Raspberry Pi Trading
30 Station Road
Cambridge
CB1 2JH
UK

Web
http://raspberrypi.org

MPE Calculation - FCC ID:2ABCB-RPI3BP

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 3 Model B+ 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 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 = 11.6dBm

G = 3.5dBi (x 2.24)

EIRP = 15.1dBm (32mW)

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_{req1} = 1.0 mW/cm^2

Calculation:

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

$= 32/(12.56 \times 20^2)$

$= 32/(5024)$

S_1 = 0.0064

(Equivalent to 1.6cm safe operating distance)

Calculation for 2.4GHz WLAN

Values:

Transmitter frequency range = 2412 – 2462MHz

P = 14.7dBm

G = 3.5dBi

EIRP = 18.2dBm = 66.1mW

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_{req2} = 1.0 mW/cm^2

Calculation:

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

$= 66.1/(12.56 \times 20^2)$

$= 66.1/(5024)$

$S_2 = 0.013$

(Equivalent to 2.3cm safe operating distance)

Calculation for 5.0GHz WLAN

Values:

Transmitter frequency range = 5170 - 5825MHz

P = 14.0dBm

G = 2.3dBi

EIRP = 16.3dBm = 42.7mW

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 1900MHz for 5GHz

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

Calculation:

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

$= 42.7/(12.56 \times 20^2)$

$= 42.7/(5024)$

$S_3 = 0.0084$

(Equivalent to 1.84cm 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 3 Model B+ using an antenna having a maximum gain of 3.5dBi (2.4GHz) and 2.3dBi (5GHz).