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

Firenze, March 13, 2026
Rev. 0

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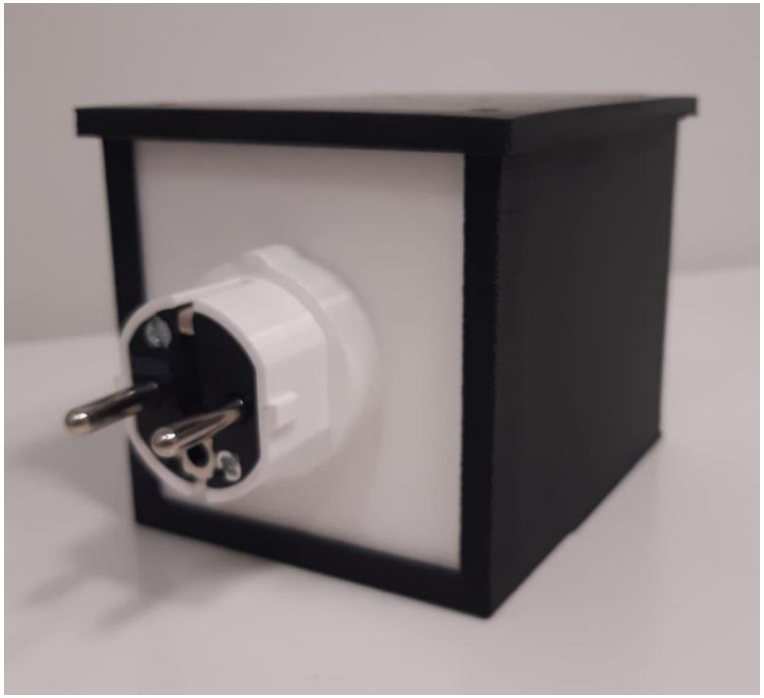
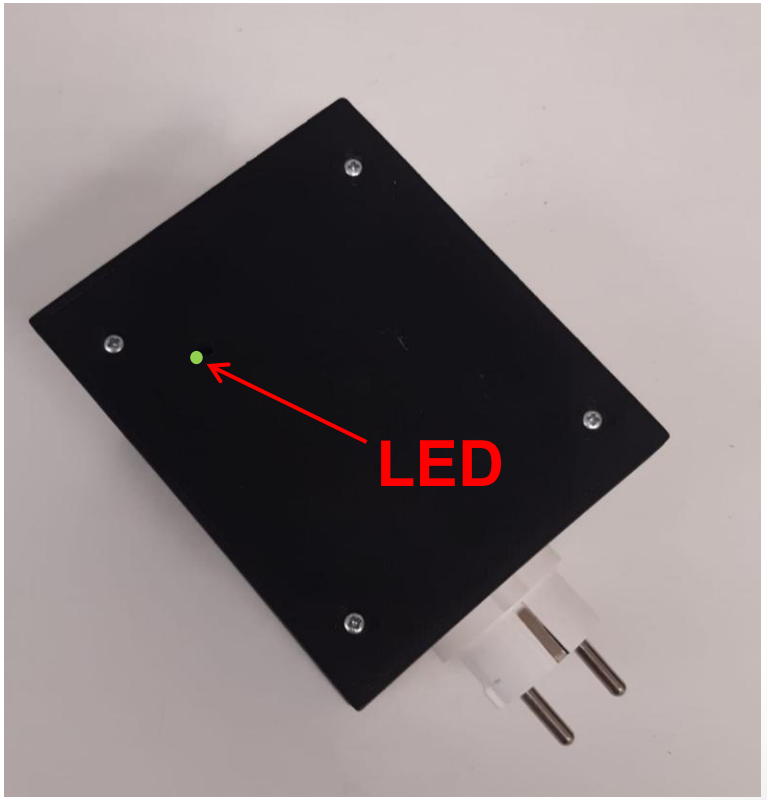
Travelling Sample for the 9 kHz to 30 MHz frequency range (Conducted Emission)





General information

- Number of participants: 15
- Start date: April 2025
- Stop date: March 2026
- Scheme of the proficiency test PTC(CE-9k-30M-VII): https://www.dinfo.unifi.it/vp-436-schemes-of-the-proficiency-tests.html
- Issues faced:
  - None

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/A1:2017, 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 in line and neutral conductors is measured. A total number of twenty (20) measurements (two conductors times ten frequencies) is reported to the Coordinator by the Laboratory.

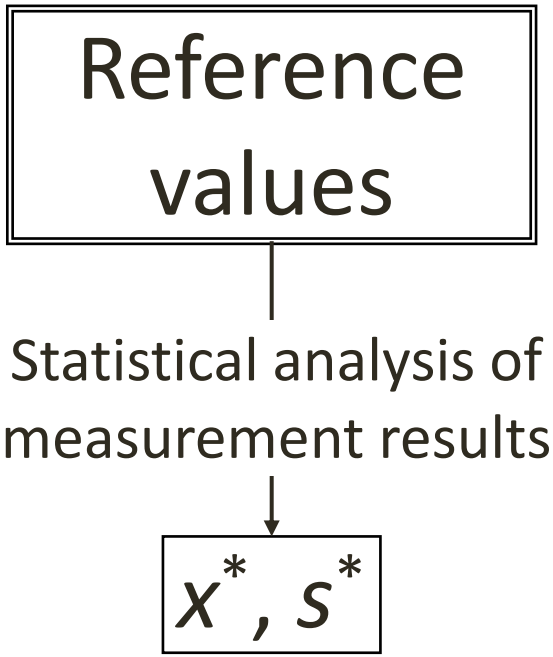
Sequence of operations

- 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.

