

RF Exposure

The Equipment Under Test (EUT) is a Smart Mirror with 2.4G Wi-Fi function operating at 2412-2462MHz, 5G Wi-Fi function operating in 5150MHz~5250MHz, 5725MHz~5850MHz and Bluetooth 5.0 (dual-mode) function operating in 2402-2480MHz. The EUT is powered by AC120V/60Hz. For more detail information pls. refer to the user manual.

Bluetooth Version: 5.0 EDR mode.

Antenna Type: Integral antenna.

Antenna Gain: 4.21dBi.

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

The nominal radiated output power (e.i.r.p) specified: 6.0dBm (± 2 dB)

According to the KDB 447498:

The maximum peak radiated emission for the EUT is 102.7dB μ V/m at 3m in the frequency 2402MHz (EDR mode)

The EIRP = $[(FS^*D)^2 / 30]$ mW = 7.47dBm
which is within the production variation.

The minimum peak radiated emission for the EUT is 99.7dB μ V/m at 3m in the frequency 2480MHz (EDR mode)

The EIRP = $[(FS^*D)^2 / 30]$ mW = 4.47dBm
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 = 6.31mW

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:

$$\begin{aligned} &= 6.31\text{mW} / 4\pi R^2 \\ &= 0.0013 \text{ mW/cm}^2 \\ &< 1\text{mW/cm}^2 \end{aligned}$$

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.

Bluetooth Version: 5.0BLE mode.

Antenna Type: Integral antenna.

Antenna Gain: 4.21dBi.

Modulation Type: GFSK.

The nominal radiated output power (e.i.r.p) specified: 6.0dBm (± 2 dB)

According to the KDB 447498:

The maximum peak radiated emission for the EUT is 102.9dB μ V/m at 3m in the frequency 2402MHz (EDR mode)

The EIRP = $[(FS^*D)^2 / 30]$ mW = 7.67dBm

which is within the production variation.

The minimum peak radiated emission for the EUT is 100.3dB μ V/m at 3m in the frequency 2480MHz (EDR mode)

The EIRP = $[(FS^*D)^2 / 30]$ mW = 4.77dBm

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 = 6.31mW

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:

$$= 6.31\text{mW} / 4\pi R^2$$

$$= 0.0013 \text{ mW/cm}^2$$

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

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

ANT1: 4.28dBi

ANT2: 4.21dBi

Directional gain: 7.26dBi

Modulation Type: BPSK, QPSK, 16QAM, 64QAM for OFDM; CCK, DQPSK, DBPSK for DSSS.

The nominal conducted output power specified: 24dBm (Tolerance: ± 5 dB).

The maximum conducted output power for the EUT is 28.72dBm in the frequency 2437MHz(IEEE 802.11n40 MIMO) which is within the production variation.

The minimum conducted output power for the EUT is 20.30dBm in the frequency 2412MHz(IEEE 802.11b ANT1) 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 = 29dBm + 7.26dBi = 36.26dBm = 4226.69mW

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:

$$= 4226.69\text{mW} / 4\pi R^2$$

$$= 0.8413 \text{ mW/cm}^2$$

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.

5GHz WiFi:

Antenna Type: Integral Antenna.

Antenna Gain:

ANT1: 4.93dBi,

ANT2: 5.53dBi

Directional gain: 8.25dBi

Modulation Type: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)

The nominal conducted output power specified: 15dBm (Tolerance: ± 5 dB).

The maximum conducted output power for the EUT is 19.00dBm in the frequency 5775MHz(IEEE 802.11 ac80 MIMO) which is within the production variation.

The minimum conducted output power for the EUT is 10.23dBm in the frequency 5200MHz(IEEE 802.11 ac20 MIMO) 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 = 20dBm + 8.25dBi = 28.25dBm = 668.34mW

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:

$$= 668.34\text{mW} / 4\pi R^2$$

$$= 0.1330 \text{ mW/cm}^2$$

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.

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 = $0.8413/1 + 0.1330/1 = 0.9743 < 1$

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 = $0.8413/1 + 0.0013/1 = 0.8426 < 1$

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 = $0.1330/1 + 0.0013/1 = 0.1343 < 1$

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 = $0.8413/1 + 0.0013/1 + 0.1330/1 = 0.9756 < 1$

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.”