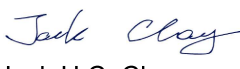


Prüfbericht-Nr.: <i>Test report no.:</i>	50335250 002	Auftrags-Nr.: <i>Order no.:</i>	238106791	Seite 1 von 93 Page 1 of 93
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	24-Jun-2019	
Auftraggeber: <i>Client:</i>	WatchGuard Technologies, Inc. 505 5th Avenue S, Suite 500, Seattle, WA 98104-3892, USA			
Prüfgegenstand: <i>Test item:</i>	Firebox			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	Firebox T20-W			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report (Wifi 2.4G)			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247			
Wareneingangsdatum: <i>Date of sample receipt:</i>	15-Nov-2019			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A001025332-002 A001025332-003			
Prüfzeitraum: <i>Testing period:</i>	03-Jan-2020 ~ 15-Jan-2020			
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Laboratory Taipei			
Prüflaboratorium: <i>Testing laboratory:</i>	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
überprüft von: <i>reviewed by:</i>	genehmigt von <i>authorized by:</i>			
Datum: 04-May-2020 <i>Date:</i>	 <u>Jack H.C. Chang</u>	Datum: 04-May-2020 <i>Date:</i>	 <u>Arvin Ho</u>	
Stellung / Position:	Project Manager	Stellung / Position:	Vice General Manager	
Sonstiges / Other: The test report No. 50335250 001 is replaced by this new test report No. 50335250 002 for added RBW/VBW on page 86. Test report No. 50335250 001 becomes invalid since 2020-05-04.				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Passed

5.1.2 PEAK OUTPUT POWER

RESULT: Passed

5.1.3 6dB BANDWIDTH

RESULT: Passed

5.1.4 POWER DENSITY

RESULT: Passed

5.1.5 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100kHz BANDWIDTH

RESULT: Passed

5.1.6 SPURIOUS EMISSION

RESULT: Passed

5.1.7 MAINS CONDUCTED EMISSIONS

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

Contents

1.	GENERAL REMARKS	5
1.1	COMPLEMENTARY MATERIALS.....	5
1.2	DECISION RULE OF CONFORMITY.....	5
2.	TEST SITES	6
2.1	TEST LABORATORY	6
2.1	TEST FACILITY.....	6
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	7
2.3	TRACEABILITY	8
2.4	CALIBRATION	8
2.5	MEASUREMENT UNCERTAINTY	8
3.	GENERAL PRODUCT INFORMATION.....	9
3.1	PRODUCT FUNCTION AND INTENDED USE	9
3.2	SYSTEM DETAILS AND RATINGS.....	9
3.3	INDEPENDENT OPERATION MODES	10
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS	10
3.5	SUBMITTED DOCUMENTS.....	10
4.	TEST SET-UP AND OPERATION MODES.....	11
4.1	PRINCIPLE OF CONFIGURATION SELECTION	11
4.2	TEST OPERATION AND TEST SOFTWARE.....	12
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	13
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	13
4.5	TEST SETUP DIAGRAM	13
5.	TEST RESULTS	15
5.1	TRANSMITTER REQUIREMENT & TEST SUITES	15
5.1.1	Antenna Requirement	15
5.1.2	Peak Output Power	16
5.1.3	6dB Bandwidth	17
5.1.4	Power Density	36
5.1.5	Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth.....	55
5.1.6	Spurious Emission	86
5.1.7	Mains Conducted Emissions.....	87
6.	RADIO FREQUENCY EXPOSURE COMPLIANCE	88
6.1.1	Electromagnetic Fields.....	88

Prüfbericht - Nr.: 50335250 002
Test Report No.

Seite 4 von 93
Page 4 of 93

7.	PHOTOGRAPHS OF THE TEST SET-UP.....	89
8.	LIST OF TABLES	93
9.	LIST OF PHOTOGRAPHS.....	93

1. General Remarks

1.1 Complementary Materials

The following attachments are integral parts of this test report:

Appendix P: Photo Documentation

(File Name: 50335250 002 APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50335250 002 APPENDIX D)

Test Specifications

Table 1: Applied Standard and Test Levels

Radio
FCC CFR47 Part 15: Subpart C Section 15.247 ANSI C63.10:2013 KDB558074 D01 15.247 Meas Guidance v05r02

1.2 Decision Rule of conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.1 Test Facility

TUV Rheinland Taiwan Ltd.

AC Mains Conduction:
11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)
FCC Registration No.: 180491
IC Canada Registration No.: 9465A

Radiated Test/Conducted Test:
No. 458-18, Sec 2, Fenliao., Linkou Dist.
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 226631
IC Canada Registration No.: 25563

TAF Accredited NCC Test Lab. No.:3567
TAF ISO17025 Certification effective period: 6th-May-2019 to 05th-May-2022



2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver	R&S	ESR7	102108	2019/2/06	2020/2/05
Spectrum Analyzer	R&S	FSV40	101508	2019/2/05	2020/2/04
Pre-Amplifier	Agilent	8447D	2944A10772	2019/2/22	2020/2/21
Pre-Amplifier	EMCI	EMC051845SE	980633	2019/2/25	2020/2/24
Pre-Amplifier	EMCI	EMC184045SE	980657	2019/2/23	2020/2/22
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2019/1/14	2020/1/31
Horn Antenna	ETS-Lindgren	3117	00218930	2019/12/06	2020/12/05
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2019/4/12	2020/4/11
Loop Antenna	EMCI	LPA600	287	2019/12/20	2020/12/19
Test Software	Audix	e3	Ver. 9	N/A	N/A
Test Cable	HUBER+SUHNER	SUCOFLEX 104EA 9k~18G	800056/4EA	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 104 9k~18G	804680/4	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 104 9k~18G	MY37202/4	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 102EA 1G~40G	800898/2EA	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 102EA 1G~40G	800901/2EA	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 102EA 1G~40G	801027/2EA	2019/4/18	2020/4/17
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100797	2019/1/16	2020/1/31
Two-Line V-Network (for EUT)	Rohde & Schwarz	ENV216	101243	2019/6/23	2020/06/22
Two-Line V-Network	Rohde & Schwarz	ENV216	101262	2019/7/16	2020/7/15
Impedance Stabilization Network	TESEQ	ISN T800	51949	2019/2/20	2020/2/19
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	0357.8810.54- 102102-HN	2019/7/25	2020/7/24
Spectrum Analyzer	R&S	FSV40	101513	2019/2/8	2020/2/7
ETSI power meter USB	Dare	RPR6W-1901030	1829913	2019/7/30	2020/7/29

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are $\pm 3\text{dB}$.

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
RF power, conducted	$\pm 1.5 \text{ dB}$
Adjacent channel power	$\pm 3 \text{ dB}$
Radiated emission of transmitter, valid up to 26 GHz	$\pm 6 \text{ dB}$
Radiated emission of receiver, valid up to 26 GHz	$\pm 6 \text{ dB}$
Temperature	$\pm 2 \text{ }^{\circ}\text{C}$
Humidity	$\pm 10 \text{ } \%$

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Firebox. It contains a WiFi compatible module enabling the user to communicate data through a Wireless interface.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment	Firebox
Type Designation	Firebox T20-W
FCC ID	Q6G-FS2AE5W

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	802.11b/g/n20: 2412~2462 MHz 802.11n40: 2422~2452 MHz
Channel Spacing	5 MHz
Channel number	802.11b/g/n20: 11 802.11n40: 7
Operation Voltage	12Vdc
Modulation	802.11b: DSSS (BPSK, QPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, QAM)
Antenna gain	5.19 dBi

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. Receiving
- C. Standby
- D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- | | |
|-------------------------|----------------------|
| - Block Diagram | - Circuit Diagram |
| - PCB Layout | - Instruction Manual |
| - Photo Document | - Rating Label |
| - Technical Description | |

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Table 6: Table for Parameters of Test Software Setting

Mode	Channel Frequency		
	2412 MHz	2437 MHz	2462 MHz
802.11b	20	20	19
802.11g	15	22	15
802.11n20	15	20	15
-	2422 MHz	2437 MHz	2452 MHz
802.11n40	11	16	12

4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with a USB interface which makes it possible to control them through a test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate.

The samples were used as follows:

Conducted: A001025332-002

Radiation: A001025332-003

Full test was applied on all test modes, but only worst case was shown

IEEE 802.11b mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 1Mbps data rate were chosen for full testing.

IEEE 802.11g mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT 20 mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 13Mbps data rate were chosen for full testing.

IEEE 802.11n HT 40 mode:

Channel Low (2422MHz), Channel Mid (2437MHz) and Channel High (2452MHz) with 13Mbps data rate were chosen for full testing.

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

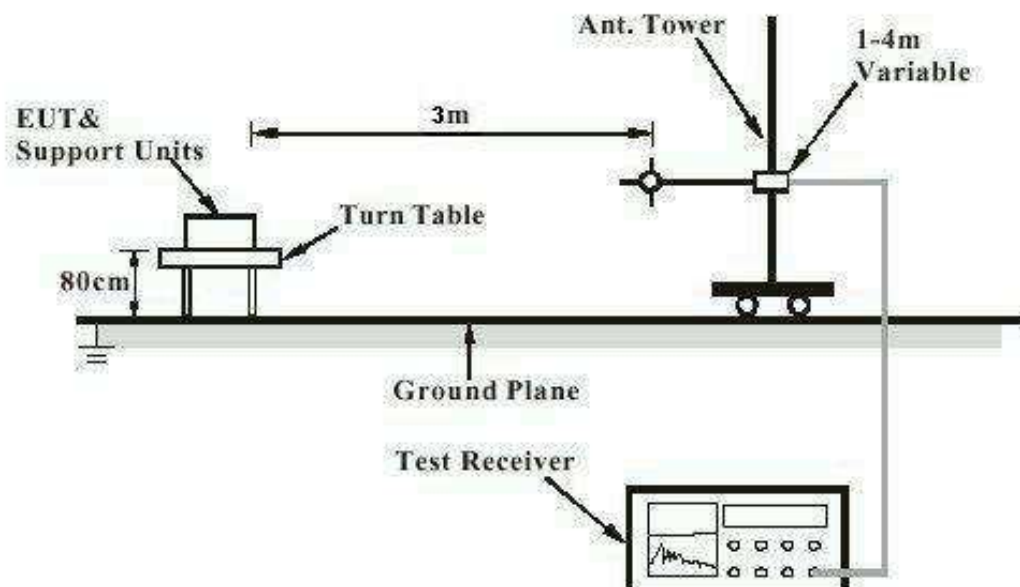
Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

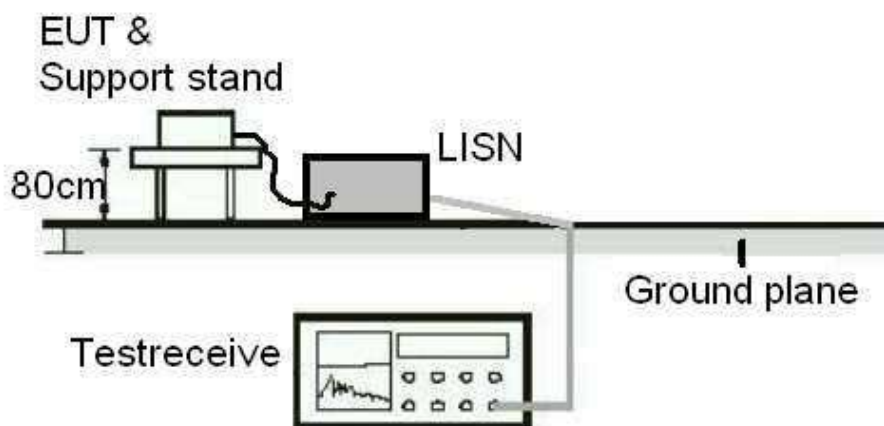
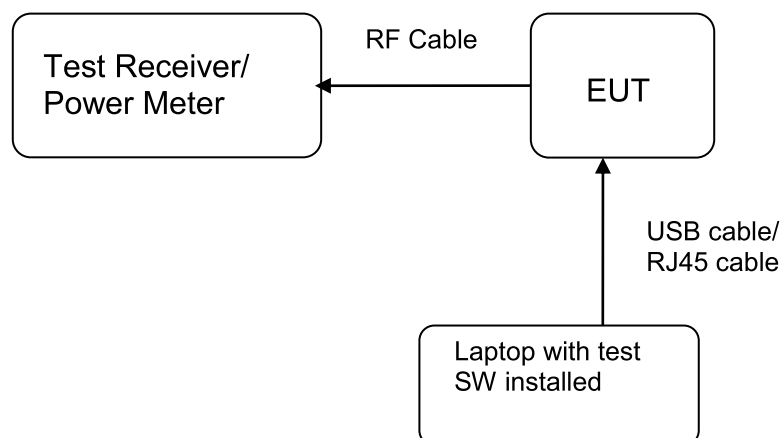


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test standard	:	FCC Part 15.247(b)(4), Part 15.203
Limit	:	the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 5.19 dBi. The antenna is a printed PCB trace with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

5.1.2 Peak Output Power

RESULT:
Passed

Test standard : FCC Part 15.247(b)(3)
 Basic standard : ANSI C63.10:2013, KDB558074
 Limit : 1 Watt
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A

Ambient temperature : 22-26 °C
 Relative humidity : 50-65 %
 Atmospheric pressure : 100-103 kPa

Table 7: Test result of Peak Output Power

Mode	Channel Frequency (MHz)	Output Power					Limit
		Ant 1 (dBm)	Ant 2 (dBm)	Ant 3 (dBm)	Total (dBm)	Total (W)	(W)
802.11b	2412	20.86	21.34	21.47	26	0.3981	1
	2437	20.04	20.51	20.35	25.08	0.3221	1
	2462	19.66	20.19	19.82	24.67	0.2931	1
802.11g	2412	19.45	19.95	19.68	24.47	0.2799	1
	2437	23.38	23.54	23.37	28.2	0.6607	1
	2462	19.43	19.85	19.71	24.44	0.2780	1
802.11n HT20	2412	19.72	20.33	20.34	24.91	0.3097	1
	2437	22.86	23.05	22.98	27.74	0.5943	1
	2462	18.44	18.61	18.8	23.39	0.2183	1
802.11n HT40	2422	15.08	15.15	15.18	19.91	0.0979	1
	2437	19.91	19.43	20.08	24.59	0.2877	1
	2452	16.07	16.53	15.89	20.94	0.1242	1

Max Total Power: 660.69mW

5.1.3 6dB Bandwidth

RESULT:
Passed

Test standard : FCC Part 15.247(a)(2)
 Basic standard : ANSI C63.10:2013, KDB558074
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A

Ambient temperature : 22-26°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

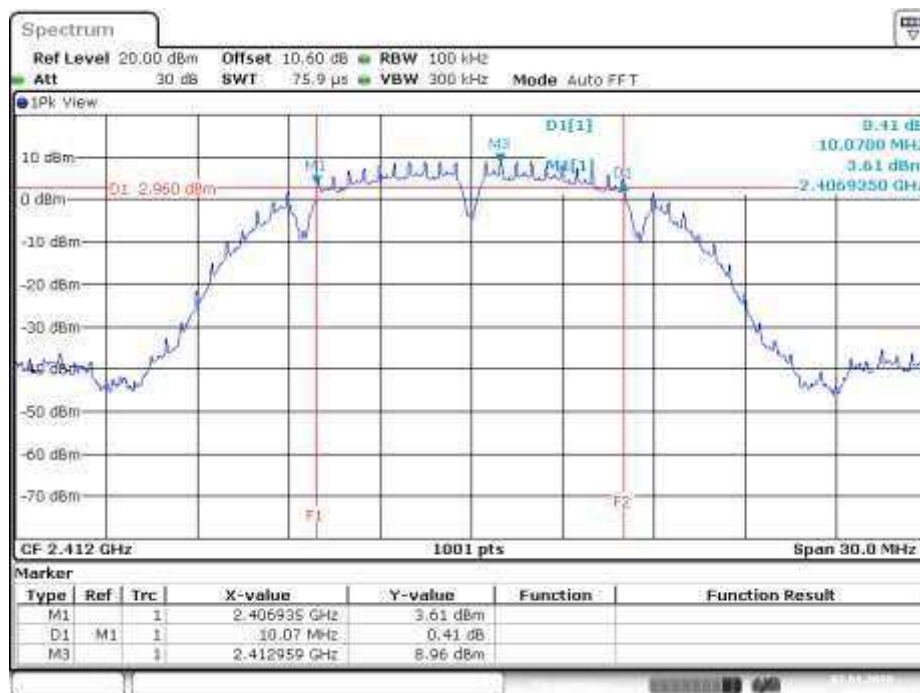
Table 8: Test result of 6dB Bandwidth

Mode	Channel Frequency (MHz)	6dB Bandwidth (MHz)			Limit (MHz)	Result
		Ant 1	Ant 2	Ant 3		
802.11b	2412	10.07	10.07	10.07	0.5	Pass
	2437	10.07	10.07	10.07	0.5	Pass
	2462	10.07	10.07	10.07	0.5	Pass
802.11g	2412	16.30	16.30	16.30	0.5	Pass
	2437	16.30	16.30	16.30	0.5	Pass
	2462	16.30	16.30	16.30	0.5	Pass
802.11n HT20	2412	17.50	17.56	17.53	0.5	Pass
	2437	17.50	17.50	17.50	0.5	Pass
	2462	17.53	17.53	17.53	0.5	Pass
802.11n HT40	2422	36.26	36.06	35.31	0.5	Pass
	2437	36.00	35.80	35.70	0.5	Pass
	2452	36.33	36.28	35.14	0.5	Pass

Test Plot of 6dB Bandwidth 802.11b

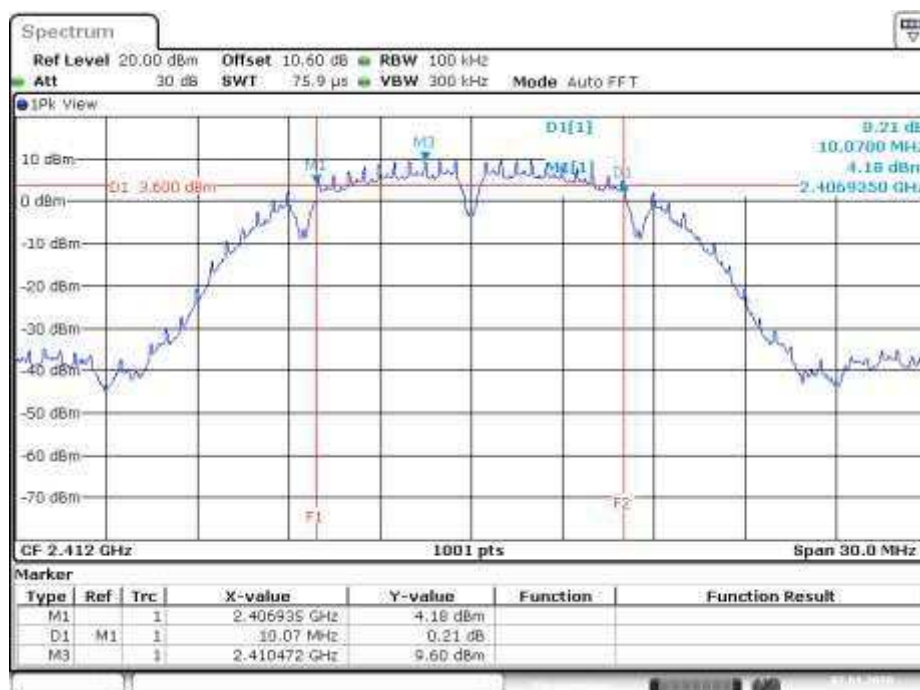
Low Channel

Ant 1

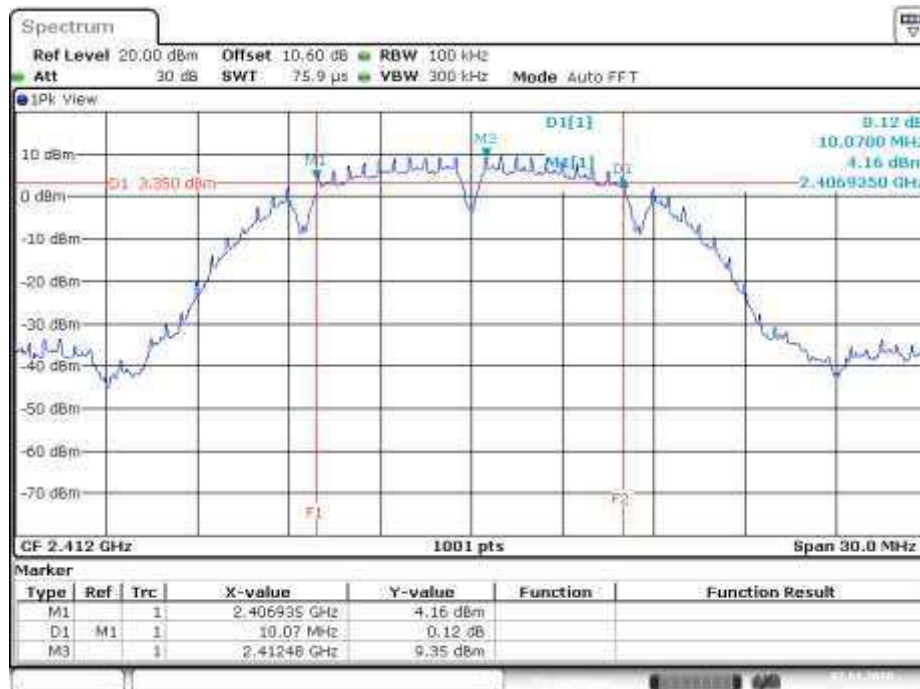


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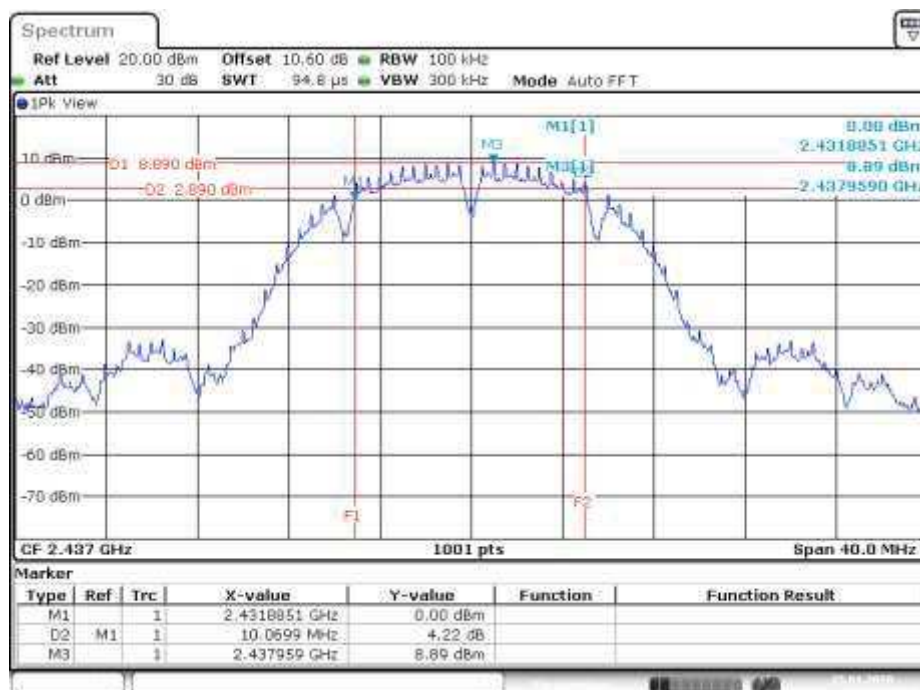
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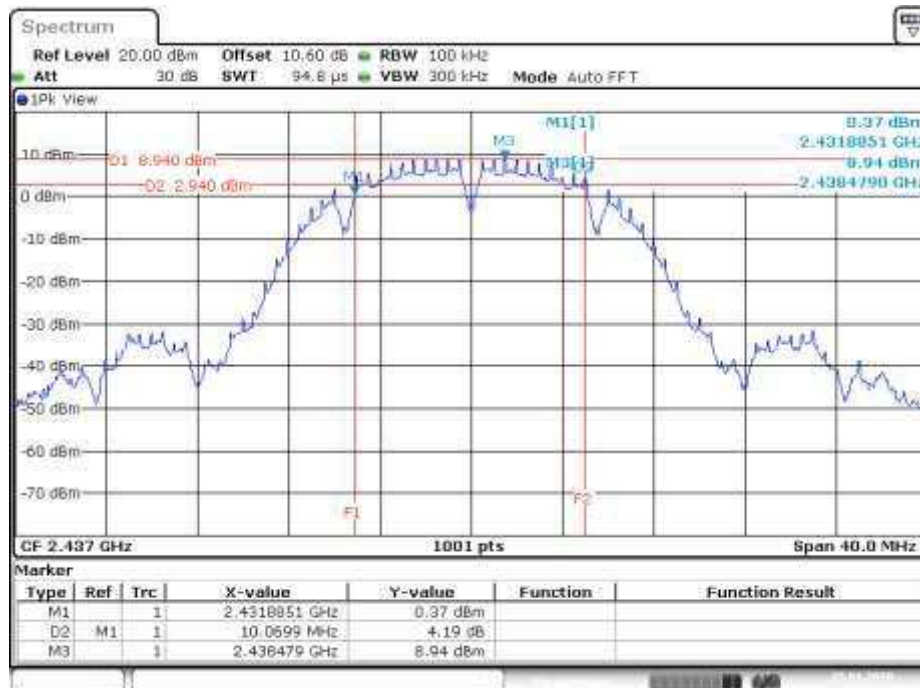
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Ant 3


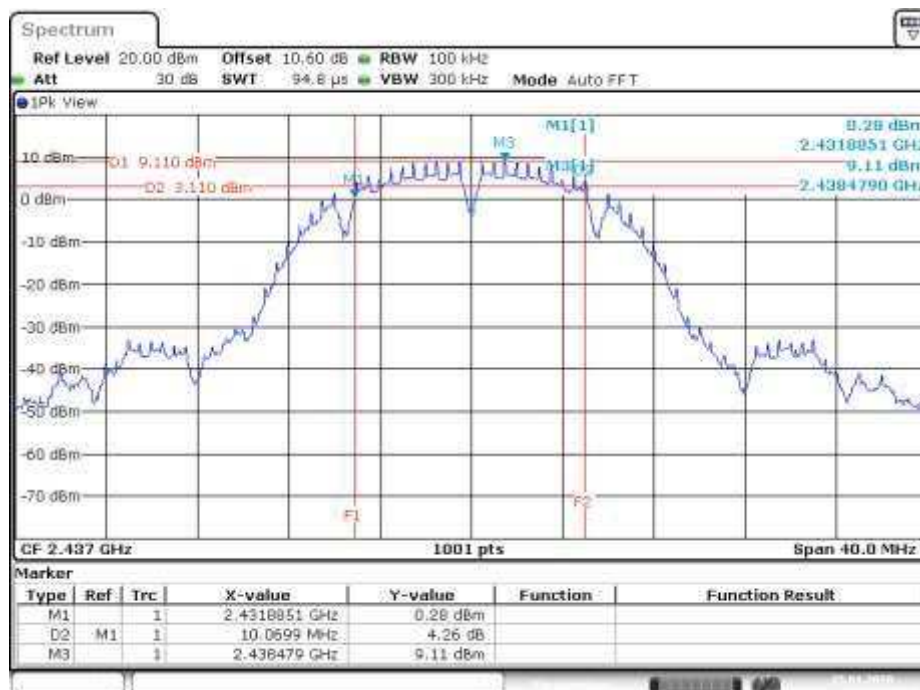
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Middle Channel
Ant 1


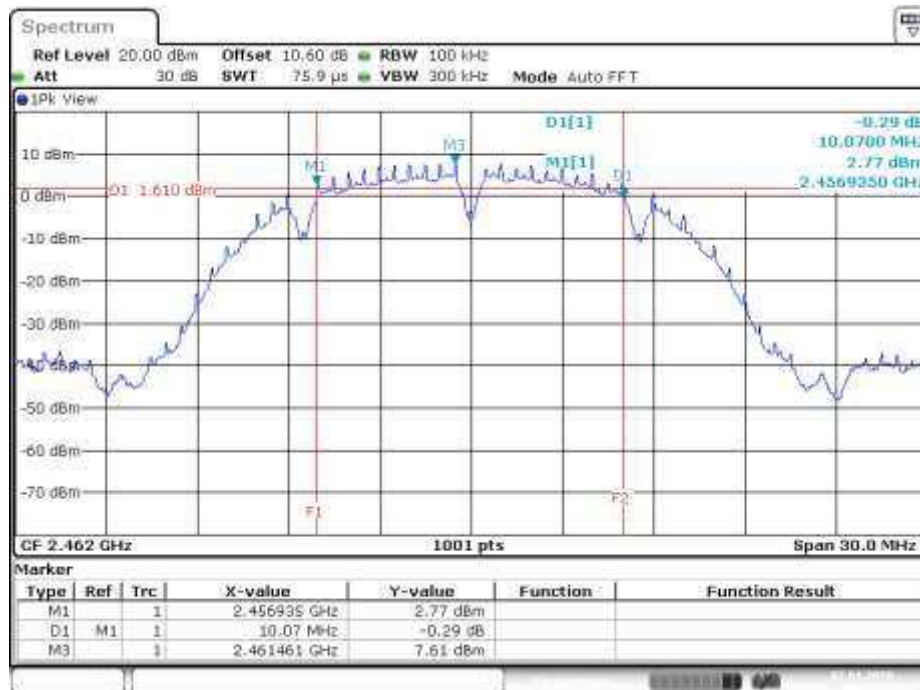
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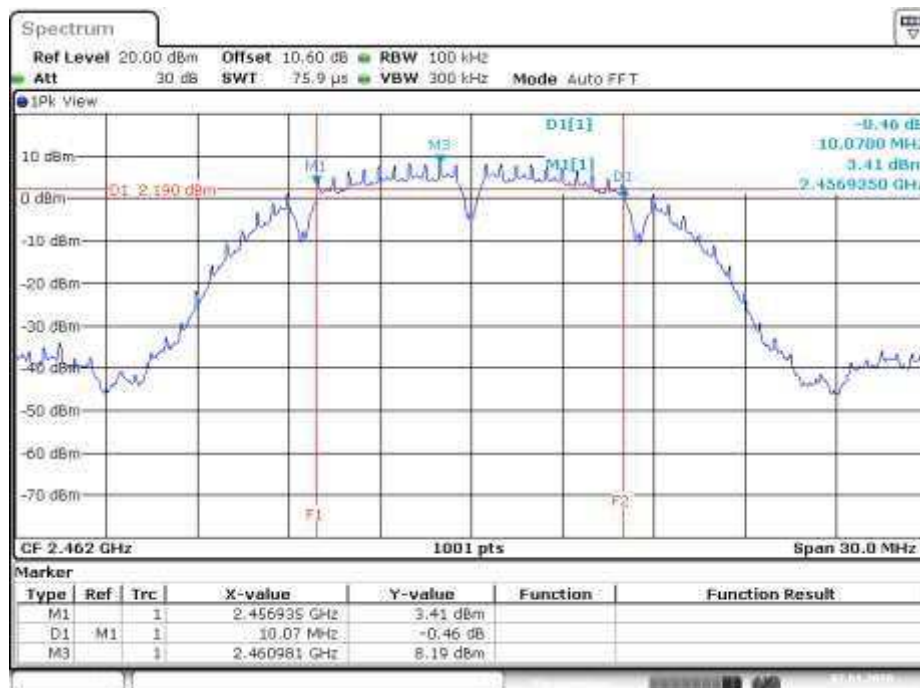
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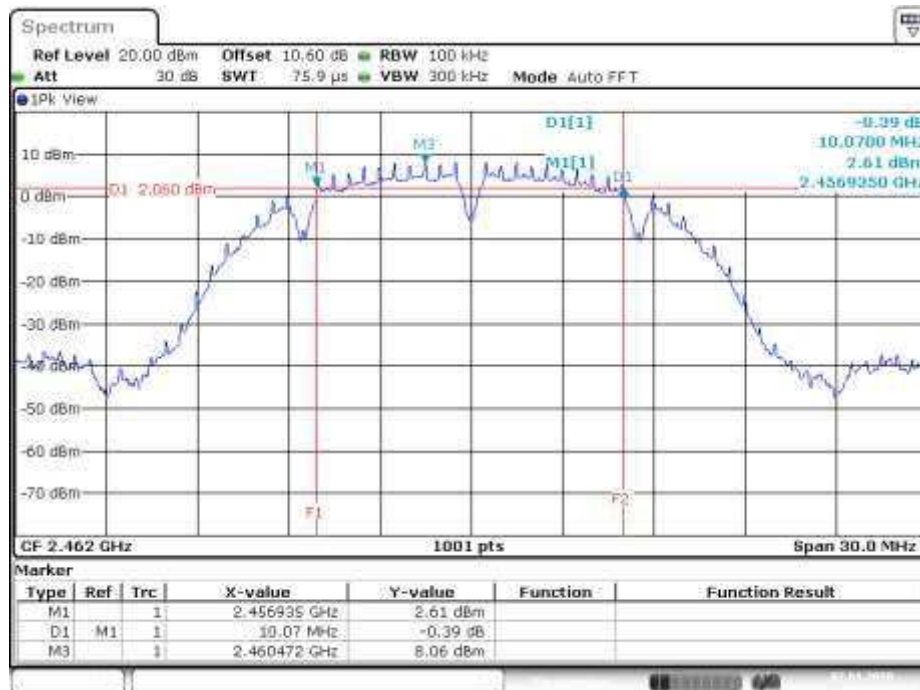
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High Channel
Ant 1


