

FCC PART 15.249

TEST REPORT

For

DewertOkin GmbH

Weststr. 1, 32278 Kirchlingern, Germany

FCC ID: O3YENH22

Report Type: Original Report	Product Type: RF-ENHANCE
Report Number: RSZ190920551-00	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	RF-ENHANCE
Model	ENH22
Frequency Range	2403MHz~2480MHz
Modulation Technique	GFSK
Antenna Specification	1 dBi
Voltage Range	DC 1.5V*3 battery
Date of Test	2019/10/09~2019/10/25
Sample serial number	190920551 (Assigned by BAEL, Shenzhen)
Received date	2019/09/20
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)

Part of system with FCC ID: O3YHE150 which had been granted.

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%
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.

78 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	/	/
20	2422	40	2442	60	2462	/	/

Channel 1, Channel 38 and Channel 78 were selected for testing.

EUT Exercise Software

No software was used.

Equipment Modifications

No modifications were made to the unit tested.

Support Equipment List and Details

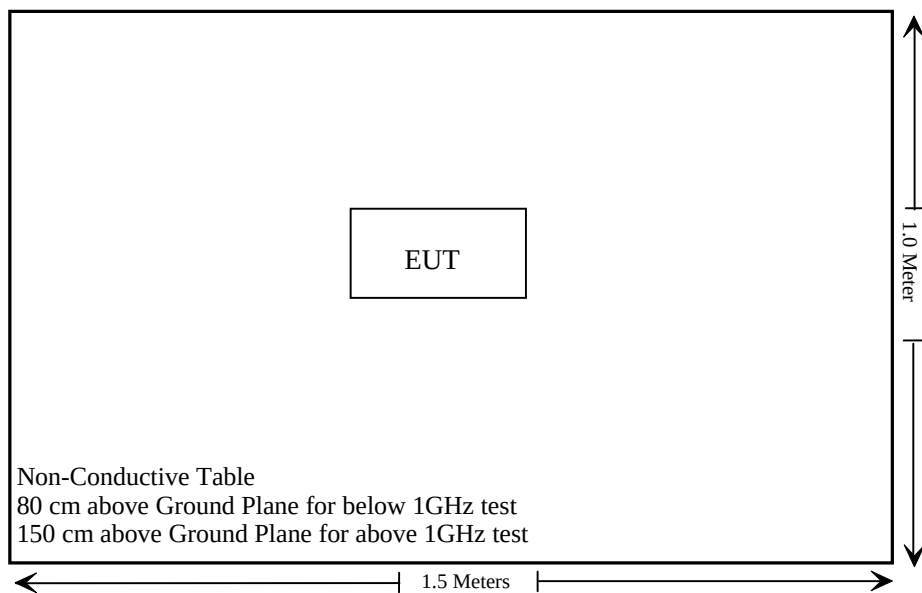
Manufacturer	Description	Model	Serial Number
N/A	N/A	N/A	N/A

Support Cable Descriptions

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

Block Diagram of Test Setup

For radiated emissions:



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

Note:

Not Applicable: The device is powered by battery only.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
A.H. System	Horn Antenna	SAS-200/571	135	2018-09-01	2021-08-31
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019-07-22	2020-07-21
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
COM-POWER	Pre-amplifier	PA-122	181919	2018-11-12	2019-11-12
Sonoma Instrument	Amplifier	310N	186238	2018-11-12	2019-11-12
Rohde & Schwarz	EMI Test Receiver	ESR3	102455	2019-07-09	2020-07-08
Ducommun technologies	RF Cable	UFA147A-2362-100100	MFR64639 231029-003	2018-11-12	2019-11-12
Ducommun technologies	RF Cable	104PEA	218124002	2018-11-12	2019-11-12
Ducommun technologies	RF Cable	RG-214	1	2018-11-12	2019-11-12
Ducommun technologies	RF Cable	RG-214	2	2018-11-12	2019-11-12
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-04	2017-12-29	2020-12-28
Heatsink Required	Amplifier	QLW-18405536-J0	15964001002	2018-11-12	2019-11-12
Sinoscite	Notch Filter	BSF2402-2480MN-0898-001	99632	2018-11-12	2019-11-12
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR

* **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 antenna which was permanently attached and the antenna gain is 1 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

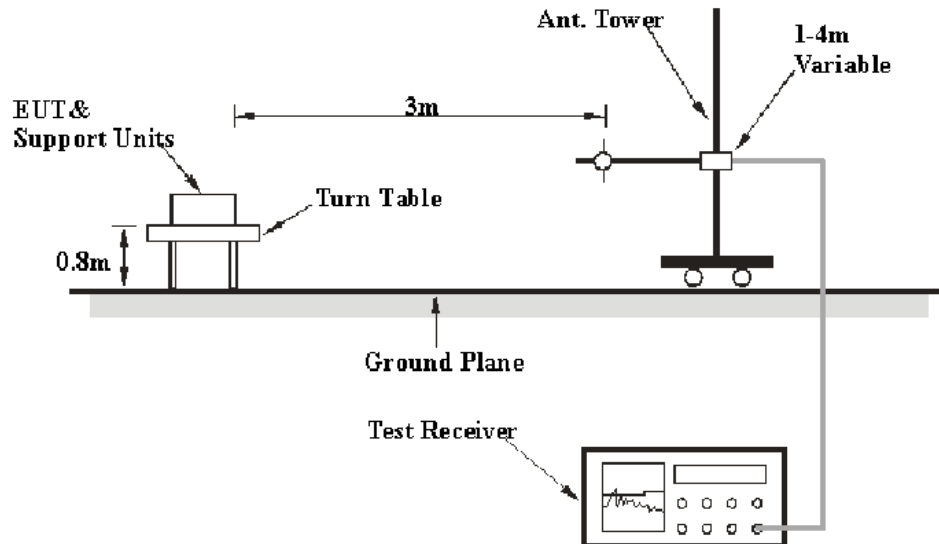
Above 1000MHz:

