



FCC PART 15.249
TEST REPORT

For

Shenzhen Loyal Electronics Co., Ltd.

No.5, First Industry Park, Shanmen Songgang, Baoan, Shenzhen, Guangdong, China

FCC ID: 2AAVD-G1317E

Report Type: Original Report	Product Type: Wireless mouse
Report Number: <u>RSZ201118004-00</u>	
Report Date: <u>2021-04-21</u>	
Reviewed By: <u>Jacob Kong</u> RF Engineer	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Wireless mouse
Tested Model	G1317E
Multiple Models	G1306E, G1303E, G1003E, G1053E, G1056E
Model Differences	Refer to the DoS letter
Frequency Range	2402-2480MHz
Maximum E-Field Strength	90.33dBuV/m@3m
Antenna Specification*	-0.61dBi(It is provided by the applicant)
Voltage Range	DC 1.5V from battery
Date of Test	2020-11-25 to 2021-04-21
Sample serial number	RSZ201118004-RF-S1 (Assigned by BAACL, Shenzhen)
Received date	2020-11-18
Sample/EUT Status	Good condition

Objective

This test report is 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 Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules.

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

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.73dB
RF conducted test with spectrum		±1.6dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1°C
Humidity		±6%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, 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.: 342867, the FCC Designation No.: CN1221.

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

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing by manufacturer.

Frequency List

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

EUT was test in channel 0, 19, 39.

EUT Exercise Software

No software was used, EUT was configured in testing mode by manufacturer

Equipment Modifications

No modifications were made to the unit tested.

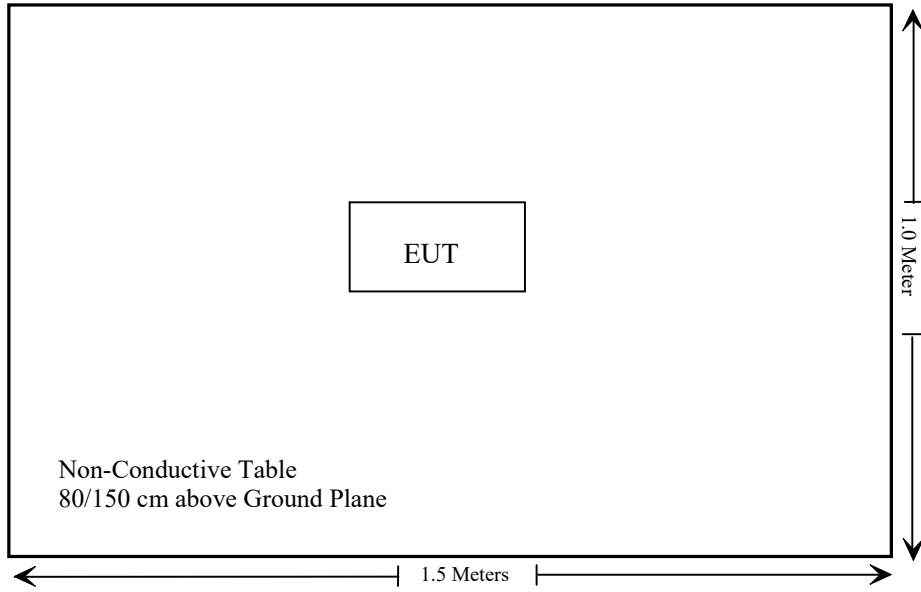
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

Support Cable Descriptions

Cable Description	Length (m)	From/Port	To
/	/	/	/

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207(a)	Conduction Emissions	Not Applicable
15.205, §15.209, §15.249(d)	Radiated Emissions& Outside of Band Emission	Compliant
§15.215 (c)	20 dB Bandwidth	Compliant

Not Applicable: The EUT was powered by battery only.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2020/08/04	2021/08/03
Sonoma instrument	Pre-amplifier	310 N	186238	2020/08/04	2021/08/03
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2017/12/22	2020/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2019/11/29	2020/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/08/04	2021/08/03
COM-POWER	Pre-amplifier	PA-122	181919	2020/11/29	2021/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/29	2021/11/28
Sunol Sciences	Horn Antenna	3115	9107-3694	2018/01/15	2021/01/14
the electro-Mechanics Co	Horn Antenna	3116	9510-2270	2019/10/13	2022/10/12
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2020/11/29	2021/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2020/11/29	2021/11/28
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2020/04/20	2021/04/20
RF Conducted Test					
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200982	2020/08/04	2021/08/03
WEINSCHHEL	3dB Attenuator	Unknown	F-03-EM121	2019/11/29	2020/11/28
WEINSCHHEL	3dB Attenuator	Unknown	F-03-EM121	2020/11/29	2021/11/28

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

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has one internal antenna which was permanently attached and the antenna gain is -0.61dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

FCC§15.205, §15.209 & §15.249(d) - 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.

