



DLS 5405 Operating Manual

High Bandwidth Noise Injection Unit



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71-000042 Revision B



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1. Overview

1.1 Introduction

The DLS 5405 is the interface between a noise generator and a wireline simulator. It injects separate VDSL2 noise signals at either end of a wireline simulator.

The DLS 5405 is 1U high and can be mounted in a standard 19" rack.

1.2 Product Features

The DLS 5405 Dual VDSL2 Injection Unit product features include:

- Up to 40 MHz bandwidth noise injection (differential outputs).
- Maximum output level of -3 dBm for a signal with a crest factor of 5.0.
- Two RJ-45 jacks per side, one for the DUT (Device Under Test), one for the wireline simulator.
- Four 50 Ω unbalanced BNC noise inputs (two each for Side A and Side B).

1.3 System Level Block Diagram

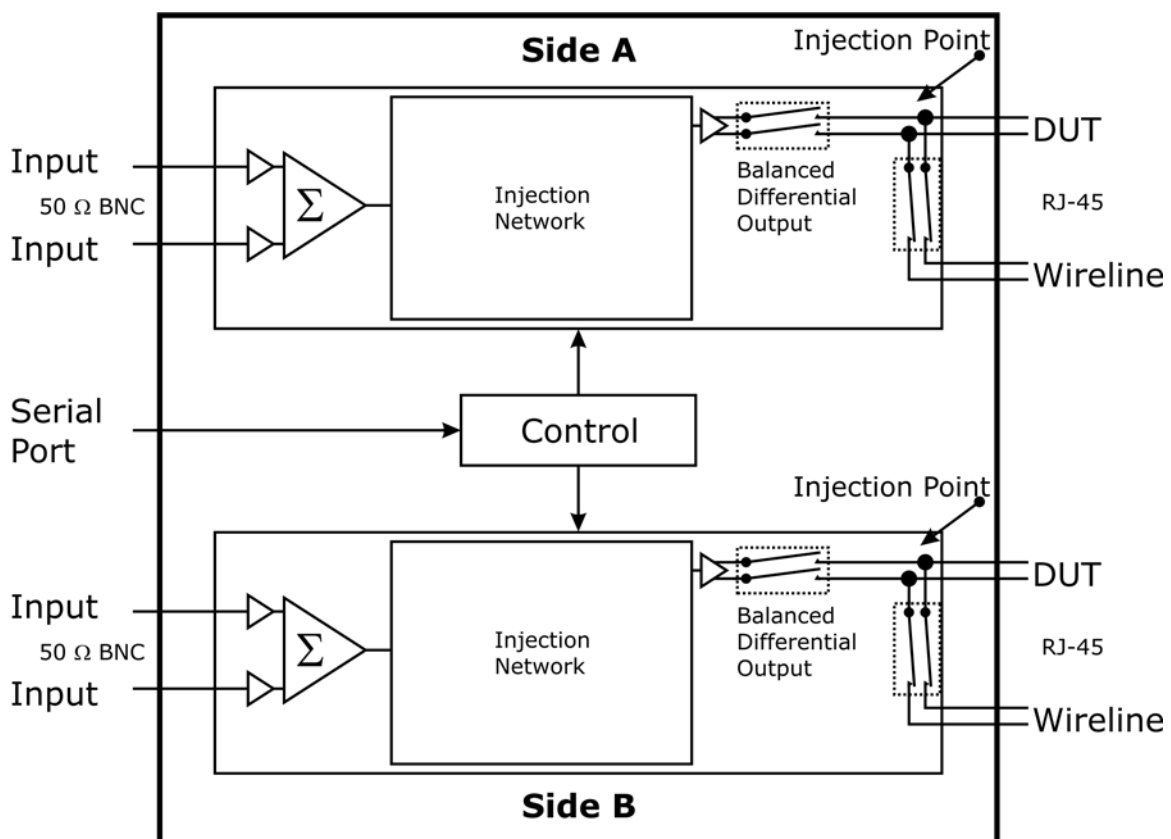


Figure 1-1 DLS 5405 System Level Block Diagram



Chapter 1: Overview

Noise profiles are supplied to the DLS 5405 by the DLS 5500. Each side must have two noise profiles connected to it, as shown in *Figure 2-5* on page 2-5. The two noise signal inputs per side are summed by the DLS 5405 and output in differential mode at the injection point (DUT and Wireline jacks) on the front panel.