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

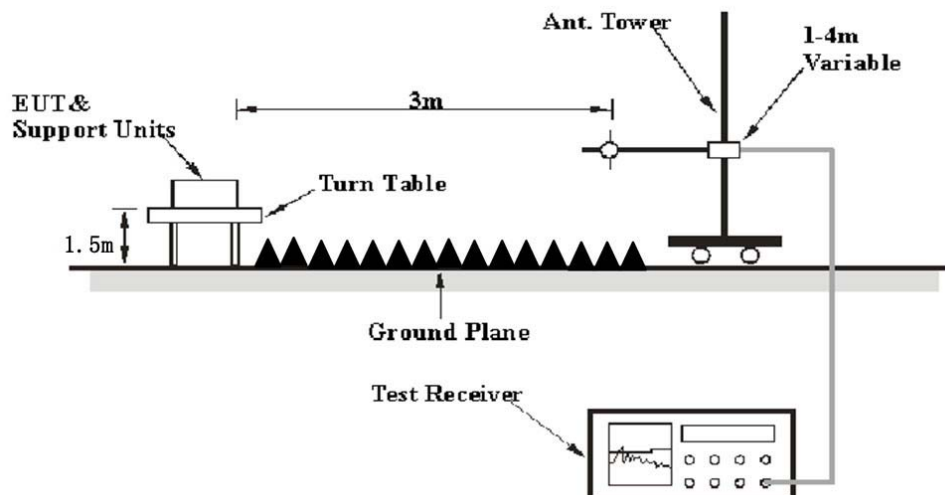
Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

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 data as following, the EUT complied with the FCC Part 15.205, 15.209 & §15.249

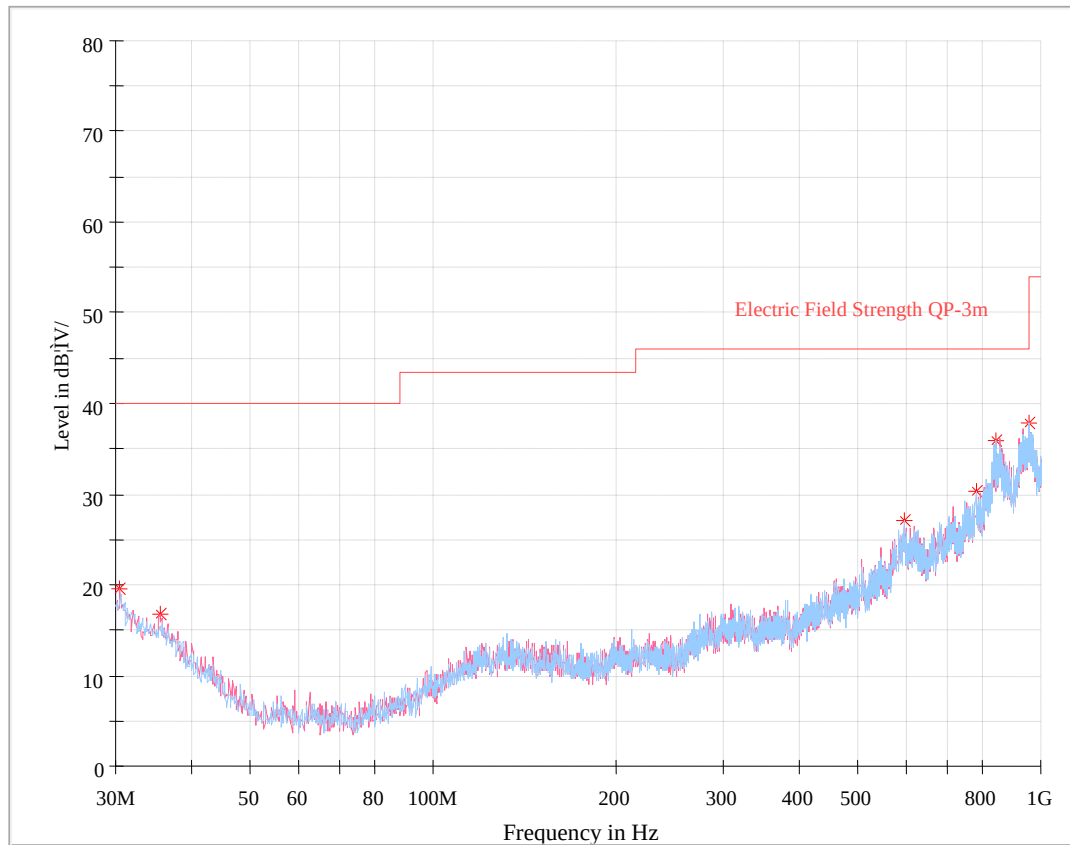
Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Zero Yan on 2019-10-09 and by Alan He on 2019-10-25.

