

5 μ H Line Impedance Stabilisation Network

1 Introduction

The TBL05100-1C is a universal 5 μ H LISN that meets the requirements of several standards. The TBL05100-1C is factory jumpered to 50 Ω // 5 μ H + 1 Ω , fulfilling the CISPR 16-1-2 and CISPR 25 impedance, phase an isolation specification. By setting internal jumper, it can be converted into 50 Ω // 5 μ H variants that support standards such as CISPR 25, MIL-STD-461G, ISO11452-4 and ISO 7637-2. By adding an external 10 μ F capacitor, the impedance will fulfil DO-160 specifications.

The LISN is inserted into the EUT's (Equipment Under Test) supply line. Conducted noise at the EUT's supply terminals can be monitored at the BNC connector with a spectrum analyzer or a measurement receiver. A 5 μ H inductor decouples the source (supply) terminal from the EUT terminal.

The use of two TBL05100-1C in conjunction with the Tekbox LISN Mate allows for the measurement of common mode and differential mode noise separately. The unit comes equipped with a N-male to N-male RG232 cable, mating connectors and ground brackets to attach it to a ground plane.



Picture 1: TBL05100-1C

2 Parameters

Topology: single path, configurable, 50 Ω // 5 μ H + 1 Ω , 50 Ω // 5 μ H; the internal capacitor can be disconnected for ISO 7637-2 and DO-160 set ups; an external 10 μ F capacitor is required for DO-160; the LISN is factory setup to 50 Ω // 5 μ H + 1 Ω , other configurations require setting of an internal high current jumper.

Supported standards: CISPR 16-1-2, CISPR 25, MIL-STD-461G, DO-160, ISO11452-4 and ISO 7637-2

Characterized frequency range: 10 kHz – 400 MHz

DC Resistance: < 5 m Ω Source+ to EUT+; < 5 m Ω Source- to EUT-

Maximum current: 100A; see plot with heat up characteristics, chapter 8

Maximum operating voltage range: 0 – 500V AC @50/60 Hz, 250V AC @ 400Hz, 1000V DC

Absolute maximum rating of internal components: 1500V DC

RF connector: N-Female

EUT connector: binding post M8, 4mm center hole, 100A, 1kV, Schützing POL 102 L / RT

SOURCE connector: binding post M8, 4mm center hole, 100A, 1kV, Schützing POL 102 L / RT

EARTH: 8 mm Earth stud with wing-nut, exposed stainless steel bottom panel with mounting slots and countersunk hole for 4mm screw

Jumper: Harwin D3087-98

Dimensions: 300 mm x 150 mm x 150 mm **Weight:** 2.7 kg

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3 Warning

Spectrum Analyzer / Measurement Receiver protection:

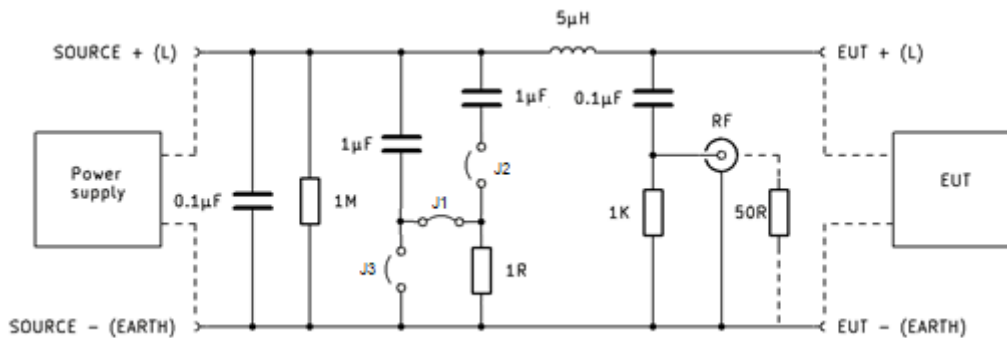
The TBL05100-1C LISN does not contain any protective elements in the RF path. Use an external attenuator and/or limiter to protect the spectrum analyzer / measurement receiver input from harmful transients or high RF noise levels.

Safety:

Because of the CISPR 16-1-2, CISPR 25 (EN 55025), MIL-STD-461G and DO-160 design requirements, LISNs do not do not comply with the maximum permissible leakage current as specified in EN61010-1. Furthermore, LISNs do not fulfil the isolation requirements of CAT II.

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 or line voltage to the ground pin puts you at risk of a lethal electric shock. The TBL05100-1C is exclusively for use in laboratories and must be operated by qualified personnel.

