

LIGHTING GLOBAL TEST REPORT: SolarWhat?!

Initial Screening Method (ISM)

in accordance with
IEC TS 62257-9-5 Ed. 4

Prepared by:
Schatz Energy Research Center
at
Humboldt State University

Report no: SERC19002ISM

Report date:
December 12, 2019

Client: Rowan Spear
Social Anthropology
Chrystal Macmillan Building
15A George Square
Edinburgh, Scotland
EH8 9LD

Manufacturer: The University of Edinburgh
Product name: SolarWhat?
Model: SW2001, SW1001
Size: A

Tested: Kaileigh Vincent-Welling, Technical Manager

Reviewed: Kimberly Thorpe, Quality Manager

Approved: Kimberly Thorpe, Quality Manager

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General information

Manufacturer :	The University of Edinburgh
Product name :	SolarWhat?!
Model # :	SW2001, SW1001
Report date:	December 12, 2019
Test start date :	September 4, 2019
Test end date :	November 18, 2019

Sampling date :	--
Sampling agent :	--
Sampling report ID :	--
Sample procurement :	Provided directly from manufacturer

Sample #	Sample ID code	Product packaging serial number
1	SolarWhat?!-0819-01	--
2	SolarWhat?!-0819-02	--
3	SolarWhat?!-0819-03	--

Included components	Model #	Number included in kit	Tested in this report?
SW2001 main unit	SW2001	1	Yes
SW1001 torch	SW1001	1	Yes
PV module	SK-321	1	Yes

Advertised appliances	Type of appliance
Mobile phone	smart phone
Radio	radio
Portable battery pack	powerbank
--	--

Product photo(s):



Results summary

Parameter tested	Unit / Appliance	Setting	Rating	Average measured value	Average percent deviation	Coefficient of variation	Comments
Component measurements							
Battery capacity [Ah]	SW2001 main unit	--	1.1	1.1	-1.4	0.06	Rating on component
	SW1001 torch		1.1	1.1	-1.8	--	Rating on component
Battery capacity storage loss [%]	SW2001 main unit	--	--	3.7	--	--	--
	SW1001 torch	--	--	7.9	--	--	
PV power [W]	PV module	--	2.7	2.6	-5.3	--	Rating on component
Power consumption [W]	SW2001 integrated light	high	Not stated	1.0	--	--	--
		medium	Not stated	0.1	--	--	--
	SW1001 torch	High	Not stated	0.6	--	--	--
		Low	Not stated	0.1	--	--	--
Energy service calculations							
Individual appliance full-battery run time	SW2001 integrated light	hours	high	6	4.9	-17.6	--
		hours	Low	96	52.9	-44.9	--
	SW1001 torch	hours	High	Not stated	4.8	--	--
		hours	Low	Not stated	23.7	--	--
	Mobile phone		on	Not stated	1.82	--	--
	Radio		on	Not stated	2.2	--	--
	Portable battery pack		on	Not stated	1.7	--	--
Combination appliance full-battery run time	SW2001 integrated light	hours	high	Not stated	0.8	--	--
	SW1001 torch	hours	High	Not stated	0.8	--	--
	Radio	hours	on	Not stated	0.61	--	--
Example Use Profile	Mobile phone	full charges	on	Not stated	0.20	--	--
Combination appliance full-battery run time	SW2001 integrated light	hours	high	Not stated	2.4	--	--
	SW1001 torch	hours	High	Not stated	2.4	--	--
	Brightest Setting						
Individual appliance solar run time	SW2001 integrated light	hours	high	Not stated	3.8	--	--
			Low	Not stated	41.0	--	--
	SW1001 torch	hours	High	Not stated	3.8	--	--
			Low	Not stated	19.0	--	--
	Mobile phone	full charges	on	Not stated	0.49	--	--
	Radio	hours	on	Not stated	1.5	--	--
	Portable battery pack	hours	on	Not stated	1.8	--	--
Combination appliance solar run time	SW2001 integrated light	hours	high	Not stated	0.64	--	--
	SW1001 torch	hours	High	Not stated	0.64	--	--
	Example Use Profile						
Combination appliance solar run time	Radio	hours	on	Not stated	0.48	--	--
	Mobile phone	full charges	on	Not stated	0.16	--	--
	Brightest Setting						
Maximum available energy to appliances after a standard solar charge [Wh]	Example use profile			Not stated	2.4	--	--
	Brightest Setting			Not stated	3.2	--	--

Solar charging time [h]	Charging the main unit and the torch			Not stated	16.3	--	--	--	
System efficiencies									
Battery efficiency [%]	SW2001 main unit	--	--	94.9	--	0.02	--	--	
	SW1001 torch			93.7	--	--			
Appliance charging efficiency [%]	SW1001 torch	--	--	75.7	--	--	--		
Solar operation efficiency [%]	SW2001 main unit	--	--	50.3	--	0.00	--		
Battery-charging circuit efficiency [%]	SW2001 main unit	--	--	68.5	--	0.00	--		
Lighting service									
Luminous flux [lm]	SW2001 integrated light	High	80	83.9	4.9	--	Rated on manufacturer website	--	
	SW1001 torch	High	50	49.7	-0.7	--			
Color rendering index	SW2001 integrated light	High	Not stated	94	--	--	--		
	SW1001 torch	High	Not stated	93	--	--	--		
Correlated color temperature [K]	SW2001 integrated light	High	3000	2809	-6.4	--	Rated on manufacturer website	--	
	SW1001 torch	High	3000	2928	-2.4	--			
Horizontal full-width half-max angle [degrees]	SW2001 integrated light	High	--	101	--	--	--	--	
	SW1001 torch	High	--	90.3	--	--			
Vertical full-width half-max angle [degrees]	SW2001 integrated light	High	--	108	--	--			
	SW1001 torch	High	--	105	--	--			
500 hour lumen maintenance [% of initial]	SW2001 integrated light	High	--	97.6	--	--	--	--	
	SW1001 torch	High	--	96.8	--	--			

Results summary continued

Visual screening

Number of non-functioning samples	0	--
Workmanship quality	good	--
Warranty	not adequate	A warranty was not provided; however, this product is designed to have its components fully replaceable as they are used, and the batteries and PV modules used with this product will vary based upon the user.
Performance reporting	not adequate	No packaging was provided with this product.
Screw terminals *	not adequate	The PV module is connected to the PCB via a screw terminal block; therefore, this product must meet Lighting Global Standards for screw terminals. The information required to meet this standard was not provided as no packaging or user manual was provided with the product.

* The screw terminal assessment is not part of IEC 62257-9-5; therefore, this result is not within the scope of accreditation to ISO/IEC 17025.

Protection tests

PV overvoltage	adequate	--
Overload	adequate	The USB port's maximum sustained current is 0.36 A. The port has output overload protection at loads higher than 0.36 A.

Parameter tested	Component	Protection type	Adequate protection observed	Comments
Charge controller				
Deep discharge protection	SW2001 main unit	active	1/1	Observed deep discharge protection battery voltage was 3.59 V.
	SW1001 torch	active	1/1	Observed deep discharge protection battery voltage was 3.5 V.
Overcharge protection	SW2001 main unit	active	1/1	Observed overcharge protection battery voltage was 4.21V.
	SW1001 torch	active	1/1	Observed overcharge protection battery voltage was 4.20 V.
Parameter tested	Unit / Appliance	Safety	Functionality	Comments
Mechanical durability				
Drop test	SW2001 integrated light	1/1	1/1	--
	SW1001 torch	1/1	1/1	--
Switches and connectors	On/Off Switch on SW2001 main unit	1/1	1/1	--
	USB port	1/1	1/1	--
	micro USB port	1/1	1/1	--
	micro USB port on torch	1/1	1/1	--
	On/Off switch on SW1001 torch	1/1	1/1	--
Strain relief	PV module	1/1	1/1	--

Parameter tested	Port	Capabilities properly advertised	Meets functionality standard	Comments
Appliance & port functionality				
Assessment of DC ports	USB	0/1	0/1	This port failed truth-in-advertising for current at the typical battery discharge voltage. Additionally, this port also failed the Lighting Global Quality functionality Standards for 5 V ports as it did not meet the minimum acceptable voltage of 4.5 V at the typical battery discharge voltage.
	Micro USB	n/a	n/a	This port is not an output port; therefore, it did not undergo ports testing.
Appliance voltage range compatibility - assessment of DC ports	SW1001 torch	--	yes	--
	SW2001 integrated light	--	yes	--
Appliance voltage range test	SW1001 torch	--	yes	--

Physical & water protection				
PV module	Highest degree tested & passed: protection against ingress of solid foreign objects	Overall level of water protection	Comments	
PV module	IP3X	permanent rooftop installation for PV modules	There weren't any sensitive electronics observed inside of the junction box; however, there was silicon potting within the box.	
Component	Highest degree tested & passed: protection against ingress of solid foreign objects	Overall level of water protection	Comments	
SW2001 main unit	IP3X	no protection	The product failed IPX1 and did not have a warning label; therefore, the SW2001 main unit does not meet the requirement for protection from occasional rain.	
SW1001 torch	IP4X	no protection	The product failed IPX1 and did not have a warning label; therefore, the SW1001 torch does not meet the requirement for protection from occasional rain.	

General comments				
Overall, the product performed close to or better than rated for most metrics. The SW2001, however, performed approximately 18% and 45% lower than rated on the manufacturer's website for full-battery run time for High and Low settings, respectively. Performance reporting was not evaluated because packaging was not provided. The product does not have adequate screw terminals information, and no warranty information was provided. Overall, the batteries for the SW2001 main unit and battery for the SW1001 torch have discharge and overcharge protection acceptable according to the Lighting Global recommended values for batteries with Li-ion chemistries. The SW2001 main unit's USB port failed to meet the Lighting Global functionality standard for 5V ports and failed to meet truth-in-advertising in regards to the advertised maximum output current. Additionally, both the SW2001 main unit and the SW1001 torch failed IPX1 and neither has an adequate warning label for water protection, thus neither meets the requirement for protection from occasional rain for portable separate products.				

Detailed test results

Record of sample receipt

Date samples were received: August 18, 2019
 Sample procurement: Provided directly from manufacturer

Battery capacity

Battery	Rating [Ah]		Procedure : IEC TS 62257-9-5 Ed. 4 Battery test
SW2001 main unit	1.1		
SW1001 torch	1.1		

Battery: SW2001 main unit

Sample	Measured capacity [Ah]	Deviation from rating [%]	Measured battery efficiency [%]	Comments
1	1.1	2.7	93	battery 1
2	1.0	-5.5	96	battery 2

Battery: SW1001 torch

Sample	Measured capacity [Ah]	Deviation from rating [%]	Measured battery efficiency [%]	Comments
1	1.1	-1.8	94	--

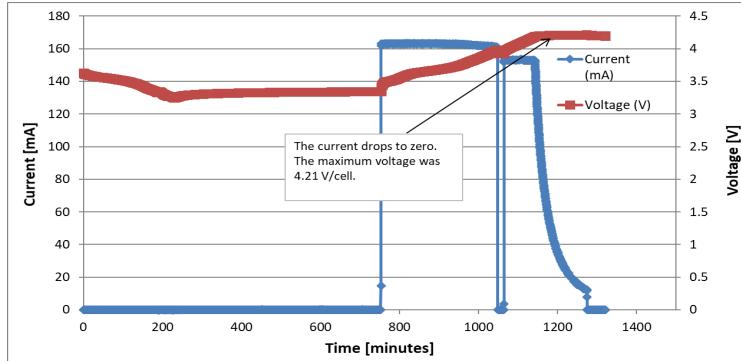
Overall comments

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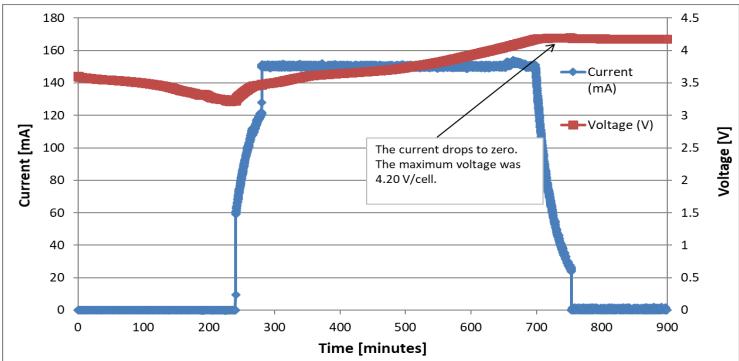
Battery storage				Procedure : IEC TS 62257-9-5 Ed. 4 Battery durability test
Battery: SW2001 main unit				
Sample	Initial measured capacity [Ah]	Final measured capacity [Ah]	Capacity loss from storing [%]	Comments
2	1.1	1.0	4	--
Battery: SW1001 torch				
Sample	Initial measured capacity [Ah]	Final measured capacity [Ah]	Capacity loss from storing [%]	Comments
2	1.1	1.1	8	--
Overall Comments				
--				

Charge controller									
				Procedure : IEC TS 62257-9-5 Ed. 4 Charge controller behaviour test					
Unit tested	Battery chemistry								
SW2001 main unit	Li-Ion (3.6-3.7 V/cell)								
SW1001 torch	Li-Ion (3.6-3.7 V/cell)								
Component:		SW2001 main unit							
Battery chemistry:		Li-Ion (3.6-3.7 V/cell)							
Sample	Has active overcharge protection	Active overcharge protection voltage [V/cell]	Has passive overcharge protection	Passive overcharge protection continuous charging current [mA]	Standby loss current [mA]	If applicable, time to enter low-power standby mode [h]			
2	yes	4.21	no	--	0.06	--			
Component:		SW1001 torch							
Battery chemistry:		Li-Ion (3.6-3.7 V/cell)							
Sample	Has active overcharge protection	Active overcharge protection voltage [V/cell]	Has passive overcharge protection	Passive overcharge protection continuous charging current [mA]	Standby loss current [mA]	If applicable, time to enter low-power standby mode [h]			
2	yes	4.20	no	--	0.00	--			
Component:		SW1001 torch							
Battery chemistry:		Li-Ion (3.6-3.7 V/cell)							
Sample	Has active overcharge protection	Active overcharge protection voltage [V/cell]	Has passive overcharge protection	Passive overcharge protection continuous charging current [mA]	Standby loss current [mA]	If applicable, time to enter low-power standby mode [h]			
2	yes	4.20	no	--	0.00	--			
Component:		SW1001 torch							
Battery chemistry:		Li-Ion (3.6-3.7 V/cell)							
Sample	Has deep discharge protection?	Type of deep discharge protection [active or passive]	Deep discharge protection voltage [V/cell]	If applicable, is active deep discharge protection internal to the battery?	Passive deep discharge protection voltage at 24 h, if applicable [V]	Comments			
2	yes	active	3.59	yes	--	Battery 1 was used for reporting this measurement.			
Test conditions for standby loss									
The main unit was connected to the PV module, which was placed face-down on black fabric, with no appliances connected and the integrated light turned OFF during the standby loss test. The current was measured and averaged over 10 minutes.									
Overall comments									
The torch and the main unit meet the Lighting Global requirements.									

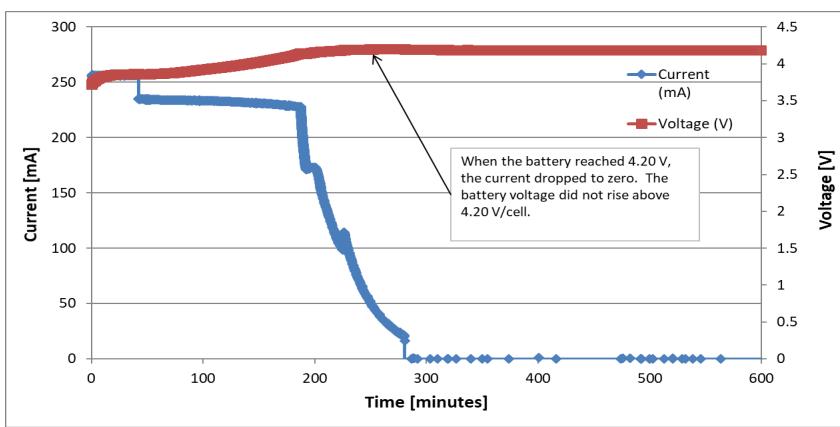
Overcharge protection observation while charging over time (voltage and current versus time)



SW2001 main unit battery 1 chart shown above

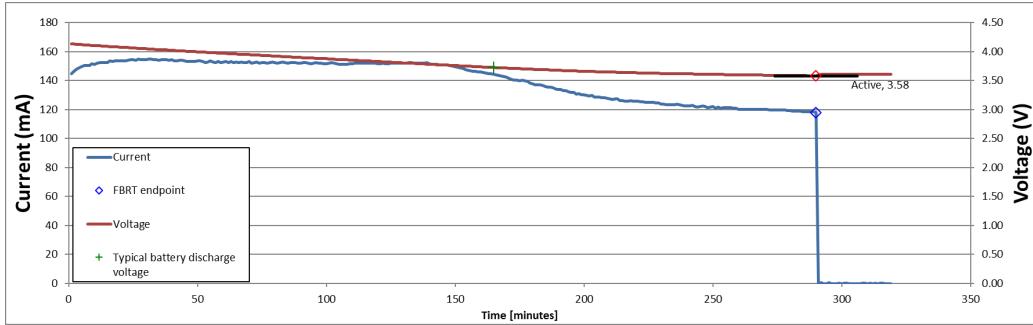


SW2001 main unit battery 2 chart shown above

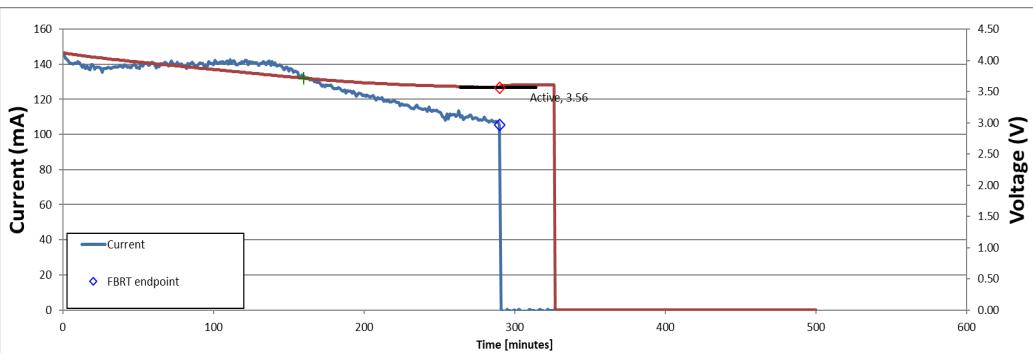


To the left is the battery chart for the SW1001 torch

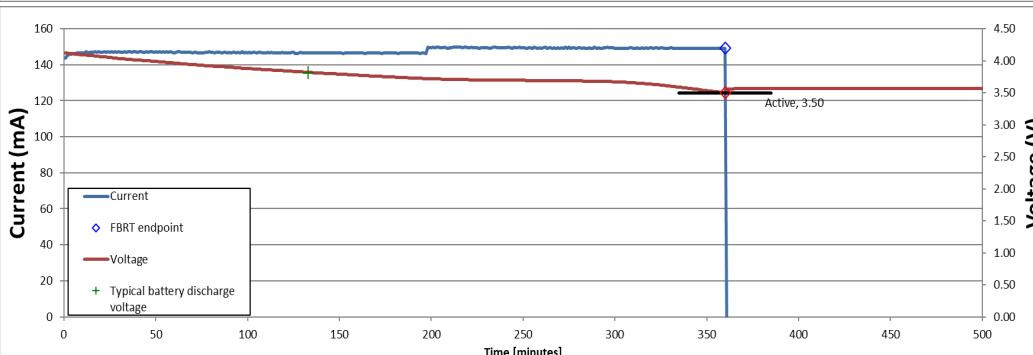
Deep discharge protection during the full-battery run time test



To the left is the SW2001 integrated light's full-battery run time for battery 1.



