



## 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<sup>2</sup> = 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 (EMeas):	89.70(dBuV/m)=0.0305V/m (f=433.92 MHz)
Measurement Distance(dMeas):	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 0.280mW/4  $\pi$  R<sup>2</sup> = 5.5704\*10<sup>-5</sup>(mW/cm<sup>2</sup>) < 0.28928 (mW/cm<sup>2</sup>)

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

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Date: 2025-02-18

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