4 Principle schematic



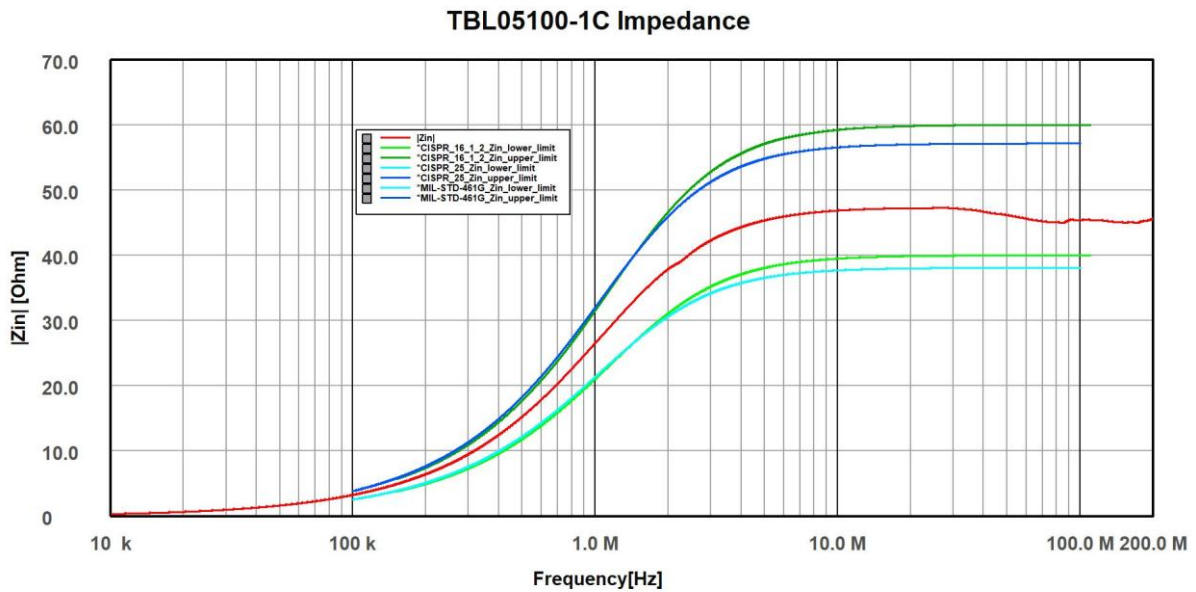
Picture 2: principle schematic

| Standards | Jumper J1 | Jumper J2 | Jumper J3 |
|---|-----------|-----------|-----------|
| CISPR 16-1-2; CISPR 25: 50Ω // 5μH + 1Ω | shorted | shorted | open |
| CISPR 25, MIL-STD-461G, ISO 11452-4: 50Ω // 5μH | open | open | shorted |
| CISPR 25 High Voltage Artificial Network (HV-AN) | open | open | open |
| DO-160; 10μF capacitor attached to source terminals | open | open | open |
| ISO 7637-2 | open | open | open |

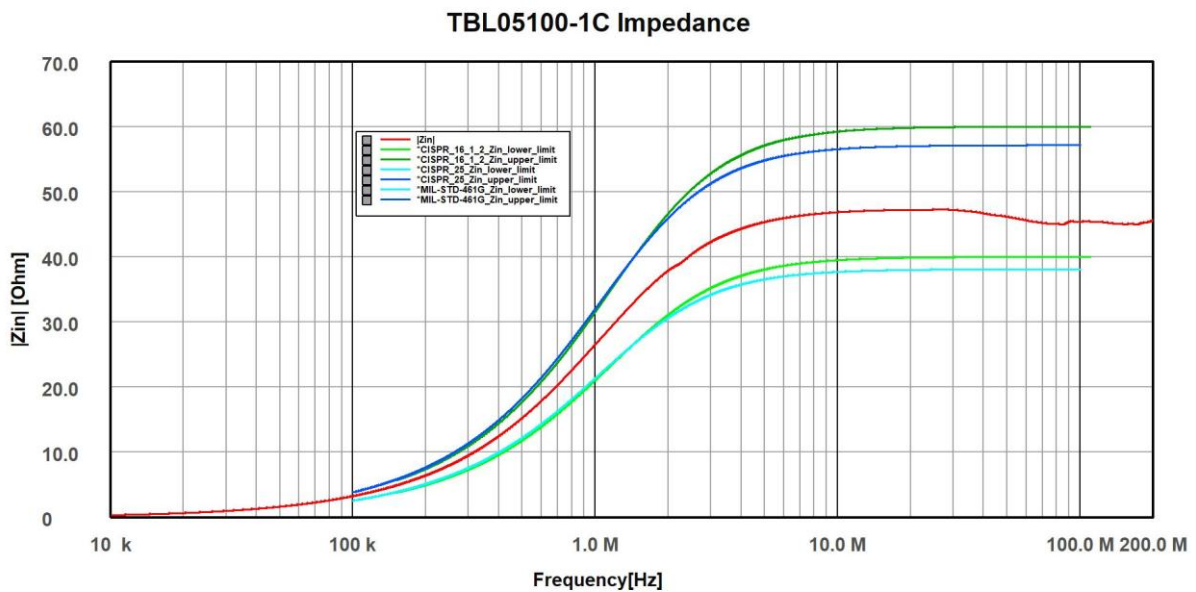
To access the jumpers, the housing cover must be removed. Re-attach it after setting the jumpers. Refer to the table above, or to the table on the silkscreen print of the PCB. There is a parking position for the jumper (J3).

