

RF Exposure Report

Report No.: SA140407E07D

FCC ID: TLZ-CM389NF

Test Model: AW-CM389NF

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Applicant: AzureWave Technologies, Inc.

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Release Control Record

| Issue No. | Description | Date Issued |
|--------------|-------------------|---------------|
| SA140407E07D | Original release. | June 17, 2016 |

1 Certificate of Conformity

Product: IEEE 802.11 2X2 MIMO ac/a/b/g/n Wireless LAN + Bluetooth + NFC NGFF Module

Brand: AzureWave

Test Model: AW-CM389NF

Sample Status: ENGINEERING SAMPLE

Applicant: AzureWave Technologies, Inc.


Test Date: June 06, 2016


Standards: FCC Part 2 (Section 2.1093)

KDB 447498 D01 General RF Exposure Guidance v06

IEEE C95.1-1992

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.

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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 | | | | |
| 300-1500 | ... | ... | F/1500 | 30 |
| 1500-100,000 | ... | ... | 1.0 | 30 |

F = Frequency in MHz

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 20cm away from the body of the user.

So, this device is classified as **Mobile Device**.

3 Antenna Gain

1. The WLAN / BT antenna provided to the EUT, please refer to the following table:

| Antenna Set. | Transmitter Circuit | Brand | Model | Antenna Gain(dBi) < including cable loss> | Frequency range (MHz to MHz) | Antenna Type | Connector Type | Cable Length (cm) |
|--------------|----------------------|---------------------------|----------------------------|--|---------------------------------|--------------|----------------|-------------------|
| 1 | Chain (0) | MAG.LAYERS | MSA-4008-25GC1-A1 | 2.98 | 2400~2500 | PIFA | i-pex(MHF) | 15 |
| | | | | 5.16 | 4900~5900 | | | |
| | Chain (1) | MAG.LAYERS | MSA-4008-25GC1-A1 | 2.98 | 2400~2500 | PIFA | i-pex(MHF) | 15 |
| | | | | 5.16 | 4900~5900 | | | |
| 2 | Main Antenna Chain 0 | Wistron Neweb Corporation | DC33001KT00 (81EAAL15.G92) | 1.54 | 2400~2500 | PIFA | i-pex(MHF) | 36.3 |
| | | | | 1.26 | 5150~5850 | | | |
| | Aux Antenna Chain 1 | Wistron Neweb Corporation | DC33001KT10 (81EAAL15.G75) | 0.63 | 2400~2500 | PIFA | i-pex(MHF) | 59.3 |
| | | | | 1.84 | 5150~5850 | | | |
| Antenna Set. | Transmitter Circuit | Brand | Model | Antenna Gain(dBi) | Frequency range (MHz to MHz) | Antenna Type | Connector Type | Cable Loss (dB) |
| 3 | Chain (0) | TE connectivity | 2195487 | -0.77 | 2400~2500 | Dipole | i-pex(MHF) | 0.4 |
| | | | | 3.64 | 5150~5850 | | | 0.5 |
| | Chain (1) | TE connectivity | 2195487 | -0.77 | 2400~2500 | Dipole | i-pex(MHF) | 0.4 |
| | | | | 3.64 | 5150~5850 | | | 0.5 |
| 4 | Chain (0) | TE connectivity | 2195501-1 | 2.35 | 2400~2500 | Slot | i-pex(MHF) | 0.35 |
| | | | | 4.08 | 5150~5850 | | | 0.45 |
| | Chain (1) | TE connectivity | 2195501-1 | 2.35 | 2400~2500 | Slot | i-pex(MHF) | 0.35 |
| | | | | 4.08 | 5150~5850 | | | 0.45 |
| 5 | Chain (0) | TE connectivity | 2195505-1 | 0.41 | 2400~2500 | Slot | i-pex(MHF) | 0.35 |
| | | | | 4.82 | 5150~5850 | | | 0.45 |
| | Chain (1) | TE connectivity | 2195505-1 | 0.41 | 2400~2500 | Slot | i-pex(MHF) | 0.35 |
| | | | | 4.82 | 5150~5850 | | | 0.45 |

2. The NFC antenna provided to the EUT, please refer to the following table:

| Brand | Model | Antenna Gain(dBi) | Frequency Range (MHz) | Antenna Type | Connector Type |
|---------|--------------|-------------------|-----------------------|--------------|----------------|
| Marvell | 30X40X4T_PCB | 0.5 | 13.56 | PCB | i-pex(MHF) |

4 Calculation Result

For NFC max power data was copied from the original test report (Report No.: SA140407E07)

WLAN

| Frequency Band (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|---------------------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2412-2462 | 624.507 | 5.99 | 20 | 0.49348 | 1 |
| 5180-5240 | 64.539 | 8.17 | 20 | 0.08425 | 1 |
| 5260-5320 | 70.809 | 8.17 | 20 | 0.09243 | 1 |
| 5500 ~ 5580 & 5660 ~ 5700 | 74.062 | 8.17 | 20 | 0.09668 | 1 |
| 5745-5825 | 69.979 | 8.17 | 20 | 0.09135 | 1 |

Note:

2.4GHz: Directional gain = 2.98dBi + 10log(2) = 5.99dBi

5GHz: Directional gain = 5.16dBi + 10log(2) = 8.17dBi

BT-EDR

| Frequency Band (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2402-2480 | 9.016 | 2.98 | 20 | 0.00356 | 1 |

BT-LE

| Frequency Band (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2402-2480 | 7.031 | 2.98 | 20 | 0.00278 | 1 |

NFC

| Frequency (MHz) | Max EIPR Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|-----------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 13.56 | 0.00055 | 0.5 | 20 | 0.1×10^{-6} | 0.9789 |

Note: Limit of Power Density= $180/f^2$

$$E = \sqrt{(30 \cdot P \cdot G) / D}$$

$$P \cdot G = (E \cdot D)^2 / 30$$

$$E(\text{dBuV/m}) = 62.6$$

$$D(\text{m}) = 3$$

$$P \cdot G(\text{mW}) = 0.00055$$

Conclusion:

Both of the WLAN, Bluetooth and NFC can transmit simultaneously, the formula of calculated the MPE is:

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

CPD = Calculation power density

LPD = Limit of power density

For WLAN (2.4G), Bluetooth and NFC:

Therefore, the worst-case situation is $0.49348 / 1 + 0.00356 / 1 + (0.1 \times 10^{-6}) / 0.9789 = 0.49704$, which is less than "1".

For WLAN (5G), Bluetooth and NFC:

Therefore, the worst-case situation is $0.09668 / 1 + 0.00356 / 1 + (0.1 \times 10^{-6}) / 0.9789 = 0.10024$, which is less than "1".

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

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