

RADIO PERFORMANCE TEST REPORT

Test Report No. : OT-19D-RWD-055

AGR No. : A19NA-376

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. : A3LWCT732M

Model Name : WCT732M

Serial number : N/A

Total page of Report : 174 pages (including this page)

Date of Incoming : November 29, 2019

Date of issue : December 16, 2019

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.

Reviewed by: 

Yu-Seog Sim / Assistant Manager
ONETECH Corp.

Approved by: 

Jae-Ho Lee / Chief Engineer
ONETECH Corp.

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-19D-RWD-055	December 16, 2019	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 Engineer
 Telephone No. : +82-31-277-2688
 FCC ID : A3LWCT732M
 Model Name : WCT732M
 Brand Name : 
 Serial Number : N/A
 Date : December 16, 2019

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 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

-. Lab Accreditation:

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

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

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The Samsung Electronics Co Ltd, Model WCT732M (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))
	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))
	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))
	5 470 MHz ~ 5 725 MHz Band	5 500 MHz ~ 5 700 MHz (802.11a/n(HT20)/ac(VHT20))
		5 510 MHz ~ 5 670 MHz (802.11n(HT40)/ac(VHT40))
		5 530 MHz (802.11ac(VHT80))
	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	12.27 dBm
		2 Mbps	12.26 dBm
	Bluetooth	1 Mbps	11.23 dBm
		2 Mbps	10.79 dBm
		3 Mbps	10.99 dBm
	WLAN 2.4 GHz	Antenna 0	19.25 dBm(802.11b) 15.07 dBm(802.11g) 14.01 dBm(802.11n_HT20) 12.23 dBm(802.11n_HT40)
		Antenna 1	20.53 dBm(802.11b) 16.02 dBm(802.11g) 14.99 dBm(802.11n_HT20) 13.61 dBm(802.11n_HT40)
		Multiple Antenna	18.53 dBm(802.11g) 17.49 dBm(802.11n_HT20) 15.95 dBm(802.11n_HT40)

RF OUTPUT POWER	5 150 MHz ~ 5 250 MHz Band	Antenna 0	11.73 dBm(802.11a) 10.58 dBm(802.11n_HT20) 9.20 dBm(802.11n_HT40) 8.70 dBm(802.11ac_VHT80)
		Antenna 1	11.46 dBm(802.11a) 10.27 dBm(802.11n_HT20) 8.87 dBm(802.11n_HT40) 8.43 dBm(802.11ac_VHT80)
		Multiple Antenna	14.61 dBm(802.11a) 13.44 dBm(802.11n_HT20) 12.05 dBm(802.11n_HT40) 11.58 dBm(802.11ac_VHT80)
	5 250 MHz ~ 5 350 MHz Band	Antenna 0	12.13 dBm(802.11a) 10.80 dBm(802.11n_HT20) 9.80 dBm(802.11n_HT40) 9.26 dBm(802.11ac_VHT80)
		Antenna 1	11.85 dBm(802.11a) 10.42 dBm(802.11n_HT20) 9.22 dBm(802.11n_HT40) 8.51 dBm(802.11ac_VHT80)
		Multiple Antenna	15.00 dBm(802.11a) 13.59 dBm(802.11n_HT20) 12.53 dBm(802.11n_HT40) 11.91 dBm(802.11ac_VHT80)

RF OUTPUT POWER	5 470 MHz ~ 5 725 MHz Band	Antenna 0	11.93 dBm(802.11a) 10.72 dBm(802.11n_HT20) 9.11 dBm(802.11n_HT40) 9.09 dBm(802.11ac_VHT80)
		Antenna 0_Straddle	10.89 dBm(802.11a) 10.44 dBm(802.11n_HT20) 9.48 dBm(802.11n_HT40) 8.78 dBm(802.11ac_VHT80)
		Antenna 1	12.09 dBm(802.11a) 11.10 dBm(802.11n_HT20) 9.45 dBm(802.11n_HT40) 9.20 dBm(802.11ac_VHT80)
		Antenna 1_Straddle	11.19 dBm(802.11a) 10.83 dBm(802.11n_HT20) 9.83 dBm(802.11n_HT40) 8.98 dBm(802.11ac_VHT80)
		Multiple Antenna	15.02 dBm(802.11a) 13.86 dBm(802.11n_HT20) 12.23 dBm(802.11n_HT40) 12.16 dBm(802.11ac_VHT80)
		Multiple Antenna _Straddle	14.05 dBm(802.11a) 13.65 dBm(802.11n_HT20) 12.67 dBm(802.11n_HT40) 11.89 dBm(802.11ac_VHT80)

RF OUTPUT POWER	5 725 MHz ~ 5 850 MHz Band	Antenna 0	11.98 dBm(802.11a) 10.75 dBm(802.11n_HT20) 9.56 dBm(802.11n_HT40) 9.15 dBm(802.11ac_VHT80)
		Antenna 0_Straddle	3.57 dBm(802.11a) 3.57 dBm(802.11n_HT20) -1.86 dBm(802.11n_HT40) -5.51 dBm(802.11ac_VHT80)
		Antenna 1	12.16 dBm(802.11a) 11.39 dBm(802.11n_HT20) 10.02 dBm(802.11n_HT40) 9.80 dBm(802.11ac_VHT80)
		Antenna 1_Straddle	4.09 dBm(802.11a) 3.89 dBm(802.11n_HT20) -1.53 dBm(802.11n_HT40) -5.42 dBm(802.11ac_VHT80)
		Multiple Antenna	15.08 dBm(802.11a) 14.09 dBm(802.11n_HT20) 12.81 dBm(802.11n_HT40) 12.50 dBm(802.11ac_VHT80)
		Multiple Antenna _Straddle	6.85 dBm(802.11a) 6.74 dBm(802.11n_HT20) 1.32 dBm(802.11n_HT40) -2.45 dBm(802.11ac_VHT80)

ANTENNA TYPE	Chip Antenna		
ANTENNA GAIN	Bluetooth LE	-0.94 dBi	
	Bluetooth	-0.94 dBi	
	WLAN 2.4 GHz	Antenna 0	2.01 dBi
		Antenna 1	2.06 dBi
		Multiple Antenna	5.05 dBi
	5 150 MHz ~ 5 250 MHz Band	Antenna 0	0.92 dBi
		Antenna 1	1.24 dBi
		Multiple Antenna	4.09 dBi
	5 250 MHz ~ 5 350 MHz Band	Antenna 0	1.79 dBi
		Antenna 1	2.66 dBi
		Multiple Antenna	5.25 dBi
	5 470 MHz ~ 5 725 MHz Band	Antenna 0	2.73 dBi
		Antenna 1	1.72 dBi
		Multiple Antenna	5.25 dBi
	5 725 MHz ~ 5 850 MHz Band	Antenna 0	1.71 dBi
		Antenna 1	0.69 dBi
		Multiple Antenna	4.23 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.

-. 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	Samsung Electronics Co., Ltd.	HDWB-2095S V2.2	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
WCT732M	Samsung Electronics Co., Ltd.	Wi-Fi/BT Transceiver (EUT)	
HP Probook	HP	Notebook PC	EUT
PPP009C	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.

Modulation	DATA RATE	OUTPUT POWER[dBm]	
		Antenna 0	Antenna 1
802.11 b (Middle Channel)	1 Mbps	19.54	20.36
	2 Mbps	19.46	20.34
	5.5 Mbps	19.39	20.30
	11 Mbps	19.28	20.28
802.11 g (Middle Channel)	6 Mbps	15.18	15.98
	9 Mbps	15.13	15.84
	12 Mbps	14.97	15.68
	18 Mbps	14.83	15.52
	24 Mbps	14.68	15.37
	36 Mbps	14.52	15.23
	48 Mbps	14.36	15.08
	54 Mbps	14.13	14.90
802.11 HT 20 (Middle Channel)	6.5 Mbps	13.94	14.73
	13 Mbps	13.87	14.67
	19.5 Mbps	13.82	14.60
	26 Mbps	13.76	14.52
	39 Mbps	13.68	14.46
	52 Mbps	13.60	14.39
	58.5 Mbps	13.53	14.33
	65 Mbps	13.45	14.27
802.11 HT 40 (Middle Channel)	13.5 Mbps	12.26	13.45
	27 Mbps	12.21	13.38
	40.5 Mbps	12.17	13.33
	54 Mbps	12.13	13.25
	81 Mbps	12.08	13.18
	108 Mbps	12.03	13.11
	121.5 Mbps	11.96	13.05
	135 Mbps	11.90	12.99

-. 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 “XZ” axis.

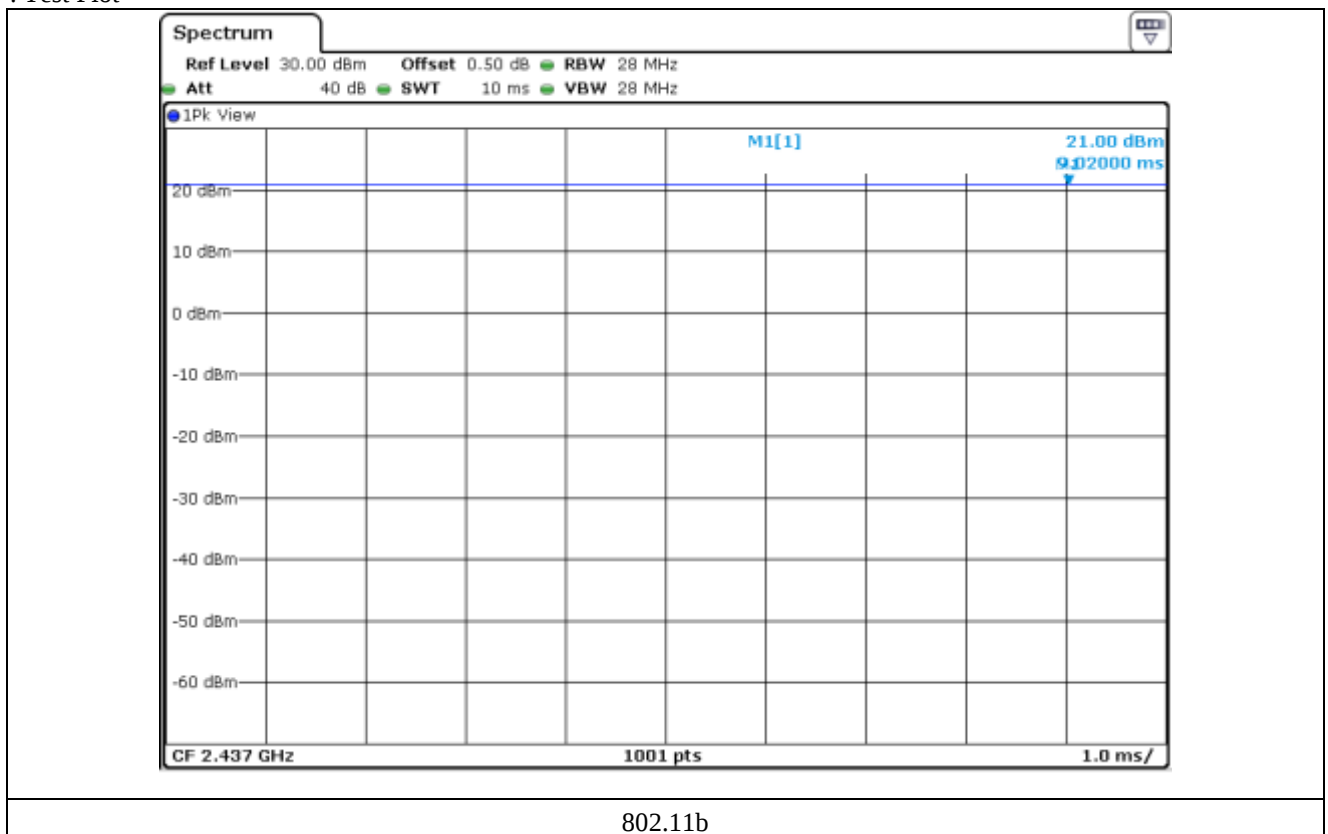
-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
802.11b	-	-	100.00	-
802.11g	-	-	100.00	-
802.11n HT 20	-	-	100.00	-
802.11n HT 40	-	-	100.00	-

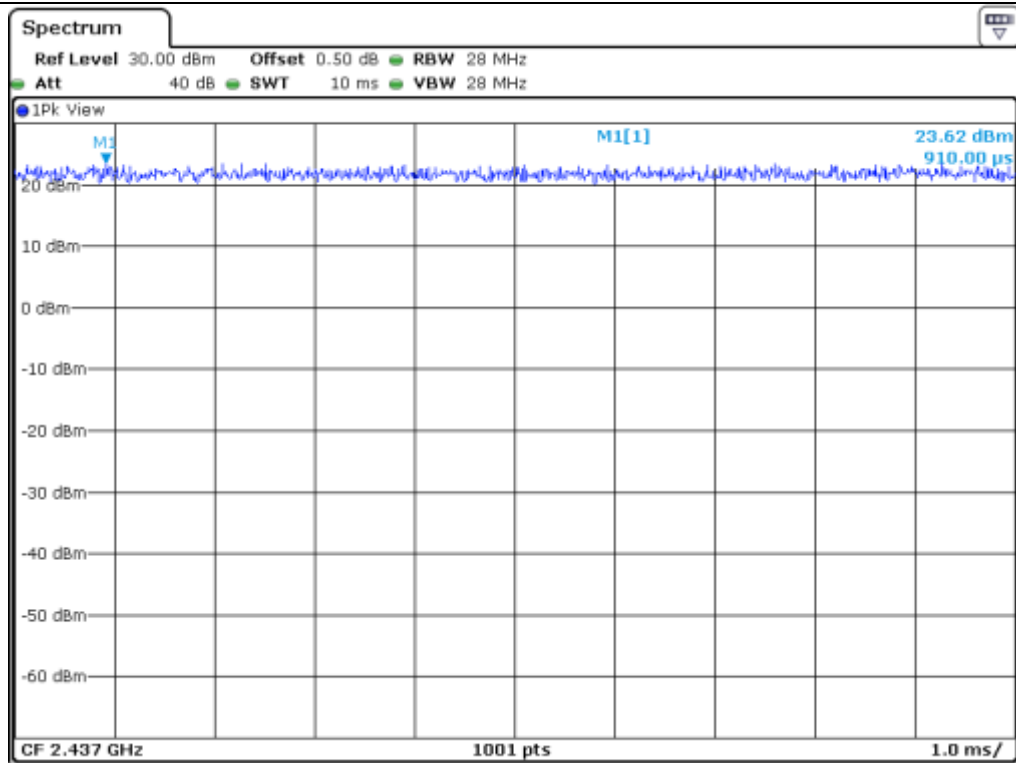
Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

