

50 μ H Line Impedance Stabilisation Network

1 Introduction

The TBL501000-1 is a high current single path 50 μ H // 50 Ω LISN for conducted emission measurements of DC or AC-powered electronic equipment. It is designed according to the CISPR 16-1-2 standard and characterized in the frequency range of 150 kHz to 30 MHz.

Combining two LISN with the Tekbox LISN Mate enables separate measurement of common mode and differential mode noise. EUTs with 3 phase supply require three or four pieces of TBL501000-1, depending on whether the product is supplied in delta or star configuration.

The LISN is equipped with fans to enable continuous operation up to 1000 A. The fans are available with either 100 V – 120 V or with 200V – 240 V supply voltage. A C14 connector with integrated switch sits on the rear panel. The LISN can be operated continuously with up to 500 A without fan.

An exposed stainless steel bottom profile enables convenient ground plane connection.



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2 Specification

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

Characterized Frequency range: 100 kHz – 30 MHz

DC Resistance: < 3 m Ω

Maximum current: 1000 A continuous with fan ON; 500 A continuous without fan

Operating voltage range: 0 – 1000V DC; 0 - 500V AC (50/60 Hz)

High pass to suppress residual AC: default jumpered ON; residual AC suppression > 66dB; RF out not terminated

EUT connector: High current wing terminal, M16 x 1.5

Source connector: High current wing terminal, M16 x 1.5

Earth: exposed stainless steel profile with mounting slots

RF connector: N-Female

Fan: Available with 100V-120V or 220V-240V supply voltage; C14 connector with integrated switch on rear panel

Dimensions: W x H x L; 480 mm x 600 mm x 660 mm;

Weight: 70 kg

2.1 Conformity

The TBL501000-1 is compliant with CISPR 16-1-2

In line with the CISPR 16-1-2 standard compliant design and setup specification, the LISN exhibits high ground leakage currents and non-standard isolation and consequently it 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 DUT sockets. Before connecting any other conductor to the LISN, connect the Earth profile at the bottom of the LISN to protective Earth.

Protective Earth must not be disconnected from the Earth brackets 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 TBL501000-1 shall be operated by qualified laboratory staff only.

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2.3 Warning

Spectrum Analyzer / Measurement Receiver protection:

The TBL501000-1 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 Tekbox highpass filters or to insert the internal highpass jumper.

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 pre – compliance 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 brackets 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 mains supply 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.

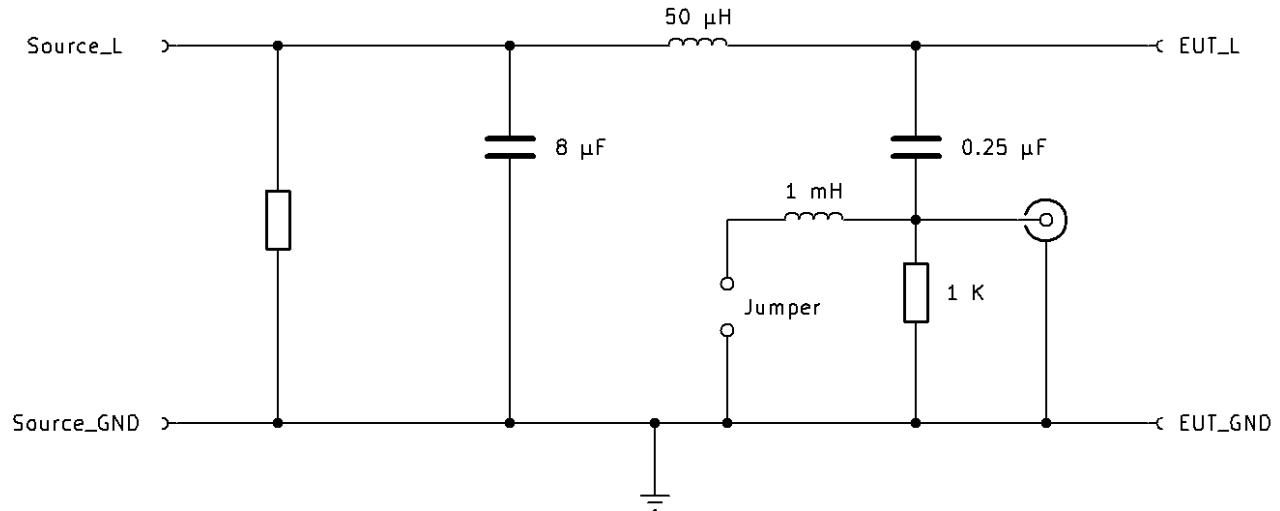
Do not carry out any modifications or manipulations of the TBL501000-1.

