RADIO PERFORMANCE TEST REPORT

Test Report No.	**: OT-213-RWD-002**
Reception No.	**: 2008003253**
Applicant	**: PS TEC Co., Ltd.**
Address	**: 80, HWANGGEUM 3-RO 7BEON-GIL, YANGCHON-EUP, GIMPO-SI, GYEONGGI-DO, KOREA**
Manufacturer	**: PS TEC Co., Ltd.**
Address	**: 80, HWANGGEUM 3-RO 7BEON-GIL, YANGCHON-EUP, GIMPO-SI, GYEONGGI-DO, KOREA**
Type of Equipment	**: Autonomous Terminal**
FCC ID.	**: 2AVSN-PSM-NGT-G01**
Model Name	**: PSM-NGT-G01**
Multiple Model Name	**: N/A**
Serial number	**: N/A**
Total page of Report	**: 93 pages (including this page)**
Date of Incoming	**: January 08, 2021**
Date of issue	**: March 02, 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.

Tested by	Reviewed by	Approved by
/Youngyong Kim/ Assistant Manager	/ Ha-Ram Lee / Manager	/ Ki-Hong, Nam / General Manager
ONETECH Corp.	ONETECH Corp.	ONETECH Corp.

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CONTENTS

PAGE

1. VERIFICATION OF COMPLIANCE **6**

2. TEST SUMMARY **7**

2.1 TEST ITEMS AND RESULTS 7

2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS 7

2.3 RELATED SUBMITTAL(S) / GRANT(S) 7

2.4 PURPOSE OF THE TEST 7

2.5 TEST METHODOLOGY 7

2.6 TEST FACILITY 7

3. GENERAL INFORMATION **8**

3.1 PRODUCT DESCRIPTION 8

3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT. 9

4. EUT MODIFICATIONS **9**

5. SYSTEM TEST CONFIGURATION **9**

5.1 JUSTIFICATION 9

5.2 PERIPHERAL EQUIPMENT 9

5.3 MODE OF OPERATION DURING THE TEST 10

5.4 CONFIGURATION OF TEST SYSTEM 17

5.5 ANTENNA REQUIREMENT 17

6. PRELIMINARY TEST **18**

6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS 18

6.2 GENERAL RADIATED EMISSIONS TESTS 18

7. MIMIMUM 6 DB BANDWIDTH & 99 % OCCUPIED BANDWIDTH **19**

7.1 OPERATING ENVIRONMENT 19

7.2 TEST SET-UP 19

7.3 TEST DATE 19

7.4 TEST DATA FOR 802.11B WLAN MODE 20

7.5 TEST DATA FOR 802.11G WLAN MODE 24

7.6 TEST DATA FOR 802.11N (HT 20) WLAN MODE 28

7.7 TEST DATA FOR 802.11N (HT 40) WLAN MODE 32

8. MAXIMUM PEAK OUTPUT POWER **36**

8.1 OPERATING ENVIRONMENT 36

8.2 TEST SET-UP 36

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8.3 TEST DATE 36
8.4 TEST DATA FOR 802.11B WLAN MODE 37
8.5 TEST DATA FOR 802.11G WLAN MODE 39
8.6 TEST DATA FOR 802.11N(HT20) WLAN MODE 41
8.7 TEST DATA FOR 802.11N(HT40) WLAN MODE 43
9. 100 KHZ BANDWIDTH OUTSIDE THE FREQUENCY BAND **45**
9.1 OPERATING ENVIRONMENT 45
9.2 TEST SET-UP FOR CONDUCTED MEASUREMENT 45
9.3 TEST SET-UP FOR RADIATED MEASUREMENT 45
9.4 TEST DATE 45
9.5 TEST DATA FOR CONDUCTED EMISSION 46
9.5.1 Test data for 802.11b WLAN Mode *46*
9.5.2 Test data for 802.11g WLAN Mode *51*
9.5.3 Test data for 802.11n (HT20) WLAN Mode *56*
9.5.4 Test data for 802.11n (HT40) WLAN Mode *61*
9.6 TEST DATA FOR RADIATED EMISSION 66
9.6.1 Radiated Emission which fall in the Restricted Band *66*
10. PEAK POWER SPECTRAL DENSITY **74**
10.1 OPERATING ENVIRONMENT 74
10.2 TEST SET-UP 74
10.3 TEST DATE 74
10.4 TEST DATA FOR 802.11B WLAN MODE 75
10.5 TEST DATA FOR 802.11G WLAN MODE 77
10.6 TEST DATA FOR 802.11N (HT20) WLAN MODE 79
10.7 TEST DATA FOR 802.11N (HT40) WLAN MODE 81
11. RADIATED EMISSION TEST **83**
11.1 OPERATING ENVIRONMENT 83
11.2 TEST SET-UP 83
11.3 TEST DATE 83
11.4 TEST DATA FOR WLAN 2.4 GHZ 84
11.4.1 Test data for 30 MHz ~ 1 GHz *84*
11.4.2 Test data for Below 30 MHz *85*
11.4.3 Test data for above 1 GHz *85*
11.5 TEST DATA FOR INTERMODULATION MODE(WLAN 2.4 GHZ + BLUETOOTH LE(MDBT50Q-U) + CERTIFIED BLUETOOTH LE(RN4870)) 86
11.5.1 Test data for 30 MHz ~ 1 GHz *86*

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11.5.2 Test data for Below 30 MHz *87*
11.5.3 Test data for above 1 GHz *87*
12. CONDUCTED EMISSION TEST **88**
12.1 OPERATING ENVIRONMENT 88
12.2 TEST SET-UP 88
12.3 TEST DATE 88
12.4 TEST DATA FOR WLAN 2.4 GHZ 89
12.5 TEST DATA FOR INTERMODULATION MODE(WLAN 2.4 GHZ + BLUETOOTH LE(MDBT50Q-U) + CERTIFIED BLUETOOTH LE(RN4870)) 91
13. LIST OF TEST EQUIPMENT **93**

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-213-RWD-002	March 02, 2021	Initial Release	All

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1. VERIFICATION OF COMPLIANCE

Applicant : PS TEC Co., Ltd.
Address : 80, HWANGGEUM 3-RO 7BEON-GIL, YANGCHON-EUP, GIMPO-SI, GYEONGGI-DO, KOREA
Contact Person : Bo Young Hwang/General Manager
Telephone No. : +82-2-3408-1750
FCC ID. : 2AVSN-PSM-NGT-G01
Model Name : PSM-NGT-G01
Brand Name : N/A
Serial Number : N/A

EQUIPMENT CLASS	DTS-Digital Transmission System
E.U.T. DESCRIPTION	Autonomous Terminal
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
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.

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2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (2)	6 dB bandwidth	Met the Limit / PASS
15.247 (b) (3)	Maximum Peak Conducted 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-4112/ C-14617/ G-10666 / T-1842

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

-. Site Accreditation:

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

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The PS TEC Co., Ltd., Model PSM-NGT-G01 (referred to as the EUT in this report) is an Autonomous Terminal. Product specification information described herein was obtained from product data sheet or user's manual.

Device Type	Autonomous Terminal	
Operating Frequency	Bluetooth LE	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz Band	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))
		2 422 MHz ~ 2 452 MHz (802.11n(HT40))
RF Output Power	Bluetooth LE	-2.04 dBm
	WLAN 2.4 GHz Band	802.11b (8.23 dBm) 802.11g (3.10 dBm) 802.11n(HT20) (3.11 dBm) 802.11n(HT40) (0.52 dBm)
Number of Channel	Bluetooth LE	40 Channels
	WLAN 2.4 GHz Band	11 Channels
Modulation Type	Bluetooth LE	DSSS Modulation(GFSK)
	WLAN 2.4 GHz Band	DSSS Modulation(DBPSK/DQPSK/CCK) OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
Antenna Type	Bluetooth LE (Model Name: MDBT50Q-U)	Dipole Antenna
	WLAN 2.4 GHz Band	
Antenna Gain	Bluetooth LE (Model Name: MDBT50Q-U)	5.33 dBi
	WLAN 2.4 GHz Band	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	26 MHz, 32 MHz	
Rated Supply Voltage	DC 5.0 V	

Note 1: The Product has total of 3 Modules including certified Bluetooth LE Module (Model Name: RN4870), Bluetooth LE Module (MDBT50Q-U) and WLAN module. For details of Certified Module, Please refer to the report. (Report No.: 10053523 001 / Model name: RN4870 / FCC ID: A8TBM70ABCDEFGH)

Note 2: Bluetooth LE (MDBT50Q-U), Certified Bluetooth LE(RN4870) and WLAN operate simultaneously.

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

-. None

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	N/A	N/A	-

5.2 Peripheral equipment

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
PSM-NGT-G01	PS TEC Co., Ltd.	Autonomous Terminal (EUT)	
Notebook PC	HP	PROBOOK	

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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

Band	Channel	Frequency
802.11b 802.11g 802.11n(HT20)	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
802.11n(HT40)	3	2 422
	4	2 427
	5	2 432
	6	2 437
	7	2 442
	8	2 447
	9	2 452

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Modulation	Data Rate	Output Power [dBm]
802.11b (Low Channel)	1 Mbps	7.73
	2 Mbps	6.73
	5.5 Mbps	5.85
	11 Mbps	5.22
802.11g (Low Channel)	6 Mbps	3.10
	9 Mbps	2.95
	12 Mbps	2.55
	18 Mbps	2.04
	24 Mbps	1.72
	36 Mbps	1.44
	48 Mbps	1.06
	54 Mbps	0.88
802.11n(HT 20) (Low Channel)	6.5 Mbps	3.01
	13 Mbps	2.90
	19.5 Mbps	2.49
	26 Mbps	1.98
	39 Mbps	1.70
	52 Mbps	1.38
	58.5 Mbps	1.02
	65 Mbps	0.85
802.11n(HT 40) (Low Channel)	13.5 Mbps	0.52
	27 Mbps	0.48
	40.5 Mbps	0.29
	54 Mbps	0.25
	81 Mbps	0.22
	108 Mbps	0.18
	121.5 Mbps	0.14
	135 Mbps	0.11

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

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Modulation	Data Rate	Output Power [dBm]
802.11b (Middle Channel)	1 Mbps	8.23
	2 Mbps	7.20
	5.5 Mbps	6.32
	11 Mbps	5.65
802.11g (Middle Channel)	6 Mbps	3.08
	9 Mbps	2.91
	12 Mbps	2.50
	18 Mbps	2.01
	24 Mbps	1.68
	36 Mbps	1.41
	48 Mbps	1.03
	54 Mbps	0.83
802.11n(HT 20) (Middle Channel)	6.5 Mbps	3.11
	13 Mbps	2.98
	19.5 Mbps	2.55
	26 Mbps	2.06
	39 Mbps	1.74
	52 Mbps	1.45
	58.5 Mbps	1.09
	65 Mbps	0.91
802.11n(HT 40) (Middle Channel)	13.5 Mbps	-0.02
	27 Mbps	-0.07
	40.5 Mbps	-0.22
	54 Mbps	-0.28
	81 Mbps	-0.31
	108 Mbps	-0.35
	121.5 Mbps	-0.40
	135 Mbps	-0.44

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

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Modulation	Data Rate	Output Power [dBm]
802.11b (High Channel)	1 Mbps	8.15
	2 Mbps	7.05
	5.5 Mbps	6.18
	11 Mbps	5.47
802.11g (High Channel)	6 Mbps	2.99
	9 Mbps	2.81
	12 Mbps	2.40
	18 Mbps	1.90
	24 Mbps	1.56
	36 Mbps	1.34
	48 Mbps	0.95
	54 Mbps	0.73
802.11n(HT 20) (High Channel)	6.5 Mbps	3.06
	13 Mbps	2.94
	19.5 Mbps	2.53
	26 Mbps	2.05
	39 Mbps	1.72
	52 Mbps	1.44
	58.5 Mbps	1.05
	65 Mbps	0.90
802.11n(HT 40) (High Channel)	13.5 Mbps	-0.29
	27 Mbps	-0.35
	40.5 Mbps	-0.53
	54 Mbps	-0.57
	81 Mbps	-0.63
	108 Mbps	-0.66
	121.5 Mbps	-0.70
	135 Mbps	-0.73

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

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-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
802.11b	4.425	0.495	89.94	0.46
802.11g	0.715	0.520	57.89	2.37
802.11n(HT20)	0.595	0.520	53.36	2.73
802.11n(HT40)	0.305	0.510	37.42	4.27

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

Correction Factor : 10 * Log(1 / (Duty Cycle / 100))

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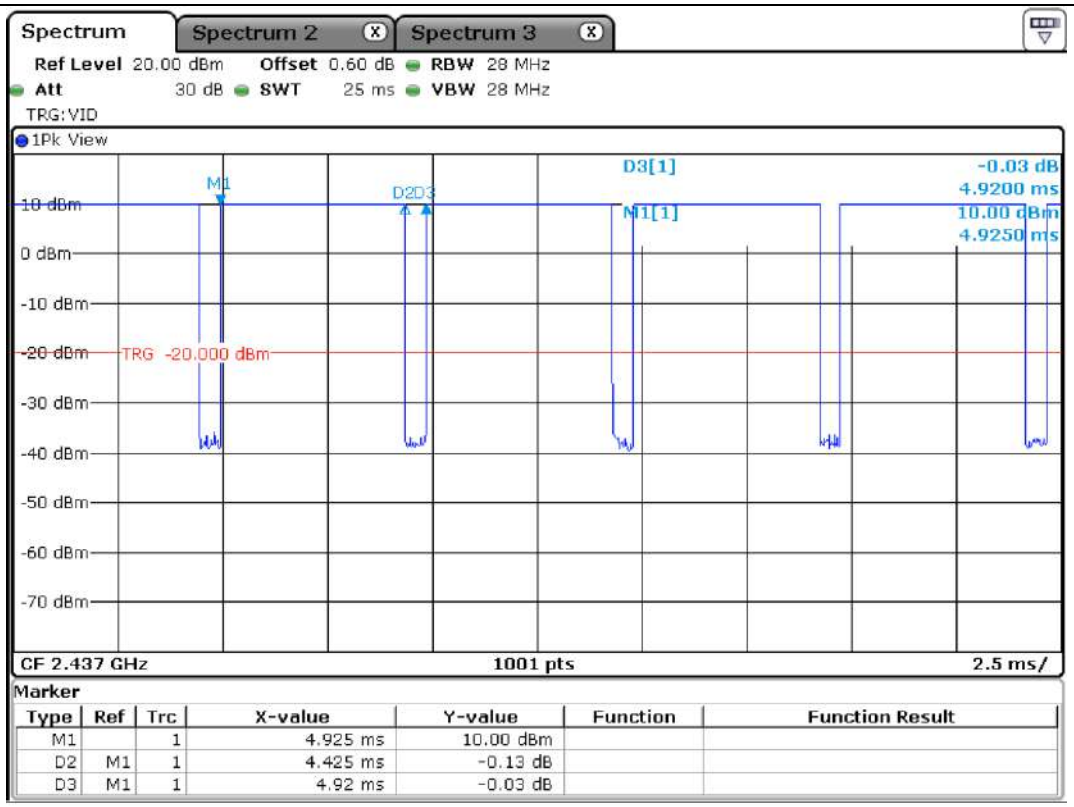
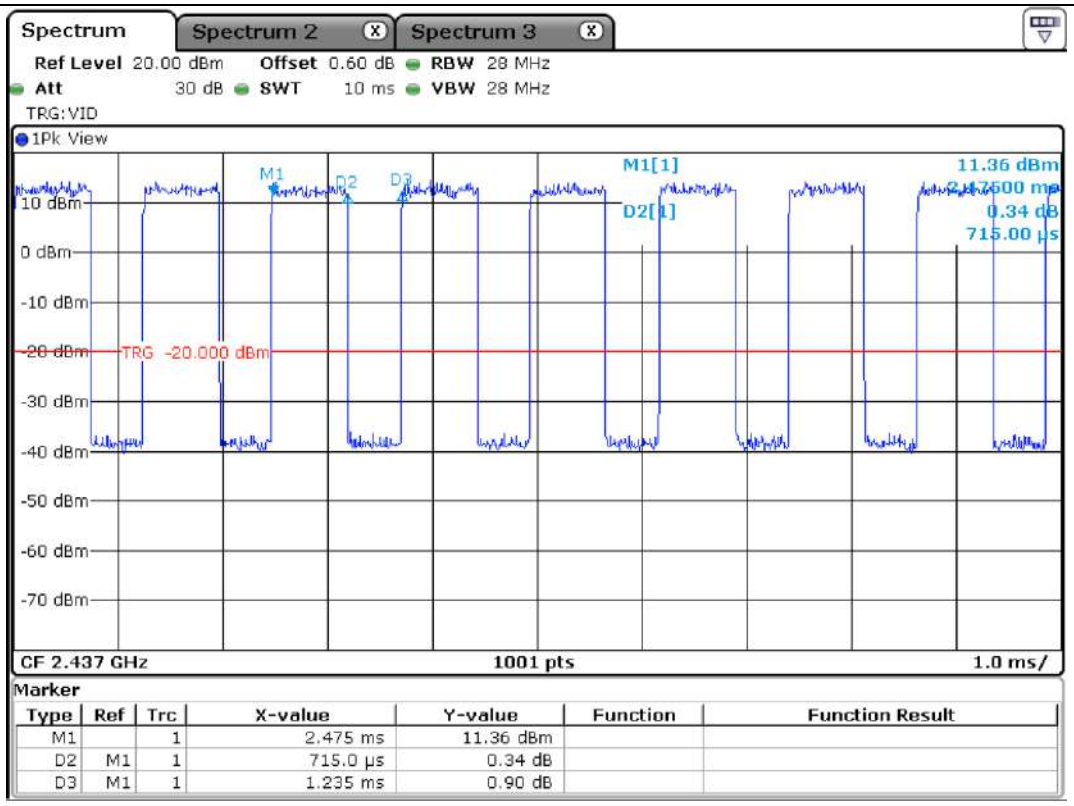
-. Test Plot



802.11 b



802.11 g

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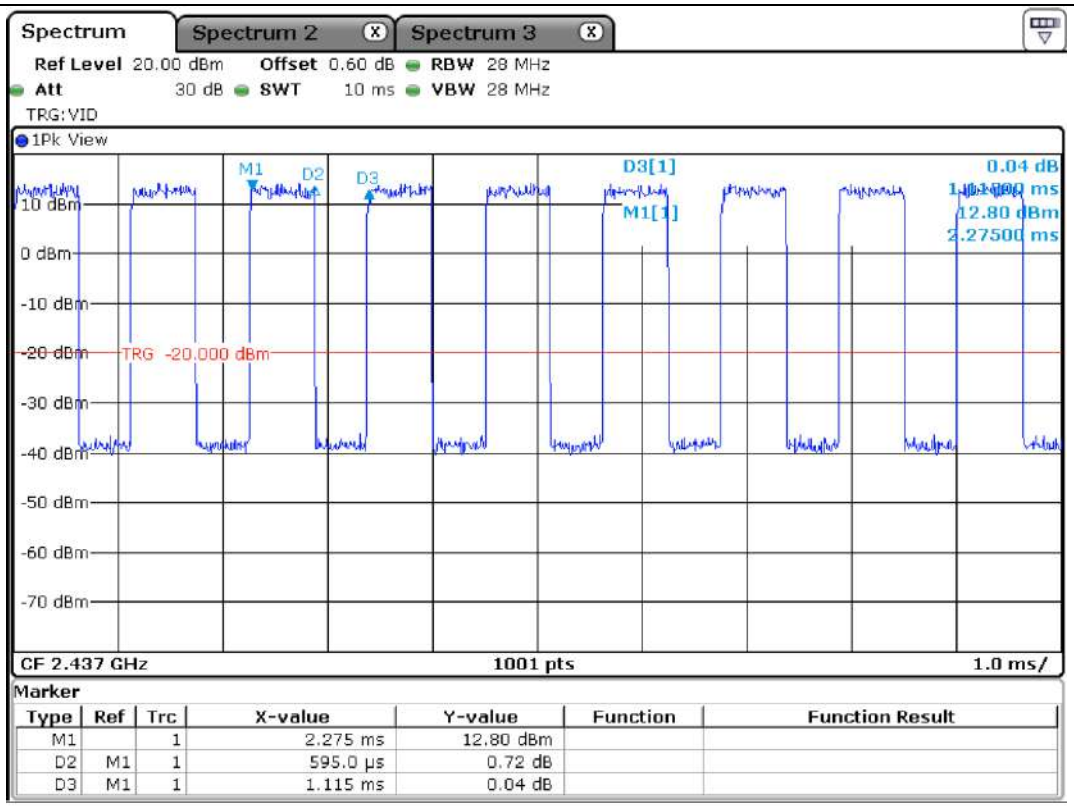
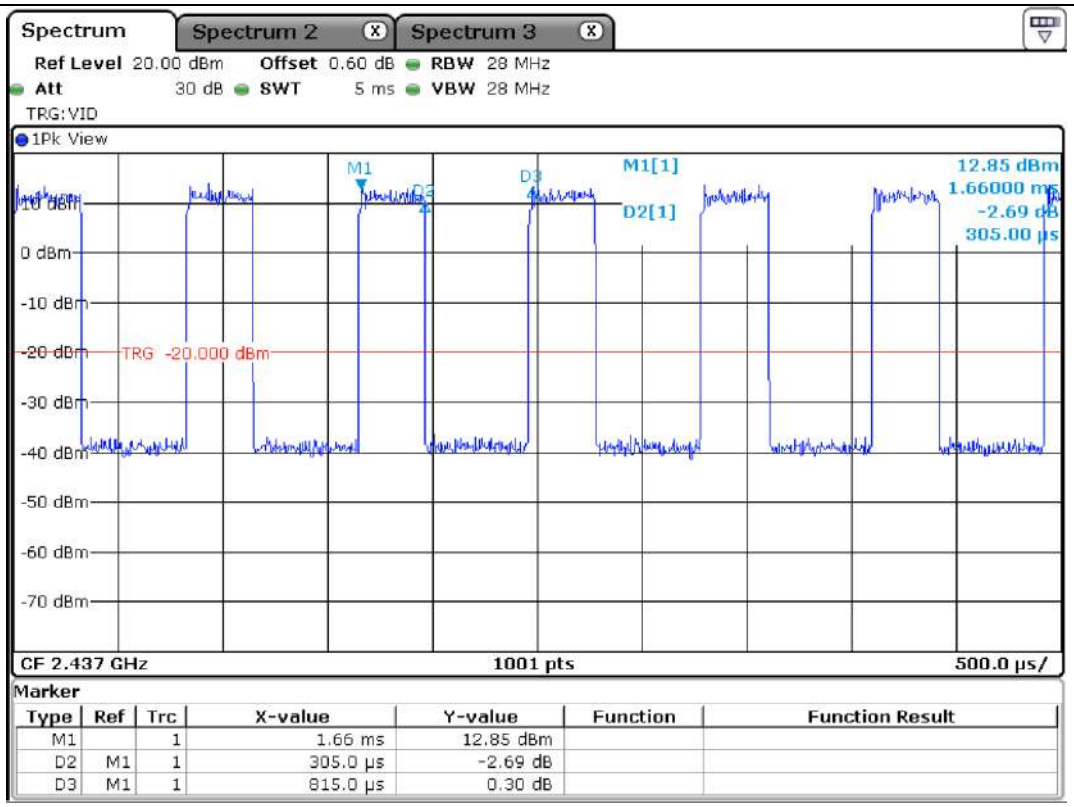


802.11 HT 20



802.11 HT 40

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5.4 Configuration of Test System

Line Conducted Test: The EUT was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter open area test site.

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 Dipole antenna is connected to EUT, so no consideration of replacement by the user.

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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)
Charging 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

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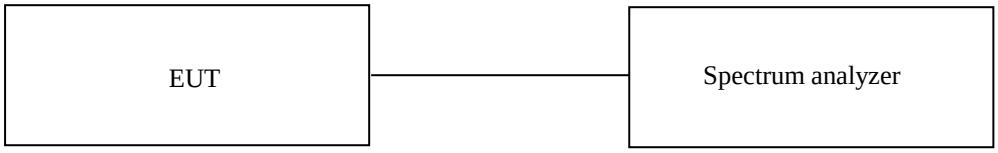
7. MIMIMUM 6 dB BANDWIDTH & 99 % OCCUPIED BANDWIDTH

7.1 Operating environment

Temperature	:	22.5 °C
Relative humidity	:	49 % 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

January 06, 2021 ~ January 11, 2021

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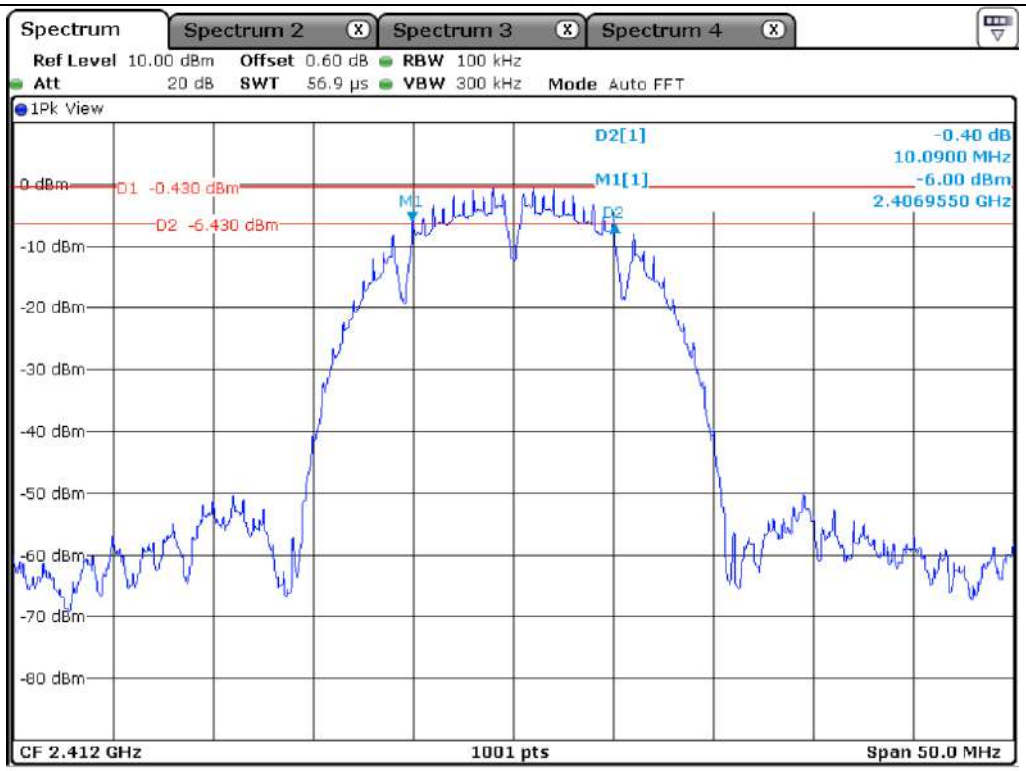
7.4 Test data for 802.11b WLAN Mode

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	LIMIT (MHz)	Bandwidth Margin(MHz)	
					6 dB	99 %
Low	2 412.00	10.09	14.44	0.50	9.59	-
Middle	2 437.00	10.09	14.49	0.50	9.59	-
High	2 462.00	10.09	14.49	0.50	9.59	-

Remark. Margin = Measured Value – Limit



Low Channel (6 dB Bandwidth)

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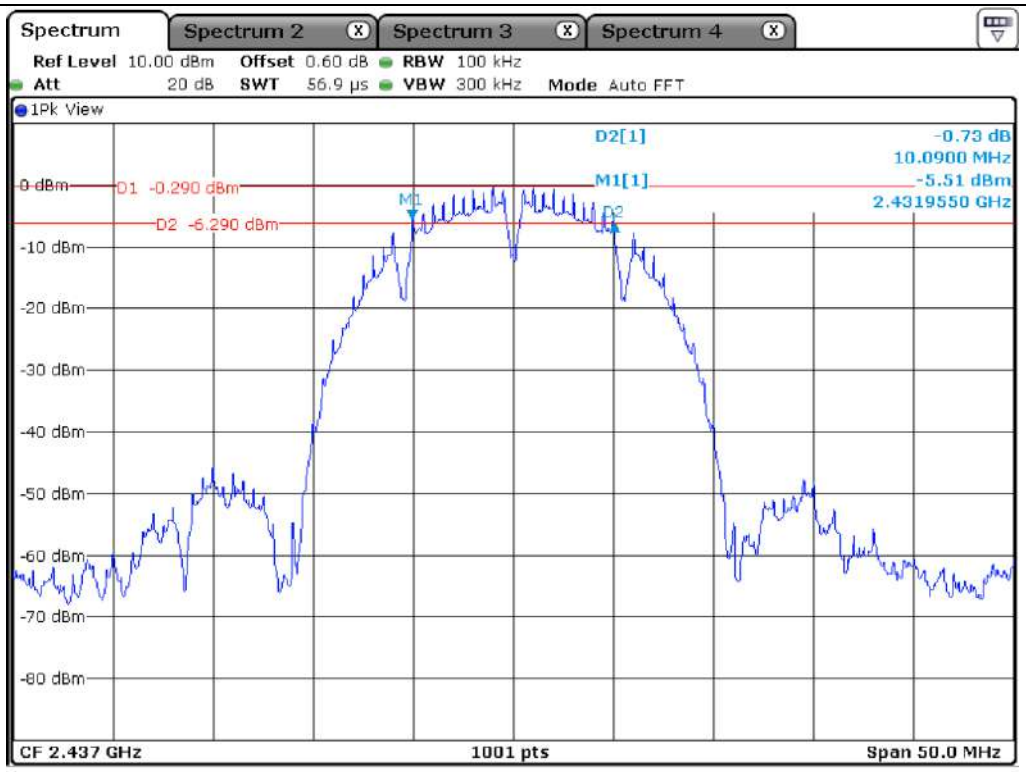
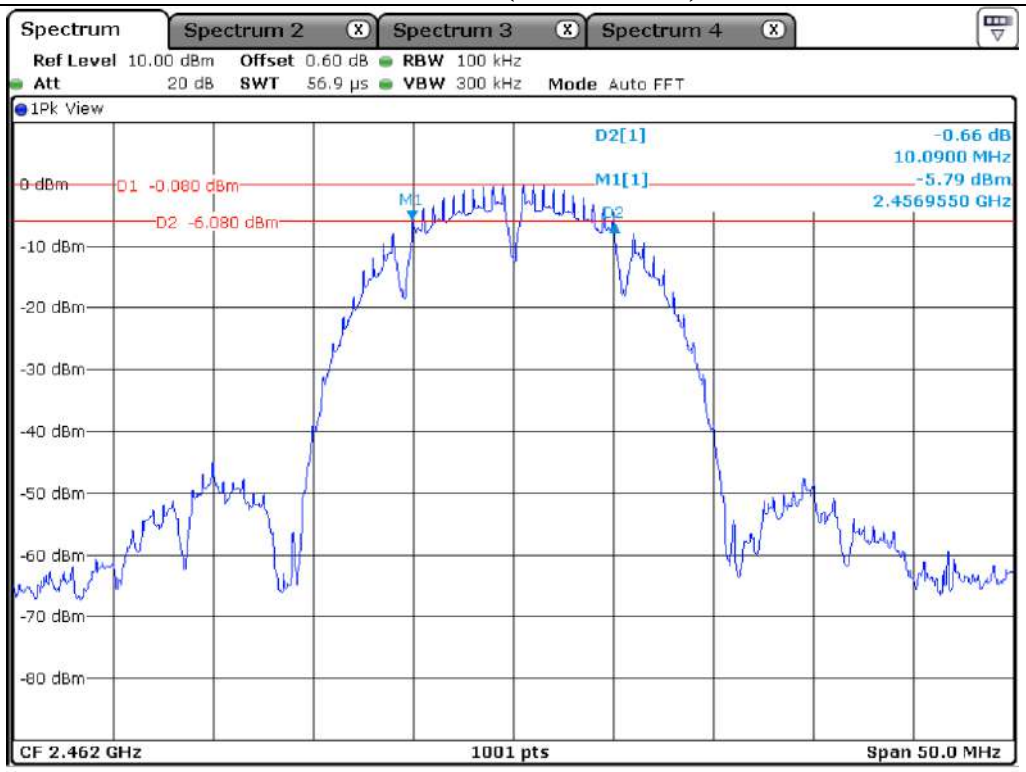


Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

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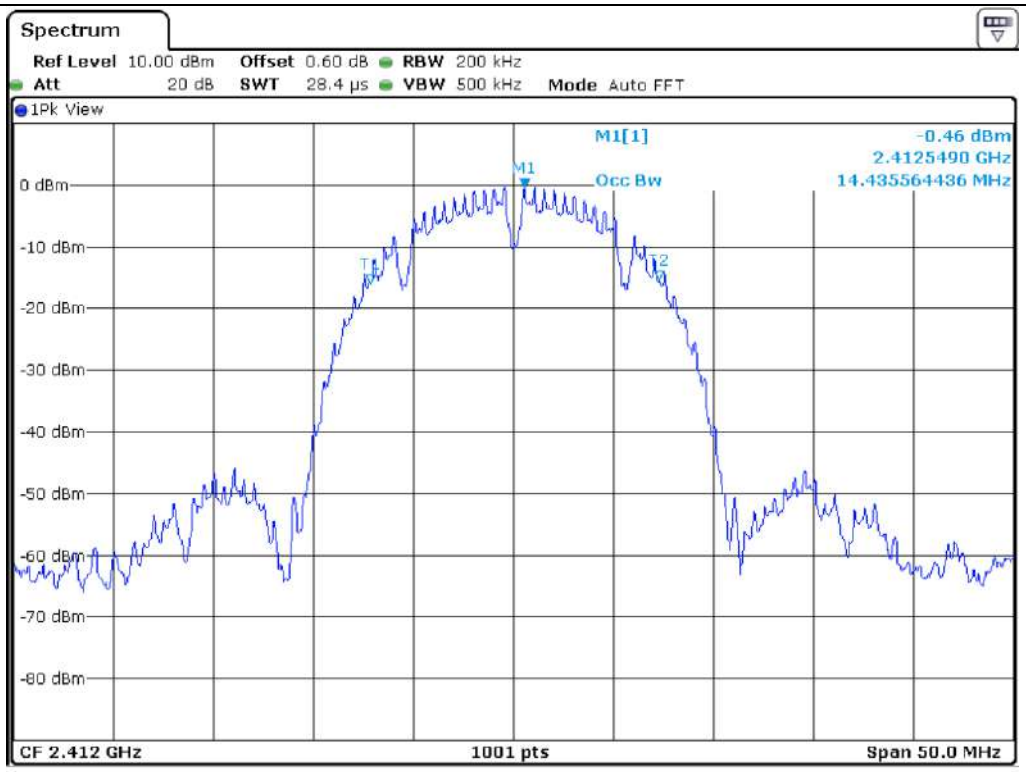
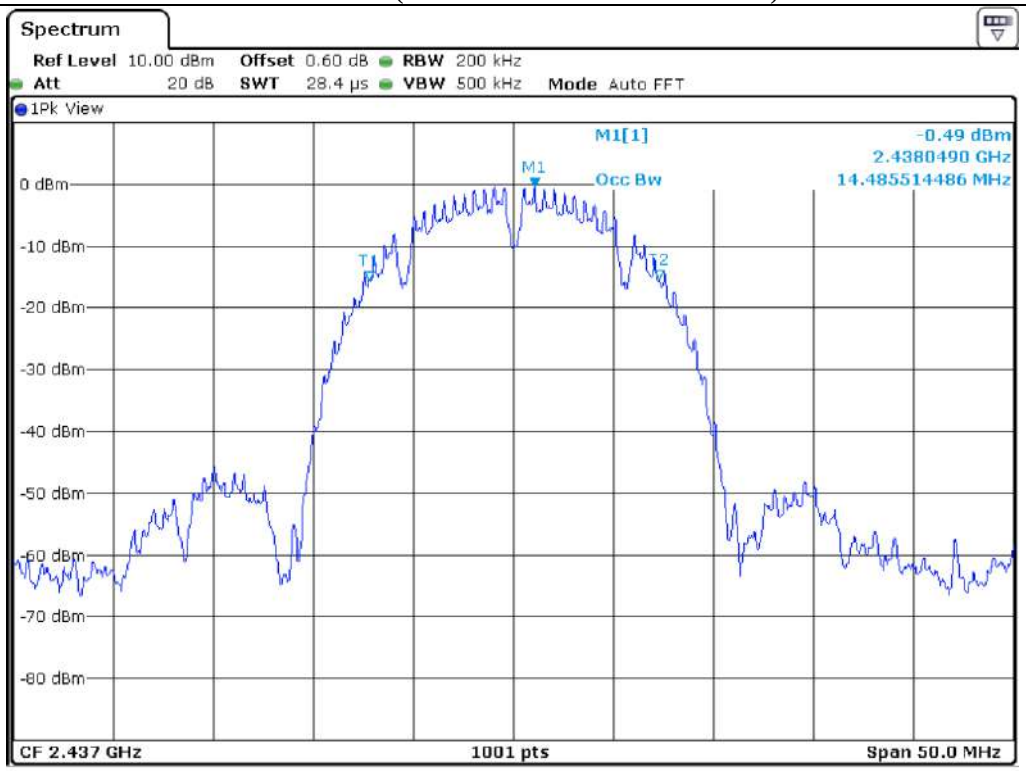
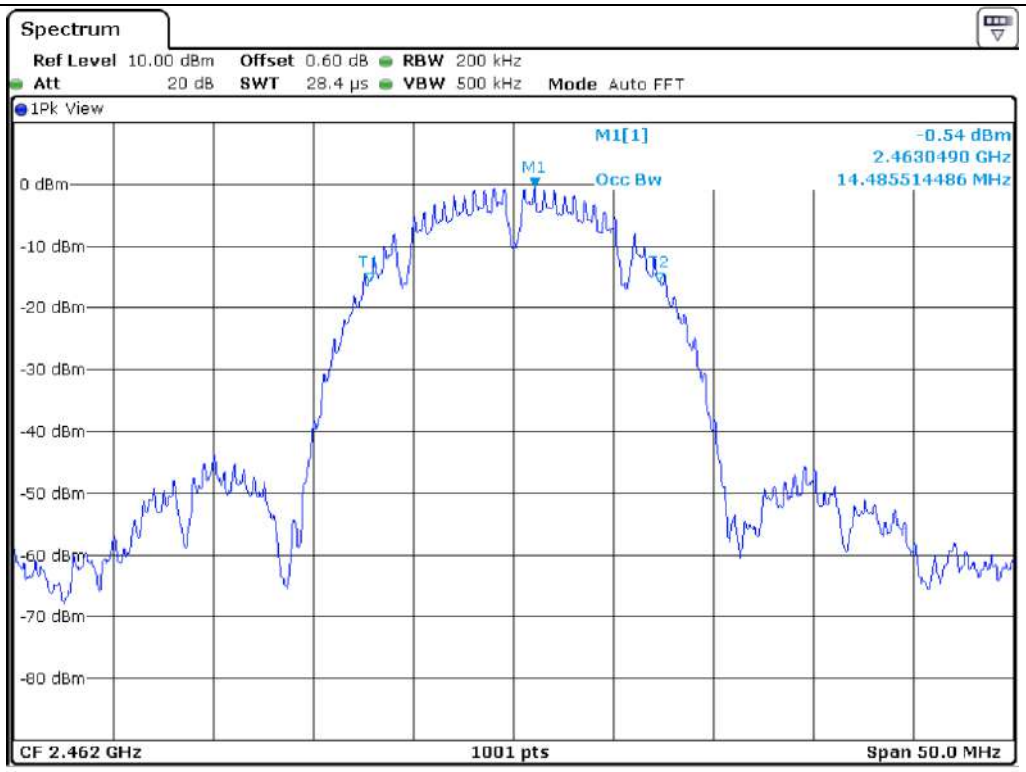


Low Channel (99 % OCCUPIED BANDWIDTH)



Middle Channel (99 % OCCUPIED BANDWIDTH)

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



High Channel (99 % OCCUPIED BANDWIDTH)

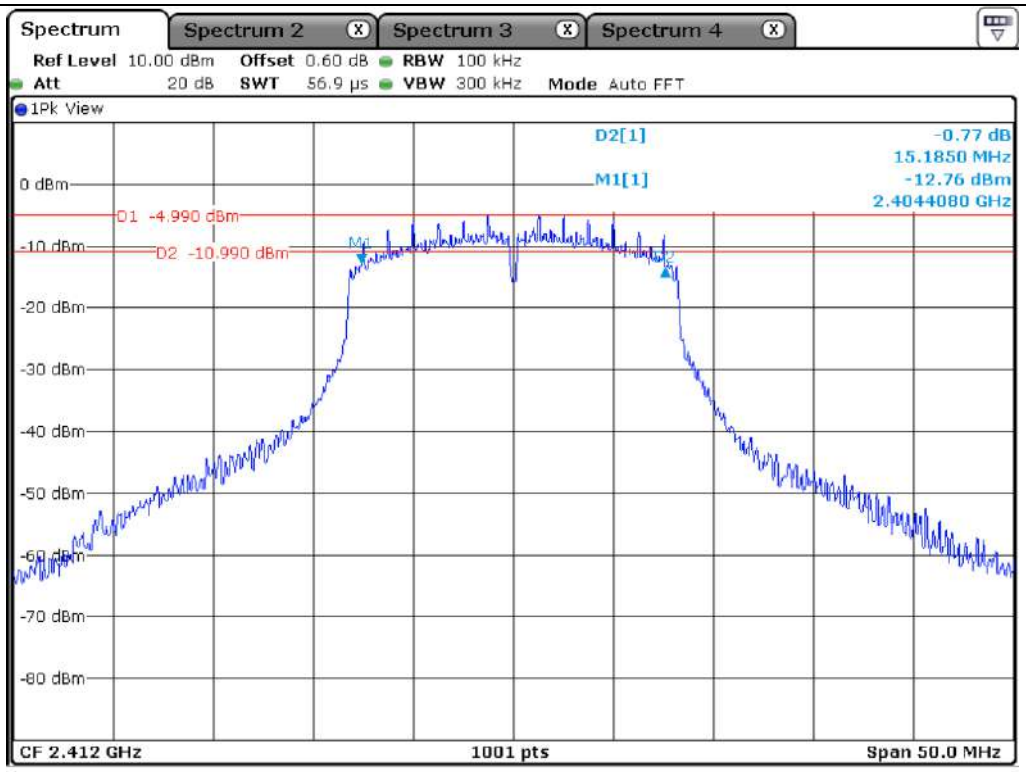
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

7.5 Test data for 802.11g WLAN Mode

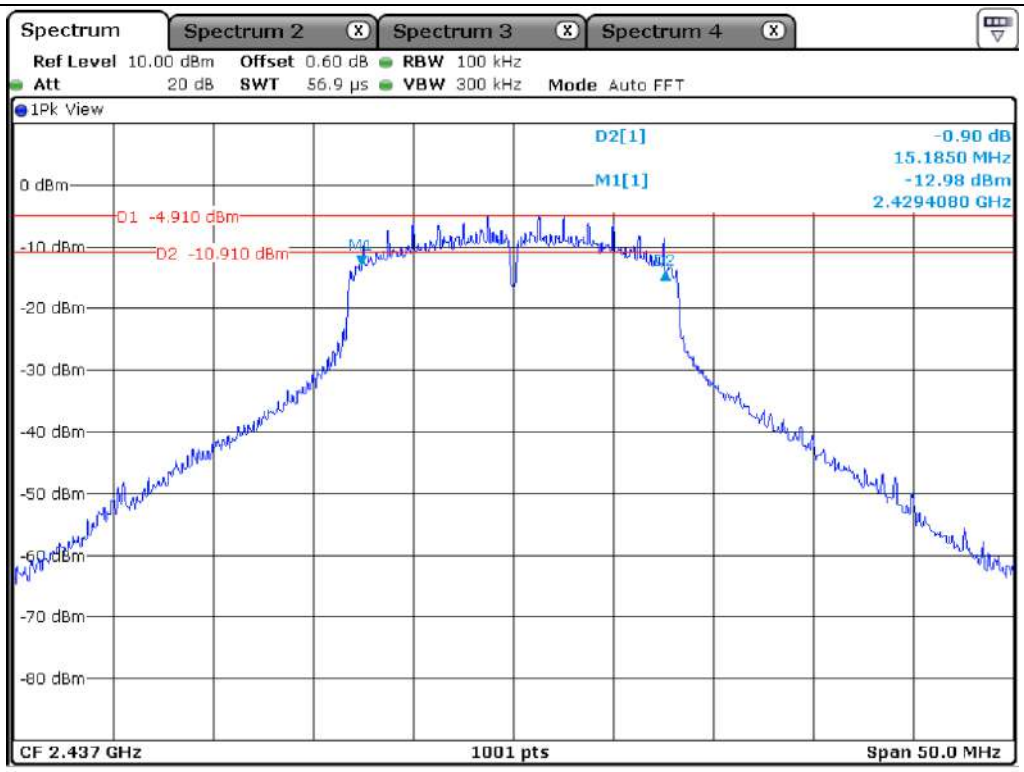
-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	LIMIT (MHz)	Bandwidth Margin(MHz)	
					6 dB	99 %
Low	2 412.00	15.19	16.18	0.50	14.69	-
Middle	2 437.00	15.19	16.23	0.50	14.69	-
High	2 462.00	15.19	16.18	0.50	14.69	-

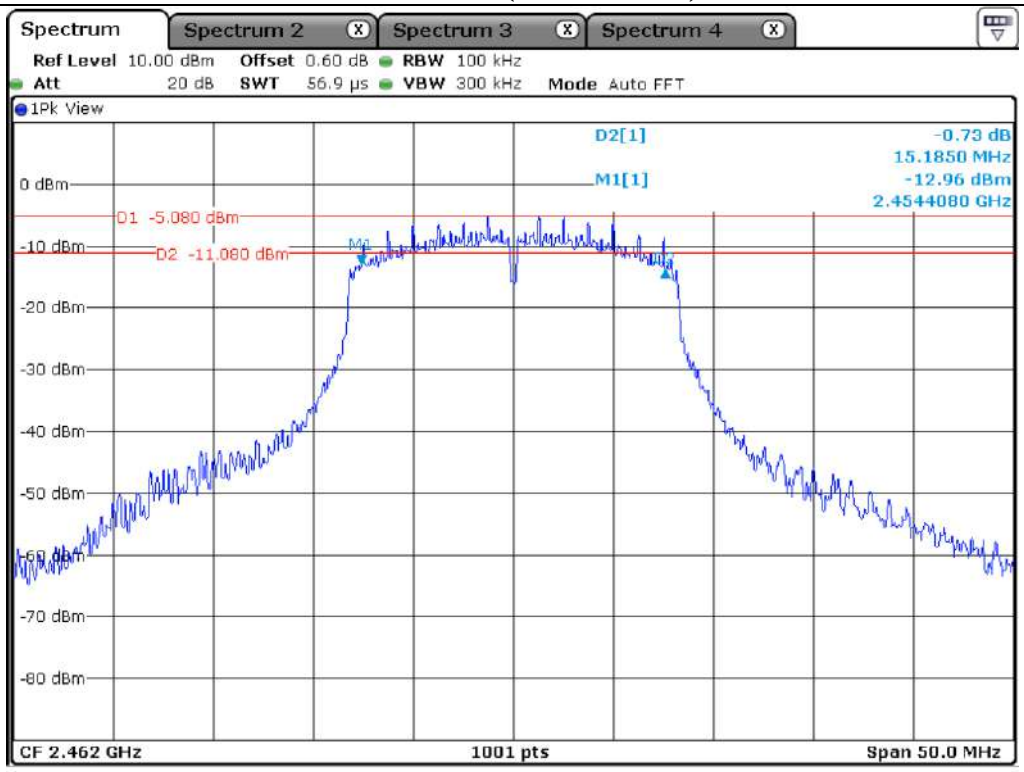
Remark. Margin = Measured Value - Limit



Low Channel (6 dB Bandwidth)



Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

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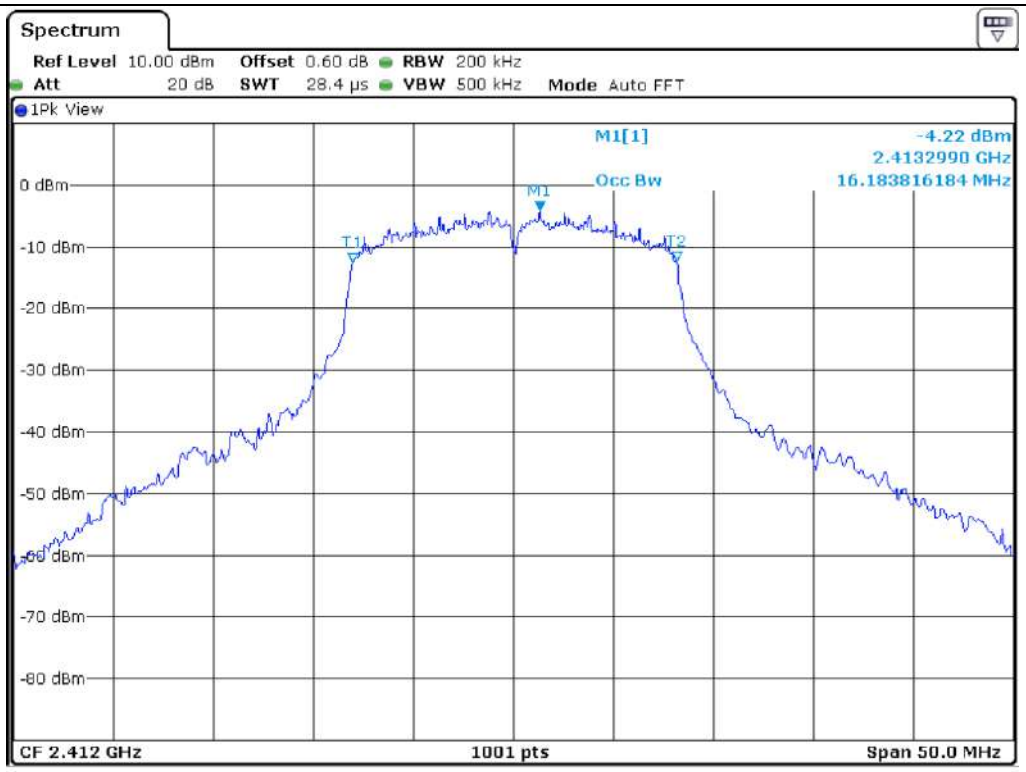
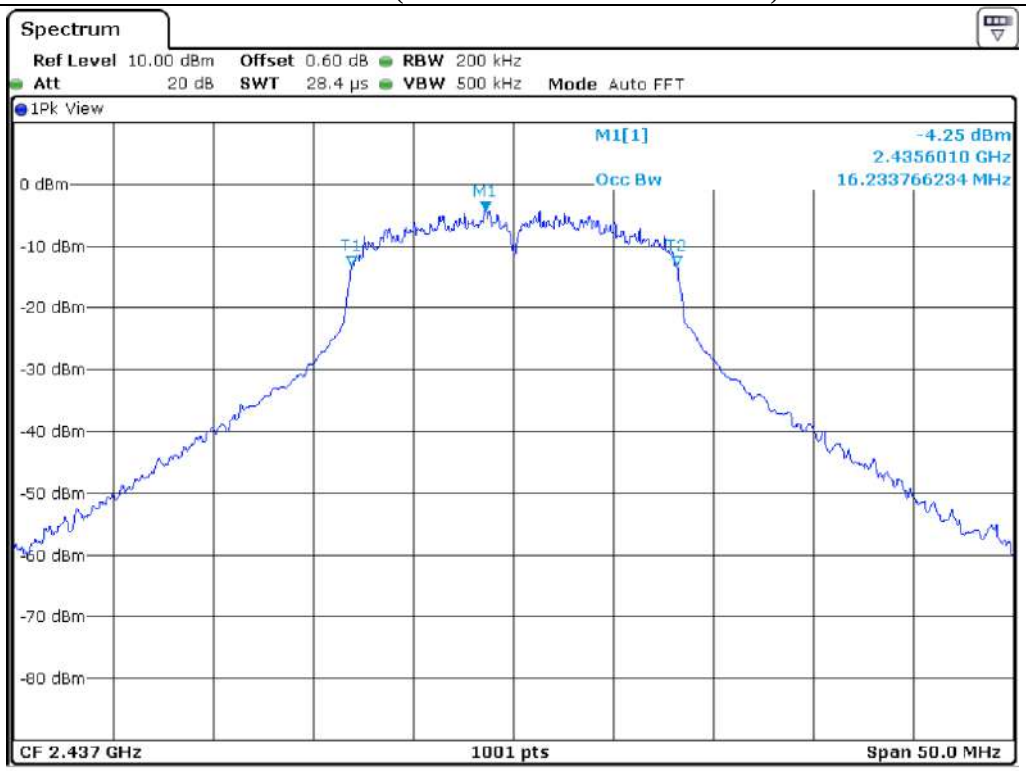
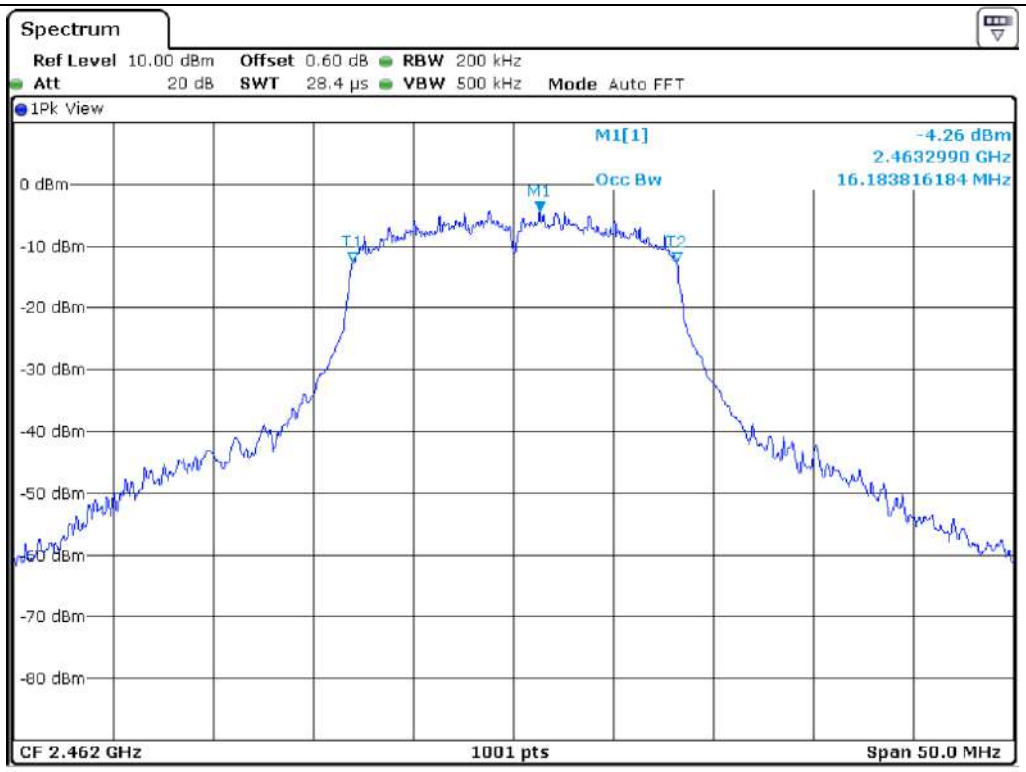


Low Channel (99 % OCCUPIED BANDWIDTH)



Middle Channel (99 % OCCUPIED BANDWIDTH)

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



High Channel (99 % OCCUPIED BANDWIDTH)

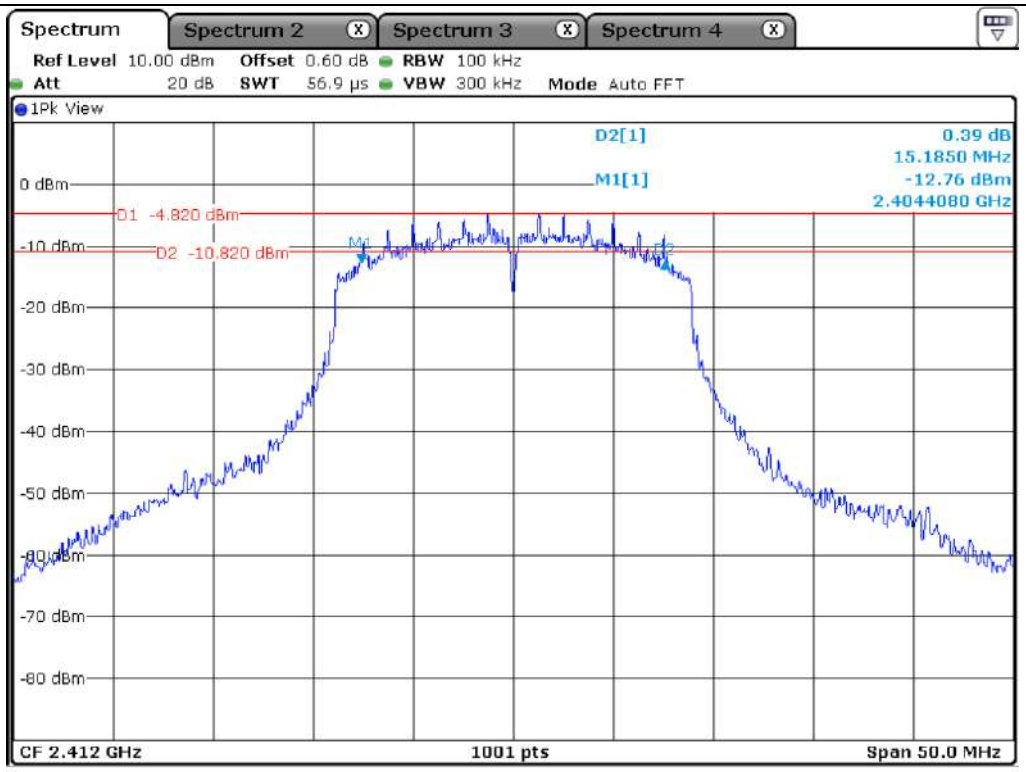
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

7.6 Test data for 802.11n (HT 20) WLAN Mode

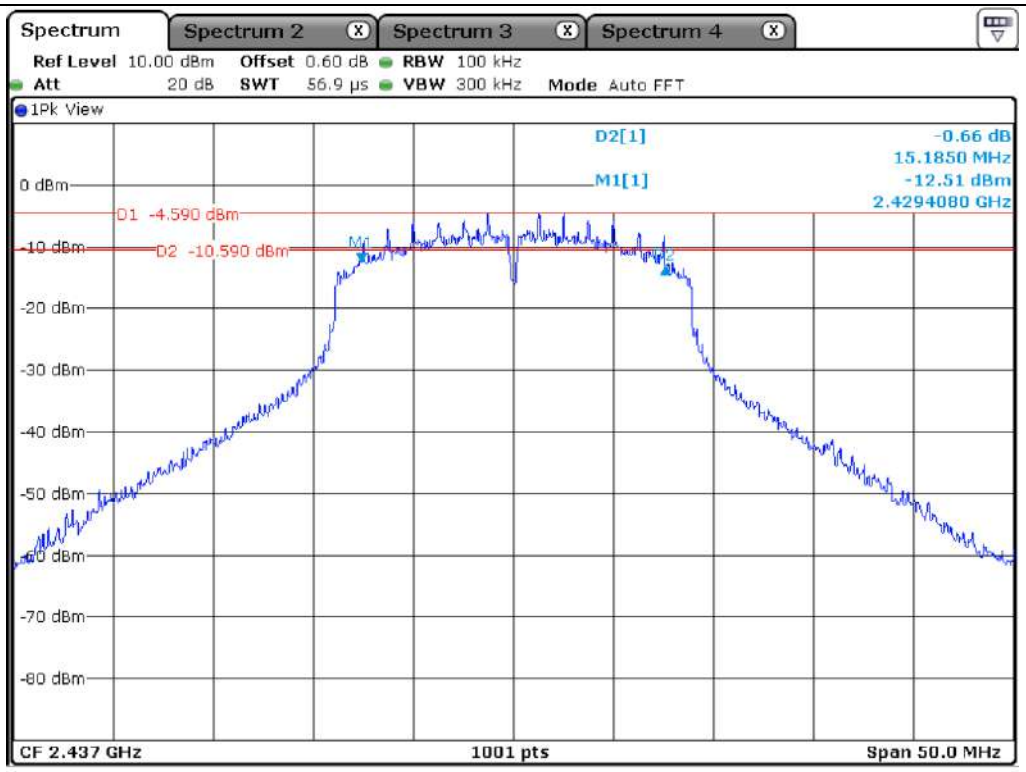
-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	LIMIT (MHz)	Bandwidth Margin(MHz)	
					6 dB	99 %
Low	2 412.00	15.19	17.33	0.50	14.69	-
Middle	2 437.00	15.19	17.43	0.50	14.69	-
High	2 462.00	15.19	17.28	0.50	14.69	-

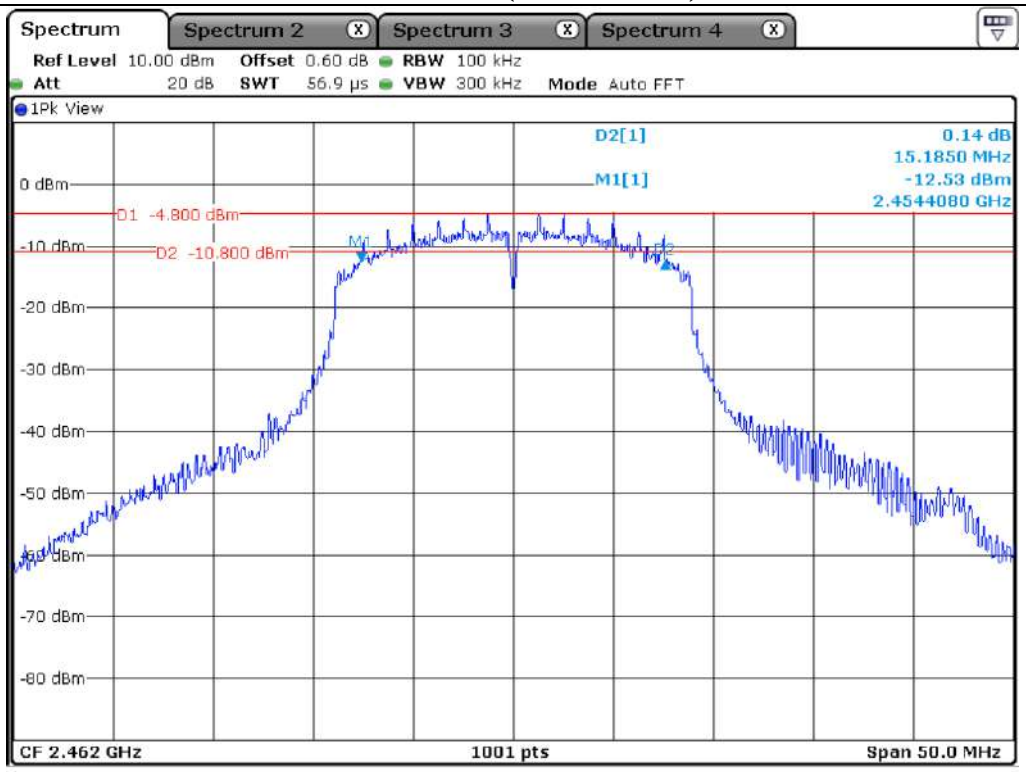
Remark. Margin = Measured Value - Limit



Low Channel (6 dB Bandwidth)

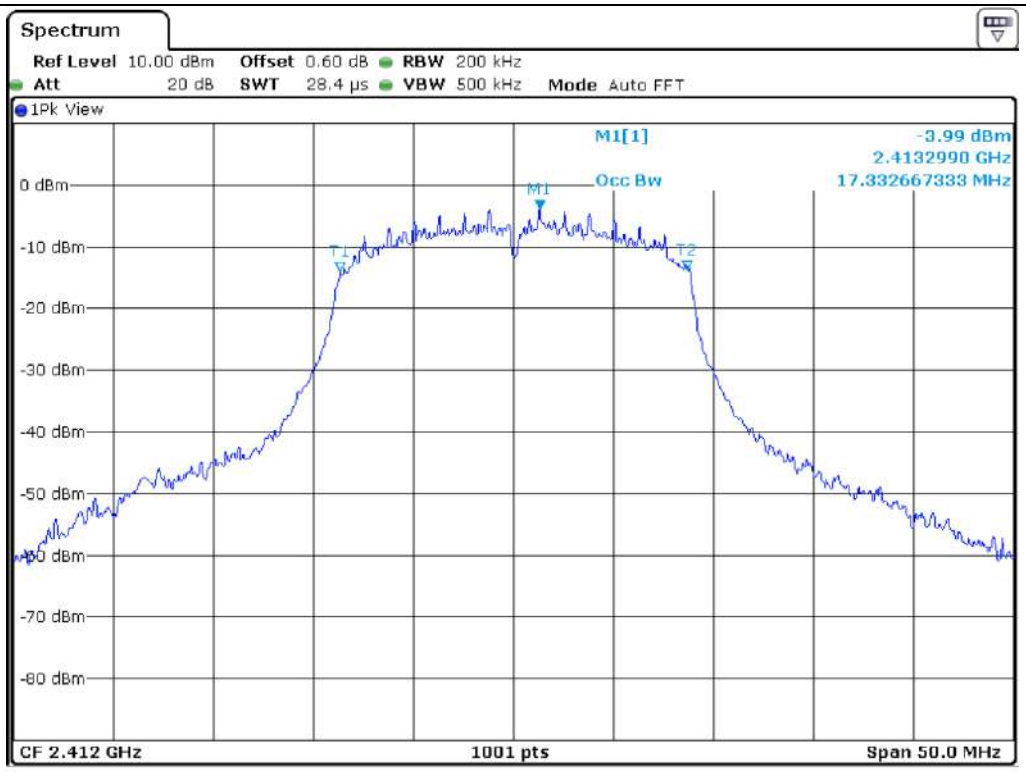


Middle Channel (6 dB Bandwidth)

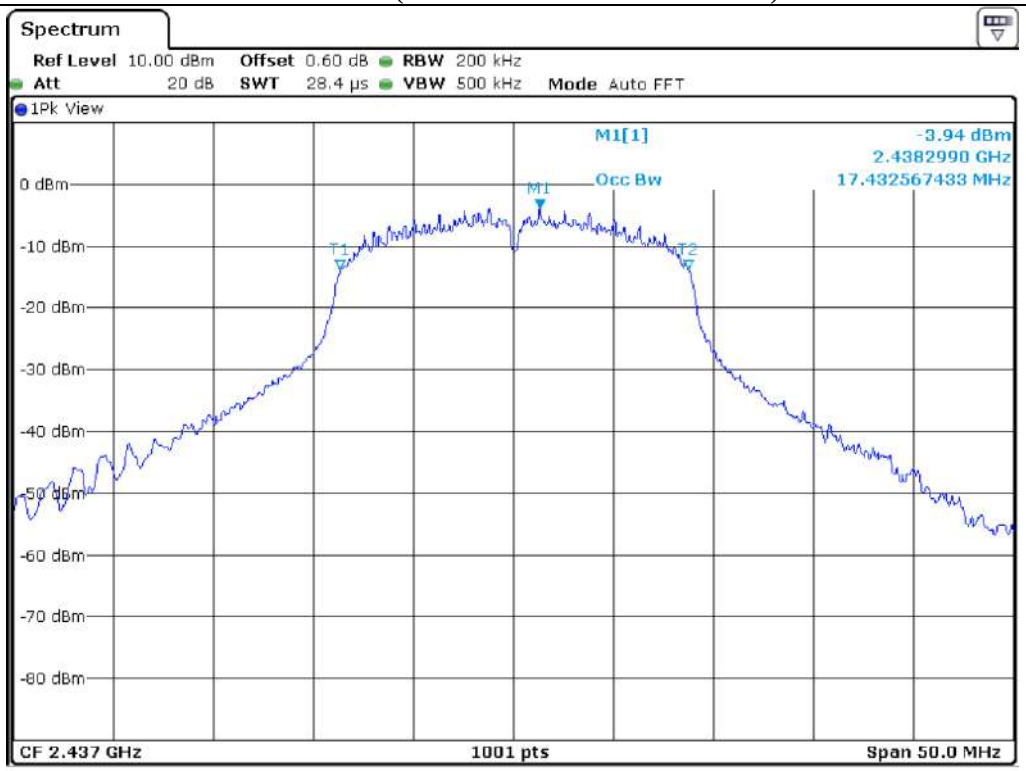


High Channel (6 dB Bandwidth)

