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**RF Exposure** 

### Reference test Report No: ULR-TC56882230000062F/63F/64F

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# 1 Maximum Permissible Exposure

## 1.1 RF Exposure Compliance Requirement

The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The gain of the antennas used in the product is extracted from the Antenna data sheets provided and also the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis Transmission formula is far field assumption, the calculated result of that is an over-prediction for near field power density. It is taken as worst case to specify the safety range.

### **1.2 RF Exposure Limits:**

#### 1.2.1 For FCC

 According to FCC Part 1 Subpart I 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of the human exposure to radio-frequency (RF) radiation as specified in 1.1307 (b) showed in Table 1.

Frequency Range	Electric Field	Magnetic Field	Power Density (mW/cm <sup>2</sup> )			
(MHz)	Strength (V/m)	Strength (A/m)				
Limits for Occupational / controlled Exposures						
300 - 1500			F/300			
1500 – 100000			5.0			
Lim	ts for General populati	on / Uncontrolled Expo	sure			
300 - 1500			F/1500			
1500 - 100000	00 - 100000		1.0			

F or f = Frequency in MHz

#### Friss Formula

Friss Transmission Formula: Pd = (Pout \* G) / (4\*pi\*r<sup>2</sup>)

Where

Pd = power density in mW/cm<sup>2</sup>

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = Distance between observation point and the center of radiator in cm

If we know the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value at distance 20cm.

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#### **Test Results:**

Manufacturer has declared the tune-up value as  $\pm 1$  dB is considered in MPE calculation.

Antenna: Molex 2042811100 balanced, dipole-type antenna

Antenna Gain: 2.0dBi for 2.4GHz & 3.3dBi for 5GHz

Protocol	Frequen cy (MHz)	Maximum measured RF output power at antenna terminal (dBm)	Tune-up tolerance (dB)	Max power Including tune-up tolerance * (mW)	Min Separation distance (CM)	Power Density (Pd) (mW/cm²)	FCC Limit (mW/cm2)
802.11b/g/n/ax	2462	16.64	±1	58.0764	20	0.0183	1
Bluetooth Low Energy	2440	-11.84	±1	0.0877	20	0.00003	1
Bluetooth	2402	-11.57	±1	0.0827	20	0.00003	1
802.11a/n/ac/ax	5755	17.56	±1	71.7794	20	0.03051	1

Note: Maximum conducted output power taken from test Reports: ULR-TC56882230000062F/63F/64F

#### Test Results for Maximum Permissible Exposure for Simultaneous operating mode of Wi-Fi and BLE

RF Protocol	Calculated MPE (mW)	Final MPE((mW/cm <sup>2</sup> )	Limit (mW/cm²)
Wi-Fi 2.4 GHz + BLE	(0.0183)+(0.00003)	0.01833	<1
Wi-Fi 2.4 GHz + BT	(0.0183)+(0.00003)	0.01833	<1

### 1.3 Conclusion

The Power density of the EUT is less than defined limit as shown above, hence EUT is exempted from routine SAR.