



RF Exposure Evaluation Report

APPLICANT : Wistron NeWeb Corporation
EQUIPMENT : Connected Cooler Radio USA and North America version
BRAND NAME : Wistron NeWeb Corporation
MODEL NAME : D54A1
FCC ID : NKRD54A1
STANDARD : 47 CFR Part 2.1091

We, SPORTON INTERNATIONAL (SHENZHEN) 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 (SHENZHEN) INC., the test report shall not be reproduced except in full.

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**Revision History**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA6N0801	Rev. 01	Initial issue of report	Jan. 04, 2017

**1. Administration Data****1.1. Testing Laboratory**

Testing Site	
Test Site	SPORTON INTERNATIONAL (SHENZHEN) INC.
Test Site Location	1F & 2F,Building A, Morning Business Center, No. 4003 ShiGu Rd., Xili Town, Nanshan District, Shenzhen, Guangdong, P. R. China TEL: +86-755-8637-9589 FAX: +86-755-8637-9595

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	Connected Cooler Radio USA and North America version
Brand Name	Wistron NeWeb Corporation
Model Name	D54A1
IMEI	014760000031610
FCC ID	NKRD54A1
Wireless Technology and Frequency Range	WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 12: 699 MHz ~ 716 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	· RMC 12.2Kbps · HSDPA · HSUPA · HSPA+ (16QAM uplink is not supported) · LTE: QPSK, 16QAM · 802.11b/g/n HT20/HT40 · Bluetooth v4.1 LE(Uplink Only)
HW Version	v1.0
SW Version	D54A1_v00.01
EUT Stage	Identical Prototype
Note: 1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description. 2. For all LTE Bands, 10M 16QAM, 50RB Offset 0 is disabled . 3. The device has no voice function. 4. WLAN supports search capabilities, but unable to connect to other devices.	

**3. Maximum RF average output power among production units****<WCDMA>**

Band		WCDMA Band II	WCDMA Band V
Mode		Tune-up	
3GPP Rel 99	RMC 12.2Kbps	25.00	25.00
3GPP Rel 6	HSDPA Subtest-1	23.50	23.50
3GPP Rel 6	HSDPA Subtest-2	23.50	23.50
3GPP Rel 6	HSDPA Subtest-3	23.00	23.00
3GPP Rel 6	HSDPA Subtest-4	23.00	23.00
3GPP Rel 6	HSUPA Subtest-1	23.00	23.00
3GPP Rel 6	HSUPA Subtest-2	22.00	22.50
3GPP Rel 6	HSUPA Subtest-3	22.00	22.50
3GPP Rel 6	HSUPA Subtest-4	22.00	23.00
3GPP Rel 6	HSUPA Subtest-5	23.00	23.50

**<LTE>**

LTE Band 12				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Target Power
QPSK	10	≤ 12	0	24.50
QPSK	10	> 12	0-1	23.50
16QAM	10	≤ 12	0-1	23.50
16QAM	10	> 12	0-2	22.50
QPSK	5	≤ 8	0	24.50
QPSK	5	> 8	0-1	23.50
16QAM	5	≤ 8	0-1	23.50
16QAM	5	> 8	0-2	22.50
QPSK	3	≤ 4	0	24.50
QPSK	3	> 4	0-1	23.50
16QAM	3	≤ 4	0-1	23.50
16QAM	3	> 4	0-2	22.50
QPSK	1.4	≤ 5	0	24.50
QPSK	1.4	> 5	0-1	23.50
16QAM	1.4	≤ 5	0-1	23.50
16QAM	1.4	> 5	0-2	22.50

LTE Band 5				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Target Power
QPSK	10	≤ 12	0	24.00
QPSK	10	> 12	0-1	23.00
16QAM	10	≤ 12	0-1	23.00
16QAM	10	> 12	0-2	22.00
QPSK	5	≤ 8	0	24.00
QPSK	5	> 8	0-1	23.00
16QAM	5	≤ 8	0-1	23.00
16QAM	5	> 8	0-2	22.00
QPSK	3	≤ 4	0	24.00
QPSK	3	> 4	0-1	23.00
16QAM	3	≤ 4	0-1	23.00
16QAM	3	> 4	0-2	22.00
QPSK	1.4	≤ 5	0	24.00
QPSK	1.4	> 5	0-1	23.00
16QAM	1.4	≤ 5	0-1	23.00
16QAM	1.4	> 5	0-2	22.00



