The Nebraska Center for Excellence in Electronics
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RF Exposure rev4

Reference: CFR 47 FCC Part 1.1310
RSS-102. Issue 5

Description:

All measurements were peak power readings taken from test reports from accredited test labs. Antenna gains were taken from the manufacturer's specifications.

Limits: Maximum exposure limits from CFR 47, FCC Part 1.1310:

Table 1 - 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 Exposure				
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
300-1,500			f/300	6
1,500-100,000			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
300-1,500			f/1500	30
1,500-100,000			1.0	30

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Occupational/Controlled	0
General Population/uncontrolled	1

Transmitter	Frequency	Antenna Gain	Power (conducted)	Power (conducted) +10% for tolerance	Power Density	Limit at specified distance	% of limit	Highest	Total
	MHz	numerical	mW	mW	mW/cm^2	mW/cm^2			
1	2412	1.74	180.30	198.33	0.06869	1	6.87%		
1	2442	1.74	189.67	208.64	0.07226	1	7.23%	1	7.23%
1	2462	1.74	171.79	188.97	0.06545	1	6.54%		
								TOTAL	7.23%

Distance	20	cm	PASS?	YES

Calculations:

Table 2 - Calculations according to CFR 47, Part 1.1310, Table 1(B)

Transmitter 1: Murata 1DX module on Hunter Douglas Wireless Hub

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Table 3 - From Table 4 of RSS-102 Issue 5

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
$0.003\text{-}10^{21}$	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

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Table 4 - Calculation according to Industry Canada RSS-102, Table 6

Occupational/Controlled	0
General Population/uncontrolled	1

Transmitter	Frequency	Antenna Gain	Power (conducted)	Power (conducted) +10% for tolerance	Power Density	Limit at specified distance	% of limit	Highest	Total
	MHz	numerical	mW	mW	mW/cm^2	mW/cm^2			
1	2412	1.74	180.30	198.33	0.06869	0.536602	12.80%		
1	2442	1.74	189.67	208.64	0.07226	0.540397	13.37%	1	13.37%
1	2462	1.74	171.79	188.97	0.06545	0.544179	12.03%		
								TOTAL	**13.37%**

Notes: The minimum separation distance was defined as the closest point from the transmitting antenna to any part of the body or extremity of a user or bystander.

Transmitter 1: Murata 1DX module on Hunter Douglas Wireless Hub

The limit was converted from W/cm^2 to mW/m^2 by dividing by 10
(W→mW = .001) × (/cm^2→/m^2 = 100) = 0.1 = /10
The power density is calculated as shown below:

S = (P x G)/(4 x π x d^2) – used to calculate exposure at 20 cm

d = √(S/(P x G) x 4 X π) – used to calculate minimum distance to meet limits

1 mW/cm^2 = 10 W/m^2

S= power density
P = transmitter conducted power (in mW)
G = antenna numeric gain
D = distance to radiation center