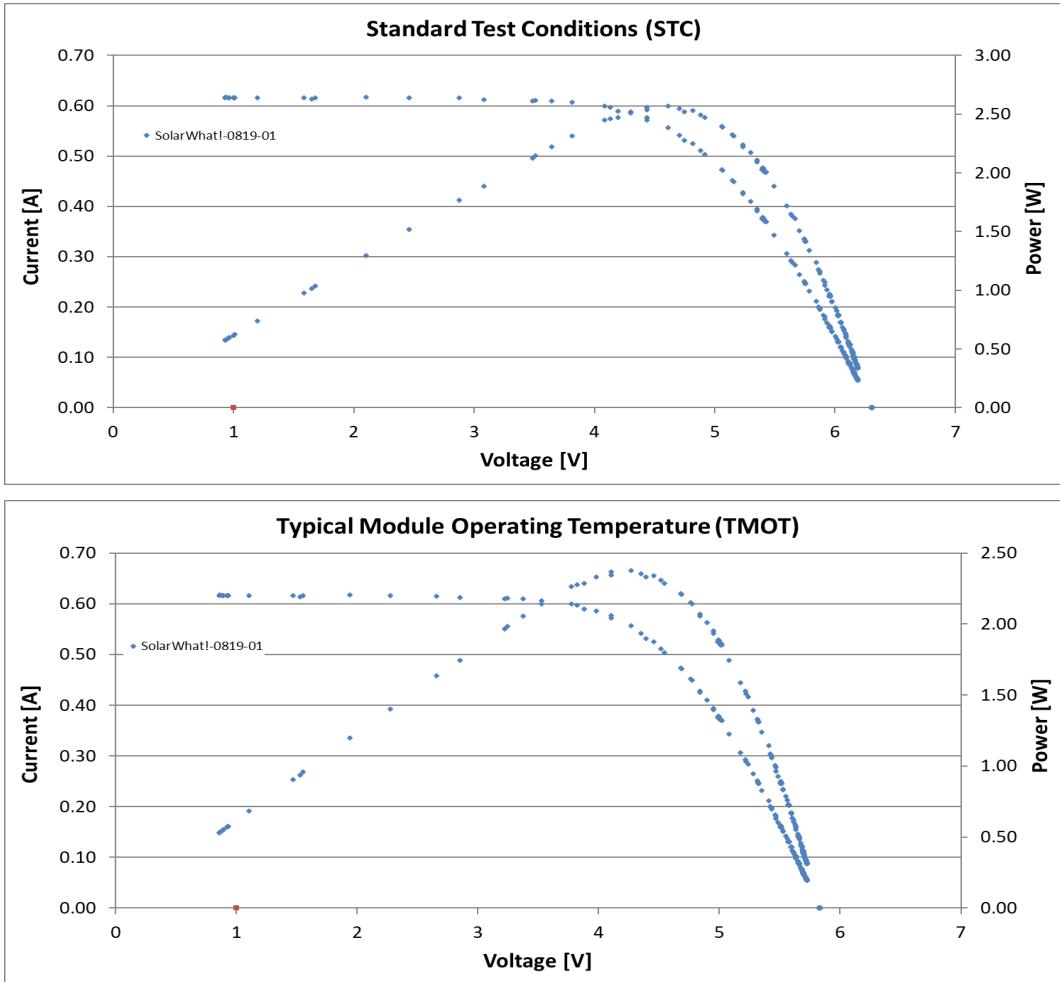
To the left is the SW2001 integrated light's full-battery run time for battery 2.



To the left is the SW1001 torch's full-battery run time

PV power						
PV module :	PV module					Procedure : IEC TS 62257-9-5 Ed. 4
STC rating [W] :	2.7					I-V characteristics test
Light source :	Natural sunlight					
Results at standard test conditions: 25°C, 1000W/m ²						
Sample	Maximum power point power [W]	Deviation from rating [%]	Short circuit current [A]	Open circuit voltage [V]	Maximum power current [A]	Maximum power voltage [V]
1	2.6	-5.3	0.62	6.3	0.56	4.6
Sample	Fill factor [%]	Temperature coefficient of open-circuit voltage (β_{rel}) [%/°C]				
1	66	-0.301				
Results at typical module operating temperature: 50°C, 1000W/m ²						
Sample	Maximum power point power [W]	Short circuit current [A]	Open circuit voltage [V]	Maximum power current [A]	Maximum power voltage [V]	
1	2.4	0.62	5.8	0.56	4.2	
Temperature correction details						
Method:	IEC 62257-9-5	Adjustment based on temperature coefficient of open-circuit voltage				
Sample	Testing temperature 1 [°C]	Testing temperature 2 [°C]	$V_{\text{oc}} 1$ [V]	V_{oc} Temperature 1 [°C]	$V_{\text{oc}} 2$ [V]	V_{oc} Temperature 2 [°C]
1	55.0	--	6.3	5.7	24.5	54.3
Sample	Comments			Overall comments		
1	--			--		

Module characteristic curves

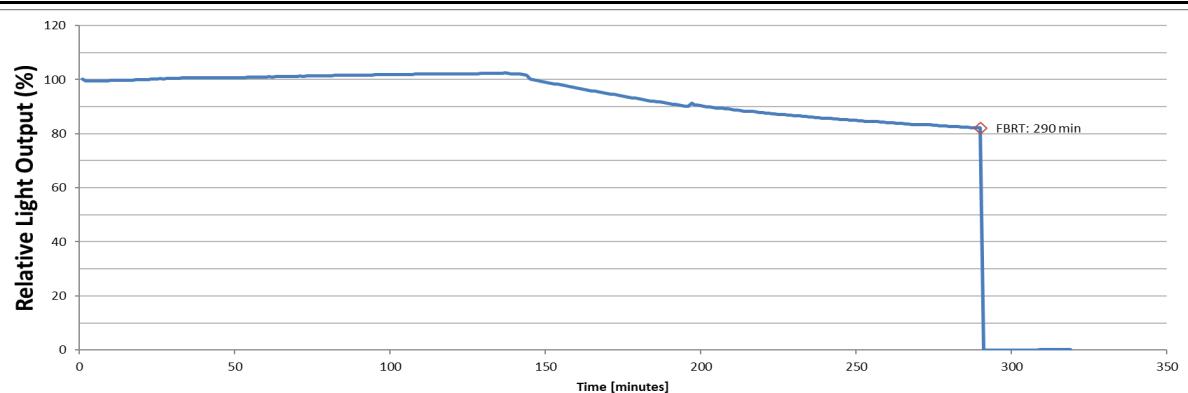


Sample	Comments	Overall comments
1	--	--

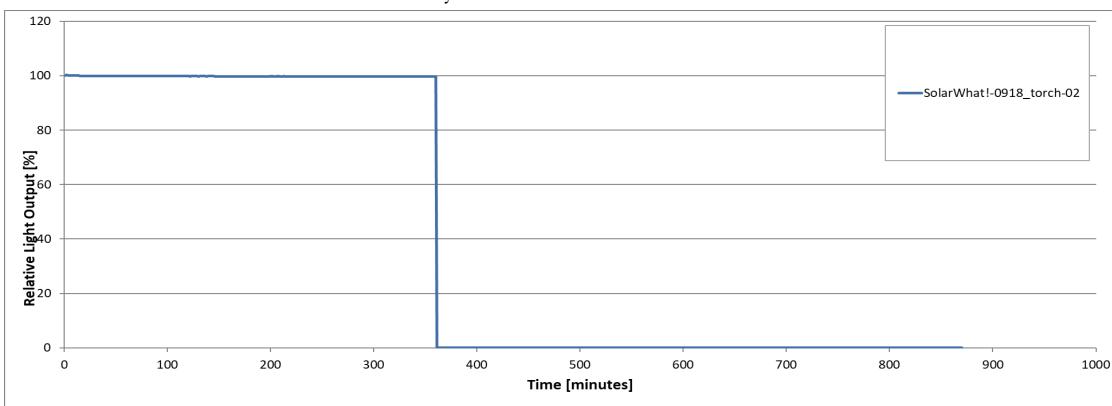
Full-battery run time test											
Main unit or appliance	Setting or appliance configuration			Rating [h]							
SW2001 main unit	high			6							
SW1001 torch	high			5							
SW2001 main unit	SW2001 main unit			Procedure: IEC TS 62257-9-5 Ed. 4 --							
Setting	high										
Sample	Full-battery run time [h]	Deviation from rating [%]	Typical battery discharge voltage [V]	Current at typical battery discharge voltage [A]	Average power [W]	If passive discharge protection, voltage at 24 hours [V]					
2	4.8	-19.44	3.72	0.144	1.03	--					
Sample	Energy removed from battery over full-battery run time [Wh]	Energy removed from battery to LVD or other stopping criterion [Wh]		Comments							
2	5.0	5.0		--							
SW2001 main unit	SW1001 torch			Procedure: IEC TS 62257-9-5 Ed. 4 --							
Setting	high										
Sample	Full-battery run time [h]	Deviation from rating [%]	Typical battery discharge voltage [V]	Current at typical battery discharge voltage [A]	Average power [W]	If passive discharge protection, voltage at 24 hours [V]					
2	6.0	16.7	3.82	0.15	0.56	--					
Sample	Energy removed from battery over full-battery run time [Wh]	Energy removed from battery to LVD or other stopping criterion [Wh]		Comments							
2	3.36	3.21		--							
Overall comments											
The full-battery run time test set up did not deviate from the accepted test methods as originally expected. The first acceptable trial was on 12/4/19. The test, however, was repeated on 12/6 because of a data acquisition problem; the full-battery run time from the first acceptable attempt on 12/4/19 was 4.5 h. This suggests variability in test results for this metric for this product.											

Lighting full-battery run time (continued)

Relative light output over the full-battery run time

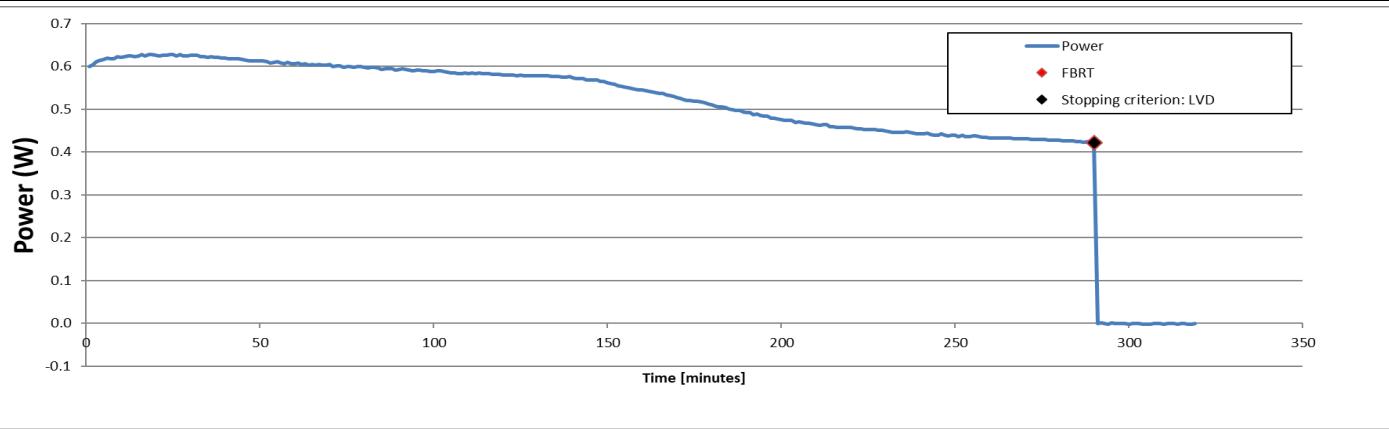


Above is the SW2001 main unit's full-battery run time

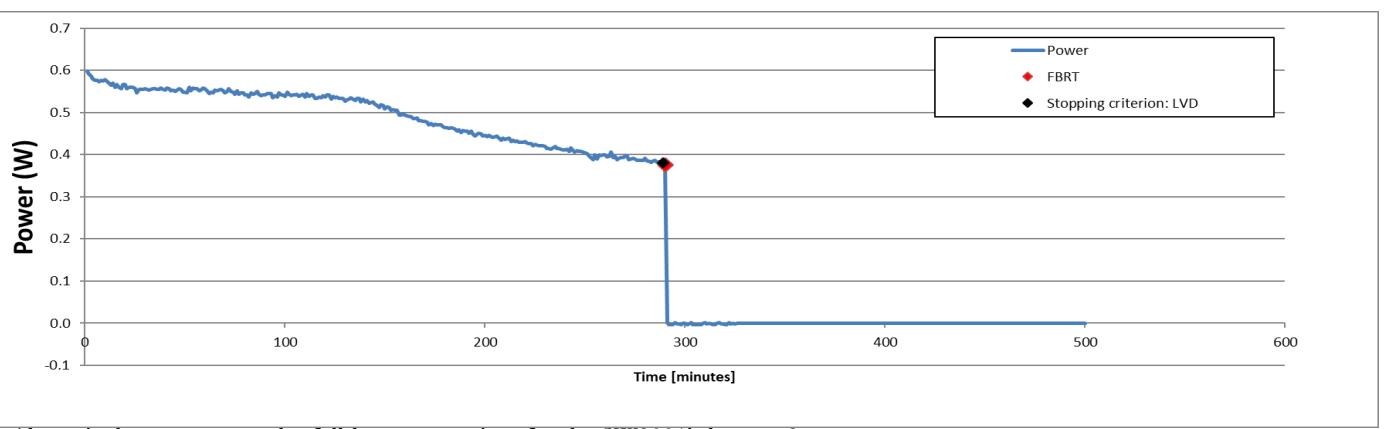


Above is the SW1001 torch's full-battery run time

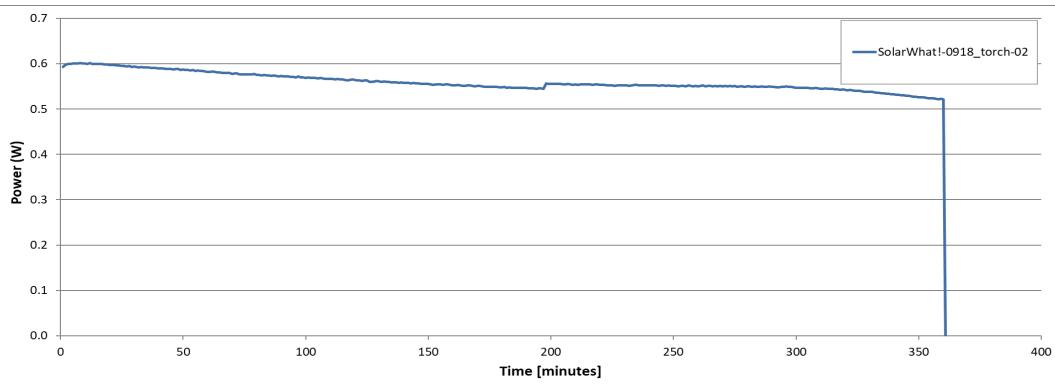
Power over the full-battery run time



Above is the power over the full-battery run time for the SW2001's battery 1



Above is the power over the full-battery run time for the SW2001's battery 2



Above is the SW1001 torch's full-battery run time

Energy service calculations - parameters				
			Procedure : IEC TS 62257-9-5 Ed. 4 Energy service calculations	
Appliance parameters				
Appliance	Appliance type	Port	Charging power [W]	Source of charging power value
SW2001 integrated light	included	built-in	--	--
SW1001 torch	included	USB	--	--
Mobile phone	advertised	USB	5	Annex HH
Radio	advertised	USB	2.25	Annex HH
Portable battery pack	advertised	USB	--	--

Note: Charging power for included appliances with batteries is reported in the appliance charging efficiency test section below.

Appliance full-battery run time for appliances with batteries				
Appliance	Setting	Appliance full-battery run time	Source	
SW1001 torch	High	6.0	Full-battery run time test	
	Low	37.0	Estimated from appliance power consumption test	
Mobile phone	on	--	--	
Radio	on	3.0	Calculated from Annex HH values	
Portable battery pack	on	8.0	Calculated from Annex HH values	

Note: for parameters based on test data, only the average value for all samples is shown here.

Appliance battery energy capacity for appliances with batteries				
Appliance	Setting	Appliance battery energy capacity	Source	
SW1001 torch	High	3.2	Full-battery run time test	
	Low	4.0	Calculated from run time and power	
Mobile phone	on	5.7	Annex HH	
Radio	on	3.7	Annex HH	
Portable battery pack	on	8.0	Calculated from run time and power	

Note: for parameters based on test data, only the average value for all samples is shown here.

Additional parameters for advertised appliances				
Appliance	Setting	Power [W]	Source of power value	
Mobile phone	on	--	--	
Radio	on	0.5	Annex HH	
Portable battery pack	on	2.25	Annex HH	

Note: Power consumption for included removable appliances is reported in the appliance power consumption test section below.
Power consumption for built-in appliances is reported in the assessment of DC ports section below.

Energy service calculations - full-battery run time individual estimates

 Procedure : IEC TS 62257-9-5 Ed. 4
 Energy service calculations

Scenario: Appliances on individually

Appliance	Setting	Rating	
SW2001 integrated light	high	6	hours
	medium	15	hours
	Low	96	hours
SW1001 torch	High	5	hours
	Low	24	hours
Mobile phone	on	Not stated	
Radio	on	Not stated	
Portable battery pack	on	Not stated	

Note: run times for multiple identical appliances used simultaneously are calculated using the same procedure as for advertised combinations.

