



Integrating Sphere Test Report

Test results reported for:

Part number: **Revolution Microelectronics V1000W**
Type of device: **LED**

CSA Group report: **REVS002-010**

Original issue date: **26-Oct-2018**

Prepared for:
Revolution Microelectronics
5300 Powers Ferry Rd NW
Atlanta, GA 30327

Attn: Greg Richter
greg@recolutionmicro.com
404.884.1663

Test report prepared by:

Handwritten signature of Marius Timbus in black ink.

Marius Timbus
Test Technician,
Test and Measurement Services

Testing performed by:
CSA Group
14833 NE 87th St
Redmond, WA 98052
425-605-8500
www.csagroup.org

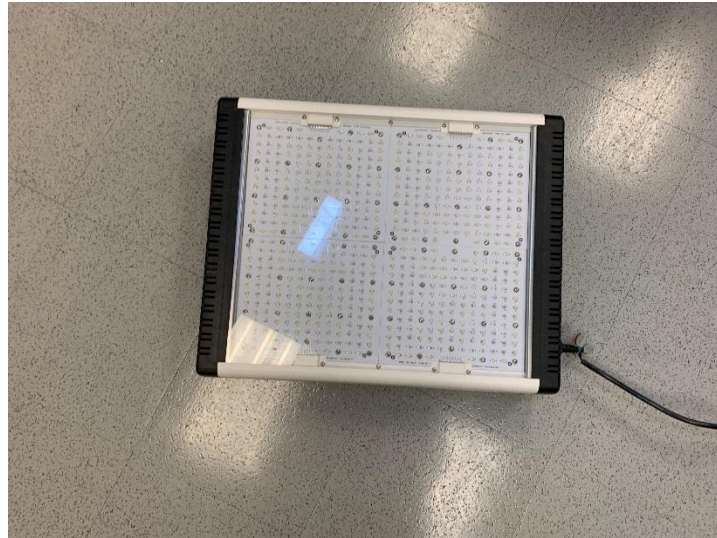
Test report approved by:

Handwritten signature of KC Fletcher in black ink.

KC Fletcher
SSL Program Manager,
Test and Measurement Services

1.0 Description of test sample

Manufacturer part number:	V1000W	Electrical/optical characteristics (customer/matrix manufacturer spec's):			
Manufacturer: Revolution Microelectronics CSA device ID serial#: 01 Comments: 1 device Description: LED		V_{RMS} (VAC)	240	Color	-
		I_f (A)	-	λ_{peak}	-
		$R(\Omega)$	-	$\lambda_{Dominant}$	-
		$P(W)$	-	$\lambda_{Centroid}$	-
		$f(Hz)$	60	$\Delta\lambda$	-



DUT, as received

2.0 Scope of testing

Testing was performed to evaluate SSL product electrical and spectral characteristics, including V/I, spectral radiant flux, spectral photon flux, efficacy, PAR, PPF, and YPF. Spectral radiant flux is reported for spectral range 350 - 1020nm in units W/nm, with wavelength resolution of 1nm, and accuracy of $\pm 0.5\text{nm}$.

2.1 Test protocol and data reduction

The device under test (DUT) is mounted inside of a 3 meter diameter integrating sphere. Testing is conducted using the 3 meter integrating sphere and spectroradiometer calibrated for absolute radiometric flux using a NIST traceable flux standard. The DUT is powered on and monitored for stabilization prior to measurement as per IES: LM-79. All voltage and current measurements are taken in-situ using a power analyzer. Optimal spectrometer signal saturation is achieved with selectable integration time. Spectrometer integration times are set to a multiple of 60Hz.

2.2 Measurement setup

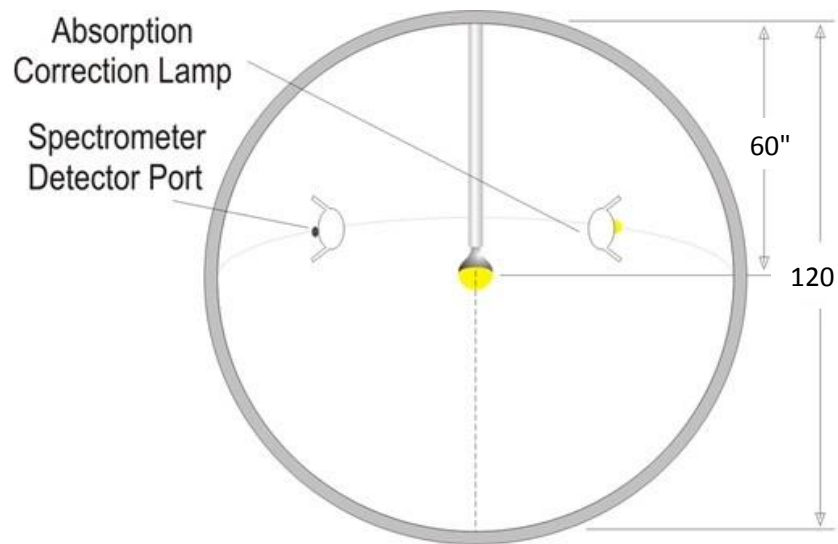


Illustration of integrating sphere test geometry. Absorption-correction is performed for each device geometry. Optical measurements are made via a SMA fiber port located at the equator.

