

FCC PART 15.249



TEST REPORT

For

Shenzhen Rapoo Technology Co., Ltd.

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Shenzhen, Guangdong, China

FCC ID: PP23710P

Report Type: Original Report	Product Type: Wireless Laser Mouse
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The ShenZhen Rapoo Technology Co., Ltd.'s product, model number: 3710P (FCC ID: PP23710P) (the "EUT") in this report was a Wireless Laser Mouse, which was measured approximately: 10.8cm(L) x 5.6 cm(W) x 3.3 cm(H), rated input voltage: DC 3V from 2*AAA Series battery.

All measurement and test data in this report was gathered from production sample serial number: 120921003 (Assigned by BACL, Dongguan). The EUT was received on 2012-09-21.

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, B and C of the Federal Communication Commissions rules.

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

Related Submittal(s)/Grant(s)

No related submittal(s)

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Dongguan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

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 Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 02, 2012. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

16 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	5727	5	5750	9	5771	13	5796
2	5730	6	5753	10	5776	14	5799
3	5734	7	5756	11	5779	15	5802
4	5738	8	5759	12	5782	16	5804

EUT was tested with Channel 1, 9 and 16.

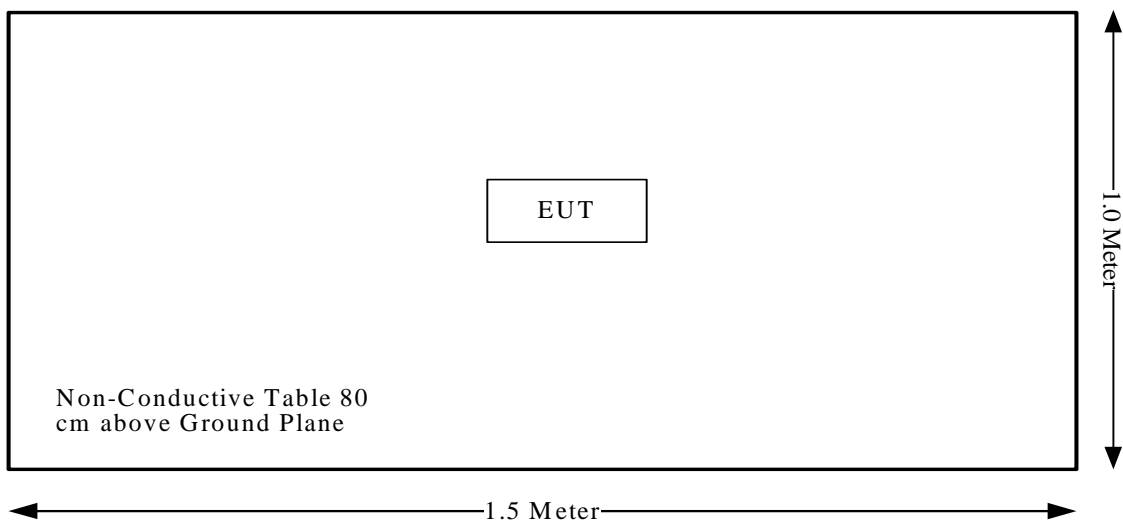
EUT Exercise Software

No exercise software was used.

Equipment Modifications

No modifications were made to the unit tested.

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	N/A*
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.249(d)	Outside of Band Emission (50dB attenuation)	Compliance

N/A*: Battery operation.

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 a ceramic antenna, which was permanently attached on the PCB, and the maximum gain was -0.27 dBi, fulfill the requirement of §15.203. Please refer to the internal 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.

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement from 30MHz to 1GHz at Bay Area Compliance Laboratories Corp. (Dongguan) is 4.0 dB. (k=2, 95% level of confidence), and the uncertainty will not be taken into consideration for all the test data recorded in the report.

