FCC - TEST REPORT

Report Number	:	**64.790.18.04286.02-1**	Date of Issue:	June 10, 2020
Model	:	D04013		
Product Type	:	Smart Access Point Lite		
Applicant	:	ABB Xiamen Smart Technology Co., Ltd.		
Manufacturer	:	ABB Xiamen Smart Technology Co., Ltd.		
Address	:	No.7 Fangshan South Road, Torch High Technology,Development Zone (Xiang An), Industrial Zone, 361000 Xiamen S.E.Z, Fujian Province, PEOPLE'S REPUBLIC OF CHINA		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	56		

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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

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

FCC Registration No.: 514049
IC registration number: 10320A

3 Description of the Equipment Under Test

Product:	Smart Access Point Lite
Model no.:	D04013
FCC ID:	2AEBL-D04012
Options and accessories:	Nil
Rating Input:	DC 24V
RF Transmission Frequency:	2412MHz-2462MHz
No. of Operated Channel:	802.11b/g/n20: 11 channel 802.11n40: 7 channel
Modulation:	802.11b: CCK DSSS 802.11g: OFDM 802.11n20: OFDM 802.11n40: OFDM
Antenna Type:	Internal antenna
Antenna Gain:	ANT1:3.6dBi ANT2:3.6dBi
Description of the EUT:	The EUT is a Smart Access Point Lite of a door entry system.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2019 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 v05r02 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
§15.207	Conducted emission AC power port	10	Pass
§15.247(b)(1)	Conducted peak output power	13	Pass
§15.247(e)	Power spectral density	14	Pass
§15.247(a)(2)	6dB bandwidth	20	Pass
§15.247(a)(1)	20dB bandwidth and 99% 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	26	Pass
§15.247(d)	Band edge	43	Pass
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter	48	Pass
§15.203	Antenna requirement	See note 1	Pass

Note 1: N/A=Not Applicable.
Note 2: The EUT uses two internal antennas (antenna 1 support 802.11b/g/n(20)/n(40); antenna 2 only support 802.11n(20)), both gains are 3.6dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

EUT supports Wi-Fi functions: 2412MHz - 2472MHz for 2.4GHz Wi-Fi; 5150 - 5250 MHz, 5250 - 5350 MHz, 5470 - 5725 MHz and 5725-5850 MHz for 5GHz Wi-Fi. There are two antennas for 2.4GHz Wi-Fi band: antenna 2.4G-1 supports 802.11b/g/n(20)/n(40), antenna 2.4G-2 only support 802.11n(20).
This submittal(s) (test report) is intended for FCC ID:2AEBL-D04012 and only for the 2.4GHz Wi-Fi band. It complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules. D04012 has been approved by FCC with FCC ID:2AEBL-D04012 and the report number was 64.790.18.04286.01-1.
The differences of new model D04013 and approved original model D04012 as below:
Adding one RJ45 port (extend from the original chip), and also add the encryption chip, no any change of RF part.
1. Extend the second RJ45 port by switch from the chip KSZ8463 of original board, add the RJ45 and transformer and relevant components.
2. Add the encryption chip SLB9670, communicated with CPU by SPI.
According to a technical evaluation, there is no change about RF part, so only conducted emission and radiated spurious emissions tests were performed on D04013, other test data are referred from 64.790.18.04286.01-1.

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: 2018-07-10

Testing Start Date: 2018-07-13

Testing End Date: 2020-03-13

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Reviewed by:	Prepared by:	Tested by:
Tony Liu	Kevin Ouyang	Louise Liu

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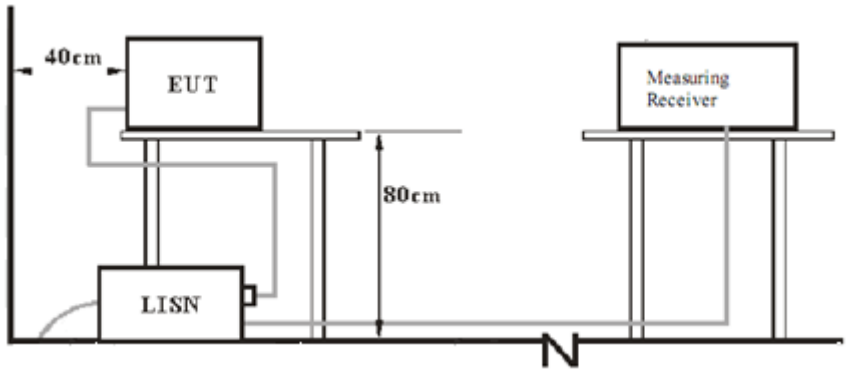
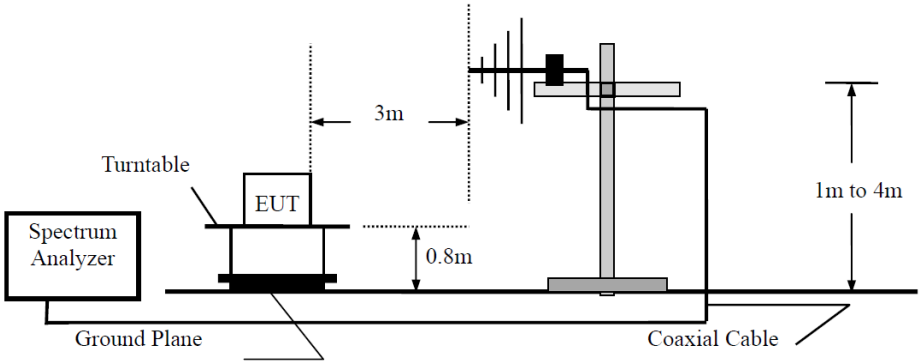
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

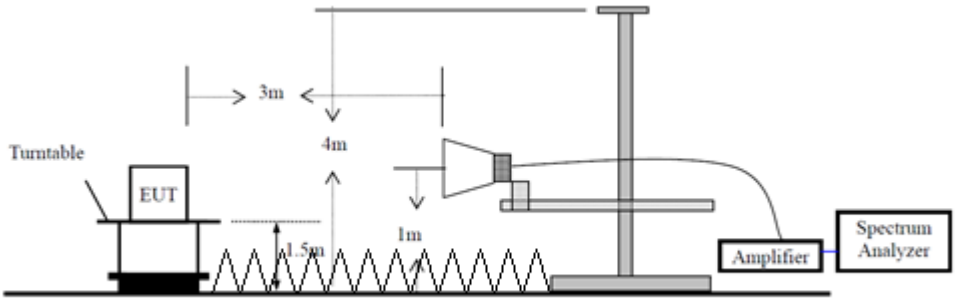


7.2 Radiated test setups

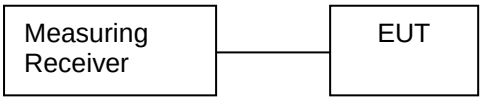
Below 1GHz



Above 1GHz



7.3 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MODEL NO.(SHIELD)	MANUFACTURER
IP touch 7, LAN+WiFi, T-loop	H8236-.	ABB
IP touch 10, LAN / WLAN	H8237-.	ABB
IP touch 7, LAN+LAN, T-loop	H8236-*	ABB
IP touch 10, LAN / LAN	H8237-*	ABB
Outdoor station Bar pushbutton module	5138.SP.	ABB
Outdoor station Round pushbutton module	5138.RP.	ABB
Outdoor station keypad module	5138.K-.	ABB
System controller	YSM01	ABB
POE Switch	TL-SL1218P	TP-LINK

Test channel & mode:
The was Interactive Tablet configured using a proprietary communication interface provided by the client. The interface allows channel control required to support the evaluation.

Duty cycle during test: 100%

802.11b/802.11g/802.11n-HT20

Test mode	Channel	Frequency(MHz)
TX	1	2412
TX	6	2437
TX	11	2462

802.11n-HT40

Test mode	Channel	Frequency(MHz)
TX	3	2422
TX	6	2437
TX	9	2452

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

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

Remark: “*” Decreasing linearly with logarithm of the frequency

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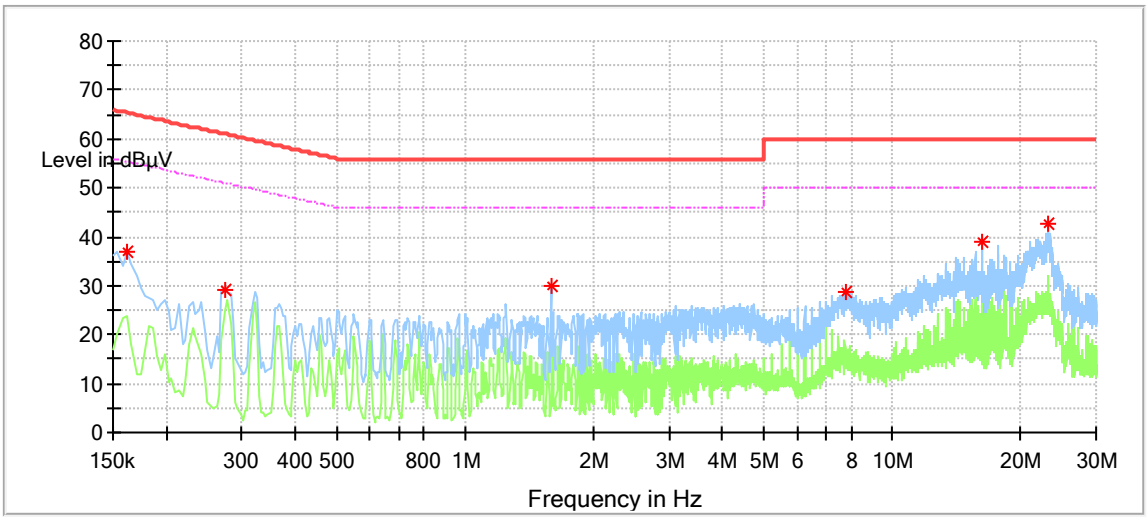
Conducted Emission

Product Type	:	Smart Access Point Lite
M/N	:	D04013
Operating Condition	:	WiFi function on.
Test Specification	:	L
Comment	:	AC 120V/60Hz
Test date	:	2020-01-10



No significant emission was detected within 10 dB to limit

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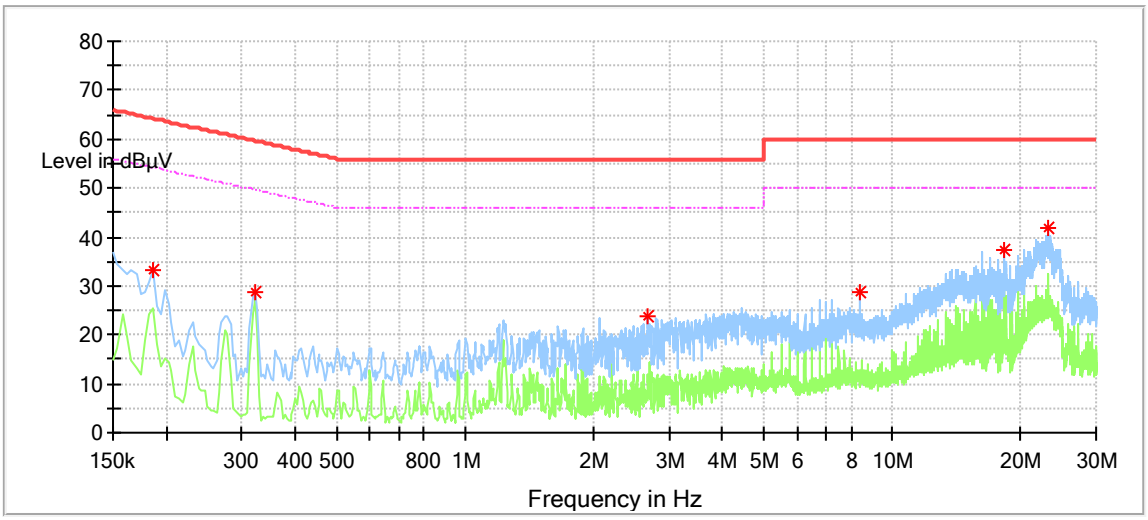
Conducted Emission

Product Type	:	Smart Access Point Lite
M/N	:	D04013
Operating Condition	:	WiFi function on.
Test Specification	:	N
Comment	:	AC 120V/60Hz
Test date	:	2020-01-10



No significant emission was detected within 10 dB to limit

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9.2 Conducted peak 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 peak output power limit as below:

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

Conducted peak output power

TestMode	Antenna	Channel (MHz)	Peak power		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Verdict
			Chain1 (dBm)	Chain2 (dBm)				
11B	Ant1	2412	12.95			12.95	30	PASS
		2437	13.51			13.51	30	PASS
		2462	13.31			13.31	30	PASS
11G	Ant1	2412	18.89			18.89	30	PASS
		2437	18.67			18.67	30	PASS
		2462	18.53			18.53	30	PASS
11N20	Ant1&2	2412	17.46	18.48	126.2	21.01	28	PASS
		2437	17.70	18.91	136.7	21.36	28	PASS
		2462	17.47	18.95	134.3	21.28	28	PASS
11N40	Ant1	2422	17.82			17.82	30	PASS
		2437	17.87			17.87	30	PASS
		2452	17.85			17.85	30	PASS

Remark:
Chain1(antenna 2.4G-1) supports 802.11b/g/n(20)/n(40), Chain2(antenna 2.4G-2) only support 802.11n(20).
Per KDB 662911, the conducted powers Chain1 and Chain2 were first measured separately during MIMO transmission as shown in section above. The measured values were then summed in linear power units then converted back to dBm.
Note: For 11N20, directional gain shall be calculated as the sum of 10 log (number of array elements) plus the directional gain of the element having the highest gain. directional gain= 10log(2)+3.6 dBi = 6.6 dBi > 6 dBi, the limit of 11N20 shall be reduced by 2dB.

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9.3 Power spectral density

Test Method

1. Connect EUT test port to spectrum analyzer.
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
≤ 8 dBm/3KHz

TestMode	Antenna	Channel (MHz)	PSD measured		Total PSD (dBm/3KHz)	Limit (dBm/3KHz)	Verdict
			Chain1 (dBm/3KHz)	Chain2 (dBm/3KHz)			
11B	Ant1	2412	-12		-12	8	PASS
		2437	-0.6		-0.6	8	PASS
		2462	-11.72		-11.72	8	PASS
11G	Ant1	2412	-14.32		-14.32	8	PASS
		2437	-15.28		-15.28	8	PASS
		2462	-14.75		-14.75	8	PASS
11N20	Ant1&2	2412	-15.32	-4.6	-4.24	6	PASS
		2437	-14.14	-4.17	-3.75	6	PASS
		2462	-16.24	-4.23	-3.96	6	PASS
11N40	Ant1	2422	-18.12		-18.12	8	PASS
		2437	-17.94		-17.94	8	PASS
		2452	-19.8		-19.8	8	PASS

Remark: For 11N20, directional gain shall be calculated as the sum of 10 log (number of array elements) plus the directional gain of the element having the highest gain.
So directional gain= 10log(2)+3.6 dBi = 6.6 dBi > 6 dBi, the limit of 11N20 shall be reduced by 2dB.

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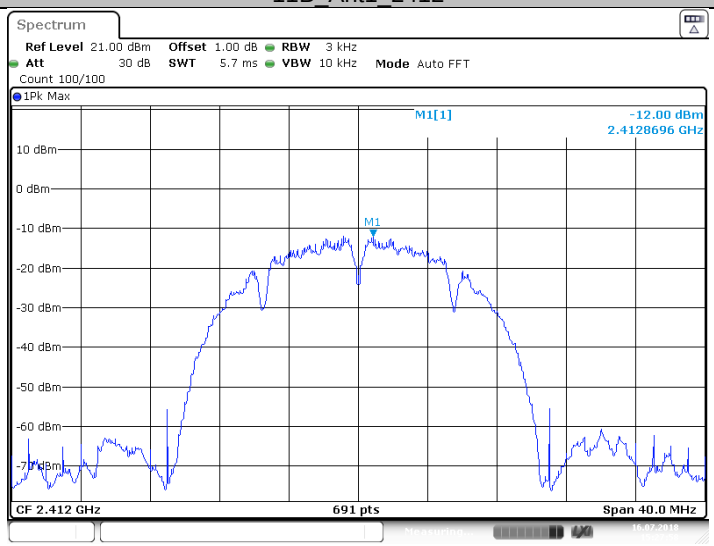
Test Graphs

11B_Ant1_2412



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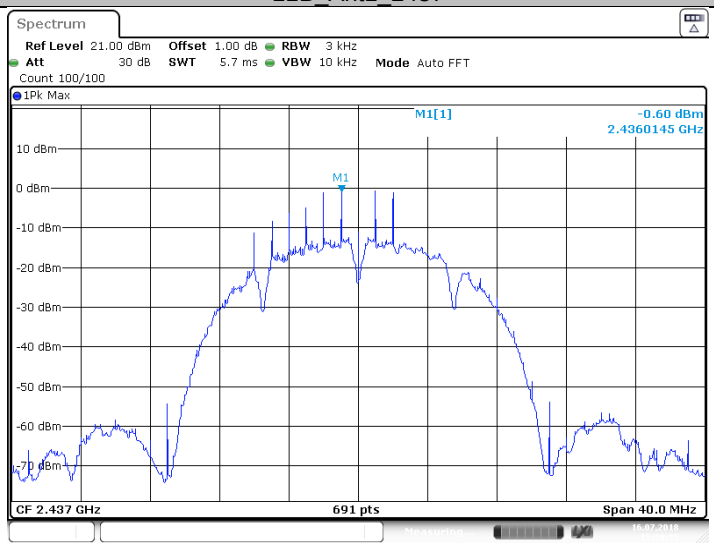

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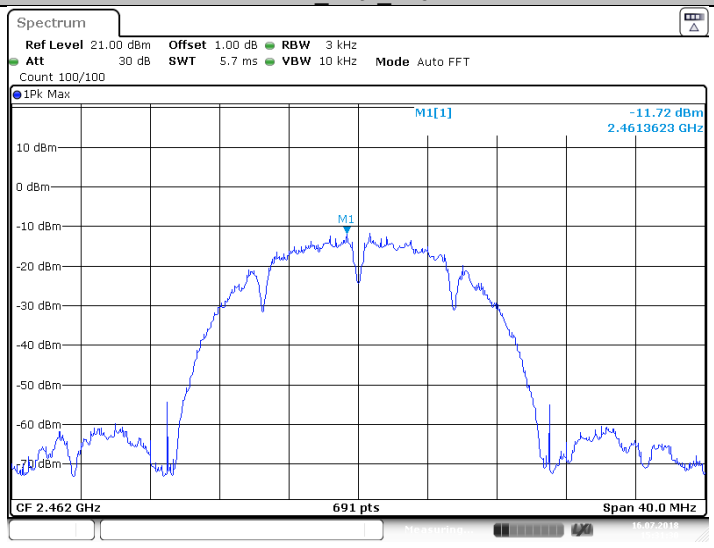

