

FCC PART 15.249 TEST REPORT

For

DewertOkin GmbH

Weststr. 1, 32278 Kirchlingern, Germany

FCC ID: O3YENS

Report Type: Original Report	Product Type: RF-ENHANCE-ANGLE
Report Number: RSZ200319553-00	
Report Date: 2020-05-19	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	RF-ENHANCE-ANGLE
Tested Model	ENS20
Multiple Model	ENS18
Model different	Refer to the DOS
Frequency Range	2406.975-2457.415MHz
Maximum Field Strength	87.81dBuV/m@3m
Antenna Specification	0dBi
Voltage Range	DC 3*1.5V batteries
Date of Test	2020-04-02 to 2020-05-07
Sample serial number	RSZ200319553-RF-S1 for ENS20, RSZ200319553-RF-S2 for ENS18 (Assigned by BACL, Shenzhen)
Received date	2020/03/19
Sample/EUT Status	Good condition

Objective

This type approval report is prepared on behalf of *DewertOkin GmbH* 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.

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

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	Freq.(MHz)	Channel	Freq.(MHz)	Channel	Freq.(MHz)	Channel	Freq.(MHz)
1	2406.975	17	2419.800	33	2432.585	49	2445.300
2	2407.700	18	2420.400	34	2433.300	50	2446.100
3	2408.500	19	2421.300	35	2434.000	51	2447.100
4	2409.300	20	2422.300	36	2434.900	52	2447.700
5	2410.100	21	2422.900	37	2435.700	53	2448.600
6	2410.900	22	2423.800	38	2436.500	54	2449.300
7	2411.700	23	2424.400	39	2437.300	55	2450.200
8	2412.500	24	2425.300	40	2438.000	56	2451.100
9	2413.100	25	2426.000	41	2438.800	57	2451.900
10	2414.100	26	2426.700	42	2439.700	58	2452.500
11	2414.900	27	2427.500	43	2440.500	59	2453.200
12	2415.600	28	2428.500	44	2441.400	60	2454.000
13	2416.500	29	2429.500	45	2442.000	61	2455.000
14	2417.400	30	2430.000	46	2441.600	62	2455.800
15	2418.200	31	2430.900	47	2442.900	63	2456.700
16	2419.000	32	2431.700	48	2444.500	64	2457.415

EUT was tested with Channel 1, 33 and 64.

EUT Exercise Software

No software was used to the EUT tested.

Equipment Modifications

No modifications were made to the unit tested.

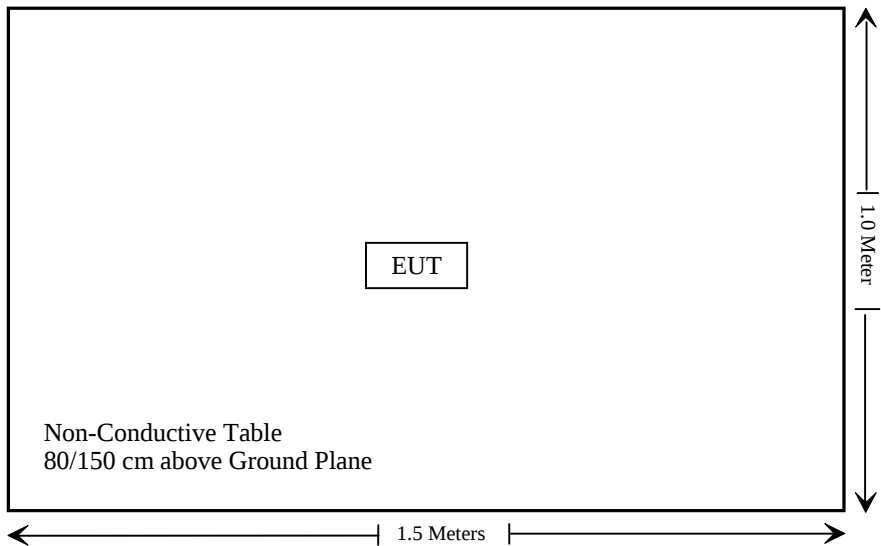
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

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

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	Not Applicable
15.205, §15.209, §15.249(d)	Radiated Emissions& Outside of Band Emission	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

Not Applicable: The EUT was powered by battery.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emissions Test (below 1G)					
R&S	EMI Test Receiver	ESR3	102455	2019/7/9	2020/7/8
Sonoma instrument	Pre-amplifier	310 N	186238	2019/4/20	2020/4/20
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
Radiated Emissions Test (above 1G)					
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 internal PCB antenna arrangement, 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§15.205, §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

