



FCC PART 15.249

TEST REPORT

For

Shenzhen VanTop Technology & Innovation Co., Ltd.

502, 5th Flr. BLDG 4, MinQi Technology Park, No. 65 Lishan Road, Taoyuan Street, Nanshan District, Shenzhen, China

FCC ID: 2AQ3A-SP600NR2420

Report Type: Original Report	Product Type: Remote
Report Number: RSZ200416817-00	
Report Date: 2020-05-08	
Reviewed By:	Jacob Kong <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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TABLE OF CONTENTS

GENERAL INFORMATION.....	3
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
OBJECTIVE	3
RELATED SUBMITTAL(S)/GRANT(S).....	3
TEST METHODOLOGY	3
MEASUREMENT UNCERTAINTY.....	4
TEST FACILITY	4
SYSTEM TEST CONFIGURATION.....	5
JUSTIFICATION	5
EUT EXERCISE SOFTWARE	5
EQUIPMENT MODIFICATIONS	5
SUPPORT EQUIPMENT LIST AND DETAILS	5
SUPPORT CABLE DESCRIPTIONS.....	5
BLOCK DIAGRAM OF TEST SETUP	6
SUMMARY OF TEST RESULTS.....	7
TEST EQUIPMENT LIST	8
FCC§15.203 - ANTENNA REQUIREMENT.....	9
APPLICABLE STANDARD	9
ANTENNA CONNECTOR CONSTRUCTION	9
FCC §15.207 – AC LINE CONDUCTED EMISSIONS.....	10
APPLICABLE STANDARD	10
EUT SETUP	10
EMI TEST RECEIVER SETUP.....	10
TEST PROCEDURE	10
CORRECTED FACTOR & MARGIN CALCULATION	11
TEST RESULTS SUMMARY	11
TEST DATA	11
FCC§15.205, §15.209 & §15.249(D) - RADIATED EMISSIONS.....	14
APPLICABLE STANDARD	14
TEST EQUIPMENT SETUP	14
EUT SETUP	15
TEST PROCEDURE	16
CORRECTED AMPLITUDE & MARGIN CALCULATION	16
TEST RESULTS SUMMARY	16
TEST DATA	16
FCC§15.215(C) - 20DB EMISSION BANDWIDTH	22
APPLICABLE STANDARD	22
TEST PROCEDURE	22
TEST DATA	22

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Remote
Tested Model	SP600NR
Multiple Model	SP520R, SP530R, SP550R, SP610R, SP620R, SP700R, SP7100R, SP7300R, SP7500R, A10R, A16R, A18R, A20R
Model Difference	Refer to the DoS letter
Frequency Range	2405~2475MHz
Antenna Specification	2dBi
Voltage Range	DC 3.7V batteries
Date of Test	2020/04/27~2020/05/04
Sample serial number	RSZ200416817-RF-S1 (Assigned by BACL, Shenzhen)
Received date	2020/04/16
Sample/EUT Status	Good condition

Objective

This type approval report is prepared on behalf of *Shenzhen VanTop Technology & Innovation Co., Ltd.* 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.

Related Submittal(s)/Grant(s)

Part of system submission with FCC ID: 2AQ3A-SP600NQ0520.

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.

Channel List:

Channel	Frequency (MHz)
0	2405
1	2445
2	2475

Channel 0, Channel 1 and Channel 2 were selected for testing.

EUT Exercise Software

No exercise software was used.

Equipment Modifications

No modifications were made to the unit tested.

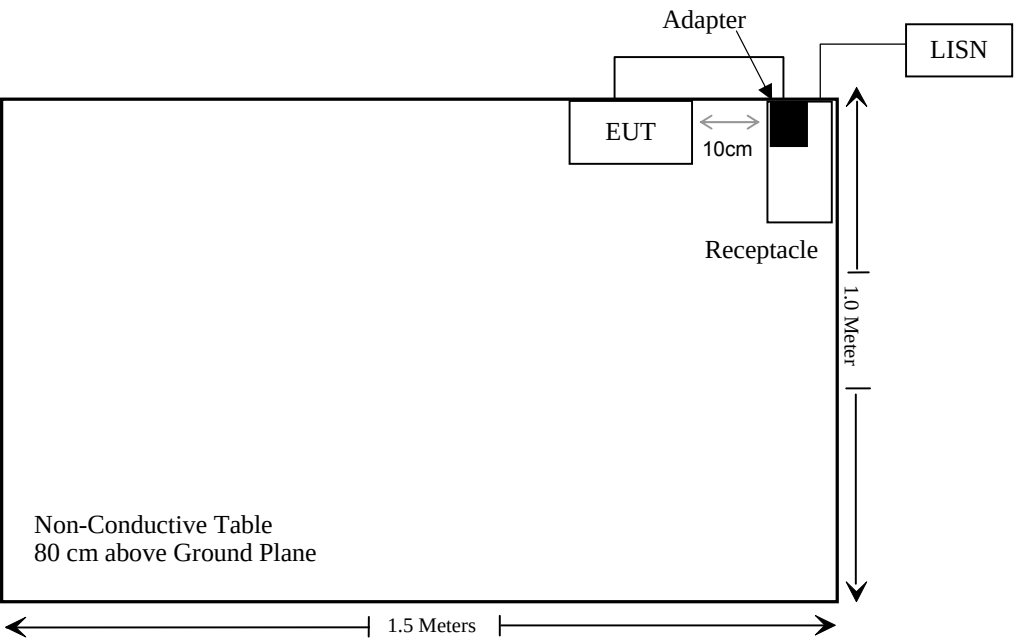
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
BLU	Adapter	EU-01-004	Unknown

