



FCC/IC - TEST REPORT

Report Number : **68.950.20.0156.01** Date of Issue: 2020-04-22

Model : **SPBL1**

Product Type : Camera

Applicant : GoPro, Inc.

Address : 3000 Clearview Way, San Mateo, CA 94402, USA

Production Facility : GoPro, Inc.

Address : 3000 Clearview Way, San Mateo, CA 94402, USA

Test Result : **Positive** **Negative**

Total pages including Appendices : **59**

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1 Table of Contents

- 1 Table of Contents 2
- 2 Details about the Test Laboratory 3
- 3 Description of the Equipment under Test 4
- 4 Summary of Test Standards 5
- 5 Summary of Test Results 6
- 6 General Remarks 7
- 7 Test Setups 8
- 8 Systems test configuration 9
- 9 Technical Requirement 10
 - 9.1 Conducted Emission 10
 - 9.2 Conducted output power & EIRP 13
 - 9.3 6dB bandwidth 15
 - 9.4 99% bandwidth 21
 - 9.5 Power spectral density 27
 - 9.6 Spurious RF conducted emissions 33
 - 9.7 Band edge 47
 - 9.8 Spurious radiated emissions for transmitter 51
- 10 Test Equipment List 58
- 11 System Measurement Uncertainty 59



2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052,
P. R. China

FCC Designation Number: CN5009

FCC Registration No.: 514049

ISED#: 10320A

Telephone: 86 755 8828 6998
Fax: 86 755 8828 5299

3 Description of the Equipment under Test

Product:	Camera
Model no.:	SPBL1
FCC ID:	CNFSPBL1
IC:	10193A-SPBL1
PMN:	SPBL1
HVIN:	SPBL1
Rating:	3.85VDC
RF Transmission Frequency:	2412MHz-2462MHz for 802.11b/g/n HT20 2422MHz-2452MHz for 802.11n HT40
No. of Operated Channel:	11
Modulation:	802.11b: BPSK, QPSK, CCK, 802.11g/802.11n HT20/40: BPSK, QPSK, 16-QAM, 64-QAM
Antenna Type:	Internal Integrated Metal Antenna
Antenna Gain:	-0.7dBi max for 2.4GHz
Description of the EUT:	The Equipment Under Test (EUT) is a Camera supports 2.4GHz Bluetooth/WIFI, 5GHz WIFI functions.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2018 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5, Amendment 1, March 2019	General Requirements and Information for the Certification of Radio Apparatus
RSS-247 Issue 2 February 2017	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10 (2013).

5 Summary of Test Results

Technical Requirements			
FCC Part 15 Subpart C/RSS-247 Issue 2/RSS-Gen Issue 5			
Test Condition		Test Result	Test Site
§15.207 RSS-GEN 8.8	Conducted emission AC power port	Pass	Site 1
§15.247 (b) (3) & RSS-247 5.4(d)	Conducted output power	Pass	Site 1
RSS-247 5.4(d)	Equivalent Isotropic Radiated Power	Pass	Site 1
§15.247(e) RSS-247 5.2(b)	Power spectral density	Pass	Site 1
§15.247(a)(2) RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth	Pass	Site 1
§15.247(a)(1) RSS-247 5.1(b)	20dB Occupied bandwidth	N/A	--
RSS-GEN 6.7	99% Occupied Bandwidth	Pass	Site 1
§15.247(a)(1) §RSS-247 5.1(b)	Carrier frequency separation	N/A	--
§15.247(a)(1)(iii) RSS-247 5.1(d)	Number of hopping frequencies	N/A	--
§15.247(a)(1)(iii) RSS-247 5.1(d)	Dwell Time	N/A	--
§15.247(d) RSS-247 5.5	Spurious RF conducted emissions	Pass	Site 1
§15.247(d) RSS-247 5.5	Band edge	Pass	Site 1
§15.247(d) & §15.209 & §15.205 RSS-247 5.5 & RSS- Gen 6.13	Spurious radiated emissions for transmitter	Pass	Site 1
§15.203 RSS-Gen 6.8	Antenna requirement	Pass See note 1	--

Note 1: N/A – Not Applicable.

Note 2: The EUT uses an Integrated antenna, which gain is -0.7dBi. In accordance to §15.203 and RSS-Gen 6.8, it is considered sufficiently to comply with the provisions of this section.



6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: CNFSPBL1, complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C

This submittal(s) (test report) is intended for IC: 10193A-SPBL1, complies with RSS-247, RSS-GEN.

The Model: SPBL1 supports Bluetooth Low Energy/Bluetooth BR+EDR /WIFI/GPS & Galileo receiving functions, power by 3.85Vdc, 1720mAh supplied by an rechargeable Lithium Ion Battery or 5Vdc supplied by USB type C port.

The TX and RX range is 2402MHz-2480MHz for Bluetooth, 2412MHz – 2462MHz for 2.4GHzWIFI, 5180MHz – 5320MHz, 5500MHz – 5700MHz, 5745MHz – 5825MHz for 5GHzWIFI, 1575.42MHz for GNSS (only GPS and Galileo) Receiver.

This report is for the WIFI 2.4GHz part.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: 2020-04-03

Testing Start Date: 2020-04-03

Testing End Date: 2020-04-20

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:

Prepared by:

Tested by:



John Zhi
EMC Project Manager

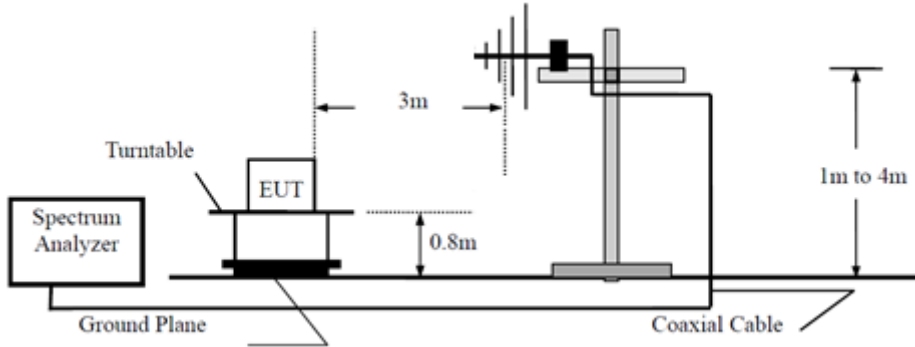
Joe Gu
EMC Project Engineer

Tree Zhan
EMC Test Engineer

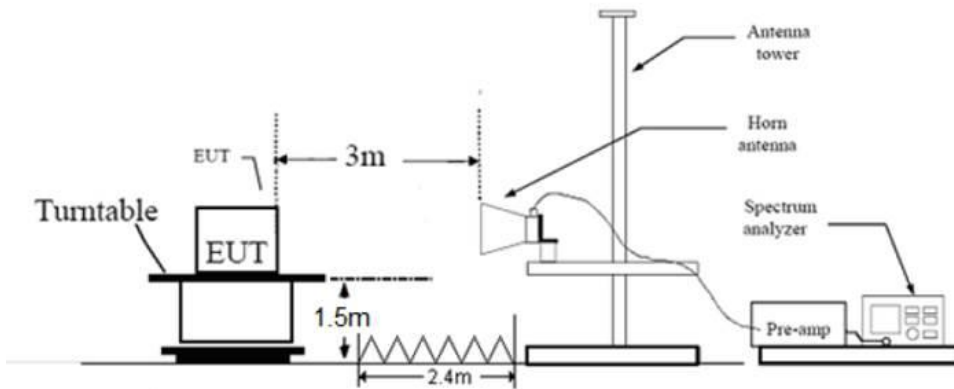
7 Test Setups

7.1 Radiated test setups

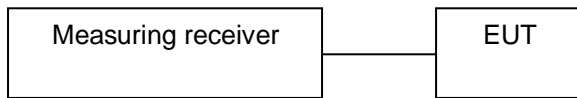
Below 1GHz



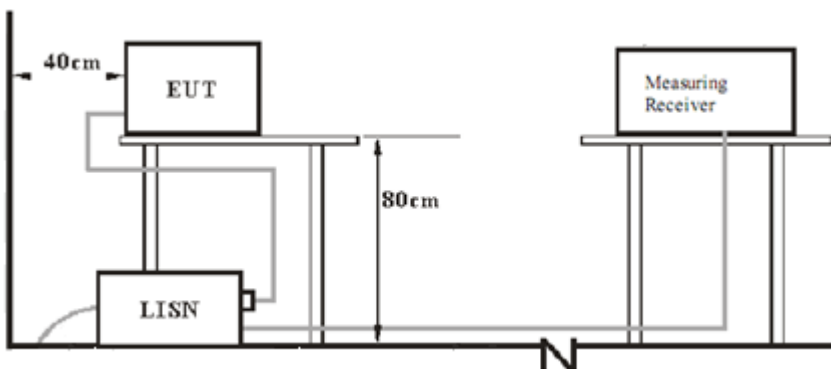
Above 1GHz



7.2 Conducted RF test setups



7.3 AC Power Line Conducted Emission test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Laptop	Lenovo	T460S	---
USB Type C cable	GoPro	0.46m (Length)	---
AC Adapter	Apple	A1401	---

Test software information:

Test Software Version	QRCT (V3.0-186.0) from QUALCOMM	
Modulation	Setting TX Power	Data Rate
802.11b	16	11b LONG 1 Mbps
802.11g	18.5	11g 6 Mbps
802.11n HT20	19	MCS0 6.5 Mbps
802.11n HT40	19	MCS0 13.5 Mbps (40MHz)

Test Channel information:

Test Mode	Channel (MHz)		
802.11b	CH 1: 2412MHz	CH 6: 2437MHz	CH 11: 2462MHz
802.11g	CH 1: 2412MHz	CH 6: 2437MHz	CH 11: 2462MHz
802.11n HT20	CH 1: 2412MHz	CH 6: 2437MHz	CH 11: 2462MHz
802.11n HT40	CH 3: 2422MHz	CH 6: 2437MHz	CH 9: 2452MHz

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively

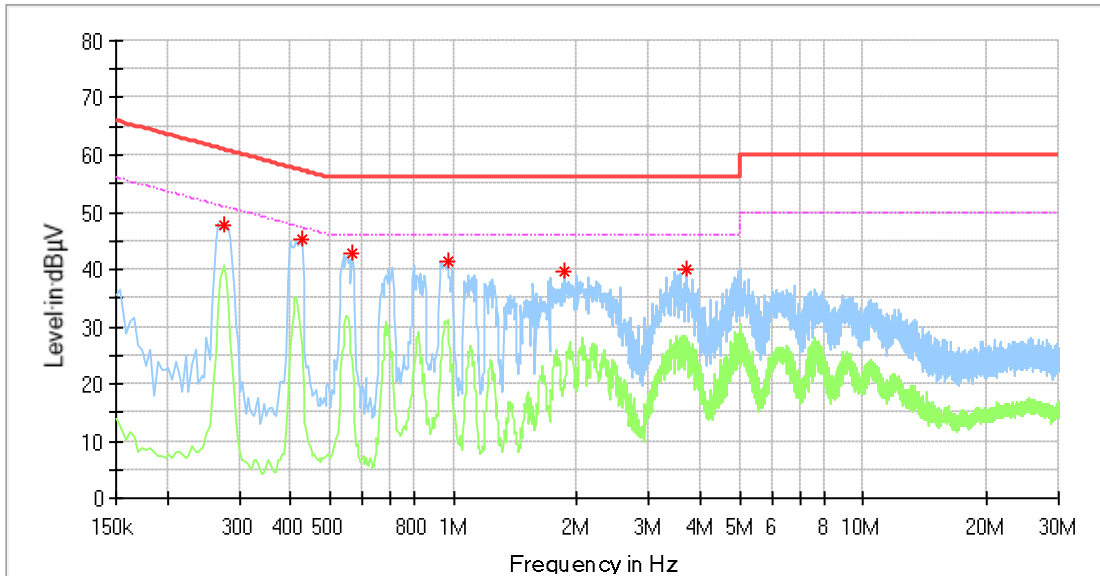
Limit According to §15.207, conducted emissions limit as below:

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

*Decreasing linearly with logarithm of the frequency

Conducted Emission

Product Type : Camera
 M/N : SPBL1
 Operating Condition : Charging + TX
 Test Specification : Power Line, Neutral
 Comment : AC 120V/60Hz (External adapter)



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.274000	47.70	---	61.00	13.30	N	10.3
0.426000	45.14	---	57.33	12.20	N	10.3
0.566000	42.69	---	56.00	13.31	N	10.3
0.970000	41.41	---	56.00	14.59	N	10.3
1.862000	39.50	---	56.00	16.50	N	10.4
3.690000	39.89	---	56.00	16.11	N	10.4

Remark :

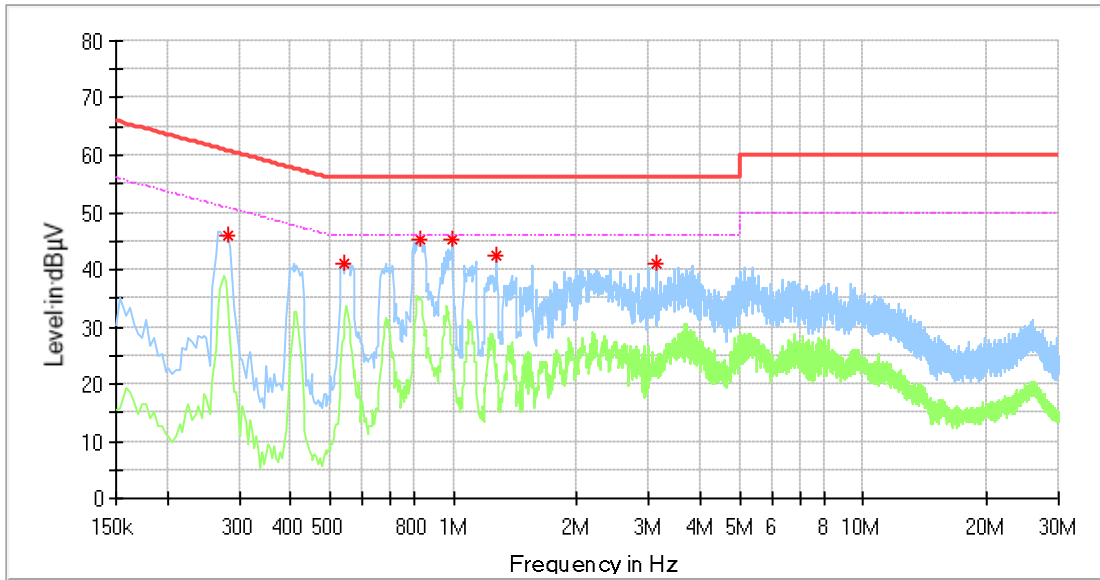
Level=Reading Level + Correction Factor

Correction Factor=Cable Loss + LISN Factor

(The Reading Level is recorded by software which is not shown in the sheet)

Conducted Emission

Product Type : Camera
 M/N : SPBL1
 Operating Condition : Charging + TX
 Test Specification : Power Line, Live
 Comment : AC 120V/60Hz (External adapter)



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.282000	45.86	---	60.76	14.89	L1	10.3
0.542000	41.14	---	56.00	14.86	L1	10.3
0.826000	45.10	---	56.00	10.90	L1	10.3
0.994000	45.13	---	56.00	10.87	L1	10.3
1.274000	42.61	---	56.00	13.39	L1	10.3
3.118000	41.23	---	56.00	14.77	L1	10.4

Remark :

Level=Reading Level + Correction Factor

Correction Factor=Cable Loss + LISN Factor

(The Reading Level is recorded by software which is not shown in the sheet)

9.2 Conducted output power & EIRP

Test Method

1. The EUT was placed on 0.8m height table, the RF output of EUT was connected to the power meter by RF cable. The path loss was compensated to the results for each measurement.
2. Setting the highest output power level of the EUT
3. Record the power value.

