

**Proficiency test through interlaboratory comparison –
Radiated emissions in the 30-1000 MHz frequency range –
Scheme of the proficiency tests**
PTC(RE-SAR-30-1000-10m)
PTC(RE-SAR-30-1000-3m)
PTC(RE-FAR-30-1000-3m)

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Rev. 1 – October 22, 2013 (see note †)

1. Scope

This document describes the participation scheme to a proficiency test performed through an interlaboratory comparison of radiated emission measurements. The scheme includes:

- 1.a) The description of the interlaboratory comparison
- 1.b) The selection criteria of the participants and the terms of admission to the proficiency test
- 1.c) The description of the technique adopted for the statistical analysis of the results of the interlaboratory comparison
- 1.d) The instructions to the participating laboratory (briefly, Laboratory) on how to perform measurements
- 1.e) The description of the method by which the results of the proficiency test are registered by the Laboratory and by the Coordinator of the proficiency test
- 1.f) The test reports issued by the Laboratory and the Coordinator

The last revision of the present document can be downloaded from the following URL:
<http://www.emc.unifi.it/CMpro-v-p-26.html>

2. Coordinator

The Coordinator of the proficiency test is Carlo Carobbi, from Università degli Studi di Firenze.

The Coordinator relies on the technical and scientific support from:

- Michele Borsero, Istituto Nazionale di Ricerca Metrologica (Torino);
- Marco Cati, Esaote S.p.A. (Firenze);
- Carlo Panconi, Elettroingegneria (Pistoia);
- Giuseppe Vizio, Istituto Nazionale di Ricerca Metrologica (Torino);

(note †) Rev. 1 replaces rev. 0 dated July 4, 2013. Changes with respect to rev. 0 are highlighted through a vertical bar at the left side of the amended text (see Clause 4 – paragraph 4.c, Annex A and Annex B).

- Alessio Bonci (Università degli Studi di Firenze).

The contact details of the Coordinator are reported below:

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3. Type of interlaboratory comparison

The interlaboratory comparison consists in the comparison of the measurements of a travelling standard (Sample) provided by the Coordinator. Each Laboratory makes a quantitative examination (Measurement) of the Sample thus providing the Coordinator with a measurement result.

The Coordinator designed and assembled the Sample. The Coordinator assigned to the Sample its reference value and the corresponding uncertainty. The reference value was obtained by the Coordinator through measurements and numerical predictions.

The measurement result provided by each Laboratory consists of a measured value and its uncertainty.

The scheme of participation in the proficiency test is sequential and it is illustrated in Fig. 1. The Coordinator passes the Sample to the 1st participating Laboratory. The 1st Laboratory takes the measurement thus obtaining the 1st measurement result. Then, the 1st Laboratory passes the Sample to the 2nd Laboratory which, in turns, makes the measurement and determines the 2nd measurement result. The 2nd Laboratory passes the Sample to the 3rd Laboratory which determines the 3rd measurement result. The 3rd Laboratory passes back the Sample to the Coordinator, so that the Coordinator can verify the operation of the Sample. Then the Coordinator passes the Sample to the 4th Laboratory and so on. The proficiency test is completed when all participating Laboratories have sent their measurement results to the Coordinator.

The measurement result provided by each Laboratory shall be compared against:

- The reference value assigned by the Coordinator;
- The average of the measurement results provided by all participating laboratories.

Two options are available to Laboratories:

- Option I:** The transmission of the test report from the Coordinator to the Laboratory shall take place only after that the proficiency test is concluded. No communication of the results of the proficiency test shall be done by the Coordinator to the Laboratory in the time period between the beginning and the conclusion of the proficiency test.
- Option II:** The Laboratory sends the measurement result to the Coordinator and the Coordinator immediately communicates to the Laboratory the outcome of the comparison

between the measurement result and the reference value assigned by the Coordinator. The communication of the outcome of the comparison between the measurement result provided by the Laboratory with the average of the results provided by all participating Laboratories shall be made at the conclusion of the proficiency test. The Coordinator shall therefore send two test reports: one partial test report with the outcome of the comparison between the measurement result and the reference value (first test report), one complete test report including both the outcome of the comparison between the measurement result and the reference value and the outcome of the comparison between the measurement result and the average and dispersion of all measurement results (second test report). A higher participation fee is requested to the Laboratory willing to choose Option II, in addition to the written agreement to not disclose the reference value assigned by the Coordinator before the end of the proficiency test.

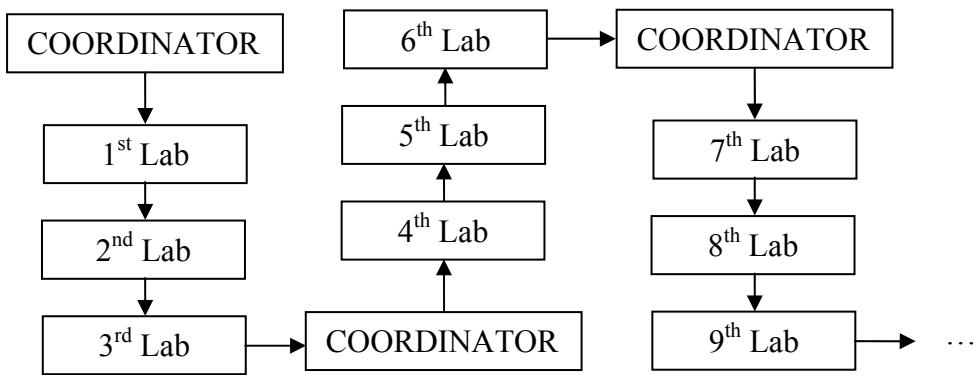


Fig. 1: Sequence by which the Sample is passed from the Coordinator to the Laboratories and from the Laboratories to the Coordinator.

The Laboratory has one week available to perform the measurement and one week to communicate the measurement result to the Coordinator.

The Coordinator has one week available to verify the correct operation of the Sample.

NOTE: The scope of the verification made by the Coordinator when the Sample returns from the Laboratory is to check the mechanical and electrical integrity of the Sample. The result of the verification are registered.

The Sample is an electromagnetic field source made of the combination of a comb generator and an antenna. The Laboratory shall make the measurement of the amplitude of nine (9) harmonics of the electromagnetic field selected by the Coordinator in the frequency range between 30 and 1000 MHz.

Two antennas shall be provided by the Coordinator: a rod antenna, for use in the 30-200 MHz frequency range, and a log-periodic antenna, for use in the 200-1000 MHz frequency range.

