



FCC PART 15.249 TEST REPORT

For

DGL Group, LTD.

195 Raritan Center Parkway, Edison, New Jersey, 08837, United States

FCC ID: 2AANZBTLED

Report Type: Original Report	Product Type: Bluetooth Wireless Color Changing Light Strip
Report Number: RSZ201013836-00	
Report Date: 2020-11-03 Jacob Kong	
Reviewed By: RF Engineer <i>Jacob Kong</i>	
Prepared By: Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn	

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Bluetooth Wireless Color Changing Light Strip
Tested Model	HY-BTLED-6FT
Multiple Model	HY-BTLED-12F
Model Differences	Refer to the DoS letter
Frequency Range	2402-2480MHz
Maximum Field Strength	68.10dBuV/m @3m
Antenna Specification*	Antenna Max. Peak Gain -3 dBi (provided by the applicant)
Voltage Range	120V/60Hz
Date of Test	2020-10-24 to 2020-10-29
Sample serial number	RSZ201013836-RF-S1(Assigned by BACL, Shenzhen)
Received date	2020-10-13
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℃
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.

40 channels from 2402MHz to 2480MHz with 2MHz step are provided to testing

EUT was tested with 2402MHz, 2440MHz and 2480MHz.

EUT Exercise Software

“wtcdb.exe” software was used to the EUT tested and power level is 10*. The software and power level was proved by the applicant.

Equipment Modifications

No modifications were made to the unit tested.

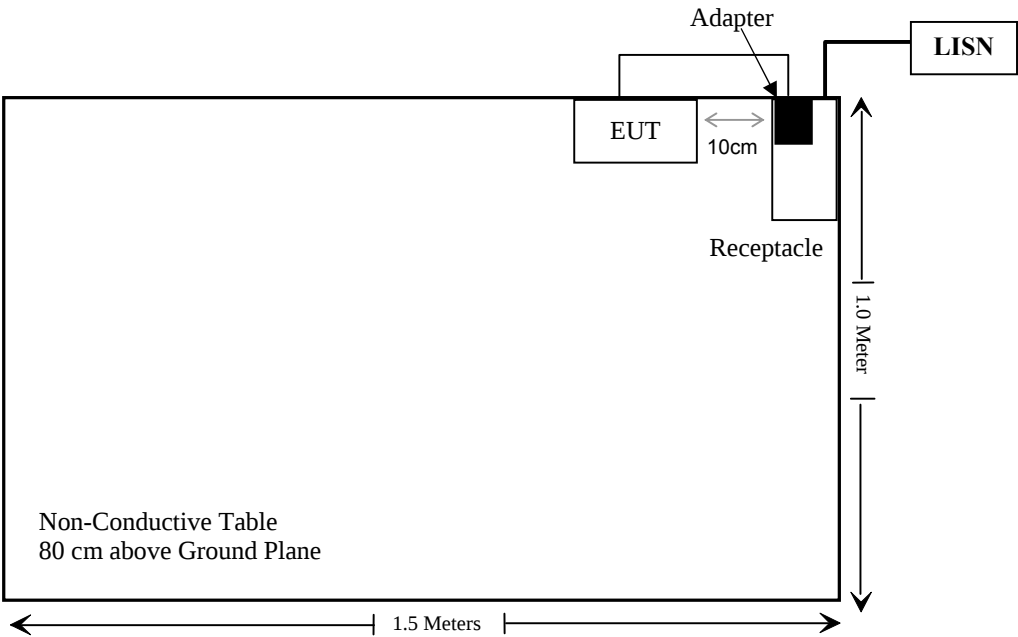
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
vonino	Adapter	RD0501000-USBA-18MG	EG216573

External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-shielding Detachable USB Cable	0.5	EUT	Adapter
Un-shielding UnDetachable AC Cable	1.0	Receptacle	LISN

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 PCB antenna which was permanently attached and the antenna gain is -3dBi, fulfill the requirement of this section. Please refer to the EUT photos.

