



New Dual FFT-based Modal EMI Receiver

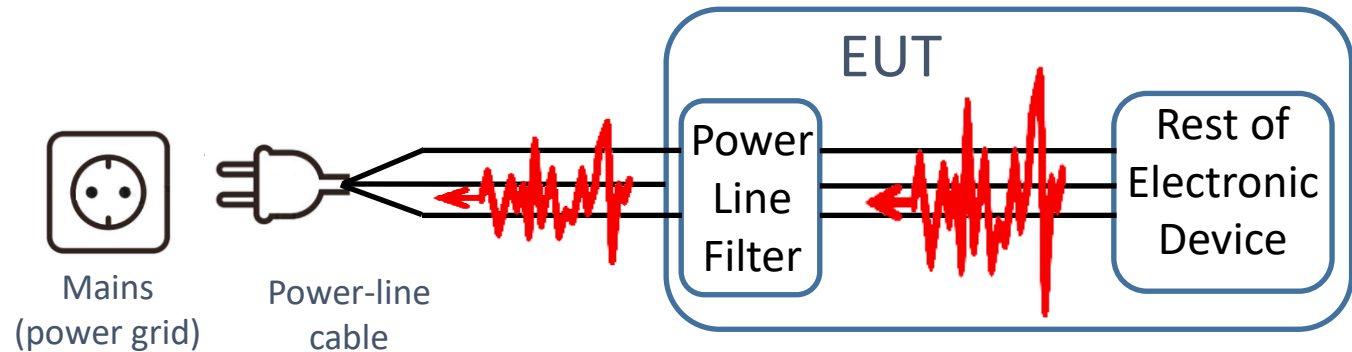
EMSCOPE

Innovative EMI receiver for modal measurements

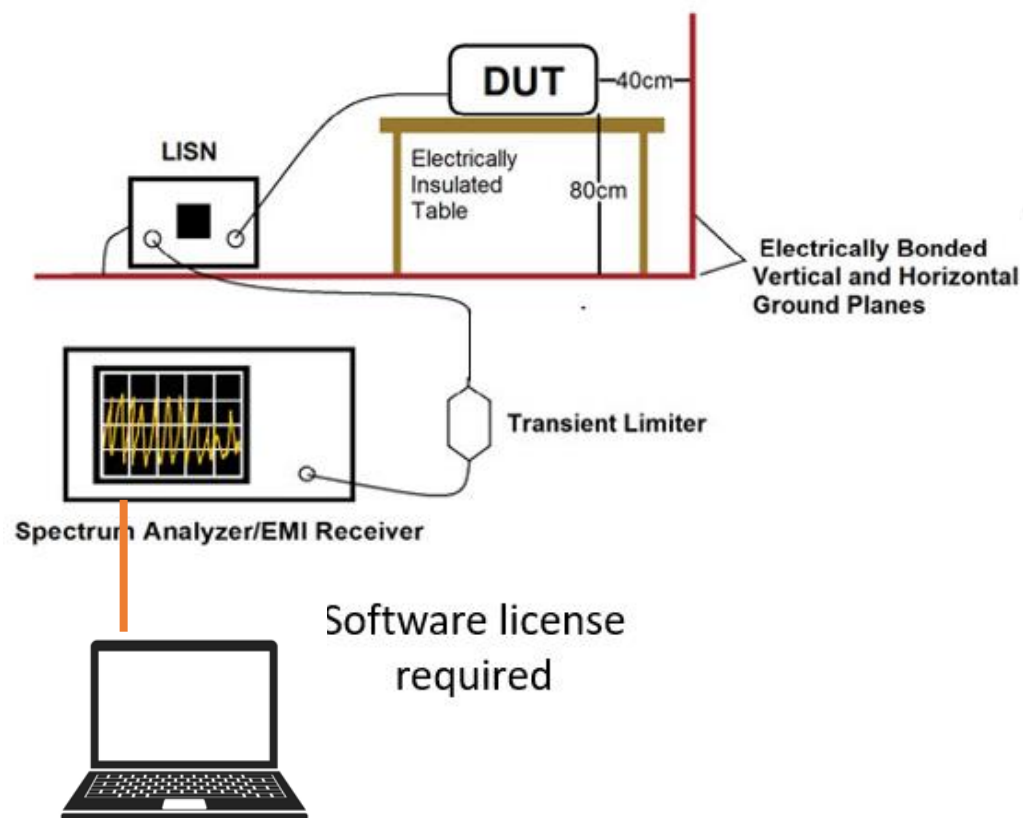
1. EMI - Conducted Emissions Tests
2. Modal Measurements
 - New approach for Conducted Emissions
 - Why are they important ?
 - EMI & Modal Measurements Example
3. EMSCOPE Advantages
4. EMSCOPE Technical Specifications
5. Other Products