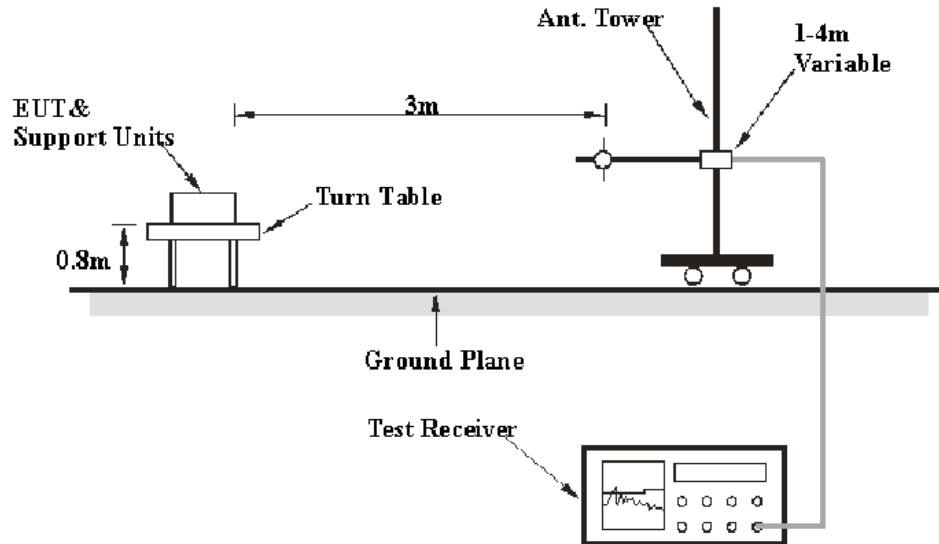
Above 1000MHz:

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

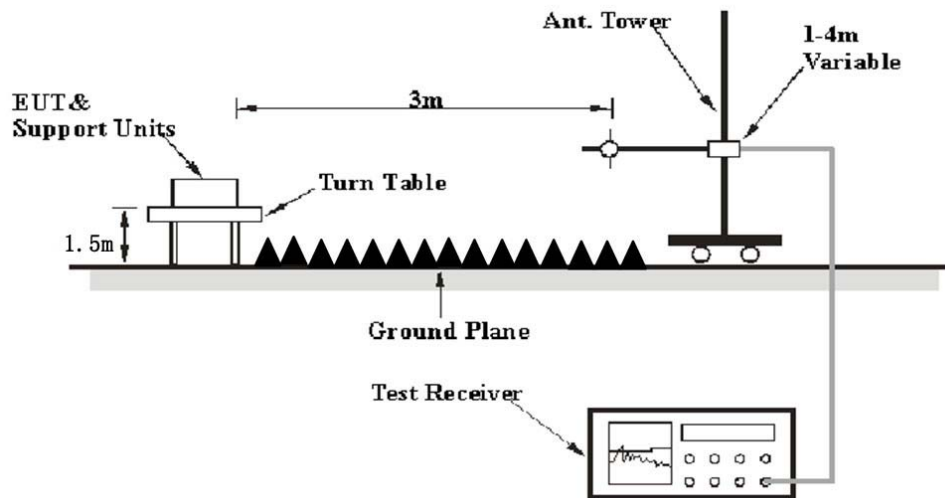
Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

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

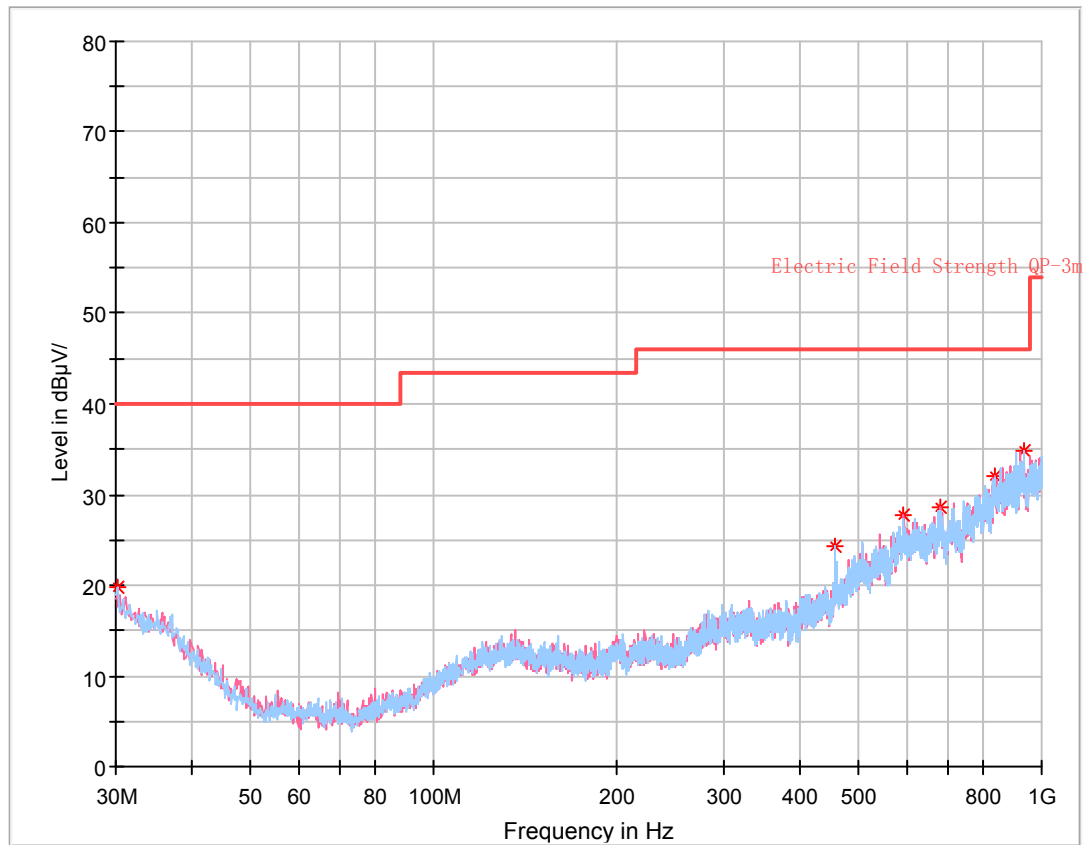
Environmental Conditions

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

The testing was performed by Zero Yan and Charlie Cha from 2020-04-02 to 2020-05-06 for Below 1GHz and Leo Huang on 2020-05-07 for Above 1GHz

