



A Test Lab Techno Corp.

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MPE Report



Test Report No.	: 1811FS15
Applicant	: Redpine Signals, Inc
Product Type	: Single Band 802.11 b/g/n, Bluetooth 5.0, ZigBee Module
Trade Name	: Redpine Signals Inc
Model Number	: M15SB
Date of Received	: Oct. 24, 2018
Test Period	: Nov. 06 ~ Nov. 07, 2018
Date of Issued	: Dec. 06, 2018
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.
Test Firm MRA designation number	: TW0010

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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Contents

1. Description of Equipment under Test (EUT).....	3
2. Human Exposure Assessment.....	4
3. RF Output Power	5
4. Test Result	9



1. Description of Equipment under Test (EUT)

Applicant	Redpine Signals, Inc 2107 N.First Street, Suite 680, San Jose, California, 95131-2019, United States		
Manufacturer	Redpine Signals, Inc 2107 N.First Street, Suite 680, San Jose, California, 95131-2019, United States		
Product Type	Single Band 802.11 b/g/n, Bluetooth 5.0, ZigBee Module		
Trade Name	Redpine Signals Inc		
Model Number	M15SB		
FCC ID	XF6-M15SB		
Frequency Range	Operate Band		Frequency Range (MHz)
	IEEE 802.11b / 802.11g / 802.11n 2.4 GHz 20 MHz		2412 - 2462
	IEEE 802.11n 2.4 GHz 40 MHz		2422 - 2452
	Bluetooth BR/EDR		2402 - 2480
	Bluetooth LE		2402 - 2480
	Zigbee		2405 - 2480
Antenna Information	Model	Type	Max. Gain (dBi)
	WS.01.B.305151	Heavy Duty Screw Mount Antenna	4.1
	RSIA15	PCB Trace Antenna	0.99
Antenna Delivery	1TX		
RF Evaluation	0.029 mW/cm ²		
Operate Temp. Range	-40 ~ +85°C		

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

Antenna Type: Heavy Duty Screw Mount Antenna

Band	Data Rate (Mbps)	Frequency (MHz)	Average Conducted power (dBm)
IEEE 802.11b	1M	2412.0	14.39
		2437.0	16.17
		2462.0	15.57
	2M	2437.0	16.16
	5.5M	2437.0	16.15
	11M	2437.0	16.12
IEEE 802.11g	6M	2412.0	7.44
		2437.0	17.04
		2462.0	7.20
	9M	2437.0	17.03
	12M	2437.0	17.01
	18M	2437.0	17.00
	24M	2437.0	16.99
	36M	2437.0	16.97
	48M	2437.0	16.96
	54M	2437.0	16.94
IEEE 802.11n 2.4 GHz 20 MHz	6.5M	2412.0	7.56
		2437.0	17.38
		2462.0	6.56
	14.4M	2437.0	17.36
	21.7M	2437.0	17.34
	28.9M	2437.0	17.33
	43.3M	2437.0	17.32
	57.8M	2437.0	17.30
	65M	2437.0	17.29
	72.2M	2437.0	17.28
IEEE 802.11n 2.4 GHz 40 MHz	13.5M	2422.0	3.73
		2437.0	8.05
		2452.0	5.12
	30M	2437.0	8.02
	45M	2437.0	8.00
	60M	2437.0	7.99
	90M	2437.0	7.98
	120M	2437.0	7.96
	135M	2437.0	7.95
	150M	2437.0	7.94