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 line-to-ground (x_{line}) 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

$x_1, x_2, \ldots, x_i, \ldots, x_p$ } Raw data (p participants)

$x^* = \text{median of } x_i \qquad (i = 1, 2, \ldots, p)$

$s^* = 1{,}483 \text{ median of } |x_i - x^*| \qquad (i = 1, 2, \ldots, p)$

} Initial reference value

$\delta = 1{,}5 s^*$

$$x_i^* = \begin{cases} x^* - \delta, & \text{if } x_i < x^* - \delta \\ x^* + \delta, & \text{if } x_i > x^* + \delta \\ x_i, & \text{otherwise} \end{cases}$$

} Transformed set of data

$x^* = \sum x_i^* / p$

$s^* = 1{,}134 \sqrt{\sum \left(x_i^* - x^*\right)^2 / (p - 1)}$

} New reference value (iterative algorithm)

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

Performance statistic ζ (Participant)

- Performance statistic ζ (clause 9.6 of ISO 13528:2022) that the Coordinator applies to the Participant providing the measurement result x_i with standard uncertainty u_{xi}

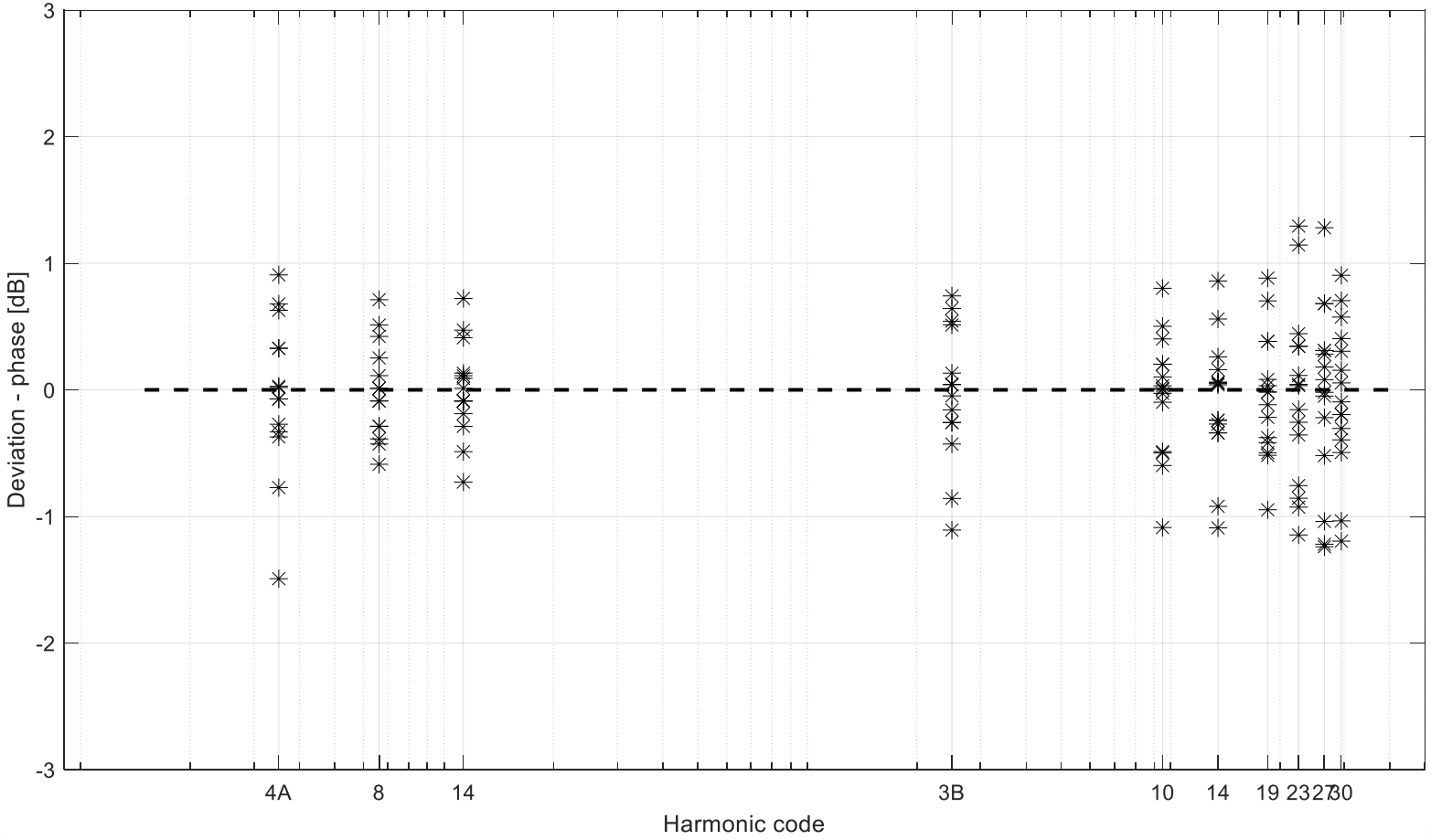
$$\zeta_i = \frac{x_i - X}{\sqrt{u_{xi}^2 + u_X^2}} \qquad X = x^*, u_X = \frac{1{,}25 \cdot s^*}{\sqrt{p}}$$

