

RF Exposure Considerations for the PULSAR PRO PUP3

The PULSAR PRO PUP3 operates at 13.56MHz using the PATRF54 module (FCC ID 2BB8L-RFID02), and also uses a BT LE pre-certified module (FCC ID: XPYNINAB22) and a WLAN pre-certified module (FCC ID: VPYLB1ZM).

The transmitters can transmit simultaneously.

The 13.56MHz, PATRF54 module has been assessed for portable use in report 14875953-3 FCC MPE calc.pdf

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 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

PULSAR PRO PUP3 MAXIMUM TRANSMITTER POWER CONSIDERATIONS

13.56MHz:

Tx Power: +53.81 dBuV/m @3m

EIRP = 56 - 95.3dBm = -43.57 dBm

BTLE 2400 – 2483.5MHz:

Maximum declared Conducted output Power: 6.00dBm (3.98 mW)

Antenna gain: 3.0dBi

EIRP = 6 + 3 = 9dBm (7.94 mW)

WLAN:

2412 – 2484MHz:

Maximum declared Conducted output Power: 19.00dBm (79.43 mW)

Antenna gain: 2.2dBi

EIRP = 19 + 2.2 = 21.2dBm (131.83 mW)

5150 – 5850MHz:

Maximum declared Conducted output Power: 17.00dBm (50.12 mW)

Antenna gain: 5.2dBi

EIRP = 17 + 5.2 = 22.2dBm (165.96 mW)

MPE CALCULATIONS

The MPE calculation 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

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

For 13.56MHz:

Values:

EIRP = -43.57dBm = 0.000044mW

R = 20cm

Power Density Requirement

From table 1 (e) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 13.56MHz

$$S_{req1} = 180/f^2 = 0.98 \text{ mW/cm}^2$$

Calculation:

$$S = 0.000044/4 \pi R^2$$

$$S = 0.000044/ (12.56 \times 20^2)$$

$$S = 0.000044/ (5024)$$

$$S_1 = 8.8 \times 10^{-9} \text{ mW/cm}^2 (<< 0.98 \text{ mW/cm}^2)$$

(Equivalent to 1.9e-3 cm safe operating distance at the RF exposure limit of 0.98mW/cm²)

For 2.4GHz and 5 GHz:

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 2.4GHz and 5 GHz

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

BTLE

Values:

Transmitter frequency range = 2400 MHz to 2483.5 MHz

EIRP = 9dBm = 7.94mW

R = 20cm

Calculation:

$$S = 7.94/4 \pi R^2$$

$$S = 7.94/(12.56 \times 20^2)$$

$$S = 7.94/(5024)$$

$$S_2 = 0.0016 \text{ mW/cm}^2 (<1.0 \text{ mW/cm}^2)$$

(Equivalent to 0.8 cm safe operating distance at the RF exposure limit of 1.0mW/cm²)

2.4 GHz WLAN

Values:

Transmitter frequency range = 2412 MHz to 2484 MHz

EIRP = 21.2dBm = 131.83mW

R = 20cm

Calculation:

$$S = 131.83/4 \pi R^2$$

$$S = 131.83/(12.56 \times 202)$$

$$S = 131.83/(5024)$$

$$S_2 = 0.0262 \text{ mW/cm}^2 (<1.0 \text{ mW/cm}^2)$$

(Equivalent to 3.24 cm safe operating distance at the RF exposure limit of 1.0mW/cm²)

5 GHz WLAN

Values:

Transmitter frequency range = 5150 MHz to 5850 MHz

EIRP = 22.2dBm = 165.96mW

R = 20cm

Calculation:

$$S = 165.96/4 \pi R^2$$

$$S = 165.96/(12.56 \times 202)$$

$$S = 165.96/(5024)$$

$$S_2 = 0.0330 \text{ mW/cm}^2 (<1.0 \text{ mW/cm}^2)$$

(Equivalent to 3.63 cm safe operating distance at the RF exposure limit of 1.0mW/cm²)

KDB447498 D01 v06 Section 7.2 SIMULTANEOUS TRANSMISSION CONSIDERATIONS

Ref. KDB447498 Section 7.2: Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0 , As per KDB, summation of calculated MPE ratios for 13.56, BTLE WLAN 2.4GHz + 5GHz:

$$\begin{aligned} \sum \text{MPE}_{\text{ratios}} &= (S_1 / S_{\text{req1}}) + (S_2 / S_{\text{req2}}) + (S_3 / S_{\text{req3}}) \quad (2.4 \text{ GHz WLAN}) \\ &= (8.8 \times 10^{-9} / 0.98) + (0.0016 / 1.0) + (0.0262 / 1.0) \\ &= 0.0262 \end{aligned}$$

$$\begin{aligned} \sum \text{MPE}_{\text{ratios}} &= (S_1 / S_{\text{req1}}) + (S_2 / S_{\text{req2}}) + (S_3 / S_{\text{req3}}) \quad (5 \text{ GHz WLAN}) \\ &= (8.8 \times 10^{-9} / 0.98) + (0.0016 / 1.0) + (0.0330 / 1.0) \\ &= 0.0346 \end{aligned}$$

Σ of MPE ratios < 1.0 , so in accordance with KDB447498 D01 V06 Section 7.2, simultaneous transmission test exclusion applies for the transmitters.

Conclusion

The required 20cm RF exposure limits for General Population/ Uncontrolled Exposure will not be exceeded for the PULSAR PRO PUP3 in the configuration detailed in this document.

Yours faithfully,



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