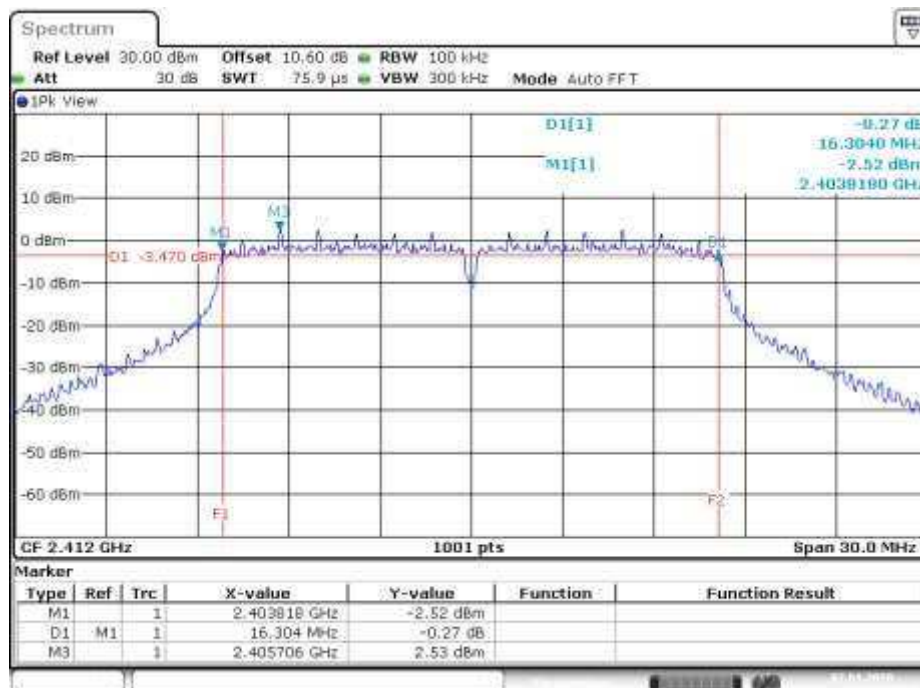
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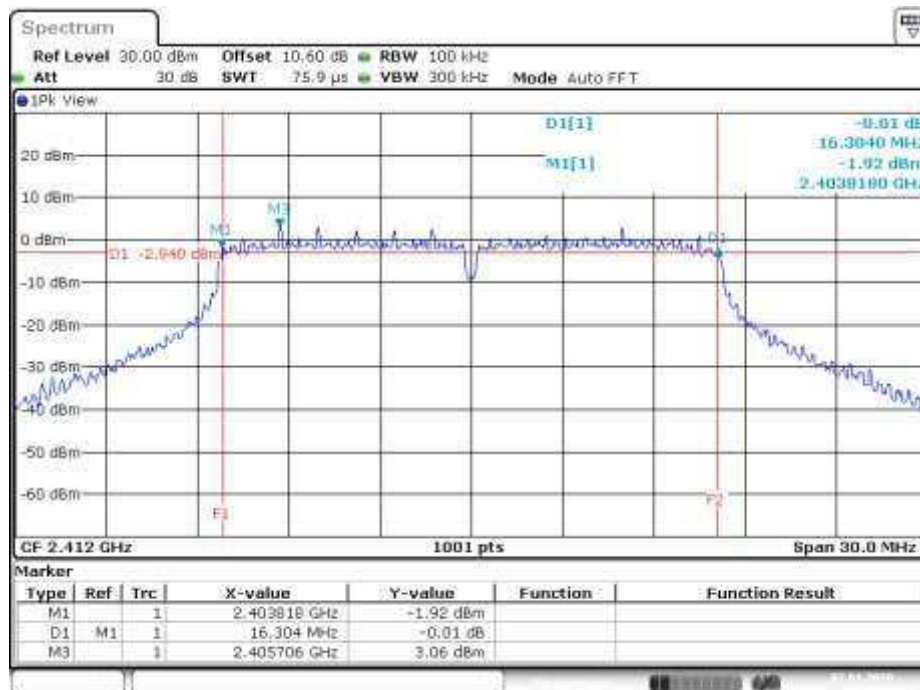
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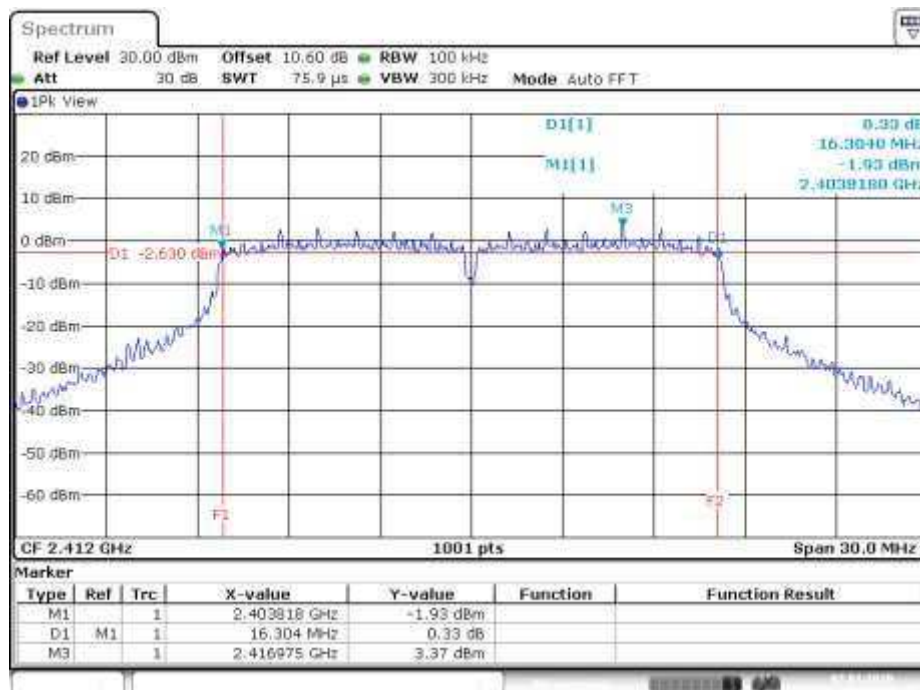
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802.11g
Low Channel
Ant 1


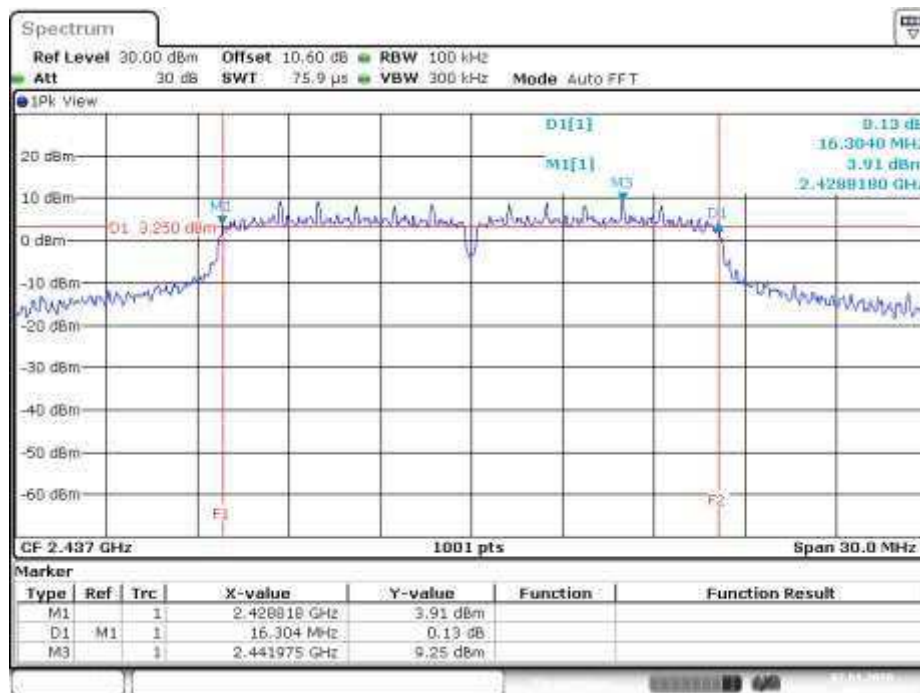
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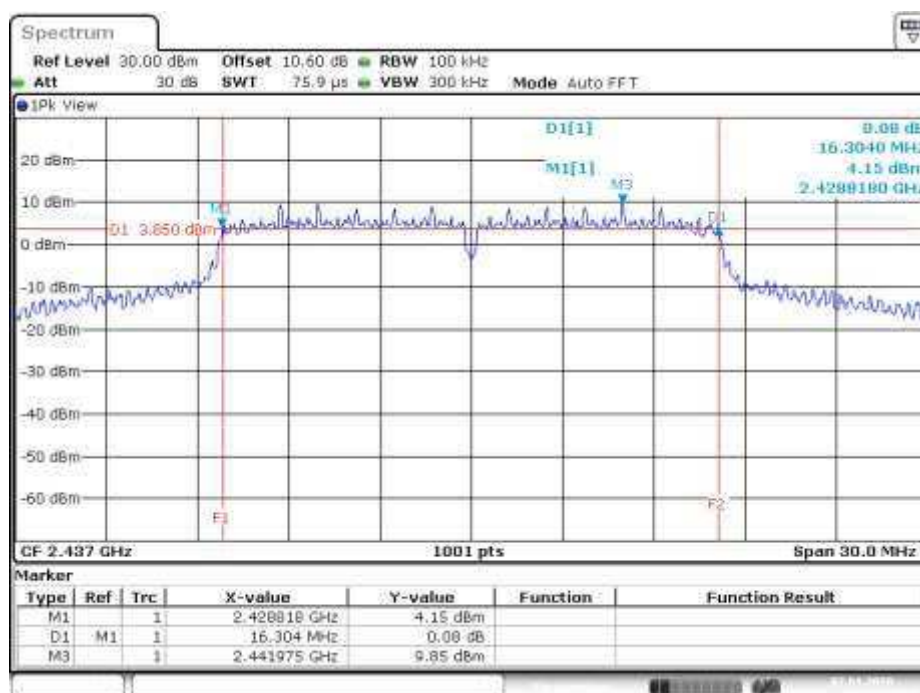
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Ant 3


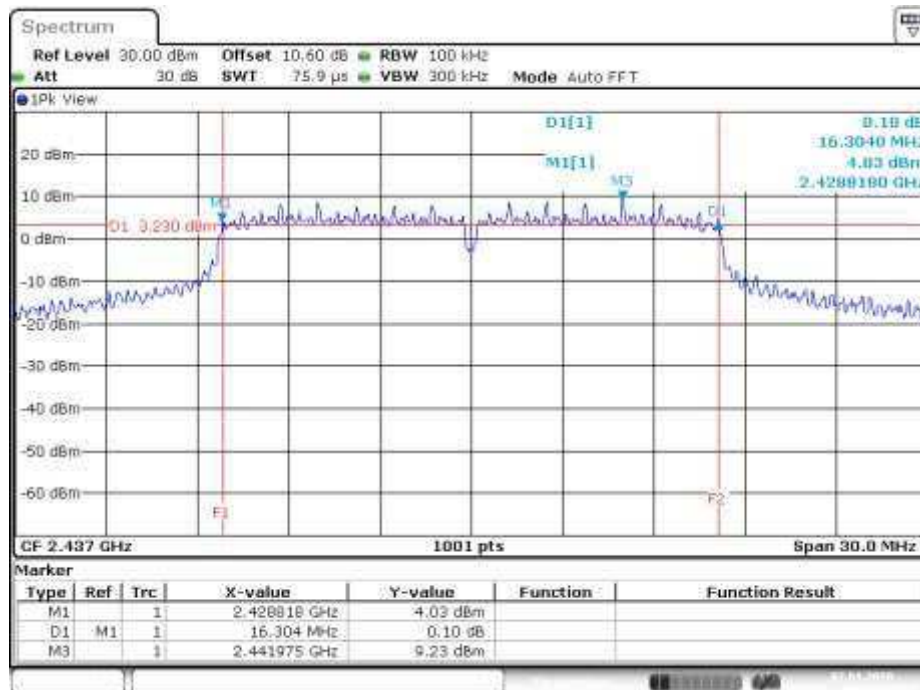
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Middle Channel
Ant 1


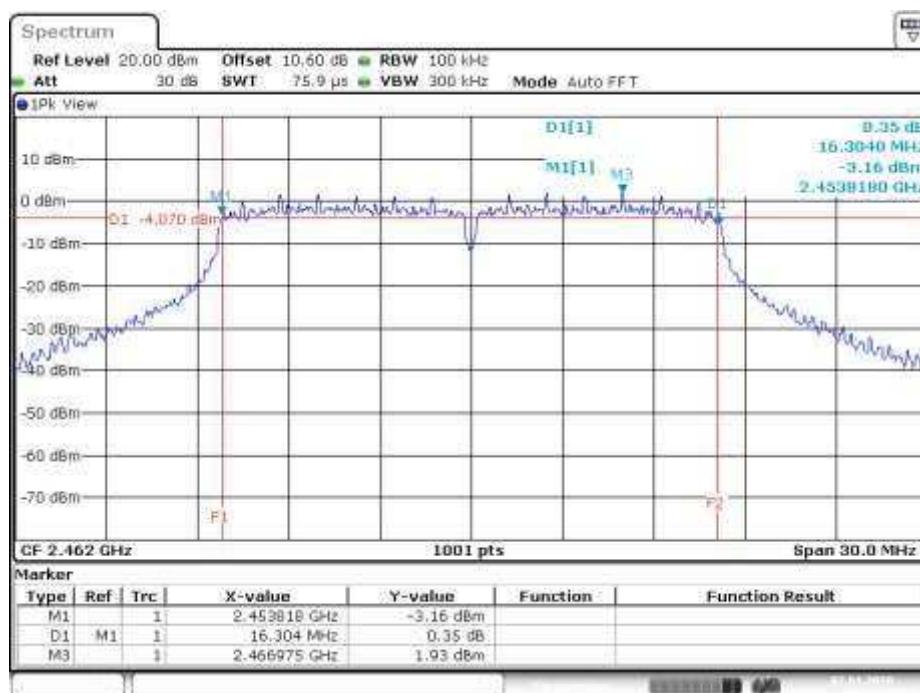
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Ant 2


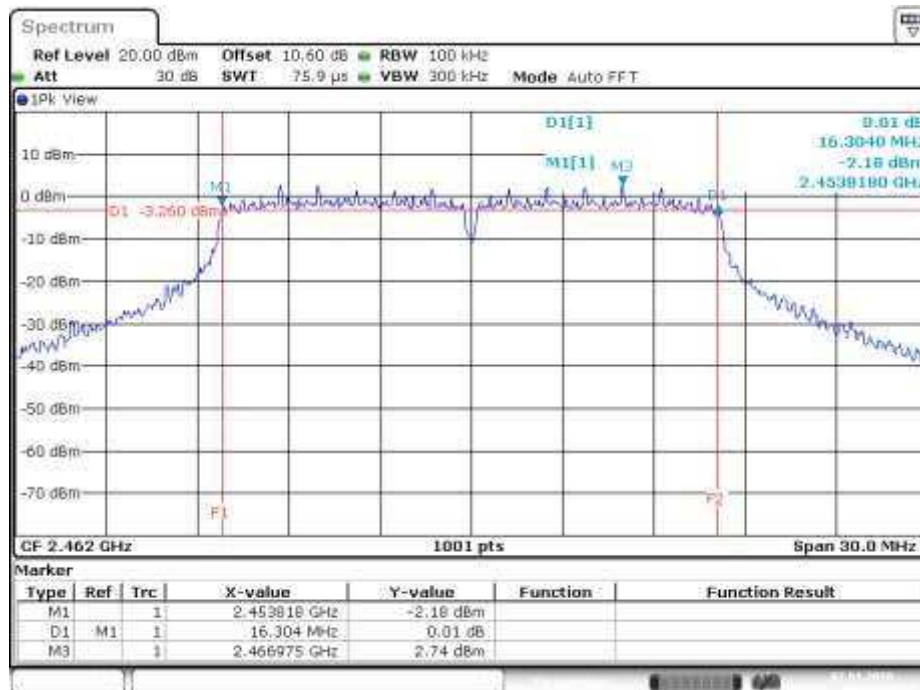
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Ant 3


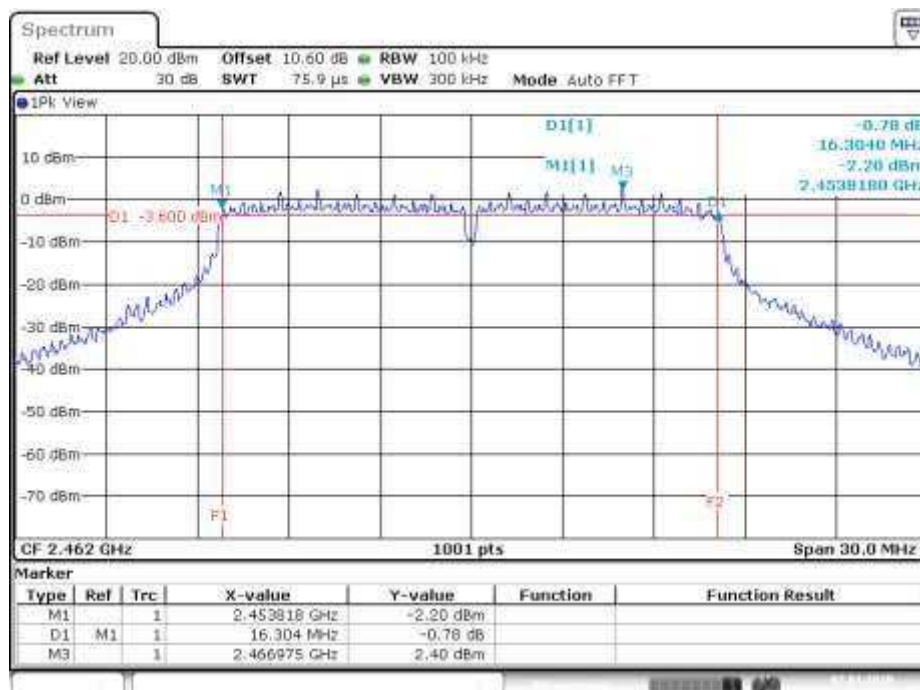
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High Channel
Ant 1