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

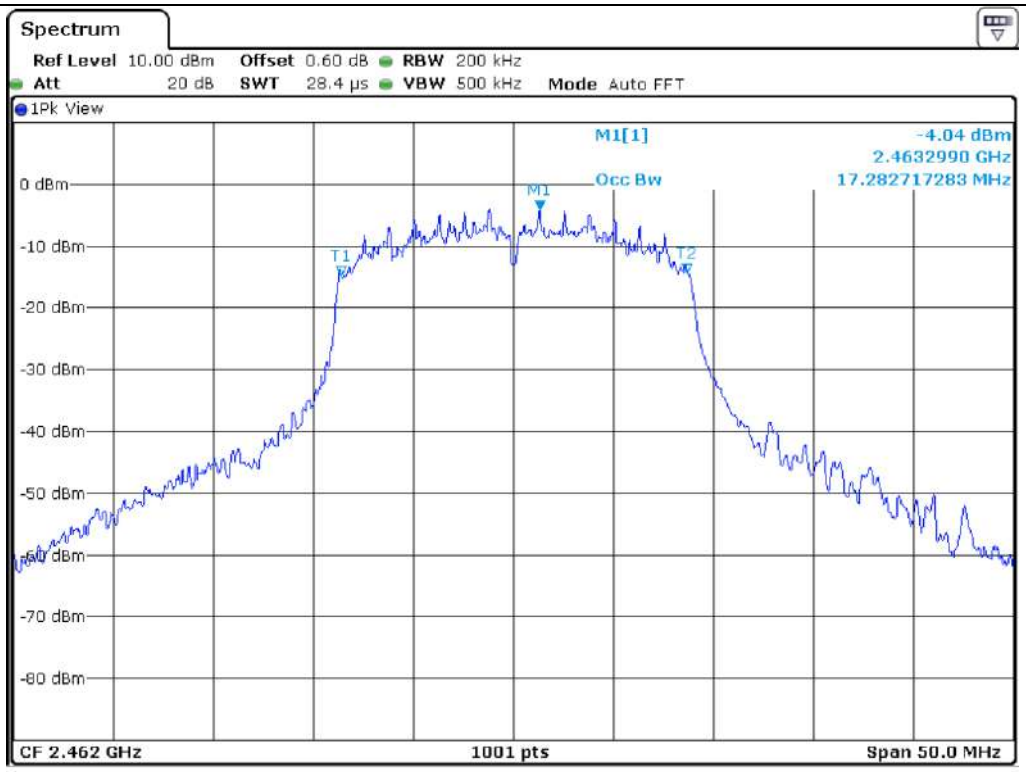


Low Channel (99 % OCCUPIED BANDWIDTH)



Middle Channel (99 % OCCUPIED BANDWIDTH)

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



High Channel (99 % OCCUPIED BANDWIDTH)

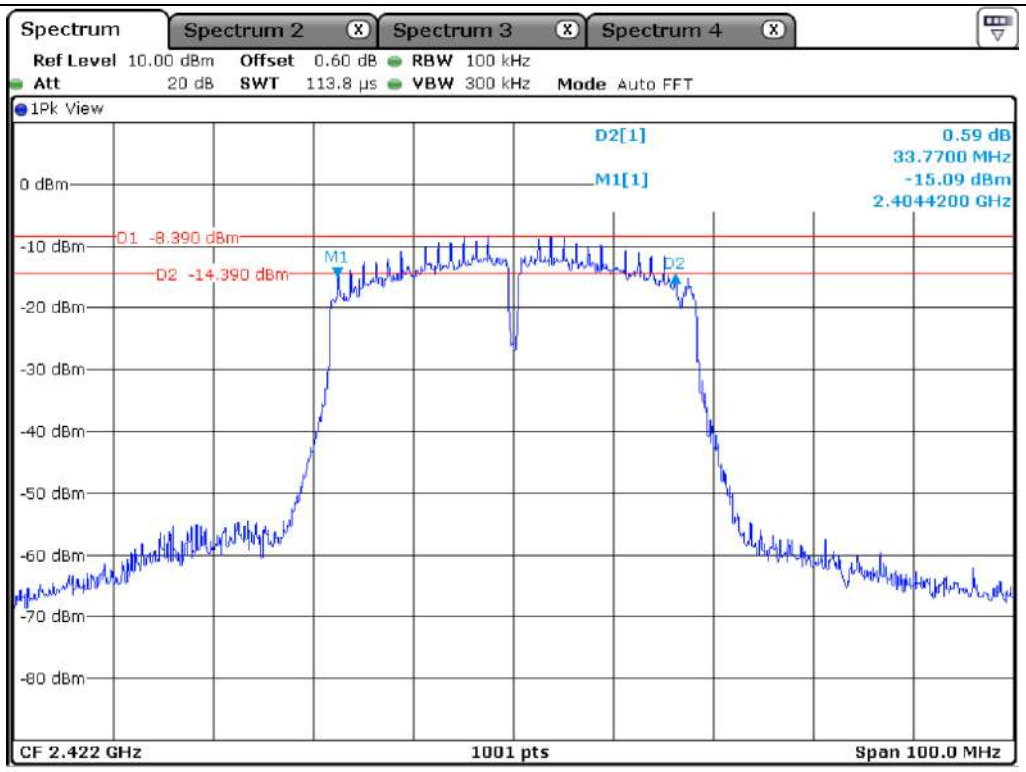
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

7.7 Test data for 802.11n (HT 40) WLAN Mode

-. Test Result : Pass

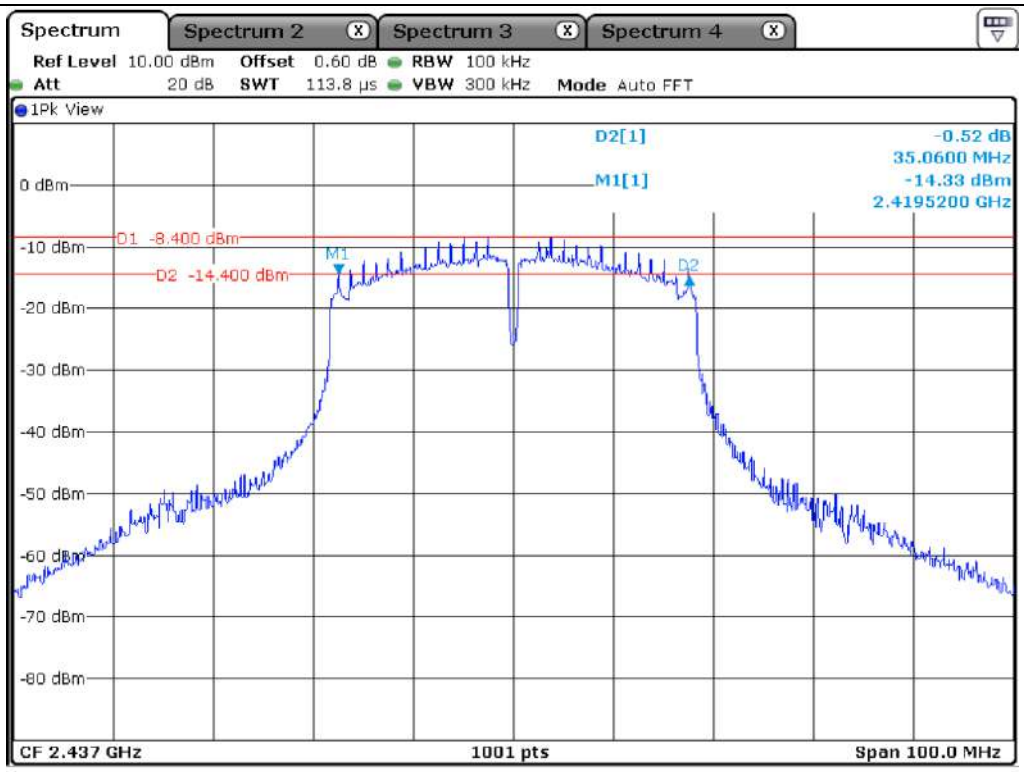
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	LIMIT (MHz)	Bandwidth Margin(MHz)	
					6 dB	99 %
Low	2 422.00	33.77	35.56	0.50	33.27	-
Middle	2 437.00	35.06	35.86	0.50	34.56	-
High	2 452.00	35.06	35.66	0.50	34.56	-

Remark. Margin = Measured Value - Limit

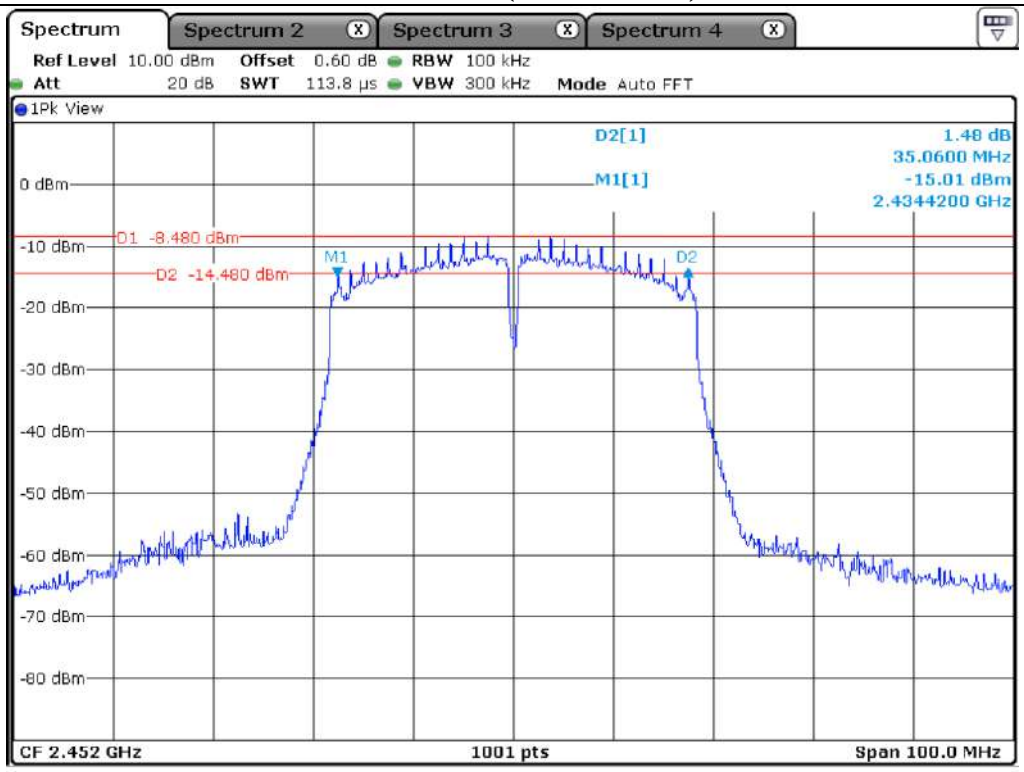


Low Channel (6 dB Bandwidth)

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



Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

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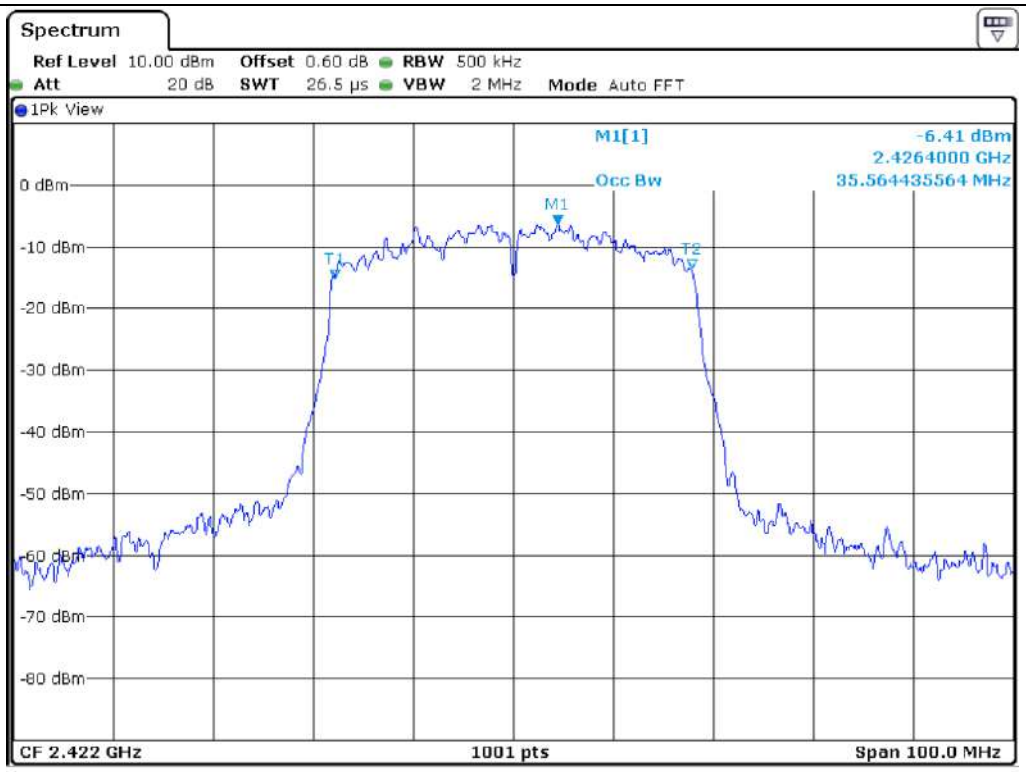
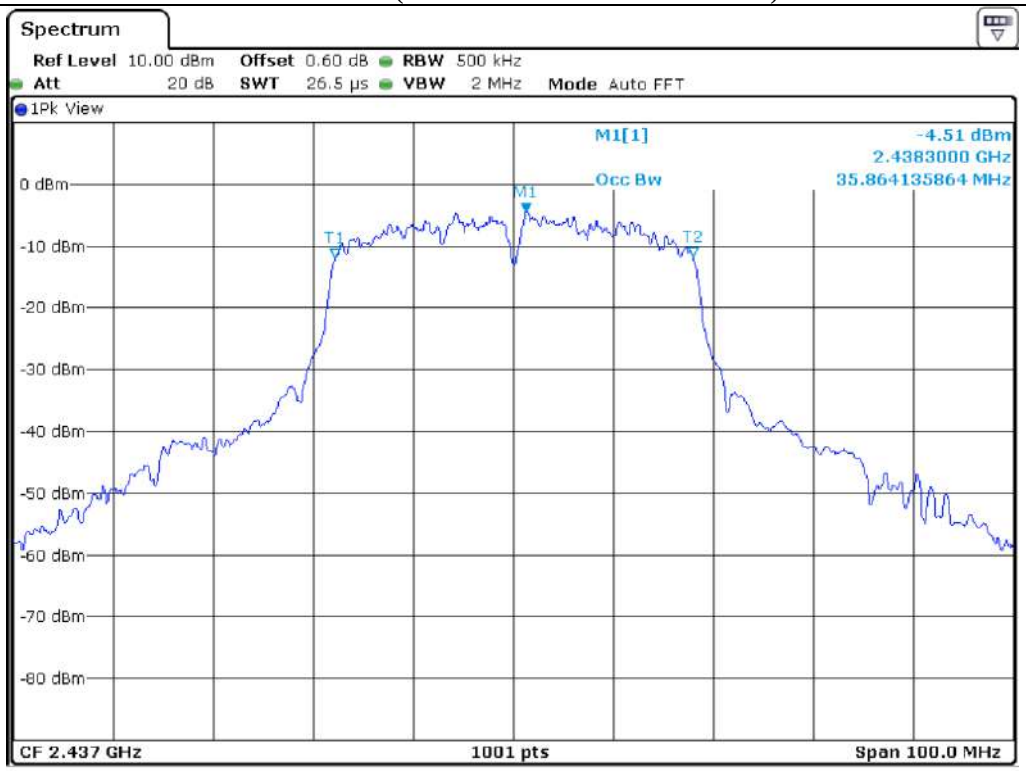


Low Channel (99 % OCCUPIED BANDWIDTH)



Middle Channel (99 % OCCUPIED BANDWIDTH)

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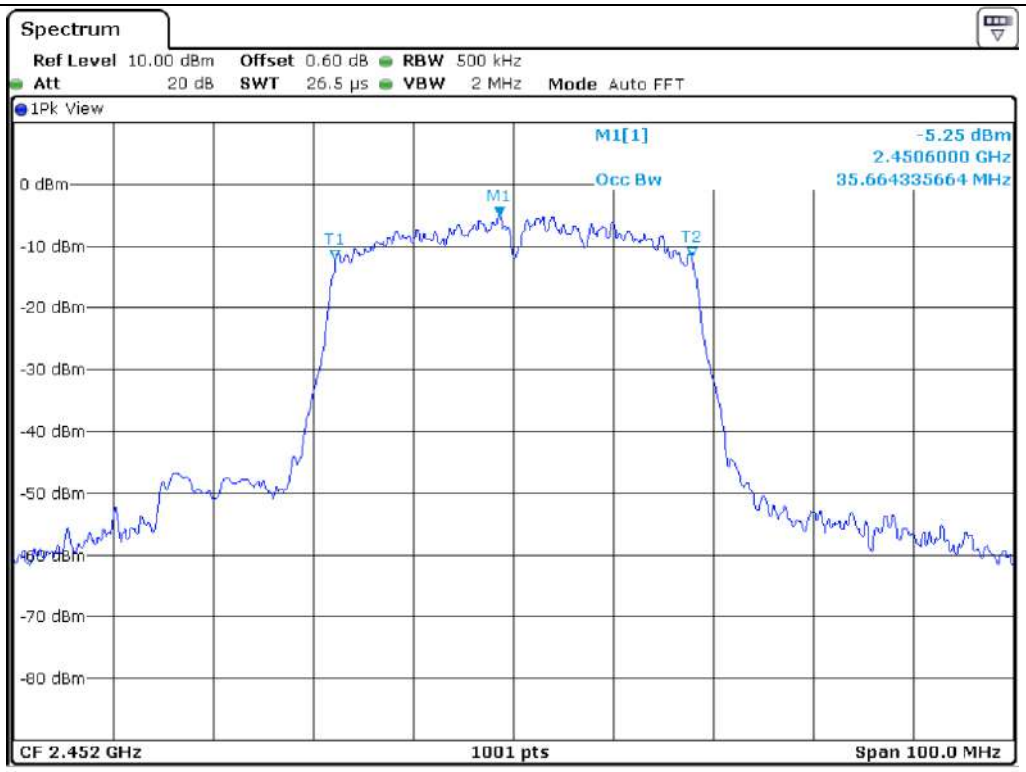


High Channel (99 % OCCUPIED BANDWIDTH)

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

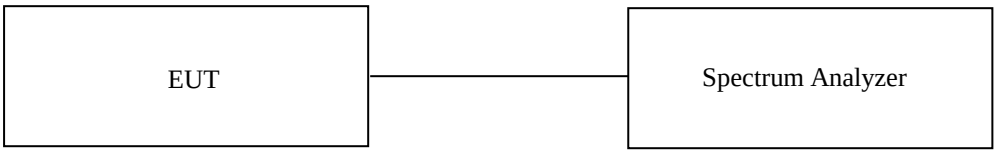
8. MAXIMUM PEAK OUTPUT POWER

8.1 Operating environment

Temperature	:	22.5 °C
Relative humidity	:	49 % R.H.

8.2 Test set-up

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99 % bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.



8.3 Test date

January 06, 2021 ~ January 11, 2021

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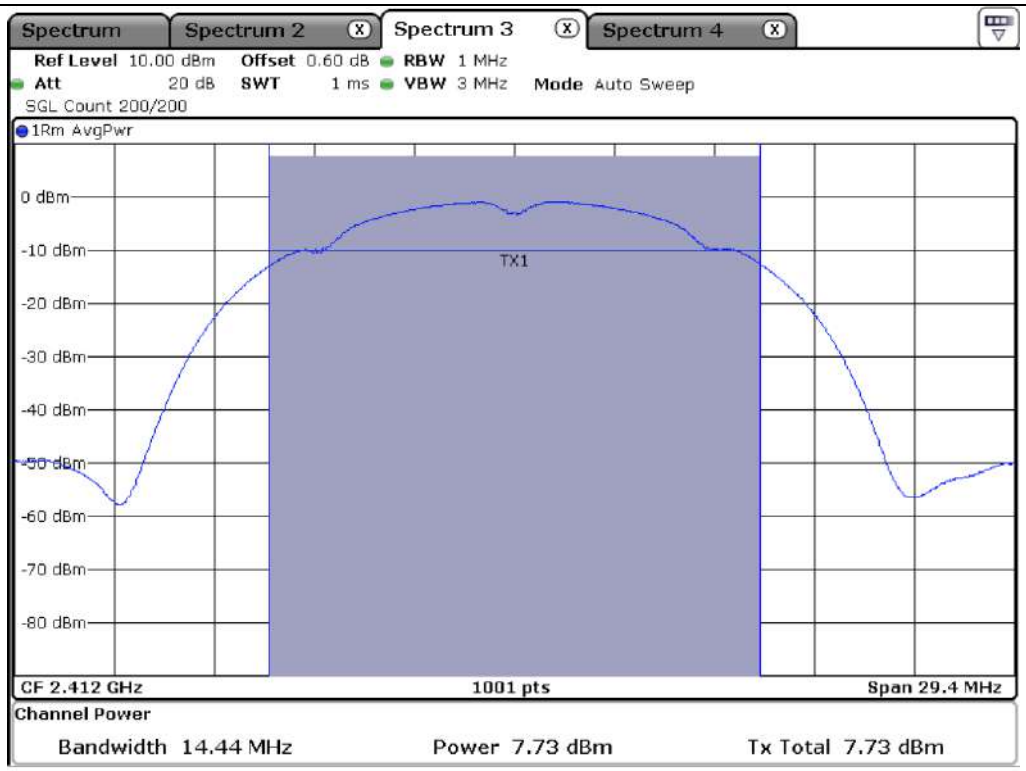
8.4 Test data for 802.11b WLAN Mode

-. Test Result : Pass

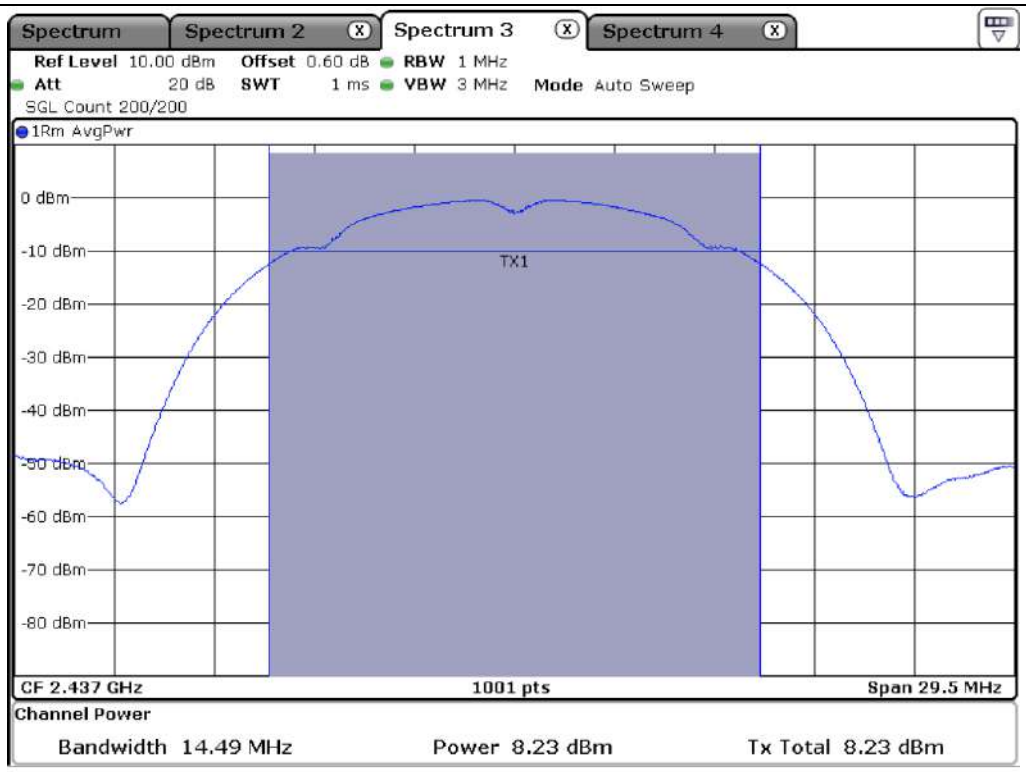
CHANNEL	FREQUENCY (MHz)	99 % Occupied Bandwidth (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	14.44	7.73	30.00	22.27
MIDDLE	2 437.00	14.49	8.23	30.00	21.77
HIGH	2 462.00	14.49	8.15	30.00	21.85

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

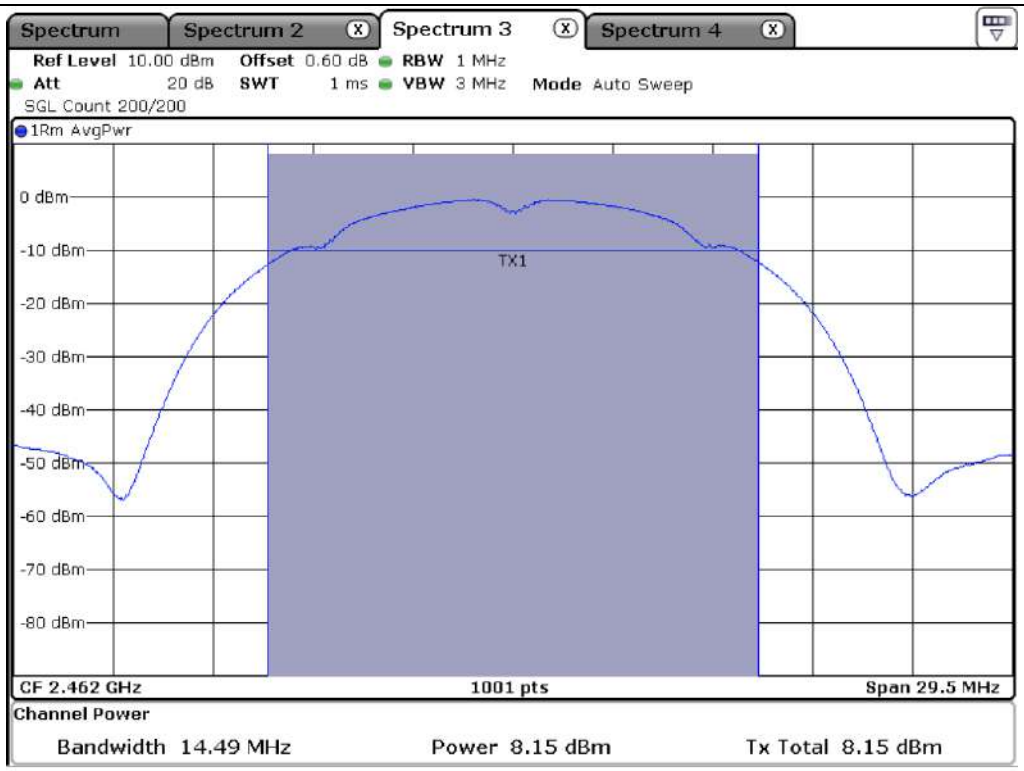


Low Channel

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



Middle Channel



High Channel

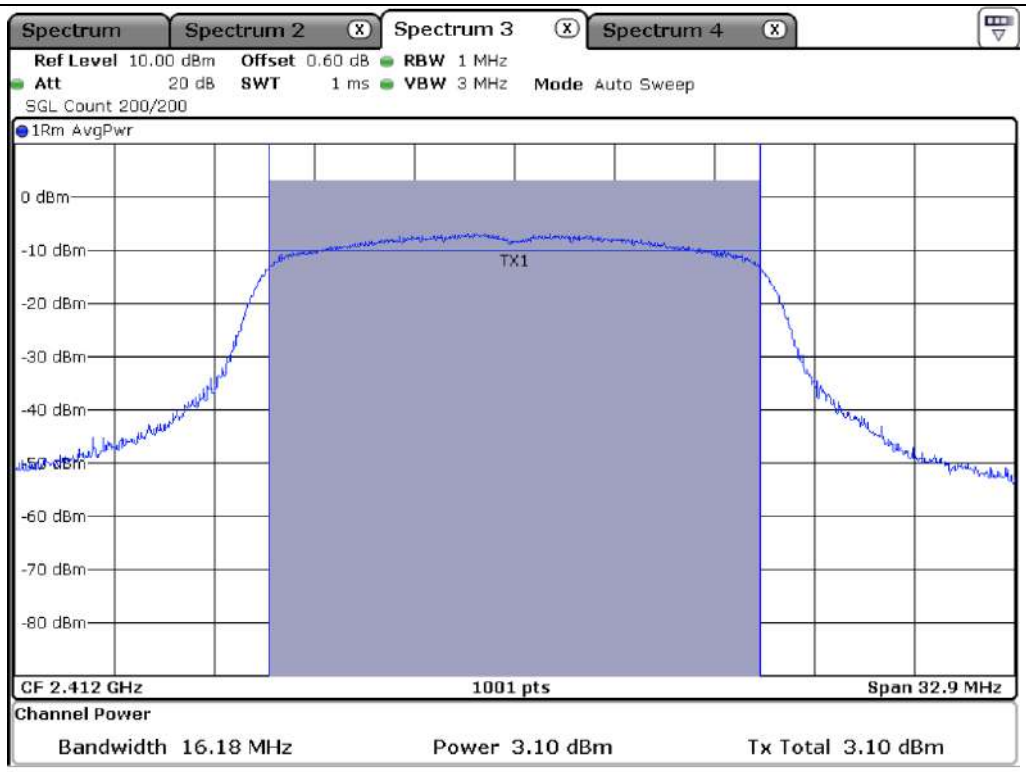
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

8.5 Test data for 802.11g WLAN Mode

-. Test Result : Pass

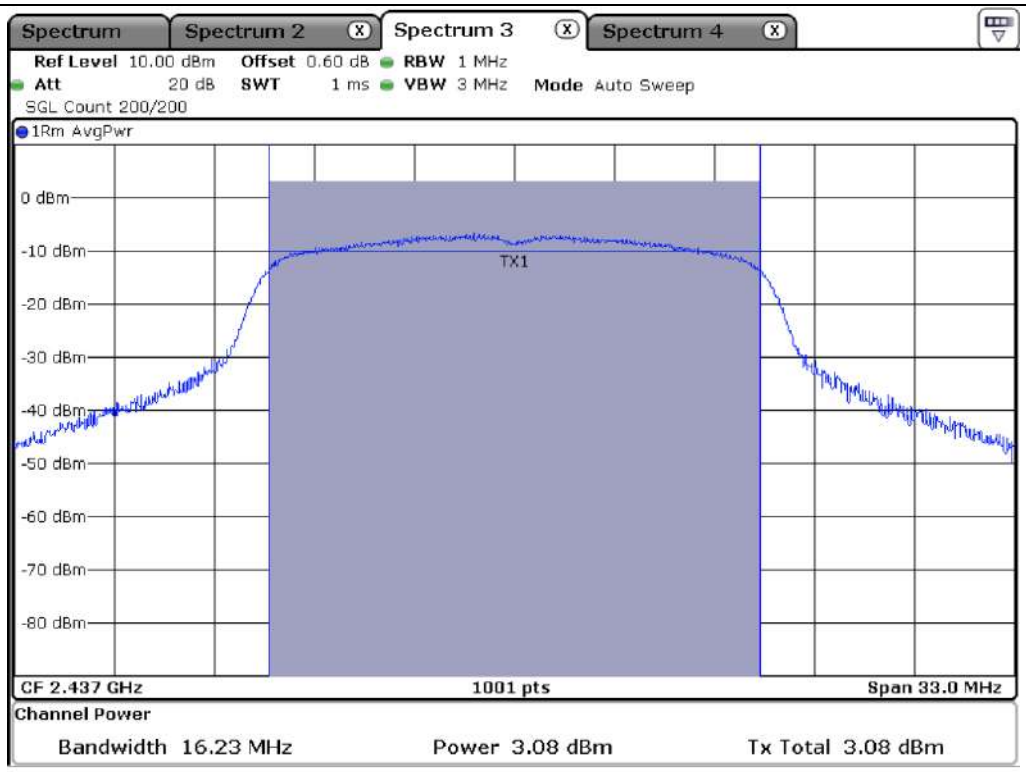
CHANNEL	FREQUENCY (MHz)	99 % Occupied Bandwidth (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	16.18	3.10	30.00	26.90
MIDDLE	2 437.00	16.23	3.08	30.00	26.92
HIGH	2 462.00	16.18	2.99	30.00	27.01

