

50 μ H Line Impedance Stabilisation Network

1 Introduction

The TBL50100-1 50 μ H is a single channel 50 Ω // 50 μ H LISN for the frequency range 150 kHz – 30 MHz according to CISPR 16-1-2.

In addition to conducted noise measurements on AC or DC supplied equipment, the LISN can be used to establish a defined impedance for a variety of other standardized tests.

The LISN is inserted into the supply line of the EUT (Device Under Test). Conducted noise, which is present at the supply terminals of the EUT can be measured at the BNC connector using a spectrum analyzer or a measurement receiver. The SOURCE (supply) terminal and the EUT terminal are decoupled by a 50 μ H inductor.

DC or single-phase measurements typically require a pair of TBL50100-1. In conjunction with the Tekbox LISN-Mate common mode noise and differential mode noise can be measured separately. EUTs with 3-phase supply require three or four pieces of TBL50100-1, depending on whether the product is connected in delta or star configuration.

The product includes a BNC-male to N-male RG232 cable, mating connectors for SOURCE and EUT and an individual calibration protocol.



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2 Parameters

LISN type: V-AMN, 50 Ω // 50 μ H; no 250 μ H pre-filter

Specified frequency range: 150 kHz – 30 MHz

Characterized frequency range: 9 kHz -100 MHz

DC Resistance: < 20 m Ω

Maximum current: 70 A continuous, 100A for 10 minutes; see heat up characteristics plot

Operating voltage range: 0 – 250V DC; 0 - 250V AC (50/60 Hz)

High current plug / screw terminals; male: Phoenix Contact 1762741, female: Phoenix Contact 1762592

RF connector: BNC female

Dimensions: 350 mm x 230 mm x 230 mm;

Weight: 5.3 kg

2.1 Conformity

The TBL50100-1 is compliant with CISPR 16-1-2.

In line with the CISPR 16-1-1 standard compliant design and setup specification, the TBL50100-1 LISN exhibits high ground leakage currents and non-standard isolation and consequently cannot meet the safety requirements of EN 61010-1.

Furthermore CISPR 16-1-2 specifies high capacitance values for the capacitors from Line / + to Ground. These capacitance values are not commercially available in Y2 rating and are implemented using AC rated capacitors with suitable voltage rating.

In order to prevent the danger of lethal electric shock, the operator is responsible for ensuring protective measures in line with IEC 60364-4-41 and IEC 60364-5-54 and to follow all safety related information of this manual.

2.2 Safety

To ensure safe operations, the user must adhere to all safety-related information in this manual. All metal parts of the housing are connected to the earth pins of the Source and EUT sockets. Before connecting any other conductor to the LISN, connect protective Earth to the base panel.

Protective Earth must not be disconnected from the base panel unless all other wiring has been disconnected first. Special care must be taken to avoid connecting AC - line or VDC+ to the EARTH pin of the SOURCE connector by mistake.

When operating the LISN with alternating current, use an isolation transformer.

While the source connector is under voltage, do not connect or disconnect it.

The TBL50100-1 shall be operated by qualified laboratory staff only.

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3 Warning

Spectrum Analyzer / Measurement Receiver protection:

The TBL50100-1 LISN does not contain any protective elements in the RF path. Use an external attenuator and / or limiter, if your EUT may produce harmful transients or high RF noise levels, in order to protect the spectrum analyser / measurement receiver input. If using without transient limiter and testing AC supplied products, it is highly recommended to protect the input of the connected analyzer with TBHPF1-9kHz or TBHPF1-150 kHz highpass filters.

Safety:

Operating an AC LISN involves dealing with potentially lethal voltages and high ground leakage currents. The LISN shall only be operated by qualified staff.



Read this manual carefully and be sure to understand the operation of the LISN. Make sure that the conducted noise test equipment is set up correctly and that the necessary earth connections are reliably bonded to avoid the risk of lethal electric shocks. The ground panel must be securely connected to the protective earth conductor available on site, before making any other electrical connection. This connection must not be separated, until the supply voltage is disconnected from the LISN setup.

When connecting the LISN to AC mains voltage, always use an isolation transformer.

Take precautions, such as validating the signal amplitude at the RF output prior to connecting a spectrum analyzer or using attenuators and/or limiters to prevent damage to your test receiver or spectrum analyzer.