As per FCC§15.249 (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.

Test Equipment Setup

The spectrum analyzer or receiver is set as:

Below 1000MHz:

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

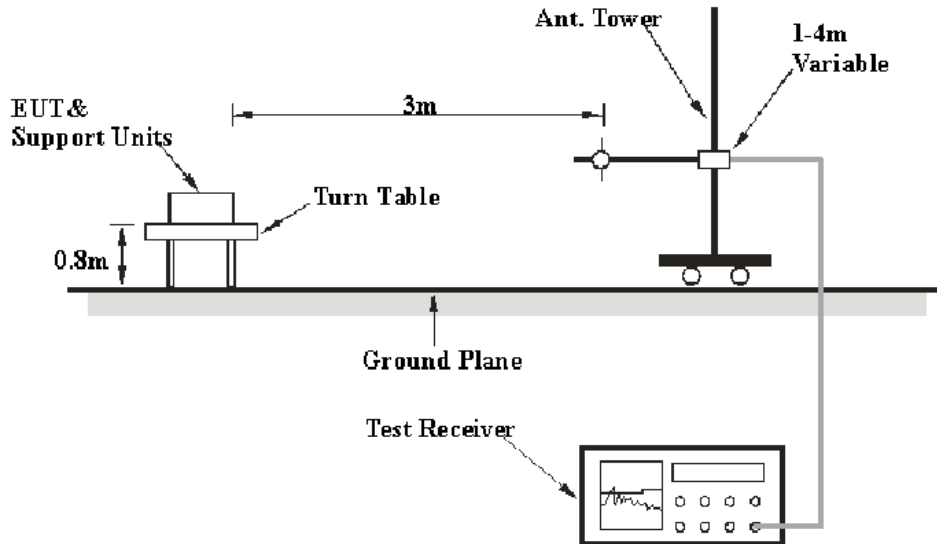
Above 1000MHz:

$$\text{Peak: RBW} = 1\text{MHz} / \text{VBW} = 3\text{MHz} / \text{Sweep} = \text{Auto}$$

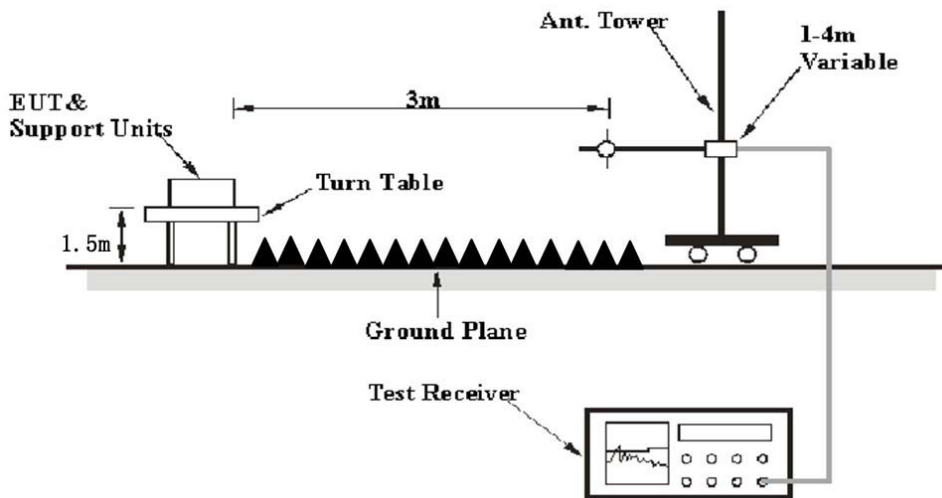
$$\text{Average: RBW} = 1\text{MHz} / \text{VBW} = 10\text{Hz} / \text{Sweep} = \text{Auto}$$

EUT Setup

Below 1GHz:



Above 1GHz:



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 C63.10-2013. 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 for below 1GHz or 1.5 meter for above 1GHz, 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 Results Summary

