

FCC PART 15.249 TEST REPORT

For

Shenzhen Rapoo Technology Co., Ltd

22,Jinxu Road East,Pingshan District,Shenzhen,China

FCC ID: PP23510

Report Type: Original Report	Product Name: Wireless Optical Mouse
Report Number: RDG180110010-00	
Report Date: 2018-01-17	
Reviewed By:	Allen Qiao RF Supervisor
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “*” .

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **Shenzhen Rapoo Technology Co., Ltd**'s product, model number: **3510 (FCC ID: PP23510)** (the "EUT") in this report was a **Wireless Optical Mouse**, which was measured approximately: 11.3 cm (L) x 6.4 cm (W) x 2.9 cm (H), rated input voltage: DC1.5V from battery.

**All measurement and test data in this report was gathered from production sample serial number: 180110010 (Assigned by BACL,Dongguan). The EUT was received on 2018-01-10.*

Objective

This type approval report is prepared on behalf of **Shenzhen Rapoo Technology Co., Ltd** in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

Part of system granted with FCC ID: PP203041C.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
Unwanted Emissions, radiated	30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

16 channels were used:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	5	2425	9	2446	13	2471
2	2405	6	2428	10	2451	14	2474
3	2409	7	2431	11	2454	15	2477
4	2413	8	2434	12	2457	16	2479

Channel 1, 9, 16 were selected for testing.

EUT Exercise Software

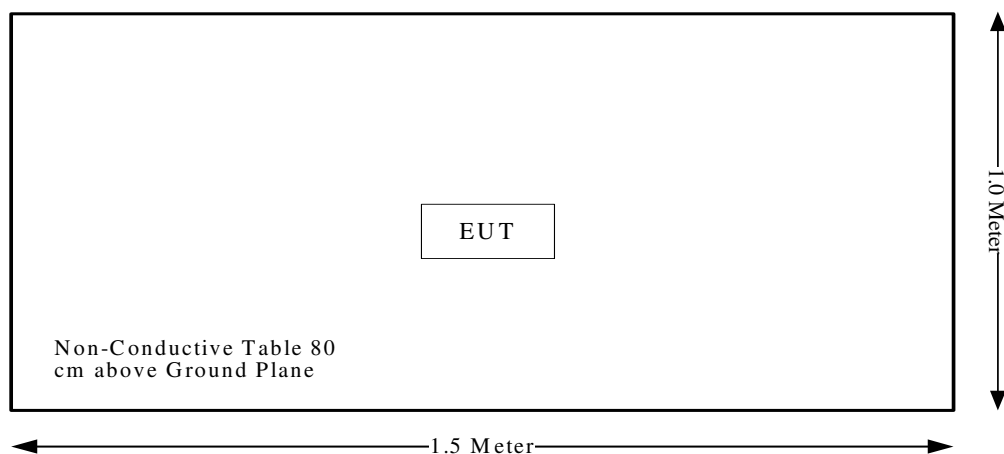
No software was used in test, the device was configured to engineer mode by manufacturer, test channel switched by keys.

Equipment Modifications

No modifications were made to the EUT.

Block Diagram of Test Setup

Below 1G:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Not Applicable*
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

Note:

Not Applicable*: the EUT is battery operated equipment.

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

Antenna Connector Construction

The EUT has one internal antenna arrangement, and the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS**Applicable Standard**

