MPE Analysis Report

The Equipment Under Test (EUT) is a Wi-Fi and BLE enabled temperature controller designed to provide timed regulation of temperature. The EUT is powered by 120VAC.

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: 2.54dBi
Nominal Conducted Power: -16.7dBm
Range of Peak Conducted Power: -20dBm to 10dBm

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	18.4dBm	10dBm to 20dBm

An internal, integral antenna has been used.
Antenna Gain: 2.54dBi

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 10dBm. 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 = 10dBm + 2.54dBi = 12.54dBm (17.95 mW)

The radiated (EIRP) source-based time-averaging output power
= (17.95 * 1) mW
= 17.95 mW

The power density at 20 cm from the antenna
= EIRP / 4πR^2
= 0.003571 mW cm-2

2) For the Wi-Fi portion, maximum conducted power was 20dBm. 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 = 20dBm + 2.54dBi = 22.54dBm (179.47 mW)

The radiated (EIRP) source-based time-averaging output power
= (179.47 * 1) mW
= 179.47 mW

The power density at 20 cm from the antenna
= EIRP / 4πR^2
= 0.035704 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;

MPE1/Limit1 + MPE2/Limit2 ≤ 1

Thus,

0.003571 / 1	+	0.035704 / 1	=	0.039275
BLE portion		Wi-Fi portion		

It is concluded that no Simultaneous Transmission evaluation is required.