

FCC - TEST REPORT

Report Number : **64.790.19.00122.02-1** Date of Issue: June 8, 2020

Model : D04011

Product Type : Smart Access Point Pro

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
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FCC Registration No.: 514049

IC registration number: 10320A

3 Description of the Equipment Under Test

Product:	Smart Access Point Pro
Model no.:	D04011
FCC ID:	2AEBL-D04011
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 Pro of a door entry system.

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).

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.

6 General Remarks

EUT supports Bluetooth function (BLE only): 2402-2480MHz; 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-D04011 and only for the 2.4GHz Wi-Fi band.

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; 2020-01-09

Testing Date: 2018-07-13~2018-07-17; 2020-01-10~2020-03-13

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

Reviewed by:

Prepared by:

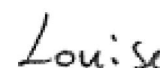
Tested by:



Tony Liu



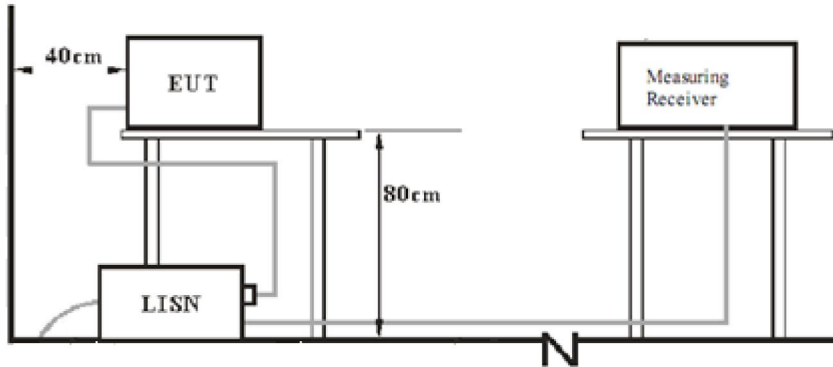
Kevin Ouyang



Louise Liu

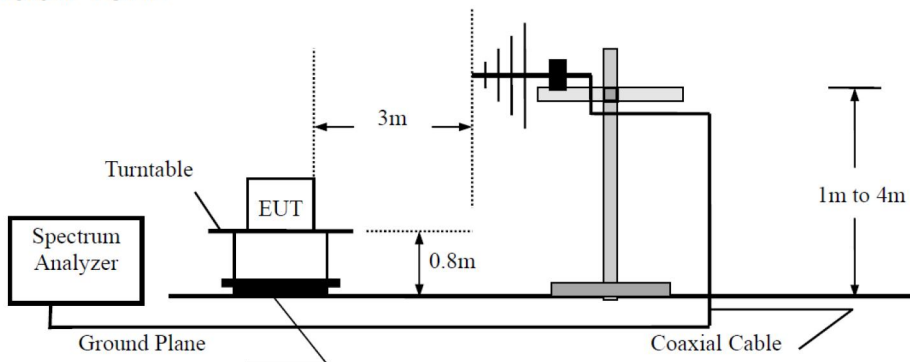
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

