TEST REPORT

Applicant Name :	Bytech NY lnc.
Address :	2585 West 13th Street Brooklyn NY 11223 USA
Report Number:	SZ3220602-21484E-RF
FCC ID:	2AHN6-DE2

Test Standard (s)

FCC PART 15.249

Sample Description

Product Type:	Mini Gaming Portable Keyboard-Dongle
Model No.:	BY-GA-AR-211-DE
Trade Name:	N/A
Date Received:	2022-06-02
Date of Test:	2022-07-06 to 2022-07-15
Report Date:	2022-07-20

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Roger.Ling

Roger.Ling
EMC Engineer

Approved By:

Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Mini Gaming Portable Keyboard-Dongle
Tested Model	BY-GA-AR-211-DE
UPC Number	805112089758, 805112089741
SKU Number	6505393
Lot Number	BY053022
Frequency Range	2402-2480MHz
Maximum E-Field Strength (Peak)	85.60dBuV/m@3m
Modulation Technique	GFSK
Antenna Specification	0dBi (It is provided by the applicant)
Voltage Range	DC5V from USB port
Sample serial number	SZ3220602-21484E-RF-S1(Assigned by ATC, Shenzhen)
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 Compliant Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
	26.5GHz - 40GHz	4.72dB
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 Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. 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.: 708358, the FCC Designation No.: CN1189.

Accredited by American Association for Laboratory Accreditation (A2LA). The Certificate Number is 4297.01

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing by manufacturer.

Frequency list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2402**	14	2442
1	2404	15	**2444**
2	2406	16	2446
3	2408	17	2448
4	2410	18	2450
5	2412	19	2452
6	2414	20	2466
7	2416	21	2468
8	2418	22	2470
9	2420	23	2472
10	2434	24	2474
11	2436	25	2476
12	2438	26	2478
13	2440	27	**2480**

Channel 0, Channel 15 and Channel 27 were selected for testing.

EUT Exercise Software

Software “scom5.13.1.exe”* was used during testing and the power level was Default Power level 7*.

Equipment Modifications

No modifications were made to the unit tested.

Support Equipment List and Details

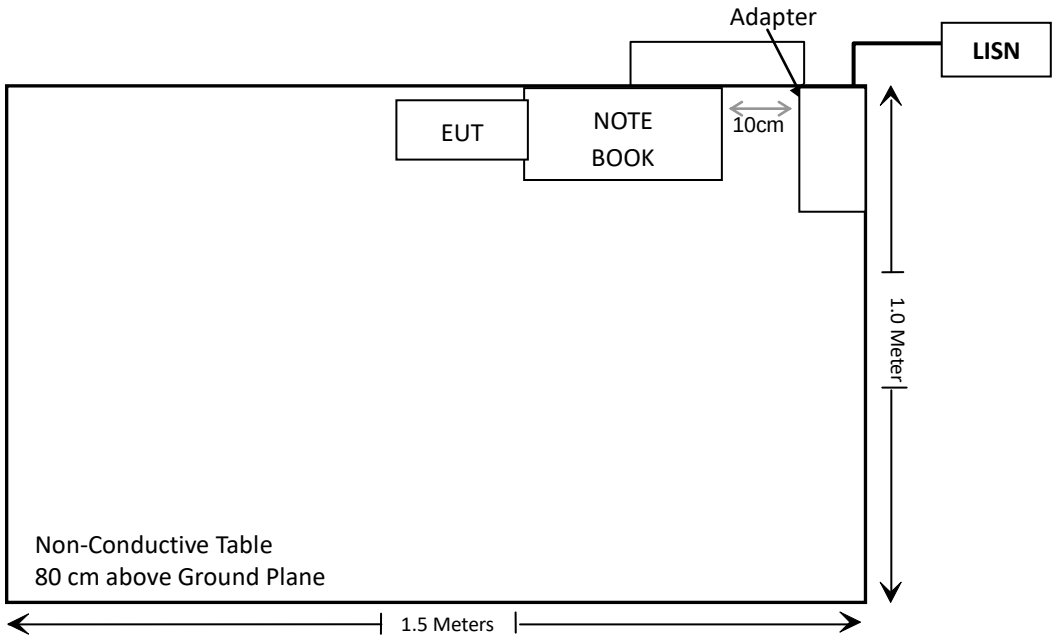
Manufacturer	Description	Model	Serial Number
LENOVO	Adapter	ADLX65NLC3A	11S45N0257Z1ZX1773ND2K
LENOVO	Notebook	ThinkPad x240	SL10F31638JS

