Electricity and Magnetism Metrology Working Group

2013 SIM EM MWG Meeting
Saturday, September 21, 09:00 h – 16:00 h
Instituto Nacional de Tecnología Industrial, INTI
INTI - Física y Metrología,
Unidad Técnica Electricidad
C.C.: 157, B1650WAB San Martin, Pcia. de Buenos Aires, Argentina

Agenda

09:00 – 09:15	**Introduction** Welcome / Introduction of the participants Approval of the Agenda	Gregory Kyriazis SIM representatives
09:15 – 10:00	**General Issues** Matters arising from the last CCEM and JCRB meeting SIM documents under elaboration Funding for SIM activities	Gregory Kyriazis SIM representatives
10:00 – 10:25	**SIM.EM-K5 Electric Power Comparison,** Pilot: CENAM, Draft B status	René Carranza
10:25 – 10:50	**SIM.EM-S7 Electric Energy Comparison,** Pilot: CENAM, Draft B status	René Carranza
10:50 – 11:15	**SIM.EM-K12 AC-DC Current Transfer Comparison,** Pilot: INTI Draft A status	Lucas Di Lillo
11:15 – 11:30	**SIM.EM-K4, SIM.EM-S4, SIM.EM-S3 Capacitance Comparison** Pilot: NIST, Final Report status	Rand Elmquist
11:30 – 11:45	**SIM.EM-S5 Voltage, Current and Resistance Comparison** Pilot: NIST and ICE, Final Report status	Harold Sánchez
11:45 – 12:10	**SIM.EM-S8 Comparison on ICT,** Pilot: UTE, Progress status	Daniel Slomovitz
12:10 – 14:00	**Interval for lunch**	
14:00 – 14:25	**SIM.EM.RF-K5b.CL Comparison on S-parameters,** Pilot: INTI Progress status	Lucas Di Lillo
14:25 – 14:40	**SIM.EM-S9.b, 1 Ω and 10 kΩ Bilateral Comparison (INTI and INIMET)**	Lucas Di Lillo
14:40 – 14:55	**SIM.EM-S10 High value resistance comparison with two terminal cryogenic current comparators,** Pilot: INTI, Final Report status	Rand Elmquist
14:55 – 16:05	**Present Status of development of graphene for QHR standards**	Rand Elmquist
15:05 – 15:30	**SIM.EM-K3 Inductance Comparison,** Pilot: CENAM, Progress status	René Carranza
15:30 – 15:55	**New and Proposed Comparisons** Pilot: CENAM SIM Pilot Study or Comparison on Current Shunts / Low-valued Resistors	René Carranza
15:55 – 16:25	**SIM and Interregional CMC Reviews** CMC SIM.EM.06.2012 – Mexico and Peru – final comments CMC APMP.EM.08.2013 – final comments CMC EURAMET.EM.08.2012 – final comments CMC EURAMET.EM.09.10.11.2013 – final comments New submissions for SIM CMC Review Updating the list of SIM reviewers	Gregory Kyriazis SIM representatives
16:25 – 17:05	**SIM/IAAC/COPANT Energy Project** Presentation of results of workshops and trainings since July 2012 Training on Electric Power Measurements and Electricity Meter Verification Training on Traceability for Power Quality Measurements Labeling Programs for Energy Efficiency in Latin America and the Caribbean: Experiences and Best Practices Traceability of measurement: An indispensable base for testing electrical household appliances: Current Status	Héctor Laiz Gregory Kyriazis
17:05 – 17:25	**Terms of Reference (ToR)** Nominees for next chair of SIM EM MWG	Gregory Kyriazis
17:25 – 17:45	**Other Business** Developments at the laboratories	SIM representatives
17:45 – 18:00	**Next SIM EM MWG Meetings** CPEM 2014, Rio de Janeiro, 30 August 2014	SIM representatives

Electricity and Magnetism Metrology Working Group

Participants at the annual SIM EM MWG meeting in Buenos Aires, on September 21, 2013

Country	NMI	Name	E-mail
Costa Rica	I.C.E.	Harold Sánchez	hsanchez@ice.go.cr
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Electricity and Magnetism Metrology Working Group

1. SIM EM MWG Annual Meeting - Introduction

Welcome and introduction of the participants.

The meeting commenced at 9:15 am with a welcome by the chairman followed by self introductions of the attendees from the various countries represented.

Gregory Kyriazis (GK) asked for a modification in the agenda to include his report of the additional bilateral comparison on ac-dc voltage transfer difference between Inmetro and LNE (France).

