

## MPE Calculation

|                       |   |
|-----------------------|---|
| Applicant:            | Coulisse B.V.                           |
| Address:              | Vonderweg 48 Enter, 7468 DC Netherlands |
| FCC ID:               | ZY4CM07B1                               |
| Product:              | Tubular Motor                           |
| Model No.:            | CM-07                                   |
| Reference RF report # | 709502404488-00B, 709502404488-00C      |

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 <sup>2</sup> ) | Averaging Time (minutes) |
| 0.3–1.34  | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30   | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 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<sup>2</sup>);

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);

## Calculated Data for BLE

|  |         |
|--|---------|
| Maximum peak output power at antenna input terminal (dBm):                               | -3.46   |
| Maximum peak output power at antenna input terminal (mW):                                | 0.45    |
| Prediction distance (cm):  | 20      |
| Antenna Gain, typical (dBi):   | 2.2     |
| Maximum Antenna Gain (numeric):  | 1.660   |
| The worst case is power density at predication frequency at 20 cm (mW/cm <sup>2</sup> ): | 0.00015 |
| MPE limit for general population exposure at prediction frequency (mW/cm <sup>2</sup> ): | 1.0     |

The max power density 0.00015 (mW/cm<sup>2</sup>) < 1 (mW/cm<sup>2</sup>)

Result: Compliant

## Calculation method for 433.92MHz

$$\text{EIRP} = p_t \times g_t = (E \times d)^2 / 30$$

where

|       |   |
|-------|---|
| $p_t$ | is the transmitter output power in watts                        |
| $g_t$ | is the numeric gain of the transmitting antenna (dimensionless) |
| $E$   | is the electric field strength in V/m                           |
| $d$   | is the measurement distance in meters (m)                       |

For 433.92MHz.

|  |   |
|--|---|
| Field Strength (E <sub>Meas</sub> ):           | 89.70(dBuV/m)=0.0305V/m<br>(f=433.92 MHz) |
| Measurement Distance(d <sub>Meas</sub> ):      | 3 (m)                                     |
| Equivalent Isotropically Radiated Power(EIRP): | 0.000280W=0.280mW                         |

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<sup>2</sup>);

PG =0.165mW (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  $0.280\text{mW}/4 \pi R^2 = 5.5704 \times 10^{-5} (\text{mW}/\text{cm}^2) < 0.28928 (\text{mW}/\text{cm}^2)$

Result: Compliant



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

- (1) BLE: the ratio is  $0.00015 / 1 = 0.00015$   
433.92MHz: the ratio is  $5.5704 \times 10^{-5} / 0.28928 = 1.9256 \times 10^{-4}$

The sum of the MPE ratios for all simultaneous transmitting antennas (433.92+2.4G BLE):  
 $0.00015 + 1.1353 \times 10^{-4} = 0.000343$

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

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:

Prepared by:

Tested by:



Hui TONG

Wenqiang LU

Chengjie GUO

EMC Section Manager

EMC Project Engineer

EMC Test Engineer

Date: 2025-02-18

Date: 2025-02-18

Date: 2025-02-18