Harmonics' spacing is approximately 20 MHz, hence the lowest measurable frequency in the 30-1000 MHz frequency range is approximately 40 MHz (2nd harmonic).

The Coordinator shall identify the harmonics to be measured through their ordinal number (e.g., the 32nd harmonic is the harmonic whose frequency is approximately 640 MHz).

The measurement result provided by the Laboratory shall be:

- 3.e) The estimate x , expressed in dB(μ V/m), of the amplitude of the selected harmonics;
- 3.f) The expanded uncertainty of the estimate x , U_{lab} , expressed in dB and obtained multiplying the standard uncertainty by the coverage factor $k = 2$ (which corresponds to a coverage probability of about 95 % assuming normal distribution).

The Laboratory may assign a different value of U_{lab} to each measured harmonic.

4. Admission requirements

The present scheme applies to Electromagnetic Compatibility (EMC) test Laboratories that:

- 4.a) Can make radiated emission measurements in accordance with the methods described in §7.3 (30-1000 MHz, semi-anechoic room or open area test site, at 3 or 10 m distance) and/or in §7.4 (30-1000 MHz, fully-anechoic room or absorber-lined semi-anechoic room or free-space open area test site, at 3 m distance) of CISPR 16-2-3:2010, in the frequency range between 30 and 1000 MHz;
- 4.b) Have evaluated the measurement uncertainty U_{lab} of the measurement methods mentioned in the previous clause 4.a).

Accreditation to ISO/IEC 17025 is not required for admission to the proficiency test. The Coordinator designed the present scheme assuming participation of both accredited and non-accredited Laboratories.

The Coordinator starts the proficiency test if there are at least five participating Laboratories. The maximum number of participating laboratories is twenty which corresponds to a total duration of the proficiency test of less than one year.

The Laboratory that is willing to participate in the proficiency test shall:

- 4.c) Fill, sign and send by mail to the Coordinator three copies of the contract in Annex A (Italian) or Annex B (English).
- 4.d) Designate a Technical Responsible and, if possible, his/her Deputy. The Technical Responsible shall sign the test report submitted by the Laboratory to the Coordinator, in addition he/she will be the reference person for correspondence with the Coordinator. Designation shall be done by means of the form in Annex C. In turn, the Coordinator shall assign a code to the Laboratory. The same code shall be used to identify the Laboratory in correspondence and in the test reports. The code shall be as follows:
 - i) **PTC(RE-SAR-30-1000-3m)LAB(#)** for Laboratories that adhere to the admission requirements 4.a) and 4.b) and use a semi-anechoic room (SAR) at 3 m distance.
 - ii) **PTC(RE-SAR-30-1000-10m)LAB(#)** for Laboratories that adhere to the admission requirements 4.a) and 4.b) and use a semi-anechoic room (SAR) at 10 m distance.
 - iii) **PTC(RE-FAR-30-1000-3m)LAB(#)** for Laboratories that adhere to the admission requirements 4.a) and 4.b) and use a fully-anechoic room (FAR) at 3 m distance.

The code is the combination of a general part that identifies the measurement method, and therefore a homogenous set of measurement results – PTC(RE-SAR-30-1000-3m), PTC(RE-SAR-30-1000-10m) and PTC(RE-FAR-30-1000-3m) – and a specific part – LAB(#) – that identifies a particular Laboratory.

4.e) Select the week during which the measurement will be performed by using the Doodle link <http://www.doodle.com/mi4rpv55wereas86>. Use the Laboratory name when making the selection, do not use the code assigned by the Coordinator.

4.f) Observe the following shipping rules:

- i) Shipping of the Sample from the Coordinator to the Laboratory is in charge of the Coordinator;
- ii) Shipping of the Sample from the Laboratory to the next Laboratory or to the Coordinator is in charge of the Laboratory;
- iii) Shipments shall be done by means of an express courier;
- iv) The same packaging used by the Coordinator shall be used for all the shipments.

4.g) Handle with care the travelling Sample. A damage to the Sample will cause a delay and eventually the interruption of the proficiency test. Each Laboratory shall verify by inspection the mechanical integrity of the Sample. Possible defects or damages, proven or suspected, shall be immediately notified to the Coordinator.

5. Statistical analysis of the measurement results

Two distinct statistical analyses are adopted and based on two corresponding performance statistics:

5.a) Statistical analysis based on the ζ performance statistic (§7.7 of ISO 13528:2005): the measurement result x_i , in dB(μ V/m), provided by the i-th Laboratory ($i=1,2,\dots,p$, where p is the number of participating Laboratories) is compared with the value X , in dB(μ V/m), assigned by the Coordinator. The standard uncertainty of x_i is $u_{xi} = (U_{lab})_i / 2$ where $(U_{lab})_i$, in dB, is the expanded uncertainty stated by the i-th Laboratory (see §3). The standard uncertainty of X is $u_X = U_{ref} / 2$, where U_{ref} , in dB, is the expanded uncertainty obtained multiplying the standard uncertainty by a coverage factor $k=2$ (which corresponds to a coverage probability of about 95 %, assuming a normal distribution) that the Coordinator assigned to the reference value X . The Coordinator calculates the following measure ζ_i of relative deviation between x_i and X :

$$\zeta_i = \frac{x_i - X}{\sqrt{u_{xi}^2 + u_X^2}}. \quad (1)$$

The value of ζ_i is calculated for each Laboratory and for each investigated frequency. Therefore as many values of ζ_i will be calculated as the number of investigated frequencies (9 frequencies investigated, 9 values of ζ_i for the i-th Laboratory). The measurement result provided by the i-th Laboratory will produce a warning signal if, at least at one frequency, we have ζ_i less than -2 or greater than +2. The measurement result provided by the i-th Laboratory will produce an attention signal if, at least at one frequency, we have ζ_i less than -3 or greater than +3. If at all

frequencies we have ζ_i greater than -2 and less than $+2$ then the measurement result provided by the i-th Laboratory will not give evidence of any anomaly.

