Loop Antenna Calibration within the CISPR 16 Series

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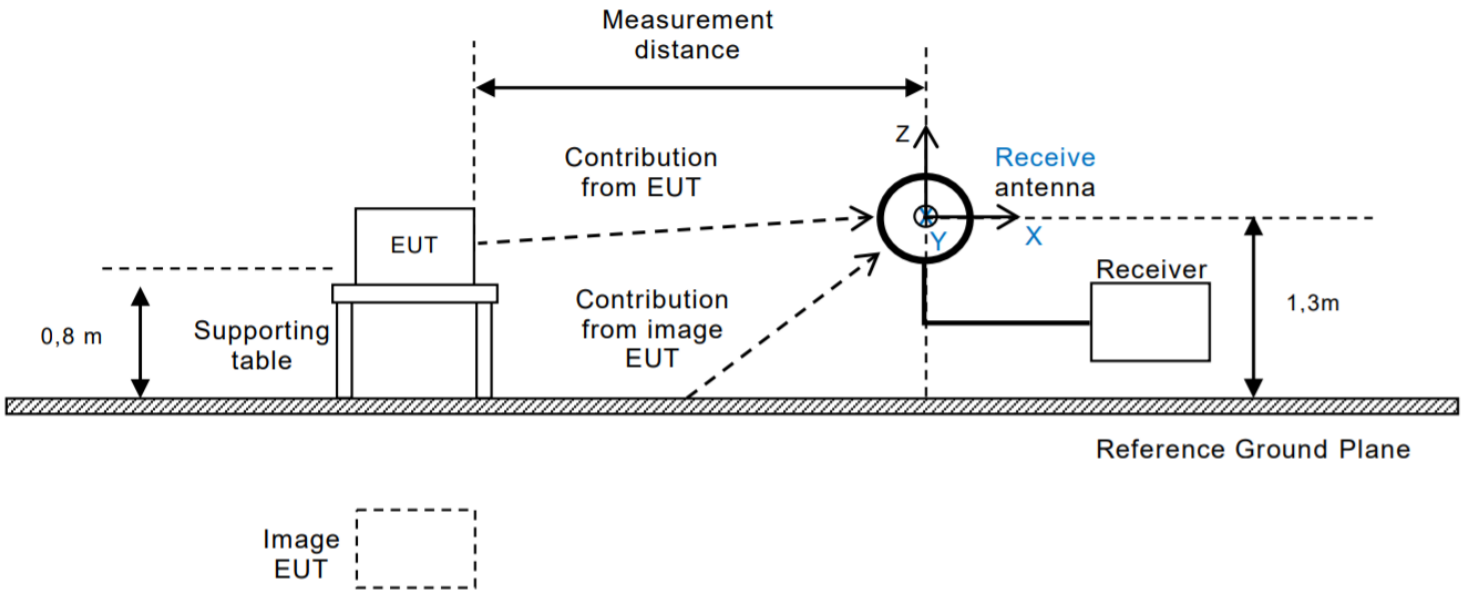
CISPR 16 under maintenance - update “below 30 MHz”

Following standards are updated:

- CISPR 16-2-3: Radiated disturbance measurements
  - Stage : 2nd CD Q1/2022-Q2/2022
- CISPR 16-1-4: Antennas and test sites for radiated disturbance measurements
  - Stage: CDV positive voted Q4/2021-Q1/2022
- CISPR 16-1-6: EMC antenna calibration
  - Stage: FDIS positive voted Q3/2021

New material in CISPR 16-2-3

Measurement method for magnetic field disturbance (9 kHz to 30 MHz):



