FCC PART 15.249

TEST REPORT

For

Shenzhen Rapoo Technology Co., Ltd.

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

FCC ID: PP23900P

Report Type: Original Report	**Product Type:** Wireless Laser Mouse
Test Engineer:	Dean Liu
Report Number:	R2DG140307005-00
Report Date:	2014-03-31
Reviewed By:	Ivan Cao RF Leader
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Shenzhen Rapoo Technology Co., Ltd.* 's product, model number: *3900P (FCC ID: PP23900P)* (the "EUT") in this report was a *Wireless Laser Mouse,* which was measured approximately: 10.2 cm (L) x6.8 cm (W) x 4.0 cm (H), rated input voltage: DC 1.5V from battery.

** All measurement and test data in this report was gathered from production sample serial number:140307005 (Assigned by BACL, Dongguan). The EUT was received on 2014-03-07.*

Objective

This type approval report was 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 Communications Commission's 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.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, 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).

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 Communications 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 C63.4-2003.

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. The engineering mode was configured as maximum power and switched the channels by keys.

16 channels were provided by the manufacturer:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	5727	5	5750	9	5771	13	5786
2	5730	6	5753	10	5776	14	5790
3	5734	7	5756	11	5779	15	5792
4	5738	8	5759	12	5782	16	5794

EUT was tested with Channel 5727MHz, 5771MHz and 5794MHz.

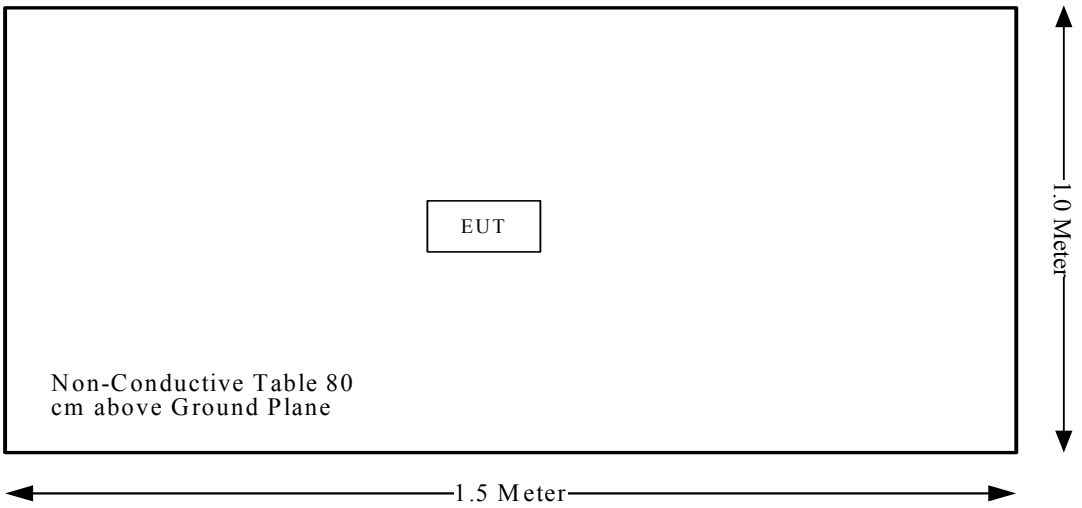
EUT Exercise Software

No software was used in the test.

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	Not Applicable*
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

Not Applicable*: the EUT was powered by battery only.

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 printed antenna on the printed circuit board, which was complied with 15.203, the maximum gain was 0.34 dBi. 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

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- 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.

