

## FCC RF Exposure Evaluation

### 1. Product Information

FCC ID	2BFQL-Q1062LT22A
Product Name	Car multimedia infotainment system
Test Model	Q1062LT22A
Power supply:	DC 12V
Modulation Type	Bluetooth: GFSK, $\pi/4$ DQPSK, 8DPSK Bluetooth LE: GFSK 2.4G WIFI: DSSS, OFDM 5G WIFI: OFDM
Antenna Type	Bluetooth ANT: PCB Antenna 2.4G & 5G WIFI ANT: Ceramic Antenna
Antenna Gain	Bluetooth ANT: -0.58dBi 2.4G WIFI ANT: 1.50dBi 5G WIFI ANT: 7.21dBi
Frequency Range	Bluetooth: 2402 – 2480MHz 2.4G WIF: 2412 - 2462MHz 5G WIFI: 5180 - 5240MHz / 5260 - 5320MHz / 5500 - 5700MHz / 5745 - 5825MHz
Exposure Category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Device

### 2. Evaluation Method and Limit

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is  $\leq 1.0$ . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

### 3. Limit

#### 3.1 Refer Evaluation Method

[ANSI C95.1-1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1091](#): Radiofrequency radiation exposure evaluation: mobile devices

#### 3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
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

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 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

F=frequency in MHz

\*=Plane-wave equivalent power density

**4. MPE Calculation Method**

Predication of MPE limit at a given distance  
Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4\pi R^2$$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

**5. Antenna Information**

Q1062LT22A can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Note
PCB Antenna	2402 MHz – 2480 MHz	Bluetooth ANT: -0.58dBi	Bluetooth Antenna
Ceramic Antenna	2412 MHz - 2462 MHz 5180 MHz - 5240 MHz 5260 MHz - 5320MHz 5500 MHz - 5700 MHz 5745 MHz - 5850 MHz	2.4G WIFI ANT: 1.50dBi 5G WIFI ANT: 7.21dBi	WLAN Antenna

**6. Conducted Power Results**

[BT Max Conducted Power]

Mode	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	2402	2.72
	2441	3.55
	2480	4.72
$\pi/4$ DQPSK	2402	2.65

8DPSK	2441	3.85
	2480	4.57
	2402	2.85
	2441	4.10
	2480	4.84

**[BLE 1M Max Conducted Power]**

Mode	Frequency (MHz)	Peak Conducted Output Power (dBm)
1M	2402	2.40
	2440	3.54
	2480	4.41

**[2.4G WIFI Max Conducted Power]**

Mode	Frequency (MHz)	Peak Conducted Output Power (dBm)
802.11b	2412	11.13
	2437	11.24
	2462	10.57
802.11g	2412	10.70
	2437	10.86
	2462	10.28
802.11n (HT20)	2412	10.68
	2437	10.85
	2462	10.24
802.11n (HT40)	2422	10.97
	2437	11.09
	2452	10.99

**[U-NII-1 Max Conducted Power]**

Mode	Frequency (MHz)	Peak Conducted Output Power (dBm)
802.11a	5180	5.14
	5200	5.67
	5240	6.24
802.11n (HT20)	5180	4.91
	5200	5.46
	5240	6.09
802.11n (HT40)	5190	5.52
	5230	6.47
802.11ac (VHT20)	5180	4.87
	5200	5.40
	5240	6.01
802.11ac (VHT40)	5190	5.50
	5230	6.41
802.11ac (VHT80)	5210	6.23

**[U-NII-2A Max Conducted Power]**

Mode	Frequency (MHz)	Peak Conducted Output Power (dBm)

802.11a	5260	5.63
	5300	6.30
	5320	6.57
802.11n (HT20)	5260	5.55
	5300	6.22
	5320	6.47
802.11n (HT40)	5270	6.07
	5310	6.74
802.11ac (VHT20)	5260	5.57
	5300	6.20
	5320	6.47
802.11ac (VHT40)	5270	6.12
	5310	6.74
802.11ac (VHT80)	5290	6.75

**[U-NII-2C Max Conducted Power]**

Mode	Frequency (MHz)	Peak Conducted Output Power (dBm)
802.11a	5500	7.56
	5580	6.79
	5700	5.37
802.11n (HT20)	5500	7.51
	5580	6.72
	5700	5.30
802.11n (HT40)	5510	7.87
	5550	7.52
	5670	6.29
802.11ac (VHT20)	5500	7.50
	5580	6.72
	5700	5.28
802.11ac (VHT40)	5510	7.91
	5550	7.55
	5670	6.33
802.11ac (VHT80)	5530	7.91
	5610	7.13

