



FCC PART 15.249


TEST REPORT

For

Shenzhen VanTop Technology & Innovation Co., Ltd.

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Nanshan District, Shenzhen, China

FCC ID: 2AQ3A-CT100F

Report Type: Original Report	Product Type: Headset Transmitter
Report Number: RSZ201126007-00	
Report Date: 2021-04-06	
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Reviewed By: RF Engineer	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Headset Transmitter
Tested Model	Captain 100
Multiple Model	Captain 200, Captain 300, Captain 400, Captain 500, A41251, A41252, A41253, A41254, A41255
Model Difference	Refer to the DoS letter
Frequency Range	2403.35~2477.35MHz
Transmit Power	82.15dBuV/m@3m
Modulation Technique	$\pi/4$ DQPSK
Antenna Specification*	0 dBi (It is provided by the applicant)
Voltage Range	DC 5V form USB port
Date of Test	2020-12-29 to 2021-03-31
Sample serial number	RSZ201126007-RF-S1 (Assigned by BACL, Shenzhen)
Received date	2020-11-26
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, 15.207, 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.

Each test item follows test standards and with no deviation.

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 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

38 channels are provided to testing:

Channel	GHz	Channel	GHz
1	2.40335	2	2.40535
3	2.40735	4	2.40935
5	2.41135	6	2.41335
7	2.41535	8	2.41735
9	2.41935	10	2.42135
11	2.42335	12	2.42535
13	2.42735	14	2.42935
15	2.43135	16	2.43335
17	2.43535	18	2.43735
19	2.43935	20	2.44135
21	2.44335	22	2.44535
23	2.44735	24	2.44935
25	2.45135	26	2.45335
27	2.45535	28	2.45735
29	2.45935	30	2.46135
31	2.46335	32	2.46535
33	2.46735	34	2.46935
35	2.47135	36	2.47335
37	2.47535	38	2.47735

EUT was tested with Channel 1, 19 and 38.

EUT Exercise Software

“VMIdrv-1.1.6.53.exe” software was used to test the EUT and power level is default*. The software and power level were provided by the applicant.

Equipment Modifications

No modifications were made to the unit tested.

Support Equipment List and Details

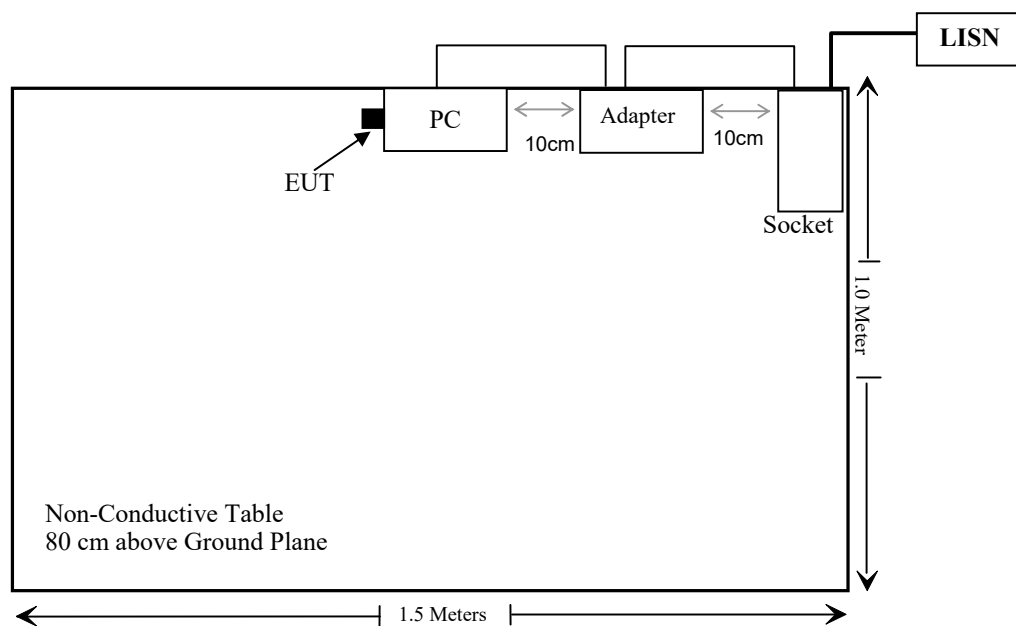
Manufacturer	Description	Model	Serial Number
DELL	PC	Latitude E5430	JG3NLV1
DELL	Adapter	PA-10	PA-10

Support Cable Descriptions

Cable Description	Length (m)	From/Port	To
Un-shielded Un-detachable DC cable	1.2	Adapter	PC
Un-shielded Detachable AC cable	1.0	Adapter	Socket

Block Diagram of Test Setup

For conducted emission:



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					
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	2020/11/29	2021/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2020/11/29	2021/11/28
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
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	2020/12/22	2023/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2020/11/29	2021/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2020/11/29	2021/11/28
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	2021/01/15	2024/01/14
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
MICRO-TRONICS	Passband filter	HPM50111	F-19-EM006	2020/04/20	2021/04/20
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-02 1304	2020/12/06	2023/12/05
RF Conducted Test					
Rohde & Schwarz	Signal and Spectrum Analyzer	FSV40	101473	2020/08/04	2021/08/03
WEINSCHL	10dB Attenuator	5324	AU3842	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 PCB antenna which was permanently attached and the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

