

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

For the 34th meeting of the CCEM, 6-7 March 2025

Contacts:

Post	Name (Email)
Head of Laboratory	Mr Johnny Poon (cypoon@itc.gov.hk)
Senior Electronics Engineer	Ms Brenda Lam (hslam@itc.gov.hk)
Electronics Engineer (DC, HV, Magnetism)	Mr Cliff Wong (cliff.wong@itc.gov.hk)
Electronics Engineer (LF, Impedance, Power)	Mr Stephen Chow (stephen.chow@itc.gov.hk)
Electronics Engineer (RF and Microwave)	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, China in 2023-2025.

Quantum Metrology

- The Programmable Josephson Voltage Standard (PJVS) was upgraded to support the automated leakage measurement. Further development on step-wise ac voltage measurement by differential sampling is in progress.

Direct Current

- The laboratory has extended the current measurement capability from 1000 A to 2000 A for clamp meters with new current coils.
- The laboratory has developed a procedure to measure earth loop impedance using volt-drop method.

Low Frequency and Power

- The laboratory has developed a new automation system to calibrate the AC/DC thermal voltage convertors.
- The laboratory is developing an alternate primary power calibration system which is based on digital sampling technique and by using an auto range current transformer and resistive voltage dividers.

RF and microwave

- The laboratory has set up a new microcalorimeter system which is the primary calibration standard for RF power up to 50 GHz.
- The laboratory is establishing a new S-parameter measurement system for 3.5 mm coaxial at frequencies from 10 MHz to 26.5 GHz by using a four port Vector Network Analyzer.
- The laboratory is establishing a S-parameter measurement system for 2.4 mm coaxial extending the frequencies range from “10 MHz to 40 GHz” to “70 kHz to 50 GHz”

EMC/EMI

- The laboratory has developed the measurement systems for:
 - E-field probes which covered the frequencies from 100 kHz to 6 GHz. The electric field strength range is from 1 V/m to 35 V/m.
 - H-field probes which covered the frequency from 300 kHz to 30 MHz. The magnetic field strength range is from 0.01 A/m to 0.1 A/m.
- The laboratory has updated the measurement procedure for the Verification of Voltage Dips and Short Interruptions Generators to the latest version “IEC 61000-4-11 Edition 3.0 2020-01”.

Digitalization

- SCL has participated in the APMP digital transformation focus group (DXFG) and GULFMET digital transformation focus group (DTFG) for the exchange of ideas and learning objectives with peer laboratories.
- SCL keeps track of the latest development on digital calibration certificate (DCC) and the proof-of-concept to generate DCCs.

Status of Key and Supplementary Comparisons

- APMP.EM-K5.1 (Comparison of AC power at 50 Hz/60 Hz)
 - Measurement completed in May 2012. Draft B report received in December 2018. Pending for approval.
- APMP.EM.RF-K8.CL (Calibration factor of power meters)
 - Measurement completed in Aug 2012. The final report approved in the APMP TCEM meeting on 25 November 2024.
- APMP.EM-K12 (Comparison of AC-DC Current Transfer Standards)
 - Measurement completed in April 2014. Draft B report received in July 2019. Approved for equivalence in Apr 2024.

- APMP.EM-S8 (Comparison on digital multimeter)
 - Measurement completed in February 2015. Draft B report received in May 2019. Pending for approval.
- GULFMET.EM-S1 (Comparison of Resistance Standards at 100 Ω)
 - Measure scheduled in March 2017. Draft B report received in November 2019. Approved in February 2022.
- GULFMET.EM-S8 (Comparison of Calibration of Multimeter)
 - Measurements completed in October 2022. SCL is the support group member of this comparison. Draft A report received and reviewed in Dec 2024.
- APMP.EM-K1.1P (Comparison on Standard Resistors 1 Ω & 10 k Ω)
 - Measurements completed and results submitted in July 2023. Pending for further update from the pilot lab (NIMT).
- CCEM.RF-K28.W (RF power from 18 GHz to 26.5 GHz in rectangular waveguide)
 - Measurement completed in March 2024 and results submitted to the pilot laboratory.
- CCEM.RF-K5.d.CL (Comparison of coaxial scattering parameter measurements 2.4 mm coaxial line system)
 - Measurements results and report will be submitted to the pilot laboratory in March 2025.

Publications

- [1] Cliff Wong, Steven Yang and Ching Tat Lai, "Calibration of Capacitance using Capacitor-discharge Method," NCSLI 2024 Conf., July 2024.
- [2] Cliff Wong, Steven Yang and Jeffrey So, "Extended Calibration of Electrocardiograph (ECG) Simulators," NCSLI 2024 Conf., July 2024.
- [3] Hau Wah Lai, Chi Kin Ma and Steven Yang, "Calibration of Type N Working Grade RF Power Sensors at SCL," NCSLI 2024 Conf., July 2024.
- [4] Hau Wah Lai, Wai Man Ho, Steven Yang and K. W. Chen "Calibration of Electric Field Probes in accordance with IEEE 1309," IEEE APS/URSI 2024, July 2024.
- [5] Stephen Chow, Steven Yang and Kin Wah Chen, "Calibration of Harmonics and Inter-Harmonics based on Digital Sampling at Standards and Calibration Laboratory (SCL)," NCSLI 2023 Conf., July 2023.
- [6] Hau Wah Lai, Chi Kin Ma, and Steven Shing Lung Yang, "Calibration of Electric Field Probes using a GTEM Cell at the Standards and Calibration Laboratory (SCL)," IEEE APS/URSI 2023, July 2023.

International Technical Activities

- SCL staff members are serving as APMP and GULFMET TCEM review board members. We have served in the GULFMET intra-RMO CMC review, APMP intra-RMO CMC review and EURAMET/AFRIMET inter-RMO CMC review.
- SCL is the support group of GULFMET.EM-S8 Comparison of Calibration of Multimeter.

Quality Matters

SCL's management system conforms to ISO/IEC 17025:2017 and ISO/IEC 17043:2023. The last two peer reviews for EM related areas were completed in 2023 (on-site) and 2025 (on-site) respectively (as listed in table below).

<u>Areas</u>	<u>Assessors</u>	<u>Date</u>
Direct current, low frequency and high voltage	Dr YANG Yan (NIM, China)	January 2025
	Dr CHEN Shih-fang (CMS, Chinese Taipei)	February 2023
	Dr LEE Hyung-Kew (KRISS, South Korea)	January 2023
Magnetism	Mr Thepbodin Borirak-Arawin (NIMT, Thailand)	January 2025
	Dr PARK Po-gyu (KRISS, South Korea)	January 2023
Radio frequency	Dr MENG Yusong (NMC, Singapore)	January 2025
	Dr KANG No-Weon (KRISS, South Korea)	February 2023

Up to February 2025, SCL has 66 EM related entries listed in Appendix C of the CIPM MRA.

Relocation of the Laboratory:

SCL will relocate to a new premise in the mid of 2025. New antenna calibration facilities will be setup in the new laboratory.

-End of report-