3.0 Summary of Results - integrating sphere measurements

Test Conditions

Test Date: 24-Oct-2018	Device Power Parameters: 240VAC
Method: sphere-spectroradiometer	60Hz
Sphere geometry: 4π	
Sample orientation: vertical	Ambient Room Temp (°C): 25.0
Correction factors applied: absorption correction	

Optical Measurements

Total Integrated Radiant Flux (W):	472.94	Total Extended PPF ($\mu\text{mol/s}$, 350-750nm):	2221.0
Radiant Efficiency (W/W):	0.4369	Total Extended PPF Efficacy ($\mu\text{mol/s/W}$):	2.052
Peak Wavelength (nm):	658.9	Total YPF* ($\mu\text{mol/s}$, 350-750nm):	1940.4
Centroid Wavelength (nm):	563.8	Total YPF Efficacy ($\mu\text{mol/s/W}$):	1.792
CCT (K):	5630.5	Total PPF ($\mu\text{mol/s}$, 400-700nm):	2191.5
U:	0.2431	Total PPF Efficacy ($\mu\text{mol/s/W}$):	2.024
V:	0.2844	Total Photon Flux ($\mu\text{mol/s}$, 350-1020nm):	2229.0
U':	0.2431	Total Photon Flux Efficacy ($\mu\text{mol/s/W}$):	2.059
V':	0.4266	Quantum Efficiency (photons/electron):	64.1

Electrical Measurements

Voltage (VAC):	240.00	Power Factor:	0.9706
Current (A):	4.647	THD V (%):	1.86
Power (W):	1082.6	THD A (%):	6.34
Frequency (Hz):	60.0		

