

FCC PART 15.249

TEST REPORT

For

Shenzhen Kingsun Enterprises Co., Ltd.

25/F, CEC Information Building, Xinwen Rd., Shenzhen, Guangdong

FCC ID: 2AAPK-TE21R

Report Type: Original Report	Product Type: 2.4G Wireless Mouse USB receiver
Report Number: RSZ200923831-00	
Report Date: 2020-11-04	
Jimmy Xiao 	
Reviewed By: RF Engineer	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	2.4G Wireless Mouse USB receiver
Tested Model	TE21-WM-TA
Multiple Model	CP-135A, WM-TE21-BL, WM-TE21-VB, WM-TE21-TR
Model Differences	Refer to the DoS letter
Frequency Range	2407~2477MHz
Maximum Field Strength	75.85dBuV/m@3m
Antenna Specification*	0 dBi (provided by the applicant)
Voltage Range	DC 5.0V from USB Port
Date of Test	2020-10-28 to 2020-11-04
Sample serial number	RSZ200923831-RF-S1(Assigned by BACL, Shenzhen)
Received date	2020-09-23
Sample/EUT Status	Good condition

Objective

This type approval 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, 15.207, 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℃
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.

Frequency List

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2408	9	2468
2	2440	10	2407
3	2467	11	2442
4	2414	12	2449
5	2437	13	2421
6	2477	14	2435
7	2410	15	2455
8	2428	16	2441

Channel 10, Channel 2 and Channel 6 were selected for testing.

EUT Exercise Software

No software was used.

Equipment Modifications

No modifications were made to the unit tested.

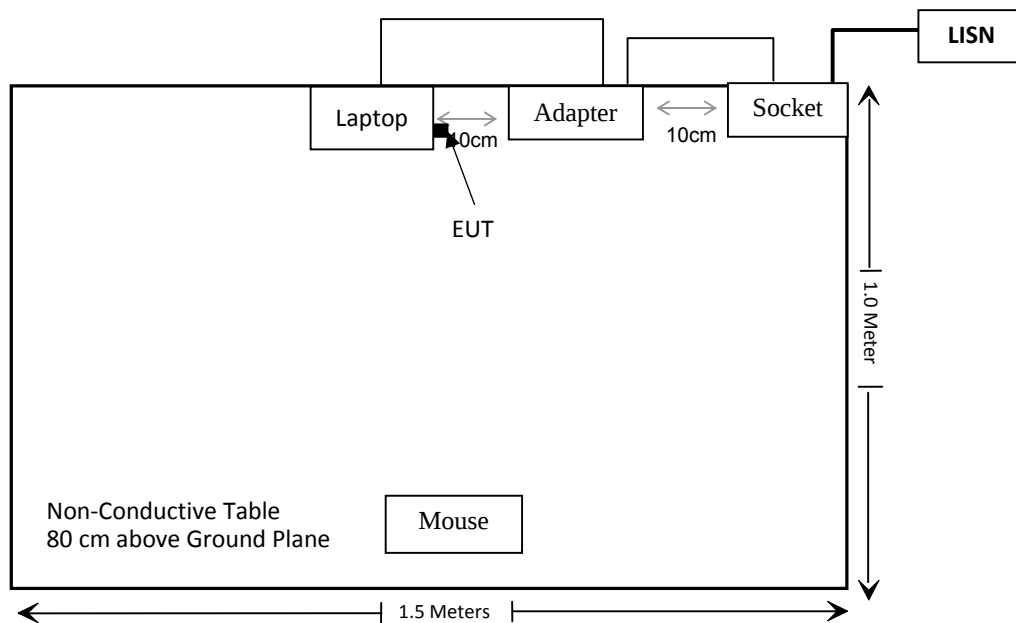
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
TOSHIBA	Laptop	Satellite C600	3B255547Q
DELL	Laptop	Latitude E5430	11429208685
Kingsun	2.4G Wireless Mouse	TE21-WM-TA	M21567864

Support Cable Descriptions

Cable Description	Length (m)	From/Port	To
Un-shielding Un-Detachable AC Cable	1.0	Socket	LISN
Un-shielding Un-Detachable DC Cable	1.2	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
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2020/08/04	2021/08/03
Rohde & Schwarz	LISN	ENV216	101613	2020/08/04	2021/08/03
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2019/11/29	2020/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2019/11/29	2020/11/28
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
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	A040904-1	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	2019/11/29	2020/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2020/04/20	2021/04/20
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-02 1304	2017/12/06	2020/12/05

* **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 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

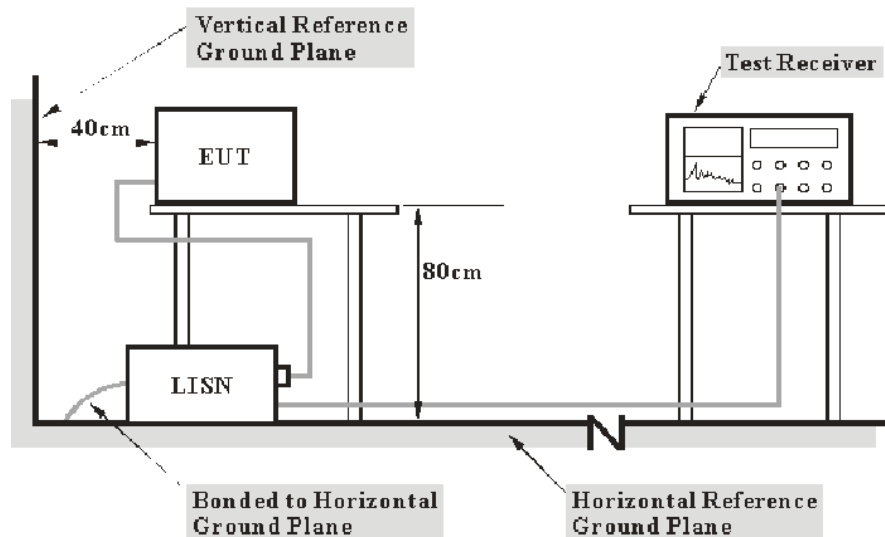
Result: Compliance.