Conducted Emissions

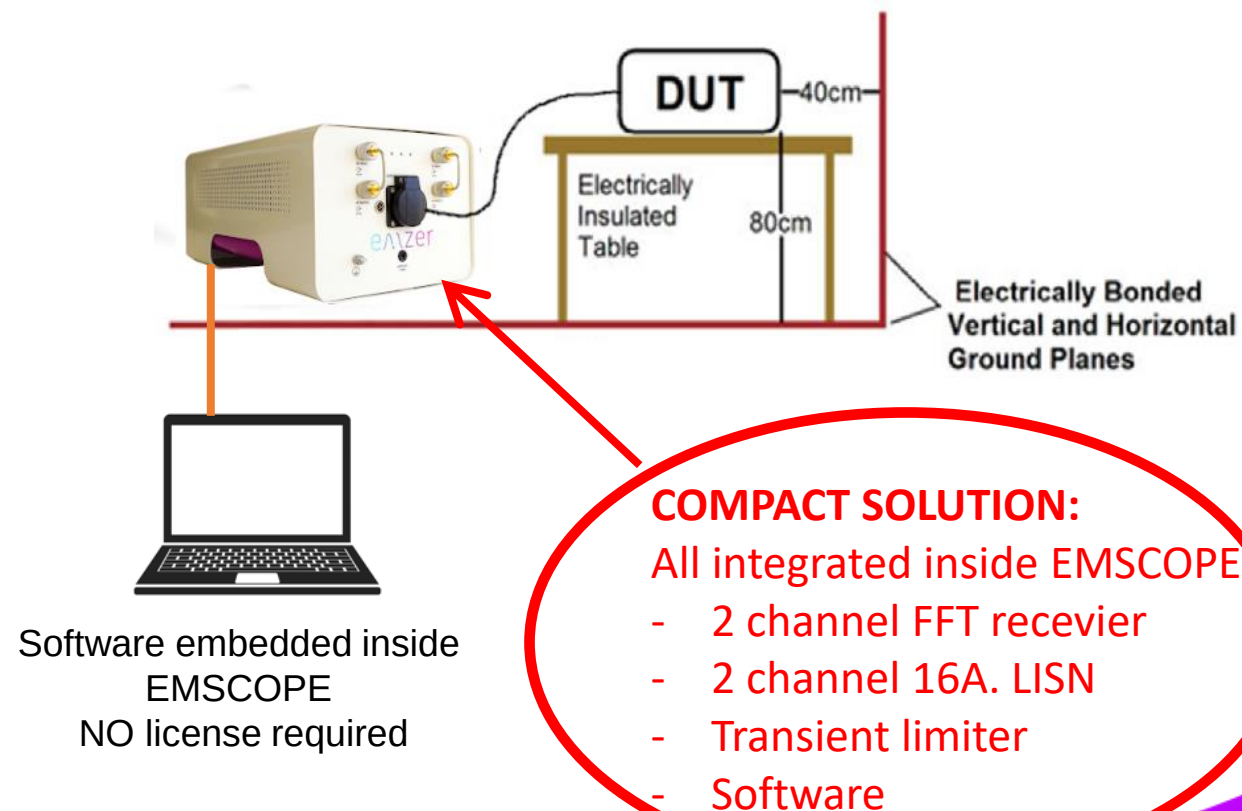
- Disturbance voltages generated by the Equipment Under Test (EUT) and transmitted to the mains supply through the power cables
- EMC Standards specify:
 - Limits for mains terminal disturbance voltages
 - Equipment required
 - Test Methods



