Potential European Partnership on Metrology
Call 2021 – Green Deal and Normative

Selected Research Topic number: **SRT-n10**
Version: 1.1

Important information about these documents

This call is being held ahead of any agreement from the Commission that the relevant funding will be available. At present the relevant legislation is still under discussion in both Council and Parliament, and there is no certainty on the detailed arrangements for funding selected projects. The funding of any selected project, and the terms and conditions of participation in the projects, are dependent on completion of the legislative process and the subsequent contractual processes between the European Commission and EURAMET. Proposers submit to this call at their own risk.

Background

Last year, EURAMET submitted a draft proposal to the EC for a further research programme to be established under article 185 of the Treaty on the Functioning of the European Union (TFEU) to follow on from EMRP and EMPIR. This was published by the EC at https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/european-partnerships-horizon-europe/candidates-digital-industry-and-space_en

The initiative would be called the European Partnership on Metrology and would aim to create, by 2030, a sustainable and effective system for metrology at European level that ensures Europe has a world-class metrology system that:

- Provides metrology solutions, fundamental metrological reference data and methods, offering fit-for-purpose solutions supporting and stimulating European innovation and responding to societal challenges.
- Supports and enables effective design and implementation of regulation and standards that underpin public policies that address societal challenges.

The Commission commissioned an impact assessment into this proposal and 11 others in similar priority areas, and, based on those findings, published their own proposal for the Partnership, their response to the impact assessment and a draft of the Decision on 23rd February 2021. See:

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:89:FIN

https://ec.europa.eu/commission/presscorner/detail/en/ip_21_702

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021SC0035&qid=1614677899327

That draft Decision is currently under discussion in the European Council and the European Parliament.

Under the assumption that the Council and Parliament pass the basic act which would form the legal basis for this research programme, and that the participating countries named in the Draft Decision submit the required commitment letters, EURAMET is publishing these potential Selected Research Topics and draft guidance notes. These documents are not approved by the Commission nor will they lead to a binding decision by EURAMET e.V. for any further negotiation or funding. All published guides and templates are subject to amendment by the EC and EURAMET e.V. as further information becomes known.

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Title: Metrology for emerging electromagnetic compatibility standards

Abstract

Emerging radio services and technologies employed in Smart Grids, Internet of Things and Industry 4.0 applications require the development of standards on electromagnetic compatibility in order to address the challenging interference scenarios. Novel and traceable measurement methods are required to assess the electromagnetic emissions in complex situations, including *in-situ* testing of large-size/high-power equipment and the statistical evaluation of interferences. CISPR (Special International Committee on radio-electric perturbation) and IEC Subcommittees and Working Groups require metrological research to support the standardisation projects and to introduce new and validated testing methods.

Keywords

Electromagnetic Compatibility (EMC), Interference Assessment, Standardisation, Internet of Things (IoT), radio.

Background to the Metrological Challenges

All electric and electronic devices or installations influence each other when interconnected or close to each other. As such, all equipment used or sold within the European Market has to fulfil the essential requirements of the European Electromagnetic Compatibility (EMC) Directive 2014/30/EU. The common approach is to show compliance with the harmonised standards by carrying out emission and immunity tests at specialised laboratories. However, as new interference scenarios are identified in the face of the emerging radio services and technologies employed in Smart Grids, Internet of Things (IoT) and Industry 4.0 applications, the validity of current standard EMC testing methodologies is not guaranteed.

One example concerns the testing of large-size/high-power equipment. A gap in CISPR standards is left in terms of *in-situ* testing, which is required when performing measurements outside standardised test sites for type testing. Previous projects such as “Alternative EMC testing methods for large machines” (TEMCA2, GRD-CT-2002-00865) or “Improved EMC test methods in industrial environments” (EMRP JRP IND60) made significant progress. However, those projects did not transfer such methods into EMC standards. Nowadays, reproducibility and traceability of *in-situ* EMC test methods remain as unsolved problems for the industry.

According to CISPR A, a topic that requires research in metrology for its standardisation is the increasing application of time-domain electromagnetic interference (EMI) measurement systems based on direct sampling techniques. Instruments such as oscilloscopes and baseband digitizers are being extensively used in applications that involve measuring transient EM disturbances, multichannel EMI test setups and worst-case emissions functioning mode identification. However, an explicit specification of how direct sampling measuring instruments should be used in the light of CISPR 16 or other EMC related IEC standards is neither available nor sufficiently clear.

