

1. General Aspects

2013 was marked by the successful completion of the 5 JRPs developed in the framework of the first EMRP call dedicated to Energy (call 2009) and the good results obtained for the second Energy call (call 2013) with 5 JRPs selected for founding. The contribution of TC-EM in iMERA+ and EMRP covers nearly 25% of the 140 founded projects.

TC-EM has continued its initiative towards simplified and more efficient MRA procedures. Within a specific run, the files of 24 countries were cleaned up by deleting old CMCs and by replacing them by the new ones including many more matrices. It results a significant reducing of total number of CMCs and, as pointed out by the KCDB office, “gain in clarity for the KCDB users, gain in efficacy for the NMIs, the RMOs and the KCDB Office as files are easier to handle and review, and more detailed information on the uncertainties that are claimed”.

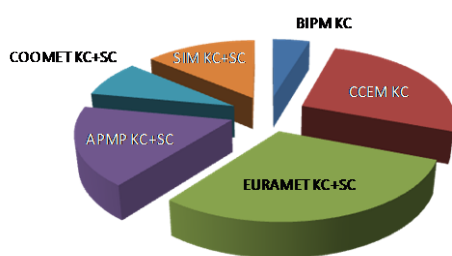
2. Projects

Detailed information about the EURAMET projects in the EM field is available from the EURAMET web-site and currently updated. An overview of the number of projects is given in the table below.

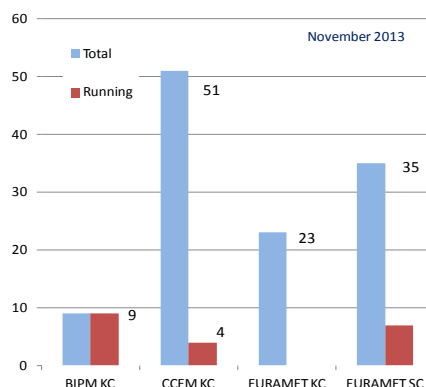
	EURAMET Comparison	Traceability	Consultation	EMRP	Co-operation & research
On-going	7	9	1	16	2
Completed	51	4	58	12	46
Total	58	13	59	28	48

3. Comparisons

During 2013, one key EURAMET comparison and one supplementary EURAMET comparison have been completed in the EM field, leading now to 7 running comparisons (0 KCs, 7 SCs). The total number of EURAMET comparisons listed in the key comparison data base sums up to 23 KCs and 35 SCs. Besides this, EURAMET is or has been active in a large number of CCEM comparisons: 9 BIPM KCs, 51 CCEM KCs. This situation is also illustrated in the following figure. The comparisons support the CMC entries of EURAMET members, published in the KCDB in the EM field, covering almost all the classified services (48 / 49 subcategories).



Completed and running comparisons per RMO



It should be noted that the number of comparisons is steadily increasing with time. For example, within EURAMET, a total of 27 EURAMET comparisons were notified as completed (11 KC +16 SC) by the end of 2003. Ten years after the number of completed comparisons reaches 51 (23 KC+ 28 SC) leading to a rate of 2 to 3 comparisons completed per year while the number of running comparisons remains at a constant level around 9 per year over the last three years. The duration of KC and SC is estimated around 4 years.

The development of a comparison toolbox initiated in 2012 with the aim at improving the comparison process (shortened duration, more labs in capability to be pilot ...) was pursued in 2013 by the dedicated task force and should be completed by the end of 2014.

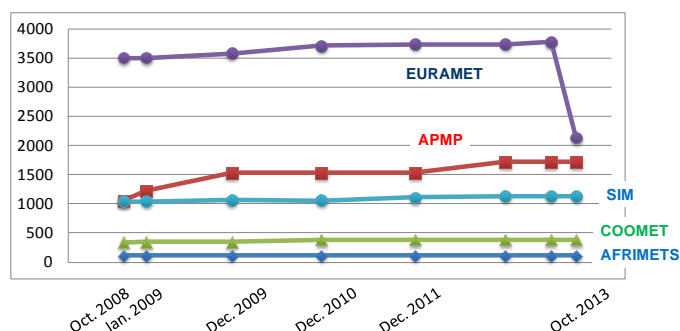
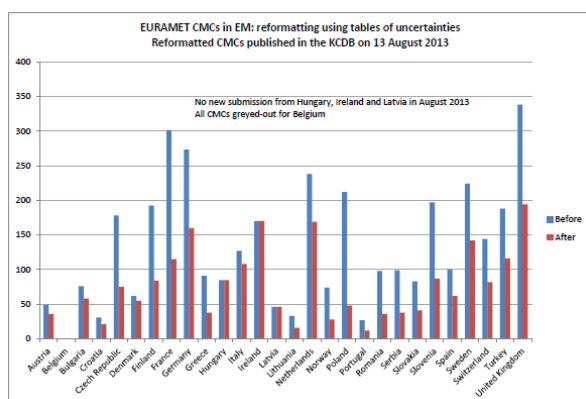
4. CMCs