Sample	SW2001 integrated light		SW2001 integrated light	
	high		Low	
	Run time [hours]	Deviation from rating [%]	Run time [hours]	Deviation from rating [%]
1	4.9	-17.6	52.9	-44.9

Sample	SW1001 torch		SW1001 torch	
	High		Low	
	Run time [--]	Deviation from rating [%]	Run time [hours]	Deviation from rating [%]
1	4.8	-4.0	23.7	-1.3

Sample	Mobile Phone		Radio		Portable battery pack	
	on		on		on	
	Run time [--]	Deviation from rating [%]	Run time [--]	Deviation from rating [%]	Run time [full charges]	Deviation from rating [%]
1	1.80	--	2.2	--	1.7	--
Overall comments						
--						

Energy service calculations - full-battery run time combination estimates

Procedure : IEC TS 62257-9-5 Ed. 4
Energy service calculations

Required combinations

Scenario	Appliance	Setting
Example Use Profile	SW2001 integrated light	high
	SW1001 torch	High
	Radio	on
	Mobile phone	on
Brightest Setting	SW2001 integrated light	high
	SW1001 torch	High

Scenario: Example Use Profile

Sample	SW2001 integrated light	SW1001 torch	Radio	Mobile phone
high	high	High	on	on
	Run time [hours]	Run time [hours]	Run time [hours]	Run time [full charges]
	1	0.8	0.8	0.6
1			0.6	0.2

Scenario: Brightest Setting

Sample	SW2001 integrated light	SW1001 torch
high	high	High
	Run time [hours]	Run time [hours]
	1	2.4
1		2.4

Sample	Appliance	Setting	Comments
1	SW2001 integrated light	high	This setting includes run time for both the integrated light and the torch on high.

Overall comments

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Charging behavior - solar charge

Procedure : IEC TS 62257-9-5 Ed. 4
Solar charge test

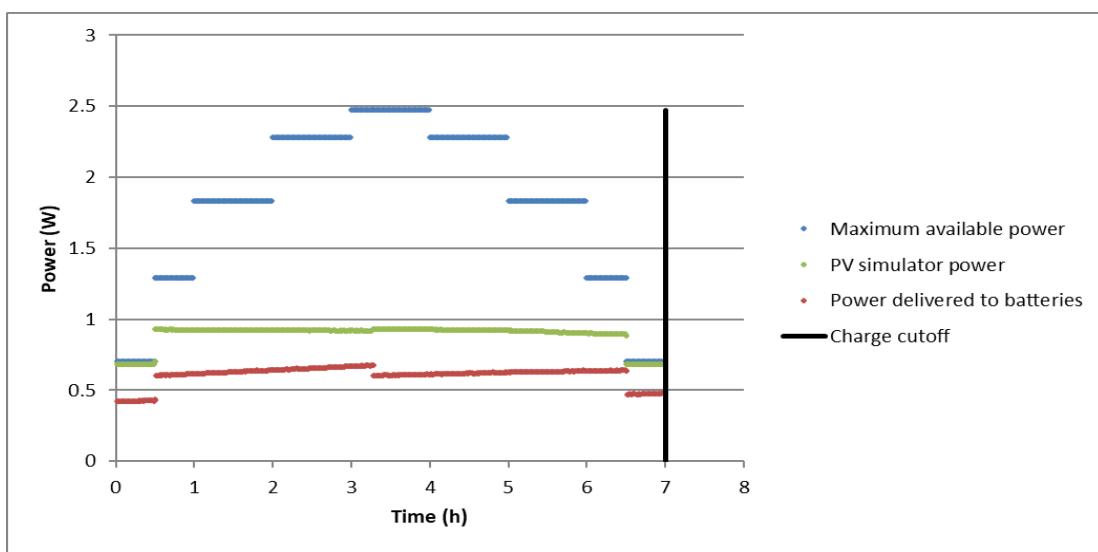
SW2001 main unit

Sample	Solar operation efficiency [%]	Battery-charging circuit efficiency [%]	DC-DC converter observed	Comments
2	50.3	68.5	yes	These are measurements taken from Battery 1 during the test.
2	50.3	68.5	yes	These are measurements taken from Battery 2 during the test.

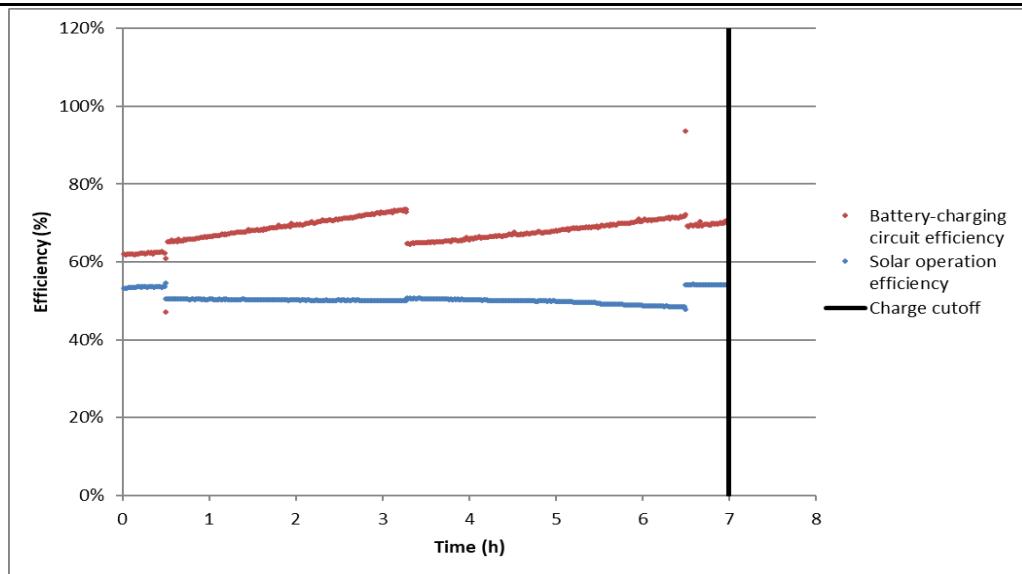
Overall comments

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Solar charging cycle plot showing the maximum power available from the PV simulator, actual power supplied by the PV simulator, and power delivered to the batteries



Solar charging cycle plot showing the instantaneous battery-charging circuit efficiency and solar operation efficiency



Energy service calculations - solar run time individual estimates

 Procedure : IEC TS 62257-9-5 Ed. 4
 Energy service calculations

Scenario: Appliances on individually

Appliance	Setting	Rating
SW2001 integrated light	high	Not stated
	medium	Not stated
	low	Not stated
SW1001 torch	High	Not stated
	Low	Not stated
Mobile phone	on	Not stated
Radio	on	Not stated
Portable battery pack	on	Not stated

Sample	SW2001 integrated light		SW2001 integrated light		SW2001 integrated light	
	high	medium	medium	low	low	low
	Run time [hours]	Deviation from rating [%]	Run time [hours]	Deviation from rating [%]	Run time [hours]	Deviation from rating [%]
1	3.8	--	--	--	41.0	--

Sample	SW1001 torch		SW1001 torch		Mobile phone	
	High	Low	Low	on	on	on
	Run time [hours]	Deviation from rating [%]	Run time [hours]	Deviation from rating [%]	Run time [full charges]	Deviation from rating [%]
1	3.8	--	19.0	--	0.5	--

Sample	Radio		Portable battery pack	
	on	on	on	on
	Run time [hours]	Deviation from rating [%]	Run time [full charges]	Deviation from rating [%]
1	1.5	--	1.8	--

Overall Comments

The solar run times were not advertised for any of the advertised or included appliances when in-use individually; therefore, there aren't deviations calculated.

Energy service calculations - solar run time combination estimates

Procedure : IEC TS 62257-9-5 Ed. 4
Energy service calculations

Required combinations

Scenario	Appliance	Setting
Example Use Profile	SW2001 integrated light	high
	SW1001 torch	High
	Radio	on
	Mobile phone	on
Brightest Setting	SW2001 integrated light	high
	SW1001 torch	High

Scenario: Example Use Profile

Sample	All appliances	SW2001 integrated light	SW1001 torch	Radio	Mobile phone
Daily energy [Wh/day]	--	high	High	on	on
	Run time [hours]	Run time [hours]	Run time [hours]	Run time [hours]	Run time [full charges]
	1	2.4	0.6	0.6	0.5
					0.2

Scenario: Brightest Setting

Sample	All appliances	SW2001 integrated light	SW1001 torch
Daily energy [Wh/day]	--	high	High
	Run time [hours]	Run time [hours]	Run time [hours]
	1	3.2	1.9
			1.9

Overall comments

--

Energy service calculations - solar charging time			
Combination	Rating [h]		Procedure : IEC TS 62257-9-5 Ed. 4 Energy service calculations
Charging the main unit and the torch	--		
Combination:		Charging the main unit and the torch	
Appliances charged: SW1001 torch (1x)			
Sample	Solar charging time [h]	Deviation from rating [%]	Comments
1	16.3	--	This calculated solar charge time includes charging the SW2001 main unit and the SW1001 torch.
Overall comments			
The solar charge time to fully charge the SW2001 main unit <i>and</i> the SW1001 torch was calculated to be approximately 15.7 hours.			

PV overvoltage protection

Procedure : IEC TS 62257-9-5 Ed. 4
PV overvoltage test

Overall results

Test performed on sample	2
Procedure used	A
Testing room temperature [°C]	22.2
DUT adequately protected	yes

Overload applied to port	DUT functional after test [yes/no]	Damage? [yes/no]	DUT safety hazard [yes/no]	DUT fault indication present [yes/no]
USB	yes	no	no	no
Micro USB	--	--	--	--
Overall	yes	no	no	

Overload applied to port	Damage description	Safety hazard description	Fault indication description
USB	n/a	n/a	n/a
Micro USB	--	--	--

Port details

Port	Allowable port voltage limit [V]	Resistor value used [$k\Omega$]	Maximum measured voltage [V]	Port adequately protected [yes/no]
USB	6	51.1 ±1%	5.2	yes
Micro USB	--	--	--	--

Overall comments

High voltages were not observed at the USB port while the port was faulted and main unit is charging and connected to its batteries. No damages or safety concerns were observed; the port and product function after the test.

Output overload protection				Procedure : IEC TS 62257-9-5 Ed. 4 Output overload test				
Port tested	Sample	Pass/Fail	Testing room temperature [°C]					
USB	2	pass	23.3					
Overcurrent protection measurements								
Port	Maximum testing current [A]	Maximum sustained current [A]	Safety hazard [yes/no]	Damage present [yes/no]	Port/DUT functional after test [yes/no]	Acceptable overload protection [yes/no]		
USB	0.625	0.36	no	no	yes	yes		
Overcurrent protection description								
Port	Type of overload protection	Spare fuses included [yes/no]	Repairs needed [yes/no]	Fault indication for output overload [yes/no]	Comments			
USB	unknown	n/a	no	no	--			
Overall comments								
USB port has overload protection. USB port functions normally after testing.								

Assessment of DC ports

Procedure : IEC TS 62257-9-5 Ed. 4
Assessment of DC ports

Voltage level definitions

Sample	Typical battery discharge voltage [V]	Low-battery voltage [V]	Overcharge protection voltage [V]
2	3.80	3.70	4.20

Assessment of DC ports - functionality assessment - Lighting Global Quality Standards

Port:	USB	Typical battery discharge voltage	Low-battery voltage	Overcharge protection voltage	
Nominal port voltage [V]:	5				To meet the functionality standard, the voltage must remain between the minimum and maximum values at all currents up to the required maximum current.
Advertised maximum current [A]		0.5	0.5	0.5	
Minimum acceptable voltage [V]		4.50	4.25	4.50	
Maximum acceptable voltage [V]		5.50	5.50	5.50	
Required maximum current [A]		0.50	0.50	0.50	

For this 5 V port, the voltage requirements apply for currents up to 0.5 A.

Voltage level	Typical battery discharge voltage				
Sample	Minimum voltage over required current range [V]	Maximum voltage [V]	Voltage meets standard [yes/no]	Estimated maximum current to meet voltage standard [A]	Current meets standard [V]
2	4.37	5.19	no	0.34	no
Overall	4.37	5.19	--	0.34	--

Voltage level	Low-battery voltage				
Sample	Minimum voltage over required current range [V]	Maximum voltage [V]	Voltage meets standard [yes/no]	Estimated maximum current to meet voltage standard [A]	Current meets standard [V]
2	4.33	5.19	yes	0.34	no
Overall	4.33	5.19	--	0.34	--

Voltage level	Overcharge protection voltage				
Sample	Minimum voltage over required current range [V]	Maximum voltage [V]	Voltage meets standard [yes/no]	Estimated maximum current to meet voltage standard [A]	Current meets standard [V]
2	5.02	5.20	yes	0.36	no
Overall	5.02	5.20	--	0.36	--

This port (USB) does not meet the Lighting Global Quality Standard for 5 V ports.

Assessment of DC ports - Truth-in-advertising assessment

Port:	USB	Typical battery discharge voltage
Nominal port voltage [V]:	5	
Advertised maximum current [A]	0.5	
Advertised maximum power [W]	--	
Advertised minimum voltage [V]	--	
Advertised maximum voltage [V]	--	

To meet the Lighting Global truth-in-advertising standard, the port must supply within 5% of the advertised current at the typical battery discharge voltage.

Voltage level	Typical battery discharge voltage		Voltage meets standard [yes/no]	Estimated maximum current to meet voltage standard [A]
Sample	Minimum voltage over advertised current range [V]	Maximum voltage [V]		
2	4.37	5.19	--	--
Overall	4.37	5.19	--	--

Sample	Measured maximum current [A]	Current meets standard	Measured maximum power [W]	Power meets standard
2	0.36	no	1.560	--
Overall	0.36	--	1.560	--

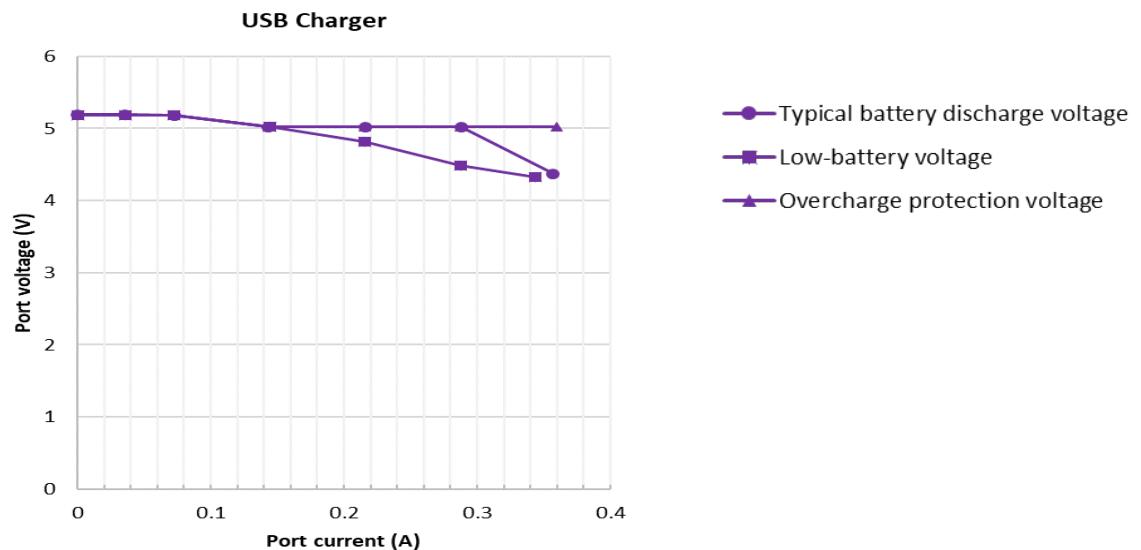
This port (USB) does not meet the Lighting Global Quality Standard for truth in advertising.

Assessment of DC ports - Port summary					
Port:		USB			
Port summary: Functionality assessment					
Sample		Voltage standard met [yes/no]	Current standard met [yes/no]	Overall functionality result [yes/no]	Testing room temperature [°C]
2		no	no	no	22.0
Port summary: Truth-in-advertising assessment					
Sample		Voltage standard met [yes/no]	Current standard met [yes/no]	Power standard met [yes/no]	Advertised appliances standard met [yes/no]
2		--	no	--	--
Port summary: Parameters					
Sample		Minimum port voltage [V]	Maximum port voltage [V]	Maximum power (all voltages) [W]	Shared resistance [Ω]
2		4.33	5.20	1.81	0.0000

Assessment of DC ports (continued)

Steady-state characteristics

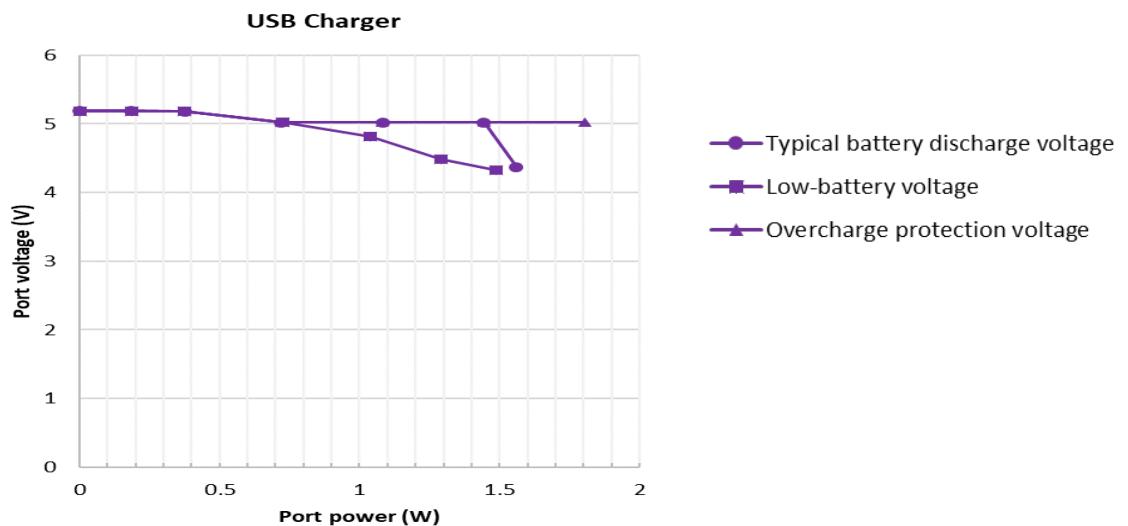
Plots of output voltage vs. output current for each port and set of test conditions



Assessment of DC ports (continued)

