



FCC PART 15.249


TEST REPORT

For

DewertOkin GmbH

Weststr. 1, 32278 Kirchlingern, Germany

FCC ID: O3YENH

Report Type: Original Report	Product Type: RF-ENHANCE-STRAIGHT
Report Number: RSZ200319552-00	
Report Date: 2020-05-05	
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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
EXTERNAL I/O CABLE.....	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§15.205, §15.209 & §15.249(D) - RADIATED EMISSIONS.....	10
APPLICABLE STANDARD	10
TEST EQUIPMENT SETUP	10
EUT SETUP	11
TEST PROCEDURE	12
CORRECTED AMPLITUDE & MARGIN CALCULATION	12
TEST RESULTS SUMMARY	12
TEST DATA	12
FCC§15.215(C) - 20DB EMISSION BANDWIDTH	20
APPLICABLE STANDARD	20
TEST PROCEDURE	20
TEST DATA	20

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	RF-ENHANCE-STRAIGHT
Tested Model	ENH22S
Multiple Model	ENH20S
Model different	Refer to the DOS
Frequency Range	2403-2480MHz
Maximum Field Strength	72.95dBuV/m@3m
Antenna Specification	0dBi
Voltage Range	DC 3*1.5V batteries
Date of Test	2020-04-02 to 2020-04-27
Sample serial number	RSZ200319552-RF-S1 for ENH22S, RSZ200319552-RF-S2 for ENH20S (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 °C
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.

Frequency List

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2403	40	2442
2	2404	41	2443
...		...	
38	2440	77	2479
39	2441	78	2480

Channel 1, 38, 78 were tested.

EUT Exercise Software

No software was used to the EUT tested.

Equipment Modifications

No modifications were made to the unit tested.

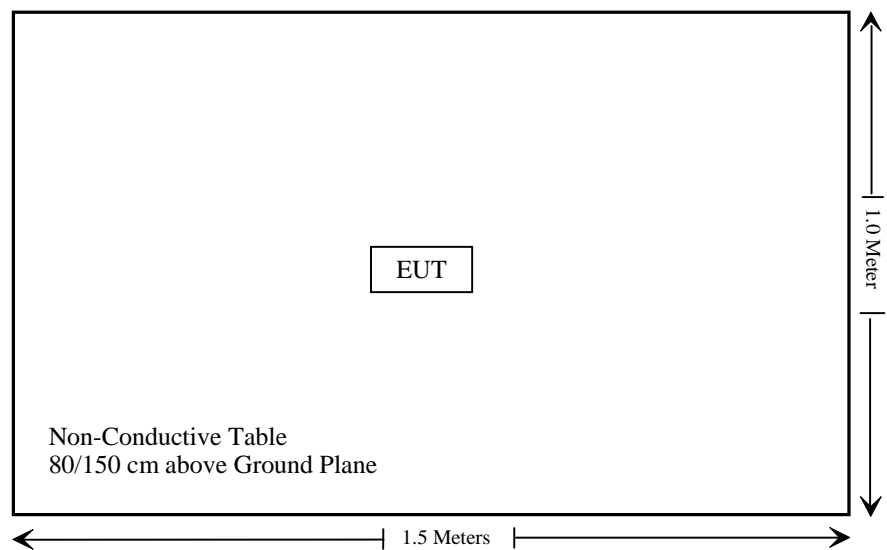
Support Equipment List and Details

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
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
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	2019/4/20	2020/4/20
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:

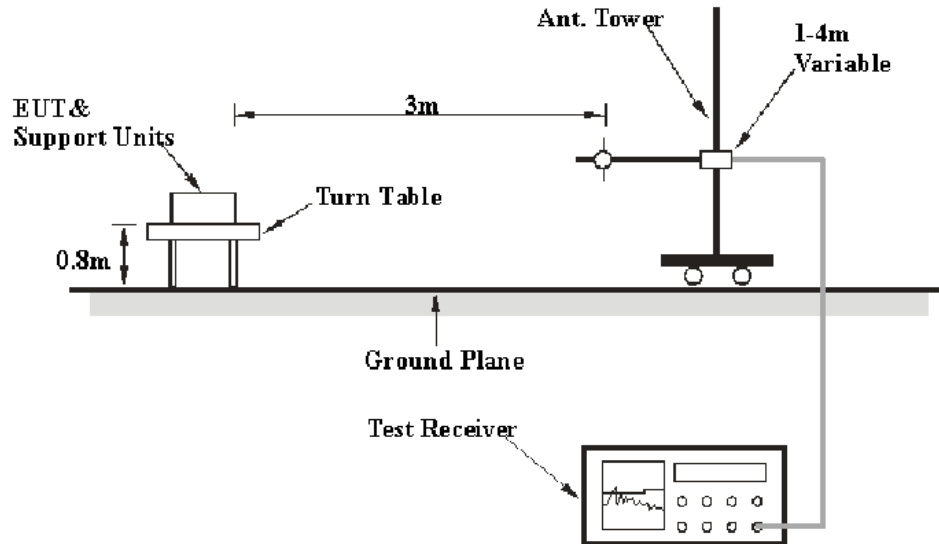
$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000MHz:

