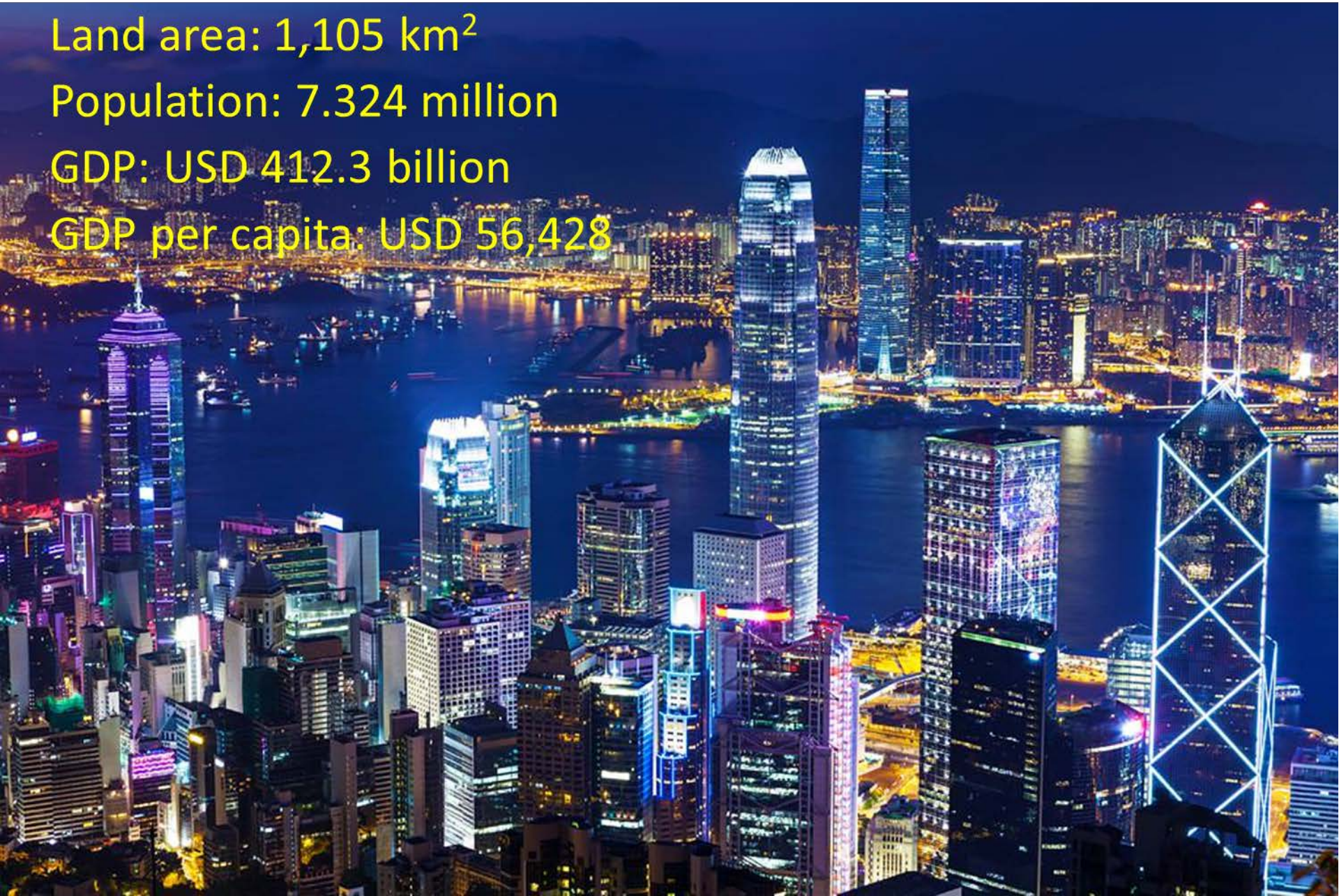
The 23rd CCPR Meeting

The HKSARG Standards & Calibration Laboratory (SCL)

Dennis Lee
Head, SCL
23 September 2016

Innovation and Technology Commission
The Government of the Hong Kong Special Administrative Region



Contents

- The Standards and Calibration Laboratory (SCL)
- Photometry and Radiometry Facilities at SCL
- The Challenges Ahead for SCL
- SCL as an Official CCPR Observer for Hong Kong

Metrology Infrastructure of Hong Kong

Legislation of Hong Kong on Weights & Measures

Chapter:	68
Section:	8
Title:	Weight and Measures Ordinance
Heading:	Reference standards of weights and measures
(3):	The reference standards shall be in the custody of the Commissioner for Innovation and Technology(1) or the Government Chemist(2) who shall lodge them at a Government laboratory.

Notes:
(1) The HKSARG Standards and Calibration Laboratory (SCL) is Hong Kong's custodian of physical reference standards.
(2) The Government Laboratory (GL) is Hong Kong's custodian of chemical reference standards.

SCL as Hong Kong's Metrology Infrastructure

- ## Chemical Metrology

The Government Laboratory (GL): 103 years of Analytical, Advisory and Forensic Science Services

Physical Metrology

The Standards and Calibration Laboratory (SCL): 32 years of Physical Metrology Services

Wan Chai Main Lab (All physical measurements)

Kowloon Bay Branch (Force)

Representation of HKSAR for Metrology Matters

The Basic Law of the Hong Kong Special Administrative Region of the People's Republic of China

Article 139

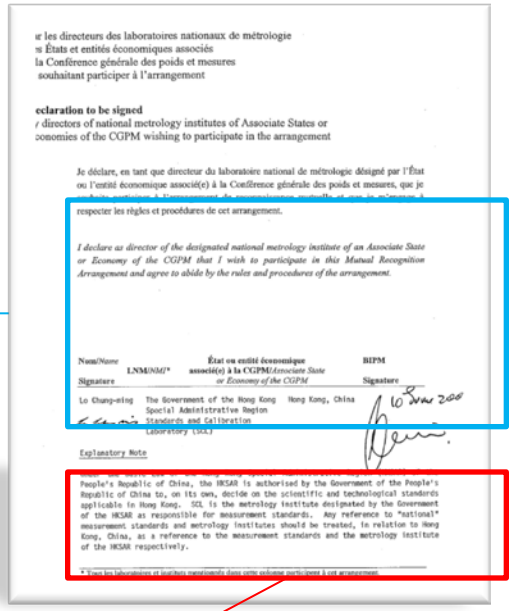
The Government of the Hong Kong Special Administrative Region shall, on its own, formulate policies on science and technology and protect by law achievements in scientific and technological research, patents, discoveries and inventions. The Government of the Hong Kong Special Administrative Region shall, on its own, decide on the scientific and technological standards* and specifications applicable in Hong Kong.

Note*: By Article 139 of the Basic Law, the SCL and GL represent Hong Kong as the Metrology Institutes on measurement matters.

SCL as an Associate of the CGPM

I declare as director of the designated national metrology institute of an Associate State or Economy of the CGPM that I wish to participate in this Mutual Recognition Arrangement and agree to abide by the rules and procedures of the arrangement.

