6800 Control Application – Communications window

The DLS 6800 Control Application controls a single DLS 6826 chassis.

To control several chassis from the same computer, launch a separate control application session for each chassis.

The DLS 6800 Control Application supports up to 16 COM ports. It will automatically detect all serial ports available on the control computer between COM1 and COM16. Only available COM ports will be listed in the “Interfaces and Identification” panel of the main DLS 6800 Control Application window. COM ports that exist on the control PC but are already open will not appear in this list.

Select the serial port connected to the chassis you want to control from the *Interfaces and Identification* panel.

NOTE

The *Interfaces and Identification* panel lists available COM ports only. If you wish to run multiple sessions of the DLS 6800 Control Application, you must launch all control application sessions first, then go online with the DLS 6826 units in each session.

3.2.2 Locate Unit

To correlate which DLS 6826 chassis is attached to which COM port, select a COM port from the *Interfaces and Identification* panel, then click the **Locate Unit** button. The



DLS 6800 Control Application will then attempt to flash the Remote LED on the DLS 6826 unit using the selected COM port. During the identification, the **Stop Identification** button will appear, and all the other buttons will be disabled until the **Stop Identification** button is clicked.

3.2.3 Start Online

Once the correct COM Port is selected, click the **Start Online** button to connect the program to the DLS 6826 chassis.

3.2.4 Start Offline

Click the **Start Offline** button to start the program without controlling a DLS 6800 unit. This is useful for viewing the features of the program where a DLS 6800 unit is not available.

3.3 Main Editing Grid

When the program starts, unless Start Offline is selected, the DLS 6800 Control Application reads the DLS 6826 on the specified interfaces to find out which lines are installed in the unit. The software will determine the gauge, current length, minimum, maximum, and increment lengths, and present the information on the screen.

The appearance of the Main Editing Grid will depend on what lines are installed in your DLS 6826 unit. The range and the gauge of the line may be different from that shown in the diagram.

3.3.1 Controlling the Line

You can adjust the length of a wireline by clicking the spin control. The length will be adjusted by the appropriate increment.

You can also type directly into a **length** field. The number entered will be adjusted to the nearest valid increment and reach for the DLS 6826.

3.3.2 Groups

Use the grouping feature to set many lines at once. Select the lines to be modified and then adjust the length in the *Control Group* area of the window.

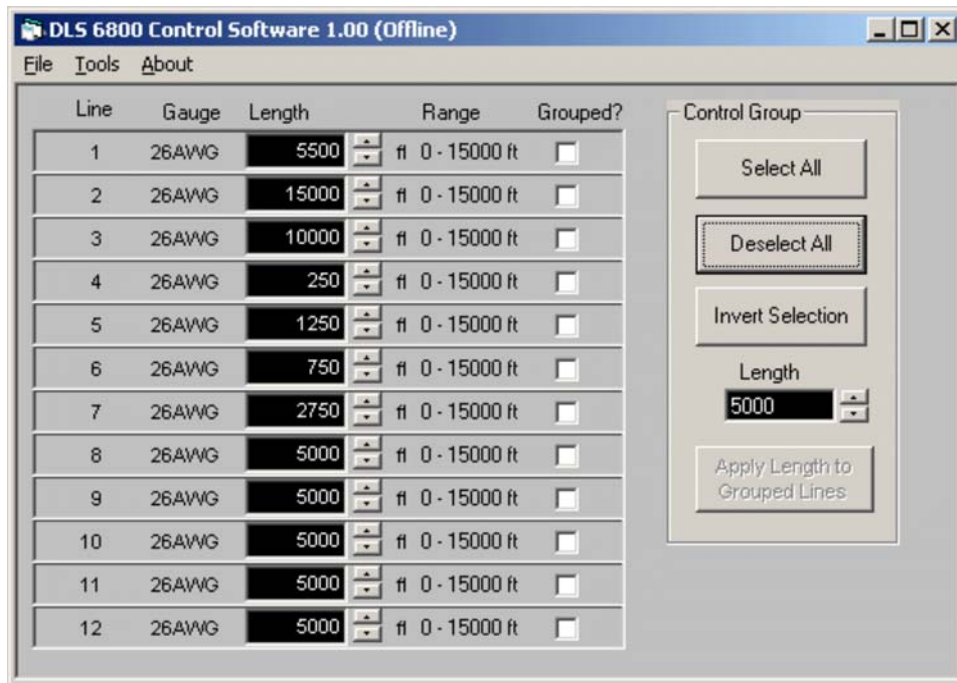


Figure 3-2 DLS 6800 Control Application main editing grid

To include a line in the group adjustment, select the checkbox next to it in the **Grouped** column.

To select all wirelines, click the **Select All** button.

To clear all wirelines, click the **Deselect All** button.

To reverse the group selection, click the **Invert Selection** button.

Once the lines are selected, adjustments made to the group **Length** field will adjust all selected wirelines.

NOTE

When changing length settings for a group, changes are made when you click the **Apply Length to Grouped Lines** button.

This differs from changing individual length settings. An individual wireline length is applied as soon as the length value is changed.

3.4 Menu Selections

3.4.1 File

Load - Retrieves a previously stored file of DLS 6826 settings from disk.

Save - Stores the current settings of the DLS 6826 to a file on disk

Exit - Shuts down the program



3.4.2 Tools

3.4.2.1 Identify Command

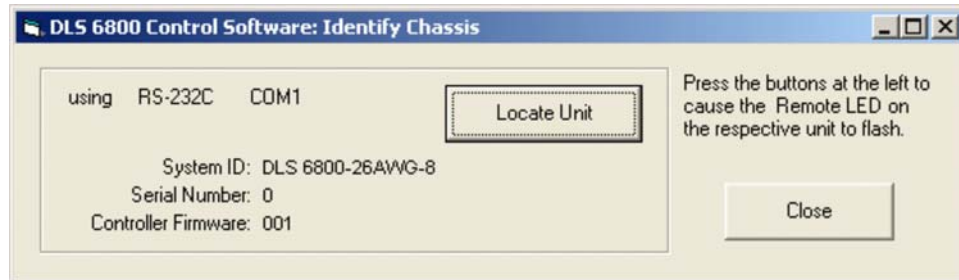


Figure 3-3 Locate Unit dialogue box

The **Identify** command opens the *Identify Chassis* dialogue box (Figure 3-3). This is useful when running multiple sessions of the control application to control several DLS 6826 chassis.

To flash the **Remote** LED on the chassis connected to this control application instance, click the **Locate Unit** button. The **Stop Identification** button appears.

To stop the LED from flashing, and allow you to continue with other operations, click the **Stop Identification** button (not shown - it replaces the **Locate Unit** button when active).