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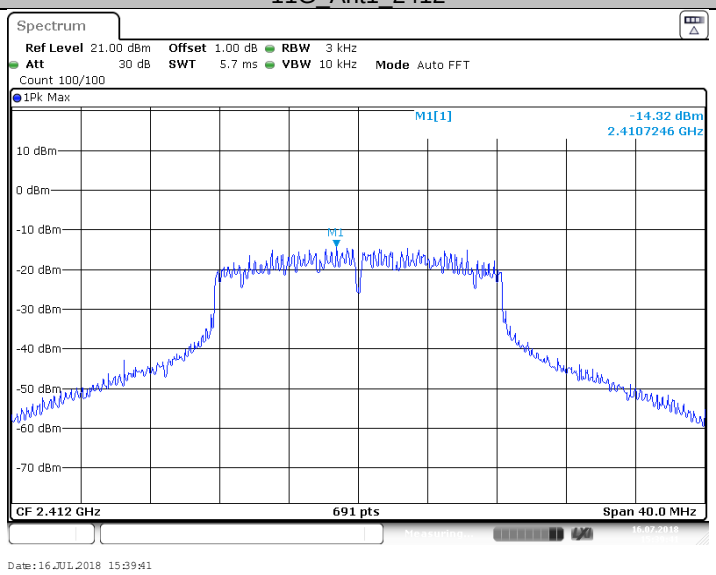
11G_Ant1_2412



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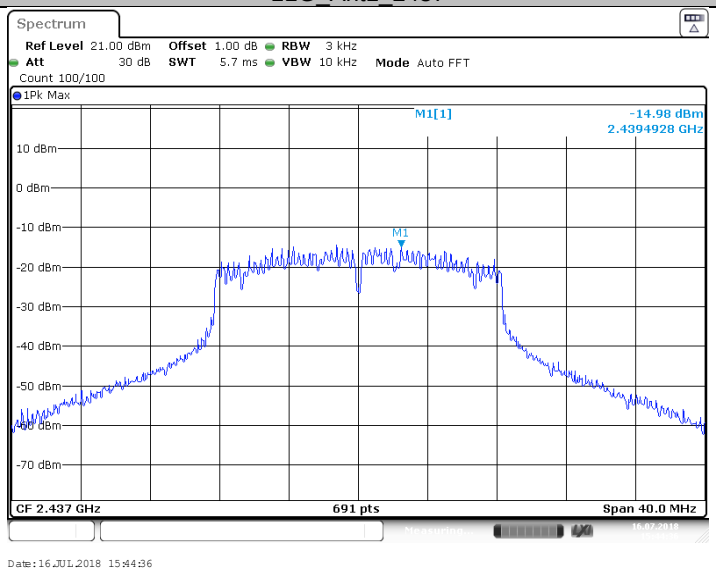

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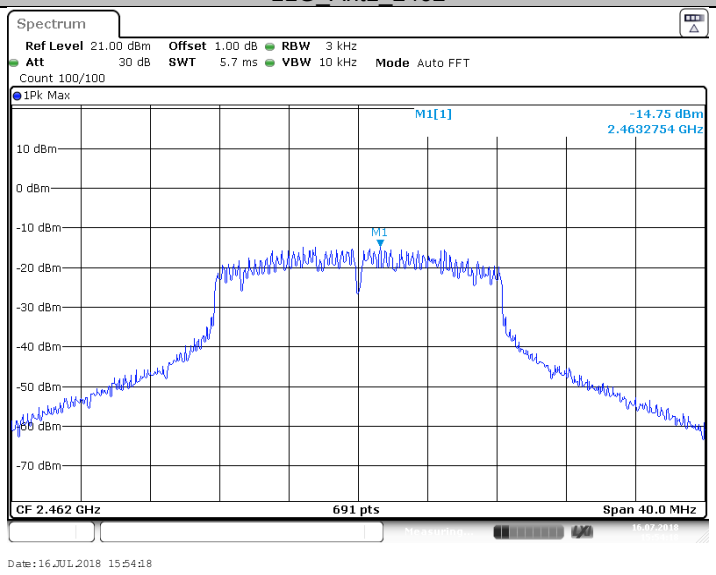

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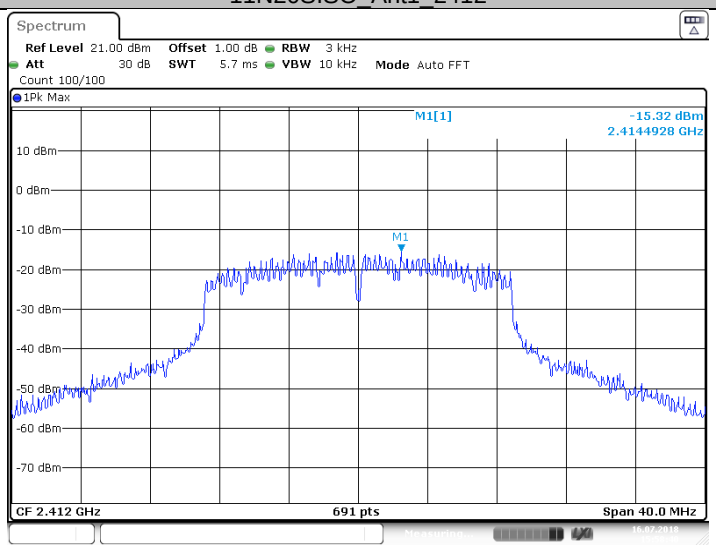 Date:16.JUL.2018 15:58:41
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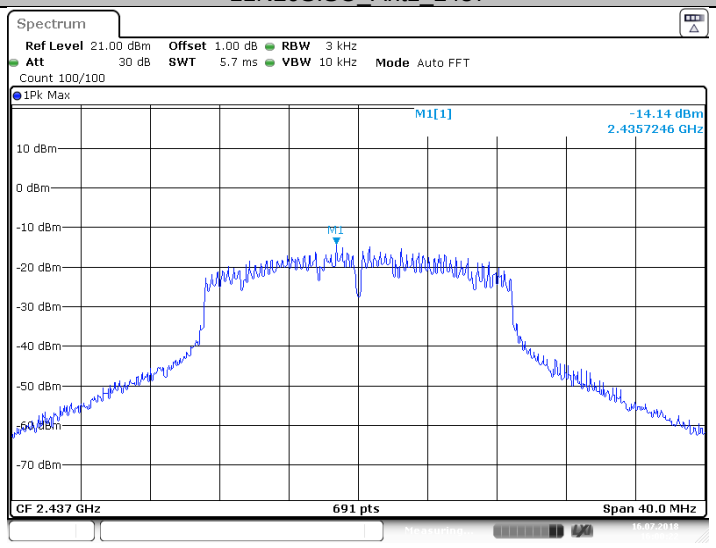 Date:16.JUL.2018 16:00:22
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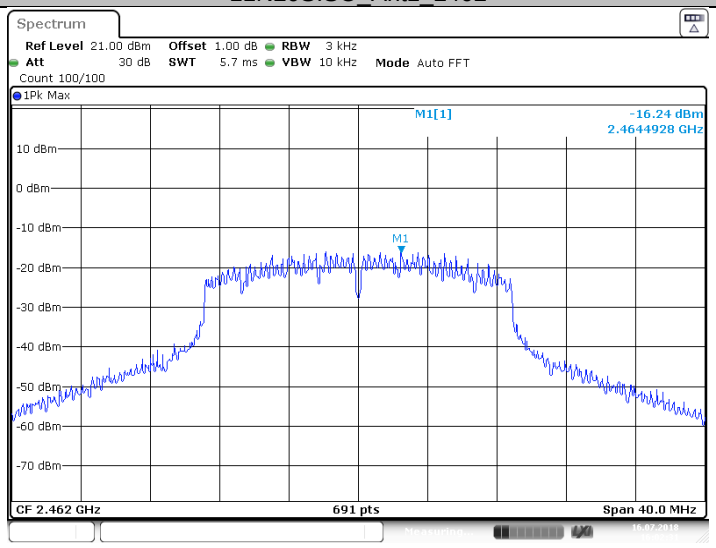 Date:16.JUL.2018 16:02:31

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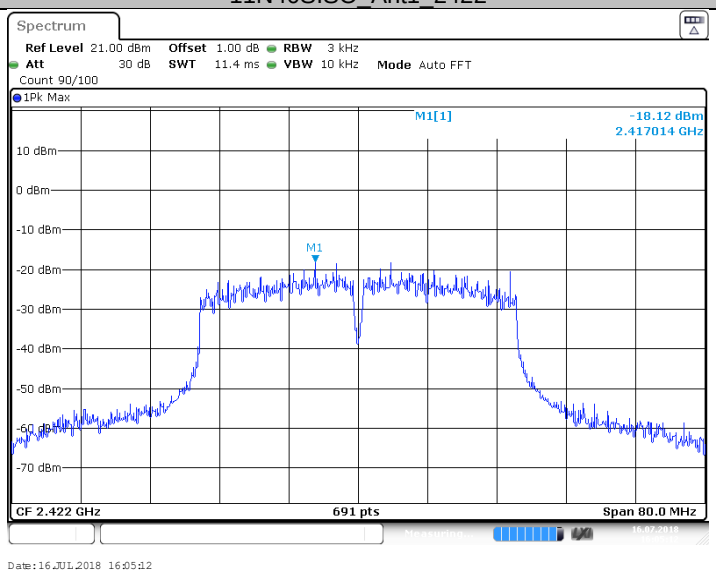
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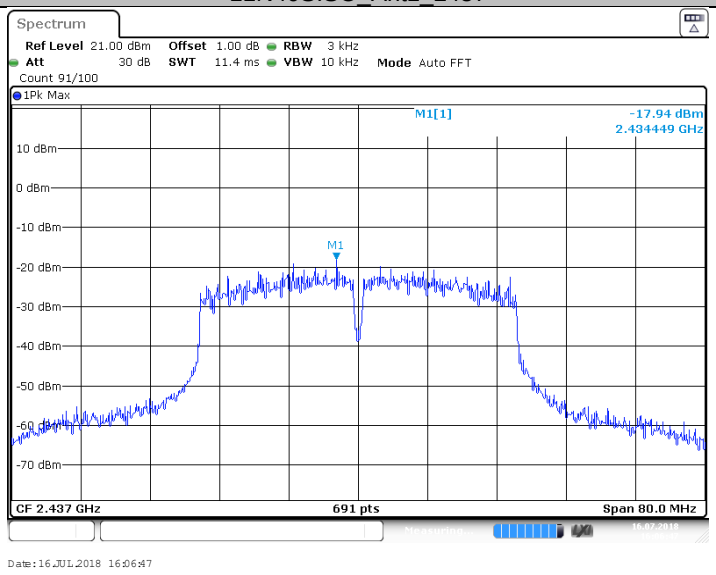
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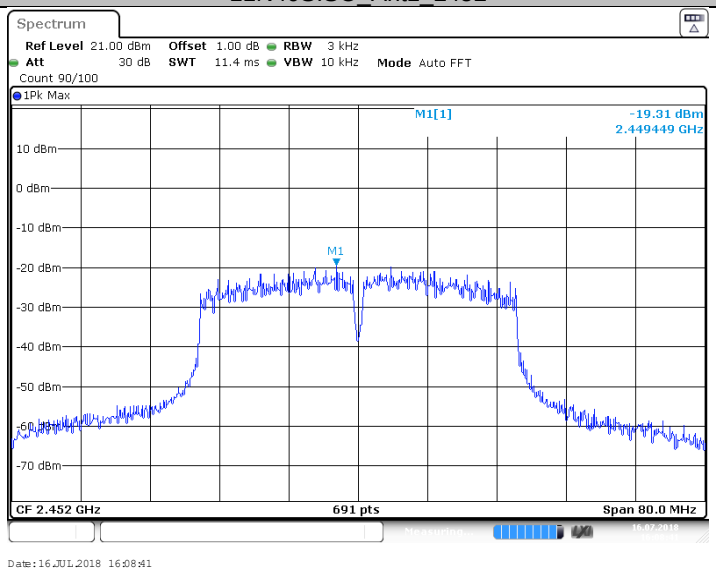

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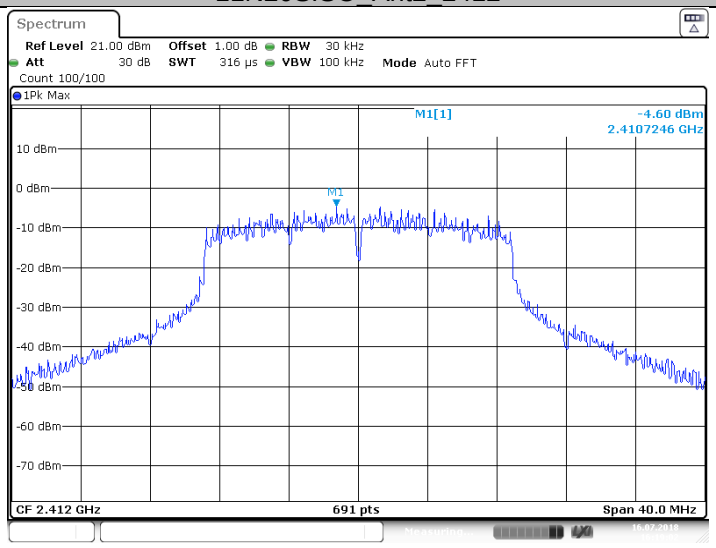

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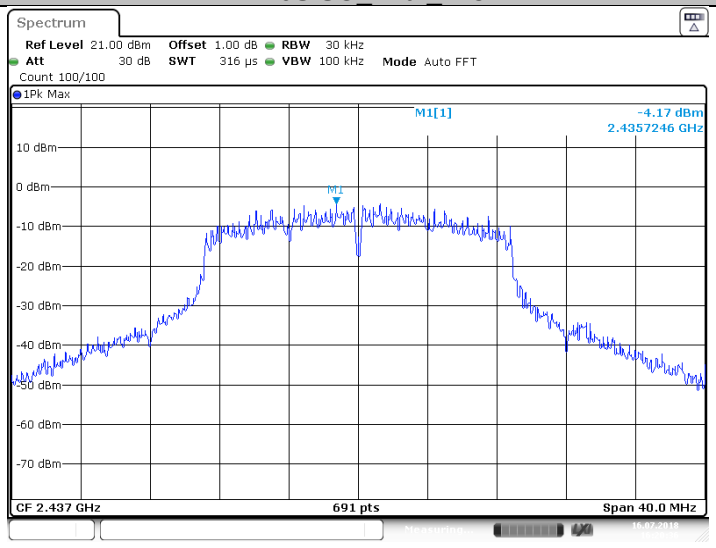

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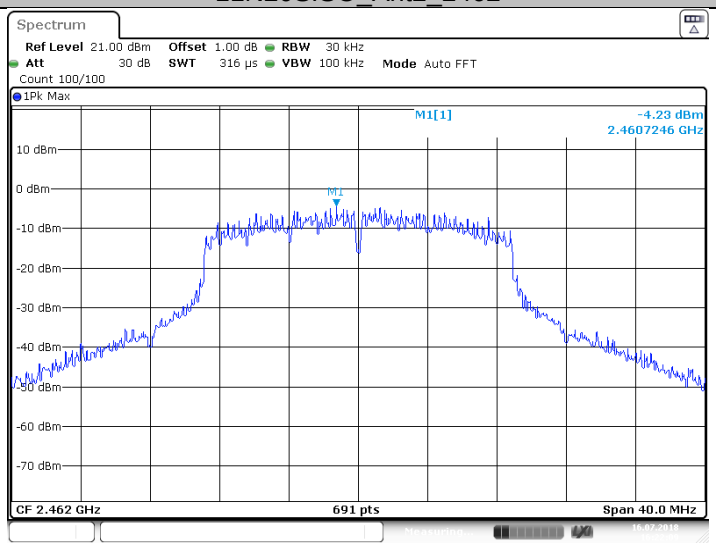

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9.4 6 dB Bandwidth

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Use the following spectrum analyzer settings:
   Set RBW ≥ 1% of the 99% bandwidth, VBW ≥ RBW.
   Sweep = auto, Detector function = peak, Trace = max hold
3. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
4. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]
≥500

TestMode	Antenna	Channel (MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Verdict
11B	Ant1	2412	10.160	2406.920	2417.080	PASS
		2437	10.160	2431.920	2442.080	PASS
		2462	10.160	2456.920	2467.080	PASS
11G	Ant1	2412	15.200	2404.400	2419.600	PASS
		2437	15.200	2429.400	2444.600	PASS
		2462	15.200	2454.400	2469.600	PASS
11N20	Ant1	2412	15.200	2404.400	2419.600	PASS
		2437	15.200	2429.400	2444.600	PASS
		2462	15.200	2454.400	2469.600	PASS
11N40	Ant1	2422	35.280	2404.400	2439.680	PASS
		2437	35.280	2419.400	2454.680	PASS
		2452	35.280	2434.400	2469.680	PASS
11N20	Ant2	2412	15.200	2404.400	2419.600	PASS
		2437	15.200	2429.400	2444.600	PASS
		2462	15.200	2454.400	2469.600	PASS

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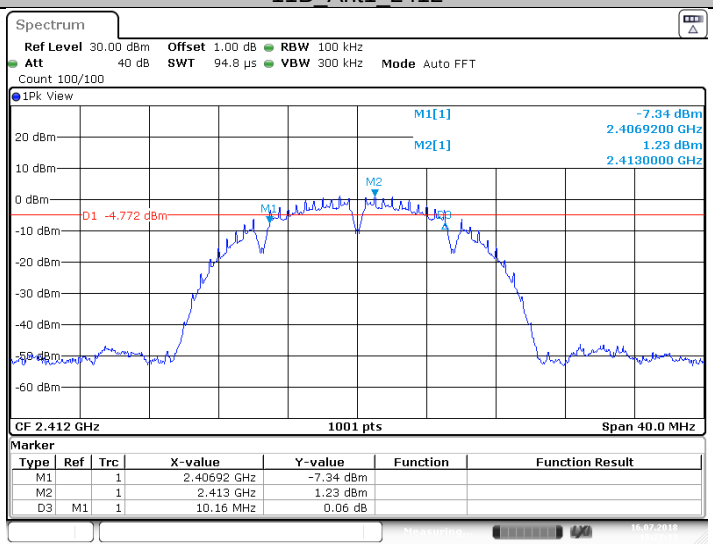
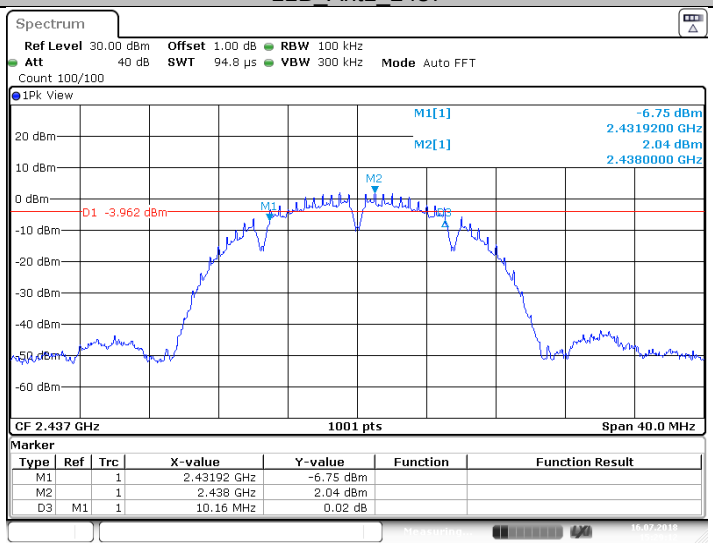
Test Graphs

