FCC - TEST REPORT

Report Number	:	**68.950.19.2657.01**	Date of Issue:	Oct 25, 2019
Model	:	**NFC7YWW01161024, NFC5YWW018512**		
Product Type	:	Notebook		
Applicant	:	Zhangzhou Wanlida Technology Co., Ltd.		
Address	:	Nanjing Wanlida Industrial Zone, Zhang Zhou, Fujian, China		
Production Facility	:	Zhangzhou Wanlida Technology Co., Ltd.		
Address	:	Nanjing Wanlida Industrial Zone, Zhang Zhou, Fujian, China		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	**62**		

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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 Designation Number:	CN5009
FCC Registration No.:	514049
Telephone:	86 755 8828 6998
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3 Description of the Equipment under Test

Product:	Notebook
Model no.:	NFC7YWW01161024, NFC5YWW018512
FCC ID:	2ARB5-ULTRAONE
Rating:	7.6VDC, 6000mAh, (Supplied by Rechargeable Lithium-ion Battery) or 20VDC (Supplied by external adapter for Charging rechargeable battery) Adapter Model: FSP060-A1UR Input:100-240VAC 50/60Hz, 1.5A, Output:5VDC,2A or 9V 2A or 12V 2A or 15V 3A or 20V 3A Manufacturer: FSP GROUP INC
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:	Integrated antenna
Antenna Gain:	ANT1: 0.9dBi max for 2.4GHz ANT2: 0.2dBi max for 2.4GHz
Description of the EUT:	The Equipment Under Test (EUT) is a Notebook supports 2.4GHz Bluetooth/WIFI, 5GHz WIFI functions.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2018Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 662911 D01 Multiple Transmitter Output v02r01 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	10	Pass	Site 1
§15.247(b)(1)	Conducted AV output power for FHSS	--	N/A	--
§15.247(b)(3)	Conducted peak output power & EIRP	13	Pass	Site 1
§15.247(e)	Power spectral density	23	Pass	Site 1
§15.247(a)(2)	6dB bandwidth	15	Pass	Site 1
§15.247(a)(1)	20dB Occupied bandwidth	--	N/A	--
§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	31	Pass	Site 1
§15.247(d)	Band edge	52	Pass	Site 1
§15.247(d) & §15.209 & §15.205	Spurious radiated emissions for transmitter	58	Pass	Site 1
§15.203	Antenna requirement	See note 2	Pass	--

Note 1: N/A – Not Applicable.
Note 2: The EUT uses an internal antenna, which ANT 1 gain is 0.9dBi, ANT 2 gain is 0.2dBi. In accordance 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: 2ARB5-ULTRAONE, complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C.
The Model: NFC7YWW01161024 supports 2.4GHz Bluetooth/WIFI, 5GHz WIFI function. The TX and RX range is 2402MHz-2480MHz for Bluetooth, 2412MHz – 2462MHz for 2.4GHzWIFI, 5180MHz – 5320MHz, 5500MHz – 5700MHz, 5745MHz – 5825MHz for 5GHzWIFI.
NFC5YWW018512 is identical with model: NFC7YWW01161024 except model name, CPU, internal storage and SSD, unless otherwise Specification the model NFC7YWW01161024 was choose as representative model to perform all test items, and model: NFC5YWW018512 was deemed to fulfil relevant requirements without further testing.

Model	CPU	internal storage	SSD
NFC5YWW018512	i5-8200Y	8G	512GB
NFC7YWW01161024	i7-8500Y	16G	1024GB

This report is for the WIFI 2.4GHz part.

SUMMARY:
All tests according to the regulations cited on page 6 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

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

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

Sample Received Date: June 26, 2019

Testing Start Date: June 26, 2019

Testing End Date: Oct 22, 2019

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

Reviewed by:	Prepared by:	Tested by:
John Zhi	Joe Gu	Tree Zhan
EMC Project Manager	EMC Project Engineer	EMC Test Engineer

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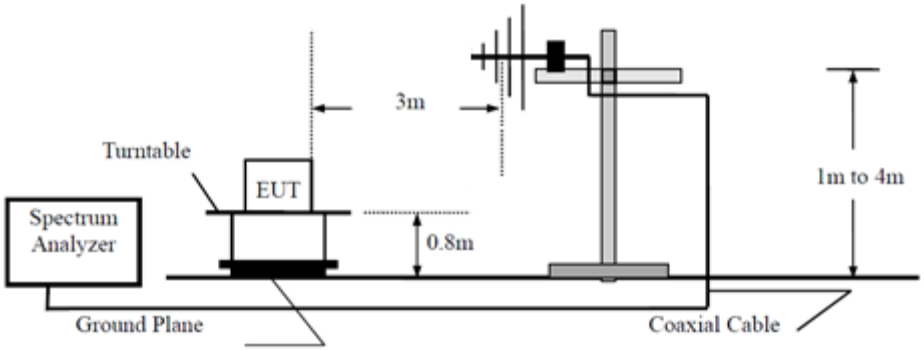
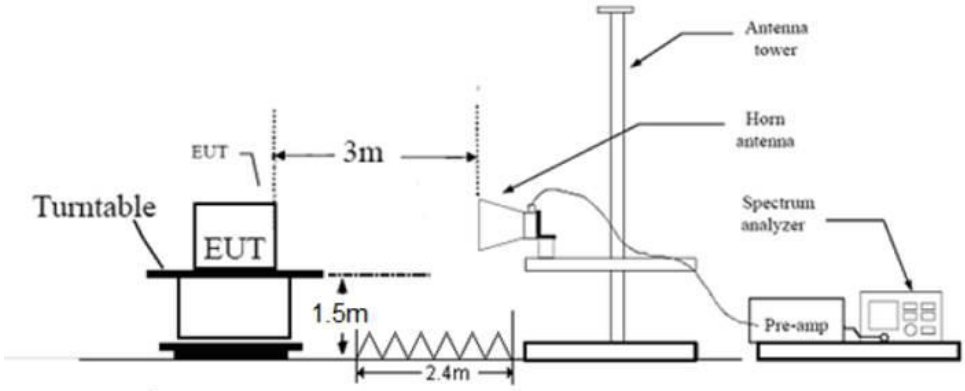
7 Test Setups

7.1 Radiated test setups

Below 1GHz

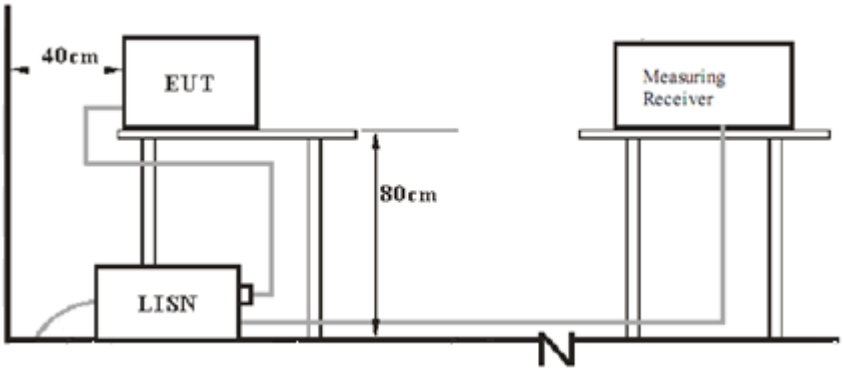


Above 1GHz



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)
---	---	---	---

The system was configured to non-hopping mode.

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

Through pre-scan all kind of modulation and all kind of rates, find the 1Mbps of rate is the worst case of 802.11b; the 6Mbps of rate is the worst case of 802.11g; the 6.5Mbps of rate is the worst case of 802.11N20, MCS0 13.5 Mbps of rate is the worst case of 802.11N40, only the worst case transmitter rate data mode in recorded in the report.

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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 dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

*Decreasing linearly with logarithm of the frequency

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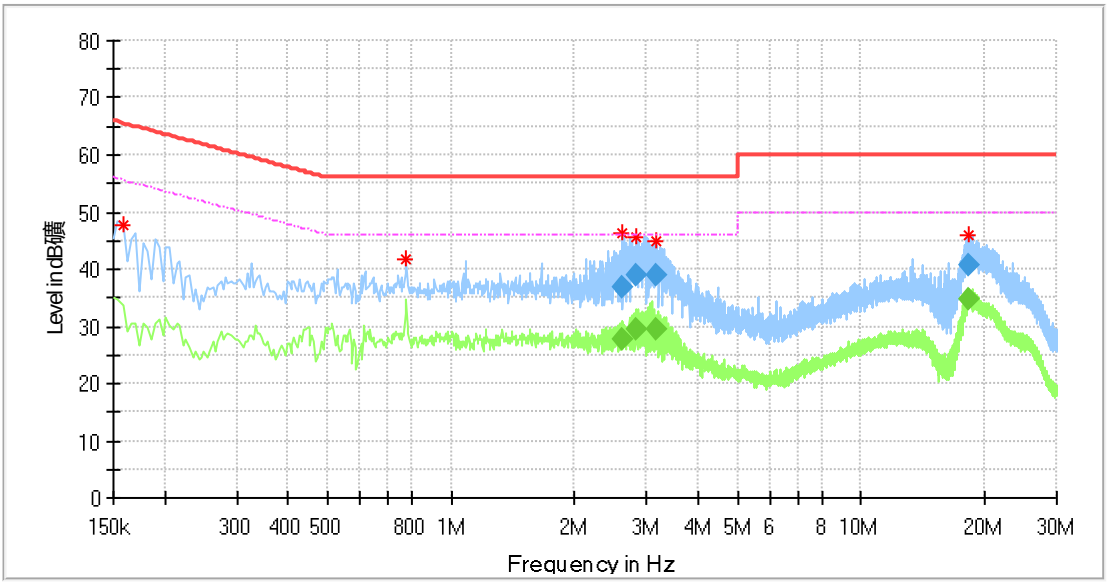
Conducted Emission

Product Type	:	Notebook
M/N	:	NFC7YWW01161024
Operating Condition	:	Charging + TX
Test Specification	:	Power Line, Live
Comment	:	AC 120V/60Hz



Critical_Freqs

Frequency (MHz)	MaxPeak* (dBµV)	Average* (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr.** (dB)
0.158000	47.87	---	65.57	17.70	L1	10.2
0.778000	41.77	---	56.00	14.23	L1	10.3
2.605500	46.45	---	56.00	9.55	L1	10.3
2.834500	45.74	---	56.00	10.26	L1	10.3
3.161500	45.05	---	56.00	10.95	L1	10.4
18.261500	46.02	---	60.00	13.98	L1	10.9

Final_Result

Frequency (MHz)	QuasiPeak* (dBµV)	Average* (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr.** (dB)
2.605500	---	27.83	46.00	18.17	L1	10.3
2.605500	36.90	---	56.00	19.10	L1	10.3
2.834500	---	29.35	46.00	16.65	L1	10.3
2.834500	38.97	---	56.00	17.03	L1	10.3
3.161500	---	29.61	46.00	16.39	L1	10.4
3.161500	38.83	---	56.00	17.17	L1	10.4
18.261500	---	34.72	50.00	15.28	L1	10.9
18.261500	40.59	---	60.00	19.41	L1	10.9

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)

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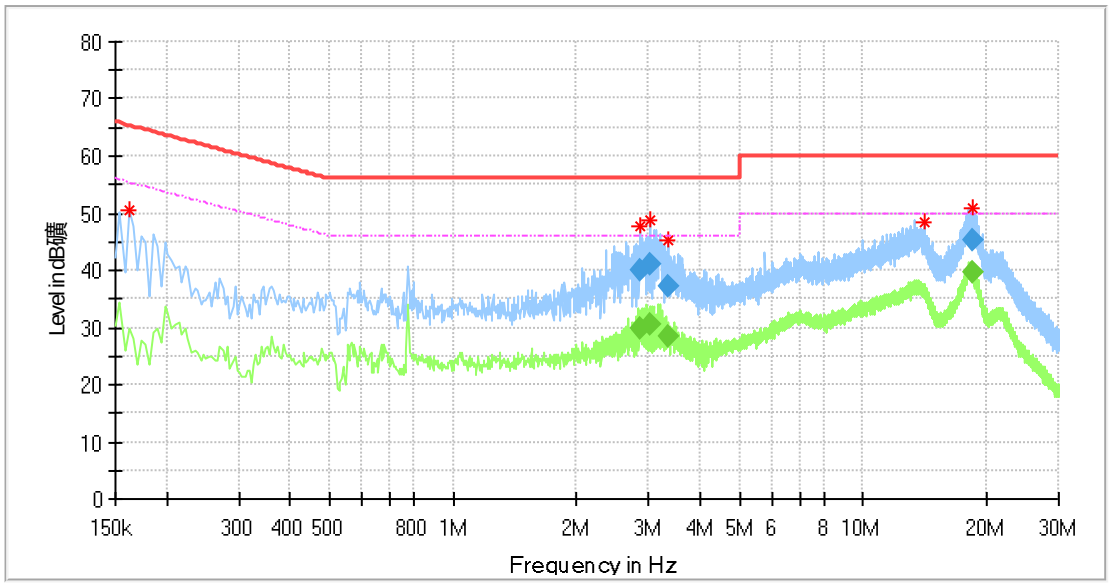
Conducted Emission

Product Type	:	Notebook
M/N	:	NFC7YWW01161024
Operating Condition	:	Charging + TX
Test Specification	:	Power Line, Neutral
Comment	:	AC 120V/60Hz



Critical_Freqs

Frequency (MHz)	MaxPeak* (dBµV)	Average* (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr.** (dB)
0.162000	50.55	---	65.36	14.81	N	10.2
2.869500	47.61	---	56.00	8.39	N	10.4
3.009500	48.74	---	56.00	7.26	N	10.4
3.334500	45.12	---	56.00	10.88	N	10.4
14.066000	48.27	---	60.00	11.73	N	10.8
18.393500	50.81	---	60.00	9.19	N	11.1

Final_Result

Frequency (MHz)	QuasiPeak* (dBµV)	Average* (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr.** (dB)
2.869500	---	29.70	46.00	16.30	N	10.4
2.869500	39.85	---	56.00	16.15	N	10.4
3.009500	---	30.40	46.00	15.60	N	10.4
3.009500	40.97	---	56.00	15.03	N	10.4
3.334500	---	28.31	46.00	17.69	N	10.4
3.334500	37.26	---	56.00	18.74	N	10.4
18.393500	---	39.57	50.00	10.43	N	11.1
18.393500	45.36	---	60.00	14.64	N	11.1

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)

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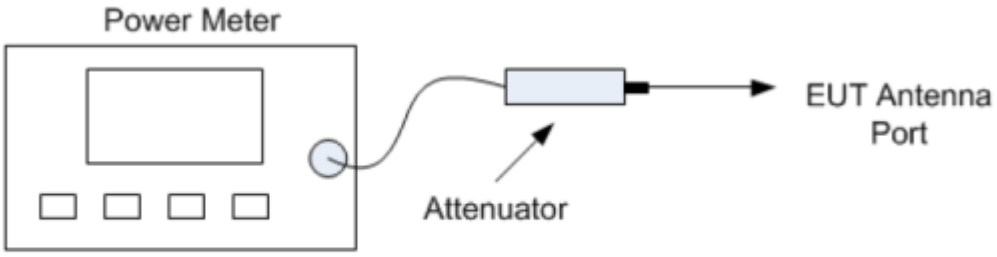
9.2 Conducted peak output power & EIRP

Test Method

1. The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
2. At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3. The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
4. Measure the average power of the transmitter. This measurement is a peak over both the ON and OFF periods of the transmitter.



Power meter conducted test setup

Limits

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

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

Test result as below table

802.11b_SISO modulation Test Result

Frequency (MHz)	Conducted Average Output Power (dBm)		Result
	Ant 1	Ant 2	
Low channel 2412MHz	18.61	18.91	Pass
Middle channel 2437MHz	18.50	18.82	Pass
High channel 2462MHz	18.61	17.67	Pass

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802.11g_SISO modulation Test Result

Frequency (MHz)	Conducted Average Output Power (dBm)		Result
	Ant 1	Ant 2	
Low channel 2412MHz	16.83	17.22	Pass
Middle channel 2437MHz	18.61	18.92	Pass
High channel 2462MHz	16.79	17.07	Pass

802.11n20_MIMO modulation Test Result

Frequency (MHz)	Conducted Average Output Power (dBm)			Result
	Ant 1	Ant 2	SUM	
Low channel 2412MHz	16.37	16.52	19.40	Pass
Middle channel 2437MHz	15.65	16.97	19.92	Pass
High channel 2462MHz	14.89	15.17	18.27	Pass

802.11n40_MIMO modulation Test Result

Frequency (MHz)	Conducted Average Output Power (dBm)			Result
	Ant 1	Ant 2	SUM	
Low channel 2422MHz	13.75	14.05	17.18	Pass
Middle channel 2437MHz	15.21	15.78	18.82	Pass
High channel 2452MHz	13.42	14.11	17.02	Pass

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9.3 6dB 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

TestMode	Antenna	Channel	DTS BW [MHz]	Verdict
11B	Ant1	2412	10.120	PASS
	Ant2	2412	10.120	PASS
	Ant1	2437	10.120	PASS
	Ant2	2437	10.120	PASS
	Ant1	2462	10.120	PASS
	Ant2	2462	10.120	PASS
11G	Ant1	2412	15.200	PASS
	Ant2	2412	15.440	PASS
	Ant1	2437	15.200	PASS
	Ant2	2437	13.960	PASS
	Ant1	2462	15.200	PASS
	Ant2	2462	15.200	PASS
11N20MIMO	Ant1+Ant2	2412	15.200	PASS
	Ant1+Ant2	2437	15.200	PASS
	Ant1+Ant2	2462	15.200	PASS
11N40MIMO	Ant1+Ant2	2422	35.280	PASS
	Ant1+Ant2	2437	33.920	PASS
	Ant1+Ant2	2452	35.760	PASS

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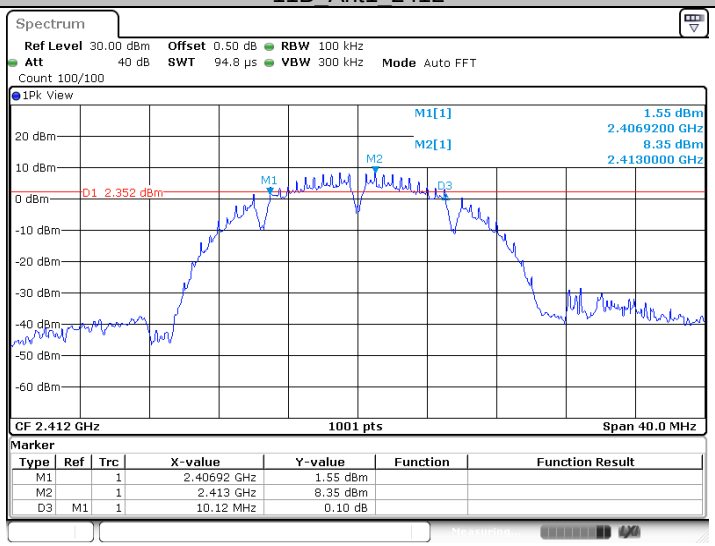
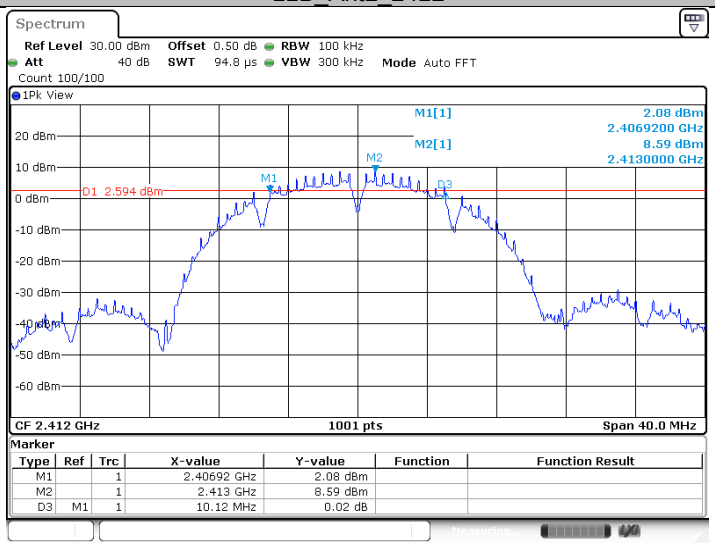
9.3.1 Test Graphs