The injection network is disconnected from the outputs (DUT and Wireline jacks) when the DLS 5405 is off or when first powered up. When the injection network is connected to the outputs (by a command from the DLS 5500), the injector loads the line slightly. The normally closed contacts between the DUT and Wireline jack are open momentarily for micro-interruption tests only, otherwise they remain closed.



2. Getting Started

2.1 Receiving And Unpacking The Unit

Each DLS 5405 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 5405 system contains the following:

- AC power cable.
- Linear power supply (Spirent # DLS 5P02).
- Three RJ-45 (1 foot long) Spirent # 7102040514.
- Two RJ-45 short cables for Modem/DSLAM connections Spirent # 7102040525.
- DB-25 Interface serial cable.

Check that you have received all the items on the list and report any discrepancies to Spirent Communications.

2.2 Quick Start Set Up

The DLS 5405 High Bandwidth Noise Injection Unit works in conjunction with a DLS 5500 VDSL2 Noise Generator to inject noise at either end of a wireline simulator. For details on noise generation, see the *DLS 5500 Operating Manual*.

NOTE

Keep all interconnecting cables as short as possible.

Follow these steps to set up and operation the DLS 5405:

- Step 1:** Connect the outputs of the DLS 5405 to the inputs on the DLS 8130 wireline simulator using the RJ-45 cables provided with the DLS 5405 (see *Figure 2-2*).
- Step 2:** Connect each output at the back of the DLS 5500 to an input at the back of the DLS 5405 as shown in *Figure 2-5* on page 5. Use short 50 Ω coaxial cables with BNC connectors at each end.
- Step 3:** Connect the RS-232 port at the back of the DLS 5405 (labelled "DB-25") to one of the COM ports at the back of the DLS 5500 VDSL2 Noise Generator using the supplied serial cable.

NOTE

The DLS 5405 must be connected to the noise generator to activate noise injection.

- Step 4:** Select the correct input voltage on the power supply for your area (115 or 230 VAC).
- Step 5:** Connect the external power supply to an AC power source.
- Step 6:** Connect the 5 pin linear power supply cord to the Power IN connector at the back of the DLS 5405.
- Step 7:** Switch on the power supply.



- Step 8:** On the DLS 5500 VDSL2 Noise Generator, select **Start >> Programs >> Spirent Communications >> DLS 5500 >> DLS 5500**. The DLS 5405 Control Application will start.
- Step 9:** Select **System >> Injector Loss** from the menu bar in the control application main window. The **Injector Loss** dialogue box will open.
- Step 10:** Choose the serial port to which the DLS 5500 is connected from the **Communications** drop-down list.
- Step 11:** Click the **Connect** button.
- Step 12:** Verify that the power and remote LED's on the front panel of the DLS 5405 are green.
- Step 13:** Start tests.

2.3 Front Panel Connections

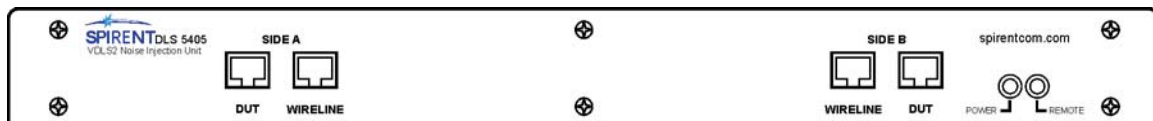


Figure 2-1 DLS 5405 front view

The front panel of the DLS 5405 contains the two noise injection points (Side A and Side B). Each injection point uses two RJ-45 jacks so that both the DUT and to the wireline simulator can be connected to the injection point.