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5 Impedance

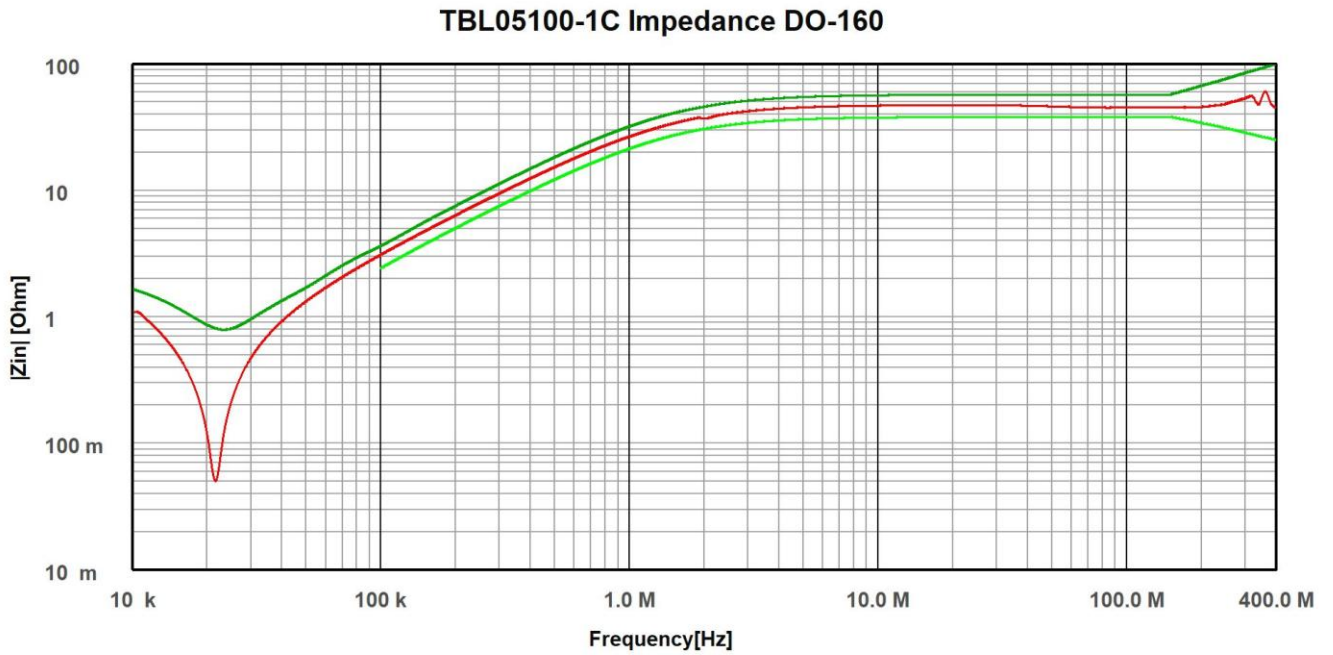


Picture 3: LISN impedance, 100 kHz – 110MHz; $50\Omega // 5\mu H + 1\Omega$; Jumper J3 open, Jumper J1,J2 shorted