11B_Ant1_2412



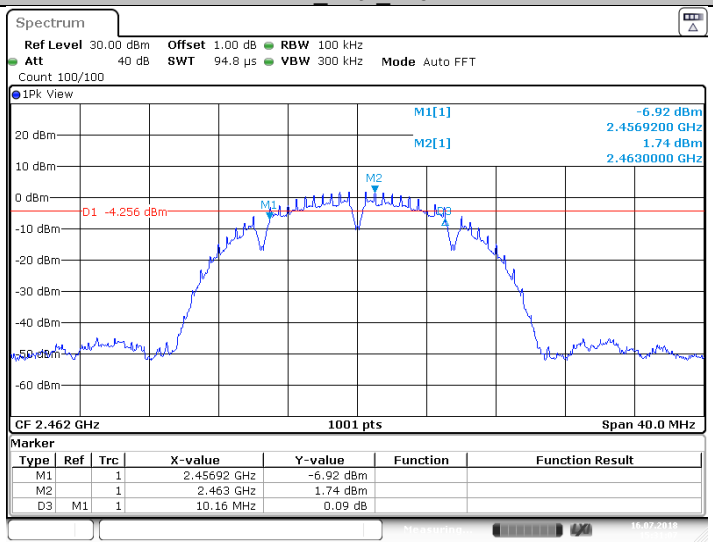
Date:16.JUL.2018 15:27:33

11B_Ant1_2437



Date:16.JUL.2018 15:29:12

11B_Ant1_2462



Date:16.JUL.2018 15:31:07

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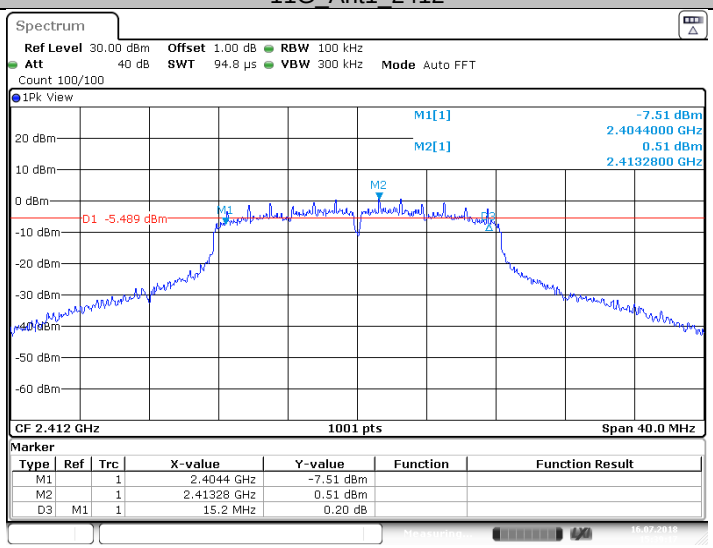
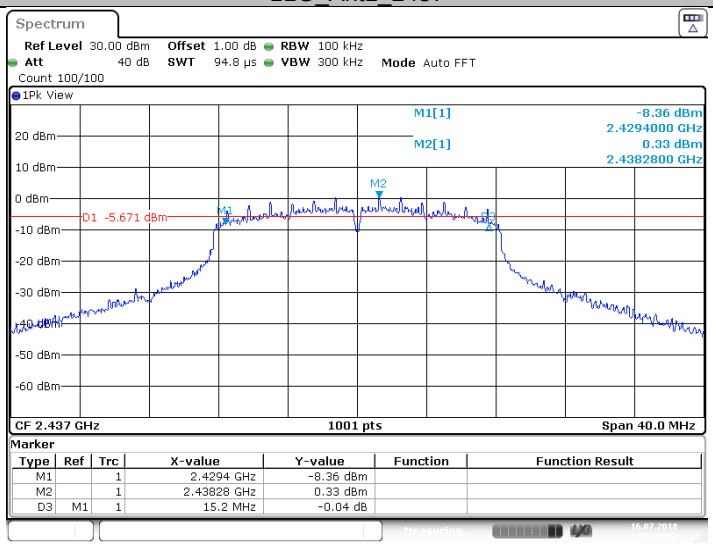
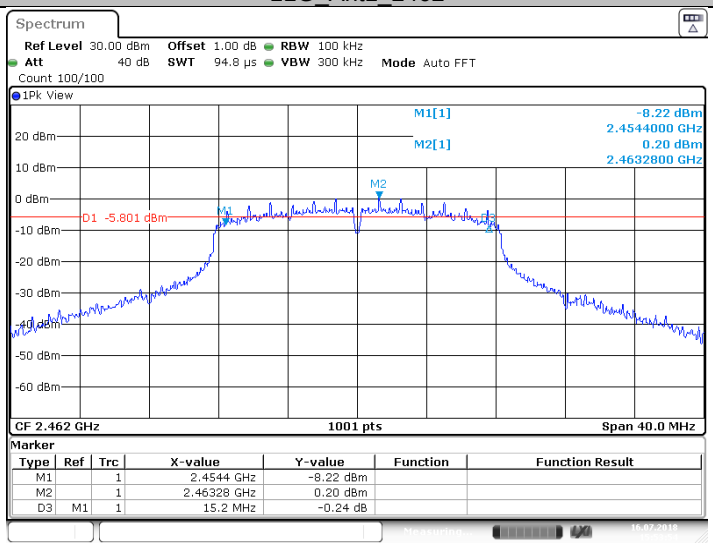
11G_Ant1_2412



11G_Ant1_2437



11G_Ant1_2462



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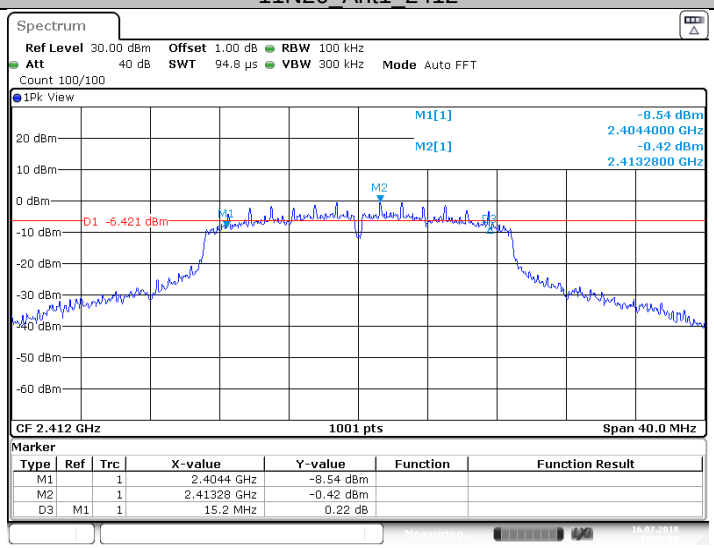
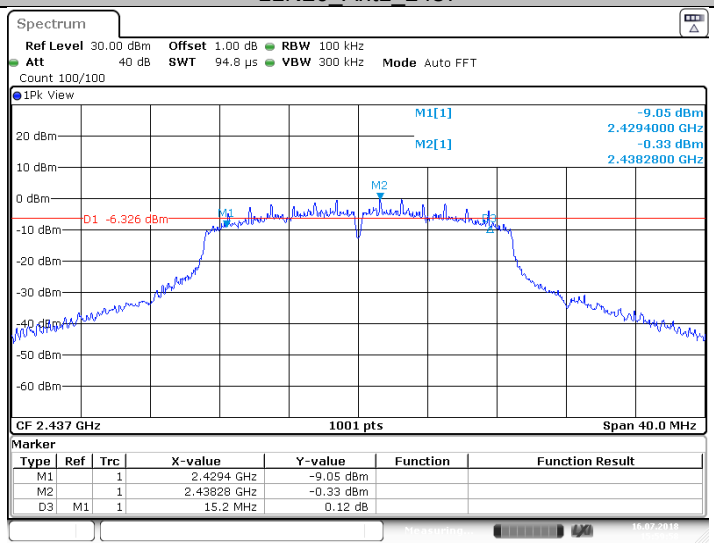
11N20_Ant1_2412



Date:16.JUL.2018 15:58:18

11N20_Ant1_2437



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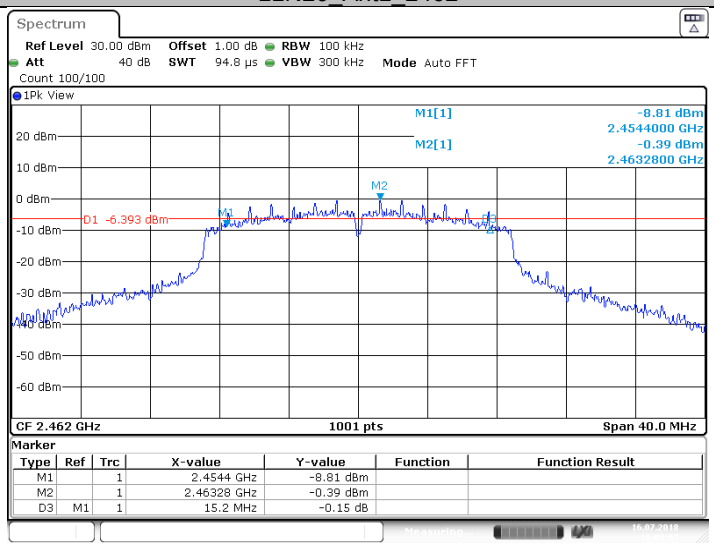
11N20_Ant1_2462



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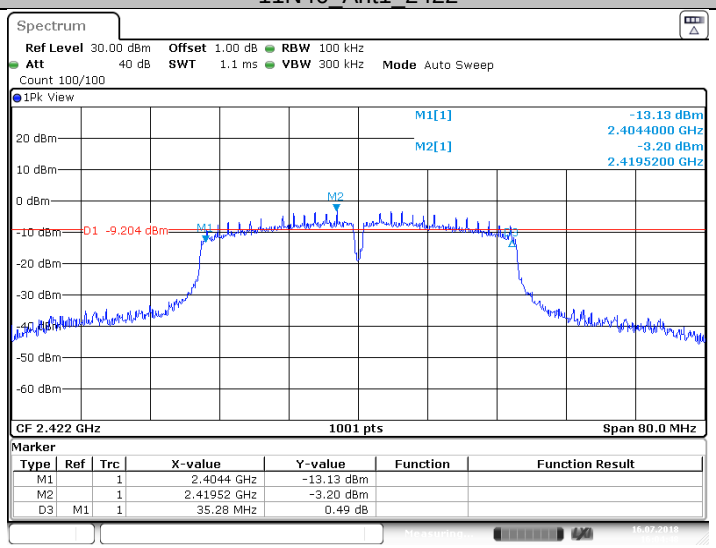
11N40_Ant1_2422



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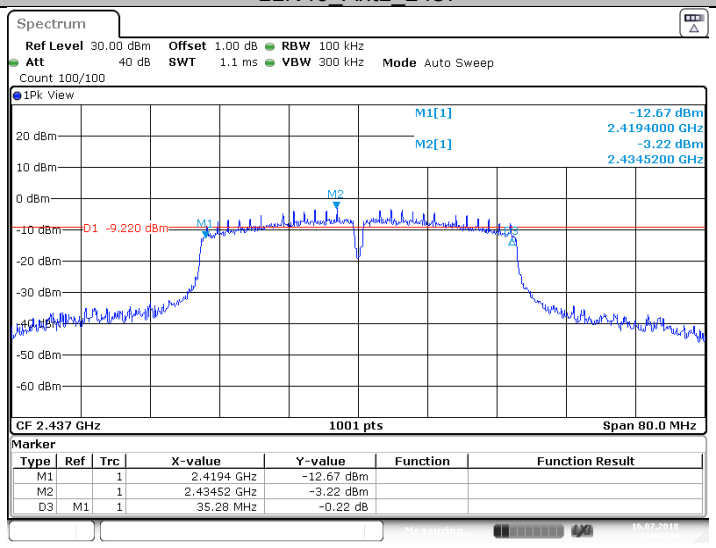
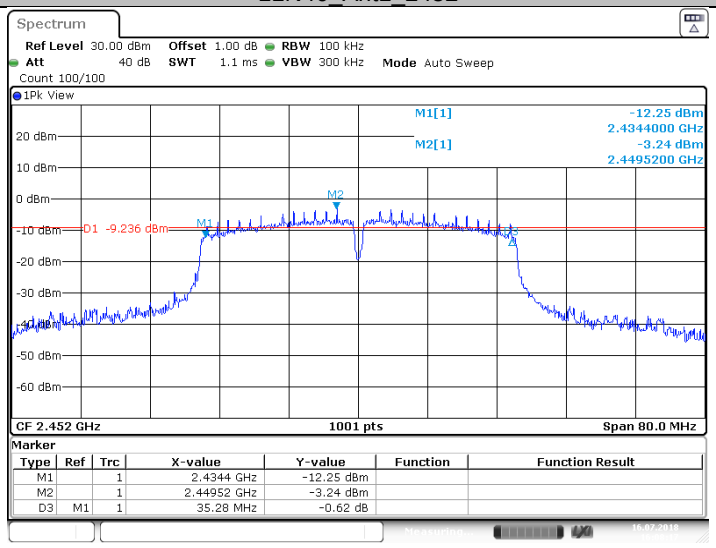
11N40_Ant1_2437



Date:16.JUL.2018 16:06:24

11N40_Ant1_2452



Date:16.JUL.2018 16:08:18

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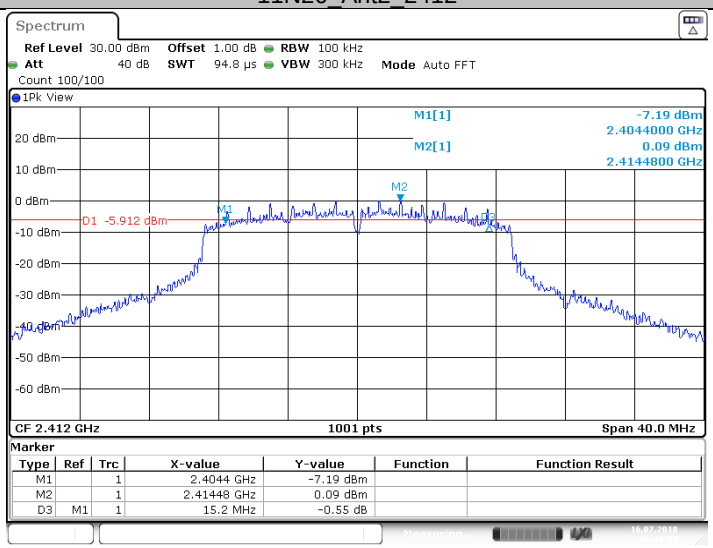
11N20_Ant2_2412



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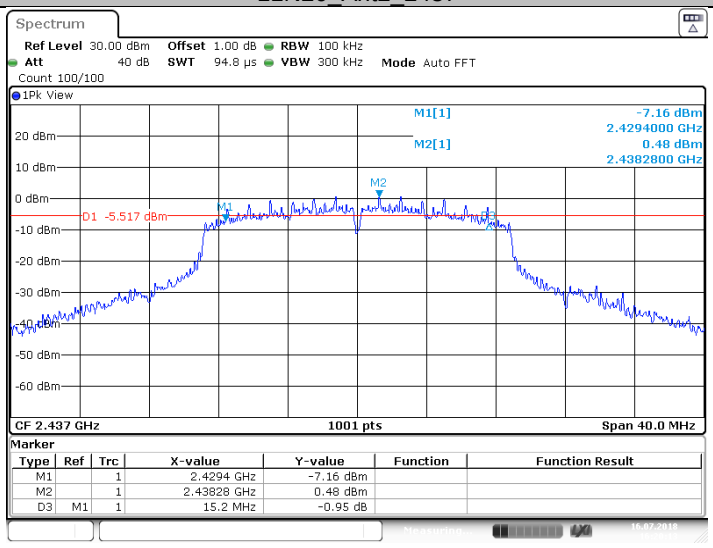
11N20_Ant2_2437



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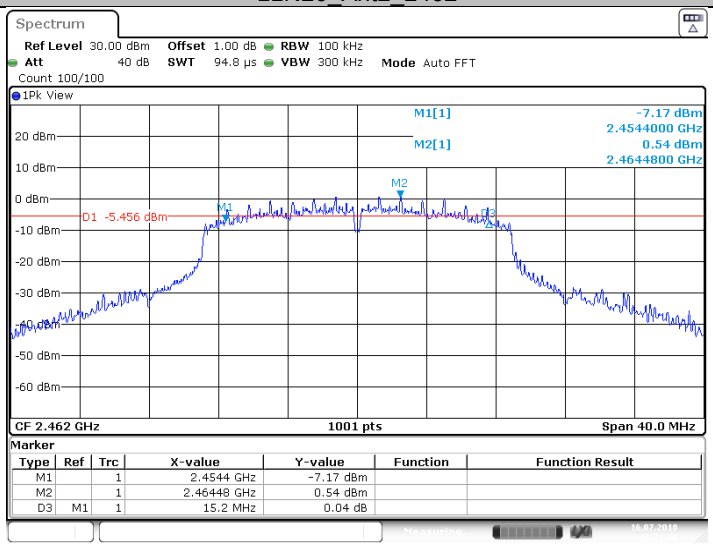
11N20_Ant2_2462



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9.5 Spurious RF conducted emissions

Test Method

1. Connect EUT test port to spectrum analyzer.
2. 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.
3. 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.
4. 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

Test Result

TestMode	Antenna	Channel (MHz)	FreqRange (MHz)	RefLevel (dBm)	Result (dBm)	Limit (dBm)	Verdict
11B	Ant1	2412	Reference	1.34	1.34	---	PASS
		2412	30~1000	1.34	-69.42	-18.66	PASS
		2412	1000~26500	1.34	-46.73	-18.66	PASS
		2437	Reference	1.90	1.90	---	PASS
		2437	30~1000	1.90	-69.17	-18.1	PASS
		2437	1000~26500	1.90	-49.59	-18.1	PASS
		2462	Reference	1.55	1.55	---	PASS
		2462	30~1000	1.55	-68.51	-18.45	PASS
		2462	1000~26500	1.55	-48.72	-18.45	PASS
11G	Ant1	2412	Reference	0.51	0.51	---	PASS
		2412	30~1000	0.51	-69.05	-19.49	PASS
		2412	1000~26500	0.51	-53.08	-19.49	PASS
		2437	Reference	0.26	0.26	---	PASS
		2437	30~1000	0.26	-68.73	-19.74	PASS
		2437	1000~26500	0.26	-52.43	-19.74	PASS
		2462	Reference	0.15	0.15	---	PASS
		2462	30~1000	0.15	-69.21	-19.85	PASS
		2462	1000~26500	0.15	-52.97	-19.85	PASS
11N20	Ant1	2412	Reference	-0.55	-0.55	---	PASS
		2412	30~1000	-0.55	-68.36	-20.55	PASS
		2412	1000~26500	-0.55	-52.5	-20.55	PASS
		2437	Reference	-0.30	-0.30	---	PASS
		2437	30~1000	-0.30	-68.73	-20.3	PASS
		2437	1000~26500	-0.30	-53.42	-20.3	PASS
		2462	Reference	-0.35	-0.35	---	PASS
		2462	30~1000	-0.35	-68.78	-20.35	PASS
		2462	1000~26500	-0.35	-52.3	-20.35	PASS
11N40	Ant1	2422	Reference	-3.51	-3.51	---	PASS
		2422	30~1000	-3.51	-69.17	-23.51	PASS
		2422	1000~26500	-3.51	-52.66	-23.51	PASS
		2437	Reference	-3.56	-3.56	---	PASS
		2437	30~1000	-3.56	-69.04	-23.56	PASS
		2437	1000~26500	-3.56	-53.4	-23.56	PASS
		2452	Reference	-3.22	-3.22	---	PASS
		2452	30~1000	-3.22	-67.93	-23.22	PASS
		2452	1000~26500	-3.22	-52.93	-23.22	PASS
11N20	Ant2	2412	Reference	0.06	0.06	---	PASS
		2412	30~1000	0.06	-69.13	-19.94	PASS
		2412	1000~26500	0.06	-52.7	-19.94	PASS
		2437	Reference	0.58	0.58	---	PASS
		2437	30~1000	0.58	-68.96	-19.42	PASS
		2437	1000~26500	0.58	-52.97	-19.42	PASS
		2462	Reference	0.52	0.52	---	PASS
		2462	30~1000	0.52	-68.78	-19.48	PASS
		2462	1000~26500	0.52	-53.17	-19.48	PASS

