



RF Exposure Evaluation Report

APPLICANT : Wistron NeWeb Corporation
EQUIPMENT : Zubie Key (LTE version): LTE single-mode
B13/B4 hotspot and GPS tracker
BRAND NAME : Wistron Neweb Corporation
MODEL NAME : D58U2
FCC ID : NKRGL700
STANDARD : 47 CFR Part 2.1091

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

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

SPORTON INTERNATIONAL (KUNSHAN) INC.

No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China



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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA591404	Rev. 01	Initial issue of report	Oct. 07, 2015



1. Administration Data

1.1. Testing Laboratory

Testing Laboratory	
Test Site	SPORTON International (Kunshan) Inc.
Test Site Location	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China TEL: 86-0512-5790-0158 FAX: 86-0512-5790-0958
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	Zubie Key (LTE version): LTE single-mode B13/B4 hotspot and GPS tracker
Brand Name	Wistron Neweb Corporation
Model Name	D58U2
FCC ID	NKRGL700
Wireless Technology and Frequency Range	LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 4: 1712.5 MHz ~ 1752.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz
Mode	• LTE • 802.11b/g/n HT20/HT40
LTE Release	R9,Cat 4
Antenna Type	WWAN: PIFA Antenna WLAN: PCB Antenna
Antenna Gain	LTE Band 13: -1.80 dBi LTE Band 4: -4.00 dBi WLAN:-1.30 dBi
HW Version	GL700 V2.0
SW Version	3.3.3.0
EUT Stage	Production Unit
Remark: 1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description. 2. The device has no voice function.	



3. Conducted RF Output Power (Unit: dBm)

<LTE Conducted Power>

<LTE Band 13>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel			Channel	23230			Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)			Frequency (MHz)	782				
10	QPSK	1	0	21.75			23.00	0
10	QPSK	1	25	22.23				
10	QPSK	1	49	21.96				
10	QPSK	25	0	20.74			22.00	0-1
10	QPSK	25	12	20.80				
10	QPSK	25	25	20.80				
10	QPSK	50	0	20.73			22.00	0-1
10	16QAM	1	0	20.97				
10	16QAM	1	25	21.30				
10	16QAM	1	49	21.11			21.00	0-2
10	16QAM	25	0	19.79				
10	16QAM	25	12	19.81				
10	16QAM	25	25	19.84			21.00	0-2
10	16QAM	50	0	19.81				
Channel			Channel	23205	23230	23255		
Frequency (MHz)			Frequency (MHz)	779.5	782	784.5		
5	QPSK	1	0	22.01	22.00	21.96	23.00	0
5	QPSK	1	12	22.15	22.07	22.03		
5	QPSK	1	24	22.19	22.11	21.78		
5	QPSK	12	0	20.93	20.76	20.75	22.00	0-1
5	QPSK	12	7	20.87	20.67	20.72		
5	QPSK	12	13	20.91	20.68	20.71		
5	QPSK	25	0	20.88	20.79	20.74	22.00	0-1
5	16QAM	1	0	21.14	21.17	21.13		
5	16QAM	1	12	21.31	21.23	21.23		
5	16QAM	1	24	21.32	21.29	20.97	21.00	0-2
5	16QAM	12	0	19.93	19.80	19.74		
5	16QAM	12	7	19.92	19.79	19.73		
5	16QAM	12	13	19.98	19.79	19.68	21.00	0-2
5	16QAM	25	0	19.94	19.84	19.73		



<LTE Band 4>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel			Channel	20050	20175	20300		
Frequency (MHz)			Frequency (MHz)	1720	1732.5	1745		
20	QPSK	1	0	22.00	22.47	22.59	23.00	0
20	QPSK	1	49	21.79	22.40	22.41		
20	QPSK	1	99	21.75	22.25	21.93		
20	QPSK	50	0	20.75	21.31	21.47	22.00	0-1
20	QPSK	50	24	20.71	21.35	21.30		
20	QPSK	50	50	20.71	21.32	20.92		
20	QPSK	100	0	20.74	21.32	21.21	22.00	0-1
20	16QAM	1	0	21.23	21.68	21.87		
20	16QAM	1	49	21.02	21.66	21.64		
20	16QAM	1	99	21.01	21.48	20.93	21.00	0-2
20	16QAM	50	0	19.85	20.42	20.55		
20	16QAM	50	24	19.81	20.42	20.42		
20	16QAM	50	50	19.81	20.38	20.08	21.00	0-2
20	16QAM	100	0	19.87	20.39	20.30		
Channel			Channel	20025	20175	20325		
Frequency (MHz)			Frequency (MHz)	1717.5	1732.5	1747.5		
15	QPSK	1	0	21.90	22.35	22.47	23.00	0
15	QPSK	1	37	21.71	22.26	22.19		
15	QPSK	1	74	21.63	22.27	21.79		
15	QPSK	36	0	20.63	21.34	21.38	22.00	0-1
15	QPSK	36	20	20.57	21.30	21.11		
15	QPSK	36	39	20.56	21.29	20.82		
15	QPSK	75	0	20.61	21.26	21.08	22.00	0-1
15	16QAM	1	0	21.06	21.67	21.73		
15	16QAM	1	37	20.92	21.53	21.49		
15	16QAM	1	74	20.77	21.57	20.85	21.00	0-2
15	16QAM	36	0	19.76	20.42	20.48		
15	16QAM	36	20	19.73	20.39	20.26		
15	16QAM	36	39	19.68	20.37	19.99	21.00	0-2
15	16QAM	75	0	19.69	20.35	20.18		