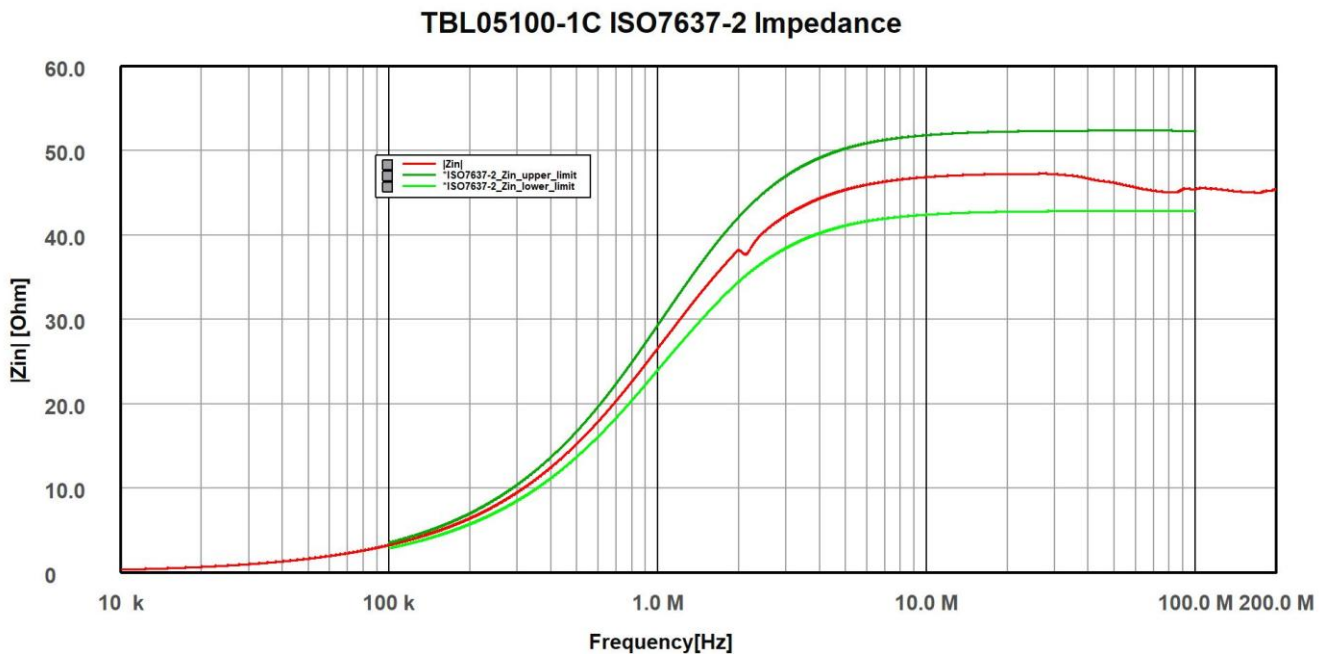


Picture 4: LISN impedance, 100 kHz – 110MHz; $50\Omega // 5\mu H$; Jumper J3 shorted, Jumper J1,J2 open

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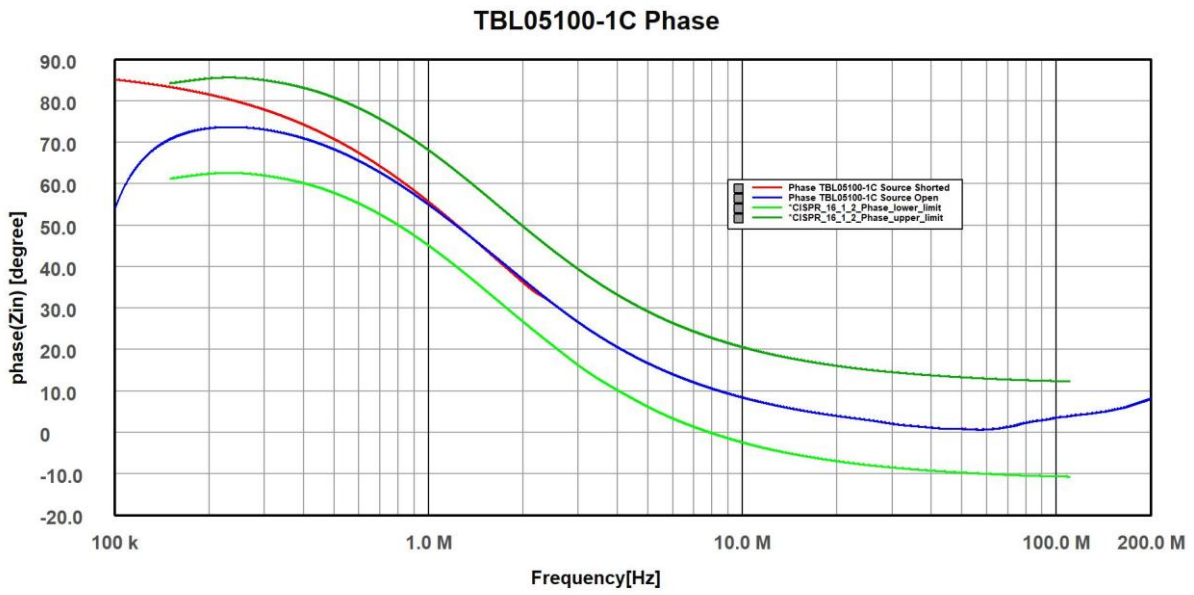
Picture 5: LISN impedance, 10 kHz – 400MHz; 50 Ω // 5 μ H; Jumper J1,J2 & J3 open
external 10 μ F capacitor connected at the source port



Picture 6: LISN impedance, 100 kHz – 100MHz; 50 Ω // 5 μ H; Jumper J1,J2 & J3 open

