



1. General Aspects

EURAMET nominated the new SC Convenors Antti Manninen (SC-DC&QM), Damir Ilic (SC-LF) and Andrew Smith (SC-RF&MW), in office since 01.01.2017 for a period of five years.

TC-EM has defined a draft, provisionally called "Terms of Reference", to define the scope and activity of the TC and its subcommittees and working groups.

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	Research	EMRP/EMPIR
On-going	6	12	2	20

The Guide no. 12, "Guidelines on the Evaluation of Vector Network Analysers (VNA)" is currently under review and will be presented to EURAMET during 2017.

The revision of the Guide n. 15 "Calibration of digital multimeters" was published and is available.

3. Comparisons

During 2016, 4 supplementary EURAMET comparisons have been completed in the EM field. Besides this, EURAMET is or has been active in a number of CCEM comparisons.

The Comparison Toolbox, presented in 2016 at EURAMET TCC and accepted as official EURAMET tool, is presently under extensive testing with two comparisons.

4. CMCs

04.1 EURAMET EM CMCs

04.1.1 EURAMET.EM.13.2015.

The CMC set EURAMET.EM.13.2015 is in force since its publication on the JCRB website on 2016.04.21.

04.1.2 EURAMET.EM.14.2016.

The new run for CMCs EURAMET.EM.14.2016 was launched on 2016.04.29 with a deadline for submission of 2016.06.10.

The intra-RMO review of the CMC set EURAMET.EM.14.2016 was carried out between July and October 2016.

11 NMIs submitted in total 128 entries. Of these, 47 are new entries, together with 37 matrices. 64 are improved existing entries, together with 36 matrices. For 11 rows and 1 matrices, minor

changes were proposed: the scope was reduced, the uncertainty was increased or editorial modifications were applied. 3 entries (and 5 matrices) are announced for removal from the KCDB.

All the entries were reviewed by the members of the working group on the analysis of CMCs. The outcome of the reviewing is that 118 new or modified entries were approved, and that for 11 editorial changes needed were approved. 1 submitted entry was not approved (simply because it was merged in another entry) and 4 entries will have to be definitively deleted from the KCDB.

The 118 new or modified entries have been submitted for the inter-RMO Review on 2016.11.06. The first review outcome was available on 2017.04.07. The revised set is under preparation and will be submitted in May 2017.

Following a TC-EM action, EURAMET has reformatted the QMS questionnaire. It will be distributed to the submitting NMIs, to be compiled during the intra-RMO review stage of EURAMET.EM.14.2016.

04.2 Inter-regional review of CMCs

In 2016, EURAMET TCEM was involved in five inter-RMO reviews. In agreement with the other RMOs, it has been decided to share the inter-RMO review of these sets between the other RMOs. The EURAMET review concerned the CMC sets

APMP.EM.10.2015. Posted on 2015.12.21. EURAMET review 2016.03.24. Approved 2016.10.21, published 2016.12.05.

COOMET.EM.11.2016. Posted on 2016.07.05. EURAMET review 2016.08.19. Published 2016.09.07

SIM.EM.9.2016. Posted on 2016.10.04. EURAMET review 2017.02.09. Approved and under publication.

SIM.EM.10.2017. Posted on 2017.02.13. EURAMET review 2017.03.24. Approved and under publication.

5. Activities of the Subcommittees

The activities of the four subcommittees (DC and Quantum Metrology, Low Frequency, Radiofrequency and Microwave, Power and Energy) are largely dominated by R&D activities related to EMRP and EMPIR.

In 2017, the following SC meetings are programmed:

SC-DC&QM Contact Person Meeting, VTT, Finland, 1-2 June 2017

SC-LF Contact Person Meeting, UME, Istanbul, Turkey, 29-30 May 2017;

SC RF&MW Contact Person Meeting, CMI, Prague, Czech Republic, 4-5 April 2017;

SC Power and Energy Meeting, June 5-6 2017, NPL, UK.

6. Participation in EMRP/ EMPIR

2016 Call

A workshop was held on January 21-22, 2016 at VSL, Delft, The Netherlands. Local organizer was Gert Rietveld. As outcome of the meeting, 16 PRT ideas for the Energy call were discussed.

