

Analysis Report

The Equipment Under Test (EUT), is a 2.4GHz Bluetooth BLE (1Mbps) Transceiver and a 13.56MHz RFID device for a hair styler. For the BLE mode, the sample supplied operated on 40 channels, normally at 2402 – 2480MHz. The channels are separated with 2MHz spacing. For the RFID mode, the sample supplied operated on a single channel, 13.56MHz.

The EUT is powered by 120VAC. After switching on the EUT, it can be paired up with a smartphone and different status and settings can be viewed through a mobile app. After placing different RFID tag at the tip and switching on the EUT, air with different strength and temperature will be exhausted based on the buttons pressed on the hair styler.

RFID Portion

Antenna Type: Internal, Integral

Antenna Gain: 0dBi

Conducted Power Range: -30dBm to 0dBm

Bluetooth BLE Portion

Antenna Type: Internal, Integral

Antenna Gain: 2.5dBi

Conducted Power Range: 0dBm to 2.5dBm

According to the KDB447498 D01 v06:

Conducted Power (Maximum of RFID Portion) = 0dBm (1 mW)

The SAR Exclusion Threshold Level for 13.56MHz when minimum test separation distance < 50 mm:

$$= [474 * (1 + \log_{10}(f(\text{MHz}))) / 2]$$
$$= 442.7 \text{ mW}$$

Conducted Power (Maximum of Bluetooth BLE Portion) = 2.5 dBm (1.8 mW)

The SAR Exclusion Threshold Level:

$$= 3.0 * (\text{min. test separation distance, mm}) / \sqrt{\text{freq. in GHz}}$$
$$= 3.0 * 5 / \sqrt{(2.480)} \text{ mW}$$
$$= 9.53 \text{ mW}$$

Since the above conducted output power is well below the SAR Exclusion threshold level, so the EUT is considered to comply with SAR requirement without testing.

Simultaneous Transmission SAR exclusion considerations

Since the RFID and Bluetooth transmitters of this device may operate simultaneously, simultaneous transmission analysis is required. Per KDB447498 D01 v06, simultaneous transmission SAR test exclusion can be applied when the sum of 1-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit ($\leq 1.6\text{W/kg}$). When the standalone SAR test exclusion is applied, the standalone 1-g SAR must be estimated according to the following equation,

$$\text{Estimated SAR} = (\sqrt{F(\text{GHz}) / 7.5}) \times (P_{\text{max}} / TD)$$

where

$F(\text{GHz})$ is the RF channel transmit frequency in GHz

P_{max} is the max. power of channel, including tune-up tolerance, mW

TD is the min. test separation distance, mm

For RFID operation,

Maximum Time-averaged Conducted Power of this device = **1 mW (0dBm)**

Therefore, the Estimated SAR will be determined as follow,

$$\begin{aligned} \text{Estimated SAR} &= (\sqrt{F(\text{GHz}) / 7.5}) \times (P_{\text{max}} / TD) \\ &= \mathbf{0.00311 \text{ W/kg}} \end{aligned}$$

where $P_{\text{max}} = 1 \text{ mW}$, $TD = 5 \text{ mm}$ and $F(\text{GHz}) = 0.01356 \text{ GHz}$

For Bluetooth BLE operation,

Maximum Time-averaged Conducted Power of this device = **1.8 mW (2.5dBm)**

Therefore, the Estimated SAR will be determined as follow,

$$\begin{aligned} \text{Estimated SAR} &= (\sqrt{F(\text{GHz}) / 7.5}) \times (P_{\text{max}} / TD) \\ &= \mathbf{0.0756 \text{ W/kg}} \end{aligned}$$

where $P_{\text{max}} = 1.8 \text{ mW}$, $TD = 5 \text{ mm}$ and $F(\text{GHz}) = 2.480 \text{ GHz}$

Simultaneous Transmission Analysis

RFID SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	Simultaneous SAR Required
0.00311	0.0756	0.07871	No

Conclusion

Since the above summed SAR result for all simultaneous transmission conditions were below the SAR limit (1.6 W/kg), SAR evaluation for simultaneous transmission configuration is not required.