



Report on Electricity and Magnetism Metrology Activities at the Standards and Calibration Laboratory (SCL), Hong Kong

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Contact:

Electrical Laboratory: Dr Steven Yang (steven.yang@itc.gov.hk)

Radio Frequency Laboratory: Dr Terry Lai (terry.lai@itc.gov.hk)

This report gives a brief summary on key activities in the field of electricity and magnetism at the Standards and Calibration Laboratory (SCL), Hong Kong in 2015-2017.

Quantum Metrology

- The laboratory will replace the existing Quantum Hall Resistance (QHR) system with a new one. The new system will be installed by the end of 2017. The laboratory will seek for resistance bi-lateral comparison to validate the performance of the new system.
- The laboratory will pilot an inter-laboratory comparison on 10 V and 1.018 V DC voltages with GULFMET (GULFMET.EM.BIPM-K11). The linking laboratories are BIPM and KRISS (Korea), and the participating laboratories are EMI (United Arab Emirates) and SASO (Saudi Arabia). The transfer standards are 2 units of Fluke 732B provided by EMI and SASO. The characterization of the two standards will be conducted by SCL in Jan – Jun 2017. Measurements will begin in July 2017.
- The laboratory has planned for the procurement of a new Programmable Josephson Voltage Standard (PJVS) to replace the existing Josephson array voltage standard (JAVS). The laboratory will seek for bi-lateral and PJVS on-site comparison to validate the system performance after installation and commission.

Power and Power Quality

- The laboratory is in the process of setting up a second set of 3 phase power and energy calibration system to support the increase in calibration demand from local power companies. This second system is targeted to be ready by mid of 2017. It will be mainly used to support automated calibration of working grade (80 ppm) power and energy meters with current up to 160 A.
- The SCL has set up calibration services for power quality instruments to support the needs from the local testing laboratories including, voltage and current harmonic, flicker (sine/rectangular modulation) and inter-harmonic.
- In addition, the laboratory has been working on techniques to calibrate electronic load, which is required for performing functional tests of batteries, photovoltaic (PV) cells, power supplies, inverters and transformers.

Medical Testing Equipment

- The laboratory has been providing calibration services for medical testing equipment since 2013, as the local hospitals and medical institutes were looking for traceable calibration of their medical testing equipment. For electrical type medical testing equipment, SCL has developed calibration services for electrical safety analyzers, defibrillator analyzers and electro-cardio graph (ECG) simulators.
- The laboratory is in the process of developing calibration service for electro-surgical unit (ESU) analyzers, and is targeted to be completed by Q4 2017.

RF and microwave

- The SCL extends the frequency range for RF and microwave measurement for power, VSWR and attenuation to 40 GHz. More calibration services with SMA 3.5mm connector will be provided to complete the calibration services for the frequency bands from RF to microwave.
- New calibration service of RF probe will be provided around Q3 in 2017.

EMC/EMI

- For the EMC services, the calibration of surge generator was updated in accordance with the latest standard IEC61000-4-5:2014. The calibration of EMI Quasi-Peak (QPK) Measuring Receiver in accordance with the IEC CISPR 16-1-1:2006 will be updated to the latest standard IEC CISPR 16-1-1:2010. The calibration of Electrical Fast Transient/Burst Generator will also be updated in accordance with the latest standard IEC61000-4-4:2012. The future plan of EMC/EMI development is to extend the service to 40 GHz, such as the calibration of EMI receiver in 40 GHz.

Photonics

- The SCL sets up new calibration services for wavelength, output power level and output power stability of fibre optic laser sources (FOLS). The service of calibration of optical time-domain reflectometer (OTDR) is also available in 2016.

Key and Supplementary Comparisons

- APMP.EM-K12 (Comparison of AC-DC Current Transfer Standards)
 - Measurement completed in April 2014.
- APMP.EM.BIPM-K11.3 (DC Voltage, Zener diode)
 - Reviewed draft B report in January 2015.
- APMP.EM-S8 (Comparison on digital multimeter)
 - Measurement completed in February 2015.

- Bilateral comparison with National Metrology Centre (NMC) in Singapore for comparison of 2.4 mm power sensor)
 - Measurement completed in Feb 2015.
- APMP.EM-S12 (Comparison of Standards for the Calibration of Voltage, Current and Resistance Meters)
 - Measurement completed in March 2016.
- GULFMET.EM.BIPM-K11 (Comparison on 10 V and 1.018 V DC Voltages)
 - SCL is the pilot laboratory of this comparison.
 - Measurement will start from July 2017.
- GULFMET.EM.S1 (Comparison of Resistance Standards at 100 Ω)
 - Measurements scheduled in March 2017.

Publications

- [1] "Calibration of defibrillator analyzers," Steven Yang, Aaron Yan, NCSLI Measure, vol. 10, no.4, pp. 46-51, Oct 2015
- [2] "VRC Measurement for 3.5 mm Coaxial System Using Network Analyzer Fitted with Type K Connector," Samuel Ko, Aaron Yan, CPEM 2016
- [3] "Bilateral Comparison of RF Power Measurements with 2.4 mm Connectors between SCL and NMC, A*STAR," Samuel Ko, Aaron Yan, CPEM 2016
- [4] "High Accuracy and Traceable Power Quality Instrument Calibration using High-Speed Digitizing Technique," Steven Yang, Aaron Yan, Chris Ng, CPEM 2016
- [5] "Calibration of optical fiber time domain reflectometers in accordance with IEC 61749-1:2009," Samuel Ko, Aaron Yan, NCSLI 2016 (*received the best paper award from the conference*)
- [6] "Calibration of Electro-Cardio Graph Simulators," Steven Yang, Aaron Yan, Chris Ng, NCSLI 2016 (*received the best paper award from the conference*)
- [7] "Computer Aided Calibration of Voltage and Current Surge Generator in accordance with IEC 61000-4-5:2014," Samuel Ko, Aaron Yan, HW Li, NCSLI 2016
- [8] "Calibration of Defibrillator Analyzers," Steven Yang, Aaron Yan, NCSLI 2015 (*received the best paper award from the conference*)
- [9] "Calibration of Flicker Meters," Steven Yang, Aaron Yan, HM Chan, NCSLI 2015

International Technical Activities

- SCL joined GULFMET as an associate member in December 2014
- CIPM accepted SCL to join CCEM as an observer in October 2016

Peer Reviews

The laboratory has completed peer reviews for direct current, low frequency and radio frequency areas led by Hong Kong Accreditation Service (HKAS).

<u>Areas</u>	<u>Assessors</u>	<u>Date</u>
Direct current (DC), Low frequency (LF), high voltage (HV) and magnetism	Dr Yi-hua Tang (NIST, USA) Mr Siu-hung Lau (HKAS Lead Assessor)	7-11 December 2015
Radio frequency	Dr Tae-weon Kang (KRISS, Korea) Mr Siu-hung Lau (HKAS Lead Assessor)	1-2 February 2016

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