5.b) Statistical analysis based on the z performance statistic (§7.4 of ISO 13528:2005): the measurement result x_i , in dB(μ V/m), provided by the i-th Laboratory, is compared with the average value x^* , in dB(μ V/m), obtained combining the measurement results provided by all participating Laboratories. The Coordinator calculates the following measure z_i of relative deviation between x_i and x^* :

$$z_i = \frac{x_i - x^*}{s^*}, \quad (2)$$

where s^* is the estimate of the dispersion (standard deviation) of x_i about x^* , obtained combining the measurement results provided by all participating Laboratories. The value of z_i is calculated for each Laboratory and for each investigated frequency. Therefore as many values of z_i will be calculated as the number of investigated frequencies (9 frequencies investigated, 9 values of z_i for the i-th Laboratory). The measurement result provided by the i-th Laboratory will produce a warning signal if, at least at one frequency, we have less than -2 or greater than $+2$. The measurement result provided by the i-th Laboratory will produce an attention signal if, at least at one frequency, we have z_i less than -3 or greater than $+3$. If at all frequencies we have z_i greater than -2 and less than $+2$ then the measurement result provided by the i-th Laboratory will not give evidence of any anomaly.

The values of x^* and s^* are obtained by the Coordinator by using the robust analysis (Algorithm A) described in Annex C of ISO 13528:2005. The robust analysis is based on an iterative calculation. At the first step of iteration

$$x^* = \text{median of } x_i \quad (i=1,2,\dots,p) \quad (3)$$

and

$$s^* = 1,483 \cdot \left\{ \text{median of} |x_i - x^*| \right\} \quad (i=1,2,\dots,p). \quad (4)$$

NOTE 1: The performance statistics ζ and z provide for complementary information. Indeed, since usually the standard uncertainty u_X of the reference value X is small with respect to the standard uncertainty u_{xi} of the measurement result x_i and it is expected that x^* does not deviate much from X , then from (1) and (2) we have:

$$\zeta_i \approx \frac{x_i - X}{u_{xi}} \quad (5)$$

and

$$z_i \approx \frac{x_i - X}{s^*}. \quad (6)$$

Now, it is evident from (5) and (6) that comparing ζ_i with z_i is equivalent to comparing u_{xi} with s^* . In particular if it does not result that $u_{xi} \approx s^*$ then one performance statistic may give, for the same Laboratory, a warning or action signal while the other does not. This may happen, for example, when a Laboratory produces a measurement result whose deviation from the reference value, $|x_i - X|$, is relatively large when compared with the deviations produced by the other Laboratories. If the Laboratory has correctly calculated measurement uncertainty then (5) gives no action or warning signal, i.e. $|\zeta_i| < 2$, while (6) gives an action or warning signal, i.e. $|z_i| > 2$. On the other end, if a Laboratory produces a measurement result whose deviation from the reference value is comparable with that of the other Laboratories but whose measurement uncertainty is underestimated then it may happen that $|z_i| < 2$ and $|\zeta_i| > 2$.

NOTE 2: The factor 1,483 which appears in (4) represents the ratio between the standard deviation σ and the median of the absolute deviations from the median, MAD , assuming normal distribution. It is indeed possible to show that in the case of symmetric distribution, $MAD / \sigma = \Phi^{-1}(3/4)$, where Φ is the cumulative distribution function. In the case of normal distribution $\Phi^{-1}(3/4) = 0,6745$ and therefore $\sigma = 1,4826 \cdot MAD$.

NOTE 3: The uncertainty of the reference value of the electric field strength assigned by the Coordinator is $U_{ref} = 1,3$ dB for frequencies lower than 200 MHz and $U_{ref} = 0,9$ dB for frequencies greater than 200 MHz. The Coordinator expects the measurement uncertainty of the Laboratory, U_{lab} , to be greater than U_{ref} .

NOTE 4: The Coordinator compares the reference value assigned to the electric field strength with the average of the measurement results provided by the Laboratories by using the performance statistic described in §5.7 of ISO 13528:2005 where x^* and s^* are obtained by using the robust analysis (Algorithm A) described in Annex C of the standard ISO 13528:2005. In this way the Coordinator can highlight the presence of a possible bias affecting the reference value (due to an uncorrected systematic effect) or the measurement results produced by the Laboratories (because inherent in the standard measurement method).

6. Measurement procedure

Electromagnetic field measurement must be preceded by a preliminary measurement of the power that the comb generator (CG) delivers to a 50Ω load at 100, 200, 500 and 1000 MHz.

- 6.a) The CG shall be connected to the input of a receiver (not necessarily the same used for the measurement of the electromagnetic field) through the male-male N adaptor provided by the Coordinator. It is up to the Laboratory to verify that the operation of the receiver is linear (negligible compression and generation of harmonics). Any detector can be used (peak, quasi-peak, average, rms). The Laboratory records the readings P_m (in dBm, rounded to one decimal figure) at each of the frequencies in Tab. 1. Next the deviations $\Delta = P_m - P_{ref}$, in dB and for each frequency, from the reference values P_{ref} , in dBm, are recorded in the same Tab. 1. It must result that $-2,5 \text{ dB} \leq \Delta \leq 2,5 \text{ dB}$. If this preliminary verification produces a positive outcome at each of

the frequencies in Tab. 1 then the Laboratory can proceed to the measurement of the electromagnetic field, otherwise the Laboratory shall contact the Coordinator.

Tab. 1: Table for the verification of the power that the CG delivers to a 50Ω load. In order to obtain the approximate frequency of the harmonic in megahertz multiply the harmonic # by 20. It should result $-2,5\text{ dB} \leq \Delta \leq 2,5\text{ dB}$.

Harmonic #	P_{ref} [dBm]	P_m [dBm]	Δ [dB]
5	-24,8		
10	-24,3		
25	-26,3		
50	-25,7		

NOTE 1: The critical value of 2,5 dB was derived assuming that the Laboratory uses, for both this verification and the measurement of the electromagnetic field, a meter which complies with the requirements of the standard CISPR 16-1-1:2010 (see §4.3, §5.4, §6.4 and §7.4). It is expected that the preliminary test is passed also in case of use of a good quality, but not necessarily CISPR compliant, spectrum analyzer.

Once that the preliminary CG power verification is completed then the electromagnetic field measurement can be carried out.

6.b) Measurements performed above a reflective ground plane in the frequency range comprised between 30 and 1000 MHz (§7.3 of CISPR 16-2-3:2010) at 3 or 10 m distance.