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

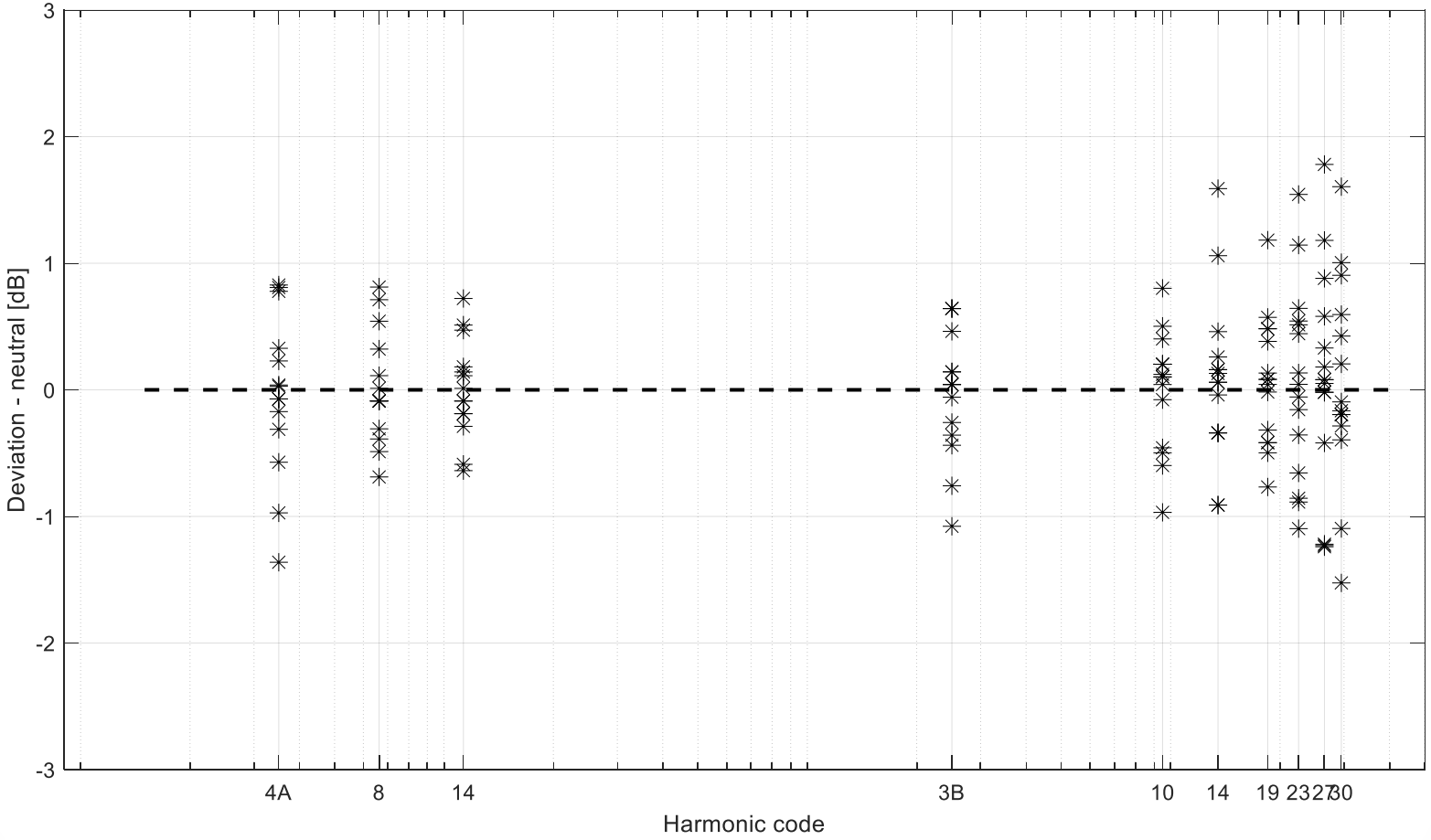
Results

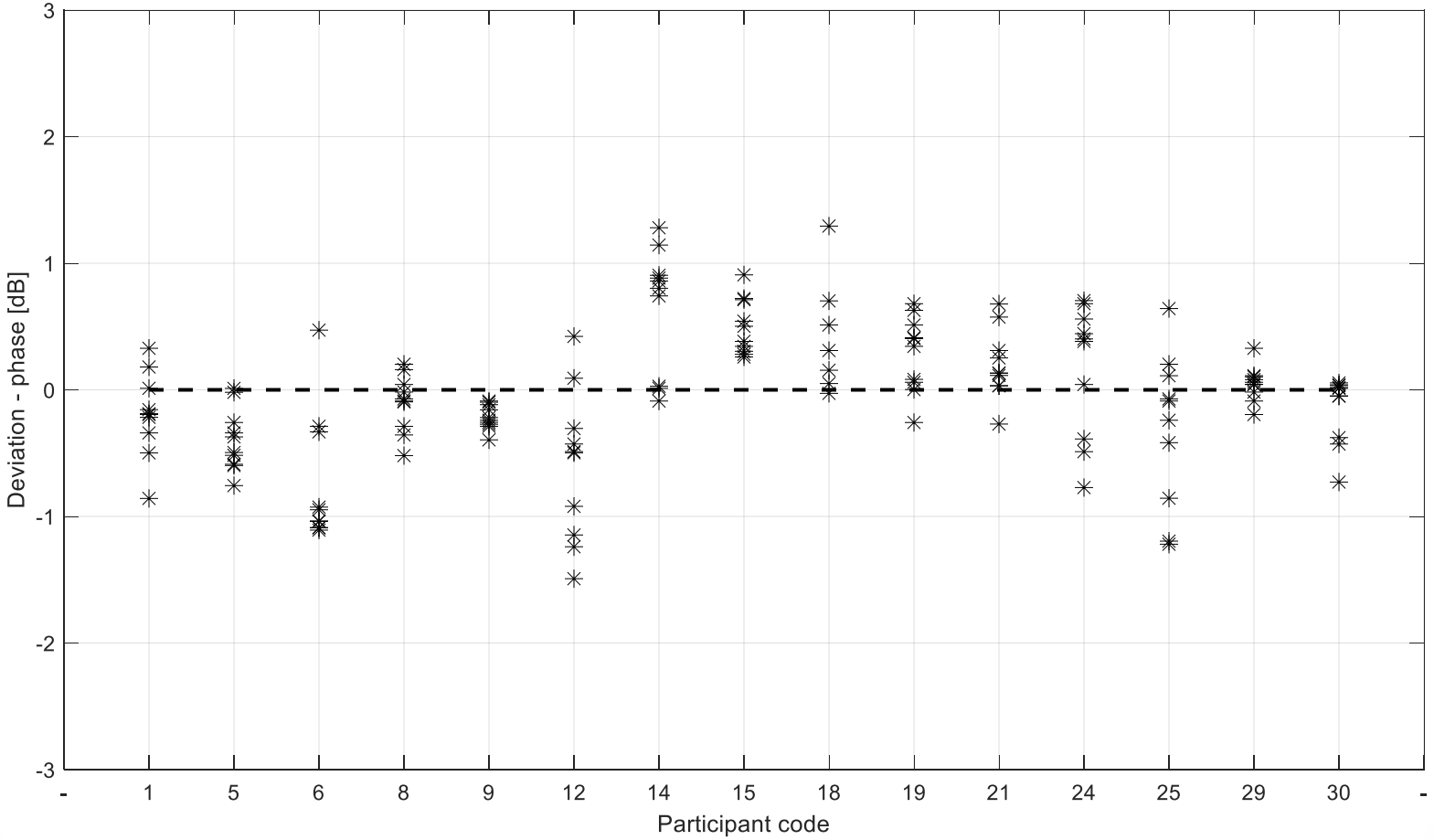
Harmonic code to frequency conversion

