RF Exposure

The Equipment Under Test (EUT) is an ONN 32" 2.1 Soundbar which has 2.4G SRD, Bluetooth and Wi-Fi function. The 2.4G SRD module carry with double antennas, but it can't transmit at the same time. The EUT was powered DC 18V/2A through an adapter. Bluetooth and Wi-Fi transmitters are share one antenna while they cannot transmit simultaneously. For more detailed features description, please refer to the user's manual.

Standalone evaluation for BT function
Bluetooth Version: 4.2 EDR
Antenna Type: Integral antenna.
Antenna Gain: 5.5dBi.
Modulation Type: GFSK, π/4DQPSK, 8DPSK.
The nominal conducted output power specified: 1.5dBm (+/-4dB)
The nominal radiated output power (e.i.r.p) specified: 7dBm (+/- 4dB)

The maximun peak radiated emission for the EUT is 105.4dBμV/m at 3m in the frequency 2402MHz
The EIRP = [(FS*D) ^2 / 30] mW = 10.17dBm
which is within the production variation.

The minimum peak radiated emission for the EUT is 99.3dBμV/m at 3m in the frequency 2480MHz
The EIRP = [(FS*D) ^2 / 30] mW = 4.07dBm
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 = 11dBm = 12.6mW

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:
= 12.6mW/ 4πR^2
= 0.003 mW/cm^2
<1mW/cm^2

Bluetooth Version: 4.2 BLE
Antenna Type: Integral antenna.
Antenna Gain: 5.5dBi.
Modulation Type: GFSK
The nominal conducted output power specified: 3dBm (+/-3dB).
The nominal radiated output power (e.i.r.p) specified: 8.5dBm (+/- 3dB)

The maximun conducted output power for the EUT is 3.51dBm in the frequency 2402MHz which is within the production variation.

The minimum conducted output power for the EUT is 2.93dBm in the frequency 2480MHz 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 = 11.5dBm = 14.1mW

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:
= 14.1mW/ 4πR^2
= 0.003 mW/cm^2
<1mW/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.

Standalone evaluation for WIFI function

2.4GHz Wi-Fi:
Antenna Type: Integral Antenna.
Antenna Gain: 5.5dBi.
Modulation Type: CCK, BPSK, QPSK, 16QAM, 64QAM, DQPSK, DBPSK.
The nominal conducted output power specified: 22dBm (Tolerance: +/-4dB).

The maximun conducted output power for the EUT is 25.03dBm in the frequency 2462MHz(IEEE 802.11g) which is within the production variation.

The minimum conducted output power for the EUT is 19.95dBm in the frequency 2412MHz(IEEE 802.11b) 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 = 22+4+5.5= 31.5dBm = 1412.5mW

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna for 2.4GHz WIFI band can be calculated according to OET 65 as follow:
= 1412.5/ 4πR^2
= 0.281 mW/cm^2
<1mW/cm^2

5GHz Wi-Fi:
Antenna Type: Integral Antenna.
Antenna Gain: 6dBi.
Modulation Type: BPSK, QPSK, 16QAM, 64QAM and OFDM.
The nominal conducted output power specified: 16dBm (Tolerance: +/-3dB).

The maximun conducted output power for the EUT is 18.84dBm in the frequency 5230MHz(IEEE 802.11ac-HT40) which is within the production variation.

The minimum conducted output power for the EUT is 14.06dBm in the frequency 5755MHz(IEEE 802.11n-HT40) which is within the production variation.

The source-based time averaged maximum radiated power = 16+3+6= 25dBm = 316.2mW

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna for 5GHz WIFI band can be calculated according to OET 65 as follow:
= 316.2mW/ 4πR^2
= 0.063 mW/cm^2
<1mW/cm^2

The MPE limit is 1.0 mW/cm^2 for general population and uncontrolled exposure in the WIFI 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.

2.4G SRD:
Antenna Type: Integral antenna.
Antenna Gain: 4.8dBi.
Modulation Type: Pi/4 DQPSK
The nominal conducted output power specified: 3dBm (+/-3dB).
The nominal radiated output power (e.i.r.p) specified: 7.8dBm (+/- 3dB)

The maximun conducted output power for the EUT is 3.56dBm in the frequency 2403.35MHz of ANT1 which is within the production variation.

The minimum conducted output power for the EUT is 2.55dBm in the frequency 2403.35MHz of ANT0 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 = 10.8dBm = 12.0mW

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:
= 12.0mW/ 4πR^2
= 0.002 mW/cm^2
<1mW/cm^2

The MPE limit is 1.0 mW/cm^2 for general population and uncontrolled exposure in the 2.4GHz 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.

Simultaneous Transmission Evaluation

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

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = 0.281/1 + 0.063/1 = 0.344 < 1

For Simultaneous transmitting of 2.4GHz WiFi and 2.4G SRD, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = 0.281/1 + 0.002/1 = 0.283 < 1

For Simultaneous transmitting of 5GHz WiFi and 2.4G SRD, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = 0.063/1 + 0.002/1 = 0.065< 1

For Simultaneous transmitting of 2.4GHz WiFi, 2.4G SRD and 5GHz WiFi, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = 0.281/1 + 0.002/1 + 0.063/1 = 0.346< 1

For Simultaneous transmitting of Bluetooth and 2.4G SRD, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = 0.003/1 + 0.002/1 = 0.005< 1

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