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

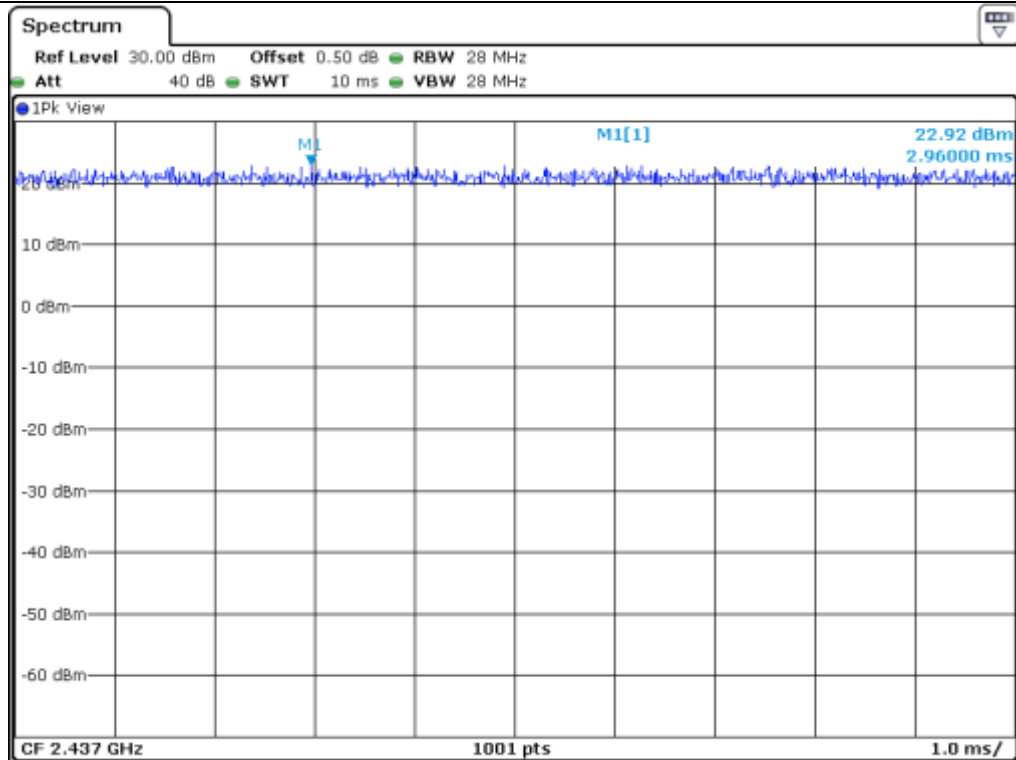
-. Test Plot



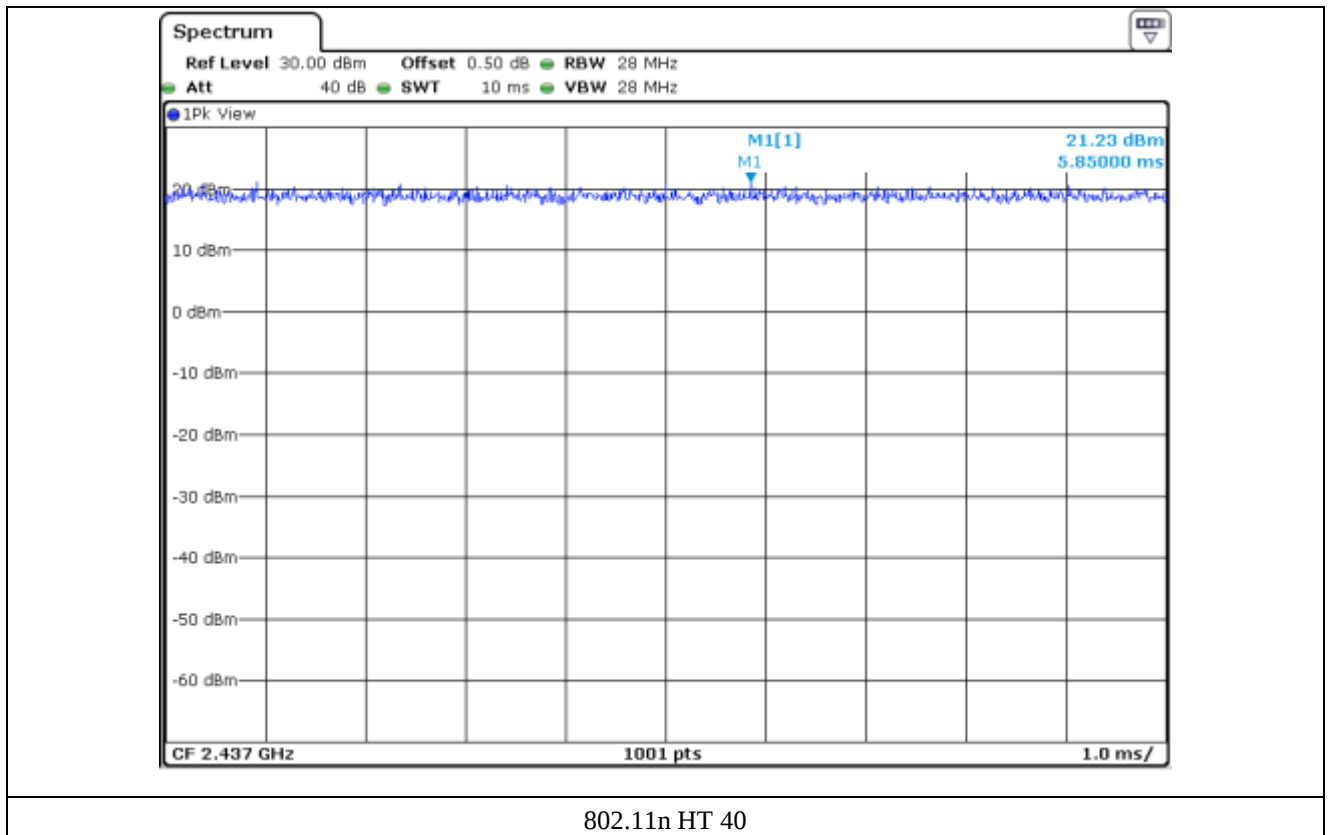
802.11b



802.11g



802.11n HT 20



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: 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 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

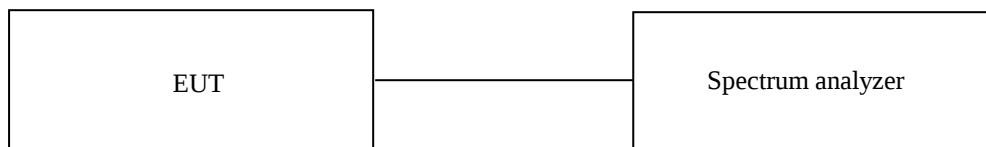
7. MINIMUM 6 dB BANDWIDTH

7.1 Operating environment

Temperature : 24 °C
Relative humidity : 48 % 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 equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101199	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

7.4 Test data for 802.11b WLAN Mode

7.4.1 Test data for Antenna 0

-. Test Date : December 02, 2019 ~ December 11, 2019

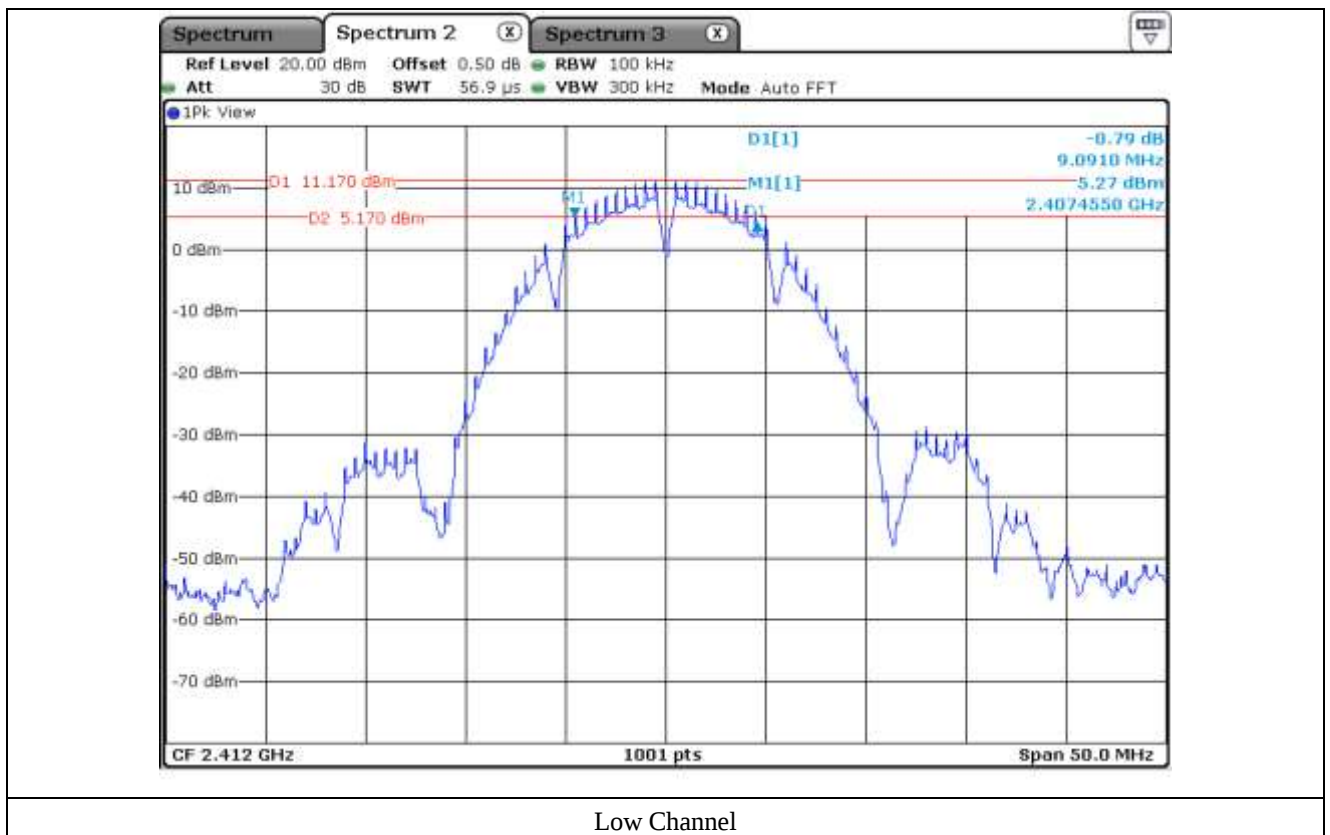
-. Test Result : Pass

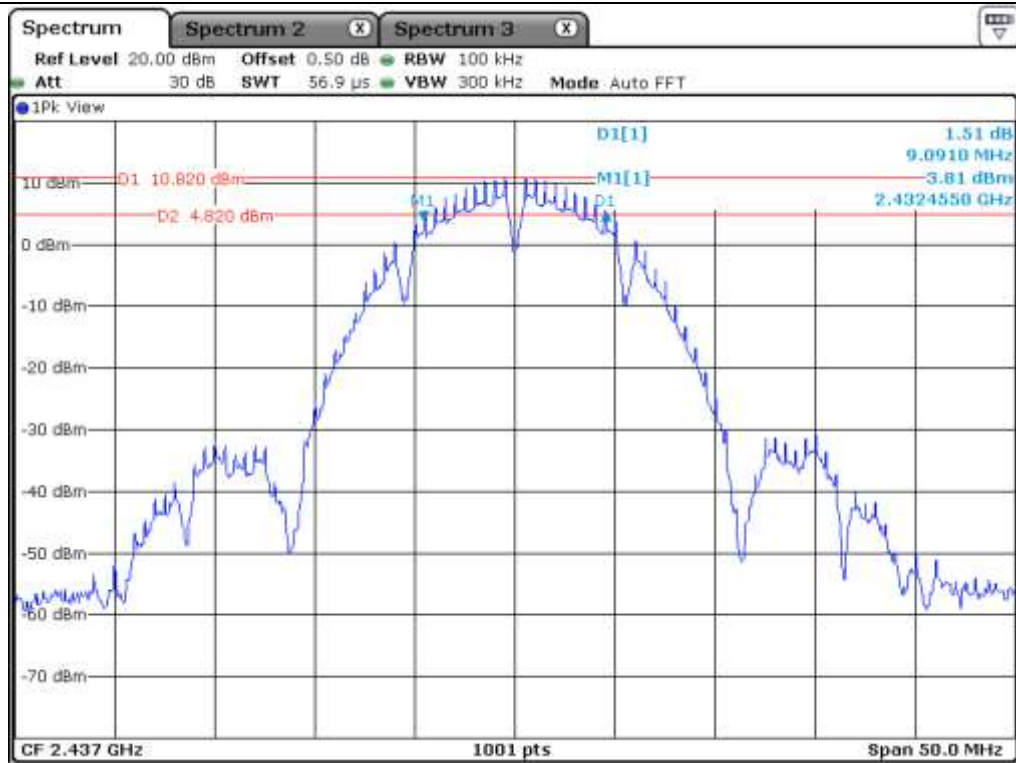
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	9.09	0.50	8.59
Middle	2 437.00	9.09	0.50	8.54
High 11	2 462.00	9.09	0.50	8.59
High 12	2 467.00	9.04	0.50	8.54
High 13	2 472.00	9.04	0.50	8.54