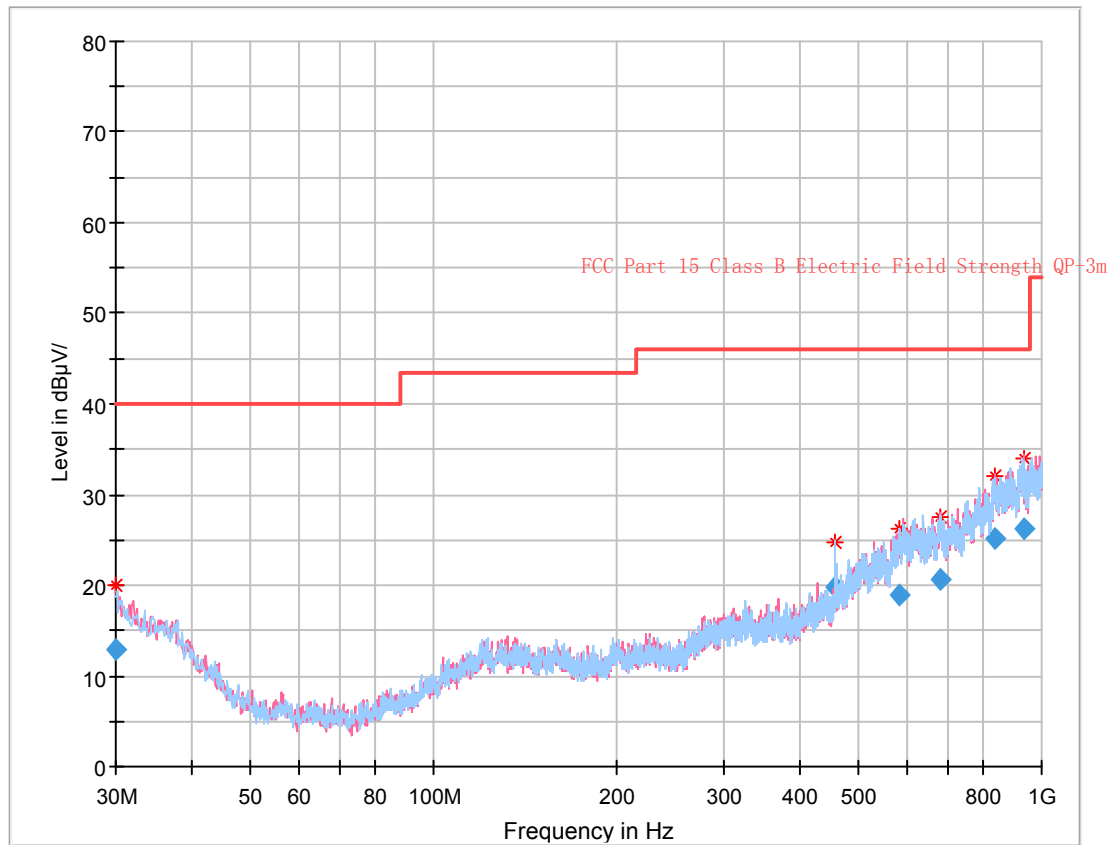
Test Mode: Transmitting(Pre-scan in the X, Y and Z axes of orientation, the worst case X- axes of orientation was recorded)

Model: ENS20

30MHz – 1 GHz: Worst case at Middle Channel

Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
30.121250	19.85	105.0	H	225.0	-7.7	40.00	20.15
458.618750	24.22	305.0	H	25.0	-7.7	46.00	21.78
590.660000	27.79	105.0	V	0.0	-2.0	46.00	18.21
680.991250	28.54	205.0	V	3.0	-1.4	46.00	17.46
835.827500	32.04	105.0	V	184.0	2.7	46.00	13.96
935.373750	34.90	305.0	H	66.0	4.8	46.00	11.10

Model: ENS18

30MHz – 1 GHz: Worst case at Middle Channel

Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
30.020346	12.91	341.0	H	230.0	-7.6	40.00	27.09
457.814375	19.73	297.0	H	148.0	-7.8	46.00	26.27
583.229250	18.93	376.0	V	214.0	-2.4	46.00	27.07
679.563750	20.65	397.0	V	206.0	-1.4	46.00	25.35
836.270375	25.06	243.0	V	125.0	2.7	46.00	20.94
934.962625	26.20	184.0	V	105.0	4.8	46.00	19.80

