

A04438 RF Exposure Exhibit
RSS-102 Issue 5 / 47 CFR 1.1310
ANT (and simultaneous MPE Calculation)

HVIN A04438		Test Number: 240304	
MPE Calculator	RF Exposure uses EIRP for calculation. EIRP is based on TX power added to the antenna gain in dBi.		
dBi = dB gain compared to an isotropic radiator.			
S = power density in mW/cm ²			
Peak Transmitter Output power (mW)		1.8	
Peak Transmitter Output power (W)		0.002	
Output Power for 100% duty Cycle operation (Watts)		100	
Output Power for 0.417% duty Cycle operation (Watts)		0.0018	
Antenna Gain (dBi)		3.28	
Antenna Gain (Numeric)		2.13	
Tx Frequency (MHz)	2402	Calculation power (Watts)	0.0018
dBd + 2.17 = dBi		dBi to dBd	
2.2		Antenna Gain (dBd)	
1.11		Antenna minus cable (dB)	
Cable Loss (dB)	0.0	Adjusted Power (dBm)	2.46
Antenna Gain (Numeric)		2.13	
Calculated ERP (mw) 2.275		EIRP = Po(dBm) + Gain (dB)	
Calculated EIRP (mw) 3.750		Radiated (EIRP) dBm	
		ERP = EIRP - 2.17 dB	
		3.570	
Power density (S) mW/cm ² = $\frac{\text{EIRP}}{4 \pi r^2}$			
r (cm) EIRP (mW)			
Occupational Limit			
FCC radio frequency radiation exposure limits per 1.1310			
Frequency (MHz)		Occupational Limit (mW/cm ²)	Public Limit (mW/cm ²)
5	30-300	1	0.2
50	300-1,500	0.300	0.1500
1	1,500-10,000	5	1
10			
Occupational Limit			
IC radio frequency radiation exposure limits per RSS-102			
Frequency (MHz)		Occupational Limit (W/m ²)	Public Limit (W/m ²)
0.6455 f ^{0.5}	100-6,000	0.6455 f ^{0.5}	
39.4	6,000-15,000	50	
0.02619 f ^{0.5834}	48-300		1.291
5.4	300-6,000		0.02619 f ^{0.5834}
	6,000-15,000	50	10
f = Transmit Frequency (MHz)		f (MHz) =	2402
P _T = Power Input to Antenna (mW)		P _T (mW) =	1.7620
Duty cycle (percentage of operation)		% =	100
P _A = Adjusted Power due to Duty cycle or Cable Loss (mW)		P _A (mW) =	1.76
G _N = Numeric Gain of the Antenna		GN (numeric) =	2.13
S ₂₀ = Power Density of device at 20cm (mW/cm2)		S ₂₀ (mW/cm2) =	0.001
S ₃₀ = Power Density of device at 30cm (W/m ²)		S ₃₀ (W/m ²) =	0.01
S _L = Power Density Limit (W/m ²) FCC		S _L (W/m ²) =	10.000
S _L = Power Density Limit (W/m ²) Canada		S _L (W/m ²) =	5.351
R _C = Minimum distance to the Radiating Element for Compliance (cm) FCC		R _C (cm) =	0.5
R _C = Minimum distance to the Radiating Element for Compliance (cm) Canada		R _C (cm) =	0.7
S _C = Power Density of the device at the Compliance Distance R _C (W/m ²) FCC		S _C (W/m ²) =	10.00
S _C = Power Density of the device at the Compliance Distance R _C (W/m ²) Canada		S _C (W/m ²) =	5.35
R ₃₀ = 20cm		R ₂₀ =	20
For Compliance with Canada General Population Limits, User Manual must indicate a minimum separation distance of		0.7 cm	
Or in Meters for Compliance with Canada General Population Limits, a minimum separation distance of		0.01 Meters	
Summary: Standalone MPE Calculations and Summary			
Band 1, (MHz)	Tx Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)
ANT 2400-2483.5	100	2402	1.76
Band 2, (MHz)	Tx Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)
BT 2400-2483.5	100	2402	7.89
Band 3, (MHz)	Tx Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)
WiFi 2400-2483.5	100	2412	17.82
Simultaneous MPE Calculation			
Transmitter 1		Transmitter 2	
Tx Frequency (MHz)		Tx Frequency (MHz)	
2402		2402	
S ₂₀ (W/m ²)		S ₂₀ (W/m ²)	
0.01		0.02	
S _L (W/m ²)		S _L (W/m ²)	
5.351		5.37	
Power Ratio (S _L / S ₂₀)		Power Ratio (S _L / S ₂₀)	
0.001		0.004	
Sum of Power Ratios at 20cm		0.022	
Requirement = Σ of MPE Ratio ≤ 1			