2017 Call

A workshop was held on January 12-13, 2017 at METAS, Bern-Wabern, Switzerland. Local organizers were Markus Zeier and Marc-Olivier André. The meeting was structured with two plenary sessions at the beginning and the end of the meeting, and three simultaneous sessions: one for the FUN call, one for the IND call focused on RF&MW/Communication subjects, and the last for the IND call with a focus on Power and Energy and other subjects.

A summary of the PRT topic discussed, with a proposal for possible merging is provided at the end of this report.

7. Capacity Building: Activities of the last year and future needs

TC-EM Chair was invited as speaker at two Capacity Building and Knowledge Transfer courses:

2016 BIPM "Leaders of Tomorrow" Course, 7-18 November 2016 at BIPM, Paris, France, presentation "Specific guidelines for comparisons and CMCs in Electricity and Magnetism II"

2017 BIPM-EURAMET "TC Leadership" Course, 7-10 February 2017 at BIPM, Paris, France, presentations "EURAMET Guide on Comparisons (Toolbox)" and "Specific guidelines for comparisons, CMCs and TC operation in Electricity and Magnetism"

8. Meetings

TC-EM Contact Person Meeting. The 10th EURAMET Electricity and Magnetism Technical Committee Contact Persons Meeting was held in October 13 and 14, 2016 at BEV, Arltgasse 35, 1160 Wien, Austria. 35 29 people representing 28 EURAMET members and one person from BIPM attended it.

A summary of the agenda is the following:

- 01 Confirmation of the agenda; Minutes of the 2015 meeting; Annual report 2015/2016
- 02 Information: News from EURAMET; News from JCRB and BIPM
- 03 New developments in the subcommittees: DC&QM, LF, P&E, RF&MW
- 04 Cooperation/Traceability/Consultation/Research: Review of ongoing projects; Consultation projects; Proposals for new projects
- 05 Comparisons: Review of ongoing comparisons; Proposals for new comparisons; Comparisons toolbox
- 06 Technical talks: Technical talks: "Power Quality Propagation Measurements on Bornholm Island Distribution Network"; "Quantum Hall arrays based on epitaxial graphene"; "EURAMET Guide cg-12".
- 08 Lab news; Poster session
- 09 CMCs: status of EURAMET.EM.14.2016; CMC inter-RMO review in 2016; EURAMET CMC Review group update
- 10 EMRP/EMPIR: status, announcement of future meetings, EMPIR WorkPlan 2016-17; EMPIR 2017 Calls; Capacity building in EURAMET

11 Date and place of the next meeting.

WGSP meeting: 12 October 2016, Wien, Austria, hosted by BEV (Wolfgang Waldmann).

CPEM 2016. The Conference on Precision Electromagnetic Measurements took place in Ottawa, Canada, July 10-15 2016. Several satellite meetings relevant for TC-EM were:

CCEM WG on the electrical methods to monitor the stability of the kilogram
SC-Power and Energy experts meeting (informal)
SC-Low Frequency experts meeting (informal)
SC-DC and Quantum Metrology experts meeting (informal)
WGSP meeting (informal) devoted to the EMPIR 2017 call
CODATA meeting

9. Issues

The Convenors for the TC-EM Subcommittees DC&QM, LF, RF&MW (JT Janssen, J. Melcher, M. Zeier) ended their third two-year period of appointment. Elections to propose new Convenors to EURAMET for appointments were conducted in May/June 2016.

10. Strategic Planning

Strategic Planning will be addressed at the next WGSP meetings (see below) and discussed at the next TC-EM meeting.

11. Outlook for 2017/2018

See also the list SC Contact Person Meetings occurring immediately after the EURAMET General Assembly.

2017 TC-EM Contact Person Meeting and **WGSP meeting** are scheduled for 3-4 October 2017 in IPQ, Caparica, Lisbon, Portugal.

CPEM 2018. The Conference on Precision Electromagnetic Measurements will take place in Ottawa, Canada, July 8-13 2018. Several satellite meetings relevant for TC-EM will be scheduled.

TC-EM EMPIR 2018 meeting will take place in January.

