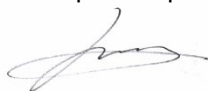


FCC & ISED CERTIFICATION TEST REPORT

Project Number : EA2002C-029
Test Report Number : TR-W2006-011
Type of Equipment : WiFi/BT Combo Module
Model Name : SBW-M3
Equipment Class : DTS - Digital Transmission System
FCC ID : WF5SBWM3
ISED Canada ID : 9080A-SBWM3
Applicant : Aroot Co., Ltd.
Address : 28-6, Gajangsaneopdong-ro, Osan-si, Gyeonggi-do, Republic of Korea
Manufacturer : Aroot Co., Ltd.
Address : 28-6, Gajangsaneopdong-ro, Osan-si, Gyeonggi-do, Republic of Korea
Regulation : FCC Part 15 Subpart C Section 15.247, ISED RSS-247 Issue2
Total page of Report : 124 Pages
Date of Receipt : 2020-02-10
Date of Issue : 2020-06-09
Test Result : PASS

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.

Prepared by	Song, In-young / Senior Engineer		2020-06-09
		Signature	Date
Reviewed by	Choi, Yeong-min / Technical Manager		2020-06-09
		Signature	Date

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Release Control Record

Issue Report No.	Issued Date	Details/Revisions
TR-W2006-011	2020-06-09	Initial Release
-	-	-

1. TEST SUMMARY

1.1 Regulations and results

The sample submitted for evaluation (Hereafter referred to as the EUT) has been tested in accordance with the following regulations or standards.

FCC Reference Section	ISED Reference Section	Description	Result			
			P	F	N.T.	Note
15.247(a)(2)	RSS-247 5.2 a)	6 dB Bandwidth Occupied Bandwidth	P			
15.247(b)(3)	RSS-247 5.4 d)	Maximum peak output power	P			
15.247(d)	RSS-247 5.5	Band Edge Conducted spurious emission	P			
15.247(e)	RSS-247 5.2 b)	Power spectral density	P			
15.205(a) 15.209(a)	RSS 247 5.5 RSS-GEN 8.9	Radiated spurious emissions	P			
15.207(a)	RSS GEN 8.8	AC power line conducted emissions	P			
Remark: P means Passed F means Failed N.T. means Not Tested						

1.2 Test Methodology

The tests mentioned in clause 1.1 in this test report were performed according to FCC CFR 47 Part 2, CFR 47 Part 15 and ANSI C63.10-2013, and RSS-Gen Issue 4.

KDB 558074 D01DTS Meas. Guidance v05r02: Measurement Procedure PK is used for power measurement.

1.3 Additions, deviations, exclusions from standards

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

1.4 Purpose of the test

The test was performed to determine whether the equipment under test fulfills the requirements of the regulation stated in FCC Part 15 Subpart C Section 15.247, RSS-Gen and RSS-247.

1.5 Test Facility

The measurement facilities are located at 135-60 Gyeongchung-daero, Gonjam-eup, Gwangju-si, Gyeonggi-do 12813, Korea. Our test facilities are accredited as a Conformity Assessment Body (CAB) by the FCC and ISED Canada, designated by the RRA (National Radio Research Agency), and accredited by KOLAS (Korea Laboratory Accreditation Scheme) in Korea and approved by TUV Rheinland, TUV SÜD and Korean Register of Shipping according to the requirement of ISO/IEC 17025.

Laboratory Qualification	Registration No.	Mark
FCC	KR0160	
ISED Canada	12721A	
RRA	KR0160	
TUV Rheinland	UA 50314109-0002	
TUV SÜD	CARAT 094465 0004 Rev.00	
Korean Agency for Technology and Standards	KT733	
KOREAN REGISTER OF SHIPPING	PCT40841-TL001	

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2. EUT (Equipment Under Test) INFORMATION

2.1 General Description

The Aroot Co., Ltd., Model SBW-M3 (referred to as the EUT in this report) is a WiFi/BT Combo Module, which has 3 Equipment Class, DSS, DTS, and NII. This test report covers DTS portion only and other functions are covered by other test report. The product specification described herein was obtained from product data sheet or user's manual.

Equipment Class	DTS – Digital Transmission System
Operating Frequency	(Bluetooth LE) 2 402 MHz ~ 2 480 MHz (WLAN 802.11b/g/n HT20) 2 412 MHz ~ 2 462 MHz (WLAN 802.11n HT40): 2 422 MHz ~ 2 452 MHz
Max. RF Output Power	(Bluetooth LE): (WLAN 802.11b/g/n HT20/HT40):
Modulation Types	(Bluetooth LE): GFSK (WLAN 802.11b): DSSS (DBPSK/DQPSK/CCK) (WLAN 802.11g/n HT20/HT40): OFDM (BPSK/QPSK/16QAM/64QAM)
Number of Channels	(Bluetooth LE) 40 channels (WLAN 802.11b/g/n HT20) 11 channels (WLAN 802.11n HT40): 7 channels
Channel Spacing	(Bluetooth LE) 2 MHz (WLAN 802.11b/g/n HT20/HT40) 5 MHz
Generated or used Freq. in EUT	32.768 kHz, 37.4 MHz
Type of Antenna	■ Integrated Type(BLE / Chip antenna) ■ Dedicated Type(WLAN / FPCB antenna)
Antenna Gain	(Bluetooth LE) 2.07dBi (WLAN 802.11b/g/n HT20/HT40) 3.37 dBi
Operating Temperature	- 20 °C ~ + 85 °C
Normal Test Voltage	DC 3.3 V
Electrical Rating	DC 3.3 V
Test SW Version	(Bluetooth LE) Broadcom BlueTool v1.9.4.5 (WLAN) DBGMon DC1650-SDK
Software Version	Ver 1.0
Hardware Version	Ver 1.0

2.2 Additional Model

None

2.3 Available channel number and frequency

Operating Mode: Bluetooth LE, 2 MHz Channel Spacing					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2 402	14	2 430	28	2 458
1	2 404	15	2 432	29	2 460
2	2 406	16	2 434	30	2 462
3	2 408	17	2 436	31	2 464
4	2 410	18	2 438	32	2 466
5	2 412	19	2 440	33	2 468
6	2 414	20	2 442	34	2 470
7	2 416	21	2 444	35	2 472
8	2 418	22	2 446	36	2 474
9	2 420	23	2 448	37	2 476
10	2 422	24	2 450	38	2 478
11	2 424	25	2 452	39	2 480
12	2 426	26	2 454		
13	2 428	27	2 456		

Operating Mode: 802.11 b/g/n HT20/HT40, 5 MHz Channel Spacing					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2 412	5	2 432	9	2 452
2	2 417	6	2 437	10	2 457
3	2 422	7	2 442	11	2 462
4	2 427	8	2 447		

3. TEST CONDITION

3.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description	Model No.	Serial No.	Manufacturer.
WiFi/BT Combo Module (EUT)	SBW-M3	N/A	Aroot Co., Ltd.
Notebook PC	15s-du0069TU	CND9503W22	HP
Adapter for Notebook PC	TPN-CA14	N/A	Chicony Power Technology (Chongqing) Co., Ltd.

3.2 Mode of operation during the test

Software used to control the EUT for staying in continuous transmitting mode is programmed.

The used modulation type for the testing is GFSK and BPSK (DSSS & OFDM)

3.3 Preliminary Testing for Worst case configuration

For finding worst case configuration and operating mode, preliminary testing was performed and radiated emission and conducted emission tests were performed with the EUT set to transmit and receive at the channel with the highest output power as worst case scenario. All spurious emission tests were performed in X, Y and Z axis direction. And the worst Y-axis (9 kHz ~ 30 MHz), Y-axis (30 MHz ~ 1 GHz, above 1 GHz) test condition was recorded in this test report.

Based on preliminary testing following operating modes were selected for the final test as listed below.

3.3.1 Conducted & Radiated Test Channel and Frequency

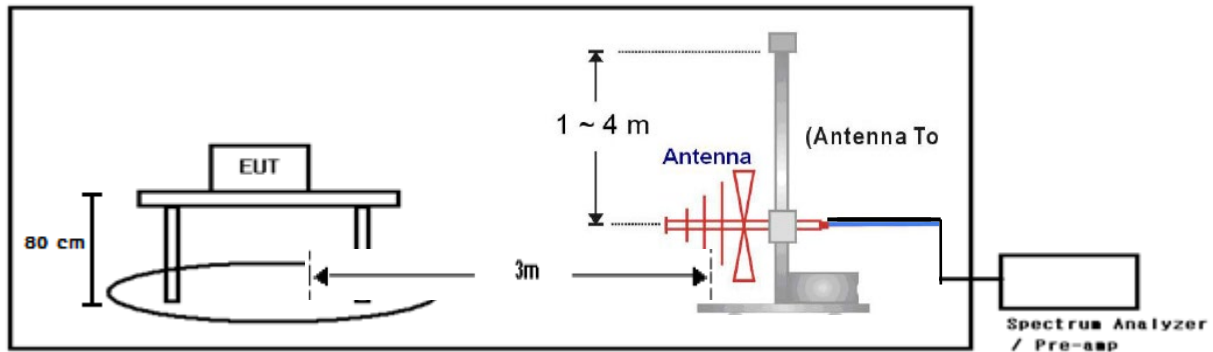
Operating Mode	Channel	Frequency (MHz)	Data rate (Mbps)	Output Power (dBm)
BLE	0	2 402	1	4.51
	19	2 440	1	5.06
	39	2 480	1	4.34
802.11b	1	2 412	1	11.82
	6	2 437	1	11.92
	11	2 462	1	11.84
802.11g	1	2 412	6	10.63
	6	2 437	6	10.65
	11	2 462	6	10.54
802.11n HT20	1	2 412	6.5	8.95
	6	2 437	6.5	8.97
	11	2 462	6.5	8.93

Operating Mode	Channel	Frequency (MHz)	Data rate (Mbps)	Output Power (dBm)
802.11n HT40	3	2 422	13.5	6.88
	6	2 437	13.5	6.94
	9	2 452	13.5	6.88

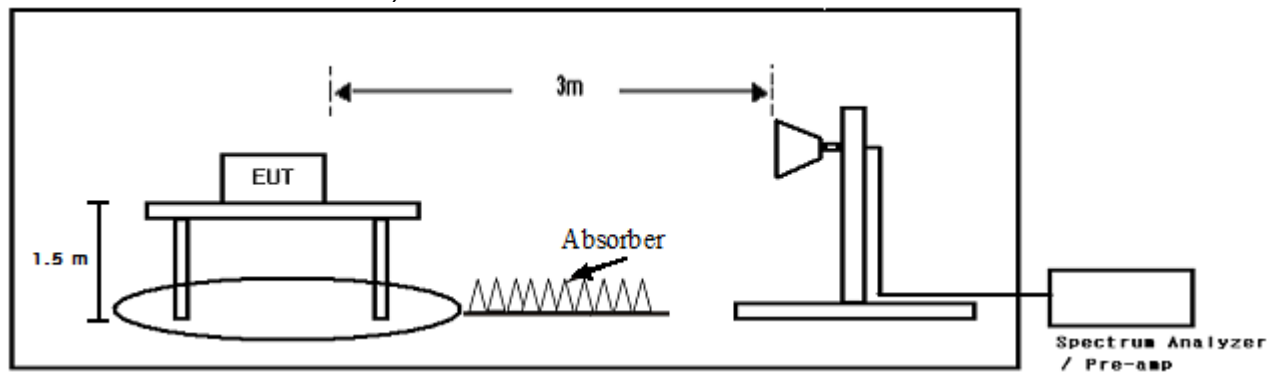
3.3.2 AC Power-Line Conducted Emission Test Mode

Operating Mode	Tested Channel	Data rate (Mbps)	Output Power (dBm)
BLE	19	1	5.06
802.11b	11	1	11.92

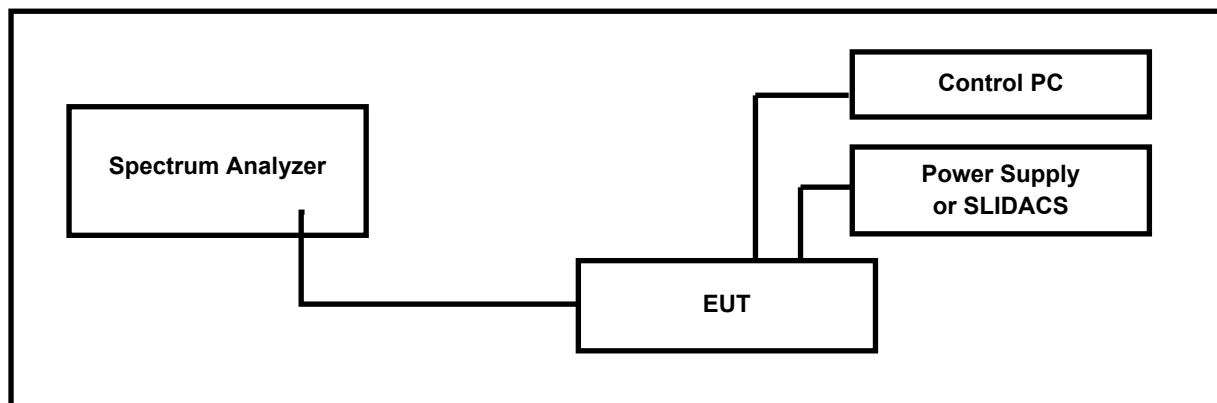
3.4 Test Setup Drawing (Radiated Test below 1 GHz)



(Radiated Test above 1 GHz)



(Conducted Test)



3.5 EUT Modifications

- No EMC Relevant Modifications were performed by this test laboratory.

4. ANTENNA REQUIREMENT

According to FCC CFR 47 Part 15 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provision of this section.

4.1 Antenna Description

Frequency Band (GHz)	Antenna Type	Max Peak Gain (dBi)	Connector Type
2.4 – 2.485	Chip Antenna	2.07	-
2.4 – 2.485	PCB Pattern Antenna	3.37	IPEX

4.2 Conclusion

The antenna connector type of the EUT is Chip and PCB Pattern Antenna, so the EUT met the requirement.

5. TEST RESULT

5.1 6 dB Bandwidth

5.1.1 Limit

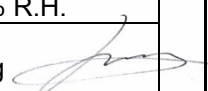
The minimum 6 dB bandwidth shall be at least 500 kHz acc to Section 15.247 (a) (2), and RSS-247 5.2 (a).

5.1.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v05r02: 8.2

The transmitter output is connected to a spectrum analyzer with the RBW set to 100 kHz, VBW $\geq 3 \times$ RBW, peak detector and max hold.