Remark. Margin = Measured Value - Limit

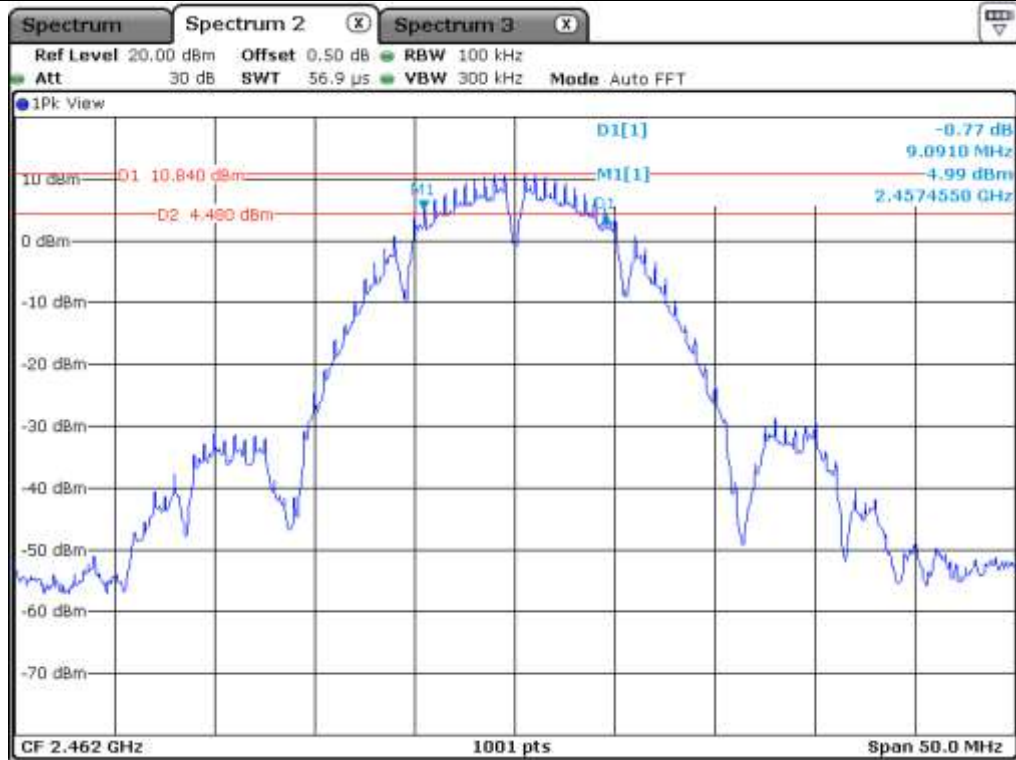


Tested by: Ha-Ram, Lee / Assistant Manager

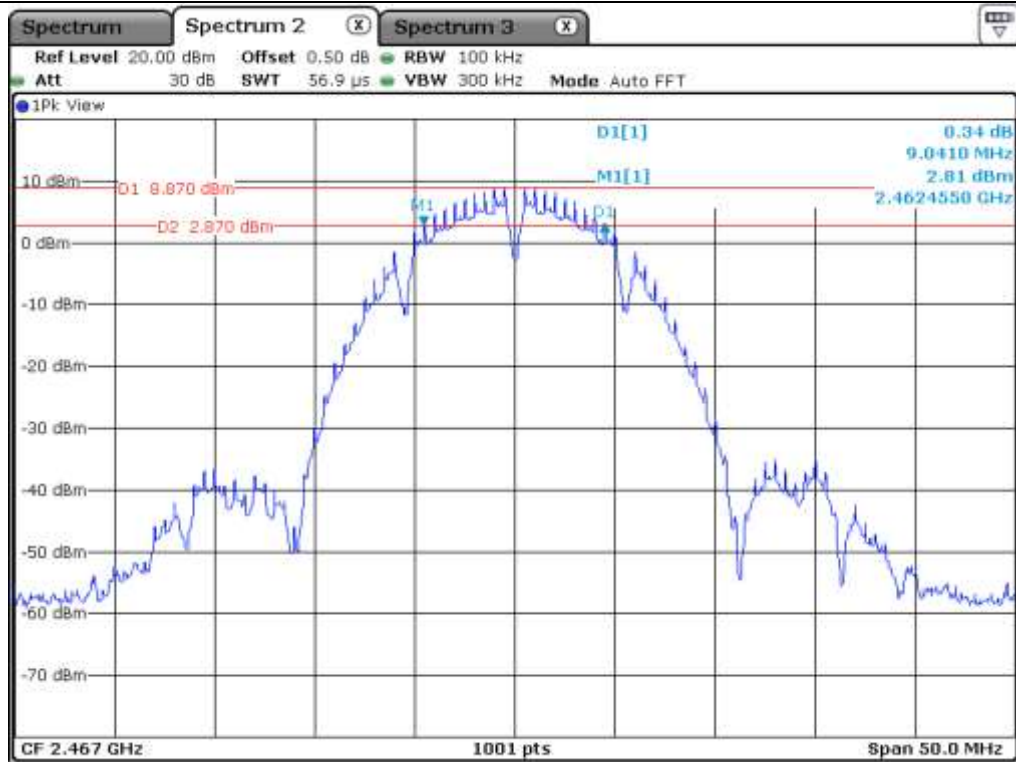




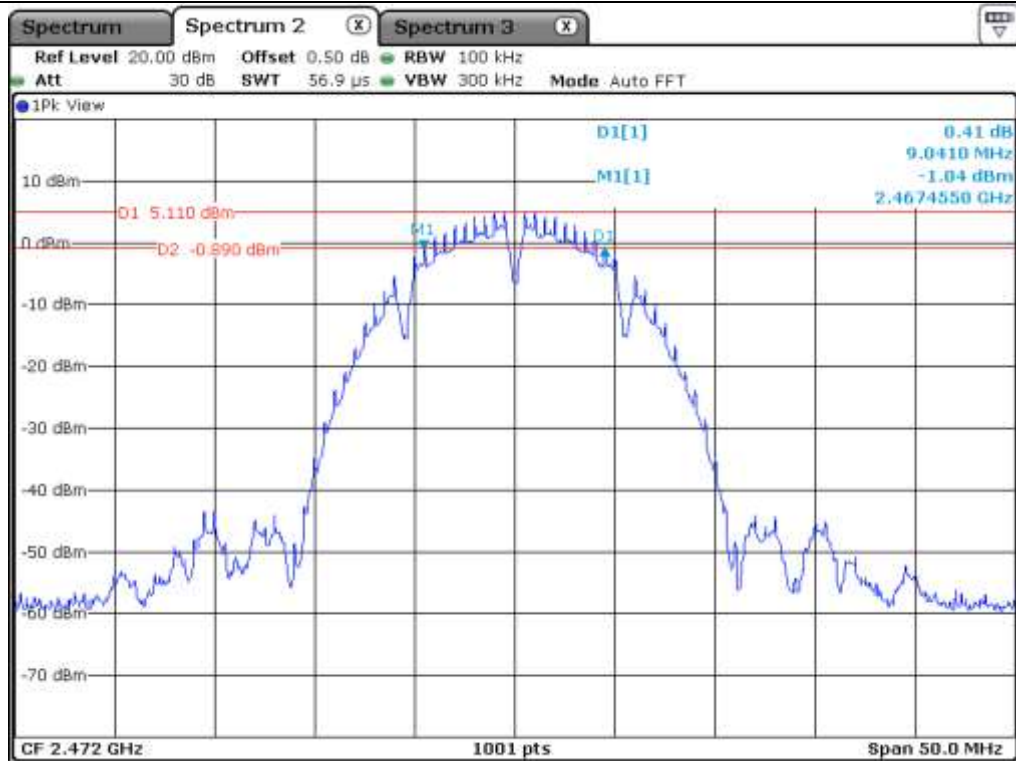
Middle Channel



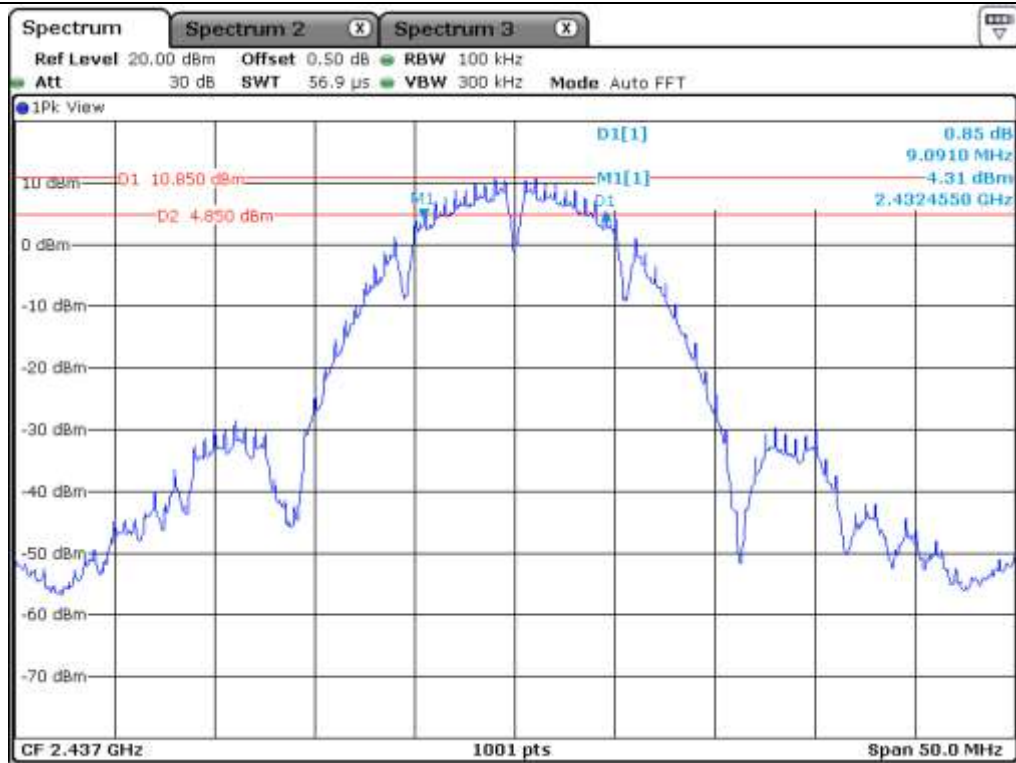
High Channel 11



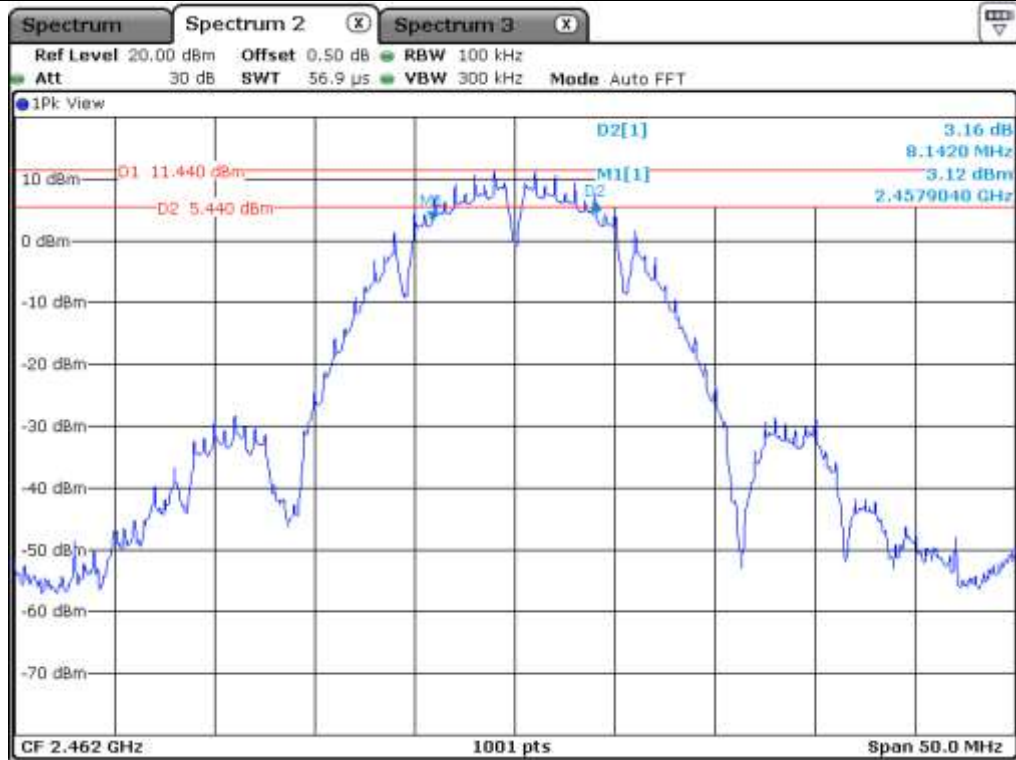
High Channel 12



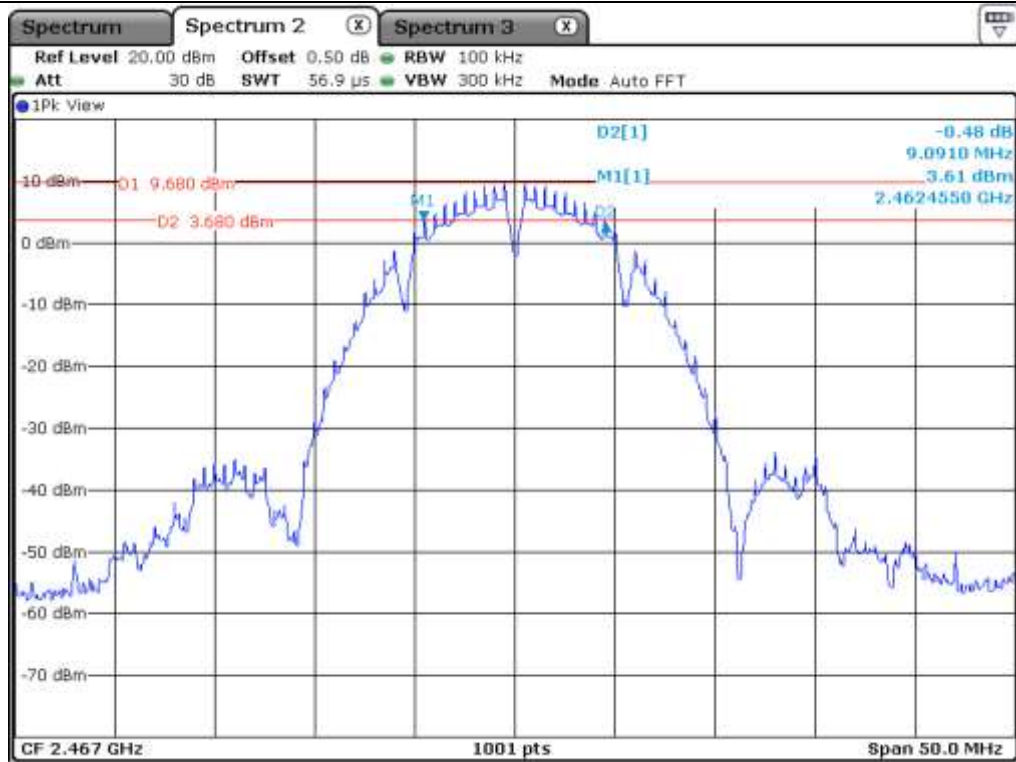
High Channel 13



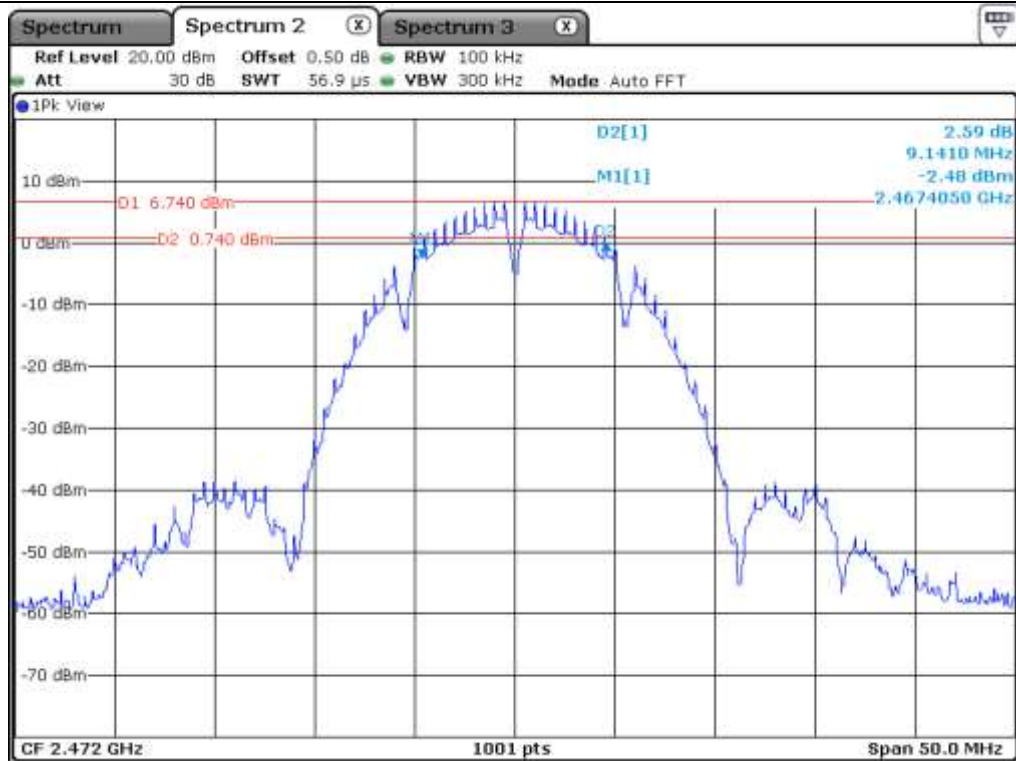
Middle Channel



High Channel 11



High Channel 12



High Channel 13

7.5 Test data for 802.11g WLAN Mode

7.5.1 Test data for Antenna 0

-. Test Date : December 02, 2019 ~ December 11, 2019

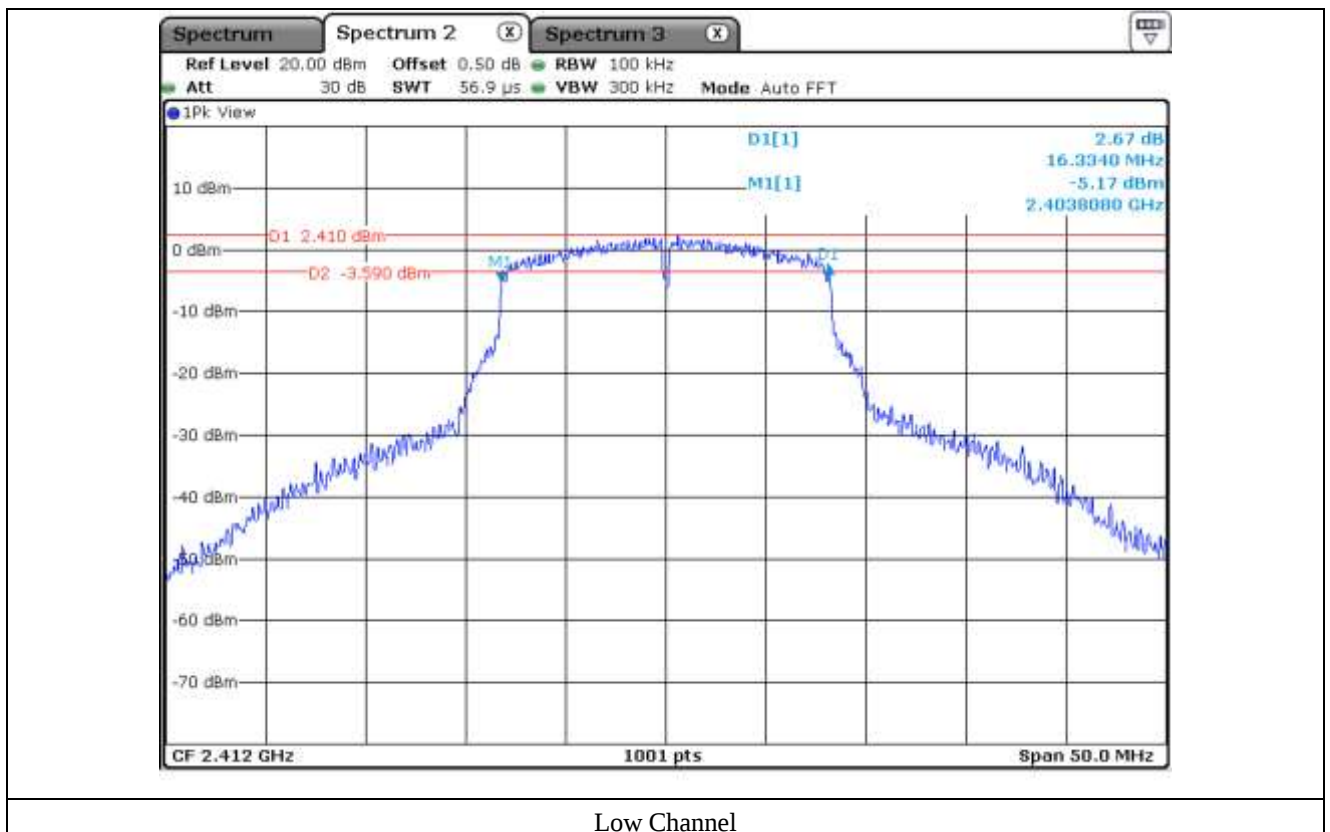
-. Test Result : Pass

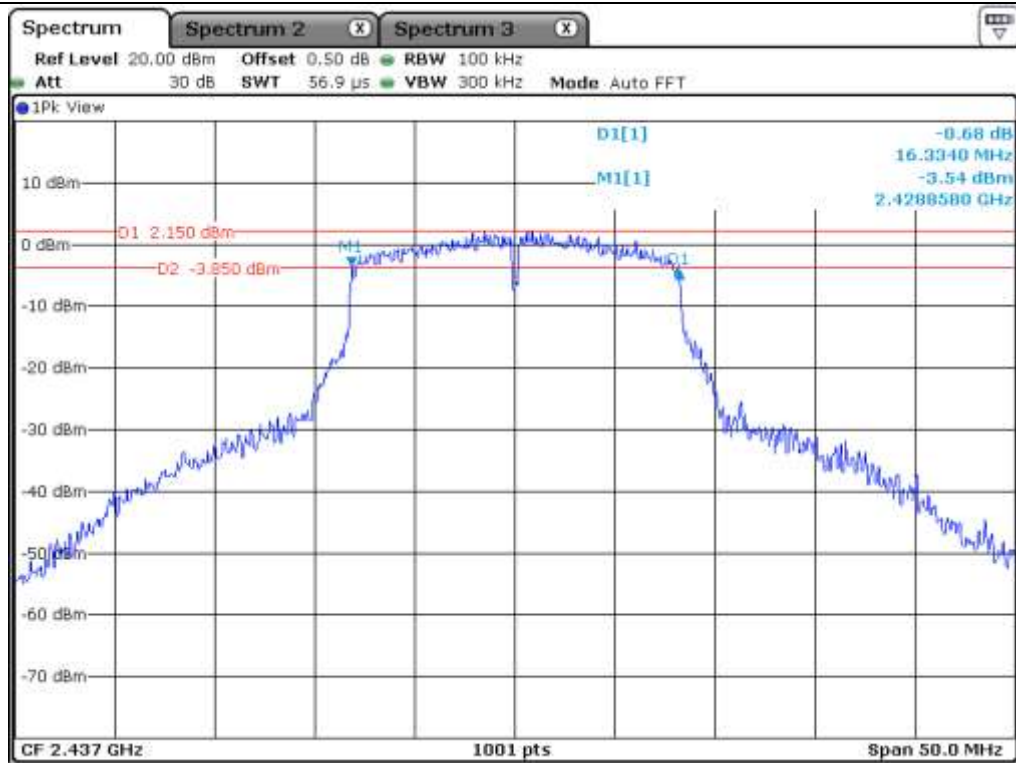
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	16.33	0.50	15.83
Middle	2 437.00	16.33	0.50	15.83
High 11	2 462.00	16.33	0.50	15.83
High 12	2 467.00	16.28	0.50	15.78
High 13	2 472.00	16.38	0.50	15.88

