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Why Differential Mode and Common Mode measurements are required while doing Conducted EMI measurements ?

Manoj Gulati
PhD Scholar at IIIT Delhi

In case of designing Differential Mode and Common Mode EMI filters we do Differential Mode and Common Mode Conducted EMI measurements, can't we measure Vp and Vn separately and do maths around this to get these two components?

If we relate this with a LISN that is also doing something similar, we can measure Vp and Vn (not sure we can measure both at the same time using LISN). Also some papers that I have read, show some circuits to separate CM and DM components.

Please suggest why so.

Thanks
Manoj G.

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3 comments

Venkatramanan D
Electrical Engineer

Hi Manoj,
I will just share what I know..LISN is actually meant to measure the CM and DM 'currents' injected by the equipment into the grid....It employs a 50 Ohm resistor to do the same..and only with the 50 Ohm resistance in place, CM and DM 'voltages' attain meaning...And your range is 150kHz to 30MHz...
I didn't get your question. Are you asking why we need to use a LISN plus spectrum analyser to do CM and DM measurements?
First of all, is your measurement system capable for measuring 30MHz signals accurately, and is your processor fast enough to do computations on a 30MHz signal?
Did you mean to say we may measure Vpg and Vng seperately w/o LISN and do math on the same to get CM and DM voltages?

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NAYAN SHELAT
Senior Member Tchnical Staff at MDA Corporation, Satellite Systems

Consider a system consist of several units (say RF or microwave units) connected in series and ad by each of the being transmitted.

Commen mode noise flows via common ground path. it make chassis of any particular unit at different potential than other units in system. Now signal withing that unit is referenced to chassis of that unit. As signal travelles travels from one unit to other connected unit, it see noisy difference in the reference. The common mode noise adds as unnecessary spurious.

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Michael Schutten
Electrical Engineer at General Electric Global Research Center

Let me first of all assume that by Vp and Vn, you are referring to the voltages measured across

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Michael

the 50 Ohm LISN measurement resistors.
The common mode and differential mode signals are related to the LISN Vp and Vn signals by:
Vdm = 1/2 x (Vp – Vn)
Vcm = 1/2 x (Vp + Vn)
The standard spectrum analyzer is a superhetrodyning machine, which means, among other things, that the phase information is lost. Without the phase information, you cannot determine whether Vp and Vn are in phase, out of phase, or somewhere in between.
For example, if Vp = cos(wt) and Vn= cos(wt), the spectrum analyzer outputs for Vp and Vn would be the same as for the case where Vp = cos(wt) and Vn = -cos(wt), but obviously Vdm and Vcm are different between the two cases. Thus, we cannot accurately calculate Vdm and Vcm directly from the spectrum analyzer output signals.
Instead the Vdm or Vcm calculation is performed with the Vp and Vn signals directly from the LISN, the sum or difference calculation performed, appropriate scaling, and then this information is then provided to the spectrum analyzer to give Vdm or Vcm.
Hope this helps.
Mike

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