FCC Test Report

Part 15 subpart C

Client Information:

Applicant: VVDN Technologies Pvt. Ltd.

Applicant add.: 398, Sector 8, Imt Manesar, Gurugram, Haryana 122051.

Product Information:

EUT Name: QCS610-410EVK

Model No.: QCS610 EVK (SOM+Carrier)

Brand Name: **VVDN**

FCC ID: 2A8AKQC610-410EVK

Standards: FCC PART 15 Subpart C: 2013 section 15.247

Serial Model: QCS410 SOM, QCS610 SOM

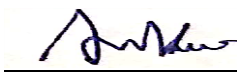
AA Electro Magnetic Test Laboratory Private Limited

Add. : Plot No 174, Udyog Vihar - Phase 4, Sector 18,
Gurgaon, Haryana, India

Date of Receipt:	Mar. 28, 2022	Date of Test:	Mar. 28 ~ May. 04, 2022
Date of Issue:	May. 05, 2022	Test Result:	Pass

This device described above has been tested by AA Electro Magnetic Test Laboratory Private Limited, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

*This test report must not be used by the client to claim product endorsement by any agency of the U.S. government.

Prepared By (+ signature) Ankur Kumar: 

Reviewed & Approved by: (+ signature) 

Dr. Lenin Raja (Authorized Representative)
(/ lenin83/)

1 Contents

2 Test Summary

Compliance with FCC Part 15 subpart C

Test	Test Requirement	Standard Paragraph	Result
Antenna Requirement	FCC Part 15 C:2013	Section 15.247(c)	**PASS**
Conduction Emissions	FCC Part 15 C:2013	Section 15.207(a)	**PASS**
Radiated Emissions	FCC Part 15 C:2013	Section 15.247(d)	**PASS**
Occupied Bandwidth	FCC Part 15 C:2013	Section 15.247(a)(2)	**PASS**
Peak power density	FCC Part 15 C:2013	Section 15.247(e)	**PASS**
Maximum Peak Output Power	FCC Part 15 C:2013	Section 15.247(b)(1)	**PASS**
Band edge	FCC Part 15 C:2013	Section 15.247(d)	**PASS**
Conducted Spurious Emissions	FCC Part 15 C:2013	Section 15.247(d)	**PASS**
Note:			
(1)	Reference to the KDB 558074 D01 DTS Meas Guidance v03r03		
(2)	Reference to ANSI C63.10:2013.		

Test Location

All tests were performed at:

AA Electro Magnetic Test Laboratory Private Limited

Plot No 174, Udyog Vihar - Phase 4, Sector 18, Gurgaon, Haryana, India

Tel.: +91-0124-4235350

Measurement Uncertainty

All measurements involve certain levels of uncertainties, The following measurements uncertainty Levels have estimated based on ANSI C63.4:2013, the maximum value of the uncertainty as below

No.	Item	Uncertainty
1	Conducted Emission Test	2.69dB
2	Radiated Emission Test	3.09dB

3 Test Facility

The test facility is recognized, certified or accredited by the following organizations:

ILAC / NABL Accreditation No.: TC-8597

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by National Accreditation Board for Testing and Calibration Laboratories (NABL).

ILAC –A2LA Accreditation No.: 5593.01

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered American Association of Laboratory Accreditation (A2LA.)

FCC- Recognition No.: 137777

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by Federal Communications Commission (FCC).

ISED Recognition No.: 26046

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by Institute for Social and Economic Development.(ISED)

VCCI- Registration No: 4053

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by Voluntary Control Council for Interference.(VCCI)

TEC Designation No.: IND063

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by Telecommunication Engineering (TEC) Center.

BIS Recognition No: 816586

BIS recognized as per CRS scheme for IT electronics, LED control gears, Lamp, Inverter / UPS are recognized as per LRS 2020.

Deviation from standard

None

Abnormalities from standard conditions

None

4 General Information

General Description of EUT

Manufacturer:	VVDN Technologies Pvt. Ltd.
Manufacturer Address:	398, Sector 8, Imt Manesar, Gurugram, Haryana 122051.
EUT Name:	QCS610-410EVK
Model No:	QCS610 EVK (SOM+Carrier)
Brand Name:	**VVDN**
Serial No:	12
Derivative model No.:	QCS410 SOM, QCS610 SOM
Operation frequency:	2402 MHz to 2480 MHz
NUMBER OF CHANNEL:	40
Modulation Technology:	GSFK
Bluetooth version:	5.0
Antenna Type:	Flexible Antenna with Cable
Antenna Gain:	3.2dBi
H/W No.:	QCS610 SOM Board:-701-1-01948_A1 QCS410 SOM Board:-701-1-02751_A1 Carrier Board:- 701-1-01949_A3
S/W No.:	QCS410 SOM : FW version 0.0.2 QCS610 SOM : FW version 0.0.8
Power Supply Range:	**Input of EUT:** Powered through Adapter **Input for Meanwell adapter:** 110-240VAC,50/60Hz,1.4A, Output: 12VDC,5A, 60W (max)
Output power（max）:	6.87 dBm
Condition of Sample on receipt:	Good
Note:	1 .For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual. 2. Antenna gain and antenna type provided by manufacturer.

Description of Channel:			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

Description of Test conditions

(1) EUT was tested in normal configuration (Please See following Block diagram)

1. Block diagram of EUT configuration(TX Mode)

Note: 1.The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

2. Using the notebook and the transform board to control the fixed transmitting frequency and other test mode. After finishing the test setting, the notebook and the transform board will be removed during measurements.

(2) E.U.T. test conditions:

15.31(e): For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

(3) Test frequencies:

According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and. If required reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

(4) Frequency range of radiated measurements:

According to the 15.33, the test range will be up to the tenth harmonic of the highest fundamental frequency.

Test Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	signal cable
1	Laptop	DELL	N/A	Latitude 3490	5M2Z1W2	2m unshielded	N/A

EUT Peripheral List

No.	Equipment	Manufacturer	Model No.	Serial No.	Power cord	signal cable
1.	AC-DC Adapter	Meanwell	GST60A12	SC103R1080	1m Unshielded wire	N/A
2	Micro SD Card	Sandisk	32GB Class 10	-	-	-
3	HDMI Monitor	LAPCARE	-	-	--	-
4	HDMI Cable	-	-	-	N/A	1.5m shielded wire
5	Camera Module	ECON	e-CAM83_CUMI415_MOD	-	N/A	N/A
6	Camera Cable	I-PEX	81214-530B-300-1	-	N/A	30cm unshielded cable
7	USB 3.0 Pen drive	Sandisk	16GB	-	N/A	N/A
8	Ethernet Cable	-	-	-	N/A	2m UTP LAN Cable
9	RF Antenna	Molex	1461530050	-	-	-

5 Equipments List for All Test Items

No	Test Equipment	Manufacturer	Model No	Serial No	Cal. Date	Cal.Due Date
1	Spectrum Analyzer	Rohde and Schwarz	FSP40	101163	2020/12/11	2022/12/10
2	Loop antenna	DAZE Beijing	ZN30900C	18052	2021/01/29	2023/01/28
3	Hi power horn antenna	DAZE Beijing	ZN30700	18012	2021/01/30	2023/01/29
4	Horn antenna	DAZE Beijing	ZN30702	18006	2021/01/30	2023/01/29
5	Horn antenna	DAZE Beijing	ZN30703	18005	2021/01/30	2023/01/29
6	Pre amplifier	KELIANDA	LNA-0009295	-	2021/01/13	2023/01/13
7	Pre amplifier	KELIANDA	CF-00218	-	2021/01/13	2023/01/13
8	Biconical Antenna	DAZE Beijing	ZN30505C	17038	2021/01/13	2023/01/13
9	EMI-RECEIVER	Schwarzbeck	FCKL	1528194	2021/01/13	2023/01/13
10	Spectrum Analyzer	ADVANTEST	R3361	-	2021/01/13	2023/01/13
11	LISN	Kyoritsu	KNW-407	8-1789-5	2021/01/13	2023/01/13
12	Network-LISN	SCHWAR ZBECK	NNBM8125	81251314	2021/01/13	2023/01/13
13	Network-LISN	SCHWAR ZBECK	NNBM8125	81251315	2021/01/13	2023/01/13
14	PULSELIMITER	Rohde and Schwarz	ESH3-Z2	100681	2022/05/13	2023/05/12
15	50ΩCoaxialSwitch	DAIWA	1565157	-	2022/05/13	2023/05/12
16	50ΩCoaxialSwitch	-	-	-	2022/05/13	2023/05/12
17	Wireless signal power meter	DARE!!	RPR3006W	RFSW190220	2021/01/13	2023/01/13

18	Signal Generator	KEYSIGHT	N5181A	512071	2021/01/13	2023/01/13
19	RF Vector Signal Generator	Keysight	N5182B	512094	2021/01/13	2023/01/13
20	Spectrum analyzer	R&S	FSV-40N	101385	2021/01/13	2023/01/13
21	Radio Communication Tester	R&S	CMW 500	124589	2022/05/15	2023/05/14
22	Signal Generator	R&S	SMP02	837017/004 836593/005	2022/05/15	2023/05/14
23	DC Power Supply	Guanker	JK15040K	TNC/ET/C/001/15	2021/02/02	2023/02/01
24	Pro. Temp & Humi. chamber	MENTEK	MHP-150-1C	MAA08112501	2021/02/02	2023/02/01
25	Attenuators	AGILENT	8494B	-	-	-
26	Attenuators	AGILENT	8495B	-	-	-

6 Test Result

Antenna Requirement

6.1.1 Standard requirement

15.203 requirements: For intentional device, according to 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.

15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

6.1.2 EUT Antenna

The antenna is a Flexible Antenna with Cable which is connected to the board using a N-type to U.FL cable which is connected to the board via U.FL connector. Antenna gain is maximum 3.2dBi from 2.4GHz to 2.5 GHz

Conduction Emissions Measurement

6.1.3 Applied procedures / Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

Note: Decreases with the logarithm of the frequency.