Date: 7.JAN.2020 11:30:31

Ant 2


Date: 7.JAN.2020 11:29:14

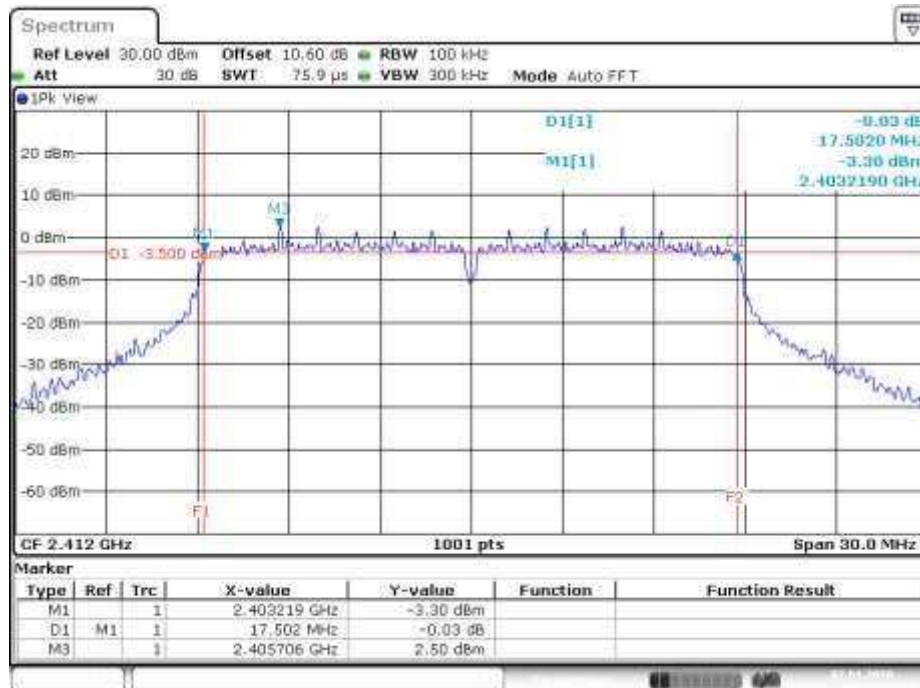
Ant 3


Date: 7.JAN.2020 11:27:50

802.11n HT20

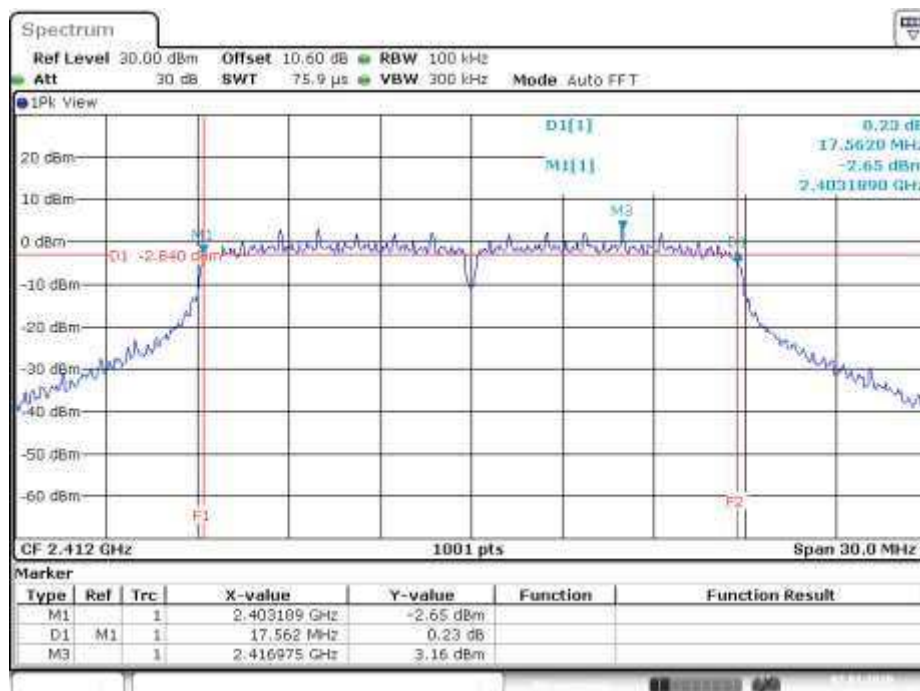
Low Channel

Ant 1

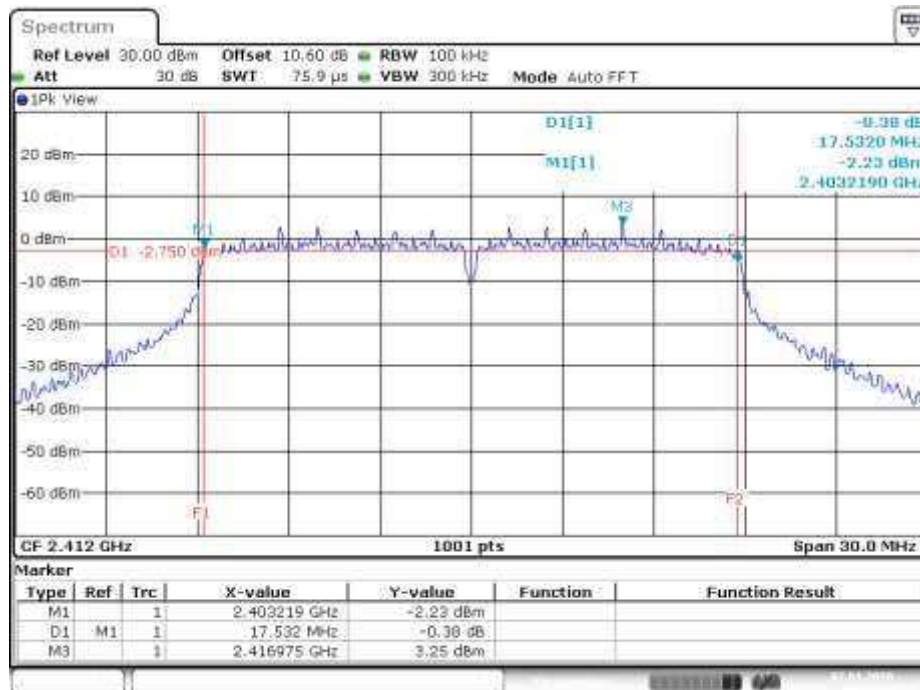


Date: 7.JAN.2020 11:43:30

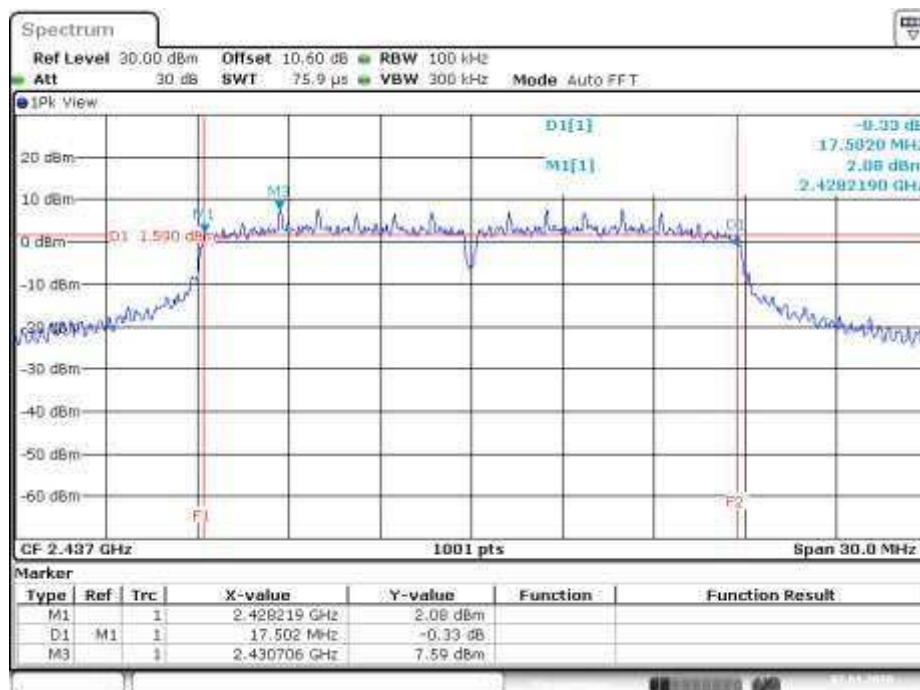
Ant 2



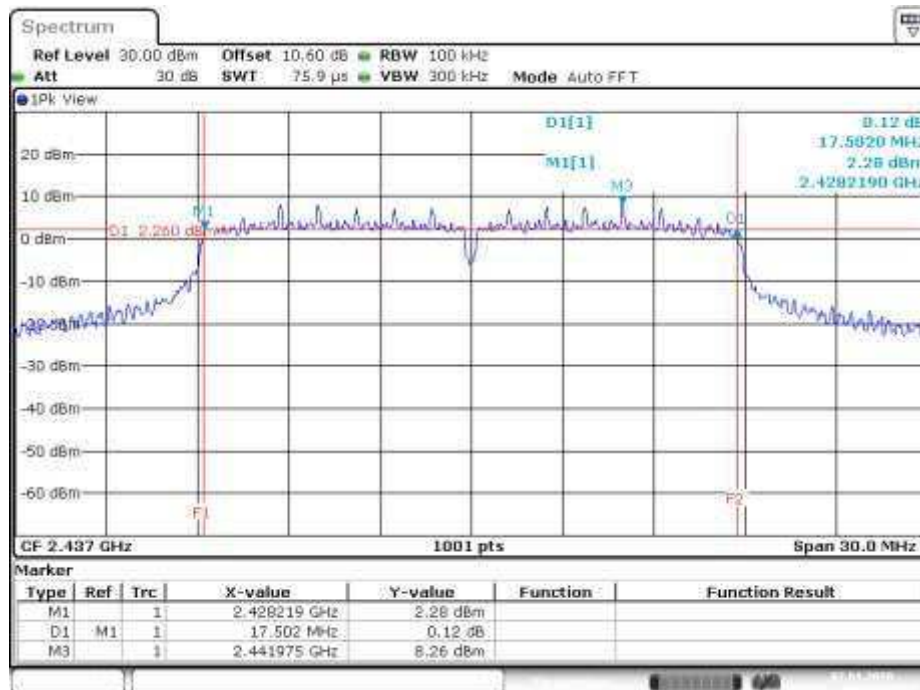
Date: 7.JAN.2020 11:44:52

Ant 3


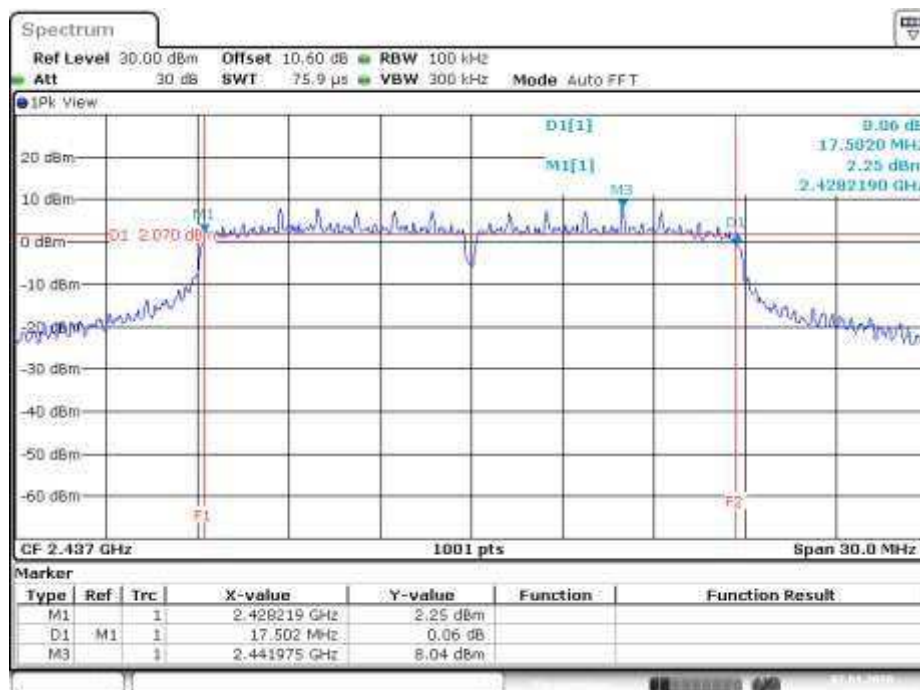
Date: 7.JAN.2020 11:46:29

Middle Channel
Ant 1


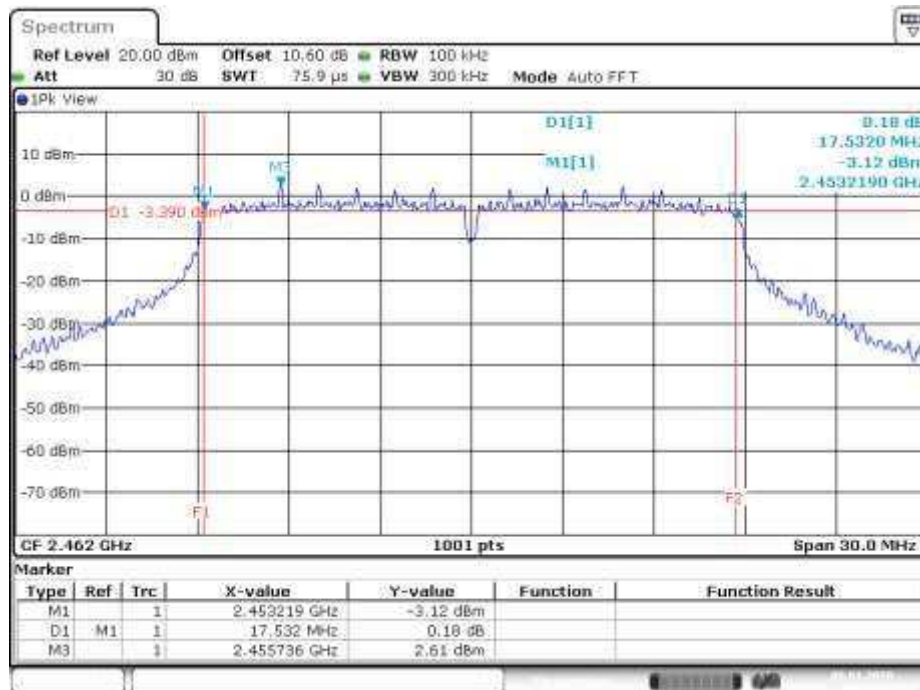
Date: 7.JAN.2020 11:51:33

Ant 2


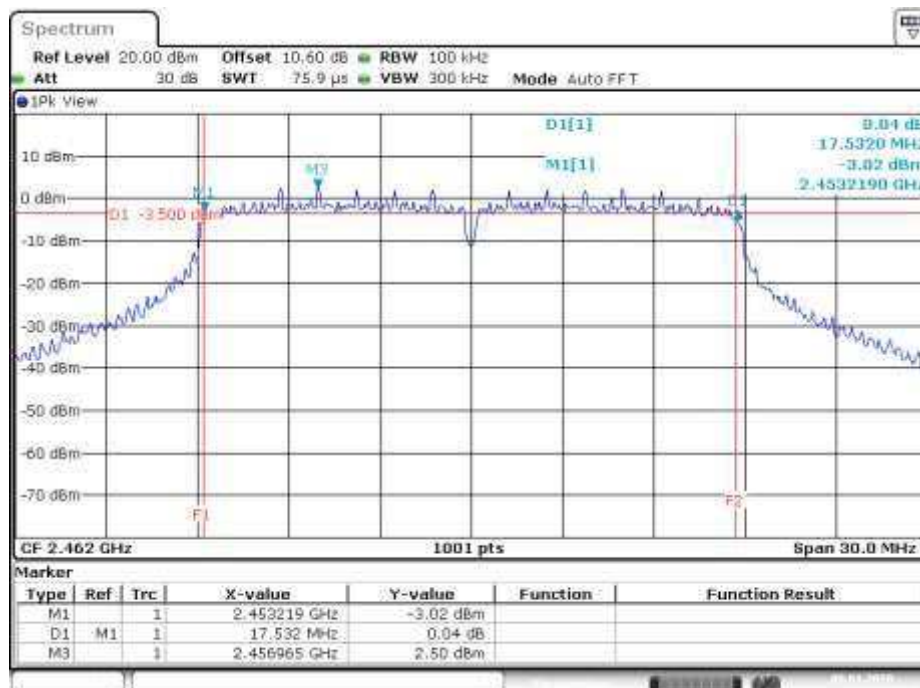
Date: 7.JAN.2020 11:50:07

Ant 3


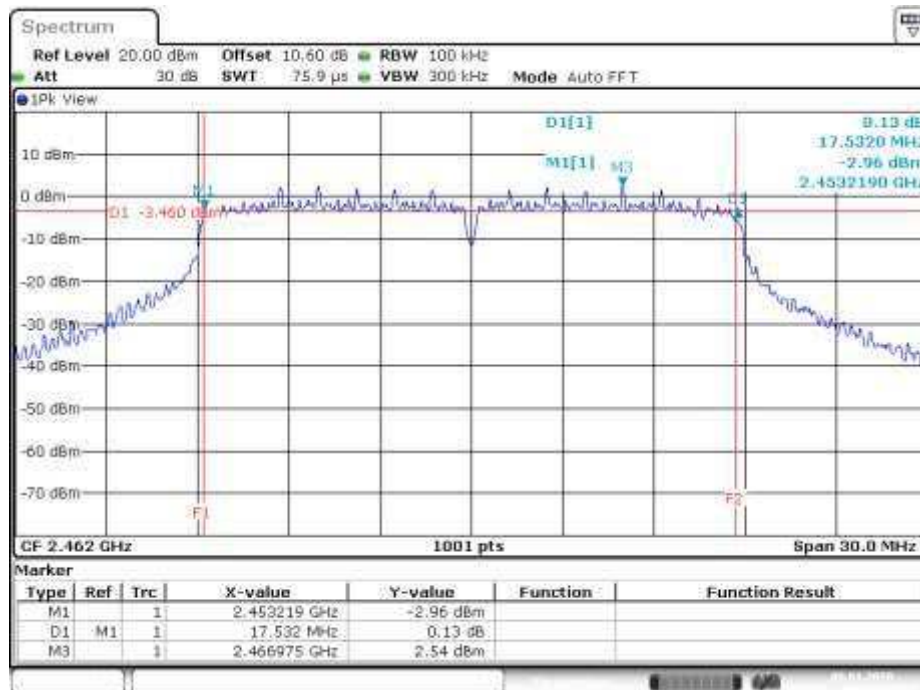
Date: 7.JAN.2020 11:48:26

High Channel
Ant 1


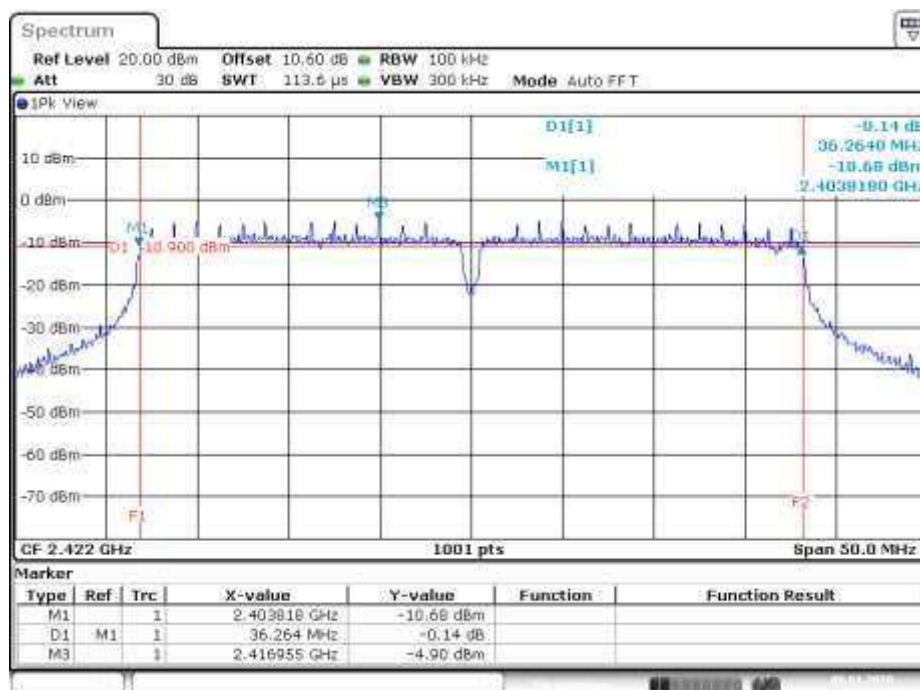
Date: 8.JAN.2020 10:17:06

Ant 2


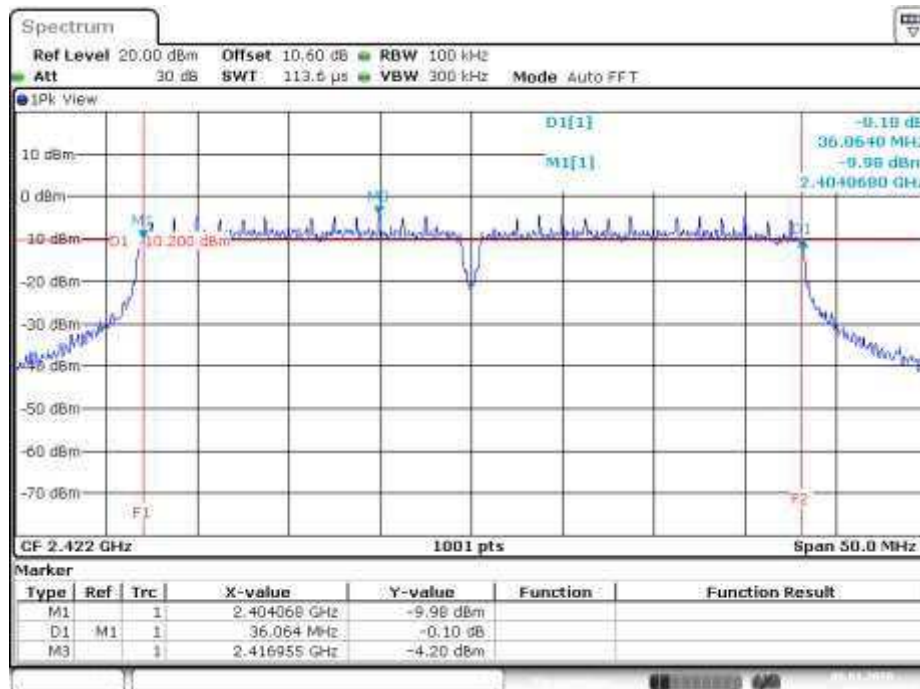
Date: 8.JAN.2020 10:18:20

Ant 3


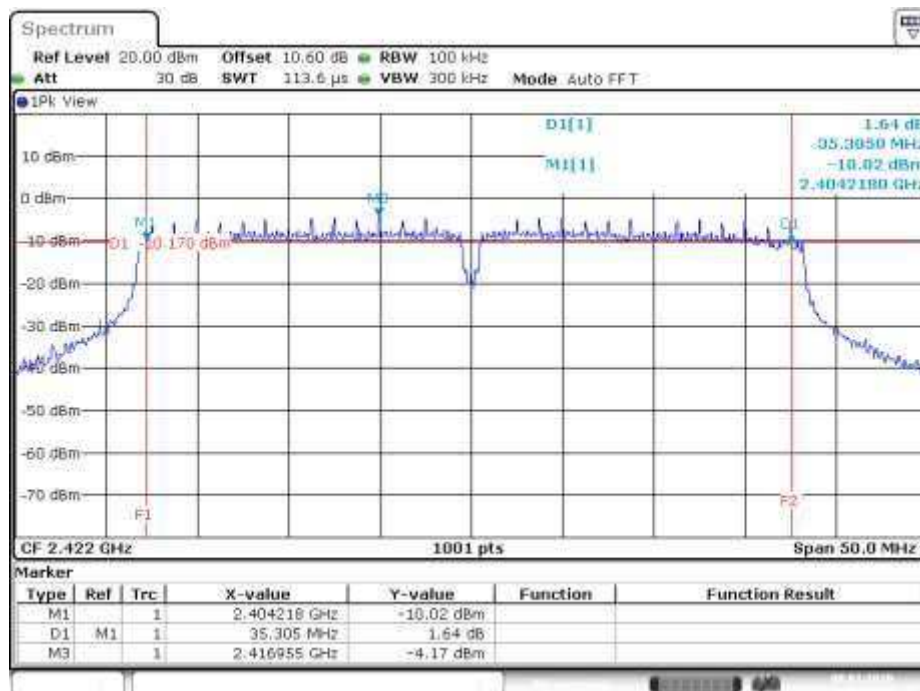
Date: 8.JAN.2020 10:19:25

802.11n HT40
Low Channel
Ant 1


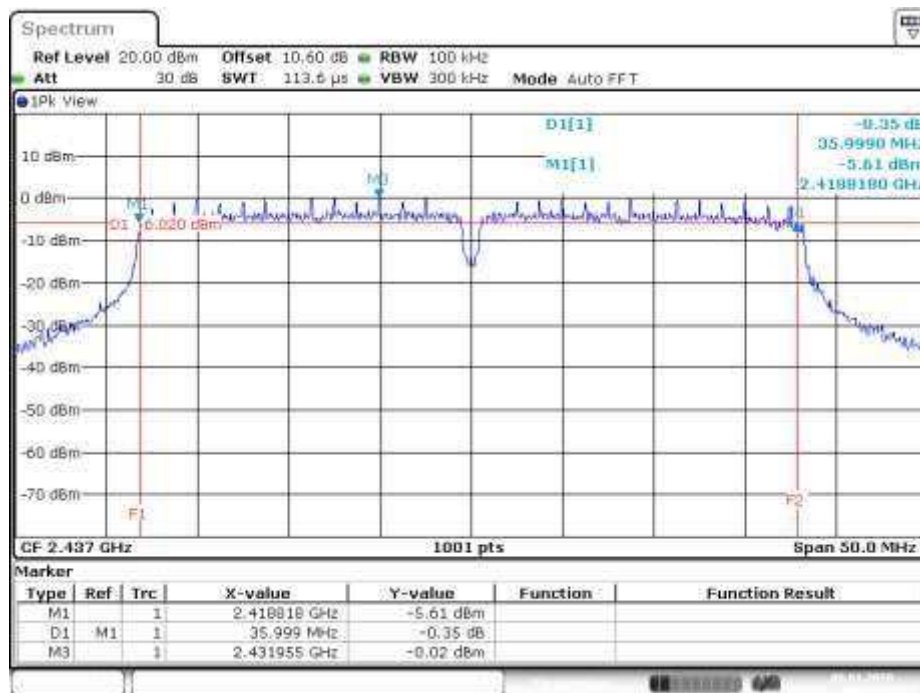
Date: 8.JAN.2020 10:40:21

Ant 2


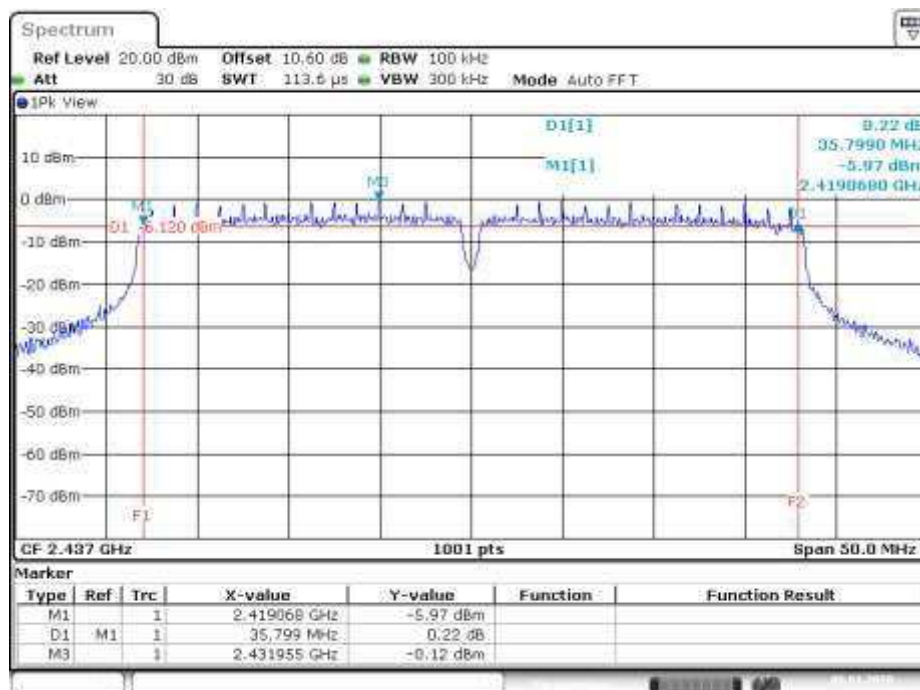
Date: 8.JAN.2020 10:39:12

Ant 3


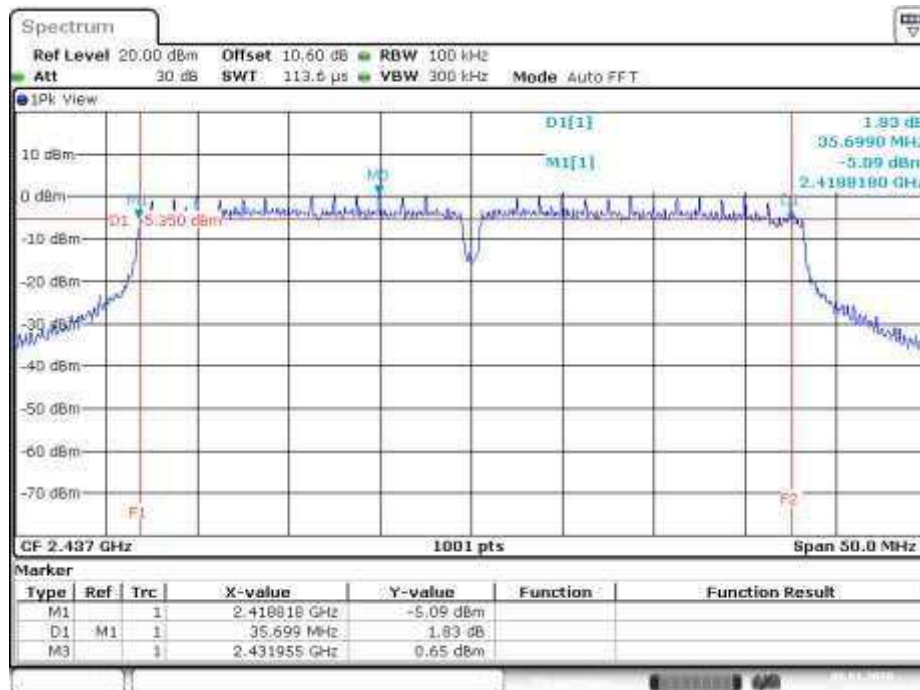
Date: 8.JAN.2020 10:37:57

Middle Channel
Ant 1


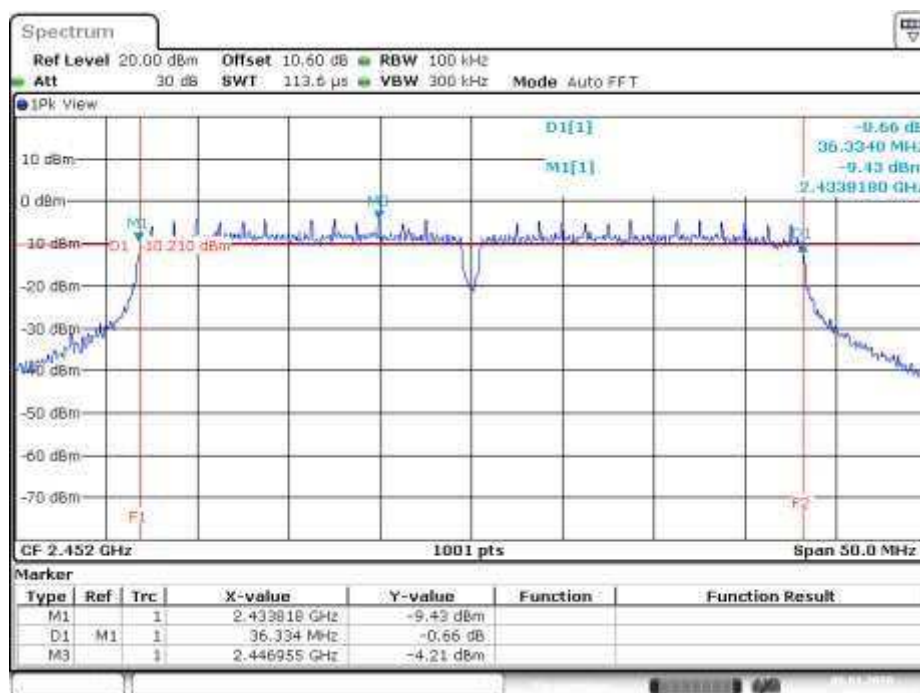
Date: 8.JAN.2020 10:41:54

Ant 2


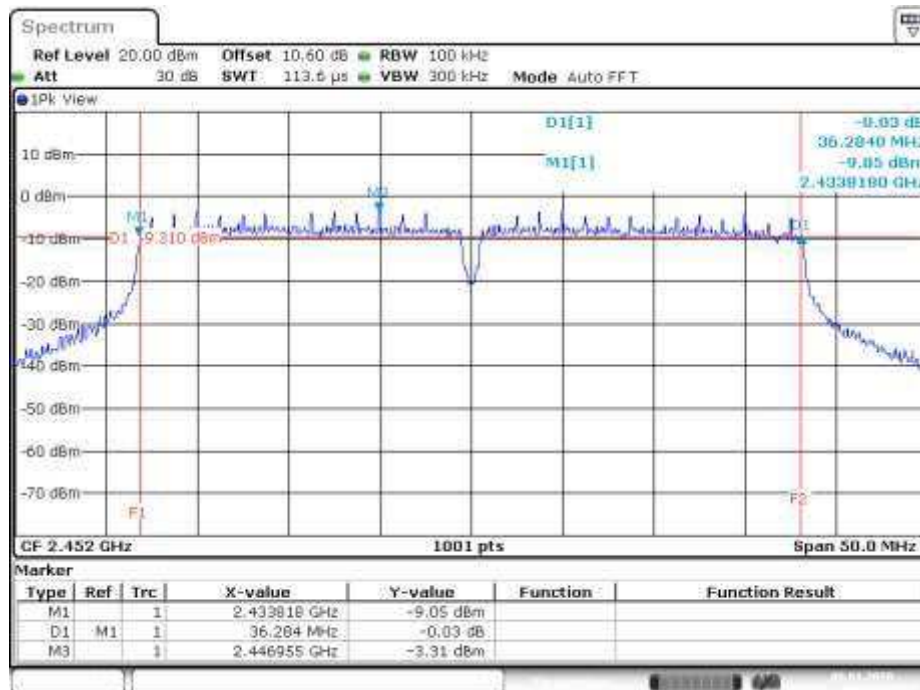
Date: 8.JAN.2020 10:43:14

Ant 3


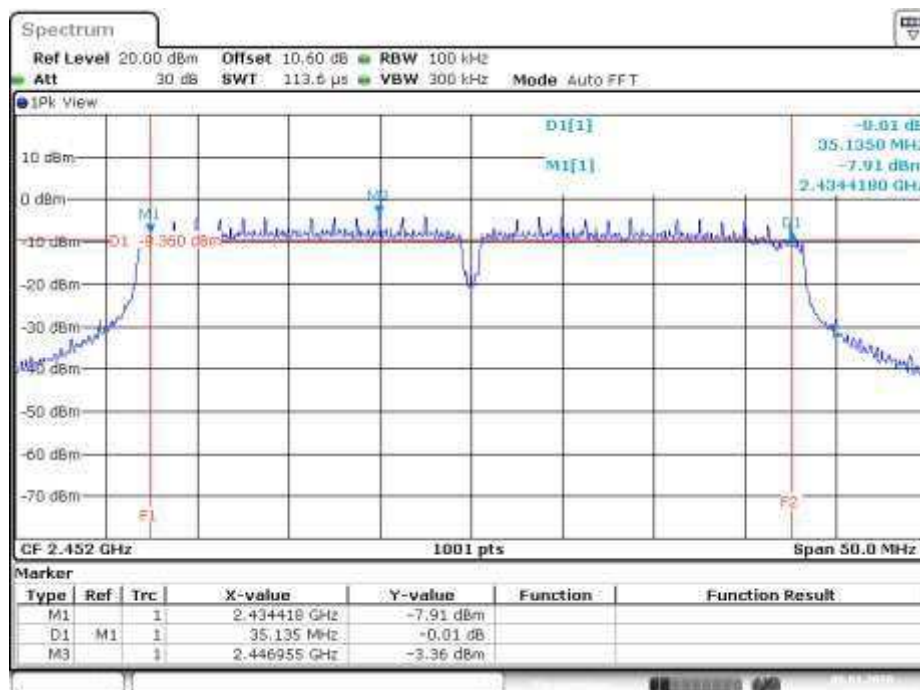
Date: 8.JAN.2020 10:44:35

High Channel
Ant 1


Date: 8.JAN.2020 10:48:41

Ant 2


Date: 8.JAN.2020 10:47:32

Ant 3


Date: 8.JAN.2020 10:46:10

5.1.4 Power Density

RESULT:
Passed

Test standard : FCC Part 15.247(e)
 Basic standard : ANSI C63.10:2013, KDB558074
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A
 Ambient temperature : 22-26°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

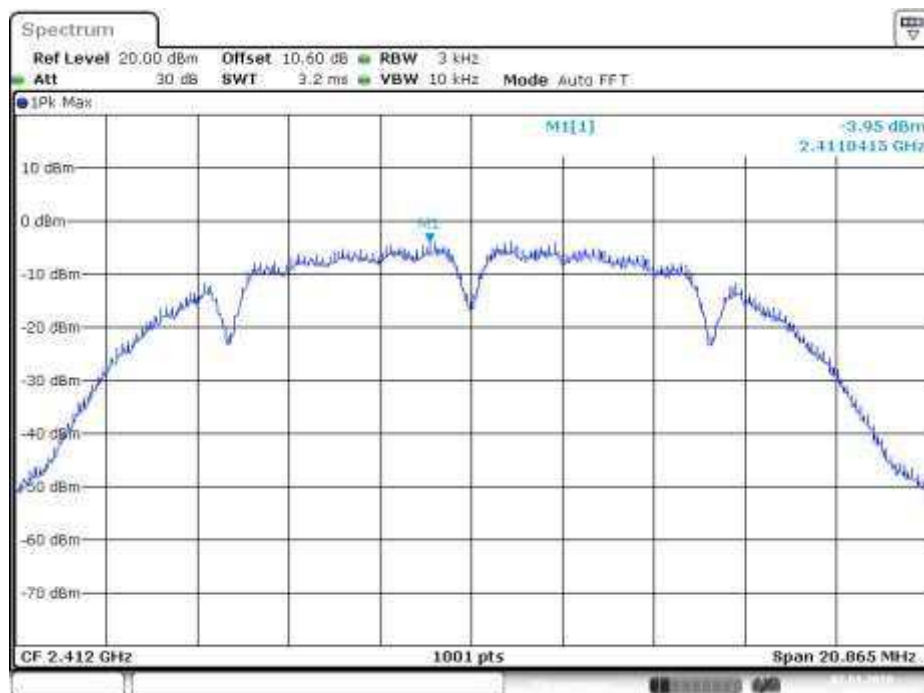
Table 9: Test result of Power Density

Mode	Channel Frequency (MHz)	Power Density (dBm)				Limit (dBm)
		Ant 1	Ant 2	Ant 3	Total	
802.11b	2412	-3.95	-3.75	-3.55	1.02	8
	2437	-4.73	-4.08	-4.55	0.33	8
	2462	-5.79	-4.76	-5.40	-0.52	8
802.11g	2412	-9.55	-9.52	-9.44	-4.73	8
	2437	-3.37	-3.65	-3.65	1.22	8
	2462	-10.48	-9.66	-9.85	-5.21	8
802.11n HT20	2412	-11.16	-10.32	-9.84	-5.64	8
	2437	-6.11	-5.75	-6.58	-1.36	8
	2462	-11.74	-11.07	-11.34	-6.60	8
802.11n HT40	2422	-18.22	-17.24	-17.75	-12.95	8
	2437	-13.05	-13.76	-12.53	-8.31	8
	2452	-17.30	-16.81	-17.30	-12.36	8