11B_Ant1_2412



11B_Ant2_2412



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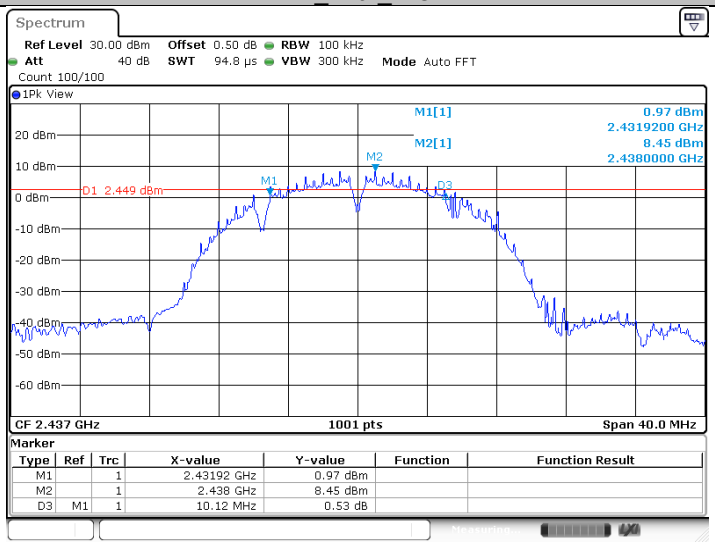
11B_Ant1_2437



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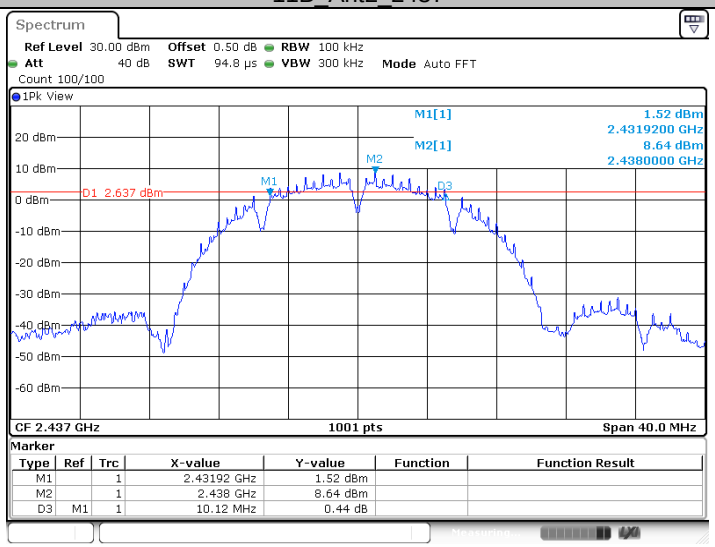

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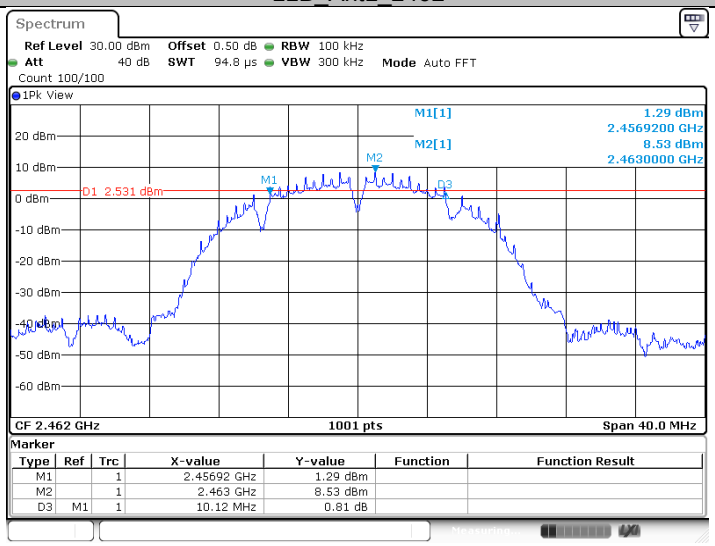

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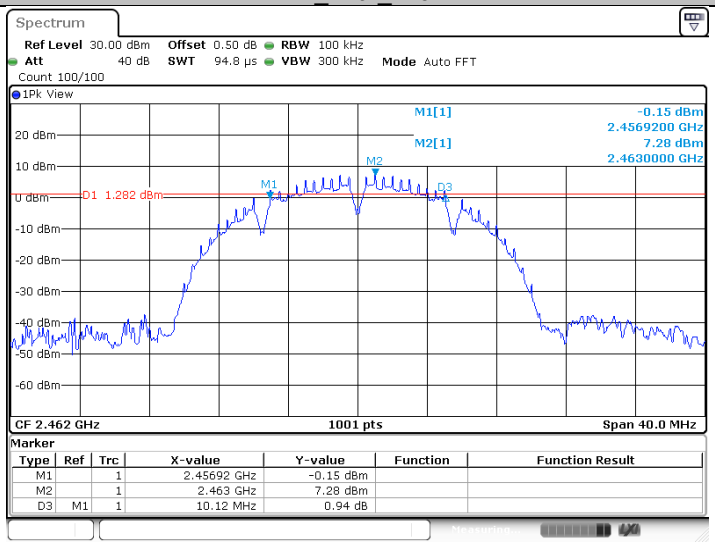

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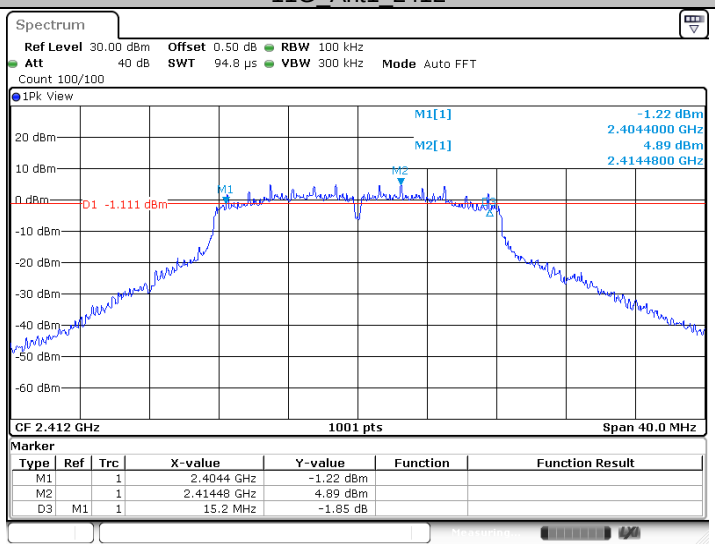

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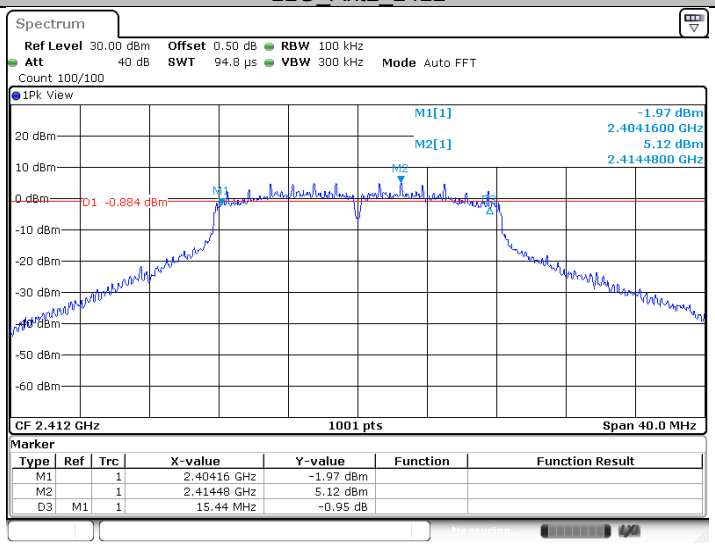

11G_Ant1_2437

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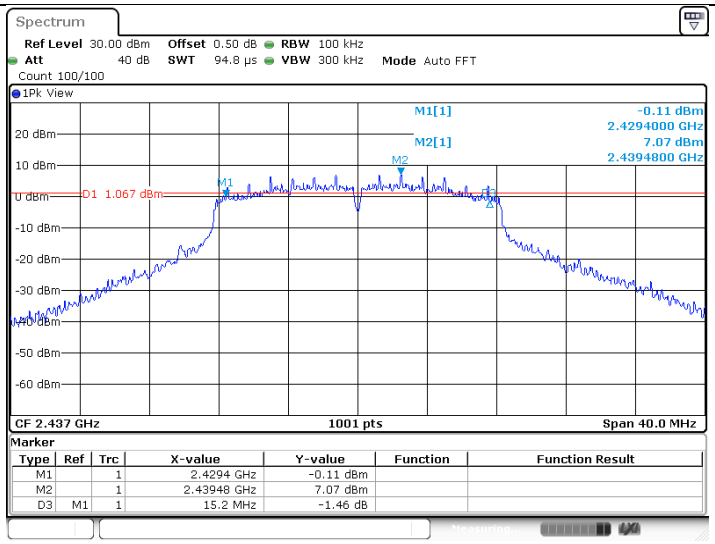
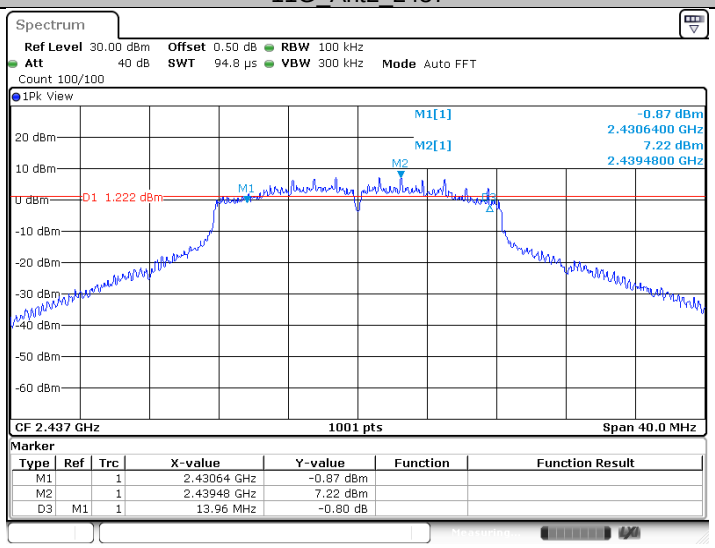
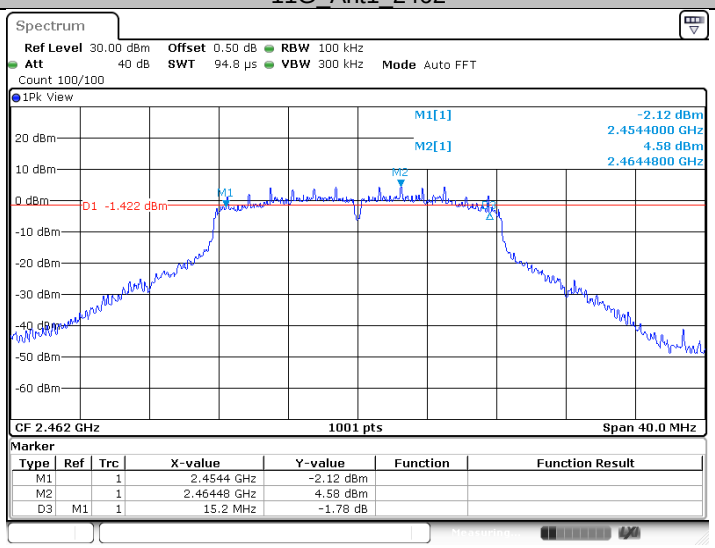


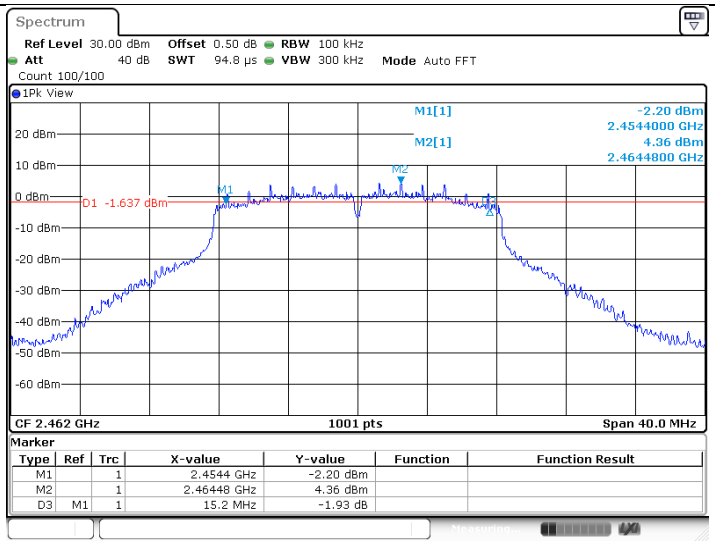
11G_Ant2_2437



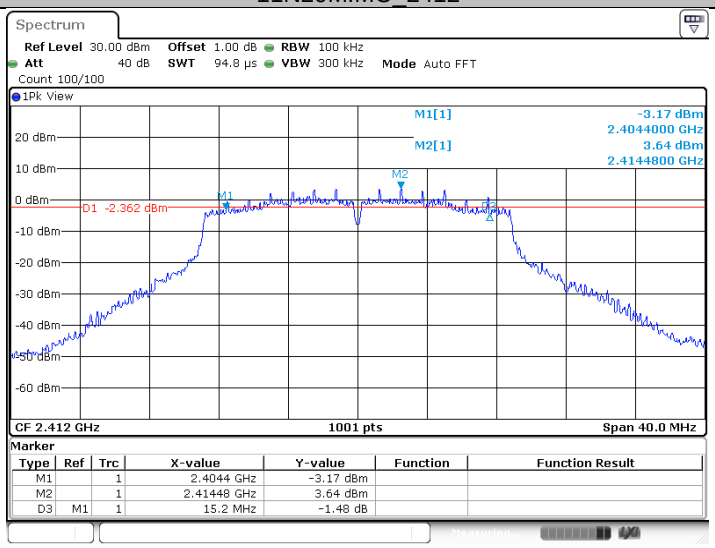
11G_Ant1_2462



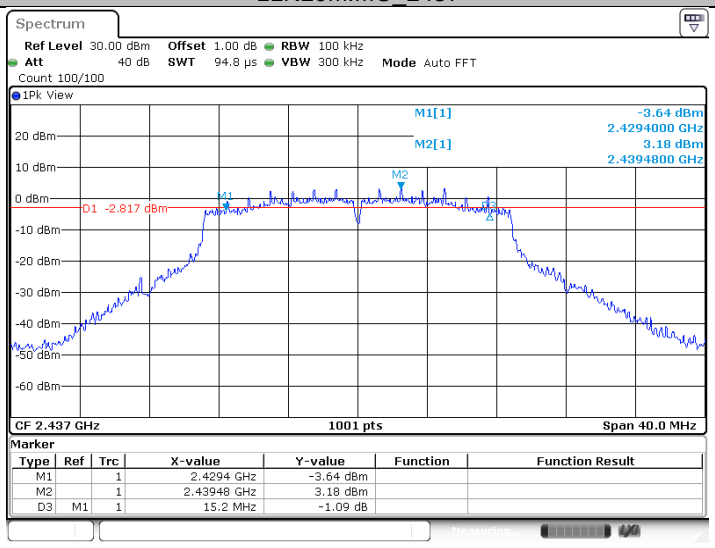
11G_Ant2_2462



11N20MIMO_2412



11N20MIMO_2437



11N20MIMO_2462

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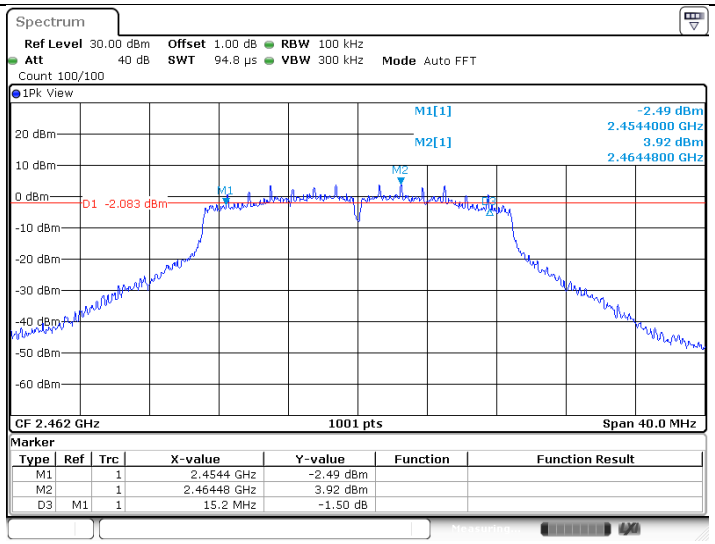
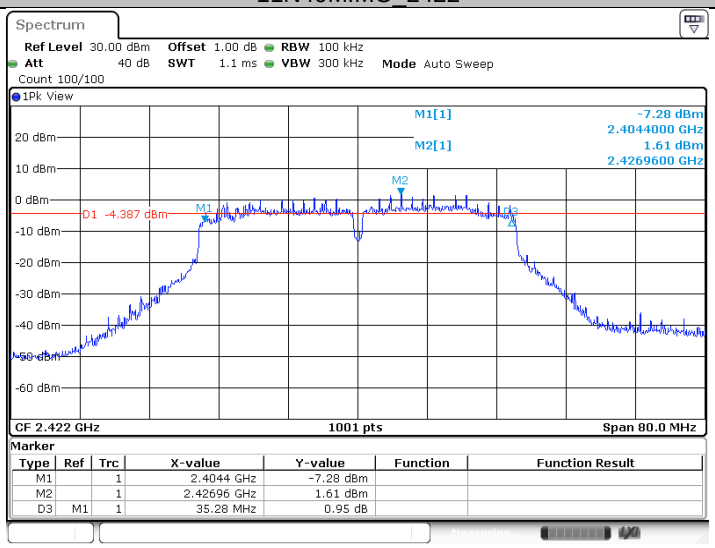
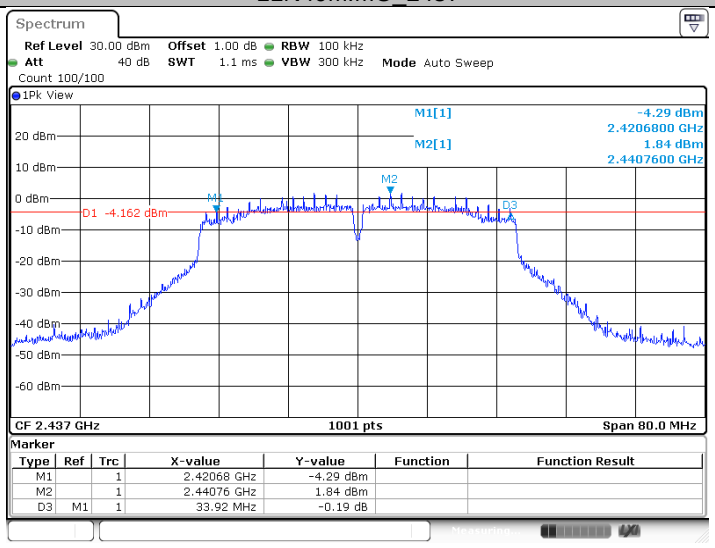