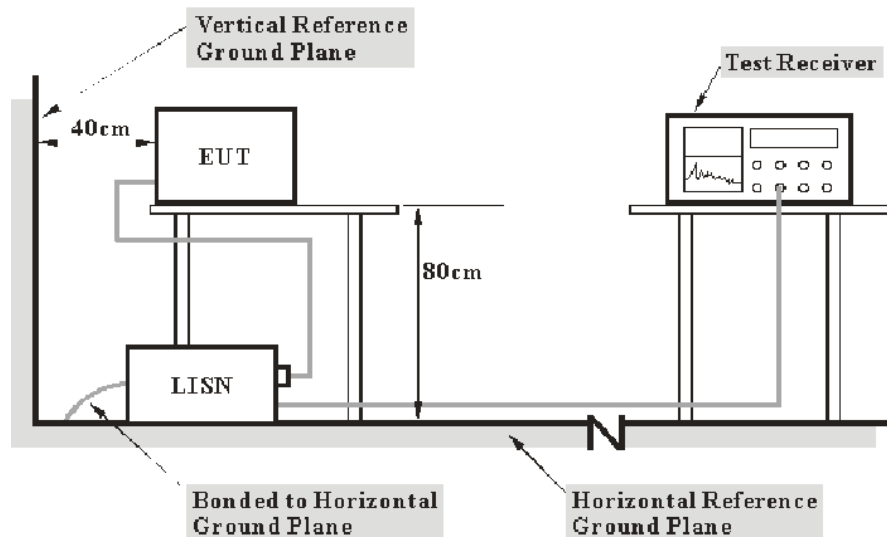
Result: Pass

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 Data

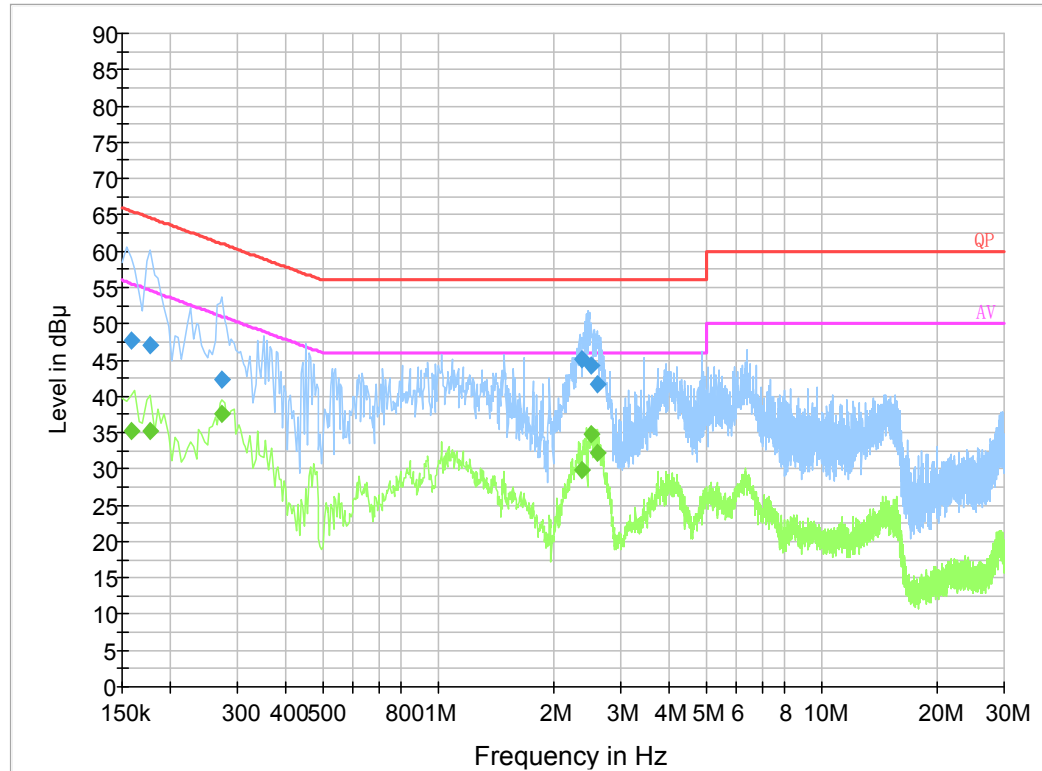
Environmental Conditions

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

The testing was performed by Haiguo Li on 2020-10-28.

Test Mode: Transmitting (worst case in middle channel)

AC 120V/60 Hz, Line

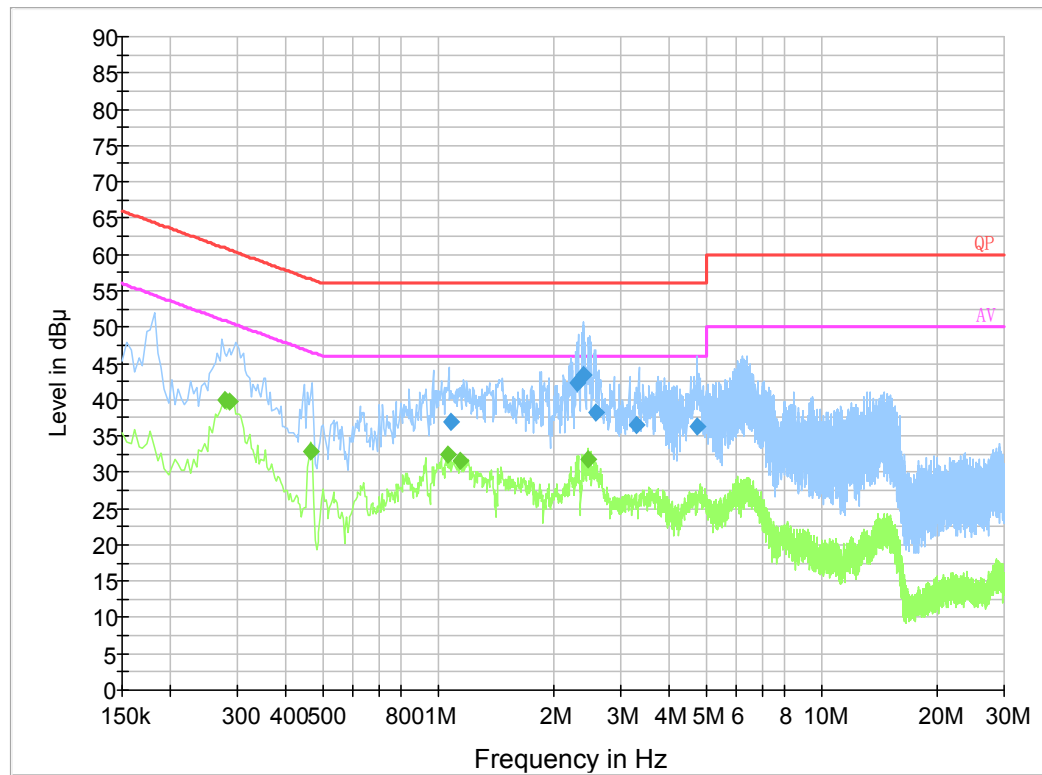


Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.158000	47.7	9.000	L1	19.8	17.9	65.6
0.177500	47.0	9.000	L1	19.9	17.6	64.6
0.273500	42.4	9.000	L1	19.8	18.6	61.0
2.370870	45.2	9.000	L1	19.9	10.8	56.0
2.500950	44.3	9.000	L1	19.8	11.7	56.0
2.594610	41.6	9.000	L1	19.9	14.4	56.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.158000	35.3	9.000	L1	19.8	20.3	55.6
0.177500	35.2	9.000	L1	19.9	19.4	54.6
0.273500	37.6	9.000	L1	19.8	13.4	51.0
2.370870	29.9	9.000	L1	19.9	16.1	46.0
2.500950	34.7	9.000	L1	19.8	11.3	46.0
2.594610	32.3	9.000	L1	19.9	13.7	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)
1.077950	37.1	9.000	N	19.8	18.9	56.0
2.307110	42.4	9.000	N	19.8	13.6	56.0
2.390090	43.3	9.000	N	19.8	12.7	56.0
2.586610	38.3	9.000	N	19.8	17.7	56.0
3.291870	36.6	9.000	N	19.9	19.4	56.0
4.726930	36.3	9.000	N	19.9	19.7	56.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.278000	40.0	9.000	N	19.7	10.9	50.9
0.286000	39.7	9.000	N	19.7	10.9	50.6
0.466000	32.9	9.000	N	19.8	13.7	46.6
1.066000	32.5	9.000	N	19.8	13.5	46.0
1.142000	31.6	9.000	N	19.8	14.4	46.0
2.474000	31.8	9.000	N	19.8	14.2	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 system was investigated from 30 MHz to 25 GHz.

