Updates on LISN Internals and Comparison with CM and DM sensing circuit

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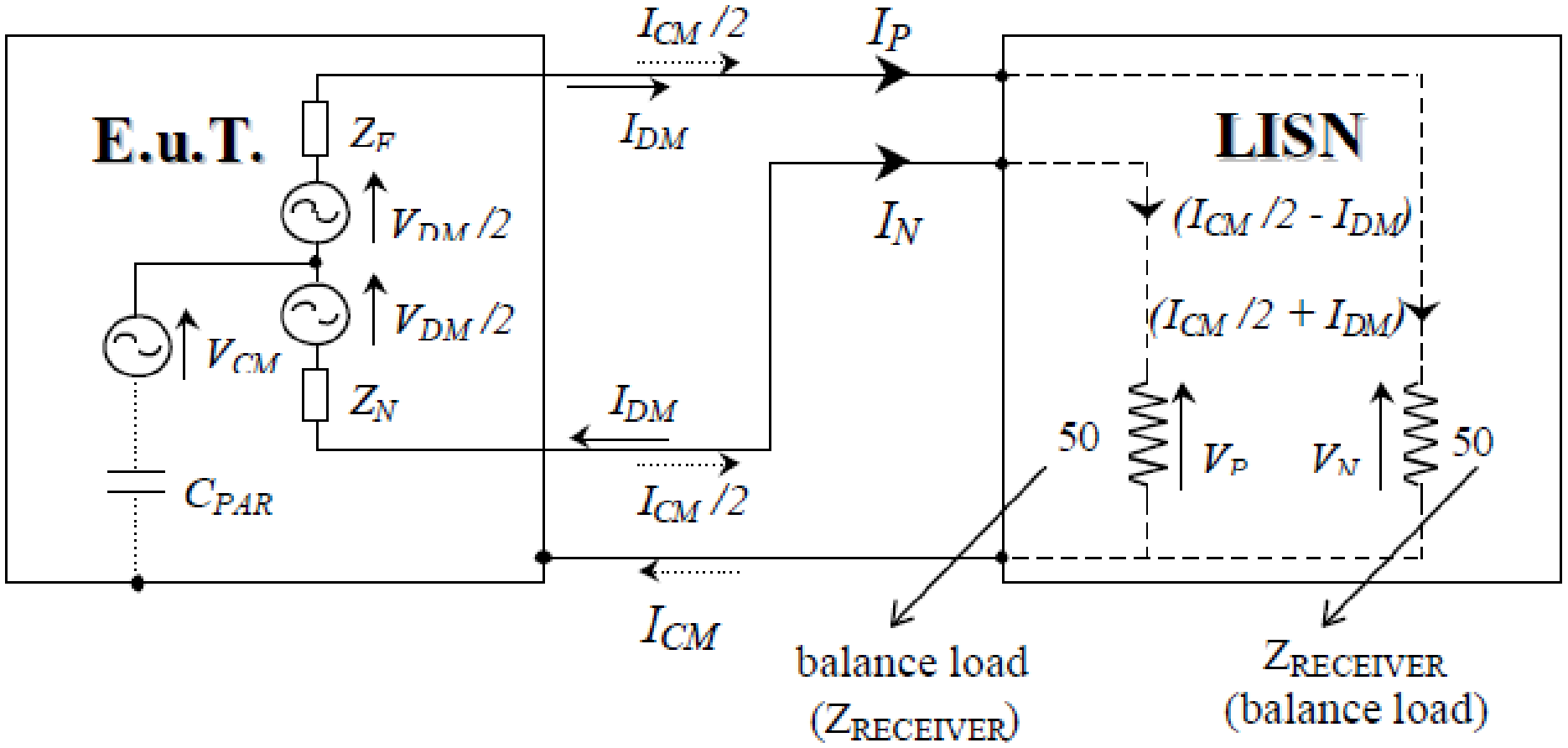
Paper-1: Devices for the Separation of the Common and Differential Mode Noise-Design and Realization



Separating common mode and differential mode conducted EMI using LISN

LISN: Line Impedance Stabilization Network as per CISPR Std.