Test Equipment Setup

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

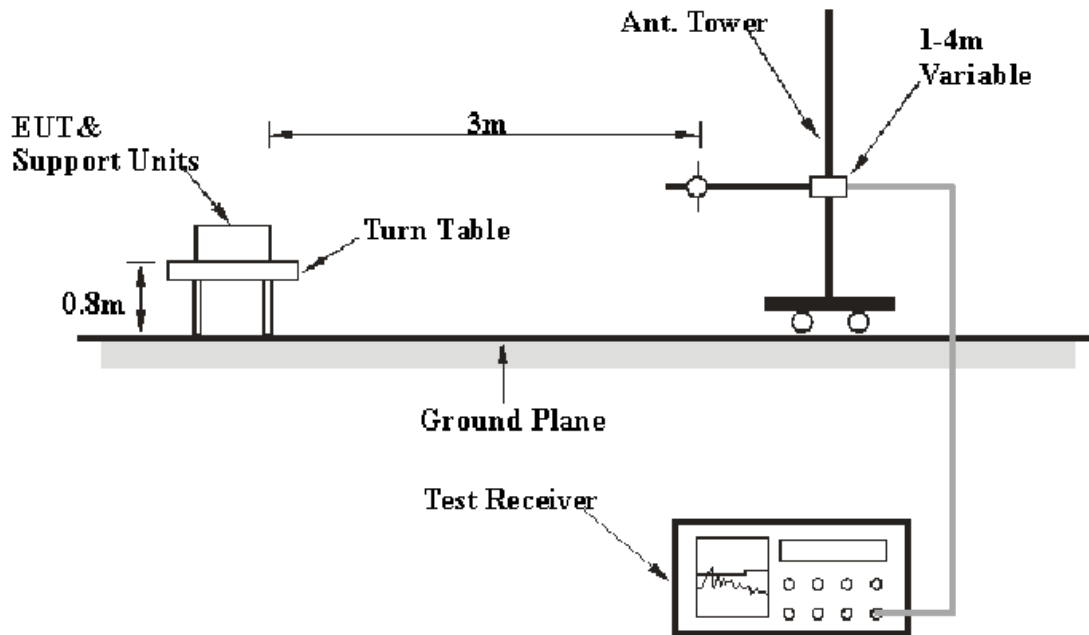
$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000 MHz:

$$\text{Peak: RBW} = 1\text{MHz} / \text{VBW} = 1\text{MHz} / \text{Sweep} = \text{Auto}$$

$$\text{Average: RBW} = 1\text{MHz} / \text{VBW} = 10\text{Hz} / \text{Sweep} = \text{Auto}$$

EUT Setup



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.4-2009. The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

Test Procedure

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

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 mete, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

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
Rohde & Schwarz	EMI Test Receiver	ESCI	101121	2011-10-8	2012-10-7
Sunol Sciences	Hybrid Antennas	JB3	A060611-1	2011-9-6	2013-9-5
HP	Pre-amplifier	8447E	2434A02181	2011-10-8	2012-10-7
Rohde & Schwarz	Spectrum Analyzer	FSEM 30	1079 8500	2011-10-9	2012-10-8
Dayang	Horn Antenna	OMCDH101 80	10279001B	2010-7-30	2015-7-29
Mini-Circuits	Wideband Amplifier	ZVA-183-S+	96901149	N/A	N/A

Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209 & 15.205 & 15.249, with the worst margin reading of:

6.96 dB at 5725 MHz in the Horizontal polarization

Test Data

Environmental Conditions

Temperature:	25.9 °C
Relative Humidity:	60 %
ATM Pressure:	100.5 kPa

The testing was performed by Ares Liu on 2012-09-25.

