

Garmin GMN-0278310 RF Exposure Exhibit

Controlled / Occupational Environment

HVIN/PMN: GMN-0278310

47CFR 1.1307, RSS-102 Issue 6

Summary and Simultaneous SFX-SBD MPE Calculation

					Antenna Gain (dBi)	3.0		
					dBi to dBd	2.2		
Tx Frequency (MHz)	1621	Peak Power (Watts)	1.7	dBd + 2.17 = dBi	Antenna Gain (dBd)	0.83		
		Peak Power (mW)	1721.9		Antenna Gain (numeric)	2.0		
Cable Loss (dB)	0.0	(dBm)	32.4		Antenna minus cable (dBi)	3.00		
		Duty Cycle (%)	9.1%					
		Adjusted Power (mW)	156.7					
		Adjusted Power (dBm)	2.9					
	Calculated ERP (mw)	2084.491		EIRP = Po(dBM) + Gain (dB)				
	Calculated EIRP (mw)	3435.579			Radiated (EIRP) dBm	35.360		
				ERP = EIRP - 2.17 dB				
					Radiated (ERP) dBm	33.190		
Power density (S) EIRP ----- = mW/cm^2 4 π r^2 r (cm) EIRP (mW)		FCC radio frequency radiation exposure limits per 1.1310						
		Frequency (MHz)	Occupational Limit W/m²	Public Limit W/m²				
		300-1,500	f/30	f/150				
		1,500-100,000	50	10				
		1621.0	50	10				
IC radio frequency radiation exposure limits per RSS-102, Issue 6 Field Reference Level FRL Limit (W/m²)								
Frequency (MHz)	Uncontrolled		Frequency (MHz)	Controlled				
10-20	2.0	2.0	10-20	10.0	10.0			
20-48	8.944/f ^{0.5}	0.2	20-48	44.72/f ^{0.5}	1.1			
48-300	1.291	1.291	48-100	6.455	6.455			
300-6,000	0.02619*f ^{0.6834}	4.1	100-6,000	0.6455*f ^{0.5}	26.0			
6,000-15,000	5.0	10.0	6,000-15,000	50.0	50.0			
15,000-150,000	10	10.0	15,000-150,000	50.0	50.0			
150,000-300,000	6.67*(10 ⁻⁵)*f	0.1	150,000-300,000	3.33*(10 ⁻⁴)*f	0.5			
					FCC	ISED		
f = Transmit Frequency (MHz)				f (MHz) =	1621.0	1621.0 MHz		
P _T = Power Input to Antenna (mW)				P _T (mW) =	1,721.9	1,721.9 mW		
Duty cycle (percentage of operation)				% =	9.1%	9.1% %		
P _A = Adjusted Power due to Duty cycle or Cable Loss (mW)				P _A (mW) =	156.69	156.69 mW		
G _N = Numeric Gain of the Antenna				G _N (numeric) =	2.00	2.00 numeric		
S ₂₀ = Power Density of device at 20cm (mW/m²)			S ₂₀ =(P _A G _N)/(4πR ₂₀) ²	S ₂₀ (mW/m²) =	0.06	0.06 mW/m²		
S ₂₀ = Power Density of device at 20cm (W/m²)			S ₂₀ =(P _A G _N)/(4πR ₂₀) ²	S ₂₀ (W/m²) =	0.62	0.62 W/m²		
S _L = Power Density Limit (W/m²)				S _L (W/m²)=	50.00	25.99 W/m²		
R _C = Minimum distance to the Radiating Element for Compliance (cm)			R _C =√(P _A G _N /4πS _L)	R _C (cm) =	2.2	3.1 cm		
S _C = Power Density of the device at the Compliance Distance R _C (W/m²)			S _C =(P _A G _N)/(4πR _C) ²	S _C (W/m²) =	50.00	25.99 W/m²		
R ₂₀ = 20cm				R ₂₀ =	20	20 cm		
R _{SC} = Simultaneous Minimum distance to the Radiating Element for Compliance (cm)				R _{SC} =	30.6	42.1 cm		
S _{SC} = Power Density of the device at the Simultaneous Compliance Distance R _{SC} (W/m²)				S _{SC} =	0.27	0.14 W/m2		
				For Compliance with General Population Limit	2.2	3.1 cm		
				Or in Meters for Compliance with General Population Limits	0.02	0.03 Meters		
Summary: Standalone MPE Calculations and Summary								
Radio	Tx Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)	Antenna Gain (dBi)	S _L (W/m²)	S ₂₀ (W/m²)	R _C (cm)	S _C (W/m²)
SBD (FCC)	9.1%	1621.0	156.7	3.0	50.0	0.62	2.2	50.0
SFX (FCC)	36.4%	1621.0	27613.04	3.0	50.0	109.6	30.6	46.8
	Tx Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)	Antenna Gain (dBi)	SL (W/m2)	S20 (W/m2)	RC (cm)	S _C (W/m²)
SBD (ISED)	9.1%	1621.0	1,721.9	3.0	26.0	0.6	3.1	26.0
SFX (ISED)	36.4%	1621.0	27,613.0	3.0	26.0	109.6	42.1	24.8
FCC Simultaneous MPE Calculation				ISED Simultaneous MPE Calculation				
	SBD (FCC)	SFX (FCC)			SBD (ISED)	SFX (ISED)		
Tx Frequency (MHz)	1621.0	1621.0		Tx Frequency (MHz)	1621.0	1621.0		
Compliance Distance (cm)	30.6	30.6		Compliance Distance (cm)	42.1	42.1		
S _{SC} (W/m²)	0.27	46.79		S _{SC} (W/m²)	0.14	24.77		
S _L (W/m²)	50.000	50.000		S _L (W/m²)	26.0	26.0		
Power Ratio (S _L / S _{SC})	0.005	0.936		Power Ratio (S _L / S _{SC})	0.005	0.953		
Sum of Power Ratios at compliance distance (Tx1 + Tx2)		0.941		Sum of Power Ratios at compliance distance (Tx1 + Tx2)		0.958		
Requirement = Σ of MPE Ratio < 1				Requirement = Σ of MPE Ratio < 1				

