

RADIO PERFORMANCE TEST REPORT

Test Report No. : OT-21O-RWD-038

Reception No. : 2110004558

Applicant : Samsung Electronics Co Ltd

Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States

Manufacturer : Samsung Electronics Co Ltd

Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do 16677, Korea

Type of Equipment : Wi-Fi/BT Transceiver

FCC ID. : A3LWCB731M

Model Name : WCB731M

Multiple Model Name : WCB730M, WCB737M, WCB736M

Serial number : N/A

Total page of Report : 208 pages (including this page)

Date of Incoming : October 07, 2021

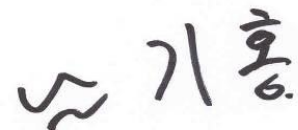
Date of issue : October 25, 2021

SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART C Section 15.247**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.



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OTC-TRF-RF-001(0)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

CONTENTS

	Page
1. VERIFICATION OF COMPLIANCE	7
2. TEST SUMMARY	8
2.1 TEST ITEMS AND RESULTS	8
2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS	8
2.3 RELATED SUBMITTAL(S) / GRANT(S)	8
2.4 PURPOSE OF THE TEST	8
2.5 TEST METHODOLOGY.....	8
2.6 TEST FACILITY.....	8
3. GENERAL INFORMATION	9
3.1 PRODUCT DESCRIPTION.....	9
3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.....	14
4. EUT MODIFICATIONS	14
5. SYSTEM TEST CONFIGURATION	15
5.1 JUSTIFICATION	15
5.2 PERIPHERAL EQUIPMENT	15
5.3 MODE OF OPERATION DURING THE TEST	16
5.4 CONFIGURATION OF TEST SYSTEM	27
5.5 ANTENNA REQUIREMENT	27
6. PRELIMINARY TEST	27
6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS.....	27
6.2 GENERAL RADIATED EMISSIONS TESTS	27
7. MIMIMUM 6 dB BANDWIDTH	28
7.1 OPERATING ENVIRONMENT	28
7.2 TEST SET-UP	28
7.3 TEST DATE	28
7.4 TEST DATA FOR 802.11B WLAN MODE	29
7.4.1 Test data for Antenna 0.....	29
7.4.2 Test data for Antenna 1.....	32
7.5 TEST DATA FOR 802.11G WLAN MODE.....	35
7.5.1 Test data for Antenna 0.....	35
7.5.2 Test data for Antenna 1.....	38
7.6 TEST DATA FOR 802.11N_HT20 WLAN MODE	41

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7.6.1 Test data for Antenna 0	41
7.6.2 Test data for Antenna 1	44
7.7 TEST DATA FOR 802.11N_HT40 WLAN MODE	47
7.7.1 Test data for Antenna 0	47
7.7.2 Test data for Antenna 1	50
8. MAXIMUM CONDUCTED (AVERAGE) OUTPUT POWER	53
8.1 OPERATING ENVIRONMENT	53
8.2 TEST SET-UP	53
8.3 TEST DATE	53
8.4 TEST DATA FOR 802.11B WLAN MODE	54
8.4.1 Test data for Antenna 0	54
8.4.2 Test data for Antenna 1	54
8.5 TEST DATA FOR 802.11G WLAN MODE	55
8.5.1 Test data for Antenna 0	55
8.5.2 Test data for Antenna 1	55
8.5.3 Test data for Multiple Transmit	56
8.6 TEST DATA FOR 802.11N_HT20 WLAN MODE	57
8.6.1 Test data for Antenna 0	57
8.6.2 Test data for Antenna 1	57
8.6.3 Test data for Multiple Transmit	58
8.7 TEST DATA FOR 802.11N_HT40 WLAN MODE	59
8.7.1 Test data for Antenna 0	59
8.7.2 Test data for Antenna 1	59
8.7.3 Test data for Multiple Transmit	60
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND	61
9.1 OPERATING ENVIRONMENT	61
9.2 TEST SET-UP FOR CONDUCTED MEASUREMENT	61
9.3 TEST SET-UP FOR RADIATED MEASUREMENT	61
9.4 TEST DATE	61
9.5 TEST DATA FOR CONDUCTED EMISSION	62
9.5.1 Test data for 802.11b WLAN Mode	62
9.5.2 Test data for 802.11g WLAN Mode	78
9.5.3 Test data for 802.11n_HT20 WLAN Mode	94
9.5.4 Test data for 802.11n_HT40 WLAN Mode	110
9.6 TEST DATA FOR RADIATED EMISSION	126
9.6.1 Radiated Emission which fall in the Restricted Band	126

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9.6.2 Spurious & Harmonic Radiated Emission	131
10. PEAK POWER SPECTRUL DENSITY	141
10.1 OPERATING ENVIRONMENT	141
10.2 TEST SET-UP	141
10.3 TEST DATE.....	141
10.4 TEST DATA FOR 802.11B WLAN MODE	142
10.4.1 Test data for Antenna 0.....	142
10.4.2 Test data for Antenna 1.....	145
10.5 TEST DATA FOR 802.11G WLAN MODE	148
10.5.1 Test data for Antenna 0.....	148
10.5.2 Test data for Antenna 1.....	151
10.5.3 Test data for Multiple Transmit.....	154
10.6 TEST DATA FOR 802.11N_HT20 WLAN MODE.....	155
10.6.1 Test data for Antenna 0.....	155
10.6.2 Test data for Antenna 1.....	158
10.6.3 Test data for Multiple Transmit.....	161
10.7 TEST DATA FOR 802.11N_HT40 WLAN MODE.....	162
10.7.1 Test data for Antenna 0.....	162
10.7.2 Test data for Antenna 1.....	165
10.7.3 Test data for Multiple Transmit.....	168
11. RADIATED EMISSION TEST.....	169
11.1 OPERATING ENVIRONMENT	169
11.2 TEST SET-UP	169
11.3 TEST DATE.....	169
11.4 TEST DATA FOR THE BASIC MODEL (WCB731M)	170
11.4.1 Test data for 30 MHz ~ 1 000 MHz.....	170
11.5 TEST DATA FOR THE MULTIPLE MODEL (WCB730M).....	173
11.5.1 Test data for 30 MHz ~ 1 000 MHz.....	173
11.6 TEST DATA FOR THE MULTIPLE MODEL (WCB737M).....	176
11.6.1 Test data for 30 MHz ~ 1 000 MHz.....	176
11.7 TEST DATA FOR THE MULTIPLE MODEL (WCB736M).....	179
11.7.1 Test data for 30 MHz ~ 1 000 MHz.....	179
11.8 TEST DATA FOR BELOW 30 MHz.....	182
11.9 TEST DATA FOR ABOVE 1 GHz	182
12. CONDUCTED EMISSION TEST	183
12.1 OPERATING ENVIRONMENT	183

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12.2 TEST SET-UP	183
12.3 TEST DATE.....	183
12.4 TEST DATA FOR THE BASIC MODEL (WCB731M)	184
<i>12.4.1 Test data for WLAN 2.4 GHz</i>	<i>184</i>
<i>12.4.2 Test data for Intermodulation Mode(Bluetooth LE + WLAN 2.4 GHz + WLAN 5 GHz).....</i>	<i>186</i>
<i>12.4.3 Test data for Intermodulation Mode(Bluetooth + WLAN 2.4 GHz + WLAN 5 GHz).....</i>	<i>188</i>
12.5 TEST DATA FOR THE MULTIPLE MODEL (WCB730M).....	190
<i>12.5.1 Test data for WLAN 2.4 GHz</i>	<i>190</i>
<i>12.5.2 Test data for Intermodulation Mode(Bluetooth LE + WLAN 2.4 GHz + WLAN 5 GHz).....</i>	<i>192</i>
<i>12.5.3 Test data for Intermodulation Mode(Bluetooth + WLAN 2.4 GHz + WLAN 5 GHz).....</i>	<i>194</i>
12.6 TEST DATA FOR THE MULTIPLE MODEL (WCB737M).....	196
<i>12.6.1 Test data for WLAN 2.4 GHz</i>	<i>196</i>
<i>12.6.2 Test data for Intermodulation Mode(Bluetooth LE + WLAN 2.4 GHz + WLAN 5 GHz).....</i>	<i>198</i>
<i>12.6.3 Test data for Intermodulation Mode(Bluetooth + WLAN 2.4 GHz + WLAN 5 GHz).....</i>	<i>200</i>
12.7 TEST DATA FOR THE MULTIPLE MODEL (WCB736M).....	202
<i>12.7.1 Test data for WLAN 2.4 GHz</i>	<i>202</i>
<i>12.7.2 Test data for Intermodulation Mode(Bluetooth LE + WLAN 2.4 GHz + WLAN 5 GHz).....</i>	<i>204</i>
<i>12.7.3 Test data for Intermodulation Mode(Bluetooth + WLAN 2.4 GHz + WLAN 5 GHz).....</i>	<i>206</i>
13. LIST OF TEST EQUIPMENT	208

Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-21O-RWD-038	October 25, 2021	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co Ltd
 Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States
 Contact Person : Jenni Chun / General Manager
 Telephone No. : 973-808-6375
 FCC ID : A3LWCB731M
 Model Name : WCB731M
 Brand Name : 
 Serial Number : N/A
 Date : October 25, 2021

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	Modular Transmitter, Wi-Fi/BT Transceiver
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247 KDB 558074 D01 15.247 Meas Guidance v05r02
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (2)	Minimum 6 dB Bandwidth	Met the Limit / PASS
15.247 (b) (3)	Maximum Conducted(average) Output Power	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (e)	Peak Power Spectral Density	Met the Limit / PASS
15.209	Radiated Emission Limits	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / PASS

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The Samsung Electronics Co Ltd, Model WCB731M (referred to as the EUT in this report) is a Wi-Fi/BT Transceiver. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Wi-Fi/BT Transceiver	
Temperature Range	-20 °C ~ 50 °C	
OPERATING FREQUENCY	Bluetooth LE	2 402 MHz ~ 2 480 MHz
	Bluetooth	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz	2 412 MHz ~ 2 472 MHz (802.11b/g/n(HT20))
		2 422 MHz ~ 2 462 MHz (802.11n(HT40))
	WLAN 5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz (802.11a/n(HT20)/ac(VHT20))
		5 190 MHz ~ 5 230 MHz (802.11n(HT40)/ac(VHT40))
		5 210 MHz (802.11ac(VHT80))
	WLAN 5 250 MHz ~ 5 350 MHz Band	5 260 MHz ~ 5 320 MHz (802.11a/n(HT20)/ac(VHT20))
		5 270 MHz ~ 5 310 MHz (802.11n(HT40)/ac(VHT40))
		5 290 MHz (802.11ac(VHT80))
	WLAN 5 470 MHz ~ 5 725 MHz Band	5 500 MHz ~ 5 720 MHz (802.11a/n(HT20)/ac(VHT20))
		5 510 MHz ~ 5 710 MHz (802.11n(HT40)/ac(VHT40))
		5 530 MHz ~ 5 690 MHz (802.11ac(VHT80))
	WLAN 5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 825 MHz (802.11a/n(HT20)/ac(VHT20))
		5 755 MHz ~ 5 795 MHz (802.11n(HT40)/ac(VHT40))
		5 775 MHz (802.11ac(VHT80))
MODULATION TYPE	Bluetooth LE	GFSK for 1 Mbps / 2 Mbps
	Bluetooth	GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8-DPSK for 3Mbps
	WLAN 2.4 GHz	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK)
		802.11g/n(HT20)/n(HT40): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
	WLAN 5 GHz	802.11a/n(HT20)/n(HT40)/ac(VHT80): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)

RF OUTPUT POWER	Bluetooth LE	1 Mbps	11.26 dBm
		2 Mbps	11.25 dBm
	Bluetooth	1 Mbps	11.26 dBm
		2 Mbps	10.89 dBm
		3 Mbps	11.19 dBm
	WLAN 2.4 GHz	Antenna 0	17.30 dBm(802.11b) 11.15 dBm(802.11g) 10.75 dBm(802.11n_HT20) 9.49 dBm(802.11n_HT40)
		Antenna 1	17.32 dBm(802.11b) 14.60 dBm(802.11g) 14.31 dBm(802.11n_HT20) 13.54 dBm(802.11n_HT40)
		Multiple Antenna	16.22 dBm(802.11g) 15.90 dBm(802.11n_HT20) 14.98 dBm(802.11n_HT40)
	WLAN 5 150 MHz ~ 5 250 MHz Band	Antenna 0	8.73 dBm(802.11a) 8.77 dBm(802.11n_HT20) 10.33 dBm(802.11n_HT40) 8.88 dBm(802.11ac_VHT80)
		Antenna 1	9.02 dBm(802.11a) 8.88 dBm(802.11n_HT20) 10.46 dBm(802.11n_HT40) 9.22 dBm(802.11ac_VHT80)
		Multiple Antenna	11.79 dBm(802.11a) 11.69 dBm(802.11n_HT20) 13.27 dBm(802.11n_HT40) 12.06 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 250 MHz ~ 5 350 MHz Band	Antenna 0	9.82 dBm(802.11a) 9.67 dBm(802.11n_HT20) 9.69 dBm(802.11n_HT40) 10.53 dBm(802.11ac_VHT80)
		Antenna 1	9.12 dBm(802.11a) 9.05 dBm(802.11n_HT20) 8.95 dBm(802.11n_HT40) 10.35 dBm(802.11ac_VHT80)
		Multiple Antenna	12.40 dBm(802.11a) 12.27 dBm(802.11n_HT20) 12.35 dBm(802.11n_HT40) 13.45 dBm(802.11ac_VHT80)
	WLAN 5 470 MHz ~ 5 725 MHz Band	Antenna 0	9.83 dBm(802.11a) 9.80 dBm(802.11n_HT20) 10.16 dBm(802.11n_HT40) 10.28 dBm(802.11ac_VHT80)
		Antenna 0_Straddle	8.38 dBm(802.11a) 8.23 dBm(802.11n_HT20) 9.65 dBm(802.11n_HT40) 10.80 dBm(802.11ac_VHT80)
		Antenna 1	10.68 dBm(802.11a) 11.18 dBm(802.11n_HT20) 11.77 dBm(802.11n_HT40) 10.50 dBm(802.11ac_VHT80)
		Antenna 1_Straddle	11.29 dBm(802.11a) 11.07 dBm(802.11n_HT20) 12.29 dBm(802.11n_HT40) 14.30 dBm(802.11ac_VHT80)

RF OUTPUT POWER	WLAN 5 470 MHz ~ 5 725 MHz Band	Multiple Antenna	13.00 dBm(802.11a) 13.47 dBm(802.11n_HT20) 13.89 dBm(802.11n_HT40) 13.40 dBm(802.11ac_VHT80)
		Multiple Antenna _Straddle	13.08 dBm(802.11a) 12.89 dBm(802.11n_HT20) 14.18 dBm(802.11n_HT40) 15.90 dBm(802.11ac_VHT80)
	WLAN 5 725 MHz ~ 5 850 MHz Band	Antenna 0	8.85 dBm(802.11a) 8.93 dBm(802.11n_HT20) 7.67 dBm(802.11n_HT40) 7.83 dBm(802.11ac_VHT80)
		Antenna 0_Straddle	0.54 dBm(802.11a) 0.90 dBm(802.11n_HT20) -2.66 dBm(802.11n_HT40) -4.53 dBm(802.11ac_VHT80)
		Antenna 1	10.67 dBm(802.11a) 10.78 dBm(802.11n_HT20) 10.94 dBm(802.11n_HT40) 10.77 dBm(802.11ac_VHT80)
		Antenna 1_Straddle	3.53 dBm(802.11a) 3.78 dBm(802.11n_HT20) 0.13 dBm(802.11n_HT40) -0.95 dBm(802.11ac_VHT80)
		Multiple Antenna	12.86 dBm(802.11a) 12.77 dBm(802.11n_HT20) 12.62 dBm(802.11n_HT40) 12.55 dBm(802.11ac_VHT80)
		Multiple Antenna _Straddle	5.30 dBm(802.11a) 5.58 dBm(802.11n_HT20) 1.97 dBm(802.11n_HT40) 0.63 dBm(802.11ac_VHT80)

ANTENNA TYPE	Chip Antenna		
ANTENNA GAIN	Bluetooth LE	-0.44 dBi	
	Bluetooth	-0.44 dBi	
	WLAN 2.4 GHz	Antenna 0	1.54 dBi
		Antenna 1	1.35 dBi
		Multiple Antenna	4.46 dBi
	5 150 MHz ~ 5 250 MHz Band	Antenna 0	1.00 dBi
		Antenna 1	1.25 dBi
		Multiple Antenna	4.14 dBi
	5 250 MHz ~ 5 350 MHz Band	Antenna 0	1.53 dBi
		Antenna 1	1.42 dBi
		Multiple Antenna	4.49 dBi
	5 470 MHz ~ 5 725 MHz Band	Antenna 0	1.51 dBi
		Antenna 1	1.50 dBi
		Multiple Antenna	4.52 dBi
	5 725 MHz ~ 5 850 MHz Band	Antenna 0	0.86 dBi
		Antenna 1	1.51 dBi
		Multiple Antenna	4.21 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		40 MHz	

3.2 Alternative type(s)/model(s); also covered by this test report.

-. The following lists consist of the added model and their differences.

Model Name	Differences	Tested
WCB731M	Basic Model (2 MIC, IRB at the Top)	☒
WCB730M	This model is identical to the basic model except for the removal of MIC.	☒
WCB737M	This model is identical to the basic model except for the IRB at the Bottom	☒
WCB736M	This model is identical to the basic model except for IRB at the Bottom and the removal of MIC	☒

Note: 1. Applicant consigns only basic model to test. Therefore this test report just guarantees the units, which have been tested.

2. The Applicant/manufacture is responsible for the compliance of all variants.

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	Samsung Electronics Co Ltd	HDWB-2285 V1.0	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
WCB731M	Samsung Electronics Co Ltd	Wi-Fi/BT Transceiver (EUT)	-
HP Probook	HP	Notebook PC	EUT
PPP009L-E	LIE-ON TECHNOLOGY (CHANGZHOU)CO.,LTD.	AC Adapter	-

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting mode is programmed.

-. Frequency / Channel Operations

Channel	Frequency
1	2 412
2	2 417
3	2 422
4	2 427
5	2 432
6	2 437
7	2 442
8	2 447
9	2 452
10	2 457
11	2 462
12	2 467
13	2 472

Modulation	DATA RATE	OUTPUT POWER[dBm]	
		Antenna 0	Antenna 1
802.11 b (Low Channel)	1 Mbps	16.92	16.25
	2 Mbps	16.89	16.24
	5.5 Mbps	16.88	16.22
	11 Mbps	16.85	16.20
802.11 g (Low Channel)	6 Mbps	10.62	14.56
	9 Mbps	10.60	14.53
	12 Mbps	10.57	14.52
	18 Mbps	10.57	14.50
	24 Mbps	10.53	14.46
	36 Mbps	10.09	13.87
	48 Mbps	9.00	12.76
	54 Mbps	8.96	12.73
802.11 HT 20 (Low Channel)	6.5 Mbps	10.44	14.20
	13 Mbps	10.43	14.19
	19.5 Mbps	10.39	14.17
	26 Mbps	10.38	14.15
	39 Mbps	9.69	13.59
	52 Mbps	9.67	13.55
	58.5 Mbps	8.69	12.56
	65 Mbps	8.67	12.54
802.11 HT 40 (Low Channel)	13.5 Mbps	9.04	13.38
	27 Mbps	9.02	13.35
	40.5 Mbps	9.01	13.35
	54 Mbps	8.99	13.34
	81 Mbps	8.54	12.84
	108 Mbps	8.51	12.81
	121.5 Mbps	7.64	11.88
	135 Mbps	7.61	11.87

-. The worse case data rate for each modulation is determined 1 Mbps(Ant.0/Ant.1) for IEEE 802.11b, 6 Mbps(Ant.0/Ant.1) for IEEE 802.11g, 6.5 Mbps(Ant.0/Ant.1) for HT20, 13.5 Mbps(Ant.0/Ant.1) for HT40.

-. To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is "XY" axis.

Modulation	DATA RATE	OUTPUT POWER[dBm]	
		Antenna 0	Antenna 1
802.11 b (Middle Channel)	1 Mbps	17.30	17.11
	2 Mbps	17.27	17.10
	5.5 Mbps	17.26	17.08
	11 Mbps	17.23	17.06
802.11 g (Middle Channel)	6 Mbps	11.15	14.60
	9 Mbps	11.13	14.57
	12 Mbps	11.10	14.56
	18 Mbps	11.10	14.54
	24 Mbps	11.06	14.50
	36 Mbps	10.62	13.91
	48 Mbps	9.53	12.80
	54 Mbps	9.49	12.77
802.11 HT 20 (Middle Channel)	6.5 Mbps	10.75	14.31
	13 Mbps	10.74	14.30
	19.5 Mbps	10.70	14.28
	26 Mbps	10.69	14.26
	39 Mbps	10.00	13.70
	52 Mbps	9.98	13.66
	58.5 Mbps	9.00	12.67
	65 Mbps	8.98	12.65
802.11 HT 40 (Middle Channel)	13.5 Mbps	9.49	13.54
	27 Mbps	9.47	13.51
	40.5 Mbps	9.46	13.51
	54 Mbps	9.44	13.50
	81 Mbps	8.99	13.00
	108 Mbps	8.96	12.97
	121.5 Mbps	8.09	12.04
	135 Mbps	8.06	12.03

-. The worse case data rate for each modulation is determined 1 Mbps(Ant.0/Ant.1) for IEEE 802.11b, 6 Mbps(Ant.0/Ant.1) for IEEE 802.11g, 6.5 Mbps(Ant.0/Ant.1) for HT20, 13.5 Mbps(Ant.0/Ant.1) for HT40.

-. To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is "XY" axis.

Modulation	DATA RATE	OUTPUT POWER[dBm]	
		Antenna 0	Antenna 1
802.11 b (High Channel_11)	1 Mbps	16.49	17.30
	2 Mbps	16.46	17.29
	5.5 Mbps	16.45	17.27
	11 Mbps	16.42	17.25
802.11 g (High Channel_11)	6 Mbps	10.16	14.00
	9 Mbps	10.14	13.97
	12 Mbps	10.11	13.96
	18 Mbps	10.11	13.94
	24 Mbps	10.07	13.90
	36 Mbps	9.63	13.31
	48 Mbps	8.54	12.20
	54 Mbps	8.50	12.17
802.11 HT 20 (High Channel_11)	6.5 Mbps	9.83	13.82
	13 Mbps	9.82	13.81
	19.5 Mbps	9.78	13.79
	26 Mbps	9.77	13.77
	39 Mbps	9.08	13.21
	52 Mbps	9.06	13.17
	58.5 Mbps	8.08	12.18
	65 Mbps	8.06	12.16
802.11 HT 40 (High Channel_9)	13.5 Mbps	9.25	13.14
	27 Mbps	9.23	13.11
	40.5 Mbps	9.22	13.11
	54 Mbps	9.20	13.10
	81 Mbps	8.75	12.60
	108 Mbps	8.72	12.57
	121.5 Mbps	7.85	11.64
	135 Mbps	7.82	11.63

-. The worse case data rate for each modulation is determined 1 Mbps(Ant.0/Ant.1) for IEEE 802.11b, 6 Mbps(Ant.0/Ant.1) for IEEE 802.11g, 6.5 Mbps(Ant.0/Ant.1) for HT20, 13.5 Mbps(Ant.0/Ant.1) for HT40.

-. To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is "XY" axis.

Modulation	DATA RATE	OUTPUT POWER[dBm]	
		Antenna 0	Antenna 1
802.11 b (High Channel_12)	1 Mbps	15.05	17.32
	2 Mbps	15.02	17.31
	5.5 Mbps	15.01	17.29
	11 Mbps	14.98	17.27
802.11 g (High Channel_12)	6 Mbps	9.08	13.17
	9 Mbps	9.06	13.14
	12 Mbps	9.03	13.13
	18 Mbps	9.03	13.11
	24 Mbps	8.99	13.07
	36 Mbps	8.55	12.48
	48 Mbps	7.46	11.37
	54 Mbps	7.42	11.34
802.11 HT 20 (High Channel_12)	6.5 Mbps	8.88	13.03
	13 Mbps	8.87	13.02
	19.5 Mbps	8.83	13.00
	26 Mbps	8.82	12.98
	39 Mbps	8.13	12.42
	52 Mbps	8.11	12.38
	58.5 Mbps	7.13	11.39
	65 Mbps	7.11	11.37
802.11 HT 40 (High Channel_10)	13.5 Mbps	9.11	12.96
	27 Mbps	9.09	12.93
	40.5 Mbps	9.08	12.93
	54 Mbps	9.06	12.92
	81 Mbps	8.61	12.42
	108 Mbps	8.58	12.39
	121.5 Mbps	7.71	11.46
	135 Mbps	7.68	11.45

-. The worse case data rate for each modulation is determined 1 Mbps(Ant.0/Ant.1) for IEEE 802.11b, 6 Mbps(Ant.0/Ant.1) for IEEE 802.11g, 6.5 Mbps(Ant.0/Ant.1) for HT20, 13.5 Mbps(Ant.0/Ant.1) for HT40.

-. To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is "XY" axis.

