

# LSX 2025.x

## xDSL Line Simulator

*The Sparnex LSX 2025.x is the world's first Active Line Simulator, allowing to test the limits of xDSL modem technology. In just seconds, any type of line or loop in the world can be simulated with an unmatched accuracy. The LSX 2025.x is **the** reference for testing all types of xDSL systems.*



### BENEFITS

- One system for testing all xDSL technologies up to 4.5 MHz, including HDSL, ADSL, ADSL2+, SDSL, and SHDSL.
- Enables you to:
  - accurately replicate any line or loop as it occurs in the field (anywhere in the world).
  - test the actual limits in the field of your xDSL technology (performance testing).
  - test the compliance against ITU, ANSI, ETSI, and Bellcore standards.
- Far more accurate than passive xDSL test systems (better than 0.5 dB at 1 MHz).
- Delivers consistent results regardless of temperature or ageing of passive components.
- Future proof investment towards new xDSL technologies and standards because the hardware is controlled by configurable software.
- Comes with standard line libraries (ITU, ANSI, ETSI, and Bellcore).
- User friendly Win95/98/NT/2000 Graphical User Interface.
- Easy insertion of all noise models with the Sparnex NGE or ANG Math 2005 Noise Generator .

### THE LSX 2025.x LINE SIMULATOR

The LSX 2025.x Line Simulator is based on the unique ACC® (Active Analog Concept) technology, with linear signal processing, which allows unlimited configuration of copper line characteristics and lengths.

Any copper line in the world can be simulated with one-and-the-same hardware platform for all xDSL technologies (including HDSL, ADSL, ADSL2+, SDSL, SHDSL) providing the user with an unequalled flexibility.



The LSX 2025.x Line Simulator is programmed by software that tunes the hardware until the country and network specific copper lines or loops are reproduced exactly. Once a configuration is loaded, the user can alter different parameters such as length, temperature, dielectric, noise level, wire diameter, and attenuation at any frequency.

By changing the parameter under study - while keeping all other parameters constant - one is able to test the limits of the xDSL modem technology on each individual parameter of the copper line.

The LSX 2025.x comes with libraries of pre-programmed loop configurations and line types, including all ITU, ANSI, ETSI, and Bellcore standards. Country specific libraries are available for more than 50 countries, and new country or customer specific libraries can be generated easily.

The Sparnex Line Simulator is future proof as it allows to create any new copper line model as set by ITU, ANSI, ETSI, or by any operator, manufacturer, or certification laboratory.

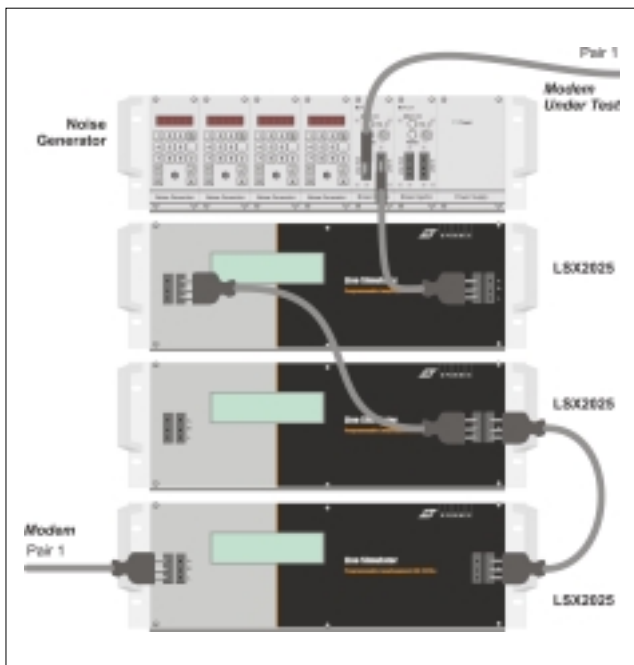
# LSX 2025.x: xDSL Line Simulator

## KEY FEATURES

- Designed to test Performance (the transmission limit) of high bandwidth applications, as well as Compliance according to ITU, ANSI, ETSI, and Bellcore standards.
- Lines can be retrieved from all above standards or individually set according to the specific characteristics of the loop under study.
- The ACC® technology creates the most reliable simulation environment and resolves the inconsistency of passive components.
- Line parameters are freely configurable by the user, without any hardware limitations.
- Stable and consistent simulation; an accuracy of 0.5 dB with automatic start-up calibration and diagnostic self-testing.
- Accurate simulation of Propagation and Group Delay, calculated on the basis of exact parameter settings.