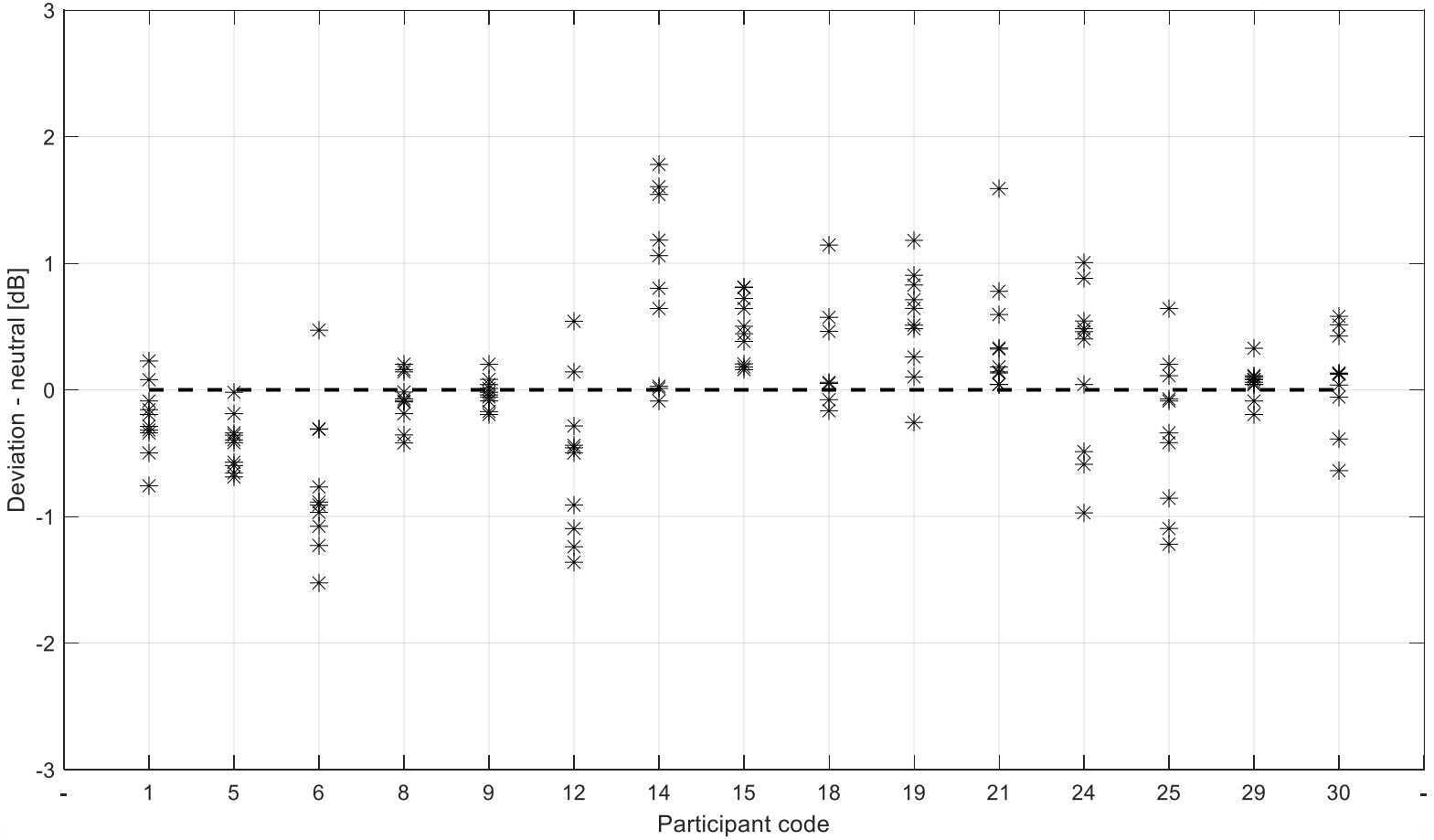
Band	Harmonic #	Frequency MHz
A	4	0.0351
A	8	0.0663
A	14	0.1131
B	3	2.5
B	10	9.5
B	14	13.5
B	19	18.5
B	23	22.5
B	27	26.5
B	30	29.5