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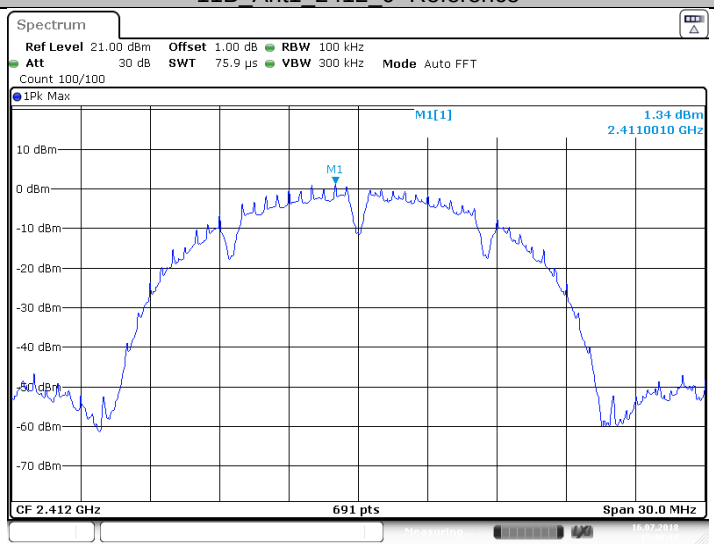
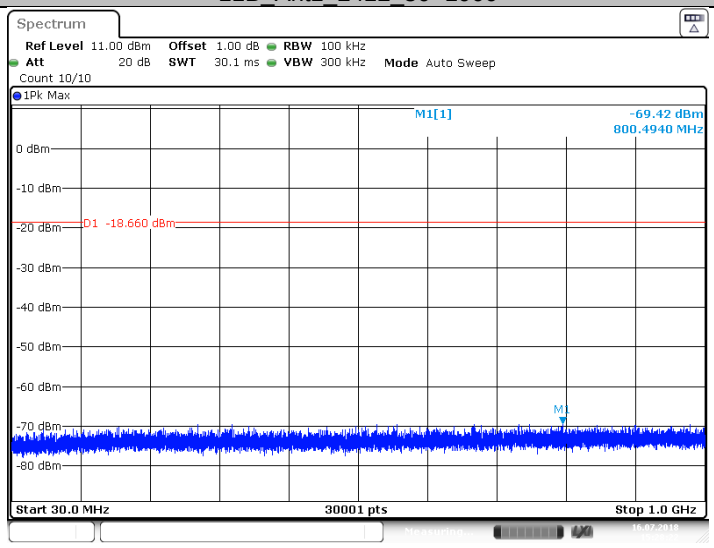
Test Graphs

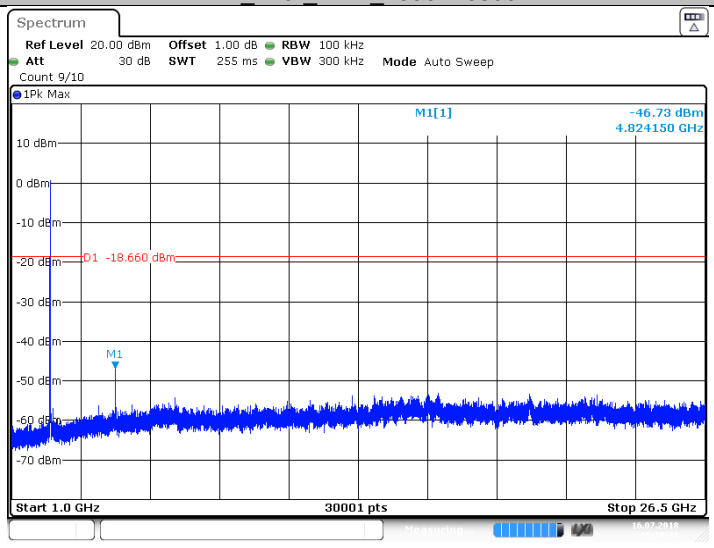
11B_Ant1_2412_0~Reference



11B_Ant1_2412_30~1000



11B_Ant1_2412_1000~26500



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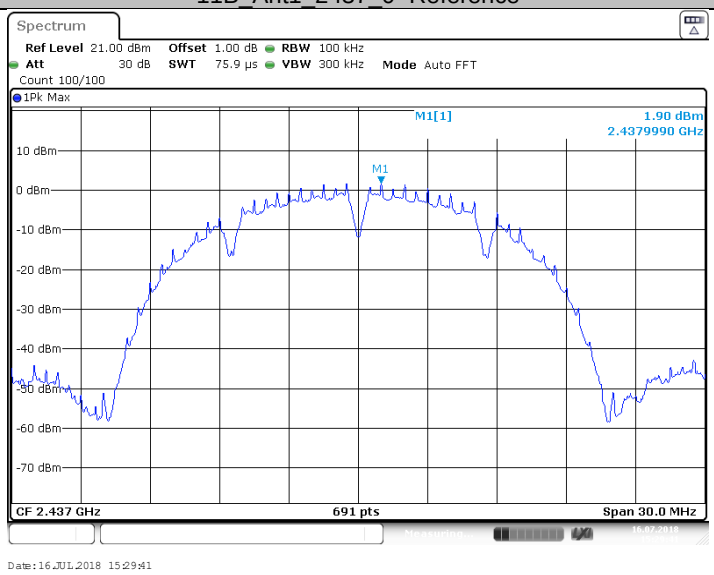
11B_Ant1_2437_0~Reference

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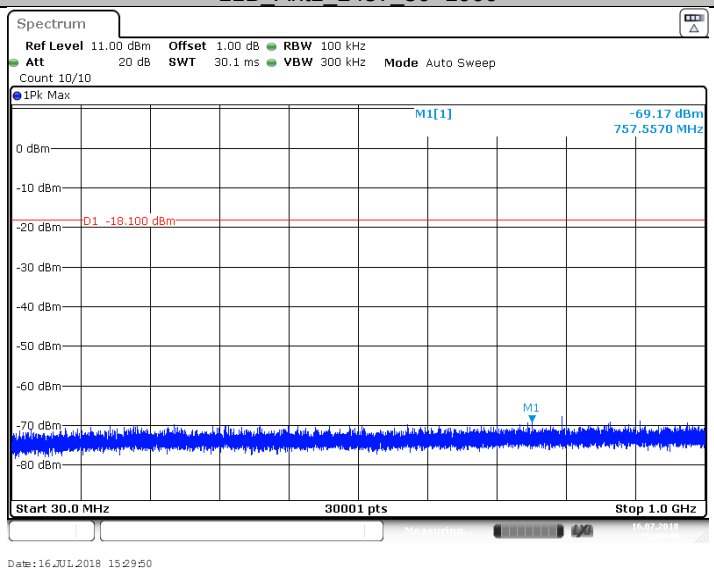
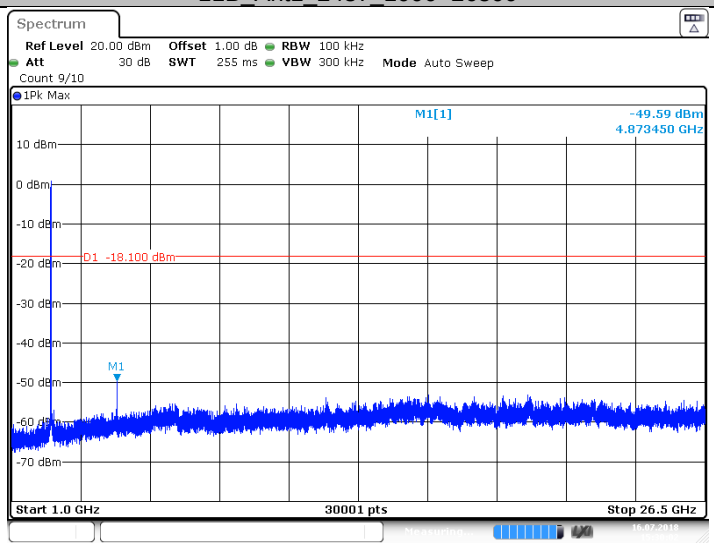

11B_Ant1_2437_1000~26500


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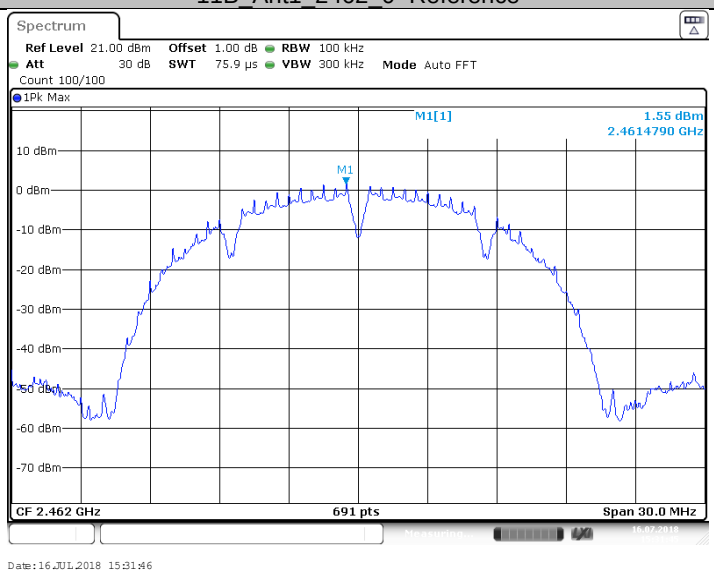
11B_Ant1_2462_0~Reference



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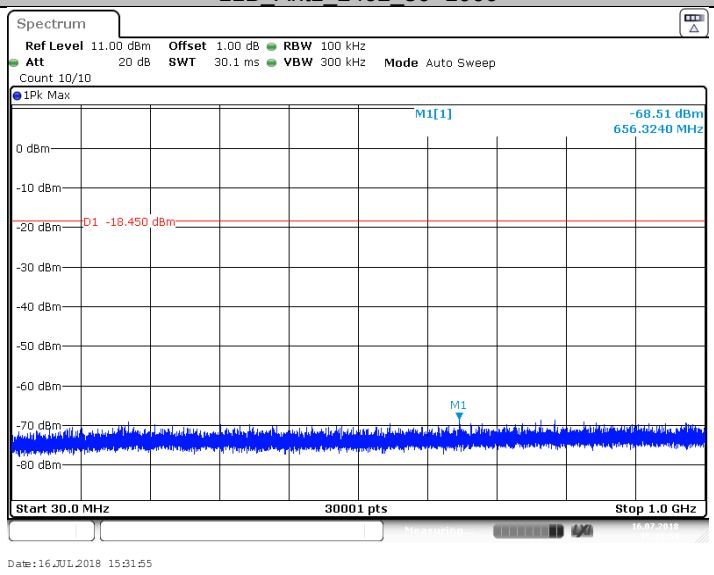
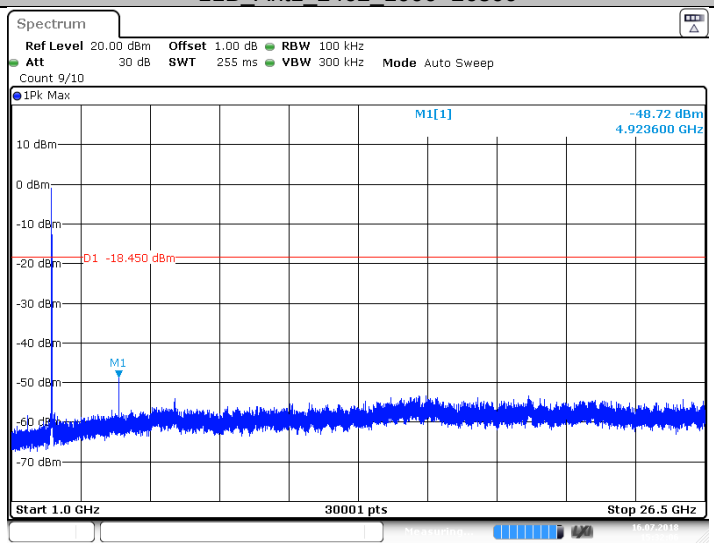


11B_Ant1_2462_1000~26500



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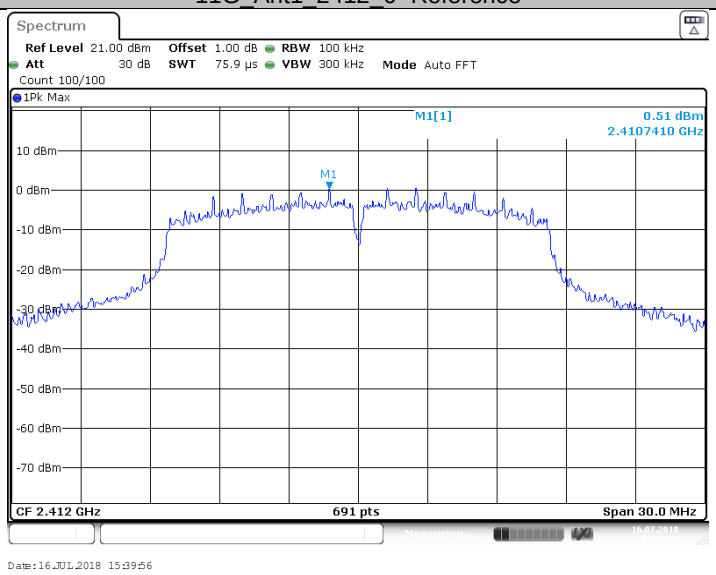
11G_Ant1_2412_0~Reference

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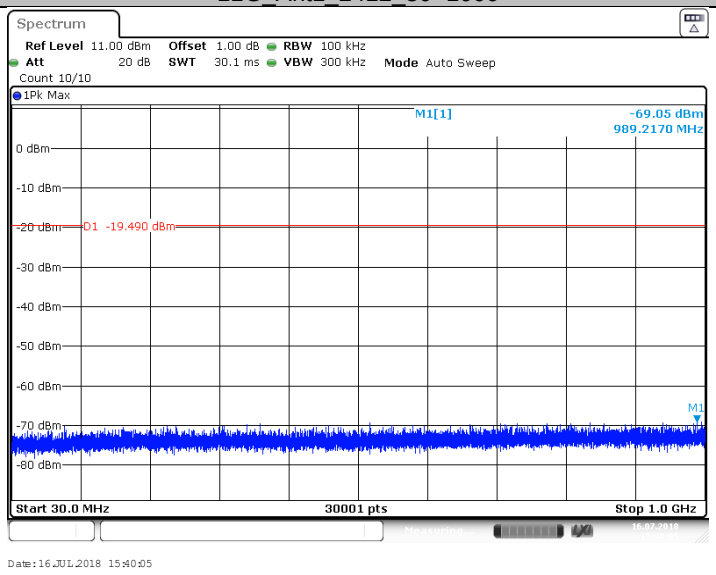
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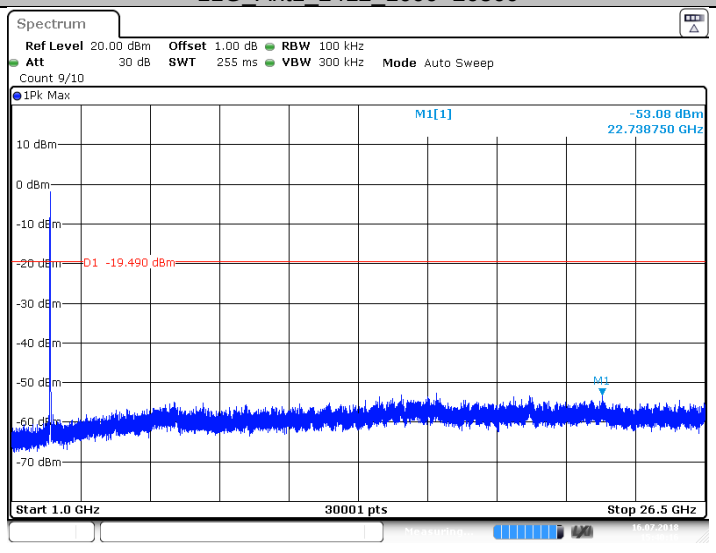

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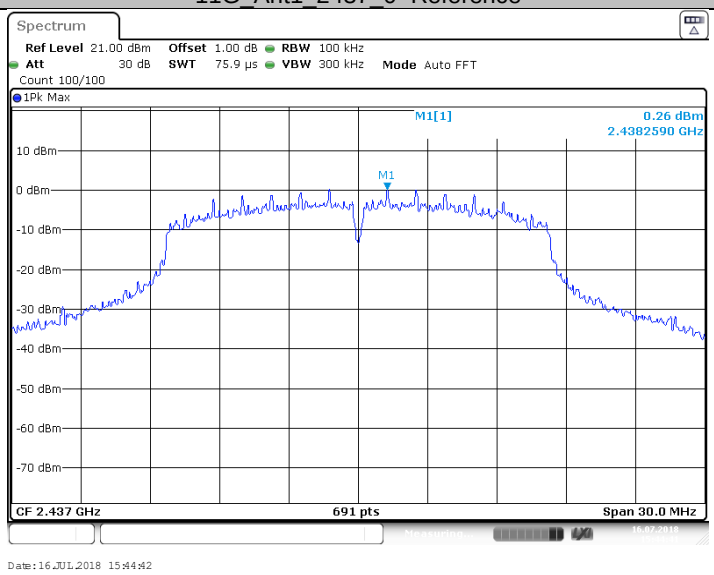
11G_Ant1_2437_0~Reference