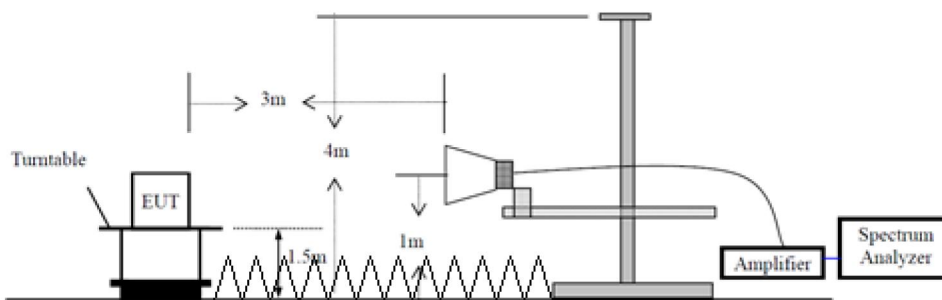


7.2 Radiated test setups

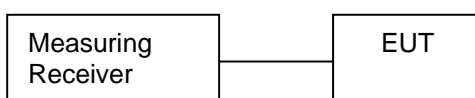
Below 1GHz



Above 1GHz



7.3 Conducted RF test setups



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

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

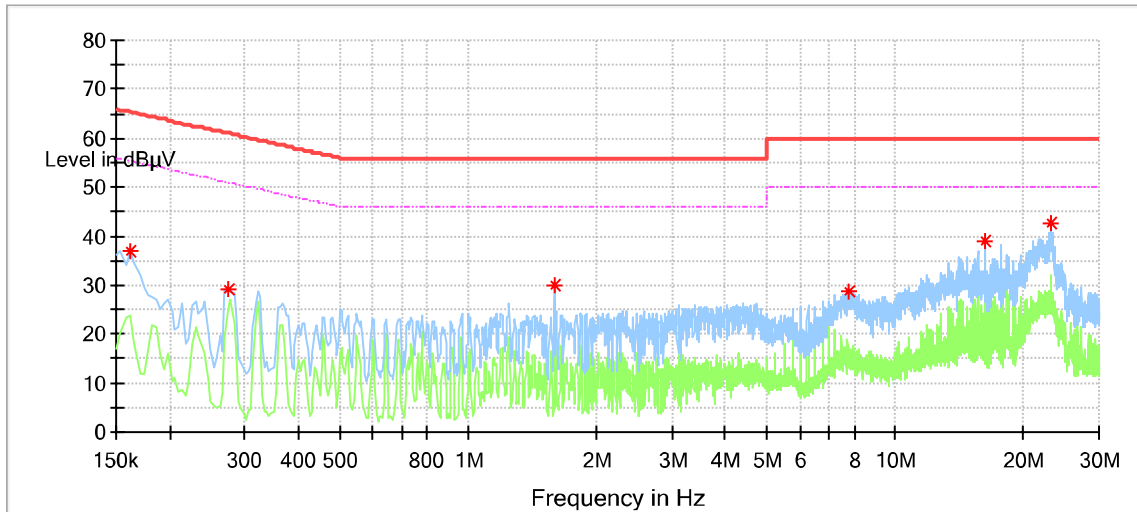
According to §15.207, conducted emissions limit as below:

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

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

Conducted Emission

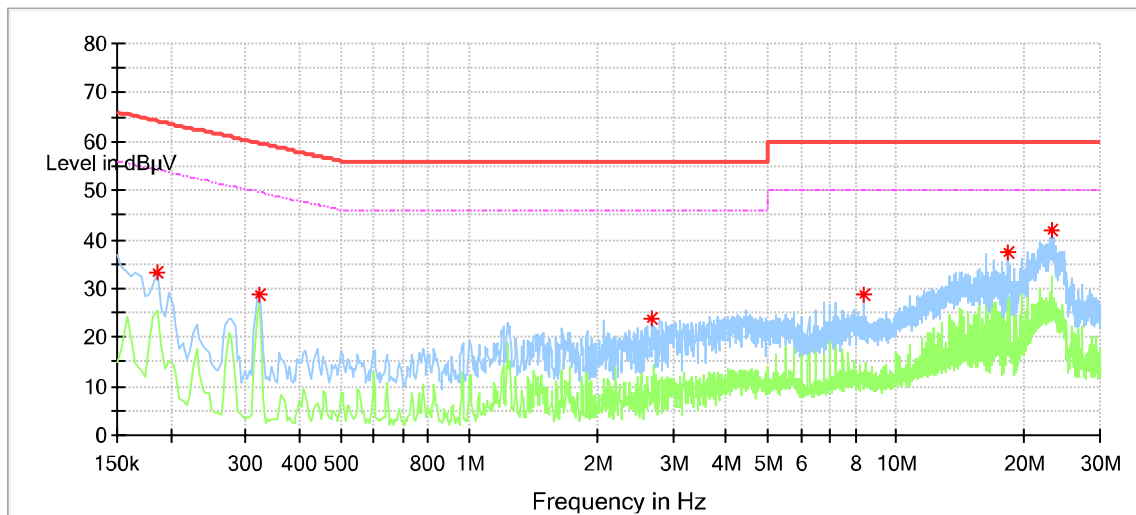
Product Type : Smart Access Point Pro
 M/N : D04011
 Operating Condition : WiFi function on.
 Test Specification : L
 Comment : AC 120V/60Hz
 Test date : 2020-01-10



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.162000	36.78	---	65.36	28.58	L1	9.5
0.274000	29.06	---	61.00	31.93	L1	9.5
1.586000	29.97	---	56.00	26.03	L1	9.6
7.790000	28.82	---	60.00	31.18	L1	9.7
16.230000	39.16	---	60.00	20.84	L1	9.7
23.130000	42.73	---	60.00	17.27	L1	9.8