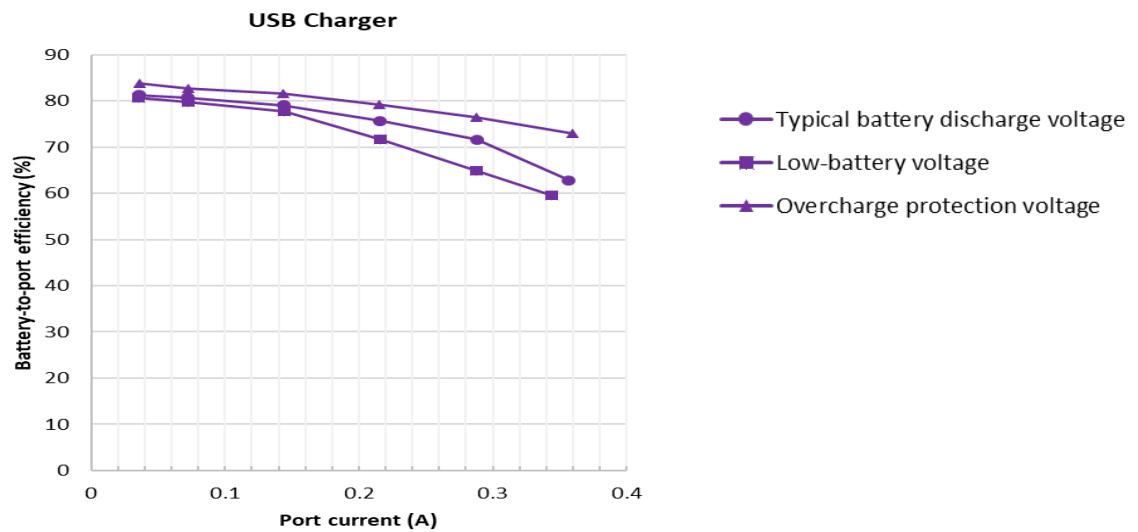
Steady-State Characteristics (continued)

Plots of output voltage vs. output power for each port and set of test conditions



Assessment of DC ports (continued)

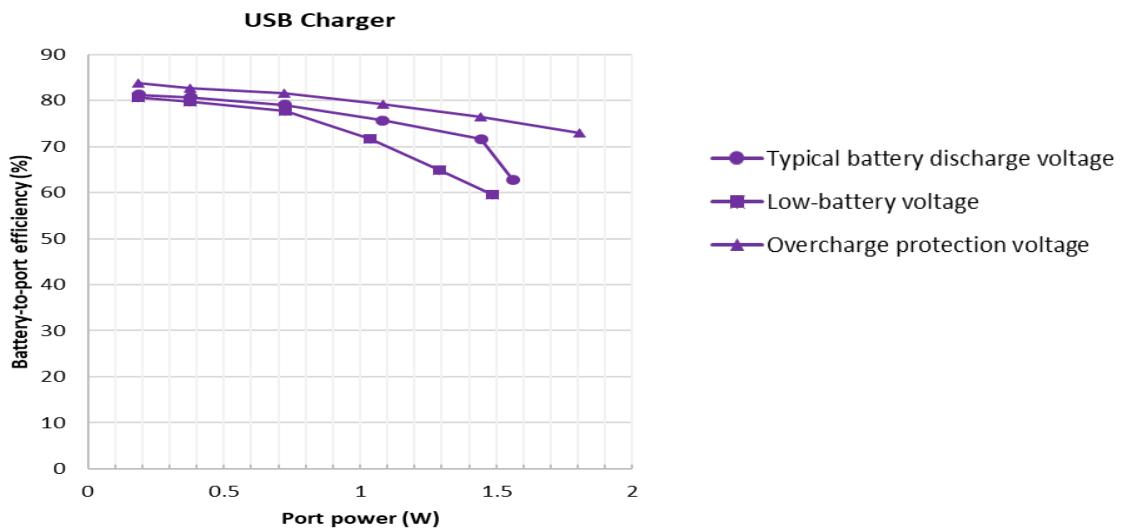
Plots of battery-to-port efficiency vs. output current for each port and set of test conditions



Assessment of DC ports (continued)

Steady-state characteristics (continued)

Plots of battery-to-port efficiency vs. output power for each port and set of test conditions



Assessment of DC ports (continued)

Appliance functionality and built-in appliance power consumption

Note: appliance power consumption is only given for built-in appliances. Power consumption for other appliances is measured in the Appliance Power Consumption test.

Appliance: SW1001 torch (With battery)		State of charge: fully charged		Appliance sample: 2
Power control unit sample	Simulated battery voltage level			
	Typical battery discharge voltage	Low-battery voltage		Overcharge protection voltage
	Appliance functionality [yes/no]	Power consumption [W]	Appliance functionality [yes/no]	Appliance functionality [yes/no]
2	yes	--	yes	yes
Appliance: SW1001 torch (With battery)		State of charge: fully discharged		Appliance sample: 2
Power control unit sample	Simulated battery voltage level			
	Typical battery discharge voltage	Low-battery voltage		Overcharge protection voltage
	Appliance functionality [yes/no]	Power consumption [W]	Appliance functionality [yes/no]	Appliance functionality [yes/no]
2	yes	--	yes	yes

Assessment of DC ports (continued)							
Appliance functionality and built-in appliance power consumption (continued)							
Appliance:	SW2001 integrated (Built-in) light	Setting:	off	Appliance sample: 2			
Power control unit sample	Simulated battery voltage level						
	Typical battery discharge voltage		Low-battery voltage				
	Appliance functionality [yes/no]	Power consumption [W]	Appliance functionality [yes/no]				
2	yes	0.0	yes	yes			
Appliance:	SW2001 integrated (Built-in) light	Setting:	low	Appliance sample: 2			
Power control unit sample	Simulated battery voltage level						
	Typical battery discharge voltage		Low-battery voltage				
	Appliance functionality [yes/no]	Power consumption [W]	Appliance functionality [yes/no]				
2	yes	0.094	yes	yes			
Appliance:	SW2001 integrated (Built-in) light	Setting:	high	Appliance sample: 2			
Power control unit sample	Simulated battery voltage level						
	Typical battery discharge voltage		Low-battery voltage				
	Appliance functionality [yes/no]	Power consumption [W]	Appliance functionality [yes/no]				
2	yes	1.01	yes	yes			
Assessment of DC ports - Comments							
Sample	Port	Comments					
2	USB	The voltage stabilized at 4.35 V. The maximum current of the port was measured as 0.36 A at overcharge protection voltage and 0.34 A at typical battery discharge and low battery voltages, which are lower than the required 0.5 A for USB 5V ports. Additionally, the minimum voltages over the required current ranges measured at the low-battery and typical battery discharge voltages were below the required 4.5 V. The maximum current of the port was measured as 0.36 A at overcharge protection voltage and 0.34 A at typical battery discharge and low battery voltages, which are lower than the required 0.5 A for USB 5V ports. Additionally, the minimum voltages over the required current ranges measured at the low-battery and typical battery discharge voltages were below the required 4.5 V.					
Overall comments							
--							

Appliance power consumption				Procedure : IEC TS 62257-9-5 Ed. 4 Power consumption test		
Appliance	Setting	Rating [W]	Test room temperature [°C]			
SW1001 torch	High	Not stated	21.9			
	Low	Not stated	21.9			
Appliance: SW1001 torch				Setting:	High	
Sample	Appliance operating voltage [V]	Measured voltage [V]	Measured current [A]	Power [W]	Deviation from rating [%]	Functionality (yes/no)
2	3.70	3.70	0.16	0.57	--	yes
Appliance power consumption continued						
Appliance: SW1001 torch				Setting:	Low	
Sample	Appliance operating voltage [V]	Measured voltage [V]	Measured current [A]	Power [W]	Deviation from rating [%]	Functionality (yes/no)
2	3.70	3.70	0.03	0.11	--	yes

Appliance power consumption continued

Estimated full-battery run time

Appliance	Setting	Rating [h]
SW1001 torch	High	Not stated
	Low	Not stated

Appliance: SW1001 torch

Setting: High

Sample	Estimated full-battery run time [h]	Deviation from rating [%]
2	6.98	--

Appliance: SW1001 torch

Setting: Low

Sample	Estimated full-battery run time [h]	Deviation from rating [%]
3	37.0	--

Overall comments

--

Appliance charging efficiency						
				Procedure : IEC TS 62257-9-5 Ed. 4 Charging efficiency test		
Appliance:	SW1001 torch					
Sample	Appliance operating voltage [V]	Charging functionality [yes/no]	Appliance plug power [W]	Appliance battery power [W]	Appliance charging efficiency [%]	Testing room temperature [°C]
2	5.00	yes	1.34	1.02	75.68	21.90

Overall comments
--

Appliance operating voltage range				Procedure : IEC TS 62257-9-5 Ed. 4 Appliance operating voltage range test						
Overall results										
Test performed on sample		2								
Test room temperature [°C]		21.9								
Appliance		Functional under all test conditions		Functional with no damage or safety hazard after test						
SW1001 torch		yes		yes						
Details										
Appliance: SW1001 torch (With battery)			Port:	USB						
State of charge	Test inputs/conditions			Functionality during test						
	Power consumption [W]	Minimum voltage [V]	Maximum voltage [V]	Functionality at minimum voltage [yes/no]	Functionality at maximum voltage [yes/no]					
0.5	1.34	4.72	5.00	yes	yes					
State of charge	Functionality and safety results			Comments						
	Functionality after test [yes/no]	Safety hazard [yes/no]	Damage [yes/no]							
0.5	yes	no	no	--						
State of charge	Damage description			Safety hazard description						
	n/a			n/a						
Overall comments (all appliances)										
--										

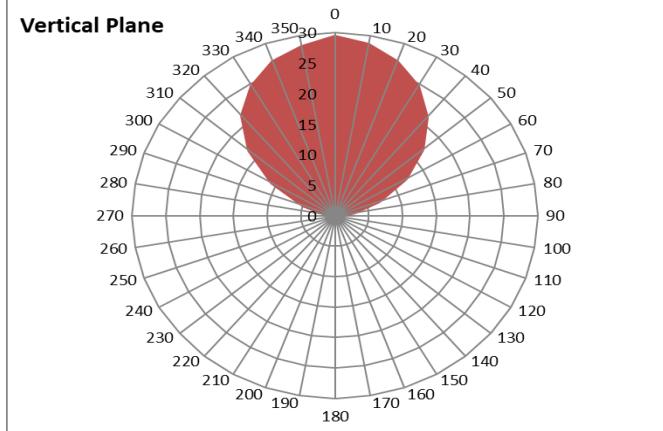
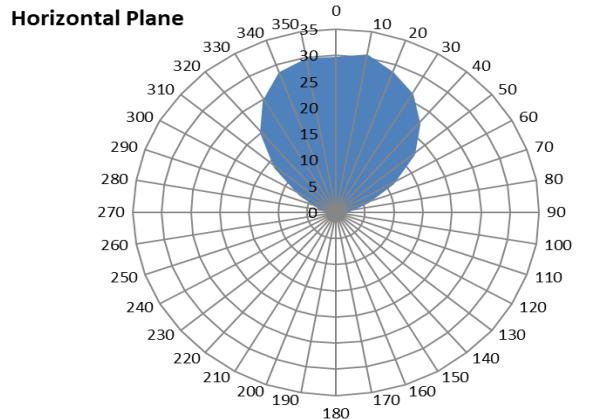
Luminous flux				Procedure : IEC TS 62257-9-5 Ed. 4 Light output test		
Appliance	Setting	Rating [lm]	Testing room temperature [C]			
SW2001 integrated light	High	80	21.9			
SW1001 torch	High	50	22.2			
Appliance:	SW2001 integrated light		Setting	High		
Sample	Total lumen output [lm]	Deviation from rating [%]	Drive voltage [V]	Drive current [A]	Stabilization time [min]	Luminous efficacy* [lm/W]
2	84	5%	3.8	0.272	52	81.6
Appliance:	SW1001 torch		Setting	High		
Sample	Total lumen output [lm]	Deviation from rating [%]	Drive voltage [V]	Drive current [A]	Stabilization time [min]	Luminous efficacy* [lm/W]
2	50	-1%	3.9	0.154	53	83.5
Overall comments						
--						

* Luminous efficacy is calculated by dividing luminous flux by the power consumption from the appliance tests or assessment of DC ports. This calculation is not defined in IEC 62257-9-5 and is therefore not an ISO/IEC 17025 accredited test result.

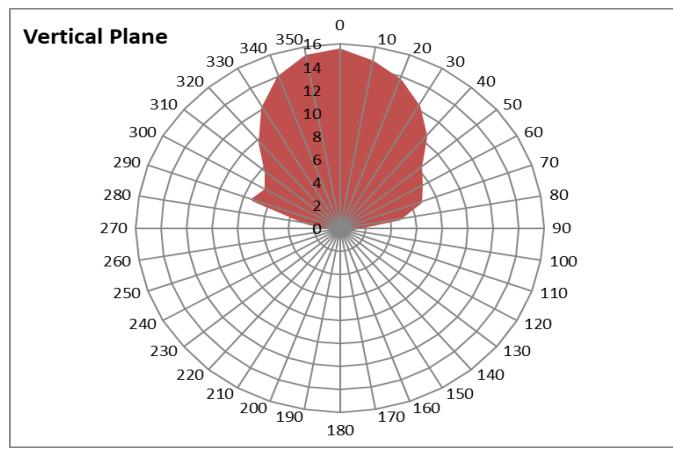
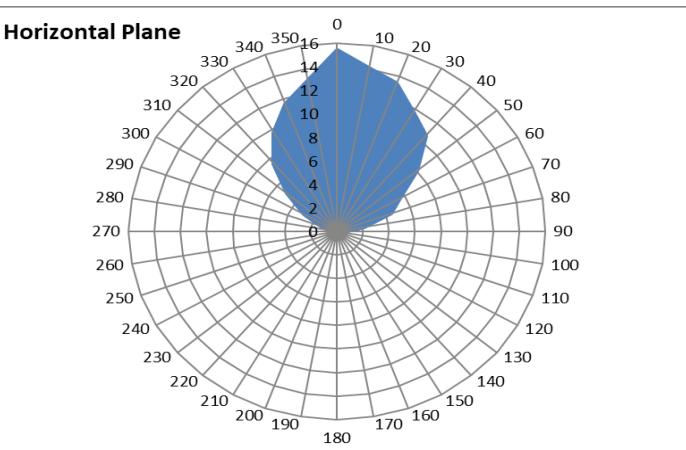
Color characteristics				Procedure : IEC TS 62257-9-5 Ed. 4 Light output test			
Appliance	Setting	CRI rating [-]	CCT rating [K]				
SW2001 integrated light	High	Not stated	3000				
SW1001 torch	High	Not stated	3000				
Appliance: SW2001 integrated light							
Setting	High						
Sample	CRI [-]	Deviation from rating [%]	CCT [K]	Deviation from rating [%]			
2	94.1	--	2809	-0.06			
Appliance: SW1001 torch							
Setting	High						
Sample	CRI [-]	Deviation from rating [%]	CCT [K]	Deviation from rating [%]			
2	93.1	--	2928	-0.02			
Sample	Appliance	Comments					
2	SW2001 integrated light	--					
2	SW1001 torch	--					
Overall comments							
--							

Lighting service - Task/ambient			
		Procedure : IEC TS 62257-9-5 Ed. 4 Light distribution test	
Light point	Testing room temperature [C]		
SW2001 integrated light		20.6	
SW1001 torch		22.1	
Light point:	SW2001 integrated light		
Setting:	High		
Sample	Horizontal full-width, half-max angle [degrees]	Vertical full-width, half-max angle [degrees]	Comments
2	101	108	--
Sample	Drive current [A]	Drive voltage at light point [V]	Stabilization time [mins]
2	0.3	3.74	44
Light point:	SW1001 torch		
Setting:	High		
Sample	Horizontal full-width, half-max angle [degrees]	Vertical full-width, half-max angle [degrees]	Comments
2	90	105	--
Sample	Drive current [A]	Drive voltage at light point [V]	Stabilization time [mins]
2	0.2	3.82	19
Overall comments			
--			

Polar plots at 1 m distance



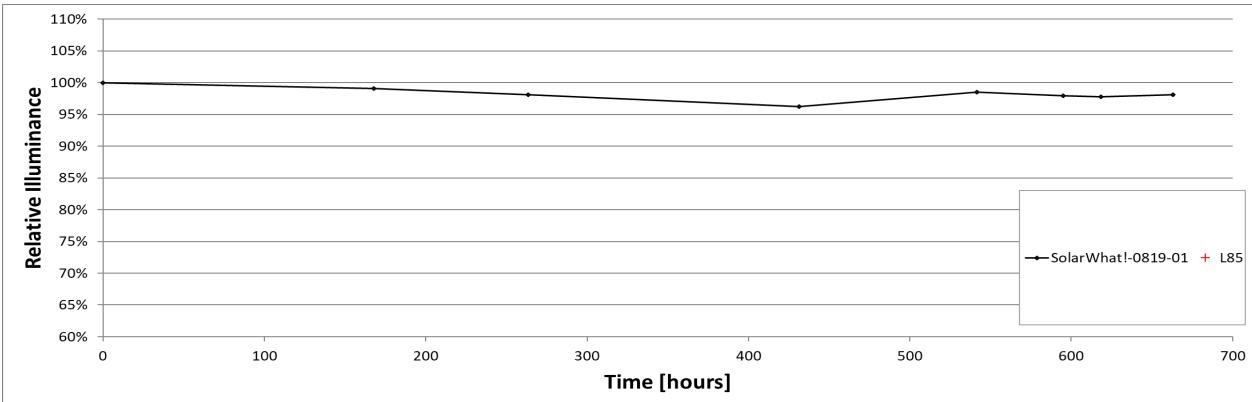
The polar plots for the SW2001 main unit integrated light are shown above.



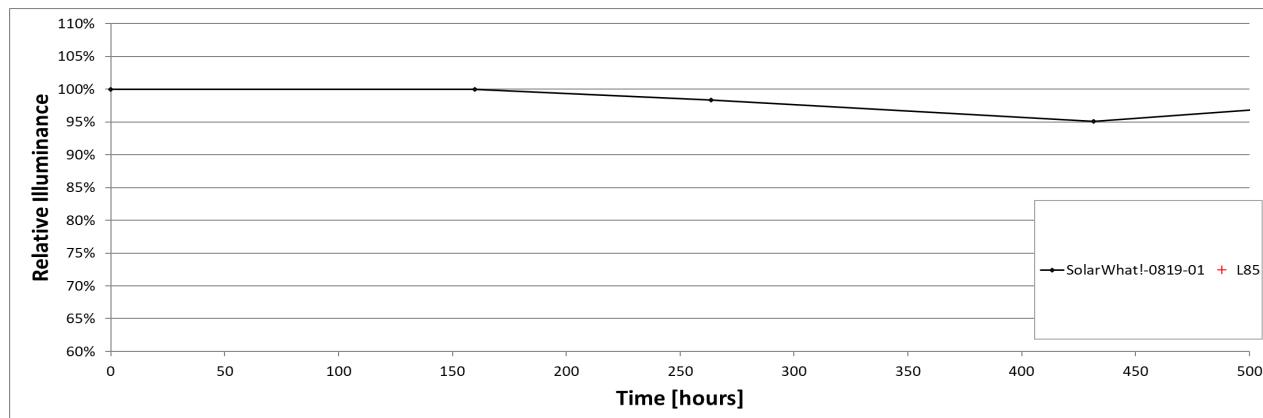
The polar plots for the SW1001 torch are shown above.

