

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: 2AQA6-H5040

EUT Specification

EUT	WIFI Gateway
Frequency band (Operating)	<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: 433.92MHz
Device category	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others ____
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm ²) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna diversity	<input checked="" type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity
Max. output power	WIFI: 16.29 dBm (0.0426W); 433.92: -15.5dBm(0.000028W)
Antenna gain (Max)	WIFI: 2 dBi; 433.92MHz: 0 dBi
Evaluation applied	<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 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: $P_d = \frac{P_{out} * G}{4 * \pi * R^2}$

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

2.4G WiFi

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	15.13	15.13±1	16.13	2	0.0129	1
	2437	15.14	15.14±1	16.14	2	0.0130	1
	2462	14.82	14.82±1	15.82	2	0.0120	1
802.11g	2412	14.41	14.41±1	15.41	2	0.0110	1
	2437	16.24	16.24±1	17.24	2	0.0167	1
	2462	15.86	15.86±1	16.86	2	0.0153	1
802.11n (HT20)	2412	14.23	14.23±1	15.23	2	0.0105	1
	2437	16.29	16.29±1	17.29	2	0.0169	1
	2462	15.70	15.70±1	16.70	2	0.0147	1

433.92MHz:

Channel Frequency (MHz)	Antenna Gain (dBi)	Max Output power (dBuV/m)	Max Output power (dBm)	Power Included Tune-up(dBm)	Power density at 20cm(mW/cm ²)	Power density Limits (mW/cm ²)
433.92	0	79.75	-15.5	-14.5	0.71e-5	1

MPE Calculation Method

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

R = Separation distance between radiator and human body (m)=0.2m

The formula can be changed to

$$Pd = Pout * G / (4 * \pi * R^2)$$

$$EIRP = E - 104.8 + 20 \log D = 79.75 - 104.8 + 20 \log 3 = -15.5 \text{ dBm}$$

WiFi+433.92MHz (worst case) :

$$0.0169 + 0.71e-5 = 0.01691 < 1$$

The SAR measurement is not necessary.