Conducted Emission

Product Type : Smart Access Point Pro
 M/N : D04011
 Operating Condition : WiFi function on.
 Test Specification : N
 Comment : AC 120V/60Hz
 Test date : 2020-01-10



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.186000	33.22	---	64.21	31.00	N	9.5
0.322000	28.61	---	59.66	31.04	N	9.6
2.682000	23.66	---	56.00	32.34	N	9.6
8.370000	28.65	---	60.00	31.35	N	9.7
18.246000	37.29	---	60.00	22.71	N	9.8
23.070000	41.78	---	60.00	18.22	N	9.9

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 $10\log(1/x)$, 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 $10\log(\text{number of array elements})$ plus the directional gain of the element having the highest gain. $\text{directional gain} = 10\log(2) + 3.6\text{ dBi} = 6.6\text{ dBi} > 6\text{ dBi}$, the limit of 11N20 shall be reduced by 2dB.

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 \geq 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

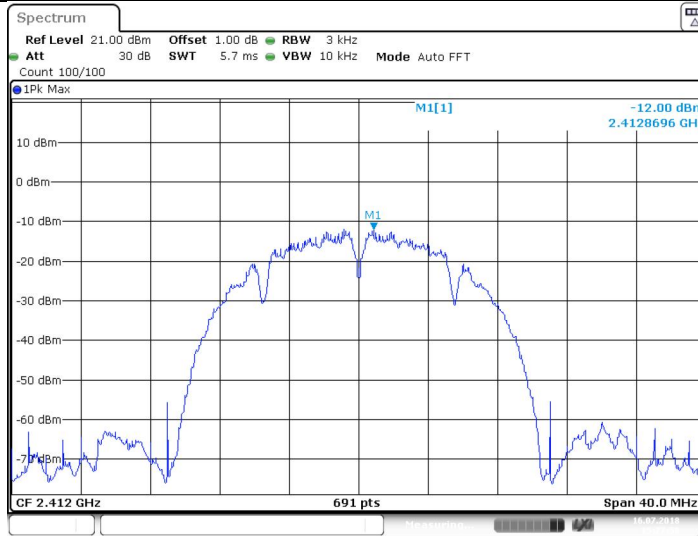
TestMode	Antenna	Channel (MHz)	PSD measured		Total PSD (dBm/3KHz)	Limit (dBm/3KHz)	Verdict
			Chain1 (dBm/3KHz)	Chain2 (dBm/3KHz)			
11B	Ant1	2412	-12	/	-12	8	PASS
		2437	-0.6		-0.6	8	PASS
		2462	-11.72		-11.72	8	PASS
11G	Ant1	2412	-14.32		-14.32	8	PASS
		2437	-15.28		-15.28	8	PASS
		2462	-14.75		-14.75	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.

