FCC- TEST REPORT

Report Number	:	**68.910.17.0038.01**	Date of Issue:	May 24, 2018
Model	:	**A7, X780, X785**		
Product Type	:	Robotic Vacuum Cleaner		
Applicant	:	Shenzhen ZhiYi Technology Co., Ltd.		
Address	:	3rd Floor, Bld B, Hytera Technology Park, No.3, 4th of Baolong Road, Long-gang, 518100 Shenzhen, PEOPLE'S REPUBLIC OF CHINA		
Production Facility	:	Shenzhen ZhiYi Technology Co., Ltd.		
Address	:	3rd Floor, Bld B, Hytera Technology Park, No.3, 4th of Baolong Road, Long-gang, 518100 Shenzhen, PEOPLE'S REPUBLIC OF CHINA		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	58		

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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 peak output power 12
9.3 6dB and 99% bandwidth 14
9.4 Power spectral density 21
9.5 Spurious RF conducted emissions 29
9.6 Band edge 42
9.7 Spurious radiated emissions for transmitter 47
10 Test Equipment List 56
11 System Measurement Uncertainty 57
12 General product information 58

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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 Registration Number:	514049
Telephone:	86 755 8828 6998
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3 Description of the Equipment under Test

Description of the Equipment Under Test

Product:	Robotic Vacuum Cleaner
Model no.:	X780, A7, X785
FCC ID:	2AO2M-A580
Options and accessories:	NIL
Rated Input:	100-240VAC, 50/60Hz, Max. 0.5A (for adapter) 19Vdc , 600mA (for robotic vacuum cleaner)
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
Duty Cycle:	100%
Antenna Type:	Integral Antenna
Antenna Gain:	3dBi
Description of the EUT:	The Equipment Under Test (EUT) is an Robotic Vacuum Cleaner supports 2.4GHz WIFI functions. Tested with external approved adaptor Model: GSCU0600S019V12E (by Hu Nan Giantsun Power Electronics Co., Ltd): Input:100-240V~; 50/60Hz; 0.5A Max; Output: DC19V; 600mA

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2017 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 D01 v04 DTS Measurement Guidance and ANSI C63.10 (2013).

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5 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C				
Test Condition		Pages	Test Result	Test Site
§15.207	Conducted emission AC power port	9	Pass	Site 1
§15.247(b)(1)	Conducted peak output power	13	Pass	Site 1
§15.247(e)	Power spectral density*	20	Pass	Site 1
§15.247(a)(2)	6dB bandwidth	14	Pass	Site 1
§15.247(a)(1)	20dB bandwidth and 99% Occupied Bandwidth	14	Pass	Site 1
§15.247(a)(1)	Carrier frequency separation	--	N/A	--
§15.247(a)(1)(iii)	Number of hopping frequencies	--	N/A	--
§15.247(a)(1)(iii)	Dwell Time	--	N/A	--
§15.247(d)	Spurious RF conducted emissions	26	Pass	Site 1
§15.247(d)	Band edge	32	Pass	Site 1
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter	36	Pass	Site 1
§15.203	Antenna requirement	See note 1	Pass	--

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses a permanently integral antenna, which gain is 3dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2AO2M-A580, complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C rules.

The difference of all models is described in Appendix A, therefore the model X780 was chosen as the representative model to perform all the tests, other models are deemed to fulfill relevant EMC requirement without further test.

The EUT has multiple work modes, the worst test results are listed in the report.

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: November 17, 2017

Testing Start Date: November 17, 2017

Testing End Date: March 24, 2018

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

Reviewed by:	Prepared by:	Tested by:
Laurent Yuan	Dawi Xu	Tree Zhan
EMC Project Manager	EMC Project Engineer	EMC Test Engineer

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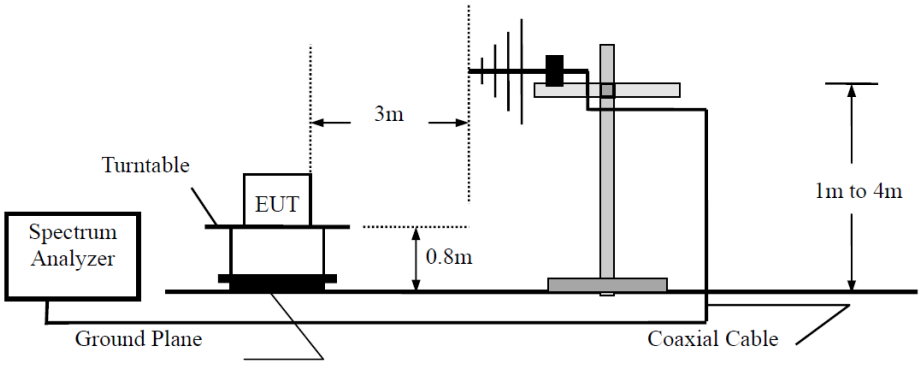
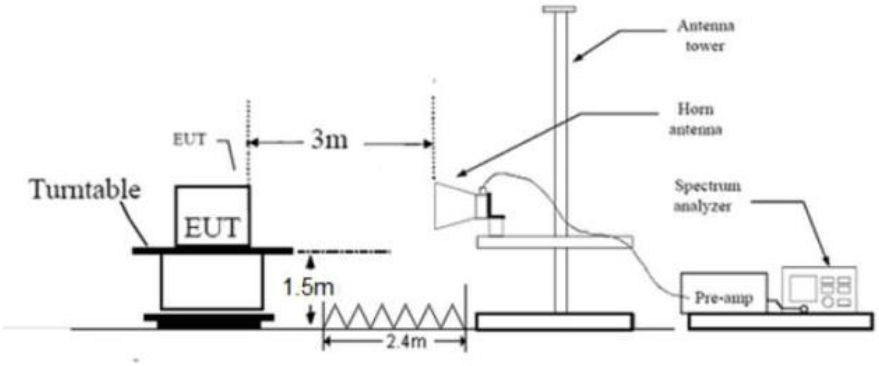
7 Test Setups

7.1 Radiated test setups

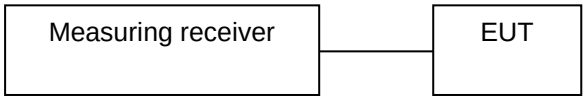
Below 1GHz



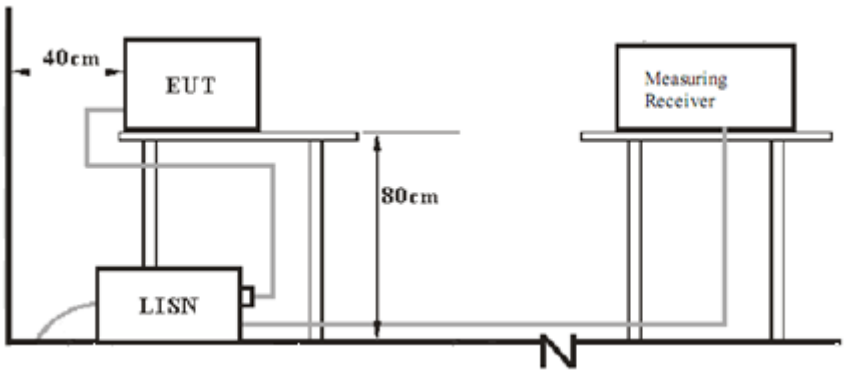
Above 1GHz



7.2 Conducted RF test setups



7.3 AC Power Line Conducted Emission test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
---	---	---	---

Test software: RF test tool

The system was configured to channel 1, 6 and 11 for the test.

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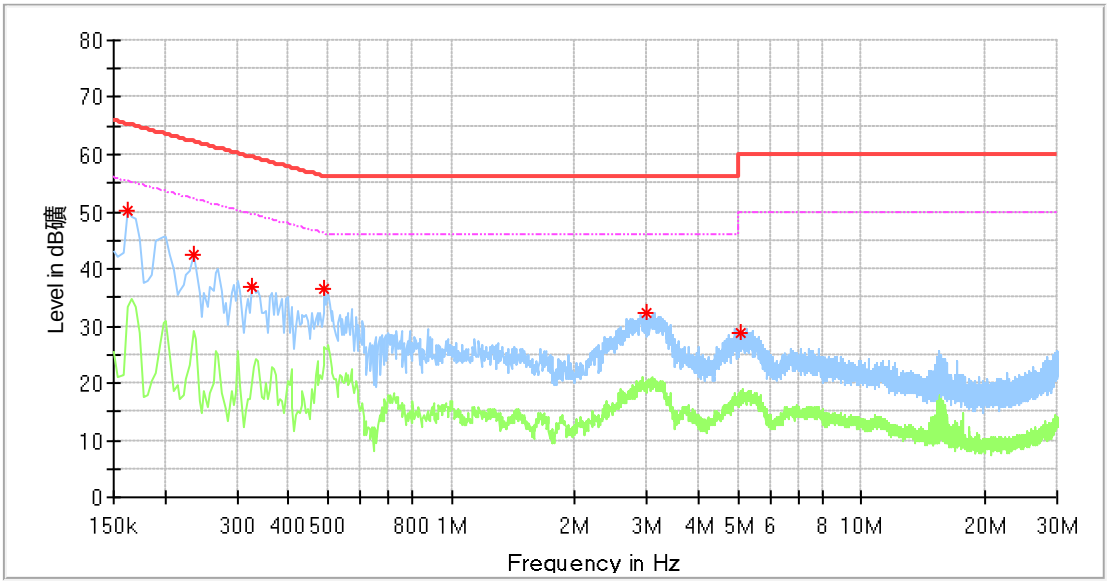
9 Technical Requirement

9.1 Conducted Emission

Conducted Emission Test 150kHz – 30MHz

M/N: X780
Op Cond.: Charging + TX
Test Spec.: Power Line, Live
Comment: AC 120V/60Hz

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.162000	50.11	---	65.36	15.25	L1	10.2
0.234000	42.62	---	62.31	19.68	L1	10.2
0.326000	36.90	---	59.55	22.66	L1	10.2
0.490000	36.50	---	56.17	19.67	L1	10.4
2.978000	32.27	---	56.00	23.73	L1	10.3
5.066000	28.72	---	60.00	31.28	L1	10.4

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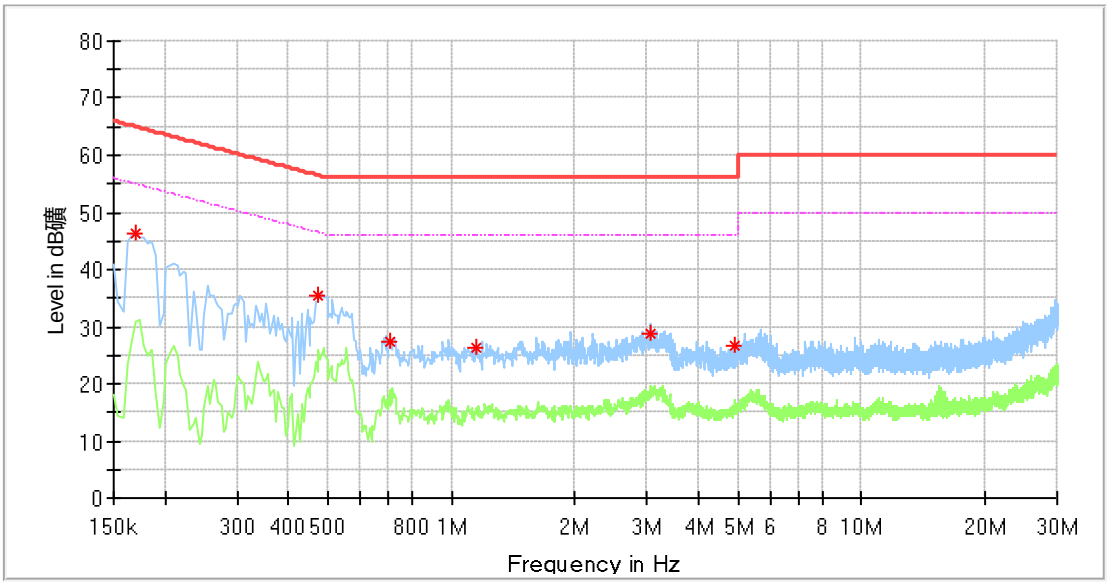
Conducted Emission Test 150kHz – 30MHz

M/N: X780
Op Cond.: Charging + TX
Test Spec.: Power Line, Neutral
Comment: AC 120V/60Hz

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.170000	46.16	---	64.96	18.80	N	10.3
0.474000	35.60	---	56.44	20.84	N	10.3
0.710000	27.31	---	56.00	28.69	N	10.4
1.154000	26.47	---	56.00	29.53	N	10.4
3.074000	28.63	---	56.00	27.37	N	10.5
4.898000	26.73	---	56.00	29.27	N	10.6

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9.2

9.2 Conducted Average output power

Test Method

1. Connect the power meter to the EUT
   a) The EUT is configured to transmit continuously, or to transmit with a constant duty factor.
   b) At all times the EUT is transmitting at its maximum power control level.
   c) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
3. Adjust the measurement in dBm by adding 10log (1/x), where x is the duty cycle to the measurement result.

Limits

According to §15.247 (b) (1), conducted AV output power limit as below:

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

Test result as below table

802.11b

Frequency MHz	Conducted AV Output Power dBm	Result
Top channel 2412MHz	17.1	Pass
Middle channel 2437MHz	16.3	Pass
Bottom channel 2462MHz	16.4	Pass

802.11g

Frequency MHz	Conducted AV Output Power dBm	Result
Top channel 2412MHz	17.2	Pass
Middle channel 2437MHz	16.5	Pass
Bottom channel 2462MHz	16.5	Pass

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802.11nHT20

Frequency	Conducted AV Output Power	Result
MHz	**dBm**	
Top channel 2412MHz	16.9	Pass
Middle channel 2437MHz	16.4	Pass
Bottom channel 2462MHz	16.4	Pass

802.11nHT40

Frequency	Conducted AV Output Power	Result
MHz	**dBm**	
Top channel 2422MHz	16.6	Pass
Middle channel 2437MHz	16.7	Pass
Bottom channel 2452MHz	16.9	Pass

9.3 6dB and 99% bandwidth

Test Method

1. Use the following spectrum analyzer settings:
   RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. 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.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]
≥500

Test result

802.11b

Frequency MHz	6dB bandwidth KHz	99% bandwidth KHz	Result
Bottom channel 2412MHz	10116	13719	Pass
Middle channel 2437MHz	9841	13863	Pass
Top channel 2462MHz	10072	13892	Pass

802.11g

Frequency MHz	6dB bandwidth KHz	99% bandwidth KHz	Result
Bottom channel 2412MHz	16237	16497	Pass
Middle channel 2437MHz	16440	16468	Pass
Top channel 2462MHz	16440	16468	Pass

802.11nHT20

Frequency MHz	6dB bandwidth KHz	99% bandwidth KHz	Result
Bottom channel 2412MHz	17583	17713	Pass
Middle channel 2437MHz	17598	17626	Pass
Top channel 2462MHz	17511	17627	Pass

802.11nHT40

Frequency MHz	6dB bandwidth KHz	99% bandwidth KHz	Result
Bottom channel 2422MHz	36013	36121	Pass
Middle channel 2437MHz	36064	36063	Pass
Top channel 2452MHz	36237	36121	Pass

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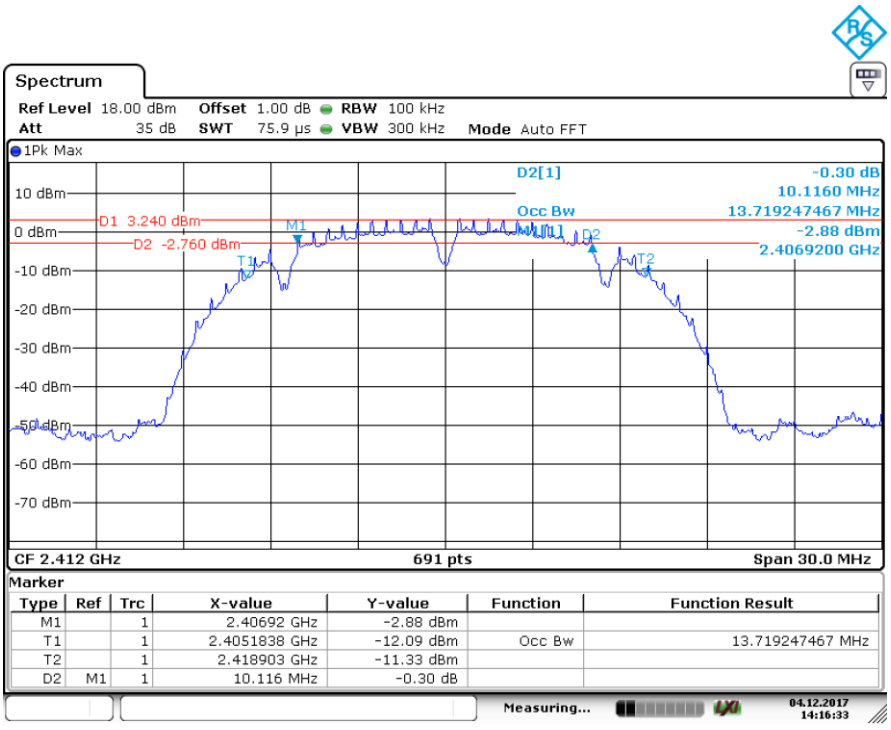
802.11b



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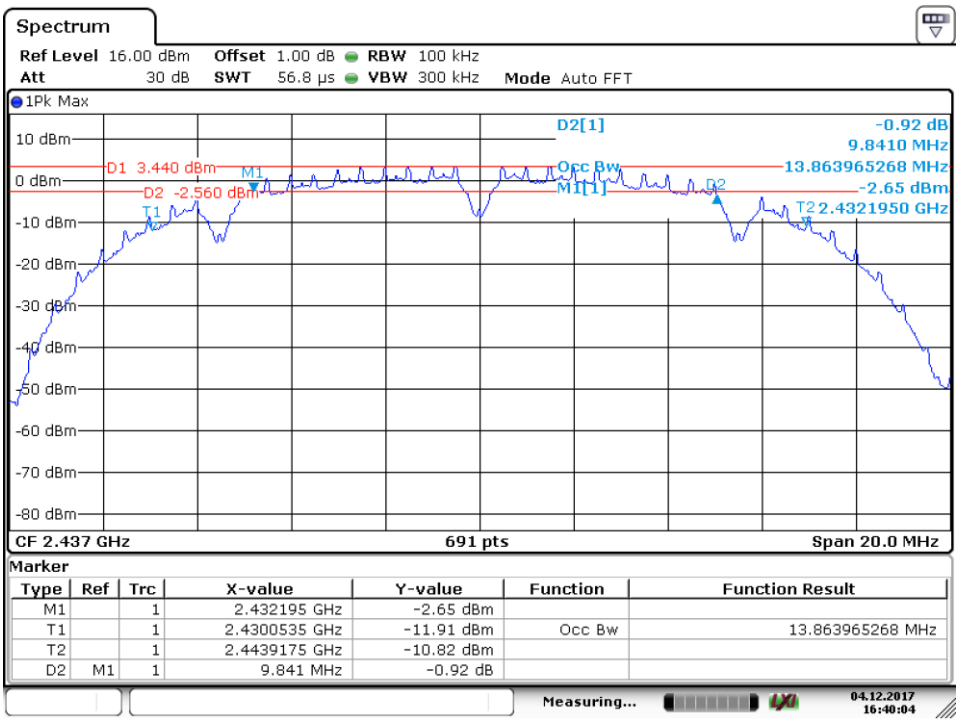
2412MHz



