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

BLE mode

Frequency Range (MHz)	Output power (dBm)	Output power (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
2402~2480	1.30	1.35	0.00012	1.0	PASS

Remark: antenna gain=-3.57dBi

NFC mode

Frequency Range (MHz)	Output power (dBm)	Output power (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
13.56	-32.52	0.00056	0.0000001	0.98	PASS

Remark: antenna gain=0dBi

According to ANSI C63.10

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

Field strength =62.70dBuV/m @3m

Ant gain =0dBi, so gt =1

So pt = $(E \times d)^2/30 \times gt = \{ [10^{62.70/20)}/10^6 \times 3]^2/30x1\}x1000$ mW =0.00056mW

Simultaneous Transmission:

$$\sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k}$$

BLE+NFC=(0.00012/1)+(0.0000001/0.98)=0.00012010204<1

Remark:

The max power density is less than SAR exempt limit, so SAR evaluation is not required.