

TEST REPORT

Application No.: FYFR2203000001AT
Applicant: UAB Teltonika Networks
Address of Applicant: K. Barsausko st. 66, Kaunas, LT-51436 Lithuania
Manufacturer: UAB Teltonika Networks
Address of Manufacturer: K. Barsausko st. 66, Kaunas, LT-51436 Lithuania
Factory: TELTONIKA EMS UAB
Address of Factory: Liepkalnio st. 132A, LT-02121, Vilnius, Lithuania
Equipment Under Test (EUT):
EUT Name: LTE Router
Model No.: RUT950
Trade Mark: TELTONIKA
FCC ID: 2AET4RUT955AF
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2022-03-07
Date of Test: 2022-03-07 to 2022-03-11
Date of Issue: 2022-03-15

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Kidd Yang
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2022-03-15		Original

Authorized for issue by:			
			
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		Tree Zhan/Project Engineer	
			
		<hr/>	
		Winkey Wang/Reviewer	



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2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
Radiated Spurious Emissions Below 1GHz	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Conducted Peak Output Power		ANSI C63.10 (2013) Section 11.9.1	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass

Remark:

Model No.: RUT950

This test report (Ref. No.: FYFR220300000102) is only valid with the original test report (Ref. No.: SZEM200600490905).

Review this report and original report, this report just changed the address of applicant, manufacturer.

According to the declaration from the applicant, the models in this report and models in original report were identical, only difference with being RUT950 does not support RS232 , RS485 , GNSS , USB interfaces and I/O connector(RUT950 is depopulated version of RUT955).

Considering to the difference, pre-scan were performed on the sample in this report to find the items which can be influential to the result in the original test report for fully retest.

Therefore in this report Antenna Requirement, Radiated Spurious Emissions Below 1GHz and Conducted Peak Output Power were fully retested on model and shown the data in this report, other tests please refer to original report SZEM200600490905.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 9-30V AC/DC Adapter Mode: SJ-09010033 Input: AC100-240V, 50/60Hz, 0.8A Output: DC 9.0V, 1.0A
Cable(s):	DC Cable: 2m, Unshielded Network Cable: 1.5m, Unshielded Wifi Antenna: 3m, Unshielded Mobile Antenna: 3m, Unshielded
Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz 802.11n(HT40): 2422MHz to 2452MHz
Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Number of Channels:	802.11b/g/n(HT20):11 802.11n(HT40):7
Channel Spacing:	5MHz
Antenna Type:	Dipole Antenna
Antenna Gain:	Antenna 1 & 2: 5dBi
S/N:	1107178102
Hardware version:	17
Firmware version:	RUT9xx_R_AA.BB.CC
RF software:	art2_ver_2_28_7BIN_[RUT95x]
Software Power setting:	Tx Power: Target (The peak output power refer to Appendix 15.247)

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
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The EUT has been tested as an independent unit.

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Radiated Spurious Emissions Below 1GHz	± 3.1dB (Below 1GHz)
Conducted Peak Output Power	± 0.8dB



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Remark:

The U_{lab} (lab Uncertainty) is less than $U_{CISPR/ETSI}$ (CISPR/ETSI Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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4.4 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc. Shenzhen branch.

Fuyong lab. Xinlong TechnoPark, Fengtang Road, Fuyong Subdistrict, Bao'an, Shenzhen, China

Tel: +86 755 8866 3988 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **A2LA (Certificate No. 6606.01)**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6606.01.

- **FCC –Designation Number: CN1322**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized as an accredited testing laboratory.

Designation Number: CN1322. Test Firm Registration Number: 718073

- **Innovation, Science and Economic Development Canada**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0129.