Operate Band	Frequency (MHz)	Packet Type	Average Conducted power (dBm)
Bluetooth BR GFSK	2402.0	DH1	15.59
		DH3	15.60
		DH5	15.62
	2441.0	DH1	15.88
		DH3	15.89
		DH5	15.91
	2480.0	DH1	14.10
		DH3	14.12
		DH5	14.13
Bluetooth EDR $\pi/4$ -DQPSK	2402.0	2DH1	15.00
		2DH3	15.01
		2DH5	15.03
	2441.0	2DH1	15.21
		2DH3	15.23
		2DH5	15.25
	2480.0	2DH1	13.56
		2DH3	13.58
		2DH5	13.60
Bluetooth EDR 8DPSK	2402.0	3DH1	15.08
		3DH3	15.10
		3DH5	15.13
	2441.0	3DH1	15.23
		3DH3	15.25
		3DH5	15.27
	2480.0	3DH1	13.59
		3DH3	13.61
		3DH5	13.62
Bluetooth LE	2402.0	---	11.36
	2440.0		11.04
	2480.0		9.21
Bluetooth 2LE	2402.0	---	15.59
	2440.0		16.68
	2480.0		10.53
Bluetooth BLR C2	2402.0	---	11.32
	2440.0		11.00
	2480.0		9.12
Bluetooth BLR C8	2402.0	---	11.34
	2440.0		11.01
	2480.0		9.16
Zigbee	2405.0	---	14.93
	2440.0		14.38
	2480.0		14.43



Antenna Type: PCB Trace Antenna

Band	Data Rate (Mbps)	Frequency (MHz)	Average Conducted power (dBm)
IEEE 802.11b	1M	2412.0	16.36
		2437.0	16.17
		2462.0	16.53
	2M	2437.0	16.16
	5.5M	2437.0	16.15
	11M	2437.0	16.12
IEEE 802.11g	6M	2412.0	9.46
		2437.0	17.04
		2462.0	11.52
	9M	2437.0	17.03
	12M	2437.0	17.01
	18M	2437.0	17.00
	24M	2437.0	16.99
	36M	2437.0	16.97
	48M	2437.0	16.96
54M	2437.0	16.94	
IEEE 802.11n 2.4 GHz 20 MHz	6.5M	2412.0	8.91
		2437.0	17.38
		2462.0	10.86
	14.4M	2437.0	17.36
	21.7M	2437.0	17.34
	28.9M	2437.0	17.33
	43.3M	2437.0	17.32
	57.8M	2437.0	17.30
	65M	2437.0	17.29
72.2M	2437.0	17.28	
IEEE 802.11n 2.4 GHz 40 MHz	13.5M	2422.0	6.95
		2437.0	10.50
		2452.0	7.72
	30M	2437.0	10.48
	45M	2437.0	10.47
	60M	2437.0	10.45
	90M	2437.0	10.44
	120M	2437.0	10.43
	135M	2437.0	10.42
150M	2437.0	10.41	



Operate Band	Frequency (MHz)	Packet Type	Average Conducted power (dBm)
Bluetooth LE	2402.0	---	17.08
	2440.0		17.10
	2480.0		13.70
Bluetooth 2LE	2402.0	---	15.52
	2440.0		16.53
	2480.0		11.66
Bluetooth BLR C2	2402.0	---	17.04
	2440.0		17.07
	2480.0		13.69
Bluetooth BLR C8	2402.0	---	17.06
	2440.0		17.08
	2480.0		13.66
Zigbee	2405.0	---	16.81
	2440.0		15.23
	2480.0		15.10