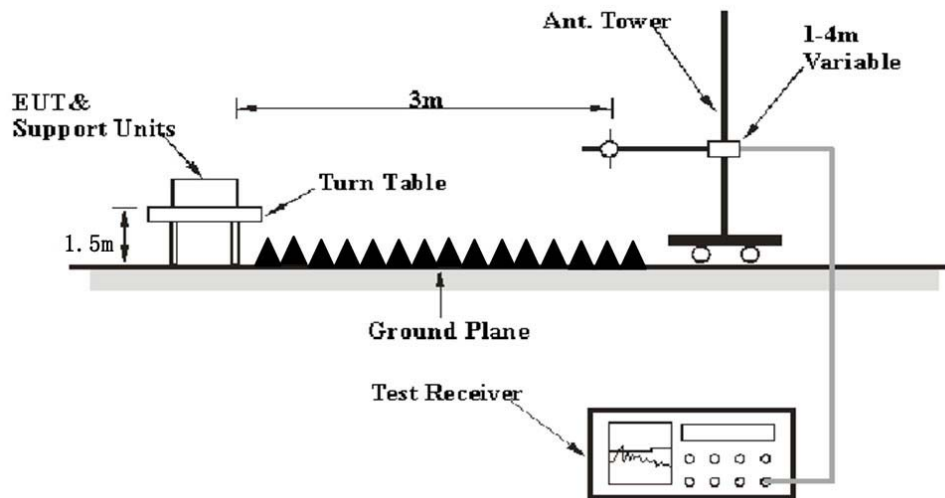
$$\begin{aligned} \text{Peak: } \text{RBW} &= 1\text{MHz} / \text{VBW} = 1\text{MHz} / \text{Sweep} = \text{Auto} \\ \text{Average: } \text{RBW} &= 1\text{MHz} / \text{VBW} = 10\text{Hz} / \text{Sweep} = \text{Auto} \end{aligned}$$

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

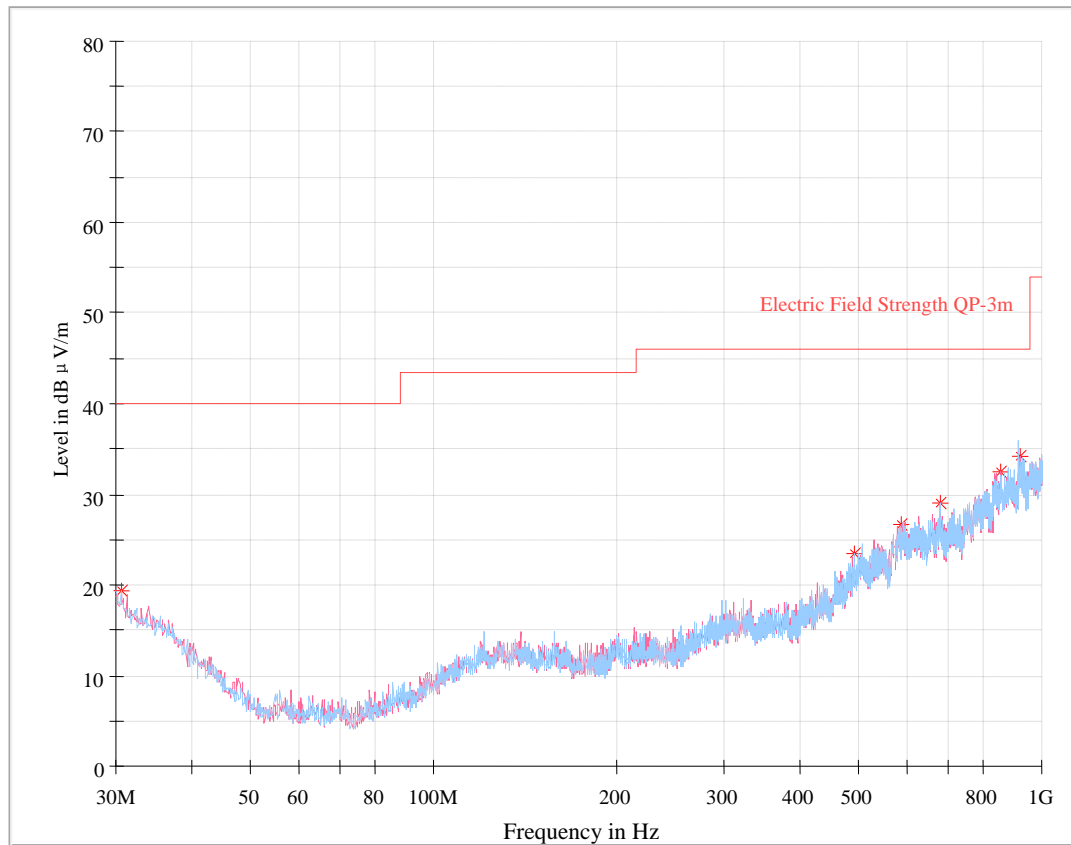
Environmental Conditions

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

The testing was performed by Zero Yan on 2020-04-02 and 2020-04-27 for Below 1GHz and Leo Huang on 2020-04-10 for Above 1GHz

