RF Exposure Evaluation Report

APPLICANT	:	Wistron NeWeb Corporation
EQUIPMENT	:	LTE Cat.1 LGA module
BRAND NAME	:	WNC
MODEL NAME	:	M14A2A
FCC ID	:	NKRM14A2A
STANDARD	:	47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC., would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091, and pass the limit. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.)

Table of Contents

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA622604	Rev. 01	Initial issue of report	Apr. 13, 2016

1. Administration Data

1.1. Testing Laboratory

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	Wistron NeWeb Corporation
Address	20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan, R.O.C

Manufacturer	
Company Name	Wistron NeWeb Corporation
Address	20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan, R.O.C

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	LTE Cat.1 LGA module
Brand Name	WNC
Model Name	M14A2A
FCC ID	NKRM14A2A
Wireless Technology and Frequency Range	LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 12: 699 MHz ~ 716 MHz
Mode	・LTE: QPSK, 16QAM
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

3. Maximum RF average output power among production units

LTE Band 2 Average Power (dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Power
QPSK	20	≤ 18	0	23.5
QPSK	20	> 18	1	22.5
16QAM	20	≤ 18	1	22.5
16QAM	20	> 18	2	21.5
QPSK	15	≤ 16	0	23.5
QPSK	15	> 16	1	22.5
16QAM	15	≤ 16	1	22.5
16QAM	15	> 16	2	21.5
QPSK	10	≤ 12	0	23.5
QPSK	10	> 12	1	22.5
16QAM	10	≤ 12	1	22.5
16QAM	10	> 12	2	21.5
QPSK	5	≤ 8	0	23.5
QPSK	5	> 8	1	22.5
16QAM	5	≤ 8	1	22.5
16QAM	5	> 8	2	21.5

LTE Band 4 Average Power (dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Power
QPSK	20	≤ 18	0	23.5
QPSK	20	> 18	1	22.5
16QAM	20	≤ 18	1	22.5
16QAM	20	> 18	2	21.5
QPSK	15	≤ 16	0	23.5
QPSK	15	> 16	1	22.5
16QAM	15	≤ 16	1	22.5
16QAM	15	> 16	2	21.5
QPSK	10	≤ 12	0	23.5
QPSK	10	> 12	1	22.5
16QAM	10	≤ 12	1	22.5
16QAM	10	> 12	2	21.5
QPSK	5	≤ 8	0	23.5
QPSK	5	> 8	1	22.5
16QAM	5	≤ 8	1	22.5
16QAM	5	> 8	2	21.5

LTE Band 12 Average Power (dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Power
QPSK	10	≤ 12	0	23.5
QPSK	10	> 12	1	22.5
16QAM	10	≤ 12	1	22.5
16QAM	10	> 12	2	21.5
QPSK	5	≤ 8	0	23.5
QPSK	5	> 8	1	22.5
16QAM	5	≤ 8	1	22.5
16QAM	5	> 8	2	21.5

4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	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				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

Where:
S = Power Density
P = Output Power at Antenna Terminals
G = Gain of Transmit Antenna (linear gain)
R = Distance from Transmitting Antenna

5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

Note: For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum ERP (dBm)	Maximum ERP (W)	Maximum EIRP (dBm)	Maximum EIRP (W)	Maximum Output Power Limit (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)
LTE Band 12	699	10.10	23.50	31.450	1.396	33.600	2.291	3.000	2290.868	0.456	0.466
LTE Band 4	1710	6.50	23.50	27.850	0.610	30.000	1.000	1.000	1000.000	0.199	1.000
LTE Band 2	1850	9.50	23.50	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000

5.2. Collocated Power Density Calculation

Note:

1. This MPE analysis is applicable to any collocated transmitters with transmit power for WLAN/WiMax is less than or equal to 29dBm and for Bluetooth is less than or equal to 15dBm.
2. A maximum antenna gain of 5 dBi for WLAN/WiMAX/BT has been assumed for all collocated antennas.

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
LTE Band 12	699	7.00	23.50	30.5	1.12	1122.02	0.223	0.466	0.479
LTE Band 4	1710	6.50	23.50	30.0	1.00	1000.00	0.199	1.000	0.199
LTE Band 2	1850	9.50	23.50	33.0	2.00	1995.26	0.397	1.000	0.397
WLNA2.4GHz Band	2412	5.0	29.0	34.0	2.51	2511.89	0.500	1.000	0.500
WLNA5GHz Band	5180	5.0	29.0	34.0	2.51	2511.89	0.500	1.000	0.500
WiMax2.6GHz	2500	5.0	29.0	34.0	2.51	2511.89	0.500	1.000	0.500
WiMax3.5GHz	3400	5.0	29.0	34.0	2.51	2511.89	0.500	1.000	0.500
WiMax3.7GHz	3600	5.0	29.0	34.0	2.51	2511.89	0.500	1.000	0.500
Bluetooth	2402	5.0	15.0	20.0	0.10	100.00	0.020	1.000	0.020

<Collocated analysis>

Note:

1. For colocation analysis, LTE Band 12 is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
2. ∑(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + WLAN + Bluetooth and WWAN + WiMax + Bluetooth.
3. Considering the WWAN module collocation with the other transmitters of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 3 collocated transmitters is compliant.

Max WLAN Power Density / Limit	Max Bluetooth Power Density / Limit	Max WWAN Power Density / Limit	Σ(Power Density / Limit) of WWAN+WLAN+Bluetooth
0.500	0.020	0.479	0.999

Max WiMax Power Density / Limit	Max Bluetooth Power Density / Limit	Max WWAN Power Density / Limit	Σ(Power Density / Limit) of WWAN+WiMax+Bluetooth
0.500	0.020	0.479	0.999

Conclusion:

Based on FCC OET Bulletin 65 Supplement C and 47 CFR §2.1091, the analysis concludes that this product when transmitting in standalone within a host device, is compliant with the FCC RF exposure requirements in mobile exposure condition, provided the conducted power and antenna gain do not exceed the limits for each given frequency band per wireless technology as follow table:

Technology	Band	Maximum Conducted Power (dBm)	Maximum Standalone Antenna Gain (dBi)	Maximum Collocated Antenna Gain (dBi)
LTE	Band 2	23.5	9.50	9.50
	Band 4	23.5	6.50	6.50
	Band 12	23.5	10.10	7.00