

FCC PART 15.249

TEST REPORT

For

W S Trading Limited

1/F, HK SPINNERS BLDG PHASE I & II, 800 CHEUNG SHA WAN RD, KOWLOON, Hong Kong

FCC ID: 2AVGAMU2

Report Type: Original Report	Product Type: SLIM WIRELESS MOUSE USB Dongle
Report Number: RSZ191122835-00	
Report Date: 2019-12-24	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	SLIM WIRELESS MOUSE USB Dongle		
Model	MU21002-D		
UPC Number	Master UPC Number	Individual UPC Number	Color
	4895095120209	4895095120209	Black
	4895095120209	4895095122302	White
	4895095120209	4895095122319	Marble
	4895095120209	4895095122326	Blue Swirl
SKU Number	0003266186		
Frequency Range	2405~2475MHz		
Modulation Technique	GFSK		
Antenna Specification	4 dBi		
Voltage Range	DC 5.0V		
Date of Test	2019/12/06~2019/12/08		
Sample serial number	RSZ191122835-RF-S1 (Assigned by BACL, Shenzhen)		
Received date	2019/11/22		
Sample/EUT Status	Good condition		

Objective

This type approval report is prepared on behalf of *W S Trading Limited* 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, 15.207, 15.205, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

Submitted with part of a system with FCC ID: 2AVGAMU21002.

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 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, 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.: 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.

8 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2405	4	2457
1	2411	5	2463
2	2417	6	2469
3	2451	7	2475

Channel 0, Channel 3 and Channel 7 were selected for testing.

EUT Exercise Software

“HID_Tool.exe” software was used.

Equipment Modifications

No modifications were made to the unit tested.

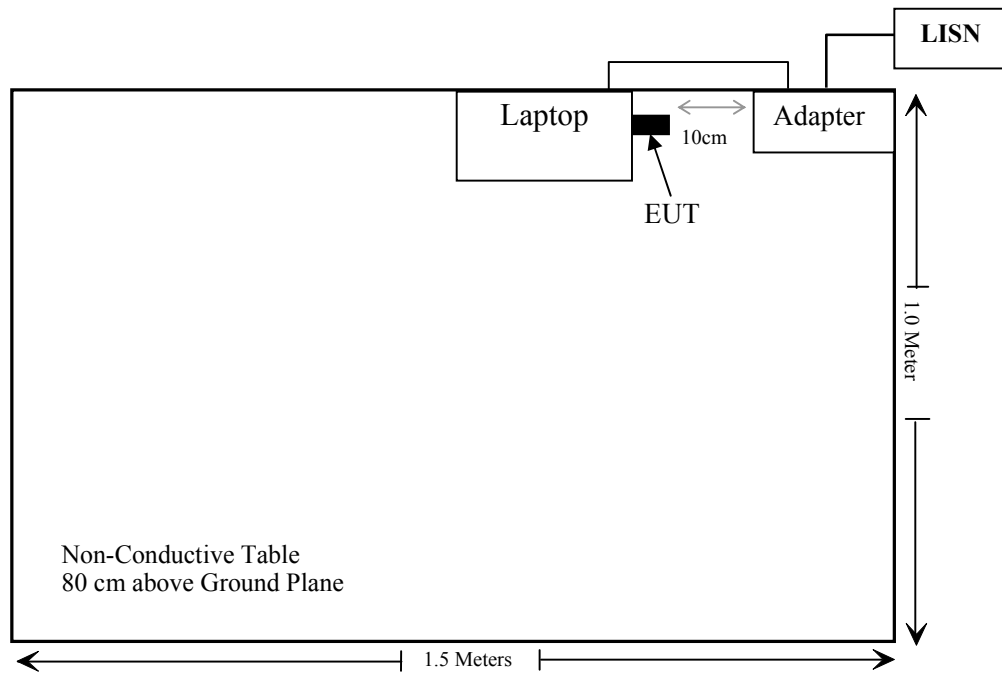
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	Latitude E5430	11429208685
DELL	Adapter	PA-10	0933 DMYD-AT59637-B

Support Cable Descriptions

Cable Description	Length (m)	From/Port	To
Un-shielded Detachable DC Cable	1.0	Adapter	Laptop

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	Compliance
15.205, § 15.209, § 15.249(d)	Radiated Emissions& Outside of Band Emission	Compliance
§ 15.215 (c)	20 dB Bandwidth	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conducted Emission Test					
R&S	EMI Test Receiver	ESCI	101120	2019-07-09	2020-07-08
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2019-01-25	2020-01-25
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2019-03-02	2020-03-01
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
Unknown	Conducted Emission Cable	78652	UF A210B-1-0720-504504	2019-11-12	2020-11-12
Radiated Emission Test					
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017-12-22	2020-12-21
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019-07-22	2020-07-21
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
COM-POWER	pre-amplifier	PA-122	181919	2019-04-20	2020-04-20
Sonoma Instrument	Amplifier	310N	186238	2019-11-12	2020-11-12
R&S	EMI Test Receiver	ESR3	102455	2019-07-09	2020-07-08
Ducommun technologies	RF Cable	UFA147A-2362-100100	MFR64639 231029-003	2019-11-12	2020-11-12
Ducommun technologies	RF Cable	104PEA	218124002	2019-11-12	2020-11-12
Ducommun technologies	RF Cable	RG-214	1	2019-11-19	2020-05-19
Ducommun technologies	RF Cable	RG-214	2	2019-11-12	2020-11-12
Ducommun technologies	Horn Antenna (18-26G)	ARH-4223-02	1007726-04	NCR	NCR
Heatsink Required	Amplifier	QLW-18405536-J0	15964001002	2019-11-12	2020-11-12
Sinoscite	Band Reject filter	BSF2402-2480MN-0898-001	N/A	2019-04-20	2020-04-20
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR

* **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 PCB antenna which was permanently attached and the antenna gain is 4 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

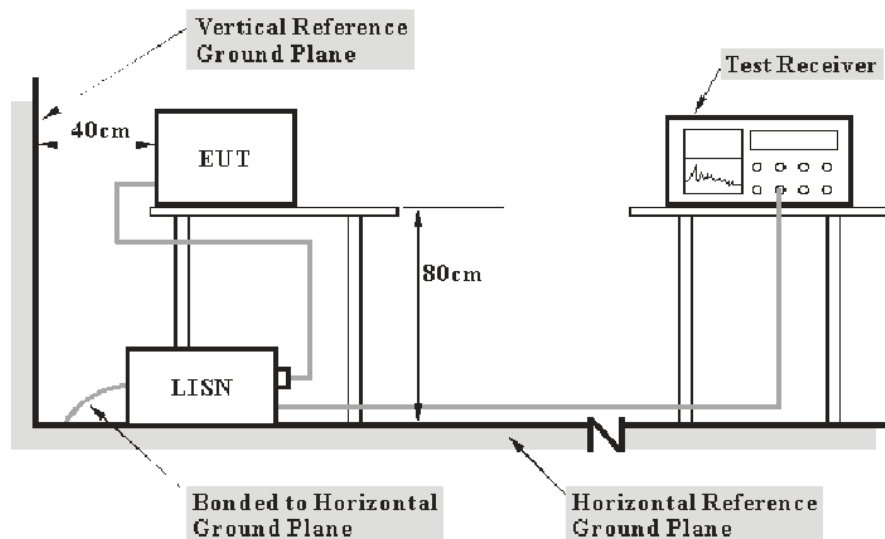
Result: Compliance.