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

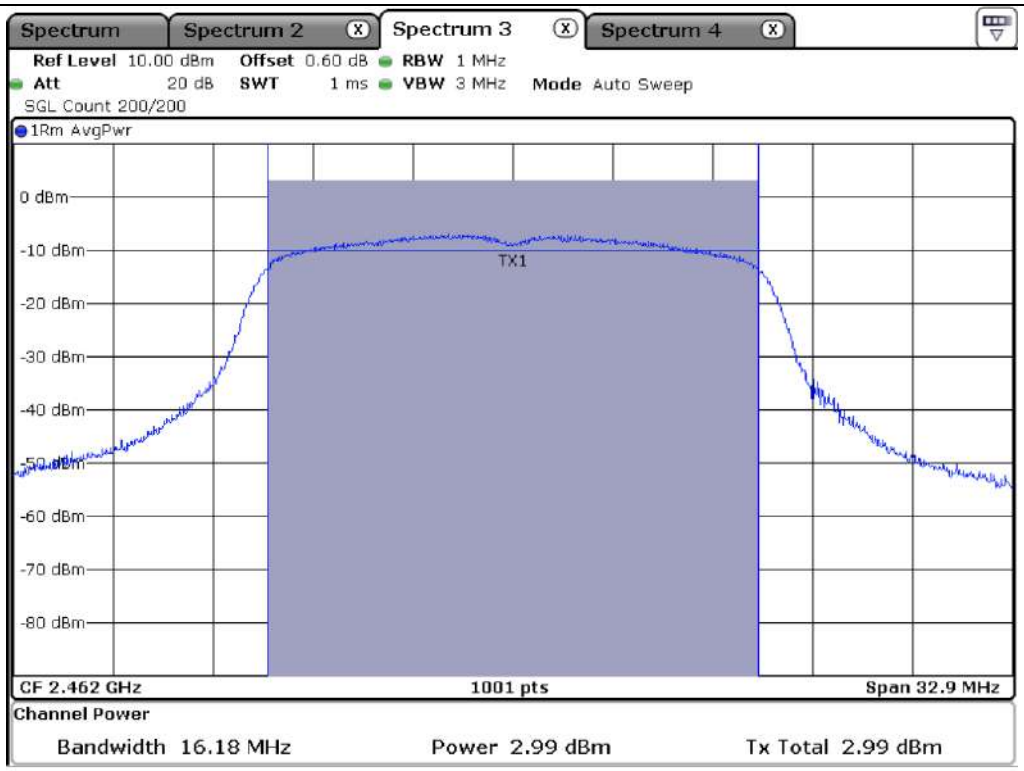


Low Channel

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



Middle Channel



High Channel

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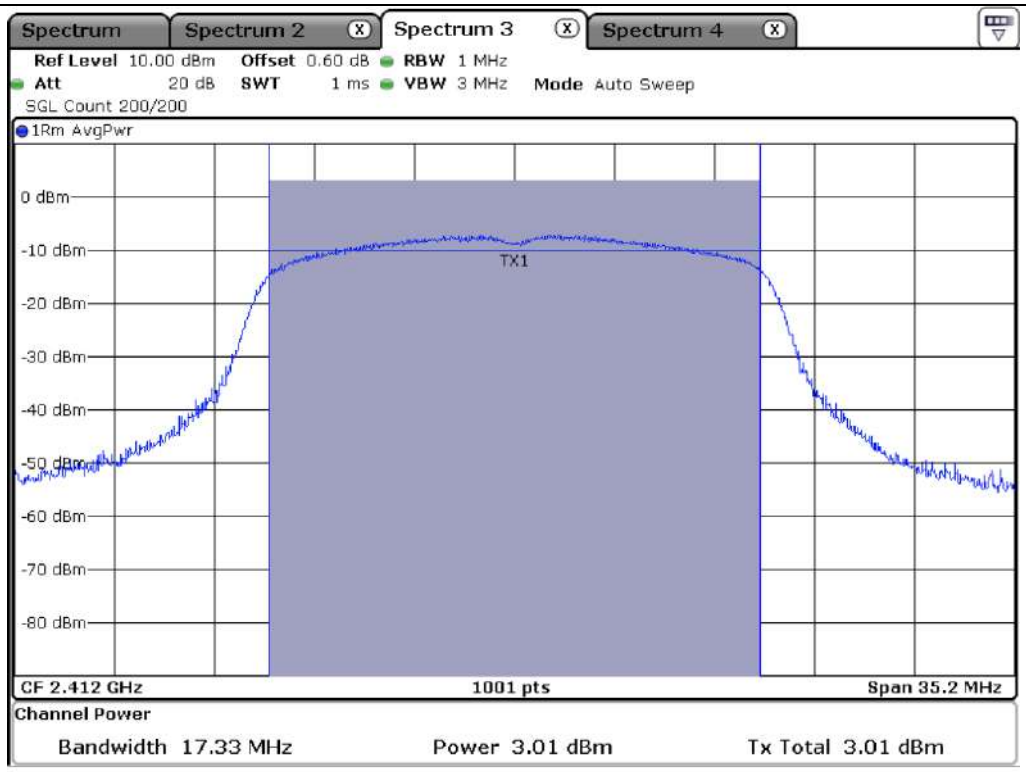
8.6 Test data for 802.11n(HT20) WLAN Mode

-. Test Result : Pass

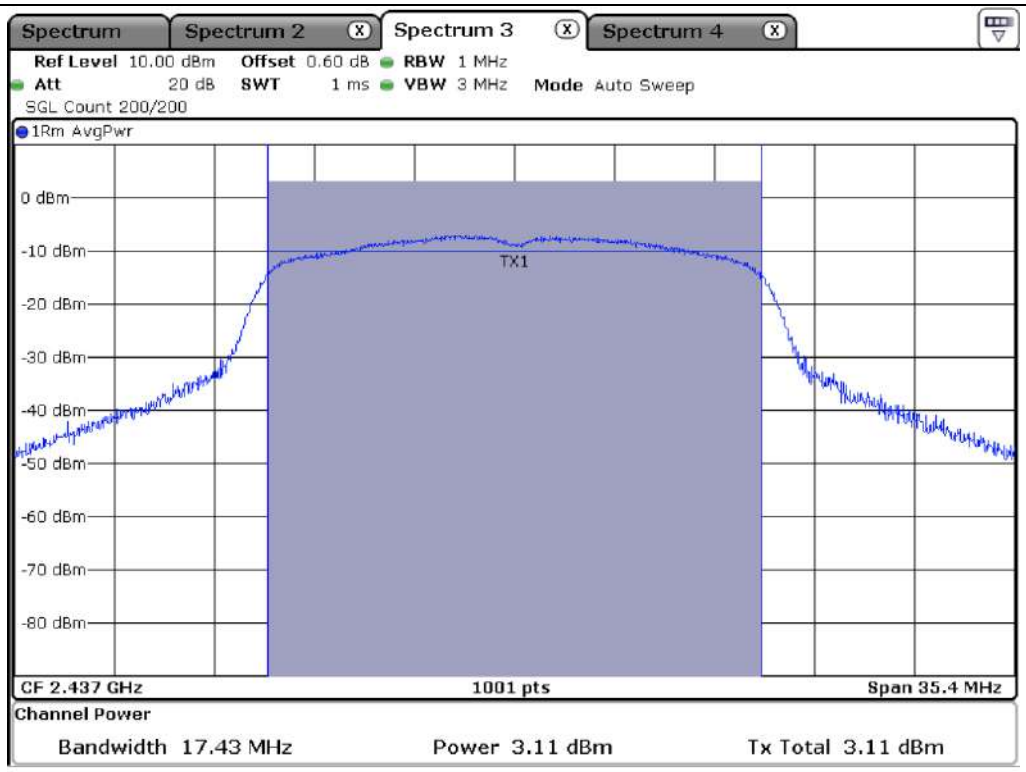
CHANNEL	FREQUENCY (MHz)	99 % Occupied Bandwidth (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	17.33	3.01	30.00	26.99
MIDDLE	2 437.00	17.43	3.11	30.00	26.89
HIGH	2 462.00	17.28	3.06	30.00	26.94

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

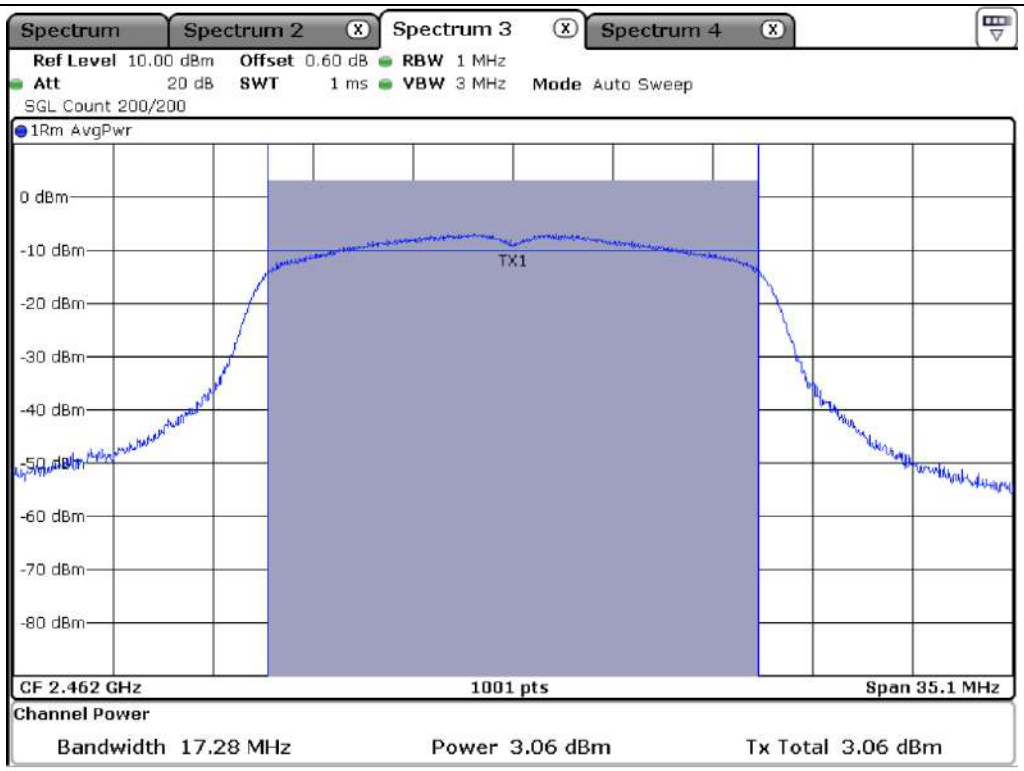


Low Channel

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



Middle Channel



High Channel

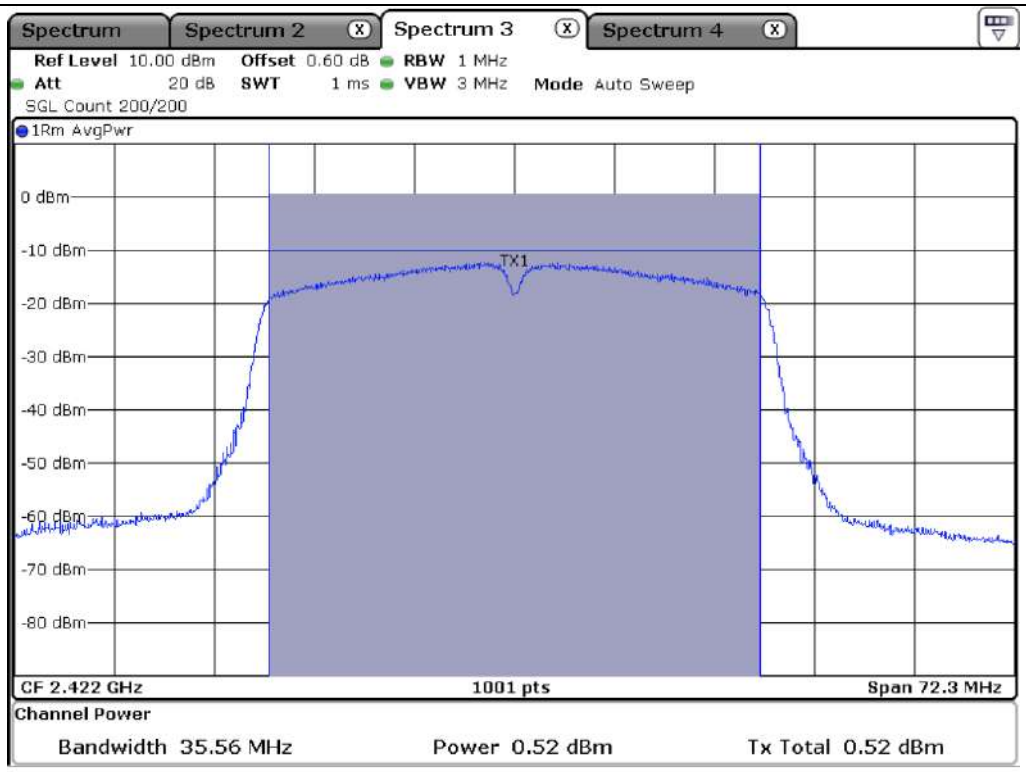
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

8.7 Test data for 802.11n(HT40) WLAN Mode

-. Test Result : Pass

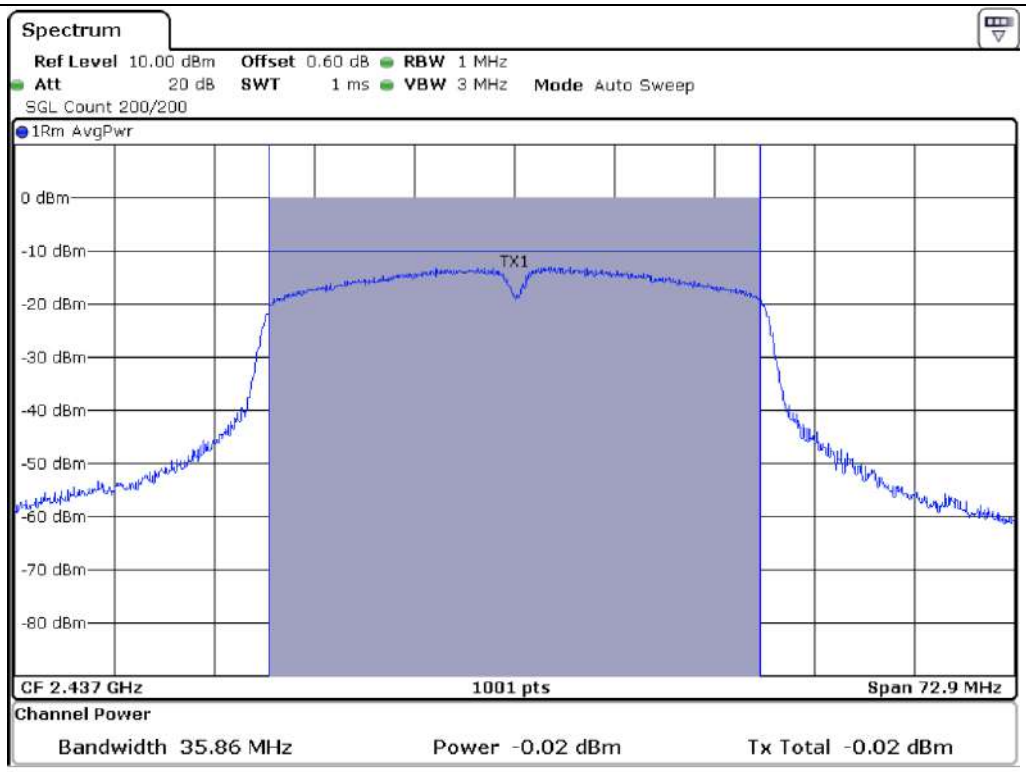
CHANNEL	FREQUENCY (MHz)	99 % Occupied Bandwidth (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 422.00	35.56	0.52	30.00	29.48
MIDDLE	2 437.00	35.86	-0.02	30.00	30.02
HIGH	2 452.00	35.66	-0.29	30.00	30.29

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

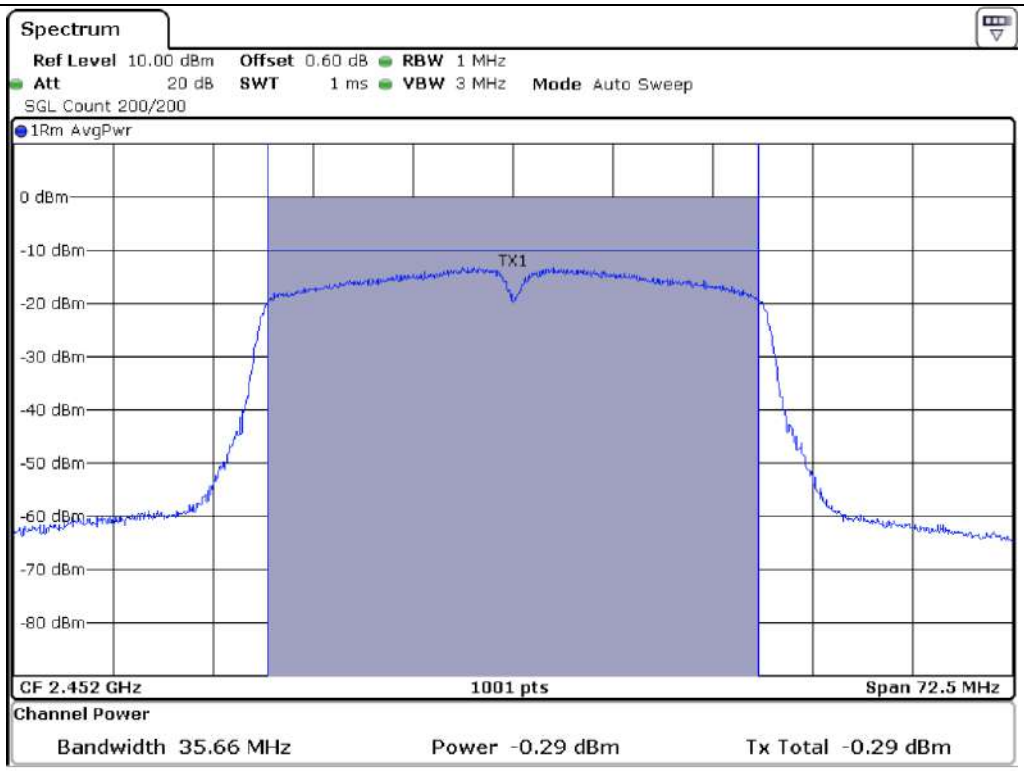


Low Channel

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



Middle Channel



High Channel

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

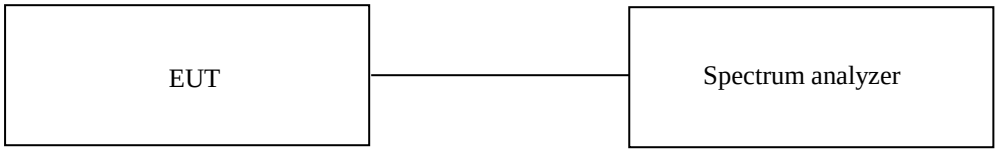
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature	:	22.5 °C
Relative humidity	:	49 % 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, open-field test site. The EUT was placed on a non-conductive turntable above the ground plane.

The frequency spectrum from 30 MHz to 40 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

January 06, 2021 ~ January 11, 2021

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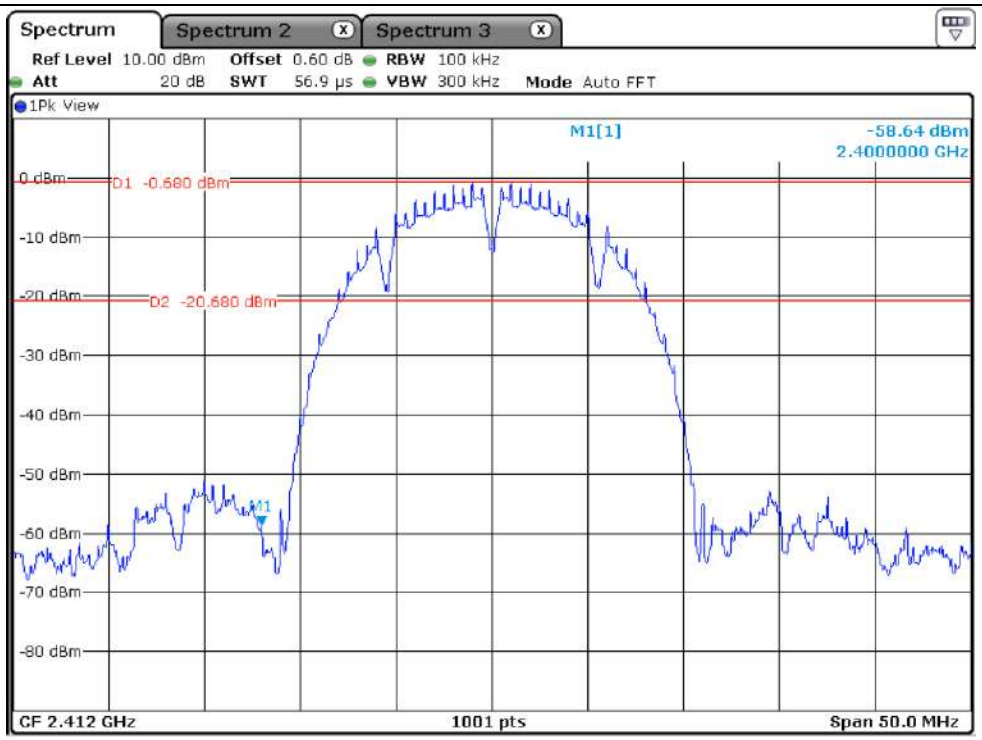
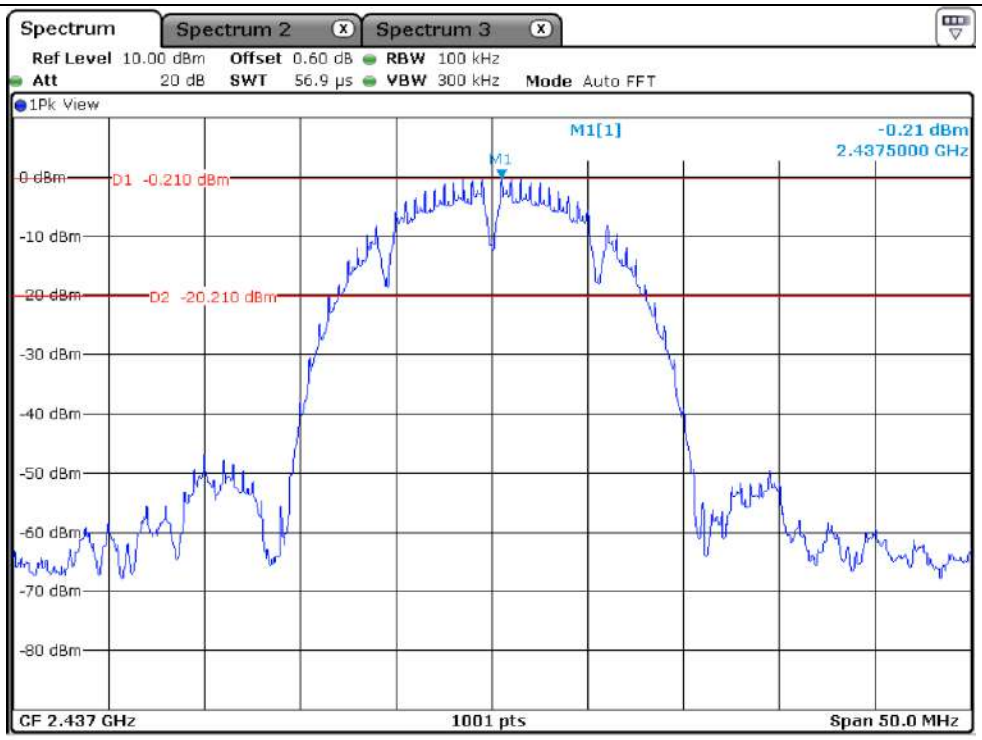
9.5 Test data for conducted emission

9.5.1 Test data for 802.11b WLAN Mode

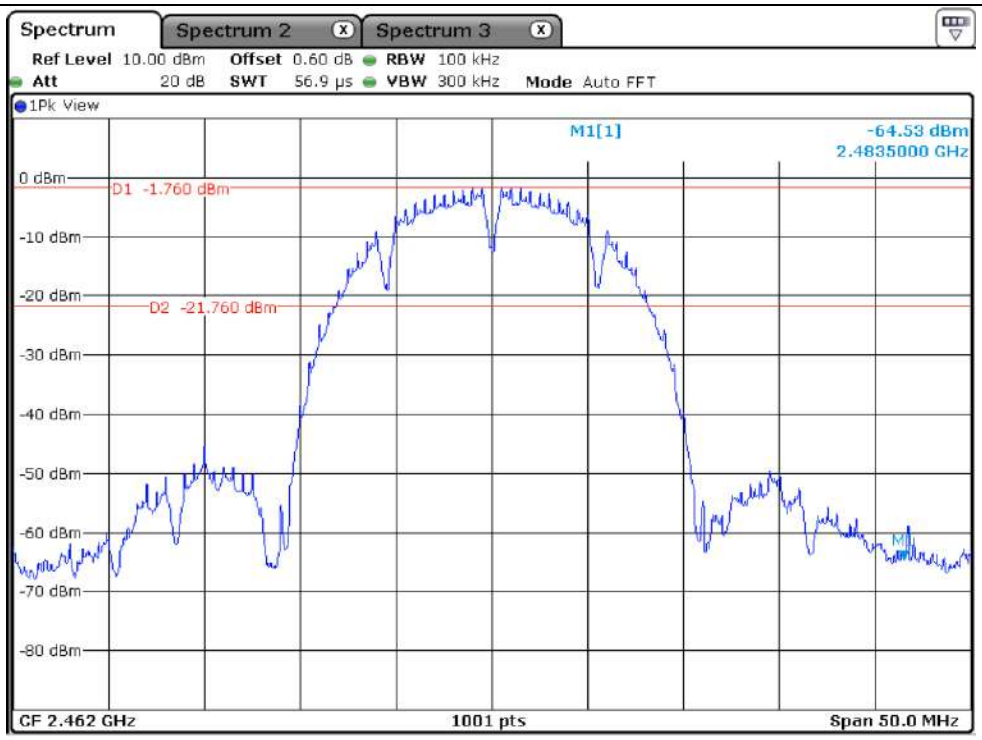


Low Channel



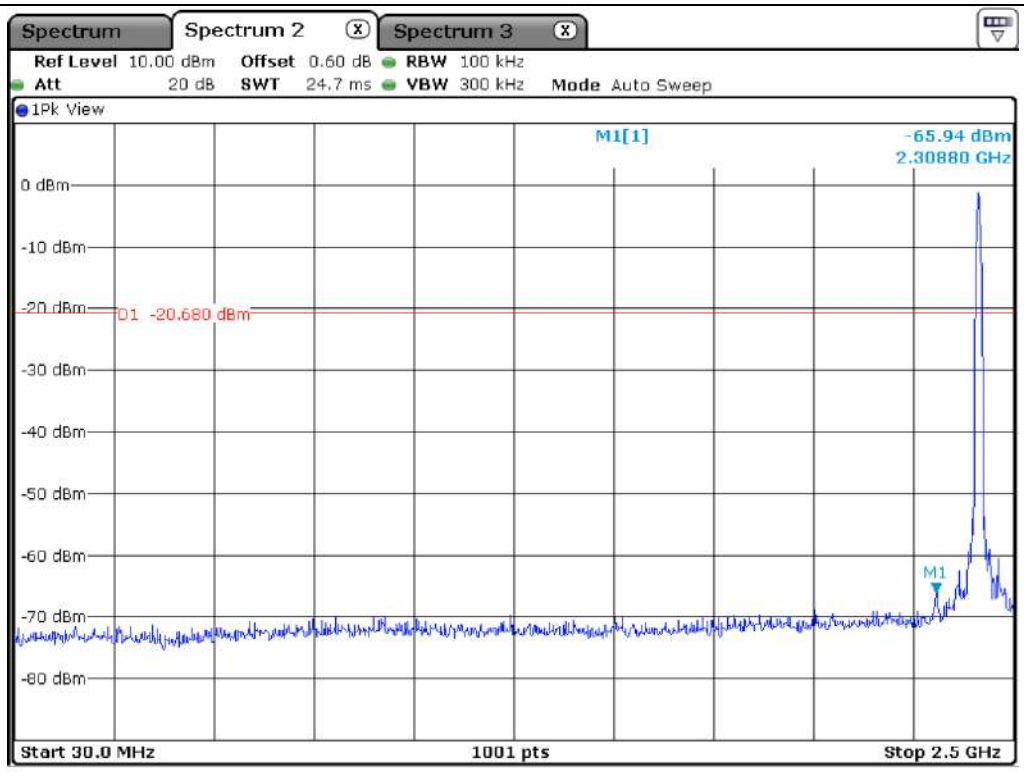
Middle Channel

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

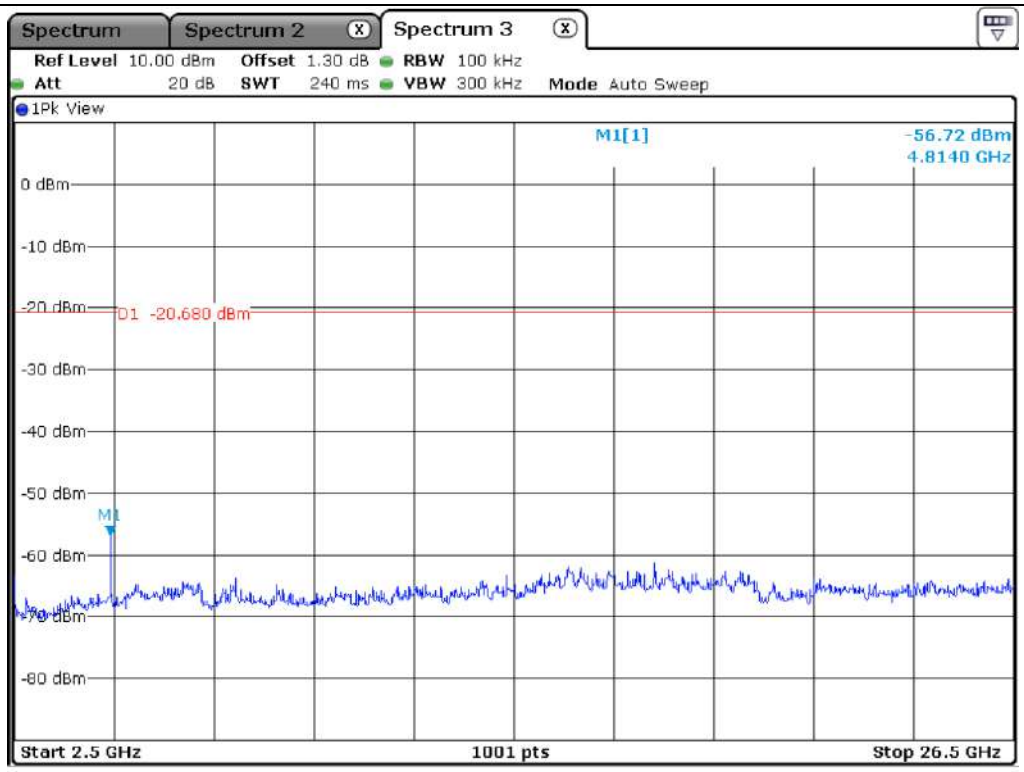


High Channel

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



Low Channel



Low Channel

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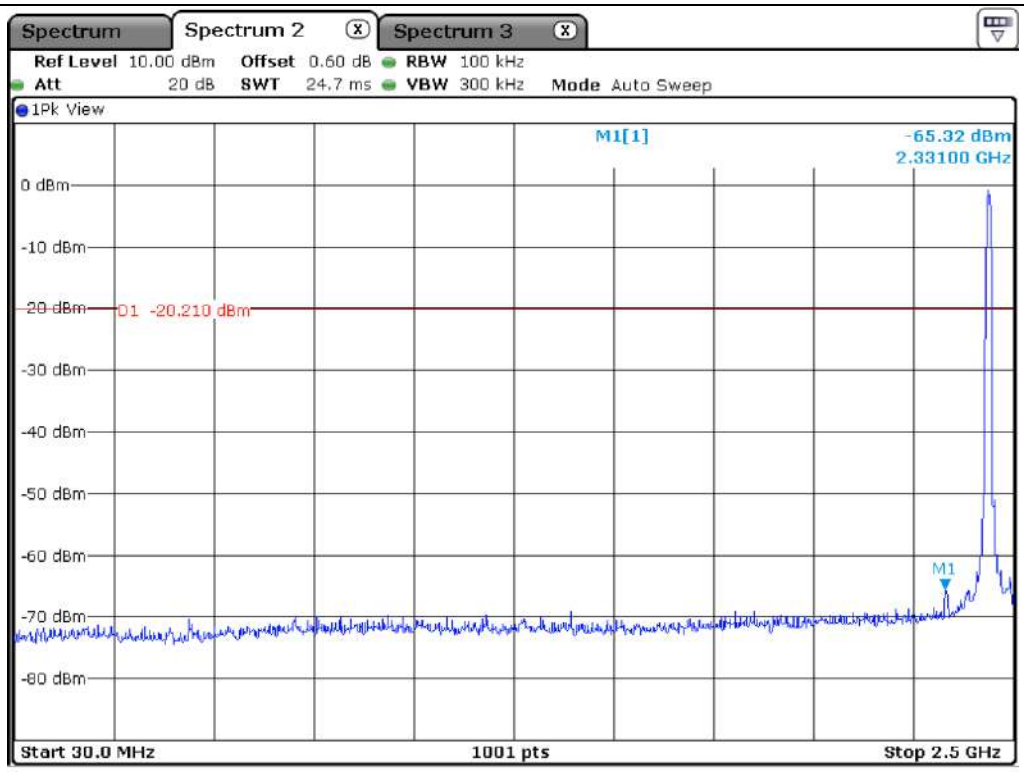
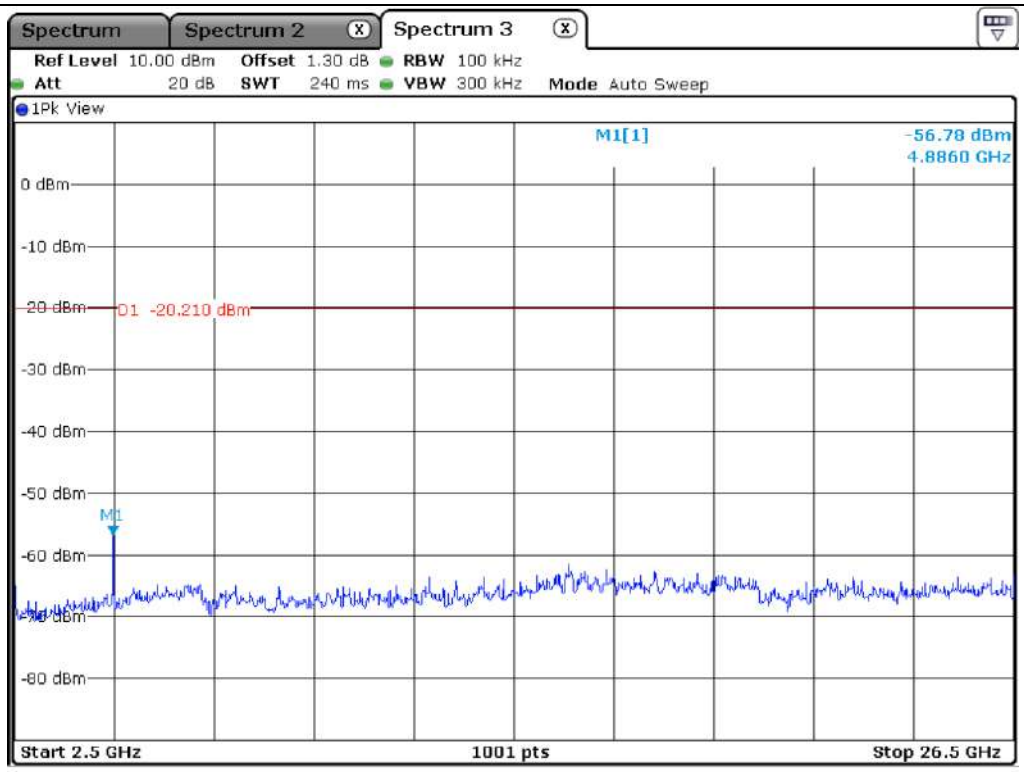


