FCC / ISED – TEST REPORT

Report Number	:	**60.790.23.023.01R02**	Date of Issue:	**September 12, 2023**
Model/HVIN	:	**AURORA V2.2**		
Product Type	:	Retail IoT Sensor		
Applicant	:	RetailNext Inc.		
Address	:	60 S Market St, 3rd Floor, Suite 310, San Jose, California 95113, United States		
Manufacturer	:	Altek Coroporation		
Address	:	No.12, Lixing Road, East District, Hsinchu City, Taiwan		
Test Result	:	**n Positive** o Negative		
Total pages including Appendices	:	**88**		

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1 Table of Contents

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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, Guankou Erlu, Nantou, Nanshan District, Shenzhen, Guangdong, China
Telephone:	86 755 8828 6998
Fax:	86 755 8828 5299
FCC Registration No.:	514049
FCC Deignation No.:	CN5009
IC Registration No.:	10320A
ISED CAB Identifier:	CN0077

3 Description of the Equipment Under Test

Product:	Retail IoT Sensor
Model no.:	AURORA V2.2
Hardware Version Identification No. (HVIN)	AURORA V2.2
Product Marketing Name (PMN)	AURORA V2.2
Brand name:	RetailNext
FCC ID:	2AFSV-AURORA-V2-2
IC:	30959-AURORAV22
Rating:	36 – 57 VDC, 15.4W (POE802.3af)
RF Transmission Frequency:	2412MHz-2462MHz for 802.11b/g/n20 (WiFi) 2422MHz-2452MHz for 802.11n40 (WiFi)
No. of Operated Channel:	11 for 802.11b/g/n20 (Wi-Fi) 7 for 802.11n40 (Wi-Fi)
Modulation:	DSSS, OFDM
Antenna Type:	FPC PIFA
Antenna	Gain: 4.06 dBi max (2.4GHz)
Description of the EUT:	The Equipment Under Test (EUT) is a Retail IoT Sensor which support Bluetooth function and Wi-Fi operated at 5GHz and 2.4GHz. Only 2.4GWiFi included in this report.

NOTE:

1. The above EUT's information is declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2021 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5 April 2018 + Amendment 1 March 2019 + Amendment 2 February 2021	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 3 August 2023	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10-2020.

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5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C/ RSS-247 Issue 3 / RSS-Gen Issue 5 + A1 + A2						
Test Condition		Test Site	Test Result			Test Environment
			Pass	Fail	N/A	
§15.207 & RSS-GEN 8.8	Conducted emission AC power port	Site 1	☒	☐	☐	T: 24.8℃ H: 53.7%
§15.247 (b) (3) & RSS-247 5.4(d)	Conducted peak output power	Site 1	☒	☐	☐	T: 24.8℃ H: 53.7%
RSS-247 5.4(d)	Equivalent Isotropic Radiated Power	Site 1	☒	☐	☐	T: 24.8℃ H: 53.7%
§15.247(a)(2) & RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth and 99% Occupied Bandwidth	Site 1	☒	☐	☐	T: 24.8℃ H: 53.7%
§15.247(e) & RSS-247 5.2(b)	Power spectral density	Site 1	☒	☐	☐	T: 24.8℃ H: 53.7%
§15.247(d) & RSS-247 5.5	Spurious RF conducted emissions	Site 1	☒	☐	☐	T: 24.8℃ H: 53.7%
§15.247(d) & RSS-247 5.5	Band edge	Site 1	☒	☐	☐	T: 24.8℃ H: 53.7%
§15.247(d) & §15.209 & §15.205 & RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	Site 1	☒	☐	☐	T: 24.7℃ H: 49.3%
§15.203 & RSS-Gen 6.8	Antenna requirement	See note 2	☒	☐	☐	--

Note 1: N/A=Not Applicable.
Note 2: The EUT uses a FPC PIFA antenna, which gain is 4.06 dBi. In accordance to §15.203 & RSS-Gen 6.8, it is considered sufficiently to comply with the provisions of this section.
Note 3: T :Temperature, H: Humidity

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for **FCC ID: 2AFSV-AURORA-V2-2**, **IC: 30959-AURORAV22**, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules and RSS-247, RSS-GEN.

SUMMARY:

All tests according to the regulations cited on page 5 were

n - Performed

o - **Not** Performed

The Equipment Under Test

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

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

Sample Received Date:	July 10, 2023
Testing Start Date:	July 11, 2023
Testing End Date:	August 29, 2023

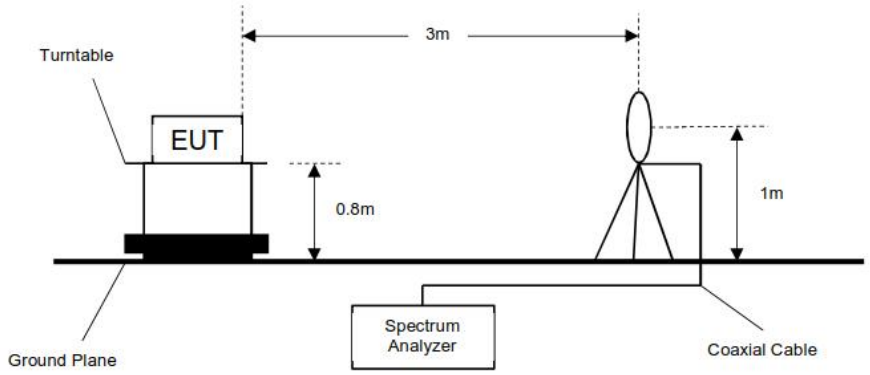
- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:	Prepared by:	Tested by:
Eric LI	Kevin DU	Louise LIU
Section Manager	EMC Project Engineer	EMC Test Engineer

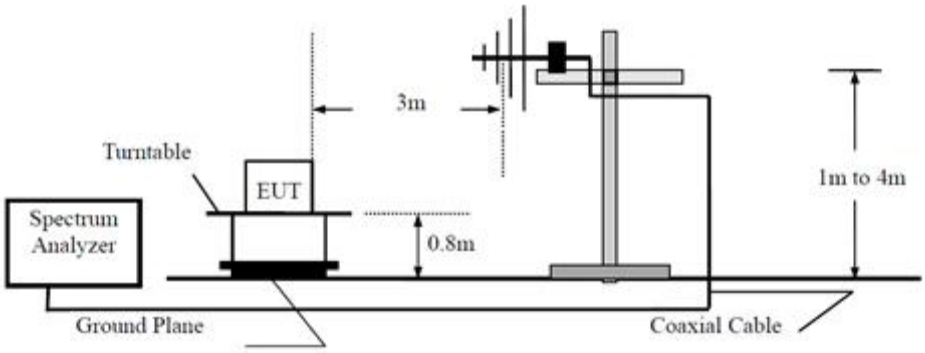
7 Test Setups

7.1 Radiated test setups

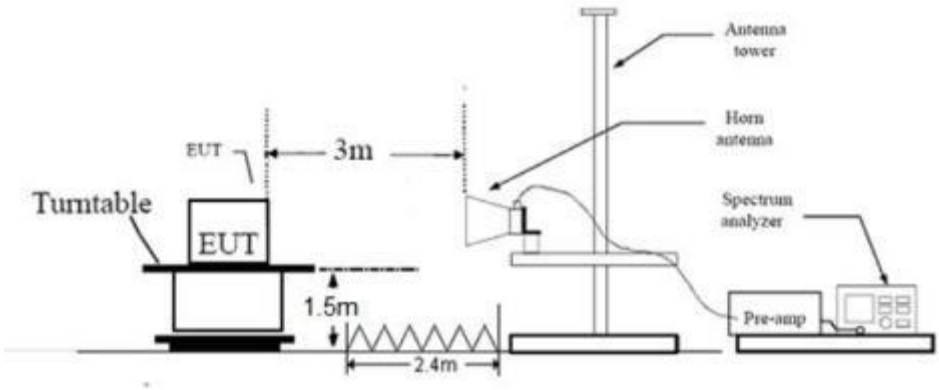
9KHz - 30MHz



30MHz - 1GHz



Above 1GHz



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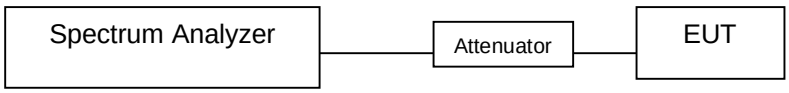
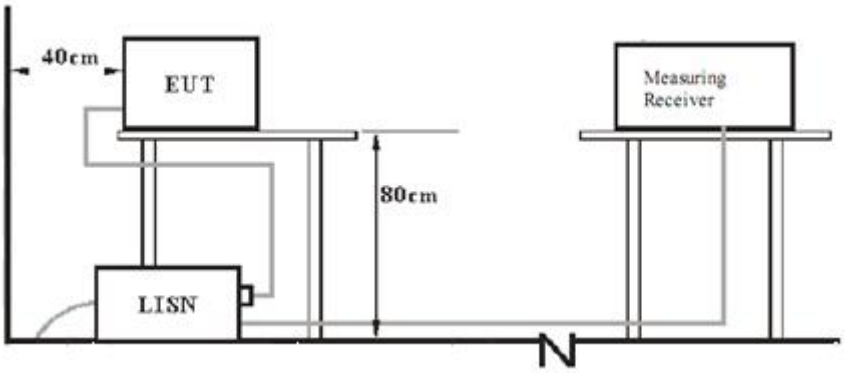
7.2 Conducted RF test setup



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.	Remark
Laptop	Thinkpad	T460S	---
Router	D-Link corporation	DIR-605L	---
AC/DC Adaptor	TP-Link Corporation Ltd	T480050-2D1	Input: 100-240 VAC 0.8A Output: 48 VDC 0.5A, 24.0W
POE Injector	TP-Link Corporation Ltd	TL-POE150S	Input: 48 VDC, 0.5A Output: 48 VDC 0.35A

Cables Used During Test:

Cable	Length	Shielded/unshielded	With / without ferrite
Connection Cable	1.0m	Shielded	Without ferrite

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 11Mbps of rate is the worst case of 802.11b; the 54Mbps of rate is the worst case of 802.11g; the 65Mbps of rate is the worst case of 802.11n20 & 802.11n40, only the worst case transmitter rate data mode is recorded in the report.

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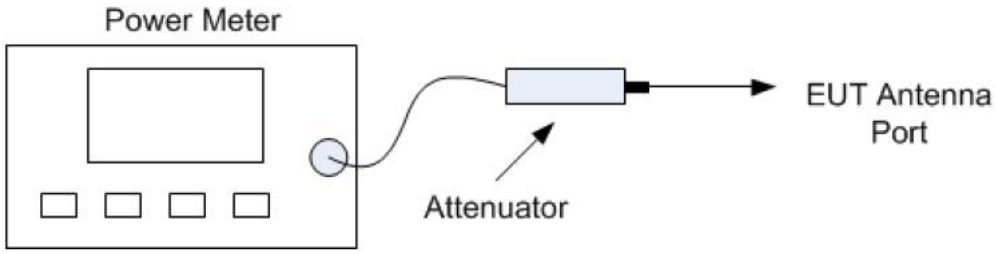
9 Technical Requirement

9.1 Conducted 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 peak 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) (3) & RSS-247 5.4(d), conducted peak output power limit as below:

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

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

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤4	≤36

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Test result as below table

802.11b Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2412MHz	11.2	4.06	15.26	Pass
Middle channel 2437MHz	14.5	4.06	18.56	Pass
High channel 2462MHz	15.5	4.06	19.56	Pass

802.11g Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2412MHz	11.1	4.06	15.16	Pass
Middle channel 2437MHz	14.0	4.06	18.06	Pass
High channel 2462MHz	15.0	4.06	19.06	Pass

802.11n20 Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2412MHz	11.1	4.06	15.16	Pass
Middle channel 2437MHz	13.9	4.06	17.96	Pass
High channel 2462MHz	13.9	4.06	17.96	Pass

802.11n40 Test Result

Frequency (MHz)	Conducted Peak Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
Low channel 2422MHz	15.8	4.06	19.86	Pass
Middle channel 2437MHz	15.3	4.06	19.36	Pass
High channel 2452MHz	15.3	4.06	19.36	Pass

9.2 6dB Bandwidth and 99% Occupied Bandwidth

Test Method for 6 dB Bandwidth

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   RBW=100KHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Use the automatic bandwidth measurement capability of an instrument, use the X dB bandwidth mode with X set to 6 dB.
5. Allow the trace to stabilize, record the 6 dB Bandwidth value.

Test Method for 99 % Bandwidth

1. Connect EUT test port to spectrum analyzer.
   Use the following spectrum analyzer settings:
   RBW=1% to 5% of the actual occupied, VBW≥3RBW, Sweep = auto,
   Detector function = peak, Trace = max hold
2. Use the occupied bandwidth measurement capability of test receiver.
3. Allow the trace to stabilize, record the occupied bandwidth value.

