Analysis Report

The Equipment Under Test (EUT) is a Bluetooth Speaker with USB Interface. The EUT is using adaptive frequency hopping for Bluetooth module and using 2.3MHz transceiver for signal control, amp and muting. The Bluetooth can support Bluetooth 4.0 BLE and Bluetooth 3.0. The Bluetooth portion operates in frequency range from 2402MHz to 2480MHz The EUT is powered by 7.4VDC (2500mAh Li-ion rechargeable battery). The EUT can charge another device via this USB port (5VDC). The Aux port is for playback MP3 from MP3 device only. The Mirco-USB port is for charging internal rechargeable battery of EUT only.

2.4GHz Bluetooth Module:
Modulation Type: GFSK
Antenna Type: Integral, Internal
Frequency Range for Bluetooth 3.0: 2402MHz - 2480MHz, 1MHz channel spacing, 79 channels
Nominal field strength is 107.0dBµV/m @ 3m
Production Tolerance of field strength is +/- 3dB
Antenna gain is 0dBi

2.4GHz Bluetooth Module:
Modulation Type: GFSK
Antenna Type: Integral, Internal
Frequency Range for Bluetooth 4.0(BLE):2402MHz -2480MHz, 2MHz channel spacing, 40 channels.
Nominal field strength is 107.0dBµV/m @ 3m
Production Tolerance of field strength is +/- 3dB
Antenna gain is 0dBi

2.3MHz Transceiver Module
Modulation Type: FM 1kHz
Antenna Type: Integral, internal
Frequency Range: 2.3MHz, 1 channel.
Nominal field strength is 39.3dBµV/m @ 3m
Production Tolerance of field strength is +/- 3dB
Antenna gain is 0dBi

For 2.4 GHz Bluetooth,
According to the KDB 447498:

Based on the Maximum allowed field strength of production tolerance was 110.0dBμV/m at 3m in frequency 2.4GHz, thus;

The EIRP = [(FS*D) ^2*1000 / 30] = 0.03W=30mW

According to MPE ,

Conducted power = Radiated Power (EIRP) – Antenna Gain
So;

Conducted Power = 30mW

The power density at 20cm = 30 *1.00/ $\mathbf{4\pi R^2}$
= 0.0060 $mWcm^{-2}$

In the frequency range of 1,500 - 100,000MHz, the MPE limit is 1.0 $mWcm^{-2}$ for general population and uncontrolled exposure.

For 2.3MHz transceiver,
According to the KDB 447498:

Based on the Maximum allowed field strength of production tolerance was 42.3dBμV/m at 3m in frequency 2.4GHz, thus;

The EIRP = [(FS*D) ^2*1000 / 30] = $5.0947x10^{-6}$mW

According to MPE ,

Conducted power = Radiated Power (EIRP) – Antenna Gain
So;

Conducted Power = $5.0947x10^{-6}$mW

The power density at 20cm = $5.0947x10^{-6}$ *1.00/ $\mathbf{4\pi R^2}$
= $1.0135x10^{-9}$ mW cm^{-2}

In the frequency range of 1.34MHz – 30.00MHz , the MPE Limit is 34.03$mWcm^{-2}$ for general population and uncontrolled exposure.

Per KDB 447498 D01 v05, simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0.

The MPE ratio for 2.4GHz Bluetooth Transmission can be calculated as follow:

= The power density at 20cm / MPE limit
= 0.0060 mW cm^{-2} / 1.0 mW cm^{-2}
= 0.0060

The MPE ratio for 2.3MHz Transmission can be calculated as follow:

= The power density at 20cm / MPE limit
= 1.0135×10^{-9} mW cm^{-2} / 34.03 mW cm^{-2}
= 2.9782×10^{-11}

The sum of the MPE ratios for all simultaneous transmitting antennas
= 0.0060 + 2.9782×10^{-11}
= 0.0060

As the sum of MPE ratios for all simultaneous transmitting antennas is ≤ 1.0, simultaneous transmission MPE test exclusion will be applied.

Conclusion

As simultaneous transmission MPE test exclusion is applied and the measured power density at 20cm from all the standalone transmissions 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 speaker unit at least 20cm from nearby persons."