- Standard EMC Measurement



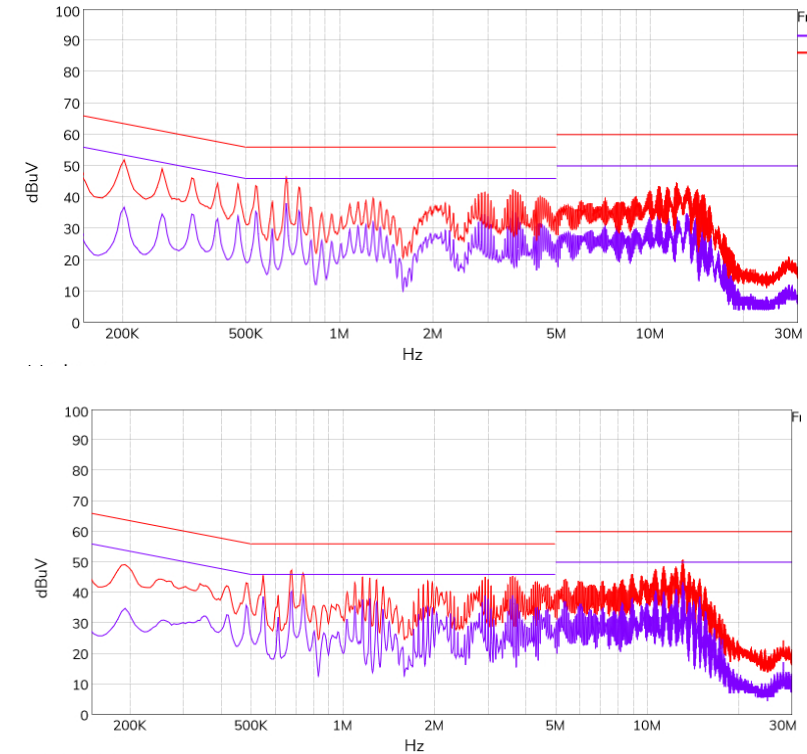
- EMSCOPE Solution



Typical EMI Measurements – Standard approach

- Only Line and Neutral are measured
- Not possible to determine the source of the noise
- Not enough information to help designing a power line filter
- Time consuming when analog receivers are used
- Cost consuming
- **New approach : Modal Measurements**

*Line (QP & AVG) & Neutral (QP & AVG)
Measurements*



Modal measurements:

- Common Mode (Asymmetrical) Composed of signals that travels though line and neutral in in the same direction.
- Differential mode (symmetrical) Composed of signals that travels though line and neutral in opposite directions.

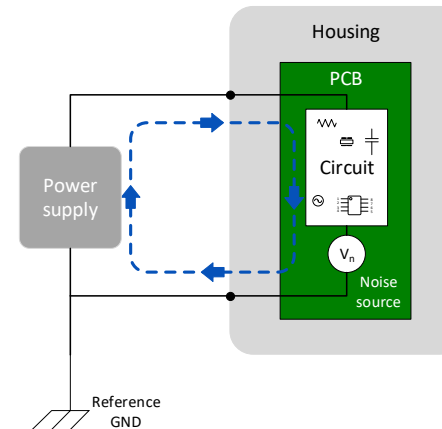
Why is modal measurements that important?