In the same vein, the standard that defines the characteristics and key specifications of the measuring receivers, CISPR 16-1-1, lacks clarity when it comes to the metrological definition of the calibration method and standard reference to be used for giving traceability to the response to pulses of the weighting detectors. In the past, this situation has been subject to debate, and preceding research projects have worked towards developing capacities for National Measurement Institutes to provide traceability to the high amplitude sub-nanosecond pulse generators that have been used for this purpose. Further research is required to address the complete waveform specification of the measuring receiver calibration pulse generator. Furthermore, alternative reference waveforms with well-defined mathematical descriptions and spectral properties need to be recommended for their inclusion in standards.

Finally, a major challenge for the EMC standards is to embrace the statistical analysis of interference and its correlation with communication quality metrics. Nowadays, this is more important than ever as the increase of wireless connected devices, resulting from the explosion of IoT and the advent of 5G, poses challenges of coexistence. Research in metrology is required for defining emissions limits based on the degradation suffered by digital communication systems when subject to electromagnetic emissions of the equipment under test. This type of assessment can be implemented with the amplitude probability distribution (APD) measuring function provided its reformulation in two key aspects. First, the standard definition of the APD must be changed to allow for frequencies below 1 GHz. Second, the measurement bandwidth should be made according to the characteristics of the communication channel. Both changes should be incorporated in the

standards such as CISPR 16-1-1 and CISPR 11. Likewise, a specific calibration method for the APD measuring function of the EMI receivers should be developed for providing the required traceability.

Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on metrology research necessary to support standardisation in electromagnetic compatibility through the introduction of new, validated, and traceable emissions measurement methods suitable for the forthcoming CISPR EMC standards.

The specific objectives are

1. To develop traceable electromagnetic emissions measurement methods optimised for *in-situ* assessment of large-size/high-power equipment and to validate the proposed test procedures in realistic scenarios. This includes the characterisation of influence factors such as non-stationary interferences and sources of background noise, to correct the impact of transient interference. To define a measurement protocol for selecting adequate antenna location, height, and polarisation and other relevant parameters for the setup.
2. To provide metrological evidence of the validity of time-domain electromagnetic interference measurement systems (EMI), based on direct sampling techniques, and to define standardisable conditions at which the usage of oscilloscopes/baseband digitisers is acceptable or preferred in comparison to measuring receivers based on frequency sweep or stepped scan techniques. The estimation of the uncertainty in time-domain EMI measurement systems should also be addressed.
3. To improve the standard calibration method for the response to pulses of measuring receivers through a complete waveform specification of the calibration pulse generator. To develop alternative reference waveforms with well-defined mathematical description and spectral properties inclusion in standards as a means of validating the weighting function of the detectors, thus reducing the uncertainty of the receiver's response to pulses calibration to 0.2 dB.
4. To redefine the standard amplitude probability distribution (APD) measuring function in EMI measuring receivers as part of the emissions compliance assessment based on the communication quality metrics. To define the criterion for establishing emissions limits based on APD measurements making it part of the emission compliance assessment.
5. To contribute to the standards development work of the technical committees CISPR/CIS/A/WG1 & WG2 (supporting CISPR 16 and CISPR 16-1-1), CISPR/CIS/B/WG1 (supporting CISPR 11), and CISPR/CIS/B/WG7 (supporting CISPR 37 ed. 1) to ensure that the outputs of the project are aligned with their needs. To communicate quickly to those developing the standards and to those who will use them (test laboratories and manufacturers related to IoT, E-mobility and technologies), and in a form that can be incorporated into the standards at the earliest opportunity.

The proposed research shall be justified by clear reference to the measurement needs within strategic documents published by the relevant Regulatory body or Standards Developing Organisation or by a letter signed by the convenor of the respective TC/WG. EURAMET encourages proposals that include representatives from industry, regulators and standardisation bodies actively participating in the projects. The proposal must name a "Chief Stakeholder", not a member of the consortium, but a representative of the user community that will benefit from the proposed work. The "Chief Stakeholder" should write a letter of support explaining how their organisation will make use of the outcomes from the research, be consulted regularly by the consortium during the project to ensure that the planned outcomes are still relevant, and be prepared to report to EURAMET on the benefits they have gained from the project.

Proposers should establish the current state of the art, and explain how their proposed research goes beyond this. In particular, proposers should outline the achievements of the EMRP project IND60 EMC and how their proposal will build on those.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 0.8 M€, and has defined an upper limit of 1.0 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution across all selected projects in this TP.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the “end user” community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to the electronics sector, test laboratories and manufacturers related to IoT, E-mobility and technologies.

You should detail other impacts of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Projects (JRPs)”

You should also detail how your approach to realising the objectives will further the aim of the potential European Partnership on Metrology to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically, the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work.

Time-scale

The project should be of up to 3 years duration.