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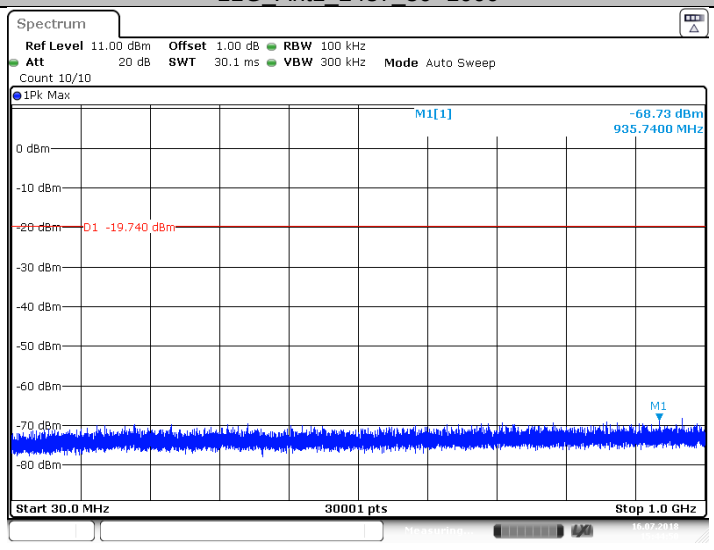
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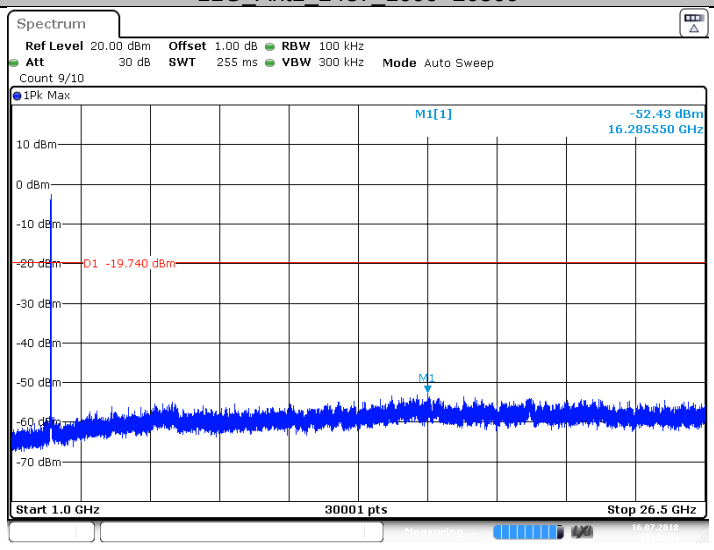

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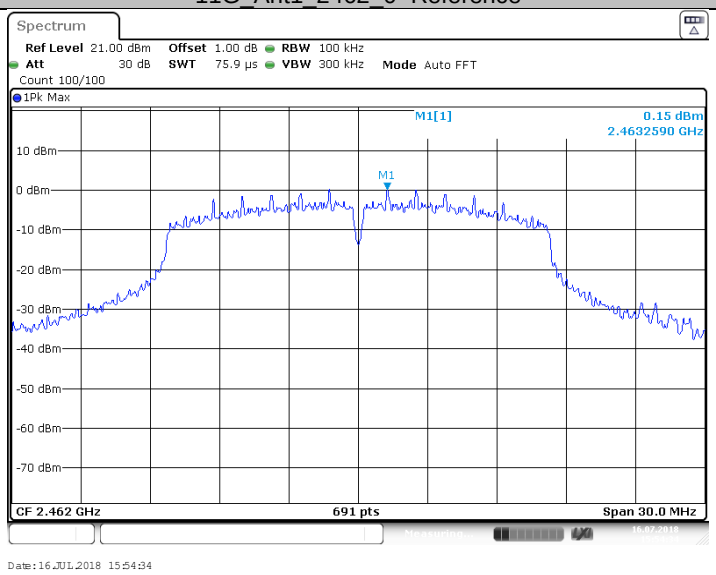
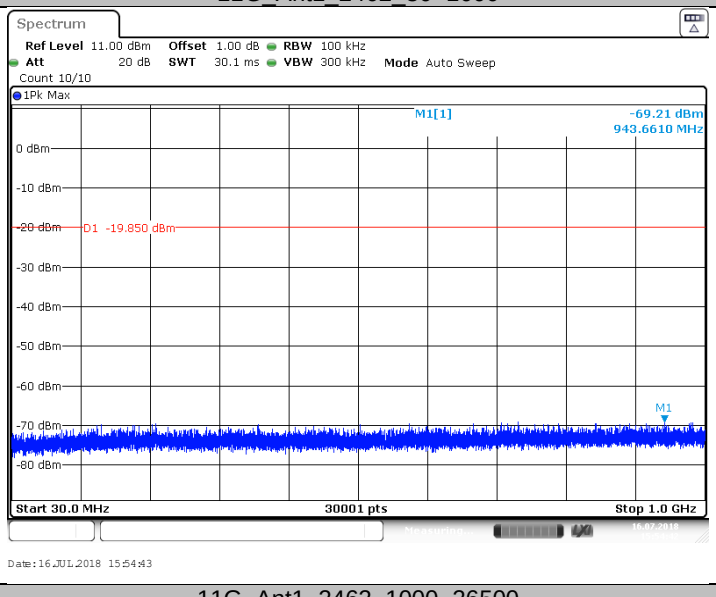
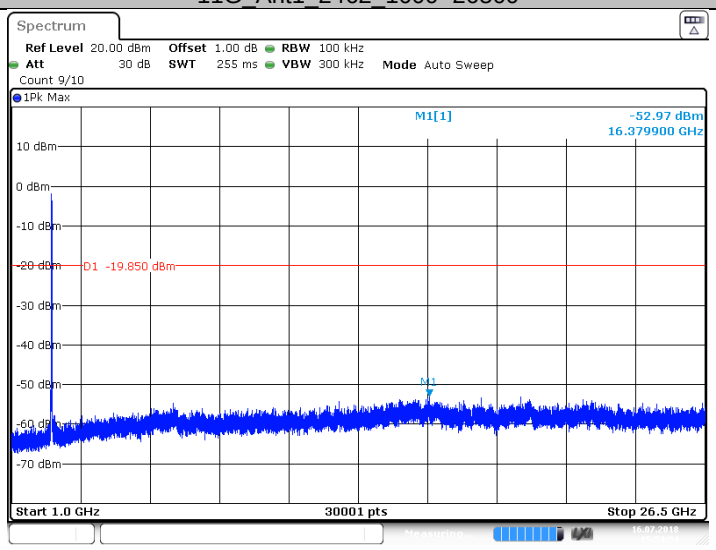
11G_Ant1_2462_0~Reference

11G_Ant1_2462_30~1000

11G_Ant1_2462_1000~26500


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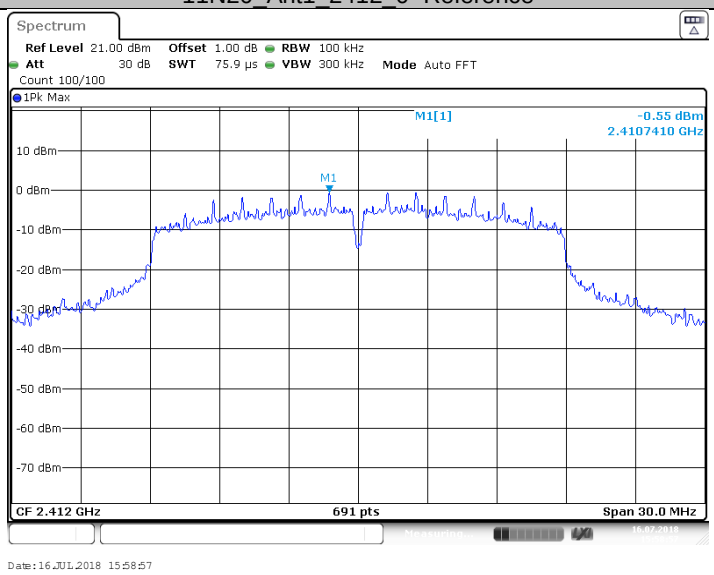
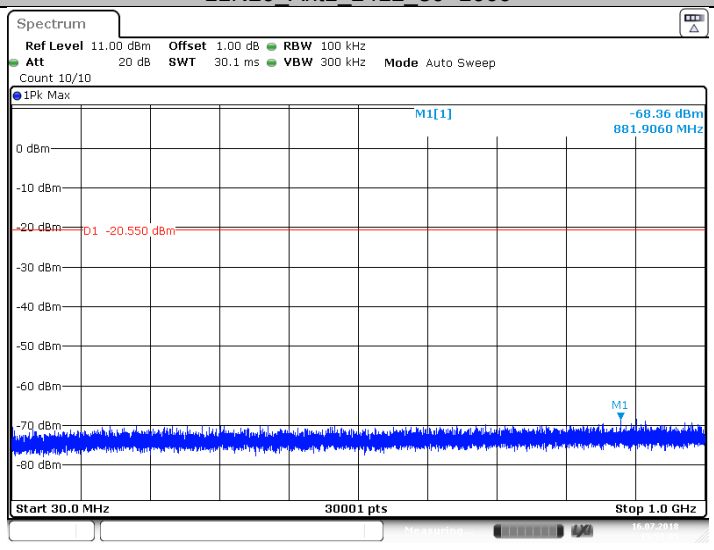
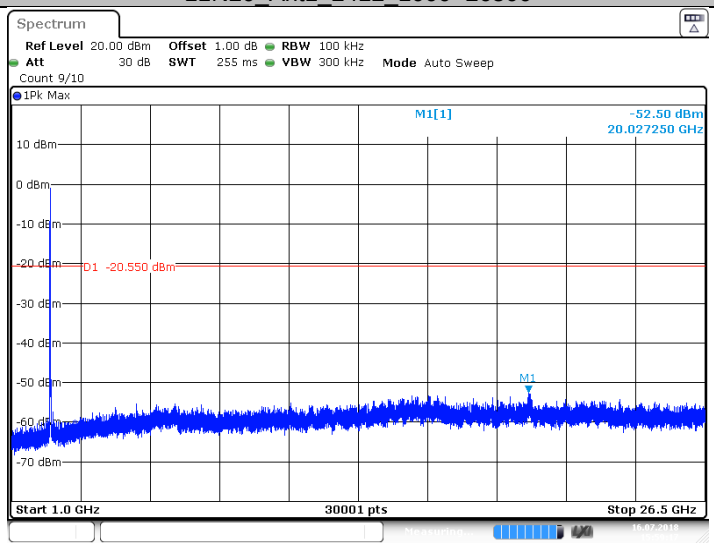
11N20_Ant1_2412_0~Reference

11N20_Ant1_2412_30~1000

11N20_Ant1_2412_1000~26500


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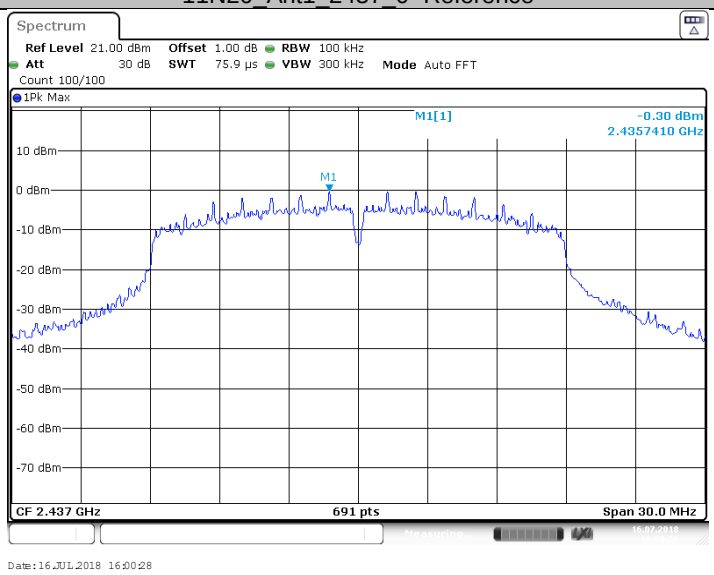
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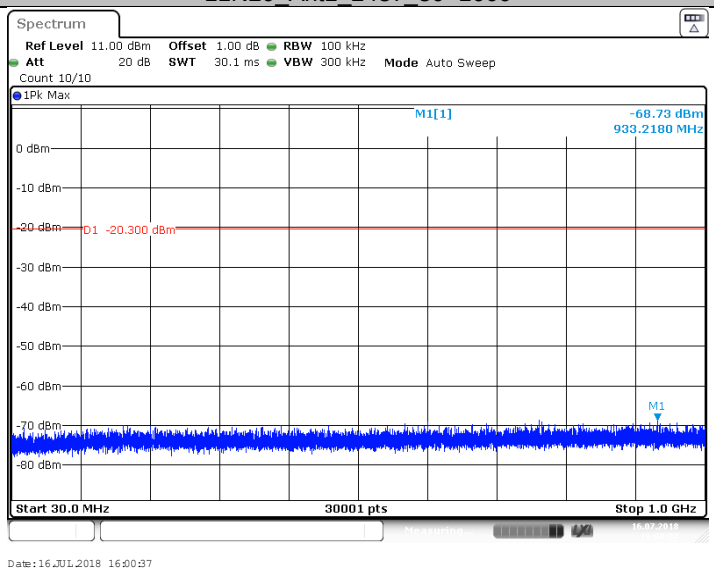
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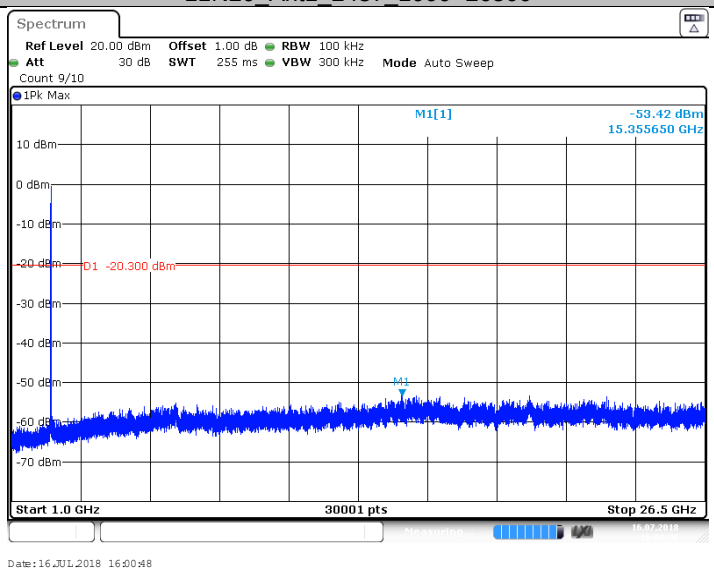

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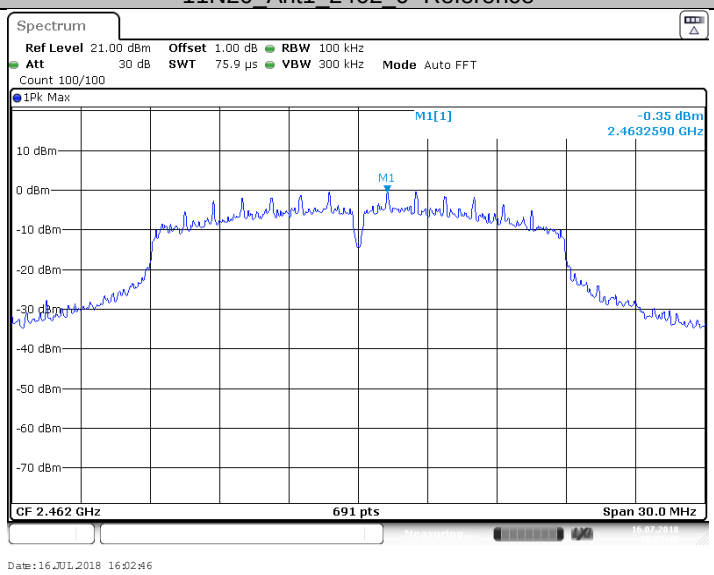
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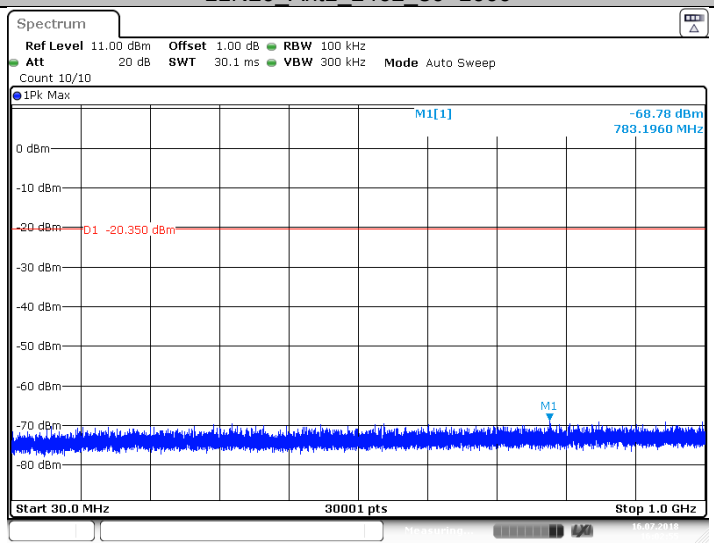
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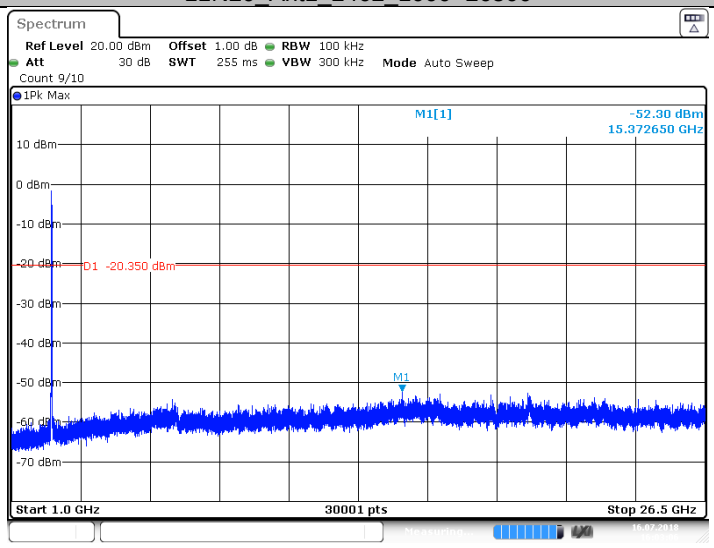

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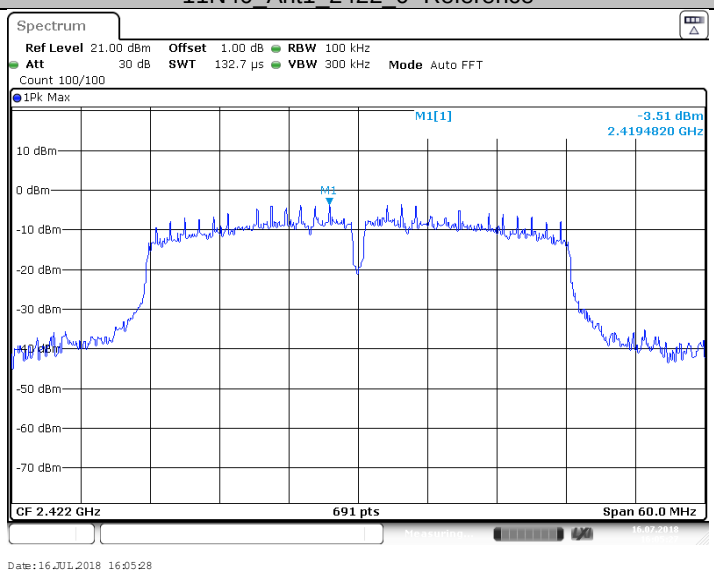
11N40_Ant1_2422_0~Reference