According to the EUT complied with the FCC Part 15.205, 15.209 & §15.249

Test Data

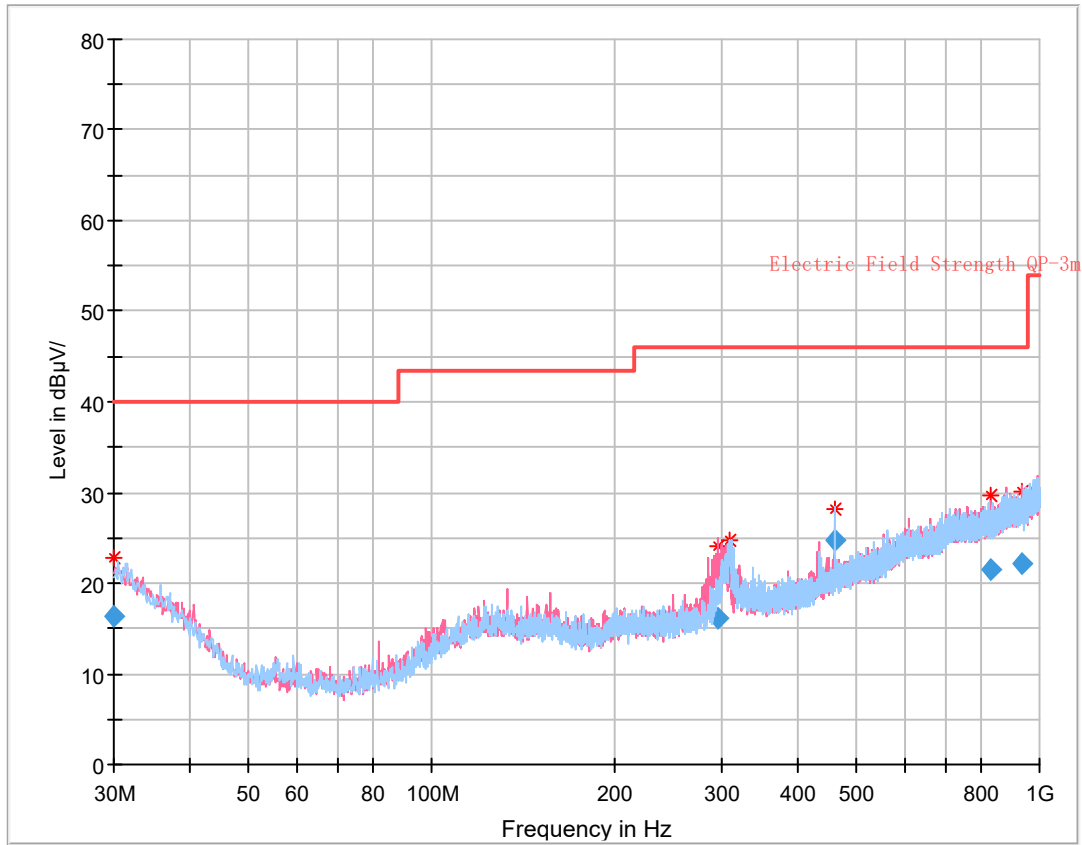
Environmental Conditions

Temperature:	29~32.2 °C
Relative Humidity:	55~56 %
ATM Pressure:	100.7~101.0 kPa

The testing was performed by Charlie Cha on 2020-11-25 for below 1GHz and Alan He on 2020-12-23 for above 1GHz.

Test Mode: Transmitting

30MHz – 1 GHz: (Middle channel was worst case)



Final Result

Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.023271	16.27	40.00	23.73	145.0	H	333.0	-4.5
296.202000	16.09	46.00	29.91	273.0	V	301.0	-9.3
308.674500	20.76	46.00	25.24	346.0	H	132.0	-9.0
460.991500	24.64	46.00	21.36	230.0	H	148.0	-5.7
833.688875	21.55	46.00	24.45	115.0	V	76.0	0.3
932.955625	22.09	46.00	23.91	199.0	V	251.0	1.8