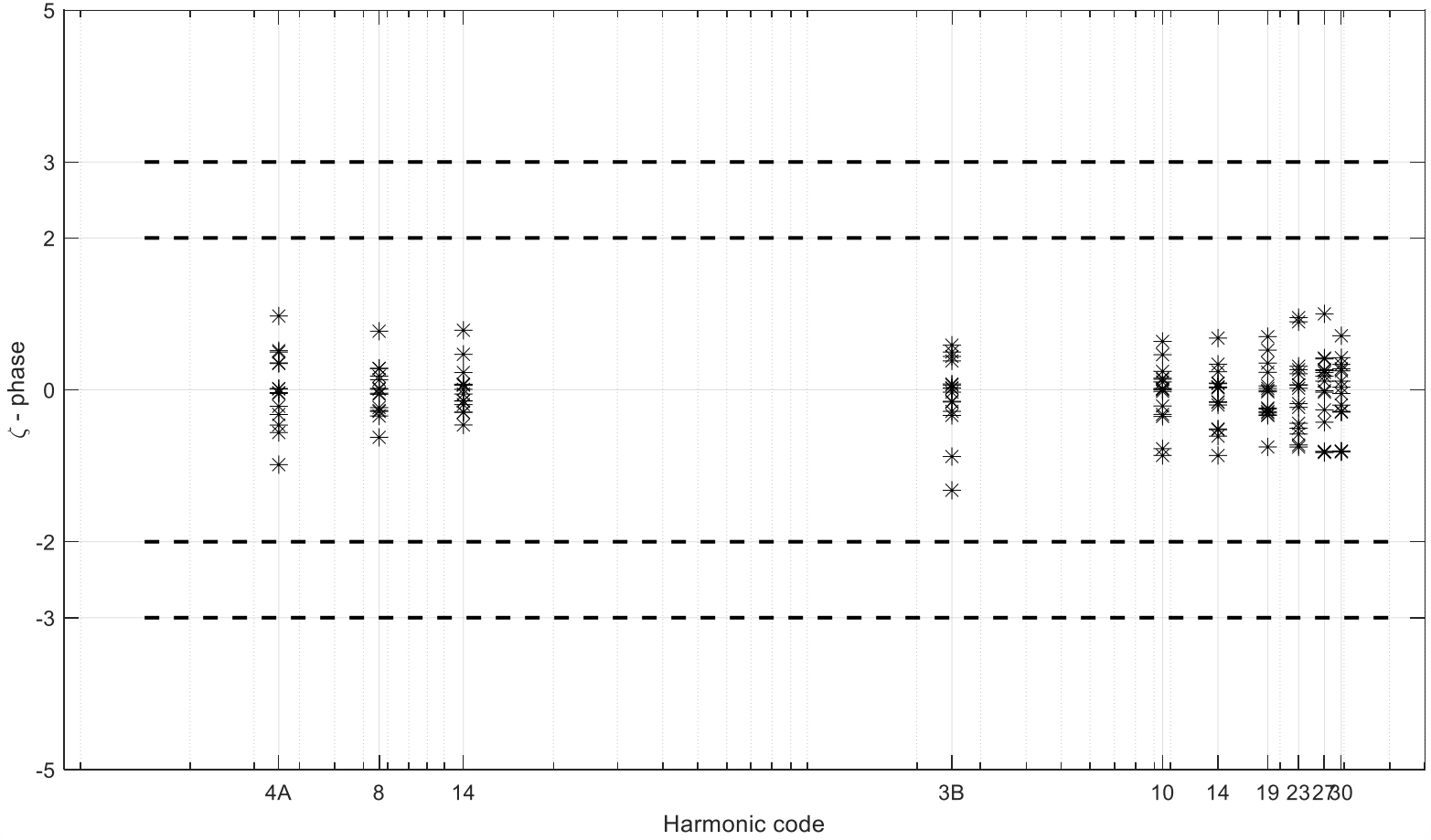

Deviation - phase [dB]
3
2
1
0
-1
-2
-3
4A
8
14
3B
10
14
19
23
27
30
Harmonic code