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	Unknown	PK
	1 MHz	10 Hz	Unknown	Average

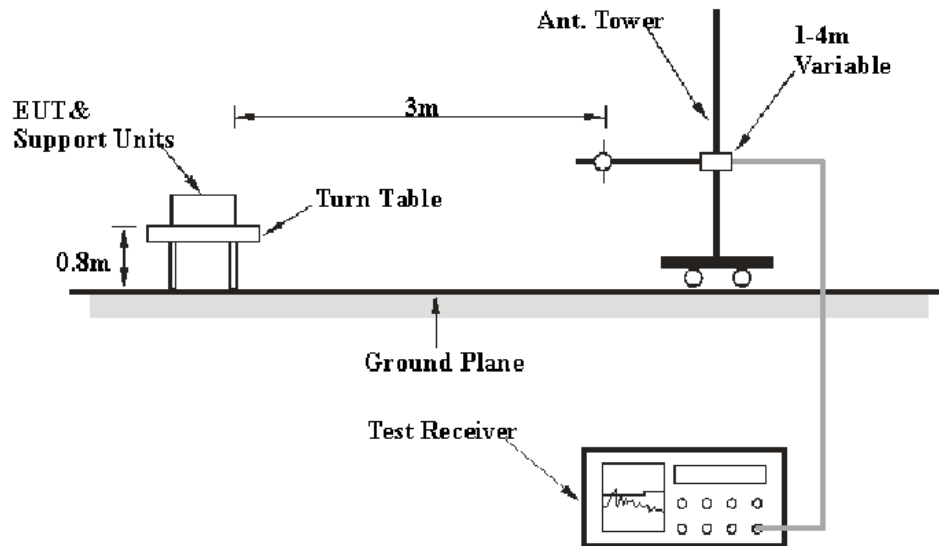
Test Procedure

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

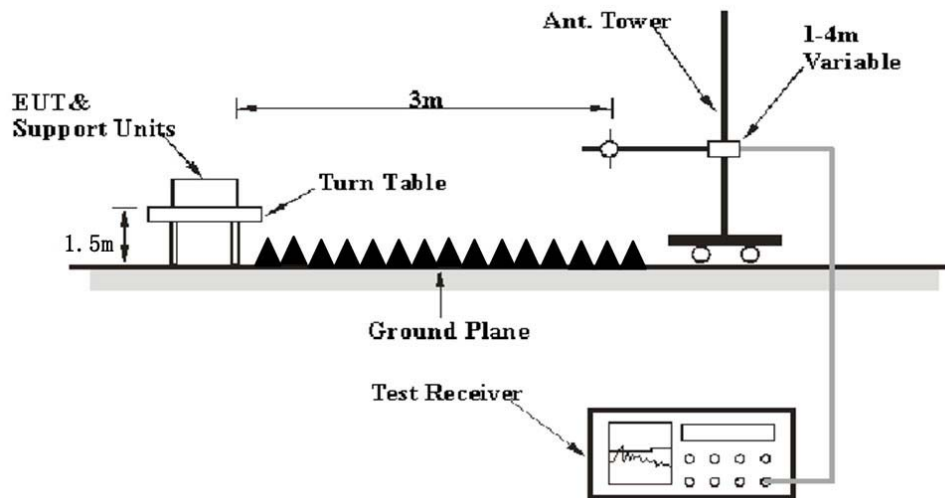
All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak and Average detection modes for frequencies above 1 GHz.

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 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:

