EMRP Call 2013 – Energy and Environment

Selected Research Topic number: **SRT-v16**
Version: 1.0

Title: Low frequency acoustical noise

Abstract

The growing presence of environmental (indoor and outdoor) low frequency noise sources in everyday life requires new and improved methods of measuring low frequency acoustical noise and the extension of sound insulation measurement methods to frequencies below 100 Hz. The strong evidence of a relationship between environmental noise and effects on health, wellness and cognitive performance makes sound protection a crucial issue for society.

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 23 and 24.

Keywords

Acoustics, noise protection, low frequency noise, subjective measurements, psychoacoustics, wind turbines, sound insulation

Background to the Metrological Challenges

Sound measurements in air at low frequencies (<100 Hz) are difficult and sometimes controversial. “The Hum” [1, 2] is a reoccurring story in media across the world. Concern about low frequency noise is a feature of environmental impact assessments for wind farms [3, 4], and standardised measurement procedures are often limited at low frequencies by lack of reproducibility [5].

The existing standards for measurements of sound insulation are being revised and users are asking for methods below 100 Hz to be included. However, at present the statistical basis for an evaluation of the reproducibility of the proposed guidelines is insufficient and only “informative guidelines” can be offered.

The development of a standardised and validated method for objective and subjective assessment of noise impact as the primary stress-making environmental factor in Europe is a key aim of acoustical metrology, with the intention of sustaining and improving the quality of life in the 21st Century. According to a WHO study published in 2011 [6], at least one million healthy life years are lost every year from traffic-related noise in the western part of Europe. There is strong evidence for a relationship between environmental noise and health effects, including cardiovascular disease, cognitive impairment, sleep disturbance, tinnitus, and annoyance.

Wind energy is one of the renewable sources of energy that has a large potential for development from small applications (providing mechanical power or charging batteries) to large scale wind farms connected to the supply network. Although this source of energy is clean, and once in operation is nearly free of greenhouse gases emissions, one of the main obstacles that this form of energy faces is the reluctance of the surrounding communities to accept the establishment of wind farms. This reluctance has its roots in many aspects, for instance, noise and visual contamination of the landscape. While objections to the visual detriment are likely to fade as subsequent generations of the population become accustomed to the presence of turbines, the nuisance due to noise is likely to persist. Therefore, one of the main objectives of the designers of wind turbines is to design turbines that are quiet and efficient.

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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 indoor and outdoor noise, and sound insulation performance of building elements at low frequencies, below 100 Hz.

The specific objectives are

1. The development of methodologies (instrumentation, data acquisition, data analysis, numerical representation) to measure airborne and impact sound insulation of facades and building elements at low frequencies (20 to 100 Hz), due to different noise sources (traffic, wind turbines, domestic equipment, aircraft passages, audio systems), in laboratory and in situ.
2. Documentation of the successful methods in a form that will allow rapid adoption in ISO standards.
3. The development of methodologies for improved measurement of environmental noise below 20 Hz, for example near wind farms. This should include models that relate the physical measurements to predictions of annoyance.

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.

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 (eg letters of support) is encouraged.

You should detail how your JRP results are going to:

- feed into the development of urgent documentary standards through appropriate standards bodies

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
- the metrology capacity of Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development to be increased
- outside researchers & research organisations other than NMIs and DIs to be involved 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] BBC News - Who, What, Why: Why is 'the hum' such a mystery? (http://www.bbc.co.uk/news/magazine-13752688)

[2] What is infrasound? Geoff Leventhall, Progress in Biophysics and Molecular Biology 93 (2007) 130–137

[3] Low frequency noise from large wind turbines, Final Report AV1272/10 (http://www.madebydelta.com/imported/images/A401929-Danish-Energy-Authority-EFP-06-project-Final-report-for-LF-noise-from-large-wind-turbines-av127210.pdf)

[4] Infrasound and low frequency noise from wind turbines: exposure and health effects, Karl Bolin et al, Environ. Res. Lett. 6, 035103

[5] D B Pedersen: Measurement of the low-frequency sound insulation of building components. Synthesis report for EC Contract No Mat 1-CT-930027. DELTA Acoustics and Vibration, Aarhus, 1997.

[6] WHO, 2011: Burden of disease from environmental noise. Quantification of healthy life years lost in Europe, xvii + 108 pages, http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf