Maximum Permissible Exposure (MPE) Evaluation Report

Report No. : EME-020636
Model No. : M4Y-0305M
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Summary of Tests

MPE Evaluation meet FCC OET No. 65: 1997/ IEEE C95.1-1999

2.4GHz Wireless LAN Card-Model: XI-305M
FCC ID: M4Y-0305M

Test	Reference	Results
MPE Evaluation	FCC Guidelines for Human Exposure IEEE C95.1	Complies

1. Introduction

The EUT operates in the 2.4GHz ISM band. Due to the EUT (include antenna) at its normal operation distance is at least 20 cm from the human body, the EUT was defined as a Mobile Device.

The EUT can be equipped with three kind of antenna, the three combinations are listed as below:

Type of EUT	**Definition in this report**
Module with Path antenna	XI-305M (with Antenna 1)
Module with DIPOLE antenna (single)	XI-305M (with Antenna 2)
Module with DIPOLE antenna (a set of two)	XI-305M (with Antenna 3)

In characteristic, Antenna 2 and Antenna 3 are identical even the antenna gain, the difference is only in number of antenna.

The reason to do the MPE Evaluation is to avoid the RF hazard to human body. The maximum output power and gain of the antenna were used to calculate the limited distance from the product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed.

The Notice in Installation Manual has been stated as below:
While installing and operating this transmitter, the radio frequency exposure limit of 1mW/(cm*cm) may be exceeded at distances close to the transmitter. therefore, the user must maintain a minimum distance of 20 cm from the device at all time.

2. RF Exposure Limit

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

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A) Limits for Occupational / Control Exposures				
30-300	61.4	0.163	1.0	6
300-1500	-	-	F/300	6
1500-100,000	-	-	5	6
(B) Limits for General Population / Uncontrolled Exposure				
30-300	27.5	0.073	0.2	30
300-1500	-	-	F/1500	30
1500-100,000	-	-	1.0	30

F= Frequency in MHz

3. RF Exposure calculations

From §FCC 1.1310 table 1, the maximum permissible RF exposure for an uncontrolled environment is 1mW/(cm*cm), where, (cm*cm) = square cm.
The electric field generated for a 1mW/(cm*cm) exposure (S) is calculated as follows:

S = E*E/Z

where, S = Power density
E = Electric field
Z = Impedance
so, 1mW/(cm*cm) = 10 W/(m*m)

Z is 377 ohm of the impedance of free space, where E and H field are perpendicular.
Thus the Electric field to produce a 1mW/(cm*cm) exposure is:
$E = (10 \times 377)^{1/2}$ = 61.4 V/m, which is equivalent to 1mW/(cm*cm)

Test Condition: Path antenna

Maximum conducted peak output power is 14.01 dBm and maximum antenna gain is 0 dBi. The maximum radiated output power resulted in 25.176 mW.

Using the relationship between electric field E, effective radiated power in watts P, and distance in meters D, the corresponding distance D to produce a 1mW/(cm*cm) is calculated by the following expression:

$D = (P \times 30)^{1/2} / E = (25.176 \times 10 \times 30)^{1/2} / 61.4 = 1.42$ cm
where, P: maximum effective radiated power measured, 14.01 dBm (25.176 mW)
E: electric field equivalent to 1mW/(cm*cm), 61.4 V/m

The minimum distance by calculation and normal use distance were listed in the table as below:

Peak output power		Calculated RF Exposure Allowable Minimum Separation Distance(cm)	Normal Use Minimum RF Exposure Separation Distance(cm)
dBm	mW	1.42	20
14.01	25.176		

The calculated Minimum allowable distance is very close to the antenna, and is far away from the normal use distance.

Test Condition: DIPOLE antenna

Maximum conducted peak output power is 14.01 dBm and maximum antenna gain is 3 dBi. The maximum radiated output power resulted in 50.234 mW.

Using the relationship between electric field E, effective radiated power in watts P, and distance in meters D, the corresponding distance D to produce a 1mW/(cm*cm) is calculated by the following expression:

$D = (P \times 30)^{1/2} / E = (50.234 \times 10 \times 30)^{1/2} / 61.4 = 2.00$ cm
where, P: maximum effective radiated power measured, 17.01 dBm (50.234 mW)
E: electric field equivalent to 1mW/(cm*cm), 61.4 V/m

The minimum distance by calculation and normal use distance were listed in the table as below:

Peak output power		Calculated RF Exposure Allowable Minimum Separation Distance(cm)	Normal Use Minimum RF Exposure Separation Distance(cm)
dBm	mW	2.00	20
17.01	50.234		

The calculated Minimum allowable distance is very close to the antenna, and is far away from the normal use distance.