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

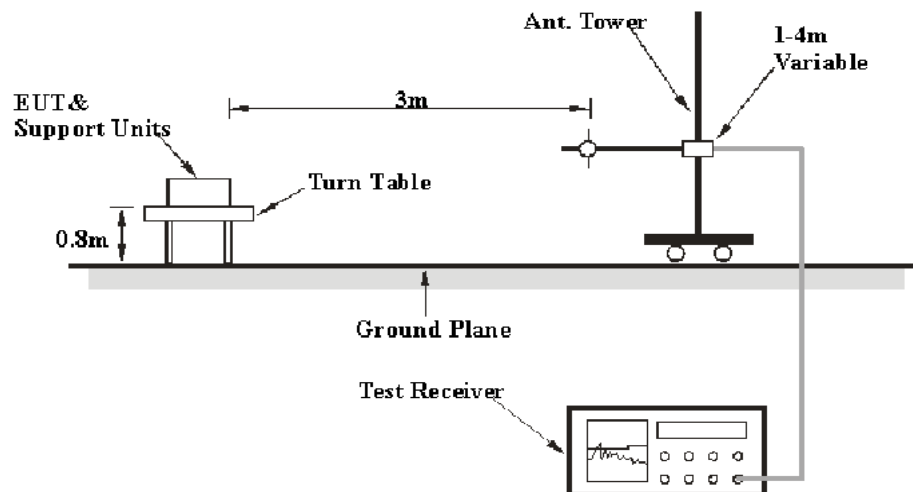
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

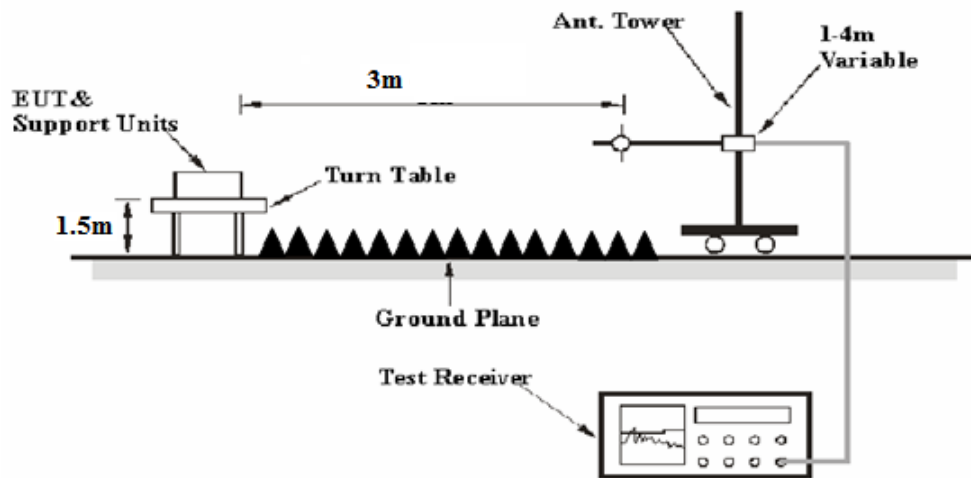
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters distance, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

Test Equipment Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detection mode from 30 MHz to 1GHz, peak detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2017-09-01	2018-09-01
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2018-11-10
HP	Amplifier	8447D	2727A05902	2017-09-05	2018-09-05
R&S	Spectrum Analyzer	FSEM	831259/019	2017-07-18	2018-07-18
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017-09-05	2018-09-05
Ducommun	Horn Antenna	ARH-4223-02	1007726-02 1304	2016-11-18	2019-11-18
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2017-06-27	2018-06-27
Chengdu Ouli	Band Rejection Filter	2400-2483.5	002	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0400-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0075-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-1000-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-2.4J2.4J-50	C-0700-01	2017-06-27	2018-06-27
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

