RF Exposure Evaluation

FCC 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

WCDMA Band II

Channel	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
Lowest (1852.4MHz)	156.3148	0.03918	1.0	PASS
Middle (1880.0MHz)	157.3983	0.03945	1.0	PASS
Highest (1907.6MHz)	157.7611	0.03955	1.0	PASS

Remark: antenna gain=1.0 dBi, Tune-up tolerance: 21±1

WCDMA Band V

Channel	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
Lowest (826.4MHz)	187.0682	0.04689	0.551	PASS
Middle (836.6MHz)	190.1078	0.04765	0.558	PASS
Highest (846.6MHz)	198.6095	0.04979	0.564	PASS

Remark: antenna gain=1.0 dBi, Tune-up tolerance: 22±1

LTE mode

Band	Frequency (MHz)	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
LTE Band 2	1852.5	21.99	158.1248	0.03964	1.0	PASS
LTE Band 4	1732.5	21.98	157.7611	0.03955	1.0	PASS
LTE Band 5	825.5	22.00	158.4893	0.03973	0.550	PASS
LTE Band 12	714.5	21.99	158.1248	0.03964	0.476	PASS
LTE Band 13	779.5	21.98	157.7611	0.03955	0.520	PASS

Remark: antenna gain=1.0 dBi

Tune-up tolerance: 22±1

For BLE

According to 447498 D01 General RF Exposure Guidance
The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances > 50 mm are determined by:

{[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz

eirp = pt x gt = $(EXd)^2/30$

where:

pt = transmitter output power in watts,

gt = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m, --- $10^{((dBuV/m)/20)}/10^6$

d = measurement distance in meters (m) ---3m

So pt = $(EXd)^2/30$ x gt

Field strength =89.63 dBuV/m @3m

Ant gain =1.0dBi, so Ant numeric gain= 1.26
So pt={ $[10^{89.63/20)}/10^6$ x 3]^2/30x1.26}x1000 mW =0.219mW<96mW (illustrated in Appendix B)