

## RF EXPOSURE EVALUATION

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in §1.1307(b)

FCC ID: 2APSE-SIREN

### EUT Specification

<b>EUT</b>	<b>Keypad Siren</b>
<b>Frequency band (Operating)</b>	<input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5825GHz <input checked="" type="checkbox"/> Others: 2.402GHz~2.480GHz (BLE) <input checked="" type="checkbox"/> Others: 13.56MHz (NFC)
<b>Device category</b>	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others ____
<b>Exposure classification</b>	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm <sup>2</sup> ) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm <sup>2</sup> )
<b>Antenna diversity</b>	<input type="checkbox"/> Single antenna <input checked="" type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity
<b>Max. output power</b>	Wifi 2.4G: 15.30 dBm (0.0339W) BLE: -1.867 dBm (0.00065W) NFC: -9.52 dBm (0.0001W)
<b>Antenna gain (Max)</b>	Wifi 2.4G/BLE: 3.4 dBi NFC: 0 dBi
<b>Evaluation applied</b>	<input checked="" type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation

Limits for Maximum Permissible Exposure(MPE)

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density(mW/cm <sup>2</sup> )	Average Time
<b>(A) Limits for Occupational/Control Exposures</b>				
300-1500	--	--	<b>F/300</b>	<b>6</b>
1500-100000	--	--	<b>5</b>	<b>6</b>
<b>(B) Limits for General Population/Uncontrol Exposures</b>				
300-1500	--	--	<b>F/1500</b>	<b>6</b>
1500-100000	--	--	<b>1</b>	<b>30</b>

## Friis transmission formula: $P_d = \frac{P_{out} * G}{4 * \pi * R^2}$

Where

$P_d$  = Power density in  $mW/cm^2$

$P_{out}$  = output power to antenna in Mw

$G$  = gain of antenna in linear scale

$\pi = 3.1416$

$R$  = distance between observation point and center of the radiator in cm

$P_d$  the limit of MPE,  $1mW/cm^2$ . If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

## Measurement Result

Operating Mode	Channel Frequency (MHz)	Measured Power (dBm)	Tune up tolerance (dBm)	Max. Tune up Power (dBm)	Antenna Gain (dBi)	Power density at 20cm ( $mW/cm^2$ )	Power density Limits ( $mW/cm^2$ )
802.11b	2412	14.77	14.77±1	15.77	3.4	0.0164	1
	2437	15.30	15.30±1	16.30	3.4	0.0186	1
	2462	14.85	14.85±1	15.85	3.4	0.0167	1
802.11g	2412	13.35	13.35±1	14.35	3.4	0.0119	1
	2437	13.12	13.12±1	14.12	3.4	0.0112	1
	2462	13.21	13.21±1	14.21	3.4	0.0115	1
802.11n (HT20)	2412	12.78	12.78±1	13.78	3.4	0.0104	1
	2437	12.03	12.03±1	13.03	3.4	0.0087	1
	2462	12.25	12.25±1	13.25	3.4	0.0092	1
802.11n (HT40)	2422	12.21	12.21±1	13.21	3.4	0.0091	1
	2437	12.71	12.71±1	13.71	3.4	0.0102	1
	2452	12.94	12.94±1	13.94	3.4	0.0108	1
BLE	2402	-2.415	-2.415±1	-1.415	3.4	0.0003	1
	2440	-2.975	-2.975±1	-1.975	3.4	0.0003	1
	2480	-1.867	-1.867±1	-0.867	3.4	0.0004	1
NFC	13.56	-9.52	-9.52±1	-8.52	0	0.00003	1

$$E = \text{EIRP} - 20 \log D + 104.8$$

where:

E = electric field strength in dB $\mu$ V/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

**NFC:**

$$\text{EIRP} = E - 104.8 + 20 \log D = 85.73 - 104.8 + 20 \log 3 = -9.52 \text{ dBm}$$

Conclusion: The SAR measurement is not necessary.