Test Plot of Power Density 802.11b

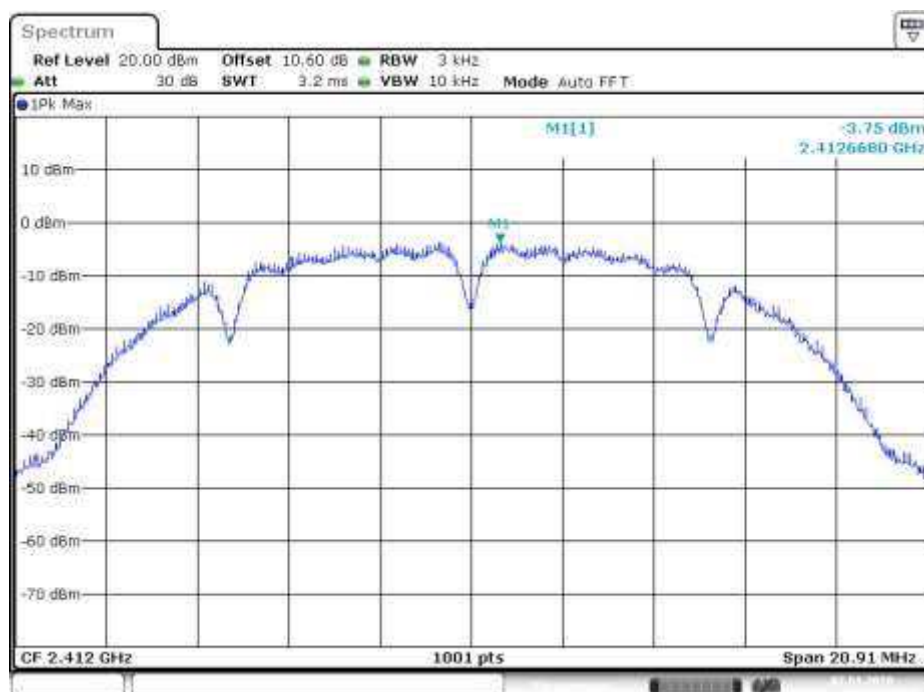
Low Channel

Ant 1

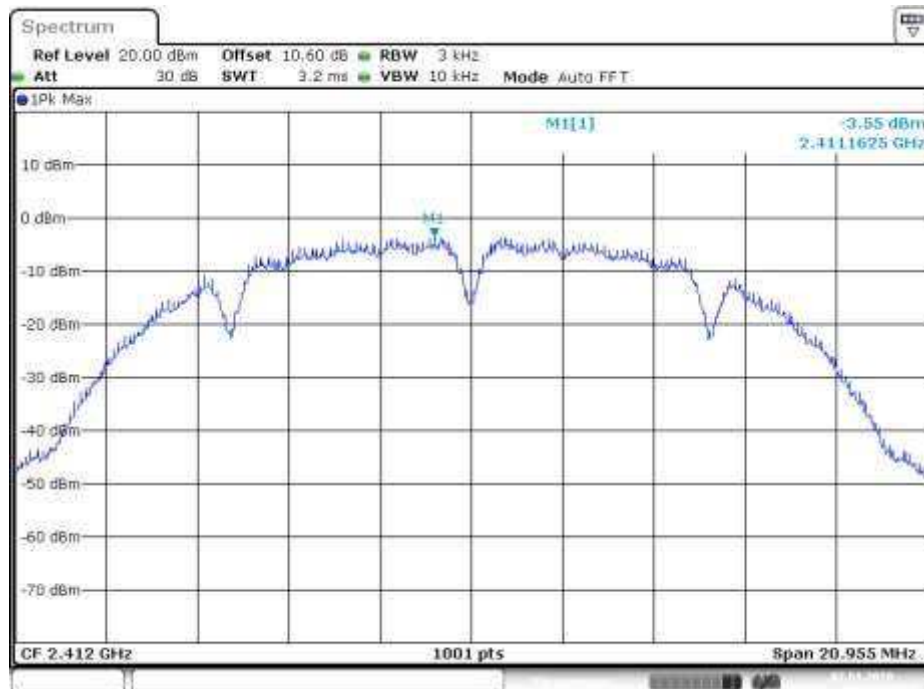


Date: 7.JAN.2020 12:14:56

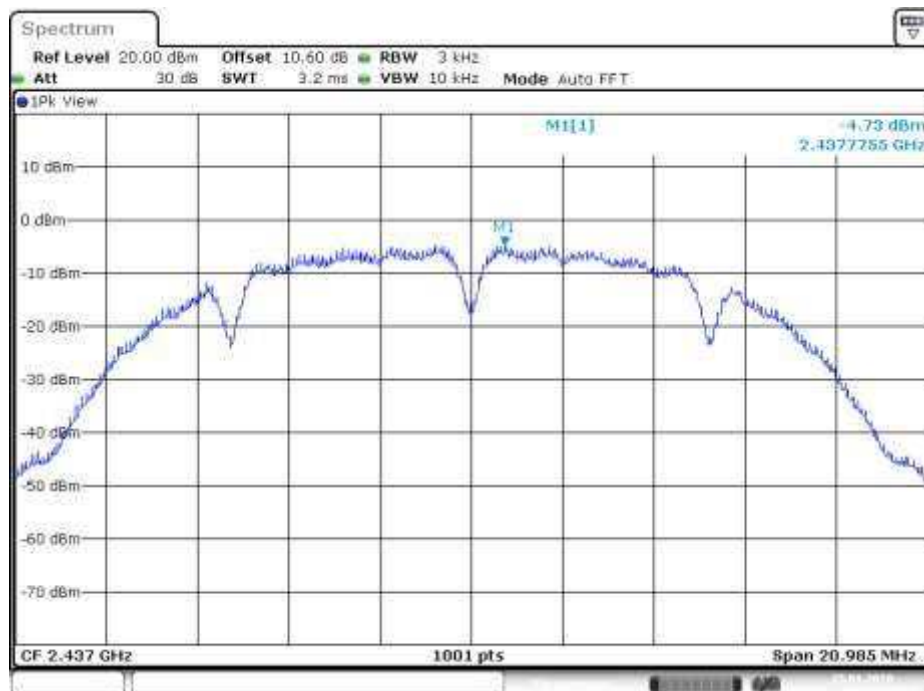
Ant 2



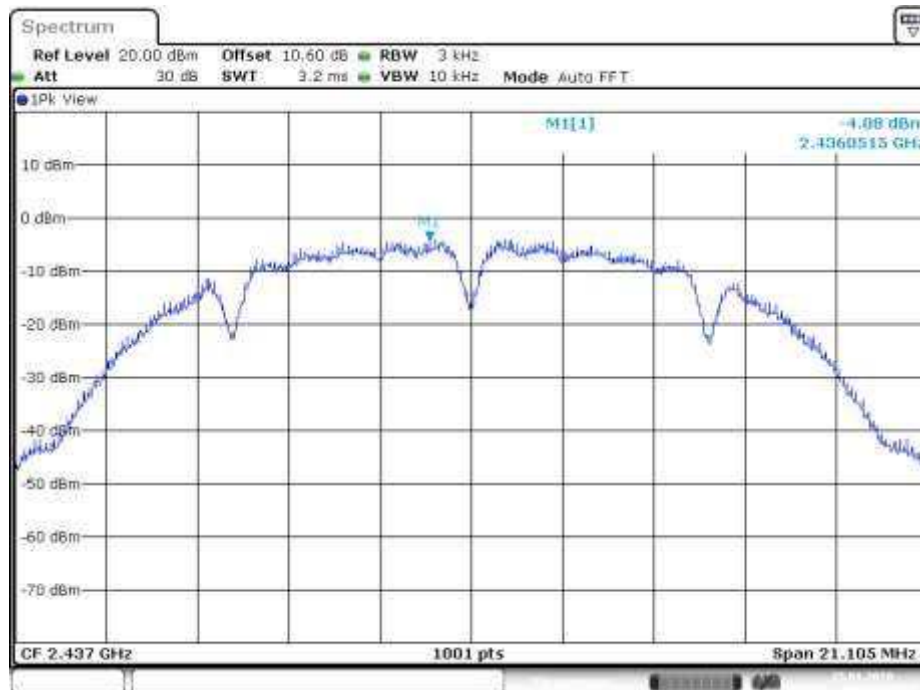
Date: 7.JAN.2020 12:35:52

Ant 3


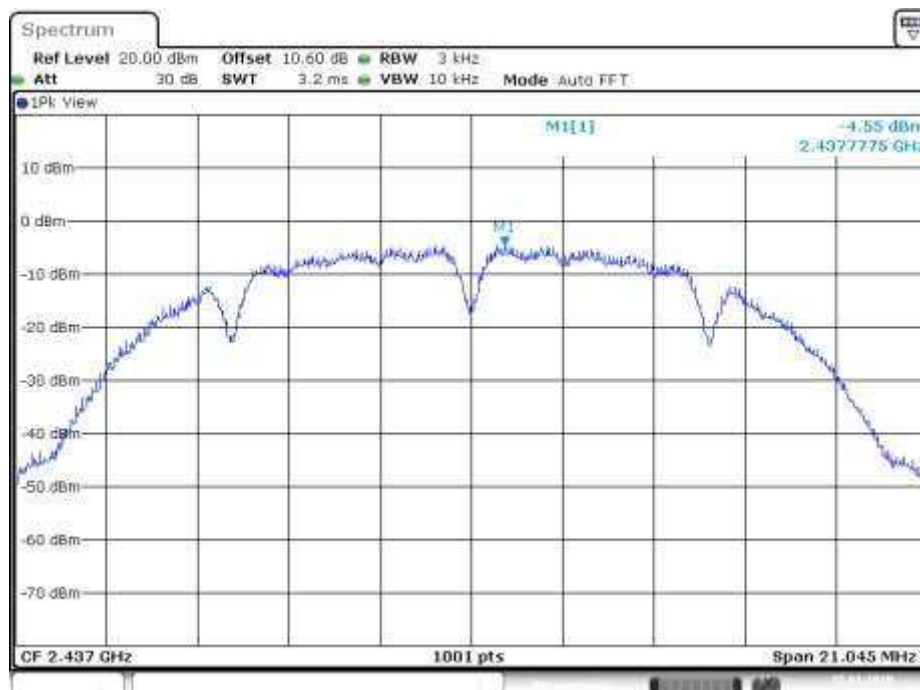
Date: 7.JAN.2020 12:54:53

Middle Channel
Ant 1


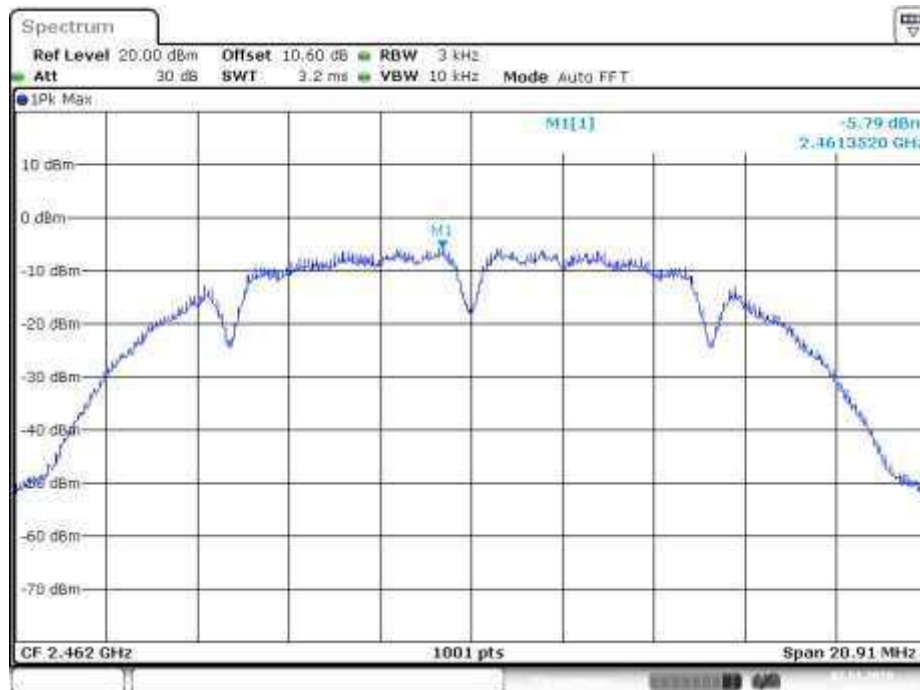
Date: 15.JAN.2020 18:03:36

Ant 2


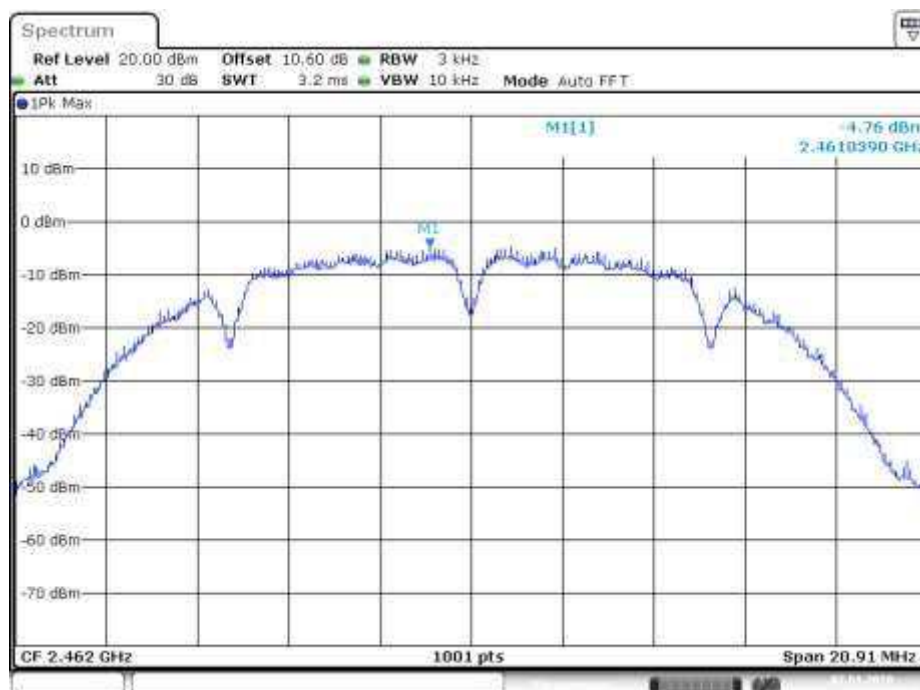
Date: 15.JAN.2020 18:14:00

Ant 3


Date: 15.JAN.2020 18:15:54

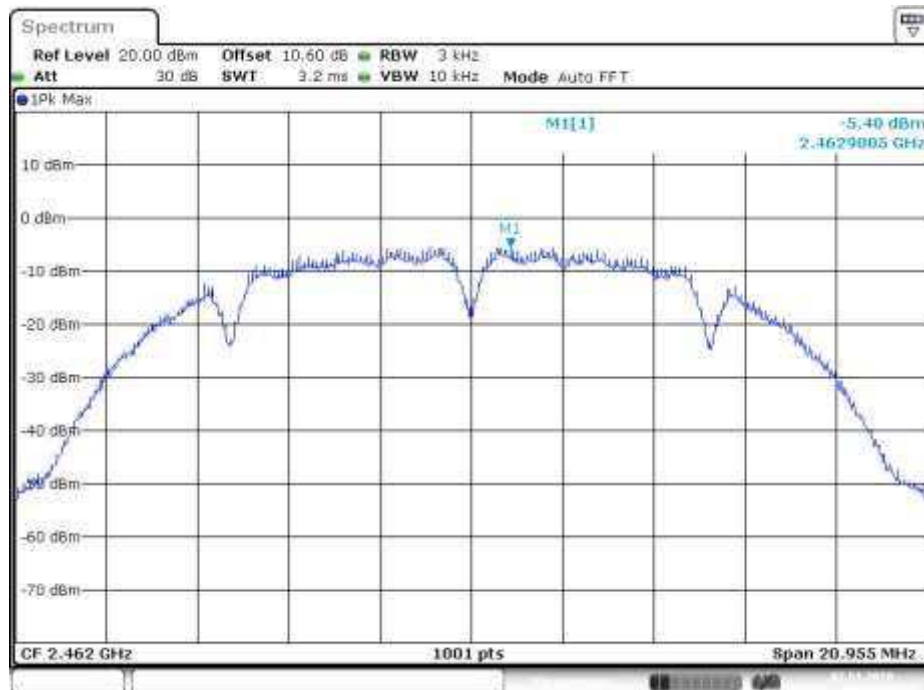
High Channel
Ant 1


Date: 7.JAN.2020 12:19:47

Ant 2


Date: 7.JAN.2020 12:39:20

Ant 3

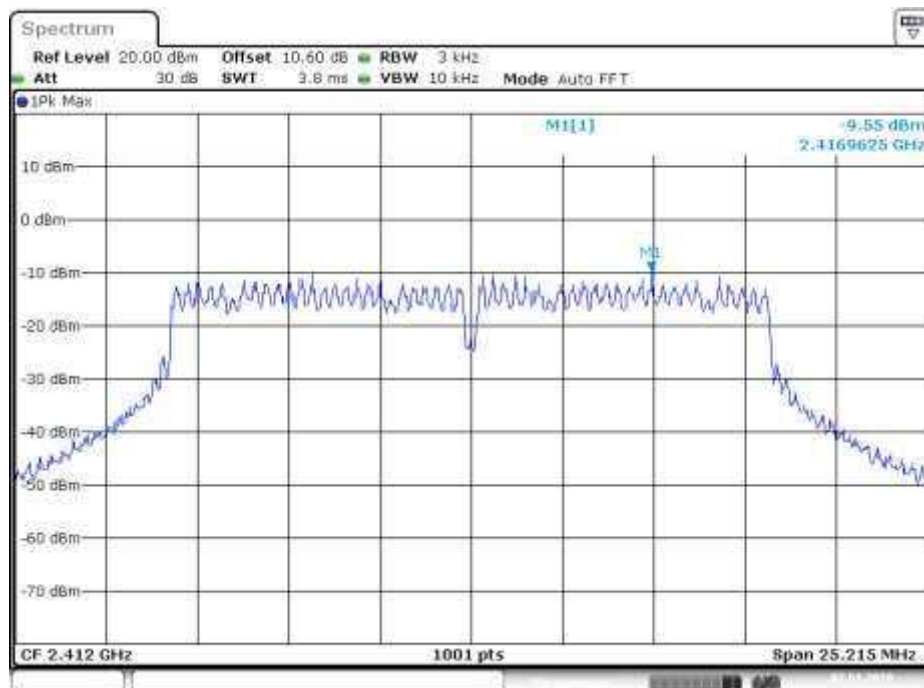


Date: 7.JAN.2020 12:58:49

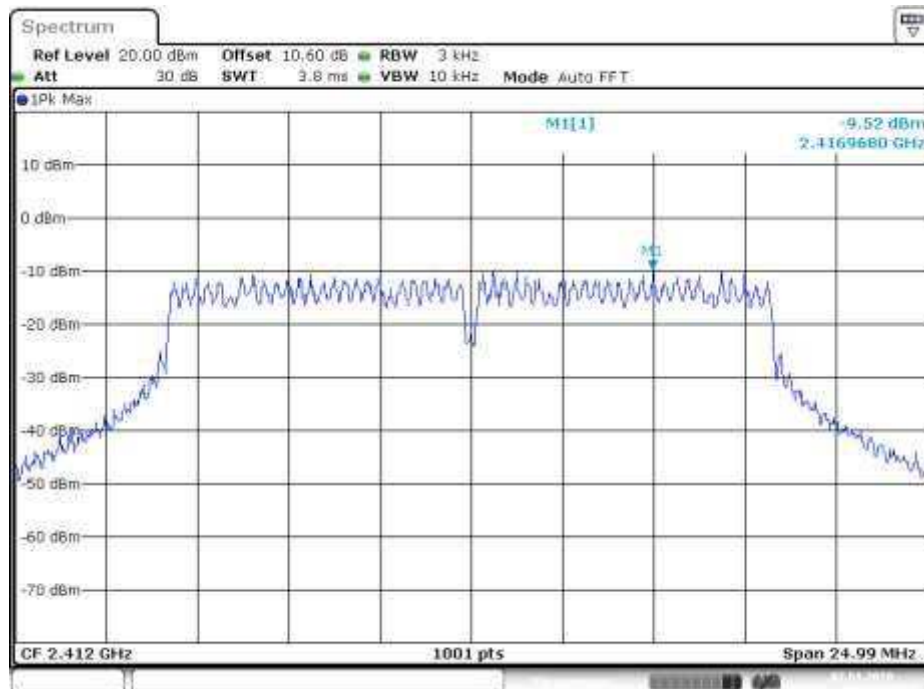
802.11g

Low Channel

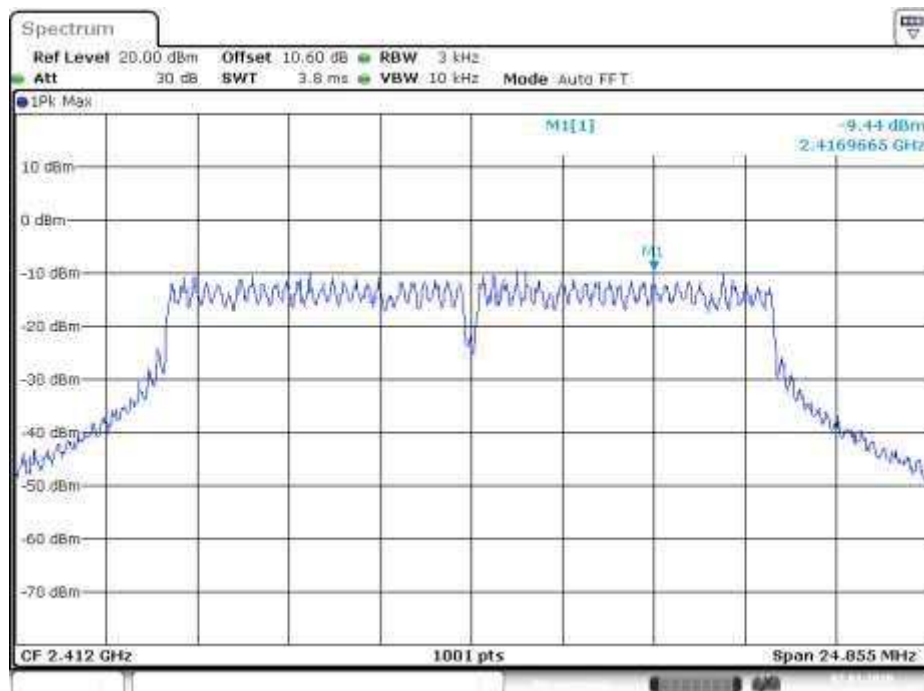
Ant 1



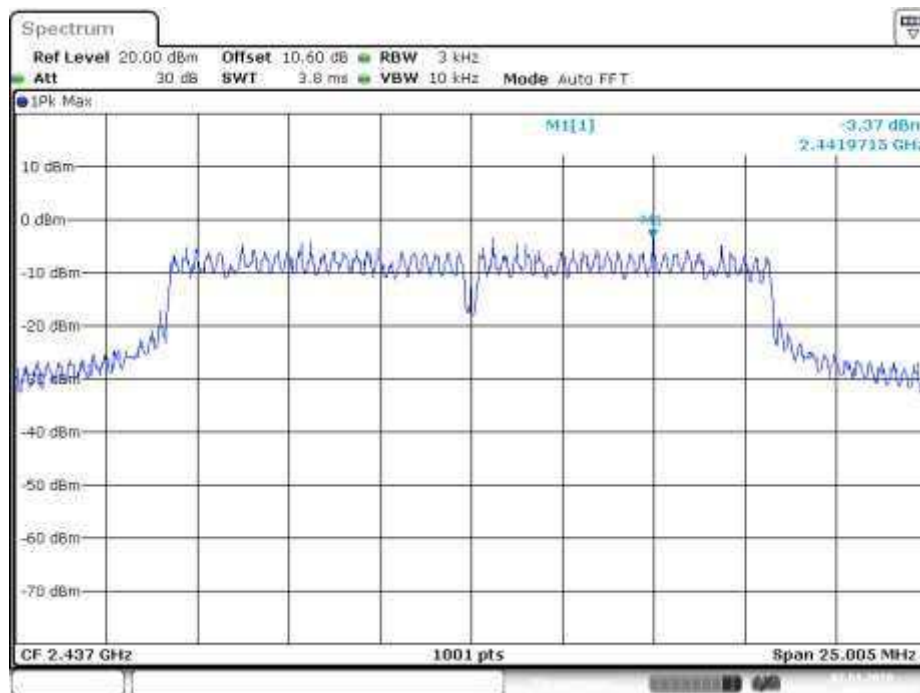
Date: 7.JAN.2020 12:23:31

Ant 2


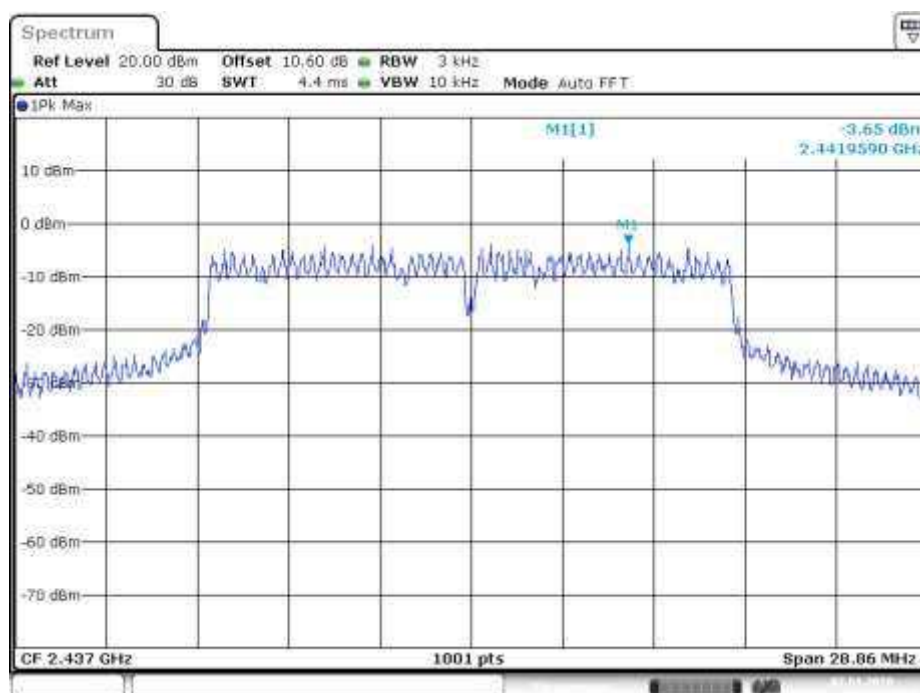
Date: 7.JAN.2020 12:42:40

Ant 3


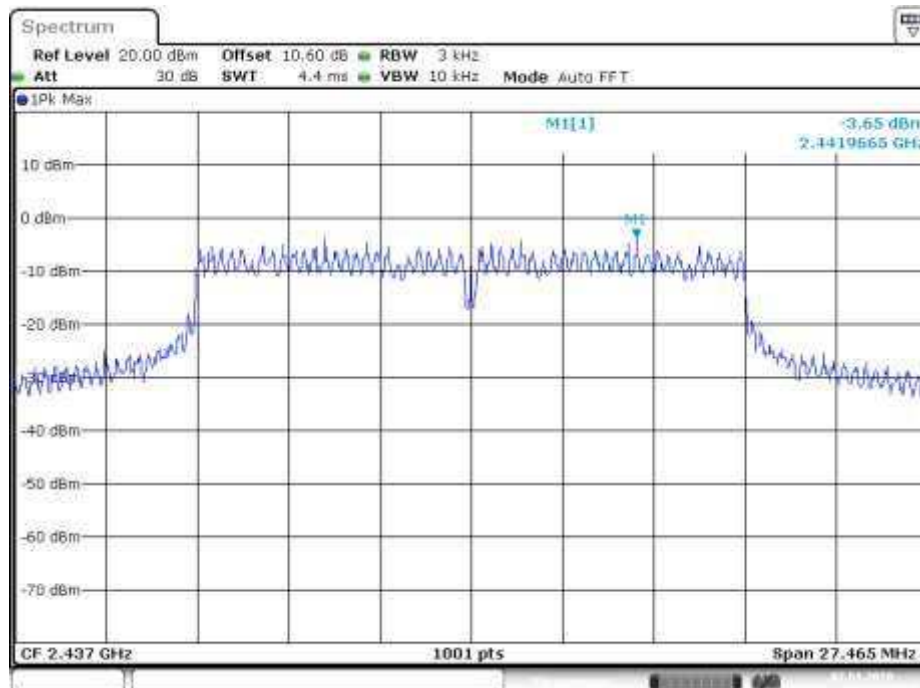
Date: 7.JAN.2020 13:01:40

Middle Channel
Ant 1


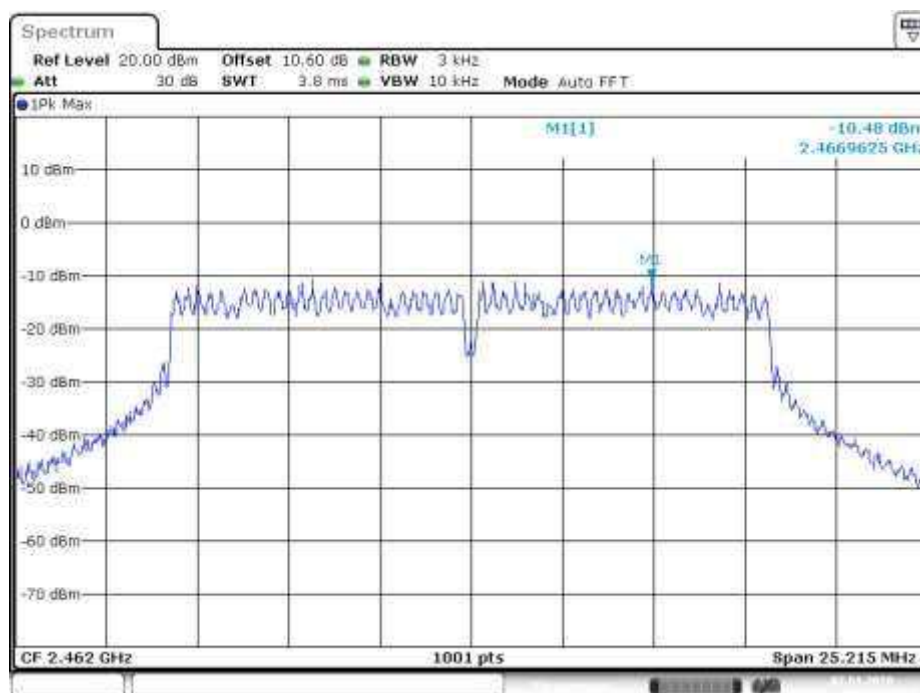
Date: 7.JAN.2020 12:26:16

Ant 2


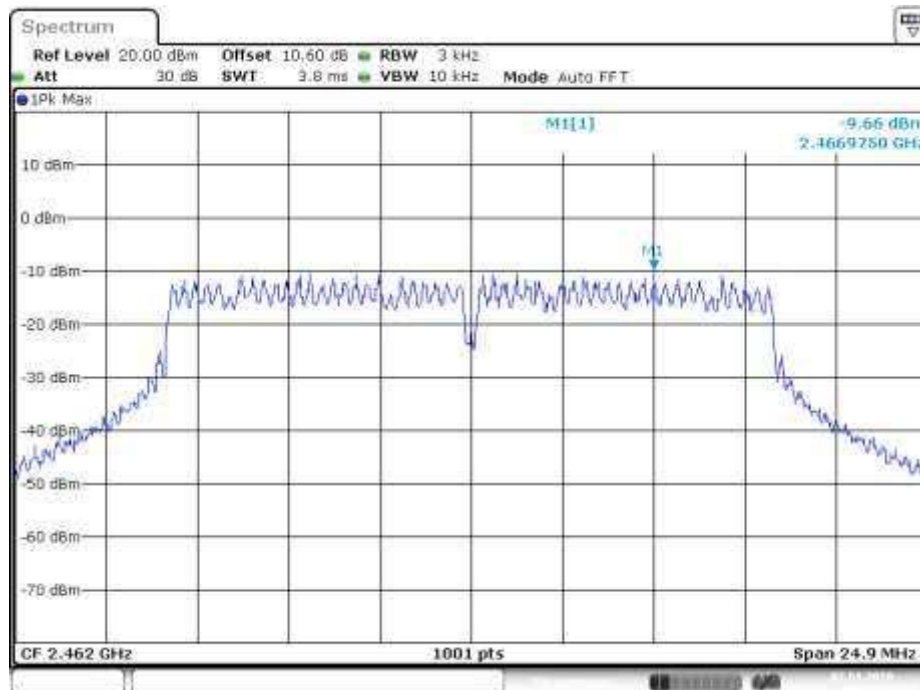
Date: 7.JAN.2020 12:44:22

Ant 3


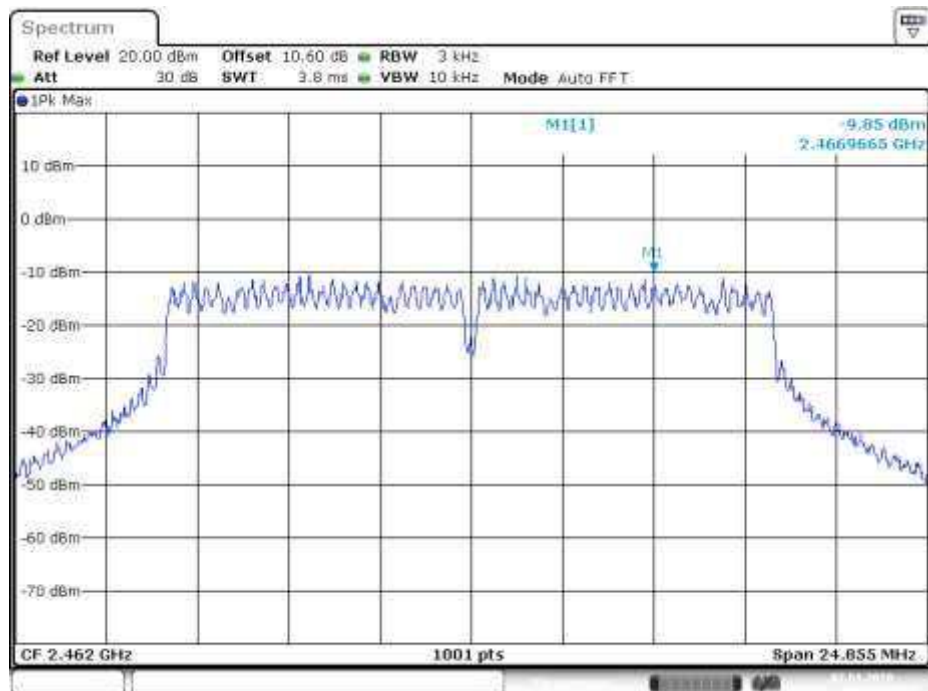
Date: 7.JAN.2020 13:03:30

High Channel
Ant 1


Date: 7.JAN.2020 12:27:59

Ant 2


Date: 7.JAN.2020 12:46:13

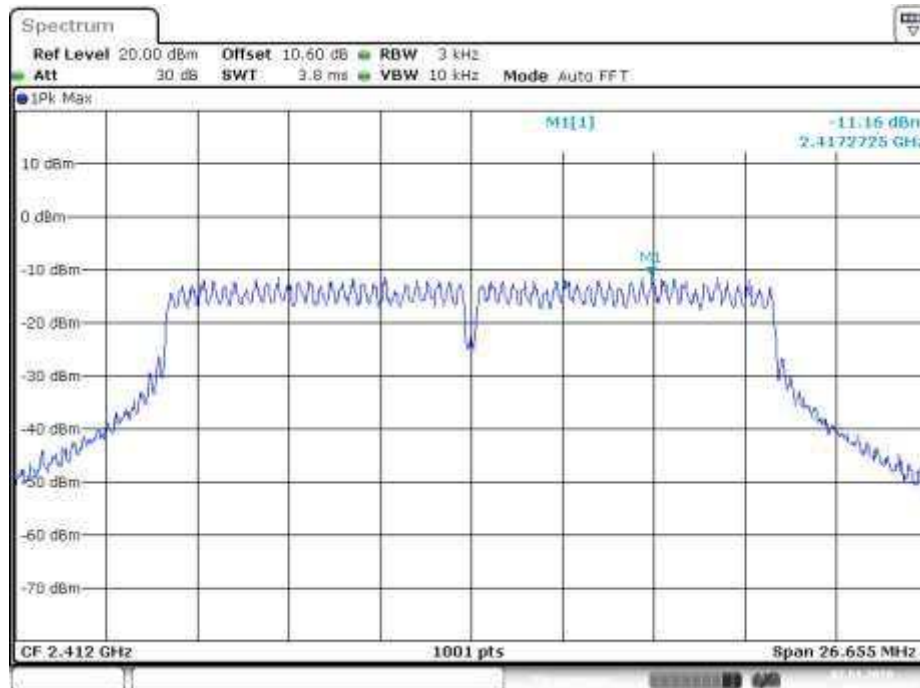
Ant 3


Date: 7.JAN.2020 13:05:05

802.11n HT20

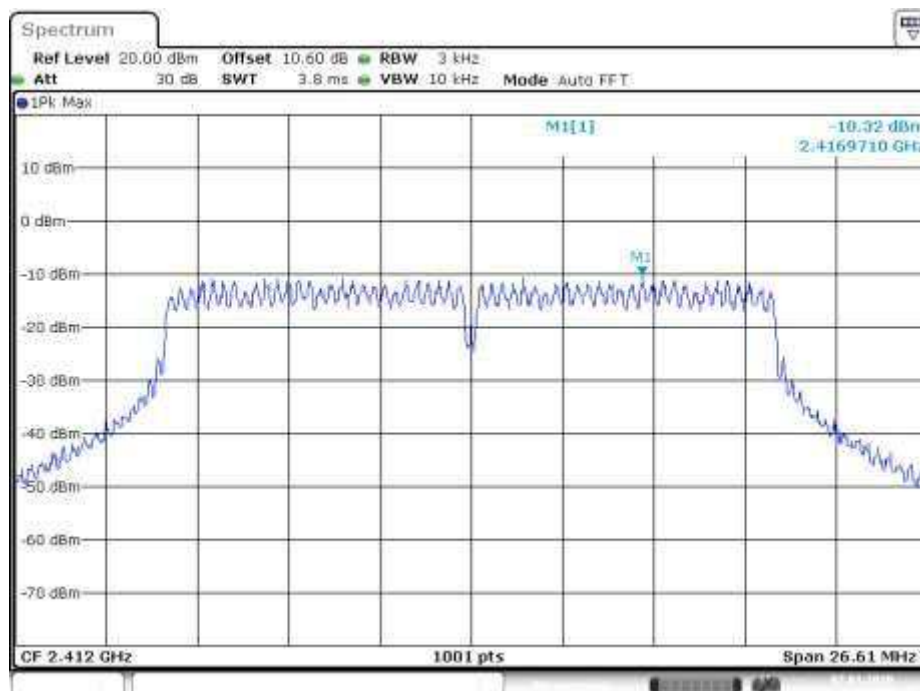
Low Channel

Ant 1

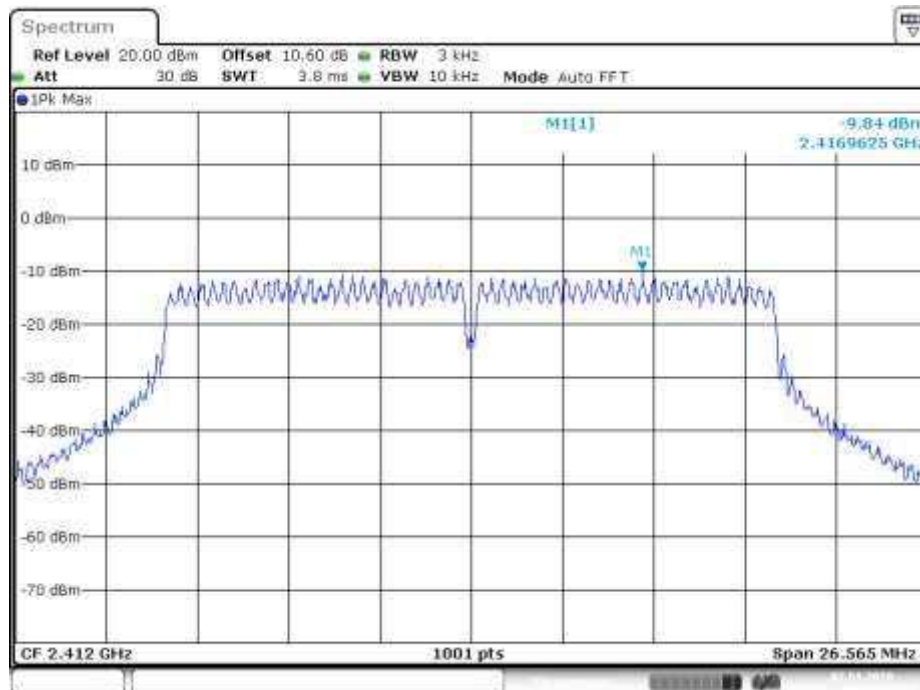


Date: 7.JAN.2020 12:30:43

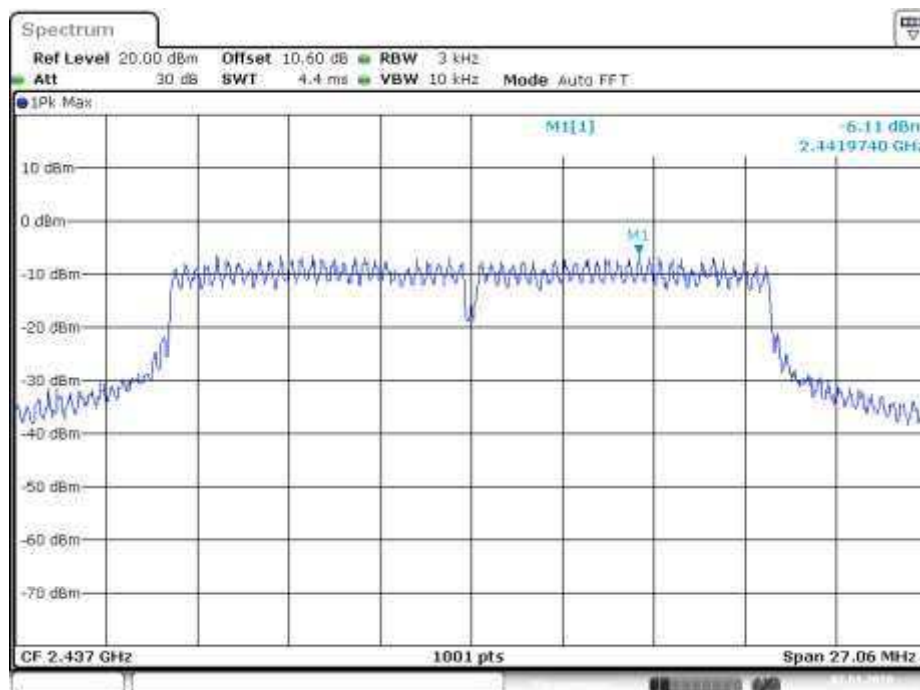
Ant 2



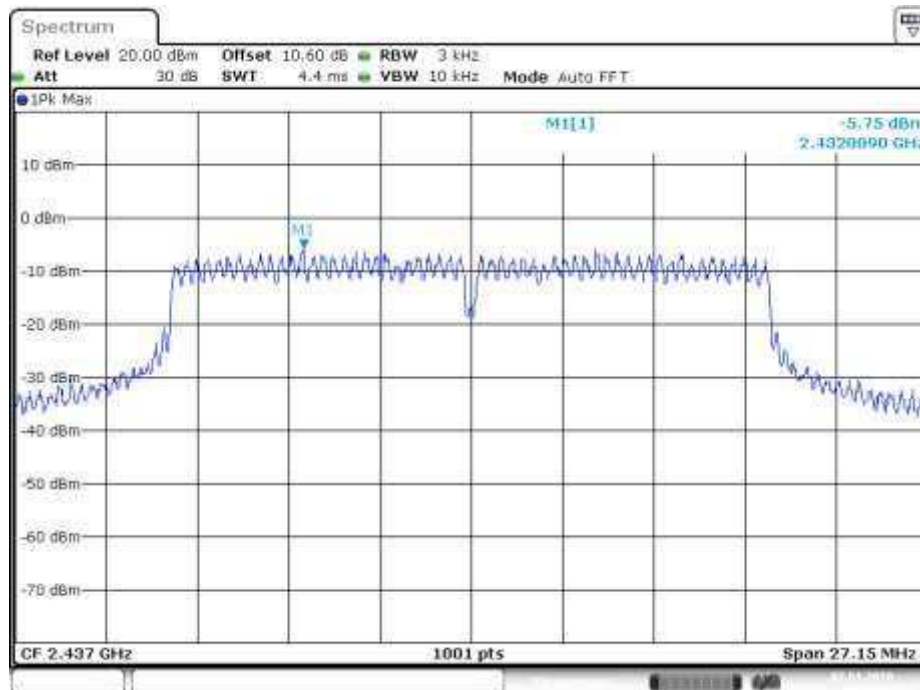
Date: 7.JAN.2020 12:49:00

Ant 3


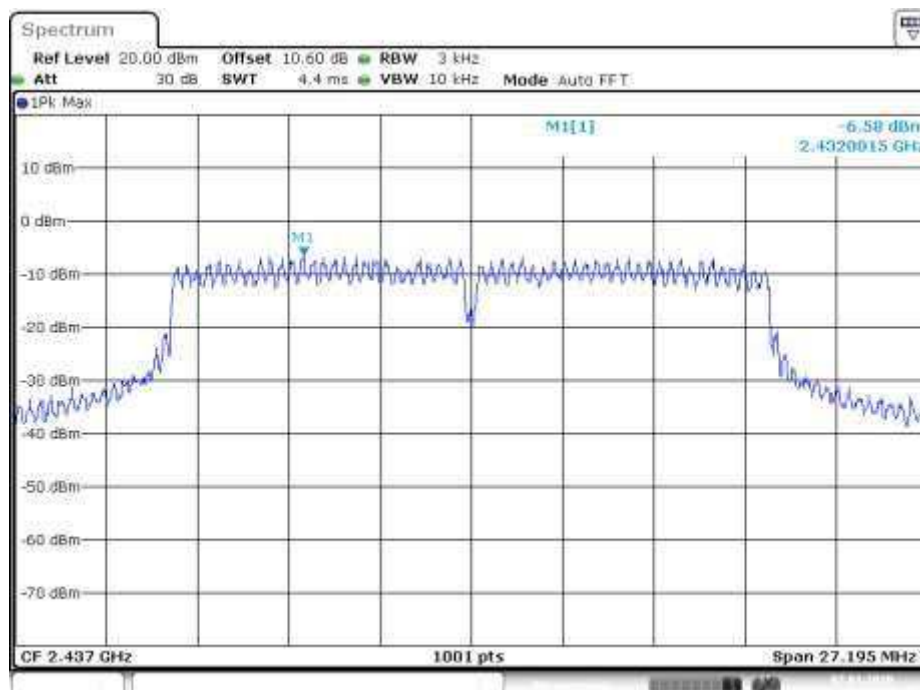
Date: 7.JAN.2020 13:07:54

Middle Channel
