



# RF Exposure Evaluation Report

APPLICANT : Maestro Wireless Solutions Limited  
EQUIPMENT : 4G WIFI Router  
BRAND NAME : Maestro  
MODEL NAME : E228#245DH#25  
MARKETING NAME : E228  
FCC ID : 2AJF3-E228-7  
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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**SPORTON INTERNATIONAL (SHENZHEN) INC.**

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**Revision History**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA691310	Rev. 01	Initial issue of report	Oct. 28, 2016

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

Test 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	Maestro Wireless Solutions Limited
Address	FLAT A & B, 9/F, WING CHEONG FACTORY BUILDING, 121 KING LAM STREET, CHEUNG SHA WAN, HONG KONG

Manufacturer	
Company Name	Maestro Wireless Solutions Limited
Address	FLAT A & B, 9/F, WING CHEONG FACTORY BUILDING, 121 KING LAM STREET, CHEUNG SHA WAN, HONG KONG

**2. Description of Equipment Under Test (EUT)**

Product Feature & Specification				
EUT Type	4G WIFI Router			
Brand Name	Maestro			
Model Name	E228#245DH#25			
Marketing Name	E228			
FCC ID	2AJF3-E228-7			
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz			
Mode	· WLAN 2.4GHz 802.11b/g/n HT20/HT40			
Antenna Type	WLAN: Dipole Antenna			
Antenna Function for Transmitter		Ant. 1	Ant. 2	
	802.11 b/g/n SISO	V	V	
	802.11 b/g/n MIMO	V	V	
HW Version	V07			
SW Version	V2.1.2			
EUT Stage	Pre-Production			

**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****<WLAN 2.4GHz Antenna 1>**

Mode		Maximum Average Power (dBm)
2.4GHz	802.11b	13.0
	802.11g	13.0
	802.11n-HT20	12.0
	802.11n-HT40	9.0

**<WLAN 2.4GHz Antenna 2>**

Mode		Maximum Average Power (dBm)
2.4GHz	802.11b	11.0
	802.11g	11.0
	802.11n-HT20	11.0
	802.11n-HT40	8.0

**<WLAN 2.4GHz Antenna 1+2>**

Mode		Maximum Average Power (dBm)
2.4GHz	802.11b	15.0
	802.11g	15.0
	802.11n-HT20	14.0
	802.11n-HT40	12.0



#### **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 <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	30
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

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 <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Power Density / Limit
WLAN2.4GHz 802.11b Ant 1	2412.0	3.80	13.0	16.800	0.048	47.863	0.010	1.000	0.010
WLAN2.4GHz 802.11g Ant 1	2412.0	3.80	13.0	16.800	0.048	47.863	0.010	1.000	0.010
WLAN2.4GHz 802.11n-HT20 Ant 1	2412.0	3.80	12.0	15.800	0.038	38.019	0.008	1.000	0.008
WLAN2.4GHz 802.11n-HT40 Ant 1	2422.0	3.80	9.0	12.800	0.019	19.055	0.004	1.000	0.004
WLAN2.4GHz 802.11b Ant 2	2412.0	3.80	11.0	14.800	0.030	30.200	0.006	1.000	0.006
WLAN2.4GHz 802.11g Ant 2	2412.0	3.80	11.0	14.800	0.030	30.200	0.006	1.000	0.006
WLAN2.4GHz 802.11n-HT20 Ant 2	2412.0	3.80	11.0	14.800	0.030	30.200	0.006	1.000	0.006
WLAN2.4GHz 802.11n-HT40 Ant 2	2422.0	3.80	8.0	11.800	0.015	15.136	0.003	1.000	0.003
WLAN2.4GHz 802.11b Ant 1+2	2412.0	6.81	15.0	21.810	0.152	151.705	0.030	1.000	0.030
WLAN2.4GHz 802.11g Ant 1+2	2412.0	6.81	15.0	21.810	0.152	151.705	0.030	1.000	0.030
WLAN2.4GHz 802.11n-HT20 Ant 1+2	2412.0	6.81	14.0	20.810	0.121	120.504	0.024	1.000	0.024
WLAN2.4GHz 802.11n-HT40 Ant 1+2	2422.0	6.81	12.0	18.810	0.076	76.033	0.015	1.000	0.015

**Note:** 1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band  
2. WLAN MIMO gain=3.80+10log2=6.81dBi



## 5.2. Collocated Power Density Calculation

**Note:**

This device contains WWAN module which FCC ID: N7NHL7588, so for evaluated the Co-located with WLAN, list the followings WWAN power density.

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Power Density / Limit
WCDMA Band 5	826.4	2.0	24.0	26.000	0.398	398.11	0.079	0.551	0.144
WCDMA Band 2	1852.4	2.0	24.0	26.000	0.398	398.11	0.079	1.000	0.079
LTE Band 17	706.5	2.0	24.0	26.000	0.398	398.11	0.079	0.471	0.168
LTE Band 5	824.7	2.0	24.0	26.000	0.398	398.11	0.079	0.550	0.144
LTE Band 13	779.5	2.0	24.0	26.000	0.398	398.11	0.079	0.520	0.152
LTE Band 4	1710.7	2.0	24.5	26.500	0.447	446.68	0.089	1.000	0.089
LTE Band 2	1850.7	2.0	24.0	26.000	0.398	398.11	0.079	1.000	0.079

Mode	Frequency	Power Density / Limit	$\Sigma$ (Power Density / Limit) of WWAN+WLAN
WLAN2.4GHz	2412MHz ~ 2462MHz	0.030	0.20
WWAN Band 17	706.5MHz ~ 713.5MHz	0.168	

**Note:**

- For collocation analysis, LTE Band 17 is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
- $\Sigma$ (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 module 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.