1 GHz - 25 GHz (Model: ENS20 worst case):

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 (2406.975 MHz)									
2406.975	55.94	PK	281	1.2	H	31.87	87.81	114	26.19
2406.975	49.51	Ave.	281	1.2	H	31.87	81.38	94	12.62
2406.975	50.01	PK	264	1.1	V	31.87	81.88	114	32.12
2406.975	45.68	Ave.	264	1.1	V	31.87	77.55	94	16.45
2389.65	28.32	PK	97	1.2	H	31.87	60.19	74	13.81
2389.65	14.57	Ave.	97	1.2	H	31.87	46.44	54	7.56
2400.00	28.13	PK	40	2.3	H	31.87	60.00	74	14.00
2400.00	14.65	Ave.	40	2.3	H	31.87	46.52	54	7.48
2483.62	28.21	PK	11	2.1	H	32.13	60.34	74	13.66
2483.62	14.56	Ave.	11	2.1	H	32.13	46.69	54	7.31
4813.95	46.22	PK	193	2.0	H	6.28	52.50	74	21.50
4813.95	30.29	Ave.	193	2.0	H	6.28	36.57	54	17.43
Middle Channel (2432.585MHz)									
2432.585	55.46	PK	275	2.4	H	31.97	87.43	114	26.57
2432.585	49.42	Ave.	275	2.4	H	31.97	81.39	94	12.61
2432.585	49.35	PK	19	1.2	V	31.97	81.32	114	32.68
2432.585	44.38	Ave.	19	1.2	V	31.97	76.35	94	17.65
4865.17	46.51	PK	91	2.3	H	6.76	53.27	74	20.73
4865.17	30.38	Ave.	91	2.3	H	6.76	37.11	54	16.89
High Channel (2457.415 MHz)									
2457.415	54.87	PK	270	2.3	H	32.03	86.90	114	27.10
2457.415	49.22	Ave.	270	2.3	H	32.03	81.25	94	12.75
2457.415	48.66	PK	215	1.3	V	32.03	80.69	114	33.31
2457.415	43.29	Ave.	215	1.3	V	32.03	75.32	94	18.68
2388.46	28.15	PK	6	2.4	H	31.87	60.02	74	13.98
2388.46	14.43	Ave.	6	2.4	H	31.87	46.30	54	7.70
2483.53	28.21	PK	195	2.3	H	32.13	60.34	74	13.66
2483.53	14.35	Ave.	195	2.3	H	32.13	46.48	54	7.52
4914.83	46.17	PK	276	2.3	H	6.76	52.93	74	21.07
4914.83	30.52	Ave.	276	2.3	H	6.76	37.28	54	16.72

Note:

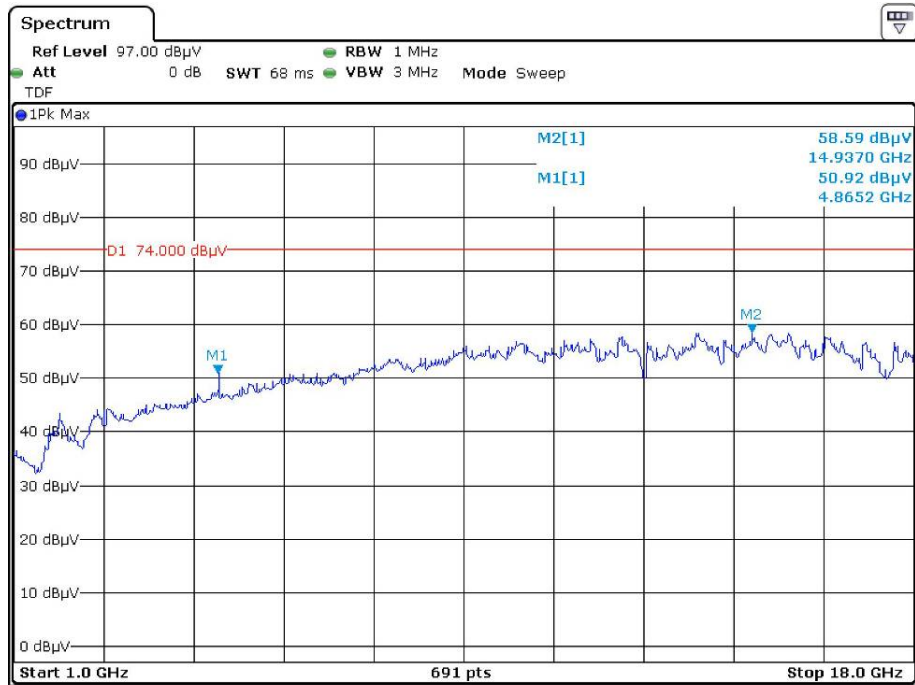
Corrected Amplitude = Corrected Factor + Reading