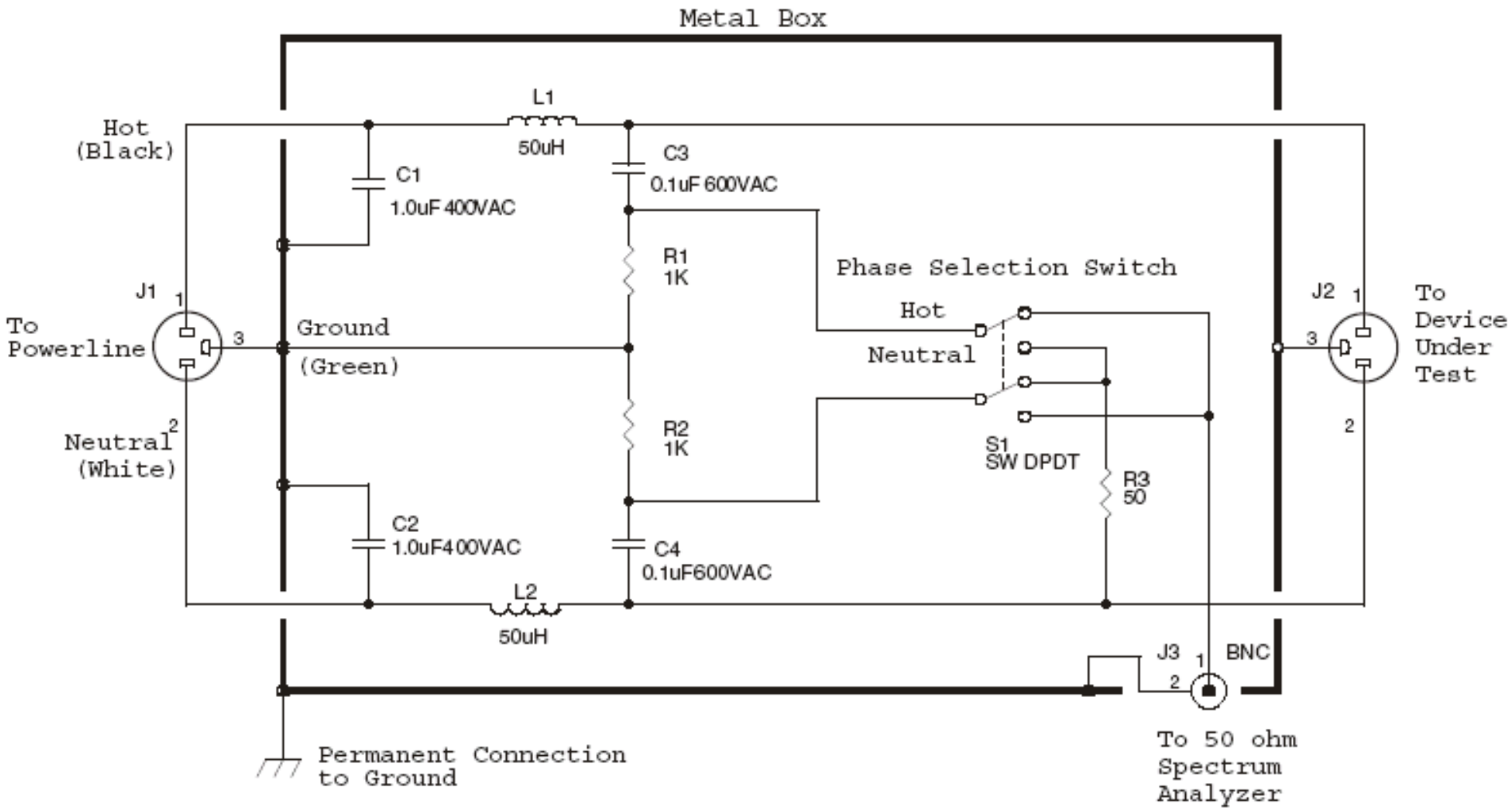