IC#: 28189.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

Radiated Spurious Emissions Below 1GHz					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Trilog-Broadband Antenna(25MHz-2GHz)	Schwarzbeck	VULB9168	SEM003-33	2021/9/25	2024/9/24
Biconical Antenna(150MHz-1GHz)	Schwarzbeck	VUBA9117	SEM003-35	2021/12/26	2024/12/25
Loop Antenna(9kHz-30MHz)	ETS-LINDGREN	6502	SEM003-36	2021/9/26	2024/9/25
MXE EMI receiver(20Hz-8.4GHz)	Agilent	N9038A	SEM004-05	2021/7/13	2022/7/12
Pre-amplifier (0.1-1.3GHz)	HP	8447D	SEM005-02	2021/7/13	2022/7/12
Broad-Band Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2021/7/11	2024/7/10
Broad-Band Horn Antenna (1-18GHz)	Schwarzbeck	BBHA 9120D	SEM003-32	2021/9/26	2024/9/25
Double-ridged waveguide horn (1-18GHz)	ETS-LINDGREN	3117	SEM003-34	2021/9/25	2024/9/24
Spectrum Analyzer(20Hz-43GHz)	Rohde & Schwarz	101288	SEM004-08	2021/7/13	2022/7/12
Low Noise Amplifier(100MHz-18GHz)	CLAVIIO	BDLNA-0118-352810	SEM005-05	2021/7/13	2022/7/12
Pre-amplifier(26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2021/7/13	2022/7/12
Pre-amplifier(18GHz-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2021/7/13	2022/7/12

Conducted Peak Output Power					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2021/7/13	2022/7/12
MXA Signal Analyzer(10Hz-26.5GHz)	Agilent	N9020A	SEM004-20	2021/7/13	2022/7/12
Signal Generator(9kHz-40GHz)	Agilent	N5173B	SEM006-05	2021/7/13	2022/7/12
ESG Vector Signal Generator(250kHz-	Agilent	E4438C	SEM006-15	2021/7/13	2022/7/12



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6GHz)					
Power Sensor	Erika Fiedler	U2021XA	SEM009-15	2021/7/13	2022/7/12
Power Sensor	Erika Fiedler	U2021XA	SEM009-16	2021/7/13	2022/7/12
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-08	2021/7/13	2022/7/12
Programmable DC Source	Chroma	62024P-80-60	SEM011-09	2021/7/13	2022/7/12
Attenuator(18GHz, 20dB, 2W)	Huber+Suhner	6620_SMA-50-1	SEM021-09	2021/7/13	2022/7/12
Electric and Magnetic Field Probe - Analyzer(3kHz-30MHz)	Narda	EHP-200AC	SEM022-20	2021/4/8	2022/4/7

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-22	2021-07-13	2022-07-12
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-23	2021-07-13	2022-07-12
Barometer	DUMAI	DYM3	SEM002-24	2021-07-13	2022-07-12



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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

6.1.2 Conclusion

Standard Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6dBi.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the Antenna 1 & 2 are 5dBi, MIMO gain is 8.01dBi.

Antenna location: Refer to internal photo.



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7 Radio Spectrum Matter Test Results

7.1 Radiated Spurious Emissions Below 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5
Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
960-1000	500	3

7.1.1 E.U.T. Operation

Operating Environment:
Temperature: 21.6 °C Humidity: 52.9 % RH Atmospheric Pressure: 1020 mbar

7.1.2 Test Mode Description

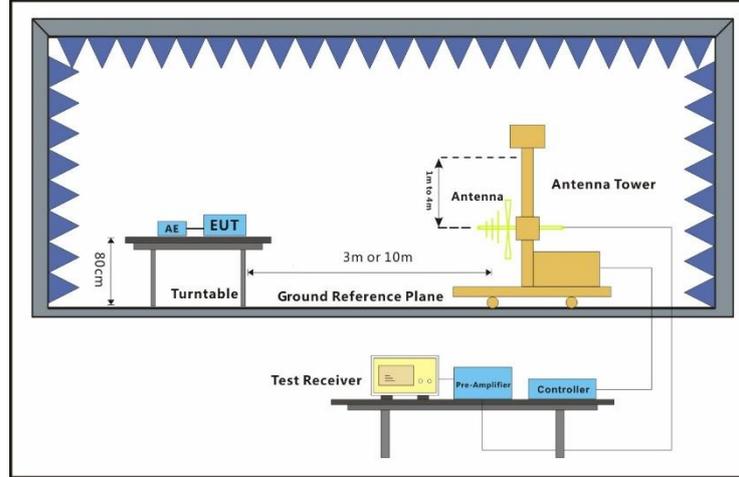
Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20); data rate @ 13.5Mbps is the worst case of IEEE 802.11n(HT40). Only the data of worst case is recorded in the report.