Middle Channel



Middle Channel

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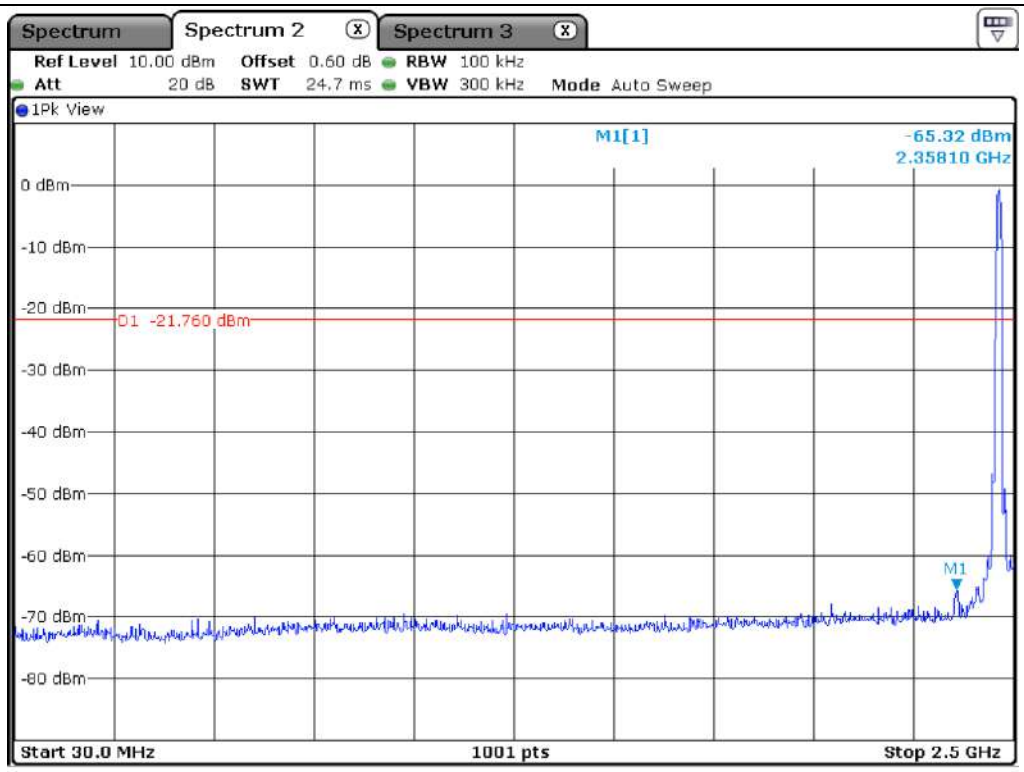
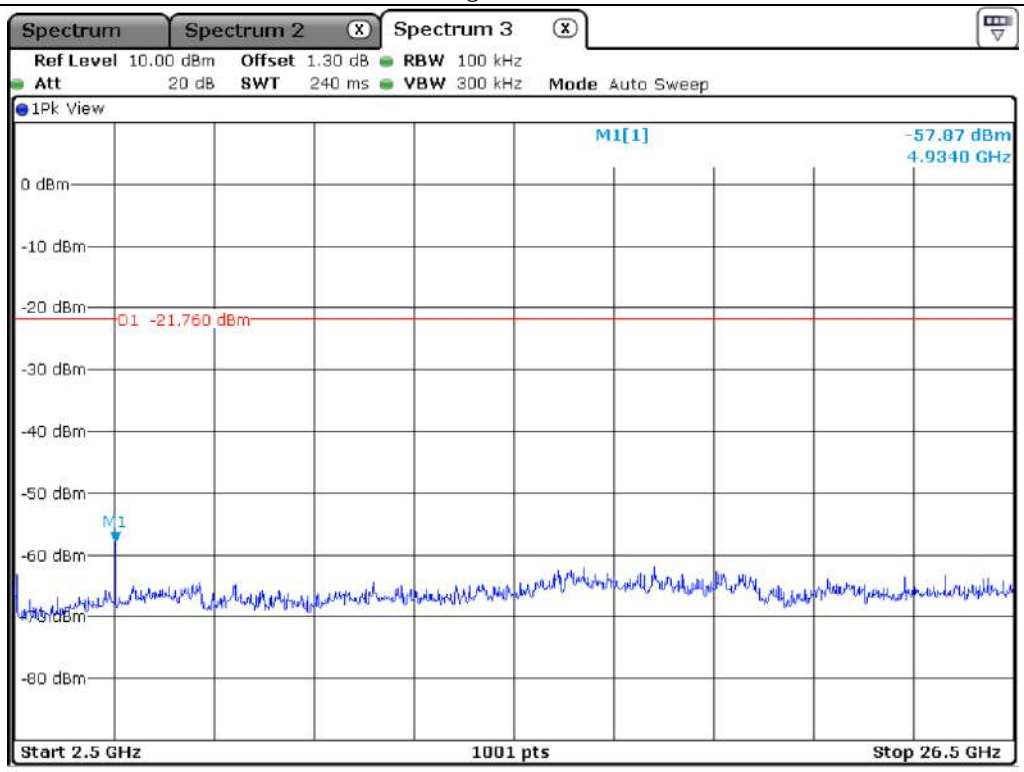