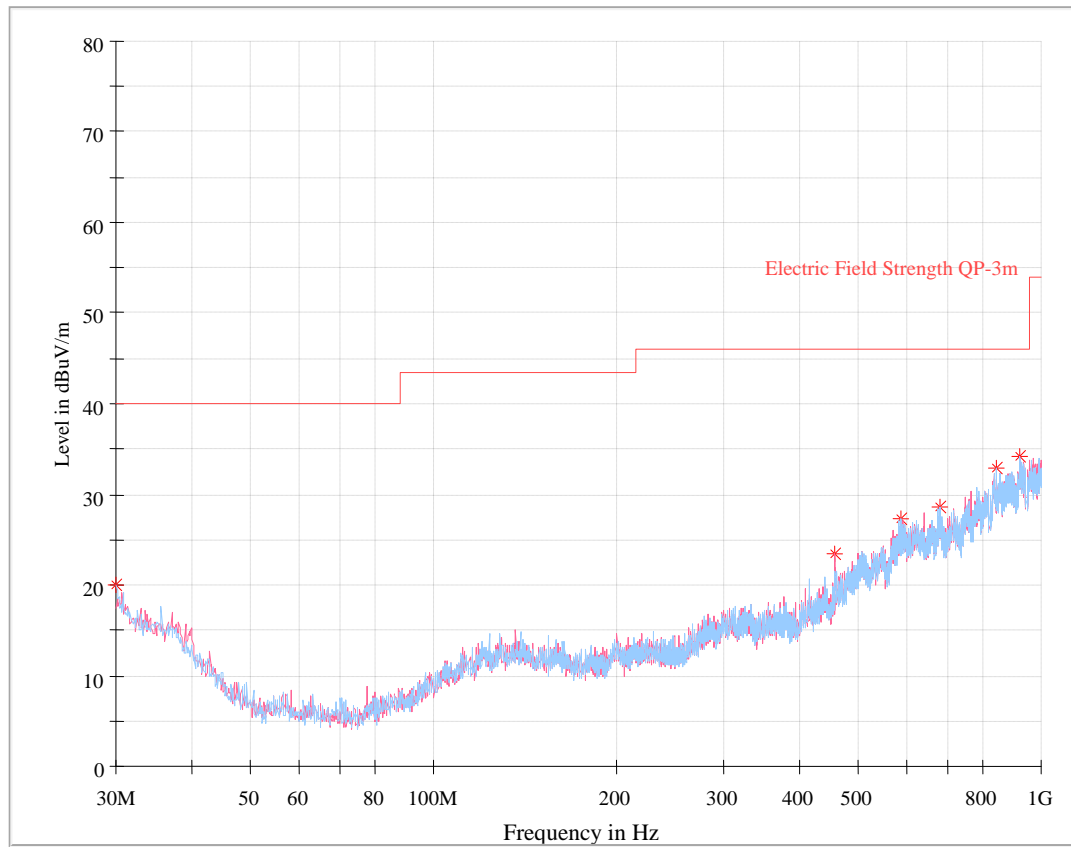
Test Mode: Transmitting (Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was record)

Model: ENH22S

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)
30.606250	19.40	205.0	H	333.0	-8.0	40.00	20.60
492.326250	23.35	205.0	H	146.0	-5.7	46.00	22.65
589.568750	26.63	305.0	V	234.0	-2.1	46.00	19.37
682.931250	29.12	390.0	V	110.0	-1.4	46.00	16.88
856.197500	32.56	205.0	V	359.0	3.2	46.00	13.44
922.036250	34.28	390.0	V	0.0	4.6	46.00	11.72

Model: ENH20S

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)
30.000000	20.01	305.0	H	240.0	-7.6	40.00	19.99
458.376250	23.41	305.0	V	292.0	-7.7	46.00	22.59
586.537500	27.23	105.0	H	24.0	-2.3	46.00	18.77
679.657500	28.70	390.0	H	179.0	-1.4	46.00	17.30
841.890000	32.82	105.0	H	332.0	2.9	46.00	13.18
924.825000	34.21	305.0	H	133.0	4.6	46.00	11.79