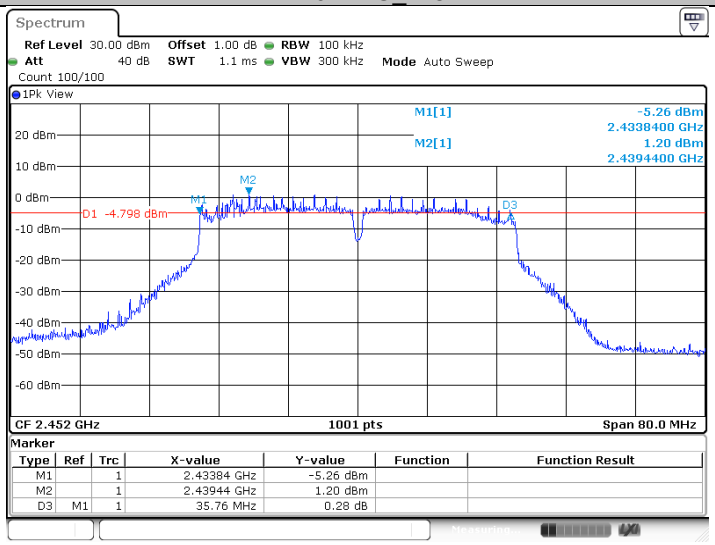
11N40MIMO_2422



11N40MIMO_2437



11N40MIMO_2452



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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:

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	Antenna	Channel[MHz]	Result[dBm/3KHz]	Limit[dBm/3KHz]	Verdict
11B	Ant1	2412	-5.04	<=8	PASS
	Ant2	2412	-5.75	<=8	PASS
	Ant1	2437	-6.2	<=8	PASS
	Ant2	2437	-4.87	<=8	PASS
	Ant1	2462	-5.76	<=8	PASS
	Ant2	2462	-6.23	<=8	PASS
11G	Ant1	2412	-9.41	<=8	PASS
	Ant2	2412	-8.63	<=8	PASS
	Ant1	2437	-7.76	<=8	PASS
	Ant2	2437	-7.01	<=8	PASS
	Ant1	2462	-9.76	<=8	PASS
	Ant2	2462	-10.2	<=8	PASS
11N20MIMO	Ant1+ Ant2	2412	-9.92	<=8	PASS
		2437	-10.7	<=8	PASS
		2462	-11.07	<=8	PASS
11N40MIMO	Ant1+ Ant2	2422	-13.9	<=8	PASS
		2437	-14.01	<=8	PASS
		2452	-14.68	<=8	PASS

NOTE: According to the test results of output power, Ant2 is considered to have the highest power, so PSD for Multiple mode are performed with this antenna and add 3dBi factor, this factor has been compensated in the test.

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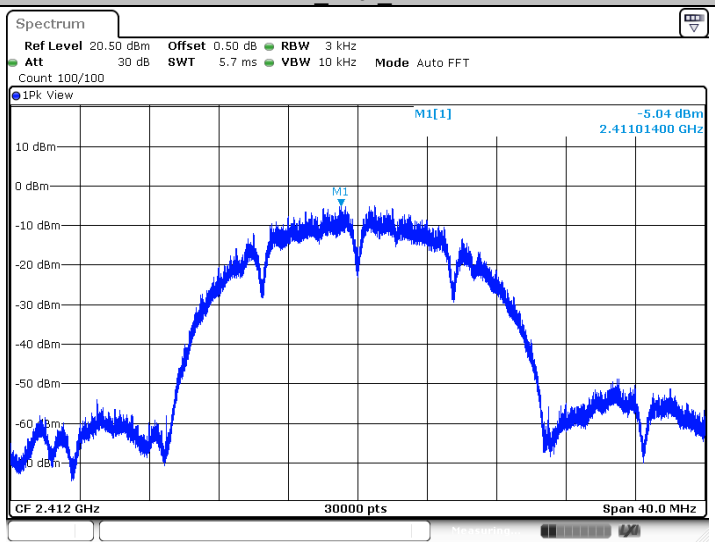
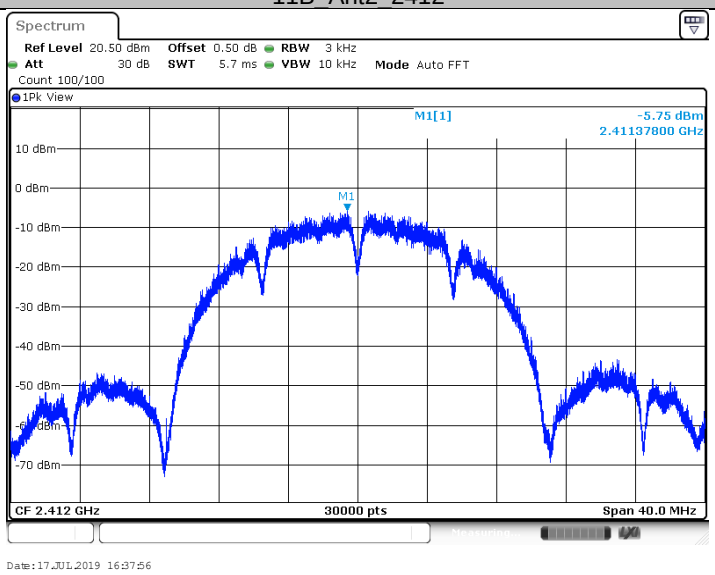
9.4.1 Test Graphs

11B_Ant1_2412



11B_Ant2_2412



11B_Ant1_2437

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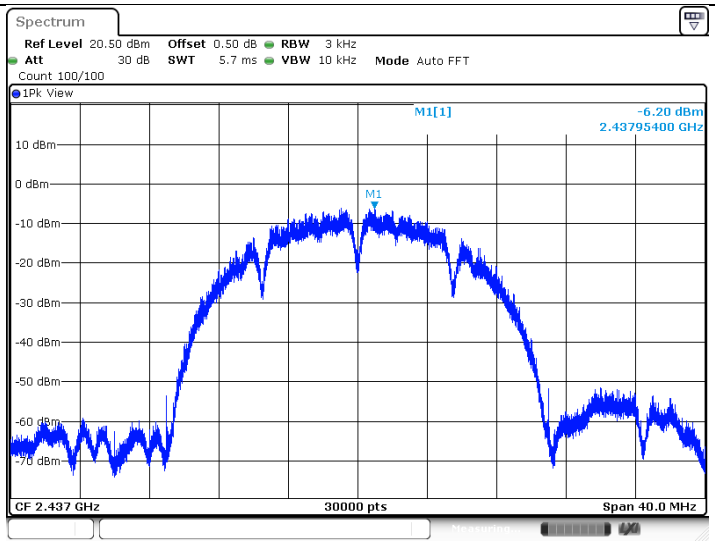
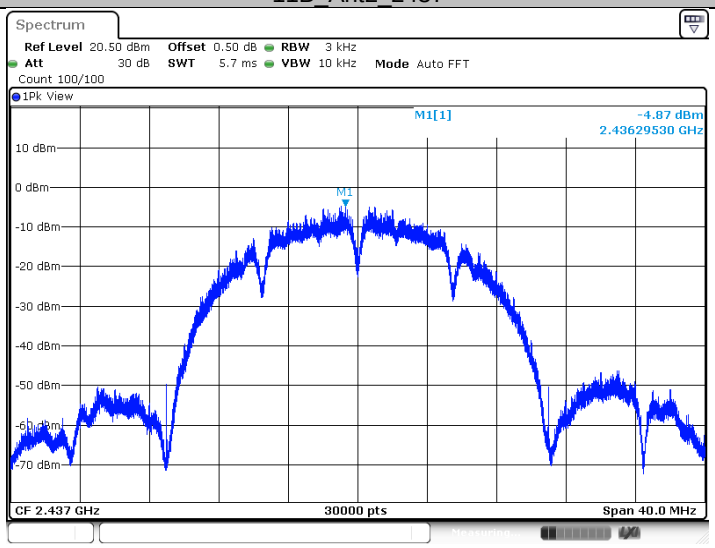
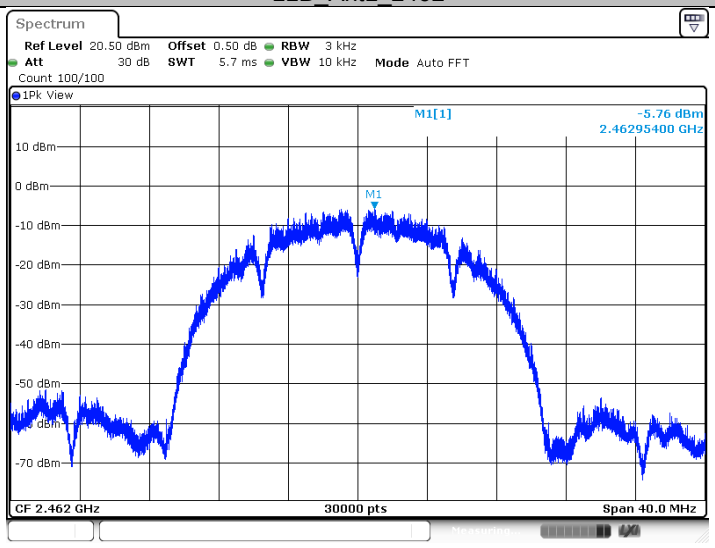


11B_Ant2_2437



11B_Ant1_2462



11B_Ant2_2462

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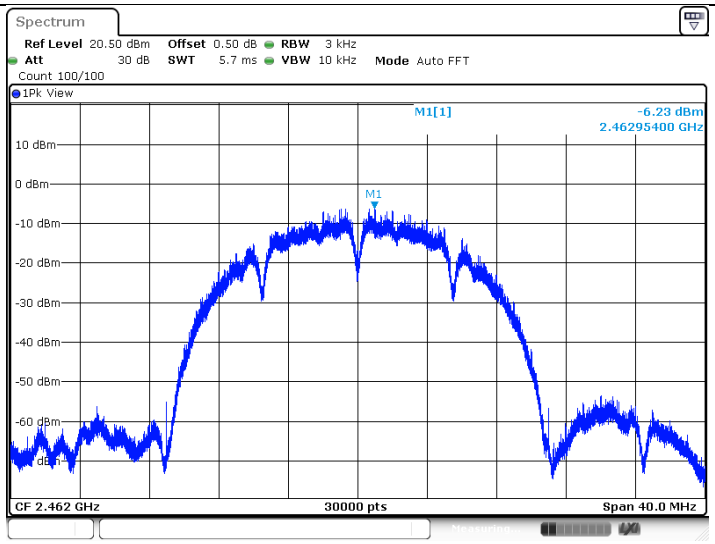
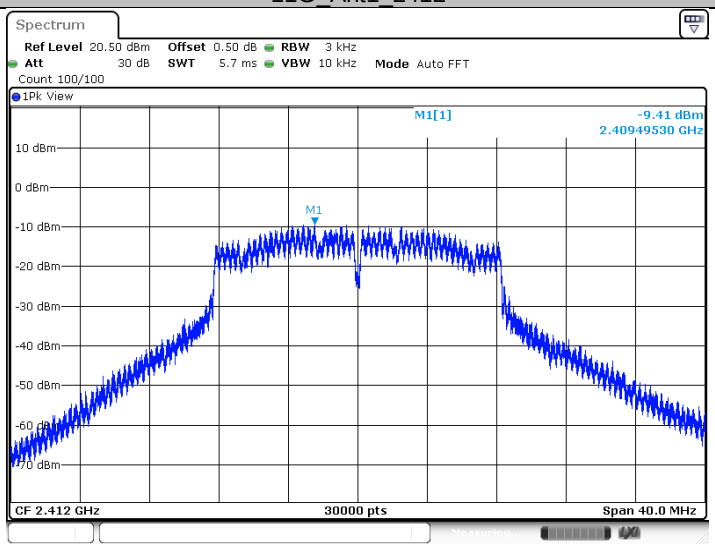
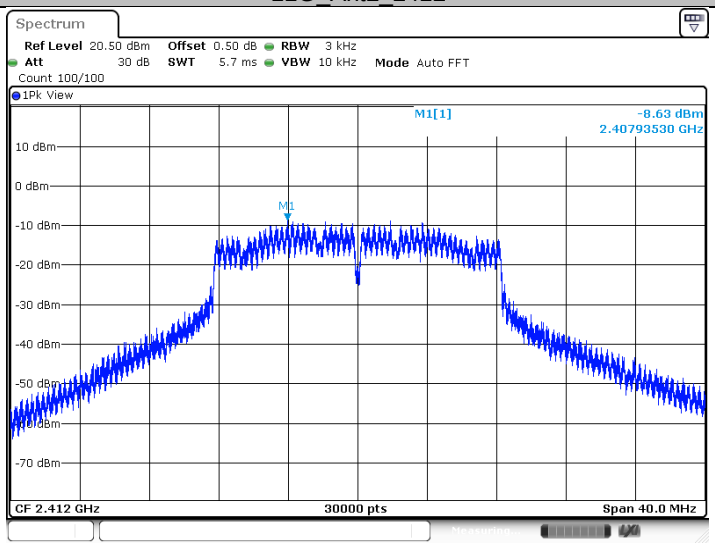


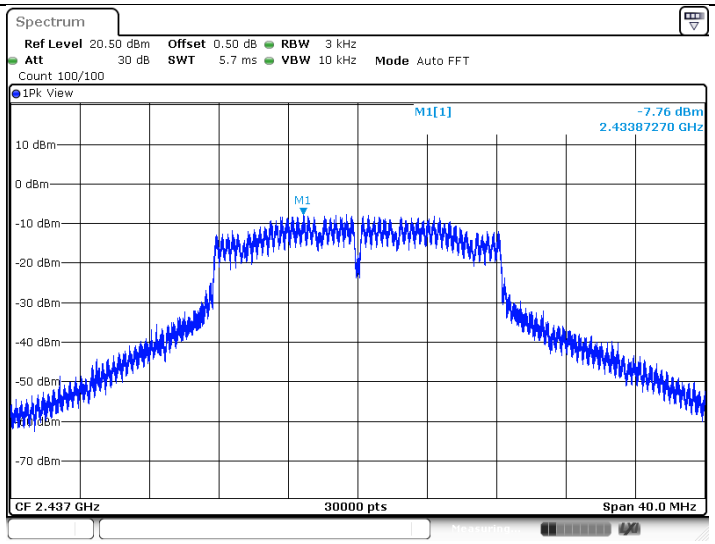
11G_Ant1_2412



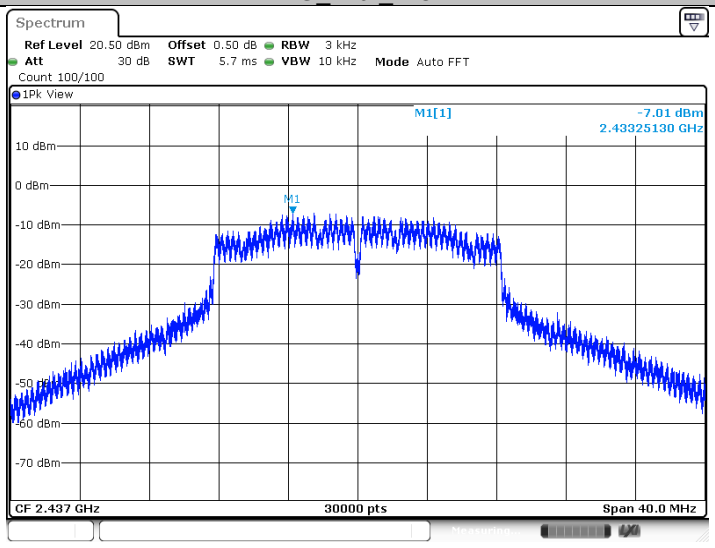
11G_Ant2_2412



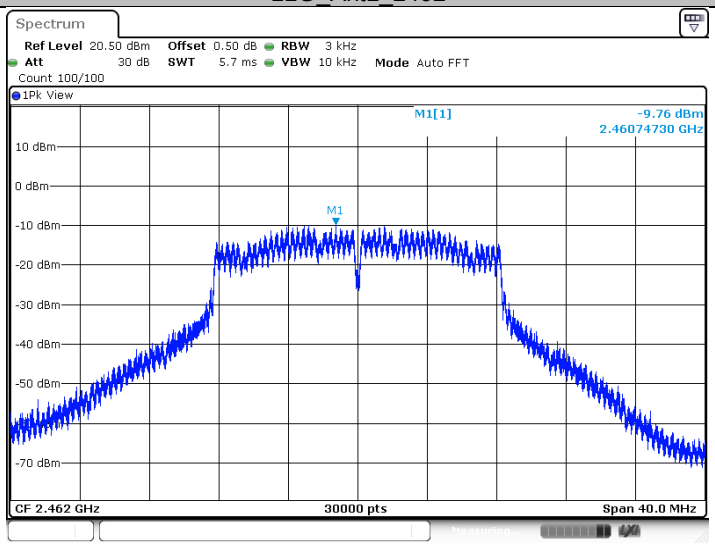
11G_Ant1_2437



11G_Ant2_2437



11G_Ant1_2462



11G_Ant2_2462

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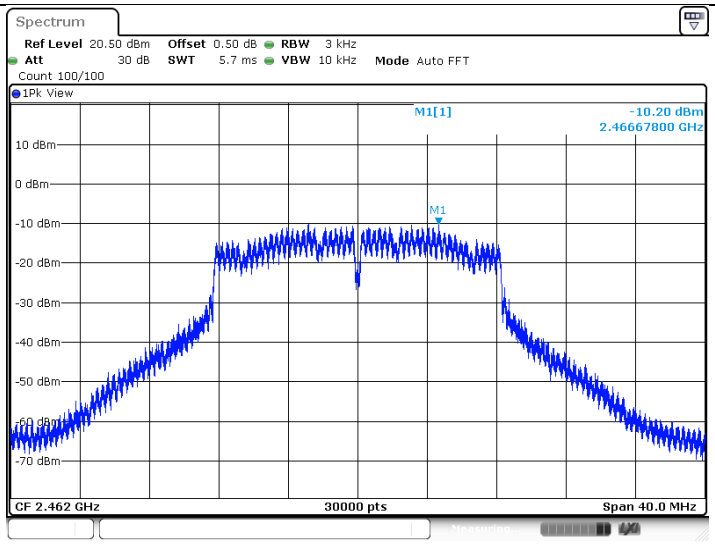
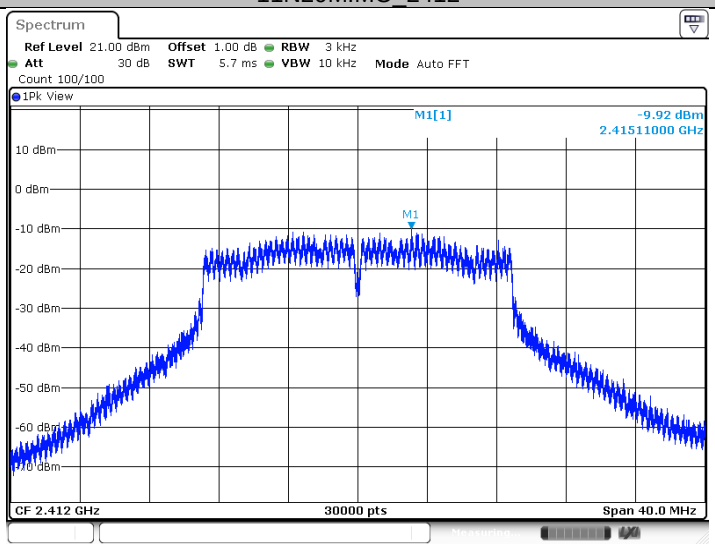
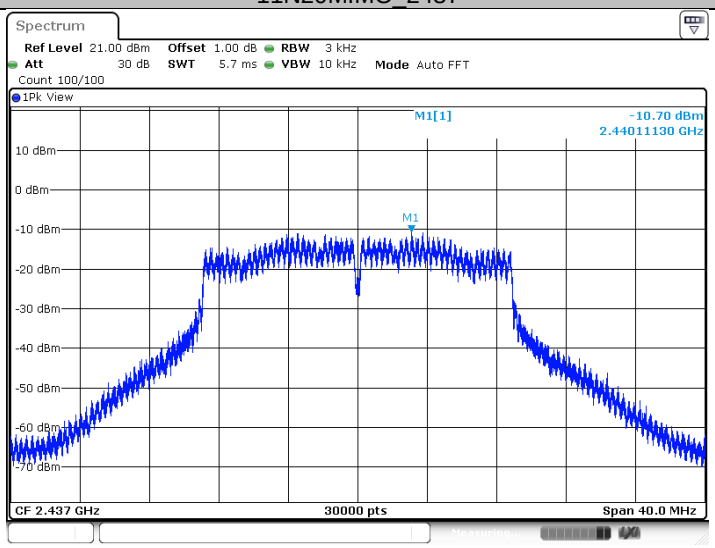