Test Mode: Transmitting

Low Channel (Worst Mode):**30MHz – 1 GHz:**

Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
30.485000	19.48	102.0	V	36.0	-7.9	40.00	20.52
35.456250	16.75	300.0	V	116.0	-10.8	40.00	23.25
596.480000	27.13	300.0	H	0.0	-1.8	46.00	18.87
781.022500	30.36	102.0	H	302.0	1.0	46.00	15.64
841.526250	35.99	202.0	H	322.0	6.1	46.00	10.01
953.318750	37.85	202.0	H	0.0	9.7	46.00	8.15

1 GHz - 25 GHz:

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	42.56	PK	6	1.1	H	31.87	74.43	114	39.57
2403.00	39.49	Ave.	6	1.1	H	31.87	71.36	94	22.64
2403.00	40.57	PK	66	1.3	V	31.87	72.44	114	41.56
2403.00	38.24	Ave.	66	1.3	V	31.87	70.11	94	23.89
2389.13	27.77	PK	313	2.1	H	31.87	59.64	74	14.36
2389.13	13.92	Ave.	313	2.1	H	31.87	45.79	54	8.21
2497.42	28.16	PK	160	1.8	H	32.13	60.29	74	13.71
2497.42	14.03	Ave.	160	1.8	H	32.13	46.16	54	7.84
4806.00	54.44	PK	172	1.5	H	5.40	59.84	74	14.16
4806.00	46.98	Ave.	172	1.5	H	5.40	52.38	54	1.62
Middle Channel (2440 MHz)									
2440.00	42.67	PK	95	2.1	H	31.97	74.64	114	39.36
2440.00	39.58	Ave.	95	2.1	H	31.97	71.55	94	22.45
2440.00	40.69	PK	227	1.4	V	31.97	72.66	114	41.34
2440.00	38.44	Ave.	227	1.4	V	31.97	70.41	94	23.59
4880.00	52.38	PK	321	1.5	H	6.43	58.81	74	15.19
4880.00	45.25	Ave.	321	1.5	H	6.43	51.68	54	2.32
High Channel (2480 MHz)									
2480.00	42.85	PK	182	2.3	H	32.13	74.98	114	39.02
2480.00	39.63	Ave.	182	2.3	H	32.13	71.76	94	22.24
2480.00	41.22	PK	336	1.0	V	32.13	73.35	114	40.65
2480.00	38.68	Ave.	336	1.0	V	32.13	70.81	94	23.19
2310.75	28.04	PK	148	1.9	H	31.64	59.68	74	14.32
2310.75	14.13	Ave.	148	1.9	H	31.64	45.77	54	8.23
2483.53	36.73	PK	64	1.5	H	32.13	68.86	74	5.14
2483.53	15.11	Ave.	64	1.5	H	32.13	47.24	54	6.76
4960.00	52.58	PK	157	1.4	H	6.95	59.53	74	14.47
4960.00	45.25	Ave.	157	1.4	H	6.95	52.20	54	1.80

Note:

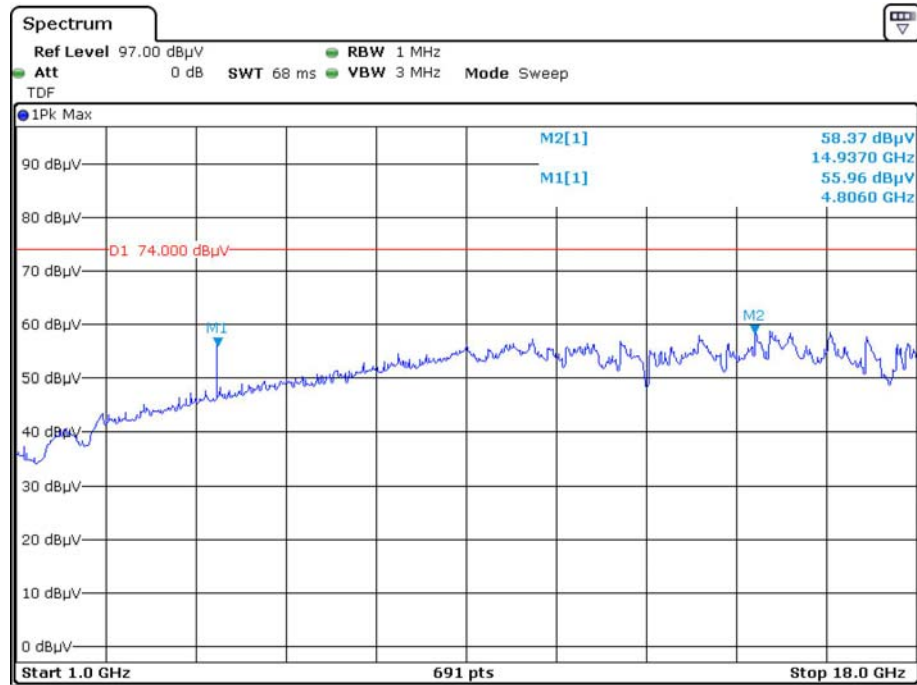
Corrected Amplitude = Corrected Factor + Reading

