

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

EUT	Keypad Siren
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz ☐ WLAN: 5.745GHz ~ 5825GHz ☒ Others: 2.402GHz~2.480GHz (BLE) ☒ Others: 13.56MHz (NFC)
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others ____
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm ²) ☒ General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna diversity	☐ Single antenna ☒ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☐ Tx/Rx diversity
Max. output power	Wifi 2.4G: 15.30 dBm (0.0339W) BLE: -1.867 dBm (0.00065W) NFC: -9.52 dBm (0.0001W)
Antenna gain (Max)	Wifi 2.4G/BLE: 3.4 dBi NFC: 0 dBi
Evaluation applied	☒ MPE Evaluation ☐ 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 ²)	Average Time
(A) Limits for Occupational/Control Exposures				
300-1500	--	--	F/300	6
1500-100000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300-1500	--	--	F/1500	6
1500-100000	--	--	1	30

Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

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 μ 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.