The agenda was approved by all participants.

Peter Filipski (PF) volunteered to take the minutes of the meeting.

2. General Issues

2.1 Matters arising from the last CCEM meeting

CCEM has decided that RMOs should have their guidance documents on Quality System and Measurement Comparisons made available on their webpages.

2.2 Matters arising from the last JCRB meeting

JCRB concluded that the interregional reviews take too much time to perform and introduced several changes to the process, as well as time limits. The changes are elaborated in the document *Changes_CIPM MRA-D-4* attached to the minutes. GK noted that the SIM EMWG has already the review time schedule. The deadline changes in scheduling the reviews are mostly for the chairman to follow. He also noted that all NMIs are dissatisfied with the CMCs review process and want it simplified and shortened.

To simplify the presentation of CMCs, JCRB will enforce use of matrices. EURAMET countries have all converted their CMCs in this fashion and submitted them for approval. However, since this is only an editorial change, there is no need for the other RMOs to review it. They were then approved in a fast-track process.

PF noted that PTB wants BIPM to convert CMCs into a searchable database, so that industrial clients can easily evaluate which NMI offers the lowest uncertainty. GK explained that thus far BIPM has no money for such conversion. He has made a suggestion to include this task in the strategic plan of BIPM.

GK informed that JCRB approved the realization of a comparison on harmonic power. The number of countries in this comparison was reduced to 4 or 5; SIM will be represented by NIST and NRC.

The key comparison CCEM-K5 on electric power will be repeated; SIM will be represented by NRC, CENAM and INMETRO.

2.3 Matters arising from the last SIM Technical Committee meeting

GK informed that the new SIM chairman, José Dajes, is from Peru and thus the SIM webpage was transferred from Brazil to Peru.

A new SIM Working Group on Evaluation of Uncertainties was proposed. Due to the lack of funding, the Technical Committee did not support this proposal. However, the SIM Council requested organization of this Working Group. GUM is undergoing revisions; the revised version will be published next year. Thus far SIM has no formal way to influence these changes. The new Working Group will be able to work in this area.

3. SIM.EM-K5 Key Comparison on Electric Power

Pilot – CENAM.
Report by René Carranza.
Status: Draft B circulated to participants.

René Carranza (RC) made a presentation on the comparison. It is finished and the traveling standard is at CENAM. Draft B was issued and distributed to participants.
Measurements using Radian RD-22-311 as a traveling standard were performed by CENAM, NIST, NRC, Inmetro, UTE, and INTI; using Radian RD-23-432 by LCPN-ME, SNM-INDECOPI, INM, CENAM, ICE, CENAMEP AIP. Draft B results presented by RC showed high stability of the traveling standards (± 2 ppm) during the comparison.

The results were very good, both for active and reactive power, showcasing SIM countries capabilities. The Draft B linked SIM comparison results to the CCEM-K5 results, limited in range only by the range of the CCEM Key Comparison. The Birge ratio – the test of consistency of results – shows that the link is good enough.
The pilot lab will be able to prepare the Executive Report only after NRC, NIST and INM submit 1 page measurement method description.

Rene Carranza will prepare a paper about the comparison on power and energy to be presented during the next CPEM.

Action agreed	Responsible	Date
Draft B approval by participants	René Carranza	OK
Submission of the measurement method	Representatives/participants NRC, NIST, INM	October 6 2013 (2 weeks)
Executive Report issued by participants	René Carranza	October 27 2013 (1 month)
Paper to be submitted to CPEM 2014	René Carranza	January 15, 2014
Draft B and Executive Report sent to SIM chairperson	René Carranza	
Final Report published in KCDB	Chairperson	

4. SIM.EM-S7 Supplementary Comparison on Electric Energy

Pilot – CENAM.
Report by René Carranza.
Status: Draft B is in preparation.
The comparison was conducted at the same time as the power comparison, using the same travelling standards. It is now finished and the traveling standards are at CENAM. Draft B will be prepared by the end of the year and distributed to participants.

Action agreed	Responsible	Date
Draft B preparation	René Carranza	December 2013
Draft B approval by participants	René Carranza/participants	
Executive Report issued by participants	René Carranza	
Draft B and Executive Report sent to SIM chairperson	René Carranza	
Final Report published in KCDB	Chairperson	

5. SIM.EM-K12 Key Comparison on AC-DC Current Transfer

Pilot – INTI.
Report by Lucas Di Lillo.
Status: Comparison completed. Draft A will be submitted shortly.