Remark. Margin = Measured Value - Limit

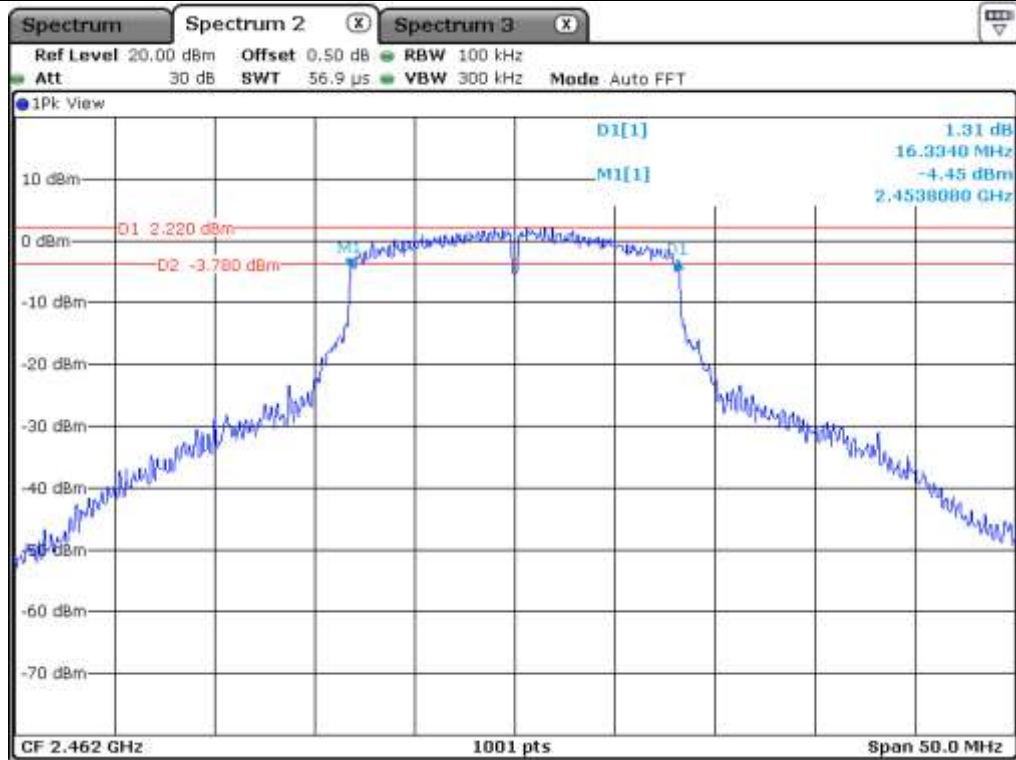


Tested by: Ha-Ram, Lee / Assistant Manager

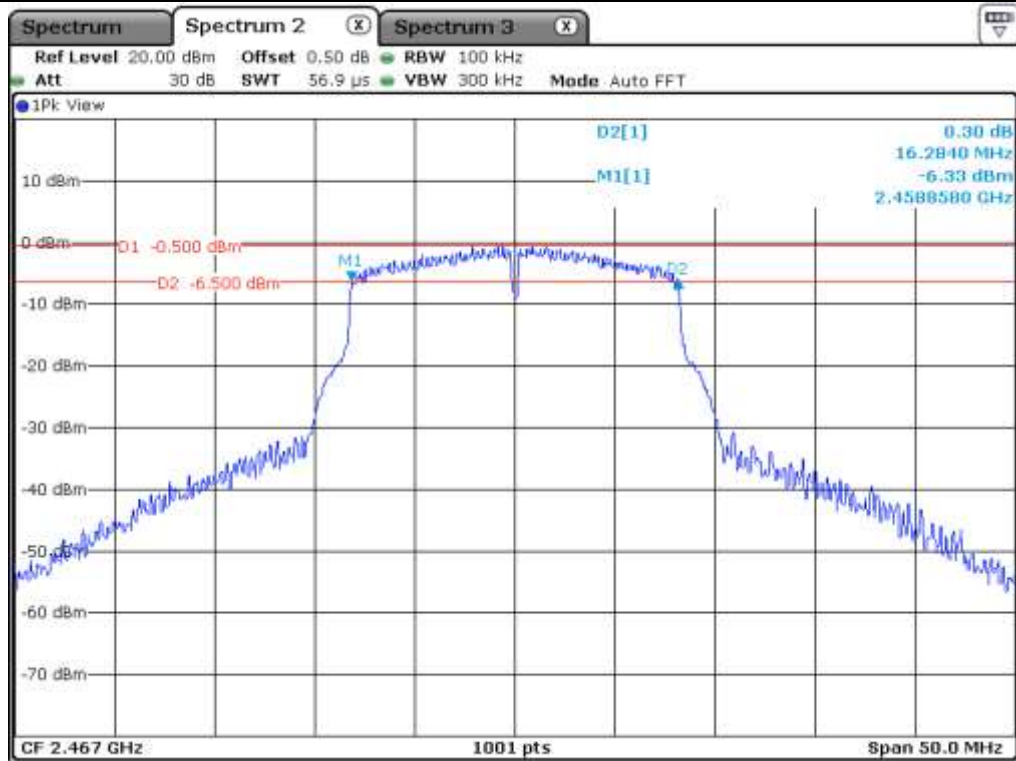




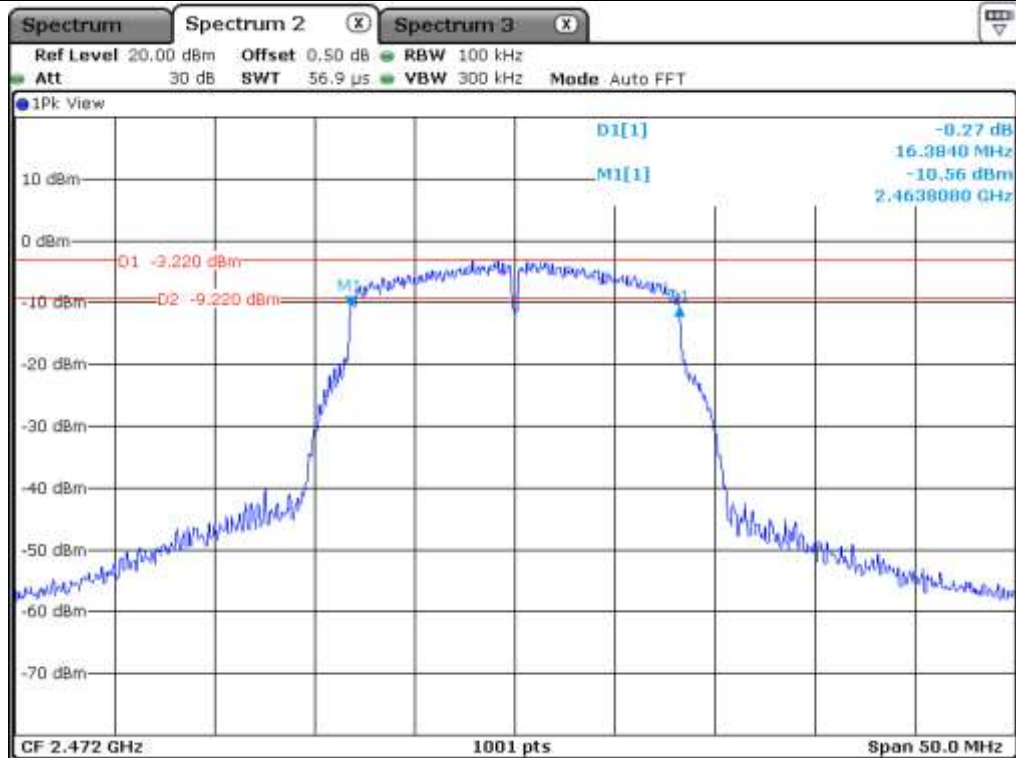
Middle Channel



High Channel 11



High Channel 12



High Channel 13

7.5.2 Test data for Antenna 1

-. Test Date : December 02, 2019 ~ December 11, 2019

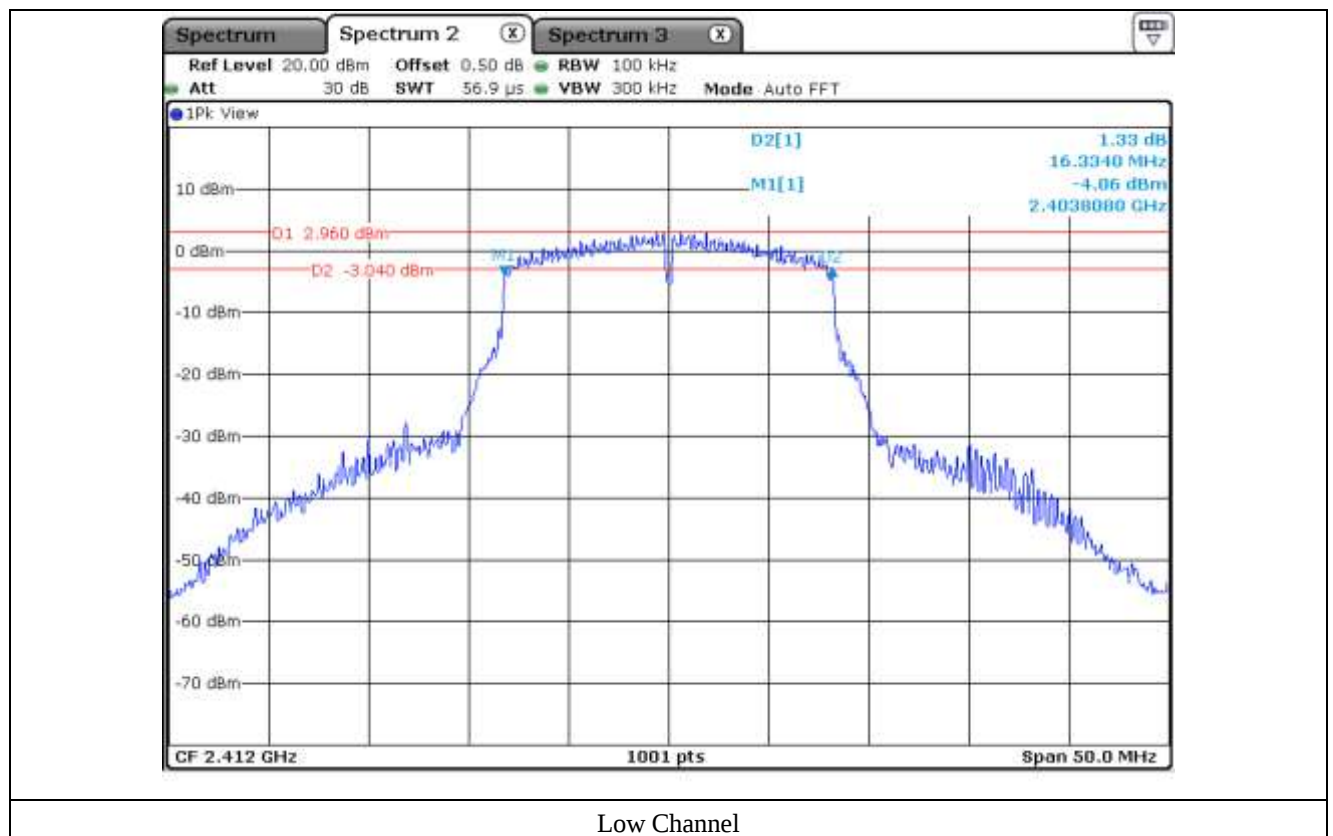
-. Test Result : Pass

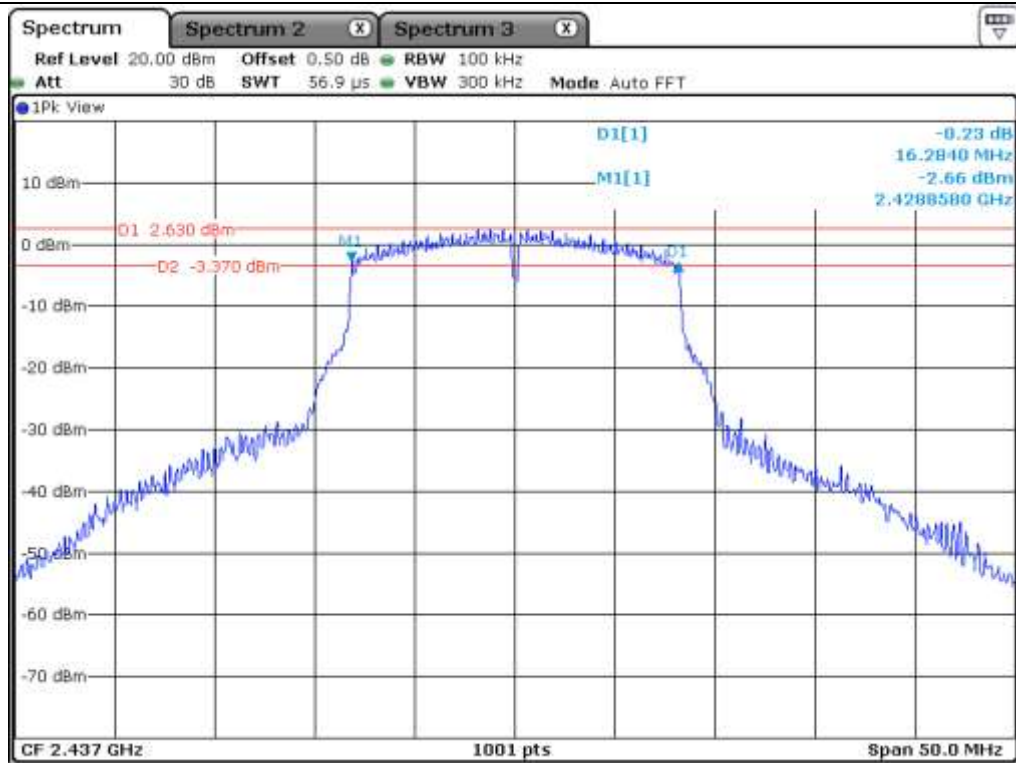
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	16.33	0.50	15.83
Middle	2 437.00	16.28	0.50	15.78
High 11	2 462.00	16.28	0.50	15.78
High 12	2 467.00	16.33	0.50	15.83
High 13	2 472.00	16.33	0.50	15.83