4.1 EURAMET EM CMCs

As announced during the CCEM meeting, a run dedicated only on a cleaning up of the CMC tables and on extending the use of matrices was started on 18 March 2013. For this run, new entries or improved entries were not allowed. Using the current format, the NMIs were strongly encouraged to use matrices as much as possible and to present a single CMC line (with a single matrix) for each sub-sub category whenever possible. This run was also considered as an opportunity for the NMIs to correct all the misprints and editorial typos, to increase uncertainty values or to reduce the scope of CMC entries, or to delete CMC entries, etc.

Great efforts have been spent by most of the NMIs in the use of matrices. 25 NMIs have indeed positively contributed to this run by creating or improving 438 matrices (121 matrices were deleted) and consequently the total number of CMC entries for EURAMET TCEM have been reduced by a factor of 2 and reach a value of 1821 CMCs including in total 650 matrices ($\approx 26\,000$ uncertainty numbers).

The intra-RMO review of the whole CMC set was started on 14 May. The entries were reviewed by the members of the working group on the analysis of CMCs until 10 July. Inter RMO review is not needed for this specific set (no new entries, nor improved entries) and consequently a fast track process was undertaken. The CMC set was composed of 3 batches (EURAMET.EM.9.2013, EURAMET.EM.10.2013, EURAMET.EM.11.2013) and was posted separately in time in July leading to a publication in KCDB on 14 August.



A new run for CMCs Set (EURAMET.12.2014) which can integrate new or improved CMC entries was started on 5 October 2013 with a deadline for submission fixed on 31 December 2013. 17 NMIs submitted in total 88 new entries (incl. 96 matrices) and 191 improved entries (incl. 92 matri-

ces). In addition, for 55 entries (10 matrices) the scope was reduced, the uncertainty was increased or editorial modifications were applied. 175 entries (31 matrices) are announced for removal from the KCDB. It should be noted that, for this run, NSAI/NML (Ireland) has proceeded to a cleaning-up of its tables and to the use of matrices (151 delete entries, 20 created matrices). The intra EURAMET review of this run has started on February 2014 and should be completed by the end of May.

4.2 Inter-regional review of CMCs

In 2013, EURAMET TCEM was involved in two inter-RMO reviews which concern APMP and AFRIMETS.

APMP.EM.8.2013

The CMC set was posted for interregional review on the CMC web site of the JCRB on 25 February 2013. In agreement with the other RMOs, it has been decided to share the inter-RMO review of the set APMP.EM.8.2013 between SIM, COOMET, AFRIMETS and EURAMET as following:

- 1st part (SIM): 43 new entries, cat 1 to 6, 4 improved entries cat 1 to 6
- 2nd part (COOMET): 7 new entries (cat 7 to 10), 8 improved entries (cat 7 to 10), 17 new entries (cat 11 from NMIA), 5 improved entries (cat 11 from NMIA)
- 3rd part (AFRIMETS): 32 new entries and 13 improved entries (cat 11 from NIM)
- 4th part (EURAMET): 46 new entries, (cat 11 from NMIJ and NIMT)

55 entries in category 11 were finally reviewed by EURAMET (the review was ended on 1st July 2013). The collaboration between the APMP laboratories and the review team was constructive. Most of the questions were answered in time so that the review could be finished with a very small delay in respect with the given time.

It should be noted that the next run planned by APMP this year 2014 will be dedicated to a cleaning-up of their CMC tables and to the use of matrices, thus following the example of EURAMET.