3.4.3 About

Shows information about the program such as version number.

NOTE

When contacting Spirent Support, provide them with the program identification details displayed by this dialogue box.





4. Remote Control

The DLS 6826 is controlled via the RS-232 (serial) interface, allowing the integration of the DLS 6826 into a larger test system. The DLS 6826 remote control is designed with several standards in mind:

- The Common Commands follow IEEE 488.2.
- The Device Dependent Commands (see *Section 4.4 "Device Dependent Commands"*) are based upon the Standard Commands for Programmable Interfaces (SCPI).
- The serial port physical interface follows the EIA RS-232 standard.

4.1 RS-232 Serial Interface

The DLS 6826 uses a female DB-25 or an RJ-45 connector, and is configured as a DCE device. It can therefore be connected directly to a PC serial port.

The RS-232 standard is equivalent to the European V.24/V.28 standards. In this manual we use the term RS-232 to refer to both of these two standards.

NOTE

The words "serial interface" and "COMn" (where "n" is a number) to refer to the RS-232 interface.

NOTE

The DLS 6826 cannot use the parallel port of a computer (the female connector).

To use the RS-232 interface, connect your computer to the DLS 6826 and set the computer to 9600 bps baud rate, no parity, 8 data bits per character, 1 stop bit and RTS/CTS hardware flow control.

NOTE

Do NOT use a null modem with a computer that has a standard COM port configured as a DTE.

The DLS 6826 stops transmitting data when the RTS line is low, and restarts when the RTS line is high. The DLS 6826 lowers the CTS and the DSR lines when it cannot accept data, and raises them when it can. Note that the RTS line is not the usual "Request To Send" as defined by the RS-232 standard. You can leave the RTS line set, and use only the CTS line.

Most serial port communication programs can be used to control the DLS 6826. Any ASCII terminal emulator can be used. Configure it to add linefeeds and echo typed characters locally.

4.1.1 Message Terminators

Messages sent to the DLS 6826 through the serial interface MUST be terminated with the line feed character (ASCII <LF>, decimal 10, hex 0A). To ensure that no characters are left in the receive buffer of the DLS 6826 from a previous incomplete command, you can send the line feed character by itself before sending new commands.

Messages from the DLS 6826 are always terminated with a Line Feed character.



4.1.2 Example Using the Serial Port

To change the length of the line to 4000 ft, do the following:

Step 1: transmit ":SET:CHAN:LINE 1, 4000 ft"

Step 2: check that the REMOTE LED is still green; if it turns red, see Section Chapter 5 "Troubleshooting".

To send and receive messages with error checking follow these steps:

Step 1: set all relevant enable bits (only done once)

Step 2: send the message

Step 3: read the answer until you receive LF (decimal 10, hex 0A)

Step 4: check if an error occurred with the command *ESR?

For example, to get the identification message with the RS-232 interface, do the following:

- | | |
|-----------------------|--|
| 1) transmit "*ESE 60" | enable all the error bits (needed only once) |
| 2) transmit "*IDN?" | query the identification message |
| 3) read the answer | the messages are always terminated with LF |
| 4) transmit "*ESR?" | check if an error occurred |
| 5) read the answer. | If not 0, an error has occurred. See Event Status Register (ESR) Section for description of the error(s) |

4.2 Data Formats

The DLS 6826 adheres to the IEEE 488.2 principle of Forgiving Listening and Precise Talking.

The data formats supported by the DLS 6826 are:

- Talking:**
- a) <NR1> Numeric Response Data – Integer
 - b) Arbitrary ASCII Response Data

<NR1> is an implicit point representation of an integer.

Arbitrary ASCII Response Data is a generic character string without any delimiting characters. It is usually used to send data in response to a query, such as with the *IDN? command (see Section Section 4.5 "Common Command Set").

- Listening:** <NRf> Decimal Numeric Program Data

<NRf> is the Flexible Numeric Representation defined in the IEEE 488.2 standard which can represent just about any number.

The DLS 6826 can accept data in the <NRf> format, which means that numbers can be made of a combination of digits, signs, decimal point, exponent, multiplier, unit and spaces. For example, any of the following is a valid representation for 4000 feet: 4kft, 4.0kft, 4000, .04e2k, 0.4 e4 ft, +4000. If a unit (i.e. ft, m, bps, etc.) is appended to a number, that unit must be valid and not abbreviated. Note that the period separates the decimal part of a number.

4.3 Command Syntax

The DLS 6826 adheres to the IEEE 488.2 format for command syntax. As with the Data Format, the principle is Forgiving Listening and Precise Talking.



Commands may take one of two forms: either a Device Dependent Command starting with a colon (Section *Section 4.3 "Command Syntax"*) or a Common Command starting with a star (Section *Section 4.5 "Common Command Set"*). Each type may be preceded by one or more spaces, and each must have one or more spaces between its mnemonic and the data associated with it.

Common commands are preceded by the character "*". Device Dependent commands are preceded by a colon, with a colon separating each level of the command. Commands may be either in upper or lower case. Multiple commands may be concatenated by separating each command by semi-colons.

The following are some examples:

```
*RST
*RST;*IDN;:SET:CHANNEL:LINE 1, 4000 ft
*ESE 45; *SRE 16
```

Messages to the DLS 6826 must be terminated with a Line Feed character (ASCII <LF>, decimal 10, hex 0A). Messages from the DLS 6826 are always terminated with a Line Feed character.

As defined in the SCPI specifications, a Device Dependent Command may be sent in its short form or long form, in upper or lower case. The following commands are therefore identical in operation:

```
:SET:CHANNEL:LINE 1, 4000 ft
:SET:CHAN:LINE 1, 4000 ft
```

Queries of the system follow the same format as the commands, except that the data normally associated with a command is replaced by a question mark "?". Following receipt of such a command, the DLS 6826 will place the appropriate response in the output queue, where the controller can read it. Examples are:

```
*IDN?
*ESE?;*SRE?
:SET:CHAN:LINE?
```

When a command does not begin with a colon, the DLS 6826 assumes that the command is at the same level as the previous command. For example, to set a line one does NOT need to specify ":SYS:CAL" each time, as in:

```
:SYS:CAL:Date Dec 2001;Expiry Dec 2002
```

This shorter form is valid because both commands are at the same level.

4.4 Device Dependent Commands

As recommended by the SCPI consortium and to simplify programming of the various Access Emulation Division simulators, the DLS 6826 uses the following tree structure:

```
:SETting
  :CHANnel
    :LINE <Line Number>,<Length>
  :SYStem
    :CALibration
      :DATE <date>
      :EXPIry <date>
  :SYStem
    :COMMunicate
      :SERial <date>
```



:ECHO <Off|ON>

Each section of the command may be sent in the full or the truncated form (indicated in upper case). The command itself may be sent in upper or lower case form.