Support Cable Descriptions

Cable Description	Length (m)	From/Port	To
Un-shielding Detachable USB Cable	0.4	EUT	Adapter

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	2019/7/9	2020/7/8
Rohde & Schwarz	LISN	ENV216	101613	2020/1/22	2021/1/21
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	2019/7/9	2020/7/8
Sonoma instrument	Pre-amplifier	310 N	186238	2020/4/20	2021/4/20
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	2019/7/22	2020/07/21
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	2020/4/20	2021/4/20
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-02 1304	2017/12/6	2020/12/5

* **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 integrated antenna which was permanently attached and the antenna gain is 2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

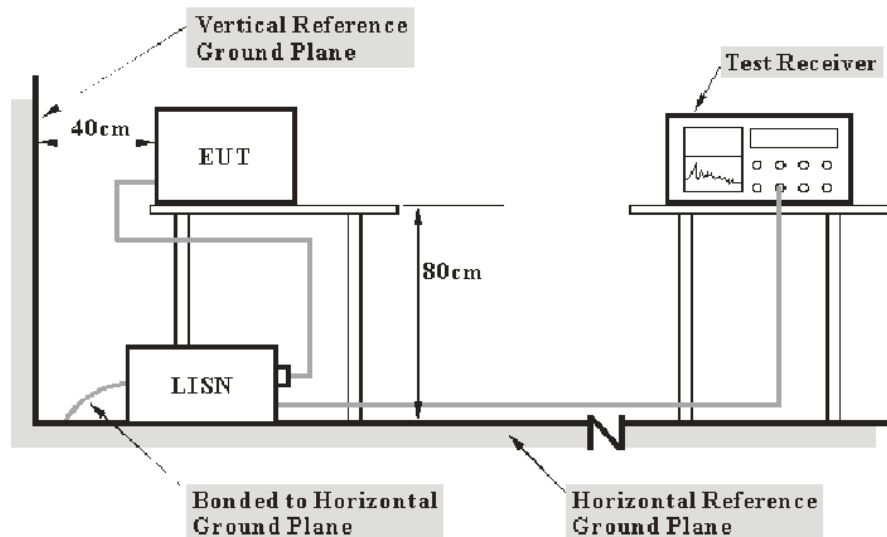
Result: Compliance.