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

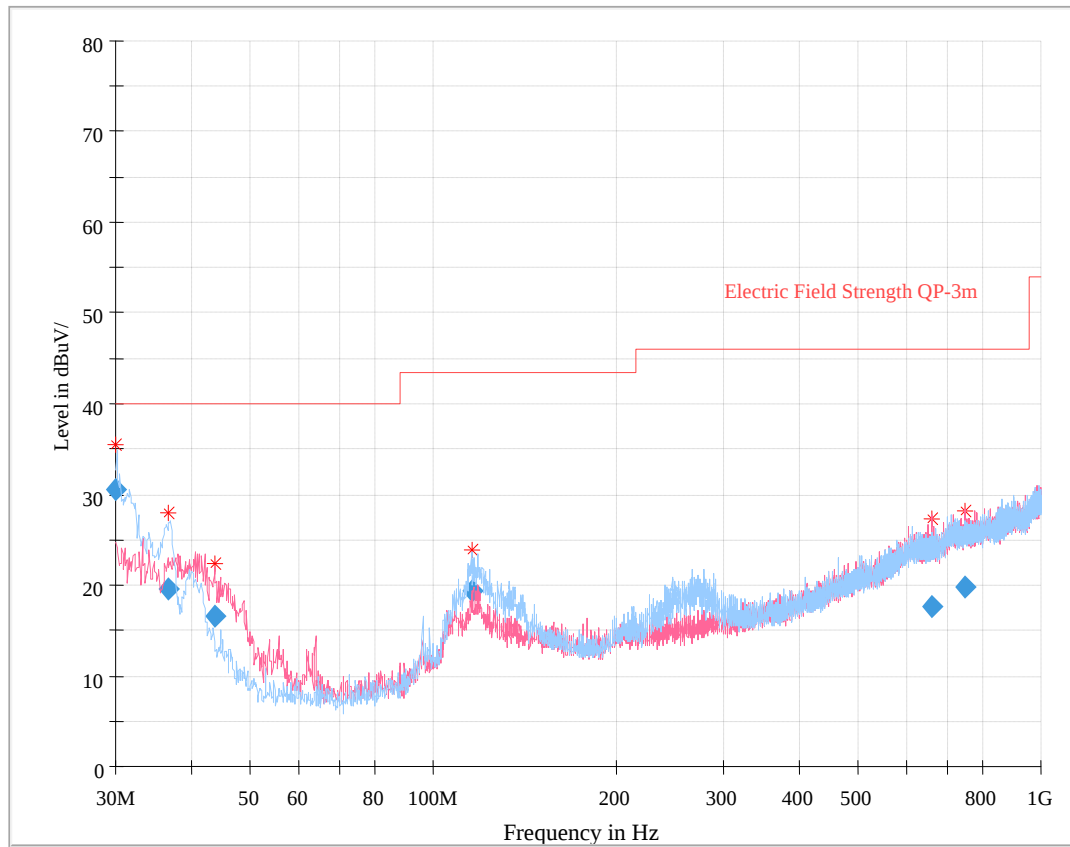
Test Data

Environmental Conditions

Temperature:	26.8~27°C
Relative Humidity:	45~55 %
ATM Pressure:	101.0~101.1 kPa

The testing was performed by Charlie Cha on 2020-10-29 for below 1GHz and by Alan He on 2020-10-24 for above 1GHz.

Test Mode: Transmitting

30MHz – 1 GHz: (worst case in middle channel)**Final Result**

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.025627	30.44	40.00	9.56	356.0	H	38.0	-4.5
36.701500	19.67	40.00	20.33	354.0	H	100.0	-8.5
43.810375	16.54	40.00	23.46	110.0	V	76.0	-13.3
115.868750	19.28	43.50	24.22	254.0	H	120.0	-11.3
662.079250	17.72	46.00	28.28	137.0	V	254.0	-1.9
752.210375	19.71	46.00	26.29	173.0	V	119.0	-0.1

1 ~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	66.27	PK	352	2.3	H	-0.36	65.91	114	48.09
2402.00	65.10	Ave.	352	2.3	H	-0.36	64.74	94	29.26
2402.00	60.27	PK	280	2.2	V	-0.36	59.91	114	54.09
2402.00	58.75	Ave.	280	2.2	V	-0.36	58.39	94	35.61
2341.25	29.19	PK	117	2.1	H	31.64	60.83	74	13.17
2341.25	14.52	Ave.	117	2.1	H	31.64	46.16	54	7.84
2491.06	29.03	PK	279	1.6	H	32.13	61.16	74	12.84
2491.06	14.33	Ave.	279	1.6	H	32.13	46.46	54	7.54
4804.00	51.10	PK	10	1.4	H	5.40	56.50	74	17.50
4804.00	44.40	Ave.	10	1.4	H	5.40	49.80	54	4.20
Middle Channel (2440MHz)									
2440.00	68.36	PK	313	2.2	H	-0.26	68.10	114	45.90
2440.00	67.50	Ave.	313	2.2	H	-0.26	67.24	94	26.76
2440.00	64.55	PK	329	2.4	V	-0.26	64.29	114	49.71
2440.00	63.50	Ave.	329	2.4	V	-0.26	63.24	94	30.76
4880.00	49.73	PK	198	1.7	H	6.43	56.16	74	17.84
4880.00	43.02	Ave.	198	1.7	H	6.43	49.45	54	4.55
High Channel (2480MHz)									
2480.00	66.12	PK	48	1.4	H	-0.15	65.97	114	48.03
2480.00	65.06	Ave.	48	1.4	H	-0.15	64.91	94	29.09
2480.00	62.68	PK	105	2.5	V	-0.15	62.53	114	51.47
2480.00	61.23	Ave.	105	2.5	V	-0.15	61.08	94	32.92
2358.34	29.38	PK	217	2.3	H	31.77	61.15	74	12.85
2358.34	14.48	Ave.	217	2.3	H	31.77	46.25	54	7.75
2495.14	29.45	PK	184	1.0	H	32.13	61.58	74	12.42
2495.14	14.54	Ave.	184	1.0	H	32.13	46.67	54	7.33
4960.00	49.99	PK	234	1.3	H	6.95	56.94	74	17.06
4960.00	43.94	Ave.	234	1.3	H	6.95	50.89	54	3.11

Note:

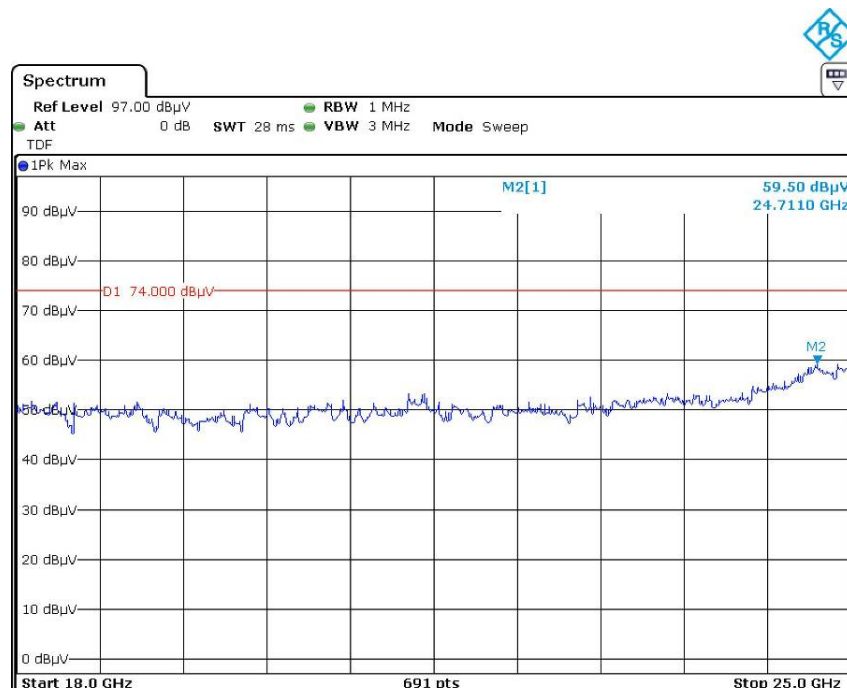
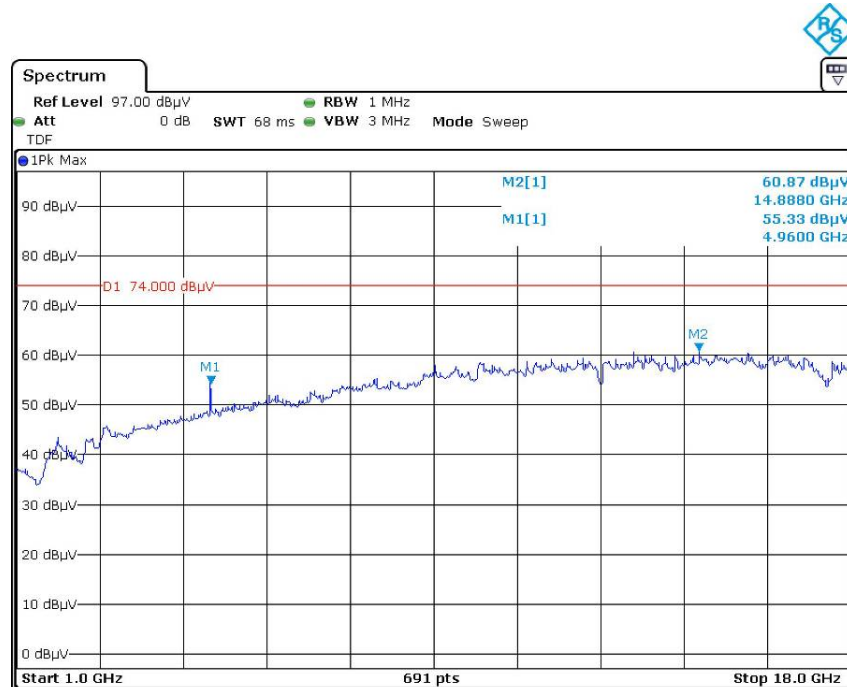
Corrected Amplitude = Corrected Factor + Reading