Limits

According to §15.247 (b) (3) & RSS-247 5.4(d), conducted output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

According to & RSS-247 5.4(d), EIRP limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤4	≤36.2

Test result as below table

802.11b_SISO modulation Test Result

Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2412MHz	17.20	-0.7	16.50	Pass
Middle channel 2437MHz	17.90	-0.7	17.20	Pass
High channel 2462MHz	17.92	-0.7	17.22	Pass

802.11g_SISO modulation Test Result

Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2412MHz	19.26	-0.7	18.56	Pass
Middle channel 2437MHz	19.70	-0.7	19.00	Pass
High channel 2462MHz	20.00	-0.7	19.30	Pass

802.11n20_SISO modulation Test Result

Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2412MHz	19.51	-0.7	18.81	Pass
Middle channel 2437MHz	20.09	-0.7	19.39	Pass
High channel 2462MHz	20.23	-0.7	19.53	Pass

802.11n40_SISO modulation Test Result

Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2422MHz	19.70	-0.7	19.00	Pass
Middle channel 2437MHz	20.00	-0.7	19.30	Pass
High channel 2452MHz	20.10	-0.7	19.40	Pass



9.3 6dB bandwidth

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Use the following spectrum analyzer settings:
RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
3. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
4. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

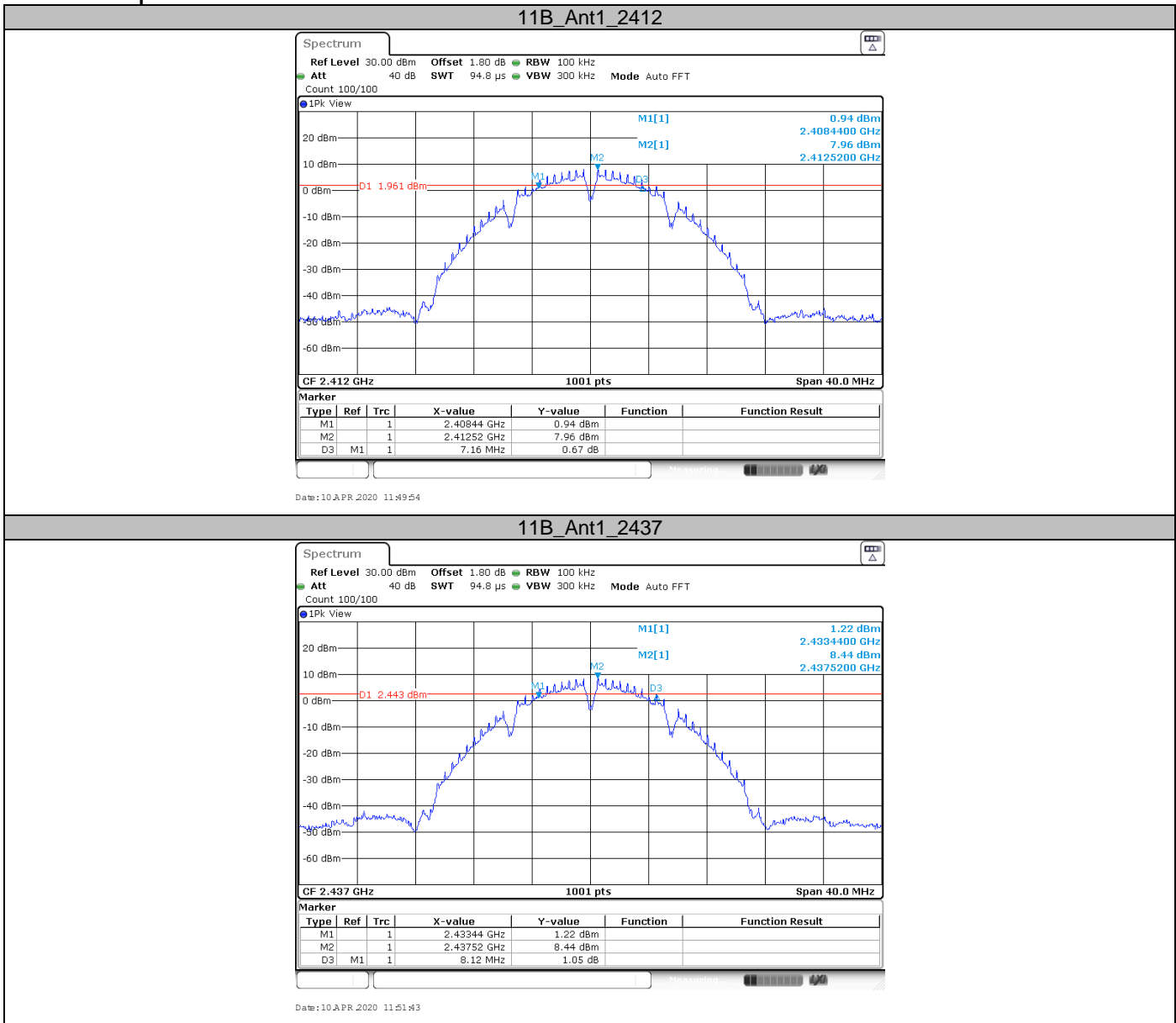
Limit [kHz]

—————
≥500

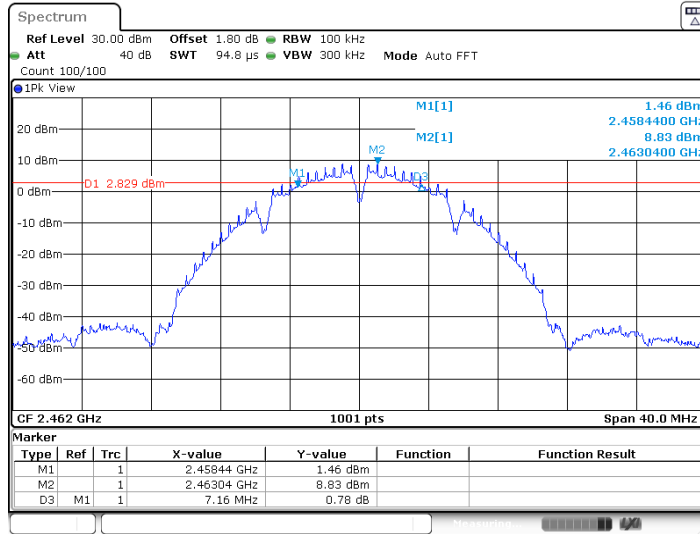
Test result

TestMode	Channel	DTS BW [MHz]	Limit [MHz]	Verdict
11B	2412	7.160	0.5	PASS
	2437	8.120	0.5	PASS
	2462	7.160	0.5	PASS
11G	2412	15.240	0.5	PASS
	2437	15.240	0.5	PASS
	2462	15.240	0.5	PASS
11N20SISO	2412	15.240	0.5	PASS
	2437	15.240	0.5	PASS
	2462	15.240	0.5	PASS
11N40SISO	2422	35.280	0.5	PASS
	2437	35.280	0.5	PASS
	2452	35.280	0.5	PASS

Test Graphs

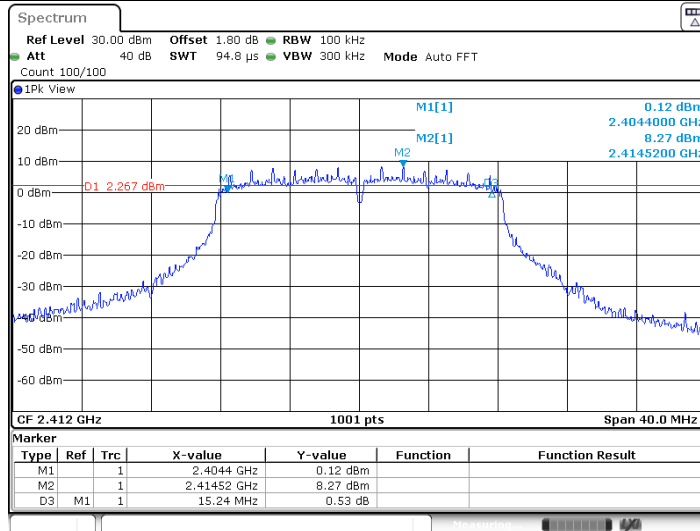


11B_Ant1_2462



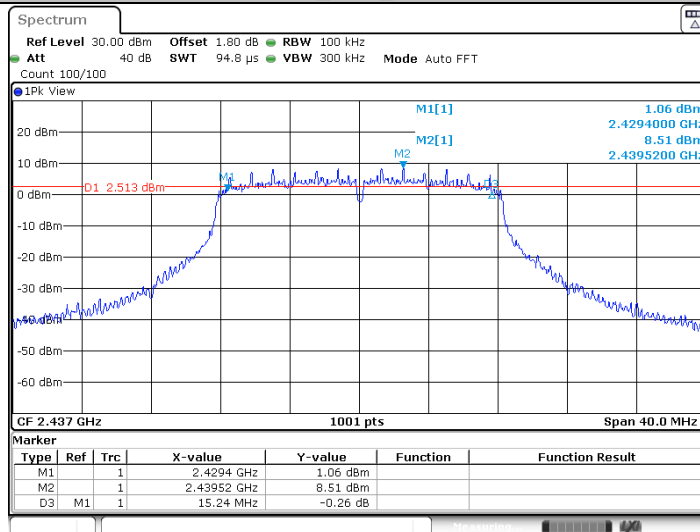
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11G_Ant1_2412



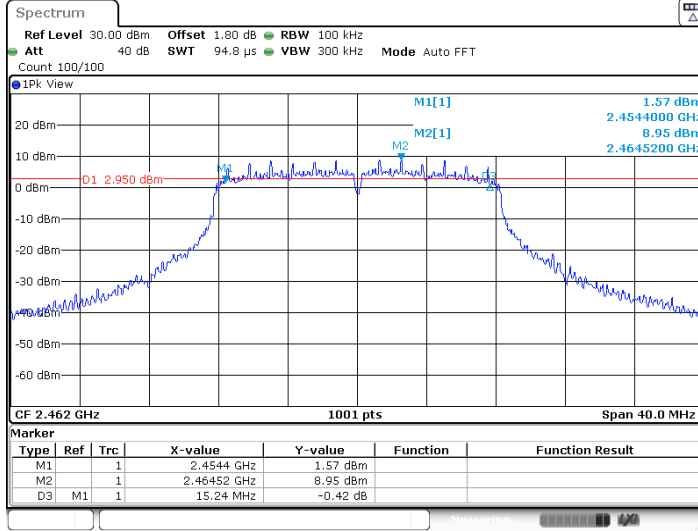
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11G_Ant1_2437



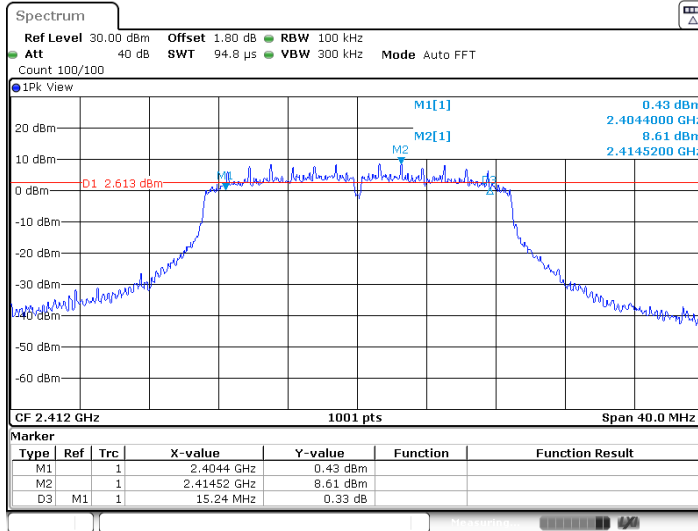
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11G_Ant1_2462



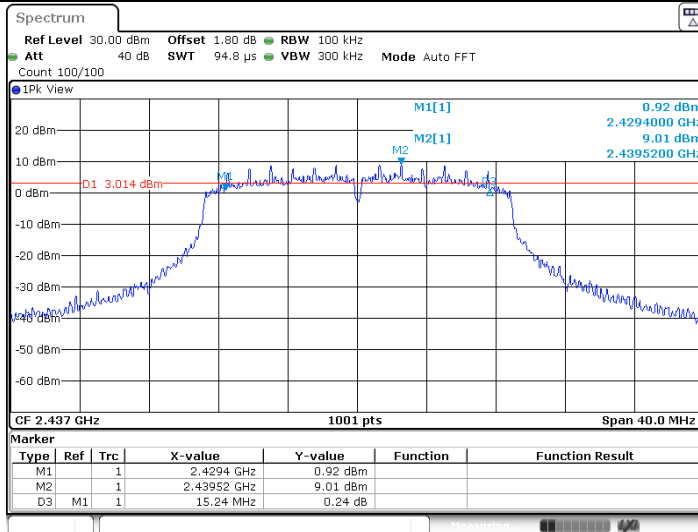
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11N20SISO_Ant1_2412



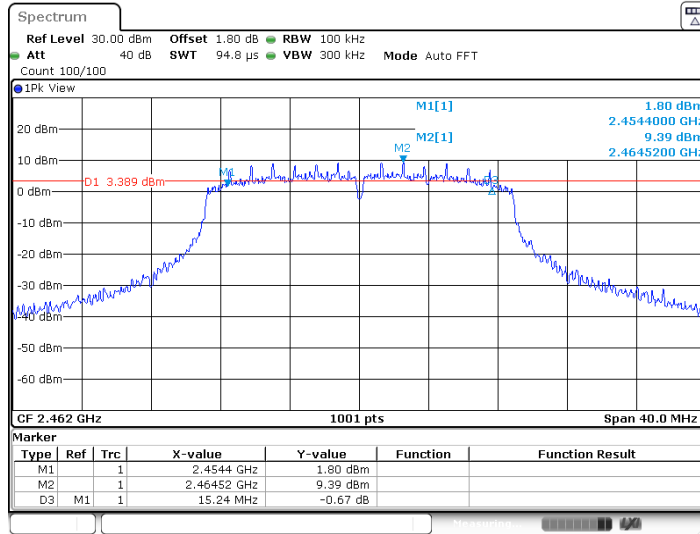
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11N20SISO_Ant1_2437



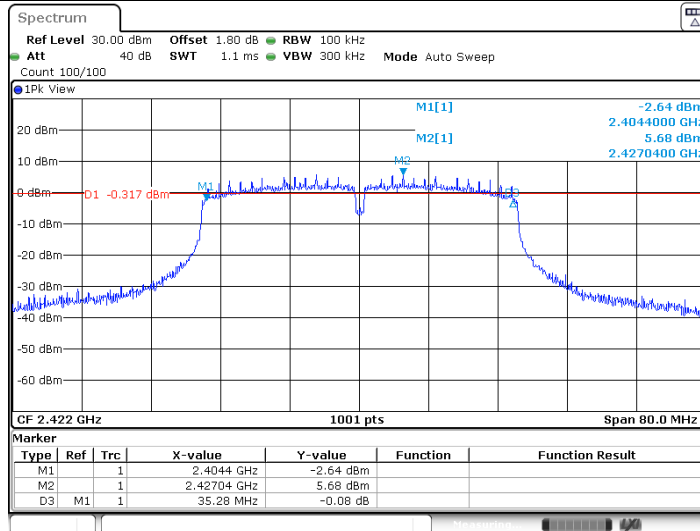
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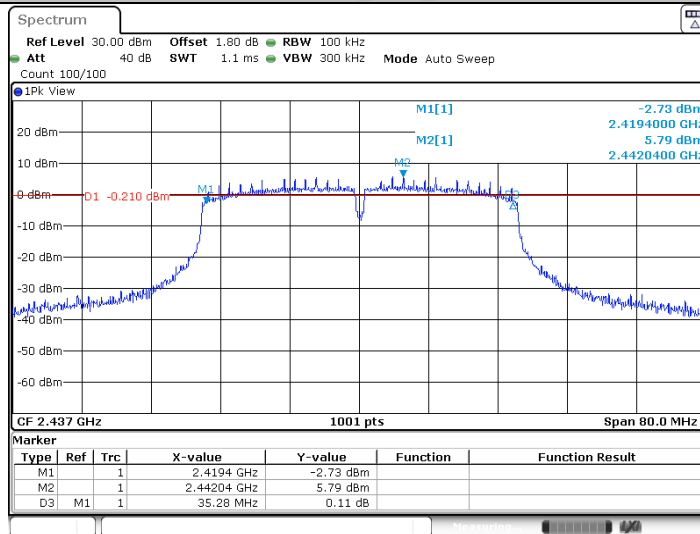
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11N40SISO_Ant1_2422



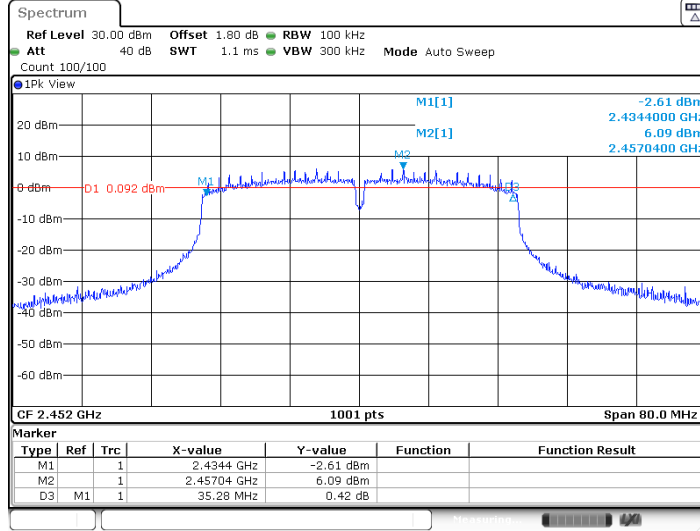
Date: 10 APR 2020 12:06:36

11N40SISO_Ant1_2437



Date: 10 APR 2020 12:08:20

11N40SISO_Ant1_2452



Date: 10.APR.2020 12:10:09

9.4 99% bandwidth

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Use the following spectrum analyzer settings:
 RBW=1% to 5% of the actual occupied, VBW≥3RBW, Sweep = auto,
 Detector function = peak, Trace = max hold
3. Use the automatic bandwidth measurement capability of an instrument, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
4. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