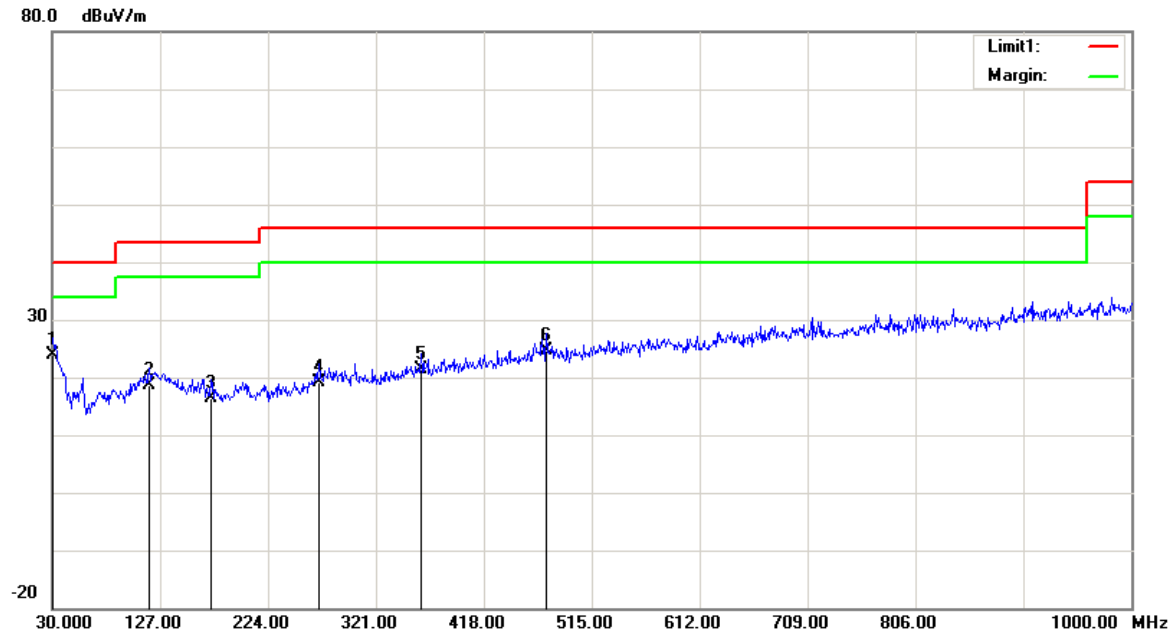
Temperature:	18.3~21.9 °C
Relative Humidity:	29~34 %
ATM Pressure:	101.3~101.5 kPa

The testing was performed by Eric Xiao from 2018-01-12 to 2018-01-14.

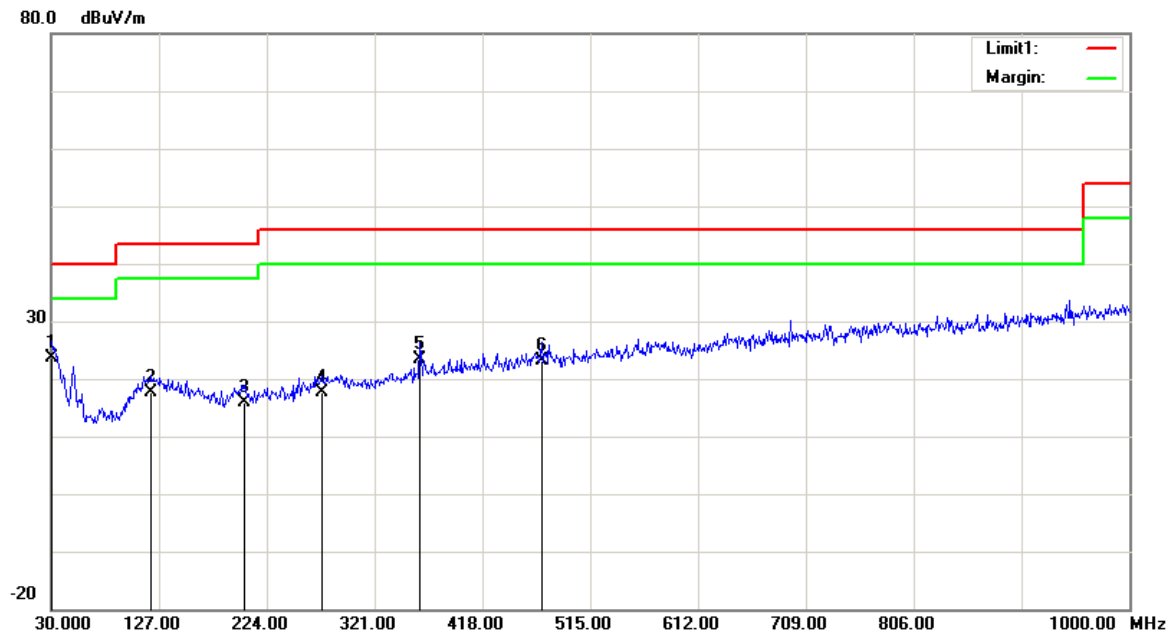
Test Mode: Transmitting

1) 30MHz-1GHz(Worst Case at Low Channel)