Lumen maintenance							
			Procedure : IEC TS 62257-9-5 Ed. 4 Lumen maintenance test				
Lighting unit	Test method						
SW2001 integrated light	Photometer box						
SW1001 torch	Photometer box						
<i>Measured values</i>							
Light point:	SW2001 integrated light						
Setting :	High						
Sample	Percent of initial lumen output measured at 500 h [%]	Percent of initial lumen output measured at 1000 h [%]	Percent of initial lumen output measured at 2000 h [%]	L ₈₅ [h]	Comments		
1	97.6	--	--	--	--		
Light point:	SW1001 torch						
Setting :	High						
Sample	Percent of initial lumen output measured at 500 h [%]	Percent of initial lumen output measured at 1000 h [%]	Percent of initial lumen output measured at 2000 h [%]	L ₈₅ [h]	Comments		
1	96.8	--	--	--	--		
Overall comments							
--							

Light output degradation over the duration of the test



to the left is the SW2001 main unit



to the left is the SW1001 torch

Table of measurements taken over the duration of the test

Time interval	Temperatures [°C]	SolarWhat!-0819-01		
		Relative Illuminance [lux]	Voltage at product [V]	Current into product [mA]
+60min	22.1	106.0	3.70	274
+24h	22.1	105.0	3.68	263
+48h	23.3	104.0	3.70	265
+48h	22.7	102.0	3.70	262
+48h	21.9	104.4	3.70	267
+48h	21.8	103.8	3.70	264
+1week	22.5	103.6	3.70	267
+1week	22.5	104.0	3.70	267

to the left is the SW2001 main unit

Time interval	Temperatures [°C]	SolarWhat!-0819-01		
		Relative Illuminance [lux]	Voltage at product [V]	Current into product [mA]
+60min	22.1	61.0	3.70	160
+24h	21.6	61.0	3.70	158
+48h	23.3	60.0	3.70	158
+48h	22.8	58.0	3.70	157
+48h	21.9	59.7	3.70	154
+48h	21.2	58.0	3.69	157
+1week	22.5	57.6	3.69	157
+1week	22.5	59.3	3.68	157

to the left is the SW1001 torch

Mechanical durability - Drop test

Procedure : IEC TS 62257-9-5 Ed. 4
Mechanical durability test

Components tested	Results
SW2001 integrated light	pass
SW1001 torch	pass

Description: SW2001 integrated light **pass/fail:** pass

Sample	Functional	Safety concern	Damage	Comments
3	pass	pass	pass	--

Description: SW1001 torch **pass/fail:** pass

Sample	Functional	Safety concern	Damage	Comments
3	pass	pass	pass	--

Overall comments

--

Drop test photo(s)



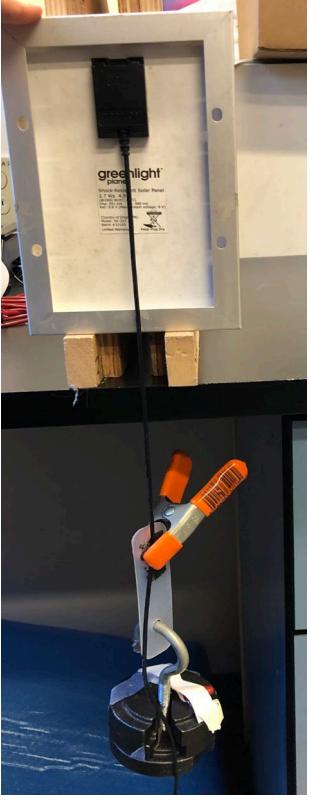
Mechanical durability - switches, connectors, and/or goosenecks								
			Procedure : IEC TS 62257-9-5 Ed. 4 Mechanical durability test					
Switches, connectors, goosenecks and moving parts tested		Results						
On/Off Switch on SW2001 main unit		pass						
USB port		pass						
micro USB port		pass						
micro USB port on torch		pass						
On/Off switch on SW1001 torch		pass						
Description: On/Off Switch on SW2001 main unit			pass/fail: pass					
Sample	Cycles achieved	Safety hazard [Pass/Fail]	Damage [Pass/Fail]	Functions after test [Pass/Fail]	Comments			
3	1000	pass	pass	pass	--			
Description: USB port			pass/fail: pass					
Sample	Cycles achieved	Safety hazard [Pass/Fail]	Damage [Pass/Fail]	Functions after test [Pass/Fail]	Comments			
3	1000	pass	pass	pass	--			
Description: micro USB port			pass/fail: pass					
Sample	Cycles achieved	Safety hazard [Pass/Fail]	Damage [Pass/Fail]	Functions after test [Pass/Fail]	Comments			
3	1000	pass	pass	pass	--			
Description: micro USB port on torch			pass/fail: pass					
Sample	Cycles achieved	Safety hazard [Pass/Fail]	Damage [Pass/Fail]	Functions after test [Pass/Fail]	Comments			
3	1000	pass	pass	pass	--			
Description: On/Off switch on SW1001 torch			pass/fail: pass					
Sample	Cycles achieved	Safety hazard [Pass/Fail]	Damage [Pass/Fail]	Functions after test [Pass/Fail]	Comments			
3	1000	pass	pass	pass	--			
Overall comments								
No damages or safety hazards were observed during or after the tests.								

Mechanical durability - Strain relief					
Cables tested		Results		Procedure : IEC TS 62257-9-5 Ed. 4 Mechanical durability test	
PV module		pass			
Description: PV module				pass/fail:	pass
Sample	Angle tested [degrees]	Functional	Safety hazard	Damage	Time achieved (s)
3	0	pass	pass	pass	60
	45	pass	pass	pass	60
	90	pass	pass	pass	60

Overall comments

There was no damage nor safety hazards observed during or after this test.

Photo(s)

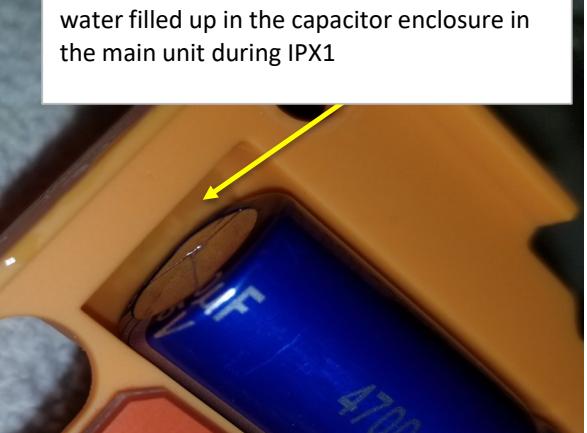
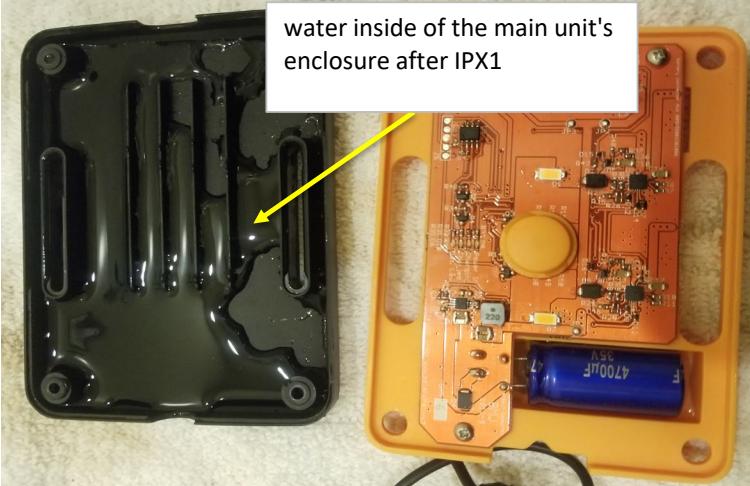


Estimated IP class & level of water protection		Procedure : IEC TS 62257-9-5 Ed. 4 Physical and water ingress protection test
PV modules tested	Form factor	
PV module	PV module-separate	
PV module:	PV module	
<i>Assessment</i>	<i>Result</i>	<i>Comments</i>
Protection against ingress of solid foreign objects		
Assessment of IP3X	pass	--
Protection against ingress of water with harmful effects		
Sensitive electronics present?	no	No sensitive electronics were observed.
Enclosure completely potted with silicone or similar sealant?	no	--
Assessment of modified IPX4	not examined	--
Technical level of water protection	not assessed	--
PV level of water protection	permanent rooftop installation for PV modules	--
Overall comments :	--	

Estimated IP class & level of water protection (continued)

Procedure : IEC TS 62257-9-5 Ed. 4

Physical and water ingress protection test

Components tested	Form factor	Water ingress IP rating for enclosure:		
SW2001 main unit	portable separate	IPX1		
SW1001 torch	portable separate	IPX1		
Component:	SW2001 main unit			
Component type:	Main Unit			
Assessment	Result	Comments		
Protection against ingress of solid foreign objects				
Levels tested (List all levels tested: IP2X, IP4X, etc.)	IP2X, IP3X, IP4X	--		
Highest level passed	IP3X	--		
Protection against ingress of water with harmful effects				
Levels tested (List all levels tested: IPX1, IPX3, etc.)	IPX1	--		
Highest water ingress level passed	IPX0	--		
Enclosure-only level of water protection	no protection	--		
Adequate warning label	no	--		
Technical level of water protection	not assessed	--		
Overall level of water protection	no protection	--		
Overall comments:	Water entered the integrated light's enclosure during the IPX1 test. The PV module was connected during the test. Additionally, there is no water protection label included with this product.			
Photo(s)				
 <div style="border: 1px solid black; padding: 5px; width: fit-content;"> water filled up in the capacitor enclosure in the main unit during IPX1 </div>				
 <div style="border: 1px solid black; padding: 5px; width: fit-content;"> water inside of the main unit's enclosure after IPX1 </div>				

Component:	SW1001 torch			
Component type:	Included Appliance			
<i>Assessment</i>	<i>Result</i>	<i>Comments</i>		
Protection against ingress of solid foreign objects				
Levels tested (List all levels tested: IP2X, IP4X, etc.)	IP2X,IP3X,IP4X	--		
Highest level passed	IP4X	--		
Protection against ingress of water with harmful effects				
Levels tested (List all levels tested: IPX1, IPX3, etc.)	IPX1	--		
Highest water ingress level passed	IPX0	--		
Enclosure-only level of water protection	no protection	--		
Adequate warning label	no	--		
Technical level of water protection	not assessed	--		
Overall level of water protection	no protection	--		
Overall comments:	Water entered the torch's enclosure during the IPX1 test. There is no water protection warning label included with this product.			
Photo(s)				
 				

Visual screening -- External

Procedure : IEC TS 62257-9-5:2018
Visual screening

Functionality test

<u>DUT sample number</u>	<u>Functional main unit (switches, connectors)</u>	<u>Functional appliances</u>	<u>Functional accessories</u>	<u>Can any appliance turn on/charge while charging with PV module?</u>	<u>Functional ports</u>	<u>Functional solar charging</u>
Sample 1	yes	yes	n/a	yes	yes	yes
Sample 2	yes	yes	n/a	yes	yes	yes
Sample 3	yes	yes	n/a	yes	yes	yes
<u>DUT sample number</u>	<u>Functional charging (if applicable, grid, mechanical, etc.)</u>	<u>Functional indicators/ user interface</u>	<u>Current enters battery when charge indicator turns on</u>	<u>Description of potential hazards or safety issues</u>	<u>Description of any failure</u>	
Sample 1	yes	n/a	yes	--	--	
Sample 2	yes	n/a	yes	--	--	
Sample 3	yes	n/a	yes	--	--	
Functional samples	3/3					
Overall comments:	The samples tested for functionality during visual screening includes all product components (SW2001 main unit, SW1001 torch, and the PV module).					

External product inspection

Arrangement/housing description	The main SW2001 main unit is a flat, rectangular shape and has a clear cap that allows the user to see the electronics within the unit. The ON/OFF button is round and in the center top of the main unit. The main unit has an integrated light that provides light from the top of the product and one USB port on the side that is advertised to have the ability to charge various appliances. On one side of the main unit is a small opening lined with a rubber gasket that is for the PV module cable to be strung through after installation. The SW1001 torch has a similar design as the SW2001 main unit, except it is smaller and a long, oval-shape. The top of the torch is slightly frosted, so the interior electronics cannot be clearly seen, and there is a micro-USB port on the side to allow for charging from the main unit using a USB to micro-USB cable (not provided).			
<u>Component name</u>	<u>Number of items included</u>	<u>Form factor</u>	<u>Expected use (for lights only, ambient light, task light, torch, n/a if does not apply)</u>	<u>Description of form factor</u>
SW2001 main unit	1	portable separate	task light	--
SW1001 torch	1	portable separate	task light	--
PV module	1	PV module-separate	n/a	This product came with a Greenlight Planet PV module; however, it is advertised as being able to receive PV input from 5V to 24 V from any PV module manufacturer.

<u>Component name</u>	<u>Material 1</u>	<u>Material 2</u>	<u>Material 3</u>	<u>Material 4</u>	<u>Description of material(s)</u>
SW2001 main unit	plastic	metal	--	--	The main unit has a plastic enclosure with internal PCB and batteries.
SW1001 torch	plastic	metal	--	--	The torch has a plastic enclosure with internal PCB and a battery.
<u>Light source name</u>	<u>Type of light source</u>	<u>Number of light sources in light point</u>	<u>Number of arrays in light point</u>	<u>Number of light points of this type</u>	<u>Description</u>
SW2001 integrated light	LED	2	1	The main unit integrated light has 2 LEDs.	--
SW1001 torch	LED	1	1	The torch light has one LED.	--
Appliance	Setting number	Setting name	Setting description		
SW2001 integrated light	1	high	2 LEDS illuminated on high		
	2	medium	2 LEDS illuminated on medium		
	3	low	2 LEDS illuminated on low		
SW1001 torch	1	High	1 LED on high		
	2	Low	1 LED on low		
<u>Component name</u>	<u>Feature(s)</u>	<u>Description of feature(s)</u>	<u>Description of component</u>		
SW2001 main unit	Detachable, replaceable	The main unit enclosure is fully detachable and parts are made to be easily replaced by user.	--		
SW1001 torch	Detachable, replaceable	The torch enclosure is fully detachable and parts are made to be easily replaced by user.	--		

<u>Component name</u>	<u>Mass [g]</u>	<u>Width [cm]</u>	<u>Height [cm]</u>	<u>Depth [cm]</u>
Entire product in package	--	--	--	--
SW2001 main unit	192	9.0	12.5	2.5
SW2001 integrated light	--	--	--	--
SW1001 torch	80	11.4	4.3	2.5
PV module	411	13.5	20.0	1.5

* If a star is present, it indicates the reported value is not an ISO 17025 accredited test result

Indicators

<u>Component name</u>	<u>Number of indicator(s)</u>	<u>Description of indicator(s)</u>
SW2001 main unit	3	Green LED - Power on, Red LED - battery low, Amber - charging
SW1001 torch	3	Green LED - Power on, Red LED - battery low, Amber - charging

Charging options

Solar :	yes	Comments :	--
Grid :	no	Comments :	--
Electromechanical :	no	Comments :	--

Grid charger safety

Is the grid charger included	no
Does the product advertise that it can be charged with a charger that is readily available in the market (e.g. Nokia charger)?	no
Does the charger carry any recognized safety marks (e.g. CE)?	n/a
Description of approval/rating.	--

Mobile phone charging information

Mobile phone charging	yes	Description:	Main unit has one USB for mobile charging or powering the torch
Mobile phone charging adapters	no	Description:	--
Removing PV module required to charge mobile phone?	no	Description:	--
Is it advertised that a mobile phone can charge directly from the PV module?	no	Description:	--
Other accessories:	n/a	Description:	--

Cable inspection

<u>Cable</u>	<u>*Length [m]</u>	<u>To be used outdoors</u>	<u>Outdoor certification</u>	<u>Description</u>
SW2001 main unit	--	--	--	This product does not have a permanent attached cable; the PV cable is described below.
SW1001 torch	--	--	--	This appliance does not have a cable.
PV module	4.09	n/a	n/a	The PV module provided by the manufacturer is a generic PV module that represents an option for this product, as this product was designed to be functional with different PV modules within a given range from different manufacturers.

* If a star is present, it indicates the reported value is not an ISO 17025 accredited test result

Solar module inspection

<u>PV module</u>	<u>*Active area [cm²]</u>	<u>Form</u>	<u>Solar material</u>	<u>Encasing material</u>	<u>Description of robustness</u>
PV module	168	External	Poly-Si	0	The PV module seems robust.
<u>PV module</u>	<u>Junction box workmanship</u>		<u>Description of visual defect conditions</u>		<u>General comments</u>
PV module	The junction box workmanship appears acceptable.		--		

* If a star is present, it indicates the reported value is not an ISO 17025 accredited test result

Port characteristics

Port number	Port name	Receptable Type	Number of identical ports	Nominal port voltage [V]	Source of nominal voltage
1	USB	USB Type A, Standard, 2.0	1	5	Manufacturer-provided information
2	Micro USB	USB Type B, Micro, 3.0	1	5	Manufacturer-provided information

Port characteristics (continued)

Port number	Rated maximum port current [A]	Source of maximum current	Advertised maximum current at low battery voltage, if different [A]	Rated maximum power [W]	Source of maximum power	Is the port intended or expected to be used for charging mobile devices?
1	0.5	Manufacturer-provided information	--	--	--	yes
2	--	--	--	--	--	no

indicates a source that is not consumer-facing.

Port characteristics (continued)

Port number	Rated minimum voltage [V]	Rated maximum voltage [V]	Advertised minimum voltage at lower battery voltage, if different [V]	Source of advertised voltage specifications	Power control unit for this port
1	--	5	--	Manufacturer-provided information #	SW2001 main unit
2	5	5.5	--	Manufacturer-provided information #	SW1001 torch

indicates a source that is not consumer-facing.