Modulation	DATA RATE	OUTPUT POWER[dBm]	
		Antenna 0	Antenna 1
802.11 b (High Channel_13)	1 Mbps	13.30	14.74
	2 Mbps	13.27	14.73
	5.5 Mbps	13.26	14.71
	11 Mbps	13.23	14.69
802.11 g (High Channel_13)	6 Mbps	8.00	12.16
	9 Mbps	7.98	12.13
	12 Mbps	7.95	12.12
	18 Mbps	7.95	12.10
	24 Mbps	7.91	12.06
	36 Mbps	7.47	11.47
	48 Mbps	6.38	10.36
	54 Mbps	6.34	10.33
802.11 HT 20 (High Channel_13)	6.5 Mbps	6.69	10.86
	13 Mbps	6.68	10.85
	19.5 Mbps	6.64	10.83
	26 Mbps	6.63	10.81
	39 Mbps	5.94	10.25
	52 Mbps	5.92	10.21
	58.5 Mbps	4.94	9.22
	65 Mbps	4.92	9.20
802.11 HT 40 (High Channel_11)	13.5 Mbps	7.82	11.92
	27 Mbps	7.80	11.89
	40.5 Mbps	7.79	11.89
	54 Mbps	7.77	11.88
	81 Mbps	7.32	11.38
	108 Mbps	7.29	11.35
	121.5 Mbps	6.42	10.42
	135 Mbps	6.39	10.41

-. The worse case data rate for each modulation is determined 1 Mbps(Ant.0/Ant.1) for IEEE 802.11b, 6 Mbps(Ant.0/Ant.1) for IEEE 802.11g, 6.5 Mbps(Ant.0/Ant.1) for HT20, 13.5 Mbps(Ant.0/Ant.1) for HT40.

-. To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is "XY" axis.

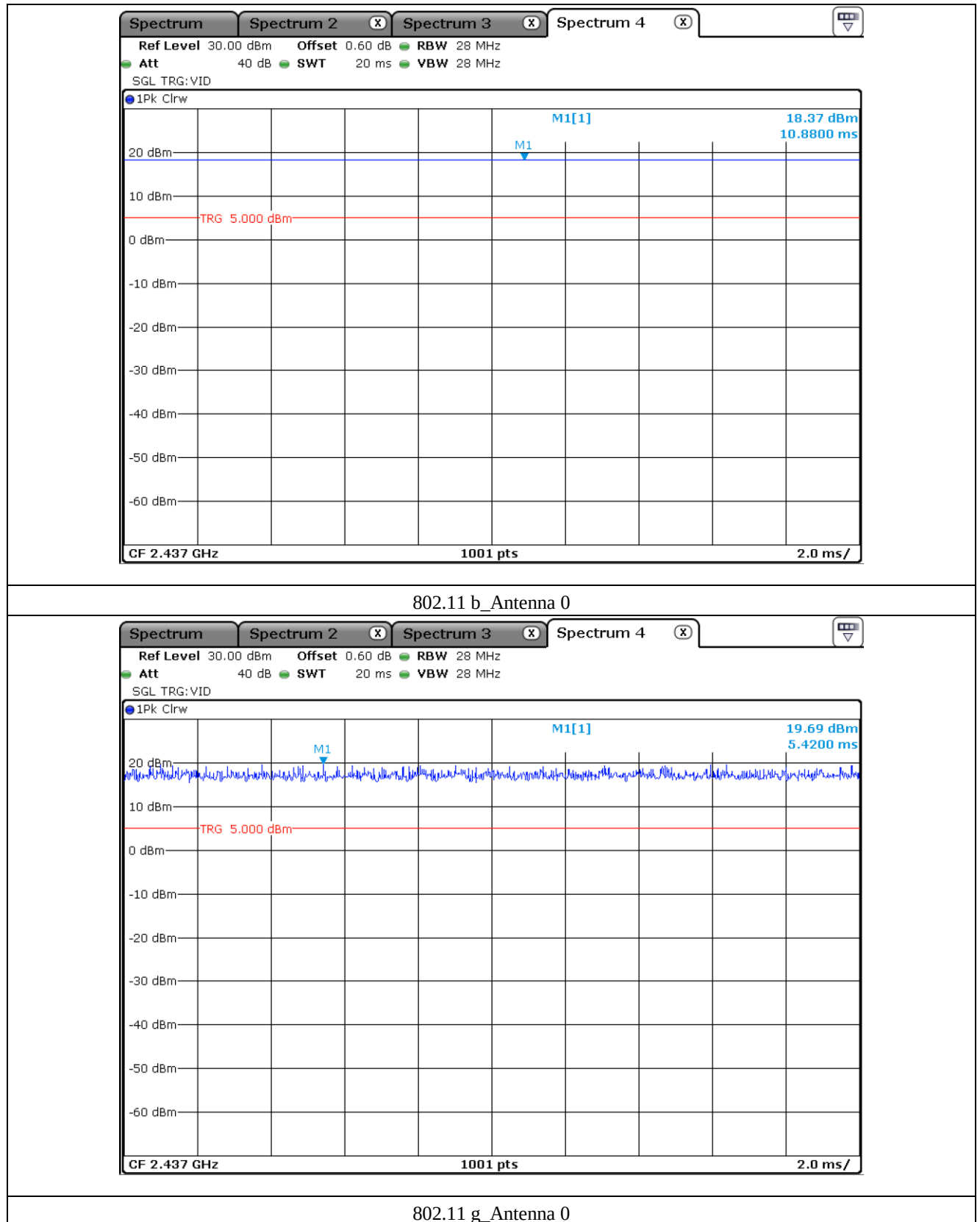
-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
802.11 b_Antenna 0	-	-	100.00	-
802.11 g_Antenna 0	-	-	100.00	-
802.11 HT 20_Antenna 0	-	-	100.00	-
802.11 HT 40_Antenna 0	-	-	100.00	-
802.11 b_Antenna 1	-	-	100.00	-
802.11 g_Antenna 1	-	-	100.00	-
802.11 HT 20_Antenna 1	-	-	100.00	-
802.11 HT 40_Antenna 1	-	-	100.00	-

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

Correction Factor : $10 * \log(1 / (\text{Duty Cycle} / 100))$

-. Test Plot

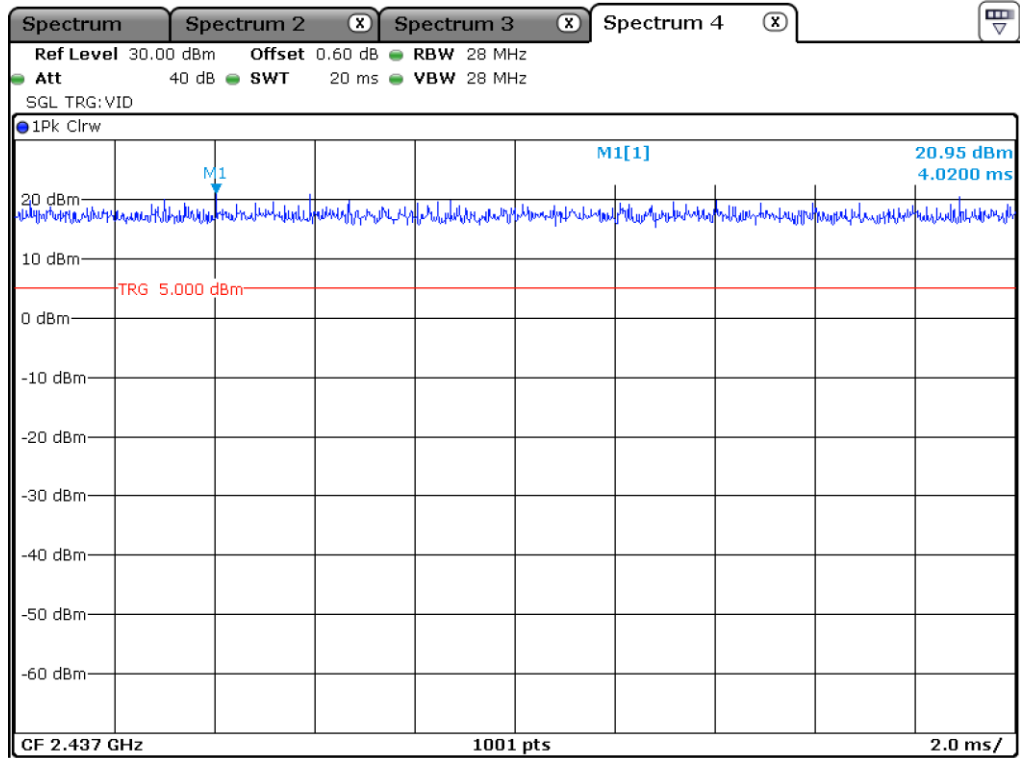


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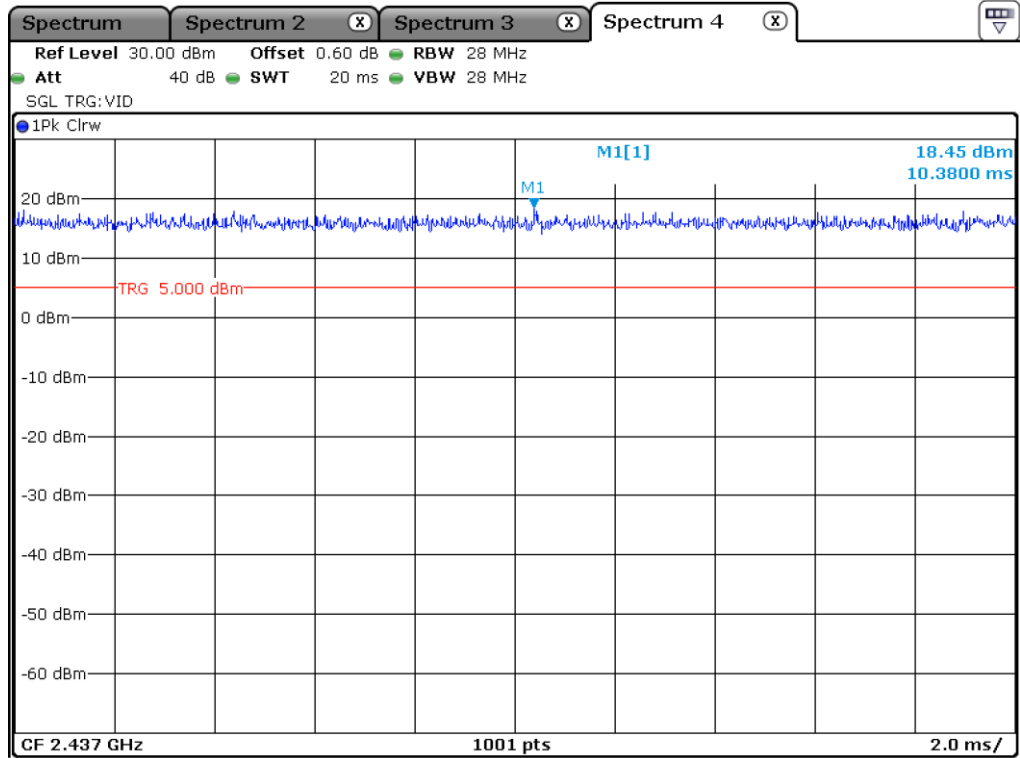
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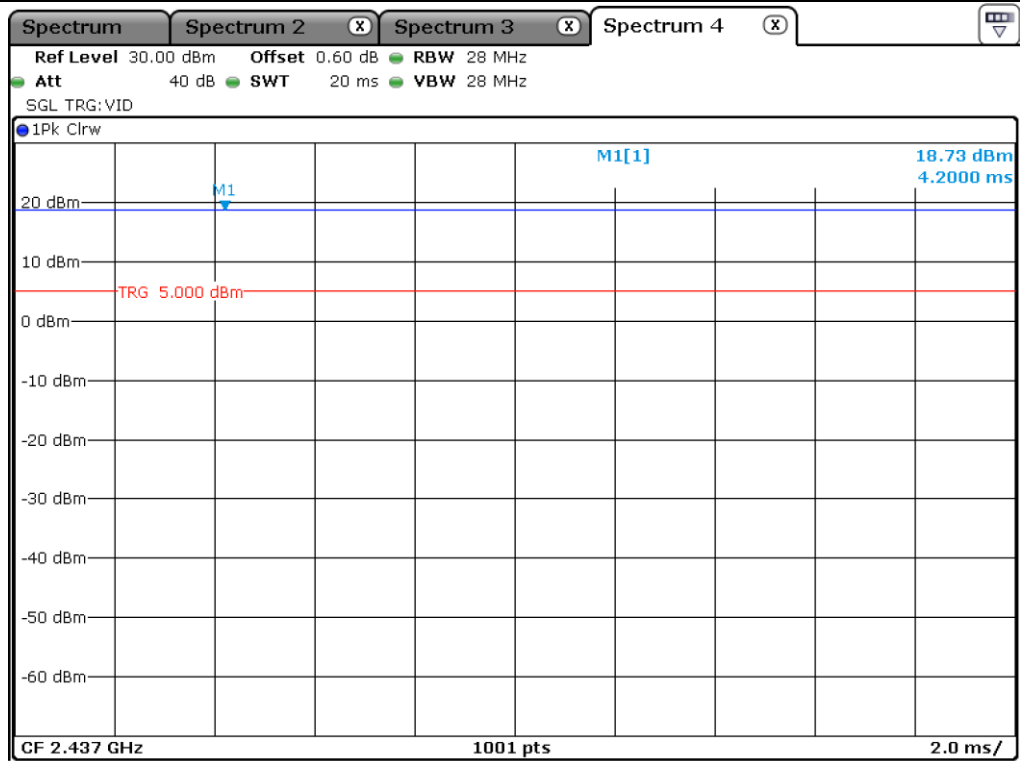
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



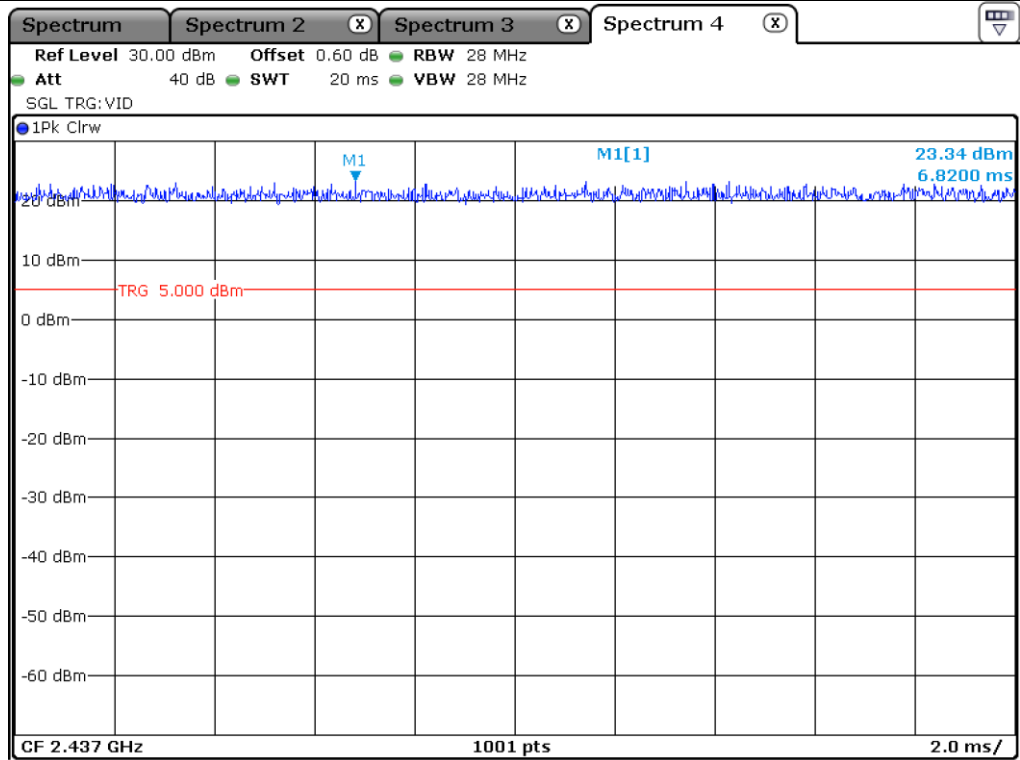
802.11 HT 20_Antenna 0



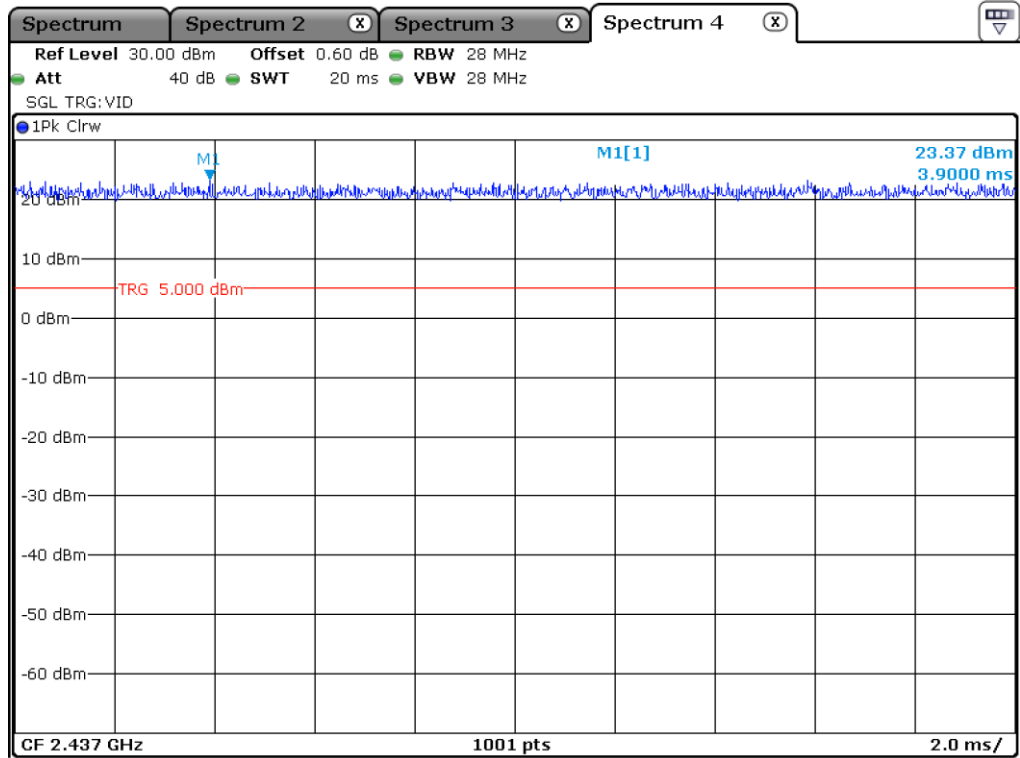
802.11 HT 40_Antenna 0



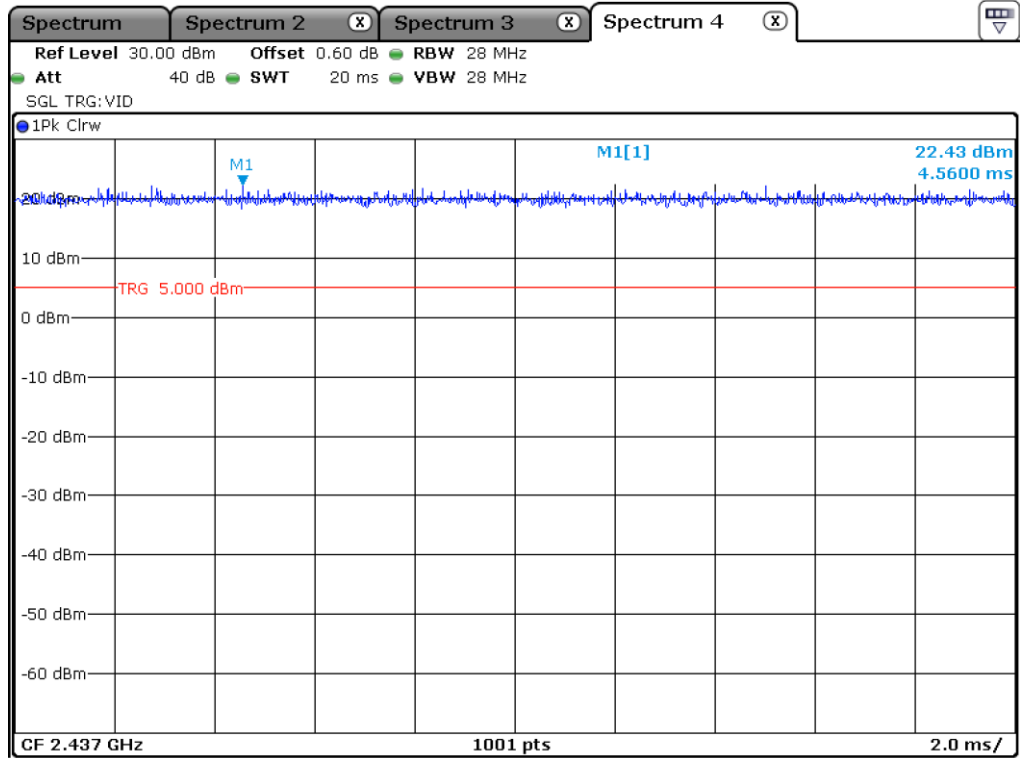
802.11 b_Antenna 1



802.11 g_Antenna 1



802.11 HT 20_Antenna 1



802.11 HT 40_Antenna 1

5.4 Configuration of Test System

Line Conducted Test: The EUT was connected to USB and the power of USB was connected to Notebook PC. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2020 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2020 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The antenna of the EUT is Chip Antenna on the main board in the EUT, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

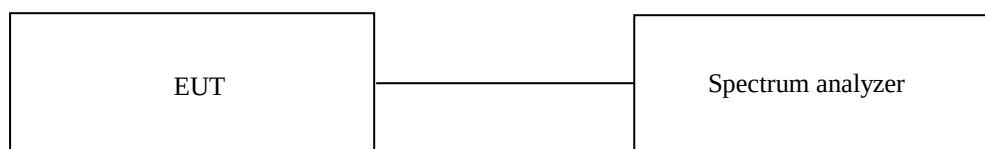
7. MINIMUM 6 dB BANDWIDTH

7.1 Operating environment

Temperature : 23 °C
Relative humidity : 45 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



