

# RF Exposure evaluation

FCC ID	2BRFA-D1-WIFI
Product Name	Smart lock
Model/Type reference	D1-WIFI
Listed Model(s)	N/A
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Device

## 1. Reference

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: Radio frequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radio frequency radiation exposure evaluation: mobile devices

## 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

### 3. 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

### 4. Antenna Information

External Antenna can only use antennas certificated as follows provided by manufacturer;

Antenna No.	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
2.4GWIFI	PCB Antenna	2.45dBi	2400-2500MHz

### 5. Conducted Peak Output Power

Mode	Channel	Peak Output Power (dBm)	Peak Output Power (mW)
IEEE 802.11b	1	7.91	6.18
	6	7.62	5.78
	11	8.37	6.87
IEEE 802.11g	1	8.44	6.98
	6	7.66	5.83
	11	8.33	6.81
IEEE 802.11n_20	1	7.64	5.81
	6	7.43	5.53
	11	8.11	6.47

### 6. Manufacturing Tolerance

IEEE 802.11b			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	7	7	8
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11g			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	8	7	8
Tolerance ±(dB)	1.0	1.0	1.0

IEEE 802.11n_20			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	7	7	8
Tolerance $\pm$ (dB)	1.0	1.0	1.0

## 7. Standalone MPE Result

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 is 2.54dBi, the RF power density can be obtained.

Mode	Output power		Antenna Gain (dBi)	Antenna Gain(linear)	MPE (mW/cm <sup>2</sup> )	MPE Limits (mW/cm <sup>2</sup> )
	dBm	mW				
2.4GWIFI	9	7.94	2.45	1.76	0.00278	1.0000

Remark:

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

## 8. Conclusion

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

-----End of the report-----