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7.1.3 Test Setup Diagram



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7.1.4 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using quasi-peak method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- i. Repeat above procedures until all frequencies measured was complete.

Remark:

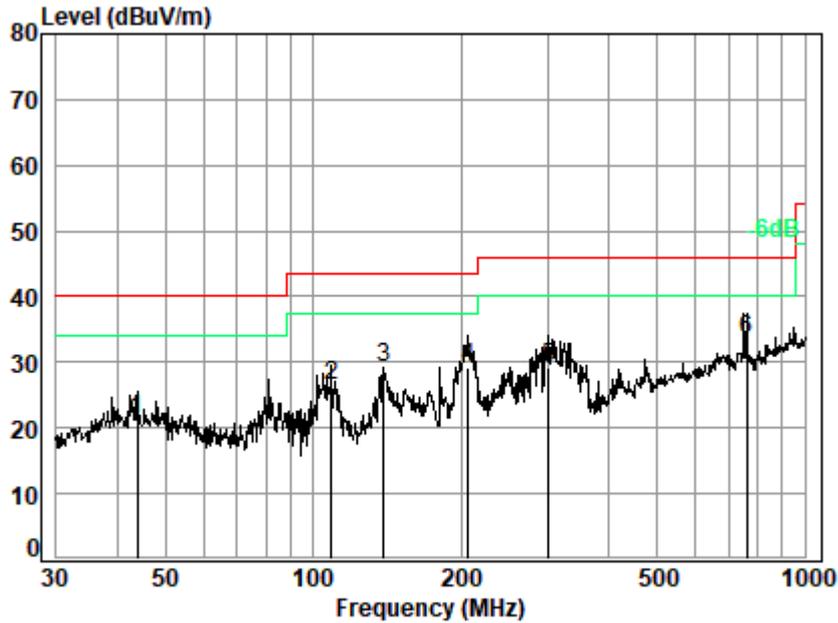
- 1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
- 2. Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3. The disturbance below 1GHz was very low and the harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.



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Test Mode: 00; Polarity: Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No : 00001AT
Mode : 00

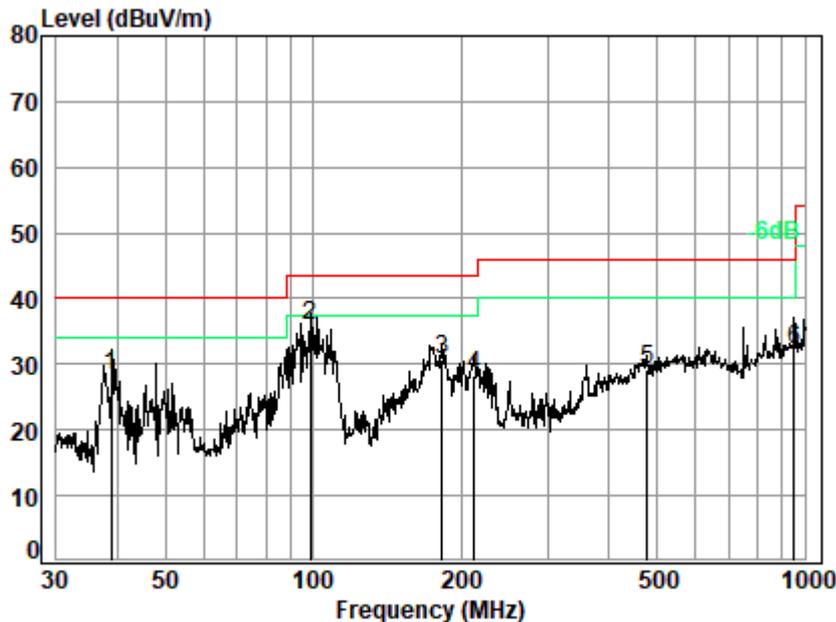
	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dB	
1	43.8119	0.21	17.29	25.87	29.78	40.00	-18.59	QP
2	108.6470	0.88	15.22	25.75	36.06	43.50	-17.09	QP
3	139.3613	0.91	17.39	25.59	36.43	43.50	-14.36	QP
4	206.3976	0.72	15.38	25.34	38.42	43.50	-14.32	QP
5	301.4224	1.03	18.38	25.11	34.78	46.00	-16.92	QP
6 p	760.7036	2.07	26.49	26.64	31.57	46.00	-12.51	QP



