



**Raspberry Pi
Trading Ltd**

Raspberry Pi Trading
3 West Wing,
The Maurice Wilkes Building,
St John's Innovation Park,
Cowley Road,
Cambridge,
CB4 0DS
UK

Web
<http://raspberrypi.org>

MPE Calculation - FCC ID: 2ABCB-RPIZ2

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 Raspberry Pi Zero 2 covers the 2.4GHz operating band.

Simultaneous transmission is not supported between any of the transmitters

The following FCC Rule Parts are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

Part 2.1091(c) – Radiofrequency radiation exposure evaluation: mobile devices

CALCULATION

The following far field power density equation is applicable:

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

Where

S = Power density

EIRP = Effective Isotropically 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)

Calculation for 2.4GHz BT (BDR/ EDR worst case):

Values:

Transmitter frequency range = 2402 – 2480MHz

P = 7.2dBm

G = 2.5dBi (x 1.78)

EIRP = 9.7dBm (9.33mW)

R = 20cm

Power Density Requirement

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

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

Calculation:

$$\begin{aligned} S &= \text{EIRP} / 4 \pi R^2 \\ &= 9.33 / (12.56 \times 20^2) \\ &= 9.33 / (5024) \end{aligned}$$

$$S_1 = 0.0019$$

(Equivalent to 0.86cm safe operating distance)

Calculation for 2.4GHz WLAN

Values:

Transmitter frequency range = 2412 – 2462MHz

P = 26dBm

G = 2.5dBi

EIRP = 28.5dBm = 707.95mW

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 1900MHz for 2.4GHz

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

Calculation:

$$\begin{aligned} S &= \text{EIRP} / 4 \pi R^2 \\ &= 707.95 / (12.56 \times 20^2) \\ &= 707.95 / (5024) \end{aligned}$$

$$S_2 = 0.1408$$

(Equivalent to 7.51cm safe operating distance)

Conclusion

The required 20cm RF exposure limits for General Population/ Uncontrolled Exposure FCC Rule Part 1.1310 limits will not be exceeded for the Raspberry Pi Zero 2 using antenna having a maximum gain of 2.5dBi.

Signed;

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Gordon Hollingworth
CPO