

INTERTEK TESTING SERVICES

RF Exposure

The Equipment Under Test (EUT) is a Voice Control Centre (VCC I) with BT function and 433 MHz transmitter operating at 2402-2480MHz for Bluetooth, 79 channels with 1MHz channel spacing. The EUT is powered by DC 5V/500mA through an adapter, which has an USB type A port. The wireless function will not be disabled or stop transmission during the power on. For more detailed features description, please refer to the user's manual.

For Bluetooth:

Antenna Type: Integral Antenna

Antenna Gain: 0dBi

Modulation Type: GFSK

The normal radiated output power (e.i.r.p) is: 4.0dBm (tolerance: +/-1dB).

The normal conducted output power is 4.0dBm (tolerance: +/-1dB).

The maximum conducted output power for the EUT is 4.67dBm in the frequency 2.402GHz BT mode which is within the production variation.

The minimum conducted output power for the EUT is 3.37dBm in the frequency 2.440GHz BT 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 maximum radiated power = 3.16mW

At the distance (R) of 20cm to 40cm and in 0.3 GHz to 6 GHz, MPE Exclusion Threshold Level:

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

The MPE limit is 3060mW for general population and uncontrolled exposure in the 2.4GHz frequency range according to FCC Part 1.1307. 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.

Power density (S) is calculated by the following formula:

$$S = (P * G) / 4 \pi R^2$$

$$E.I.R.P = P * G$$

Where, S = Power density (mW/cm²)

P = Output power to antenna (mW)

R = Distance between radiating structure and observation point (cm)

G = Gain of antenna in numeric

$$\pi = 3.14$$

As the measured power density at 20cm from the transmitter

$$S = (P * G) / 4 \pi R^2 = 0.00629$$

For 433 transmitter:

Antenna Type: Integral Antenna

Antenna Gain: 0.0dBi Max

Modulation Type: OOK

The nominal radiated output power (e.i.r.p) specified: -9.0dBm (+/- 1dB)

$$\text{Max e.i.r.p} = \text{e.i.r.p} - 2.15 = -9 - 2.15 = -11.15 \text{ dBm} = 0.097 \text{ mW}$$

The maximum peak radiated emission for the EUT is 87.24dBμV/m at 3m in the frequency 433.92MHz.

$$\text{The EIRP} = [(FS * D)^2 / 30] \text{ mW} = -8.0 \text{ dBm}$$

$$\text{The ERP} = -8.0 - 2.15 = -10.15 \text{ dBm}$$

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:

At the distance (R) of 20cm to 40cm and in 0.3 GHz to 6 GHz, MPE Exclusion Threshold Level:

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

The MPE limit is 885mW for general population and uncontrolled exposure in the 433.92MHz frequency range according to FCC Part 1.1307. 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.

Power density (S) is calculated by the following formula:

$$S = (P * G) / 4 \pi R^2$$

$$E.I.R.P = P * G$$

Where, S = Power density (mW/cm²)

P = Output power to antenna (mW)

R = Distance between radiating structure and observation point (cm)

G = Gain of antenna in numeric

$$\pi = 3.14$$

As the measured power density at 20cm from the transmitter

$$S = (P * G) / 4 \pi R^2 = 0.00002$$

For Simultaneous transmitting of 433 transmitter and Bluetooth, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency

$$\text{dependent MPE limits} = 0.00629/1 + 0.00002/0.29 =$$

$$0.00629 + 0.000069 = 0.006359 < 1$$

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.”