



A Test Lab Techno Corp.

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MPE Report

Test Report No.	: 1610FS16-01
Applicant	: ZyXEL Communications Corporation
Product Type	: Wireless N VDSL2 Gateway with USB
Trade Name	: ZYXEL
Model Number	: VMG1312-B10D
Date of Received	: Aug. 26, 2016
Test Period	: Sep. 05, 2016
Date of Issued	: Nov. 29, 2016
Test Specification	: ANSI / IEEE Std.C95.1-1992 / IEEE Std. 1528-2013 47 CFR § 2.1091 47 CFR § 1.1310
Location of Test Lab.	: Chang-an Lab.

1. The test operations have to be performed with cautious behavior, the test results are as attached.
2. The test results are under chamber environment of A Test Lab Techno Corp. A Test Lab Techno Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples.
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1. Description of Equipment under Test (EUT)

Applicant	ZyXEL Communications Corporation No.2, Industry East Road IX, Science Park, Hsinchu, Taiwan			
Manufacturer	ZyXEL Communications Corporation No.2, Industry East Road IX, Science Park, Hsinchu, Taiwan			
Product Type	Wireless N VDSL2 Gateway with USB			
Trade Name	ZYXEL			
Model Number	VMG1312-B10D			
FCC ID	I88VMG1312B10D			
Frequency Range	IEEE 802.11b / 802.11g / 802.11n 2.4GHz 20MHz : 2412 - 2462 MHz IEEE 802.11n 2.4GHz 40MHz : 2422 - 2452 MHz			
Antenna information	ANT	Model Number	Type	Max. Gain (dBi)
	Ant-0	3101500652	Dipole Antenna	3
	Ant-1	3101500653	Dipole Antenna	3
Directional Gain	3 dBi (please refer to RF report)			
Antenna Delivery	IEEE 802.11b: 1TX + 1RX (Diversity) IEEE 802.11g / 802.11n 2.4GHz 20MHz / 40MHz: 2TX + 2RX (MIMO)			
Temperature Range	0 ~ +40 °C			
RF Evaluation	0.079 mW/cm ²			

The above equipment was tested by A Test Lab Techno Corp. For compliance with the requirements set forth in 47 CFR § 2.1091 / 47 CFR § 1.1310. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties



2. Human Exposure Assessment

Due to the design and installation of this product, it is not possible to conduct SAR evaluation. This is because client either manufactures or supplies the antenna(s) that will be used in the installation of this product. Therefore, this product will be evaluated as a mobile device per 47 CFR § 1.1310 titled "Radiofrequency radiation exposure limits", generally referred to as MPE limits.

In 47 CFR § 2.1091, paragraph (b) defines a mobile device as "a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 cm is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. " This product is intended to be installed into a vehicle such that the unit is physically secured at one location. In the installation guide supplied with the product,

Client has made the following statement: "IMPORTANT: To meet the FCC's RF Exposure Guidelines, the antenna should be installed so there is at least 20 cm of separation between the body of the user and nearby persons and the antenna". Based on the installation of the transceiver and the antenna, the transmitters radiating structure is more than 20 cm from the user. Thus, this product is a "mobile device" as defined in section § 2.1091 paragraph (b).

Exposure evaluation

$$S = \frac{PG}{4\pi R^2}$$

Where

S: power density

P: power input to the antenna

G: power gain of the antenna in the direction of interest relative to an isotropic radiator.

R: distance to the center of radiation of the antenna.



3. RF Output Power

The conducted power turn-up tolerance reference manufacturer specification.

Band	Data Rate	CH	Frequency (MHz)	Average Conducted power (dBm)		
				ANT-0	ANT-1	ANT-0+1
IEEE 802.11b	1M	1	2412	18.08	---	---
		6	2437	18.01	---	---
		11	2462	14.79	---	---
	2M	6	2437	18.00	---	---
	5.5M	6	2437	17.96	---	---
	11M	6	2437	17.99	---	---
IEEE 802.11g	6M	1	2412	12.86	14.94	17.03
		6	2437	17.85	20.39	22.31
		11	2462	9.46	12.99	14.58
	9M	6	2437	17.81	20.34	22.27
	12M	6	2437	17.82	20.38	22.30
	18M	6	2437	17.77	20.37	22.27
	24M	6	2437	17.79	20.33	22.25
	36M	6	2437	17.83	20.30	22.25
	48M	6	2437	17.80	20.35	22.27
	54M	6	2437	17.89	20.29	22.26
IEEE 802.11n 2.4GHz 20MHz	13M	1	2412	10.36	13.18	15.01
		6	2437	17.03	19.64	21.54
		11	2462	8.75	11.58	13.40
	26M	6	2437	17.01	19.61	21.51
	39M	6	2437	17.02	19.58	21.50
	52M	6	2437	16.95	19.60	21.48
	78M	6	2437	16.97	19.63	21.51
	104M	6	2437	16.92	19.52	21.42
	117M	6	2437	16.99	19.55	21.47
	130M	6	2437	16.90	19.62	21.48
IEEE 802.11n 2.4GHz 40MHz	27M	3	2422	8.46	11.41	13.19
		6	2437	10.43	12.50	14.60
		9	2452	8.29	10.33	12.44
	54M	6	2437	10.35	12.48	14.55
	81M	6	2437	10.39	12.49	14.58
	108M	6	2437	10.32	12.44	14.52
	162M	6	2437	10.40	12.39	14.52
	216M	6	2437	10.41	12.47	14.57
	243M	6	2437	10.38	12.46	14.55
	270M	6	2437	10.30	12.42	14.50

4. Test Result

Band	Data Rate	Frequency (MHz)	Limit (mw)	Distance [R] (cm)	Max tune-up Power (upper limit) [P] (dBm)	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	[P] x [G] with Duty cycle [TP] (mW)	Power Density [S] (mw/cm ²)
IEEE 802.11b (Ant-0)	1M	2412	1	20	19.00	3.00	2	1	158.87	0.032
		2437	1	20	19.00	3.00	2	1	158.87	0.032
		2462	1	20	15.00	3.00	2	1	63.25	0.013
IEEE 802.11g (CDD)	6M	2412	1	20	18.00	3.00	2	1	126.19	0.025
		2437	1	20	23.00	3.00	2	1	399.05	0.079
		2462	1	20	15.00	3.00	2	1	63.25	0.013
IEEE 802.11n 2.4GHz 20MHz (CDD)	13M	2412	1	20	16.00	3.00	2	1	79.62	0.016
		2437	1	20	22.00	3.00	2	1	316.98	0.063
		2462	1	20	14.00	3.00	2	1	50.24	0.010
IEEE 802.11n 2.4GHz 40MHz (CDD)	27M	2422	1	20	14.00	3.00	2	1	50.24	0.010
		2437	1	20	15.00	3.00	2	1	63.25	0.013
		2452	1	20	13.00	3.00	2	1	39.91	0.008

Note:

1. Mobile or fixed location transmitters, minimum separation distance is 20cm, even if calculations indicate MPE distance is less.
2. The Numeric Gain calculated by $10^{(\text{ant. Gain(dBi)} / 10)}$.
3. Each band max power which perform MPE of any configurations.
4. The MPE results are evaluated by lowest data rate for WLAN.
5. The device operating IEEE 802.11 b mode is 1TX (Diversity) only.
6. The device operating IEEE 802.11 g/n mode is 2TX MIMO / CDD.