6.1.4 Test procedure

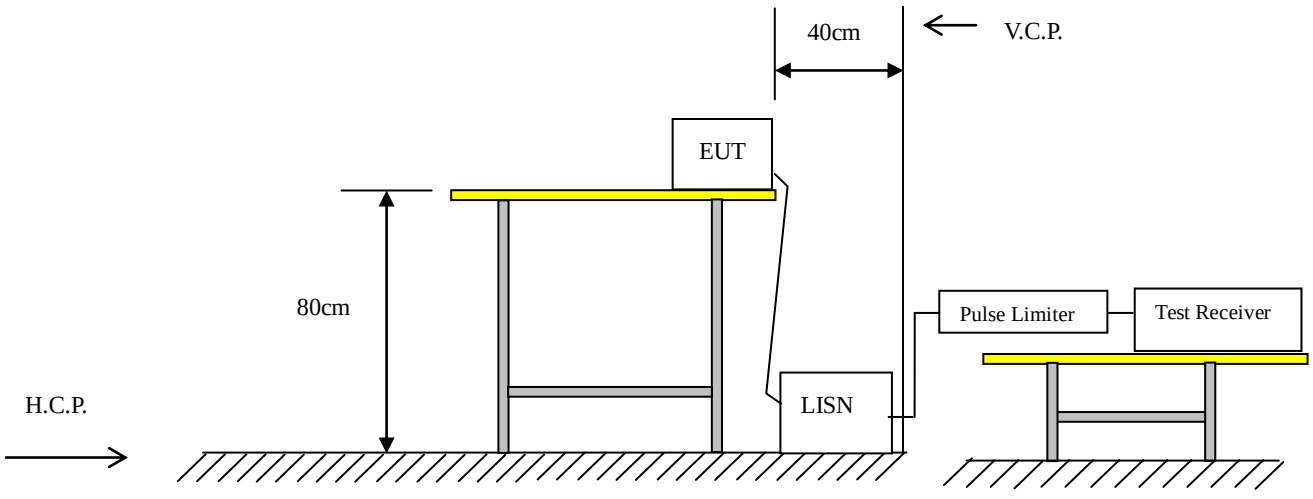
1. The mains terminal disturbance voltage test was conducted in a shielded room.

2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50µH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

Test setup

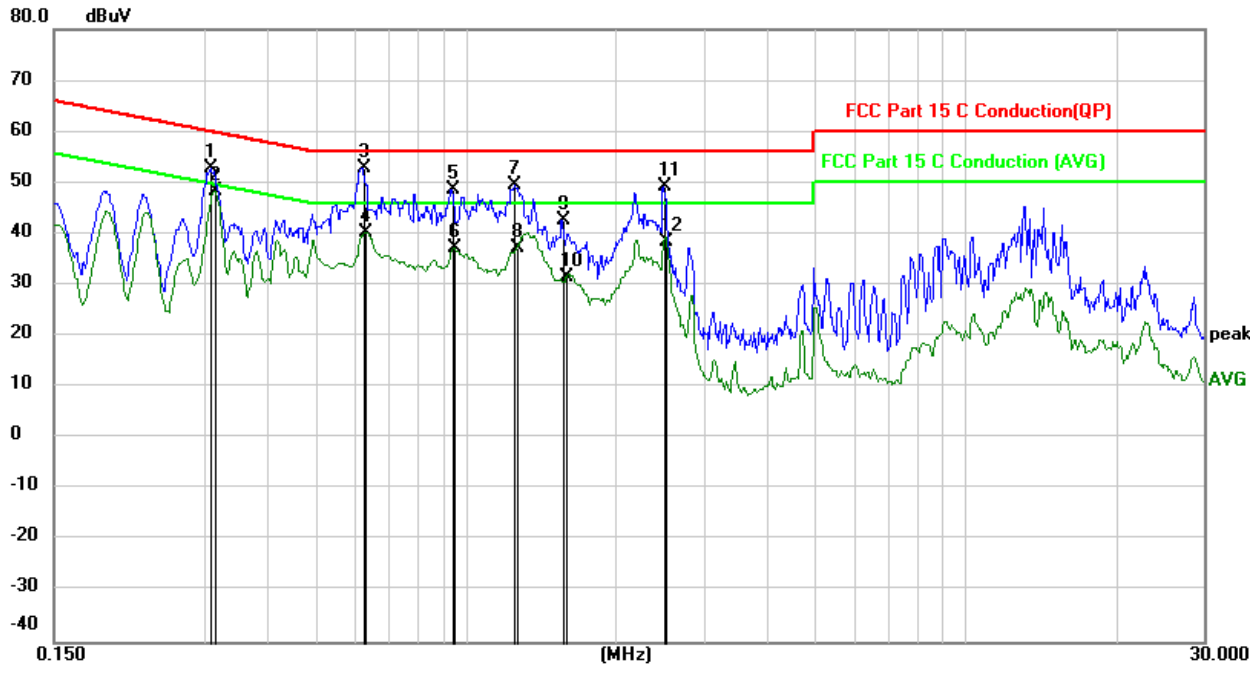


6.1.5 Test results

EUT:	QCS610-410EVK	Model Name. :	QCS610 EVK (SOM+Carrier)
Temperature:	25 ℃	Relative Humidity:	51%
Pressure:	1010hPa	Test Date :	2022-03-28
Test Mode:	TX CH00 (worst case)	Phase :	Positive
Test Voltage :	DC 12V		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.3085	52.46	0.45	52.91	60.01	-7.10	QP
2	*	0.3134	48.03	0.45	48.48	49.88	-1.40	AVG
3		0.6260	52.39	0.41	52.80	56.00	-3.20	QP
4		0.6303	39.77	0.41	40.18	46.00	-5.82	AVG
5		0.9410	48.26	0.40	48.66	56.00	-7.34	QP
6		0.9498	36.87	0.40	37.27	46.00	-8.73	AVG
7		1.2424	49.14	0.40	49.54	56.00	-6.46	QP
8		1.2648	36.85	0.40	37.25	46.00	-8.75	AVG
9		1.5620	42.35	0.41	42.76	56.00	-13.24	QP
10		1.5933	31.13	0.41	31.54	46.00	-14.46	AVG
11		2.4890	48.85	0.41	49.26	56.00	-6.74	QP
12		2.5159	37.99	0.41	38.40	46.00	-7.60	AVG

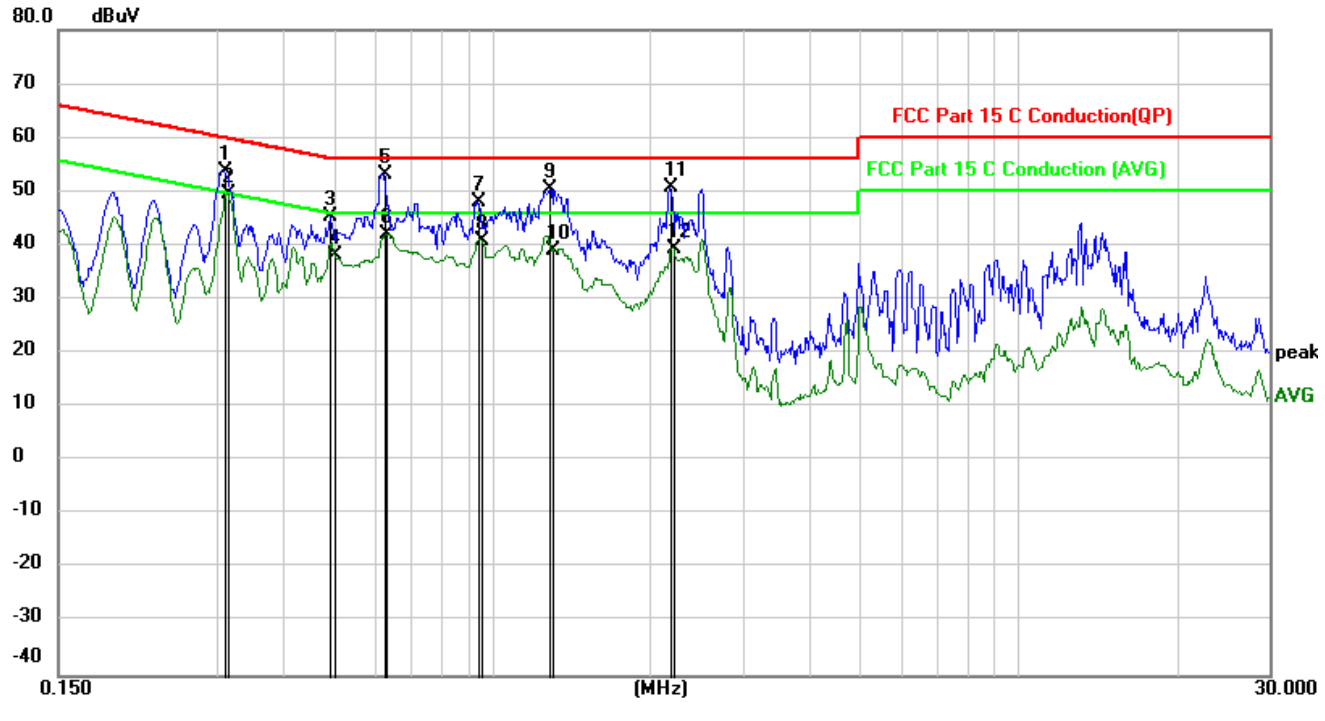
Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.



EUT:	QCS610-410EVK	Model Name. :	QCS610 EVK (SOM+Carrier)
Temperature:	25 ℃	Relative Humidity:	51%
Pressure:	1010hPa	Test Date :	2022-03-28
Test Mode:	TX CH00 (worst case)	Phase :	Negative
Test Voltage :	DC 12V		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.3103	53.41	0.45	53.86	59.96	-6.10	QP
2	*	0.3140	49.14	0.45	49.59	49.86	-0.27	AVG
3		0.4916	45.06	0.41	45.47	56.14	-10.67	QP
4		0.5043	37.79	0.41	38.20	46.00	-7.80	AVG
5		0.6260	52.69	0.41	53.10	56.00	-2.90	QP
6		0.6303	41.75	0.41	42.16	46.00	-3.84	AVG
7		0.9410	47.54	0.40	47.94	56.00	-8.06	QP
8		0.9544	40.33	0.40	40.73	46.00	-5.27	AVG
9		1.2830	49.95	0.40	50.35	56.00	-5.65	QP
10		1.2963	38.77	0.40	39.17	46.00	-6.83	AVG
11		2.1785	50.39	0.41	50.80	56.00	-5.20	QP
12		2.2053	38.81	0.41	39.22	46.00	-6.78	AVG

Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.



