

RF Exposure Considerations for P3310 Module

FCC ID: FCC ID: 2ARGS-P3310

The FCC requires that the calculated MPE be equal to or less than a given limit dependent on frequency at a distance of 20 cm from a device to the body of a user.

The transmitter operation for the P3310 module covers 2.4 GHz and 5 GHz operating bands using Bluetooth and WLAN 802.11a/b/g/n/ac technologies. WLAN operation uses 2x2 MIMO.

The following FCC Rule Parts and procedures are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

Part 2.1091 – Radiofrequency radiation exposure evaluation: mobile devices

KDB447498 D01 v06

Mobile and Portable Devices RF Exposure Procedures and Equipment Authorisation Policies

MPE CONSIDERATIONS

The MPE calculation used to calculate the safe operating distance for the user is:

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

Where S = Power density

$EIRP$ = Effective Isotropic Radiated Power ($EIRP = P \times G$)

P = Conducted Transmitter Power

G = Antenna Gain (relative to an isotropic radiator)

R = distance to the centre of radiation of the antenna (safe operating distance)

Power Density Requirement (S)

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC §1.1310 (e) **for $f > 1500\text{MHz}$** :

$$S_{req} = 1.0 \text{ mW/cm}^2$$

Transmitter Powers (P)

Maximum (worst case) transmitter Powers (taken from Module grant FC ID: VOB-P3310):

Bluetooth (2402-2480MHz) = 7.3mW

2.4GHz WLAN (2412-2472MHz) = 69.8mW

5GHz WLAN (5500 – 5700MHz) = 85.3mW

Antenna Gains (G)

2.4GHz Operation = 3.73dBi (x 2.4)

5GHz Operation = 5.18dBi (x 3.3)

CALCULATIONS:

For Bluetooth

Values:

$$S_{req1} = 1.0 \text{ mW/cm}^2$$

$$\text{EIRP} = 7.3 \times 2.4 = 17.52 \text{ mW}$$

$$R = 20 \text{ cm}$$

Calculation:

$$S = 17.52 / (12.56 \times 20^2)$$

$$S = 17.52 / (5024)$$

$$S_1 = 0.0035 \text{ mW/cm}^2 (< 1.0 \text{ mW/cm}^2)$$

For WLAN 2.4GHz

Values:

$$S_{req2} = 1.0 \text{ mW/cm}^2$$

$$\text{EIRP} = 69.8 \times 2.4 = 167.52$$

$$R = 20 \text{ cm}$$

Calculation:

$$S = 167.52 / (12.56 \times 20^2)$$

$$S = 167.52 / (5024)$$

$$S_2 = 0.033 \text{ mW/cm}^2 (< 1.0 \text{ mW/cm}^2)$$

For WLAN 5GHz

Values:

$$S_{req3} = 1.0 \text{ mW/cm}^2$$

$$\text{EIRP} = 85.3 \times 3.3 = 281.49$$

$$R = 20 \text{ cm}$$

Calculation:

$$S = 281.49 / (12.56 \times 20^2)$$

$$S = 281.49 / (5024)$$

$$S_3 = 0.056 \text{ mW/cm}^2 (< 1.0 \text{ mW/cm}^2)$$

KDB447498 D01 v06 Section 7.2 SIMULTANEOUS TRANSMISSION CONSIDERATIONS

Requirement for simultaneous transmission test exclusion:

$$\sum \text{MPE}_{\text{ratios}} = (S_1 / S_{req1}) + (S_2 / S_{req2}) + \dots + (S_n / S_{reqn}) < 1.0$$

For the P3310 module:

Considering all transmitters operating with simultaneous transmission:

$$\text{ie: } \sum \text{MPE}_{\text{ratios}} = (S_1 / S_{req1}) + (S_2 / S_{req2}) + (S_3 / S_{req3})$$

$$= (0.0035 / 1.0) + (0.033 / 1.0) + (0.056 / 1.0)$$

$$= 0.093$$

\sum of MPE ratios < 1.0, so in accordance with KDB447498 Section 7.2, simultaneous transmission test exclusion applies for the P3310 transmitters.

Conclusion

The required 20cm RF exposure limits for General Population/ Uncontrolled Exposure will not be exceeded for the P3310 module using antennas having a maximum gain of 3.73 dBi for 2.4GHz operation and 5.18 dBi for 5GHz operation.