FCC §15.207 – AC LINE CONDUCTED EMISSIONS

Applicable Standard

According to FCC §15.207

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with per ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

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

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

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.107.

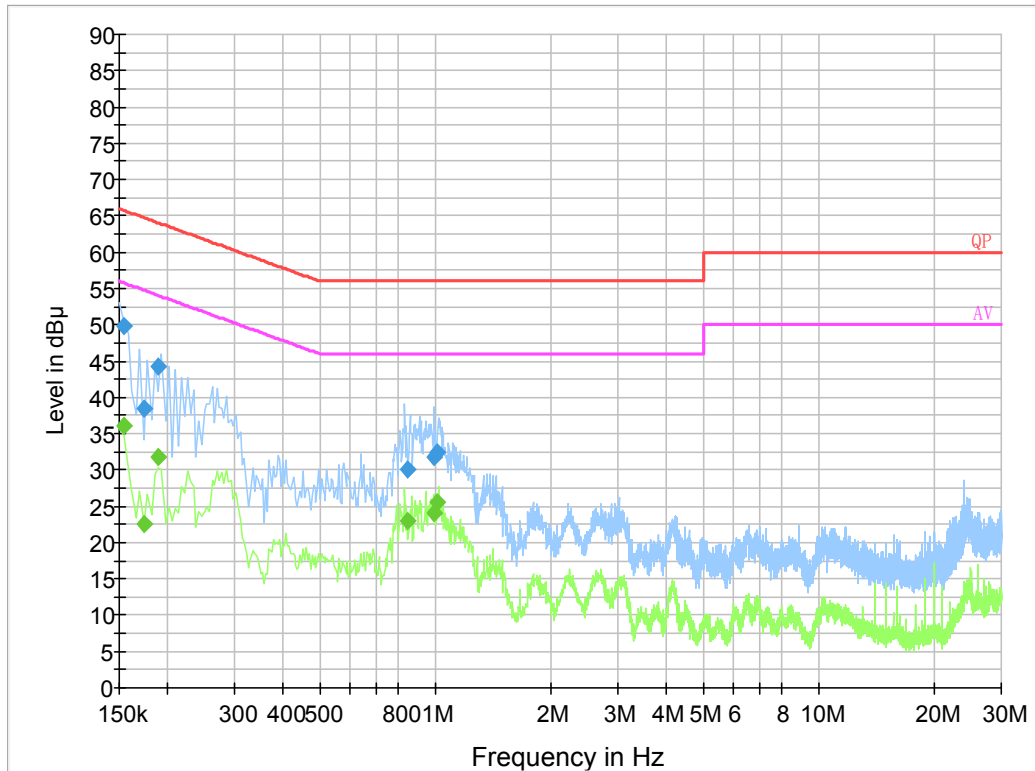
Test Data

Environmental Conditions

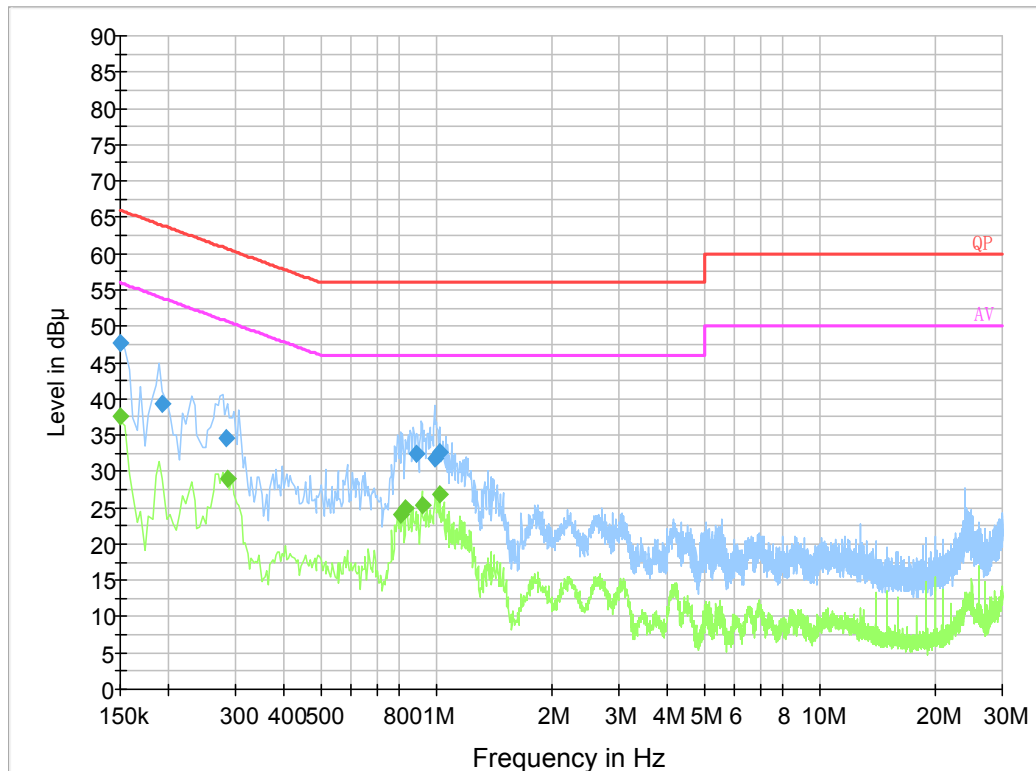
Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2019-12-06.