The scope of the measurement is to obtain the best estimate and measurement uncertainty of the measurand. The measurand is the maximum electric field strength, in $\text{dB}(\mu\text{V/m})$, emitted by the Sample in vertical polarization (± 2 deg), at the specified horizontal distance from the Sample (3 or 10 m) at a height between 1 and 4 m above the reflecting ground plane. The reference point (RP) of the Sample for distance measurements is: the point where the axis of the rod crosses the bottom plate of the CG when using the rod transmitting antenna (TA), see Fig. 2, the midpoint of the tip when using the log-periodic TA, see Fig. 3. A dielectric pole (DP) with a metallic clamp is provided by the Coordinator to hold the CG when the rod TA is used. The clamp shall hold the CG approximately midway between the top and the bottom of the CG itself (see Fig. 2). A tripod (not provided by the Coordinator) shall be used to support the CG through the DP or directly the log-periodic TA. The log-periodic TA is connected to the CG through the adapter provided by the Coordinator. The rod TA is directly connected to the CG, there is no need of an adapter. The height of the TA over the reflecting ground plane shall be: (140 ± 2) cm for the rod TA, (150 ± 2) cm for the log-periodic TA. The use of the same measuring instrumentation as that used for radiated emission tests in the corresponding frequency range is recommended. Measurement frequencies and the corresponding TA to be used are reported in Tab. 2.

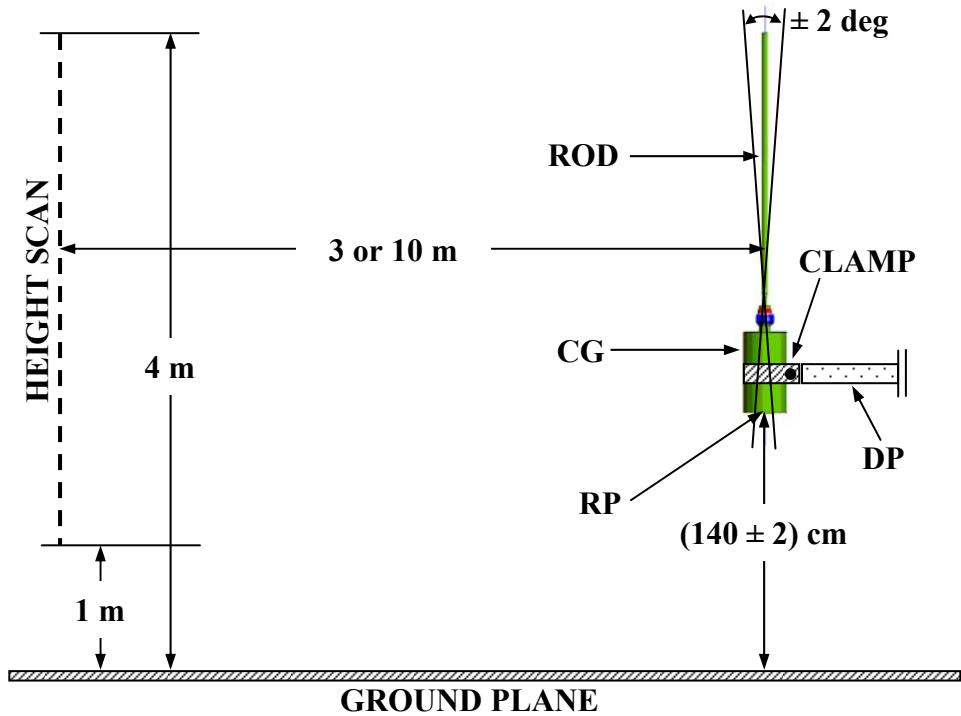


Fig. 2: Measurement layout for the 30 to 200 MHz frequency range, semi-anechoic room (3 or 10 m). The meaning of the acronyms is as follows: CG = Comb Generator, RP = Reference Point, DP = Dielectric Pole. The tripod to support the CG through the DP (not in figure) is not provided by the Coordinator.

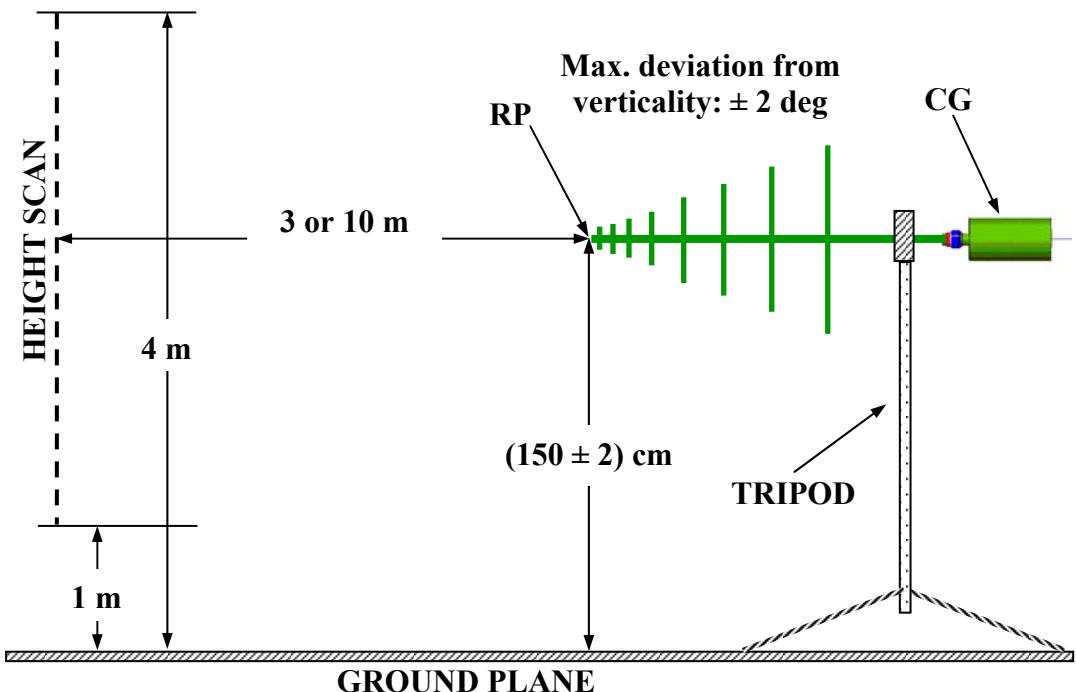


Fig. 3: Measurement layout for the 200 to 1000 MHz frequency range, semi-anechoic room (3 or 10 m). The meaning of the acronyms is as follows: CG = Comb Generator, RP = Reference Point. The tripod is not provided by the Coordinator.

6.c) Measurements performed in a free-space environment in the frequency range comprised between 30 and 1000 MHz (§7.4 of CISPR 16-2-3:2010) at 3 m distance.