Lucas Di Lillo (INTI) made a presentation on the comparison. This comparison was performed at two values, 10 mA and 5 A, using a shunt manufactured by INTI and a planar thermal converter manufactured by PTB.
Participants: INTI, UTE, NRC, NIST, CENAM, INM, Inmetro, and NIS (Egypt).
During the comparison an input connector of the travelling standard shunt failed; it was repaired by the pilot lab and the measurements repeated.
The presented Draft A has a link to the Key Comparison CCEM-K12, calculated in a manner similar to the calculations in SIM.EM-K5 report. However, the SIM comparison was so close in time to the CCEM comparison, that no reproducibility uncertainty was introduced in calculating the link uncertainty.

Lucas Di Lillo will prepare a paper about the AC-DC current transfer difference comparison to be presented during the next CPEM.

Action agreed	Responsible	Date
Draft A distributed to participants	Lucas Di Lillo	October 6 2013 (2 weeks)
Draft A approved by participants	Lucas Di Lillo/participants	October 27 2013 (1 month)
Paper to be submitted to CPEM 2014	Lucas Di Lillo	January 15, 2014

6. SIM.EM-K4, SIM.EM-S4, SIM.EM-S3 Key and Supplementary Comparisons on Capacitance

Pilot – NIST.
Report by Rand Elmquist (on behalf of Andrew Koffman).
Status: Final Report approved by CCEM.
Participants: NIST, CENAM, ICE, NRC, INTI, Inmetro, UTE.
Traveling standards at NIST.
Technical paper published at CPEM 2012.
Rand Elmquist made a short presentation on the comparison. This comparison is now finished.

6. SIM.EM-S5 Supplementary Comparison on Voltage, Current and Resistance using a Digital Multimeter
Pilot – NIST.
Report by Harold Sánchez, ICE.
Participants: NORAMET (only NIST participated as the pilot laboratory), CAMET (ICE, CENAMEP AIP), CARIMET (TTBS), ANDIMET (SNM-INDECOPI, CMEE, SIC) and SURAMET (INTI, UTE, LCPN-ME, Inmetro).
Technical paper published at CPEM 2012.
Status: Draft B under evaluation by CCEM.
Harold Sánchez made a presentation on the comparison.

This comparison has a long history, it started in 2004. The work on the report stopped when the pilot lab researcher responsible for the comparison has retired. In 2011 the result files were recovered from NIST. Harold Sanchez (HS) from ICE has prepared the Draft A of the report and sent it to participants. Subsequently a statistician from NIST introduced several changes to the calculations. In 2012 Draft B of the report was prepared and sent to participants. Draft B was approved in May 31 2013.
HS concluded his presentation by stating that:
- The comparison took too long.
- The results were not available to participants on time to react.
He made a suggestion that participants should be informed by the pilot lab about the quality of their results while the traveling standard is still in the lab; this would give the laboratory an opportunity to repeat the measurements immediately.

This last conclusion was controversial. Other participants disagreed with HS. The general opinion was that the main solution to the problem was a quick execution of the comparison (2 years or less) and an immediate presentation of the Draft A report to the participants. Then, if necessary, the corrective actions can be started.

There was also a discussion whether Draft B of the report can contain results obtained from the corrective action, with the Draft A results abandoned. The general consensus was that the corrected results can be only added as an Appendix.

GK has reminded the participants that six DMMs were purchased with OAS resources for SIM.EM-S5 (only four were used in the comparison). They have been distributed by NIST to the three pivot laboratories from SURAMET, ANDIMET and CAMET, namely INTI, ICE and INDECOPI. Each NMI received 2 (two) DMMs and will be responsible for coordinating sub-regional comparisons in the future. The laboratories should consider if the comparison SIM.EM-S5 can be repeated soon.

As a corrective action from this comparison, a bilateral comparison for 10 Ω resistance (SIM.EM-S5.1) between UTE (Uruguay) and INTI (Argentina) was proposed. A protocol will be written and submitted. CMCs should be compatible with the corrected results. Gregory Kyriazis stated that Inmetro would be interested in participating in a quick trilateral comparison for 10 Ω resistance (SIM.EM-S5.1).