Remark. Margin = Measured Value - Limit

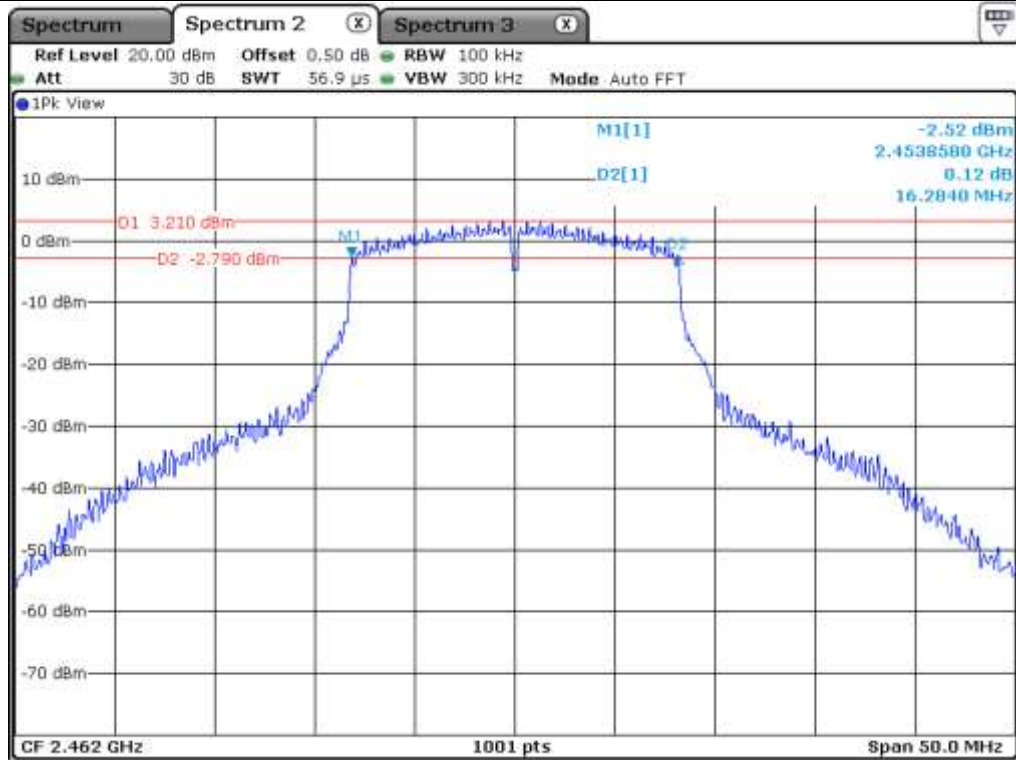


Tested by: Ha-Ram, Lee / Assistant Manager





Middle Channel



High Channel 11

7.6 Test data for 802.11n_HT20 WLAN Mode

7.6.1 Test data for Antenna 0

-. Test Date : December 02, 2019 ~ December 11, 2019

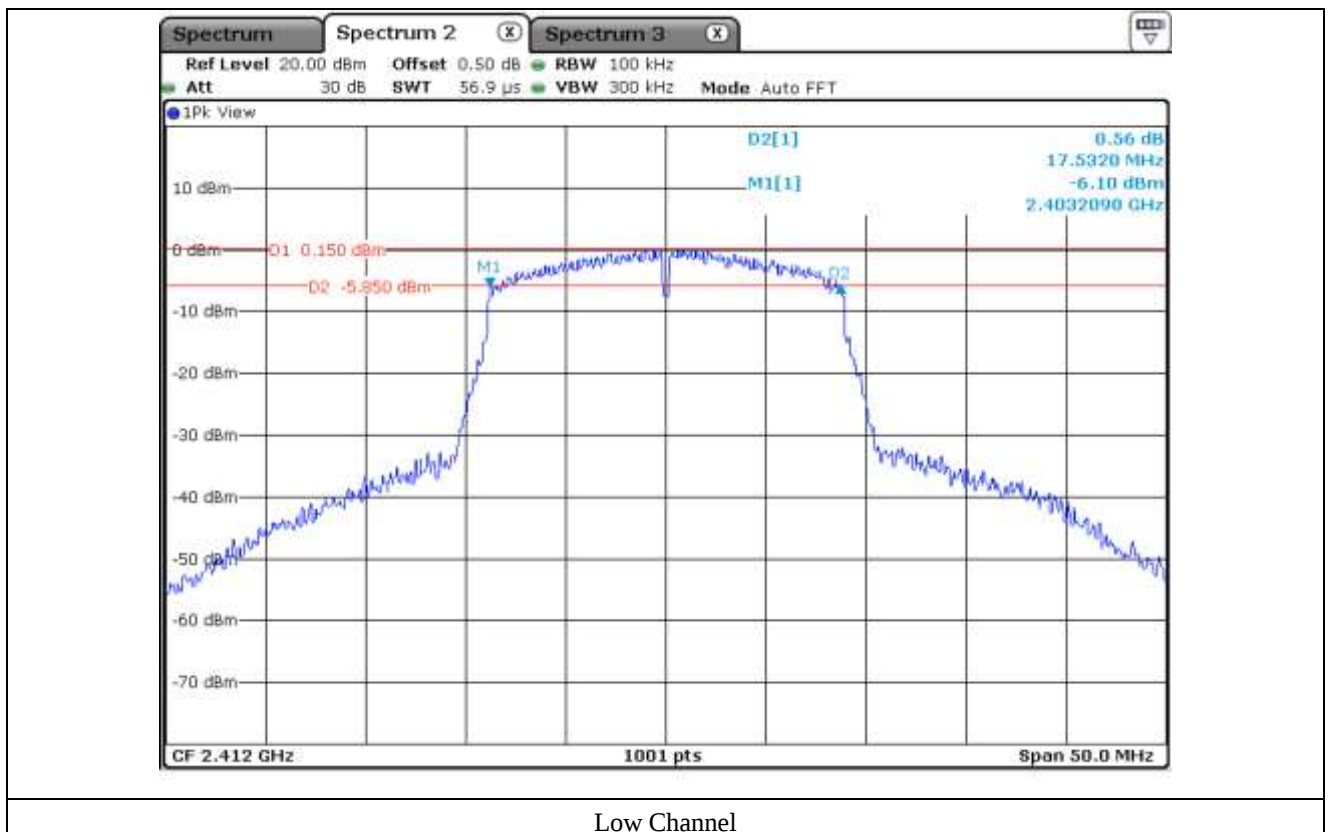
-. Test Result : Pass

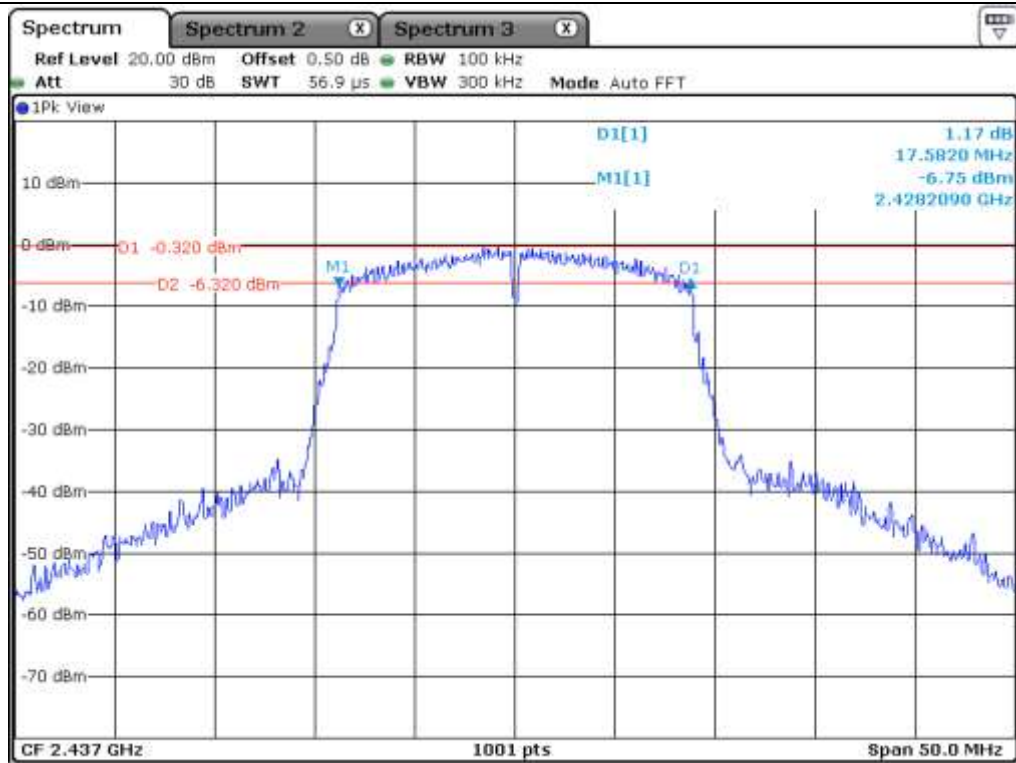
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	17.53	0.50	17.03
Middle	2 437.00	17.58	0.50	17.03
High 11	2 462.00	17.53	0.50	17.03
High 12	2 467.00	17.53	0.50	17.03
High 13	2 472.00	17.53	0.50	17.03

Remark. Margin = Measured Value - Limit

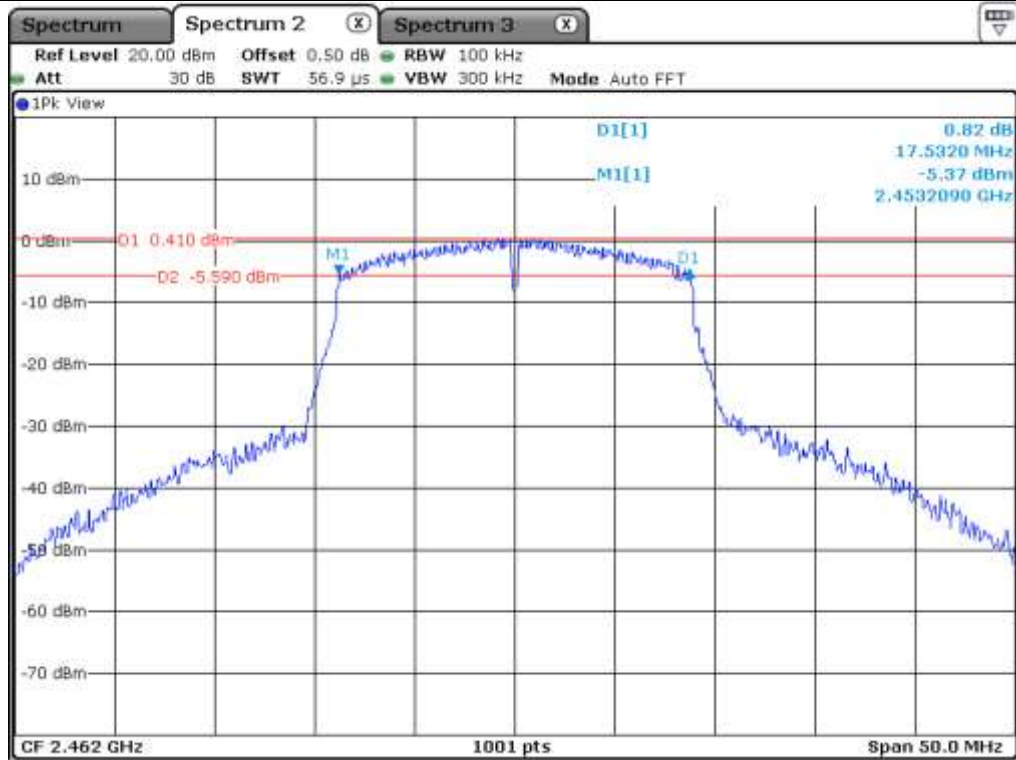


Tested by: Ha-Ram, Lee / Assistant Manager

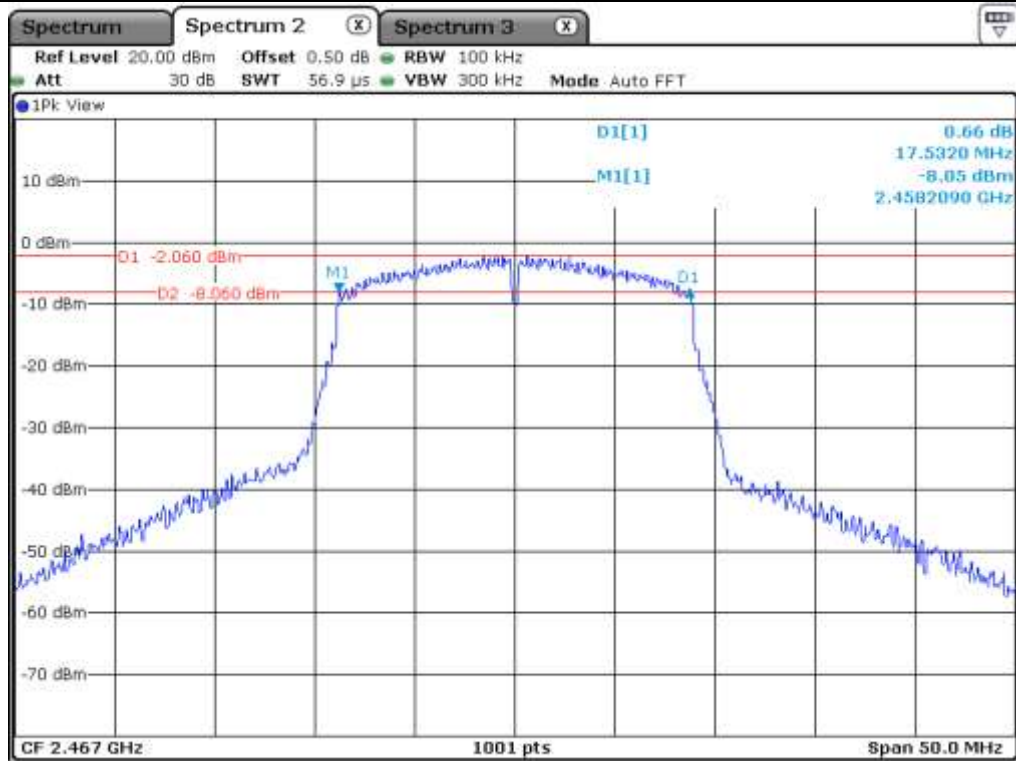




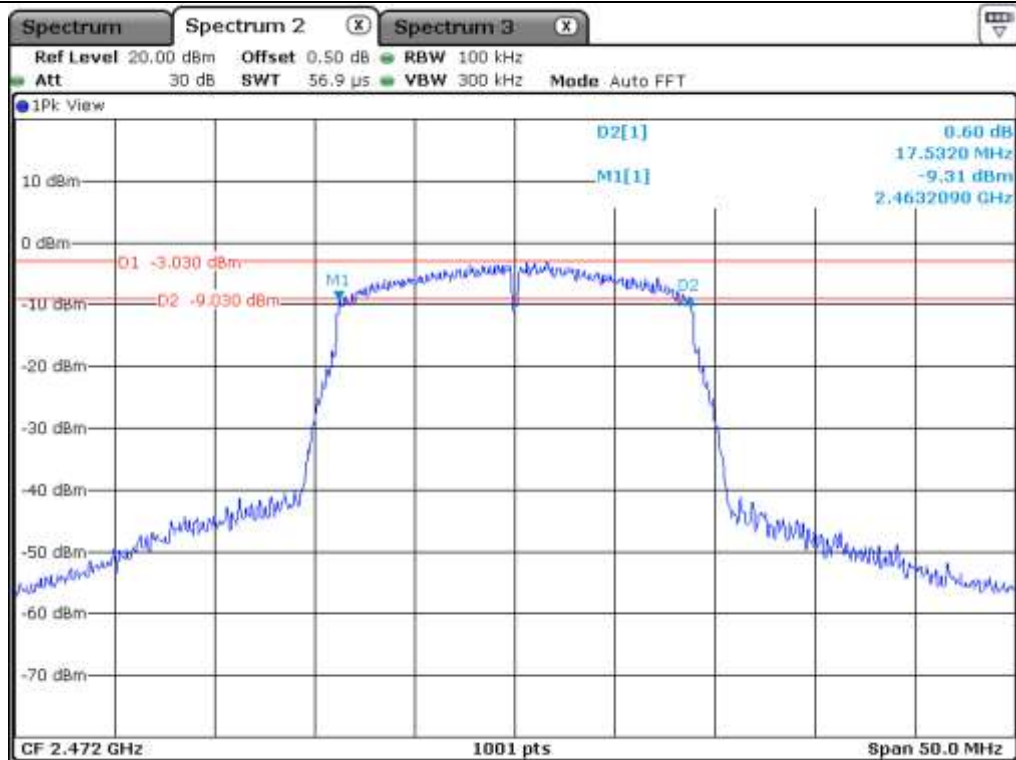
Middle Channel



High Channel 11



High Channel 12



High Channel 13

7.6.2 Test data for Antenna 1

-. Test Date : December 02, 2019 ~ December 11, 2019

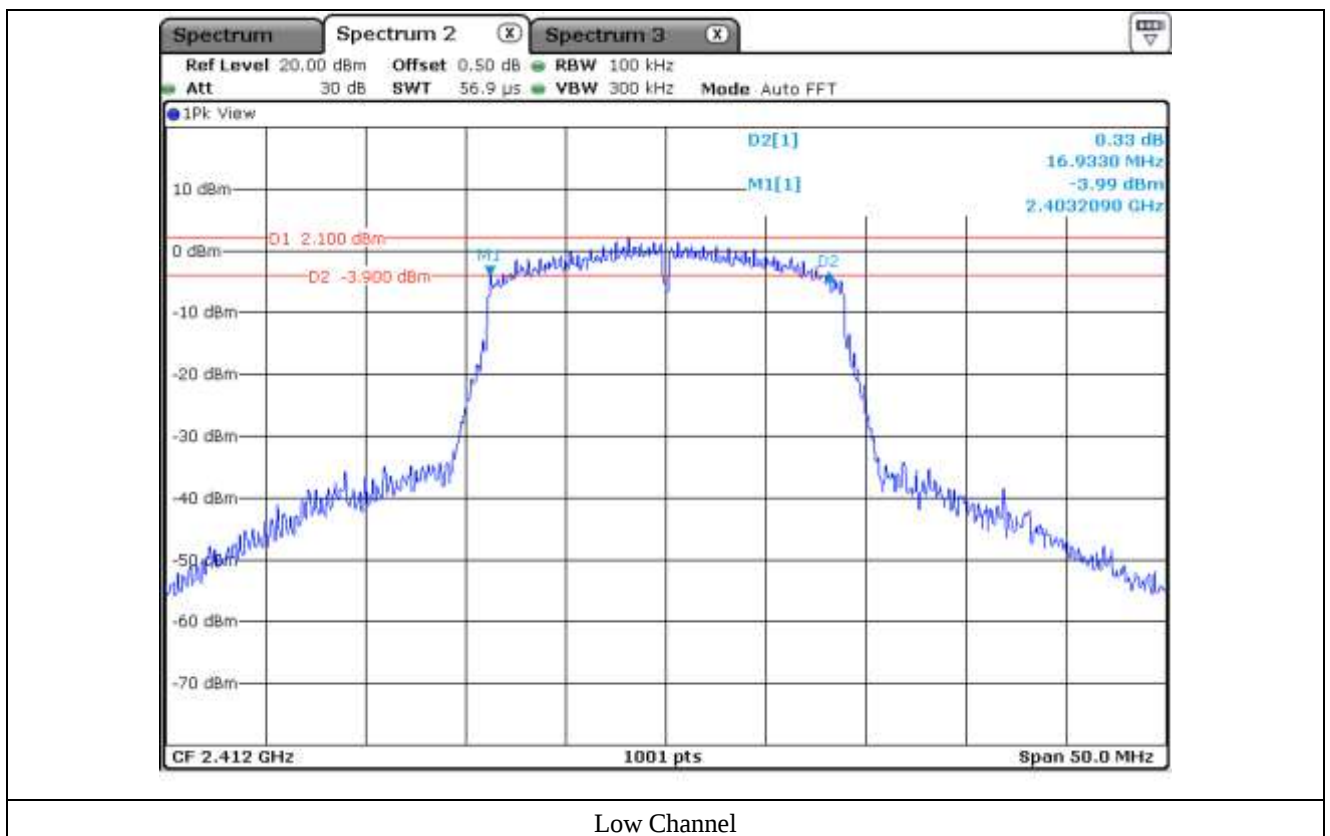
-. Test Result : Pass

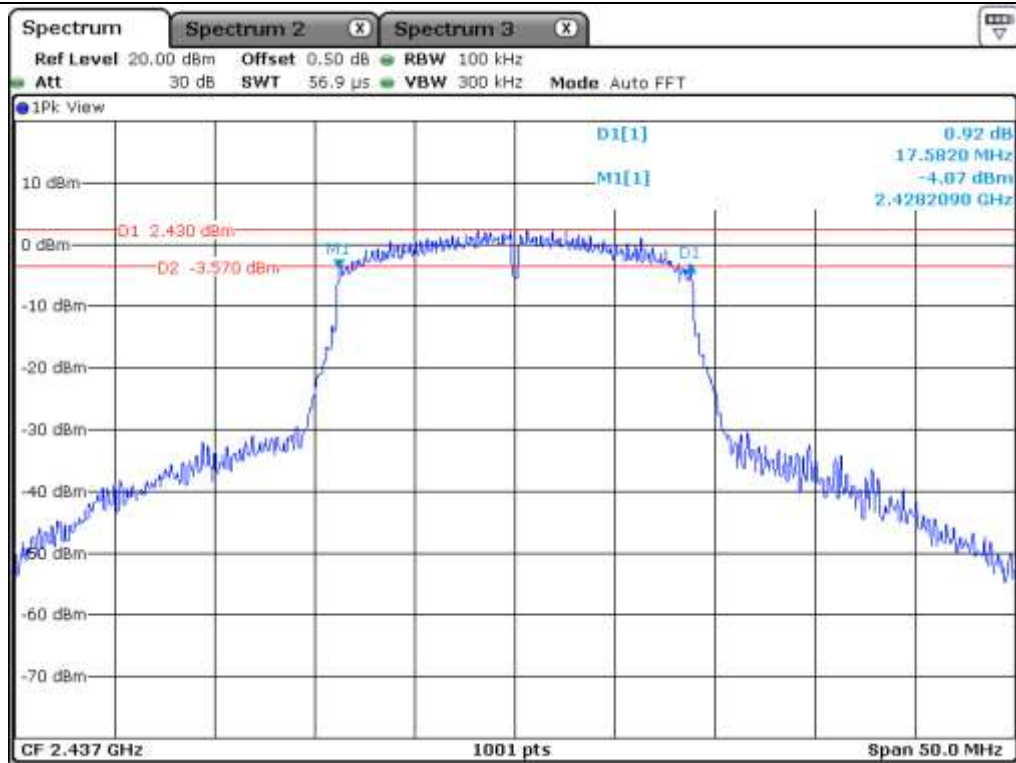
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	16.93	0.50	16.43
Middle	2 437.00	17.58	0.50	17.03
High 11	2 462.00	17.53	0.50	17.03
High 12	2 467.00	17.53	0.50	17.03
High 13	2 472.00	17.53	0.50	17.03