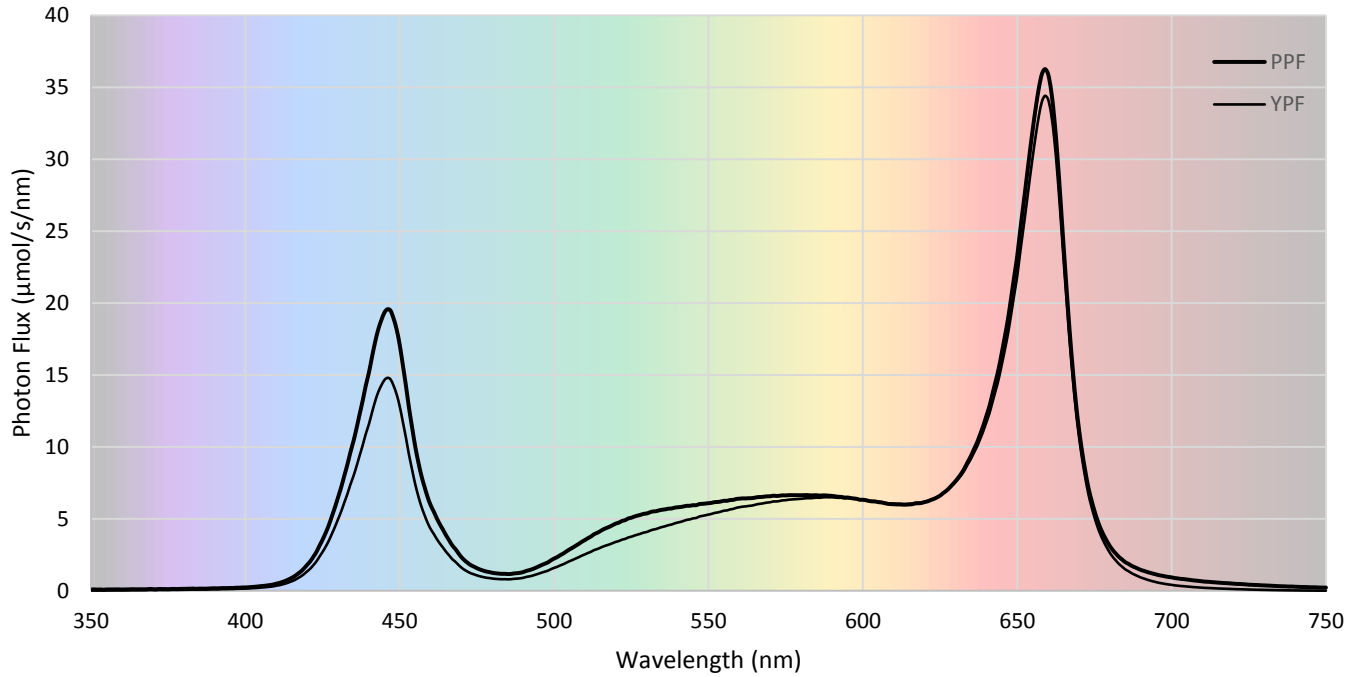
Thermal Measurements

Ambient Temperature (°C):	25.00
DUT Temperature (°C):	49.70

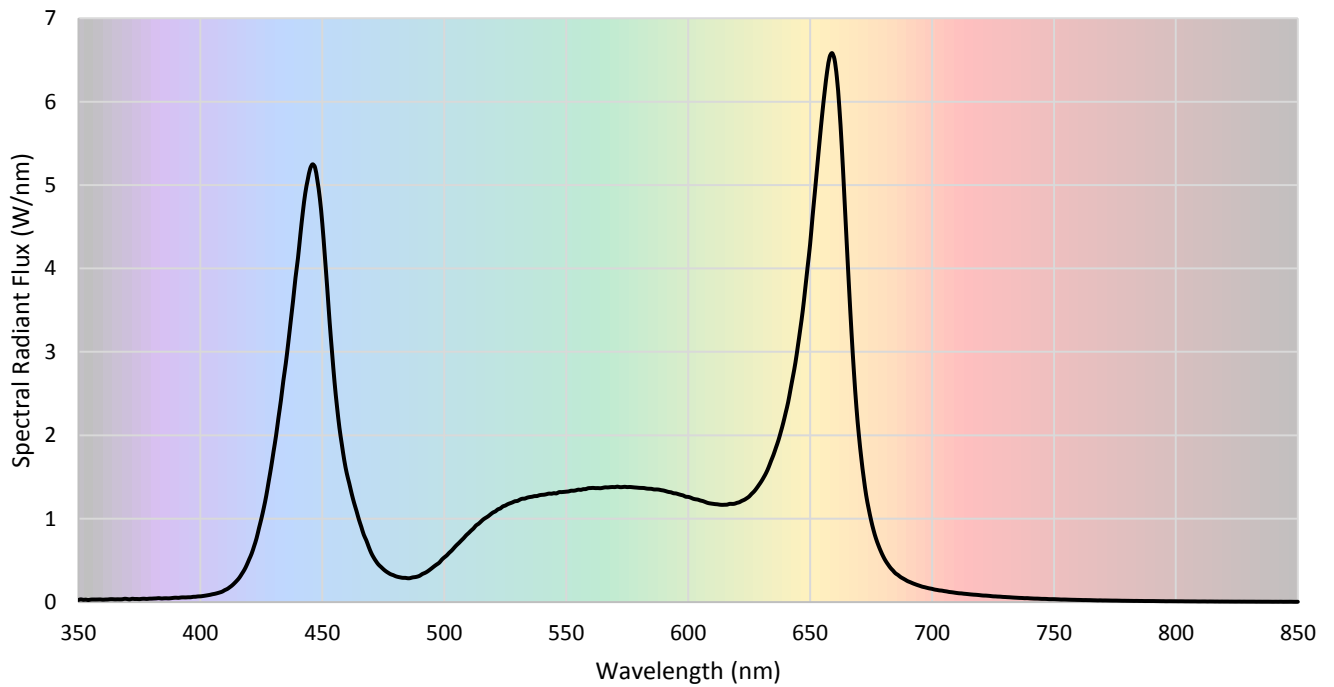
* YPF has the same spectral range and units as Extended PPF, but is weighted by the McCree curve.

4.0 Charts - Measured Spectral Radiant Flux and PAR Spectra

Spectral Photon Flux



Spectral Radiant Flux



5.0 Test Equipment

Item	Description /use	ID Number	Calibration Due Date
Integrating sphere	76" diameter	LMS760	N/A
Spectrometer	optical measurements	CDS 1100	N/A
Power Analyzer	electrical measurements	WT210	Dec-18
Power Supply	AC power	LPS100	N/A
TEC Thermal Controller	temperature monitor	TEC-100	N/A
Regulated Power Supply	Device power supply	Chroma 61603	N/A
Optometer - Goniometer	optical measurements	Gigahertz Optik P9801	N/A
Power Supply - Goniometer	Device power supply	Chroma 61602	N/A
Power Analyzer - Goniometer	electrical measurements	Yokogawa WT210	Nov-18

6.0 Additional Information

McCree, K. J., 1972. The action spectrum, absorptance and quantum yield of photosynthesis in crop plants. *Agrie. Meteorol*, 9: 191-216.

END OF REPORT