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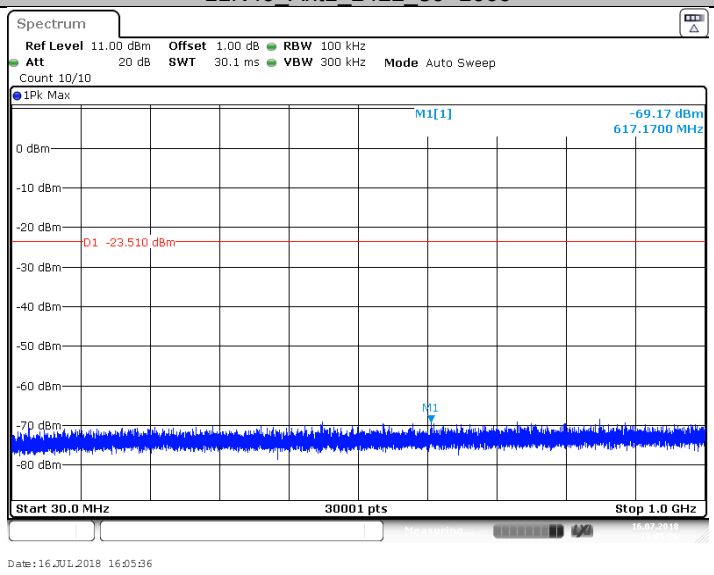
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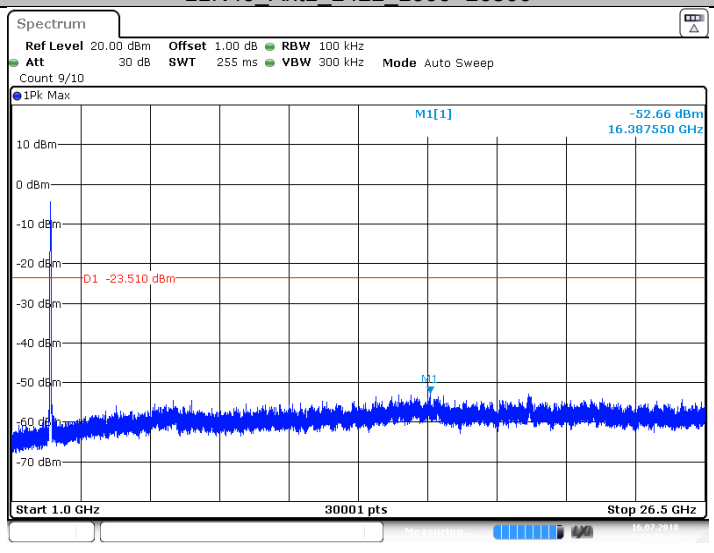

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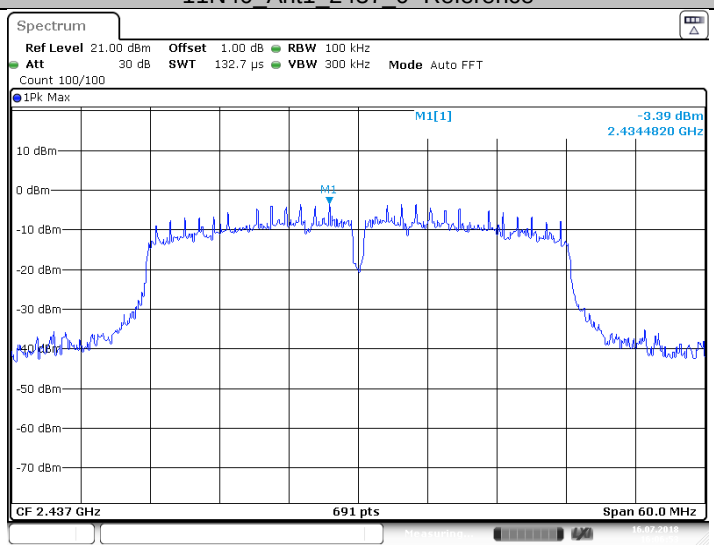
11N40_Ant1_2437_0~Reference

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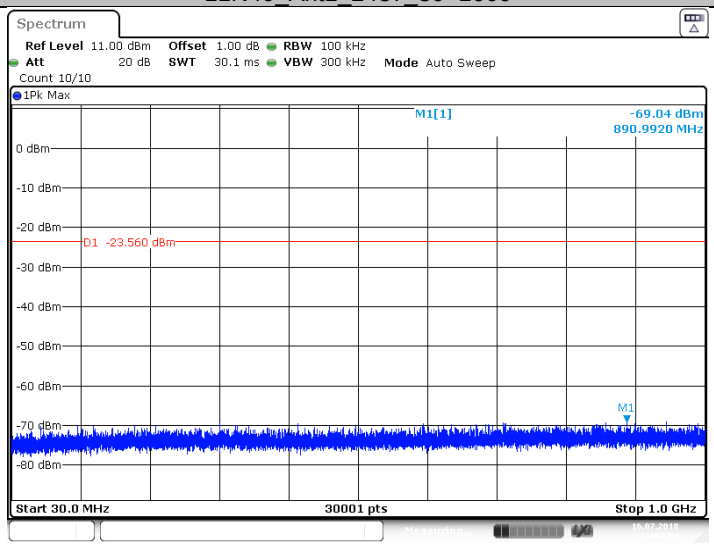
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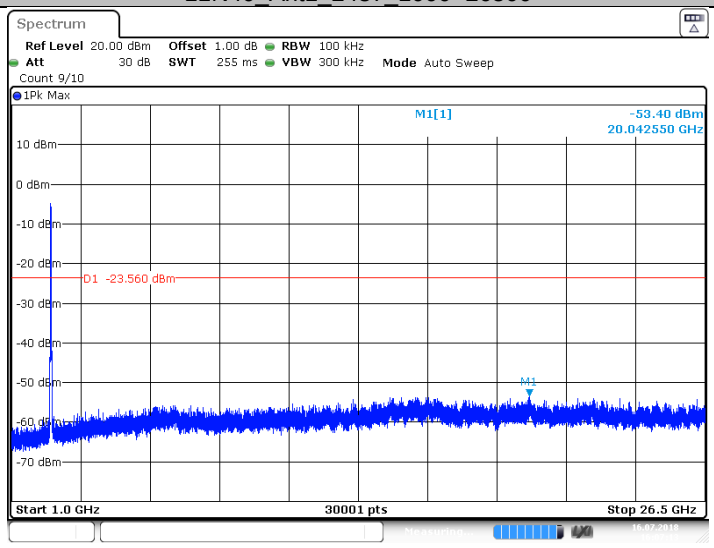

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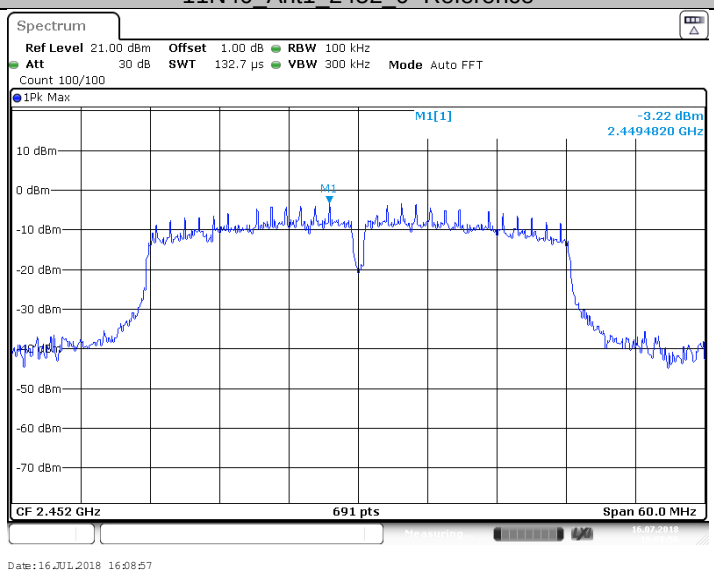
11N40_Ant1_2452_0~Reference

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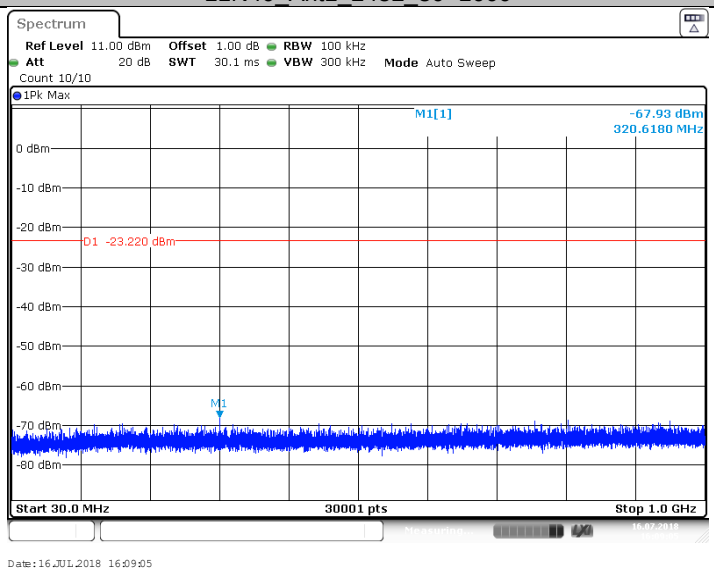
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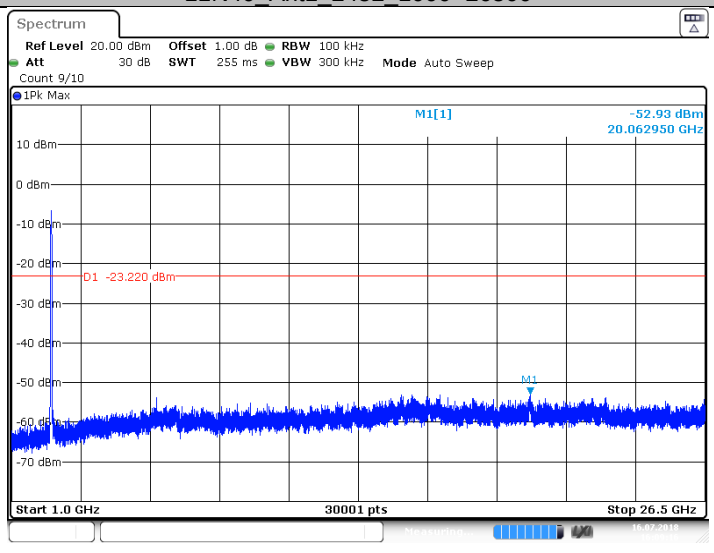

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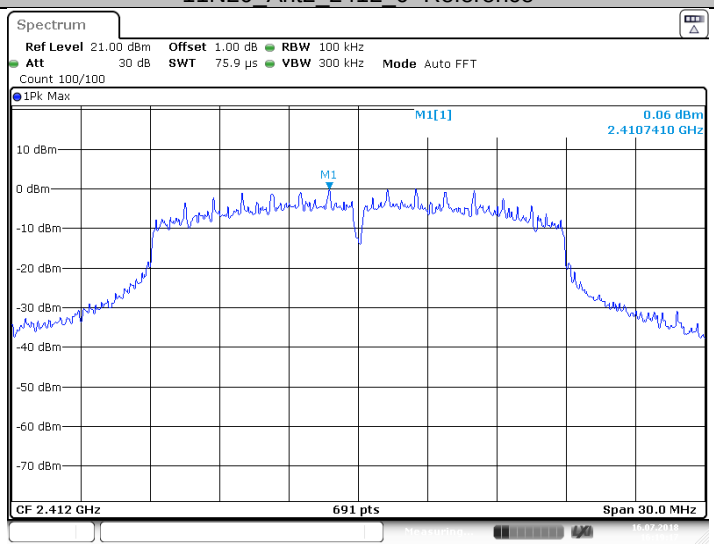
11N20_Ant2_2412_0~Reference


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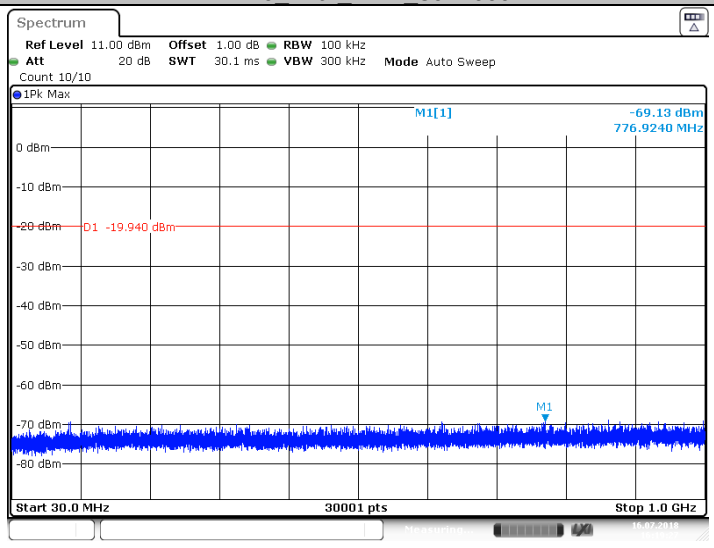

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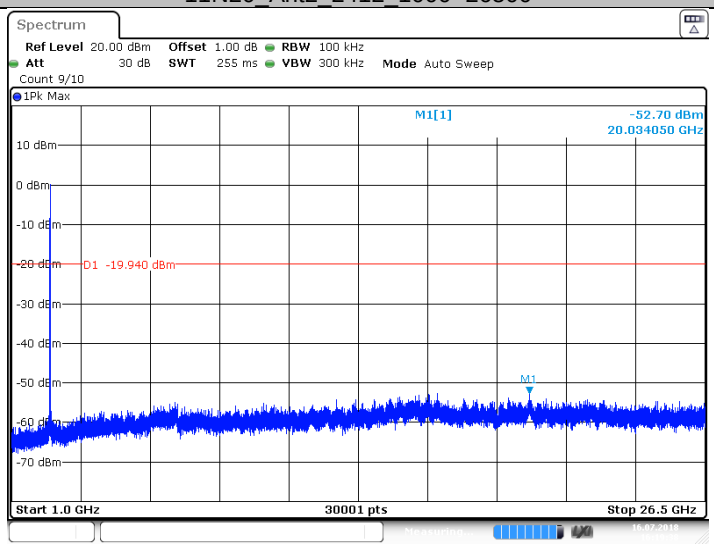

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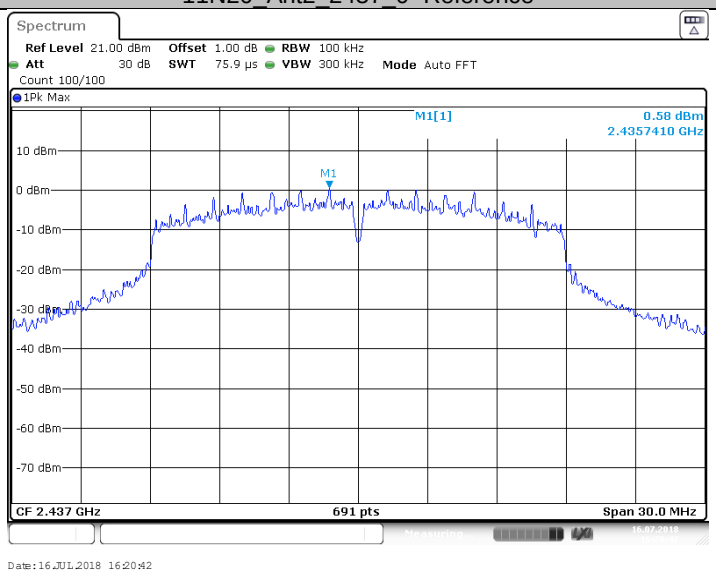
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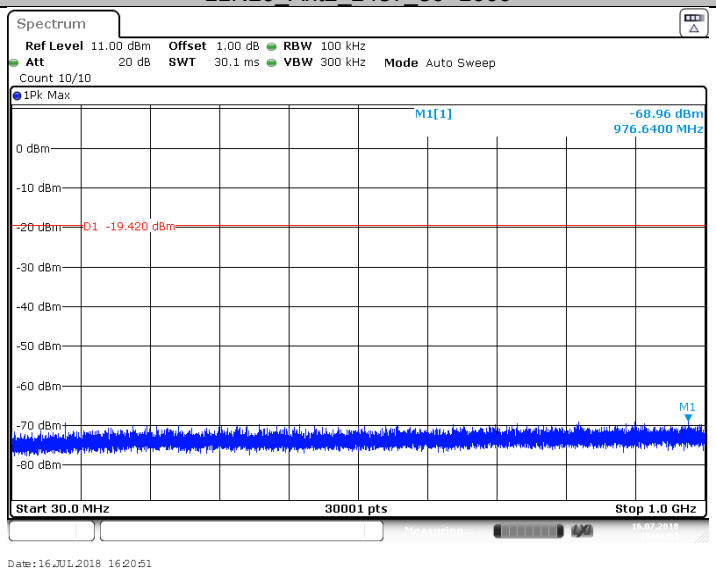
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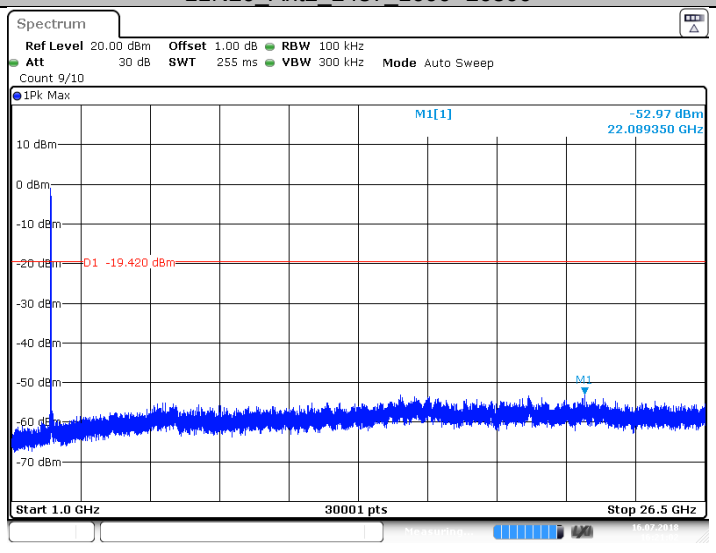

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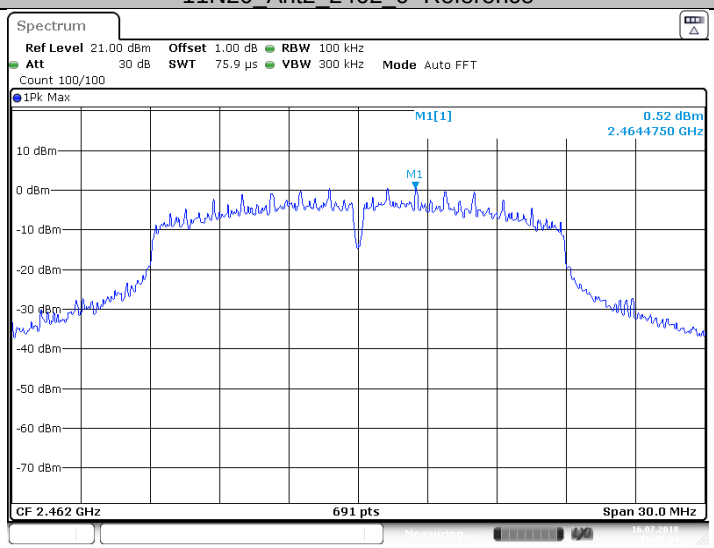
11N20_Ant2_2462_0~Reference

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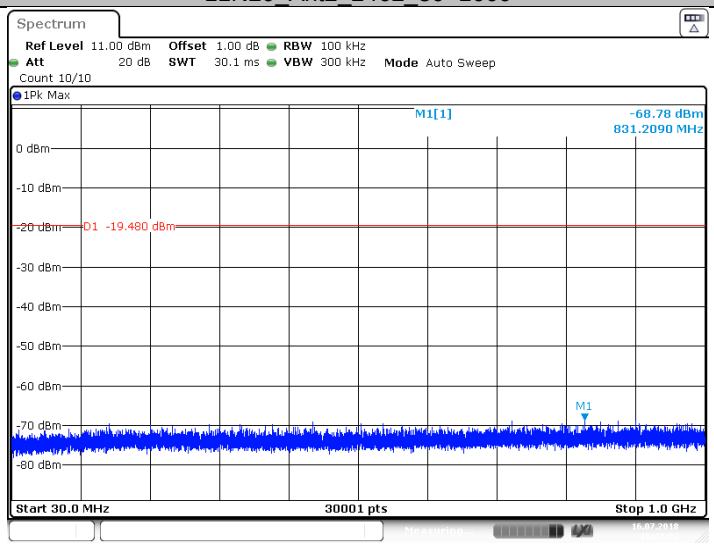
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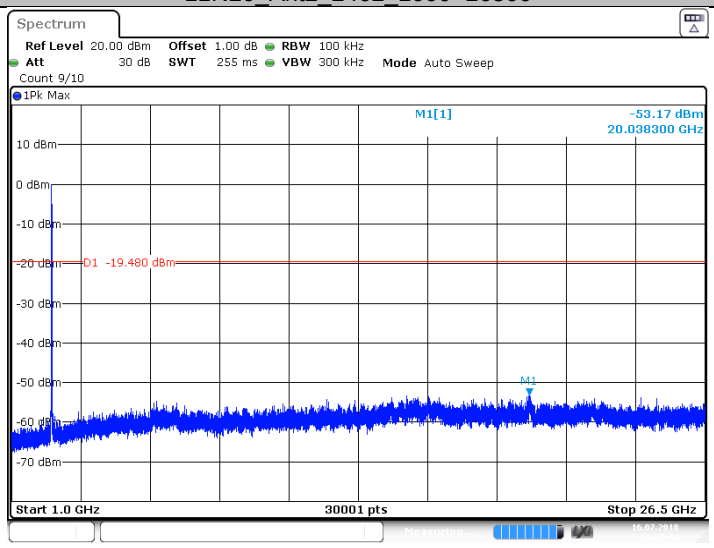

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9.6 Band edge testing

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Set spectrum analyzer setting as below:
   Set RBW ≥ 1% of the span, VBW ≥ RBW.
   Set Sweep = auto. Set Detector function = peak. Allow the trace to stabilize.
   Set Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
3. Repeat above procedures until all frequencies measured were complete.