Remark. Margin = Measured Value - Limit

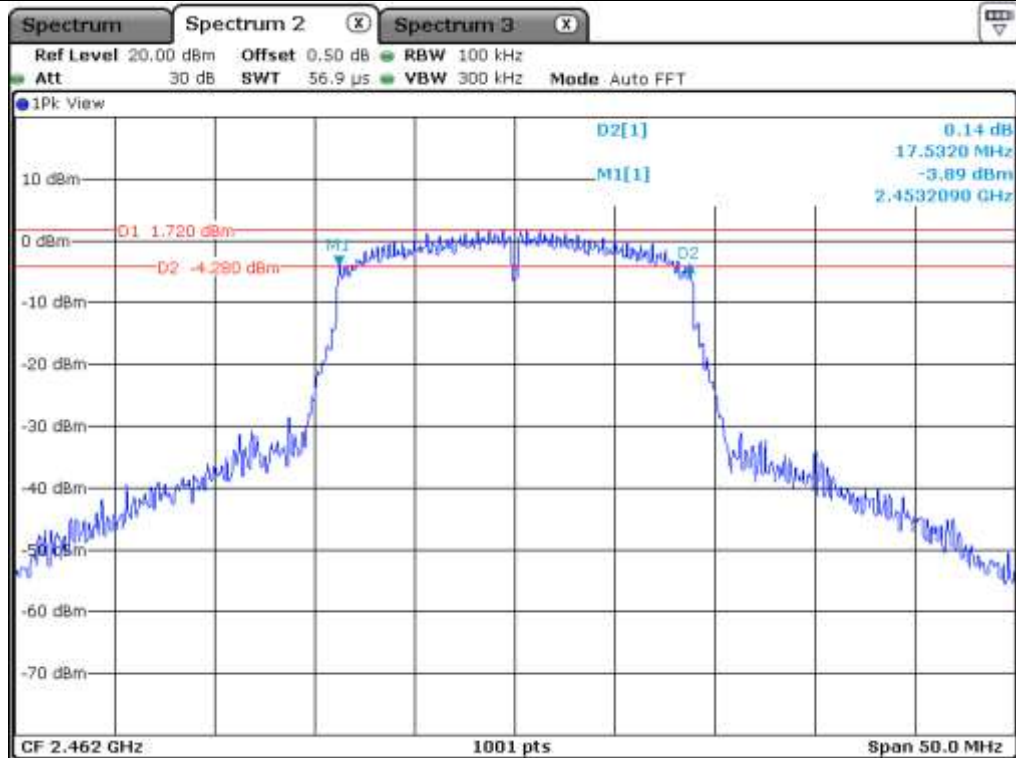


Tested by: Ha-Ram, Lee / Assistant Manager

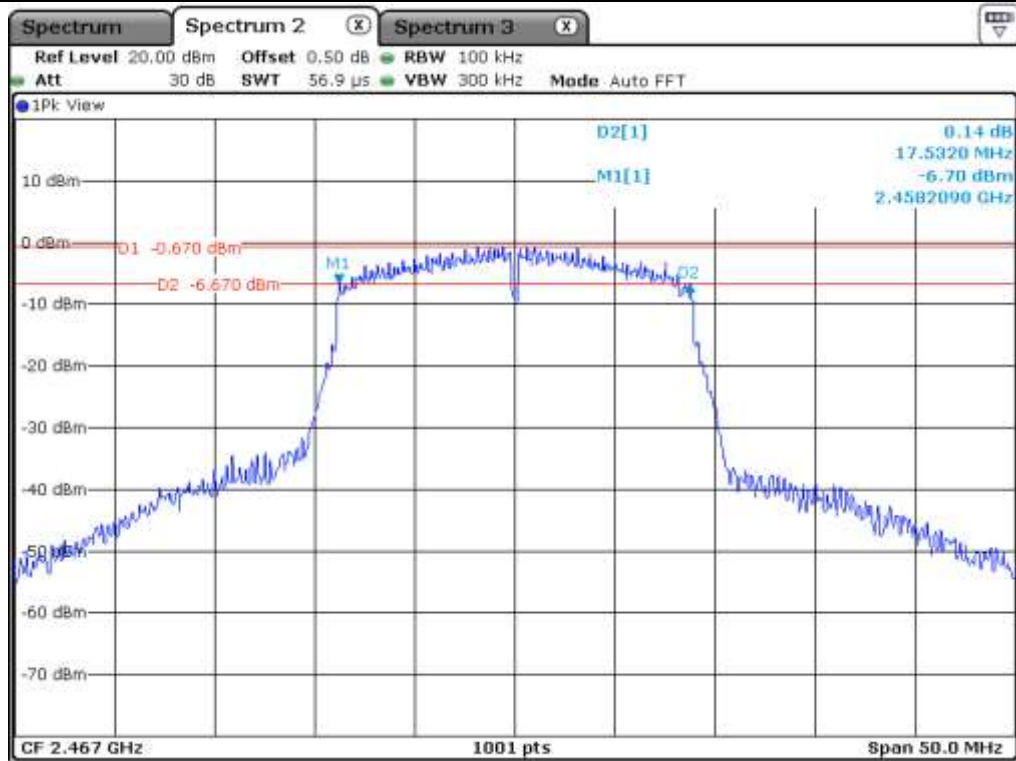




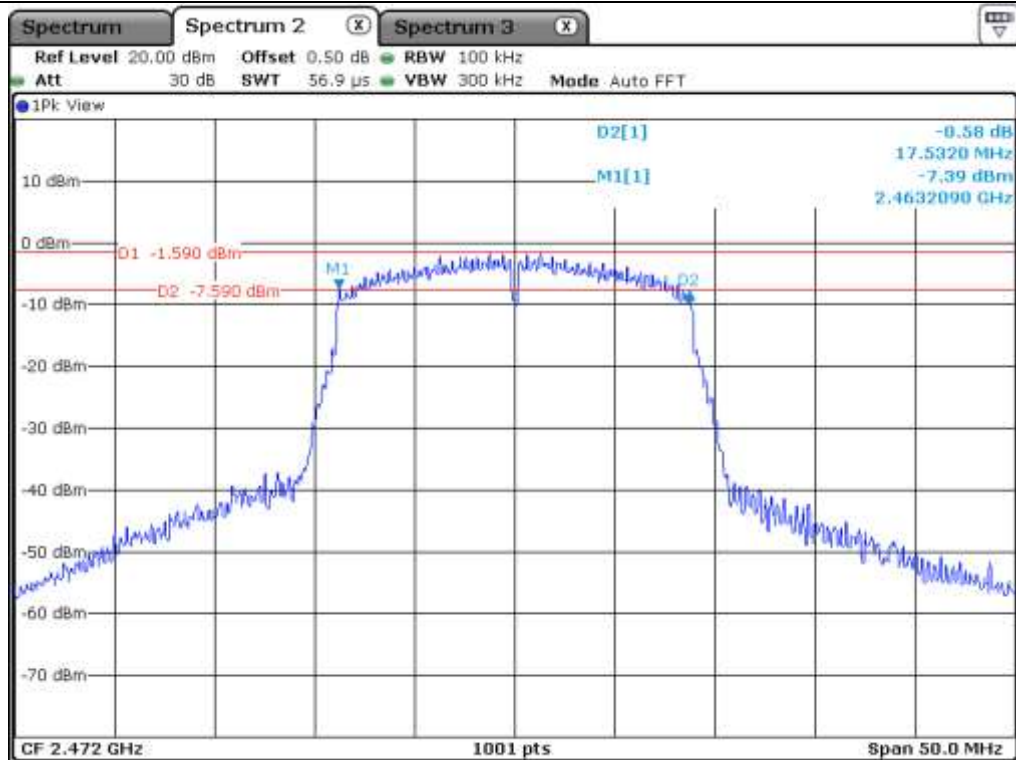
Middle Channel



High Channel 11



High Channel 12



High Channel 13

7.7 Test data for 802.11n_HT40 WLAN Mode

7.7.1 Test data for Antenna 0

-. Test Date : December 02, 2019 ~ December 11, 2019

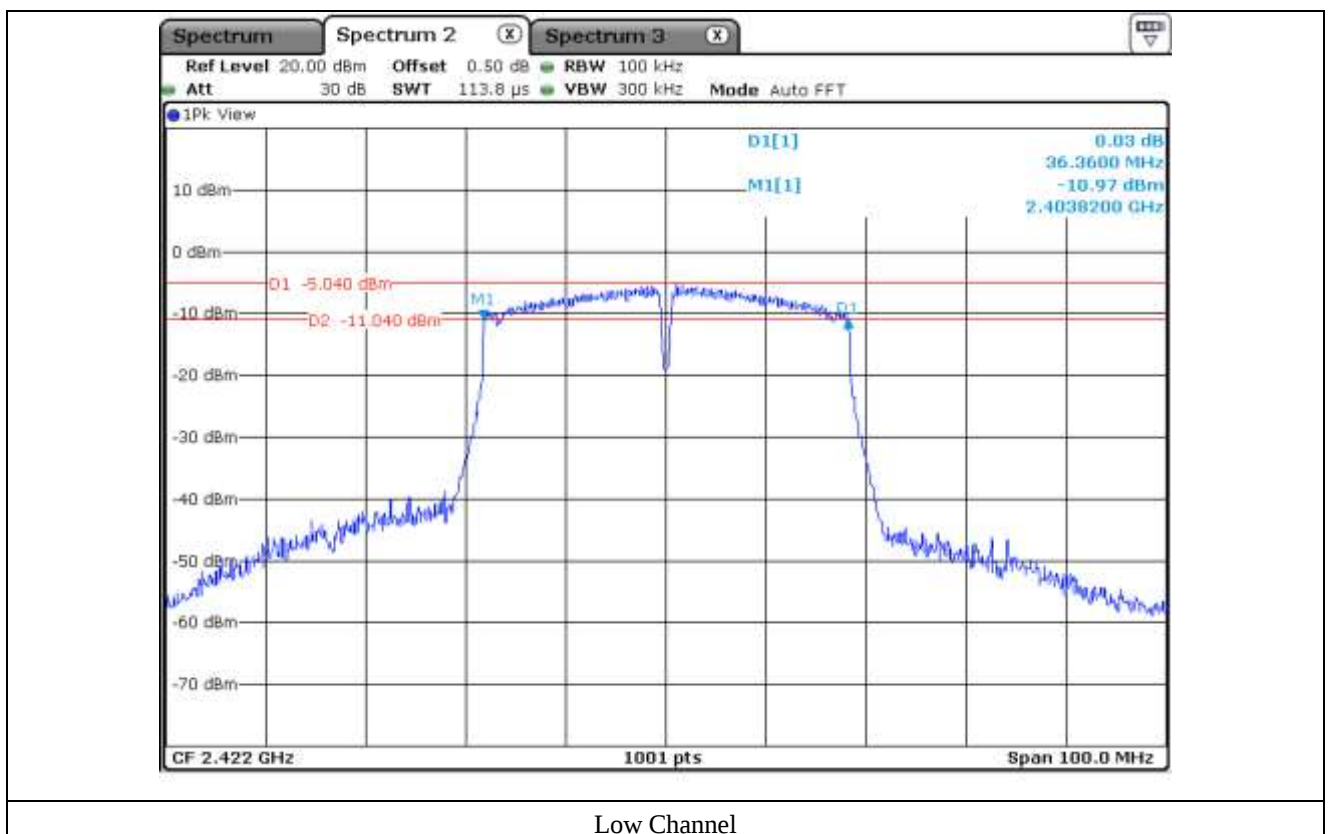
-. Test Result : Pass

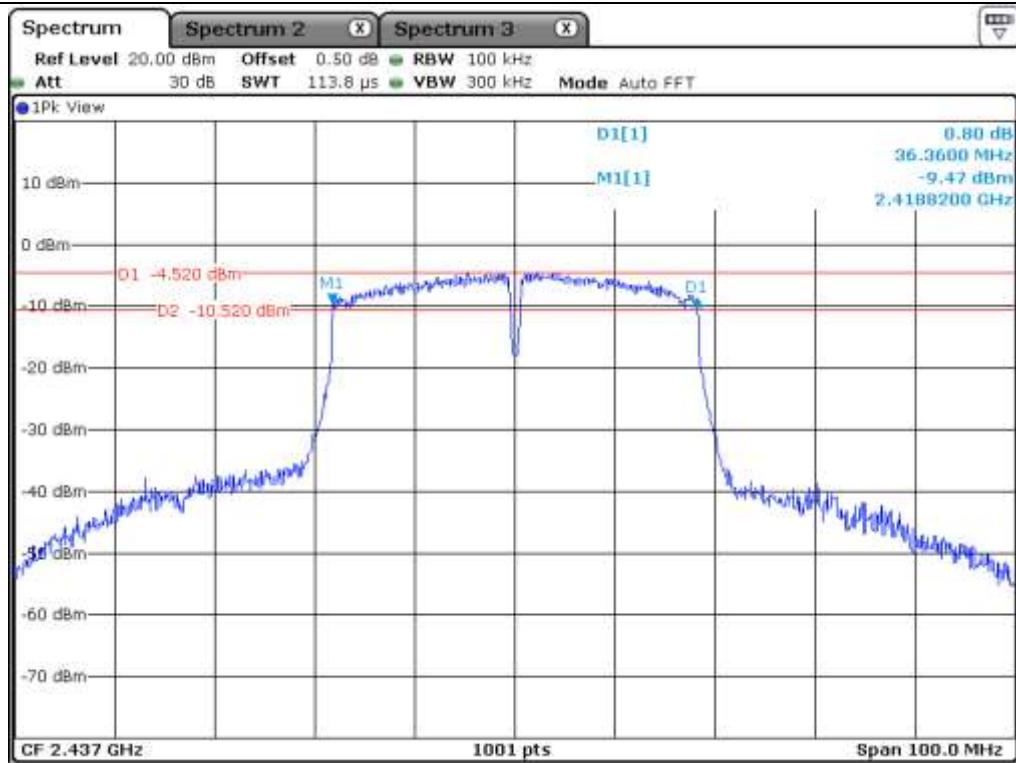
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 422.00	36.36	0.50	35.86
Middle	2 437.00	36.36	0.50	35.96
High 9	2 452.00	36.56	0.50	36.06
High 10	2 457.00	36.56	0.50	36.06
High 11	2 462.00	36.56	0.50	36.06