Radiated Emissions Measurement

6.1.6 Applied procedures / Limit

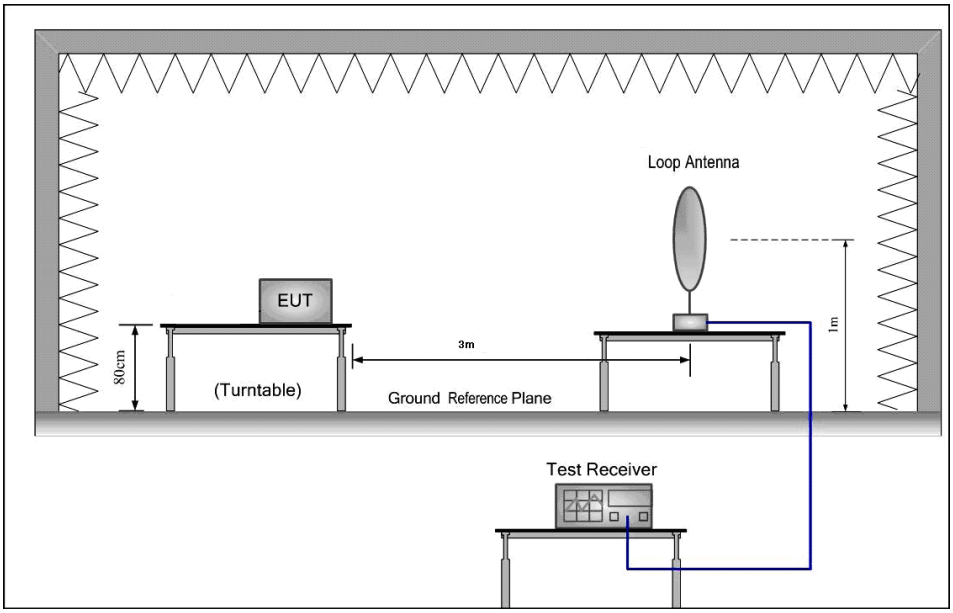
15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Frequency of Emission (MHz)	Field Strength		Measurement Distance (meters)
	µV/m	dBµV/m	
0.009-0.49	2400/F(kHz)		300
0.49-1.705	24000/F(kHz)		30
1.705-30	30		30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

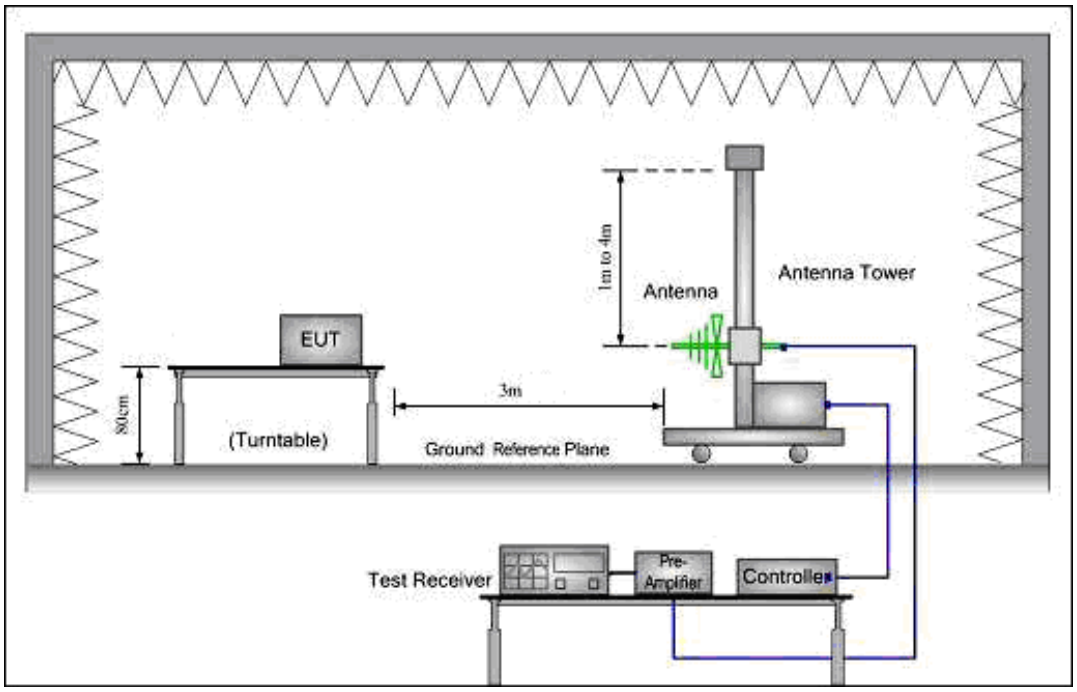
6.1.7 Test setup

Test Configuration:

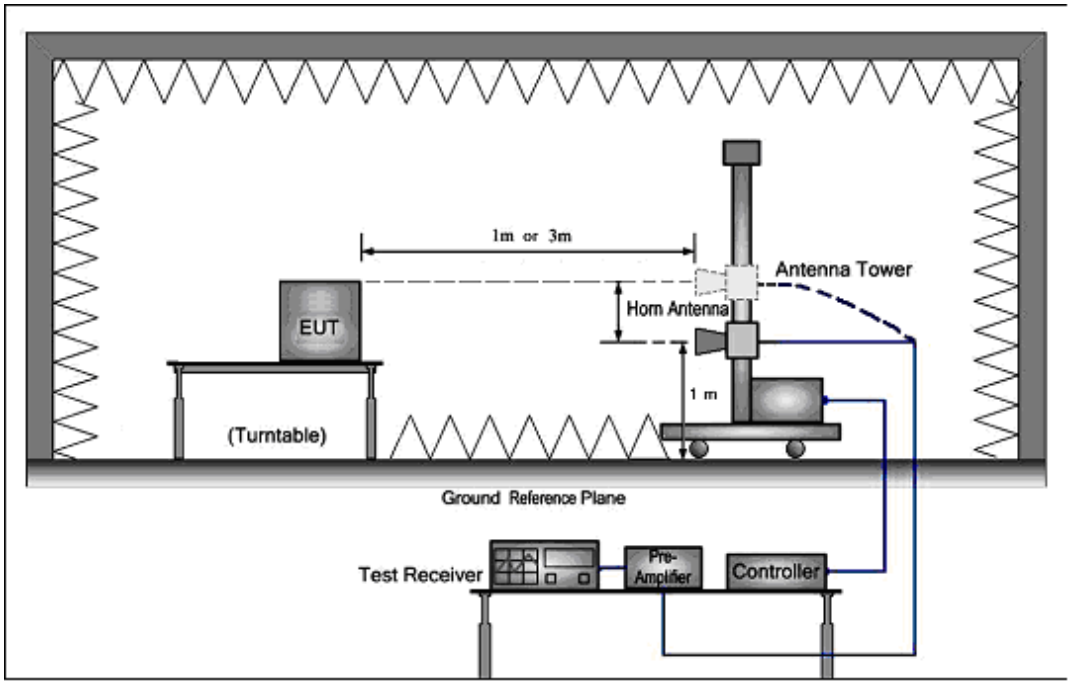
1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 25 GHz emissions:



6.1.8 Test procedure

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter, for the test frequency of above 1GHz, horn antenna opening in the test would have been facing the EUT when rise or fall) and the table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. The resolution bandwidth and video bandwidth of the test receiver was 1MHz and 1MHz for Peak detection at frequency above 1GHz.

g. Test the EUT in the lowest channel (2402MHz), the middle channel (2440MHz), the Highest channel (2480MHz)

h. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.

i. Repeat above procedures until all frequencies measured was complete.

For measurement at frequency above 1GHz

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

For Average measurement at frequency above 1GHz.

The resolution bandwidth of the test receiver was 1MHz; due to the shortest pulse width T is 116us, according the video bandwidth should not smaller than 1/T, so the video bandwidth is 10Hz.

In 18GHz to 25GHz, The EUT was checked by Horn ANT. But the test result at least have 20dB margin.

The EUT was tested in Chamber Site.

6.1.9 Test Result

Radiated Emissions Test Data Below 30MHz

EUT:	QCS610-410EVK	Model Name. :	QCS610 EVK (SOM+Carrier)
Temperature:	23 ℃	Test Data	2022-03-29
Pressure:	1005 hPa	Relative Humidity:	56%
Test Mode :	TX	Test Voltage :	DC 12V
Measurement Distance	3 m	Frequency Range	9KHz to 30MHz
RBW/VBW	9KHz~150KHz/RB 200Hz for QP, 150KHz~30MHz/RB 9KHz for QP		

No emission found between lowest internal used/generated frequencies to 30MHz.

Radiated Emissions Test Data Below 1GHz

EUT:	QCS610-410EVK	Model Name. :	QCS610 EVK (SOM+Carrier)
Temperature:	23 ℃	Test Data	2022-03-29
Pressure:	1005 hPa	Relative Humidity:	56%
Test Mode :	TX:802.11b 2.412 GHz(worst-case)	Test Voltage :	DC 12V
Measurement Distance	3 m	Frequency Range	30MHz to 1GHz
RBW/VBW	100KHz / 300KHz for spectrum, RBW=120KHz for receiver.		

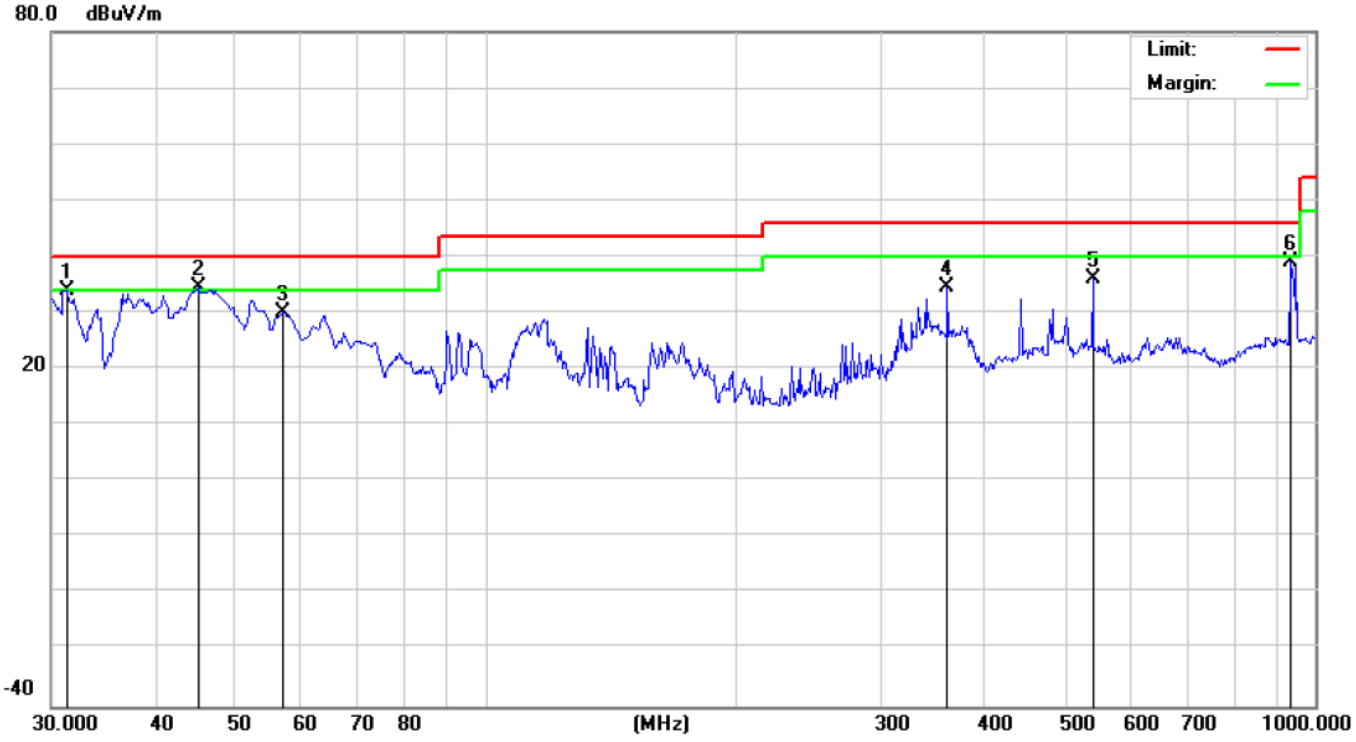
Test at Channel 00 (2.402 GHz) in transmitting status (Worst Case)