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,

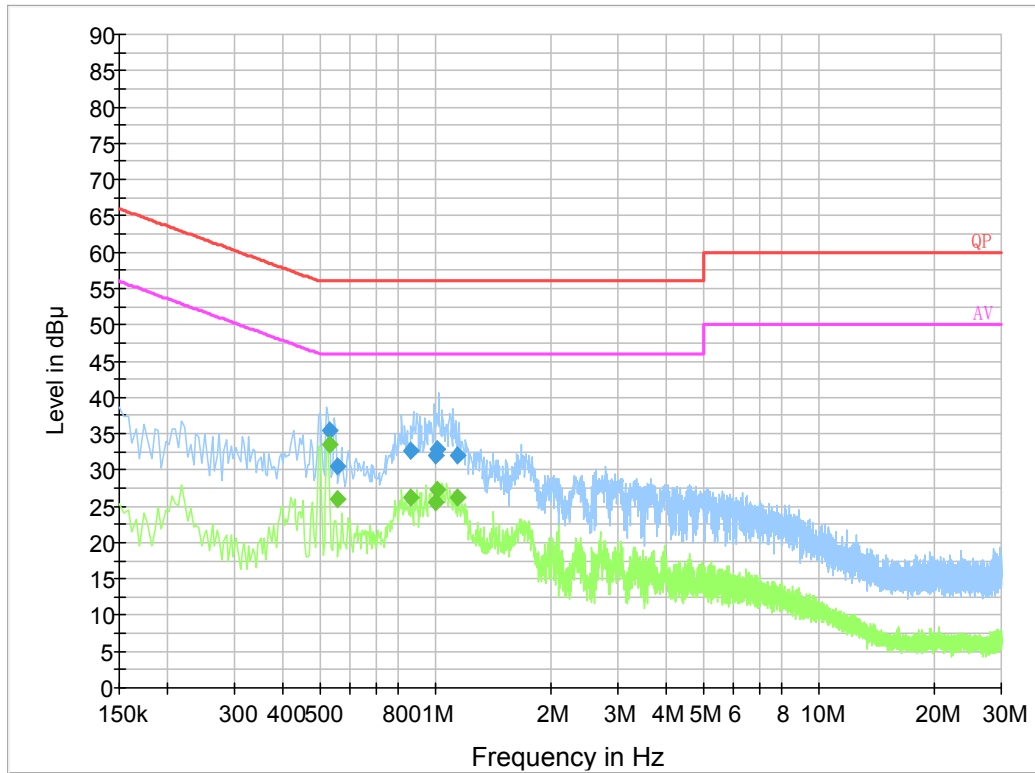
Test Data

Environmental Conditions

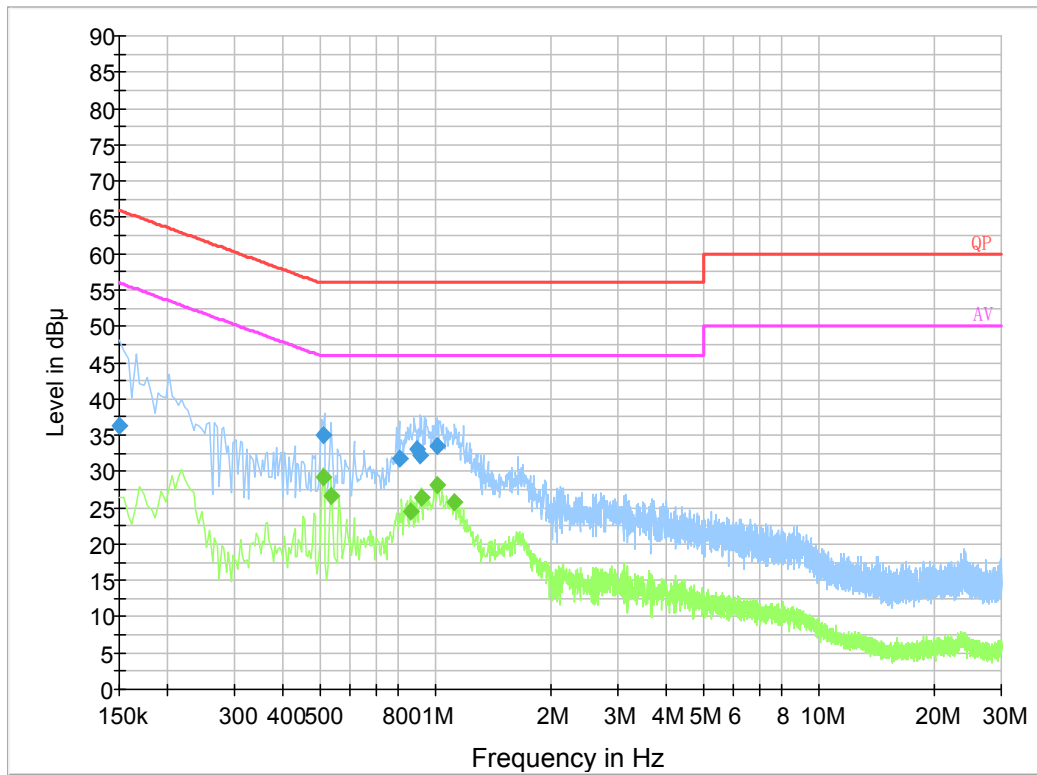
Temperature:	25 °C
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2020-04-27.

EUT Operation Mode: Charging&Transmitting

AC 120V/60 Hz, Line

Frequency (MHz)	Corrected Amplitude (dBμV)	Corrected Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/QP/Ave.)
0.529830	35.4	19.8	56.0	20.6	QP
0.553810	30.5	19.8	56.0	25.5	QP
0.864830	32.7	19.8	56.0	23.3	QP
1.006670	32.0	19.9	56.0	24.0	QP
1.011030	32.9	19.9	56.0	23.1	QP
1.148990	31.9	19.8	56.0	24.1	QP
0.529830	33.5	19.8	46.0	12.5	Ave.
0.553810	25.9	19.8	46.0	20.1	Ave.
0.864830	26.1	19.8	46.0	19.9	Ave.
1.006670	25.6	19.9	46.0	20.4	Ave.
1.011030	27.4	19.9	46.0	18.6	Ave.
1.148990	26.1	19.8	46.0	19.9	Ave.

AC 120V/60 Hz, Neutral

Frequency (MHz)	Corrected Amplitude (dBμV)	Corrected Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/QP/Ave.)
0.150000	36.3	19.8	66.0	29.7	QP
0.510290	35.0	19.8	56.0	21.0	QP
0.805910	31.8	19.8	56.0	24.2	QP
0.895230	33.0	19.7	56.0	23.0	QP
0.916290	32.3	19.7	56.0	23.7	QP
1.014790	33.5	19.8	56.0	22.5	QP
0.510000	29.2	19.8	46.0	16.8	Ave.
0.538000	26.7	19.8	46.0	19.3	Ave.
0.862000	24.4	19.8	46.0	21.6	Ave.
0.922000	26.4	19.8	46.0	19.6	Ave.
1.014000	28.1	19.8	46.0	17.9	Ave.
1.126000	25.9	19.8	46.0	20.1	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 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 1GHz	1 MHz	3 MHz	/	PK

