

INTERTEK TESTING SERVICES

RF Exposure

The equipment under test (EUT) is a Wireless Module with Bluetooth 5.0 (single-mode) function operating in 2402-2480MHz, 2.4G WIFI function operating in 2412-2462MHz and 5G WIFI function operating in 5150MHz~5250 MHz, 5250MHz~5350MHz, 5470MHz-5725MHZ, 5725MHz~5850MHz. The EUT is powered by DC 3.3V. For more detail information pls. refer to the user manual.

Bluetooth Version: 5.0 BLE mode.

Antenna Type: On-board Antenna.

Antenna Gain: 1.85dBi.

Modulation Type: GFSK.

The normal conducted output power is 6.0dBm (tolerance: +/-2dB).

The maximum conducted output power for the EUT is 5.15dBm in the frequency 2.402GHz which is within the production variation.

The minimum conducted output power for the EUT is 4.95dBm in the frequency 2.480GHz which is within the production variation.

According to FCC Part 2.1091, this unlicensed transmitting devices is categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, According to the KDB 447498 and OET 65, the simple calculation as below:

The source-based time maximum radiated power = 8dBm+1.85 = 9.85dBm = 9.7mW

Power density (S) is calculated by the following formula:

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

$$E.I.R.P = P * G$$

Where, S = Power density (mW/cm²)

P = Output power to antenna (mW)

R = Distance between radiating structure and observation point (cm)

G = Gain of antenna in numeric

$$\pi = 3.14$$

As the measured power density at 20cm from the transmitter

$$S = E.I.R.P / 4 \pi R^2 = 0.0019 \text{ mW/cm}^2$$

2.4GHz Wi-Fi

Antenna Type: On-board Antenna

Antenna Gain: 1.85dBi

Modulation Type: CCK, BPSK, QPSK, 16QAM, 64QAM

802.11B: The nominal conducted output power specified: 18dBm (Tolerance: +/-2dB).

802.11G: The nominal conducted output power specified: 14dBm (Tolerance: +/-2dB).

802.11N20: The nominal conducted output power specified: 13dBm (Tolerance: +/-2dB).

The maximum conducted output power for the EUT is 19.0dBm in the frequency 2.462GHz 802.11B mode which is within the production variation.

The minimum conducted output power for the EUT is 13.0dBm in the frequency 2.412GHz 802.11N20 mode which is within the production variation.

According to FCC Part 2.1091, this unlicensed transmitting devices is categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, According to the KDB 447498 and OET 65, the simple calculation as below:

The source-based time maximum radiated power = 20dBm+1.85= 21.85dBm = 153.1mW

Power density (S) is calculated by the following formula:

$$S = (P * G) / 4 \Pi R^2$$

$$E.I.R.P = P * G$$

Where, S = Power density (mW/cm²)

P = Output power to antenna (mW)

R = Distance between radiating structure and observation point (cm)

G = Gain of antenna in numeric

$$\Pi = 3.14$$

As the measured power density at 20cm from the transmitter

$$S = E.I.R.P / 4 \Pi R^2 = 0.0305 \text{ mW/cm}^2$$

5GHz Wi-Fi:

Antenna Type: On-board Antenna.

Antenna Gain: 1.52dBi

Modulation Type: BPSK, QPSK, 16QAM, 64QAM and OFDM.

The nominal conducted output power specified: 12dBm (Tolerance: +/-2dB).

The maximum conducted output power for the EUT is 13.96dBm in the frequency 5260MHz (802.11 N-HT20 mode) which is within the production variation.

The minimum conducted output power for the EUT is 11.14dBm in the frequency 5320MHz (802.11 A, SISO mode) which is within the production variation.

According to FCC Part 2.1091, this unlicensed transmitting device is categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, According to the KDB 447498 and OET 65, the simple calculation as below:

The source-based time maximum radiated power= 14dBm + 1.52 = 15.52dbm
= 44.9mW

Power density (S) is calculated by the following formula:

$$S = (P * G) / 4 \Pi R^2$$

$$E.I.R.P = P * G$$

Where, S = Power density (mW/cm²)

P = Output power to antenna (mW)

R = Distance between radiating structure and observation point (cm)

G = Gain of antenna in numeric

$$\Pi = 3.14$$

As the measured power density at 20cm from the transmitter

$$S = E.I.R.P / 4 \Pi R^2 = 0.0071 \text{ mW/cm}^2$$

For Simultaneous transmitting of 2.4GHz Wi-Fi and Bluetooth, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = $0.0305/1 + 0.0019/1 = 0.0324 < 1$

For Simultaneous transmitting of 5GHz Wi-Fi and Bluetooth, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = $0.0071/1 + 0.0019/1 = 0.0090 < 1$

For Simultaneous transmitting of 5GHz Wi-Fi and 2.4GHz Wi-Fi, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = $0.0071/1 + 0.0305/1 = 0.0376 < 1$

For Simultaneous transmitting of 5GHz Wi-Fi and 2.4GHz Wi-Fi and Bluetooth, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = $0.0071/1 + 0.0305/1 + 0.0019/1 = 0.0395 < 1$

Since the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in the device is ≤ 1.0 , the EUT is considered to satisfy MPE compliance for simultaneous transmission operations.

The following RF exposure statement or similar sentence is proposed to be included in the user manual:

“FCC RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons.”