EUT Operation Mode: Transmitting (worst case is middle channel)

AC 120V/60 Hz, Line

Frequency (MHz)	Corrected Amplitude (dBμV)	Corrected Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/QP/Ave.)
0.154000	49.8	19.8	65.8	16.0	QP
0.173500	38.5	19.9	64.8	26.3	QP
0.189500	44.3	19.8	64.1	19.8	QP
0.846510	30.1	19.8	56.0	25.9	QP
0.991090	31.8	19.9	56.0	24.2	QP
1.014730	32.5	19.9	56.0	23.5	QP
0.154000	36.1	19.8	55.8	19.7	Ave.
0.173500	22.6	19.9	54.8	32.2	Ave.
0.189500	31.8	19.8	54.1	22.3	Ave.
0.846510	22.9	19.8	46.0	23.1	Ave.
0.991090	24.0	19.9	46.0	22.0	Ave.
1.014730	25.5	19.9	46.0	20.5	Ave.

AC 120V/60 Hz, Neutral

Frequency (MHz)	Corrected Amplitude (dBμV)	Corrected Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/QP/Ave.)
0.150000	47.7	19.8	66.0	18.3	QP
0.193500	39.3	19.8	63.9	24.6	QP
0.282500	34.7	19.7	60.7	26.0	QP
0.884890	32.3	19.7	56.0	23.7	QP
0.991150	31.7	19.8	56.0	24.3	QP
1.022670	32.6	19.8	56.0	23.4	QP
0.150000	37.6	19.8	56.0	18.4	Ave.
0.286000	28.9	19.7	50.6	21.7	Ave.
0.806000	24.0	19.8	46.0	22.0	Ave.
0.834000	25.0	19.8	46.0	21.0	Ave.
0.918000	25.4	19.8	46.0	20.6	Ave.
1.022000	26.8	19.8	46.0	19.2	Ave.

Note:

- 1) Correction Factor = LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
The corrected factor has been input into the transducer of the test software.
- 2) Corrected Amplitude = Reading + Correction Factor
- 3) Margin = Limit – Corrected Amplitude

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:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Average

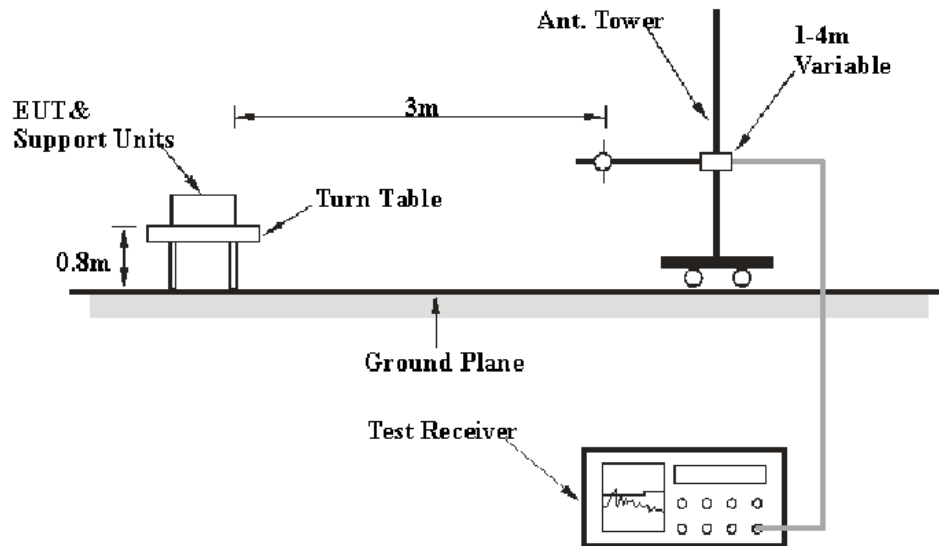
Test Procedure

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

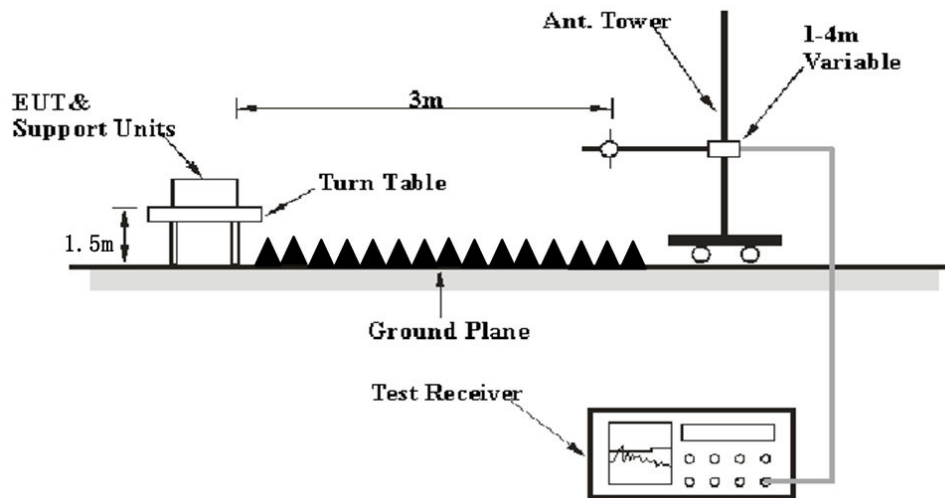
All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak and Average detection modes for frequencies above 1 GHz.

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 recorded data in following table, the EUT complied with the FCC Part 15.205, 15.209 & §15.249