Limit

6dB bandwidth Limit [kHz]	99% bandwidth Limit [kHz]
≥500	--

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Test result as below table

802.11b modulation Test Result

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit (MHz)	Result
Low channel 2412MHz	9.120	13.387	0.5	Pass
Middle channel 2437MHz	8.120	13.467	0.5	Pass
High channel 2462MHz	8.160	13.427	0.5	Pass

802.11g modulation Test Result

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit (MHz)	Result
Low channel 2412MHz	16.400	17.423	0.5	Pass
Middle channel 2437MHz	16.360	17.502	0.5	Pass
High channel 2462MHz	15.800	17.423	0.5	Pass

802.11n20 modulation Test Result

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit (MHz)	Result
Low channel 2412MHz	17.280	18.342	0.5	Pass
Middle channel 2437MHz	16.920	18.342	0.5	Pass
High channel 2462MHz	17.240	18.342	0.5	Pass

802.11n40 modulation Test Result

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit (MHz)	Result
Low channel 2422MHz	36.080	36.124	0.5	Pass
Middle channel 2437MHz	35.280	36.284	0.5	Pass
High channel 2452MHz	36.480	36.284	0.5	Pass

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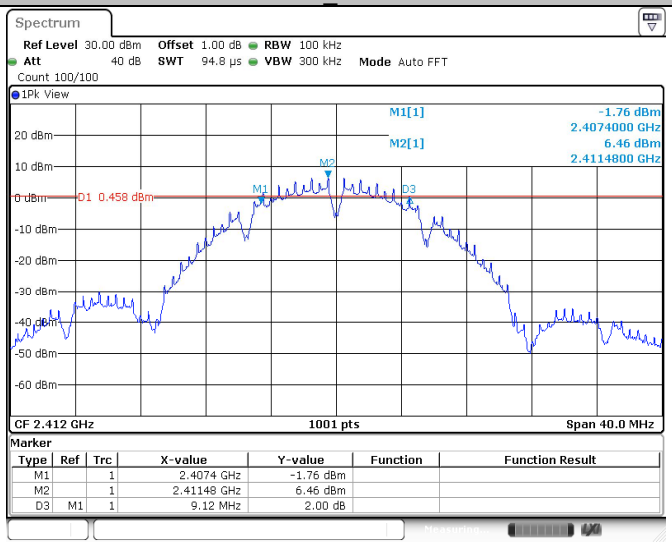
6 dB Bandwidth

11B_2412



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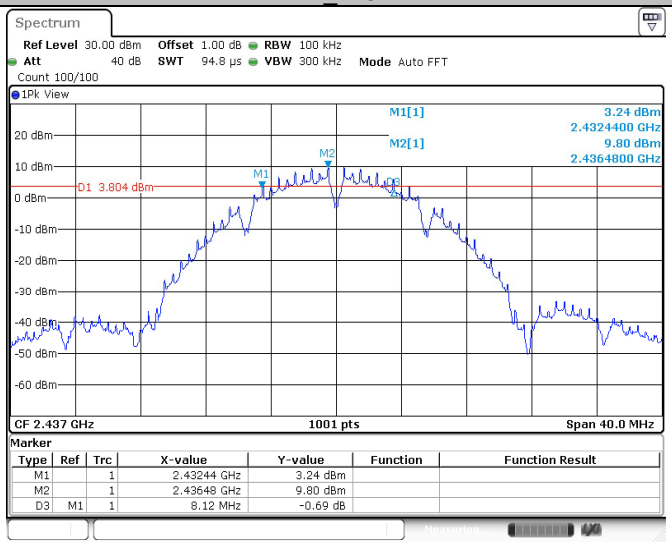

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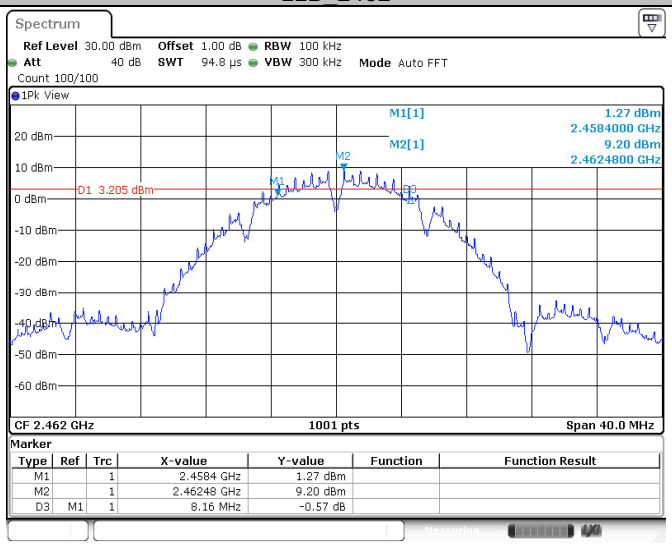
11B_2462



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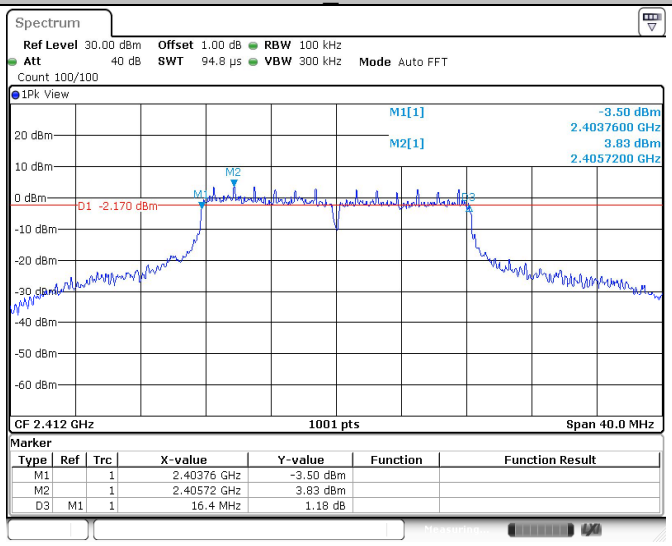

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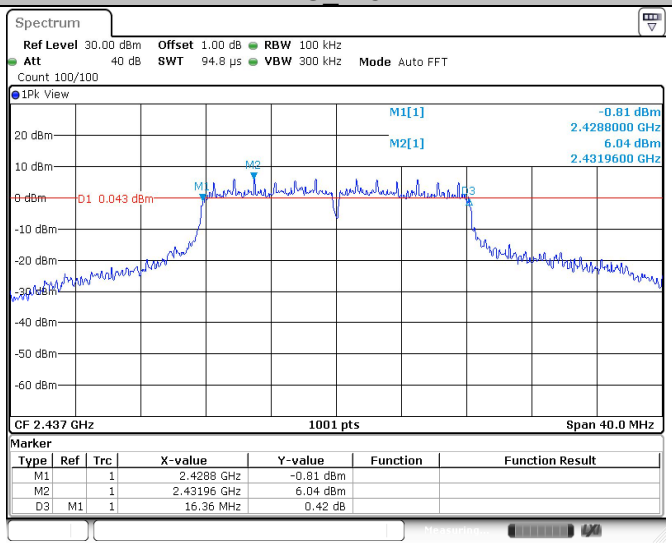

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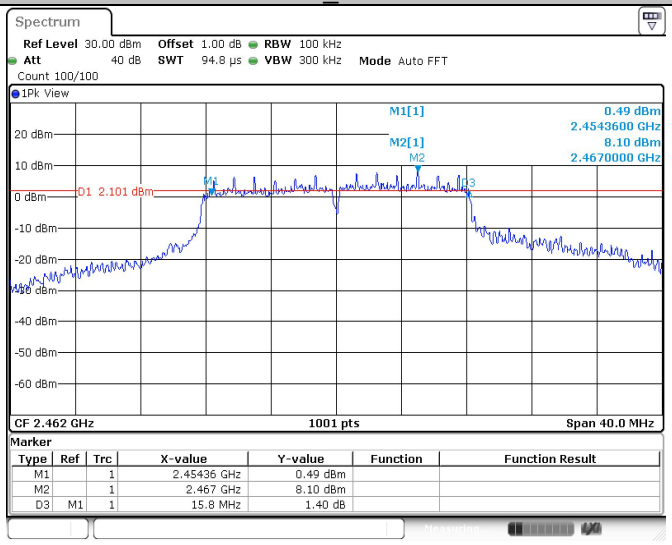
11G_2462



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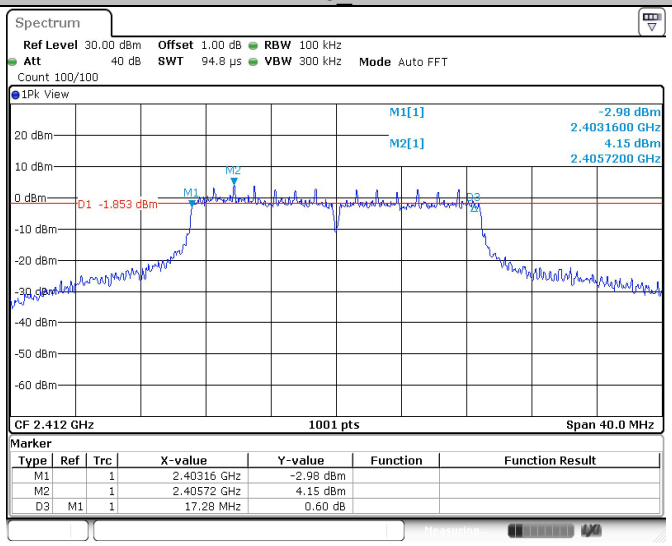

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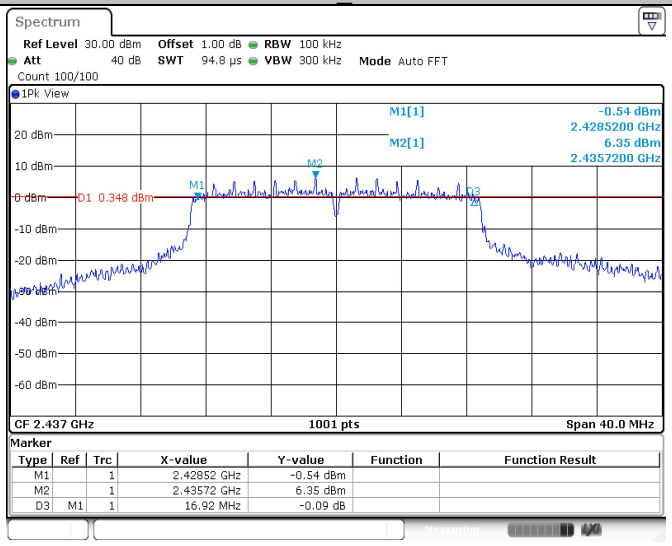

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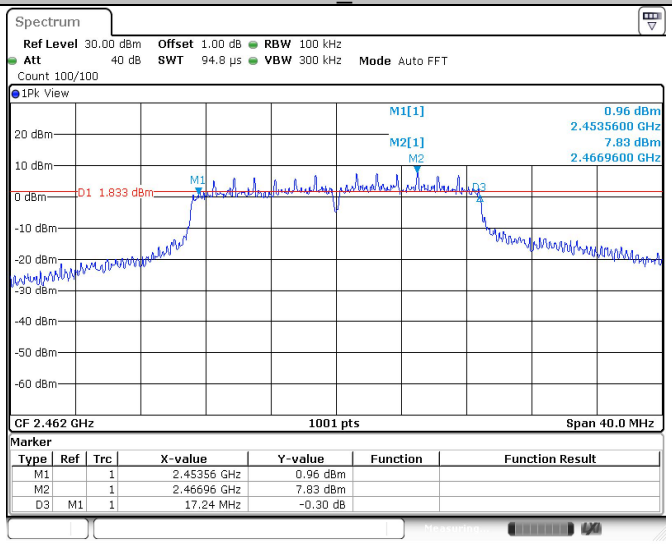
11N20_2462



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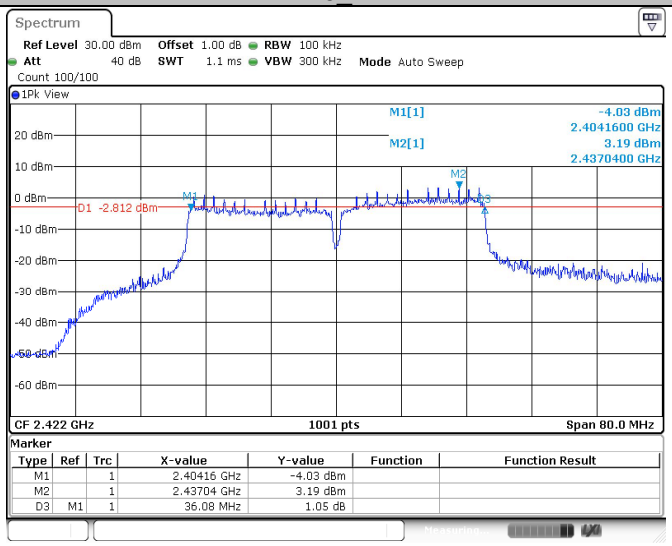

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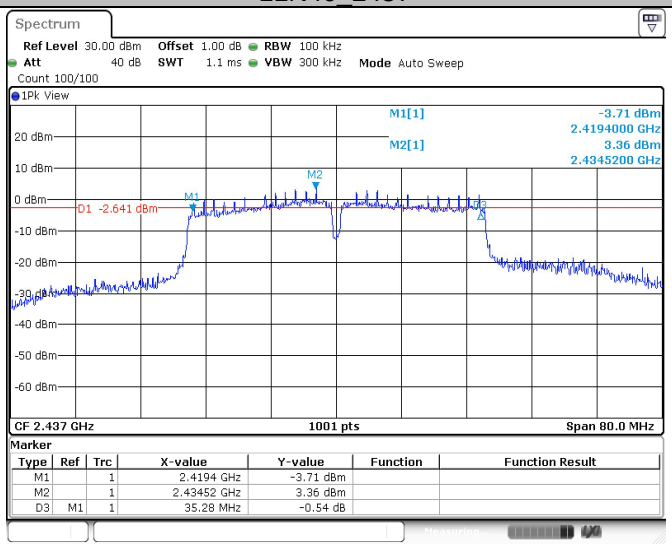