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

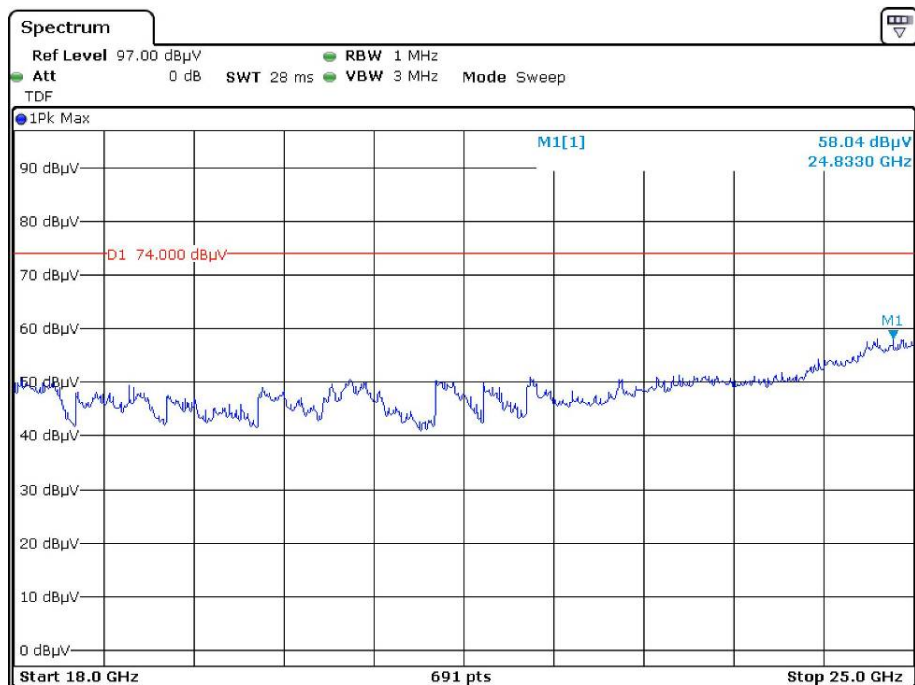
Margin = Limit- Corr. Amplitude

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

Pre-scan with middle channel Peak Horizontal

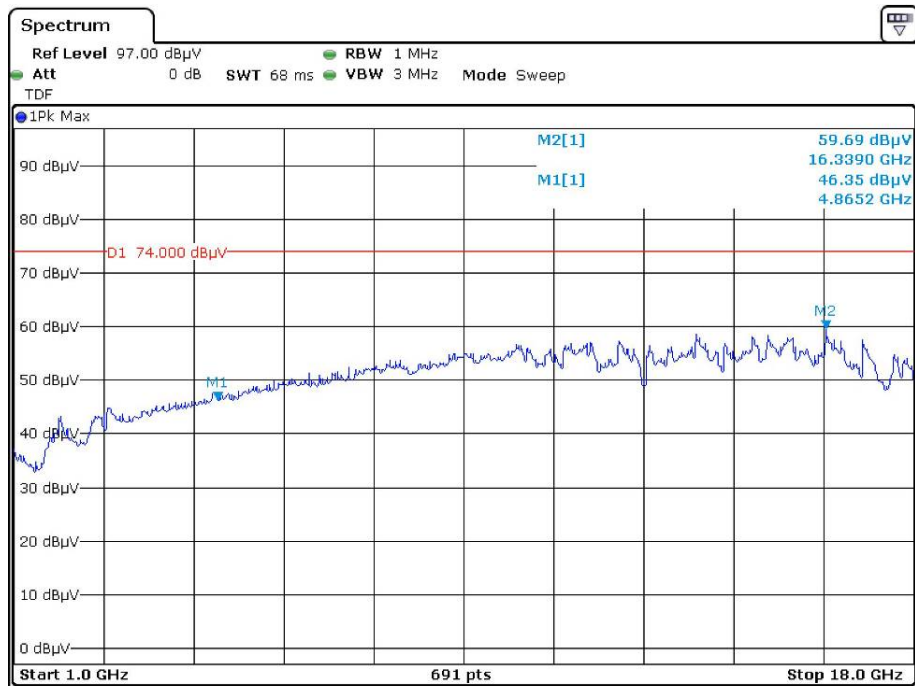


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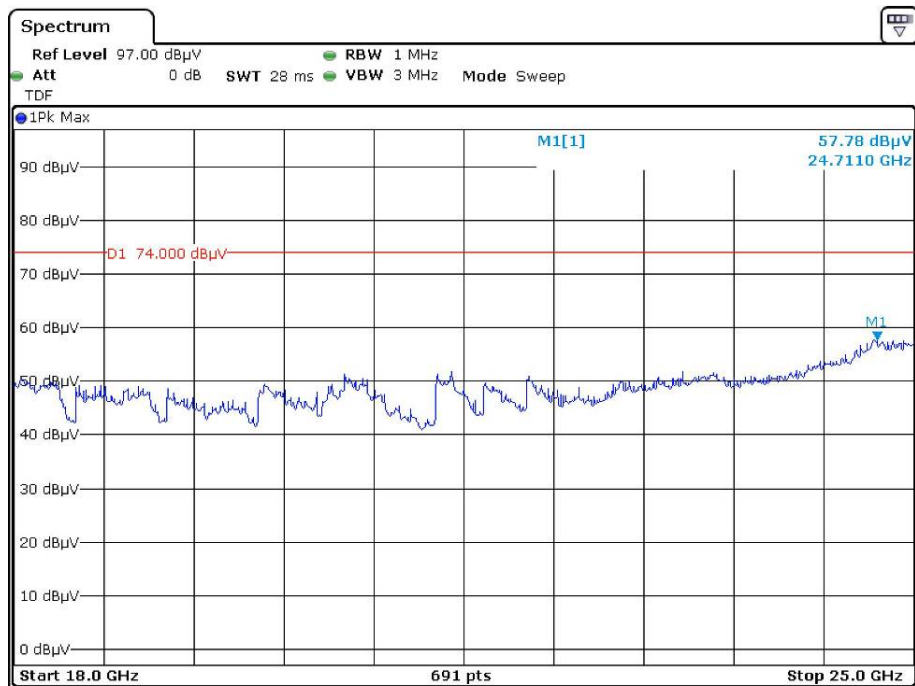


