European Partnership on Metrology
Call 2025 – Health, Integrated European Metrology, Regulation and Research Potential

Selected Research Topic number: **SRT-n01**
Version: 1.0

Title: Metrology to support legislation for electric vehicle supply equipment

Abstract

The regulation of electric vehicle supply equipment (EVSE) on the European level needs efficient easy-to-use measurement systems and procedures for testing in the field within the market surveillance to ensure a reliable energy measurement. However, currently testing of high-power EVSE in the field lacks adequate equipment and efficient procedures, leading to high effort or even no possibility for testing, especially if mega-watt-charging systems (MCSs) are considered. The necessary metrology infrastructure is needed to comply with the European regulation of EVSE. This should create possibilities for testing existing and future DC EVSE and further provide guidance for implementing phantom power testing for MCS.

Keywords

Electric vehicle charging stations, high-power charging, verification, re-verification, market surveillance, mega-watt charging system (MCS), legal metrology, Measuring Instruments Directive (MID), regulation 2023/1804

Background to the Metrological Challenges

To support the EU's goal to be climate neutral by 2050, the new regulation 2023/1804 of the European Parliament and the Council of 13 September 2023 on the deployment of alternative fuels infrastructure (AFIR) has been established. With this new regulation, the European Commission expressed its goal to expand the infrastructure of electric vehicles. By the end of 2025, it aims to establish at least one recharging point with 150 kW power every 60 km on the Trans-European Transport Network (TEN-T) core road network. Additionally, 15 % of the TEN-T road network shall be covered by recharging pools where at least one charging point shall have a power of 350 kW. As a result, the amount of high-power charging stations in Europe will increase. Additionally with the new annex of the Measuring Instruments Directive (MID) [1] which was proposed by the European Commission in December 2024, charging stations will need be regulated and harmonised. This will avoid the emergence of diverging national legislation, that would lead to high costs and a delayed rollout of the technology.

An essential requirement for measurement devices of the current MID is, that the measuring tasks of a measuring device shall be controllable after the instrument has been placed into market. Since charging stations after installation are largely immovable, the tests must be conducted in the field. This leads to the need for easy-to-use inspection-measuring systems. This need, concerned with improved DC power metrology infrastructure, has also been identified by the EMN for Smart Electricity Grids [2].

To bill correctly accurate energy measurements in DC grid charging stations are needed. If electric vehicle supply equipment (EVSE) does not place any special requirements (e.g. voltage and current, or stability over time) on the test points, an electric vehicle together with an already commercially available in-cable-measuring system, for currents up to 500 A, could be sufficient. However, if there are special requirements, the test personnel face the problem of an inadequate load for high-power charging stations. Possible load types can be regenerative real-power loads, passive real-power loads and phantom power test equipment. Use of regenerative loads is usually not possible due to lack of a high-power feed-back point at the charging station. Passive real-power loads are usually huge and uneconomic because the energy will be dissipated into heat. Up to now there are also significant limitations in the measurement points using real-power loads as they are predefined during the manufacturing process, but first systems begin to be commercially available, overcoming

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this disadvantage. Therefore, the implementation and testing of a passive real-power load with individually adjustable measuring points for an in-field test system is urgently needed to test existing charging stations.

The use of phantom power equipment technically overcomes these problems, but most of the charging stations already installed in the field do not support the measurements with phantom power. Here a European standardisation is necessary to avoid the development of diverging proprietary test equipment. A draft of a pre-standard for using phantom power in combined charging systems (CCS) has been developed. The rapid adoption of phantom power technology for MCS and integration into European standardisation charging station manufacturers would add these capabilities to their products. Therefore, enabling the efficient and economic metrological testing of charging stations in the future.

Currently, in some countries, the necessary set of test points for measurements in the scope of the market surveillance are proprietary and manufacturer-specific, making the construction of efficient test equipment difficult. Furthermore, the establishment of a standardised process for market surveillance authorities is more complicated especially for re-verification. To reduce time and costs of the verification whilst also maintaining trust in the metrology of the charging station, test procedures (e.g. the amount of test points and required time duration) must be optimised.

