

INTERTEK TESTING SERVICES

RF Exposure

The equipment under test (EUT) is an onn. 4K Streaming Box with Bluetooth 5.0 (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 from an adapter. For more detail information pls. refer to the user manual.

Bluetooth Version: 5.0

Antenna Type: Integral antenna.

Antenna Gain: 2.29dBi.

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

The nominal radiated output power (e.i.r.p) specified: -3.5dBm (+/- 3dB)

According to the KDB 447498:

The maximum peak radiated emission for the EUT is 89.2dB μ V/m at 3m in the frequency 2402MHz (EDR mode)

The EIRP = $[(FS \cdot D)^2 / 30]$ mW = -6.03dBm
which is within the production variation.

The minimum peak radiated emission for the EUT is 90.8dB μ V/m at 3m in the frequency 2480MHz (BLE mode)

The EIRP = $[(FS \cdot D)^2 / 30]$ 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 source-based time averaged maximum radiated power = -0.5dBm = 0.89mW

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna for 5.0 BLE mode can be calculated according to OET 65 as follow:

$$\begin{aligned} &= 0.89\text{mW} / 4\pi R^2 \\ &= 0.0002 \text{ mW/cm}^2 \\ &< 1\text{mW/cm}^2 \end{aligned}$$

The MPE limit is 1.0 mW/cm² 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.

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2.4GHz WiFi:

Antenna Type: Integral Antenna.

Antenna1 Gain: 2.78dBi. Antenna2 Gain: 2.61dBi. MIMO:5.7dBi

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

The nominal conducted output power specified: 23dBm (Tolerance: +/-3dB).

The maximum conducted output power for the EUT is 27.0dBm in the frequency 2437MHz(IEEE 802.11n-HT20) which is within the production variation.

The minimum conducted output power for the EUT is 20.9dBm 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 = 26dBm +5.7dBi = 31.7dBm = 1479.11mW

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:

$$= 849.18\text{mW} / 4\pi R^2$$

$$= 0.2944 \text{ mW/cm}^2$$

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

The MPE limit is 1.0 mW/cm² for general population and uncontrolled exposure in the 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.

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5GHz WiFi:

Antenna Type: Integral Antenna.

Antenna1 Gain: 4.34dBi. Antenna2 Gain: 4.02dBi. MIMO: 7.19dBi.

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

The nominal conducted output power specified: 16dBm (Tolerance: +3dB/-10dB).

The maximum conducted output power for the EUT is 19.5dBm in the frequency 5775MHz(IEEE 802.11 ac-HT80) which is within the production variation.

The minimum conducted output power for the EUT is 6.54dBm in the frequency 5320MHz(IEEE 802.11 ac-HT20) 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 = 18dBm +7.19dBi = 25.19dBm =330.37mW

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:

$$\begin{aligned} &= 330.37\text{mW} / 4\pi R^2 \\ &= 0.0658 \text{ mW/cm}^2 \\ &<1\text{mW/cm}^2 \end{aligned}$$

The MPE limit is 1.0 mW/cm² 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.

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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 = $0.2944/1 + 0.0658/1 = 0.3602 < 1$

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 = $0.2944/1 + 0.0002/1 = 0.2946 < 1$

For Simultaneous transmitting of 5GHz 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 = $0.0658/1 + 0.0002/1 = 0.0660 < 1$

For Simultaneous transmitting of 2.4GHz WiFi, Bluetooth 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 = $0.2944/1 + 0.0002/1 + 0.0658/1 = 0.3604 < 1$

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.”