7.3 Test Date

October 07, 2021 ~ October 20, 2021

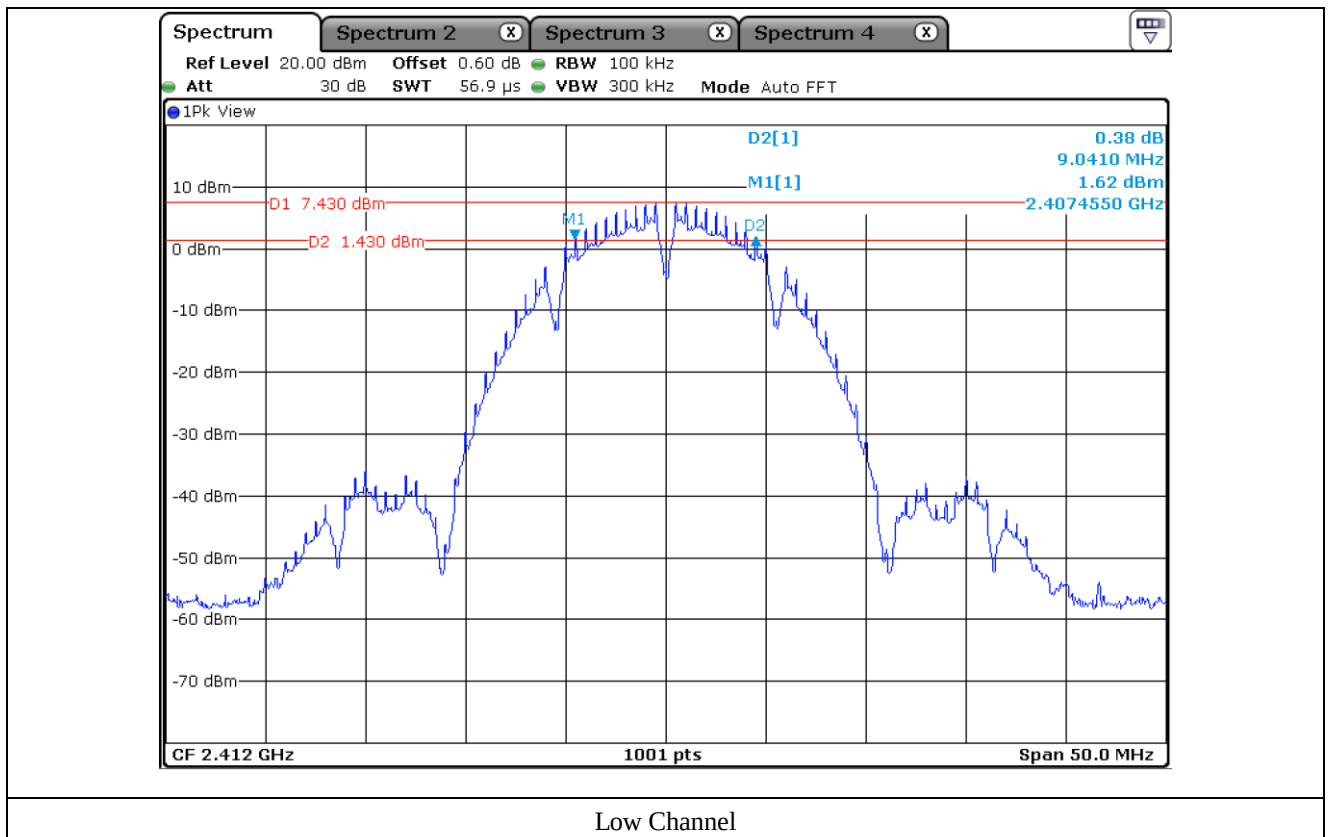
7.4 Test data for 802.11b WLAN Mode

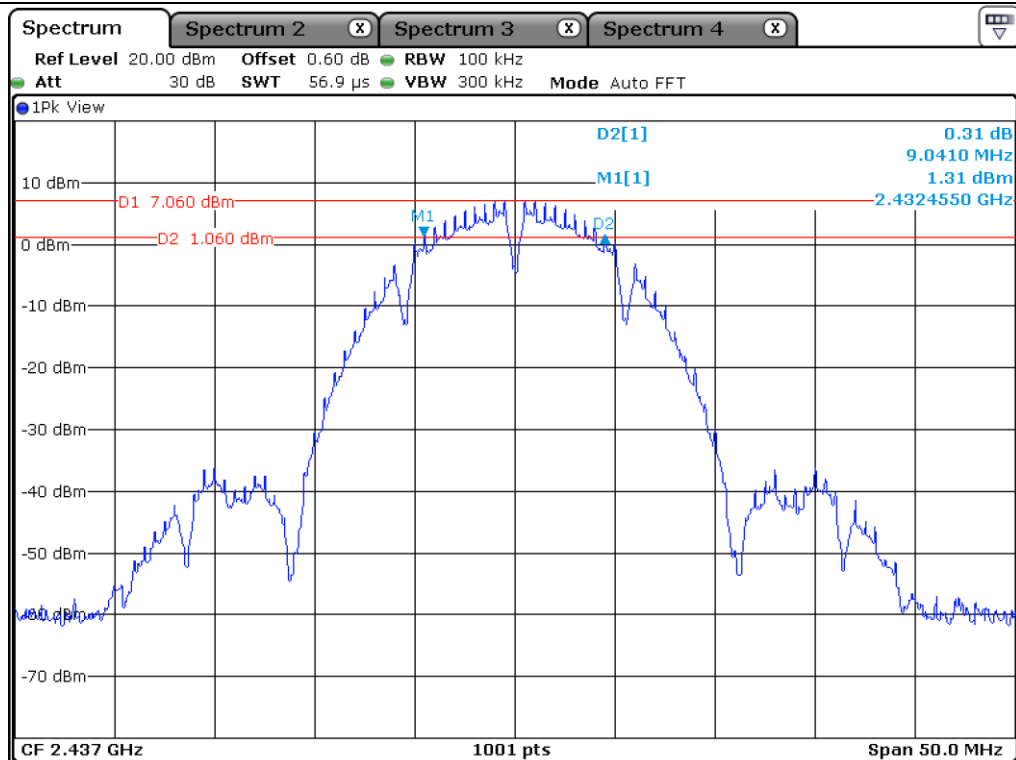
7.4.1 Test data for Antenna 0

-. Test Result : Pass

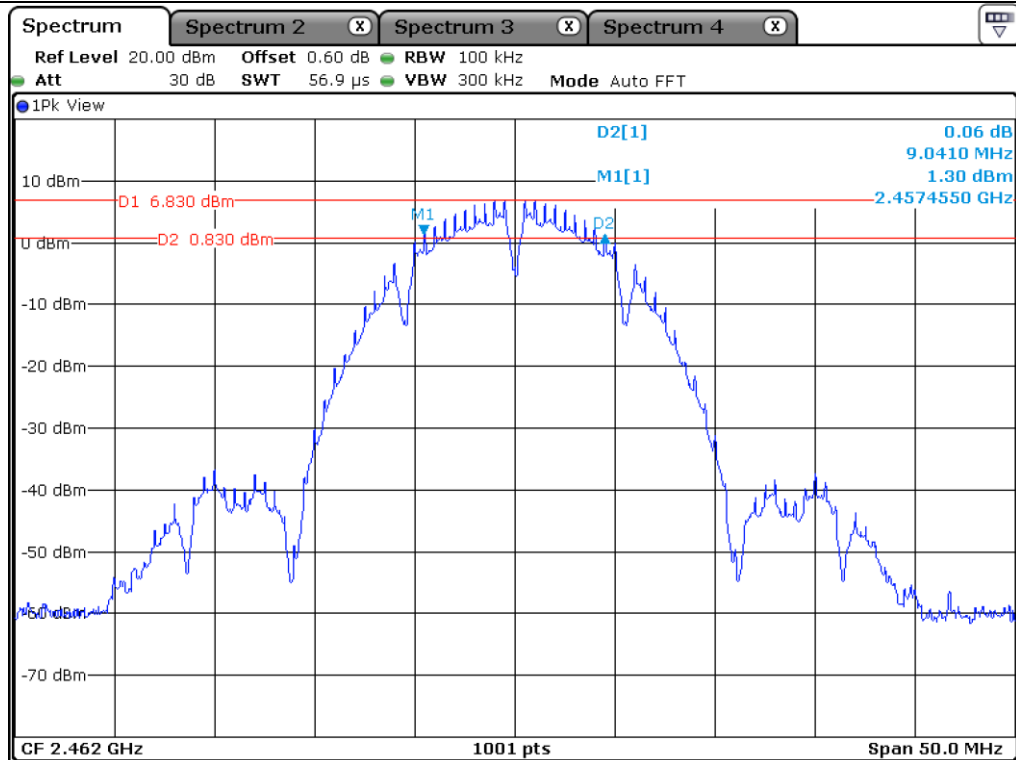
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	9.04	0.50	8.54
Middle	2 437.00	9.04	0.50	8.54
High 11	2 462.00	9.04	0.50	8.54
High 12	2 467.00	9.04	0.50	8.54
High 13	2 472.00	9.04	0.50	8.54

Remark. Margin = Measured Value - Limit





Middle Channel



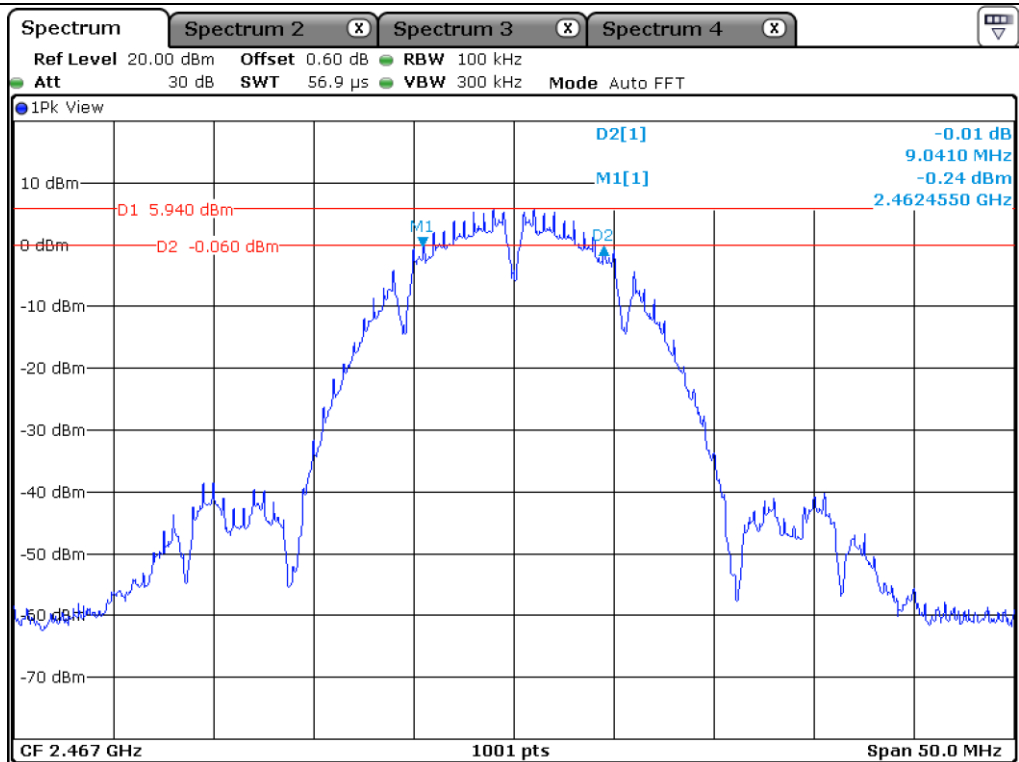
High Channel 11

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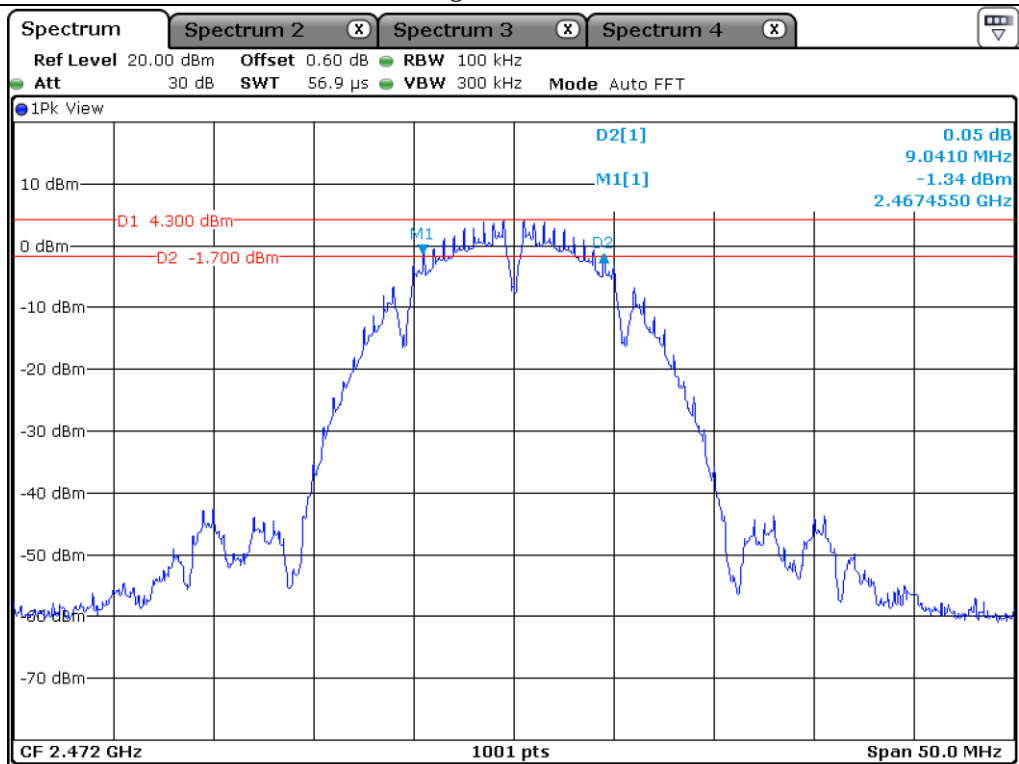
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High Channel 12



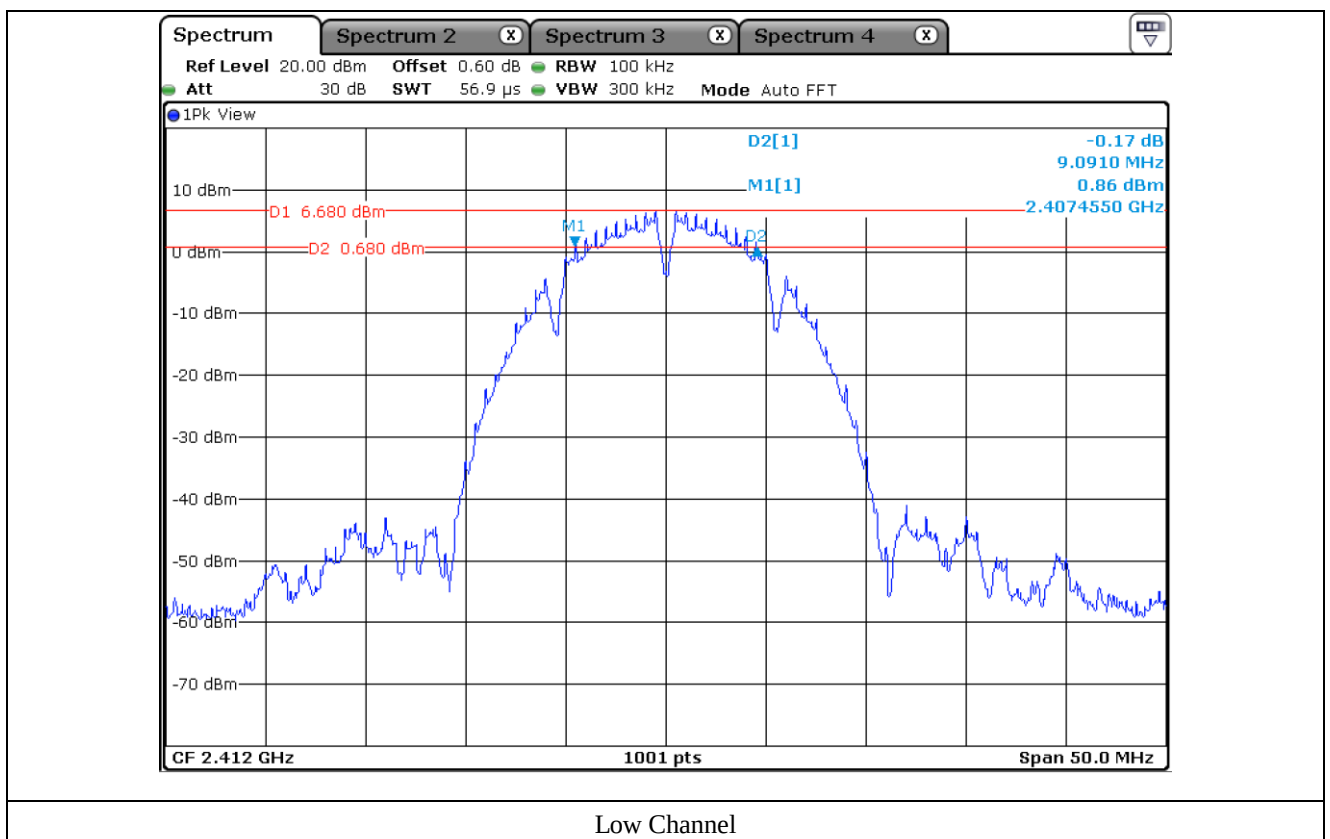
High Channel 13

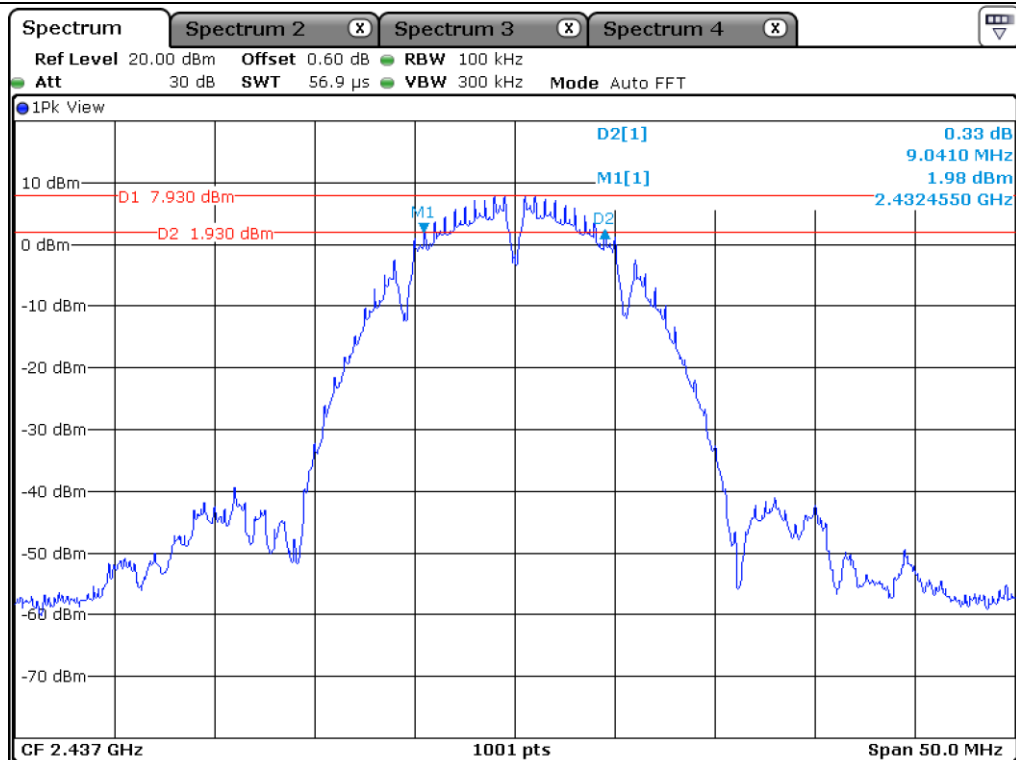
7.4.2 Test data for Antenna 1

-. Test Result : Pass

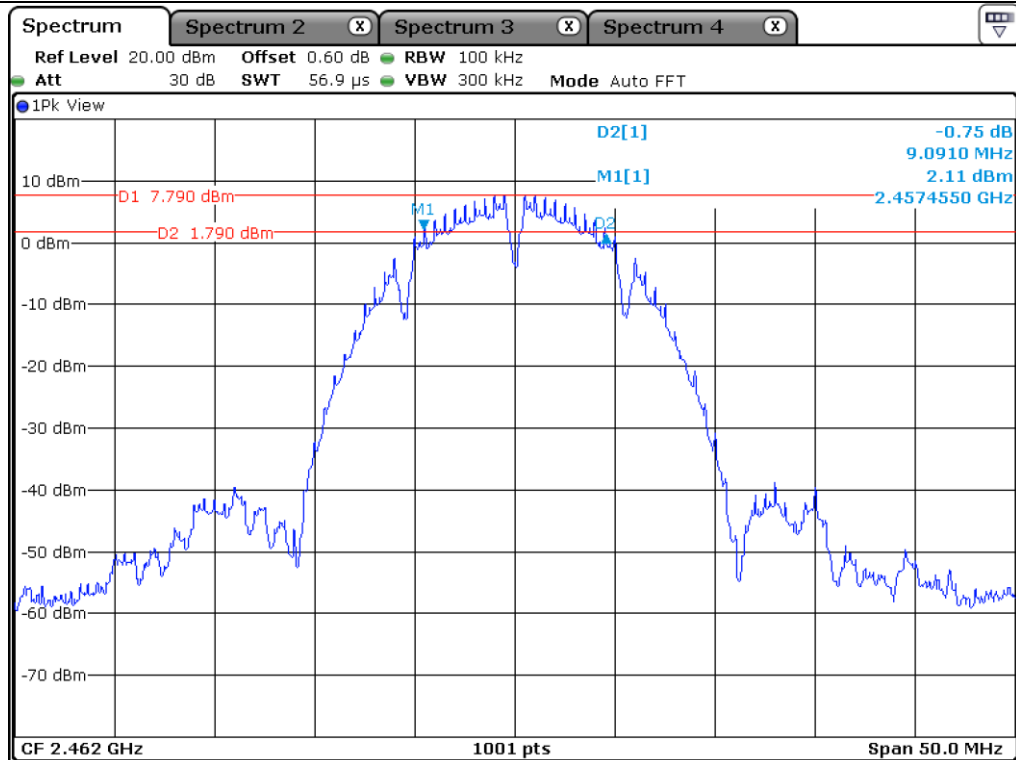
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	9.09	0.50	8.59
Middle	2 437.00	9.04	0.50	8.54
High 11	2 462.00	9.09	0.50	8.59
High 12	2 467.00	8.14	0.50	7.64
High 13	2 472.00	9.04	0.50	8.54

Remark. Margin = Measured Value - Limit





Middle Channel



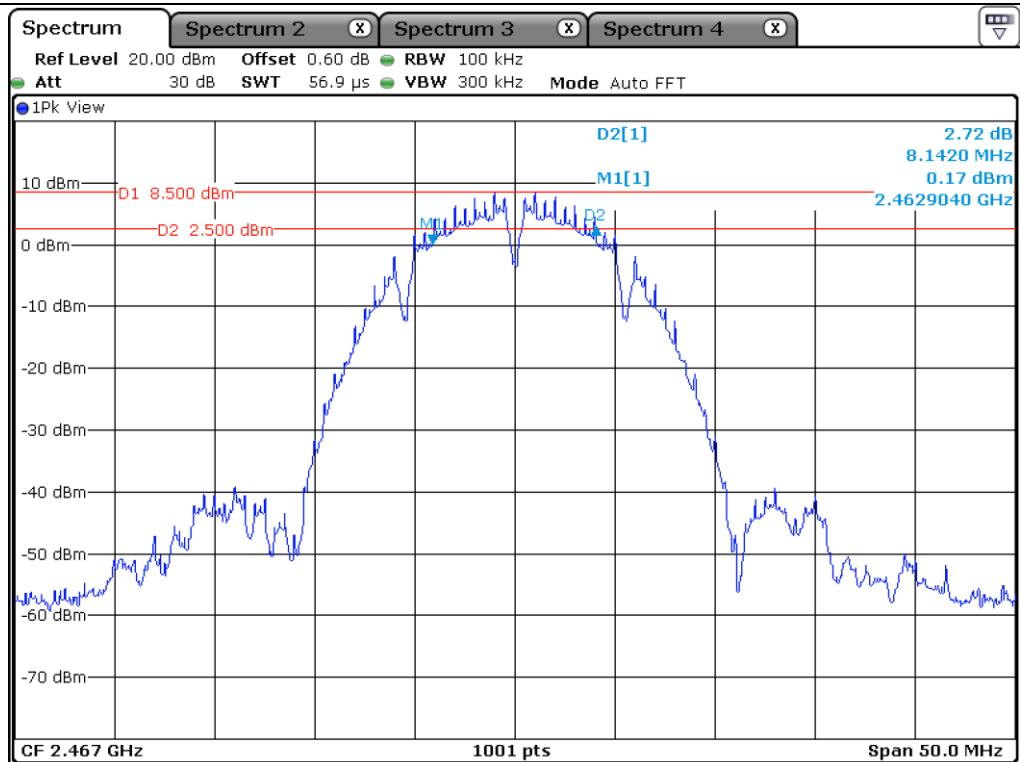
High Channel 11

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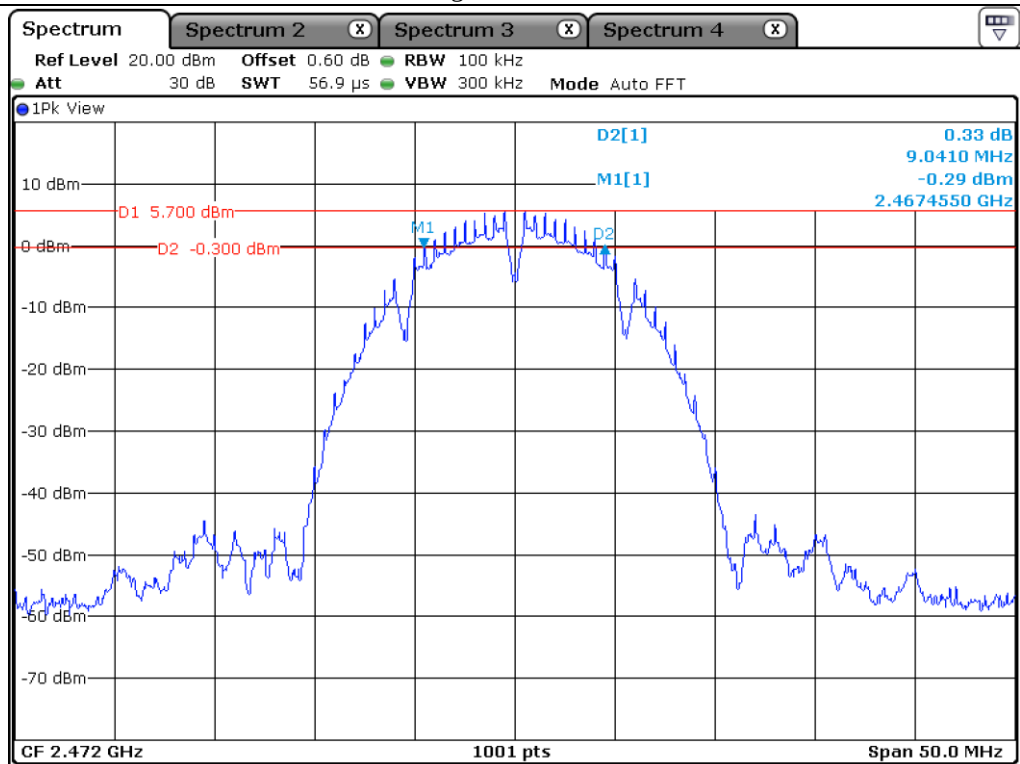
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High Channel 12



