GARMIN

May 6, 2020

Re: Permissive Change for FCC ID: IPH-02356, IC: 1792A-02356, RF Exposure

Pursuant to 47 CFR Section 1.1310 and RSS-102, the limits for RF Exposure are as follows:

| | **Occupational Limit** | FCC radio frequency radiation exposure limits per 1.1310 | | |
|---|---|---|---|---|
| 5.0 | $mW/cm^2$ | Frequency (MHz) | Occupational Limit ($mW/cm^2$) | Public Limit ($mW/cm^2$) |
| 50.0 | $W/m^2$ | 30-300 | 1 | 0.2 |
| | **General Public Limit** | 300-1,500 | f/300 | f/1500 |
| 1.0 | $mW/cm^2$ | 1,500-10,000 | 5 | 1 |
| 10.0 | $W/m^2$ | | | |
| | | | | |
| | | | | |
| | **Occupational Limit** | | | |
| 5.0 | $mW/cm^2$ | IC radio frequency radiation exposure limits per RSS-102 | | |
| 50.0 | $W/m^2$ | Frequency (MHz) | Occupational Limit ($W/m^2$) | Public Limit ($W/m^2$) |
| | **General Public Limit** | 100-6,000 | $0.6455f^{0.5}$ | |
| 1.0 | $mW/cm^2$ | 48-300 | | 1.291 |
| 10.0 | $W/m^2$ | 300-6,000 | | $0.02619f^{0.6834}$ |
| | | 6,000-15,000 | 50 | 10 |

To meet the power density limitation a safe distance determined by the following equation is required:

$$PD_{MPE} = P_{av} * G_t / 4\pi R^2$$

Where,
*$PD_{MPE}$ = power density for maximum permissible exposure*
*$G_t$ = transmitter gain*
*$P_{av}$ = average power = peak power x duty cycle (D)*
*$R = R_{safe}$ = distance between transmitter and user*

In the case of directional scanning antennas, such as this one, the power at any point is varying with the rotation so the average power density at a fixed point is reduced by the antenna main lobe -3dB beam-width $\theta$, divided by the scanning angle.

$$Pav(Scanning) = Pav(Fixed) \times \theta/360$$

Solving for R safe distance yields

$$R_{safe} = \sqrt{\frac{P_t \cdot D \cdot Gt}{PD_{MPE} \cdot \frac{360}{\theta} \cdot 4\pi}}$$

Where,
FCC Public Limit, $PD_{MPE} = 1mW/cm^2 = 10W/m^2$
FCC Occupational Limit, $PD_{MPE} = 5mW/cm^2 = 50W/m^2$
IC Public Limit, $PD_{MPE} = 10W/m^2 = 1mW/cm^2$

The $R_{safe}$ distance for the transmitter referenced herein is as follows:

| | Model: | 21dBi Antenna | 22dBi Antenna |
|---|---|---|---|
| $P_t$ | Maximum Output Power [W]: | 4000 | 4000 |
| $D$ | Maximum Duty Cycle [%]: | 0.1 | 0.1 |
| $G_t$ | Maximum Antenna Gain [dBi]: | 21.3 | 22.6 |
| θ | Main Lobe -3dB Beam Width [Degrees]: | 5.2 | 3.7 |
| | | | |
| $R_{safe}$ | User Distance at 100W/m² [m]: | 0.08 | 0.08 |
| | User Distance at 50W/m² [m]: | 0.11 | 0.11 |
| | User Distance at 10W/m² [m]: | 0.25 | 0.24 |

Sincerely,

Scot Rogers