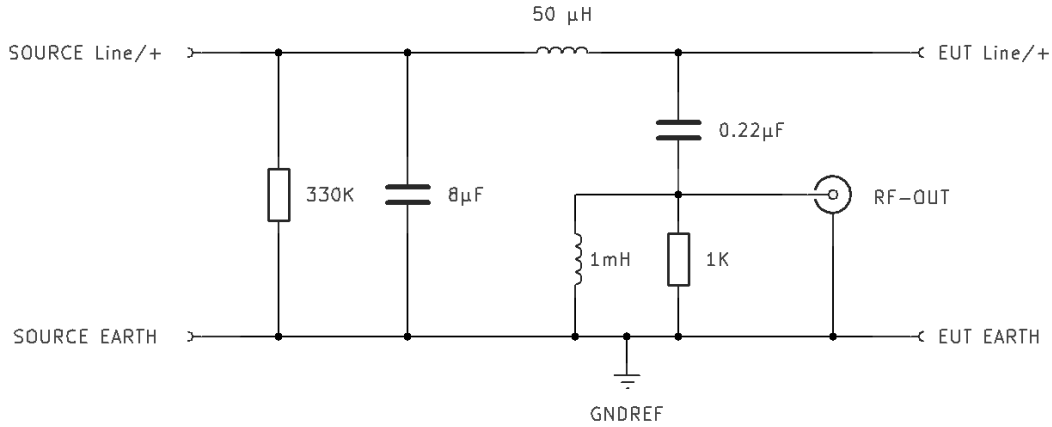
Do not carry out any modifications or manipulations of the TBL50100-1.

Avoid touching the housing, when operating the LISN at maximum current over extended time. The housing temperature may rise up to 60°C. Turn off the EUT after measurements to avoid unnecessary dissipation.

The LISN housing is connected to the negative / ground SOURCE and EUT pin of the terminal block and the ground of the RF connector. Inadvertently connecting the positive voltage to the ground pin will expose you to the risk of electric shock. The maximum source voltage rating with respect to component ratings is 250V.

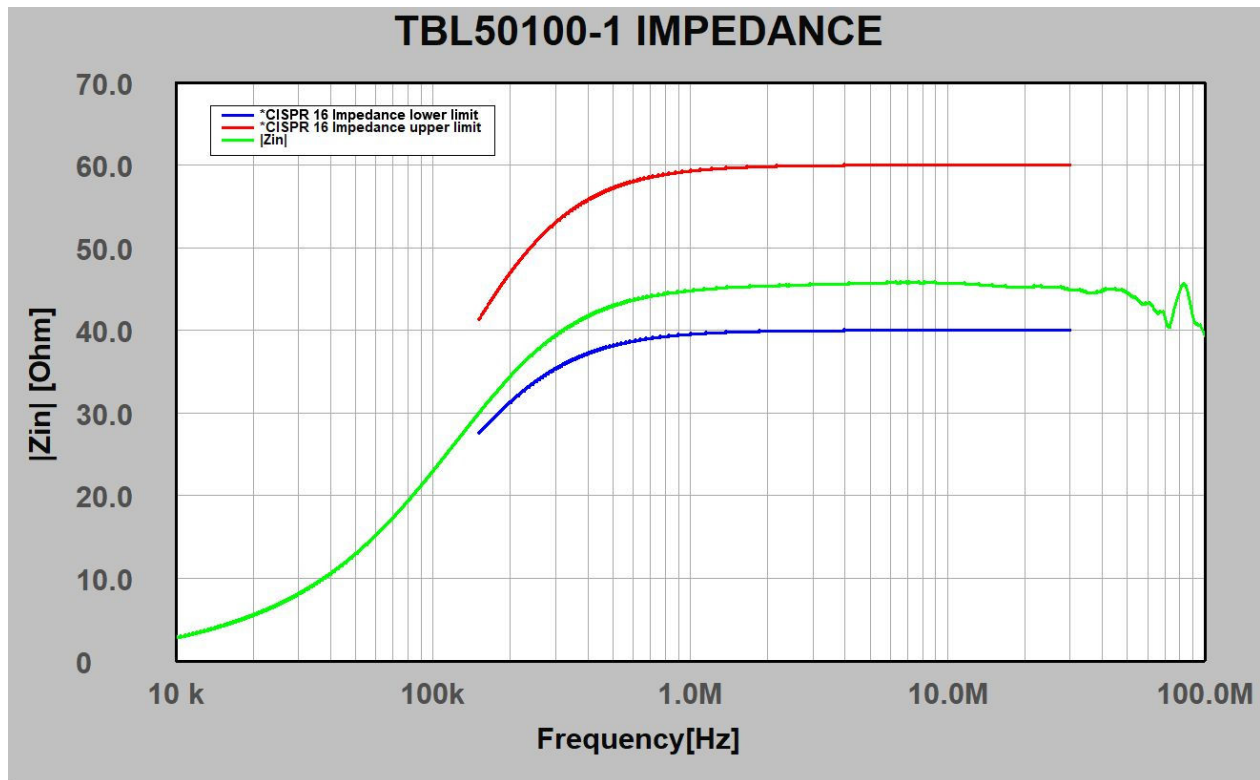
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4 Principle schematic