Support Cable Descriptions

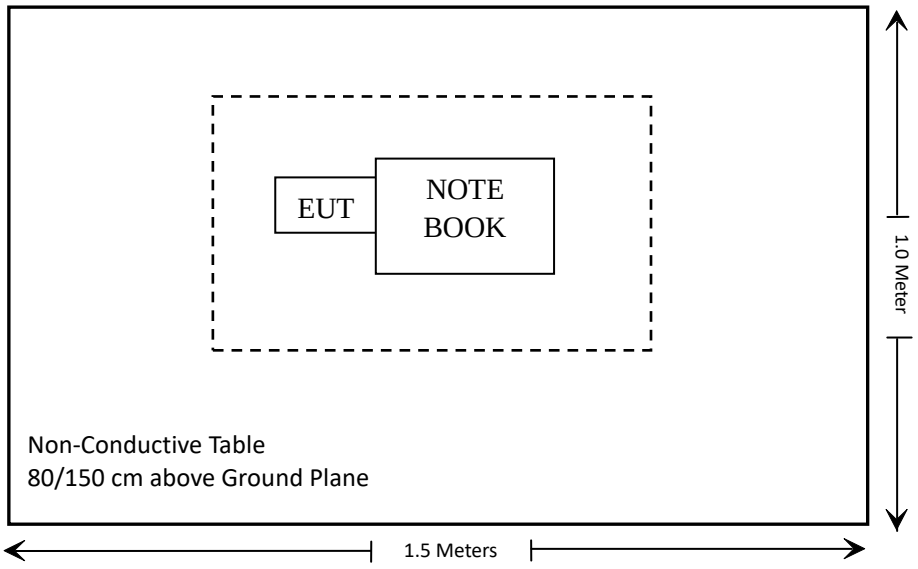
Cable Description	Length (m)	From/Port	To
/	/	/	/

Block Diagram of Test Setup

For Conducted Emission:



For Radiated Emmision



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 (b) & §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	Conduction Emissions	Compliant
15.205, §15.209, §15.249(d)	Radiated Emissions& Outside of Band Emission	Compliant
§15.215 (c)	20dB Bandwidth	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100784	2021/12/13	2022/12/12
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2021/12/13	2022/12/12
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable	No.17	N0350	2021/12/14	2022/12/13
Radiated Emission Test					
Rohde & Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde & Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Radiated Emission Test Software: e3 19821b (V9)					
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable (From Manufacturer)	Unknown	AS5631	Each time	

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. Attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1307 (b) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D04 Interim General RF Exposure Guidance v01, clause 2.1.2 – 1-mW test Exemption:

Per §1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance.
This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

Test Result

For worst case:

Mode	Frequency	Maximum Tune-up Power		1-mW test Exemption
	(MHz)	(dBm)	(mW)	
2.4G SRD	2402-2480	-9.0	0.13	Yes

Note 1: Test maximum EIRP=85.60(dBμV/m) - 95.2= -9.6dBm
Note 2: The tune-up power is -9dBm, which was declared by the applicant.

Result: Compliant.

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.

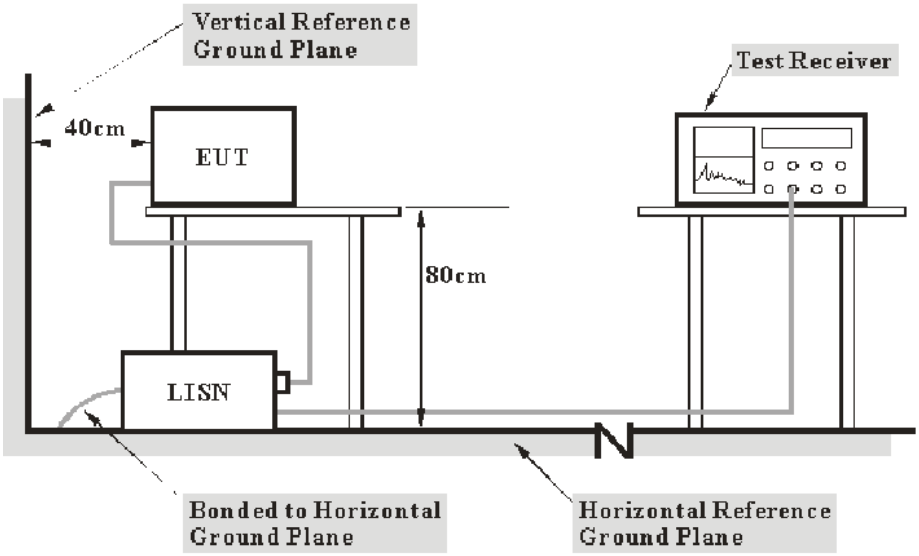
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

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 ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

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

During the conducted emission test, the adapter was connected to the outlet of the LISN.

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.

Factor & Margin Calculation

The factor is calculated by adding LISN VDF (Voltage Division Factor) and Cable Loss. The basic equation is as follows:

Factor = LISN VDF + Cable Loss

The "**Over limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over limit of -7 dB means the emission is 7 dB below the limit. The equation for calculation is as follows:

Over Limit = Level – Limit
Level = Read Level + Factor

Test Data

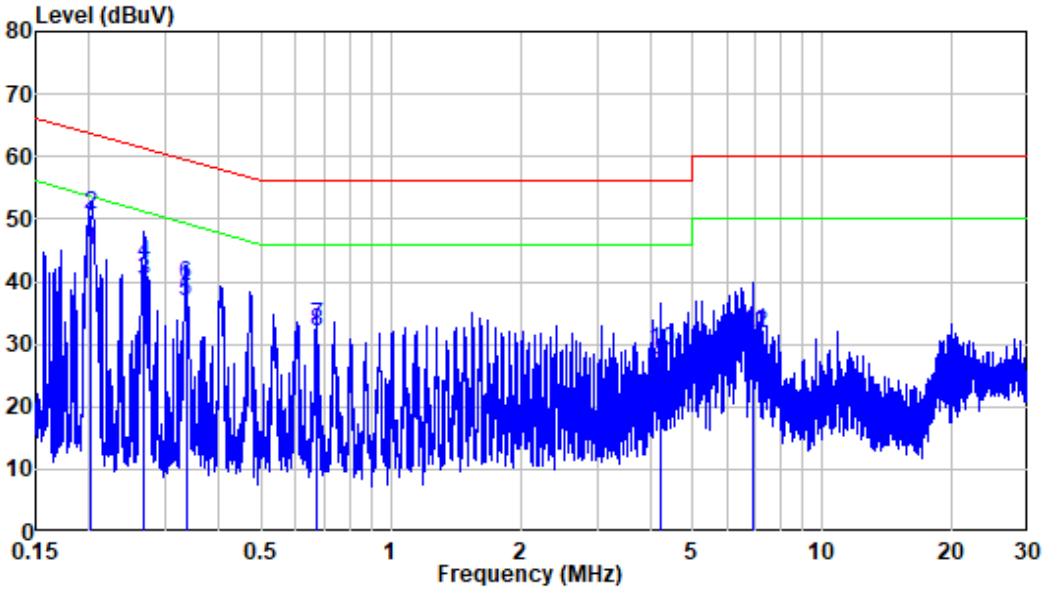
Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	43 %
ATM Pressure:	101.1 kPa