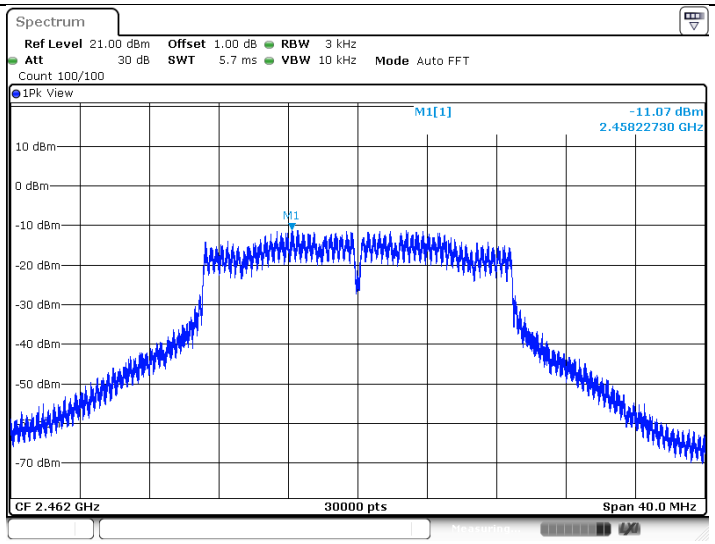
11N20MIMO_2412



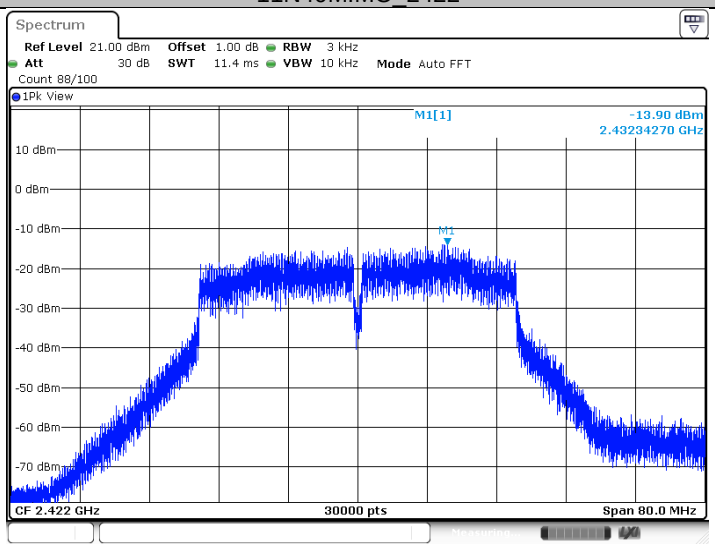
11N20MIMO_2437



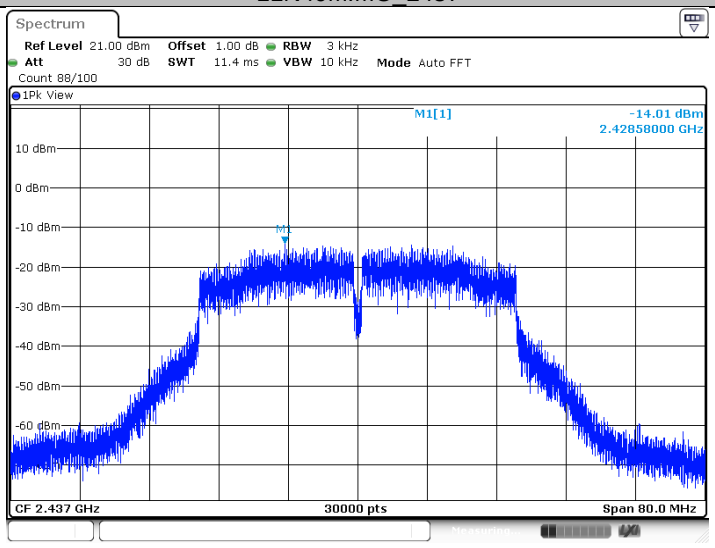
11N20MIMO_2462



11N40MIMO_2422



11N40MIMO_2437



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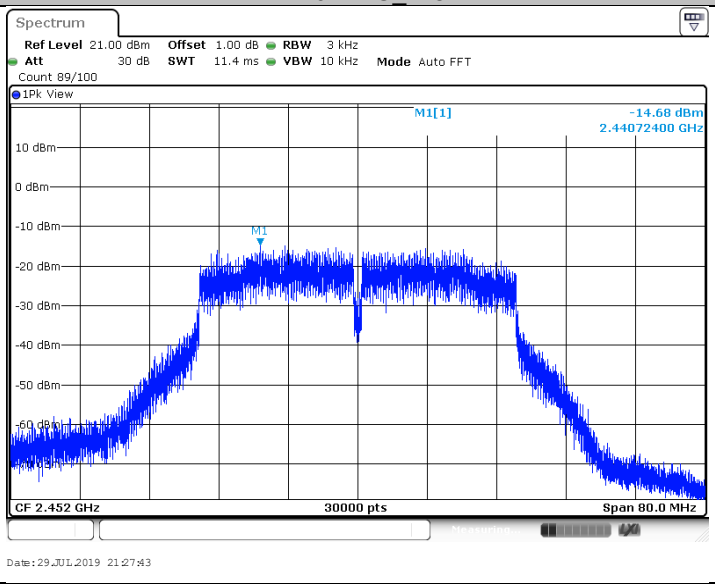
11N40MIMO_2452


9.5 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

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Test Result

TestMode	Antenna	Channel[MHz]	FreqRange[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	Reference	8.48	8.48	---	PASS
		2412	30~1000	30~1000	-67.98	<=-11.52	PASS
		2412	1000~26500	1000~26500	-44.49	<=-11.52	PASS
	Ant2	2412	Reference	8.65	8.65	---	PASS
		2412	30~1000	30~1000	-67.74	<=-11.35	PASS
		2412	1000~26500	1000~26500	-52.66	<=-11.35	PASS
	Ant1	2437	Reference	8.39	8.39	---	PASS
		2437	30~1000	30~1000	-67.13	<=-11.61	PASS
		2437	1000~26500	1000~26500	-52.63	<=-11.61	PASS
	Ant2	2437	Reference	8.70	8.70	---	PASS
		2437	30~1000	30~1000	-67.85	<=-11.3	PASS
		2437	1000~26500	1000~26500	-49.03	<=-11.3	PASS
	Ant1	2462	Reference	8.61	8.61	---	PASS
		2462	30~1000	30~1000	-68.87	<=-11.39	PASS
		2462	1000~26500	1000~26500	-48.95	<=-11.39	PASS
	Ant2	2462	Reference	7.35	7.35	---	PASS
		2462	30~1000	30~1000	-68.76	<=-12.65	PASS
		2462	1000~26500	1000~26500	-50.82	<=-12.65	PASS
11G	Ant1	2412	Reference	4.53	4.53	---	PASS
		2412	30~1000	30~1000	-68.34	<=-15.47	PASS
		2412	1000~26500	1000~26500	-52.49	<=-15.47	PASS
	Ant2	2412	Reference	5.21	5.21	---	PASS
		2412	30~1000	30~1000	-68.62	<=-14.79	PASS
		2412	1000~26500	1000~26500	-52.67	<=-14.79	PASS
	Ant1	2437	Reference	6.82	6.82	---	PASS
		2437	30~1000	30~1000	-68.31	<=-13.18	PASS
		2437	1000~26500	1000~26500	-53.06	<=-13.18	PASS
	Ant2	2437	Reference	7.10	7.10	---	PASS
		2437	30~1000	30~1000	-68.77	<=-12.9	PASS
		2437	1000~26500	1000~26500	-52.62	<=-12.9	PASS
	Ant1	2462	Reference	4.32	4.32	---	PASS
		2462	30~1000	30~1000	-68.62	<=-15.68	PASS
		2462	1000~26500	1000~26500	-52.75	<=-15.68	PASS
	Ant2	2462	Reference	4.48	4.48	---	PASS
		2462	30~1000	30~1000	-68.48	<=-15.52	PASS
		2462	1000~26500	1000~26500	-52.78	<=-15.52	PASS
11N20MIMO	Ant2	2412	Reference	3.63	3.63	---	PASS
		2412	30~1000	30~1000	-67.9	<=-16.37	PASS
		2412	1000~26500	1000~26500	-52.18	<=-16.37	PASS
		2437	Reference	1.68	1.68	---	PASS
		2437	30~1000	30~1000	-66.28	<=-18.32	PASS
		2437	1000~26500	1000~26500	-52.05	<=-18.32	PASS
		2462	Reference	3.75	3.75	---	PASS
		2462	30~1000	30~1000	-67.95	<=-16.25	PASS
		2462	1000~26500	1000~26500	-52.19	<=-16.25	PASS
11N40MIMO	Ant2	2422	Reference	1.38	1.38	---	PASS
		2422	30~1000	30~1000	-67.51	<=-18.62	PASS
		2422	1000~26500	1000~26500	-51.78	<=-18.62	PASS
		2437	Reference	1.38	1.38	---	PASS
		2437	30~1000	30~1000	-67.4	<=-18.62	PASS
		2437	1000~26500	1000~26500	-52.08	<=-18.62	PASS
		2452	Reference	0.57	0.57	---	PASS
		2452	30~1000	30~1000	-67.84	<=-19.43	PASS
		2452	1000~26500	1000~26500	-51.58	<=-19.43	PASS

NOTE: We test Ant1 and Ant2 separately, only the WORSE case recorded in this report.

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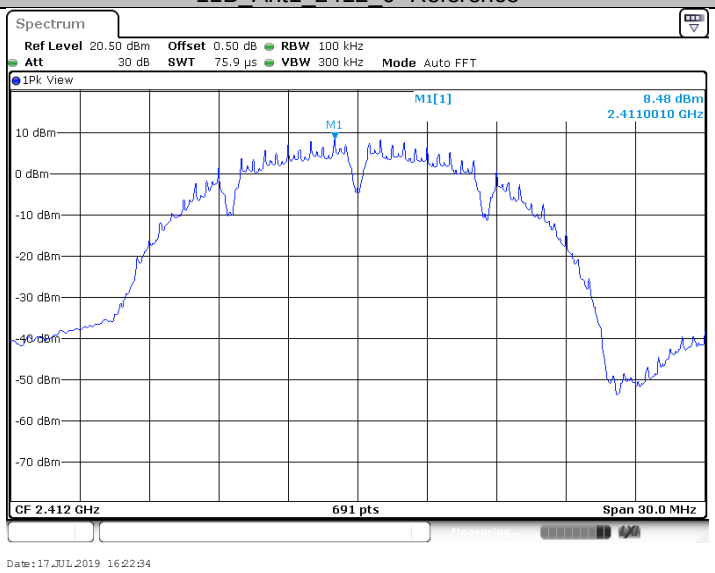
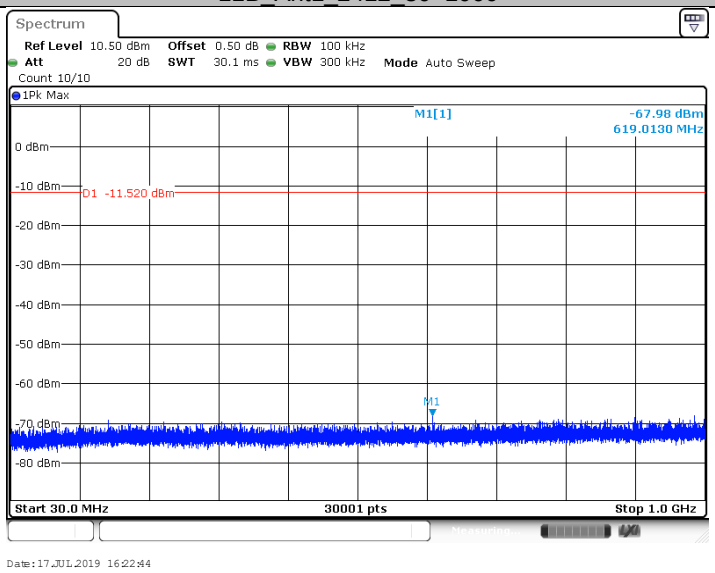
9.5.1 Test Graphs

11B_Ant1_2412_0~Reference



11B_Ant1_2412_30~1000



11B_Ant1_2412_1000~26500

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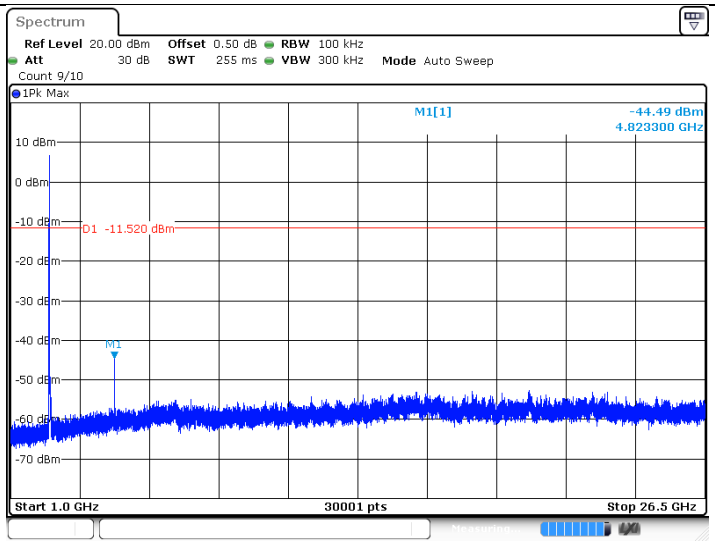
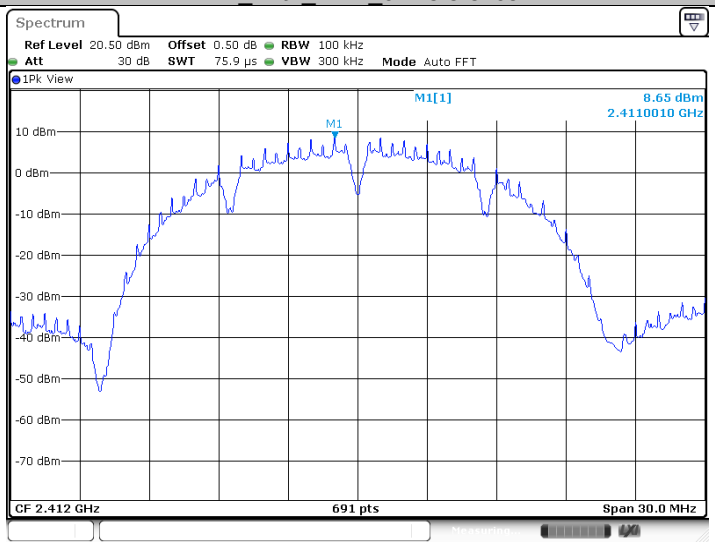
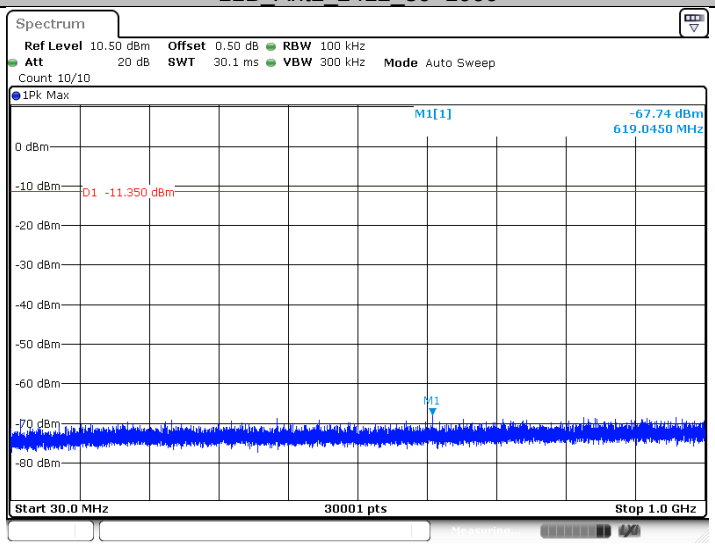


11B_Ant2_2412_0~Reference



11B_Ant2_2412_30~1000



11B_Ant2_2412_1000~26500

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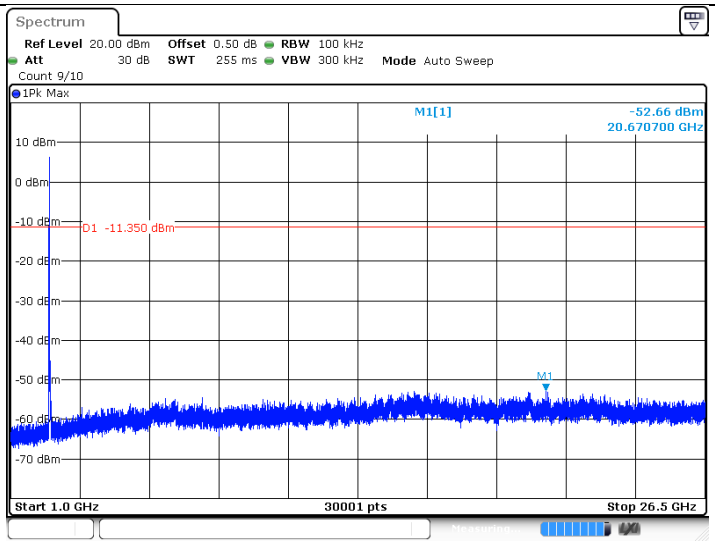
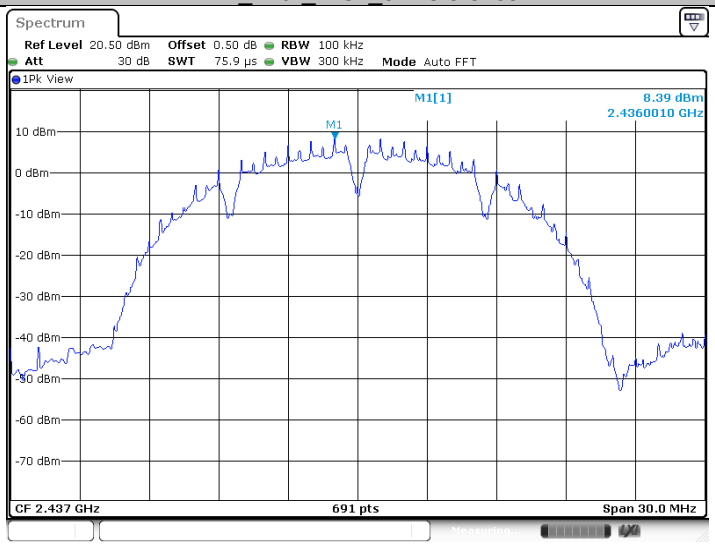