The scope of the measurement is to obtain the best estimate and measurement uncertainty of the measurand. The measurand is the electric field strength, in dB(μ V/m), emitted by the Sample at 3 m distance from the Sample in the boresight direction. The reference point (RP) of the Sample for distance measurements is: the point where the axis of the rod crosses the bottom plate of the CG (see Fig. 4) when using the rod transmitting antenna (TA), the midpoint of the tip when using the log-periodic TA (see Fig. 5). A dielectric pole (DP) with a metallic clamp is provided by the Coordinator to hold the CG when the rod TA is used. The clamp shall hold the CG approximately midway between the top and the bottom of the CG itself (see Fig. 4). A tripod (not provided by the Coordinator) shall be used to support the CG through the DP or directly the log-periodic TA. The log-periodic TA is connected to the CG through the adapter provided by the Coordinator. The rod TA is directly connected to the CG (no need of an adapter). The height of the TA shall be at least 1 m from the floor and 50 cm from the absorbing material. The use of the same measuring instrumentation as that used for radiated emission tests in the corresponding frequency range is recommended. Measurement frequencies and the corresponding TA to be used are reported in Tab. 2.

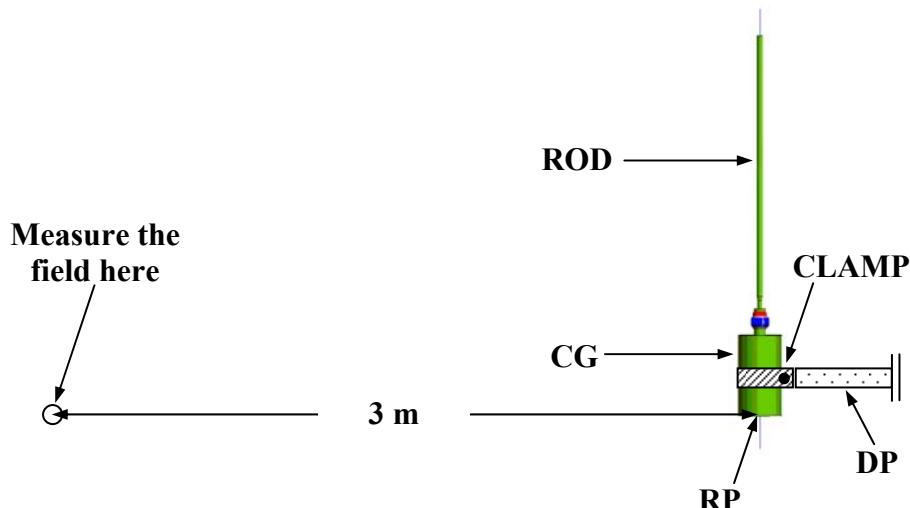


Fig. 4: Measurement layout for the 30 to 200 MHz frequency range, fully-anechoic room. The meaning of the acronyms is as follows: CG = Comb Generator, RP = Reference Point, DP = Dielectric Pole. The tripod to support the CG through the DP (not in figure) is not provided by the Coordinator.

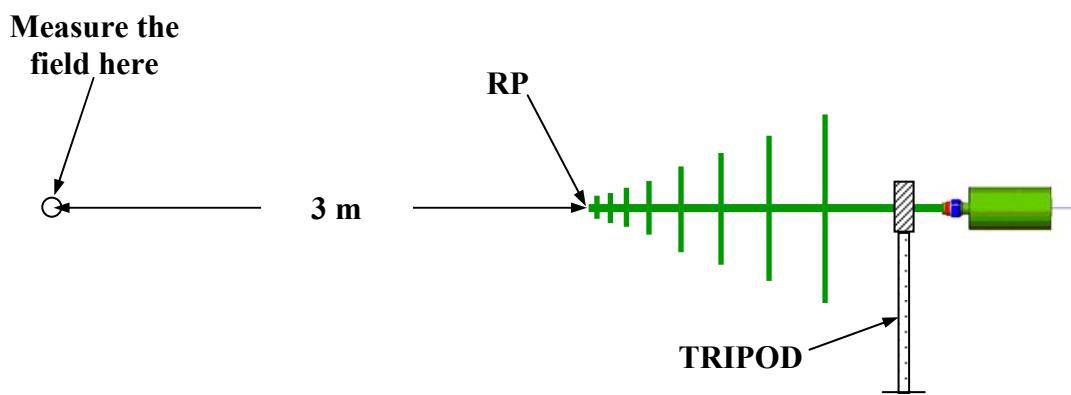


Fig. 5: Measurement layout for the 200 to 1000 MHz frequency range, fully-anechoic room. The meaning of the acronyms is as follows: CG = Comb Generator, RP = Reference Point. The tripod is not provided by the Coordinator.

6.d) It is up to the Laboratory to use fresh batteries for the CG (4 batteries, type AA - 1,5 V). Fresh batteries permit more than 24 hours continuous operation of the CG. The CG does not switch on if the batteries are not adequately charged or, if previously switched on, it switches off. The on/off button is the red one. The CG is switched on when the button is pressed. In order to replace the batteries loosen the caps placed in the bottom plate. Insert the batteries with the appropriate polarity, as printed in the caps (+ polarity at the cap's side). Handle the Sample with care.

6.e) The receiver's detector (peak, quasi-peak, average or rms) is set by the Laboratory according to the requirements of the standard measurement method. Since the standard method allows the use of more than one detector, the decision rests in part with Laboratory's convenience. Since the field strength generated by the Sample is a narrowband signal, all detectors are equivalent to the purpose of this proficiency test.

6.f) The electric field strength to be measured is comprised between 30 and 80 dB(μ V/m).

7. Recording electric field strength measurement results

The measured electric field strength x , in dB(μ V/m), shall be rounded up to 1 decimal figure (e.g. 68,5 dB(μ V/m)). Measurement uncertainty U_{lab} , in dB, shall be rounded up to 2 significant figures (e.g. 4,3 dB). The values of x and U_{lab} shall be recorded in the sixth and seventh column of Tab. 2, respectively. The Coordinator shall complete the rest of the table (columns two, four, five, eight nine, ten and eleven).

Tab. 2: Table to be used for recording the electric field strength measurement result x and its measurement uncertainty U_{lab} . Columns six and seven shall be filled up by the Laboratory. Columns two, four, five, eight, nine, ten and eleven shall be filled up by the Coordinator. In order to obtain the approximate frequency of the harmonic in megahertz multiply the harmonic # by 20.