Picture 1: principle schematic

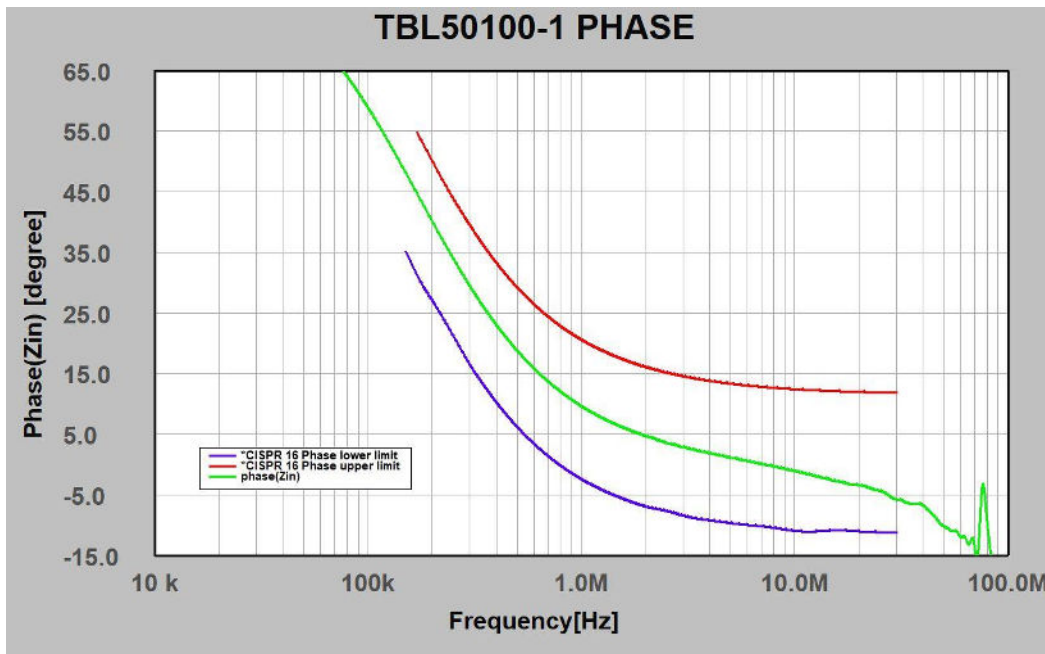
5 Impedance



Picture 2: LISN impedance

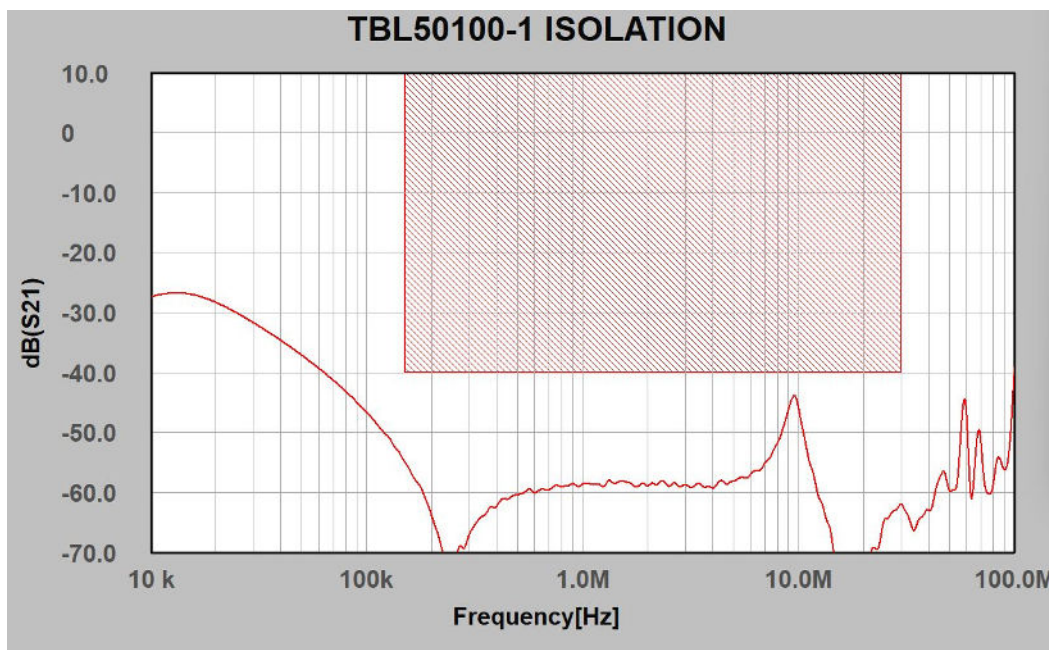
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6 Phase



