Combined MPE Calculation for Collocation of Intentional Transmission for a mobile device.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

When all the antennas are at least 20cm away from the user, but individual antennas can not be separated by 20cm from each other.

If

[Pd(1) / LPd(1)] + [Pd(2) / LPd(2)] + ….. + [Pd(n) / LPd(n)] < 1,

then device complies with FCC's RF radiation exposure limit for general population for a mobile device.

Where;

Pd(n) = Power density of n^{th} transmitter at 20cm
LPd(n) = Power density limit for the n^{th} transmitter

The unit has two operations, one is the GPS function which transmits either in the cellular band of 850MHz, or in the PCS band which is 1900MHz and the other is the wireless transmission in the 2.4GHz band.

The highest gain values were used for antenna gain.

FCC ID: N7N-MC5725

WiFi Calculations

Maximum peak output power at the antenna terminal:	19.48	(dBm)
Maximum peak output power at the antenna terminal:	88.7156012	(mW)
Antenna gain(typical):	3	(dBi)
Maximum antenna gain:	1.995262315	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.035215	(mW/cm^2)

Cellular Calculations

Maximum peak output power at the antenna terminal:	29.23	(dBm)
Maximum peak output power at the antenna terminal:	837.5292821	(mW)
Antenna gain(typical):	2	(dBi)
Maximum antenna gain:	1.584893192	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	850	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.5667	(mW/cm^2)
Power density at prediction frequency:	0.264077	(mW/cm^2)

PCS Calculations

Maximum peak output power at the antenna terminal:	28.83	(dBm)
Maximum peak output power at the antenna terminal:	763.8357836	(mW)
Antenna gain(typical):	4	(dBi)
Maximum antenna gain:	2.511886432	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	1900	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.381707	(mW/cm^2)

Combined Calculations

FCC ID: N7N-MC5725

Collocation in Cellular Band

[(0.035215 / 1) + (0.264077 / 0.5667)] = **0.5012 < 1**

Collocation in PCS Band

[(0.035215 / 1) + (0.381707 / 1)] = **0.4169 < 1**

The unit meets the general population limit for both operating bands with WiFi enabled

FCC ID: N7N-MC5728

WiFi Calculations

Maximum peak output power at the antenna terminal:	19.48	(dBm)
Maximum peak output power at the antenna terminal:	88.7156012	(mW)
Antenna gain(typical):	3	(dBi)
Maximum antenna gain:	1.995262315	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.035215	(mW/cm^2)

Cellular Calculations

Maximum peak output power at the antenna terminal:	29.05	(dBm)
Maximum peak output power at the antenna terminal:	803.5261222	(mW)
Antenna gain(typical):	2	(dBi)
Maximum antenna gain:	1.584893192	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	836.52	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.5577	(mW/cm^2)
Power density at prediction frequency:	0.253355	(mW/cm^2)

PCS Calculations

Maximum peak output power at the antenna terminal:	28.59	(dBm)
Maximum peak output power at the antenna terminal:	722.7698036	(mW)
Antenna gain(typical):	4	(dBi)
Maximum antenna gain:	2.511886432	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	836.52	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.361185	(mW/cm^2)

Combined Calculations

FCC ID: N7N-MC5728

Collocation in Cellular Band

[(0.035215 / 1) + (0.253355 / 0.5577)] = **0.4895 < 1**

Collocation in PCS Band

[(0.035215 / 1) + (0.361185 / 1)] = **0.3964 < 1**

The unit meets the general population limit for both operating bands with WiFi enabled

FCC ID: N7NMC8790

WiFi Calculations

Maximum peak output power at the antenna terminal:	19.48	(dBm)
Maximum peak output power at the antenna terminal:	88.7156012	(mW)
Antenna gain(typical):	3	(dBi)
Maximum antenna gain:	1.995262315	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.035215	(mW/cm^2)

Cellular Calculations

Maximum peak output power at the antenna terminal:	31.83	(dBm)
Maximum peak output power at the antenna terminal:	1524.052754	(mW)
Antenna gain(typical):	2	(dBi)
Maximum antenna gain:	1.584893192	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	824.2	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.5495	(mW/cm^2)
Power density at prediction frequency:	0.480541	(mW/cm^2)

PCS Calculations

Maximum peak output power at the antenna terminal:	28.71	(dBm)
Maximum peak output power at the antenna terminal:	743.0191379	(mW)
Antenna gain(typical):	4	(dBi)
Maximum antenna gain:	2.511886432	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	1850.2	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.371304	(mW/cm^2)

Combined Calculations

FCC ID: N7NMC8790

Collocation in Cellular Band

[(0.035215 / 1) + (0.480541 / 0.5495)] = **0.9097 < 1**

Collocation in PCS Band

[(0.035215 / 1) + (0.371304 / 1)] = **0.4065 < 1**

The unit meets the general population limit for both operating bands with WiFi enabled