Avoid touching the housing, when operating the LISN at maximum current over extended time. The housing temperature may rise up to 45°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.

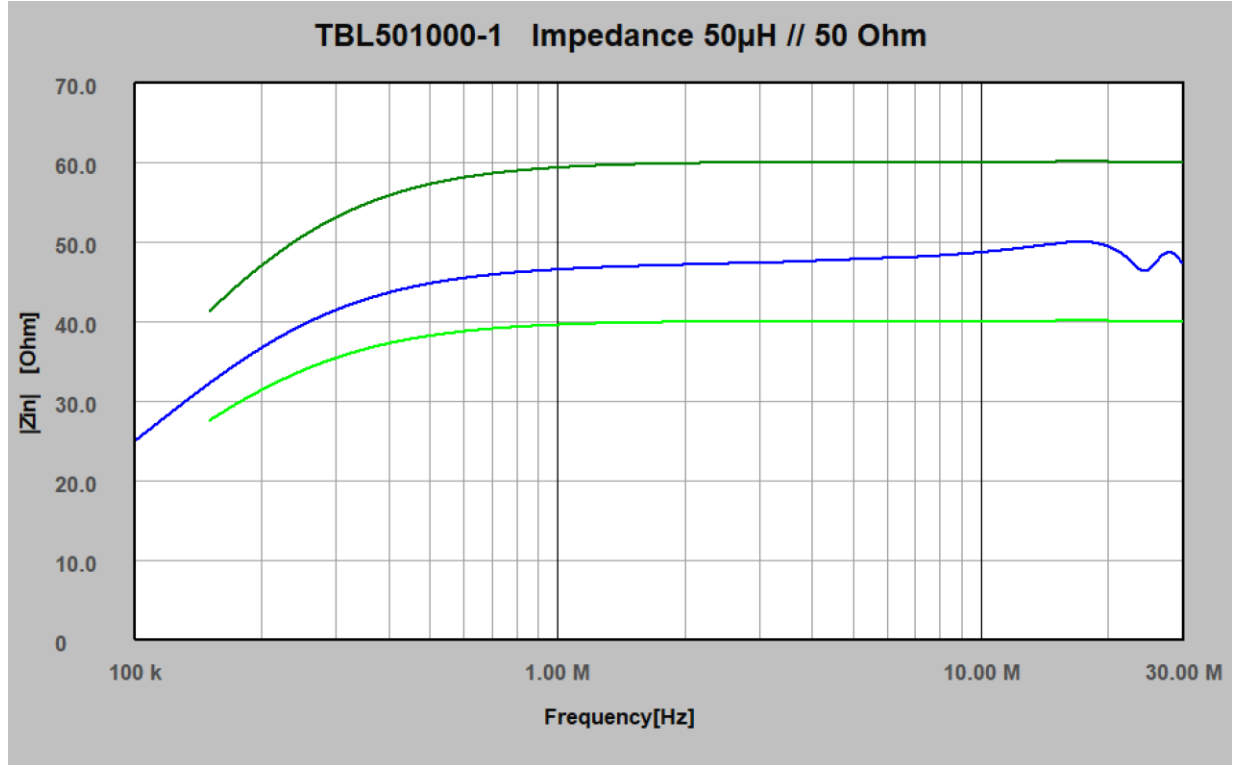
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3 Principle schematic