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

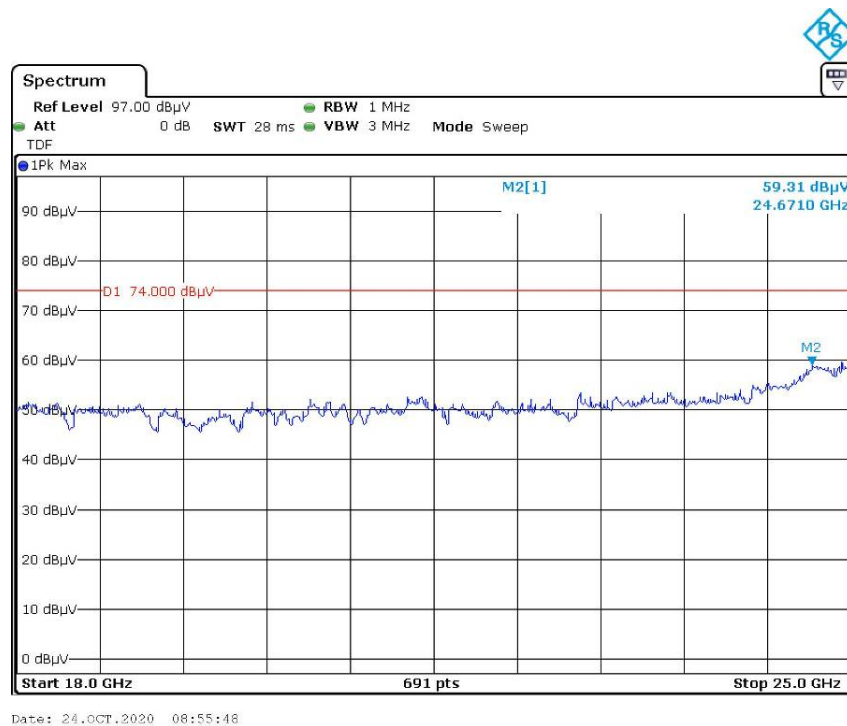
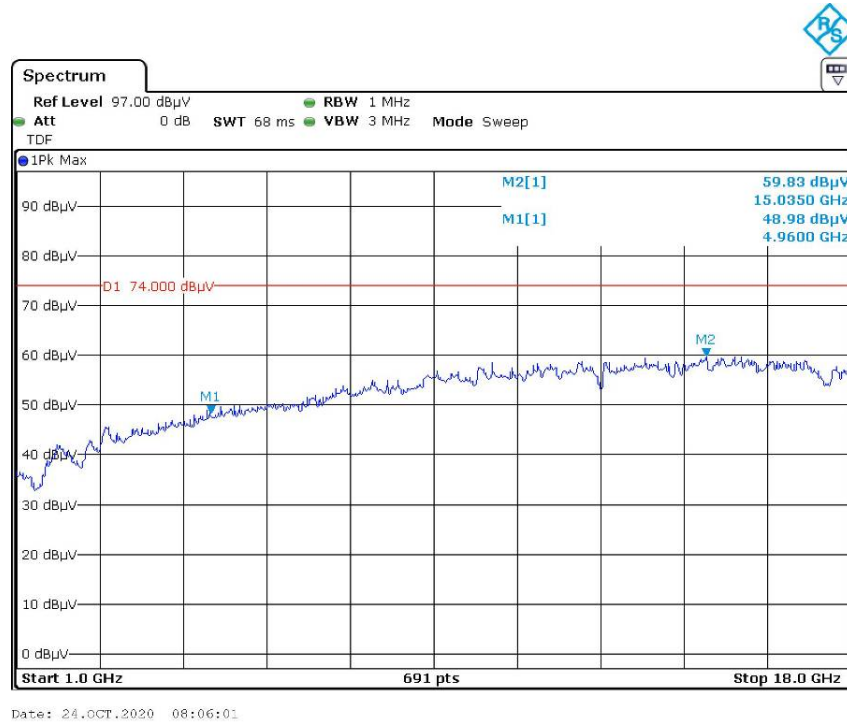
Margin = Limit- Corr. Amplitude

The emission more than 4dB below the limit was not required to be recorded.

