

## **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:

$$S = \text{EIRP} / 4 \pi R^2$$

**Where**

- S = Power density
- EIRP = Effective Isotropic Radiated Power (EIRP = P x 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 >1500MHz** :

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

**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:

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

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

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

Calculation:

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

$$S = 17.52/(5024)$$

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

**For WLAN 2.4GHz**

Values:

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

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

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

Calculation:

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

$$S = 167.52/(5024)$$

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

**For WLAN 5GHz****Values:**

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

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

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

**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:

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

For the P3310 module:

Considering all transmitters operating with simultaneous transmission:

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

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

$$= 0.093$$

$\sum$  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.