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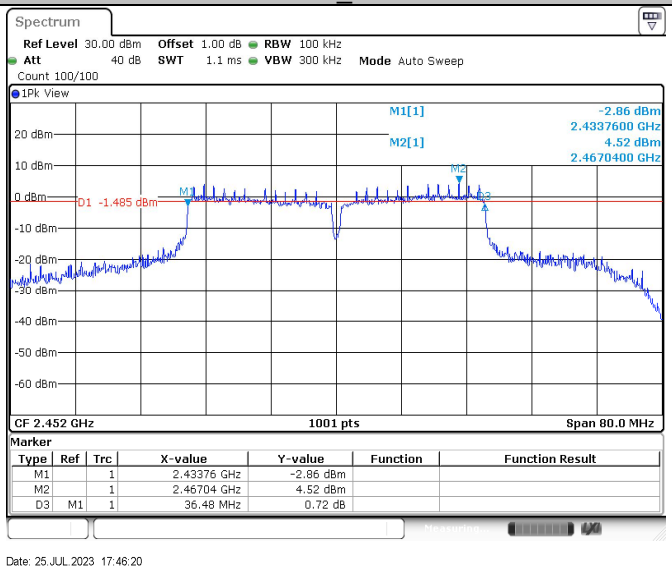
11N40_2452


Spectrum
Ref Level 30.00 dBm Offset 1.00 dB RBW 100 kHz
Att 40 dB SWT 1.1 ms VBW 300 kHz Mode Auto Sweep
Count 100/100
1Pk View
M1[1] -2.86 dBm
2.4337600 GHz
M2[1] 4.52 dBm
2.4670400 GHz
D1 -1.485 dBm
CF 2.452 GHz
1001 pts
Span 80.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.43376 GHz -2.86 dBm
M2 1 2.46704 GHz 4.52 dBm
D3 M1 1 36.48 MHz 0.72 dB
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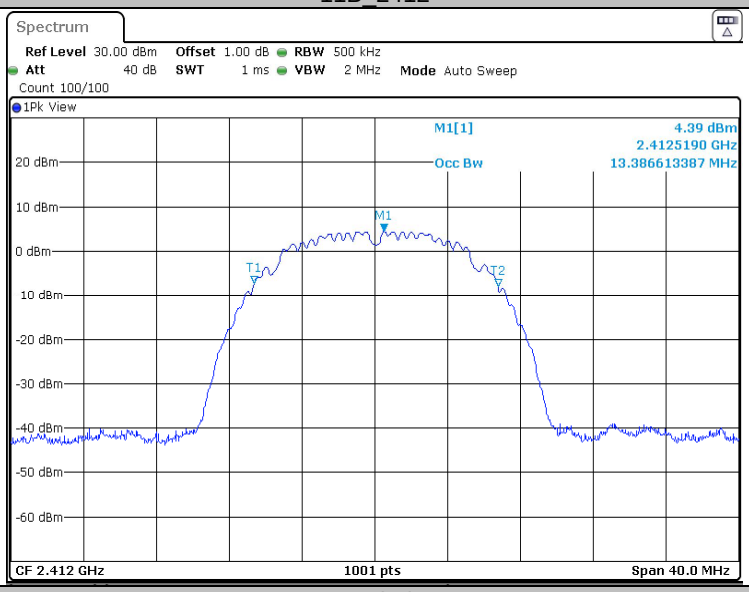
99% Bandwidth

11B_2412



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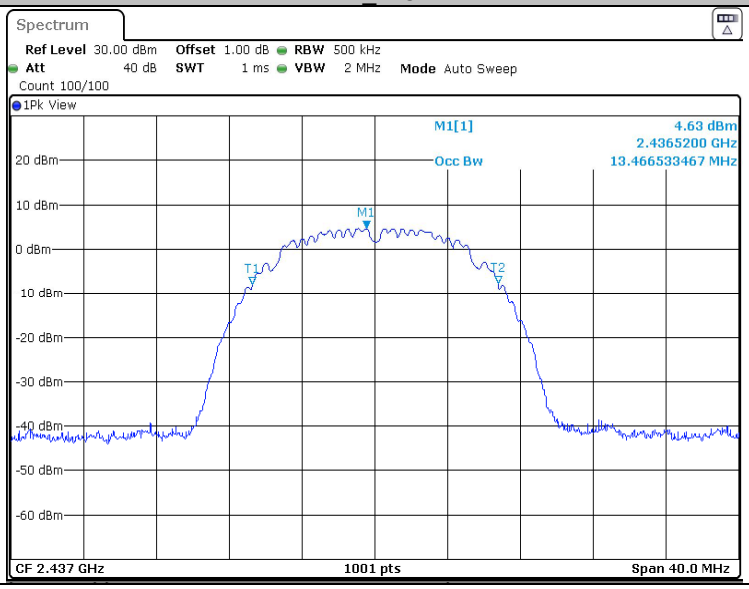

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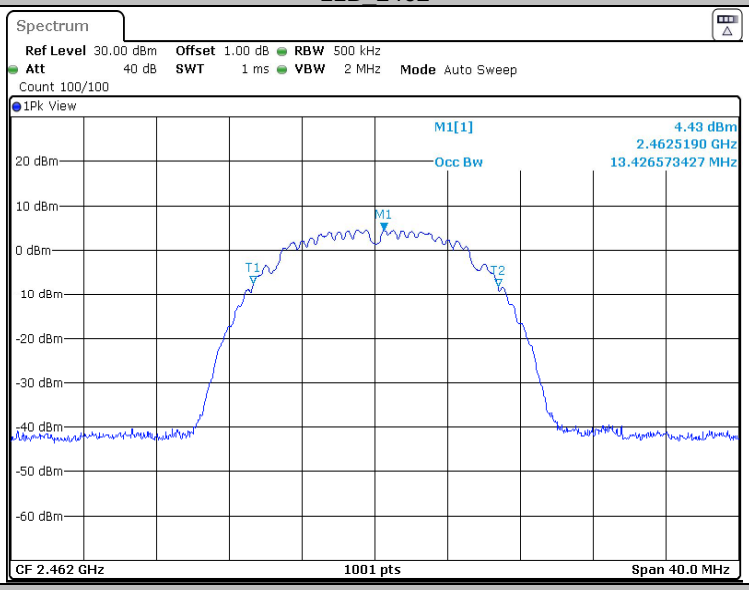
11B_2462



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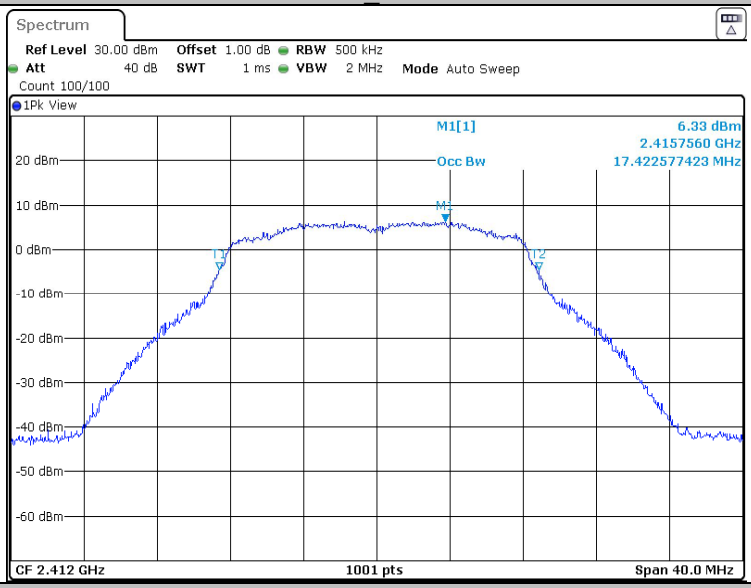

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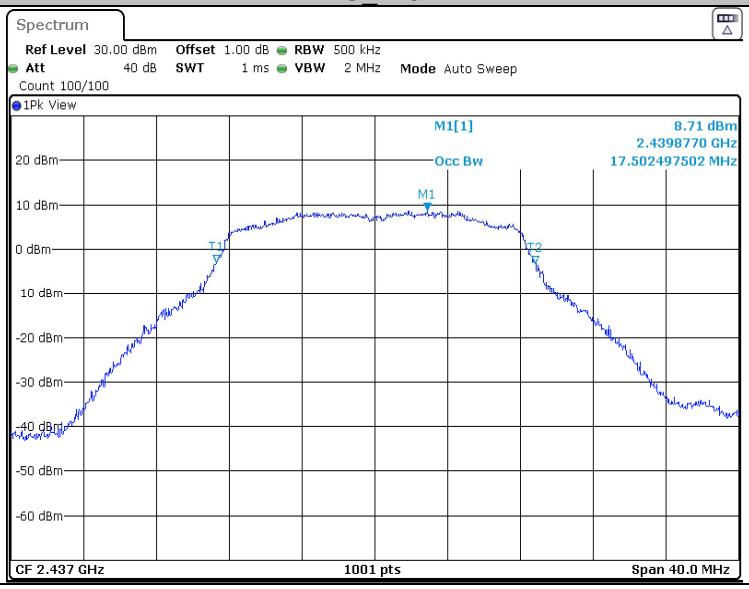

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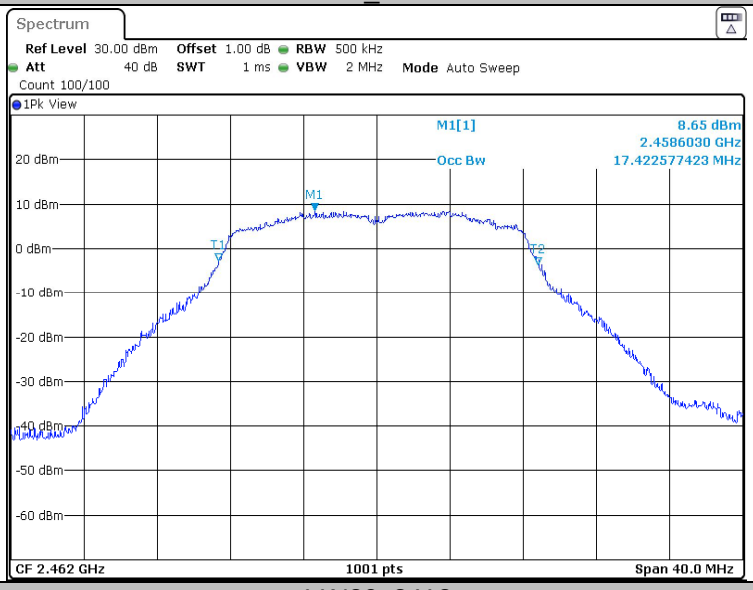

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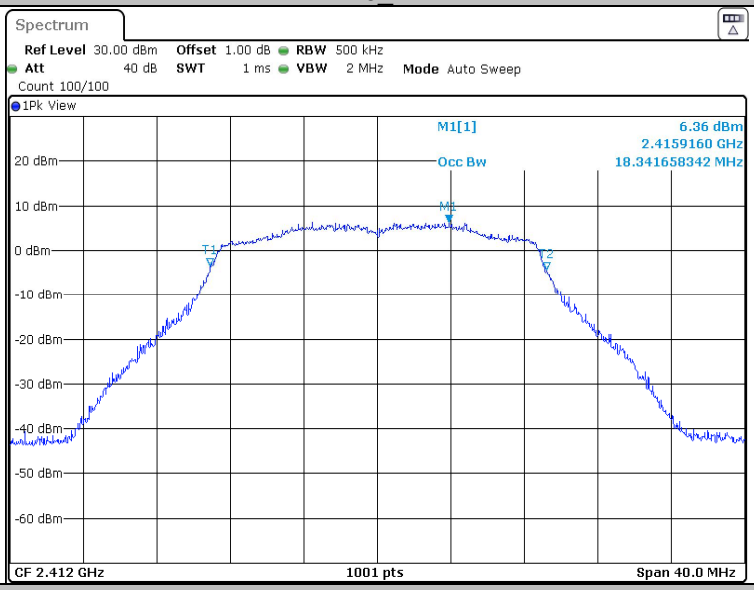

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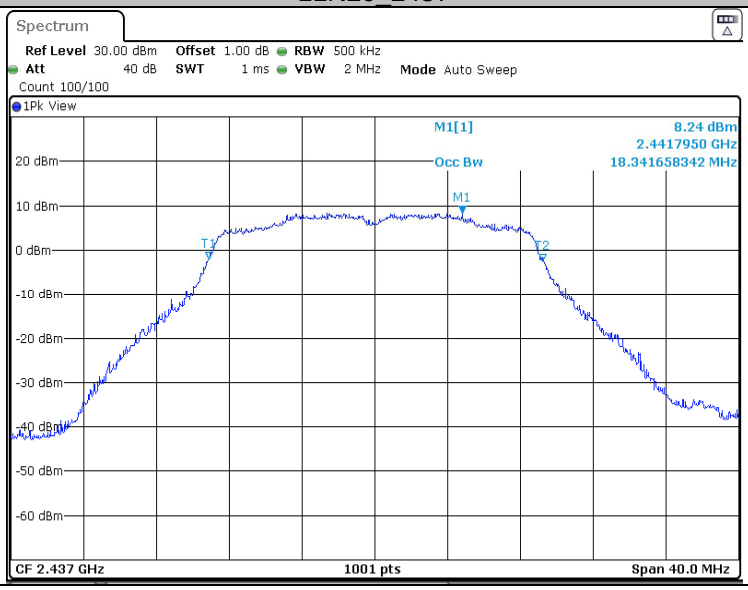

