RF Exposure Evaluation Report

APPLICANT	:	**Quectel Wireless Solutions Co., Ltd.**
EQUIPMENT	:	**LTE-A Cat 12 M.2 Module**
BRAND NAME	:	**Quectel**
MODEL NAME	:	**EM12-G**
FCC ID	:	**XMR201901EM12G**
STANDARD	:	**47 CFR Part 2.1091** **FCC KDB 447498 D01 v06**

We, Sporton International (Kunshan) Inc., 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 (Kunshan) Inc., the test report shall not be reproduced except in full.

Mark Qu

Approved by: Mark Qu / Manager

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Sporton International (Kunshan) Inc.
No. 1098, Pengxi North Road, Kunshan Economic Development Zone,
Jiangsu Province 215335, China

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA8N2911	Rev. 01	Initial issue of report	Jan. 30, 2019

1. Administration Data

1.1. Testing Laboratory

Testing Laboratory	
Test Site	Sporton International (Kunshan) Inc.
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone, Jiangsu Province 215335, China TEL : 86-512-57900158 FAX : 86-512-57900958

Applicant	
Company Name	Quectel Wireless Solutions Co., Ltd.
Address	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China

Manufacturer	
Company Name	Quectel Wireless Solutions Co., Ltd.
Address	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	LTE-A Cat 12 M.2 Module
Brand Name	Quectel
Model Name	EM12-G
FCC ID	XMR201901EM12G
IMEI Code	869710030005957
Wireless Technology and Frequency Range	WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 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 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 30: 2305 MHz ~ 2315 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz
Mode	RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+ (16QAM uplink) LTE: QPSK/16QAM/64QAM/256QAM(Downlink only)
HW Version	R1.0
SW Version	EM12GPAR01A08M4G
EUT Stage	Identical Prototype
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

<WCDMA/LTE >

Mode		Maximum Average power(dBm)
WCDMA	Band II	24.00
	Band IV	24.00
	Band V	24.00
LTE	Band 2	24.50
	Band 4	24.50
	Band 5	24.50
	Band 7	24.50
	Band 12	24.50
	Band 13	24.50
	Band 14	24.50
	Band 17	24.50
	Band 25	24.50
	Band 26	24.50
	Band 30	20.50
	Band 38	24.50
	Band 41	24.50
	Band 66	24.50

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

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)
WCDMA Band II	1852.4	7.00	24.00	31.000	1.259	1258.925	0.251	1.000
WCDMA Band IV	1712.4	5.00	24.00	29.000	0.794	794.328	0.158	1.000
WCDMA Band V	826.4	6.00	24.00	30.000	1.000	1000.000	0.199	0.551
LTE Band 2	1850.7	7.00	24.50	31.500	1.413	1412.538	0.281	1.000
LTE Band 4	1710.7	5.00	24.50	29.500	0.891	891.251	0.177	1.000
LTE Band 5	824.7	6.00	24.50	30.500	1.122	1122.018	0.223	0.550
LTE Band 7	2502.5	7.00	24.50	31.500	1.413	1412.538	0.281	1.000
LTE Band 12	699.7	5.00	24.50	29.500	0.891	891.251	0.177	0.466
LTE Band 13	779.5	5.00	24.50	29.500	0.891	891.251	0.177	0.520
LTE Band 14	790.5	5.00	24.50	29.500	0.891	891.251	0.177	0.527
LTE Band 17	706.5	5.00	24.50	29.500	0.891	891.251	0.177	0.471
LTE Band 25	1850.7	7.00	24.50	31.500	1.413	1412.538	0.281	1.000
LTE Band 26	814.7	6.00	24.50	30.500	1.122	1122.018	0.223	0.543
LTE Band 30	2307.5	4.00	20.50	24.500	0.282	281.838	0.056	1.000
LTE Band 38	2572.5	7.00	24.50	31.500	1.413	1412.538	0.281	1.000
LTE Band 41	2498.5	7.00	24.50	31.500	1.413	1412.538	0.281	1.000
LTE Band 66	1710.7	5.00	24.50	29.500	0.891	891.251	0.177	1.000

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

General Note:

1. This MPE analysis is applicable to any collocated transmitters with EIRP for WLAN/BT is less than or equal to 26dBm.
2. A maximum antenna gain of 6dBi for WLAN/BT has been assumed for all collocated antennas.