1 GHz - 25 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.249	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel(2402MHz)									
2402.00	57.29	PK	133	2.4	H	31.87	89.16	94	4.84
2402.00	53.54	PK	302	2.0	V	31.87	85.41	94	8.59
2400.00	31.33	PK	39	2.4	H	31.87	63.20	74	10.8
2400.00	14.10	Ave	39	2.4	H	31.87	45.97	54	8.0
2328.58	29.26	PK	12	1.7	H	31.64	60.90	74	13.10
2328.58	14.54	Ave	12	1.7	H	31.64	46.18	54	7.82
2483.75	31.20	PK	145	2.3	H	32.13	63.33	74	10.67
2483.75	14.62	Ave	145	2.3	H	32.13	46.75	54	7.25
4804.00	57.22	PK	178	2.5	H	6.28	63.50	74	10.50
4804.00	29.23	Ave	178	2.5	H	6.28	35.51	54	18.49
Middle Channel(2440MHz)									
2440.00	58.36	PK	249	1.5	H	31.97	90.33	94	3.67
2440.00	53.92	PK	129	1.4	V	31.97	85.89	94	8.11
4880.00	57.04	PK	163	1.0	H	6.76	63.80	74	10.20
4880.00	29.70	Ave	163	1.0	H	6.76	36.46	54	17.54
High Channel(2480 MHz)									
2480.00	56.34	PK	342	2.1	H	32.13	88.47	94	5.53
2480.00	52.83	PK	232	1.9	V	32.13	84.96	94	9.04
2318.51	29.47	PK	316	2.1	H	31.64	61.11	74	12.89
2318.51	14.57	Ave	316	2.1	H	31.64	46.21	54	7.79
2483.53	35.51	PK	53	1.5	H	32.13	67.64	74	6.36
2483.53	14.63	Ave	53	1.5	H	32.13	46.76	54	7.24
4960.00	56.38	PK	164	1.1	H	6.80	63.18	74	10.82
4960.00	29.49	Ave	164	1.1	H	6.80	36.29	54	17.71

Note:

Corrected Amplitude = Corrected Factor + Reading

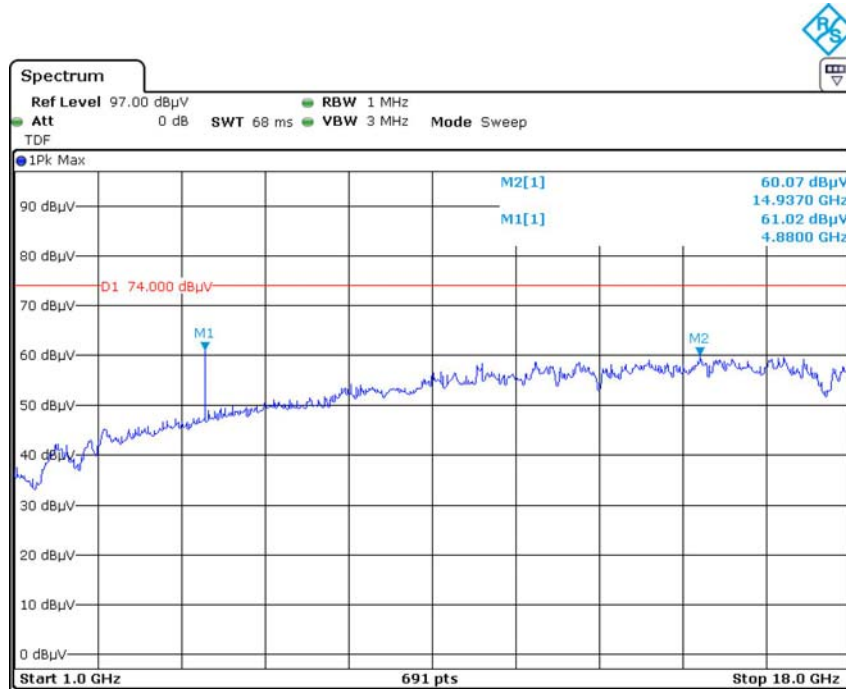
Corrected Factor=Antenna factor (RX) +cable loss – amplifier factor

Margin = Limit- Corr. Amplitude

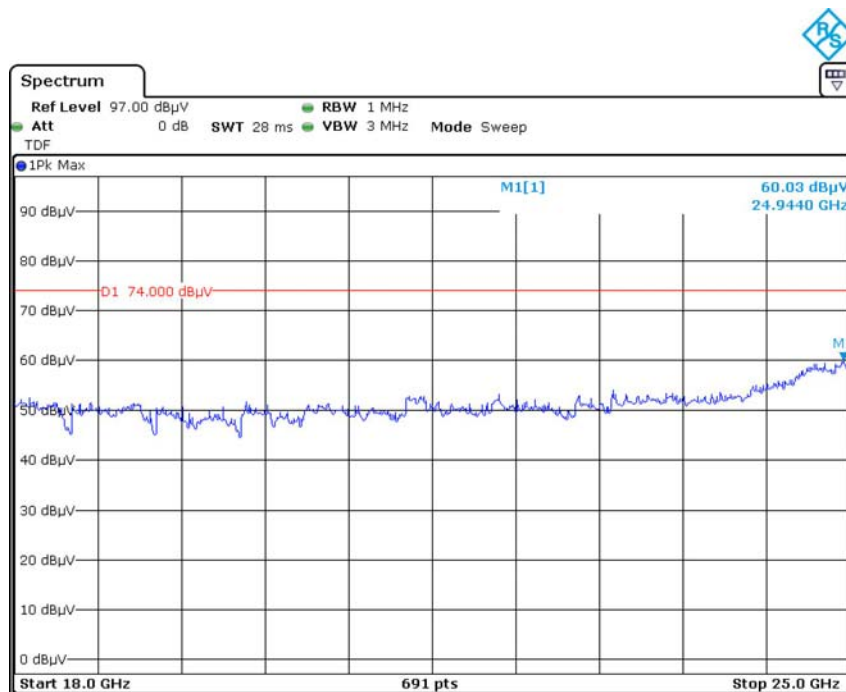
The emission more than20dB below the limit was not required to be recorded.