Picture 3: LISN phase

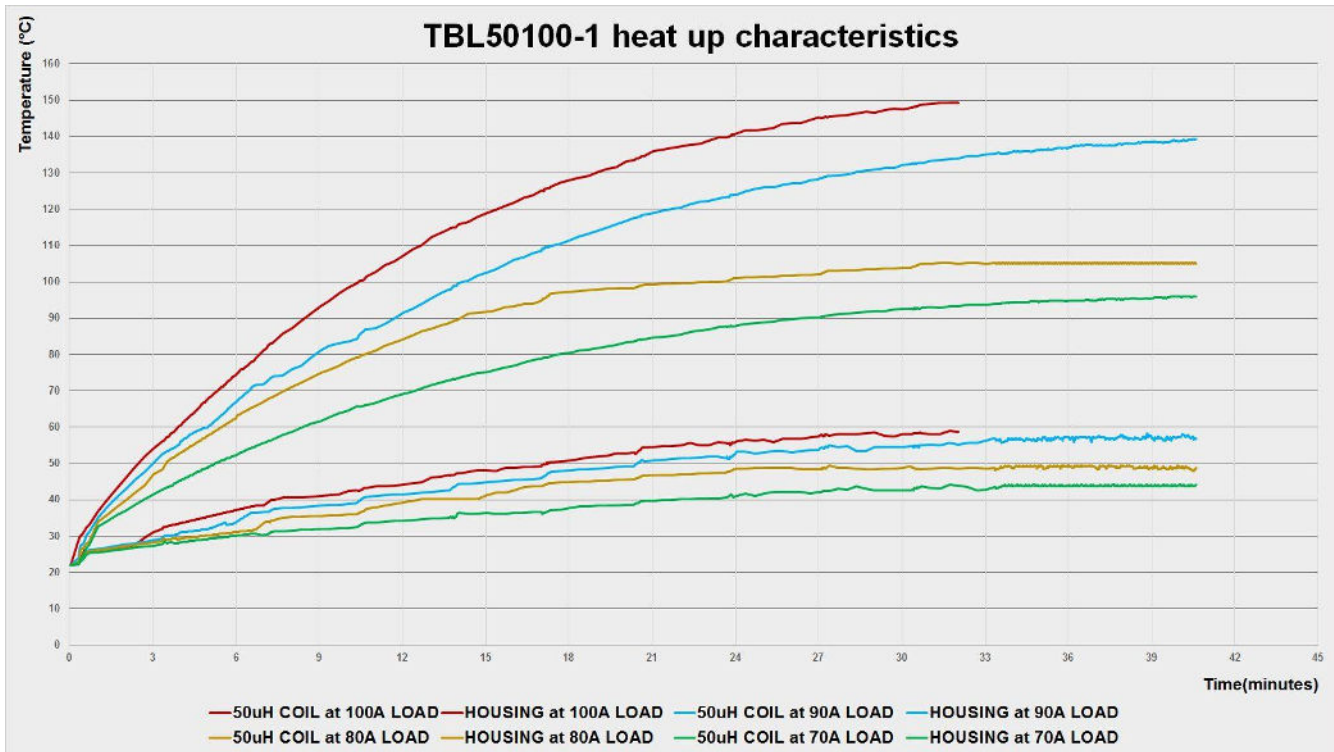
7 Isolation



Picture 4: LISN Isolation, Source to RF out

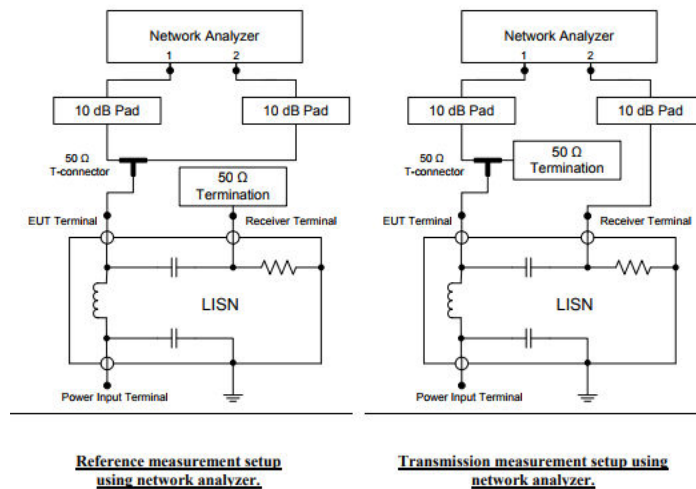
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8 Thermal characteristics