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2437MHz

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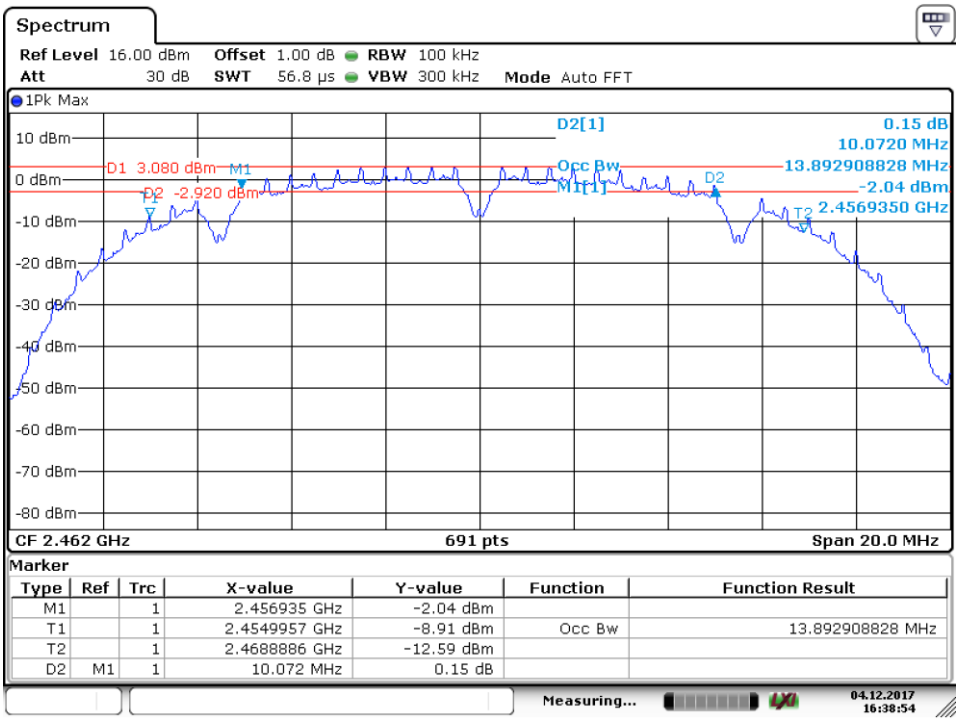

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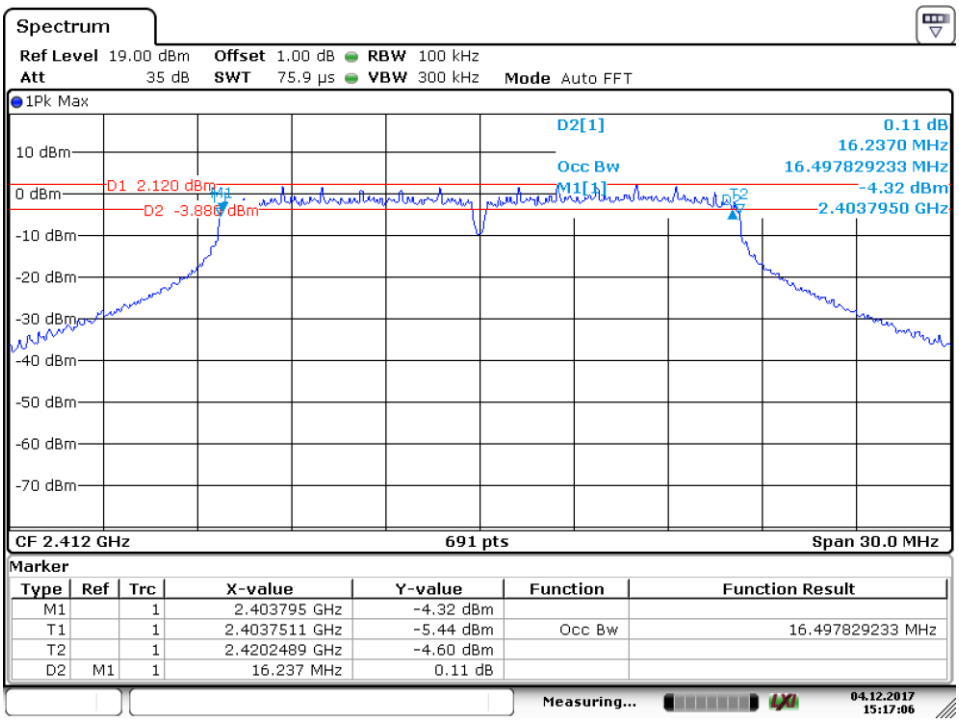
2462MHz

802.11g



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2412MHz

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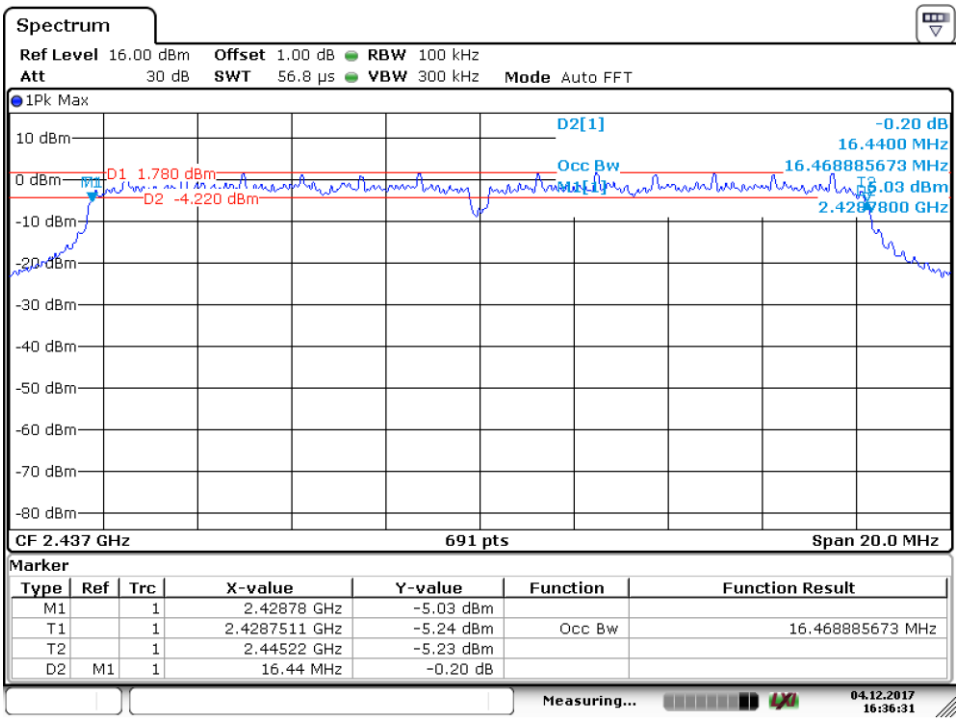

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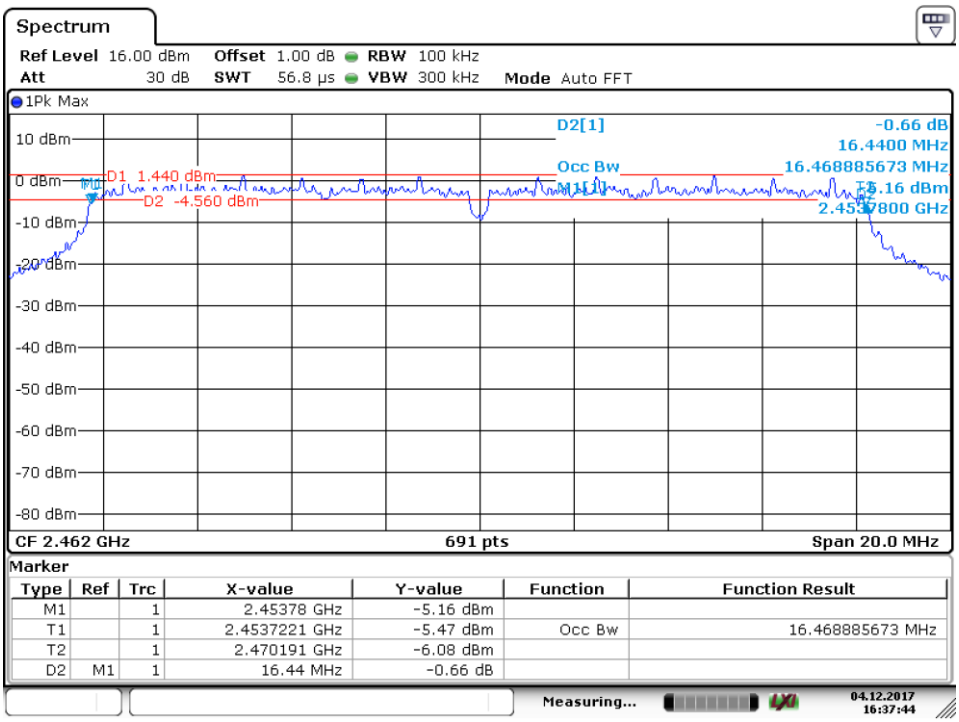
2437MHz



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2462MHz

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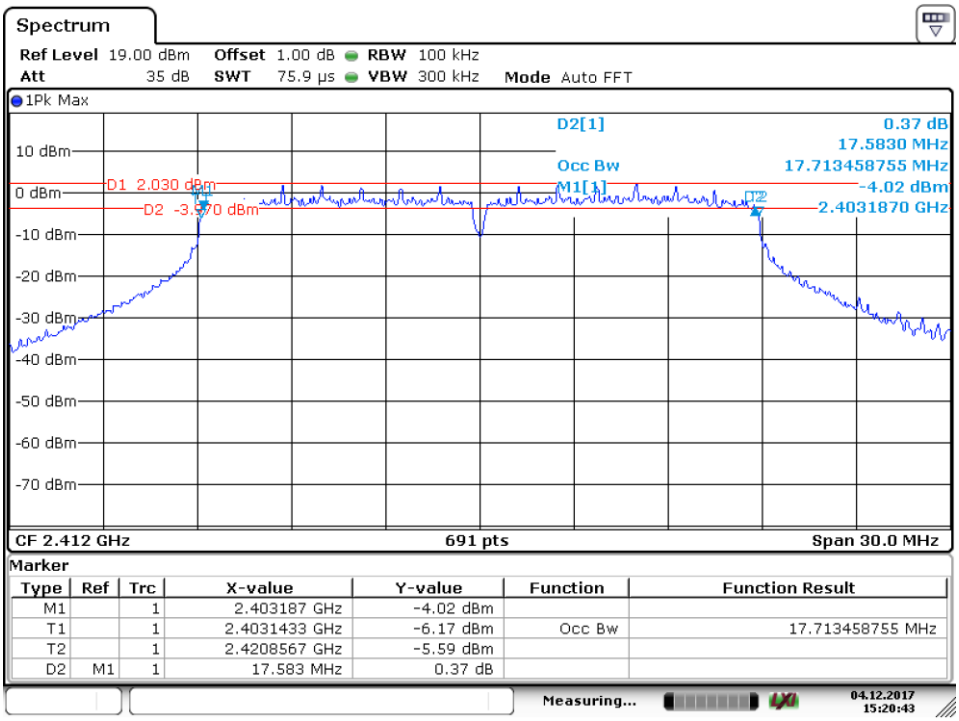
802.11nHT20



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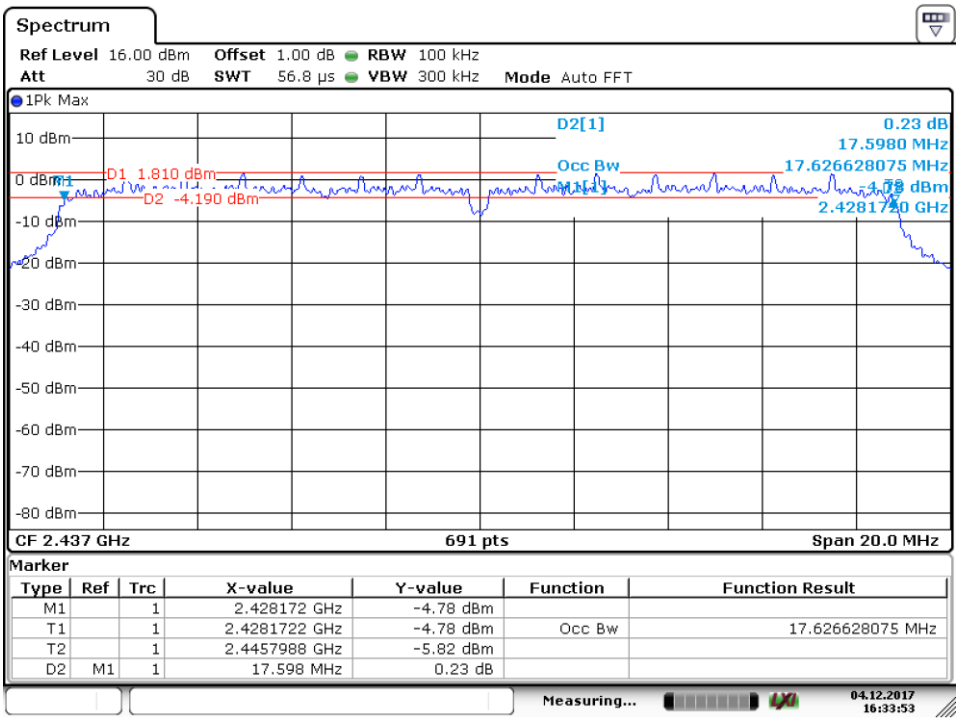
2412MHz



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2437MHz

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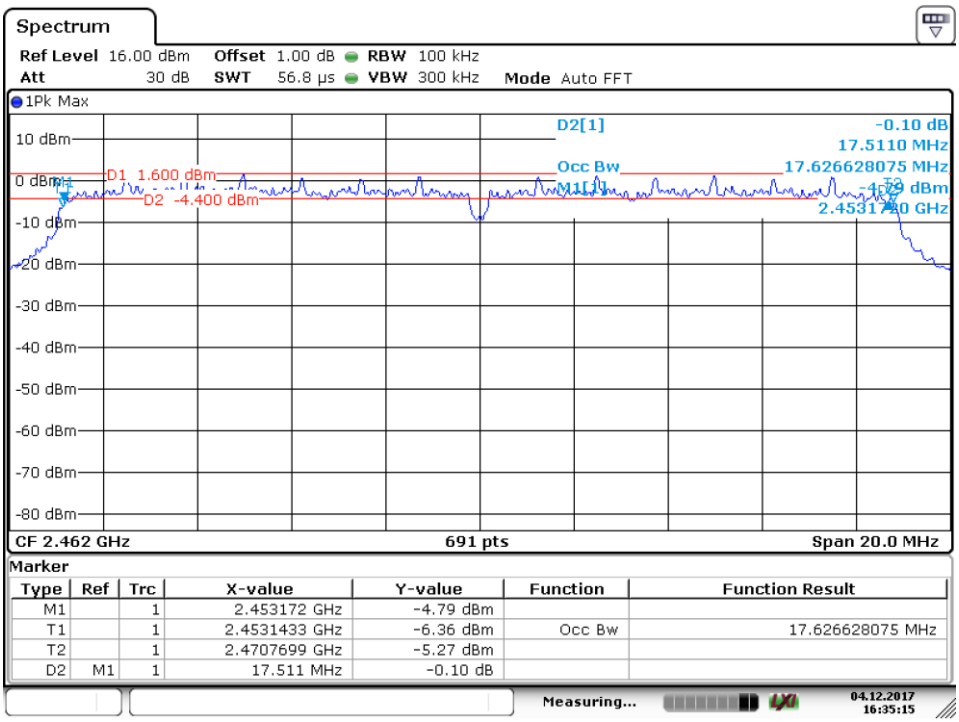

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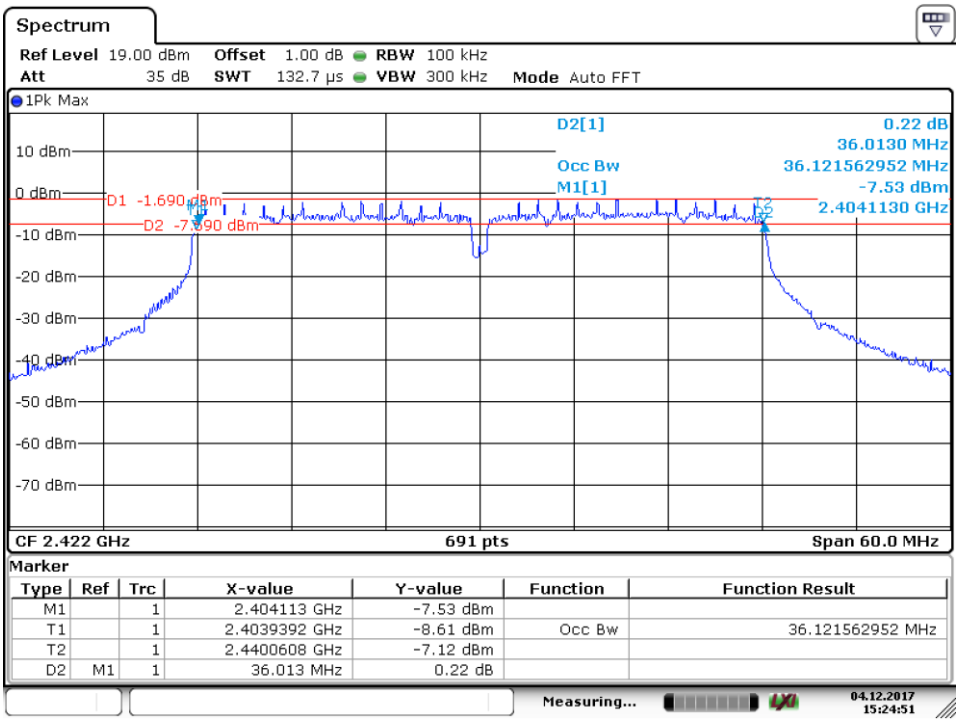
2462MHz