## SIMULATION FEATURES

A comprehensive Windows Graphical User Interface facilitates an easy and intuitive dialogue between simulator and user.



Example of a LSX 2025.3 configuration with NGE Noise Generator

### The LSX 2025.x allows to simulate:

- lines of different wire diameter, insulation material, and temperature;
- line attenuation, phase shift, and group delay for attenuation ranging from 0 dB to 99 dB at 1 MHz;
- propagation delays so that echo's will return only after the correct time delay;
- complex impedance of the line in order to enable proper testing of analogue hybrid circuits (Analog Front End) and generation of the proper echo's;
- the DC (copper-) resistance of the line in order to enable up to 400 V remote powering testing;
- different kinds of noise spectrums on the line;
- noise can be injected at any point in the loop and at several points simultaneously;
- selectable uni-directional or bi-directional operation.

## LINE SIMULATOR TERMINOLOGY

- **line:** a certain length of 2 twisted copper wires, called 'a pair'
- **linetype:** the type of copper wire in a segment (wire diameter, insulation type, resistance, ...)
- **segment:** a homogeneous twisted copper pair of a specified (but programmable) length
- **loop:** a network of connected segments (bridge taps allowed)
- **cable:** a number of lines in one and the same bundle
- **line characteristics:** attenuation, propagation delay, complex impedance, etc.
- **line parameters:** all the adjustable properties that belong to the linetype of a segment in a loop, e.g. length, reference temperature, attenuation, etc.

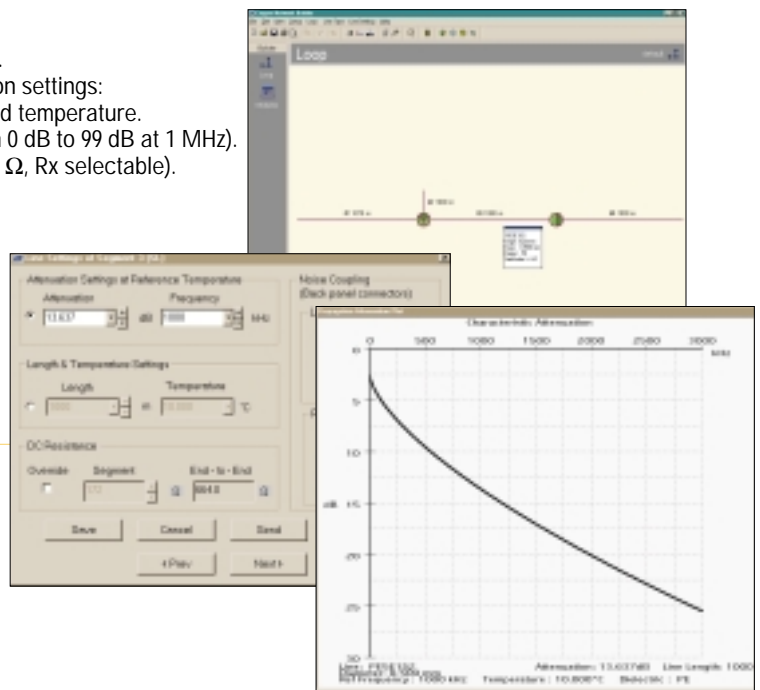
## SEGMENT SETTINGS

### Line configuration through the use of libraries:

- Standard ITU, ANSI, ETSI, and Bellcore line libraries.
- Custom libraries according to saved line configuration settings:
  - User defined specifications for length, diameter, and temperature.
  - User defined attenuation range up to 4.5 MHz (from 0 dB to 99 dB at 1 MHz).
  - Impedance settings: Left/Right (ZcLow, ZcHigh, 120  $\Omega$ , Rx selectable).
  - DC loop resistance: 46  $\Omega$  to 1316  $\Omega$ .
  - Insulation type: Paper, PE, PVC, PET.