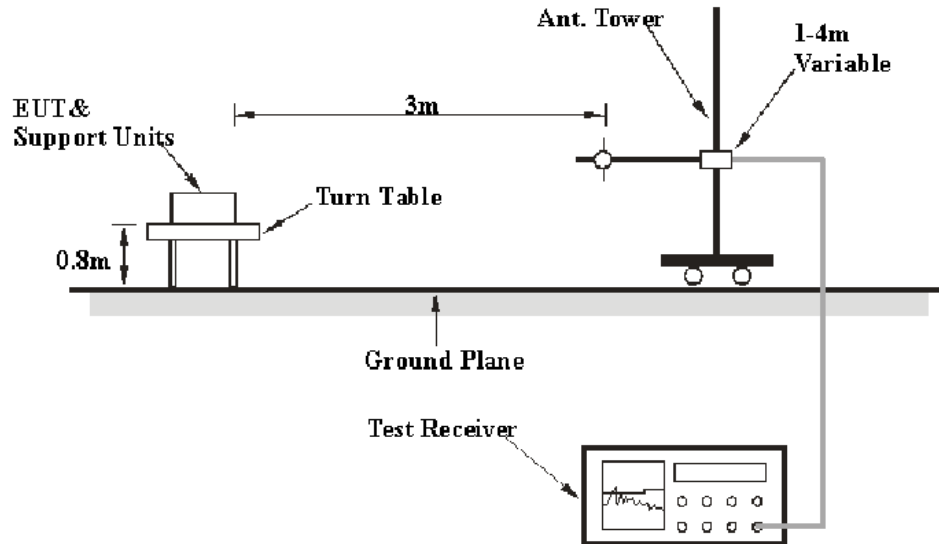
Test Procedure

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

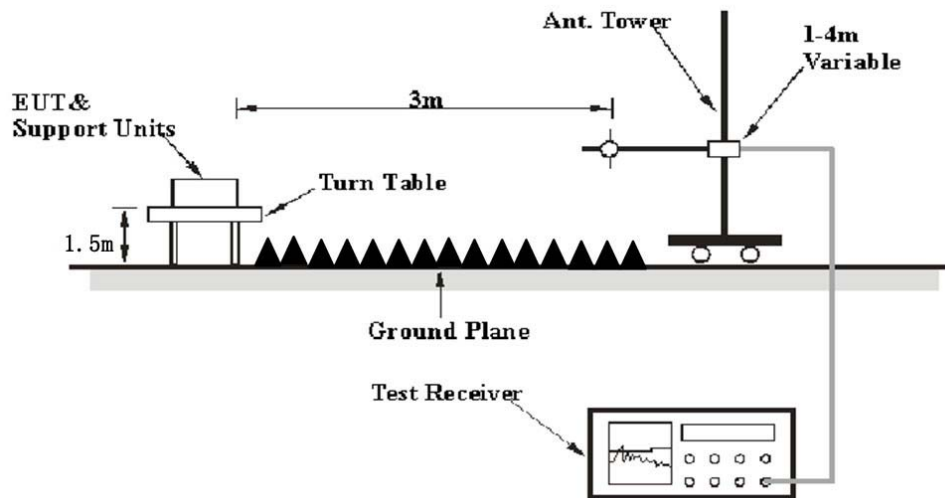
All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak mode for frequencies above 1 GHz.

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 Results Summary

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

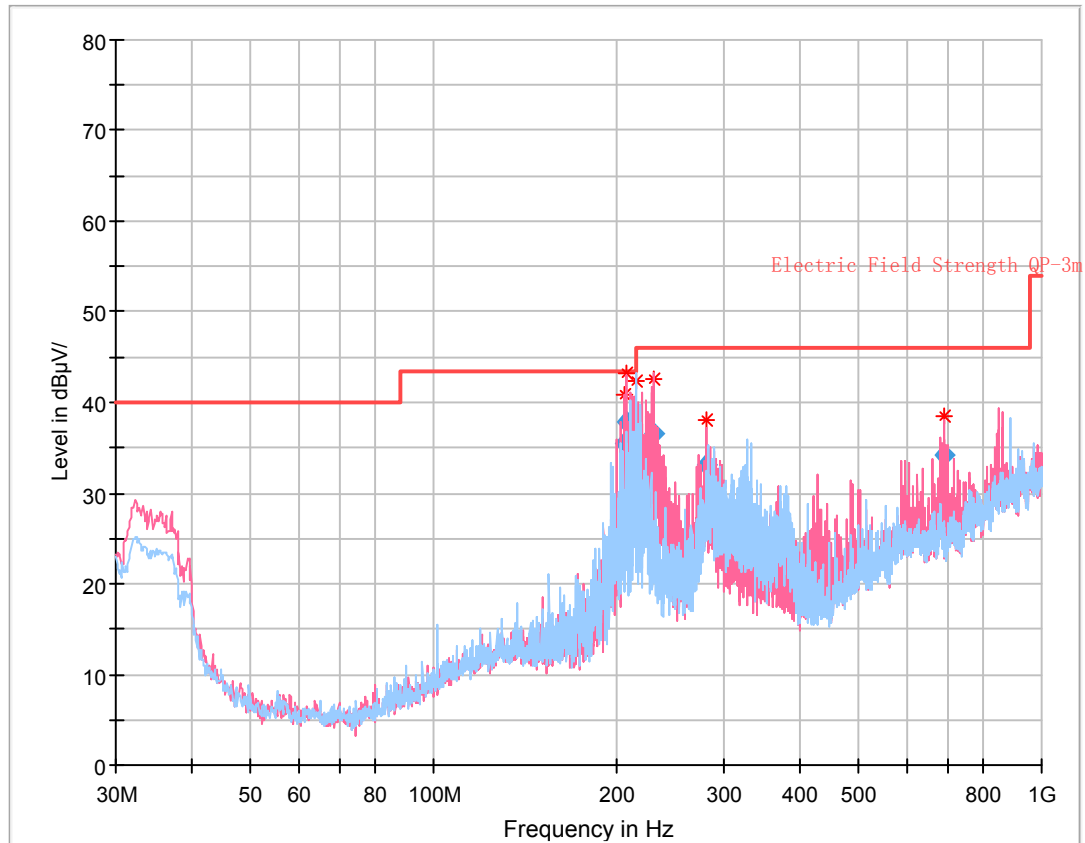
Test Data

Environmental Conditions

Temperature:	26 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Hans He on 2020-04-30 for below 1GHz and by Leven Gan on 2020-05-04 for above 1GHz.