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	22.72	QP	1.08	23.80	40.00	16.20
117.3000	23.71	QP	-5.01	18.70	43.50	24.80
172.5900	24.07	QP	-7.57	16.50	43.50	27.00
269.5900	23.28	QP	-4.08	19.20	46.00	26.80
361.7400	24.20	QP	-2.90	21.30	46.00	24.70
474.2600	25.53	QP	-0.93	24.60	46.00	21.40

Vertical:

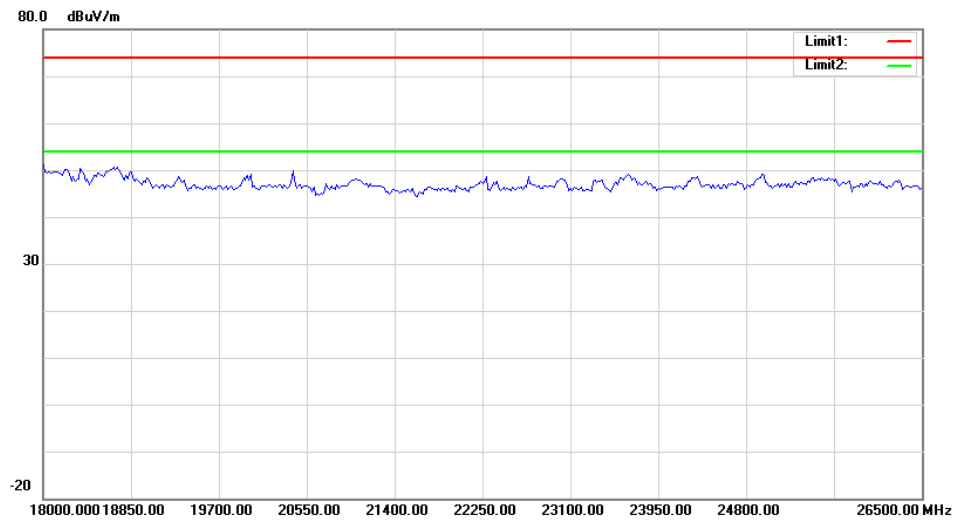
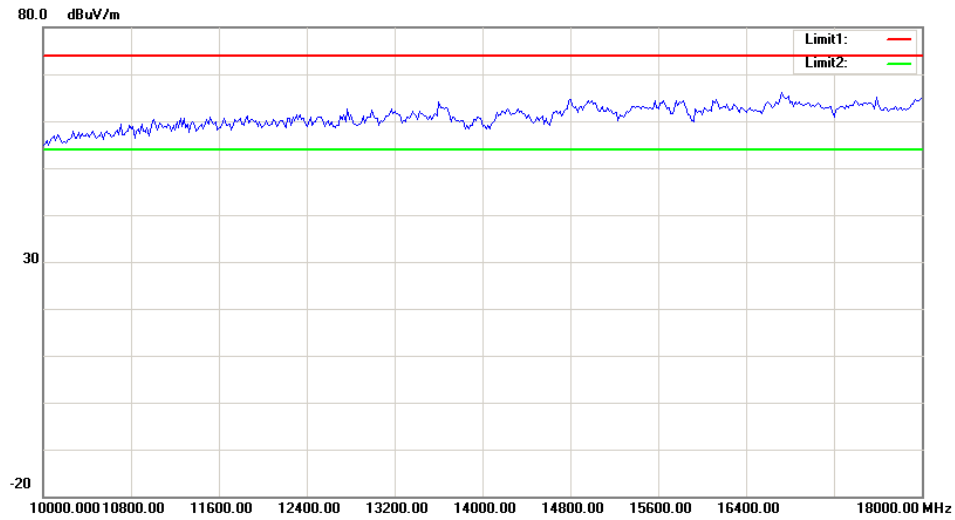
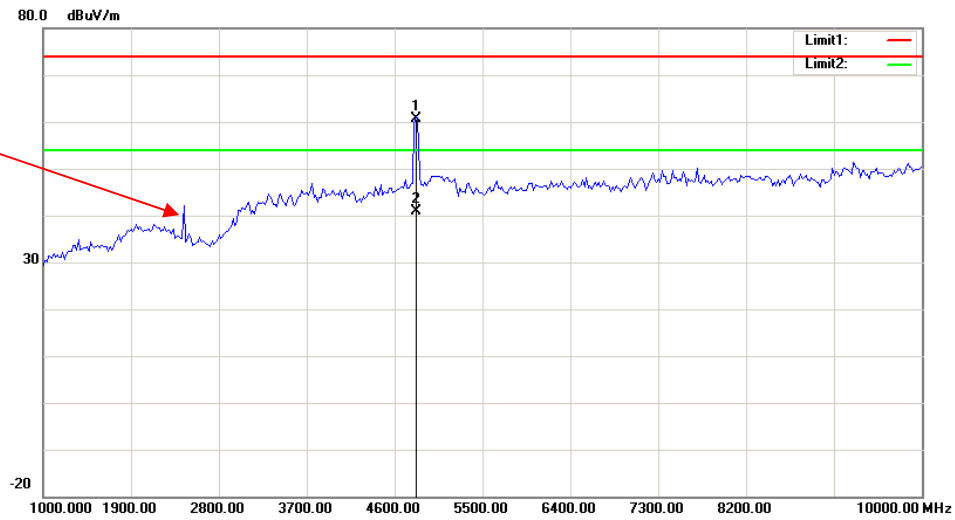
Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	23.25	QP	0.35	23.60	40.00	16.40
120.2100	22.64	QP	-4.94	17.70	43.50	25.80
203.6300	22.37	QP	-6.47	15.90	43.50	27.60
273.4700	21.40	QP	-3.80	17.60	46.00	28.40
361.7400	26.30	QP	-2.90	23.40	46.00	22.60
471.3500	24.09	QP	-0.89	23.20	46.00	22.80

