RF Exposure Evaluation
Limits
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)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz

Friis transmission formula: **Pd = (Pout*G)/(4*pi*r^2)**

Where

Pd = power density in mW/cm^2, **Pout** = 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

Pd id the limit of MPE, 1 mW/cm^2. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

Test Procedure
Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

Test Result of RF Exposure Evaluation

For BLE: Antenna gain=2.68dBi

Mode	Output power (dBm)	Output power (mW)	Numeric antenna gain	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
BLE	2.27	1.69	1.85	0.00062	1.0	PASS

For 2.4G WIFI mode: Antenna gain=2.68dBi

Mode	Output power (dBm)	Output power (mW)	Numeric antenna gain	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
802.11b	10.12	10.28	1.85	0.00378	1.0	PASS
802.11g	10.71	11.78	1.85	0.00434	1.0	PASS
802.11n(HT20)	10.58	11.43	1.85	0.00421	1.0	PASS
802.11n(HT40)	7.88	6.14	1.85	0.00226	1.0	PASS

For 5.2G WIFI mode: Antenna gain=4.22dBi

Mode	Output power (dBm)	Output power (mW)	Numeric antenna gain	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
802.11a	10.91	12.33	2.64	0.00648	1.0	PASS
802.11n(HT20)	10.90	12.30	2.64	0.00646	1.0	PASS
802.11n(HT40)	8.07	6.41	2.64	0.00337	1.0	PASS
802.11ac(HT20)	10.81	12.05	2.64	0.00633	1.0	PASS
802.11ac(HT40)	8.18	6.58	2.64	0.00346	1.0	PASS
802.11ac(HT80)	4.03	2.53	2.64	0.00133	1.0	PASS

For 5.8G WIFI mode: Antenna gain=4.22dBi

Mode	Output power (dBm)	Output power (mW)	Numeric antenna gain	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
802.11a	10.71	11.78	2.64	0.00619	1.0	PASS
802.11n(HT20)	10.69	11.72	2.64	0.00616	1.0	PASS
802.11n(HT40)	8.43	6.97	2.64	0.00366	1.0	PASS
802.11ac(HT20)	10.55	11.35	2.64	0.00596	1.0	PASS
802.11ac(HT40)	8.55	7.16	2.64	0.00376	1.0	PASS
802.11ac(HT80)	4.24	2.65	2.64	0.00139	1.0	PASS

If BLE and 2.4G WIFI operate simultaneously, Total power density=0.00062/1+0.00434/1=0.00496<1.0

If BLE and 5.2G WIFI operate simultaneously, Total power density=0.00062/1+0.00648/1=0.00710<1.0

If BLE and 5.8G WIFI operate simultaneously, Total power density=0.00062/1+0.00619/1=0.00681<1.0

Shenzhen ZKT Technology Co., Ltd.
1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen,China

+86-400-000-9970   +86-755-2233 6688   zkt@zkt-lab.com   www.zkt-lab.com