There are two status lights on the front panel. A green Power LED indicates that power is connected and the DLS 5405 has not detected any internal faults. A green Remote LED indicates that the DLS 5405 is communicating properly with the noise generator.

All cables must be kept as short as possible for accurate wireline simulation. They must also be kept as far apart from each other as possible.

The recommended setups (*Figure 2-2* and *Figure 2-3*) yields the shortest interconnection cabling possible.

The recommended configuration for VDSL2 North American Wireline Configuration is shown in *Figure 2-2*. It consists of a DLS 8130 wireline simulator, a DLS 5500 VDSL2 Noise Generator, and a DLS 5405 VDSL2 Noise Injector.

The recommended configuration for ADSL2++ North American Wireline Configuration is shown in *Figure 2-3*. It consists of a DLS 410 wireline simulator, a DLS 5500 VDSL2 Noise Generator, and a DLS 5405 VDSL2 Noise Injector.

For connections between the wireline simulators and DUT (Device Under Test), use the supplied 2-foot long cables (Spirent #7102040526).

For connections between the DLS 5405 noise injector and the wireline simulators, use the supplied 1-foot long cables (Spirent # 7102040514).



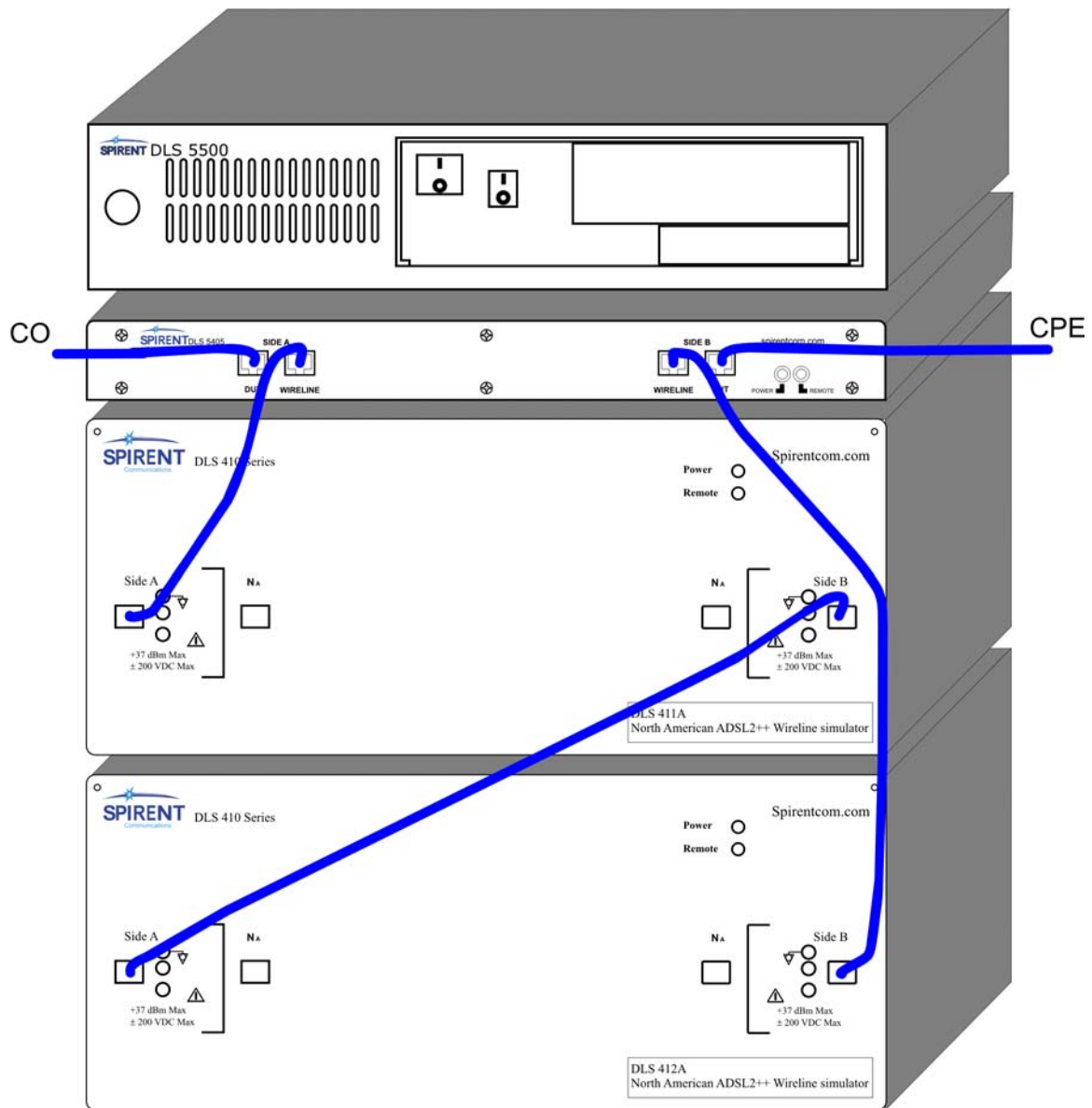


Figure 2-3 ADSL2+ + North American Wireline Configuration

2.4 Back Panel Connections

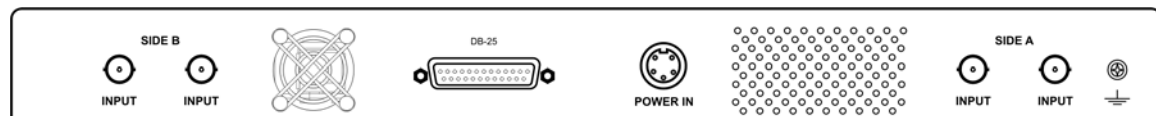


Figure 2-4 DLS 5405 back view

Each of the four noise signals generated by the DLS 5500 are connected to the four unbalanced BNC inputs at the back of the DLS 5405, using four 50 Ω coaxial cables (Figure 2-5). Connect the DLS 5500 to the DLS 5405 as shown in Figure 2-5.



The DLS 5405 and DLS 5500 must also be connected by a serial cable. The DLS 5405 will not function without it.

Power to the DLS 5405 is supplied by an external power supply, and connected at the back of the unit.

NOTE

The power supply must be set to the correct line voltage for your area (115 or 230 VAC).