The upcoming regulation of the charging stations will also include charging stations for large commercial electric vehicles and trucks where the charging power will go up into the mega-watt range. Consequently, the current problems for the market authorities with testing high power charging stations will get worse with even higher power. Currently no test equipment for verification and re-verification of MCS is commercially available. To eliminate a repeat of the difficulties regulating high power chargers with MCS the implementation of phantom power in MCS needs to be developed and standardised at the earliest convenience. To achieve this, the draft standard about phantom power needs to be adapted to MCS.

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 proposal shall focus on metrology research necessary to support the proposed new MID Annex Va for in-field verification and market surveillance of electric vehicle charging stations.

The specific objectives are

1. To develop easy-to-use measurement methods and hardware for real and phantom power in-field test systems up to 1000 V and 500 A, for combined charging system (CCS) type EVSEs. This will contribute to requirement 7.6 of Annex I of the MID.
2. To develop efficient and trustworthy procedures for measuring passive real power across a maximum of four test-points and with a maximum duration of five minutes for each measurement.
3. To develop easy-to-use measurement methods and hardware for phantom power and in-cable test and measurement systems up to 1250 V and 1500 A, with the potential to extend up to 3000 A for mega-watt-charging (MCS) type EVSEs. This will involve adapting the methods and hardware developed in Objective 1. In addition, to develop methods to calibrate the MCS test equipment.
4. To support the implementation of the potential updated EU Measuring Instruments Directive (Annex I and Annex Va) and facilitate the take up of the technology, methods and measurement infrastructure developed in the project by regulatory authorities (WELMEC WG 11, OIML TC 12), the measurement supply chain (market authorities, test equipment manufacturers), standards developing organisations (IEC/TC13 WG11 and IEC/TC13 PT 62057), and end users (manufacturers of MCS charging stations).

The proposed research shall respond to documented requirements related to specific regulations and legislation or explore the background and feasibility of expected possible future regulation. To enhance the impact of the research, the involvement of the appropriate user community such as regulatory authorities, conformity assessment bodies, standardisation bodies, and industry, is strongly recommended. Where relevant, proposals are encouraged to build on, or seek collaboration with, existing projects and develop synergies with other relevant European, national or regional initiatives and funding programmes. In particular, links are encouraged with (i) the projects funded under earlier relevant topics of the Horizon Europe programme; or (ii) other relevant European Partnerships.

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 Metrology Partnership project 23IND06 Met4EVCS and how their proposal will build on those.

Proposers should note that the programme funds the activity of researchers to develop the capability, not the required infrastructure and capital equipment, which must be provided from other sources.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 1.0 M€ and has defined an upper limit of 1.3 M€ for this proposal.

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

Any industrial beneficiaries that will receive significant benefit from the results of the proposed project are expected to be beneficiaries without receiving funding or associated 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 proposal's 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,
- Facilitate improved industrial capability, or improved quality of life for European citizens in terms of personal health, protection of the environment and the climate, or energy security,
- Transfer knowledge to the energy and transportation sectors and regulatory authorities.

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 Metrology Partnership 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.

Timescale

The project should be of up to 3 years duration.

Additional information

The links provided in this section are only correct at the time of publication up until the end of the Call year.

The references below were provided by PRT submitters; proposers should therefore establish the relevance of any references.

[1] L96/149, *Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments (recast)*
http://data.europa.eu/eli/dir/2014/32/oj

[2] EMN Smart Grids Strategic Research Agenda
https://www.euramet.org/research-innovation/metrology-partnership/strategic-research-and-innovation-agendas

These references have been provided by EURAMET.

[3] *M/581 – C(2022)1710 COMMISSION IMPLEMENTING DECISION of 24.3.2022 on a standardisation request to the European standardisation organisations as regards communication exchange, electricity and hydrogen supply for road, maritime transport and inland navigation in support of Directive 2014/94/EU and its planned revision under the 'Fit for 55' package*
https://ec.europa.eu/growth/tools-databases/enorm/mandate/581_en