Channel			Channel	20000	20175	20350	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)			Frequency (MHz)	1715	1732.5	1750		
10	QPSK	1	0	21.71	22.38	22.23	23.00	0
10	QPSK	1	25	21.48	22.20	21.93		
10	QPSK	1	49	21.47	22.33	21.55		
10	QPSK	25	0	20.49	21.32	21.07	22.00	0-1
10	QPSK	25	12	20.39	21.26	20.87		
10	QPSK	25	25	20.43	21.25	20.64		
10	QPSK	50	0	20.46	21.28	20.90	22.00	0-1
10	16QAM	1	0	21.01	21.66	21.49		
10	16QAM	1	25	20.65	21.48	21.19		
10	16QAM	1	49	20.79	21.60	20.84	21.00	0-2
10	16QAM	25	0	19.60	20.39	20.21		
10	16QAM	25	12	19.56	20.38	20.01		
10	16QAM	25	25	19.56	20.37	19.79	21.00	0-2
10	16QAM	25	25	19.56	20.37	19.79		
10	16QAM	50	0	19.57	20.37	20.02		
Channel			Channel	19975	20175	20375	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)			Frequency (MHz)	1712.5	1732.5	1752.5		
5	QPSK	1	0	21.63	22.35	21.89	23.00	0
5	QPSK	1	12	21.43	22.15	21.75		
5	QPSK	1	24	21.36	22.34	21.56		
5	QPSK	12	0	20.45	21.20	20.69	22.00	0-1
5	QPSK	12	7	20.32	21.19	20.60		
5	QPSK	12	13	20.28	21.17	20.55		
5	QPSK	25	0	20.35	21.24	20.60	22.00	0-1
5	16QAM	1	0	20.84	21.66	21.09		
5	16QAM	1	12	20.64	21.37	21.05		
5	16QAM	1	24	20.66	21.60	20.77	21.00	0-2
5	16QAM	12	0	19.55	20.35	19.84		
5	16QAM	12	7	19.50	20.29	19.75		
5	16QAM	12	13	19.41	20.25	19.68	21.00	0-2
5	16QAM	12	13	19.41	20.25	19.68		
5	16QAM	25	0	19.52	20.36	19.76		



	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b	CH 1	2412	1Mbps	15.58	17.50	100
		CH 6	2437		16.78	18.50	
		CH 11	2462		16.72	18.50	
	802.11g	CH 1	2412	6Mbps	12.55	14.50	100
		CH 6	2437		13.33	15.00	
		CH 11	2462		12.61	14.50	
	802.11n-HT20	CH 1	2412	MCS0	11.89	13.50	100
		CH 6	2437		12.41	14.00	
		CH 11	2462		11.92	13.50	
	802.11n-HT40	CH 3	2422	MCS0	11.66	13.50	100
		CH 6	2437		12.45	14.00	
		CH 9	2452		12.37	14.00	



The table below summarized necessary items addressed in KDB 941225 D05 v02r03

FCC ID	NKRGL700																																						
EUT	Zubie Key (LTE version): LTE single-mode B13/B4 hotspot and GPS tracker																																						
Operating Frequency Range of each LTE transmission band	LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 4: 1712.5 MHz ~ 1752.5 MHz																																						
Channel Bandwidth	LTE Band 13: 5MHz, 10MHz LTE Band 4: 5MHz, 10MHz, 15MHz, 20MHz																																						
uplink modulations used	QPSK and 16QAM																																						
LTE MPR permanently built-in by design	<p align="center">Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3</p> <table border="1"> <thead> <tr> <th rowspan="2">Modulation</th> <th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th> <th rowspan="2">MPR (dB)</th> </tr> <tr> <th>1.4 MHz</th> <th>3.0 MHz</th> <th>5 MHz</th> <th>10 MHz</th> <th>15 MHz</th> <th>20 MHz</th> </tr> </thead> <tbody> <tr> <td>QPSK</td> <td>> 5</td> <td>> 4</td> <td>> 8</td> <td>> 12</td> <td>> 16</td> <td>> 18</td> <td>≤ 1</td> </tr> <tr> <td>16 QAM</td> <td>≤ 5</td> <td>≤ 4</td> <td>≤ 8</td> <td>≤ 12</td> <td>≤ 16</td> <td>≤ 18</td> <td>≤ 1</td> </tr> <tr> <td>16 QAM</td> <td>> 5</td> <td>> 4</td> <td>> 8</td> <td>> 12</td> <td>> 16</td> <td>> 18</td> <td>≤ 2</td> </tr> </tbody> </table>	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
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.																																						

Transmission (H, M, L) channel numbers and frequencies in each LTE band								
Band 13								
	Bandwidth 5 MHz				Bandwidth 10 MHz			
	Channel #		Frequency (MHz)		Channel #		Frequency (MHz)	
L	23205		779.5		23230		782	
M	23230		782					
H	23255		784.5					
LTE Band 4								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20375	1752.5	20350	1750	20325	1747.5	20300	1745



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
LTE Band 13	779.5	-1.80	23.00	21.20	0.13	131.83	0.03	0.52	0.05
LTE Band 4	1710.7	-4.00	23.00	19.00	0.08	79.43	0.02	1.00	0.02
WLAN2.4GHz b	2412.0	-1.30	18.50	17.20	0.05	52.48	0.01	1.00	0.01

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

5.2. Collocated Power Density Calculation

Mode	Frequency	WLAN Power Density / Limit	LTE Band 13 Power Density / Limit	Σ (Power Density / Limit) of WWAN+WLAN
WLAN2.4GHz b	2412MHz ~ 2462MHz	0.01	0.05	0.06

Note:

- For collocation analysis, LTE is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
- 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 + WLAN.
- Considering the WWAN collocation with the WLAN transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 2 collocated transmitters is compliant.

Conclusion:

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