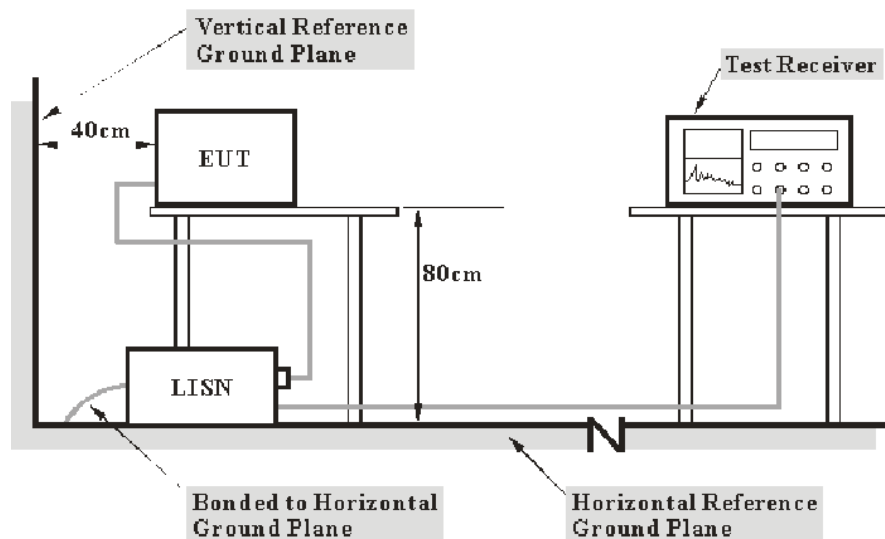
Result: Compliance.

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 EUT complied with the FCC Part 15.207,

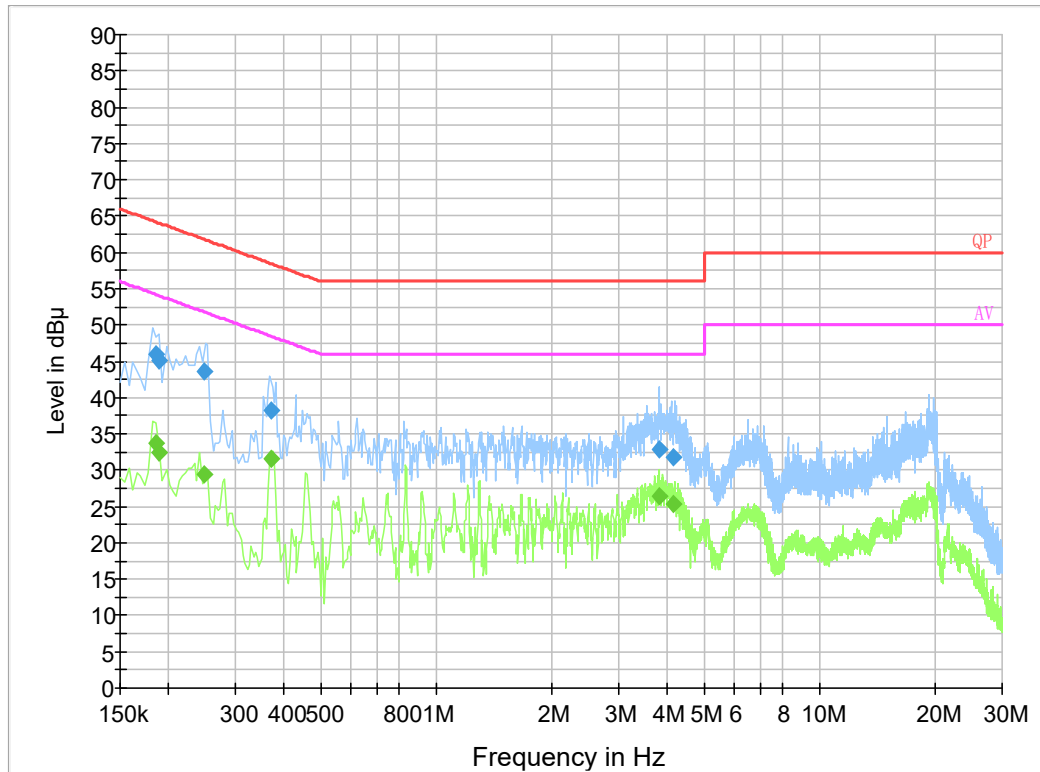
Test Data

Environmental Conditions

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

The testing was performed by Haiguo Li on 2020-12-29.

