

RF Exposure Calculation

Applicant: 3M Company
FCC ID: DGFIPD3200

The electronic stethoscope contains a low power Bluetooth (class II) transmitter completely housed in the stainless steel structure of the stethoscope. Calculated and radiated transmit power is under the low threshold.

The internal antenna used for this portable transmitter must provide a separation distance of 1mm what is assured by the thickness of the stethoscope housing.

Threshold calculation

frequency		2480		
	low threshold		High threshold	
general population	d<2,5	24,19354839 mW	d<20	362,903 mW
	d>=2,5	48,38709677 mW		
occupational	d<2,5	151,2096774 mW	d<20	907,258 mW
	d>=2,5	362,9032258 mW		
frequency		2440		
	low threshold		High threshold	
general population	d<2,5	24,59016393 mW	d<20	368,852 mW
	d>=2,5	49,18032787 mW		
occupational	d<2,5	153,6885246 mW	d<20	922,131 mW
	d>=2,5	368,852459 mW		

The appropriate max conducted power can be drawn from the test report no. G0M20810-2051-P-15

The far field on-axis power flux density (W/m^2) is calculated using the following formula: see spread sheet below

S = Power density (mW/cm^2)

ERP = effective radiated power (mW)

EIRP = isotropically radiated power (mW)

r = Distance in cm

According to § 1.1310 Radiofrequency radiation exposure limits Table 1—Limits for Maximum Permissible Exposure (MPE) Limit for General/Uncontrolled Use for the 2.48 GHz frequency range is specified to $1 mW/cm^2$.

Calculations

name			nature value	log value
max conducted power			2,20 mW	3,42 dBm
max Antenna gain dBi			0,06	-12,00 dBi
max Antenna gain dBd			0,04	-14,15 dBd
calculated radiated power	EIRP		0,1387 mW	-8,58 dBm
	ERP		0,0846 mW	-10,73 dBm
measured radiated power	EIRP		0,16 mW	-7,90 dBm
	ERP		mW	dBm
duty cycle factor				
frequency	2400 MHz			
dwel time			50,0 ms	
Time of occupancy/puls-train time			100 ms	
duty cycle factor	10log(dwel time/100 ms)		50,00%	-3,01 dB
max source-based time-averaged power				
conducted power			1,10 mW	0,41 dB
calculated radiated power		EIRP	0,07 mW	-11,59 dB
measured radiated power		EIRP	0,08 mW	-10,91 dB
M P E				
$S = \frac{PG}{4\pi R^2}$		calculated with max source-based time-averaged power measured conducted power		
r [cm]		20	2,5	1,5
S [mW/cm ²]		0,0000	0,0009	0,0025
Limit general population		[mW/cm ²]	1,0	
Limit occupational population		[mW/cm ²]	5,0	for f = 2400 MHz
$S = \frac{EIRP}{4\pi R^2} = \frac{1.64 ERP}{4\pi R^2} = \frac{0.41 ERP}{\pi R^2}$		calculated with max source-based time-averaged power measured radiated power		
r [cm]		20	2,5	1,5
S [mW/cm ²]		0,0000	0,0010	0,0029