RF Exposure Evaluation Report

APPLICANT	:	**MTRLC LLC**
EQUIPMENT	:	**AX3000 Dual-band Mesh WiFi**
BRAND NAME	:	**Motorola**
MODEL NAME	:	**Q11**
FCC ID	:	**2AF5PQ11**
STANDARD	:	**47 CFR Part 2.1091** **FCC KDB 447498 D01 v06**

We, Sporton International Inc. (Kunshan), would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091 and FCC KDB 447498 D01 v06, and pass the limit. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Tony Zhang

Reviewed by: Tony Zhang / Supervisor

Kat Yin

Approved by: Kat Yin / Manager

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People's Republic of China

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA1D0112	Rev. 01	Initial issue of report	Mar. 18, 2022

1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	SAR01-KS	CN1257	314309

Applicant	
Company Name	MTRLC LLC
Address	275 Turnpike Street Suite 101 Canton, MA 02021

Manufacturer	
Company Name	MTRLC LLC
Address	275 Turnpike Street Suite 101 Canton, MA 02021

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	AX3000 Dual-band Mesh WiFi
Brand Name	Motorola
Model Name	Q11
FCC ID	2AF5PQ11
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz WLAN 5.9GHz Band: 5845 MHz ~ 5885 MHz
Mode	WLAN 2.4GHz 802.11b/g/n/ HT20/ HT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 WLAN 5GHz 802.11ax HE20/HE40/HE80/HE160
Antenna Function Description	Mode / Ant. 1 / Ant. 2 WLAN 2.4GHz 802.11 b/g/n SISO/MIMO / V / V WLAN 5GHz 802.11 a/n/ac/ax SISO/MIMO / V / V
Antenna Type	Dipole Antenna
Antenna gain	<Ant. 1> WLAN 2.4GHz: gain 3.4 dBi WLAN 5.2GHz: gain 4.1 dBi WLAN 5.3GHz: gain 4.1 dBi WLAN 5.5GHz: gain 4.1 dBi WLAN 5.8GHz: gain 4.1 dBi WLAN 5.9GHz: gain 3.0 dBi <Ant. 2> WLAN 2.4GHz: gain 3.4 dBi WLAN 5.2GHz: gain 4.8 dBi WLAN 5.3GHz: gain 4.8 dBi WLAN 5.5GHz: gain 4.8 dBi WLAN 5.8GHz: gain 4.8 dBi WLAN 5.9GHz: gain 3.0 dBi
HW Version	REV1.0
SW Version	REV1.0
EUT Stage	Identical Prototype

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. WLAN2.4GHz and WLAN5GHz supports SISO/MIMO mode, for MIMO mode power is higher than SISO mode, So only chose MIMO mode power to perform MPE calculation.
3. WLAN2.4GHz and WLAN5GHz chose the higher SISO gain as MIMO gain to perform MPE calculation.

Comments and Explanations:
1. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. 2. The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.

3. Maximum RF average output power among production units

<WLAN 2.4GHz MIMO Mode>

Mode		Maximum Average Power (dBm) MIMO <Ant. 1+2>
2.4GHz	802.11b	30.00
	802.11g	30.00
	802.11n-HT20	29.00
	802.11n-HT40	25.00
	802.11ax-HE20	29.00
	802.11ax- HE40	25.00

<WLAN 5GHz MIMO Mode >

Mode		Maximum Average Power (dBm) MIMO <Ant. 1+2>
WLAN 5.2GHz	802.11a	28.00
	802.11n-HT20	28.00
	802.11n-HT40	27.00
	802.11ac-VHT20	28.00
	802.11ac-VHT40	27.00
	802.11ac-VHT80	22.00
	802.11ax-HE20	29.00
	802.11ax- HE40	29.00
	802.11ax- HE80	23.00
WLAN 5.3GHz	802.11a	22.00
	802.11n-HT20	22.00
	802.11n-HT40	24.00
	802.11ac-VHT20	22.00
	802.11ac-VHT40	24.00
	802.11ac-VHT80	23.00
	802.11ax-HE20	23.00
	802.11ax- HE40	24.00
	802.11ax- HE80	23.00
	802.11ax-HE160	22.00
WLAN 5.5GHz	802.11a	22.00
	802.11n-HT20	22.00
	802.11n-HT40	24.00
	802.11ac-VHT20	22.00
	802.11ac-VHT40	24.00
	802.11ac-VHT80	24.00
	802.11ax-HE20	23.00
	802.11ax- HE40	24.00
	802.11ax- HE80	24.00
	802.11ax-HE160	23.00
WLAN 5.8GHz	802.11a	30.00

	802.11n-HT20	30.00
	802.11n-HT40	30.00
	802.11ac-VHT20	30.00
	802.11ac-VHT40	30.00
	802.11ac-VHT80	26.00
	802.11ax-HE20	30.00
	802.11ax- HE40	30.00
	802.11ax- HE80	26.00
WLAN 5.9GHz	802.11a	28.00
	802.11n-HT20	28.00
	802.11n-HT40	30.00
	802.11ac-VHT20	28.00
	802.11ac-VHT40	30.00
	802.11ac-VHT80	24.00
	802.11ax-HE20	28.00
	802.11ax- HE40	30.00
	802.11ax- HE80	24.00
	802.11ax-HE160	21.00

Note: WLAN2.4GHz/WLAN5GHz all support SISO/MIMO mode, we only chose MIMO tune up power to perform MPE calculation conservatively for MIMO power is higher.

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 24 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 24cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WLAN 2.4GHz	2412	3.40	30.00	33.40	2.19	2187.76	0.302	1.000	**0.302**
WLAN 5.2GHz	5180	4.80	29.00	33.80	2.40	2398.83	0.332	1.000	0.332
WLAN 5.3GHz	5260	4.80	24.00	28.80	0.76	758.58	0.105	1.000	0.105
WLAN 5.5GHz	5500	4.80	24.00	28.80	0.76	758.58	0.105	1.000	0.105
WLAN 5.8GHz	5745	4.80	30.00	34.80	3.02	3019.95	0.417	1.000	**0.417**
WLAN 5.9GHz	5845	3.00	30.00	33.00	2.00	1995.26	0.276	1.000	0.276

Note:
1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. Chose the maximum power to do MPE analysis.
3. WLAN2.4GHz and WLAN5GHz chose the higher SISO gain as MIMO gain to perform MPE calculation.

5.2. Collocated Power Density Calculation

WLAN 2.4GHz Power Density / Limit	WLAN 5GHz Power Density / Limit	Σ(Power Density / Limit) of WLAN 2.4GHz + WLAN 5GHz
0.302	0.417	0.719

Note:
1. Chose the worst power density among WLAN2.4 and WLAN5GHz to do co-located.
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 WLAN2.4G + WLAN5G.
3. Considering the WLAN2.4G module collocation with the WLAN5G 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.

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