



## 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 <sup>2</sup> )	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 <sup>2</sup> )	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 <sup>2</sup> )	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:  $P_d = (P_{out} * G) / (4 * \pi * r^2)$

Where

$P_d$  = power density in mW/cm<sup>2</sup>,  $P_{out}$  = 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

$P_d$  is the limit of MPE, 1 mW/cm<sup>2</sup>. 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

### BR+EDR

Mode	Output power to antenna (dBm)	Tune-up Power(dBm)	Max Tune-up Power(dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Result
8DPSK	2.31	2(±1)	3	1.995	0.0004	1.0	PASS

### 2.4G Wi-Fi

Mode	Output power to antenna (dBm)	Tune-up Power(dBm)	Max Tune-up Power(dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Result
802.11b	12.25	12(±1)	13	19.953	0.0045	1.0	PASS

### ZigBee

Mode	Output power to antenna (dBm)	Tune-up Power(dBm)	Max Tune-up Power(dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Result
GFSK	-0.21	0(±1)	1	1.259	0.0004	1.0	PASS

Notes: 94.99dBuV/m-95.2=-0.21dBm

Remark: ZigBee antenna gain= 1.9dBi; BR+EDR/2.4G Wi-Fi antenna gain= 0.54dBi.

The device can transmit with ZigBee, 2.4G WI-FI and Bluetooth BR+EDR simultaneously.

Calculations for simultaneously transmit:

Mode	Ratios	Result	Limit	Result
ZigBee	0.0004	0.0053	1	PASS
BR+EDR	0.0004			
2.4G Wi-Fi	0.0045			

Ratios = Power Density / Power density Limit

So a SAR test is not required