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

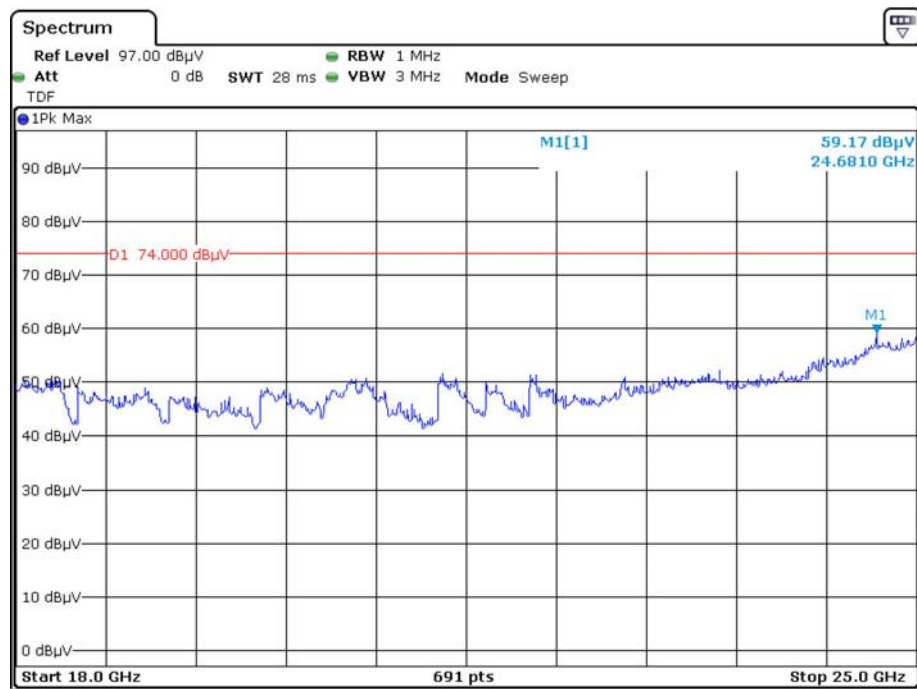
Margin = Limit- Corr. Amplitude

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

Pre-scan with Low channel Peak Horizontal

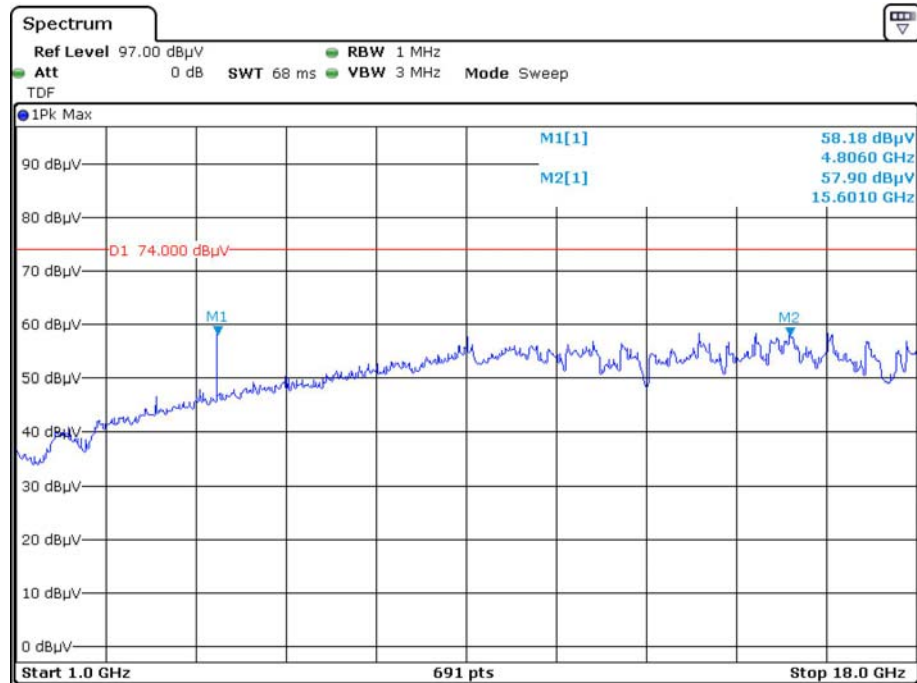


Date: 25.OCT.2019 16:58:44

