RF300 Large loop antenna, an analysis of changes to the standards

These changes are due to the amendments to CISPR15 and CISPR16

The latest versions are now …..
CISPR15:2006 + A2:2009 and
CISPR16-1-4:2007 + A1:2008

The key changes related to LLAs are:

1. Sections related to the construction and specification of LLAs are moved from CISPR15 to CISPR16. Note that in the new CISPR15, the requirements for the LLA are referred to Section 4.7.1 in the new CISPR16, which does not exist! It seems that the reference should be to Section 4.6.1. The same error is repeated in CISPR16 which again refers in Annex C to the non-existent section 4.7.
2. The definition of the calibration data has been re-defined.

Note 1.
The details of the LLA were given in Annex B of CISPR15. These are now transferred to Annex C of CISPR16. Most of the content has remained the same, but Table 1 summarises those items that have changed.

Previous CISPR15	New CISPR16	Notes	Significant changes
Annex B Annex C	Annex C	Description, construction and validation of LAS	Both annexes combined into one.
Clause B1	Clause C1	Introduction	Loop antenna named LAS (Loop Antenna System)
Clause B2	Clause C2	Construction of LAS	Additional requirements for cables and connectors.
	Clause C3	Construction of loop	Information previously included with diagrams now included in text. Note low R for inner conductor is required.
Clause B3	-----	Positioning of the LAS	Requirement for minimum distance to nearby objects,…… not included in new CISPR16
Clause B4	Clause C4	Validation	New definition for validation factor. (see below).
Figure B1	Figure C1	General view	None
Figure B2	Figure C2	Position of slits	None
	Figure C3	Construction of slits	None
	Figure C5	Metal box for current probe	None
Figure B3	Figure C4	Example slit construction	None
Figure B4	Figure C8	Validation factor	Converted from dBuA to dB(Ω). See below.

	Figure C7	Positions of calibration loop	None
	Figure C9	Construction of calibration loop	None
Figure C1	Figure C11	Sensitivity vs diameter	None
Figure C2	Figure C10	Conversion factors between loop current and magnetic field strength at a distance.	Factors for magnetic field with electric field added. Factors for distance 30m removed.

Note 2
CISPR15 gave the verification data as a plot of loop current in dBuA vs frequency for the standard test signal (1V, open circuit voltage with a source impedance of 50ohm). This seems to be a straightforward method, especially as the limits are quoted in dBuA, so it's a direct correlation between the calibration loop and the limits.

CISPR16 is essentially the same information, but presented differently. It specifies the relationship between the source voltage (1V, as specified above) and the output current in the loop as measured by the current probe. Note that the current probe has a transfer characteristic of 1V/A. The relationship between volts and current is ohms, hence the use of dB(ohms) as the 'validation factor'.

The result is therefore a conversion factor scaled in dB(Ω) to convert current to voltage,
CISPR16 defines the validation factor dB(Ω) = 20*log(Vs/Ii) where Vs is the source voltage and Ii is the loop current.
Vs = 1V = 1,000,000uV

Using the 'old' CISPR15, fig P.8., this gives for Ii @ 100KHz = 46dBuA = 200uA
So the new CISPR16 value should be 20*log(1000000/200) = 74 dB(Ω)
and
Old CISPR15, fig P.8., for an Ii @ 30MHz = 29dBuA = 29uA
So the new CISPR16 value is 20*log(1000000/29) = 91 dB(Ω)

These calculations confirm the relationship between the CISPR15 plot and the CISPR16 validation factor.

The plots in the standards assume a current probe with a 1V/A transfer function. Such probes are 'active' but provide a flat frequency response. The Laplace RF300 uses passive probes which have a non-flat frequency response. This is not important if the probe is 'inside' the calibration loop and has a linear transfer function with amplitude. These factors hold true for the probe that is used. So the RF300 antenna uses an antenna factor correction to produce a calibration that agrees with the validation factor. This antenna factor is supplied with each antenna, and is equivalent to the correction factors as supplied with all EMC antennas, test cells, LISNs and other types of transducer.

Using the antenna factor data with the RF300 enables the output to be compared directly with the limits as specified in EN55015.