Nom/*Name*	LNM/*NMI**	État ou entité économique associé(e) à la CGPM/*Associate State or Economy of the CGPM*	BIPM
Signature			**Signature**
Lo Chung-ming	The Government of the Hong Kong Special Administrative Region Standards and Calibration Laboratory (SCL)	Hong Kong, China	10 June 2000



Under the Basic Law of the Hong Kong Special Administrative Region (HKSAR) of the People's Republic of China, the HKSAR is authorised by the Government of the People's Republic of China to, on its own, decide on the scientific and technological standards applicable in Hong Kong. SCL is the metrology institute designated by the Government of the HKSAR as responsible for measurement standards. Any reference to "national" measurement standards and metrology institutes should be treated, in relation to Hong Kong, China, as a reference to the measurement standards and the metrology institute of the HKSAR respectively.

SCL's Participation in International Metrology Organizations

APMP: Full Member since 1997

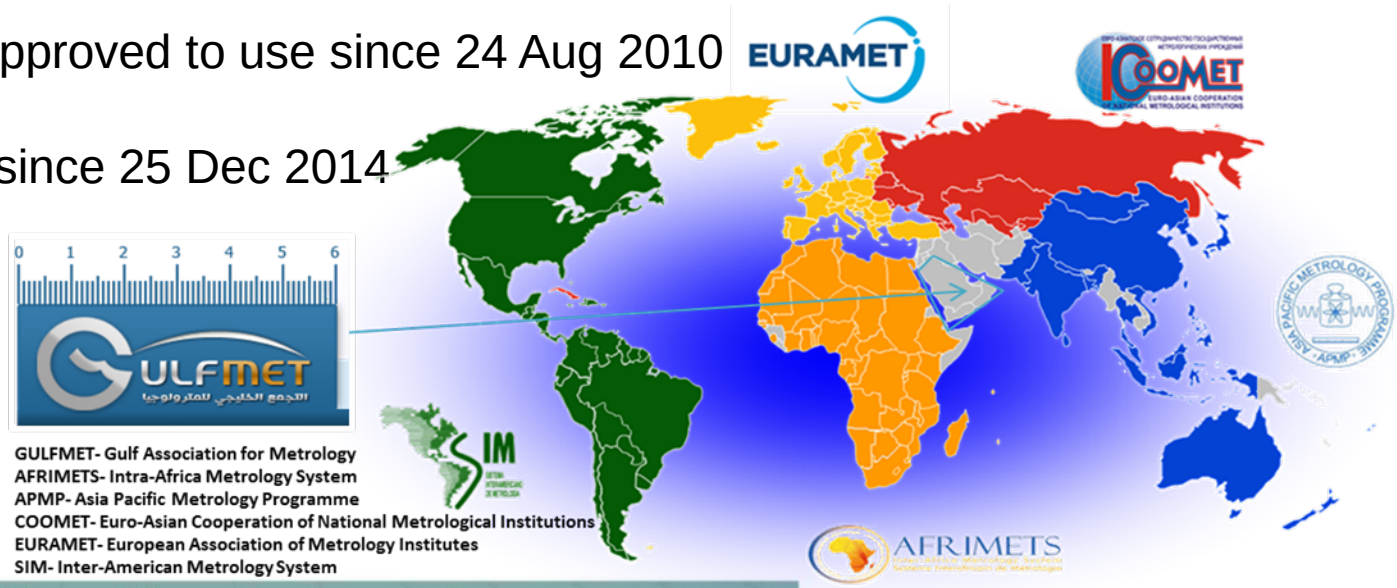
CGPM: Associate since 8 Apr 2000

CIPM MRA: signed on 31 May 2000

CMCs in KCDB: since 19 Apr 2001

CIPM MRA logo: approved to use since 24 Aug 2010

GULFMET: Associate since 25 Dec 2014



GULFMET- Gulf Association for Metrology
AFRIMETS- Intra-Africa Metrology System
APMP- Asia Pacific Metrology Programme
COOMET- Euro-Asian Cooperation of National Metrological Institutions
EURAMET- European Association of Metrology Institutes
SIM- Inter-American Metrology System

SCL's CMCs listed on the BIPM website

http://www.bipm.org/utils/common/pdf/KCDB/KCDB CMCs.pdf

Member State
Associate of the CGPM
International Organization

Distribution of CMCs recorded in the KCDB

The meanings of the acronyms are given in the last page of this document

Country	AUV				Mass and Related Quantities										Length			PR	T	TF	EM	
	A	W	V	Total	Mass 1	Dens 2	Pres 3	F 4	Torq 5	Visc 6	H 7	Grav 8	FF 9	Total	Laser	Dim Met	Total	Total	Total	Total	Total	Matrices
Albania					7									7								
Argentina	5		4	9	29	16	13	11					4	73		10	10	3	17		78	Yes (21)
Australia	13		10	23	18	2	4	5						29		6	6	17	26	21	114	Yes (10)
Austria	17		6	23	8	2	7	4		7	4	1	29	62	5	22	27	4	20	17	36	Yes (10)
Bangladesh																						
Belarus	8			8	6					2	1			9	1	12	13	3	37	31	39	Yes (2)
Belgium					10		2	3						15	3	14	17		20			
Bolivia																						
Bosnia and Herzegovina					7									7								
Botswana																						
Brazil	57		31	88	27	4	14	16	1	22			4	88	2	17	19	11	11	13	131	Yes
Bulgaria	12		18	30	8		15			1				24	3	15	18	6	32	16	58	Yes (33)
Canada	18	2	8	28	32	8	9						3	52	10	9	19	68	64	7	236	No
CARICOM																						
Chile					24			9						33		1	1		10			
China	19	3	31	53	10	4	8	3	1	15	14		12	67	2	48	50	27	30	28	238	Yes (15)
Chinese Taipei	21		18	39	10		12	4			3		21	50	1	38	39	45	27	8	140	Yes
Colombia																						
Costa Rica					24								8	32					8		54	Yes
Croatia							10							10	3	15	18		32		21	Yes (12)
Cuba													12	12					8			
Czech Republic	4		4	8	10		12	4	1				20	47	15	62	77	20	45	17	75	Yes (47)
Denmark	29		2	31	7		14	4					36	61		15	15	8	23		55	Yes (8)
Ecuador					20									20								
Egypt					7		6	4	1	5				23	2		2			4	2	Yes (1)
ESA																						
Estonia																			4			
Finland	17		13	30	8	2	14					1	3	28	11	48	59	53	44	11	99	Yes (38)
France	57		2	59	10	12	19	8	5	31			17	102	5	22	27	29	101	11	115	Yes (51)
Georgia																			9			
Germany	18	5	53	76	10	22	23	10	4	67	24		40	200	4	90	94	76	116	25	160	Yes (54)
Ghana																						
Greece					9								15	24	2	2	4		54		38	Yes (12)
Hong Kong, China	15			15	9	6	6	4	3		6			34	2	11	13		30	29	200	Yes
Hungary	6			6	8	14	16	8			5		8	59	3	16	19	57	36	5	85	Yes
IAEA																						
India	23		11	34	16	2	17	6	1	6	3		3	54	2	45	47	14	4	11	95	Yes (25)
Indonesia	15			15	24		3							27		5	5		11		49	No
Iraq																						
Ireland	4			4	7									7		13	13		33	7	170	Yes
IRMM																						
Israel																						
Italy	23	2	17	42	8	8	14	7		29	15	1	16	98	7	36	43	23	62	14	108	Yes (31)
Jamaica					22									22								
Japan	4		4	8	12	7	11	3	3	28	3		26	93	7	38	45	49	44	27	117	Yes (29)
Kazakhstan					6						8			14	3	3	6		5	4		
Kenya																						