Limit:

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

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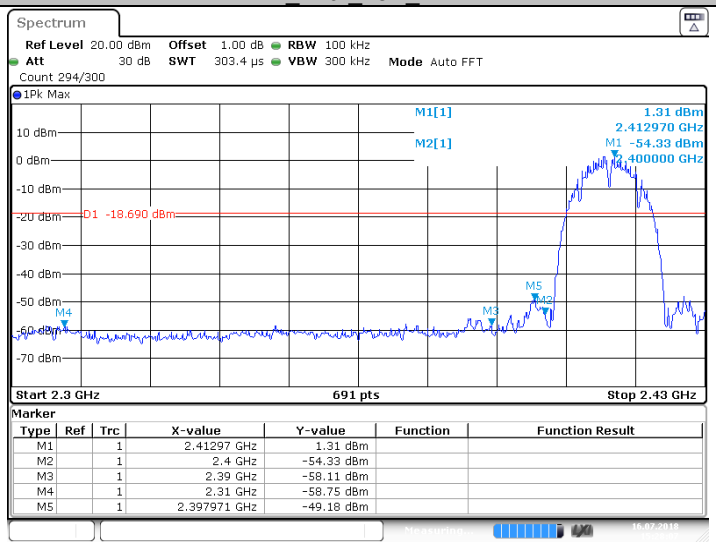
Band edge testing

Test result

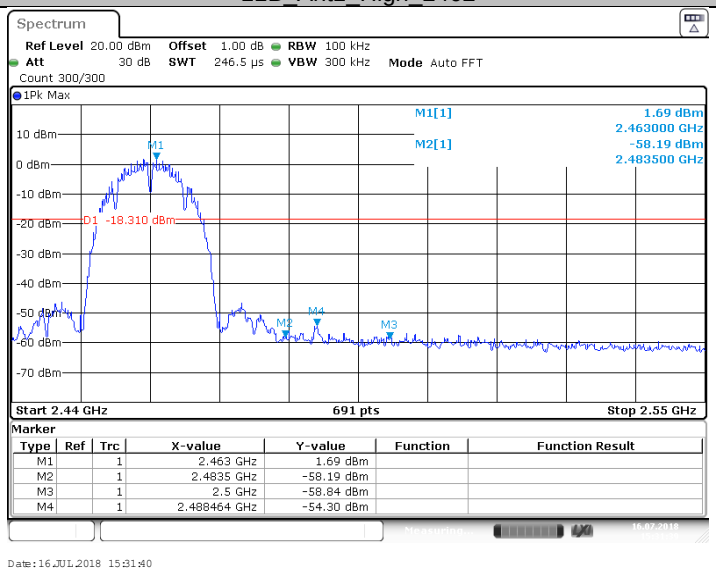
TestMode	Antenna	ChName	Channel (MHz)	RefLevel (dBm)	Result (dBm)	Limit (dBm)	Verdict
11B	Ant1	Low	2412	1.31	-49.18	-18.69	PASS
		High	2462	1.69	-54.3	-18.31	PASS
11G	Ant1	Low	2412	0.58	-30.07	-19.42	PASS
		High	2462	0.14	-48.06	-19.86	PASS
11N20	Ant1	Low	2412	-0.71	-28.97	-20.71	PASS
		High	2462	-0.41	-43.35	-20.41	PASS
11N40	Ant1	Low	2422	-3.30	-35.82	-23.3	PASS
		High	2452	-3.19	-38.92	-23.19	PASS
11N20	Ant2	Low	2412	-0.10	-29	-20.1	PASS
		High	2462	0.43	-47.2	-19.57	PASS

Test Graphs

11B_Ant1_Low_2412



11B_Ant1_High_2462



11G_Ant1_Low_2412

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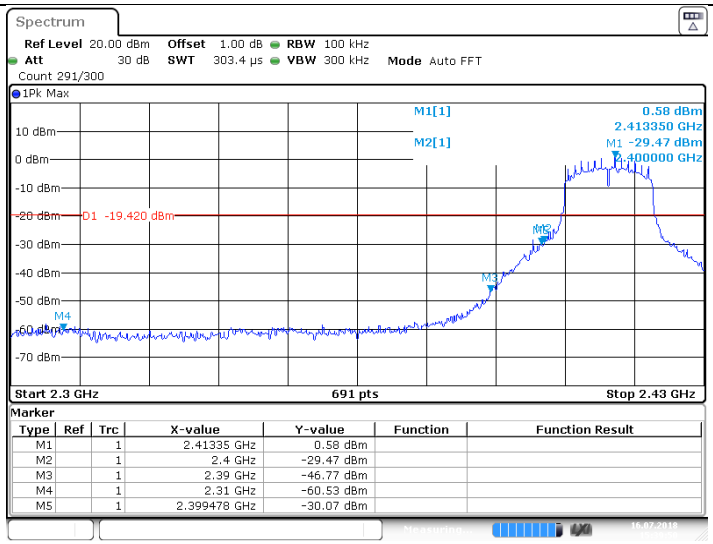
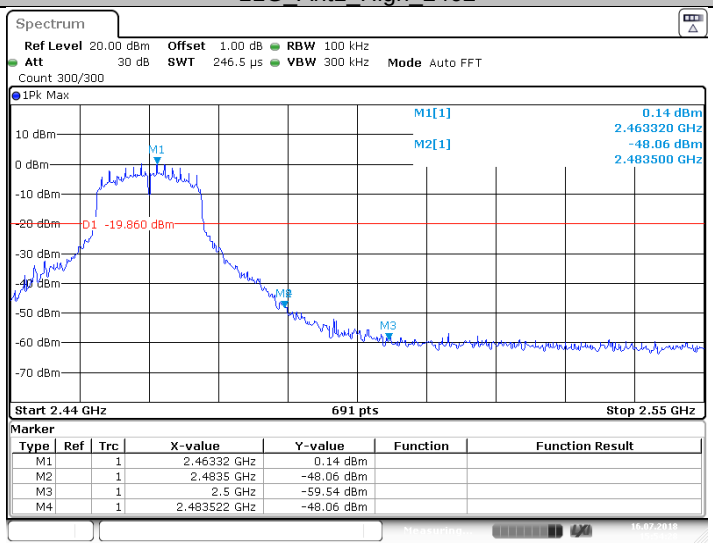
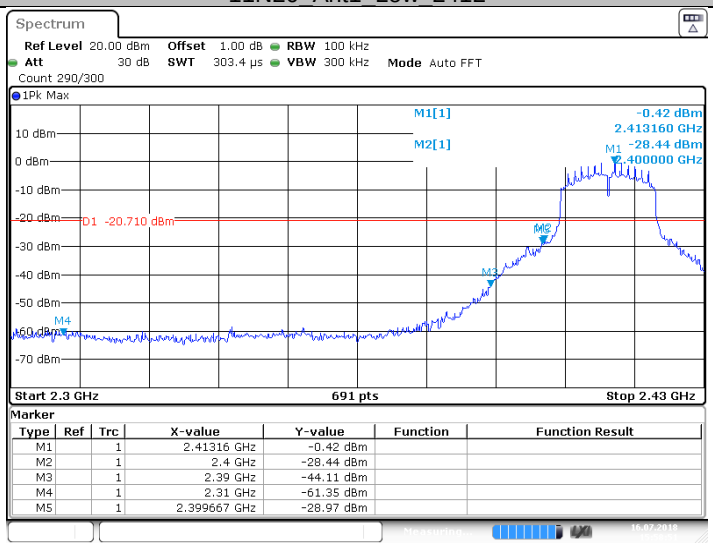


11G_Ant1_High_2462



11N20_Ant1_Low_2412



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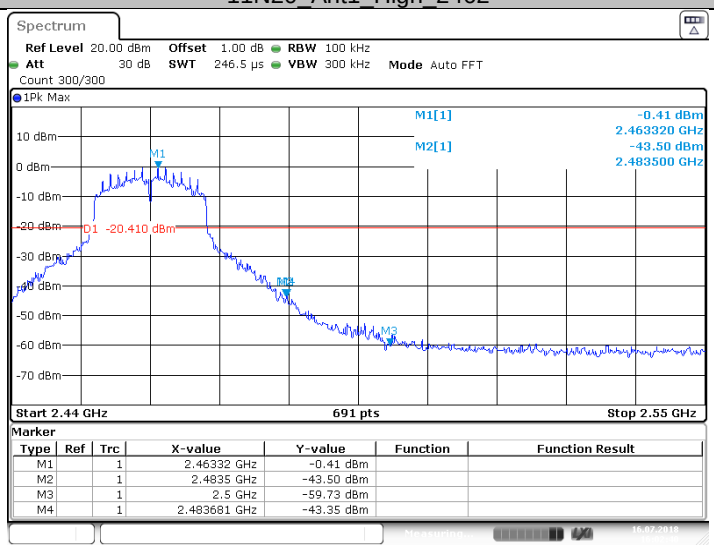
11N20_Ant1_High_2462

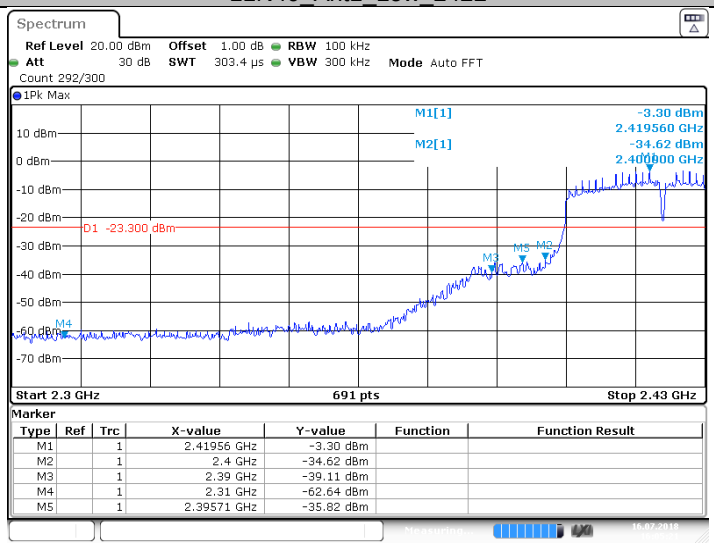


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.46332 GHz	-0.41 dBm		
M2		1	2.4835 GHz	-43.50 dBm		
M3		1	2.5 GHz	-59.73 dBm		
M4		1	2.483681 GHz	-43.35 dBm		

Date:16.JUL.2018 16:02:40

11N40_Ant1_Low_2422

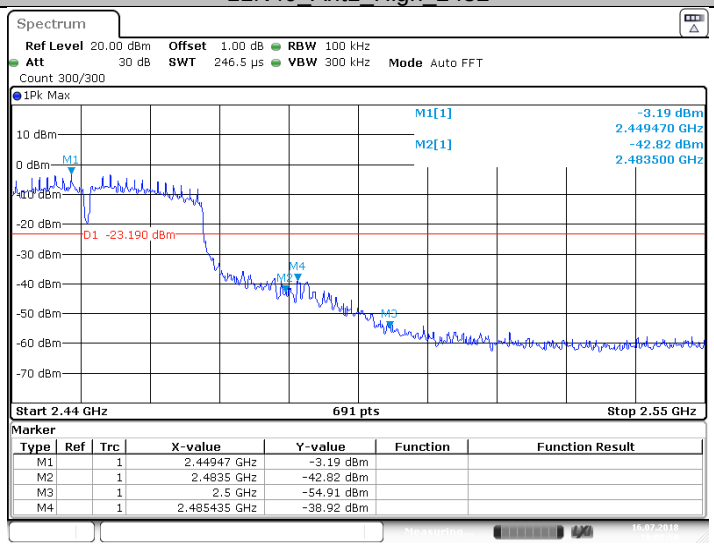


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41956 GHz	-3.30 dBm		
M2		1	2.4 GHz	-34.62 dBm		
M3		1	2.39 GHz	-39.11 dBm		
M4		1	2.31 GHz	-62.64 dBm		
M5		1	2.39571 GHz	-35.82 dBm		

Date:16.JUL.2018 16:05:22

11N40_Ant1_High_2452



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.44947 GHz	-3.19 dBm		
M2		1	2.4835 GHz	-42.82 dBm		
M3		1	2.5 GHz	-54.91 dBm		
M4		1	2.485435 GHz	-38.92 dBm		

Date:16.JUL.2018 16:08:50

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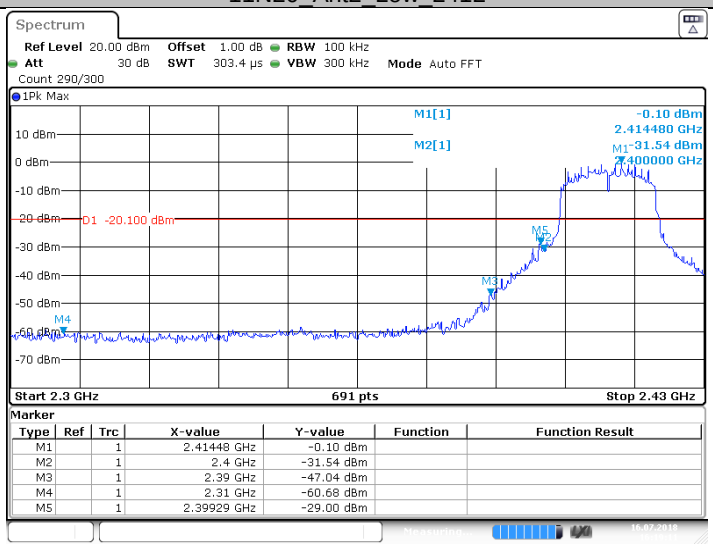
11N20_Ant2_Low_2412

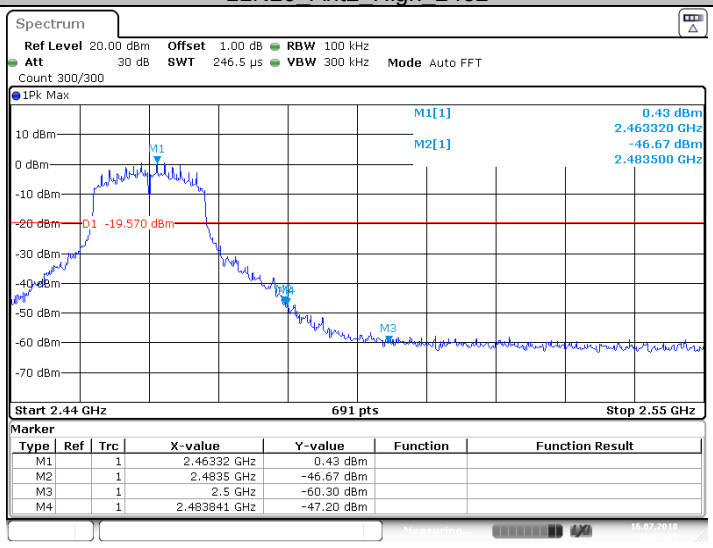


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41448 GHz	-0.10 dBm		
M2		1	2.4 GHz	-31.54 dBm		
M3		1	2.39 GHz	-47.04 dBm		
M4		1	2.31 GHz	-60.68 dBm		
M5		1	2.39929 GHz	-29.00 dBm		

Date:16.JUL.2018 16:19:12

11N20_Ant2_High_2462



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.46332 GHz	0.43 dBm		
M2		1	2.4835 GHz	-46.67 dBm		
M3		1	2.5 GHz	-60.30 dBm		
M4		1	2.483841 GHz	-47.20 dBm		

Date:16.JUL.2018 16:22:18

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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