802.11nHT40



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2422MHz

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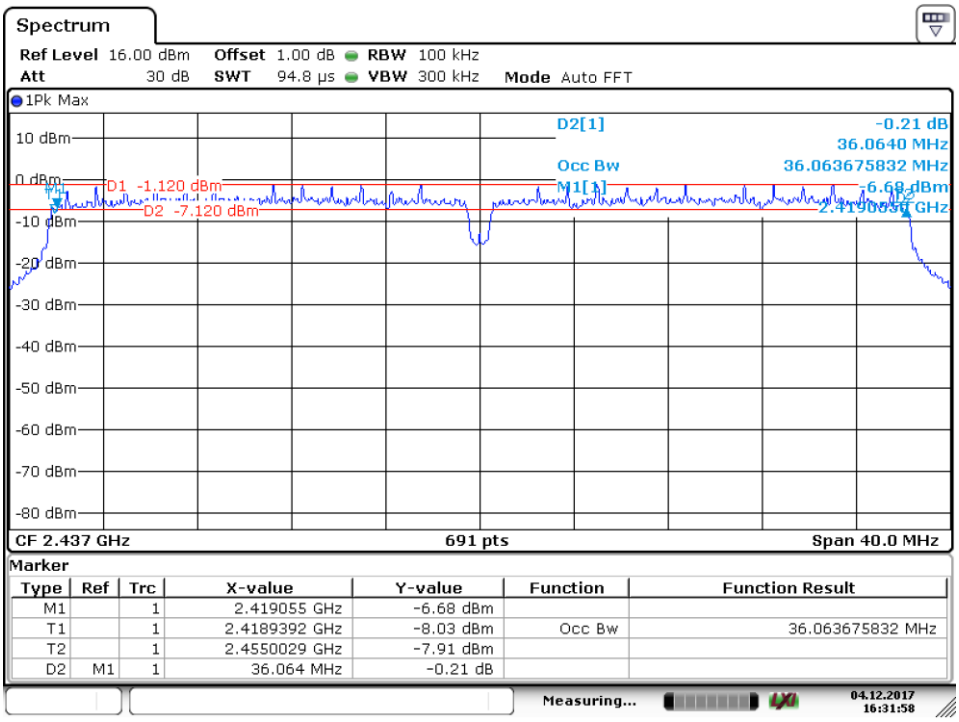

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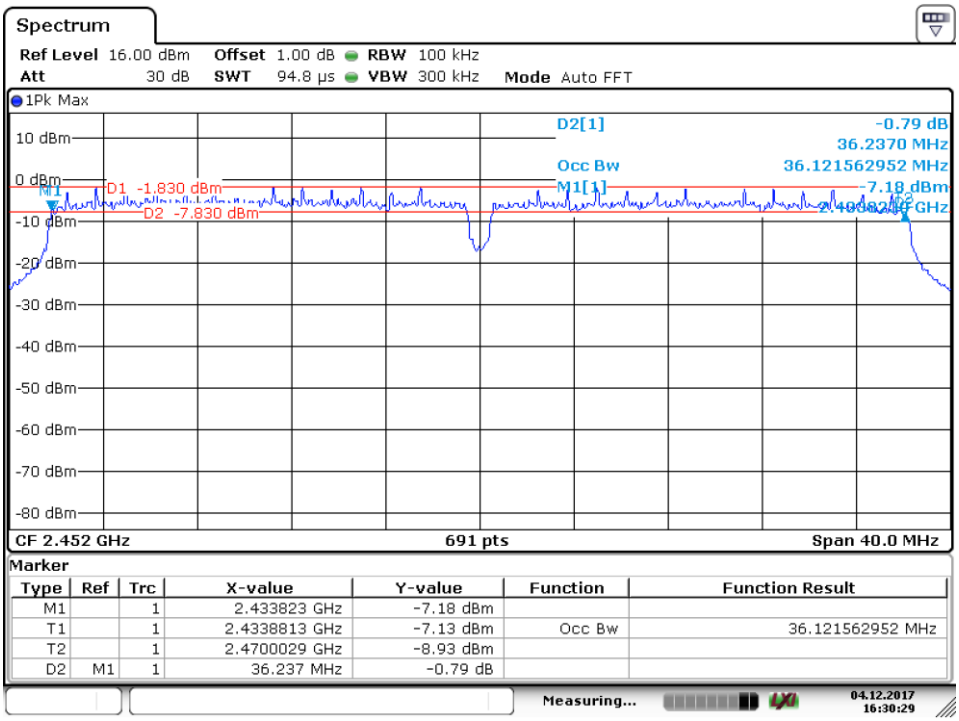
2437MHz



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2452MHz

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9.4 Power spectral density

Test Method

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

1. 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.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm]
≤8

Test result

802.11b

Frequency	Power spectral density	Result
MHz	**dBm**	
Top channel 2412MHz	-11.43	Pass
Middle channel 2437MHz	-10.27	Pass
Bottom channel 2462MHz	-11.21	Pass

802.11g

Frequency	Power spectral density	Result
MHz	**dBm**	
Top channel 2412MHz	-9.93	Pass
Middle channel 2437MHz	-10.86	Pass
Bottom channel 2462MHz	-11.04	Pass

802.11nHT20

Frequency	Power spectral density	Result
MHz	**dBm**	
Top channel 2412MHz	-11.41	Pass
Middle channel 2437MHz	-11.29	Pass
Bottom channel 2462MHz	-12.16	Pass

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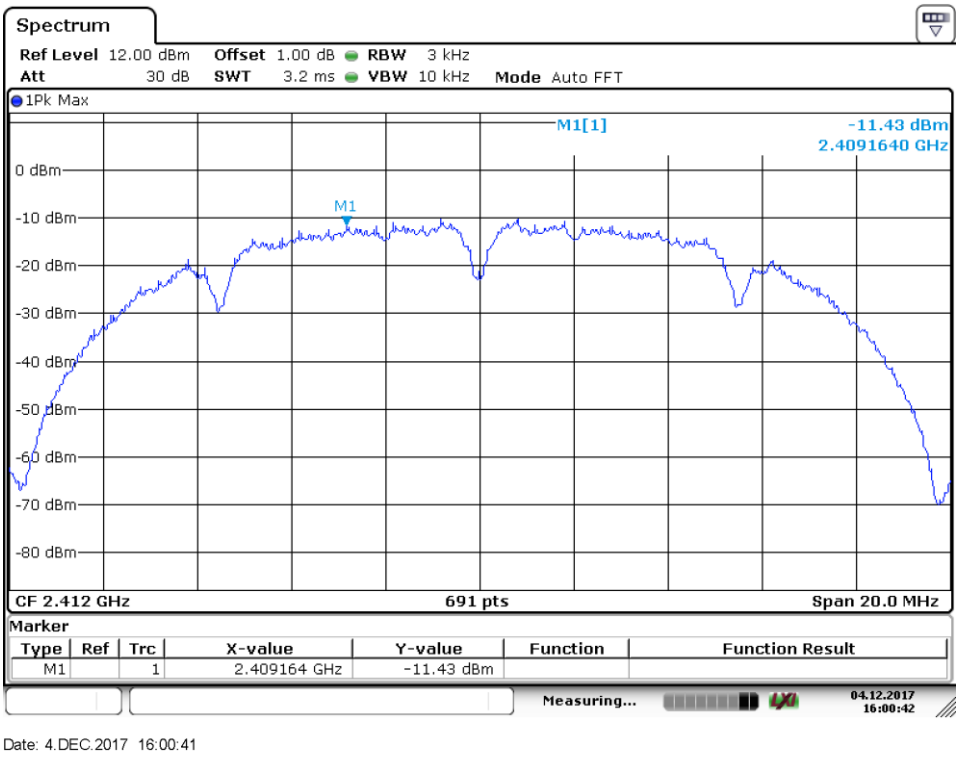
802.11nHT40

Frequency	Power spectral density	Result
MHz	**dBm**	
Top channel 2422MHz	-14.94	Pass
Middle channel 2437MHz	-14.63	Pass
Bottom channel 2452MHz	-14.38	Pass

802.11b



2412MHz

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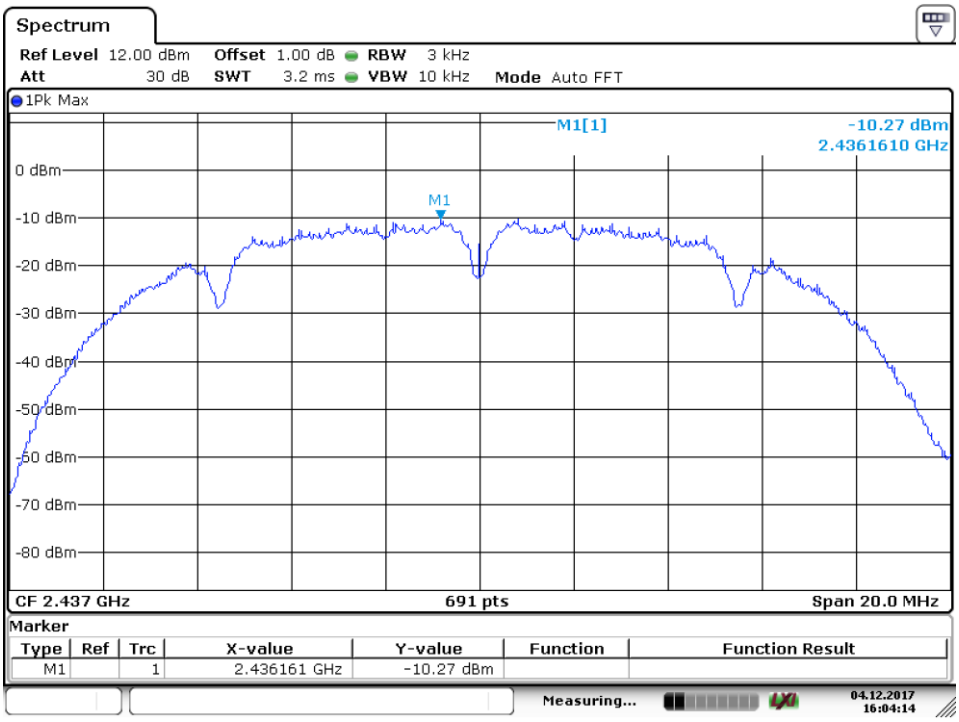

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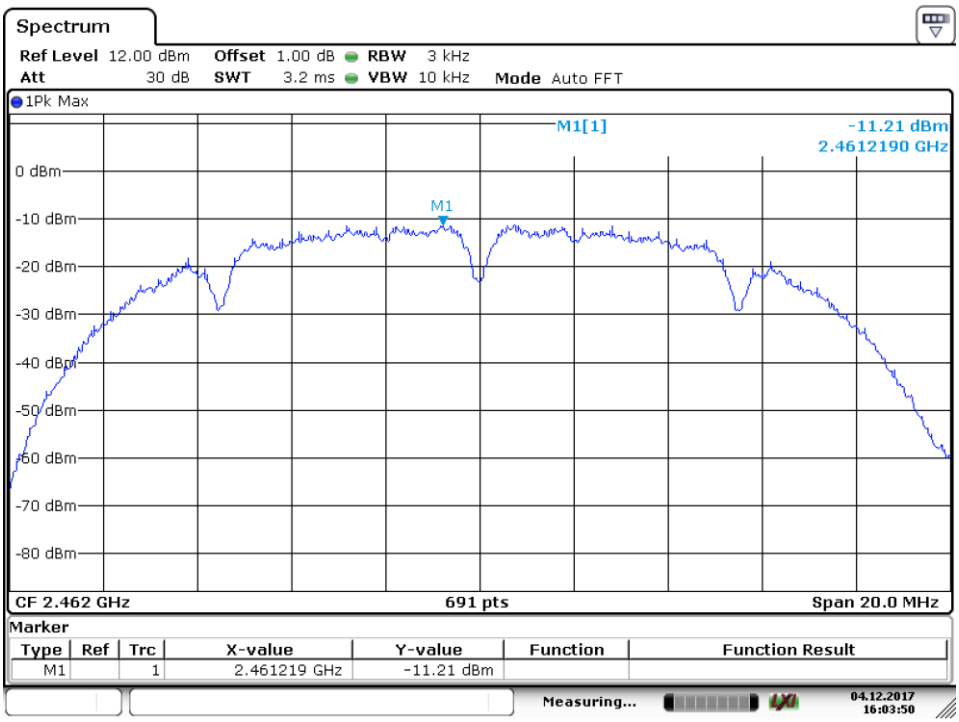
2437MHz



Date: 4.DEC.2017 16:03:50

2462MHz

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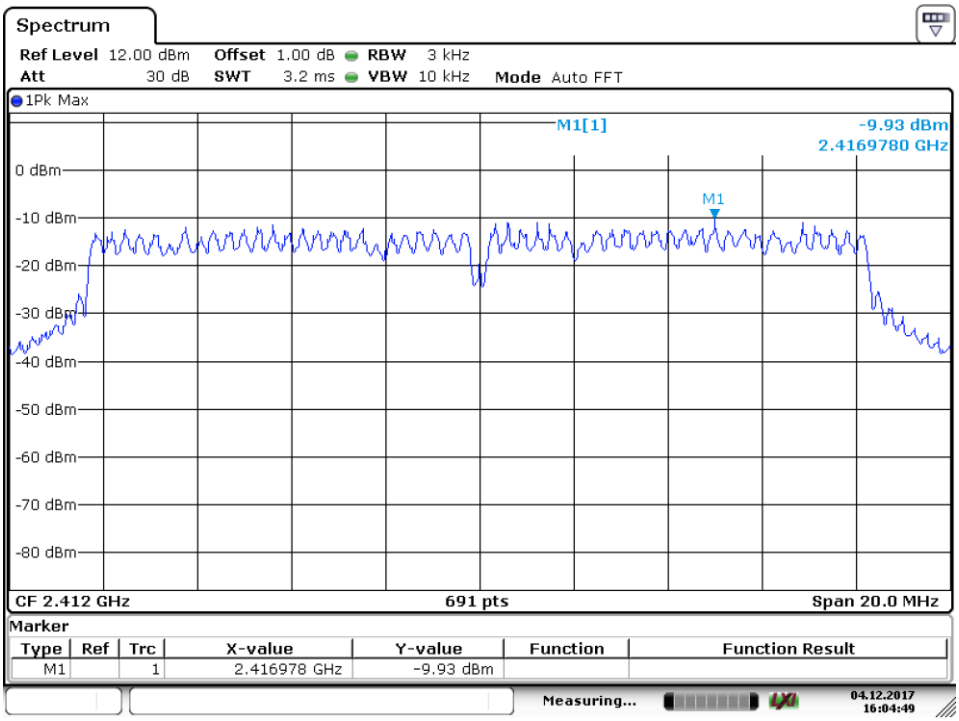
802.11g



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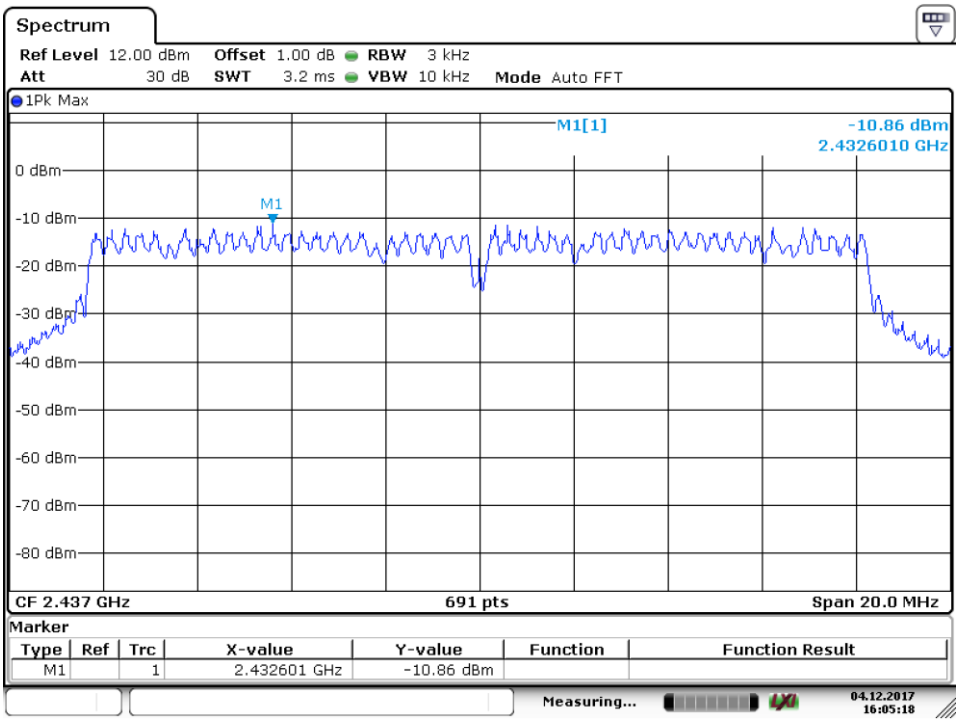
2412MHz



Date: 4.DEC.2017 16:05:18

2437MHz

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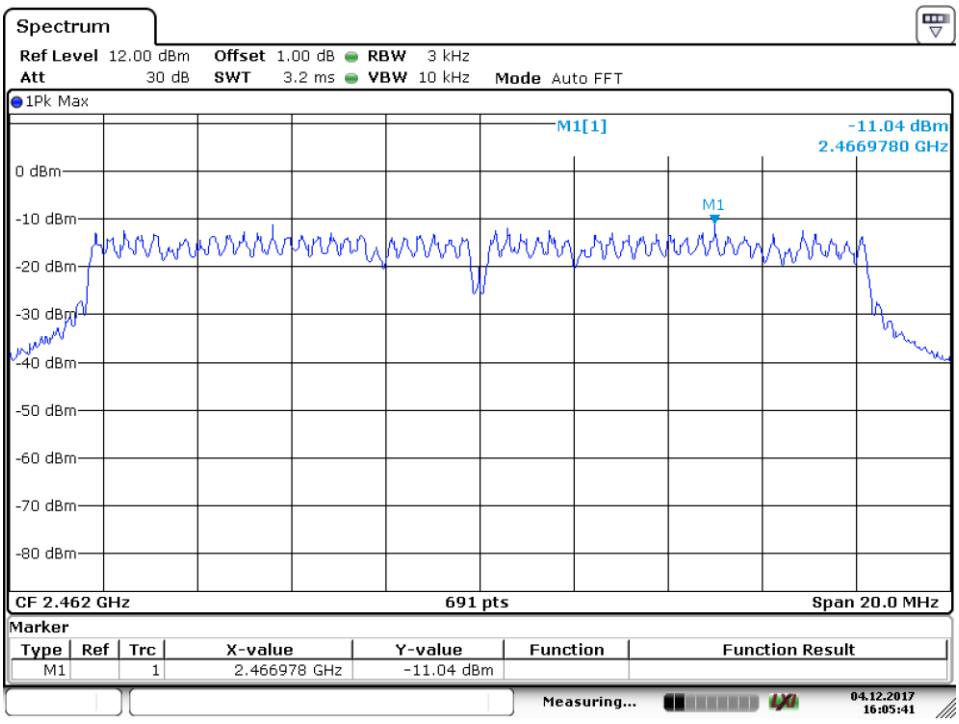