Member State
Associate of the CGPM
International Organization

Country	Ionizing Radiation																				
	RI(I) 1	RI(II) 2	RI(III) 3	Total	QM / 1	QM / 2	QM / 3	QM / 4	QM / 5	QM / 6	QM										
Albania																					
Argentina		48		48		5	6		2												
Australia	15	32	2	49	25		4	11	18												
Austria	52	100		152				1													
Bangladesh																					
Belarus	21	30		51				13		1											
Belgium																					
Bolivia																					
Bosnia and Herzegovina																					
Botswana																					
Brazil	8	96	15	119	5		22	27	2	5											
Bulgaria	7	16		23						5											
Canada	10		1	11	22	1			39												
CARICOM																					
Chile																					
China	17	176	2	195	197	52	89	166		4											
Chinese Taipei	7	78	4	89				3													
Colombia																					
Costa Rica																					
Croatia																					
Cuba	13	63		76																	
Czech Republic	7	104	12	123				13		2											
Denmark										4											
Ecuador																					
Egypt	2			2			1														
ESA																					
Estonia																					
Finland	30			30				5													
France	82	166	15	263		13	22	39	7	3											
Georgia																					
Germany	88	158	20	266	25	31	17	82	22	7											
Ghana																					
Greece	35			35					1					1	4					6	161
Hong Kong, China					3	3			4	1			1	9	13		5			39	360
Hungary	28	78		104				19		3	4									26	397
IAEA	22			22																	22
India								1												1	260
Indonesia																					107
Iraq																					0
Ireland																					234
IRMM		110		110	30	9	10		4				9	17	6	2	30			117	227
Israel																					0
Italy	76	13	9	98				3			2	3	2	2						12	500
Jamaica																					22
Japan	18	217	13	248	70	27	12	158	22	6		3	13	5	111		72			499	1130
Kazakhstan																					29
Kenya															1					1	1

SCL's first 30 years: 1984 to 2014

1977	Hong Kong became a member economy of the Asia Pacific Metrology Program (APMP), the oldest regional metrological specialist body.
1978	Consultancy study was conducted on the needs for a metrology infrastructure for Hong Kong by Mr CH Dix, NPL(UK).
1979	A government primary standards laboratory was recommended to be established by the Advisory Committee on Diversification, initially in the fields of electrical and electronics measurements.
1984	"The HKG Standards and Calibration Laboratory (SCL)" was established, initially for Electricity & Thermometry, under the Industry Department.
1986	SCL established the Ceasium Beam Electron Clock (primary realisation of the SI unit for Hz) as HK's primary standard for frequency.
1986	SCL acquired the British Calibration Service, BCS, accreditation status. (BCS became National Measurement Accreditation Service, NAMAS and then United Kingdom Accreditation Service, UKAS, later on.)
1987	SCL established the water triple point cells (primary realisation of the SI unit for K) as HK's primary standard for temperature.

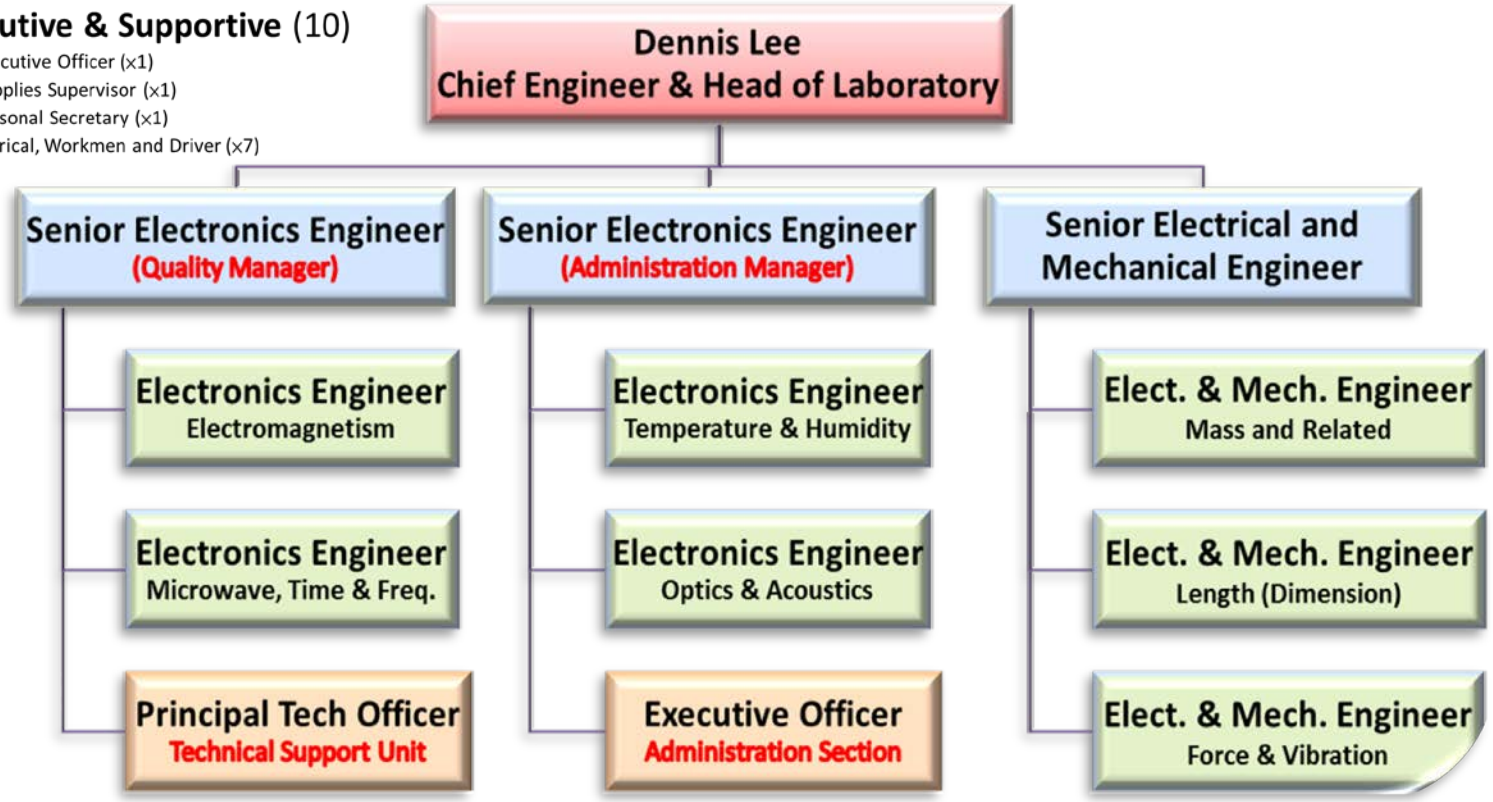
1987 to 1994	The following mechanical measurement standards were set up: Mass, Length, Pressure, Volume, Torque, Hardness.
1993	SCL acquired the BIPM Kilogram Prototype No. 75 as HK's primary mass standard with traceability directly to the SI.
1994	SCL established the High Voltage Laboratory capable for calibration of direct current electricity up to 100 kV.
1994	SCL established the Josephson Array Voltage Standard (an agreed representation of SI for volt) as HK's primary standard for electricity.
1994	SCL stopped seeking accreditation by NAMAS and changed to the Hong Kong Laboratory Accreditation Scheme (HOKLAS).
1996	SCL established the micro-calorimeter as HK's primary standard for radio frequency power with traceability to the SI.
1997	The Asia Pacific Metrology Program (APMP) Memorandum of Understanding (MoU) was drafted and SCL was the MOU signatory.

