

**POWER DENSITY ESTIMATIONS BASED ON POWER OUTPUT, ANTENNA GAIN, AND DISTANCE FROM ANTENNA**

$$( P G ) / ( 4 R ^ 2 \pi ) = S$$

<b>where:</b>	<b>S =</b>	maximum power density (mW/cm <sup>2</sup> )	<b>transmitter operating variables:</b>	<small>must be blank if dB values are entered</small>	
	<b>P =</b>	power input to the antenna ----->>	=	<b>23.5</b> (dBm) - or -	(mW)
	<b>G =</b>	gain of the antenna - worst case ----->>	=	<b>2</b> (dBi) - or -	(numeric gain)
	<b>R =</b>	distance to the center of the radiation of the antenna -->>	=	<b>20</b>	(cm)

$$( P \quad G ) / ( 4 * R ^ 2 * \pi ) = S \quad (mW/cm^2)$$

$$\left( \frac{223.8721139}{(mw)} \quad \frac{1.58489}{(gain)} \right) / \left( 4 * \frac{20}{(cm)}^2 * \pi \right) = S \quad (mW/cm^2)$$

$$( 354.8133892 ) / ( 4 * 400 * \pi ) = S \quad (mW/cm^2)$$

$$( 354.8133892 ) / ( 5026.548246 ) = 0.070588 \quad (mW/cm^2)$$

The highest MPE reading has an EIRP of 25.50 dBm

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<b>where:</b>	<b>S =</b>	maximum power density (mW/cm <sup>2</sup> )	<b>transmitter operating variables:</b>	<small>must be blank if dB values are entered</small>	
	<b>P =</b>	power input to the antenna ----->>	=	<b>10.7</b> (dBm) - or -	(mW)
	<b>G =</b>	gain of the antenna - worst case ----->>	=	<b>2.1</b> (dBi) - or -	(numeric gain)
	<b>R =</b>	distance to the center of the radiation of the antenna -->>	=	<b>20</b>	(cm)

$$( P \quad G ) / ( 4 * R ^ 2 * \pi ) = S \quad (mW/cm^2)$$

$$\left( \frac{11.74897555 \text{ (mw)}}{1.62181 \text{ (gain)}} \right) / \left( 4 * \frac{20 \text{ (cm)}}{}^2 * \pi \right) = S \quad (mW/cm^2)$$

$$( 19.05460718 ) / ( 4 * 400 * \pi ) = S \quad (mW/cm^2)$$

$$( 19.05460718 ) / ( 5026.548246 ) = 0.003791 \quad (mW/cm^2)$$

The highest MPE reading as an EIRP of 12.8 dBm

**Power Density Based on**

20 separation distance (cm)

2462	Frequency (MHz)
23.5	Power to Antenna (dBm)
2	Antenna gain (dBi)

**FCC**

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 <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposure</b>				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f <sup>2</sup>	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f <sup>2</sup>	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

**0.071**

Power Density (mW/cm<sup>2</sup>)

Canada	FCC	Limit (mW/cm <sup>2</sup> )
0.544	1	Limit (mW/cm <sup>2</sup> )
0.474	0.929	Margin
0.130	0.071	MPE Ratio

(General Population)

Device FCC ID ONCWCSCLV  
 Date 5/2/2019  
 Prepared By Kyle F.

**Canada**

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

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

Note The FCC ID for the WiFi Module is 2AC7Z-ESPWROOM02

**Power Density Based on**

20 separation distance (cm)

2442	Frequency (MHz)
10.7	Power to Antenna (dBm)
2.1	Antenna gain (dBi)

**FCC**

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 <sup>2</sup> )	Averaging (minutes)
<b>(A) Limits for Occupational/Controlled Exposure</b>				
0.3-3.0	614	1.63	*100	
3.0-30	1842/f	4.89/f	*900/f <sup>2</sup>	
30-300	61.4	0.163	1.0	
300-1,500			f/300	
1,500-100,000			5	
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*100	
1.34-30	824/f	2.19/f	*180/f <sup>2</sup>	
30-300	27.5	0.073	0.2	
300-1,500			f/1500	
1,500-100,000			1.0	

**0.004**

Power Density (mW/cm<sup>2</sup>)

Canada	FCC	Limit (mW/cm <sup>2</sup> )
0.541	1	Limit (mW/cm <sup>2</sup> )
0.537	0.996	Margin
0.007	0.004	MPE Ratio

(General Population)

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**Canada**

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

**Note:** f is frequency in MHz.  
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MPE Ratio of simultaneous operation based on highest power density compared to the **FCC** limits

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e.i.r.p				
25.50	0.071	Ratio 1	2.4GHz WiFi	
12.80	0.004	Ratio 2	BLE	

**0.075** Total Ratio Must be <=1

0.925 Remaining

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is  $\leq 1.0$ , according to calculated/estimated, numerically modeled, or measured field strengths or power density.

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