For fundamental, Peak level meet the average limit.

Pre-scan with Middle channel Peak Horizontal

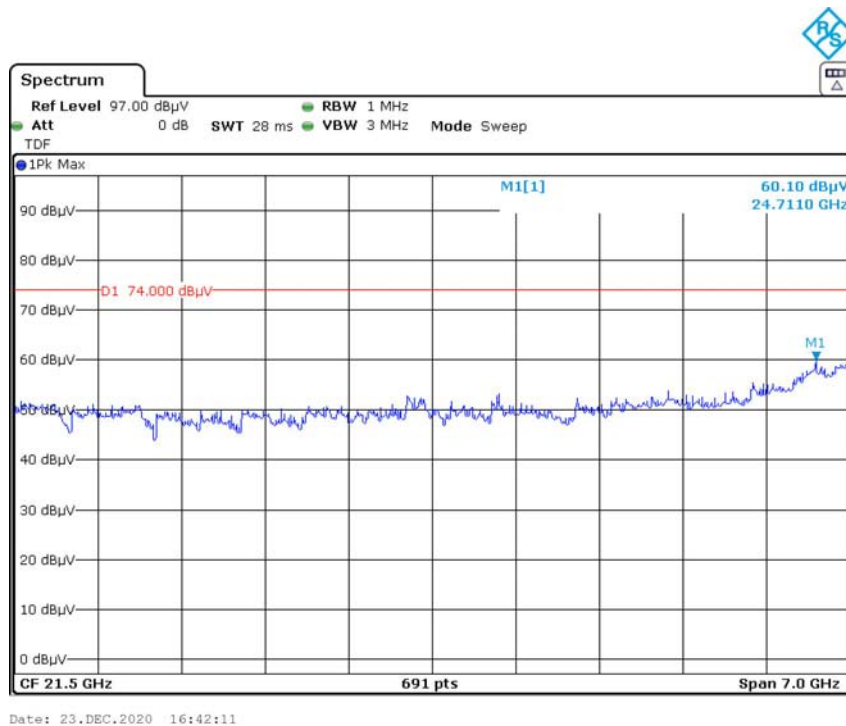
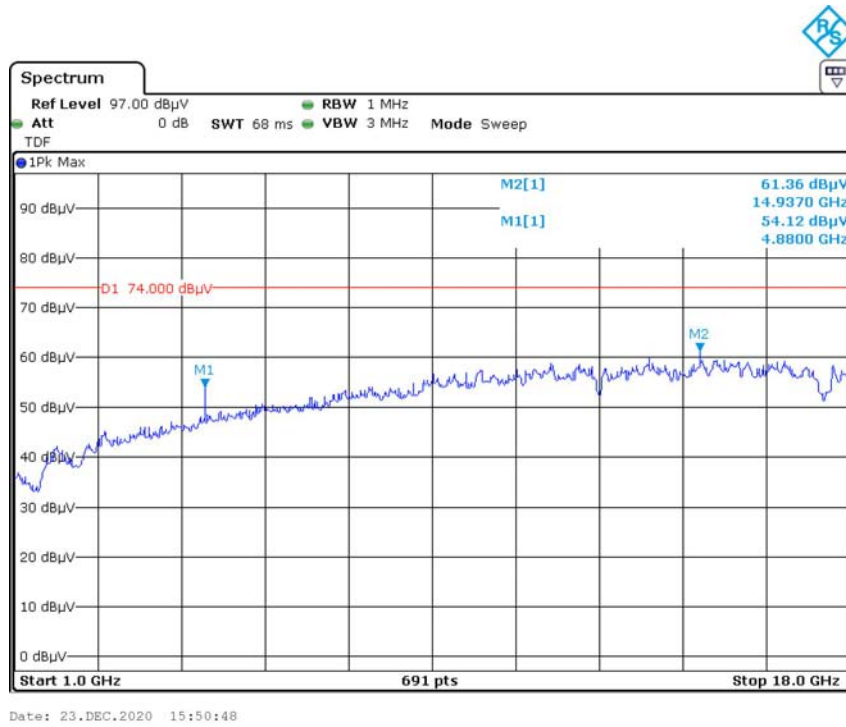