2) 1GHz-25GHz:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	54.76	PK	H	24.82	5.41	0.00	84.99	113.98	28.99
2402.00	34.44	AV	H	24.82	5.41	0.00	64.67	93.98	29.31
2402.00	50.22	PK	V	24.82	5.41	0.00	80.45	113.98	33.53
2402.00	29.45	AV	V	24.82	5.41	0.00	59.68	93.98	34.30
2400.00	28.96	PK	H	24.82	5.41	0.00	59.19	74.00	14.81
2400.00	14.06	AV	H	24.82	5.41	0.00	44.29	54.00	9.71
4804.00	50.93	PK	H	29.71	7.25	27.36	60.53	74.00	13.47
4804.00	31.25	AV	H	29.71	7.25	27.36	40.85	54.00	13.15
7206.00	39.05	PK	H	33.93	8.94	27.19	54.73	74.00	19.27
7206.00	20.30	AV	H	33.93	8.94	27.19	35.98	54.00	18.02
Middle Channel: 2446 MHz									
2446.00	57.03	PK	H	24.90	5.41	0.00	87.34	113.98	26.64
2446.00	35.79	AV	H	24.90	5.41	0.00	66.10	93.98	27.88
2446.00	47.76	PK	V	24.90	5.41	0.00	78.07	113.98	35.91
2446.00	27.45	AV	V	24.90	5.41	0.00	57.76	93.98	36.22
4892.00	49.82	PK	H	29.88	7.63	27.58	59.75	74.00	14.25
4892.00	30.28	AV	H	29.88	7.63	27.58	40.21	54.00	13.79
7338.00	39.20	PK	H	34.14	9.24	27.24	55.34	74.00	18.66
7338.00	20.15	AV	H	34.14	9.24	27.24	36.29	54.00	17.71
High Channel: 2479 MHz									
2479.00	56.37	PK	H	24.96	5.41	0.00	86.74	113.98	27.24
2479.00	35.61	AV	H	24.96	5.41	0.00	65.98	93.98	28.00
2479.00	48.00	PK	V	24.96	5.41	0.00	78.37	113.98	35.61
2479.00	26.10	AV	V	24.96	5.41	0.00	56.47	93.98	37.51
2483.50	32.46	PK	H	24.97	5.41	0.00	62.84	74.00	11.16
2483.50	10.80	AV	H	24.97	5.41	0.00	41.18	54.00	12.82
4958.00	50.36	PK	H	30.02	7.63	27.37	60.64	74.00	13.36
4958.00	30.15	AV	H	30.02	7.63	27.37	40.43	54.00	13.57
7437.00	39.60	PK	H	34.30	9.09	27.22	55.77	74.00	18.23
7437.00	20.17	AV	H	34.30	9.09	27.22	36.34	54.00	17.66