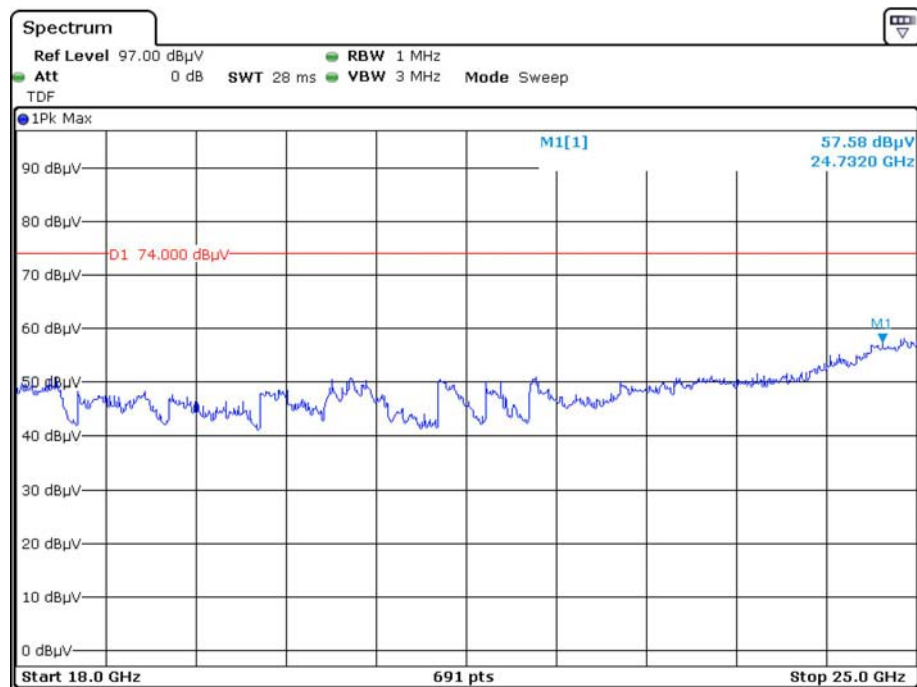


Date: 25.OCT.2019 17:58:46

Vertical

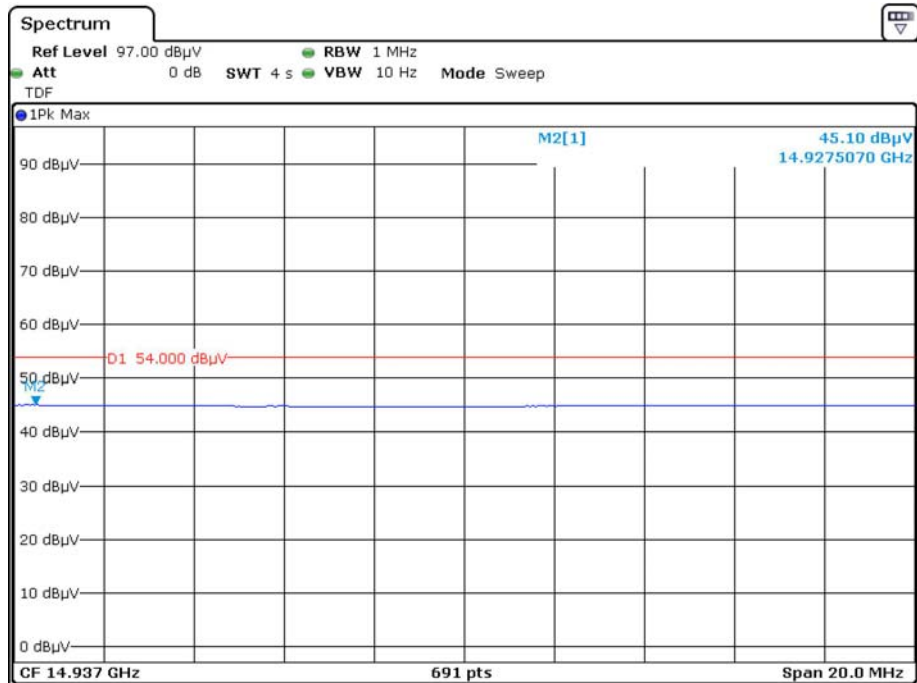


Date: 25.OCT.2019 17:07:15

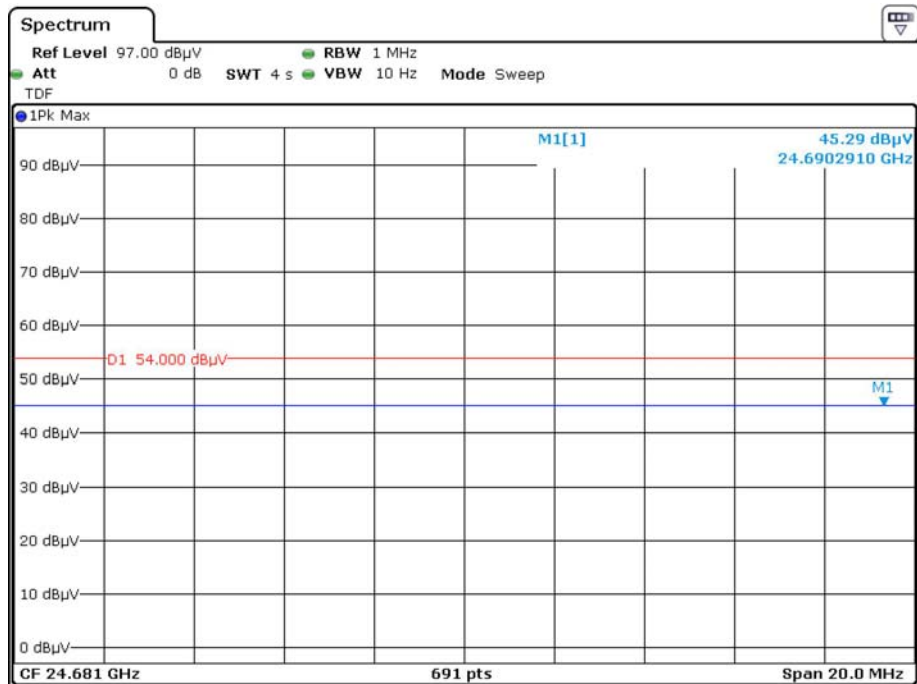


Date: 25.OCT.2019 18:05:45

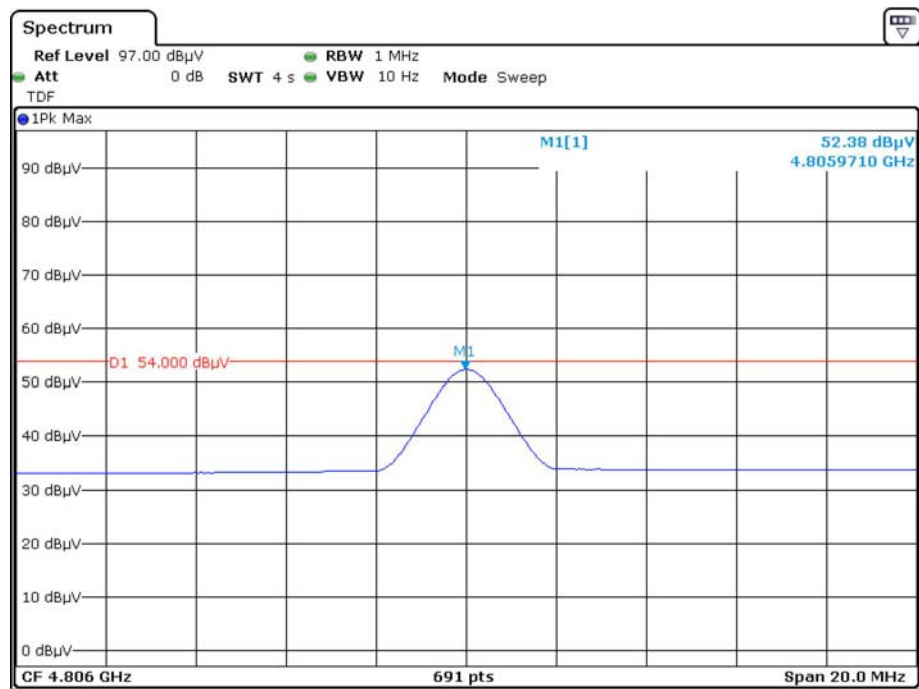
**Average value for the peak point at pre-scan
Horizontal**