- Detect the conducted noise source
- Better characterization of DUT (Device Under Test)
- Minimize the efforts to pass EMC tests

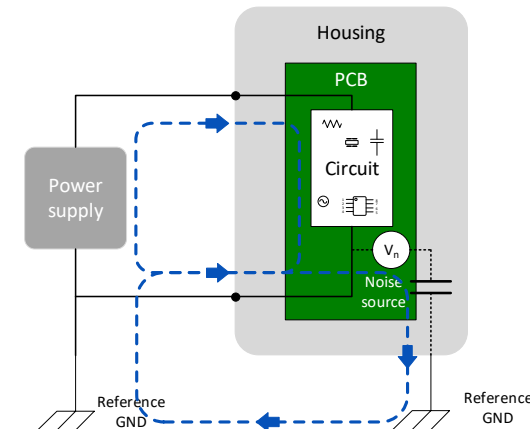
Easy implementation/design of Power Line Filter (PLF)

- Precise and effective filter to reduce emissions
- Minimize additional testing costs and efforts
- Cost-effective
- Improvement of the DUT immunity

Differential mode noise

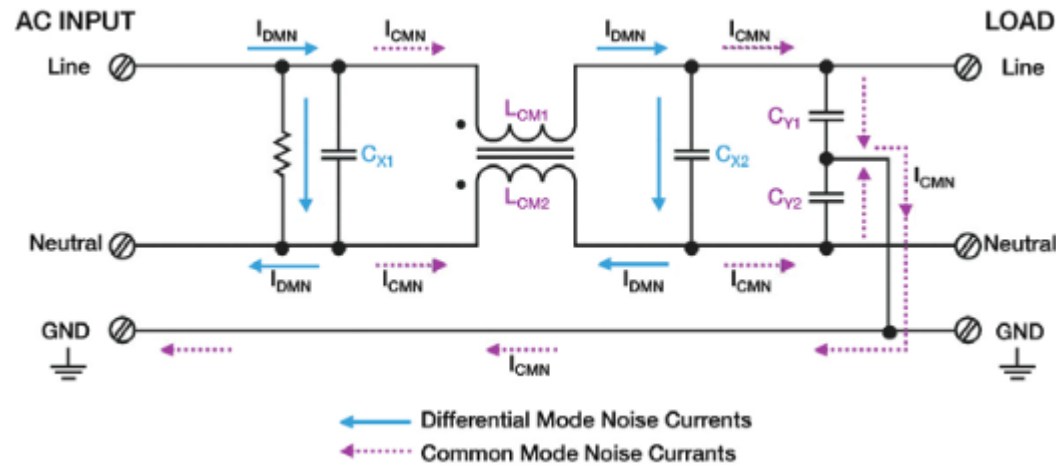


Common mode noise



EMCSCOPE Modal Measurements Capabilities:

- 2-ports receiver measuring simultaneously Line and Neutral allow the modal decomposition
- Identify the dominant mode to find the required components for the power-line filters



Components to reduce CM and DM noise

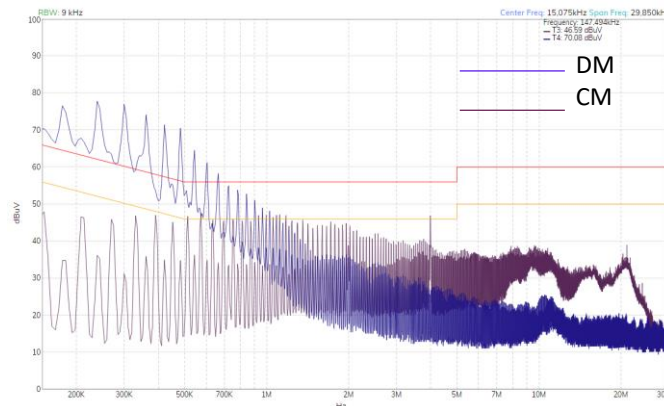
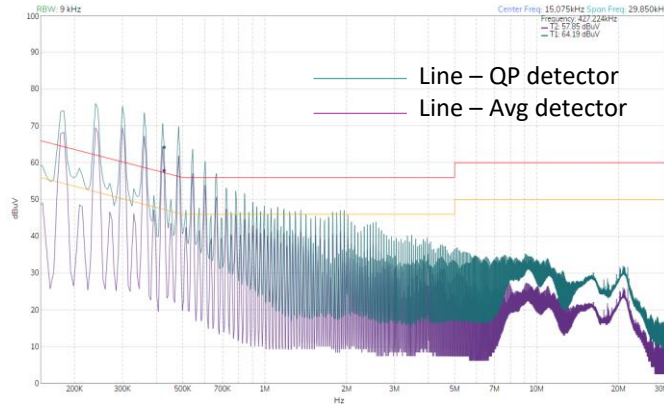
Common Mode	Common-Mode choke CY capacitors
Differential Mode	CX capacitors