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 EUT complied with the FCC Part 15.207,

Test Data

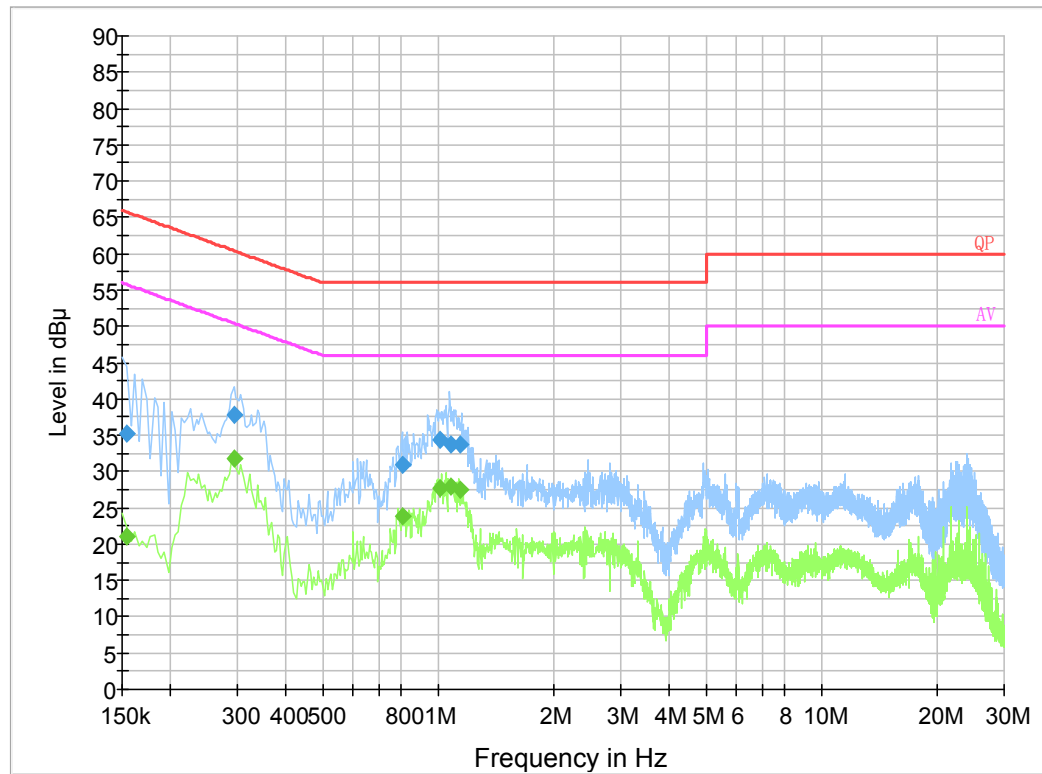
Environmental Conditions

Temperature:	25 °C
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2020-11-04

EUT operation mode: Transmitting

AC 120V/60 Hz, Line

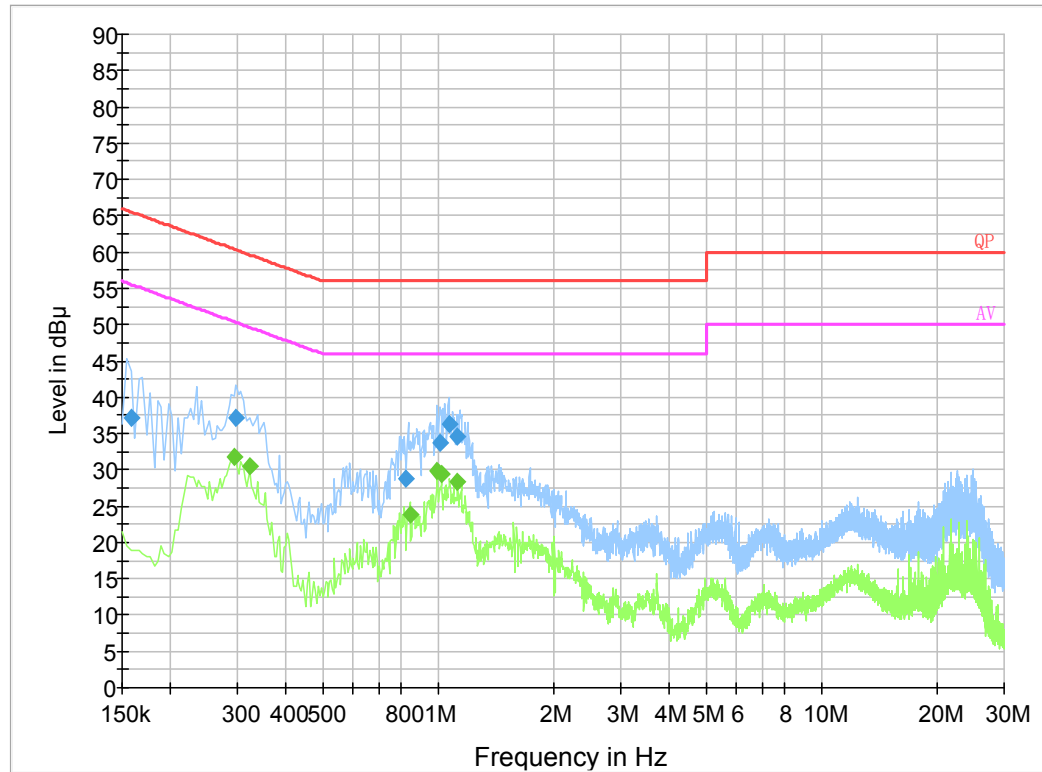


Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.154500	35.3	9.000	L1	19.8	30.5	65.8
0.293500	37.7	9.000	L1	19.7	22.7	60.4
0.809910	31.0	9.000	L1	19.8	25.0	56.0
1.008910	34.3	9.000	L1	19.9	21.7	56.0
1.085890	33.8	9.000	L1	19.9	22.2	56.0
1.148690	33.7	9.000	L1	19.8	22.3	56.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.154500	21.0	9.000	L1	19.8	34.8	55.8
0.293500	31.9	9.000	L1	19.7	18.5	50.4
0.809910	23.9	9.000	L1	19.8	22.1	46.0
1.008910	27.7	9.000	L1	19.9	18.3	46.0
1.085890	27.9	9.000	L1	19.9	18.1	46.0
1.148690	27.4	9.000	L1	19.8	18.6	46.0