11B_Ant1_2437_0~Reference



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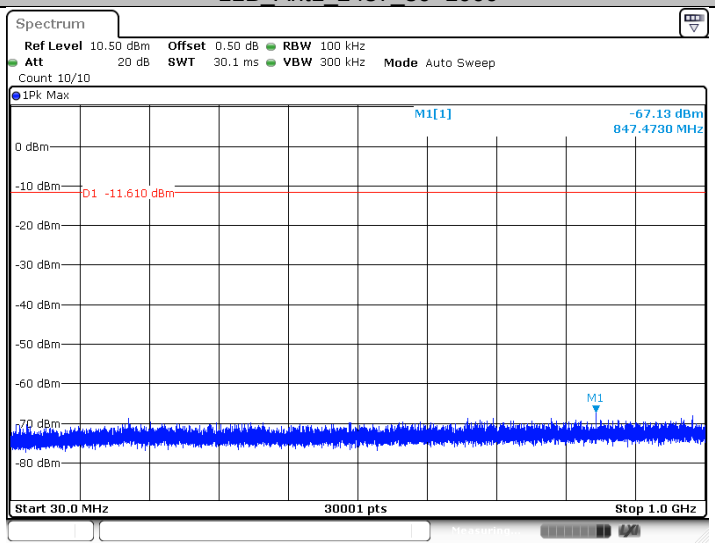

11B_Ant1_2437_1000~26500

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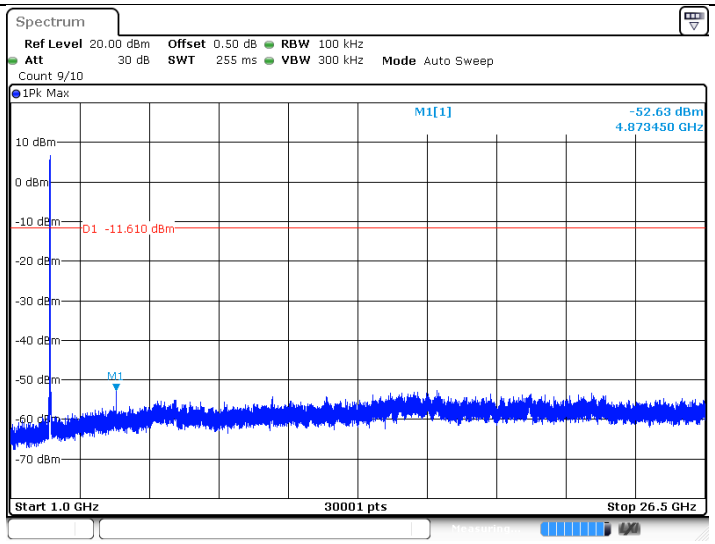

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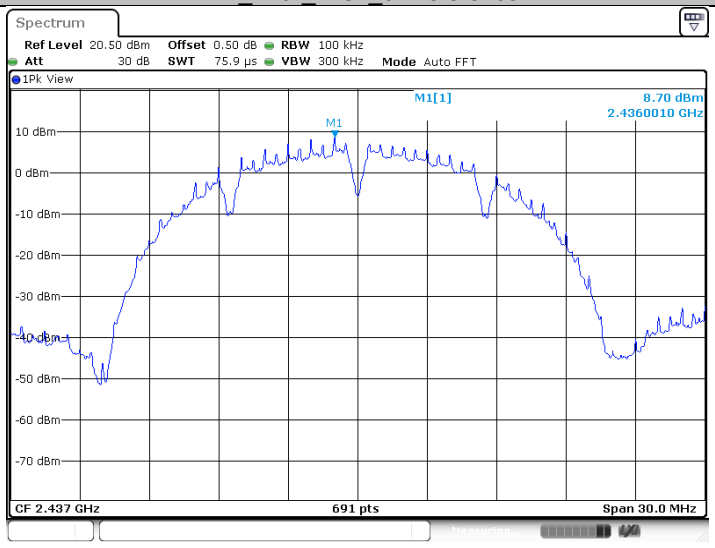

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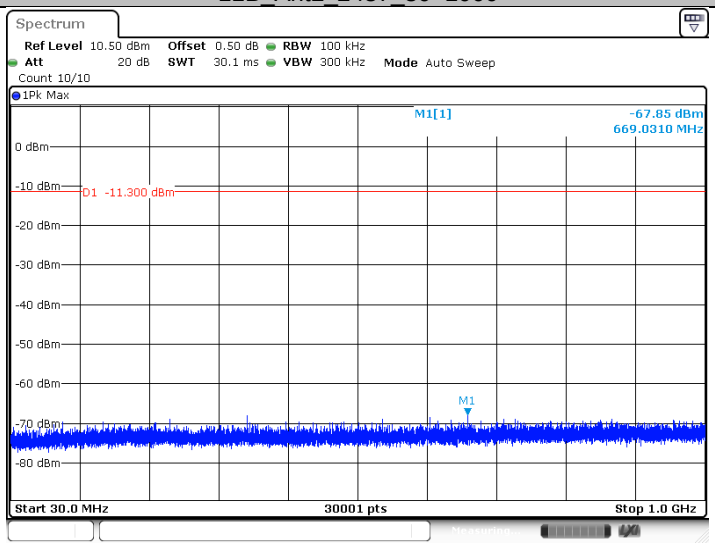

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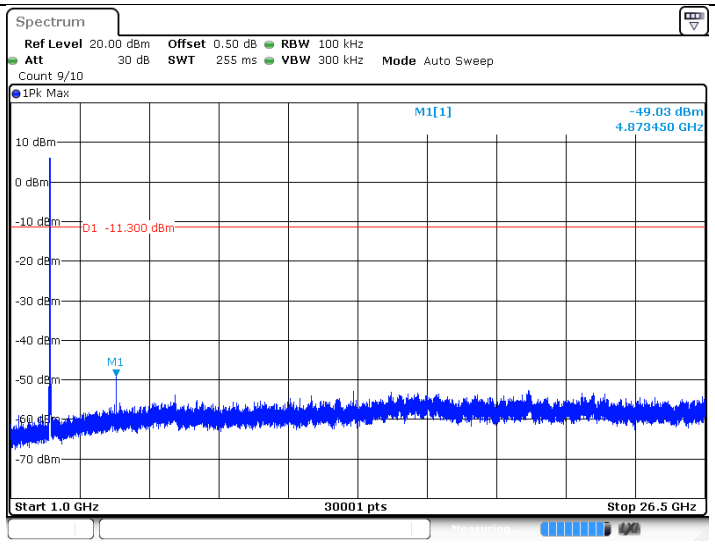

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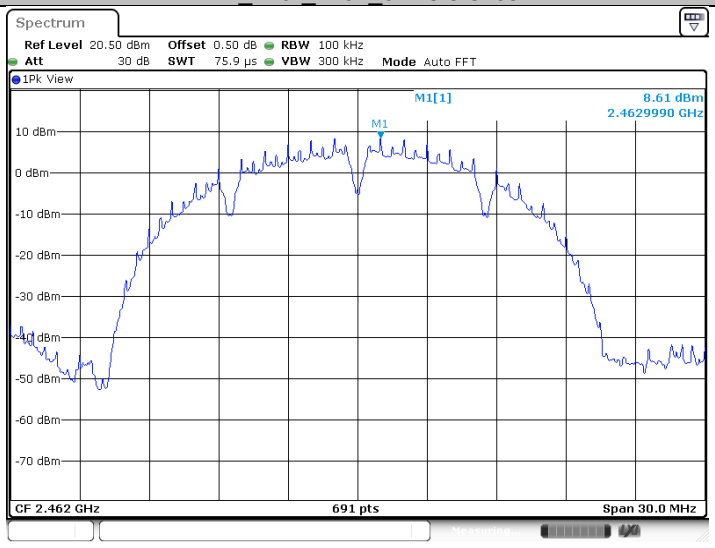

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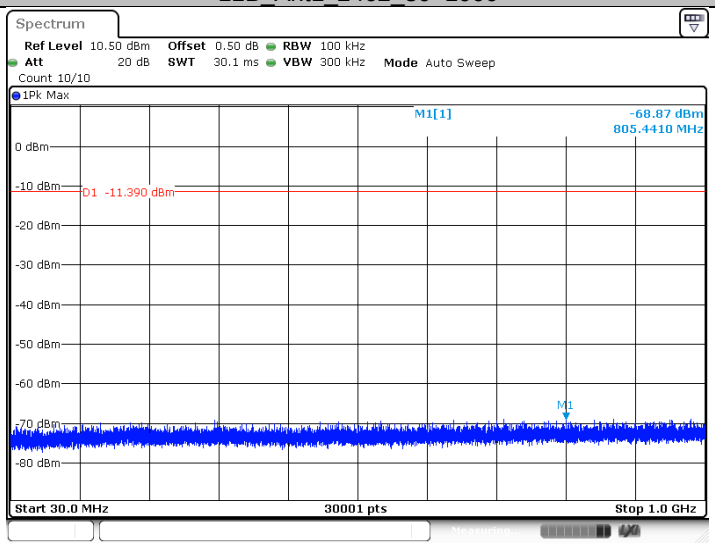

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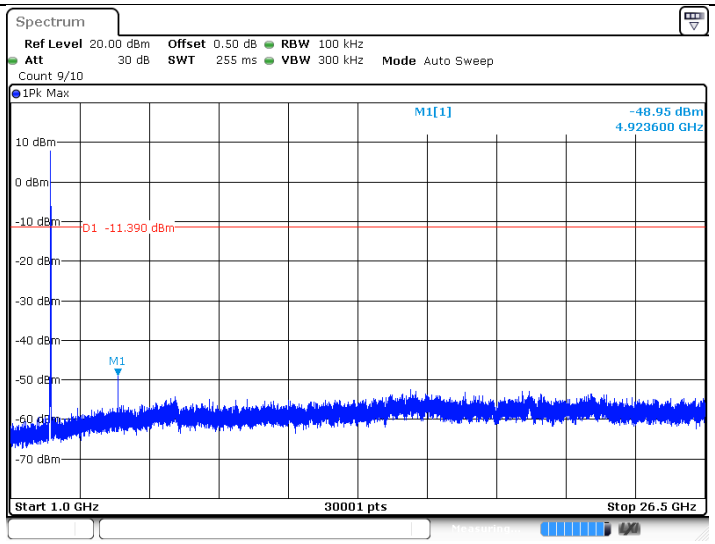

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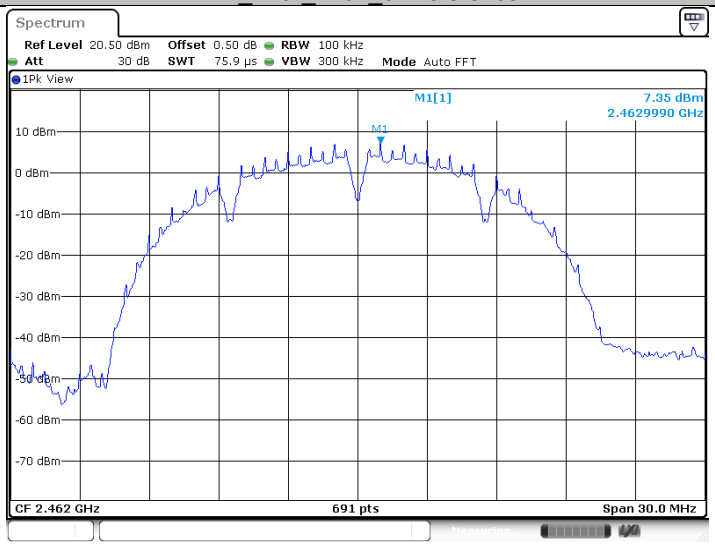

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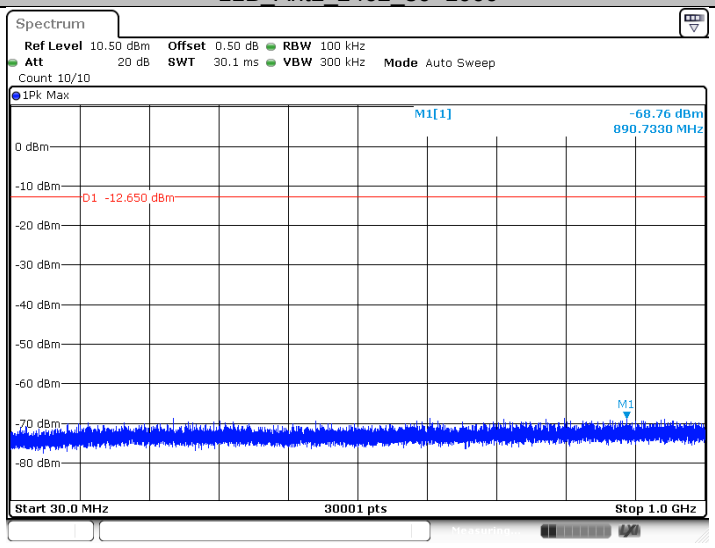

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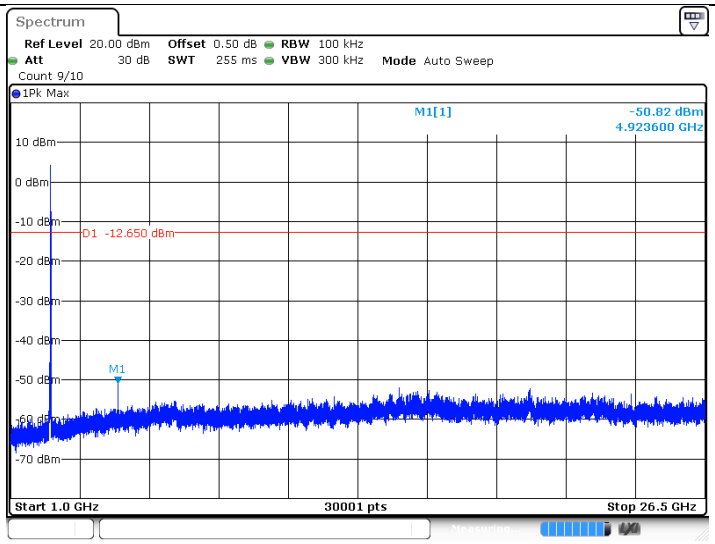

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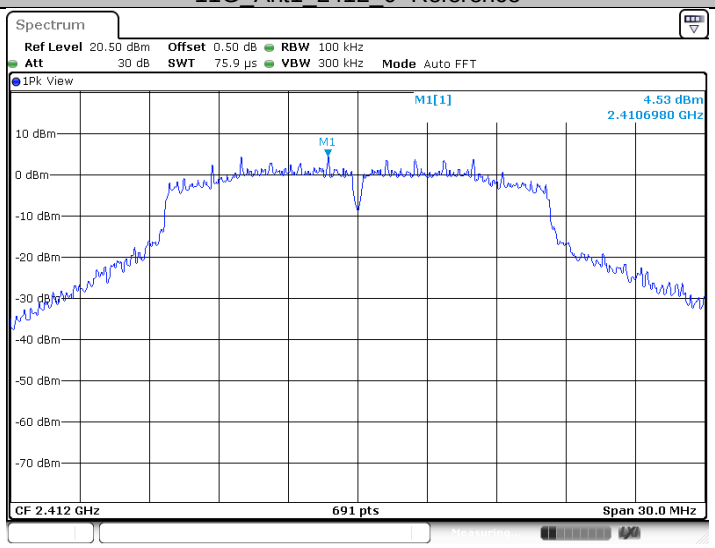

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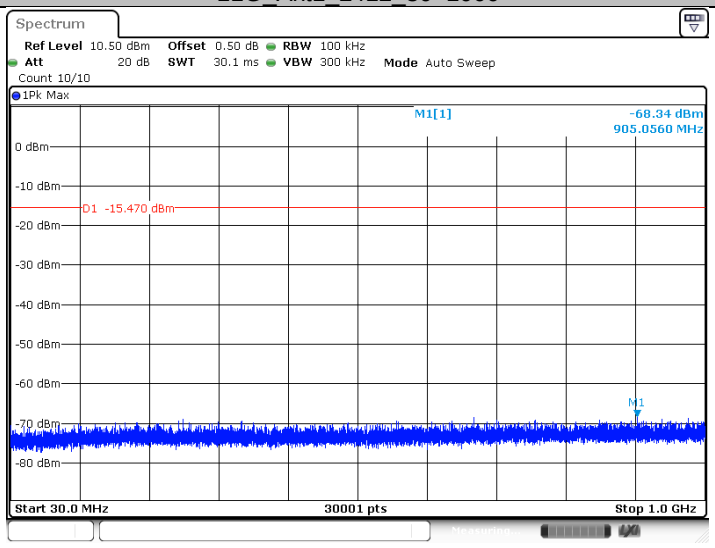

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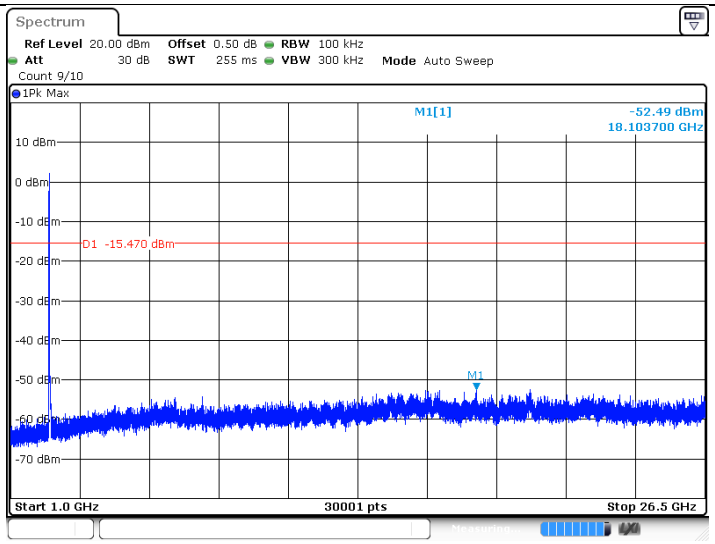

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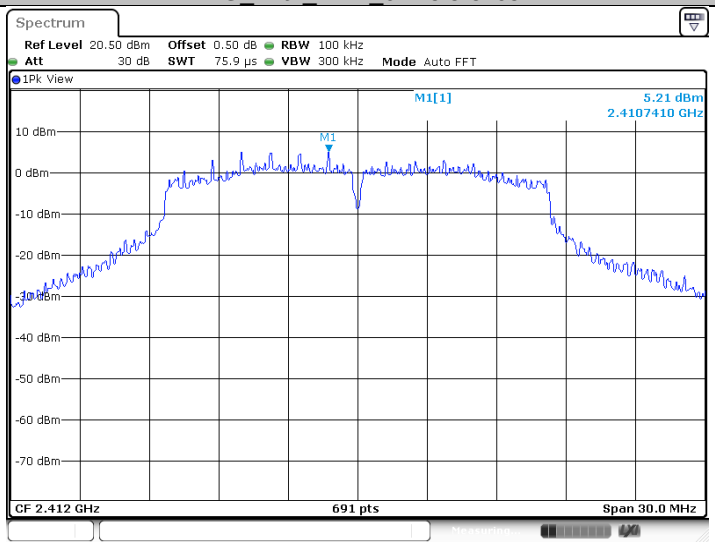