The DLS 6826 will round any number to the nearest number permitted by the resolution of the parameter.

Sections *Section 4.2 "Data Formats"* and *Section 4.3 "Command Syntax"* give more information on the data format and the command syntax.

4.4.1 :SETting:CHANnel:LINE <Line Number>,<Length>

Select the reach (length) of the line, where <Line Number> is the line number is a valid line according to the model of the unit (1 to 8 or 1 to 12 lines), and <Length> is the length of the simulated line.

The length of the DLS 6826 can be adjusted from 0 to 4,000 in 250 foot increments, and from 4,000 to 15,000 in 500 foot increments.

If a value for <Length> is used that does not conform to the increment size, the DLS 6826 will round the value to the nearest valid length. For example, if a length of 4,251 is sent, the DLS 6826 will round up to the nearest valid increment (500 feet), or 4,500. If a length of 4,200 is sent, the DLS 6826 will round down to the nearest valid increment of 4,000.

To set the length of line 1 to 4,000 ft, send:

```
:SET:CHAN:LINE 1,4000 ft
```

To set the length of *all lines* to the same length, specify line 0. For example, to set all lines to 4,000 ft, send:

```
:SET:CHAN:LINE 0,4000 ft
```

The units of the length are optional, but they must be in "ft" if present for the DLS 6826. For more details on the numeric format supported by the DLS 6826, see *Section 4.2 "Data Formats"*.

To query the length of line currently simulated by the DLS 6826 send:

```
:SET:CHAN:LINE 1?
```

The command will return the line number and the current length followed by the wire gauge. For example, if the length of line 1 is 4000 and is 26 AWG gauge, the returned message will be:

```
1,4000 FT,26AWG
```

If there is no simulated line at the <Line Number>, then the DLS 6826 will return "<Line NUMBER>,NONE". For example:

```
17,NONE
```

4.4.2 :System:Range?

Returns the number of reach ranges, the minimum and maximum of each reach range in feet, and the step increment of each range in feet.

Return format:

```
<N Ranges>, <minimum1>, <maximum1>, <step size1>;...<minimum n>,  
<maximum n>, <step size n>
```

Where <N ranges> is the number of ranges, <minimum n> and <maximum n> are the minimum and maximum reach for range n and <step size n> is the step size



(increment) for range n. "n" will be a number between 1 and the number of ranges (<N Ranges>).

Example:

```
:System:Range?
```

Will return:

```
2, 0, 4000, 250; 4000, 15000, 500
```

4.4.3 :SYStem:Communicate:serial:echo <Off|On>

Set the echo off or on. For example:

```
:sys:comm:ser:echo on
```

When the echo is on, the DLS 6826 will echo back all the characters sent to the unit and display the prompt character ">".

To query the echo state, send:

```
:sys:comm:ser:echo?
```

NOTE

The factory default setting is echo off.

4.4.4 :SYStem:COMMunicate:SERial:PACE <pace>

Set the receiver and transmitter pace method (flow control) of the serial interface, where <pace> is any of the following choices:

```
NONE | CTS | RTS/CTS | XON/XOFF | ALL
```

For example, to set the pace method to RTS/CTS, send:

```
:SYS:COMM:SER:PACE RTS/CTS
```

NOTE

The new pacing must be used immediately for any further serial communication.

To query the current pacing method send:

```
:SYS:COMM:SER:PACE?
```

The command will return the pacing method as a string. For example, if the pacing method is RTS/CTS, the returned message will be:

```
RTS/CTS
```

To simplify the setting of the serial interface, we used a slightly modified SCPI command set. The SCPI standard requires separate settings for the RTS/CTS flow control and XOn/XOff pacing, and differentiates between the receive and the transmit sides. The command set of the DLS 6826 combines the ":RTS" and the "XON" settings into one ":PACE" command.

Note that the SCPI standard assumes a DTE configuration, whereas the DLS 6826 is configured as a DCE port (thus not requiring a Null Modem).



4.5 Common Command Set

As specified in the IEEE 488.2 standard, a number of common commands are required to set up and control the standard functions of remote-controlled devices. These common commands are as follows:

*CLS Clear Status Command

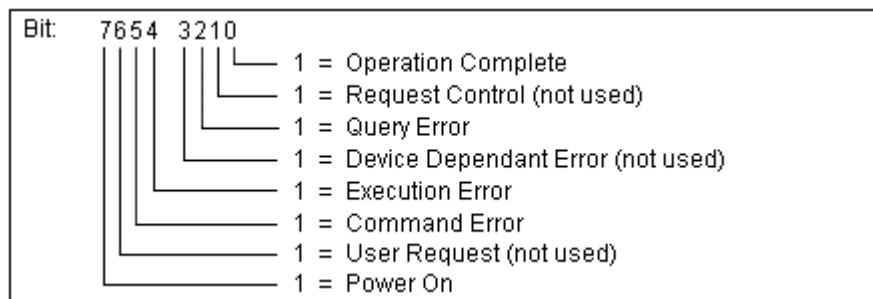
Type: Status command

Function: Clears the Event Status Register (ESR). Clearing the Event Status Register will also clear ESB, the bit 5 of the Status Byte Register (STB). It does not affect the output queue (bit 4 of the STB).

*ESE <NRf> Event Status Enable

Type: Status command

Function: Sets the Event Status Enable Register (ESER) using an integer value from 0 to 255, representing a sum of the bits in the following bit map:



Bits 7 to 0 have values of 128, 64, 32, 16, 8, 4, 2 and 1, respectively. For example, if bits 3 and 5 are set then the integer value is 40 (8+32).

On power-on, the register is cleared if the Power-on Status Clear bit is 1, or restored if the bit is 0 (see *PSC for more details).

*ESE? Event Status Enable Query

Type: Status command

Function: An integer value between 0 and 255 representing the value of the Event Status Enable Register (ESER) is placed in the output queue. The possible values are described in the *ESE command section.

*ESR? Event Status Register Query

Type: Status command

Function: An integer value between 0 and 255 representing the value of the Event Status Register (ESR) is placed in the output queue. Once the value is placed in the output queue, the register is cleared. The command will turn the REMOTE LED green if the LED was red. The possible values are described in the *ESE command section.