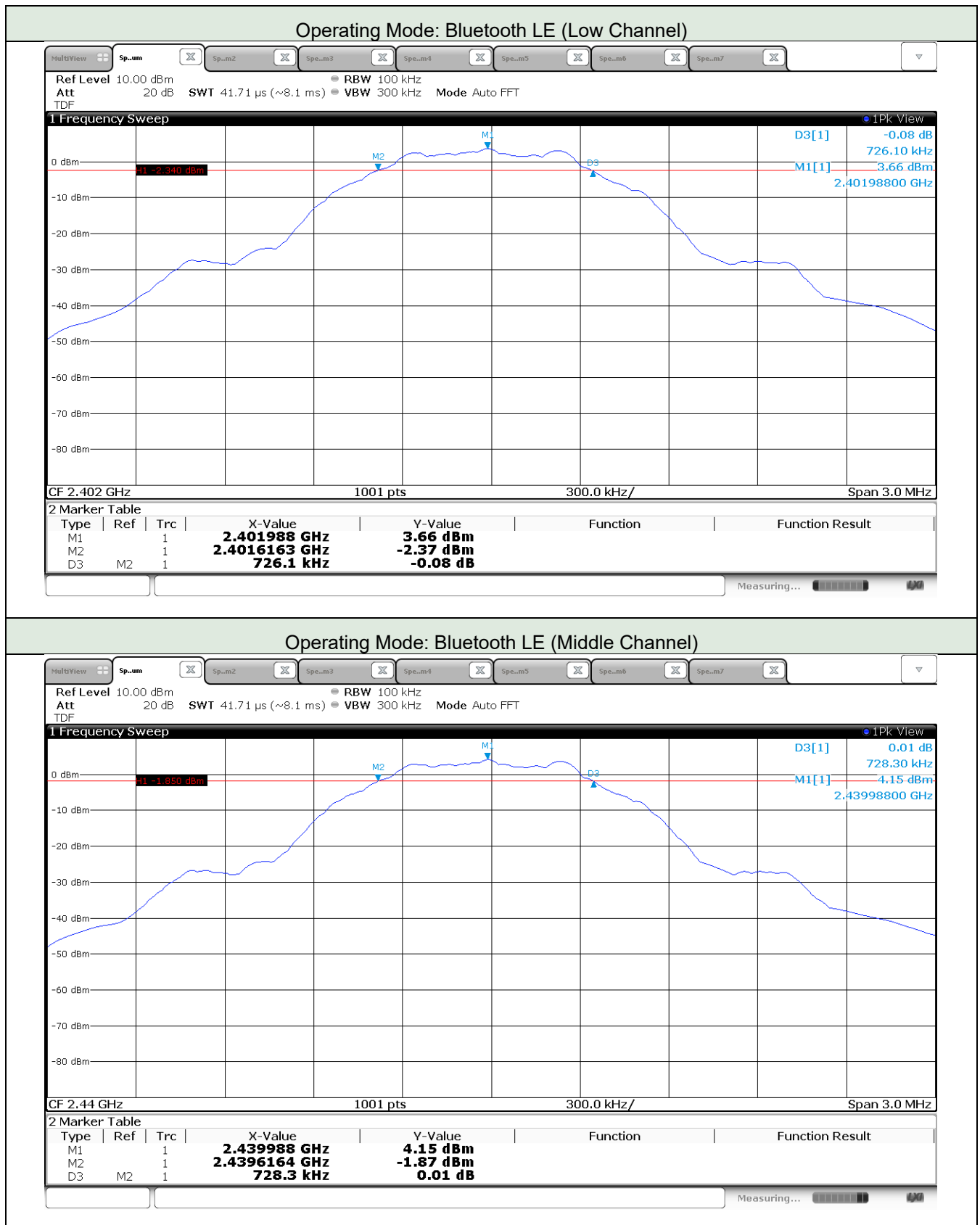
5.1.3 Test Data

Date of Test	2020-04-07	Temperature	(21.0 $\pm$ 0.9) °C
		Relative humidity	(39.0 $\pm$ 0.4) % R.H.
Test Result	PASS	Tested by	In-yong, Song 
Operating Mode: Bluetooth LE			
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2 402	0.726	0.5
Middle	2 440	0.728	
High	2 480	0.734	

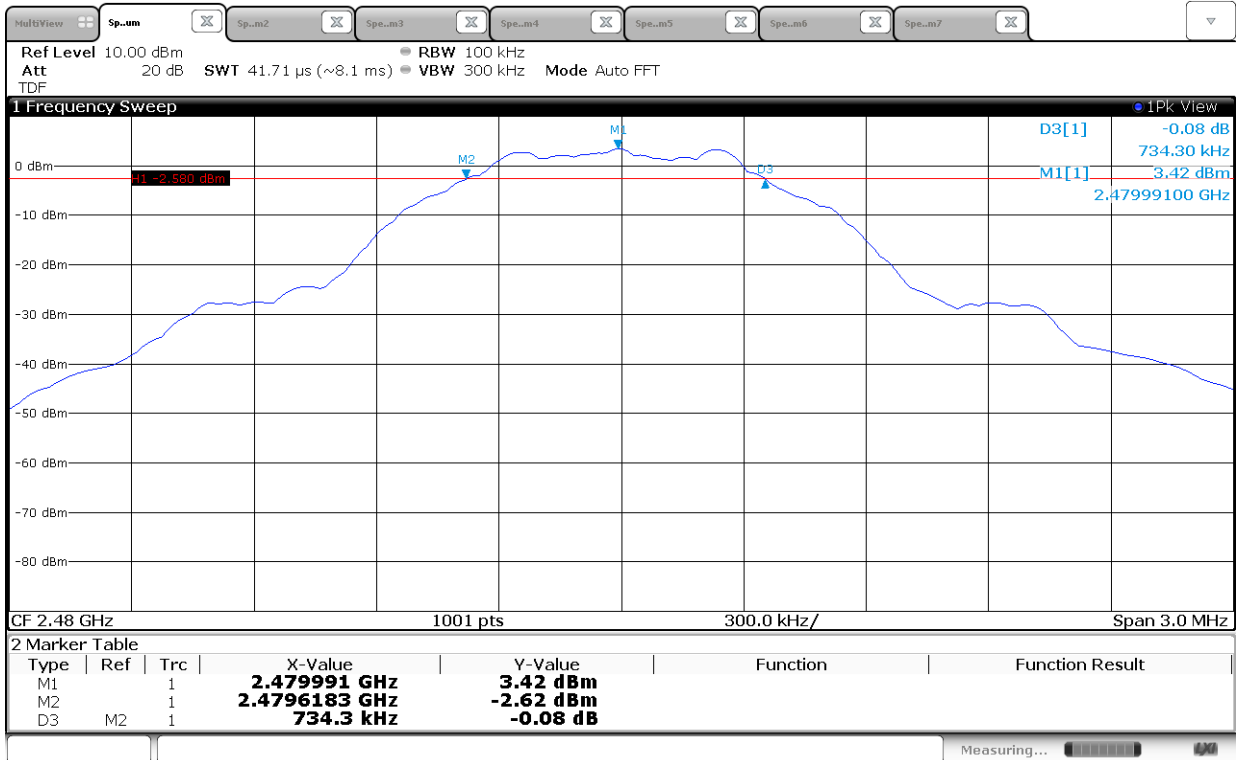
Operating Mode: WLAN 802.11b			
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2 412	9.111	0.5
Middle	2 437	9.111	
High	2 462	9.111	
Operating Mode: WLAN 802.11g			
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2 412	16.424	0.5
Middle	2 437	16.424	
High	2 462	16.416	
Operating Mode: WLAN 802.11n HT20			
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2 412	17.671	0.5
Middle	2 437	17.662	
High	2 462	17.655	

Operating Mode: WLAN 802.11n HT40			
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2 422	36.463	0.5
Middle	2 437	36.383	
High	2 452	36.463	

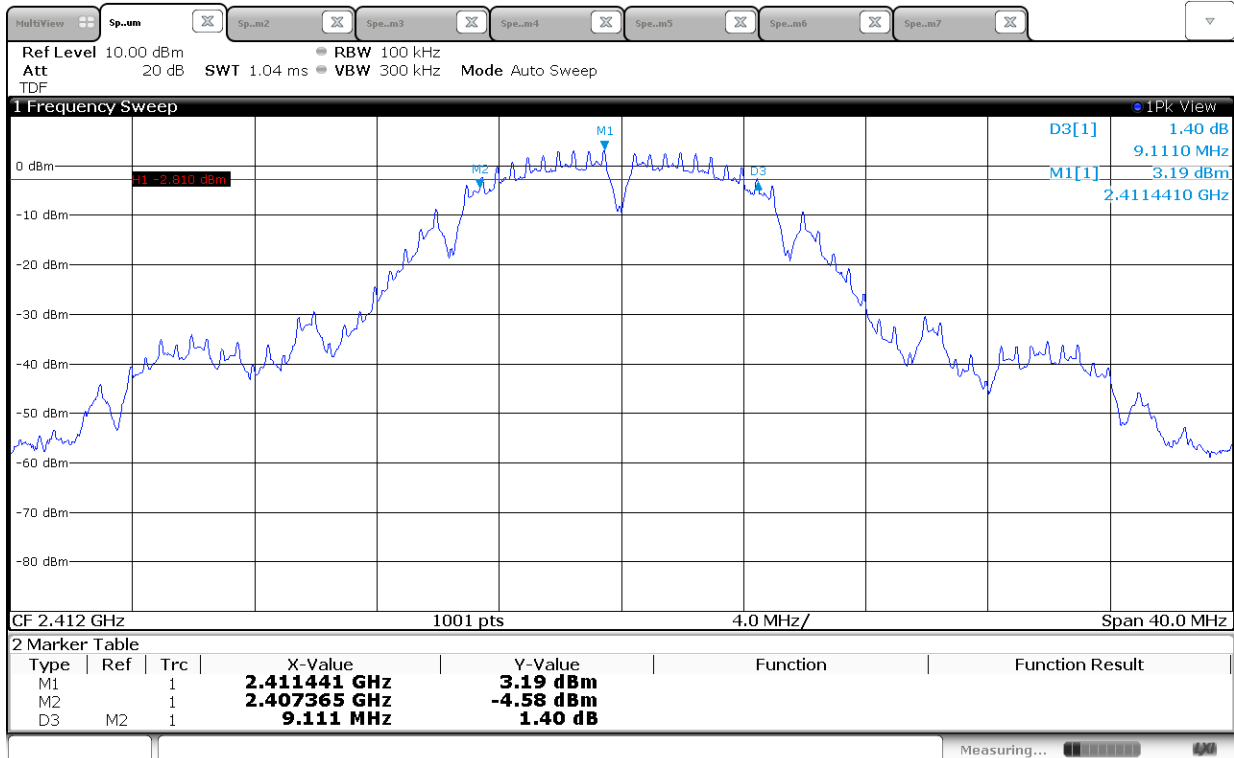
5.1.4 Test Plots



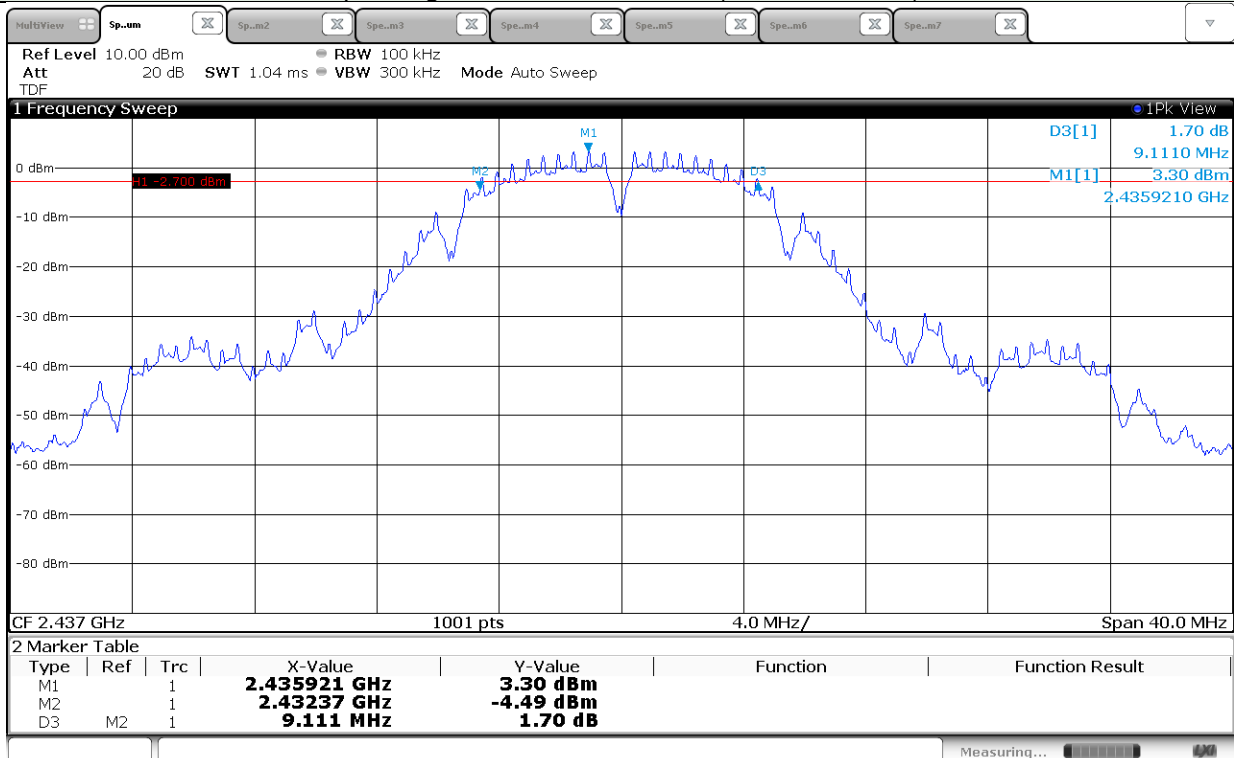
Operating Mode: Bluetooth LE (High Channel)



