FCC RADIO TEST REPORT

FCC ID	:	**B94SNPRC2150**
Equipment	:	**802.11b/g/n (2.4GHz) Wi-Fi + BT / BLE Radio Module**
Brand Name	:	
Model Name	:	**SNPRC-2150**
Applicant	:	**HP Singapore (Private) Limited** **1 Depot Close, Singapore 109841**
Manufacturer	:	**HP Inc.** **1501 Page Mill Road, Palo Alto 94304, U.S.A. 650-857-1501**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Oct. 22, 2020 and testing was started from Oct. 22, 2020 and completed on Dec. 16, 2020. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (USA) Inc., the test report shall not be reproduced except in full.

Neil Kao

Reviewed by: Neil Kao

Sporton International (USA) Inc.
1175 Montague Expressway, Milpitas, CA 95035

TEL : 408 9043300

Table of Contents

History of this test report **3**
Summary of Bluetooth Test Result **4**
1 General Description **5**
1.1 Product Feature of Equipment Under Test 5
1.2 Product Specification of Equipment Under Test 6
1.3 Modification of EUT 6
1.4 Testing Location 6
1.5 Applicable Standards 7
2 Test Configuration of Equipment Under Test **8**
2.1 Carrier Frequency Channel 8
2.2 Test Mode 9
2.3 Connection Diagram of Test System 11
2.4 Support Unit used in test configuration and system 11
2.5 EUT Operation Test Setup 11
2.6 Measurement Results Explanation Example 12
3 Test Result **13**
3.1 Number of Channel Measurement 13
3.2 Hopping Channel Separation Measurement 16
3.3 Dwell Time Measurement 27
3.4 20dB and 99% Bandwidth Measurement 30
3.5 Output Power Measurement 51
3.6 Conducted Band Edges Measurement 54
3.7 Conducted Spurious Emission Measurement 67
3.8 Radiated Band Edges and Spurious Emission Measurement 86
3.9 AC Conducted Emission Measurement 123
3.10 Antenna Requirements 127
4 List of Measuring Equipment **128**
5 Uncertainty of Evaluation **129**

History of this test report

Report No.	Version	Description	Issued Date
FR200819001A	01	Initial issue of report	Feb. 08, 2021

Summary of Bluetooth Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(1)	Number of Channels	Pass	-
3.2	15.247(a)(1)	Hopping Channel Separation	Pass	-
3.3	15.247(a)(1)	Dwell Time of Each Channel	Pass	-
3.4	15.247(a)(1)	20dB Bandwidth	Pass	-
3.4	2.1049	99% Occupied Bandwidth	Reporting only	-
3.5	15.247(b)(1)	Peak Output Power	Pass	-
3.6	15.247(d)	Conducted Band Edges	Pass	-
3.7	15.247(d)	Conducted Spurious Emission	Pass	-
3.8	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 4.60 dB at 213.330 MHz
3.9	15.207	AC Conducted Emission	Pass	Under limit 13.83 dB at 0.511 MHz
3.10	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	802.11b/g/n (2.4GHz) Wi-Fi + BT / BLE Radio Module
Brand Name	hp
Model Name	SNPRC-2150
FCC ID	B94SNPRC2150
EUT supports Radios application	WLAN 11b/g/n HT20 Bluetooth BR/EDR/LE
EUT Stage	Identical Prototype

Sample Information			
Sample	Sample 1	Sample 2	Sample 3
Labelled	0960-4992	0960-4991	0960-4977
Antenna	Main: PCB Antenna	Main: PCB Antenna	Main: PCB Antenna
	Aux.: PCB Antenna	Aux.: External Antenna with cable 300mm (or 200mm)	Aux.: PCB Antenna
Config	Miligrid / 12 pin header connector	Miliigrid / 12 pin header connector	FFC connector

Remark:

1. The EUT's information listed above is declared by manufacturer. Please refer to Comments and Explanations in report summary
2. There are two antenna cables of different lengths that can be equipped on Sample 2 (Labelled: 0960-4991), 300mm and 200mm. As per technical assessment, the cable of 200mm length equipped on Sample 2 is determined to be a worse case and tested as a representative in this report.

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx/Rx Frequency Range	2400 MHz ~ 2483.5 MHz (Channel 00: 2402MHz ~ Channel 78: 2480MHz)
Number of Channels	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Maximum Output Power to Antenna	**<Main Antenna for Sample 1>** Bluetooth BR(1Mbps) : 9.27 dBm (0.0085 W) Bluetooth EDR (2Mbps) : 7.10 dBm (0.0051 W) Bluetooth EDR (3Mbps) : 7.35 dBm (0.0054 W) **<Aux. Antenna for Sample 1>** Bluetooth BR(1Mbps) : 9.20 dBm (0.0083 W) Bluetooth EDR (2Mbps) : 7.13 dBm (0.0052 W) Bluetooth EDR (3Mbps) : 7.29 dBm (0.0054 W)
99% Occupied Bandwidth	**<Main Antenna for Sample 1>** Bluetooth BR(1Mbps) : 0.984MHz Bluetooth EDR (2Mbps) : 1.207MHz Bluetooth EDR (3Mbps) : 1.181MHz **<Aux. Antenna for Sample 1>** Bluetooth BR(1Mbps) : 0.981MHz Bluetooth EDR (2Mbps) : 1.207MHz Bluetooth EDR (3Mbps) : 1.181MHz
Antenna Gain	PCB Antenna: 4 dBi External Antenna: 0.9 dBi
Type of Modulation	Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : π/4-DQPSK Bluetooth EDR (3Mbps) : 8-DPSK

Remark: The EUT's information listed above is declared by manufacturer. Please refer to Comments and Explanations in report summary

1.3 Modification of EUT

No modifications are made to the EUT during all test items.

1.4 Testing Location

Test Site	SPORTON INTERNATIONAL (USA) INC.		
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL: (408) 904-3300		
Test Site No.	**Sporton Site No.**		
	TH01-CA	CO01-CA	03CH02-CA
Test Engineer	Andy Kao	Ram Prashanth Vallam	Calvin Wu
Temperature	20.8~23.5°C	18~21℃	19~ 22℃
Relative Humidity	43.4~45.7%	30.6~34.8%	39 ~45%

1.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.

2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	27	2429	54	2456
	1	2403	28	2430	55	2457
	2	2404	29	2431	56	2458
	3	2405	30	2432	57	2459
	4	2406	31	2433	58	2460
	5	2407	32	2434	59	2461
	6	2408	33	2435	60	2462
	7	2409	34	2436	61	2463
	8	2410	35	2437	62	2464
	9	2411	36	2438	63	2465
	10	2412	37	2439	64	2466
	11	2413	38	2440	65	2467
	12	2414	39	2441	66	2468
	13	2415	40	2442	67	2469
	14	2416	41	2443	68	2470
	15	2417	42	2444	69	2471
	16	2418	43	2445	70	2472
	17	2419	44	2446	71	2473
	18	2420	45	2447	72	2474
	19	2421	46	2448	73	2475
	20	2422	47	2449	74	2476
	21	2423	48	2450	75	2477
	22	2424	49	2451	76	2478
	23	2425	50	2452	77	2479
	24	2426	51	2453	78	2480
	25	2427	52	2454	-	-
	26	2428	53	2455	-	-

2.2 Test Mode

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

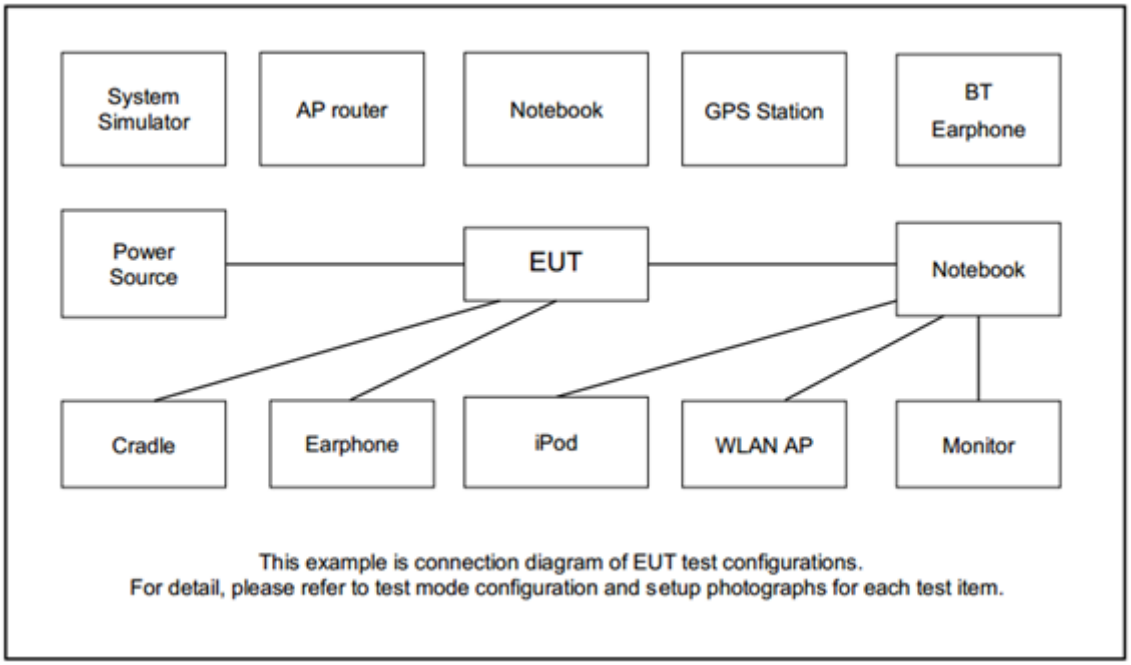
The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Conducted Test Cases						
Modulation	**Mode**	**Channel**	**Frequency**	**Data Rate**	**Antenna**	**Sample**
Bluetooth BR GFSK	Tx	CH00	2402 MHz	1Mbps	Main	1
	Tx	CH39	2441 MHz	1Mbps	Main	1
	Tx	CH78	2480 MHz	1Mbps	Main	1
	Tx	CH00	2402 MHz	1Mbps	Aux.	1
	Tx	CH39	2441 MHz	1Mbps	Aux.	1
	Tx	CH78	2480 MHz	1Mbps	Aux.	1
Bluetooth EDR π/4-DQPSK	Tx	CH00	2402 MHz	2Mbps	Main	1
	Tx	CH39	2441 MHz	2Mbps	Main	1
	Tx	CH78	2480 MHz	2Mbps	Main	1
	Tx	CH00	2402 MHz	2Mbps	Aux.	1
	Tx	CH39	2441 MHz	2Mbps	Aux.	1
	Tx	CH78	2480 MHz	2Mbps	Aux.	1
Bluetooth EDR 8-DPSK	Tx	CH00	2402 MHz	3Mbps	Main	1
	Tx	CH39	2441 MHz	3Mbps	Main	1
	Tx	CH78	2480 MHz	3Mbps	Main	1
	Tx	CH00	2402 MHz	3Mbps	Aux.	1
	Tx	CH39	2441 MHz	3Mbps	Aux.	1
	Tx	CH78	2480 MHz	3Mbps	Aux.	1

Summary table of Radiated Test Cases						
Modulation	**Mode**	**Channel**	**Frequency**	**Data Rate**	**Antenna**	**Sample**
Bluetooth BR GFSK	Tx	CH00	2402 MHz	1Mbps	Main	1
	Tx	CH39	2441 MHz	1Mbps	Main	1
	Tx	CH78	2480 MHz	1Mbps	Main	1
	Tx	CH00	2402 MHz	1Mbps	Aux.	1
	Tx	CH39	2441 MHz	1Mbps	Aux.	1
	Tx	CH78	2480 MHz	1Mbps	Aux.	1
	Tx	CH78	2480 MHz	1Mbps	Main	2
	Tx	CH00	2402 MHz	1Mbps	Aux.	2
	Tx	CH39	2441 MHz	1Mbps	Aux.	2
	Tx	CH78	2480 MHz	1Mbps	Aux.	2
Remark: For radiated test cases, the worst mode data rate 1Mbps was reported only since the highest RF output power in the preliminary tests. The conducted spurious emissions and conducted band edge measurement for other data rates were not worse than 1Mbps, and no other significantly frequencies found in conducted spurious emission.						

Summary table of AC Conducted Emission
Mode 1 :WLAN (2.4GHz) Link + Bluetooth Idle for Sample 3
Mode 2 : WLAN (2.4GHz) Idle + Bluetooth Link for Sample 3
Mode 3 : WLAN (2.4GHz) Link + Bluetooth Idle for Sample 2
Remark: The worst case of conducted emission is mode 2; only the test data of it was reported.

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Altos PS548 Series	82600085033	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
2.	AP Router	NetGear	R6080	PY316400359	N/A	N/A
3.	Power Adapter	CanaKit	DCAR-052A5	N/A	N/A	Unshielded, 1.3 m with core
4.	Fixture	Raspberry Pi	N/A	N/A	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “PuTTY &Release 0.70” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

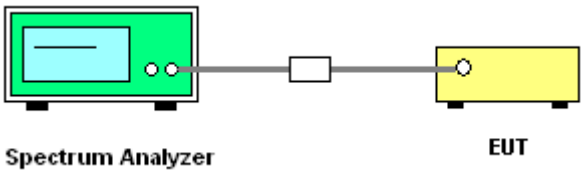
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW = 300kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

3.1.4 Test Setup

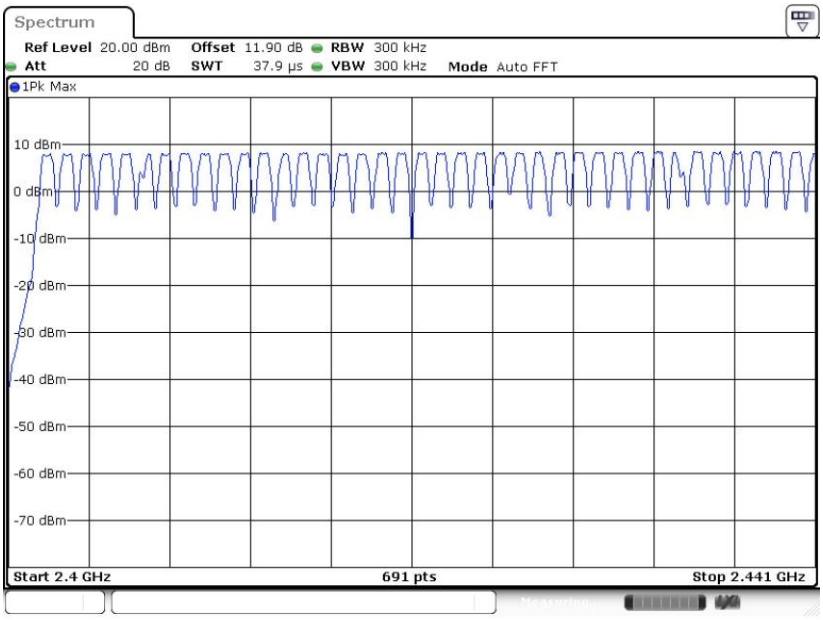


3.1.5 Test Result of Number of Hopping Frequency

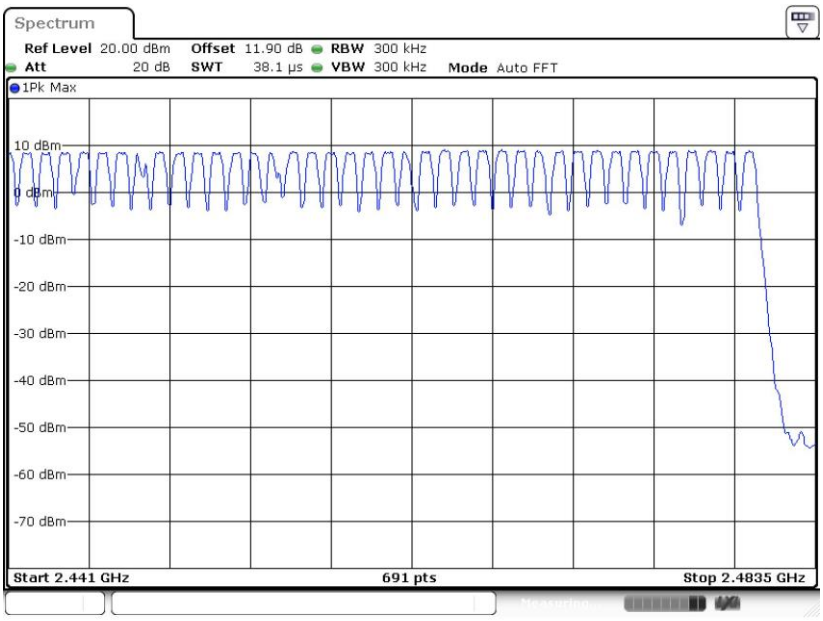
<Main Antenna>

Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail
79	20	> 15	Pass

Number of Hopping Channel Plot on Channel 00 - 78



Date: 16.NOV.2020 15:24:56

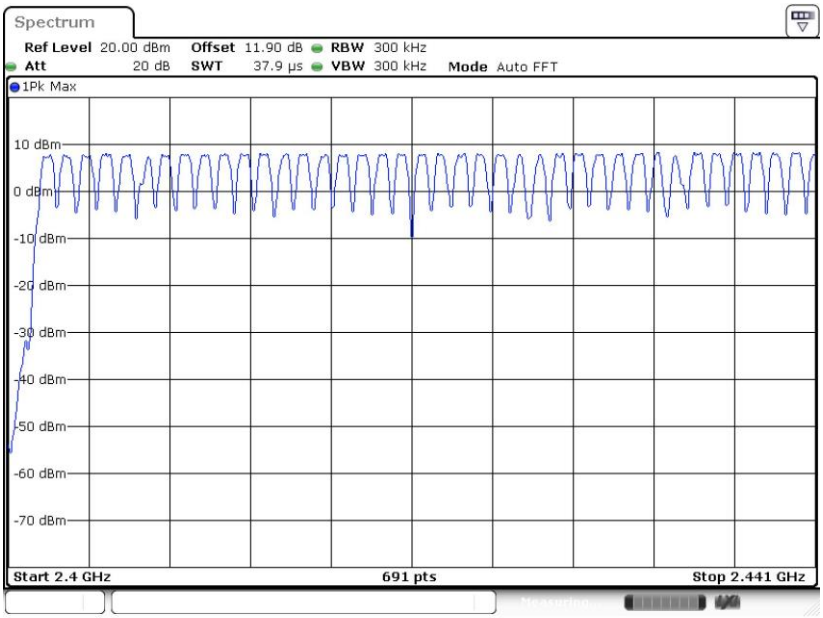


Date: 16.NOV.2020 15:25:58

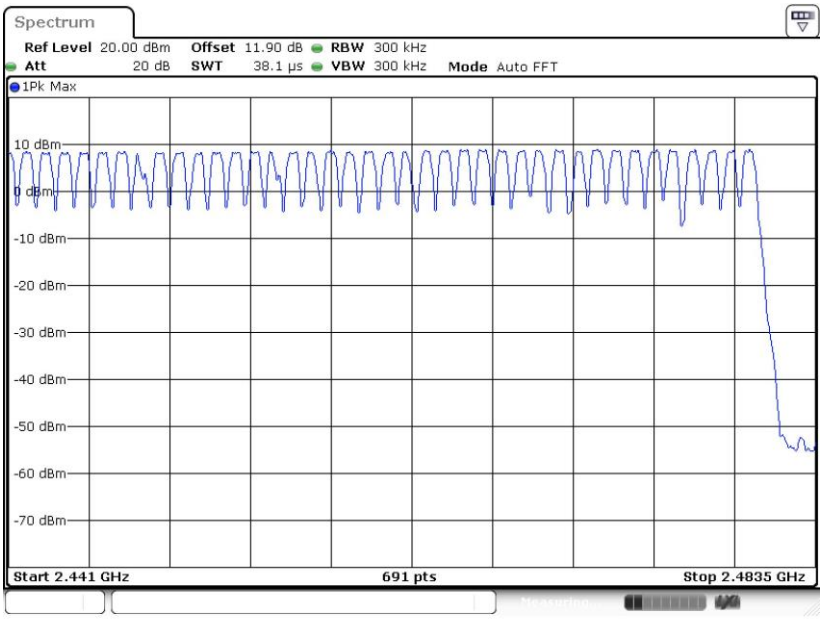
<Aux. Antenna>

Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail
79	20	> 15	Pass

Number of Hopping Channel Plot on Channel 00 - 78



Date: 16.NOV.2020 17:59:56



Date: 16.NOV.2020 18:00:36

3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

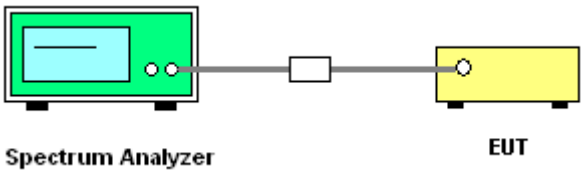
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.2.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 300kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.2.4 Test Setup



