

Maximum Permissible Exposure

Equipment : 802.11abgn Bluetooth Mini PCIe module
Brand Name : Fukuda Denshi
Model No. : WPEA-251N(BT)
FCC ID : RFH-DS101WIFI
Standard : FCC Part 2.1091
Applicant : IEI Integration Corp.
No. 29, Chung-Hsing Rd., Sijhih City,
New Taipei City 221, Taiwan (R.O.C.)
Manufacturer : SparkLAN Communications, Inc.
8F., No. 257, Sec. 2, Tiding Blvd., Neihu District,
Taipei 11493, Taiwan

The product sample received on Jan. 06, 2017 and completely tested on Jan. 21, 2017. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in FCC Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:


Jordan Hsiao / Manager





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Revision History

| Report No. | Version | Description | Issued Date |
|------------|---------|-------------------------|---------------|
| FA710527 | Rev. 01 | Initial issue of report | Apr. 17, 2017 |
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1 Human Exposure Assessment

1.1 Product Details

| | |
|---|-----|
| The difference between the report no. : N/A | |
| The Difference | N/A |

| | |
|----------------------|-----|
| Evaluated Test Items | N/A |
|----------------------|-----|

1.2 Maximum Permissible Exposure

1.2.1 Limit of Maximum Permissible Exposure

| 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 ²) | Averaging Time E ² , H ² or S (minutes) |
| 0.3-3.0 | 614 | 1.63 | (100)* | 6 |
| 3.0-30 | 1842 / f | 4.89 / f | (900 / f ²)* | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1500 | - | - | F/300 | 6 |
| 1500-100,000 | - | - | 5 | 6 |
| 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 ²) | Averaging Time E ² , H ² or S (minutes) |
| 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 |
| Note 1: f = frequency in MHz ; *Plane-wave equivalent power density | | | | |
| Note 2: For the applicable limit, see FCC 1.1310 | | | | |

1.2.2 MPE Calculation Method

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)



1.2.3 Result of Maximum Permissible Exposure (2.4G)

| RF General Information | | | | | |
|------------------------|---------------------------|---------------------|----------------|--|-----------------------|
| Frequency Range (MHz) | IEEE Std. 802.11 Protocol | Ch. Frequency (MHz) | Channel Number | Number of Transmit Chains (N _{TX}) | RF Output Power (dBm) |
| 2400-2483.5 | b | 2412-2462 | 1-11 [11] | 2 | 19.21 |
| 2400-2483.5 | g | 2412-2462 | 1-11 [11] | 2 | 23.25 |
| 2400-2483.5 | n (HT20) | 2412-2462 | 1-11 [11] | 2 | 22.56 |
| 2400-2483.5 | n (HT40) | 2422-2452 | 3-9 [7] | 2 | 14.85 |

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.

| Worst Maximum RF Output Power Result | | | | | |
|---|-----------------|--|----------|------------|------------------------------|
| Exposure Environment | | General Population / Uncontrolled Exposure | | | |
| Separation Distance (cm) | | 20 | | | |
| Condition | | RF Output Power (dBm) | | | |
| Modulation Mode | N _{TX} | RF Output Power | DG (dBi) | EIRP Power | PD (S) (mW/cm ²) |
| g | 2 | 23.25 | 2.00 | 25.25 | 0.06664 |
| Maximum Permissible Exposure Limit (mW/cm²) | | | | | 1 |

Note 1: N_{TX} = Number of Transmit Chains



1.2.4 Result of Maximum Permissible Exposure (Bluetooth)

| RF General Information | | | | | |
|------------------------|---------------------------|---------------------|----------------|--|-----------------------|
| Frequency Range (MHz) | IEEE Std. 802.11 Protocol | Ch. Frequency (MHz) | Channel Number | Number of Transmit Chains (N _{TX}) | RF Output Power (dBm) |
| 2400-2483.5 | BR/EDR | 2402-2480 | 0-78 [79] | 1 | 2.73 |
| 2400-2483.5 | LE | 2402-2480 | 0-39 [40] | 1 | 2.16 |

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.

| Worst Maximum RF Output Power Result | | | | |
|---|--|--------------------|------------|------------------------------|
| Exposure Environment | General Population / Uncontrolled Exposure | | | |
| Separation Distance (cm) | 20 | | | |
| Condition | RF Output Power (dBm) | | | |
| Modulation Mode | RF Output Power | Antenna Gain (dBi) | EIRP Power | PD (S) (mW/cm ²) |
| BR/EDR | 2.73 | 2.00 | 4.73 | 0.00059 |
| LE | 2.16 | 2.00 | 4.16 | 0.00052 |
| Maximum Permissible Exposure Limit (mW/cm²) | | | | 1 |