Remark. Margin = Measured Value - Limit

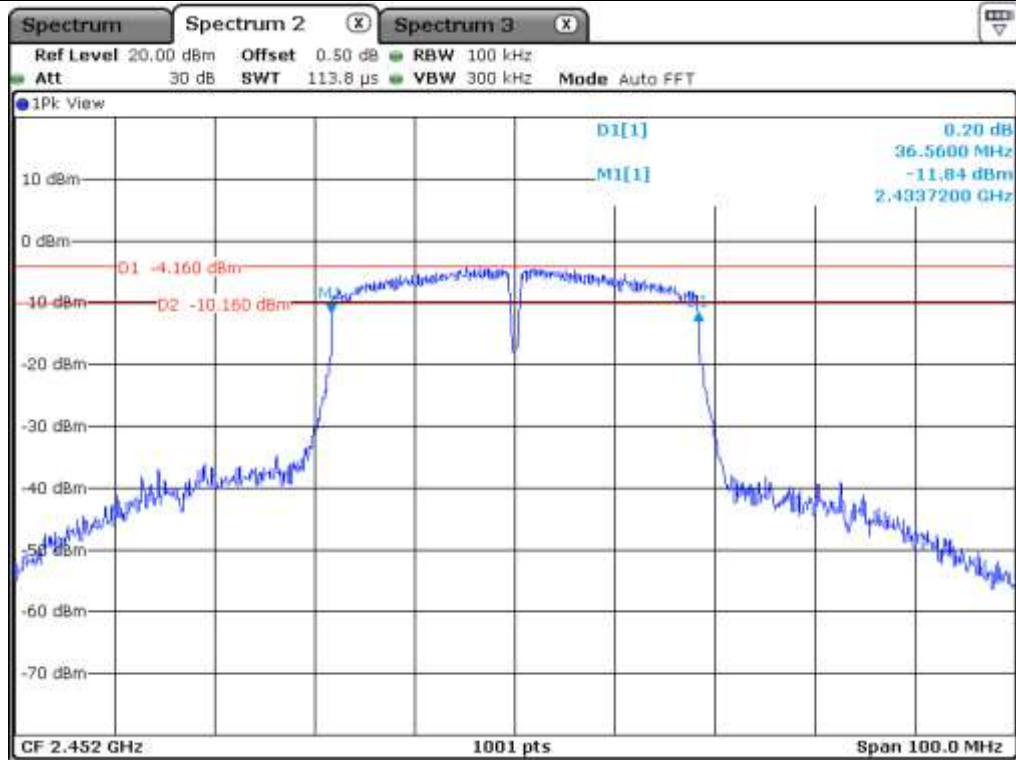


Tested by: Ha-Ram, Lee / Assistant Manager

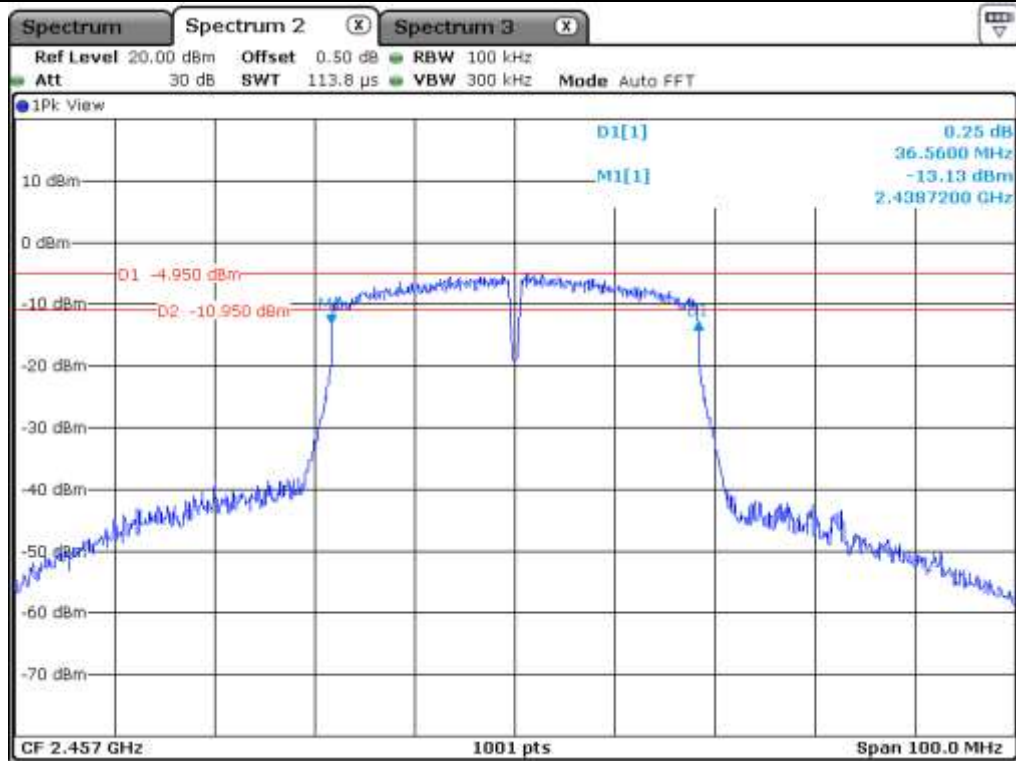




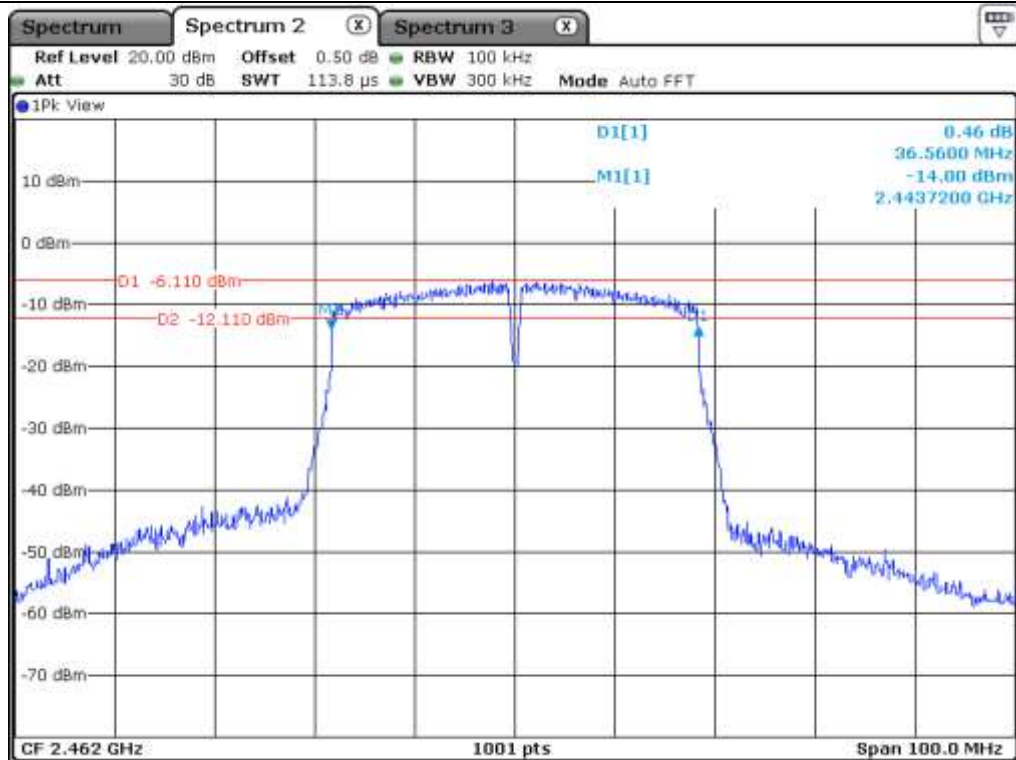
Middle Channel



High Channel 9



High Channel 10



High Channel 11

7.7.2 Test data for Antenna 1

-. Test Date : December 02, 2019 ~ December 11, 2019

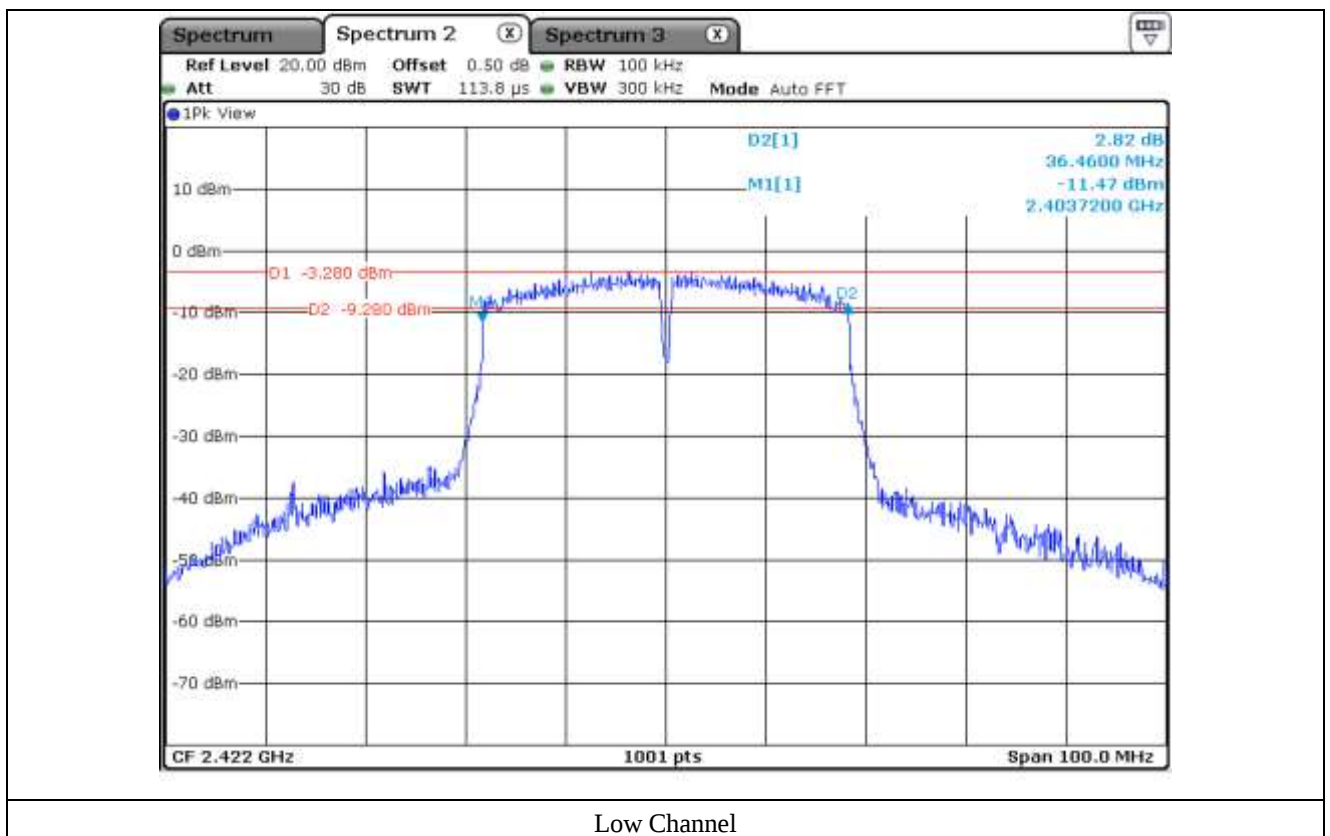
-. Test Result : Pass

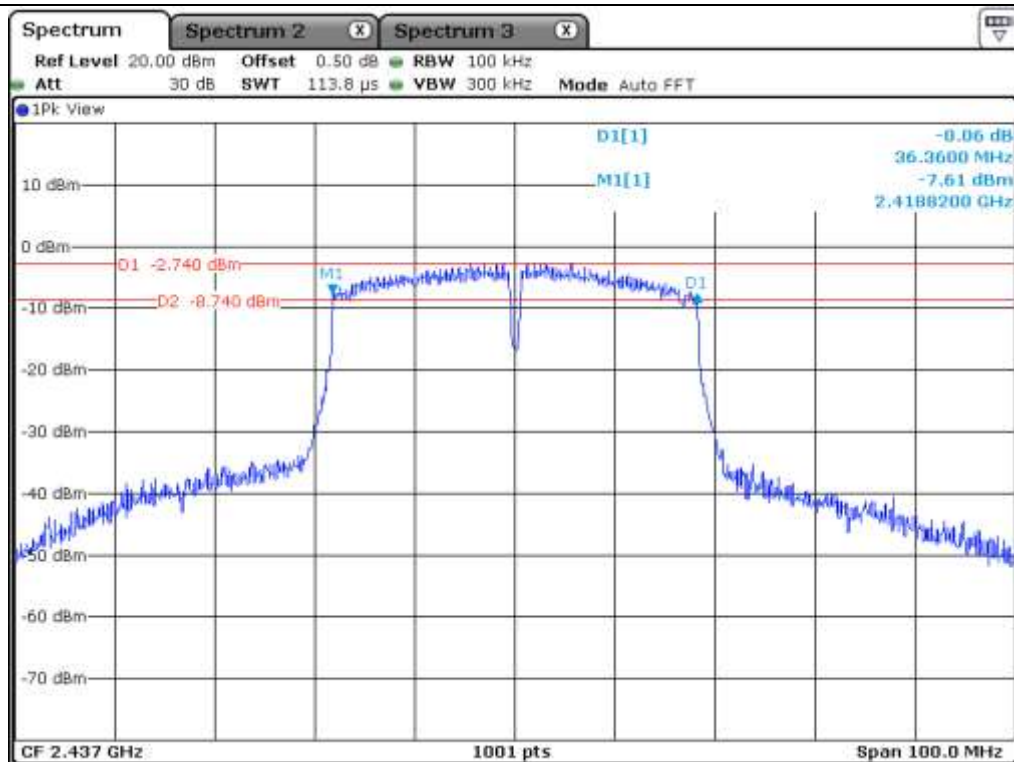
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 422.00	36.46	0.50	35.96
Middle	2 437.00	36.36	0.50	35.86
High 9	2 452.00	36.26	0.50	35.76
High 10	2 457.00	36.46	0.50	35.96
High 11	2 462.00	36.46	0.50	35.96