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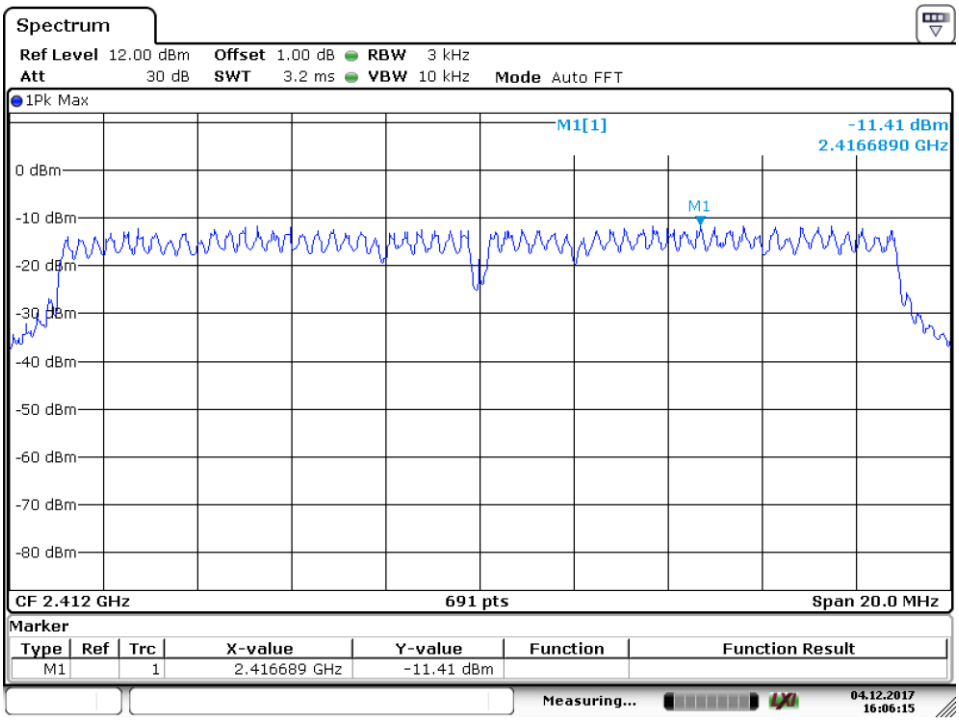
2462MHz

802.11nHT20



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2412MHz

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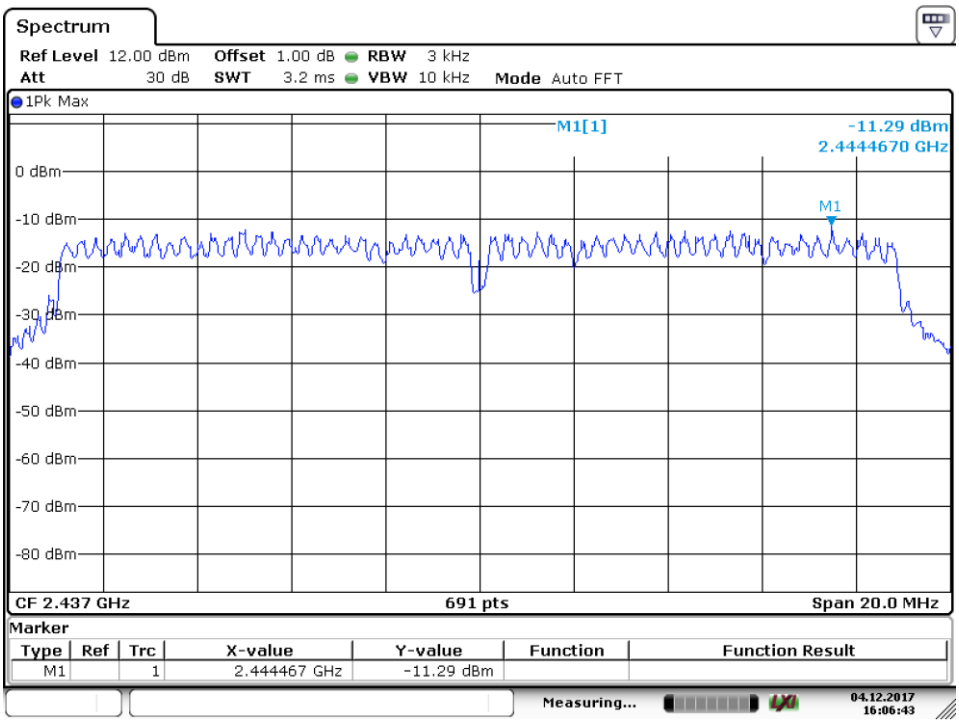

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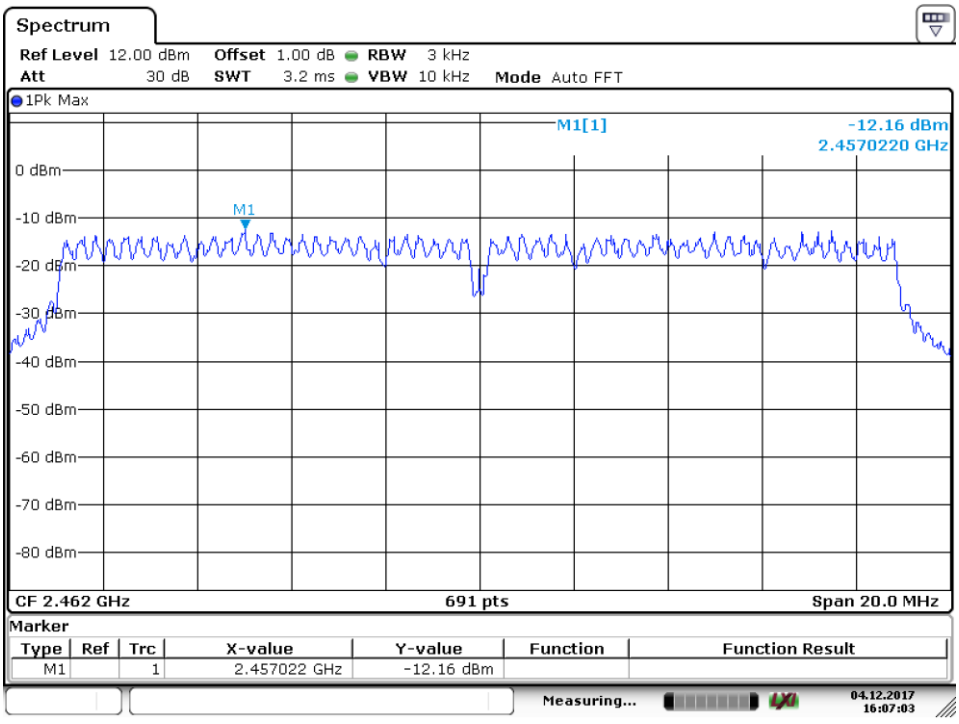
2437MHz



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2462MHz

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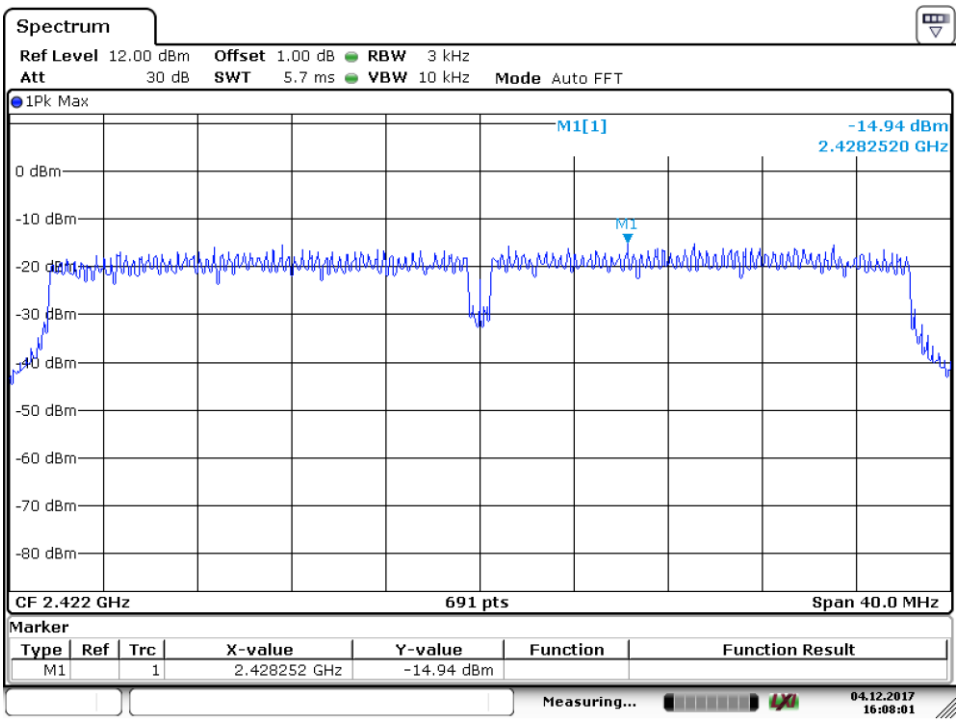
802.11nHT40



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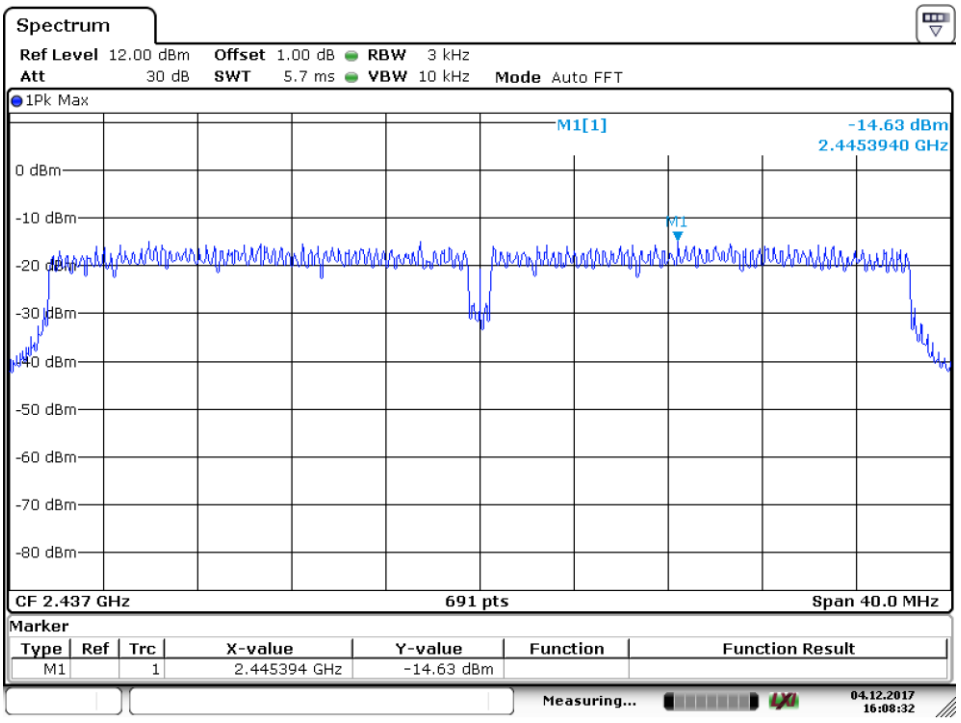
2422MHz



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2437MHz

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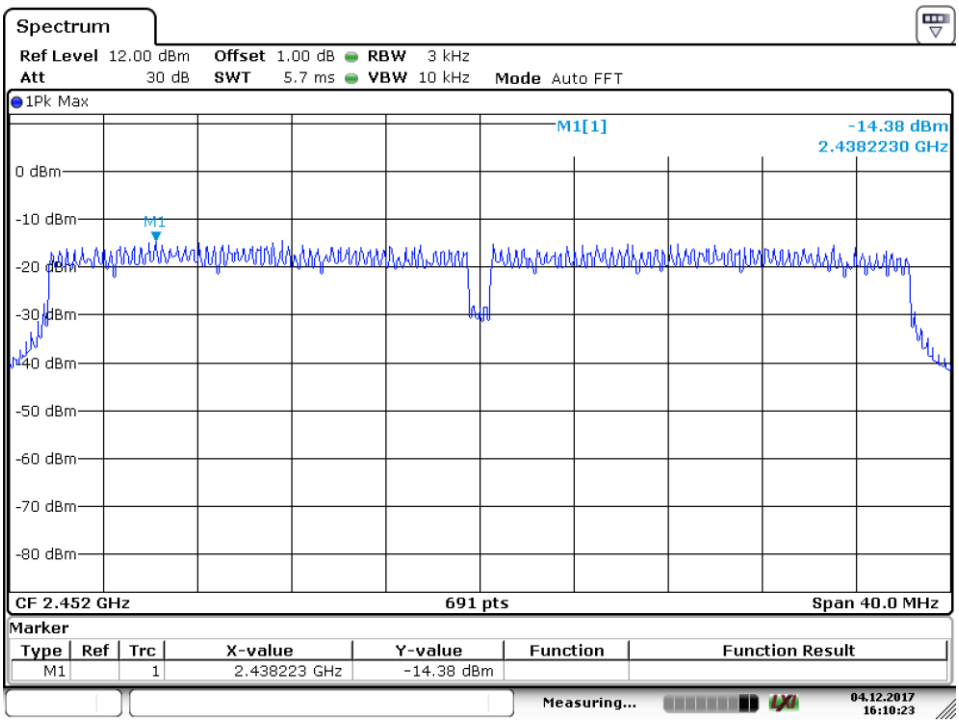

Date: 4.DEC.2017 16:10:23

2452MHz

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9.5 Spurious RF conducted emissions

Test Method

1. Establish a reference level by using the following procedure:
   a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
   b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish the reference level.
   a. Set the center frequency and span to encompass frequency range to be measured.
   b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
3. Repeat above procedures until other frequencies measured were completed.

Limit

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

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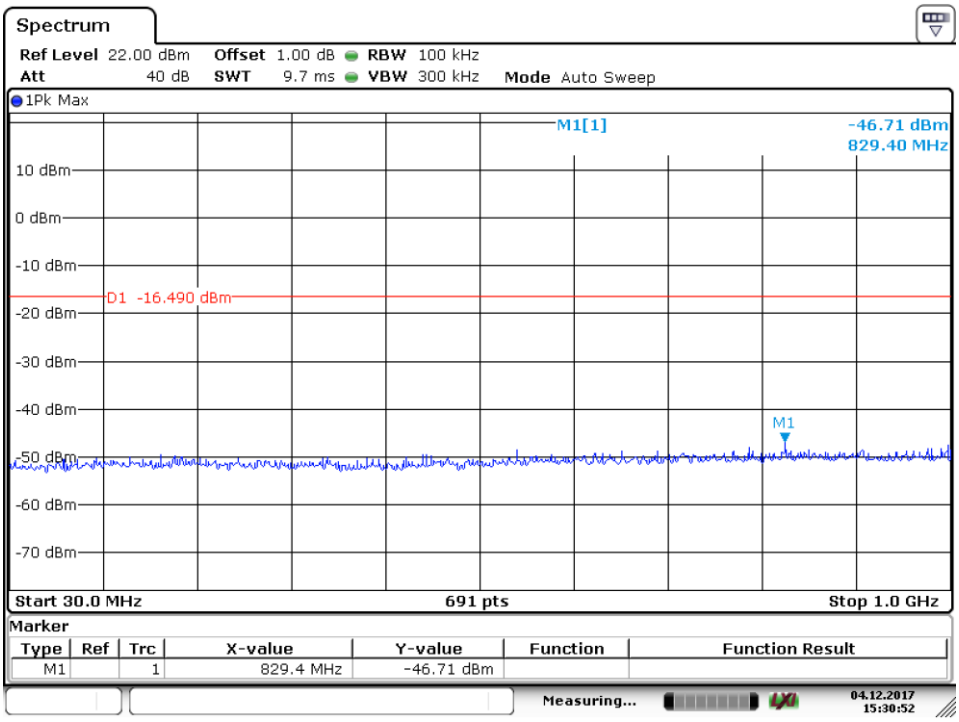
Spurious RF conducted emissions

802.11b



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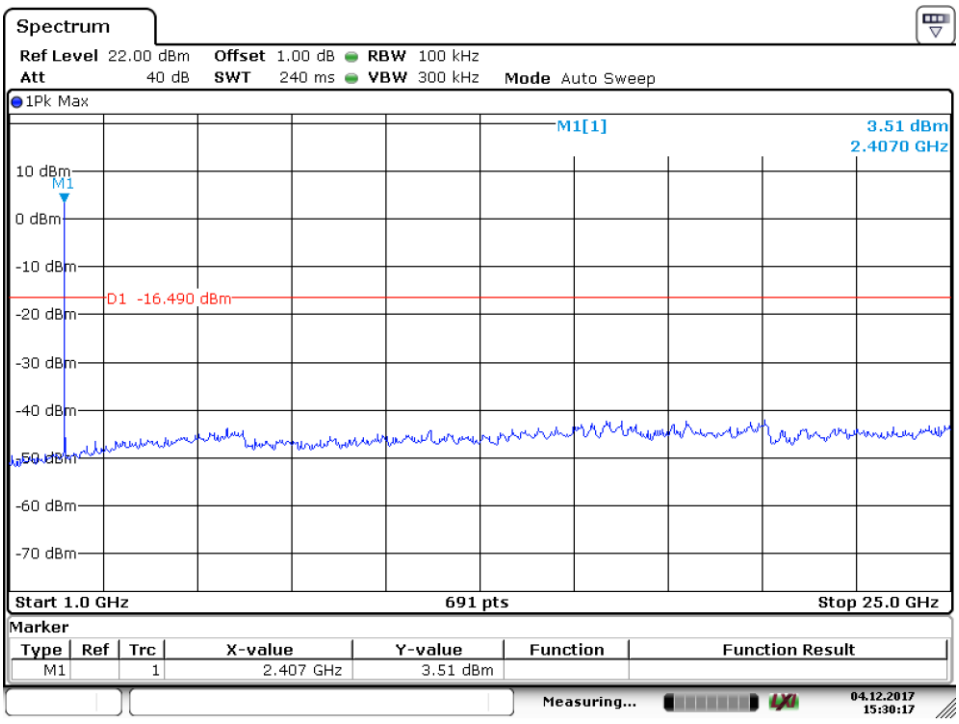