AFRIMETS.EM.1.2013

The first CMC set from AFRIMETS was posted for inter RMO review on the CMC web site of the JCRB on 18 December 2013. This set was composed of 4 new CMC entries submitted by NIS in category 2. This was supported by AFRIMETS TC-QS confirmation of the NIS QMS and laboratory QS for resistance.

EURAMET and COOMET have decided to review this set. The EURAMET review was ended on 8 January 2014. The uncertainties claimed in the 4 CMC entries were agreed, supported by the key comparison EURAMET.EM-K2.1 and a paper published in a peer reviewed journal and detailing the uncertainty budgets and method used. These CMC entries were finally merged in two CMC entries thanks to the use of a single matrix. The collaboration between the NIS expert and the EURAMET reviewer was constructive with very prompt and fruitful exchanges.

5. Activities of the Sub-Committees

The activities of the four subcommittees (DCQM-„DC and Quantum Metrology“, LF-„Low frequency“, PE-„Power and energy“, RFMW-„Radiofrequency and microwave“ are largely dominated by R&D activities related to EMRP (see 5.2) and EMPIR. Discussions on on-going comparisons, CMCs and Calibration guides were also held during the regular expert meetings below:

- SC “LF” meeting: 16 and 17 May 2013, PTB, Braunschweig
- SC “DC and Quantum Metrology” meeting: 21 and 22 May 2013, CEM, Madrid

- SC “RF and microwave” meeting: 22 and 23 April 2013, SIQ, Ljubljana

5.1 Participation in the last 2013 EMRP call

The TC-EM community was involved in the elaboration of proposal for the following JRP in the targeted program “Energy” of 2013 EMRP call (no involvement in TP “Environment”):

g15 Metrology for III-V materials based high efficiency multi-junction solar cells (ENG51 – SolCell)

g18 Measurement tools for Smart Grid stability and quality (ENG52 - SmartGrid II)

g20 Non-conventional voltage and current sensors for future power grids (ENG61 - FutureGrids)

g10 Metrology for efficient and safe innovative lighting

g16 Sensor network metrology for the determination of electrical grid characteristics (ENG63 - GridSens)

g02 Eco-Design Metrology to support the application of the EcoDesign directive to electrical appliances

g24 Electromobility Metrology to support electromobility

g03 Energy harvesting

g19 HV Transmission Metrology for high voltage energy transmission

Most of these proposed JRPs (8/9) came from the proposed research topics discussed during the dedicated workshop, which was held on 15-16 January 2013 at VSL in Delft (Eleven potential PRTs were originally defined and drafted). 5 of the 9 proposed JRPs were selected for funding (title underlined).

5.2 Overall participation of TCEM in EMRP

Over a total number of 140 funded JRPs in the frame work of iMERA+ and EMRP, 33 JRPs come from Electricity and magnetism domain, *i.e.* a rate of 24 % which demonstrates the importance of that domain and a very good level of R&D activity. The success rate reaches a satisfying level of 62 % (20 proposed JRPs were unsuccessful). The table shows the founded JRPs within the four subcommittees of the TCEM. These JRPs have involved and involve more than 50 academic laboratories, more than 10 industrial partners and a bit less than 10 non EURAMET NMIs.

iMERA+				EMRP											
2008 - 2011				call 2009 2010 - 2013	call 2010 2011 - 2014	call 2011 2012 - 2015				call 2012 2013 - 2016				call 2013 2014 - 2017	
SI	Health	Length	EM	Energy 1	Env. 1	Health	New techno.	SI BS 1		Industry 2	SI BS 2	Open excellence		Energy 2	Env. 2
e-Mass			JOSY	Energy harvesting	EMINDA	MRI safety	THz security	KNOW		EMC	Graphohm	SPINCAL		SolCell	
LNE 5 NMIs			PTB 10 NMIs	PTB 7 NMIs	NPL 6 NMIs	PTB 3 NMIs	PTB 6 NMIs	INRIM 4 NMIs		TUBITAK 8 NMIs	PTB 8 NMIs	PTB 3 NMIs		LNE	
Reuniam			ULQHE	Power plant	MetMags		MEMS	Qu-ampere		MORSE	Q-WAVE	uphoton		SmartGrid 2	
PTB 6 NMIs			LNE 6 NMIs	PTB 9 NMIs	PTB 5 NMIs		NPL 6 NMIs	PTB 4 NMIs		NPL 5 NMIs	PTB 12 NMIs	MIKES 4 NMIs		NPL	
			Nanospin	SSL	Ultrafast Electronics						HF-Circuits			FutureGrids	
			INRIM 5 NMIs	VSL 14 NMIs	PTB 7 NMIs						NPL 7 NMIs			MIKES	
			Power & Energy	Smart elec. grids							Aim-QUTE			MESaIL	
			NPL 16 NMIs	VSL 17 NMIs							PTB 11 NMIs			VSL	
			EMF&SAR	HVDC										GridSens	
			PTB 7 NMIs	SP 7 NMIs										NPL	

