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DLS 400E

xDSL Wireline Simulator



SPECIFICATIONS

The Perfect Testbed
The Spirent Communications DLS Division's DLS 400E simulates various types, lengths and configurations of twisted pair telephony cable in order to test ADSL and other wireline technology based products. The DLS 400E also simulates impairments, such as noise and impulse noise in order to determine the margin upon which this technology will operate.

Fully ETSI / T1E1.4 Compliant
The DLS 400E provides all of the test loops and impairments called for in the ETSI ETR 328 standard for ADSL. In fact DLS Division also provides the DLS 400 which meets the American standard for testing ADSL.

Supports CAP or DMT
The DLS 400E simulates the cable characteristics from DC to 2.0 MHz. This makes the DLS 400E capable of testing devices based on either CAP, DMT, 2B1Q or any other coding technique.

A Modular Approach
The DLS 400E is designed using a modular approach. It can accept one or many wireline modules thus allowing users to purchase all or just a subset of the test loops defined by ETSI.

2 & 6 Mbit/s ADSL
Since the DLS 400E simulates up to 2.0 MHz of useable bandwidth, it is excellent for testing 2 or 6 Mbit/s ADSL.

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Table 1 Values for X

Loop	2M-3/1 noise A	2M-3/2 noise A	2M-3/1 noise B	2M-3/2 noise B	2M1 noise A	2M1 EC noise A	2M1 noise B	2M1 EC noise B
#	X (km)	X (km)	X (km)	X (km)	X (km)	X (Km)	X (Km)	X (Km)
1	3,45	3,60	2,45	2,55	2,90	2,80	1,80	1,90
2	4,55	4,80	3,20	3,40	3,85	3,60	2,35	2,55
3	2,30	2,50	1,30	1,40	1,80	1,75	0,60	0,70
4	1,80	2,00	0,80	0,90	1,25	1,05	0,15	0,15
5	2,40	2,55	1,40	1,50	1,85	1,65	0,70	0,80
6	2,25	2,40	1,25	1,35	1,70	1,50	0,60	0,60
7	1,35	1,55	0,40	0,50	0,85	0,70	0,00	0,00
8	1,50	2,10	1,00	1,10	1,45	1,20	0,35	0,35

Table 2 Chassis Configuration

	2 Mbit/s	6 Mbit/s
Chassis 1	8 x 0,9 mm	8 x 0,9 mm
	1 x 0,63 mm	1 x 0,63 mm
	6 x 0,5 mm	6 x 0,5 mm
	7 x 0,4 mm	7 x 0,4 mm
	1 x 0,32 mm	1 x 0,32 mm
Chassis 2	3 x 0,4 mm	1 x 0,4 mm
	4 x 0,5 mm	2 x 0,5 mm

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Accurate & Repeatable
The DLS 400E is the only reference standard in the world for testing Euro-ADSL. It uses selectable "sections" of passive components (L,R,C) to make up a desired length of cable. This method means that the DLS 400E provides a repeatable and comparable reference standard.

Easy to Use
The DLS 400E is supplied with DLS 100 series software which runs on a Windows™ compatible PC. The connection between the PC and the DLS 400E can be made with a regular RS-232C serial cable or alternatively with an IEEE 488 interface. The software allows users to easily select test loops and noise settings.

Noise & Impairments
The DLS 400E simulates all of the noise and impairments specified in the appendix of the ANSI T1.413 document and ETSI ETR 328. Each value is user selectable over a range of values. The DLS 400E uses a unique crossover technique to couple the impairments to the simulated cable. The internal noise card is voltage protected and will not be damaged by DC voltage, ring signal etc.

A Company with Experience
Spirent Communications DLS Systems has been a leading pioneer in cable and impairment simulators since 1980.

The company has developed simulators for VF, DDS, BRI ISDN, HDSL, HDSL2, ADSL, G.Lite and VDSL. The years of experience behind the DLS 400E ensure accuracy and stability.

Ordering Information
The DLS 400E can be configured to simulate all the standard loops set out in ETR 328 for both 6 Mbit/s ADSL and 2 Mbit/s ADSL. Up to two noise and impairment modules(DLS 5A01) per 400E chassis, and software which runs on a standard Windows™ compatible PC are available as priced options. Both require a dual chassis solution, as per the configurations set out in the table below.