1997 and 2000	SCL was renamed as "The HKSARG Standards and Calibration Laboratory (SCL)" and came under the Innovation and Technology Commission (ITC).
1998	SCL established the Iodine stabilized Helium Neon laser, at 633 nm, as HK's primary standard for length with traceability to the SI.
2000	SCL established the Quantum Hall Resistance Standard (an agreed representation of SI for ohm) as HK's primary standard for electricity.
2000	SCL became an Associate of CGPM and signatory of the CIPM MRA.
2001	SCL's 1st batch of Calibration and Measurement Capabilities (CMC) published on the Appendix C of the CIPM MRA.
2001	A consultancy study was conducted on the role of SCL by Dr Inglis, Director of National Measurement Laboratory, CSIRO, Australia.
2001	SCL established the Force Laboratory at the PWCL Building for calibration up to 3000 kN.

2005	SCL established the facility for calibration of instruments for ultrasonic fault detection and electromagnetic compatibility testing
2005	SCL established the Acoustics Laboratory with all results traceable to the SCL primary standard (for sound level, noise dosimetric and audiometric measurement).
2008	SCL embarked on nano-metrology activities (typically for investigation of the relationship between optical and physical positions).
2011	SCL established the facility for magnetic measurement.
2012	SCL established the facility for air speed measurement.
2013	SCL established the facility for photometry and radiometry for calibration of quantities related to luminous intensity in the unit of candela.
2014	SCL celebrates its 30th Anniversary!

Organization Structure of SCL

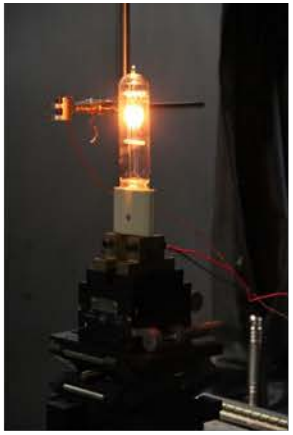
- **Professional** (11)
  - HL (Chief Engineer x1)
  - SLs (Senior Engineers x3)
  - ELs (Engineers x7)
- **Technical** (23)
  - PT (Principal Technical Officer x1)
  - STOs (Senior Technical Officers x11)
  - TOs (Technical Officers x11)
- **Executive & Supportive** (10)
  - Executive Officer (x1)
  - Supplies Supervisor (x1)
  - Personal Secretary (x1)
  - Clerical, Workmen and Driver (x7)



Contents

- The Standards and Calibration Laboratory (SCL)
- Photometry and Radiometry Facilities at SCL
- The Challenges Ahead for SCL
- SCL as an Official CCPR Observer for Hong Kong

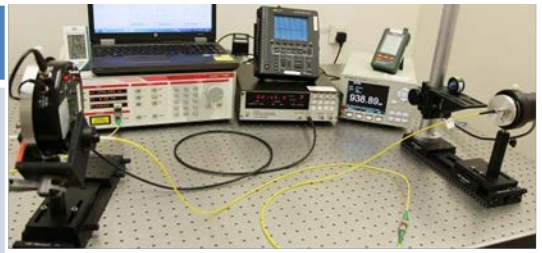
SCL's Photometry and Radiometry Capabilities

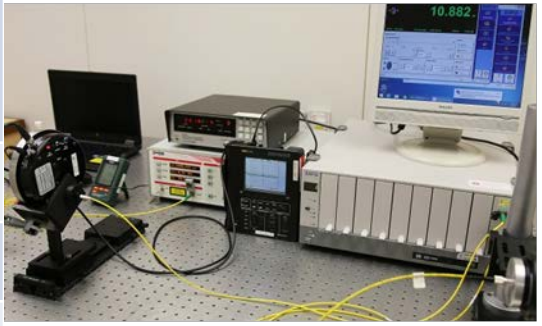


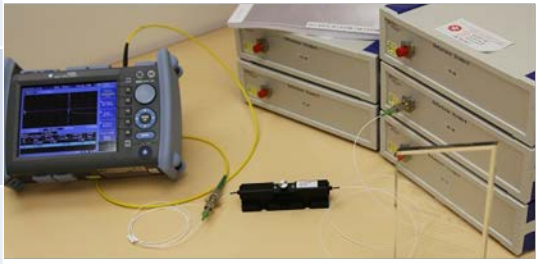
It started on some wooden benches in the direct current electrical laboratory in 2012.

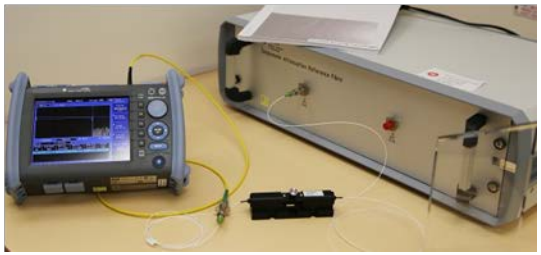
SCL's Accredited Optical Calibration Services

Item / Materials to be tested	Parameters
Light Sources	Total Luminous Flux Luminous Intensity Correlated Color Temperature Spectral Radiant Flux Spectral Irradiance / Radiance
Luxmeters	Illuminance
Broadband Detectors	Spectral Power Responsivity
Optical Filters	Regular Spectral Transmittance
Optical Time Domain Reflectrometers	Location, Loss, Reflectance deviation
Optical Fibre Power Meter, Laser Source, Wavelength Meter	Power, Wavelength
Optical Fibre attenuator	Absolute attenuation, step attenuation