1 Harmonic #	2 X [dB(μ V/m)]	3 U_{ref} [dB]	4 x^* [dB(μ V/m)]	5 s^* [dB]	6 x [dB(μ V/m)]	7 U_{lab} [dB]	8 $x - X$ [dB]	9 ζ	10 $x - x^*$ [dB]	11 z
2*	-	1,3	-	-			-	-	-	-
4*	-	1,3	-	-			-	-	-	-
6*	-	1,3	-	-			-	-	-	-
8*	-	1,3	-	-			-	-	-	-
10*	-	1,3	-	-			-	-	-	-
20**	-	0,9	-	-			-	-	-	-
30**	-	0,9	-	-			-	-	-	-
40**	-	0,9	-	-			-	-	-	-
50**	-	0,9	-	-			-	-	-	-

* Transmitting Antenna: Rod

** Transmitting Antenna: Log-periodic

The Laboratory fills column six and seven and sends a copy of Tab. 2 to the Coordinator. The coordinator completes the rest of Tab. 2 and sends a copy to the Laboratory. The proficiency test result does not give evidence of any anomaly if, at all frequencies, $-2 \leq \zeta \leq 2$ and $-2 \leq z \leq 2$. Otherwise anomalies shall be described in terms of warning and action signals as discussed in 5.a) and 5.b).

NOTE 1: Warning signals do not add up to give an action signal.

NOTE 2: If at a specific frequency one performance statistic gives evidence of an anomaly while the other does not the anomaly is however confirmed.

8. Test reports

The test report issued by the Laboratory to the Coordinator shall conform to Annex D and it shall be signed by the Technical Responsible or his/her Deputy (see 4.d). The test report issued by the Coordinator to the Laboratory shall conform to Annex E. Annexes D and E, once completed by the Laboratory and the Coordinator, will be integral part of the present document and they will provide evidence of the participation of the Laboratory to the proficiency test.

9. Remarks and complaints

The Coordinator issued and made freely available this document in order to prevent remarks and complaints from the Laboratories during the progress of the proficiency test.

Remarks and complaints shall be considered by the Coordinator only if they are related to management or technical aspects actually relevant to the proficiency test but not considered in the present document. Subscription of the contract in Annex A (Italian) or B (English) implies formal acceptance of the terms and conditions of participation in the proficiency test described in this document.

Laboratories are allowed to verbally contact (e.g. by phone) the Coordinator to represent possible remarks and complaints about management and technical problems related to the proficiency test that appear during the progress of the proficiency test itself. If possible, and depending on the importance of the problem originating the remark or complaint, the Coordinator shall give advice to the Laboratories in order to resolve the problem.

If the Coordinator judges that the problem cannot be verbally solved through an advice to the Laboratory then he will ask the Laboratory a written communication of the remarks and complaints. The Coordinator will discuss the remarks and complaints with his technical and scientific collaborators (see §2) and collectively take a decision about their management.

Possible technical problems related to the management of the Sample (including shipment), delay in the progress of the proficiency test caused by a Laboratory or by the Coordinator himself, can be solved by the Coordinator without involving the scientific and technical collaborators.

10. Confidentiality and impartiality

The Coordinator and his technical and scientific collaborators shall keep confidential any information pertaining the performance of the Laboratories involved in the proficiency test during its progress and after its completion. The Coordinator warrants that the results originated from the participation of the Laboratories in the proficiency test shall be kept confidential through:

10.a) Keeping anonymous the result associated with each Laboratory. The individual result produced by each Laboratory may be released only in such a way that the anonymity of the Laboratory is preserved.

10.b) Keeping anonymous aggregate results (i.e., statistical average, dispersion, ...). The aggregate proficiency test results may be released only in such a way that the anonymity of the Laboratories that generated the results is preserved.

10.c) Informing accredited Laboratories about a possible request of the Accreditation Body to reveal their proficiency test result. The proficiency test result shall be revealed to the Accreditation Body under written permission of the accredited test Laboratory.

The Coordinator and his scientific and technical collaborators shall avoid any conduct that could cause some Laboratories to take advantage with respect to the others in the successful participation in the proficiency test.

Laboratories shall avoid to raise issues that, if positively solved by the Coordinator and his scientific and technical collaborators, could generate a situation of disparity in the successful completion in the proficiency test.

Annex A

Compilare, firmare e spedire per posta fisica al Coordinatore tre copie del contratto. La spedizione per posta elettronica o fax non è accettabile.

**CONTRATTO TRA LA(ragione sociale del Committente) E
IL DIPARTIMENTO DI INGNERIA DELL'INFORMAZIONE DELL'UNIVERSITA' DI
FIRENZE PER L'EFFETTUAZIONE DELLA SEGUENTE PRESTAZIONE:**

“Prova valutativa di misura di emissione radiata nell’intervallo di frequenza 30-1000 MHz”

(Art. 3/C del Regolamento emanato in 5 giugno 2013, Prot. 41287 e artt.67/69 del Regolamento dell'Amministrazione, Finanza e Contabilità)

Tra

la/il (*ragione sociale o nominativo del Committente*) c.f.P.I.con sede in ...
in seguito indicata/o “Committente”, rappresentato da (*nome, cognome e qualifica*)

e

il Dipartimento di Ingegneria dell'Informazione dell'Università di Firenze, c.f. e P.I. 01279680480, in seguito indicato “Unità Amministrativa”, rappresentato dal Prof. Enrico Del Re in qualità di Direttore

PREMESSA

DINFO ha le capacità per fornire servizi di circuito interlaboratorio ai Laboratori operanti nel settore delle prove di Compatibilità Elettromagnetica e il Committente intende dare evidenza della propria competenza tecnica attraverso la partecipazione a circuiti interlaboratorio.

SI CONVIENE E SI STIPULA QUANTO SEGUE

Art. 1

Oggetto del contratto

L’Unità Amministrativa effettuerà la seguente prestazione:

“Prova valutativa di misura di emissione radiata nell’intervallo di frequenza 30-1000 MHz”, voce di tariffa “Partecipazione a circuito interlaboratorio tipo” (*inserire “B” per Opzione I oppure “E” per Opzione II*) approvata dal Consiglio dell’Unità Amministrativa in data 21 Marzo 2013.

Art. 2

Responsabile dell'attività

Responsabile dello svolgimento della prestazione è il Prof. Carlo Carobbi. La prestazione sarà eseguita nei locali dell'Unità Amministrativa con le modalità definite nel documento tecnico dal titolo “Proficiency test through interlaboratory comparison – Radiated emissions in the 30-1000 MHz frequency range – Scheme of the proficiency tests PTC(RE-SAR-30-1000-3m), PTC(RE-SAR-30-1000-10m), PTC(RE-FAR-30-1000-3m)” (in seguito Allegato Tecnico) che accompagna il presente atto e ne costituisce parte integrante.

