

RF Exposure Evaluation for the SAP-S-3-US Access Point

FCC ID: 2A06WSAP-S-3-US

The SAP-S-3-US Access Point 2.0 operates at 2.4GHz with IEEE 802.15.4 protocol together with 2.4/ 5GHz WLAN.

The following FCC Rule Parts and procedures are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

Part 2.1091 – Radiofrequency radiation exposure evaluation: mobile devices

KDB447498 D01 v06

Mobile and Portable Devices RF Exposure Procedures and Equipment Authorisation Policies

MAXIMUM TRANSMITTER POWER

2.4GHz 802.15.4 :

Power conducted = 20.0dBm max

Antenna Gain: +1.5dBi

EIRP = 21.5dBm = 141.25 mW

2.4GHz WLAN :

Power conducted = 17.55dBm max

Antenna Gain: +1.5dBi

EIRP = 19.05dBm = 80.35 mW

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5.0GHz WLAN :

Power conducted = 16.05dBm max

Antenna Gain: +4.7dBi

EIRP = 20.75dBm = 97.72 mW

MPE CALCULATIONS (>20cm Usage)

The MPE calculation used to calculate the safe operating distance for the user is.

$$S = \text{EIRP} / 4 \pi R^2$$

Where

S = Power density

EIRP = Effective Isotropic Radiated Power (EIRP = P x G)

P = Conducted Transmitter Power

G = Antenna Gain (relative to an isotropic radiator)

R = distance to the centre of radiation of the antenna (20cm requirement).

For 2.4GHz 802.15.4Values:

Transmitter frequency range = 2402 MHz to 2482MHz

EIRP = 141.25 mW

R = 20cm

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 2.4GHz

$$S_{\text{req1}} = 1.0 \text{ mW/cm}^2$$

Calculation for 20cm separation:

$$S = \text{EIRP} / 4 \pi R^2$$

$$S = 141.25 / (12.56 \times 20^2)$$

$$S = 141.25 / (5024)$$

$$S_1 = 0.028 \text{ mW/cm}^2 (< 1.0 \text{ mW/cm}^2)$$

This equates to minimum safe operating distance of 3.35 cm at the RF exposure limit of 1.0 mW/cm²

For WLAN 2.4GHz

Values:

Transmitter frequency range = 2402 MHz to 2482MHz

EIRP = 80.35 mW

R = 20cm

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of
FCC Rule Part 1.1310 for 2.4GHz

$$S_{\text{req2}} = 1.0 \text{ mW/cm}^2$$

Calculation for 20cm separation:

$$S = \text{EIRP} / 4 \pi R^2$$

$$S = 80.35 / (12.56 \times 20^2)$$

$$S = 80.35 / (5024)$$

$$S_2 = 0.016 \text{ mW/cm}^2 (< 1.0 \text{ mW/cm}^2)$$

This equates to minimum safe operating distance of 2.53 cm at the RF exposure limit of 1.0 mW/cm²

For WLAN 5GHz**Values:**

Transmitter frequency range = 5170 MHz to 5835MHz

EIRP = 97.72 mW

R = 20cm

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 5GHz

$$S_{\text{req3}} = 1.0 \text{ mW/cm}^2$$

Calculation for 20cm separation:

$$S = \text{EIRP} / 4 \pi R^2$$

$$S = 97.72 / (12.56 \times 20^2)$$

$$S = 97.72 / (5024)$$

$$S_3 = 0.019 \text{ mW/cm}^2 (< 1.0 \text{ mW/cm}^2)$$

This equates to minimum safe operating distance of 2.79 cm at the RF exposure limit of 1.0 mW/cm²

KDB447498 D01 v05 Section 7.2 SIMULTANEOUS TRANSMISSION CONSIDERATIONS

Worst case summation of calculated MPE ratios for 2.4GHz 802.15.4, WIFI 2.4GHz/ 5GHz

$$\text{ie: } \sum \text{MPE}_{\text{ratios}} = (S_1 / S_{\text{req1}}) + (S_3 / S_{\text{req3}}) + (S_5 / S_{\text{req5}})$$

$$= (0.028/1.0) + (0.016/1.0) + (0.019/1.0)$$

$$= 0.063$$

Σ of MPE ratios < 1.0, so in accordance with KDB447498 Section 7.2, simultaneous transmission test exclusion applies for the 802.15.4 and WLAN transmitters.

Conclusion

The required 20cm RF exposure limits for General Population/ Uncontrolled Exposure will not be exceeded for the SAP-S-3-US Access Point 2.0 using antennas having a maximum gain of +1.5dBi for 802.15.4, +1.5dBi for 2.4 GHz WLAN and +4.7dBi for 5 GHz WLAN operation.