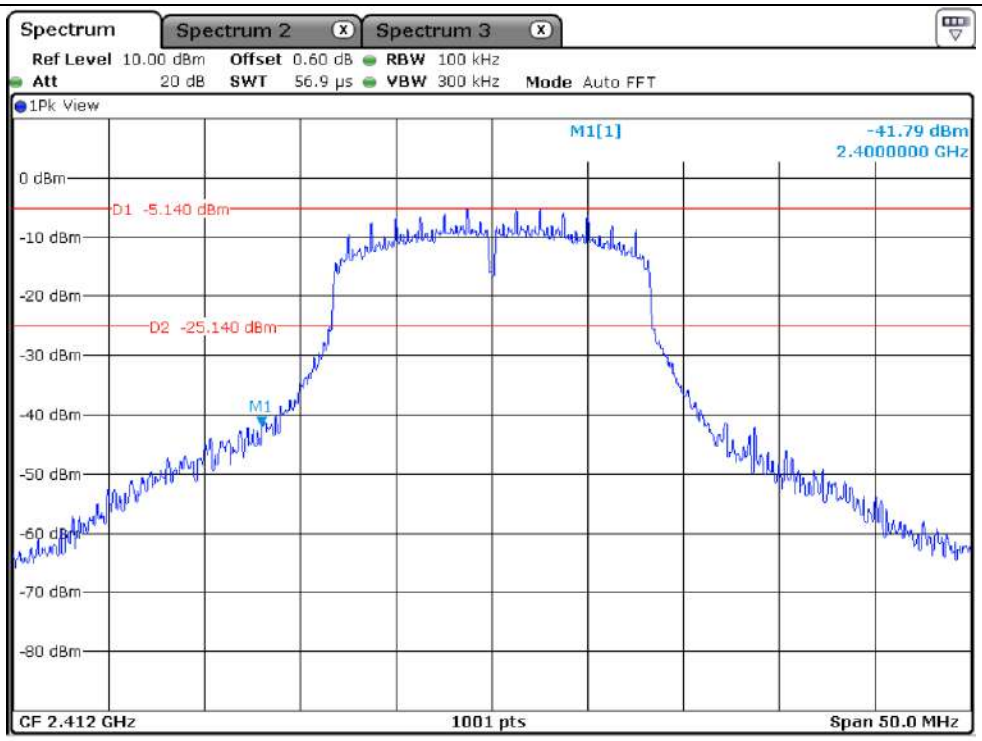
High Channel



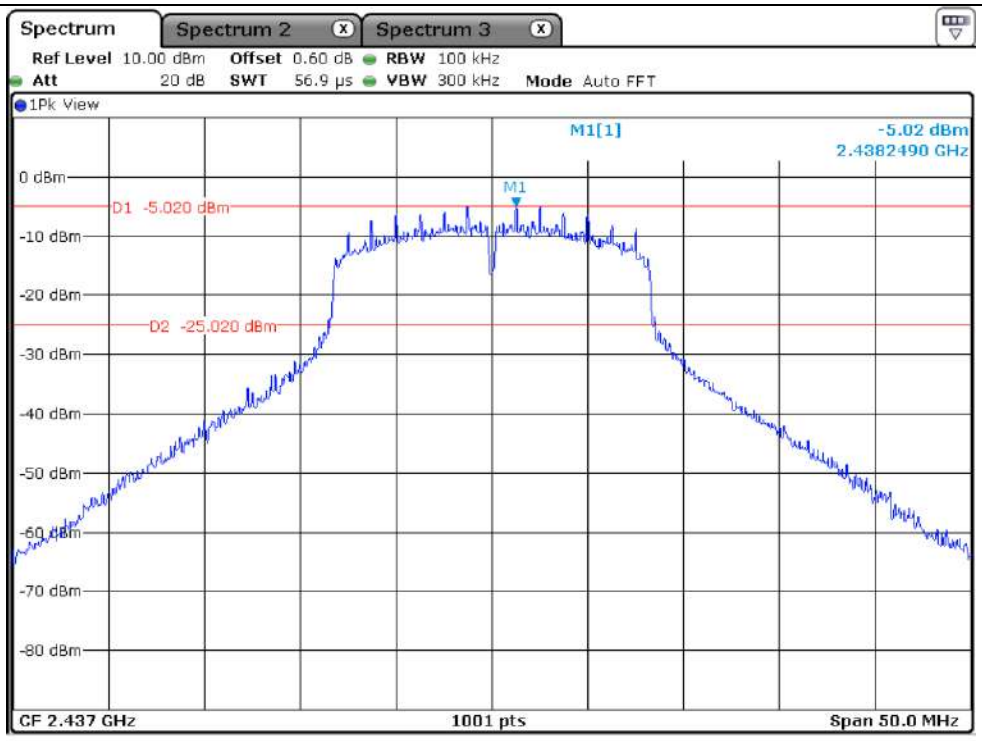
High Channel

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

9.5.2 Test data for 802.11g WLAN Mode

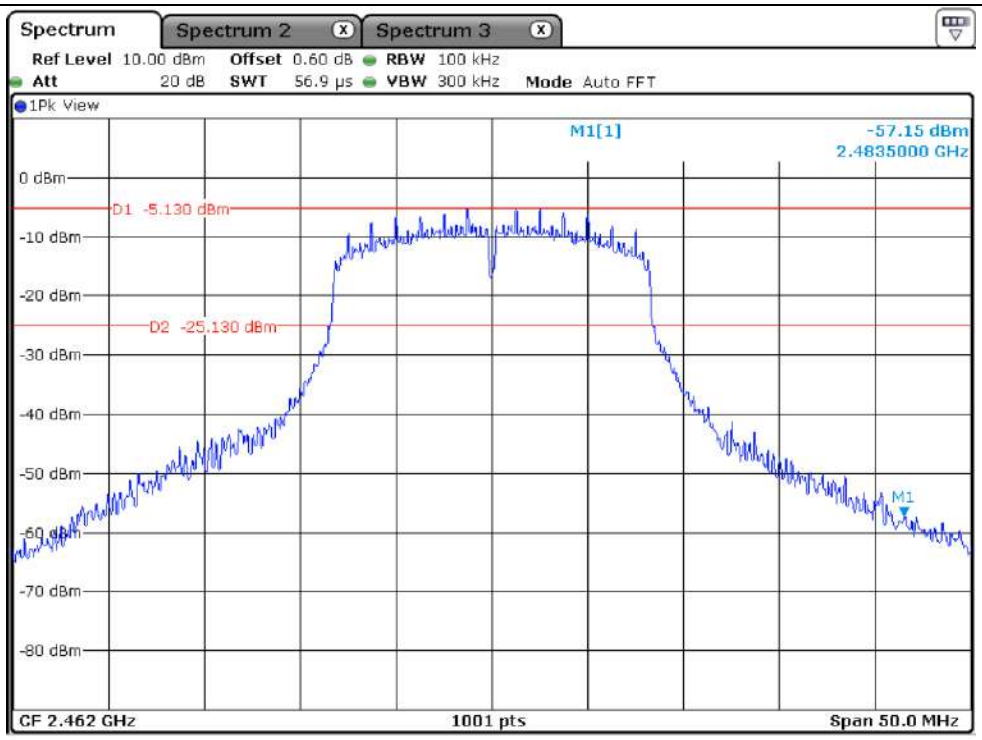


Low Channel



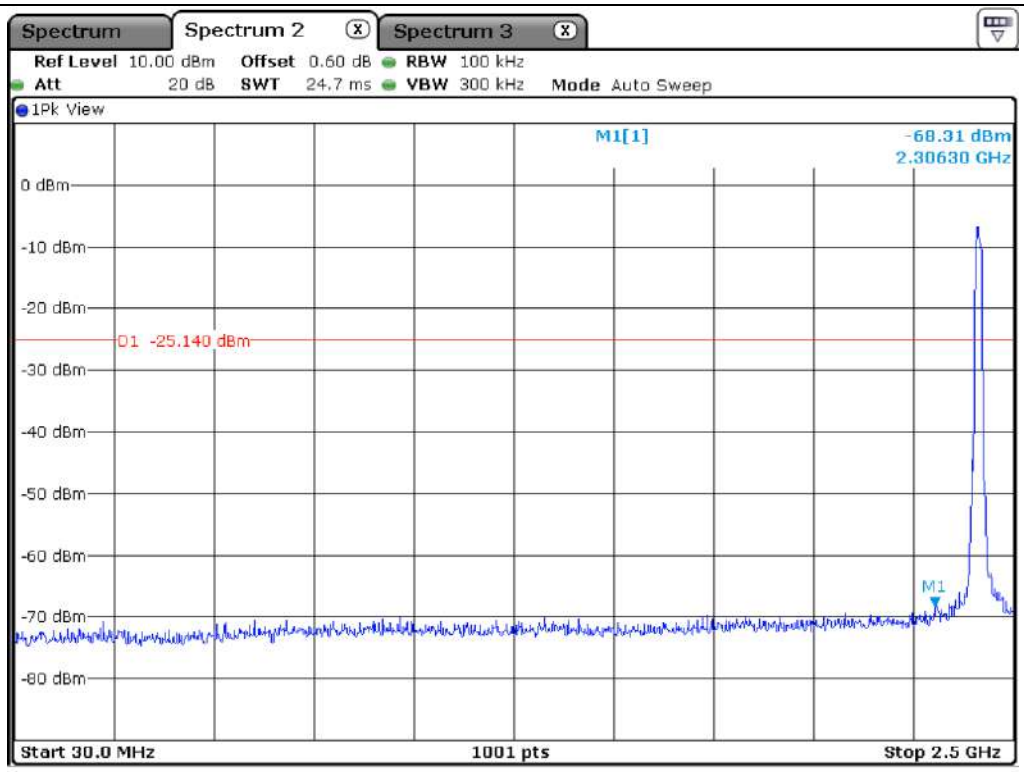
Middle Channel

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

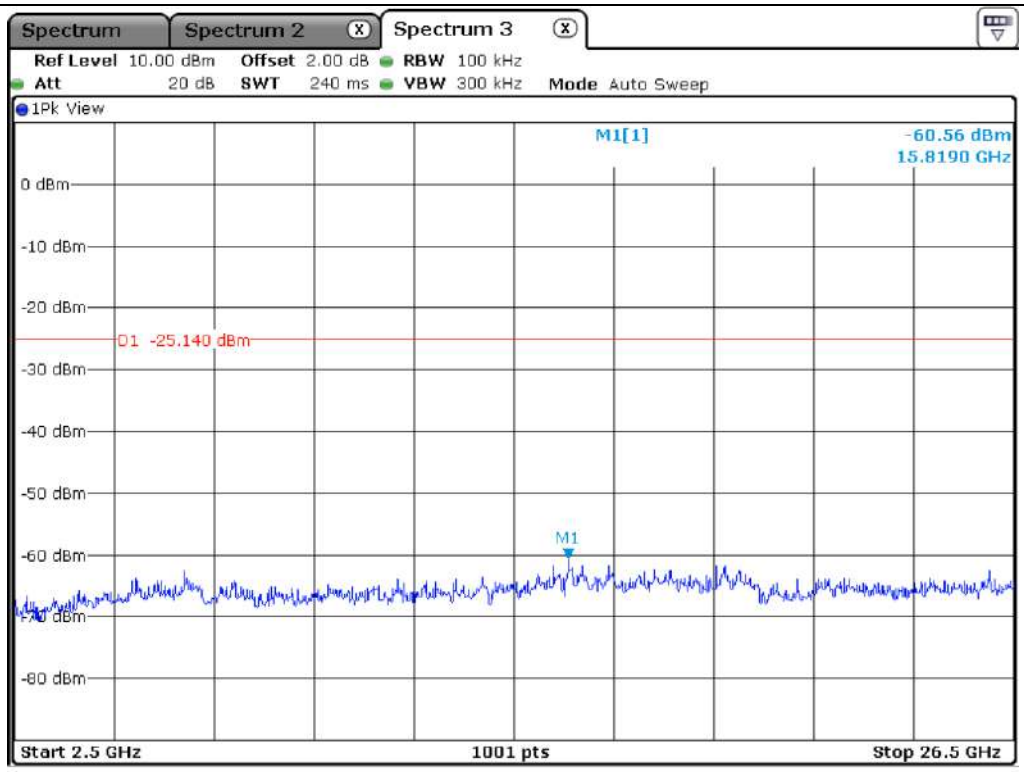


High Channel

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

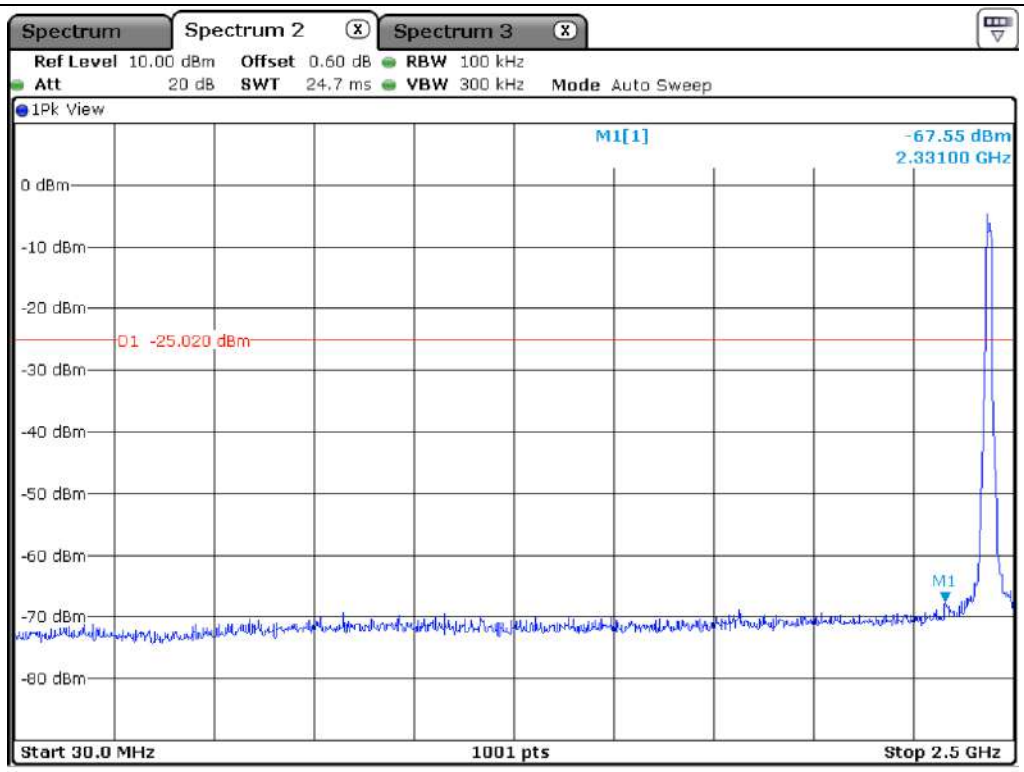


Low Channel

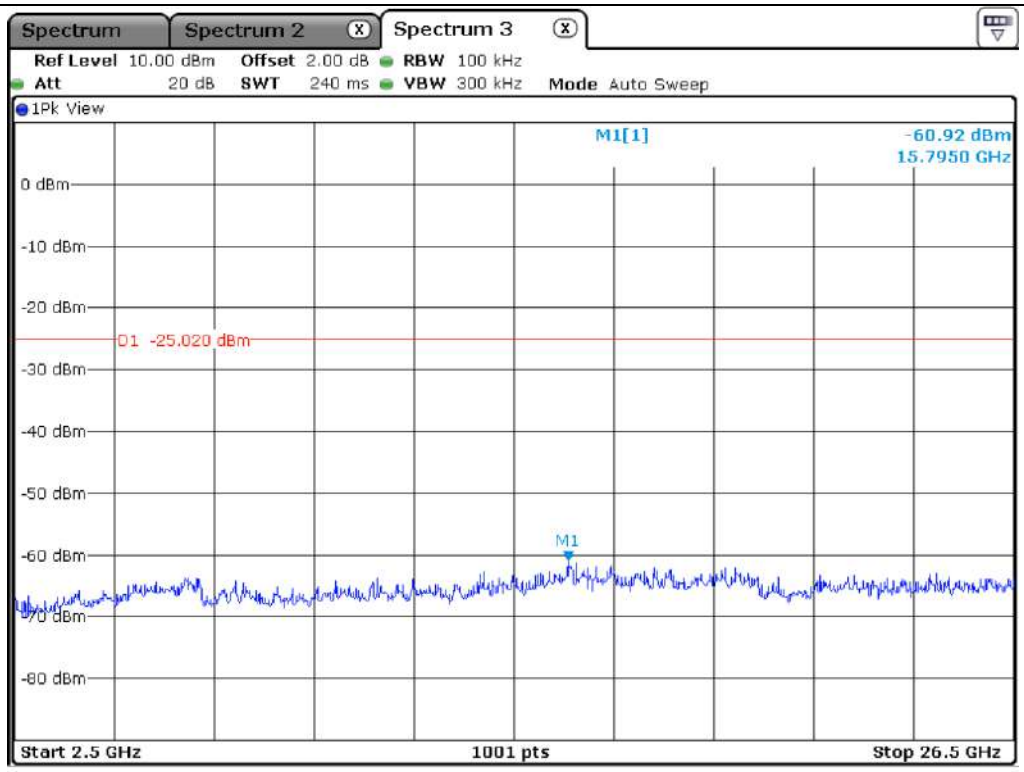


Low Channel

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

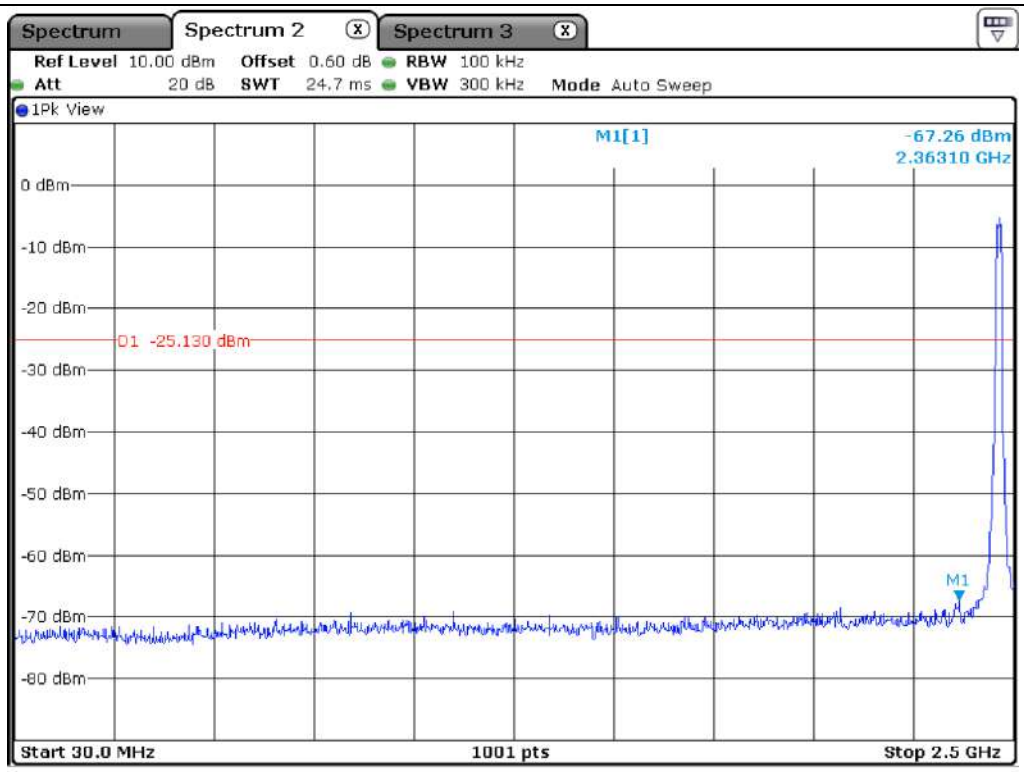


Middle Channel

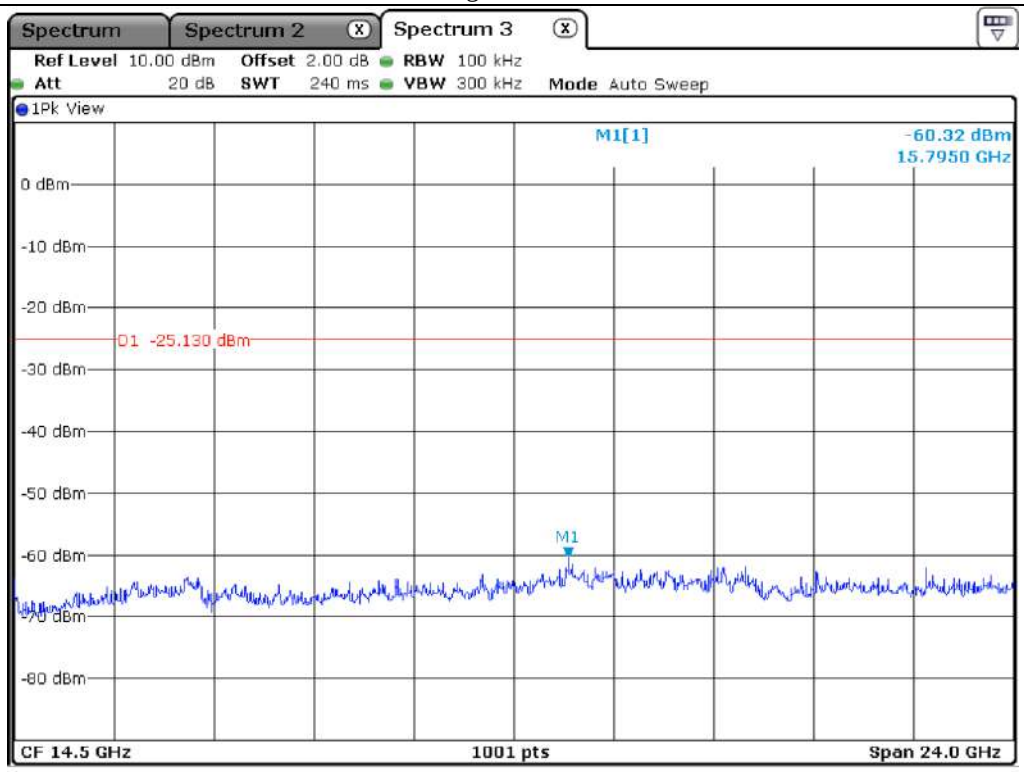


Middle Channel

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



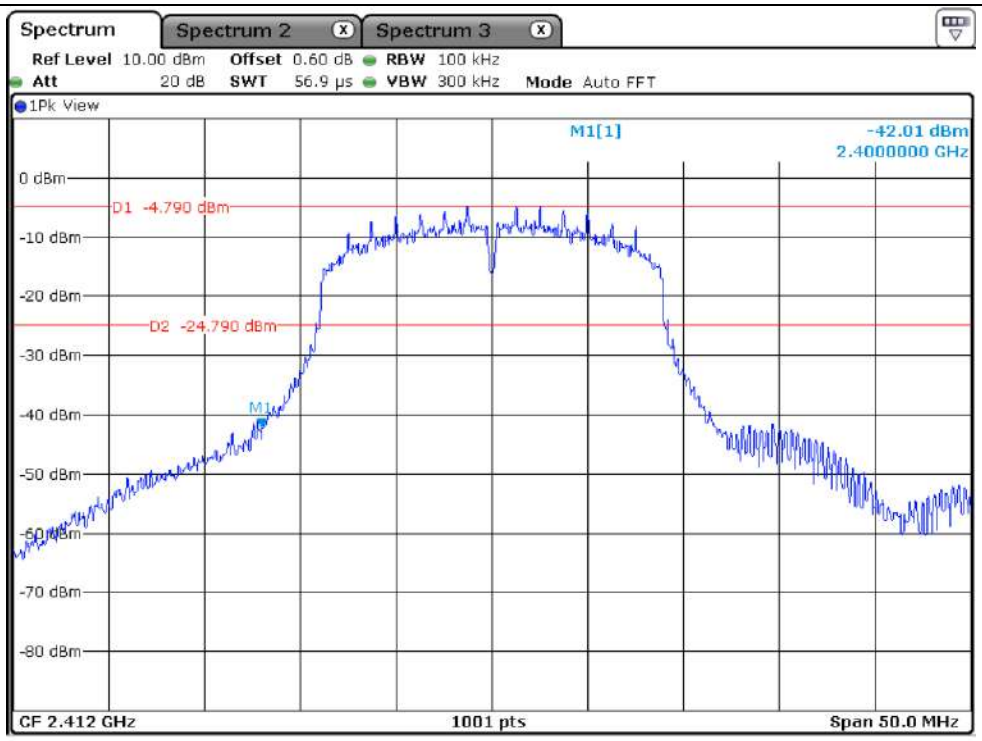
High Channel



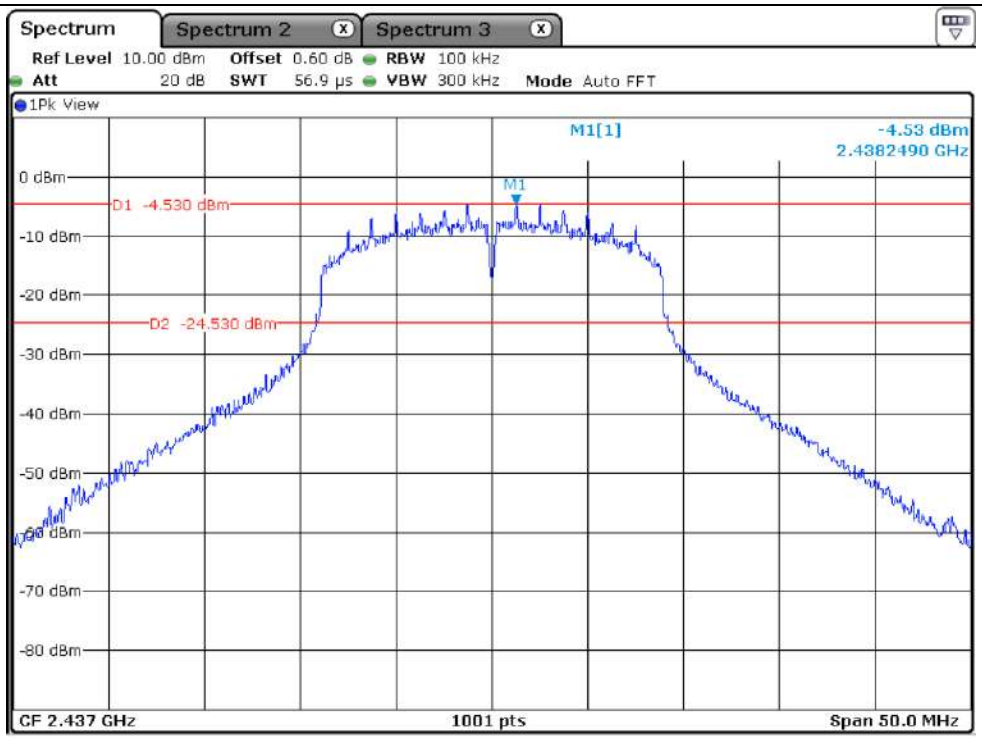
High Channel

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

9.5.3 Test data for 802.11n (HT20) WLAN Mode

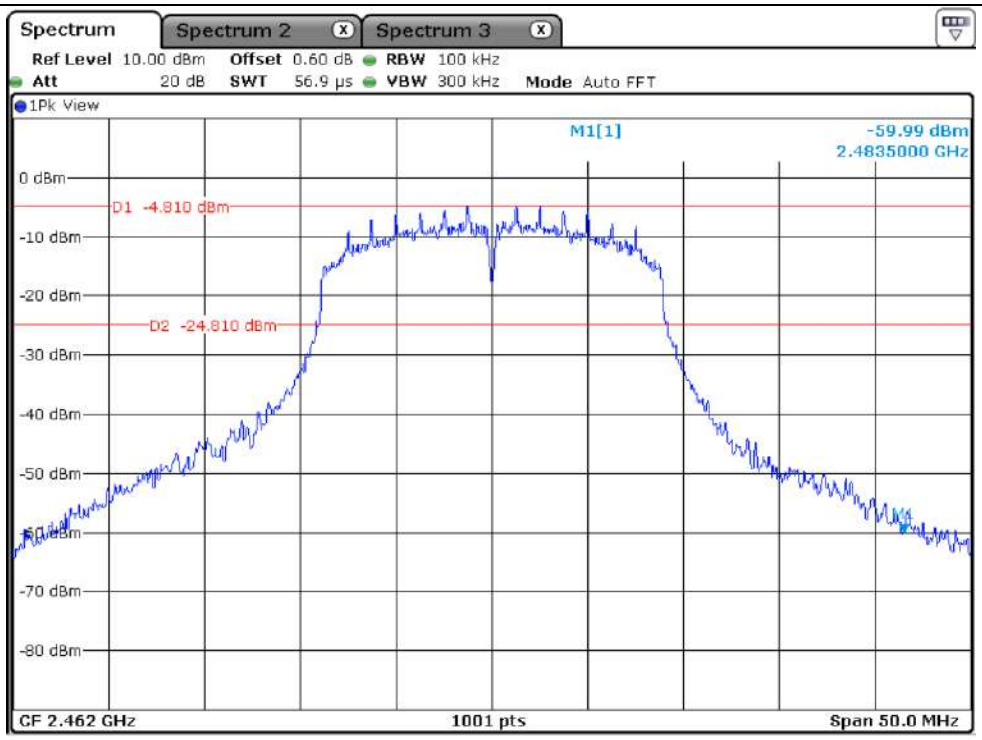


Low Channel



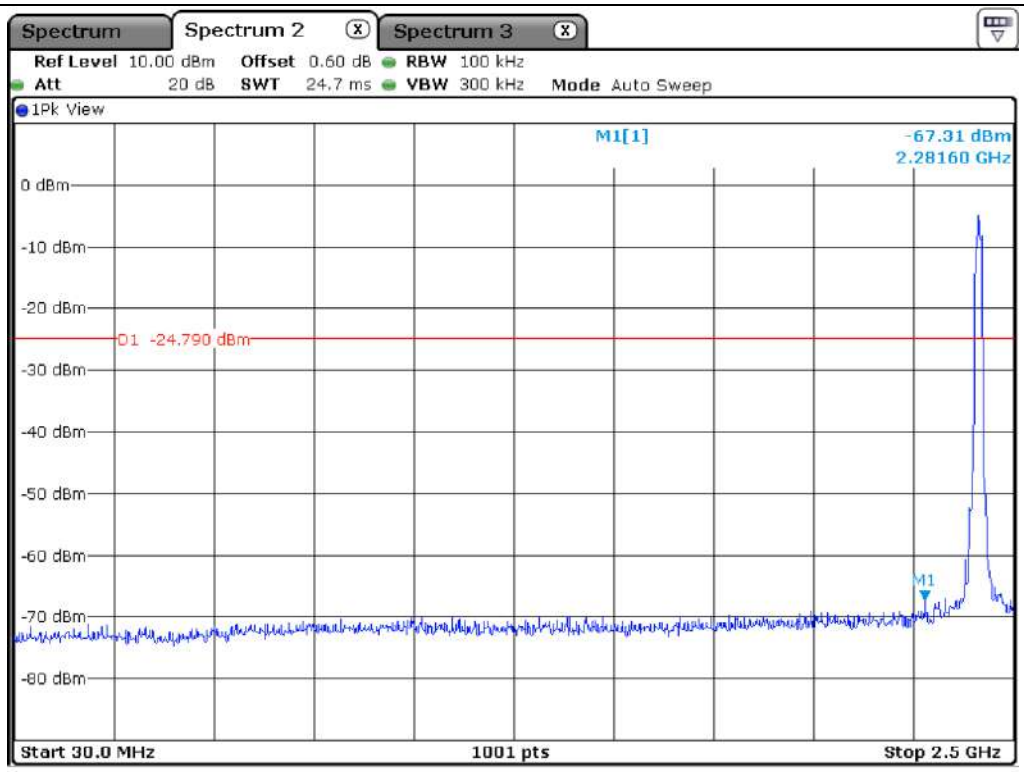
Middle Channel

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

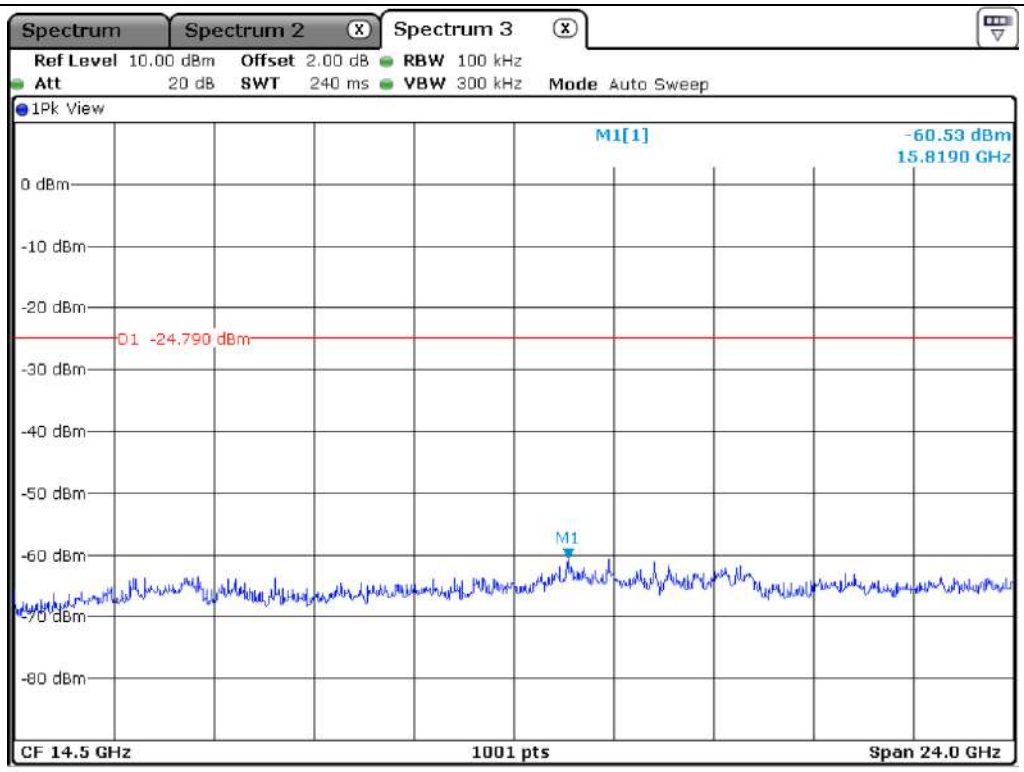


High Channel

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

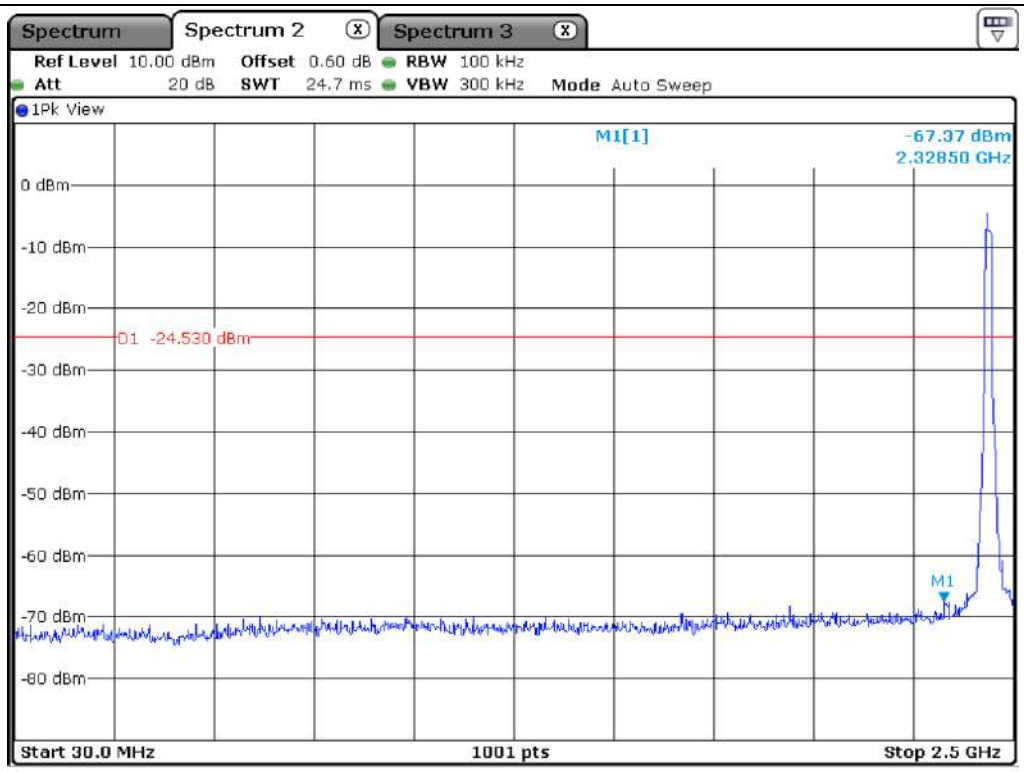


Low Channel

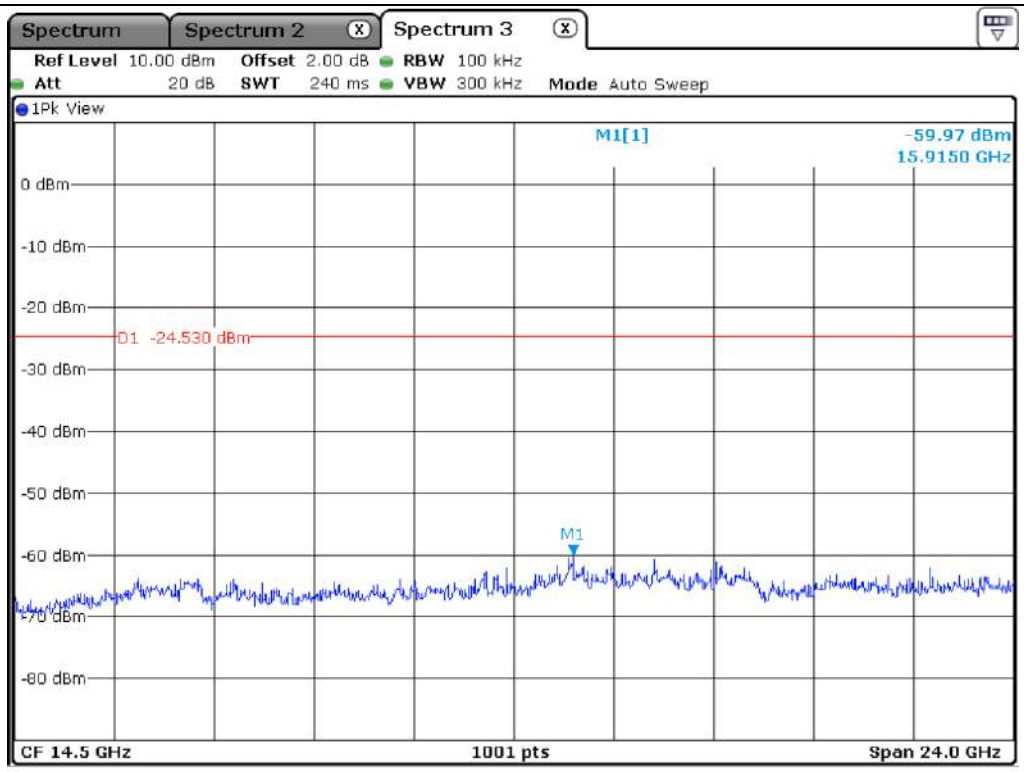


Low Channel

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

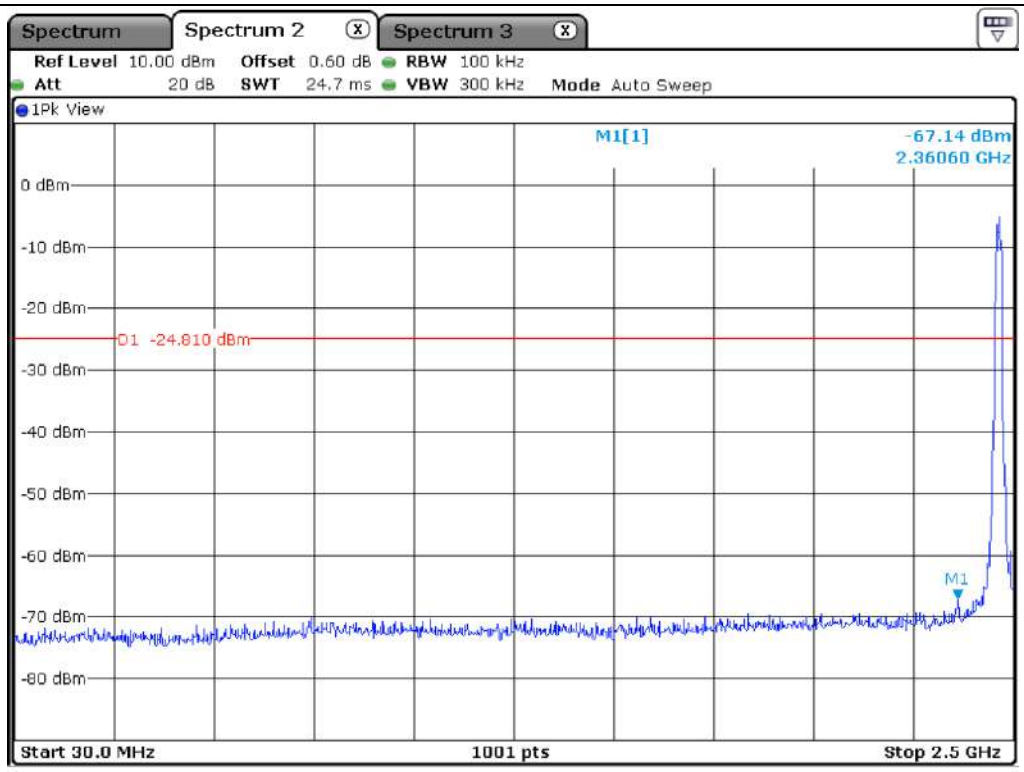


Middle Channel

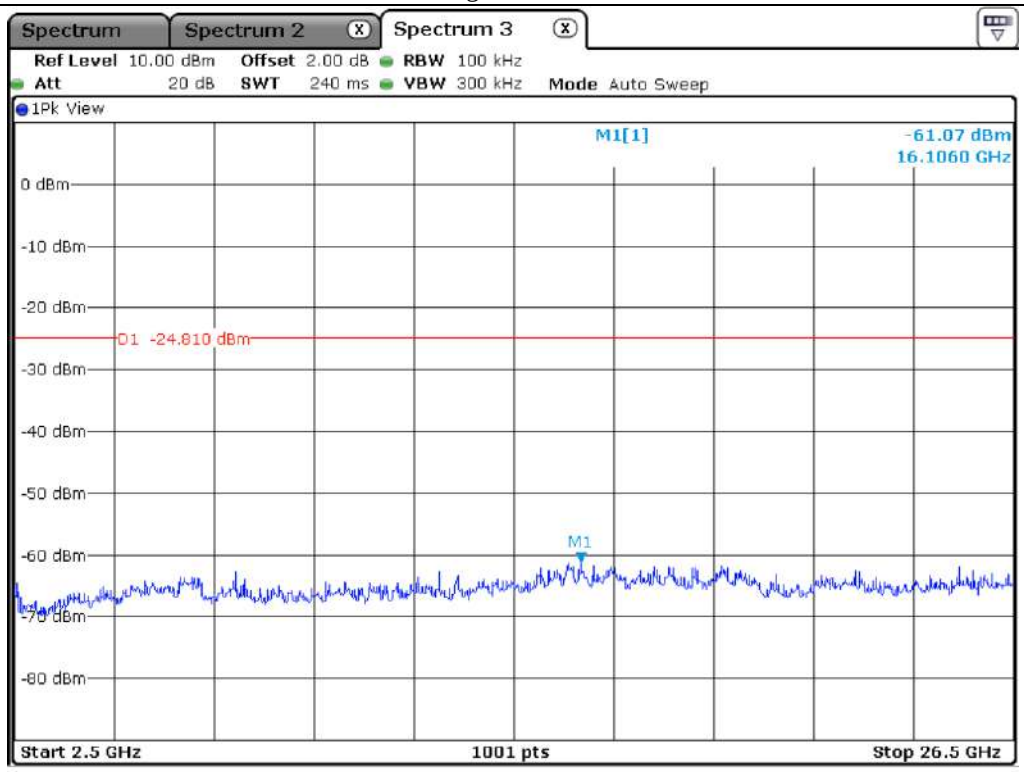


Middle Channel

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



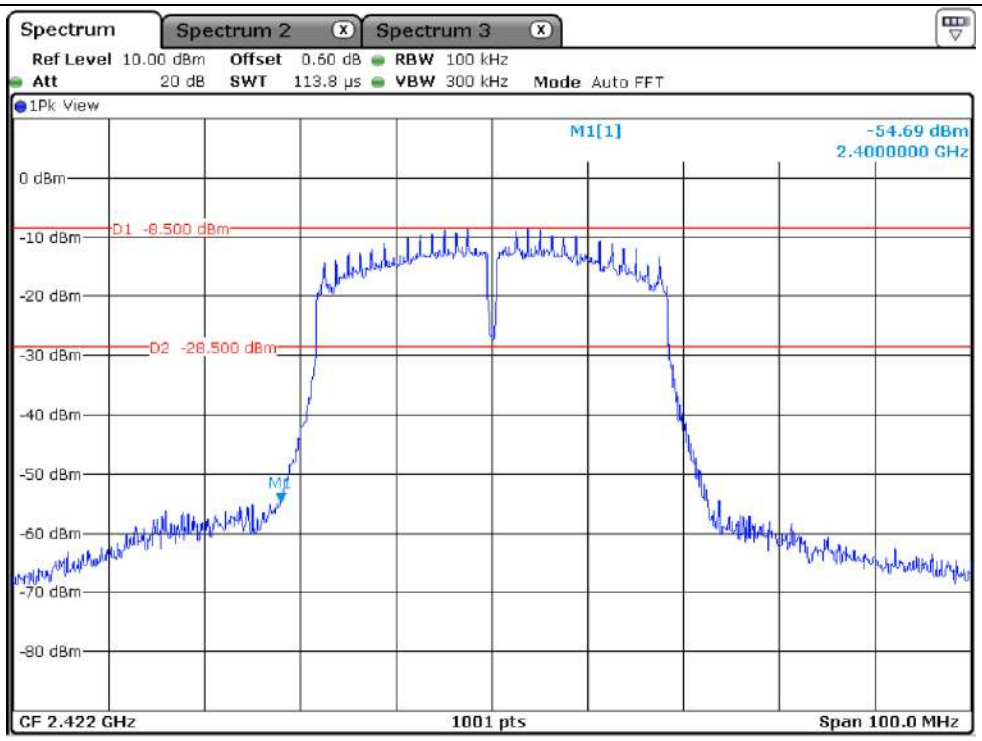
High Channel



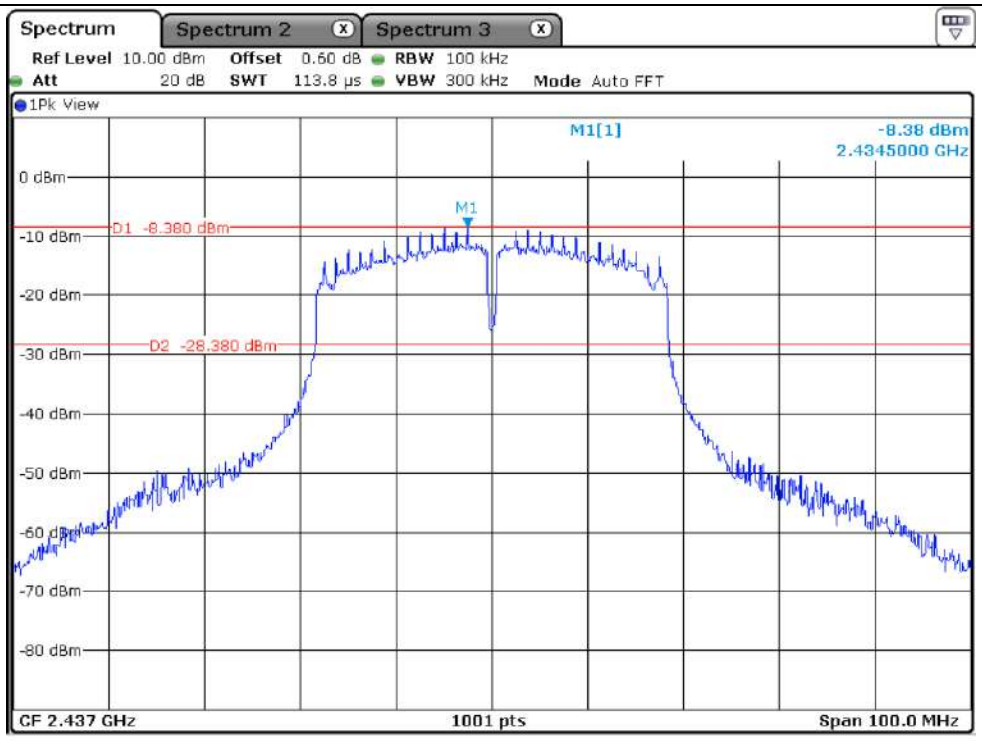
High Channel

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

9.5.4 Test data for 802.11n (HT40) WLAN Mode

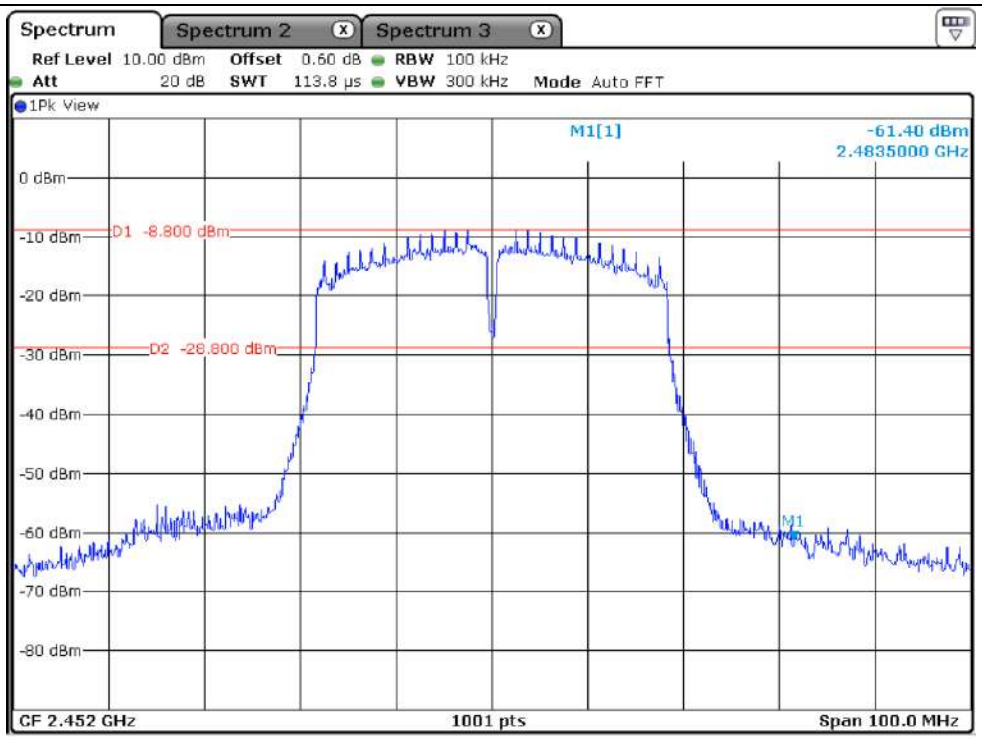


Low Channel



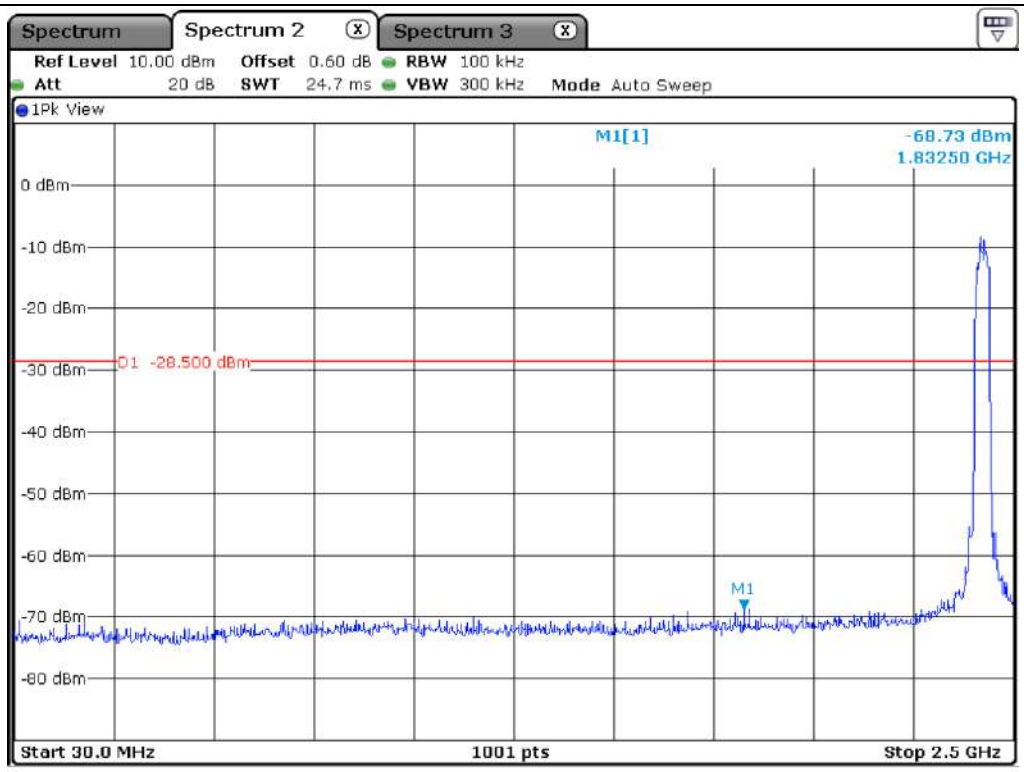
Middle Channel

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

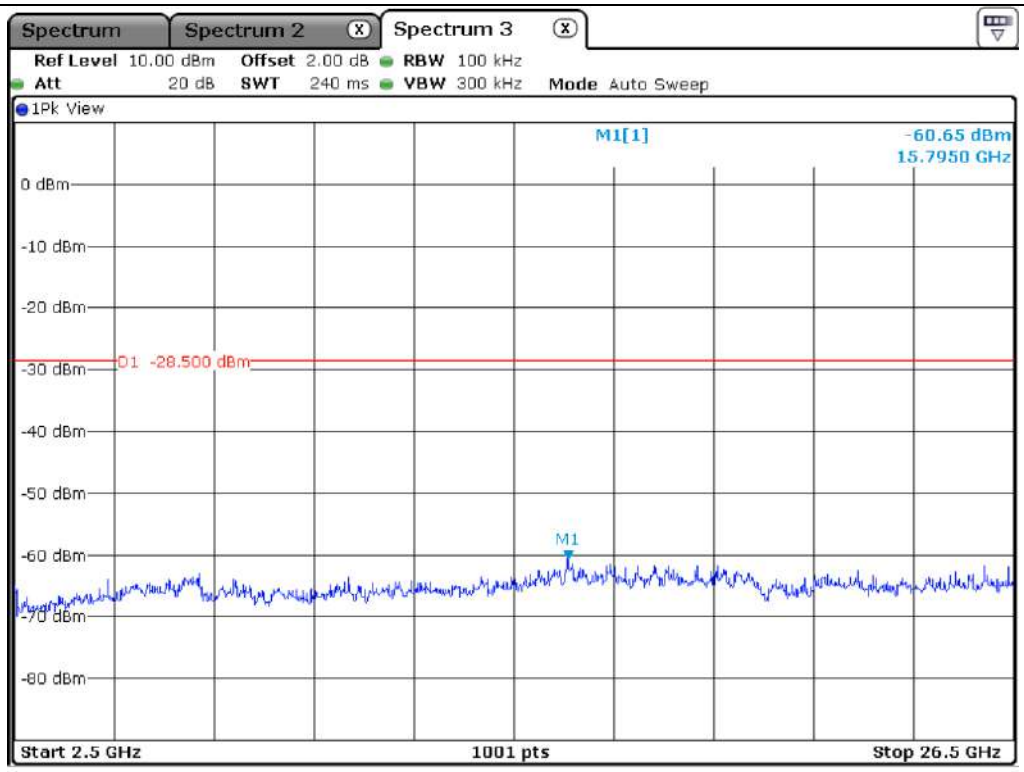


High Channel

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

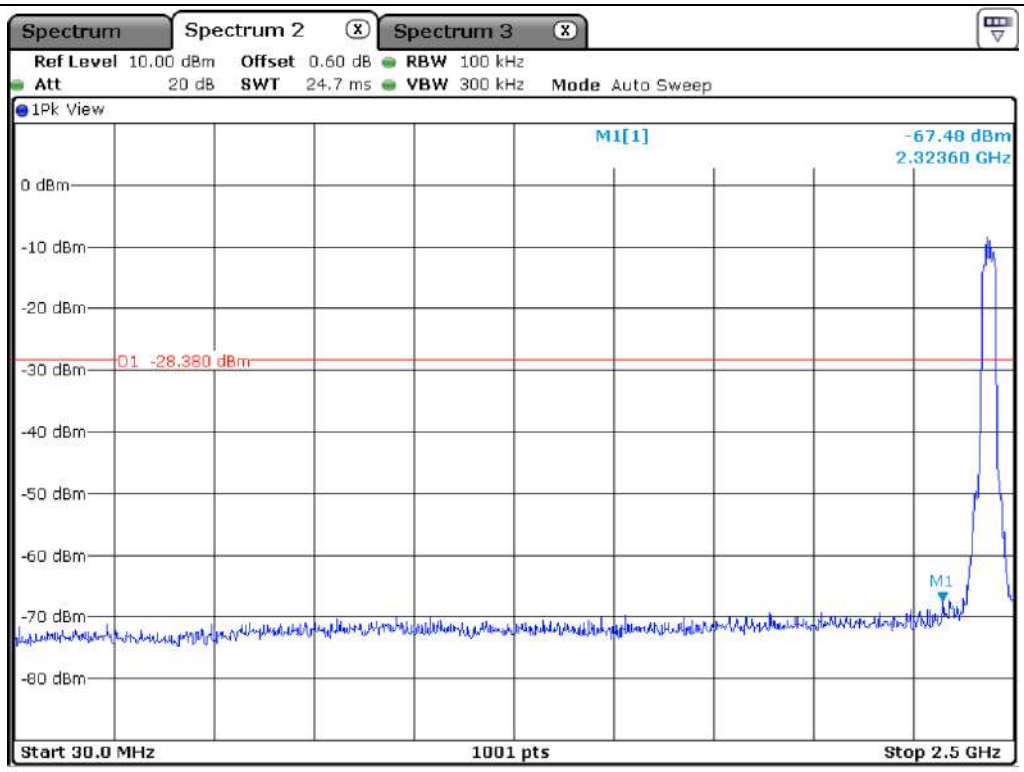


Low Channel

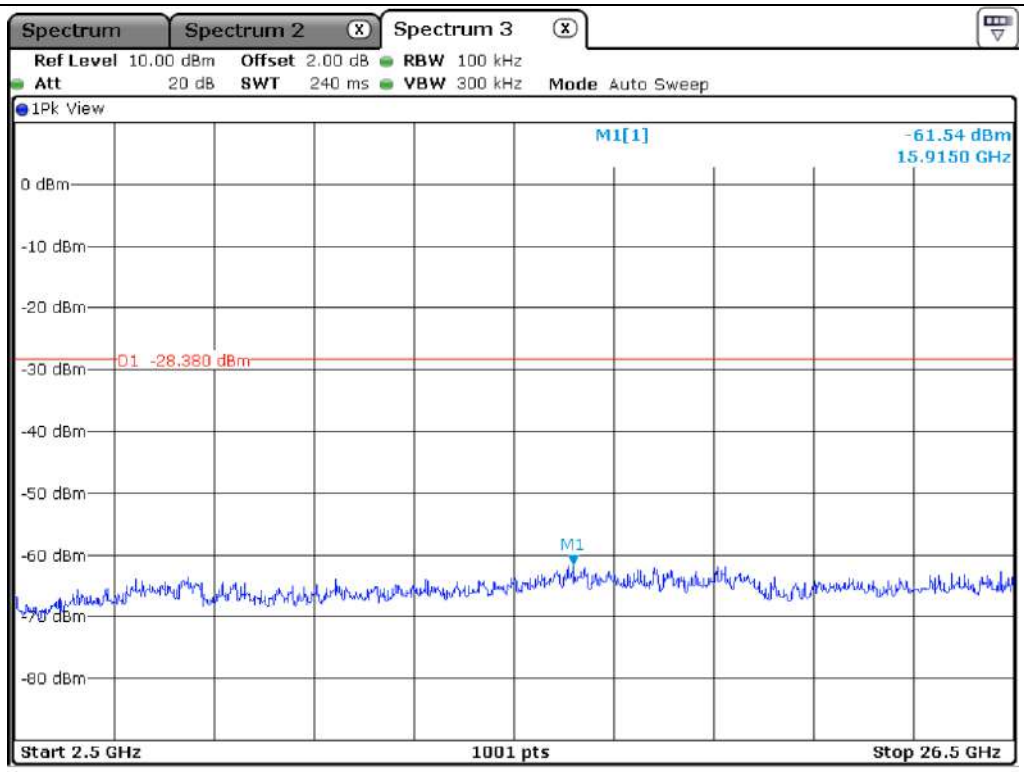


Low Channel

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

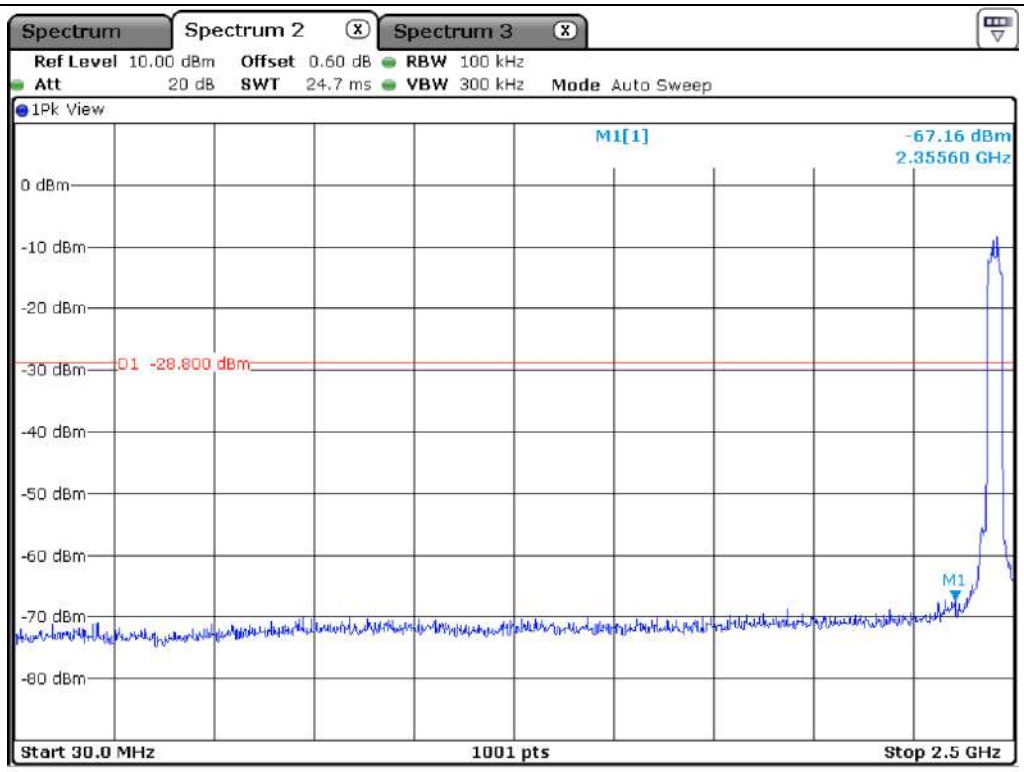


Middle Channel

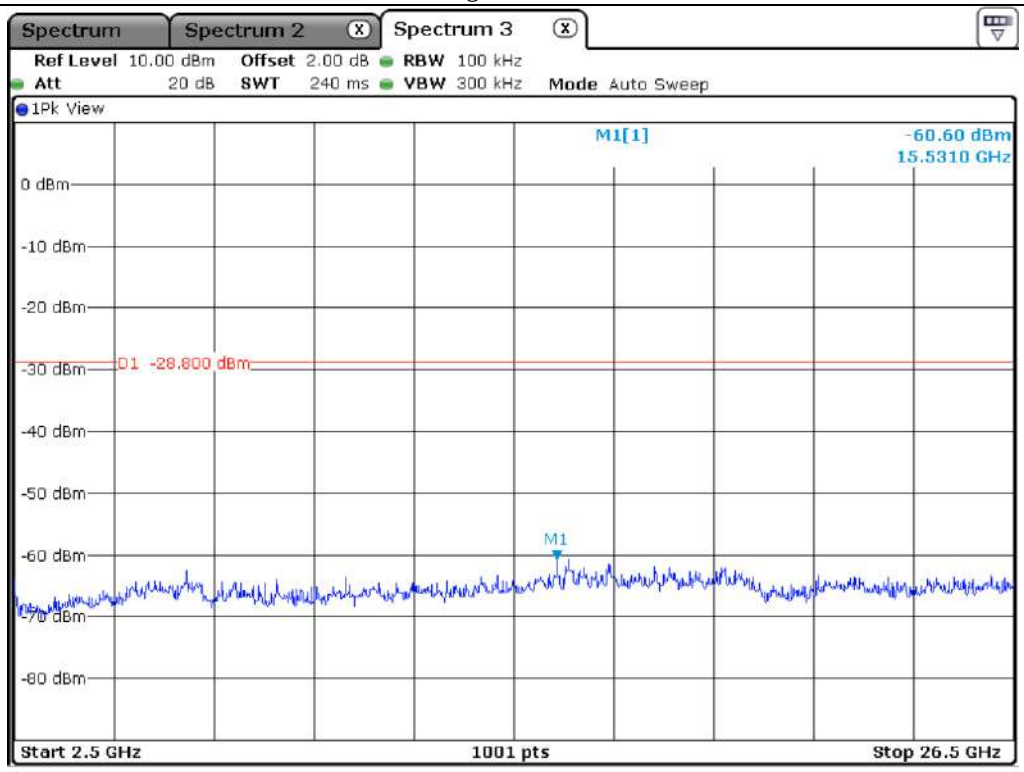


Middle Channel

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



High Channel



High Channel

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

9.6 Test data for radiated emission

9.6.1 Radiated Emission which fall in the Restricted Band

9.6.1.1 Test data for 802.11b WLAN Mode

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Detector : Peak Mode(Peak), Average Mode(RMS)