**[U-NII-3 Max Conducted Power]**

Mode	Frequency (MHz)	Peak Conducted Output Power (dBm)
802.11a	5745	6.81
	5785	6.70
	5825	7.21
802.11n (HT20)	5745	6.74
	5785	6.78
	5825	7.11
802.11n	5755	7.14

(HT40)	5795	7.38
802.11ac (VHT20)	5745	6.77
	5785	6.71
	5825	7.12
802.11ac (VHT40)	5755	7.06
	5795	7.16
802.11ac (VHT80)	5775	7.34

**7.Manufacturing Tolerance**

**<BT >**

GFSK (Peak)			
Channel	2402 MHz	2441 MHz	2480 MHz
Target (dBm)	3.0	4.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0
π /4DQPSK(Peak)			
Channel	2402 MHz	2441 MHz	2480 MHz
Target (dBm)	3.0	4.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK(Peak)			
Channel	2402 MHz	2441 MHz	2480 MHz
Target (dBm)	3.0	4.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0

**<BLE 1M >**

GFSK (Peak)			
Channel	2402 MHz	2440 MHz	2480 MHz
Target (dBm)	2.0	4.0	4.0
Tolerance ±(dB)	1.0	1.0	1.0

**<2.4G WIFI >**

11B (Average)			
Channel	2412MHz	2437MHz	2462MHz
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
11G (Average)			
Channel	2412MHz	2437MHz	2462MHz
Target (dBm)	11.0	11.0	10.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 (Average)			
Channel	2412MHz	2437MHz	2462MHz
Target (dBm)	11.0	11.0	10.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 (Average)			
Channel	2422MHz	2437MHz	2452MHz

Target (dBm)	11.0	11.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

## &lt;U-NII-1&gt;

11A (Average)			
Channel	5180MHz	5200MHz	5240MHz
Target (dBm)	5.0	6.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 (Average)			
Channel	5180MHz	5200MHz	5240MHz
Target (dBm)	5.0	5.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 (Average)			
Channel	5190MHz	5230MHz	
Target (dBm)	6.0	6.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC20 (Average)			
Channel	5180MHz	5200MHz	5240MHz
Target (dBm)	5.0	5.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 (Average)			
Channel	5190MHz	5230MHz	
Target (dBm)	6.0	6.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC80 (Average)			
Channel	5210MHz		
Target (dBm)	6.0		
Tolerance $\pm$ (dB)	1.0		

## &lt;U-NII-2A&gt;

11A (Average)			
Channel	5260MHz	5300MHz	5320MHz
Target (dBm)	6.0	6.0	7.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 (Average)			
Channel	5260MHz	5300MHz	5320MHz
Target (dBm)	6.0	6.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 (Average)			
Channel	5270MHz	5310MHz	
Target (dBm)	6.0	7.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC20 (Average)			
Channel	5260MHz	5300MHz	5320MHz

Target (dBm)	6.0	6.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 (Average)			
Channel	5270MHz	5310MHz	
Target (dBm)	6.0	7.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC80 (Average)			
Channel	5290MHz		
Target (dBm)	7.0		
Tolerance $\pm$ (dB)	1.0		

## &lt;U-NII-2C&gt;

11A (Average)			
Channel	5500MHz	5580MHz	5700MHz
Target (dBm)	8.0	7.0	5.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 (Average)			
Channel	5500MHz	5580MHz	5700MHz
Target (dBm)	8.0	7.0	5.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 (Average)			
Channel	5510MHz	5550MHz	5670MHz
Target (dBm)	8.0	8.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC20 (Average)			
Channel	5500MHz	5580MHz	5700MHz
Target (dBm)	8.0	7.0	5.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 (Average)			
Channel	5510MHz	5550MHz	5670MHz
Target (dBm)	8.0	8.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC80 (Average)			
Channel	5530MHz	5610MHz	
Target (dBm)	8.0	7.0	
Tolerance $\pm$ (dB)	1.0	1.0	

## &lt;U-NII-3&gt;

11A (Average)			
Channel	5745MHz	5785MHz	5825MHz
Target (dBm)	7.0	7.0	7.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 (Average)			
Channel	5745MHz	5785MHz	5825MHz
Target (dBm)	7.0	7.0	7.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

11N40 (Average)			
Channel	5755MHz	5795MHz	
Target (dBm)	7.0	7.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC20 (Average)			
Channel	5745MHz	5785MHz	5825MHz
Target (dBm)	7.0	7.0	7.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 (Average)			
Channel	5755MHz	5795MHz	
Target (dBm)	7.0	7.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC80 (Average)			
Channel	5775MHz		
Target (dBm)	7.0		
Tolerance $\pm$ (dB)	1.0		

