# 4 FCC §2.1091 & IC RSS-102 - RF Exposure

## 4.1 Applicable Standards

FCC §2.1091

(a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Exposure

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density ($mW/cm^2$) | Averaging Time (minutes) |
|---|---|---|---|---|
| **(A) Limits for Occupational/Controlled Exposures** | | | | |
| 0.3-3.0 | 614 | 1.63 | *(100) | 6 |
| 3.0-30 | 1842/f | 4.89/f | *($900/f^2$) | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1500 | / | / | f/300 | 6 |
| 1500-100,00 | / | / | 1 | 6 |
| **(B) Limits for General Population/Uncontrolled Exposure** | | | | |
| 0.3-1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34-30 | 842/f | 2.19/f | *($180/f^2$) | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | / | / | f/150 | 30 |
| 1500-100,000 | / | / | 1 | 30 |

f = frequency in MHz
* = Plane-wave equivalent power density

Note 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

According to IC RSS-102 Issue 2 section 4.4, RF Field Strength Limits for Controlled Use Devices (Controlled Environment).

| Frequency Range (MHz) | Electric Field (V/m rms) | Magnetic Field (A/m rms) | Power Density ($W/m^2$) | Time Averaging (min) |
|---|---|---|---|---|
| 0.003 - 1 | 600 | 2.19 | - | 6 |
| 1 - 10 | 600 / f | 4.9 / f | - | 6 |
| 10 - 30 | 60 | 4.9 / f | - | 6 |
| 30 – 300 | 60 | 0.163 | 10* | 6 |
| 300 – 1 500 | $3.54\ f^{0.5}$ | $0.0094f^{0.5}$ | f/30 | 6 |
| 1 500 – 15 000 | 137 | 0.364 | 50 | 6 |
| 15 000 – 150 000 | 137 | 0.364 | 50 | $616000 / f^{1.2}$ |
| 150 000- 300 000 | $0.354f^{0.5}$ | $9.4 \times 10^{-4}\ f^{0.5}$ | $3.33 \times 10^{-4}\ f$ | $616000 / f^{1.2}$ |

**Note:** *f* is frequency in MHz
* = Power density limit is applicable at frequencies greater than 100 MHz

**Antenna:**

The manufacturer does not specify an antenna. A typical vehicle antenna has a gain of 6 dBi was used with this device.This device has provisions for operation in a vehicle, or a fixed location.

**Operating Cionfiguration and exposure conditions:**

Device category: Mobile per Part 2.1091

Environment: Controlled Exposure

Typical use qualifies for a maximum duty cycle factor of 50%. The manufacturer also markets this device only for occupation use.

- Vehicle Operation: A typical vehicle installation consists of an antenna system with a coaxial cable of the type RG 58 which has a loss of 1 dB for a length of 15 feet.

## MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 37.73 |
| Maximum peak output power at antenna input terminal (mW): | 5929.3 |
| Prediction distance (cm): | 80 |
| Prediction frequency (MHz): | 160.075 |
| Maximum Antenna Gain, typical (dBi): | 6.0 |
| Maximum Antenna Gain (numeric): | 3.98 |
| Cable Loss (dB): | 1.0 |
| Power density of prediction frequency at 80 cm ($W/m^2$): | 1.17 |
| Power density of prediction frequency at 80 cm ($mW/cm^2$): | 0.117 |
| MPE limit for uncontrolled exposure at prediction frequency ($W/m^2$): | 10 |
| MPE limit for uncontrolled exposure at prediction frequency ($mW/cm^2$): | 1.0 |

Note: The conducted power output is 5.929 watt, the coax loss was taken as 1 dB, and Antenna gain was taken as 6 dBi, 50% talk time in 6 minutes

## Conclusion

The device complies with the MPE requirements by providing a safe separation distance of 80 cm between the antenna, including any radiating structure, and any persons when normally operated.

**Proposed RF exposure safety information to include in User's Manual**:

**"FCC RF Exposure Requirements":**

CAUTION:

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This device is approved with emissions having a source-based timeaveraging duty factor not exceeding 50%.

Vehicle – Antenna Installation:

- Antennas used for this transmitter must not exceed an antenna gain of 6 dBi
- For rear deck trunk and roof top installations, the antenna must be located at least 80 cm away from rear-seat passengers and bystanders in order to comply with the FCC RF exposure requirements.

The following label will be mounted in conspicuous view on the radio.