Analysis Report

The Equipment Under Test (EUT) is a Bluetooth Headphone 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 3.7VDC Li-ion rechargeable battery. 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 103.8dBµV/m @ 3m

Production Tolerance of field strength is 100.0 dBµV/m to 104.0 dBµV/m

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 103.8dBµV/m @ 3m

Production Tolerance of field strength is 100.0 dBµV/m to 104.0 dBµV/m

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 39.0dBµV/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 104.0 dBμV/m at 3m in frequency 2.4GHz, thus;

The EIRP = [(FS*D) ^2*1000 / 30] =7.54mW

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

Conducted Power = 7.54mW

The SAR Exclusion Threshold Level:
= 3.0 * (min. test separation distance, mm) / sqrt(freq. in GHz)
= 3.0 * 5 / sqrt (2.48) mW
= 9.53 mW

For 2.3MHz transceiver,
According to the KDB 447498:

Based on the Maximum allowed field strength of production tolerance was 42.0dBμV/m at 3m in frequency 2.3MHz, thus;

The EIRP = [(FS*D) ^2*1000 / 30] = 4.7547×10^{-6}mW

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

Conducted Power = 4.7547×10^{-6}mW

Simultaneous Transmission SAR exclusion considerations

For standalone Bluetooth operation,

Maximum Conducted Power of this device = 7.54 mW

Therefore, the Estimated 1-g SAR will be determined as follow,

Estimated 1-g SAR = $(\sqrt{F(GHz)}/7.5)x(P\max/TD)$
= 0.3 W/kg

where *Pmax* = 7.54 mW, *TD* = 5 mm and *F(GHz)* = 2.480 GHz

For 2.3M transceiver operation,

Maximum Conducted Power of this device = $4.7547x10^{-6}$mW

Therefore, the Estimated 1-g SAR will be determined as follow,

Estimated 1-g SAR = $(\sqrt{F(GHz)}/7.5)x(P\max/TD)$
= 6.08079x10^{-9} W/kg

where *Pmax* = 4.7547x10^{-6} mW, *TD* = 5 mm and *F(GHz)* = 0.0023GHz

The sum of the estimated SAR values [SAR1+SAR2]= 0.3+6.08079x10^{-9}= 0.3 W/kg

where *SAR1* = 0.3 W/kg, *SAR2* = 6.08079x10^{-9} W/kg

Conclusion

Since the sum of the estimated SAR values ≤ 1.6W/kg, SAR evaluation for simultaneous transmission is not required.