1 GHz - 25 GHz (Model: ENH22S 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 (2403 MHz)									
2403.00	69.78	PK	112	2.0	H	-0.36	69.42	114	44.58
2403.00	63.54	Ave.	112	2.0	H	-0.36	63.18	94	30.82
2403.00	72.28	PK	27	1.5	V	-0.36	71.92	114	42.08
2403.00	66.78	Ave.	27	1.5	V	-0.36	66.42	94	27.58
2389.12	42.93	PK	211	2.2	V	-0.36	42.57	74	31.43
2389.12	28.31	Ave.	211	2.2	V	-0.36	27.95	54	26.05
2400.00	51.54	PK	232	1.4	V	-0.36	51.18	74	22.82
2400.00	29.05	Ave.	232	1.4	V	-0.36	28.69	54	25.31
2486.50	42.74	PK	16	2.2	V	-0.15	42.59	74	31.41
2486.50	28.12	Ave.	16	2.2	V	-0.15	27.97	54	26.03
4806.00	52.88	PK	126	1.2	V	6.28	59.16	74	14.84
4806.00	47.02	Ave.	126	1.2	V	6.28	51.50	54	2.50
Middle Channel (2440MHz)									
2440.00	70.48	PK	274	1.9	H	-0.26	70.22	114	43.78
2440.00	64.51	Ave.	274	1.9	H	-0.26	64.25	94	29.75
2440.00	73.21	PK	30	1.6	V	-0.26	72.95	114	41.05
2440.00	66.53	Ave.	30	1.6	V	-0.26	66.27	94	27.73
4880.00	49.78	PK	336	1.2	V	6.76	56.54	74	17.46
4880.00	42.00	Ave.	336	1.2	V	6.76	48.76	54	5.24
High Channel (2480 MHz)									
2480.00	67.98	PK	75	2.4	H	-0.15	67.83	114	46.17
2480.00	61.53	Ave.	75	2.4	H	-0.15	61.38	94	32.62
2480.00	72.04	PK	150	1.5	V	-0.15	71.89	114	42.11
2480.00	66.31	Ave.	150	1.5	V	-0.15	66.16	94	27.84
2387.16	42.40	PK	221	2.1	V	-0.36	42.04	74	31.96
2387.16	28.29	Ave.	221	2.1	V	-0.36	27.93	54	26.07
2486.35	42.77	PK	53	2.3	V	-0.15	42.62	74	31.38
2486.35	28.30	Ave.	53	2.3	V	-0.15	28.15	54	25.85
4960.00	49.23	PK	249	1.1	V	6.80	56.03	74	17.97
4960.00	41.92	Ave.	249	1.1	V	6.80	48.72	54	5.28

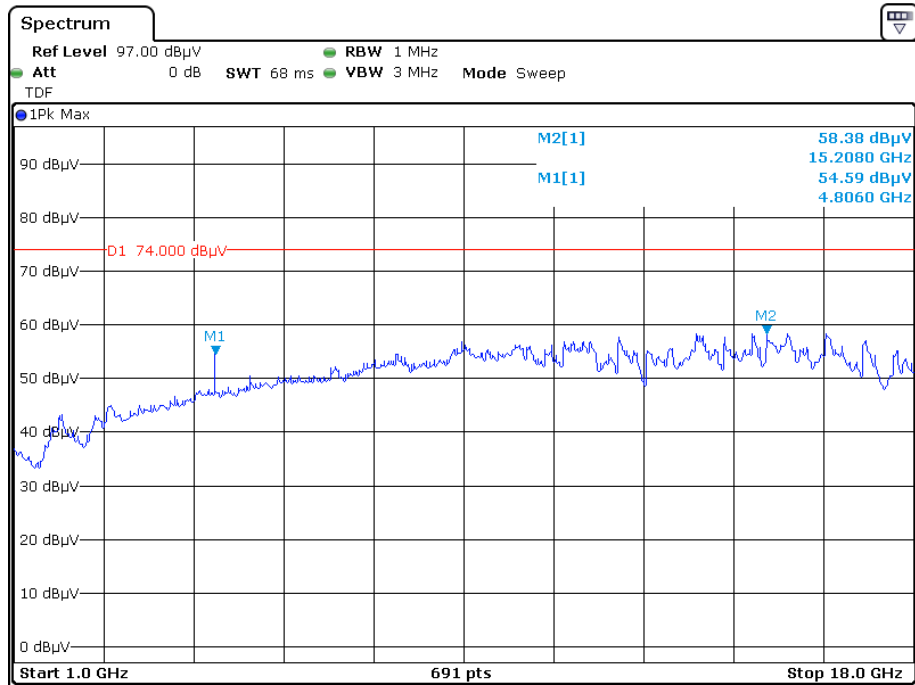
Note:

Corrected Amplitude = Corrected Factor + Reading

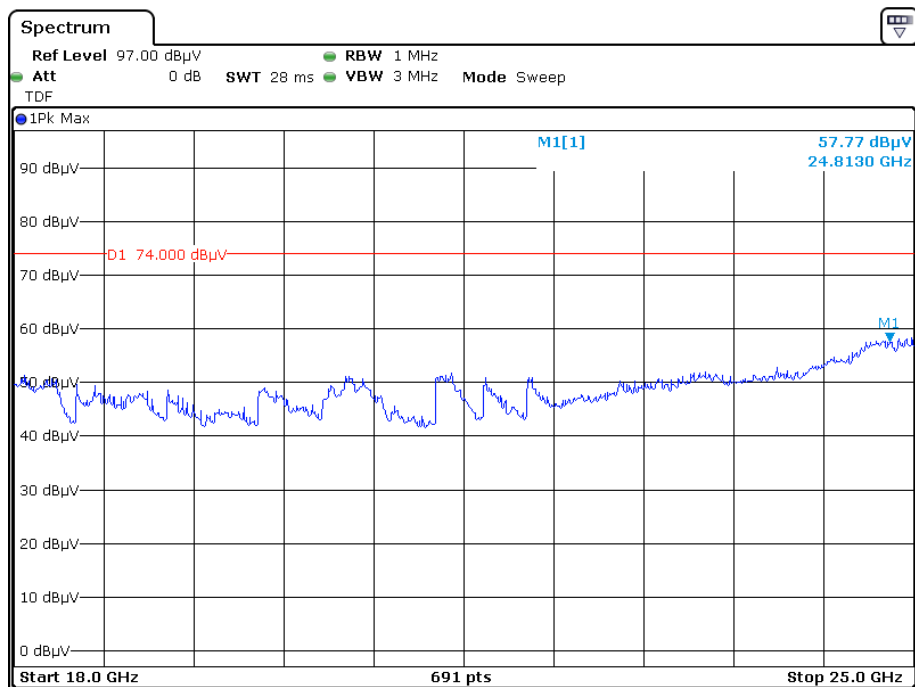
Corrected Factor=Antenna factor (RX) +cable loss – amplifier factor

