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# Ossila Solar Simulator Calibration Certificate

<b>Manufacturer</b>	Ossila Limited
<b>Model</b>	G2009 - Solar Simulator
<b>Simulator Type</b>	Steady-State
<b>Intended Use</b>	Electrical Performance Measurements
<b>Certificate Number</b>	0017
<b>Serial Number</b>	17
<b>Date of Calibration</b>	2023-08-14
<b>Classification Used</b>	IEC 60904-9:2020 (Edition 3.0)
<b>Calibrated by</b>	T Jaskiernia

The measurement equipment used for calibration is traceable to national standards of the National Institute of Standards and Technology (NIST), Physikalisch-Technische Bundesanstalt (PTB), or other national or international standards which realise the units of measurements according to the International System of Units (SI).

Measurements were performed in accordance with international standard IEC 60904-9:2020 (Edition 3.0).

Spectral match calibration used a JETI Specbos 1211-UV-2 with serial number 2221542 and calibration mark 5764 WK-L 2022-05.

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# Classification

- Classification uses the extended wavelength range (300 - 1200 nm) from IEC 60904-9:2020 (edition 3.0).
- All classification measurements were performed with the lamp at 100% power.
- The designated test area was a 15.0 mm radius circle centred beneath the lamp.

## Spectral Match

**Table 1:** Percentage of total irradiance in each wavelength band and classification at 4 locations relative to centre.

Position (mm)	300 - 470 nm	470 - 561 nm	561 - 657 nm	657 - 772 nm	772 - 919 nm	919 - 1200 nm	Classification
[0.0, 0.0]	16.85%	17.45%	17.40%	16.54%	16.92%	14.07%	A
[-15.0, 0.0]	15.51%	17.32%	17.39%	16.54%	17.41%	15.06%	A+
[7.5, 13.0]	15.76%	16.91%	15.90%	16.83%	18.51%	15.35%	A+
[7.5, -13.0]	17.11%	17.67%	16.17%	15.21%	19.03%	14.08%	A

## Spatial Non-Uniformity

**Table 2:** Diameter, average irradiance, and standard deviation of irradiance of illumination area for each classification level.

Classification	Diameter (mm)	Non-Uniformity (%)	Average Irradiance (W/m <sup>2</sup> )	Standard Deviation of Irradiance (W/m <sup>2</sup> )
A+	13	1	1057.43	6.03
A	18	2	1046.62	12.08
B	28	5	1015.97	30.22
C	36	10	970.61	58.63

## Temporal Instability

**Table 3:** Short term and long term temporal instability and classification. Sampling rate for temporal instability measurements was ~1.5 Hz.

Instability Type	Instability (%)	Uncertainty (±)	Classification
Short Term	0.48	0.07	A
Long Term	0.59	0.04	A+

## Classification Data

Spectral irradiance, spectral irradiance uncertainty, and spatial irradiance data can be found on the USB drive provided with the Solar Simulator. This data can also be requested by emailing Ossila at [info@ossila.com](mailto:info@ossila.com).

## Verification of Classification

Verification of the classification of the Solar Simulator will be required if the lamp hours exceed the maximum hours stated in this data sheet.

# Other Specifications

Lamp Output	
Irradiance (at 100% power)	1000 W/m <sup>2</sup>
LED Temperature During Classification	41.57 °C
Warm Up Time	5 minutes 0 seconds
Spectral Deviation	67.13%
Spectral Coverage	83.56%
Maximum I-V Measurement Time	600 seconds
Lamp Hours	
Time on Lamp	7.05 hours
Maximum Lamp Time	10000 hours
Operating Conditions	
Working Distance	85 mm
Ambient Temperature Range	5°C to 40°C
Maximum Relative Humidity	80% at 31°C
Miscellaneous	
Power Requirements:	24 VDC / 1.8 A

# Methodology

## Spectral Match

Spectral irradiance and total irradiance were measured using a JETI Specbos 1211-UV calibrated spectroradiometer. The Solar Simulator was positioned 85 mm above the spectroradiometer and measurements were performed at 4 positions: centred beneath the Solar Simulator, and 3 positions equally spaced 15.0 mm from the centre. Spectral irradiance data was split into the wavelength bands specified in IEC 60904-9:2020 (Edition 3.0) and integrated to obtain the irradiance in each band. The proportion of the total irradiance that each band contributes was then compared to the values in IEC 60904-9:2020 (Edition 3.0) to determine the classification.

## Spatial Non-Uniformity

Spatial non-uniformity was measured using a Broadcom AFBR-S20M2WV Qmini Spectrometer. The spectrometer was positioned 85 mm beneath the Solar Simulator and moved over a 40.0 x 40.0 mm area in steps of 2.5 mm. At each point, 1 spectral irradiance measurement was performed, and the average and standard deviation determined. The mean spectrum was integrated to obtain the total irradiance at each point. Once all points in the area had been measured the areas of different classification levels were determined in accordance with IEC 60904-9:2020 (Edition 3.0).

## Temporal Instability

Temporal instability was measured using a Broadcom AFBR-S20M2WV Qmini Spectrometer. The spectrometer was centred 85 mm beneath the Solar Simulator. Spectral irradiance measurements were performed at a rate of approximately 1.54 Hz for 10.0 minutes, and each measurement was integrated to obtain the irradiance. For short-term instability the maximum instability value of each adjacent pair was calculated. For long-term instability the data was split into 5 equal sections and calculated for each section according to IEC 60904-9:2020 (Edition 3.0).