Port number	Comments
1	The manufacturer provided a specifications sheet for both units; however, this spec sheet can also be found on their public product website. The website is found here: http://www.solarwhat.xyz/
2	--

Documentation available				
Company information:	The University of Edinburgh; Old College, South Bridge, Edinburgh EH8 9YL, UK; +44 131 650 1000; info@solarwhat.xyz; solarwhat.xyz			
Operation manual provided?	yes	Type : on the product website		
Operation manual languages :	English			
Comments :	--			
Topic	Does the user's manual include graphics and/or language describing the following:			
	Required guidance:	[yes/no]	Recommended guidance:	[yes/no]
PV proper handling	do not shade PV module	no	keep PV module surface clean	no
			do not ding PV module from the back	no
			do not carry PV module by the cable	no
PV operation	how to connect PV module to unit for charging	--	prevent PV module from cracking	no
	face PV module surface toward the sun	yes		
Installation	any required pre-use steps described (fully charge battery, insert supplied fuse, if applicable)	yes	keep away from fire	no
	instructions for wire termination or connection during installation, if applicable	yes	install securely	yes
	how to make all required permanent connections	yes	install by company that sells the DUT and/or trained technicians (and if so, if technician training documentation or other detailed installation	n/a
			instructions regarding wire or cable connections (e.g. warnings to prevent shorting connections, directions on stripping the wires and instructions to securely screw down the wires	yes
Product operation	how to connect all advertised appliances	no	display instructions, if display is included	n/a
	battery state-of-charge instructions	no	avoid dropping/ do not drop	no
			do not cut or heat cable	no
			avoid keeping at a low state of charge for long periods of time	no
Maintenance	specifications for components that may require replacement (fuses, lights, PV, batteries)	yes	instructions for replacing components that may require replacement (fuses, lights, PV, batteries)	no
			fully charge before long-term storage	n/a
Hazard labelling:	--			

Warranty

Warranty included :	no	Consumer-facing:	no
Duration :	--	Warranty source :	--
Does the warranty explain how the consumer can access the warranty :	n/a		
Warranty description :	A warranty was not provided with this product; nor is there one found on the public website.		

Visual screening -- Internal

Procedure : IEC TS 62257-9-5:2018
Annex F, Visual screening

Workmanship

Methods used to secure parts inside the DUT and included appliances

<u>Component name</u>	<u>Screws</u>	<u>Glue</u>	<u>Tape</u>	<u>Clamps</u>	<u>Other(s)</u>	<u>Batteries securely fixed</u>
SW2001 main unit	--	yes	no	no	no	--
SW1001 torch	--	yes	no	no	no	--
PV module	--	yes	no	no	no	--

Overall comments: The components inside of this product and appliance appear to be adequately secured.

Methods used for securing wire and cable

<u>Component name</u>	<u>Solder</u>	<u>Pin-and-socket or similar connector</u>	<u>Screw terminals</u>	<u>Other(s)</u>	<u>Comments</u>
SW2001 main unit	yes	no	yes	--	Internal electronics are soldered in-place, and the PCB board is screwed in-place; whereas, the PV module cables are connected via a screw terminal.
SW1001 torch	yes	no	no	--	Internal electronics are soldered in-place.
PV module	no	no	yes	--	The cables are connected to the main unit via screw terminals.

Methods used for securing wire and cable (continued)

<u>Component name</u>	<u>Cables and wires properly laid out and not wedged by other components</u>	<u>Is this a plug-and- play component?</u>	<u>Is cable strain relief used?</u>	<u>Description of strain relief (if applicable)</u>	<u>Comments</u>
SW2001 main unit	yes	no	yes	There are three plastic pieces aligned near the screw terminals for the PV module that are in place to allow the PV leads strung through the openings between them, which provides strain relief to the attached PV cable.	--
SW1001 torch	n/a	yes	n/a	--	--
PV module	n/a	n/a	n/a	--	--

Screw Terminals *		
Screw terminal requirement	Is the requirement met?	Comments
The connection is straightforward to make, provides a good quality electrical connection, and does not require technical expertise to make (such as wrapping wire in a specific direction, soldering, or crimping in the field) if installed by consumer.	yes	The connection for the PV module is a screw terminal block, where a flat head screw driver is needed to loosen/tighten and a Philips head screw driver is needed to open the enclosure to access the terminal.
Adequate instructions are provided for making each type of connection, including a list of all required tools and sufficient instructions with illustrations.	no	Instructions and details regarding installation and replacement, including which tools are needed, are included in the user manual found on the product's public website; however, this information was not provided with the product, which is required.
After installation, all terminals (excluding connections on the charger controller) are insulated so that no live parts can be contacted or are enclosed in a way that the component would meet IP2X?	yes	--
Connectors on charge controllers are designed in a way to minimize the potential for short-circuiting, such as with plastic dividers.	yes	There is a plastic divider in between the two batteries (where each is connected to the PCB).
The leads from the battery to the charge controller and PV module to the charge controller have short circuit protection.	no	There are no evident physical barriers on the screw terminal block that would prevent short-circuiting the PV leads should they touch, which is possible if the insulation on the leads are stripped back too far by the user.
Adequate strain relief is provided, the method is clearly described in the installation instructions, and if any equipment or devices are required, these are included with the kit.	yes	Strain relief for the PV module connection is described in the user manual on the product public website.
Easily disconnected terminals, such as blade terminals, are enclosed so that the consumer cannot easily access the terminals.	n/a	The screw terminals are enclosed, and they are not easily disconnected from the PCB.
A means is provided and described in the instructions to identify wires or cables in order to avoid incorrect connections (e.g. color coding or labeling of wires)?	no	There are "+" and "-" symbols at the screw terminal block to indicate correct polarity for the PV module leads connections; however, explicit instructions were not provided with the product. Instructions are found on the manufacturer website.

All required tools other than commonly available tools are provided, or, if exclusively installed by an authorized technician, documentation is provided confirming that the necessary tools are supplied to the installing technicians?	yes	Screw drivers are needed to open the enclosure to install the PV module for this product.
All required materials (e.g. wire and terminals) are provided with the kit, supplied to the installing technician, or adequately specified to allow the installer to select the correct materials to make the connection.	no	The type of batteries and size of PV modules that can be used with this product are identified and described in the user manual, found on the product's public website; however, this information was not provided with the product, which is required.
All connectors or terminals are appropriate for the wire type and size, number of wires, current, voltage, and installation location. If terminals are for indoor use only, this limitation is clearly indicated in the installation instructions. Connectors are used within their design limits.	no	There is no statement reporting that the terminals are for indoor use only, which is a requirement.
Description of any screw terminal connections		
The screw terminal block is located inside of the main unit's enclosure, and will not become easily disconnected from the PCB. The PV module leads are fed into the screw terminals to provide power to the unit.		
Picture(s) of screw terminal connections		
		
Overall comments:	Overall, the indoor use information along with information regarding protection from short circuiting the PV leads are not reported for this product.	
* The screw terminal assessment is not part of IEC 62257-9-5; therefore, these results are not within the scope of accreditation to ISO/IEC 17025.		

Component Easy Replaceability

<u>Component name</u>	<u>Easily replaceable PCB</u>	<u>Easily replaceable battery</u>	<u>Battery connectors</u>	<u>Battery replacement guide available</u>	<u>Warranty void when product is opened</u>	<u>Comments</u>
SW2001 main unit	yes	yes	yes	yes	n/a	A warranty was not provided
SW1001 torch PV module	yes	yes	yes	yes	n/a	--
--	--	--	--	--	--	--

Batteries

<u>Component name</u>	<u>Contains internal circuitry</u>	<u>Sufficient information on proper disposal</u>	<u>External cell protection or balancing present?</u>	<u>Chemistry</u>	<u>Battery package type</u>	<u>Manufacturer</u>
SW2001 main unit	yes	yes	yes	Li-Ion (3.6-3.7 V/cell)	Other	Duracell
SW1001 torch	yes	yes	yes	Li-Ion (3.6-3.7 V/cell)	Other	Duracell

Overall comments:

Internal circuitry photo(s)



SW2001 main unit internal circuitry



SW1001 torch internal circuitry

Internal inspection deficiencies									
Sample	Count of deficiencies								
	Soldering	Wiring	Fixture	Battery	Safety	Functional			
1	0	0	0	0	0	0			
2	0	0	0	0	0	0			
3	0	0	0	0	0	0			
Deficiency score	0								
Workmanship quality	good								
Internal workmanship comments	Overall, workmanship quality is good. There weren't any deficiencies noted upon inspection.								
Overall internal screening comments	No deficiencies were found during the visual inspection.								
Internal screening photo(s)									
Visual screening -- Specifications									
				Procedure : IEC TS 62257-9-5:2018					
				Visual screening					
Specifications available									
PV module: PV module									
Category	Parameter	Units	Value	Source of information	Conflicting value [yes/no]				
PV	PV module PMPP	W	2.7	On component	no				
	PV module VOC	V	5.8	On component	no				
	PV module ISC	mA	586	On component	no				
	PV module VMPP	V	4.9	On component	no				
	PV module IMPP	mA	Not stated	--	n/a				
Main unit: SW2001 main unit									
Category	Parameter	Units	Value	Source of information	Conflicting value [yes/no]				
Battery	Battery chemistry	--	Li-Ion (3.6-3.7 V/cell)	Website	no				
	Rated battery capacity	Ah	1.1	Website	no				
	Nominal battery voltage	V	3.7	On component#	no				
	Battery package type	--	Other	On component	no				
Electronics	Charge controller in design	--	yes	Other#	no				
	Charge Controller LVD	V	Not stated	--	n/a				
	Charge Controller OVP	V	Not stated	--	n/a				
	Maximum input voltage range	V	5	Website	no				
	Minimum input voltage range	V	30	Website	no				
Energy	Number of mobile phones charged from this appliance's internal battery, with a full battery	--	Not stated	--	n/a				
	Number of mobile phones charged from this appliance's internal battery, in a day of solar charging	--	Not stated	--	n/a				
	Daily energy service	Wh/day	Not stated	--	n/a				

Power consumption	Average power	W	Not stated	--	n/a
	Standby power usage	W	Not stated	--	n/a
	Setting				
	high	W	Not stated	--	n/a
	medium	W	Not stated	--	n/a
	low	W	Not stated	--	n/a
Run time	Full-battery run time				
	high	hr	6	Website	no
	medium	hr	15	Website	no
	low	hr	96	Website	no
	--	hr	--	--	no
	Daily solar run time				
	high	hr	Not stated	--	n/a
	medium	hr	Not stated	--	n/a
	low	hr	Not stated	--	n/a
	Electromechanical run time				
	high	hr	Not stated	--	n/a
	medium	hr	Not stated	--	n/a
	low	hr	Not stated	--	n/a
	Grid run time				
	high	hr	Not stated	--	n/a
	medium	hr	Not stated	--	n/a
	low	hr	Not stated	--	n/a
	Other run time				
	high	hr	Not stated	--	n/a
	medium	hr	Not stated	--	n/a
	low	hr	Not stated	--	n/a

Charging time	Charging time required to fully charge battery	hr	Not stated	--	n/a
	Daily charging time required to achieve advertised solar run time	hr	Not stated	--	n/a
	Duration of charging or amount of effort required to achieve advertised electromechanical run time	hr	Not stated	--	n/a
	Duration of charging required to achieve advertised grid run time	hr	Not stated	--	n/a
	Duration of charging for additional run time specification	hr	Not stated	--	n/a
Light source	Lamp type	--	LED	Website	no
	Lamp driver	--	Not stated	--	n/a
	Correlated color temperature	K	3000	Website	no
	Color rendering index	--	Not stated	--	n/a
	Setting				
	high	lm	40	Website	no
	medium	lm	15	Website	no
	low	lm	5	Website	no

Included appliances					
Appliance: SW1001 torch					
Category	Parameter	Units	Value	Source of information	Conflicting value [yes/no]
Battery	Battery chemistry	--	Li-Ion (3.6-3.7 V/cell)	On component#	no
	Rated battery capacity	Ah	1.1	On component#	no
	Nominal battery voltage	V	3.7	On component#	no
	Battery package type	--	Not stated	--	n/a
Electronics	Charge controller in design	--	yes	Other#	no
	Charge controller LVD	V	Not stated	--	n/a
	Charge controller OVP	V	Not stated	--	n/a
	Maximum input voltage range	V	5	Website	no
	Minimum input voltage range	V	5.5	Website	no
Energy	Number of mobile phones charged from this appliance's internal battery, with a full battery	--	Not stated	--	n/a
	Number of mobile phones charged from this appliance's internal battery, in a day of solar charging	--	Not stated	--	n/a
	Daily energy service	Wh/day	Not stated	--	n/a
Power consumption	Average power	W	Not stated	--	n/a
	Standby power usage	W	Not stated	--	n/a
	Setting				
	High	W	Not stated	--	n/a
	Low	W	Not stated	--	n/a
Run time	Full-battery run time				
	High	hr	5	Website	no
	Low	hr	24	Website	no
	Daily solar run time				
	High	hr	Not stated	--	n/a
	Low	hr	Not stated	--	n/a
	Electromechanical run time				
	High	hr	Not stated	--	n/a
	Low	hr	Not stated	--	n/a
	Grid run time				
	High	hr	Not stated	--	n/a
	Low	hr	Not stated	--	n/a
	Other run time				
	High	hr	Not stated	--	n/a
	Low	hr	Not stated	--	n/a

Charging time	Charging time required to fully charge battery	hr	Not stated	--	n/a
	Daily charging time required to achieve advertised solar run time	hr	Not stated	--	n/a
	Duration of charging or amount of effort required to achieve advertised electromechanical run time	hr	Not stated	--	n/a
	Duration of charging required to achieve advertised grid run time	hr	Not stated	--	n/a
	Duration of charging for additional run time specification	hr	Not stated	--	n/a
Light source	Lamp type	--	Not stated	--	n/a
	Lamp driver	--	Not stated	--	n/a
	Correlated color temperature	K	3000	Website	no
	Color rendering index	--	Not stated	--	n/a
	Setting				
	High	lm	50	Website	no
	Low	lm	10	Website	no

Advertised appliances

Appliance: Mobile phone					
Category	Parameter	Units	Value	Source of information	Conflicting value [yes/no]
Battery	Battery chemistry	--	Not stated	--	n/a
	Rated battery capacity	Ah	--	--	n/a
	Nominal battery voltage	V	Not stated	--	n/a
Electronics	Maximum input voltage range	V	Not stated	--	n/a
	Minimum input voltage range	V	Not stated	--	n/a
Energy	Daily energy service	Wh/day	--	--	n/a
Power consumption	Average power	W	5	Annex HH#	n/a
	Standby power usage	W	Not stated	--	n/a
	Power consumption during charging	W	5	Annex HH#	n/a
	Setting				
	on	W	Not stated	--	n/a
Run time	Full-battery run time				
	on	hr	Not stated	--	n/a
	Daily solar run time				
	on	hr	Not stated	--	n/a
	Electromechanical run time				
	on	hr	Not stated	--	n/a
	Grid run time				
	on	hr	Not stated	--	n/a
	Other run time				
	on	hr	Not stated	--	n/a

Appliance: Radio					
Category	Parameter	Units	Value	Source of information	Conflicting value [yes/no]
Battery	Battery chemistry	--	Not stated	--	n/a
	Rated battery capacity	Ah	--	--	
	Nominal battery voltage	V	Not stated	--	n/a
Electronics	Maximum input voltage range	V	Not stated	--	n/a
	Minimum input voltage range	V	Not stated	--	n/a
Energy	Daily energy service	Wh/day	--	--	n/a
Power consumption	Average power	W	0.5	Annex HH#	n/a
	Standby power usage	W	Not stated	--	n/a
	Power consumption during charging	W	2.25	Annex HH#	n/a
	Setting				
	on	W	Not stated	--	n/a
Run time	Full-battery run time				
	on	hr	Not stated	--	n/a
	Daily solar run time				
	on	hr	Not stated	--	n/a
	Electromechanical run time				
	on	hr	Not stated	--	n/a
	Grid run time				
	on	hr	Not stated	--	n/a
	Other run time				
	on	hr	Not stated	--	n/a

Appliance: Portable battery pack					
Category	Parameter	Units	Value	Source of information	Conflicting value [yes/no]
Battery	Battery chemistry	--	Not stated	--	n/a
	Rated battery capacity	Ah	--	--	n/a
	Nominal battery voltage	V	Not stated	--	n/a
Electronics	Maximum input voltage range	V	Not stated	--	n/a
	Minimum input voltage range	V	Not stated	--	n/a
Energy	Daily energy service	Wh/day	--	--	n/a
Power consumption	Average power	W	2.25	Annex HH#	n/a
	Standby power usage	W	Not stated	--	n/a
	Power consumption during charging	W	Not stated	--	n/a
	Setting				
	on	W	2.25	Annex HH#	n/a
Run time	Full-battery run time				
	on	hr	Not stated	--	n/a
	Daily solar run time				
	on	hr	Not stated	--	n/a
	Electromechanical run time				
	on	hr	Not stated	--	n/a
	Grid run time				
	on	hr	Not stated	--	n/a
	Other run time				
	on	hr	Not stated	--	n/a

Specification source key

LG SSS	Lighting Global Standardized Specification Sheet
Outside package	Documentation on side of packaging box
Inside package	Documentation inside packaging box (e.g. pamphlet)
On component	Specifications on component
Website	Manufacturer's public website
LG MIF	Lighting Global manufacturer information form
Annex HH	IEC 62257-9-5 Annex HH - Generic appliances

indicates a source that is not consumer-facing.

Describe Other Source, if specified : --

Performance Reporting Requirement:	No product packaging was provided.
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General specification comments/discrepancies

There were no discrepancies.