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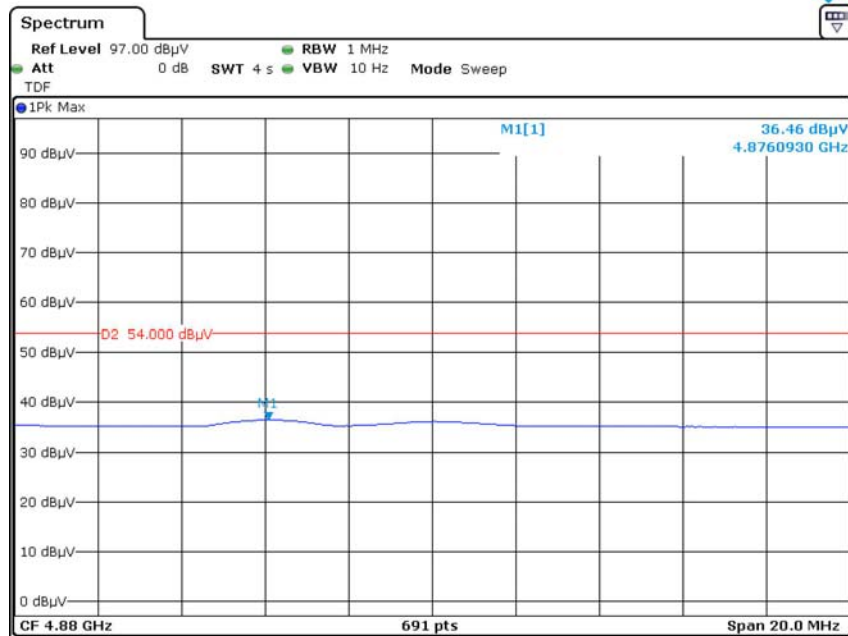


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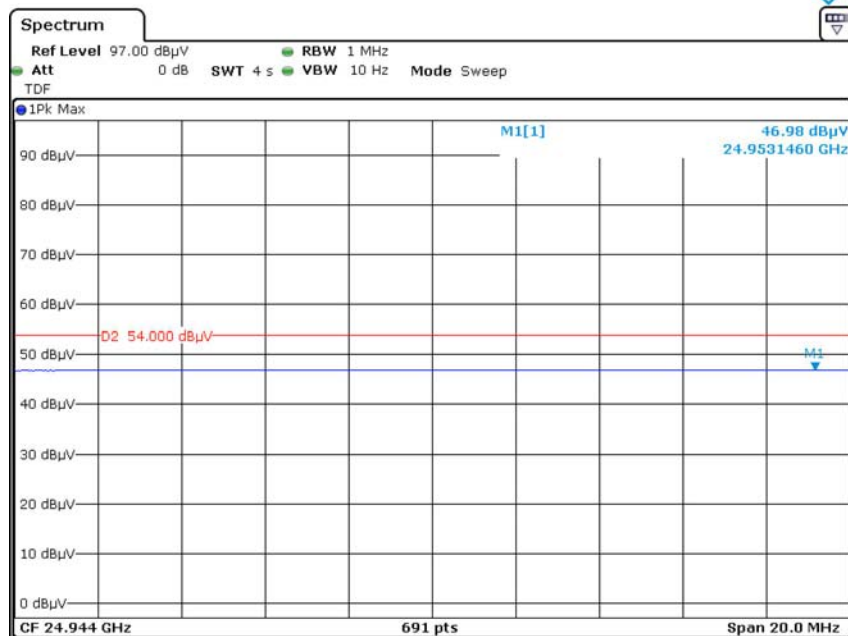
Vertical