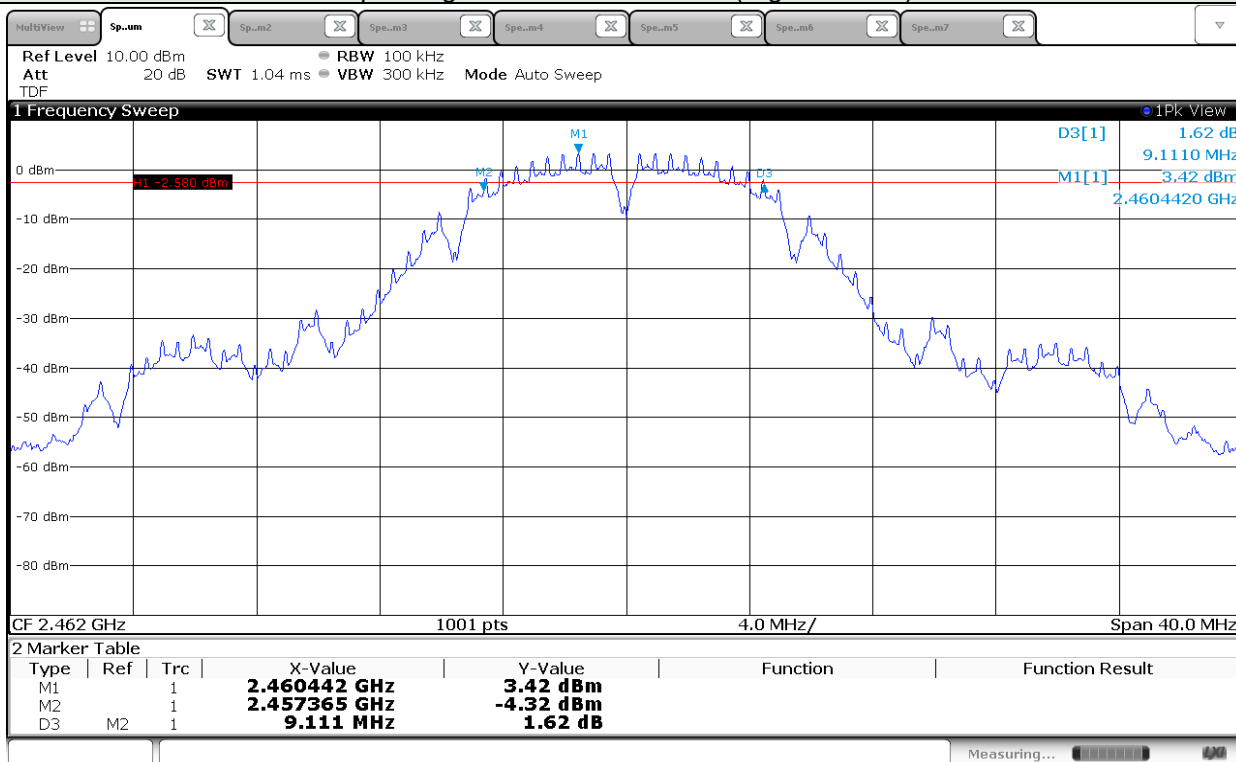
Operating Mode: WLAN 802.11b (Low Channel)



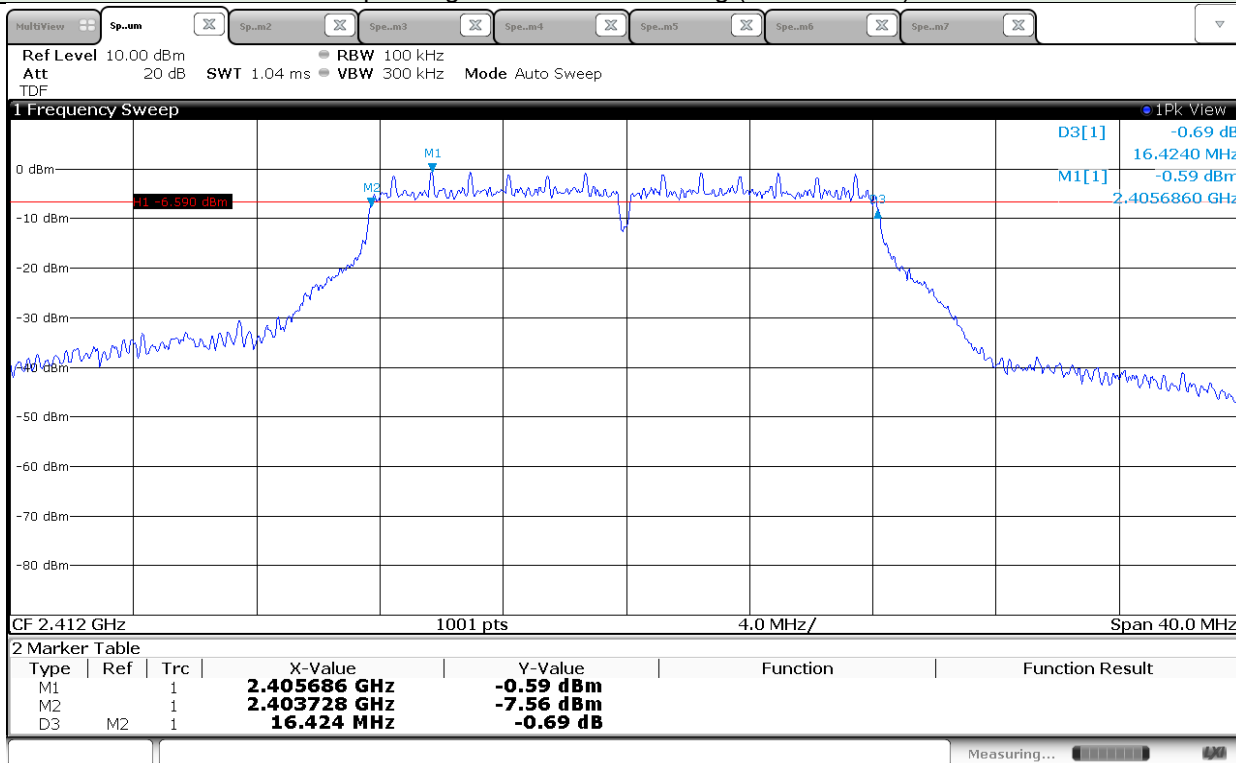
Operating Mode: WLAN 802.11b (Middle Channel)



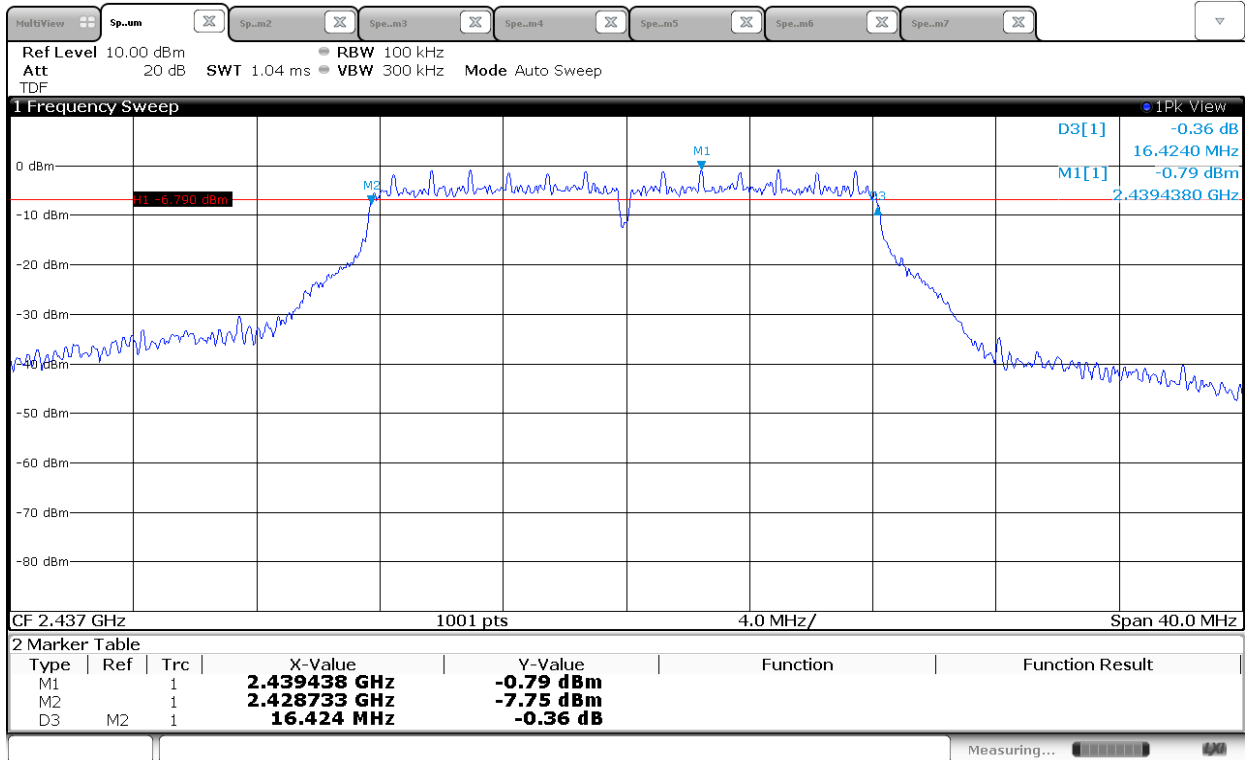
Operating Mode: WLAN 802.11b (High Channel)



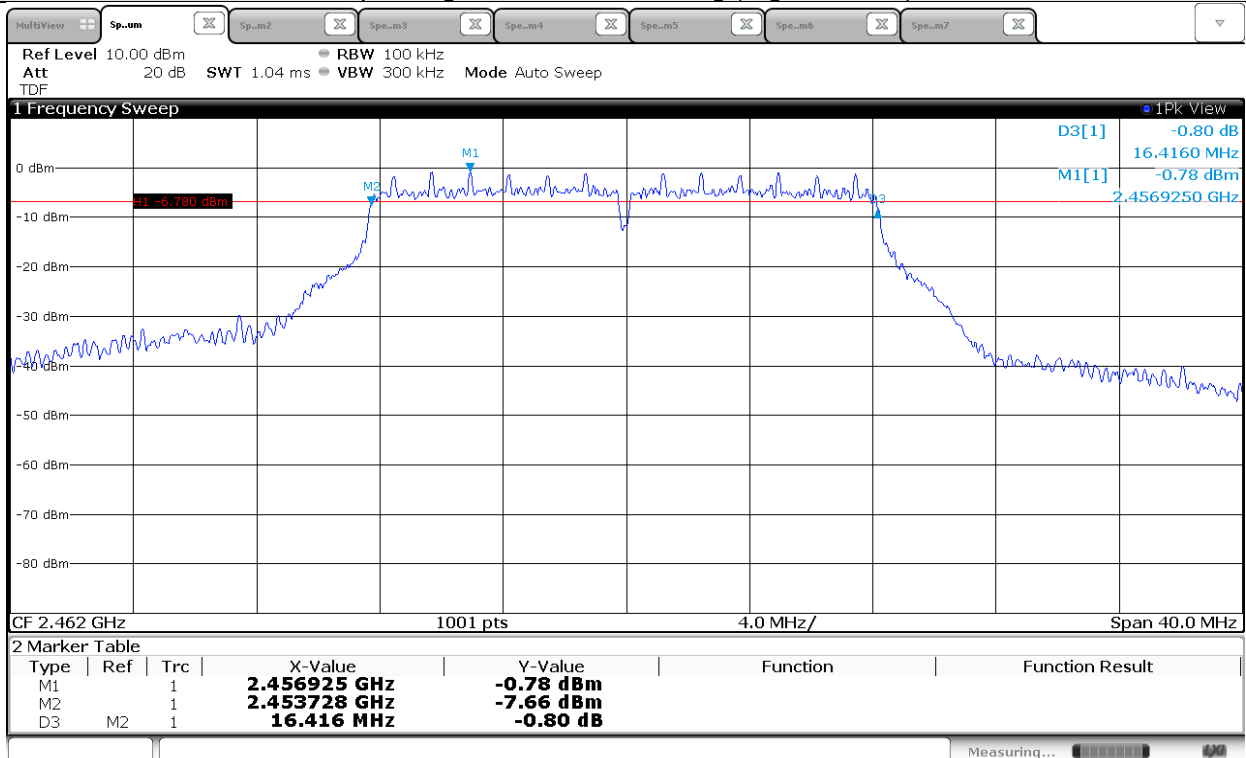
Operating Mode: WLAN 802.11g (Low Channel)



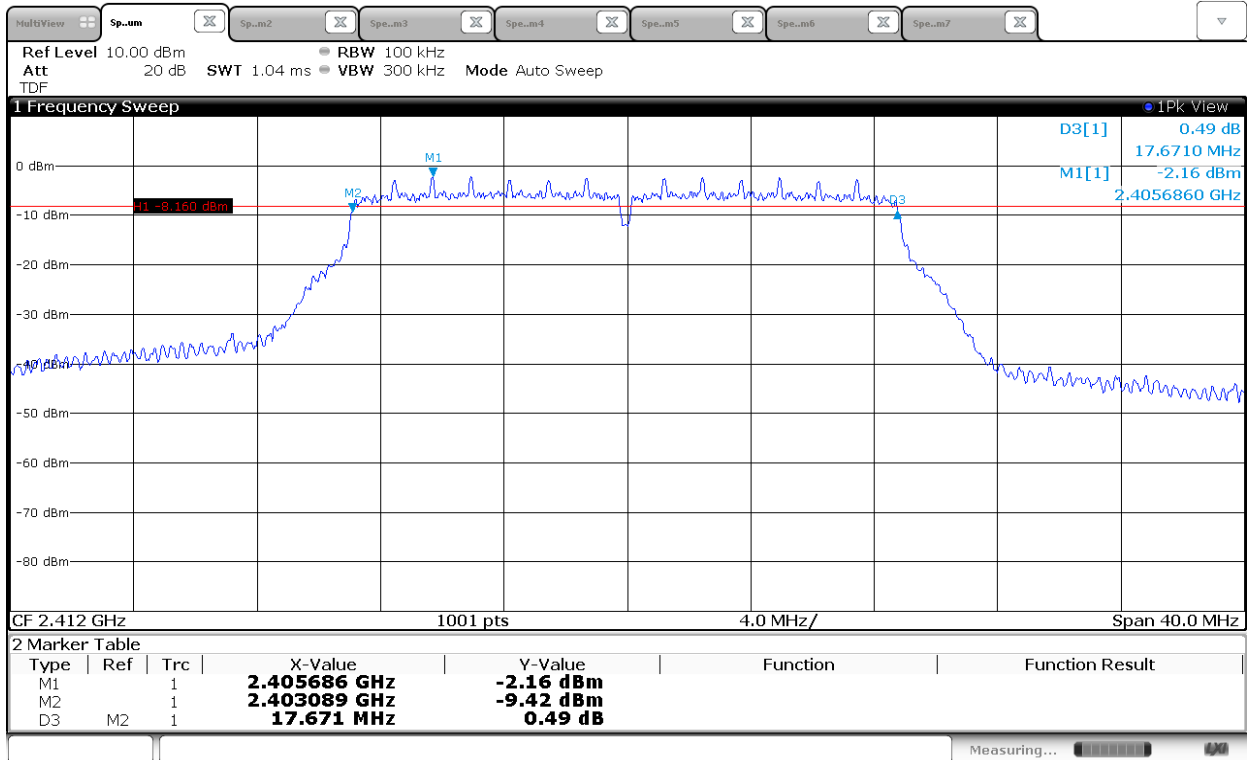
Operating Mode: WLAN 802.11g (Middle Channel)