Test Data

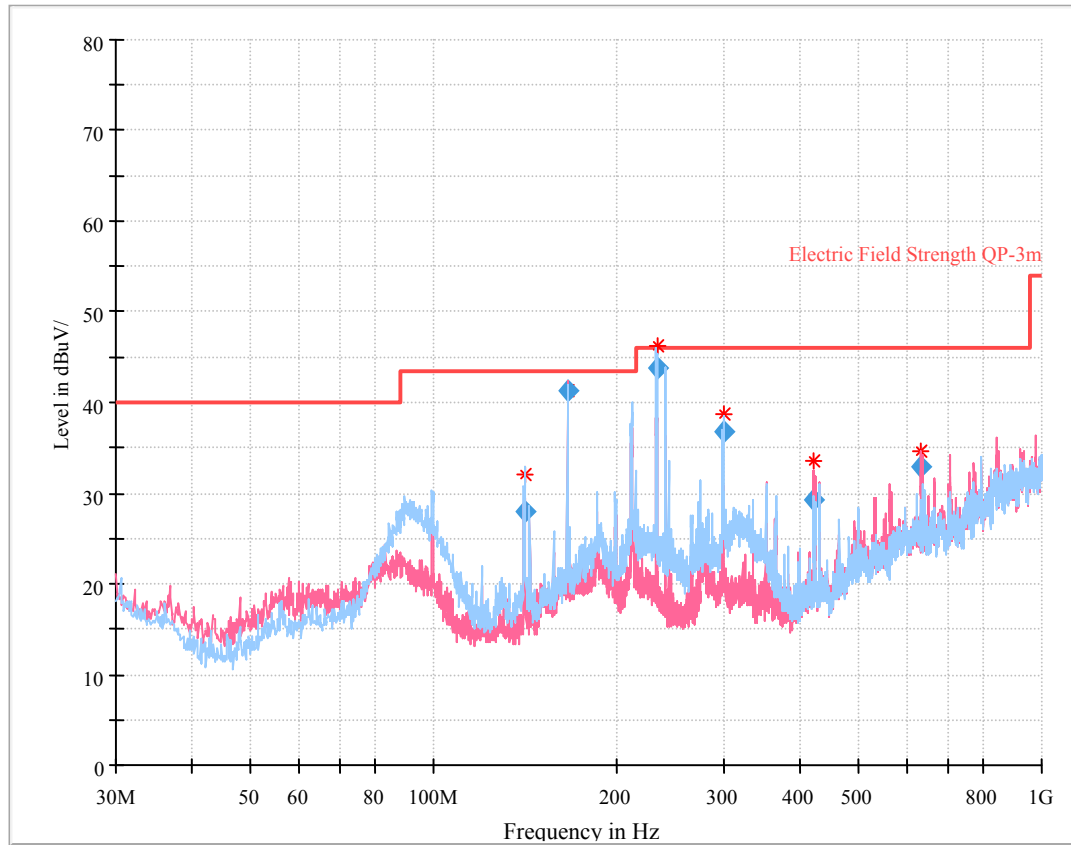
Environmental Conditions

Temperature:	23 °C
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Steve Lan on 2019-12-08 for below 1GHz and by Alan He on 2019-12-07 for above 1GHz.

Test Mode: Transmitting

30MHz – 1 GHz (worst case is middle channel):



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
141.326625	28.06	188.0	H	90.0	-14.2	43.50	15.44
166.279750	40.22	109.0	V	293.0	-14.7	43.50	3.28
232.795375	42.91	123.0	H	236.0	-14.0	46.00	3.09
299.321375	36.85	103.0	H	18.0	-10.7	46.00	9.15
422.389375	29.28	105.0	V	0.0	-9.4	46.00	16.72
633.711375	32.97	176.0	V	334.0	-1.6	46.00	13.03

Above 1 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.249&15.209	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2405 MHz)									
2405.00	58.58	PK	308	2.1	H	31.87	90.45	114	23.55
2405.00	55.5	Ave.	308	2.1	H	31.87	87.37	94	6.63
2405.00	51.8	PK	360	1.9	V	31.87	83.67	114	30.33
2405.00	48.17	Ave.	360	1.9	V	31.87	80.04	94	13.96
2312.30	28.52	PK	249	2.3	H	31.64	60.16	74	13.84
2312.30	13.76	Ave.	249	2.3	H	31.64	45.40	54	8.60
2491.50	28.16	PK	46	1.7	H	32.13	60.29	74	13.71
2491.50	13.62	Ave.	46	1.7	H	32.13	45.75	54	8.25
4810.00	53.73	PK	248	2.0	H	5.40	59.13	74	14.87
4810.00	43.37	Ave.	248	2.0	H	5.40	48.77	54	5.23
7215.00	43.48	PK	258	1.4	H	12.02	55.50	74	18.50
7215.00	30.27	Ave.	258	1.4	H	12.02	42.29	54	11.71
Middle Channel (2451 MHz)									
2451.00	59.42	PK	31	1.2	H	32.03	91.45	114	22.55
2451.00	56.45	Ave.	31	1.2	H	32.03	88.48	94	5.52
2451.00	52.28	PK	280	1.0	V	32.03	84.31	114	29.69
2451.00	48.9	Ave.	280	1.0	V	32.03	80.93	94	13.07
4902.00	53.39	PK	341	1.2	H	6.43	59.82	74	14.18
4902.00	42.93	Ave.	341	1.2	H	6.43	49.36	54	4.64
7353.00	43.62	PK	56	2.0	H	12.21	55.83	74	18.17
7353.00	29.71	Ave.	56	2.0	H	12.21	41.92	54	12.08

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.249&15.209	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (2475 MHz)									
2475.00	60.21	PK	78	2.2	H	32.13	92.34	114	21.66
2475.00	57.27	Ave.	78	2.2	H	32.13	89.40	94	4.60
2475.00	53.68	PK	83	1.7	V	32.13	85.81	114	28.19
2475.00	50.22	Ave.	83	1.7	V	32.13	82.35	94	11.65
2324.80	28.23	PK	225	1.7	H	31.64	59.87	74	14.13
2324.80	13.73	Ave.	225	1.7	H	31.64	45.37	54	8.63
2499.30	28.35	PK	41	1.6	H	32.13	60.48	74	13.52
2499.30	14.45	Ave.	41	1.6	H	32.13	46.58	54	7.42
4950.00	52.90	PK	268	1.1	H	6.95	59.85	74	14.15
4950.00	42.07	Ave.	268	1.1	H	6.95	49.02	54	4.98
7425.00	44.20	PK	286	1.1	H	12.31	56.51	74	17.49
7425.00	31.08	Ave.	286	1.1	H	12.31	43.39	54	10.61

Note:

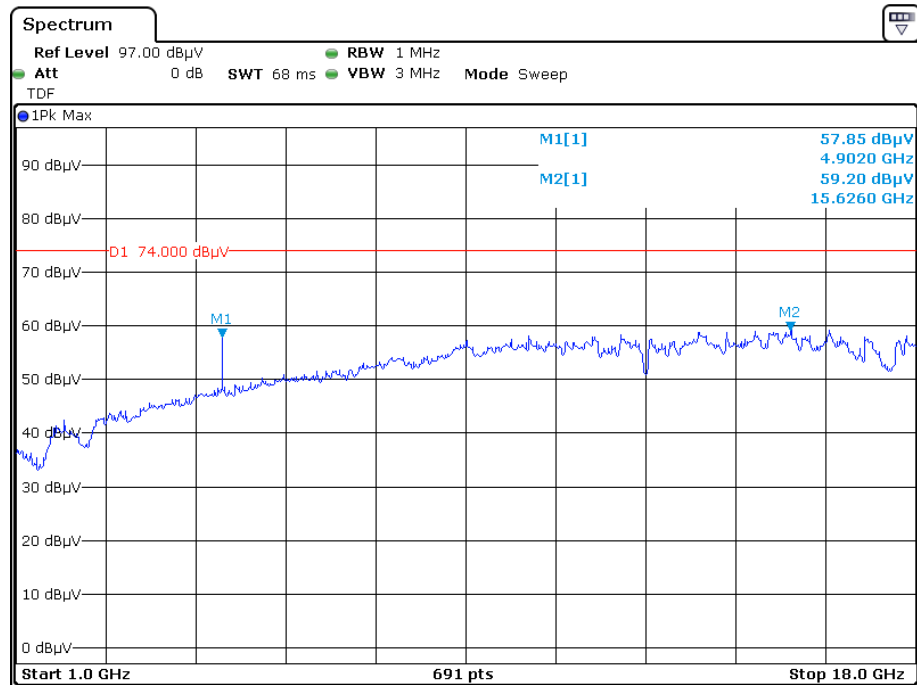
Corrected Amplitude = Corrected Factor + Reading