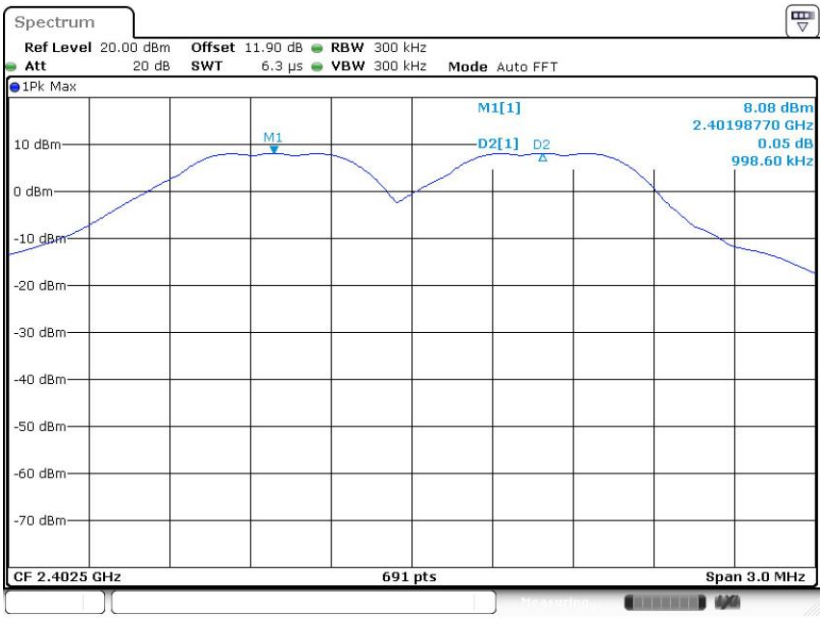
3.2.5 Test Result of Hopping Channel Separation

<Main Antenna>

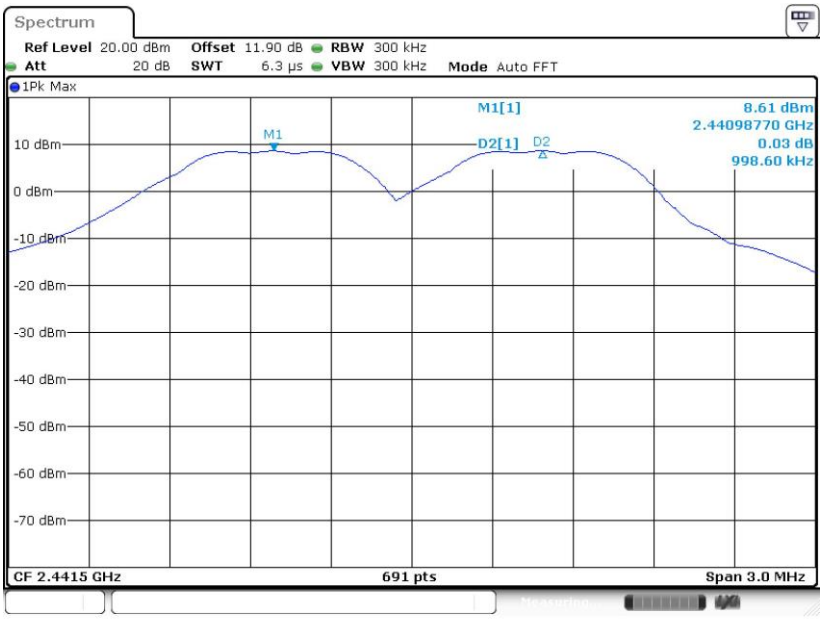
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.999	0.6908	Pass
DH	1Mbps	1	39	2441	0.999	0.6908	Pass
DH	1Mbps	1	78	2480	0.999	0.6908	Pass
2DH	2Mbps	1	0	2402	0.999	0.8915	Pass
2DH	2Mbps	1	39	2441	0.999	0.8915	Pass
2DH	2Mbps	1	78	2480	1.003	0.8915	Pass
3DH	3Mbps	1	0	2402	1.003	0.8567	Pass
3DH	3Mbps	1	39	2441	0.999	0.8596	Pass
3DH	3Mbps	1	78	2480	0.999	0.8567	Pass

<1Mbps>

Channel Separation Plot on Channel 00 - 01

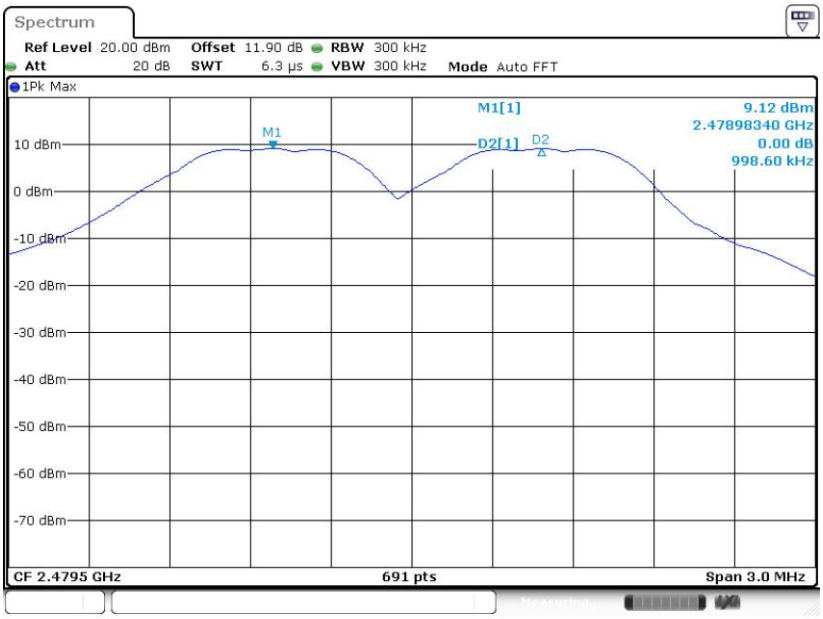


Channel Separation Plot on Channel 39 - 40



Date: 16.NOV.2020 16:01:22

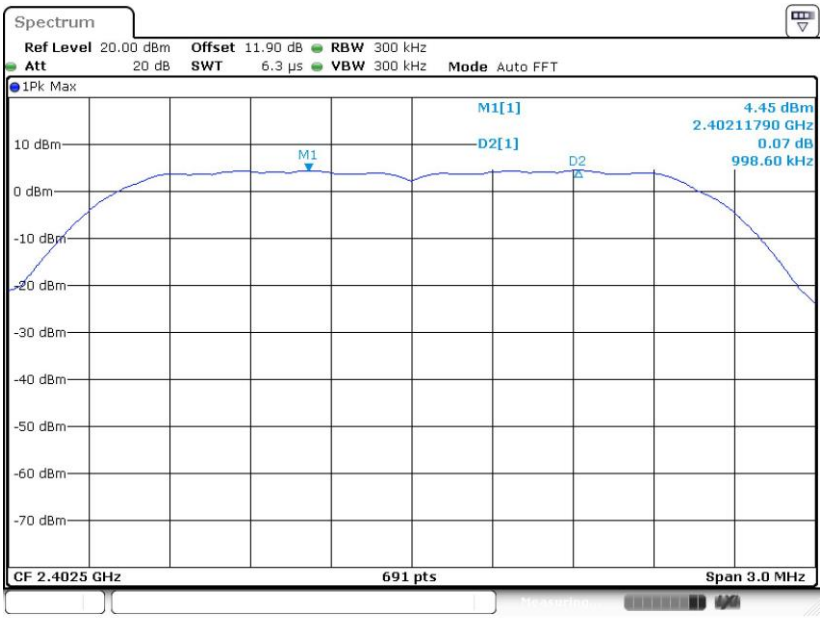
Channel Separation Plot on Channel 77 - 78



Date: 16.NOV.2020 20:22:09

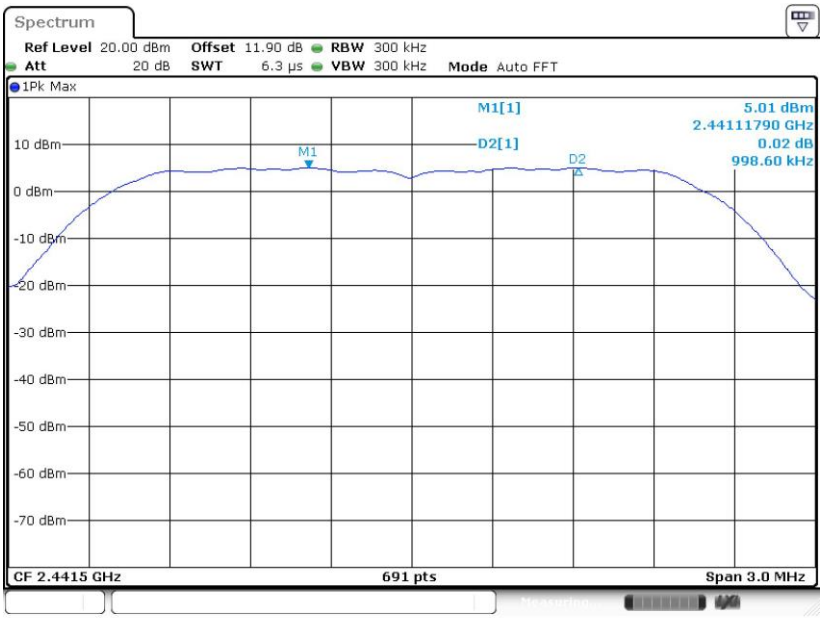
<2Mbps>

Channel Separation Plot on Channel 00 - 01



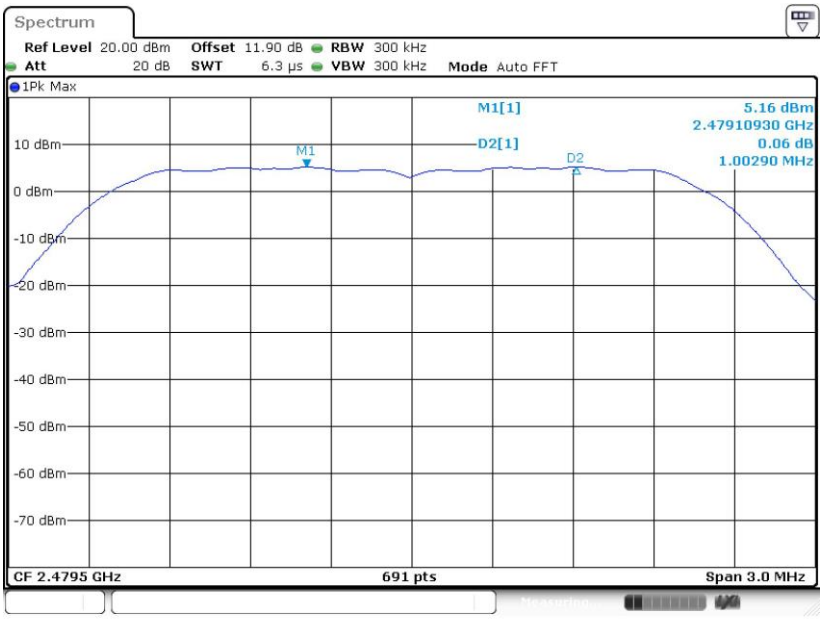
Date: 16.NOV.2020 20:24:01

Channel Separation Plot on Channel 39 - 40



Date: 16.NOV.2020 16:42:38

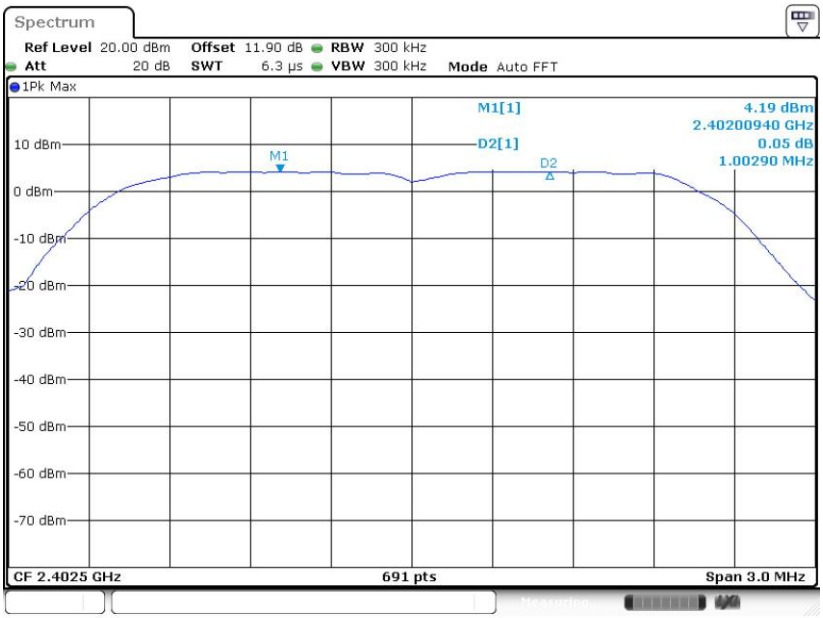
Channel Separation Plot on Channel 77 - 78