-. Frequency range : 30 MHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 89.94 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	DUTY Factor	AMP Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
2 386.280	46.93	Peak	H	28.30	8.20	-	45.30	38.13	74.00	35.87
2 386.680	37.78	Average	H			0.46	45.30	29.44	54.00	24.56
2 389.960	52.83	Peak	V			-	45.30	44.03	74.00	29.97
2 389.960	45.47	Average	V			0.46	45.30	37.13	54.00	16.87
Test Data for High Channel										
2 483.970	47.09	Peak	H	28.70	8.23	-	45.50	38.52	74.00	35.48
2 490.360	36.88	Average	H			0.46	45.50	28.77	54.00	25.23
2 483.500	54.24	Peak	V			-	45.50	45.67	74.00	28.33
2 483.500	46.94	Average	V			0.46	45.50	38.83	54.00	15.17

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Duty Factor – AMP Factor

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9.6.1.2 Test data for 802.11g WLAN Mode

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Detector : Peak Mode(Peak), Average Mode(RMS)

-. Frequency range : 30 MHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 57.89 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	DUTY Factor	AMP Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
2 389.320	48.52	Peak	H	28.30	8.20	-	45.30	39.72	74.00	34.28
2 389.960	37.17	Average	H			2.37	45.30	30.74	54.00	23.26
2 390.000	65.38	Peak	V			-	45.30	56.58	74.00	17.42
2 389.960	49.41	Average	V			2.37	45.30	42.98	54.00	11.02
Test Data for High Channel										
2 493.840	47.15	Peak	H	28.70	8.23	-	45.50	38.58	74.00	35.42
2 483.500	36.76	Average	H			2.37	45.50	30.56	54.00	23.44
2 483.500	63.58	Peak	V			-	45.50	55.01	74.00	18.99
2 483.500	50.39	Average	V			2.37	45.50	44.19	54.00	9.81

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Duty Factor – AMP Factor

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9.6.1.3 Test data for 802.11n (HT 20) WLAN Mode

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Detector : Peak Mode(Peak), Average Mode(RMS)

-. Frequency range : 30 MHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 53.36 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	DUTY Factor	AMP Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
2 389.160	48.60	Peak	H	28.30	8.20	-	45.30	39.80	74.00	34.20
2 389.960	37.11	Average	H			2.73	45.30	31.04	54.00	22.96
2 389.960	66.55	Peak	V			-	45.30	57.75	74.00	16.25
2 389.960	50.07	Average	V			2.73	45.30	44.00	54.00	10.00
Test Data for High Channel										
2 483.500	48.59	Peak	H	28.70	8.23	-	45.50	40.02	74.00	33.98
2 483.540	37.35	Average	H			2.73	45.50	31.51	54.00	22.49
2 483.500	67.30	Peak	V			-	45.50	58.73	74.00	15.27
2 483.500	52.15	Average	V			2.73	45.50	46.31	54.00	7.69

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Duty Factor – AMP Factor

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9.6.1.4 Test data for 802.11n (HT 40) WLAN Mode

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Detector : Peak Mode(Peak), Average Mode(RMS)

-. Frequency range : 30 MHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 37.42 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	DUTY Factor	AMP Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
2 385.240	50.24	Peak	H	28.30	8.20	-	45.30	41.44	74.00	32.56
2 388.840	37.56	Average	H			4.27	45.30	33.03	54.00	20.97
2 389.960	68.93	Peak	V			-	45.30	60.13	74.00	13.87
2 389.960	53.61	Average	V			4.27	45.30	49.08	54.00	4.92
Test Data for High Channel										
2 484.390	50.84	Peak	H	28.70	8.23	-	45.50	42.27	74.00	31.73
2 485.600	37.31	Average	H			4.27	45.50	33.01	54.00	20.99
2 485.400	70.88	Peak	V			-	45.50	62.31	74.00	11.69
2 483.600	55.95	Average	V			4.27	45.50	51.65	54.00	2.35

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Duty Factor – AMP Factor

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9.6.2 Spurious & Harmonic Radiated Emission

9.6.2.1 Test data for 802.11b WLAN Mode

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Detector : Peak Mode(Peak), Average Mode(RMS)

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 89.94 %

-. Result : PASSED

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	DUTY Factor	AMP Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
4 824.00	43.51	Peak	H	33.40	11.21	-	46.30	41.82	74.00	32.18
	34.31	Average	H			0.46	46.30	33.08	54.00	20.92
	44.45	Peak	V			-	46.30	42.76	74.00	31.24
	34.40	Average	V			0.46	46.30	33.17	54.00	20.83
Test Data for Middle Channel										
4 874.00	43.23	Peak	H	33.50	11.23	-	46.33	41.63	74.00	32.37
	34.18	Average	H			0.46	46.33	33.04	54.00	20.96
	44.46	Peak	V			-	46.33	42.86	74.00	31.14
	34.32	Average	V			0.46	46.33	33.18	54.00	20.82
Test Data for High Channel										
4 924.00	43.50	Peak	H	33.30	11.25	-	46.35	41.70	74.00	32.30
	33.70	Average	H			0.46	46.35	32.36	54.00	21.64
	43.61	Peak	V			-	46.35	41.81	74.00	32.19
	34.18	Average	V			0.46	46.35	32.84	54.00	21.16

Tabulated test data for Spurious & Harmonic

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Duty Factor – AMP Factor

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9.6.2.2 Test data for 802.11g WLAN Mode

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Detector : Peak Mode(Peak), Average Mode(RMS)

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 57.89 %

-. Result : PASSED

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	DUTY Factor	AMP Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
4 824.00	43.89	Peak	H	33.40	11.21	-	46.30	42.20	74.00	31.80
	34.41	Average	H			2.37	46.30	35.09	54.00	18.91
	44.52	Peak	V			-	46.30	42.83	74.00	31.17
	34.79	Average	V			2.37	46.30	35.47	54.00	18.53
Test Data for Middle Channel										
4 874.00	43.94	Peak	H	33.50	11.23	-	46.33	42.34	74.00	31.66
	34.13	Average	H			2.37	46.33	34.90	54.00	19.10
	44.10	Peak	V			-	46.33	42.50	74.00	31.50
	34.50	Average	V			2.37	46.33	35.27	54.00	18.73
Test Data for High Channel										
4 924.00	43.98	Peak	H	33.30	11.25	-	46.35	42.18	74.00	31.82
	34.18	Average	H			2.37	46.35	34.75	54.00	19.25
	43.80	Peak	V			-	46.35	42.00	74.00	32.00
	34.28	Average	V			2.37	46.35	34.85	54.00	19.15

Tabulated test data for Spurious & Harmonic

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Duty Factor – AMP Factor

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9.6.2.3 Test data for 802.11n (HT 20) WLAN Mode

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Detector : Peak Mode(Peak), Average Mode(RMS)

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 53.36 %

-. Result : PASSED

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	DUTY Factor	AMP Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
4 824.00	43.53	Peak	H	33.40	11.21	-	46.30	41.84	74.00	32.16
	34.15	Average	H			2.73	46.30	35.19	54.00	18.81
	43.74	Peak	V			-	46.30	42.05	74.00	31.95
	34.99	Average	V			2.73	46.30	36.03	54.00	17.97
Test Data for Middle Channel										
4 874.00	43.94	Peak	H	33.50	11.23	-	46.33	42.34	74.00	31.66
	34.17	Average	H			2.73	46.33	35.30	54.00	18.70
	44.79	Peak	V			-	46.33	43.19	74.00	30.81
	34.32	Average	V			2.73	46.33	35.45	54.00	18.55
Test Data for High Channel										
4 924.00	44.06	Peak	H	33.30	11.25	-	46.35	42.26	74.00	31.74
	34.07	Average	H			2.73	46.35	35.00	54.00	19.00
	44.28	Peak	V			-	46.35	42.48	74.00	31.52
	34.17	Average	V			2.73	46.35	35.10	54.00	18.90

Tabulated test data for Spurious & Harmonic

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Duty Factor – AMP Factor

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9.6.2.4 Test data for 802.11n (HT 40) WLAN Mode

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Detector : Peak Mode(Peak), Average Mode(RMS)

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 37.42 %

-. Result : PASSED

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	DUTY Factor	AMP Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
4 824.00	44.36	Peak	H	33.40	11.21	-	46.30	42.67	74.00	31.33
	34.45	Average	H			4.27	46.30	37.03	54.00	16.97
	44.48	Peak	V			-	46.30	42.79	74.00	31.21
	34.60	Average	V			4.27	46.30	37.18	54.00	16.82
Test Data for Middle Channel										
4 874.00	44.51	Peak	H	33.50	11.23	-	46.33	42.91	74.00	31.09
	34.25	Average	H			4.27	46.33	36.92	54.00	17.08
	44.58	Peak	V			-	46.33	42.98	74.00	31.02
	34.27	Average	V			4.27	46.33	36.94	54.00	17.06
Test Data for High Channel										
4 924.00	43.98	Peak	H	33.30	11.25	-	46.35	42.18	74.00	31.82
	34.09	Average	H			4.27	46.35	36.56	54.00	17.44
	44.66	Peak	V			-	46.35	42.86	74.00	31.14
	34.45	Average	V			4.27	46.35	36.92	54.00	17.08

Tabulated test data for Spurious & Harmonic

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Duty Factor – AMP Factor

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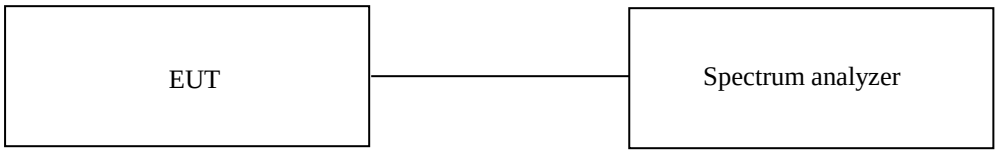
10. PEAK POWER SPECTRAL DENSITY

10.1 Operating environment

Temperature	:	22.5 °C
Relative humidity	:	49 % R.H.

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 3 kHz, the video bandwidth is set to 3 times the resolution bandwidth.



10.3 Test date

January 06, 2021 ~ January 11, 2021

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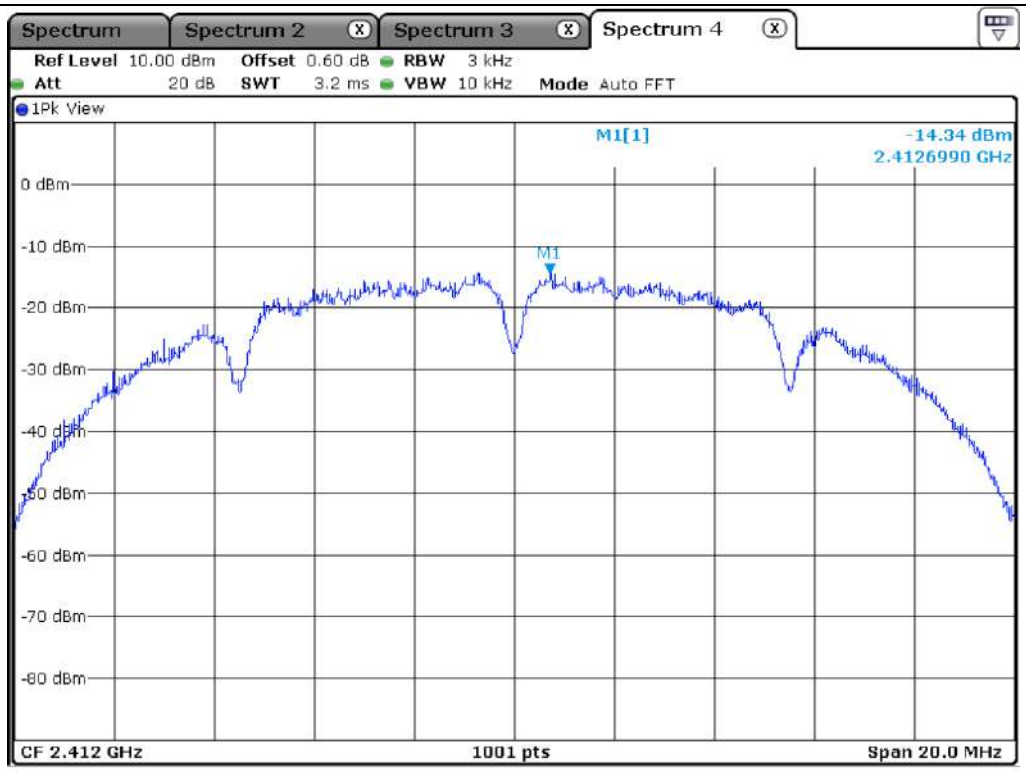
10.4 Test data for 802.11b WLAN Mode

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-14.34	8.00	22.34
Middle	2 437.00	-12.56	8.00	20.56
High	2 462.00	-13.85	8.00	21.85

Remark. Margin = Limit – Measured value



Low Channel

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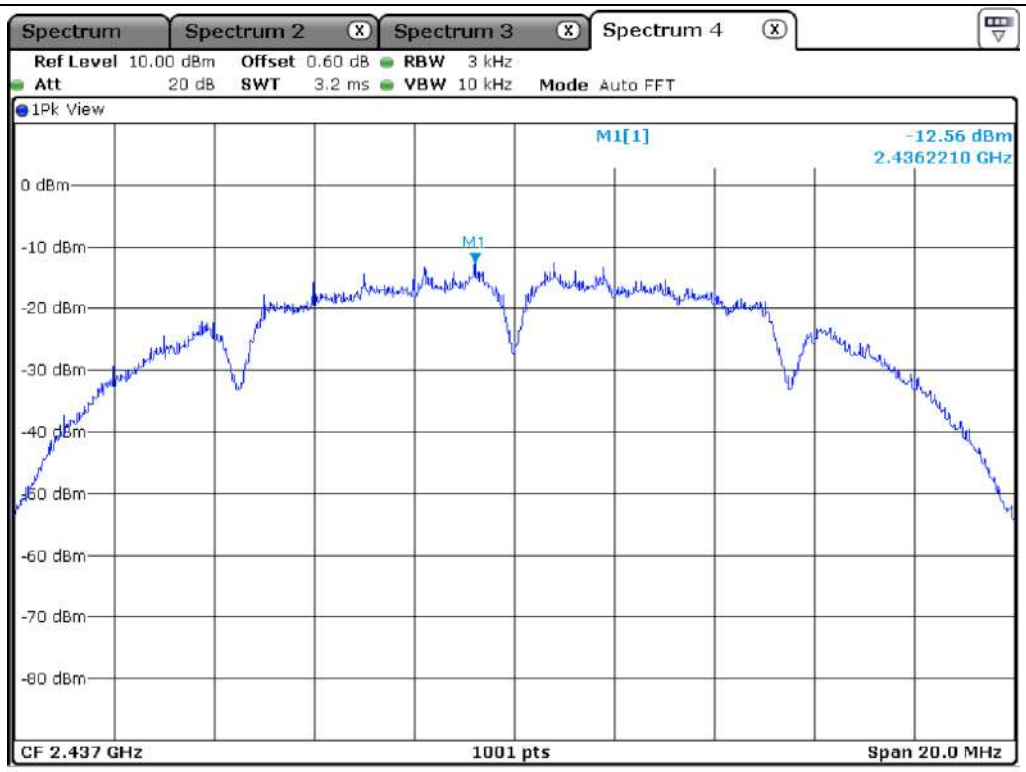
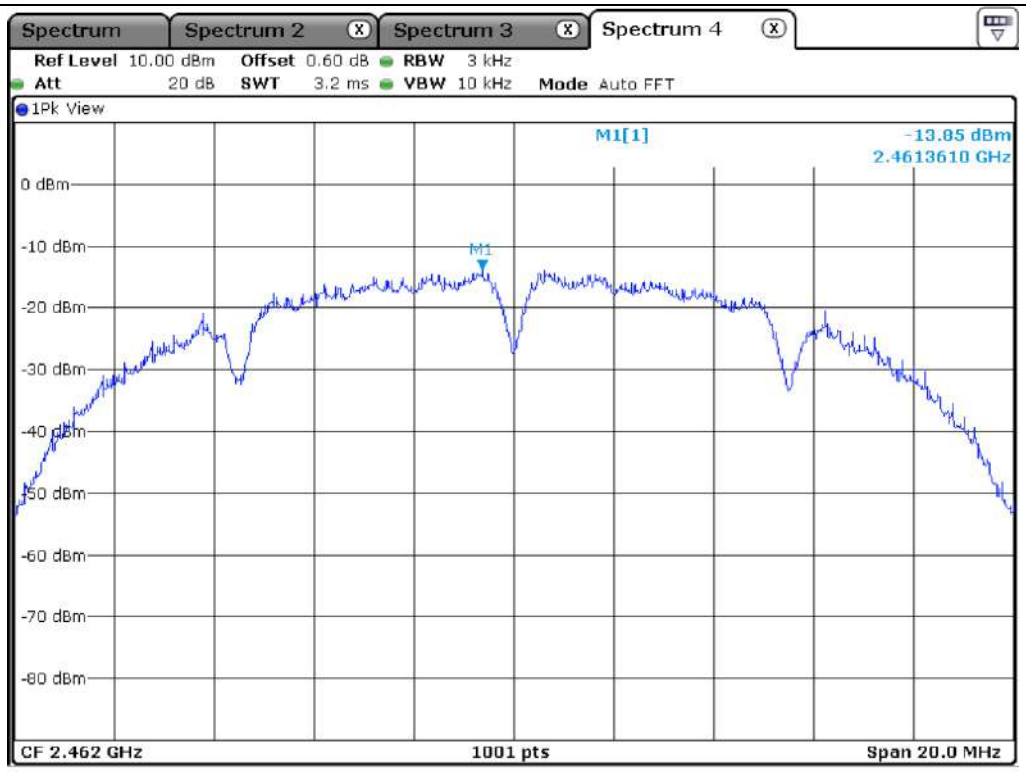


Middle Channel



High Channel

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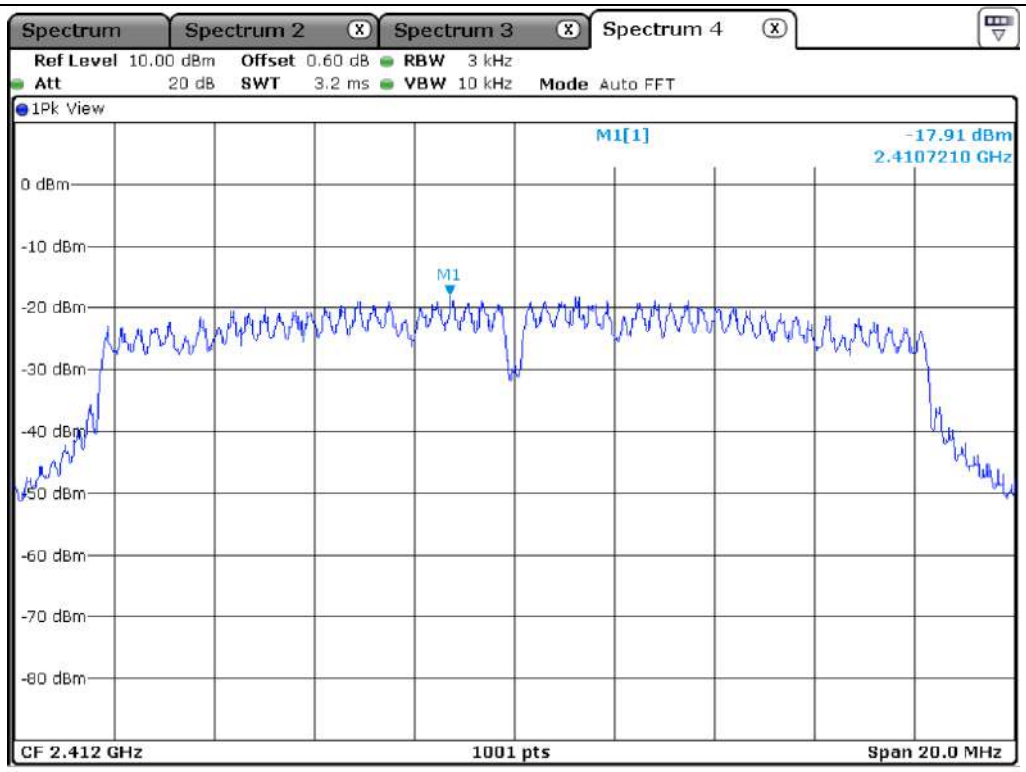
10.5 Test data for 802.11g WLAN Mode

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-17.91	8.00	25.91
Middle	2 437.00	-18.52	8.00	26.52
High	2 462.00	-19.03	8.00	27.03

Remark. Margin = Limit – Measured value



Low Channel

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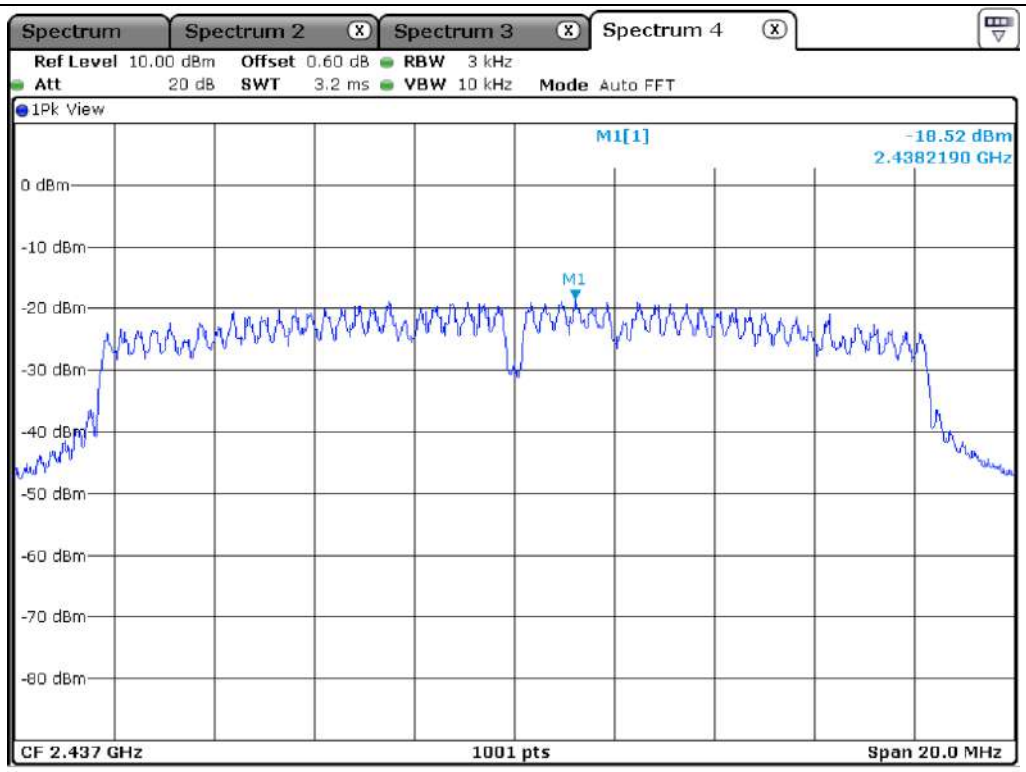
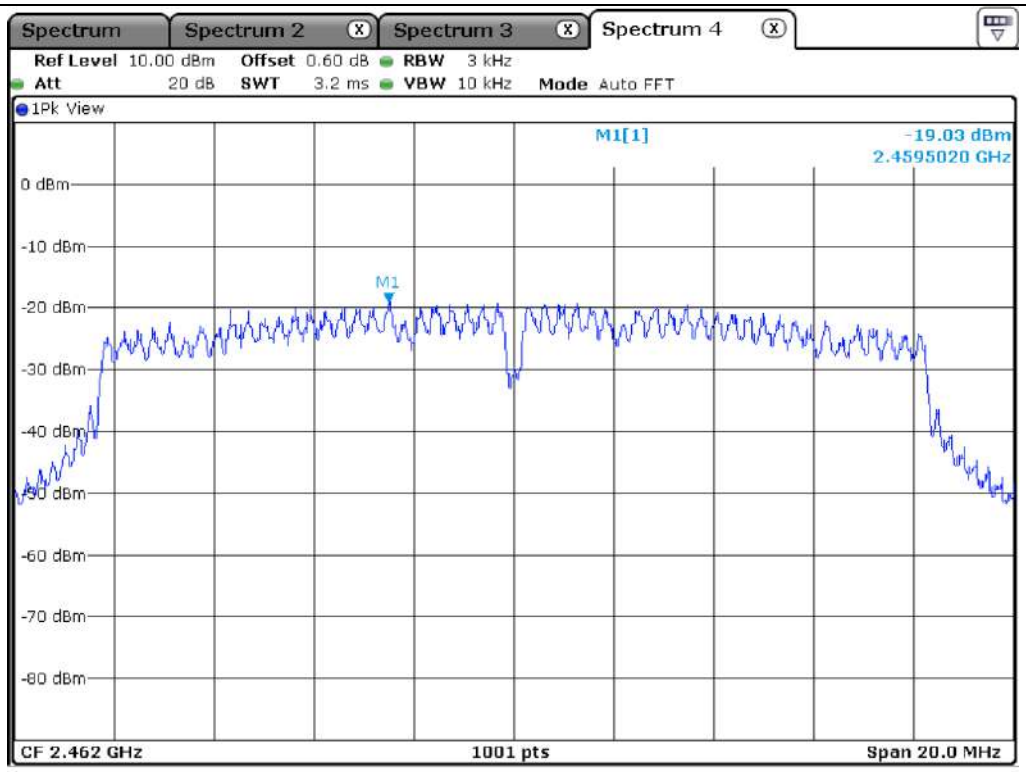


Middle Channel



High Channel

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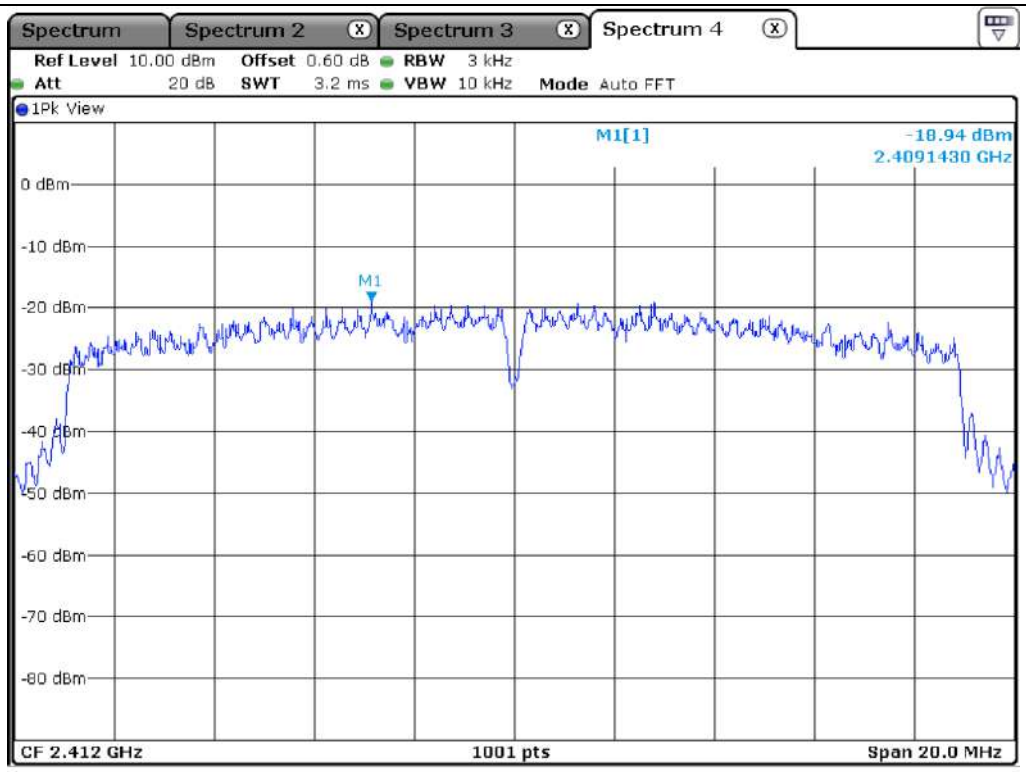
10.6 Test data for 802.11n (HT20) WLAN Mode

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-18.94	8.00	26.94
Middle	2 437.00	-19.01	8.00	27.01
High	2 462.00	-18.49	8.00	26.49