AC 120V/60 Hz, Neutral**Final Result 1**

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.158500	37.1	9.000	N	19.8	28.4	65.5
0.297500	37.1	9.000	N	19.7	23.2	60.3
0.825430	28.8	9.000	N	19.8	27.2	56.0
1.012970	33.6	9.000	N	19.8	22.4	56.0
1.073950	36.3	9.000	N	19.8	19.7	56.0
1.124870	34.6	9.000	N	19.8	21.4	56.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.294000	31.7	9.000	N	19.7	18.7	50.4
0.322000	30.5	9.000	N	19.8	19.2	49.7
0.846000	23.8	9.000	N	19.8	22.2	46.0
0.998000	29.8	9.000	N	19.8	16.2	46.0
1.022000	29.4	9.000	N	19.8	16.6	46.0
1.126000	28.3	9.000	N	19.8	17.7	46.0

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:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

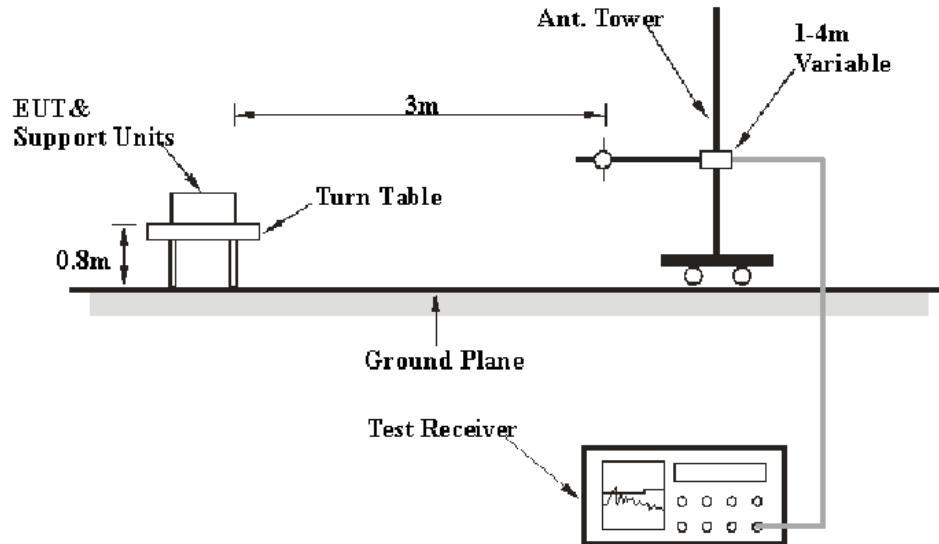
Above 1000MHz:

Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto

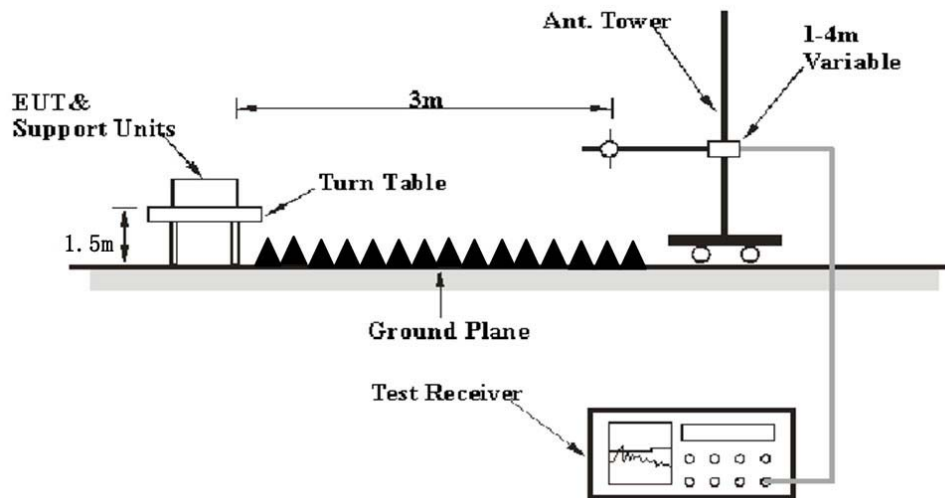
Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