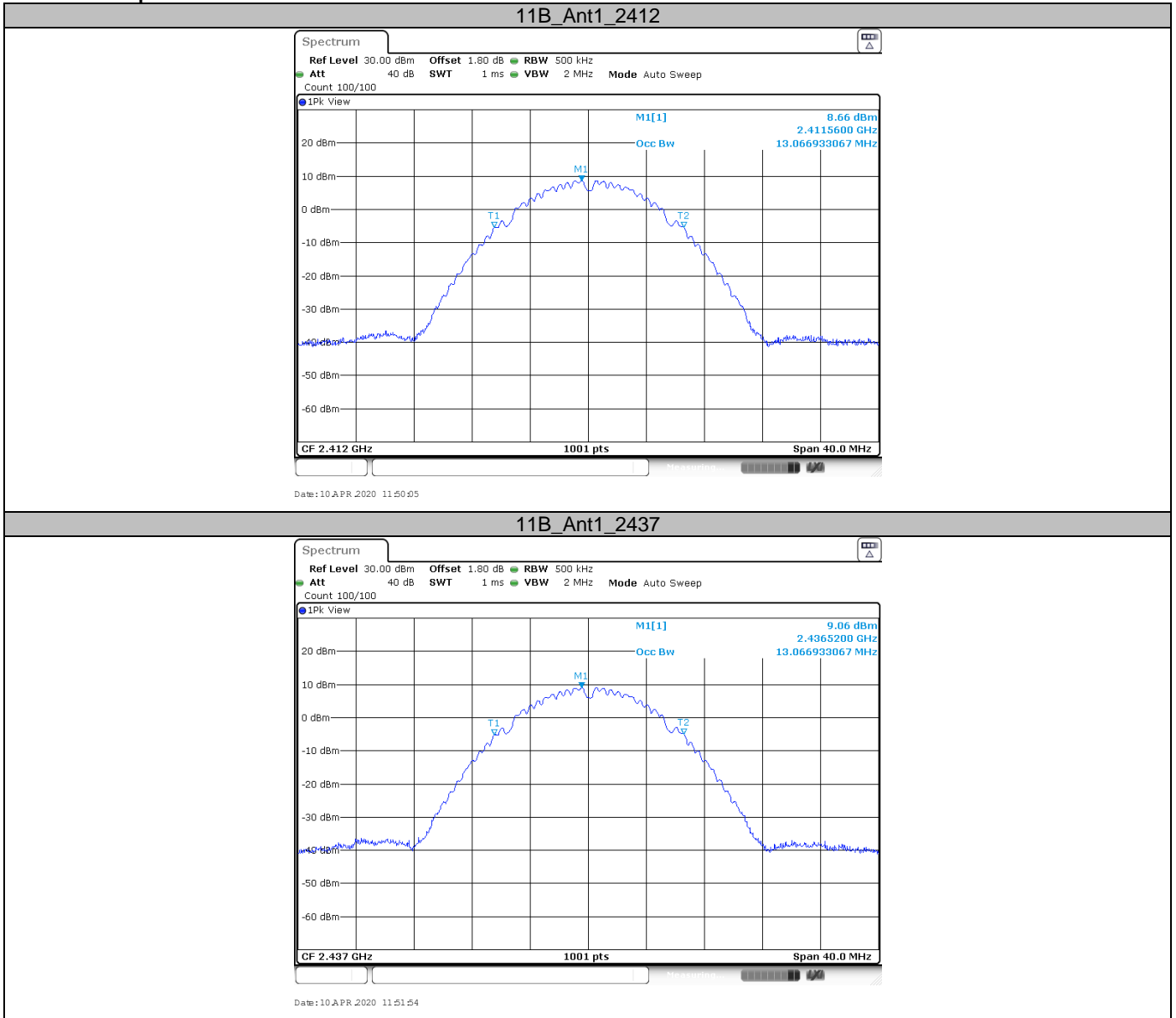
Limit [kHz]

--

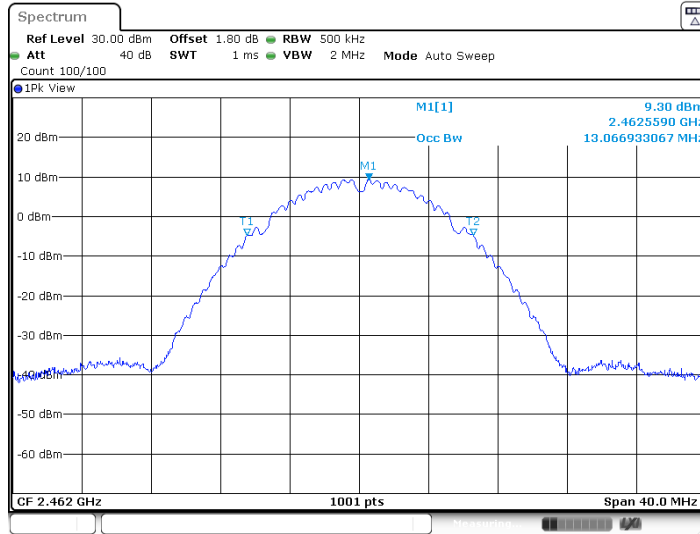
Test Result

TestMode	Channel	OCB [MHz]	Limit[MHz]	Verdict
11B	2412	13.067	---	PASS
	2437	13.067	---	PASS
	2462	13.067	---	PASS
11G	2412	16.543	---	PASS
	2437	16.583	---	PASS
	2462	16.583	---	PASS
11N20SISO	2412	17.582	---	PASS
	2437	17.582	---	PASS
	2462	17.622	---	PASS
11N40SISO	2422	36.124	---	PASS
	2437	36.124	---	PASS
	2452	36.124	---	PASS

Test Graphs

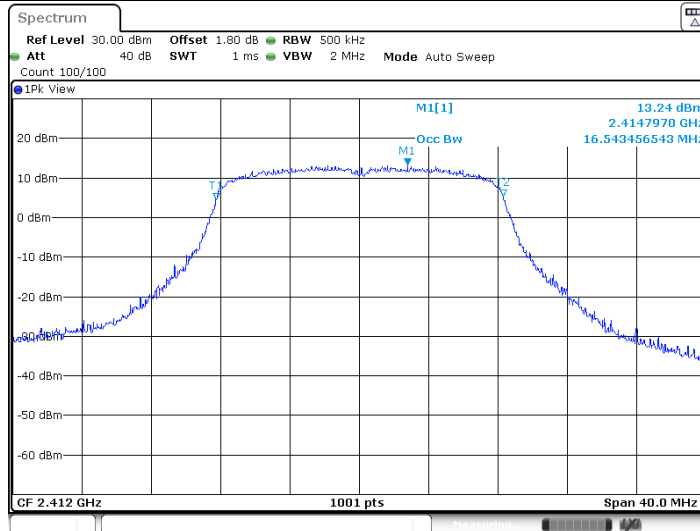


11B_Ant1_2462



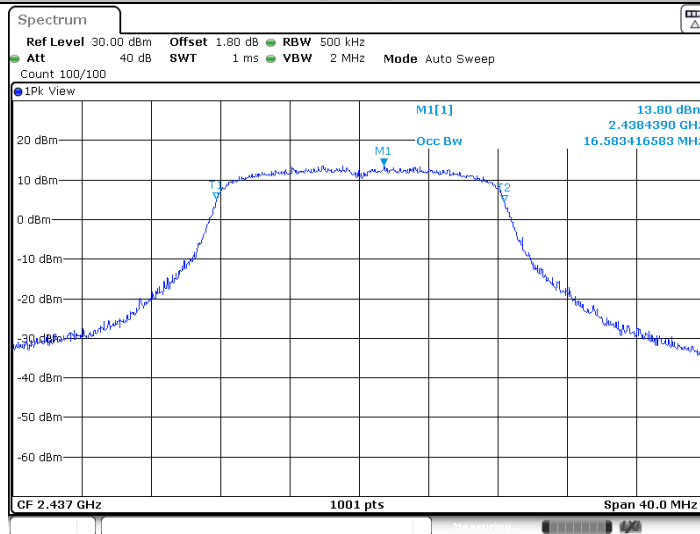
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11G_Ant1_2412



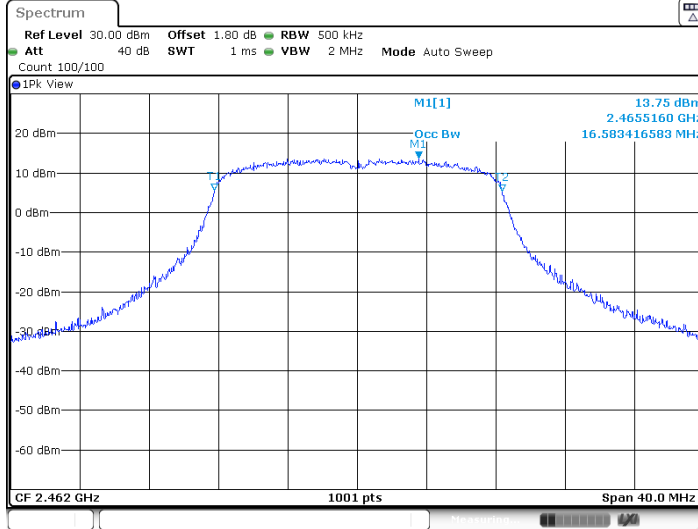
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11G_Ant1_2437



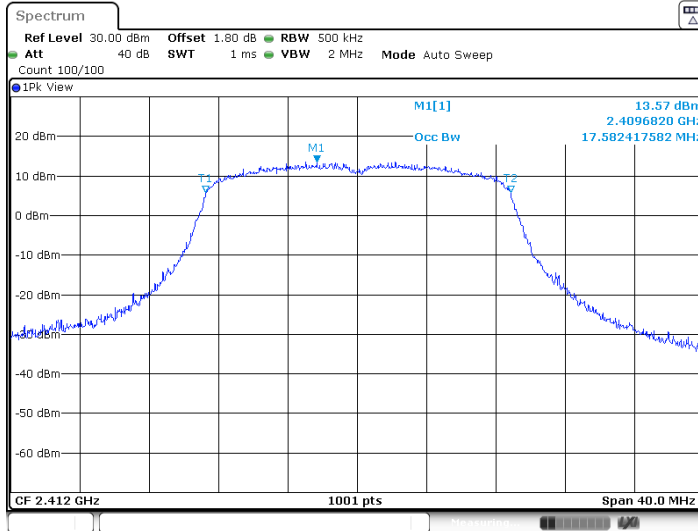
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11G_Ant1_2462



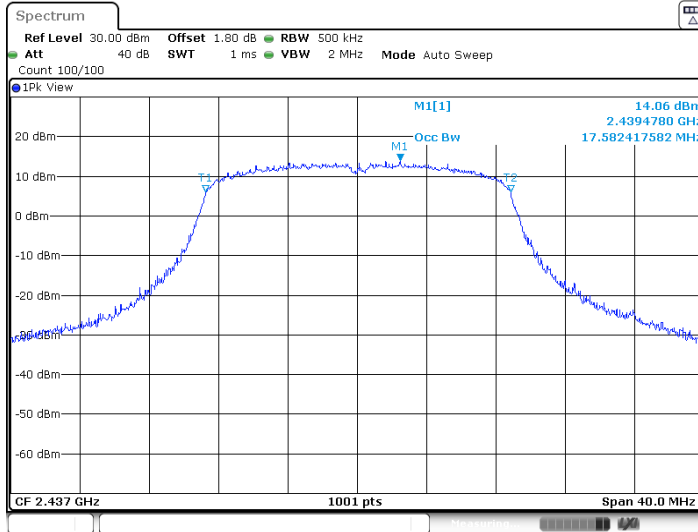
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11N20SISO_Ant1_2412



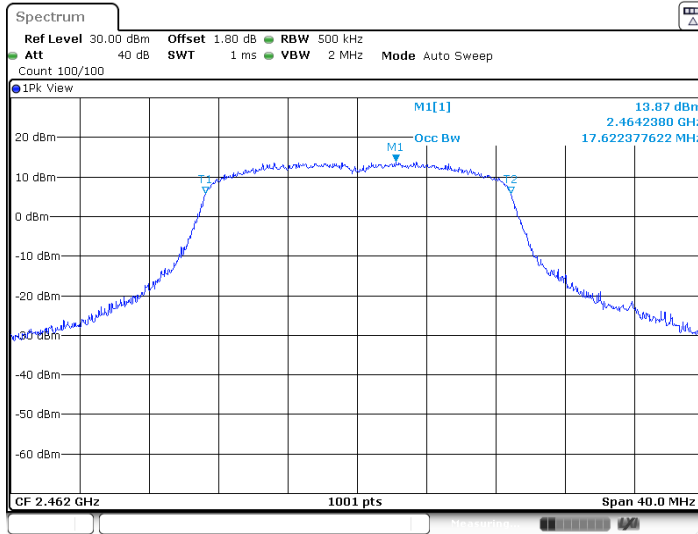
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11N20SISO_Ant1_2437



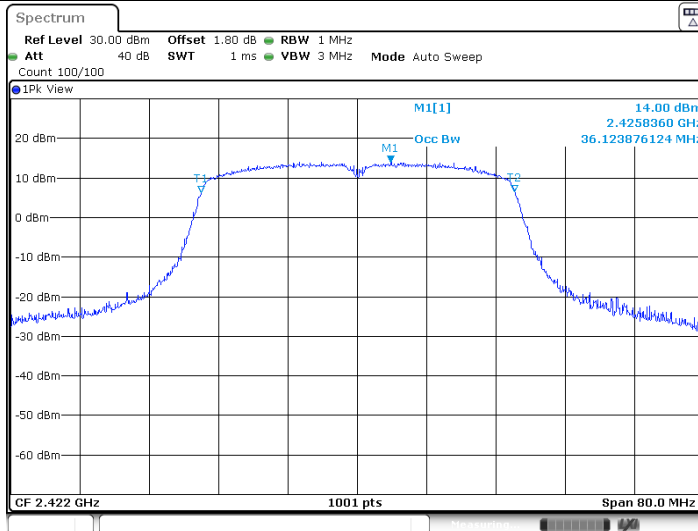
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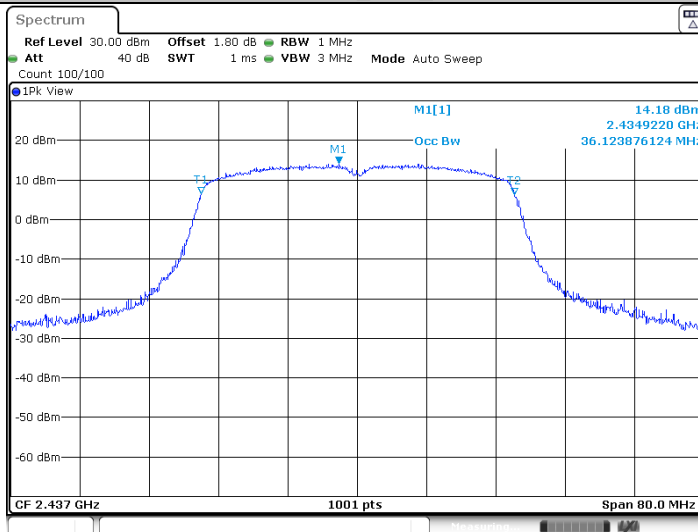
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11N40SISO_Ant1_2422



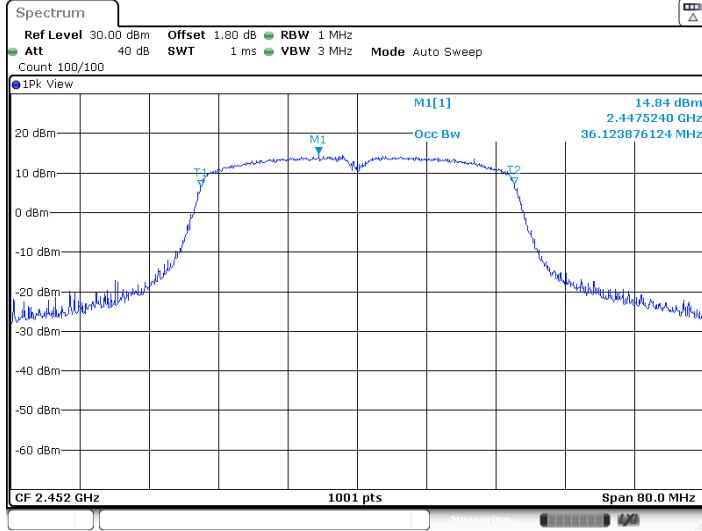
Date: 10 APR 2020 12:06:47

11N40SISO_Ant1_2437



Date: 10 APR 2020 12:08:31

11N40SISO_Ant1_2452



Date: 10.APR.2020 12:10:20

9.5 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
3. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
4. Repeat above procedures until other frequencies measured were completed.