Test Mode: Transmitting

Frequency (MHz)	Receiver/S.A.		Antenna		Cable Loss (dB)	Amplifier Gain (dB)	Cord. Amp. (dBµV/m)	FCC 15.209/15.249	
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBµV/m)	Margin (dB)
Low Channel: 5727 MHz									
5725	54.11	PK	H	34.64	4.83	26.53	67.04	74.00	6.96
5725	51.84	PK	V	34.64	4.83	26.53	64.77	74.00	9.23
11454	19.43	AV	V	40.93	7.95	26.01	42.30	54.00	11.70
11454	18.92	AV	H	40.93	7.95	26.01	41.79	54.00	12.21
11454	37.51	PK	V	40.93	7.95	26.01	60.38	74.00	13.62
11454	36.33	PK	H	40.93	7.95	26.01	59.20	74.00	14.80
372.84	33.84	QP	H	15.70	2.34	21.70	30.18	46.00	15.82
5725	23.00	AV	H	34.64	4.83	26.53	35.93	54.00	18.07
5725	20.52	AV	V	34.64	4.83	26.53	33.45	54.00	20.55
5727	73.04	PK	H	34.64	4.85	26.53	86.00	114	28.00
5727	69.14	PK	V	34.64	4.85	26.53	82.10	114	31.90
5727	41.1	AV	H	34.64	4.85	26.53	54.06	94	39.94
5727	40.36	AV	V	34.64	4.85	26.53	53.32	94	40.68
Middle Channel: 5771 MHz									
11542	19.12	AV	H	41.08	7.91	26.06	42.05	54.00	11.95
11542	18.94	AV	V	41.08	7.91	26.06	41.87	54.00	12.13
11542	37.28	PK	H	41.08	7.91	26.06	60.21	74.00	13.79
11542	36.51	PK	V	41.08	7.91	26.06	59.44	74.00	14.56
409.56	32.94	QP	H	16.44	2.46	21.79	30.05	46.00	15.95
5771	72.83	PK	H	34.66	5.16	27.04	85.61	114.00	28.39
5771	71.41	PK	V	34.66	5.16	27.04	84.19	114.00	29.81
5771	41.46	AV	H	34.66	5.16	27.04	54.24	94.00	39.76
5771	41.05	AV	V	34.66	5.16	27.04	53.83	94.00	40.17
High Channel: 5804 MHz									
5878.55	51.52	PK	H	34.73	5.58	26.30	65.52	74.00	8.48
5878.55	48.64	PK	V	34.73	5.58	26.30	62.64	74.00	11.36
11608	19.12	AV	H	41.19	8.05	25.98	42.39	54.00	11.61
11608	18.94	AV	V	41.19	8.05	25.98	42.21	54.00	11.79
11608	37.28	PK	H	41.19	8.05	25.98	60.55	74.00	13.45
11608	36.51	PK	V	41.19	8.05	25.98	59.78	74.00	14.22
218.73	36.49	QP	H	11.52	1.79	21.47	28.33	43.50	15.17
5878.55	20.54	AV	H	34.73	5.58	26.30	34.54	54.00	19.46
5878.55	18.73	AV	V	34.73	5.58	26.30	32.73	54.00	21.27
5804	73.68	PK	H	34.68	5.17	26.87	86.67	114.00	27.33
5804	71.89	PK	V	34.68	5.17	26.87	84.88	114.00	29.12
5804	42.24	AV	H	34.68	5.17	26.87	55.23	94.00	38.77
5804	41.68	AV	V	34.68	5.17	26.87	54.67	94.00	39.33

FCC §15.249(d) - OUT OF BAND EMISSION (50 dB ATTENUATION)

Applicable Standard

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

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM 30	1079 8500	2011-10-9	2012-10-8

Test Data

Environmental Conditions

Temperature:	27.8 °C
Relative Humidity:	64 %
ATM Pressure:	100.5 kPa

* The testing was performed by Ares Liu on 2012-09-25.

