

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

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

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

$(P \quad G)$	$/$	$(4 * R^2 * \pi)$	$=$	S	(mW/cm^2)
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$(\frac{223.8721139}{(mw)} \quad \frac{1.58489}{(gain)})$	$/$	$(4 * \frac{20}{(cm)}^2 * \pi)$	$=$	S	(mW/cm^2)
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(354.8133892)	$/$	$(4 * 400 * \pi)$	$=$	S	(mW/cm^2)
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(354.8133892)	$/$	(5026.548246)	$=$	0.070588	(mW/cm^2)
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The highest MPE reading has an EIRP of 25.50 dBm

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

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

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

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

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

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

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 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

0.071Power Density (mW/cm²)

Canada	FCC	
0.544	1	Limit (mW/cm ²)
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 ²)	Reference Period (minutes)
0.003-10 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	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ f ^{1.2}
150000-300000	0.158 f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/ f ^{1.2}
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 ²)	Averaging (minutes)
(A) Limits for Occupational/Controlled Exposure				
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3.0-30	1842/f	4.89/f	*900/f ²	
30-300	61.4	0.163	1.0	
300-1,500			f/300	
1,500-100,000			5	
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	
1.34-30	824/f	2.19/f	*180/f ²	
30-300	27.5	0.073	0.2	
300-1,500			f/1500	
1,500-100,000			1.0	

0.004Power Density (mW/cm²)

Canada	FCC	
0.541	1	Limit (mW/cm ²)
0.537	0.996	Margin
0.007	0.004	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 ²)	Reference Period (minutes)
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150000-300000	0.158 f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/ f ^{1.2}
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MPE Ratio of simultaneous operation based on highest power density compared to the **FCC** limits

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

e.i.r.p

25.50	0.071	Ratio 1	2.4GHz WiFi
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12.80	0.004	Ratio 2	BLE
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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 ≤ 1.0 , according to calculated/estimated, numerically modeled, or measured field strengths or power density.

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