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Report No.: 14-10597416-FCC-2
Date: December 23, 2014
Model No.: RS9110-N-11-22
FCC ID.: XF6-RS9110N1122

FCC Maximum Permissible Exposure Report

**in accordance with
FCC Part 1 Subpart I §1.1307(b) & §1.1310**

for

WiFi Module

Redpine Signals Inc.

2107 N.First Street, Suite 680, San Jose, CA 95131-2019 United States

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Summary of Test Results:

The following tests were performed on a sample submitted for evaluation of compliance with FCC Part 1 Subpart I Section 1.1307(b) & 1.1310

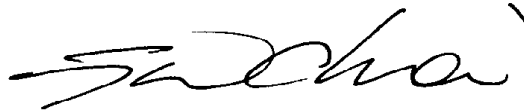
No	Reference Clause No.	Conformance Requirements	Result	Verdict	Remark
1	1.1307(b)(1) 1.1310	Maximum Permissible Exposure (Exposure of Humans to RF Fields)	Complied		

Conclusion:

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea Ltd. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.



Witness tested by
Changmin, Kim WiSE Engineer
UL Verification Services- 3014ASEO
UL Korea Ltd.
Dec. 23, 2014



Reviewed by
Jeawoon, Choi, WiSE Operations Manager
UL Verification Services- 3014ASEO
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Dec. 23, 2014

Test Report Details

Tests Performed By: UL Korea Ltd.
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Test Site: EMC compliance Ltd.
65, Sinwon-ro, Yeongtong-gu, Suwon- si, Gyeonggi-do, 443-390, Korea

Applicant: Redpine Signals Inc.
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Applicant Contact: Soon-oh Lee
Title: Manager
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Product Type: 802.11 bgn Connection Module

Model Number: RS9110-N-11-22

Trademark 

Sample Serial Number: N/A

Test standards: FCC Part 1 Subpart I §1.1307(b) & §1.1310

Sample Serial Number: N/A

Sample Receive Date: Dec. 16, 2014

Testing Date: Dec. 16, 2014 ~ Dec. 22, 2014

Testing Complete Date: Dec. 22, 2014

Overall Results: Pass

UL Korea Ltd. reports apply only to the specific test samples and test results submitted for UL's review. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or any agency of the National Authorities. This report may contain test results that are not covered by the NVLAP or KOLAS accreditation.

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1. General Product Information

1.1. Equipment Description:

The RS9110-N-11-22 module is a IEEE 802.11bgn based WLAN device that directly provides a wireless interface to any equipment with a UART or SPI interface for data transfer.

1.2. Details of Test Equipment (EUT)

- Equipment Type : WiFi Module
- Model No. : RS9110-N-11-22
- Trade name : Redpine Signals
- Type of test Equipment : Portable type
- Operating characteristic : Short range wireless device operating in the 2400 – 2483.5 ISM frequency band
- Manufacturer : Redpine Signals Inc.
2107 N.First Street, Suite 680, San Jose, CA 95131-2019 United States

1.3. Equipment Configuration

The EUT is consisted of the following component provided by the manufacturer.

Use*	Product Type	Manufacturer	Model	Comments
EUT	WiFi Module	Redpine Signals Inc.	RS9110-N-11-22	-
Note: Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)				

1.4. Technical Data:

Transmitter frequency range(s)	2,412~2,472 MHz
Number of Channel	13 channels
Receiver frequency range(s)	2,412~2,472 MHz
Transmitter power	16.60 dBm
Modulation	DSSS (CCK), OFDM(BPSK, QPSK, 16QAM, 64QAM)
Power supply	DC 3.1V ~ 3.6V from Host device

Note ;

1. All the technical data described above were provided by the manufacturer.

1.5. Antenna Information:

- Antenna Model Name : PCA-4606-2G4C1-B8-FM
- Antenna Type : PCB Antenna
- Manufacturer : MAG.LAYERS
- Transmit Gain : Max. 3.3 dBi
- Azimuth Beam Pattern : Linear Vertical

1.6. Equipment Type:

- Radio and ancillary equipment for fixed or semi-fixed use
- Radio and ancillary equipment for vehicular mounted use
- Radio and ancillary equipment for portable or handheld use

- Stand alone Host connected

- Self contained single unit Module with associated connection or interface

1.7. Maximum Output Power (Baseline Measurement)

802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Output Average Power (dBm)	GC Value
b	11Mbps	2 412	16.60	53
		2 442	16.08	53
		2 472	10.08	40
g	24Mbps	2 412	11.18	44
		2 442	11.42	46
		2 472	6.40	35
HT20	MCS0	2 412	10.31	41
		2 442	10.94	44
		2 472	5.45	31

1.8. Technical description and documents:

No.	Document Title and Description
1	User Manual
Note: The following documents were provided by the manufacturer.	