If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

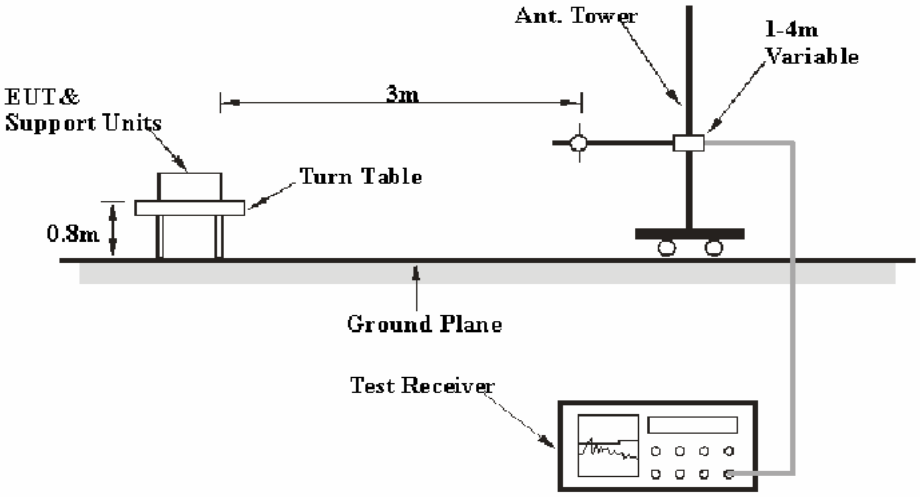
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:
30M~200MHz: 5.0 dB
200M~1GHz: 6.2 dB
1G~6GHz: 4.45 dB
6G~18GHz: 5.23 dB

Table 1 – Values of U_{cispr}

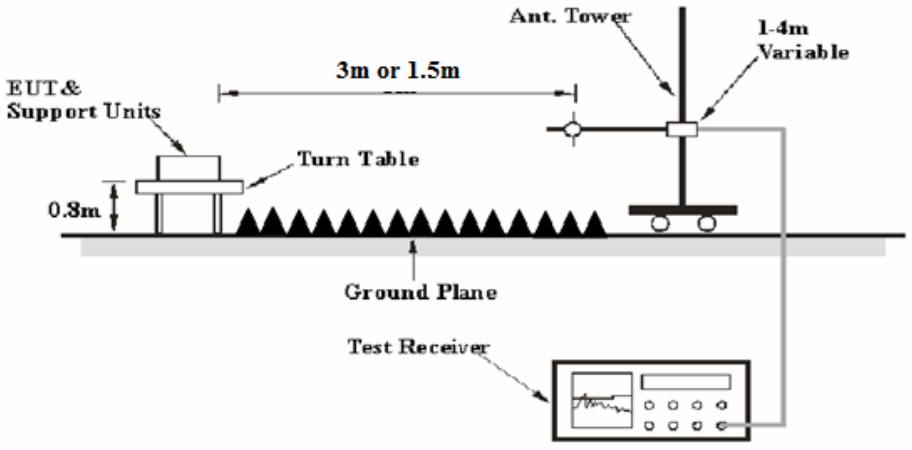
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1 GHz:



Above 1 GHz:



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 C63.4-2003. 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 40 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	Detector
30MHz – 1000 MHz	120 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

Test Procedure

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

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz and peak and Average detection modes for the frequencies in the restricted band above 1 GHz, peak detection modes for the frequencies in the un-restricted band above 1 GHz.

The Radiated measurements was performed, The EIRP converted to field strength as follows:

EIRP[dBm] = E[dBuV/m] + 20 log(d[meters]) - 104.77

Or, if d is 3 meters:

EIRP[dBm] = E[dBuV/m] - 95.2

According to C63.4, the above 1G test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1.5m
Distance extrapolation factor =20 log (1.5m/3m) dB
Extrapolation result = Corrected Amplitude (dBµV/m) -6dB

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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit –Extrapolation result

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2013-05-06	2014-05-05
Sunol Sciences	Antenna	JB3	A060611-1	2011-09-06	2014-09-05
HP	Amplifier	8447E	2434A02181	2013-09-06	2014-09-05
R&S	Spectrum Analyzer	FSEM	DE31388	2013-05-07	2014-05-06
ETS LINDGREN	Horn Antenna	3115	000 527 35	2012-09-06	2015-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2014-02-19	2015-02-18
R&S	Spectrum Analyzer	FSP 38	100478	2013-06-16	2014-06-15
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2013-06-16	2014-06-15
Ducommun Technolagies	Horn Antenna	ARH-2823-02	1007726-01 1302	2013-06-16	2014-06-15
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2013-09-06	2014-09-05

*** 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 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:

3.03 dB at **17382MHz** in the **Horizontal** polarization

Test Data

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	67 %
ATM Pressure:	100.8 kPa

The testing was performed by Dean Liu on 2014-03-20.

Test Mode: Transmitting

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m) @1.5m	Extrapolation result (dBμV/m) @3m	Limit (dBμV/m)	Margin (dB)
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)						
Low Channel:5727 MHz										
5727	74.1	PK	H	32.15	6.04	26.78	85.51	79.51	114.00	34.49
5727	62.09	AV	H	32.15	6.04	26.78	73.50	67.50	94.00	26.50
5727	69.86	PK	V	32.15	6.04	26.78	81.27	75.27	114.00	38.73
5727	61.48	AV	V	32.15	6.04	26.78	72.89	66.89	94.00	27.11
5725	61.35	PK	H	32.15	6.04	26.78	72.76	66.76	74.00	7.24
5725	27.13	AV	H	32.15	6.04	26.78	38.54	32.54	54.00	21.46
11450	35.98	PK	H	37.85	9.79	25.92	57.70	51.70	74.00	22.30
11450	21.32	AV	H	37.85	9.79	25.92	43.04	37.04	54.00	16.96
17175	40.08	PK	H	40.55	14.35	25.07	69.91	63.91	74.00	10.09
17175	27.11	AV	H	40.55	14.35	25.07	56.94	50.94	54.00	3.06 *
3262.5	43.34	PK	H	28.04	6.17	27.43	50.12	44.12	74.00	29.88
3262.5	24.45	AV	H	28.04	6.17	27.43	31.23	25.23	54.00	28.77
2274	33.45	PK	H	25.31	4.21	27.21	35.76	29.76	74.00	44.24
2274	18.45	AV	H	25.31	4.21	27.21	20.76	14.76	54.00	39.24
325	29.4	QP	H	14.61	2.16	21.58	24.59	24.59	46.00	21.41
Middle Channel:5771 MHz										
5771	73.83	PK	H	32.15	6.12	26.72	85.38	79.38	114.00	34.62
5771	62.11	AV	H	32.15	6.12	26.72	73.66	67.66	94.00	26.34
5771	69.27	PK	V	32.15	6.12	26.72	80.82	74.82	114.00	39.18
5771	61.61	AV	V	32.15	6.12	26.72	73.16	67.16	94.00	26.84
11542	36.74	PK	H	37.90	9.81	25.92	58.53	52.53	74.00	21.47
11542	22.04	AV	H	37.90	9.81	25.92	43.83	37.83	54.00	16.17
17313	42.68	PK	H	41.38	13.60	24.77	72.89	66.89	74.00	7.11
17313	26.57	AV	H	41.38	13.60	24.77	56.78	50.78	54.00	3.22 *
3262.5	42.98	PK	H	28.04	6.17	27.43	49.76	43.76	74.00	30.24
3262.5	23.71	AV	H	28.04	6.17	27.43	30.49	24.49	54.00	29.51
2274	33.61	PK	H	25.31	4.21	27.21	35.92	29.92	74.00	44.08
2274	18.76	AV	H	25.31	4.21	27.21	21.07	15.07	54.00	38.93
325	28.9	QP	H	14.61	2.16	21.58	24.09	18.09	46.00	27.91
278	27.5	QP	H	13.76	2.01	21.51	21.76	21.76	46.00	24.24
High Channel:5794 MHz										
5794	72.15	PK	H	32.16	6.13	26.69	83.75	77.75	114.00	36.25
5794	61.72	AV	H	32.16	6.13	26.69	73.32	67.32	94.00	26.68
5794	67.35	PK	V	32.16	6.13	26.69	78.95	72.95	114.00	41.05
5794	60.41	AV	V	32.16	6.13	26.69	72.01	66.01	94.00	27.99
5875	39.15	PK	H	32.18	6.31	26.69	50.95	44.95	74.00	29.05
5875	23.89	AV	H	32.18	6.31	26.69	35.69	29.69	54.00	24.31
11588	33.98	PK	H	37.90	9.73	25.91	55.70	49.70	74.00	24.30
11588	21.87	AV	H	37.90	9.73	25.91	43.59	37.59	54.00	16.41
17382	40.05	PK	H	41.79	13.23	24.62	70.45	64.45	74.00	9.55
17382	26.57	AV	H	41.79	13.23	24.62	56.97	50.97	54.00	3.03 *
3262.5	43.57	PK	H	28.04	6.17	27.43	50.35	44.35	74.00	29.65
3262.5	23.89	AV	H	28.04	6.17	27.43	30.67	24.67	54.00	29.33
2274	34.02	PK	H	25.31	4.21	27.21	36.33	30.33	74.00	43.67
2274	18.94	AV	H	25.31	4.21	27.21	21.25	15.25	54.00	38.75
325	28.6	QP	H	14.61	2.16	21.58	23.79	23.79	46.00	22.21