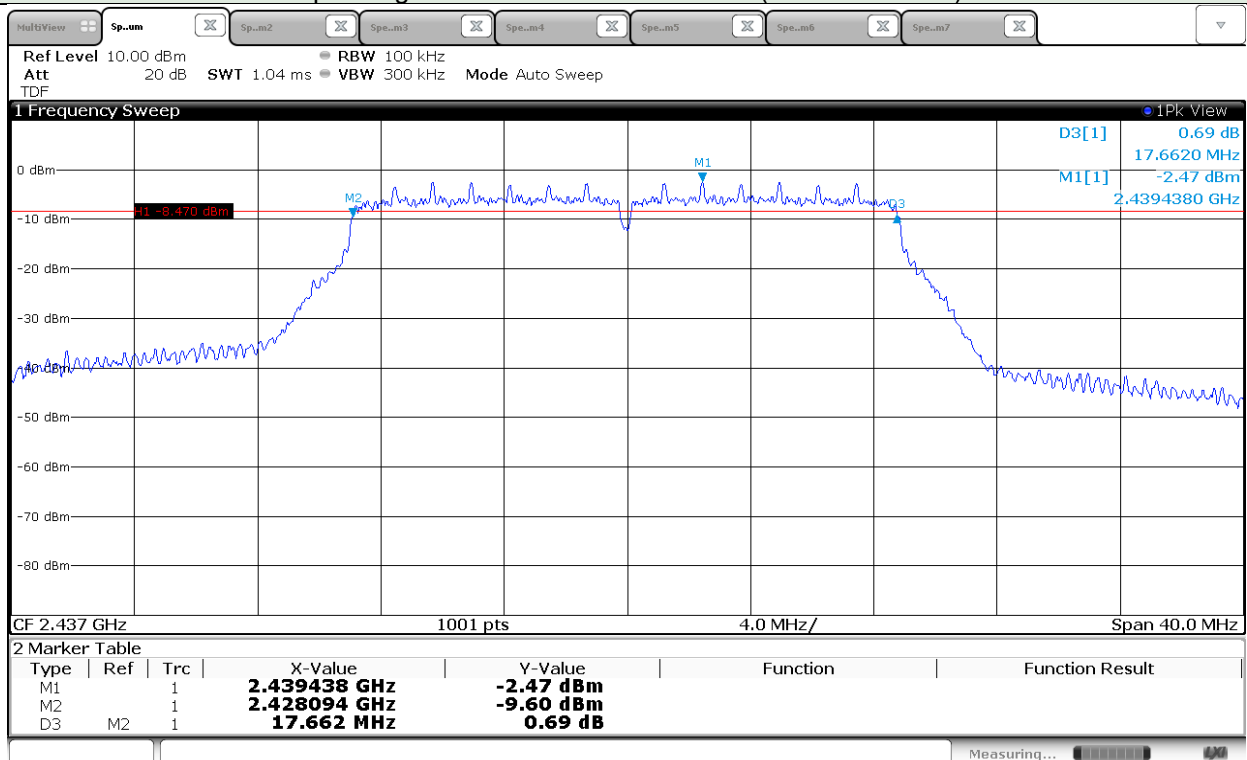
Operating Mode: WLAN 802.11g (High Channel)

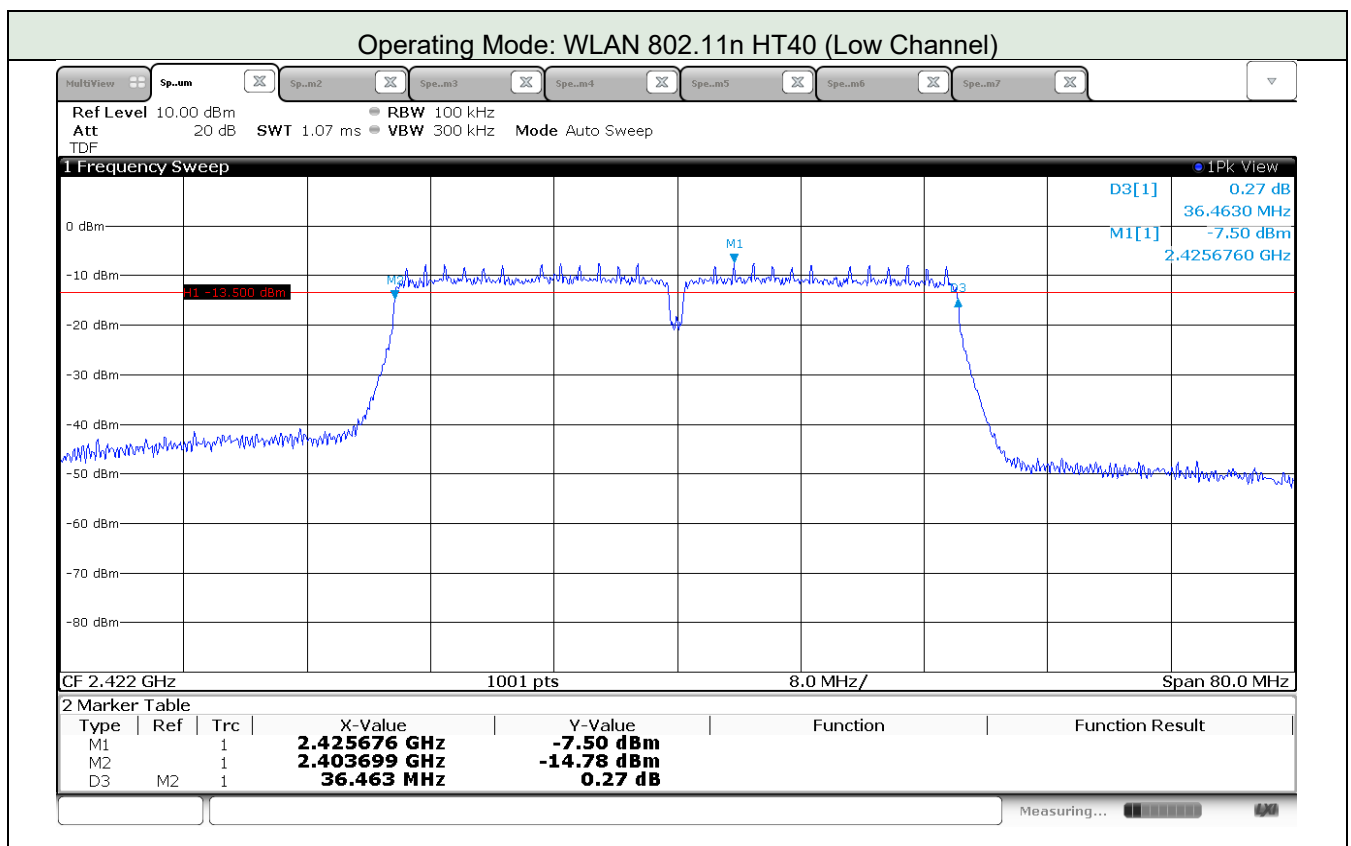
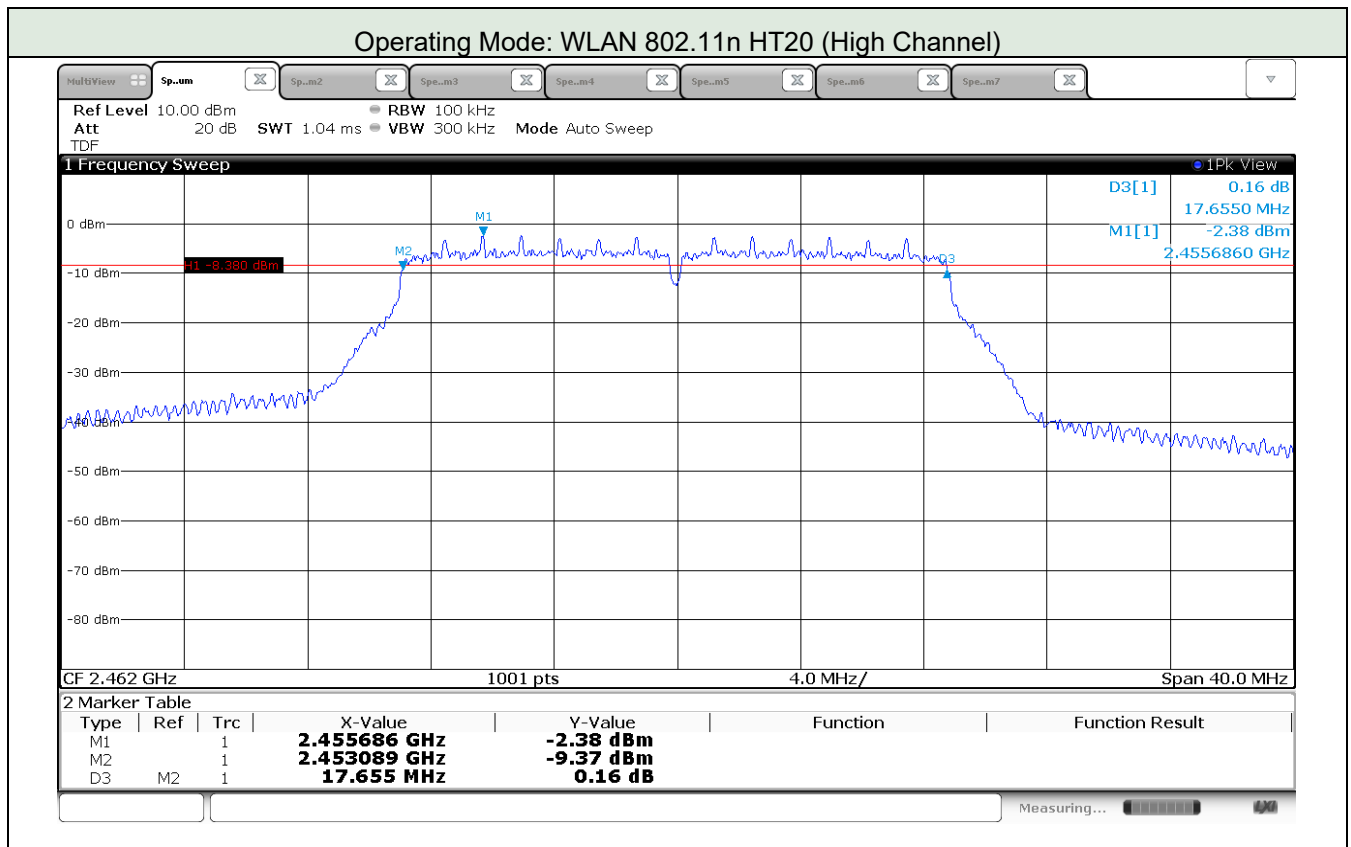


Operating Mode: WLAN 802.11n HT20 (Low Channel)

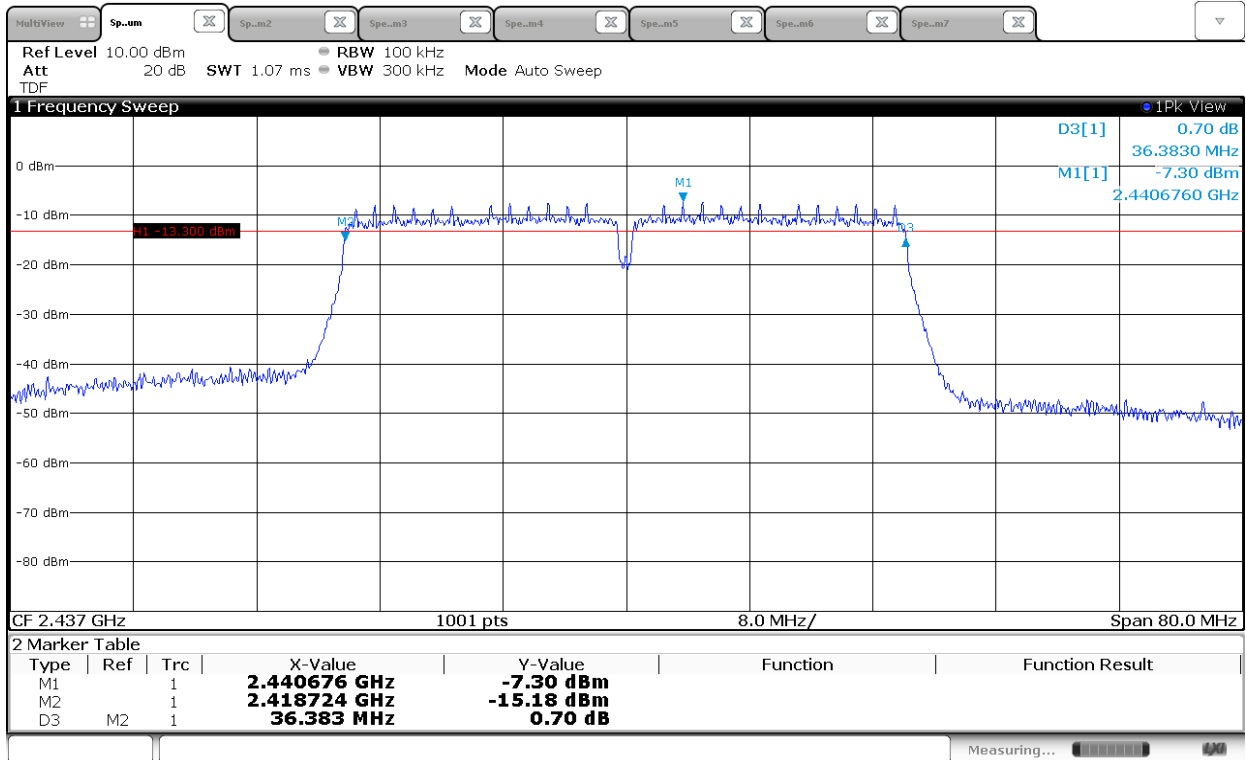


Operating Mode: WLAN 802.11n HT20 (Middle Channel)