Test Mode: Transmitting

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

Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
205.923375	35.59	215.0	V	0.0	-13.9	43.50	7.91
208.072000	37.86	200.0	V	347.0	-13.9	43.50	5.64
215.301375	35.34	143.0	H	277.0	-13.9	43.50	8.16
229.647875	36.62	195.0	V	20.0	-14.0	46.00	9.38
280.079250	33.02	126.0	V	45.0	-12.0	46.00	12.98
691.391500	34.28	149.0	V	210.0	-1.3	46.00	11.72

Above 1 GHz:**Peak**

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	40.53	PK	241	2.0	H	31.87	72.40	114	41.60
2405.00	39.31	PK	101	2.1	V	31.87	71.18	114	42.82
2398.37	27.66	PK	318	1.4	H	31.87	59.53	74	14.47
2484.06	27.47	PK	31	1.9	H	32.13	59.60	74	14.40
4810.00	52.20	PK	252	1.7	H	6.28	58.48	74	15.52
Middle Channel (2445 MHz)									
2445.00	39.62	PK	100	1.8	H	31.97	71.59	114	42.41
2445.00	38.74	PK	138	1.3	V	31.97	70.71	114	43.29
4890.00	52.12	PK	73	2.5	H	6.28	58.40	74	15.60
High Channel (2475 MHz)									
2475.00	39.76	PK	208	1.7	H	32.13	71.89	114	42.11
2475.00	37.04	PK	49	2.5	V	32.13	69.17	114	44.83
2397.54	27.82	PK	353	1.7	H	31.87	59.69	74	14.31
2484.61	27.74	PK	212	1.3	H	32.13	59.87	74	14.13
4950.00	51.17	PK	79	2.3	H	6.80	57.97	74	16.03

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.

Average

Frequency	Peak value@3m	Rx Antenna	Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249&15.209	
(MHz)		Polar (H / V)			Limit (dBμV/m)	Margin (dB)
Low Channel(2405MHz)						
2405.00	72.40	H	-15.56	56.84	94	37.16
2405.00	71.18	V	-15.56	55.62	94	38.38
2398.37	59.53	H	-15.56	43.97	54	10.03
2484.06	59.60	H	-15.56	44.04	54	9.96
4810.00	58.48	H	-15.56	42.92	54	11.08
Middle Channel(2445MHz)						
2445.00	71.59	H	-15.56	56.03	94	37.97
2445.00	70.71	V	-15.56	55.15	94	38.85
4890.00	58.40	H	-15.56	42.84	54	11.16
High Channel(2475 MHz)						
2475.00	71.89	H	-15.56	56.33	94	37.67
2475.00	69.17	V	-15.56	53.61	94	40.39
2397.54	59.69	H	-15.56	44.13	54	9.87
2484.61	59.87	H	-15.56	44.31	54	9.69
4950.00	57.97	H	-15.56	42.41	54	11.59

Note:

Corrected Amplitude = Corrected Factor + Reading

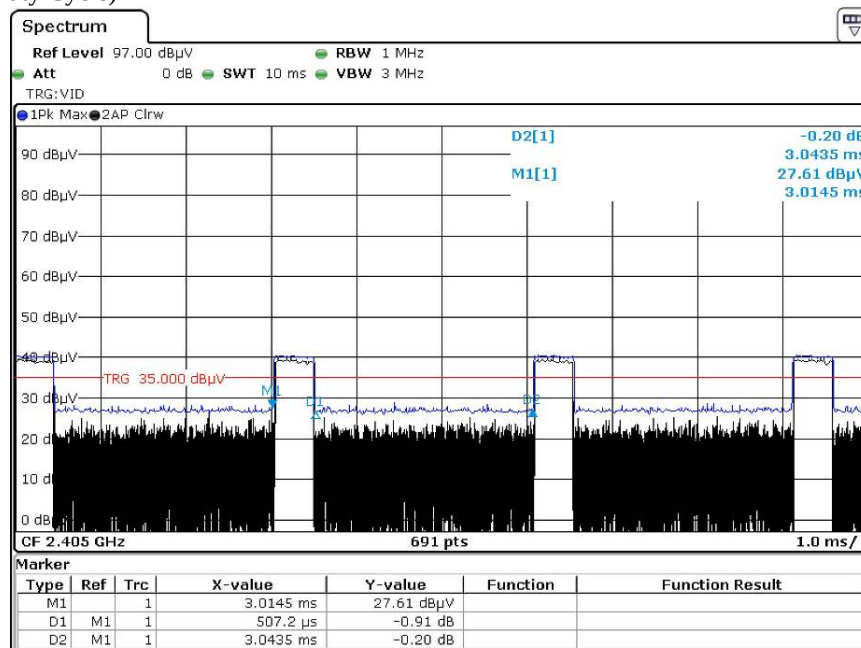
Corrected Factor=Antenna factor (RX) +cable loss – amplifier factor