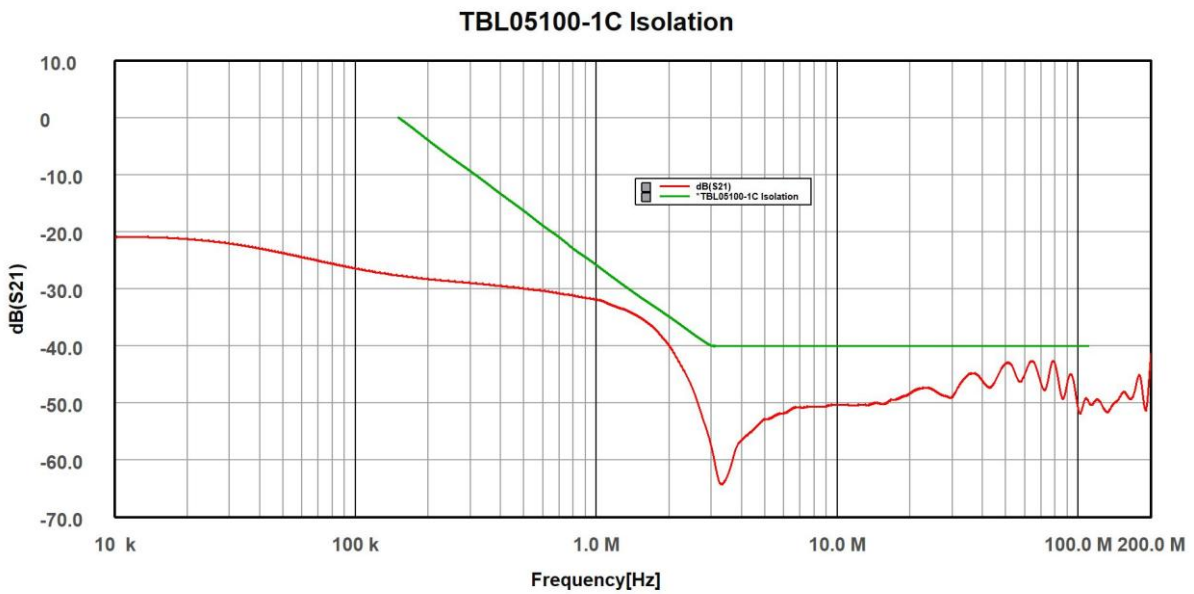
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6 Phase



Picture 7: LISN phase, 100 kHz – 110MHz; 50Ω // 5μH+1Ω

7 Isolation

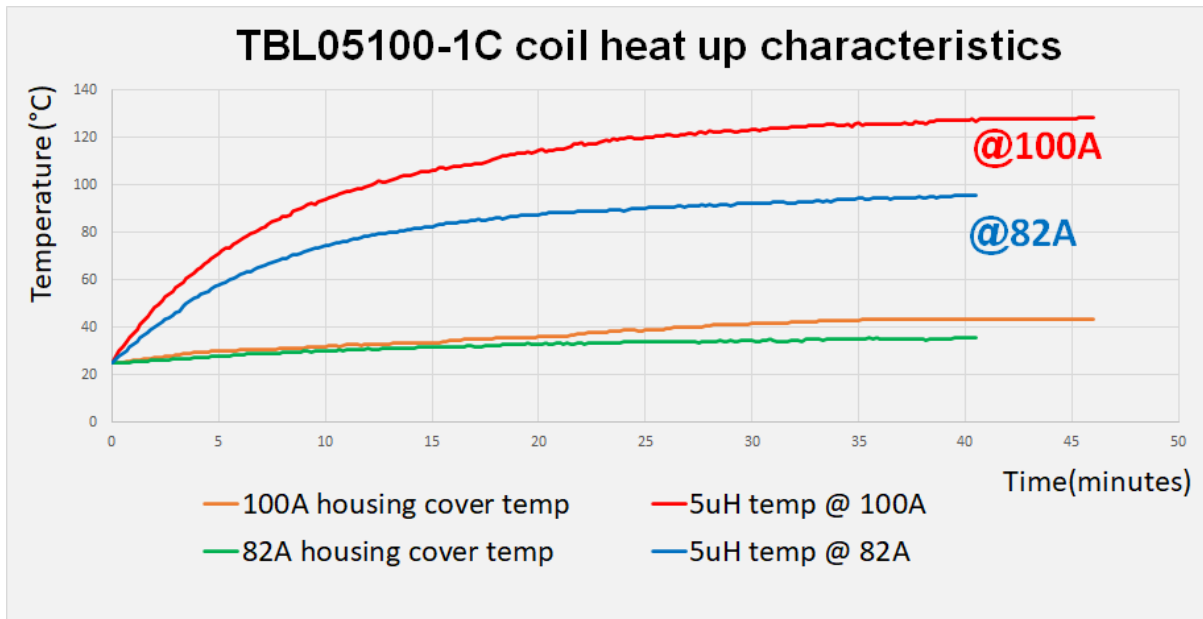


Picture 8: LISN Isolation, 100 kHz – 110MHz, 50Ω // 5μH+1Ω

The isolation is measured between SOURCE port and RF port, with the EUT port terminated with 50 Ohm.