Avenger Horizontal

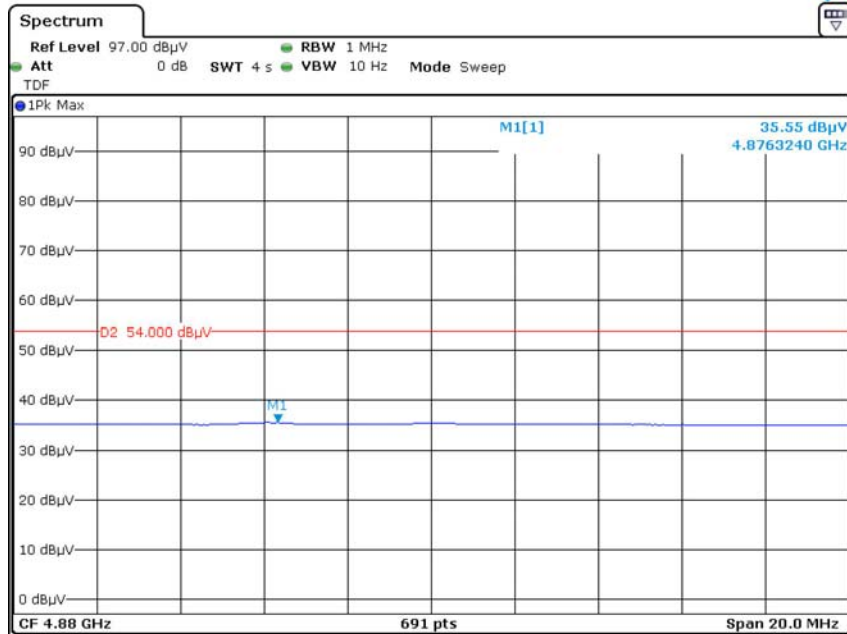


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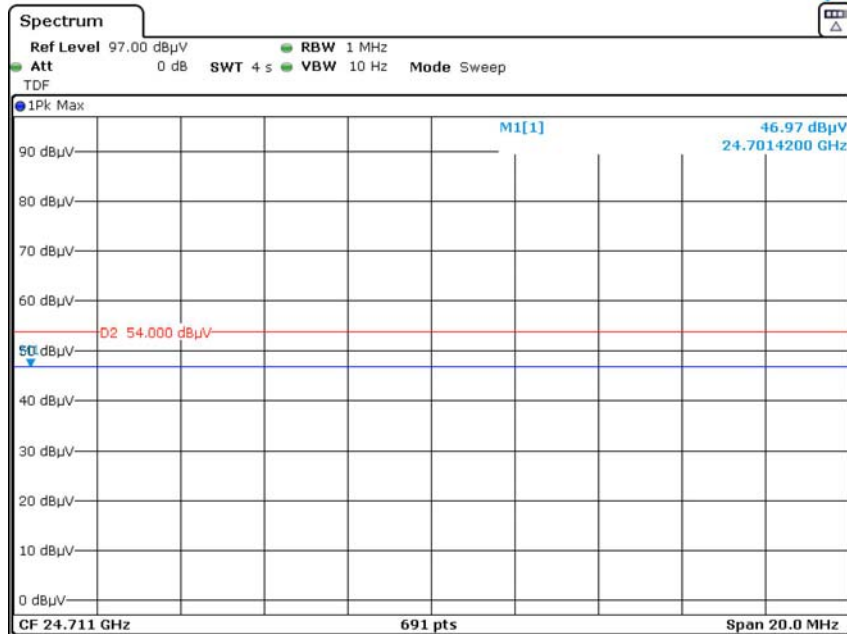