Picture 1: principle schematic

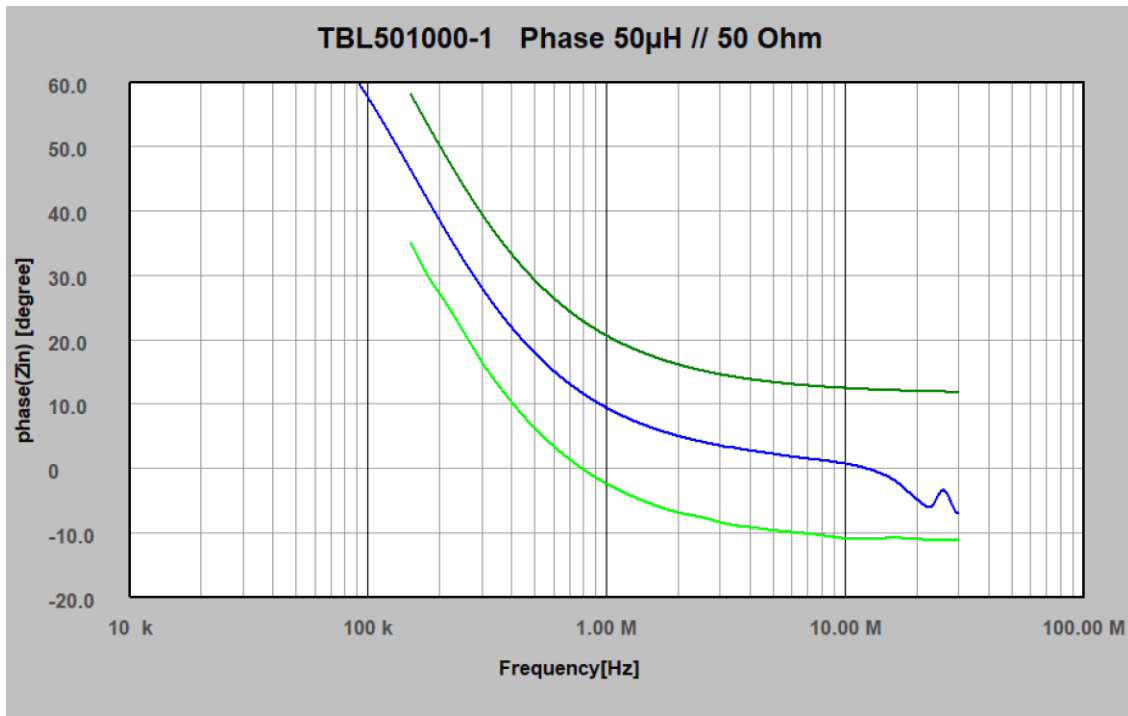
4 Impedance



Picture 2: LISN impedance, 50 Ω // 50 μ H, CISPR 16 limits

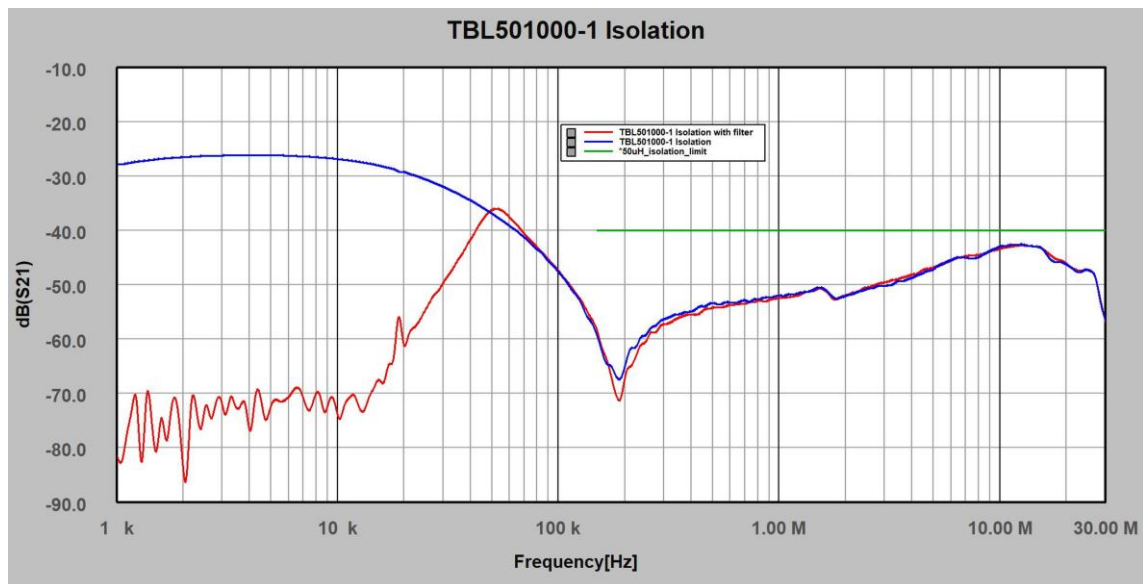
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5 Phase