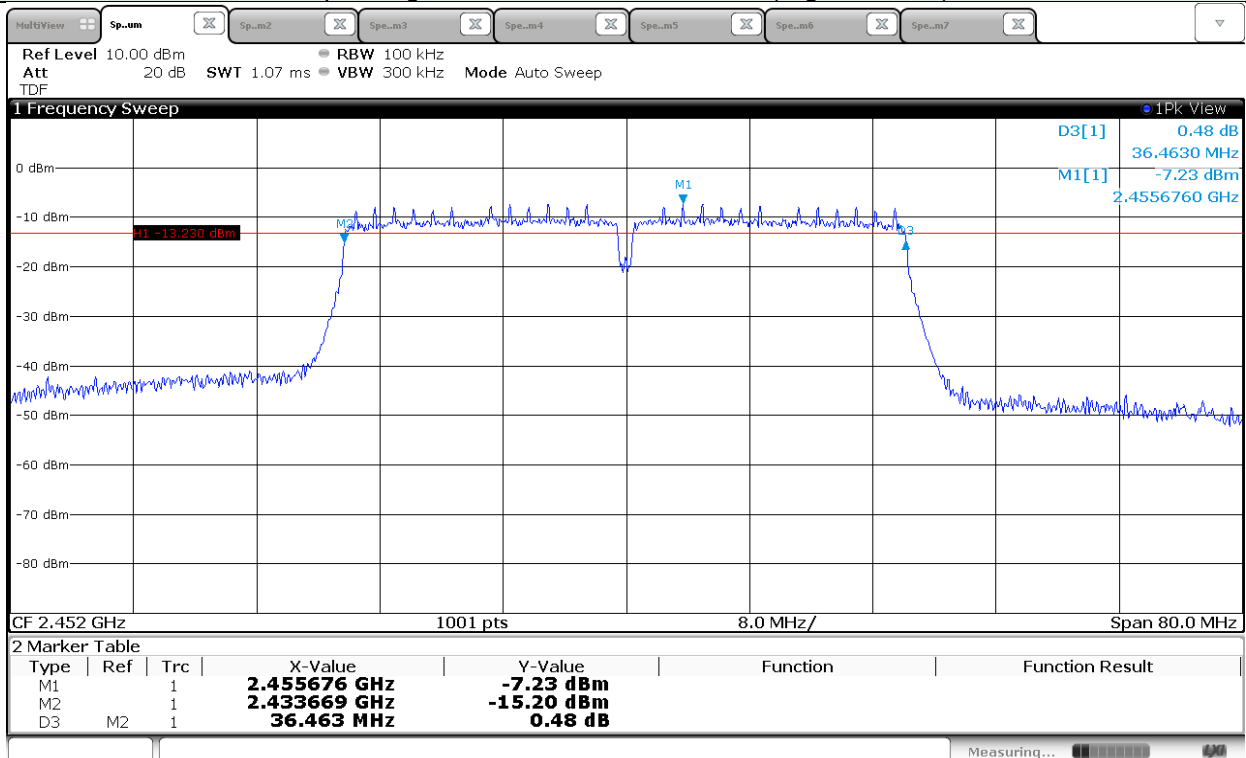




Operating Mode: WLAN 802.11n HT40 (Middle Channel)



Operating Mode: WLAN 802.11n HT40 (High Channel)



5.2 99 % Bandwidth

5.2.1 Limit

Not applicable.

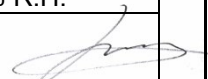
5.2.2 Method of Measurement

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1 % to 5 % of the OBW.

The span is set to capture all products of the modulation process, including the emission skirts.

The VBW is set to 3 times the RBW. The sweep time is coupled and peak detection and max hold mode is used. The spectrum analyzer internal 99% bandwidth function is utilized.

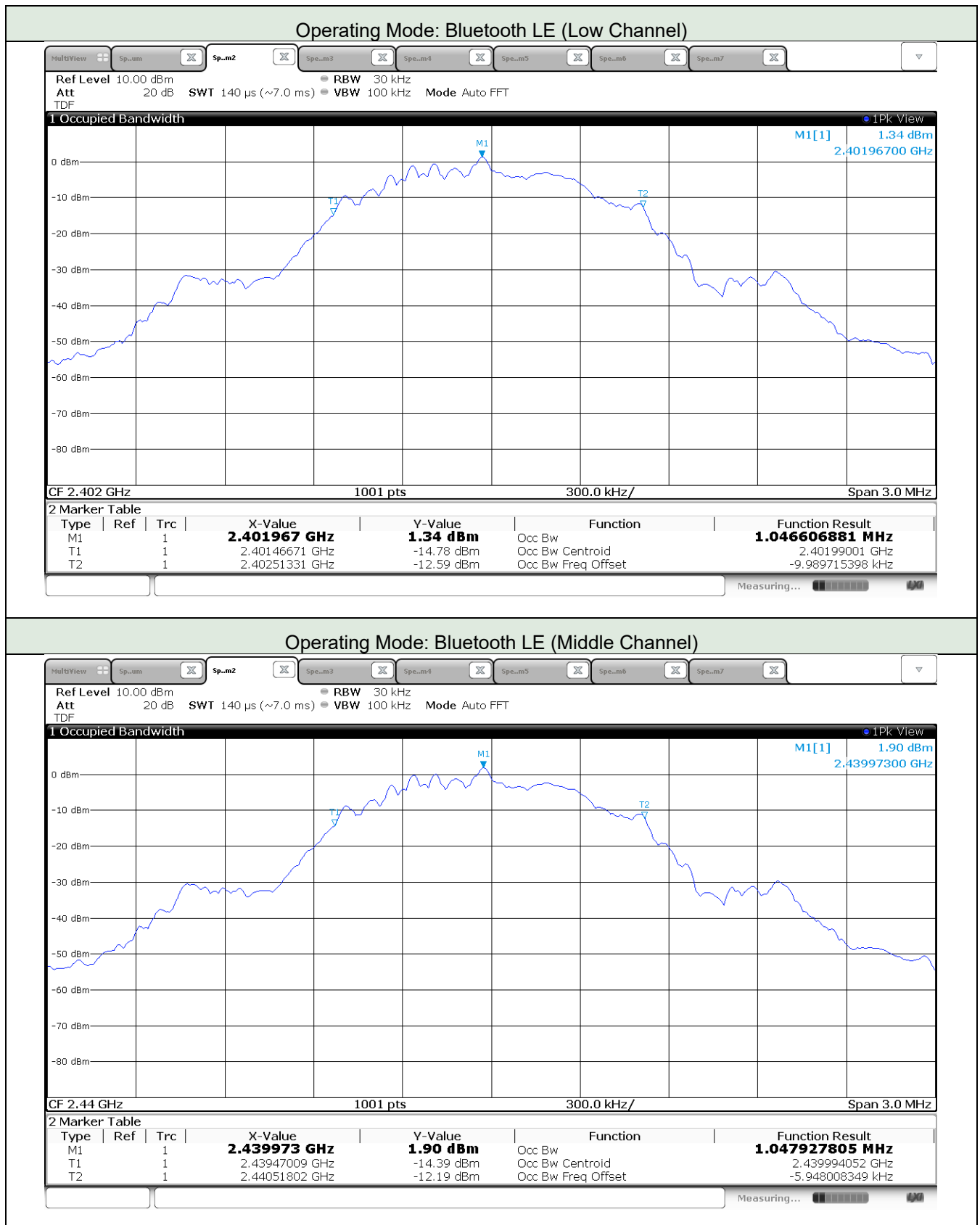
5.2.3 Test Data

Date of Test	2020-04-07	Temperature	(21.0 ± 0.9) °C
		Relative humidity	(39.0 ± 0.4) % R.H.
Test Result	PASS	Tested by	In-yong Song 
Operational Mode: Bluetooth LE			
Channel	Frequency (MHz)	99 % Bandwidth (MHz)	
Low	2 402	1.047	
Middle	2 440	1.048	
High	2 480	1.048	

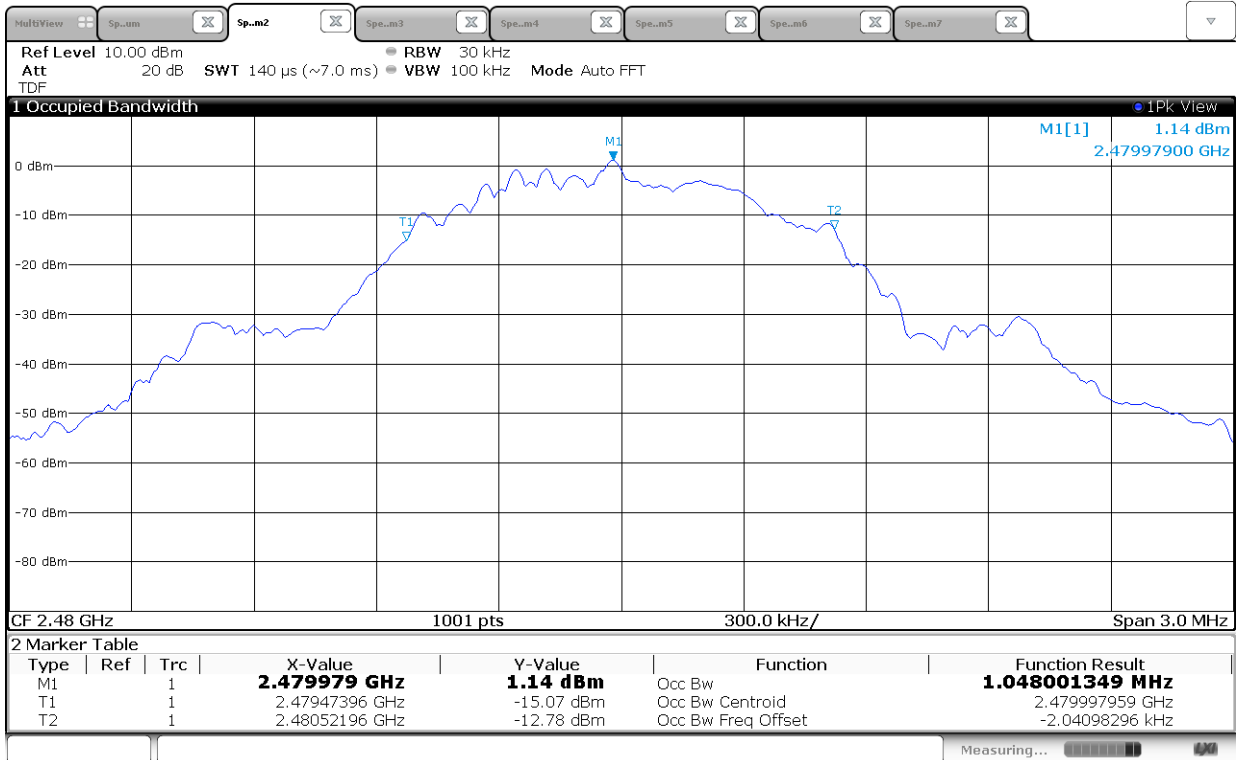
Operational Mode: WLAN 802.11b		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 412	12.052
Middle	2 437	12.060
High	2 462	12.070
Operational Mode: WLAN 802.11g		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 412	16.719
Middle	2 437	16.725
High	2 462	16.730
Operational Mode: WLAN 802.11n HT20		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 412	17.911
Middle	2 437	17.930
High	2 462	17.918

Operational Mode: WLAN 802.11n HT40		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 422	36.545
Middle	2 437	36.539
High	2 452	36.520

