17 October 2023 | 14:33 BST

MPE Calculation - FCC ID: 2ABCB-RPI5

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 5 covers the 2.4GHz and 5GHz operating bands.

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:

$$S = EIRP/(4 * \pi * R^2)$$

Where S = Power density

EIRP = Effective Isotropic Radiated Power (EIRP = P * 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 = 7.0dBm (including max. tune up tolerance)

G = 3.5dBi

EIRP = 10.5dBm = 11.22mW

R = 20cm

Power Density Requirement

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

S_{req1} = 1.0 mW/cm^2

Calculation:

$S = EIRP/(4 * \pi * R^2)$

$= 11.22/(4 * \pi * 20^2)$

$S_1 = 0.0022$

(Equivalent to 0.94cm safe operating distance)

Calculation for 2.4GHz BT LE

Values:

Transmitter frequency range = 2402 – 2480MHz

P = 4.77dBm (including max. tune up tolerance)

G = 3.5dBi

EIRP = 8.27dBm = 6.71mW

R = 20cm

Power Density Requirement

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

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

Calculation:

$S = EIRP/(4 * \pi * R^2)$

$= 6.71/(4 \times \pi \times 20^2)$

$S_2 = 0.0013$

(Equivalent to 0.73 cm safe operating distance)

Calculation for 2.4GHz WLAN

Values:

Transmitter frequency range = 2412 – 2462MHz

P = 13.41dBm (including max. tune up tolerance)

G = 3.5dBi

EIRP = 16.91dBm = 49.1mW

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_{req3} = 1.0 mW/cm^2

Calculation:

$S = EIRP/(4 * \pi * R^2)$

$= 49.1/(4 * \pi * 20^2)$

S_3 = 0.0098

(Equivalent to 1.98cm safe operating distance)

Calculation for 5.0GHz WLAN

Values:

Transmitter frequency range = 5170 – 5825MHz

P = 14.84dBm (including max. tune up tolerance)

G = 2.5dBi

EIRP = 17.34dBm = 54.2mW

R = 20cm

Power Density Requirement

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

S_{req4} = 1.0 mW/cm^2

Calculation:

$S = EIRP/(4 * \pi * R^2)$

$= 54.2/(4 * \pi * 20^2)$

$S_4 = 0.011$

(Equivalent to 2.08cm 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 5 using antennas having a maximum gain of 3.5dBi (2.4GHz) and 2.5dBi (5GHz).

DocuSigned by:

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James Adams

Chief Operating Officer

17 October 2023 | 14:33 BST