




# Maximum Permissible Exposure Evaluation

**FCC ID: 2APN5-MINIZBRBS**

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) Radiation as specified in §1.1307(b).

**EUT Specification**

|                            |  |
|----------------------------|--|
| Product Name:              | <b>Smart Roller Shutter Switch</b>   |
| Trade Mark:                |  , Sonoff   |
| Model/Type Reference:      | MINI-ZBRBS   |
| Listed Model(s):           | MINI-ZBRBS-ZS  |
| Model Differences:         | All these models are identical in the same PCB, layout, electrical circuit and enclosure. The only difference lies in the fact that the sales channels are different.  |
| Frequency Band (Operating) | Zigbee: 2405MHz ~ 2480MHz  |
| Device Category            | <input type="checkbox"/> Portable (<5mm separation)<br><input type="checkbox"/> Mobile (>20cm separation)<br><input checked="" type="checkbox"/> Fixed (>20cm separation)<br><input type="checkbox"/> Others ____              |
| Exposure Classification    | <input type="checkbox"/> Occupational/Controlled exposure ( $S=5\text{mW}/\text{cm}^2$ )<br><input checked="" type="checkbox"/> General Population/Uncontrolled exposure ( $S=1\text{mW}/\text{cm}^2$ )                        |
| Antenna Diversity          | <input checked="" type="checkbox"/> Single antenna<br><input type="checkbox"/> Multiple antennas<br><input type="checkbox"/> Tx diversity<br><input type="checkbox"/> Rx diversity<br><input type="checkbox"/> Tx/Rx diversity |
| Antenna Gain (Max)         | Zigbee: 0.77dBi  |
| Evaluation Applied         | <input checked="" type="checkbox"/> MPE Evaluation<br><input type="checkbox"/> SAR Evaluation  |

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**Limits for Maximum Permissible Exposure (MPE)**

| Frequency Range (MHz)                                   | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
|---|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| (A) Limits for Occupational/Controlled Exposure         |                               |                               |                                     |                          |
| 300-1500  | --                            | --                            | F/300                               | <6                       |
| 1500-100000   | --                            | --                            | 5                                   | <6                       |
| (B) Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
| 300-1500  | --                            | --                            | F/1500                              | <30                      |
| 1500-100000   | --                            | --                            | 1                                   | <30                      |

**Calculation Method**

Friis transmission formula:  $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where:

$P_d$  = Power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

G = gain of antenna in linear scale

$\pi$  = 3.1416

R = distance between observation point and center of the radiator in cm

$P_d$  limit of MPE is 1mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

**Measurement Result**

| Mode   | Frequency (MHz) | Antenna Gain (dBi) | Maximum Power (dBm) | Tune Up Tolerance (dB) | Max. Tune Up Power (dBm) | Power Density at 20cm (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) |
|--------|-----------------|--------------------|---------------------|------------------------|--------------------------|---|-----------------------------|
| Zigbee | 2405            | 0.77               | 8.56                | ±1                     | 9                        | 0.0019                                      | 1                           |

Note:

1. Calculate in the worst-case mode.
2. Max. Tune Up Power is declared by manufacturer, and used to calculate.
3. For a more detailed features description, please refer to the RF Test Report.

\*\*\*\*\*THE END\*\*\*\*\*