Date: 25.OCT.2019 17:02:14

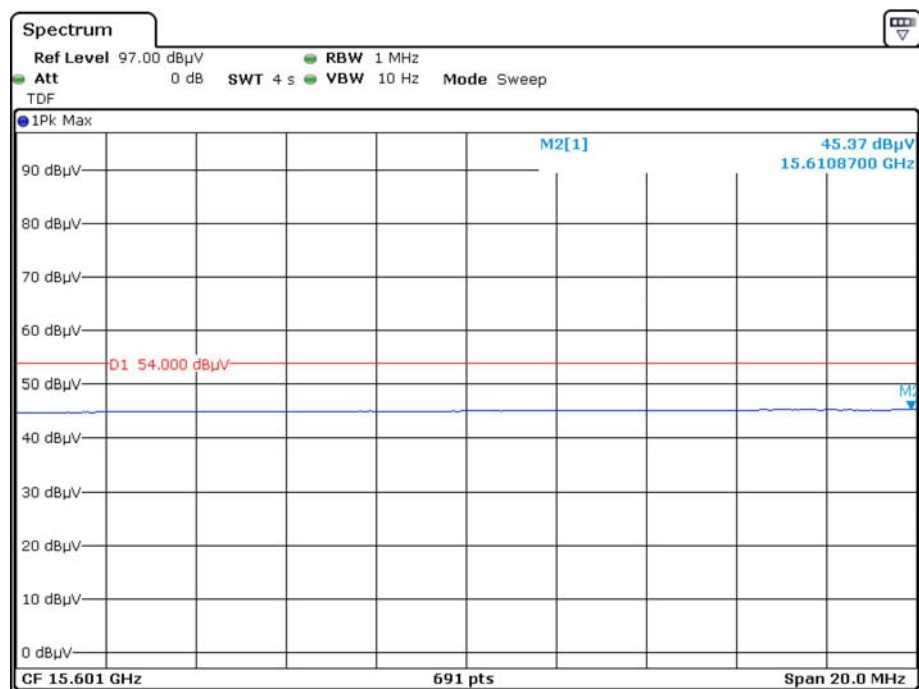


Date: 25.OCT.2019 18:02:09

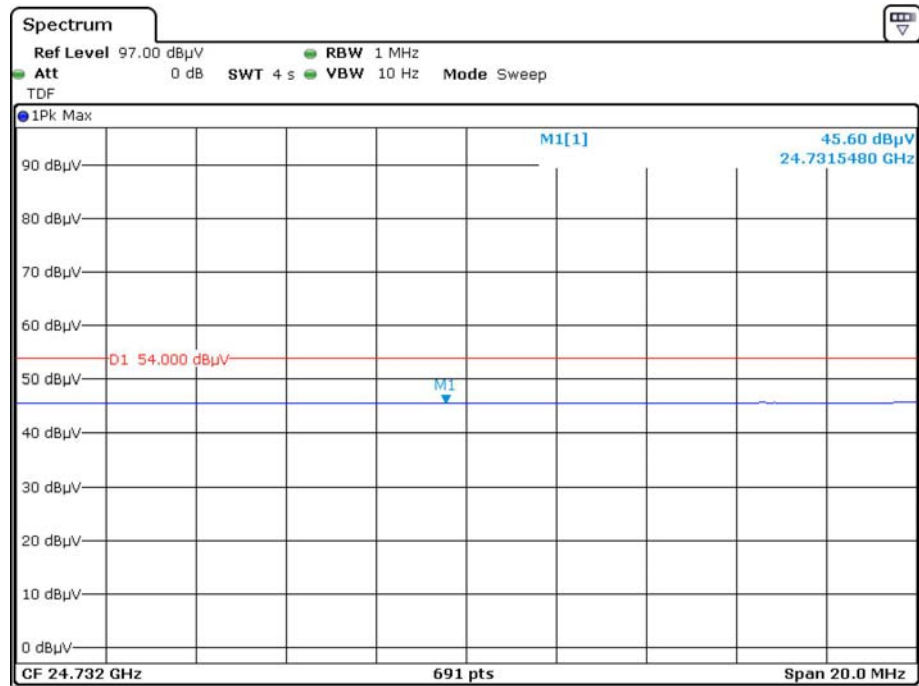


Date: 25.OCT.2019 17:18:24

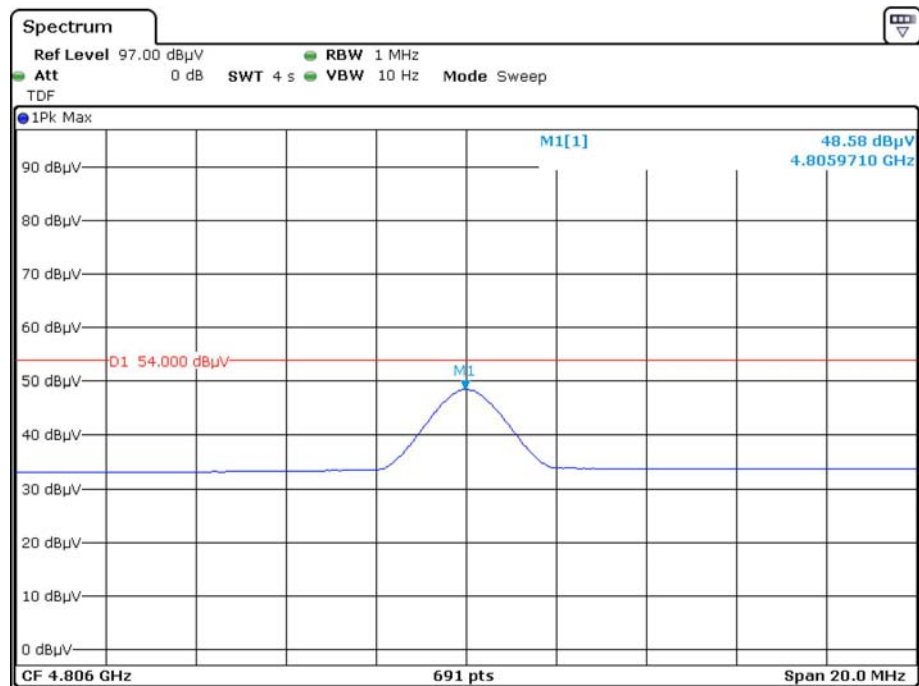
Vertical



Date: 25.OCT.2019 17:10:58