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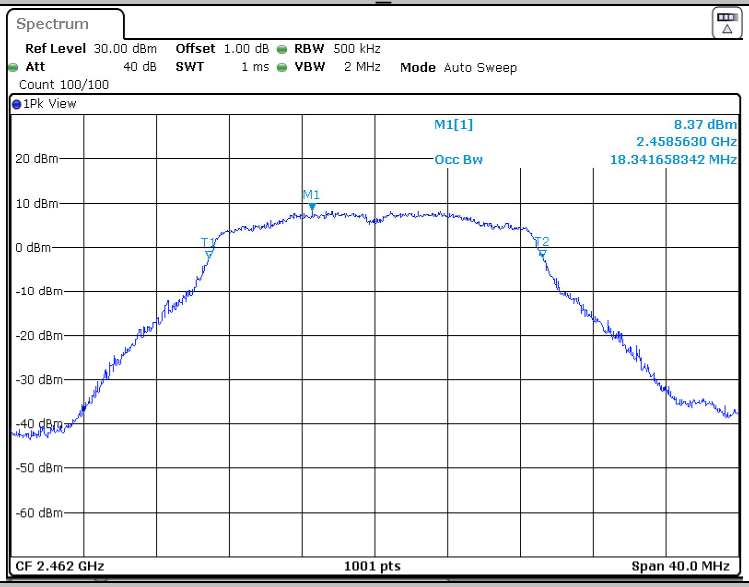

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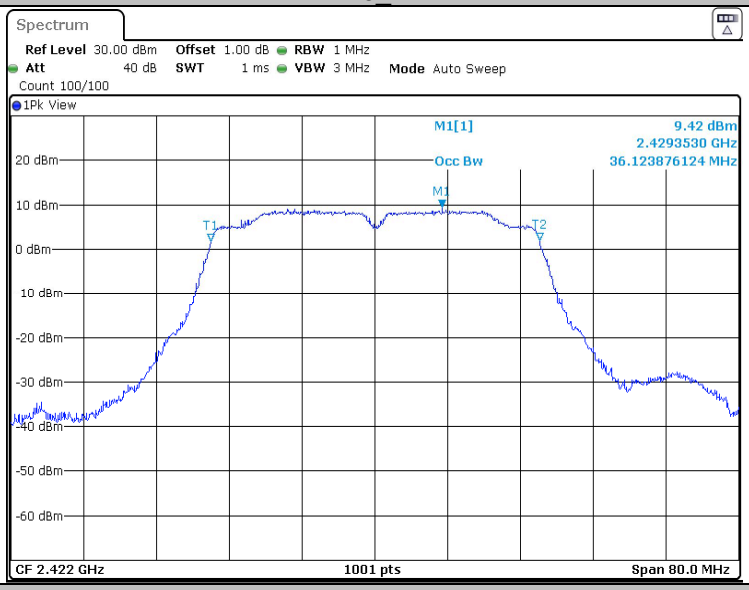

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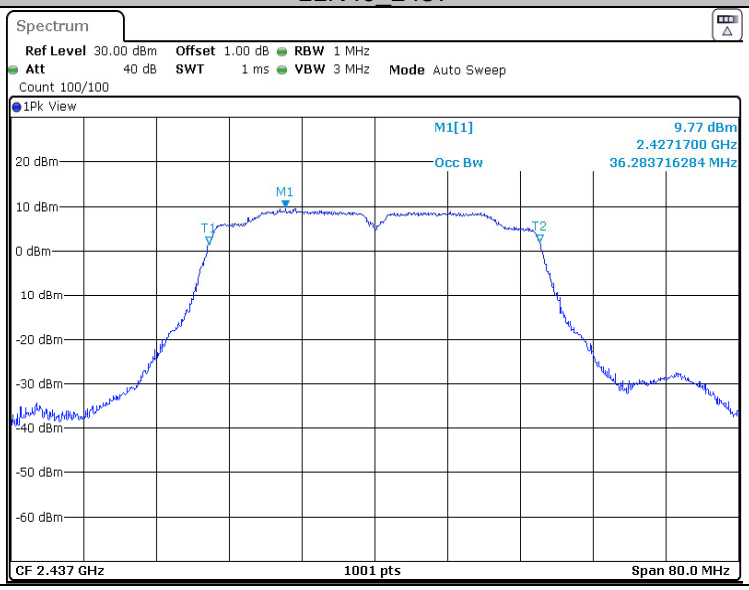

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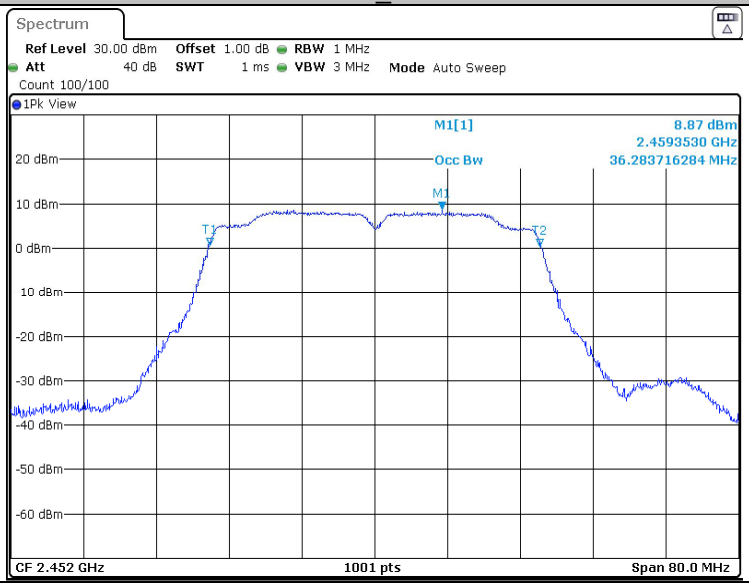

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9.3 Power Spectral Density

Test Method

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

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
4. 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.
5. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
6. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3KHz]
≤8

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Test result as below table

802.11b modulation Test Result

Frequency (MHz)	Power spectral density (dBm)	Limit (dBm)	Result
Low channel 2412MHz	-10.45	8	Pass
Middle channel 2437MHz	-10.22	8	Pass
High channel 2462MHz	-9.9	8	Pass

802.11g modulation Test Result

Frequency (MHz)	Power spectral density (dBm)	Limit (dBm)	Result
Low channel 2412MHz	-11.82	8	Pass
Middle channel 2437MHz	-9.72	8	Pass
High channel 2462MHz	-8.01	8	Pass

802.11n-HT20 modulation Test Result

Frequency (MHz)	Power spectral density (dBm)	Limit (dBm)	Result
Low channel 2412MHz	-10.74	8	Pass
Middle channel 2437MHz	-8.58	8	Pass
High channel 2462MHz	-7.86	8	Pass

802.11n-HT40 modulation Test Result

Frequency (MHz)	Power spectral density (dBm)	Limit (dBm)	Result
Low channel 2422MHz	-12.31	8	Pass
Middle channel 2437MHz	-11.63	8	Pass
High channel 2452MHz	-10.22	8	Pass

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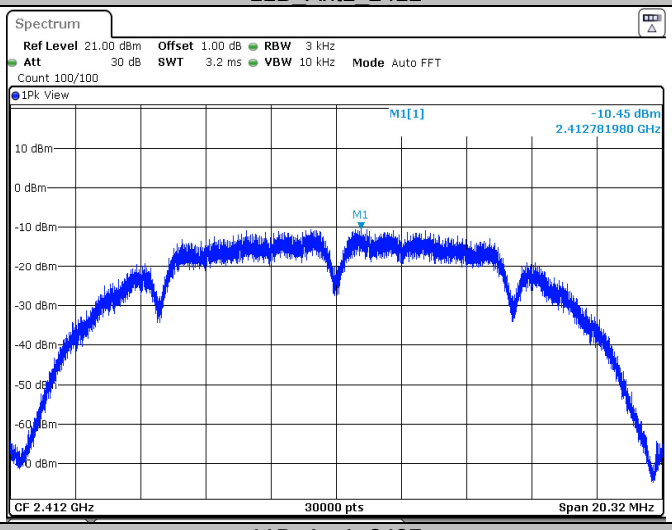

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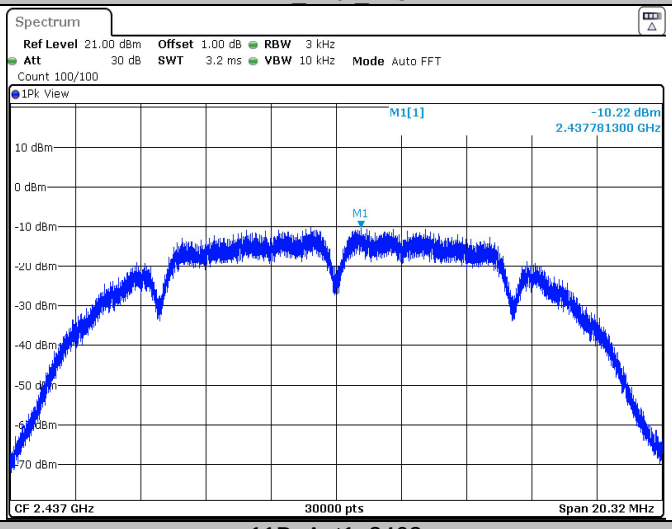

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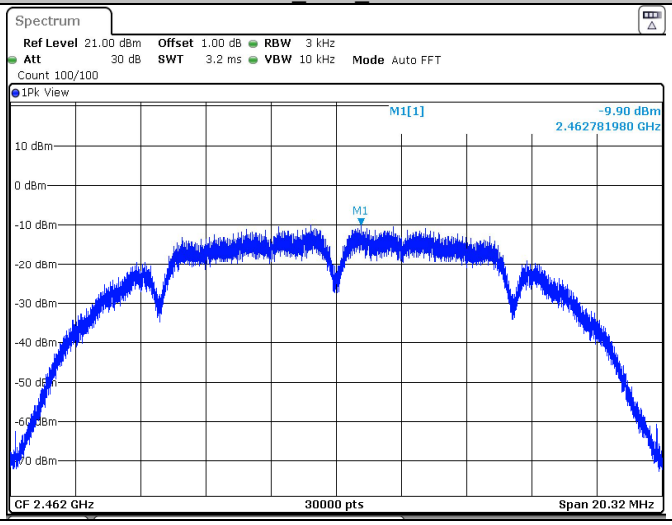

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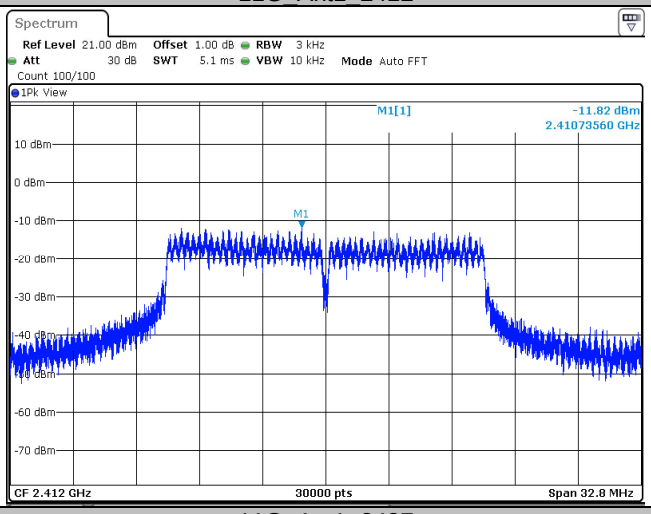

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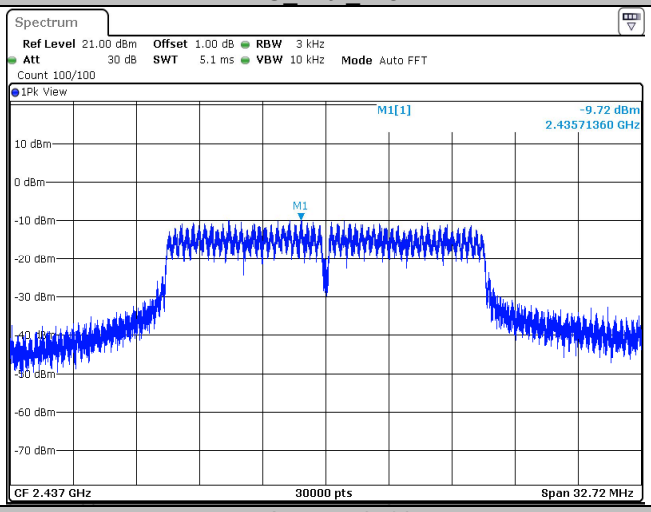

