

# INTERTEK TESTING SERVICES

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## RF Exposure

The equipment under test (EUT) is a Wireless Module with Bluetooth 4.1 (dual-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 5V. For more detail information pls. refer to the user manual..

Bluetooth Version: 4.1 EDR mode.

Antenna Type: Integral antenna.

Antenna Gain: 1.6dBi.

Modulation Type: GFSK,  $\pi/4$ DQPSK, 8DPSK.

The nominal radiated output power (e.i.r.p) specified: 8.0dBm (+/- 2dB)

According to the KDB 447498:

The maximum peak radiated emission for the EUT is 104.3dB $\mu$ V/m at 3m in the frequency 2441MHz

The EIRP =  $[(E \cdot D)^2 / 30] W = 9.07dBm$

which is within the production variation.

The minimum peak radiated emission for the EUT is 102.7dB $\mu$ V/m at 3m in the frequency 2402MHz

The EIRP =  $[(E \cdot D)^2 / 30] W = 7.47dBm$

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 averaged maximum radiated power = 8dBm + 2db  
= 10.0mW

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

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

$$E.I.R.P = P \cdot G$$

Where, S = Power density (mW/cm<sup>2</sup>)

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

$$S = 10 / 4 \pi R^2 = 0.0020$$

Bluetooth Version: 4.1 BLE mode.

Antenna Type: Integral antenna.

Antenna Gain: 1.6dBi.

Modulation Type: GFSK.

The nominal radiated output power (e.i.r.p) specified: 6.0dBm (+/- 2dB)

The maximum peak radiated emission for the EUT is 103.0dB $\mu$ V/m at 3m in the frequency 2402MHz

The EIRP =  $[(E \cdot D)^2 / 30] W = 7.77\text{dBm}$

which is within the production variation.

The minimum peak radiated emission for the EUT is 100.1dB $\mu$ V/m at 3m in the frequency 2480MHz

The EIRP =  $[(E \cdot D)^2 / 30] W = 4.87\text{dBm}$

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 averaged maximum radiated power = 6dbm +2dB  
=6.30mW

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

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

$$E.I.R.P = P \cdot G$$

Where, S = Power density (mW/cm<sup>2</sup>)

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

$$S = 6.3 / 4 \Pi R^2 = 0.0013$$

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Antenna Type: Integral Antenna  
Antenna Gain: 2.0dBi for each antenna  
MIMO Gain: 5.0dBi  
Modulation Type: CCK, BPSK, QPSK, 16QAM, 64QAM  
The normal conducted output power is 20.0dBm (tolerance: +/-4dB).

The maximum conducted output power for the EUT is 23.92dBm in the frequency 2.437GHz 802.11n-HT40 MIMO mode which is within the production variation.

The minimum conducted output power for the EUT is 17.1dBm in the frequency 2.462GHz 802.11b mode ANT2 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 averaged maximum radiated power = 20dBm+4dB+5= 29dBm = 794.3mW

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/cm<sup>2</sup>)

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

$$S = 10 / 4 \Pi R^2 = 0.1581$$

5GHz Wi-Fi:

Antenna Type: Integral Antenna.

Antenna Gain: 2.0dBi for each antenna

MIMO Gain: 5.0dBi

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

The nominal conducted output power specified: 11dBm (Tolerance: +/-4dB).

The minimum conducted output power for the EUT is 13.73dBm in the frequency

5180MHz (802.11 n-HT20, SISO mode) which is within the production variation.

The maximum conducted output power for the EUT is 7.23dBm in the frequency

5700MHz (802.11 a 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= 15dBm + 2dB + 5dB = 22dbm = 158.5mW

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/cm<sup>2</sup>)

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

$$S = 10 / 4 \Pi R^2 = 0.0315$$

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 =  $0.1581/1 + 0.0020/1 = 0.1601 < 1$

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 =  $0.0315/1 + 0.0020/1 = 0.0335 < 1$

Since the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in the device is  $\leq 1.0$ , 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.”