

Appendix A: RF Exposure RF Exposure FCC Rules Parts 1.1307, 1.1310, 2.1091, 2.1093

1 General Information

Environment: General Population/Uncontrolled Exposure

Device category: Disturbance sensor

Modulation Type/Mode: FMCW

Regulatory	Frequency	Environment	Limit	Averaging Time
FCC §1.1310; OET Bulletin 65	24 GHz	Uncontrolled (General Population)	10 W/m ² (1 mW/cm ²)	30 minutes

2 Antenna Operating Configuration and Test Conditions

FCC 15.245 Antenna	Simulated Antenna Gain (dBi)
Integrated Patch Array	11

Note: Simulated gain presented but not used in calculations below. Instead, the worst-case EIRP is used for RF Exposure calculations below.

Convert field strength to EIRP (in dBm or W)

For free-space radiation at 3 m distance, the relation between EIRP (in dBm) and field strength EEE (in dBμV/m) is:

$EIRP \text{ (dBm)} = E \text{ (dB}\mu\text{V/m)} - 104.77 + 20\log_{10}(d)$. At the standard test distance of 3 m: $20\log_{10}(3) = 9.54 \text{ dBm}$

$EIRP \text{ (dBm)} = 107.3 - 104.77 + 9.54 = 12.1 \text{ dBm}$

Antenna Type	Highest Peak Measured EIRP Power (dBμV/m)	Highest Peak Measured EIRP Power (dBm)	Highest Peak Measured EIRP Power (mW)
Integrated Patch Array	107.3	12.1	16

3 MPE Calculation

The maximum distance from the antenna at which MPE is met or exceeded (d), in centimeters, is calculated from the power density S, in mW/cm², transmit power P in mW, and the transmit antenna numeric gain G. The limit for general population/uncontrolled exposure from 1500-100000 MHz is 1 mW/cm².

$$S = EIRP \text{ (mW)} / (4 \cdot \pi \cdot d^2)$$

$$d = \sqrt{EIRP \text{ (mw)} / S \cdot 4\pi}$$

where: S = Power density (mW/cm²); EIRP = Effective Isotropic Radiated Power (mW); d = distance

Below is the MPE Calculation for the EUT and its integrated patch array antenna using the 1 mW/cm² power density limit for the general population/uncontrolled exposure, and the worst-case measured peak EIRP of 16 mW, and solving for distance (d) in (cm), and solving for the worst-case power density at 20 cm worst-case mobile distance is as follows:

Linear	Log
Duty % = 100	0 dB
Worst-case measured peak EIRP = 16 mW	12.1 dBm
<u>d = 1.1 cm</u>	<u>S (20cm) = 0.003183 mW/cm² / 0.0318 W/m²</u>

4 Conclusion

At a standard minimum evaluation distance of 20 cm, the measured power density (0.0032 mW/cm² / 0.032 W/m²) is over 300 times lower than the maximum permissible limit for FCC uncontrolled exposure conditions.

The EUT is compliant with FCC §1.1310 for Uncontrolled Exposure.