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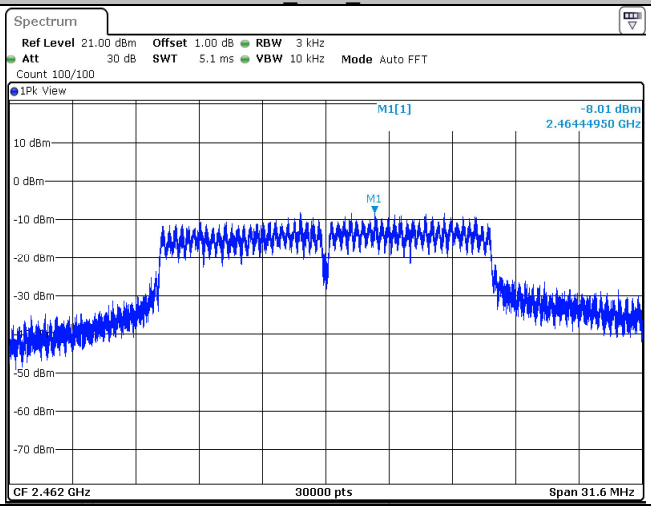

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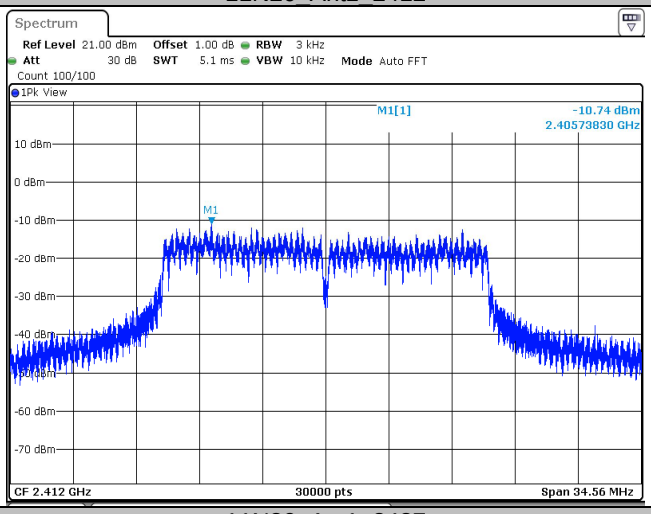
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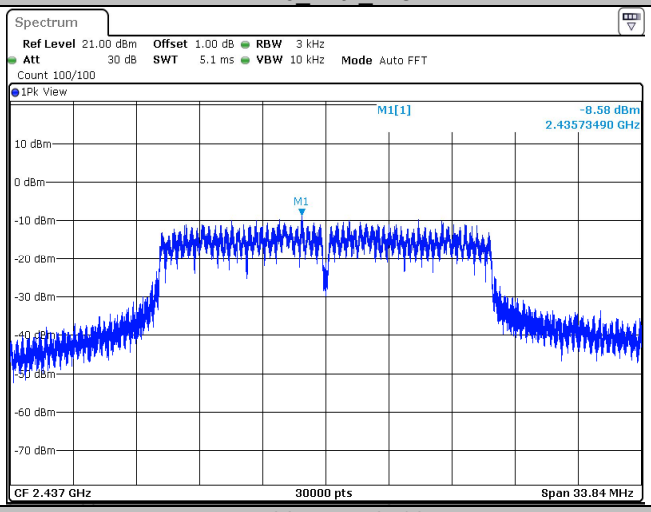
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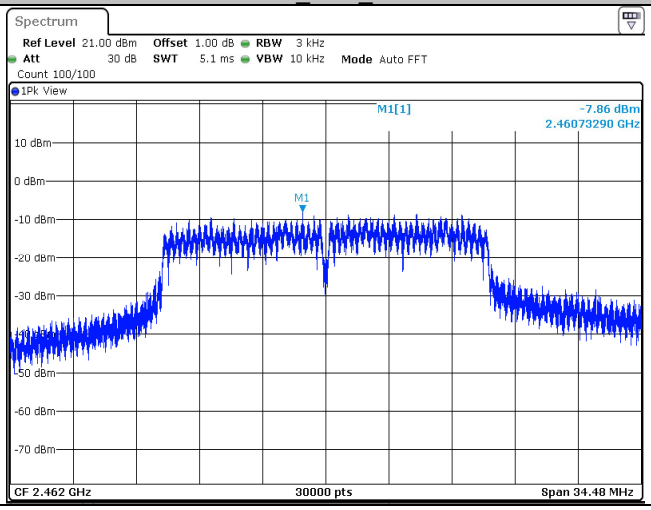

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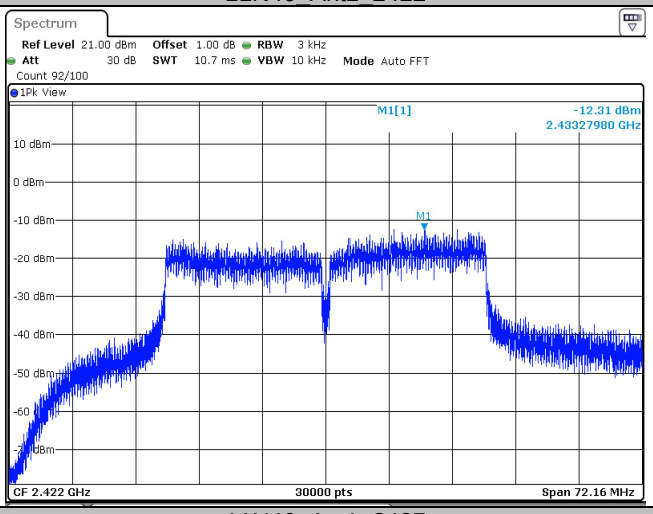
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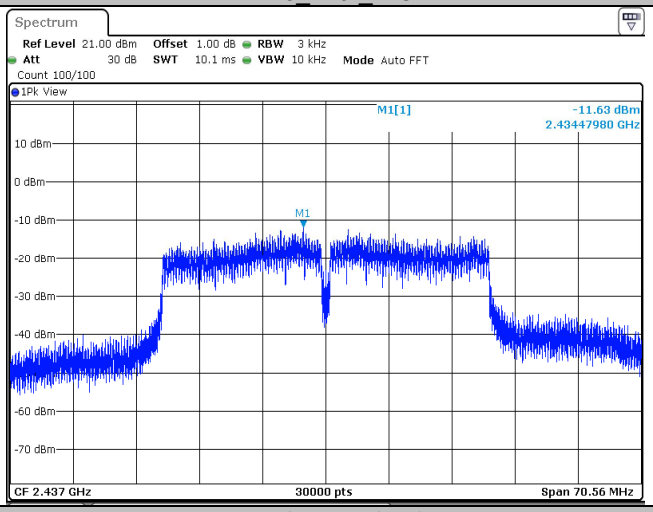
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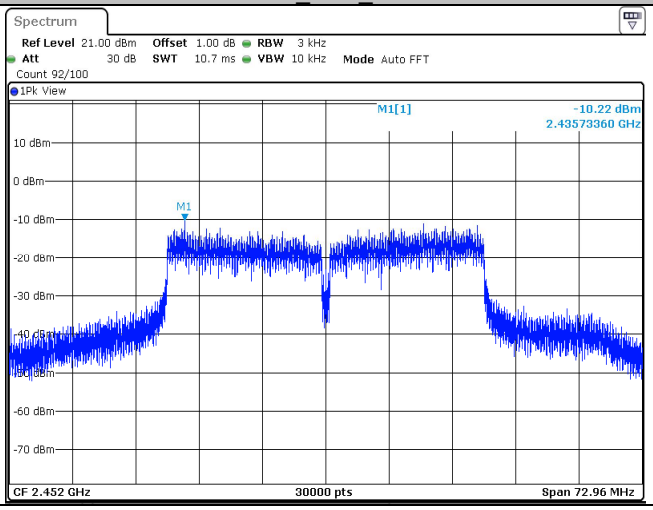

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9.4 Spurious RF Conducted Emissions

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. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. 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≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under § 15.247(b)(3) and RSS 247 section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB.

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

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Spurious RF conducted emissions

Test Mode	Channel (MHz)	Frequency Range (MHz)	Reference Level	Result (dBm)	Limit (dBm)	Verdict
11B	2412	Reference	6.47	6.47	---	PASS
		30~1000	30~1000	-68.45	<=-13.53	PASS
		1000~26500	1000~26500	-33.86	<=-13.53	PASS
	2437	Reference	9.91	9.91	---	PASS
		30~1000	30~1000	-65.57	<=-10.09	PASS
		1000~26500	1000~26500	-48.48	<=-10.09	PASS
	2462	Reference	9.36	9.36	---	PASS
		30~1000	30~1000	-68.02	<=-10.64	PASS
		1000~26500	1000~26500	-47.22	<=-10.64	PASS
11G	2412	Reference	3.69	3.69	---	PASS
		30~1000	30~1000	-68.25	<=-16.31	PASS
		1000~26500	1000~26500	-23.51	<=-16.31	PASS
	2437	Reference	3.14	3.14	---	PASS
		30~1000	30~1000	-66.99	<=-16.86	PASS
		1000~26500	1000~26500	-48.63	<=-16.86	PASS
	2462	Reference	7.96	7.96	---	PASS
		30~1000	30~1000	-67.62	<=-12.04	PASS
		1000~26500	1000~26500	-29.01	<=-12.04	PASS
11N20	2412	Reference	4.12	4.12	---	PASS
		30~1000	30~1000	-67.84	<=-15.88	PASS
		1000~26500	1000~26500	-24.68	<=-15.88	PASS
	2437	Reference	6.21	6.21	---	PASS
		30~1000	30~1000	-68.28	<=-13.79	PASS
		1000~26500	1000~26500	-49.01	<=-13.79	PASS
	2462	Reference	7.80	7.80	---	PASS
		30~1000	30~1000	-67.52	<=-12.2	PASS
		1000~26500	1000~26500	-27.05	<=-12.2	PASS
11N40	2422	Reference	3.00	3.00	---	PASS
		30~1000	30~1000	-66.2	<=-17	PASS
		1000~26500	1000~26500	-28.4	<=-17	PASS
	2437	Reference	3.17	3.17	---	PASS
		30~1000	30~1000	-67.86	<=-16.83	PASS
		1000~26500	1000~26500	-33.78	<=-16.83	PASS
	2452	Reference	4.53	4.53	---	PASS
		30~1000	30~1000	-63.22	<=-15.47	PASS
		1000~26500	1000~26500	-26.58	<=-15.47	PASS

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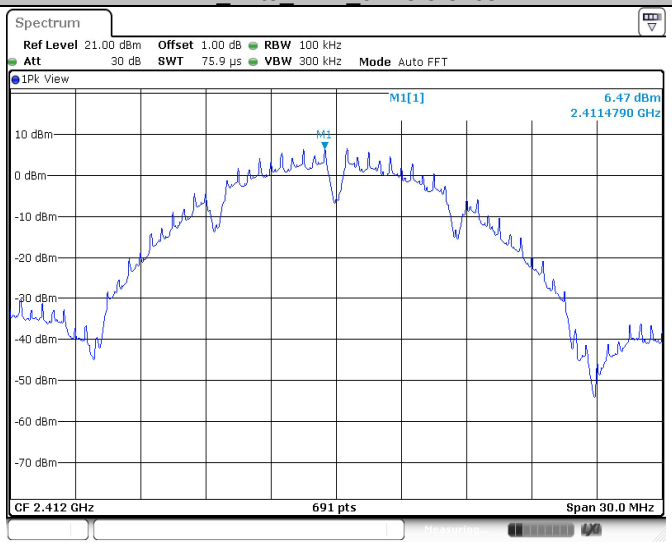

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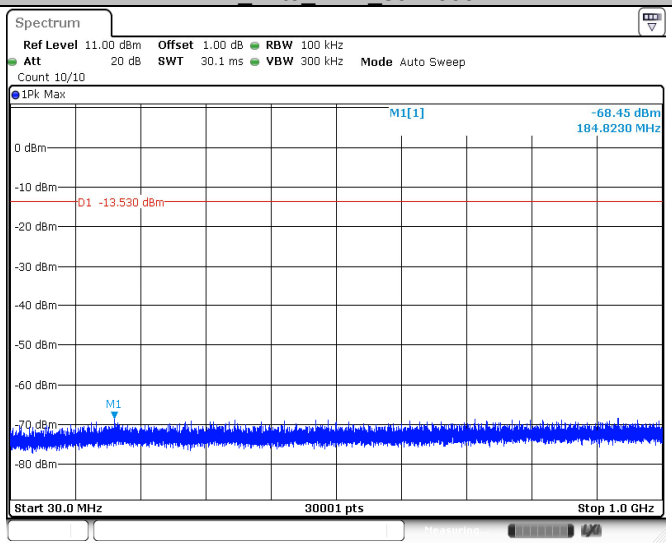

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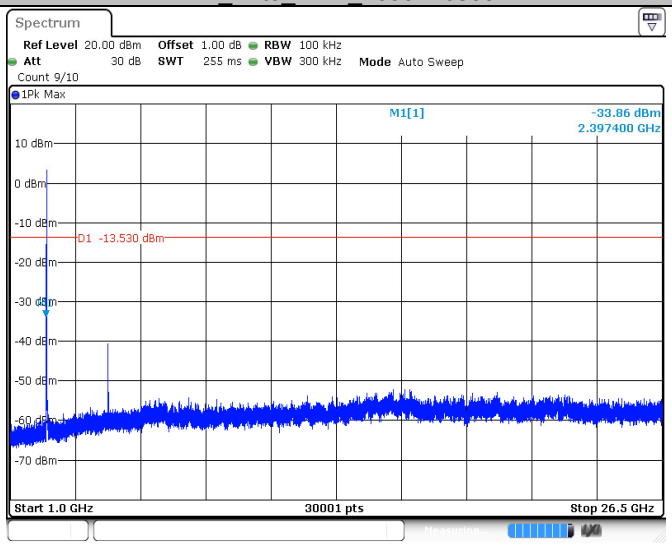