Bluetooth

	HVIN: A04438			Test Number: 240304				
MPE Calculator	RF Exposure uses EIRP for calculation. EIRP is based on TX power added to the antenna gain in dBi. dBi = dB gain compared to an isotropic radiator. S = power density in mW/cm^2							
	Transmitter Output power (mW)		7.9					
	Transmitter Output power (W)		0.008					
Output Power for 100% duty Cycle operation (Watts)	100	0.008			Antenna Gain (dBi)	0.94		
	Output Power for 100% duty Cycle operation (Watts)	0.008			Antenna Gain (Numeric)	1.24		
Tx Frequency (MHz)	2402	Calculation power (Watts)	0.008	dBd + 2.17 = dBi	dBi to dBd	2.17		
Cable Loss (dB)	0.0	Adjusted Power (dBm)	8.97		Antenna Gain (dBd)	-1.23		
					Antenna minus cable (dBi)	0.94		
					Antenna Gain (Numeric)	1.24		
	Calculated ERP (mw) 5.943				EIRP = Po(dBm) + Gain (dB)			
	Calculated EIRP (mw) 9.795				Radiated (EIRP) dBm	9.910		
					ERP = EIRP - 2.17 dB			
					Radiated (ERP) dBm	7.740		
	Power density (S) mW/cm² = EIRP ----- 4 p r^2 r (cm) EIRP (mW)							
	Occupational Limit	FCC radio frequency radiation exposure limits per 1.1310						
	mW/cm²	Frequency (MHz)	Occupational Limit (mW/cm²)	Public Limit (mW/cm²)				
5	W/m²	30-300	1	0.2				
50.0		300-1,500	f/300	f/1500				
	General Public Limit							
1	mW/cm²	1,500-10,000	5	1				
10.0	W/m²							
	Occupational Limit	IC radio frequency radiation exposure limits per RSS-102						
	W/m²	Frequency (MHz)	Occupational Limit (W/m²)	Public Limit (W/m²)				
0.6455f^0.5	W/m²	100-6,000	0.6455f^0.5					
31.6		6,000-15,000	50					
	General Public Limit							
0.02619f^0.6834	W/m²	48-300		1.291				
5.35	W/m²	300-6,000		0.02619f^0.6834				
		6,000-15,000	50	10				
f = Transmit Frequency (MHz)				f (MHz) =	2402	2402 MHz		
Pt = Power Input to Antenna (mW)				Pt (mW) =	7.8886	7.8886 mW		
Duty cycle (percentage of operation)				% =	100	100 %		
Pa = Adjusted Power due to Duty cycle or Cable Loss (mW)				PA (mW) =	7.89	7.89 mW		
GN = Numeric Gain of the Antenna				GN (numeric) =	1.24	1.24 numeric		
S20 = Power Density of device at 20cm (mW/cm2)		S20=(PA GN)/(4πR20²)		S20 (mW/cm2) =	0.002	0.002 mW/cm2		
S20 = Power Density of device at 20cm (W/m²)		S20=(PA GN)/(4πR20²)		S20 (W/m²) =	0.02	0.02 W/m²		
S_L = Power Density Limit (W/m²) FCC				S_L (W/m²) =	10.000	50.000 W/m²		
S_L = Power Density Limit (W/m²) Canada				S_L (W/m²) =	5.351	31.636 W/m²		
R_C = Minimum distance to the Radiating Element for Compliance (cm) FCC		R_C=√(PA GN/4ε0)		R_C (cm) =	0.9	0.4 cm		
R_C = Minimum distance to the Radiating Element for Compliance (cm) Canada		R_C=√(PA GN/4ε0)		R_C (cm) =	1.2	0.5 cm		
S_C = Power Density of the device at the Compliance Distance R_C (W/m²) FCC		S_C=(PA GN)/(4πR_C²)		S_C (W/m²) =	10.00	50.00 W/m²		
S_C = Power Density of the device at the Compliance Distance R_C (W/m²) Canada		S_C=(PA GN)/(4πR_C²)		S_C (W/m²) =	5.35	31.64 W/m²		
R20 = 20cm				R20=	20	20 cm		
For Compliance with Canada General Population Limits, User Manual must indicate a minimum separation distance of					1.2 cm			
Or in Meters for Compliance with Canada General Population Limits, a minimum separation distance of					0.01 Meters			
Summary: Standalone MPE Calculations and Summary					Public Limit		Public	
	Tx Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)	Antenna Gain (numeric)	S_L (W/m²)	S_20 (W/m²)	R_C (cm)	S_C (W/m²)
FCC	100	2402	8	1.24	10.000	0.02	0.9	10.00
Canada	100	2402	8	1.24	5.351	0.02	1.2	5.35
		Limit	Overall Minimum (cm)	Overall Minimum (inches)				
	Public	Occupational						
FCC (cm)	0.9	0.4						
FCC (inches)	1.0	1.0						
Canada (cm)	1.2	0.5						
Canada (inches)	1.0	1.0						
Overall Minimum Limit Public		Overall Minumu Limit Occupational						
2 cm		1 cm						
1 inches		1 inches						