Picture 4: LISN phase, 50 Ω // 50 μ H, CISPR 16 limits

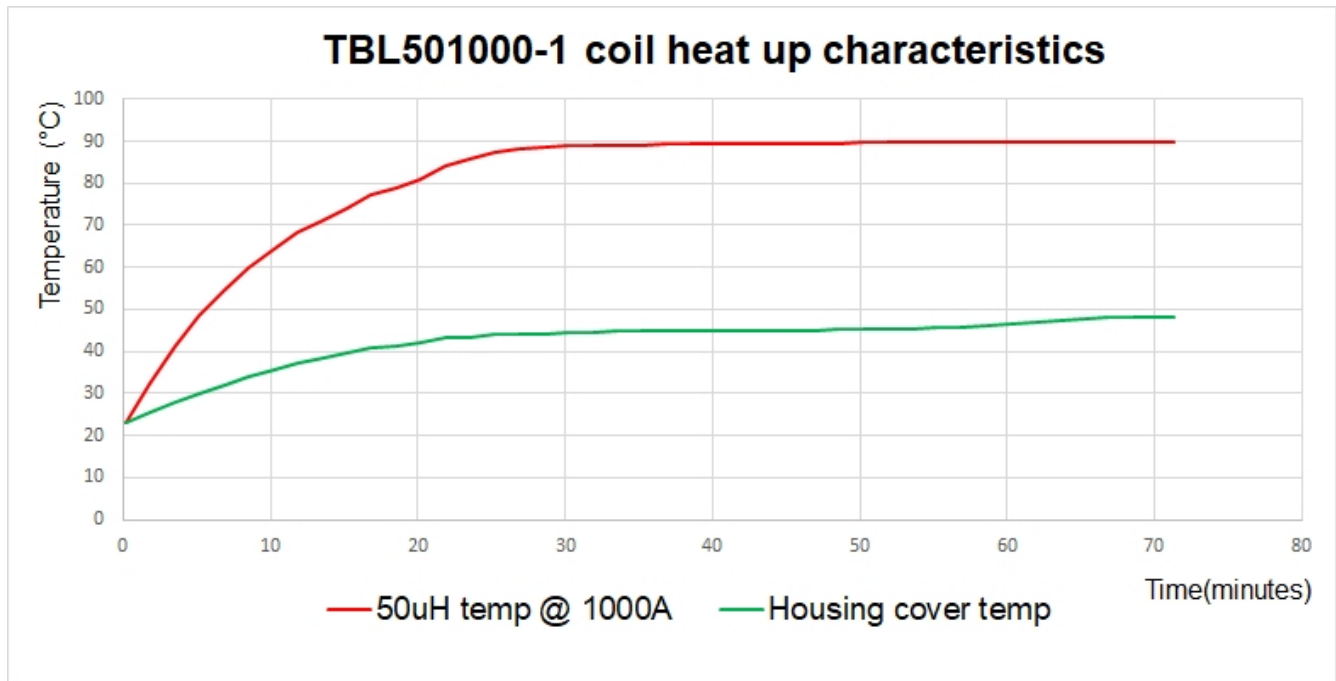
6 Isolation



Picture 5: LISN Isolation, Source to RF out, 50 Ω // 50 μ H CISPR 16 limit

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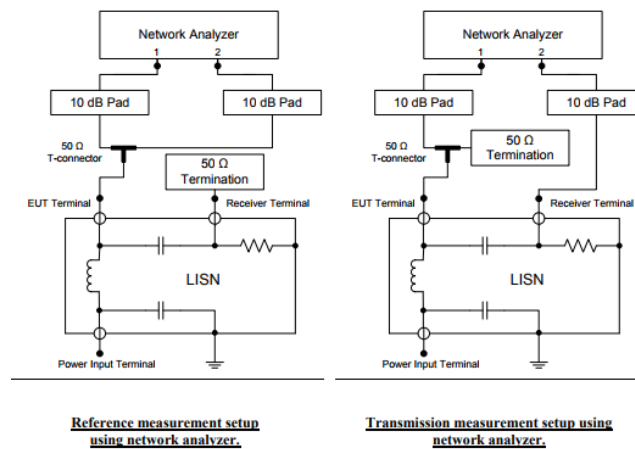
7 Thermal characteristics



