SPECTRAL RADIANCE CALIBRATION SERVICE

On-site Service for Recalibration and Servicing of Uniform Source Systems

SERVICE RECOMMENDED IF

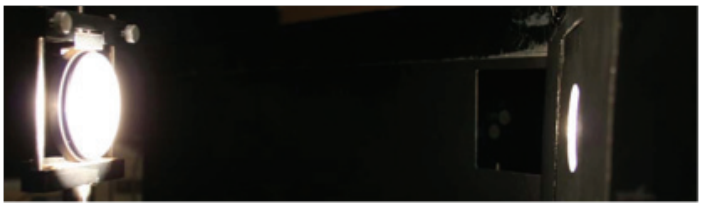
System lamps have been operated for more than 50 hours

Uniform source system is more than two years old

System has operated or been stored in dusty environment

Quality Management System mandates annual calibrations on critical measurement equipment

Monitor detector disagrees with the original calibration certificate



The spectral radiance measurement service of an integrating sphere source of uniform radiance ("uniform source") is performed by direct comparison of measurements carried out with equipment and methods traceable to the NIST. Measurement uncertainty is determined by best practices of expressions of uncertainties.

The measurements are accomplished by referencing a calibrated Spectralon target of known diffuse reflectance factor that is irradiated by an FEL type tungsten halogen spectral irradiance lamp standard. The Spectralon target becomes the reference source of spectral radiance expressed as:

$$L_\lambda = \frac{E_\lambda \rho_\lambda}{\pi} \qquad (mW/cm^2\ sr\ \mu m)$$

Where L is the spectral radiance of the target, E is the spectral irradiance of the FEL at its calibrated distance and ρ is the spectral reflectance factor of the Spectralon target.

The spectral radiance is then used to calibrate the field service spectroradiometer. The spectroradiometer spectral radiance responsivity is achieved by scanning and collecting the spectral radiance of the irradiated target and recording the responses. The spectral radiance responsivity calibration is performed on a full range UV-VIS-NIR dispersive spectroradiometer. The spectral measurements are performed with this FOV positioned at the center of the plane of the diffuse target. The radiance of the Spectralon target is transferred to the diffraction grating array spectrometer with a fixed mounted 1.2 meter metal clad fiber optic cable coupled to a 5 degree field of view foreoptic radiance detector head via an SMA-905 connector. Long pass order sorting filters are used reduce stray light and block higher orders. The complete spectral measurement range requires three array detectors and three diffraction gratings. A 512 element UV enhanced Si array is used for the 300 to 1000 nm spectral region. From 1000 to 1900 nm a 256 element extended InGaAs array is used and a second 256 extended InGaAs array is used from 1900 nm to 2400 nm.

SERVICE FEATURES

Professional assessment of the overall condition of system

Relamping the sphere with before and after measurements

Power supply calibration option

NIST traceable measurements with reported uncertainty

Calibration is certified on-site

Minimal downtime with flexible scheduling

The spectroradiometer spectral radiance responsivity calibration is performed in Labsphere's radiometric laboratories prior to performing the spectral radiance measurement field service. The uncertainty of the instrument calibration in the lab is expanded to determine the uncertainty of the measurements in the field. The uncertainty of the target radiance is defined as:

$$L_e = \frac{\beta \rho_{45} E_{e0} \left(\frac{I_e}{I_{e0}}\right)^{M_I} (1-\alpha\Delta t) 50^2}{\pi \sqrt{D^2 - x^2 - z^2}}$$

Where:
β is angular dependency of the target reflectance factor
ρ is the Spectralon target spectral reflectance factor
E is the Spectral irradiance of the FEL reference standard
I is the FEL operating current
M is FEL irradiance relationship factor
$(1-\alpha\Delta t)$ is the FEL tungsten halogen lamp aging factor
D is the calibration distance of the FEL
x is the lateral tilting offset of the distance measurement, and
z is the offset of the between the target and the center and the reference plane of the target

Applied, the irradiated target spectral radiance expanded relative uncertainty in coverage factor k=2 is presented in Table 1[1].

TABLE 1

Wavelength (nm)	Spectral Radiance Expanded Relative Uncertainty (k=2)
350	2.3%
450	2.0%
555	1.9%
654.6	1.8%
900	1.9%
1600	2.0%
2000	2.1%
2300	1.9%
2400	2.2%

The values in Table 1 are used to determine the uncertainty of the field spectrometer responsivity calibration which in turn is used to determine the expended relative uncertainty of the on-site spectral radiance measurements. Estimated uncertainties are available upon request.

[1] Actual values subject to vary with reference lamp standard usage.

Labsphere, Inc. · 231 Shaker St. · North Sutton, NH 03260 · USA · Tel: +1 (603) 927-4266 · www.labsphere.com
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SPECIFICATIONS OF TRANSFER SPECTRORADIOMETER

Specifications	Min	Typ	Max	Unit	Comment
Wavelength Range	300		2400	nm	
Spectral Resolution		≤4		nm	300 to 1000
Spectral Resolution		≤10		nm	1500
Spectral Resolution		≤7		nm	2400
Spectral Sampling		≤2		nm	300
Spectral Sampling		≤1.5		nm	350 to 1000
Spectral Sampling		≤3.8		nm	1500
Spectral Sampling		≤2.5		nm	2400
Wavelength Accuracy			0.5	nm	300 to 2400
Wavelength Reproducibility			0.1	nm	300 to 2400
Spectrometer Type					Diffraction Grating (3)
Detector Array Types	300		1000	nm	512 UV Enhanced Si Array
Detector Array Types	970		1900	nm	256 UV Enhanced InGaAs Array
Detector Array Types	1900		2500	nm	256 UV Enhanced InGaAs Array
Optical Fiber					1.2m Metal Clad
Optical Fiber Length		1.2		m	
Radiance Head		5		degree	FOV
Shutter					Mechanical
Operating Temperature Range	15		3	°C	
Power Input					110/220VAC 50/60Hz

PART NUMBERS FOR ORDERING

RC-00001-000 1 Day Spectral Radiance Calibration Service*
RC-00002-000 2 Day Spectral Radiance Calibration Service*
RC-00003-000 On-Site Power Supply Calibration

*The requirement for a 1 or 2 day service will be determined through a site survey questionnaire and advisement with Labsphere's service department.