The testing was performed by Jason Liu on 2022-07-15.

EUT operation mode: Transmitting

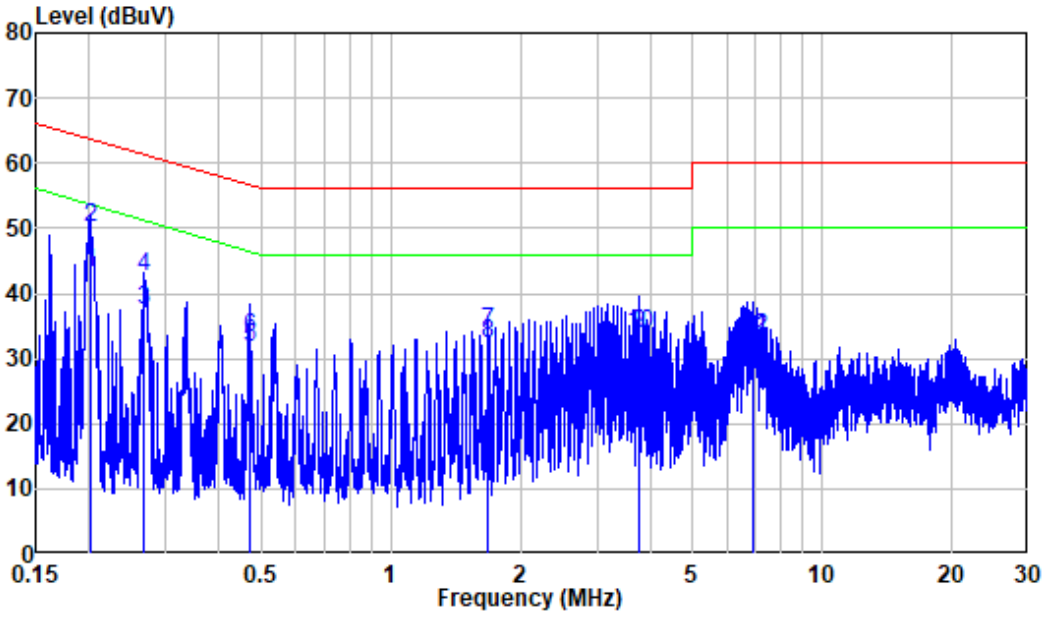
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : SZ3220602-21484E-RF
Mode : Transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.201	9.80	35.06	44.86	53.55	-8.69	Average
2	0.201	9.80	41.04	50.84	63.55	-12.71	QP
3	0.268	9.80	30.21	40.01	51.17	-11.16	Average
4	0.268	9.80	33.12	42.92	61.17	-18.25	QP
5	0.335	9.80	26.95	36.75	49.33	-12.58	Average
6	0.335	9.80	29.80	39.60	59.33	-19.73	QP
7	0.671	9.81	23.15	32.96	46.00	-13.04	Average
8	0.671	9.81	22.23	32.04	56.00	-23.96	QP
9	4.230	9.84	17.35	27.19	46.00	-18.81	Average
10	4.230	9.84	19.19	29.03	56.00	-26.97	QP
11	6.919	9.87	22.17	32.04	50.00	-17.96	Average
12	6.919	9.87	21.93	31.80	60.00	-28.20	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Job No. : SZ3220602-21484E-RF
Mode : Transmitting
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.201	9.80	33.27	43.07	53.56	-10.49	Average
2	0.201	9.80	40.37	50.17	63.56	-13.39	QP
3	0.268	9.80	27.73	37.53	51.19	-13.66	Average
4	0.268	9.80	32.84	42.64	61.19	-18.55	QP
5	0.470	9.80	21.91	31.71	46.51	-14.80	Average
6	0.470	9.80	23.48	33.28	56.51	-23.23	QP
7	1.681	9.82	24.28	34.10	46.00	-11.90	Average
8	1.681	9.82	22.39	32.21	56.00	-23.79	QP
9	3.767	9.84	24.01	33.85	46.00	-12.15	Average
10	3.767	9.84	23.97	33.81	56.00	-22.19	QP
11	6.923	9.97	23.24	33.21	50.00	-16.79	Average
12	6.923	9.97	23.24	33.21	60.00	-26.79	QP

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 ©, 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