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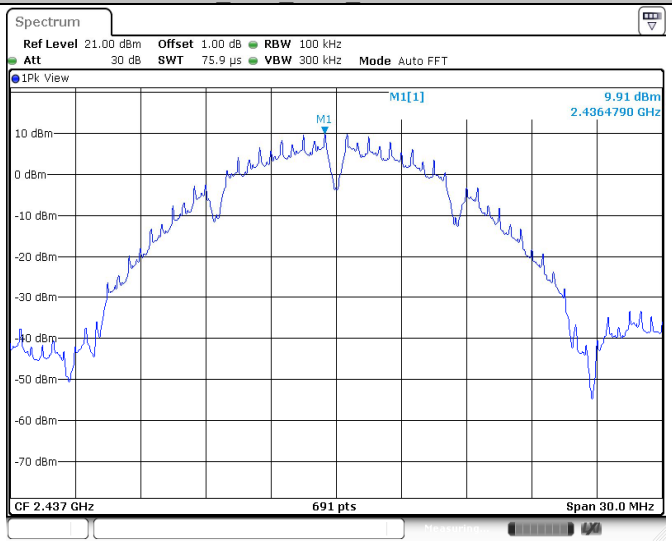

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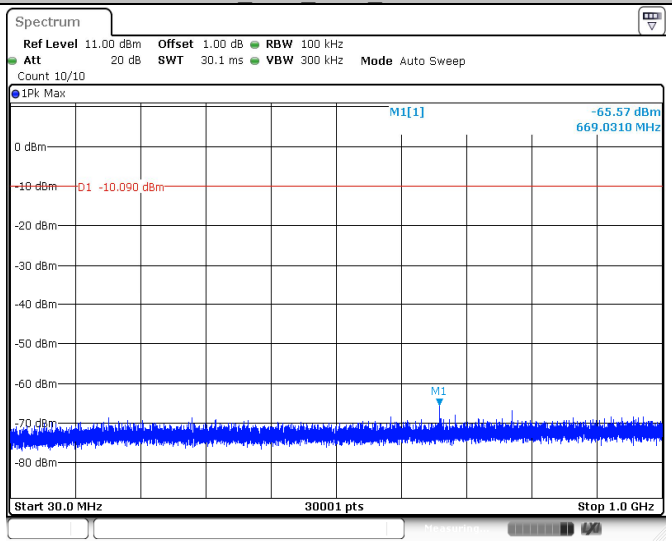

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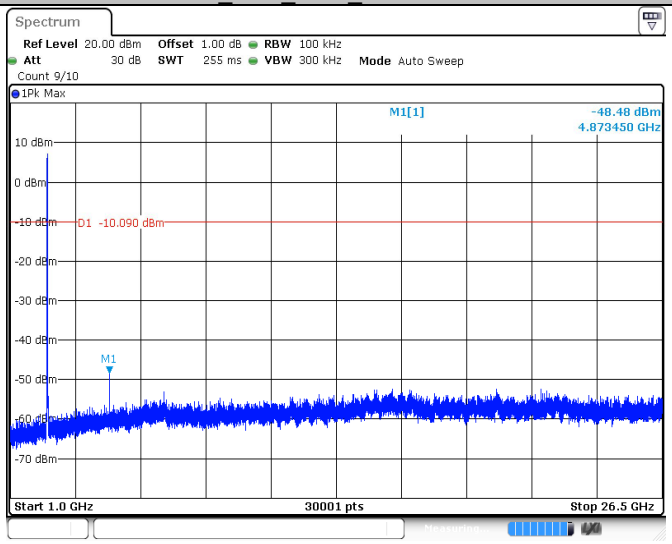

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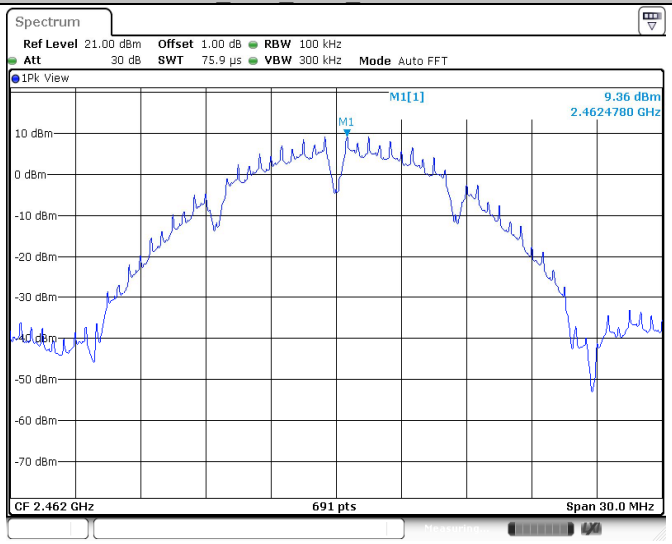
11B_Ant0_2462_0~Reference



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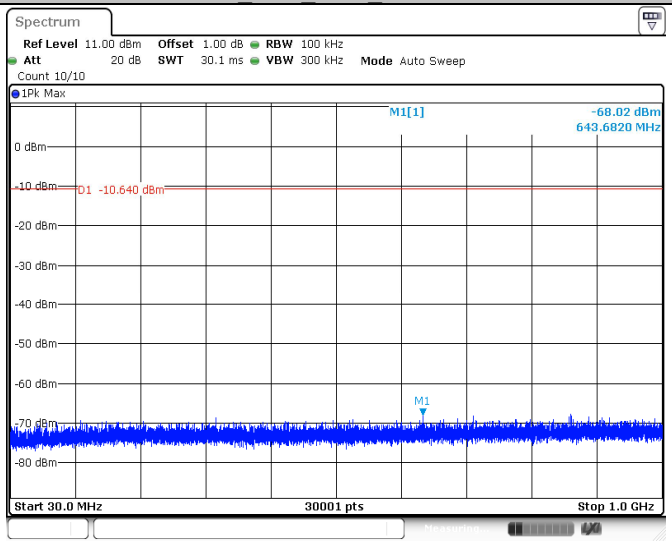

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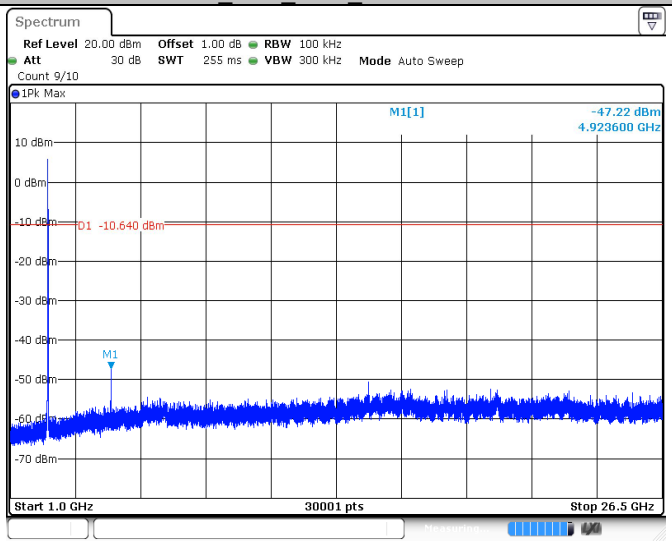

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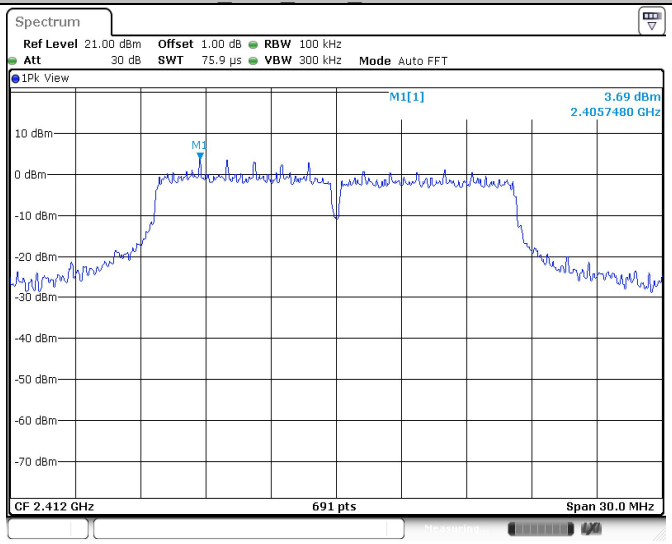

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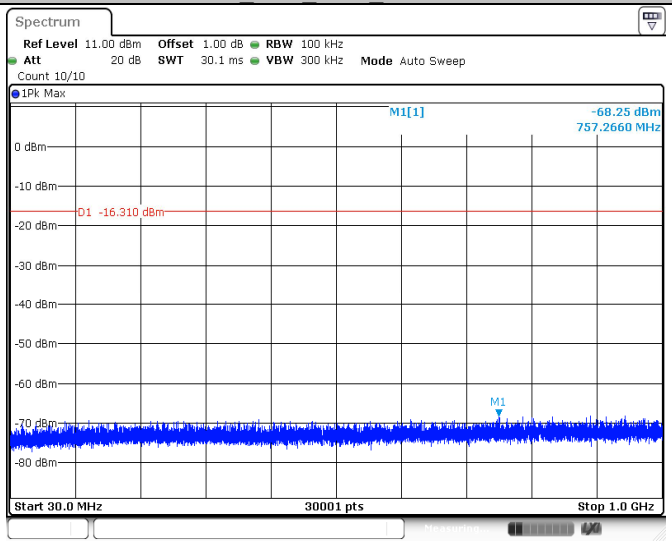

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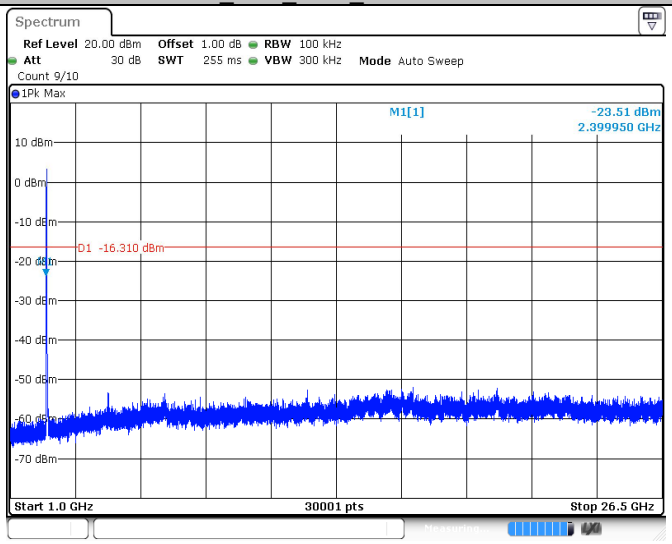

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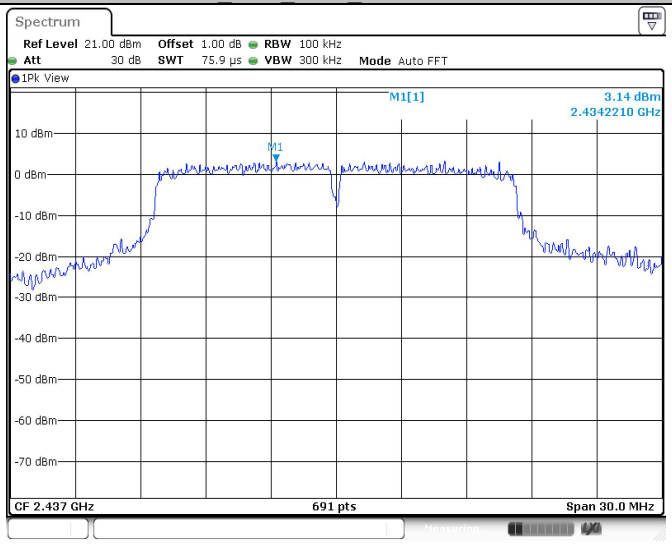
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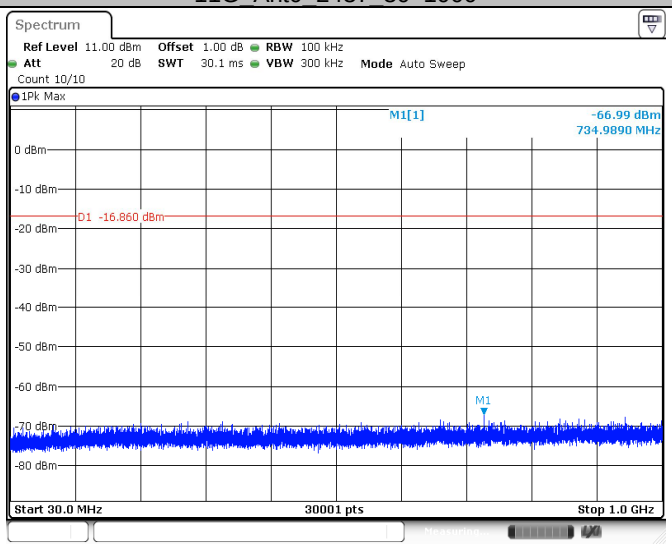
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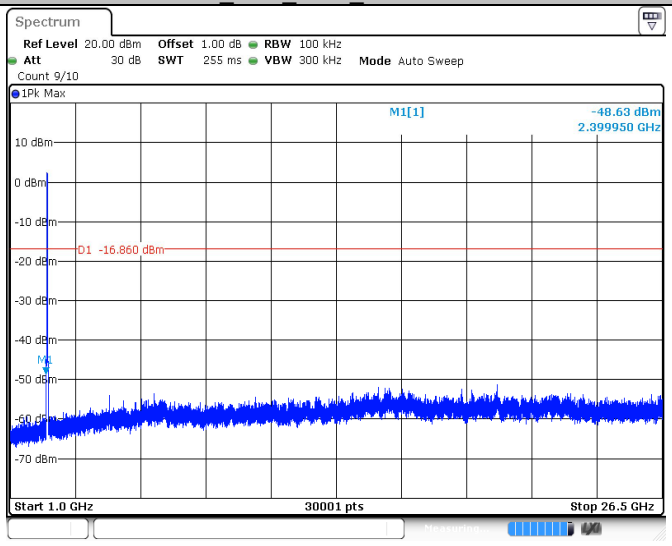

