

INTERTEK TESTING SERVICES

RF Exposure

The equipment under test (EUT) is a XAG DL1 Data Link with Bluetooth 5.0 function operating in 2402-2480MHz, 2.4G WIFI function operating in 2412-2462MHz. 5G WIFI function operating in 5725MHz~5850MHz. The EUT is powered by DC 3.65 V from rechargeable battery. For more detail information pls. refer to the user manual.

Bluetooth Version: 5.0 BLE mode.

Antenna Type: Internal antenna.

Antenna Gain: 2.13dBi.

Modulation Type: GFSK.

The nominal conducted output power specified: 4.0dBm (+/-1dB)

The maximum conducted output power for the EUT is 4.07dBm in the frequency 2440MHz which is within the production variation.

The minimum conducted output power for the EUT is 3.81dBm in the frequency 2402MHz 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 = 5dBm +2.13dBi = 7.13dBm = 5.16mW

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:

$$\begin{aligned} &= 5.16\text{mW} / 4\pi R^2 \\ &= 0.001 \text{ mW/cm}^2 \\ &< 1\text{mW/cm}^2 \end{aligned}$$

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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2.4GHz Wi-Fi:

Antenna Type: Internal Antenna.

Antenna Gain: 3.7dBi.

MAX MIMO Gain: 6.71 dBi

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

The nominal conducted output power specified: 21dBm (Tolerance: +/-3dB).

The maximum conducted output power for the EUT is 23.8dBm in the frequency 2462MHz(IEEE 802.11G SISO ANT1) which is within the production variation.

The minimum conducted output power for the EUT is 18.8dBm in the frequency 2412MHz(IEEE 802.11N20 MIMO ANT2)) which is within the production variation.

According to FCC Part 2.1091, this unlicensed transmitting device 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 = 24dBm +6.71dBi = 30.71dBm = 1177.6mW

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:

$$= 1177.6\text{mW} / 4\pi R^2$$

$$= 0.2344 \text{ mW/cm}^2$$

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

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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5.8GHz WiFi:

Antenna Type: Integral Antenna.

Antenna0 Gain: 3.7 dBi Max for 5G WIFI.

Antenna1 Gain: 3.7 dBi Max for 5G WIFI.

Antenna2 Gain: 5.87 dBi Max for 5G WIFI.

Antenna3 Gain: 5.87 dBi Max for 5G WIFI.

MIMO Gain: 10.87 dBi Max for 5G WIFI.

Modulation Type: BPSK, QPSK, 16QAM, 64QAM

The nominal conducted output power specified: 20dBm (Tolerance: +/-4.6dB).

The maximum conducted output power for the EUT is 24.6dBm in the frequency 5745MHz(IEEE 802.11 n-HT20 MIMO Total) which is within the production variation.

The minimum conducted output power for the EUT is 16.32dBm in the frequency 5785MHz(IEEE 802.11 n-HT20 MIMO ANT3) 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 = 24.6dBm +10.87dBi = 35.47dBm =3523.71mW

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:

$$= 3523.71\text{mW} / 4\pi R^2$$

$$= 0.701 \text{ mW/cm}^2$$

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

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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For Simultaneous transmitting of BLE, 2.4GHz WiFi and 5.8GHz 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 = $0.001/1 + 0.234/1 + 0.701/1 = 0.937 < 1$

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.”