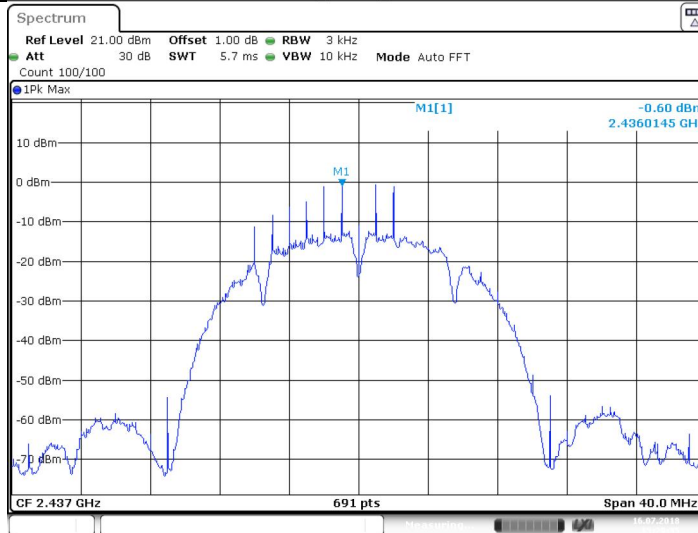
Test Graphs

11B_Ant1_2412



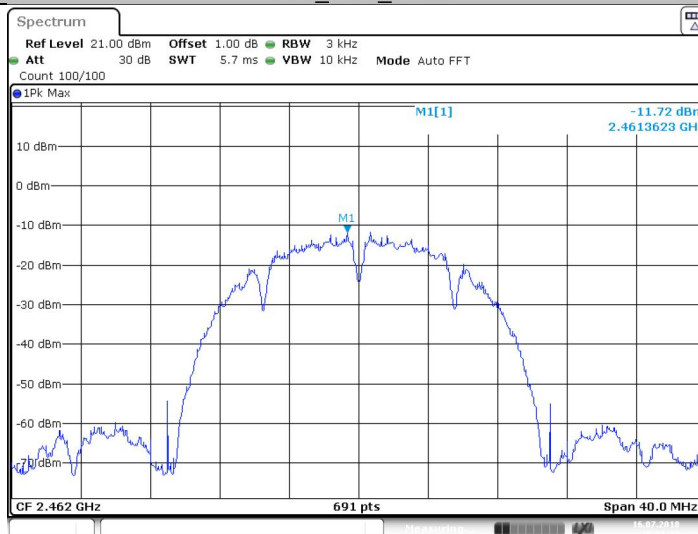
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11B_Ant1_2437



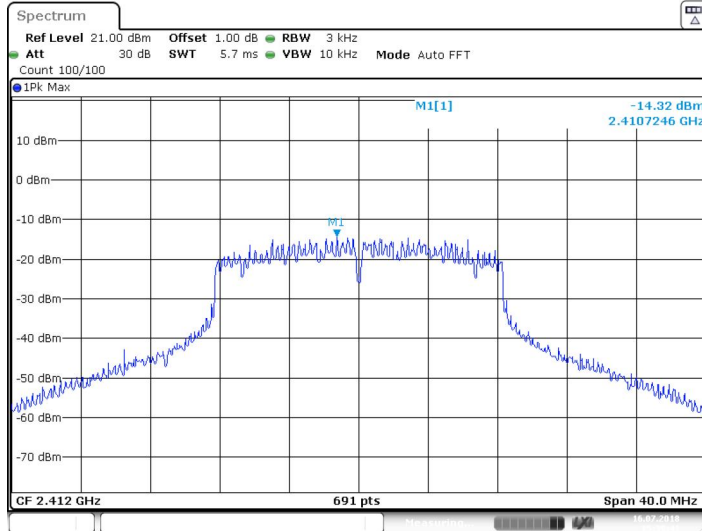
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11B_Ant1_2462



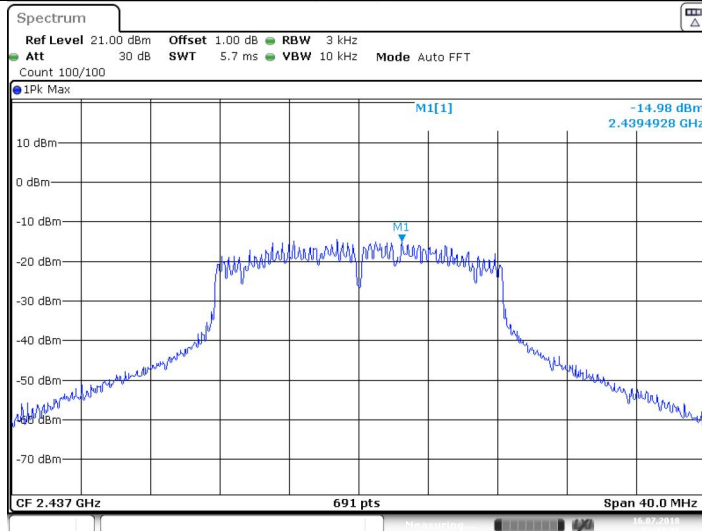
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11G_Ant1_2412