High Channel 13

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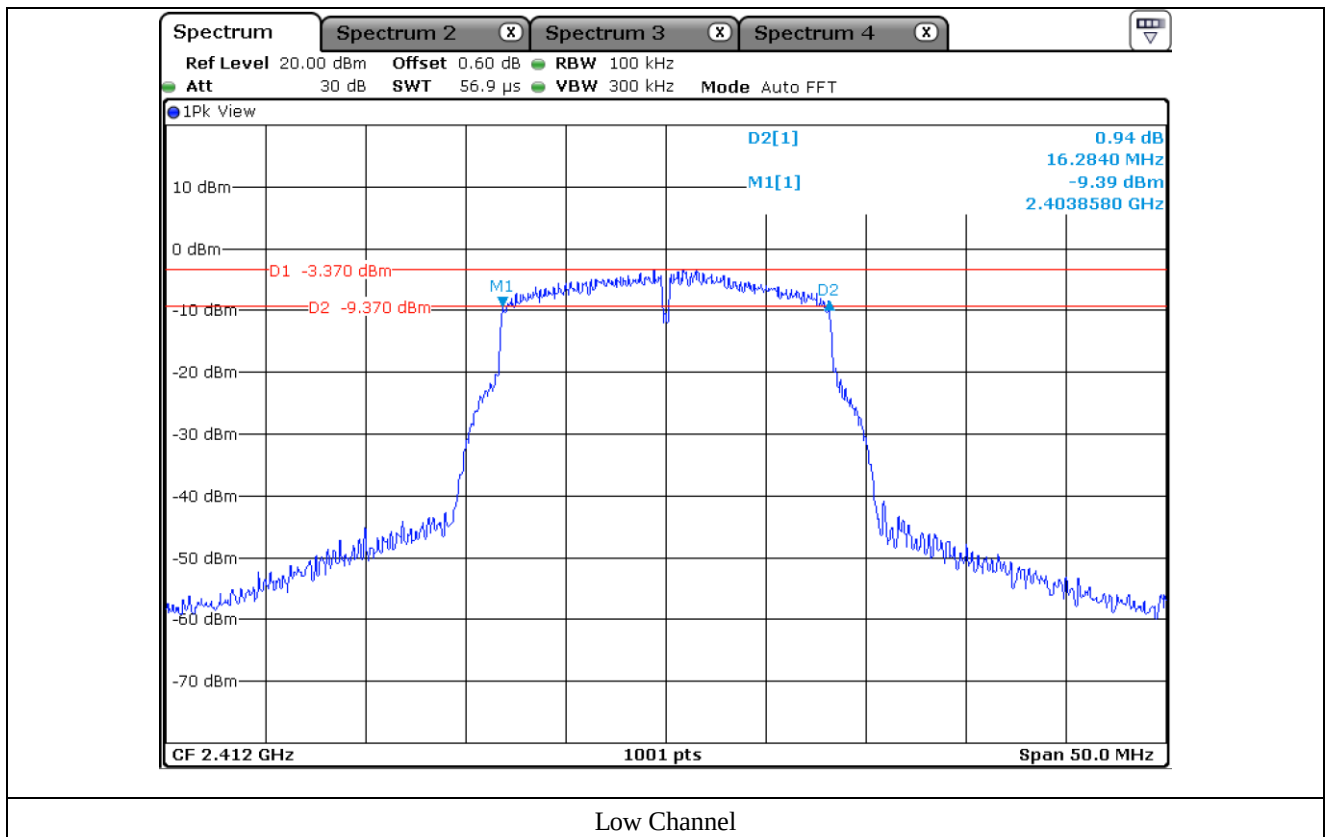
7.5 Test data for 802.11g WLAN Mode

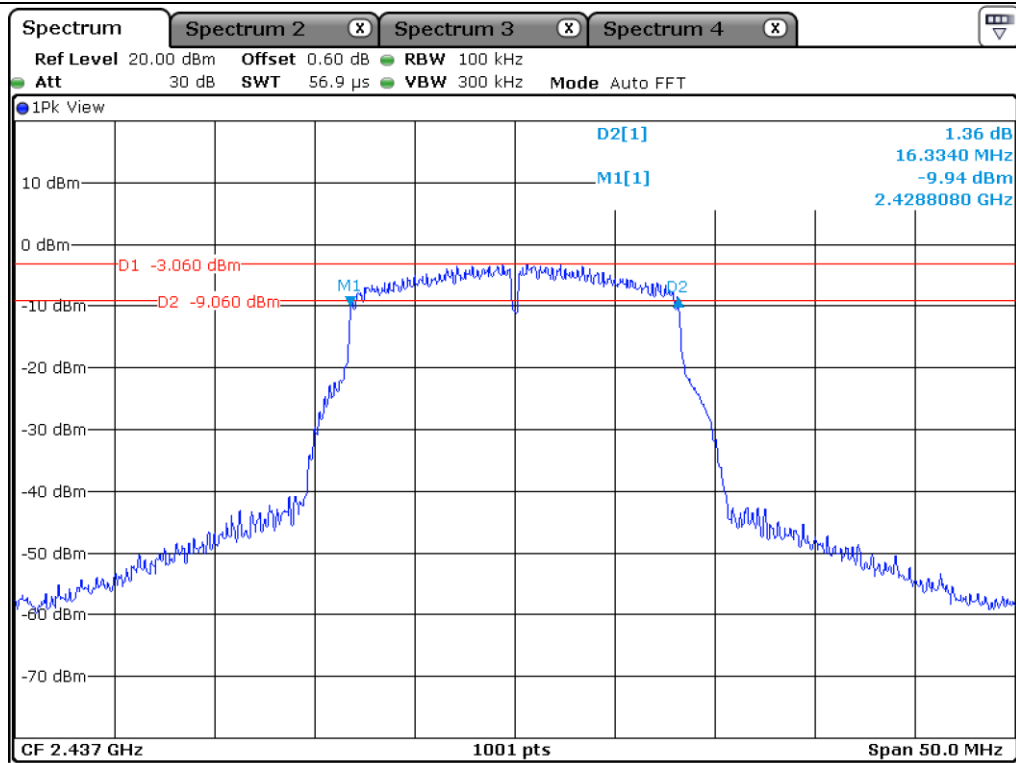
7.5.1 Test data for Antenna 0

-. Test Result : Pass

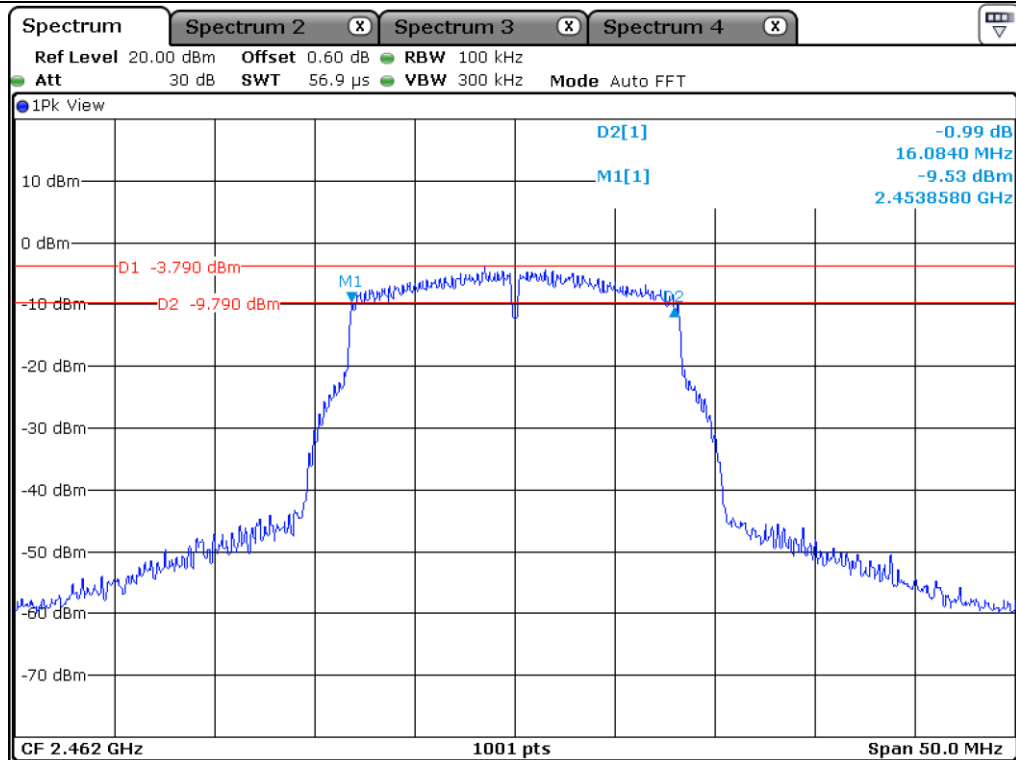
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	16.28	0.50	15.78
Middle	2 437.00	16.33	0.50	15.83
High 11	2 462.00	16.08	0.50	15.58
High 12	2 467.00	16.28	0.50	15.78
High 13	2 472.00	16.28	0.50	15.78

Remark. Margin = Measured Value - Limit

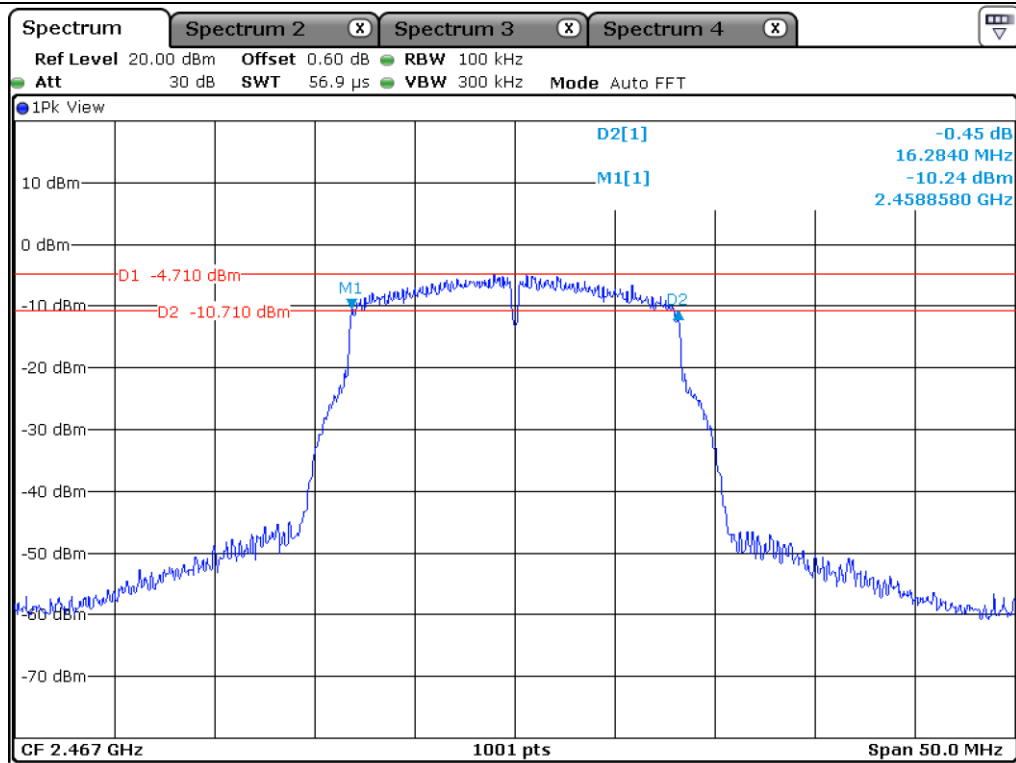




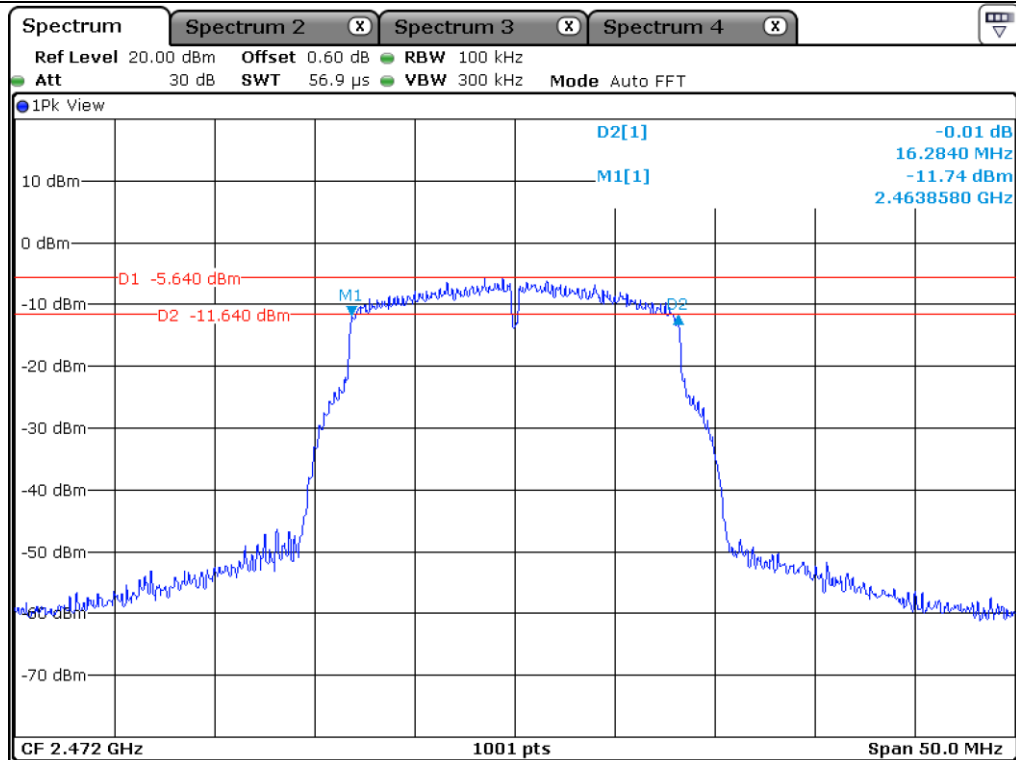
Middle Channel



High Channel 11



High Channel 12



High Channel 13

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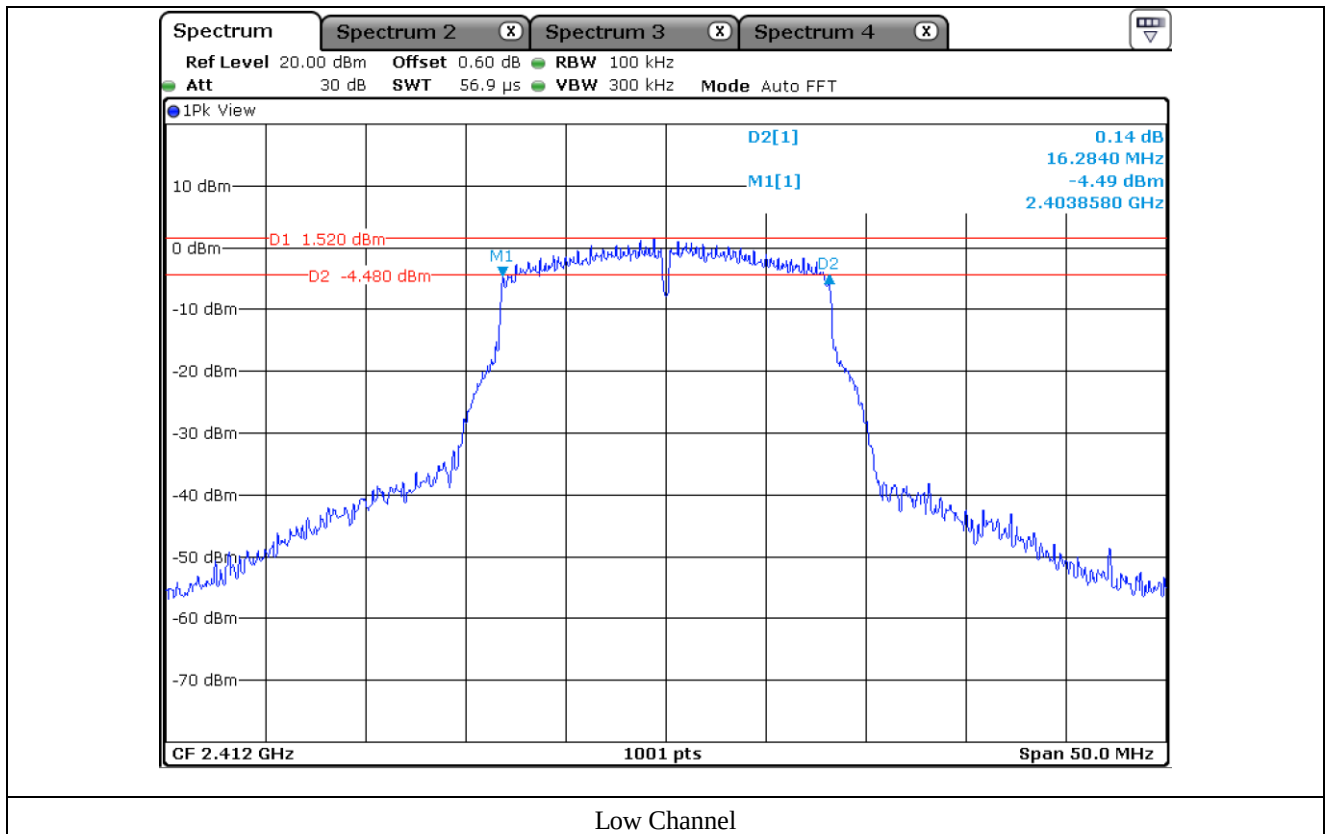
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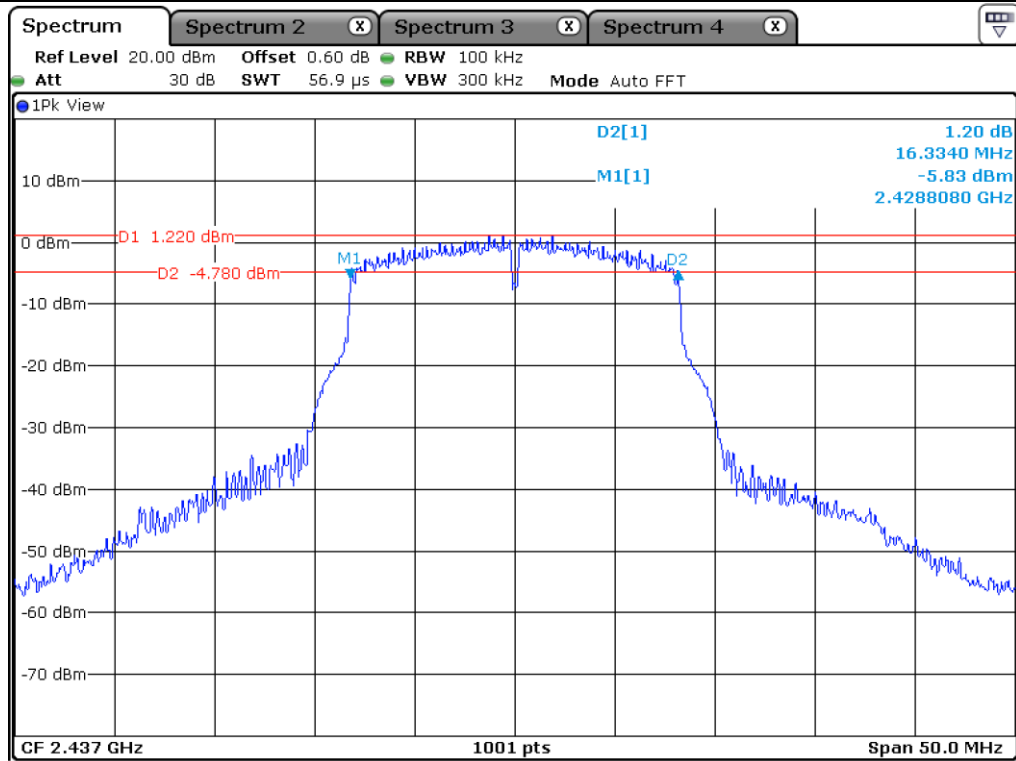
7.5.2 Test data for Antenna 1

-. Test Result : Pass

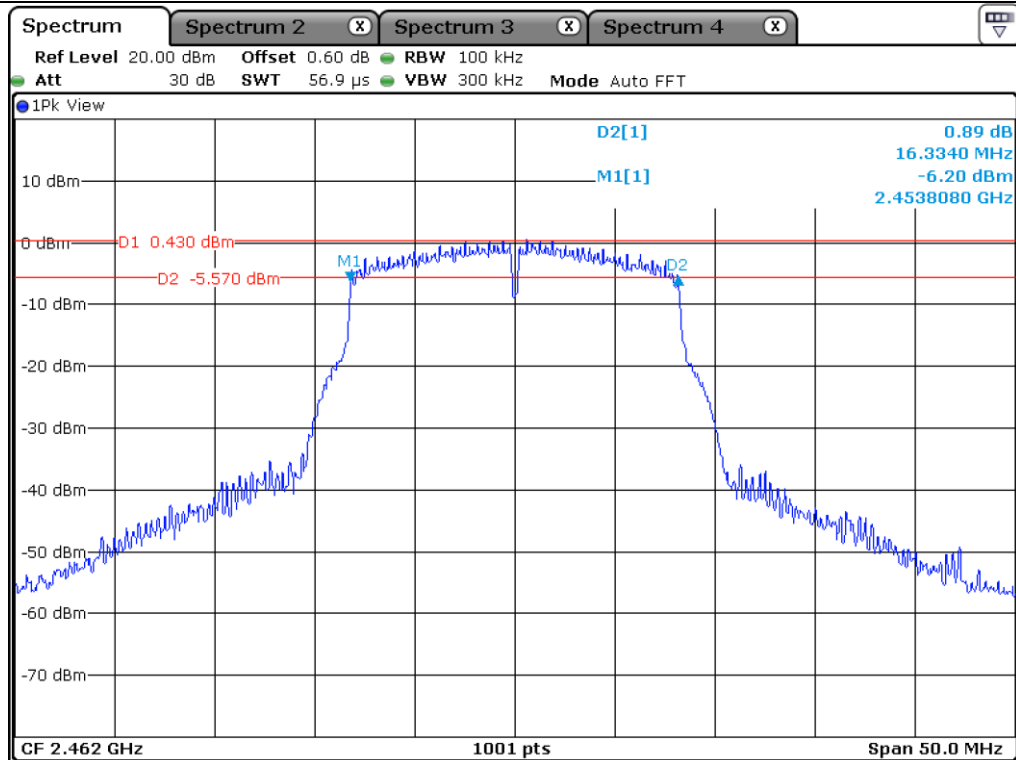
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	16.28	0.50	15.78
Middle	2 437.00	16.33	0.50	15.83
High 11	2 462.00	16.33	0.50	15.83
High 12	2 467.00	16.33	0.50	15.83
High 13	2 472.00	16.33	0.50	15.83

