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/cm2)	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/f2)	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/f2)	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*r2)

Where

Pd = power density in mW/cm2, 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/cm2. 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.

BR/EDR

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
8DPSK	10.59	11.455	0.0033	1.0	PASS

BLE

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
GFSK	8.39	6.902	0.0020	1.0	PASS

2.4G Wi-Fi

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
802.11n(HT20)	7.21	5.260	0.0015	1.0	PASS

5.2G Wi-Fi ANT 1

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
802.11a	6.25	4.217	0.0012	1.0	PASS
802.11 n40	6.08	4.055	0.0012	1.0	PASS

5.2G Wi-Fi ANT 2

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
802.11a	5.5	3.548	0.0010	1.0	PASS
802.11 n40	4.81	3.027	0.0009	1.0	PASS

5.8G Wi-Fi ANT 1

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
802.11a	4.93	3.112	0.0009	1.0	PASS
802.11 n20	4.62	2.897	0.0008	1.0	PASS

5.8G Wi-Fi ANT 2

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
802.11n	6.11	4.083	0.0012	1.0	PASS
802.11 n40	5.41	3.475	0.0010	1.0	PASS

Remark: BT antenna gain=1.6dBi, 2.4G antenna gain=1.6dBi, 5G antenna gain=1.6dBi

Results for 5GWiFi MIMO transmit simultaneously

No.	Configurations	Maximum MPE Value mW/cm^2		Transmit simultaneously	Limits
		5.2GHz Wi-Fi ANT1	5.2GHz Wi-Fi ANT2		
1	5.2GHz Wi-Fi ANT1+ 5.2GHz Wi-Fi ANT2	0.0012	0.0009	0.0021	1
2	5.8GHz Wi-Fi ANT1+ 5.8GHz Wi-Fi ANT2	0.0008	0.0010	0.0018	1
At the transmit simultaneously calculation method is as follows: Transmit simultaneously MPE = Σ of MPE ratios^2 MPE ratios = Field strengths or power density / MPE limit at the test frequency					

Results for transmit simultaneously

No.	Configurations	Maximum MPE Value mW/cm^2		Transmit simultaneously	Limits
1	BT+2.4GWiFi	0.0033	0.0015	0.0048	1
2	BT+5.2GWiFi	0.0033	0.0012	0.0045	1
3	BT+5.8GWiFi	0.0033	0.0012	0.0045	1

At the transmit simultaneously calculation method is as follows:

Transmit simultaneously MPE = Σ of MPE ratios^2

MPE ratios = Field strengths or power density / MPE limit at the test frequency

So a SAR test is not required