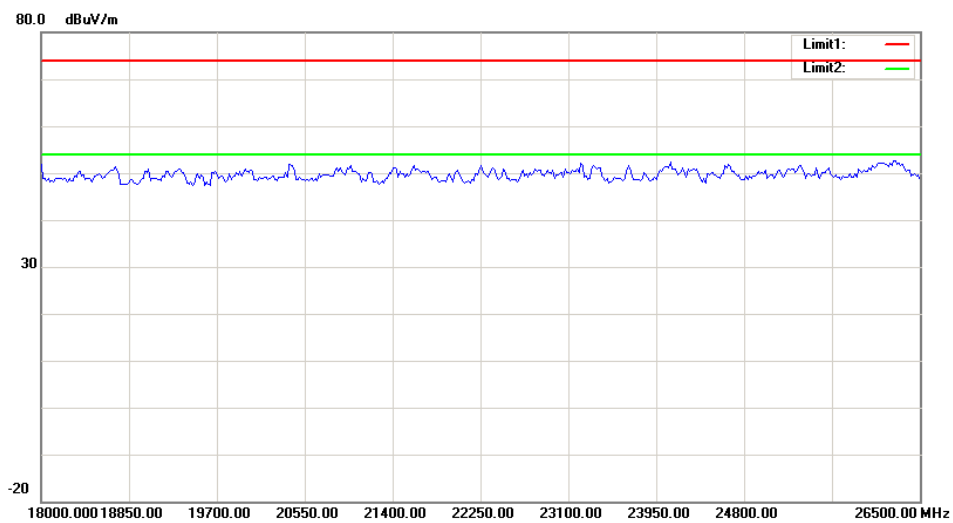
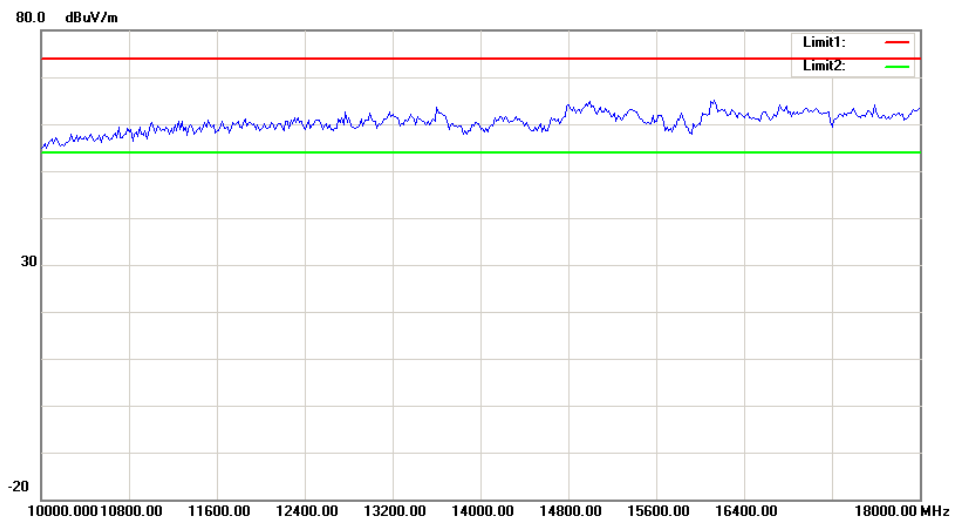
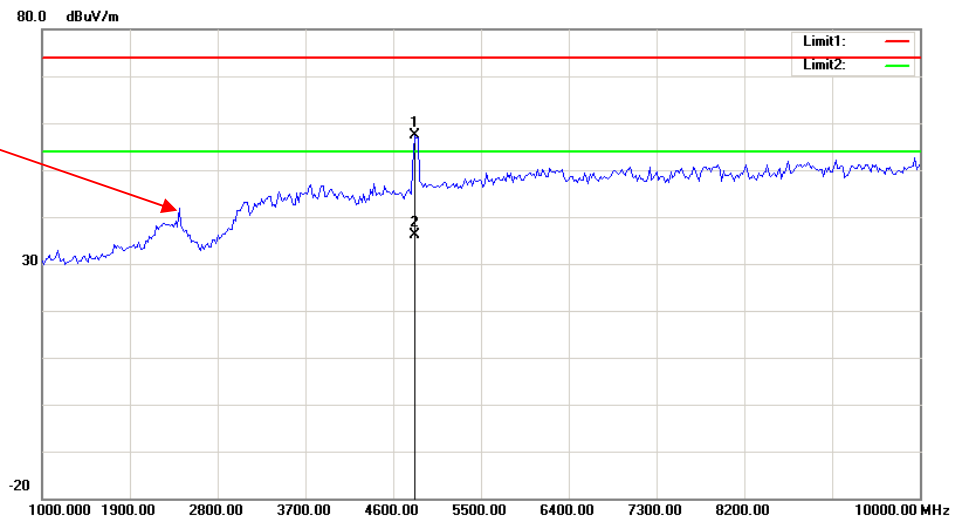
Test plots at Low Channel Horizontal