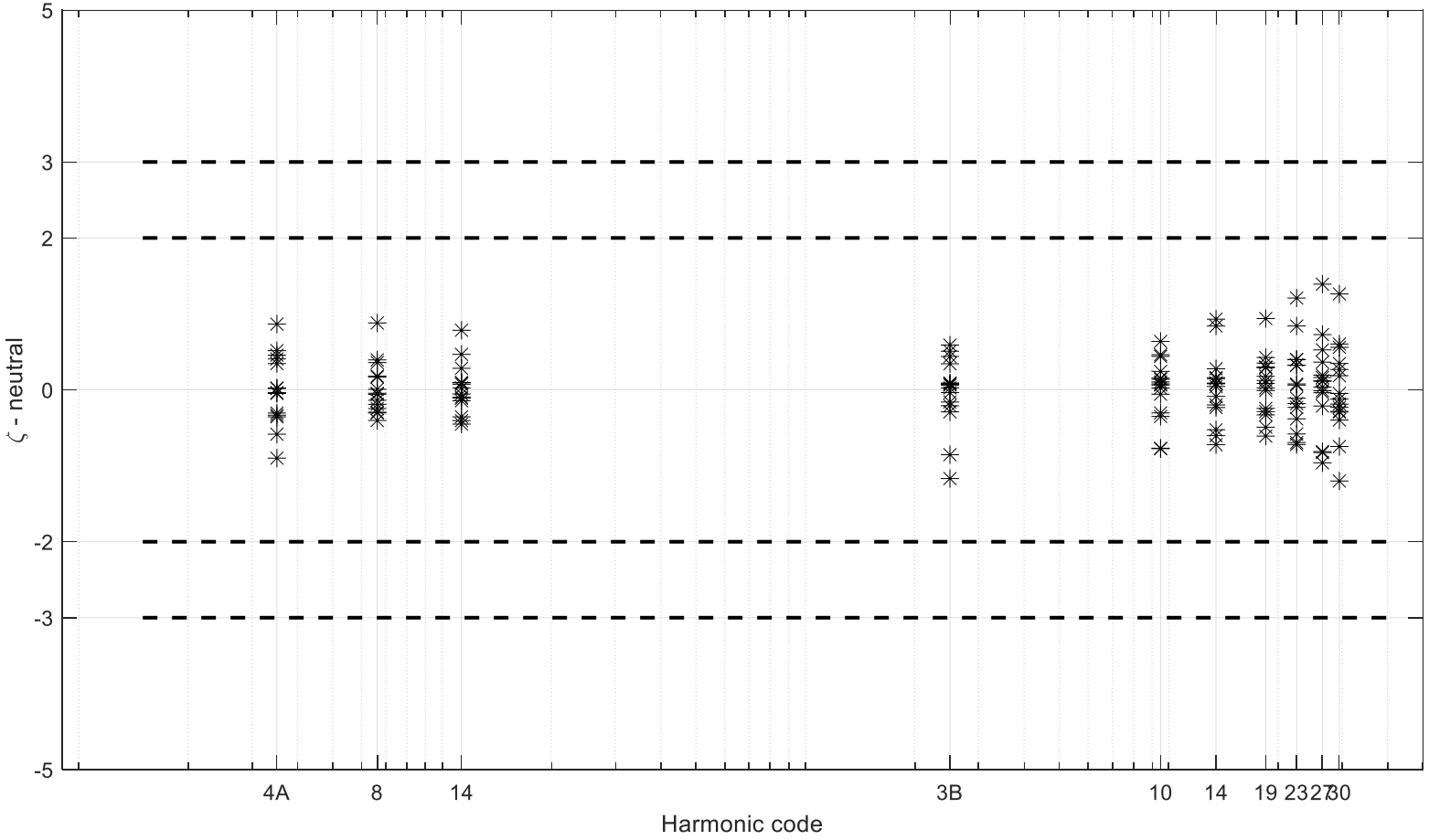
Conducted Emission 9 kHz – 30 MHz

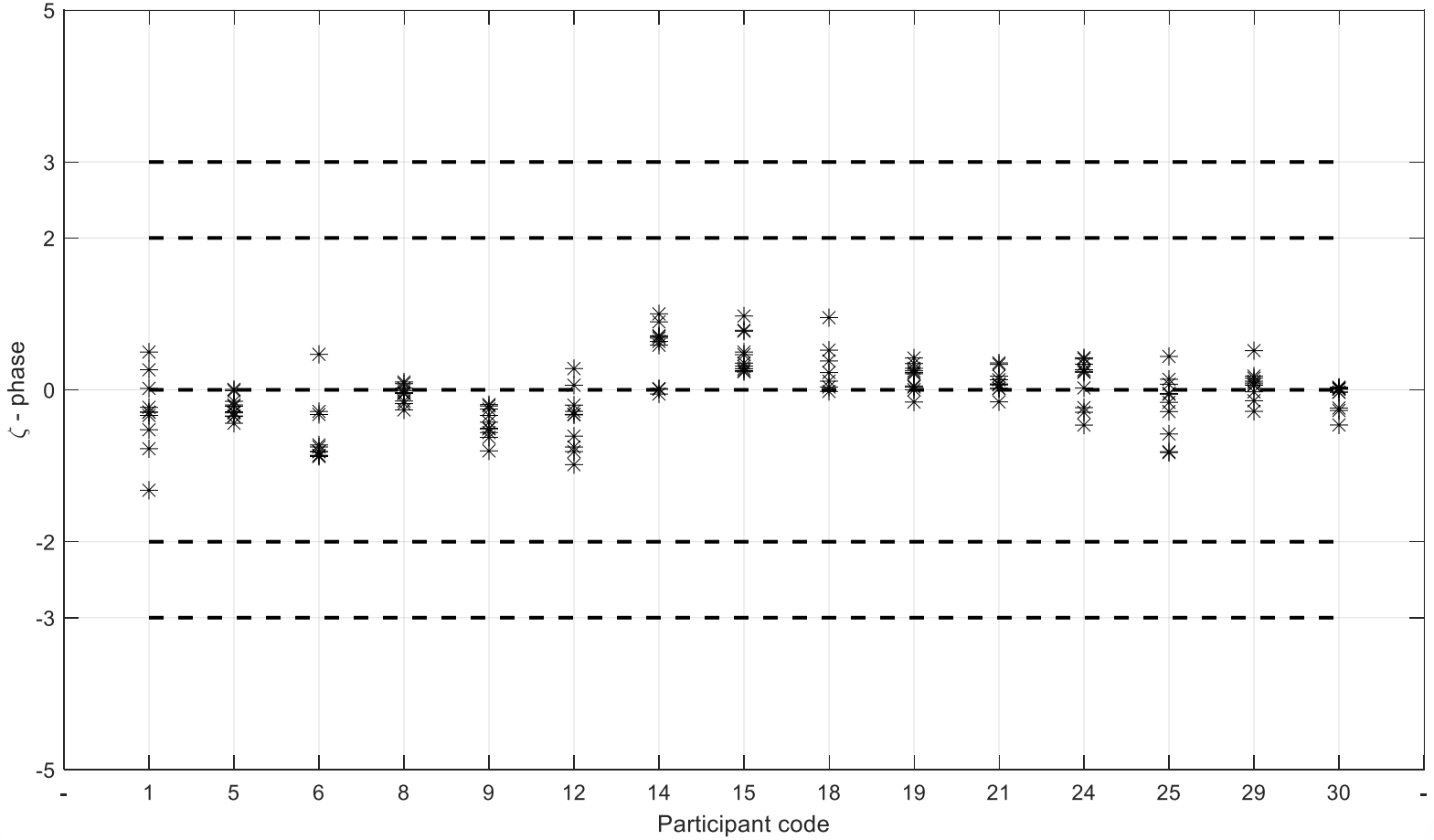