Limit

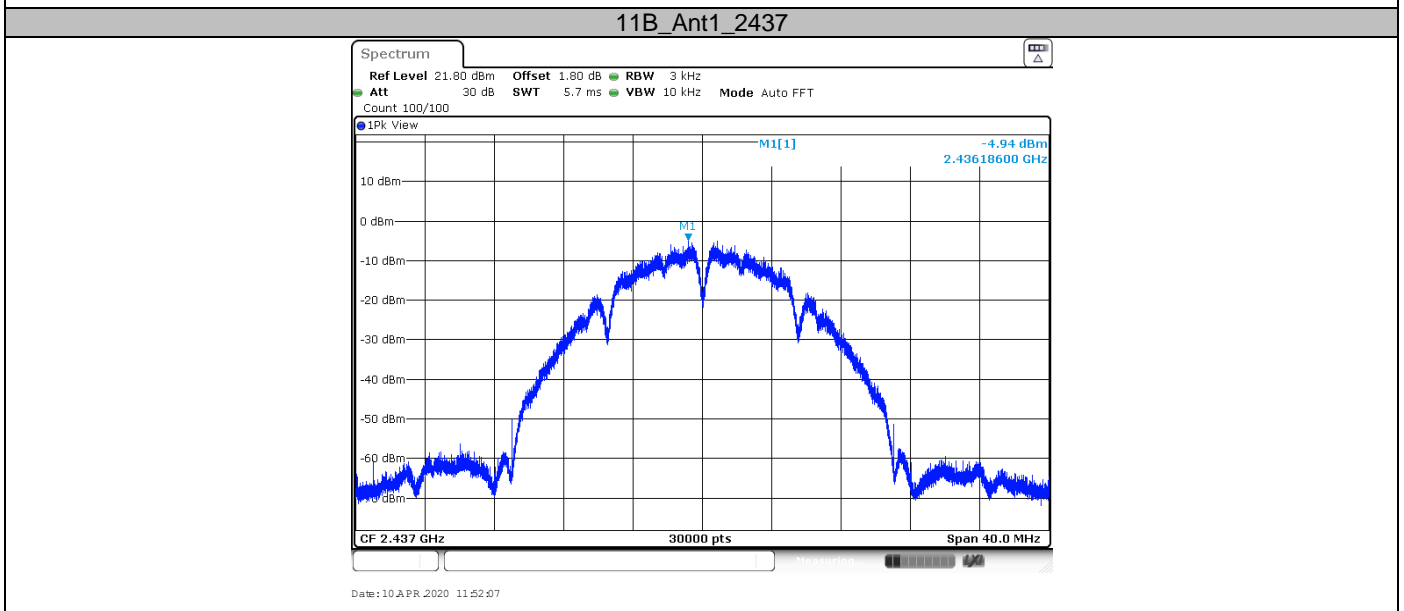
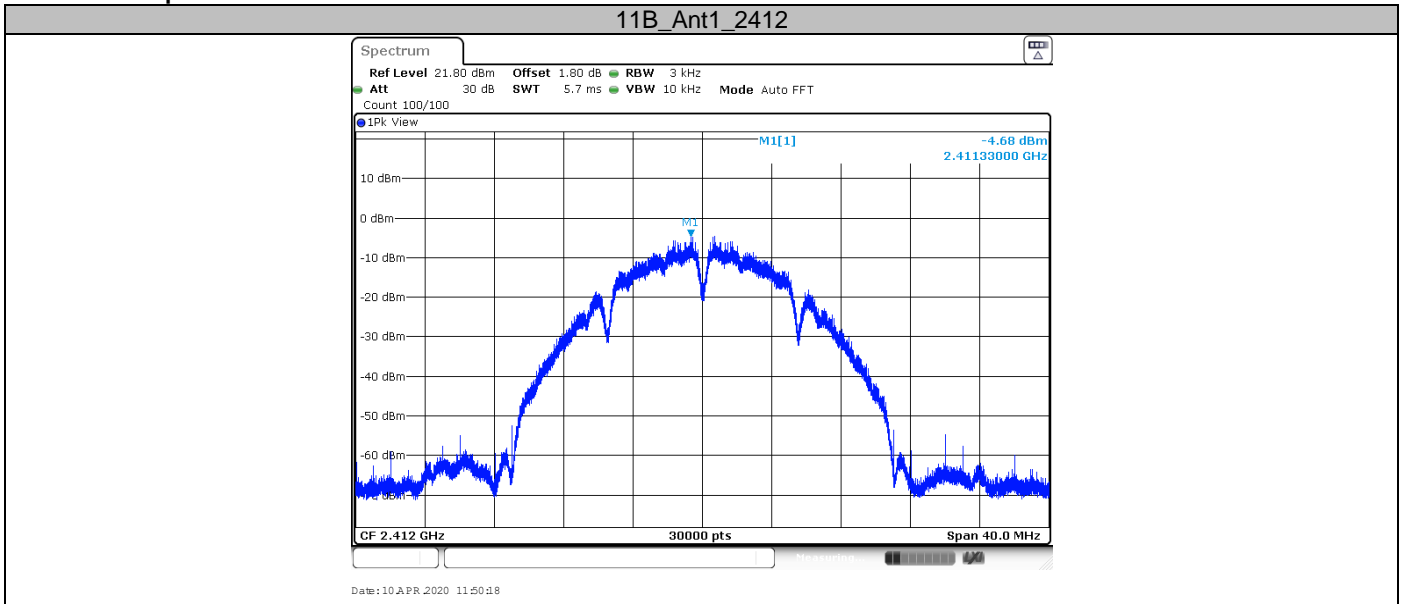
Limit [dBm/3KHz]

≤8

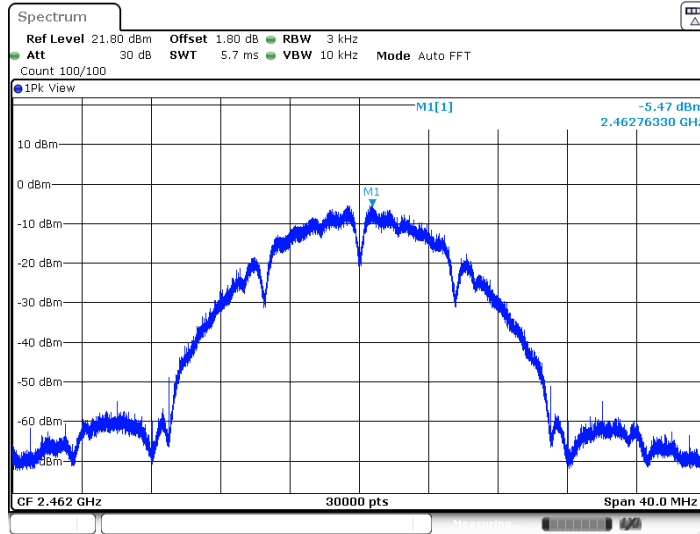
Test result

TestMode	Channel	Result(dBm/3KHz)	Limit(dBm/3KHz)	Verdict
11B	2412	-4.68	≤8	PASS
	2437	-4.94	≤8	PASS
	2462	-5.47	≤8	PASS
11G	2412	-5.56	≤8	PASS
	2437	-5.21	≤8	PASS
	2462	-4.17	≤8	PASS
11N20SISO	2412	-4.26	≤8	PASS
	2437	-5.33	≤8	PASS
	2462	-3.86	≤8	PASS
11N40SISO	2422	-9.4	≤8	PASS
	2437	-7.74	≤8	PASS
	2452	-8.7	≤8	PASS

Test Graphs

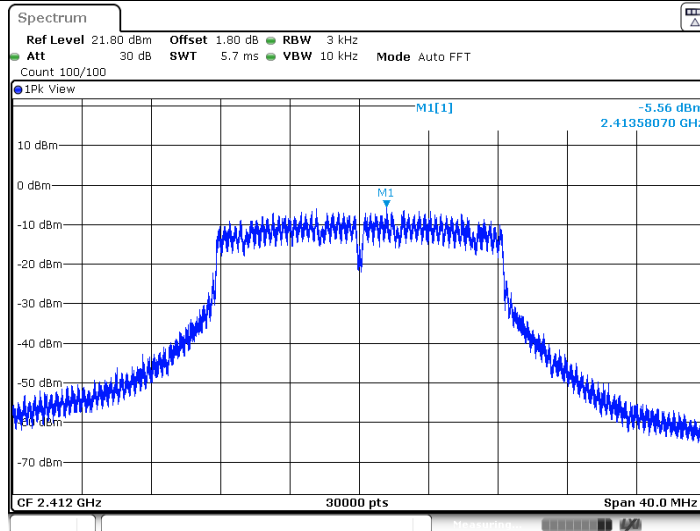


11B_Ant1_2462



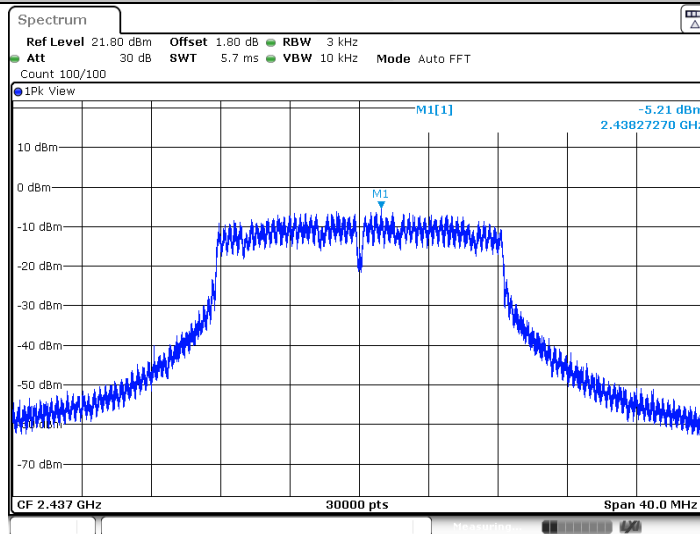
Date: 10 APR 2020 11:53:41

11G_Ant1_2412



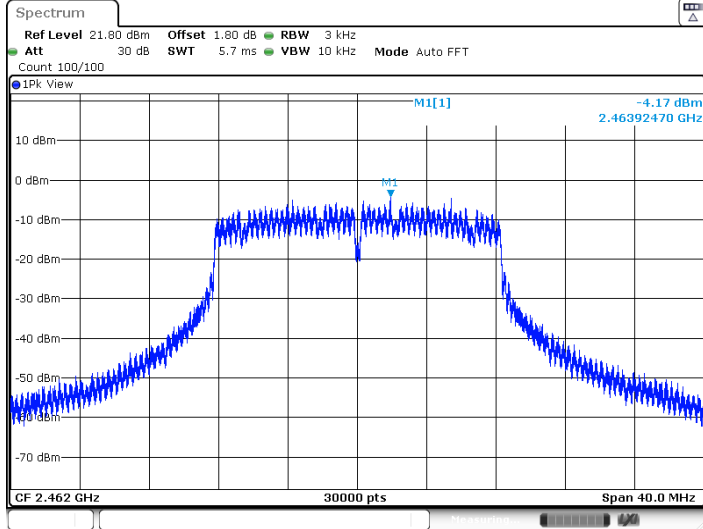
Date: 10 APR 2020 11:55:41

11G_Ant1_2437



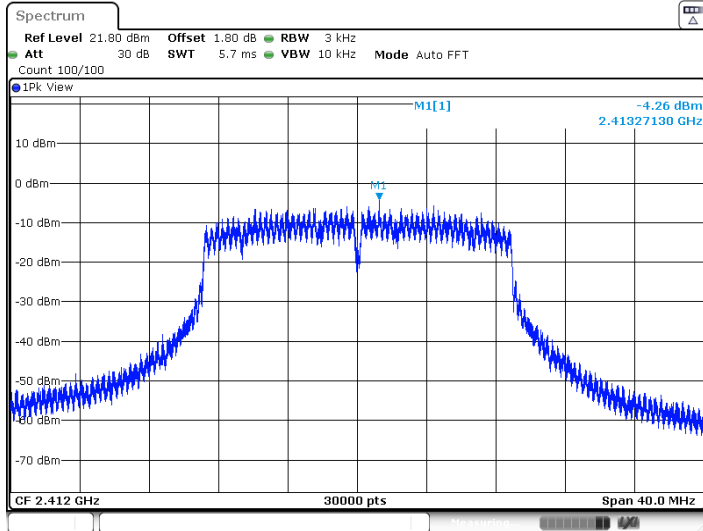
Date: 10 APR 2020 11:57:26

11G_Ant1_2462



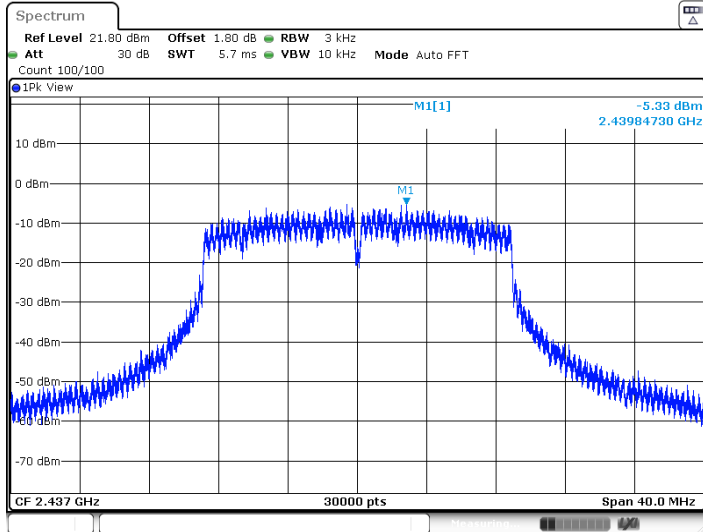
Date: 10.APR.2020 11:59:00

11N20SISO_Ant1_2412



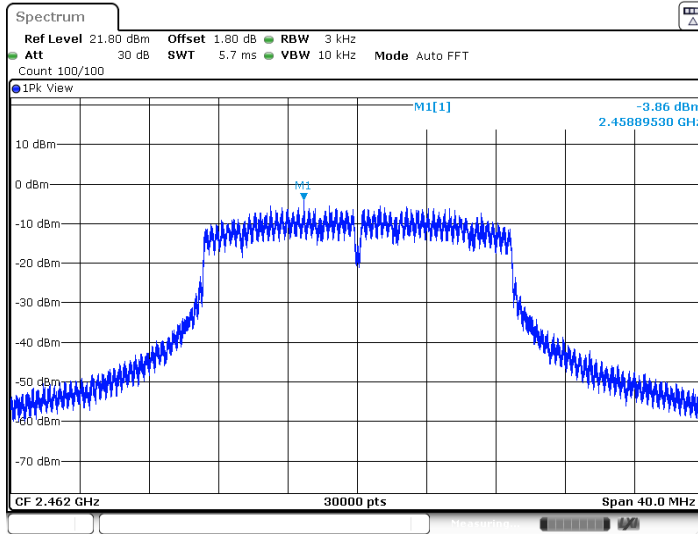
Date: 10.APR.2020 12:01:15

11N20SISO_Ant1_2437



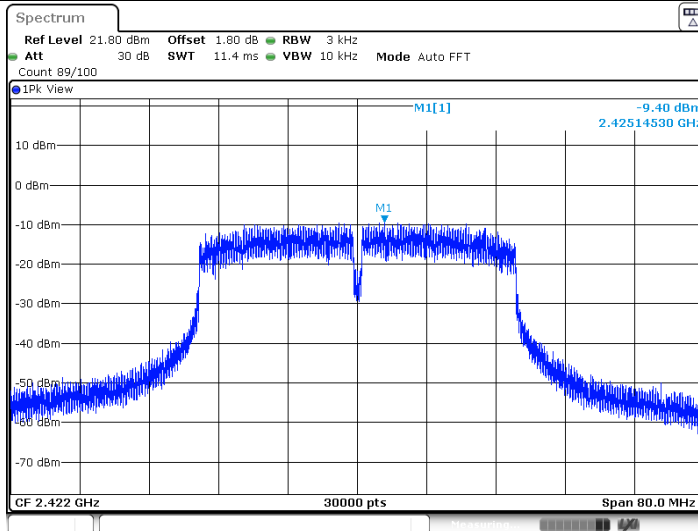
Date: 10.APR.2020 12:03:18

11N20SISO_Ant1_2462



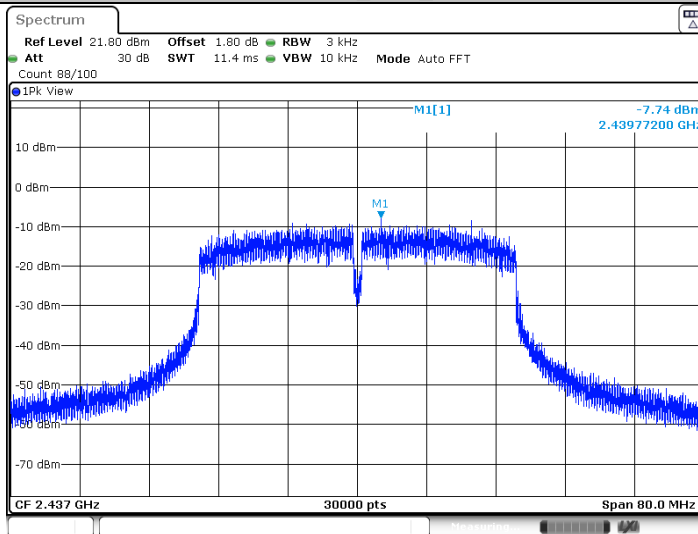
Date: 10 APR 2020 12:04:52

11N40SISO_Ant1_2422



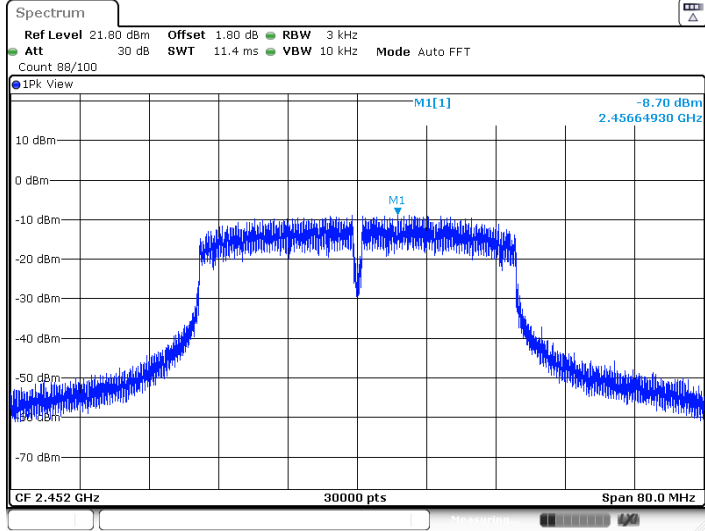
Date: 10 APR 2020 12:07:00

11N40SISO_Ant1_2437



Date: 10 APR 2020 12:08:44

11N40SISO_Ant1_2452



Date: 10.APR.2020 12:10:33



9.6 Spurious RF conducted emissions

Test Method

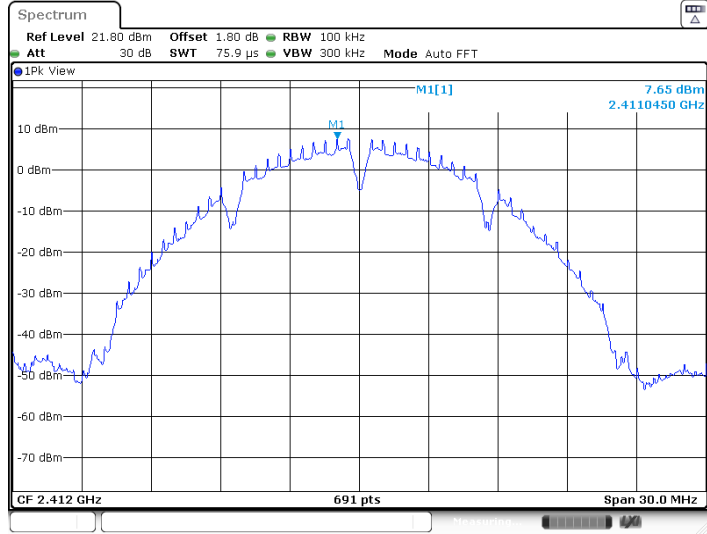
1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Use the following spectrum analyzer settings:
 Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
 RBW = 100 kHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
3. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
4. The level displayed must comply with the limit specified in this Section. Submit these plots.
5. Repeat above procedures until all frequencies measured were complete.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

