

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: 2AYHW-TN7231N1

EUT Specification

EUT	TN7231N1 3 Key control box
Frequency band (Operating)	<input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.24GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5.825GHz <input checked="" type="checkbox"/> Others: 2.402GHz~2.480GHz
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	BLE: 0.17 dBm (0.0010W) WiFi 2.4G: 15.47 dBm (0.0352W)
Antenna gain (Max)	1.9 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: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

P_d = Power density in mW/cm²

P_{out} = output power to antenna in Mw

G = gain of antenna in linear scale

π = 3.1416

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

P_d the limit of MPE, 1mW/cm². 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.

Max Measurement Result

Operating Mode	Channel Frequency	Measured Power	Tune up tolerance	Max. Tune up Power	Antenna Gain	Power density at 20cm	Power density Limits (mW/cm ²)
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/cm ²)	
802.11b	2412	14.09	14.09 ±1	15.09	1.9	0.0100	1
	2437	12.65	12.65 ±1	13.65	1.9	0.0071	1
	2462	12.57	12.57 ±1	13.57	1.9	0.0070	1
802.11g	2412	13.87	13.87 ±1	14.87	1.9	0.0095	1
	2437	14.66	14.66 ±1	15.66	1.9	0.0113	1
	2462	14.76	14.76 ±1	15.76	1.9	0.0116	1
802.11n (HT20)	2412	13.99	13.99 ±1	14.99	1.9	0.0097	1
	2437	14.76	14.76 ±1	15.76	1.9	0.0116	1
	2462	15.47	15.47 ±1	16.47	1.9	0.0137	1
802.11n (HT40)	2422	13.38	13.38 ±1	14.38	1.9	0.0084	1
	2437	12.90	12.90 ±1	13.90	1.9	0.0076	1
	2452	12.95	12.95 ±1	13.95	1.9	0.0077	1
BLE	2402	-0.27	-0.27 ±1	0.73	1.9	0.0004	1
	2440	-1.40	-1.40 ±1	-0.40	1.9	0.0003	1
	2480	0.17	0.17 ±1	1.17	1.9	0.0004	1

The WLAN 2.4G and BLE can transmit simultaneously:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$$= S_{WIFI2.4} / S_{limit-2.4} + S_{BLE} / S_{limit-2.4}$$

$$= 0.0137 / 1 + 0.0004 / 1$$

$$= 0.0141$$

$$< 1.0$$