Maximum Permissible Exposure (MPE) Evaluation Report

Report No. : EME-021561

Model No. : WB1500SH

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ITS Intertek Testing Services
ETL SEMKO

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Summary of Tests

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

802.11b Wireless Short PC Card with high power
Model: WB1500SH
FCC ID: MQ4WB1K5SH

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.   The EUT (antenna included) is compliant with modular approval and the normal operation distance (after installing in other device, such as router or access point), 20cm from the human body; therefore, the EUT is defined as a Mobile Device.

The EUT can be equipped with four kinds of antenna, and the combinations are listed as below:

Item	Type of EUT	Definition in this report
1	Module with dipole antenna (with ground, a set of two antennas, 15cm & 12cm, white and black color)	WB1500SH (with antenna A)
2	Module with dipole antenna (without ground, a set of two antennas, 15cm & 12cm, white and black color)	WB1500SH (with antenna A1)
3	Module with dipole antenna (the same as item 2, the only difference is manufacturer)	WB1500SH (with antenna A2)
4	Module with dipole antenna (with ground, single antenna)	WB1500SH (with antenna B)

In characteristic, Antenna A1 and Antenna A2 are identical even the antenna gain

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: A set of two antennas (antenna A, A1&A2)

Maximum conducted peak output power is 19.69 dBm and maximum antenna gain is 2 dBi. The maximum radiated output power resulted in 147.57 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:

$D = (P \times 30)^{1/2} /E = (147.57 \times 10 \times 30)^{1/2} /61.4 = 3.43$ cm
where, P: maximum effective radiated power measured, 21.69 dBm (147.57 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:

E.I.R.P.		Calculated RF Exposure Allowable Minimum Separation Distance(cm)	Normal Use Minimum RF Exposure Separation Distance(cm)
dBm	mW	3.43	20
21.69	147.57		

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

Test Condition: Signal antennas (antenna B)

Maximum conducted peak output power is 19.69 dBm and maximum antenna gain is 1.8 dBi. The maximum radiated output power resulted in 140.93 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:

$D = (P \times 30)^{1/2} / E = (140.93 \times 10 \times 30)^{1/2} / 61.4 = 3.35$ cm
where, P: maximum effective radiated power measured, 21.49 dBm (140.93 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:

E.I.R.P.		Calculated RF Exposure Allowable Minimum Separation Distance(cm)	Normal Use Minimum RF Exposure Separation Distance(cm)
dBm	mW		
21.49	140.93	3.35	20

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