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Vertical

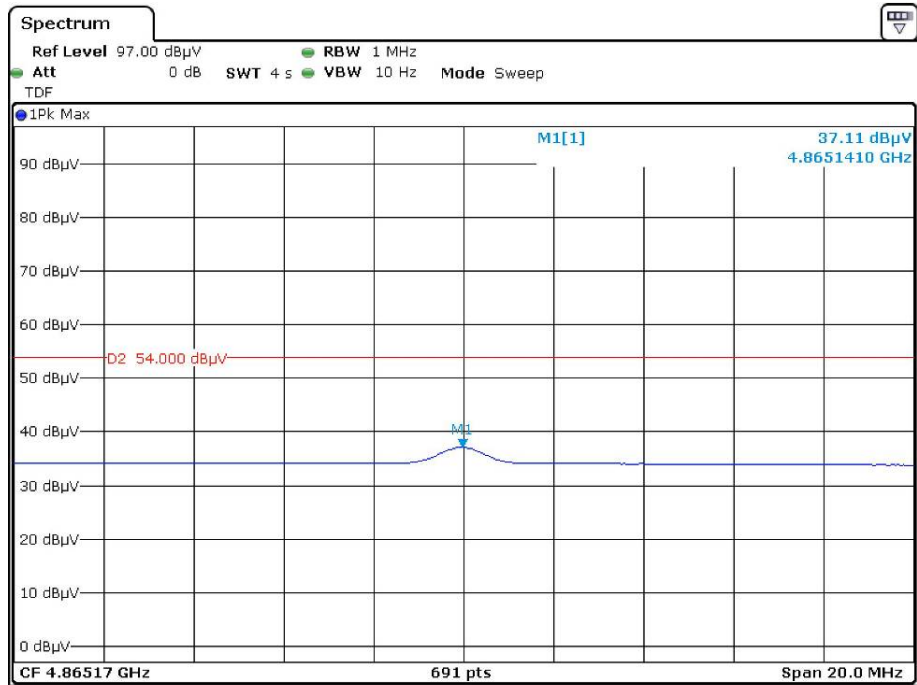


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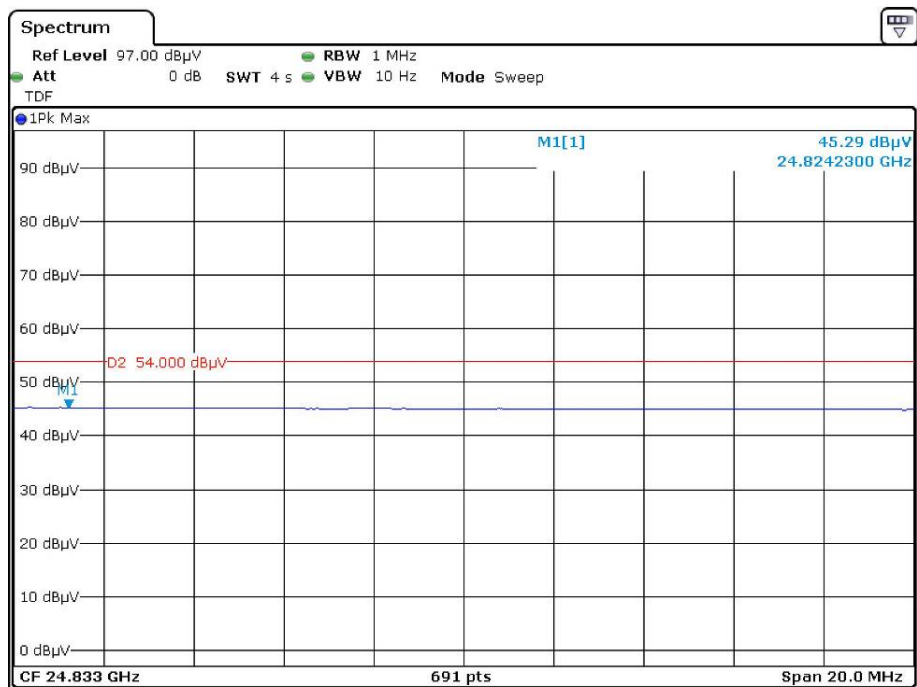