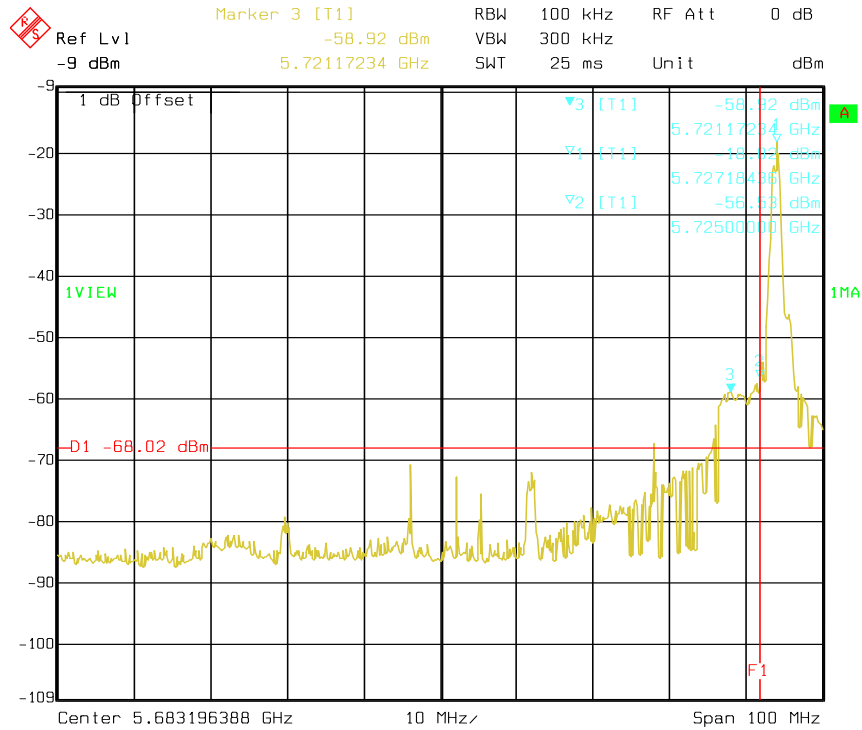
Test Result: Compliance.

Please refer to the following table and plots:

Frequency (MHz)	Delta Peak to Band Emission (dBc)
5725	38.51 (note)
5878.55	50.02

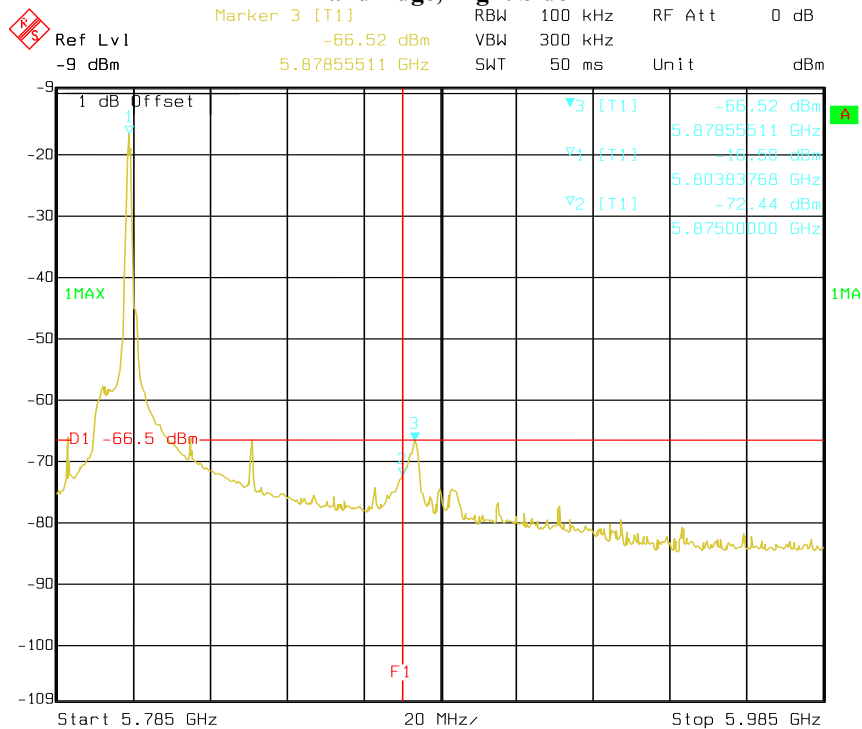
Note: The EUT meets FCC Part 15.209 at this frequency, please refer to the radiated emissions data.

Band Edge, Left Side



Date: 27.SEP.2012 16:14:54

Band Edge, Right Side



Date: 27.SEP.2012 16:17:40

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