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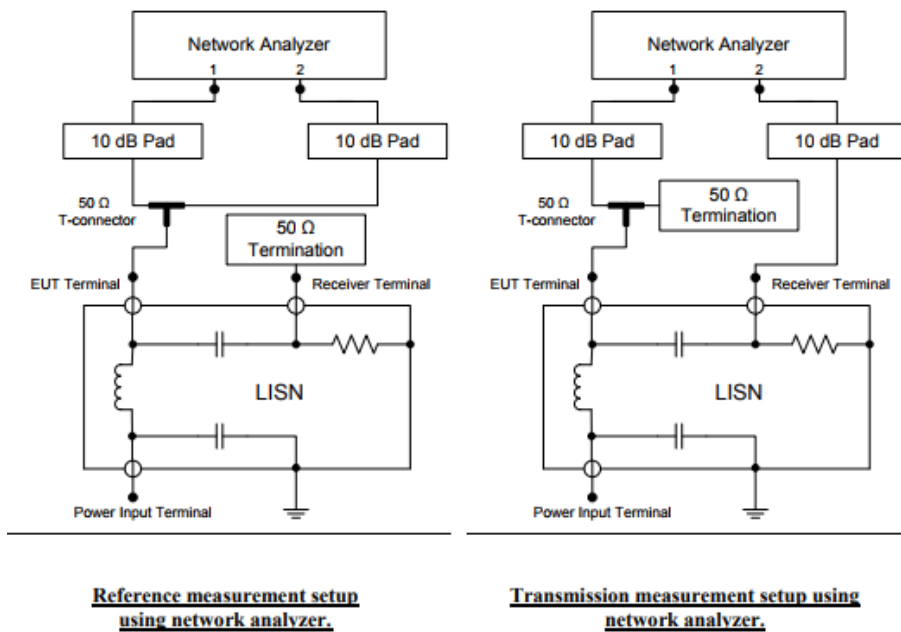
8 Thermal characteristics



Picture 9: Coil and housing temperature, measured at 27°C ambient temperature

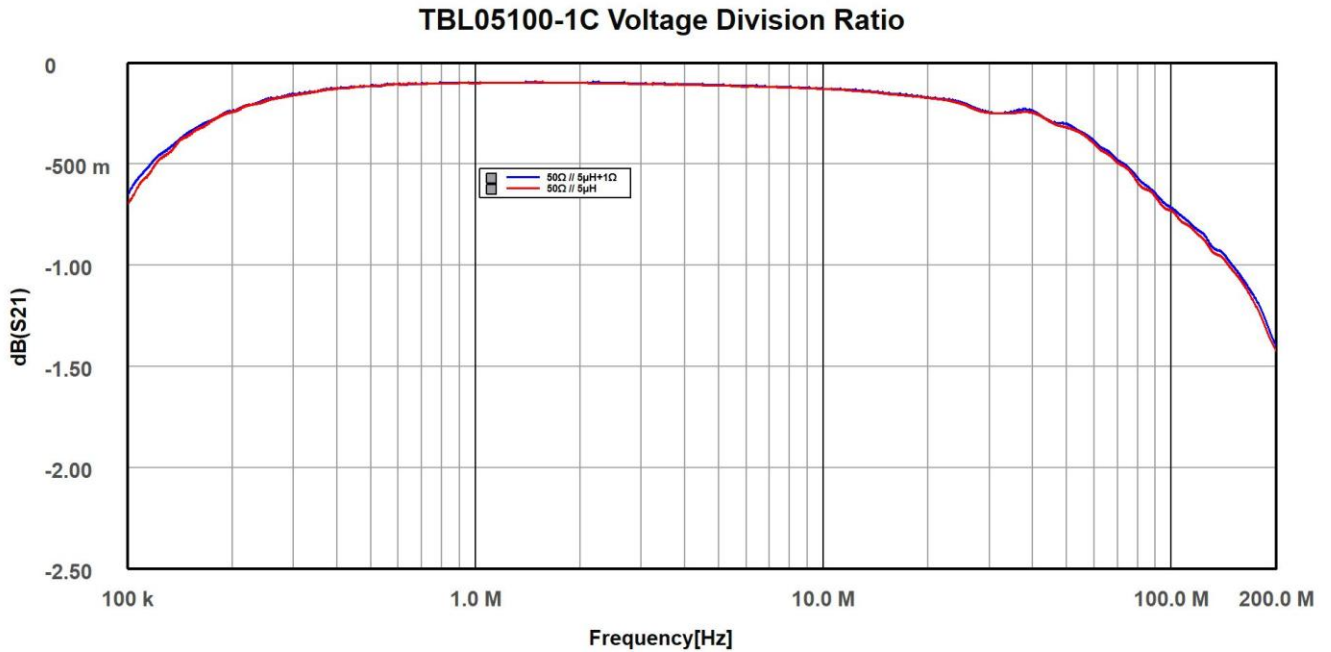
The curves in picture 9 are applicable for DC supply current. When using the LISN with 400Hz AC, the internal 5 Ohm resistor generates additional dissipation. Keep the measurement duration as short as possible, and be mindful that the housing temperature will rise.