Action agreed	Responsible	Date
Draft B under evaluation by CCEM	Chairperson	September 18, 2013
Final Report published in the KCDB	Chairperson	
Protocol on bilateral comparison between UTE, INTI (and possibly Inmetro) to be issued	Daniel Slomovitz	August 07, 2013
Protocol on bilateral (or trilateral) comparison to be sent to Chairperson	Daniel Slomovitz	September 14, 2013

8. SIM.EM-S8 Supplementary Comparison on current ratios using instrument transformers

Pilot: UTE.
Report by Daniel Izquierdo (on behalf of Daniel Slomovitz).
Measurement ratios: 5 A, 10 A, 50 A, 100 A, 500 A, 1000 A to 5 A.
Currents for each ratio: 1%, 5%, 20%, 100% and 120% of nominal current (In).
Frequency: 50 Hz or 60 Hz or both.

Participants: UTE, Inmetro, INM, CENAMEP, NRC and INTI.
Status: Comparison started.

Daniel Izquierdo made a short presentation on the comparison. The traveling standard is now in Brazil. There is a delay in comparison due to the fact that the traveling standard arrived at the courier central point in São Paulo and not at Inmetro. Inmetro will have to transport the standard from São Paulo to Duque de Caxias. The agreement was that each country should send the traveling standard to the next institute and this did not occur in this case. Gregory Kyriazis stated that in the future laboratories sending travelling standards to any next institute should not use a courier service, unless one can be sure that the traveling standard will be sent directly to that institute (door-to-door delivery).

Action agreed	Responsible	Date
New schedule prepared	Alejandro Santos	ASAP
Draft A to be issued	Alejandro Santos	November, 2014 (?)

9. SIM.EM.RF-K5b.CL Key Comparison on Scattering Coefficients by Broadband Methods

Pilot lab: INTI.
Report by Lucas Di Lillo (on behalf of Hernando Silva and Guillermo Monasterios).

2 GHz - 18 GHz - Type N Connector.
Participants: CENAM, INTI, NIST, NRC, Korea, India.
Status: Comparison started.

Lucas Di Lillo made a presentation on the comparison.

Scattering parameters of Type N connector devices selected for this comparison will be measured from 2 GHz to 18 GHz (inclusive) in 1 GHz steps. For one-port devices (matched and mismatched loads) the measurand is the complex-valued reflection coefficient S11. The VSWR 1.0 (matched) load and VSWR 2.0 (mismatched) load were chosen to perform reaction measurements with low and high magnitude values. When measuring two-port devices (3 dB and 20 dB attenuators) the measurands are the four complex-valued S-parameters (S11, S21, S12 and S22). The values of 3 dB and 20 dB were chosen to cover transmission measurements with high and low magnitude values.

The analysis of the results will be done only for S11 (for one-port devices) and S21 (for two-port devices) at 2 GHz, 9 GHz and 18 GHz to reduce the amount of data to be analyzed for the comparison. These three frequencies were chosen to cover the low, medium and high frequency range.

This is the first SIM comparison on RF!

NIST finished the tests and the standard is now in Canada. The next laboratory in the loop was Korea. However, the paperwork for the travelling standard will expire in November and the standard should return to INTI before then. For this reason, NRC after finishing the tests should send the standard to Mexico rather than to Korea. The comparison is delayed because of some internal problems at NIST. INTI asked the participants to try to do the measurements as soon as possible.

Action agreed	Responsible	Date
Results to be send to INTI	Rand Elmquist/Ron Ginley	ASAP
New schedule prepared	Lucas Di Lillo	ASAP
Draft A to be issued	Lucas Di Lillo	

10. SIM.EM-S9.b, 1 Ω and 10 kΩ Bilateral Comparison

Pilot lab: INTI.
Report by Alejandra Tonina.
Participants: INTI and INIMET (Cuba).
Status: Draft B under evaluation by CCEM.
This was the first SIM comparison with the INIMET (Cuba); they belong to COOMET (Euro-Asian Cooperation of National Metrological Institutions).
INIMET measurements uncertainties covered the comparison reference values.

Action agreed	Responsible	Date
Draft B under evaluation by CCEM	Chairperson	September 18, 2013
Final Report published in KCDB	Chairperson	

11. SIM.EM-S10 High value resistance comparison with two terminal cryogenic current comparators

Pilot lab: NIST.
Report by Rand Elmquist.

Test points: 1 MΩ, 10 MΩ, (two standards), 100 MΩ, (two standards), 1 GΩ.
Participants: NIST, INTI and CENAM.