Fundamental
Test with Band
Rejection Filter



Vertical

Fundamental
Test with Band
Rejection Filter



FCC §15.215(c) – 20 dB BANDWIDTH TESTING**Applicable Standard**

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
3. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2017-12-08	2018-12-08
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	Each Time	/

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	22.6 °C
Relative Humidity:	39 %
ATM Pressure:	101.5 kPa

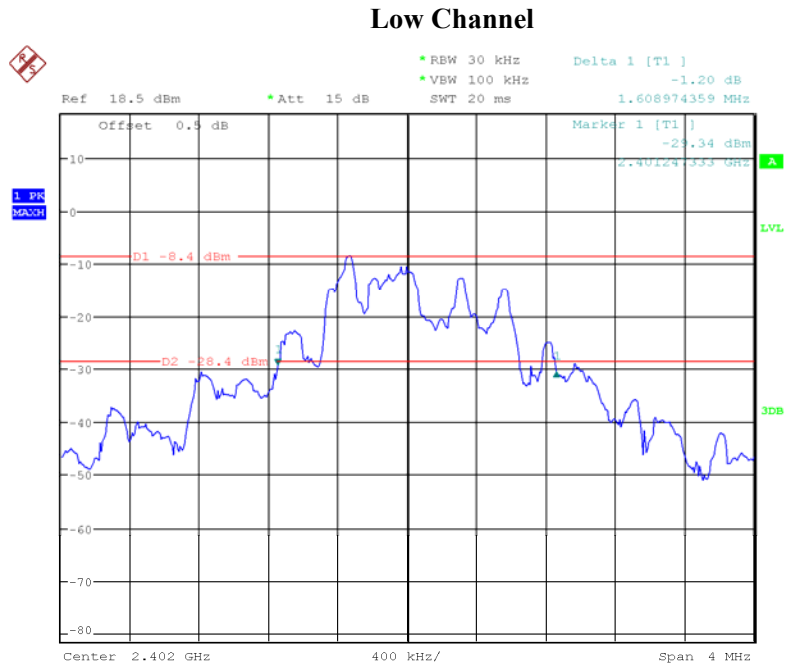
The testing was performed by Harry Yang on 2018-01-14.