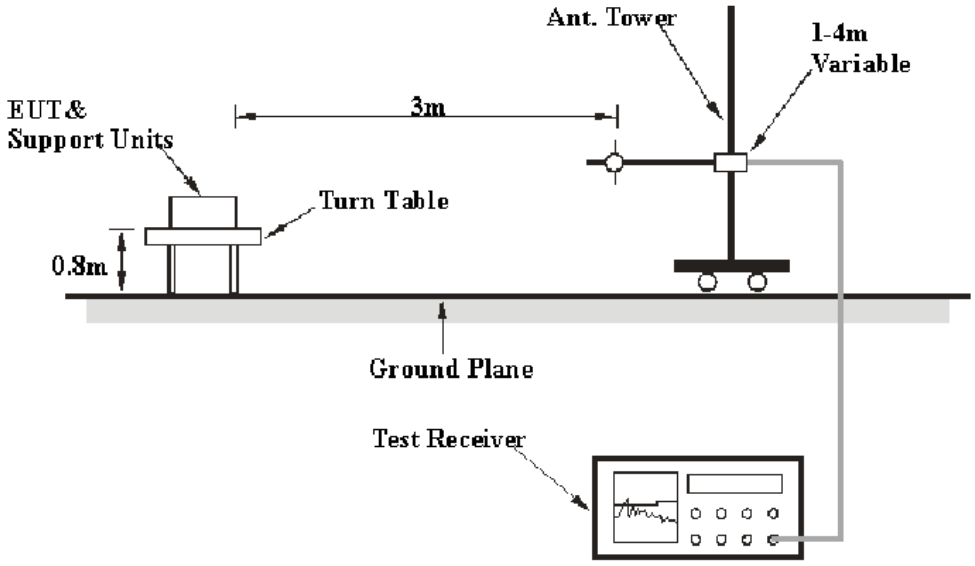
Above 1000MHz:

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

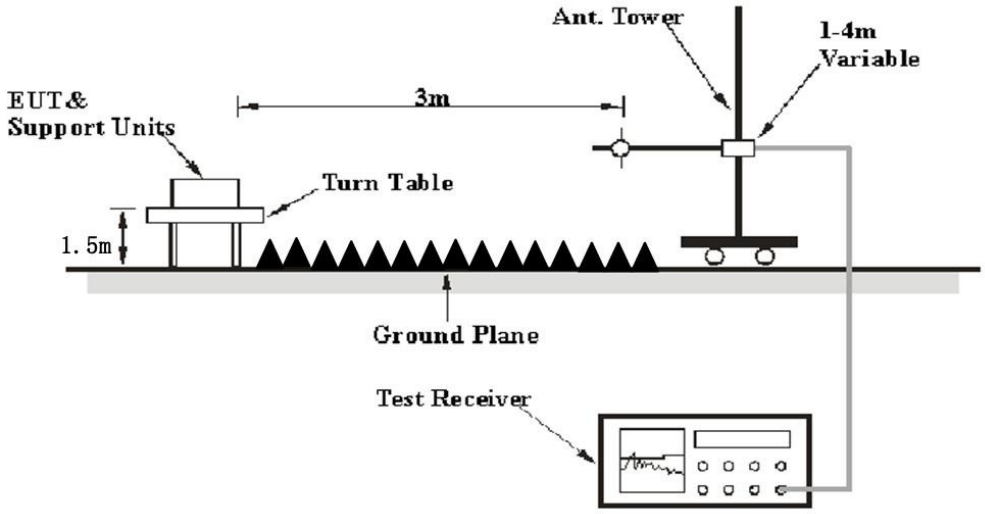
If the maximized peak measured value complies with the limit, then it is unnecessary to perform QP/Average measurement.

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission and out of band emission tests were performed in the 3meters 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 Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss – Amplifier Gain

The "**Over Limit/Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit/margin of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

Over Limit/Margin = Level / Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Results Summary

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

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	58 %
ATM Pressure:	108.0kPa

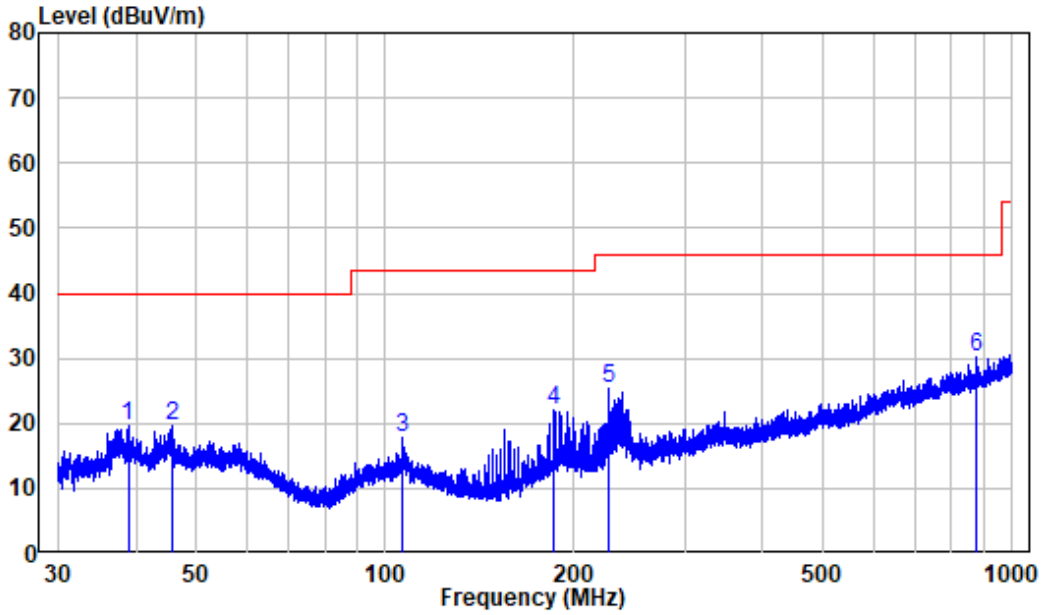
The testing was performed by Level Li on 2022-07-15.