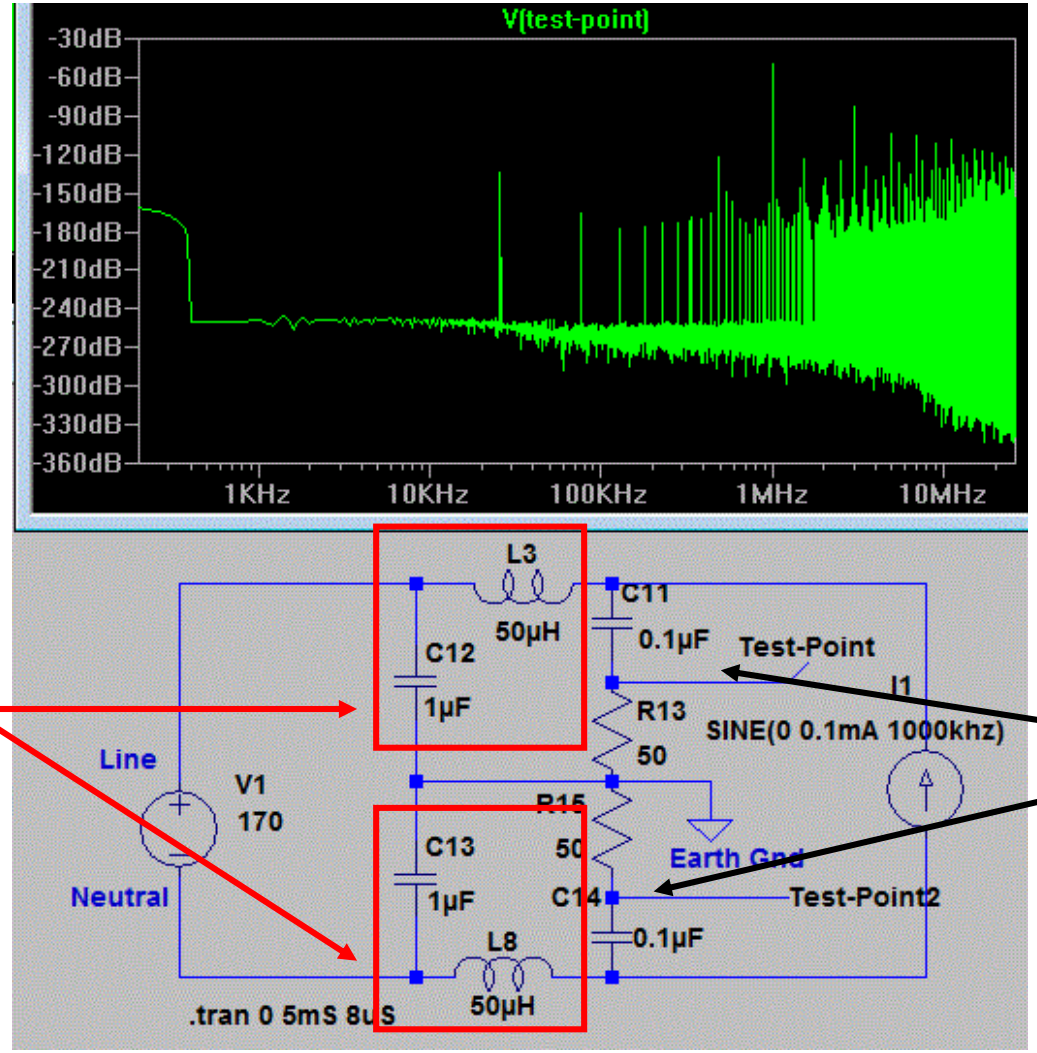