Picture 6: Coil and housing temperature at 1000 A AC current, 50 Hz, fan ON

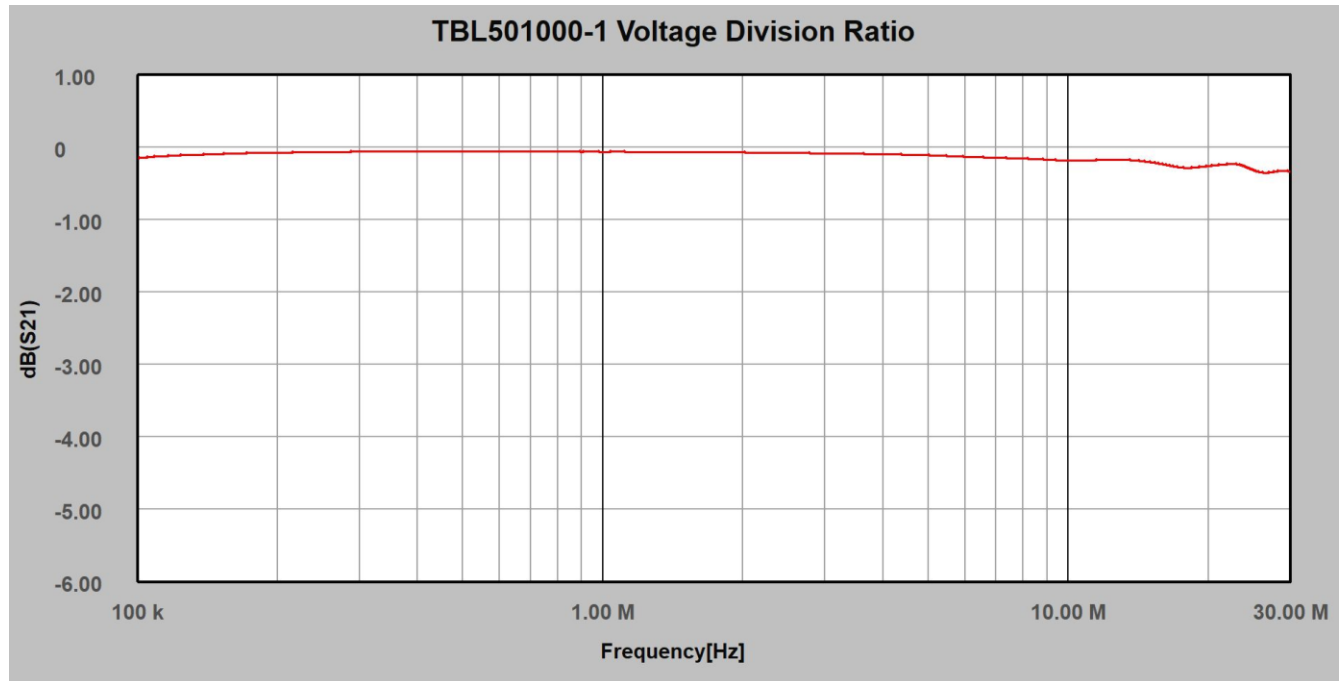
Note: ensure that the cables connected to EUT and source port have sufficient cross-section to avoid overheating the wing terminals.

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



Picture 7: Calibration set up according to CISPR 16-1-2 Annex A.8.