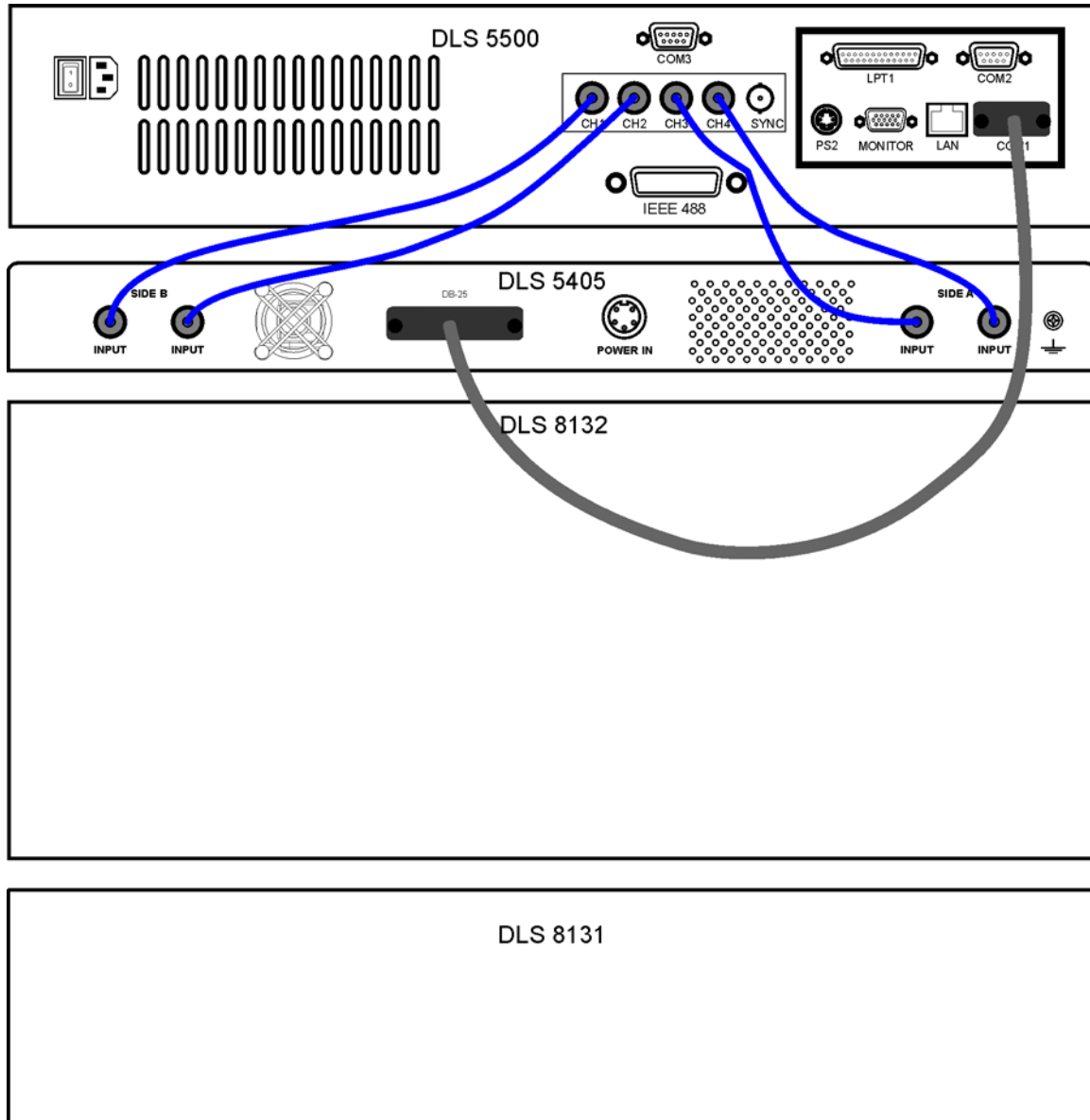


Figure 2-5 DLS 5500, DLS 5405 And DLS 8130 wireline configuration (back view)



2.5 DLS 5405 Control Software

The DLS 5405 is controlled by the noise generator via an RS-232 connection. The noise generator includes all necessary control software.

2.6 Calibration Setup

Figure 2-6 illustrates the recommended setup for measuring noise profiles from the DLS 5405 High Bandwidth Noise Injection Unit. Note the following points when setting up for measurements:

- 1) Cabling between the Balun and the noise injector must be very short. Spirent recommends a maximum length of two inches.
- 2) Connect the center tap to the balun's metal case.
- 3) The frequency response of the balun transformers must be considered. Spirent recommends that you use the following North Hills balun transformers, depending on the frequency range:

Frequency Range	North Hills Balun Model
1 KHz — 15 MHz	0311LB
100 KHz — 40 MHz	0301BB