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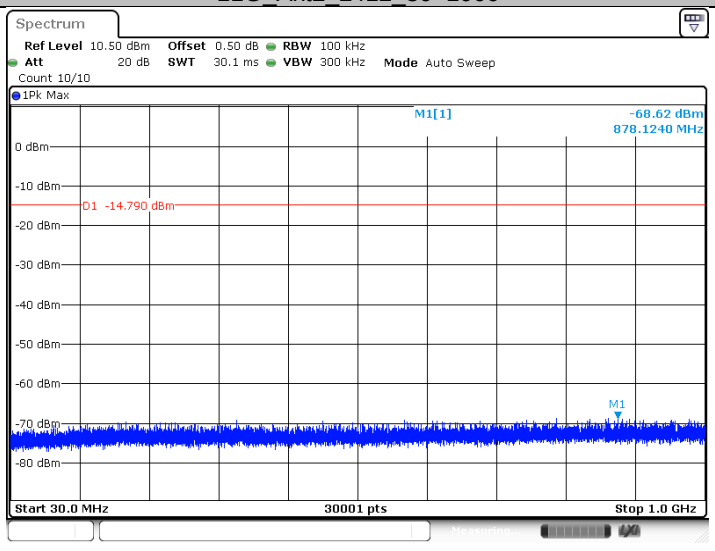

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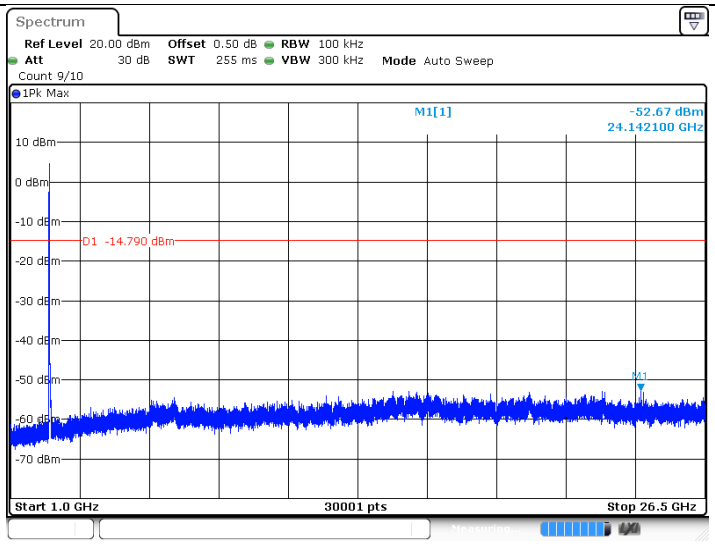

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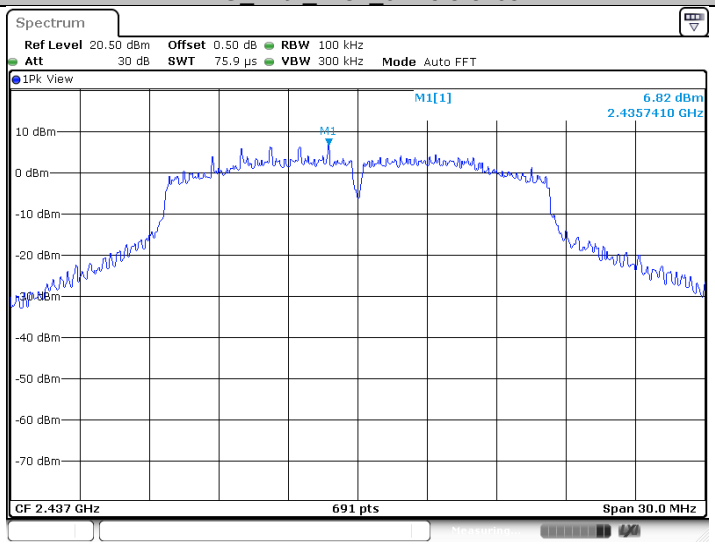

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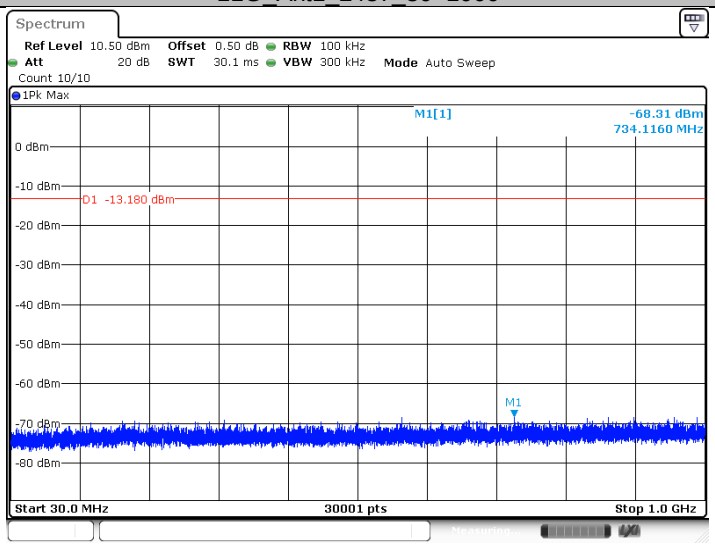

11G_Ant1_2437_1000~26500

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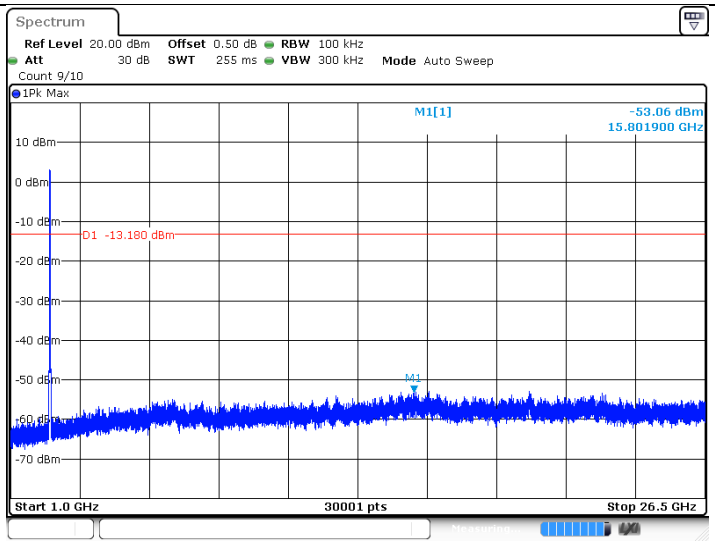

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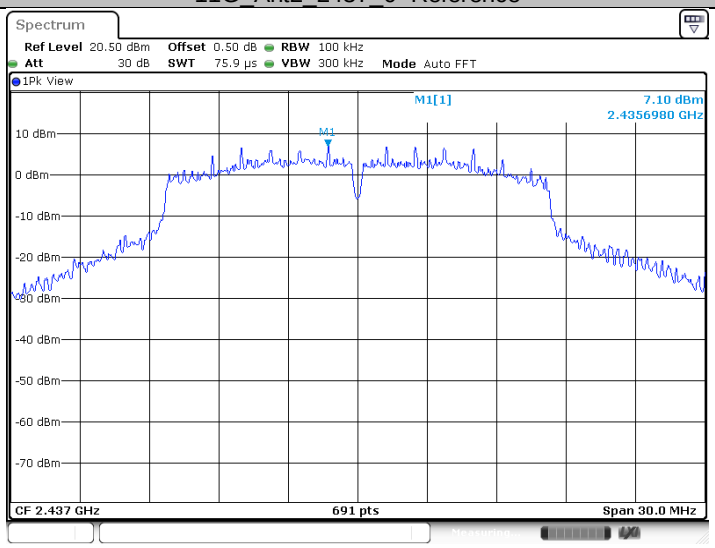

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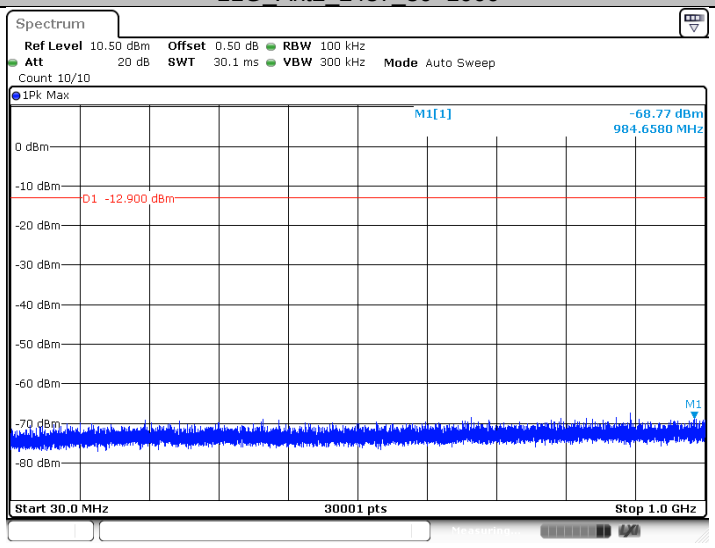

11G_Ant2_2437_1000~26500

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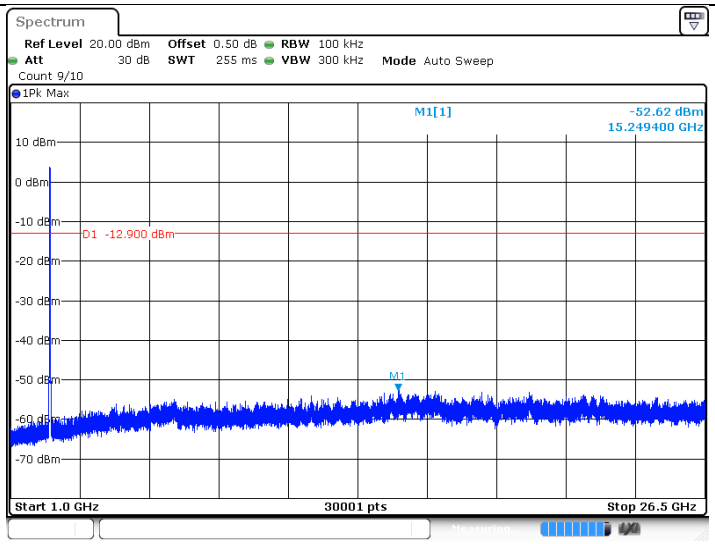

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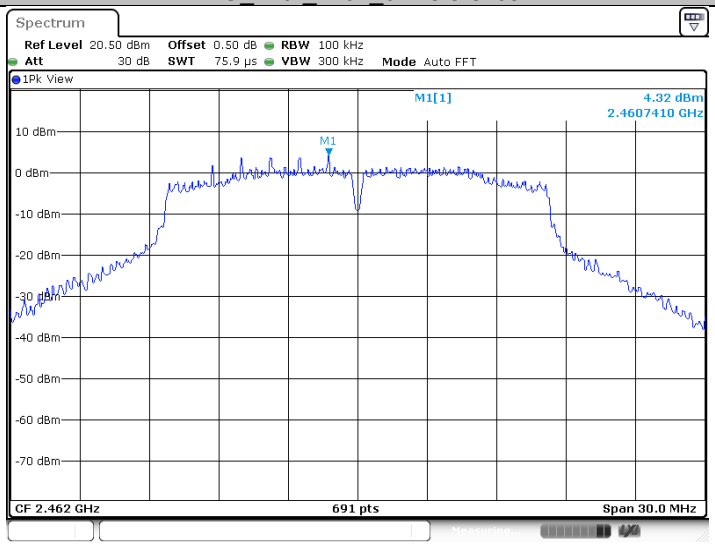

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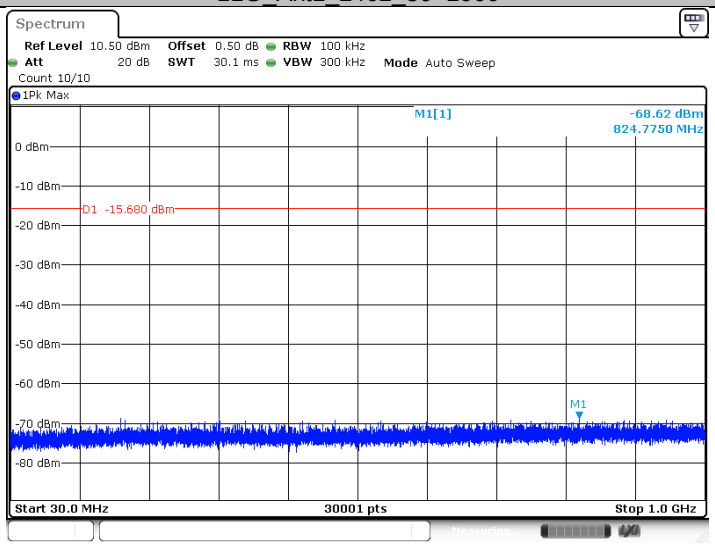

11G_Ant1_2462_1000~26500

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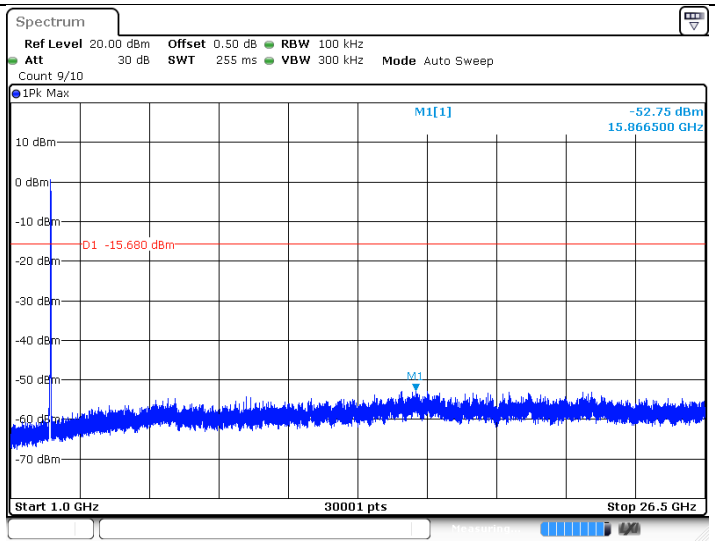

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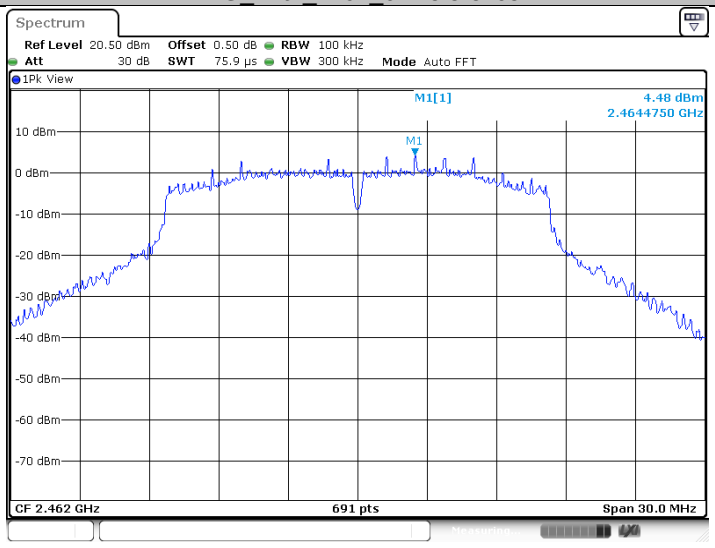

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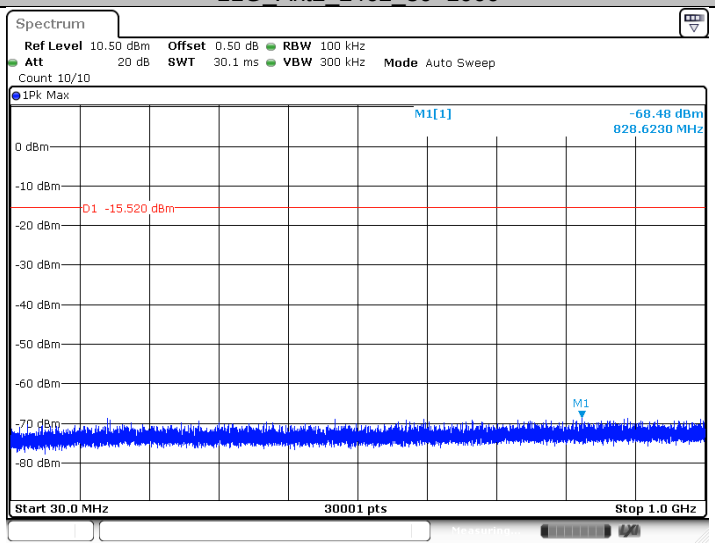

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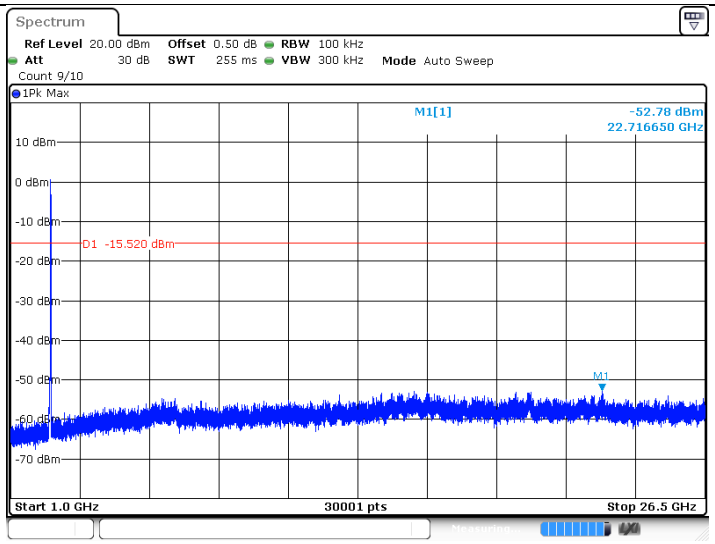

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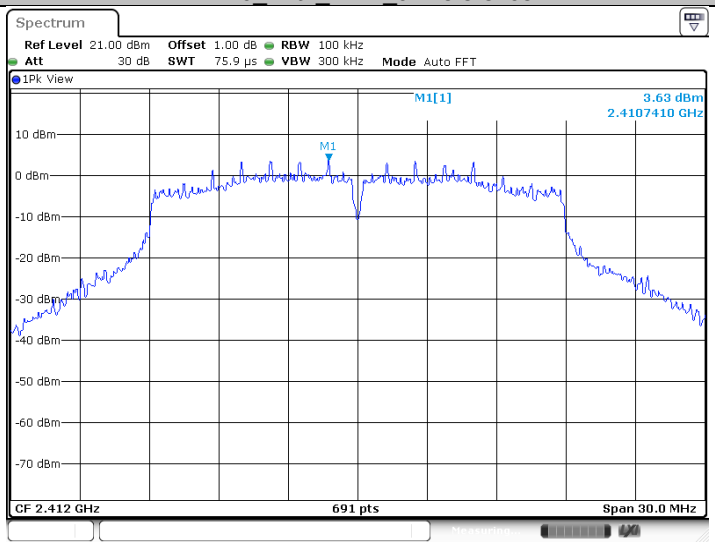