LTE Band 4				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Target Power
QPSK	20	≤ 18	0	24.50
QPSK	20	> 18	0-1	23.50
16QAM	20	≤ 18	0-1	23.50
16QAM	20	> 18	0-2	22.50
QPSK	15	≤ 16	0	24.50
QPSK	15	> 16	0-1	23.50
16QAM	15	≤ 16	0-1	23.50
16QAM	15	> 16	0-2	22.50
QPSK	10	≤ 12	0	24.50
QPSK	10	> 12	0-1	23.50
16QAM	10	≤ 12	0-1	23.50
16QAM	10	> 12	0-2	22.50
QPSK	5	≤ 8	0	24.50
QPSK	5	> 8	0-1	23.50
16QAM	5	≤ 8	0-1	23.50
16QAM	5	> 8	0-2	22.50
QPSK	3	≤ 4	0	24.50
QPSK	3	> 4	0-1	23.50
16QAM	3	≤ 4	0-1	23.50
16QAM	3	> 4	0-2	22.50
QPSK	1.4	≤ 5	0	24.50
QPSK	1.4	> 5	0-1	23.50
16QAM	1.4	≤ 5	0-1	23.50
16QAM	1.4	> 5	0-2	22.50

LTE Band 2				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Target Power
QPSK	20	≤ 18	0	24.00
QPSK	20	> 18	0-1	23.00
16QAM	20	≤ 18	0-1	23.00
16QAM	20	> 18	0-2	22.00
QPSK	15	≤ 16	0	24.00
QPSK	15	> 16	0-1	23.00
16QAM	15	≤ 16	0-1	23.00
16QAM	15	> 16	0-2	22.00
QPSK	10	≤ 12	0	24.00
QPSK	10	> 12	0-1	23.00
16QAM	10	≤ 12	0-1	23.00
16QAM	10	> 12	0-2	22.00
QPSK	5	≤ 8	0	24.00
QPSK	5	> 8	0-1	23.00
16QAM	5	≤ 8	0-1	23.00
16QAM	5	> 8	0-2	22.00
QPSK	3	≤ 4	0	24.00
QPSK	3	> 4	0-1	23.00
16QAM	3	≤ 4	0-1	23.00
16QAM	3	> 4	0-2	22.00
QPSK	1.4	≤ 5	0	24.00
QPSK	1.4	> 5	0-1	23.00
16QAM	1.4	≤ 5	0-1	23.00
16QAM	1.4	> 5	0-2	22.00



<Bluetooth>

Mode	Maximum Average Power (dBm)
Bluetooth v4.1 LE	4.00

<2.4GHz WLAN>

Mode	Maximum Average Power (dBm)
2.4GHz WLAN	17.90

Summarized necessary items addressed in KDB 941225 D05 v02r05								
FCC ID	NKRD54A1							
EUT	Connected Cooler Radio USA and North America version							
Operating Frequency Range of each LTE transmission band	LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz TE Band 5: 824 MHz ~ 849 MHz							
Channel Bandwidth	LTE Band 12:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 4:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 2:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz							
Uplink modulations used	QPSK and 16QAM							
LTE MPR permanently built-in by design	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3							
	Modulation	Channel bandwidth / Transmission bandwidth (RB)					MPR (dB)	
		1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz		20 MHz
	QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
	16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
	16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
LTE -MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI).							
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.							
LTE Release Version	R10							
CA Supports	NO							



Transmission (H, M, L) channel numbers and frequencies in each LTE band												
LTE Band 12												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	23017	699.7	23025	700.5	23035	701.5	23060	704				
M	23095	707.5	23095	707.5	23095	707.5	23095	707.5				
H	23173	715.3	23165	714.5	23155	713.5	23130	711				
LTE Band 4												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745
LTE Band 2												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900
LTE Band 5												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829				
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5				
H	20643	848.3	20635	847.5	20625	846.5	20600	844				

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/f ²)	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/f ²)	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

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
WCDMA Band V	826.4	1.0	25.0	26.000	0.398	398.107	0.079	0.551	0.144
WCDMA Band II	1852.4	4.0	25.0	29.000	0.794	794.328	0.158	1.000	0.158
LTE Band 12	699.7	2.0	24.5	26.500	0.447	446.684	0.089	0.466	0.191
LTE Band 5	824.7	1.0	24.0	25.000	0.316	316.228	0.063	0.550	0.114
LTE Band 4	1710.7	4.0	24.5	28.500	0.708	707.946	0.141	1.000	0.141
LTE Band 2	1850.7	4.0	24.0	28.000	0.631	630.957	0.126	1.000	0.126
Bluetooth	2402.0	1.0	4.0	5.000	0.003	3.162	0.001	1.000	0.001
WLAN	2412.0	1.0	17.9	18.900	0.078	77.625	0.015	1.000	0.015

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

**5.2. Collocated Power Density Calculation**

Mode	Frequency	Maximum EIRP (dBm)	Calculated Power Density (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit	LTE Band 12 Power Density / Limit	Σ (Power Density / Limit) of WWAN+ Bluetooth/ WWAN+ WLAN
Bluetooth	2402MHz ~2480MHz	5.000	0.001	1	0.001	0.191	0.192
WLAN	2412MHz ~2462MHz	18.900	0.015	1	0.015		0.206

Note:

1. For collocation analysis, LTE Band 12 is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
2. Σ (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + Bluetooth, WWAN + WLAN.
3. Bluetooth and WLAN share the same antenna, and cannot transmit simultaneously.

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.