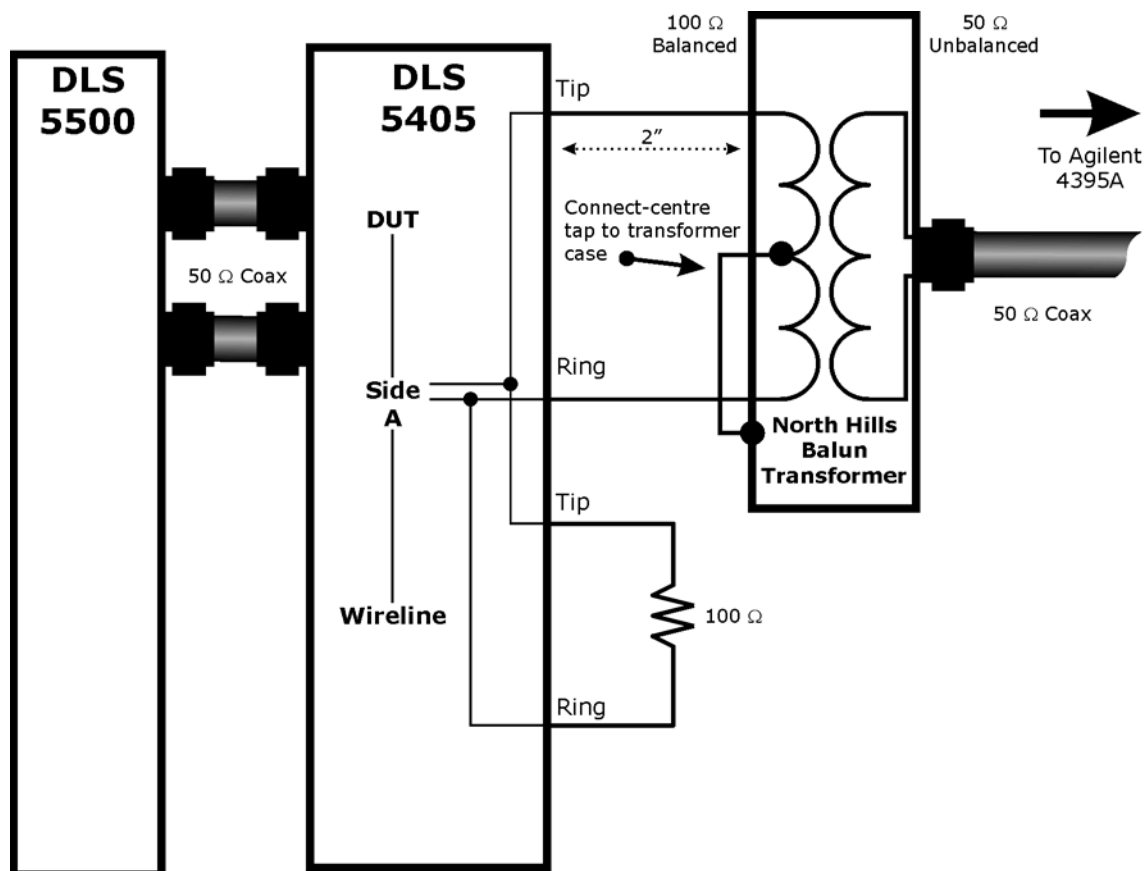


Figure 2-6 Measuring electrical characteristics



3. Customer Support

3.1 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.

3.2 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.

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-year manufacturer's warranty.

Three-Year Calibration Agreement

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

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. Spirent Communications sends out an e-mail 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 gives:

- Three yearly 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**.



4. 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 centre 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:

Spirent Communications

Toll Free: 1-800-SPIRENT

International calls: +1 818-676-2616

Support Email: ae.service@spirentcom.com

Web: <http://support.spirentcom.com>

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.



5. Shipping The Unit

To prepare the unit for shipment, turn the power off, disconnect all cables (including the power cable) and pack the unit in its original carton. 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.

The RMA number is mandatory and must be obtained from a Spirent Communications Customer Service center before shipping the unit (see Section 3 "Customer Support" for details on how to contact the nearest Spirent Communications Customer Service center).



6. Specifications

INJECTION POINT

Number of injection points:	2
Injection Mode	Differential
Bandwidth	4 kHz to 40 MHz
Noise Floor:	
4 kHz to 100 kHz:	< -140 dBm/Hz
100kHz to 40MHz	< -150 dBm/Hz

NOISE INPUTS

Noise Inputs:	4 (two for each side)
Input Mode	Unbalanced
Input Impedance:	50 Ω
Power Loss * (between input and injection point)	15.3 dB $\pm$ 0.25 dB at 20 MHz
Frequency Response (with calibration load)	relative to 20 MHz
Uncompensated:	< $\pm$ 0.5 dB from 10 kHz to 30 MHz