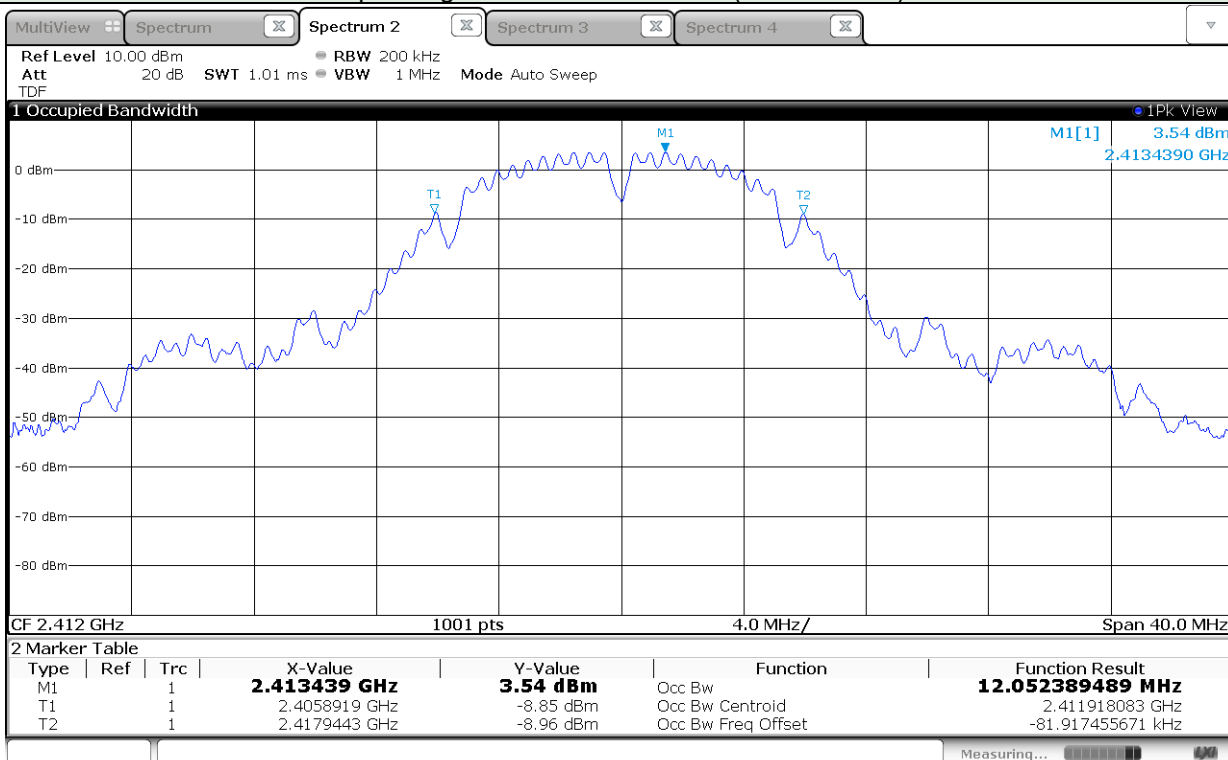
5.2.4 Test Plots



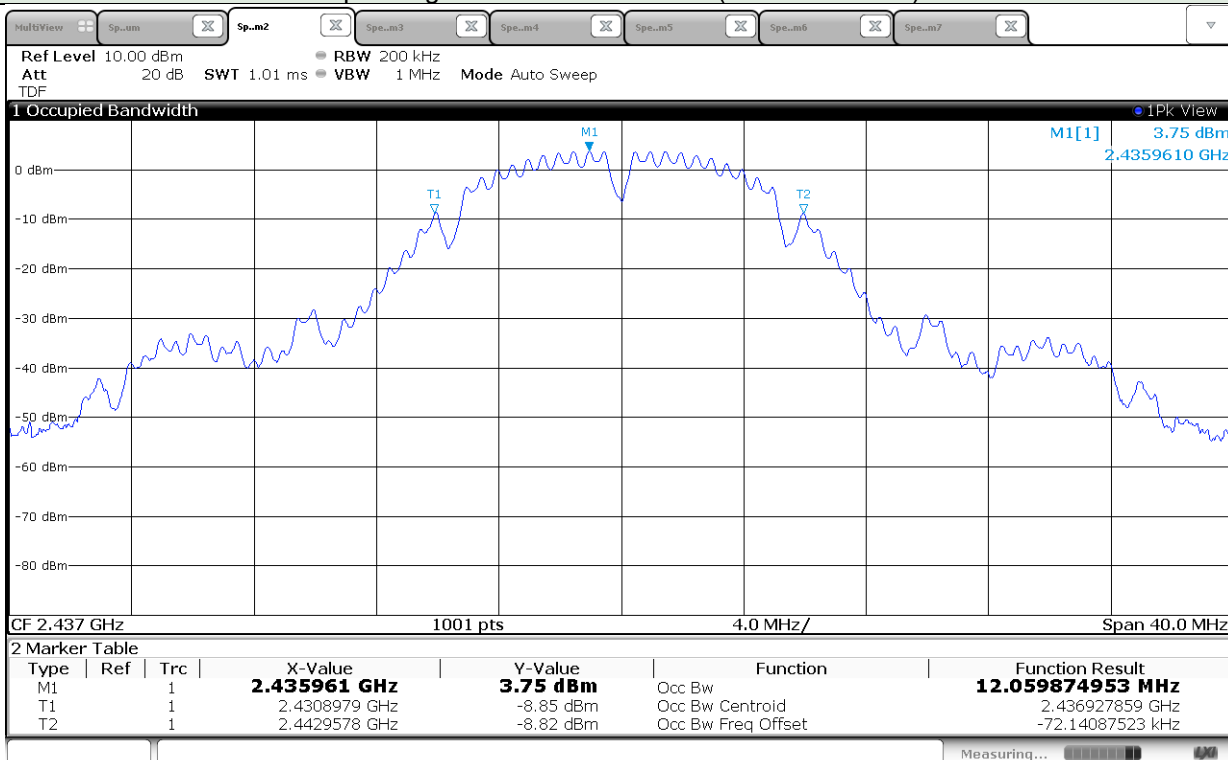
Operating Mode: Bluetooth LE (High Channel)



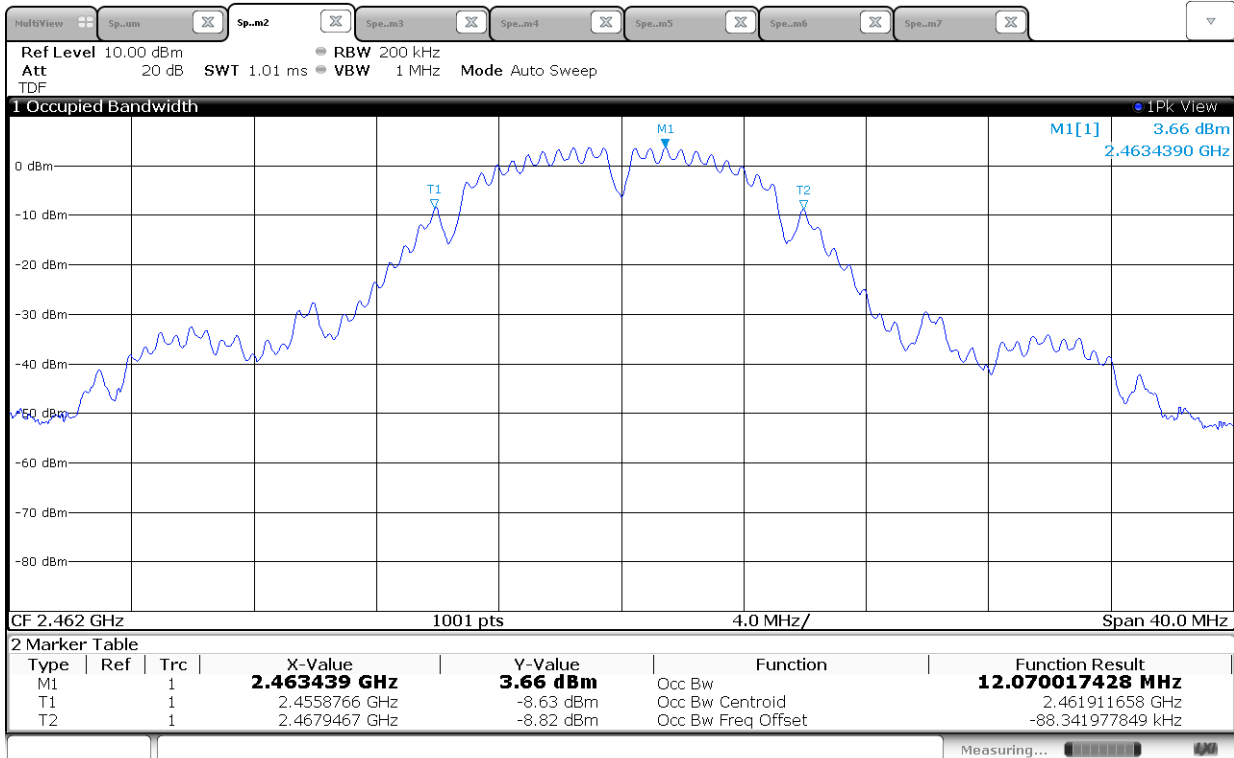
Operating Mode: WLAN 802.11b (Low Channel)



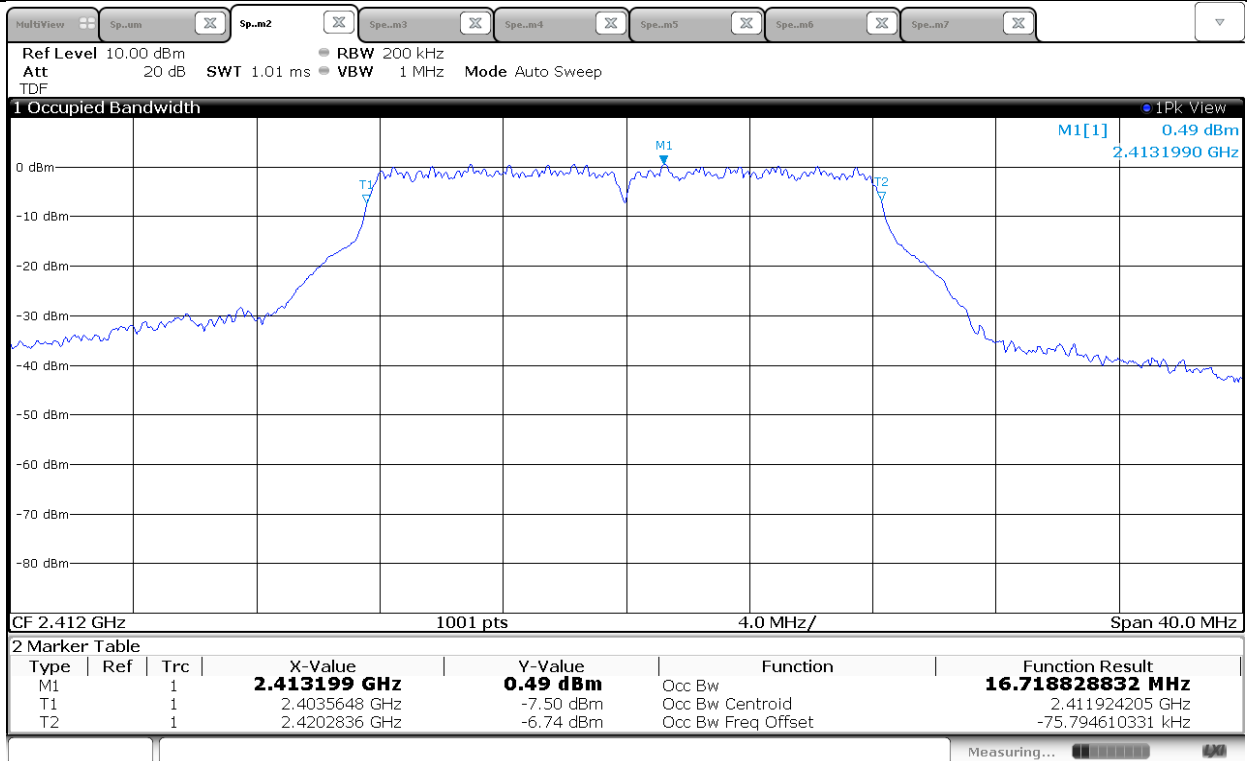
Operating Mode: WLAN 802.11b (Middle Channel)



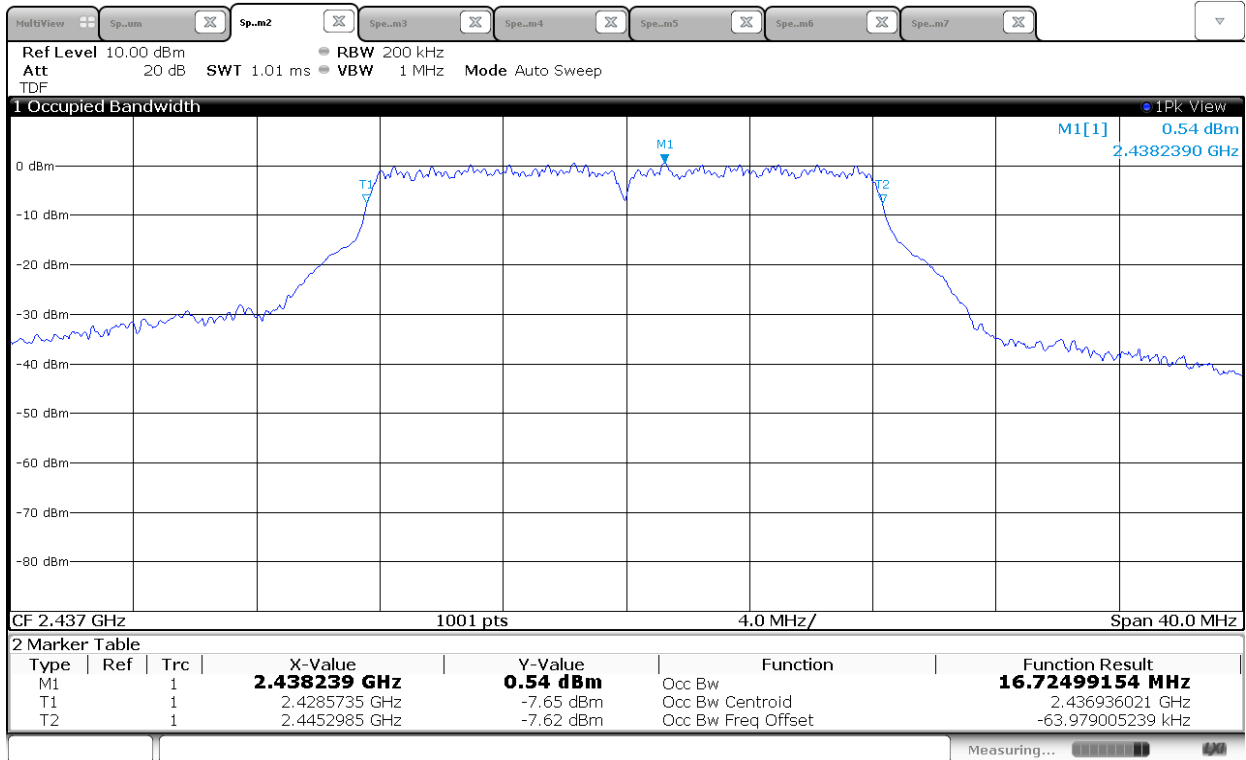
Operating Mode: WLAN 802.11b (High Channel)



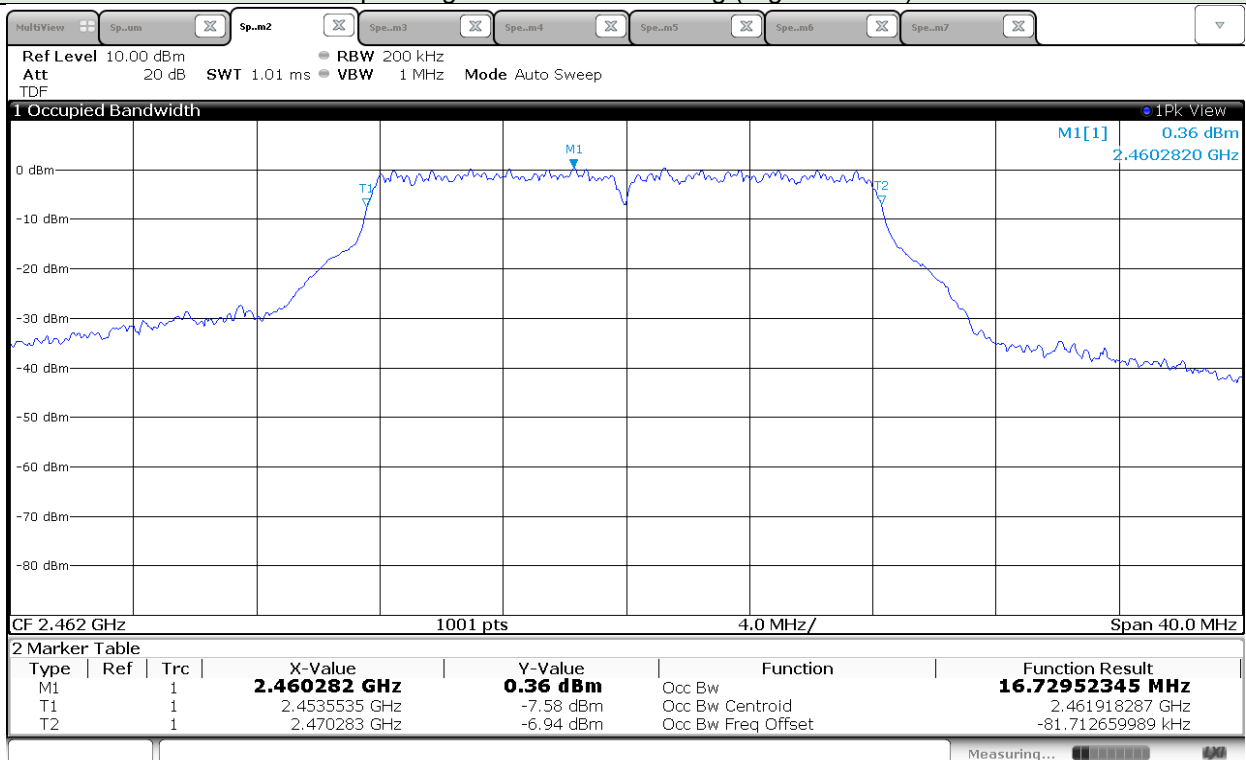
Operating Mode: WLAN 802.11g (Low Channel)