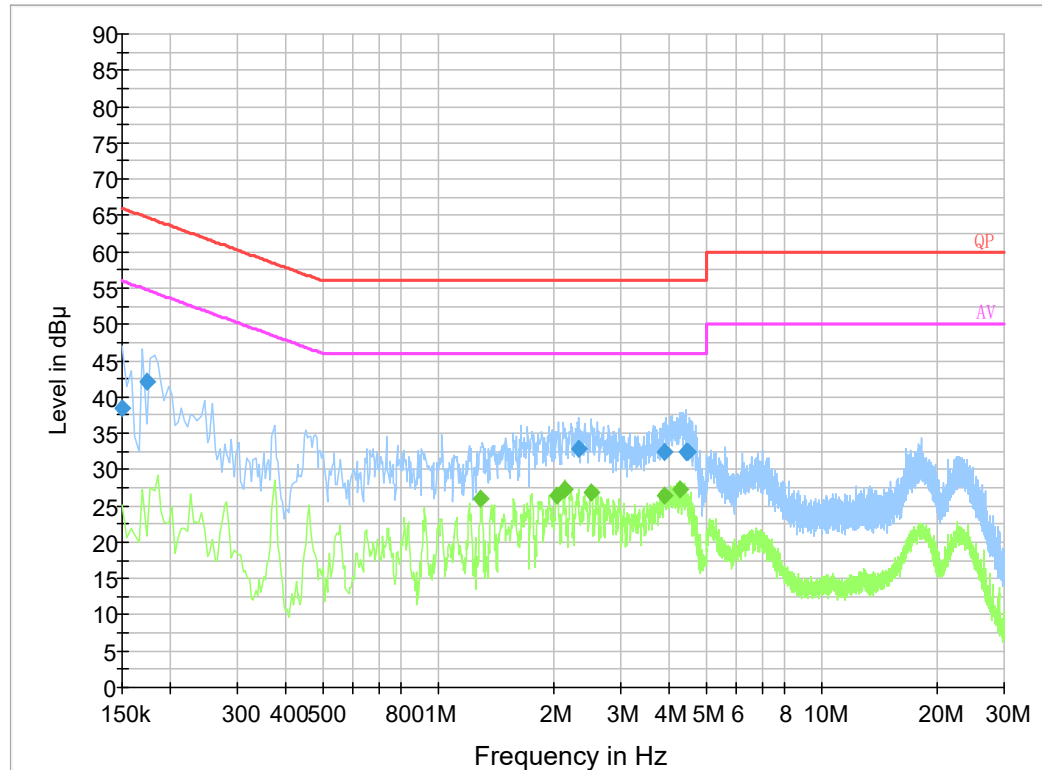
EUT Operation Mode: Transmitting

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)
0.186500	45.9	9.000	L1	19.8	18.3	64.2
0.189500	45.1	9.000	L1	19.8	19.0	64.1
0.249500	43.7	9.000	L1	19.8	18.1	61.8
0.372450	38.2	9.000	L1	19.9	20.2	58.4
3.836490	32.8	9.000	L1	19.9	23.2	56.0
4.155150	31.7	9.000	L1	19.9	24.3	56.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.186500	33.8	9.000	L1	19.8	20.4	54.2
0.189500	32.4	9.000	L1	19.8	21.7	54.1
0.249500	29.4	9.000	L1	19.8	22.4	51.8
0.372450	31.5	9.000	L1	19.9	16.9	48.4
3.836490	26.4	9.000	L1	19.9	19.6	46.0
4.155150	25.2	9.000	L1	19.9	20.8	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)
0.150000	38.5	0.200	N	19.8	27.5	66.0
0.173500	42.1	9.000	N	19.8	22.7	64.8
2.327110	32.9	9.000	N	19.8	23.1	56.0
3.907110	32.5	9.000	N	19.9	23.5	56.0
4.459190	32.4	9.000	N	19.9	23.6	56.0
4.478290	32.5	9.000	N	19.9	23.5	56.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
1.294000	26.0	9.000	N	19.8	20.0	46.0
2.038000	26.4	9.000	N	19.9	19.6	46.0
2.138000	27.2	9.000	N	19.9	18.8	46.0
2.514000	26.9	9.000	N	19.8	19.1	46.0
3.890000	26.3	9.000	N	19.9	19.7	46.0
4.274000	27.3	9.000	N	19.9	18.7	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

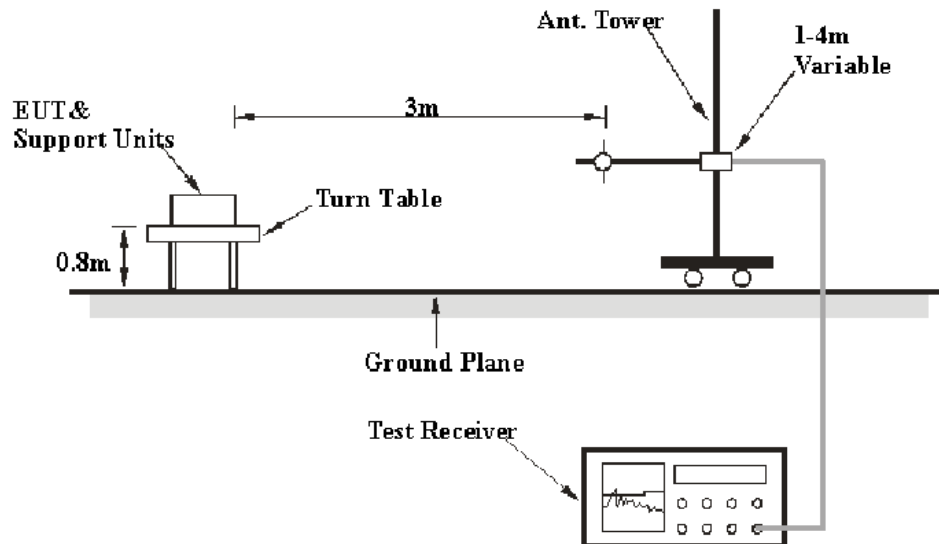
Above 1000MHz:

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

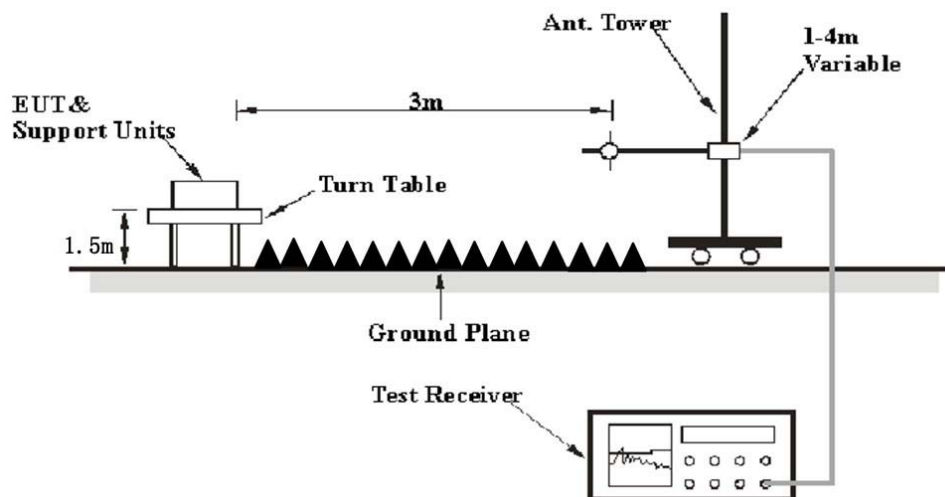
Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

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 meter, 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

