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Design of a Low-Cost High-Current LISN for EMC Test

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Electromagnetic compatibility (EMC) is an essential ability of electronic and electrical products, which can be evaluated by electromagnetic emission and susceptibility measurements. As specified in several national standards and industry regulations, such as Federal Communication Commission (FCC) and the International Special Committee on Radio Interference (CISPR-xx), a line impedance stabilization network (LISN) is used to isolate power interference and provide stable impedance for equipment under test (EUT) in all EMC test items [1]. In high-power applications, the design and product development of LISNs for high-voltage and high-current EUTs will be challenged.

In this work, a low-cost compact LISN based on a coreless inductor has been designed with a 1 kV rated voltage and a 100 A rated current. According to the MIL-STD-461G standard [2], the LISN circuit shall be following the schematic shown in Figure 1(a) below, and the stabilized impedance 50 Ω of LISN at a frequency range of 10 kHz to 10 MHz is required. The current that supplies power to the EUT mainly flows through the inductor L1. To meet the requirements of the high tolerant current and compact size range, L1 is composed of an inner coil and an outer coil without the magnetic core. These two parallel coils are wound with high-temperature resistance enameled wire. The diameters of the coils are 74 mm and 79 mm, and the diameter of the wire is 4 mm. The coil turns are both 52. The LISN impedance characteristics are measured with a Wayne Kerr WK6500B LCR analyzer. As represented in Figure 1(b), the performance of the proposed LISN is achieved compared to the MIL-STD-461G standard.

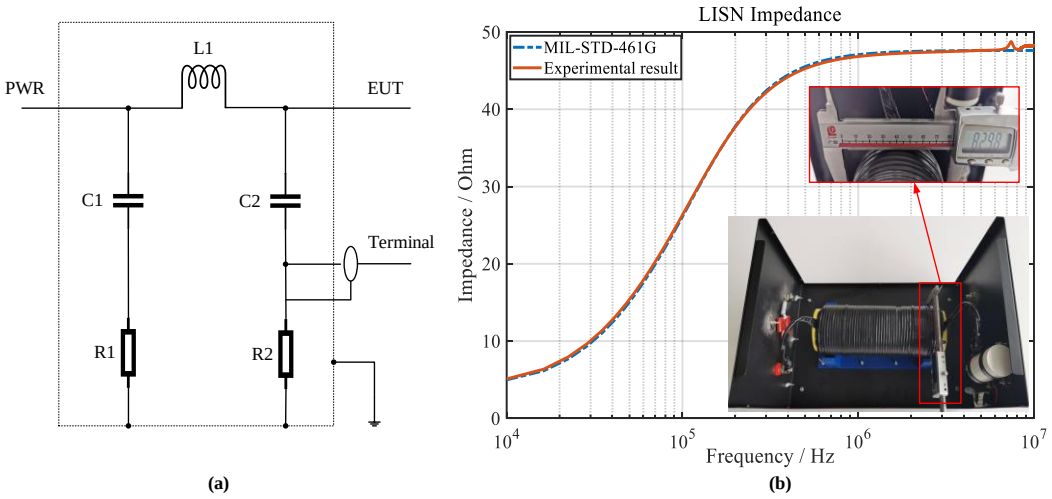

Figure 1. Design and product development of the proposed LISN. (a) LISN schematic with L1 = 50 **μH**, C1 = 8 **μF**, C2 = 0.25 **μF**, R1 = 5 Ω, and R2 = 1 kΩ; (b) equipment and experimental result.

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References

[1] R. Amjadifard, M. Tavakoli Bina, H. Khaloozadeh and F. Bagheroskouei, "Proposing an Improved DC LISN for Measuring Conducted EMI Noise," in IEEE Transactions on Electromagnetic Compatibility, vol. 63, no. 3, pp. 752-761, June 2021, doi: 10.1109/TEMC.2020.3025459.

[2] Department of Defense Standard, "Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment," MIL-STD-461G dated 11 December 2015.