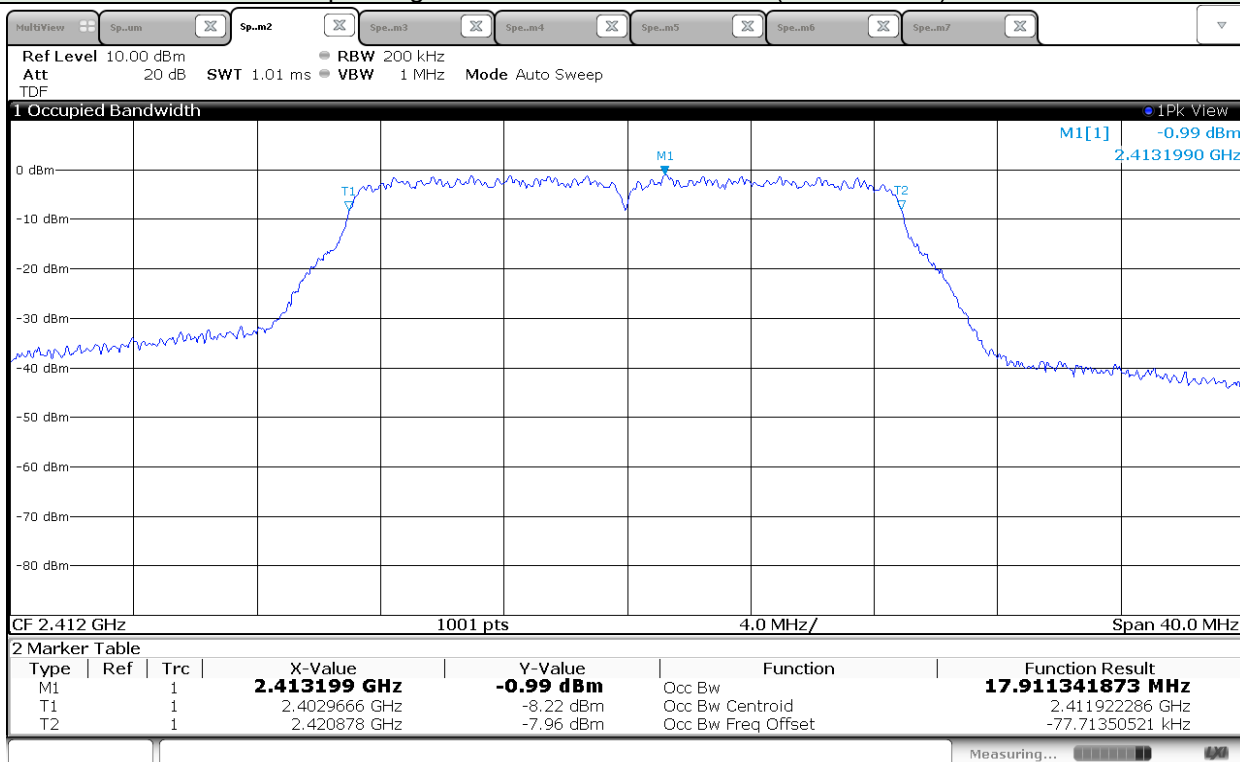
Operating Mode: WLAN 802.11g (Middle Channel)



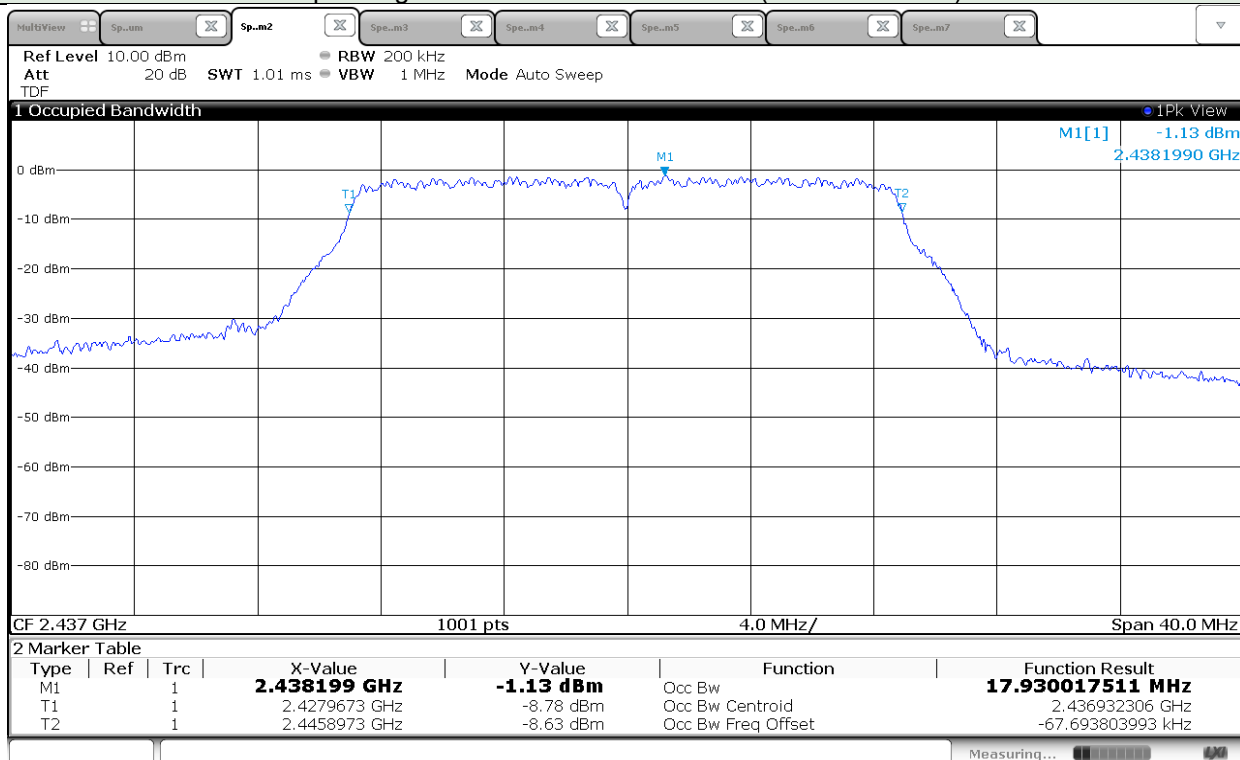
Operating Mode: WLAN 802.11g (High Channel)



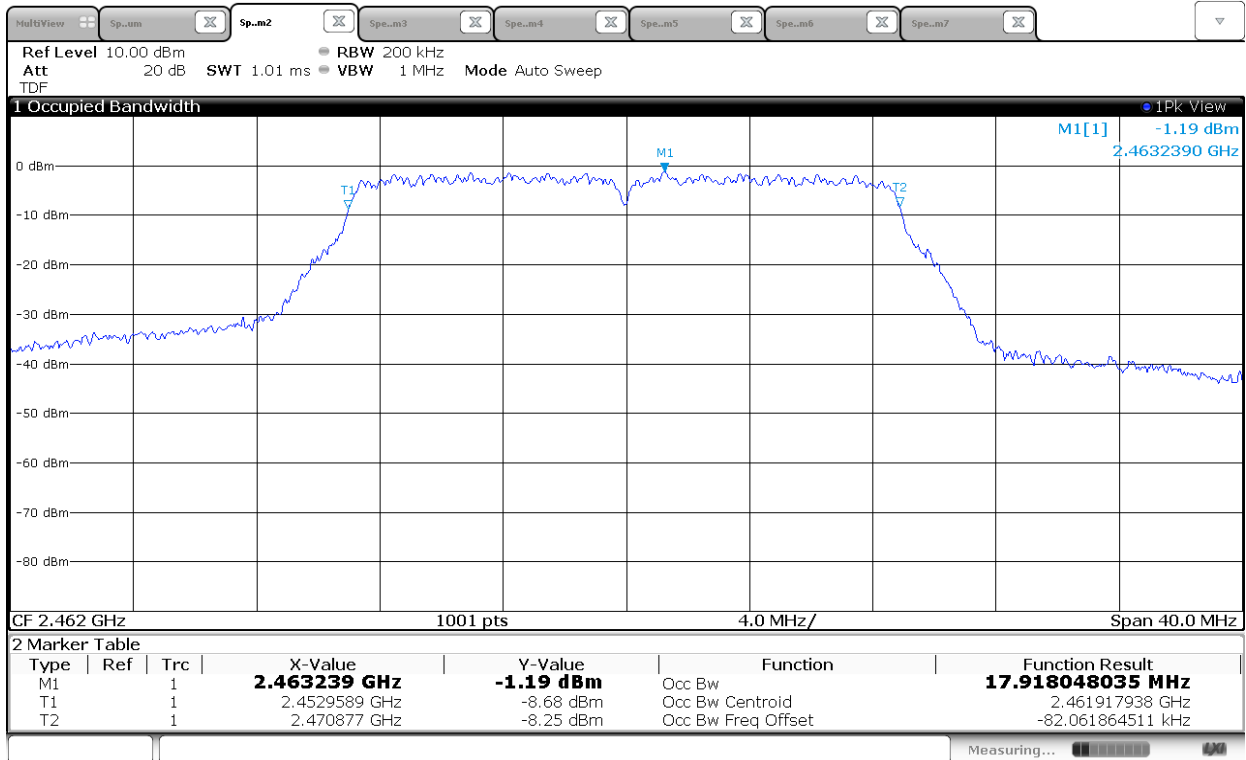
Operating Mode: WLAN 802.11n HT20 (Low Channel)



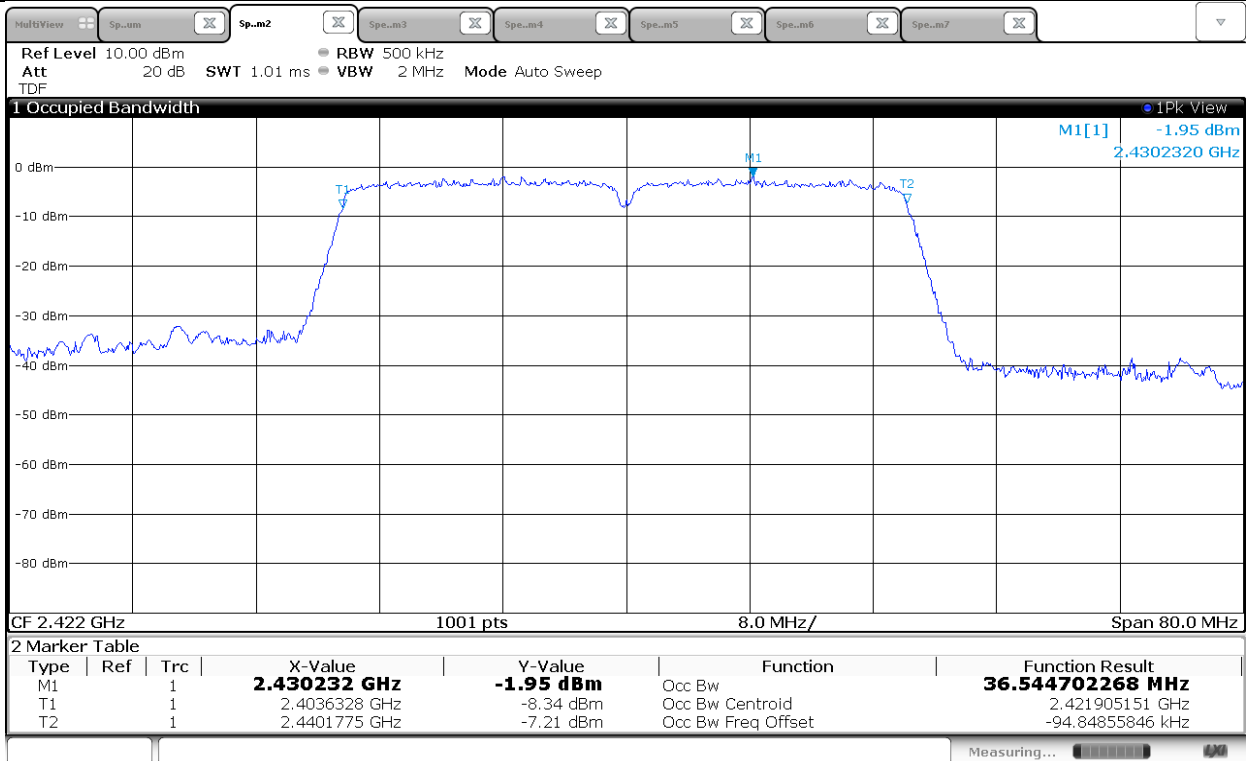
Operating Mode: WLAN 802.11n HT20 (Middle Channel)



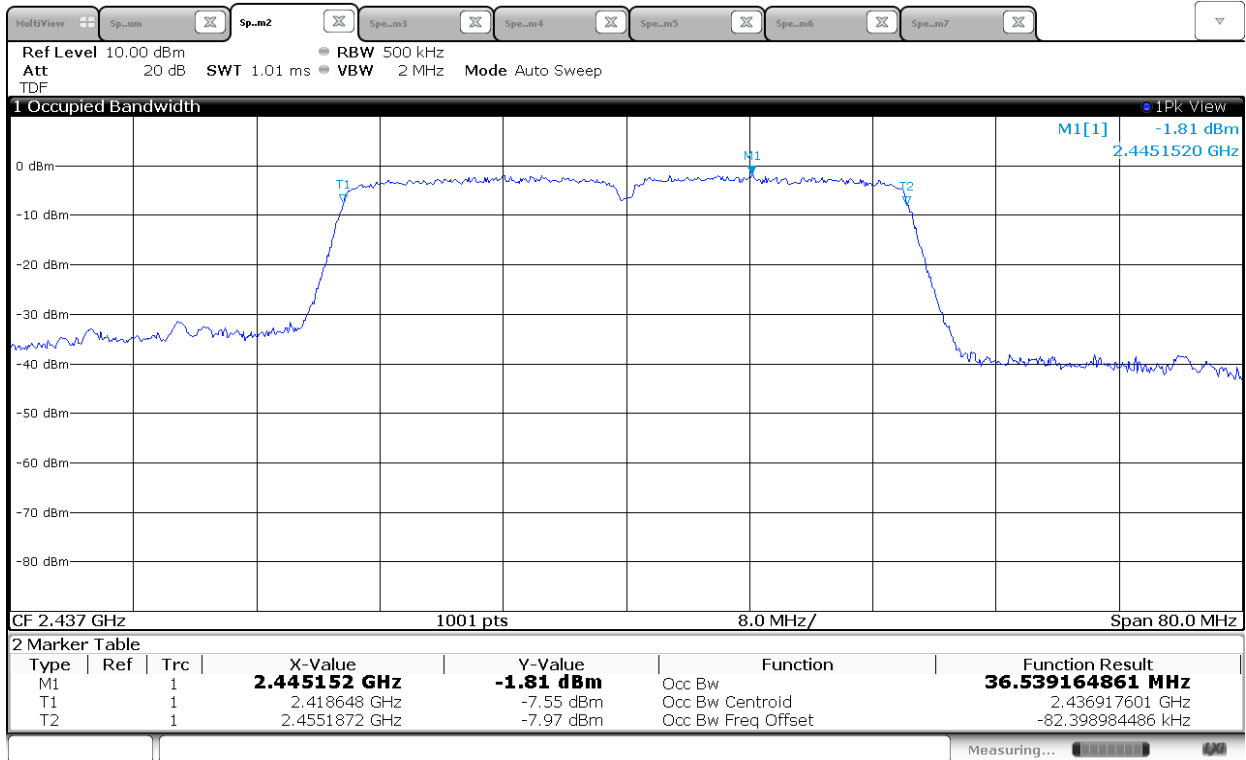
Operating Mode: WLAN 802.11n HT20 (High Channel)