Test Result: Compliant.

Please refer to following tables and plots

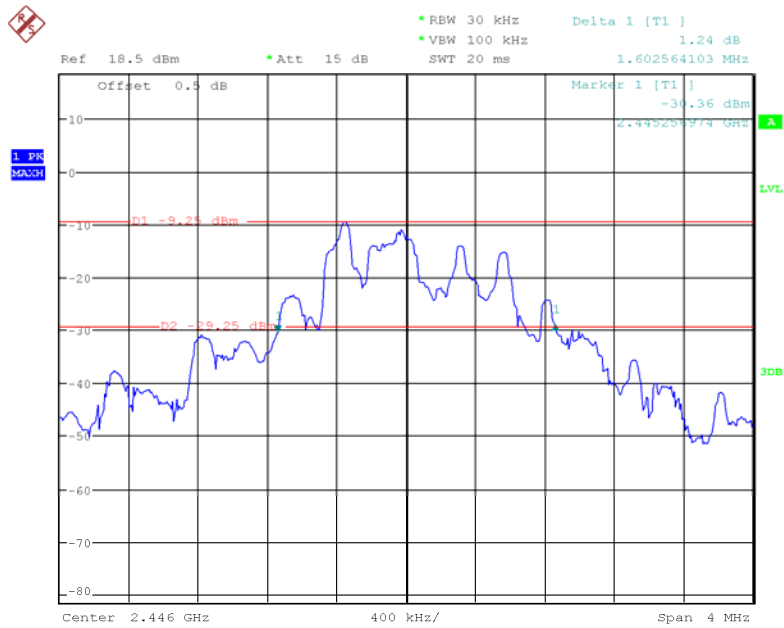
Test Mode: Transmitting

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2402	1.609
Middle	2446	1.603
High	2479	1.596



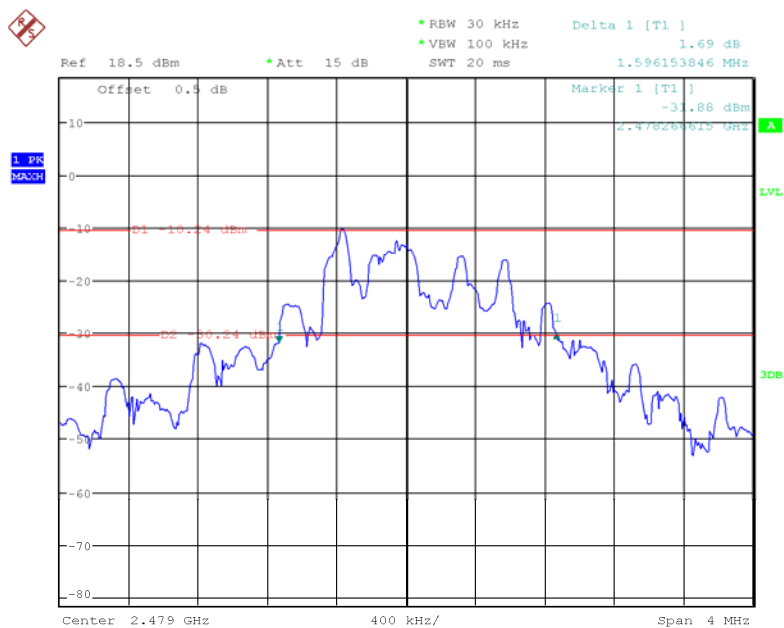
Date: 14.JAN.2018 10:13:25

Middle Channel



Date: 14.JAN.2018 10:14:46

High Channel



Date: 14.JAN.2018 10:19:17

***** END OF REPORT *****