*IDN?	Identification Query
Type:	System command
Function:	Returns the ID of the unit. Upon receiving this command the DLS 6826 will put the following string into the output queue: SPIRENT COMM. INC,DLS 6826,<SN>,<Ver> where: <SN> is the serial number of the unit <Ver> is the revision level of the control firmware (always 2 digits)
*OPC	Operation Complete
Type:	Synchronization command
Function:	Indicates to the controller when the current operation is complete. This command will cause the DLS 6826 to set bit 0 in the Event Status Register (ESR) when all pending operations have been completed. The bit is read with the *ESR? command, which also clears the bit. Communication can proceed as normal after this command.
*OPC?	Operation Complete Query
Type:	Synchronization command
Function:	Indicates when the current operation is complete. This will cause the DLS 6826 to put an ASCII 1 (decimal 49, hex 31) in the output queue when the current operation is complete. Communication can proceed as normal after this command, but be prepared to receive the "1" at any time.
*RST	Reset
Type:	Internal command
Function:	Does a hard reset, identical to power-cycling the unit. The DLS 6826 will initialize to the maximum reach (15,000 feet).





5. Troubleshooting

- 1) The power LED flashes red:

At power up, the DLS 6826 performs a self-test. If this self-test fails, the power LED flashes red. If this happens, consult the factory.

- 2) The power LED is orange:

If the DLS 6826 detects an internal error, it does a full system initialisation and turns the power LED orange. If this happens, consult the factory.

- 3) The remote LED is off:

This is normal after both a power-up and a reset.

- 4) The remote LED is red:

The DLS 6826 received an invalid command from the computer. See *Chapter 4 "Remote Control"* for more details.

- 5) The DLS 6826 program indicates a communication error:

- Check that no device (such as a mouse) is connected to the same serial port as the DLS 6826.
- Check the cabling.





6. References

- IEEE 488.2-1992, IEEE Standard Codes, Formats, Protocols, and Common Commands (The Institute of Electrical and Electronics Engineers, Inc. 345 East 47th Street, New York, NY 10017-2394, USA)
- SCPI Standard Commands for Programmable Instruments, available from some interface controller manufacturers (SCPI Consortium, 8380 Hercules Drive, Suite P.S., La Mesa, CA 91942, Phone: (619) 697-8790, Fax: (619) 697-5955)
- ITU-T Recommendation G.996.1 (International Telecommunication Union, Place des Nations, CH1211 Geneva 20, Switzerland)
- ITU-T Recommendation G.992.3 (International Telecommunication Union, Place des Nations, CH1211 Geneva 20, Switzerland)
- ITU-T Draft Recommendation G.992.5, ADSL2plus specification (International Telecommunication Union, Place des Nations, CH1211 Geneva 20, Switzerland)
- ANSI T1.601-1991, ISDN Basic Access Interface for use on Metallic Loops for Application on the Network Side of the NT (American National Standards Institute, 11 West 42nd Street, New York, NY 10036, USA)
- ANSI T1.413-1995, Asymmetric Digital Subscriber Line (ADSL) Metallic Interface, and ANSI T1.413 Issue 2 (American National Standards Institute, 11 West 42nd Street, New York, NY 10036, USA)
- Belcore PUB 62310, Digital Data System Channel Interface Specification. September 1983.
- ITU-T G.991.2 Annex A (G.shdsl Annex A) (International Telecommunication Union (ITU) Place des Nations CH-1211 Geneva 20 Switzerland, Tel: +41 22 730 511, Fax: +41 22 733 7256).





7. Customer Support

7.1 Customer Service Contact Information

For all North American customers, please direct any questions or concerns regarding the operation of a purchased unit, to the Spirent Communications Customer Service team by one of the following methods:

Toll Free: (800) 774-7368
Telephone: (613) 592-7301
Fax: (613) 592-0522
Internet: <http://support.spirentcom.com>
Email: ae.service@spirentcom.com

All other customers should check the Customer Service Center (CSC) website at: **<http://support.spirentcom.com>** for the contact information of the nearest Customer Service center or contact the main Spirent Communications service center for assistance (contact information is listed above).

The most recently published user manuals, application notes, software and firmware updates are available on the CSC website.

7.2 Protecting Your Investment

Spirent Communications is committed to providing the highest quality products and customer support possible. An annual calibration is required to ensure that your unit is operating properly.

Spirent Communications is pleased to offer two cost-effective optional service programs. Each of these programs is designed to improve the ease and efficiency of servicing Spirent Communications test equipment.

7.3 Extended Warranty

Spirent Communications' Extended Warranty gives two years in addition to the original one-year manufacturer's warranty. Under the warranty agreement, Spirent Communications repairs any covered product that needs service during the warranty period. At the time of repair, any required firm ware and/or software upgrades are installed free of charge and if required as part of the repair, the unit receives a complete calibration. Spirent Communications also provides return shipment of any unit covered under warranty at Spirent Communications's cost.

The Extended Warranty gives:

- Extension of the original one-year limited warranty by two years (giving a total warranty coverage of three years).
- Required firm ware and software upgrades installed free at time of repair.
- If required because of a repair, free calibration due to repair during the coverage period.
- Prepaid, return shipment of repaired products worldwide.



Spirent Communications' Extended Warranty can be purchased at any time up until the expiration of the original one (1) year manufacturer's warranty.

7.4 Three-Year Calibration Agreement

Specific Spirent Communications products are shipped with a National Institute of Standards and Technology (N.I.S.T.) traceable calibration that expires one year from the original ship date. With ISO-9000 and other manufacturer specific metrology requirements, timely calibrations become critical to your operations.

The Spirent Communications three year calibration agreement gives the opportunity to invest in a yearly calibration for three (3) years at a significant cost saving, ensuring optimum product performance.

Spirent Communications sends out an email reminder when the next calibration is due. A report containing all calibration data is shipped with the product.

The Spirent Communications's three-year calibration agreement provides:

- Three (3) annual N.I.S.T traceable calibrations (one per year).
- Notification from Spirent Communications when calibration is due.
- Calibration data report.
- Prepaid return shipment of calibrated unit worldwide.
- The Spirent Communications' three-year calibration agreement may be purchased at any time.

Please contact Spirent Communications Customer Service for more information on these programs, or visit us on the web at **ae.spirentcom.com**.



8. Warranty

Spirent Communications warrants all equipment bearing its nameplate to be free from defects in workmanship and materials, during normal use and service, for a period of twelve (12) months from the date of shipment.

In the event that a defect in any such equipment arises within the warranty period, it shall be the responsibility of the customer to return the equipment by prepaid transportation to a Spirent Communications service center prior to the expiration of the warranty period for the purpose of allowing Spirent Communications to inspect and repair the equipment.