Status: Draft B under evaluation by CCEM
This was a supplementary comparison conducted between August 2012 and January 2013. The purpose of this comparison was to compare high resistance cryogenic current comparator scaling at the participating NMIs. It was very successful and improved uncertainties at CENAM and INTI.

Action agreed	Responsible	Date
Draft B under evaluation by CCEM	Chairperson	September 18, 2013
Final Report published in KCDB	Chairperson	

12. Present Status of development of graphene for QHR standards

Talk by Rand Elmquist. The presentation slides are attached to the minutes.

Graphene has a potential application in precision metrology. In Europe, Graph-Ohm is the EUROMET key project in metrology, led by PTB.

Graphene does not have all the plateaus that the gallium arsenide has. GaAs has a bigger energy gap that graphene. There is a hope that you can operate graphene Quantum Hall devices at 10 K, with magnetic fields of 0.5 T to 1 T. At such a relatively low magnetic field of 1 T, a permanent magnet would suffice; there would be no need for a superconducting magnet of 15 T, expensive in exploitation. Long term goal is to make on the same chip Quantum Hall and Single Electron Tunneling devices.

13. SIM.EM-K3 Inductance Comparison

Pilot – CENAM.
Report by René Carranza (on behalf of Angel Moreno).

Participants: UTE, CENAM, ICE, Inmetro, INTI, NIST, NRC.
Status: Comparison started.

René Carranza made a presentation on the comparison.

The last inductance comparison CCEM-K3 was in 2001. NIST was the only participant from the SIM region. It was expected that the PTB would serve as a link between SIM.EM-K3 and CCEM-K5. However, Jürgen Melcher declined after considering that there was no way to ensure the link between the two comparisons, due to the long lag time in–between. A new CCEM comparison was preferred.

In the SIM.EM-K3, CENAM and NRC would serve as the link to the planned CCEM-K3 to start in the near future.
At the CCEM meeting in 2013, there was not discussion about the CCEM-K3 comparison. INTI (Marcelo Cazabat) has also proposed to be one of the linking laboratories to the future CCEM-K3.
GK noted that according to the CCEM Strategic Plan the repetition of CCEM-K3 is foreseen for 2020. The Strategic Plan and the comparison table will be periodically reviewed (supposedly at each CCEM meeting) and if the need would arise to carry out a comparison earlier as initially foreseen, this could be changed. Therefore, if SIM MWG-1 thinks that a new CCEM-K3 would be needed earlier, he should point this out at the next meeting of WGLF in 2014. A new CCEM comparison is in fact needed. Lucas Di Lillo (INTI) recommended that this should be pointed out in the next meeting of the CCEM Working Group on Low Frequencies (WGLF) in 2014.

The SIM.EM-K3 started on August 27, 2013 with measurements at CENAM. Reference standards were sent to NRC on 9th of September. NIST is expected to make measurements between October and November.

Action agreed	Responsible	Date
Draft A distributed to participants	Angel Moreno	
Draft A approved by participants	Angel Moreno	

14. SIM.EM-K6.1, K9.1 Bilateral Comparison on AC-DC Voltage Transfer Difference

Pilot – LNE (France).
Report by Gregory Kyriazis (on behalf of Renata Vasconcellos).
Participants: LNE and Inmetro.
Status: Draft B under evaluation by CCEM.
Gregory Kyriazis made a presentation on the comparison.
The reviewers of the report suggested several changes in the report and the corrected version was submitted.
GK noted that Francois Piquemal (LNE) objected to this comparison and suggested that in the future such supplementary comparisons should be conducted within SIM. GK explained to him that this comparison was part of collaboration between LNE and Inmetro.

Action agreed	Responsible	Date
Draft B under evaluation by CCEM	Chairperson	September 18, 2013
Final Report published in KCDB	Chairperson	

15. New and Proposed Comparisons

15.1 Low Resistance Comparison

Pilot – CENAM.
Report by René Carranza (on behalf of Felipe Hernández).
Participants: to be determined.
Status: Questionnaire sent to SIM members.

René Carranza made a presentation on the comparison.

1. CENAM characterized 5 standard resistors: 100 mΩ; 10 mΩ and 1 mΩ.
2. There was a delay due to an update of CENAM´s measurement system.
3. NIST was asked to lend 3 standard resistors for a redundant set of standards.
4. NIST will join CENAM in the characterization of the standard resistors.
5. The comparison may start in February 2014 at 100 mΩ; 10 mΩ and 1 mΩ, at a power of 100 mW. Participants may choose a power of 10 mW.
6. The preferred oil bath temperature is 25 °C.