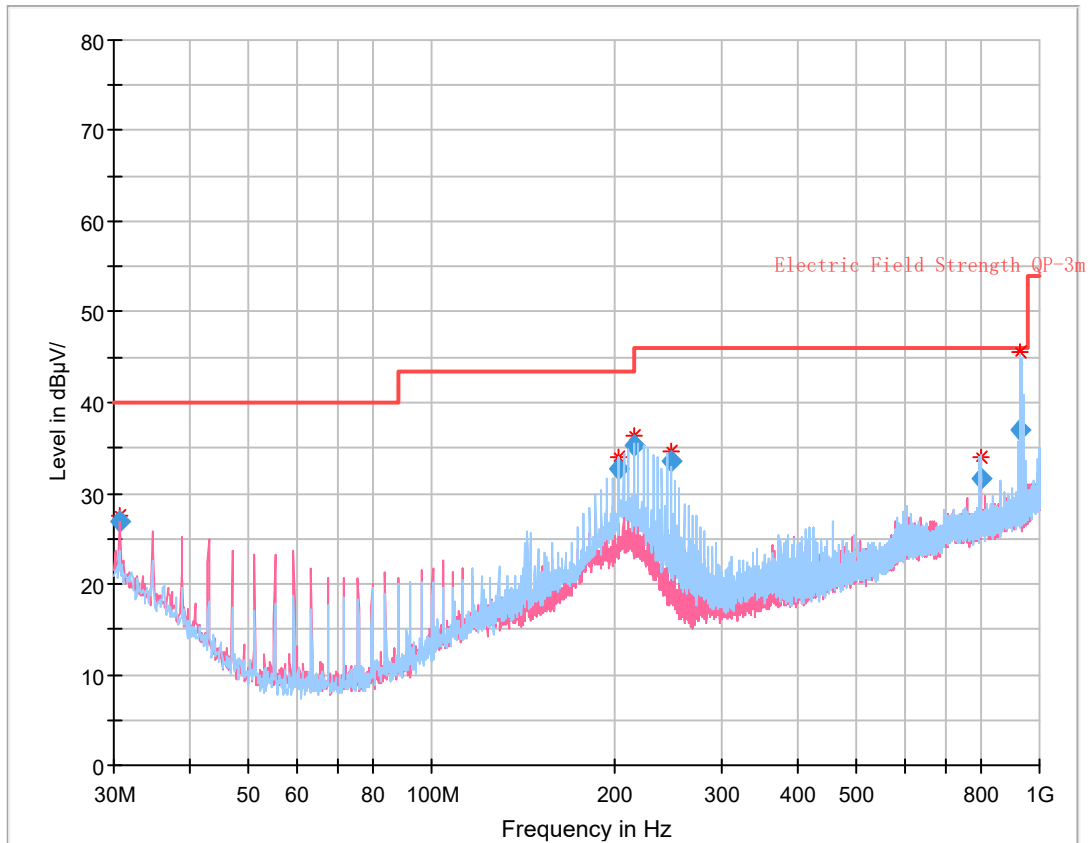
Test Data

Environmental Conditions

Temperature:	24~25.5 °C
Relative Humidity:	51~55 %
ATM Pressure:	101.0~101.2 kPa

The testing was performed by Kilroy Deng on 2020-12-29 for below 1GHz and Troy Wang on 2021-03-14 for above 1GHz.

Test Mode: Transmitting

30MHz – 1 GHz:**Final Result**

Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.728750	26.87	40.00	13.13	102.0	V	253.0	-4.9
202.749125	32.66	43.50	10.84	119.0	H	316.0	-10.6
215.055750	35.31	43.50	8.19	149.0	H	317.0	-10.7
247.813875	33.48	46.00	12.52	110.0	H	261.0	-10.8
799.749125	31.55	46.00	14.45	122.0	H	20.0	-0.2
931.266625	37.08	46.00	8.92	154.0	H	285.0	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&15.209	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel(2403.35MHz)									
2403.35	50.03	PK	306	1.6	H	31.87	81.90	114	32.1
2403.35	45.81	Ave.	306	1.6	H	31.87	77.68	94	16.3
2403.35	48.34	PK	243	1.1	V	31.87	80.21	114	33.8
2403.35	43.93	Ave.	243	1.1	V	31.87	75.80	94	18.2
2400.00	28.99	PK	70	2.2	H	31.87	60.86	74	13.14
2400.00	14.38	Ave.	70	2.2	H	31.87	46.25	54	7.75
2486.17	29.53	PK	292	2.1	H	32.13	61.66	74	12.34
2486.17	14.43	Ave.	292	2.1	H	32.13	46.56	54	7.44
4806.70	48.64	PK	346	1.9	H	6.28	54.92	74	19.08
4806.70	39.29	Ave.	346	1.9	H	6.28	45.57	54	8.43
Middle Channel(2439.35MHz)									
2439.35	50.18	PK	343	1.7	H	31.97	82.15	114	31.9
2439.35	45.35	Ave.	343	1.7	H	31.97	77.32	94	16.7
2439.35	48.32	PK	137	1.1	V	31.97	80.29	114	33.7
2439.35	44.23	Ave.	137	1.1	V	31.97	76.20	94	17.8
4878.70	47.24	PK	205	1.7	H	6.76	54.00	74	20.00
4878.70	37.12	Ave.	205	1.7	H	6.76	43.88	54	10.12
High Channel(2477.35 MHz)									
2477.35	49.58	PK	65	1.4	H	32.13	81.71	114	32.3
2477.35	44.77	Ave.	65	1.4	H	32.13	76.90	94	17.1
2477.35	46.14	PK	333	2.2	V	32.13	78.27	114	35.7
2477.35	41.60	Ave.	333	2.2	V	32.13	73.73	94	20.3
2387.82	28.60	PK	171	2.5	H	31.87	60.47	74	13.53
2387.82	14.37	Ave.	171	2.5	H	31.87	46.24	54	7.76
2486.54	29.52	PK	118	1.2	H	32.13	61.65	74	12.35
2486.54	14.45	Ave.	118	1.2	H	32.13	46.58	54	7.42
4954.70	46.74	PK	57	1.5	H	6.80	53.54	74	20.46
4954.70	36.26	Ave.	57	1.5	H	6.80	43.06	54	10.94