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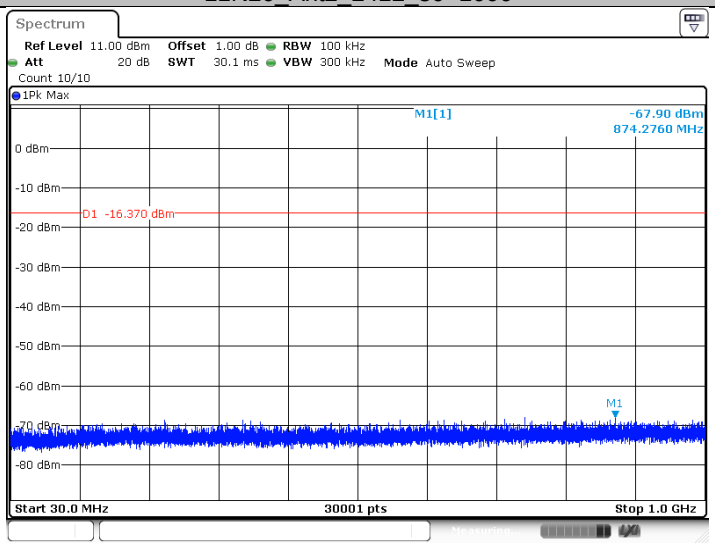

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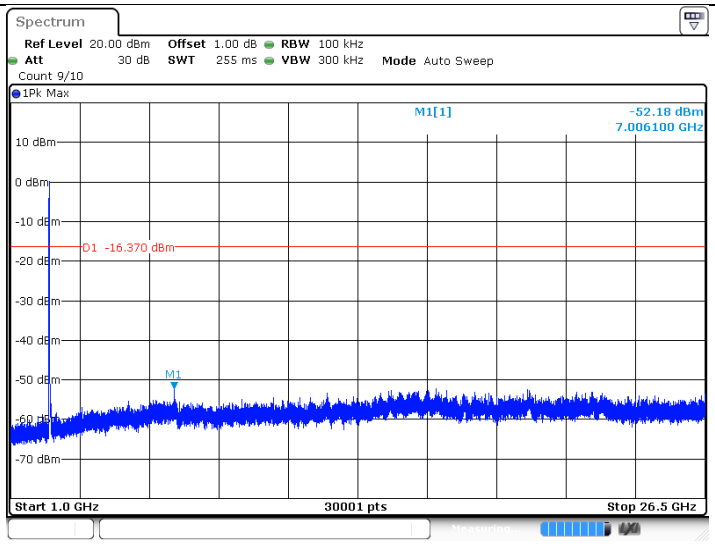

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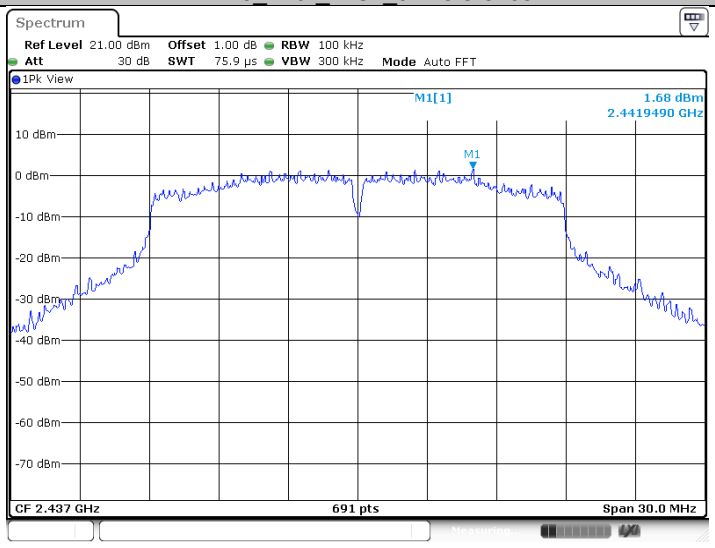

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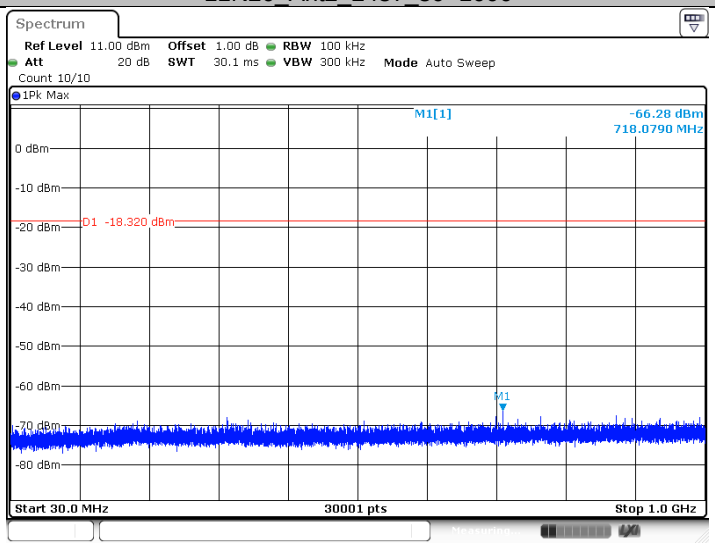

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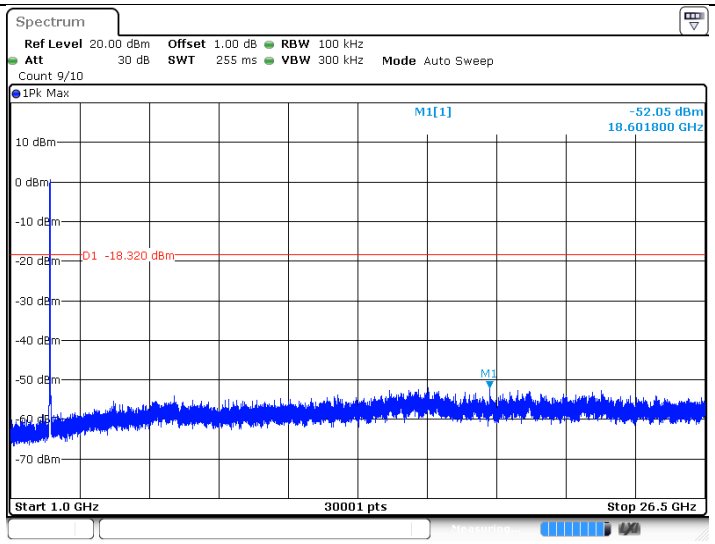

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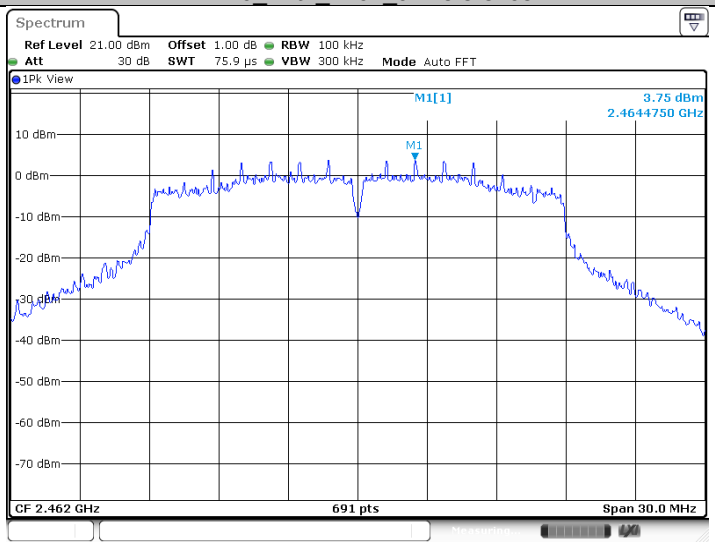

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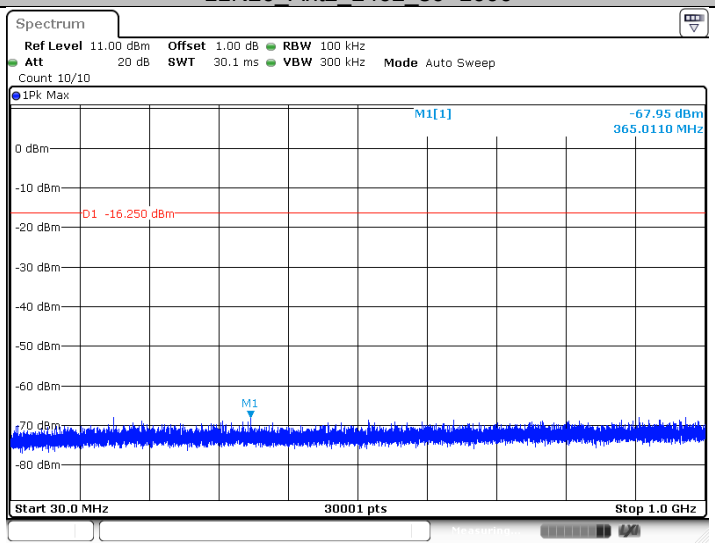

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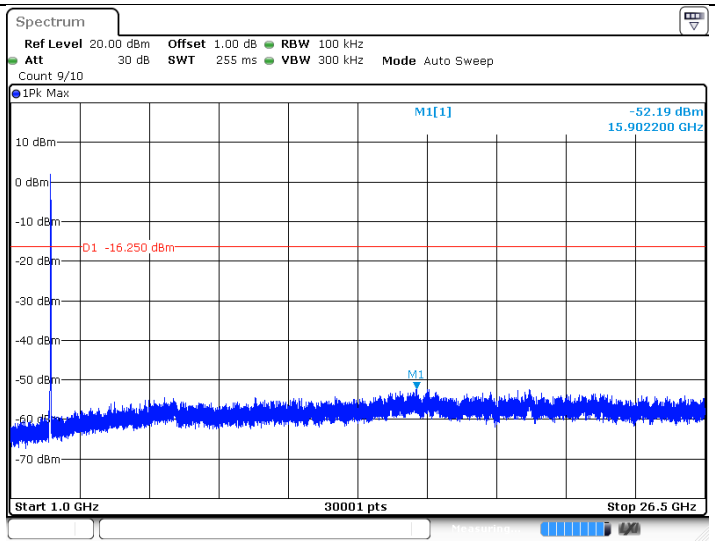

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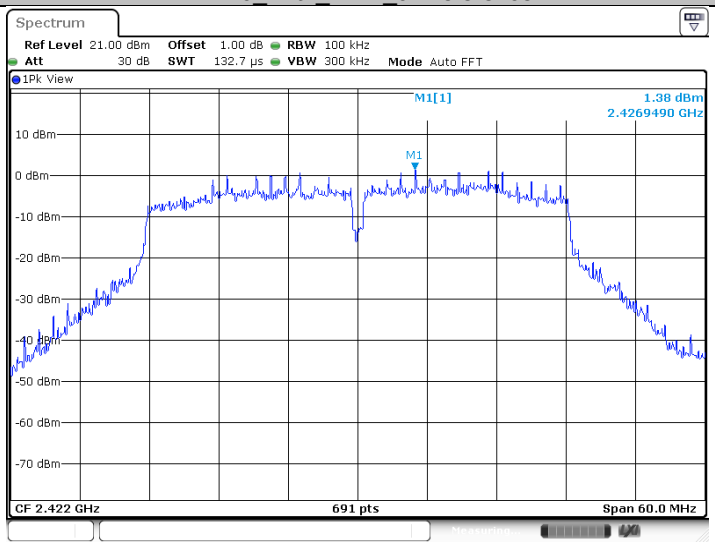

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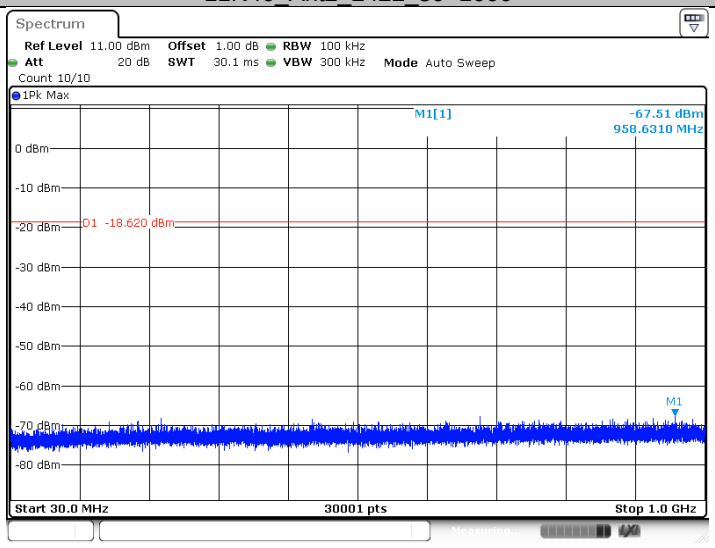

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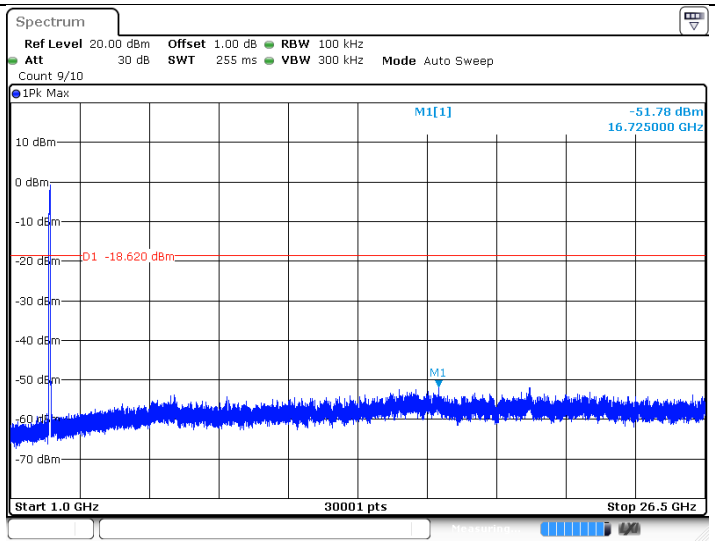

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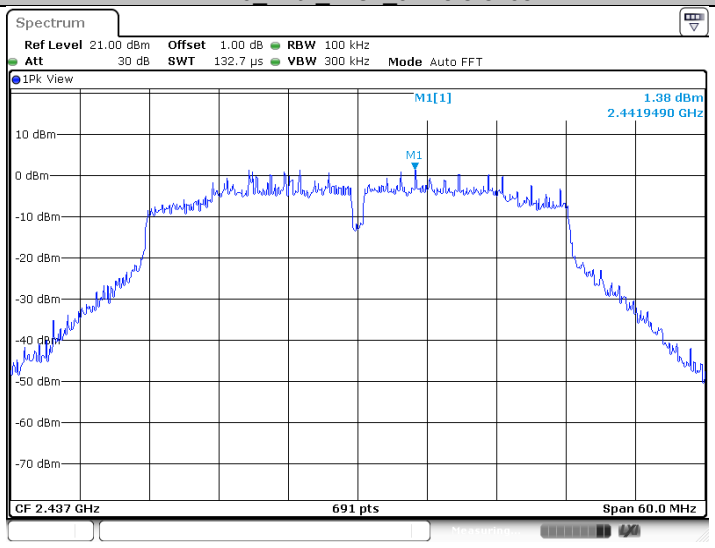

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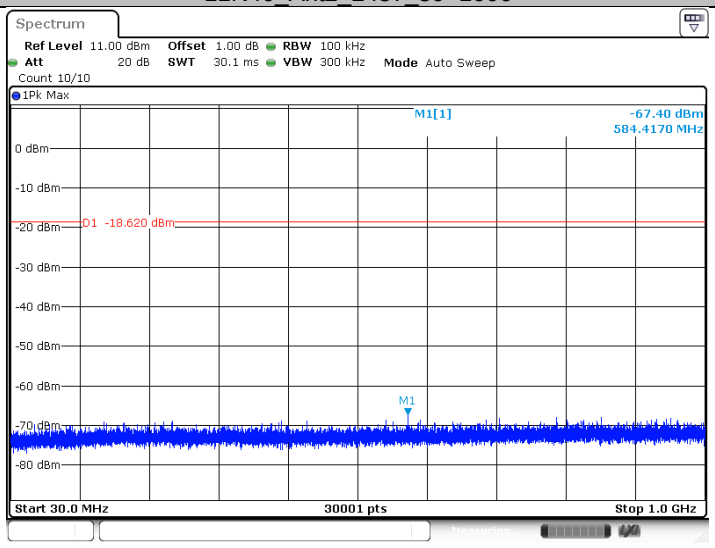

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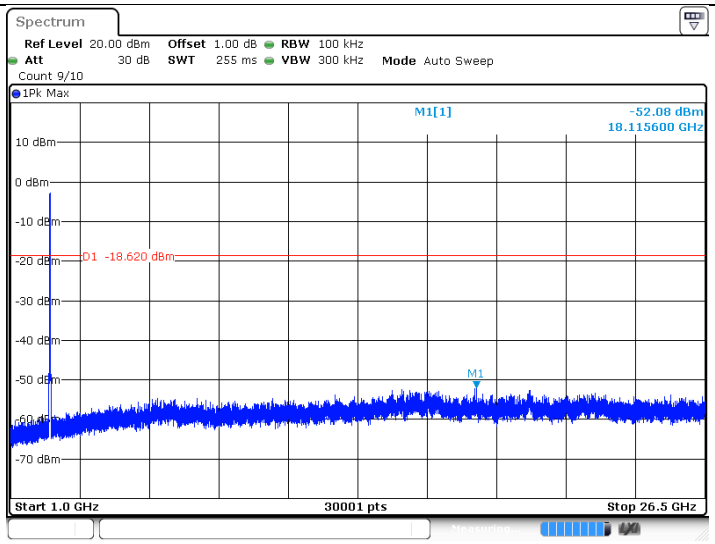

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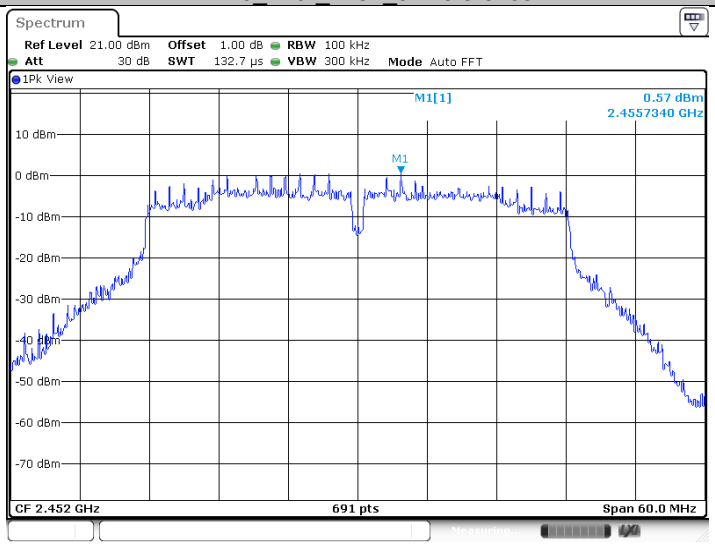

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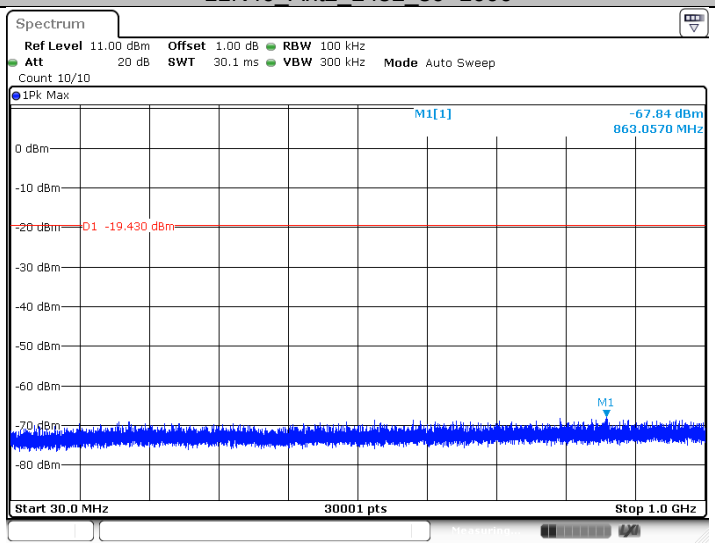