Remark. Margin = Measured Value – Limit

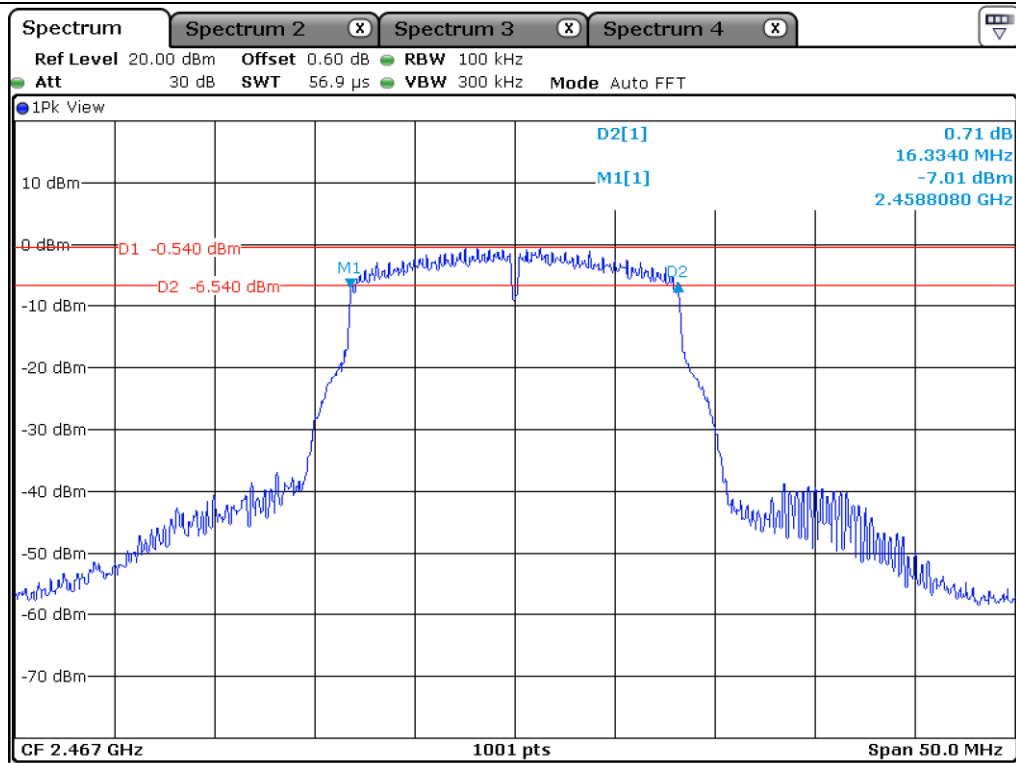




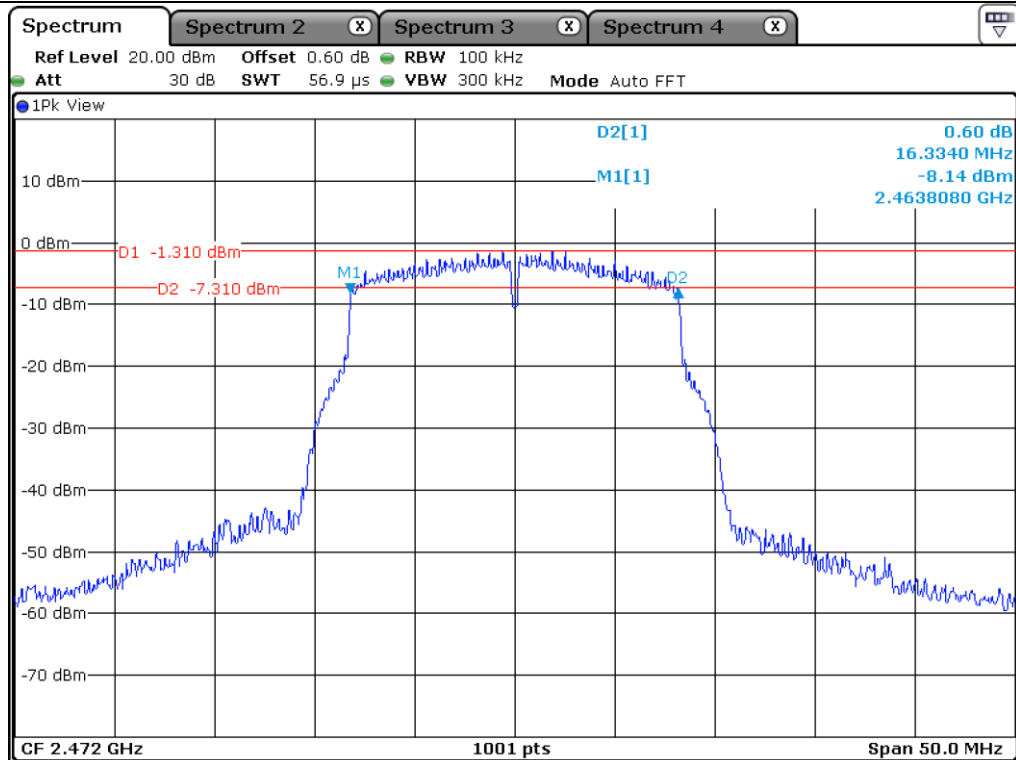
Middle Channel



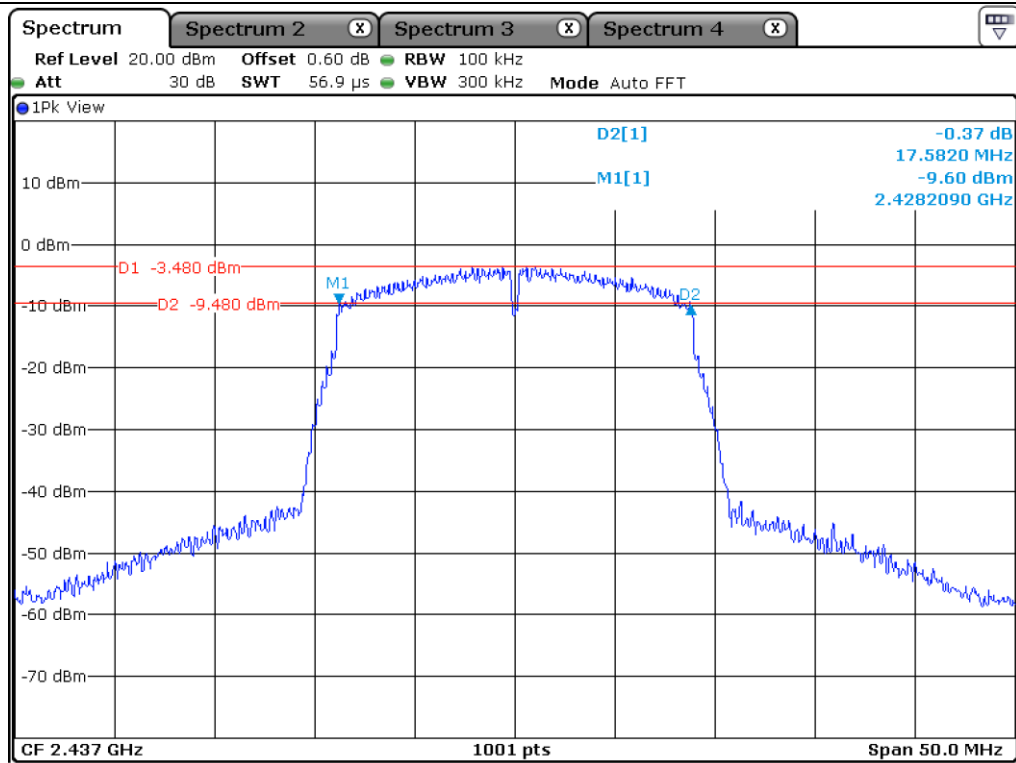
High Channel 11



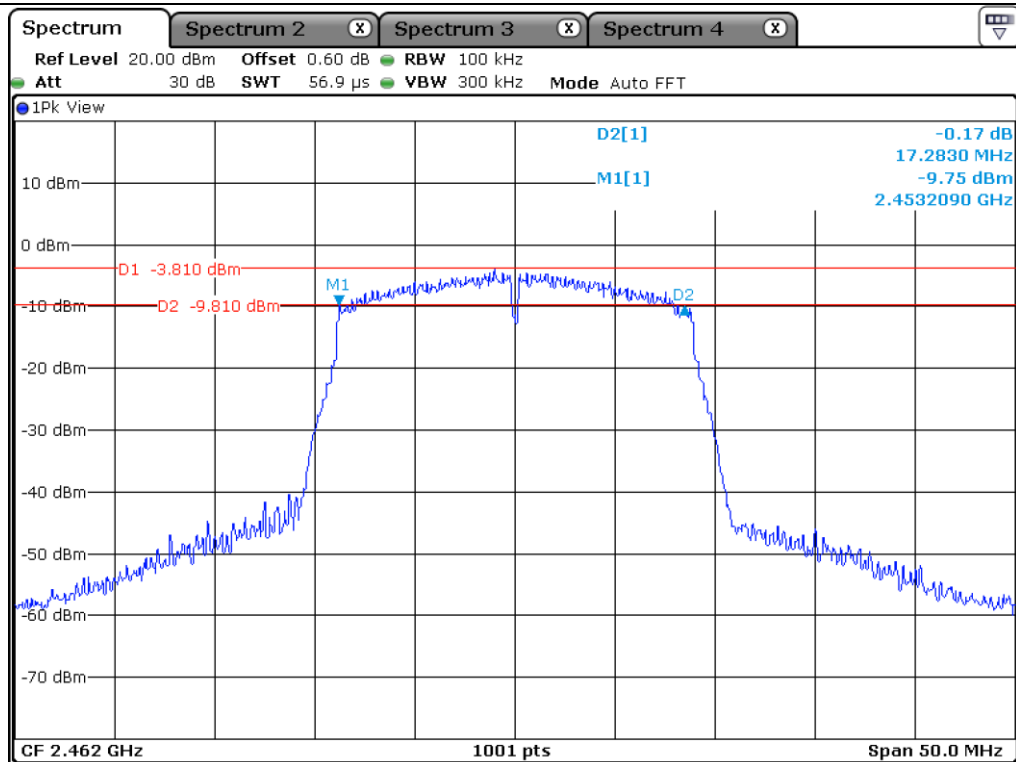
High Channel 12



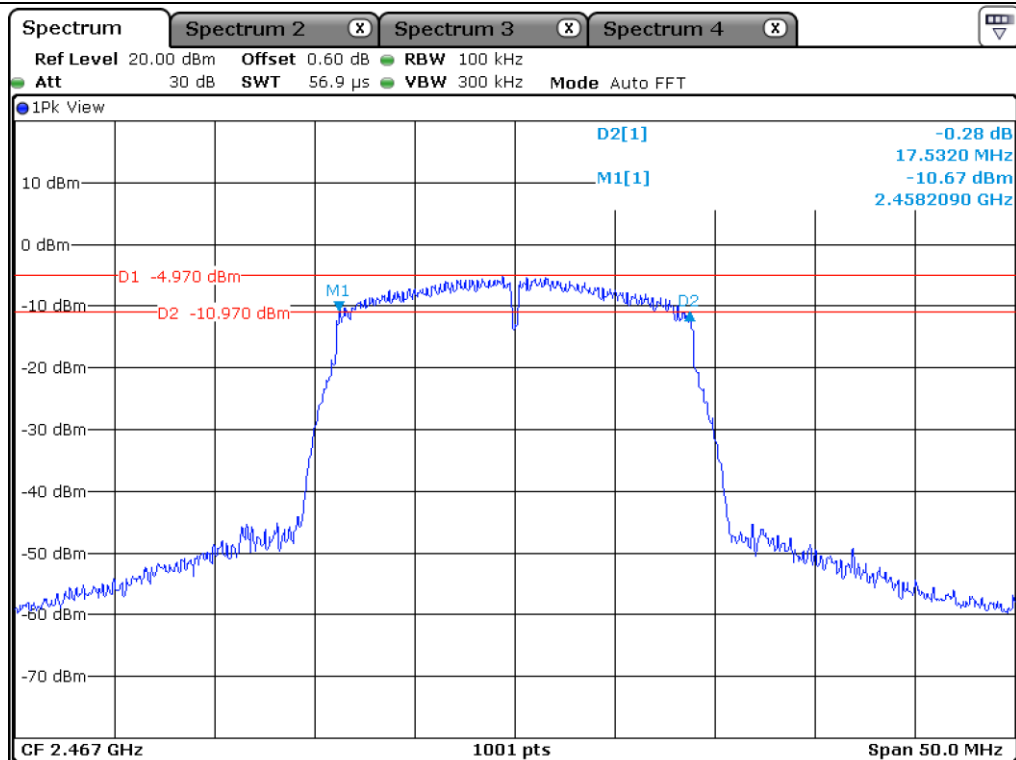
High Channel 13



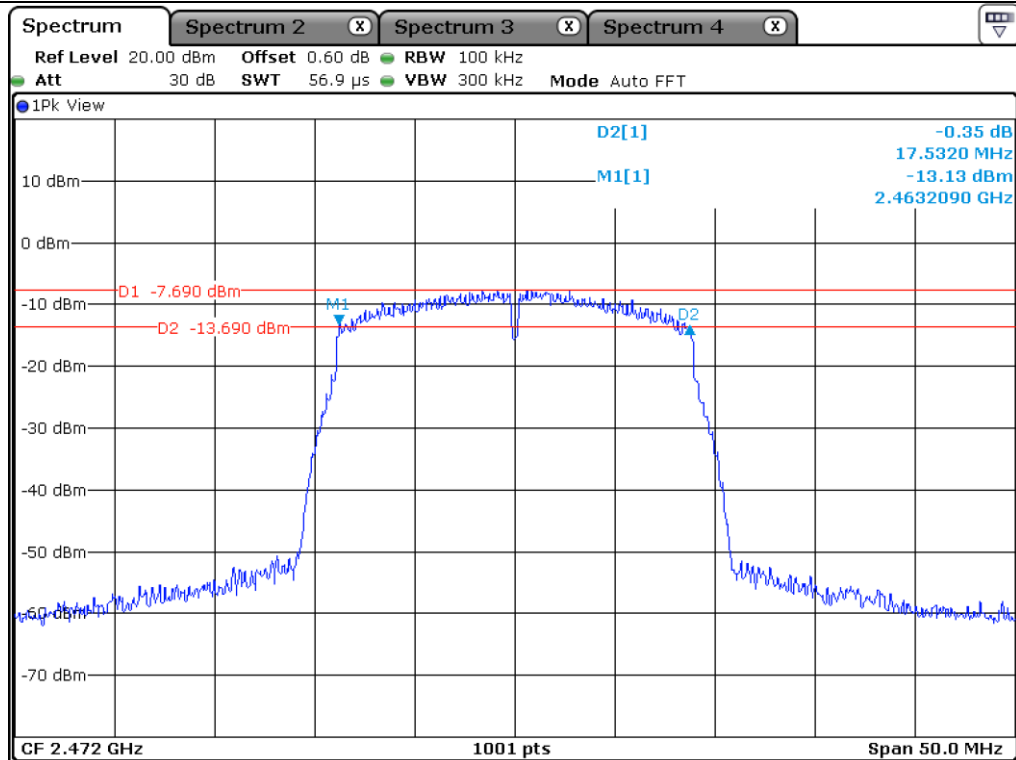
Middle Channel



High Channel 11



High Channel 12



High Channel 13

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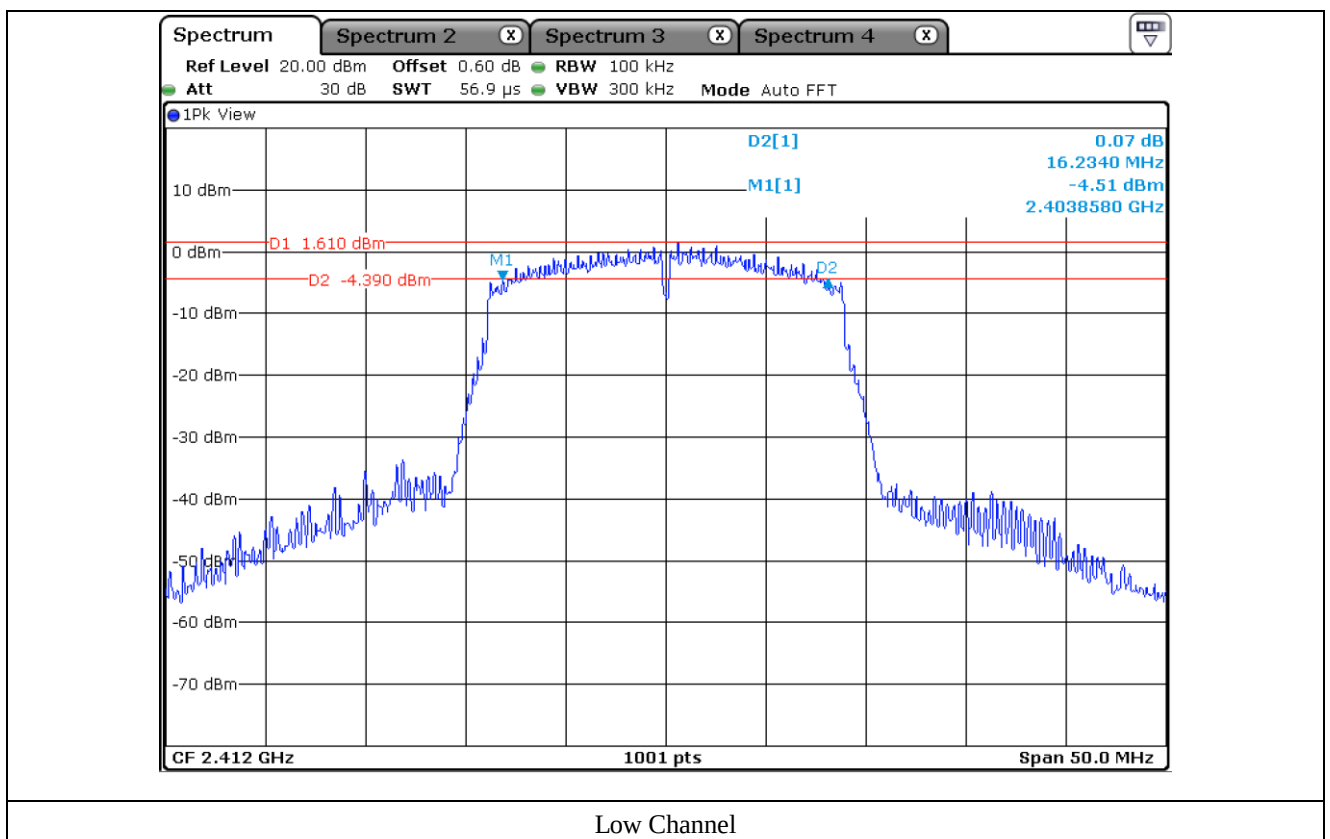
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7.6.2 Test data for Antenna 1

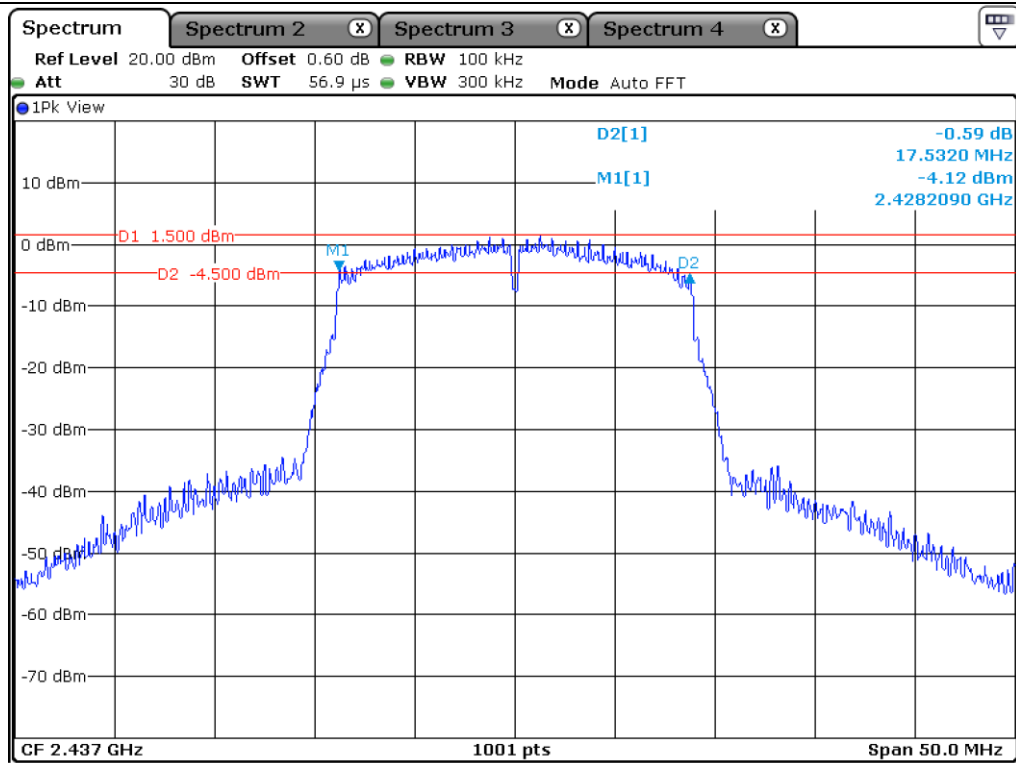
-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	16.23	0.50	15.73
Middle	2 437.00	17.53	0.50	17.03
High 11	2 462.00	17.53	0.50	17.03
High 12	2 467.00	17.53	0.50	17.03
High 13	2 472.00	17.53	0.50	17.03

