

RF EXPOSURE EVALUATION

EUT Specification

EUT	WIFI+BT Module
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☒ WLAN: 5.150GHz ~ 5.250GHz ☒ WLAN: 5.725GHz ~ 5850GHz ☒ Others(Bluetooth: 2.402GHz ~ 2.480GHz)
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others ____
Antenna diversity	☒ Single antenna ☐ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☐ Tx/Rx diversity
Max. output power	6.53dBm(4.50mW) for Bluetooth -BDR+EDR -0.82dBm(0.83mW) for Bluetooth -BLE 21.87dBm(153.82mW) for 2.4G WLAN 19.80dBm (95.50mW) for 5G WLAN Band 5150-5250 19.40dBm (87.10mW) for 5G WLAN Band 5725-5850
Antenna gain	0.38dBi for 2.4G 2.95dBi for 5G
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/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.

Measurement Result

Channel	Channel Frequency (MHz)	Max Output power (dBm)	Tolerance	Max Tune-UP power (mW)	Power density at 20cm (mW/cm ²)	Power density Limits (mW/cm ²)
Test Mode: 802.11b						
Low	2412	17.05	±0.5	56.89	0.012353	1
Middle	2437	16.91	±0.5	55.08	0.011960	1
High	2462	16.38	±0.5	48.75	0.010585	1
Test Mode: 802.11g						
Low	2412	20.55	±0.5	127.35	0.027652	1
Middle	2437	20.61	±0.5	129.12	0.028036	1
High	2462	20.06	±0.5	113.76	0.024701	1
Test Mode: 802.11n(HT20)						
Low	2412	21.87	±0.5	172.58	0.037473	1
Middle	2437	21.46	±0.5	157.04	0.034099	1
High	2462	20.99	±0.5	140.93	0.030601	1
Test Mode: 802.11n(HT40)						
Low	2422	20.50	±0.5	125.89	0.027335	1
Middle	2437	20.33	±0.5	121.06	0.026286	1
High	2452	20.03	±0.5	112.98	0.024532	1

Channel	Channel Frequency (MHz)	Max Output power (dBm)	Tolerance	Max Tune-UP power (mW)	Power density at 20cm (mW/cm ²)	Power density Limits (mW/cm ²)
Test Mode: BLE						
Low	2402	-0.82	± 0.5	0.93	0.000202	1
Middle	2440	-0.83	± 0.5	0.93	0.000202	1
High	2480	-1.17	± 0.5	0.86	0.000187	1
Test Mode: GFSK						
Low	2402	5.36	± 0.5	3.85	0.000836	1
Middle	2441	5.57	± 0.5	4.05	0.000879	1
High	2480	5.05	± 0.5	3.59	0.000780	1
Test Mode: $\pi/4$-DQPSK						
Low	2402	6.29	± 0.5	4.78	0.001038	1
Middle	2441	6.53	± 0.5	5.05	0.001097	1
High	2480	6.12	± 0.5	4.59	0.000997	1
Test Mode: 8DPSK						
Low	2402	5.55	± 0.5	4.03	0.000875	1
Middle	2441	5.78	± 0.5	4.25	0.000923	1
High	2480	5.30	± 0.5	3.80	0.000825	1

Note: For the device consider simultaneous transmission of 2.4G WIFI and BT, the worst MPE evaluation = $0.037473 + 0.001097 = 0.03857 < 1.0$

Channel	Channel Frequency (MHz)	Max Output power (dBm)	Tolerance	Max Tune-UP power (mW)	Power density at 20cm (mW/cm ²)	Power density Limits (mW/cm ²)
Test Mode: 802.11a						
Low	5180	17.56	±0.5	63.97	0.025102	1
Middle	5200	17.39	±0.5	61.52	0.024140	1
High	5240	19.80	±0.5	107.15	0.042046	1
Test Mode: 802.11n(HT20)						
Low	5180	15.25	±0.5	37.58	0.014746	1
Middle	5200	15.16	±0.5	36.81	0.014444	1
High	5240	17.47	±0.5	62.66	0.024588	1
Test Mode: 802.11n(HT40)						
Low	5190	15.23	±0.5	37.41	0.014680	1
Middle	5230	17.34	±0.5	60.81	0.023862	1
Test Mode: 802.11ac(VHT20)						
Low	5180	15.41	±0.5	38.99	0.015300	1
Middle	5200	15.46	±0.5	39.45	0.015480	1
High	5240	17.31	±0.5	60.40	0.023701	1
Test Mode: 802.11ac(VHT40)						
Low	5190	15.19	±0.5	37.07	0.014546	1
High	5230	17.23	±0.5	59.29	0.023265	1
Test Mode: 802.11ac(VHT80)						
Nominal	5210	18.19	±0.5	73.96	0.029022	1

Channel	Channel Frequency (MHz)	Max Output power (dBm)	Tolerance	Max Tune-UP power (mW)	Power density at 20cm (mW/cm ²)	Power density Limits (mW/cm ²)
Test Mode: 802.11a						
Low	5745	17.56	±0.5	63.97	0.025102	1
Middle	5785	16.45	±0.5	49.55	0.019443	1
High	5825	16.89	±0.5	54.83	0.021515	1
Test Mode: 802.11n(HT20)						
Low	5745	19.40	±0.5	97.72	0.038345	1
Middle	5785	18.45	±0.5	78.52	0.030811	1
High	5825	18.91	±0.5	87.30	0.034257	1
Test Mode: 802.11n(HT40)						
Low	5755	17.51	±0.5	63.24	0.024815	1
Middle	5795	16.81	±0.5	53.83	0.021123	1
Test Mode: 802.11ac(VHT20)						
Low	5745	17.48	±0.5	62.81	0.024647	1
Middle	5785	16.30	±0.5	47.86	0.01878	1
High	5825	16.90	±0.5	54.95	0.021562	1
Test Mode: 802.11ac(VHT40)						
Low	5755	17.45	±0.5	62.37	0.024474	1
High	5795	16.48	±0.5	49.89	0.019577	1
Test Mode: 802.11ac(VHT80)						
Nominal	5775	18.22	±0.5	74.47	0.029222	1