



# RF Exposure Evaluation Report

**Equipment** : SunPower Monitoring System with PVS5x  
**Brand Name** : SUNPOWER  
**Model No.** : PVS5x  
**FCC ID** : YAW522350L  
**Standard** : 47 CFR Part 2.1091  
**Applicant** : SunPower Corporation  
1414 Harbour Way South Suite 1901, Richmond, CA  
94804, USA  
**Manufacturer (1)** : Zyxel Communications Corporation  
No.2 Industry East RD. IX, Hsinchu Science Park,  
Hsinchu 30075, Taiwan  
**Manufacturer (2)** : MitraStar Technology Corporation  
No. 6, Innovation Rd II, Science-Based Industrial,  
Hsin-Chu, Taiwan  
**Manufacturer (3)** : Wuxi MitraStar Technology Co. Ltd  
1-1# Minshan Road, Wuxi New Wu District, Jiangsu,  
China

The product sample received on Jun. 26. 2015 and completely tested on Feb. 01, 2018. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with 47 CFR Part 2.1091 and pass the limit.

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Sam Chen  
SPORTON INTERNATIONAL INC.





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### **PHOTOGRAPHS OF EUT V01**

## REVISION HISTORY

[illegible]

# 1 General Description

## 1.1 EUT General Information

| RF General Information |                       |                           |                                                                                 |
|------------------------|-----------------------|---------------------------|---------------------------------------------------------------------------------|
| Evaluation Mode        | Frequency Range (MHz) | Operating Frequency (MHz) | Modulation Type                                                                 |
| 2.4GHz WLAN            | 2400-2483.5           | 2412-2462                 | 802.11b: DSSS (DBPSK, DQPSK, CCK)<br>802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) |
| Zigbee                 | 2400-2483.5           | 2405-2475                 | DSSS (O-QPSK)                                                                   |

Note: The device contains transmitter module (FCC ID: XMR201605EC25A)

## 1.2 Testing Location

| Testing Location                    |        |                                                                                                                               |
|-------------------------------------|--------|-------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/>            | HWA YA | ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.<br>TEL : 886-3-327-3456 FAX : 886-3-327-0973   |
| <input checked="" type="checkbox"/> | JHUBEI | ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.<br>TEL : 886-3-656-9065 FAX : 886-3-656-9085 |

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086D with Industry Canada.

## 2 Maximum Permissible Exposure

### 2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| 0.3-3.0               | 614                               | 1.63                              | (100)*                                   | 6                                                                |
| 3.0-30                | 1842 / f                          | 4.89 / f                          | (900 / f)*                               | 6                                                                |
| 30-300                | 61.4                              | 0.163                             | 1.0                                      | 6                                                                |
| 300-1500              |                                   |                                   | F/300                                    | 6                                                                |
| 1500-100,000          |                                   |                                   | 5                                        | 6                                                                |

(B) Limits for General Population / Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                   | 30                                                               |
| 1.34-30               | 824/f                             | 2.19/f                            | (180/f)*                                 | 30                                                               |
| 30-300                | 27.5                              | 0.073                             | 0.2                                      | 30                                                               |
| 300-1500              |                                   |                                   | F/1500                                   | 30                                                               |
| 1500-100,000          |                                   |                                   | 1.0                                      | 30                                                               |

Note: f = frequency in MHz ; \*Plane-wave equivalent power density

### 2.2 MPE Calculation Method

The MPE was calculated at 25 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

**E** = Electric field (V/m)

**P** = RF output power (W)

**G** = EUT Antenna numeric gain (numeric)

**d** = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

## 2.3 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

<For WLAN>

| Mode        | DG (dBi) | Power (dBm) | EIRP (dBm) | Tolerance (dB) | Tune-up EIRP (dBm) | Tune-up EIRP (W) | Distance (cm) | S (mW/cm <sup>2</sup> ) | S Limit (mW/cm <sup>2</sup> ) |
|-------------|----------|-------------|------------|----------------|--------------------|------------------|---------------|-------------------------|-------------------------------|
| 2.4G;D1D    | 4.20     | 27.96       | 32.16      | 0.5            | 32.66              | 1.84502          | 25            | 0.23503                 | 1                             |
| 2.4G Zigbee | 2.30     | 21.29       | 23.59      | 0.5            | 24.09              | 0.25645          | 25            | 0.03266                 | 1                             |

<For WWAN>

| Mode                           | DG (dBi) | Power (dBm) | EIRP (dBm) | Tolerance (dB) | Tune-up EIRP (dBm) | Tune-up EIRP (W) | Distance (cm) | S (mW/cm <sup>2</sup> ) | S Limit (mW/cm <sup>2</sup> ) |
|--------------------------------|----------|-------------|------------|----------------|--------------------|------------------|---------------|-------------------------|-------------------------------|
| WCDMA Band V<br>826.4-846.6    | 10.92    | 23.50       | 34.42      | 0.5            | 34.92              | 3.10456          | 25            | 0.39548                 | 0.551                         |
| WCDMA Band II<br>1852.4-1907.6 | 13.51    | 23.50       | 37.01      | 0.5            | 37.51              | 5.63638          | 25            | 0.71800                 | 1                             |
| WCDMA IV<br>1712.4-1752.6      | 13.51    | 23.50       | 37.01      | 0.5            | 37.51              | 5.63638          | 25            | 0.71800                 | 1                             |
| LTE Band II<br>1850.7-1909.3   | 13.01    | 24.00       | 37.01      | 0.5            | 37.51              | 5.63638          | 25            | 0.71800                 | 1                             |
| LTE Band IV<br>1710.7-1754.3   | 13.01    | 24.00       | 37.01      | 0.5            | 37.51              | 5.63638          | 25            | 0.71800                 | 1                             |
| LTE Band XII<br>699.7-715.3    | 9.69     | 24.00       | 33.69      | 0.5            | 34.19              | 2.62422          | 25            | 0.33429                 | 0.466                         |

**Simultaneous Transmission Analysis Mode: WLAN + Zigbee + WWAN (FCC ID:XMR201605EC25A)**

| Mode                           | DG (dBi) | Power (dBm) | EIRP (dBm) | Tolerance (dB) | Tune-up EIRP (dBm) | Tune-up EIRP (W) | Distance (cm) | S (mW/cm <sup>2</sup> ) | S Limit (mW/cm <sup>2</sup> ) | Ratio (S/Limit) |
|--------------------------------|----------|-------------|------------|----------------|--------------------|------------------|---------------|-------------------------|-------------------------------|-----------------|
| 2.4G;D1D                       | 4.20     | 27.96       | 32.16      | 0.5            | 32.66              | 1.84502          | 25            | 0.23503                 | 1                             | 0.23503         |
| 2.4G Zigbee                    | 2.30     | 21.29       | 23.59      | 0.5            | 24.09              | 0.25645          | 25            | 0.03266                 | 1                             | 0.03266         |
| WCDMA Band II<br>1852.4-1907.6 | 13.51    | 23.50       | 37.01      | 0.5            | 37.51              | 5.63638          | 25            | 0.71800                 | 1                             | 0.71800         |
|                                |          |             |            |                |                    |                  |               |                         | Sum Ratio                     | 0.98569         |
|                                |          |             |            |                |                    |                  |               |                         | Ratio Limit                   | 1               |