Art. 3

Pagamenti

Per la realizzazione della prestazione il Committente corrisponderà all'Università la somma di € (*inserire 750 per Opzione I oppure 1500 per Opzione II*) oltre IVA.

Il pagamento verrà effettuato dal Committente dietro presentazione di note di addebito, cui seguiranno regolari fatture, mediante versamenti sul:

- codice IBAN IT88A0200802837000041126939, BIC/SWIFT:UNCRITM1F86 (per pagamenti da enti privati),

oppure

- contabilità speciale 36739 (*per pagamenti da altre amm.ni in regime di tesoreria unica*) presso la Banca Unicredit S.p.A. Via Vecchietti 11 Firenze, a favore dell'Università di Firenze, Dipartimento di Ingegneria dell'Informazione, Cod. U.A. 58507, con le seguenti modalità:

- in un'unica soluzione alla stipula del presente atto.

Le note di addebito verranno inoltrate tramite pec all'indirizzo: (*indirizzo pec del Committente*).

Ai fini della tracciabilità finanziaria si indica altresì che il Codice Identificativo di Gara (CIG), attribuito al presente contratto dall'Autorità di Vigilanza sui Contratti Pubblici di lavori, servizi e forniture (AVCP) su richiesta della stazione appaltante è il seguente: (*Tale obbligo è a carico del Committente nel caso in cui sia UN ENTE PUBBLICO. In tutti gli altri casi, si può omettere*).

Art. 4

Risultati e proprietà intellettuale

Le parti concordano che, in base alla natura del servizio, non si prevede che possano derivare da questa attività invenzioni brevettabili.

Gli eventuali risultati della ricerca condivisa saranno pubblicati dopo che tutte le parti si saranno accordate sui termini e le condizioni della pubblicazione medesima.

Art. 5

Durata e termini di esecuzione del servizio

La prestazione avrà inizio dalla data di stipula del presente accordo e verrà effettuata entro un anno secondo la procedura descritta nell'Allegato Tecnico, che costituisce parte integrante del presente Contratto. Firmando questo Contratto il Committente accetta i termini di svolgimento del servizio descritti nell'Allegato Tecnico.

L'importo delle prestazioni e la durata può essere estesa attraverso un nuovo accordo sottoscritto dalle parti.

Art. 6

Riservatezza e pubblicità

Il Dipartimento ed il personale coinvolto sono tenuti a rispettare gli obblighi di non concorrenza e riservatezza (le informazioni che devono essere considerate riservate sono specificate nell'Allegato Tecnico).

Art. 7

Disposizioni finali e Foro Competente

Per tutto quanto non espressamente stabilito, restano ferme le disposizioni previste dal Codice Civile. Tutte le eventuali dispute connesse all'esecuzione del presente contratto dovranno essere risolte in via amichevole fra le parti. In caso ciò non risultasse possibile, si dichiara sin d'ora che deve considerarsi foro esclusivamente competente il Tribunale di Firenze

Art. 8

Spese del contratto

Il presente atto verrà registrato solo in caso d'uso ai sensi dell'art. 5, II comma, del D.P.R. n. 131 del 26/4/1986 e successive modifiche, a cura e spese della parte richiedente.

Le spese di bollo sono a carico del Committente

p. il COMMITTENTE , lì
(.....)

.....
p. l'UNITA' AMMINISTRATIVA Firenze, lì
(Il Direttore Prof. Enrico Del Re)

.....
Per presa visione,
il responsabile dell'attività
(Prof. Carlo Carobbi)

.....
Per presa visione ed espressa e separata accettazione, anche ai sensi e per gli effetti dell'art. 1341 c.c., delle clausole sub. 3 (pagamenti), 4 (risultati e proprietà intellettuale), 5 (durata e termini di esecuzione del servizio), 6 (riservatezza e pubblicità), 7 (disposizioni finali e Foro competente).

p. il COMMITTENTE , lì
(.....)

Annex B

Fill, sign and send to the Coordinator by physical mail three copies of the contract. Transmission by e-mail or fax is not acceptable.

**CONTRACT BETWEEN (*corporate name of the Customer*) AND THE
DEPARTMENT OF INFORMATION ENGINEERING OF THE UNIVERSITY OF
FLORENCE FOR THE FOLLOWING SERVICE**

**“Proficiency test of radiated emission measurements in the frequency range between 30 and
1000 MHz”**

Between

..... (*corporate name of the Customer*), tax identification number, with
premises in hereinafter referred to as “XXX”, represented by
..... (*first name, last name, qualification*)

and

The Department of Information Engineering of the University of Florence, fiscal code and VAT
number 01279680480, hereinafter referred to as “DINFO”, represented by Prof. Enrico Del Re, in
his capacity as head of DINFO

whereas

DINFO has the capability to provide the interlaboratory comparison service to Laboratories
operating in the sector of Electromagnetic Compatibility testing and XXX is willing to give
evidence of his technical competence through participation to interlaboratory comparisons.

the following agreement is drawn-up

Art.1. – Subject of the Contract

DINFO will carry out the following service “Proficiency test of radiated emission measurements in the frequency range between 30 and 1000 MHz” as approved by the Board of DINFO in March 21, 2013.

Art. 2. Responsibility of the service

The person (Responsible) in charge of carrying out the service is Prof. Carlo Carobbi. The service will be carried out in the DINFO premises according to the procedure defined in the technical document titled “Proficiency test through interlaboratory comparison – Radiated emissions in the 30-1000 MHz frequency range – Scheme of the proficiency tests PTC(RE-SAR-30-1000-3m), PTC(RE-SAR-30-1000-10m), PTC(RE-FAR-30-1000-3m),” (for brevity “Technical Annex” in the following) which is an integral part of this Contract.

Art. 3. Fees

In order to obtain the service specified in the Technical Annex, XXX will pay the sum of €
(insert 750 if Option I is selected, or 1500 if Option II is selected) plus VAT.

The sum will be paid to DINFO under the following terms of payment:

- The whole amount upon signing this Contract.

All payments will be made by XXX, on presentation of debit notes followed by regular invoices, addressed to:

Bank name: UNICREDIT Banca

Bank's address: Via Vecchietti 11 – Firenze

Account holder: University of Florence - Department of Information Engineering - (cod. UA. 58507)

Account Number: 41126939

IBAN: IT88A0200802837000041126939

BIC/SWIFT: UNCRITM1F86

Art. 4. Results and Intellectual property

The parties agree that, due to the nature of the service, it is not expected that patentable inventions can arise from this activity.