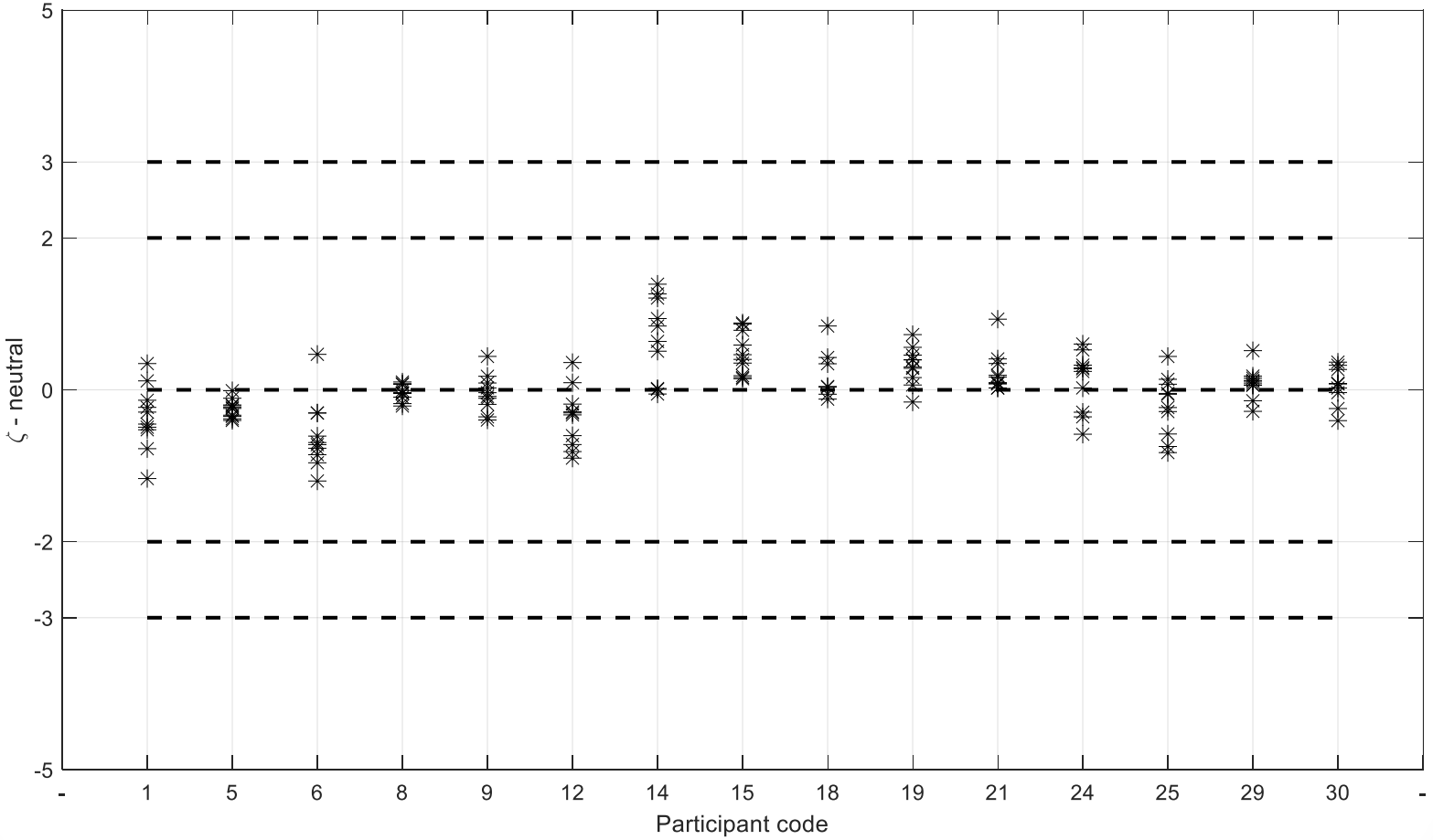

Deviation - phase [dB]
3
2
1
0
-1
-2
-3
-
1
5
6
8
9
12
14
15
18
19
21
24
25
29
30
-
Participant code