Date: 25.OCT.2019 18:09:12



Date: 25.OCT.2019 17:15:18

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 20dB bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

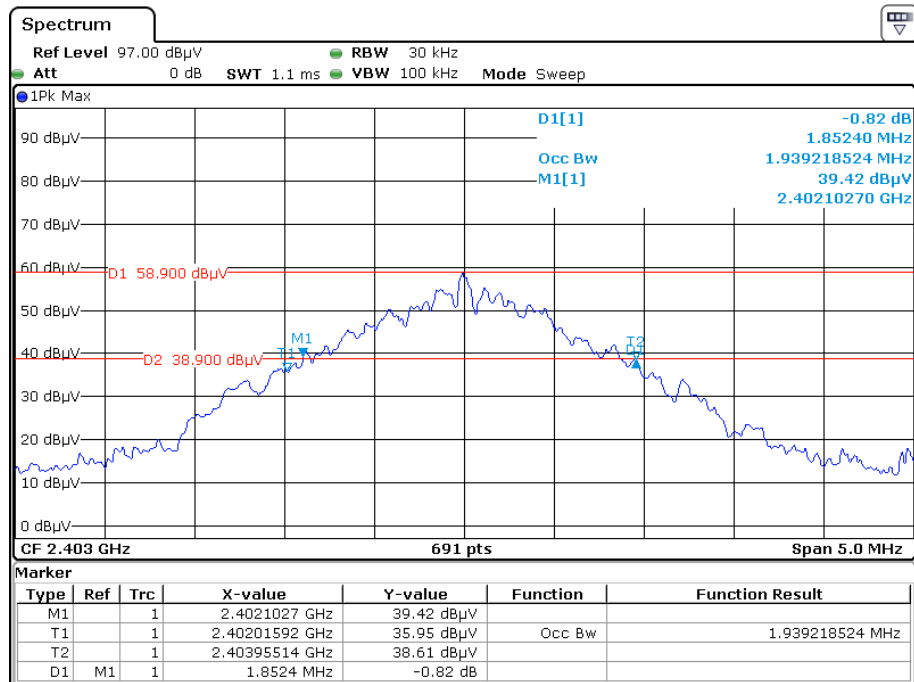
The testing was performed by Alan He on 2019-10-10

