TC-Chair Annual Report 2010/2011
TC Electricity and Magnetism

30 May 2011

1. General Aspects

The TC-EM faces a number of scientific and technological challenges:

- Electricity and magnetism covers a large number of quantities. The range of values for an individual quantity may cover up to 20 orders of magnitude; the frequency of the electromagnetic signals may vary from DC up to the THz region.
- New fields of activities emerge and gain in importance: e.g. nanomagnetism, single electronics, bioelectronics, THz radiation.
- In the classical fields of activities, new needs arise, as e.g. the new measurement needs in the development of smart electrical grids.

Thanks to the subfield structure in the TC-EM, good networks of experts are established in Europe to respond to the challenges in a coordinated way. Many of the pressing needs for the EM metrology are addressed in the EMRP and the TC-EM community participates very actively in this programme.

Beside the development work, the organisation and analysis of comparisons and the review of Calibration and Measurement Capabilities (CMC) continue to play an important role in the agenda of the TC-EM. A special effort was made in 2011 to simplify and to improve the efficiency of the MRA procedures.

2. Projects

Detailed information about the EURAMET projects in the EM field can be obtained from the EURAMET web-site. An overview of the number of projects is given in the table below.

	Comparison	**Consultation**	**Co-operation & research**	**Traceability**	**Total**
On-going	20 (21)	1 (2)	3 (1)	11 (10)	35 (34)
Completed	74 (69)	58 (57)	45 (45)	2 (2)	179 (173)
Total	94 (90)	59 (59)	48 (46)	13 (12)	214 (207)

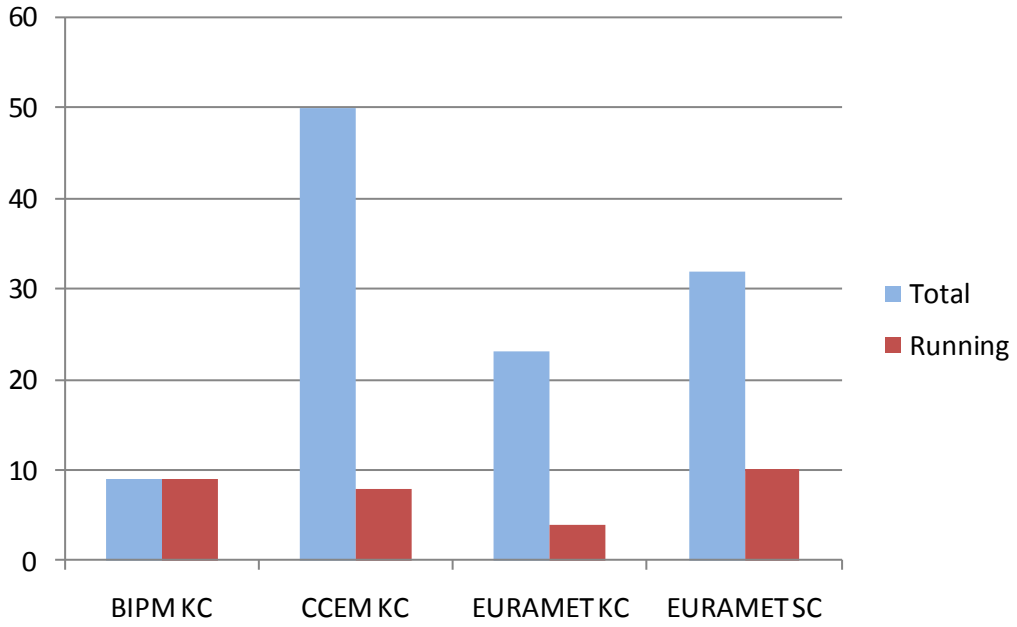
(Figures in brackets denote the numbers of the previous period)

The number of projects is on the level of the preceding years. In the co-operation and research projects a shift towards joint research projects in the framework of the EMRP has occurred. The number of traceability projects does not reflect the real situation in the field. Especially the cases, where a NMI establishes traceability through the calibration of its equipment in another NMI, are not documented. The present form for documenting traceability is not ideal and should be rethought to get a better view of the actual situation.

3. Comparisons

Presently, 12 (16) (number in brackets: previous period) EURAMET key or supplementary comparisons (4 KCs, 8 SCs) are active in the EM field. The total number of EURAMET comparisons listed in the key comparison data base sums up to 23 (23) KCs and 32 (31) SCs. Besides this, EURAMET is or has been active in a large number of CCEM comparisons: 9 BIPM KCs, 48 CCEM

KCs and 2 CCEM SCs. This situation is also illustrated in the following figure. The comparisons support a total of 3635 entries of EURAMET members, published in the KCDB in the EM field.



Comparisons still take too much time. The TC-EM develops ideas to improve the speed of comparisons and to encourage more labs to become pilots. A small working group has formulated a catalogue of possible measures to improve the situation.

4. CMCs

4.1 EURAMET EM CMCs

The following CMC sets passed the intra-RMO and inter-RMO review in 2010/11:

- The set EURAMET.EM.7.2010 was started on 31 May 2010. 15 NMIs submitted in total 215 new entries (incl. 41 matrices) and 293 modified entries (incl. 54 matrices). In addition, for 395 entries (23 matrices) the scope was reduced, the uncertainty was increased or editorial modifications were applied. 171 entries are announced for removal from the KCDB. The entries were reviewed by the members of the working group on the analysis of CMCs and the entries which successfully passed the EURAMET review process were submitted on 6 December 2010 to the inter-RMO review for approval.