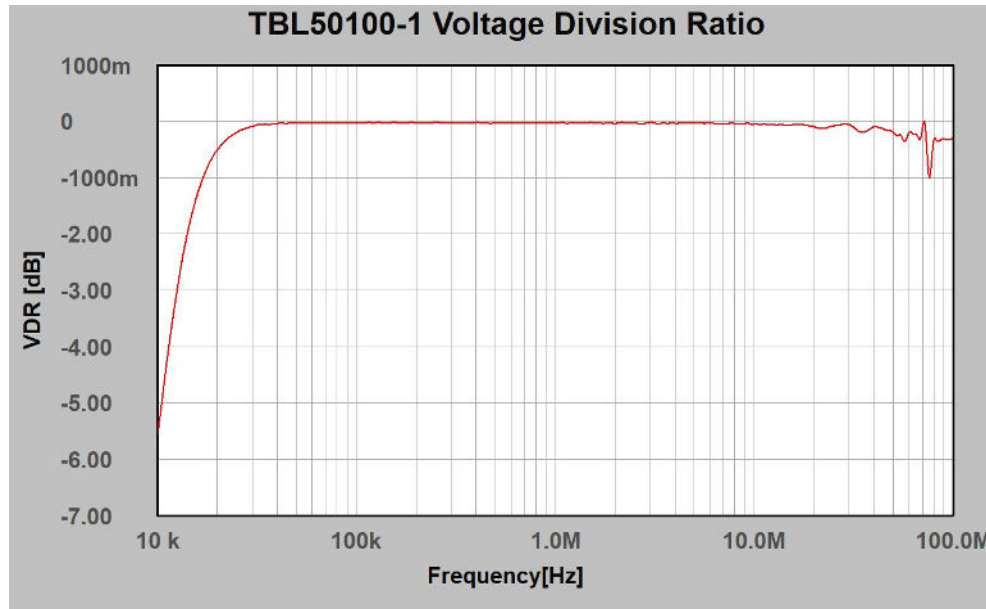
Picture 5: Coil and housing temperature vs. current

9 Calibration data according to CISPR 16 -1-2 Annex A8



Picture 6: Calibration set up according to CISPR 16-1-2 Annex A.8.

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Picture 7: Voltage division ratio EUT terminals to RF connector

Frequency [MHz]	Voltage Division Ratio EUT port to RF port [dB]	Frequency [MHz]	Voltage Division Ratio EUT port to RF port [dB]	Frequency [MHz]	Voltage Division Ratio EUT port to RF port [dB]
0,009	-6,85	3	-0,04	24	-0,14
0,01	-5,77	4	-0,04	25	-0,11
0,015	-1,63	5	-0,04	26	-0,08
0,02	-0,53	6	-0,05	27	-0,07
0,025	-0,21	7	-0,06	28	-0,06
0,05	-0,04	8	-0,06	29	-0,05
0,075	-0,04	9	-0,06	30	-0,06
0,1	-0,04	10	-0,08	35	-0,21
0,125	-0,04	11	-0,07	40	-0,12
0,15	-0,04	12	-0,07	45	-0,19
0,175	-0,04	13	-0,07	50	-0,24
0,2	-0,04	14	-0,07	55	-0,23
0,3	-0,04	15	-0,06	60	-0,29
0,4	-0,04	16	-0,06	65	-0,30
0,5	-0,04	17	-0,06	70	-0,15
0,6	-0,04	18	-0,07	75	-0,89
0,7	-0,04	19	-0,08	80	-0,34
0,8	-0,04	20	-0,11	85	-0,37
0,9	-0,04	21	-0,14	90	-0,32
1	-0,04	22	-0,16	95	-0,35
2	-0,04	23	-0,16	100	-0,28

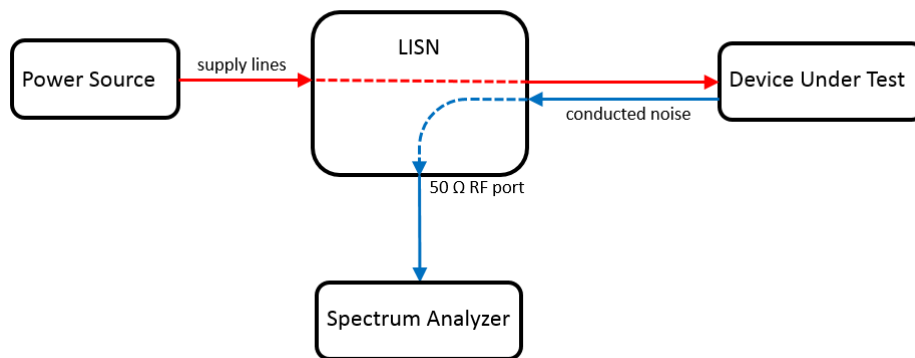
Table 1 - LISN calibration data, voltage division ratio, typical data

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10 Application

The abbreviation LISN stands for Line Impedance Stabilisation Network.

