

MPE Analysis Report

The Equipment Under Test (EUT) is a Wi-Fi and BLE enabled thermostat designed to provide timed regulation of electric underfloor heating systems. The EUT is powered by 110-240VAC.

For Wi-Fi portion, the Equipment Under Test (EUT) operates at frequency range of 2412MHz to 2462MHz with 11 channels and 2422MHz to 2452MHz with 9 channels. For BLE Portion, it operates at frequency range of 2402.000 MHz to 2480.000 MHz with 40 channels, the channels are separated with 2MHz spacing.

BLE portion

Antenna Type: Internal, integral

Antenna Gain: 3.37dBi

Nominal Conducted Power: 4dBm

Range of Peak Conducted Power: 0dBm to 10dBm

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	18.7dBm	10dBm to 20dBm
802.11g	17.7dBm	10dBm to 20dBm
802.11n (HT20)	16.5dBm	10dBm to 20dBm
802.11n (HT40)	15.8dBm	10dBm to 20dBm

An internal, integral antenna has been used.

Antenna Gain: 3.37dBi

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 BLE portion, maximum field strength measured (FS) was 10 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:

The radiated power = 10dBm + 3.37dBi = 13.37dBm (21.7 mW)

The radiated (EIRP) source-based time-averaging output power
= (21.7 * 1) mW
= 21.7 mW

The power density at 20 cm from the antenna
= EIRP / 4πR²
= 0.004323 mW cm⁻²

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2) For the WiFi portion, maximum field strength measured (FS) was 20 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:

$$\text{The radiated power} = 20\text{dBm} + 3.37\text{dBi} = 23.37\text{dBm} (217.3 \text{ mW})$$

$$\begin{aligned} \text{The radiated (EIRP) source-based time-averaging output power} \\ &= (217.3 * 1) \text{ mW} \\ &= 217.3 \text{ mW} \end{aligned}$$

$$\begin{aligned} \text{The power density at 20 cm from the antenna} \\ &= \text{EIRP} / 4\pi R^2 \\ &= 0.043225 \text{ mW cm}^{-2} \end{aligned}$$

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 Internet Music System at least 20cm from nearby persons.”

In addition, for this product with multiple transmitter and antenna (BLE 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,

$$\begin{array}{rcccl} 0.004323 / 1 & + & 0.043225 / 1 & = & 0.047548 \\ \text{BLE portion} & & \text{WiFi portion} & & \end{array}$$

It is concluded that no Simultaneous Transmission evaluation is required.