RADIO FREQUENCY EXPOSURE

1. Limit

According to §1.1310 and §2.1091 RF exposure is calculated.

Table: Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Power Density (S) (mW/cm2)
0.3–1.34	*(100)
1.34–30	*($180/f^2$)
30–300	0.2
300–1500	f/1500
1500–100,000	1.0

F = frequency in MHz
* = Plane-wave equivalent power density

Maximum Permissible Exposure

The MPE was calculated at 20cm to show compliance with the power density limit.

$S = PG/4\pi R^2$

S = Power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna.

Note:

1. Manufacturer declared that the maximum antenna gain is 0.0dBi (Max.) for Bluetooth, ZigBee and 2.4G WLAN (So the G for calculate the MPE is 1.00).

2. Manufacturer declared that the nearest distance between human and the EUT is 20cm.

3. Only record worst case data.

2 Test Results

Standalone MPE

Test		Channel	ANT Power (dBm)	ANT Max. Tune Up Power (dBm)	ANT Max. Tune Up Power (mW)	ANT MPE (mW/cm^2)	Limit (mW/cm^2)
Bluetooth	GFSK	1	-2.204	-1.0±1.0	1.0000	0.0002	1.0
		40	-1.871	-1.0±1.0	1.0000	0.0002	1.0
		79	-2.065	-1.0±1.0	1.0000	0.0002	1.0
	π/4DQPSK	1	-2.318	-1.0±1.0	1.0000	0.0002	1.0
		40	-1.878	-1.0±1.0	1.0000	0.0002	1.0
		79	-2.032	-1.0±1.0	1.0000	0.0002	1.0
	8DPSK	1	-2.339	-1.0±1.0	1.0000	0.0002	1.0
		40	-1.929	-1.0±1.0	1.0000	0.0002	1.0
		79	-2.068	-1.0±1.0	1.0000	0.0002	1.0
ZigBee	O-QPSK	0	8.020	9.0±1.0	10.0000	0.0020	1.0
		7	8.637	9.0±1.0	10.0000	0.0020	1.0
		15	9.797	9.0±1.0	10.0000	0.0020	1.0
2.4GWLAN	802.11b	1	18.320	18.0±1.0	79.4328	0.0158	1.0
		6	18.260	18.0±1.0	79.4328	0.0158	1.0
		11	18.150	18.0±1.0	79.4328	0.0158	1.0
	802.11g	1	17.380	17.0±1.0	63.0957	0.0126	1.0
		6	17.550	17.0±1.0	63.0957	0.0126	1.0
		11	17.450	17.0±1.0	63.0957	0.0126	1.0
	802.11n20	1	16.780	16.0±1.0	50.1187	0.0100	1.0
		6	16.880	16.0±1.0	50.1187	0.0100	1.0
		11	16.590	16.0±1.0	50.1187	0.0100	1.0
	802.11n40	3	15.390	15.0±1.0	39.8107	0.0079	1.0
		6	15.150	15.0±1.0	39.8107	0.0079	1.0
		9	15.260	15.0±1.0	39.8107	0.0079	1.0

Simultaneous transmission MPE

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
∑∑of MPE ratios ≤ 1.0

Mode	Channel	∑ MPE ratios	Limit	Results
Bluetooth+ZigBee+2.4GWLAN				
IEEE 802.11b + Bluetooth + ZigBee	Low	0.0180	1.000	Pass
	Middle	0.0180	1.000	Pass
	High	0.0180	1.000	Pass
IEEE 802.11g + Bluetooth + ZigBee	Low	0.0148	1.000	Pass
	Middle	0.0148	1.000	Pass
	High	0.0148	1.000	Pass
IEEE 802.11n HT20 + Bluetooth + ZigBee	Low	0.0122	1.000	Pass
	Middle	0.0122	1.000	Pass
	High	0.0122	1.000	Pass
IEEE 802.11n HT40+ Bluetooth + ZigBee	Low	0.0101	1.000	Pass
	Middle	0.0101	1.000	Pass
	High	0.0101	1.000	Pass

Note: The estimation distance is 20cm.

Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.