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# RF EXPOSURE REPORT

**REPORT NO.:** SA140407E07

**MODEL NO.:** AW-CM389NF

**FCC ID:** TLZ-CM389NF

**RECEIVED:** Apr. 07, 2014

**TESTED:** May 20 to 29, 2014

**ISSUED:** July 02, 2014

**APPLICANT:** AzureWave Technologies, Inc.

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**ISSUED BY:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

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**TEST LOCATION (1):** No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C.

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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
SA140407E07	Original release	July 02, 2014



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## 1. CERTIFICATION

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

**BRAND NAME:** AzureWave

**MODEL NO.:** AW-CM389NF

**TEST SAMPLE:** ENGINEERING SAMPLE

**APPLICANT:** AzureWave Technologies, Inc.

**TESTED DATE:** May 20 to 29, 2014

**STANDARDS:** FCC Part 2 (Section 2.1091)

FCC OET Bulletin 65, Supplement C (01-01)

IEEE C95.1

The above equipment (Model: AW-CM389NF) 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 :** Phoenix Huang, **DATE:** July 02, 2014  
(Phoenix Huang, Specialist)

**APPROVED BY :** May Chen, **DATE:** July 02, 2014  
(May Chen, Manager)



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## 2. RF EXPOSURE LIMIT

### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

FREQUENCY RANGE (MHz)	ELECTRIC FIELD STRENGTH (V/m)	MAGNETIC FIELD STRENGTH (A/m)	POWER DENSITY (mW/cm <sup>2</sup> )	AVERAGE TIME (minutes)
<b>LIMITS FOR GENERAL POPULATION / UNCONTROLLED EXPOSURE</b>				
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	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

## 3. MPE CALCULATION FORMULA

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

where

Pd = power density in mW/cm<sup>2</sup>

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

## 4. 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**.



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## 5. ANTENNA GAIN

The antennas provided to the EUT, please refer to the following table:

For WLAN / BT used (Set 1 antenna)									
Antenna No.	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				
2	Chain (1)	MAG.LAYERS	MSA-4008-25GC1-A1	2.98	2400~2500	PIFA	i-pex(MHF)	15	
				5.16	4900~5900				
For WLAN / BT used (Set 2 antenna)									
Antenna No.	Transmitter Circuit	Brand	Model	Antenna Gain(dBi) < including cable loss>	Frequency range (MHz to MHz)	Antenna Type	Connector Type	Cable Length (cm)	
3	Main Antenna Chain 0	Wistron Neweb Corporation	DC33001KT00 (81EAAL15.G92)	1.54	2400~2500	PIFA	i-pex(MHF)	36.3	
				1.26	5150~5850				
4	Aux Antenna Chain 1	Wistron Neweb Corporation	DC33001KT10 (81EAAL15.G75)	0.63	2400~2500	PIFA	i-pex(MHF)	59.3	
				1.84	5150~5850				
For NFC used									
Antenna No.	Brand		Model	Antenna Gain(dBi)	Frequency range (MHz)	Antenna Type	Connector Type	Cable Length (cm)	
5	Marvell		30X40X4T_PCB	0.5	13.56	PCB	i-pex(MHF)	N/A	



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## 6. CALCULATION RESULT OF MAXIMUM CONDUCTED POWER

For WLAN: 15.247(2.4GHz)

802.11b

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
2412 - 2462	71.042	5.99	20	0.05614	1.00

NOTE: Directional gain = 2.98dBi + 10log(2) = 5.99dBi.

802.11g

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
2412 - 2462	694.376	5.99	20	0.54869	1.00

NOTE: Directional gain = 2.98dBi + 10log(2) = 5.99dBi.

802.11n (HT20)

FREQUENCY BAND (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
2412 - 2462	695.976	2.98	20	0.27499	1.00

802.11n (HT40)

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
2422 - 2452	286.123	2.98	20	0.11305	1.00



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**For WLAN: 15.247(5GHz)**

802.11a

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
5745 - 5825	372.853	8.17	20	0.48671	1.00

NOTE: Directional gain = 5.16dBi + 10log(2) = 8.17dBi.

**802.11ac (VHT20)**

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
5745 - 5825	370.202	5.16	20	0.24164	1.00

**802.11ac (VHT40)**

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
5755 - 5795	335.013	5.16	20	0.21867	1.00

**802.11ac (VHT80)**

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
5775	541.874	5.16	20	0.35369	1.00



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### For WLAN: 15.407(5GHz)

#### 802.11a

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
5180 - 5240, 5260 - 5320, 5500 - 5580 & 5660 - 5700	74.508	8.17	20	0.09726	1.00

NOTE: Directional gain = 5.16dBi + 10log(2) = 8.17dBi.

#### 802.11ac (VHT20)

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
5180 - 5240, 5260 - 5320, 5500 - 5580 & 5660 - 5700	76.001	5.16	20	0.04961	1.00

#### 802.11ac (VHT40)

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
5190 - 5230, 5270 - 5310, 5510 - 5550 & 5670	67.59	5.16	20	0.04412	1.00

#### 802.11ac (VHT80)

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
5210 - 5290, 5530	16.936	5.16	20	0.01105	1.00



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**For Bluetooth:**

**GFSK**

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
2402-2480	8.61	2.98	20	0.0034	1.00

**8DPSK**

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
2402-2480	7.43	2.98	20	0.00294	1.00

**BT-LE (GFSK)**

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
2402 - 2480	7.709	2.98	20	0.00305	1.00



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### For NFC (RFID):

NFC

FREQUENCY (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
13.56	0.00055	0.5	20	$0.1 \times 10^{-6}$	0.9789

Note: Limit of Power Density=180/f<sup>2</sup>

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

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

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

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

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

### CONCLUSION:

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

$$CPD_1 / LPD_1 + CPD_2 / LPD_2 + \dots \text{etc.} < 1$$

**CPD = Calculation power density**

**LPD = Limit of power density**

### For WLAN (2.4G), Bluetooth and NFC:

Therefore, the worst-case situation is  $0.54869 / 1 + 0.0034 / 1 + (0.1 \times 10^{-6}) / 0.9789 = 0.552$ , which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

### For WLAN (5G), Bluetooth and NFC:

Therefore, the worst-case situation is  $0.48671 / 1 + 0.0034 / 1 + (0.1 \times 10^{-6}) / 0.9789 = 0.490$ , which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

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