Analysis Report

The Equipment Under Test (EUT), is a portable composite device which contains a 2.4GHz BLE Transceiver and a 13MHz RFID reader for a pod. For the BLE portion, the sample supplied operated on 40 channels, normally at 2402 - 2480MHz. The channels are separated with 2MHz spacing. For the RFID reader, the sample supplied operated on a single channel, 13.56MHz.

The EUT is powered by 1 x 3.7V Lithium-ion battery. After switching on the EUT, the EUT, the pod can be paired up with a smartphone and perform different functions through a mobile app. The RFID reader can be used to detect whether a bottle of spray is inserted into the pod body.

Bluetooth BLE Portion

Antenna Type: Internal, integral
Antenna Gain: 0.5dBi
Frequency Range: 2402MHz to 2480MHz, 2MHz channel spacing, 40 channels

Nominal rated field strength (average): 78.2dBμV/m at 3m (-17 dBm)
Maximum allowed field strength of production tolerance: +/- 5dB

According to the KDB 447498 D04 v01:

Conducted Power (maximum)
= (-17dBm + 5dB - 0.5dBi) dBm = -12.5 dBm (0.056 mW)

The SAR Exclusion Threshold Level:
= 3.0 * (min. test separation distance, mm) / sqrt(freq. in GHz)
= 3.0 * 5 / sqrt (2.480) mW
= 9.53 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.

13.56MHz NFC portion (single channel)
Antenna Type: Internal, Integral
Antenna Gain: 0dBi
Nominal rated field strength: 27.6dBμV/m at 3m
Maximum allowed field strength of production tolerance: +/- 3dB

Radiated Power (maximum)
= 30.6 dBμV/m at 3m (0.0000003 mW)

Conducted Power (maximum)
= 0.0000003 mW

The SAR Exclusion Threshold Level for 13.56MHz when minimum test separation distance < 50 mm:
= [474 * (1 + log100/f(MHz))]/2
= 442.7 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 NFC 13.56MHz and Bluetooth transmitters of this device may operate simultaneously, simultaneous transmission analysis is required. Per KDB 447498 D04 v01, 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 (≤ 1.6W/kg). When the standalone SAR test exclusion is applied, the standalone 1-g SAR must be estimated according to the following equation,

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

where
F(GHz) is the RF channel transmit frequency in GHz
Pmax is the max. power of channel, including tune-up tolerance, mW
TD is the min. test separation distance, mm

For NFC operation,

Maximum Time-averaged Conducted Power of this device = 0.0000003 **mW**

Therefore, the Estimated SAR will be determined as follow,

$$\text{Estimated SAR} = (\sqrt{F(GHz)}/7.5)x(P\max/TD)$$
= **0.000000001 W/kg**

where *Pmax* = 0.0000003 mW, *TD* = 5 mm and *F(GHz)* = 0.01356 GHz

For Bluetooth operation,

Maximum Time-averaged Conducted Power of this device = **0.056 mW**

Therefore, the Estimated SAR will be determined as follow,

$$\text{Estimated SAR} = (\sqrt{F(GHz)}/7.5)x(P\max/TD)$$
= **0.0024 W/kg**

where *Pmax* = 0.056 mW, *TD* = 5 mm and *F(GHz)* = 2.480

GHz **Simultaneous Transmission Analysis**

NFC SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	Simultaneous SAR Required
0.000000001	0.0024	0.0024	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 are not required.