Date: 16.NOV.2020 17:11:12

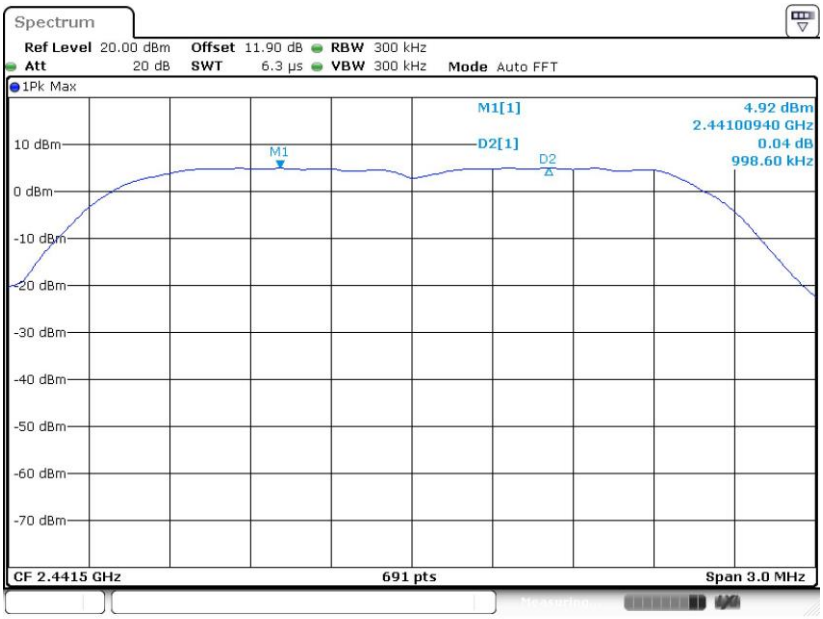
<3Mbps>

Channel Separation Plot on Channel 00 - 01



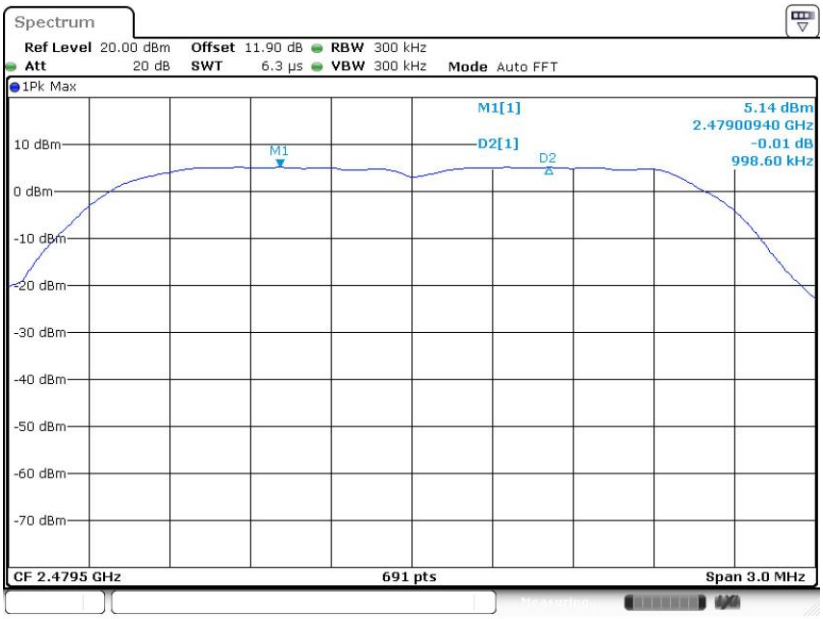
Date: 16.NOV.2020 17:17:57

Channel Separation Plot on Channel 39 - 40



Date: 16.NOV.2020 17:24:49

Channel Separation Plot on Channel 77 - 78



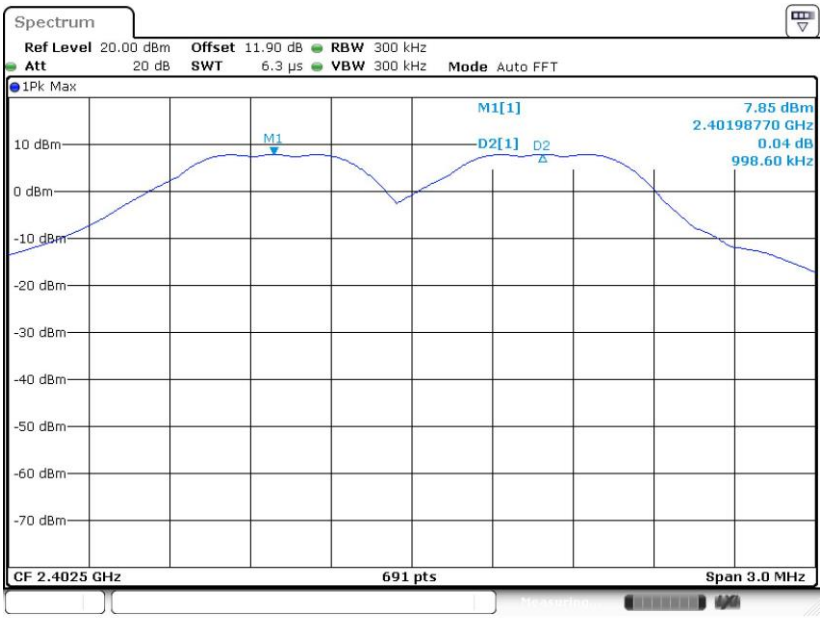
Date: 16.NOV.2020 17:50:47

<Aux. Antenna>

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.999	0.6908	Pass
DH	1Mbps	1	39	2441	1.003	0.6908	Pass
DH	1Mbps	1	78	2480	1.003	0.6908	Pass
2DH	2Mbps	1	0	2402	0.999	0.8915	Pass
2DH	2Mbps	1	39	2441	0.999	0.8943	Pass
2DH	2Mbps	1	78	2480	0.999	0.8943	Pass
3DH	3Mbps	1	0	2402	0.999	0.8567	Pass
3DH	3Mbps	1	39	2441	1.003	0.8567	Pass
3DH	3Mbps	1	78	2480	0.999	0.8539	Pass

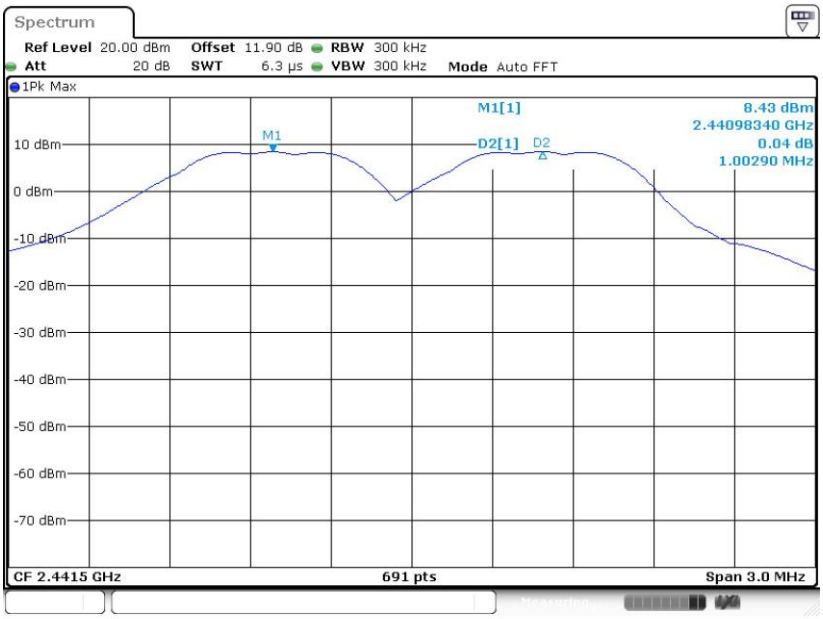
<1Mbps>

Channel Separation Plot on Channel 00 - 01



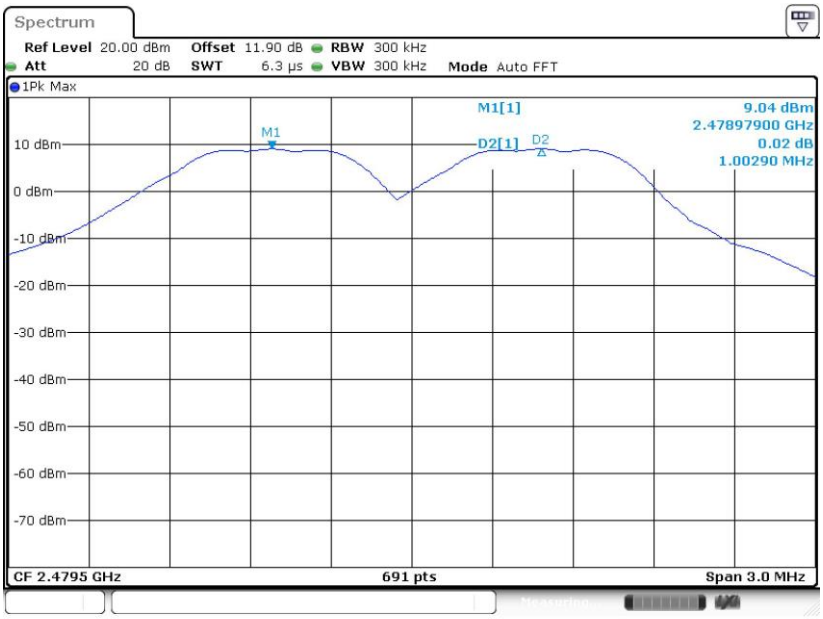
Date: 16.NOV.2020 18:14:14

Channel Separation Plot on Channel 39 - 40



Date: 16.NOV.2020 18:20:13

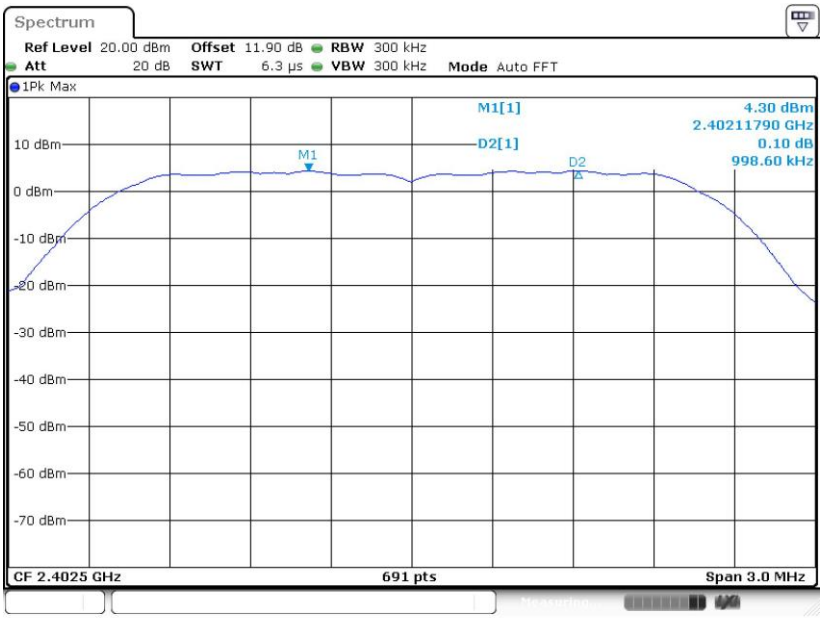
Channel Separation Plot on Channel 77 - 78



Date: 16.NOV.2020 18:29:14

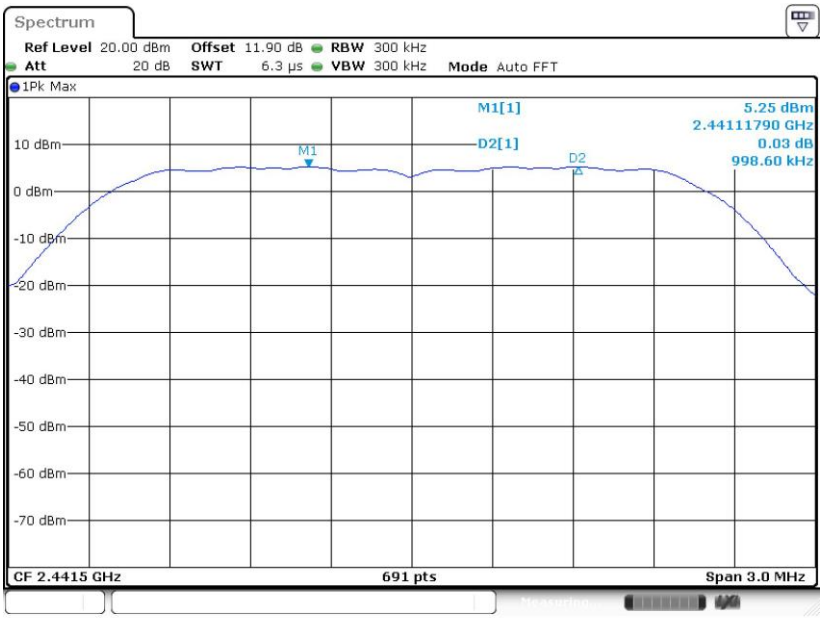
<2Mbps>

Channel Separation Plot on Channel 00 - 01



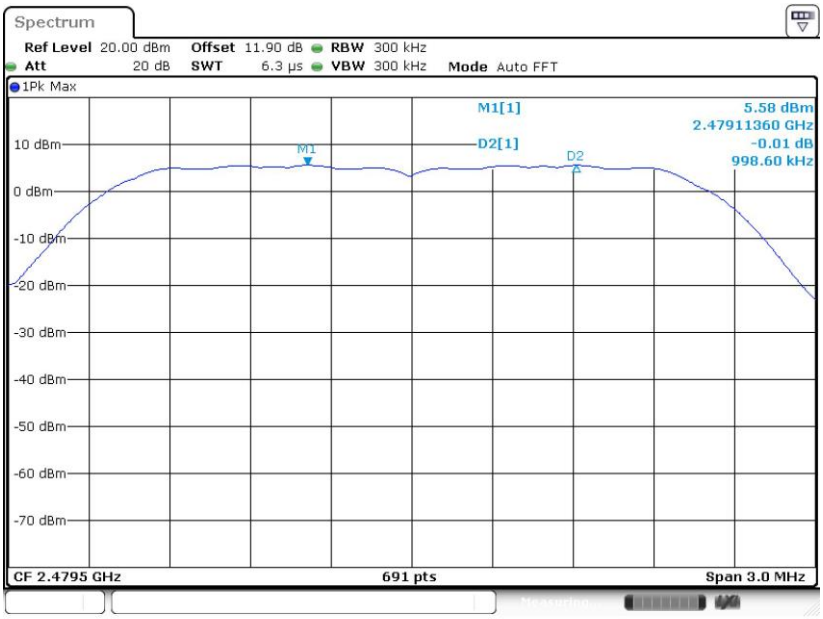
Date: 16.NOV.2020 18:37:19

Channel Separation Plot on Channel 39 - 40



Date: 16.NOV.2020 18:47:32

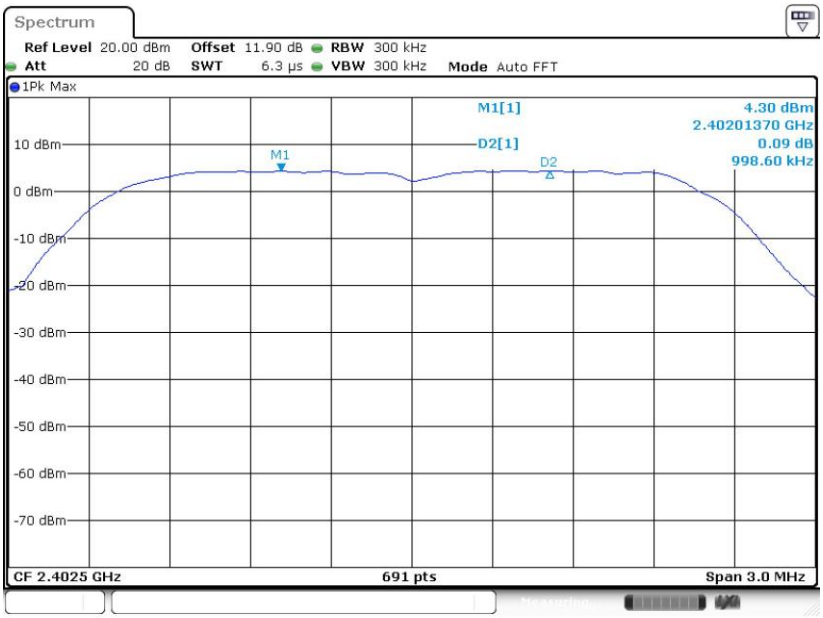
Channel Separation Plot on Channel 77 - 78



Date: 16.NOV.2020 19:35:56

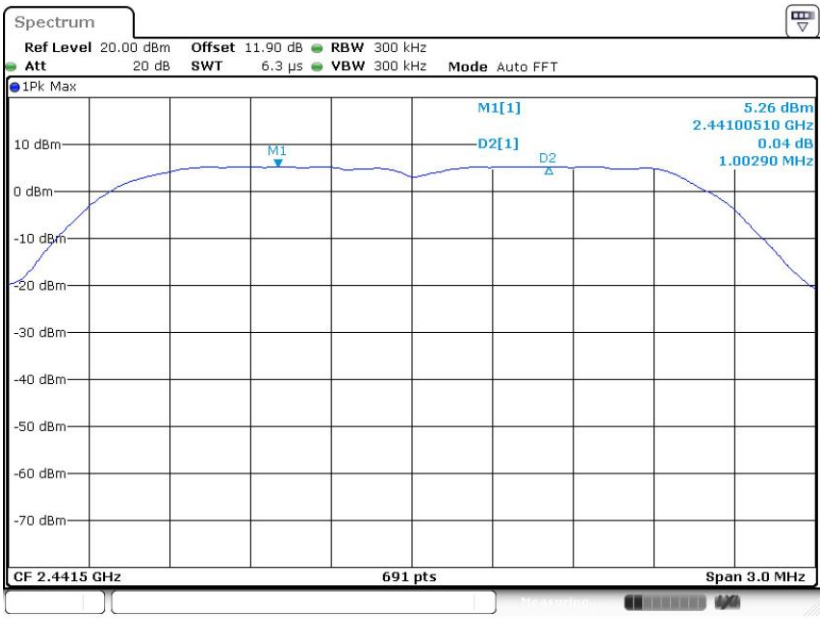
<3Mbps>

Channel Separation Plot on Channel 00 - 01



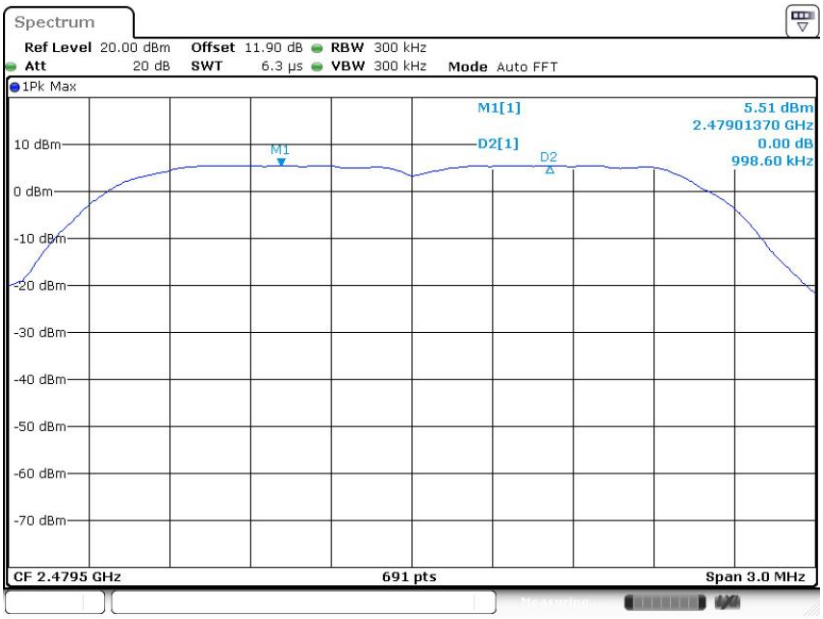
Date: 16.NOV.2020 19:48:12

Channel Separation Plot on Channel 39 - 40



Date: 16.NOV.2020 20:08:17

Channel Separation Plot on Channel 77 - 78



Date: 16.NOV.2020 20:14:40

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

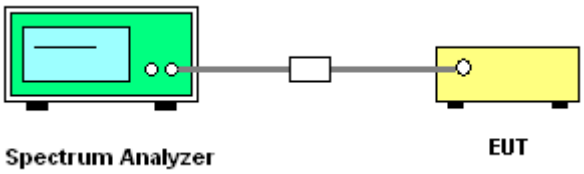
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.3.4 Test Setup

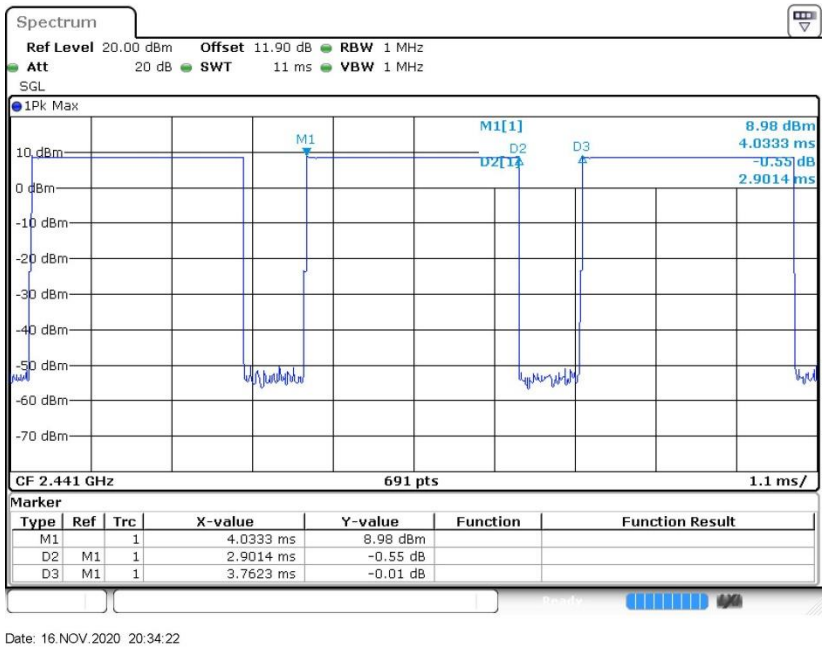


3.3.5 Test Result of Dwell Time

<Main Antenna>

Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Nomal	79	106.67	2.90	0.31	0.4	Pass
AFH	20	53.33	2.90	0.15	0.4	Pass

Package Transfer Time Plot



Remark:

1. In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels. With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.