- It is a low pass filter typically placed between a power source and the supply terminals of an equipment under test (EUT).
- It has a feed-through path to supply the EUT with power
- It provides a well-defined RF-impedance to the EUT
- It couples electrical emissions generated by the EUT to a 50 Ω RF port, which can be connected to a spectrum analyser or measurement receiver
- It suppresses electrical noise from the supply side towards the EUT
- It suppresses electrical noise from EUT side towards the supply



Picture 8: Basic diagram of a conducted emission measurement setup with a LISN

Note that the above basic diagram is simplified. Typically, a standard conformant setup needs two TBL50100-1. One LISN is inserted in the positive supply line and the other LISN is inserted in the negative supply line. Conducted emission measurements have to be carried out on both supply lines. While measuring the emissions on one of the supply lines, the RF output of the other LISN must be terminated with 50 Ohm. Similarly, when testing an AC supplied product, one LISN must be inserted in the phase line and the other LISN in the neutral line. Products with 3 phase AC supply can be tested using three (delta configuration) or four (star configuration) TBL50100-1.

10.1 Operation

The TBL50100-1 LISN does not contain a 250 μ H pre-filter. It contains a high pass to reduce the residual 50 Hz amplitude at the RF output, but no transient limiter and no attenuator.

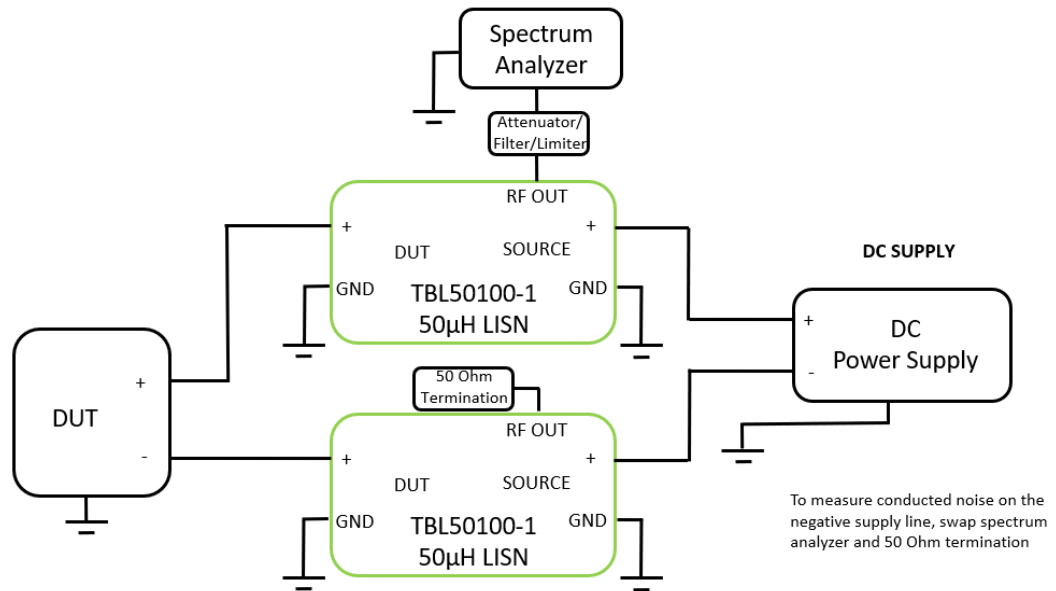
To protect the spectrum analyzer / measurement receiver input, it is highly recommended to use an external filter/attenuator/transient limiter such as the TBFL1 or similar. External attenuators may also be necessary, depending on the behaviour of the EUT.

Furthermore, the TBL50100-1 LISN has an 8 μ F capacitor to ground. In AC applications, the capacitor draws a significant amount of blind current, which would trip the mains ground fault switch. Hence, the TBL0550-1 must be supplied through an isolation transformer.

Separate measurement of differential and common mode noise can be carried out using two TBL50100-1 in combination with the Tekbox LISN Mate TBLM1.

