Garmin GPSMAP X3 Ultrawide A05068 MPE Exhibit

HVIN/PMN: A05068

47CFR 1.1310, RSS-102 Issue 6

Measurements and Calculations

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	Power density (S) EIRP ------- = mW/cm^2 4 p r^2 r (cm) EIRP (mW)			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		
Frequency (MHz)	Occupational Limit W/m	Public Limit W/m^2
300-1,500	f/30	f/150
1,500-100,000	50	10
2437.0	50	10

IC radio frequency radiation exposure limits per RSS-102, Issue 6 Field		
Frequency (MHz)	Mobile	
10-20	1.0	1.0
20-48	$4.49/f^{0.5}$	$4.49/f0.5$
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 Frequecny (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)	$S_{20}=(P_AG_N)/(4\pi R_{20})^2$	S_{20} (mW/m^2) =	0.01	0.01	mW/m^2
S_{20} = Power Density of device at 20cm (W/m^2)	$S_{20}=(P_AG_N)/(4\pi R_{20})^2$	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)	$R_C=\sqrt{(P_AG_N/4\pi S_L)}$	R_C (cm) =	2.8	4.5	cm
S_C = Power Density of the device at the Compliance Distance R_C (W/m^2)	$S_C=(P_AG_N)/(4\pi R_C)^2$	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 Complaince with Use Case Limits	0.03	0.04	Meters

Summary: Standalone MPE Calculations and Summary

Radio	Tx Duty Cycle (%)	Tx Frequeny (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 Simlutaneous MPE Calculation		
	ANT	WiFi 802.11n
Tx Frequeny (MHz)	2402	2437
S_{20} (W/m^2)	0.01	0.08
S_L (W/m^2)	10.000	10.000
Power Ratio (S_L / S_{20})	0.001	0.008
Sum of Power Ratios at 20cm:		**0.009**
Requirement = Σ of MPE Ratio ≤ 1		

ISED Simlutaneous MPE Calculation		
	ANT	WiFi 802.11n
Tx Frequeny (MHz)	2402	0.08244985
S_{20} (W/m^2)	0.01	0.08
S_L (W/m^2)	2.68	2.70
Power Ratio (S_L / S_{20})	0.004	0.031
Sum of Power Ratios at 20cm:		**0.034**
Requirement = Σ of MPE Ratio ≤ 1		

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.