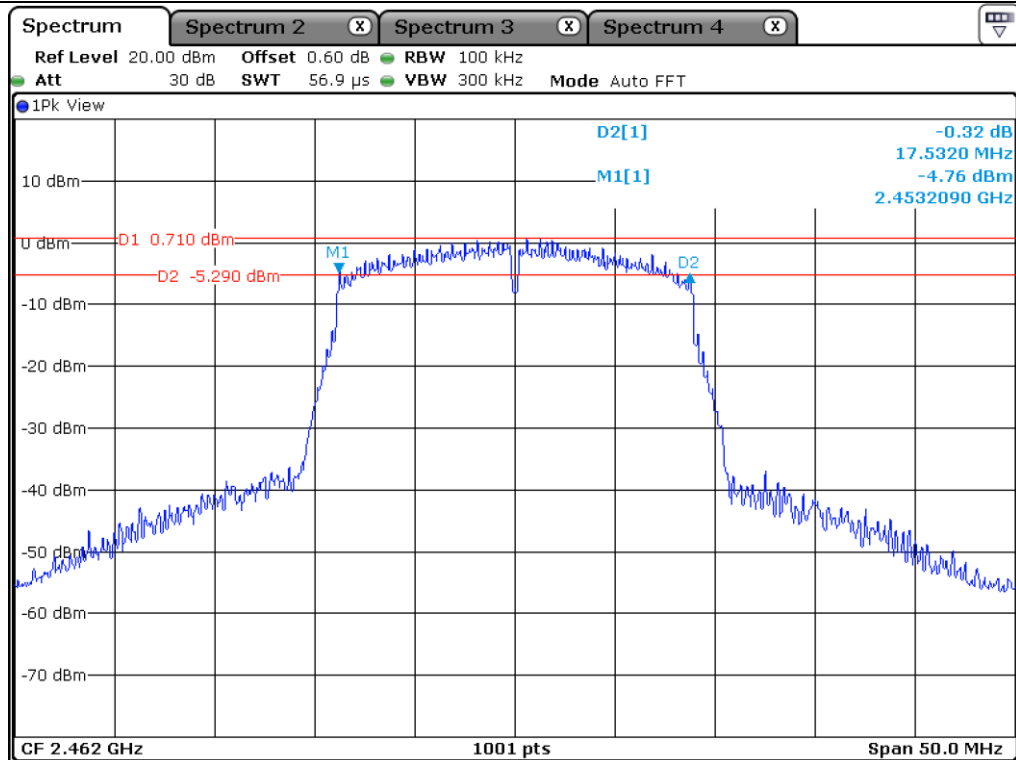
Remark. Margin = Measured Value - Limit



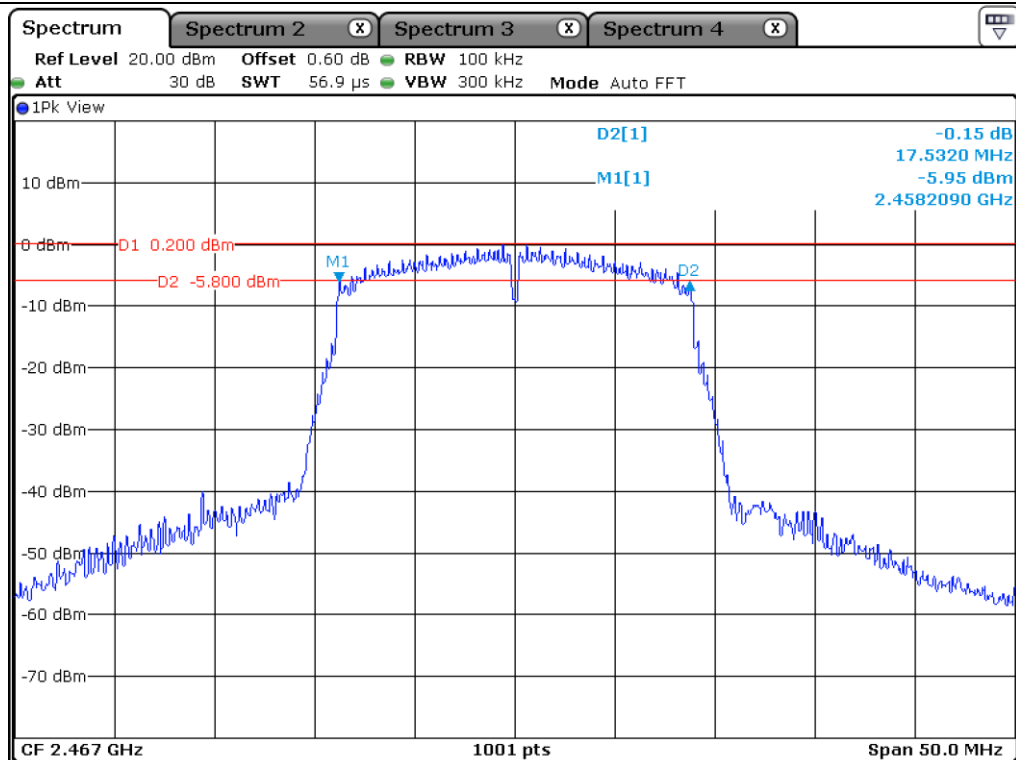
Low Channel



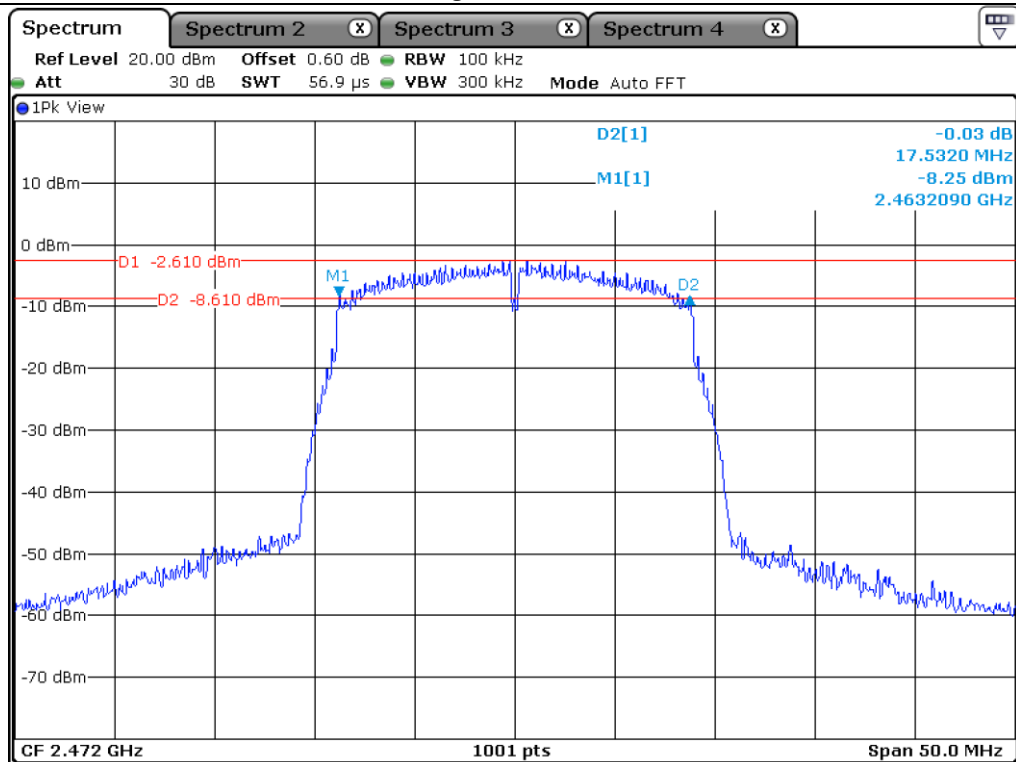
Middle Channel



High Channel 11



High Channel 12



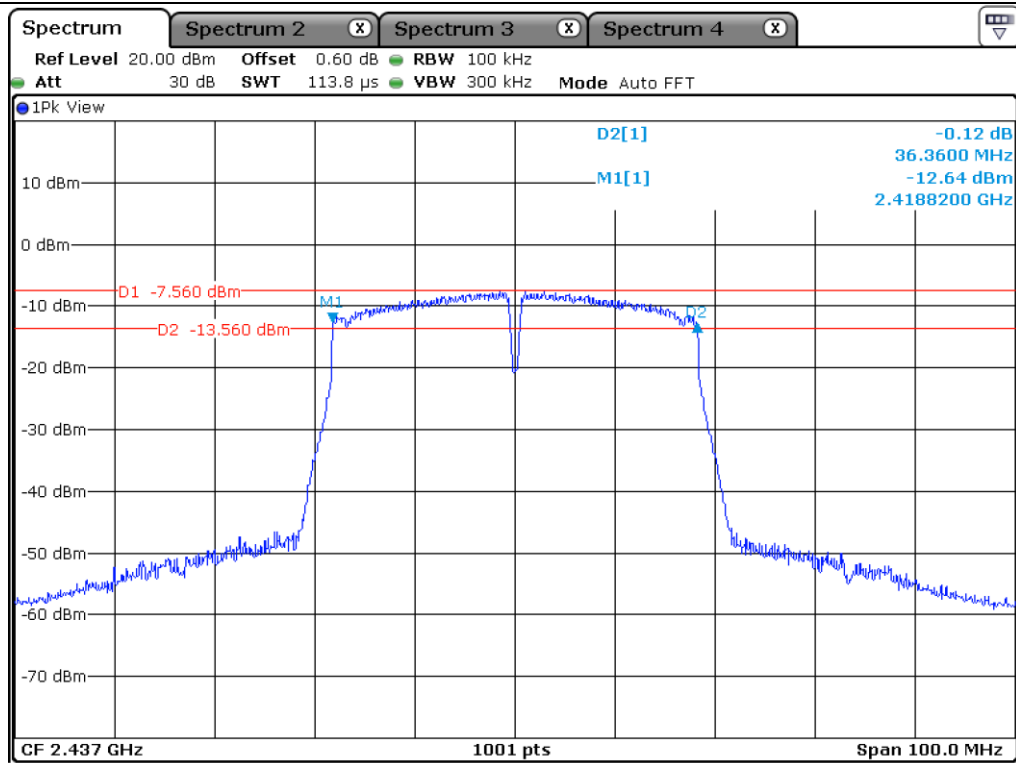
High Channel 13

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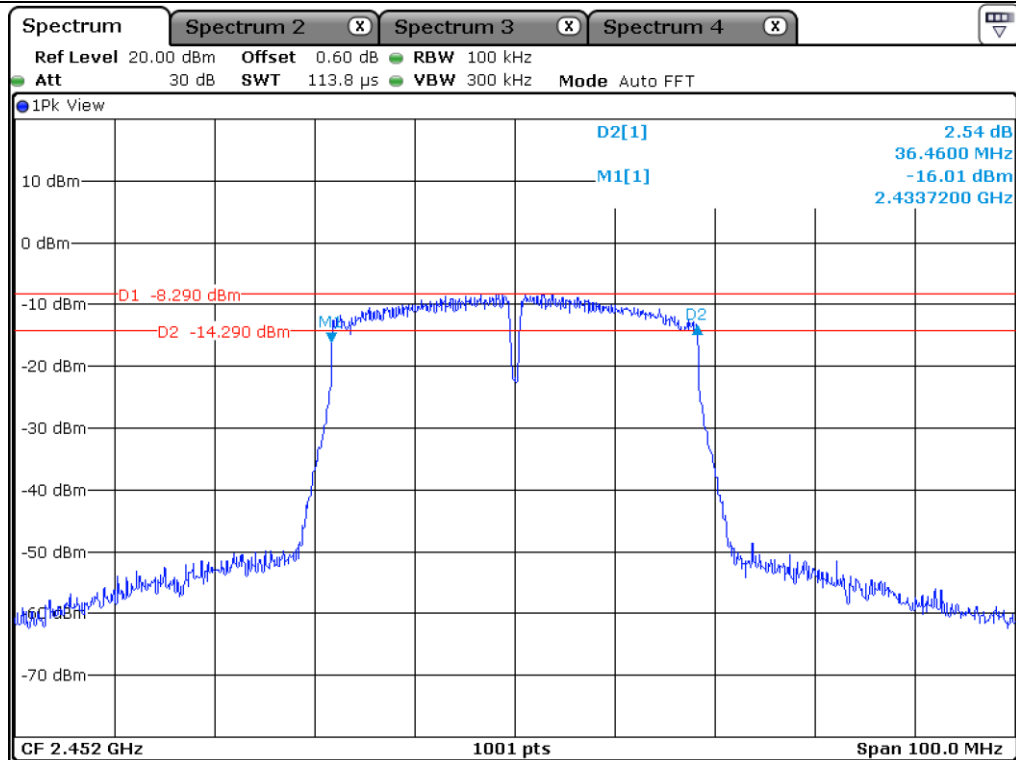
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Middle Channel



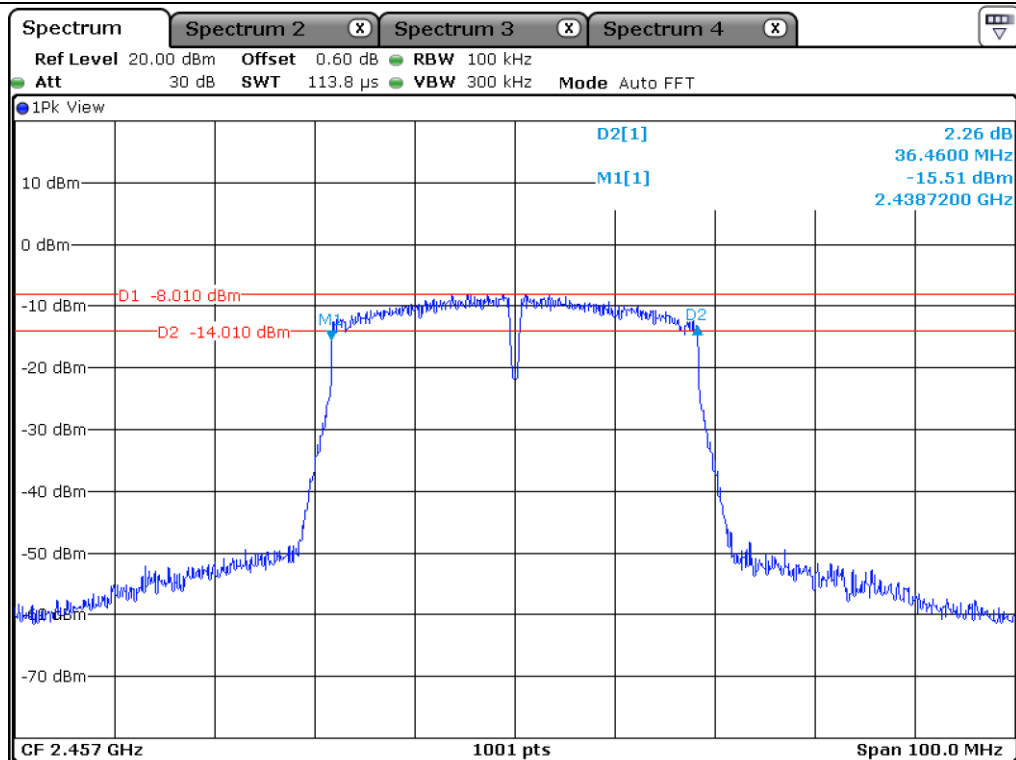
High Channel 9

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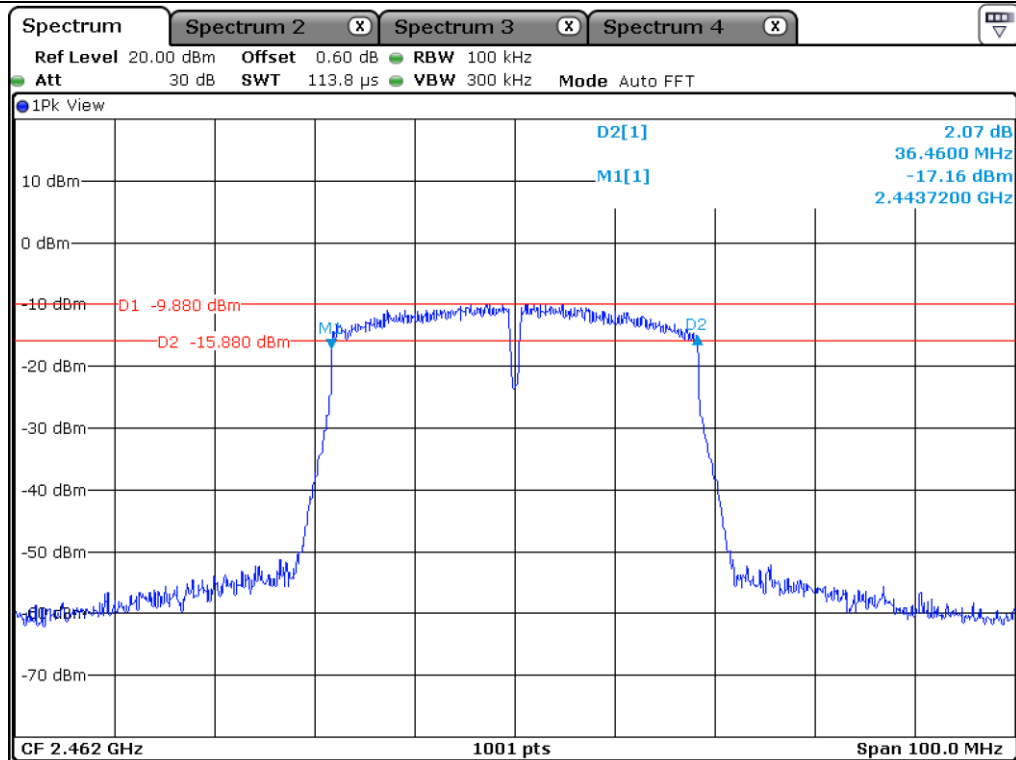
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High Channel 10



High Channel 11

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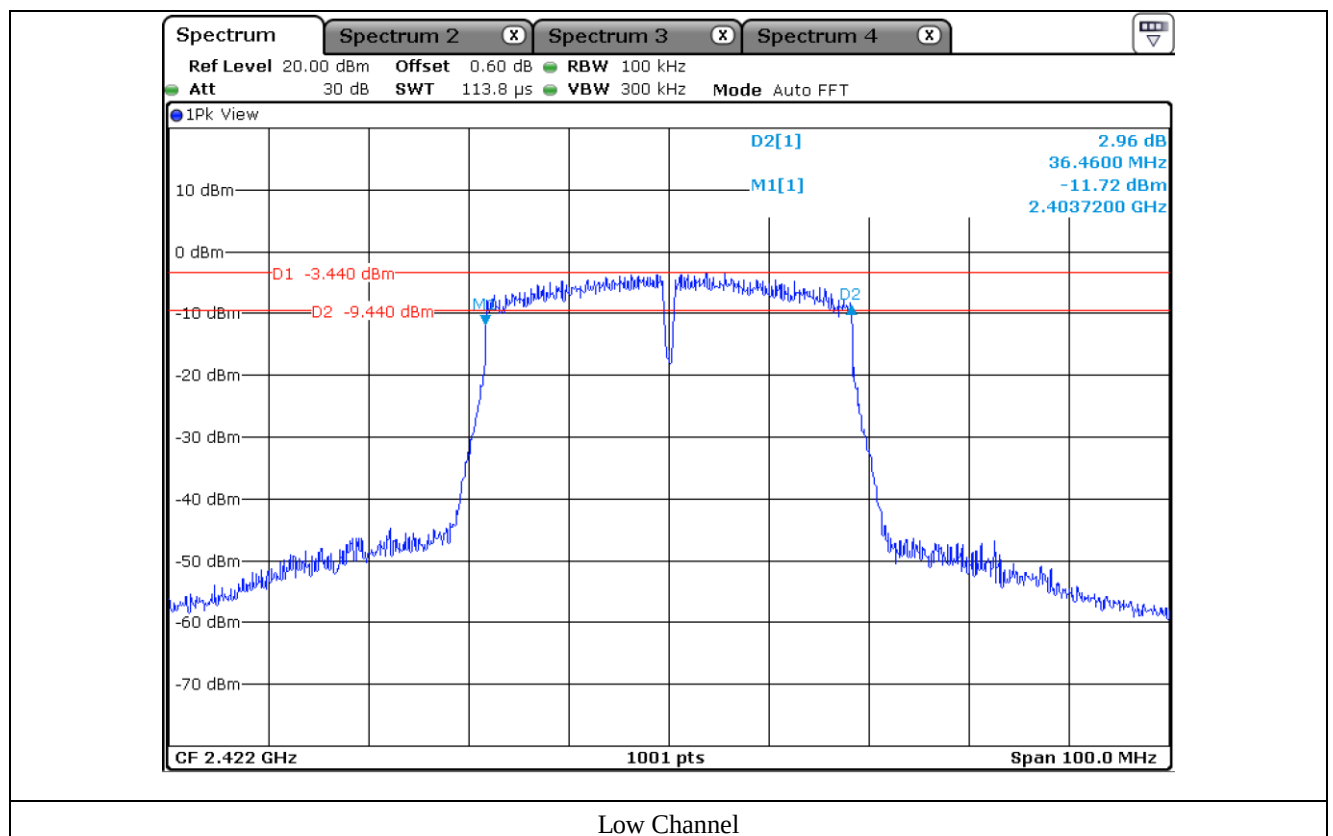
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

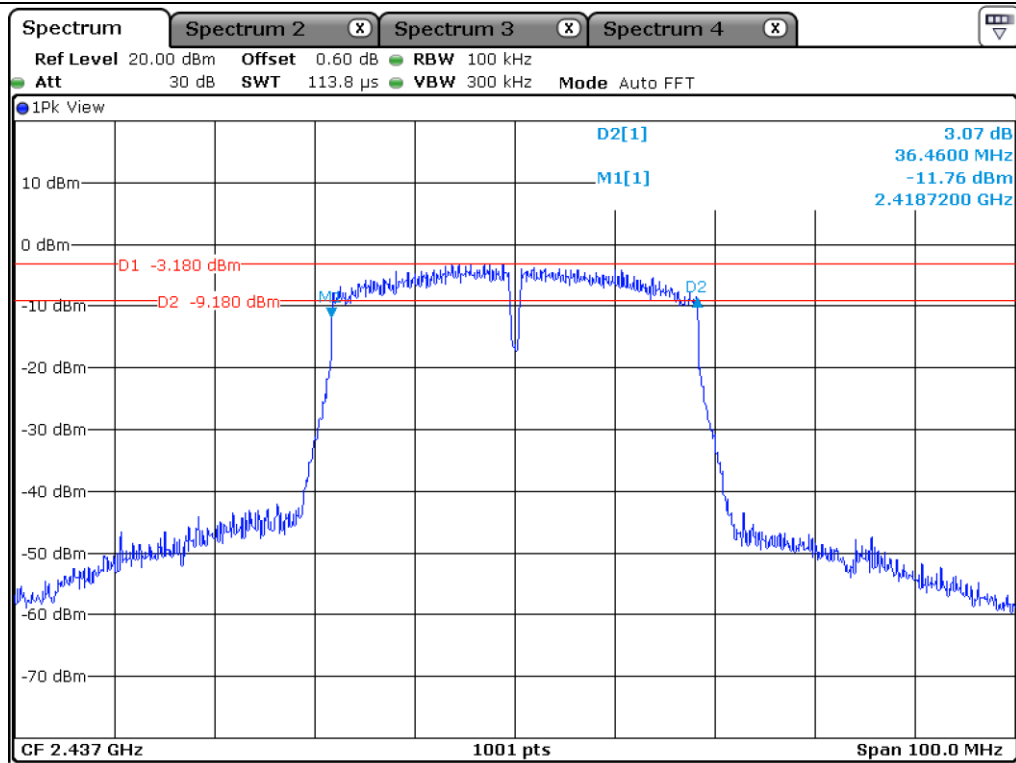
7.7.2 Test data for Antenna 1

-. Test Result : Pass

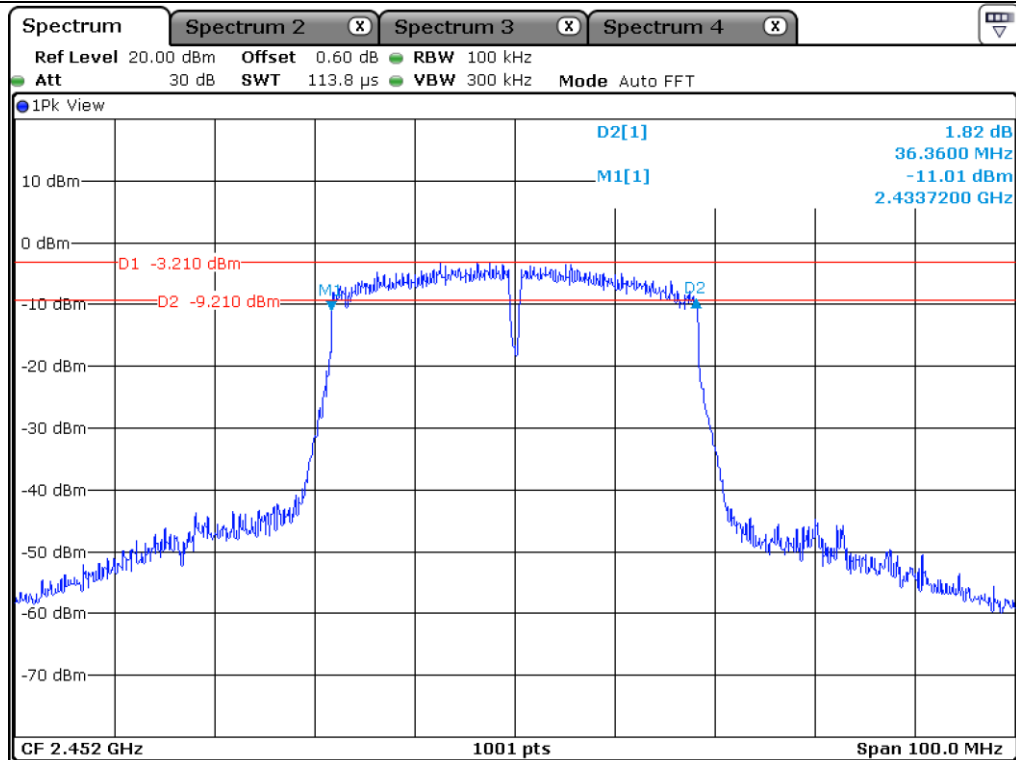
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 422.00	36.46	0.50	35.96
Middle	2 437.00	36.46	0.50	35.96
High 9	2 452.00	36.36	0.50	35.86
High 10	2 457.00	36.46	0.50	35.96
High 11	2 462.00	36.46	0.50	35.96

Remark. Margin = Measured Value - Limit





Middle Channel



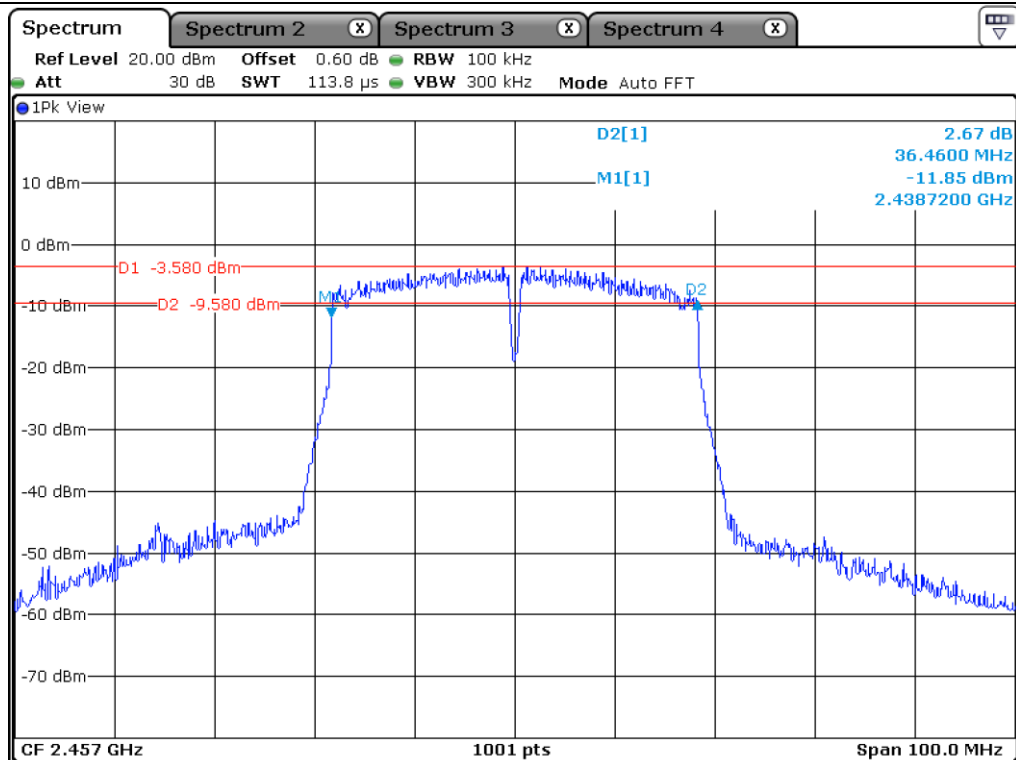
High Channel 9

This Report is not correlated with the authentication of KOLAS

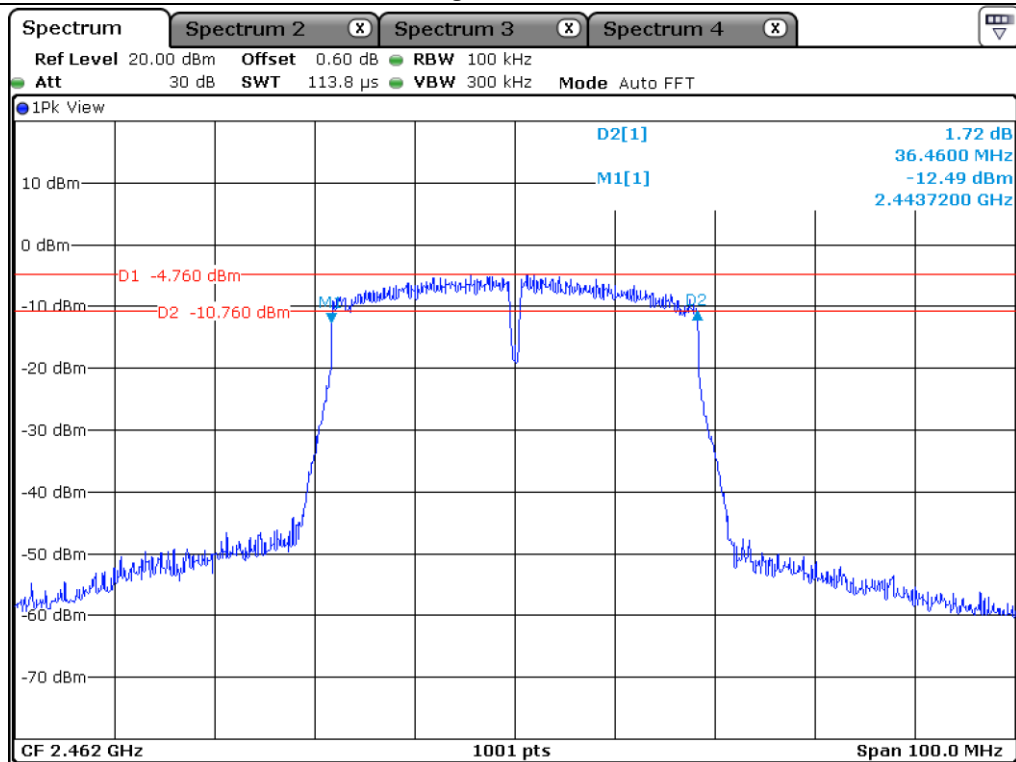
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High Channel 10



High Channel 11

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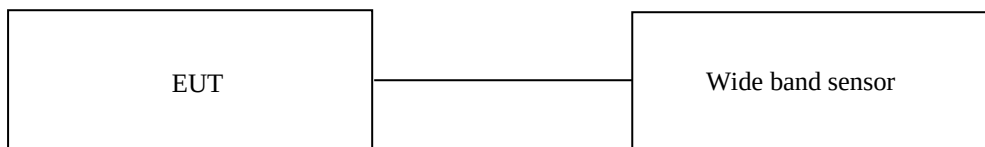
8. MAXIMUM CONDUCTED (AVERAGE) OUTPUT POWER

8.1 Operating environment

Temperature : 23 ° C
Relative humidity : 45 % R.H.

