

MPE Calculation

Model : **D04011**
Product Type : Smart Access Point Pro
Applicant : ABB Xiamen Smart Technology Co., Ltd.
Manufacturer : ABB Xiamen Smart Technology Co., Ltd.
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FCC ID : 2AEBL-D04011

According to subpart 15.247(i), 15.407(f), subpart §1.1307(b)(1) and §2.1091, 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. All equipment shall be considered to operate in a "general population/uncontrolled" environment.

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 ²)	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	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/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 (appropriate units, e.g., cm);

Calculated Data:

For BLE:

Maximum peak output power at antenna input terminal (dBm):	4.01
Maximum peak output power at antenna input terminal (mW):	2.52
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	1
Maximum Antenna Gain (numeric):	1.26
The worst case is power density at predication frequency at 20 cm (mW/cm2):	6.32x 10⁻⁴
MPE limit for general population exposure at prediction frequency (mW/cm2):	1.0

6.32x 10⁻⁴ (mW/cm2) < 1 (mW/cm2)

For 2.4G WIFI:

Ant1:

Maximum peak output power at antenna input terminal (dBm):	18.89
Maximum peak output power at antenna input terminal (mW):	77.4
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	3.6
Maximum Antenna Gain (numeric):	2.29
The worst case is power density at predication frequency at 20 cm (mW/cm2):	0.035
MPE limit for general population exposure at prediction frequency (mW/cm2):	1.0

Ant2:

Maximum peak output power at antenna input terminal (dBm):	18.95
Maximum peak output power at antenna input terminal (mW):	78.5
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	3.6
Maximum Antenna Gain (numeric):	2.29
The worst case is power density at predication frequency at 20 cm (mW/cm2):	0.036
MPE limit for general population exposure at prediction frequency (mW/cm2):	1.0

0.036 (mW/cm2) < 1 (mW/cm2)

For 5G WIFI:

Maximum output power at antenna input terminal (dBm):	20.40
Maximum peak output power at antenna input terminal (mW):	109.6
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	4.2
Maximum Antenna Gain (numeric):	2.63
The worst case is power density at predication frequency at 20 cm (mW/cm2):	0.057
MPE limit for general population exposure at prediction frequency (mW/cm2):	1.0

0.057 (mW/cm2) < 1 (mW/cm2)



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For simultaneous transmission: BLE and 2.4G WIFI and 5G WIFI transmit at the same time:

The total power density at predication frequency at 20 cm (mW/cm2):	6.32×10^{-4} $+0.035+0.036+0.057=0.128632$
MPE limit for general population exposure at prediction frequency (mW/cm2):	1.0

$0.128632 \text{ (mW/cm}^2) < 1 \text{ (mW/cm}^2)$

Result: Compliant

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