WiFi

	HVIN: A04438				Test Number: 230405D				
MPE Calculator	RF Exposure uses EIRP for calculation. EIRP is based on TX power added to the antenna gain in dBi. dBi = dB gain compared to an isotropic radiator. S = power density in mW/cm^2								
	Transmitter Output power (mW)		17.8						
	Transmitter Output power (W)		0.018						
Output Power for % duty Cycle operation (Watts)	100		0.018		Antenna Gain (dBi)	4.16			
Output Power for 100% duty Cycle operation (Watts)			0.018		Antenna Gain (Numeric)	2.61			
Tx Frequency (MHz)	2412	Calculation power (Watts)	0.018		dBd + 2.17 = dBi	dBi to dBd	2.17		
Cable Loss (dB)	0.0	Adjusted Power (dBm)	12.51		Antenna Gain (dBd)	1.99			
					Antenna minus cable (dBi)	4.16			
					Antenna Gain (Numeric)	2.61			
		Calculated ERP (mw) 28.184			EIRP = Po(dBm) + Gain (dB)				
		Calculated EIRP (mw) 46.452			Radiated (EIRP) dBm	16.670			
					ERP = EIRP - 2.17 dB				
					Radiated (ERP) dBm	14.500			
		Power density (S) mW/cm² = ----- 4 p r^2 r (cm) EIRP (mW)							
	Occupational Limit	FCC radio frequency radiation exposure limits per 1.1310							
	mW/cm²	Frequency (MHz)	Occupational Limit (mW/cm²)	Public Limit (mW/cm²)					
5 50.0	W/m²	30-300	1	0.2					
	General Public Limit	300-1,500	f/300	f/1500					
1 10.0	mW/cm²	1,500-10,000	5	1					
	W/m²								
	Occupational Limit	IC radio frequency radiation exposure limits per RSS-102							
	W/m²	Frequency (MHz)	Occupational Limit (W/m²)	Public Limit (W/m²)					
0.6455 f^0.5 31.7	W/m²	100-6,000	0.6455 f^0.5						
	General Public Limit	6,000-15,000	50						
0.02619 f^0.6834 5.37	W/m²	48-300		1.291					
	W/m²	300-6,000		0.02619 f^0.6834					
		6,000-15,000	50	10					
f = Transmit Frequency (MHz)					f (MHz) =	2412	2412 MHz		
Pₐ = Power Input to Antenna (mW)					Pₜ (mW) =	17.8238	17.8238 mW		
Duty cycle (percentage of operation)					% =	100	100 %		
Pₐ = Adjusted Power due to Duty cycle or Cable Loss (mW)					Pₐ (mW) =	17.82	17.82 mW		
G_N = Numeric Gain of the Antenna					GN (numeric) =	2.61	2.61 numeric		
S₂₀ = Power Density of device at 20cm (mW/cm²)		S₂₀=(PₐG_N)/(4πR₂₀)²			S₂₀ (mW/cm²) =	0.009	0.009 mW/cm²		
S₃₀ = Power Density of device at 20cm (W/m²)		S₃₀=(PₐG_N)/(4πR₃₀)²			S₃₀ (W/m²) =	0.09	0.09 W/m²		
S_L = Power Density Limit (W/m²) FCC					S_L (W/m²) =	10.000	50.000 W/m²		
S_L = Power Density Limit (W/m²) Canada					S_L (W/m²) =	5.366	31.702 W/m²		
R_C = Minimum distance to the Radiating Element for Compliance (cm) FCC		R_C=√(PₐG_N/4ε_S)			R_C (cm) =	1.9	0.9 cm		
R_C = Minimum distance to the Radiating Element for Compliance (cm) Canada		R_C=√(PₐG_N/4ε_S)			R_C (cm) =	2.6	1.1 cm		
S_C = Power Density of the device at the Compliance Distance R_C (W/m²) FCC		S_C=(PₐG_N)/(4πR_C)²			S_C (W/m²) =	10.00	50.00 W/m²		
S_C = Power Density of the device at the Compliance Distance R_C (W/m²) Canada		S_C=(PₐG_N)/(4πR_C)²			S_C (W/m²) =	5.37	31.70 W/m²		
R_20 = 20cm					R20=	20	20 cm		
For Compliance with Canada General Population Limits, User Manual must indicate a minimum separation distance of							2.6 cm		
Or in Meters for Compliance with Canada General Population Limits, a minimum separation distance of							0.03 Meters		
Summary: Standalone MPE Calculations and Summary						Public Limit		Public	
	Tx Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)	Antenna Gain (numeric)	S_L (W/m²)	S_30 (W/m²)	R_C (cm)	S_C (W/m²)	
FCC	100	2412	18	2.61	10.000	0.09	1.9	10.00	
Canada	100	2412	18	2.61	5.366	0.09	2.6	5.37	
			Limit	Overall Minimum (cm)	Overall Minimum (inches)				
		Public	Occupational						
	FCC (cm)	1.9	0.9						
	FCC (inches)	1.0	1.0						
	Canada (cm)	2.6	1.1						
	Canada (inches)	2.0	1.0						
Overall Minimum Limit Public		Overall Minumu Limit Occupational							
3 cm		2 cm							
2 inches		1 inches							

Rogers Labs, a division of The Compatibility Center LLC
7915 Nieman Road FCC ID: IPH-04438 IC: 1792A-04438
Lenexa, KS 66214 Test: 240304 SN's: 3475527948, 3465437947, 865000094, 865000102
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