Ant 1


Date: 7.JAN.2020 12:32:34

Ant 2


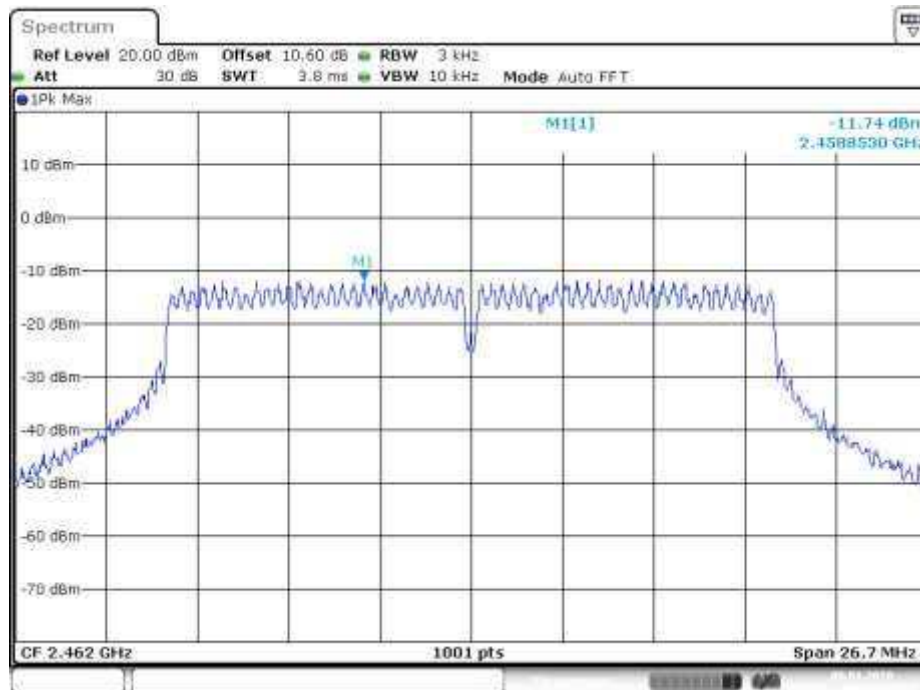
Date: 7.JAN.2020 12:51:11

Ant 3


Date: 7.JAN.2020 13:09:41

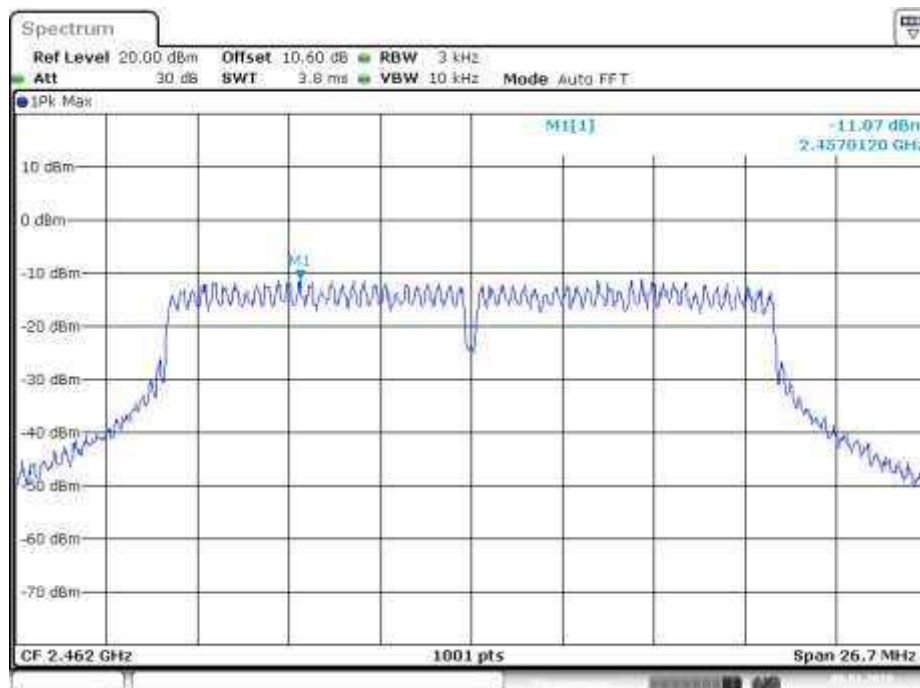
High Channel

Ant 1



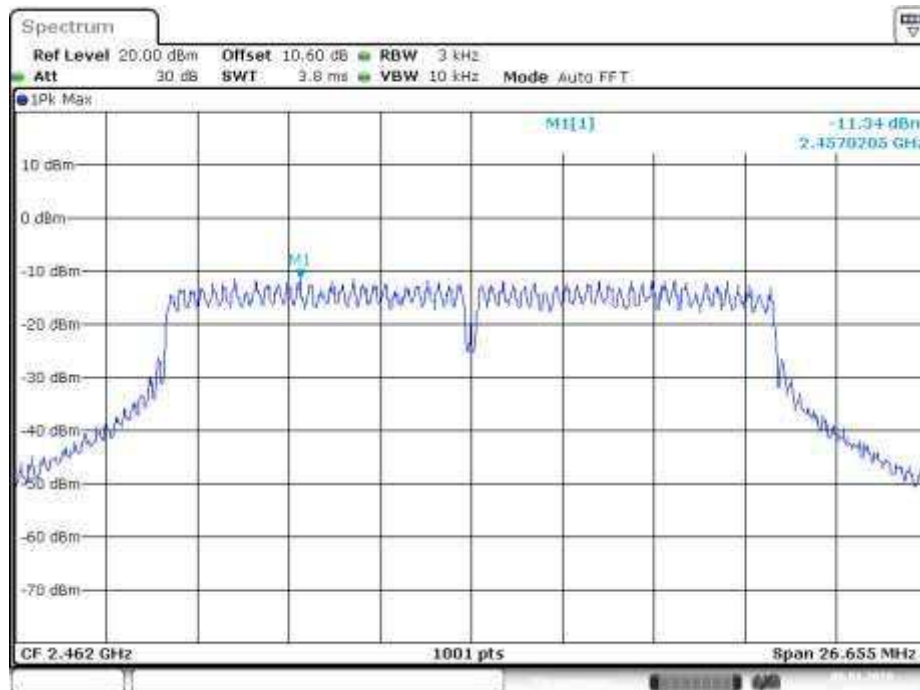
Date: 8.JAN.2020 10:24:24

Ant 2



Date: 8.JAN.2020 10:26:16

Ant 3

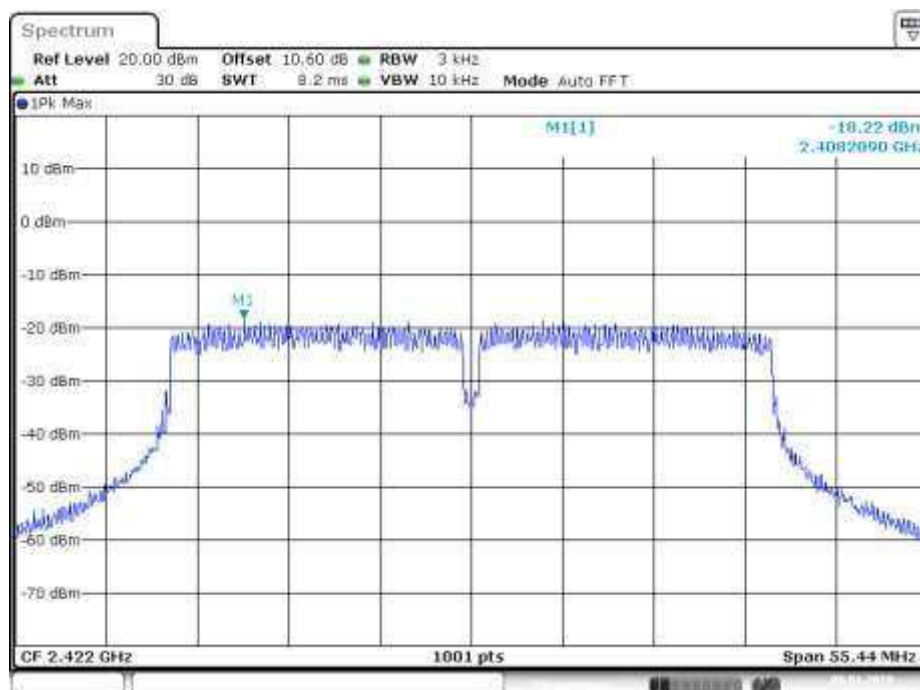


Date: 8.JAN.2020 10:27:55

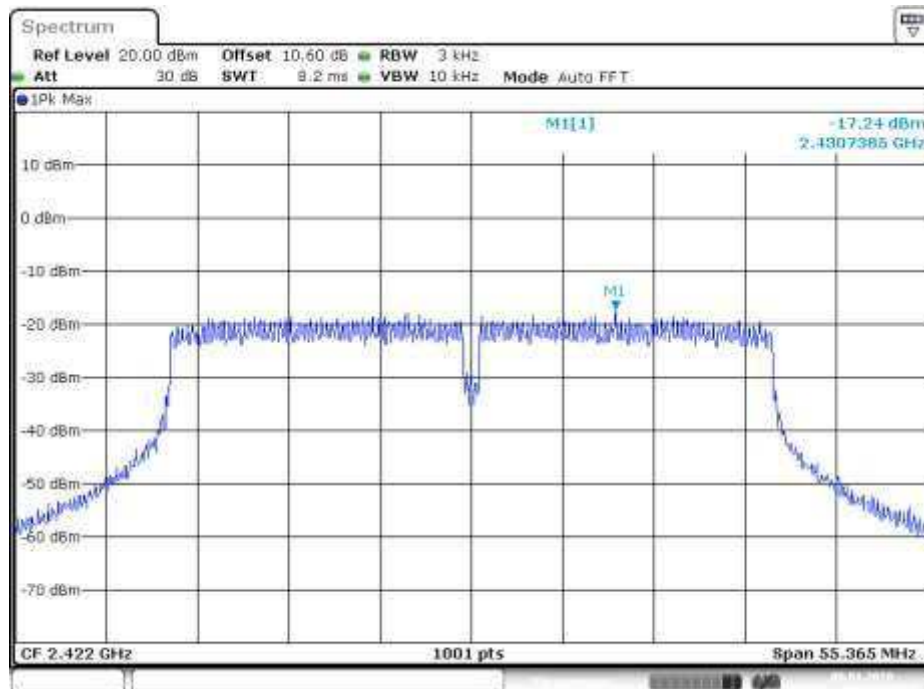
802.11n HT40

Low Channel

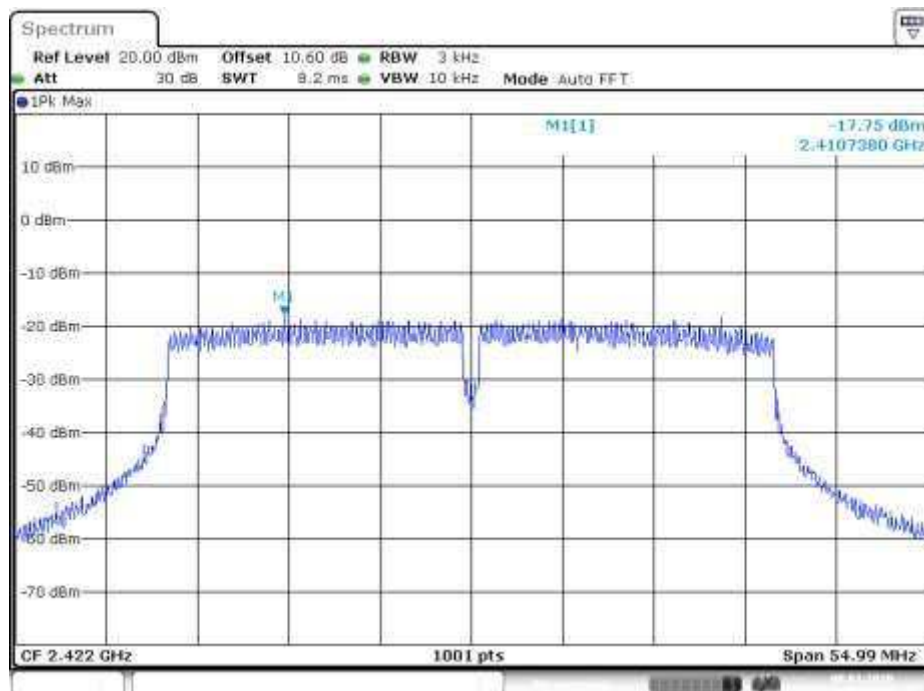
Ant 1



Date: 8.JAN.2020 10:56:52

Ant 2


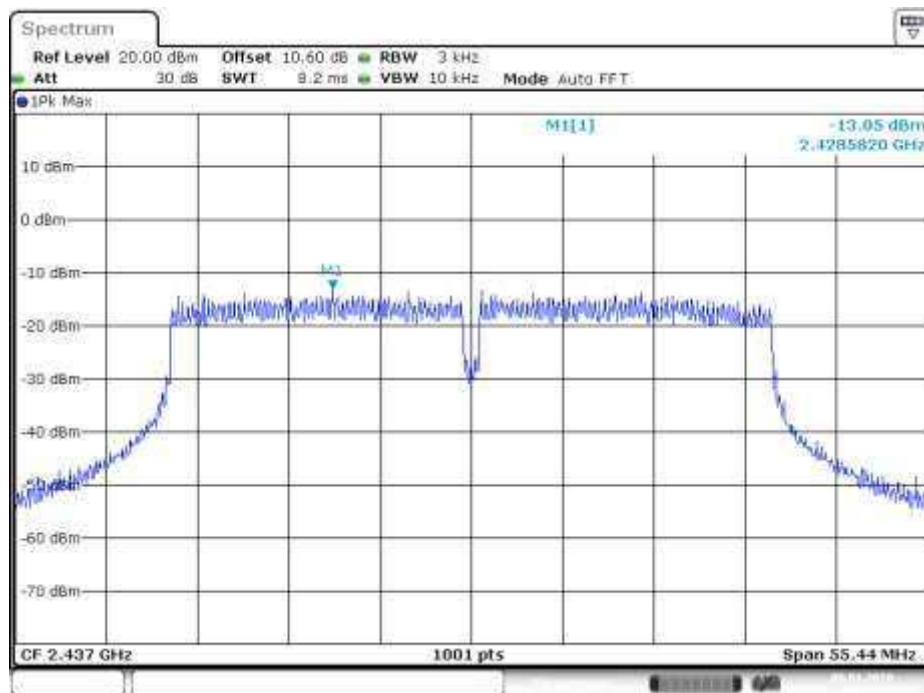
Date: 8.JAN.2020 11:07:17

Ant 3


Date: 8.JAN.2020 11:09:36

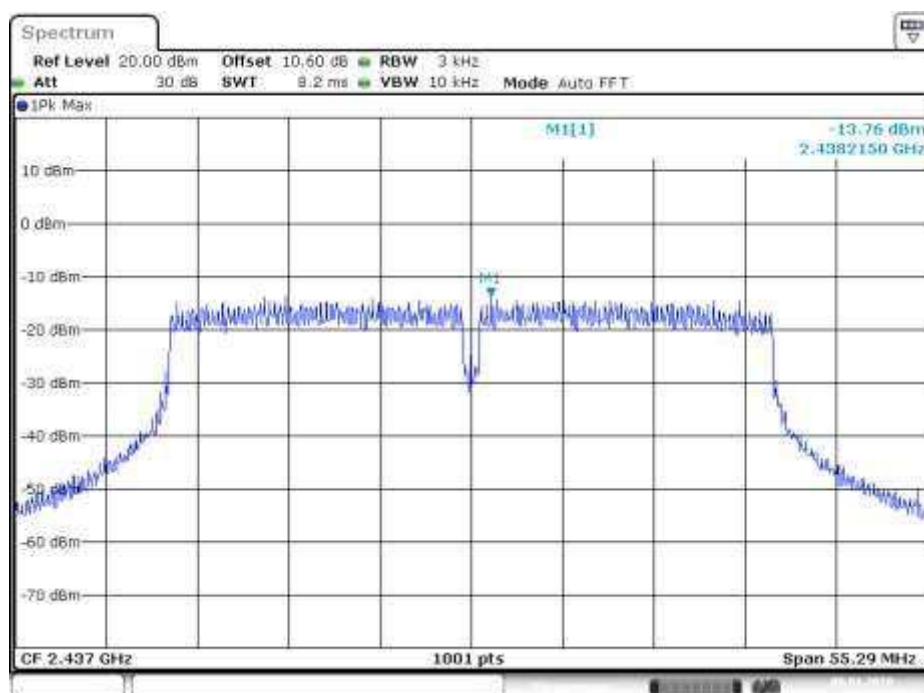
Middle Channel

Ant 1

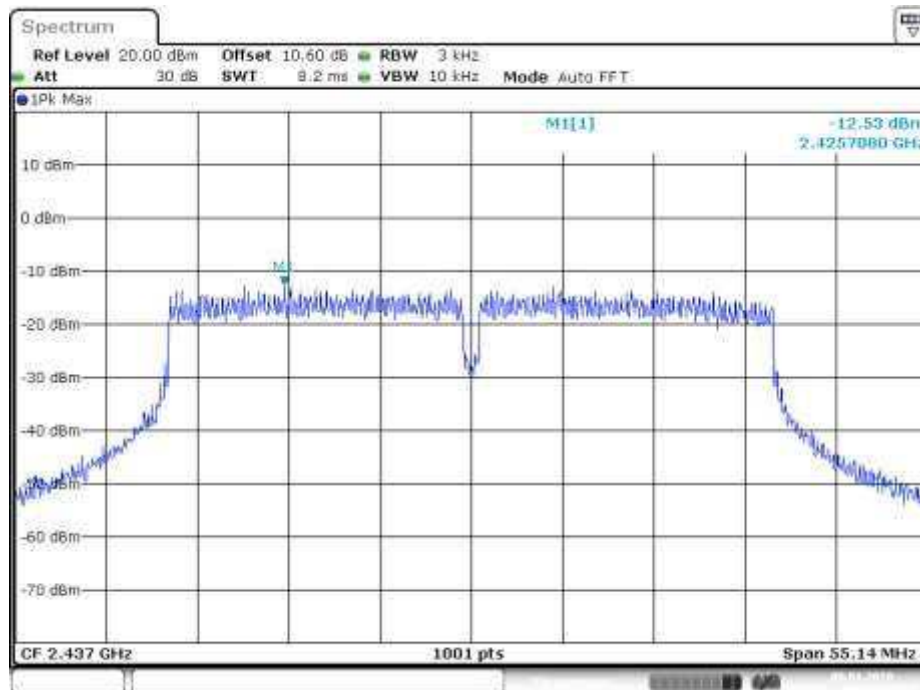


Date: 8.JAN.2020 10:58:34

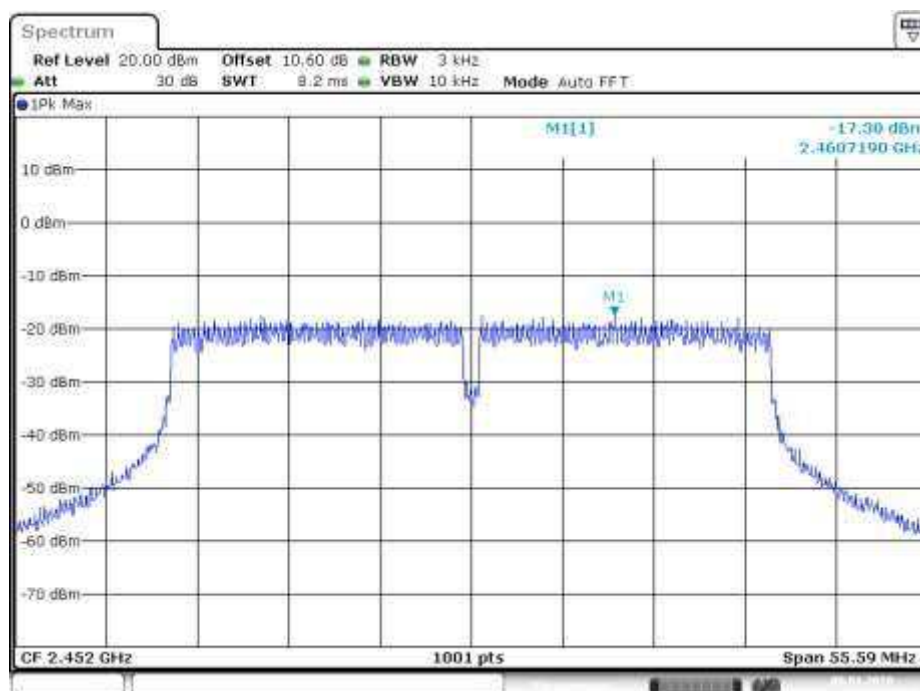
Ant 2



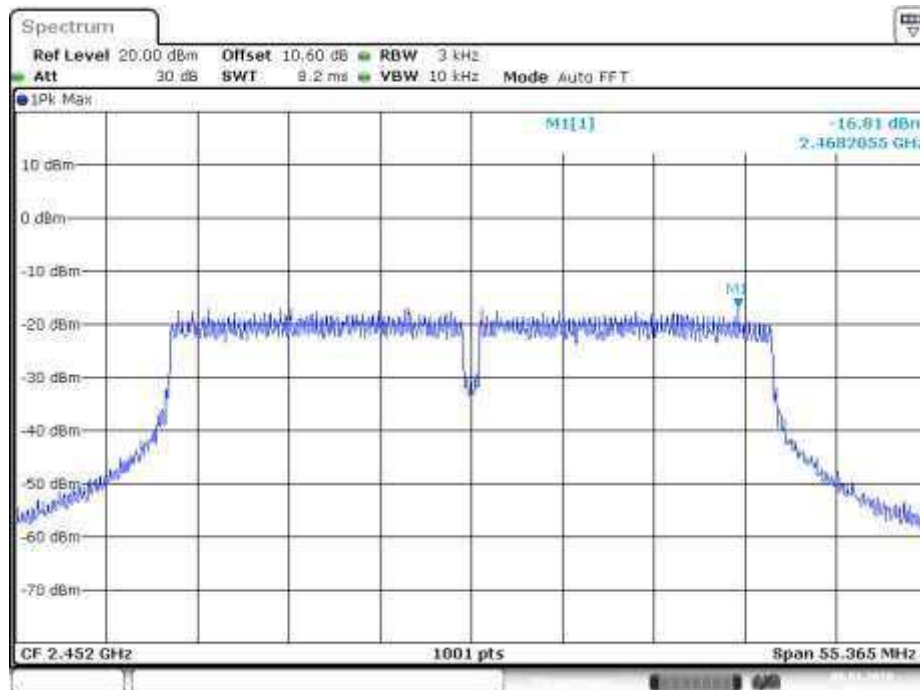
Date: 8.JAN.2020 11:04:51

Ant 3


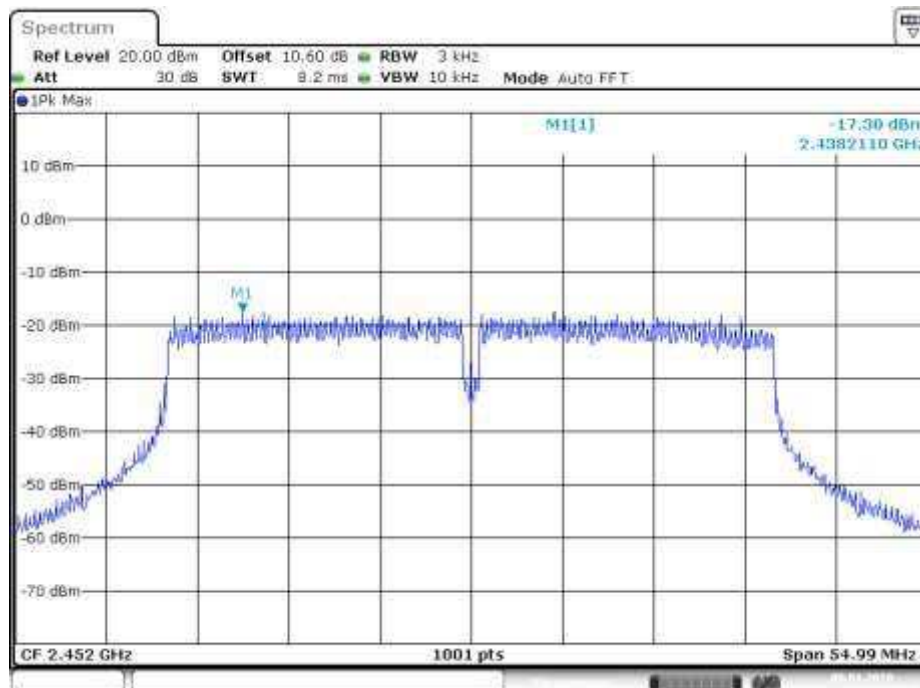
Date: 8.JAN.2020 11:11:09

High Channel
Ant 1


Date: 8.JAN.2020 10:59:51

Ant 2


Date: 8.JAN.2020 11:04:19

Ant 3


Date: 8.JAN.2020 11:12:26

5.1.5 Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth

RESULT:**Passed**

Test standard	:	FCC part 15.247(d)
Basic standard	:	ANSI C63.10:2013, KDB558074
Limit	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power)
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Low/ Middle/ High for Conducted Spurious Low/High for Frequency Band Edge
Operation mode	:	A
Ambient temperature	:	22-26°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

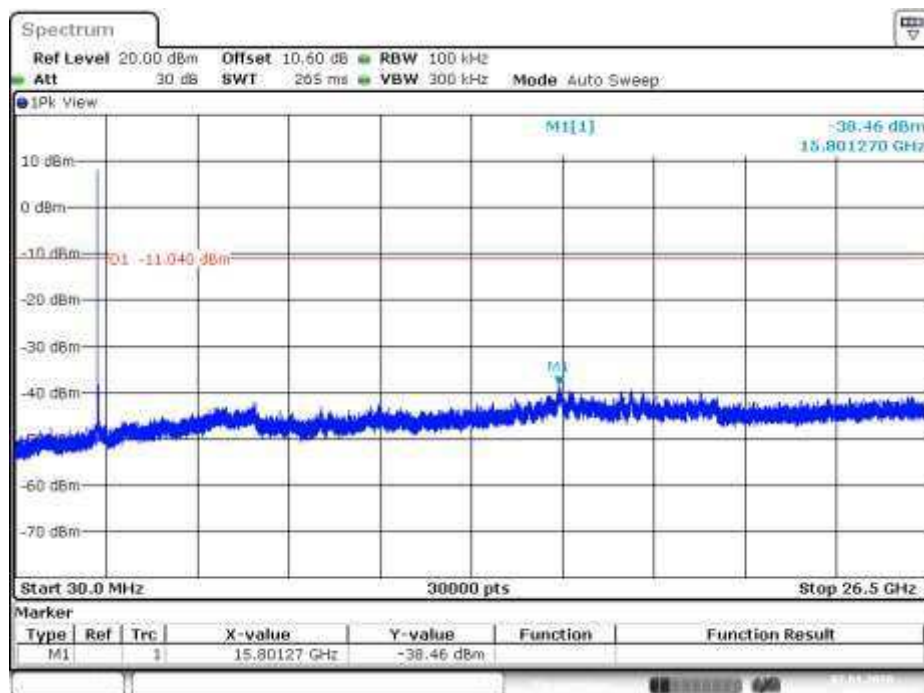
All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.

Due to the small size of the product and that there are no inductive components of significant size connected to the antenna port, 9kHz to 30MHz frequency range is not tested based on technical judgment.