If inspection by Spirent Communications discloses a defect in workmanship or material it shall, at its option, repair or replace the equipment without cost to the customer and return it to the customer by the least expensive mode of transportation, the cost of which shall be prepaid by Spirent Communications.

In no event shall this warranty apply to equipment which has been modified without the written authorization of Spirent Communications, or which has been subjected to abuse, neglect, accident or improper application. If inspection by Spirent Communications discloses that the repairs required are not covered under this warranty, the regular repair charges shall apply to any repairs made to the equipment.

For international customers, please contact your local Spirent Communications sales representative or check the **ae.spirentcom.com** web site for the contact information of the nearest service center.

In North America, if warranty service becomes necessary, the customer must contact Spirent Communications to obtain a return authorization number and shipping instructions. See *Chapter 7 "Customer Support"* for contact details.

This warranty constitutes the only warranty applicable to the equipment sold by Spirent Communications, and no other warranty or condition, statutory or otherwise, expressed or implied, shall be imposed upon Spirent Communications nor shall any representation made by any person, including a representation by a representative or agent of Spirent Communications, be effective to extend the warranty coverage provided herein.

In no event (including, but not limited to the negligence of Spirent Communications, its agents or employees) shall Spirent Communications be liable for special consequential damages or damages arising from the loss of use of the equipment, and on the expiration of the warranty period all liability of Spirent Communications whatsoever in connection with the equipment shall terminate.





9. Shipping The Unit

To prepare the unit for shipment, turn the power off, disconnect all cables (including the power cable) and pack the simulators in their original cartons. Do not place any cables or accessories directly against the front panel as this may scratch the surface of the unit. It is highly recommended that all shipments are marked with labels indicating that the contents are fragile.

If sending a unit back to the factory, ensure that the Return Material Authorization (RMA) number given by the Spirent Communications Customer Service department is shown on the outside.

NOTE

The RMA number is mandatory and must be obtained from a Spirent Communications Customer Service center before shipping the unit (see Section 7 "Customer Support" for details on how to contact the nearest Spirent Communications Customer Service center).





10. Specifications

10.1 General

Type of Wire:	26 AWG as per ANSI T1.417
Number of Lines:	8 or 12 lines
Reach (max):	15,000 feet Symmetric upstream and downstream characteristics
Reach Increment:	250 foot increments (0 to 4,000 feet) 500 foot increments (4,000 to 15,000 feet)
Bandwidth:	25 kHz to 30 MHz
DC Rating:	200 VDC Maximum Tip-to-Ring
Loop Attenuation Accuracy:	± 1 dB across all VDSL reaches
Channel-to-Channel Accuracy:	$MAE \leq 1$ dB on all channels
Usable Attenuation Range:	0 to -80 dB
Crosstalk:	Greater than 80dB of channel-to-channel crosstalk protection across all frequencies
Impedance:	$\pm 12\%$ (250 to 1,000 feet) $\pm 10\%$ (1,250 to 15,000 feet)
Control Interface:	Remote via RS-232 port
Connections:	Shielded RJ-45 jacks
Power Supply:	External AC power supply: 100 - 130 VAC, 60Hz –OR– 230 - 240 VAC (+6/-10%) 50/60 Hz



10.2 Environmental

Operating Temperature:	50°F to 104°F (+10°C to +40°C)
Storage Temperature:	-4°F to 158°F (-20°C to +70°C)
Cable Reference Temperature:	72°F (22°C)
Humidity:	90% non-condensing maximum

10.3 Mechanical

Chassis Weight:	45 lbs/ 20 kg per chassis
Dimensions:	10.5" x 17.25" x 17.8" (268 mm x 438 mm x 452 mm) (H x W x D) 6U height

NOTE

Includes rack mount brackets (factory installed, removable).

10.4 Configurations

DLS 6826-8	26 AWG 8 Lines X 15,000 feet
DLS 6826-12	26 AWG 12 Lines X 15,000 feet

10.5 Control Software

Operating System	Windows NT, 2000 or XP
Automation:	SCPI command set

10.6 Carton Contents:

- 1) DLS 6826 Series chassis
- 2) 1 AC to DC wall plug-in adapter
- 3) 1 RS-232C inter-connection cable
- 4) 1 DLS 6826 CD (software and related documents)
- 5) 1 Operating Manual on CD



11. Safety

11.1 Information

11.1.1 Protective Isolation

The DLS 6826 is isolated from hazardous AC line voltages by the supplied AC/DC adapter. If the AC/DC adapter comes with a protective earth terminal, never wilfully interrupt this connection.

11.1.2 Before Operating the Unit

- Inspect the equipment for any signs of damage, and read this manual thoroughly.
- Become familiar with all safety symbols and instructions in this manual to ensure that the equipment is used and maintained safely.

11.1.3 AC Power Supply Requirements

100-240 VAC ($\pm 10\%$) 50/60 Hz

11.1.4 Fuse Configuration

There are no fuses used in the unit. A non-replaceable thermal fuse is used in the supplied AC/DC adapter.

11.1.5 Connections to a Power Supply

In accordance with international safety standards, the unit uses an approved AC/DC adapter.

11.1.6 Operating Environment

To prevent potential fire or shock hazard, do not expose the equipment to any source of excessive moisture.

11.1.7 Class of Equipment

The unit consists of an exposed metal chassis that is connected directly to earth via the protective grounding conductor. in accordance with the HARMONIZED EUROPEAN STANDARD EN 61010-1 1993, it is classified as a Safety Class 1 equipment.

WARNING

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.



11.2 Instructions

The following safety instructions must be observed whenever the unit is operated, serviced or repaired. Failing to comply with any of these instructions or with any precaution or warning contained in the Operating Manual is in direct violation of the standards of design, manufacture and intended use of the equipment.

NOTE

Spirent Communications assumes no liability for the customer's failure to comply with any of these requirements.

11.2.1 Before Operating the Unit

- Inspect the equipment for any signs of damage, and read the Operating Manual thoroughly.
- Install the equipment as specified in the relevant section of this manual.
- Ensure that the equipment and any devices or cords connected to it are properly grounded.

11.2.2 Operating the Unit

- Do not operate the equipment when its covers or panels have been removed.
- Do not operate equipment if an interruption to the protective grounding is suspected. Ensure that the instrument remains inoperative.
- Unless absolutely necessary, do not attempt to adjust or perform any maintenance or repair procedure when the equipment is opened and connected to a power source at the same time. Any such procedure should only be performed by qualified service professional.
- Disconnect the power supply cord from the equipment before adding or removing any components.
- Do not operate the equipment in the presence of flammable gases or fumes.
- Do not perform any operating or maintenance procedure that is not described in the Operating and Reference Manual.
- Some of the equipment's capacitors may be charged even when the equipment is not connected the power source.