Appendix A. Visual screening - Photos

Procedure : IEC TS 62257-9-5 Ed. 4

Visual screening



Top: Top view
of the SW2001
main unit



Side view of the
SW2001 main
unit, and the
bottom view

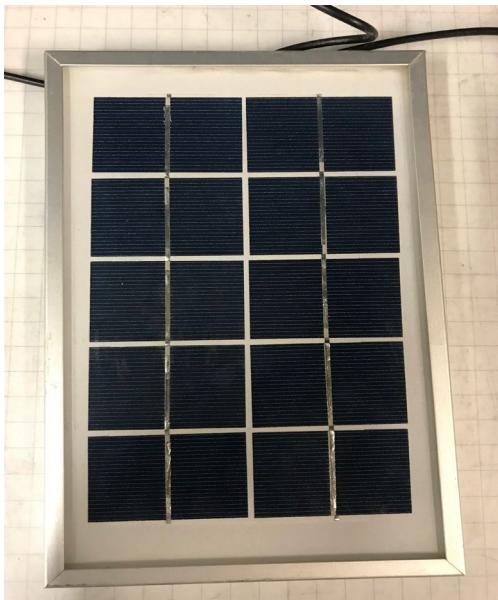


Battery-enclosure of the SW1001,
and the side view

Appendix A. Visual screening - Photos (continued)



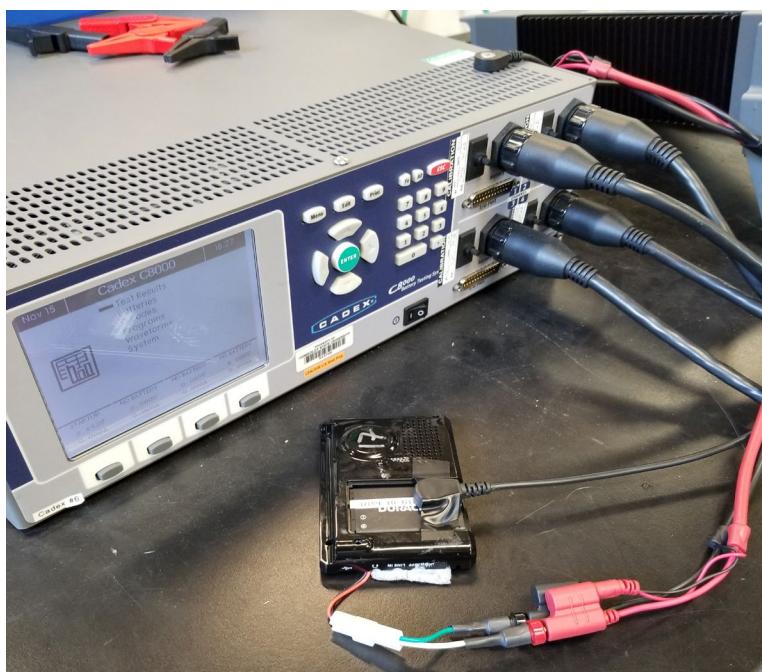
Bottom view of
the torch, and
the top view of
the torch



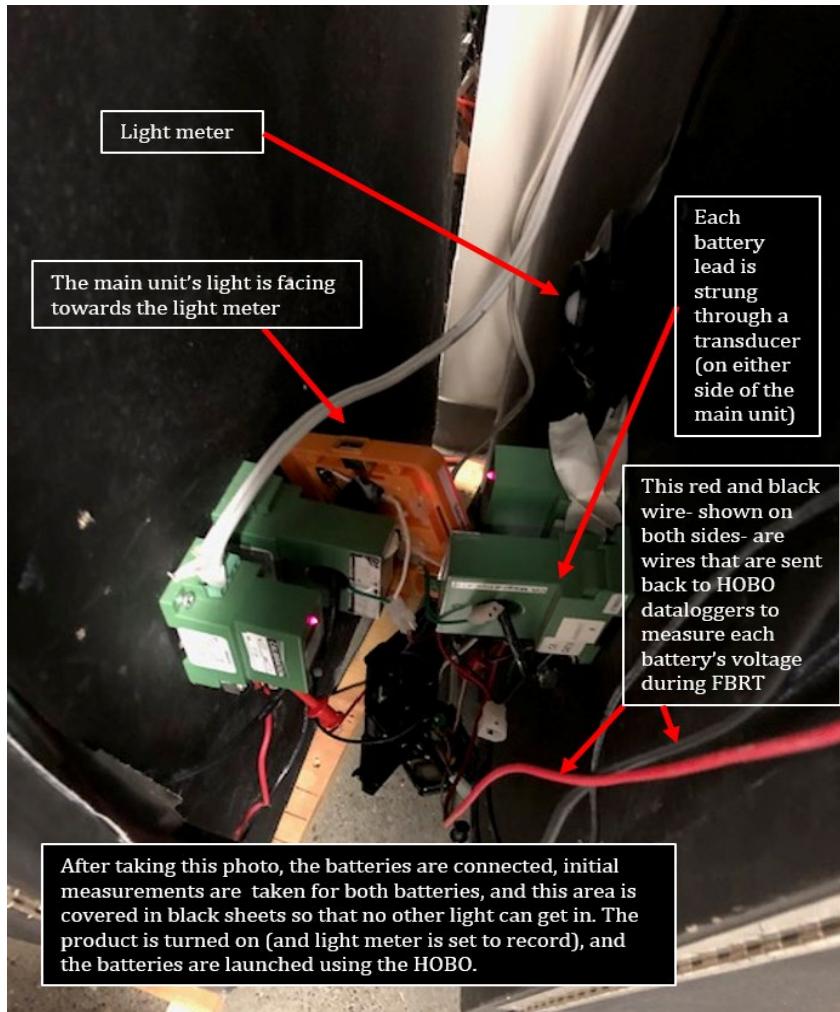
Front view of the
PV module, and
the back view.

Appendix A. Visual screening - Photos (continued)

Battery capacity Test

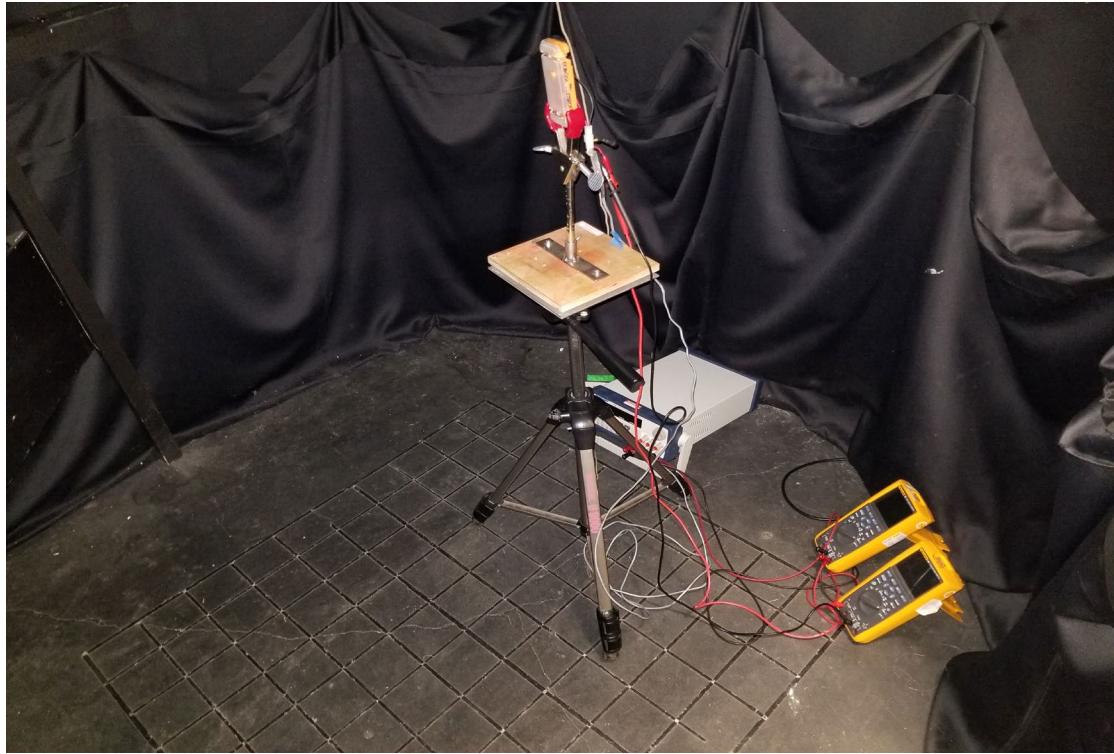


Full-battery run time test

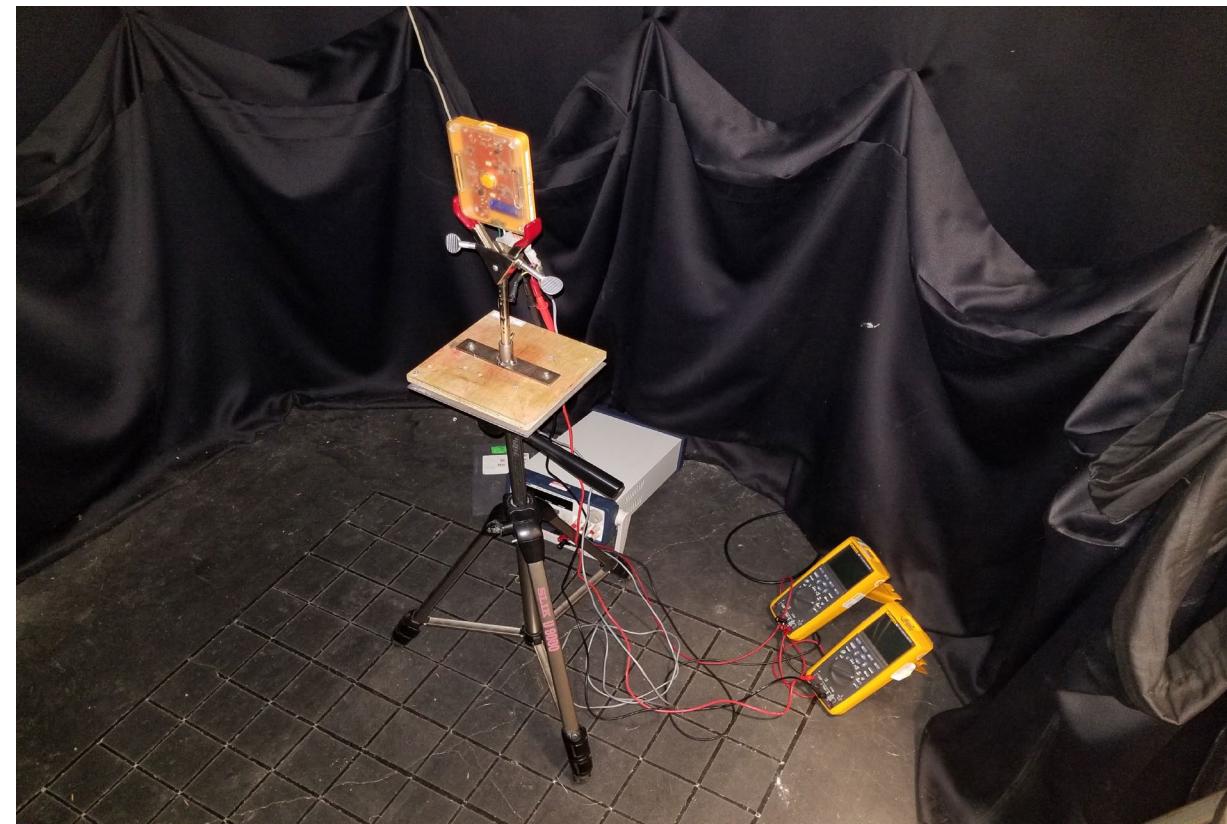


Appendix A. Visual screening - Photos (continued)

Light Distribution Test



Torch

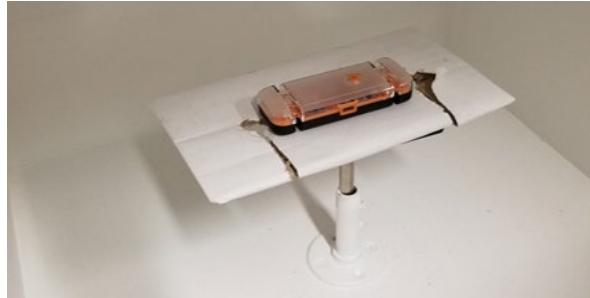


Main unit

Appendix A. Visual screening - Photos (continued)

Lumen maintenance Test

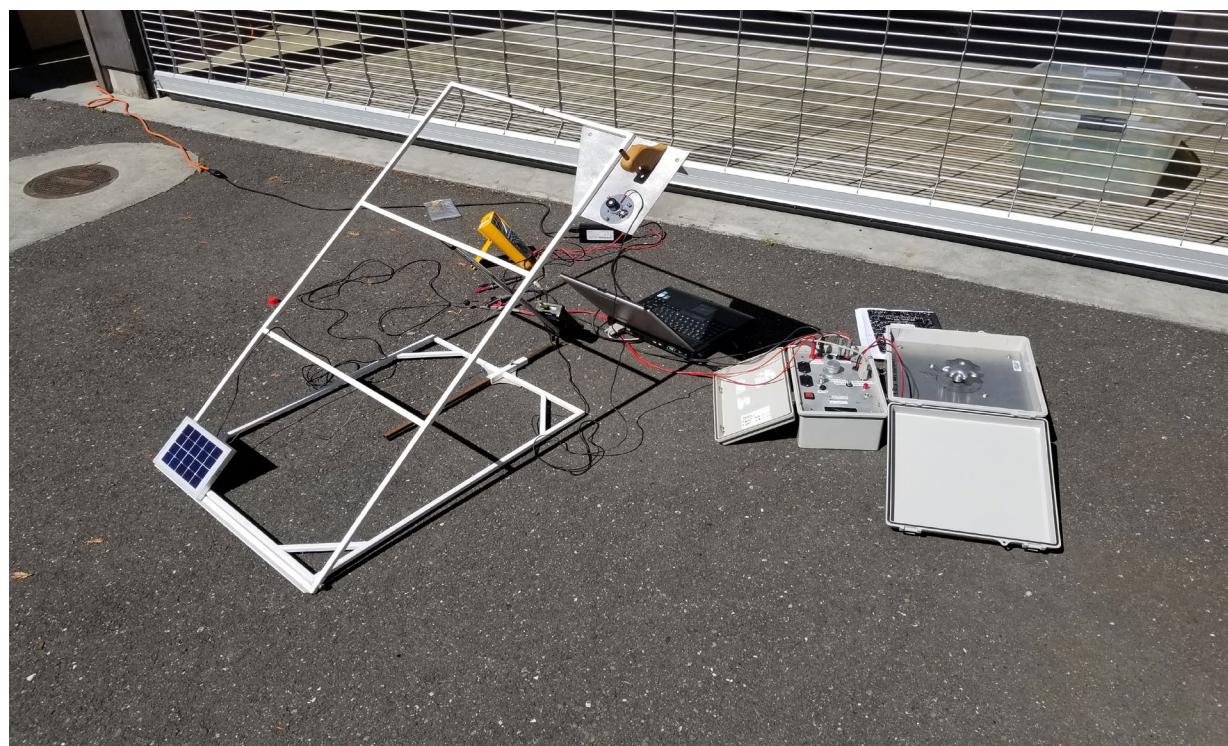
The torch set-up in the dark box (the light meter is not pictured by is located in the upper left corner). The torch is placed in this position each time lux is measured.



The main unit set-up in the dark box each time the lux is measured during lumen maintenance test.

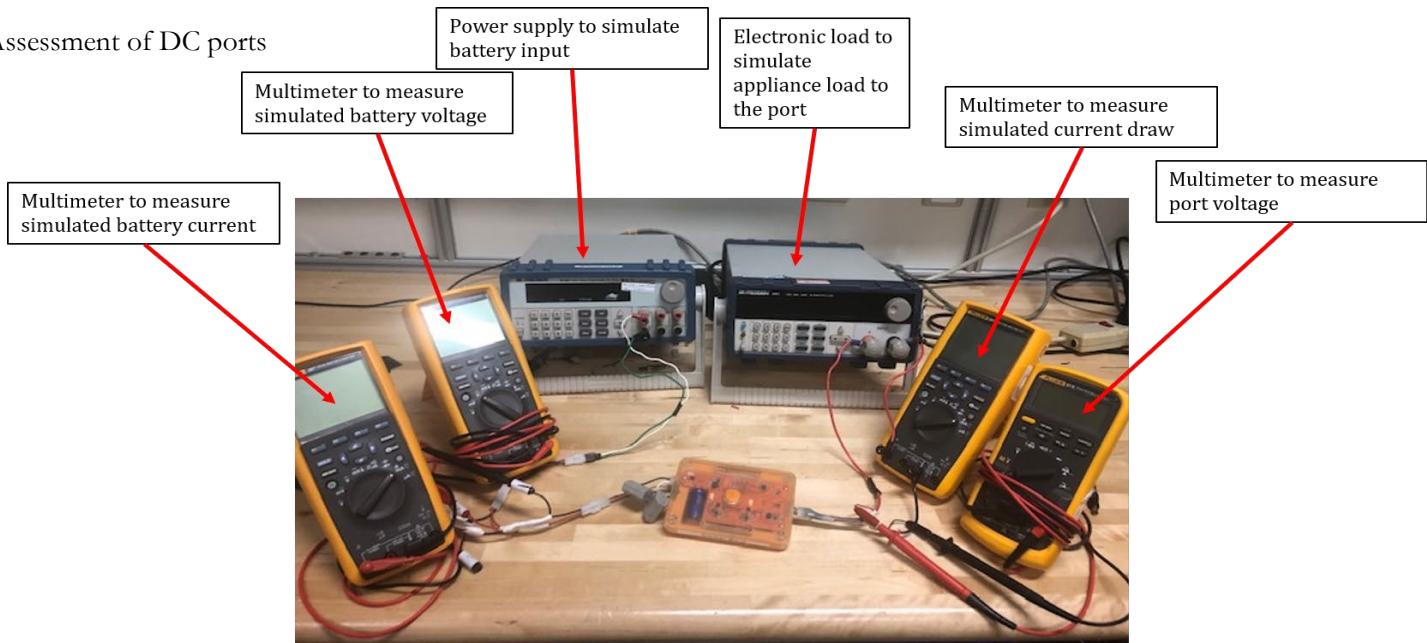


Outdoor IV Curve Test



Appendix A. Visual screening - Photos (continued)

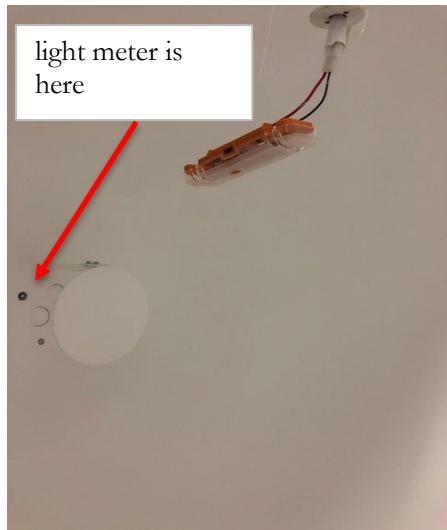
Assessment of DC ports



Assessment of DC ports set-up: SolarWhat?!

Charging efficiency-- similar to set-up in photo above; however, replace the electronic load with the torch (with a battery at 50% state of charge) to measure the voltage and current from the simulated PV input (the power supply is attached to the screw terminal box) and for battery input into the torch's battery to calculate charging efficiency.