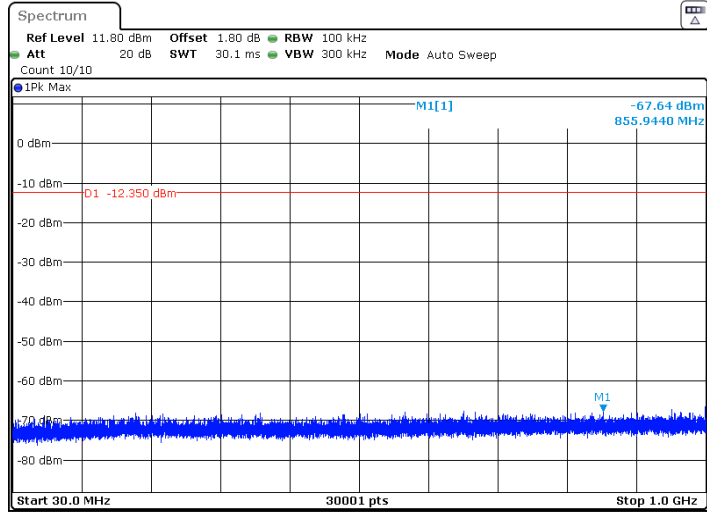
Test Result

11B_Ant1_2412_0~Reference



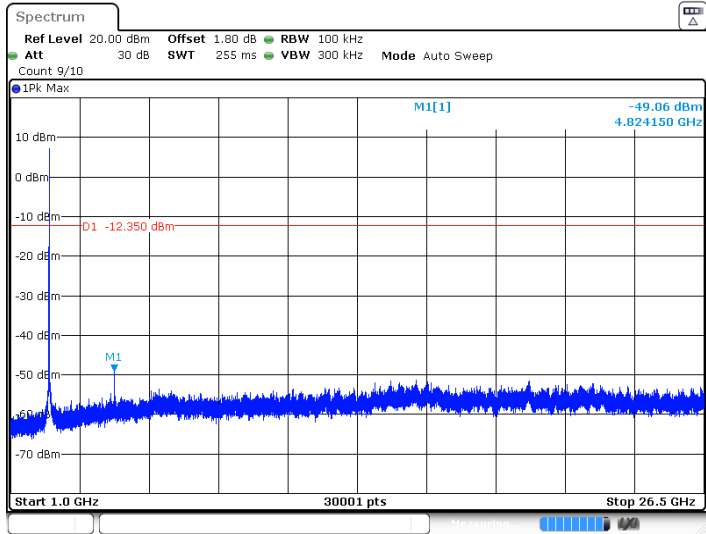
Date: 10.APR.2020 11:50:34

11B_Ant1_2412_30~1000



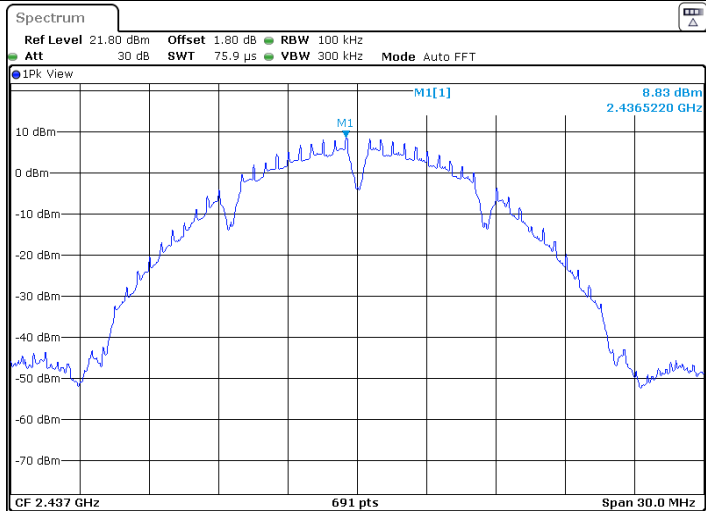
Date: 10.APR.2020 11:50:43

11B_Ant1_2412_1000~26500



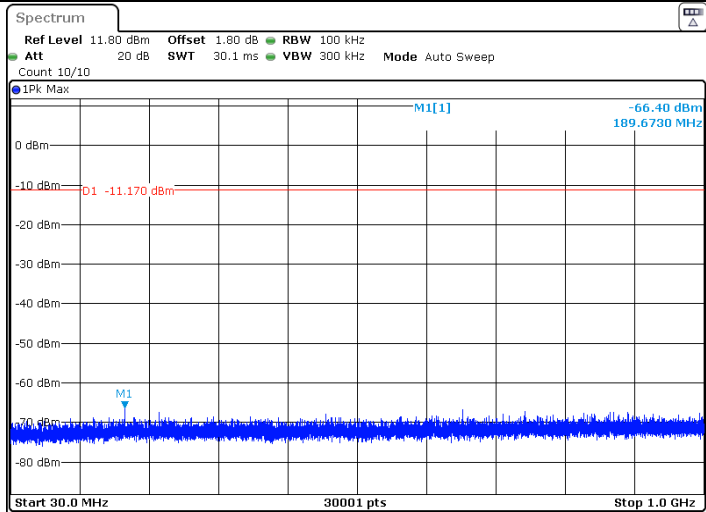
Date: 10 APR 2020 11:50:55

11B_Ant1_2437_0~Reference



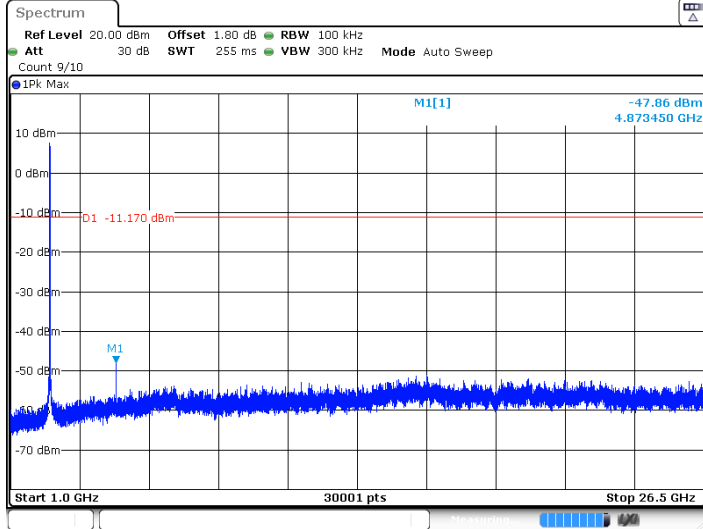
Date: 10 APR 2020 11:52:13

11B_Ant1_2437_30~1000



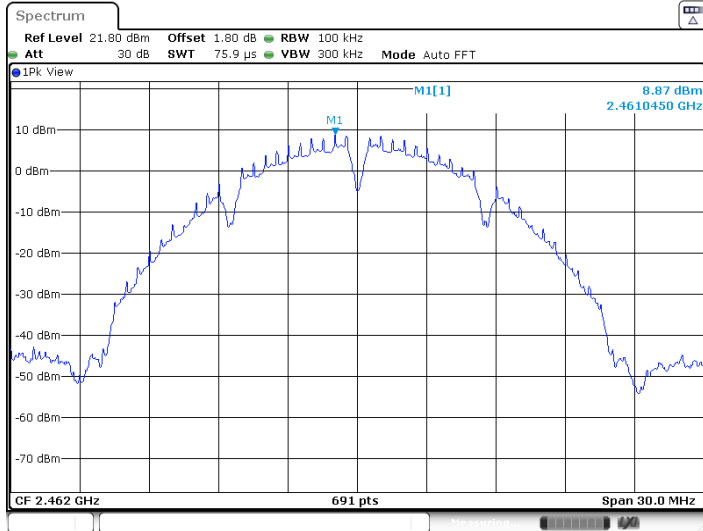
Date: 10 APR 2020 11:52:23

11B_Ant1_2437_1000~26500



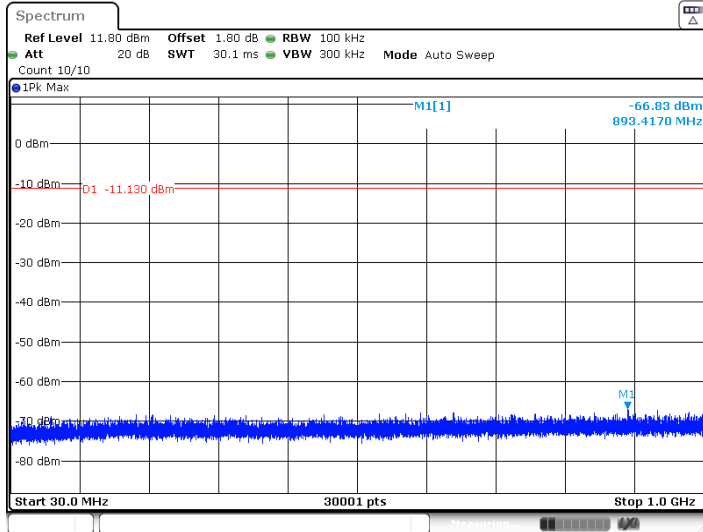
Date: 10.APR.2020 11:52:34

11B_Ant1_2462_0~Reference



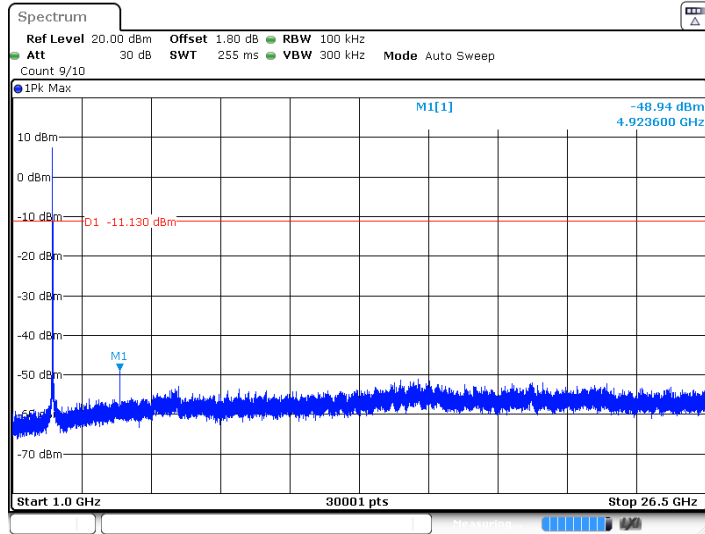
Date: 10.APR.2020 11:53:57

11B_Ant1_2462_30~1000



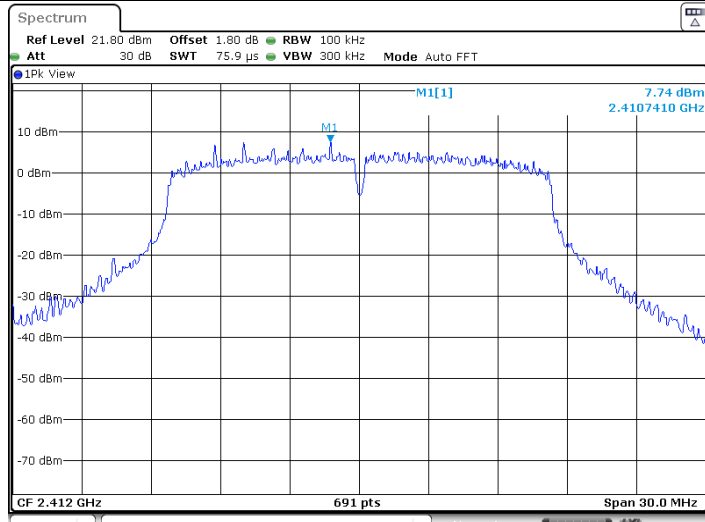
Date: 10.APR.2020 11:54:07

11B_Ant1_2462_1000~26500



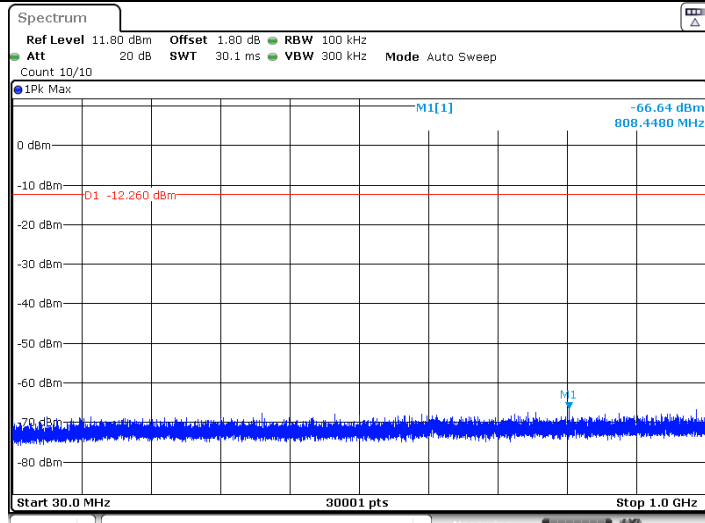
Date: 10 APR 2020 11:54:18

11G_Ant1_2412_0~Reference



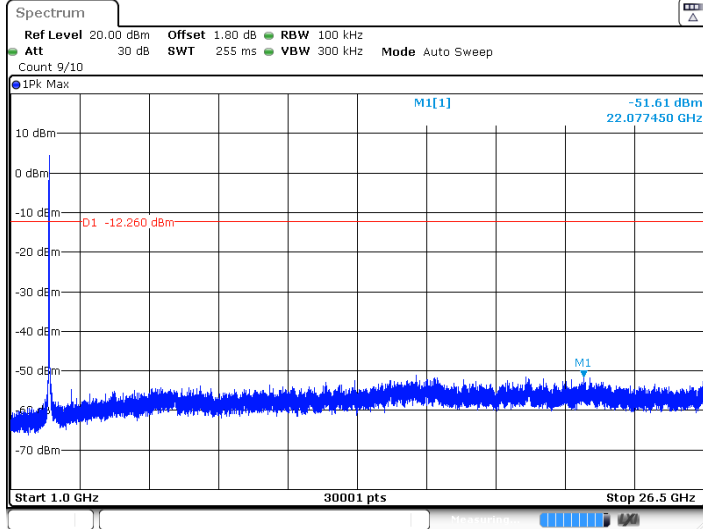
Date: 10 APR 2020 11:55:56

11G_Ant1_2412_30~1000



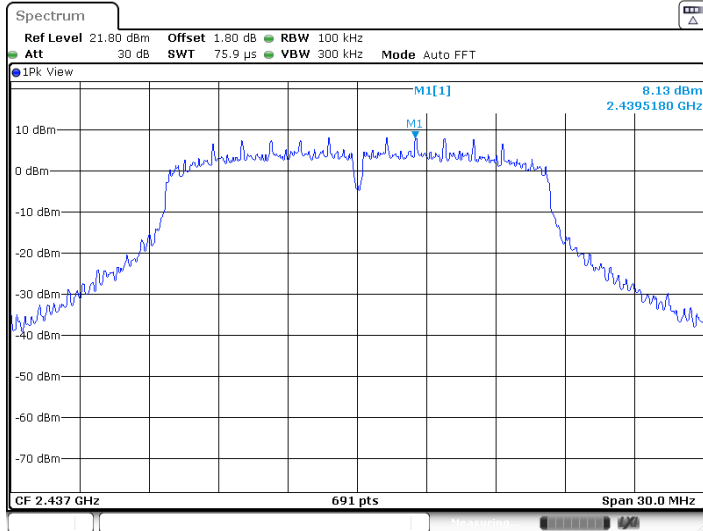
Date: 10 APR 2020 11:56:06

11G_Ant1_2412_1000~26500



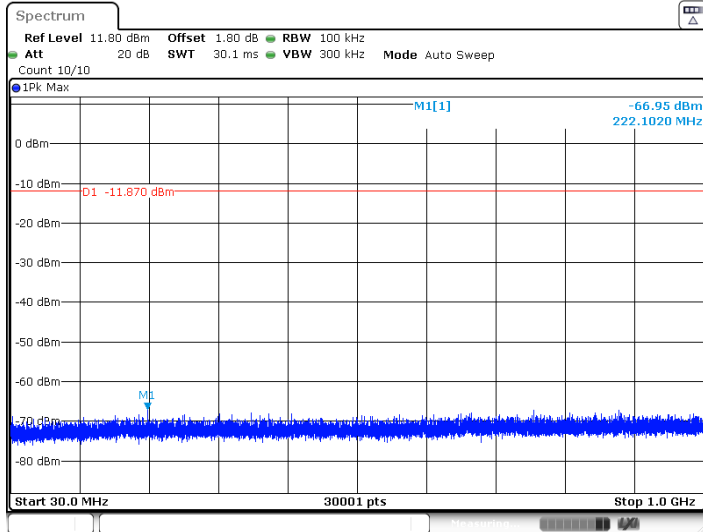
Date: 10.APR.2020 11:56:17

11G_Ant1_2437_0-Reference



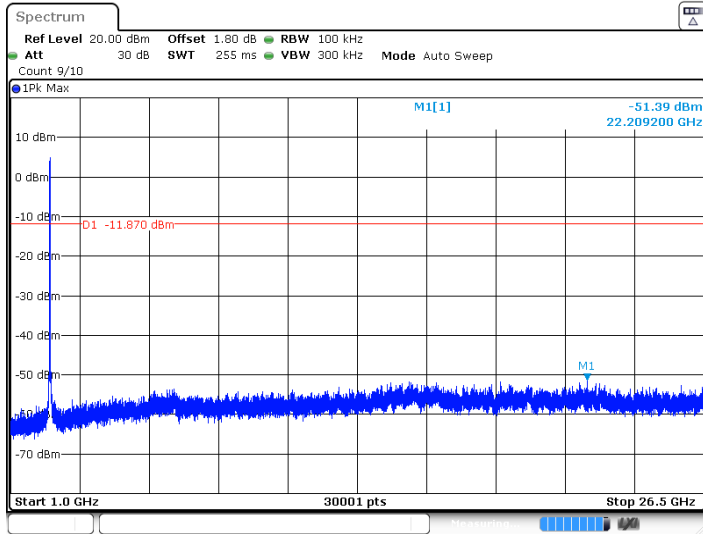
Date: 10.APR.2020 11:57:32

11G_Ant1_2437_30~1000



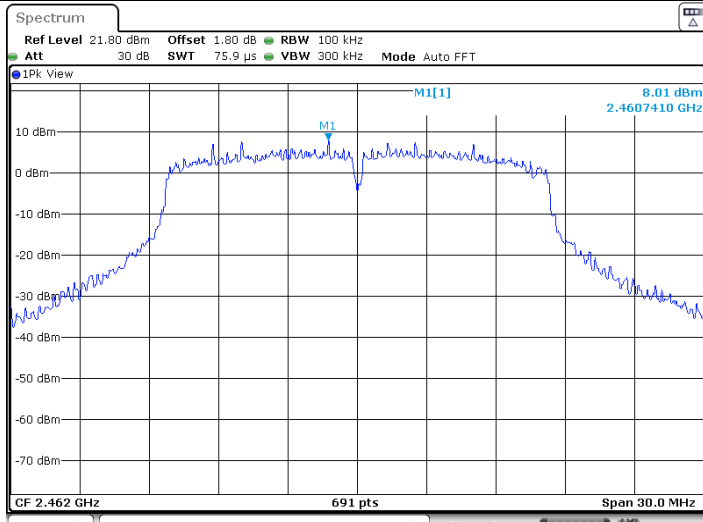
Date: 10.APR.2020 11:57:42