Description
The DLS 400E is a two wire cable simulator which can be equipped with up to two ADSL wideband noise cards. The user can select the length, line configuration, and set the various impairments using the IEEE 488 or the RS-232 interface. The command language is based on the Standard Commands for Programmable Interfaces (SCPI) standard.

Technology:	Cable simulation using networks of discrete R, L&C components.
Cable simulated:	Balanced twisted copper pair.
Cable Impedance:	Complex, varies over frequency with length and gauge.
# of conductors:	2.
Types of cables:	0.32 mm, 0.4 mm, 0.5 mm, 0.63 mm and 0.9 mm cables specified in ETSI ETR 328 and ANSI T1.413, Annex "H".
D.C. Rating:	Up to 300 $VDC_{peak\text{-}to\text{-}peak}$ across tip & ring, 100mA (150mA peak).
Bandwidth:	D.C. to 1.5 MHz, smooth response up to 2MHz.
Accuracy:	For the specified bandwidth; ±0.5 dB for all attenuations up to 20 dB, for attenuation from 20 to 70 dB the tolerance is within 5% of design to a maximum of 1.5 dB.

Impairments Generators
The DLS 400E consists of seven discrete generation sections. The features associated with one generator operate independently of the others. However, the options within a section can only be activated one at a time. The seven sections are:

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- White noise generator
- 2 x low frequency (500 kHz) NEXT PSD generator
- 1 x high frequency (2.0 MHz) NEXT PSD generator
- Shaped noise generator
- Powerline related noise
- Metallic noise
- Longitudinal noise
- Impulse noise

The output circuit is balanced with a minimum Thevenin impedance of 4000 ohms over the range 50 Hz to 2.0 MHz.

White Noise Generator

Level:	85.0 to 140.0 dBm/Hz, variable in 0.1 dB steps.
Form:	Gaussian amplitude distribution to 5 sigma.
Bandwidth:	50 Hz to 2.0 MHz.

Crosstalk Generators A and B

Level:	Levels are varied in 0.1 dB steps over a range from 6 dB below the 1 disturber level to 6 dB above the 49 disturber level. The absolute power associated with each will vary according to the NEXT PSD shape selected. The minimum level of any point on a shape is 130 dBm/Hz.
Power:	The total power of each shape is accurate to within ±0.5 dBm.
Accuracy:	Each shape will track the reference shape to within ±1.0 dB, down to a level 45 dB below the peak. Each reference may deviate its null frequencies by ±5.0%.
Shapes:	The following shapes are available in Generators A and/or B: • ANSI T1.601 - 320 KHz bandwidth • ANSI HDSL Technical report DSL Next • ANSI HDSL Technical report HDSL Next • ANSI T1.413, Issue I ADSL Next • ANSI T1.413, Issue II ADSL upstream NEXT • ANSI T1.413, Issue II ADSL upstream FEXT (9 kft, 26 AWG) • ANSI Proposed Working Draft for HDSL2 Standard HDSL2 downstream NEXT (H2TUC) • ANSI Proposed Working Draft for HDSL2 Standard HDSL2 upstream NEXT (H2TUR) • ITU Standard for G. Lite FDM ADSL downstream NEXT • ITU Standard for G. Lite FDM ADSL downstream FEXT (13.5 kft of 26 AWG) • ITU Standard for G. Lite ADSL upstream FEXT (13.5 kft of 26 AWG) • ITU-T Standard for G.Lite Euro-K

Crosstalk Generator C

Level:	Levels are varied in 0.1 dB steps over a range from 10 dB below the 1 disturber level to 10 dB above the 49 disturber level. The absolute power associated with each will vary according to the NEXT PSD shape selected. The minimum level of any point on a shape is 130 dBm/Hz.
Power:	The total power of each shape is accurate to within ±1.5 dBm.
Accuracy:	Each shape will track the reference shape to within ±1.0 dB, down to a level 40 dB

below the peak. Each reference may deviate its null frequencies by ±5.0%.