Date: 23.DEC.2020 16:36:13

Vertical



Date: 23.DEC.2020 15:55:47



Date: 23.DEC.2020 16:47:55

FCC§15.215(c) - 20dB EMISSION BANDWIDTH

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

ANSI C63.10-2013 Section 6.9

Test Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

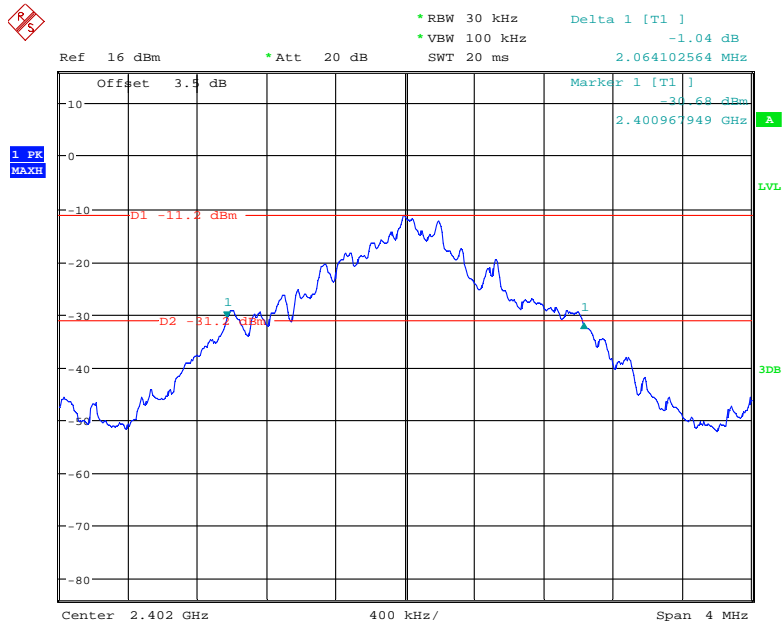
The testing was performed by Thea Xiao and Nancy Wang from 2020-11-25 to 2021-04-21.

Test Mode: Transmitting

Please refer to the following table and plots.

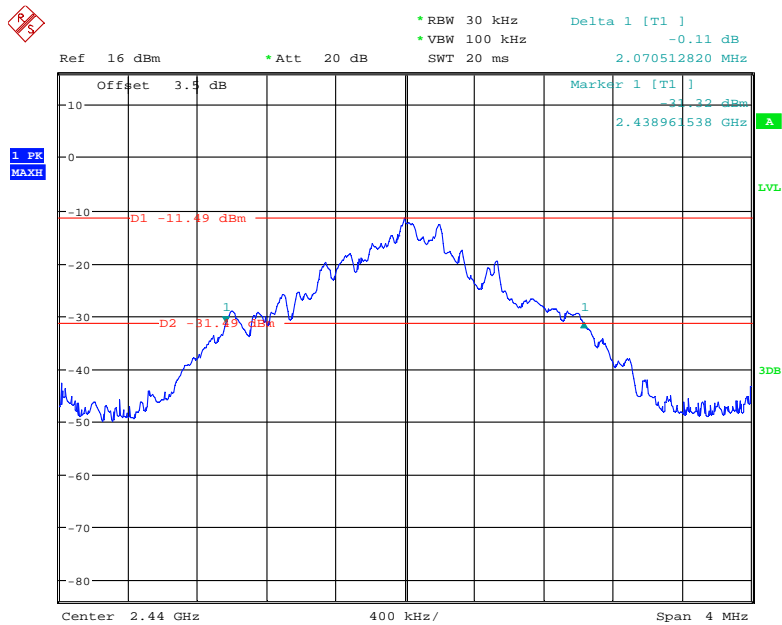
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	2.064
Middle	2440	2.071
High	2480	2.099

Low Channel



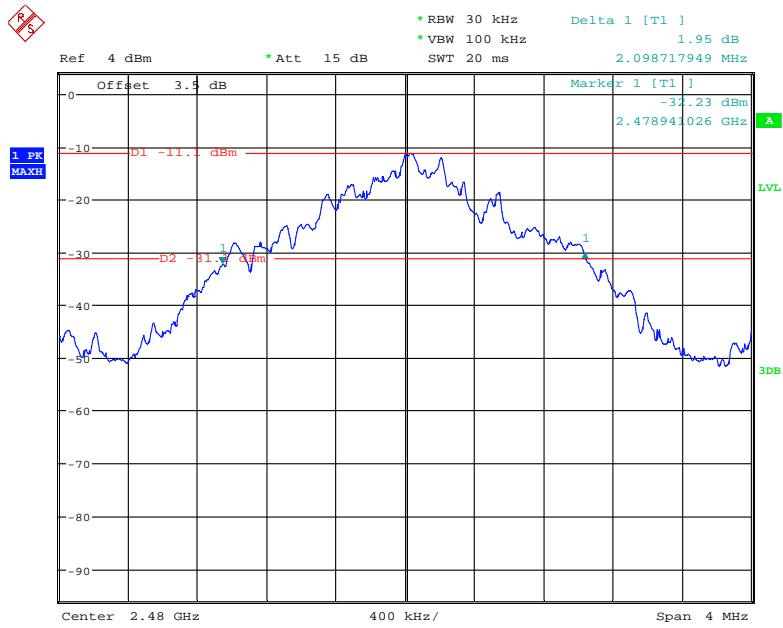
Date: 21.APR.2021 14:33:41

Middle Channel



Date: 21.APR.2021 14:36:52

High Channel



Date: 25.NOV.2020 09:46:06

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