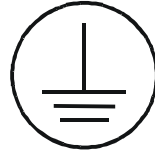


11.3 Symbols

When any of these symbols appear on the unit, this is their meaning:



EQUIPOTENTIALITY-FUNCTIONAL
EARTH TERMINAL



PROTECTIVE GROUNDING
CONDUCTOR TERMINAL



CAUTION - REFER TO ACCOMPANYING DOCUMENTS





Appendix A: Measurements And Test Results

A.1 Measurement of the DLS 6826

Use the following method to measure the insertion loss of a balanced line or line simulator throughout the frequency domain:

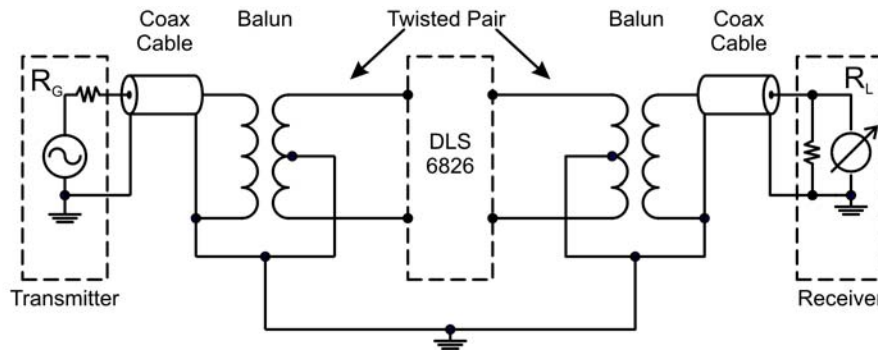


Figure A-1 Electrical characteristics measurements

In *Figure A-1*, R_G , R_L and the coax cables match the unbalanced winding of the balun. The balanced side of the winding must be 100 Ω to match the 26 AWG characteristics of the DLS 6826. The balun recommended for the DLS 6826 is North Hills 0311LB. The center tap of the balun must be grounded by connecting it to the shielding of the balun through one of its mounting screws.

The transmitter and receiver could be the transmitting and receiving sections of a network analyzer.

Transformers and cables introduce errors of attenuation and phase. For accurate measurements, first perform calibration (normalization) by replacing the simulator with a direct connection.

WARNING

The use of unbalanced signals through the DLS 6826 will usually yield incorrect measurements.

A.2 Common Errors

There are three common errors:

- Coupling between input and output via the two transformers. When trying to measure attenuations of 60 dB or so, approximately 1/1000 of the input voltage, or 1/1000000 of the input power is present on the output. It is very easy for transformers - or even wires - placed close to each other to couple together far more than this. Take care to keep inputs and outputs separate.
- The use of a high impedance measuring device with no load from tip to ring at the receive end. This results in reflections due to a bad mismatch at the end of the line, and leads to very peculiar response curves.
- Ground injected directly onto the tip or ring of the wireline simulator. This almost always leads to a very noisy spectrum, with high background noise levels and often harmonically related spectrum "spikes".



A.3 Typical Attenuation Characteristics

The graphs in this section show theoretical and measured attenuation characteristics at various length.

Calculated and measured values are with 100 Ω terminations.