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

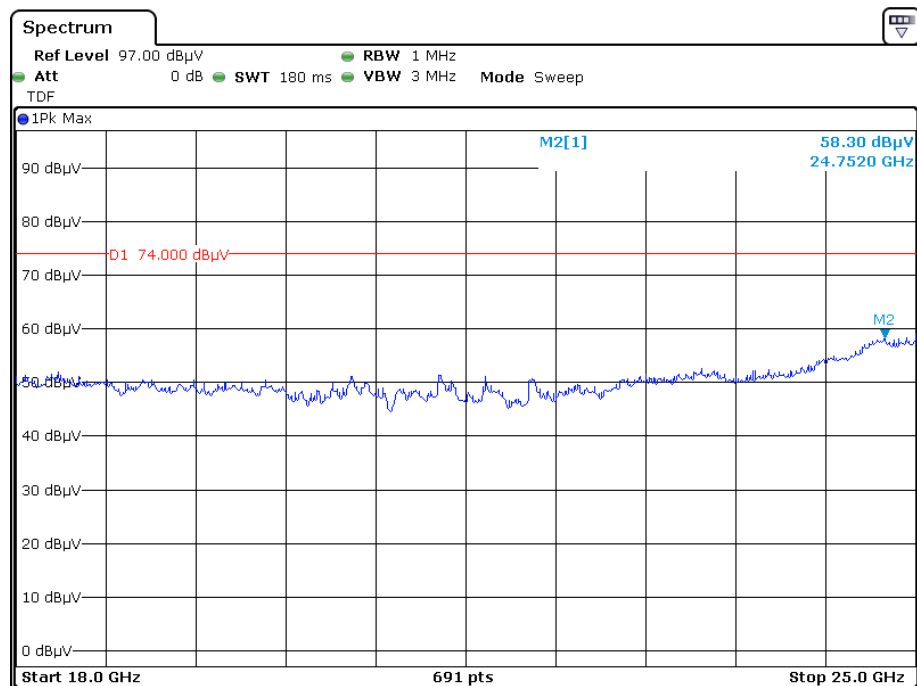
Margin = Limit- Corr. Amplitude

The emission more than 20dB below the limit was not required to be recorded.

Pre-scan with middle channel Peak Horizontal

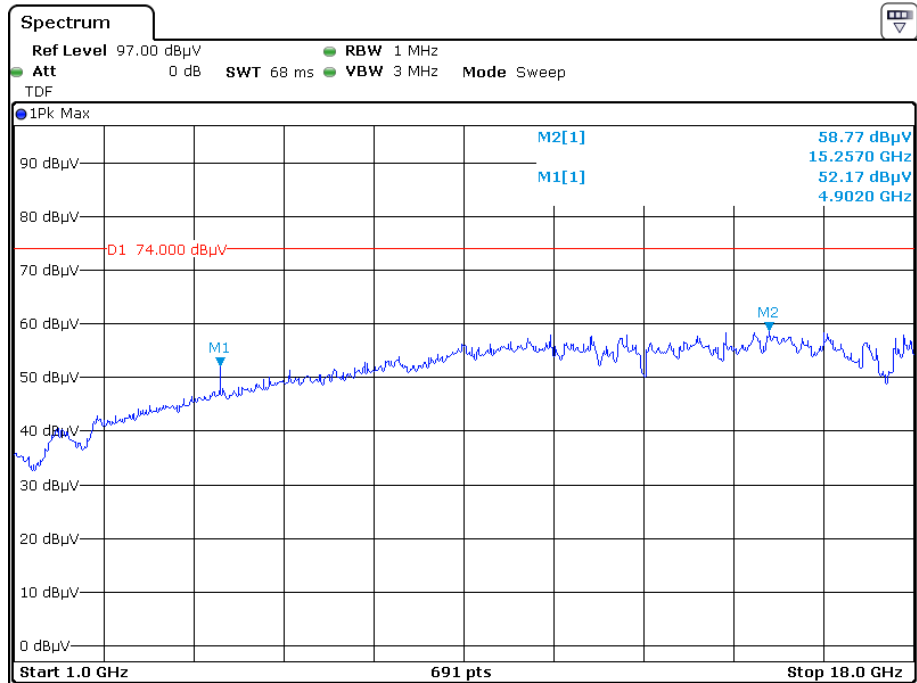


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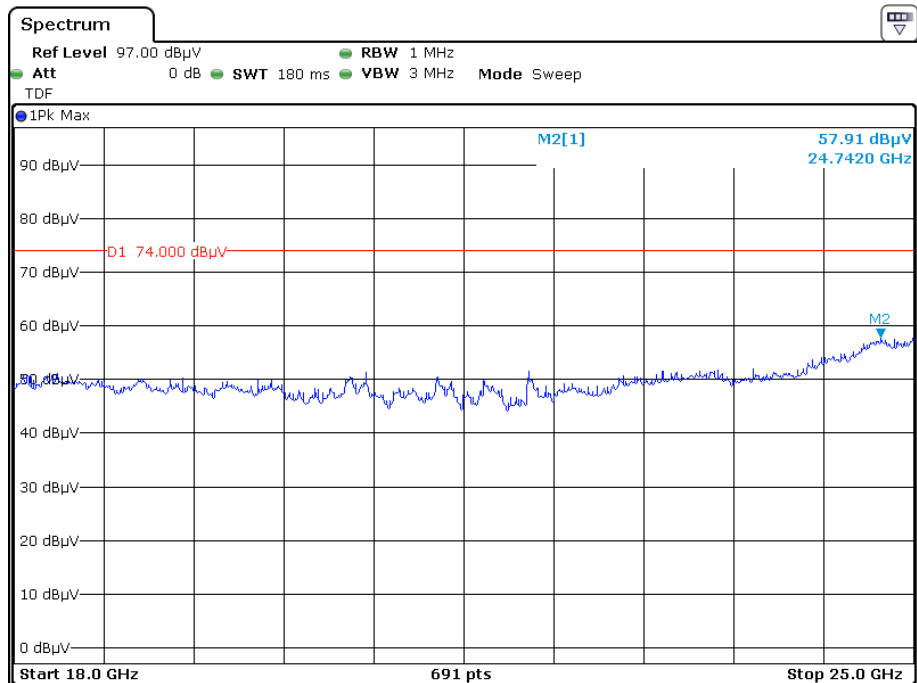