Date: 7.MAY.2020 14:33:54

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

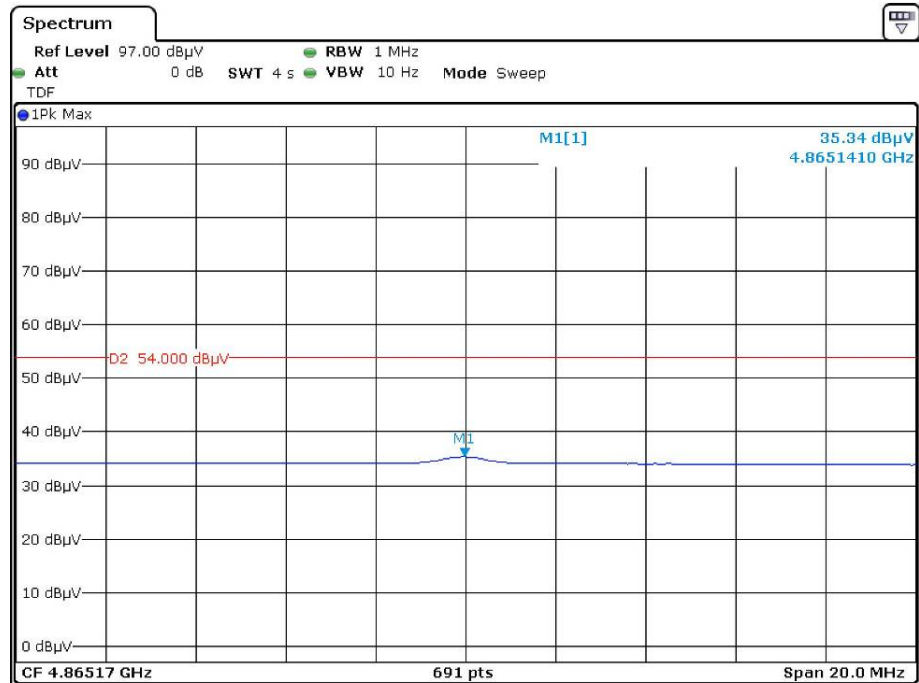


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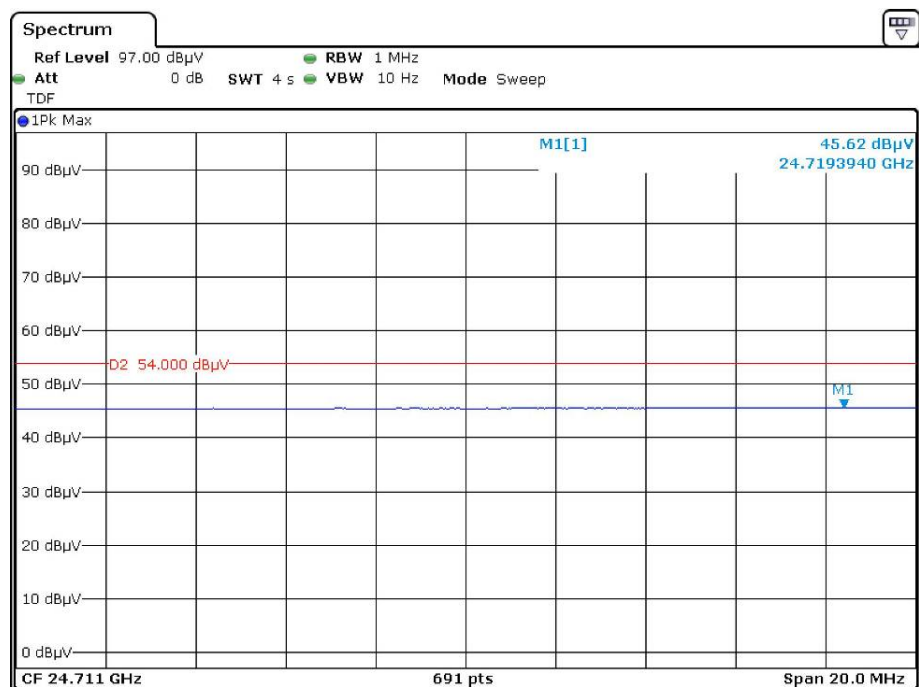


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Vertical



Date: 7.MAY.2020 14:03:11



Date: 7.MAY.2020 14:36:28

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:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

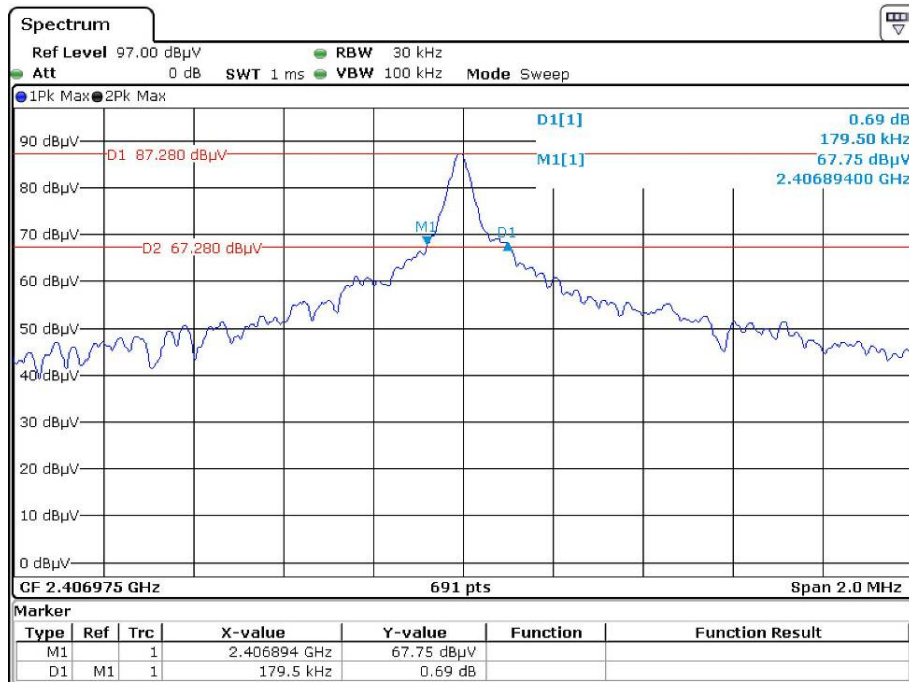
The testing was performed by Leo Huang on 2020-05-07.