2. In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels. With channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 x 20) (s), Hops Over Occupancy Time comes to (800 / 6 / 20) x (0.4 x 20) = 53.33 hops.

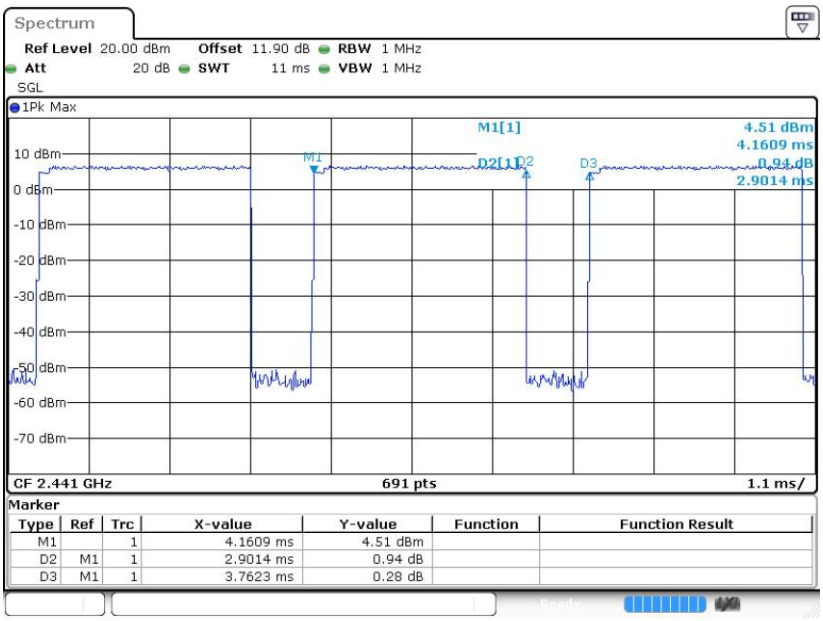
3. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

<Aux. Antenna>

Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Nomal	79	106.67	2.90	0.31	0.4	Pass
AFH	20	53.33	2.90	0.15	0.4	Pass

Package Transfer Time Plot

<Aux. Antenna>



Remark:

1. In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels. With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.

2. In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels. With channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 x 20) (s), Hops Over Occupancy Time comes to (800 / 6 / 20) x (0.4 x 20) = 53.33 hops.

3. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

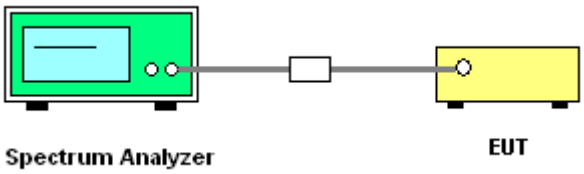
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
   Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
   Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
   RBW ≥ 1-5% of the 99% bandwidth; VBW ≥ 3 * RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
6. Measure and record the results in the test report.

3.4.4 Test Setup



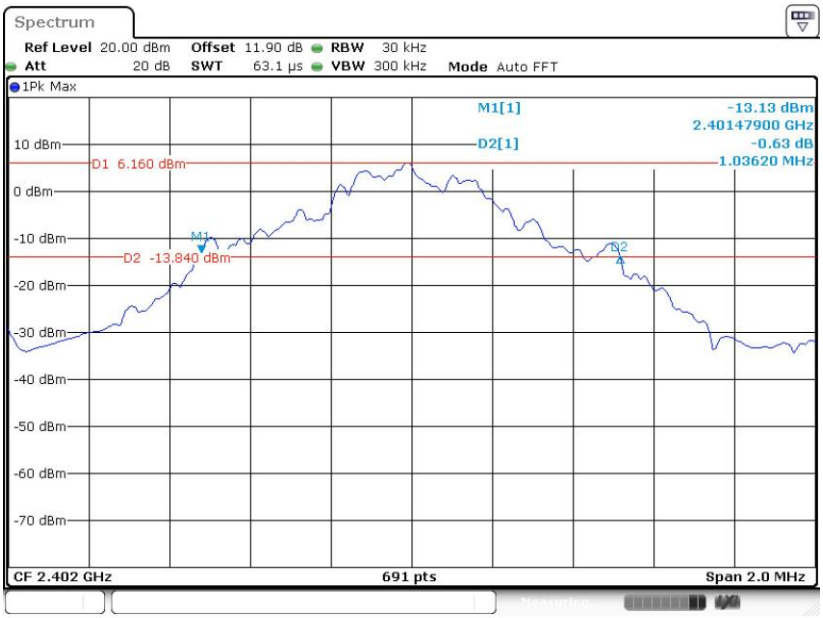
3.4.5 Test Result of 20dB Bandwidth

<Main Antenna>

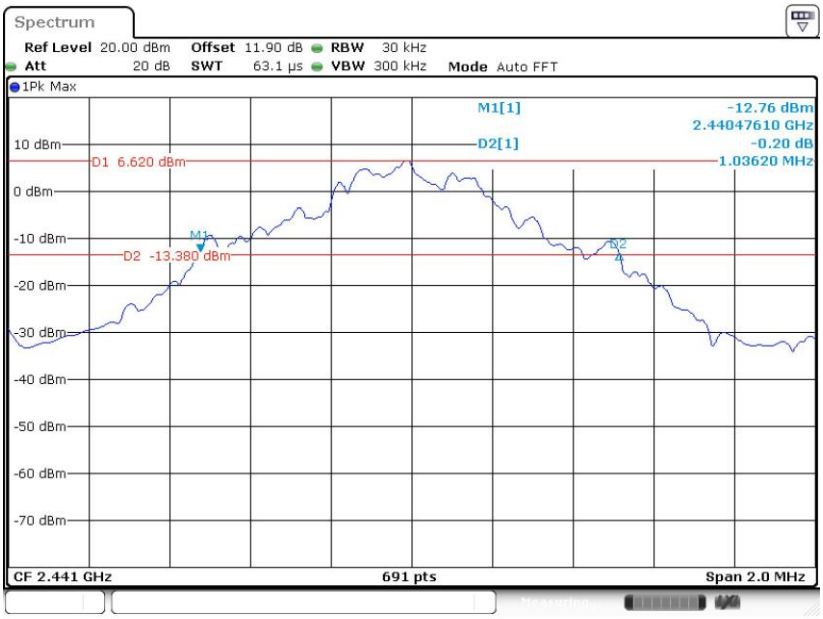
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	1.036	Pass
DH	1Mbps	1	39	2441	1.036	Pass
DH	1Mbps	1	78	2480	1.036	Pass
2DH	2Mbps	1	0	2402	1.337	Pass
2DH	2Mbps	1	39	2441	1.337	Pass
2DH	2Mbps	1	78	2480	1.337	Pass
3DH	3Mbps	1	0	2402	1.285	Pass
3DH	3Mbps	1	39	2441	1.289	Pass
3DH	3Mbps	1	78	2480	1.285	Pass