9 Voltage division ratio according to CISPR 16 -1-2 Annex A8



Picture 10: Calibration set up according to CISPR 16-1-2 Annex A.8.

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Picture 11: Voltage division ratio EUT terminals to RF connector; 100kHz – 200 MHz; 50Ω // 5μH+1Ω; 50Ω // 5μH

| Frequency [MHz] | VDR [dB] 50Ω // 5μH+1Ω | VDR [dB] 50Ω // 5μH | Frequency [MHz] | VDR [dB] 50Ω // 5μH+1Ω | VDR [dB] 50Ω // 5μH |
|-----------------|------------------------|---------------------|-----------------|------------------------|---------------------|
| 0.1 | -0.65 | -0.70 | 10 | -0.13 | -0.13 |
| 0.125 | -0.45 | -0.47 | 20 | -0.17 | -0.17 |
| 0.15 | -0.34 | -0.36 | 30 | -0.24 | -0.25 |
| 0.175 | -0.28 | -0.29 | 40 | -0.24 | -0.25 |
| 0.2 | -0.24 | -0.24 | 50 | -0.30 | -0.32 |
| 0.25 | -0.18 | -0.19 | 60 | -0.39 | -0.40 |
| 0.5 | -0.11 | -0.11 | 70 | -0.48 | -0.49 |
| 0.75 | -0.10 | -0.10 | 80 | -0.57 | -0.59 |
| 1 | -0.10 | -0.10 | 90 | -0.65 | -0.66 |
| 1.2 | -0.10 | -0.10 | 100 | -0.72 | -0.73 |
| 1.5 | -0.10 | -0.10 | 110 | -0.77 | -0.80 |
| 2 | -0.10 | -0.10 | 120 | -0.83 | -0.85 |
| 2.5 | -0.10 | -0.10 | 130 | -0.90 | -0.93 |
| 5 | -0.11 | -0.11 | 140 | -0.94 | -0.96 |
| 7.5 | -0.12 | -0.12 | 150 | -1.00 | -1.03 |

Table 1 - Voltage division ratio

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10 Application

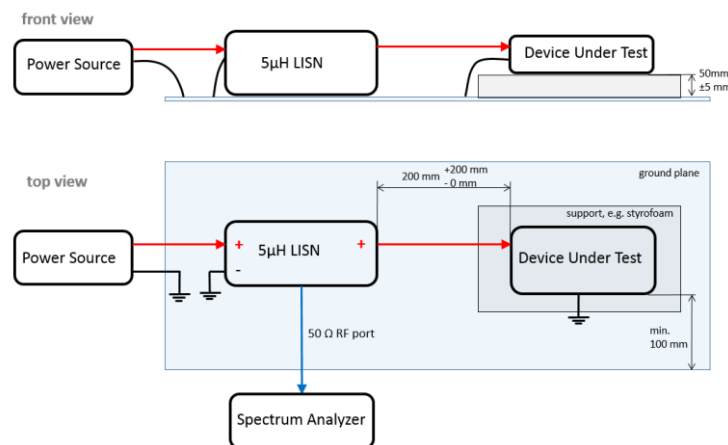
10.1 Conducted Emission Measurement Setup, Voltage Method

CISPR 25 specifies two measurement configurations:

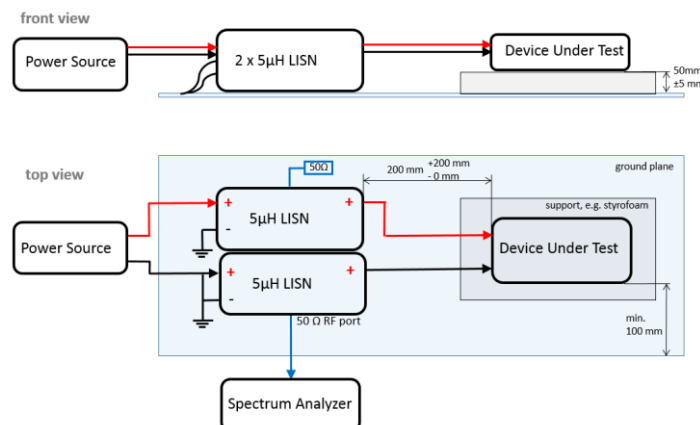
If the EUT is grounded to the vehicle chassis with a power return line shorter than 20 cm in length, a single LISN is adequate, and the conducted noise is monitored only on the positive supply line.