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2412MHz

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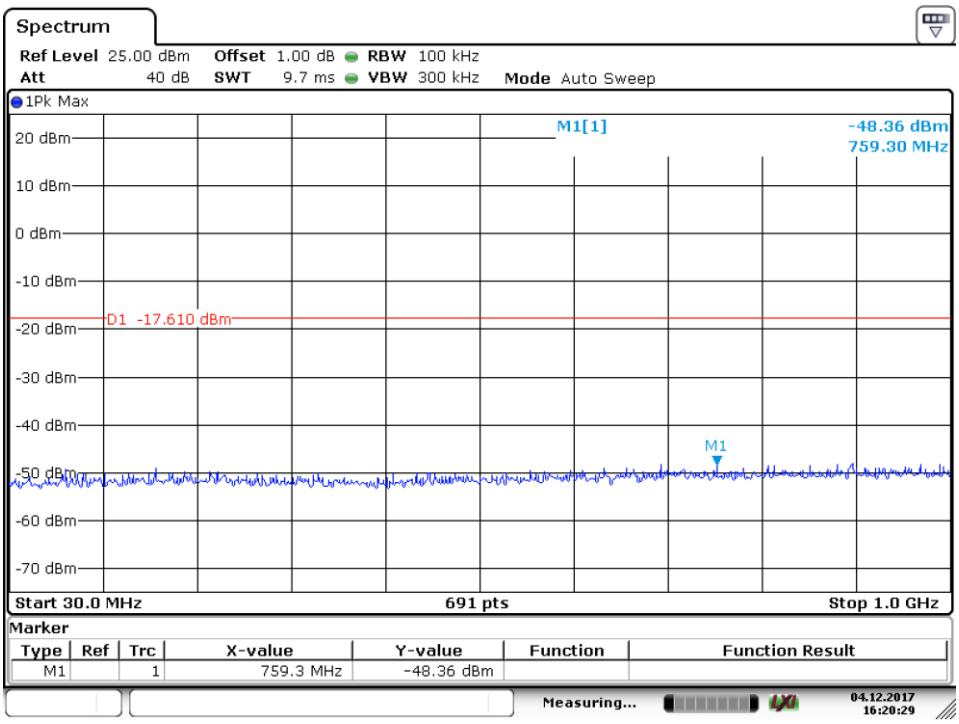

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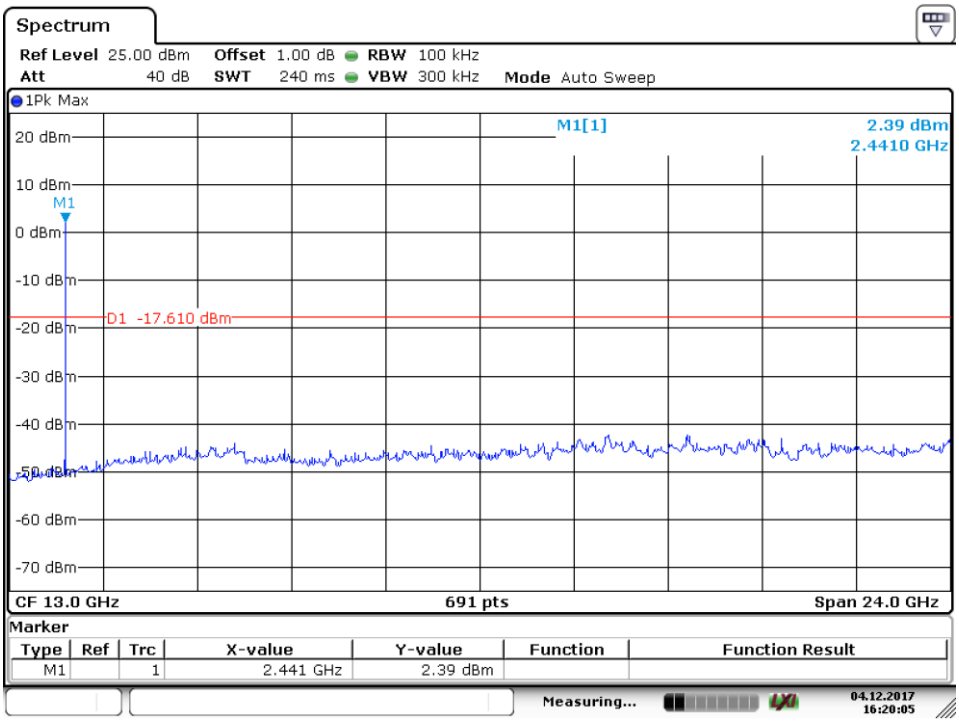

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2437MHz

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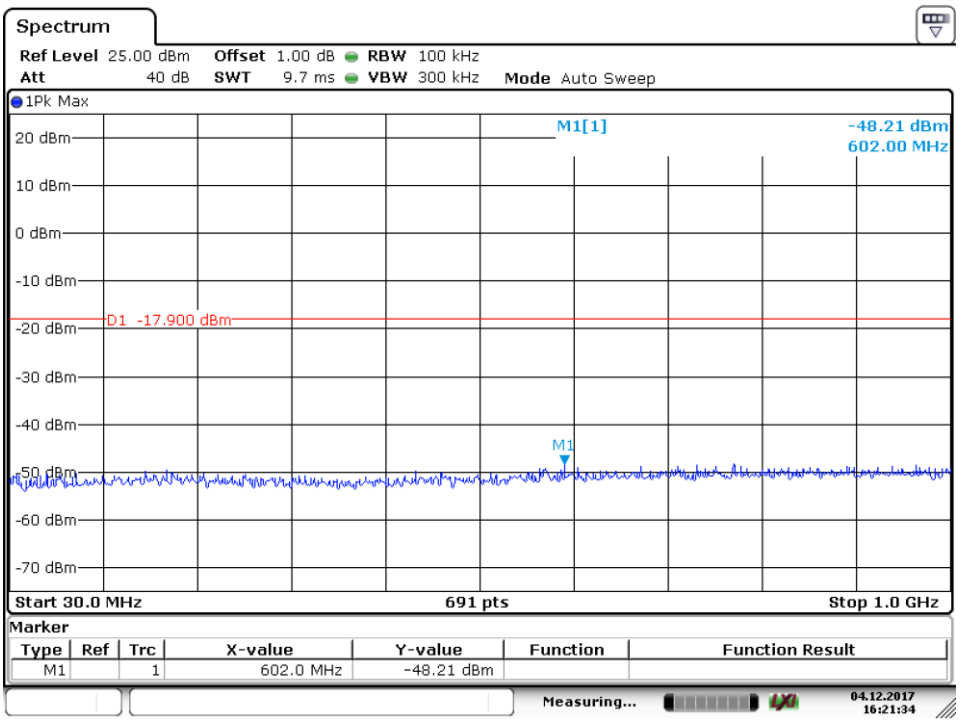
Spurious RF conducted emissions



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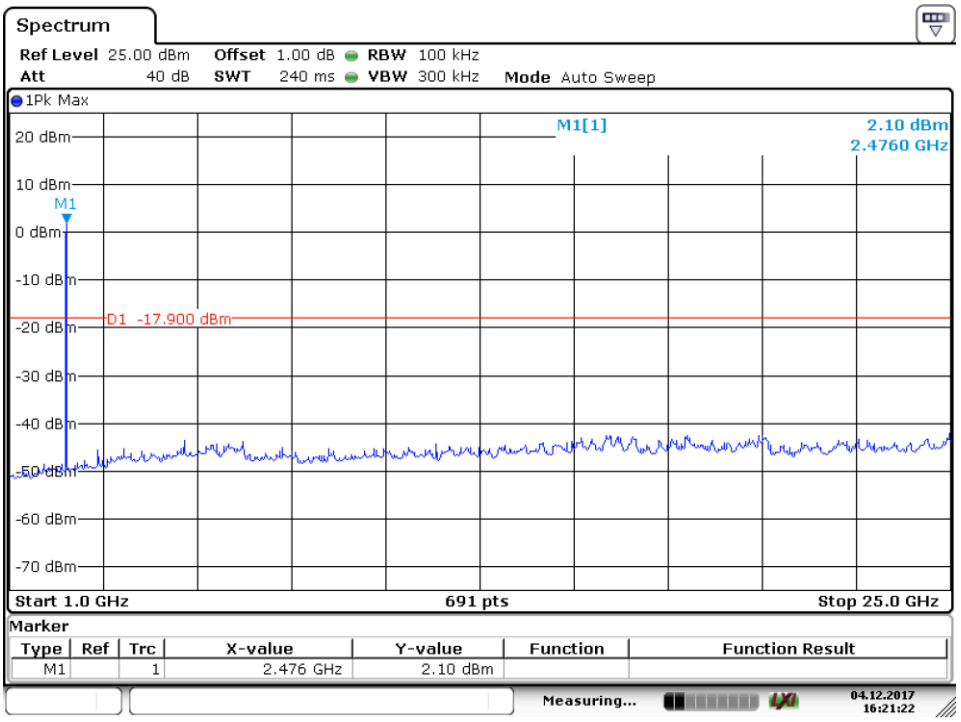

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2462MHz

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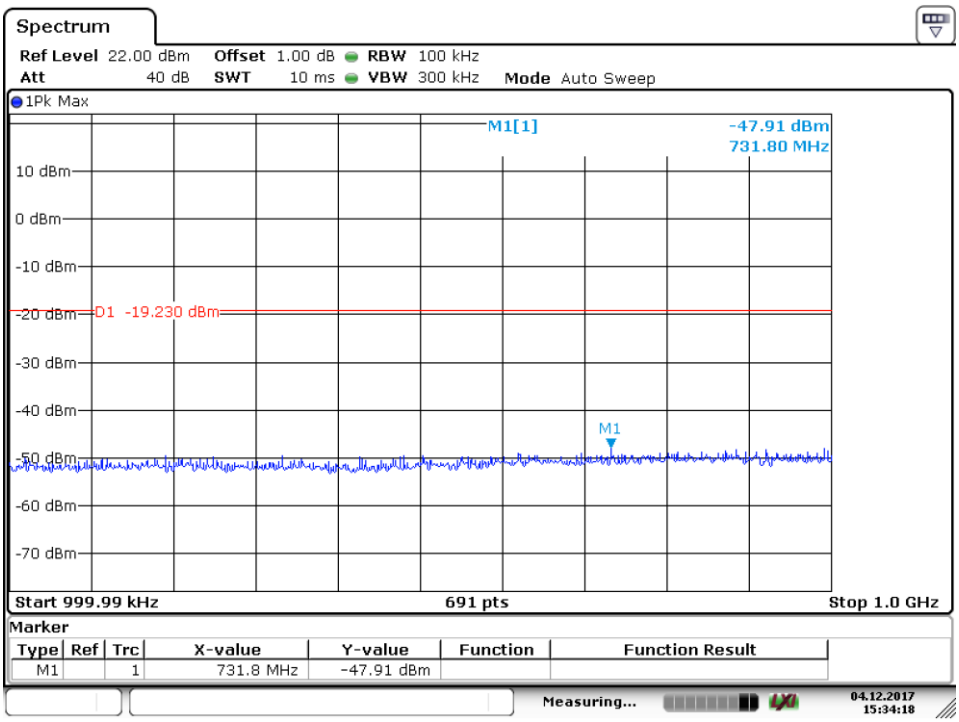
802.11g



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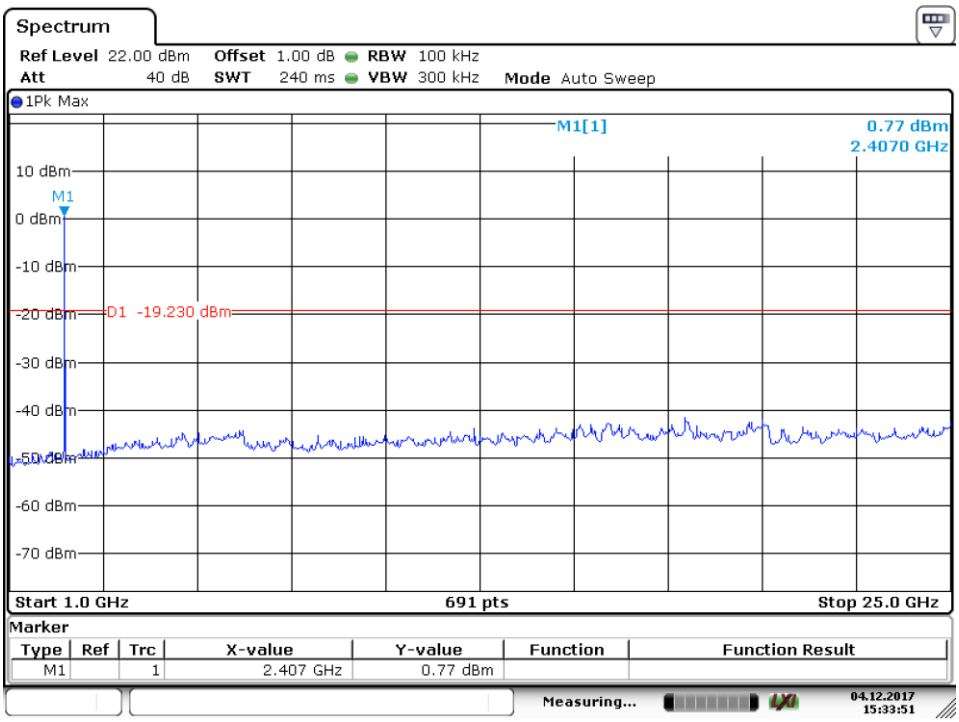

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2412MHz

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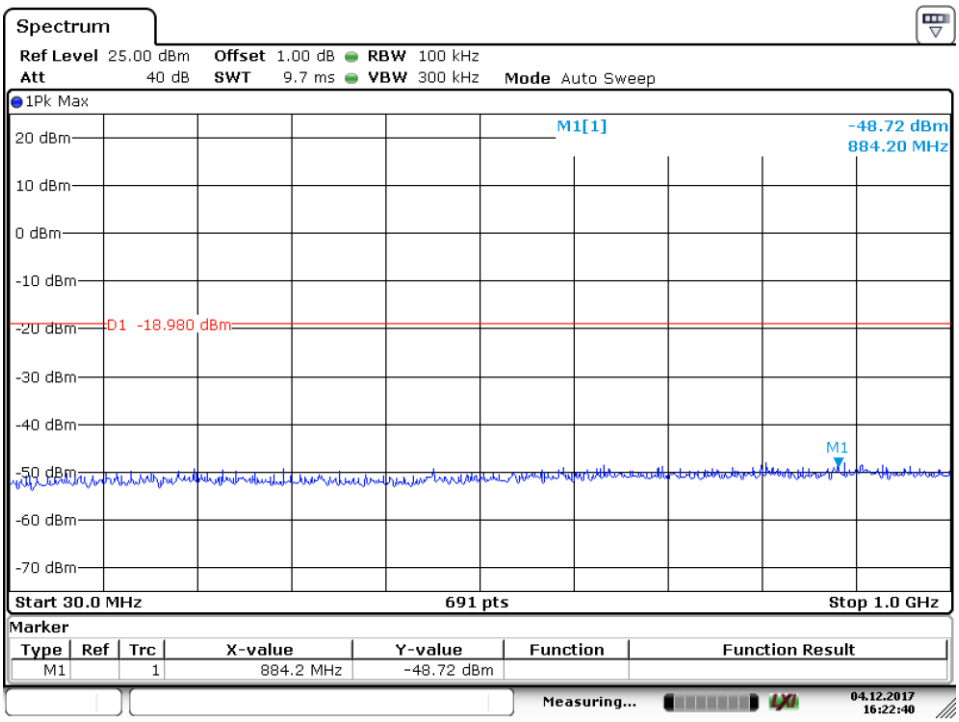
Spurious RF conducted emissions



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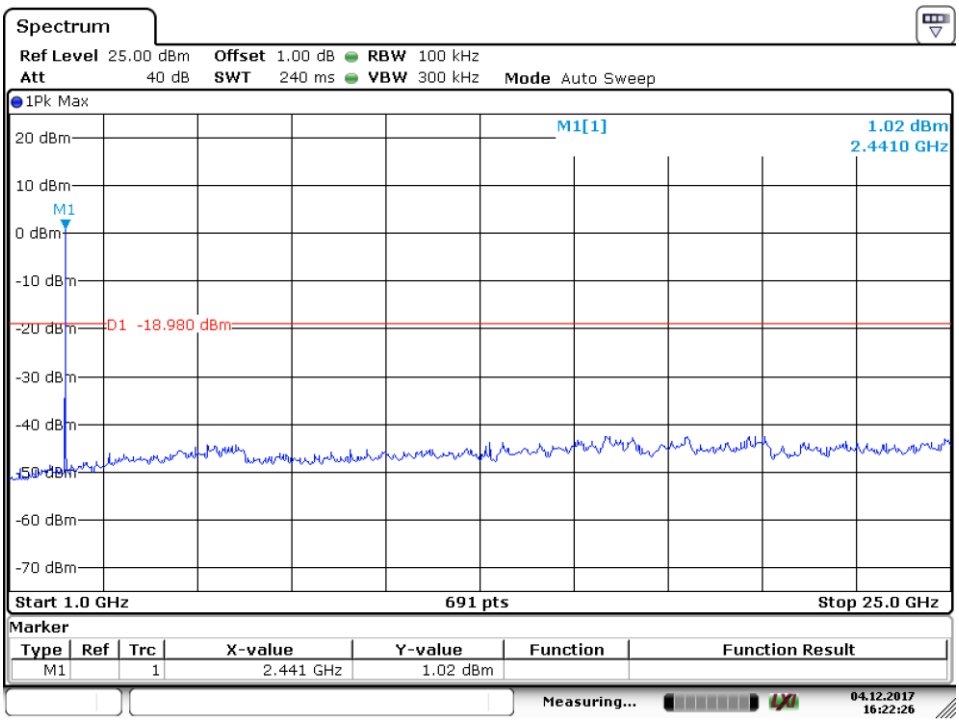

