National Renewable Energy Laboratory

Memo

To: Daryl Myers and Thomas Stoffel

From: Afshín M. Andreas

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Subject: Calibration of SRRL Baseline Measurement System (BMS) Direct UVA Radiometers
Instruments: Kipp & Zonen CUVA2 s/n 961003

NREL PV Radiometric Measurements Task monitored the millivolt output of one (1) BMS Direct UVA Radiometer while measuring the spectral distribution of natural sunlight in direct normal incidence mode on 5 September 2006 from 280 nm and 400 nm at 2nm steps using an Optronic Laboratories OL-756 (double monochromator UV spectroradiometer).

The OL-756 spectrometer calibrated against NREL's National Institute of Standards and Technology (NIST) Standard of spectral irradiance F407 on 12 April 2006. Spectral data was corrected based on measurements of the EKO portable light source made on April 12 and September 5, 2006, which was on average of about 5% increase across all wavelengths. A calibration multiplier of 13.37 was used to take into account the use of the Optronic Labs Direct Normal Tube.

The spectra were integrated between 315 nm and 400 nm to produce the total power under each spectral distribution. All data were used to compute the calibration factors shown in Table 1.

Table 1. September 5, 2006 NREL Direct UVA Calibration Summary

Time (MST)	Spectrum W/m^2	CUVA2 V (avg.)	$W/m^2/V$
13:17	29.64685	-0.37323	**-79.4328**
13:20	29.39088	-0.36841	**-79.7770**
13:23	28.92861	-0.36468	**-79.3261**
13:26	29.32043	-0.37035	**-79.1705**
13:28	28.97019	-0.36715	**-78.9059**
13:31	28.76731	-0.36514	**-78.7833**
13:34	28.60859	-0.36169	**-79.0979**
		Avg.	**-79.213**
		Sigma	**0.335**

UNCERTAINTY

The estimated uncertainty in the OL-756 spectral irradiance calibration is ±4.0% from 300 nm to 400nm.The accuracy of the CR23X data logger was about 0.8%. Estimated uncertainty in the derived calibration factor is ±4.8% (limit of error). Spectral data is plotted on the back of this sheet.

OL756 Direct Normal Spectra and CUVA2 Normalized Spectral Response