EMRP Call 2013 – Energy and Environment

Selected Research Topic number: **SRT-g10**
Version: 1.0

Title: Metrology for efficient and safe innovative lighting

Abstract

Since 2009, substantial advances in solid state lighting (SSL) technology have been made in areas including high power, phosphor-free and nano-structured LEDs; large-area and curved OLED(-arrays); and complex and smart/intelligent SSL systems. New and advanced means of realising traceability are necessary for this new generation SSL, under a broad range of operating conditions (pulsed/dimming, smart/intelligent systems) and covering safety aspects. This will enable SSL to be taken up by the complete EU market with full user confidence as the future of safe and efficient lighting.

Conformity with the Work Programme

This Call for JRPs conforms to the EMRP Outline 2008, section on “Grand Challenges” related to Energy and Environment on pages 11, 23 and 33.

Keywords

SSL efficacy, dimming, SSL standard, flickering index, OLED, SSL aging, SSL reliability, SSL life time, safety, perception

Background to the Metrological Challenges

SSL has the potential to make a significant contribution to the EC target of 20 % reduction in energy usage by 2020. However, there are large differences between SSL products in terms of output, light quality and lifetime. Standardisation of performance criteria, underpinned by proper metrology, is therefore a crucial factor in the development of innovative and safe SSL [1].

Due to the complexity of SSL devices and the electrical distortions produced by the driver electronics, standard methods of measuring optical and electrical power lead to inaccurate results. Consequently measurements of luminous efficacy and electrical power with low uncertainty are currently challenging.

Life-time is a crucial decision parameter for the adoption of SSL, but there is currently no established method for providing traceable life-time estimates. Also missing are traceable, low-uncertainty methods for measuring the luminous intensity distribution and its variation over space and wavelength, including the effects of aging and ambient temperature. This is particularly relevant to OLEDs, LED arrays, SSL based displays and other large area SSL systems.

Similarly, a full set of parameters to describe the health effects of flicker and related stroboscopic effects (including malaise, headaches and epileptic seizures) is missing. Traceable measurement procedures have to be established to reliably measure the relevant parameters established by biologists and assess to what extent new SSL products exhibit these effects.

Scientific and Technological 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 JRP-Protocol.

The JRP shall focus on the traceable measurement and characterisation of safe and innovative SSL.

The specific objectives are

1. To determine the best measurement capabilities for “luminous” characteristics, electrical power and colour properties of new generation SSL leading to efficient and safe innovative lighting and to develop methods for efficient dissemination of traceability to accredited laboratories (e.g. based on new generation SSL transfer standards);
2. To establish traceability for the efficacy of new generation pulsed SSL through the development of metrology for electrical characterisation of power meters and development of new optical measurement techniques of SSL products under pulsed conditions with low uncertainty;
3. To provide traceability including uncertainty estimation for lifetime (lumen maintenance and failure fraction) analysis of new generation SSL; to develop measurement methods and provide traceability for ageing effects on the performances of SSL (luminous flux and colour) and for SSL reliability characterisation;
4. To establish traceability and proper measurement methods for complex 3D (spectral) goniometrical measurements of large-area and curved new generation SSL;
5. To develop traceable measurement methods for safety aspects of new generation SSL (photo-biological safety, flickering and stroboscopic effects) as well as visual comfort.

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. To enhance the impact of the R&D work, the involvement of the user community such as industry, and standardisation and regulatory bodies, as appropriate, is strongly recommended.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this. In particular, proposers should outline the achievements of the EMRP project ENG05 Metrology for SSL and how their proposal will build on those.

EURAMET expects the average size of JRPs in this call to be between 3.0 to 3.5 M€, and has defined an upper limit of 5 M€ for any project. The available budget for integral Research Excellence Grants is 30 months of effort.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community. This may be through the inclusion of unfunded JRP partners or collaborators, or by including links to industrial/policy advisory committees, standards committees or other bodies. Evidence of support from the “end user” community (e.g. letters of support) is encouraged.

You should detail how your JRP is going to:

- feed into the development of urgent documentary standards through appropriate standards bodies;
- transfer knowledge to the lighting sector.

You should detail other impacts of your proposed JRP as detailed in the document “Guide 4: Writing a Joint Research Project”.

You should also detail how your approach to realising the objectives will further the aim of the EMRP to develop a coherent approach at the European level in the field of metrology and includes 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;
- increase of the metrology capacity of Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development; involvement of outside researchers & research organisations other than NMIs and DIs in the work.

Time-scale

The project should be of up to 3 years duration.

Additional information

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

[1] CELMA TF “Apples & Pears, a CELMA guiding paper: Why standardisation of performance criteria for LED luminaires is important”, Sep, 2011.