1.9. Description of additional model name

Model	Description	Comment
RS9110-N-11-22	Basic Model	-

2. Test Specification

The following test specifications and standards have been applied and used for testing.

KDB 447498 D01 : Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

3. Test Conditions

3.1. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	WiFi Module	Redpine Signals Inc.	RS9110-N-11-22	-
AE	Note PC	HP	Compad 6730b	S/N :CNU8390HKZ

***Note:** Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)

3.2. Input/Output Ports

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
1	DC input port	DC	N	Y	USB
2	Serial port	I/O	N	Y	RS-232

***Note:**
 AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
 I/O = Signal Input or Output Port (Not Involved in Process Control)
 TP = Telecommunication Ports

3.3. Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
1	3.3	-	-	DC	-	Normal operating voltage

3.4. Operating Frequencies

Mode #	Frequency tested
1	Operating frequency range: 2 412 MHz ~ 2 472 MHz (802.11b/g/n_HT20) 3 channels in the Transmitter modes of 802.11b/g/n_HT20 are tested. - Low : 2 412 MHz / CH = 1 - Mid : 2 442 MHz / CH = 7 - Top : 2 472 MHz / CH= 13

3.5. Operation Modes

Mode #	Description
1	Carrier on mode: Signal from the RF module was generated continuously for the representative channels (Low, Mid, High) by the test program incorporated
2	Carrier off (Idle) mode: RF carrier was not activated by the RF module.

Note:

1. The worst-case condition is determined by the baseline measurement of RF output power of the modular transmitter test report. The worst-case channel was determined as the channel with highest output power.
2. Output power from the device during the radiated spurious measurements are within expected tolerance of the module test results to justify using the original conducted antenna port measurements for the module

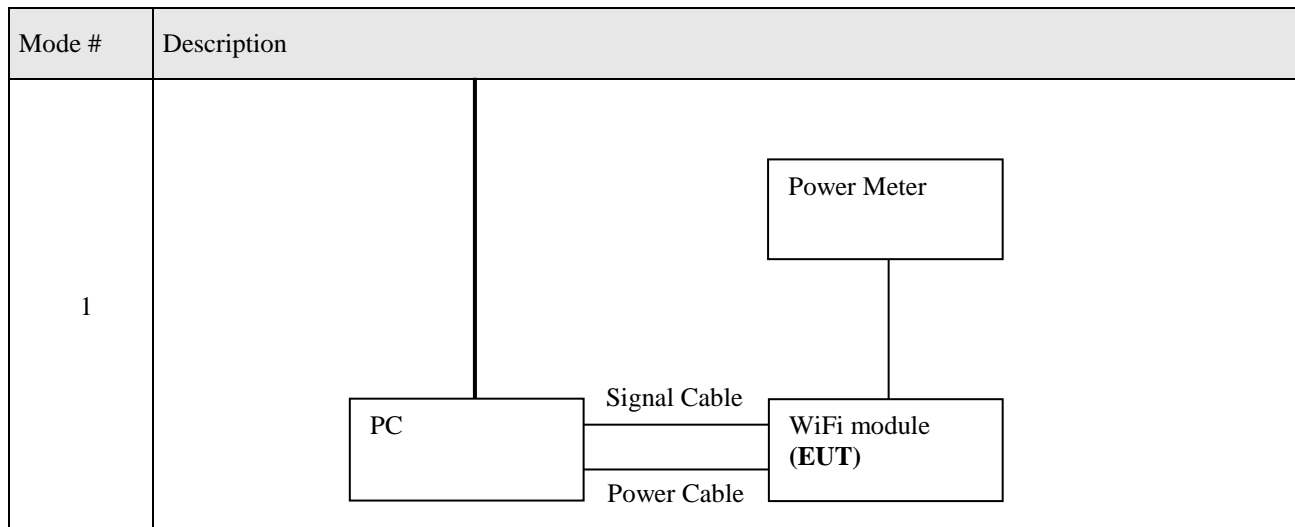
3.6. Environment Conditions

Parameters	Normal condition
Temperature	- 40°C ~ +85°C
Humidity	20% ~ 75%
Supply voltage	3.3 V dc (Rated nominal voltage)

Note ;

- The operating condition for humidity requirement has not been declared in the manufacturer's specification.
- Test has been carried out for three frequencies specified above under the normal condition.

