

## Maximum Permissible Exposure Report

### 1. Product Information

FCC ID:	2AQY4-WFP01
Product name	Smart Lock
Test Model	WFP01
Power supply	DC 6V by 4*AA Battery
Operation frequency	2402MHz ~ 2480MHz 2412MHz ~ 2462 MHz 5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz
Antenna Type	PCB Antenna
Antenna Gain	BLE/2.4G WIFI/5G WIF: 1.2dBi(Max.)
Hardware version	V1.1
Software version	V1.0
Channel Number	40 channels for Bluetooth V5.0 (BT LE) 11 Channels for 20MHz bandwidth (2412~2462MHz) 4 Channels for 20MHz bandwidth(5180-5240MHz) 4 Channels for 20MHz bandwidth(5260-5320MHz) 11 Channels for 20MHz bandwidth(5500-5700MHz) 5 channels for 20MHz bandwidth(5745-5825MHz)
Channel Spacing	5MHz
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	mobile devices

### 2. Evaluation Method

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 1 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

ES-D4 can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
Internal Antenna	2400-2500MHz 5150-5850MHz	1.2 dBi	BT/WiFi Antenna

## 6. Conducted Power

[BLE Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
BT LE	0	2402	7.895
	19	2440	8.449
	39	2480	8.620

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11B	1	2412	16.81
	6	2437	17.54
	11	2462	16.28
11G	1	2412	16.07
	6	2437	16.45
	11	2462	16.11
11N20SISO	1	2412	19.21
	6	2437	19.68
	11	2462	19.56

[5.2GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11A	36	5180	16.14
	40	5200	16.13
	48	5240	15.91
11N20 SISO	36	5180	15.78
	40	5200	14.52
	48	5240	15.42
11AC20 SISO	36	5180	15.48
	40	5200	15.27
	48	5240	15.48

## [5.3GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11A	52	5260	15.35
	56	5280	18.91
	64	5320	18.94
11N20 SISO	52	5260	15.25
	56	5280	15.09
	64	5320	14.08
11AC20 SISO	52	5260	14.47
	56	5280	13.30
	64	5320	15.51

## [5.5GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11A	100	5500	14.97
	120	5600	13.9
	140	5700	11.99
11N20 SISO	100	5500	14.88
	120	5600	13.95
	140	5700	11.78
11AC20 SISO	100	5500	12.86
	120	5600	12.32
	140	5700	10.05

## [5.8WIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11A	149	5745	14.29
	157	5785	14.49
	165	5825	14.29
11N20 SISO	149	5745	14.08
	157	5785	14.07
	165	5825	14.33
11AC20 SISO	149	5745	15.48
	157	5785	15.27
	165	5825	15.48

## 7. Measurement Results

### BLE

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	7.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

### 2.4GWIFI

11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	16.0	17.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20SISO (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	19.0	19.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

### 5.2GWIFI

11A (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	15.0	15.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC20 SISO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	15.0	15.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

## 5.3GWIFI

11A (Peak)			
Channel	Channel 52	Channel 56	Channel 64
Target (dBm)	15.0	18.0	18.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 52	Channel 56	Channel 64
Target (dBm)	15.0	15.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC20 SISO (Peak)			
Channel	Channel 52	Channel 56	Channel 64
Target (dBm)	14.0	14.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

## 5.5GWIFI

11A (Peak)			
Channel	Channel 100	Channel 120	Channel 140
Target (dBm)	15.0	14.0	12.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 100	Channel 120	Channel 140
Target (dBm)	14.0	14.0	12.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC20 SISO (Peak)			
Channel	Channel 100	Channel 120	Channel 140
Target (dBm)	12.0	12.0	10.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

## 5.8GWIFI

11A (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	14.0	14.0	14.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	14.0	14.0	14.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC20 SISO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	15.0	15.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

## 8. Evaluation Results

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.

### BLE

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
		dBm	mW				
BT LE	2.480	9.0	7.94	1.2	1.318	0.0021	1.0000

### 2.4GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
		dBm	mW				
IEEE 802.11b	2.437	18.0	63.10	1.2	1.318	0.0165	1.0000
IEEE 802.11g	2.437	17.0	50.12	1.2	1.318	0.0131	1.0000
IEEE 802.11n20	2.437	20.0	100.00	1.2	1.318	0.0262	1.0000

### 5.2GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
		dBm	mW				
11A	5.180	17.0	50.12	1.2	1.318	0.0131	1.0000
11N20 SISO	5.180	16.0	39.81	1.2	1.318	0.0104	1.0000
11AC20 SISO	5.180	16.0	39.81	1.2	1.318	0.0104	1.0000

### 5.3GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
		dBm	mW				
11A	5.320	19.0	79.43	1.2	1.318	0.0208	1.0000
11N20 SISO	5.260	16.0	39.81	1.2	1.318	0.0104	1.0000
11AC20 SISO	5.320	16.0	39.81	1.2	1.318	0.0104	1.0000

### 5.5GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
		dBm	mW				
11A	5.500	16.0	39.81	1.2	1.318	0.0104	1.0000
11N20 SISO	5.500	15.0	31.62	1.2	1.318	0.0083	1.0000
11AC20 SISO	5.500	13.0	19.95	1.2	1.318	0.0052	1.0000

### 5.8GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
		dBm	mW				
11A	5.785	15.0	31.62	1.2	1.318	0.0083	1.0000
11N20 SISO	5.825	15.0	31.62	1.2	1.318	0.0083	1.0000
11AC20 SISO	5.745	16.0	39.81	1.2	1.318	0.0104	1.0000

#### Remark:

1. Output power including turn-up tolerance;
2. Output power is burst average power;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer;
4. MPE values =  $PG/4\pi R^2$

## 9. Conclusion

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

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