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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:

$$ConductedPower_{mW} = 10^{ConductedPower(dBm)/10}$$

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

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1.2 Results:

The device contains four GSM transmitters which can transmit simultaneously (through one single shared antenna). The following calculations show that the total power density from the product at 20cm is less than the limit for general population / un-controlled exposure with all four transmitters operating at the same time.

GSM 850 Band Transmitter:

Frequency	824.2	MHz		
Limit	0.549	mW/cm^2		
Distance	20	cm		
Maximum Scaled Power	33.9	dBm		
TX Ant Gain	0	dBi		
EIRP	33.9		2454.709	mW
Source Based Duty Cycle (2/8 Timeslots)	0.25			
Source Based Output Power	613.677229	mW		
Power Density	**0.1221**	mW/cm^2 at 20cm		

GSM 1900 Band Transmitter:

Frequency	1850.2	MHz		
Limit	1.000	mW/cm^2		
Distance	20	cm		
Maximum Scaled Power	30.28	dBm		
TX Ant Gain	0	dBi		
EIRP	30.28		1066.596	mW
Source Based Duty Cycle (2/8 Timeslots)	0.25			
Source Based Output Power	266.64903	mW		
Power Density	**0.0530**	mW/cm^2 at 20cm		