11G_Ant1_2437_1000~26500



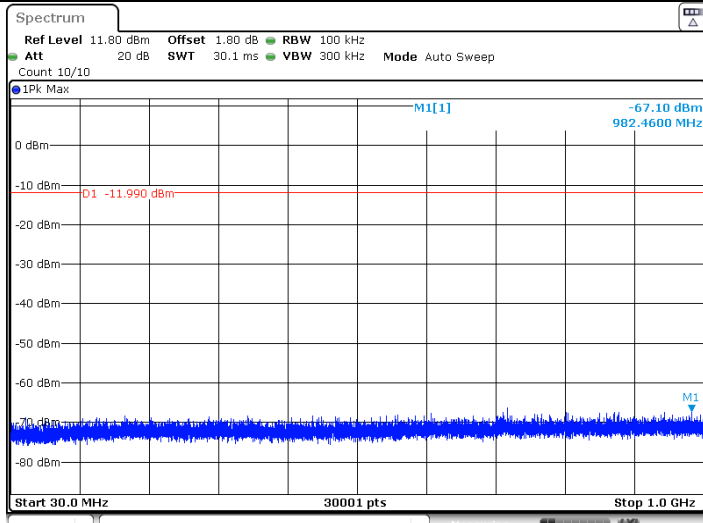
Date: 10 APR 2020 11:57:53

11G_Ant1_2462_0~Reference



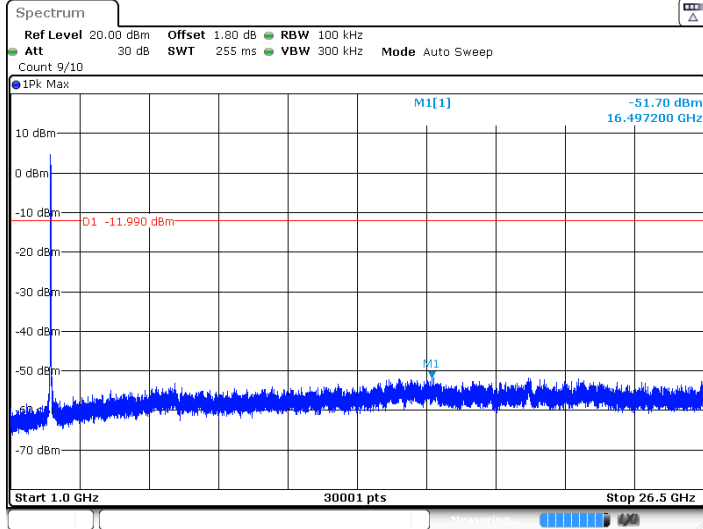
Date: 10 APR 2020 11:59:16

11G_Ant1_2462_30~1000



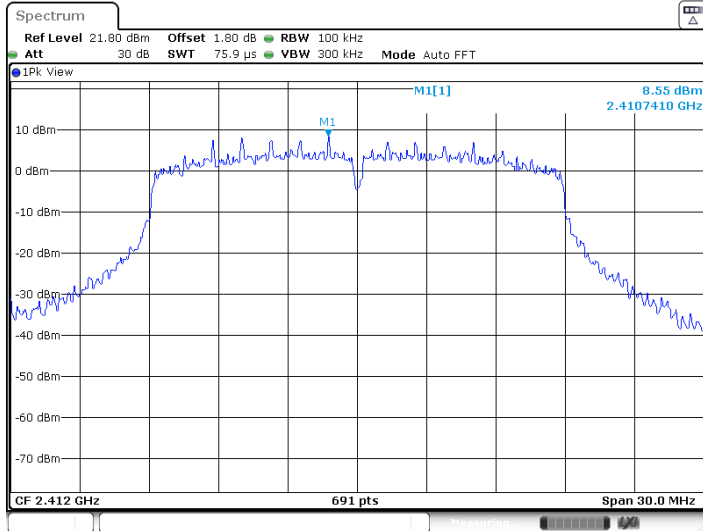
Date: 10 APR 2020 11:59:25

11G_Ant1_2462_1000~26500



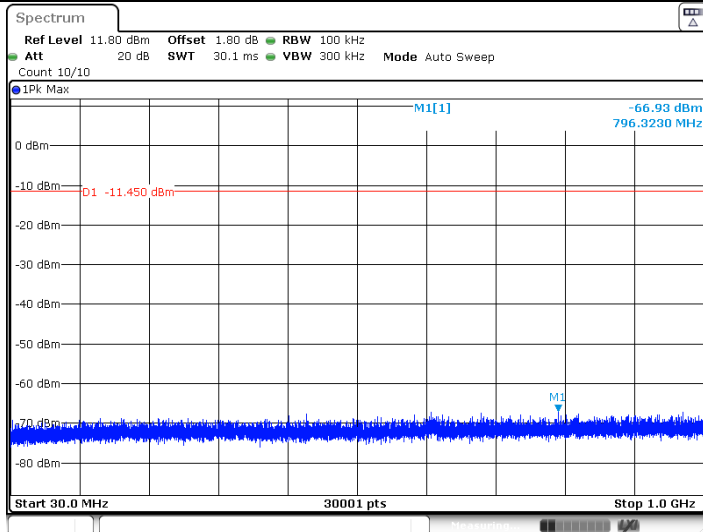
Date: 10.APR.2020 11:59:37

11N20SISO_Ant1_2412_0~Reference



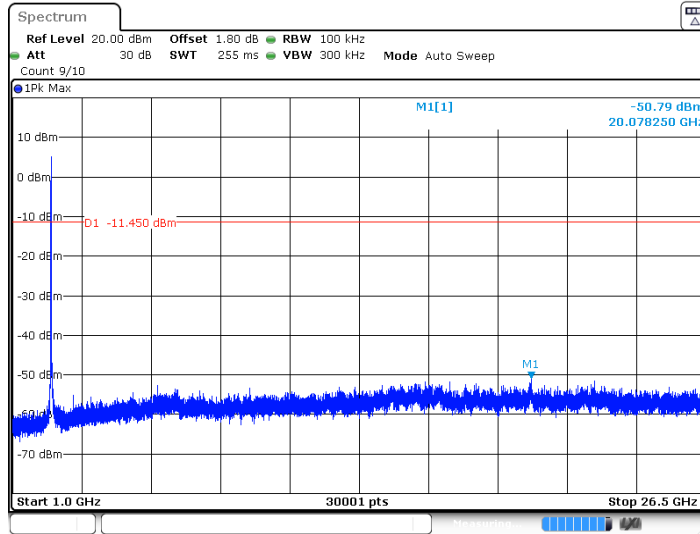
Date: 10.APR.2020 12:01:31

11N20SISO_Ant1_2412_30~1000



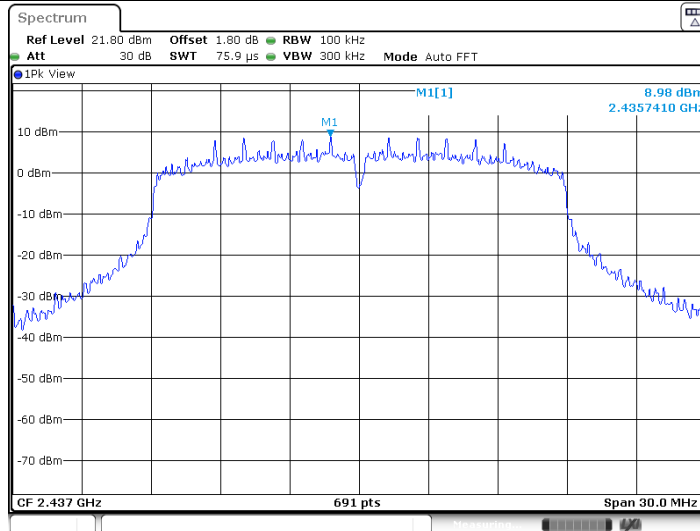
Date: 10.APR.2020 12:01:41

11N20SISO_Ant1_2412_1000~26500



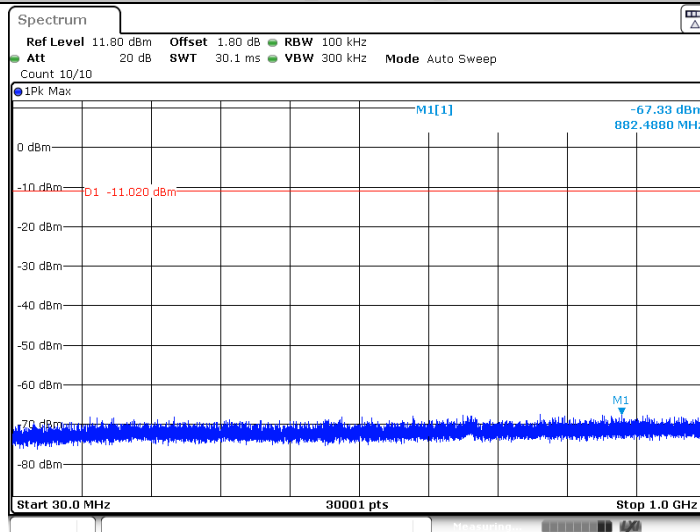
Date: 10 APR 2020 12:01:52

11N20SISO_Ant1_2437_0~Reference



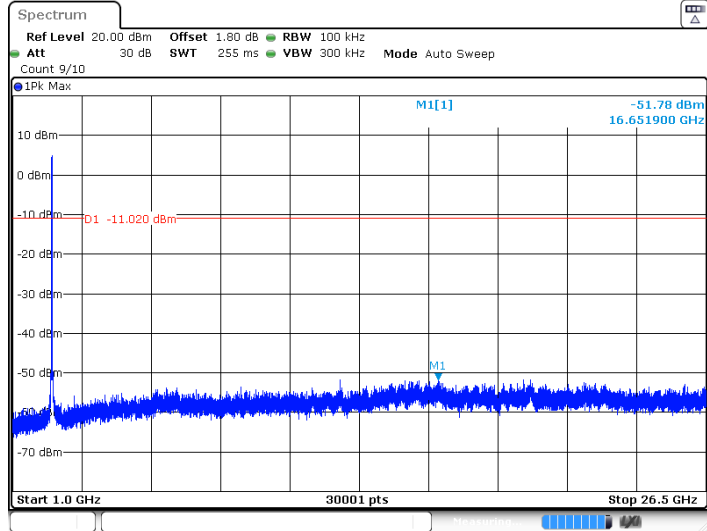
Date: 10 APR 2020 12:03:24

11N20SISO_Ant1_2437_30~1000



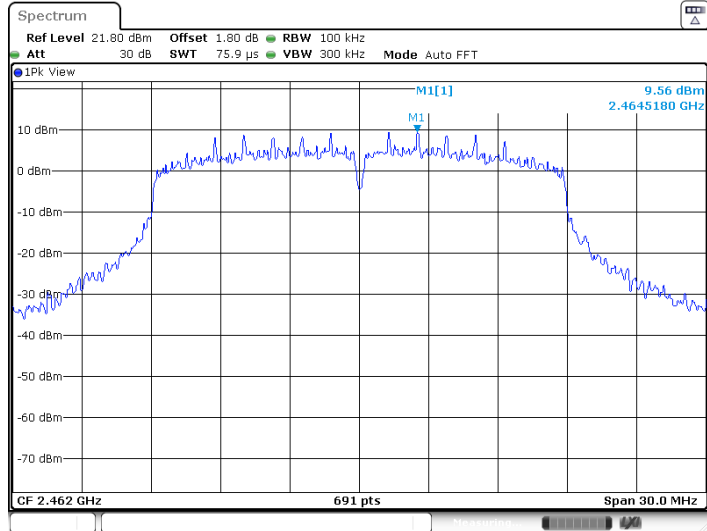
Date: 10 APR 2020 12:03:34

11N20SISO_Ant1_2437_1000~26500



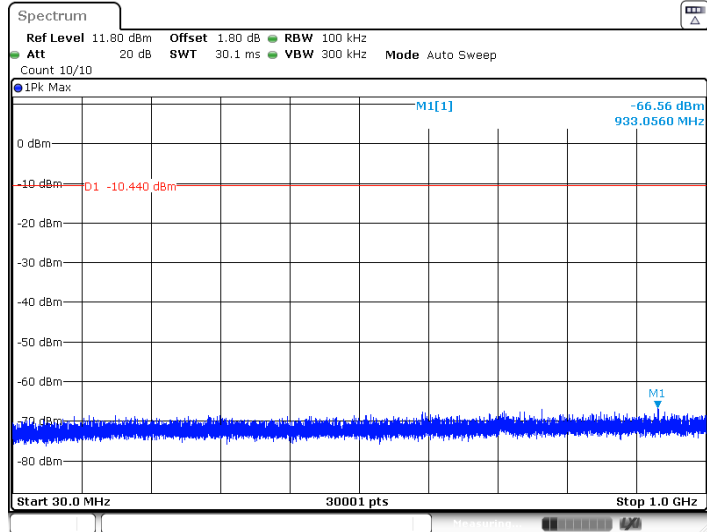
Date: 10.APR.2020 12:03:46

11N20SISO_Ant1_2462_0~Reference



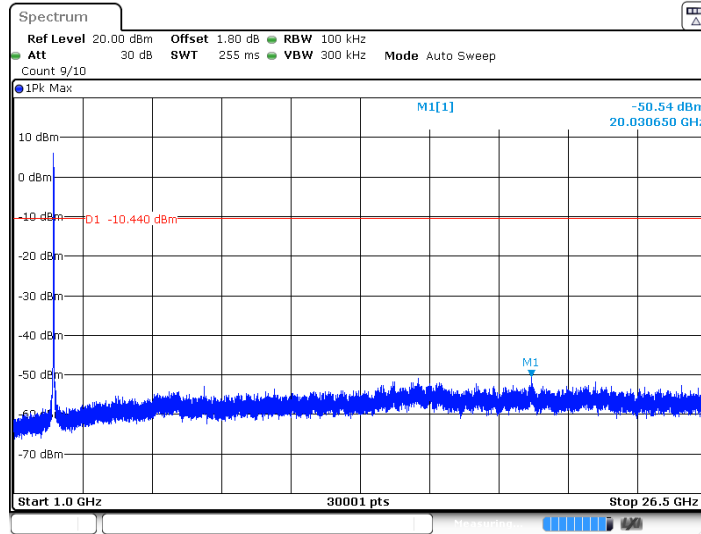
Date: 10.APR.2020 12:05:08

11N20SISO_Ant1_2462_30~1000



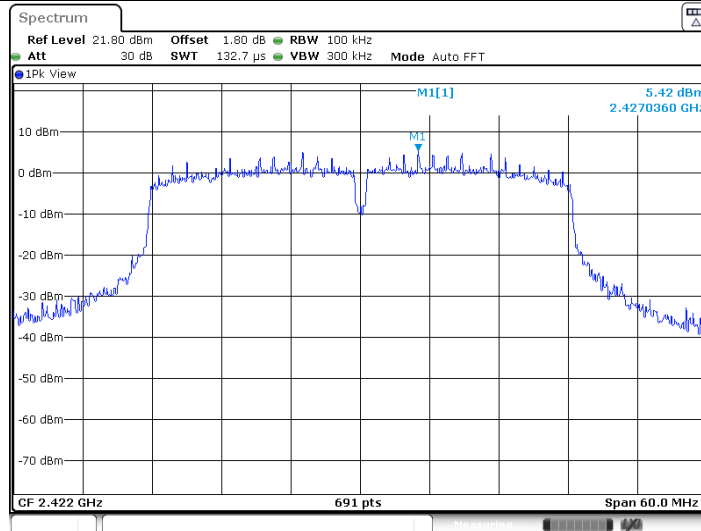
Date: 10.APR.2020 12:05:17

11N20SISO_Ant1_2462_1000~26500



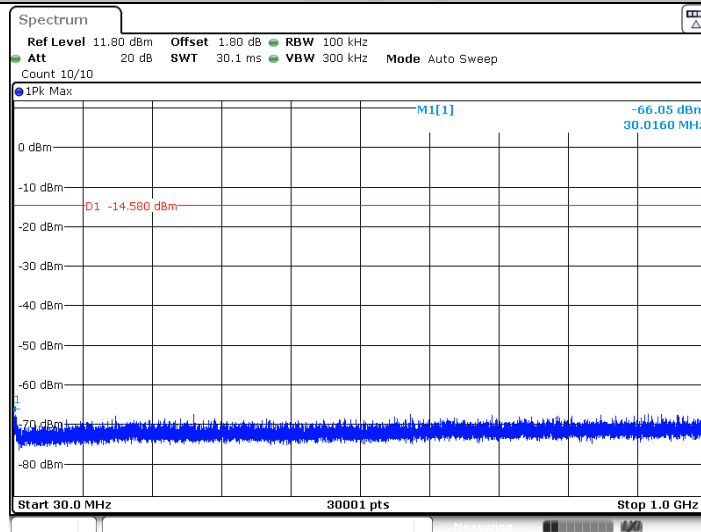
Date: 10 APR 2020 12:05:29

11N40SISO_Ant1_2422_0~Reference



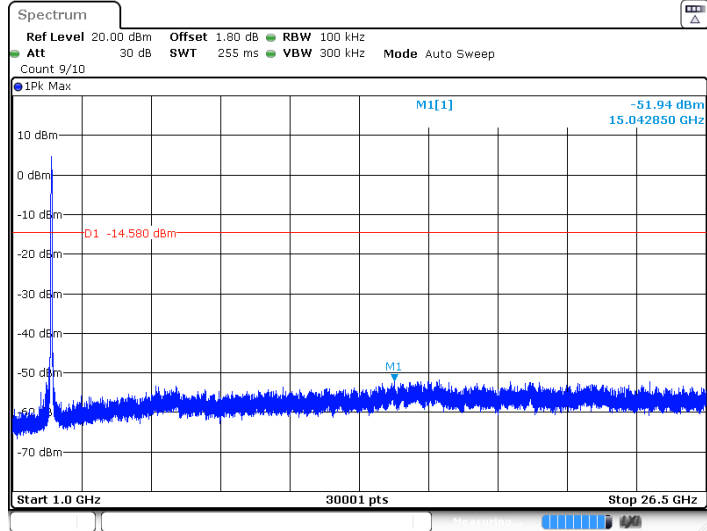
Date: 10 APR 2020 12:07:15