Margin = Limit- Corr. Amplitude

Duty Cycle = Ton/Tp*100%, Ton =0.507ms, Tp= 3.044ms

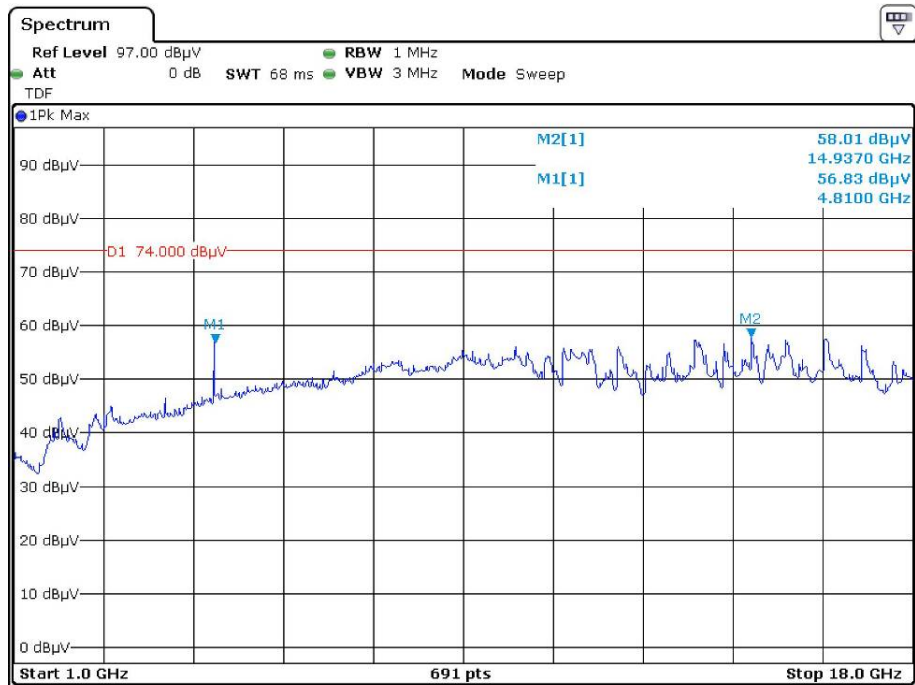
Duty Cycle Factor = 20lg(Duty Cycle) = -15.56

AV=PK+20*Ig(Duty Cycle)

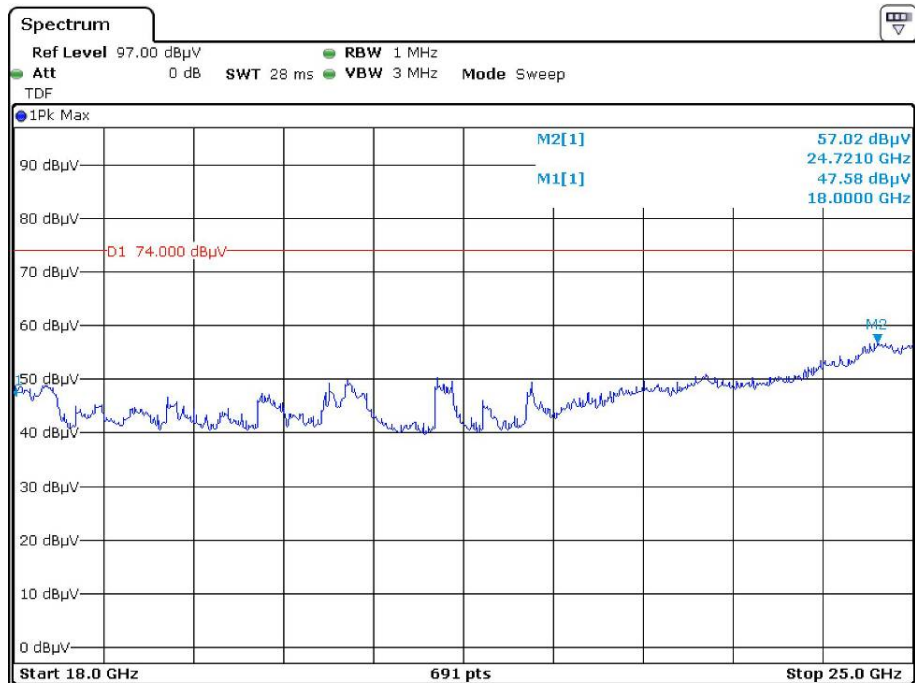


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Pre-scan with Low channel Peak
Horizontal