DC&QM	
LF	
P&E	
HF&MW	

5.3 Preparation for the first EMPIR call 2014

As in the past years with the same goal to coordinate the preparation of PRTs for the 2014 EMPIR call, a PRT preparation workshop was held on 27-28 January 2014 at LNE in Paris, gathering 40 attendees from 16 EURAMET NMIs and BIPM. 10 PRTs were identified to be prepared for this call,

and 1 PRT most suitable for the next call related to the SI. 9 PRTs were finally submitted, covering all the subfields in EM, one of them (the last one in the list below) presenting multidisciplinary aspects (electrical, mechanical and thermal properties).

- Metrology for magnetoresistive sensor applications
- Metrology of industrially-relevant properties of large-scale graphene and other novel 2D materials
- Metrology for electrical power industry
- High Frequency and Dynamic Measurements of Functional Materials
- Microwave measurements for planar circuits and components
- Electromobility Drive Technology
- Metrological infrastructure to support Ecodesign of industrial products
- Metrology for 5G Communications
- Metrology challenges in 3D integration technology for manufacturing 3D stacked integrated circuits (3D-SICs).

Most of these propositions fall within the scope of Information and Communication Technology (ICT) including nanotechnology, not only for industrial applications but also for Energy, Health and Environment.

5.4 Prenormative research

Prior to the TCEM contact person meeting, there were some email exchanges between TCEM chair and Luc Van den Berghe from CEN-CENELEC about the needs of standardization in the electrical and magnetism metrological field and suggestions for pre-normative research. Luc Van den Berghe has asked CEN and CENELEC Technical Committees, Smart Grids and Smart meters Coordination Groups for ideas. At the moment, there is no feedback.

6. TCEM contact person meeting

The annual meeting of the TC-EM was held in Warsaw on 17 and 18 October 2013 (preceding by a WGSP meeting on 16 October). The meeting was hosted by GUM. 27 people representing 24 EURAMET members, one person from NIS and one person from BIPM attended it. The main topics of the agenda were:

- Reports on new developments within EURAMET, the BIPM electricity section, the activities of the four TC-EM subfields and news from the CCEM (March-2013 meetings) and JCRB (including CMC workshop in March 2013)
- Discussion on creating a new SC or taskforce to deal with EMC&SAR. It was agreed that this field concerns mainly the RF&MW SC and was found unnecessary to create another SC or a taskforce. However, the next RFMW SC meeting (in Istanbul) will include a special session dedicated to EMC&SAR
- Review of ongoing and new projects related to research, consultation and traceability including discussion on technical guidelines
- Review of on-going and new projects on comparison
- Discussion on improvements about CMC tables and the review process with a feedback on the last CMC cleaning-up run (EURAMET.EM.9_10_11.2013). Updating exercise on service category list was launched within the 4 subcommittees for 2014.
- Three technical talks given by colleagues from GUM, Silesian University of Technology and Wrocław University of Technology
- News from NMIs in form of a poster session which has been successful in gathering 10 posters.

- EMRP (calls 2012 and 2013) and news about EMPIR including the preparation of the 1st call dedicated to Metrology for Industry
- Discussion on a European Centre on Metrology for Electrical Grids as identified future “sustainable European metrology (research) infrastructure” and the added value of such a centre compared with the PE subcommittee. A European centre on Nanometrology has also been evoked (starting on the 2-years experience of a French club untitled “Club nanometrology”).

Trappes, 19 May 2014

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for Electricity and Magnetism