

# LSX 2025

xDSL Line simulation platform for ADSL2plus and SHDSL

**Any type of line or loop can be emulated with an unmatched accuracy, in just seconds. One hardware with hundreds of line simulators inside.**



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

The LSX is programmed by software that adjusts the hardware for any copper line or loop types. Once a line type is loaded, the user can individually adjust any of the parameters, such as length, temperature, dielectric, 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 xDSL modem technology on each individual parameter of the copper line.

Libraries of pre-programmed line types include all ITU, ATIS, ETSI, Broadband Forum test configurations. Country specific libraries are available for more than 50 countries and new country or customer specific libraries can easily be generated with a program called LCC or CNB. Libraries can also be made available by Sparnex Instruments based on any Physical Layer parameters, as provided by the Service Operator.

The Sparnex Line Simulator is future proof as it allows the user to create any new copper line model as defined by ITU, ATIS, ETSI, Broadband Forum or by any operator, manufacturer or certification laboratory.

## BENEFITS

- One system for testing all xDSL technologies up to 4.5 MHz.
- 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, ATIS, ETSI, Broadband Forum and other specifications
- Delivers stable and consistent results regardless of temperature or aging of passive components.
- Standard line libraries ITU, ATIS, ETSI, Broadband Forum and others are available.
- User friendly Windows-based Graphical User Interface.

## KEY FEATURES

- Designed to test Performance (the transmission limit) of high bandwidth applications, as well as Compliance according to ITU, ATIS, ETSI, Broadband Forum and other specifications.
- Lines can be retrieved from all above specifications or individually set according to the specific characteristics of the loop under study.
- The AAC® technology creates the most reliable simulation environment and resolves the inconsistencies of passive components.
- Line parameters are easily configured by the user.
- Accurate simulation of Propagation, Impedance and Group Delay, calculated on the basis of exact parameter settings.
- Significantly more accurate on Mean Average Error (MAE) than passive xDSL test systems

## APPLICATIONS

- ADSL - RE-ADSL - ADSL2
- ADSL2plus
- HDSL - HDSL2 - HDSL4
- SDSL - SHDSL
- BONDING
- REPEATERS

## COMPLIANCE TESTING

- ITU, ATIS, ETSI, Broadband Forum
- -130 dBm/Hz noise floor
- AAC® = no coils - no digitizing!
- 4 cable impedance variation settings
- 1 - 20 µsec configurable delay
- multi-segments and bridge taps
- overall accuracy better than 0.5 dB MAE

Statement regarding Compliance & Benchmark testing:

*"if it is a matter of interoperability between vendors targeting for comparable results ... this is typically covered with our DLA product range"*

## PERFORMANCE TESTING

*"Compliant modems are not the same as good performing modems. Good performing modems are tested under representative access network conditions made possible with program-mable LSX 2020, 2025.x and 2030"*

Available Loops and Noise impairments according following specifications for the unique multi-standard tests

| ETSI                   | ATIS                     | ITU                    | Broadband Forum        |
|------------------------|--------------------------|------------------------|------------------------|
| ETR 152 (HDSL)         | T1.413 (ADSL)            | G.991.1 (HDSL)         | TR-048 (ADSL)          |
| ETR 328 (ADSL)         | T1.417 (ADSL2plus)       | G.991.2 (G.SHDSL)      | TR-067 (ADSL2)         |
| TS 101.135 (HDSL/ISDN) | T1.418 (HDSL2)           | G.992.1 (ADSL)         | TR-060 (SHDSL)         |
| TS 101.388 (ADSL/ISDN) | TA-NWT-001210 (Bellcore) | G.992.2 ADSL-G.Lite)   | TR-100/105 (ADSL2plus) |
| TS 101.524 (SDSL)      |                          | G.992.3 (ADSL2)        |                        |
|                        |                          | G.992.4 (ADSL2-G.Lite) |                        |
|                        |                          | G.992.5 (ADSL2plus)    |                        |
|                        |                          | G.996.1 (G.test)       |                        |

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## THE LSX 2025 ENABLES SIMULATION OF:

- Line types: wire diameter, length, 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 echos will return only after the correct time delay;
- Complex line impedance is selectable, 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 testing of remotely powered devices up to 400 VDC;
- Selectable uni-directional or bi-directional operation.
- Line configuration through the use of 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 to 99 dB at 1 MHz)
    - impedance settings : selectable
    - DC loop resistance : 46  $\Omega$  to 1316  $\Omega$
    - Insulation type : paper, PE, PVC, PET, ...
- Loop configuration through the use of libraries with multiple LSX 2025 segments:
  - Standard ITU, ATIS, ETSI, Broadband Forum loop libraries
  - User can configure custom loop topologies
  - Automation is optional via the Loop Switch Module (LSM)

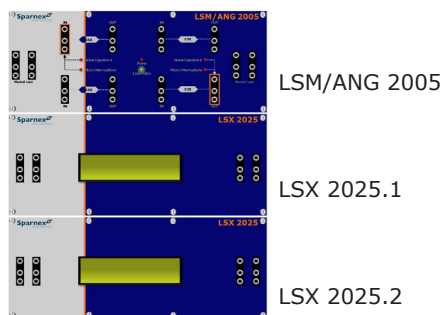
## NOISE IMPAIRMENTS (Optional)

Impairment generation can be achieved via the external Sparnex Arbitrary Noise Generator (ANG): ANG 2005, ANG 2030, LSM/ANG 2005, LSM/ANG 2030

## SIMULATING MULTI-SEGMENT LOOPS

Loops consisting of several segments can be accurately simulated by using the LSM as a test robot that automatically combines and configures several LSX 2025 segments in a complex setup.

The LSM also provides the additional simulation capability of Bridged Taps (BT) and Micro-Interruptions.



## TECHNICAL SPECIFICATIONS

|  |   |
|--|---|
| Accuracy of the line configuration attenuation         |   |
| - for 0.5...85 dB attenuation @ 1 MHz                  | $\pm 0.4$ dB                                    |
| - for 85...99 dB attenuation @ 1 MHz                   | $\pm 0.7$ dB                                    |
| Attenuation range at 1 MHz                             | 0.5 ... 99 dB                                   |
| Hardware resolution of attenuation setting @ 1 MHz     | $\pm 0.15$ 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 $\mu$ s                                     |
| Hardware resolution of propagation delay               | 0.36 $\mu$ s                                    |
| Available line impedances                              | Selectable                                      |
| - complex impedance settings                           | 120 $\Omega$ (others on request)                |
| - fixed resistive impedance settings                   | 100 $\Omega$ ; 120 $\Omega$ ; 135 $\Omega$ (and |
| Modem terminations                                     | 10 V peak, 0.5 W RMS                            |

|   |                         |
|---|-------------------------|
| Maximum input signal at rear panel connectors   | 75 $\Omega$             |
| Input/output impedance of rear panel connectors | $\pm 3\%$               |
| Deviation of input and output impedances        | 5 V                     |
| Maximum common mode signal voltage              | - 65 dB                 |
| Output signal unbalance                         | @ 100 kHz               |
| Maximum DC voltage at ports                     | $\pm 250$ V             |
| - any wire to ground                            | $\pm 400$ V             |
| - between wires                                 | $\pm 100$ mA            |
| Maximum DC current in ports                     | 46 ... 1316 $\Omega$    |
| DC loop resistance range                        | $\pm 3\%$ / 5 $\Omega$  |
| Deviation of DC resistance                      | 5 $\Omega$              |
| Hardware resolution of                          | DC resistance setting   |
| Storing conditions:                             | -20°C - +70°C           |
| Operational conditions:                         | +10°C - + 25°C          |
| Humidity:                                       | 90% max. non-condensing |

## ORDER INFORMATION

|                |              |
|----------------|--------------|
| LSX 2025.1     | 91.52.2025.M |
| LSX 2025.2     | 91.52.2025.S |
| CNB 2.0        | 71.52.2025   |
| LSX 2025.LCC   | 71.52.2925   |
| LINE LIBRARIES | on demand    |