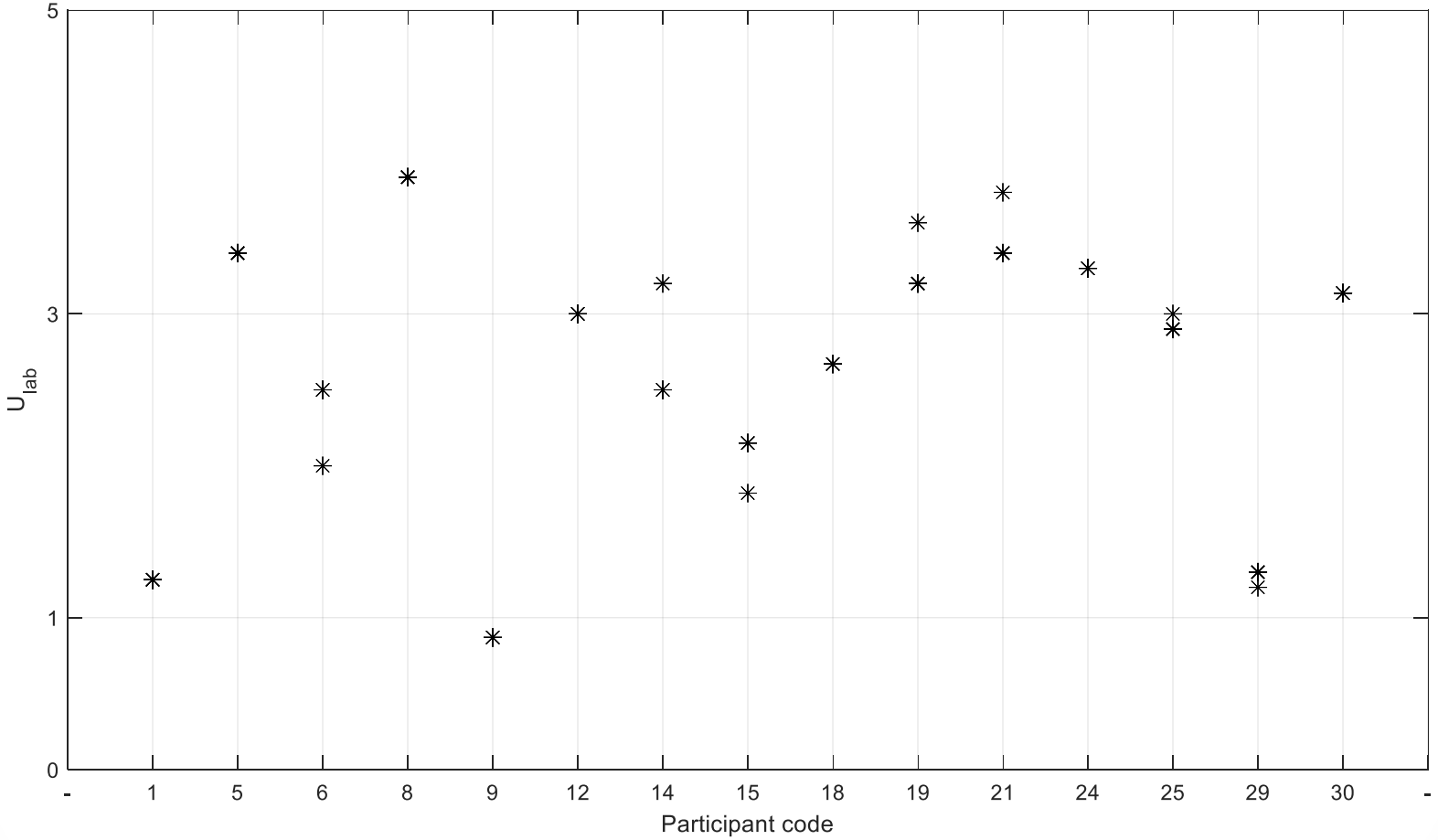

Deviation - neutral [dB]
3
2
1
0
-1
-2
-3
-
1
5
6
8
9
12
14
15
18
19
21
24
25
29
30
-
Participant code


5
3
2
0
-2
-3
-5
ζ - phase
4A
8
14
3B
10
14
19
23
27
30
Harmonic code


5
3
2
0
-2
-3
-5
ζ - neutral
4A
8
14
3B
10
14
19
23
27
30
Harmonic code


5
3
2
0
-2
-3
-5
ζ - phase
-
1
5
6
8
9
12
14
15
18
19
21
24
25
29
30
-
Participant code


5
3
2
0
-2
-3
-5
ζ - neutral
-
1
5
6
8
9
12
14
15
18
19
21
24
25
29
30
-
Participant code


5
3
1
0
U_{lab}
-
1
5
6
8
9
12
14
15
18
19
21
24
25
29
30
-
Participant code

Reproducibility as quantified by robust standard deviation *s**

f MHz	*s** dB
0.0351	0.6
0.0663	0.5
0.1131	0.4
2.5	0.5
9.5	0.5
13.5	0.5
18.5	0.5
22.5	0.8
26.5	0.9
29.5	0.7

Remarks

- The measurement results provided by the 15 participants at the 10 measurement frequencies selected by the Coordinator are approximately within –2 dB to + 2 dB from the reference values.
- 294 measurement results were provided by the participants, and no warning or action signal was issued.
- The expanded measurement uncertainty declared by the laboratories is comprised approximately between 0.9 dB and 4 dB, robust standard deviation s^* is less than 0.9 dB.