### Loop configuration through the use of libraries:

- Standard ITU, ANSI, ETSI, or Bellcore loop libraries.
- User can configure loop topology.



## NOISE IMPAIRMENTS

### Noise simulation models through the external Sparnex NGE Noise Generator:

- Gaussian White Noise
- Crosstalk NEXT/FEXT
- Impulse Noise
- Power line Related Noise:
  - Longitudinal Noise
  - Metallic Noise
- Shaped Noise
- Micro Interruptions
- Customized Noise Models

### Available Loops and Noise impairments according following standards:

ETSI	ANSI	ITU
ETR 152-3-1996 (HDSL)	T1.413-1998 (ADSL)	G.991.1 (HDSL)
ETR 328-1-1996 (ADSL)	T1.418-2000 (HDSL2)	G.991.2 (G.shdsl)
TS 101 135 (HDSL-ISDN)	TA-NWT-001210 (Bellcore)	G.992.1 [G.DMT] (ADSL)
TS 101 388 (ADSL-ISDN)		G.992.2 [G.Lite] (ADSL)
TS 101 524 (SDSL)		

For more information, please refer to the Sparnex ANG Math 2005 Noise Generator specification sheet.

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## TESTING DSL MODEMS: 3 POSSIBILITIES TO SIMULATE THE LOCAL LOOP

Testing DSL modems via →	Field Cable	Old Passive Line Simulation Technology	New Active Sparnex Line Simulators
Ability to represent reality and country specific networks	Yes	No	Yes
Change parameters of your choice	No	Very limited	Unlimited
Keep certain parameters constant	No	Very limited	Unlimited
Flexibility	No	Very limited	Unlimited
Accuracy	?	Active is far more accurate than passive	
Consistent (reproducible results)	No	No	Yes
Future proof	Yes	Additional hardware, if made available	Yes
Verify compliance with the standard	No	Yes	Yes
Determine actual field performance	Yes	No	Yes
Complex Impedance	Yes	Fixed for intended purpose.	Whole frequency range up to 4.5 MHz

## TECHNICAL SPECIFICATIONS

Accuracy of the line configuration attenuation	
- for 0.5...85 dB attenuation @ 1 MHz	± 0.4 dB
- for 85...99 dB attenuation @ 1 MHz	± 0.7 dB
Attenuation range at 1 MHz	0.5 ... 99 dB
Hardware resolution of attenuation setting @ 1 MHz	± 0.15 dB
Useful operating frequency range	5 kHz...4.5 MHz
Crosstalk attenuation between ports (20 kHz...2 MHz)	110 dB
Deviation of group delay (5 kHz...4.5 MHz)	10%
Deviation of propagation delay	0.4 µs
Hardware resolution of propagation delay	0.36 µs
Available line impedances	
- complex impedance settings	ZcHigh and ZcLow
- fixed resistive impedance settings	120 Ω and 135 Ω (others on request)
Maximum input signal at rear panel connectors	10 V peak, 0.5 W RMS
Input/output impedance of rear panel connectors	75 Ω,
Deviation of input and output impedances	± 3 %
Maximum common mode signal voltage	5 V
Output signal unbalance @ 100 kHz	-65 dB
Maximum DC voltage at ports	
- any wire to ground	± 250 V
- between wires	± 400 V
Maximum DC current in ports	± 100 mA
DC loop resistance range	46 ... 1316 Ω
Deviation of DC resistance	± 3 % / 5 Ω
Hardware resolution of DC resistance setting	5 Ω



**SPARNEX** N.V.  
S.A.