2. EMSCOPE – EMI & Modal Measurements Example

Distinguish and detect where the noise comes from.

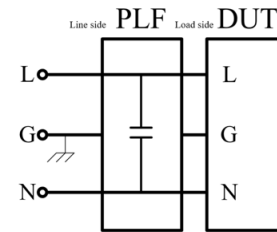
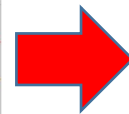
Only differential mode filtering is needed to reduce the emissions and pass EMI test.

Fail EMI
Measurements

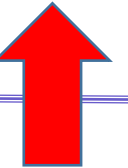
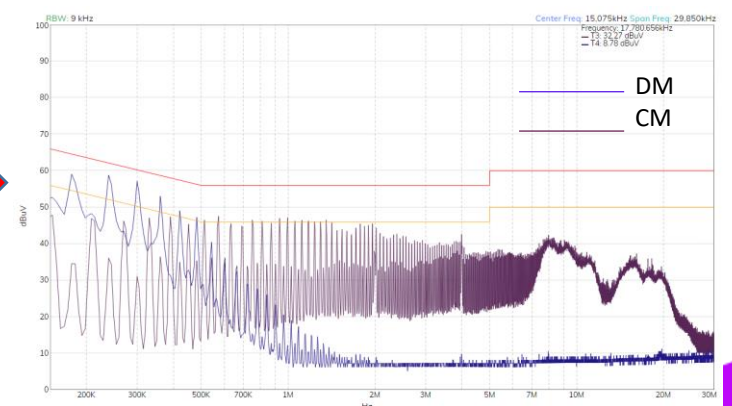
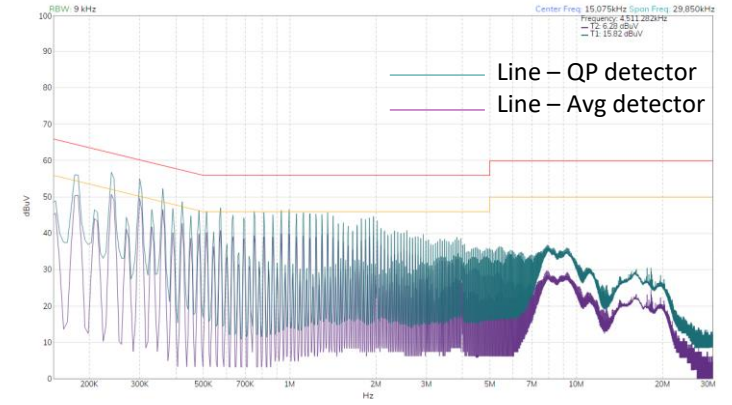
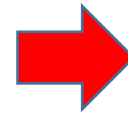


