

RF EXPOSURE REPORT

REPORT NO.: SA140407E07
MODEL NO.: AW-CM389NF
FCC ID: TLZ-CM389NF
RECEIVED: Apr. 07, 2014
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ISSUED: July 02, 2014

APPLICANT: AzureWave Technologies, Inc.

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ISSUED BY: Bureau Veritas Consumer Products Services
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RELEASE CONTROL RECORD

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

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)

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 ²)	AVERAGE TIME (minutes)
LIMITS FOR GENERAL POPULATION / UNCONTROLLED EXPOSURE				
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

3. MPE CALCULATION FORMULA

$$P_d = (P_{out} * G) / (4 * \pi * r^2)$$

where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 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**.

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

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 ²)	LIMIT (mW/cm ²)
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 ²)	LIMIT (mW/cm ²)
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 ²)	LIMIT (mW/cm ²)
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 ²)	LIMIT (mW/cm ²)
2422 - 2452	286.123	2.98	20	0.11305	1.00

For WLAN: 15.247(5GHz)

802.11a

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

For WLAN: 15.407(5GHz)

802.11a

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

For Bluetooth:

GFSK

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

For NFC (RFID):

NFC

FREQUENCY (MHz)	CONDUCTED 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 Bluetooth and WLAN can transmit simultaneously, the formula of calculated the MPE is:

$$\text{CPD}_1 / \text{LPD}_1 + \text{CPD}_2 / \text{LPD}_2 + \dots \text{etc.} < 1$$

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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