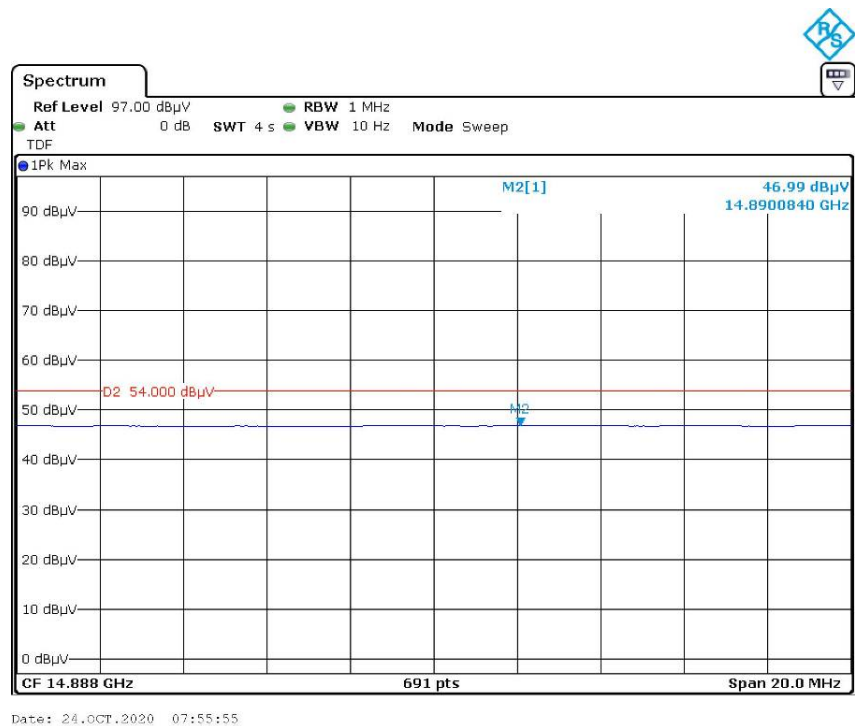
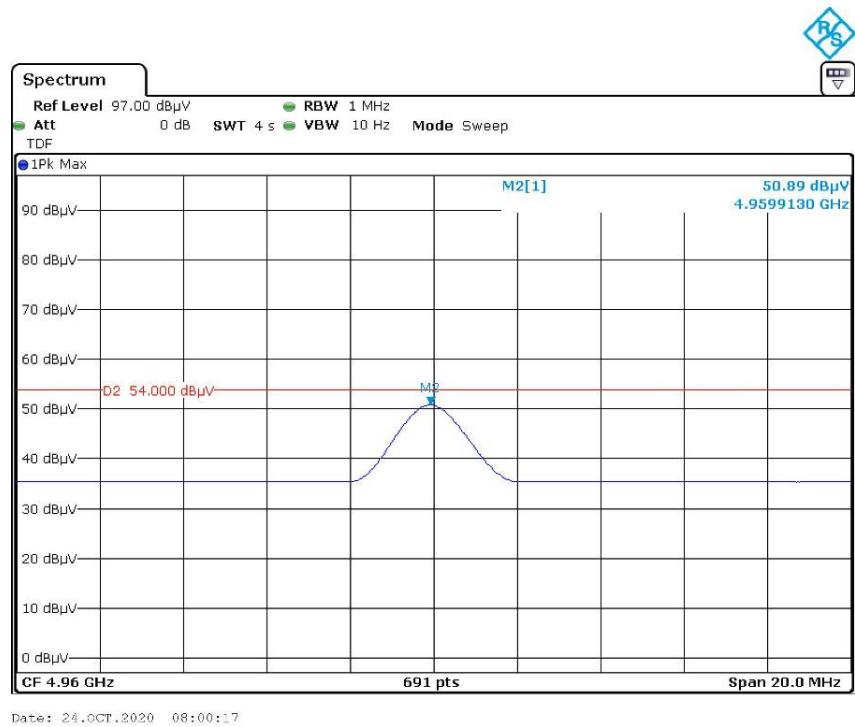
Pre-scan with High channel Peak Horizontal