Perform
MODAL
Measurements

DM is the noise
source



Apply Line filter for
DM reduction

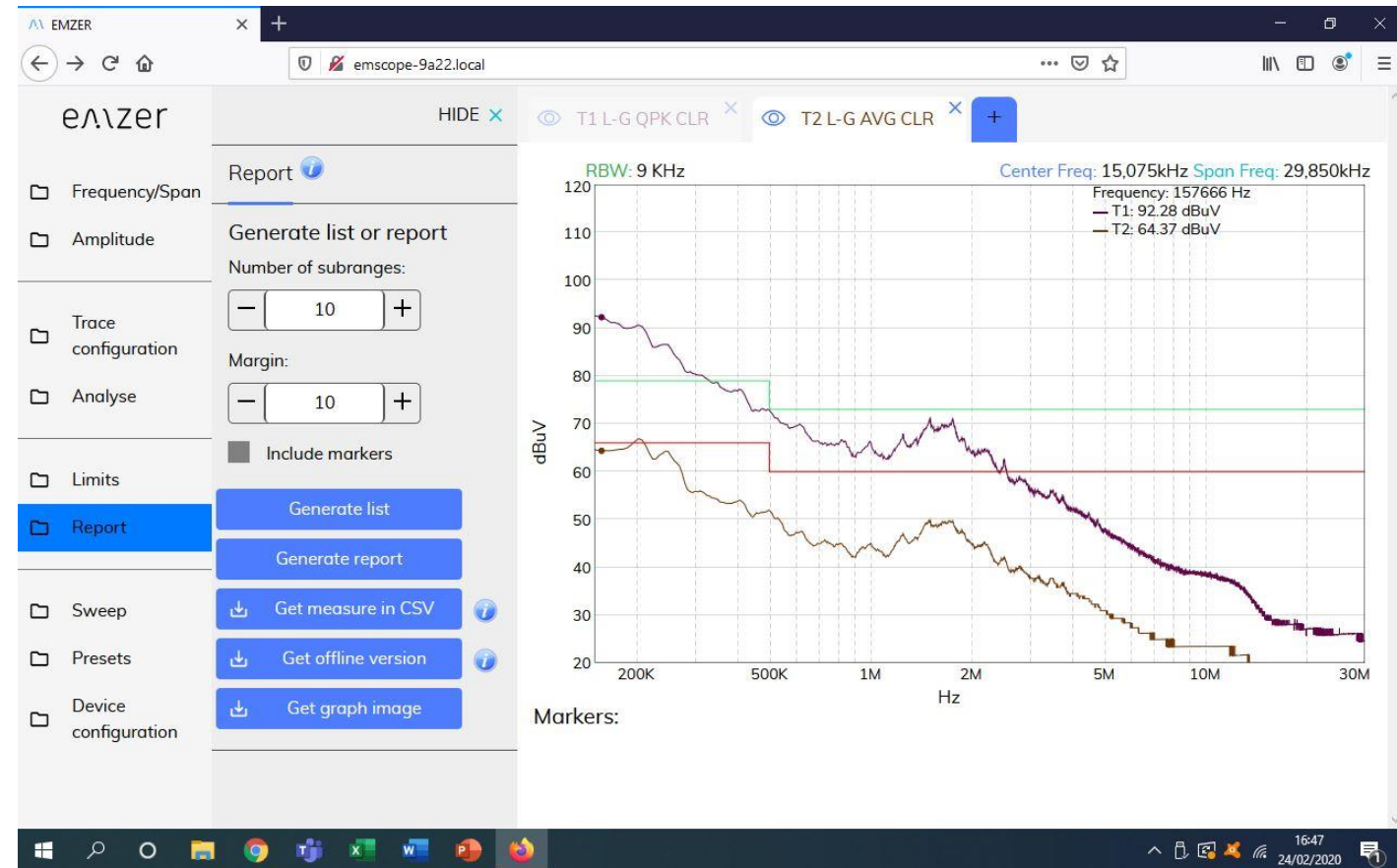


World's First Dual FFT-based MODAL EMI Receiver

- **Dual FFT-based Modal EMI Receiver**
 - Standard EMI Measurements (L & N)
 - Modal measurements
- **CISPR16-1-1 Compliant**
- **Faster Results**
 - FFT based
 - Dual Channel
 - Up to 6 simultaneous measurements (2 Channels and 3 detectors)
- **Standalone equipment**
 - Integrated LISN (external LISN also possible)
 - Integrated attenuator
 - Integrated pulse limiter
 - Software embedded – Free updates
 - Cost-effective solution
- **Ethernet Hub connection**
 - Usable by any PC in the network (or USB direct)

