

INTERTEK TESTING SERVICES

RF Exposure

The equipment under test (EUT) is a Vacuum Cleaner (Narwal Vacuuming and Mopping Robot T10) with 2.4GHz WIFI function operating in 2412-2462MHz and a wireless transmitter function operating in 915-916MHz. The EUT is powered by DC 14.4V rechargeable battery. For more detail information pls. refer to the user manual.

2.4GHz Wi-Fi:

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

Antenna Type: Integral Antenna

Antenna Gain: 2dBi

The nominal conducted output power specified: 22dBm (+/-4dB)

The maximum conducted output power for the EUT is 25.5 dBm in the frequency 2437MHz(IEEE 802.11g) which is within the production variation.

The minimum conducted output power for the EUT is 19.3 dBm in the frequency 2462MHz(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+2dBi =28dBm = 630.96 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:

$$\begin{aligned} &= 630.96 \text{ mW} / 4\pi R^2 \\ &= 0.126 \text{ mW/cm}^2 \end{aligned}$$

The MPE limit is 1.0 mW/cm² for general population and uncontrolled exposure in the 2.4GHz Wi-Fi 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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915-916MHz:

Antenna Type: Integral antenna

Modulation Type: 2FSK

Antenna Gain: 1dBi Max

The nominal conducted output power specified: 0dBm (+/-2dB)

The nominal radiated output power (e.i.r.p) specified: 1dBm (+/-2dB)

The maximum peak radiated emission for the EUT is 96.0 dBμV/m(0.8 dBm) in the frequency 915MHz which is within the production variation.

The minimum peak radiated emission for the EUT is 95.1 dBμV/m(-0.1 dBm) in the frequency 915.5MHz which is within the production variation.

The source-based time averaged maximum radiated power = 2dBm+1dBi =3dBm
= 1.995 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:

$$= 1.995 \text{ mW} / 4\pi R^2$$

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

The MPE limit is 0.61 mW/cm² for general population and uncontrolled exposure in the specified 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 915-916MHz transmitter, According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = 0.126/1 + 0.0004/0.61 = 0.1267 < 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 person.