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2437MHz

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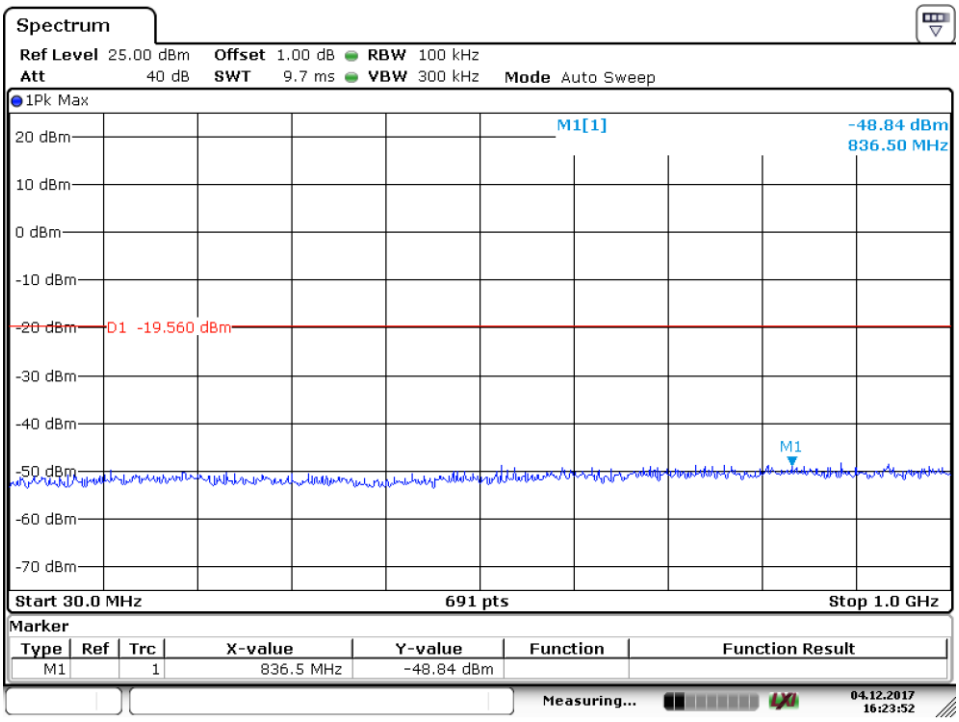

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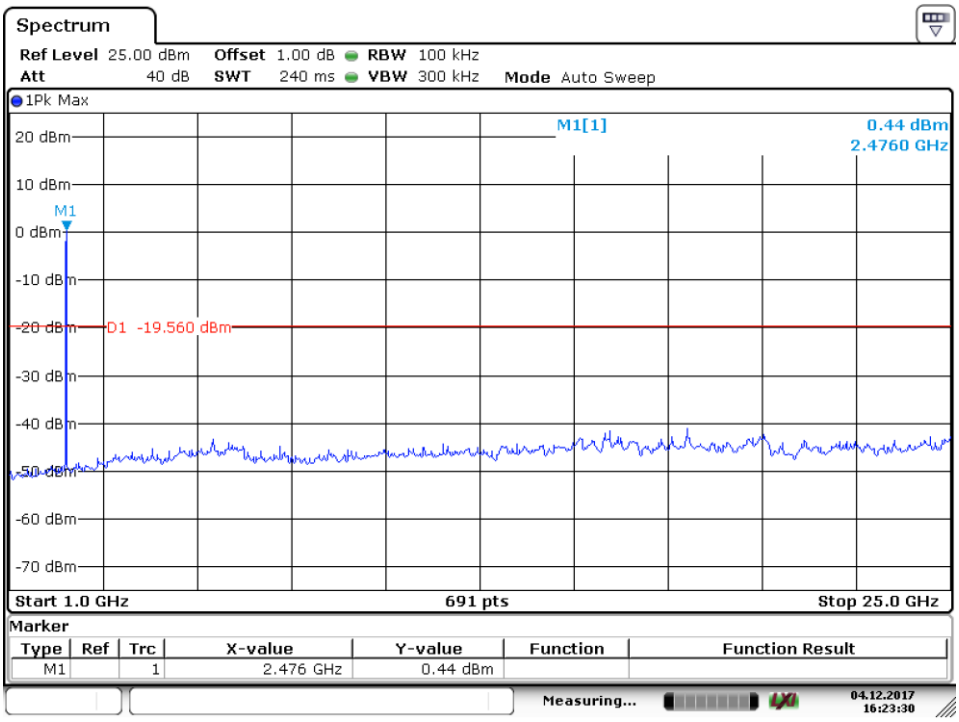

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2462MHz

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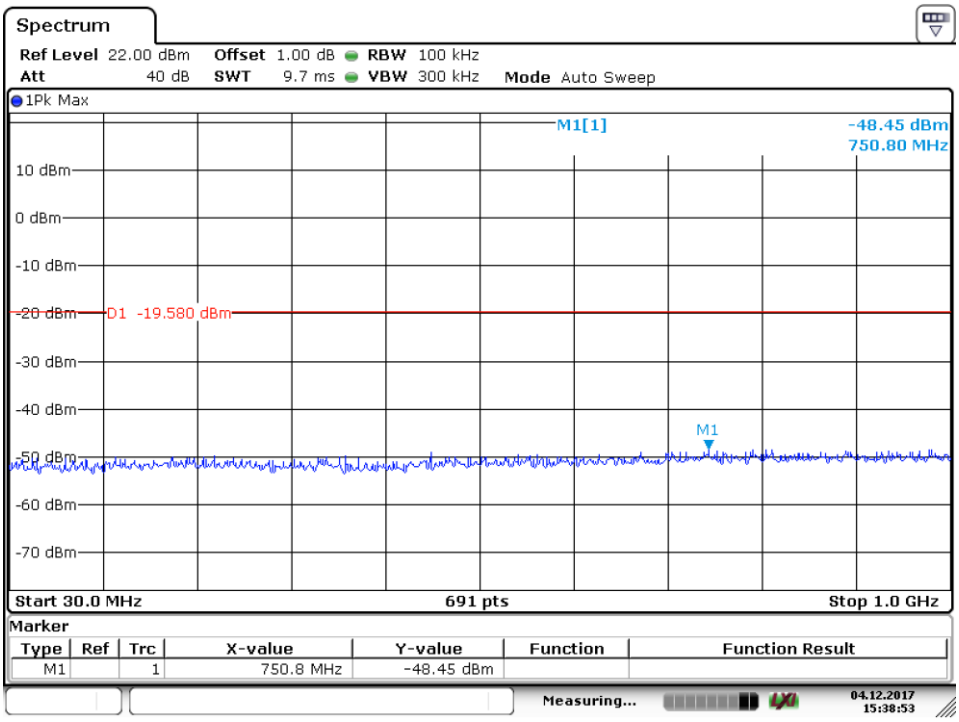
Spurious RF conducted emissions

802.11nHT20



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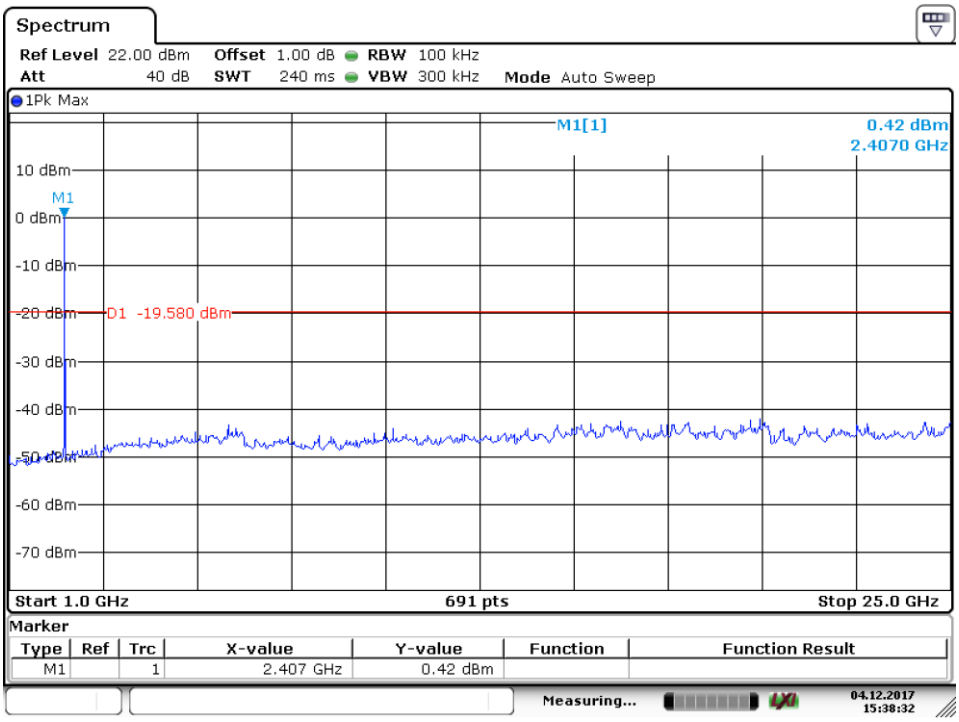

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2412MHz

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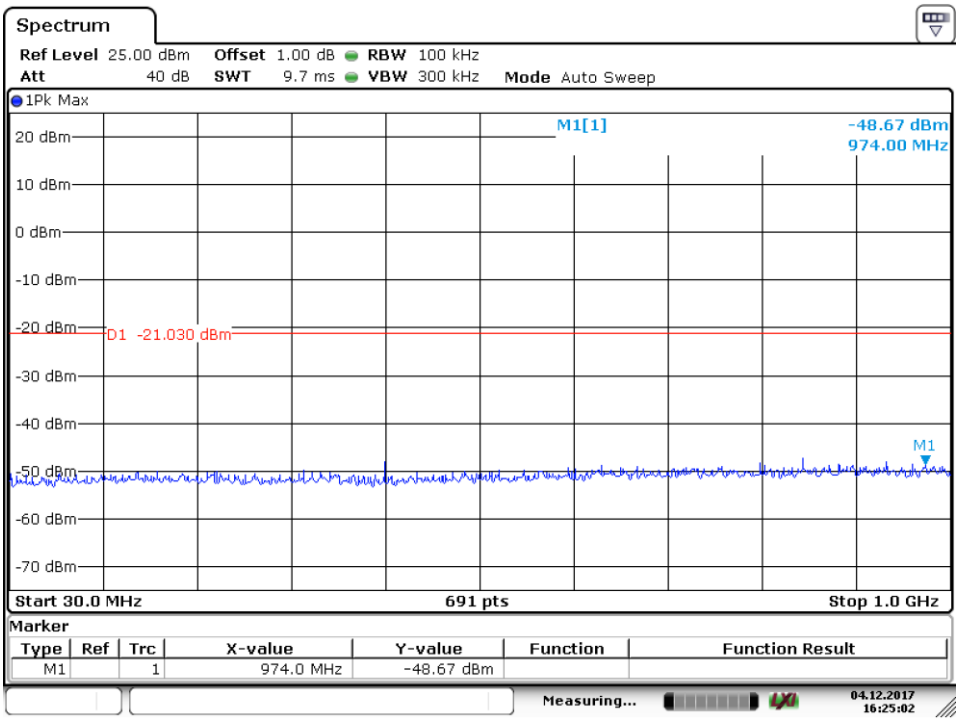

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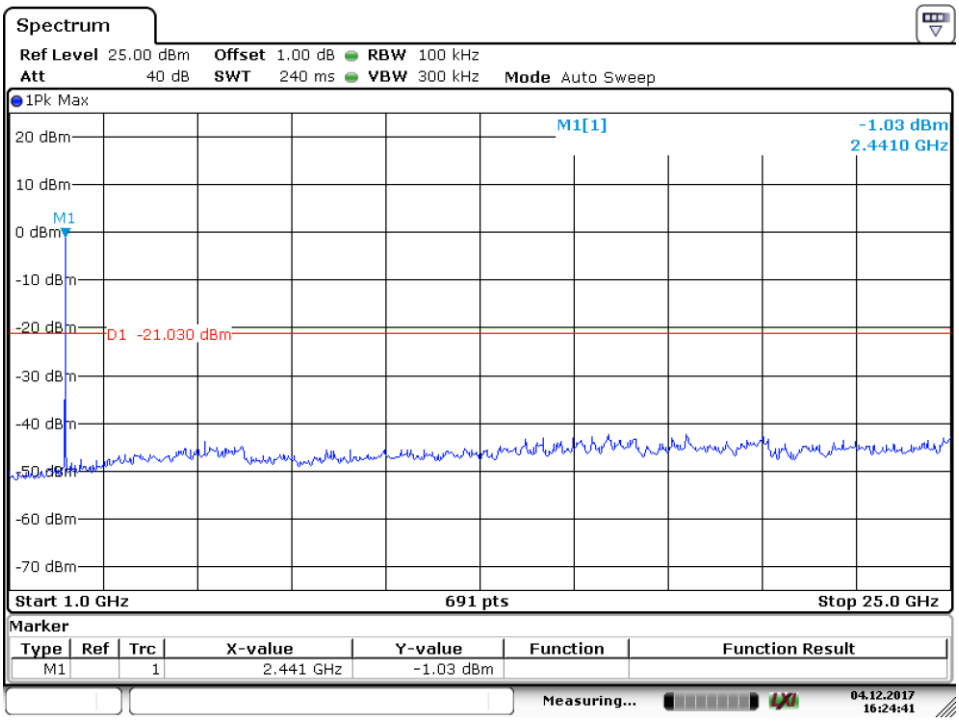

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2437MHz

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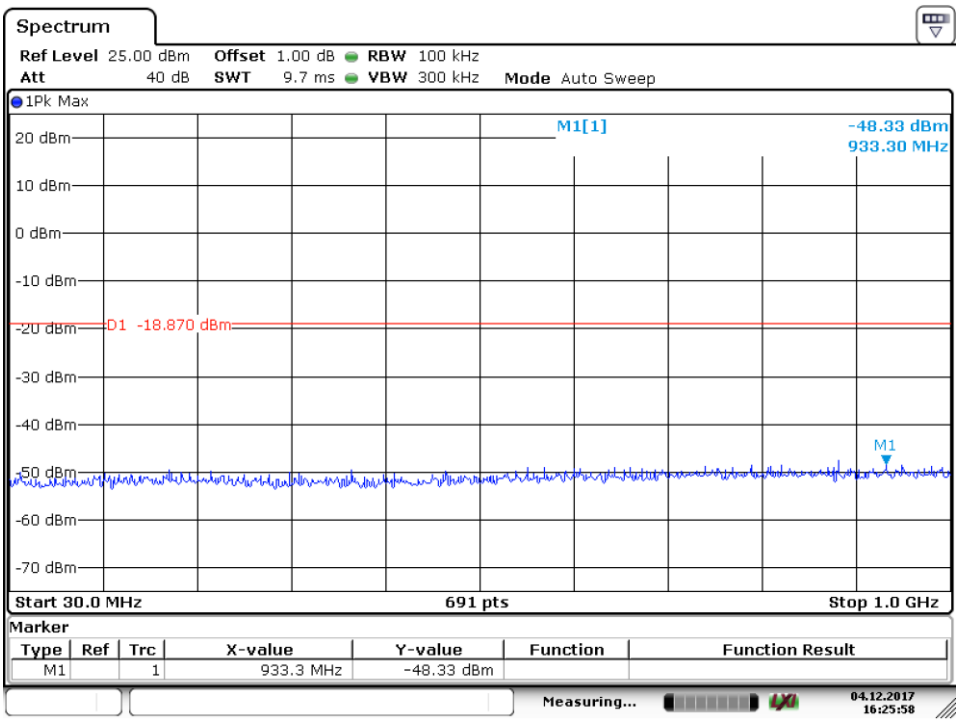
Spurious RF conducted emissions



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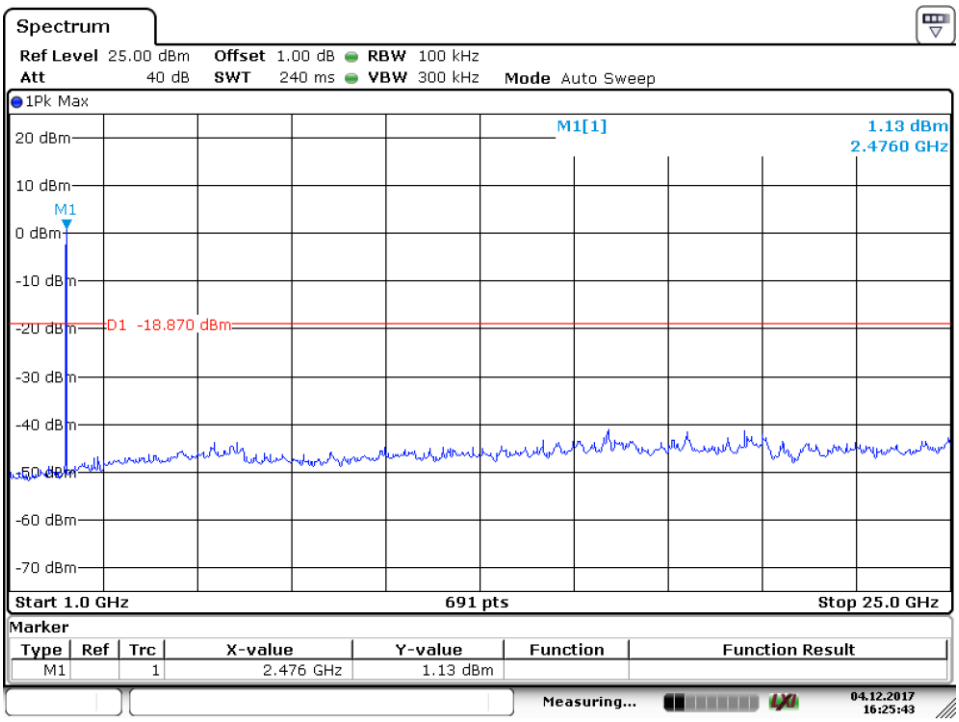

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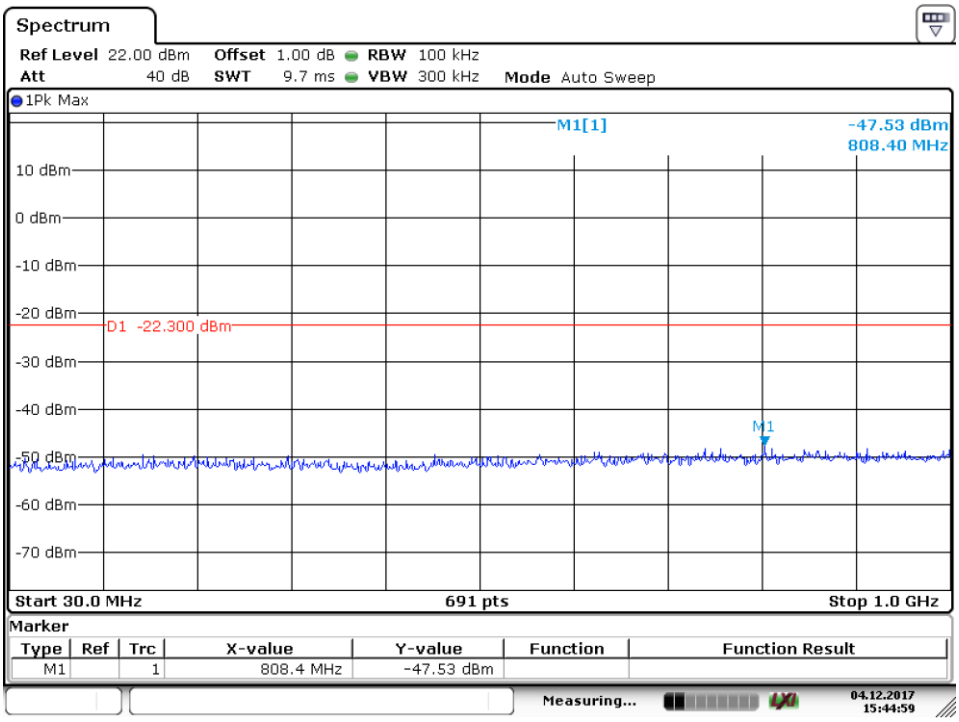
Spurious RF conducted emissions