Test Mode: Transmitting (Pre-scan in the X, Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

30MHz-1GHz: (Worst case)

High Channel

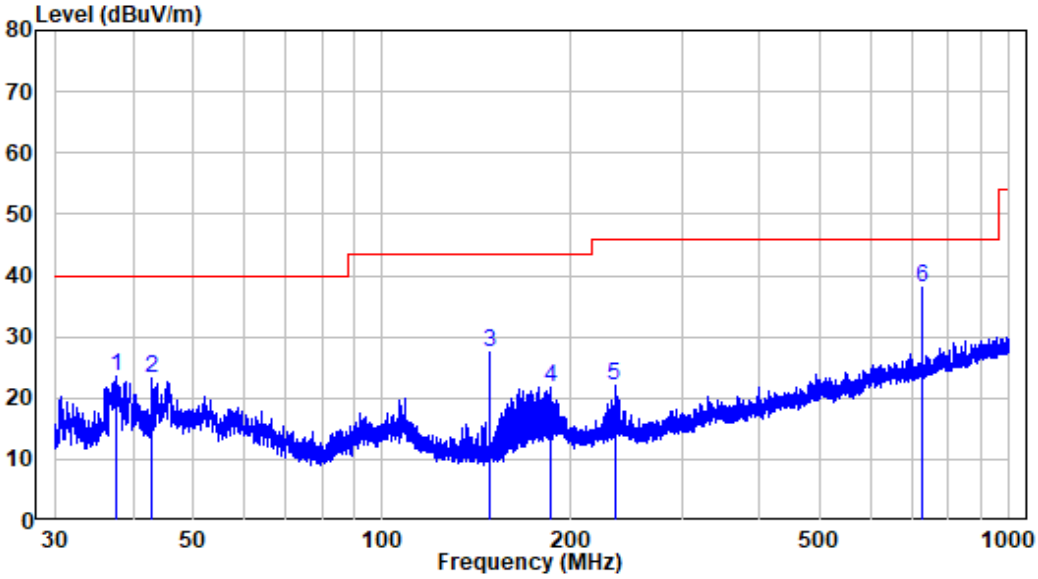
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZ3220602-21484E-RF
Test Mode: Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	38.854	-10.62	30.38	19.76	40.00	-20.24	Peak
2	45.755	-9.98	29.58	19.60	40.00	-20.40	Peak
3	106.759	-11.95	29.83	17.88	43.50	-25.62	Peak
4	185.057	-12.17	34.34	22.17	43.50	-21.33	Peak
5	227.591	-11.19	36.44	25.25	46.00	-20.75	Peak
6	879.092	1.23	28.88	30.11	46.00	-15.89	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : SZ3220602-21484E-RF
Test Mode: Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	37.531	-10.90	34.40	23.50	40.00	-16.50	Peak
2	42.956	-9.96	33.10	23.14	40.00	-16.86	Peak
3	148.376	-15.36	42.94	27.58	43.50	-15.92	Peak
4	185.057	-12.17	34.04	21.87	43.50	-21.63	Peak
5	234.579	-10.98	32.98	22.00	46.00	-24.00	Peak
6	726.487	-1.17	39.35	38.18	46.00	-7.82	Peak

Above 1 GHz:

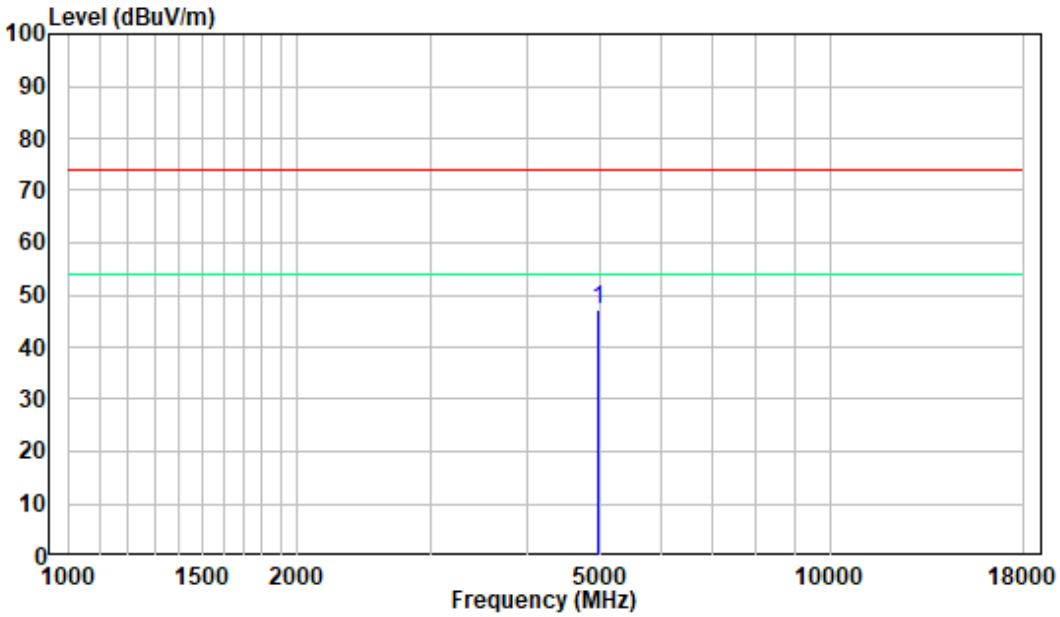
Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/AV		Height (m)	Polar (H/V)				
Low Channel									
2310	45.17	PK	122	1.1	H	-7.23	37.94	74	-36.06
2310	44.33	PK	287	1.7	V	-7.23	37.10	74	-36.9
2390	44.58	PK	298	1.2	H	-7.21	37.37	74	-36.63
2390	45.8	PK	284	1.1	V	-7.21	38.59	74	-35.41
2400	54.85	PK	122	1.1	H	-7.23	47.62	74	-26.38
2400	56.24	PK	287	1.7	V	-7.23	49.01	74	-24.99
2402	86.83	PK	230	2.0	H	-7.23	79.60	114	-34.4
2402	87.83	PK	86	1.5	V	-7.23	80.60	114	-33.4
4804	47.5	PK	86	1.5	H	-3.52	43.98	74	-30.02
4804	46.27	PK	96	1.6	V	-3.52	42.75	74	-31.25
Middle Channel									
2444	89.99	PK	266	1.7	H	-7.24	82.75	114	-31.25
2444	91.05	PK	28	1.1	V	-7.24	83.81	114	-30.19
4888	49	PK	297	1.0	H	-3.34	45.66	74	-28.34
4888	48.33	PK	237	1.6	V	-3.34	44.99	74	-29.01
High Channel									
2483.5	45.04	PK	134	1.2	H	-7.2	37.84	74	-36.16
2483.5	44.69	PK	135	1.9	V	-7.2	37.49	74	-36.51
2500	44.8	PK	134	1.2	H	-7.18	37.62	74	-36.38
2500	45.06	PK	135	1.9	V	-7.18	37.88	74	-36.12
2480	92.81	PK	121	2.2	H	-7.21	85.60	114	-28.4
2480	90.55	PK	318	1.4	V	-7.21	83.34	114	-30.66
4960	50.34	PK	318	1.4	H	-3.01	47.33	74	-26.67
4960	47.86	PK	195	1.4	V	-3.01	44.85	74	-29.15

Note:
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Absolute Level (Corrected Amplitude) = Factor + Reading
Margin = Absolute Level (Corrected Amplitude) – Limit
The other spurious emission which is in the noise floor level was not recorded.
For above 1GHz, the test result of peak was 20dB below to the limit of peak, which can be compliant to the average limit, so just peak value was recorded.

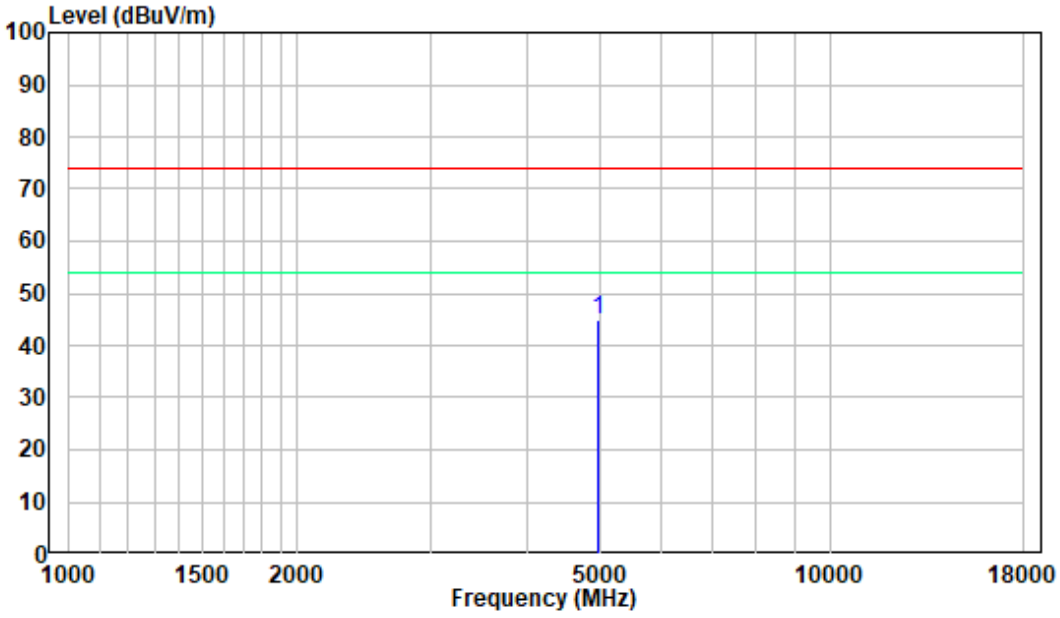
Pre-scan plots:

