1 Radio Frequency Human Exposure Evaluation:

1.1 RF Exposure Measurement

The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310. 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 Limit

According to FCC 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.

Table 1: Limits for Maximum Permissible Exposure (MPE) as per FCC			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)
Limits for Occupational / controlled Exposures			
300 - 1500	--	--	F/300
1500 – 100000	--	--	5.0
Limits for General population / Uncontrolled Exposure			
300 - 1500	--	--	F/1500
1500 – 100000	--	--	1.0

F or f = Frequency in MHz

1.3 Assessment Conditions

Protocol	Frequency band (MHz)	Maximum conducted output power in (dBm)*	Tune-up tolerance	Output power including tune-up tolerance (mW)	Antenna gain in Linear Scale	Power density (mw/cm2)	Limit(mw/cm2)
Sub GHz	908.5	16.26	±1	53.210	1.3212	0.01399	0.6056

*Note: Manufacturer declared TuneUp tollarance of ±1dB is considered in the calculation
Antenna gain : Staight 1.21 dBi

Friis Formula

Friis Formula is used for assessment of power density.

Friis Transmission Formula: $Pd = (Pout * G) / (4*pi*r^2)$

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 = Minimum 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 (MPE evaluation performed with minimum separation distance from the User is 20cm).