

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
Claire Kuan / Specialist

Approved by :  _____, **Date:** _____ Dec. 10, 2018
May Chen / Manager

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

$$Pd = (Pout * G) / (4 * \pi * r^2)$$

where

Pd = power density in mW/cm²

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 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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