

INTERTEK TESTING SERVICES

RF Exposure

The equipment under test (EUT) is a Soundbar with Bluetooth, 2.4G SRD, and WiFi functions. The 2.4G SRD module carry with double antennas, but they can't transmit at the same time. Bluetooth and Wi-Fi transmitters are share one antenna while they cannot transmit simultaneously. The EUT is powered by AC 120V/60Hz. The device will automatically discontinue transmission in case of either absence of information to transmit or operational failure. When the soundbar is absence of information to transmit or operational failure, the power supply of WIFI transmitter module will shut off, so that the EUT can't enter the work state, so as to stop transmitting the information. For more detailed features description, please refer to the user's manual.

Standalone SAR evaluation for BT function

Bluetooth Version: 5.0 BDR/EDR

Antenna Type: Integral antenna.

Antenna Gain: 3.4dBi.

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

The nominal conducted output power specified: 0dBm (+/-3dB)

The nominal radiated output power (e.i.r.p) specified: 3.4dBm (+/- 3dB)

The maximum peak radiated emission for the EUT is 100.4dB μ V/m at 3m in the frequency 2402MHz

The EIRP = $[(FS \cdot D)^2 / 30]$ mW = 5.17dBm

which is within the production variation.

The minimum peak radiated emission for the EUT is 98.5dB μ V/m at 3m in the frequency 2480MHz

The EIRP = $[(FS \cdot D)^2 / 30]$ mW = 3.27dBm

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 = 6.4dBm = 4.4mW

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:

$$= 4.4\text{mW} / 4\pi R^2$$

$$= 0.0009 \text{ mW/cm}^2$$

$$< 1\text{mW/cm}^2$$

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Bluetooth Version: 5.0 BLE mode

Antenna Type: Integral antenna.

Antenna Gain: 3.4dBi.

Modulation Type: GFSK

The nominal conducted output power specified: -3dBm (+/-3dB).

The nominal radiated output power (e.i.r.p) specified: 0.4dBm (+/- 3dB)

The maximum peak radiated emission for the EUT is 93.2dB μ V/m at 3m in the frequency 2402MHz

The EIRP = $[(FS \cdot D)^2 / 30]$ mW = -2.03dBm

which is within the production variation.

The minimum peak radiated emission for the EUT is 93.1dB μ V/m at 3m in the frequency 2440MHz

The EIRP = $[(FS \cdot D)^2 / 30]$ mW = -2.13dBm

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 = 3.4dBm = 2.2mW

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:

$$= 2.2\text{mW} / 4\pi R^2$$

$$= 0.0004 \text{ mW/cm}^2$$

$$< 1\text{mW/cm}^2$$

The MPE limit is 1.0 mW/cm² 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.

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Standalone SAR evaluation for WIFI function

2.4GHz WiFi:

Antenna Type: Integral Antenna.

Antenna Gain: 3.4dBi.

Modulation Type: BPSK, QPSK, 16QAM, 64QAM, CCK, DQPSK, DBPSK and DSSS.

The nominal conducted output power specified: 18dBm (Tolerance: +/-4dB).

The maximum conducted output power for the EUT is 20.7dBm in the frequency 2412MHz(IEEE 802.11b) which is within the production variation.

The minimum conducted output power for the EUT is 16.1dBm in the frequency 2437MHz(IEEE 802.11n-HT40) 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 = $18+4+3.4= 25.4\text{dBm} = 346.7\text{mW}$

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna for 2.4GHz WIFI band can be calculated according to OET 65 as follow:

$$= 346.7 / 4\pi R^2$$

$$= 0.069 \text{ mW/cm}^2$$

$$< 1\text{mW/cm}^2$$

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.

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5GHz WiFi:

Antenna Type: Integral Antenna.

Antenna Gain: 3.3dBi.

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

The nominal conducted output power specified: 12.5dBm (Tolerance: +/-4.5dB).

The maximum conducted output power for the EUT is 16.9dBm in the frequency 5200MHz(IEEE 802.11n-HT20) which is within the production variation.

The minimum conducted output power for the EUT is 8.27dBm in the frequency 5795MHz(IEEE 802.11ac-HT40) which is within the production variation.

The source-based time averaged maximum radiated power = $12.5+4.5+3.3= 20.3\text{dBm} = 107.2\text{mW}$

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:

$$= 107.2\text{mW} / 4\pi R^2$$

$$= 0.021 \text{ mW/cm}^2$$

$$< 1\text{mW/cm}^2$$

The MPE limit is 1.0 mW/cm^2 for general population and uncontrolled exposure in the 5GHz 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.

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Standalone SAR evaluation for 2.4G SRD

2.4GHz SRD:

Antenna Type: Integral Antenna.

Antenna Gain: 3.8dBi.

Modulation Type: GFSK.

The nominal conducted output power specified: 0dBm (Tolerance: +/-3dB).

The maximum conducted output power for the EUT is 0.93dBm in the frequency 2403.35MHz which is within the production variation.

The minimum conducted output power for the EUT is -0.01dBm in the frequency 2477.35MHz 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 = $0+3+3.8= 6.8\text{dBm} = 4.8\text{mW}$

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna for 2.4GHz WIFI band can be calculated according to OET 65 as follow:

$$= 4.8 / 4\pi R^2$$

$$= 0.001 \text{ mW/cm}^2$$

$$< 1\text{mW/cm}^2$$

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.

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Simultaneous Transmission SAR 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 = $0.069/1 + 0.021/1 = 0.09 < 1$

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 = $0.069/1 + 0.001/1 = 0.07 < 1$

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 = $0.021/1 + 0.001/1 = 0.022 < 1$

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 = $0.069/1 + 0.021/1 + 0.001/1 = 0.091 < 1$

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 = $0.0009/1 + 0.001/1 = 0.0019 < 1$

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.”