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	!	31.2892	45.77	-11.68	34.09	40.00	-5.91	QP
2	*	45.0583	52.59	-18.08	34.51	40.00	-5.49	QP
3		57.1599	47.07	-17.03	30.04	40.00	-9.96	QP
4		360.7699	43.28	-8.77	34.51	46.00	-11.49	QP
5		540.2199	40.94	-4.86	36.08	46.00	-9.92	QP
6		937.9198	36.38	2.53	38.91	46.00	-7.09	QP

Note: '*' means the worst case

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

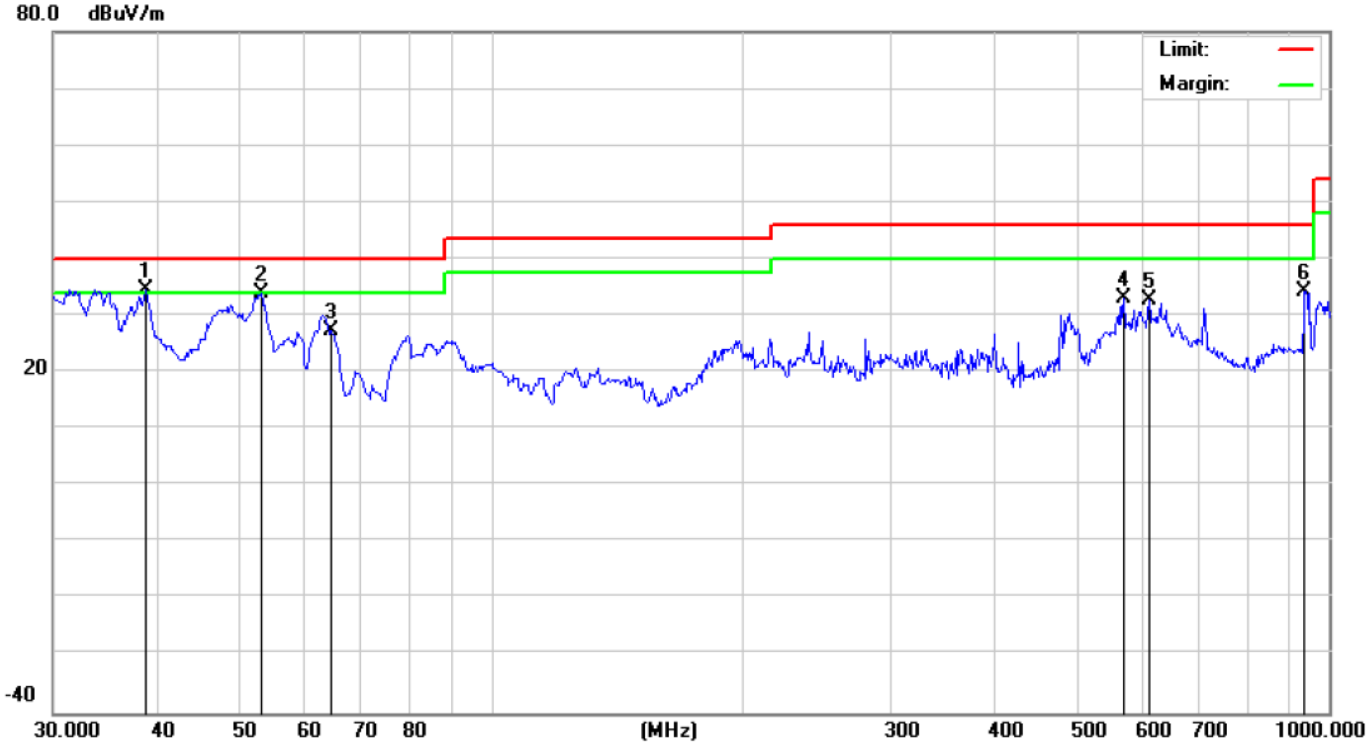
Test at Channel 00 (2.402 GHz) in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	38.7299	53.08	-18.49	34.59	40.00	-5.41	QP
2		53.2800	50.71	-16.75	33.96	40.00	-6.04	QP
3		64.4330	44.68	-17.37	27.31	40.00	-12.69	QP
4		569.3200	37.35	-4.19	33.16	46.00	-12.84	QP
5		610.0596	35.99	-3.34	32.65	46.00	-13.35	QP
6		937.9198	31.84	2.53	34.37	46.00	-11.63	QP

Note: '*' means the worst case

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

Radiated Emissions Test Data Above 1GHz

EUT:	QCS610-410EVK	Model Name. :	QCS610 EVK (SOM+Carrier)
Temperature:	25 ℃	Test Data	2022-03-29
Pressure:	1010 hPa	Relative Humidity:	56%
Test Mode :	TX	Test Voltage :	DC 12V
Measurement Distance	3 m	Frequency Range	1GHz to 25GHz
RBW/VBW	Spurious emission: 1MHz/1MHz for Peak, 1MHz/10Hz for Average. non-restricted band: 100KHz/300KHz for Peak.		

(a) Antenna polarization: Horizontal

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4804	50.95	5.06	56.01	74	-17.99	PEAK
4804	39.22	5.06	44.28	54	-9.72	AVERAGE
7206	46.61	7.03	53.64	74	-20.36	PEAK
7206	35.70	7.03	42.73	54	-11.27	AVERAGE

(b) Antenna polarization: Vertical

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4804	49.70	5.06	54.76	74	-19.24	PEAK
4804	36.64	5.06	41.70	54	-12.30	AVERAGE
7206	45.26	7.03	52.29	74	-21.71	PEAK
7206	34.95	7.03	41.98	54	-12.02	AVERAGE

Note:

8~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

Low Channel 00: 2402 MHz (Worst Case)

Data rate: 1Mbps

6.1.10 TEST RESULTS (Restricted Bands Requirements)

EUT:	QCS610-410EVK	Model Name. :	QCS610 EVK (SOM+Carrier)
Temperature:	25 ℃	Test Data	2022-03-29
Pressure:	1010 hPa	Relative Humidity:	60%
Test Mode :	TX	Test Voltage :	DC 12V
RBW/VBW	1MHz/1MHz for Peak, 1MHz/10Hz for Average.		
Note:	1. The transmitter was setup to transmit at the lowest channel. Then the field strength was measured at 2310-2390 MHz. 2. The transmitter was setup to transmit at the highest channel. Then the field strength was measured at 2483.5-2500 MHz. 3. The data of 2390MHz and 2483.5MHz was the worst.		

Test Mode	Ant.Pol. H/V	Freq. (MHz)	Reading		Ant/CF CF(dB)	Act		Limit	
			Peak (dBuv)	AV (dBuv)		Peak (dBuv/m)	AV (dBuv/m)	Peak (dBuv/m)	AV (dBuv/m)
TX	H	2390	44.57	36.09	-5.79	38.78	30.30	74	54
	V	2390	45.91	37.90	-5.79	40.12	32.11	74	54
	H	2483.5	46.45	32.60	-4.98	41.47	27.62	74	54
	V	2483.5	46.31	34.69	-4.98	41.33	29.71	74	54

BANDWIDTH TEST

6.1.11 Applied procedures / Limit

15.247(a) (2) Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

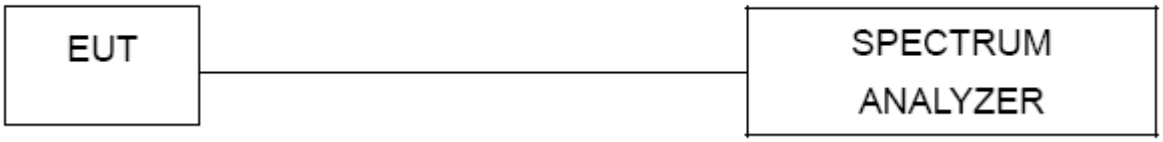
6.1.12 Test procedure

a. The testing follows FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
b. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
c. Spectrum Setting: RBW= 100KHz, VBW≧3×RBW, Sweep time = Auto, Detector Function = Peak, centering on a hopping channel Trace = Max Hold.
d. Mark the peak frequency and -6 dB points bandwidth.

6.1.13 Deviation from standard

No deviation.

6.1.14 Test setup

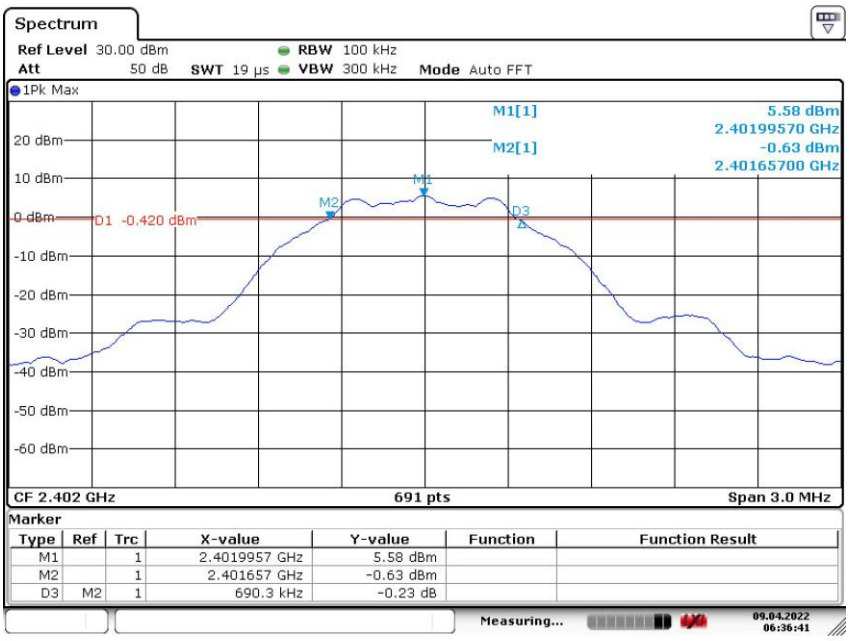


6.1.15 Test results

EUT：	QCS610-410EVK	Model Name. ：	QCS610 EVK (SOM+Carrier)
Temperature：	26 ℃	Relative Humidity：	53%
Pressure：	1010 hPa	Test Power ：	DC 12V
Test Mode ：	Tx		