Margin = Limit- Corr. Amplitude

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

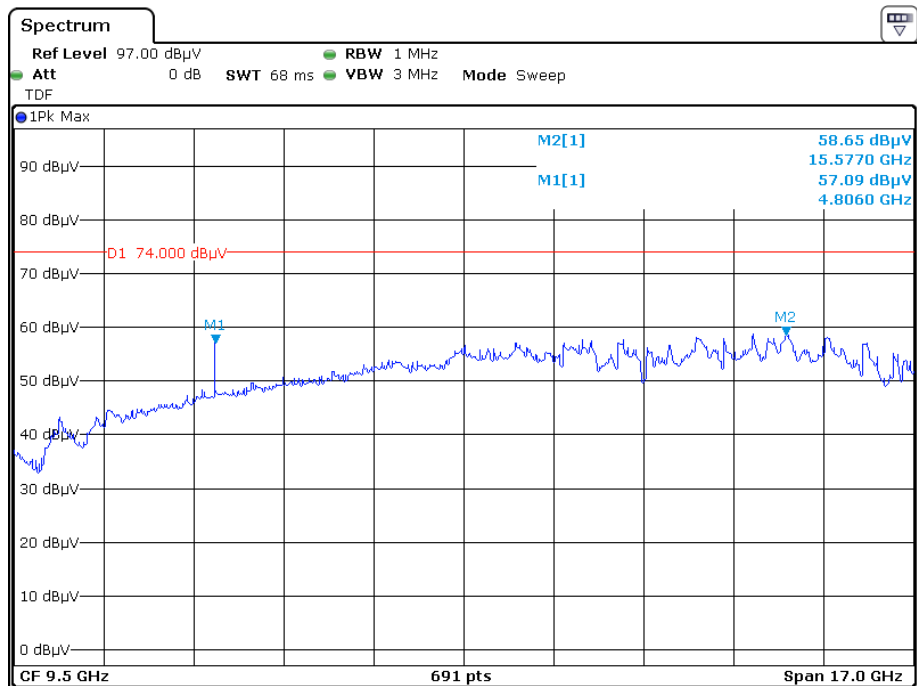
**Pre-scan with low channel Peak
Horizontal**

