Calculation to determine whether the power density could exceed the MPE

A conservative formulation is used in this worksheet to estimate the power density at a certain distance from a product. The power density is compared with the Maximum Permissible Exposure (MPE) given in [1] or [2] to estimate whether the MPE is met. If so, the product is deemed to be compliant with the relevant EME guidelines [1, 2]. If not, MPE testing or SAR testing is necessary to demonstrate EME compliance. Note that EME compliance alone is insufficient to determine total compliance of a product. For example, the FCC also limits the effective (isotropic) radiated power (ERP / EIRP).

This worksheet makes use of the free-space formula for power density [1]:

$$S = \frac{P_t G_t}{4\pi d^2 L} F = \frac{c P_m G_t}{4\pi d^2 L} F \qquad (1)$$

Where S is the power density at distance d away from an antenna with total output power P_t, gain G_t and cable loss L.

The total power P_t equals the maximum output power, P_m, scaled by the maximum duty cycle of the signal, c.

The factor F is a multiplier to provide a worst-case prediction of power density according to the FCC [1]. See "Justification" worksheet for details.

Product Description

Date	4/13/2011
Model number	PMUE3649A
Model description	UHF Range 1, 403-470 MHz, 25-40W, radio with internal GPS and Bluetooth using a

Input variables

Maximum output power, P_m	0.01	W	Enter the maximum output power of the device under normal operating temperature & humidity conditions
Duty cycle, c	29.30%		Enter the duty cycle of the signal (e.g., 100% for CW or CDMA, 12.5% for GSM)
frequency, f	2450	MHz	Enter the lowest (highest) frequency of the transmit band, for devices operating above (below) 30 MHz.
Antenna gain, G_t	5.45	dBi	dBi is dB relative to an ideal isotropic source. If antenna gain is given in dBd, add 2.15 to put it in dBi.
Cable loss, L	0	dB	Enter the loss of the cable connecting the transmitter to the antenna (0 dB if no cable loss information available).
Distance, d	20	cm	Enter the distance from the antenna
Enhancement factor, F	2.56		Choose the enhancement factor: 1 for desktop devices
			2.56 for all other devices

Output variables

Radiated power density, S 0.005234 mW/cm^2

	FCC [1]		ICNIRP [2]	
	controlled	uncontrolled	occupational	gen. public
MPE (mW/cm^2)	5.00	1.00	5.00	1.00
Power density exceeds MPE?	NO	NO	NO	NO

Comments

MPE limits are the same across 2.4-2.48GHz (BT band).
SR9230

References

[1] FCC Office of Engineering and Technology, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," OET Bulletin 65, Edition 97-01, 1997.
[2] ICNIRP, "International Commission on Non-Ionizing Radiation Protection guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (Up to 300 GHz)," Health Physics, vol. 74, no. 4, pp. 494–522, 1998.

FCD-0989 MPE Calculator Workbook Rev. 4