8.2 Test set-up

The maximum peak output power was measured with the wide band sensor connected to the antenna output of the EUT.
The Wide Band Sensor is measured when the EUT is transmitting at the appropriate center frequency its maximum power control level as described in Section 8.3(558074 D01 15.247 Meas Guidance v05r02).
Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.



8.3 Test Date

October 07, 2021 ~ October 20, 2021

8.4 Test data for 802.11b WLAN Mode

8.4.1 Test data for Antenna 0

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	16.92	30.00	13.08
MIDDLE	2 437.00	17.30	30.00	12.70
HIGH 11	2 462.00	16.49	30.00	13.51
HIGH 12	2 467.00	15.05	30.00	14.95
HIGH 13	2 472.00	13.30	30.00	16.70

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

8.4.2 Test data for Antenna 1

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	16.25	30.00	13.75
MIDDLE	2 442.00	17.11	30.00	12.89
HIGH 11	2 462.00	17.30	30.00	12.70
HIGH 12	2 467.00	17.32	30.00	12.68
HIGH 13	2 472.00	14.74	30.00	15.26

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

8.5 Test data for 802.11g WLAN Mode

8.5.1 Test data for Antenna 0

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	10.62	30.00	19.38
MIDDLE	2 442.00	11.15	30.00	18.85
HIGH 11	2 462.00	10.16	30.00	19.84
HIGH 12	2 467.00	9.08	30.00	20.92
HIGH 13	2 472.00	8.00	30.00	22.00

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

8.5.2 Test data for Antenna 1

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	14.56	30.00	15.44
MIDDLE	2 442.00	14.60	30.00	15.40
HIGH 11	2 462.00	14.00	30.00	16.00
HIGH 12	2 467.00	13.17	30.00	16.83
HIGH 13	2 472.00	12.16	30.00	17.84

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

8.5.3 Test data for Multiple Transmit

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	16.03	30.00	13.97
MIDDLE	2 437.00	16.22	30.00	13.78
HIGH 11	2 462.00	15.50	30.00	14.50
HIGH 12	2 467.00	14.60	30.00	15.40
HIGH 13	2 472.00	13.57	30.00	16.43

Remark 1 : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

Remark 2 : Calculated Output Power= $10\log(10(\text{Antenna0 Output Power}/10)+10(\text{Antenna1 Output Power}/10))$

Remark 3 : Directional gain = $10*\log[(10G0/20+10G1/20)2/N]$ dBi

8.6 Test data for 802.11n_HT20 WLAN Mode

8.6.1 Test data for Antenna 0

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	10.44	30.00	19.56
MIDDLE	2 442.00	10.75	30.00	19.25
HIGH 11	2 462.00	9.83	30.00	20.17
HIGH 12	2 467.00	8.88	30.00	21.12
HIGH 13	2 472.00	6.69	30.00	23.31

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

8.6.2 Test data for Antenna 1

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	14.20	30.00	15.80
MIDDLE	2 437.00	14.31	30.00	15.69
HIGH 11	2 462.00	13.82	30.00	16.18
HIGH 12	2 467.00	13.03	30.00	16.97
HIGH 13	2 472.00	10.86	30.00	19.14

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

8.6.3 Test data for Multiple Transmit

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	15.73	30.00	14.27
MIDDLE	2 437.00	15.90	30.00	14.10
HIGH 11	2 462.00	15.28	30.00	14.72
HIGH 12	2 467.00	14.44	30.00	15.56
HIGH 13	2 472.00	12.27	30.00	17.73

Remark 1 : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

Remark 2 : Calculated Output Power= $10\log(10^{(\text{Antenna0 Output Power}/10)} + 10^{(\text{Antenna1 Output Power}/10)})$

Remark 3 : Directional gain = $10*\log[(10^{G0/20} + 10^{G1/20})^2/N]$ dBi

8.7 Test data for 802.11n_HT40 WLAN Mode

8.7.1 Test data for Antenna 0

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 422.00	9.04	30.00	20.96
MIDDLE	2 442.00	9.49	30.00	20.51
HIGH 9	2 452.00	9.25	30.00	20.75
HIGH 10	2 457.00	9.11	30.00	20.89
HIGH 11	2 462.00	7.82	30.00	22.18

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

8.7.2 Test data for Antenna 1

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 422.00	13.38	30.00	16.62
MIDDLE	2 437.00	13.54	30.00	16.46
HIGH 9	2 452.00	13.14	30.00	16.86
HIGH 10	2 457.00	12.96	30.00	17.04
HIGH 11	2 462.00	11.92	30.00	18.08

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

8.7.3 Test data for Multiple Transmit

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 422.00	14.74	30.00	15.26
MIDDLE	2 437.00	14.98	30.00	15.02
HIGH 9	2 452.00	14.63	30.00	15.37
HIGH 10	2 457.00	14.46	30.00	15.54
HIGH 11	2 462.00	13.35	30.00	16.65

Remark 1 : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

Remark 2 : Calculated Output Power= $10\log (10^{(\text{Antenna0 Output Power}/10)}+10^{(\text{Antenna1 Output Power}/10)})$

Remark 3 : Directional gain = $10*\log[(10^{G0/20}+10^{G1/20})^2/N]$ dBi

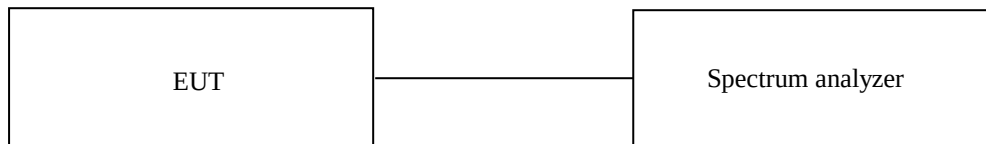
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature : 23 ° C
Relative humidity : 45 % R.H.

9.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used.



9.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

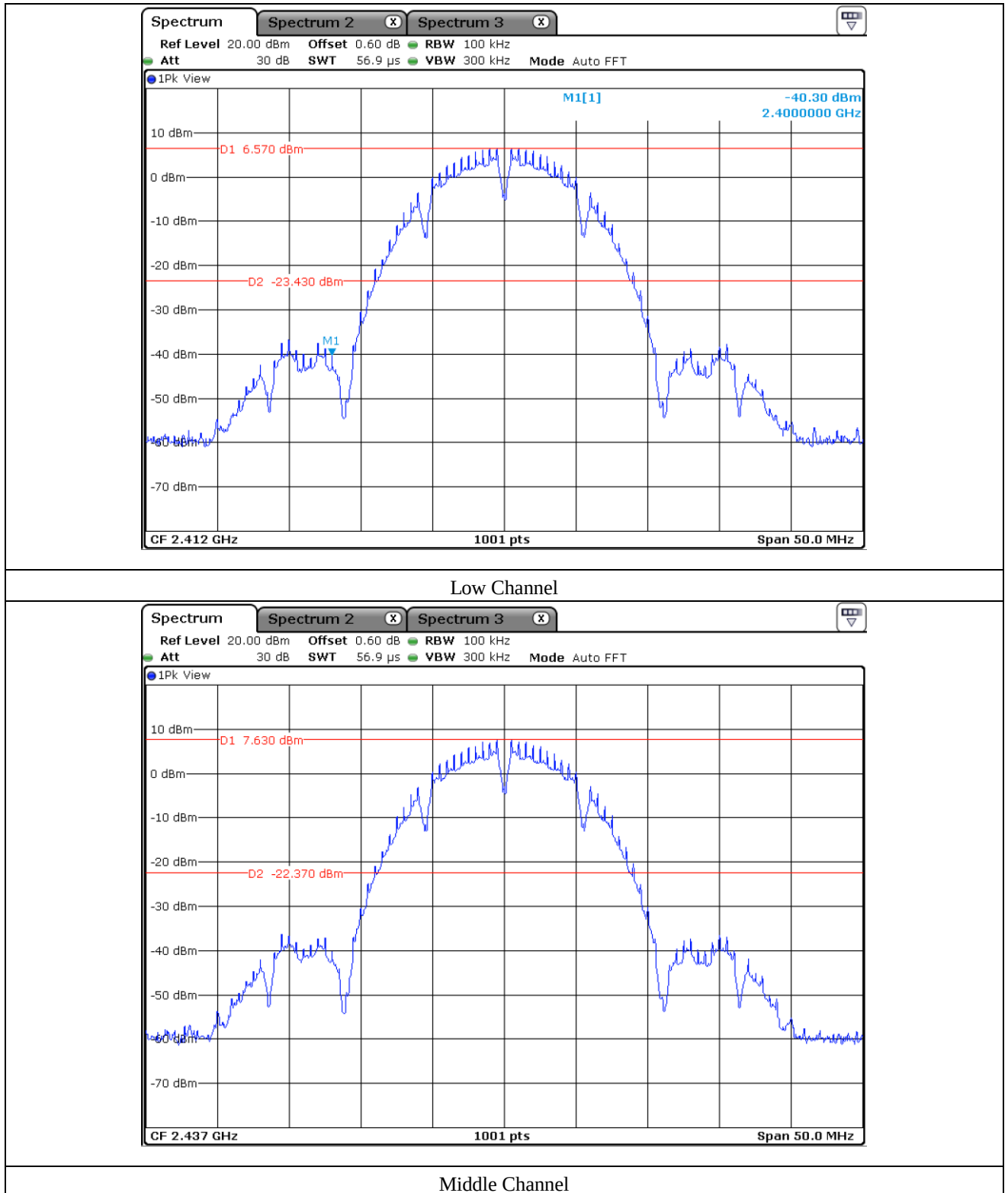
9.4 Test Date

October 07, 2021 ~ October 20, 2021

9.5 Test data for conducted emission

9.5.1 Test data for 802.11b WLAN Mode

9.5.1.1 Test data for Antenna 0

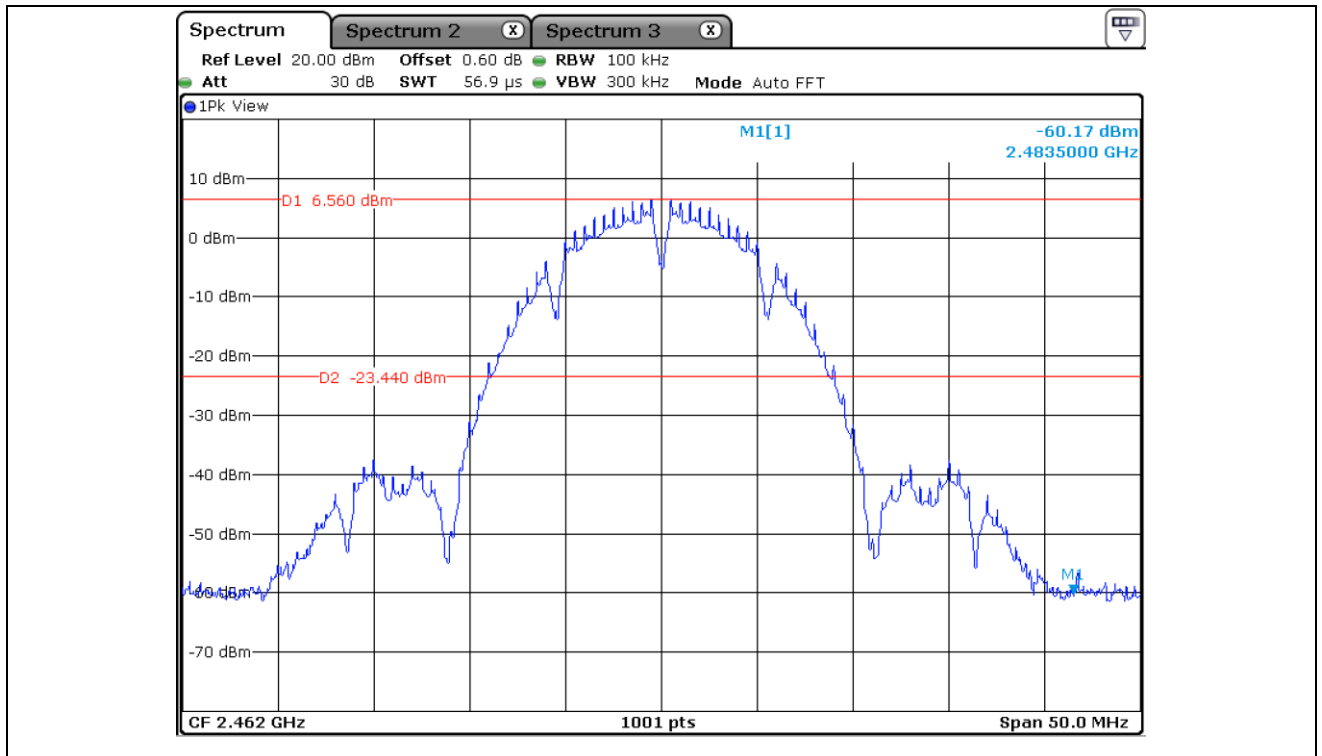


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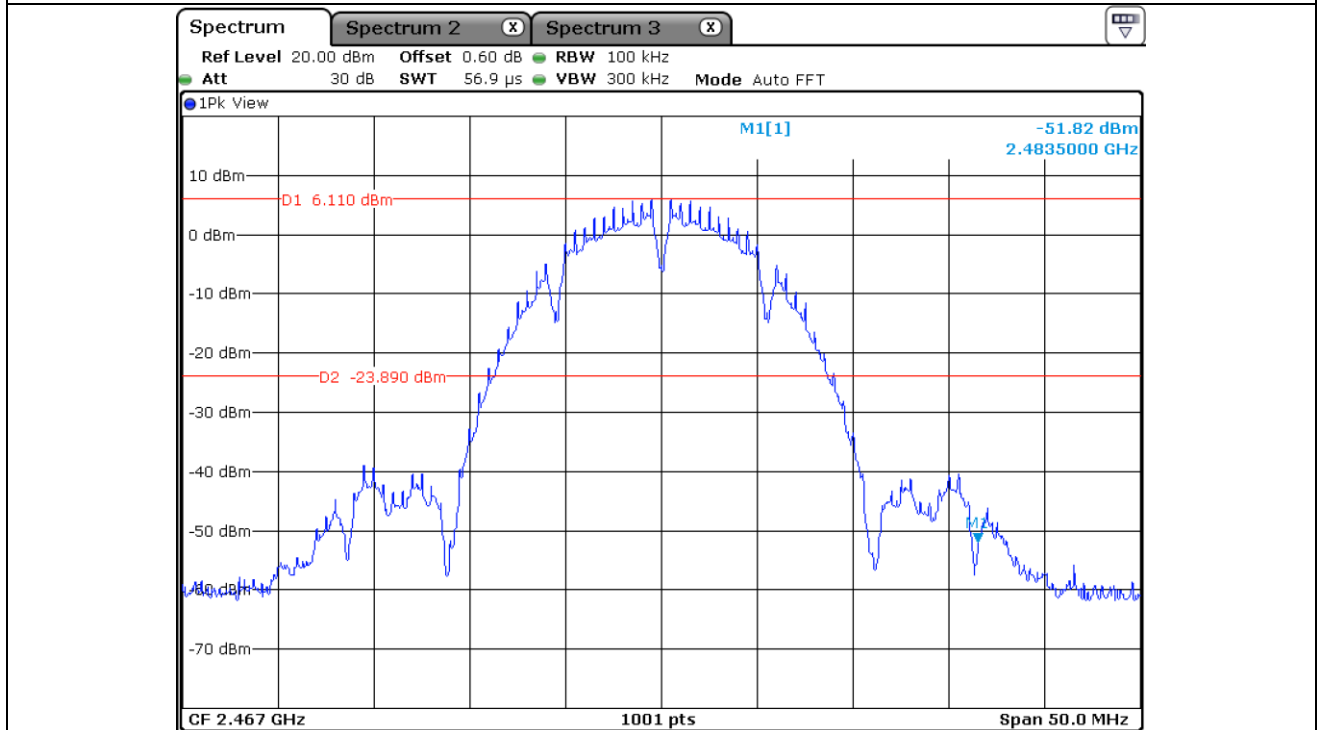
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High Channel 11



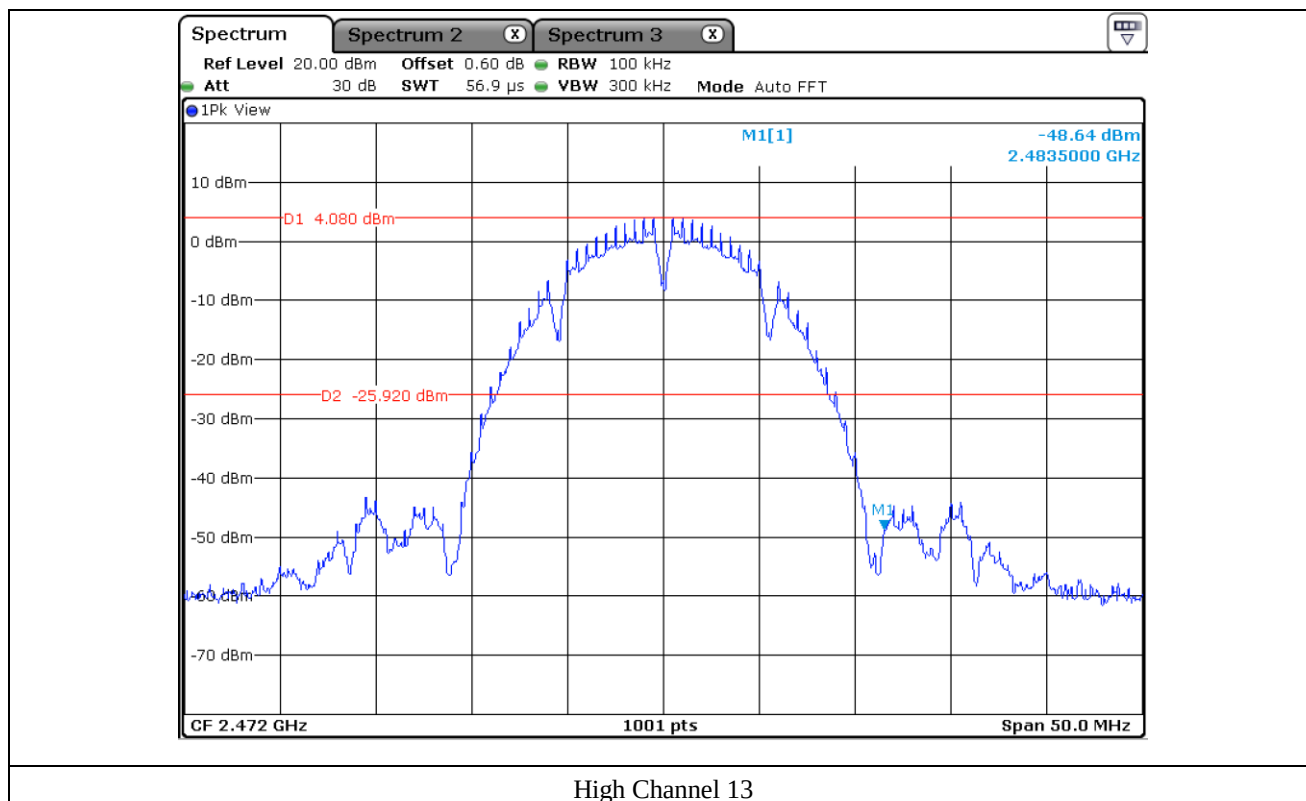
High Channel 12

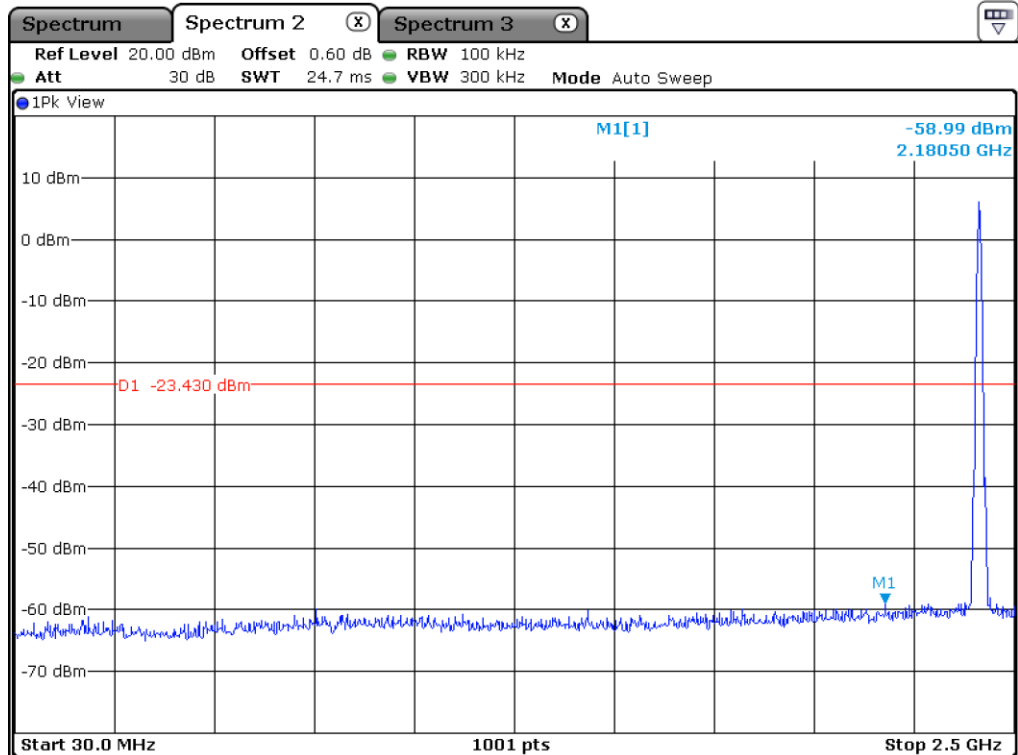
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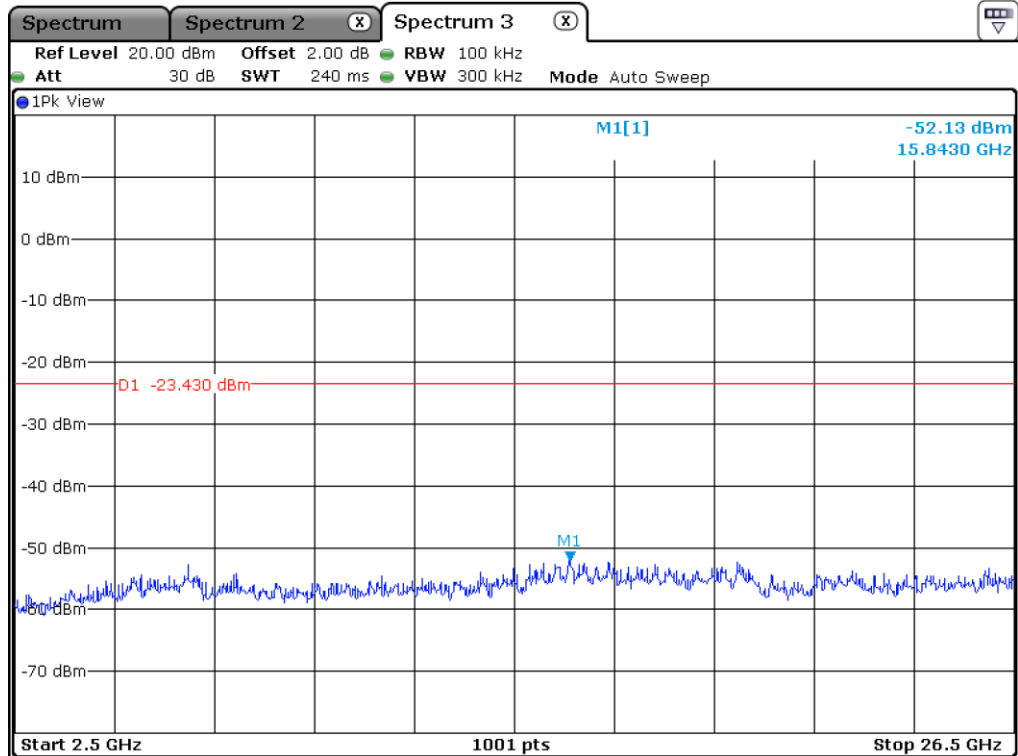
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Low Channel