Remark. Margin = Measured Value - Limit

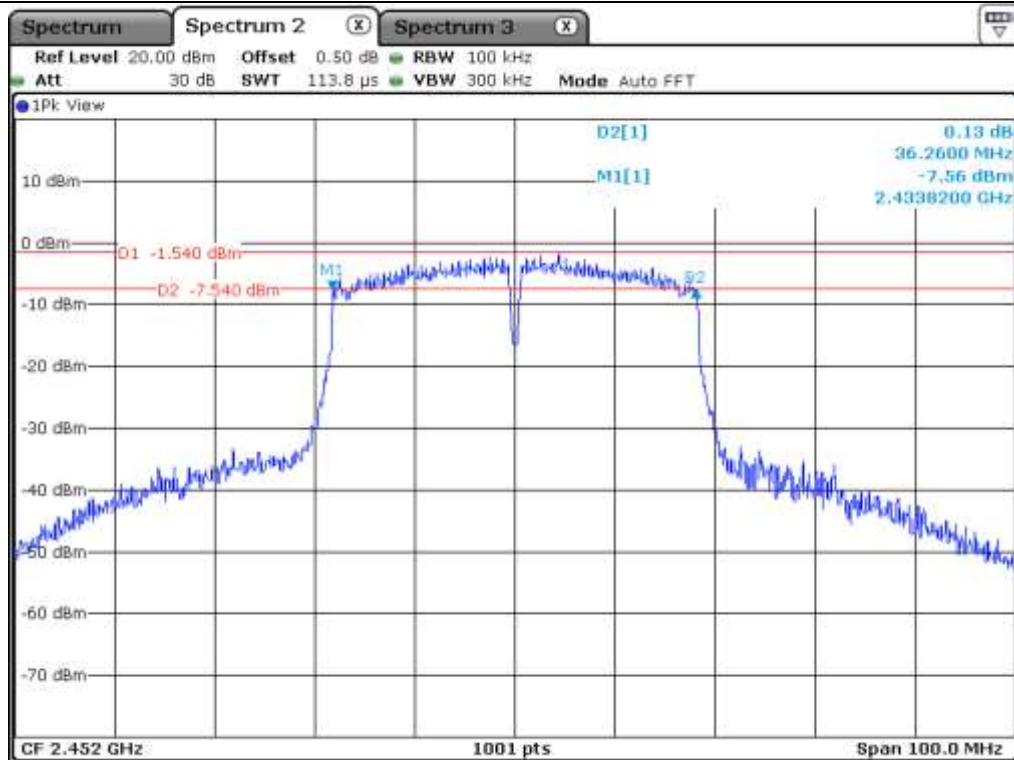


Tested by: Ha-Ram, Lee / Assistant Manager

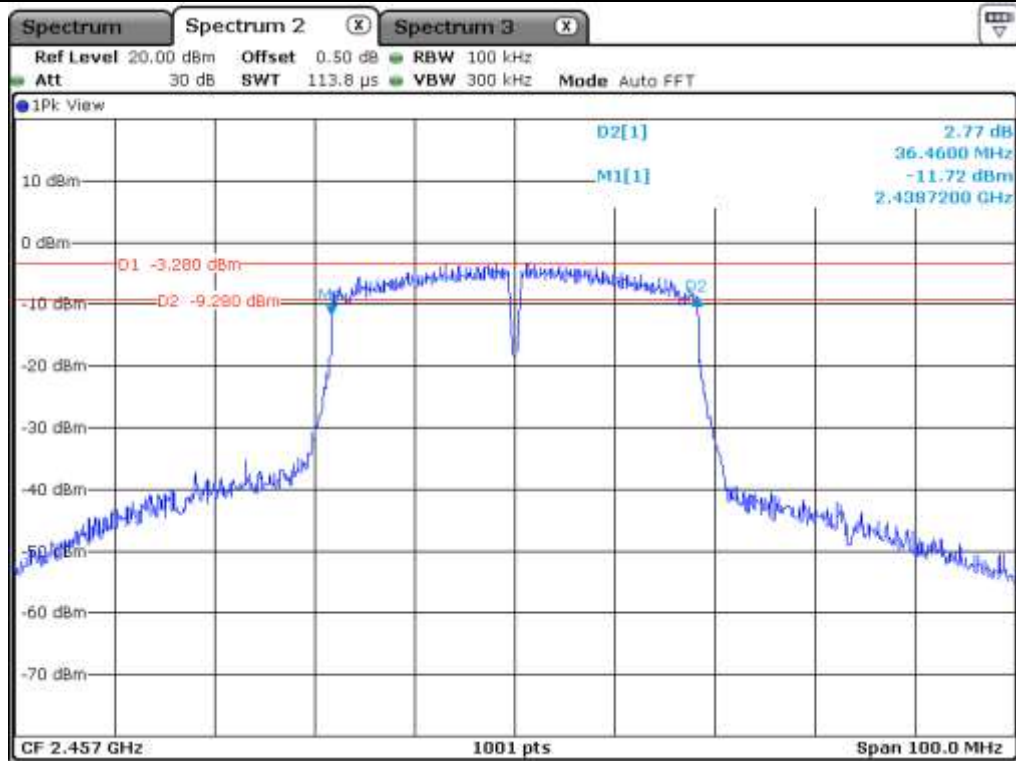




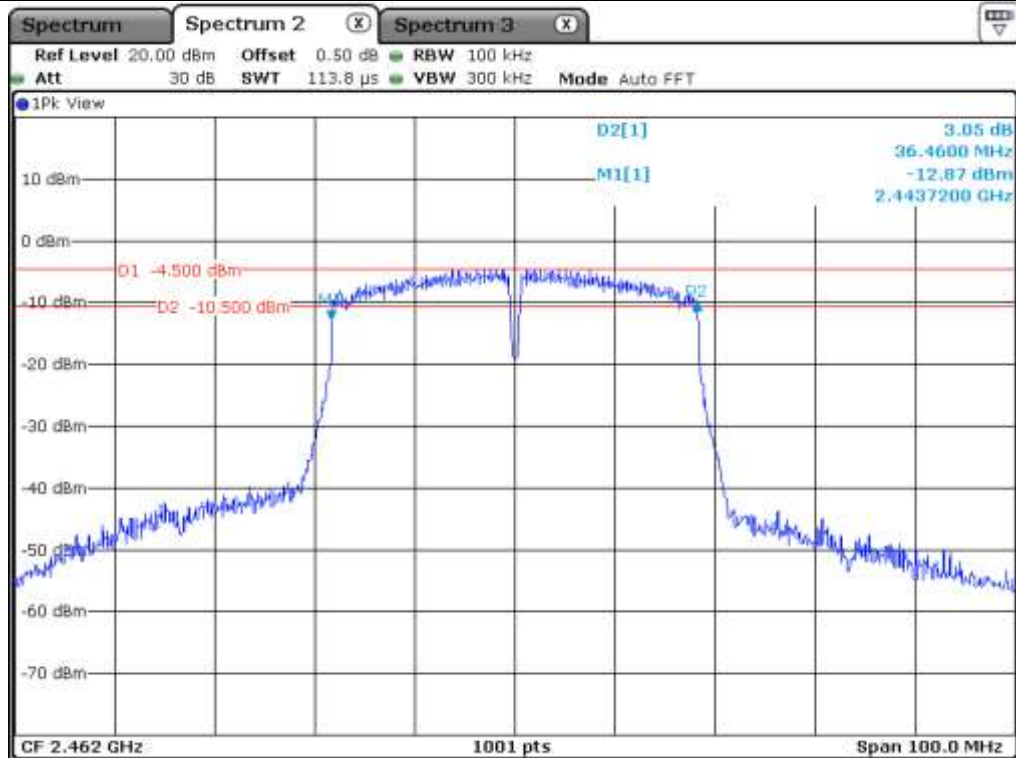
Middle Channel



High Channel 9



High Channel 10



High Channel 11

8. MAXIMUM PEAK OUTPUT POWER

8.1 Operating environment

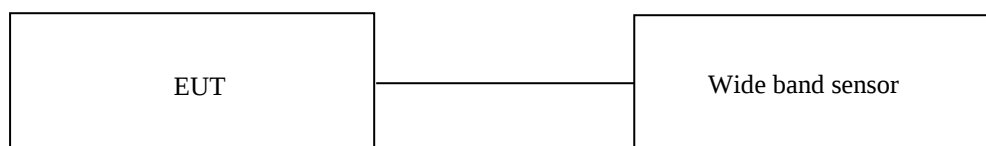
Temperature : 24 °C
Relative humidity : 48 % R.H.

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 equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - NRP-Z81	Rohde & Schwarz	Wide band Sensor	101975	Mar. 12, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

8.4 Test data for 802.11b WLAN Mode

8.4.1 Test data for Antenna 0

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	19.10	30.00	10.90
MIDDLE	2 437.00	19.12	30.00	10.88
HIGH 11	2 462.00	19.25	30.00	10.75
HIGH 12	2 467.00	17.49	30.00	12.51
HIGH 13	2 472.00	13.58	30.00	16.42

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

8.4.2 Test data for Antenna 1

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	20.35	30.00	9.65
MIDDLE	2 437.00	20.53	30.00	9.47
HIGH 11	2 462.00	20.51	30.00	9.49
HIGH 12	2 467.00	18.73	30.00	11.27
HIGH 13	2 472.00	11.83	30.00	18.17

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



Tested by: Ha-Ram, Lee / Assistant Manager

8.5 Test data for 802.11g WLAN Mode

8.5.1 Test data for Antenna 0

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	14.88	30.00	15.12
MIDDLE	2 437.00	14.96	30.00	15.04
HIGH 11	2 462.00	15.07	30.00	14.93
HIGH 12	2 467.00	12.35	30.00	17.65
HIGH 13	2 472.00	10.29	30.00	19.71

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

8.5.2 Test data for Antenna 1

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	15.86	30.00	14.14
MIDDLE	2 437.00	16.02	30.00	13.98
HIGH 11	2 462.00	15.92	30.00	14.08
HIGH 12	2 467.00	13.35	30.00	16.65
HIGH 13	2 472.00	11.50	30.00	18.50

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



Tested by: Ha-Ram, Lee / Assistant Manager

8.5.3 Test data for Multiple Transmit

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	18.41	30.00	11.59
MIDDLE	2 437.00	18.53	30.00	11.47
HIGH 11	2 462.00	18.53	30.00	11.47
HIGH 12	2 467.00	15.89	30.00	14.11
HIGH 13	2 472.00	13.95	30.00	16.05

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



Tested by: Ha-Ram, Lee / Assistant Manager

8.6 Test data for 802.11n_HT20 WLAN Mode

8.6.1 Test data for Antenna 0

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	13.81	30.00	16.19
MIDDLE	2 437.00	13.86	30.00	16.14
HIGH 11	2 462.00	14.01	30.00	15.99
HIGH 12	2 467.00	10.98	30.00	19.02
HIGH 13	2 472.00	10.09	30.00	19.91

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

8.6.2 Test data for Antenna 1

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	14.70	30.00	15.30
MIDDLE	2 437.00	14.99	30.00	15.01
HIGH 11	2 462.00	14.91	30.00	15.09
HIGH 12	2 467.00	12.46	30.00	17.54
HIGH 13	2 472.00	11.30	30.00	18.70

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



Tested by: Ha-Ram, Lee / Assistant Manager

8.6.3 Test data for Multiple Transmit

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	17.29	30.00	12.71
MIDDLE	2 437.00	17.47	30.00	12.53
HIGH 11	2 462.00	17.49	30.00	12.51
HIGH 12	2 467.00	14.79	30.00	15.21
HIGH 13	2 472.00	13.75	30.00	16.25

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



Tested by: Ha-Ram, Lee / Assistant Manager

8.7 Test data for 802.11n_HT40 WLAN Mode

8.7.1 Test data for Antenna 0

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 422.00	10.91	30.00	19.09
MIDDLE	2 437.00	12.14	30.00	17.86
HIGH 9	2 452.00	12.23	30.00	17.77
HIGH 10	2 457.00	11.12	30.00	18.88
HIGH 11	2 462.00	10.23	30.00	19.77

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

8.7.2 Test data for Antenna 1

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 422.00	12.24	30.00	17.76
MIDDLE	2 437.00	13.61	30.00	16.39
HIGH 9	2 452.00	13.29	30.00	16.71
HIGH 10	2 457.00	12.39	30.00	17.61
HIGH 11	2 462.00	11.39	30.00	18.61

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



Tested by: Ha-Ram, Lee / Assistant Manager

8.7.3 Test data for Multiple Transmit

-. Test Date : December 02, 2019 ~ December 11, 2019

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 422.00	14.64	30.00	15.36
MIDDLE	2 437.00	15.95	30.00	14.05
HIGH 9	2 452.00	15.80	30.00	14.20
HIGH 10	2 457.00	14.81	30.00	15.19
HIGH 11	2 462.00	13.86	30.00	16.14

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



Tested by: Ha-Ram, Lee / Assistant Manager

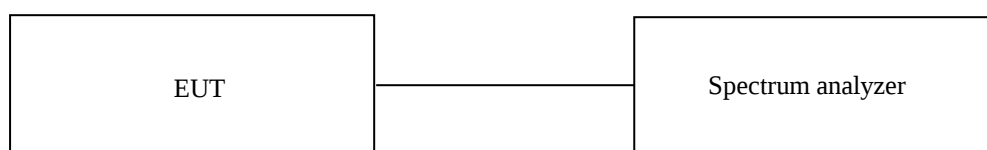
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature : 24 °C
Relative humidity : 48 % 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 equipment used

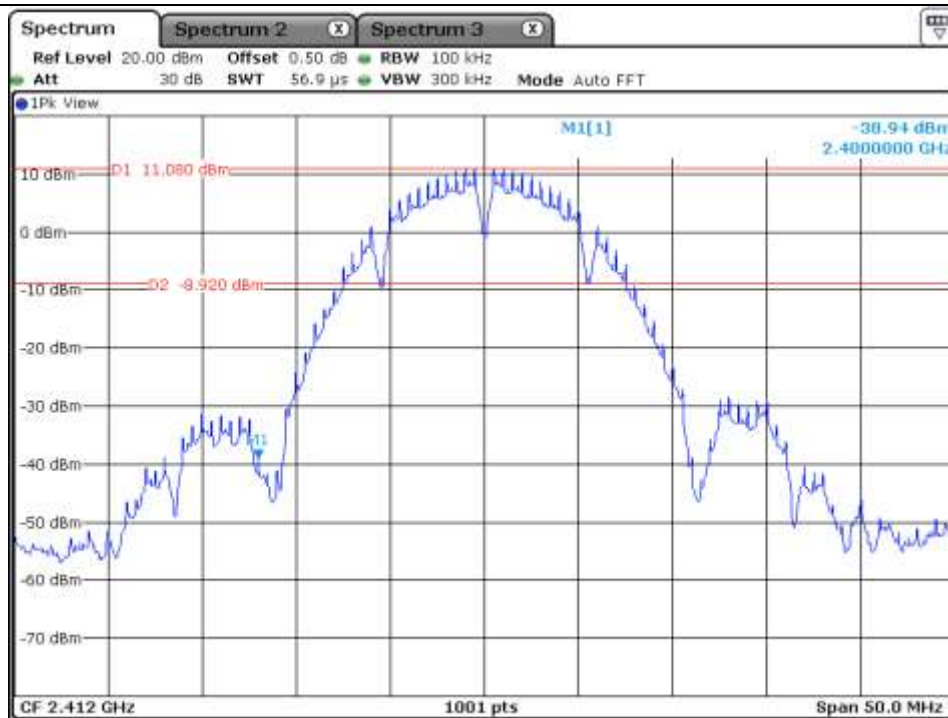
	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101199	Mar. 11, 2019 (1Y)
■ -	ESW	Rohde & Schwarz	EMI Test Receiver	101851	Aug. 07, 2019 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 18, 2019 (1Y)
■ -	DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
■ -	MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 13, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 16, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

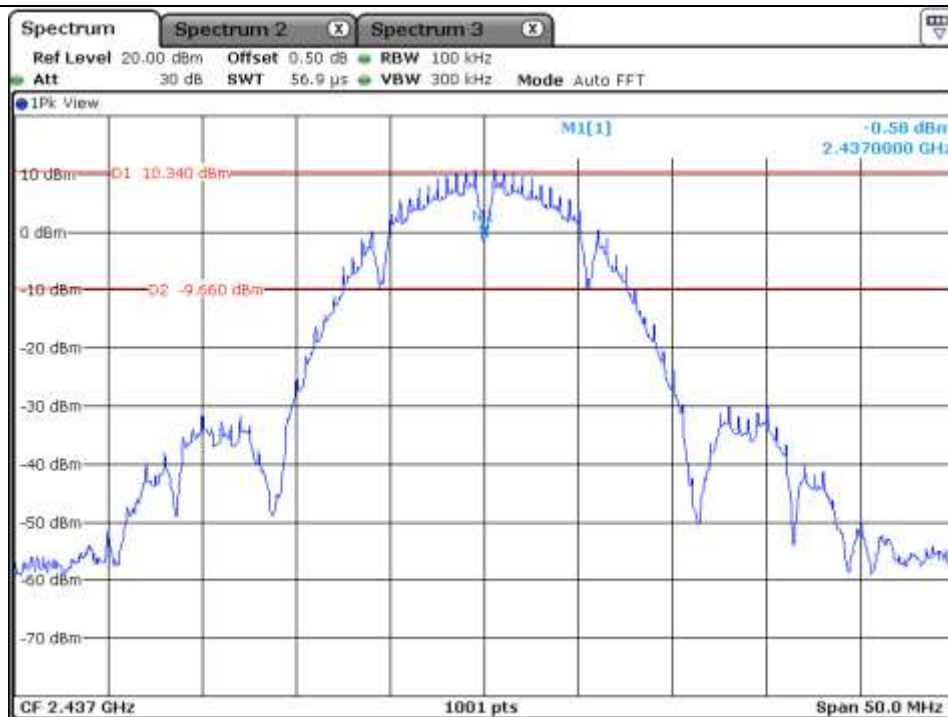
9.5 Test data for conducted emission

9.5.1 Test data for 802.11b WLAN Mode

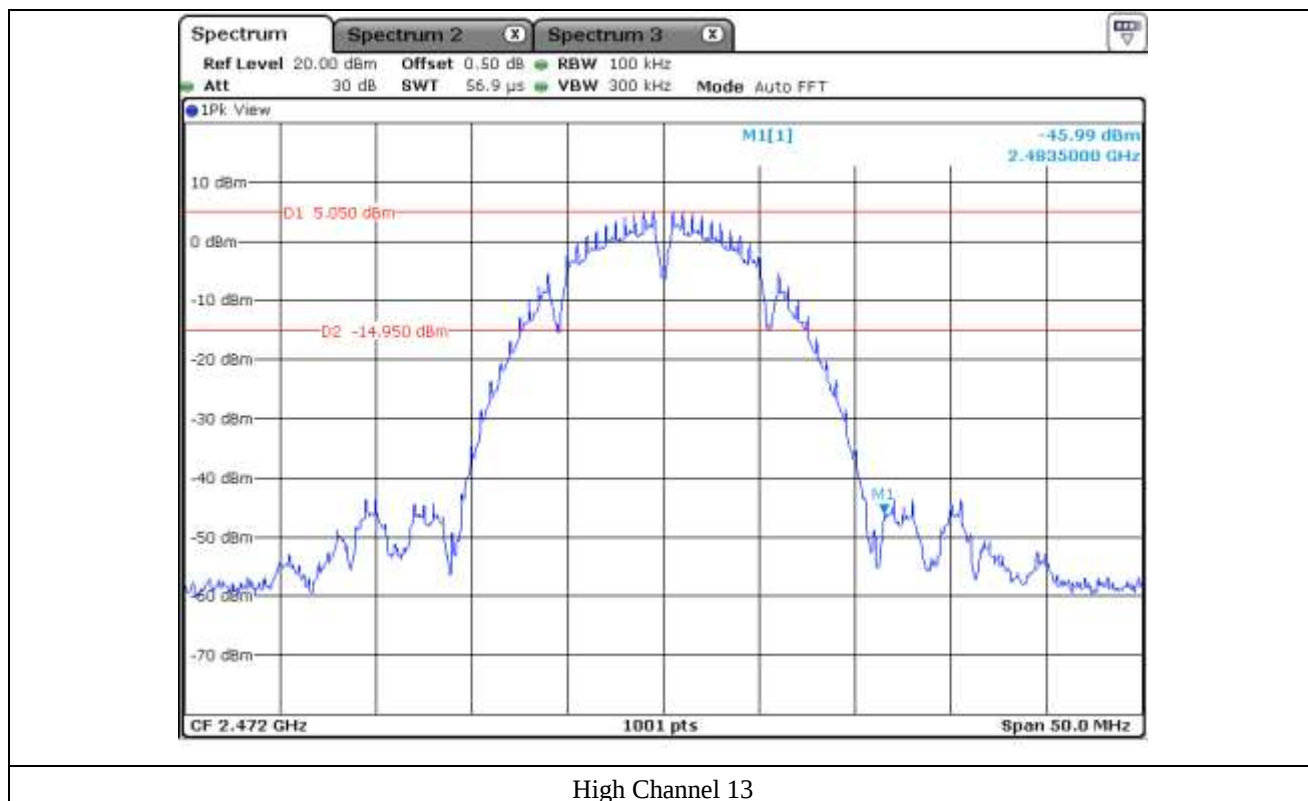
9.5.1.1 Test data for Antenna 0



Low Channel



Middle Channel



High Channel 13