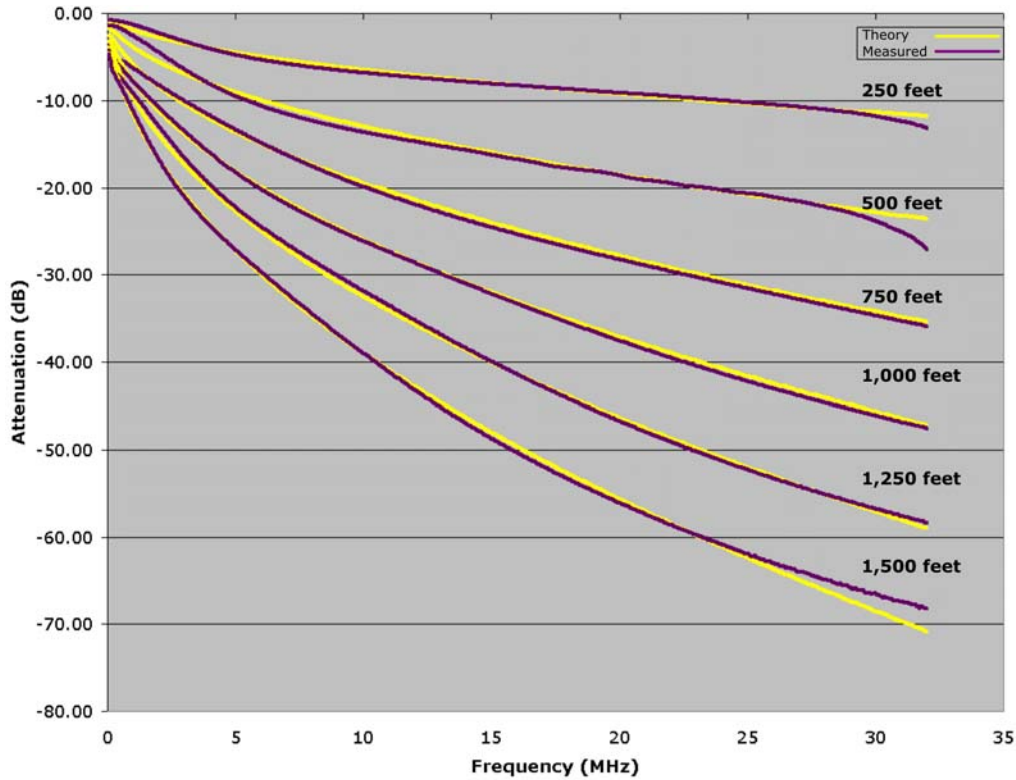


Figure A-2 DLS 6826 - Attenuation at 250, 500 750, 1.0k, 1.25k and 1.5k feet

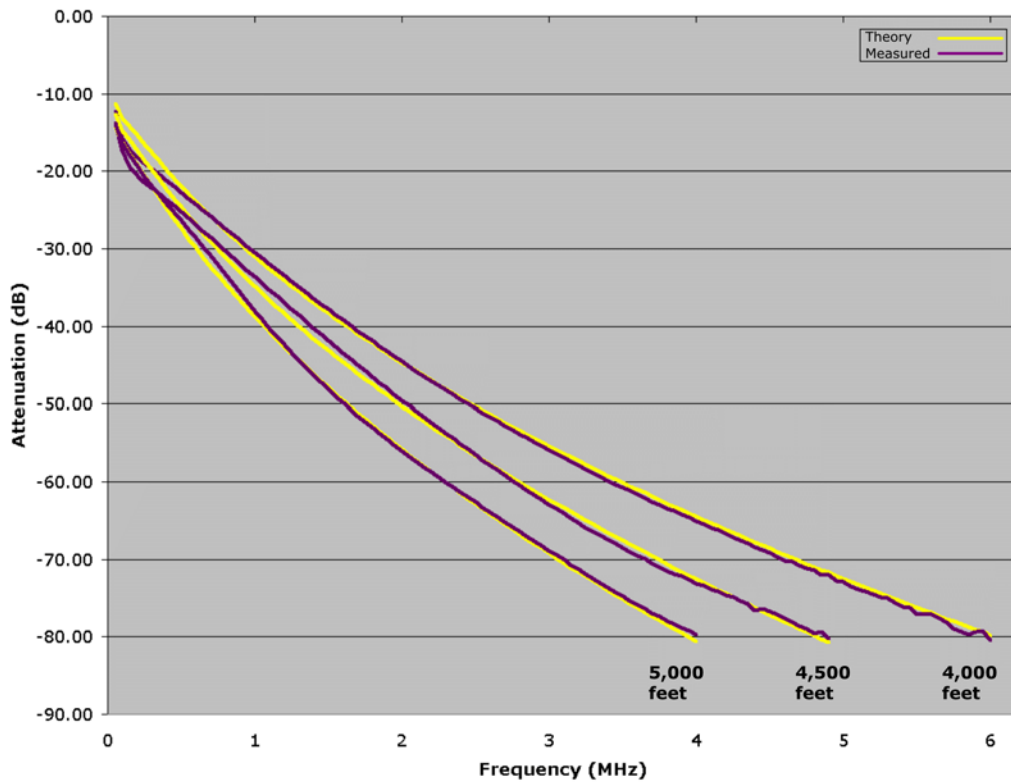


Figure A-3 DLS 6826 - Attenuation at 4,000, 4,500 and 5,000 feet

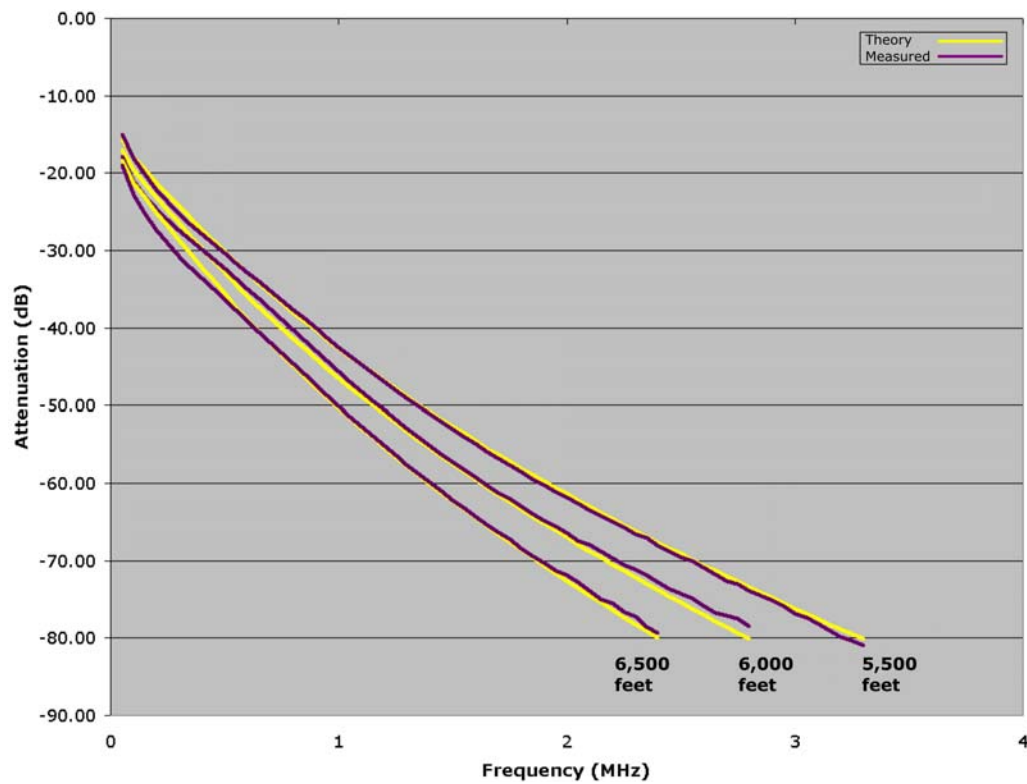


Figure A-4 DLS 6826 - Attenuation at 5,500, 6,000 and 6,500 feet

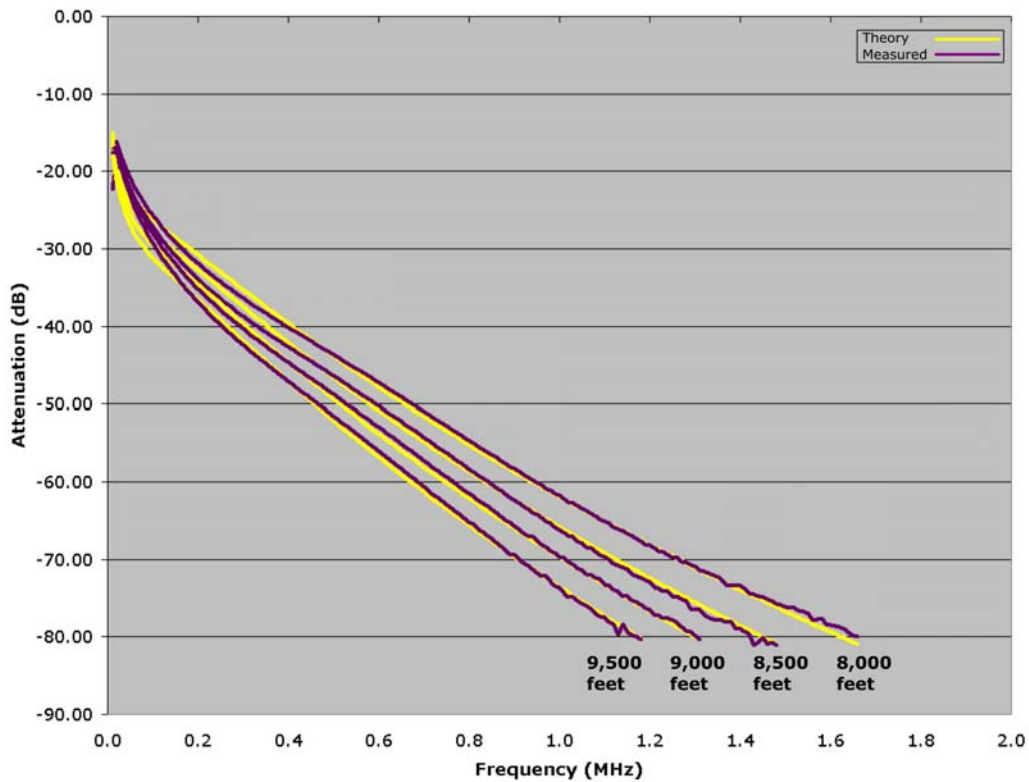


Figure A-5 DLS 6826 - Attenuation at 8,000, 8,500, 9,000 and 9,500 feet

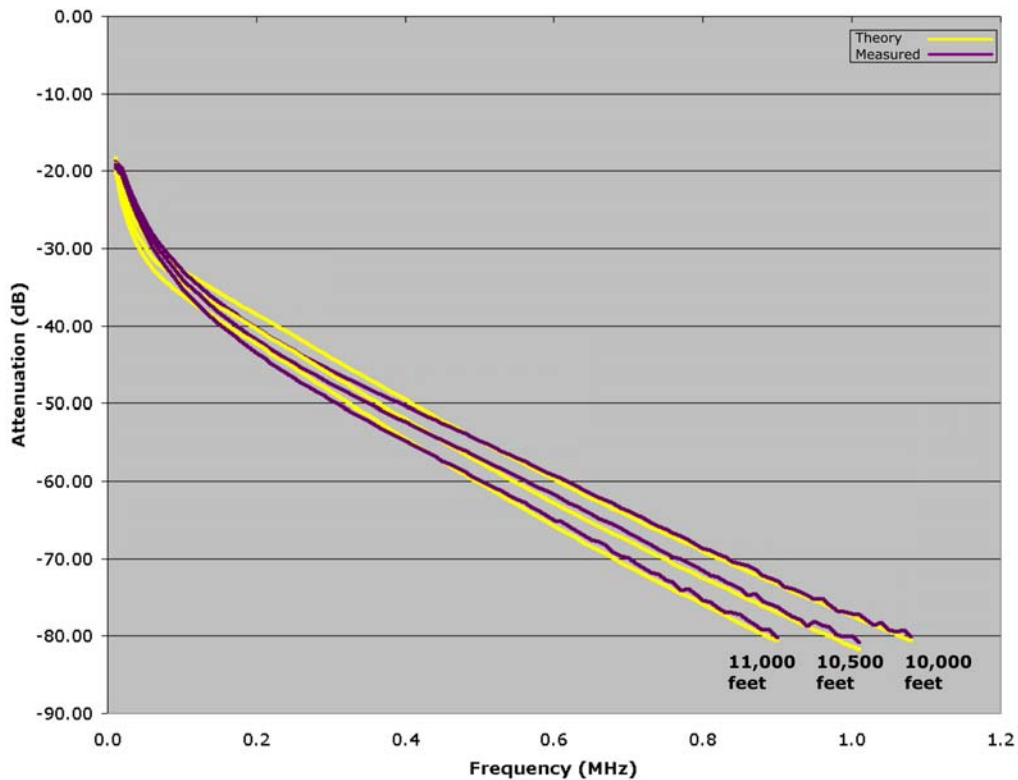


Figure A-6 DLS 6826 - Attenuation at 10,000, 10,500 and 11,000 feet



Appendix B: Background Noise Measurements

Background noise measurements for the wireline simulator are performed with a spectrum analyzer, in this case, an Agilent 4395A spectrum/network analyzer.

Input A is used in spectrum-noise mode and the results are displayed in power spectral density units, i.e. dBm/Hz.