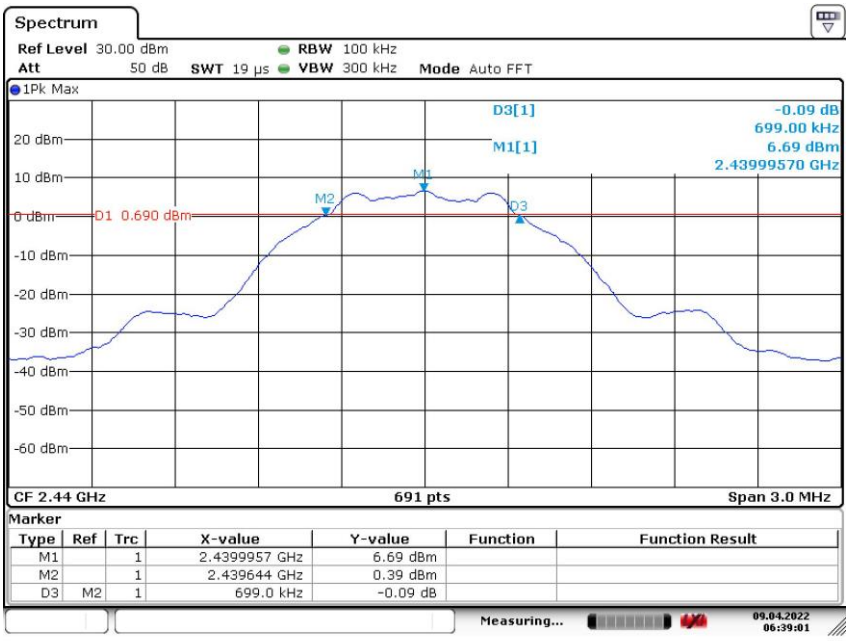
Test Mode	Test Channel	Frequency (MHz)	6 dB Bandwidth (KHz)	Limit （kHz）
Tx	CH00	2402	690.30	≥500
	CH19	2440	699.00	≥500
	CH39	2480	703.30	≥500

The Lowest Channel 00: 2402 MHz



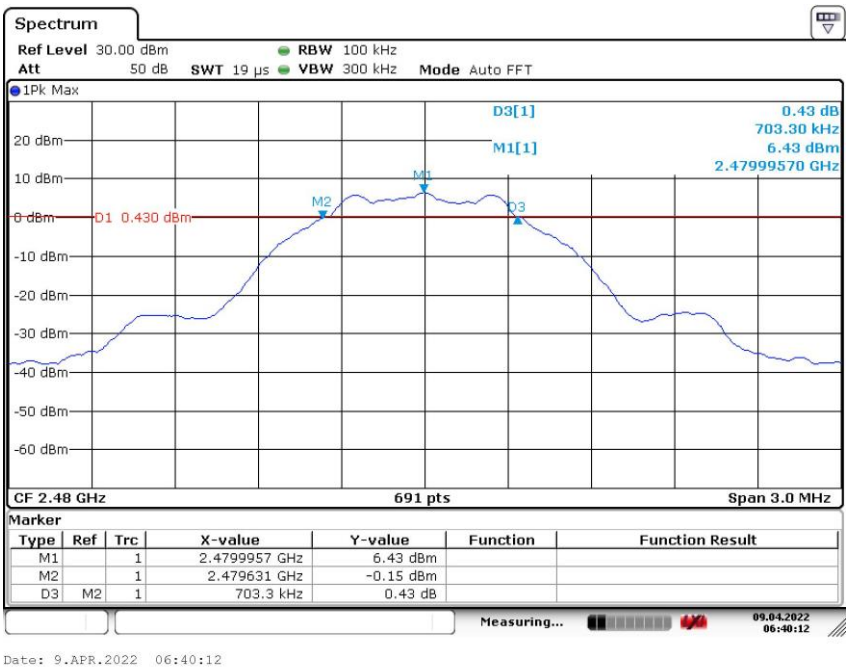
Date: 9.APR.2022 06:36:41

The Middle Channel 19: 2440 MHz



Date: 9.APR.2022 06:39:01

The High Channel 39: 2480MHz



Peak Power Density

6.1.16 Applied procedures / Limit

15.247(a) (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

6.1.17 Test procedure

a. The testing follows Measurement procedure 10.2 Method PKPSD of FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
b. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
c. Connected the antenna port to the Spectrum Analyzer, set the Spectrum Analyzer as center frequency to channel center frequency, span=1.5 times the bandwith, detector = peak
   3kHz≤RBW≤100kHz, VBW≥3×RBW kHz, Sweep time=Auto.
d. Trace mode = max hold. Mark the peak.
e. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.1.18 Deviation from standard

No deviation.

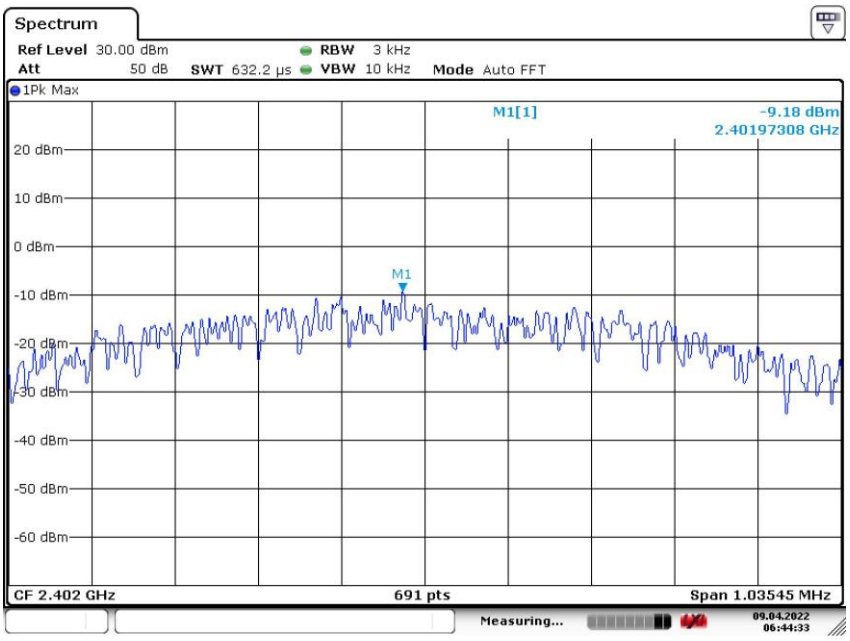
6.1.19 Test results

EUT:	QCS610-410EVK	Model Name. :	QCS610 EVK (SOM+Carrier)
Temperature:	24 ℃	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 12V
Test Mode :	TX		

Test Mode	Channel frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
TX	2402	-9.18	8	Pass
	2440	-7.96	8	Pass
	2480	-8.15	8	Pass

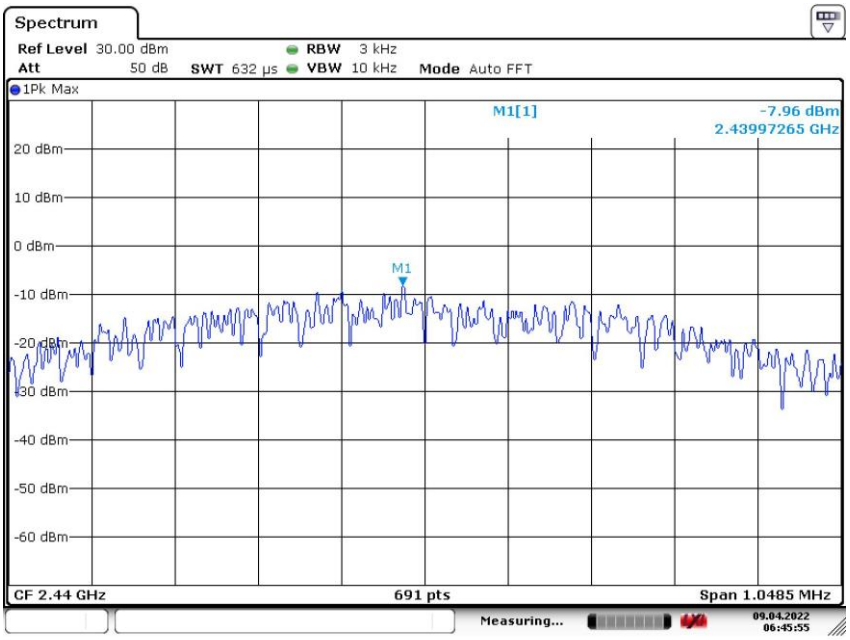
Note: The cable loss is 1.0dB

The Lowest Channel 00: 2402MHz



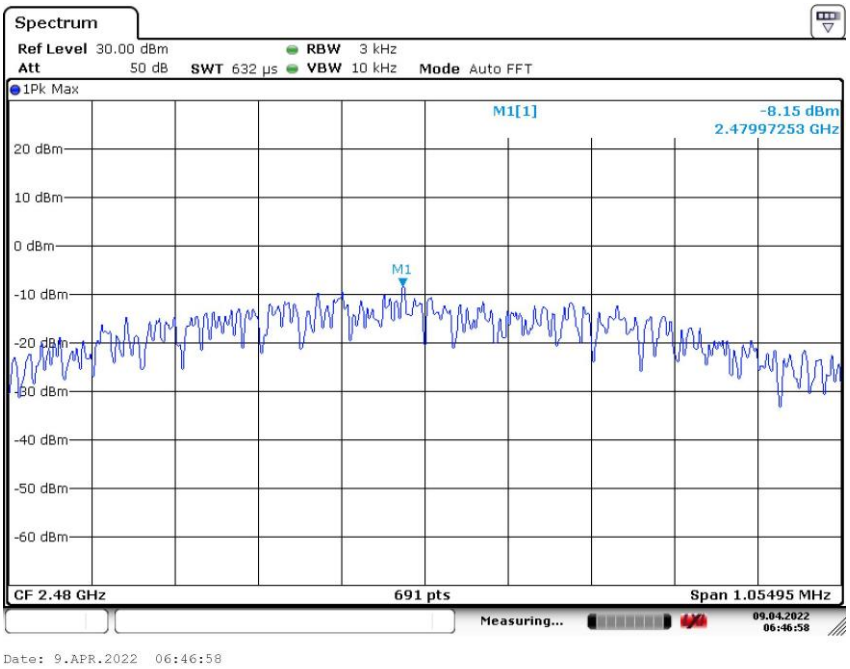
Date: 9.APR.2022 06:44:33

The Middle Channel 19: 2440MHz



Date: 9.APR.2022 06:45:55

The High Channel 39: 2480MHz



Maximum Peak Output Power

6.1.20 Applied procedures / Limit

15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

6.1.21 Test procedure

a. The testing follows FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
b. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
c. Spectrum Setting: RBW≥Bandwidth, VBW≥3×RBW, Sweep time = Auto, Span≥3×RBW,
d. Detector = peak. Trace mode = max hold.
e. Use peak marker function to determine the peak amplitude level.

6.1.22 Deviation from standard

No deviation.

