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RF Exposure and Transmitter Power Considerations for the Visteon MFA2

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The Visteon MFA2 operates in the 2.4 GHz and 5 GHz frequency bands using Bluetooth BDR / EDR / and WLAN 802.11a/b/g/n technologies. The 2.4GHz, 5GHz WLAN and BT transmitters can transmit simultaneously.

The FCC requires that the calculated MPE be equal to or less than a given limit dependent on frequency at a distance of 20 cm from a device to the body of a user.

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 CONSIDERATIONS

Conducted power values are maximum average tune up with tolerance:

Bluetooth 2.4GHz:

Power conducted = 9.5dBm

Antenna Gain: 2.0dBi

EIRP = 11.5dBm = 14.12 mW

WLAN 2.4GHz:

Power conducted = 24.5dBm

Antenna Gain: 2.0dBi

EIRP = 26.5dBm = 446.7 mW (SISO)

WLAN 5GHz:

Power conducted = 21.0dBm

Antenna Gain: 5.0dBi

EIRP = 26.0dBm = 398.1 mW (SISO)

MPE CALCULATIONS

The MPE calculation 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 (safe operating distance)

For Bluetooth 2.4GHz

Values:

Transmitter frequency range = 2400 MHz to 2483.5 MHz

EIRP = 14.12 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:

$$S = 14.12/4 \pi R^2$$

$$S = 14.12/(12.56 \times 20^2)$$

$$S = 14.12/(5024)$$

$$S_1 = 0.0028 \text{ mW/cm}^2 (<1.0 \text{ mW/cm}^2)$$

For WLAN 2.4GHz

Values:

Transmitter frequency range = 2412 MHz to 2462MHz

EIRP = 446.7 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:

$$S = 446.7/4 \pi R^2$$

$$S = 446.7/(12.56 \times 20^2)$$

$$S = 446.7/(5024)$$

$$S_2 = 0.089 \text{ mW/cm}^2 (<1.0 \text{ mW/cm}^2)$$

For WLAN 5GHz

Values:

Transmitter frequency range = 5180 MHz to 5795MHz

EIRP = 398.1 mW

R = 20cm

Power Density Requirement

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

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

Calculation:

$$S = 398.1/4 \pi R^2$$

$$S = 398.1/(12.56 \times 20^2)$$

$$S = 398.1/(5024)$$

$$S_3 = 0.079 \text{ mW/cm}^2 (< 1.0 \text{ mW/cm}^2)$$

KDB447498 D01 v05 Section 7.2 SIMULTANEOUS TRANSMISSION CONSIDERATIONS

The equipment operates from a single antenna. All transmitters can transmit simultaneously.

As per KDB, summation of calculated MPE ratios for WLAN 2.4GHz + 5GHz:

$$\begin{aligned} \Sigma \text{MPE}_{\text{ratios}} &= (S_1 / S_{req1}) + (S_2 / S_{req2}) + (S_3 / S_{req3}) \\ &= (0.0028/1.0) + (0.089/1.0) + (0.079/1.0) \\ &= 0.171 \end{aligned}$$

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

Conclusion

The required 20cm RF exposure limits for General Population/ Uncontrolled Exposure will not be exceeded for the MFA2 using antennas having a maximum gain of 2.0 dBi for 2.4GHz BT, 2.4GHz and 5.0dBi for 5GHz WLAN.

Visteon®

Signed on behalf of Visteon Electronics Germany GmbH



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