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MPE Calculation for (GSM/ UMTS) DCM300G - OET Bulletin 65

FCC ID: JUP-WCDCM300G

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 transmitter operation for the DCM300G covers GSM850 and PCS1900 and 2.4GHz WIFI operating bands.

The following FCC Rule Parts are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits
Part 2.1091(c) – Radiofrequency radiation exposure evaluation: mobile devices

Part 24.232 (b)
Mobile/ Portable stations are limited to 2 Watts EIRP peak power

Part 22.913 (a)(2)
The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

The MPE calculation as given in FCC OET Bulletin 65, page 19 is used to calculate the safe operating distance for the user.

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

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

For GSM 850

Transmitter frequency range = 824MHz to 849MHz

Max. measured conducted transmitter power = 31.7dBm (1.48W)

For Class 10 GPRS with 2 uplink time slots (2/8)

Power = 2/8 x 1.48 = 0.37W

MPE Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for GSM850

$S = f/1500$ mW/cm^2 (f = operating frequency)

$S = 824/1500 = 0.55$ mW/cm^2 (worst case)

MPE Calculation to Determine Safe Maximum Antenna Gain (G)

Values: $S = 0.55$ mW/cm^2

$P = 370$mW

$R = 20$cm

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

$0.55 = 370xG/(12.56 \times 20^2)$

$0.55 \times (12.56 \times 20^2) = 370 \times G$

$0.55 \times (12.56 \times 20^2)/ 370 = G$

$G = 7.46$ (8.7dBi)

Calculation for Maximum radiated power output

Maximum antenna gain G that can be used to comply with the maximum transmitter power limit of 7W ERP of Part 22.913 (a)(2) is calculated as:

For ERP = 7W limit (38.45dBm)

ERP = EIRP – 2.1dB (half wave dipole gain)

EIRP = 38.45 + 2.1 = 40.55dBm = 11.35W

So for max gain antenna permitted (G) :

EIRP = P x G

P conducted =1.48W

ie: 11.35 = 1.48 x G

G = 7.66 (8.8dBi)

For GSM850 maximum antenna gain is therefore limited to 8.7dBi by MPE requirements.

For PCS1900

Transmitter frequency range = 1850MHz to 1910MHz

Max. measured conducted transmitter power P = 28.6dBm (0.724W)

MPE Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for PCS1900

S = 1.0 mW/cm^2 (worst case)

MPE Calculation to Determine Safe Maximum Antenna Gain (G)

Values: S = 1.0 mW/cm^2

P = 724mW

R = 20cm

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

$1.0 = 724xG/(12.56 \times 20^2)$

$1.0 \times (12.56 \times 20^2) = 724 \times G$

$1.0 \times (12.56 \times 20^2)/ 724 = G$

G = 6.94 (8.4dBi)

Calculation for Maximum radiated power output

Maximum antenna gain G that can be used to comply with the maximum transmitter power limit of 2W EIRP of Part 24.232(b) is calculated as:

P x G = 2

P conducted =0.724W

ie: **G = 2/0.724 = 2.76 (4.4dBi)**

For PCS1900 maximum antenna gain is therefore limited to 4.4dBi by FCC Rule 24.232(b) EIRP for maximum permitted transmitter power.

For 2.4GHz band

Transmitter frequency range = 2412 – 2462MHz band

Max. measured Transmitter EIRP = 20.6dBm max using 5dBi gain antenna

MPE Requirement

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

S = 1.0 mW/cm^2 (worst case)

MPE Calculation Using 5.0dBi max Gain Antenna

Values:

PG (EIRP) = 20.6dBm (115mW)

R = 20cm

S = PxG/4 π R^2

S = 115/ (12.56 x 20^2)

= 115/ 5024

S = 0.023

This is within the required S = 1.0 mW/ cm^2 requirement.

Conclusion

The DCM300G complies with FCC Rule Part 1.1310 using a 5.0dBi gain antenna in the 2.4GHz WIFI band. FCC Rule Part 1.1310 and ERP Part 22.913 (a)(2), EIRP Part 24.232 (b) maximum transmitter power limits will not be exceeded for the DCM300G with antenna gains, including cable loss not exceeding 8.7dBi (850MHz) and 4.4dBi (1900MHz) respectively.