1.2.5 Result of Maximum Permissible Exposure (5.2G)

| RF General Information | | | | | |
|------------------------|---------------------------|---------------------|----------------|--|-----------------------|
| Frequency Range (MHz) | IEEE Std. 802.11 Protocol | Ch. Frequency (MHz) | Channel Number | Number of Transmit Chains (N _{TX}) | RF Output Power (dBm) |
| 5150-5250 | a | 5180-5240 | 36-48 [4] | 2 | 23.11 |
| 5150-5250 | n (HT20) | 5180-5240 | 36-48 [4] | 2 | 22.66 |
| 5150-5250 | n (HT40) | 5190-5230 | 38-46 [2] | 2 | 21.07 |

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.

| Worst Maximum RF Output Power Result | | | | | |
|---|-----------------|--|----------|------------|------------------------------|
| Exposure Environment | | General Population / Uncontrolled Exposure | | | |
| Separation Distance (cm) | | 20 | | | |
| Condition | | RF Output Power (dBm) | | | |
| Modulation Mode | N _{TX} | RF Output Power | DG (dBi) | EIRP Power | PD (S) (mW/cm ²) |
| a | 2 | 23.11 | 2.00 | 25.11 | 0.06453 |
| Maximum Permissible Exposure Limit (mW/cm²) | | | | | 1 |

Note 1: N_{TX} = Number of Transmit Chains



1.2.6 Result of Maximum Permissible Exposure (5.8G)

| RF General Information | | | | | |
|------------------------|---------------------------|---------------------|----------------|--|-----------------------------------|
| Frequency Range (MHz) | IEEE Std. 802.11 Protocol | Ch. Frequency (MHz) | Channel Number | Number of Transmit Chains (N _{TX}) | RF Output Power (dBm) Co-location |
| 5725-5850 | a | 5745-5825 | 149-165 [5] | 2 | 22.05 |
| 5725-5850 | n (HT20) | 5745-5825 | 149-165 [5] | 2 | 22.43 |
| 5725-5850 | n (HT40) | 5755-5795 | 151-159 [2] | 2 | 22.40 |

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.

| Worst Maximum RF Output Power Result | | | | | |
|---|-----------------|--|----------|------------|------------------------------|
| Exposure Environment | | General Population / Uncontrolled Exposure | | | |
| Separation Distance (cm) | | 20 | | | |
| Condition | | RF Output Power (dBm) | | | |
| Modulation Mode | N _{TX} | RF Output Power | DG (dBi) | EIRP Power | PD (S) (mW/cm ²) |
| n (HT20) | 2 | 22.43 | 2.00 | 24.43 | 0.05517 |
| Maximum Permissible Exposure Limit (mW/cm²) | | | | | 1 |

Note 1: N_{TX} = Number of Transmit Chains



1.2.7 Result of Maximum Permissible Exposure (Co-location)

| Worst Maximum RF Output Power Result | | | | | | | |
|---|-----------------|--|----------|------------|------------------------------|-----------------------------|---------|
| Exposure Environment | | General Population / Uncontrolled Exposure | | | | | |
| Separation Distance (cm) | | 20 | | | | | |
| Condition | | RF Output Power (dBm) | | | | | |
| Modulation Mode | N _{TX} | RF Output Power (dBm) | DG (dBi) | EIRP Power | PD (S) (mW/cm ²) | Limit (mW/cm ²) | Ratio |
| g (2.4GHz) | 2 | 23.25 | 2.00 | 25.25 | 0.06664 | 1 | 0.06664 |
| BR/EDR (Bluetooth) | 1 | 2.73 | 2.00 | 4.73 | 0.00059 | 1 | 0.00059 |
| Co-location Total | | | | | | | 0.06723 |
| Maximum Permissible Exposure Limit | | | | | | | 1 |
| <p>Note 1: NTX = Number of Transmit Chains.</p> <p>Note.2: Both of the WLAN 2.4GHz and WLAN 5GHz and Bluetooth BR/EDR can transmit simultaneously, the formula of calculated the MPE is:</p> $CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$ <p>CPD = Calculation power density</p> <p>LPD = Limit of power density</p> <p>Note 3: Refer to KDB 865664 D02 RF Exposure Reporting v01r02 for MPE Calculation Colocation.</p> | | | | | | | |