Analysis Report

The Equipment Under Test (EUT) is a Smartphone Controller which operates at frequency range of 2402MHz to 2480MHz. There are total 40 channels with 2MHz channel spacing. When the EUT pairs with a smartphone, the user can play game on the smartphone remotely. The EUT is powered by a 3.0VDC (2 X 1.5V size "AAA" batteries. The applicant declared that Bluetooth 4.0 BLE is used only.

2.4GHz Bluetooth portion
Antenna Type: Internal, Integral
Antenna Gain: 0dBi

Bluetooth 4.0
Modulation Type: GFSK
Frequency Range: 2402MHz to 2480MHz, 2MHz channel spacing, 40 channels

EIRP range is -2dBm to 4dBm

According to the KDB 447498:

Conducted Power (max) = EIRP – Antenna gain
= 4 dBm - 0 dBi
= 4 dBm (2.51 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.

Simultaneous Transmission SAR exclusion considerations

Since the tested model: PP4549SE may operate simultaneously with host device (e.g. smartphone, Tablet and etc), simultaneous transmission analysis is required. Per KDB 447498, SAR test exclusion can be determined by the SAR to peak location separation ratio.

The simultaneous transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion. Simultaneous SAR test exclusion can be applied when the SAR to peak location separation ratio ≤ 0.04 for all antenna pairs.

The SAR to peak location separation ratio is determined by the following equation for 1-g SAR test exclusion,

$$[(SAR1 + SAR2)^{1.5}] / Ri$$

where

SAR1 and SAR2 are the highest reported or estimated SAR for each antenna in the pair
Ri is the separation distance between the peak SAR locations for the antenna pair, in mm

For Model: PP4549SE standalone Bluetooth operation,

Maximum Time-averaged Conducted Power of this device = 4dBm (2.51 **mW)**

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

$$\text{Estimated 1-g SAR} = (\sqrt{F(GHz)} / 7.5) x (P\max / TD)$$
$$= \mathbf{0.105\ W/kg}$$

where *Pmax* = 2.51 mW, *TD* = 5 mm and *F(GHz)* = 2.480 GHz

For connecting host device configuration,

Estimated standalone SAR for Bluetooth = **0.105 W/kg**

Worst case SAR for the host devise = 1-g general SAR limit = **1.6 W/kg**

Separation distance between the Bluetooth antenna to host enclosure = 60 mm

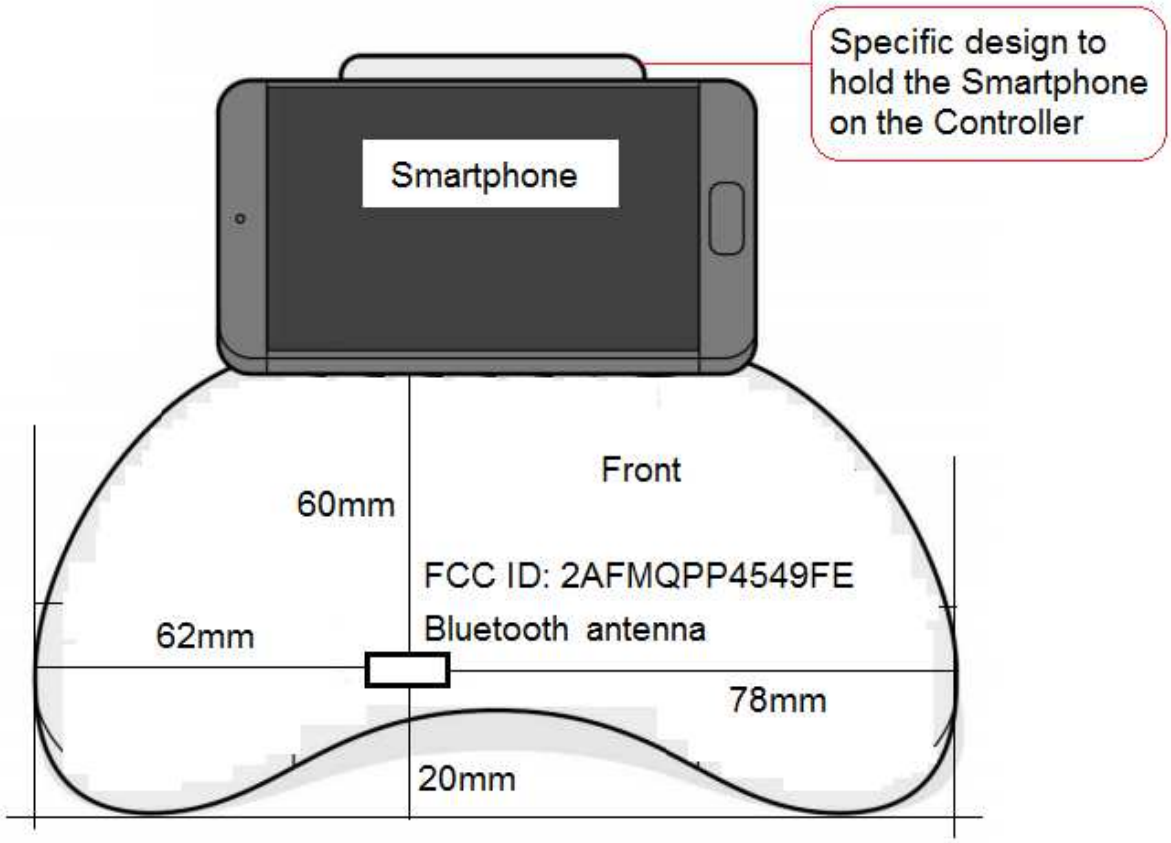
Therefore, the SAR to peak location separation ratio will be determined as follow,

$$\text{SAR to peak location separation ratio} = [(SAR1 + SAR2)^{1.5}]/Ri$$
$$= \mathbf{0.037}$$

where *SAR1* = 0.105 W/kg, *SAR2* = 1.6 W/kg and *Ri* = 60 mm

Conclusion

Since the above SAR to peak location separation ratio ≤ 0.04, SAR evaluation for simultaneous transmission for host device connecting configuration is not required.


Specific design to hold the Smartphone on the Controller
Smartphone
Front
60mm
FCC ID: 2AFMQPP4549FE
62mm
Bluetooth antenna
78mm
20mm