

# 1. RF Exposure Requirements

---

## 1.1 General Information

### Client Information

|                          |                                                  |
|--------------------------|--------------------------------------------------|
| Applicant:               | Pro Design, LLC                                  |
| Address of applicant:    | 1151 Campus Dr., Stow, Ohio 44224, United States |
| Manufacturer:            | Pro Design, LLC                                  |
| Address of manufacturer: | 1151 Campus Dr., Stow, Ohio 44224, United States |

### General Description of EUT:

|                  |                  |
|------------------|------------------|
| Product Name:    | DC Tubular Motor |
| Trade Name:      | /                |
| Model No.:       | DM25CE/S-1.1/28  |
| Adding Model(s): | DM25CE/S-1.1/16  |
| Rated Voltage:   | Battery:12V      |
| Power Adaptor :  | /                |
| FCC ID:          | 2BMF4DM25CES1128 |
| Equipment Type:  | Portable device  |

### Technical Characteristics of EUT:

|                      |                 |
|----------------------|-----------------|
| Frequency Range:     | 433.92MHz       |
| Max. Field Strength: | 80.57dBuV/m(3m) |
| Data Rate:           | /               |
| Modulation:          | 2GFSK           |
| Antenna Type:        | line Antenna    |
| Antenna Gain:        | 0dBi            |

## 1.2 RF Exposure Exemption

According to §1.1307(b)(3) and KDB 447498 D04 Interim General RF Exposure Guidance v01, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

**Option A:** FCC Rule Part 1.1307 (b)(3)(i)(A): The available maximum time-averaged power is no more than 1mW, regardless of separation distance.

**Option B:** FCC Rule Part 1.1307 (b)(3)(i)(B): The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold  $P_{th}$  (mW) described in the following formula.  $P_{th}$  is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left( \frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

$d$  = the separation distance (cm);

**Option C:** FCC Rule Part 1.1307 (b)(3)(i)(C): The minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. R must be at least  $\lambda/2\pi$ , where  $\lambda$  is the free-space operating wavelength in meters.

| Single RF Sources Subject to Routine Environmental Evaluation |                       |
|---------------------------------------------------------------|-----------------------|
| RF Source frequency (MHz)                                     | Threshold ERP (watts) |
| 0.3-1.34                                                      | $1,920 R^2$           |
| 1.34-30                                                       | $3,450 R^2/f^2$       |
| 30-300                                                        | $3.83 R^2$            |
| 300-1,500                                                     | $0.0128 R^2 f$        |
| 1,500-100,000                                                 | $19.2 R^2$            |

**For Multiple RF sources:** FCC Rule Part 1.1307(b)(3)(ii):

- (A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required).
- (B) In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

### 1.3 Calculated Result

| Radio Access Technology | Prediction Frequency (MHz) | Max. Field Strength (dBuV/m) | Antenna Gain (dBi) | Output Power (dBm) | Tune-Up Power (dBm) | ERP (dBm) |
|-------------------------|----------------------------|------------------------------|--------------------|--------------------|---------------------|-----------|
| SRD                     | 433.92                     | 80.57                        | 0                  | -14.69             | -14.00              | -14.01    |

| Frequency (MHz) | Option | Min. Distance (cm) | Max. Power (dBm) | Max. Power (mW) | Exposure Limit (mW) | Ratio | Result Pass/Fail |
|-----------------|--------|--------------------|------------------|-----------------|---------------------|-------|------------------|
| 433.92          | B      | 0.5                | -14.00           | 0.04            | 23.17               | 0.01  | Pass             |

Note: 1.  $EIRP = E - 104.8 + 20 \log D$ ; Output Power = EIRP - Antenna Gain;

$ERP = EIRP - 2.15 \text{ dB}$

2. Option A, B and C refers as clause 1.2.

3. For option B, Max (time-averaged power, effective radiated power (ERP)) converts to Max. Power.

For option C, ERP converts to Max. Power;

4. For option B,  $P_{th}$  (mW) converts to Exposure Limit (mW); For option C, ERP (W) converts to Exposure Limit (mW).

5. Ratio = Tune-Up ERP (mW) / Exposure Limit (mW)

**Mode for Simultaneous Multi-band Transmission:**

| Radio Access Technology | Ratio 1 | Ratio 2 | Ratio 3 | Simultaneous Ratio | Limit | Result Pass/Fail |
|-------------------------|---------|---------|---------|--------------------|-------|------------------|
| /                       | /       | /       | /       | /                  | /     | /                |

Result: Pass