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

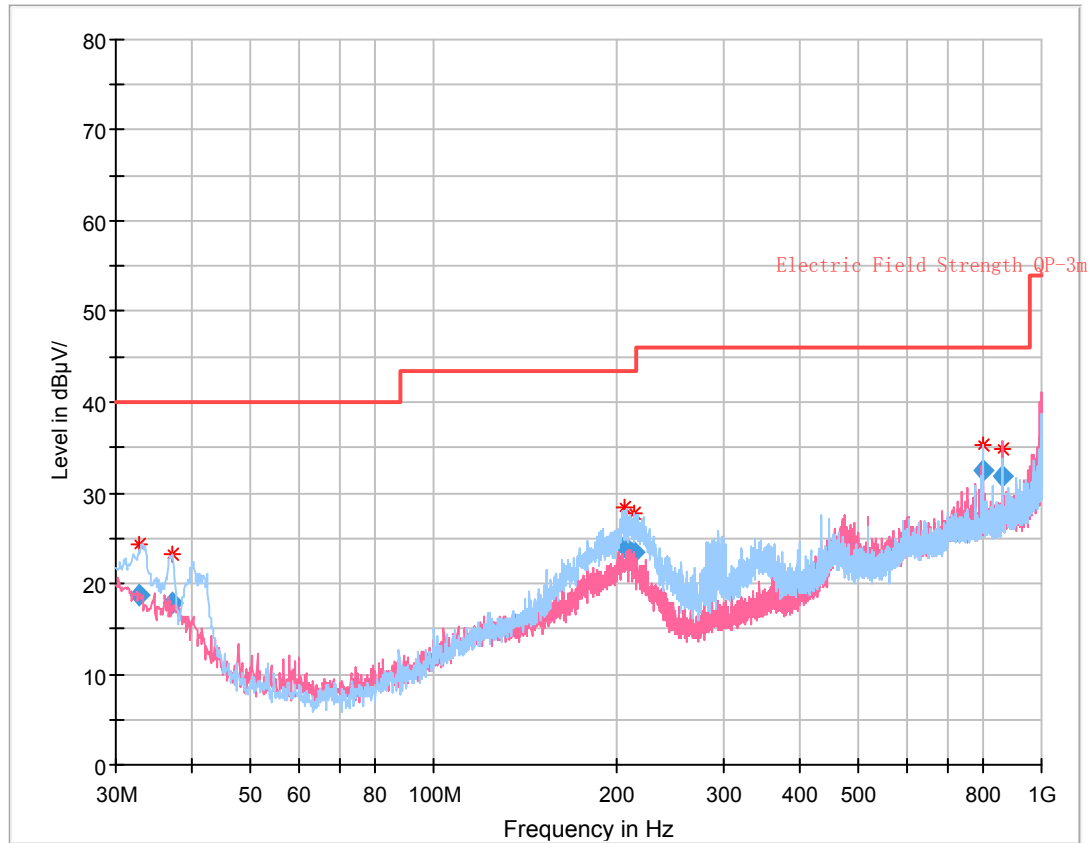
Test Data

Environmental Conditions

Temperature:	26~28.4 °C
Relative Humidity:	45~62 %
ATM Pressure:	101.0 kPa

The testing was performed by Harris He on 2020-11-04 for below 1GHz and Alan on 2020-10-28 for above 1GHz.

EUT operation mode: Transmitting

30MHz – 1 GHz: (High 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)
32.768875	18.71	40.00	21.29	126.0	H	176.0	-6.1
37.033500	17.86	40.00	22.14	110.0	H	291.0	-8.7
205.349500	24.04	43.50	19.46	153.0	H	94.0	-10.7
213.826375	23.42	43.50	20.08	138.0	H	86.0	-10.7
799.426875	32.51	46.00	13.49	133.0	H	124.0	-0.2
862.477000	31.86	46.00	14.14	327.0	V	90.0	0.8

1 GHz - 25 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 (2407MHz)									
2407.00	42.91	PK	235	1.8	H	31.87	74.78	114	39.22
2407.00	16.92	Ave.	235	1.8	H	31.87	48.79	94	45.21
2407.00	35.99	PK	23	2.0	V	31.87	67.86	114	46.14
2407.00	15.97	Ave.	23	2.0	V	31.87	47.84	94	46.16
2388.44	29.06	PK	26	1.5	H	36.23	65.29	74	8.71
2388.44	14.33	Ave.	26	1.5	H	36.23	50.56	54	3.44
2483.58	28.26	PK	11	2.4	H	36.70	64.96	74	9.04
2483.58	14.27	Ave.	11	2.4	H	36.70	50.97	54	3.03
4814.00	43.43	PK	309	1.5	H	5.40	48.83	74	25.17
4814.00	29.24	Ave.	309	1.5	H	5.40	34.64	54	19.36
Middle Channel (2440MHz)									
2440.00	43.72	PK	202	1.4	H	31.97	75.69	114	38.31
2440.00	17.17	Ave.	202	1.4	H	31.97	49.14	94	44.86
2440.00	39.58	PK	228	1.5	V	31.97	71.55	114	42.45
2440.00	16.59	Ave.	228	1.5	V	31.97	48.56	94	45.44
4880.00	43.55	PK	64	1.5	H	6.43	49.98	74	24.02
4880.00	29.13	Ave.	64	1.5	H	6.43	35.56	54	18.44
High Channel (2477MHz)									
2477.00	43.72	PK	267	1.6	H	32.13	75.85	114	38.15
2477.00	17.14	Ave.	267	1.6	H	32.13	49.27	94	44.73
2477.00	40.73	PK	111	2.3	V	32.13	72.86	114	41.14
2477.00	16.83	Ave.	111	2.3	V	32.13	48.96	94	45.04
2389.17	29.42	PK	84	2.4	H	36.23	65.65	74	8.35
2389.17	14.35	Ave.	84	2.4	H	36.23	50.58	54	3.42
2483.69	28.87	PK	120	1.1	H	36.70	65.57	74	8.43
2483.69	14.31	Ave.	120	1.1	H	36.70	51.01	54	2.99
4954.00	43.71	PK	195	2.0	H	6.95	50.66	74	23.34
4954.00	28.84	Ave.	195	2.0	H	6.95	35.79	54	18.21

Note:

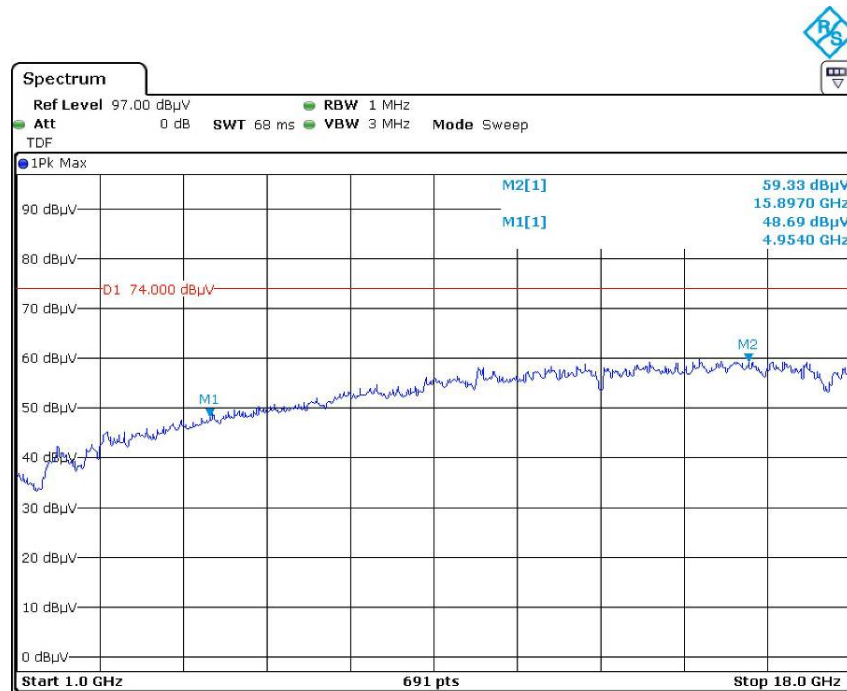
Corrected Amplitude = Corrected Factor + Reading