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Picture 8: Voltage division ratio EUT terminals to RF connector, 50 Ω // 50 μ H, CISPR 16

Frequency [MHz]	Voltage Division Ratio EUT port to RF port [dB], HPF OFF	Voltage Division Ratio EUT port to RF port[dB]; HPF ON
0,015	-3,75	-28,52
0,03	-1,18	-16,81
0,05	-0,46	-0,56
0,1	-0,14	-0,14
0,15	-0,09	-0,09
0,175	-0,08	-0,08
0,2	-0,07	-0,07
0,25	-0,06	-0,06
0,3	-0,06	-0,06
0,5	-0,06	-0,06
0,75	-0,06	-0,06
1	-0,06	-0,06
2	-0,07	-0,07
5	-0,11	-0,11
7,5	-0,14	-0,14
10	-0,18	-0,18
15	-0,20	-0,20
20	-0,26	-0,26
25	-0,32	-0,32
30	-0,33	-0,33

Table 1 - LISN calibration data, voltage division ratio, 50 Ω // 50 μ H

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8.1 High pass

If the spectrum analyzer or measurement receiver input impedance at 50 / 60 / 400 Hz is not 50 Ohm but high, residual AC voltage suppression at the LISN RF output is low. Moreover, high amplitude sub-harmonics at low frequencies may also cause receiver overload, nonlinear distortions or even damage. It is highly recommended to protect the analyzer / receiver input with 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. The TBL501000-1 also contains a simple, 3rd order high pass filter for residual AC voltage suppression, which can be activated or deactivated by setting two internal jumpers, if needed.

50 Hz suppression without high pass jumpered: 23 dB @ RF output terminated with High Z

400 Hz suppression without high pass jumpered: 9.4 dB @ RF output terminated with High Z

50 Hz suppression with high pass jumpered: 74 dB @ RF output terminated with High Z

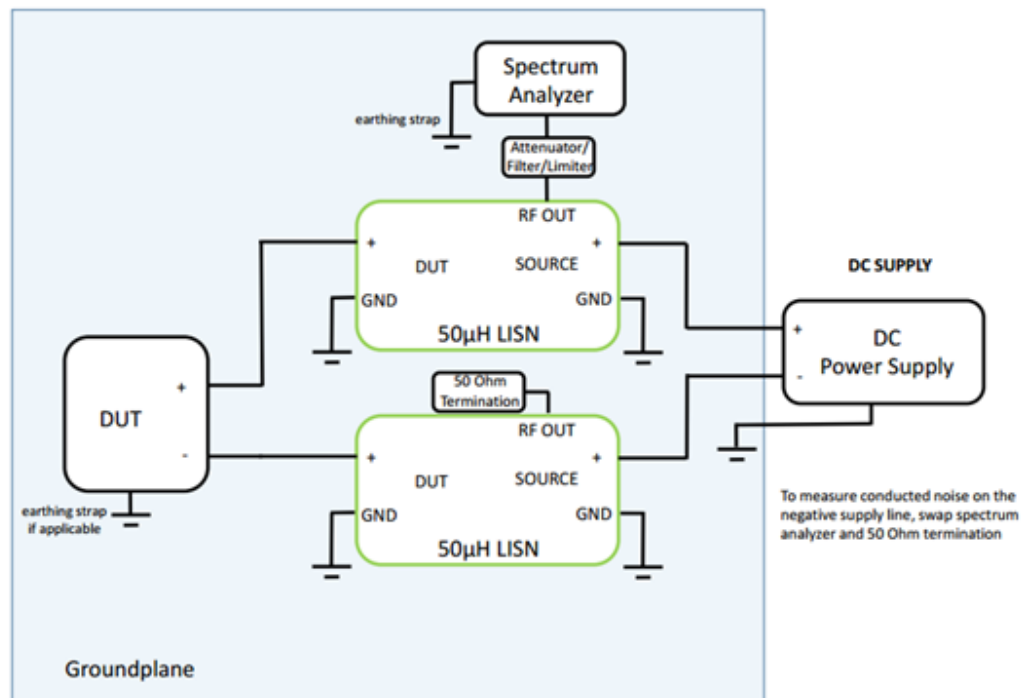
400 Hz suppression with high pass jumpered: 66 dB @ RF output terminated with High Z

According to CISPR 16 and MIL-STD, the TBL501000-1 LISN has an 8 μ F capacitor to ground. In AC applications, the capacitor draws a significant amount of reactive current, which would trip the mains ground fault switch. Hence, the TBL501000-1 must be supplied through an isolation transformer.

Separate measurement of differential and common mode noise can be carried out using two TBL501000-1 in combination with the Tekbox LISN Mate TBLM2.