Date: 10.APR.2020 07:07:02

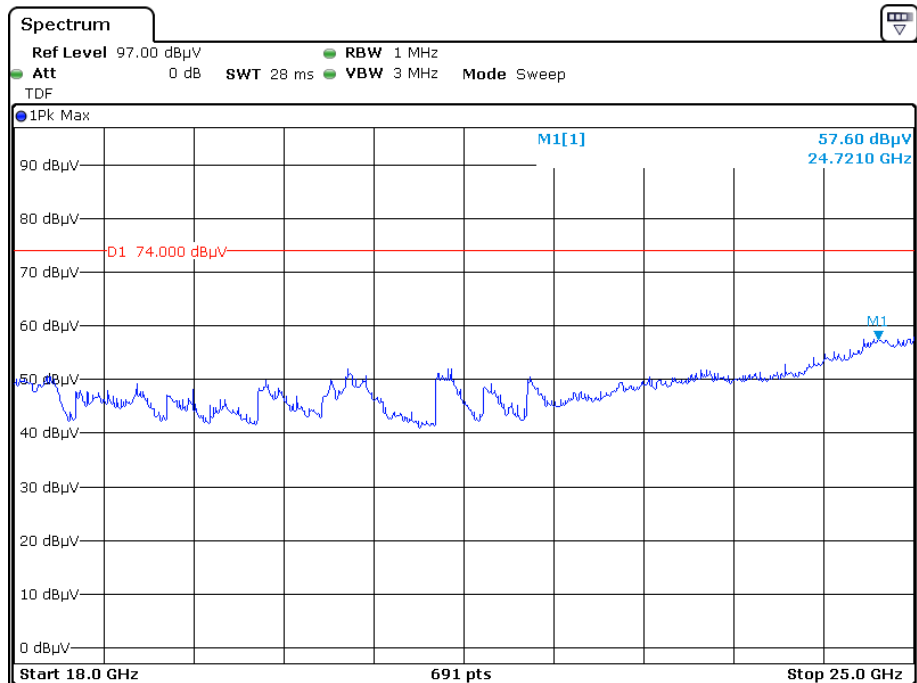


Date: 10.APR.2020 07:51:03

Vertical

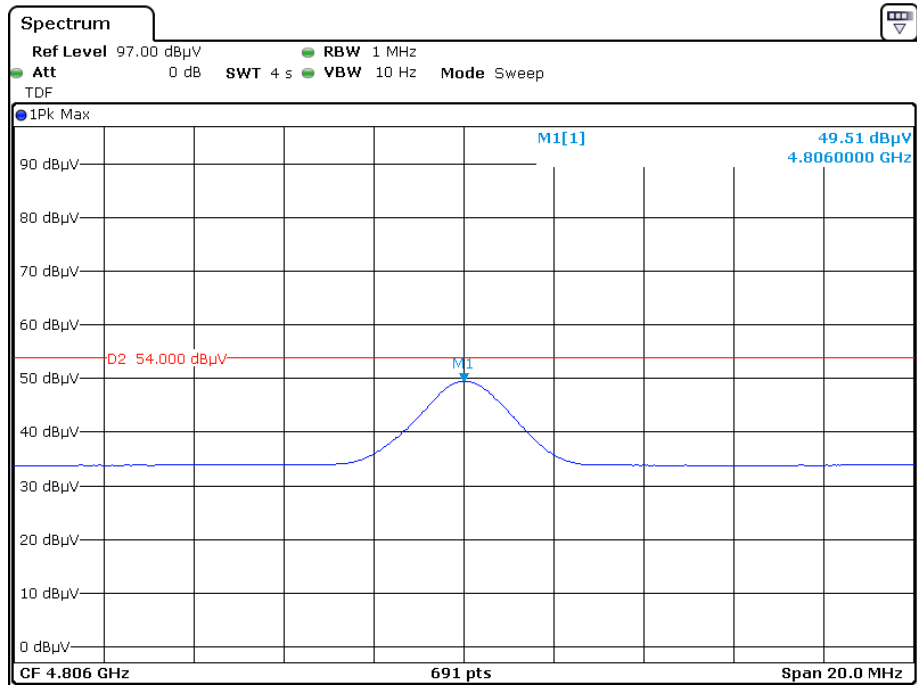


Date: 10.APR.2020 05:57:53

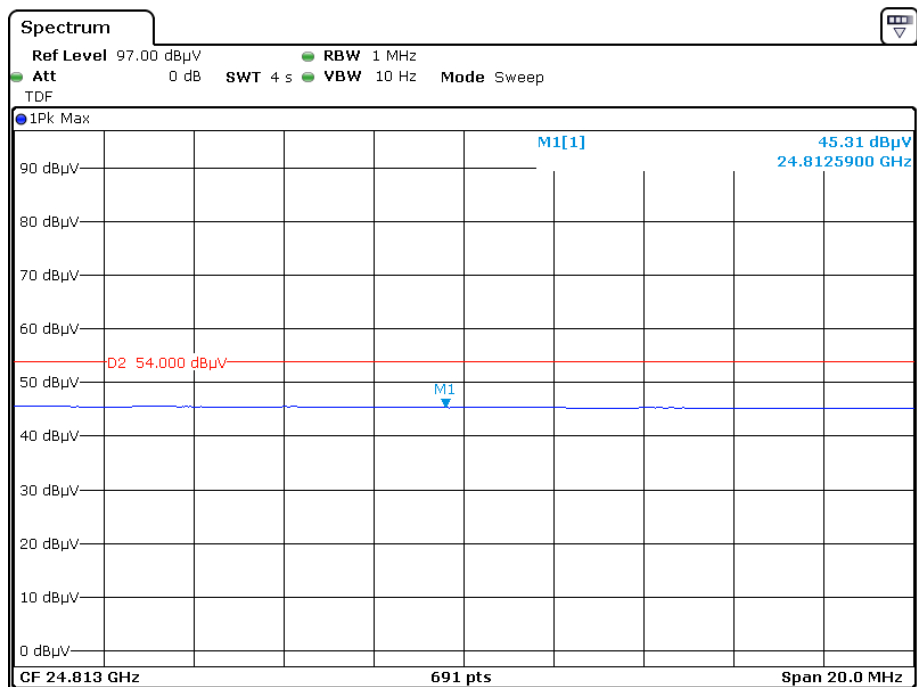


Date: 10.APR.2020 07:56:45

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

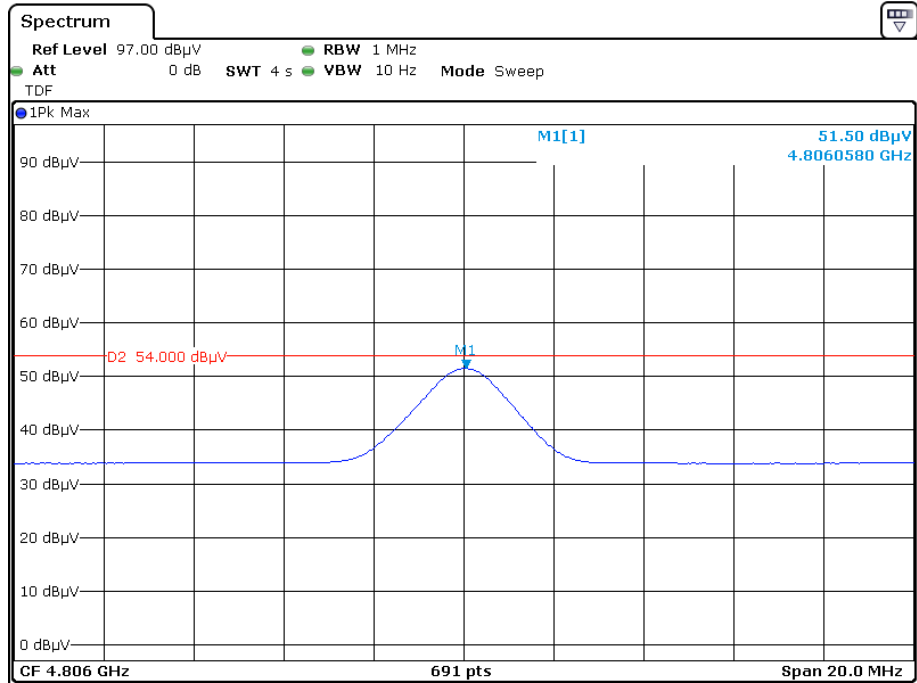