WIRELINE

Injector Insertion Loss	< 0.1 dB (4 kHz to 40 MHz)
Maximum Signal Output:	-3 dBm (per output) assuming a crest factor of 5.0
Maximum Wireline Voltage:	200V DC + peak AC (tip to ring)

***See notes next page**



***Notes:**

- 1) All specifications for levels and gains assume an input load of 50 Ω and that the output is terminated with the calibration load.
- 2) The calibration load normally consists of two nominally 100 Ω loads in parallel (see *Figure 2-6 "Measuring electrical characteristics"* on page 2-6). By definition, the output power is the power in ONE of these resistors.
- 3) The calibration load for a small number of files is defined differently than in 2) above. Refer to the relevant ETSI standard for SDSL testing.

Chassis:	1U rack mount chassis
Height, Width, Depth:	1.75" (44mm), 19.0" (482mm), 17.75" (451mm)
Weight:	8 lbs. (3.6 kg)
Power Supply:	5P02 (switchable, 115 or 230 VAC)
Environment:	
Operating Temperature:	5° to 40°C
Humidity:	95% non-condensing
Compliance:	CSA, UL (ENTELA) CE, FCC for home and office usage



7. Safety

7.1 Information

7.1.1 Protective Grounding (Earthing)

This unit consists of an exposed metal chassis that must connect directly to a ground (earth) via a protective grounding conductor in the power cord. The symbol used to indicate a protective grounding conductor terminal in the equipment is shown in this section under “symbols”.

7.1.2 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.

WARNING

To avoid risk of injury or death, ALWAYS observe the following precautions before operating the unit:

- Use only a power supply cord with a protective grounding terminal.
- Connect the power supply cord only to a power outlet equipped with a protective earth contact. Never connect to an extension cord that is not equipped with this feature.
- Do not wilfully interrupt the protective earth connection.
- The protective conductor terminal must be attached to the mains supply earth.

CAUTION

When lifting or moving the unit, be careful not to apply any pressure to the plastic grid which is located on the bottom of the chassis, toward the front right corner. Lift the chassis by gripping it on both sides at the bottom, ensuring not to touch the plastic grid.

7.1.3 Power Supply

WARNING

To avoid electrical shock, do not operate the equipment if it shows any sign of damage to any portion of its exterior surface, such as the outer casting or panels.

7.1.4 Fuses

The fuse type used is specified in the specifications chapter of this manual.

7.1.5 Connections to a Power Supply

In accordance with international safety standards, the unit uses a three-wire power supply cord. When connected to an appropriate AC power receptacle, this cord grounds the equipment chassis.



7.1.6 Operating Environment

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

7.1.7 Class of Equipment

The equipment consists of an exposed metal chassis that is connected directly to earth via the power supply cord. In accordance with HARMONIZED EUROPEAN STANDARD EN 61010-1:1993, it is classified as Safety Class I 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.

7.2 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.

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

7.2.1 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.

WARNING

The maximum signal between Tip and Ring must not exceed ± 200 V. Exceeding this limit could damage the unit.

7.2.2 Operating the Unit

- Do not operate the equipment when its covers or panels have been removed.
- Do not interrupt the protective grounding connection. Any such action can lead to a potential shock hazard that could result in serious personal injury.
- Do not operate equipment if an interruption to the protective grounding is suspected. Ensure that the instrument remains inoperative.
- Use only the type of fuse specified.
- Do not use repaired fuses and avoid any situation that could short circuit the fuse.
- 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.
- Do not attempt any adjustment, maintenance or repair procedure to the equipment if first aid is not accessible.



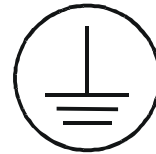
- Disconnect the power supply cord from the equipment before adding or removing any components.
- Operating the equipment in the presence of flammable gases or fumes is extremely hazardous.
- Do not perform any operating or maintenance procedure that is not described in the Operating Manual.
- Some of the equipment's capacitors may be charged even when the equipment is not connected the power source.

7.3 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