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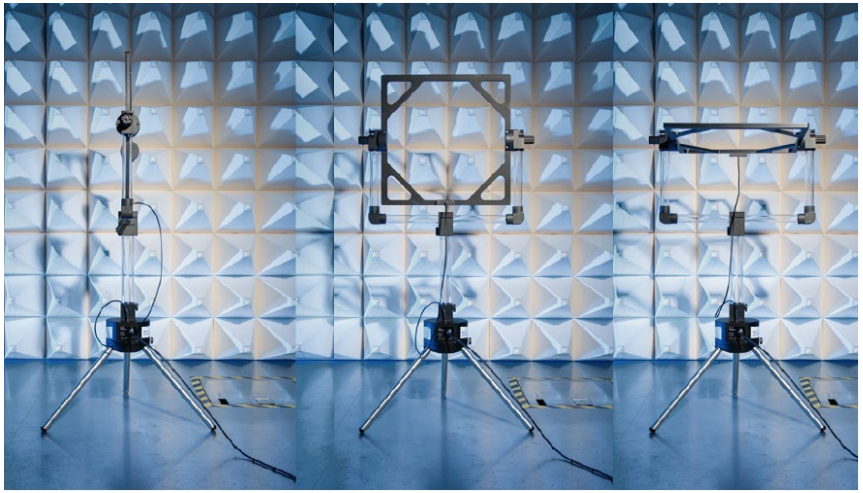
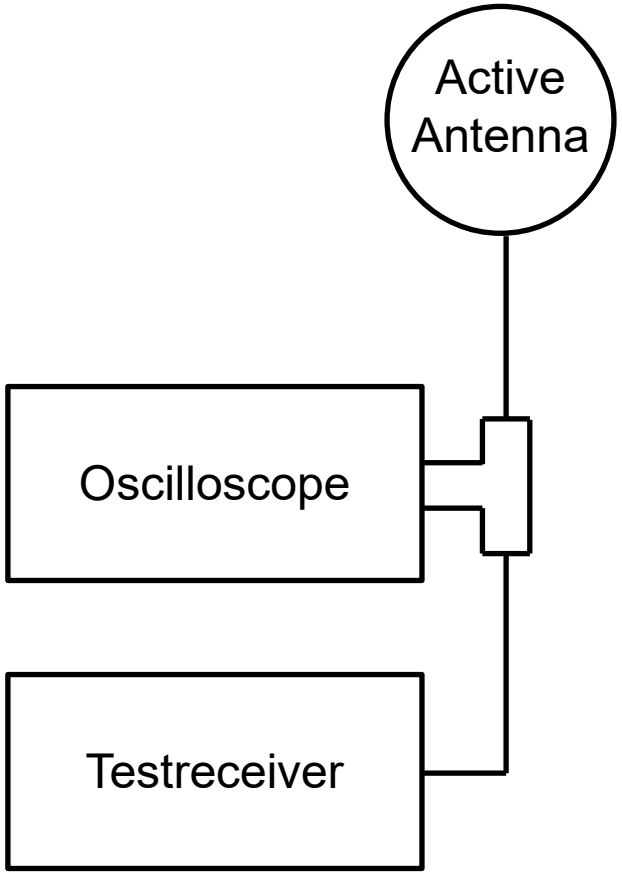
New material in CISPR 16-2-3

- 3 orthogonal orientations (X,Y, Z) of loop antenna,
- fixed height 1,3 m
- Test distance 3 m, 5 m, 10 m (30 m is considered as in-situ)
- Antenna specification according to CISPR 16-1-4
- Test site validation according to CISPR 16-1-4
- Antenna calibration according to CISPR 16-1-6
- EMI Receiver specification according to CISPR 16-1-1