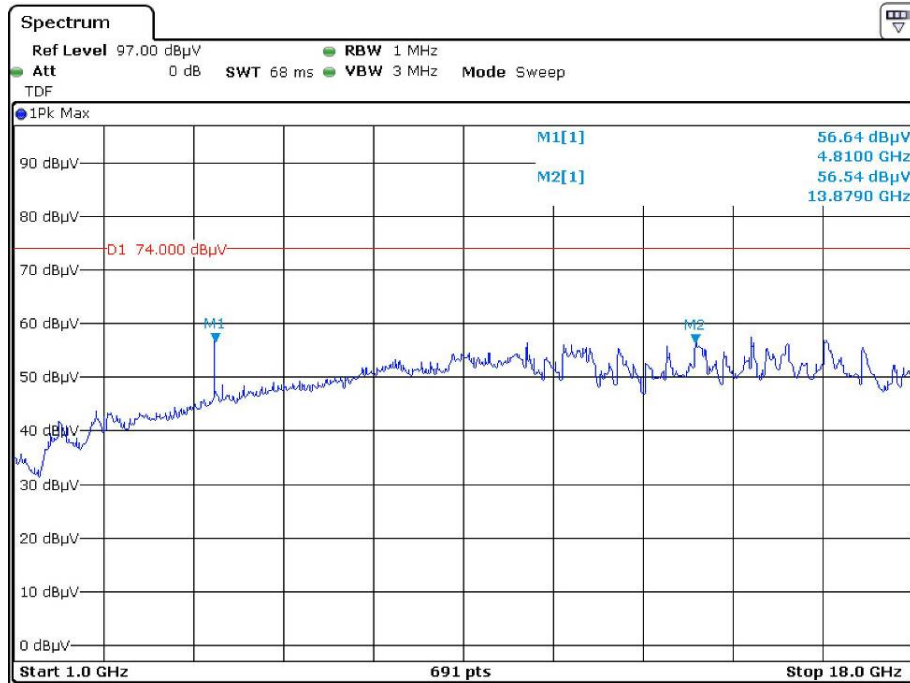


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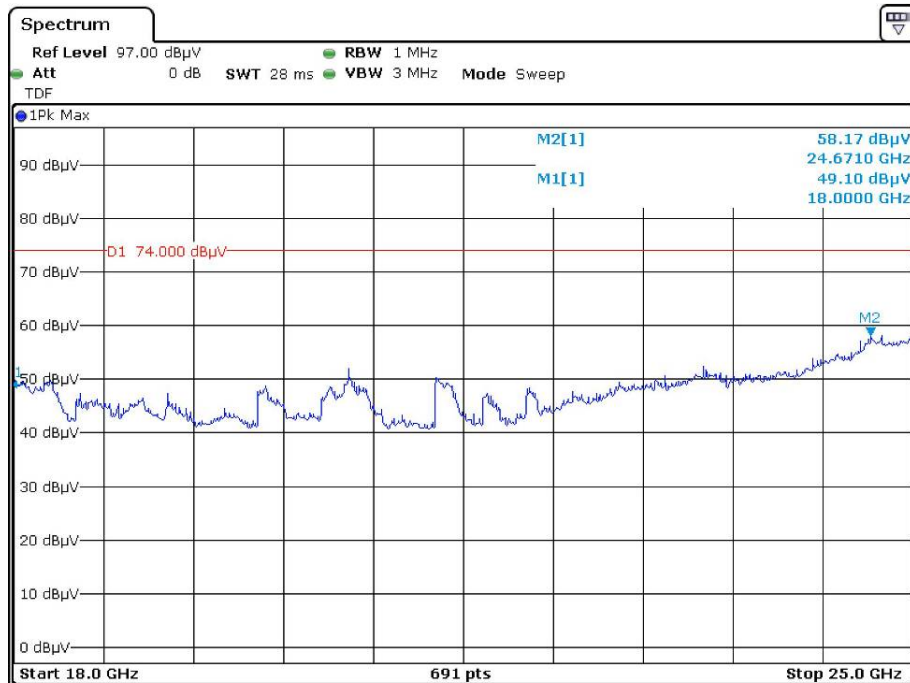


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Vertical



Date: 4.MAY.2020 19:30:06



Date: 4.MAY.2020 19:35:35

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 §6.4 & §6.9.

Test Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

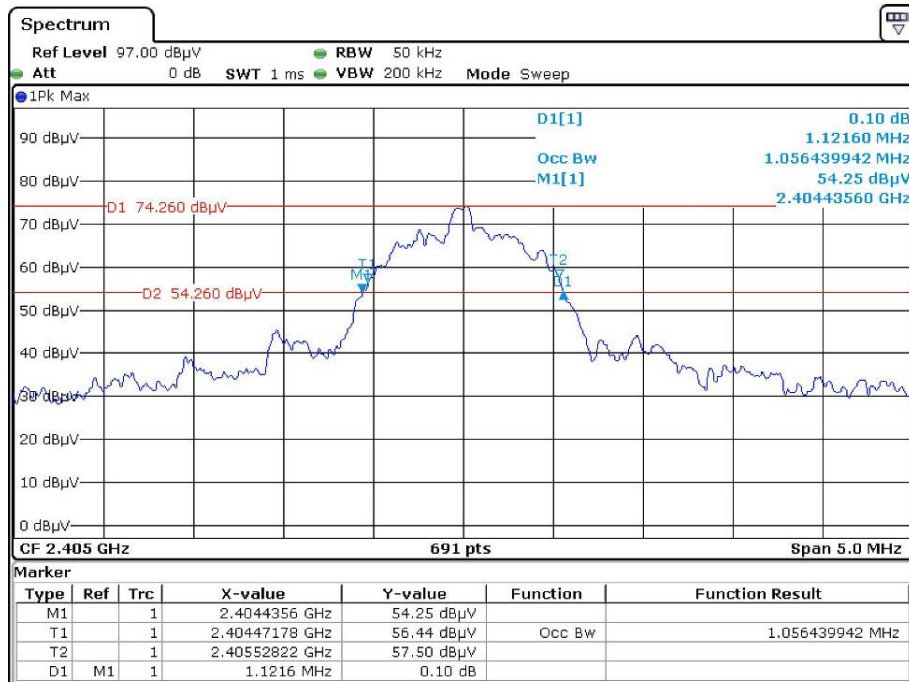
The testing was performed by Charlie Cha on 2020-05-04.

