

HVIN/PMN: A05068
47CFR 1.1310, RSS-102 Issue 6

Garmin	A05068 GPSMAP X3		Test Number:		250204					
MPE Calculator	The Usage Case for this product is in a Public / Uncontrolled Environment w/ > 20cm separation MPE 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									
					Antenna Gain (dBi)	3				
					dBd + 2.17 = dBi	dBi to dBd	2.2			
Tx Frequency (MHz)	2437	Peak Power (Watts)	0.0191		Antenna Gain (dBd)	0.83				
		Peak Power (mW)	19.1							
Cable Loss (dB)	0.0	(dBm)	12.8		Antenna minus cable (dBi)	3.00				
		Max Duty Cycle (%)	100.0%							
		Adjusted Power (mW)	19.1							
		Adjusted Power (dBm)	12.8							
		Calculated ERP (mw)	23.121		EIRP = Po(dBM) + Gain (dB)					
		Calculated EIRP (mw)	38.107			Radiated (EIRP) dBm	15.810			
					ERP = EIRP - 2.17 dB					
		Occupational Limit				Radiated (ERP) dBm	13.640			
5	mW/cm^2									
50.00000	W/m^2									
		General Public Limit								
1	mW/cm^2									
10.00000	W/m^2									
	FCC radio frequency radiation exposure limits per 1.1310			IC radio frequency radiation exposure limits per RSS-102, Issue 6 Field						
	Frequency (MHz)	Occupational Limit W/m	Public Limit W/m^2	Frequency (MHz)	Mobile					
	300-1,500	f/30	f/150	10-20	1.0	1.0				
	1,500-100,000	50	10	20-48	4.49/f^0.5	4.49/f0.5				
	2437.0	50	10	48-300	0.6	0.60				
				300-6,000	(1.31*10^-2)*f^0.6834	2.70				
				6,000-15,000	5.0	5.0				
					FCC	ISED				
f = Transmit Frequency (MHz)				f (MHz) =	2437	2437	MHz			
P_T = Power Input to Antenna (mW)				P_T (mW) =	19.1	19.1	mW			
Duty cycle (percentage of operation)				% =	100.0%	100.0%	%			
P_A = Adjusted Power due to Duty cycle or Cable Loss (mW)				P_A (mW) =	19.10	19.10	mW			
G_N = Numeric Gain of the Antenna				GN (numeric) =	2.17	2.17	numeric			
S_20 = Power Density of device at 20cm (mW/m^2)			S_20=(P_A G_N)/(4πR_20)^2	S_20 (mW/m^2) =	0.01	0.01	mW/m^2			
S_20 = Power Density of device at 20cm (W/m^2)			S_20=(P_A G_N)/(4πR_20)^2	S_20 (W/m^2) =	0.08	0.08	W/m^2			
S_L = Power Density Limit (W/m^2)				S_L (W/m^2)=	10.00	2.70	W/m^2			
R_C = Minimum distance to the Radiating Element for Compliance (cm)			R_C=√(P_A G_N/4πS_L)	R_C (cm) =	2.8	4.5	cm			
S_C = Power Density of the device at the Compliance Distance R_C (W/m^2)			S_C=(P_A G_N)/(4πR_C)^2	S_C (W/m^2) =	4.16	1.63	W/m^2			
R_20 = 20cm				R20=	20	20	cm			
				For Compliance with Use Case Limits	2.8	4.5	cm			
				Or in Meters for Compliance with Use Case Limits	0.03	0.04	Meters			
Summary: Standalone MPE Calculations and Summary										
Radio	Tx Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)	Antenna Gain (num.)	FCC S_L (W/m^2)	ISED S_L (W/m^2)	S_20 (W/m^2)	R_C (cm)	S_C (W/m^2)	
ANT	100%	2402	2.43	2.2	10.0	2.68	0.010	1.65	1.5	
WiFi 802.11n	100%	2437	19.10	2.2	10.0	2.70	0.082	2.82	4.2	
	FCC Simultaneous MPE Calculation				ISED Simultaneous MPE Calculation					
		ANT	WiFi 802.11n			ANT	WiFi 802.11n			
	Tx Frequency (MHz)	2402	2437		Tx Frequency (MHz)	2402	0.08244985			
	S_20 (W/m^2)	0.01	0.08		S_20 (W/m^2)	0.01	0.08			
	S_L (W/m^2)	10.000	10.000		S_L (W/m^2)	2.68	2.70			
	Power Ratio (S_L / S_20)	0.001	0.008		Power Ratio (S_L / S_20)	0.004	0.031			
	Sum of Power Ratios at 20cm:	0.009			Sum of Power Ratios at 20cm:	0.034				
	Requirement = Σ of MPE Ratio ≤ 1				Requirement = Σ of MPE Ratio ≤ 1					

Garmin GPSMAP X3 Ultrawide A05068 MPE Exhibit

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Conclusion

The A05068 GPSMAP X3 ULTRAWIDE, a mobile product, meets RF exposure requirements for both FCC and Industry Canada for mobile products typically >20cm from users. The product manuals clearly indicates minimum separation of 20cm from users which is more than adequate to provide safety given the above simultaneous MPE calculations.