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WCDMA Band II	1852.4	5.00	24.00	29.0	794.33	0.158	1.000	0.158
WCDMA Band IV	1712.4	4.00	24.00	28.0	630.96	0.126	1.000	0.126
WCDMA Band V	826.4	5.00	24.00	29.0	794.33	0.158	0.536	0.295
LTE Band 2	1850.7	5.00	24.50	29.5	891.25	0.177	1.000	0.177
LTE Band 4	1710.7	4.00	24.50	28.5	707.95	0.141	1.000	0.141
LTE Band 5	824.7	5.00	24.50	29.5	891.25	0.177	0.549	0.323
LTE Band 7	2502.5	5.00	24.50	29.5	891.25	0.177	1.000	0.177
LTE Band 12	699.7	4.00	24.50	28.5	707.95	0.141	0.466	0.302
LTE Band 13	779.5	4.00	24.50	28.5	707.95	0.141	0.518	0.272
LTE Band 14	790.5	4.00	24.50	28.5	707.95	0.141	0.525	0.268
LTE Band 17	706.5	4.00	24.50	28.5	707.95	0.141	0.469	0.300
LTE Band 25	1850.7	5.00	24.50	29.5	891.25	0.177	1.000	0.177
LTE Band 26	814.7	5.00	24.50	29.5	891.25	0.177	0.543	**0.327**
LTE Band 30	2307.5	3.00	20.50	23.5	223.87	0.045	1.000	0.045
LTE Band 38	2572.5	5.00	24.50	29.5	891.25	0.177	1.000	0.177
LTE Band 41	2498.5	5.00	24.50	29.5	891.25	0.177	1.000	0.177
LTE Band 66	1710.7	4.00	24.50	28.5	707.95	0.141	1.000	0.141
WLNA2.4GHz Band	2412	6.00	20.00	26.0	398.11	0.079	1.000	**0.079**
WLNA5GHz Band	5180	6.00	20.00	26.0	398.11	0.079	1.000	**0.079**
Bluetooth	2402	6.00	20.00	26.0	398.11	0.079	1.000	**0.079**

<Collocated analysis>

General Note:

1. For colocation analysis, LTE Band 26 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
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 WWAN Power Density / Limit	Max WLAN Power Density / Limit	Max Bluetooth Power Density / Limit	∑(Power Density / Limit) of WWAN + WLAN + Bluetooth
0.327	0.079	0.079	0.485

Conclusion:

Based on 47 CFR §2.1091 and FCC KDB 447498 D01 v06, 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:

Device	Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Standalone Maximum Antenna Gain (dBi)	Collocated Maximum Antenna Gain (dBi)
LTE-A Cat 12 M.2 Module	WCDMA Band II	1852.4	24.00	7.00	5.00
	WCDMA Band IV	1712.4	24.00	5.00	4.00
	WCDMA Band V	826.4	24.00	6.00	5.00
	LTE Band 2	1850.7	24.50	7.00	5.00
	LTE Band 4	1710.7	24.50	5.00	4.00
	LTE Band 5	824.7	24.50	6.00	5.00
	LTE Band 7	2502.5	24.50	7.00	5.00
	LTE Band 12	699.7	24.50	5.00	4.00
	LTE Band 13	779.5	24.50	5.00	4.00
	LTE Band 14	790.5	24.50	5.00	4.00
	LTE Band 17	706.5	24.50	5.00	4.00
	LTE Band 25	1850.7	24.50	7.00	5.00
	LTE Band 26	814.7	24.50	6.00	5.00
	LTE Band 30	2307.5	20.50	4.00	3.00
	LTE Band 38	2572.5	24.50	7.00	5.00
	LTE Band 41	2498.5	24.50	7.00	5.00
	LTE Band 66	1710.7	24.50	5.00	4.00
Collocated Transmitters	WLNA2.4GHz Band	2412	20.00		6.00
	WLNA5GHz Band	5180	20.00		6.00
	Bluetooth	2402	20.00		6.00