

MPE Calculation

§ 1.1310: The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Part 1.1310 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

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in 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.

1.1 Test Procedure

An MPE evaluation for was performed in order to show that the device was compliant with §2.1091. The maximum power density was calculated for each transmitter at a separation distance of 20cm.

For each transmitter the maximum RF exposure at a 20 cm distance using the formula:

$$PowerDensity = \frac{ConductedPower_{mW} \times Ant.Gain}{4\pi \times (20_{cm})^2}$$



1.2 Results:

The following calculations show that the total power density from each transmitter at 20cm is less than the limit for general population / un-controlled exposure. The device meets the RF exposure limit at a 20cm separation distance as required by part 2.1091 of the FCC rules when used with an antenna not exceeding the maximum antenna gain noted in the following table.

Test Summary

Frequency (MHz)	Maximum Antenna Gain (dBi)	MPE @ 20cm (mW/cm ²)	Test Result
737	7.30	0.4903	Compliant
751.5	7.51	0.5000	Compliant
881.52	7.66	0.5867	Compliant
2132.5	6.19	0.9990	Compliant
1960	1.28	0.3146	Compliant

LTE Lower Block Band:

Frequency	737	MHz	
Limit	0.4913	mW/cm ²	
Distance	20	cm	
Power	26.62	dBm	459.198 mW
TX Ant Gain	7.30	dBi	
EIRP	33.92	dBm	
Power Density	0.4903	mW/cm ²	at 20cm

LTE Upper Block Band:

Frequency	751.5	MHz	
Limit	0.5010	mW/cm ²	
Distance	20	cm	
Power	26.49	dBm	445.6562 mW
TX Ant Gain	7.51	dBi	
EIRP	34.00	dBm	
Power Density	0.5000	mW/cm ²	at 20cm



Cell Band:

Frequency	881.52	MHz		
Limit	0.5877	mW/cm ²		
Distance	20	cm		
Power	27.04	dBm	505.824	mW
TX Ant Gain	7.66	dBi		
EIRP	34.70	dBm		
Power Density	0.5867	mW/cm ² at 20cm		

AWS Band:

Frequency	2132.5	MHz		
Limit	1.0000	mW/cm ²		
Distance	20	cm		
Power	30.82	dBm	1207.81	mW
TX Ant Gain	6.19	dBi		
EIRP	37.01	dBm		
Power Density	0.9990	mW/cm ² at 20cm		

PCS Band:

Frequency	1960	MHz		
Limit	1	mW/cm ²		
Distance	20	cm		
Power	30.71	dBm		
TX Ant Gain	1.28	dBi		
EIRP	31.99		1581.24	mW
Power Density	0.3146	mW/cm ² at 20cm		