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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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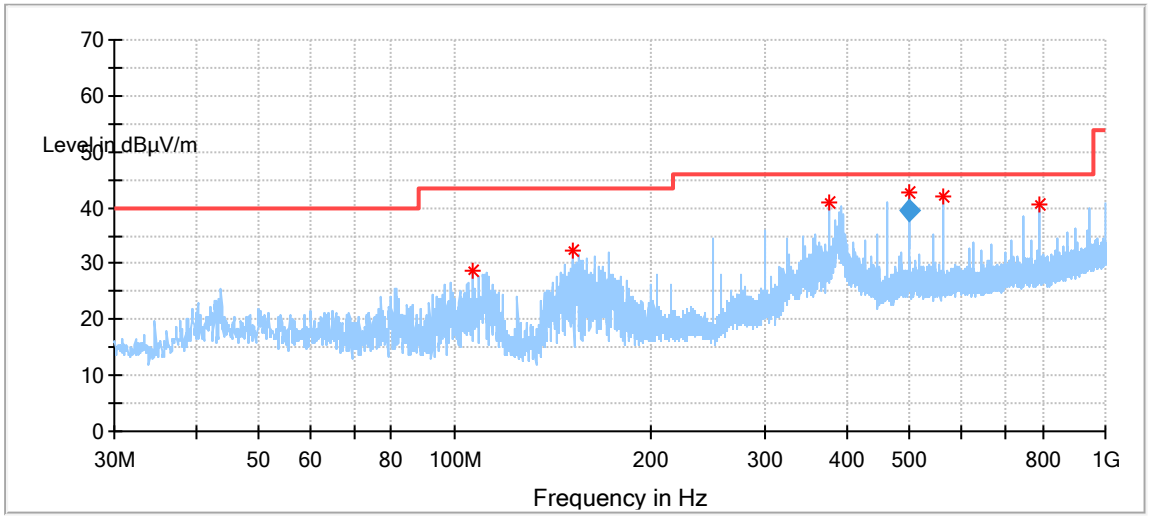
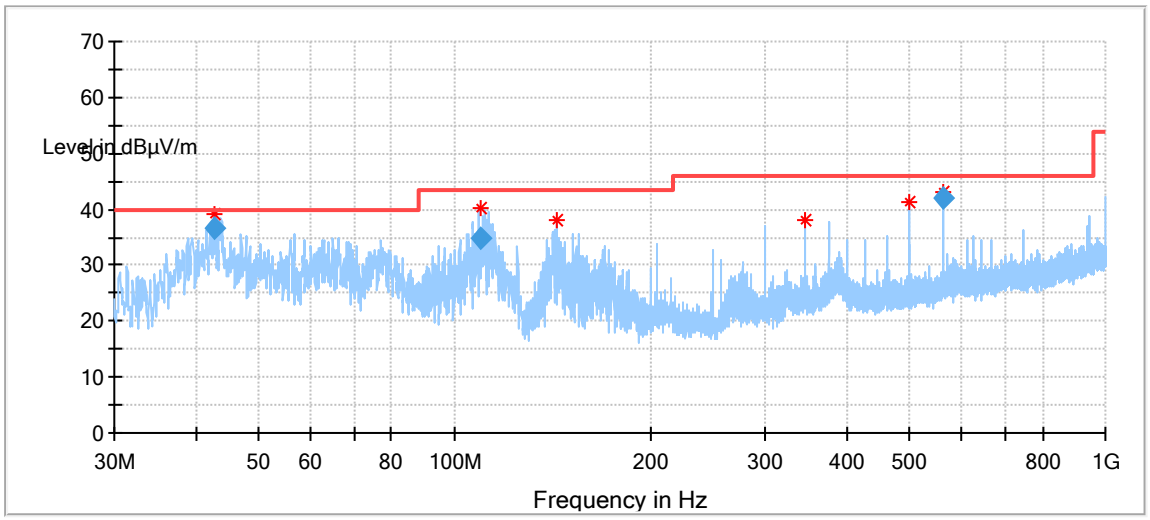
Spurious radiated emissions for transmitter

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.
Pretest all modulation type, report the data of the worst case.
Transmitting spurious emission test result as below:
For model: D04013
Emission below 1GHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
499.999422	39.41	46.00	6.59	167.0	H	6.0	18.8



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
42.780733	36.56	40.00	3.44	104.0	V	2.0	13.7
109.385556	34.93	43.50	8.57	100.0	V	65.0	11.9
563.169867	42.06	46.00	3.94	105.0	V	203.0	20.1

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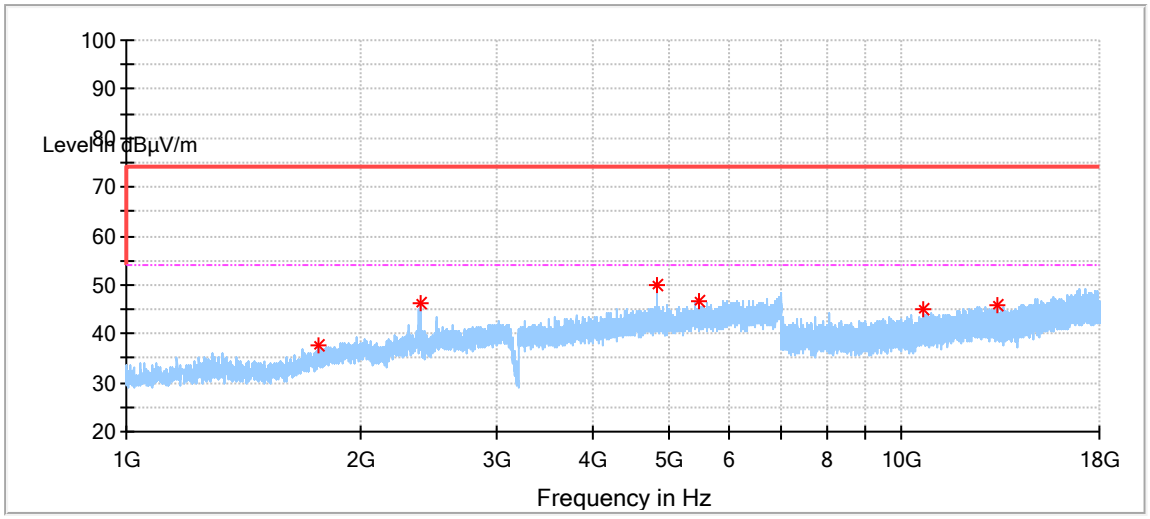
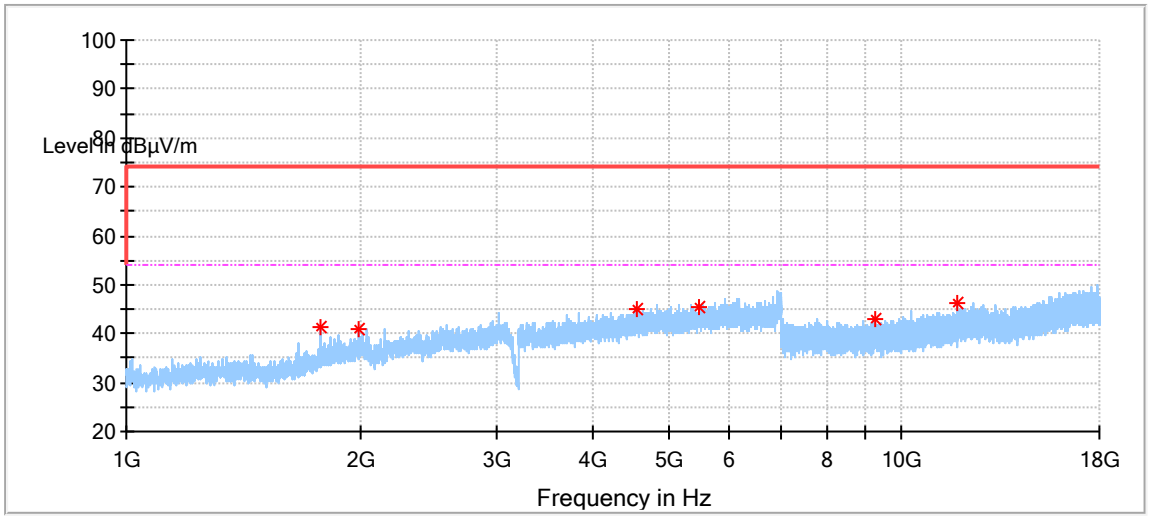
Emission between 1G-25GHz
802.11b Modulation:
2412MHz Test Result



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1766.500000	37.46	74.00	36.54	150.0	H	103.0	-6.6
2394.000000	46.28	74.00	27.72	150.0	H	282.0	-3.9
4824.500000	49.89	74.00	24.11	150.0	H	306.0	2.4
5469.500000	46.77	74.00	27.23	150.0	H	276.0	2.6
10640.000000	45.17	74.00	28.83	150.0	H	241.0	8.3
13259.500000	46.04	74.00	27.96	150.0	H	157.0	9.9



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1780.500000	41.18	74.00	32.82	150.0	V	239.0	-6.5
1993.000000	41.04	74.00	32.96	150.0	V	135.0	-5.2
4566.500000	45.06	74.00	28.94	150.0	V	105.0	2.8
5489.500000	45.54	74.00	28.46	150.0	V	138.0	2.7
9227.500000	42.89	74.00	31.11	150.0	V	152.0	7.0
11823.000000	46.07	74.00	27.93	150.0	V	65.0	9.3

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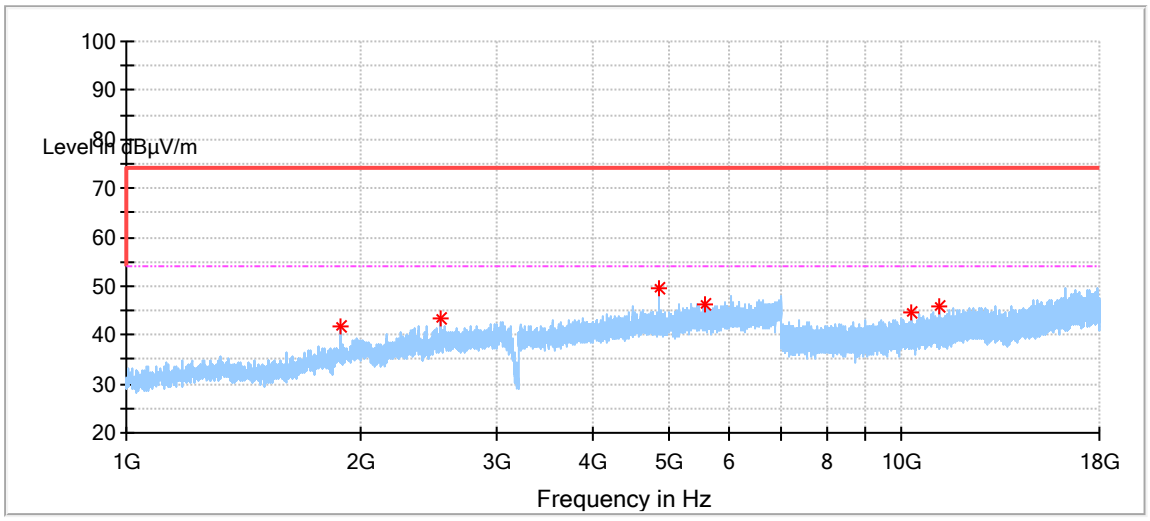
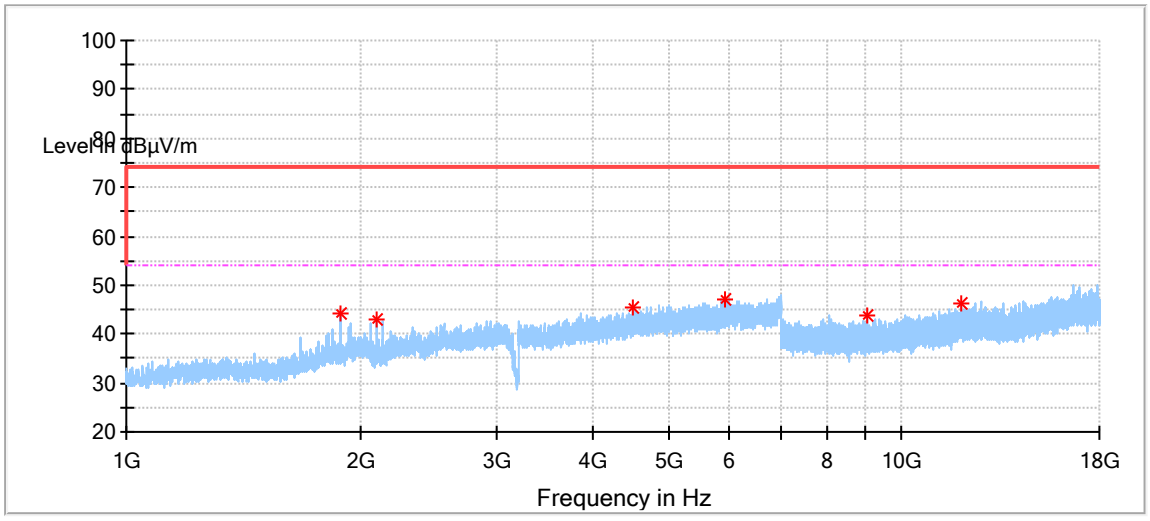
2437MHz Test Result



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1886.500000	41.59	74.00	32.41	150.0	H	71.0	-5.8
2542.500000	43.48	74.00	30.52	150.0	H	259.0	-3.2
4874.000000	49.51	74.00	24.49	150.0	H	329.0	2.4
5577.000000	46.13	74.00	27.87	150.0	H	220.0	2.9
10290.500000	44.50	74.00	29.50	150.0	H	314.0	7.9
11211.500000	45.95	74.00	28.05	150.0	H	92.0	8.3



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1886.000000	44.25	74.00	29.75	150.0	V	186.0	-5.8
2097.500000	42.87	74.00	31.13	150.0	V	186.0	-4.8
4516.000000	45.41	74.00	28.59	150.0	V	94.0	3.1
5930.000000	47.28	74.00	26.72	150.0	V	121.0	4.1
9009.000000	43.61	74.00	30.39	150.0	V	354.0	6.9
11925.000000	46.24	74.00	27.76	150.0	V	354.0	9.7

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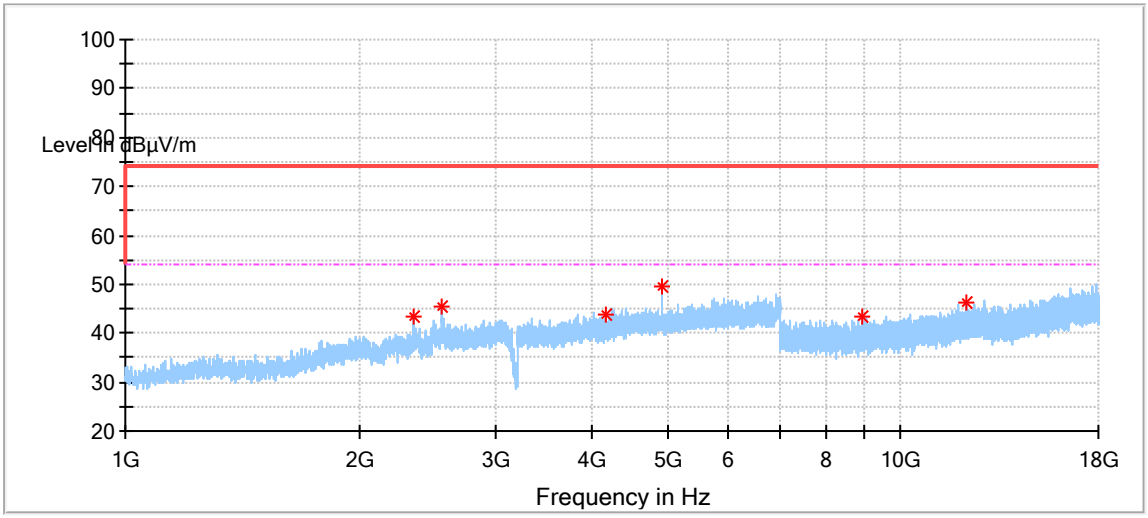
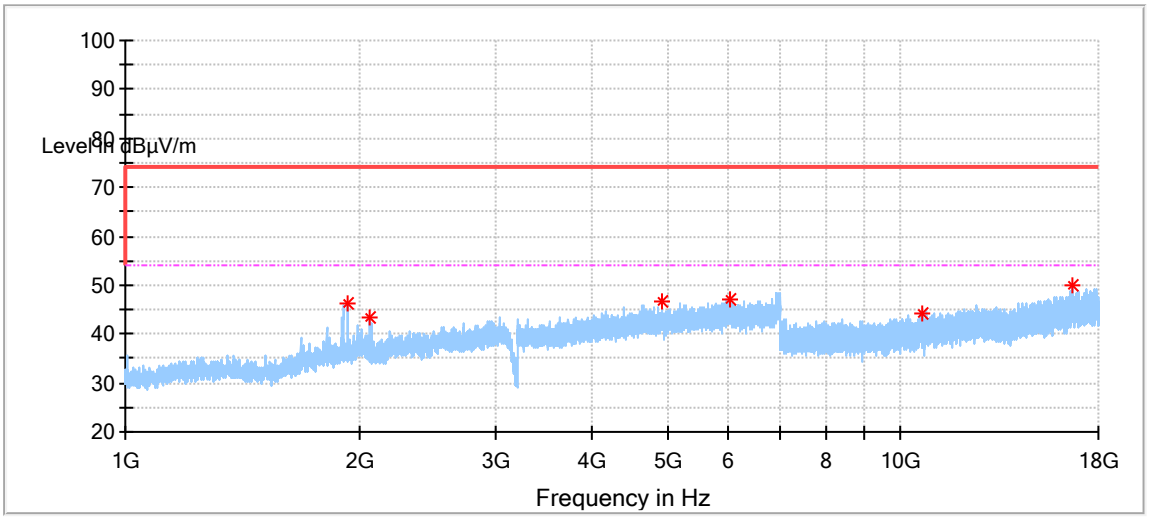
2462MHz Test Result



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2360.500000	43.41	74.00	30.59	150.0	H	285.0	-4.0
2563.500000	45.38	74.00	28.62	150.0	H	269.0	-3.2
4178.000000	43.68	74.00	30.32	150.0	H	128.0	1.8
4924.000000	49.53	74.00	24.47	150.0	H	98.0	2.3
8932.500000	43.21	74.00	30.79	150.0	H	18.0	6.9
12172.000000	46.14	74.00	27.86	150.0	H	46.0	9.6



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1933.500000	46.16	74.00	27.84	150.0	V	210.0	-5.5
2065.500000	43.50	74.00	30.50	150.0	V	176.0	-5.1
4923.500000	46.54	74.00	27.46	150.0	V	5.0	2.3
6023.500000	47.23	74.00	26.77	150.0	V	343.0	5.0
10642.500000	44.35	74.00	29.65	150.0	V	124.0	8.3
16701.500000	49.97	74.00	24.03	150.0	V	294.0	16.6

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.

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(3) Level=Reading Level + Correction Factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

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10 Test Equipment List

List of Test Instruments

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
Signal Analyzer	Rohde & Schwarz	FSV40	101031	2020-6-28
High Pass Filter (HPF)	UCL	UCL-BPF1-7G	1504005103	2020-6-28
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2020-6-29
Horn Antenna	Rohde & Schwarz	HF907	102295	2020-6-22
Wideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	12827	2020-7-12
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2020-6-28
Pre-amplifier	Rohde & Schwarz	SCU 40A	100432	2020-7-16
Attenuator	Agilent	8491A	MY39264334	2020-6-28
3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

RF conducted test

DESCRIPTION	**MANUFACTURER**	**MODEL NO.**	**SERIAL NO.**	**CAL. DUE DATE**
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2020-6-28
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2020-6-28
Power Splitter	Weinschel	1580	SC319	2020-7-7
Vector Signal Generator	Rohde & Schwarz	SMBV100A	262825	2020-6-28
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2020-7-6
Test software	Tonscend	System for BT/WIFI	Version 2.6	N/A

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- 20dB bandwidth and 99% Occupied Bandwidth
- Carrier frequency separation
- Number of hopping frequencies
- Dwell Time
- 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	
Test Items	Extended Uncertainty
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.80dB; Vertical: 4.87dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.59dB; Vertical: 4.58dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 5.05dB; Vertical: 5.04dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10^{-7} or 1%
Uncertainty Evaluation for Power Spectral Density Conducted measurement	1.17dB
Uncertainty Evaluation for Spurious emissions Conducted measurement	1.43dB

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