# Garmin GMN-0278300 RF Exposure Exhibit

HVIN/PMN: GMN-0278300
47CFR 1.1307, RSS-102 Issue 6

## Measurements and Calculations

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Garmin | | GMN-0278300 | Test Number: | 241216 | | | | | |
| MPE Calculator | The Usage Case for this product is in a Controlled / Occupational Environment | | | | | | | | |
| | 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) | 1621 | Peak Power (Watts) | 75.8600 | | | Antenna Gain (dBd) | 0.83 | | |
| | | Peak Power (mW) | 75860.0 | | | | | | |
| Cable Loss (dB) | 0.0 | (dBm) | 48.8 | | | Antenna minus cable (dBi) | 3.00 | | |
| | | 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 | | | | | |
| | **Occupational Limit** | | | | | Radiated (ERP) dBm | 18.593 | | |
| 5 | mW/cm$^2$ | | | | | | | | |
| 50.00000 | W/m$^2$ | | | | | | | | |
| | **General Public Limit** | | | | | | | | |
| 1 | mW/cm$^2$ | | | | | | | | |
| 10.00000 | W/m$^2$ | | | | | | | | |

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 | 1621 | 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) = | 2.17 | 2.17 | 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$^2$) = | 11.92 | 11.92 | 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$^2$) = | 119.21 | 119.21 | 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) = | 31.9 | 43.8 | 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$^2$) = | 46.91 | 24.82 | W/m$^2$ |
| $R_{20}$ = 20cm | | | R20= | 20 | 20 | cm |
| | | For Compliance with Use Case Limits | | 31.9 | 43.8 | cm |
| | | Or in Meters for Complaince with Use Case Limits | | 0.32 | 0.44 | Meters |

Summary: Standalone MPE Calculations and Summary

| Radio | Band (MHZ) | 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 | 1616.0-1626.5 | 36.4% | 1621 | 27,613.0 | 2.2 | 50.0 | 119.21 | 31.9 | 46.91 |

## Conclusion

The GMN-0278300 meets RF exposure requirements for both FCC and Industry Canada, given product labelling that requires users to keep a safe distance from the product. Given its use case of being in an aircraft environment and not near passengers or workers, this is very accommodatable.

## FCC:

The device needs to be a minimum of 31.9 cm distance away from people.

## Industry Canada:

The device needs to be a minimum of 43.8 cm distance away from people.