Test Plot 100kHz Conducted Emissions 802.11b

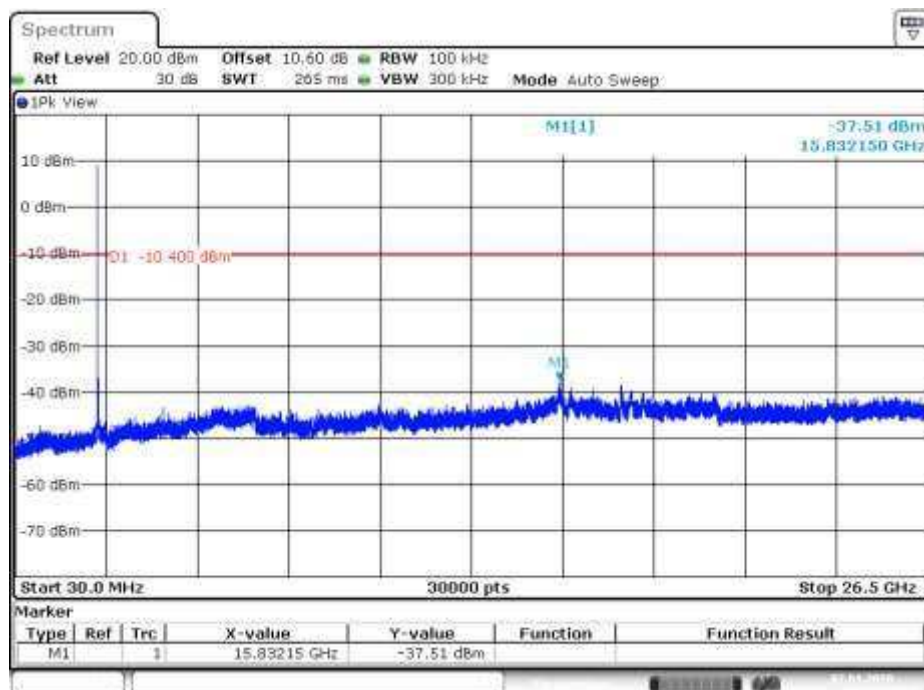
Low Channel

Ant 1

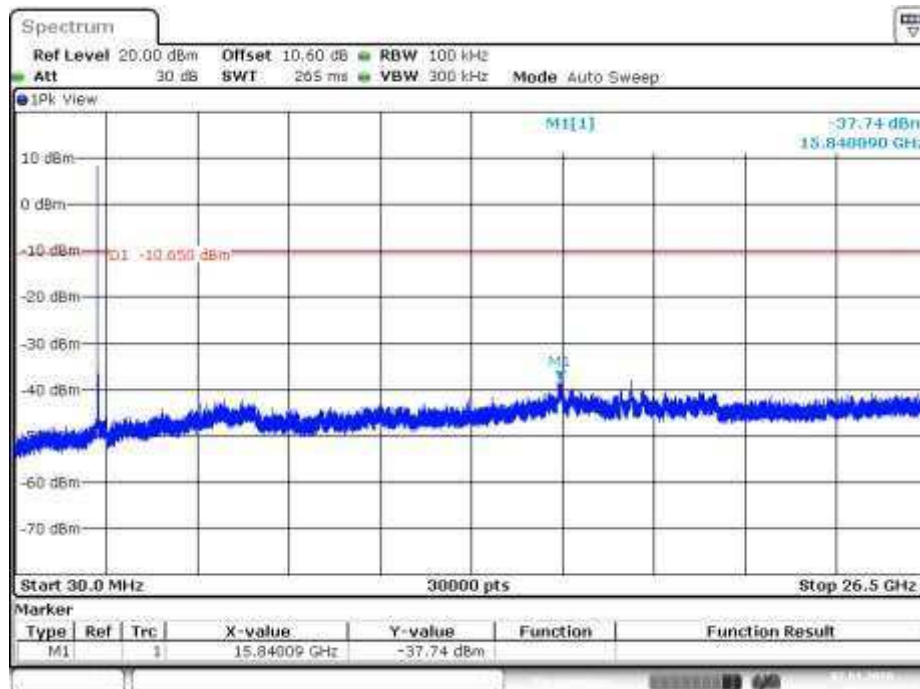


Date: 7.JAN.2020 12:16:15

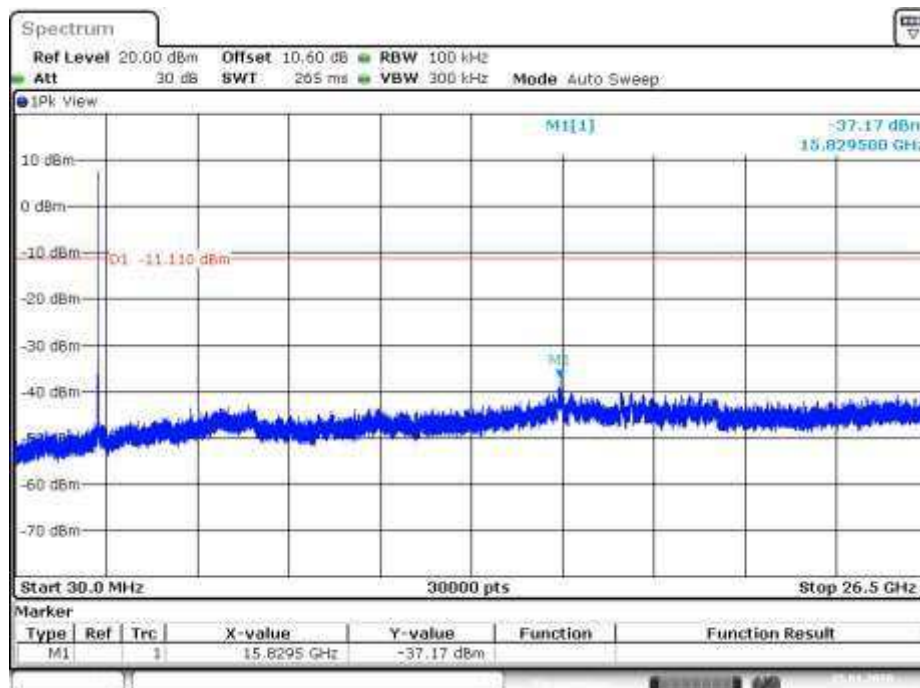
Ant 2



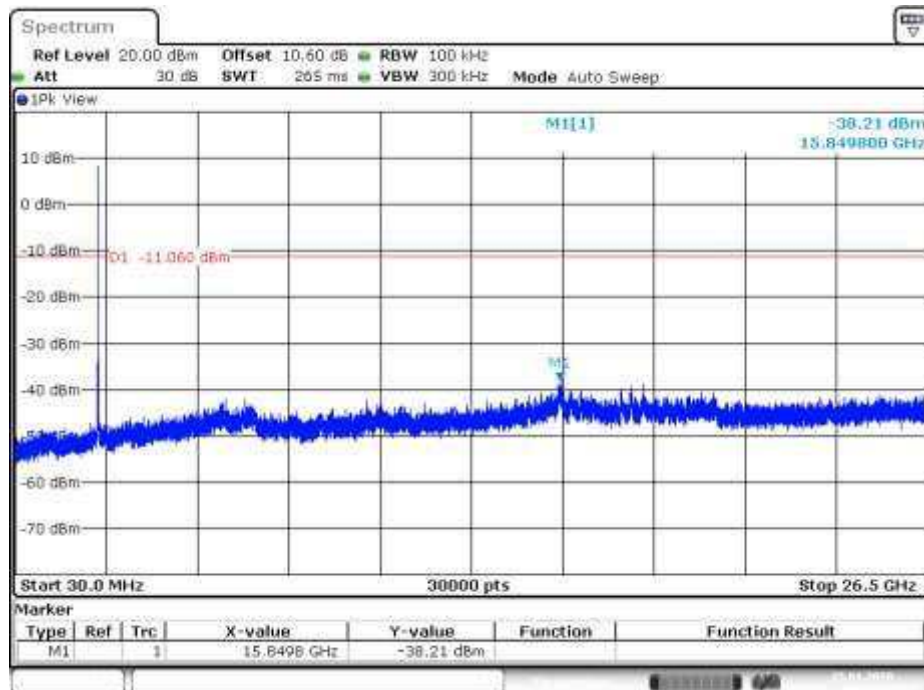
Date: 7.JAN.2020 12:37:01

Ant 3


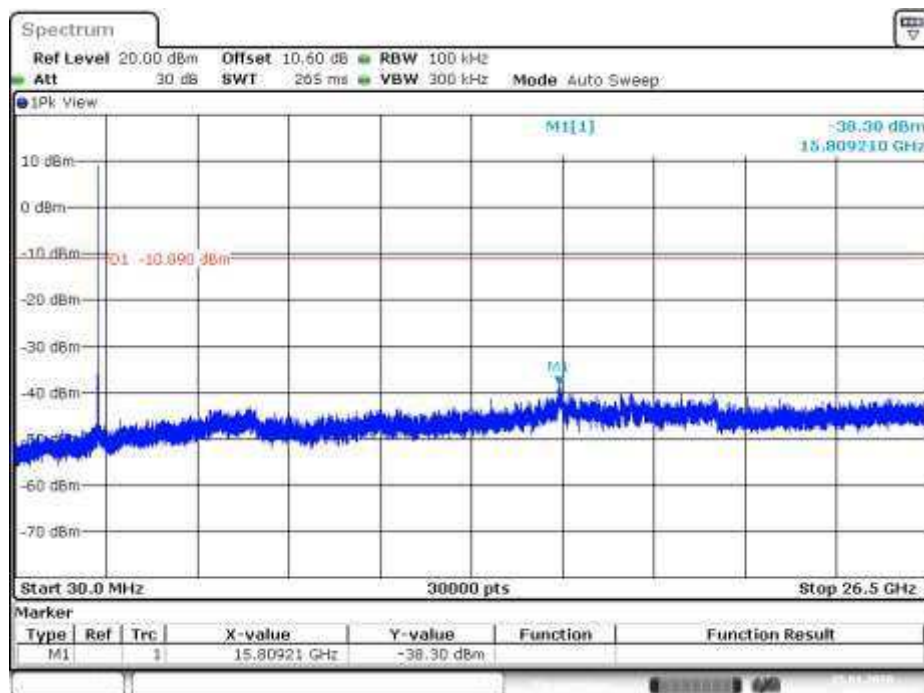
Date: 7.JAN.2020 12:55:56

Middle Channel
Ant 1


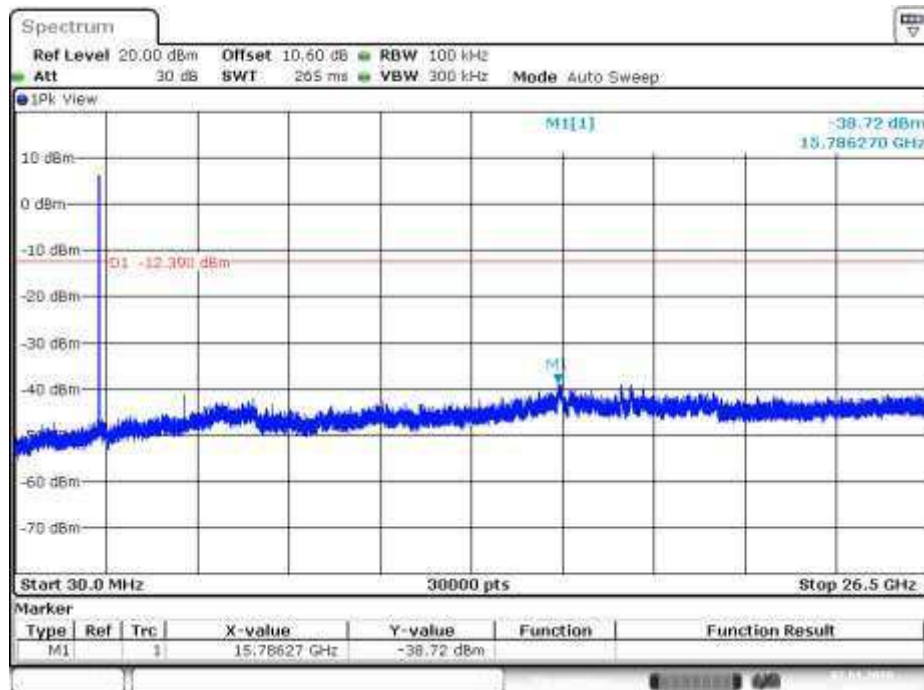
Date: 15.JAN.2020 18:04:17

Ant 2


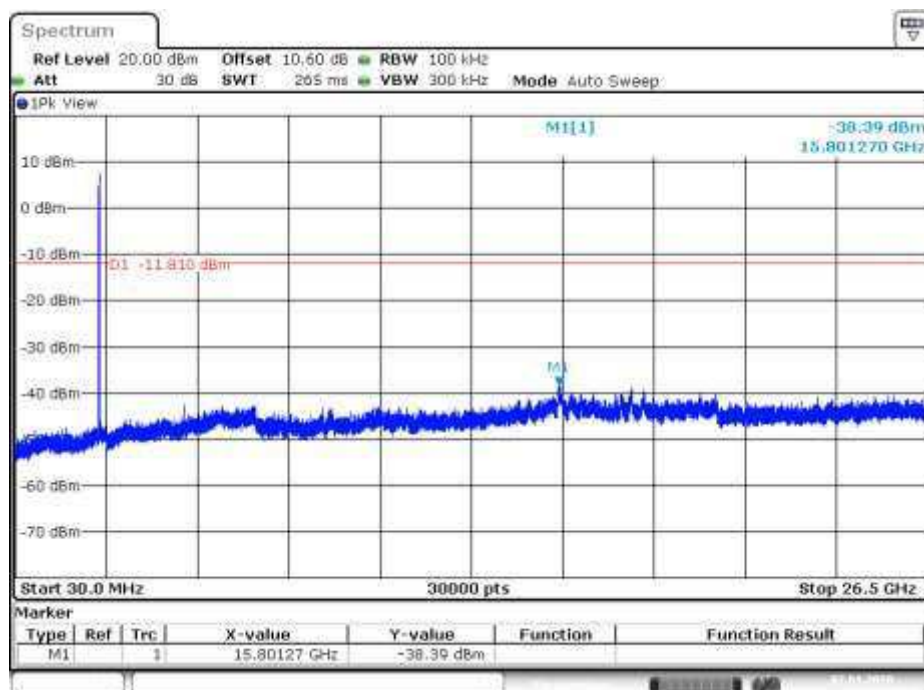
Date: 15.JAN.2020 18:13:08

Ant 3


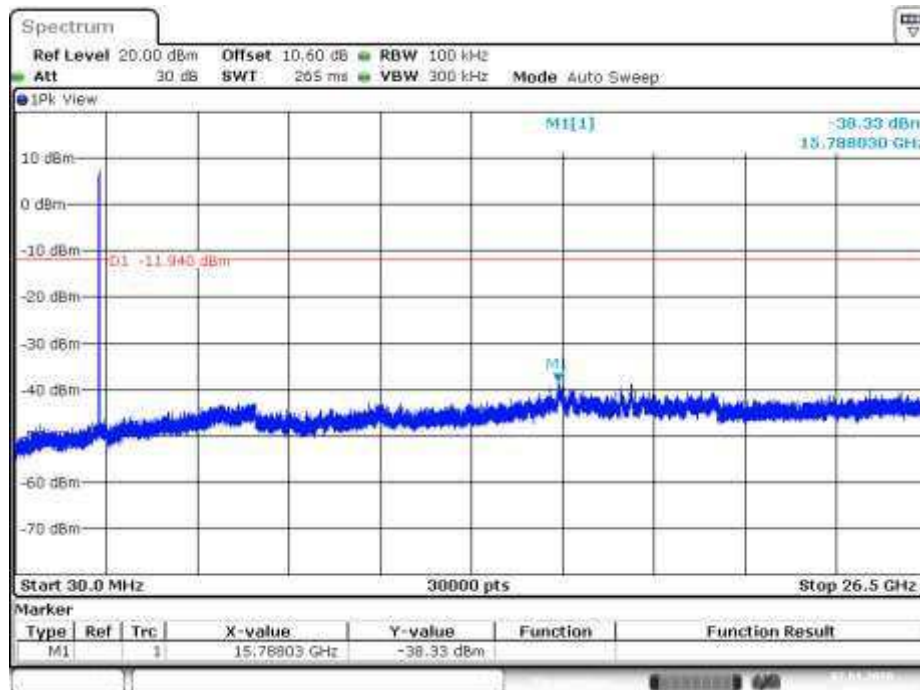
Date: 15.JAN.2020 18:10:41

High Channel
Ant 1


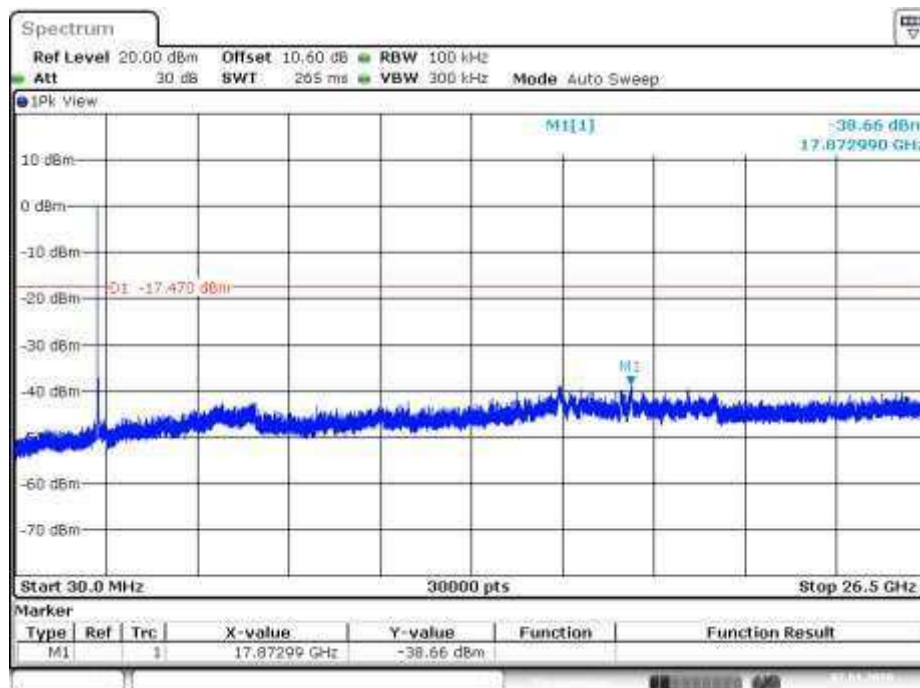
Date: 7.JAN.2020 12:21:29

Ant 2


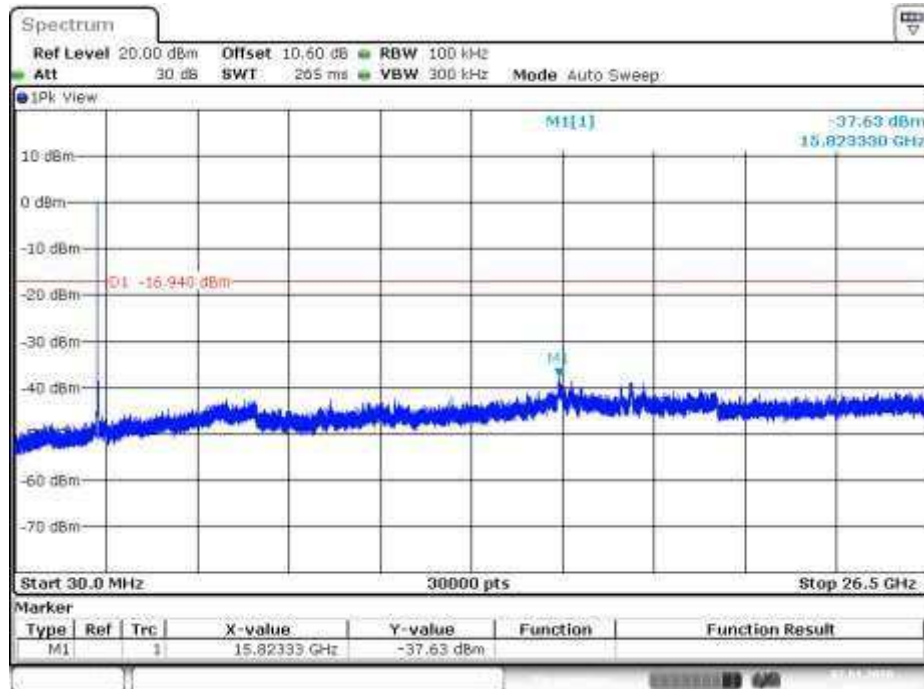
Date: 7.JAN.2020 12:40:39

Ant 3


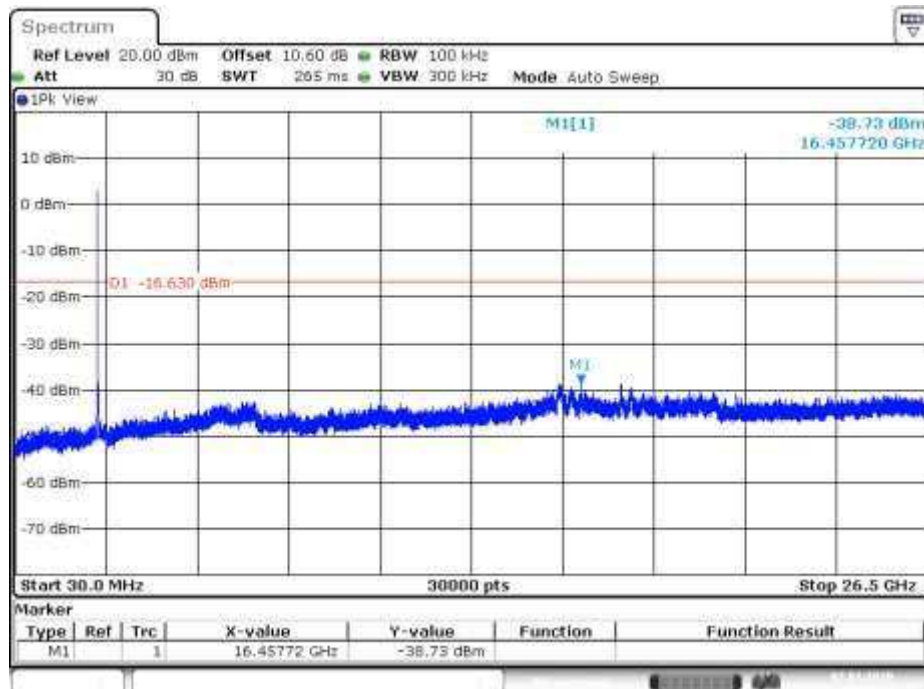
Date: 7.JAN.2020 12:59:51

802.11g
Low Channel
Ant 1


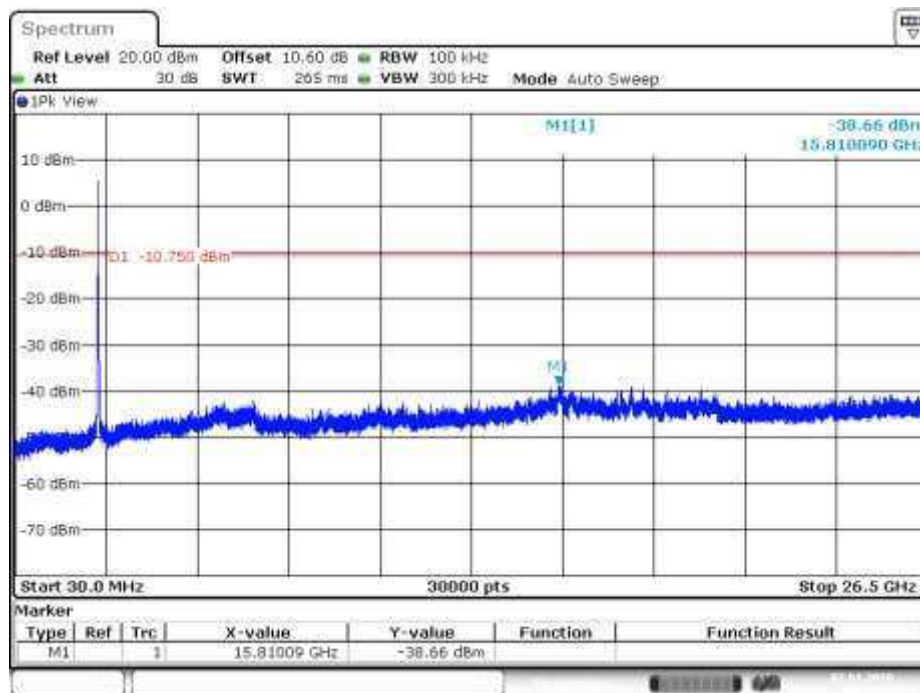
Date: 7.JAN.2020 12:24:52

Ant 2


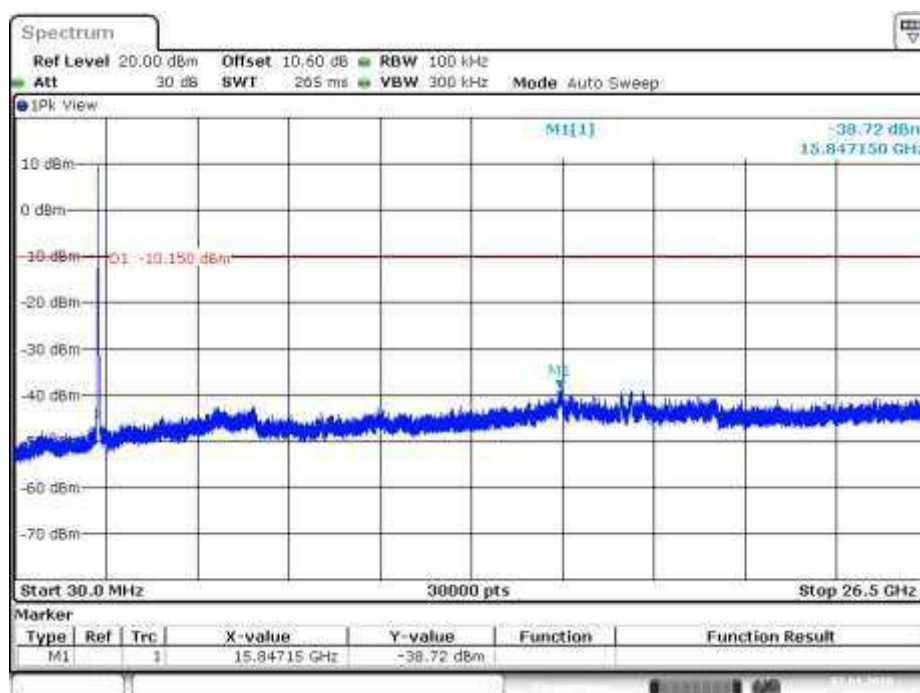
Date: 7.JAN.2020 12:43:46

Ant 3


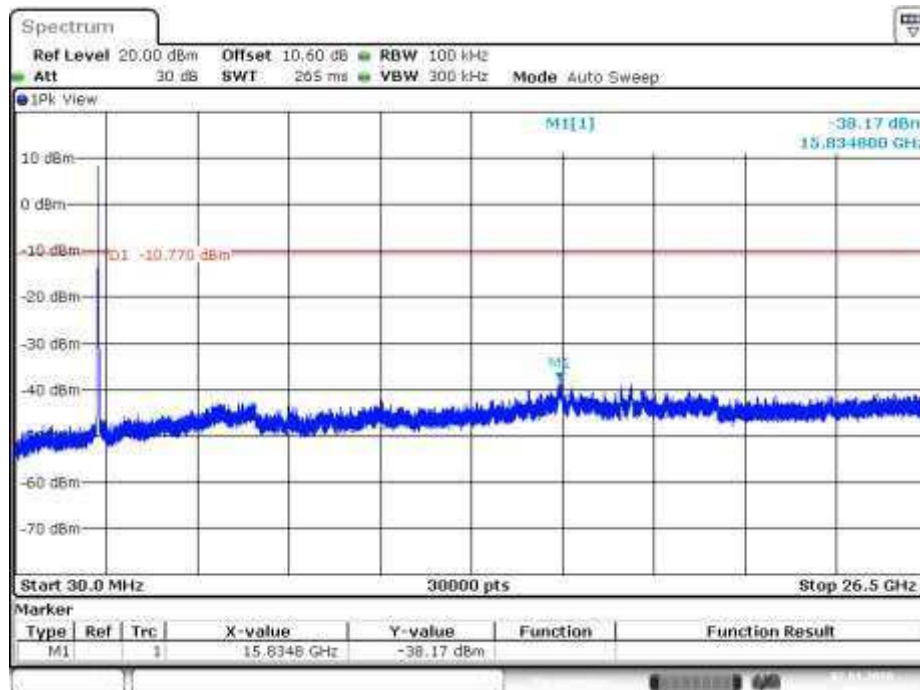
Date: 7.JAN.2020 13:02:42

Middle Channel
Ant 1


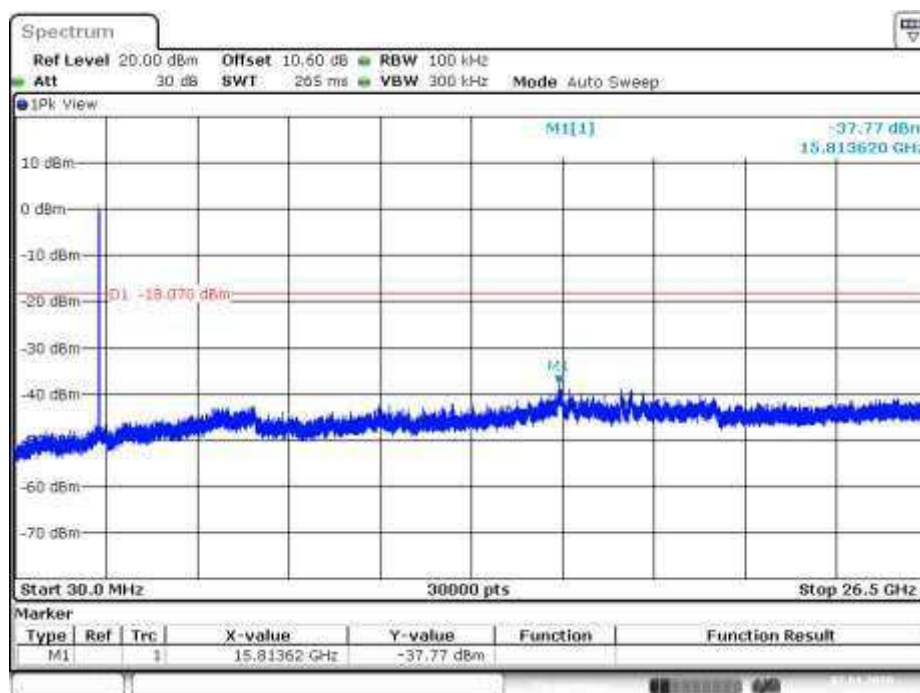
Date: 7.JAN.2020 12:26:56

Ant 2


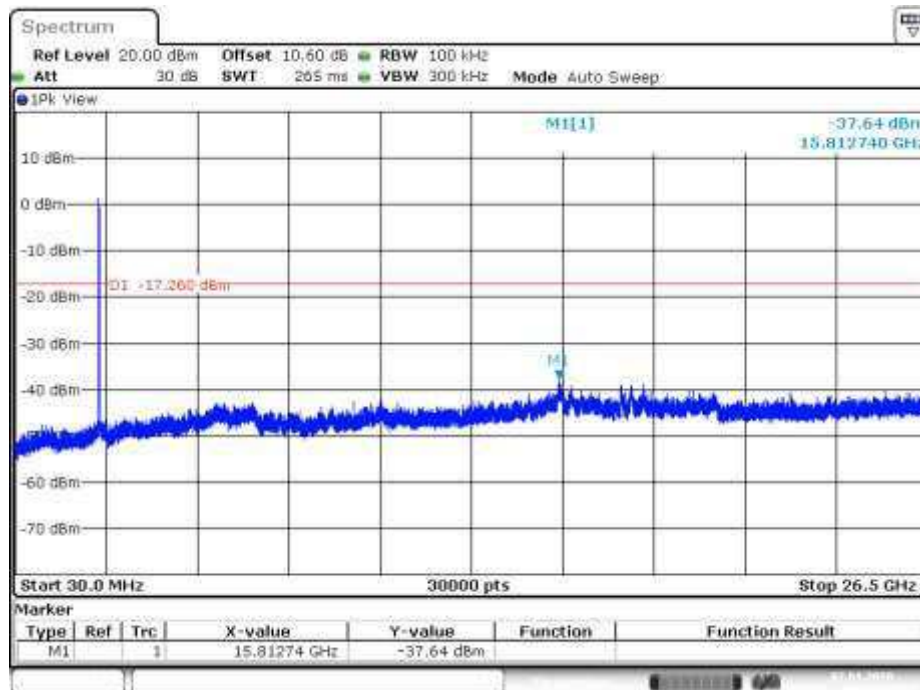
Date: 7.JAN.2020 12:45:03

Ant 3


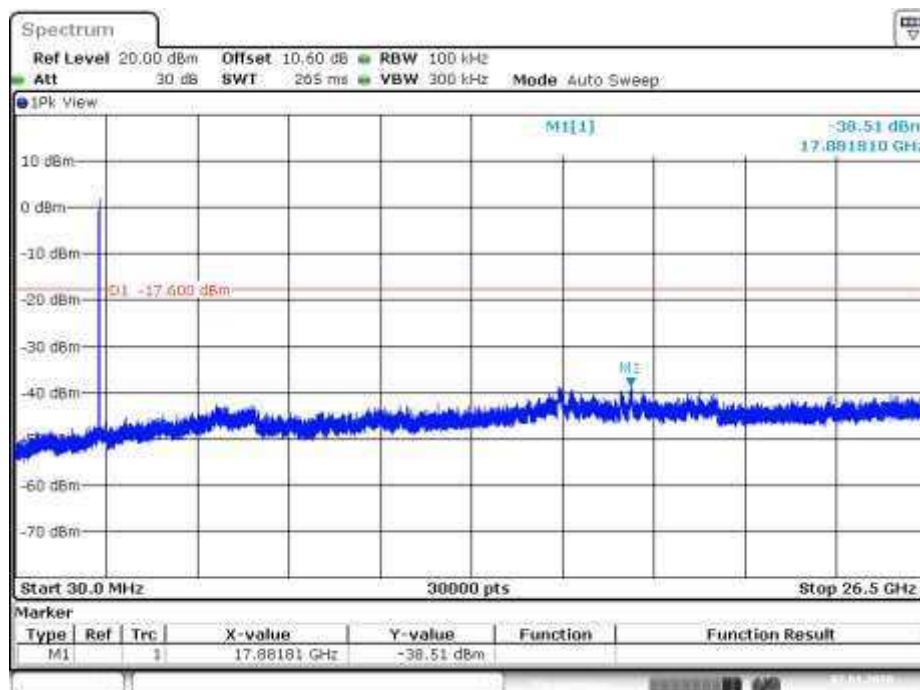
Date: 7.JAN.2020 13:04:14

High Channel
Ant 1


Date: 7.JAN.2020 12:29:03

Ant 2


Date: 7.JAN.2020 12:47:12

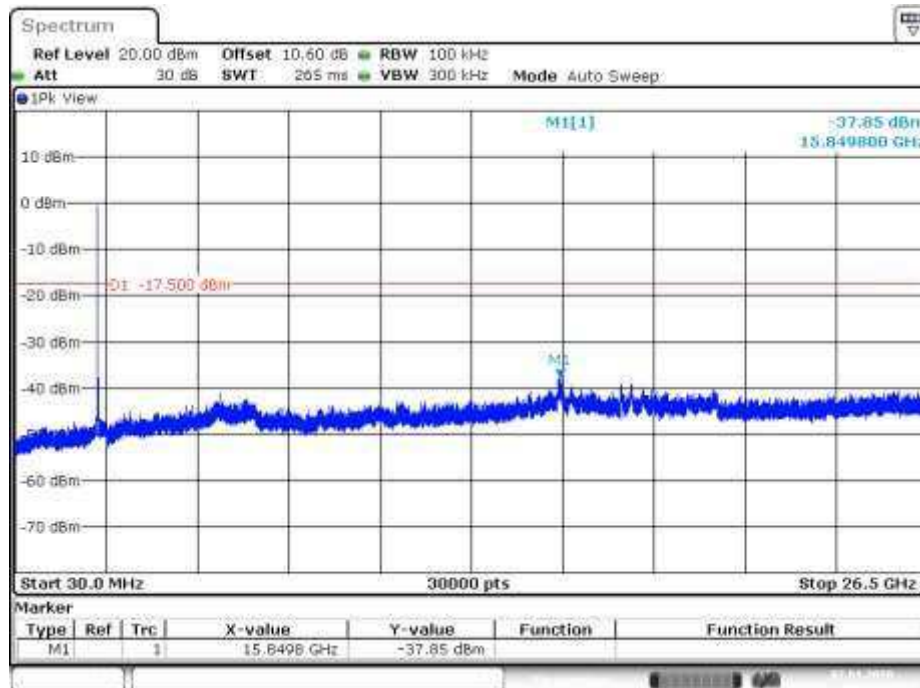
Ant 3


Date: 7.JAN.2020 13:06:13

802.11n HT20

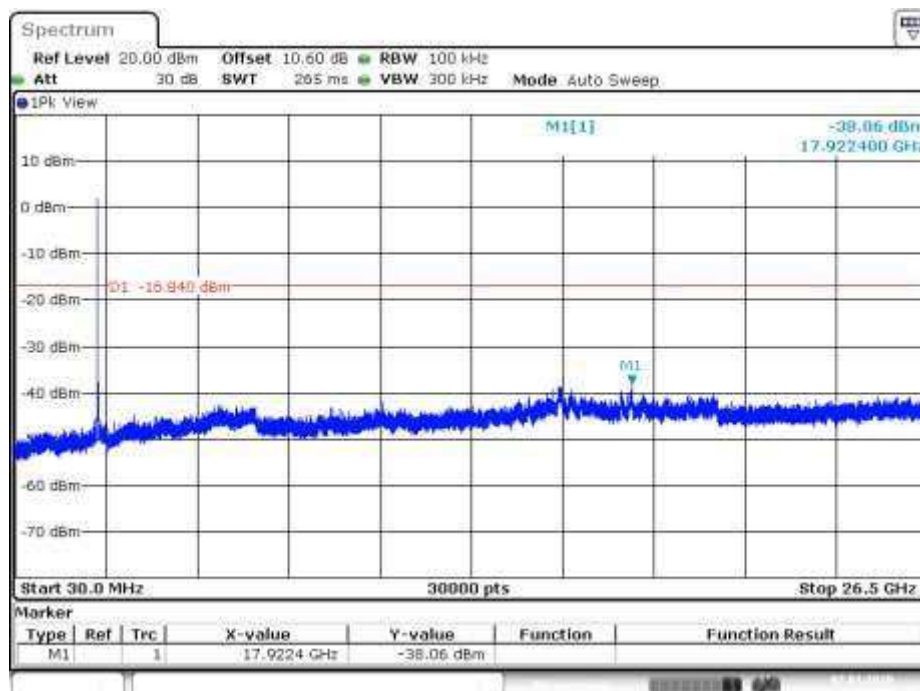
Low Channel

Ant 1

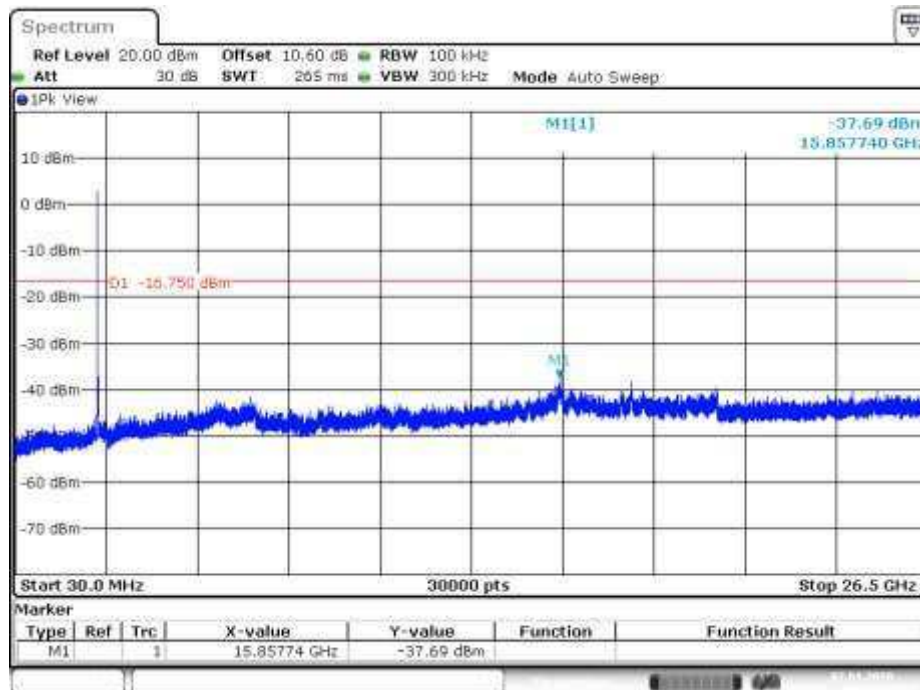


Date: 7.JAN.2020 12:31:45

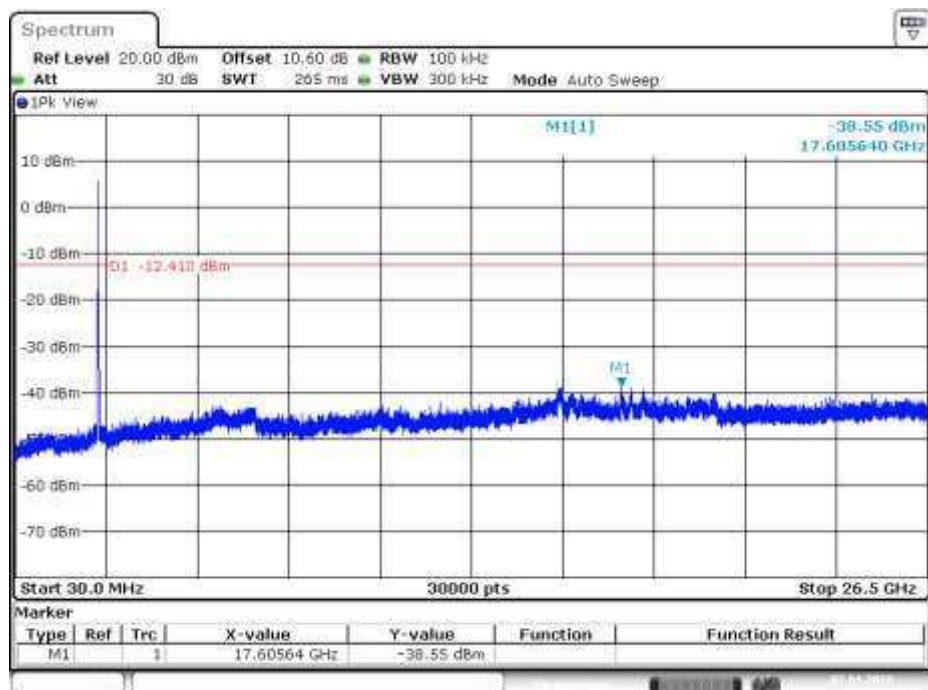
Ant 2



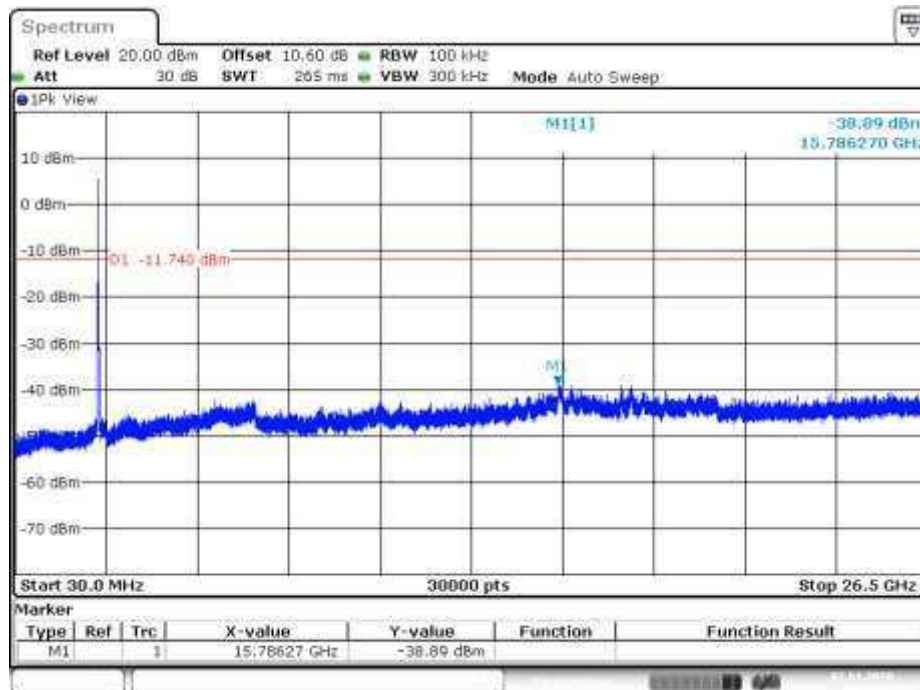
Date: 7.JAN.2020 12:50:07

Ant 3


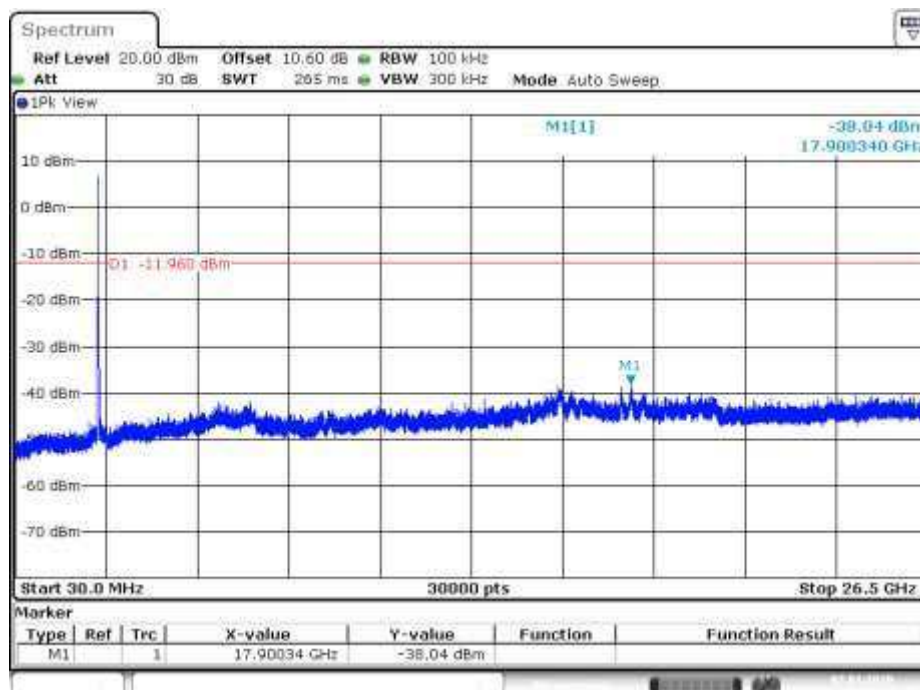
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Middle Channel
Ant 1