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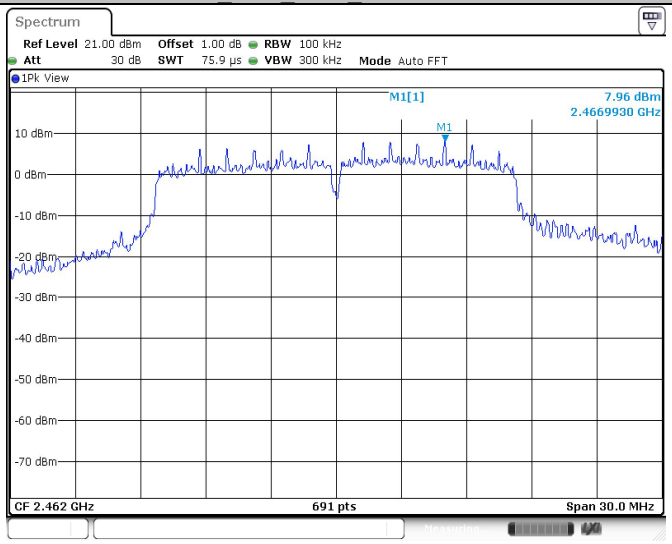
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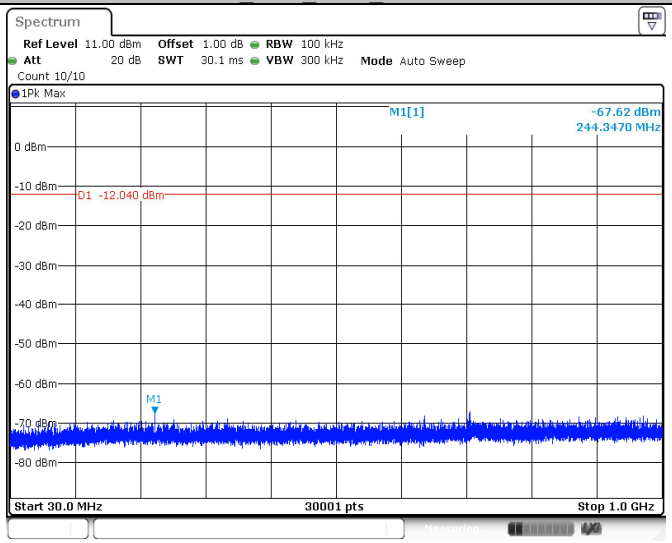
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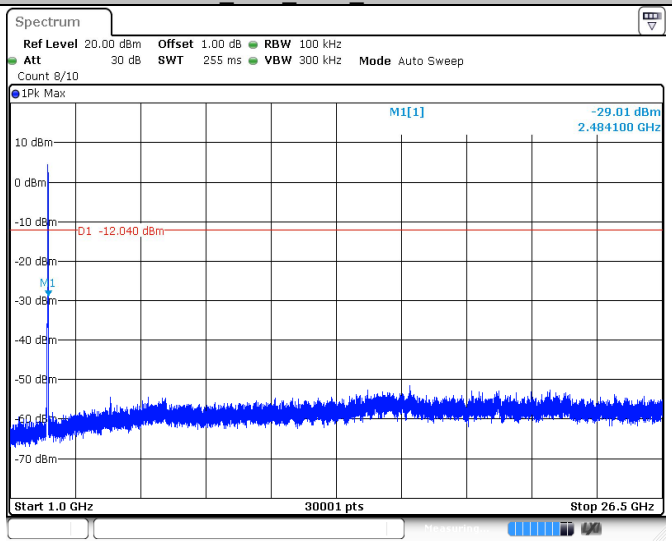

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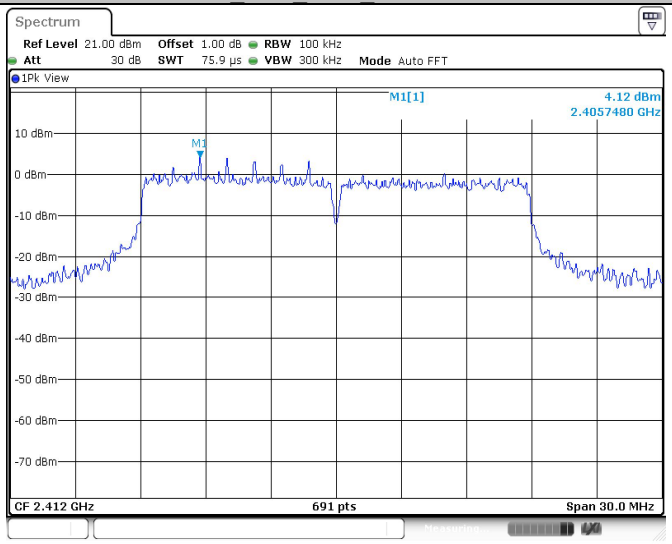

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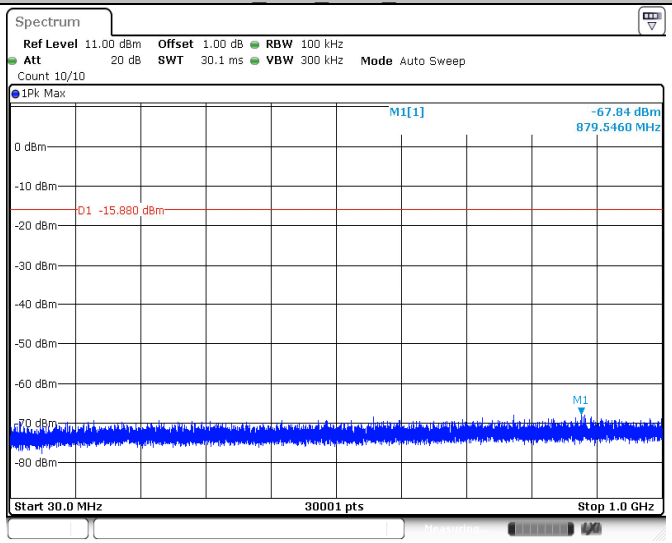

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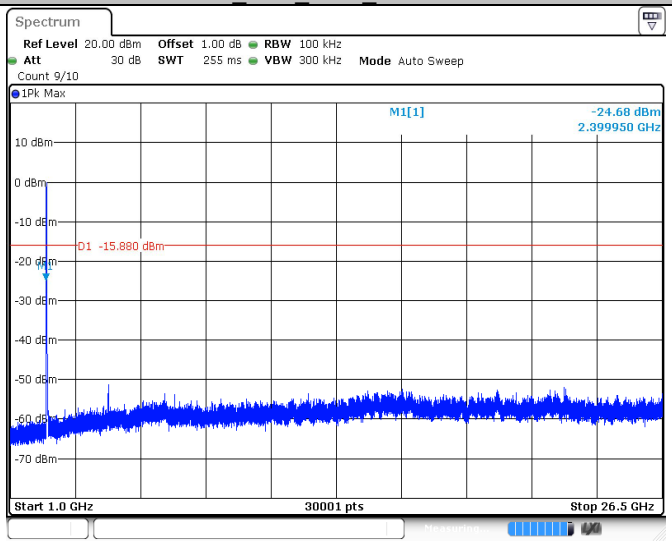

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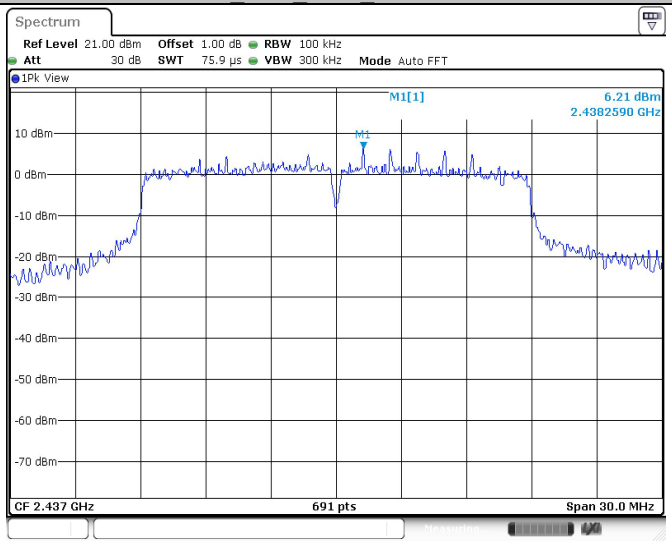 Date: 25.JUL.2023 17:37:36
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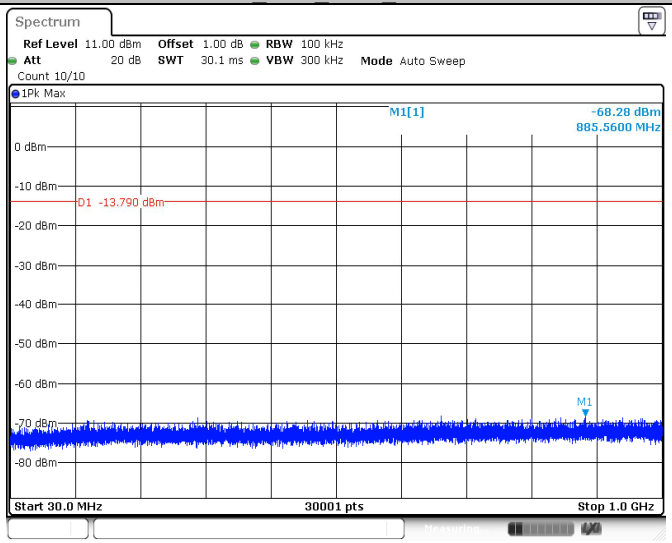 Date: 25.JUL.2023 17:37:42
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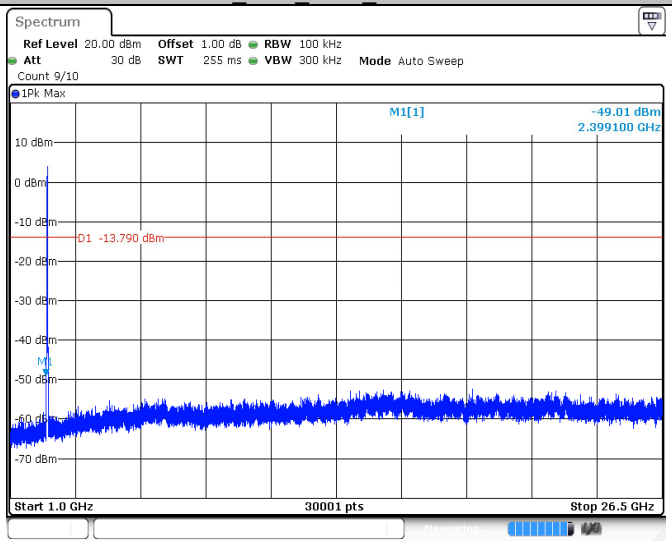 Date: 25.JUL.2023 17:37:50