<1Mbps>

20 dB Bandwidth Plot on Channel 00

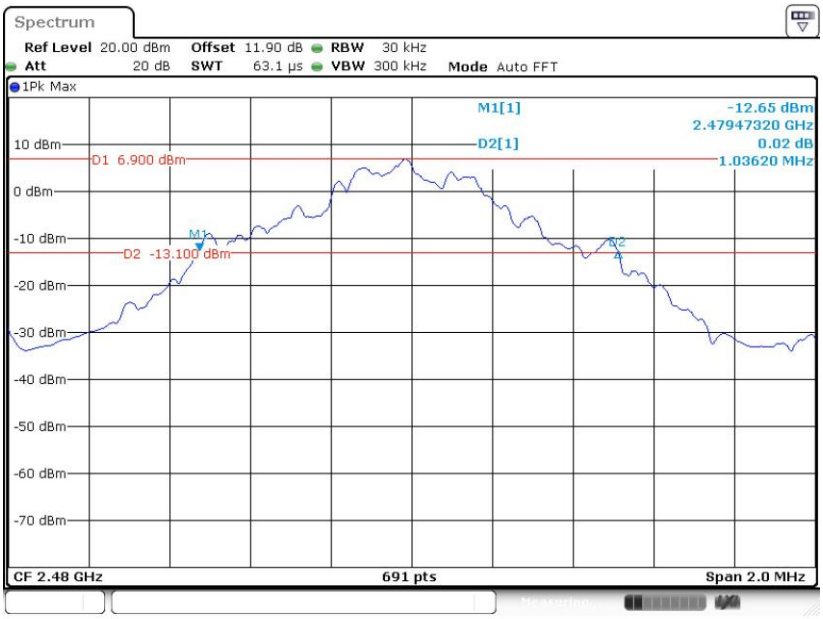


20 dB Bandwidth Plot on Channel 39



Date: 16.NOV.2020 15:53:46

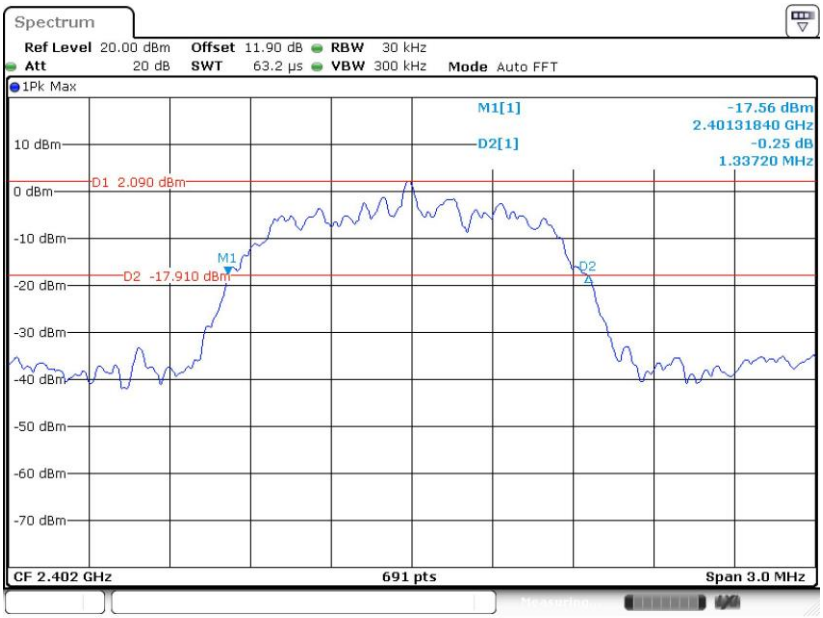
20 dB Bandwidth Plot on Channel 78



Date: 16.NOV.2020 16:04:39

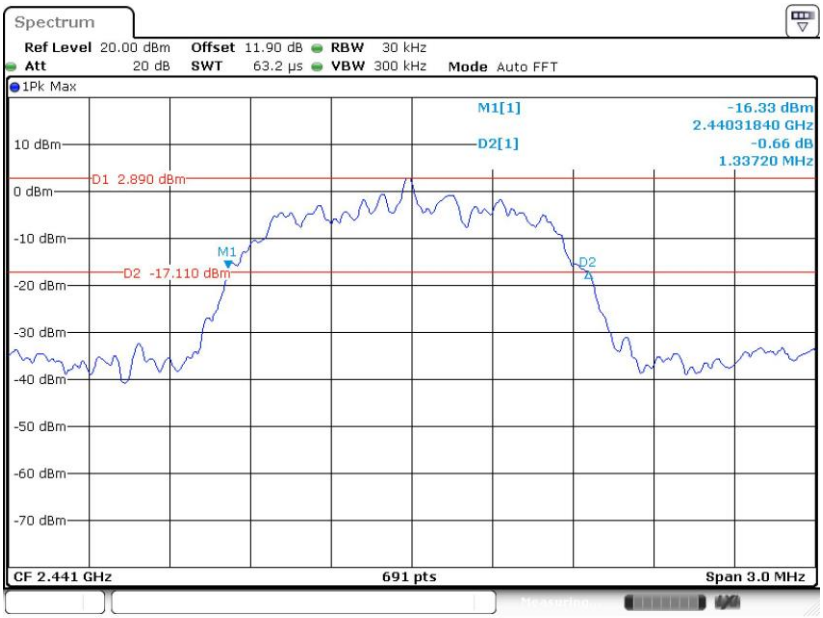
<2Mbps>

20 dB Bandwidth Plot on Channel 00



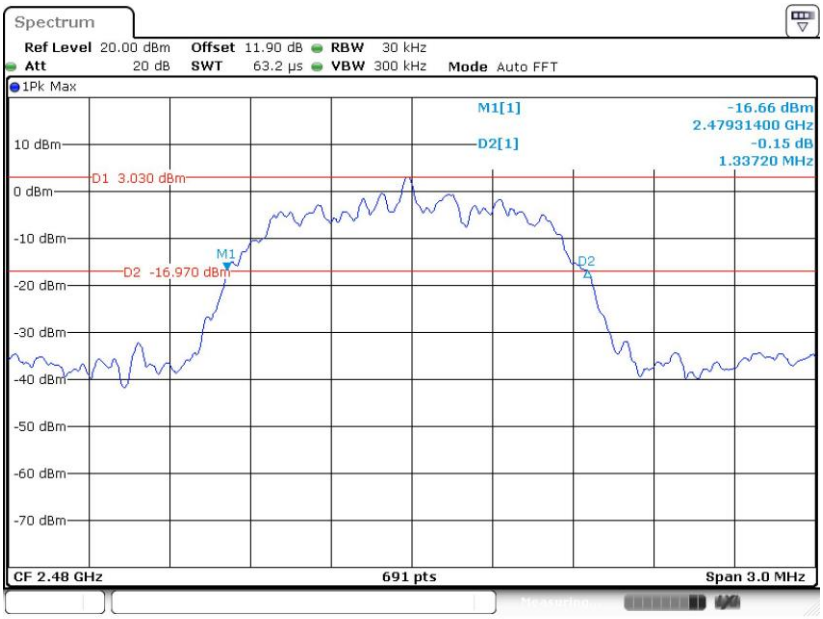
Date: 16.NOV.2020 16:13:02

20 dB Bandwidth Plot on Channel 39



Date: 16.NOV.2020 16:38:56

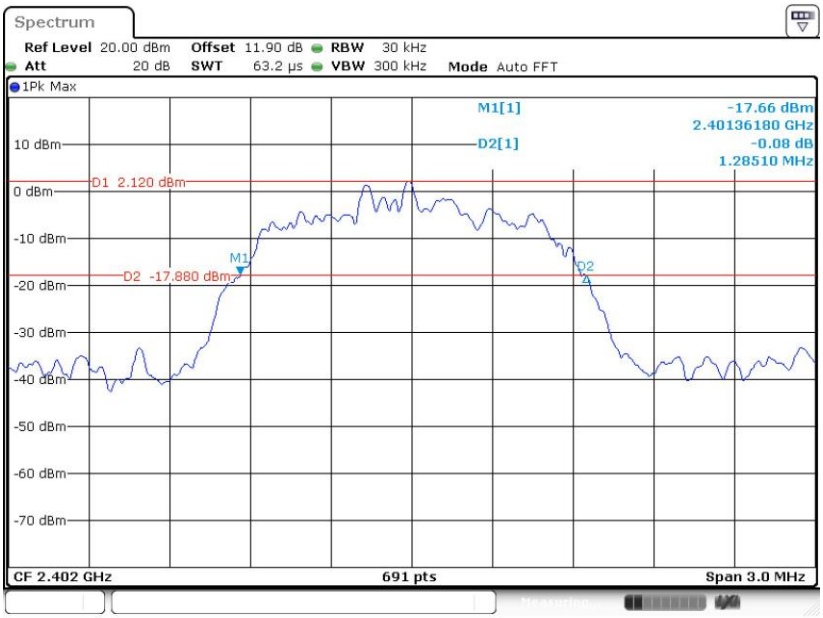
20 dB Bandwidth Plot on Channel 78



Date: 16.NOV.2020 16:44:46

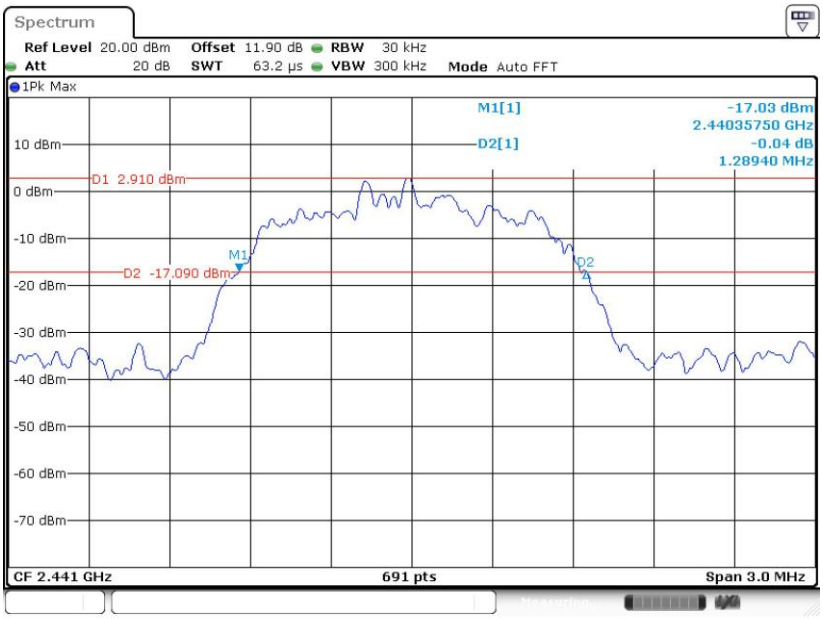
<3Mbps>

20 dB Bandwidth Plot on Channel 00



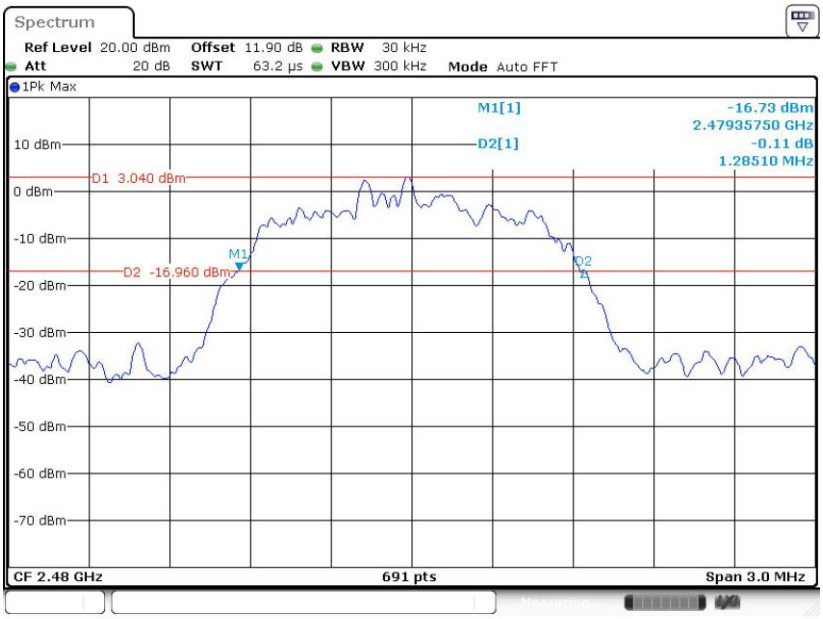
Date: 16.NOV.2020 17:13:51

20 dB Bandwidth Plot on Channel 39



Date: 16.NOV.2020 17:20:09

20 dB Bandwidth Plot on Channel 78



Date: 16.NOV.2020 17:35:03

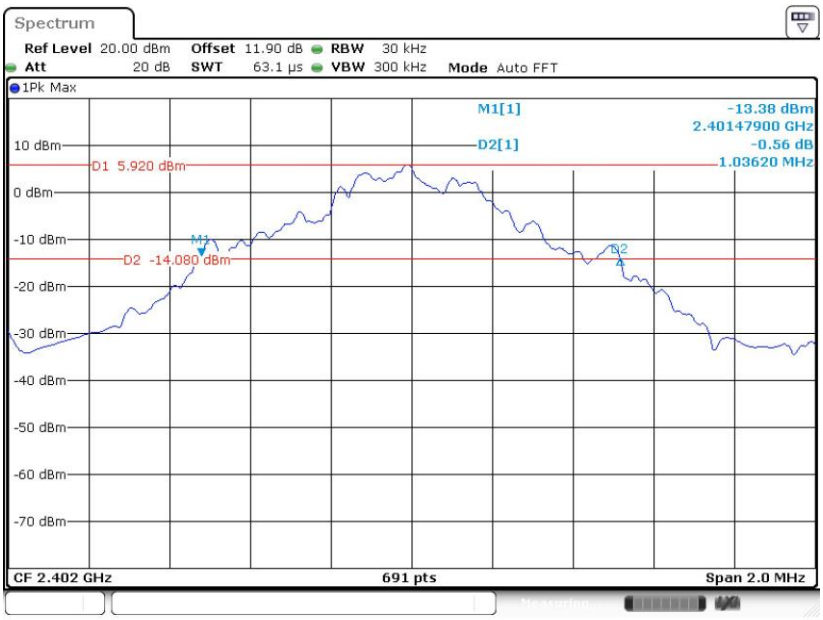
<Aux. Antenna>

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	1.036	Pass
DH	1Mbps	1	39	2441	1.036	Pass
DH	1Mbps	1	78	2480	1.036	Pass
2DH	2Mbps	1	0	2402	1.337	Pass
2DH	2Mbps	1	39	2441	1.342	Pass
2DH	2Mbps	1	78	2480	1.342	Pass
3DH	3Mbps	1	0	2402	1.285	Pass
3DH	3Mbps	1	39	2441	1.285	Pass
3DH	3Mbps	1	78	2480	1.281	Pass