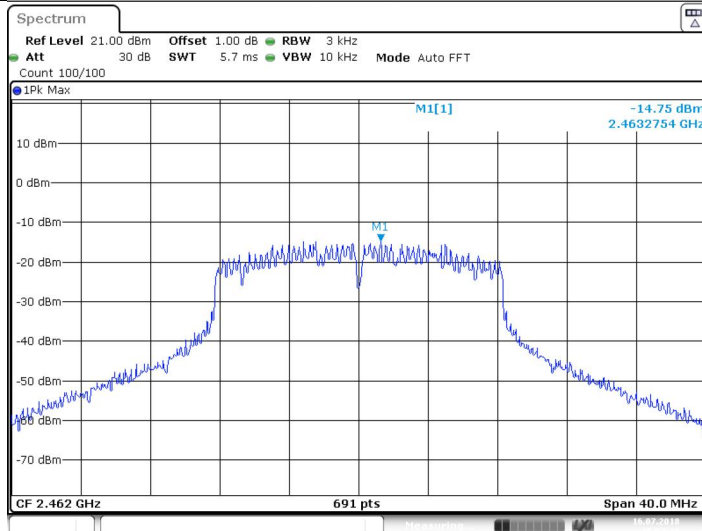
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11G_Ant1_2437



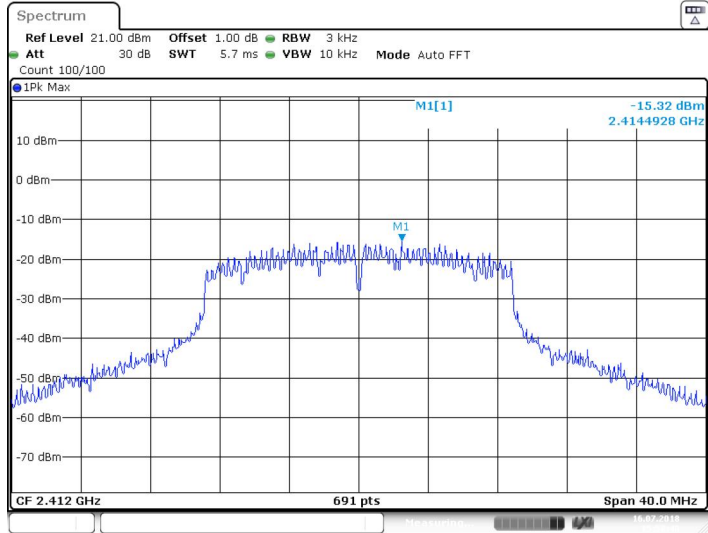
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11G_Ant1_2462

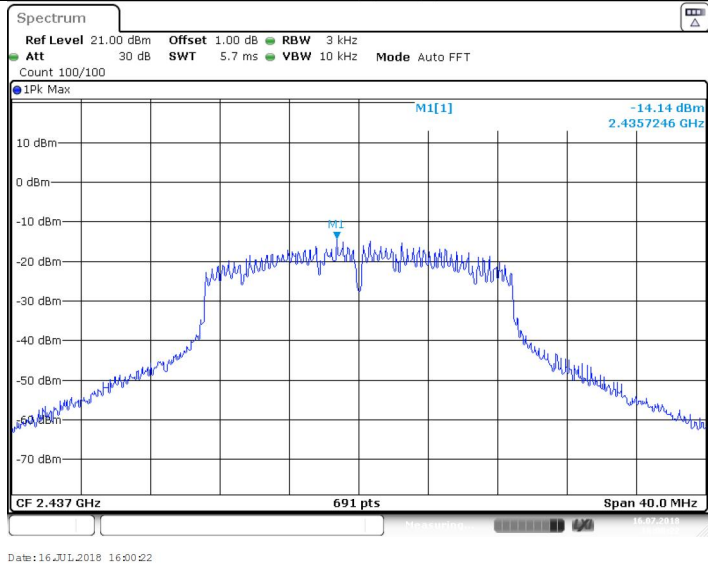


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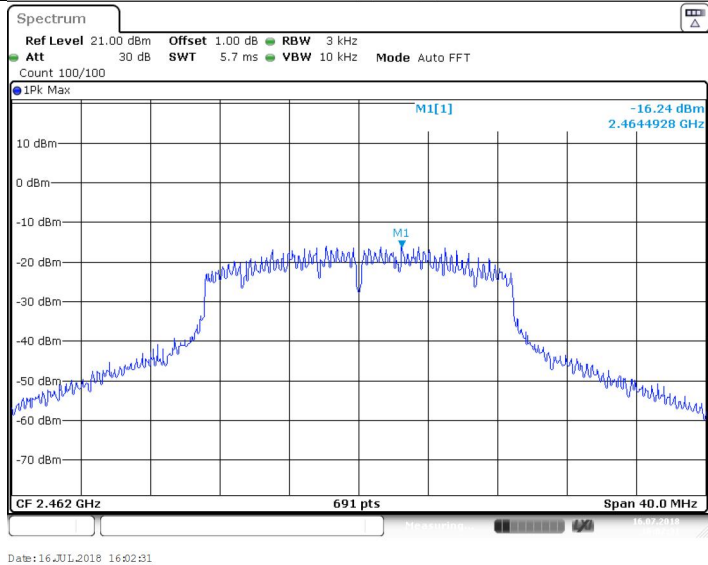
11N20SISO_Ant1_2412