Note:

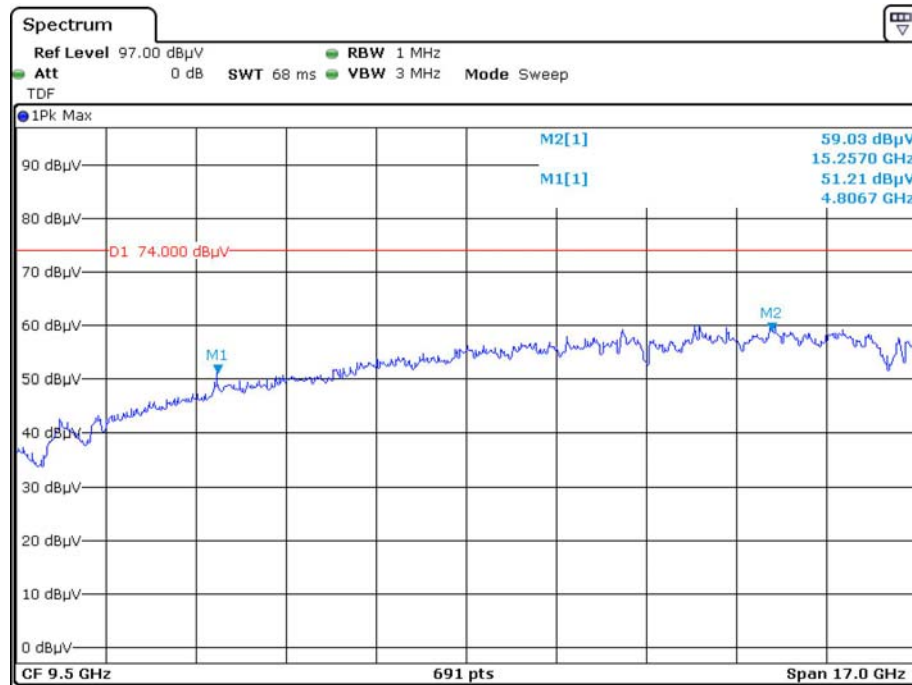
Corrected Amplitude = Corrected Factor + Reading