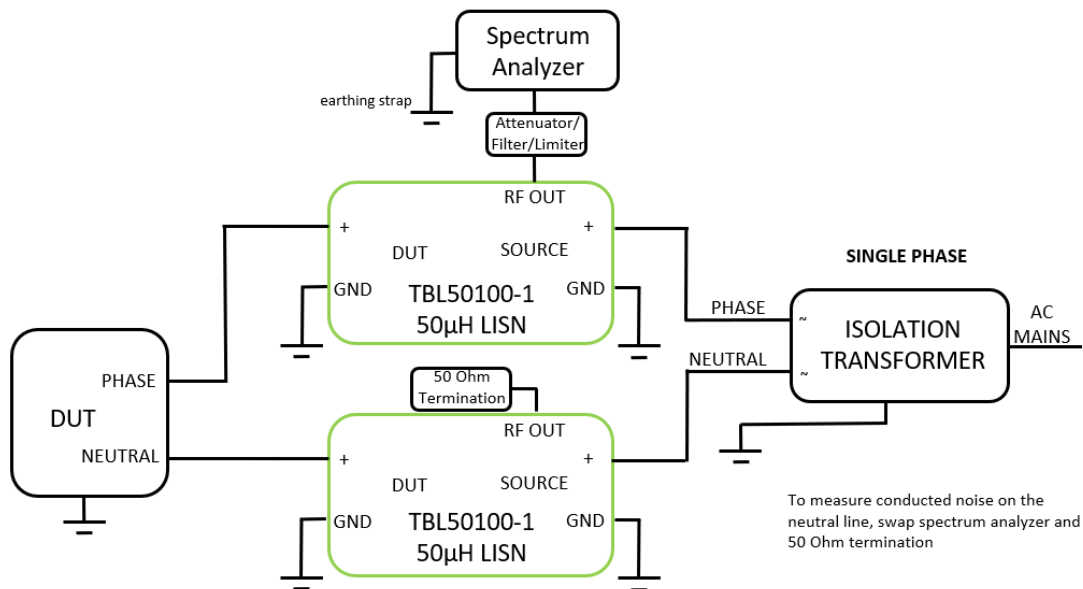
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10.2 Wiring Variants



Follow the specifications of the applicable EMC standard for the setup's layout and groundplane connectivity

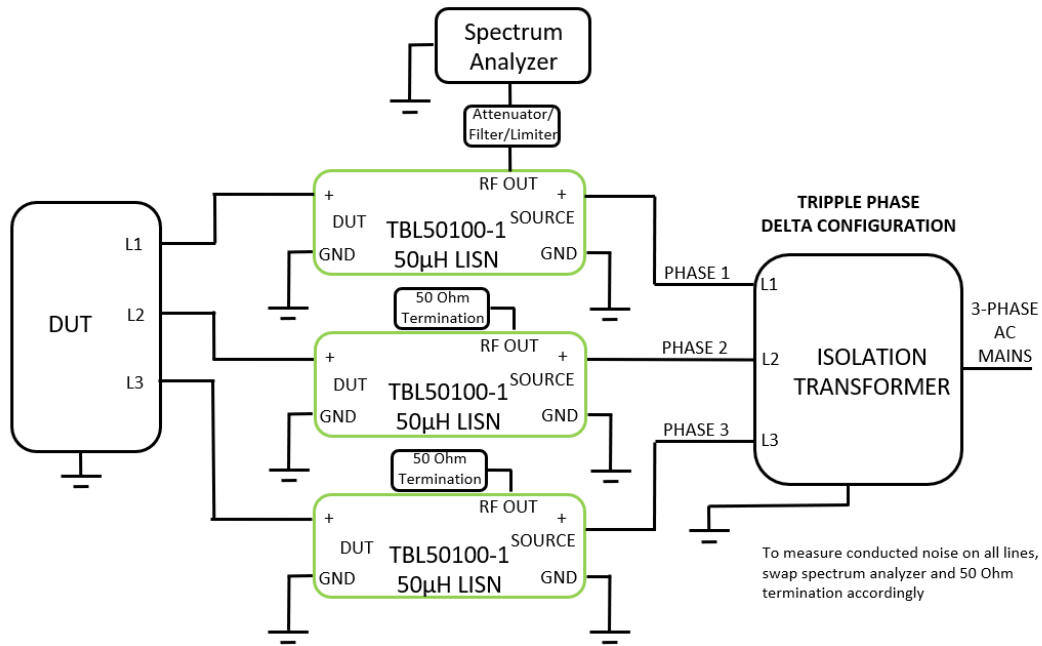
Picture 9: Measurement setup for DC supplied equipment



Follow the specifications of the applicable EMC standard for the setup's layout and groundplane connectivity