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Test Mode: 00; Polarity: Vertical



Site : chamber
Condition: 3m VERTICAL
Job No : 00001AT
Mode : 00

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	38.8879	0.20	16.47	25.88	37.50	28.29	40.00	-11.71	
2 p	98.4866	0.81	14.14	25.80	46.69	35.84	43.50	-7.66	
3	183.2005	0.67	15.95	25.41	39.66	30.87	43.50	-12.63	
4	212.2695	0.73	15.60	25.32	37.35	28.36	43.50	-15.14	
5	478.8456	1.42	22.12	26.25	31.90	29.19	46.00	-16.81	
6	952.0937	2.09	29.27	26.29	27.19	32.26	46.00	-13.74	



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7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)
Test Method: ANSI C63.10 (2013) Section 11.9.1

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥ 50 hopping channels
	0.25 for $25 \leq$ hopping channels < 50
	1 for digital modulation
2400-2483.5	1 for ≥ 75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 24.5 °C Humidity: 53.6 % RH Atmospheric Pressure: 1020 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20); data rate @ 13.5Mbps is the worst case of IEEE 802.11n(HT40). Only the data of worst case is recorded in the report.

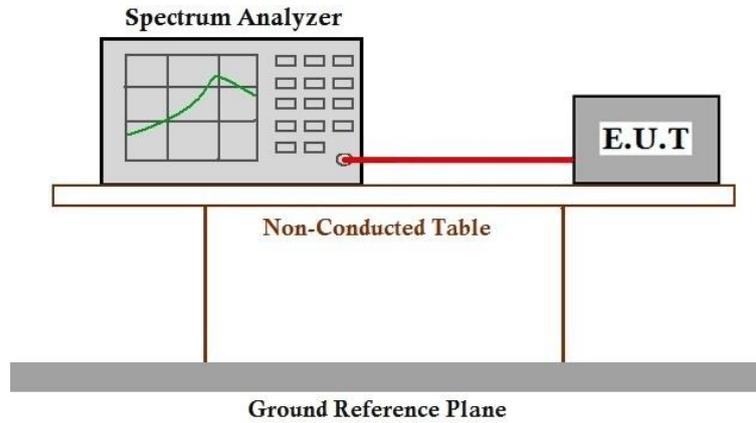


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7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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7.3 Test Setup

Please refer to setup photos.

7.4 EUT Constructional Details (EUT Photos)

Please Refer to external and internal photos for details.



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8 Appendix

8.1 Conducted Peak Output Power

8.1.1 Test Result

Test Mode	Frequency (MHz)	Tx Type	Measured Peak Output Power (dBm)			Limits (dBm)	Verdict
			Ant 1	Ant 2	Total		
802.11b	2412	SISO	13.02	14.74	/	30	PASS
	2437	SISO	13.68	15.04	/	30	PASS
	2462	SISO	14.23	15.26	/	30	PASS
802.11g	2412	SISO	18.77	19.98	/	30	PASS
	2437	SISO	19.04	20.32	/	30	PASS
	2462	SISO	20.09	20.51	/	30	PASS
802.11n(HT20)	2412	MIMO	17.99	19.27	21.69	27.99	PASS
	2437	MIMO	18.37	19.37	21.91	27.99	PASS
	2462	MIMO	19.02	19.93	22.51	27.99	PASS
802.11n(HT40)	2422	MIMO	17.27	18.58	20.98	27.99	PASS
	2437	MIMO	17.62	18.94	21.34	27.99	PASS
	2452	MIMO	17.88	19.08	21.53	27.99	PASS

- End of the Report -



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