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

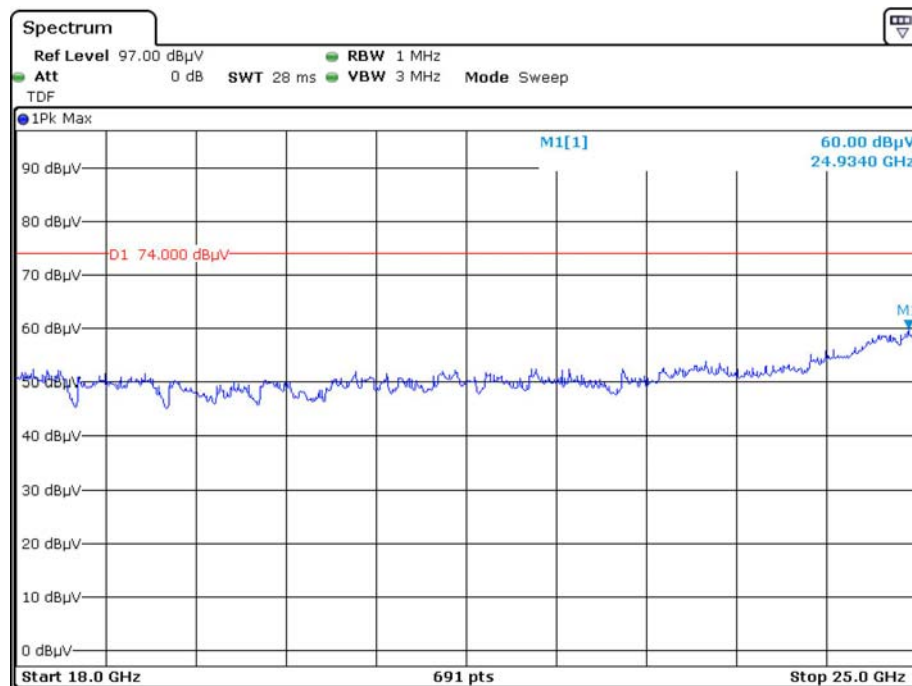
Margin = Limit- Corr. Amplitude

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

Pre-scan with low channel Peak
Horizontal

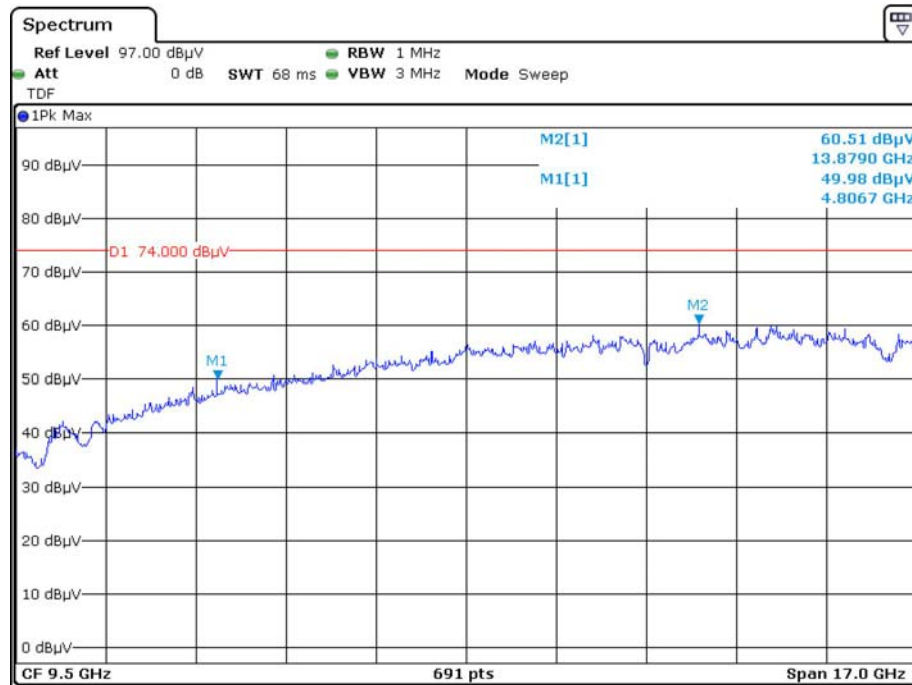


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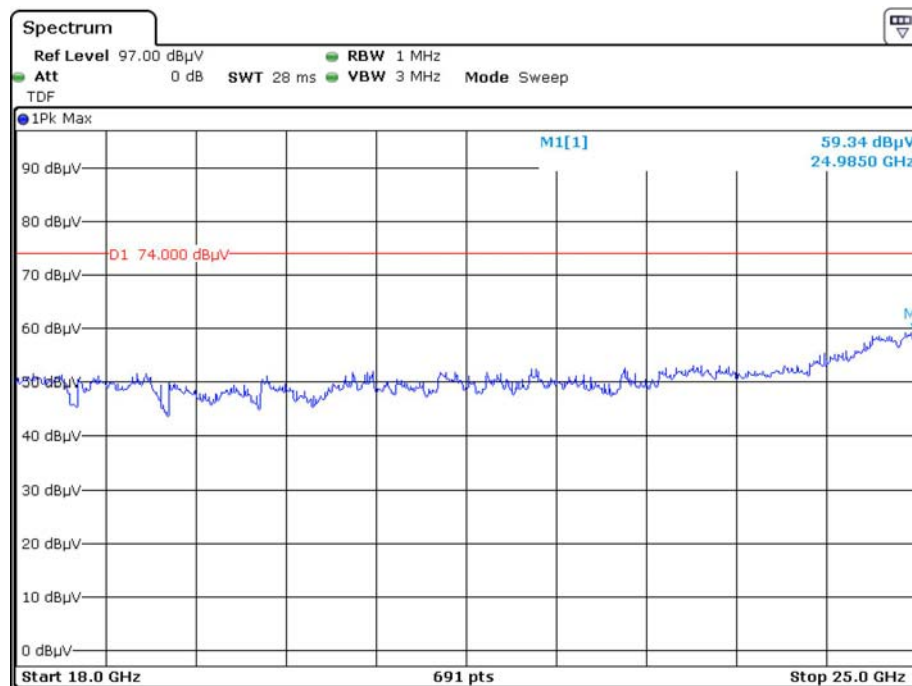


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Vertical

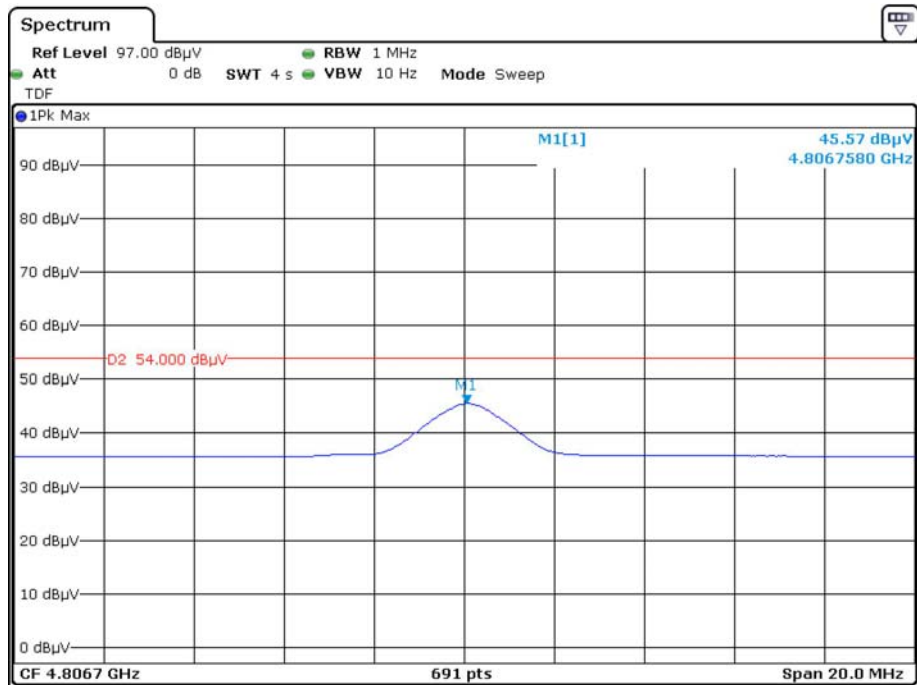


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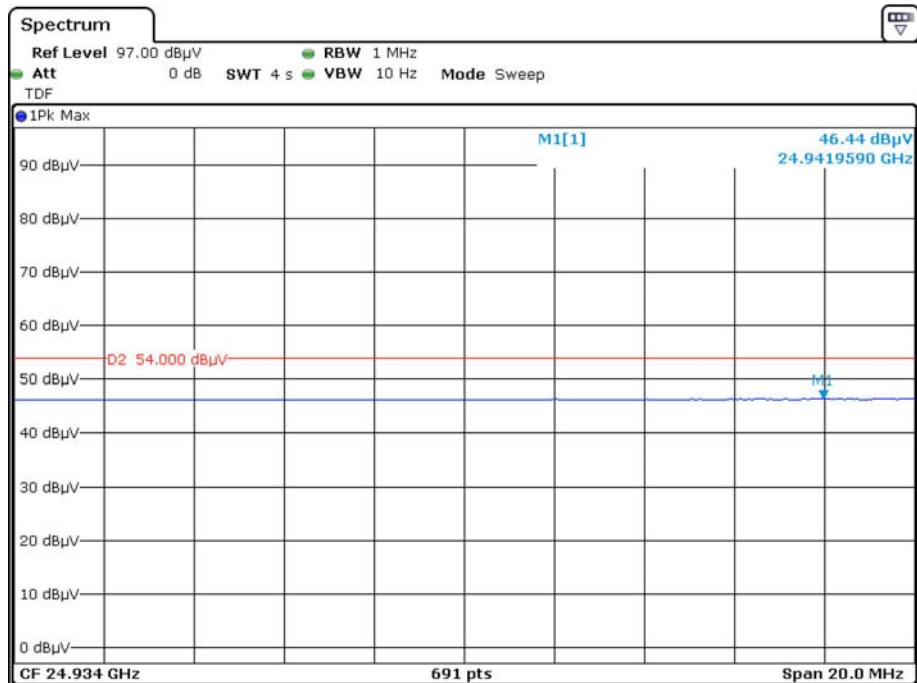


