

RF Exposure Report

Report No.: SA180803E05A

FCC ID: YAW529027

Test Model: PVS6

Received Date: Oct. 04, 2018

Test Date: Oct. 20, 2018

Issued Date: Dec. 10, 2018

Applicant: SunPower Corporation

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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**FCC Registration /
Designation Number:** 723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
SA180803E05A	Original release.	Dec. 10, 2018

1 Certificate of Conformity

Product: SunPower Monitoring System with PVS6

Brand: SUNPOWER

Test Model: PVS6

Sample Status: ENGINEERING SAMPLE

Applicant: SunPower Corporation

Test Date: Oct. 20, 2018

Standards: FCC Part 2 (Section 2.1091)

KDB 447498 D01 General RF Exposure Guidance v06

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :  , **Date:** Dec. 10, 2018
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Approved by :  , **Date:** Dec. 10, 2018
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2 RF Exposure

2.1 Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
Limits For General Population / Uncontrolled Exposure				
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	...	...	f/1500	30
1500-100,000	...	...	1.0	30

f = Frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE Calculation Formula

$$P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$$

where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

2.3 Classification

The antenna of this product, under normal use condition, is at least 25cm away from the body of the user. So, this device is classified as **Mobile Device**.

2.4 Antenna Gain

WLAN							
Ant No.	Chain No.	Brand	Model	Antenna Net Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type
1	Chain 0 (Including BT)	airgain	65-031-212002B	2.2	2.4~2.4835	PCB	I-PEX
				3.8	5.15~5.25		
				4.2	5.725~5.85		
2	Chain 1 (WLAN use only)	airgain	65-031-212003B	4.2	2.4~2.4835	PCB	I-PEX
				4.1	5.15~5.25		
				4.8	5.725~5.85		
Zigbee							
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type	
3	airgain	65-031-212004B	4.8	2.4~2.4835	PCB	I-PEX	
LTE							
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (MHz)	Antenna type	Connector type	
4	airgain	65-031-212001B	2.7	1920~1980	PCB	I-PEX	
				1850~1910			
				1710~1785			
				1710~1755			
				824 ~ 849			
				880~915			
				698~716			
				777~787			
				815 ~ 830			
				830 ~ 845			
				832 ~ 862			
				814 ~ 849			
				703 ~ 748			
				1880 ~ 1920			

2.5 Calculation Result of Maximum Conducted Power

Operation Mode	Evaluation Frequency (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
WLAN 2.4GHz	2437	762.15	6.27	25	0.41110	1
WLAN 5GHz (U-NII-1)	5240	199.38	6.96	25	0.12606	1
WLAN 5GHz (U-NII-3)	5745	268.355	7.52	25	0.19303	1
Bluetooth	2440	5.26	2.20	25	0.00111	1
Zigbee	2405	42.17	4.80	25	0.01621	1
LTE	699.7	619	2.70	25	0.14676	0.466

NOTE:

WLAN 2.4GHz: Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20})^2 / 2] = 6.27\text{dBi}$

WLAN 5GHz (U-NII-1): Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20})^2 / 2] = 6.96$

WLAN 5GHz (U-NII-3): Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20})^2 / 2] = 7.52$

LTE: Limit of Power Density = F/1500

Conclusion:

The formula of calculated the MPE is:

$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

WLAN 2.4GHz + Bluetooth + Zigbee + LTE = $0.41110 / 1 + 0.00111 / 1 + 0.01621 / 1 + 0.14676 / 0.466 = 0.74305$

WLAN 5GHz + Bluetooth + Zigbee + LTE = $0.19303 / 1 + 0.00111 / 1 + 0.01621 / 1 + 0.14676 / 0.466 = 0.52498$

Therefore the maximum calculations of above situations are less than the "1" limit.

Appendix

LTE module

MPE Evaluation for FCC ID: XMR201707BG96 Radio Module

FCC Rule Parts	Emission Designator	Frequency Range (MHz)		Output Watts (W)	Antenna Gain (dBi)	Power Density (mW/cm ²)		Ratio
		Start	Stop			Vaule	Limit	
22H	246KGXW	824.2	848.8	0.624	2.7	0.14794	0.54946	0.26925
24E	246KGXW	1850.2	1909.8	0.582	2.7	0.13799	1	0.13799
22H	249KG7W	824.2	848.8	0.188	2.7	0.04457	0.54946	0.08112
24E	248KG7W	1850.2	1909.8	0.174	2.7	0.04125	1	0.04125
24E	1M25G7D	1850.7	1909.3	0.925	2.7	0.21931	1	0.21931
24E	1M15W7D	1850.7	1909.3	0.851	2.7	0.20176	1	0.20176
27	1M21G7D	1711.5	1753.5	0.995	2.7	0.2359	1	0.2359
27	1M11W7D	1711.5	1753.5	0.989	2.7	0.23448	1	0.23448
22H	1M20G7D	824.7	848.3	0.675	2.7	0.16003	0.5498	0.29107
22H	1M05W7D	824.7	848.3	0.624	2.7	0.14794	0.5498	0.26908
27	1M21G7D	699.7	715.3	0.619	2.7	0.14676	0.46646	0.31463
27	1M08W7D	699.7	715.3	0.575	2.7	0.13633	0.46646	0.29227
27	1M18G7D	779.5	784.5	0.589	2.7	0.13964	0.51966	0.26871
27	1M03W7D	779.5	784.5	0.548	2.7	0.12992	0.51966	0.25001
22H	1M20G7D	825.5	847.5	0.724	2.7	0.17165	0.55033	0.3119
22H	1M06W7D	825.5	847.5	0.671	2.7	0.15909	0.55033	0.28908
90	1M20G7D	815.5	822.5	0.635	2.7	0.15055	0.54366	0.27692
90	1M05W7D	815.5	822.5	0.589	2.7	0.13964	0.54366	0.25685

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