6.1.23 Test setup

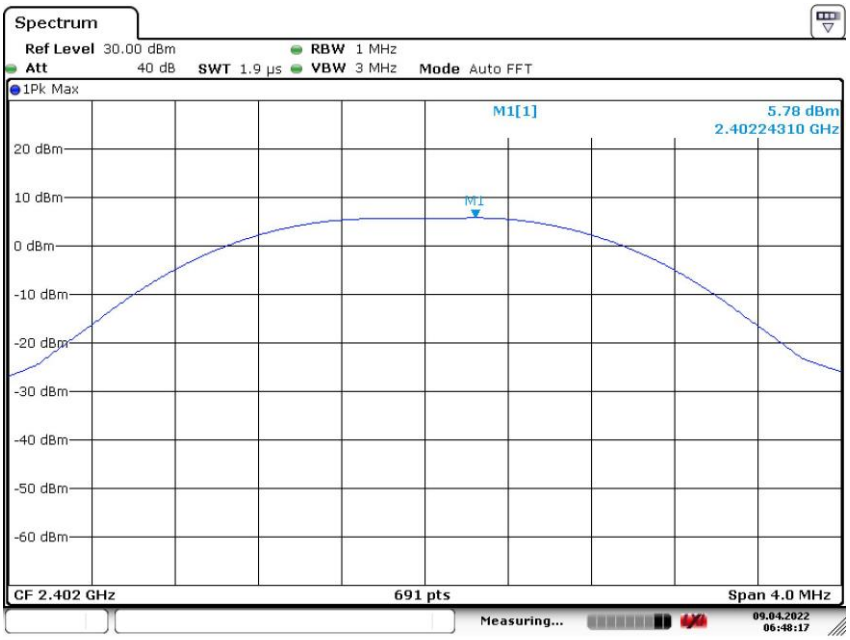
6.1.24 Test results

EUT:	QCS610-410EVK	Model Name. :	QCS610 EVK (SOM+Carrier)
Temperature:	26 °C	Relative Humidity:	60%
Pressure:	1010 hPa	Test Voltage :	DC 12V
Test Mode :	TX		
Note: N/A			

Test Mode	Frequency	Peak Output Power (dBm)	Limit (dBm)	Result
Tx	2402 MHz	5.78	30	Pass
	2440 MHz	6.87	30	Pass
	2480 MHz	6.68	30	Pass

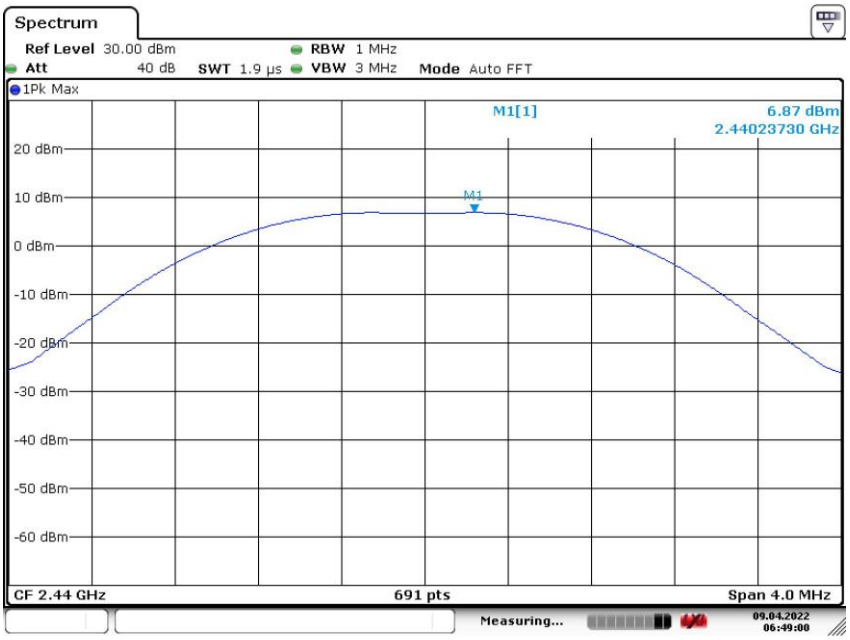
Note: The cable loss is 1.0dB

The Lowest Channel 00: 2402MHz



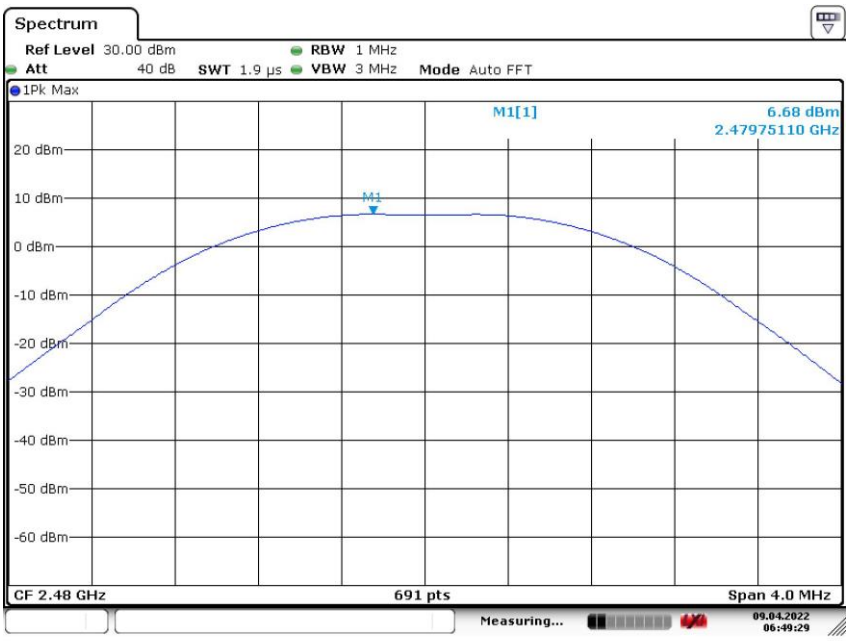
Date: 9.APR.2022 06:48:17

The Middle Channel 19: 2440MHz



Date: 9.APR.2022 06:49:00

The High Channel 39: 2480MHz



Date: 9.APR.2022 06:49:30

Band edge

6.1.25 Applied procedures / Limit

15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.1.26 Test procedure

a. The testing follows FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
b. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
c. Spectrum Setting: RBW=100kHz, VBW≧300kHz, Sweep time=Auto, Detector Function=Peak.
d. The band edges was measured and recorded Result:

   The Lower Edges attenuated more than 20dB.
   The Upper Edges attenuated more than 20dB.

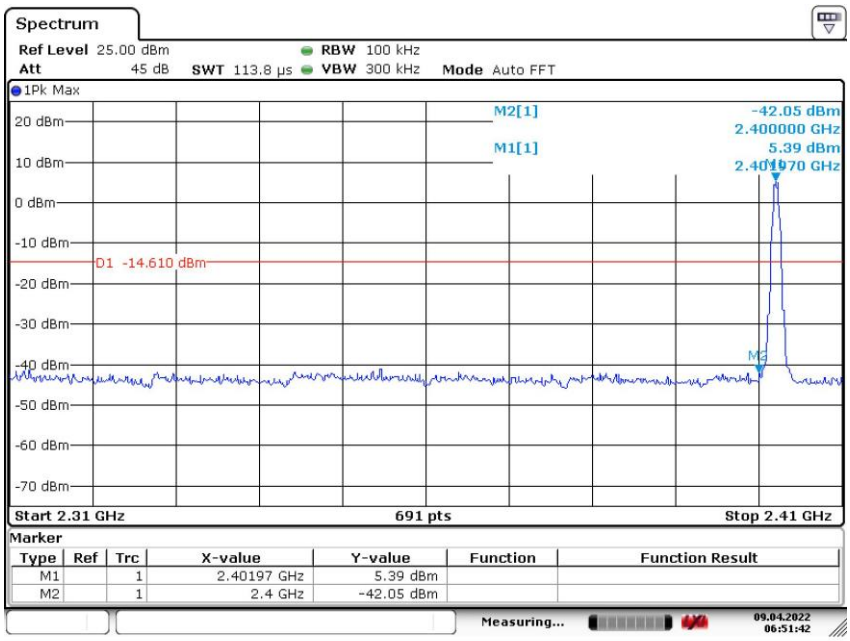
6.1.27 Deviation from standard

No deviation.

6.1.28 Test setup

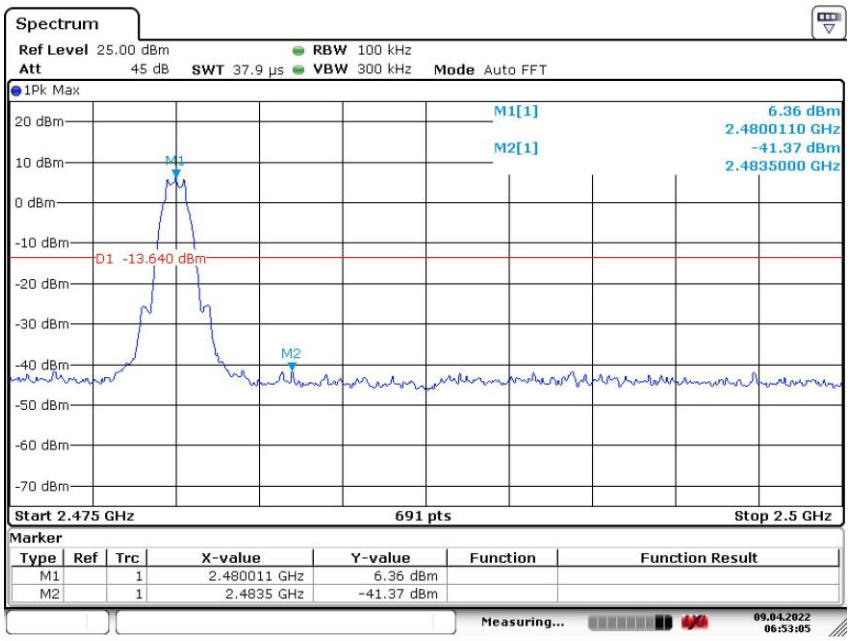
6.1.29 Test results

The Lowest Channel 00: 2402MHz



Date: 9.APR.2022 06:51:42

The High Channel 39: 2480MHz



Date: 9.APR.2022 06:53:05

Conducted Spurious Emissions

6.1.30 Applied procedures / Limit

15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

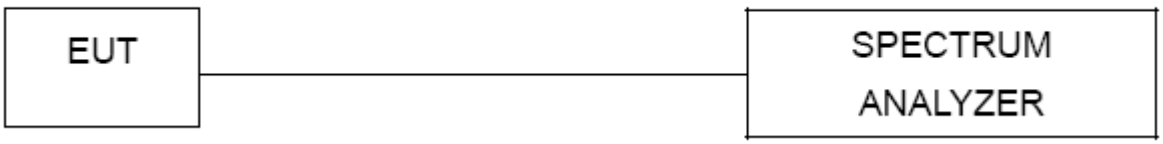
6.1.31 Test procedure

a. The testing follows FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
b. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
c. Spectrum Setting: RBW=100kHz, VBW=300kHz, Sweep time=Auto, Detector Function=Peak, sweep points ≥ investigated frequency range/RBW.