Date: 14.MAR.2021 13:59:37

**Average value for the peak point at pre-scan
Horizontal**

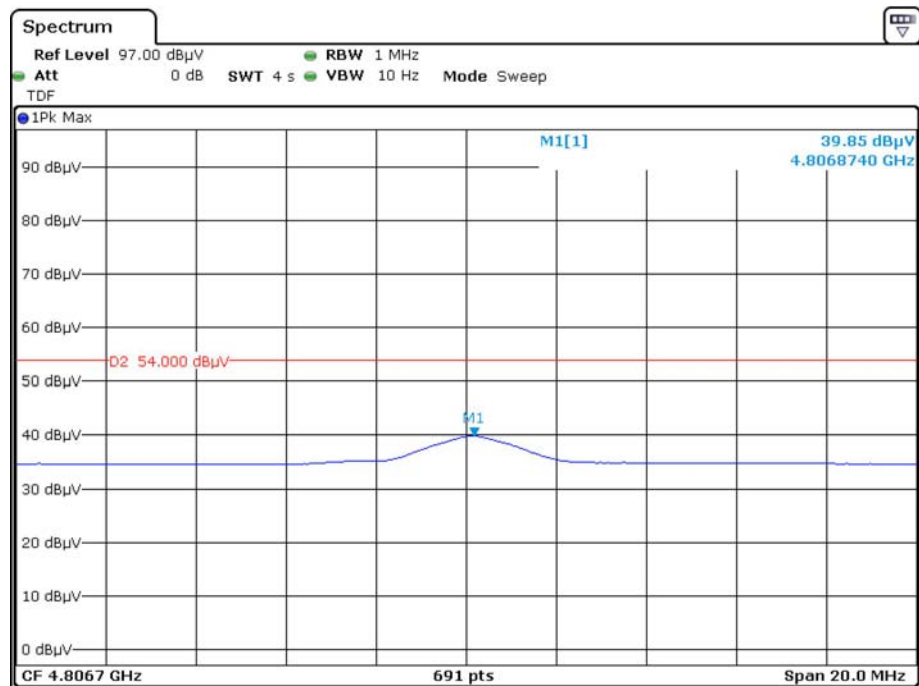


Date: 14.MAR.2021 13:07:08

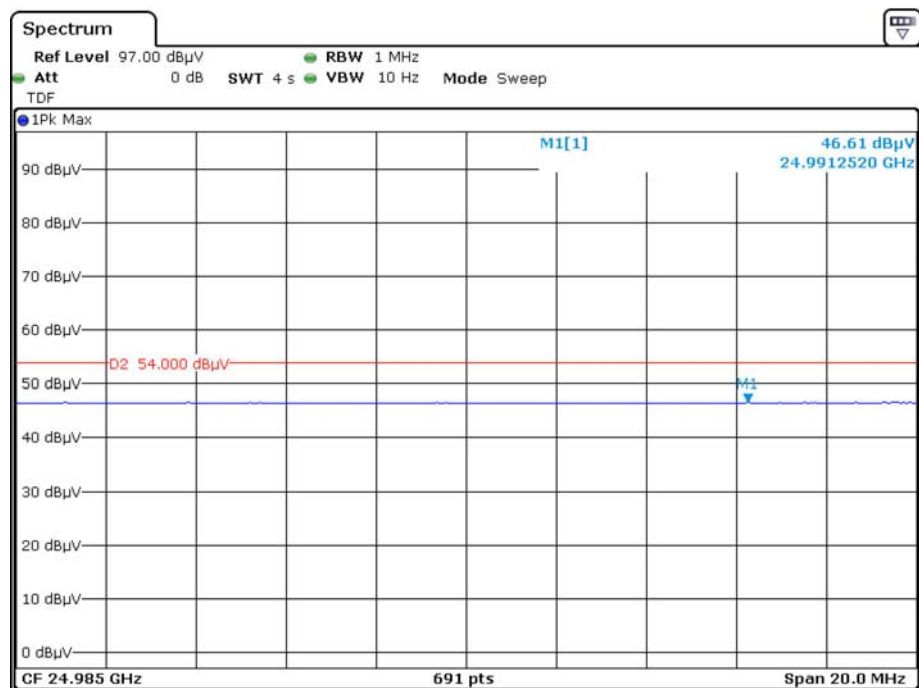


Date: 14.MAR.2021 13:55:03

Vertical



Date: 14.MAR.2021 13:17:02



Date: 14.MAR.2021 14:05:09

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:	21 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

