

MPE Calculation - FCC ID: 2AA98-DDU

The FCC requires that the calculated MPE be equal to or less than a given limit, dependent on frequency, with a user / antenna separation distance of 20 cm.

The transmitter operation for the Visteon Electronics Driver Display Unit (DDU) covers the 2.4GHz and 5GHz operating bands.

These bands support: Bluetooth Classic, WLAN 2.4GHz and WLAN 2.5 GHz

Simultaneous transmission is supported with the following radio transmitter combinations:

- Bluetooth Classic and WLAN 2.4GHz
- Bluetooth Classic and WLAN 2.5 GHz

The following FCC Rule Parts are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

Part 2.1091(c) – Radiofrequency radiation exposure evaluation: mobile devices

CALCULATION

The following far field power density equation is applicable:

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

Where

S = Power density

EIRP = Effective Isotropic Radiated Power (EIRP = P * 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)

Calculation for 2.4GHz BT (BDR/EDR worst case):

Values:

Transmitter frequency range = 2402 – 2480MHz

P = 8.28dBm (including max. tune up tolerance)

EIRP = 8.28dBm = 6.73mW

G = 0dBi

R = 20cm

Power Density Requirement

From table 1 (ii) - 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:

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

$$= 6.73 / (4 * \pi * 20^2)$$

$$S_1 = 0.0013$$

(Equivalent to 0.73cm safe operating distance)

Calculation for 2.4GHz WLAN

Values:

Transmitter frequency range = 2412 – 2462MHz

P = 18.98dBm (including max. tune up tolerance)

EIRP = 18.98dBm = 79.07mW

G = 0dBi

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:

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

$$= 79.07 / (4 * \pi * 20^2)$$

$$S_2 = 0.0157$$

(Equivalent to 2.51cm safe operating distance)

Calculation for 5.0GHz WLAN

Values:

Transmitter frequency range = 5150 - 5250MHz and 5725 - 5850MHz

Worst case power output: 5150 - 5250MHz

P = 16.84dBm (including max. tune up tolerance)

G = 0dBi

EIRP = 16.84dBm = 48.31mW

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:

$$\begin{aligned} S &= \text{EIRP} / (4 * \pi * R^2) \\ &= 48.31 / (4 * \pi * 20^2) \end{aligned}$$

$$S_3 = 0.0096$$

(Equivalent to 3.54cm safe operating distance)

KDB447498 D01 v06 Section 7.2 SIMULTANEOUS TRANSMISSION CONSIDERATIONS

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0 .

For the Visteon DDU, the BT Classic and the WLAN 2.4GHz and the BT Classic and the 5.0GHz can operate simultaneously.

BT Classic and the WLAN 2.4GHz simultaneous operation

$$\begin{aligned} \text{ie: } \sum \text{MPE}_{\text{ratios}} &= (S_1 / S_{\text{req1}}) + (S_2 / S_{\text{req2}}) \\ &= (0.0013 / 1.0) + (0.0157 / 1.0) \\ &= 0.017 \end{aligned}$$

$\sum$ of MPE ratios is < 1.0 , so in accordance with KDB447498 Section 7.2, simultaneous transmission test exclusion applies for the BT Classic and 2.4GHz WLAN transmitters

BT Classic and the WLAN 5.0GHz simultaneous operation

$$\begin{aligned}\text{ie: } \sum \text{MPE}_{\text{ratios}} &= (S_1 / S_{\text{req1}}) + (S_3 / S_{\text{req3}}) \\ &= (0.0013/1.0) + (0.0096/1.0) \\ &= \mathbf{0.0109}\end{aligned}$$

$\sum$ of MPE ratios is <1.0, so in accordance with KDB447498 Section 7.2, simultaneous transmission test exclusion applies for the BT Classic and 5.0GHz WLAN transmitters

6. Conclusion

The equipment complies with the RF exposure limits of FCC Rule Part 1.1310 at >20cm operating distances.