<Aux. Antenna>

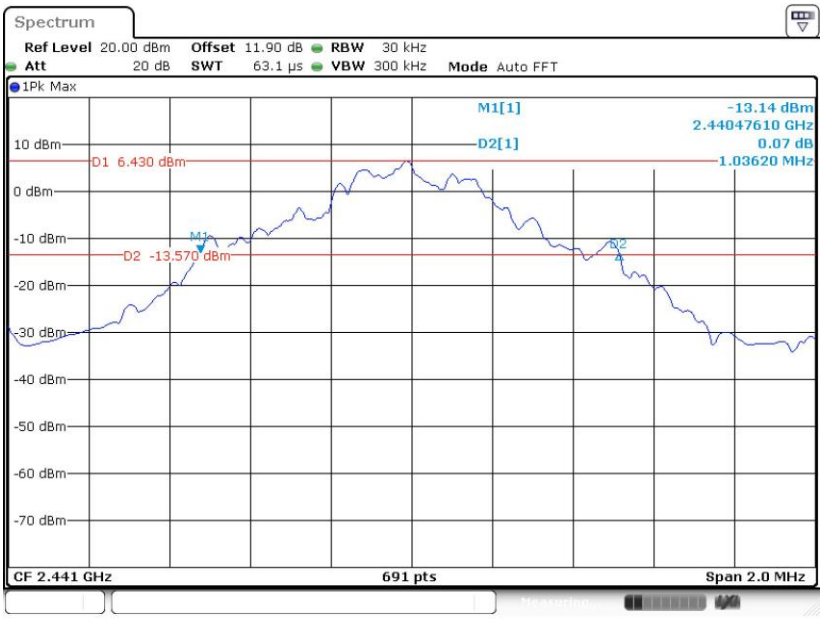
<1Mbps>

20 dB Bandwidth Plot on Channel 00



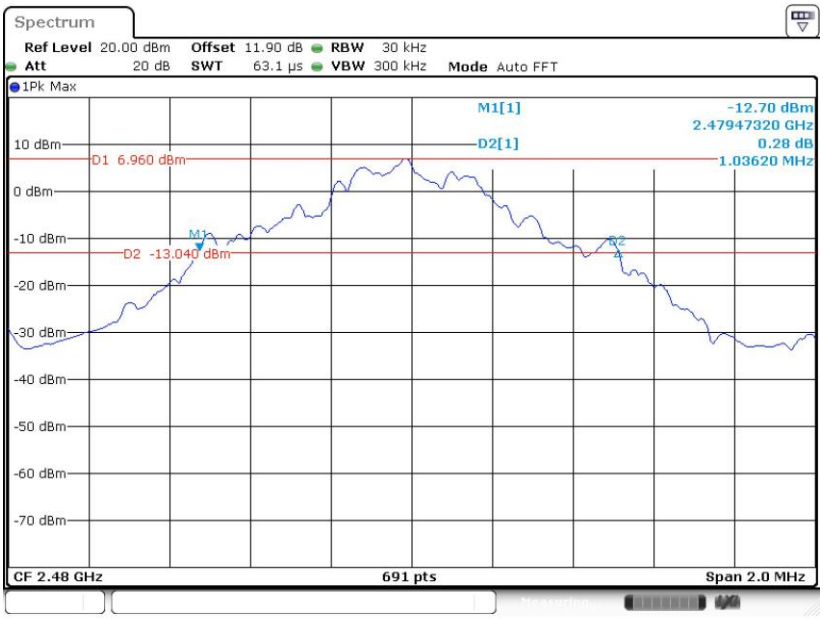
Date: 16.NOV.2020 18:09:16

20 dB Bandwidth Plot on Channel 39



Date: 16.NOV.2020 18:16:27

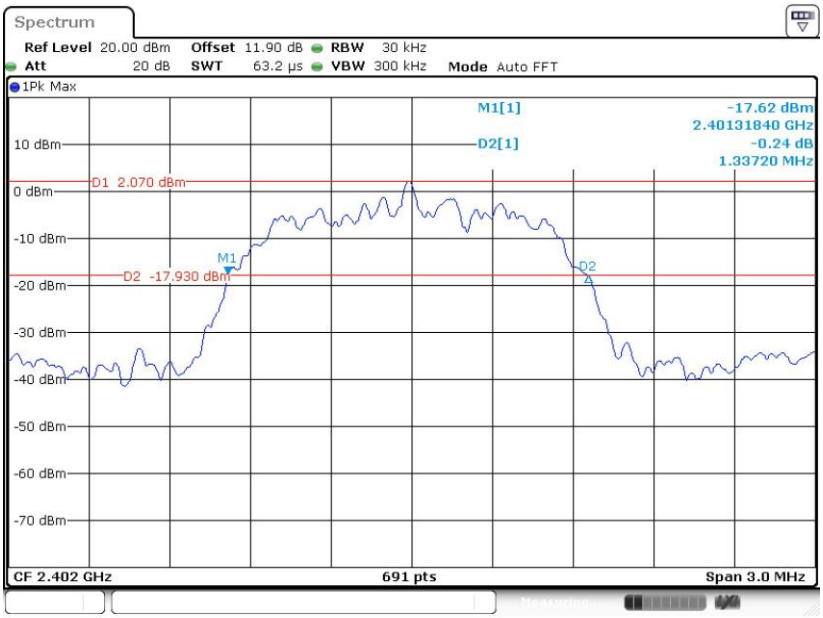
20 dB Bandwidth Plot on Channel 78



Date: 16.NOV.2020 18:24:38

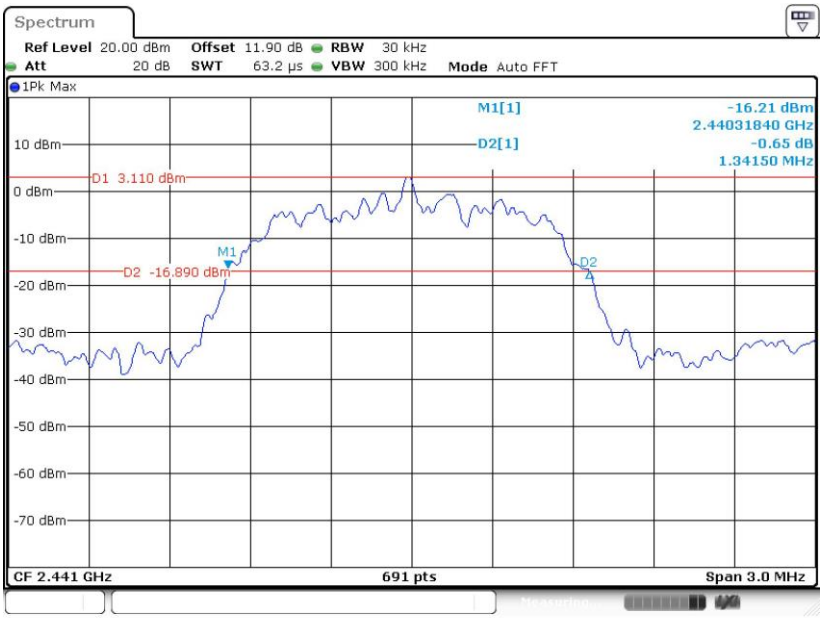
<2Mbps>

20 dB Bandwidth Plot on Channel 00



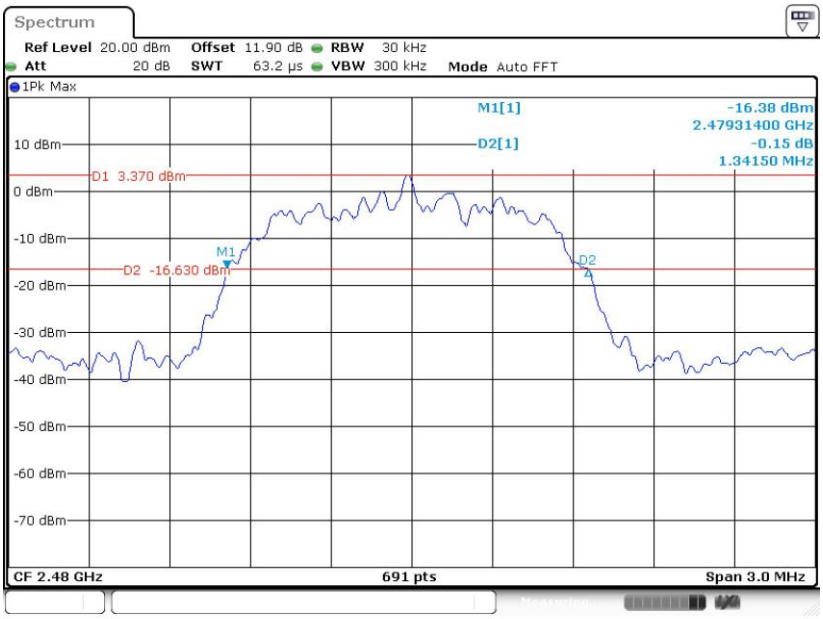
Date: 16.NOV.2020 18:32:07

20 dB Bandwidth Plot on Channel 39



Date: 16.NOV.2020 18:40:21

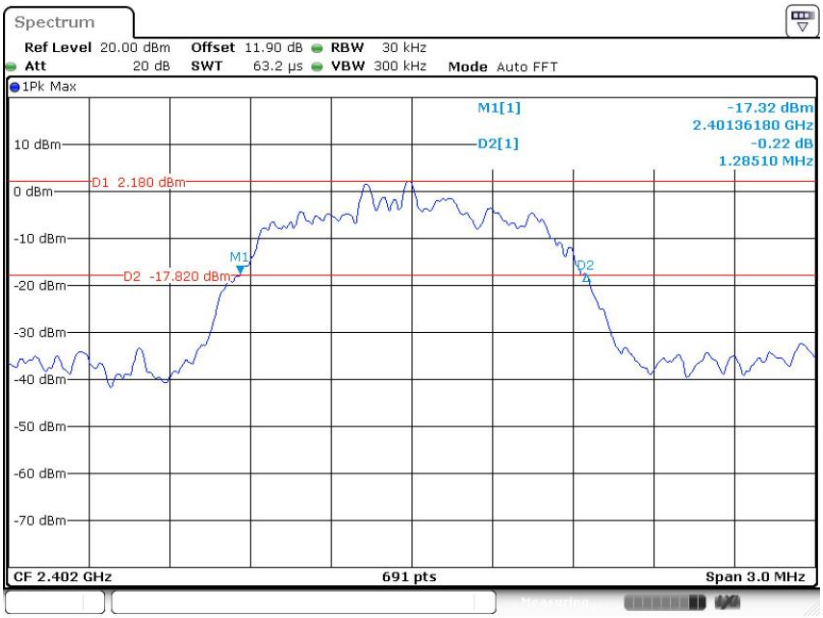
20 dB Bandwidth Plot on Channel 78



Date: 16.NOV.2020 19:30:19

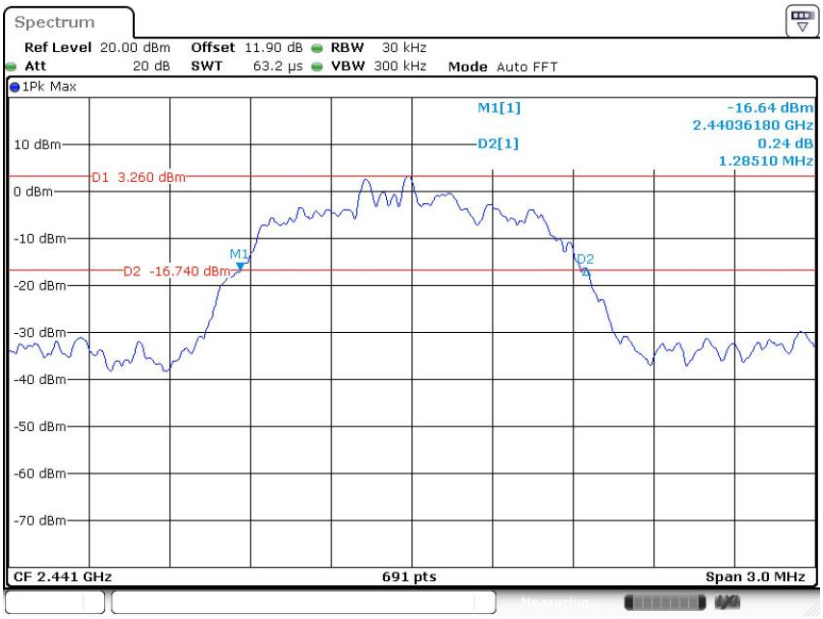
<3Mbps>

20 dB Bandwidth Plot on Channel 00



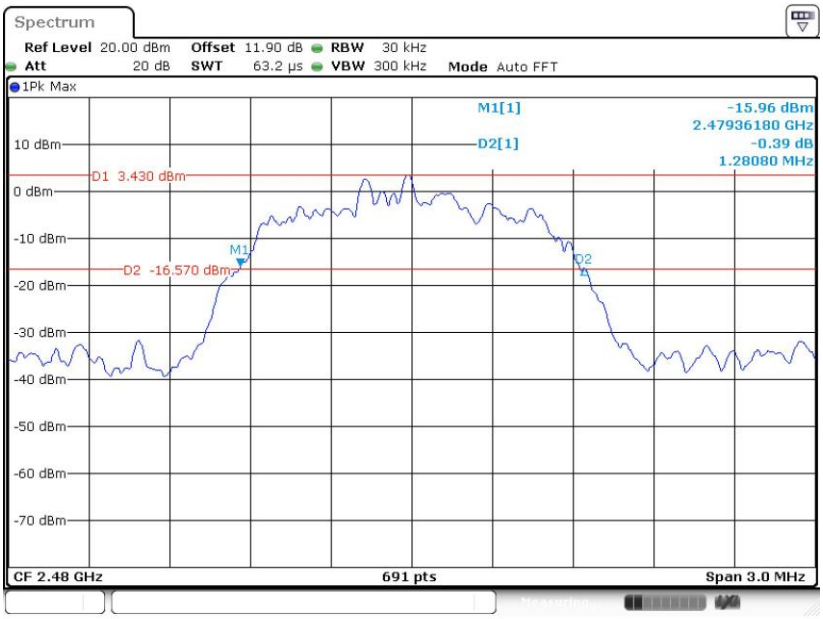
Date: 16.NOV.2020 19:39:19

20 dB Bandwidth Plot on Channel 39



Date: 16.NOV.2020 19:51:04

20 dB Bandwidth Plot on Channel 78



Date: 16.NOV.2020 20:10:11

3.4.6 Test Result of 99% Occupied Bandwidth

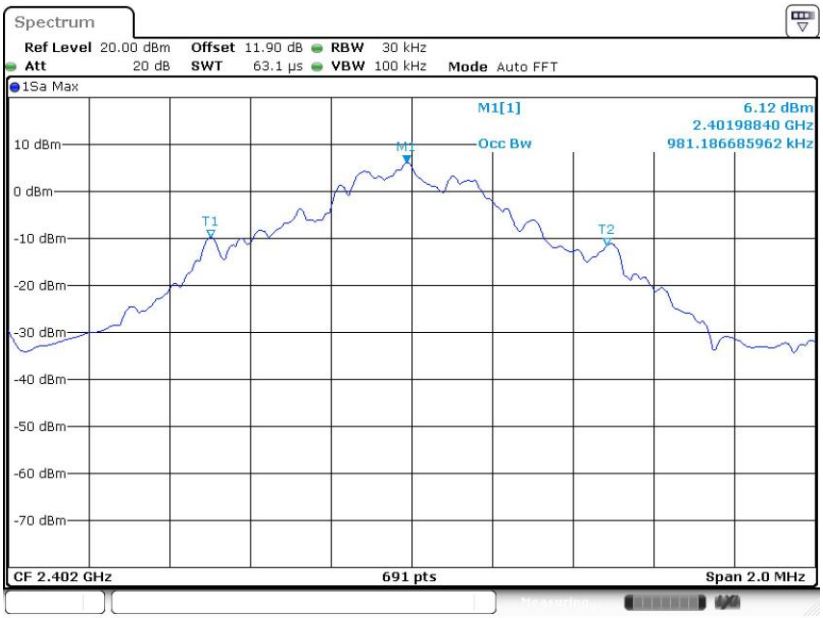
<Main Antenna>

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.981	Pass
DH	1Mbps	1	39	2441	0.984	Pass
DH	1Mbps	1	78	2480	0.981	Pass
2DH	2Mbps	1	0	2402	1.204	Pass
2DH	2Mbps	1	39	2441	1.204	Pass
2DH	2Mbps	1	78	2480	1.207	Pass
3DH	3Mbps	1	0	2402	1.178	Pass
3DH	3Mbps	1	39	2441	1.181	Pass
3DH	3Mbps	1	78	2480	1.181	Pass

<Main Antenna>

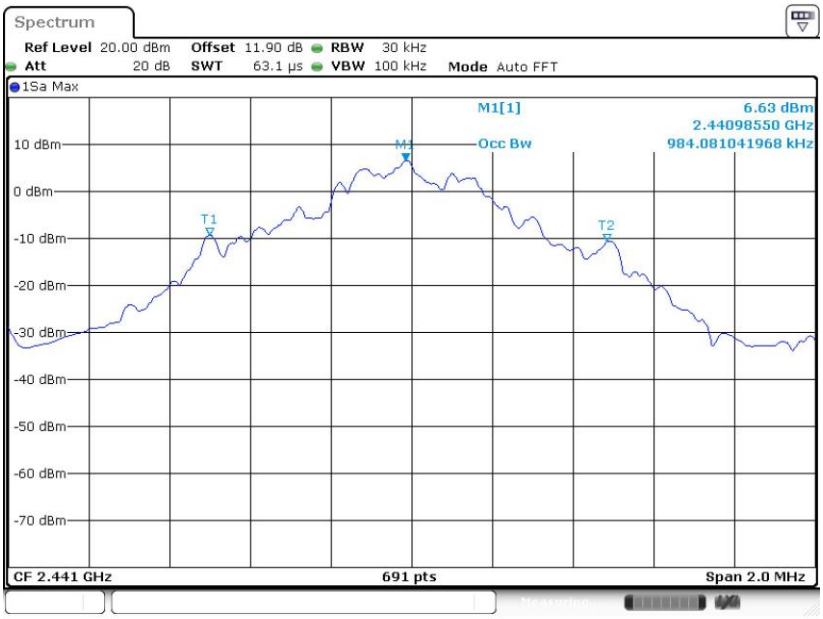
<1Mbps>

99% Occupied Bandwidth Plot on Channel 00



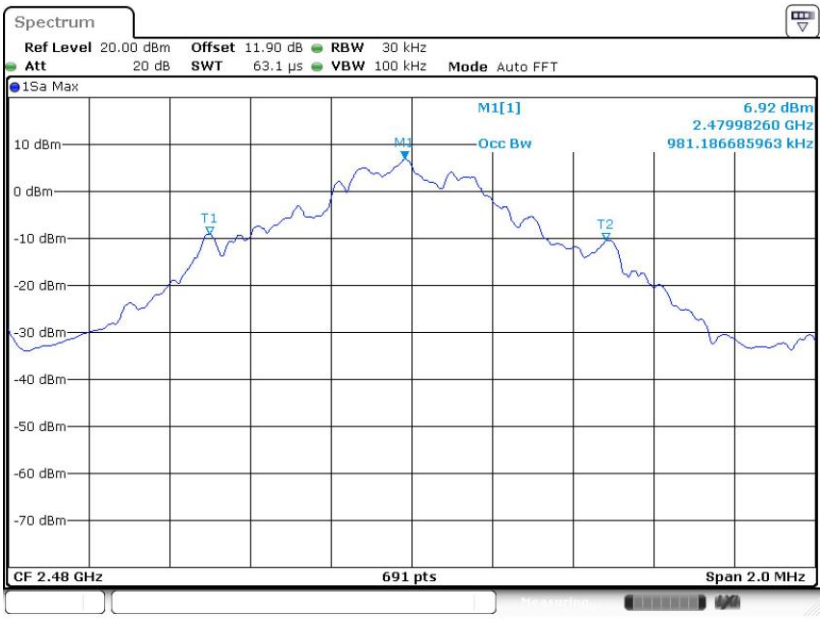
Date: 16.NOV.2020 16:02:35

99% Occupied Bandwidth Plot on Channel 39



Date: 16.NOV.2020 15:54:52

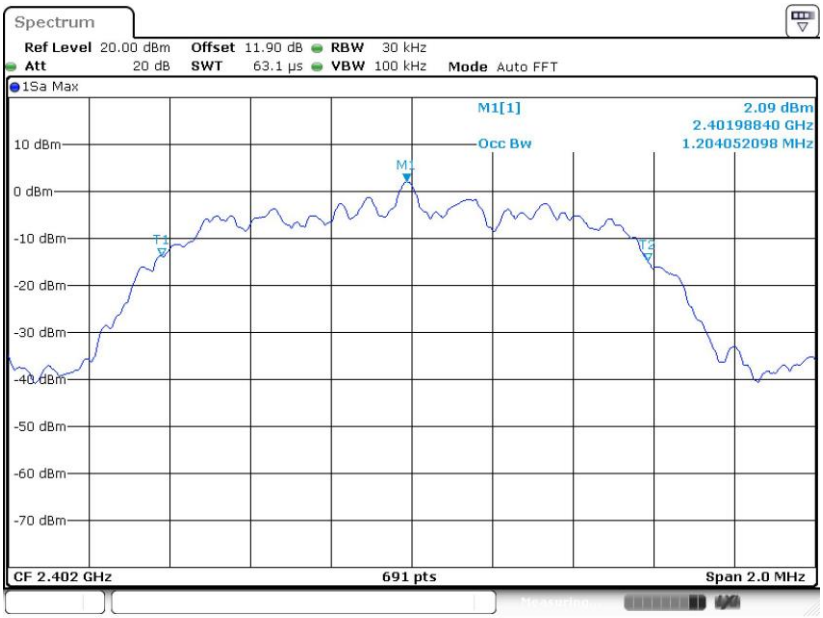
99% Occupied Bandwidth Plot on Channel 78



Date: 16.NOV.2020 16:06:25

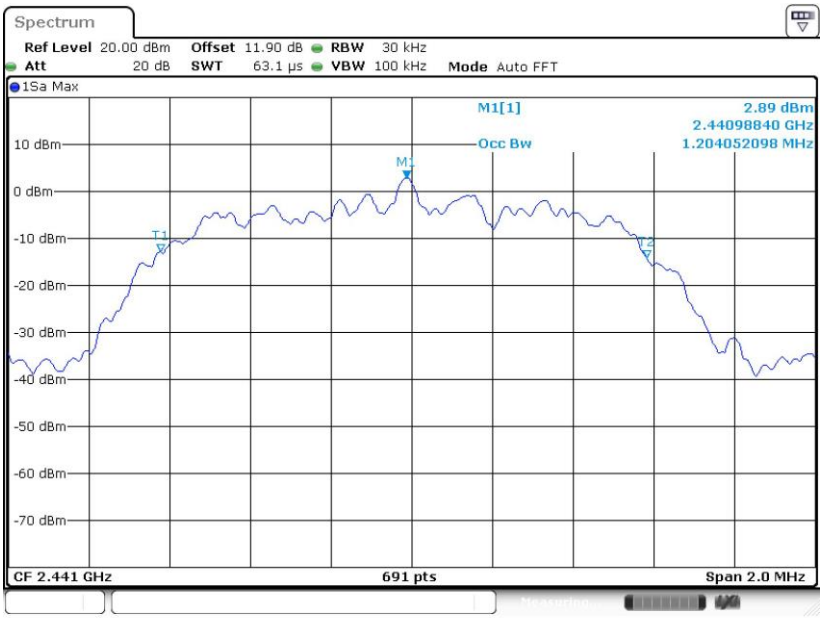
<2Mbps>

99% Occupied Bandwidth Plot on Channel 00



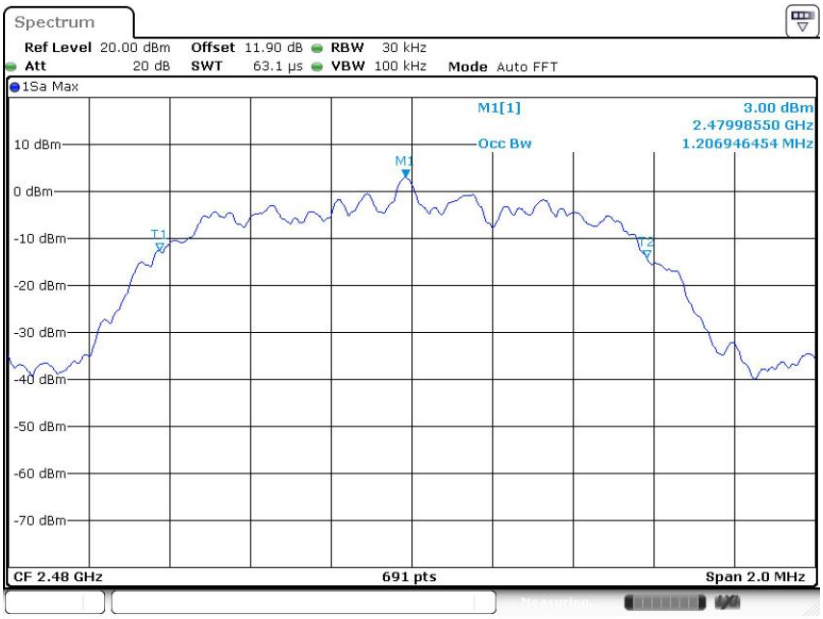
Date: 16.NOV.2020 16:14:30

99% Occupied Bandwidth Plot on Channel 39



Date: 16.NOV.2020 16:39:52

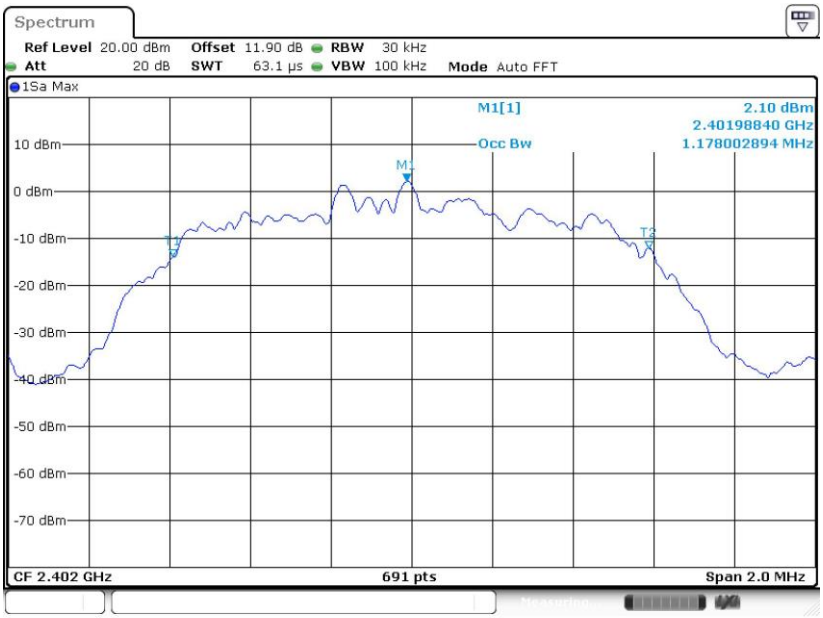
99% Occupied Bandwidth Plot on Channel 78



Date: 16.NOV.2020 16:46:08

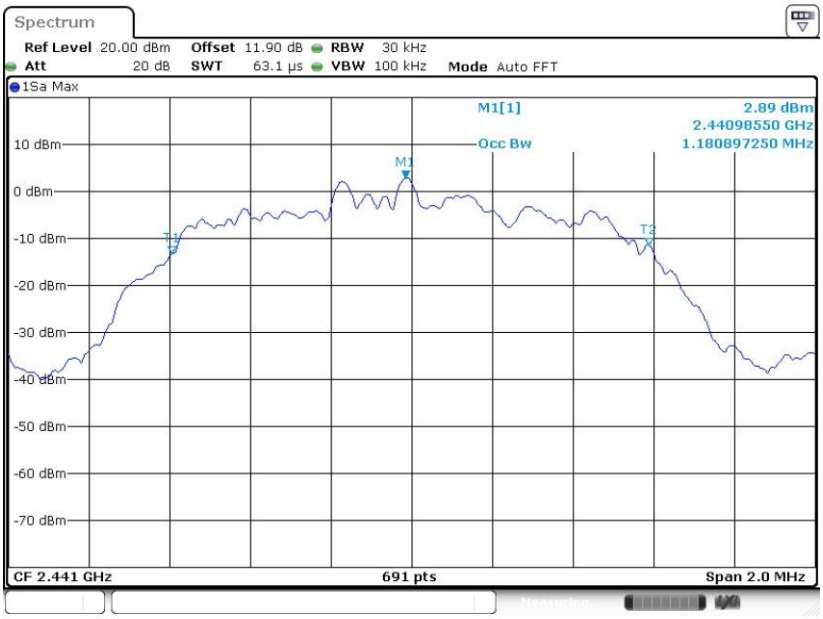
<3Mbps>

99% Occupied Bandwidth Plot on Channel 00



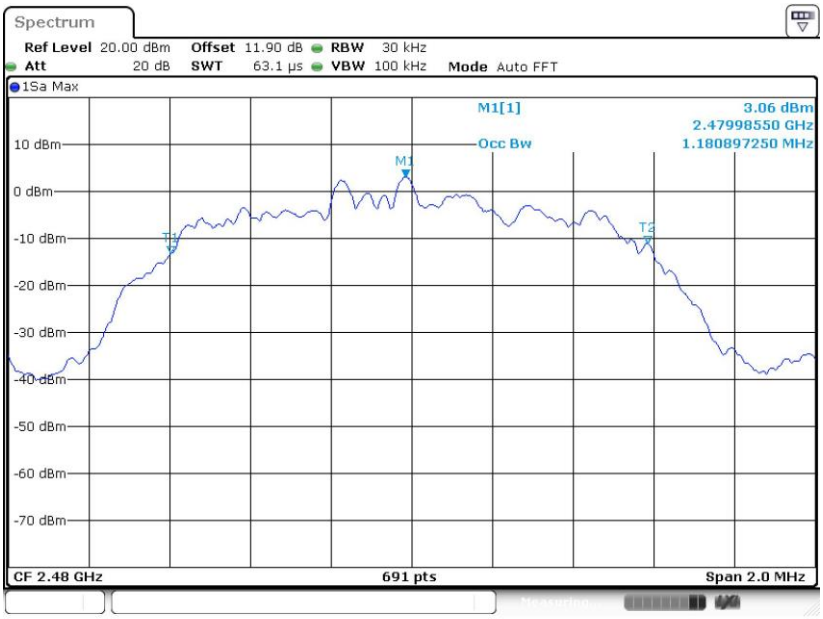
Date: 16.NOV.2020 17:15:29

99% Occupied Bandwidth Plot on Channel 39



Date: 16.NOV.2020 17:21:05

99% Occupied Bandwidth Plot on Channel 78



Date: 16.NOV.2020 17:36:25

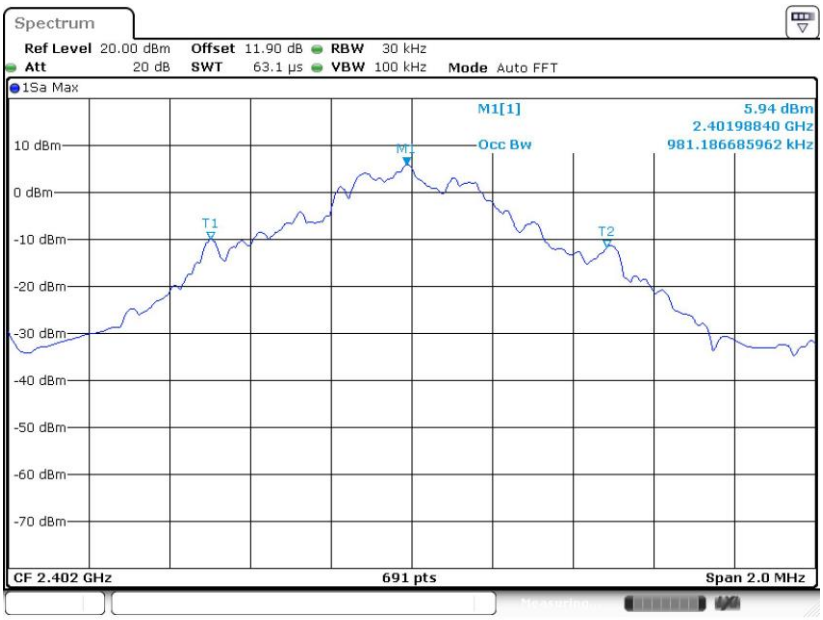
<Aux. Antenna>

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.981	Pass
DH	1Mbps	1	39	2441	0.981	Pass
DH	1Mbps	1	78	2480	0.981	Pass
2DH	2Mbps	1	0	2402	1.204	Pass
2DH	2Mbps	1	39	2441	1.207	Pass
2DH	2Mbps	1	78	2480	1.207	Pass
3DH	3Mbps	1	0	2402	1.178	Pass
3DH	3Mbps	1	39	2441	1.181	Pass
3DH	3Mbps	1	78	2480	1.181	Pass