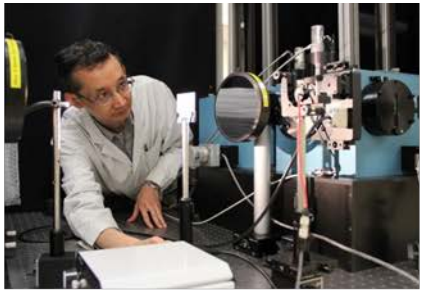
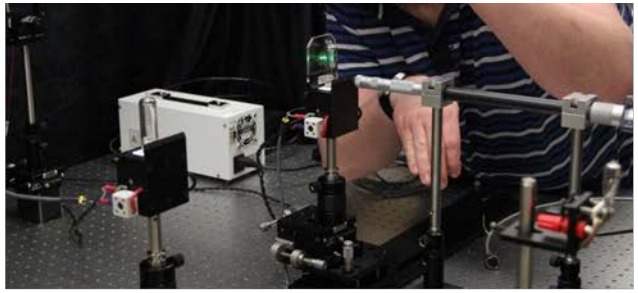


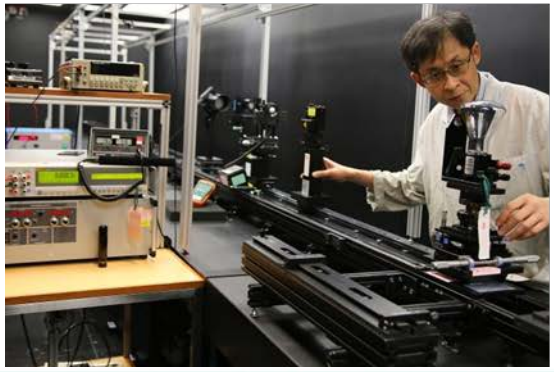
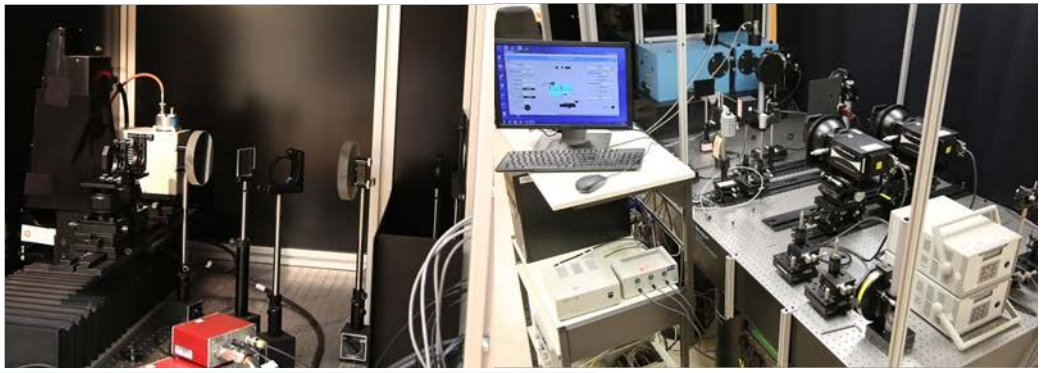




SCL's Accredited Optical Proficiency Testing Service

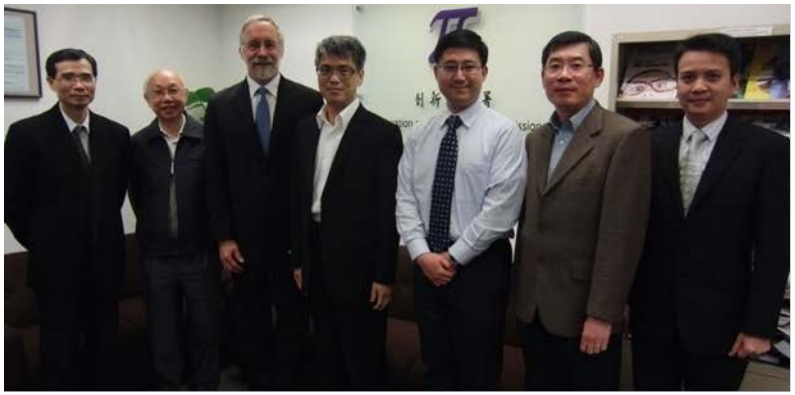
Proficiency Testing Item	Measurement Range
Illuminance Meter	Illuminance at color temperature of 2856 K over 1 lx to 3000 lx
Tungsten Standard Lamp	Luminous intensity at color temperature of 2856 K at nominal values of 280 cd and 1000 cd
Unfiltered photometer	Spectral power responsivity over the wavelength range from 300 nm to 1000 nm

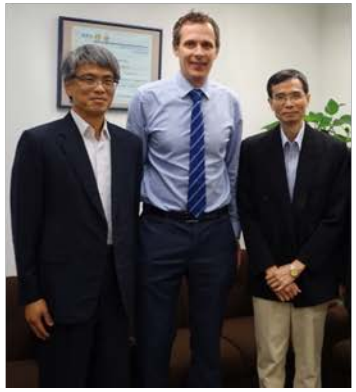



Accreditation of SCL's optical PTP service

Accreditation of SCL's optical calibration service



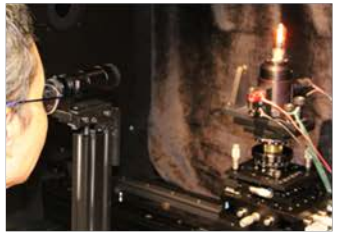


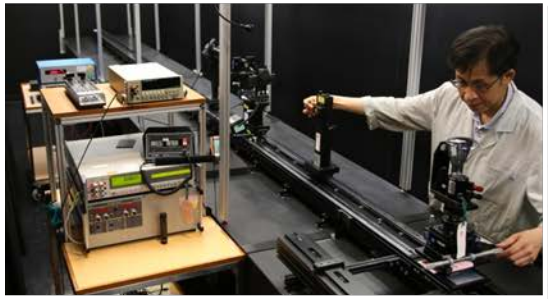
Date	Peer Reviewer	Area
Nov 12	Liu Yuanjie, NMC, A* Star	Illuminance
Nov 14	Teresa Goodman, NPL(UK)	Special Radiance & Irradiance
Jul 15	Dan Tholen, convener of WG for ISO/IEC 17043	Proficiency Test Provider
Aug 15	Andrew Deadman, NPL (UK)	Luminous and Radiant Flux

SCL Photometry & Radiometry Calibration Service

Customer (Outside Hong Kong)	Equipment
Agencia Comercial Wardley Lda. (Macau SAR)	Illumin. Meter
SONJU Engineering Services (Philippines)	Light Meter
Stryker China Limited (Mainland China)	Light Meter
Waga Calibration Svc. (PVT) Ltd. (Sri Lanka)	Chroma Meter

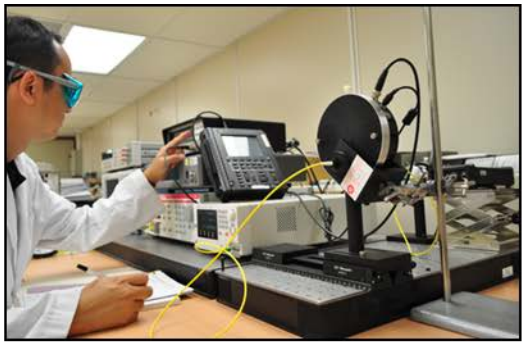
Customer (Public Sector)	Equipment
Government Laboratory	Light Meter
Highways Department	Lux Meter
Labour Department	Illuminance Meter
Leisure and Cultural Services Department	Lux Meter



