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
				dBd + 2.17 = dBi	dBi to dBd	2.2
Tx Frequency (MHz)	1621	Peak Power (Watts)	1.7		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 p r^2
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 Frequecny (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		GN (numeric) =	2.00	2.00	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) =	0.06	0.06	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) =	0.62	0.62	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 (cm)	$R_C=\sqrt{(P_AG_N/4\pi S_L)}$	R_C (cm) =	2.2	3.1	cm
S_C = Power Density of the device at the Compliance Distance R_C (W/m	$S_C=(P_AG_N)/(4\pi R_C)^2$	S_C (W/m^2) =	50.00	25.99	W/m^2
R_{20} = 20cm		R20=	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/m^2)		S_{SC} =	0.27	0.14	W/m2
	For Complaince with General Population Limit		2.2	3.1	cm
	Or in Meters for Complaince with General Population Limits		0.02	0.03	Meters

Summary: Standalone MPE Calculations and Summary								
Radio	Tx Duty Cycle (%)	Tx Frequeny (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)
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 Frequeny (MHz)	Power Total (mW)	Antenna Gain (dBi)	SL (W/m2)	S20 (W/m2)	RC (cm)	S_C (W/m^2)
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 Simlutaneous MPE Calculation		
	SBD (FCC)	SFX (FCC)
Tx Frequency (MHz)	1621.0	1621.0
Compliance Distance (cm)	30.6	30.6
S_{SC} (W/m^2)	0.27	46.79
S_L (W/m^2)	50.000	50.000
Power Ratio (S_L / S_{SC})	0.005	0.936
Sum of Power Ratios at compliance distance (Tx1 + Tx2)		0.941
Requirement = Σ of MPE Ratio ≤ 1		

ISED Simlutaneous MPE Calculation		
	SBD (ISED)	SFX (ISED)
Tx Frequency (MHz)	1621.0	1621.0
Compliance Distance (cm)	42.1	42.1
S_{SC} (W/m^2)	0.14	24.77
S_L (W/m^2)	26.0	26.0
Power Ratio (S_L / S_{SC})	0.005	0.953
Sum of Power Ratios at compliance distance (Tx1 + Tx2)		0.958
Requirement = Σ of MPE Ratio ≤ 1		

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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		EIRP = 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/cm^2
4 p r^2
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 Frequecny (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)		$S_{20}=(P_A G_N)/(4\pi R_{20})^2$	S_{20} (mW/m^2) =	10.96	10.96	mW/m^2
S_{20} = Power Density of device at 20cm (W/m^2)		$S_{20}=(P_A G_N)/(4\pi R_{20})^2$	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 (		$R_C=\sqrt{(P_A G_N/4\pi S_L)}$	R_C (cm) =	30.6	42.1	cm
S_C = Power Density of the device at the Compliance Distance R_C (\		$S_C=(P_A G_N)/(4\pi R_C)^2$	S_C (W/m^2) =	46.79	24.77	W/m^2
R_{20} = 20cm			R20=	20	20	cm
		For Compliance with Use Case Limits		30.6	42.1	cm
		Or in Meters for Complaince with Use Case Limits		0.306	0.421	Meters

Summary: Standalone MPE Calculations and Summary								
Radio	Tx Duty Cycle (%	Tx Frequeny (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

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.