Figure 4.16 A 50Ω/50μH LISN as defined by standard CISPR16-1. This circuit provides a 50-Ω output impedance for measurement of RF emissions produced by the device under test. Conducted emission measurements are carried out from 150 kHz to 30 MHz.

LISN: Line Impedance Stabilization Network Spice Model



Low Pass Filter with Fc=22.5kHz

High Pass Filter
Fc=31.8kHz

Source: http://electronics-engineering-technologist-technician-bc.ca/Circuits/Circuits.html

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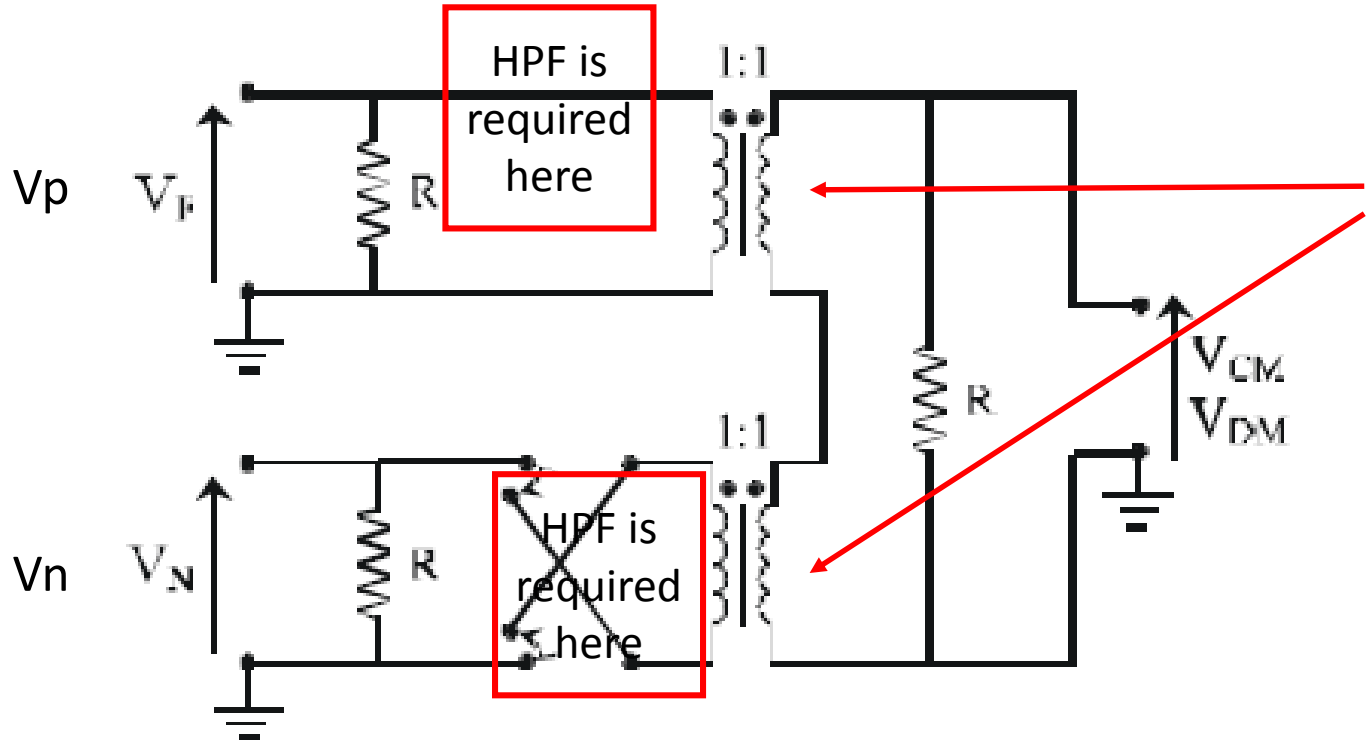

1:1 Isolation Transformers
Used as a isolation between AC power line and data Acquisition system.
Datasheet LINK

Solution-1 Using addition and subtraction to extract Vcm and Vdm components

$$(V_P + V_N) = 2 \cdot V_{CM} \qquad (V_P - V_N) = V_{DM}$$

Purpose of LISN

- Back end act as a Low pass filter on power inlet side to remove background noise and provide constant impedance to the appliance under test.
- Front end act as a High pass filter to pass EMI from 9kHz to 30MHz having a differential mode operation but with use of selection knob can provide Common mode as well as Differential mode Conducted EMI.
- This can be used to sense Vphase-ground, Vneutral-ground, Vphase-neutral but not simultaneously. As they are using a sliding switch for this selection.
- HPF is having std. 50 ohm termination to match data acquisition systems.

Complexities with LISN Design

- Air Core Inductors[1] are used for LPF making design of LISN complex and costly.
- Basic LISN design is based on CISPR or IEC guidelines.
- Different vendors have different types of protection circuits to ensure isolation.
- Parameteric value of Inductor in LPF varies with different standards. e.g. 50uH, 120uH, 5uH.

[1] Purpose of these air inductors is to provide linear magnetization curve in comparison with ferromagnetic core based inductors, thus facilitating high frequency operation.

References

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- Nan, Liu, and Yang Yugang. "A common mode and differential mode integrated EMI filter." *Power Electronics and Motion Control Conference, 2006. IPEMC 2006. CES/IEEE 5th International*. Vol. 1. IEEE, 2006.
- US4263549 Patent APPARATUS FOR DETERMINING DIFFERENTIAL MODE AND COMMON MODE NOISE