*Within measurement uncertainty!

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. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. 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	FSP 38	100478	2013-06-16	2014-06-15

*** 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:	22.3 °C
Relative Humidity:	64%
ATM Pressure:	100.6 kPa

** The testing was performed by Dean Liu on 2014-03-28.*

Test Result: Compliance.

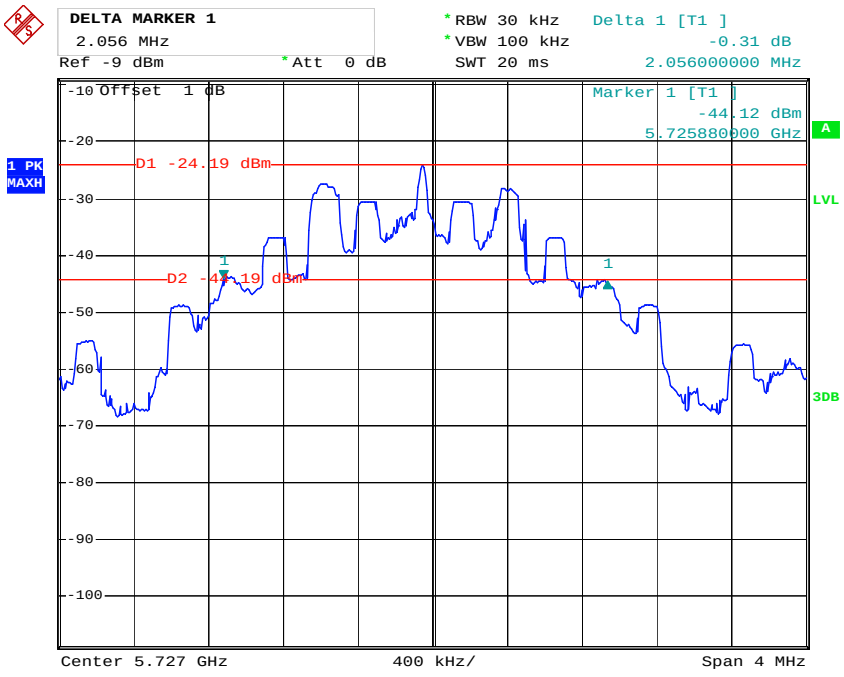
Please refer to following tables and plots