<Aux. Antenna>

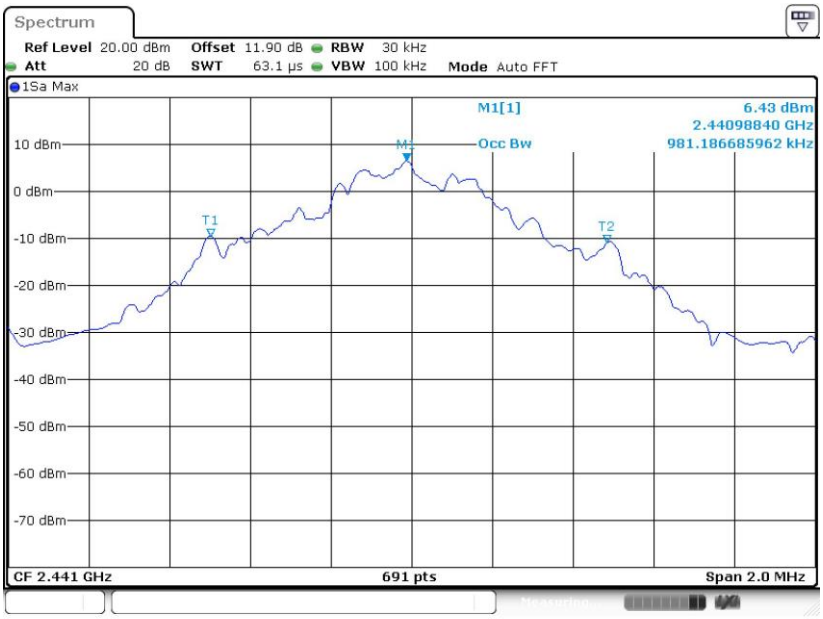
<1Mbps>

99% Occupied Bandwidth Plot on Channel 00



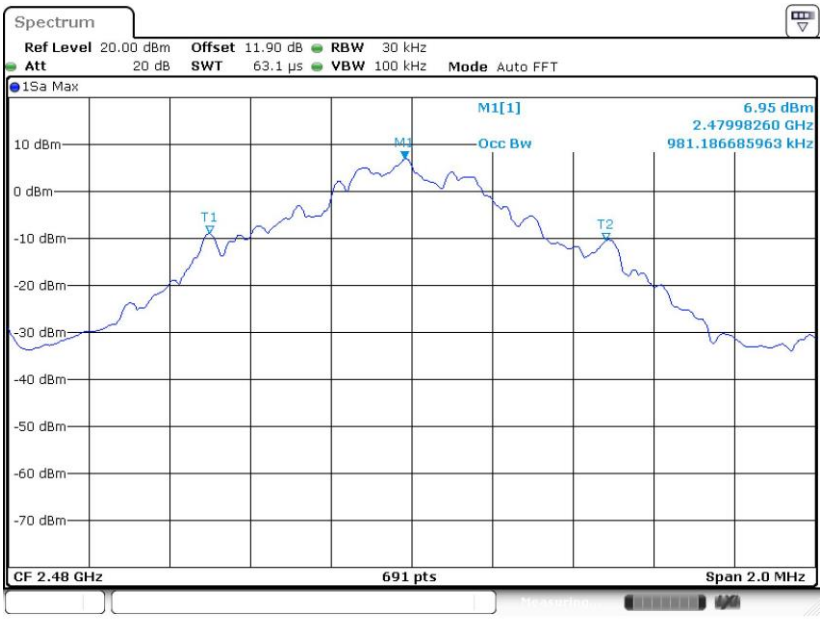
Date: 16.NOV.2020 18:11:25

99% Occupied Bandwidth Plot on Channel 39



Date: 16.NOV.2020 18:17:22

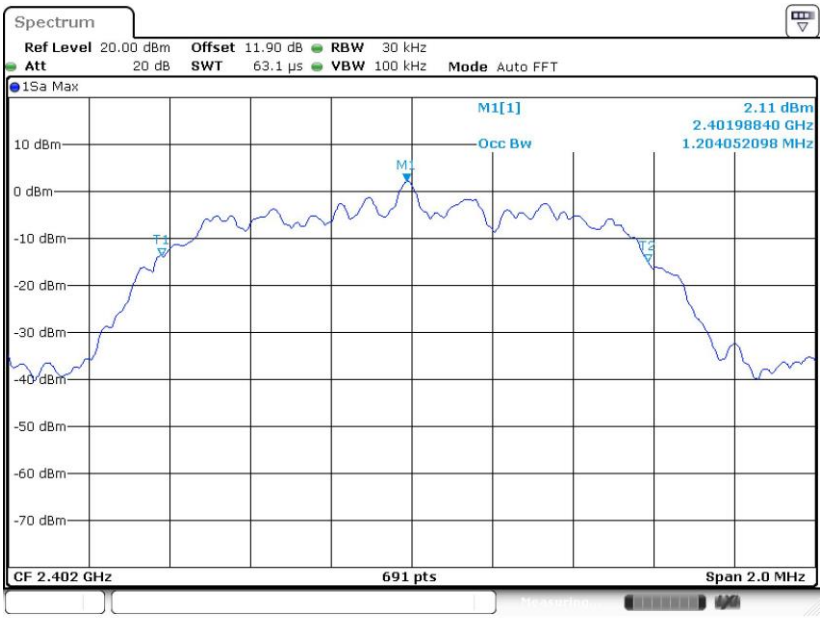
99% Occupied Bandwidth Plot on Channel 78



Date: 16.NOV.2020 18:26:25

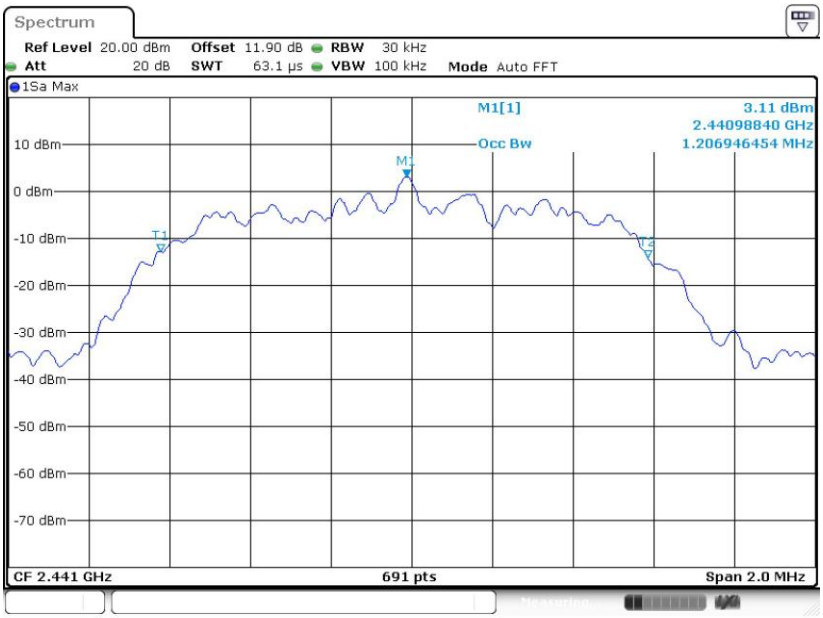
<2Mbps>

99% Occupied Bandwidth Plot on Channel 00



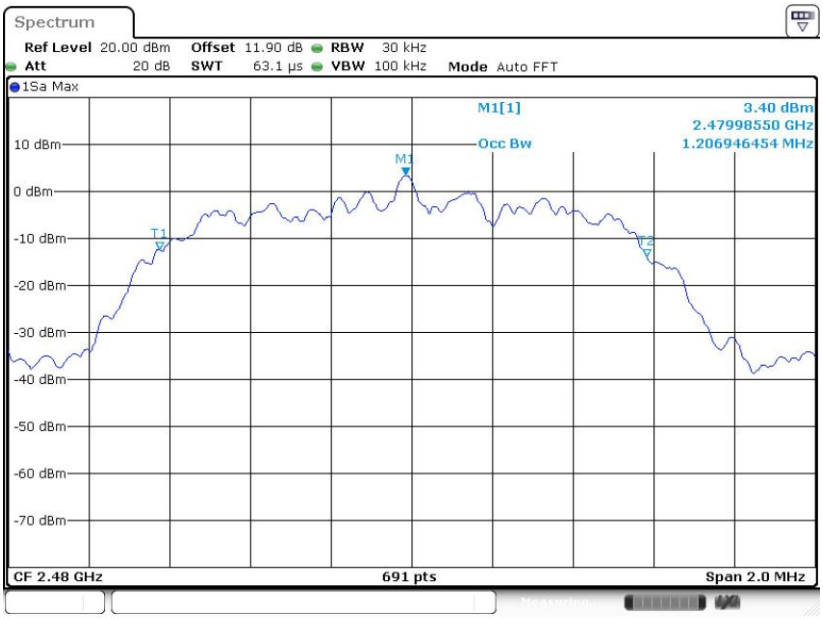
Date: 16.NOV.2020 18:33:37

99% Occupied Bandwidth Plot on Channel 39



Date: 16.NOV.2020 18:41:19

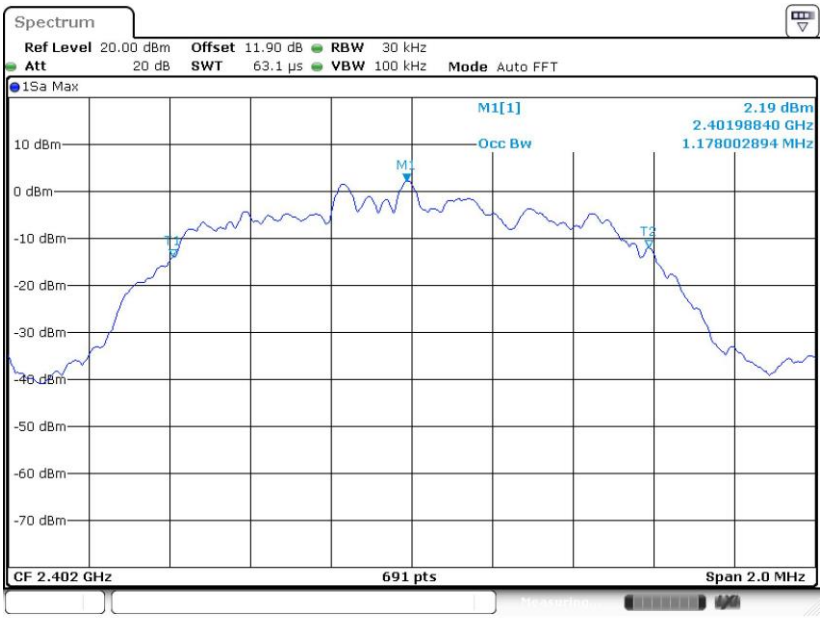
99% Occupied Bandwidth Plot on Channel 78



Date: 16.NOV.2020 19:31:55

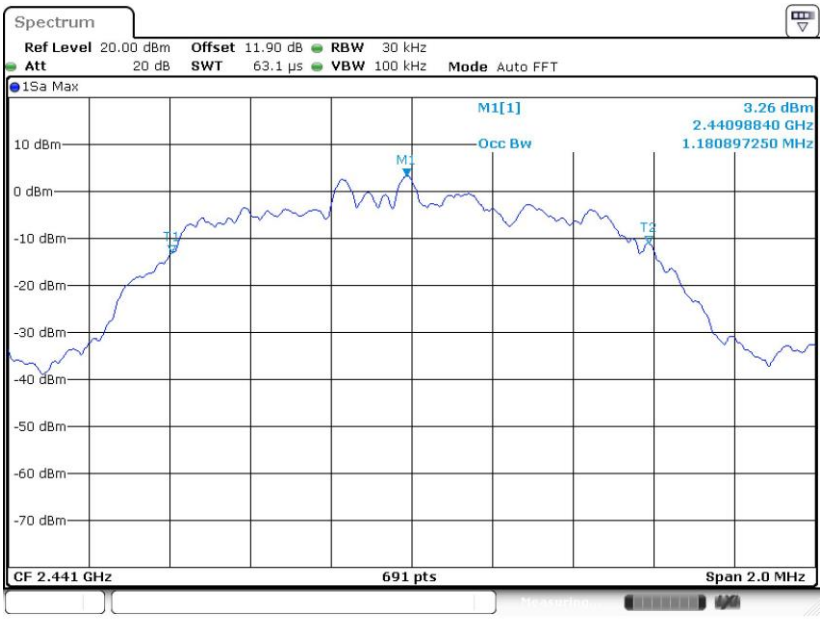
<3Mbps>

99% Occupied Bandwidth Plot on Channel 00



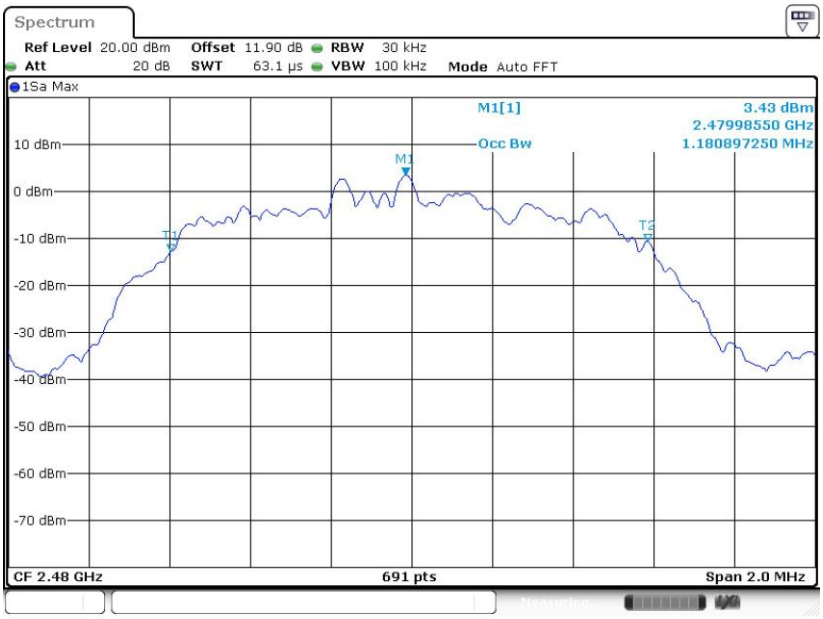
Date: 16.NOV.2020 19:40:40

99% Occupied Bandwidth Plot on Channel 39



Date: 16.NOV.2020 19:52:28

99% Occupied Bandwidth Plot on Channel 78



Date: 16.NOV.2020 20:11:34

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.5 Output Power Measurement

3.5.1 Limit of Output Power

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

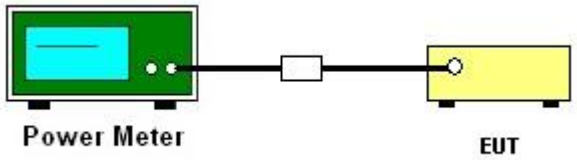
3.5.2 Measuring Instruments

See list of measuring equipment of this test report.