Gert Rietveld from the Dutch Metrology Institute (VSL) is also interested in this comparison.

Action agreed	Responsible	Date
Interested NMIs reply to questionnaire	Interested NMIs	October 5 2013

16. SIM and Interregional Reviews

CMC SIM.EM.06.2012 – Mexico and Peru – final comments
CMC APMP.EM.08.2013 – final comments
CMC EURAMET.EM.08.2012 – final comments
CMC EURAMET.EM.09.2013 – final comments
CMC EURAMET.EM.10.2013 – final comments
CMC EURAMET.EM.11.2013 – final comments

New submissions for SIM CMC Review

GK noted that all new submissions should use matrices, following JCRB requests. There is no deadline for sending SIM CMC reviews. April - October is the window for submitting SIM CMCs for interregional reviews.

Several SIM reference documents will soon be uploaded, after corrections and revisions, to the SIM webpage.

Draft SIM Reference Document SIM-01 Terms of Reference for Technical Group Chairs.
SIM Reference document SIM-05 SIM Procedure for Review of Calibration and Measurement Capabilities Submitted for Appendix C of the CIPM MRA.
Draft SIM Reference Document SIM-07. Procedure for Registration and Disposition of SIM Comparisons.
Draft SIM Reference Document SIM-10. Terms of Reference for Travels Funded by SIM.

Updating the list of SIM reviewers

GK noted a need to update a list of SIM reviewers. He will send the present list to the members.

17. SIM/IAAC/COPANT Energy Project

Héctor Laiz reported on the current status of the SIM/IAAC/COPANT project.

Gregory Kyriazis reported on tutorial on energy efficiency of household appliances.

Presentation of results of workshops and trainings since July 2012.
Training on Electric Power Measurements and Electricity Meter Verification.
Training on Traceability for Power Quality Measurements.
Labeling Programs for Energy Efficiency in Latin America and the Caribbean: Experiences and Best Practices .
Traceability of measurement: An indispensable base for testing electrical household appliances: Current Status.

There was a discussion on the possible future activities and tutorials, led by Hector Laiz (INTI) and Luciana Scarioni (PTB). Two new activities are needed for 2014. One could be linked to CPEM 2014 in Rio de Janeiro, the other to October conference at CENAM. They noted that the tutorials should benefit all participants, not only the three largest NMIs in the Region. The discussion will be continued at the end of the Tuesday tutorial.

18. Terms of Reference (ToR): Nominees for next chair of the SIM EM MWG

GK has reminded that his second term as the Working Group Chair is expiring in 2014. At the next meeting, scheduled in August 2014, the Group should elect a new chair. He solicited proposals for a new chair. The EM WG has a document listing *Terms of Reference for the Technical Group Chair*, which will be accepted by SIM as a document SIM-01. This document will also be posted on the SIM web page.

GK stated that the biggest challenge for the Chairman of the Working Group is to find funds for the Group activities. Hector Laiz noted that funding of SIM by the Organization of the American States (OAS) will probably dry up and that SIM will have to change its structure and its legal status. The WG Chair should not wait for any funds from SIM, because he will not be successful.

Gregory Kyriazis stated that if no candidate comes forward, he would be willing to continue for the third term.

19. Other Business

Harold Sanchez noted that according to BIPM, a stated CMC capability of calibrating positive dc voltage apparently does not imply that the laboratory has capability for calibrating the negative dc voltage.
GK will clarify this question with BIPM.

Rodrigo Ramos (UDEC/INN) asked about experience of other countries in testing 3 phase energy bench systems. GK stated that Inmetro has significant experience in this area to share, particularly Ana Maria Ribeiro Franco (Inmetro). Harold Sanchez said that ICE will be glad to share experience in connecting a 3 phase standard to the test bench.

GK informed that the Brazil´s Scientific and Technological Development National Council is funding a project between Inmetro, INTI and UTE on a reference system for the measurement of power up to 100 kHz. The funding, US$ 326,000, will cover travel and components. The project will not fund equipment. The project activities are divided as follows: INTI- shunts, dividers and digitizers, UTE – transformers and dividers, Inmetro – digital sampling algorithms.

20. Next SIM EM MWG Meetings

The next SIM EM MWG meeting will take place in Rio de Janeiro, on Saturday August 30, 2014 following CPEM 2014.

The meeting ended at 16:00.

2013-10-22
Gregory Kyriazis
Chair, SIM EM MWG
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