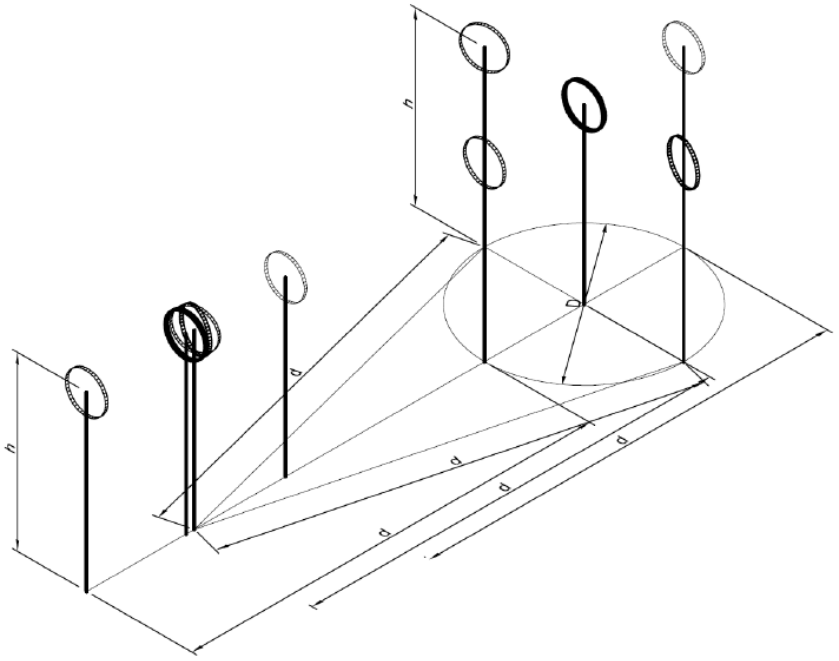
New material in CISPR 16-1-4 Antenna requirements

- Maximum size, 60 cm by 60 cm
- Active antennas
  - Large Dynamic range (3 m → 30 m)
  - None CW signals
  - Saturation detection required
    - Integrated detection
    - Observation of antenna output with a scope



New material in CISPR 16-1-4 Test Site Validation

- Similar to “NSA”
- 3 orthogonal orientations (X,Y, Z) of loop antenna
- Test distance 3 m, 5 m, 10 m
- 5 points in volume
- ± 4 dB
- Large dynamic range @ 10 m
  - Power amplifier
  - Active TX antenna
- Beware of ground loops! [see Ref. 1]



New material in CISPR 16-1-4 Test Site Validation

- Normalized Site Insertion Loss (NSIL)

$$\Delta A_i = V_{DIRECT} - V_{SITE} - F_{aH,T} - F_{aH,R} - A_{Ni}$$

  - Requires antenna factors → CISPR 16-1-6
  - Requires “sum of antenna factors” → CISPR 16-1-4

- Reference Site Method (RSM)

$$\Delta A_i = V_{DIRECT} - V_{SITE} - A_{LPR}$$

  - Requires Site Reference→ CISPR 16-1-4

SEIBERSDORF LABORATORIES

New material in CISPR 16-1-4 Sum of antenna factors

- Antennas are used as pair

$$\Delta A_i = V_{DIRECT} - V_{SITE} - \left(F_{aH,T} + F_{aH,R}\right) - A_{Ni}$$

- Simplified calibration

$$F_{a,TX} + F_{a,RX} = A_i - A_{Ni}$$

- Antenna distance 0,3 – 1 m
- > 1,3 m above ground
- No validation required, but estimation of influence required

New material in CISPR 16-1-4 Reference Site Method

- Loop Pair Reference

$$A_{LPR} = V_{DIRECT,R} - V_{SITE,R}$$

- Calibrated on OATS
  - OATS validated by NSIL method

CISPR 16-1-6
TEM (Crawford) Cell

- Simple calculation of field strength

$$E = \frac{V}{b} = \frac{\sqrt{P_{net} Z_0}}{b} \qquad H = \frac{E}{377\ \Omega}$$

- Testing with none CW signals possible
  - Validation of saturation detection circuits
- Size constraints
  - Loop size max. 2/3 of septum height
- Gold standard

SEIBERSDORF LABORATORIES

References

[1] A. Kriz, "Ground Loops During Site Validation of Anechoic Rooms Below 30 MHz," 2018 IEEE Symposium on Electromagnetic Compatibility, Signal Integrity and Power Integrity (EMC, SI & PI), Long Beach, CA, 2018, pp. 499-503, doi: 10.1109/EMCSI.2018.8495323.