Maximum Permissible Exposure (MPE) Estimation

1. Limits and Guidelines on Exposure to Electromagnetic Fields

General population/uncontrolled exposure apply in situations is which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure. The exposure levels can be expressed in terms of power density, electric field strength, or magnetic field strength, as averaged over 30 minutes for the general public and 6 minutes for trained personnel. The exposure criterion is frequency dependent, and a chart covering the range from 3 kHz to 100 GHz can be found in NCRP No.86 (references IEEE C95.1-1999). Below are the limits.

Limits for Occupational/Controlled Exposure			
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm2)
0.3-3.0	614	16.3/f	(100)*
3.0-30	1842/f	16.3/f	(900/f2)*
30-300	61.4	0.163	1.0
300-1500	--	--	f/300
15,00-100,000	--	--	5

Limits for General Population/Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm2)
0.3-1.34	614	1.63	(100)*
1.34-30.0	824/f	2.19/f	(180/f2)*
30-300	27.5	0.073	0.2
300-1500	--	--	f/1500
15,00-100,000	--	--	1

Power density S [mW/cm2] for controlled area at 460 MHz,
S= f (MHz)/300=460/300= 1.54 mW/cm2

Power density S [mW/cm2] for uncontrolled area at 460 MHz
S= f (MHz)/1500=460/1500= 0.31 mW/cm2

Reference levels are provided for exposure assessment to determine whether the basic restrictions on exposure of humans to electromagnetic fields are exceeded. The basic restrictions on exposure to electromagnetic fields are based directly on established health effects and biological considerations.

2. Prediction of the Exposure to Electromagnetic Fields

Calculations can be made on a site by site basis to ensure the power density is below the limits given above, or guidelines can be done beforehand to ensure the minimum distances from the antenna is

maintained through the site planning. The calculations are based on FCC OET 65 Appendix B.

3. Calculation method of the Safe Distance

Below method describe s a theoretical approac h to calculate possible exposure to electromagnetic radiation around a base station transceiver antenna. Precise statements are basically only possible either with measurements or complex calc ulations considering the complexity of the en vironment (e.g. soil conditions, near buildings and other obstacles) which causes reflections, scattering of electromagnetic fields. The maximum output power (given in EIRP) of a base station is usually limited by license conditions of the network operator. A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation. The calculations are based on FCC OET 65 Appendix B.

$$S = \frac{P(W) * G_{numeric}}{4 * r^2(m) * \pi}$$

Whereas:

S= Power Density

P = Maximum output power in W of the site

G numeric = Numeric gain of the antenna relative to isotropic antenna

R = distance between the antenna and the point of exposure in meters

4. Test Result

470MHz

Power at antenna connector: 30.88 dBm (1.225W)

Antenna gain: 1.5 dB (Numeric gain:1.413)

Predication Distance: 20 cm

Predication Frequency: 470 MHz

S= (1225*1.413)/ (4*20*20*3.14) =0.345 (mW/cm^2)

SO,

Power Density at Predication Frequency and Predication Distance: 0.345 (mW/cm^2)

Limit for Occupational/Controlled Exposure at the Predication Frequency: 3 (mW/cm^2)

Limit for General Population/Uncontrolled Exposure at the Predication Frequency: 0.6(mW/cm^2)

TEST RESULT: PASS