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Vertical



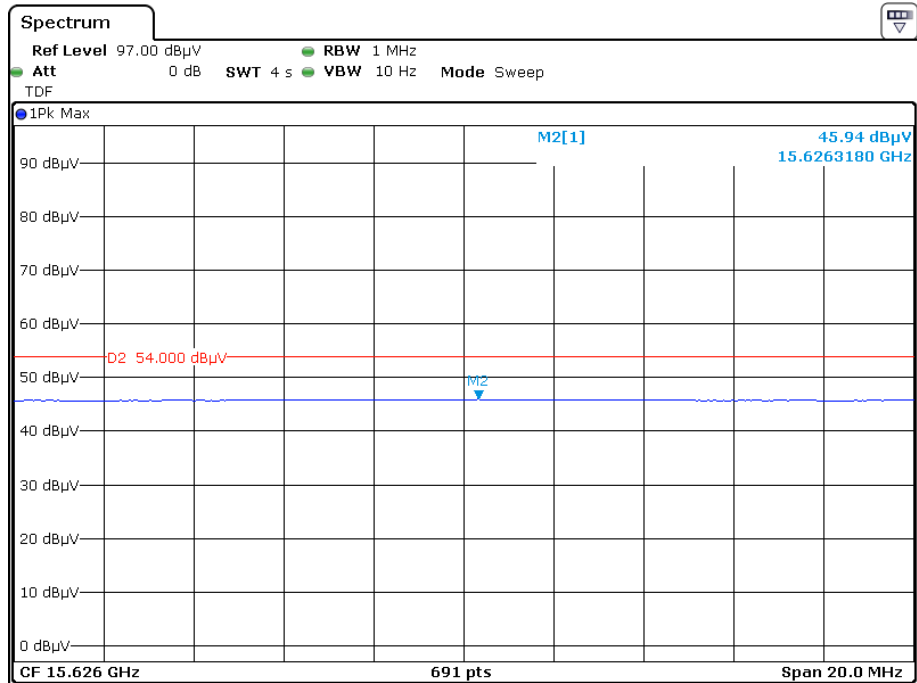
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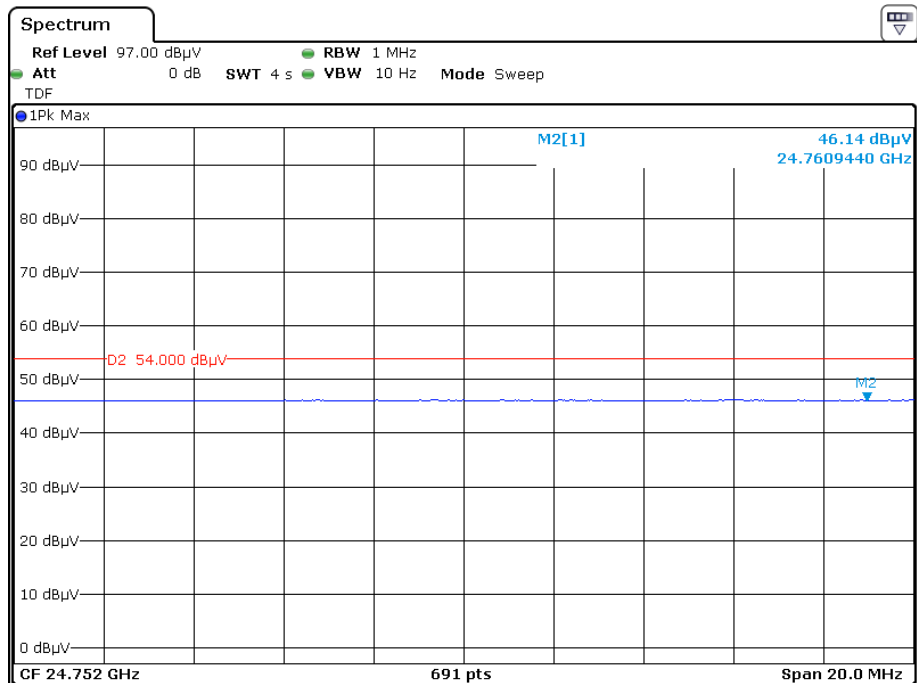
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Average value for the peak point at pre-scan

