

SAR evaluation
FCC ID: 2AP6W-DIRECTOR55290

MPE Calculation Method

$$E \text{ (V/m)} = (30 \cdot P \cdot G)^{0.5} / d$$

$$\text{Power Density: } P_d \text{ (W/m}^2\text{)} = E^2 / 377$$

E = Electric Field (V/m)

P = Peak RF output Power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$P_d = (30 \cdot P \cdot G) / (377 \cdot d^2)$$

From the peak EUT RF output power, the minimum mobile separation distance,
d=0.2m, as well

as the gain of the used antenna, the RF power density can be obtained.

Calculated WIFI Result and Limit (WORSE CASE IS AS BELOW)

Antenna Gain (Numeric)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
10.99	97.27 (19.88dBm)	0.212665	1	Compiles

Note:

Antenna Gain: 7.40dBi (2.4G Band)

Assembly Antenna Gain: 10.41dBi

Assembly Antenna Gain (Numeric): 10.99

ERP= 651.63mW

WIFI 2.4G band and 5G band cannot transmit Simultaneously

Calculated Bluetooth Result and Limit (WORSE CASE IS AS BELOW)

$$e_{\text{irp}} = p_t \times g_t = (E \cdot d)^2 / 30$$

where:

p_t = transmitter output power in watts,

g_t = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m, --- $10^{((\text{dBuV/m})/20)/10^6}$

d = measurement distance in meters (m)---3m

$$\text{So } p_t = (E \cdot d)^2 / (30 \times g_t)$$

Ant gain =7.40dBi so Ant numeric gain= 5.50

Field strength =93.71dBμV/m @3m@2480MHz

So $P_t = \{ [10^{(93.71/20)} / 10^6 \times 3]^2 / (30 \times 5.5) \} \times 1000 \text{ mW} = 0.1282 \text{ mW}$

Antenna Gain (Numeric)	Peak Output Power (mW)	Power Density (S) (mW/cm2)	Limit of Power Density (S) (mW/cm2)	Test Result
5.50	0.1282	0.00014	1	Compiles

$ERP = 0.4295 \text{ mW}$

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} = 97.27/3060 + 0.1282/3060 = 0.03183$$

$$\sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} = (651.63 + 0.4295) / 3060 = 0.21309$$

$$\sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} = (0.212665 + 0.000140) / 1 = 0.212805$$

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

$0.03183 + 0.21309 + 0.212805 = 0.457725 < 1$