Date: 10.APR.2020 07:11:28

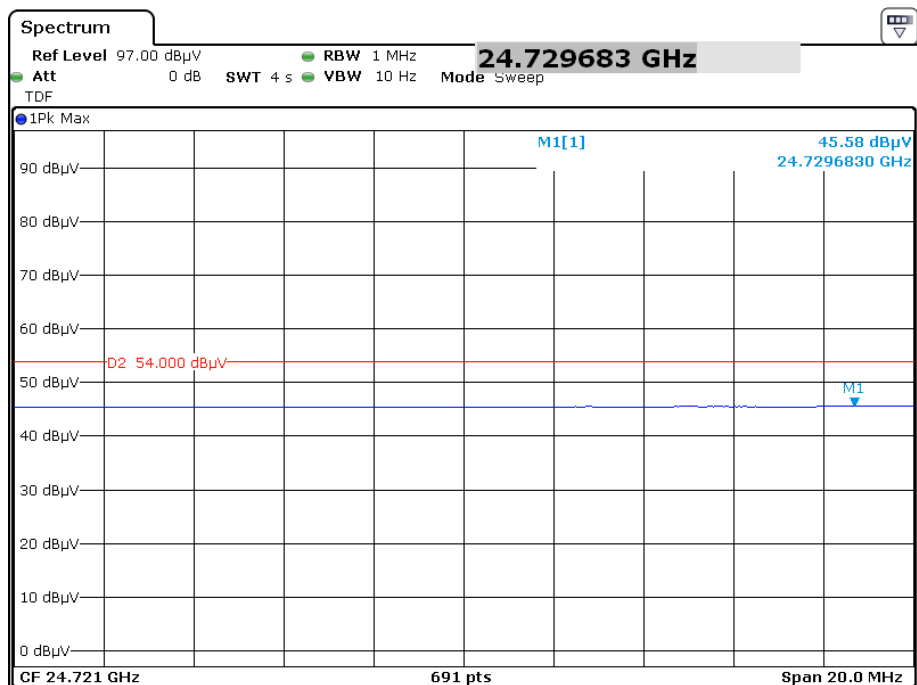


Date: 10.APR.2020 07:53:56

Vertical



Date: 10.APR.2020 07:02:59



Date: 10.APR.2020 07:59:35

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

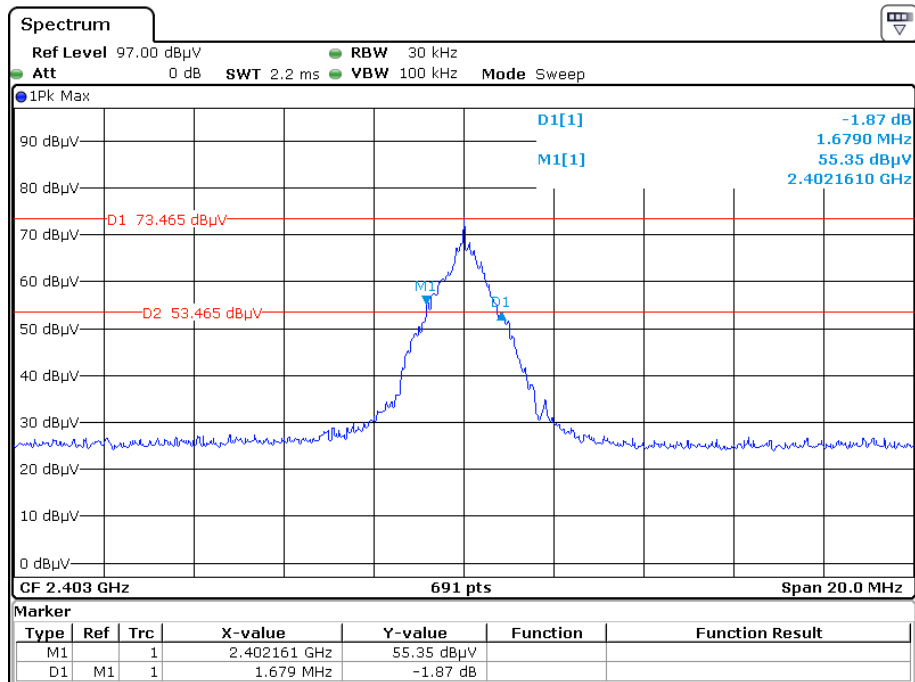
The testing was performed by Leo Huang on 2020-04-10.

