

## MPE Calculation

Applicant:	Zhejiang Lingzhu Technology Co., Ltd.
Address:	Room 302, No 1 Building Huace Center, Xihu District 310000, Hangzhou City, Zhejiang Province, PEOPLE'S REPUBLIC OF CHINA
Product:	Dual Band Wireless Multi-mode Gateway
FCC ID:	2BEWX-THP01-ZB
Model No.:	THP01-ZB-V5
Reference RF report #	4842025239900A, 4842025239900B, 4842025239900C, 4842025239900D

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) (KDB 447498 D01, §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 2.4G Wi-Fi:

Maximum peak output power at antenna input terminal (dBm):	22.74
Maximum peak output power at antenna input terminal (mW):	187.93
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	1.98
Maximum Antenna Gain (numeric):	1.58
The worst case is power density at predication frequency at 20 cm (mW/cm <sup>2</sup> ):	0.059
MPE limit for general population exposure at prediction frequency (mW/cm <sup>2</sup> ):	1.00

## For Bluetooth LE:

Maximum peak output power at antenna input terminal (dBm):	7.11
Maximum peak output power at antenna input terminal (mW):	5.14
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	1.98
Maximum Antenna Gain (numeric):	1.58
The worst case is power density at predication frequency at 20 cm (mW/cm <sup>2</sup> ):	0.0016
MPE limit for general population exposure at prediction frequency (mW/cm <sup>2</sup> ):	1.00

## For Zigbee:

Maximum peak output power at antenna input terminal (dBm):	5.67
Maximum peak output power at antenna input terminal (mW):	3.69
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	2.45
Maximum Antenna Gain (numeric):	1.76
The worst case is power density at predication frequency at 20 cm (mW/cm <sup>2</sup> ):	0.0013
MPE limit for general population exposure at prediction frequency (mW/cm <sup>2</sup> ):	1.00

## For 5G Wi-Fi:

Maximum peak output power at antenna input terminal (dBm):	17.17
Maximum peak output power at antenna input terminal (mW):	52.12
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	2.14
Maximum Antenna Gain (numeric):	1.64
The worst case is power density at predication frequency at 20 cm (mW/cm <sup>2</sup> ):	0.017
MPE limit for general population exposure at prediction frequency (mW/cm <sup>2</sup> ):	1.00

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

- (1) 2.4G Wi-Fi: the ratio is 0.059/1  
Zigbee: the ratio is 0.0013/1

The sum of the MPE ratios for all simultaneous transmitting antennas (2.4G Wi-Fi + Zigbee):  
 $0.059 + 0.0013 = 0.0603$

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

- (2) 5G Wi-Fi: the ratio is 0.017/1  
Zigbee: the ratio is 0.0013/1

The sum of the MPE ratios for all simultaneous transmitting antennas (5G Wi-Fi + Zigbee):  
 $0.017 + 0.0013 = 0.0183$

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

- (3) BLE: the ratio is 0.0016/1  
Zigbee: the ratio is 0.0013/1

The sum of the MPE ratios for all simultaneous transmitting antennas (BLE + Zigbee):  
 $0.0016 + 0.0013 = 0.0029$

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

**Result: Compliant**

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

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-----End of Test Report-----