3.7. Test Configurations



3.8. List of Test Equipment

No	Description	Manufacturer	Model	Identifier	Cal. Due
1	Wide Band Power Sensor	R&S	NRP-Z81	100677	2015.05.28

4. Test Results of RF Exposure Evaluation

TEST: RF Exposure Evaluation		
Method	<p>RF Exposure Evaluation of the EUT were measured according to the dictates in KDB 447498</p> <p>Pd the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.</p> <p>Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$</p> <p>Where Pd = power density in mW/cm²</p> <p>Pout = output power to antenna in mW</p> <p>G = gain of antenna in linear scale</p> <p>Pi = 3.1416</p> <p>R = distance between observation point and center of the radiator in cm</p> <p>General SAR test exclusion guidance</p> <p>The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at <i>test separation distances</i> ≤ 50 mm are determined by: $[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [\sqrt{f_{(GHz)}}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where</p> <ul style="list-style-type: none"> <input type="checkbox"/> f_(GHz) is the RF channel transmit frequency in GHz <input type="checkbox"/> Power and distance are rounded to the nearest mW and mm before calculation¹⁷ <input type="checkbox"/> The result is rounded to one decimal place for comparison <p>When the minimum <i>test separation distance</i> is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.</p>	
Reference Clause	Part1 I Section 1.1307(b) & 1.1310	
Parameters recorded during the test	Laboratory Ambient Temperature	
	Relative Humidity	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	2 412 MHz - 2 472 MHz	Antenna port

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	1
Supplementary information: None		

Limits

Environmental evaluation and exposure limit according to FCC Part 1, Subpart I, Section 1.1307(b) & 1.1310

According to Section 1.1310, The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational /Control Exposures				
300 – 1 500	--	--	F/300	6
1 500 – 100 000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300 – 1 500	--	--	F/1500	6
1 500 – 100 000	--	--	1	30

Environmental evaluation and exposure limit according to RSS-102

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Averaging Time (minutes)
0.003-1	280	2.19	-	6
1-10	280/ <i>f</i>	2.19/ <i>f</i>	-	6
10-30	28	2.19/ <i>f</i>	-	6
30-300	28	0.073	2*	6
300-1500	1.585 <i>f</i> ^{0.5}	0.0042 <i>f</i> ^{0.5}	<i>f</i> /150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}

Note: *f* is frequency in MHz.

* Power density limit is applicable at frequencies greater than 100 MHz.

RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Averaging Time (minutes)
0.003-1	600	4.9	-	6
1-10	600/ <i>f</i>	4.9/ <i>f</i>	-	6
10-30	60	4.9/ <i>f</i>	-	6
30-300	60	0.163	10*	6
300-1500	3.54 <i>f</i> ^{0.5}	0.0094 <i>f</i> ^{0.5}	<i>f</i> /30	6
1500-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/ <i>f</i> ^{1.2}
150000-300000	0.354 <i>f</i> ^{0.5}	9.4 x 10 ⁻⁴ <i>f</i> ^{0.5}	3.33 x 10 ⁻⁴ <i>f</i>	616000/ <i>f</i> ^{1.2}

Note: *f* is frequency in MHz.

*Power density limit is applicable at frequencies greater than 100 MHz.

4.1. Output Power into Antenna & RF Exposure Evaluation Distance for FCC

4.1.1. Evaluation at 20 cm distance

802.11 Protocol	Data Rate (Mbps)	Operation Frequency (MHz)	Channel	Output Average Power (dBm)	Antenna Gain (dBi)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
b	11	2412	1	16.60	3.3	0.01944	1
		2442	7	16.08	3.3	0.01725	
		2472	13	10.08	3.3	0.00433	
Max. output power with the tolerance		2412	1	18.60	3.3	0.03081	

Note :

1. The power density at a distance of 20 cm calculated from the friis transmission formula is far below each limits.
2. Transmit power tolerance is declared by the manufacturer. (Transmit power tolerance = +/- 2dBm)