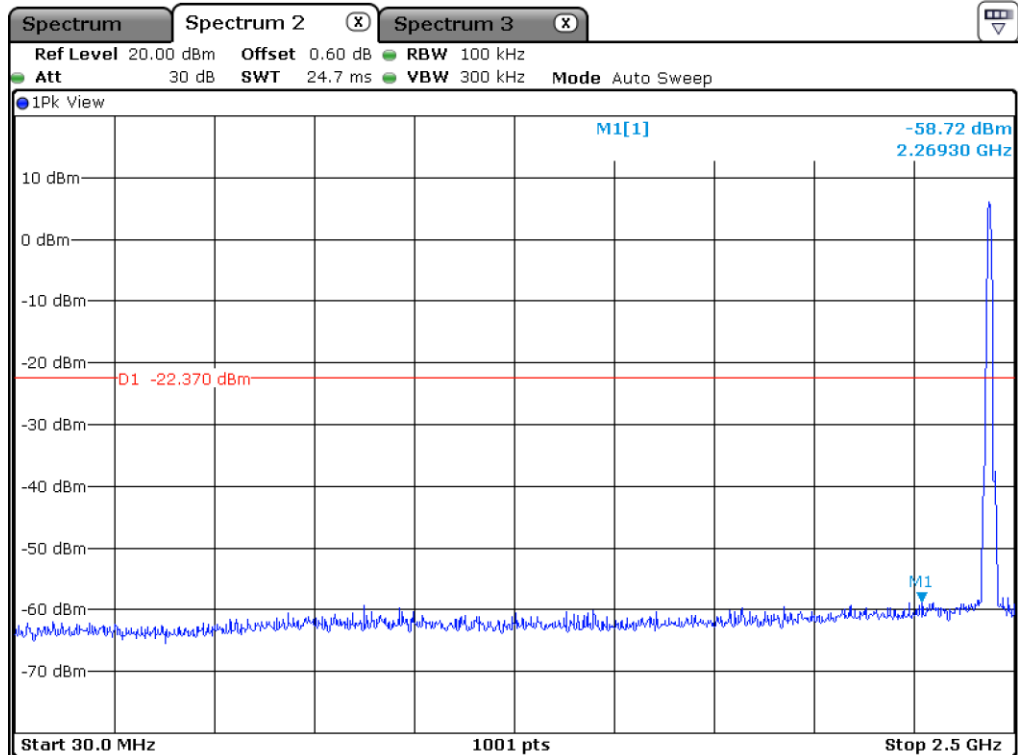
Low Channel

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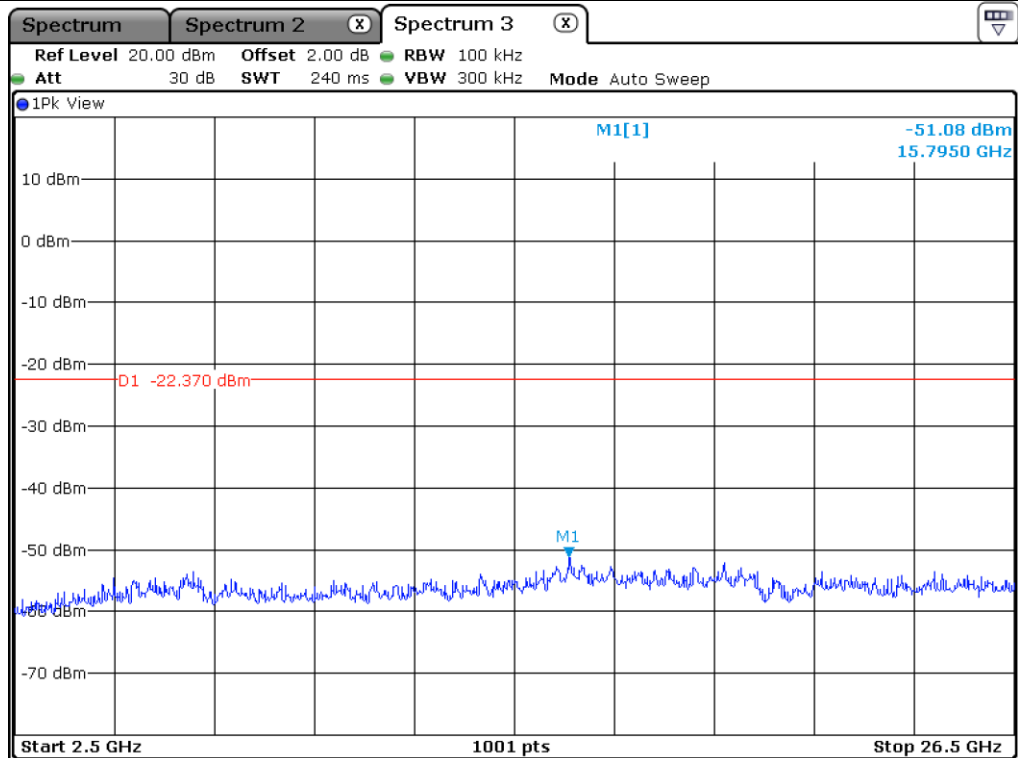
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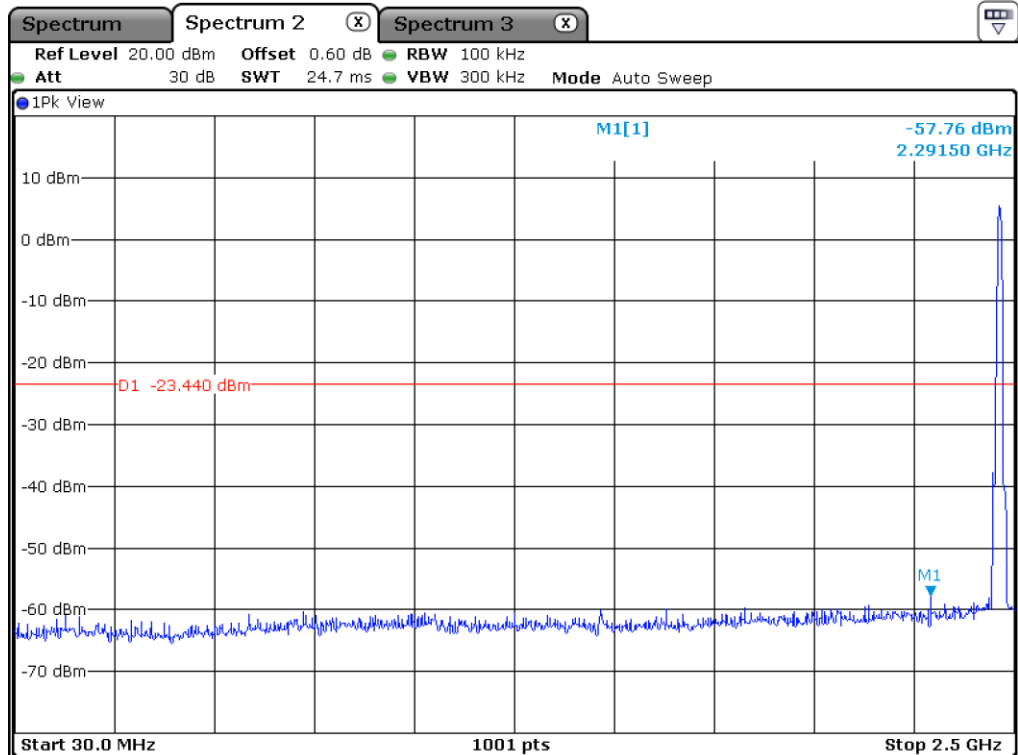
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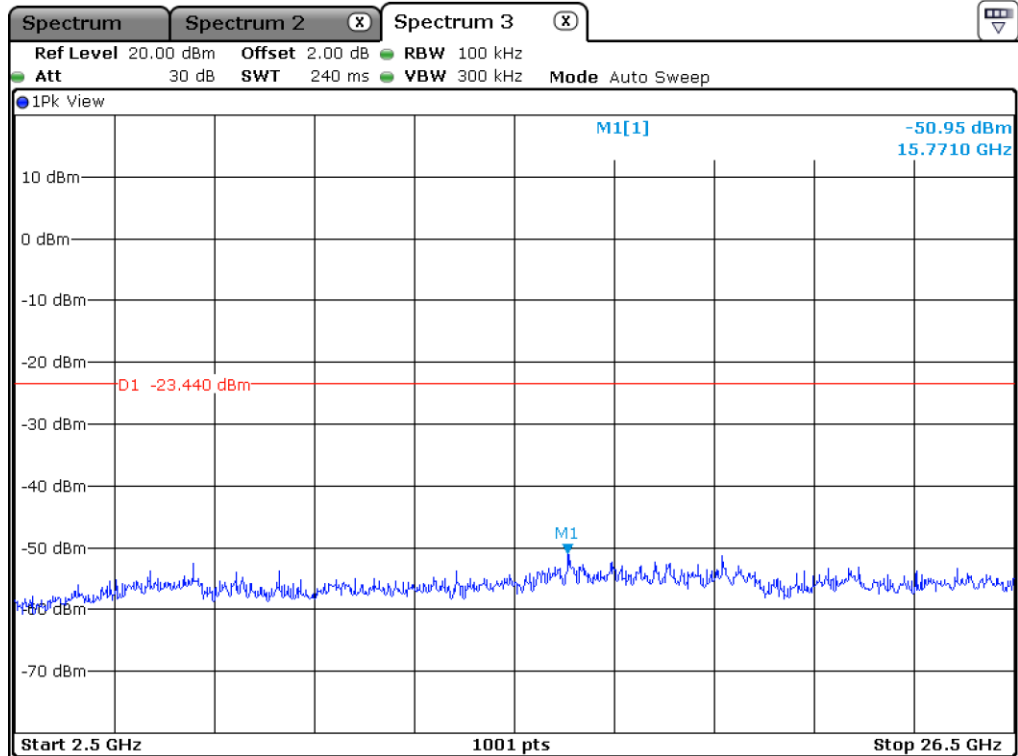
Middle Channel



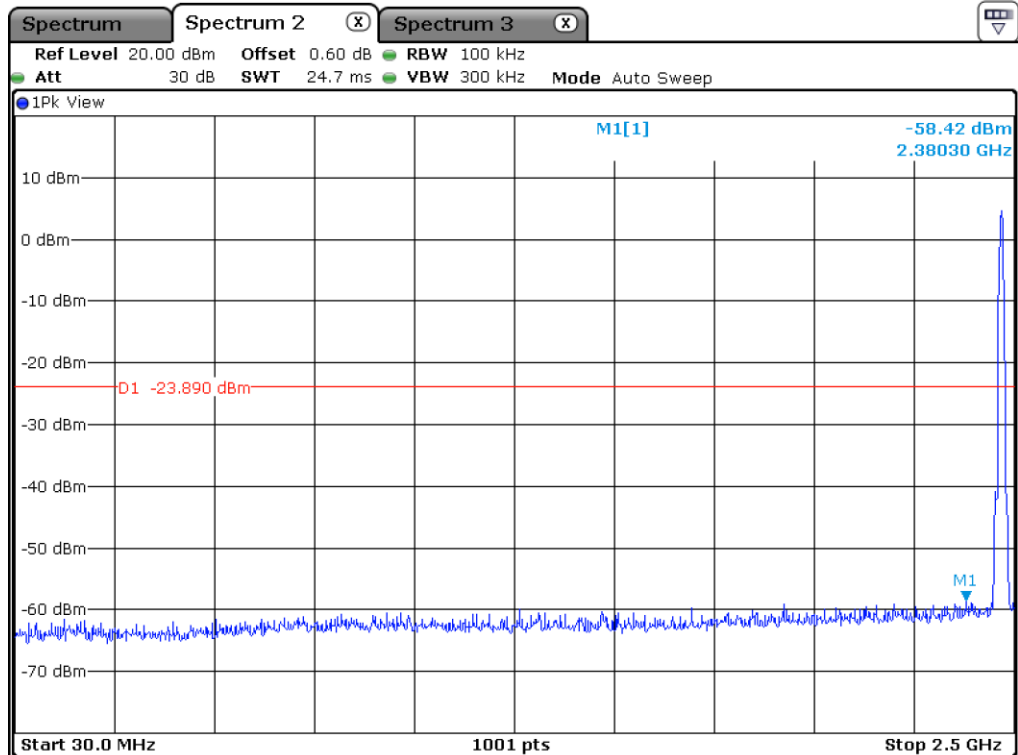
Middle Channel



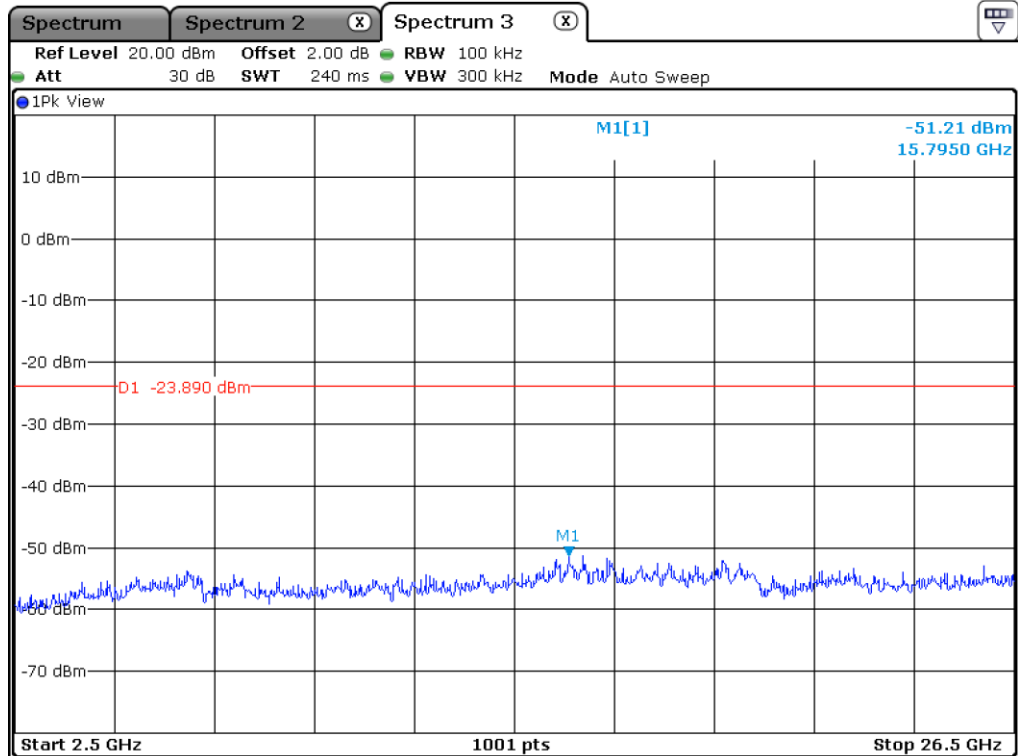
High Channel 11



High Channel 11



High Channel 12



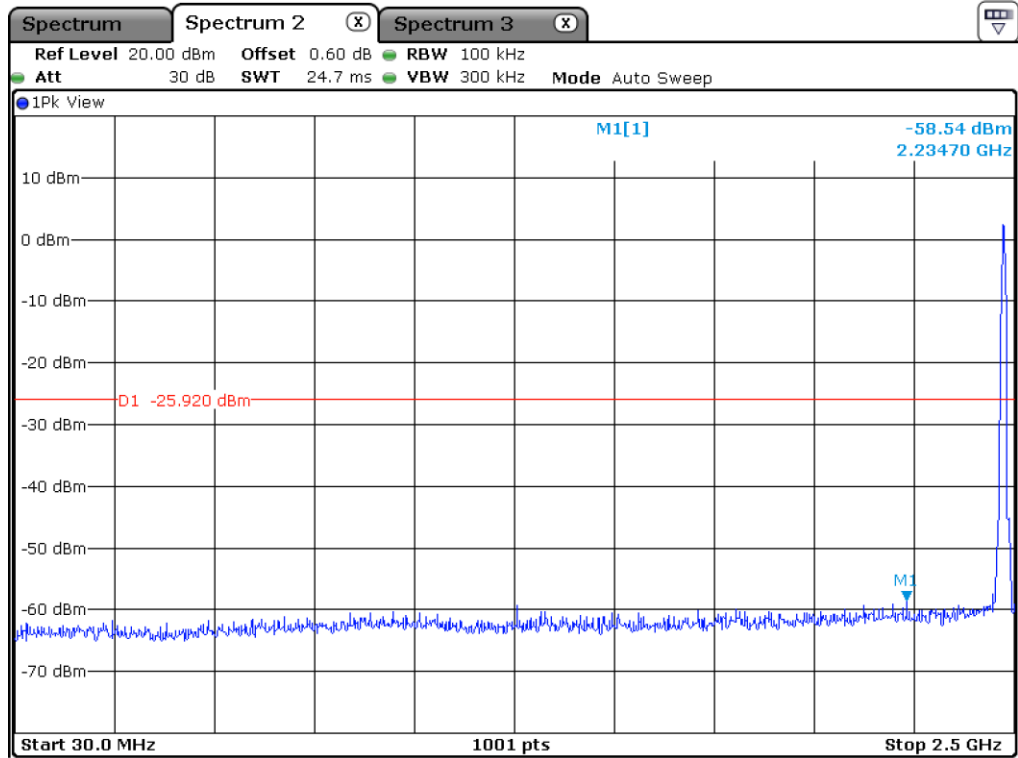
High Channel 12

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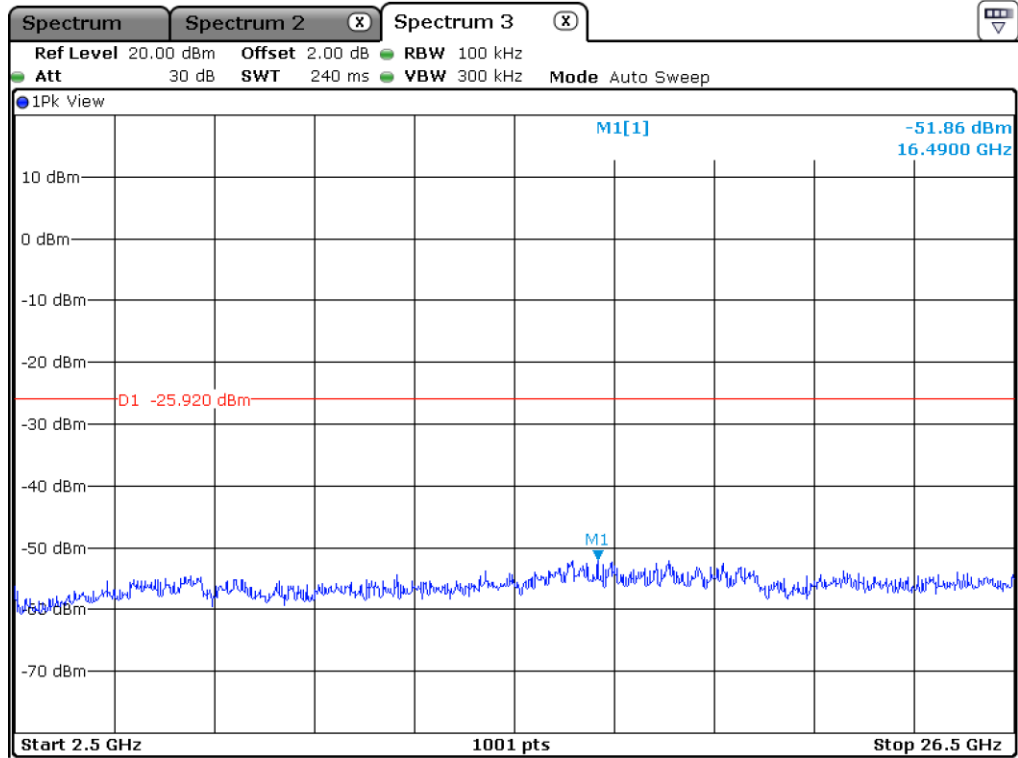
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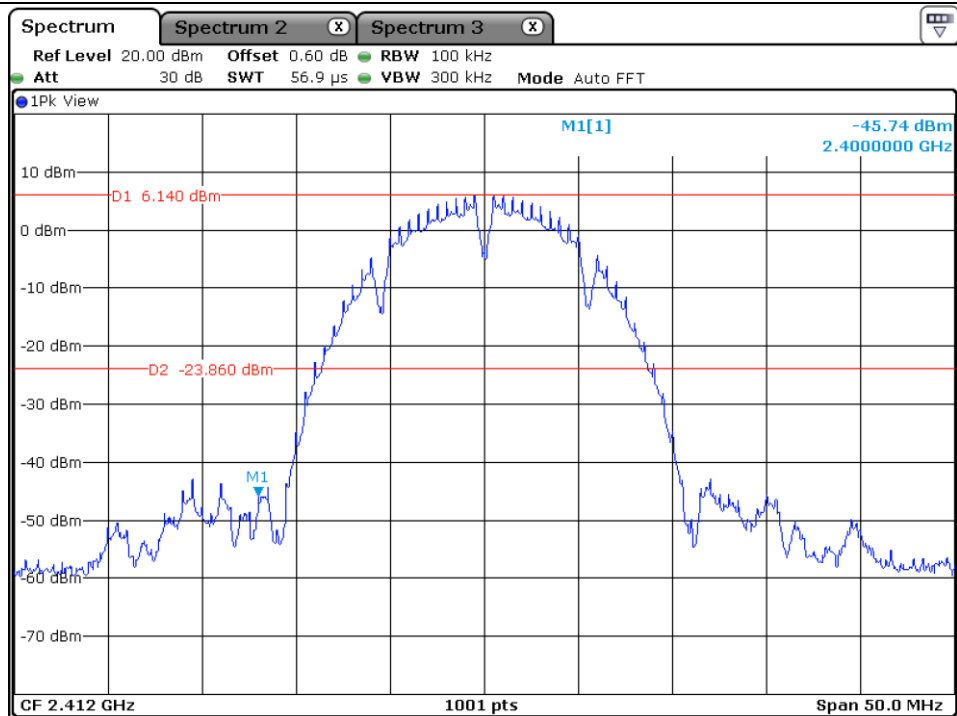


High Channel 13

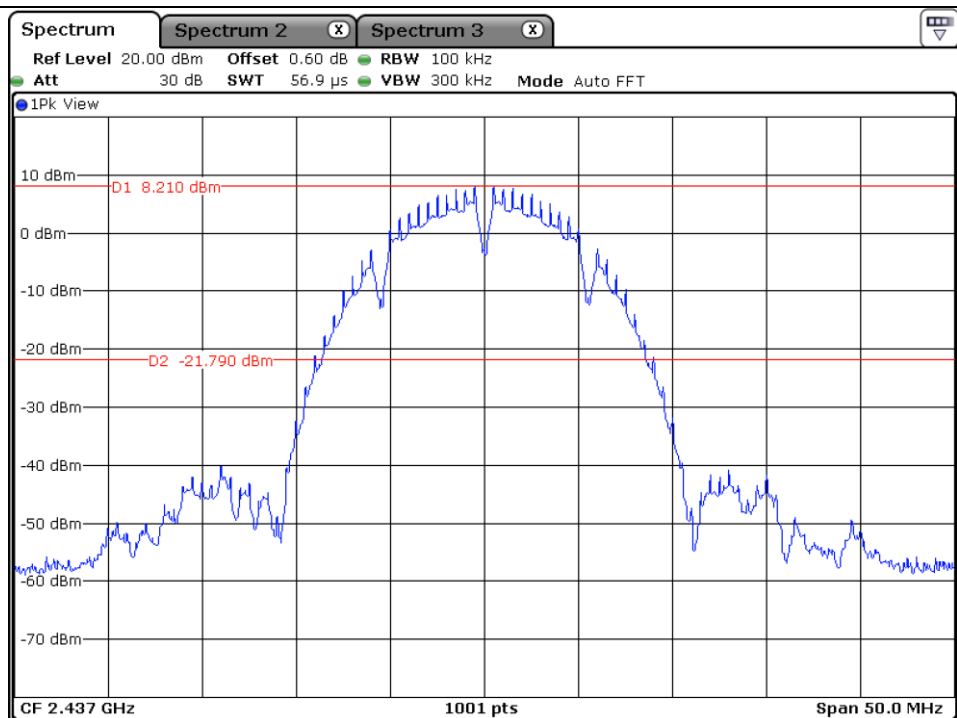


High Channel 13

9.5.1.2 Test data for Antenna 1



Low Channel



Middle Channel