Test Mode: Transmitting

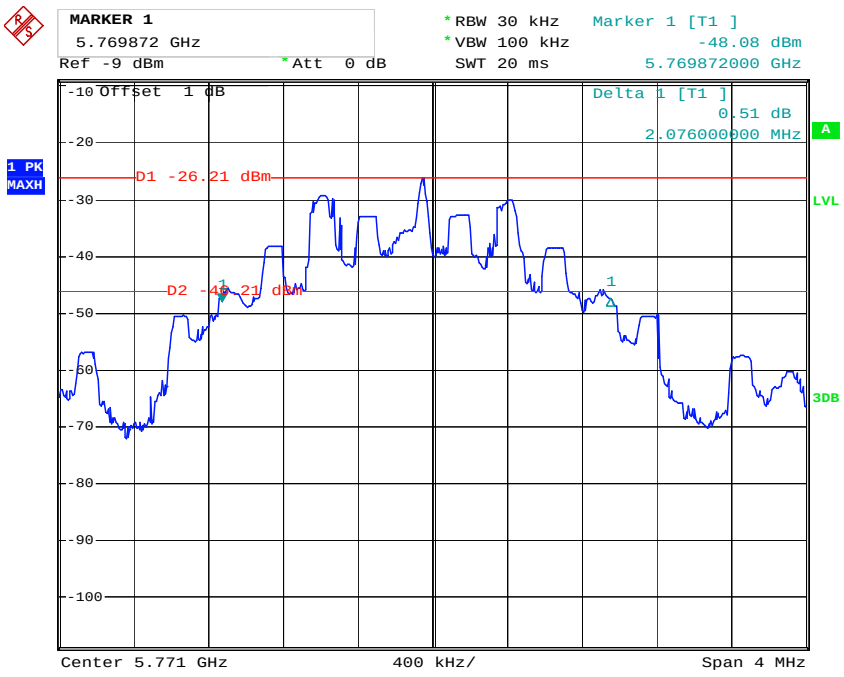
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	5727	2.06
Middle	5771	2.08
High	5794	2.09

Please refer to the following plots.

Low Channel



Middle Channel



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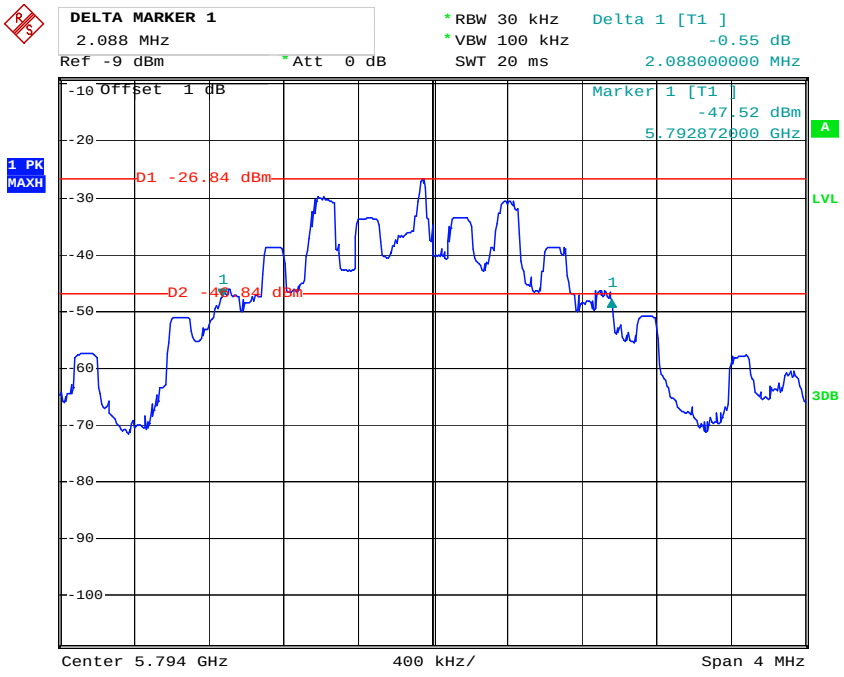
High Channel



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