

MPE Analysis Report

The Equipment Under Test (EUT) is a portable 2.4GHz and Wi-Fi Transceiver (Drone Unit) for a Video Drone.

For Wi-Fi portion, the Equipment Under Test (EUT) operates at frequency range of 2412MHz to 2462MHz with 11 channels. For 2.4GHz Portion, it operates at frequency range of 2449MHz to 2479MHz with 30 channels, the channels are shown in below table.

2449	2450	2451	2452	2453
2454	2455	2456	2457	2458
2459	2460	2461	2462	2463
2464	2465	2466	2467	2468
2469	2470	2471	2472	2473
2474	2475	2476	2477	2479

The EUT is powered by 1 x 3.7V LiPo battery. After switching on the EUT, the drone will undergo different movement based on the switches pressed in the controller. It can be paired up with a smartphone and the real time display of the camera on the drone will be transmitted to a mobile app for photo and video taking function.

2.4GHz portion

Antenna Type: Internal, integral

Antenna Gain: 0dBi

Nominal Peak Conducted Power: -33.8dBm

Range of Peak Conducted Power: -36.8dBm to -30.8dBm

WiFi portion

The WiFi portion was tested in according with the following power output and in actual application the below limit shall not be exceeded.

Operating Mode	Nominal Conducted Power	Range of Peak Conducted Power
802.11b	14.1dBm	11.1dBm to 17.1dBm
802.11g	13.2dBm	10.2dBm to 16.2dBm
802.11n (HT20)	12.8dBm	9.8dBm to 15.8dBm

An internal, integral antenna has been used.

Antenna Gain: 3.85dBi

For Maximum Permissible Exposure (MPE) evaluation of the EUT, the maximum power density at 20 cm from this transmitter shall be less than the General Population / Uncontrolled MPE limit in OET Bulletin 65.

1) For the 2.4GHz portion, maximum Peak Conducted Power was -30.8 dBm. The distance (D) between the antenna and the equipment under test (EUT) was 3 meters. And the maximum source-based time-averaging duty factor is 100%. From these data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna can be calculated according to OET Bulletin 65 as follow:

$$\text{The radiated power} = -30.8\text{dBm} + 0\text{dBi} = -30.8\text{dBm} (0.000832 \text{ mW})$$

$$\begin{aligned} \text{The radiated (EIRP) source-based time-averaging output power} \\ &= (0.000832 * 1) \text{ mW} \\ &= 0.000832 \text{ mW} \end{aligned}$$

$$\begin{aligned} \text{The power density at 20 cm from the antenna} \\ &= \text{EIRP} / 4\pi R^2 \\ &= 0.000000165 \text{ mW cm}^{-2} \end{aligned}$$

2) For the WiFi portion, maximum Peak Conducted Power was 17.1 dBm. The distance (D) between the antenna and the equipment under test (EUT) was 3 meters. And the maximum source-based time-averaging duty factor is 100%. From these data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna can be calculated according to OET Bulletin 65 as follow:

$$\text{The radiated power} = 17.1\text{dBm} + 3.85\text{dBi} = 20.95\text{dBm} (124.5 \text{ mW})$$

$$\begin{aligned} \text{The radiated (EIRP) source-based time-averaging output power} \\ &= (124.5 * 1) \text{ mW} \\ &= 124.5 \text{ mW} \end{aligned}$$

$$\begin{aligned} \text{The power density at 20 cm from the antenna} \\ &= \text{EIRP} / 4\pi R^2 \\ &= 0.024759 \text{ mW cm}^{-2} \end{aligned}$$

In the frequency range of 1,500 - 100,000MHz, the MPE limit is 1.0 mWcm⁻² for general population and uncontrolled exposure. 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 structures and body of the user or nearby persons. The following RF exposure statement is proposed to be included in the user manual:

“ FCC RF Radiation Exposure Statement

Caution: To maintain compliance with the FCC’s RF exposure guidelines, place the Unit at least 20cm from nearby persons.”

In addition, for this product with multiple transmitter and antenna (2.4GHz portion and WiFi portion), the requirement of Simultaneous Transmission evaluation has also been considered and has complied with the following conditions of the worse case;

$$\text{MPE1/Limit1} + \text{MPE2/Limit2} \leq 1$$

Thus,

$$\begin{array}{rclcl} 0.000000165 / 1 & + & 0.024759 / 1 & = & 0.024759 \\ \text{2.4GHz portion} & & \text{WiFi portion} & & \end{array}$$

It is concluded that no Simultaneous Transmission evaluation is required.