## 8. Evaluation Results

### 8.1 Standalone MPE

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance,  $r=20\text{cm}$ , as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

#### BT

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE ( $\text{mW}/\text{cm}^2$ )	MPE Limits ( $\text{mW}/\text{cm}^2$ )
	dBm	mW					
GFSK	5.0	3.1623	-0.58	0.8750	100%	0.0006	1.0000
$\pi/4$ DQPSK	5.0	3.1623	-0.58	0.8750	100%	0.0006	1.0000
8-DPSK	5.0	3.1623	-0.58	0.8750	100%	0.0006	1.0000

#### BLE 1M

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE ( $\text{mW}/\text{cm}^2$ )	MPE Limits ( $\text{mW}/\text{cm}^2$ )
	dBm	mW					
GFSK	4.0	2.5119	-0.58	0.8750	100%	0.0004	1.0000

#### 2.4G WIFI

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE ( $\text{mW}/\text{cm}^2$ )	MPE Limits ( $\text{mW}/\text{cm}^2$ )
	dBm	mW					
IEEE 802.11b	12.0	15.8489	1.50	1.4125	100%	0.0045	1.0000
IEEE 802.11g	12.0	15.8489	1.50	1.4125	100%	0.0045	1.0000
IEEE 802.11n HT20	12.0	15.8489	1.50	1.4125	100%	0.0045	1.0000
IEEE 802.11n HT40	12.0	15.8489	1.50	1.4125	100%	0.0045	1.0000

#### U-NII-1

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE ( $\text{mW}/\text{cm}^2$ )	MPE Limits ( $\text{mW}/\text{cm}^2$ )
	dBm	mW					
IEEE 802.11a	7.0	5.0119	7.21	5.2602	100%	0.0052	1.0000



IEEE 802.11 n HT20	7.0	5.0119	7.21	5.2602	100%	0.0052	1.0000
IEEE 802.11 n HT40	7.0	5.0119	7.21	5.2602	100%	0.0052	1.0000
IEEE 802.11 ac20	7.0	5.0119	7.21	5.2602	100%	0.0052	1.0000
IEEE 802.11 ac40	7.0	5.0119	7.21	5.2602	100%	0.0052	1.0000
IEEE 802.11 Ac80	7.0	5.0119	7.21	5.2602	100%	0.0052	1.0000

**U-NII-2A**

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW					
IEEE 802.11a	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000
IEEE 802.11 n HT20	7.0	5.0119	7.21	5.2602	100%	0.0052	1.0000
IEEE 802.11 n HT40	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000
IEEE 802.11 ac20	7.0	5.0119	7.21	5.2602	100%	0.0052	1.0000
IEEE 802.11 ac40	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000
IEEE 802.11 Ac80	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000

**U-NII-2C**

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW					
IEEE 802.11a	9.0	7.9433	7.21	5.2602	100%	0.0083	1.0000
IEEE 802.11 n HT20	9.0	7.9433	7.21	5.2602	100%	0.0083	1.0000
IEEE 802.11 n HT40	9.0	7.9433	7.21	5.2602	100%	0.0083	1.0000
IEEE 802.11 ac20	9.0	7.9433	7.21	5.2602	100%	0.0083	1.0000
IEEE 802.11 ac40	9.0	7.9433	7.21	5.2602	100%	0.0083	1.0000
IEEE 802.11 Ac80	9.0	7.9433	7.21	5.2602	100%	0.0083	1.0000

**U-NII-3**

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW					
IEEE 802.11a	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000
IEEE 802.11 n HT20	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000
IEEE 802.11 n HT40	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000
IEEE 802.11 ac20	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000
IEEE 802.11 ac40	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000
IEEE 802.11 Ac80	8.0	6.3096	7.21	5.2602	100%	0.0066	1.0000

**Remark:**

1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

**8.2 Simultaneous Transmission MPE**

The sample supports 1 module and 2 antennas, need to consider simultaneous transmission;

**Simultaneous transmission MPE**

U-NII-3 MPE (mW/cm <sup>2</sup> )	U-NII-2C MPE (mW/cm <sup>2</sup> )	U-NII-2A MPE (mW/cm <sup>2</sup> )	U-NII-1 MPE (mW/cm <sup>2</sup> )	2.4G WIFI MPE (mW/cm <sup>2</sup> )	BT MPE (mW/cm <sup>2</sup> )	BLE 1M MPE (mW/cm <sup>2</sup> )	Max.sum of the MPE ratios	Limit	Test Results
0.0066	0.0083	0.0066	0.0052	0.0045	0.0006	0.0004	0.0277	1	PASS

**9. Conclusion**

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

.....THE END OF REPORT.....