6.1.32 Deviation from standard

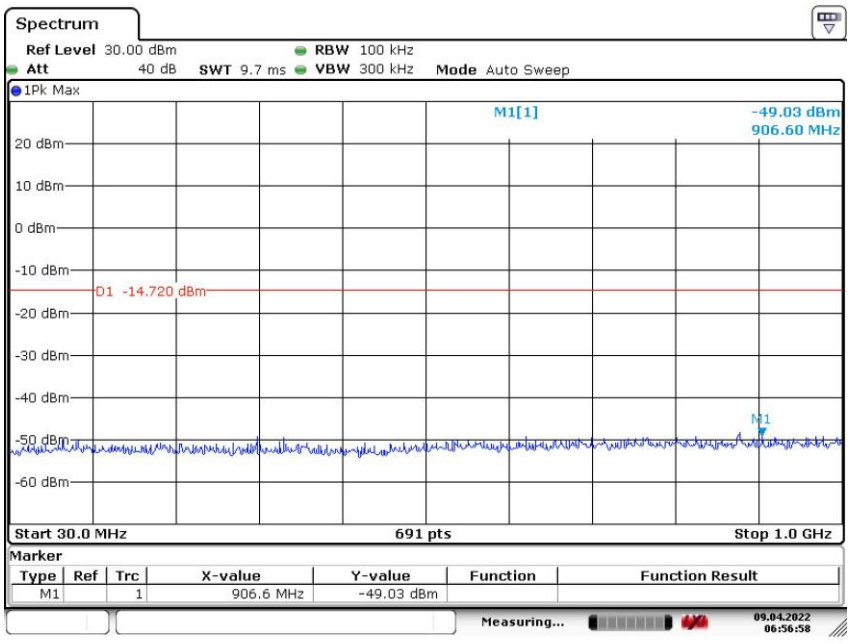
No deviation.