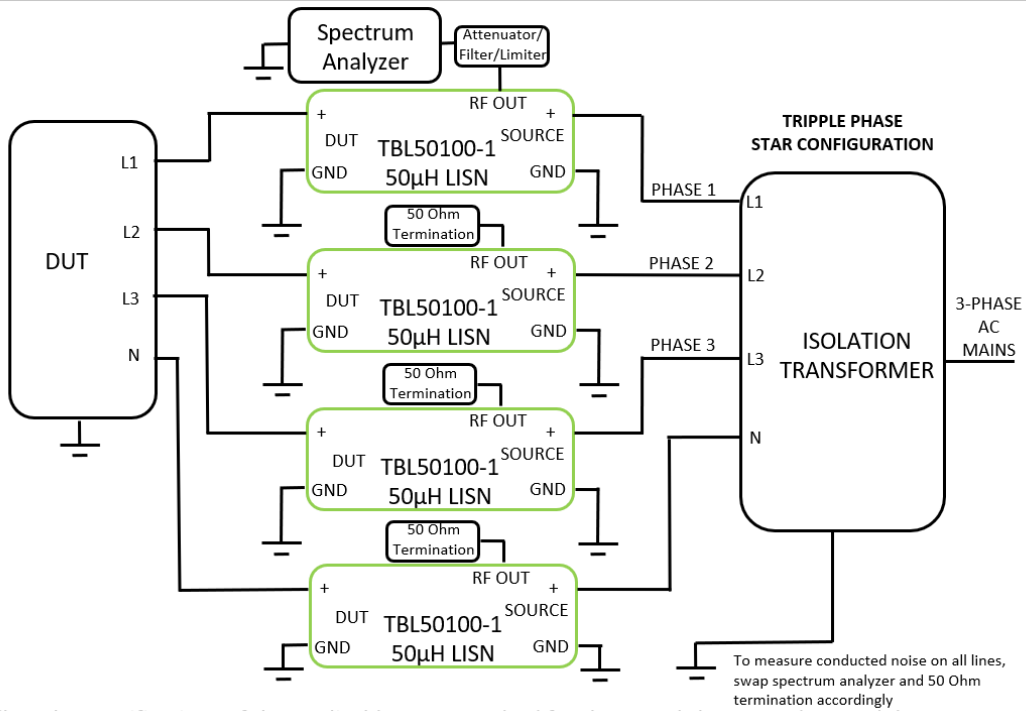
Picture 10: Measurement setup for single phase AC supplied equipment

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Follow the specifications of the applicable EMC standard for the setup's layout and groundplane connectivity

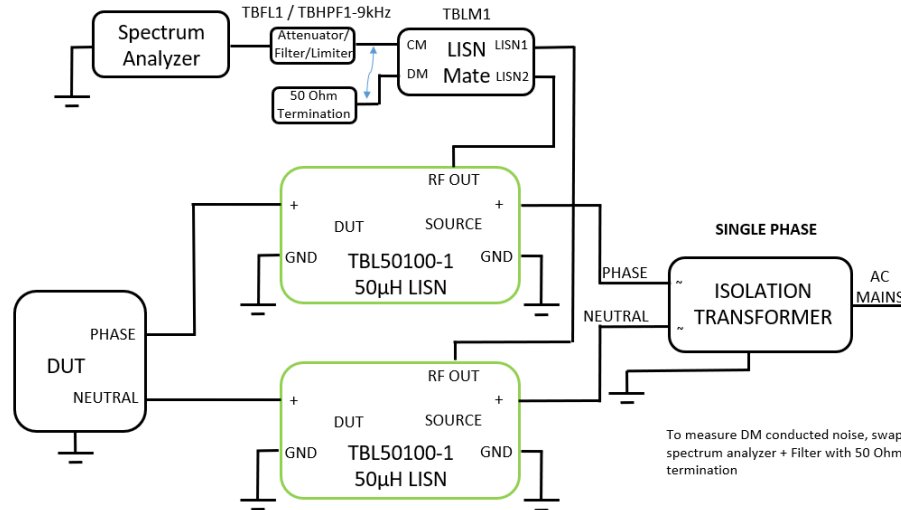
Picture 11: Measurement setup for triple phase AC supplied equipment in Delta configuration



Follow the specifications of the applicable EMC standard for the setup's layout and groundplane connectivity

Picture 12: Measurement setup for triple phase AC supplied equipment in Star configuration

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Follow the specifications of the applicable EMC standard for the setup's layout and groundplane connectivity

Picture 13: Measurement setup example for separate measurement of common mode noise and differential mode noise, using a LISN-Mate, the same principle can be applied to any wiring variant

11 Ordering Information

Part Number	Description
TBL50100-1	50μH LISN, 2pcs. female terminal blocks Phoenix Contact 1762592, 1 pc. 75 cm BNC-male to N-male RG223 cable, calibration protocol

Optional Accessories:

Part Number	Description
TBLA-PH2	BNC adapter for TBL50100 or TBL05100 EUT/SOURCE socket
TBT-BNCM-50	50 Ohm BNC termination

12 History

Version	Date	Author	Changes
V1.0	12.4.2023	Mayerhofer	Creation of the document