Light output Test



(torch hanging inside of the integrating sphere)



Standby Loss Test



Appendix A. Visual screening - Photos (continued)

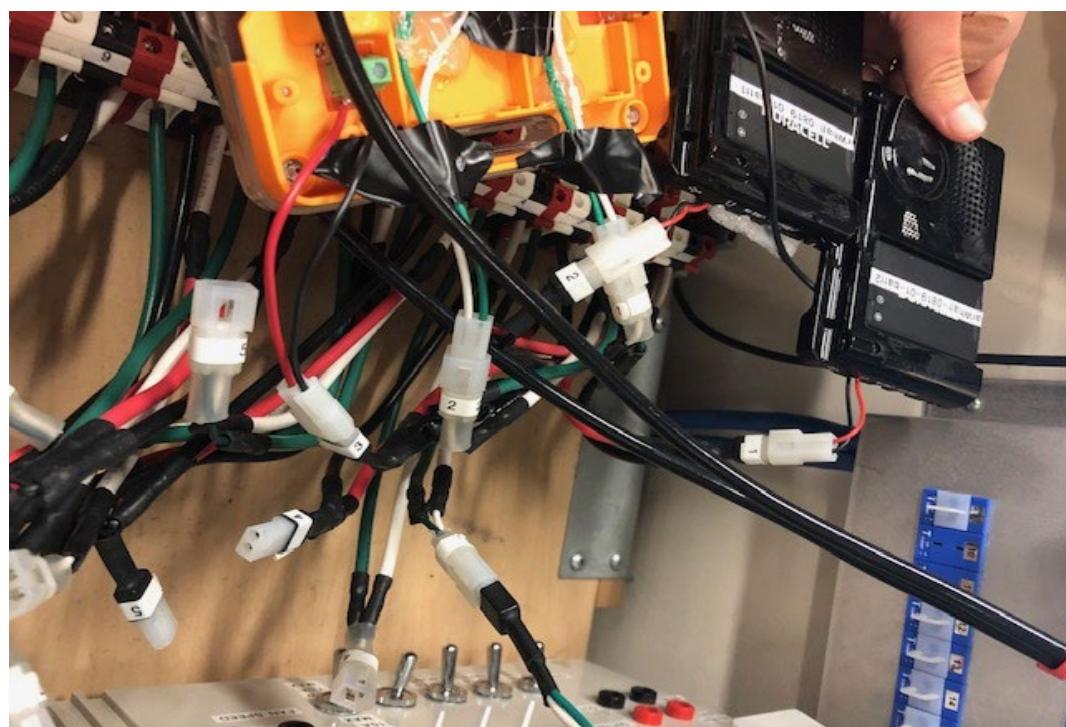
Overvoltage Protection and Solar Run time Test



Power flow for this test:

- Out of the power supply and through a variable resistor box
- out of the resistor box and into the PV socket (screw terminal)
- through the PCB and out of each battery socket
- into each battery

Each socket is plugged into our DAQ system to measure voltage and current for each.



Appendix A. Visual screening - Photos (continued)

The next few pages are documentation found on the manufacturer's website-- specification sheet and user manual

LEGAL & SAFETY INFORMATION

LEGAL

Solar What?! is licensed under Creative Commons Share Alike 4.0 International (available at: <https://creativecommons.org/licenses/by/4.0/legalcode.txt>) and as such uses the Disclaimer of Warranties and Limitation of Liability found in Section 5 of this license.

SAFETY

We have made our products as easy to assemble, disassemble, repair, and use as possible. Limited liability is required for basic maintenance. Solar What?! does, however, expect users attempting any repair to read the safety information below and have relevant technical expertise where required. Please note, this information is not exhaustive and all activities are carried out at the user's own risk.

Battery Safety

- Solar What!?** Impproperly replaced batteries may present a risk of leak or explosion and personal injury.
- Non-rechargeable batteries may present a risk of fire or chemical burn. Do not open, mutilate, or expose to conducting materials, moisture, liquid or heat above 54°C. Do not short circuit the battery by directly connecting the terminals.
- Only use users to replace what the NC batteries with other BLiC batteries. Use of other batteries and power sources has been designed for, but should only be attempted by users with appropriate electrical knowledge and at their own risk.
- Do not charge batteries with devices intended for use with other batteries. Only charge Lithium Ion batteries with devices intended for that purpose and not with devices intended to recharge Nickel Cadmium or Nickel Metal Hydride batteries.
- Keep batteries away from the reach of children.
- For further information, refer to the manufacturer of the battery used.

Battery Use, Maintenance and Disposal:

- The recommended BLiC battery is best charged at 21°C. Charging below 10°C, or above 35°C, is not recommended and Solar What?! products will not charge at temperatures below 0°C or above 50°C.
- If a battery is not working, check to see if the metal terminals are clean. If they are dirty, wipe them with a soft dry cloth.
- All batteries will experience a deterioration in performance over time. If a battery has reached the point where it is no longer providing charge for a convenient amount of time you should consider replacing it. See the relevant sections of this manual for guidance.
- For further information on using, charging or storing batteries, refer to the manufacturer of the battery used.
- Batteries should be appropriately disposed of by handing them into a battery collection point, where available. Used batteries should not be buried, burned or otherwise damaged in ways stated above.

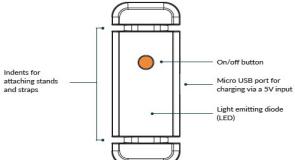
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The photos above are info from manufacturer website

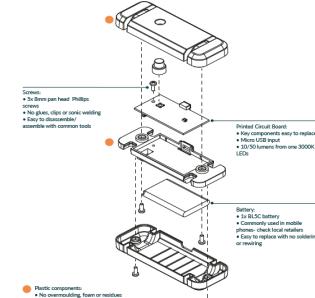
Solar What?! User Manual and Repair Guide (v1)

SOLAR WHAT?! LIGHT (SW100D) USING THE PRODUCT



SOLAR WHAT?! LIGHT (SW100D) COMPONENTS

Solar What?! Light has been designed to maximise the ease of assembly, disassembly and repair. It is simple to separate components out into electrical and plastic parts; repair or replace those which may be faulty, or just change a battery. This section outlines one way to repair this product, but we encourage experimentation and hacking if you know what you are doing and are aware of the risks.



SOLAR WHAT?! LIGHT (SW100D) MAINTENANCE AND REPAIR

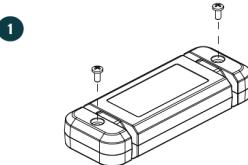
This product has been designed to allow easy access to important components when they need replacing or repairing. Nothing gets forever, but there is no need to throw away a whole product when some simple steps can help to fix a problem.

1. INITIAL PERIOD OF USE

A new Solar What?! Light should last for 2-3 years before requiring any sort of basic maintenance or repair. Depending on how frequently it is used, and how it is looked after, this period could vary in length.

2. REPLACING THE BATTERY

Tools needed:
1x Philips screwdriver (preferably PH1)
Alternatively, a small flat head or Pozidrive screwdriver



The photos above are info from manufacturer website

3. REPLACING PCB COMPONENTS

The longer the SW light is used, the more wear and tear will be experienced by key components on the printed circuit board (PCB). The micro USB connector and the switch are most likely to suffer from repeated use. Instructions for their replacement are detailed below.

Tools needed:
1x Phillips screwdriver
1x Solder wick or solder pump (optional)

The micro USB and switch both have accessible leads and a minimum pitch of 0.6mm. Most commonly available soldering irons are able to unsolder/re solder these components.

Take care when soldering in order to follow the guidance given in the Legal and Safety section of this document, on pages 3 and 4.

1. Micro USB Connector

A through-hole technology component. As the PCB is double sided, solder will need to be removed from the leads on both sides of the PCB before it can be removed.

The manufacturer's part number (1054A4031-1-L01) is written on the PCB, next to the component. It is designed to be compatible than most right angle, through-hole technology, micro USB connectors should be compatible.

This component has a built-in seal for increased ingress protection against water and dust. If this component is not used then the product may be more at risk from damage from water and dust. Refer to the Gerber files on GitHub (<https://github.com/SolarWhat/Light-SW100D>) to assess specific requirements.

1*. External Power Supply

The PCB has two through-holes located behind the micro USB port. If a suitable component is not available to replace the micro USB connector, an external 3V power supply can be soldered in place here. This will charge the battery or power the board directly should a battery be missing or flat.

Look either side of the holes for indicators of polarity.

It is important that any power supply connected in this way should be able to be turned off when battery-charging is complete or when light is no longer required.

2. Switch

This component is a surface mounted, single pole, single throw switch. All four leads will need to be unsoldered before removal.

The manufacturer's part number is F5M415MA. However, many other similar SOT23 surface mounted switches will also work. Refer to the Gerber files on GitHub (<https://github.com/SolarWhat/Light-SW100D>) to assess specific requirements.

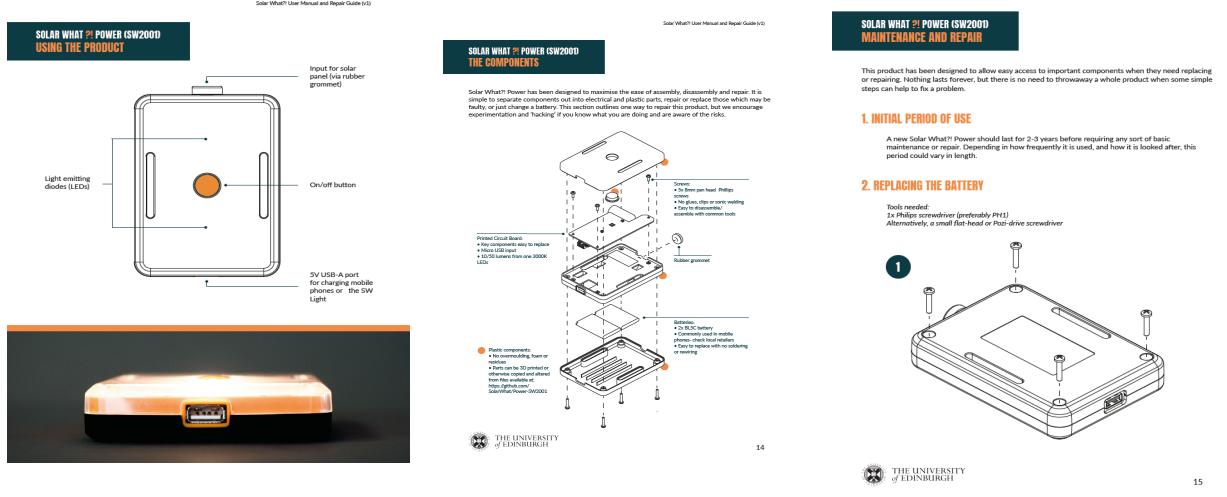
It is important to note that any repair option which does not use the same components as the originals may compromise the durability and longevity of the product.

The photos above are info from manufacturer website

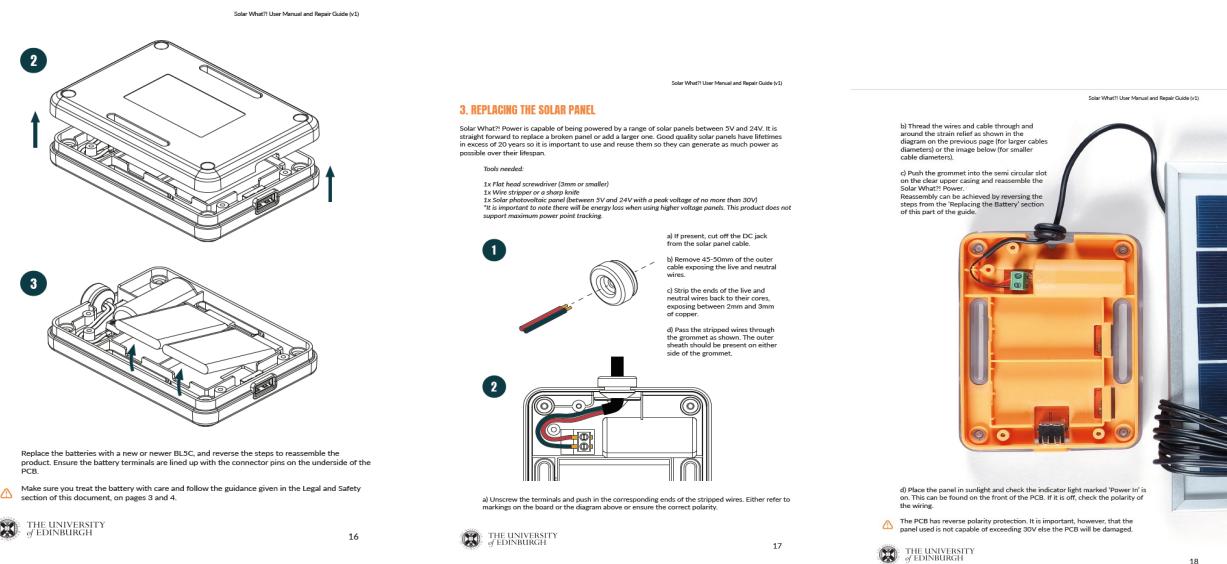
Replace the battery with a new or proven BLiC, and reverse the steps to reassemble the product. Ensure the battery terminals are lined up with the connector pins on the underside of the PCB.

⚠ Make sure you treat the battery with care and follow the guidance given in the Legal and Safety section of this document, on pages 3 and 4.

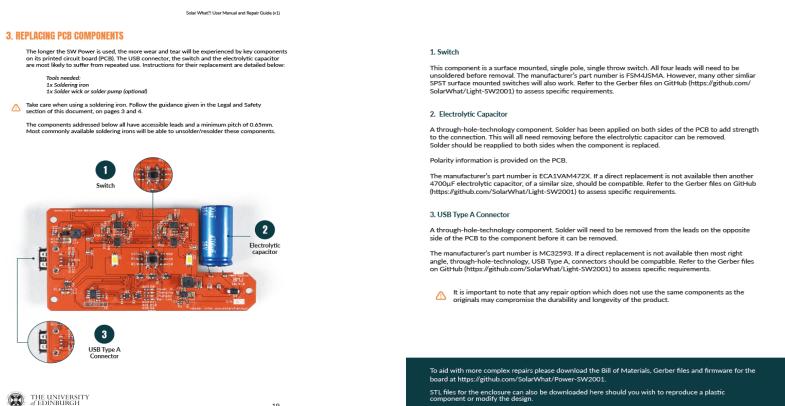
Appendix A. Visual screening - Photos (continued)



The photos above are info from manufacturer website



The photos above are info from manufacturer website



The photos above are info from manufacturer website

Appendix A. Visual screening - Photos (continued)

SOLAR WHAT?!
LIGHT (SW100)



Dimensions	Length 114mm, width 43mm, depth 25mm
Weight	TBC
Main Body	Four part, plastic, fully detachable enclosure
Solar Panel	Not included (see 'charging' for more information)
Battery	1 x BL-5C Lithium Ion Battery
Replaceable battery	Yes - fully replaceable and widely available
Screws	5 x 8mm pan head Phillips screws
Wires	None
Ultrasonic welding / Hidden parts	None
Glue or adhesives	None
Potting compound	None
Foam inserts	None
Switch	Mechanical switch, with facility to solder external power supply
LED	Main LED - warm white 3000K, 10/50 lumens. 3x status LEDs: battery low - red, charging - amber, charged - green.
Light output/duration	TBC
Battery lifespan	TBC. Varies depending on the quality and age of the BL-5C battery, and hours of use. Approximately 24 hours on low brightness and 5 hours on high brightness with a new high quality 1100mAh BL-5C battery.
Durability/Ingress Protection	IPX4
Charging	Solar What! Light is charged via micro USB (charges from anything with a 5V USB output, including portable battery packs, grid connected sockets and solar panels fitted with a micro USB output adapter (though panels must not exceed 5.5V at peak))
Output	None

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SOLAR WHAT?!
POWER (SW200)



Dimensions	Length 125mm, width 90mm, depth 25mm
Weight	TBC
Main Body	Four part, plastic, fully detachable enclosure
Solar Panel	Compatible with any solar panel between 5 - 24 volts rating, solar panel wires connected via screw terminal fittings on the interior of the product. Absolute maximum input voltage 30V. Energy loss at high voltage.
Battery	2 x BL-5C Lithium Ion Batteries
Replaceable battery	Yes - fully replaceable and widely available
Screws	7 x 8mm pan head Phillips screws
Wires	None
Ultrasonic welding / Hidden parts	None
Glue or adhesives	None
Potting compound	None
Foam inserts	None
Switch	Mechanical switch, with facility to solder external power supply
LED	2x main LEDs - warm white 3000K, 5/15/40 lumens each. 4x status LEDs: power in - green, battery low - red, charging - amber, charged - green
Light output/duration	TBC. Battery lifespan varies depending on the quality and age of the BL-5C battery, and hours of use. Should be around 96 hours on low brightness, 15 hours on medium brightness or 6 hours on high brightness with two new high quality 1100mAh BL-5C batteries.
Battery lifespan	TBC. Battery lifespan varies depending on the quality and age of the BL-5C battery, and hours of use. Should be around 96 hours on low brightness, 15 hours on medium brightness or 6 hours on high brightness with two new high quality 1100mAh BL-5C batteries.
Durability/Ingress Protection	IPX4
Charging	USB port - 5V 500mA. Can be connected to a silicon solar panel between 5 and 30 volts via two screw terminals. Connection does not require any plug or adapter.
Output	5V 500mA USB type A port, capable of charging any mobile phone (including smart phones), portable battery packs, radios and similar electronic devices

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Solar What?! Technical Specifications (v2)

SOLAR WHAT?!
ADDITIONAL INFORMATION

Additional information common to both products:

Quality	Both products are being submitted to the Lighting Global Quality Assurance Programme for initial screening in Q2 of 2019.
Circuit board	Key components use through hole technology where appropriate and all components have accessible leads with a minimum pitch of 0.6mm for ease of repair and replacement. All components are numbered.
Disassembly and reassembly	Solar What?! products are designed for disassembly. Disassembly takes approximately 3 minutes. The unit can be fully reassembled after disassembly. Assembly and disassembly requires 1 x Phillips head screwdriver and 1 x flathead screwdriver.
Basic repair information	All components are labelled on the circuit boards and basic repair information is available for download at www.solarwhat.xyz (from Q2 2019).
Plastics	Products consist of four pieces of moulded plastic: the black base, the transparent top, and orange central tray and button. Due to the challenges of sourcing recycled plastic for a small production run, first prototypes have been manufactured in non-recycled ABS-like resin. Our final products will use recycled ABS wherever possible.
Recycling	All constituent materials can be easily separated for recycling. The plastic codes can be imprinted on the underside of all enclosure components. Plastic recycling information will be available online and on the packaging.
Spare parts	Replacement parts can be 3D printed. The buttons could also be hand crafted or turned from a non-conductive material. The files will be available for download at www.solarwhat.xyz (from Q2 2019).

For further information regarding technical information or product features:

Website www.solarwhat.xyz
Email info@solarwhat.xyz