Shapes: The following shapes are available in the High Frequency Crosstalk Generator C:

- ANSI T1.413, Issue I - ADSL FEXT
- ETSI ETR 328 Model A
- ETSI ETR 328 Model B
- North American 1.544 MBps T1
- International 2.048 MBps AMI
- ANSI T1.413, Issue II T1 (AMI) NEXT
- ANSI T1.413, Issue II EC ADSL downstream NEXT
- ANSI T1.413, Issue II FDM downstream FEXT (9 kft, 26 AWG)
- ITU Standard for G.lite EC ADSL downstream NEXT
- ITU Standard for G.lite FDM ADSL downstream NEXT

Shaped Noise Generator

This section is used to generate a series of discrete tones. Its main application is to generate either the shaped noise called for in both the ETSI ISDN and HDSL recommendations or the 10 discrete tones called for in ETSI ETR 328.

Noise:	Shaped to either ETSI, ISDN, ETSI HDSL or FTZ 1TR 220.
Level:	10.0 to +20.0 dB relative to the published reference level.
"10 Tone":	As per ETSI ETR 328.
Level:	20.0 to +20.0 dB relative to the published reference level.

Impulses

Types:	This generator produces 7 different impulses. 4 are standard multi-level (unipolar + & -, bipolar, 3-level), 2 are complex as per ANSI T1.413 Annex "C", and one is the ETSI Cook pulse.
Timing:	The duration of the 4 multi-level impulses can be varied between 20 and 120 microseconds in 1 microsecond steps.
Levels:	Multi-level: 0.5 to 100.0 mVolts, 0.1 mV steps
	ANSI: 5.0 to 100.0 mVolts, 0.1 mV steps
	Cook: 20 to +6 dB relative to the reference, 0.1 dB steps

Powerline Related Metallic Noise

Type:	Dual tones as per ANSI T1.601.
Level:	15.0 to +9.0 dB relative to ANSI reference levels, 0.1 dB steps.

Longitudinal Noise

Type:	Triangular waveform.
Frequency:	50 or 60 Hz.
Level:	0-60 Volts RMS at 60 Hz. 0-50 Volts at 50 Hz, 1 volt steps using external balanced transformer.

Externally Generated Signals

In addition to the generators, this section conditions externally-generated signals, and applies them to

the line.

Frequency:	50 Hz to 2.0 MHz at all levels up to 30 dBm.
	1 kHz to 2.0 MHz at levels up to 10 dBm.
Input:	50 ohm BNC.
Output:	External signals are attenuated by 20 dB and summed with other noise signals and injected through the standard output circuit.

Mechanical

Construction:	Main chassis plus plug-in controller and noise modules.
Connectors:	Bantam jacks and 3-pin balanced CF for differential output. 2-pin terminal block for longitudinal output. BNC connector for external signals input.

IEEE 488 Remote Control
The unit can be controlled via an IEEE 488 interface. The unit supports the following functions:

- Listener
- Talker
- Local Lockout
- Serial Poll
- Selective Device Reset
- Bus Reset
- Primary Addressing from 0 to 30

RS-232 Remote Control
The unit can be controlled via an RS-232 serial interface. The unit is configured with 9600 bps baud rate, no parity, 8 data bits per character, 1 stop bit and RTS/CTS hardware flow control.

System
DLS 400 Chassis

- DLS 1100 Series Software
- Manual
- Power cord
- 2 fuses

Options
National Instruments GPIB-PCII / ZZA interface card.

Electrical
AC Power.

Rated Input Voltage:	100-240 VAC (±10%) (Automatic line voltage sensing).
Rated Frequency:	50-60 Hz.
Rated Power Consumption:	120 VA max.
Line Fuses:	Type "T" 2A/250 V SLOW BLOW (2 required, 5 mm x 20 mm).

Environmental

Operating Temperature:	+10šC to +40šC.
Storage Temperature:	+10šC to +40šC.
Humidity:	90% (non-condensing) max.

Mechanical

Weight:	28 kg.
Dimensions:	194 mm x 452 mm x 494 mm .
	(H x W x D).

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