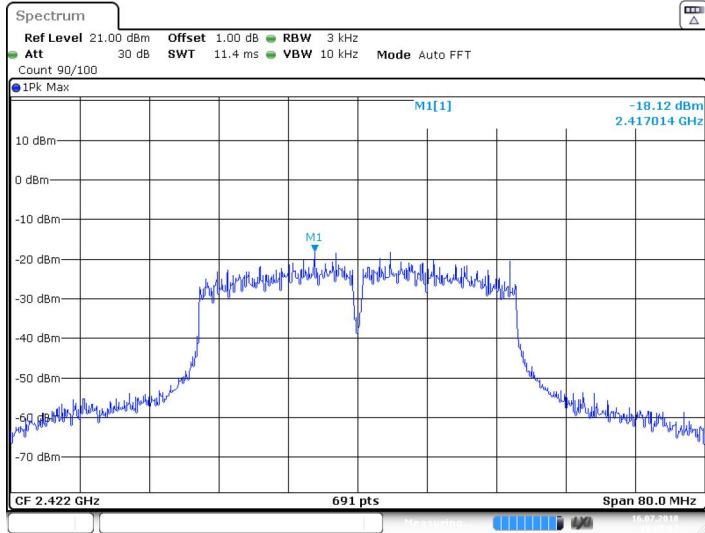
11N20SISO_Ant1_2437



11N20SISO_Ant1_2462

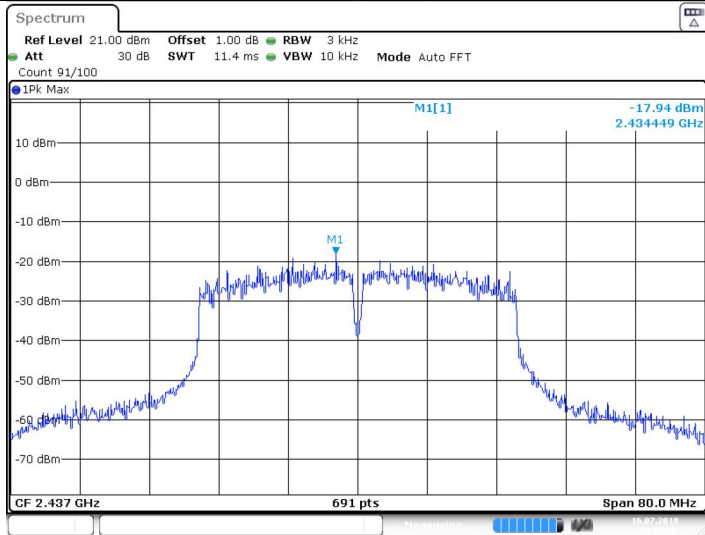


11N40SISO_Ant1_2422



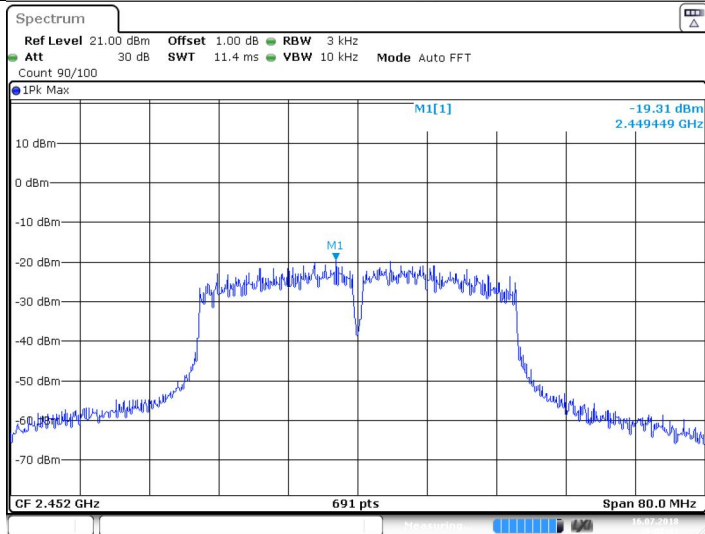
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11N40SISO_Ant1_2437