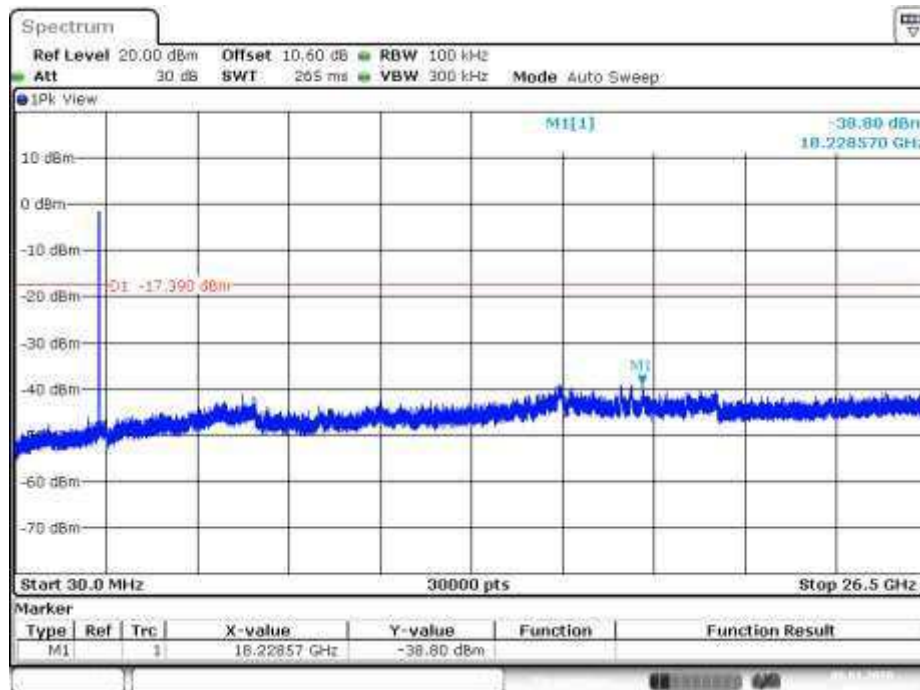
Date: 7.JAN.2020 12:33:15

Ant 2


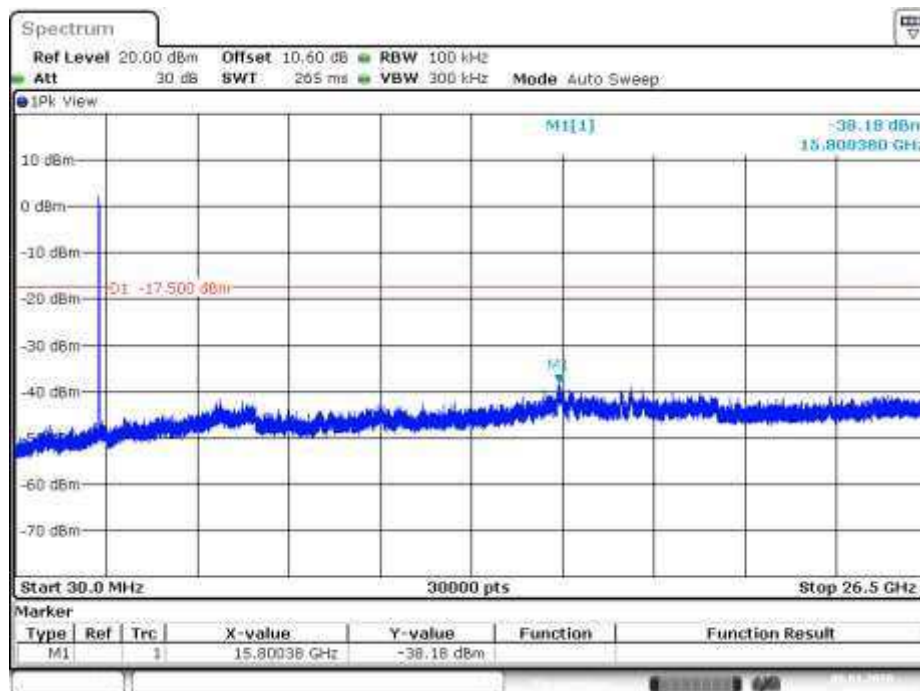
Date: 7.JAN.2020 12:51:52

Ant 3


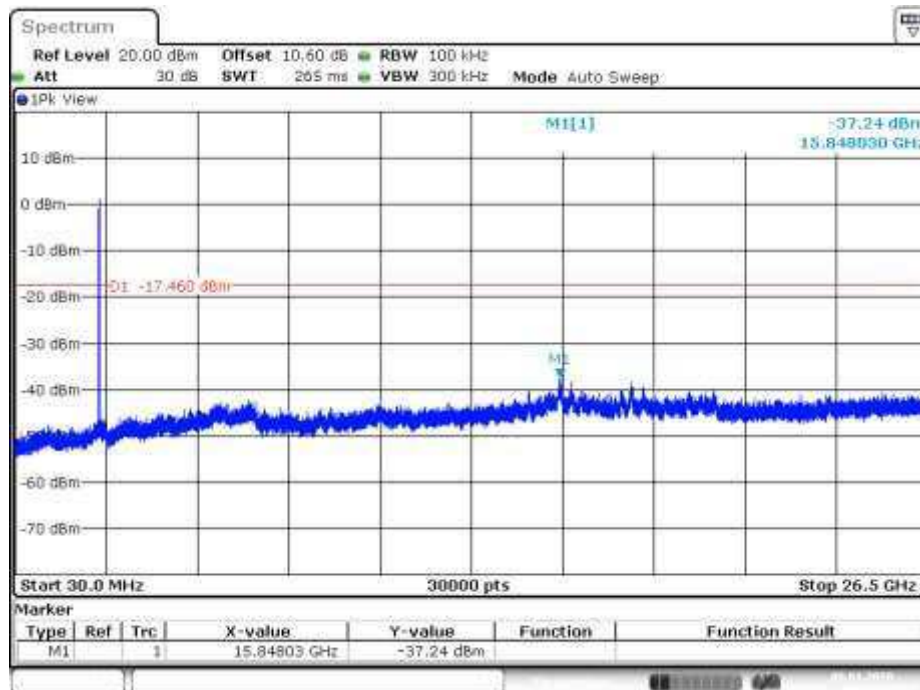
Date: 7.JAN.2020 13:10:21

High Channel
Ant 1


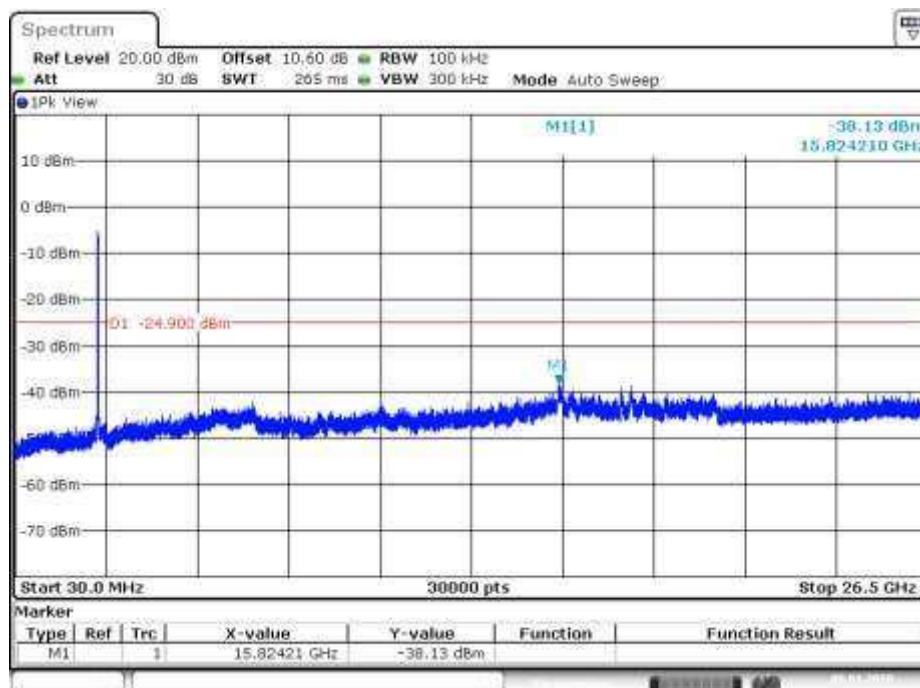
Date: 8.JAN.2020 10:25:28

Ant 2


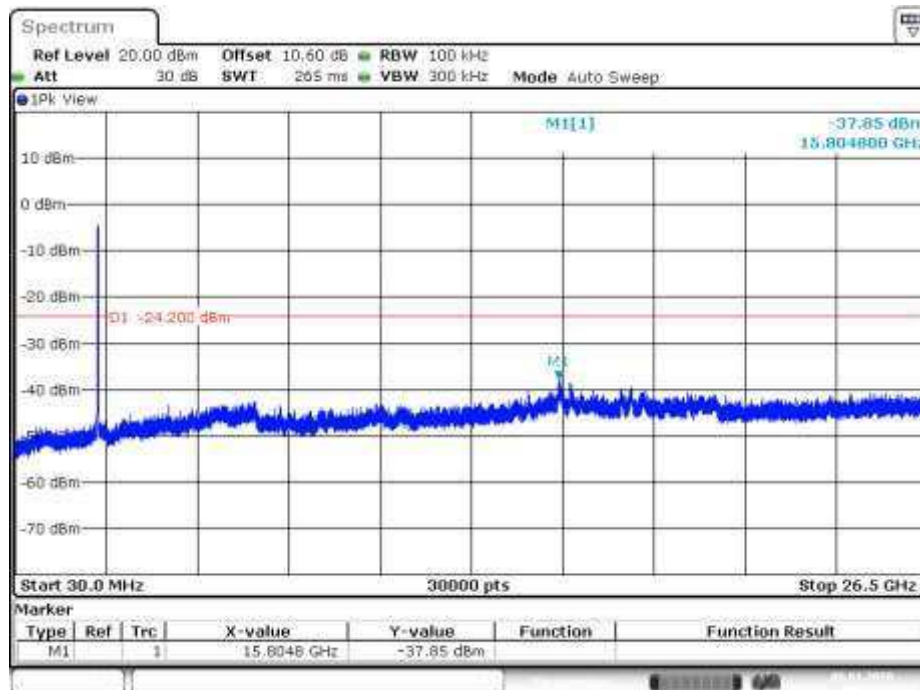
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Ant 3


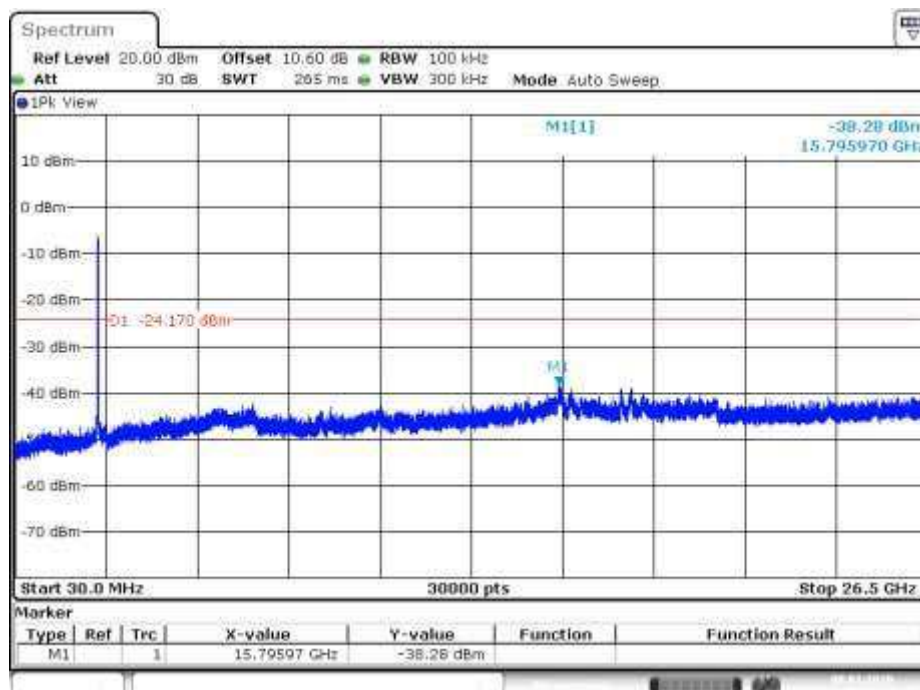
Date: 8.JAN.2020 10:28:54

802.11n HT40
Low Channel
Ant 1


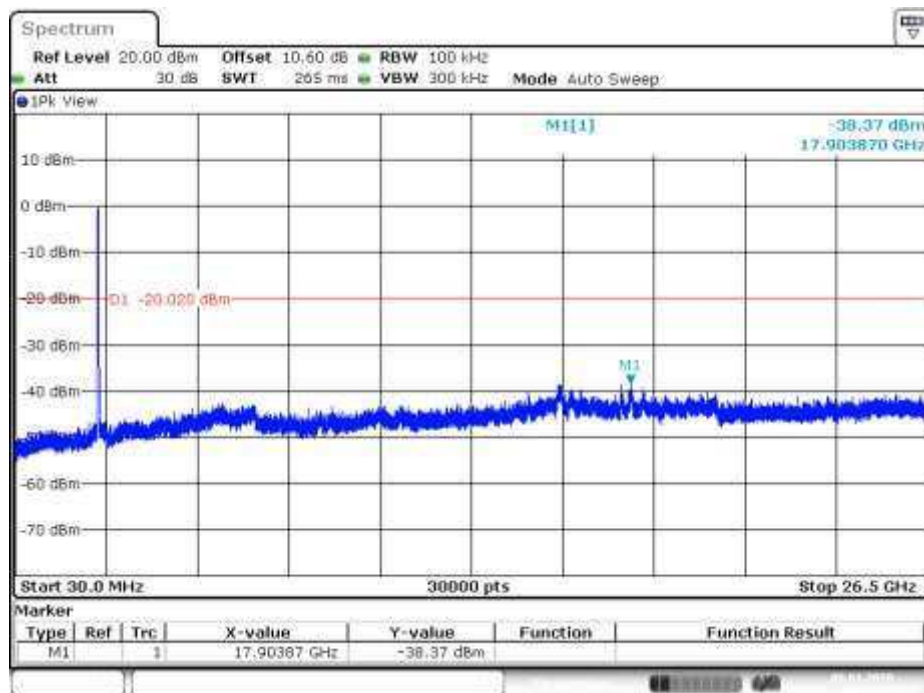
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Ant 2


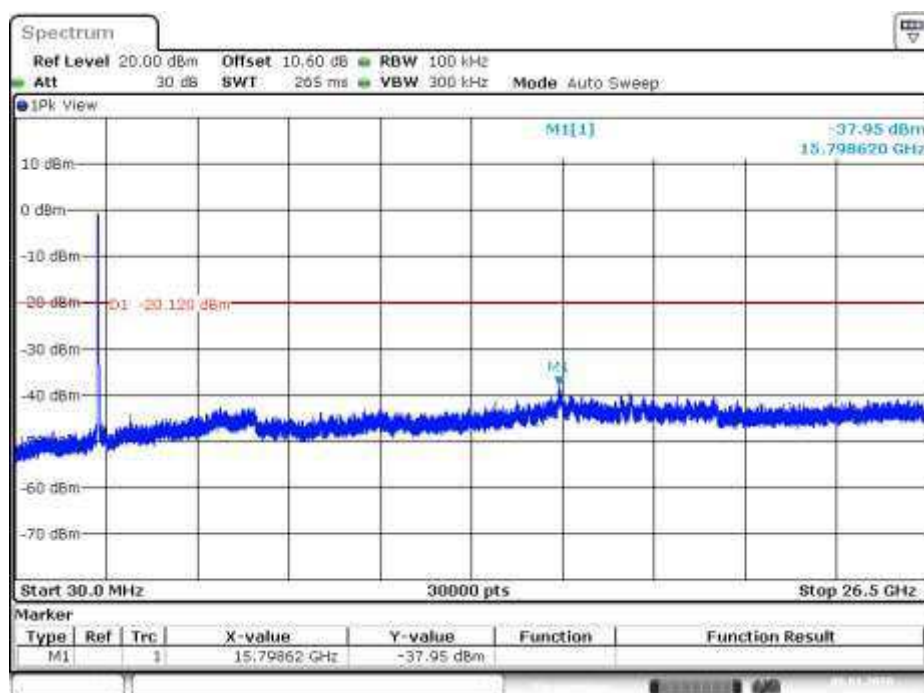
Date: 8.JAN.2020 11:08:17

Ant 3


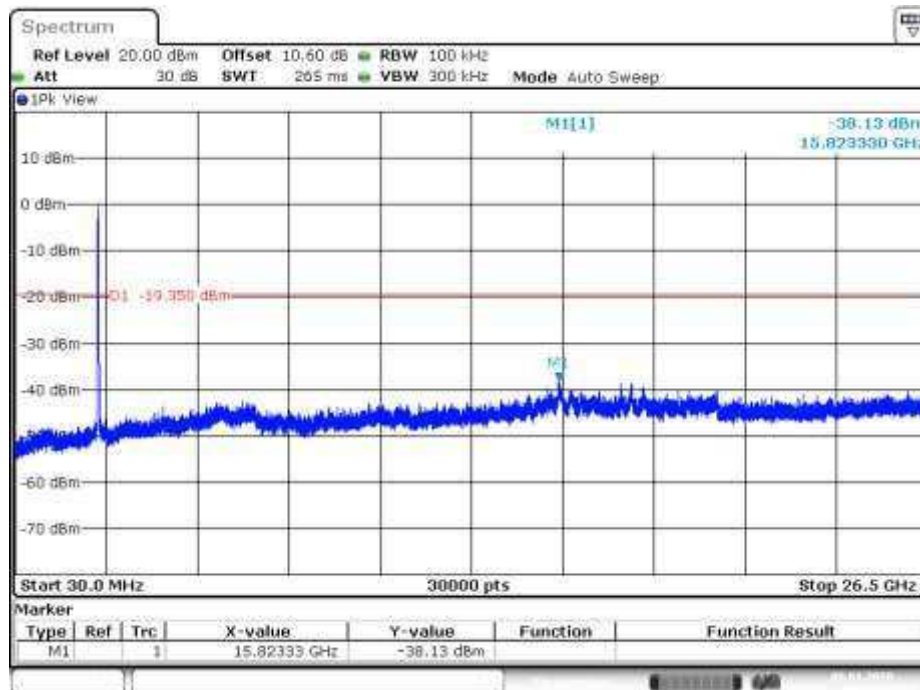
Date: 8.JAN.2020 11:10:35

Middle Channel
Ant 1


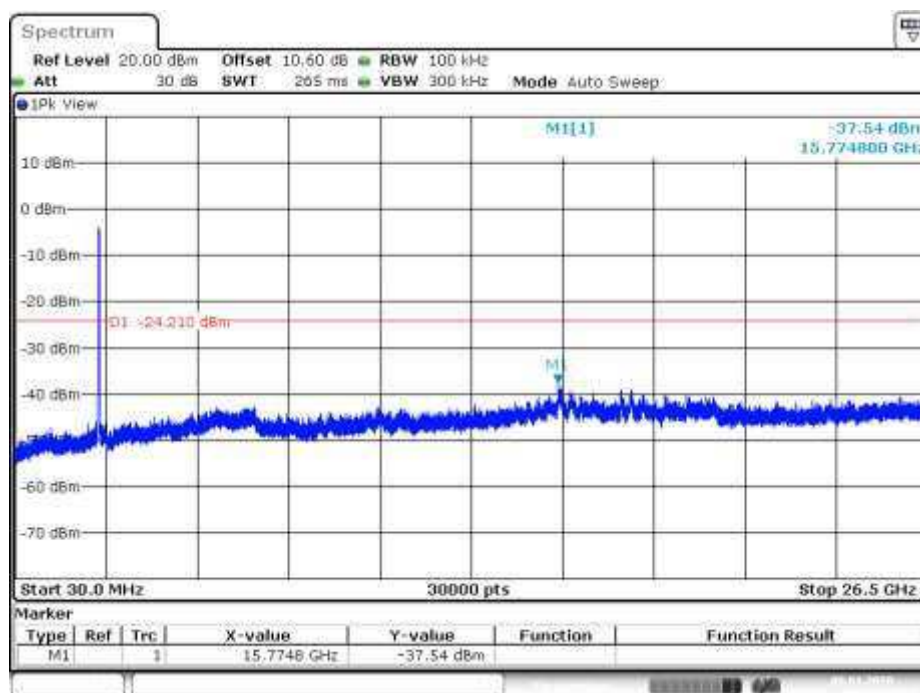
Date: 8.JAN.2020 10:59:15

Ant 2


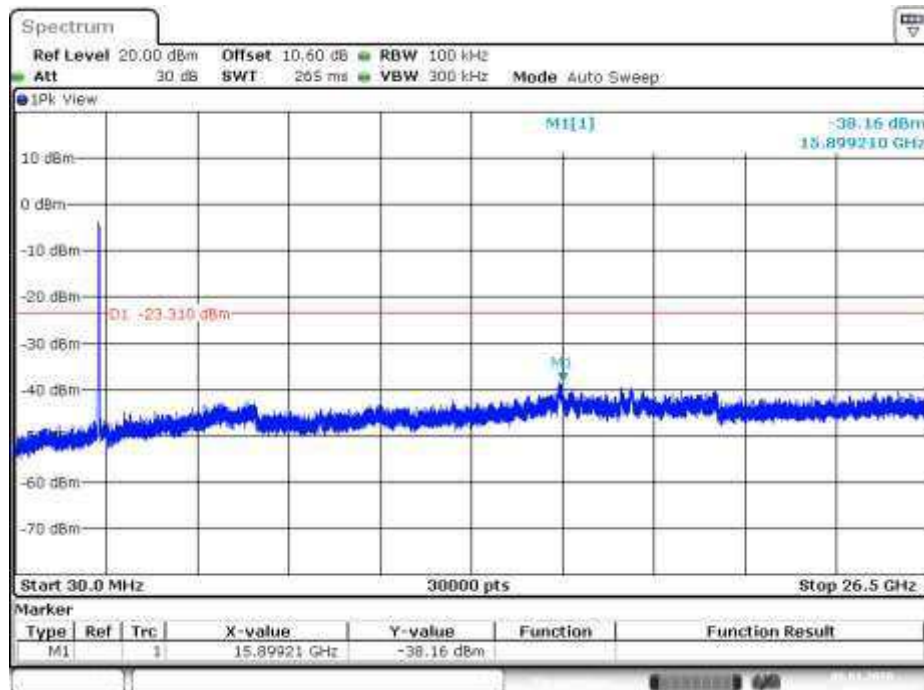
Date: 8.JAN.2020 11:05:30

Ant 3


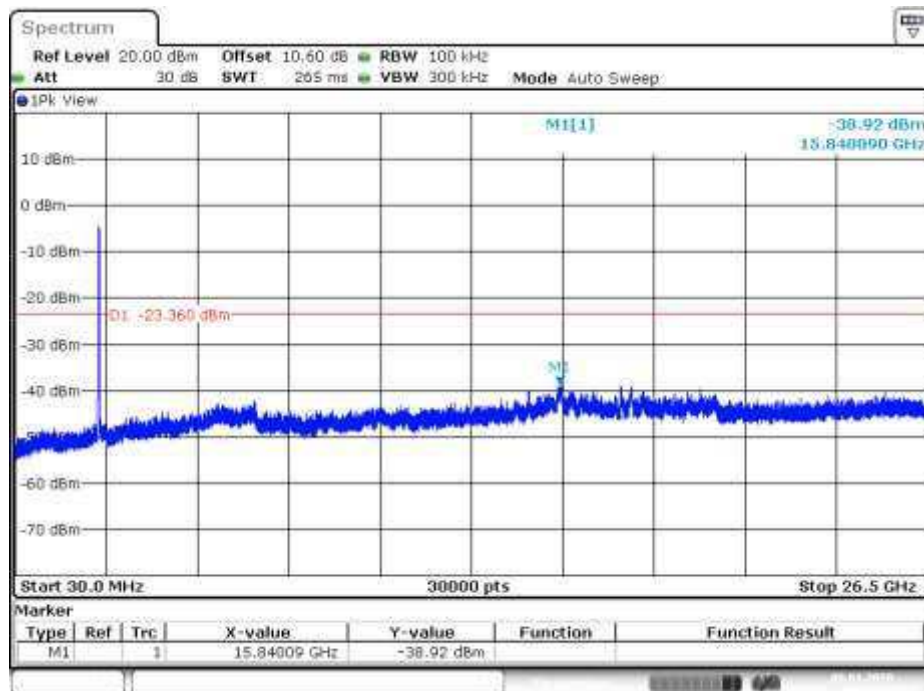
Date: 8.JAN.2020 11:11:49

High Channel
Ant 1


Date: 8.JAN.2020 11:00:50

Ant 2


Date: 8.JAN.2020 11:02:35

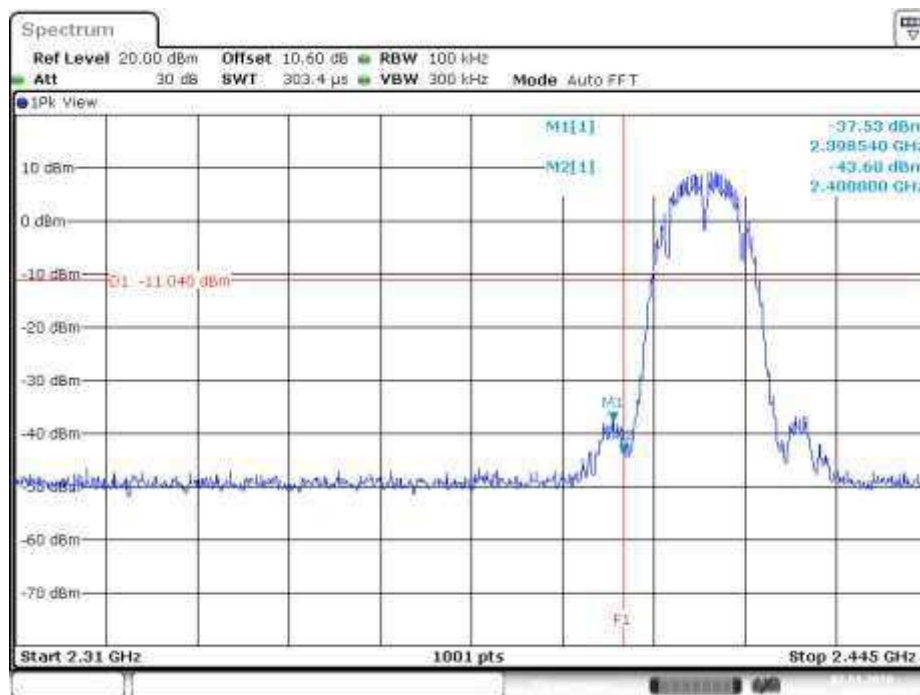
Ant 3


Date: 8.JAN.2020 11:13:25

Test Plot 100kHz RBW of Band Edge 802.11b

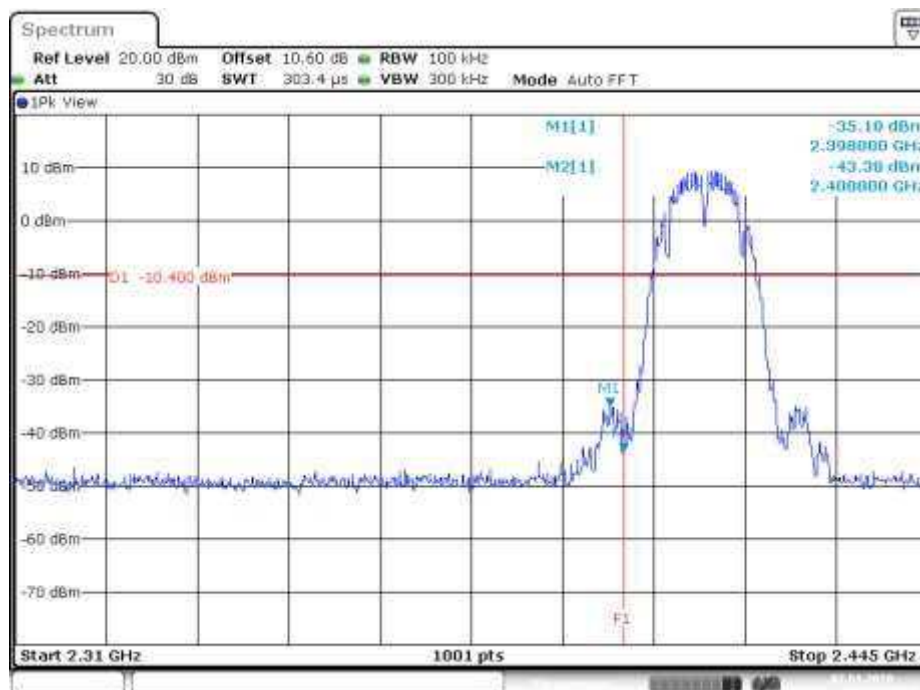
Low Channel

Ant 1

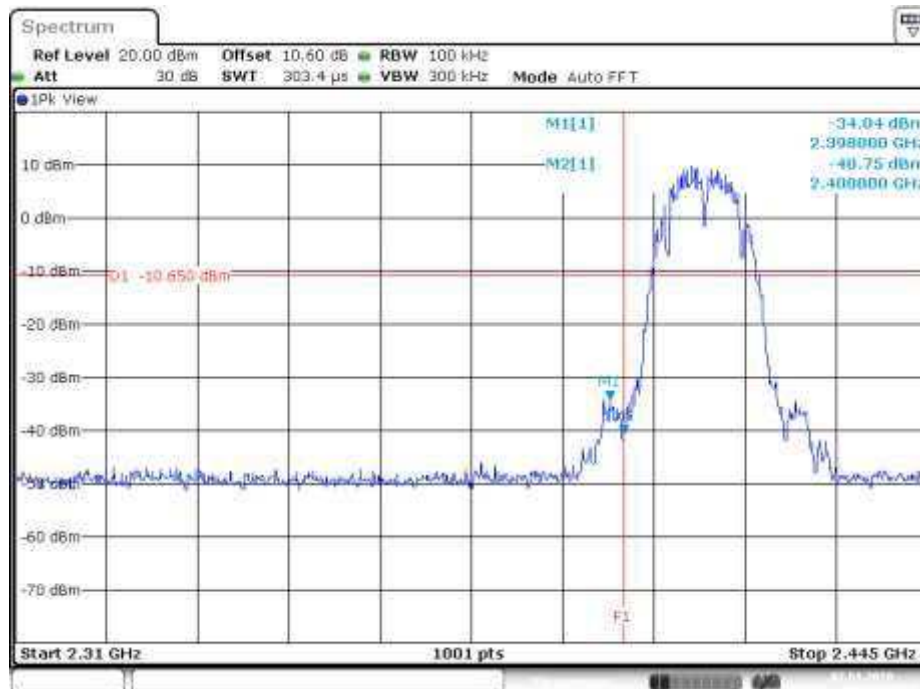


Date: 7.JAN.2020 12:15:19

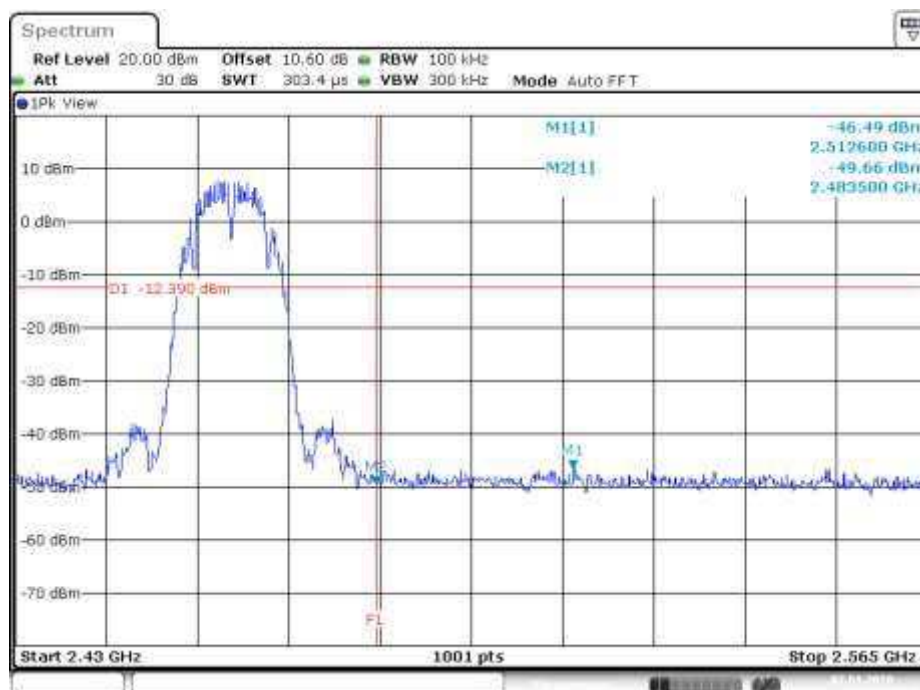
Ant 2



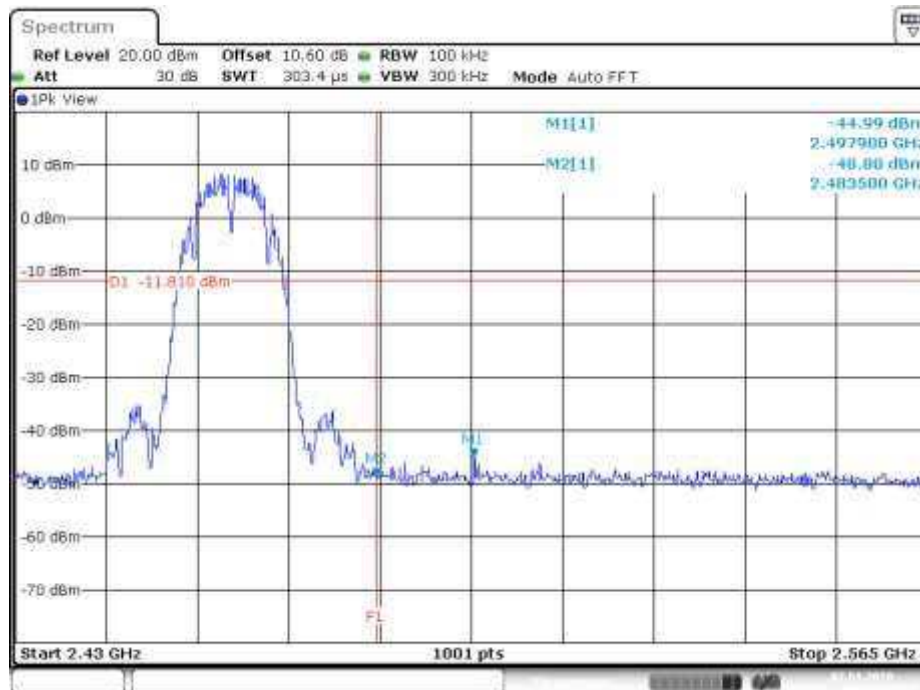
Date: 7.JAN.2020 12:36:12

Ant 3


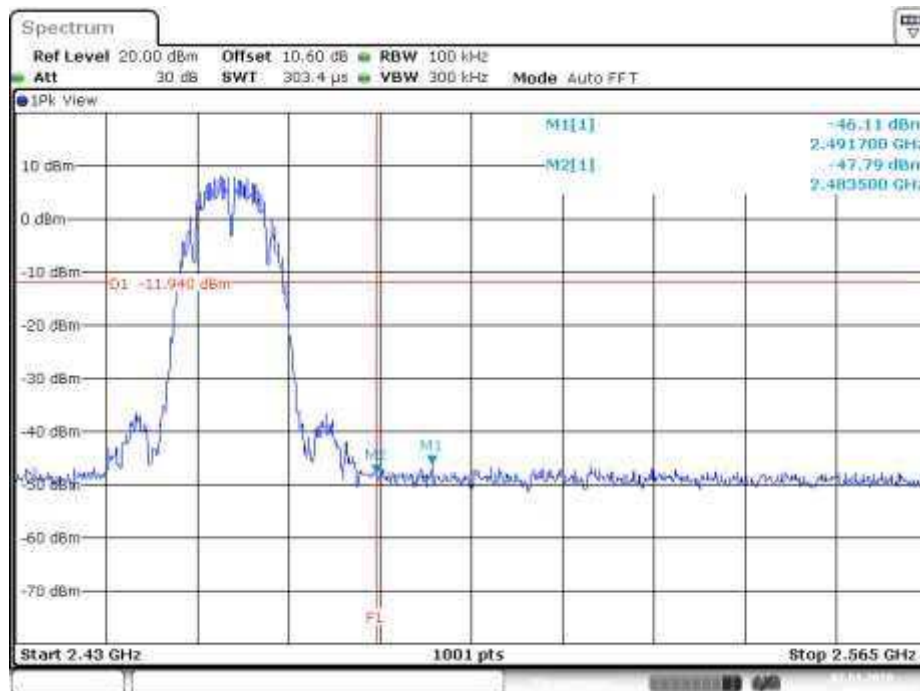
Date: 7.JAN.2020 12:55:15

High Channel
Ant 1


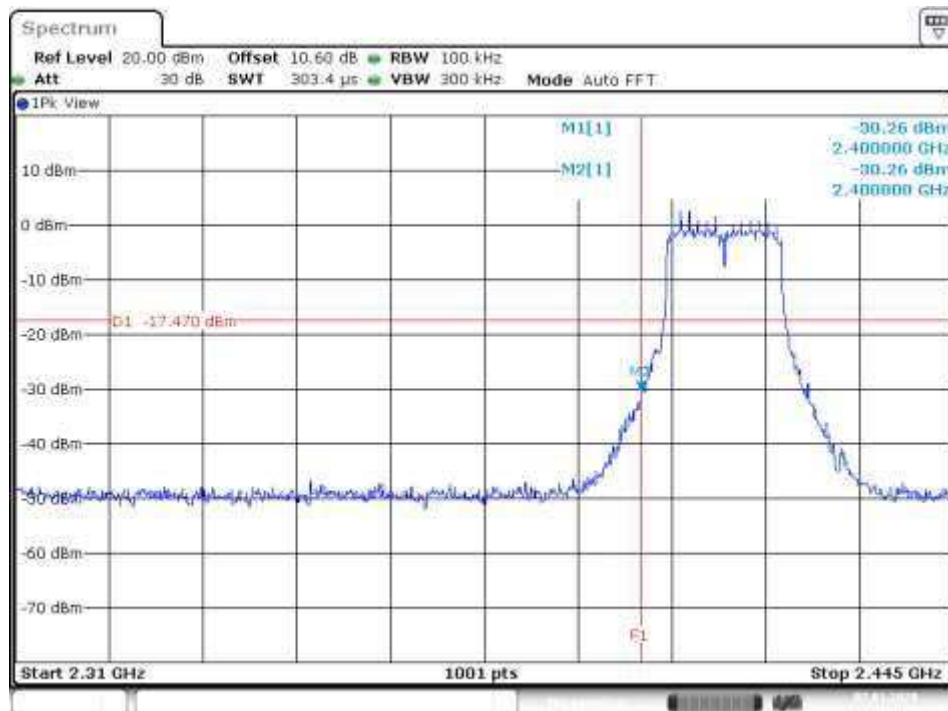
Date: 7.JAN.2020 12:20:45

Ant 2


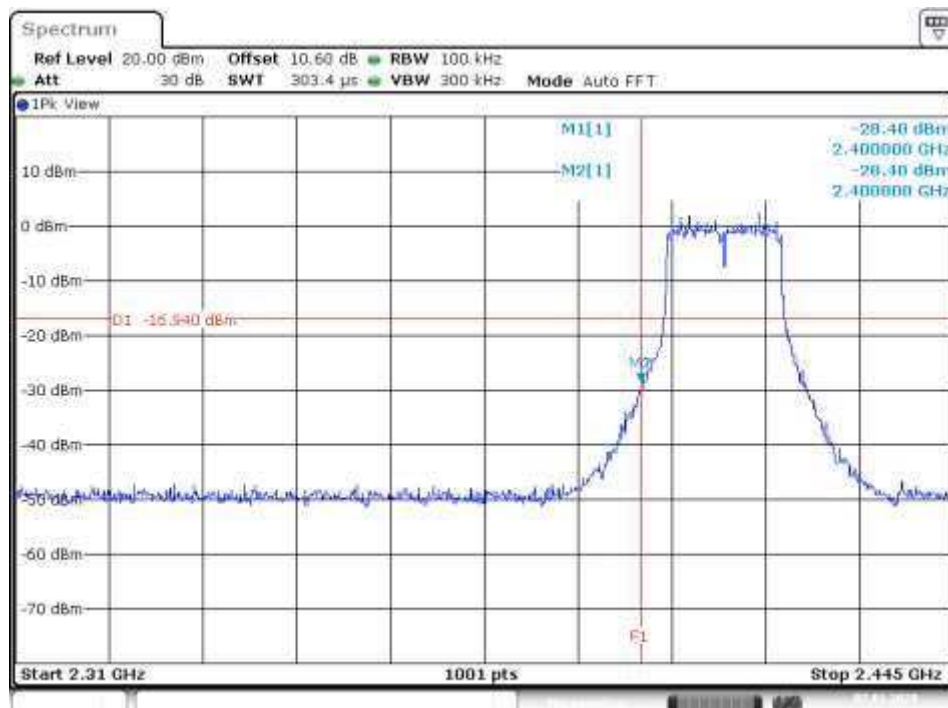
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Ant 3