Test Mode: Transmitting

Please refer to the following table and plots.

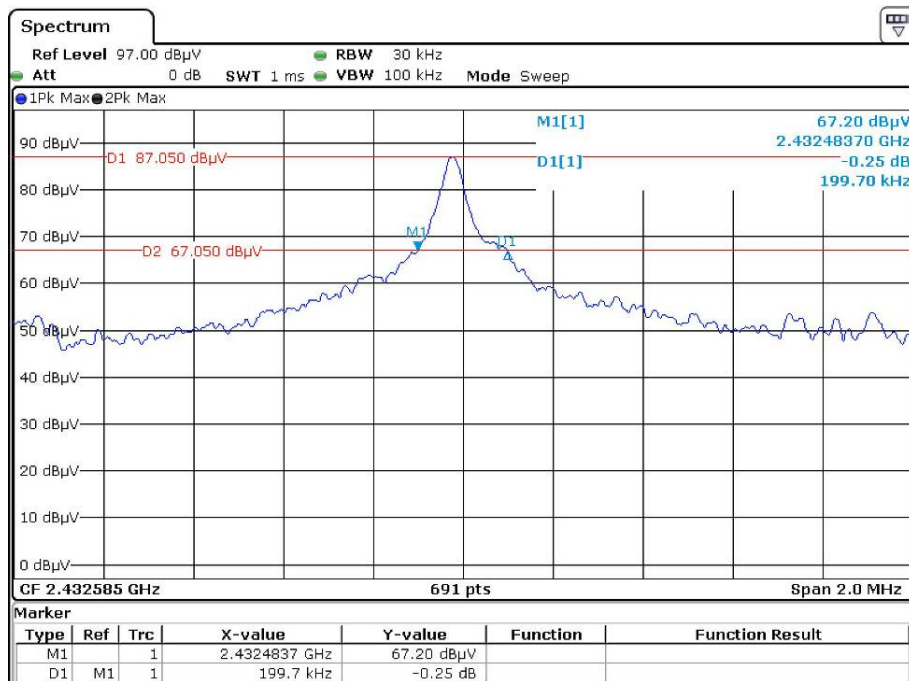
Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	2406.975	179.5
Middle	2432.585	199.7
High	2457.415	162.1

Low Channel



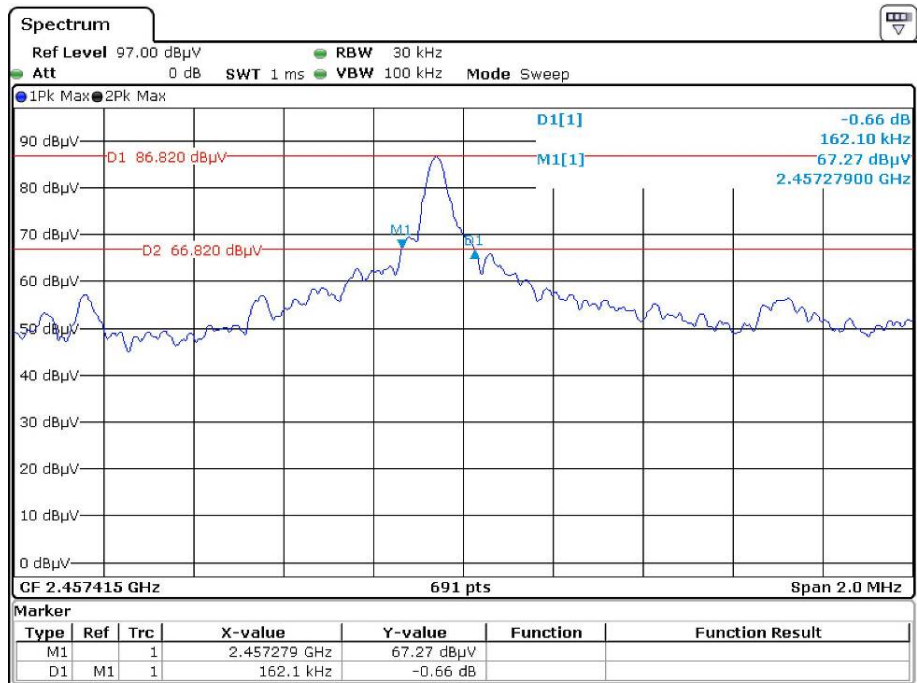
Date: 7.MAY.2020 10:52:52

Middle Channel



Date: 7.MAY.2020 10:57:23

High Channel



Date: 7.MAY.2020 10:40:22

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