Proficiency Testing of Conducted Emission Measurements PTC(CE-9k-30M-IV)

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Travelling Sample for the 9 kHz to 30 MHz frequency range (Conducted Emission)





General information

- Number of participants: 21
- Start date: August 2018
- Stop date: February 2019
- Issues faced:
 - One internal wire disconnected during transportation toward the end of the PT
 - Issue immediately identified and corrected
- Delays were recovered
- Scheme of the proficiency test PTC(CE-9k-30M-IV):

https://www.dinfo.unifi.it/vp-436-schemi-delle-provevalutative-schemes-of-the-proficiency-tests.html

Measurement procedure

- Voltage measurement by using the AMN and EMI receiver is preceded by a preliminary check of one harmonic generated by the Sample.
- Measurement by using the AMN and EMI receiver are performed according to §7.4.2 of EN 55016-2-1:2014 and next amendments, by using a V-type Artificial Mains Network (AMN).
- The Laboratory measures the amplitude of ten (10) harmonics selected by the Coordinator in the frequency range between 9 kHz and 30 MHz (i.e. covering both band A and band B). The disturbance injected by the Sample on line 1, 2 and 3 and neutral conductors is measured. A total number of twenty (40) measurements (four conductors times ten frequencies) is reported to the Coordinator by the Laboratory.

Sequence of operations

- Connect the Sample to the EUT port of the AMN;
- Power up the AMN;
- Measure the amplitude of the ten harmonics selected by the Coordinator by using the EMI receiver set with average detector;
- Power off the AMN;
- Disconnect the Sample from the AMN.

NOTE: Since the Sample plug is rated for 16 A and most of the AMN receptacles are rated for 32 A a self-constructed adapter has been realized by most of the laboratories. If the adapter length is less than about 40 cm then its influence is negligible.

Measurement result

- The measurement result provided by the Laboratory consists of:
 - The estimate x, expressed in dB(μV), of the amplitude of the selected harmonics, measured both lines-to-ground (x_{line1,2,3}) and neutral-to-ground (x_{neutral});
 - The expanded uncertainty of the estimate x, U_{lab}, expressed in dB and obtained multiplying the combined standard uncertainty by the coverage factor k = 2 (which corresponds to a coverage probability of about 95 % assuming normal distribution).

Reference values



Statistical (robust) analysis



Excerpt from Annex C, algorithm A of ISO 13528:2005

Performance statistic ζ (Participant)

 Performance statistic ζ (clause 9.6 of ISO 13528:2015) that the Coordinator applies to the Participant providing the measurement result x_i with standard uncertainty u_{xi}

$$\zeta_{i} = \frac{x_{i} - X}{\sqrt{u_{xi}^{2} + u_{x}^{2}}} \qquad \begin{cases} X = X_{cal}, u_{x} = u_{cal} \\ X = x^{*}, u_{x} = \frac{1,25 \cdot s^{*}}{\sqrt{p}} \end{cases}$$

 $\begin{cases} 2 < |\zeta_i| < 3 \Rightarrow \text{warning} \\ 3 < |\zeta_i| \Rightarrow \text{action} \end{cases}$

Performance statistic z' (Coordinator)

 Performance statistic z' (clause 7.8.1 of ISO 13528:2015) that the Coordinator applies as self-check



Results

 $\left(\begin{array}{c} 11 \end{array}\right)$



1 = 23k - 3 = 70k - 5 = 116k - 10 = 374k - 15 = 3,9M - 19 = 7,6M - 40 = 15M - 60 = 19M - 100 = 23M - 120 = 30M



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Ref. vales – comparison

f	и	X - x*	s*	
MHz	dB	dB	dB	Ζ
0.023	1.0	-1.1	0.6	-1.1
0.070	1.0	-1.1	0.4	-1.1
0.116	1.0	-1.1	0.3	-1.1
0.374	1.0	-0.7	0.5	-0.7
3.87	1.0	1.0	0.4	1.0
7.62	1.0	0.7	0.4	0.7
15.1	1.0	-0.1	0.8	-0.1
18.9	1.0	-0.3	0.8	-0.3
22.6	1.0	-0.8	1.5	-0.8
29.9	1.0	-0.9	1.6	-0.9

Remarks

- Results of LAB(2) are not shown because out of scale.
- The reference values obtained from calibration of the Sample and from robust statistical analysis are compatible each other (maximum deviation 1,1 dB, over ten frequencies).
- The measurement results provided by the 21 participants at the 10 measurement frequencies selected by the Coordinator are within –3 dB to +4 dB from the reference values).
- 792 measurement results were provided by the participants and excluding LAB(2) less than 30 signals (warning and action) were issued
- The standard measurement uncertainty declared by the laboratories is comprised between nearly 0.5 dB and 2 dB, robust standard deviation s* less than 1,6 dB.