Maximum Permissible Exposure (MPE) Evaluation Report

Report No. : **TS12110033-EME**
Model No. : **PLA4231**
Issued Date : **Dec. 13, 2012**

Applicant: **ZyXEL Communications Corporation**
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Test Method/ Standard: **FCC 1.1310**

Test By: **Intertek Testing Services Taiwan Ltd.**
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Summary of Tests

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

500 Mbps Powerline Wireless N Extender -Model: PLA4231
FCC ID: I88PLA4231

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

1. Introduction

The EUT operates in the 2.4 GHz 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 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 20 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/(cm^2) (or 10 W/m^2)*

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

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

where, S = Power density (mW/cm^2)
P = Output power to antenna (mW)
R = Distance between radiating structure and observation point (cm)
G = Gain of antenna in numeric
π = 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/cm^2) (or = 0.0995 W/m^2)

4. Description of EUT

The EUT is a 500 Mbps Powerline Wireless N Extender, the device is a MIMO product, it’s two transmitter and two receiver with one wireless module embedded.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

4.1 Antenna description

(1) Antenna 1 (Chain 0)

The EUT uses a permanently connected antenna.

Antenna Gain	: 3.1 dBi max
Antenna Type	: SMD Chip-omni antenna
Connector Type	:Fixed

(2) Antenna 2 (Chain 1)

The EUT uses a permanently connected antenna.

Antenna Gain	: 3.1 dBi max
Antenna Type	: SMD Chip-omni antenna
Connector Type	: Fixed

4.2 Adapter information

The EUT will be supplied with a power supply from below list:

Peripherals	Brand	Model No.	Serial No.	Description of Data Cable
Notebook PC	DELL	Latitude D610	FXWZK1S	(1) RJ-45 UTP Cat.5 10 meter (2) RJ-45 STP Cat.5 2 meter

5. Test results

Mode	Channel	Frequency (MHz)	Antenna Gain (numeric)	Output power to antenna (mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
802.11b	1	2412	2.04	92.26	0.037474008	1.0	20
	6	2437	2.04	86.30	0.035053400	1.0	20
	11	2462	2.04	91.41	0.037130444	1.0	20
802.11g	1	2412	2.04	145.55	0.059119417	1.0	20
	6	2437	2.04	141.91	0.057640819	1.0	20
	11	2462	2.04	138.68	0.056328754	1.0	20

Mode	Channel	Frequency (MHz)	Antenna Gain (numeric)	Output power to antenna (mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
802.11n (HT20)	1	2412	2.04	334.72	0.135960384	1.0	20
	6	2437	2.04	289.11	0.117432666	1.0	20
	11	2462	2.04	284.01	0.115363423	1.0	20
802.11n (HT40)	3	2422	2.04	285.83	0.116100427	1.0	20
	6	2437	2.04	276.10	0.112147326	1.0	20
	9	2452	2.04	283.81	0.115281638	1.0	20

The Notice in Installation Manual has been stated as below:
While installing and operating this transmitter, the radio frequency exposure limit of 1 mW/ (cm^2) 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.