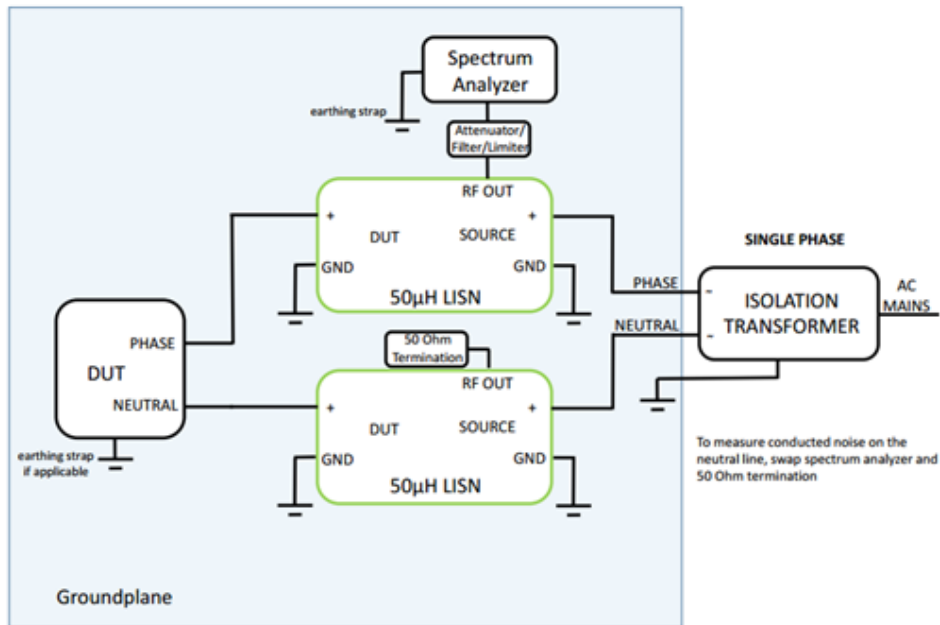
Default jumper settings: High Pass Filter ON

8.2 General Wiring Variants

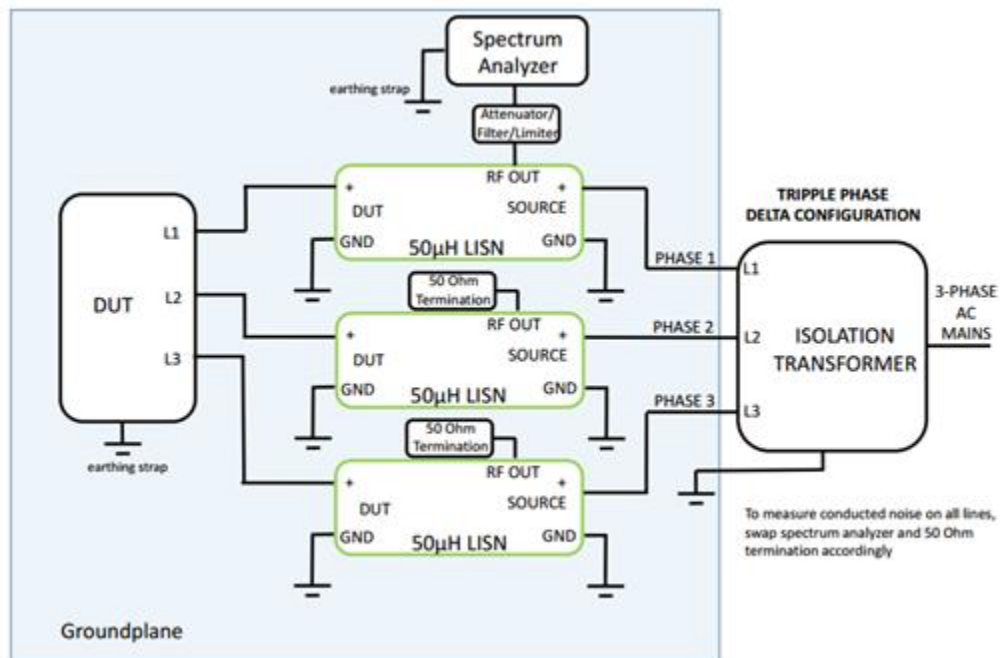


Picture 9: Measurement set up for DC supplied equipment

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Picture 10: Measurement set up for single phase AC supplied equipment



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

