



Maximum Permissible Exposure (MPE) Evaluation Report

Report No. : TS10110092-EME
Model No. : HES-309M, MAX308M
Issued Date : Jan. 06, 2010

Applicant: ZyXEL Communications Corporation
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Hsin-Chu, Taiwan

Test Method/ Standard: FCC 1.1310

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Summary of Tests

MPE Evaluation meet FCC OET No. 65: 1997, IEEE C95.1-2005

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

1. Introduction

The EUT operates in the 2.5GHz band about WiMAX IEEE 802.16e. 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 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 Power density (S) at 40 cm distance away from the product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 and Safety Code 6 are followed.

According to 1.1307 (b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission’s guideline.

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 1 mW/(cm²) (or 10 W/m²)*

Power density (S) is calculated by the following formula:

$$S = (P * G) / 4\pi R^2$$

where, S = Power density (mW/cm²)

P = Output power to antenna (mW)

R = Distance between radiating structure and observation point (cm)

G = Gain of antenna in numeric

$\pi = 3.1416$

Example:

Assume a mobile device operates at 2412MHz and its maximum output power is 50mW, and the maximum gain of antenna is 1 (numeric) /0dBi.

then the power density (S) = $(50 * 1) / 4 * \pi * 20^2 = 0.00995$ (mW/cm²) (or = 0.0995 W/m²)

4 Description of EUT

The EUT is a WiMAX Outdoor CPE and was defined as fixed station, it has two type of Bandwidth, one is 5MHz, the other is 10MHz and was defined as information technology equipment.

The customer confirmed the models listed below were identical to model HES-309M (EUT). Different brands served as marketing strategy.

<u>Trade Name</u>	<u>Model Number</u>
ZyXEL	HES-309M
MitraStar	MAX307M

4.1 Antenna description

The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.

Antenna Gain : 14dBi max
Antenna Type : Directional patch antenna
Connector Type : I-PAX

4. Test results

For 5 MHz

Modulation(Coding rate)	Frequency (MHz)	Maximum antenna gain (numeric)	Output power to antenna (mW)	Power density (mW/cm ²)	Limit of power density (mW/cm ²)
QPSK(1/2)	2502.5	25.12	498.88	0.623261289	1.0
	2590	25.12	500.03	0.624698054	1.0
	2687.5	25.12	526.02	0.657158536	1.0
QPSK(3/4)	2502.5	25.12	464.52	0.580323494	1.0
	2590	25.12	476.43	0.595209910	1.0
	2687.5	25.12	498.88	0.623261289	1.0
16QAM(1/2)	2502.5	25.12	474.24	0.592475169	1.0
	2590	25.12	486.41	0.607673298	1.0
	2687.5	25.12	506.99	0.633388470	1.0
16QAM(3/4)	2502.5	25.12	480.84	0.600717319	1.0
	2590	25.12	497.74	0.621827828	1.0
	2687.5	25.12	516.42	0.645164041	1.0

For 10 MHz

Modulation(Coding rate)	Frequency (MHz)	Maximum antenna gain (numeric)	Output power to antenna (mW)	Power density (mW/cm ²)	Limit of power density (mW/cm ²)
QPSK(1/2)	2505	25.12	458.14	0.572361158	1.0
	2590	25.12	483.06	0.603490105	1.0
	2685	25.12	515.23	0.643680205	1.0
QPSK(3/4)	2505	25.12	450.82	0.563209736	1.0
	2590	25.12	475.34	0.593840965	1.0
	2685	25.12	506.99	0.633388470	1.0
16QAM(1/2)	2505	25.12	453.94	0.567113719	1.0
	2590	25.12	477.53	0.596582010	1.0
	2685	25.12	510.50	0.637778909	1.0
16QAM(3/4)	2505	25.12	459.20	0.573680586	1.0
	2590	25.12	480.84	0.600717319	1.0
	2685	25.12	509.33	0.636312058	1.0

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 40 cm from the device at all time.