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

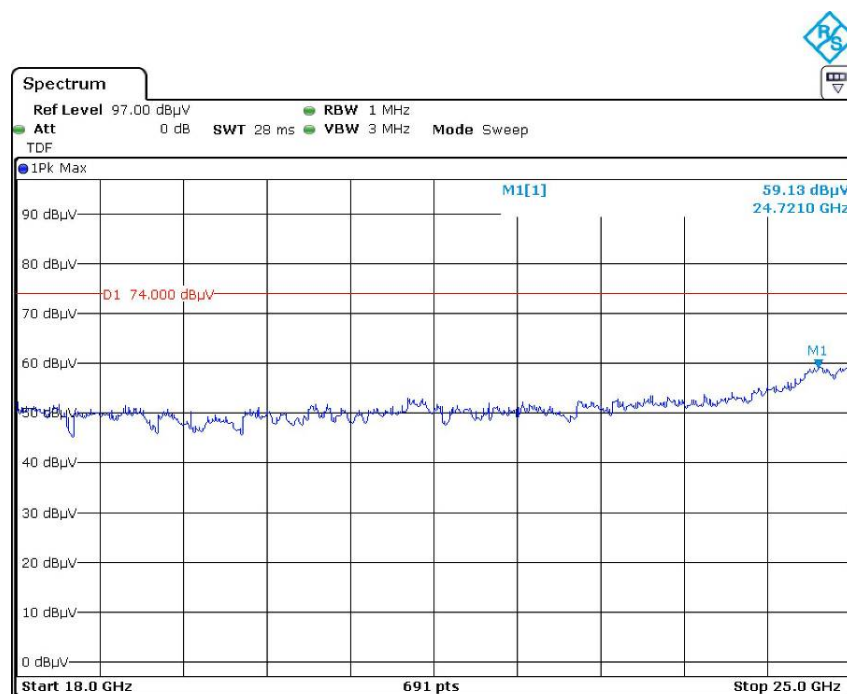
Margin = Limit- Corr. Amplitude

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

Pre-scan with High channel Peak Horizontal

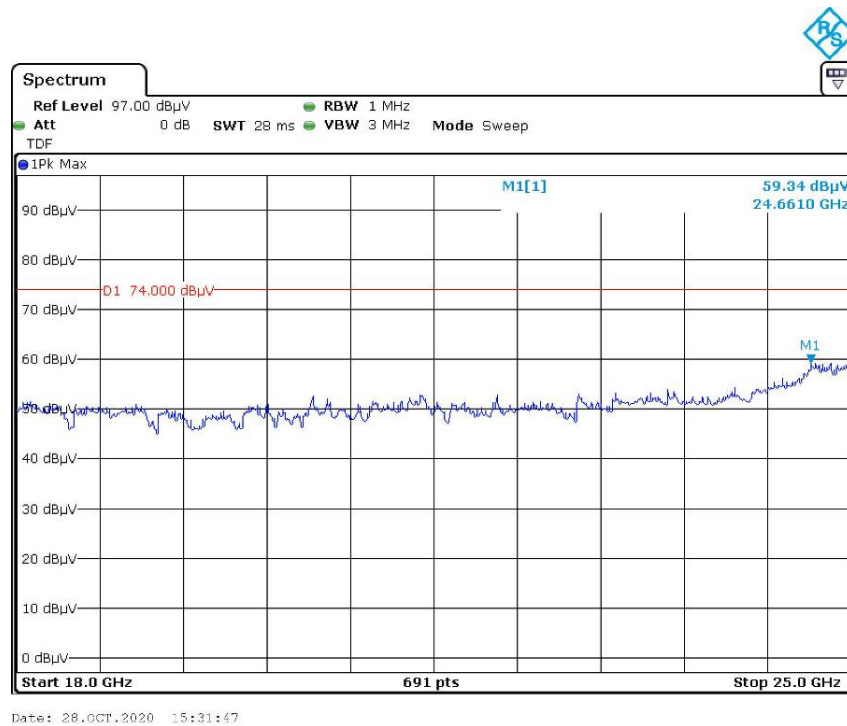
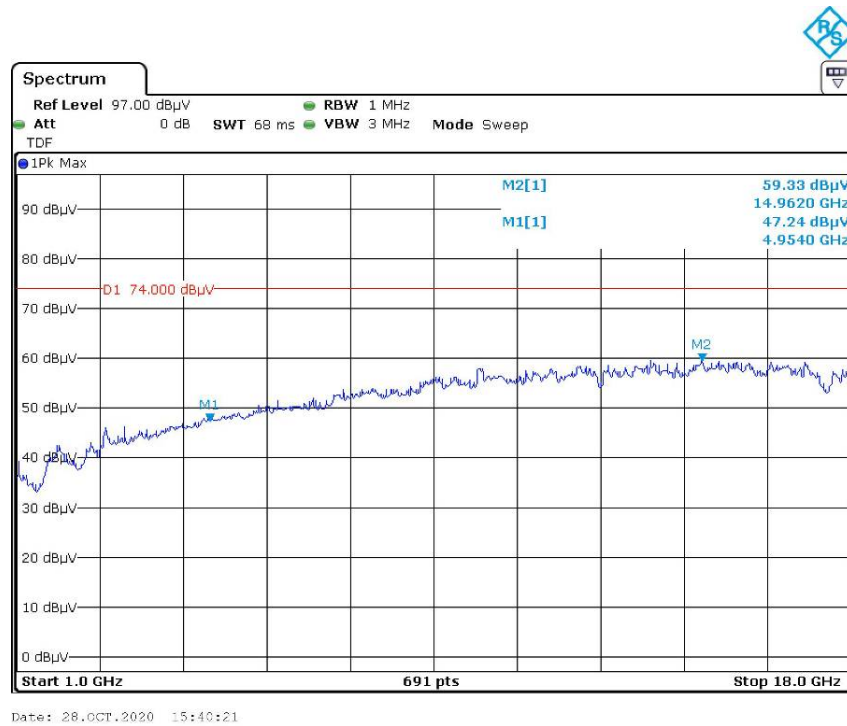