3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.5.4 Test Setup



3.5.5 Test Result of Peak Output Power

<Main Antenna>

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
DH1	0	1	8.48	30.00	Pass
	39	1	9.11	30.00	Pass
	78	1	**9.27**	30.00	Pass
2DH1	0	1	6.55	20.97	Pass
	39	1	7.07	20.97	Pass
	78	1	**7.10**	20.97	Pass
3DH1	0	1	6.70	20.97	Pass
	39	1	7.15	20.97	Pass
	78	1	**7.35**	20.97	Pass

<Aux. Antenna>

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
DH1	0	1	8.23	30.00	Pass
	39	1	8.81	30.00	Pass
	78	1	**9.20**	30.00	Pass
2DH1	0	1	6.29	20.97	Pass
	39	1	6.97	20.97	Pass
	78	1	**7.13**	20.97	Pass
3DH1	0	1	6.60	20.97	Pass
	39	1	7.23	20.97	Pass
	78	1	**7.29**	20.97	Pass

3.5.6 Test Result of Average Output Power (Reporting Only)

<Main Antenna>

DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
DH1	0	1	8.32	5.15
	39	1	8.60	5.15
	78	1	**8.94**	5.15
2DH1	0	1	4.49	5.08
	39	1	5.09	5.08
	78	1	**5.20**	5.08
3DH1	0	1	4.38	5.02
	39	1	4.64	5.02
	78	1	**5.05**	5.02

<Aux. Antenna>

DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
DH1	0	1	7.70	5.15
	39	1	8.42	5.15
	78	1	**8.82**	5.15
2DH1	0	1	3.81	5.08
	39	1	5.16	5.08
	78	1	**5.23**	5.08
3DH1	0	1	4.20	5.08
	39	1	4.55	5.08
	78	1	**5.22**	5.08

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

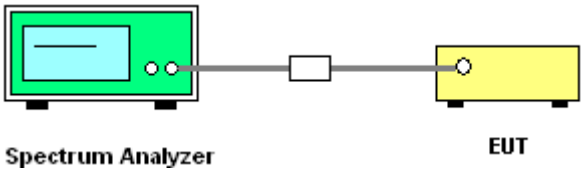
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

3.6.4 Test Setup

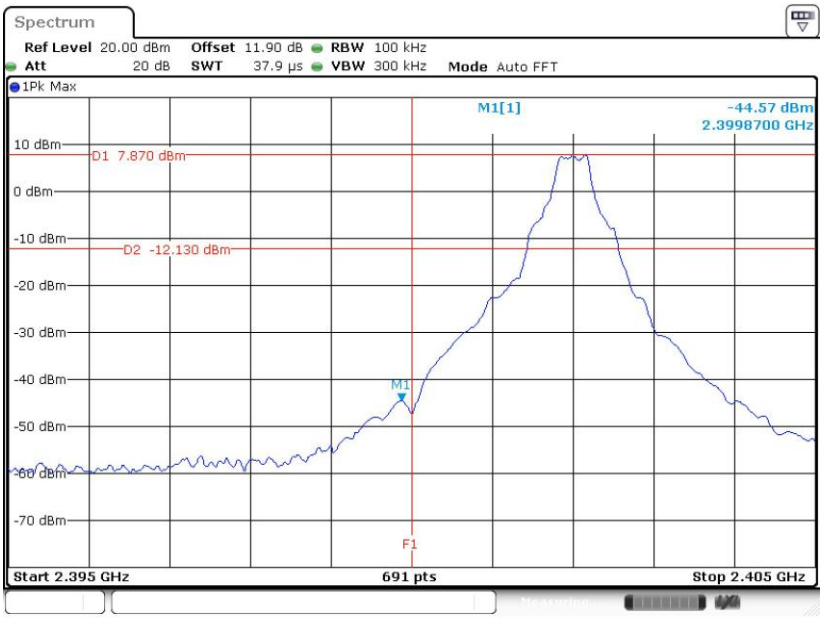


3.6.5 Test Result of Conducted Band Edges

<Main Antenna>

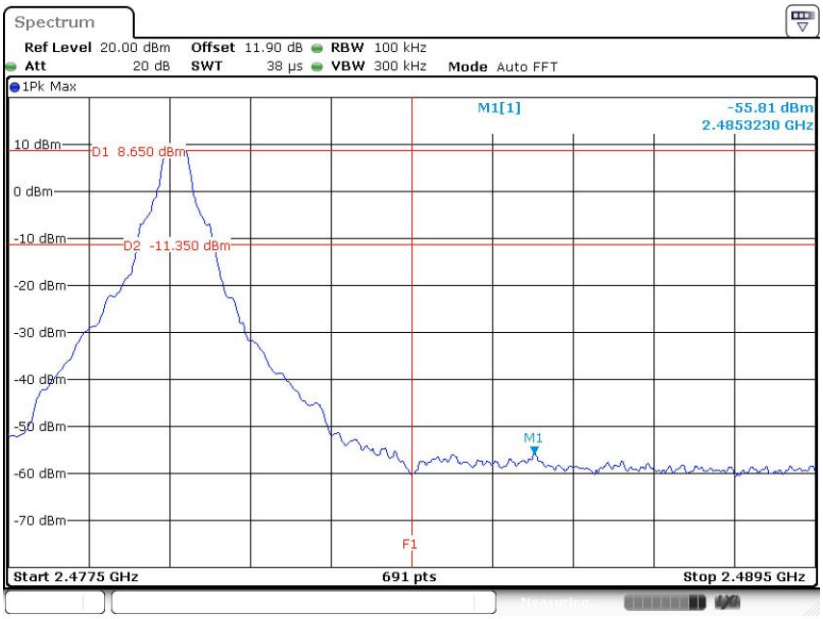
<1Mbps>

Low Band Edge Plot on Channel 00



Date: 16.NOV.2020 15:30:34

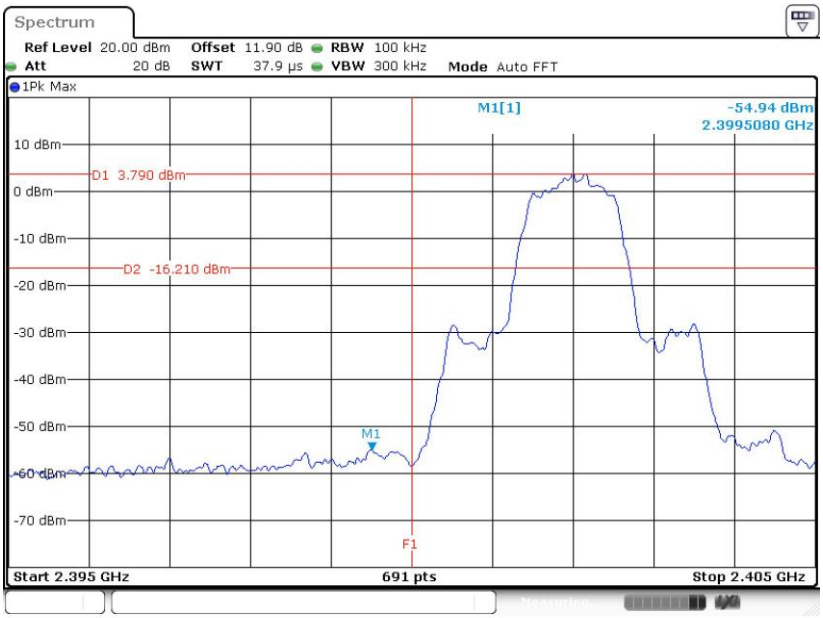
High Band Edge Plot on Channel 78



Date: 16.NOV.2020 16:05:24

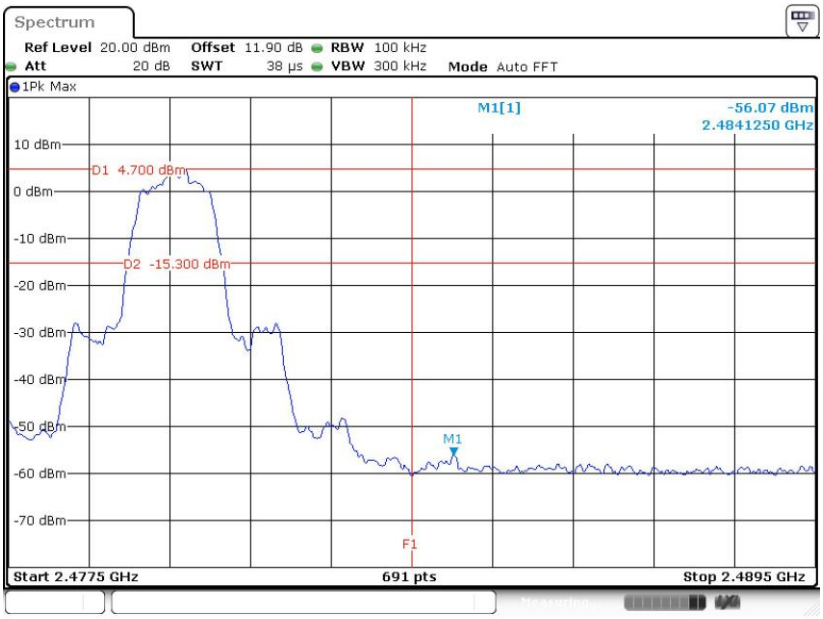
<2Mbps>

Low Band Edge Plot on Channel 00



Date: 16.NOV.2020 16:13:47

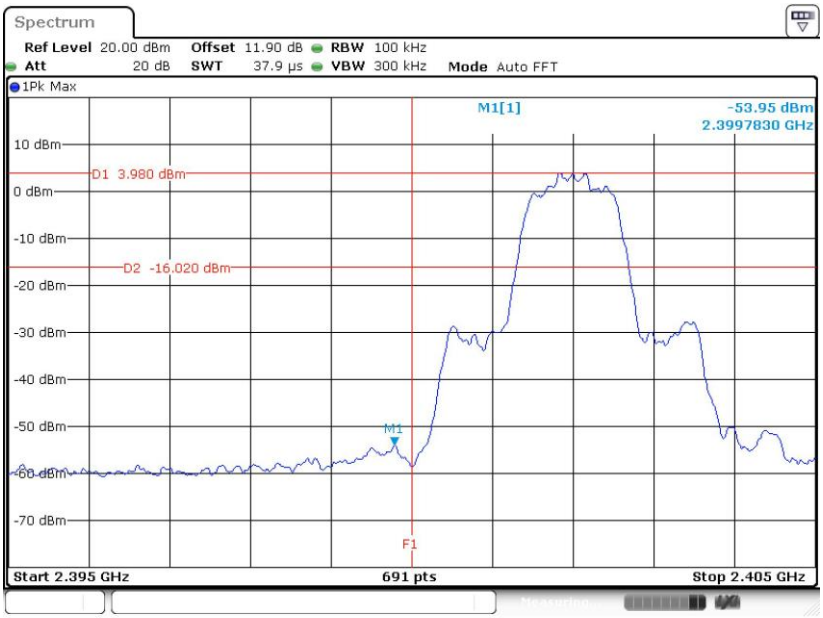
High Band Edge Plot on Channel 78



Date: 16.NOV.2020 16:45:26

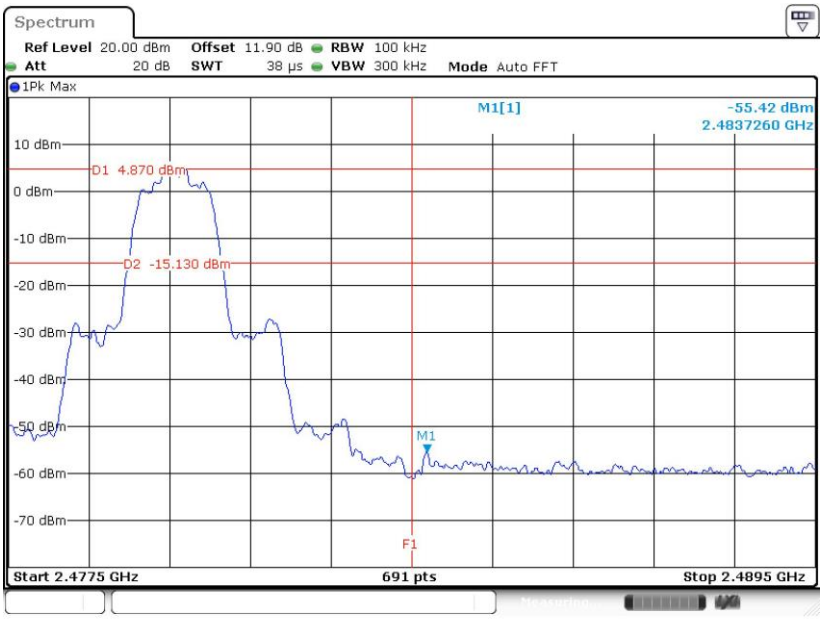
<3Mbps>

Low Band Edge Plot on Channel 00



Date: 16.NOV.2020 17:14:36

High Band Edge Plot on Channel 78

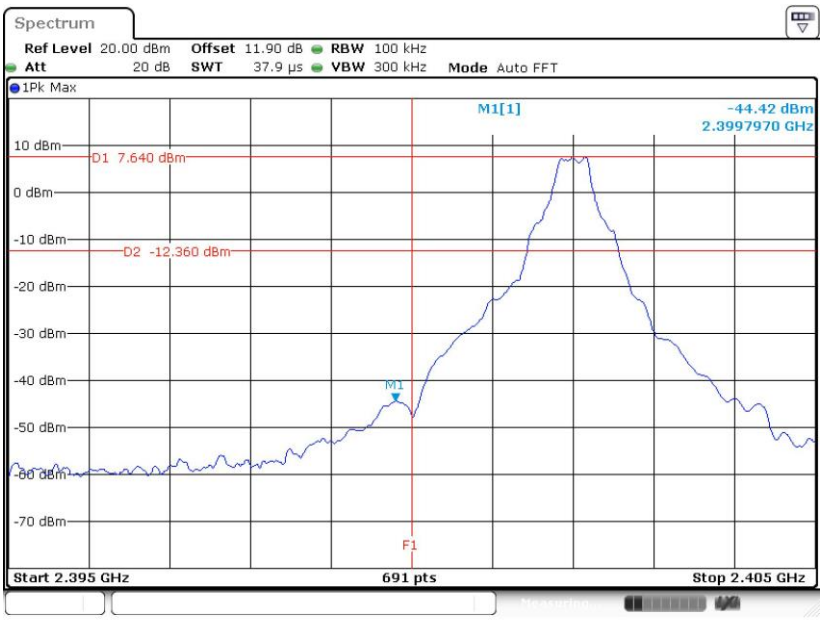


Date: 16.NOV.2020 17:35:47

<Aux. Antenna>

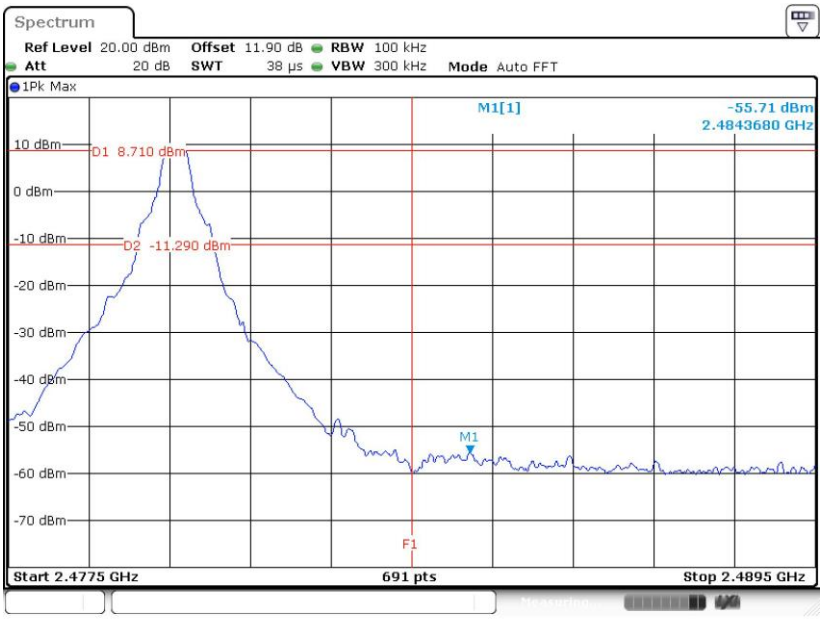
<1Mbps>

Low Band Edge Plot on Channel 00



Date: 16.NOV.2020 18:10:03

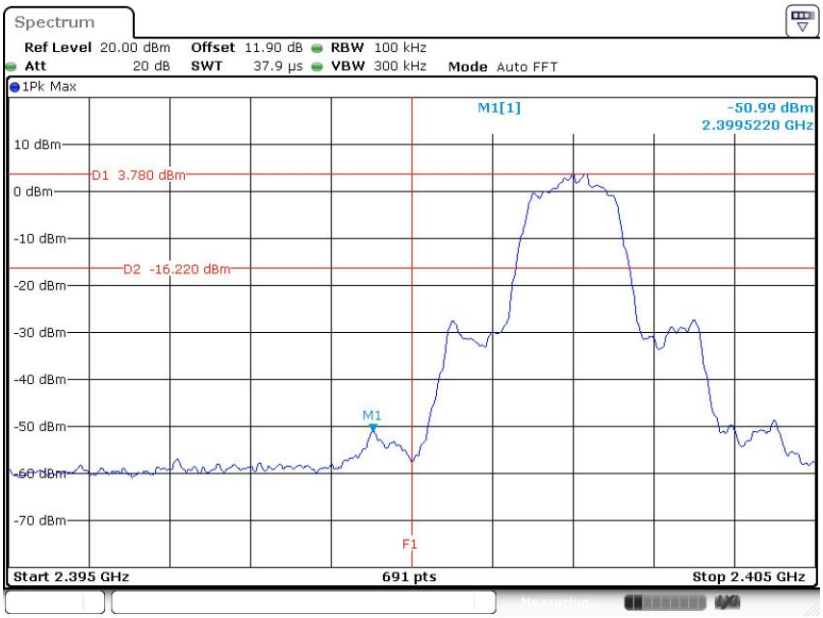
High Band Edge Plot on Channel 78



Date: 16.NOV.2020 18:25:17

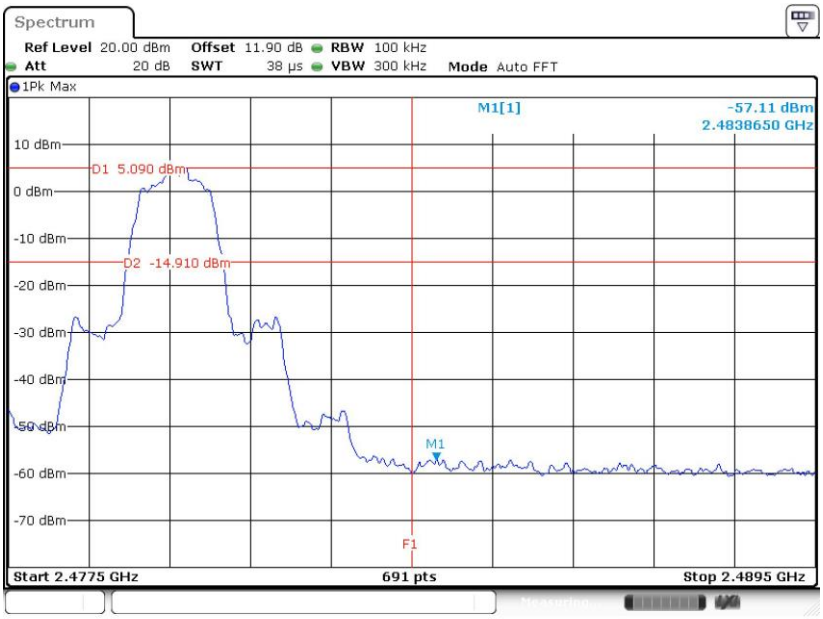
<2Mbps>

Low Band Edge Plot on Channel 00



Date: 16.NOV.2020 18:32:52

High Band Edge Plot on Channel 78



Date: 16.NOV.2020 19:31:11