4. Test Result

Antenna Type: Heavy Duty Screw Mount Antenna										
Band	Test mode/ RB/Data rate	Frequency (MHz)	Limit (mw)/cm ²	Distance [R] (cm)	Max Tune-up Power [P] (dBm)	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	Power with Duty cycle [TP] (mW)	Power Density [S] (mw)/cm ²
Bluetooth BR/EDR	1M_DH5	2402.0	1	20	16.50	4.10	2.57	1	114.8	0.023
		2441.0	1	20	16.50	4.10	2.57	1	114.8	0.023
		2480.0	1	20	16.50	4.10	2.57	1	114.8	0.023
Bluetooth 2LE	2M	2402.0	1	20	17.00	4.10	2.57	1	128.81	0.026
		2440.0	1	20	17.00	4.10	2.57	1	128.81	0.026
		2480.0	1	20	17.00	4.10	2.57	1	128.81	0.026
Zigbee	---	2405.0	1	20	15.50	4.10	2.57	1	91.19	0.018
		2440.0	1	20	15.50	4.10	2.57	1	91.19	0.018
		2480.0	1	20	15.50	4.10	2.57	1	91.19	0.018
IEEE 802.11b	1M	2412.0	1	20	16.50	4.10	2.57	1	114.8	0.023
		2437.0	1	20	16.50	4.10	2.57	1	114.8	0.023
		2462.0	1	20	16.50	4.10	2.57	1	114.8	0.023
IEEE 802.11g	6M	2412.0	1	20	17.50	4.10	2.57	1	144.52	0.029
		2437.0	1	20	17.50	4.10	2.57	1	144.52	0.029
		2462.0	1	20	17.50	4.10	2.57	1	144.52	0.029
IEEE 802.11n 2.4 GHz 20 MHz	6.5M	2412.0	1	20	17.50	4.10	2.57	1	144.52	0.029
		2437.0	1	20	17.50	4.10	2.57	1	144.52	0.029
		2462.0	1	20	17.50	4.10	2.57	1	144.52	0.029
IEEE 802.11n 2.4 GHz 40 MHz	13.5M	2422.0	1	20	8.50	4.10	2.57	1	18.19	0.004
		2437.0	1	20	8.50	4.10	2.57	1	18.19	0.004
		2452.0	1	20	8.50	4.10	2.57	1	18.19	0.004



Antenna Type: PCB Trace Antenna										
Band	Test mode/ RB/Data rate	Frequency (MHz)	Limit (mw)/cm ²	Distance [R] (cm)	Max Tune-up Power [P] (dBm)	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	Power with Duty cycle [TP] (mW)	Power Density [S] (mw)/cm ²
Bluetooth LE	1M	2402.0	1	20	17.50	0.99	1.26	1	70.86	0.014
		2440.0	1	20	17.50	0.99	1.26	1	70.86	0.014
		2480.0	1	20	17.50	0.99	1.26	1	70.86	0.014
Zigbee	---	2405.0	1	20	17.00	0.99	1.26	1	63.15	0.013
		2440.0	1	20	17.00	0.99	1.26	1	63.15	0.013
		2480.0	1	20	17.00	0.99	1.26	1	63.15	0.013
IEEE 802.11b	1M	2412.0	1	20	17.00	0.99	1.26	1	63.15	0.013
		2437.0	1	20	17.00	0.99	1.26	1	63.15	0.013
		2462.0	1	20	17.00	0.99	1.26	1	63.15	0.013
IEEE 802.11g	6M	2412.0	1	20	17.50	0.99	1.26	1	70.86	0.014
		2437.0	1	20	17.50	0.99	1.26	1	70.86	0.014
		2462.0	1	20	17.50	0.99	1.26	1	70.86	0.014
IEEE 802.11n 2.4 GHz 20 MHz	6.5M	2412.0	1	20	17.50	0.99	1.26	1	70.86	0.014
		2437.0	1	20	17.50	0.99	1.26	1	70.86	0.014
		2462.0	1	20	17.50	0.99	1.26	1	70.86	0.014
IEEE 802.11n 2.4 GHz 40 MHz	13.5M	2422.0	1	20	11.00	0.99	1.26	1	15.86	0.003
		2437.0	1	20	11.00	0.99	1.26	1	15.86	0.003
		2452.0	1	20	11.00	0.99	1.26	1	15.86	0.003

Note:

1. Mobile or fixed location transmitters, minimum separation distance is 20 cm, even if calculations indicate MPE distance is less.
2. We use maximum gain antenna to evaluated the MPE.
3. The Numeric Gain calculated by $10^{(\text{ant. Gain(dBi)} / 10)}$.
4. Each band max power which perform MPE of any configurations.
5. The MPE results are evaluated by lowest data rate for WLAN.
6. The device not support simultaneous transmission.

Transmitting :

$$\text{MPE} = 2.4 \text{ GHz MPE} = 0.029 \text{ (mw)/cm}^2 < 10 \text{ (mw)/cm}^2$$