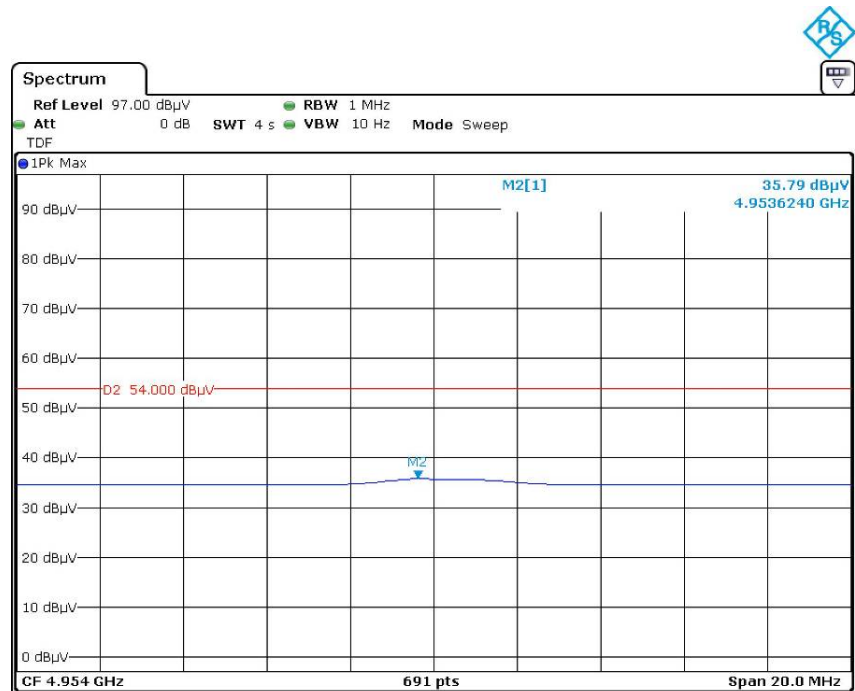
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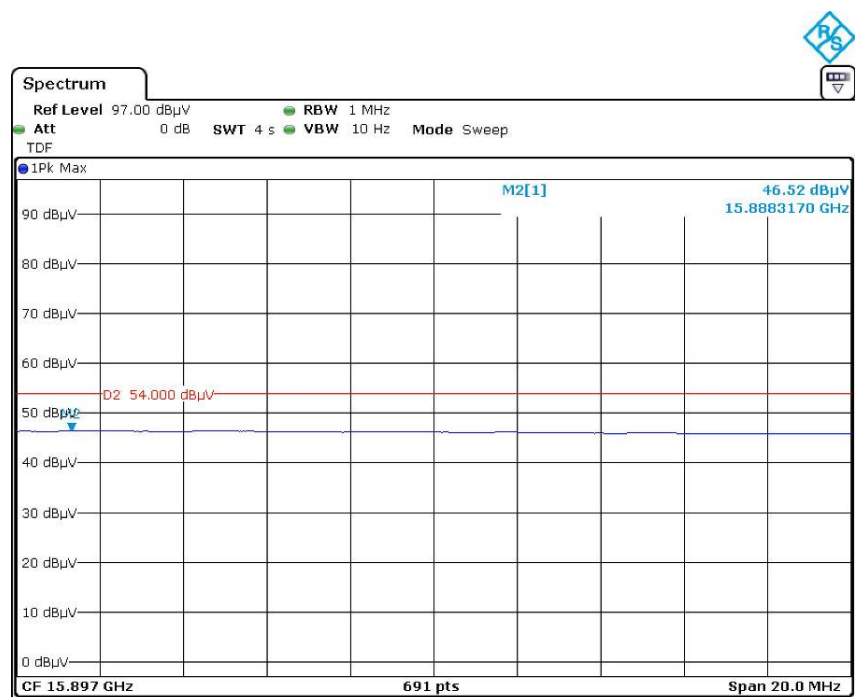
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Vertical