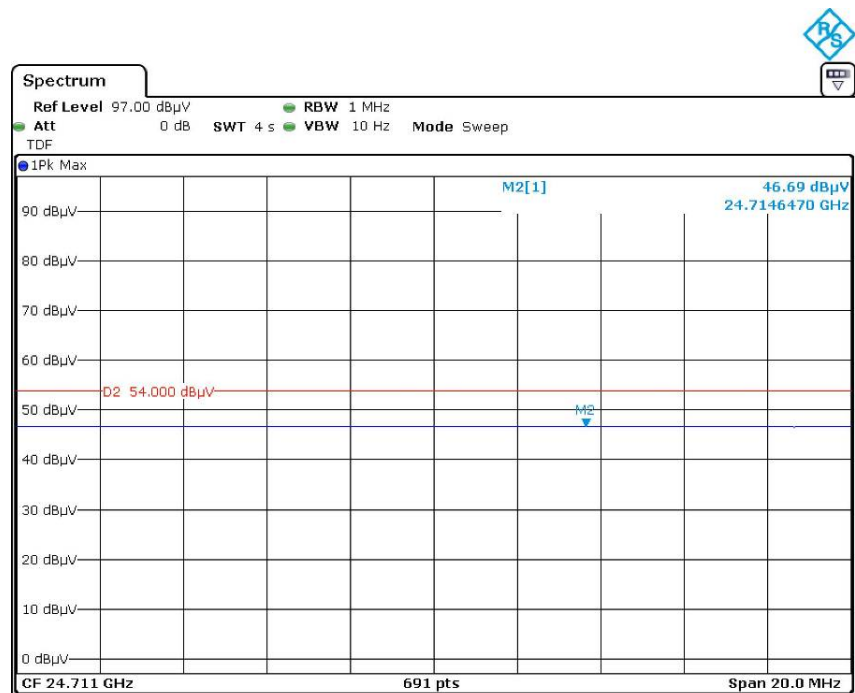


Vertical



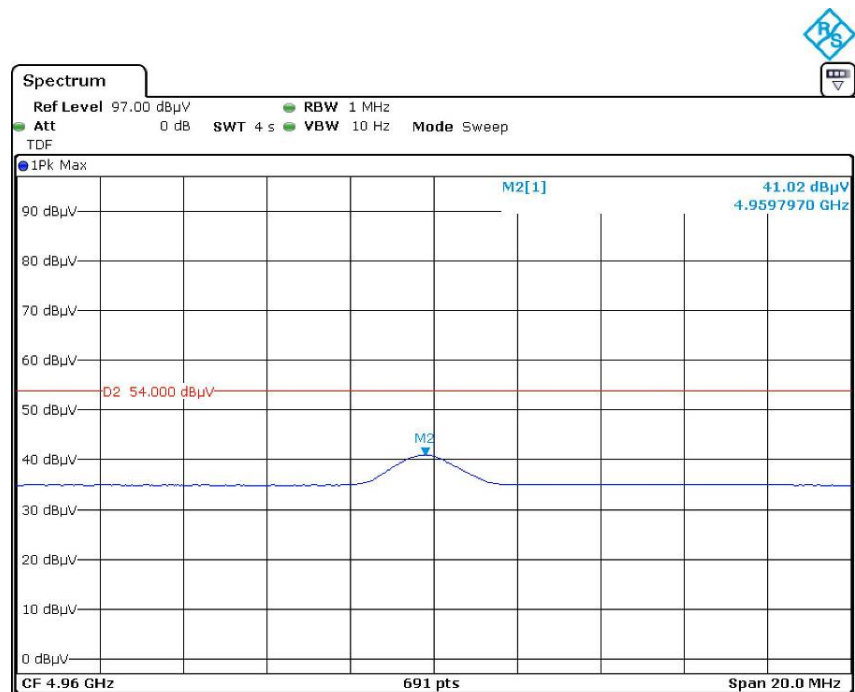
Average Horizontal



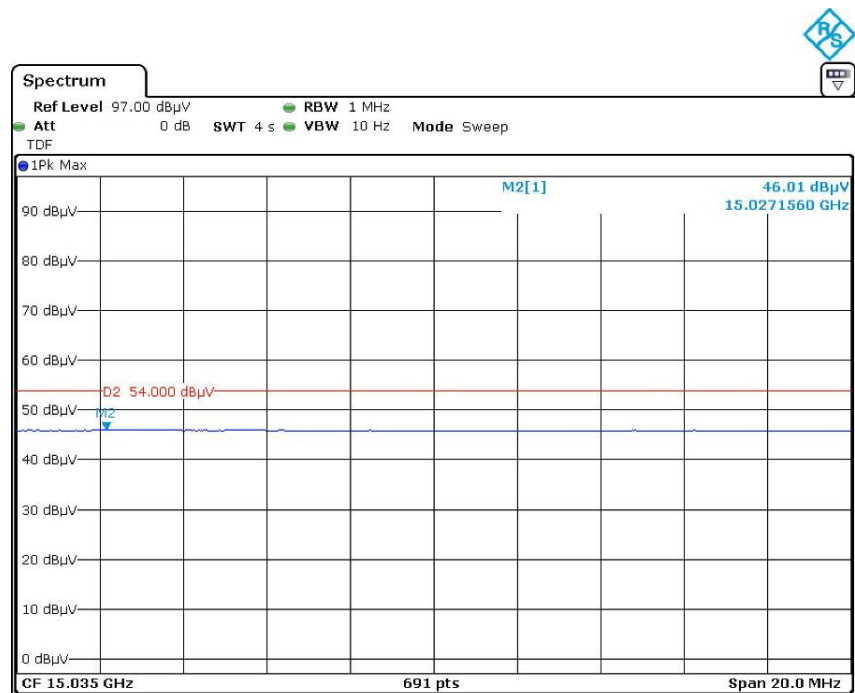


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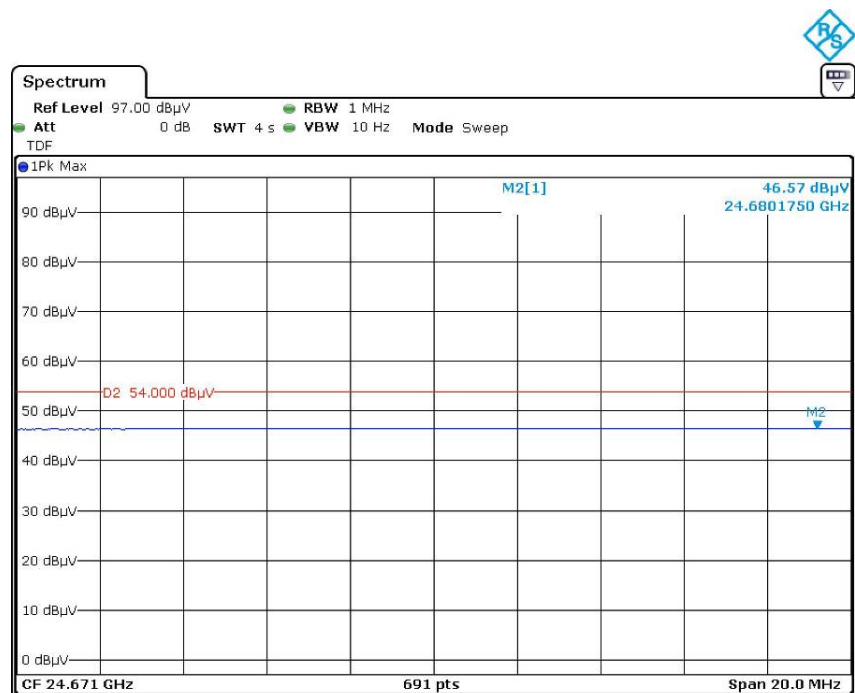
Vertical