6.1.33 Test setup

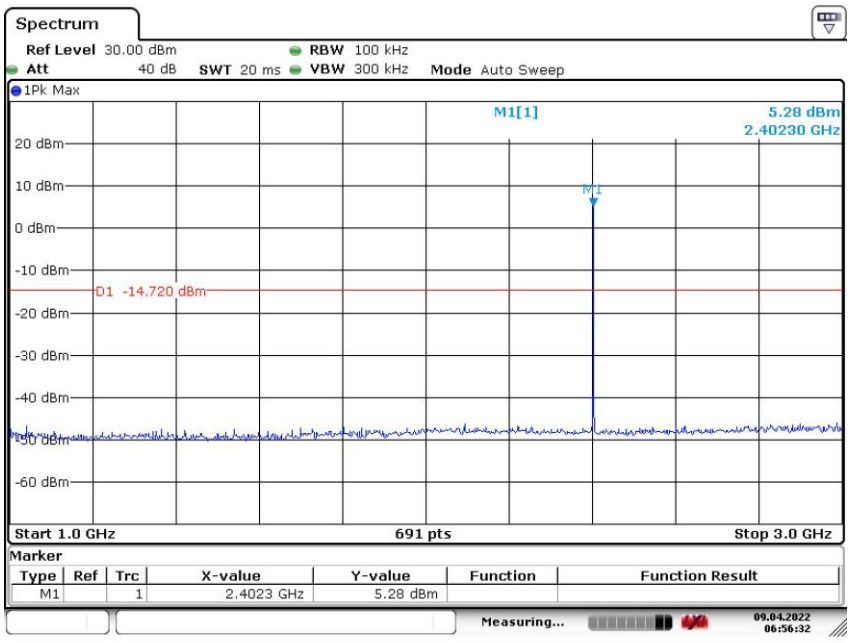


6.1.34 Test results

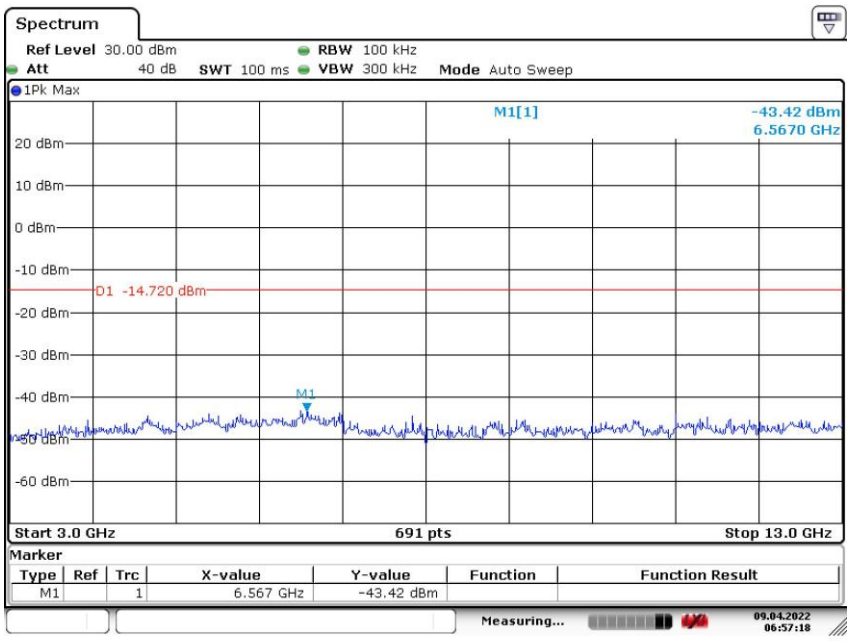
The Lowest Channel 00 : 2402MHz



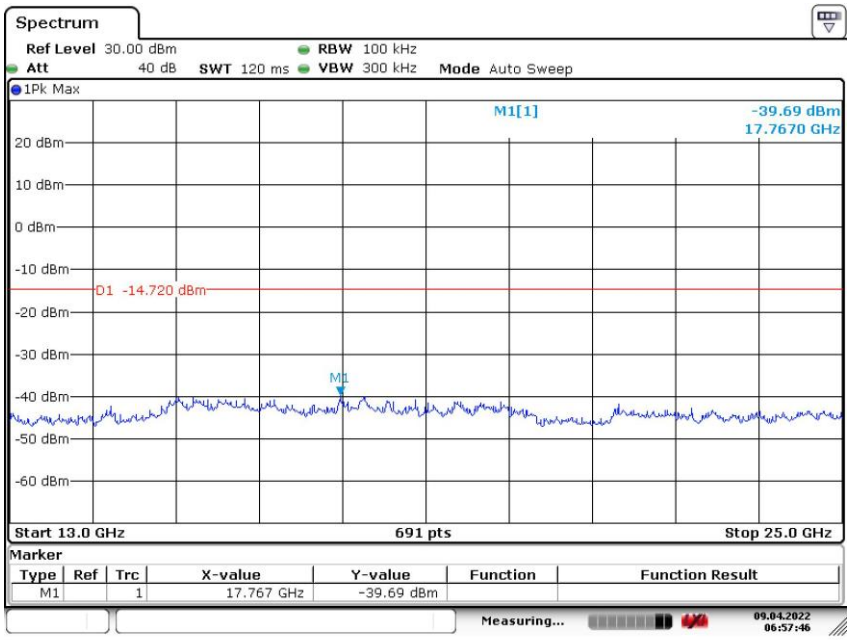
Date: 9.APR.2022 06:56:58



Date: 9.APR.2022 06:56:32

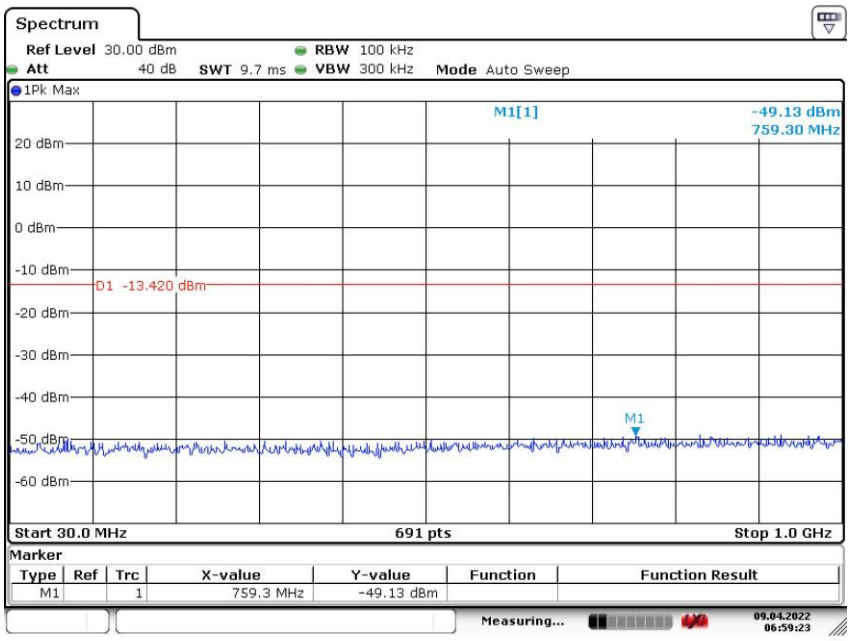


Date: 9.APR.2022 06:57:18

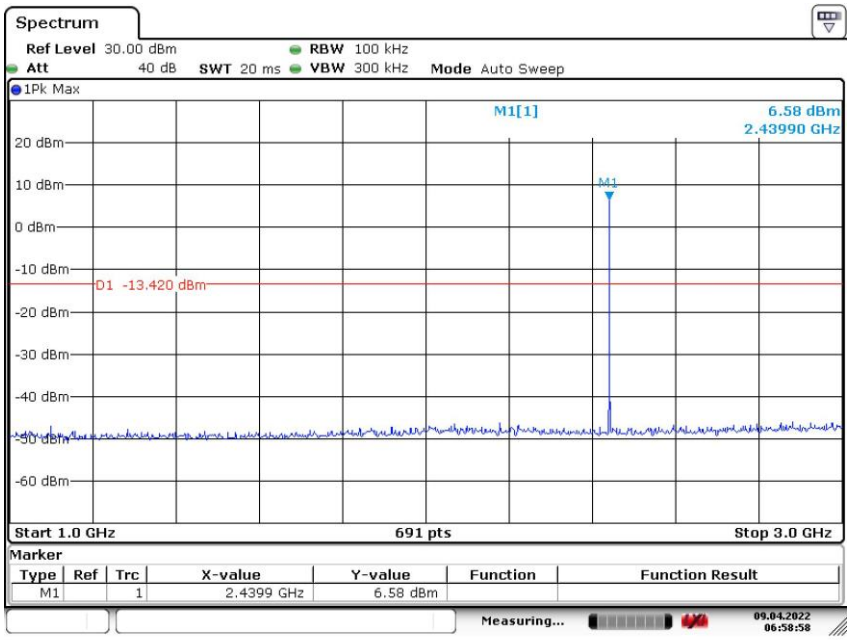


Date: 9.APR.2022 06:57:46

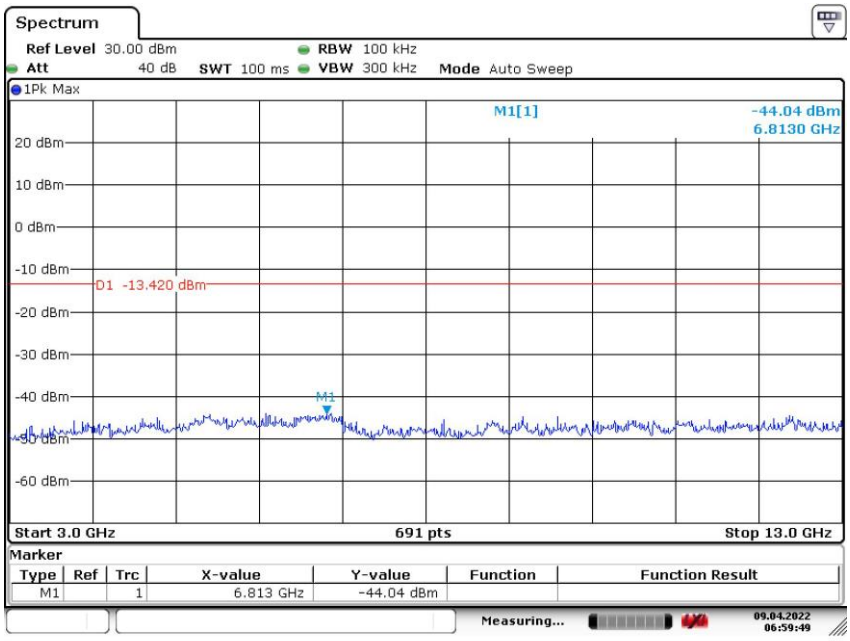
The Middle Channel 19 : 2440MHz



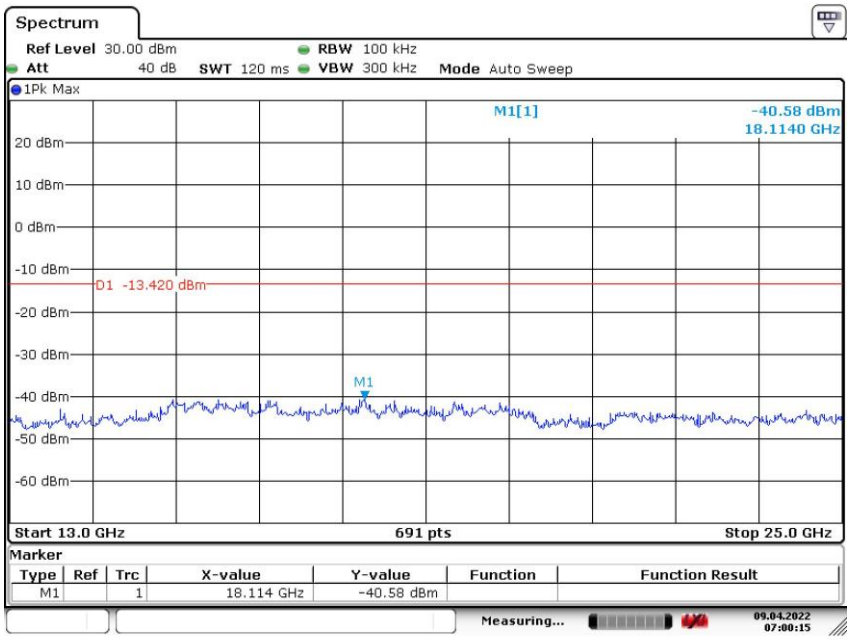
Date: 9.APR.2022 06:59:23



Date: 9.APR.2022 06:58:58

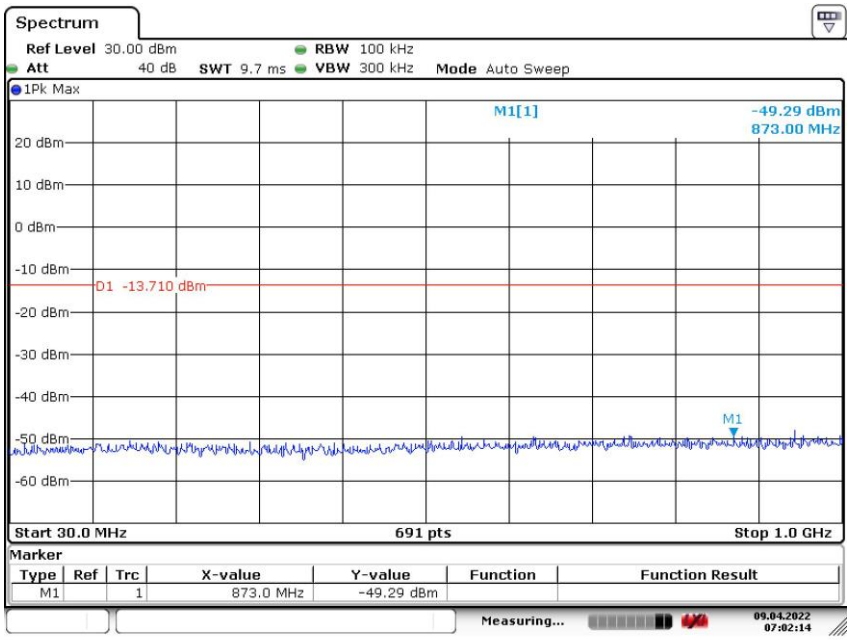


Date: 9.APR.2022 06:59:49

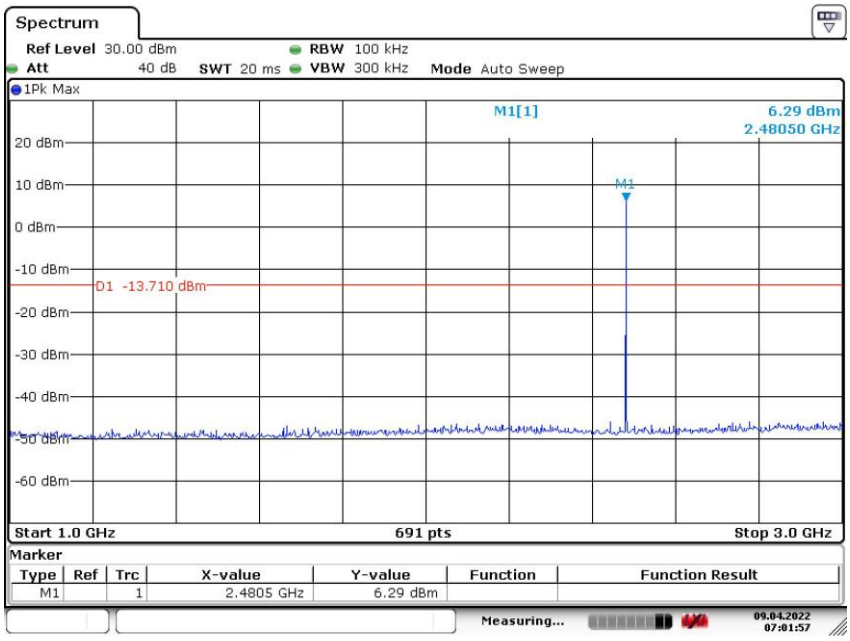


Date: 9.APR.2022 07:00:15

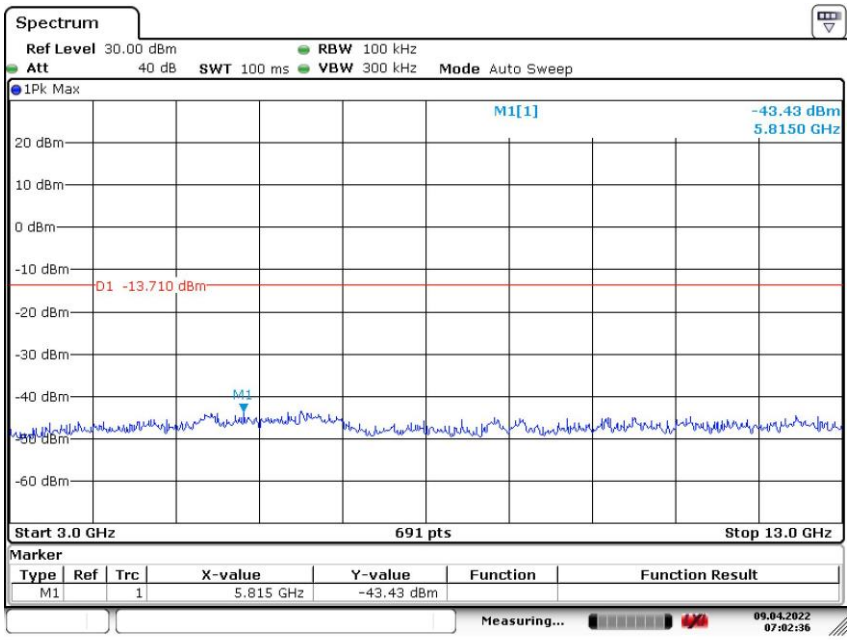
The High Channel 39 : 2480MHz



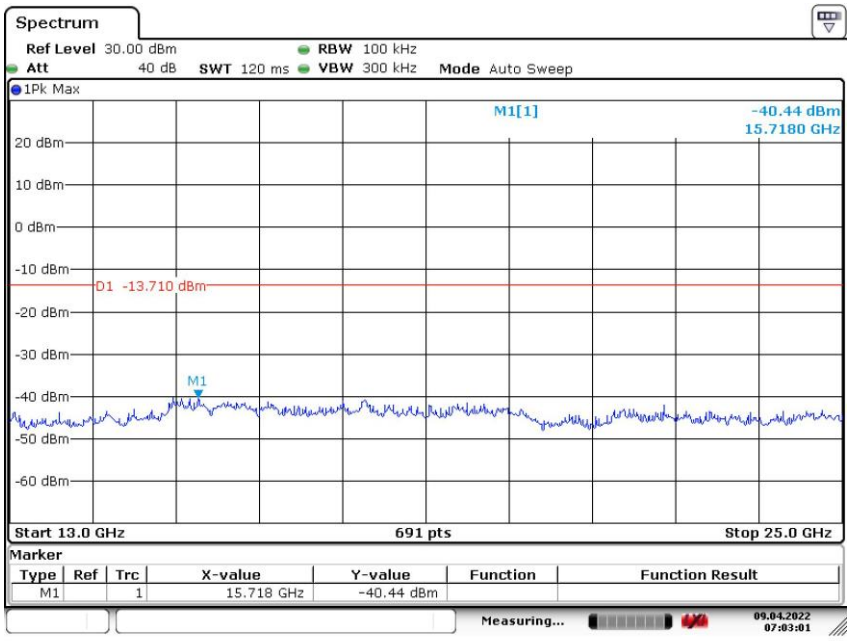
Date: 9.APR.2022 07:02:14



Date: 9.APR.2022 07:01:57



Date: 9.APR.2022 07:02:36



Date: 9.APR.2022 07:03:01

*****End of Report*****