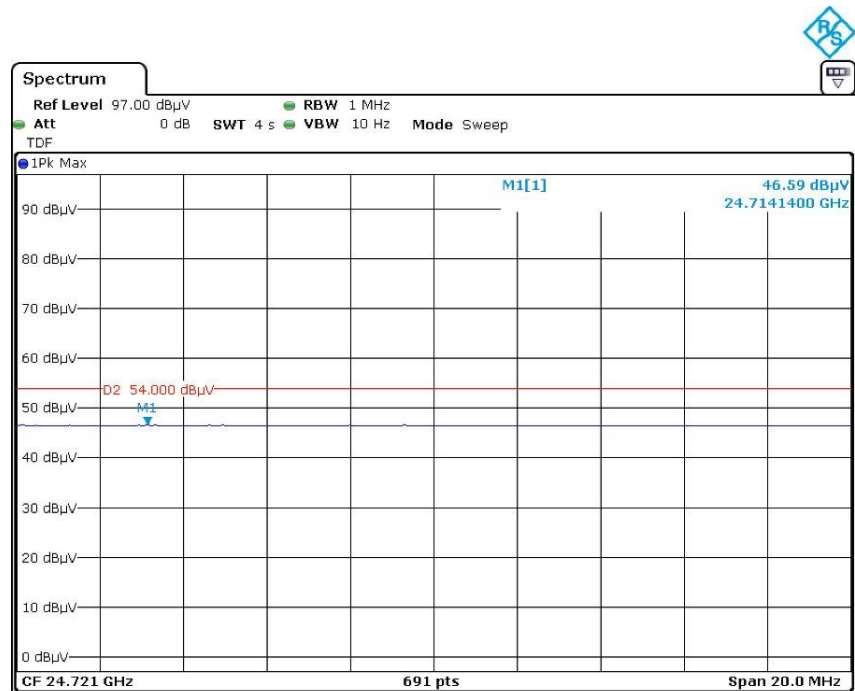


**Average value
Horizontal**

Date: 28.OCT.2020 15:35:23

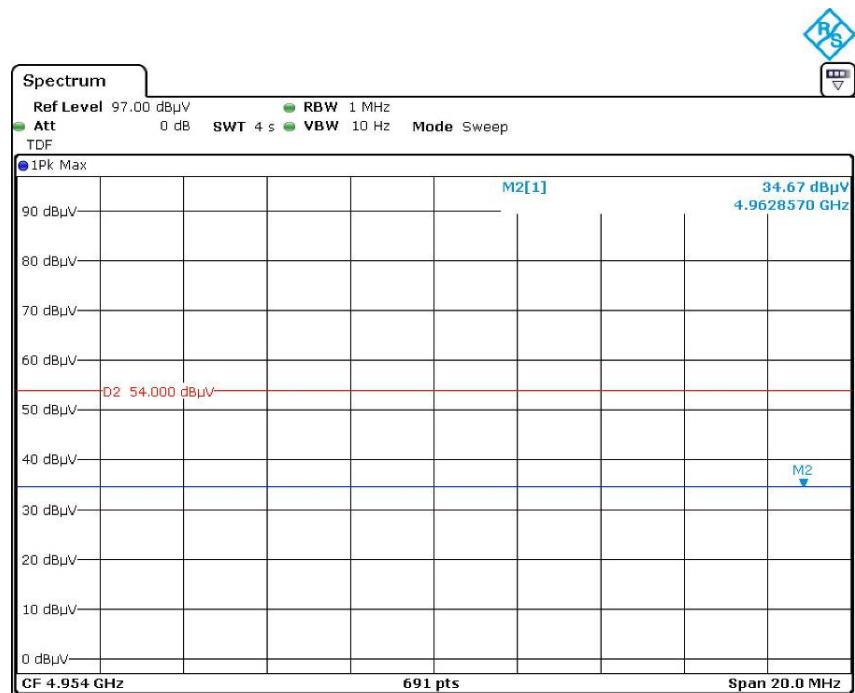


Date: 28.OCT.2020 15:31:42

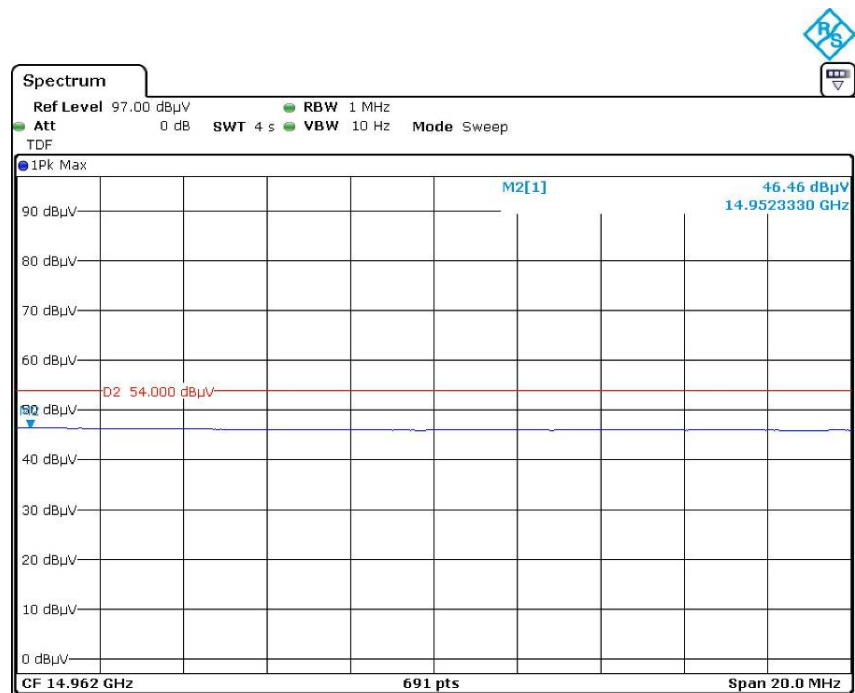


Date: 28.OCT.2020 15:27:11

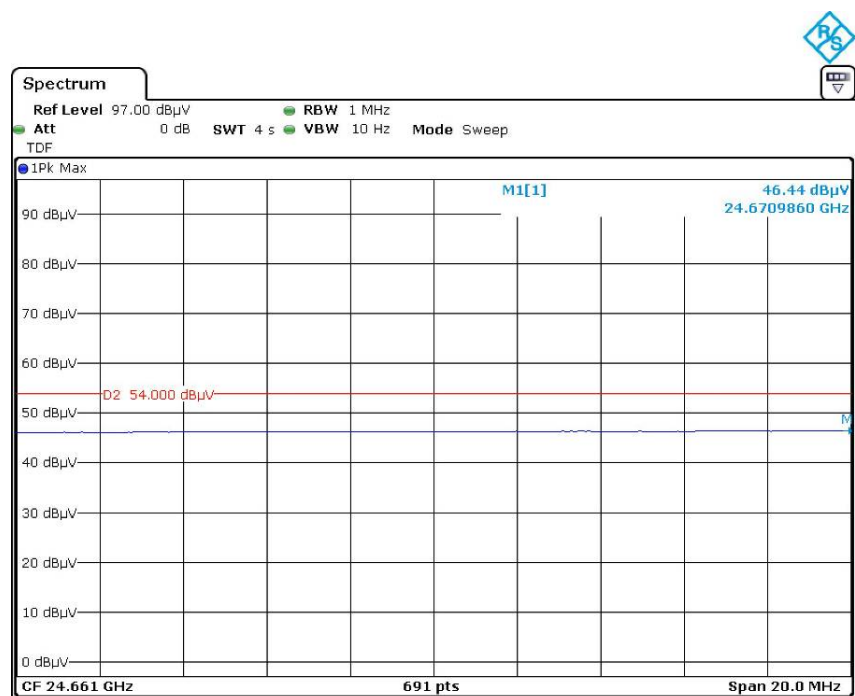
Vertical



Date: 28.OCT.2020 15:50:35



Date: 28.OCT.2020 15:45:27



Date: 28.OCT.2020 15:36:24

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:	25 °C
Relative Humidity:	56.1 %
ATM Pressure:	101.0 kPa