Remark. Margin = Limit – Measured value



Low Channel

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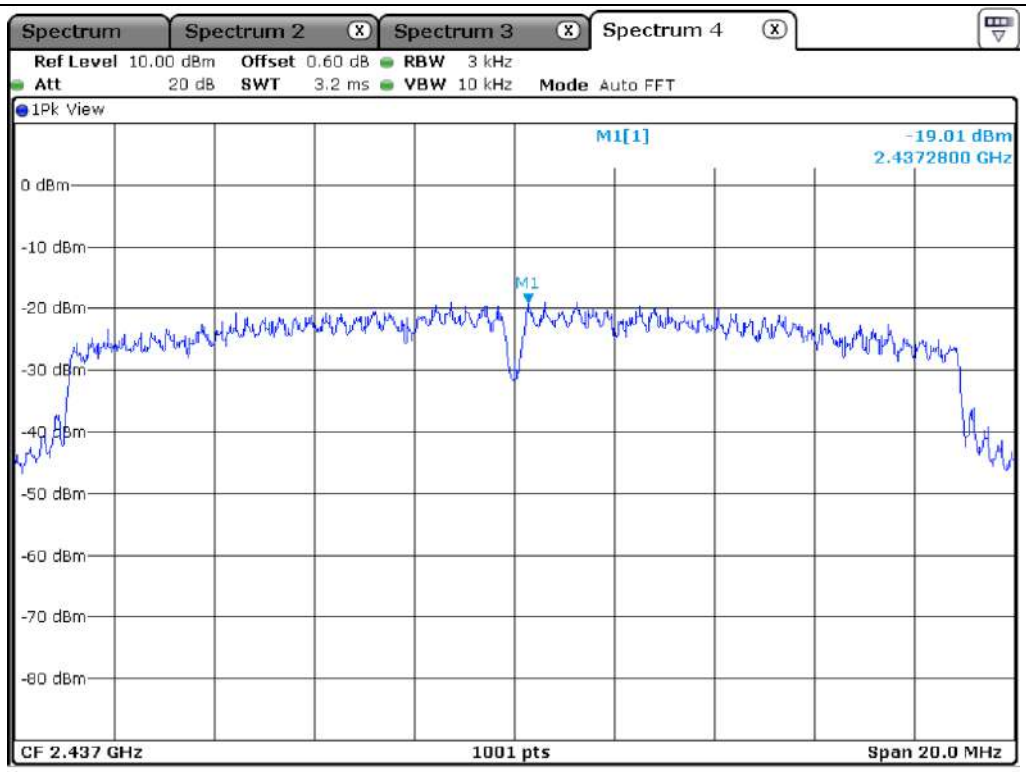
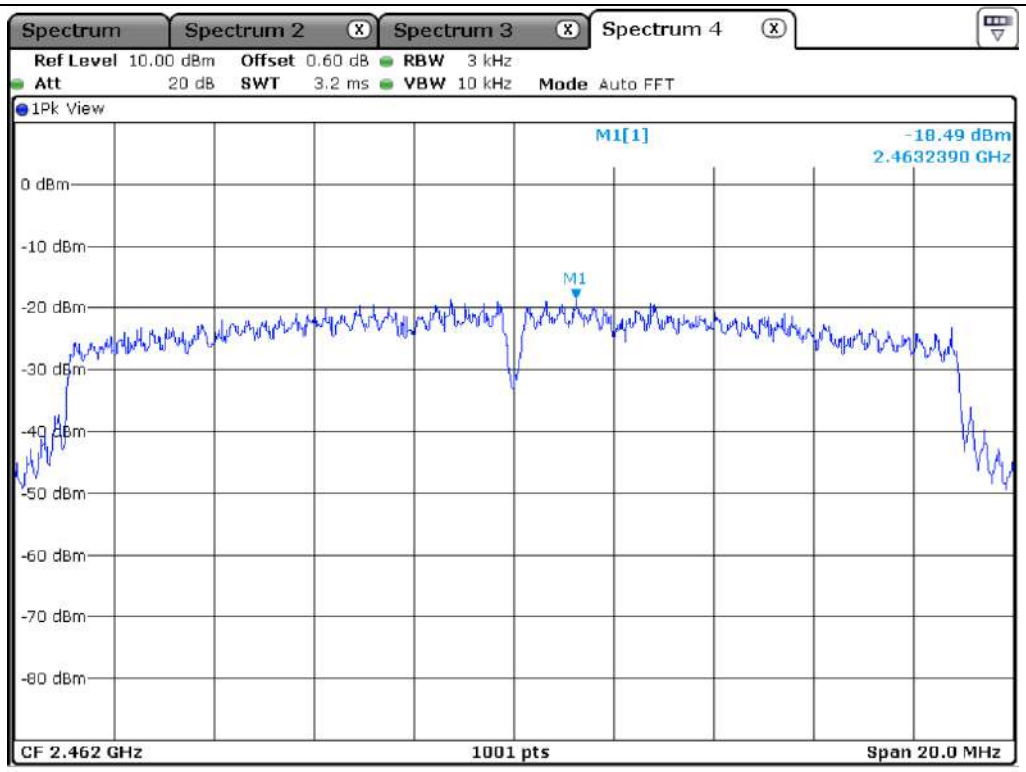


Middle Channel



High Channel

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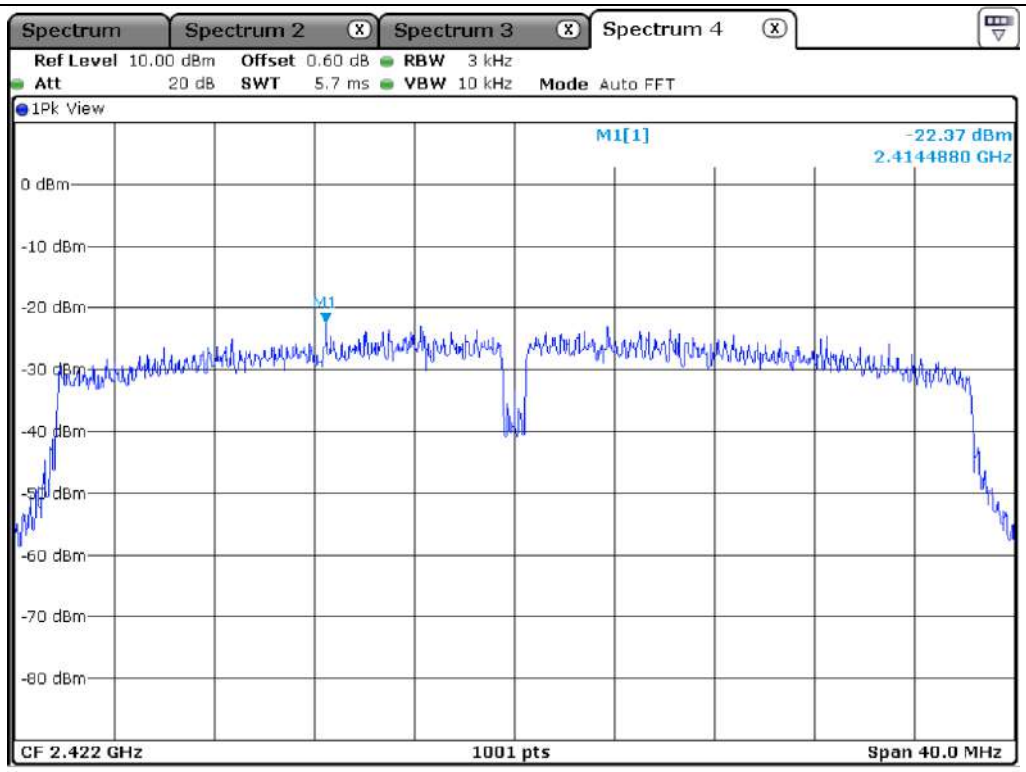
10.7 Test data for 802.11n (HT40) WLAN Mode

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 422.00	-22.37	8.00	30.37
Middle	2 437.00	-23.30	8.00	31.30
High	2 452.00	-22.76	8.00	30.76

Remark. Margin = Limit – Measured value



Low Channel

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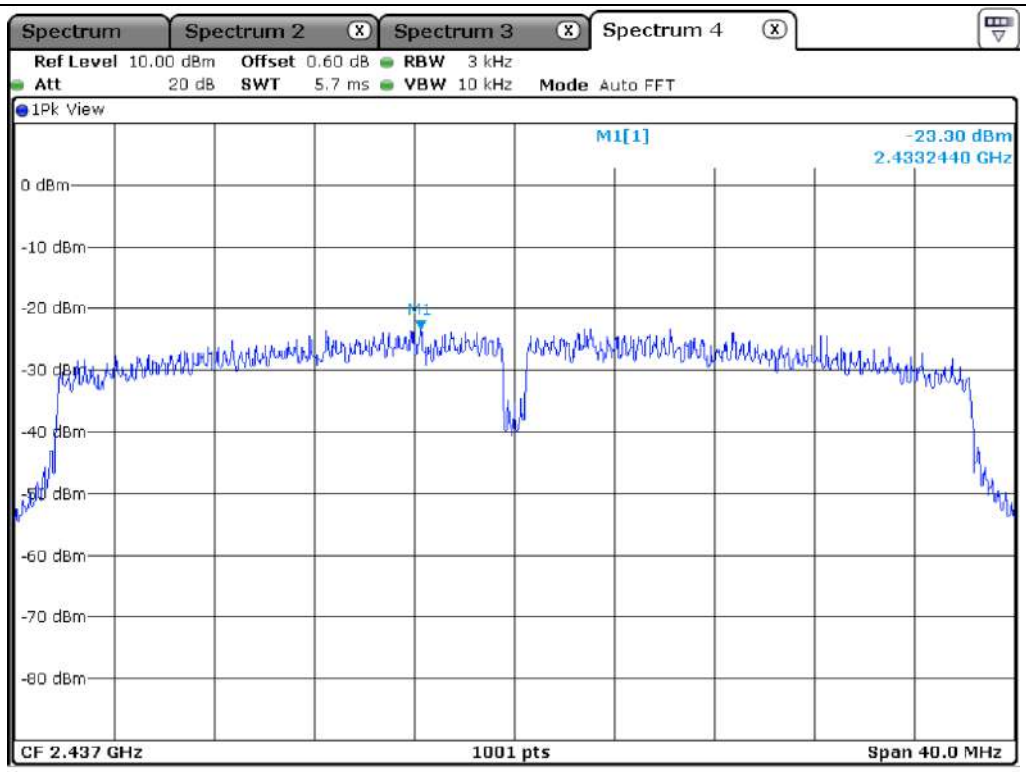
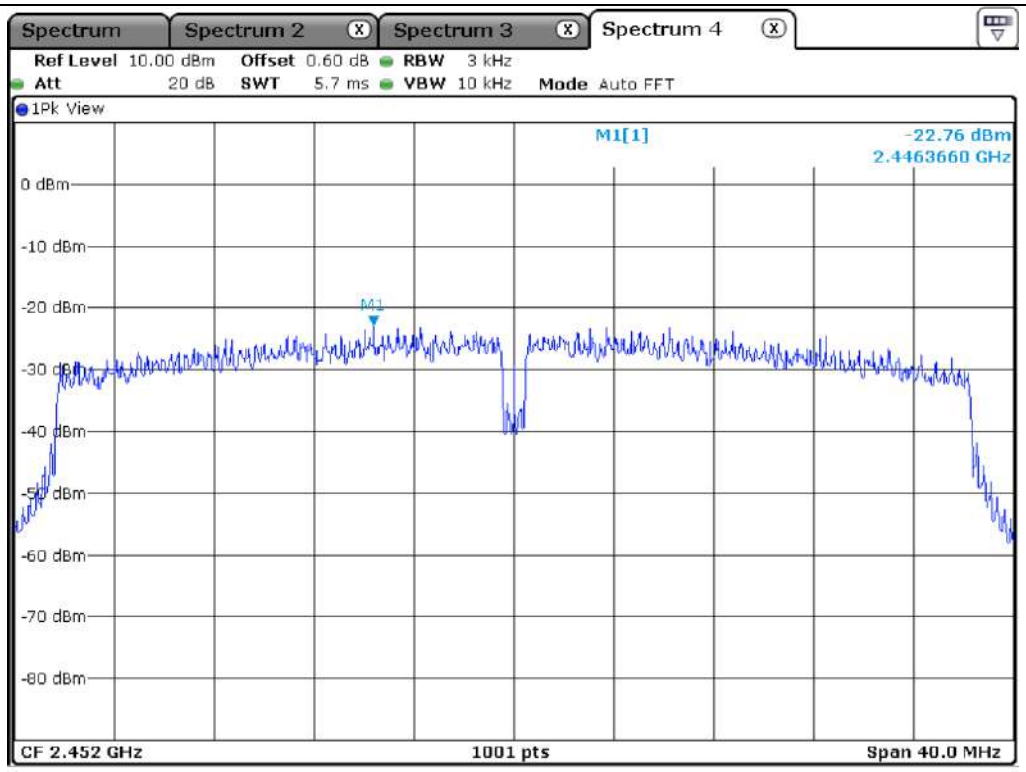


Middle Channel



High Channel

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11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature	:	22.5 °C
Relative humidity	:	49 % R.H.

11.2 Test set-up

The radiated emissions measurements were on the 3 m, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

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

11.3 Test date

January 06, 2021 ~ January 11, 2021

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11.4 Test data for WLAN 2.4 GHz

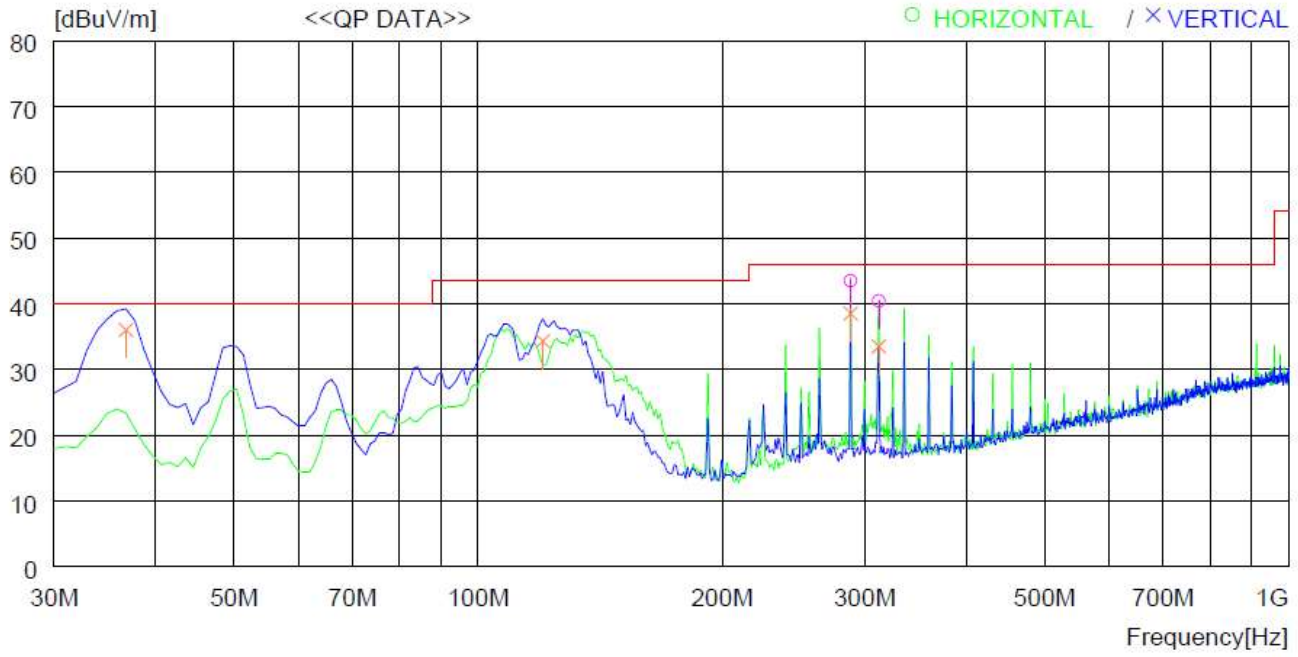
11.4.1 Test data for 30 MHz ~ 1 GHz

-. Resolution bandwith : 120 kHz

-. Frequency range : 30 MHz ~ 1 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	288.020	54.5	18.9	2.1	32.0	43.5	46.0	2.5	100	0
2	312.270	50.9	19.4	2.1	32.0	40.4	46.0	5.6	100	17
----- Vertical ------										
3	36.790	48.6	18.5	0.9	32.0	36.0	40.0	4.0	100	359
4	120.210	46.3	18.6	1.4	32.0	34.3	43.5	9.2	100	210
5	288.020	49.5	18.9	2.1	32.0	38.5	46.0	7.5	200	0
6	312.270	44.0	19.4	2.1	32.0	33.5	46.0	12.5	200	106

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11.4.2 Test data for Below 30 MHz

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									

11.4.3 Test data for above 1 GHz

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									

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11.5 Test data for Intermodulation Mode(WLAN 2.4 GHz + Bluetooth LE(MDBT50Q-U) + Certified Bluetooth LE(RN4870))

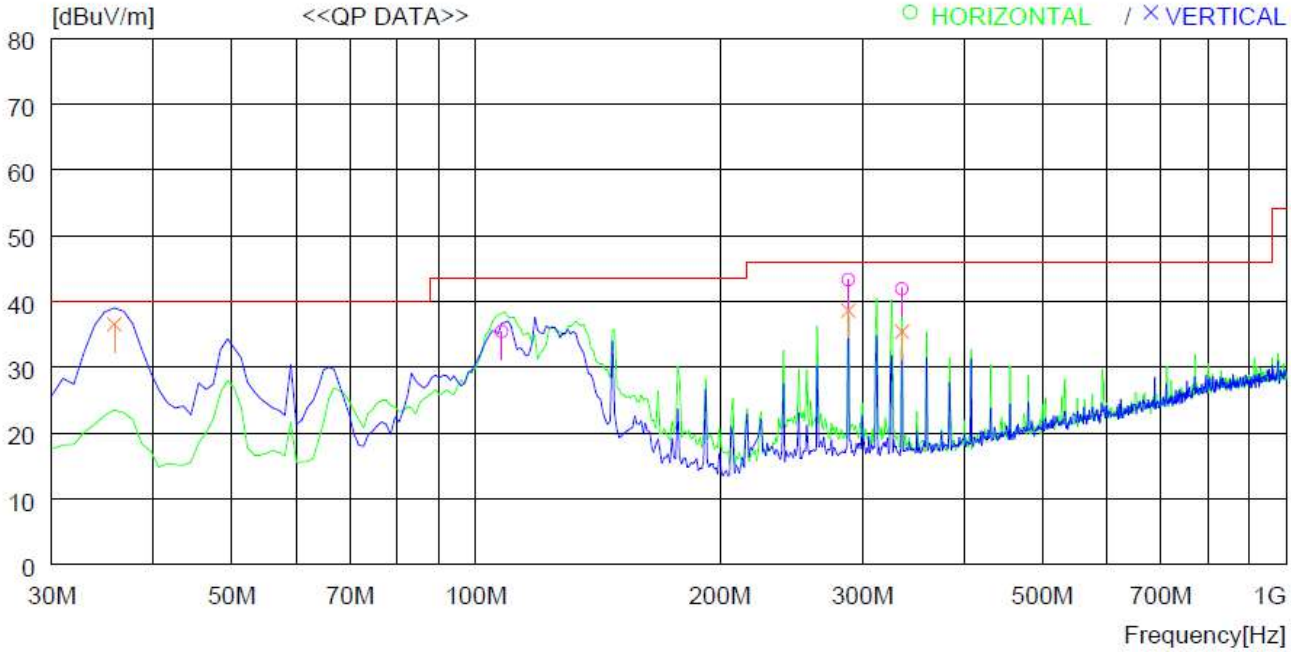
11.5.1 Test data for 30 MHz ~ 1 GHz

-. Resolution bandwith : 120 kHz

-. Frequency range : 30 MHz ~ 1 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	107.600	49.5	16.6	1.3	32.0	35.4	43.5	8.1	300	359
2	288.020	54.3	18.9	2.1	32.0	43.3	46.0	2.7	100	23
3	335.550	52.0	19.7	2.2	32.0	41.9	46.0	4.1	100	121
----- Vertical ------										
4	35.820	48.8	18.8	0.9	32.0	36.5	40.0	3.5	100	0
5	288.020	49.6	18.9	2.1	32.0	38.6	46.0	7.4	200	91
6	335.550	45.5	19.7	2.2	32.0	35.4	46.0	10.6	200	359

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11.5.2 Test data for Below 30 MHz

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									

11.5.3 Test data for above 1 GHz

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									

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12. CONDUCTED EMISSION TEST

12.1 Operating environment

Temperature	:	22.5 °C
Relative humidity	:	49 % R.H

12.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

12.3 Test date

January 06, 2021 ~ January 11, 2021

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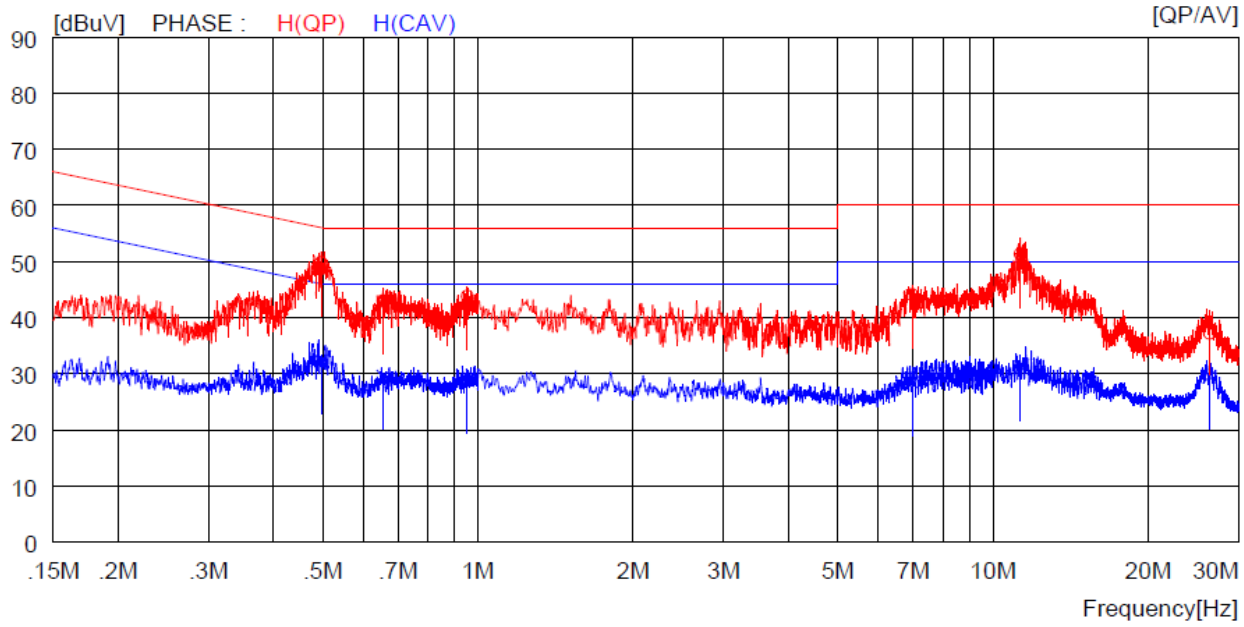
12.4 Test data for WLAN 2.4 GHz

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Tested Line : HOT LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.49600	28.3	----	21.5	49.8	----	56.1	----	6.3	----	H(QP)
2	0.65500	21.5	----	21.5	43.0	----	56.0	----	13.0	----	H(QP)
3	0.95400	22.2	----	21.6	43.8	----	56.0	----	12.2	----	H(QP)
4	6.97000	22.5	----	21.6	44.1	----	60.0	----	15.9	----	H(QP)
5	11.31000	29.9	----	21.4	51.3	----	60.0	----	8.7	----	H(QP)
6	26.33000	15.9	----	21.3	37.2	----	60.0	----	22.8	----	H(QP)
7	0.49600	----	10.8	21.5	----	32.3	----	46.1	----	13.8	H(CAV)
8	0.65500	----	8.0	21.5	----	29.5	----	46.0	----	16.5	H(CAV)
9	0.95400	----	7.3	21.6	----	28.9	----	46.0	----	17.1	H(CAV)
10	6.97000	----	6.8	21.6	----	28.4	----	50.0	----	21.6	H(CAV)
11	11.31000	----	9.8	21.4	----	31.2	----	50.0	----	18.8	H(CAV)
12	26.33000	----	8.2	21.3	----	29.5	----	50.0	----	20.5	H(CAV)

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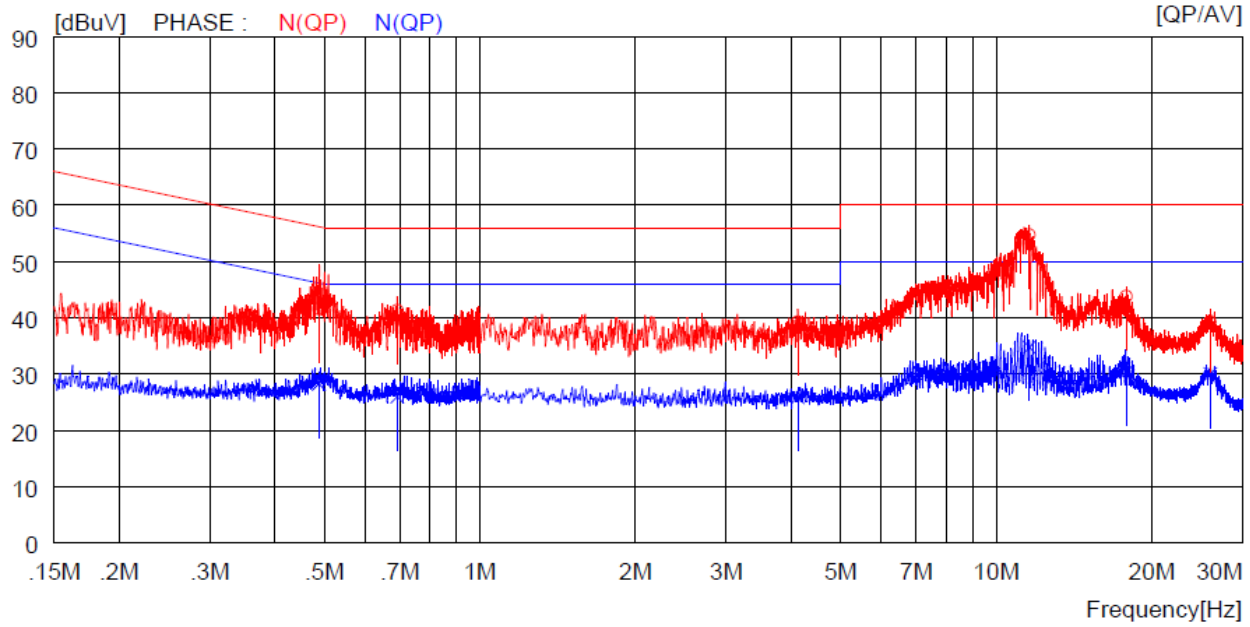
-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.48800	20.1	----	21.5	41.6	----	56.2	----	14.6	----	N(QP)
2	0.69200	19.8	----	21.5	41.3	----	56.0	----	14.7	----	N(QP)
3	4.12800	17.7	----	21.6	39.3	----	56.0	----	16.7	----	N(QP)
4	11.60000	33.3	----	21.4	54.7	----	60.0	----	5.3	----	N(QP)
5	17.86000	22.4	----	21.4	43.8	----	60.0	----	16.2	----	N(QP)
6	25.98000	18.0	----	21.3	39.3	----	60.0	----	20.7	----	N(QP)
7	0.48800	----	6.8	21.5	----	28.3	----	46.2	----	17.9	N(CAV)
8	0.69200	----	4.5	21.5	----	26.0	----	46.0	----	20.0	N(CAV)
9	4.12800	----	4.3	21.6	----	25.9	----	46.0	----	20.1	N(CAV)
10	11.60000	----	13.4	21.4	----	34.8	----	50.0	----	15.2	N(CAV)
11	17.86000	----	9.0	21.4	----	30.4	----	50.0	----	19.6	N(CAV)
12	25.98000	----	8.7	21.3	----	30.0	----	50.0	----	20.0	N(CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

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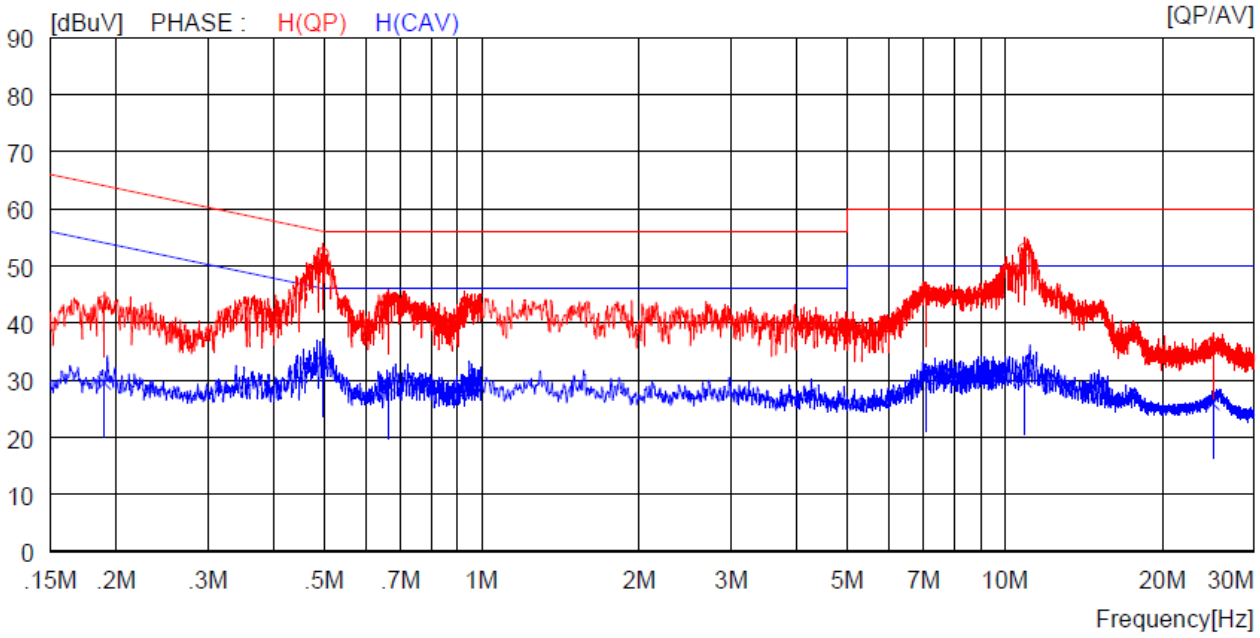
12.5 Test data for Intermodulation Mode(WLAN 2.4 GHz + Bluetooth LE(MDBT50Q-U) + Certified Bluetooth LE(RN4870))

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Tested Line : HOT LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.19000	22.1	----	21.5	43.6	----	64.0	----	20.4	----	H(QP)
2	0.49700	30.5	----	21.5	52.0	----	56.0	----	4.0	----	H(QP)
3	0.66200	22.6	----	21.5	44.1	----	56.0	----	11.9	----	H(QP)
4	7.07500	23.8	----	21.6	45.4	----	60.0	----	14.6	----	H(QP)
5	10.92000	31.4	----	21.4	52.8	----	60.0	----	7.2	----	H(QP)
6	24.97000	15.0	----	21.3	36.3	----	60.0	----	23.7	----	H(QP)
7	0.19000	----	8.0	21.5	----	29.5	----	54.0	----	24.5	H(CAV)
8	0.49700	----	11.6	21.5	----	33.1	----	46.0	----	12.9	H(CAV)
9	0.66200	----	7.6	21.5	----	29.1	----	46.0	----	16.9	H(CAV)
10	7.07500	----	8.8	21.6	----	30.4	----	50.0	----	19.6	H(CAV)
11	10.92000	----	8.5	21.4	----	29.9	----	50.0	----	20.1	H(CAV)
12	24.97000	----	4.6	21.3	----	25.9	----	50.0	----	24.1	H(CAV)

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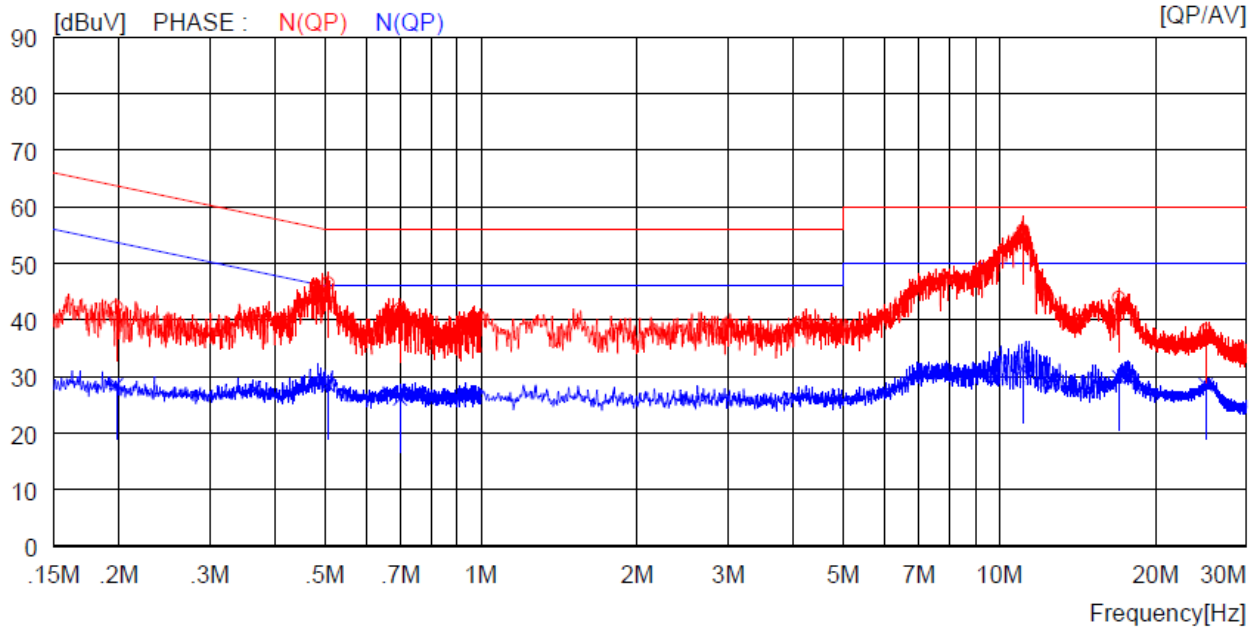
-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.19800	20.8	----	21.5	42.3	----	63.7	----	21.4	----	N(QP)
2	0.50700	25.0	----	21.5	46.5	----	56.0	----	9.5	----	N(QP)
3	0.69800	20.4	----	21.5	41.9	----	56.0	----	14.1	----	N(QP)
4	11.10000	34.4	----	21.4	55.8	----	60.0	----	4.2	----	N(QP)
5	17.00000	22.5	----	21.4	43.9	----	60.0	----	16.1	----	N(QP)
6	25.03000	16.8	----	21.3	38.1	----	60.0	----	21.9	----	N(QP)
7	0.19800	----	7.0	21.5	----	28.5	----	53.7	----	25.2	N(CAV)
8	0.50700	----	6.9	21.5	----	28.4	----	46.0	----	17.6	N(CAV)
9	0.69800	----	4.6	21.5	----	26.1	----	46.0	----	19.9	N(CAV)
10	11.10000	----	9.9	21.4	----	31.3	----	50.0	----	18.7	N(CAV)
11	17.00000	----	8.5	21.4	----	29.9	----	50.0	----	20.1	N(CAV)
12	25.03000	----	7.2	21.3	----	28.5	----	50.0	----	21.5	N(CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

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13. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 15, 2020 (1Y)
ESCI	Rohde & Schwarz	EMI TEST RECEIVER	60239	Jul. 20, 2020 (1Y)
310N	Sonoma Instrument	Pre-Amplifier	392756	Oct. 16, 2020 (1Y)
PAM-118A	Com-Power	Pre-Amplifier	18040081	Oct. 12, 2020 (1Y)
PAM-840A	Com-Power	Pre-Amplifier	461339	Oct. 16, 2020 (1Y)
DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
LT32C	AFJ	32 A LISN	32031306157	N/A
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2020 (2Y)
HLP-2008	TDK	Hybrid Antenna	131316	Feb. 27, 2020 (2Y)
AH-118	Com-Power	Horn Antenna	10050061	Oct. 15, 2020 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 07, 2021(1Y)
11947A	HP	TRANSIENT LIMITER	3107A02762	Mar. 23 2020 (2Y)

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