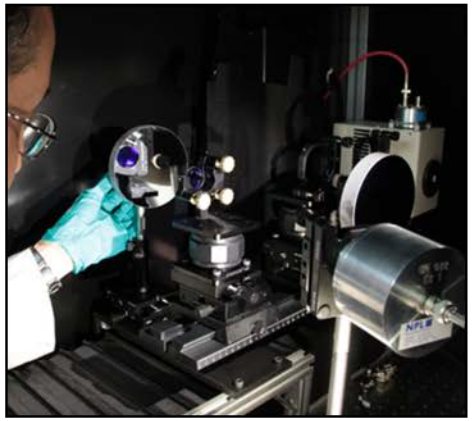


Customer (Private Sector)	Equipment
Intertek Testing Services Hong Kong Ltd	Standard Lamp & Light Meter
Hong Kong Productivity Council	Standard Light Source
API Lab Testing Limited	Luxmeter
C & K Instrument (HK) Ltd.	Standard Illuminance Meter
Geotechnics & Concrete Engineering (HK) Ltd	Luxmeter
Goodrich Asia-Pacific Ltd.	Light Meter
Hong Kong Calibration Ltd.	Standard Illuminance Meter
Iu Cheong Electric Co Ltd	Light Meter
JFC Testing and Inspection Company Limited	Light Meter
Lee & Co., Engineering Ltd.	Light Meter
Mak Hang Kei (HK) Construction Limited	Standard Illuminance Meter
Maxlab Calibration Centre Limited	Luxmeter
Takasago Thermal Engineering Co Ltd	Light Meter

Other Optical Calibration Services



Optical Fiber Power Sources/Meters and Optical Time-Domain Reflectometers
(Photonic Measurements for Optical Communications)



Standard Reference Glass Filters
(Spectrophotometry: Spectral Transmission)

Technical Publications

Commission on Illumination (CIE) Conference (2015)

EVALUATION OF MEASUREMENT UNCERTAINTY FOR PHOTOMETRIC, RADIOMETRIC AND PHOTONIC MEASUREMENTS IN ACCORDANCE WITH THE JCGM100:2008 AND JCGM 101:2008 AT THE STANDARDS AND CALIBRATION LABORATORY OF HONG KONG

Author(s): Lee, W.K. Dennis, Yan, Y.K. Aaron, Lam, H.S. Brenda, Ko, C.K. Samuel
The Government of the Hong Kong Special Administrative Region, Standards and Calibration Laboratory (SCL)

Abstract: SCL has developed new capabilities in photometric, radiometric and photonic measurements. The measurement systems, measurement models and uncertainty evaluation in accordance with the JCGM 100 are described. This paper also detailed the use of the SCL in-house developed software tool to validate the uncertainty esimtation in accordance with the JCGM 101.

1. Photometric measurement
2. Radiometric measurement
3. Photonic measurement
4. MCM simulation tool developed by SCL
5. Validation of measurement results

Innovation and Technology Commission, HKSARG
The Government of Hong Kong SAR, Standards and Calibration Laboratory, 36/F, Immigration Tower, 7 Gloucester Road,Wanchai, Hong Kong
Email: skyuan@itc.gov.hk

NCSLI Measure Journal (2015)

TECHNICAL PAPERS

Calibration of Optical Fiber Laser Sources

Samuel C. K. Ko, Aaron Y. K. Yan, and Barry K. Y. Chan

Abstract: A calibration system for optical fiber laser sources has been developed at the Government of the Hong Kong Special Administrative Region Standards and Calibration Laboratory (SCL). The measurements of wavelength, output power level and output power stability of optical fiber laser sources fitted with fiber channel/angled physical contact (FC/APC) connectors are detailed. The wavelength is directly measured by the laboratory wavelength meter. The standard measurement uncertainty obtainable by this calibration method is less than 1 picometer (pm). The output power is the summation of the measured power by the laboratory's electrically calibrated pyroelectric radiometer (ECPR), and the insertion loss between the source and the ECPR with a standard measurement uncertainty of about 3.7 %. The output power stability is evaluated by measuring the maximum and minimum fluctuation of the measured optical power using the laboratory ECPR which has three significant digits of resolution.

1. Introduction

The demand for fiber to the home (FTTH) has been growing rapidly in recent years. As a result, optical testing technology for the construction and maintenance of optical fiber cable networks has become important [1]. The fiber optic power meter, fiber optic source, optical loss test set, fiber optic spectrum analyzer and Optical Time-Domain Reflectometer (OTDR) are instruments commonly used for this purpose [2].

The calibration procedures for optical fiber power meters, wavelength measurement instruments, and OTDRs have been standardized by *IEC 61315* [3], *IEC 62129* [4], and *IEC 61746* [5], respectively. Standardization plays an important role in guaranteeing the performance of the optical measurement equipment. The international standard for the calibration of tunable laser sources, *IEC 62522*, has not yet been finalized [1].

SCL has developed a calibration system for optical fiber laser sources fitted with FC/APC connectors at 1310 nm and 1550 nm in the power range of 0.01 mW to 1 mW. The system provides for the calibration of three laser source parameters: output wavelength, output power, and output power stability. Figure 1 shows the metrological traceability of the optical laser source calibration system at SCL. The wavelength is measured by the laboratory wavelength meter traceable through measurements made by the Federal Institute of Metrology (METAS), the national metrology institute of Switzerland. The power and stability measurements are made by using an electrically calibrated pyroelectric radiometer (ECPR), which plays two main roles in the laser source calibration: power measurement and insertion loss measurement. The measurement setup at SCL for the laser source calibration is shown in Fig. 2. To minimize the errors due to non-centering of radiation through the chopper aperture, an oscilloscope is connected to the ECPR's mixer output to monitor the error signal amplitude. The chopper is repositioned until minimum error amplitude is reached.

The following sections of this paper detail the optical fiber laser source calibration procedures and list the uncertainty components of each calibration parameter.