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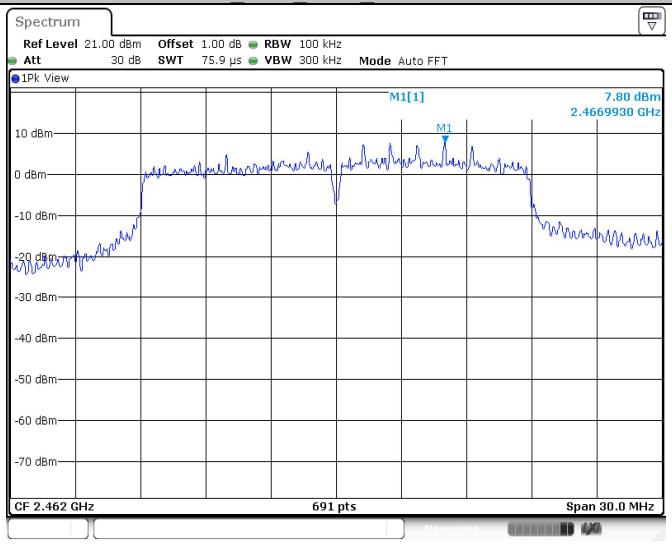
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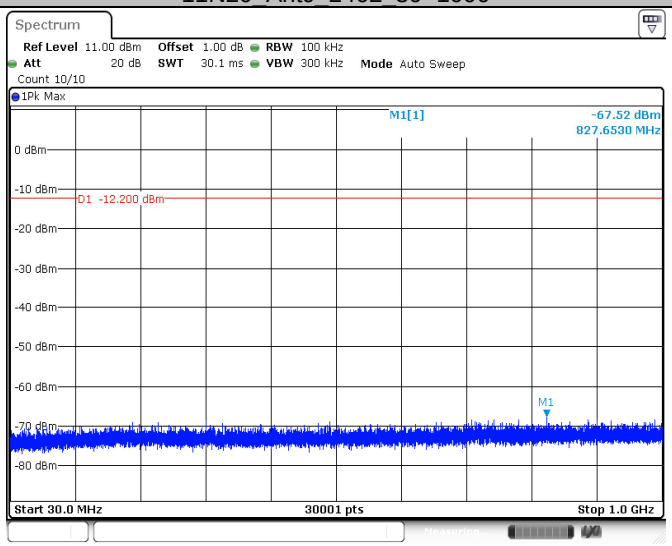
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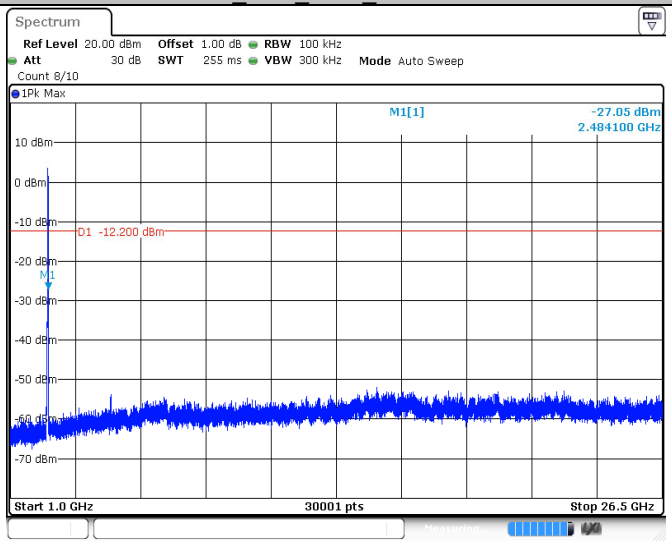

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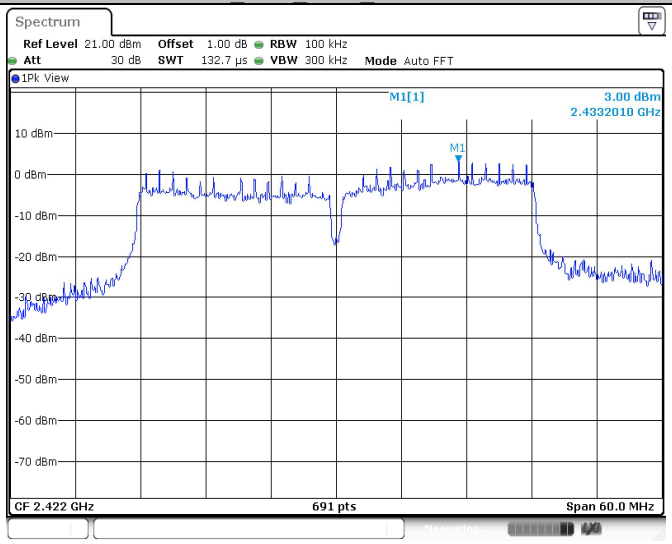
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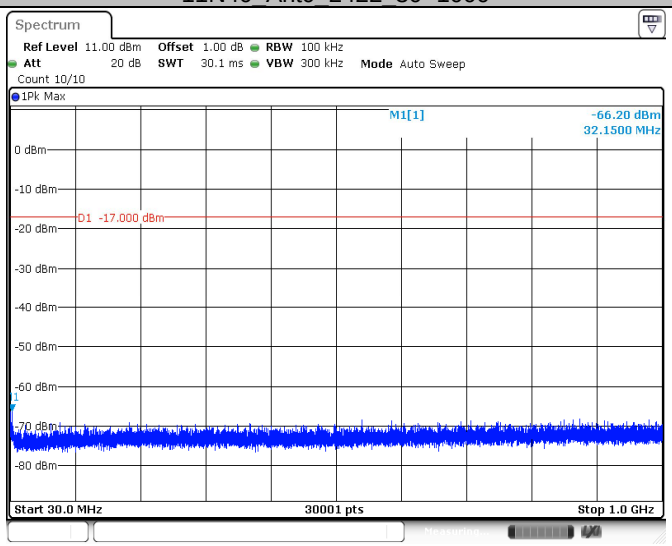
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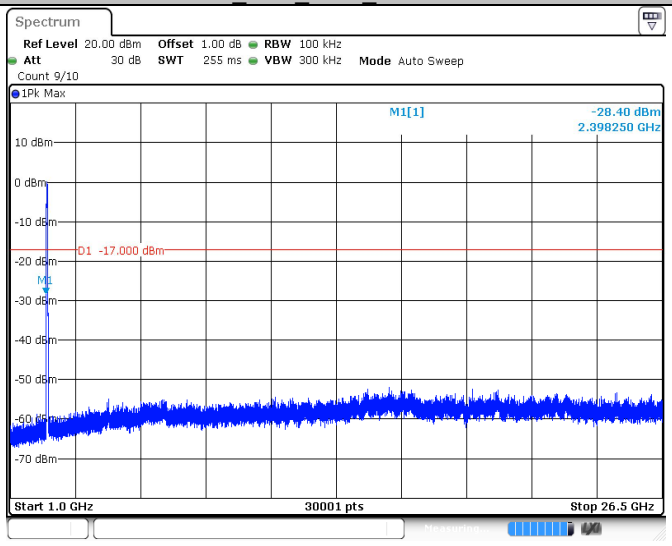

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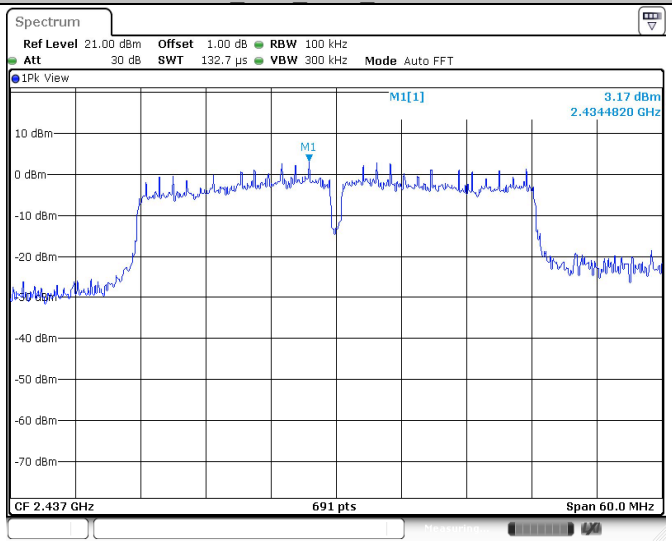
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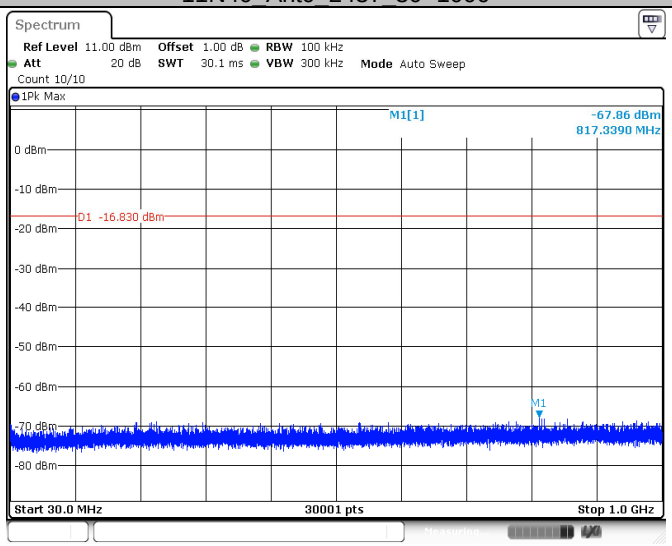
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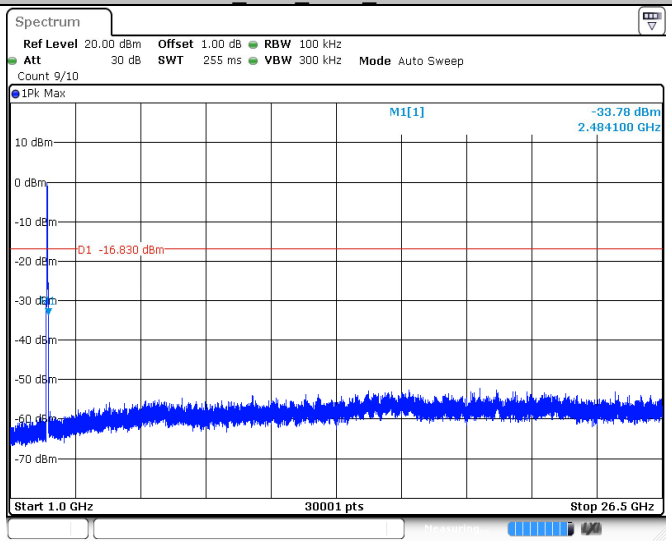

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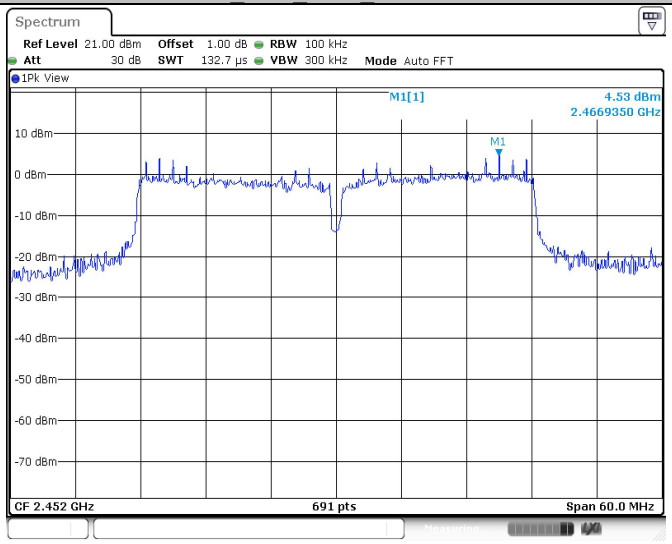

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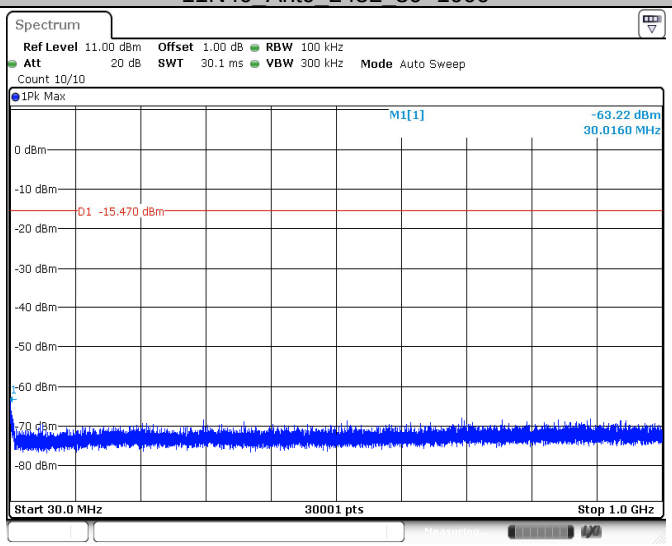

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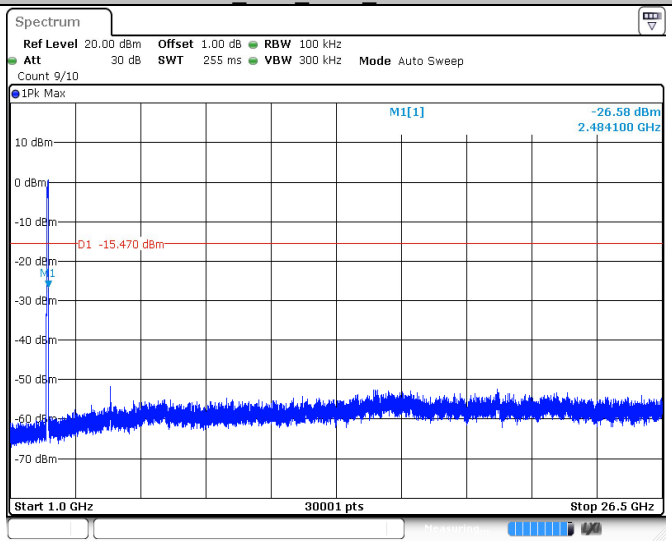

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9.5 Band Edge Testing

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. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. 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≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize, use the peak and delta measurement to record the result.
5. The level displayed must comply with the limit specified in this Section.
6. Repeat above procedures until all frequencies measured were complete and submit all the plots.

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under § 15.247(b)(3) and RSS-247 section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB.

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

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