11N40_Ant2_2452_1000~26500

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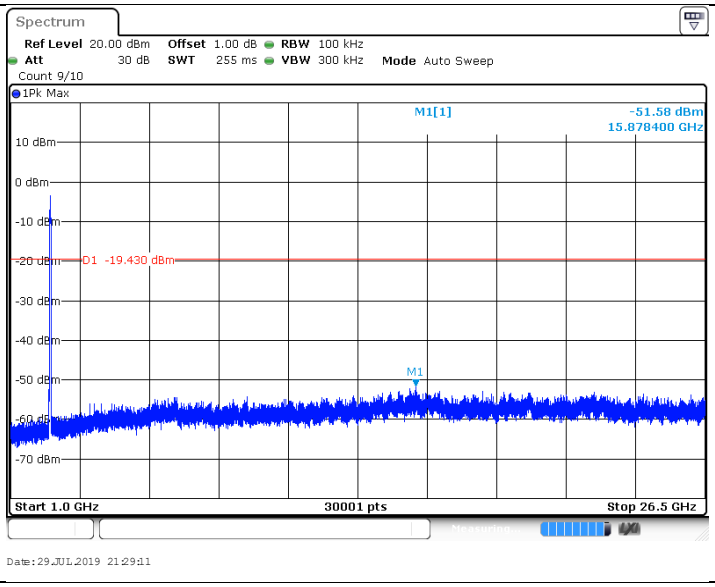

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9.6 Band edge

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≥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), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

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

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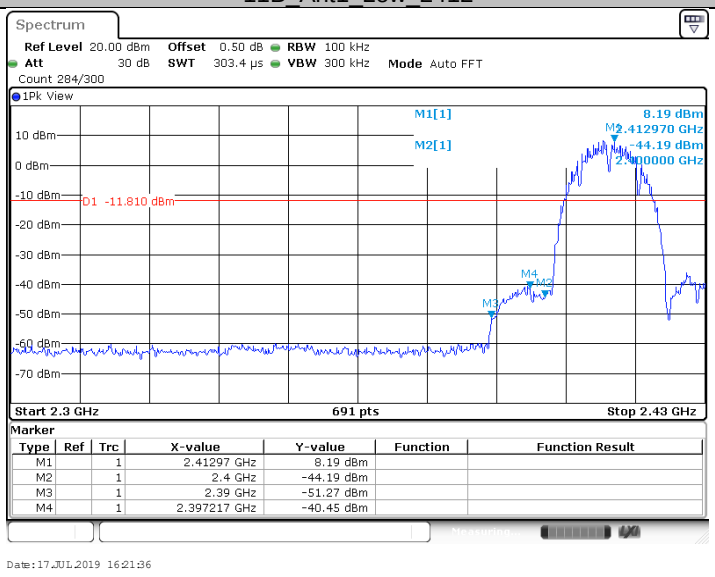
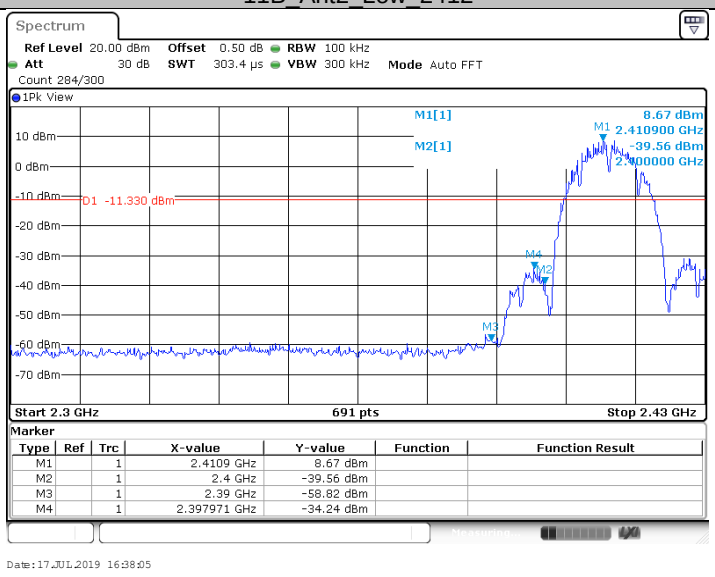
Test result

NOTE: We test Ant1 and Ant2 separately, only the WORSE case recorded in this report.

11B_Ant1_Low_2412



11B_Ant2_Low_2412



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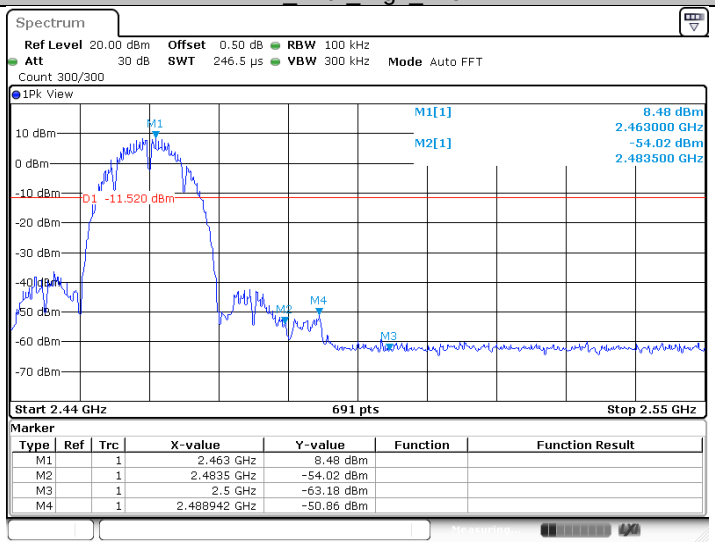
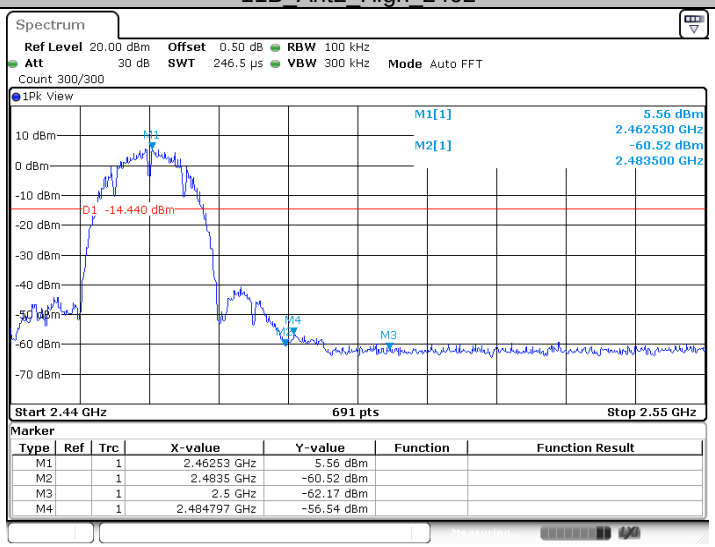
11B_Ant1_High_2462



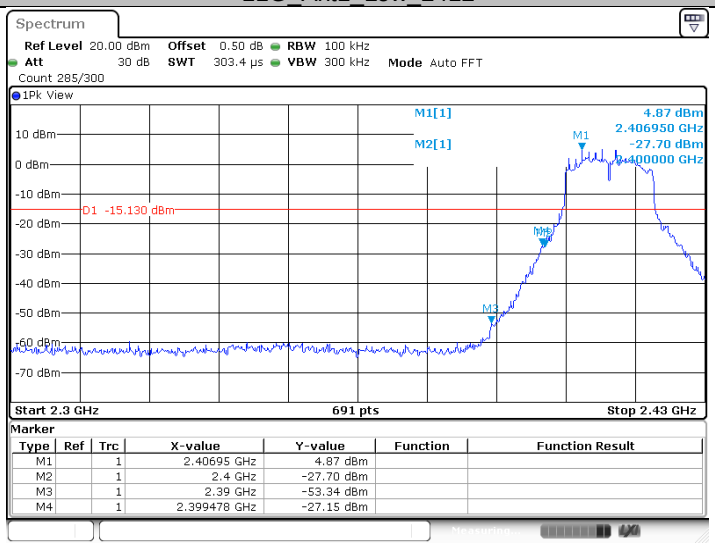
Date: 17.JUL.2019 16:26:23

11B_Ant2_High_2462



Date: 17.JUL.2019 16:44:36

11G_Ant1_Low_2412



Date: 17.JUL.2019 16:29:16

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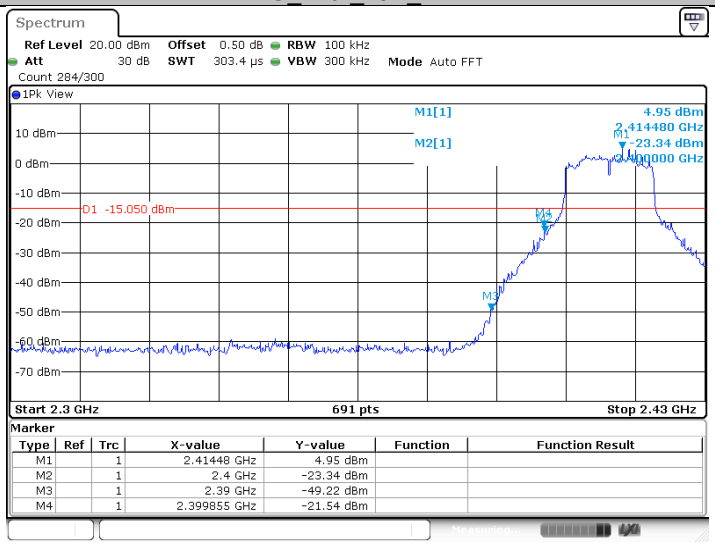
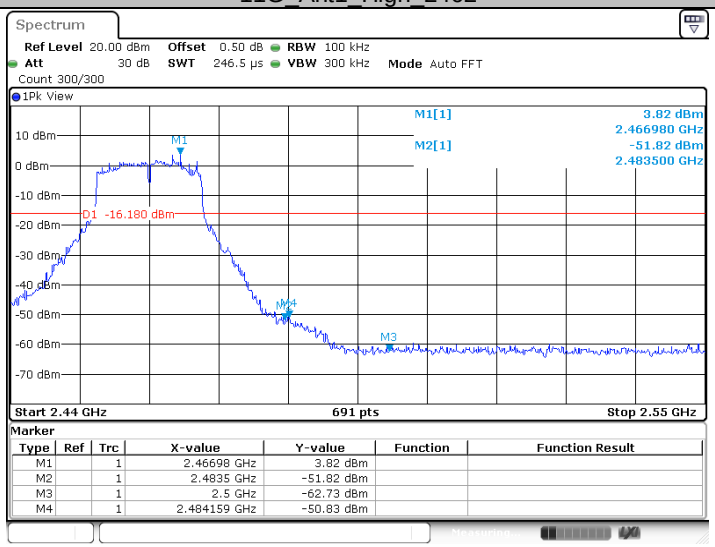
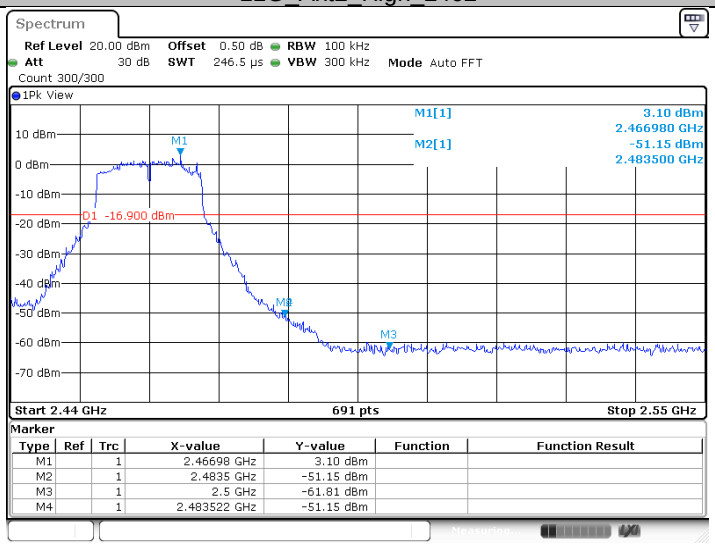
11G_Ant2_Low_2412



11G_Ant1_High_2462



11G_Ant2_High_2462



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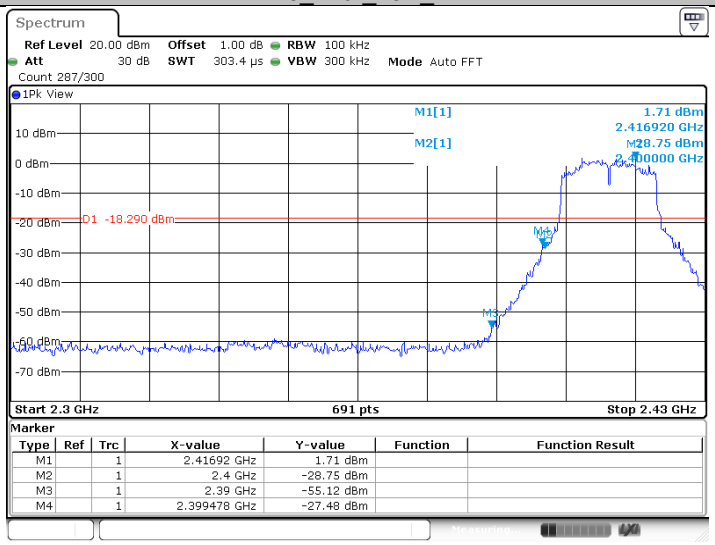
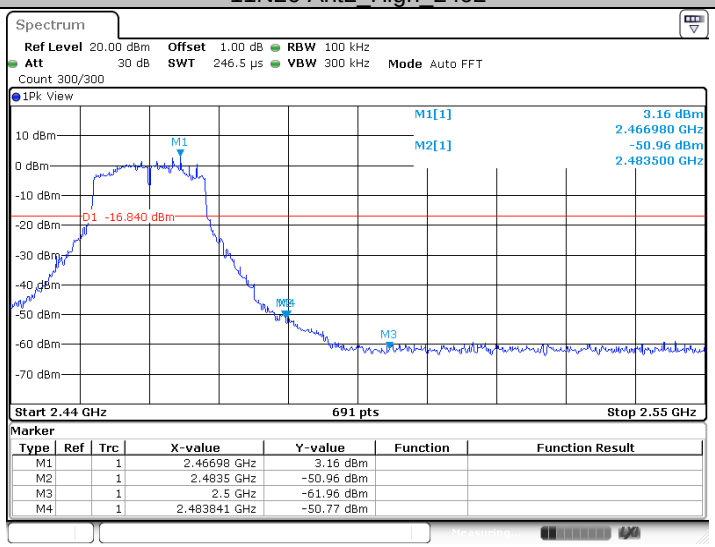
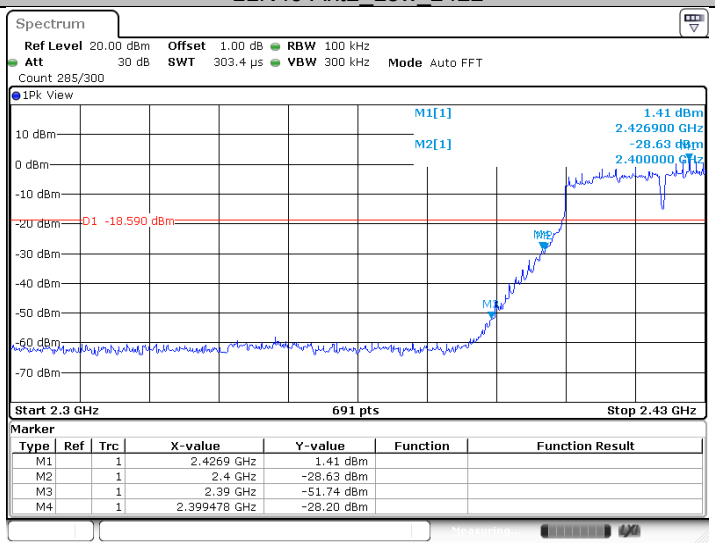
11N20_Ant2_Low_2412



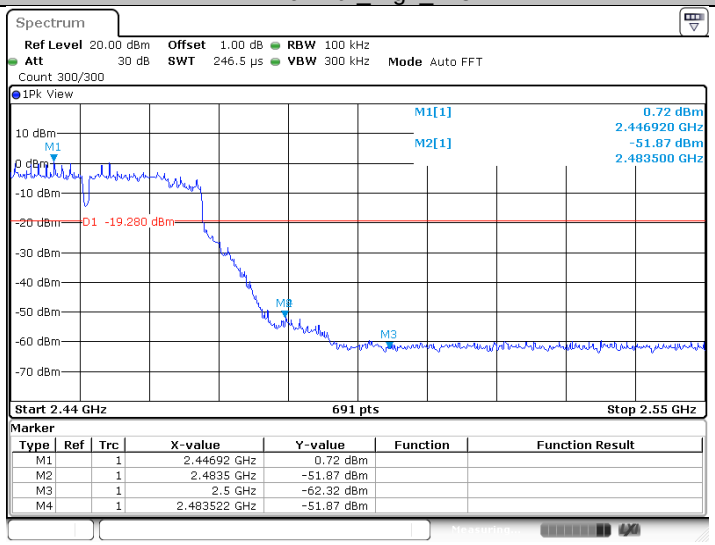
11N20 Ant2_High_2462



11N40 Ant2_Low_2422



11N40 Ant2_High_2452



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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 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 = 1 MHz.
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 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.

The only worse case (802.11n20_ MIMO modulation) test result is listed in the report.

Transmitting spurious emission test result as below:

802.11n20_ MIMO modulation 2412MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
	MHz	dBuV/m		dBµV/m		dBuV/m	(dB)	
30-1000MHz	43.15	21.45	H	40	QP	18.55	-24.9	Pass
	56.46	18.83	H	46	QP	21.17	-26.2	Pass
	*110.56	17.18	H	46	QP	26.32	-27.2	Pass
	52.04	22.49	V	40	QP	17.51	-24.6	Pass
	107.17	17.09	V	46	QP	26.41	-27.6	Pass
	235.80	24.17	V	46	QP	21.83	-23.9	Pass
1000-25000MHz	6258.75	37.63	H	74	PK	36.37	3.7	Pass
	9522.19	40.60	H	74	PK	33.40	9.1	Pass
	9303.28*	41.36	V	74	PK	32.64	8.3	Pass
	15306.09*	47.24	V	74	PK	26.76	18.5	Pass

802.11n20_ MIMO modulation 2437MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
	MHz	dBuV/m		dBµV/m		dBuV/m	(dB)	
1000-25000MHz	7042.50*	37.38	H	74	PK	36.62	5.8	Pass
	15865.78*	46.97	H	74	PK	27.03	18.2	Pass
	7531.41*	39.62	V	74	PK	34.38	6.1	Pass
	15855.94*	47.77	V	74	PK	26.23	18.2	Pass

802.11n20_ MIMO modulation 2462MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
	MHz	dBuV/m		dBµV/m		dBuV/m	(dB)	
1000-25000MHz	9379.69*	40.31	H	74	PK	33.69	8.6	Pass
	15303.75*	46.61	H	74	PK	27.39	18.5	Pass
	7409.06*	38.60	V	74	PK	35.40	6.0	Pass
	15387.19*	46.71	V	74	PK	27.29	18.4	Pass

Remark:

(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(2) 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.
(3) Level= Reading Level + Correction Factor
(4) 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)

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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
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
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
Test software	Tonscend	System for BT/WIFI	Version 2.6	N/A

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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	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz (for test using AMN ENV432 or ENV4200)	3.21dB
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%

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