Test Mode: Transmitting

Please refer to the following table and plots.

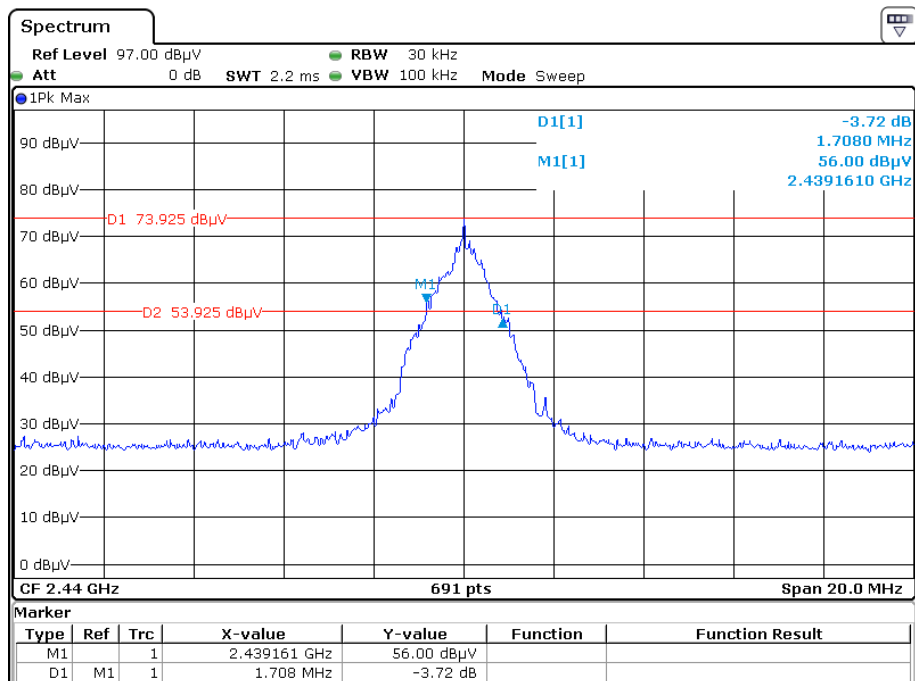
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2403	1.679
Middle	2440	1.708
High	2480	1.679

Low Channel



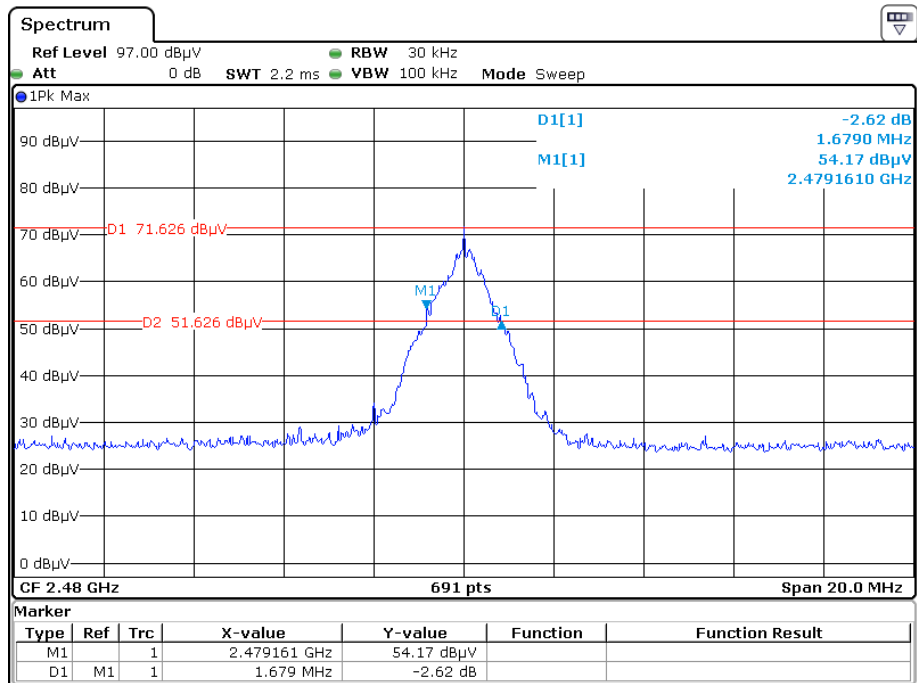
Date: 10.APR.2020 08:12:51

Middle Channel



Date: 10.APR.2020 08:15:56

High Channel



Date: 10.APR.2020 08:18:47

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