2. Output Power Calibration Procedures

SCL uses a calibrated ECPR, which is traceable through measurements made by the National Institute of Standards and Technology (NIST) through their Laser Optimized Cryogenic Radiometer (LOCR) [6] at 1 mW, to measure the optical laser source power. The block diagram of the measurement setup is shown in Fig. 3. The ECPR has a thermal detector which has a black, highly absorbent coating. It has an output that is spectrally insensitive over the wavelength regions of interest for photonics equipment calibrations. ECPR is frequently used as a laboratory standard because (1) it is sensitive to low power radiation; (2) it is relative spectrally flat, (3) it has low surface reflectance in the 600 nm to 1600 nm wavelength range; and (4) it is insensitive to angle of incidence. The sensor produces an electrical voltage proportional to instantaneous temperature changes, so the

Authors
Samuel C. K. Ko
samuel.ko@itc.gov.hk
Aaron Y. K. Yan
skyan@itc.gov.hk
Barry K. Y. Chan
ecl_rf@itc.gov.hk
The Government of the Hong Kong Special Administrative Region Standards and Calibration Laboratory (SCL)
36/F Immigration Tower, 7 Gloucester Road, Wan Chai, Hong Kong

NCSLI Workshop & Symposium (2016)

Best Paper Award

Calibration of Optical Fiber Time Domain Reflectometers in Accordance with IEC61749-1:2009

Speaker: Samuel C. K. Ko
samuel.ko@itc.gov.hk

Authors: Samuel C. K. Ko and Aaron Y. K. Yan

The Government of the Hong Kong Special Administrative Region
Standards and Calibration Laboratory
36/F Immigration Tower, 7 Gloucester Road, Wan Chai, Hong Kong

Abstract: This paper describes the calibration system developed by the Standards and Calibration Laboratory (SCL) for calibrating single mode optical time domain reflectometers (OTDR) fitted with FC connectors at wavelength 1310 nm and 1550 nm in accordance with the international standard *IEC 61746-1:2009*. The parameters calibrated include distance deviation, attenuation deviation and reflectance deviation. The principle of the calibration is to compare a set of reference standards, namely distance calibration artifact, attenuation calibration artifact and reflectance calibration artifacts against the measured values by the OTDR under test. The expanded measurement uncertainties for the distance, attenuation and reflectance deviation calibration are 2 m, 0.04 dB and 1.7 dB respectively.

1. Introduction

Optical time domain reflectometers (OTDR) are widely used in testing, installation and maintenance of optical communication networks. An OTDR launches a series of high speed pulses into a fiber network and measures the amplitude and the delay time of reflected or backscattered signals to locate events or faults along a fibre link. The measured response typically exhibits three types of features as shown in Fig. 1:

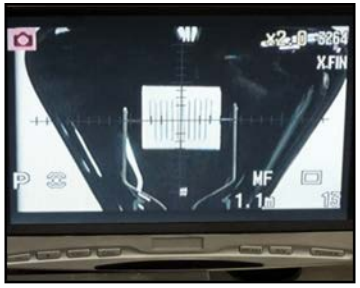
1) Rayleigh back-scattering ;
2) Positive spikes caused by discrete Fresnel reflection due to events or faults along a fiber link;
3) Steps that can either be positive or negative depending on physical fibre properties.

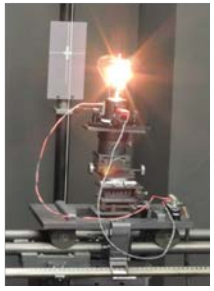
Figure 1. Trace produced by recirculating delay line.

Participation in Inter-laboratory Comparison

APMP Comparison of Luminous Intensity (APMP. PR-K3.a)

Metrology area, branch	Photometry and Radiometry, Photometry
Description	Luminous intensity
Time of measurement	2012 - 2014
Status	In progress
Reference(s)	APMP.PR-K3.a Technical Protocol
Measurand	Luminous intensity in cd
Transfer device(s)	Lamps
Comparison type	Key comparison
Consultative Committee	CCPR (Consultative Committee for Photometry and Radiometry)
Conducted by	APMP (Asia Pacific Metrology Program)





CMS	ITRI Center for Measurement Standards *Chinese Taipei*, APMP
KazInMetr	Kazakh Institute of Metrology RSE *Kazakhstan*, COOMET
MSL	Measurement Standards Laboratory of New-Zealand *New Zealand*, APMP
NIM	National Institute of Metrology *China*, APMP
NIMT	National Institute of Metrology (Thailand) *Thailand*, APMP
NIS	National Institute for Standards *Egypt*, AFRIMETS
NMC, A*STAR	National Metrology Centre, Agency for Science, Technology and Research *Singapore*, APMP
NMIJ AIST	National Metrology Institute of Japan *Japan*, APMP
NMISA	National Metrology Institute of South Africa *South Africa*, AFRIMETS
NML-SIRIM	National Metrology Laboratory, SIRIM Berhad, **now NMIM - National Metrology Institute of Malaysia** *Malaysia*, APMP
NPLI	National Physical Laboratory of India *India*, APMP
Puslit KIM-LIPI	Research Center for Calibration, Instrumentation and Metrology – Indonesian Institute of Sciences *Indonesia*, APMP
SCL	Standards and Calibration Laboratory *Hong Kong, China*, APMP
VMI-STAMEQ	Vietnam Metrology Institute, Directorate for Standards and Quality *Viet Nam*, APMP

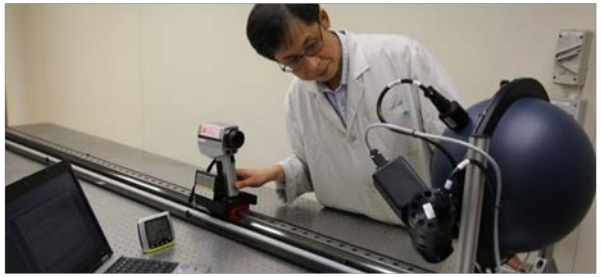
Contents

- The Standards and Calibration Laboratory (SCL)
- Photometry and Radiometry Facilities at SCL
- The Challenges Ahead for SCL
- SCL as an Official CCPR Observer for Hong Kong

On-going Projects for New Capabilities

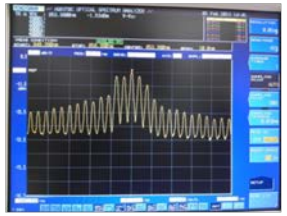
Luminance Meters

Range : (50 to1000) cd m^{-2}
Target Completion: Q1 2017

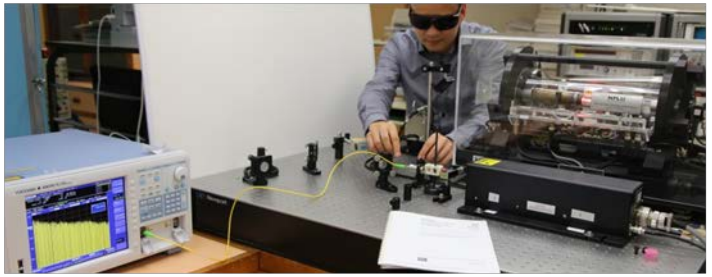


Target clients: airline operators
(e.g. Cathay Pacific Airways)
Applications: for flight stimulators