11N40SISO_Ant1_2422_30~1000



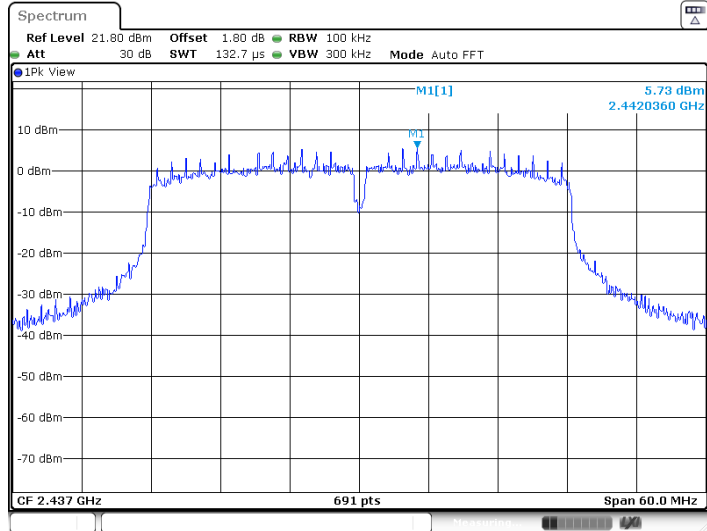
Date: 10 APR 2020 12:07:25

11N40SISO_Ant1_2422_1000~26500



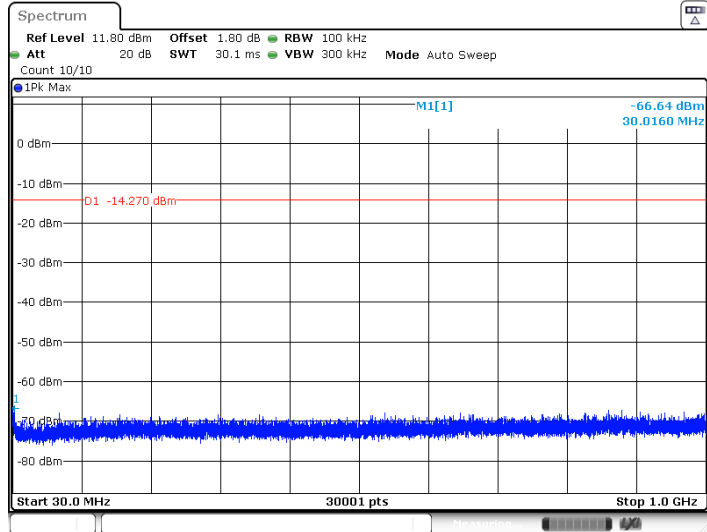
Date: 10.APR.2020 12:07:36

11N40SISO_Ant1_2437_0~Reference



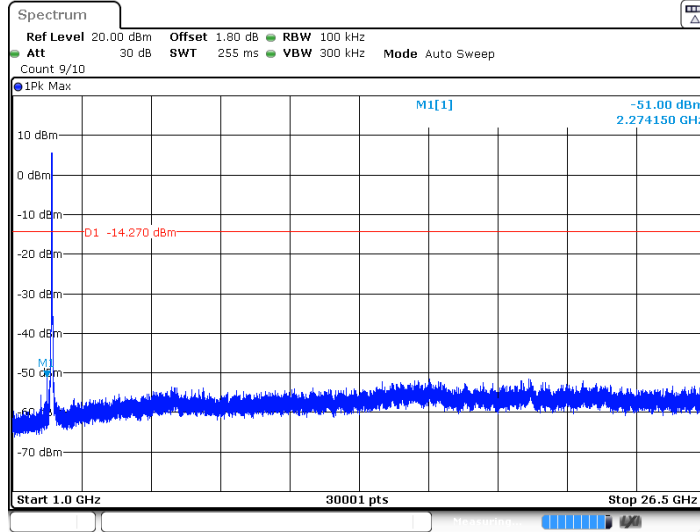
Date: 10.APR.2020 12:08:50

11N40SISO_Ant1_2437_30~1000



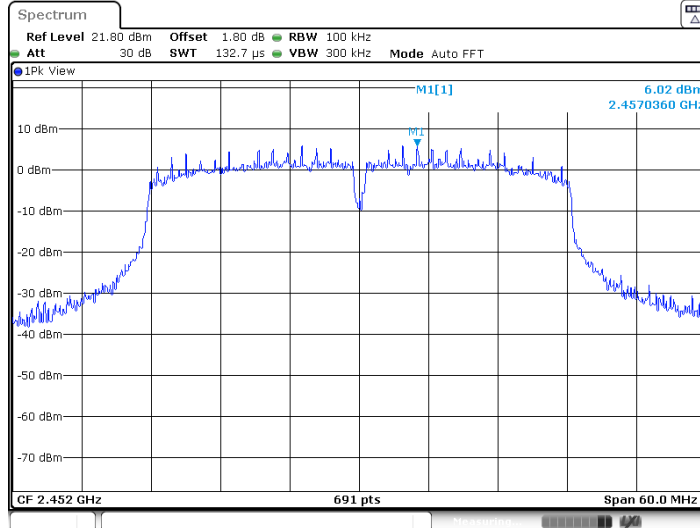
Date: 10.APR.2020 12:08:59

11N40SISO_Ant1_2437_1000~26500



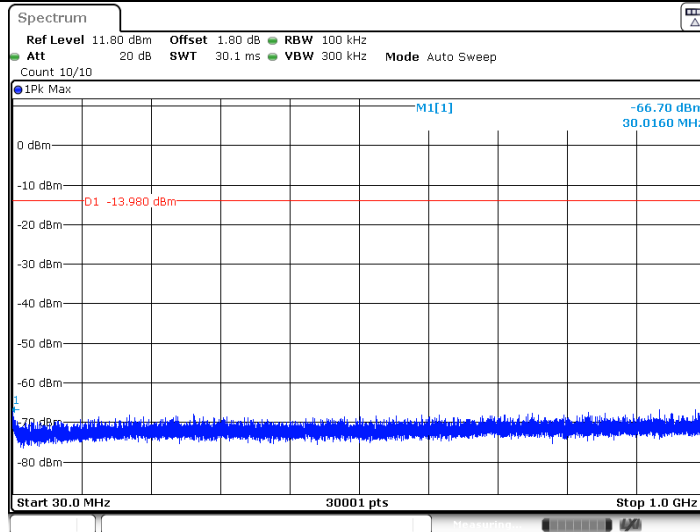
Date: 10 APR 2020 12:09:11

11N40SISO_Ant1_2452_0~Reference



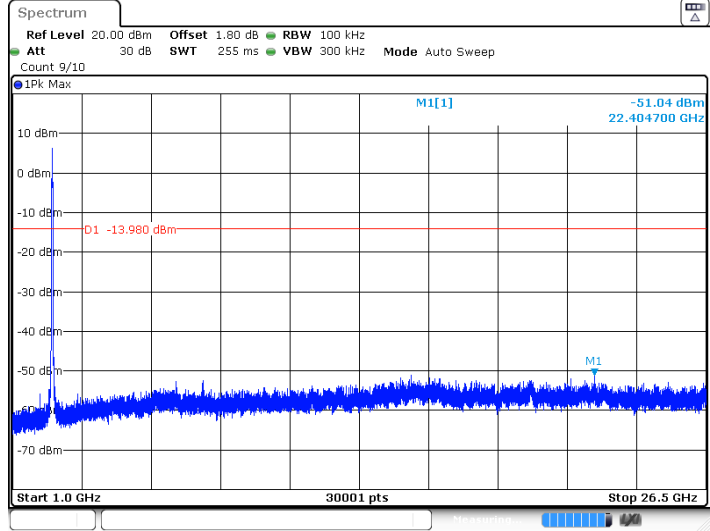
Date: 10 APR 2020 12:10:48

11N40SISO_Ant1_2452_30~1000



Date: 10 APR 2020 12:10:58

11N40SISO_Ant1_2452_1000-26500



Date: 10.APR.2020 12:11:10



9.7 Band edge

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold
3. Allow the trace to stabilize, use the peak and delta measurement to record the result. The level displayed must comply with the limit specified in this Section.
4. The level displayed must comply with the limit specified in this Section.
5. Repeat the test at the hopping off and hopping on mode, submit all the plots.

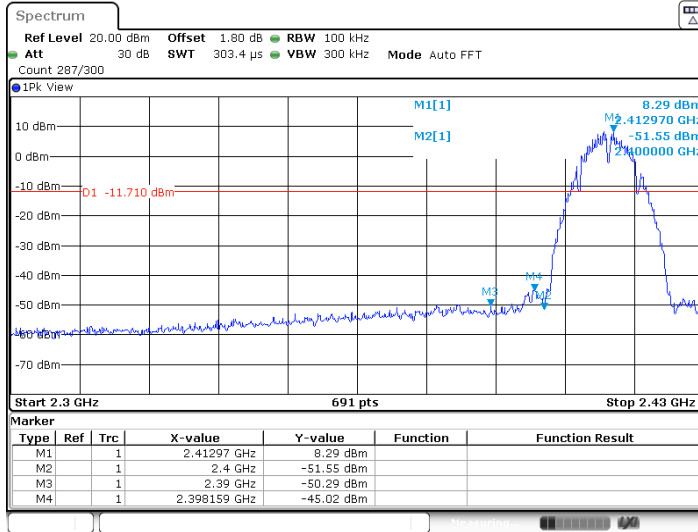
Limit:

According to §15.247(d) and RSS-247 5.5, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen 8.10, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

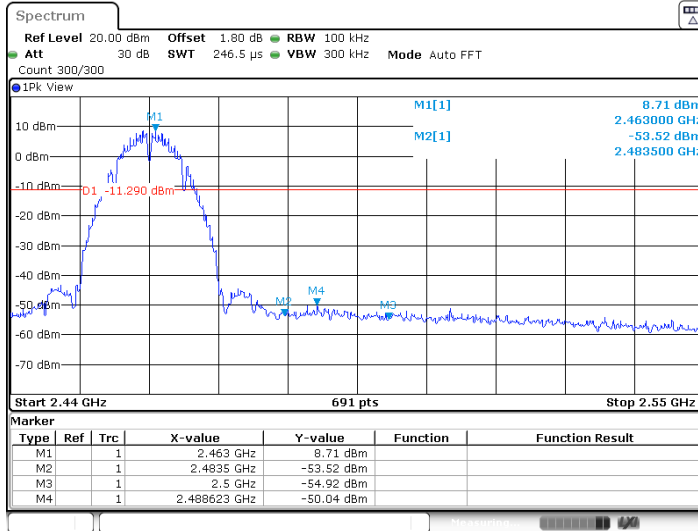
Frequency Range MHz	Limit (dBc)
30-25000	-20