If the power return line of the EUT is longer than 20 cm, two LISNs are required. One LISN connects the positive supply line to the EUT, and another LISN connects the power return line to the EUT. Conducted noise is measured on both lines. It is actually measured on one LISN at a time, with the other LISN's RF port terminated with a 50 Ohm resistor.

Professional noise measurements are performed in shielded chambers since any ambient noise picked up by the wires connecting LISN to EUT or by the EUT itself will be present at the RF terminal. In pre-compliance setups, a test should be performed with the EUT turned off to distinguish between conducted noise generated by the EUT and emissions from other sources (ambient noise). Tekbox provides low cost, desktop shielded tents or shielded bags to suppress ambient noise for pre-compliance conducted noise measurements.



Picture 13: conducted emission measurement, voltage method, EUT with power return line locally grounded



Picture 14: conducted emission measurement, voltage method, EUT with power return line remotely grounded

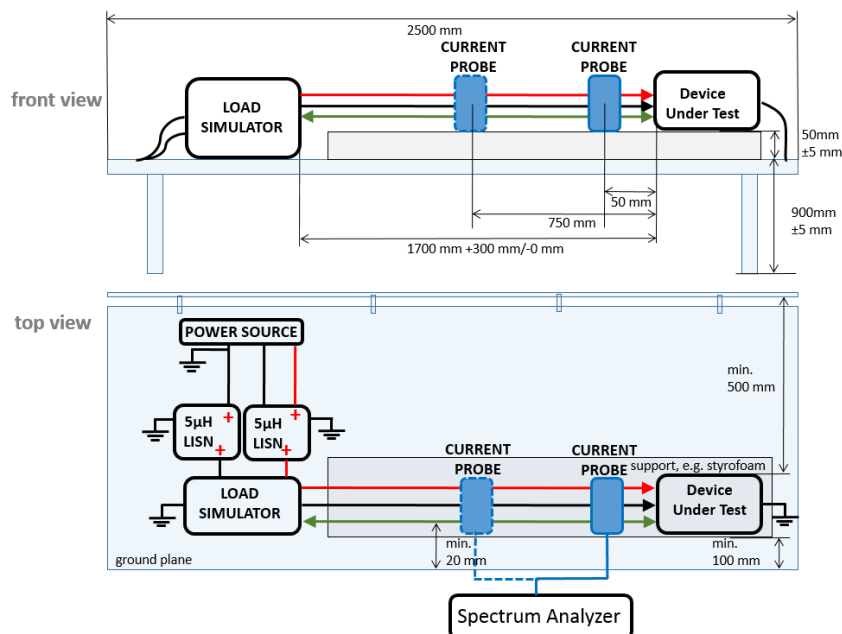
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Pictures 13 and 14 depict conducted noise measurement setups using the voltage method, as specified in CISPR 25. If the EUT is connected to additional peripheral devices, they should also be connected or emulated using a load box. If a remotely powered EUT's housing is designed for chassis grounding, it should also be grounded to the ground plane. The grounding lead should be no more than 150mm length.

Because most devices are remotely grounded, the configuration shown in Picture 14 is more frequent. The measurement must then be performed alternately on both the positive and negative power lines. The unused RF port is always terminated with 50 Ohm.

It should be noted that conducted noise testing per DO160 necessitates the insertion of a 10 μ F capacitor across the LISN's source terminals.

10.2 Conducted emission measurement set up, current probe method



Picture 15: conducted emission measurement according to CISPR 25, current probe method

The CISPR 25 current probe measurement is used to monitor conducted emissions on a wire harness, including control/signal lines of an EUT. Some vehicle manufacturers utilise the wide bandwidth of current probes to measure conducted emissions on power supply lines over a wider frequency range than LISNs can. Measurements are typically taken on various lines – plus, minus, control signals, plus + minus, plus + minus + control lines. In order to account for cable harness resonance effects, the current probe is measured at 50 mm and 750 mm distances from the EUT. Each LISN's RF output must be terminated with 50 Ohm. The current probe picks up the conducted emissions. To establish a defined impedance on the power lines, two LISNs are necessary. The load simulator is a specially designed device that simulates the load existing at the EUT's signal/control interface.

10.3 Voltage transient testing

The TBL05100-1C can be configured to meet the impedance specifications of ISO 7637-2. Chapter 4 contains the appropriate jumper configuration.

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11 Ordering Information

| Part Number | Description |
|-------------|--|
| TBL05100-1C | 5µH LISN, 1 pc. 75 cm N-male to N-male RG223 cable Factory calibration certificate and data |

Table 2 – Ordering Information

Accessories

| Part Number | Description |
|-----------------|--|
| TBL05100-1C-CAL | Calibration kit; calibration adapter BNC-female; OSL calibration box |



Picture 16: Calibration kit

12 History

| Version | Date | Author | Changes |
|---------|------------|------------|--------------------------|
| V1.0 | 15.06.2026 | Mayerhofer | Creation of the document |
| | | | |

Table 3 – History