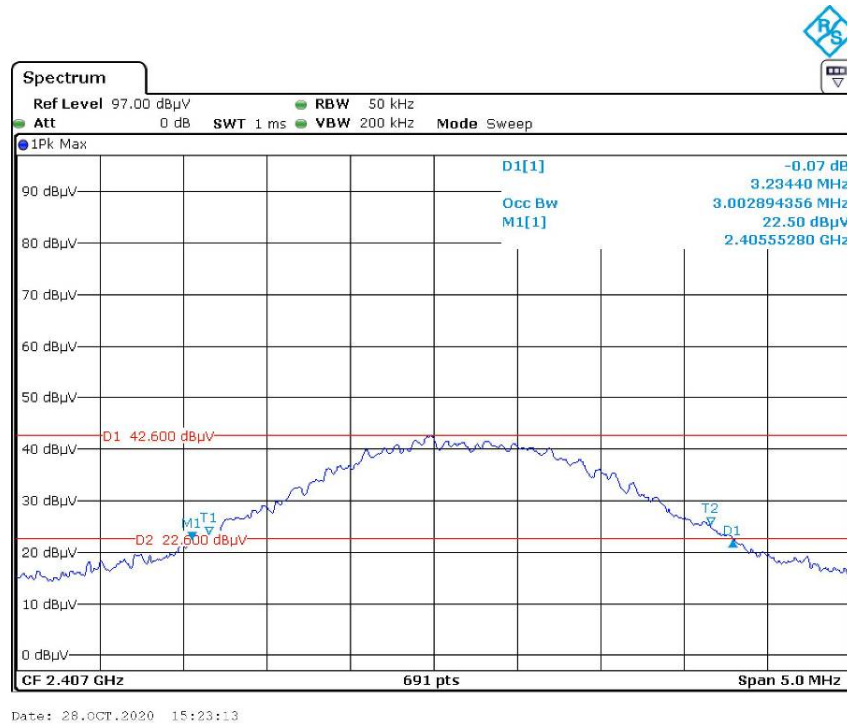
The testing was performed by Hailey Yang on 2020-10-28.

Test Mode: Transmitting

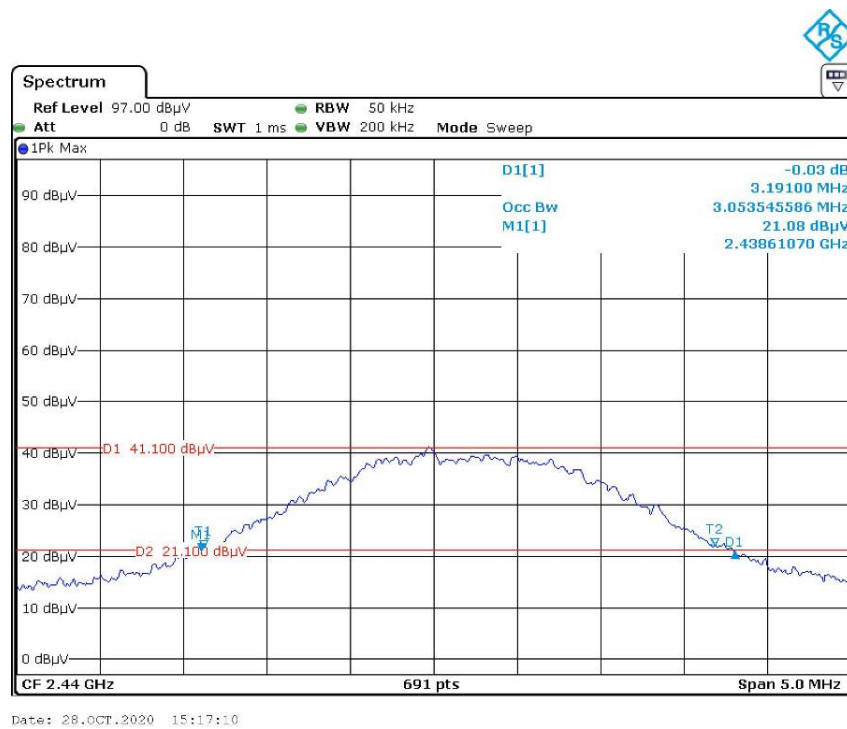
Please refer to the following table and plots.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2407	3.234
Middle	2440	3.191
High	2477	3.213

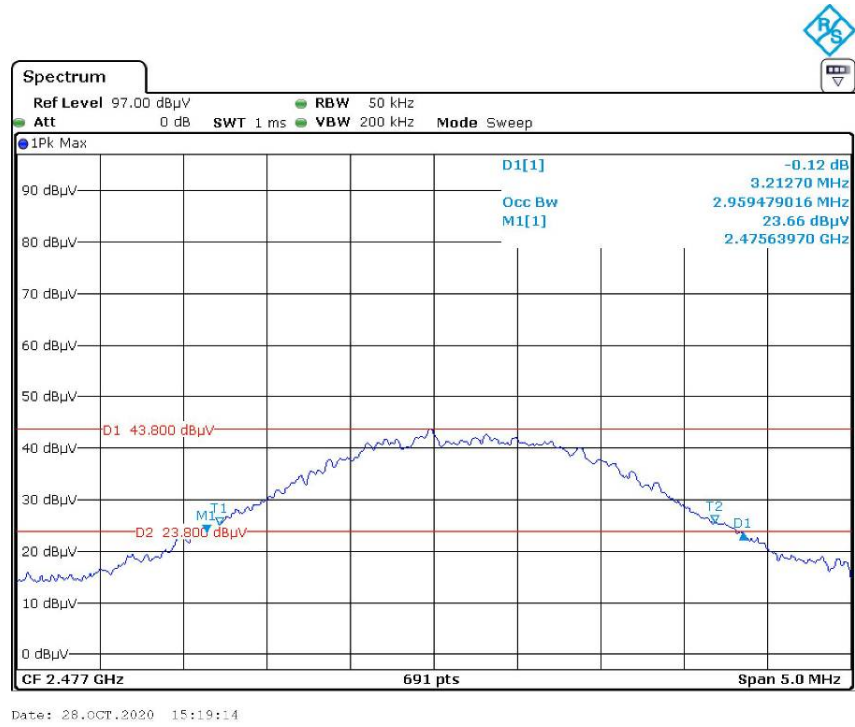
Low Channel



Middle Channel



High Channel



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