The noise floor of the Agilent 4395A with an input attenuator of 0 dB and resolution BW=30 kHz (input A not connected) is illustrated in the graph below:

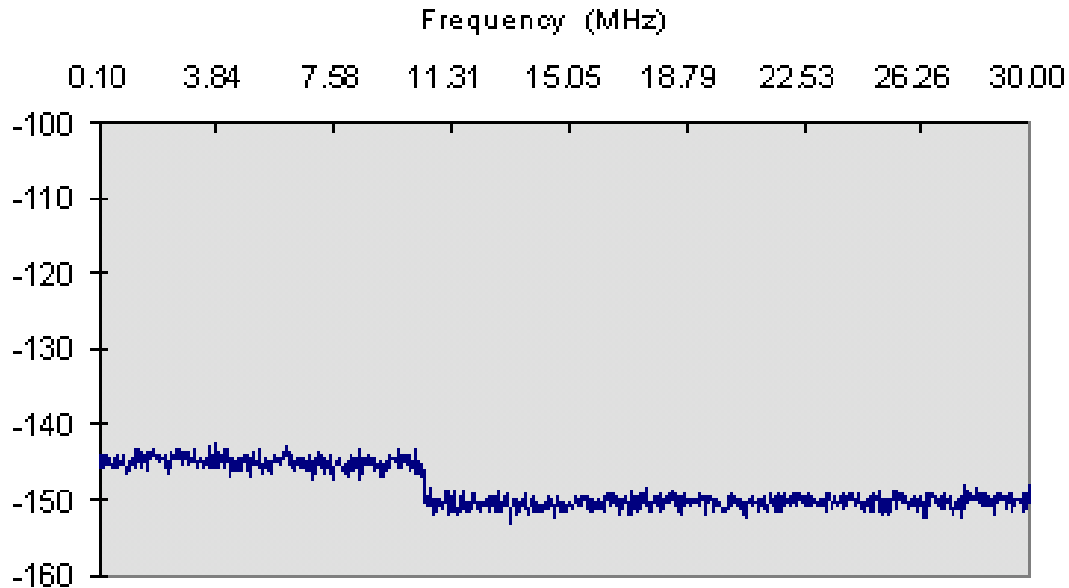


Figure B-1 HP 4395A Noise Floor

Figure B-1 demonstrates the Agilent 4395A spectrum/network analyzer's Noise Floor over a Bandwidth of 0-30MHz. The graph shows that for frequencies up to 10 MHz, the noise floor is about -144 dBm/Hz; for frequencies in the range 10-30 MHz, the noise floor is about -151 dBm/Hz. Hence, when measuring noises with values close to the noise floor of the analyzer itself, results are inaccurate in the sense that the analyzer's noise adds to the noise of the device under test (DUT); the displayed result will be worse than the real one.

In conclusion, the error introduced by the analyzer itself has to be taken into considerations when measuring noises with values close to -140 dBm/Hz.