Possible joint results of the research will be published after both parties have agreed about the publication terms.

Art. 5. Duration and terms of execution of the service

The service will be completed within one year starting from the date of drawing up of this Contract. The service will be performed according to the procedure described in the Technical Annex which is an integral part of this Contract. By signing this Contract XXX agrees on the terms of execution of the service as described in the Technical Annex. The amount of the services and the duration can be extended through an agreement signed by the parties.

Art. 6. Confidentiality and publicity

DINFO, XXX and the staff involved are bound to respect the obligations of non rivalry and confidentiality (possible details about which information must be considered confidential are specified in the Technical Annex).

Art. 7. Final dispositions

For whatsoever has not been expressly agreed, the Contract shall be governed by the law of the country where the party required to effect the characteristic performance has his habitual residence. Where it is impossible to determine the characteristic performance of the contract, it

shall have regard to the law of the country with which it is most closely connected. All disputes or differences between the Parties arising out or in connection with this Agreement which the Parties cannot settle amicably shall be finally submitted to the jurisdiction of the defendant, that is ... if XXX is the defendant, Florence Court if the University of Florence is the defendant.

Art. 8. Cost of the Contract

This Contract will be registered only in the case of use according to art. 5, paragraph II of the D.P.R. 26/4/1986 n. 131 and subsequent modifications. XXX is responsible for the necessary arrangements and expenses, including the cost of stamps.

-----00----

For XXX

.....(place),(date)

(..... first name, last name and qualification, e.g., *Chief Financial Officer*)

.....(signature)

For the Department of Information Engineering

Florence,(date)

(Prof., Enrico Del Re)

.....(signature)

Signature of acknowledgment of the Responsible of the service

Prof. Carlo Carobbi

.....(signature)

Annex C

**Proficiency test through interlaboratory comparison –
Radiated emissions in the 30-1000 MHz frequency range**

Name of the Laboratory (mandatory):

.....

Technical Responsible (mandatory)

First name: Last name:

E-mail:

Phone:

Cell phone (optional):

Deputy of the Technical Responsible (optional):

First name: Last name:

E-mail:

Phone:

Cell phone (optional):

Shipping address (mandatory):

Address:

.....

ZIP Code:

City:

Country:

Date: / /

Annex D

Page ... of ...

Test report issued by the participating Laboratory

Laboratory: Name of the Laboratory

Laboratory Code: PTC(RE-SAR-30-1000-3m) or PTC(RE-SAR-30-1000-10m) or PTC(RE-FAR-30-1000-3m) and LAB(#)

Address: Address of the Laboratory

Technical Responsible: First name and last name of the Technical Responsible or his/her Deputy

E-mail: E-mail address of the Technical Responsible or his/her Deputy

Phone: Phone number of the Technical Responsible or his/her Deputy

Date of issue: Date of issue of this test report

Date of Sample receipt:.....

Date of measurements:

Date of Sample shipment:

Test result

Fill in the empty cells of columns 6 and 7 with the measured value x and its uncertainty U_{lab} . The empty cells of columns 2, 4, 5, 8, 9, 10, and 11 shall be filled in by the Coordinator. In order to obtain the approximate frequency of the harmonic in megahertz multiply the harmonic # by 20.

1	2	3	4	5	6	7	8	9	10	11
Harmonic #	X [dB(μ V/m)]	U_{ref} [dB]	x^* [dB(μ V/m)]	s^* [dB]	x [dB(μ V/m)]	U_{lab} [dB]	$x - X$ [dB]	ζ	$x - x^*$ [dB]	z
2*	-	1,3	-	-			-	-	-	-
4*	-	1,3	-	-			-	-	-	-
6*	-	1,3	-	-			-	-	-	-
8*	-	1,3	-	-			-	-	-	-
10*	-	1,3	-	-			-	-	-	-
20**	-	0,9	-	-			-	-	-	-
30**	-	0,9	-	-			-	-	-	-
40**	-	0,9	-	-			-	-	-	-
50**	-	0,9	-	-			-	-	-	-

* Transmitting Antenna: Rod

** Transmitting Antenna: Log-periodic

Comments: Comments may be inserted here (optional)

Photos: At least two photos shall be inserted here (mandatory).

Sign of the Technical Responsible or his/her Deputy

Annex E

Page ... of ...

Test report no. XYZ

**Issued by the Coordinator of the proficiency test, code PTC(RE-SAR-30-1000-3m) or
PTC(RE-SAR-30-1000-10m) or PTC(RE-FAR-30-1000-3m)**

Carlo Carobbi
Dipartimento di Ingegneria dell'Informazione
Università degli Studi di Firenze
Via S. Marta, 3 – 50139 Firenze
Phone: +39 055 4796268
Mob. phone: +39 329 6509116
e-mail: carlo.carobbi@unifi.it

to the participating Laboratory

Laboratory: Name of the Laboratory

Laboratory Code: PTC(RE-SAR-30-1000-3m) or PTC(RE-SAR-30-1000-10m) or PTC(RE-FAR-30-1000-3m) and LAB(#)

Address: Address of the Laboratory

Start and stop dates of the proficiency test:

Number of participants:

Date of measurements of the participating Laboratory:

Data of issue of this report:

Test result

The empty cells of columns 6 and 7 are filled in by the Laboratory. The empty cells of columns 2, 4, 5, 8, 9, 10, end 11 are filled in by the Coordinator. In order to obtain the approximate frequency of the harmonic in megahertz multiply the harmonic # by 20.

1	2	3	4	5	6	7	8	9	10	11
Harmonic #	X [dB(µV/m)]	U_{ref} [dB]	x^* [dB(µV/m)]	s^* [dB]	x [dB(µV/m)]	U_{lab} [dB]	$x - X$ [dB]	ζ	$x - x^*$ [dB]	z
2*	-	1,3	-	-			-	-	-	-
4*	-	1,3	-	-			-	-	-	-
6*	-	1,3	-	-			-	-	-	-
8*	-	1,3	-	-			-	-	-	-
10*	-	1,3	-	-			-	-	-	-
20**	-	0,9	-	-			-	-	-	-
30**	-	0,9	-	-			-	-	-	-
40**	-	0,9	-	-			-	-	-	-
50**	-	0,9	-	-			-	-	-	-

* Transmitting Antenna: Rod

** Transmitting Antenna: Log-periodic

Outcome

Here the Coordinator inserts one of the following outcomes:

- No anomaly is detected
- Warning signal(s) is (are) detected
- Action signal(s) is (are) detected

Sign of the Coordinator