

MPE Analysis Report

The Equipment Under Test (EUT) is an Audio Base Speaker System. It can accept analog input sources (RCA aux-in and 3.5mm phone jack line-in), digital input sources (TOSLINK optical digital audio and HDMI) and wireless Bluetooth device. The Bluetooth module in the EUT is operating in the frequency range from 2402MHz to 2480MHz (79 channels with 1MHz channel spacing). The EUT supports NFC function to connect Bluetooth communication when it is touched with NFC enabled device. The audio signal is amplified and fed to the built-in stereo loudspeakers. The EUT can send audio data to the separate wireless subwoofer via a 2.4GHz digital wireless module, which is operating in the frequency range from 2404MHz to 2479MHz (16 channels with 5MHz channel spacing). The EUT is powered by 120VAC 60Hz. The NFC tag in EUT is a passive data device, which is powered by RF field of external reader.

For the Bluetooth Module:

Antenna Type: Internal, integral

Antenna Gain: 0dBi

Nominal rated field strength: 96.8dB μ V/m at 3m

Maximum allowed field strength of production tolerance: +/- 3dB

For the 2.4GHz Digital Wireless Module:

Antenna Type: Internal, integral

Antenna Gain: 0dBi

Nominal rated field strength: 88.4 dB μ V/m at 3m

Maximum allowed field strength of production tolerance: +/- 3dB

For Maximum Permissible Exposure (MPE) evaluation of the Audio Base Speaker System (Model: ABX3250KN), 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 Bluetooth portion of Audio Base Speaker System (Model: ABX3250KN), maximum field strength measured (FS) was 99.8 dB μ V/m. 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 5/6*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:

$$\begin{aligned} \text{The radiated power} &= (\text{FS} \cdot \text{D})^2 / 30 \\ &= 2.865 \text{ mW} \end{aligned}$$

$$\begin{aligned} \text{The radiated (EIRP) source-based time-averaging output power} \\ &= (2.865 * 5/6) \text{ mW} \\ &= 2.3875 \text{ mW} \end{aligned}$$

$$\begin{aligned} \text{The power density at 20 cm from the antenna} \\ &= \text{EIRP} / 4\pi\text{R}^2 \\ &= 0.000475 \text{ mW cm}^{-2} \end{aligned}$$

2) For the 2.4GHz Digital Wireless Module of Audio Base Speaker System (Model: ABX3250), maximum field strength measured (FS) was 91.4 dB μ V/m. 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:

$$\begin{aligned} \text{The radiated power} &= (FS \cdot D)^2 / 30 \\ &= 0.414 \text{ mW} \end{aligned}$$

$$\begin{aligned} \text{The radiated (EIRP) source-based time-averaging output power} \\ &= (0.414 \cdot 1) \text{ mW} \\ &= 0.414 \text{ mW} \end{aligned}$$

$$\begin{aligned} \text{The power density at 20 cm from the antenna} \\ &= \text{EIRP} / 4\pi R^2 \\ &= 0.000082 \text{ mW cm}^{-2} \end{aligned}$$

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 Audio Base Speaker System at least 20cm from nearby persons.”

In addition, for this multiple transmitter and antenna (Both Bluetooth & 2.4GHz Digital Wireless modules), 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,

$$\begin{aligned} 0.000475/1 \text{ (Bluetooth Module)} + 0.000082/1 \text{ (2.4GHz Digital Wireless Module)} \\ = 0.000557 \end{aligned}$$

It is concluded that no Simultaneous Transmission evaluation is required.