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RF Exposure and Transmitter Power Considerations for the Visteon MFA2

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This is MPE calculation is for the addition of BT LE functionality to the already certified Visteon MFA2. From the original application, the 2.4GHz, 5GHz WLAN and BT transmitters can transmit simultaneously and, hence, must also be considered within this calculation.

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 Low Energy 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.

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

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 Low Energy 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_{req1} = 1.0 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 = 0.0028mW/ cm^2 (<1.0 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_{req2} = 1.0 mW/cm^2

Calculation:

S = 446.7/4 π R^2

S = 446.7/(12.56 x 20^2)

S = 446.7/(5024)

S_2 = 0.089mW/ cm^2 (<1.0 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 mW/cm^2

Calculation:

S = 398.1/4 π R^2

S = 398.1/(12.56 x 20^2)

S = 398.1/(5024)

S_3 = 0.079mW/ cm^2 (<1.0 mW/cm^2)

KDB447498 D01 v06 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:

$$\Sigma MPE_{ratios} = (S_1/ S_{req1}) + (S_2/ S_{req2}) + (S_3/ S_{req3})$$

$$= (0.0028/1.0) + (0.089/1.0) + (0.079/1.0)$$

$$= \mathbf{0.171}$$

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 Low Energy, 2.4GHz and 5.0dBi for 5GHz WLAN.

Yours faithfully,

i.V.

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