The experience with recent CMC reviews has shown that the CMC processes are becoming more and more difficult to handle. The number of entries steadily increases; it is difficult to review all entries properly and to ensure their validity over time. For an external customer it is difficult to compare services published in the KCDB and to choose. For this purpose, the data base entries are often not comparable enough.

A discussion paper on the MRA processes was prepared by the TC-EM and presented to the RMO working group of the CCEM. A number of measures to improve the handling of the CMC entries, the form of the entries and the inter-RMO review process were proposed. Most of the propositions were approved by the CCEM.

4.2 Inter-regional review of CMCs

The TCEM carried out the following inter-RMO reviews in 2010/11:

- SIM.EM.4.2010: Review of entries from Brazil, Mexico and Peru. The review was completed by the end of March 2011.

5. Activities of the Sub-Committees

5.1 SC "DC and Quantum Metrology"

- An informal meeting of the SC took place on 12 June 2010, as satellite meeting of CPEM-2010. Short updates on the progress made in the iMERA-Plus projects REUNIAM, JoSY, ULQHE and Nanospin were presented. In addition, information on the EMRP was given and possible topics for the 2011 call were discussed.
- The regular meeting of the SC took place on 19 May 2011 at PTB in Berlin. It was part of a joint dissemination meeting (18 to 20 May) of the iMERA-Plus projects REUNIAM, JoSY, ULQHE and Nanospin.

5.2 SC "Low Frequency"

- The group met together with the LF experts from other RMOs on 13 June 2010, at a satellite meeting to CPEM-2010. The meeting was chaired by Ilya Budovsky, NMIA and had some 40 participants. Reports on the comparison CCEM-K12 (AC/DC current) and EURAMET.EM-K11 (AC/DC low voltages) were given; possible new comparisons in the field were discussed and some 15 contributions on technical issues and new developments in NMIs were presented.
- The regular meeting of the SC took place from 23 to 25 May 2011at INRIM, Torino, in parallel with the meeting of the SC RF&MW. A joint session of the two SCs was organised to discuss topics of common interest.

5.3 SC "Power and Energy"

- The 2nd meeting of the SC took place on 10 October 2010 at Trescal in Silkeborg, Denmark. It was held next to the project meeting of the iMERA-Plus project T4.J01: Power&Energy and had 33 participants. The group discussed possible new comparisons and decided on a new cooperation project "Precision digitisers for application in primary power measurements".
- The 3rd meeting was organised as part of dissemination event for the iMERA-Plus project "Power&Energy", 22 to 23 March 2011, Noordwijk, The Netherlands.

5.4 SC "Radio Frequencies and Microwave"

- No SC meeting was held in 2010.
- Within the SC, a revised version of the Calibration guide for Oscilloscopes was discussed and adopted.
- The regular meeting of the SC took place from 23 to 24 May 2011, at INRIM in Torino, in parallel with the meeting of the SC LF.

5.5 New SC convenors

The SC convenors are appointed for two years and may be re-appointed. A maximum of three consecutive terms for the convenors was adopted as rule in the TC-EM. For three of the SCs (SC DC and Quantum Metrology, Low Frequency and Radio-Frequency & Microwave) the 6 year peri-

ods for the convenors ended at the end of 2010. After consultation within the SCs and a formal selection procedure carried out in the TC, the following candidates were proposed and appointed as new SC convenors by the EURAMET chair in January 2011:

- SC DC-QM: Dr J.T. Janssen, NPL (replacing F. Piquemal, LNE)
- SC LF: Dr Jürgen Melcher, PTB (replacing K.-E. Rydler, SP)
- SC RF&MW: Dr Markus Zeier, METAS (replacing Z. Svetik, MIRS/SIQ)

6. Participation in the EMRP

The TC-EM community was involved in the elaboration of proposal for the following selected research topics in the 2010 Industry call (out of 28):

- SRT08i: Radio frequency metrology for wireless networks in industrial environments
- SRT09i: Metrology for Ultrafast Electronics and High-Speed Communications
- SRT10i: Metrology for high-speed microelectronics
- SRT11i: Metrology for advanced industrial magnetics
- SRT12i: Electromagnetic characterization of materials for industrial applications up to microwave frequencies

Three of the five proposals were selected for funding.

With the goal to coordinate the preparation for the PRTs within the TC-EM community as much as possible, a PRT preparation workshop was held on 10 January 2010 at LNE in Paris. The workshop was attended by delegates from 13 NMIs and 9 potential PRTs were defined and drafted.

7. Meetings

The annual meeting of the TC-EM was held in Espoo (FI) on 28 and 29 October 2010. The meeting was hosted by MIKES. It was attended by 26 delegates representing 23 EURAMET members, and the BIPM. The main topics of the agenda were:

- Reports on new developments within EURAMET, the BIPM electricity section and the activities of the four TC-EM subfields
- Report on the status of the EMRP; presentations on the running iMERA-Plus projects in TP1 and TP4; strategy of the TE-EM for the 2011 call.
- Review of ongoing and new projects
- Discussion on possible improvements in the MRA processes (comparisons and CMC review)
- Technical talks on: Progress in quantum metrology at MIKES; Metrology: Opportunities and challenges; Thoughts on the new definition of the ampere
- News from NMIs in form of a poster session.

8. Outlook for 2011

8.1 Special activities

Preparation of PRTs for the TPs “SI broader scope” and “New technology” in the framework of the Art.169-EMRP.

8.2 Meetings

- TC-EM: 13 to 14 October 2011, Istanbul, hosted by UME, Turkey
- Working group on strategic planning: 12 October 2011, Istanbul, Turkey

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Wabern, 30 May 2011

Beat Jeckelmann
Technical Committee Chairman
for Electricity and Magnetism