RF Exposure

The Equipment Under Test (EUT) is a WIFI module which has Bluetooth and WiFi function, and WiFi operating at 2412-2462MHz for 802.11b/g/n-HT20, 11 channels with 5MHz channel spacing; 2422-2452MHz for 802.11n-HT20, 7 channels with 5MHz channel spacing. The EUT was powered DC 3.3V. For more detailed features description, please refer to the user's manual.

Bluetooth Version: 2.1+EDR, 4.2, 5.0(Dual-mode)
Antenna Type: Integral antenna.
Antenna Gain: 3.1dBi.
Modulation Type: GFSK.
The nominal conducted output power specified: -6.1dBm (+/-3dB)
The nominal radiated output power (e.i.r.p) specified: -3.0dBm (+/- 3dB)

According to the KDB 447498:

The maximun peak radiated emission for the EUT is 95.1dBμV/m at 3m in the frequency 2440MHz(BLE mode)
The EIRP = [(FS*D) ^2 / 30] mW = -0.13dBm
which is within the production variation.

The minimum peak radiated emission for the EUT is 90.8dBμV/m at 3m in the frequency 2480MHz(EDR mode)
The EIRP = [(FS*D) ^2 / 30] mW = -4.43dBm
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 maximun radiated output power specified is 0dBm = 1 mW

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna for 2.4GHz band can be calculated according to OET 65 as follow:
= 1mW/ 4πR^2
= 0.0002 mW/cm^2

The MPE limit is 1.0 mW/cm^2 for general population and uncontrolled exposure in the Bluetooth frequency range according to FCC Part 1.1310. As the measured power density at 20cm from the transmitter is lower than the MPE limit, the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter's radiating structure and body of the user or nearby persons.

2.4GHz WiFi:
Antenna Type: Integral Antenna.
Antenna Gain: 3.4dBi.
Directional Gain: 6.4dBi
Modulation Type: BPSK, QPSK, 16QAM, 64QAM, CCK, DQPSK, DBPSK and DSSS, OFDM.
The nominal conducted output power specified: 19dBm (Tolerance: +/-4dB).

According to the KDB 447498:

The maximun conducted emission for the EUT is 20.82dBm in the frequency 2422MHz(IEEE 802.11n-40, MIMO mode) which is within the production variation.

The minimum conducted emission for the EUT is 16.57dBm in the frequency 2412MHz(IEEE 802.11b, SISO 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 averaged maximum radiated power in MIMO mode = 19+4+6.4= 29.4dBm = 870.96mW

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna for 2.4GHz band can be calculated according to OET 65 as follow:
= 870.96/ 4πR^2
= 0.173 mW/cm^2

The MPE limit is 1.0 mW/cm^2 for general population and uncontrolled exposure in the Bluetooth frequency range according to FCC Part 1.1310. As the measured power density at 20cm from the transmitter is lower than the MPE limit, the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter's radiating structure and body of the user or nearby persons.

For Simultaneous transmitting of 2.4GHz WiFi 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 = 0.0002mW/1mW + 0.173mW/1mW = 0.1732 < 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.”