Test Mode: Transmitting

Please refer to the following table and plots.

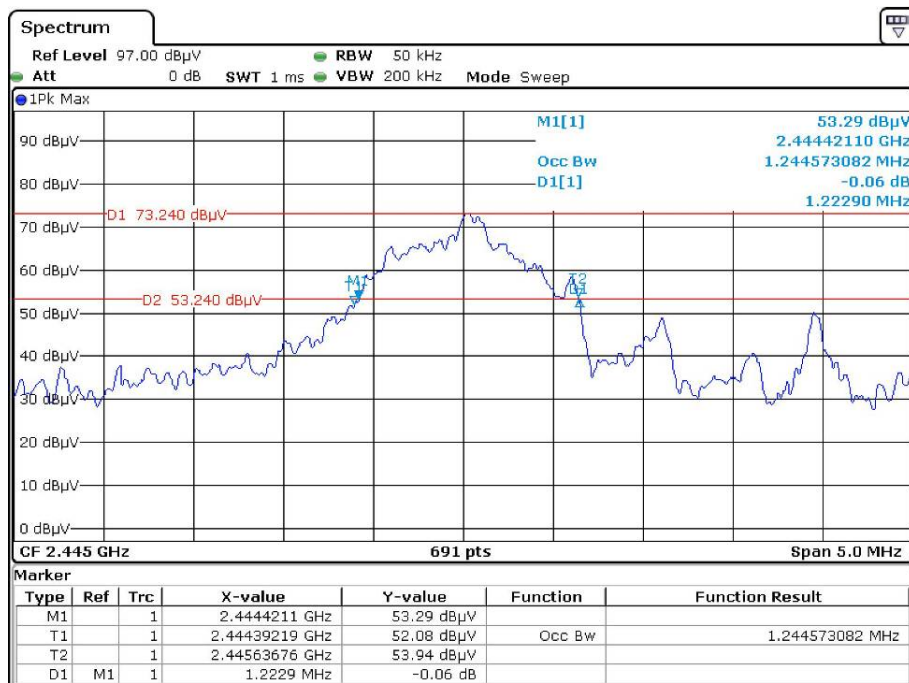
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2405	1.122
Middle	2445	1.223
High	2475	1.592

Low Channel



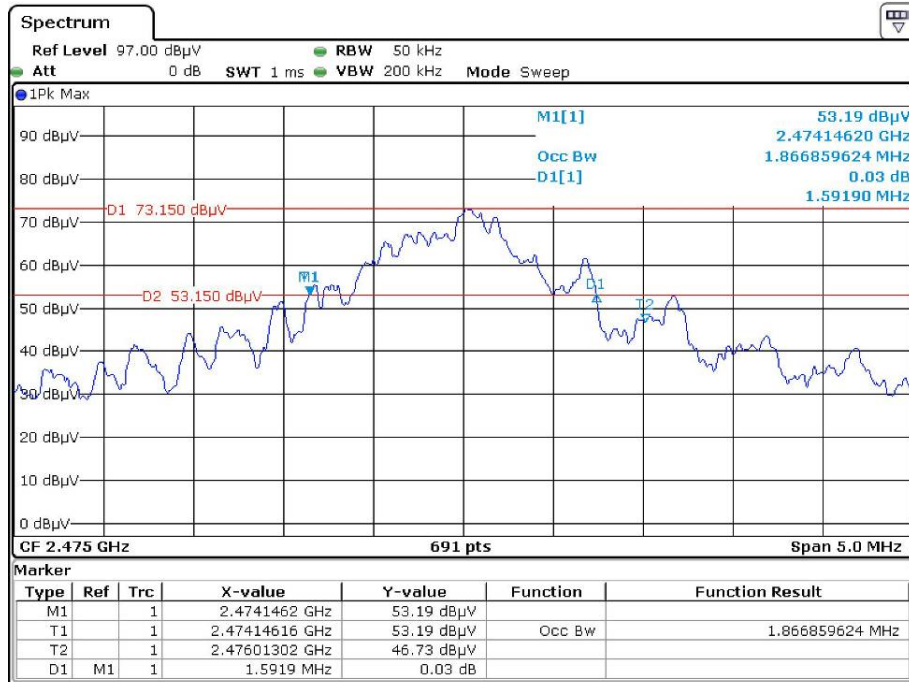
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Middle Channel



Date: 4.MAY.2020 18:52:40

High Channel



Date: 4.MAY.2020 18:47:21

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