1-18GHz: High Channel

Horizontal

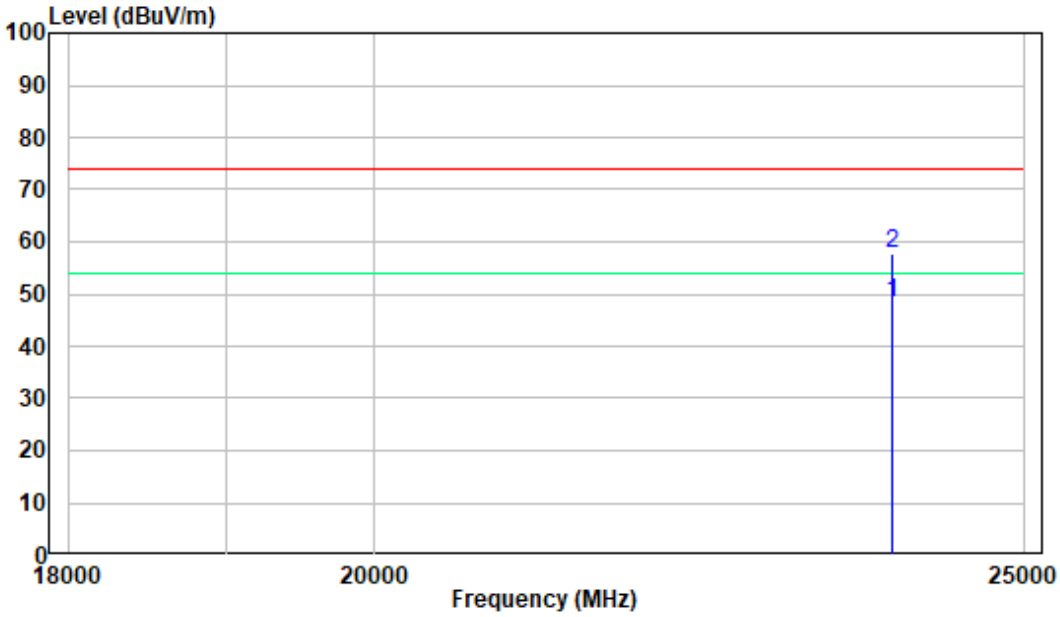


Vertical

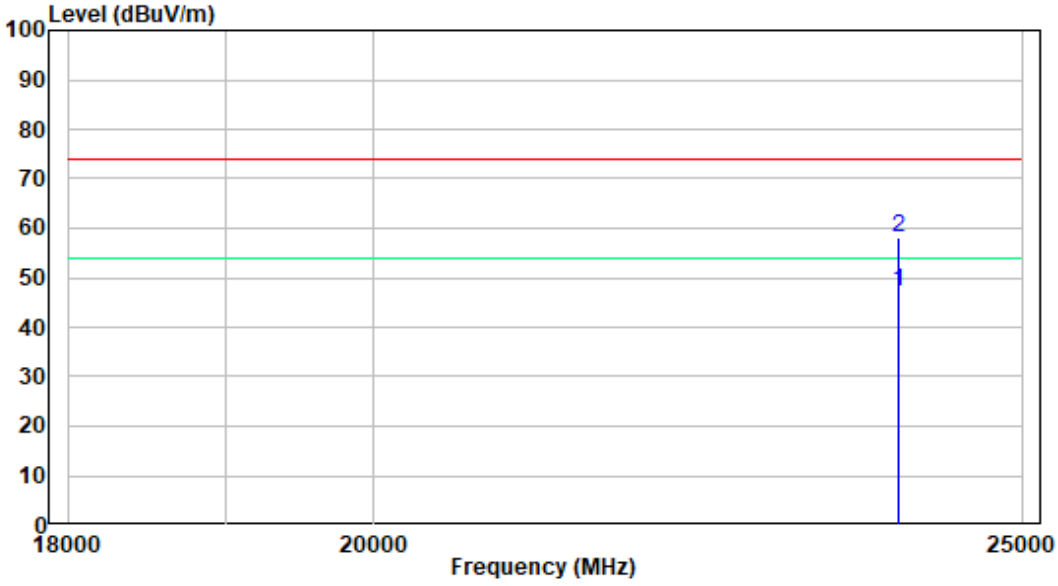


18-25GHz: High Channel

Horizontal



Vertical



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 20dBbandwidth.

4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	58 %
ATM Pressure:	101.0 kPa

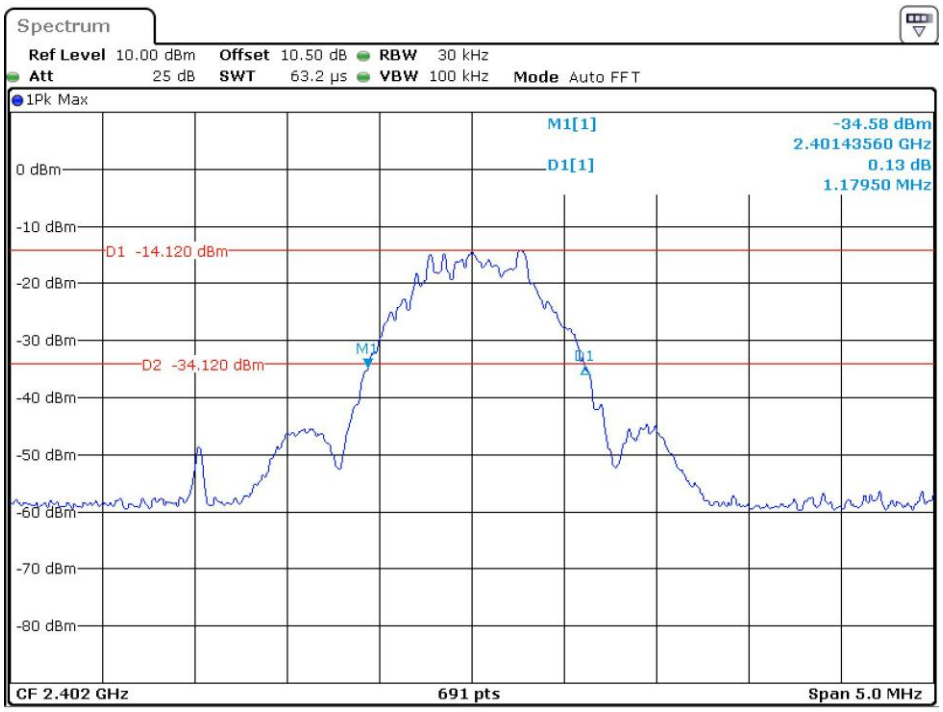
The testing was performed by Glenn Jiang on 2022-07-06.