Optical Spectrum Analyzers



Range : (600 to 1700) nm
Target Completion: Q4 2017

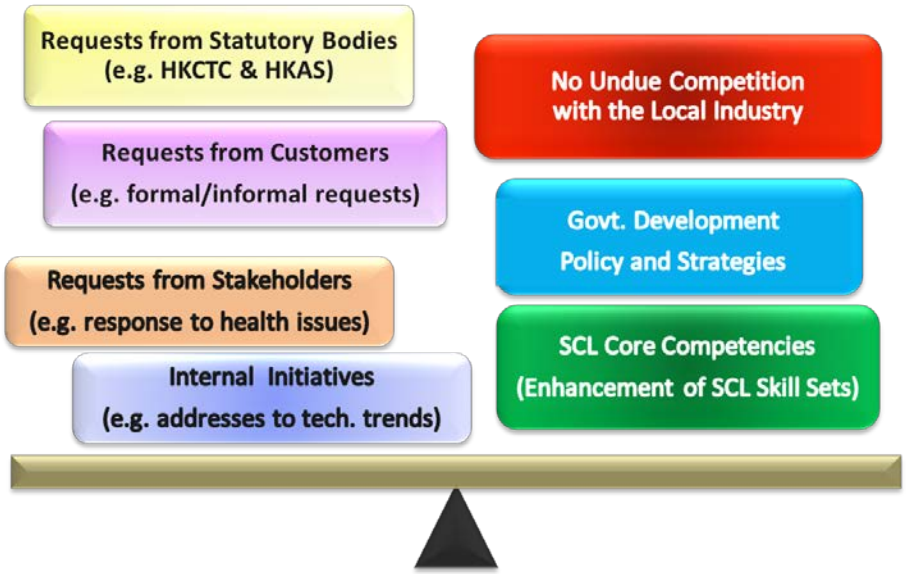


Target clients: Testing laboratories or optical communications manufacturers
Applications: equipment calibration in accordance with IEC 62129-1:2016

New Initiatives for Capability Development

SCL's role is to provide metrology supports to:

- Testing & Certification Industry
  - e.g. needs of accredited organizations
- Optical Communications
  - e.g. fiber optics
- Energy Efficiency
  - e.g. LED lighting



Supporting the Testing & Certification Industry

HKAS endorsed test certificates are accepted by over 70 ILAC MRA Partners from more than 60 economies.

Company	Test Category	Test Item	Specific Test
Fugro Technical Services Limited	Environmental Testing	Biosafety Cainetry	Lighting intensity test
Intertek Testing Service Hong Kong Limited	Lamps and Light Fitting	Product performance tests	Luminous flux, Colour temperature, Colour rendering index
		LED	Beam angle, Chromaticity shift, Correlated colour temperature, Lumen maintenance,
Bureau Veritas Hong Kong Limited	Luminaries	Compliance Inspection and Safety Tests	Various
TUV Rheiland Hong Kong Limited			
DEKRA Certification Limited			
HK Standards and Testing			

Many T&C organizations have been accredited by the Hong Kong Accreditation Service to provide optical related testing and certification.

Company	Test Category	Test Item	Specific Test
SGS Hong Kong Limited	Spectacles	Unmounted lens for non-prescription sunglasses	Optical requirements, Optical test methods, Physical requirements, Physical test methods, Impact-resistance test, Optical properties, Physical properties, Test methods.
		Lens in non-prescription sunglasses	
		Non-prescription sunglasses	
ANSECO Group (HK) Limited		Uncut finished spectacle lenses	
		Uncut finished single-vision & multifocal spectacle lenses	
		Uncut finished progressive spectacle lenses	
		Uncut finished spectacle lenses	

Company	Test Category	Test Item	
SGS Hong Kong Limited	Textiles and Garments	Colour measurement	
UL VS Hong Kong Limited		Colour fastness tests	cleaning
Bureau Veritas Hong Kong Limited		Solar UV Protective Properties	EN 13758-1

SCL is expected to provide calibration services to support them.

Supporting the Telecommunication Industry

Sizes of the Industry (Statistics in 2015):

- Mobile subscriber penetration rate : 227.8 %
- Mobile subscriber: 16,684,735
- Household broadband penetration rate: 84.7 %
- Registered broadband household: 2,364,736

Service demands:

- Telecommunication operators
- Testing laboratories
- Public utilities
- Regulatory Bodies (Govt. Depts)

Typical calibration service:

- Optical spectrum analyzers
- Optical fibre characterization
- Optical power meters
- Wavelength meters
- Optical attenuators
- Optical Time Domain Reflectometer
- Others

Supporting Environmental Friendly Lighting

In HK, changing lights bulbs to LED lighting is a huge project, which involves:

Hong Kong International Airport (one of the world's busiest airport)

- Passengers: 68.5 million per year
- Cargo handled: 4.38 million tons per year
- Air traffic movements: 406,000 planes per year

Hong Kong Railway System (one of the world's busiest railway systems)

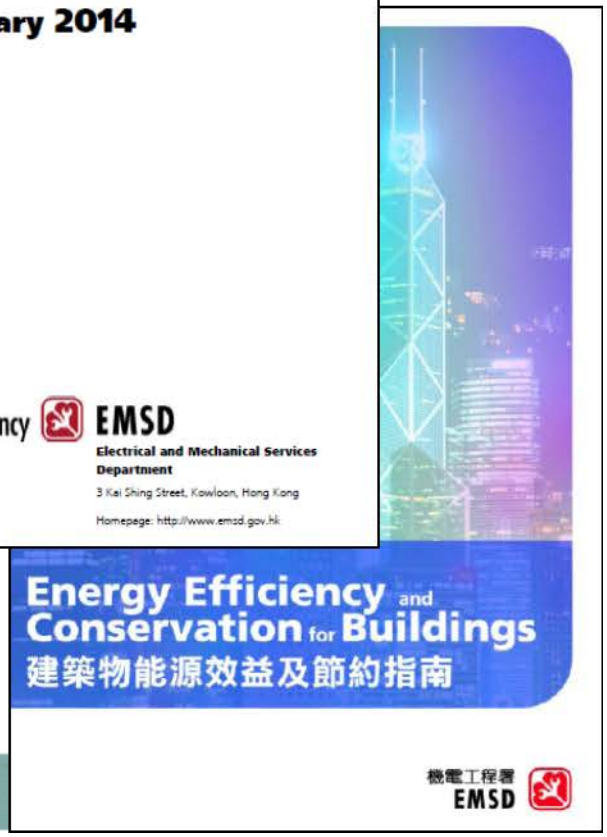
- Lines: 22
- Length: over 210 km
- Stations: 87
- Daily passengers: 5.2 million people

Hong Kong's Public Housing Estates (one of the world's largest housing provider

- 29 % of Hong Kong's population
- Units: 782,700
- Tenants: 2.12 million people

Optical Measurement for Energy Efficiency

Statutory requirements, guidelines, codes of practices and schemes are issued for law enforcement, which demands metrology supports.



Contents

- The Standards and Calibration Laboratory (SCL)
- Photometry and Radiometry Facilities at SCL
- The Challenges Ahead for SCL
- SCL as an Official CCPR Observer for Hong Kong

SCL would like to join CCPR as an observer

- Work in photometry and radiometry at SCL is in line with CCPR activities
- SCL would like to participate in CCPR working groups and workshops in order to stay at the metrological forefront and strategically positioned in future metrology development
- SCL would like to participate in CCPR meetings in order to network with experts of the field as well as to contribute its views and experience

Thank You