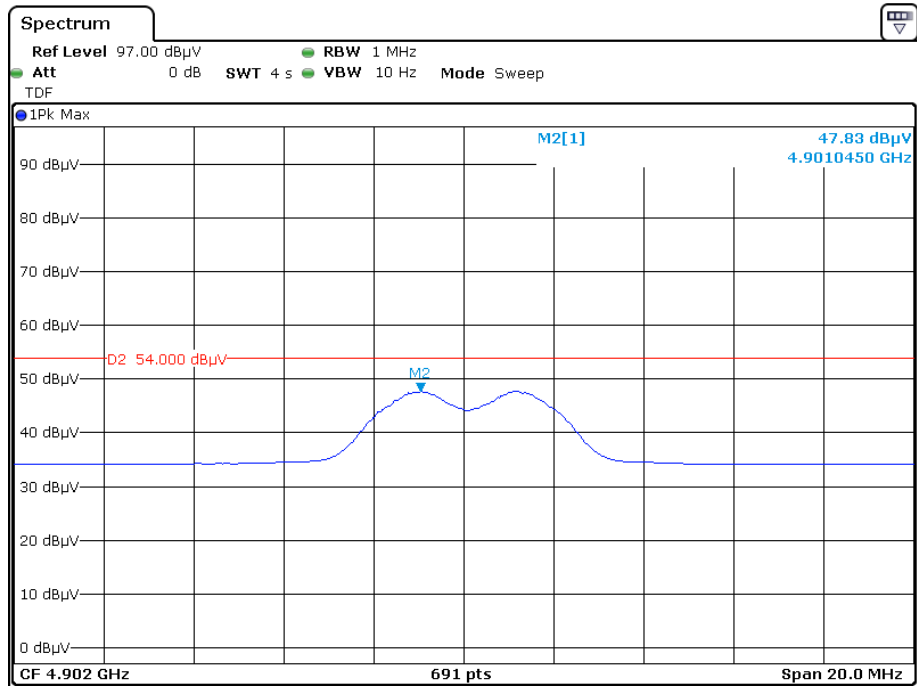
Horizontal



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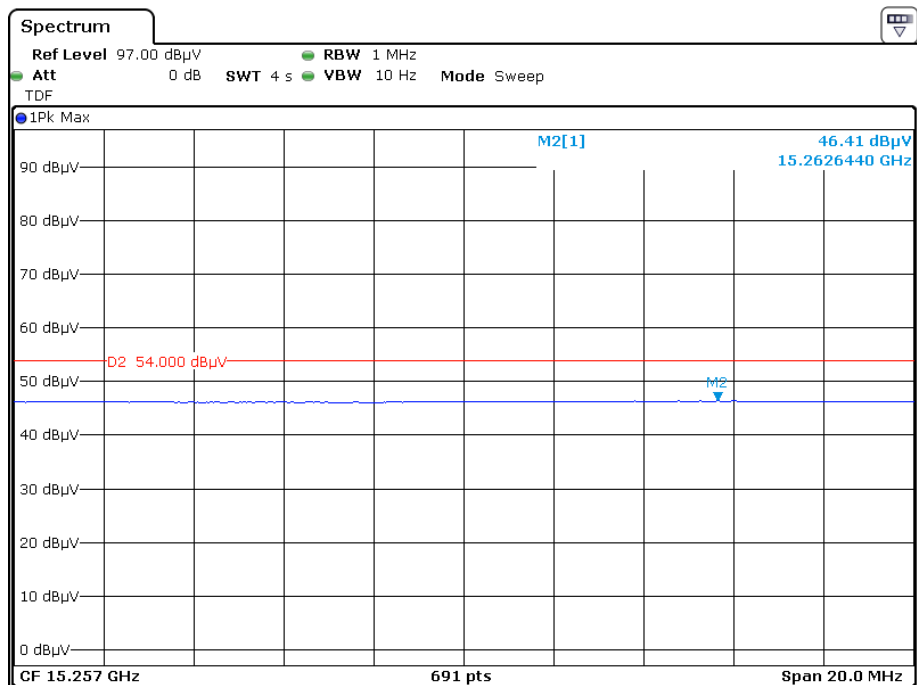


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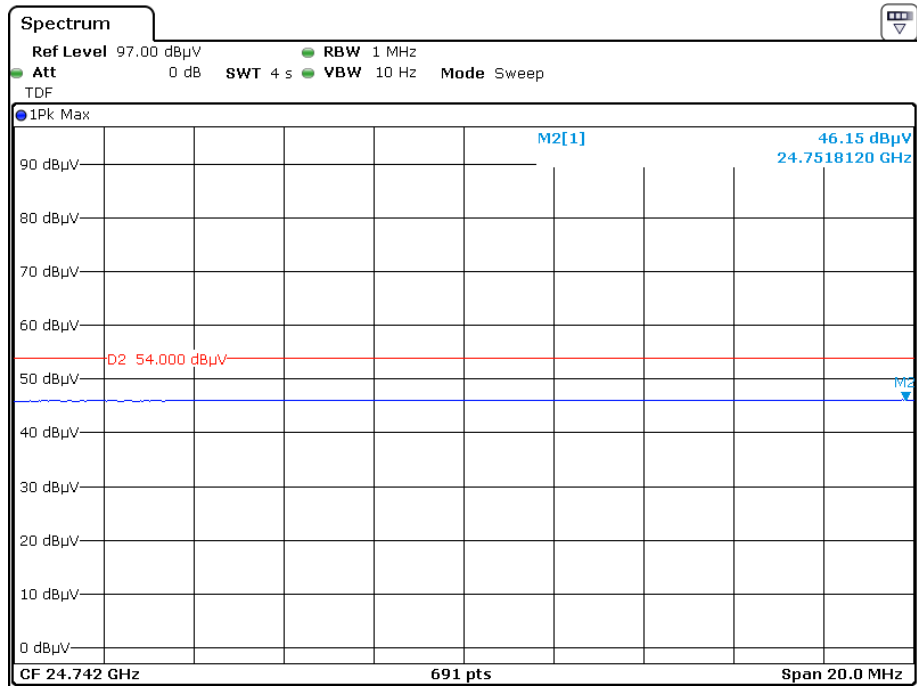


Date: 7.DEC.2019 18:01:26

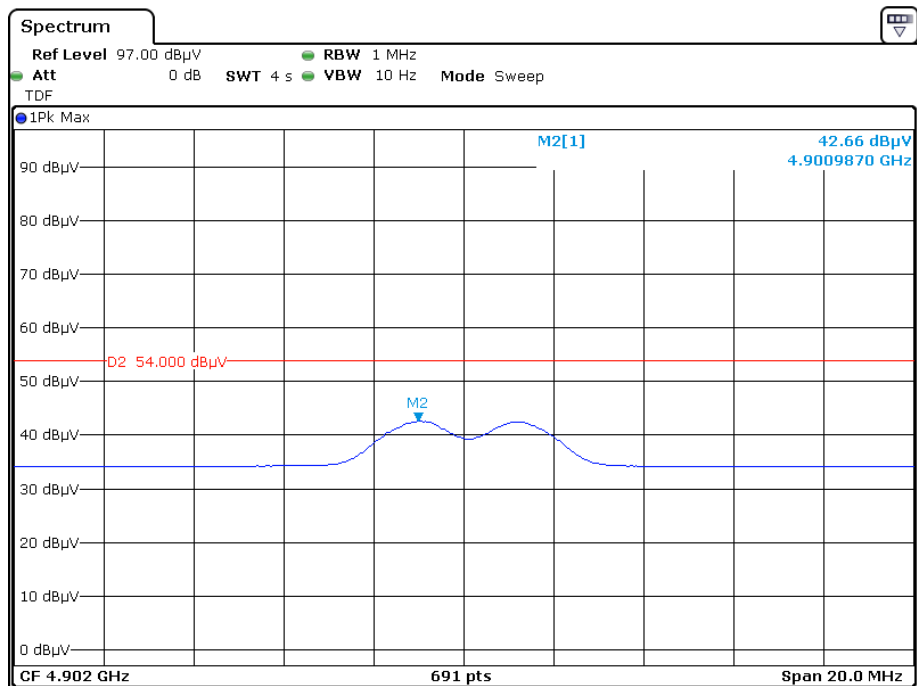
Vertical



Date: 7.DEC.2019 18:12:03



Date: 7.DEC.2019 19:05:06



Date: 7.DEC.2019 18:17:27

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

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 it to measurement instrument. 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 indicated 20dB bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Data**Environmental Conditions**

