RF Exposure

The equipment under test (EUT) is a Wireless Module with Bluetooth 5.1 (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 poweredby DC 5V. For more detail information pls. refer to the user manual..

Bluetooth Version: 5.1 EDR mode.
Antenna Type: Integral antenna.
Antenna Gain: 2.43dBi.
Modulation Type: GFSK, π/4DQPSK, 8DPSK.
The nominal radiated output power (e.i.r.p) specified: 8.0dBm (+/- 3dB)

According to the KDB 447498:
The maximun peak radiated emission for the EUT is 105.1dBμV/m at 3m in the frequency 2402MHz
The EIRP = [(E*D) ^2 / 30] W = 9.87dBm
which is within the production variation.

The minimum peak radiated emission for the EUT is 101.6dBμV/m at 3m in the frequency 2480MHz
The EIRP = [(E*D) ^2 / 30] W = 6.37dBm
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 + 3db
=11dBm= 12.6mW

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^2)
P = Output power to antenna (mW)
R = Distance between radiating structure and observation point (cm)
G = Gain of antenna in numeric
Π = 3.14
As the measured power density at 20cm from the transmitter
$S= E.I.R.P /4\Pi R^2$=0.0025 mW/cm^2

Bluetooth Version: 5.1 BLE mode.
Antenna Type: Integral antenna.
Antenna Gain: 2.43dBi.
Modulation Type: GFSK.
The normal conducted output power is 6.0dBm (tolerance: +/-3dB).

The maximum conducted output power for the EUT is 6.22dBm in the frequency 2.402GHz which is within the production variation.

The minimum conducted output power for the EUT is 5.23dBm 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 = 9dBm+2.43 = 11.43dBm = 13.9mW

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/cm^2)
P = Output power to antenna (mW)
R = Distance between radiating structure and observation point (cm)
G = Gain of antenna in numeric
Π = 3.14
As the measured power density at 20cm from the transmitter
$S= E.I.R.P /4\Pi R^2$=0.0028 mW/cm^2

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Antenna Type: Integral Antenna
Antenna Gain: 3.1dBi for each antenna
MIMO Gain: 6.1dBi
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 23.4dBm 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 2.412GHz 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 maximum radiated power = 24dBm+6.1= 30.1dBm = 1023.3mW

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^2)
P = Output power to antenna (mW)
R = Distance between radiating structure and observation point (cm)
G = Gain of antenna in numeric
Π = 3.14
As the measured power density at 20cm from the transmitter
$S= E.I.R.P /4\Pi R^2$=0.2037 mW/cm^2

5GHz Wi-Fi:
Antenna Type: Integral Antenna.
Antenna Gain: 2.3dBi for each antenna
MIMO Gain: 5.3dBi
Modulation Type: BPSK, QPSK, 16QAM, 64QAM and OFDM.
The nominal conducted output power specified: 10dBm (Tolerance: +/-7dB).

The minimum conducted output power for the EUT is 3.63dBm in the frequency 5200MHz (802.11 AC-HT20, SISO mode) which is within the production variation.

The maximum conducted output power for the EUT is 16.6dBm in the frequency 5795MHz (802.11 N40 MIMO 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= 17dBm + 5.3 = 22.3dbm = 169.8mW

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^2)
P = Output power to antenna (mW)
R = Distance between radiating structure and observation point (cm)
G = Gain of antenna in numeric
Π = 3.14
As the measured power density at 20cm from the transmitter
$S= E.I.R.P /4\Pi R^2$=0.0338 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 = 0.2037/1 + 0.0028/1 = 0.2065 < 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 = 0.0338/1 + 0.0028/1 = 0.0366< 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.”