802.11nHT40



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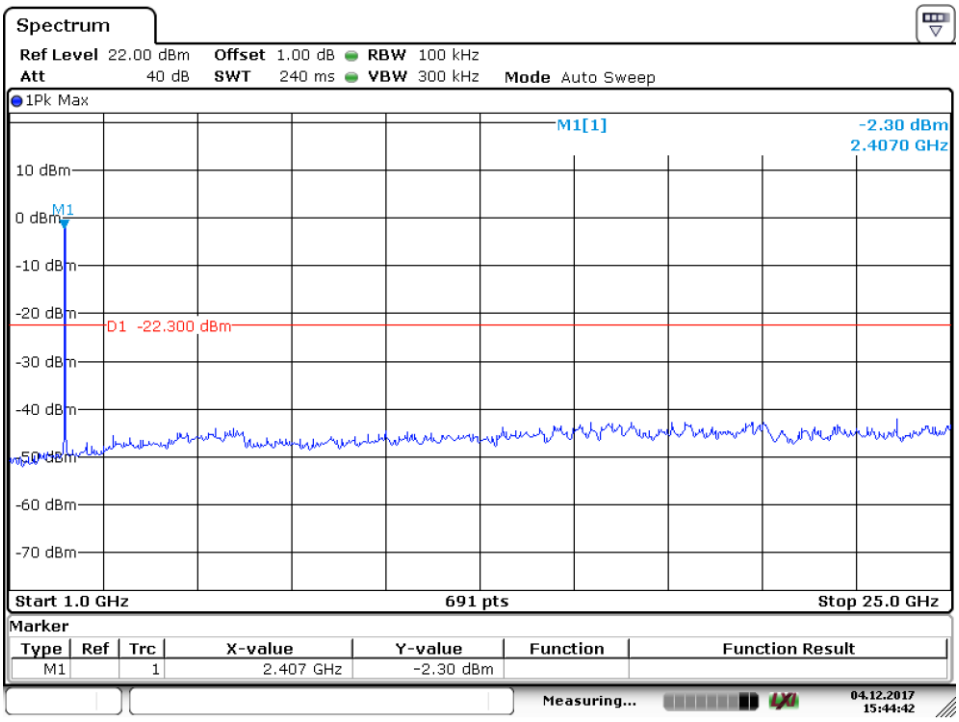

Date: 4.DEC.2017 15:44:43

2422MHz

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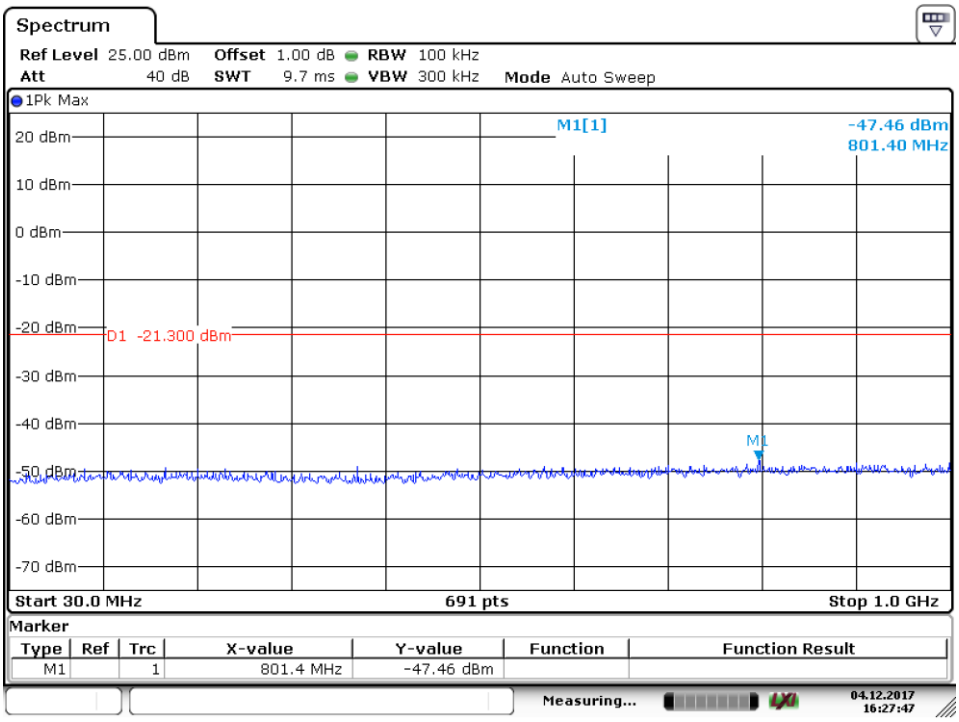

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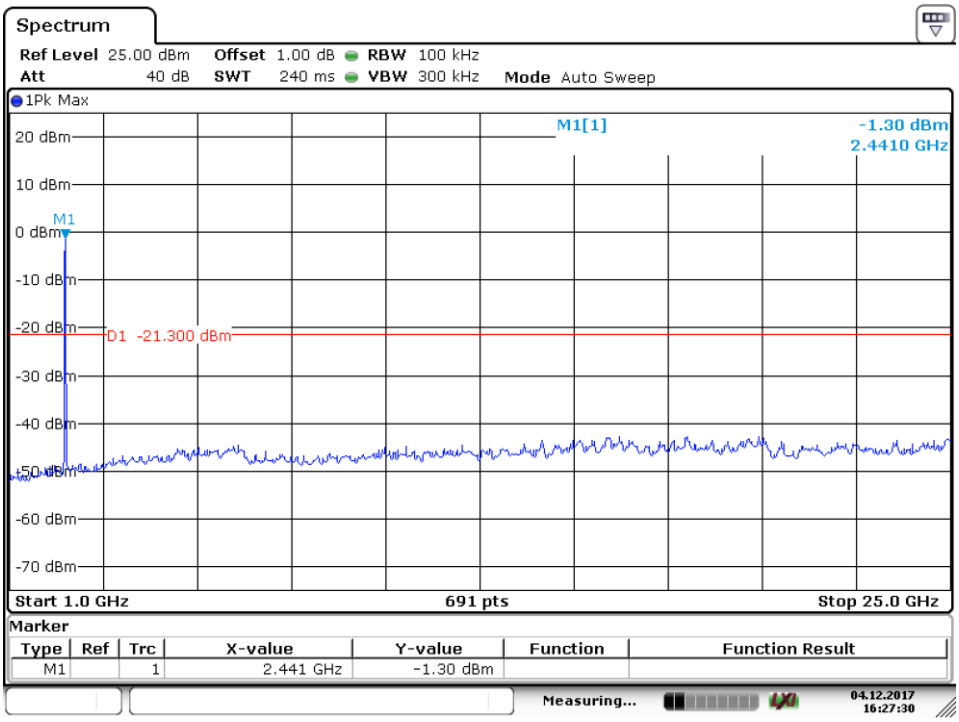

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2437MHz

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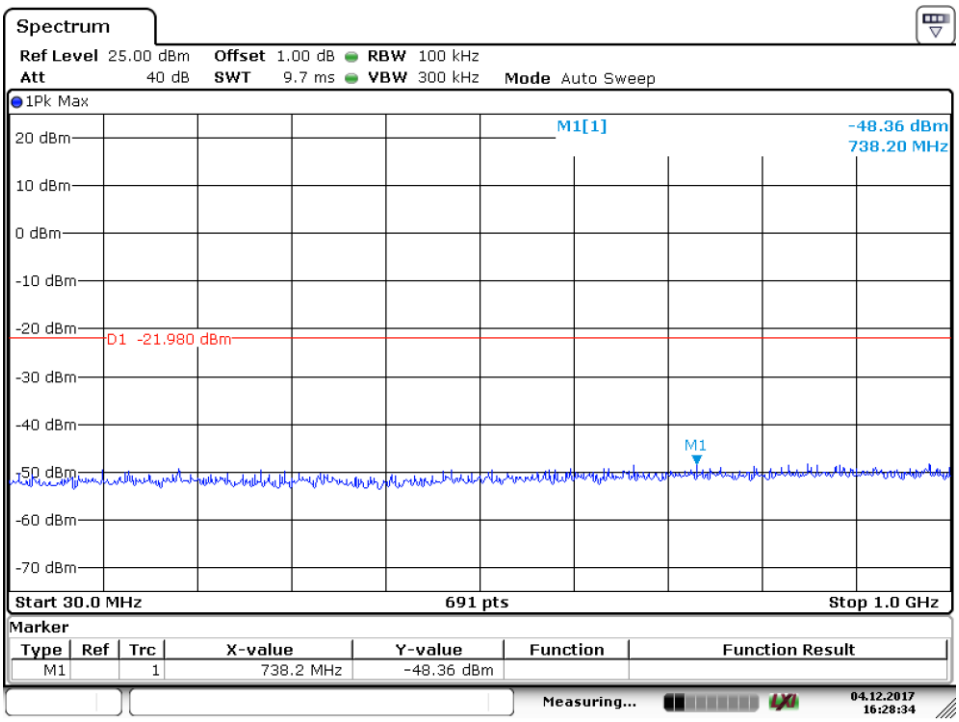
Spurious RF conducted emissions



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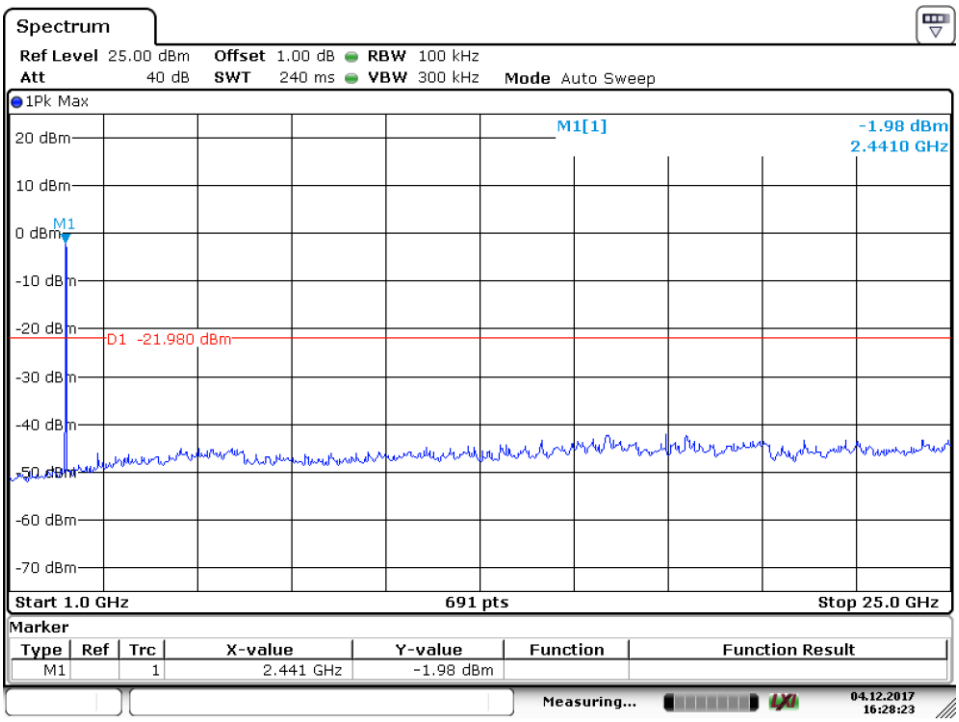

Date: 4.DEC.2017 16:28:23

2452MHz

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9.6 Band edge

Test Method

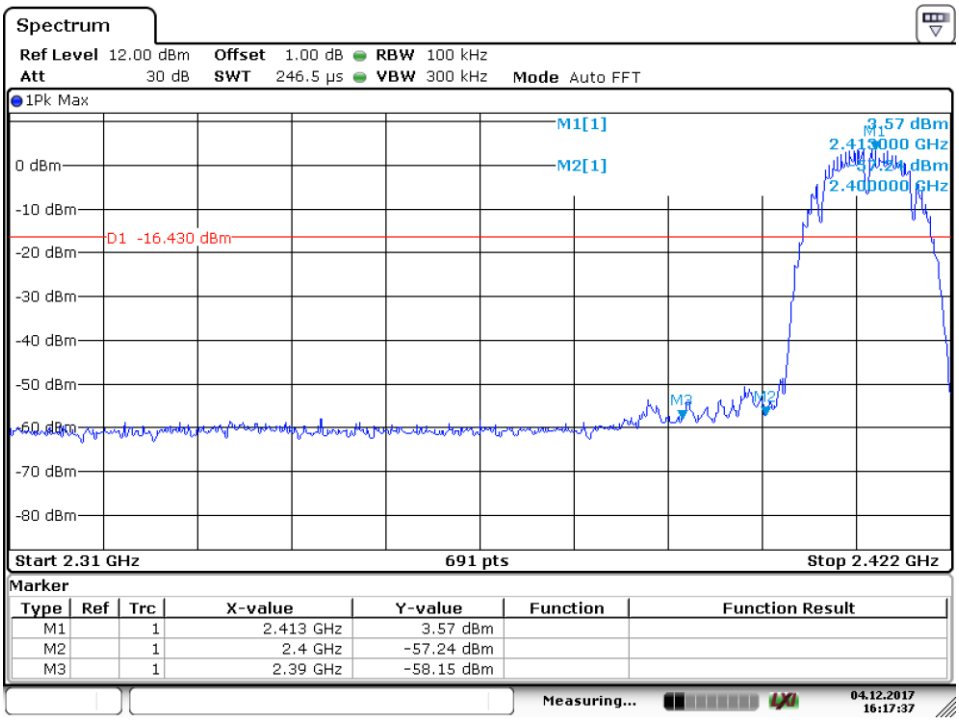
1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold.
2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
3 The level displayed must comply with the limit specified in this Section.

Limit

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

Test result

802.11b



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2412MHz

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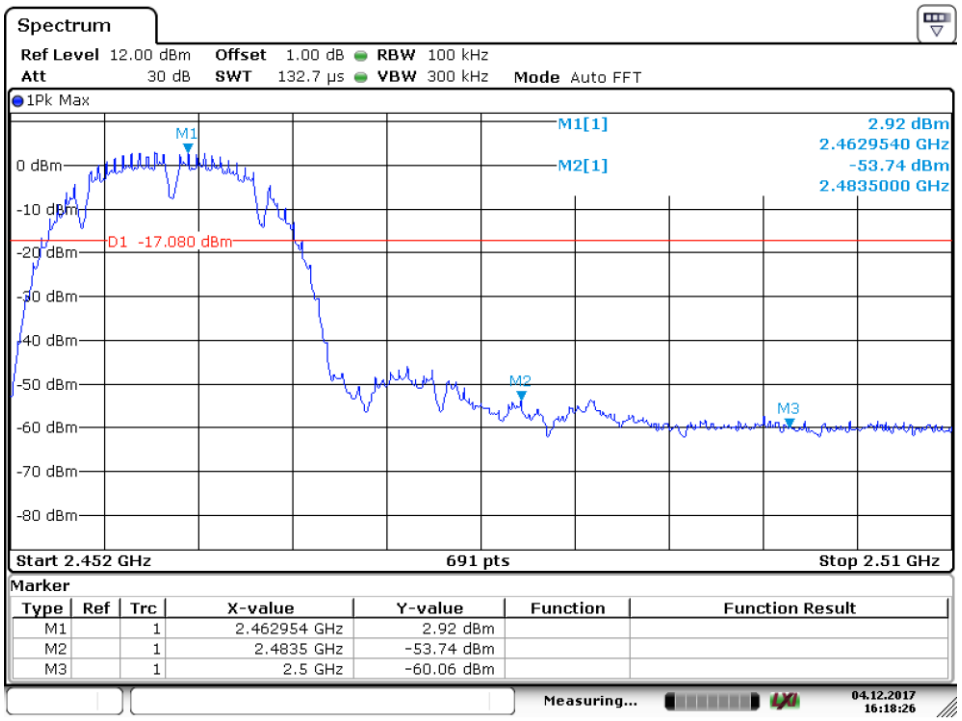
Band edge



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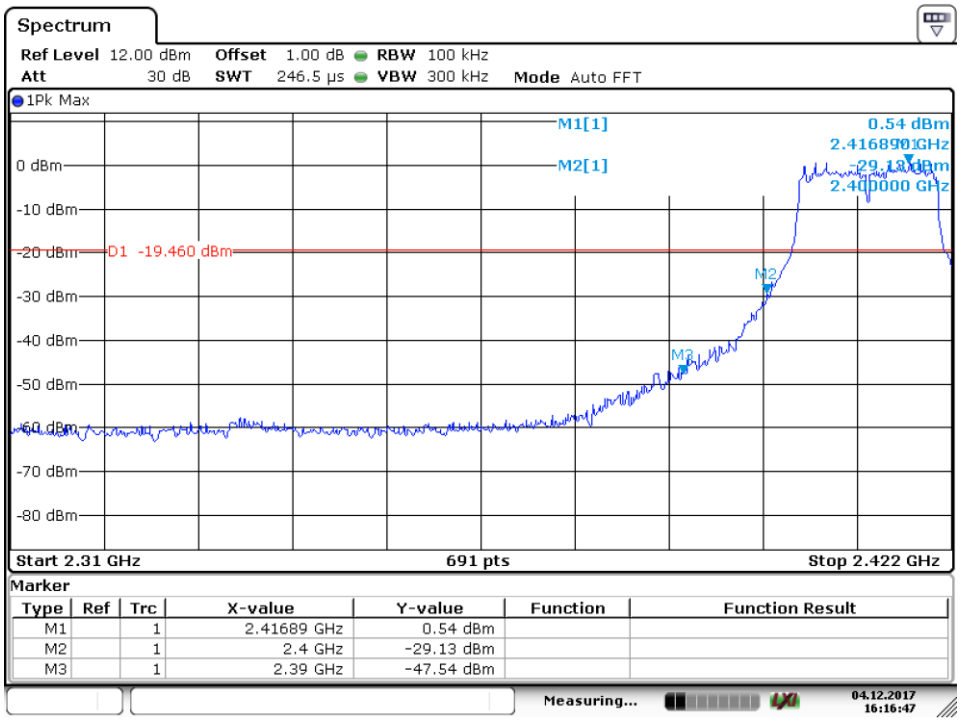
2462MHz