- **Frequency Range**
 - 9 kHz – 110 MHz
- **Compliance**
 - QP detector acc. to CISPR16-1-1 (2019)
 - AVG detector acc. to CISPR16-1-1 (2019)
- **Accurate**
 - ADC 16 bits
 - 100-120 dB dynamic range
 - 250 MHz sampling rate
- **FFT**
 - Complete B-Band
 - No frequency bands required
 - Allows measurements of slow repetition rate interferences
- **MIL-STD filters included**

- Embedded inside EMSCOPE
- Easy and intuitive operation
- No License required
- Free Updates
- Fiber Optic Connection
 - To Ethernet/HUB : visible to all PCs
 - Direct to PC/USB (optional)



- Instrument for EMI measurements that **combines an EMI-Test Receiver with a 16-A single-phase dual-port V-network LISN** and a Transient Limiter fully compliant to CISPR 16-1-1 and CISPR 16-1-2
- EMSCOPE integrates **the peak, quasi-peak and average detectors** that can be run in parallel and **real time measuring** line and neutral emissions, or CM and DM
- EMSCOPE can be **connected to LAN** using the supplied optical fiber, and it is **remotely controlled** using a friendly web-based application
- LISN impedance: $(50\mu\text{H}+5\Omega)//50\Omega$, frequency range: from **9 kHz to 30 MHz**, artificial hand connector impedance: $510\Omega + 220\text{pF}$, and several ground connectors in both front and rear panels. including a large grounding bar



4. EMSCOPE – Technical Specs

Electrical Characteristic	EMSCOPE-30	EMSCOPE-110
Reguency Range	9 kHz – 30 MHz	9 kHz – 110 MHz
Frequency range / RBW Filter	9 kHz to 150 kHz / 200 Hz 9 kHz to 150 kHz / 1 kHz 150 kHz to 30 MHz / 9 kHz 150 kHz to 30 MHz / 10 kHz	9 kHz to 150 kHz / 200 Hz 9 kHz to 150 kHz / 1 kHz 150 kHz to 30 MHz / 9 kHz 150 kHz to 30 MHz / 10 kHz 30 MHz to 110 MHz / 120kHz
RF inputs	N fem.	
Attenuator	0 dB to 78 dB (1 dB step)	
Pulse limiter	Built in. Max input 5W, up to 200 MHz. 1dB compression point: 23dBm	
Detectors	Peak, Quasi-peak, CISPR Average (all can be run simultaneously on both lines, up to 6 detectors), fully compliant to CISPR 16-1-1	
Type of measurements	EMI (line and neutral) and Modal (common and differential mode) conducted emissions	
Full spectrum measurement time	Equal to the measurement dwell time, which is totally configurable from 1s to 15s	
Display units	dBm, dBmV, dBμV, Watts, Volts	
CISPR 16-1-1 conformity	Standard compliant QP detector down to 10 Hz PRF Standard compliant Average detector down to 10 Hz PRF	
I/O Interface	SFP Optical	
Built in LISN	Fully compliant to 16-1-2 standards Continuos rated output current: 16 A Max permissible operating voltaje: 250 V _{AC} – 400 V _{DC} EUT supply frequency range: DC to 60 Hz	

EMSCOPE



LIZN: Single Phase LISN

- 16-A single-phase **dual-port** V-network Line Impedance Stabilization Network (LISN) **fully compliant to CISPR 16-1-2**
- High-performance 250- μ H inductor that provides an excellent decoupling between the device under test and the mains
- **Two N-type connectors** to allow the simultaneous measurement of line and neutral conducted emissions, making the **measurement of the CM and DM** easier
- LISN impedance: $(50\mu\text{H}+5\Omega)//50\Omega$, frequency range: from 9 kHz to 30 MHz, artificial hand connector impedance: $510\Omega + 220\text{pF}$, and several ground connectors in both front and rear panels. including a large grounding bar

EMZ10-200 : Transient Limiter and attenuator

- **9 kHz – 200 MHz**
- **10 dB** attenuation
- Max input Power: **5 W** (37 dBm, 144 dB μ V)
- Connectors: N-f / N- m

