

1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 General Information

Client Information

Applicant: Ultimate IOT (Shanghai) Technology Ltd.
Address of applicant: Building C, No. 888, Huanhu 2nd Road (West), Lin-Gang Special Area,
China (Shanghai) Pilot FTZ, China

Manufacturer: Ultimate IOT (Shanghai) Technology Ltd.
Address of manufacturer: Building C, No. 888, Huanhu 2nd Road (West), Lin-Gang Special Area,
China (Shanghai) Pilot FTZ, China

General Description of EUT:

Product Name: Zigbee
Trade Name: /
Model No.: UM89P51
Adding Model(s): /
Rated Voltage: DC3.3V
Power Adapter: /
FCC ID: 2ATY4-UM89P51

Technical Characteristics of EUT:

Zigbee

Support Standards: IEEE802.15.4
Frequency Range: 2405-2480MHz
RF Output Power: 12.01dBm (Conducted)
Type of Modulation: OQPSK
Quantity of Channels: 16
Channel Separation: 5MHz
Type of Antenna: External antenna
Antenna Gain: 0dBi

1.2 Standard Applicable

According to § 1.1307(b)(1) and KDB 447498 D01 General RF Exposure Guidance v06, 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.

(a) Limits for Occupational / Controlled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	F/300	6
1500-100000	/	/	5	6

(b) Limits for General Population / Uncontrolled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-100000	/	/	1	30

Note: f = frequency in MHz: * = Plane-wave equivalents power density

1.3 MPE Calculation Method

$$S = (30 * P * G) / (377 * R^2)$$

S = power density (in appropriate units, e.g., mw/cm²)

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 (in appropriate units, e.g., cm)

1.4 MPE Calculation Result

For Zigbee

Maximum Tune-Up output power: 12.5(dBm)

Maximum peak output power at antenna input terminal: 17.78(mW)

Prediction distance: >20(cm)

Prediction frequency: 2405(MHz)

Antenna gain: 0 (dBi)

Directional gain (numeric gain): 1.00

The worst case is power density at prediction frequency at 20cm: 0.0035w/cm²

MPE limit for general population exposure at prediction frequency: 1 (mw/cm²)

Result: Pass