802.11g



Date: 4.DEC.2017 16:16:47

2412MHz

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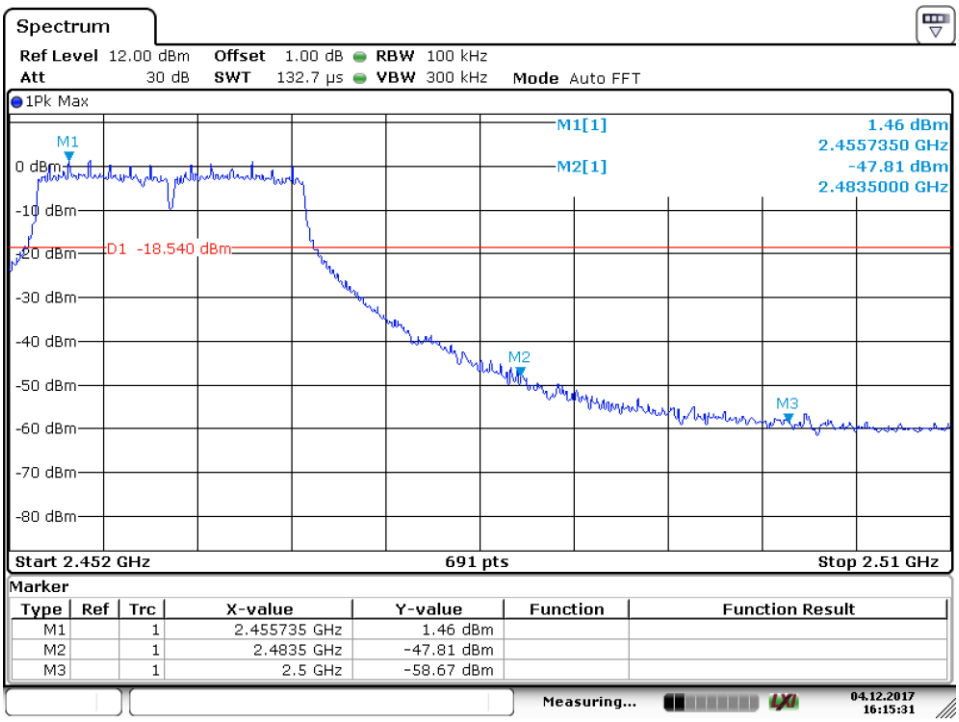
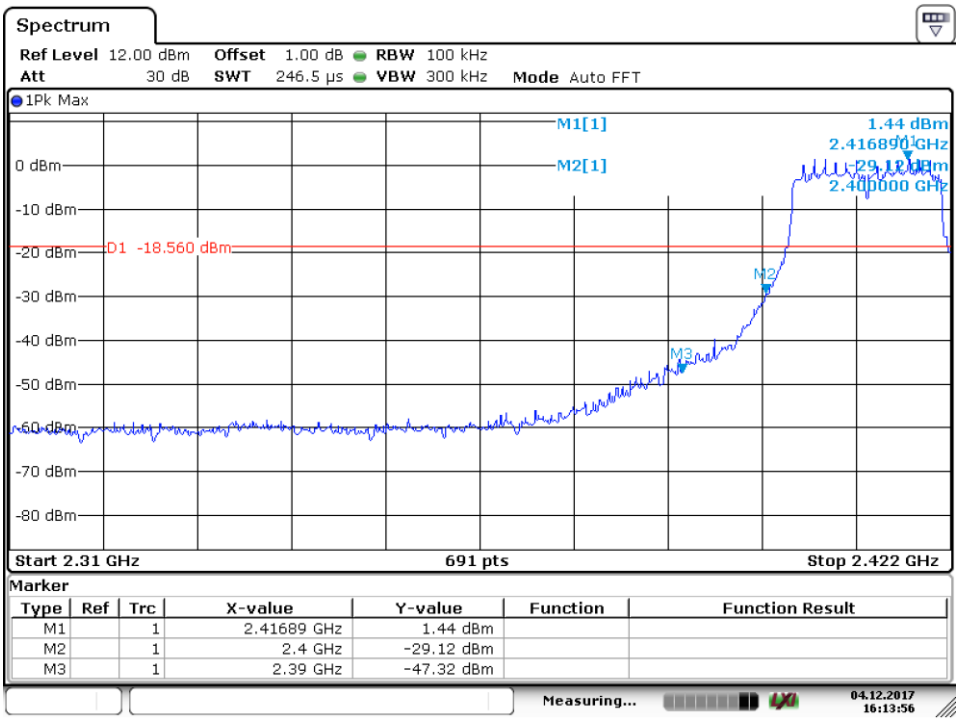
Band edge



Date: 4.DEC.2017 16:15:31

2462MHz

802.11nHT20



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2412MHz

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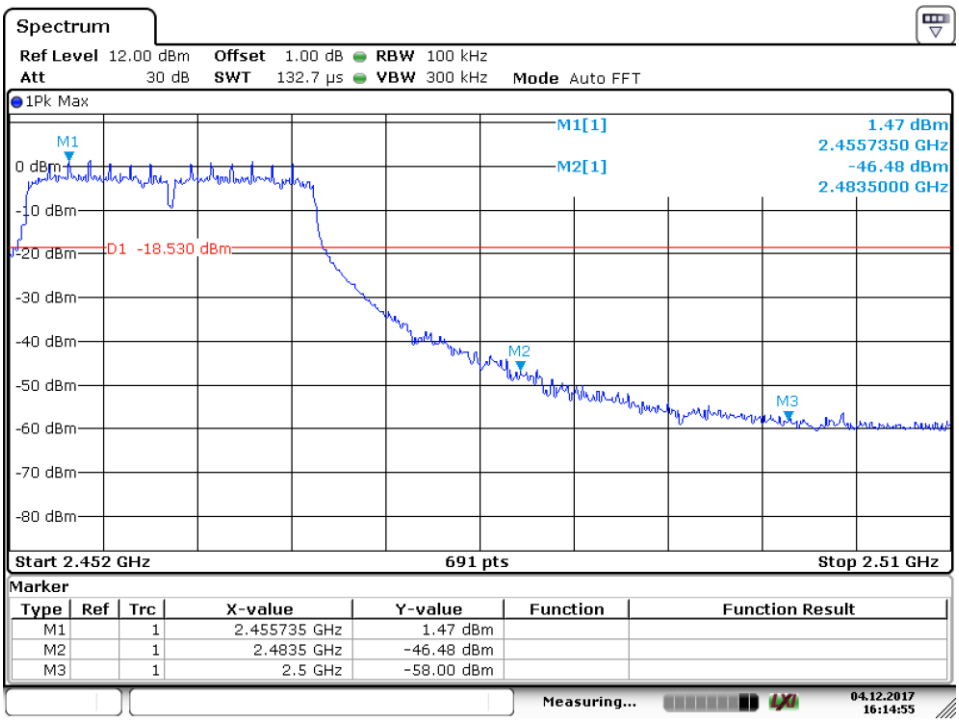
Band edge



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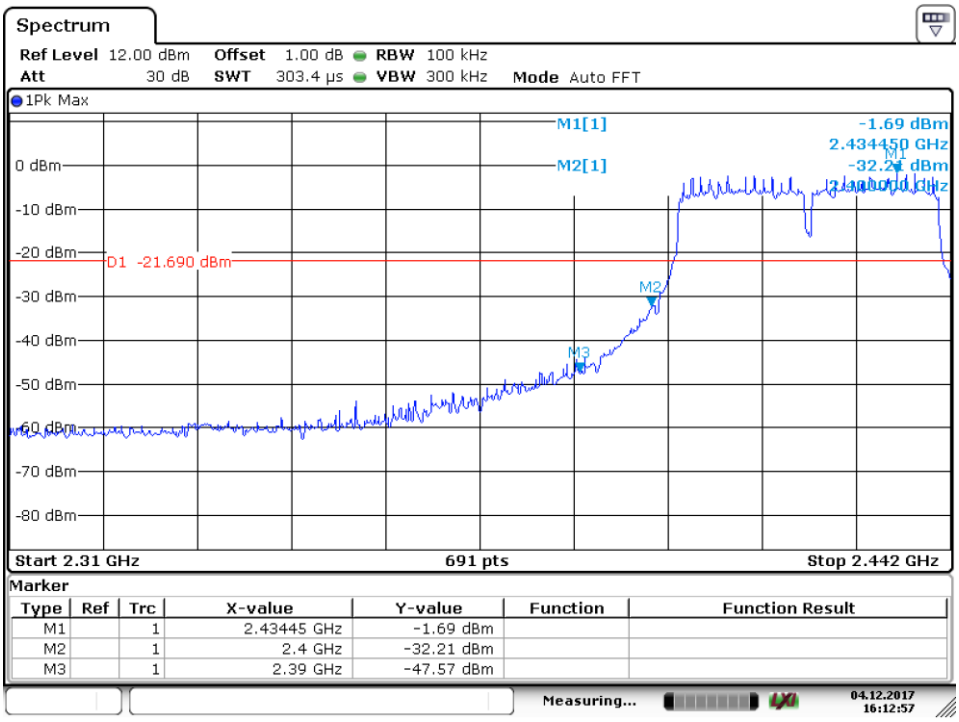
2462MHz

802.11nHT40



Date: 4.DEC.2017 16:12:57

2422MHz

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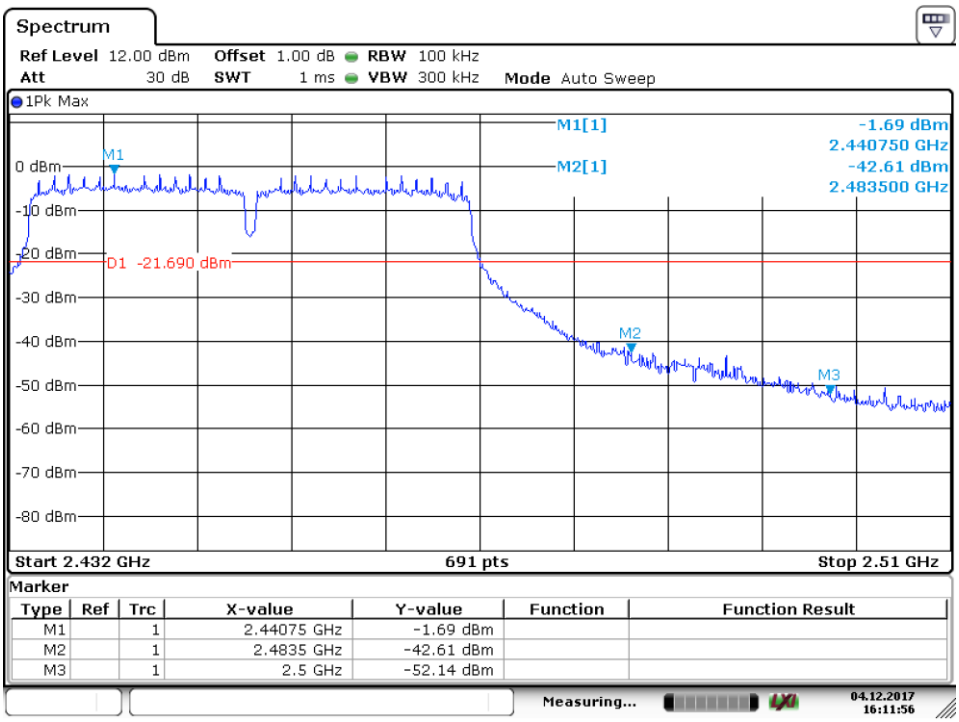
Band edge



Date: 4.DEC.2017 16:11:56

2452MHz

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9.7 Spurious radiated emissions for transmitter

Test Method

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3meter 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 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 and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

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, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.

2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.

3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).

4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

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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 section15.205, 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

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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.

Transmitting spurious emission test result as below:

802.11b
2412MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
168.00	30.65	Horizontal	43.50	QP	Pass	-31.2
944.92	36.58	Vertical	46.00	QP	Pass	-14.4

2412MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
1592.68 *	38.57	Horizontal	74.00	PK	Pass	-9.7
1599.81*	32.36	Vertical	74.00	PK	Pass	-9.4

Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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2437MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2437MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
14998.59	25.8	Horizontal	74.00	PK	Pass	18.7
1595.05*	41.17	Vertical	74.00	PK	Pass	-9.5

Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

2462MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2462MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
1599.06*	35.81	Horizontal	74.00	PK	Pass	-9.7
1592.18*	34.33	Vertical	74.00	PK	Pass	-9.6

Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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802.11g

2412MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
		Horizontal		QP	Pass
		Vertical		QP	Pass

2412MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
2244.37 *	30.57	Horizontal	74.00	PK	Pass	-6.4
2248.31*	30.34	Vertical	74.00	PK	Pass	-6.4

Remark:

(1) Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

2437MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2437MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
1599.87 *	33.41	Horizontal	74.00	PK	Pass	-9.6
1593.18*	32.02	Vertical	74.00	PK	Pass	-9.5

Remark:

(1) Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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2462MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2462MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
16558.59	48.43	Horizontal	74.00	PK	Pass	19.6
15810.93*	48.70	Vertical	74.00	PK	Pass	19.5

Remark:

(1) Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

802.11nHT20

2412MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2412MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
16301.25*	48.55	Horizontal	74.00	PK	Pass	19.9
11728.59*	43.29	Vertical	74.00	PK	Pass	17.7

Remark:

(1) Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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2437MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2437MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
1593.50*	36.51	Horizontal	74.00	PK	Pass	-9.7
16454.06*	48.72	Vertical	74.00	PK	Pass	19.8

Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

2462MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2462MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
1593.93*	34.25	Horizontal	74.00	PK	Pass	-9.5
14968.12*	47.55	Vertical	74.00	PK	Pass	18.6

Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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802.11nHT40
2422MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2422MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
1592.62 *	33.56	Horizontal	74.00	PK	Pass	-9.7
4997.18*	48.83	Vertical	74.00	PK	Pass	18.7

Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
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(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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2437MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2437MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
1599.68*	33.19	Horizontal	74.00	PK	Pass	-9.6
16317.18*	48.86	Vertical	74.00	PK	Pass	19.7

Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

2452MHz (30MHz – 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dBuV/m		dBµV/m		
--	--	Horizontal	--	QP	Pass
--	--	Vertical	--	QP	Pass

2452MHz (Above 1GHz)

Frequency	Emission Level	Polarization	Limit	Detector	Result	Corr. (dB)
MHz	dBuV/m		dBµV/m			
1599.06*	36.94	Horizontal	74.00	PK	Pass	-9.7
15786.56*	48.28	Vertical	74.00	PK	Pass	19.5

Remark:

(1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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10 Test Equipment List

List of Test Instruments

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2018-7-7
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2018-7-7
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2018-7-7
Horn Antenna	Rohde & Schwarz	HF907	102294	2018-7-7
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2018-7-7
3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2018-7-7
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2018-7-7
Horn Antenna	Rohde & Schwarz	HF907	102294	2018-7-14
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2018-7-14
LISN	Rohde & Schwarz	ENV4200	100249	2018-7-14
LISN	Rohde & Schwarz	ENV216	100326	2018-7-14
ISN	Rohde & Schwarz	ENY81	100177	2018-7-14
ISN	Rohde & Schwarz	ENY81-CA6	101664	2018-7-14
High Voltage Probe	Rohde & Schwarz	TK9420(VT9420)	9420-58	2018-7-14
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2018-7-14

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- Power spectral density*
- Spurious RF conducted emissions
- Band edge

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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

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.98dB; Vertical: 5.06dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.95dB; Vertical: 4.94dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 5.14dB; Vertical: 5.12dB;
Uncertainty for Conducted RF test with TS 8997	Power level test involved: 2.06dB Frequency test involved: 1.16×10^{-7}
Uncertainty for Conducted Emission 150kHz-30MHz (for test using AMN ENV432 or ENV4200)	3.21dB

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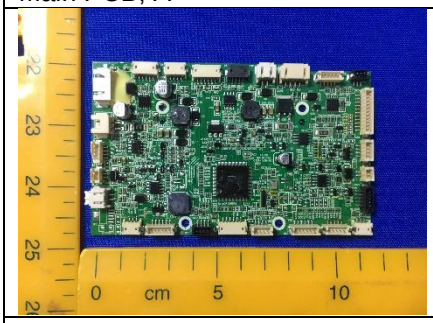
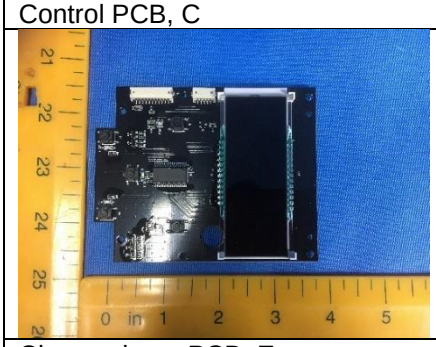
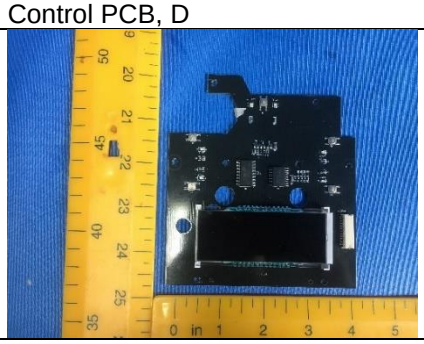
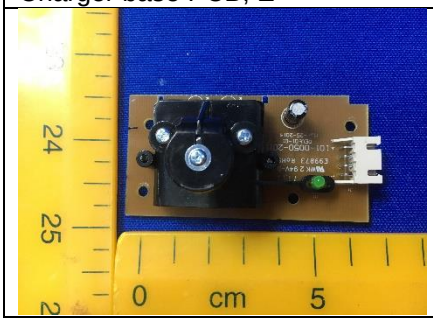
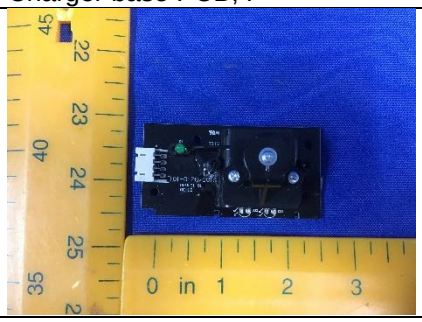
12 General product information

1. Rechargeable battery-powered robotic vacuum cleaner with docking station.

2. Model differences as below:

Model	Main PCB		control PCB		Charger base PCB		Remark
	A	B	C	D	E	F	Models A7 is the same as model X780 except model name. All models have the similar constructions except the model name, colour of product appearance, main PCB, charger base PCB and control PCB. Air pump is optional in all models.
X780	√		√		√		
A7							
X785		√		√		√	

Main PCB, A	Main PCB, B
	
Control PCB, C	**Control PCB, D**
	
Charger base PCB, E	**Charger base PCB, F**
	

Unless otherwise specified, the model X780 was chosen as the representative model to perform all the tests. selected test item of Radiated Emission Test was applied on X785, other models are deemed to fulfill relevant EMC requirement without further test.

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