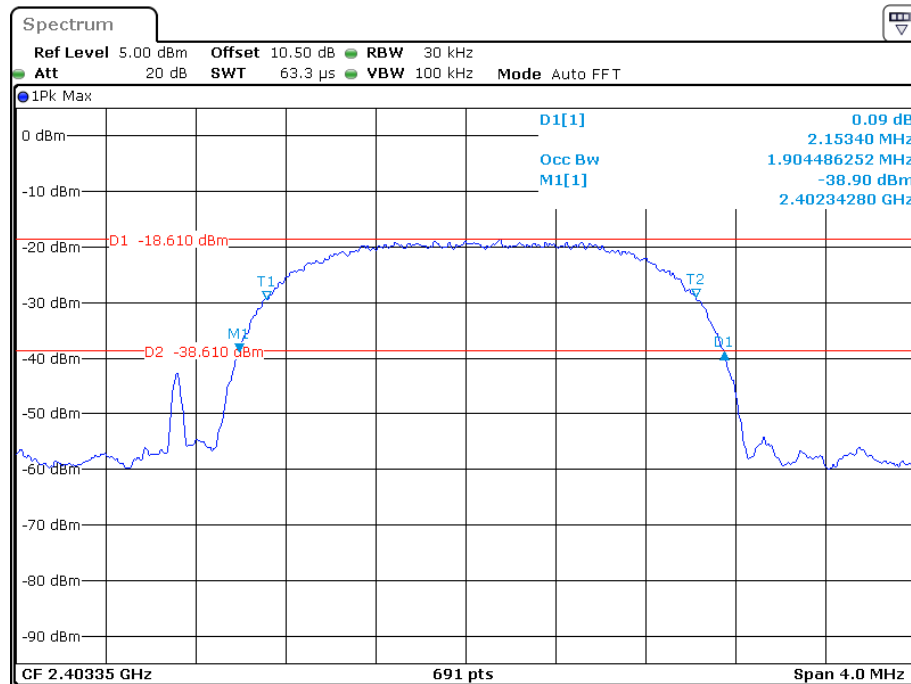
The testing was performed by Zero Yan on 2021-03-31

Test Mode: Transmitting

Please refer to the following table and plots.

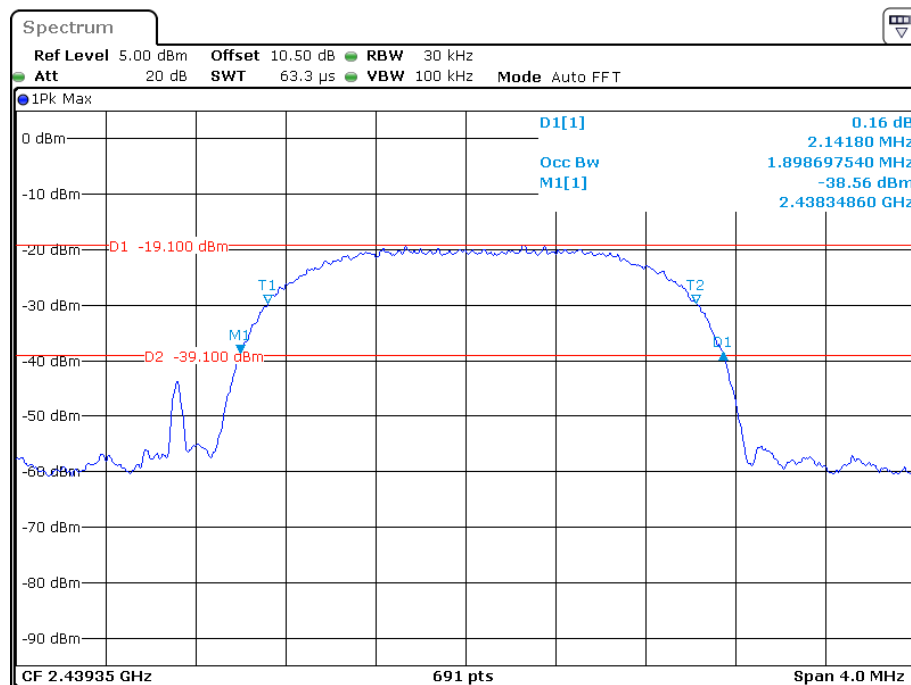
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2403.35	2.15
Middle	2439.35	2.14
High	2477.35	2.15

Low Channel



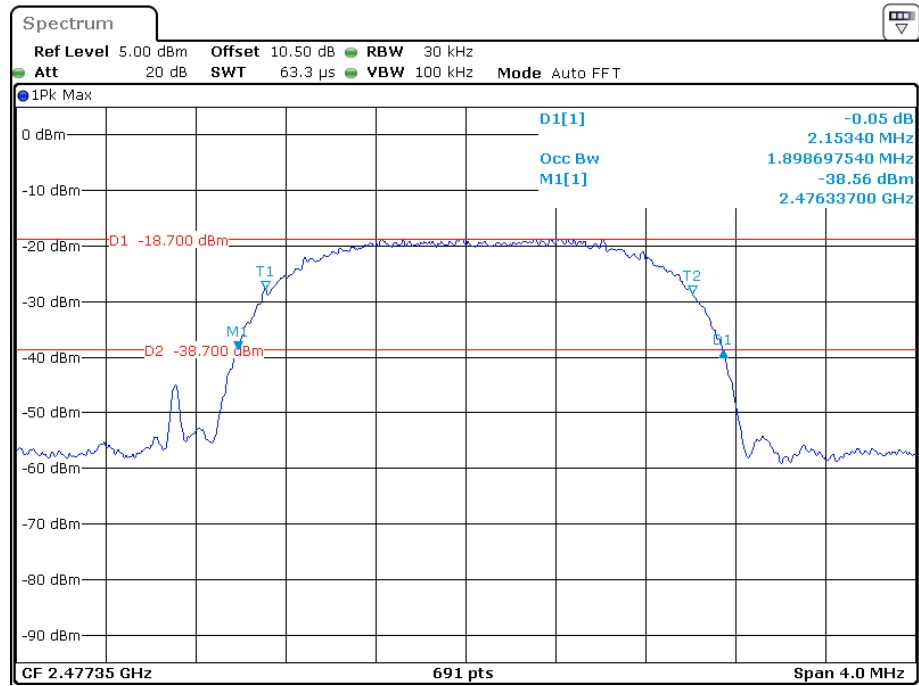
Date: 31.MAR.2021 11:10:53

Middle Channel



Date: 31.MAR.2021 11:18:33

High Channel



Date: 31.MAR.2021 11:26:51

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