Test Mode: Transmitting

Please refer to the following table and plots.

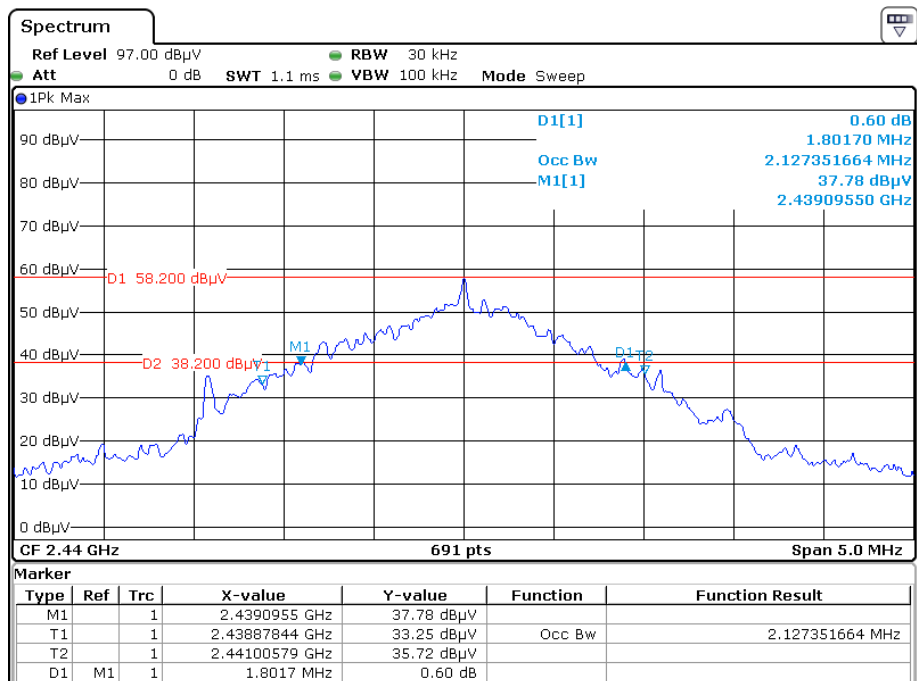
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2403	1.852
Middle	2440	1.802
High	2480	1.751

Low Channel



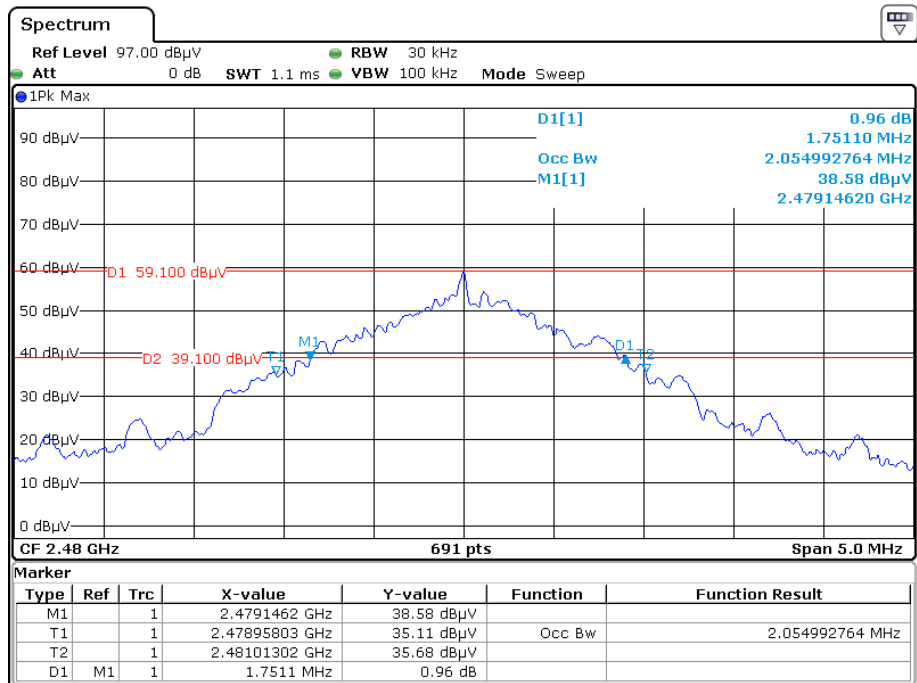
Date: 10.OCT.2019 19:59:58

Middle Channel



Date: 10.OCT.2019 20:11:39

High Channel



Date: 10.OCT.2019 19:25:40

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