# MPE Calculation

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| Address: | Vonderweg 48, 7468 DC Enter, THE NETHERLANDS |
| Product: | TUBULAR MOTOR |
| FCC ID: | ZY4CM0910B |
| Model No.: | CM-09-C120, CM-09-QC120, CM-10-QC120 |
| Reference RF report # | 709502228915-00B, 709502228915-00C |

According to subpart 15.247(i)and subpart §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

| (B) Limits for General Population/Uncontrolled Exposure | | | | |
|---|---|---|---|---|
| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density ($mW/cm^2$) | Averaging Time (minutes) |
| 0.3–1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34–30 | 824/f | 2.19/f | *(180/$f^2$) | 30 |
| 30–300 | 27.5 | 0.073 | 0.2 | 30 |
| 300–1,500 | / | / | f/1500 | 30 |
| 1,500–100,000 | / | / | 1.0 | 30 |

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:
Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. $mW/cm^2$);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);


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Calculated Data for BLE

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|---|---|
| Maximum peak output power at antenna input terminal (dBm): | -5.07 |
| Maximum peak output power at antenna input terminal (mW): | 0.31 |
| Prediction distance (cm): | 20 |
| Antenna Gain, typical (dBi): | 1.0 |
| Maximum Antenna Gain (numeric): | 1.258 |
| The worst case is power density at predication frequency at 20 cm (mW/cm$^2$): | 0.0001 |
| MPE limit for general population exposure at prediction frequency (mW/cm$^2$): | 1.0 |

The max power density 0.0001 (mW/cm$^2$) < 1 (mW/cm$^2$)
Result: Compliant

Calculation method for 433.92MHz

Calculate the EIRP from the radiated field strength in the far field using Equation (22):

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.7 \quad (22)$$

where

EIRP is the equivalent isotropically radiated power, in dBm
$E_{Meas}$ is the field strength of the emission at the measurement distance, in dBμV/m
$d_{Meas}$ is the measurement distance, in m

NOTE—Because this equation yields the identical result whether the field strength is extrapolated using the default 20 dB/decade of distance extrapolation factor, or the field strength is not extrapolated for distance, this equation can generally be applied directly (with no further correction) to determine EIRP. In some cases, a different distance correction factor may be required; see 9.1.

For 433.92MHz.

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|---|---|
| Field Strength (EMeas): | 80.47(dBuV/m)<br>(f=433.92 MHz) |
| Measurement Distance(dMeas): | 3 (m) |
| Equivalent Isotropically Radiated Power(EIRP): | -14.68dBm |

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:
Predication of MPE limit at a given distance
S = PG/4 π R² = power density (in appropriate units, e.g. mW/cm$^2$);
PG = −14.68dBm=0.03404mW (in appropriate units, e.g., mW);
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:
The max power density 0.03404/4 π R²= 7.775*10$^{-6}$(mW/cm$^2$) < 0.28928 (mW/cm$^2$)

Result: Compliant


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**Simultaneous transmission of MPE test exclusion for worst case configuration**

BLE: the ratio is 0.0001/1
433.92MHz:the ratio is $7.775*10^{-6}$ / 0.28928=$2.688*10^{-5}$

The sum of the MPE ratios for all simultaneous transmitting antennas:
0.0001+$2.688*10^{-5}$=$1.268*10^{-4}$

As the sum of MPE ratios for all simultaneous transmitting antennas is ≤ 1.0, simultaneous transmission MPE test exclusion will be applied.

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