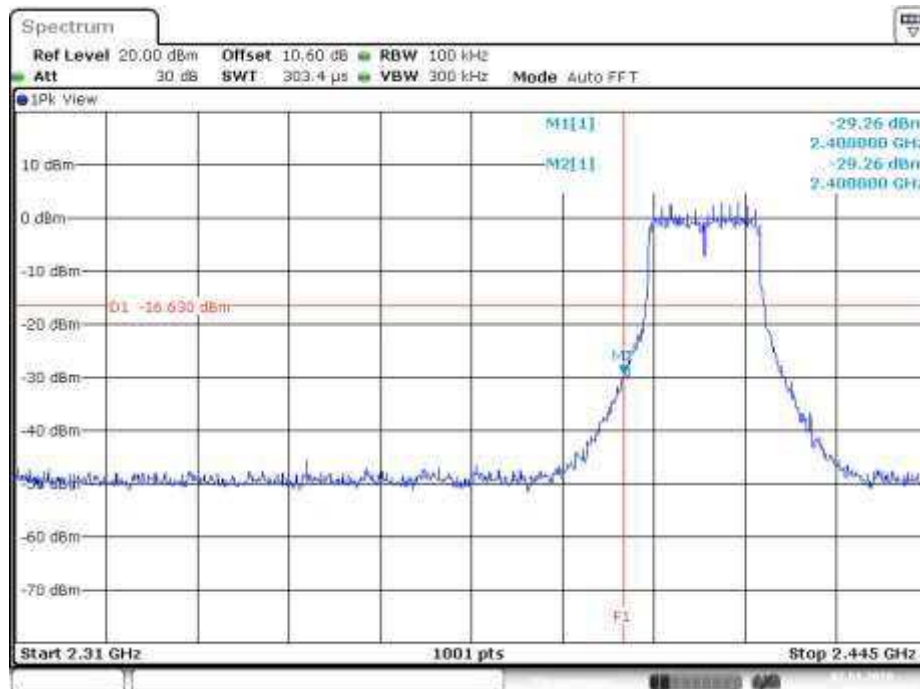
Date: 7.JAN.2020 12:59:11

802.11g
Low Channel
Ant 1


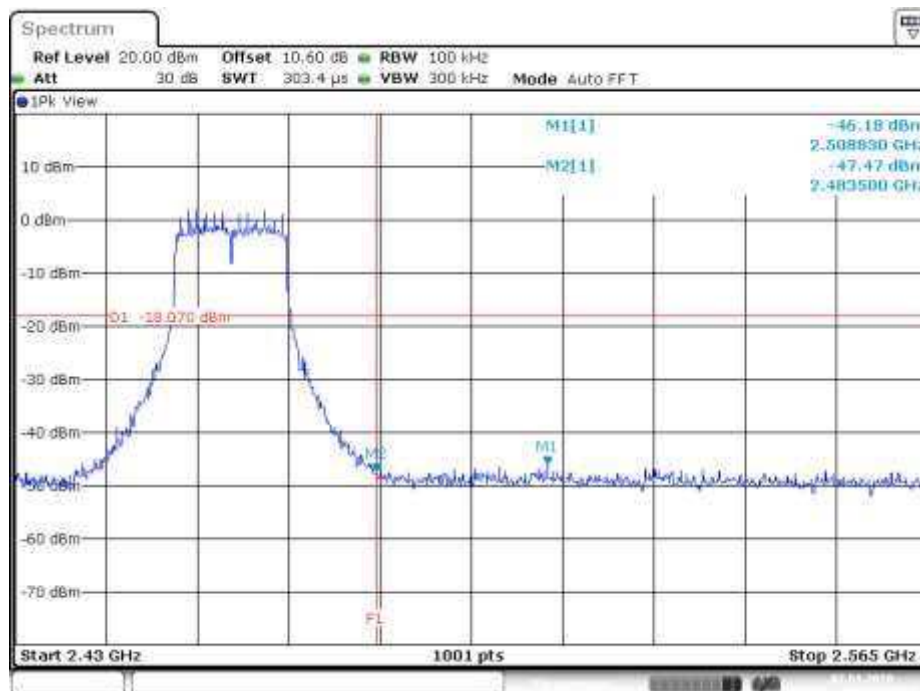
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Ant 2


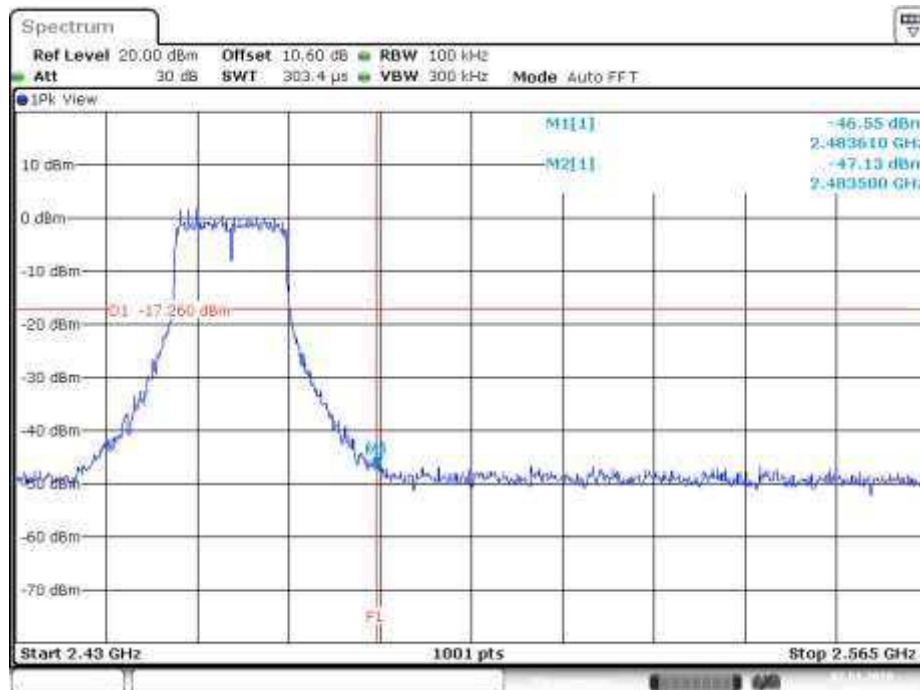
Date: 7.JAN.2020 12:43:03

Ant 3


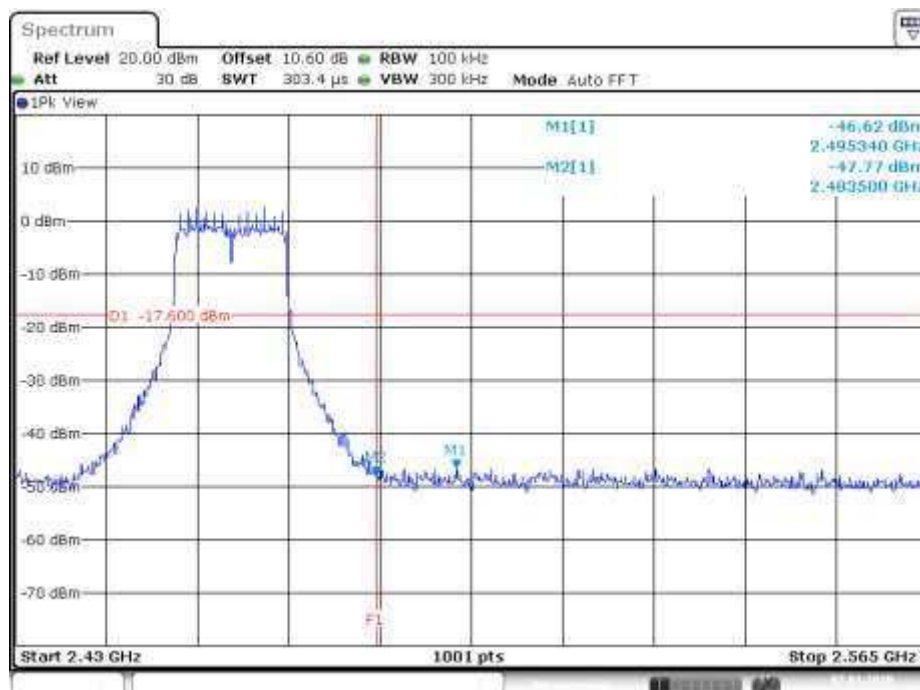
Date: 7.JAN.2020 13:02:00

High Channel
Ant 1


Date: 7.JAN.2020 12:28:19

Ant 2


Date: 7.JAN.2020 12:46:33

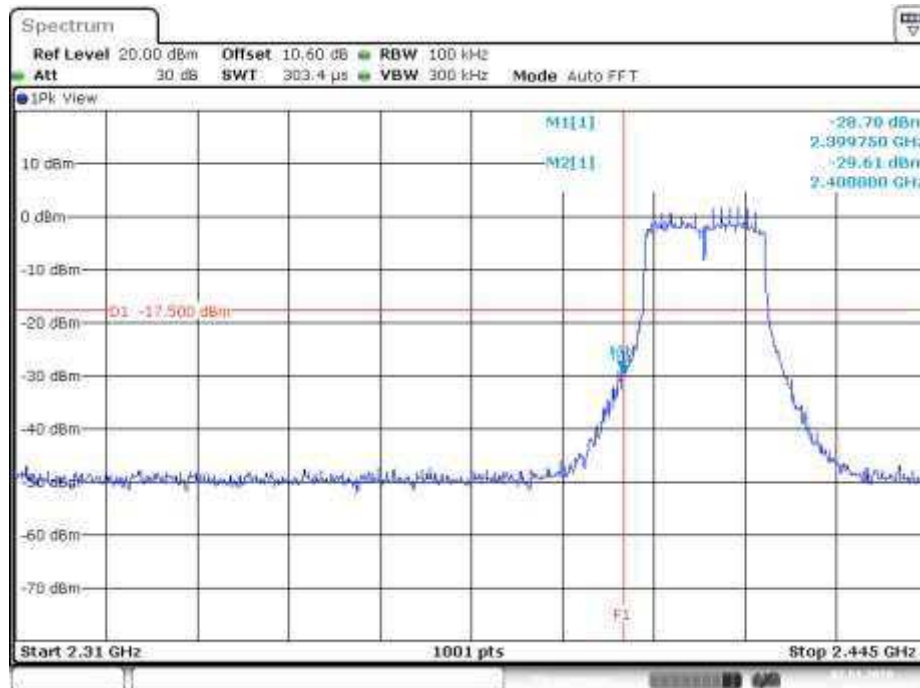
Ant 3


Date: 7.JAN.2020 13:05:32

802.11n HT20

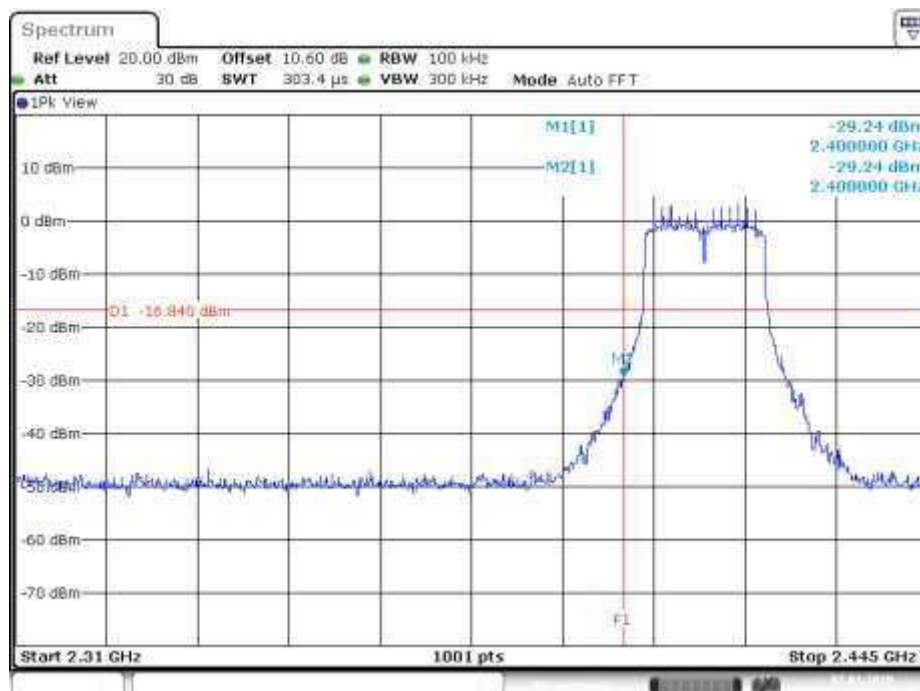
Low Channel

Ant 1



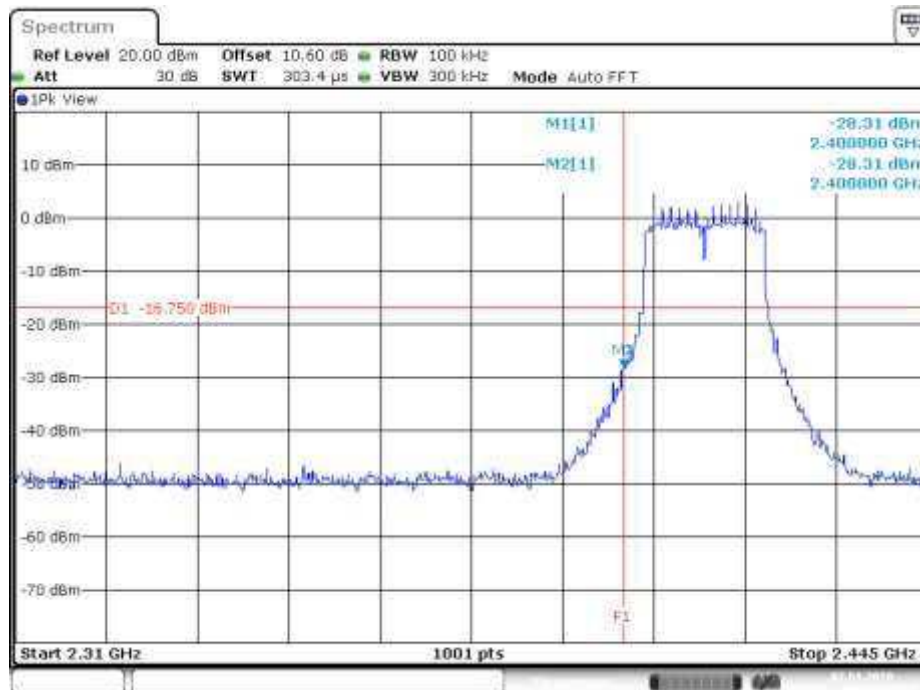
Date: 7.JAN.2020 12:31:03

Ant 2



Date: 7.JAN.2020 12:49:24

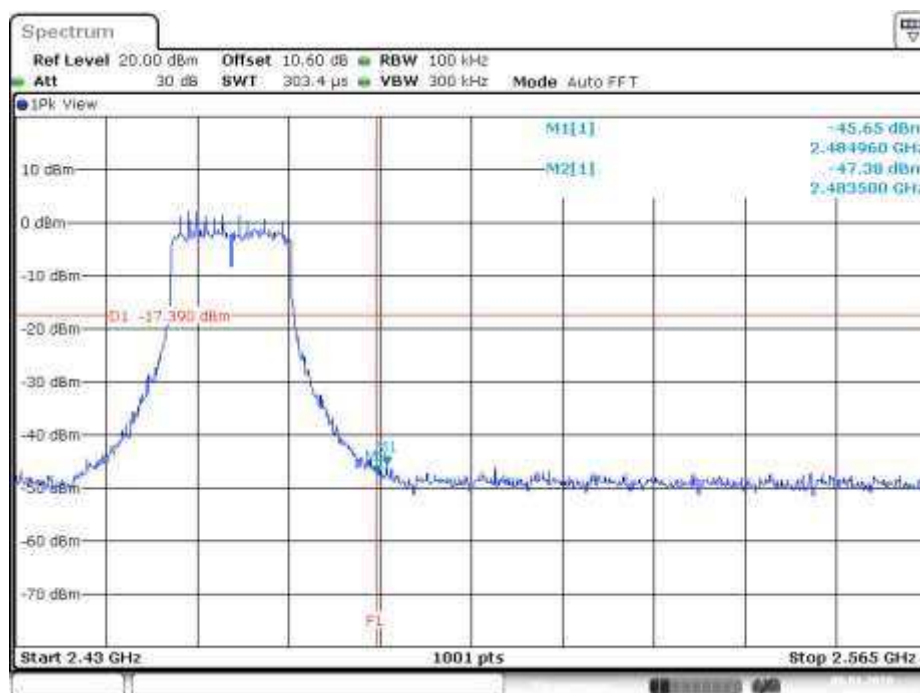
Ant 3



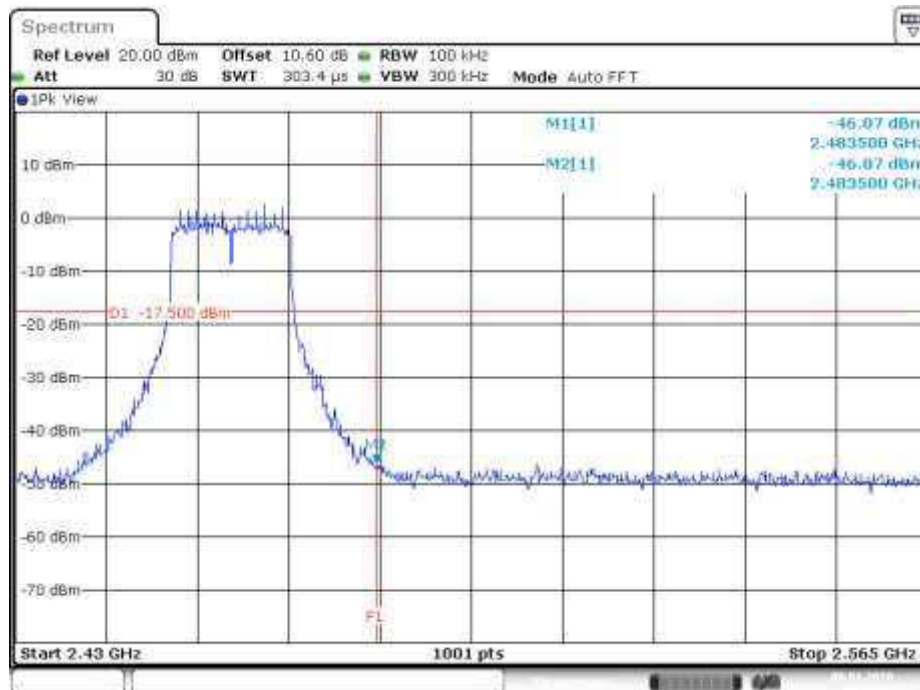
Date: 7.JAN.2020 13:08:15

High Channel

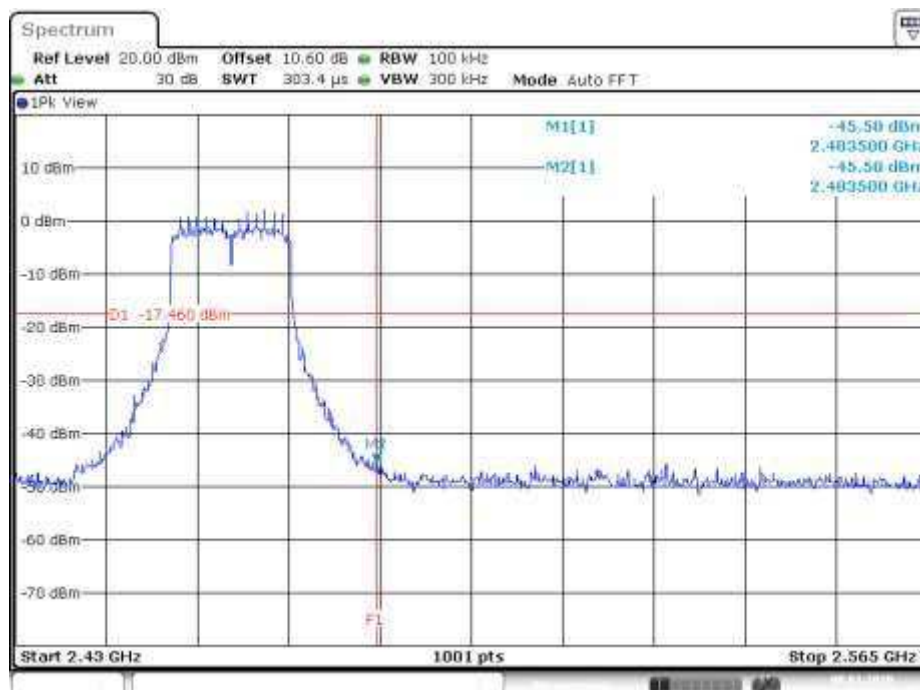
Ant 1



Date: 8.JAN.2020 10:24:49

Ant 2


Date: 8.JAN.2020 10:26:36

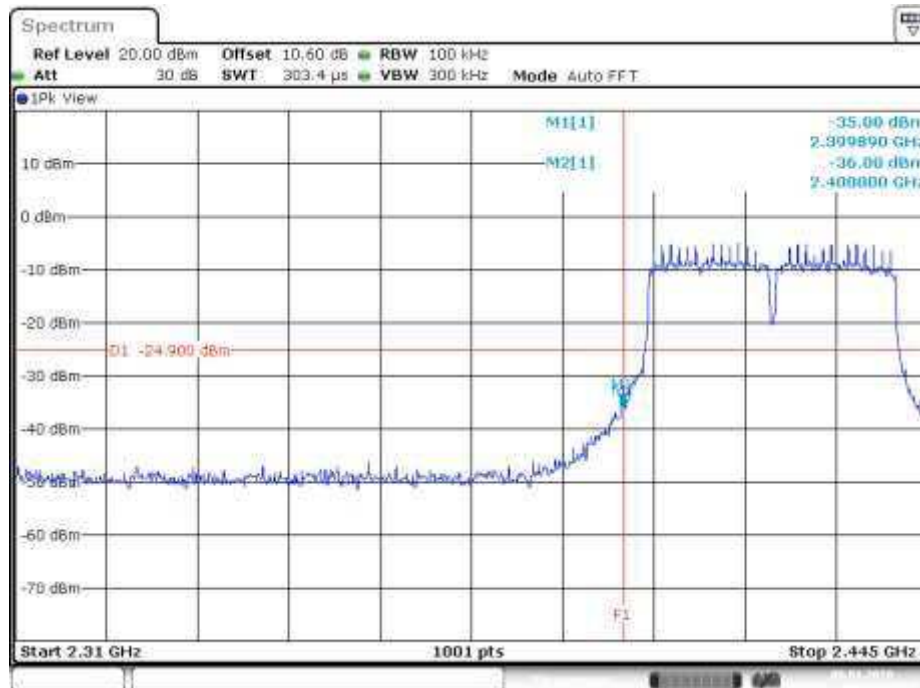
Ant 3


Date: 8.JAN.2020 10:28:15

802.11n HT40

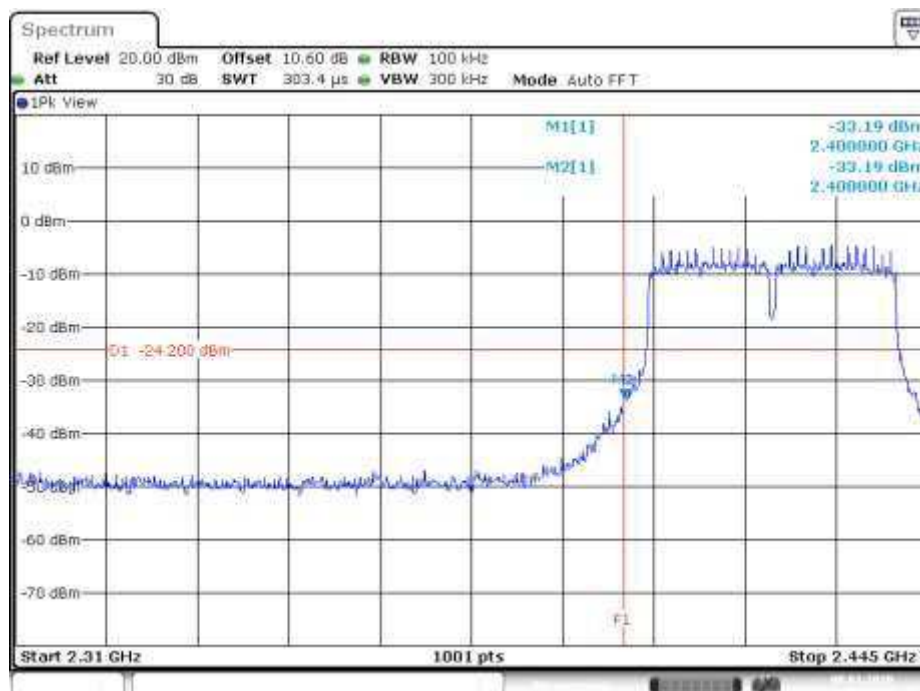
Low Channel

Ant 1

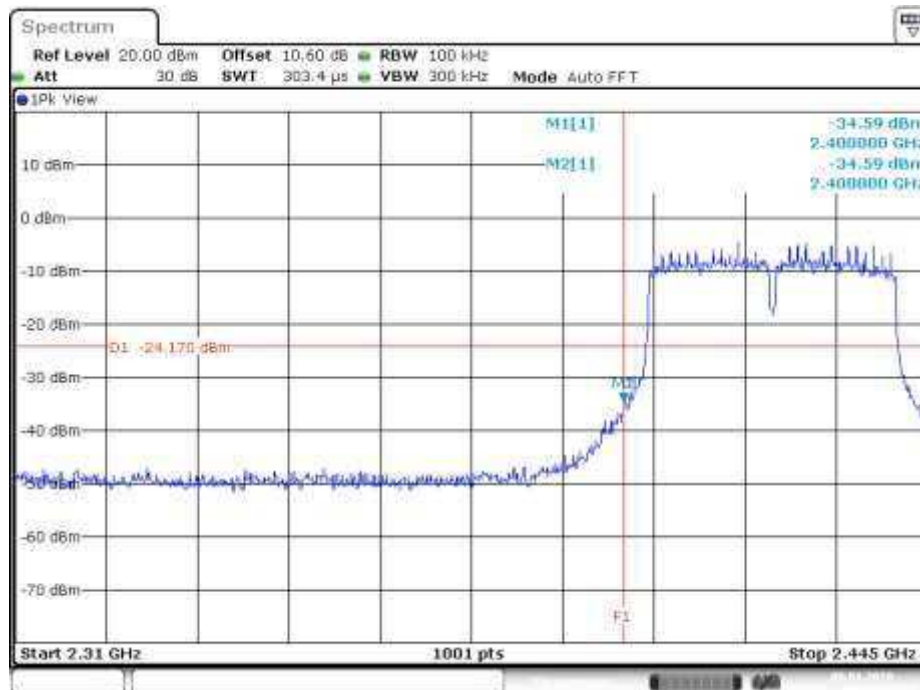


Date: 8.JAN.2020 10:57:12

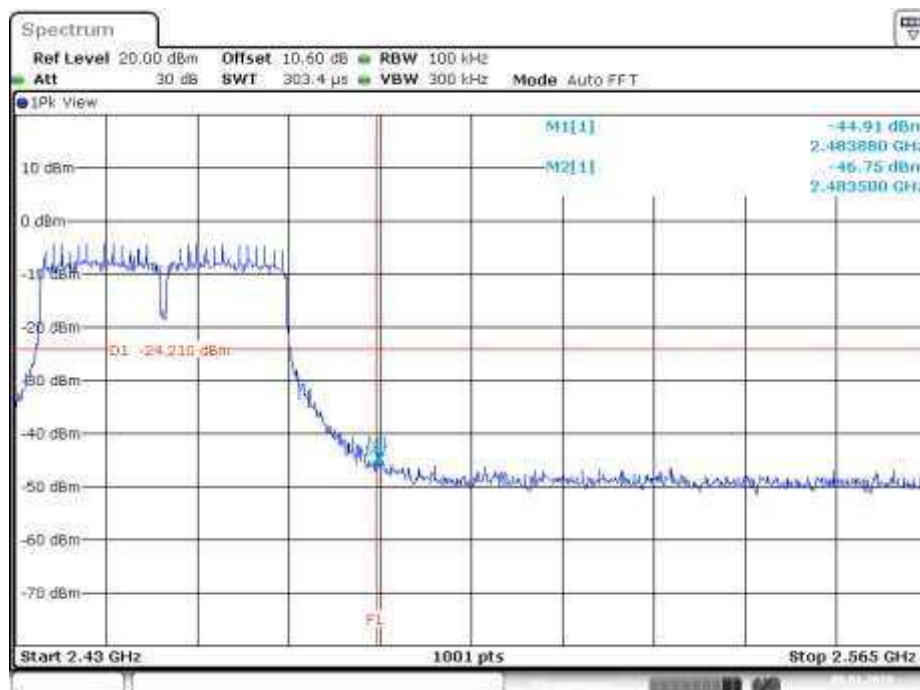
Ant 2



Date: 8.JAN.2020 11:07:37

Ant 3


Date: 8.JAN.2020 11:09:56

High Channel
Ant 1


Date: 8.JAN.2020 11:00:10

5.1.6 Spurious Emission

RESULT:**Passed**

Test standard : FCC part 15.247(d), FCC 15.205, FCC 15.209,
Basic standard : ANSI C63.10: 2013
Limits : Radiated emissions which fall in the restricted
bands, as defined in FCC 15.205(a), must
comply with the radiated emission limits
specified in FCC 15.209(a)
Emission radiated outside the restricted and
authorized frequency bands must either
comply with the radiated emission limits
specified for the restricted bands or in
FCC15.247(d)
Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : Low/ Middle/ High
Operation mode : A

	802.11b	802.11g/n20/n40
Peak	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 3MHz
Average	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 1kHz

Remark: Testing was carried out within frequency range 9kHz to the tenth harmonic.

For details refer to Appendix D.

The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The X Axis orientation is the worst-case and recorded in this test report.

5.1.7 Mains Conducted Emissions

RESULT:**Passed**

Test standard : FCC Part 15.207
FCC Part 15.107

Limits : Mains Conducted emissions as defined in
above standards

Kind of test site : Shielded Room

Test setup

Test Channel : High
Operation mode : A

Remark: For details refer to Appendix D.

6. Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:**Passed**

Test standard : FCC CFR 47 Part 2 Subpart J Section 2.1091

Separation distance is more than 20 cm, thus mobile device exposure limits can be applied.

FCC Maximum Exposure:**Maximum Exposure:**

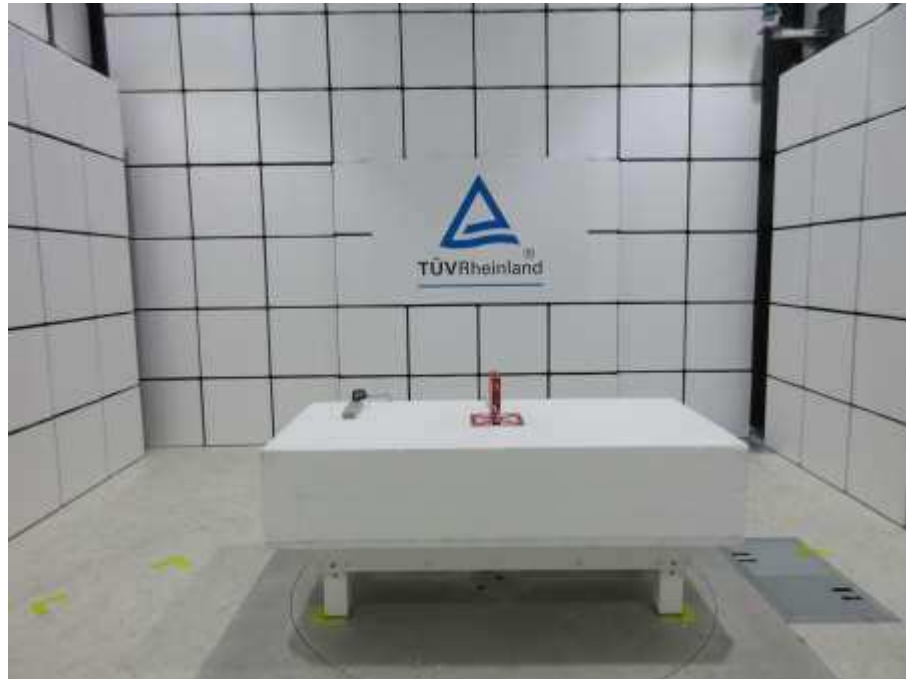
Power to Antenna (mW)	660.69 mW
Power to Antenna (dBm)	28.2 dBm
Antenna Gain	5.19 dBi
Power+Ant Gain	2182.7 mW
Distance	20 cm
S=	0.434 mW/cm ²

Limit FCC: 1500-100,000 MHz 1.0 mW/cm²

---End---

7. Photographs of the Test Set-Up

Photograph 1: Set-up for Spurious Emissions (Front View 1)



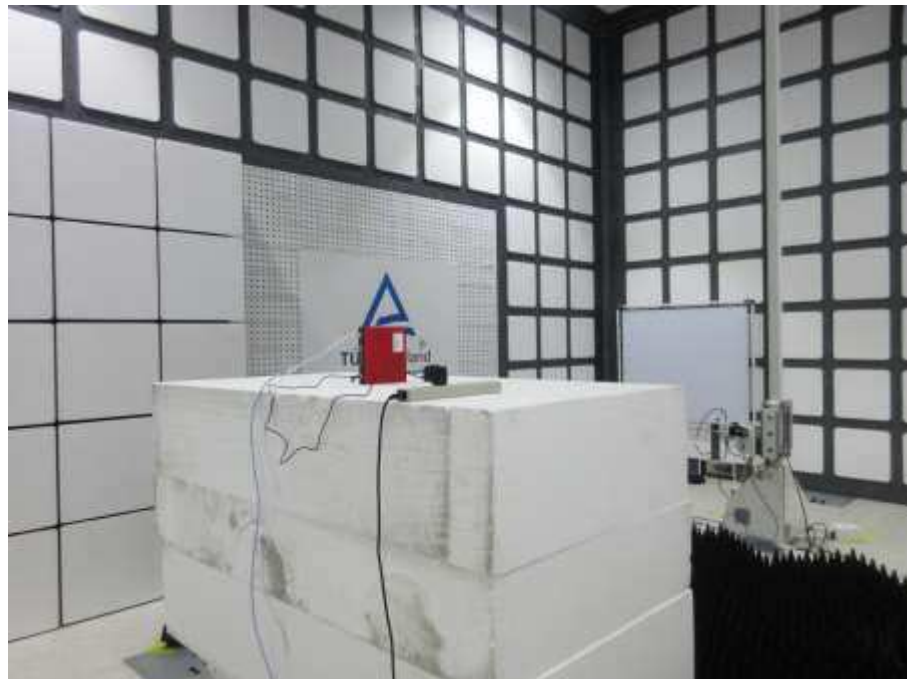
Photograph 2: Set-up for Spurious Emissions (Front View 2)



Photograph 3: Set-up for Spurious Emissions (Back View 1)



Photograph 4: Set-up for Spurious Emissions (Back View 2)



Photograph 5: Set-up for Spurious Emissions (Back View 3)



Photograph 6: Set-up for Mains Conducted testing (Front View)



Photograph 7: Set-up for Mains Conducted testing (Back View)



8. List of Tables

Table 1: Applied Standard and Test Levels	5
Table 2: List of Test and Measurement Equipment	7
Table 3: Emission Measurement Uncertainty.....	8
Table 4: Basic Information of EUT	9
Table 5: Technical Specification of EUT	9
Table 6: Table for Parameters of Test Software Setting	11
Table 7: Test result of Peak Output Power	16
Table 8: Test result of 6dB Bandwidth	17
Table 9: Test result of Power Density	36

9. List of Photographs

Photograph 1: Set-up for Spurious Emissions (Front View 1).....	89
Photograph 2: Set-up for Spurious Emissions (Front View 2).....	89
Photograph 3: Set-up for Spurious Emissions (Back View 1)	90
Photograph 4: Set-up for Spurious Emissions (Back View 2)	90
Photograph 5: Set-up for Spurious Emissions (Back View 3)	91
Photograph 6: Set-up for Mains Conducted testing (Front View).....	91
Photograph 7: Set-up for Mains Conducted testing (Back View)	92