Luca Callegaro
TC-EM Chair

TC-EM Workshop on the EMPIR 2017 Call

No.	PRT	NMI	Presenter	Call	Title
1	Ahlers	PTB	Ahlers	FUN	The quantized anomalous Hall effect of 2D-Topological Insulators (TI)
2	Bieler	PTB	Bieler	FUN	Metrology for topological spin structures
3	Calame	EMPA	Michel	FUN	CVD graphene research activities at EMPA
4	Hohls, Enrico	PTB, INRM	Hohls	FUN	Single-electron based solid state devices as future metrological tools for quantum technology
5	Manninen	VTT	Manninen	FUN	Towards a universal quantum standard for electricity
6	Poirier	LNE	Poirier	FUN	Fundamental perspectives in electrical quantum metrology at LNE
7	Zorin	PTB	Zorin	FUN	Josephson traveling wave parametric amplifier and its application for metrology and quantum information circuits
8	Manninen	VTT	Manninen	FUN	Quantum phase slip in superconducting nanowires

HV&PE&Others

No.	PRT	NMI	Presenter	Call	Title
A	Messmer	ZI	Sadik Hafizovic	IND	Ultra-high Frequency Impedance Measurements on Non-50-Ohm Systems
B	Calame	EMPA	Kishan Todkar	IND	Optimization of CVD graphene for industrial applications
1	Wright	NPL	Andrew Smith	IND	The next generation of Power Quality Instrumentation for Electricity Grids
2	Kleine-Ostmann	PTB	Thomas Kleine-Ostmann	IND	Monitoring Power Infrastructure
3	Agazar	LNE	Mohamed Agazar	IND	Metrology for High Pulsed Power (HPP)
4	Basso	INRIM	Vittorio Basso	IND	Metrology for solid-state cooling
5	Bergman	SP	Anders Bergman	IND	Accurate loss factor calibration at high voltage
6	Janeczko	GUM	Mariusz Janeczko	IND	Construction and validation of electrostatic fields standard
7	Meisner	PTB	Alf Eig	IND	Metrology for DC Power Distribution
8	Mohns	PTB	Enrico Mohns	IND	Metrology to support the transition towards digital substations
9	Tarasso	SP	Valter Tarasso	IND	Traceability for impedance spectroscopy (EIS) in the sub milli-ohm range

RF&MW

1	Sievers, Pasquale	PTB		IND	High frequency metrology for magnetic sensors and sensor materials
2	Kleine-Ostmann Hudlicka NPL	PTB CMI NPL		IND	Waveform metrology for digital signal properties Metrology for dynamic RF electrical quantities Metrology for communication technologies
3	Bieler Allal Hudlicka	PTB LNE CMI		IND	Millimeter and microwave compressed sensing Automotive Radar Testing Metrology for dynamic RF electrical quantities
4	Smith Allal Schradler, Loader	NPL LNE PTB		IND	Metrology for communication technologies Metrology for Industrial Internet of Things Metrology for Reliable RFID in Industry. (MERRY?)
5	Ridler	NPL		IND	Convergence at RF, Microwave, Millimetre-wave and Terahertz Frequencies
6	Steiger	PTB		IND	Metrology for THz NDT applications
7	Pythoud Hudlicka	METAS CMI		IND	Metrology for EMC (SIQ, CMI, LNE, NPL?, VSL?, UME?, PTB?) Metrology for dynamic RF electrical quantities
8	Sen	UME		IND	EMC Intermediate Facilities for Conformity Testing in Industry (CMI?, VSL?, INTA?, LNE?)
9	Judaschke Kuhlmann	PTB PTB		IND	Passive Intermodulation Measurement Traceability for Non-metrology coaxial connector systems
10	Fatadin NPL	NPL NPL		IND	Metrology for Data Centre Interconnects Metrology for communication technologies
11	Piquemal	LNE		IND	SMM/MEMS (METAS, CMI?, VSL?, PTB?)

Research Potential

No.	PRT	NMI	Presenter	Call	Title
1	Callegaro, Kucera	INRIM		RPOT	Versatile electrical impedance metrology calibration laboratory based on digital impedance bridges
2	Mester	METAS		RPOT	Building a primary power standard for 50 Hz and 60 Hz

Normative

No.	PRT	NMI	Presenter	Call	Title
1	Allal	LNE		NRM	Supporting the application of the european directive 2013/35/UE on worker exposure