Test Mode: Transmitting

Please refer to the following table and plots.

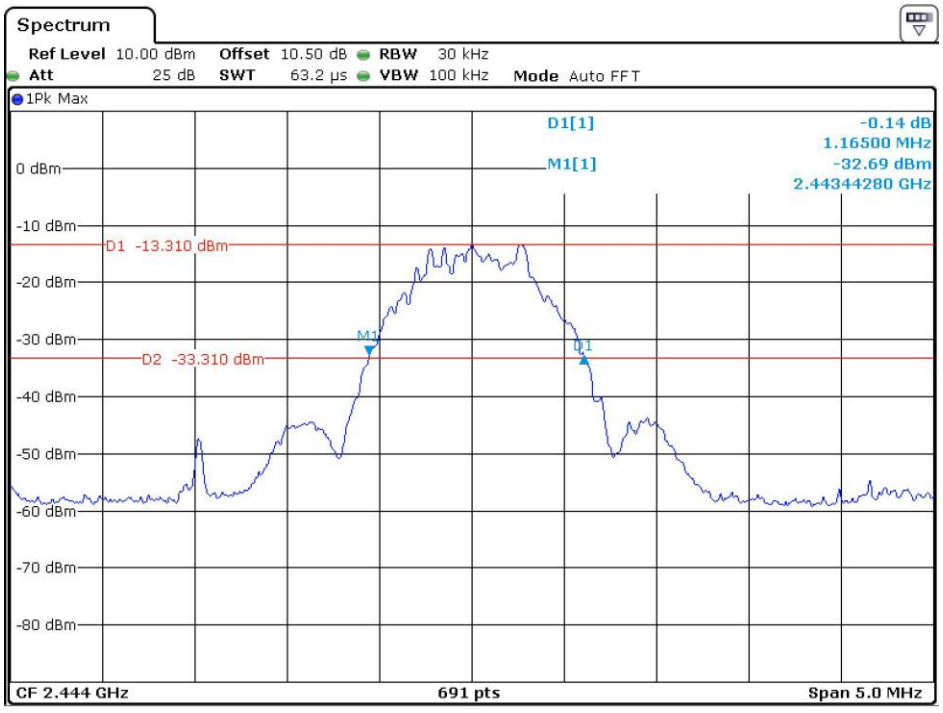
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.180
Middle	2444	1.165
High	2480	1.172

Low Channel



Date: 6.JUL.2022 19:24:08

Middle Channel



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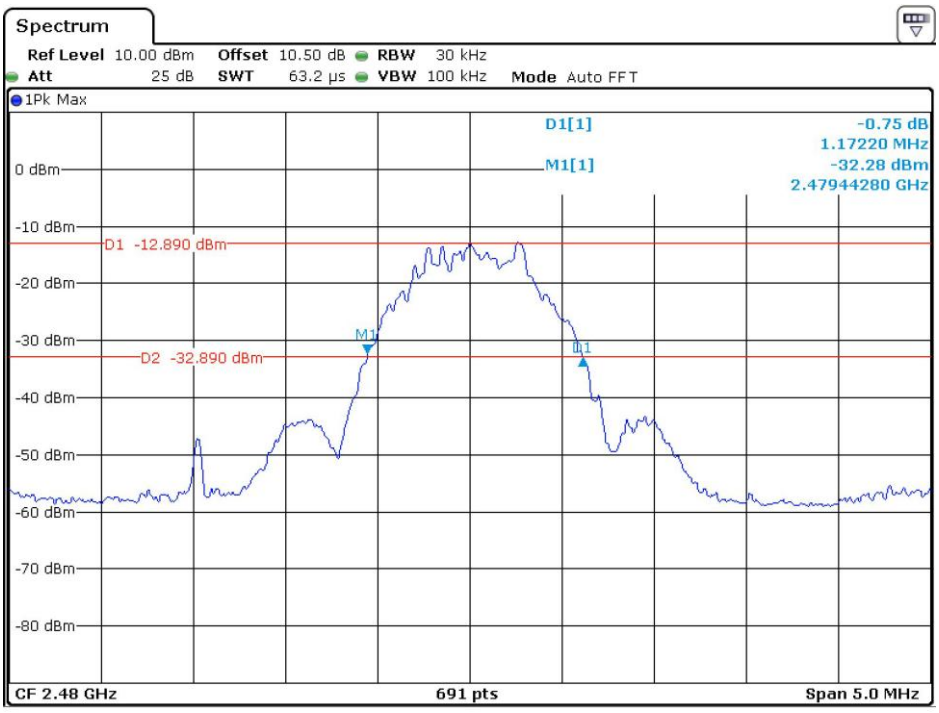
High Channel



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