

MPE Analysis Report

The Equipment Under Test (EUT) is a 2.4GHz Wi-Fi and BLE Transceiver for a smart indoor pan & tilt camera. The EUT is powered by 5VDC USB port.

For Maximum Permissible Exposure (MPE) evaluation of the unit, the maximum power density at 20 cm from this transmitter shall be less than the General Population / Uncontrolled MPE limit in OET Bulletin 65 and meet the requirement listed in KDB447498 D04 v01.

For the 2.4GHz RF portion of the unit, the measured powers among all the measured channels were within its production tolerance. The maximum source-based time-averaging duty factor is 100%. From these data and its operating configuration, the exposed power density at a distance (R) of 20 cm from the center of radiation of the antenna can be calculated according to OET Bulletin 65 as follow:

BLE Portion

Antenna Type: Internal, integral

Antenna Gain: 2.3dBi

Nominal Conducted Power: 0.7dBm

Range of Peak Conducted Power: -10dBm to 14dBm

Wi-Fi Portion

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

Operating Mode	Nominal Power	Range of Peak Conducted Power
802.11b	15.88dBm	9dBm to 22dBm
802.11g	12.59dBm	9dBm to 22dBm
802.11n(HT20)	12.20dBm	9dBm to 22dBm

An internal, integral antenna has been used.

Antenna Gain: 2.3dBi

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

1) For the BLE portion, maximum conducted power was 14dBm. 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:

The radiated power = 14dBm + 2.3dBi = 16.3dBm (42.66 mW)

The radiated (EIRP) source-based time-averaging output power
= (42.66 * 1) mW
= 42.66 mW

The power density at 20 cm from the antenna
= $EIRP / 4\pi R^2$
= 0.008487 mW cm⁻²

2) For the Wi-Fi portion, maximum conducted power was 22dBm. 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:

The radiated power = 22dBm + 2.3dBi = 24.3dBm (269.15 mW)

The radiated (EIRP) source-based time-averaging output power
= (269.15 * 1) mW
= 269.15 mW

The power density at 20 cm from the antenna
= $EIRP / 4\pi R^2$
= 0.053546 mW cm⁻²

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 (BLE portion and Wi-Fi portion), the requirement of Simultaneous Transmission evaluation has also been considered and has complied with the following conditions of the worst case;

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

Thus,

$$\begin{array}{rcl} 0.008487 / 1 & + & 0.053546 / 1 \\ \text{BLE portion} & & \text{Wi-Fi portion} \end{array} = 0.062033$$

It is concluded that no Simultaneous Transmission evaluation is required.