Rogers Labs, a division of The Compatibility Center LLC

7915 Nieman Road

Lenexa, KS 66214

Phone: (913) 660-0666

Revision 1

Garmin International, Inc

Model: GMN-0278310 FCC ID: IPH-0452810 IC: 1792A-0452810

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Test to: 47CFR 2.1307, RSS-102 Iss.6

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SFX MPE Calculation

					Antenna Gain (dBi)	3.0		
				dBd + 2.17 = dBi	dBi to dBd	2.2		
Tx Frequency (MHz)	1621	Peak Power (Watts)	75.8600		Antenna Gain (dBd)	0.83		
		Peak Power (mW)	75860.0		Antenna Gain (numeric)	2.0		
Cable Loss (dB)	0.0	(dBm)	48.8		Antenna minus cable (dBi)	3.0		
		Max Duty Cycle (%)	36.4%					
		Adjusted Power (mW)	27613.0					
		Adjusted Power (dBm)	17.8					
		Calculated ERP (mw)	72.331		ERP = Po(dBm) + Gain (dB)			
		Calculated EIRP (mw)	119.213		Radiated (EIRP) dBm	20.763		
					ERP = EIRP - 2.17 dB			
					Radiated (ERP) dBm	18.593		
Power density (S) EIRP ----- = mW/cm² 4 π r² r (cm) EIRP (mW)		FCC radio frequency radiation exposure limits per 1.1310						
		Frequency (MHz)	Occupational Limit W/m ²	Public Limit W/m ²				
		300-1,500	f/30	f/150				
		1,500-100,000	50	10				
		1621.0	50	10				
IC radio frequency radiation exposure limits per RSS-102, Issue 6 Field Reference Level FRL Limit (W/m ²)								
Frequency (MHz)	Uncontrolled		Frequency (MHz)	Controlled				
10-20	2.0	2.0	10-20	10.0	10.0			
20-48	8.944/f ^{0.5}	0.2	20-48	44.72/f ^{0.5}	1.1			
48-300	1.291	1.291	48-100	6.455	6.455			
300-6,000	0.02619*f ^{0.6834}	4.1	100-6,000	0.6455*f ^{0.5}	26.0			
6,000-15,000	5.0	10.0	6,000-15,000	50.0	50.0			
15,000-150,000	10	10.0	15,000-150,000	50.0	50.0			
150,000-300,000	6.67*(10 ⁻⁵)*f	0.1	150,000-300,000	3.33*(10 ⁻⁴)*f	0.5			
						FCC	ISED	
f = Transmit Frequency (MHz)				f (MHz) =	1621.0	1621.0	MHz	
P _T = Power Input to Antenna (mW)				P _T (mW) =	75,860.0	75,860.0	mW	
Duty cycle (percentage of operation)				% =	36.4%	36.4%	%	
P _A = Adjusted Power due to Duty cycle or Cable Loss (mW)				P _A (mW) =	27,613.04	27,613.04	mW	
G _N = Numeric Gain of the Antenna				GN (numeric) =	2.00	2.00	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) =	10.96	10.96	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) =	109.61	109.61	W/m ²	
S _L = Power Density Limit (W/m ²)				S _L (W/m ²) =	50.00	25.99	W/m ²	
R _C = Minimum distance to the Radiating Element for Compliance (R _C =√(P _A G _N /4πS _L))				R _C (cm) =	30.6	42.1	cm	
S _C = Power Density of the device at the Compliance Distance R _C (S _C =(P _A G _N)/(4πR _C) ²)				S _C (W/m ²) =	46.79	24.77	W/m ²	
R ₂₀ = 20cm				R ₂₀ =	20	20	cm	
						For Compliance with Use Case Limits	42.1	cm
						Or in Meters for Compliance with Use Case Limits	0.421	Meters
Summary: Standalone MPE Calculations and Summary								
Radio	x Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)	Antenna Gain (dBi)	S _L (W/m ²)	S ₂₀ (W/m ²)	R _C (cm)	S _C (W/m ²)
SFX (FCC)	36.4%	1621	27,613.0	3.0	50.0	109.61	30.6	46.79
SFX (ISED)	36.4%	1621	27,613.04	3.0	25.99	109.61	42.1	24.77

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Conclusion

The GMN-0278300, a device that is deployed in controlled, occupational environments, meets RF exposure requirements for both FCC and Industry Canada. For RF exposure safety, personnel should maintain a safe distance of **42.1 cm** from the product.

FCC:

The device needs to be a minimum of 30.6 cm distance away from people.

Industry Canada:

The device needs to be a minimum of 42.1 cm distance away from people.