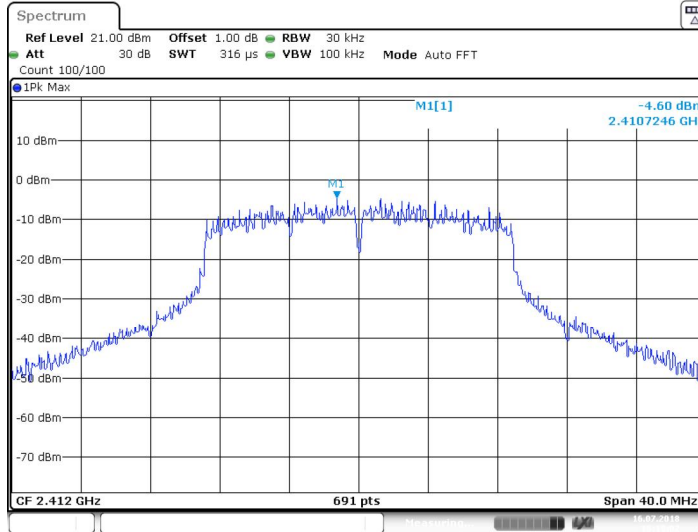
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11N40SISO_Ant1_2452



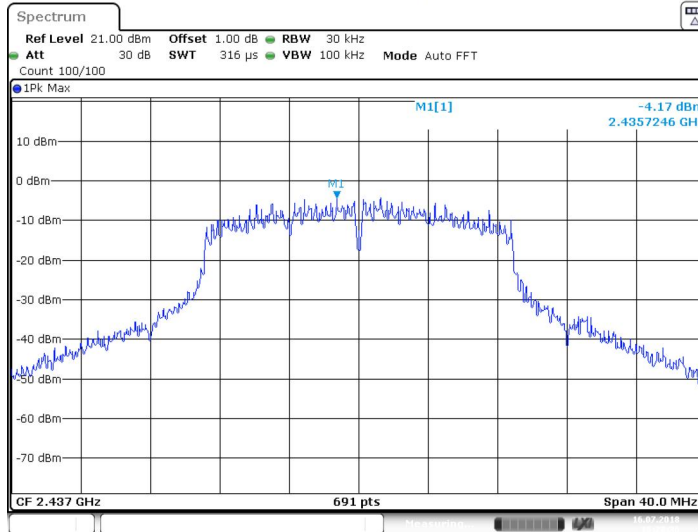
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11N20SISO_Ant2_2412



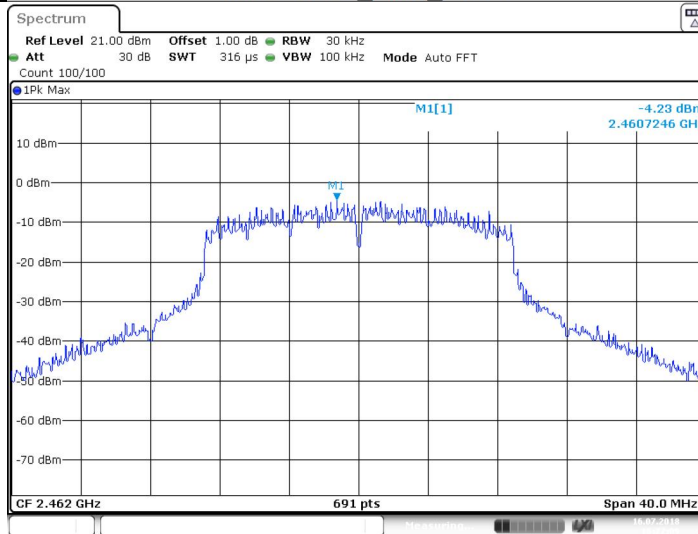
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11N20SISO_Ant2_2437



Date: 16.JUL.2018 16:20:36

11N20SISO_Ant2_2462



Date: 16.JUL.2018 16:22:09

9.4 6 dB Bandwidth

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Use the following spectrum analyzer settings:
Set RBW \geq 1% of the 99% bandwidth, VBW \geq 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 \geq 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