Temperature:	23 °C
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

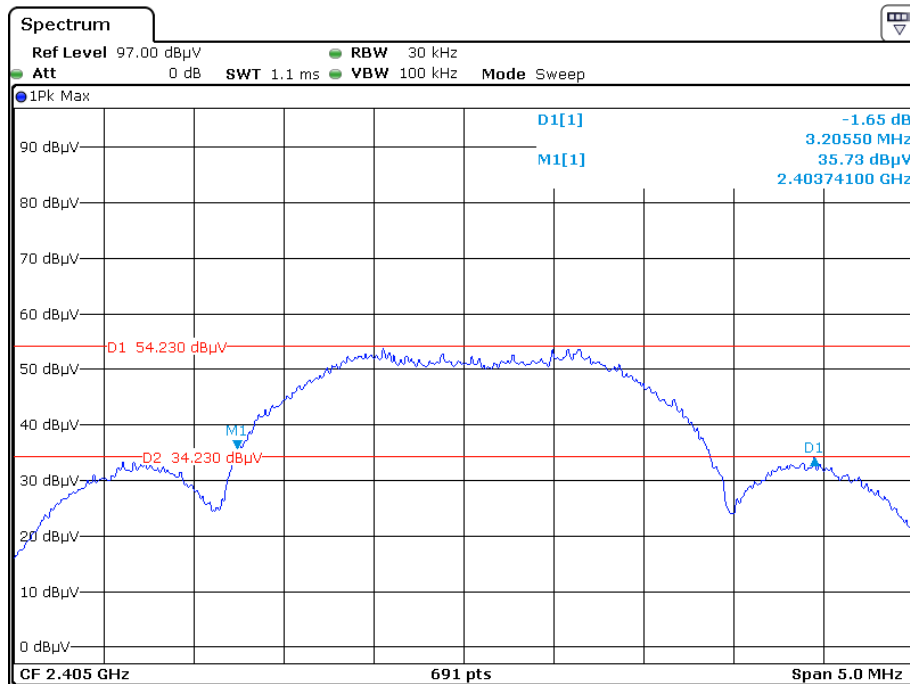
The testing was performed by Alen He on 2019-12-07.

Test Mode: Transmitting

Please refer to the following table and plots.

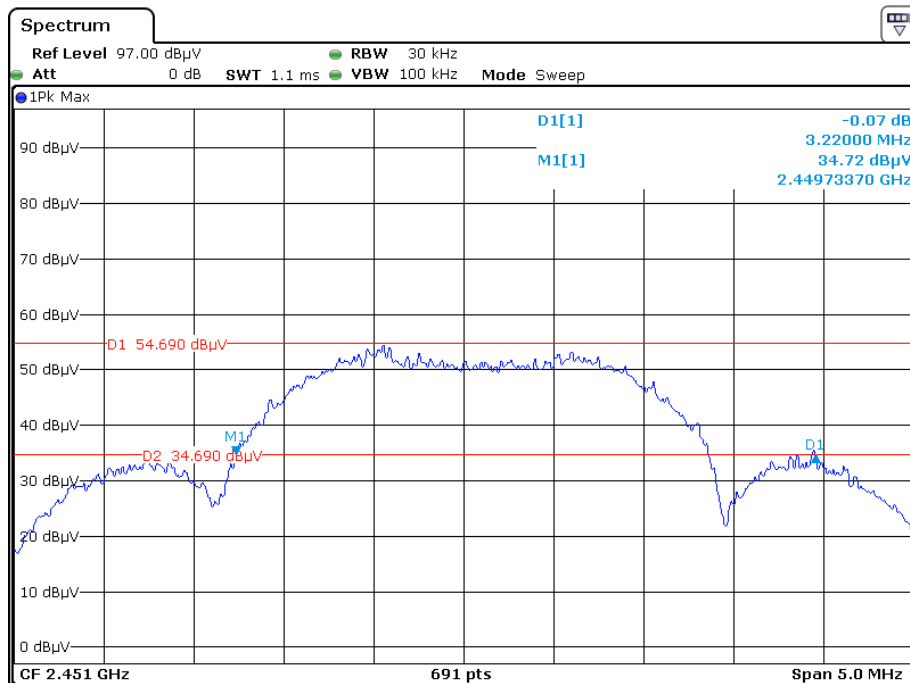
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2405	3.206
Middle	2451	3.220
High	2475	3.090

Low Channel



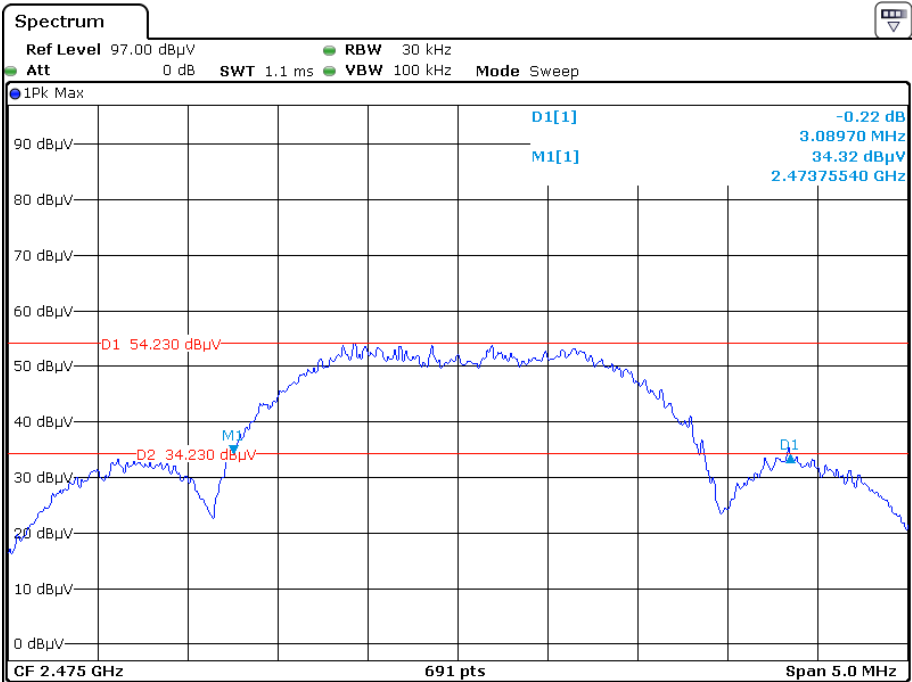
Date: 7.DEC.2019 17:10:15

Middle Channel



Date: 7.DEC.2019 16:47:56

High Channel



Date: 7.DEC.2019 16:56:56

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