Test result

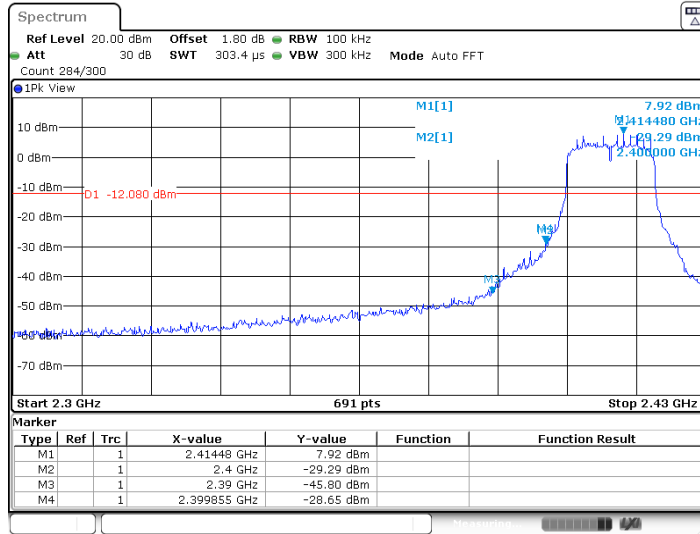
11B_Ant1_Low_2412



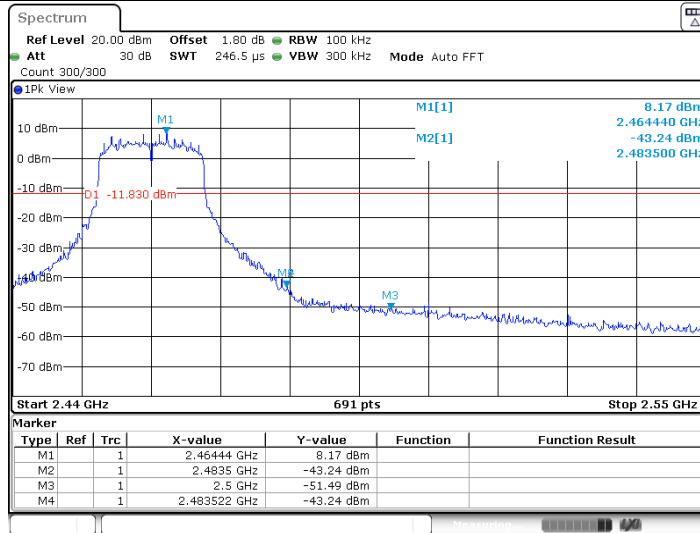
11B_Ant1_High_2462



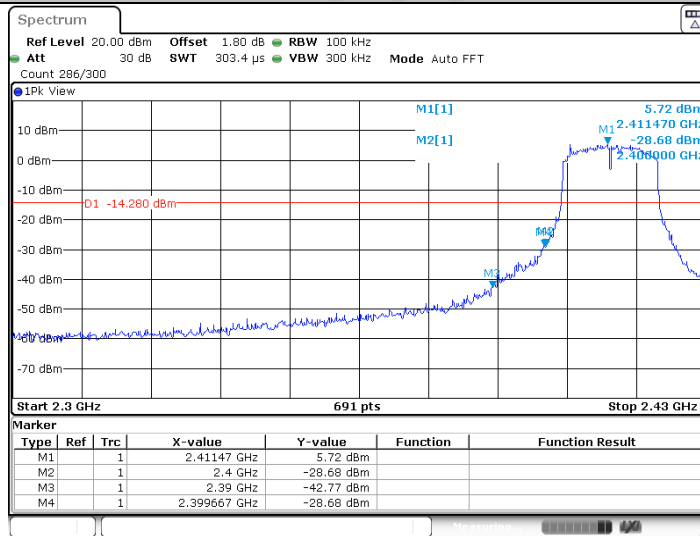
11G_Ant1_Low_2412



11G_Ant1_High_2462

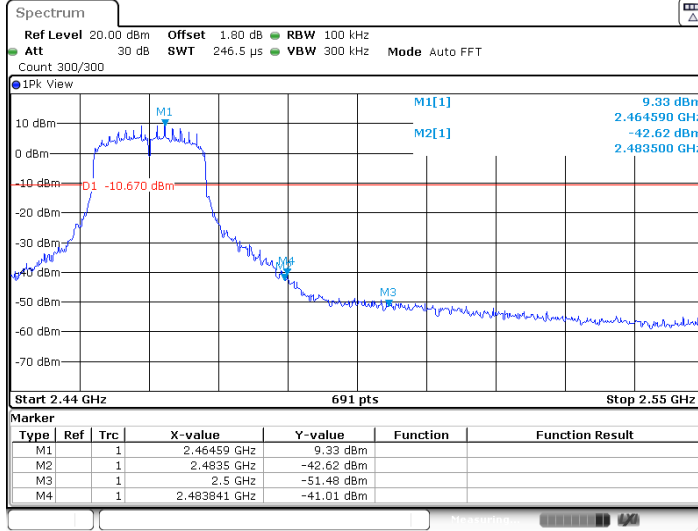


11N20SISO_Ant1_Low_2412



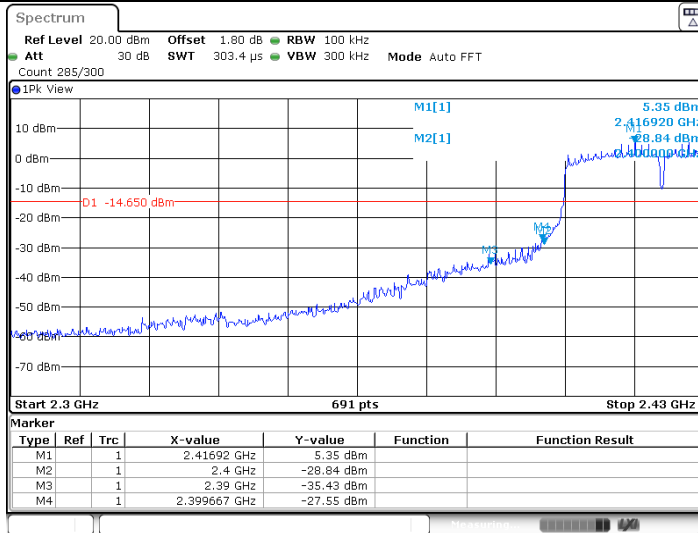


11N20SISO_Ant1_High_2462



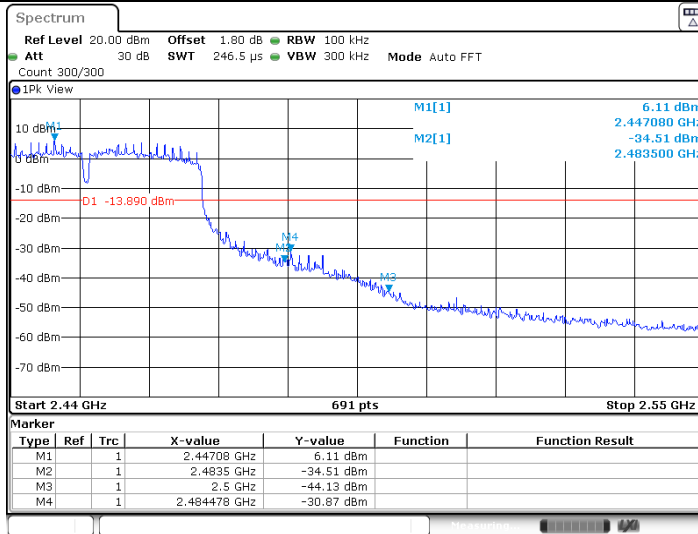
Date: 10.APR.2020 12:05:01

11N40SISO_Ant1_Low_2422



Date: 10.APR.2020 12:07:09

11N40SISO_Ant1_High_2452



Date: 10.APR.2020 12:10:42

9.8 Spurious radiated emissions for transmitter

Test Method

- 1: The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna 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.
- 4: 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5: Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 100 KHz to 120KHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 1MHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

- a) RBW = 1MHz.
- b) VBW \ [3 × RBW].
- c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
- e) Sweep time = auto.
- f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
- g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (rms) mode was used in the preceding step e), then the correction

factor is $[10 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205 and RSS-GEN 8.10, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (802.11n40) test result is listed in the report.

Transmitting spurious emission test result as below:

802.11n40 Modulation 2422MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
	MHz	dBuV/m		dBuV/m		dBuV/m		
30-1000MHz	358.24	30.31	H	46.00	QP	15.69	20	Pass
	789.31	30.90	H	46.00	QP	15.10	28	Pass
	545.44	25.31	V	46.00	QP	20.69	26	Pass
	911.47	31.35	V	46.00	QP	14.65	29	Pass
1000-25000MHz	2507.50	50.63	H	74	PK	23.37	-3.4	Pass
	5026.50	50.30	H	74	PK	23.70	2.9	Pass
	2500.50	49.34	V	74	PK	24.66	-3.4	Pass
	6006.00	49.66	V	74	PK	24.34	4.9	Pass

802.11n40 Modulation 2437MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
	MHz	dBuV/m		dBuV/m		dBuV/m		
1000-25000MHz	12186.50*	49.37	H	74	PK	24.63	9.5	Pass
	14863.50	50.15	H	74	PK	23.85	12.2	Pass
	5441.50	50.39	V	74	PK	23.61	2.9	Pass
	14957.50	50.38	V	74	PK	23.62	12.0	Pass

802.11n40 Modulation 2452MHz Test Result

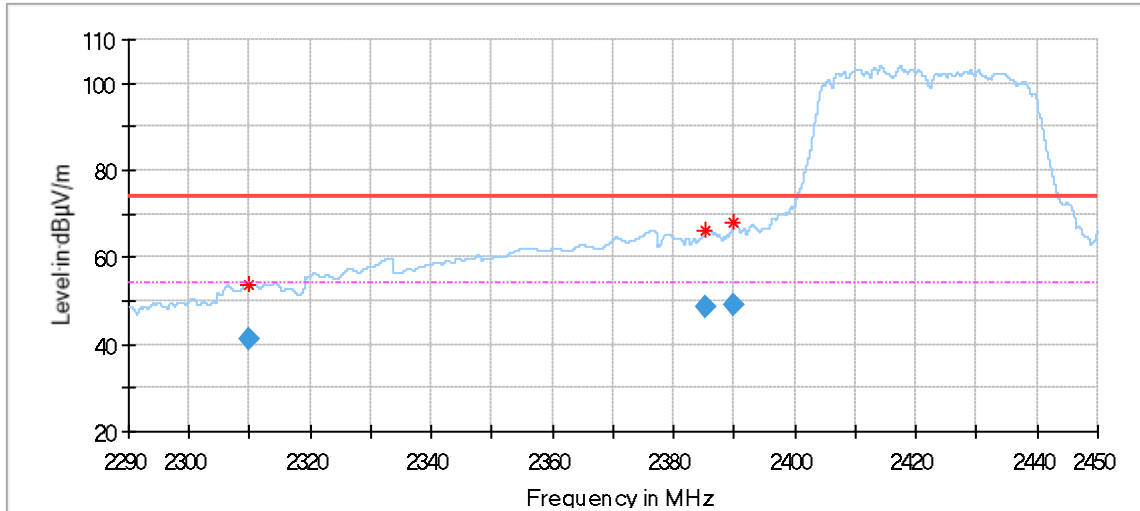
Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
	MHz	dBuV/m		dBuV/m		dBuV/m		
1000-25000MHz	12245.50*	48.66	H	74	PK	25.34	9.6	Pass
	15203.00	49.43	H	74	PK	24.57	12.5	Pass
	12306.00*	48.68	V	74	PK	25.32	10.0	Pass
	16540.50	49.60	V	74	PK	24.40	15.7	Pass

Remark:

- (1) Corrected Amplitude = Read level + Corrector factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain.
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss.
(The Reading Level is recorded by software which is not shown in the sheet)
- (2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) We test all modes and only the worst case recorded in the report.
- (4) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 10dB below the permissible limits or the field strength is too small to be measured.

Restricted bands of operation. test result as below:

802.11n40 Modulation 2422MHz



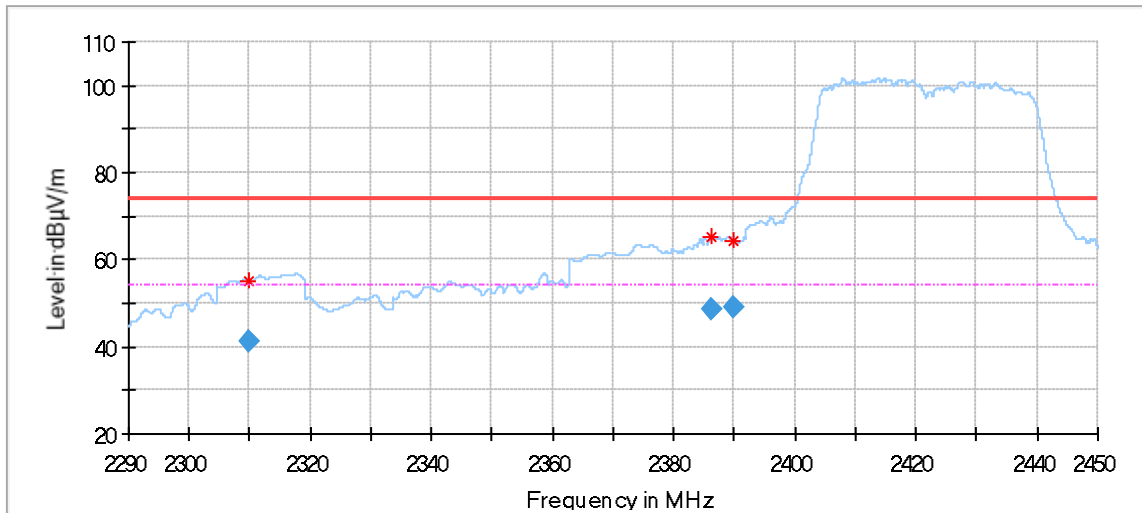
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2310.000000	53.76	74.00	20.24	150.0	H	5.0	-5.1
2385.280000	66.12	74.00	7.88	150.0	H	69.0	-4.8
2390.000000	67.87	74.00	6.13	150.0	H	91.0	-4.8
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2310.000000	41.01	54.00	12.99	150.0	H	5.0	-5.1
2385.280000	48.83	54.00	5.17	150.0	H	69.0	-4.8
2390.000000	49.27	54.00	4.73	150.0	H	91.0	-4.8

Remark:

Level=Reading Level + Correction Factor

Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier

(The Reading Level is recorded by software which is not shown in the sheet)

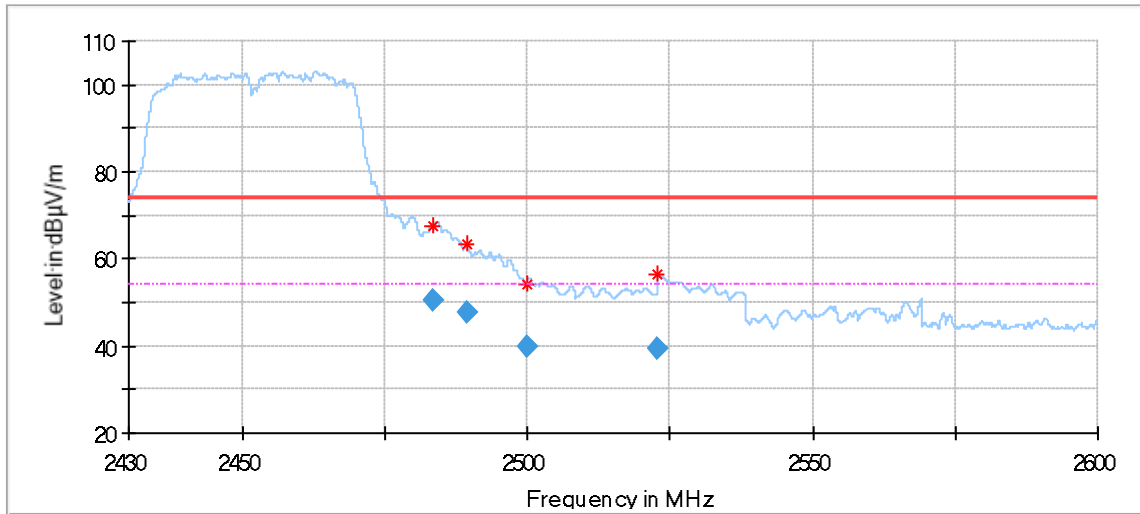


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2310.000000	54.93	74.00	19.07	150.0	V	302.0	-5.1
2386.040000	65.03	74.00	8.97	150.0	V	234.0	-4.8
2390.000000	64.22	74.00	9.78	150.0	V	243.0	-4.8
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2310.000000	41.37	54.00	12.63	150.0	V	302.0	-5.1
2386.040000	48.42	54.00	5.58	150.0	V	234.0	-4.8
2390.000000	48.85	54.00	5.15	150.0	V	243.0	-4.8

Remark:

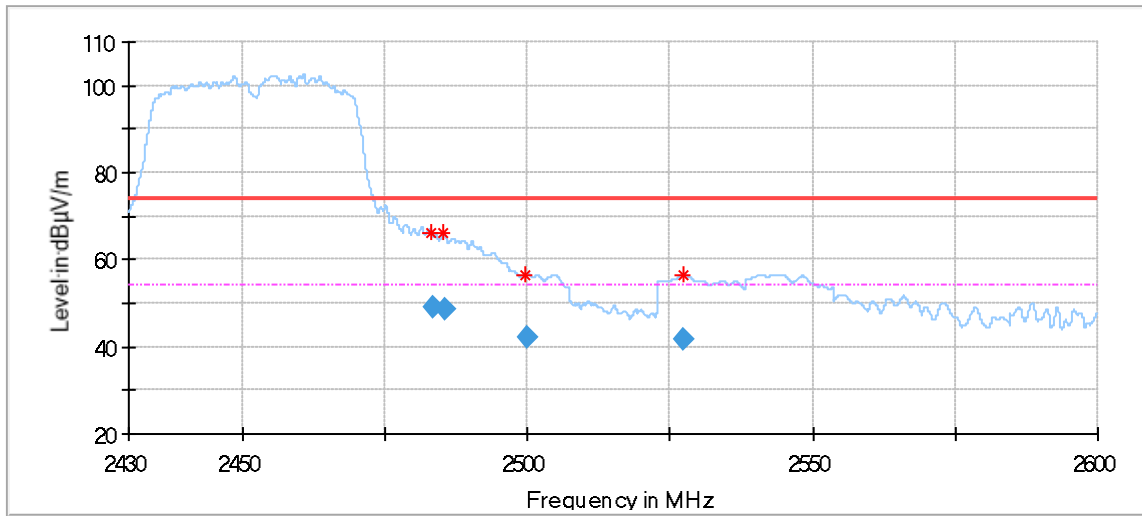
Level=Reading Level + Correction Factor
 Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier
 (The Reading Level is recorded by software which is not shown in the sheet)

802.11n40 Modulation 2452MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	67.47	74.00	6.53	150.0	H	94.0	-4.2
2489.287500	63.42	74.00	10.58	150.0	H	75.0	-4.2
2500.000000	53.97	74.00	20.03	150.0	H	97.0	-4.0
2522.862500	56.25	74.00	17.75	150.0	H	56.0	-4.1
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	50.37	54.00	3.63	150.0	H	94.0	-4.2
2489.457500	47.66	54.00	6.34	150.0	H	75.0	-4.2
2500.000000	39.86	54.00	14.14	150.0	H	97.0	-4.0
2522.862500	39.33	54.00	14.67	150.0	H	56.0	-4.1

Remark:
 Level=Reading Level + Correction Factor
 Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier
 (The Reading Level is recorded by software which is not shown in the sheet)



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.167500	66.35	74.00	7.65	150.0	V	134.0	-4.2
2485.250000	66.04	74.00	7.96	150.0	V	116.0	-4.2
2499.530000	56.63	74.00	17.37	150.0	V	167.0	-4.0
2527.155000	56.68	74.00	17.32	150.0	V	116.0	-4.1
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	49.24	54.00	4.76	150.0	V	134.0	-4.2
2485.420000	48.51	54.00	5.49	150.0	V	116.0	-4.2
2500.000000	42.33	54.00	11.67	150.0	V	167.0	-4.0
2527.155000	41.76	54.00	12.24	150.0	V	116.0	-4.1

Remark:
 Level=Reading Level + Correction Factor
 Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier
 (The Reading Level is recorded by software which is not shown in the sheet)

10 Test Equipment List

Conducted Emission Test

Description	Manufacturer	Model no.	Serial no.	cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2020-6-28
LISN	Rohde & Schwarz	ENV4200	100249	2020-6-28
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2020-6-28
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A

Radiated Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2020-6-28
High Pass Filter (HPF)	UCL	UCL-BPF1-7G	1504005103	2020-6-28
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2020-6-29
Horn Antenna	Rohde & Schwarz	HF907	102295	2020-6-22
Wideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	12827	2020-7-12
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2020-6-28
Pre-amplifier	Rohde & Schwarz	SCU 40A	100432	2020-7-16
Attenuator	Agilent	8491A	MY39264334	2020-6-28
3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

RF conducted test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2020-6-28
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2020-6-28
Power Splitter	Weinschel	1580	SC319	2020-7-7
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2020-7-6
Test software	Tonscend	System for BT/WIFI	Version 2.6	N/A

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz (for test using AMN ENV432 or ENV4200)	3.62dB
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.81dB; Vertical: 4.89dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.69dB; Vertical: 4.68dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 4.89dB; Vertical: 4.87dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10^{-7} or 1%