Date: 24.OCT.2020 08:15:09



Date: 24.OCT.2020 08:10:46



Date: 24.OCT.2020 09:00:20

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

Per ANSI C63.10-2013 §6.9

Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

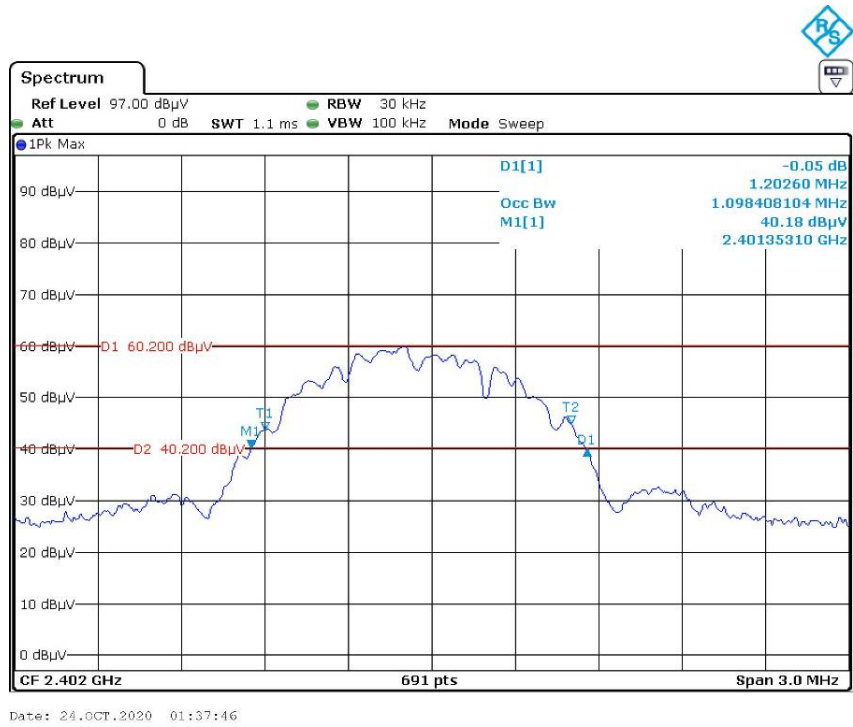
The testing was performed by Alan He on 2020-10-24.

Test Mode: Transmitting

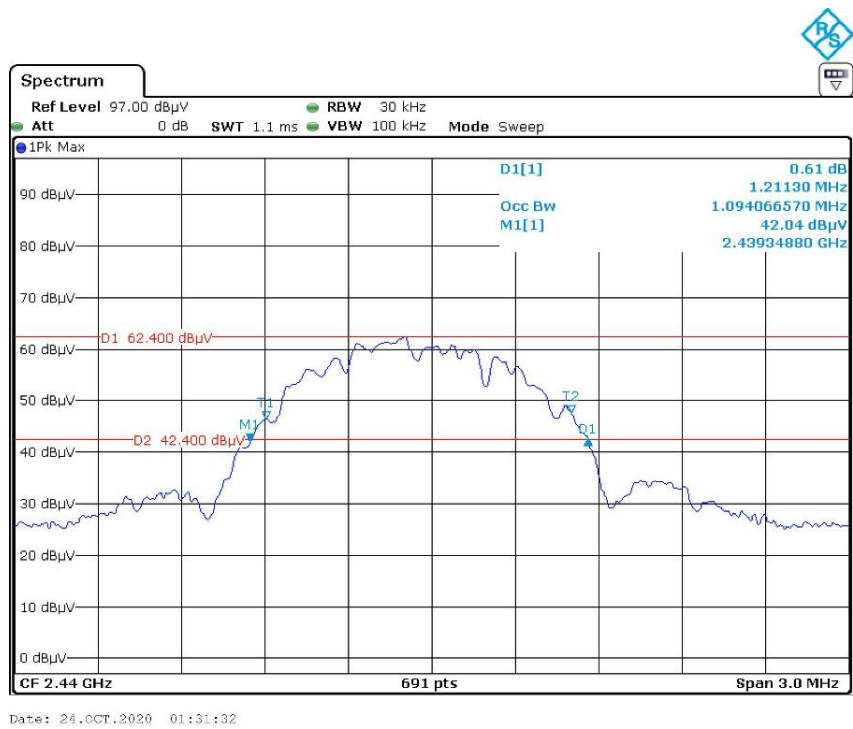
Please refer to the following table and plots.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.203
Middle	2440	1.211
High	2480	1.255

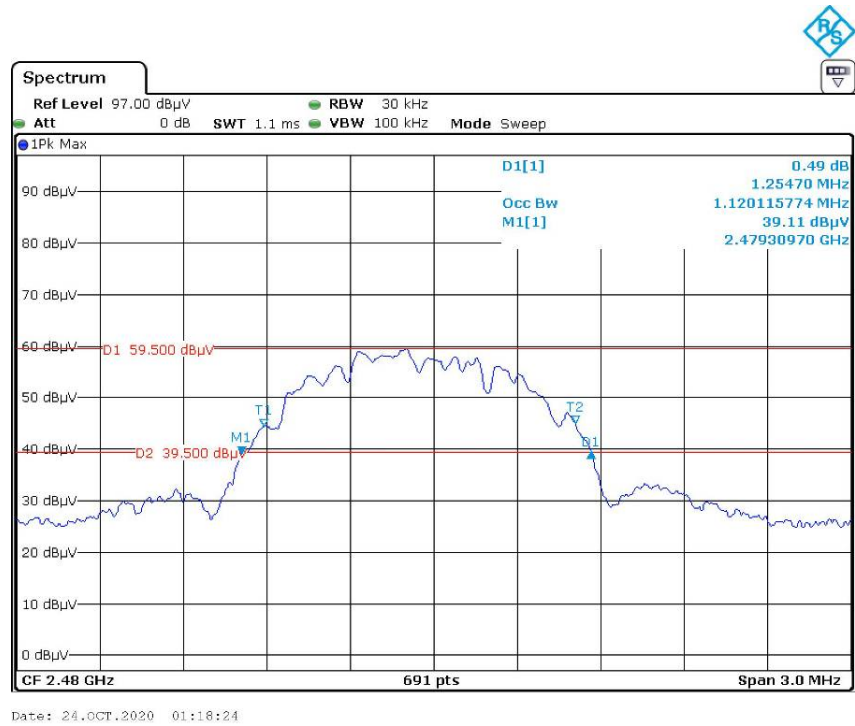
Low Channel



Middle Channel



High Channel



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