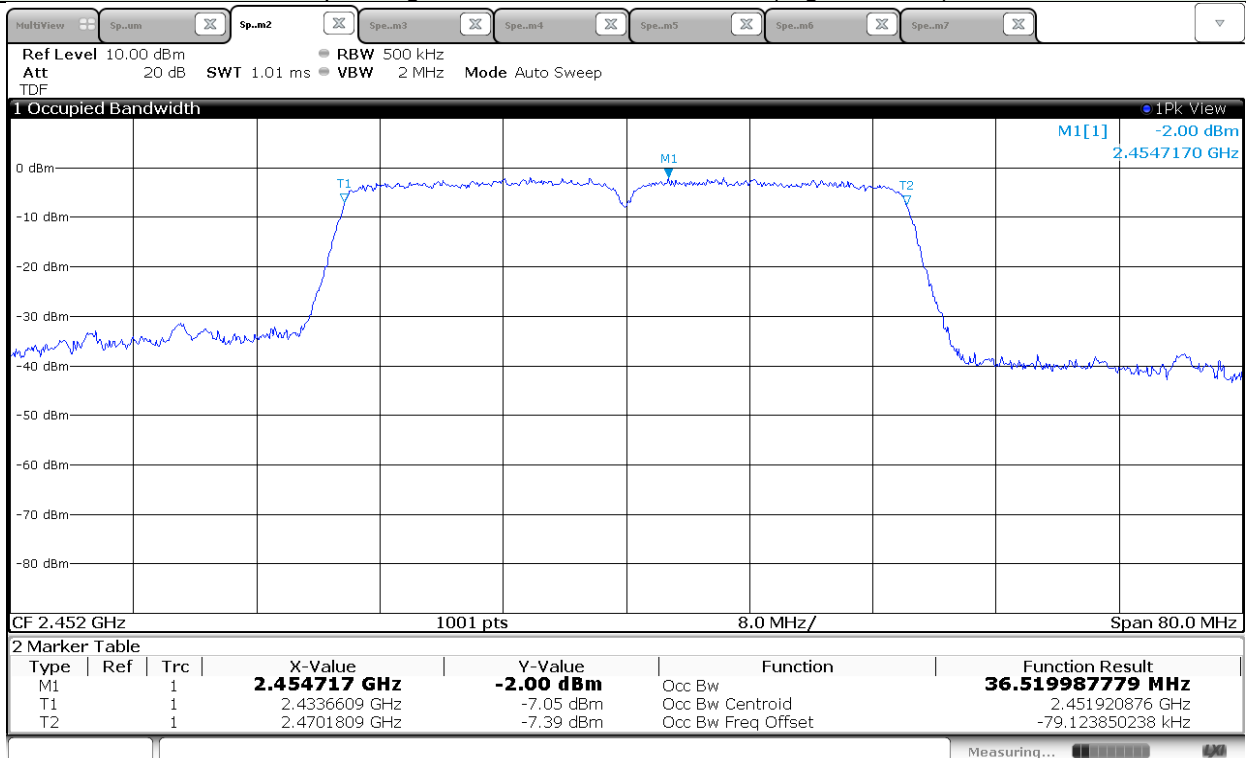
Operating Mode: WLAN 802.11n HT40 (Low Channel)



Operating Mode: WLAN 802.11n HT40 (Middle Channel)



Operating Mode: WLAN 802.11n HT40 (High Channel)



5.3 Maximum Peak Output Power

5.3.1 Limit

Acc. To section 15.247 and RSS-247 5.4 d), For system using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas. Guidance v05r02: 8.3.1.1 RBW $\geq$ DTS bandwidth

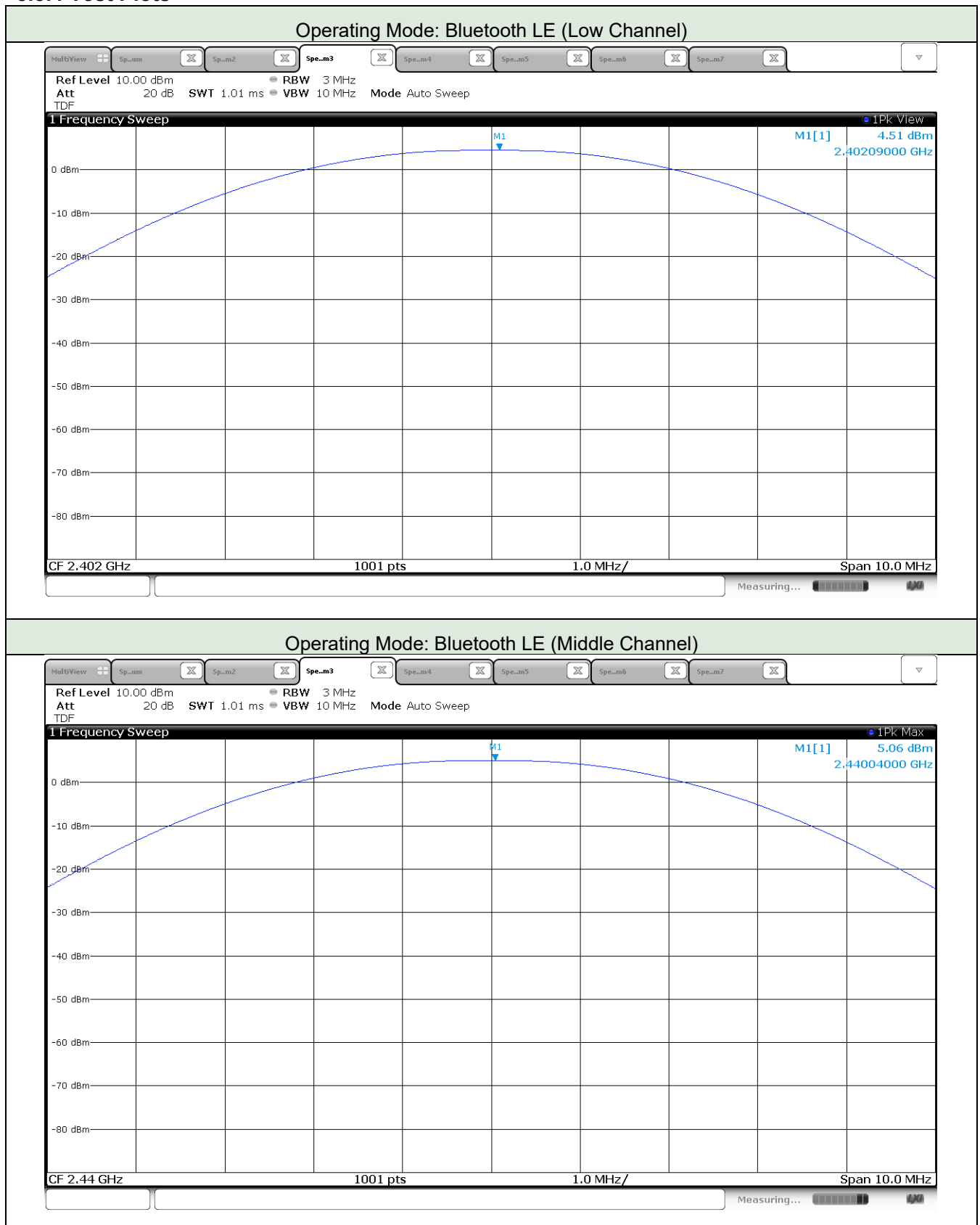
The cable assembly insertion loss was entered as an offset in the spectrum analyzer to allow for direct reading of power.

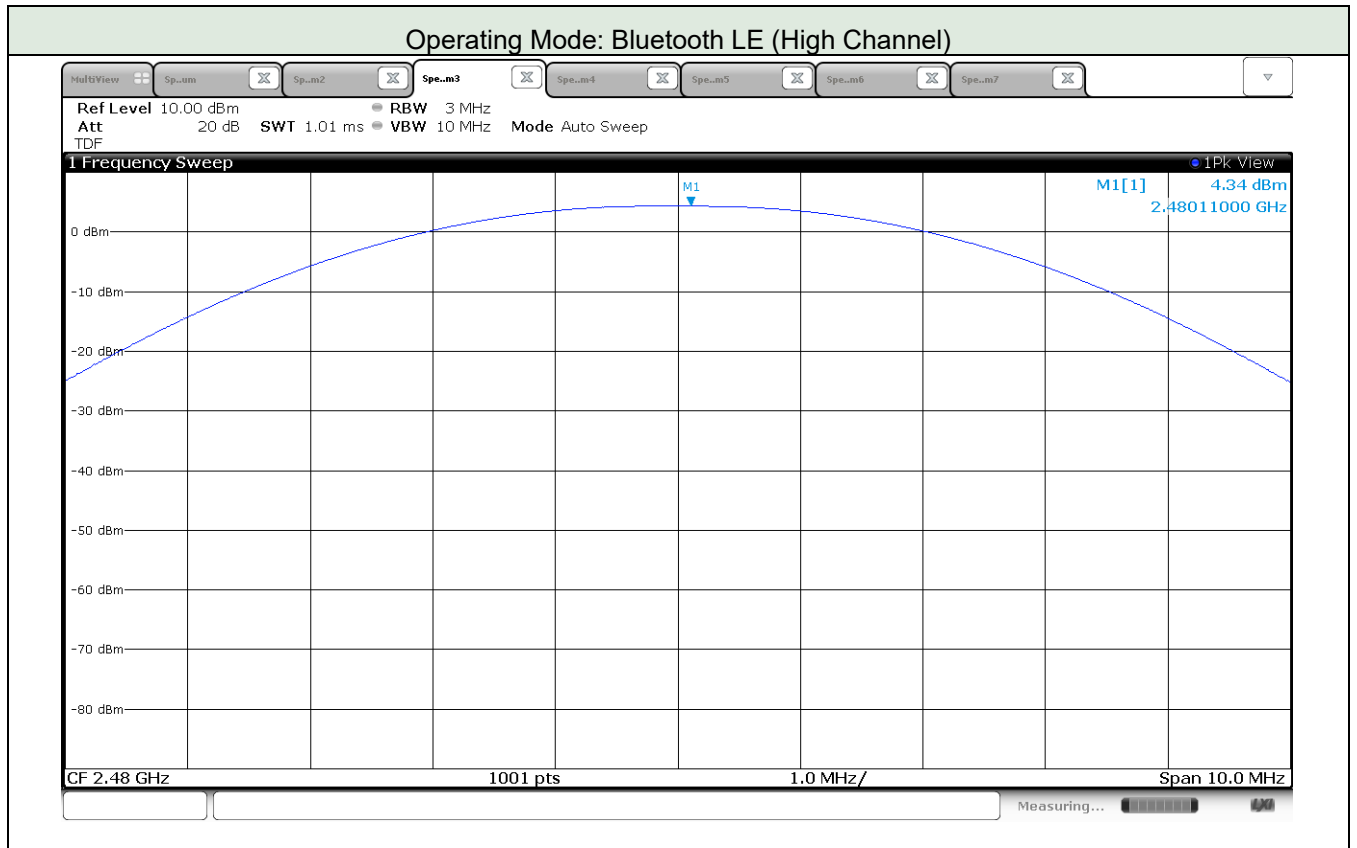
5.3.3 Test Data for Output Power

Date of Test		2020-04-07	Temperature	(21.0 ± 0.9) °C
			Relative humidity	(39.0 ± 0.4) % R.H.
Test Result		PASS	Tested by	In-yong Song 
Operating Mode: Bluetooth LE				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 402	4.51	30.00	25.49
Middle	2 440	5.06	30.00	24.94
High	2 480	4.34	30.00	25.66

Note. 1. Margin = Limit – Measured Value

5.3.4 Test Plots





5.4 Maximum Conducted Average Output Power

5.3.1 Limit

Acc. To section 15.247 and RSS-247 5.4 d), For system using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas. Guidance v05r02: 8.3.2.2 Measurement using a spectrum analyzer(SA) and ANSI C63.10-2013 11.9.2.2.4 Method AVGSA-2

The cable assembly insertion loss was entered as an offset in the spectrum analyzer to allow for direct reading of power.

5.3.3 Test Data for Output Power

Date of Test		2020-04-07		Temperature		(21.0 ± 0.9) °C	
				Relative humidity		(39.0 ± 0.4) % R.H.	
Test Result		PASS		Tested by		In-yong Song 	
Operating Mode: WLAN 802.11b							
Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)	
Low	2 412	11.75	0.07	11.82	30.00	18.18	
Middle	2 437	11.85	0.07	11.92	30.00	18.08	
High	2 462	11.77	0.07	11.84	30.00	18.16	

- Note. 1. Margin = Limit – Total Power Value
 2. Total Power = Measured value + Duty Factor
 3. Duty cycle (x): 0.98
 4 Duty factor (10log 1/x): 0.07

Operating Mode: WLAN 802.11g						
Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	10.32	0.31	10.63	30.00	19.37
Middle	2 437	10.34	0.31	10.65	30.00	19.35
High	2 462	10.23	0.31	10.54	30.00	19.46

- Note. 1. Margin = Limit – Total Power Value
 2. Total Power = Measured value + Duty Factor
 3. Duty cycle (x): 0.93
 4 Duty factor (10log 1/x): 0.31 dB

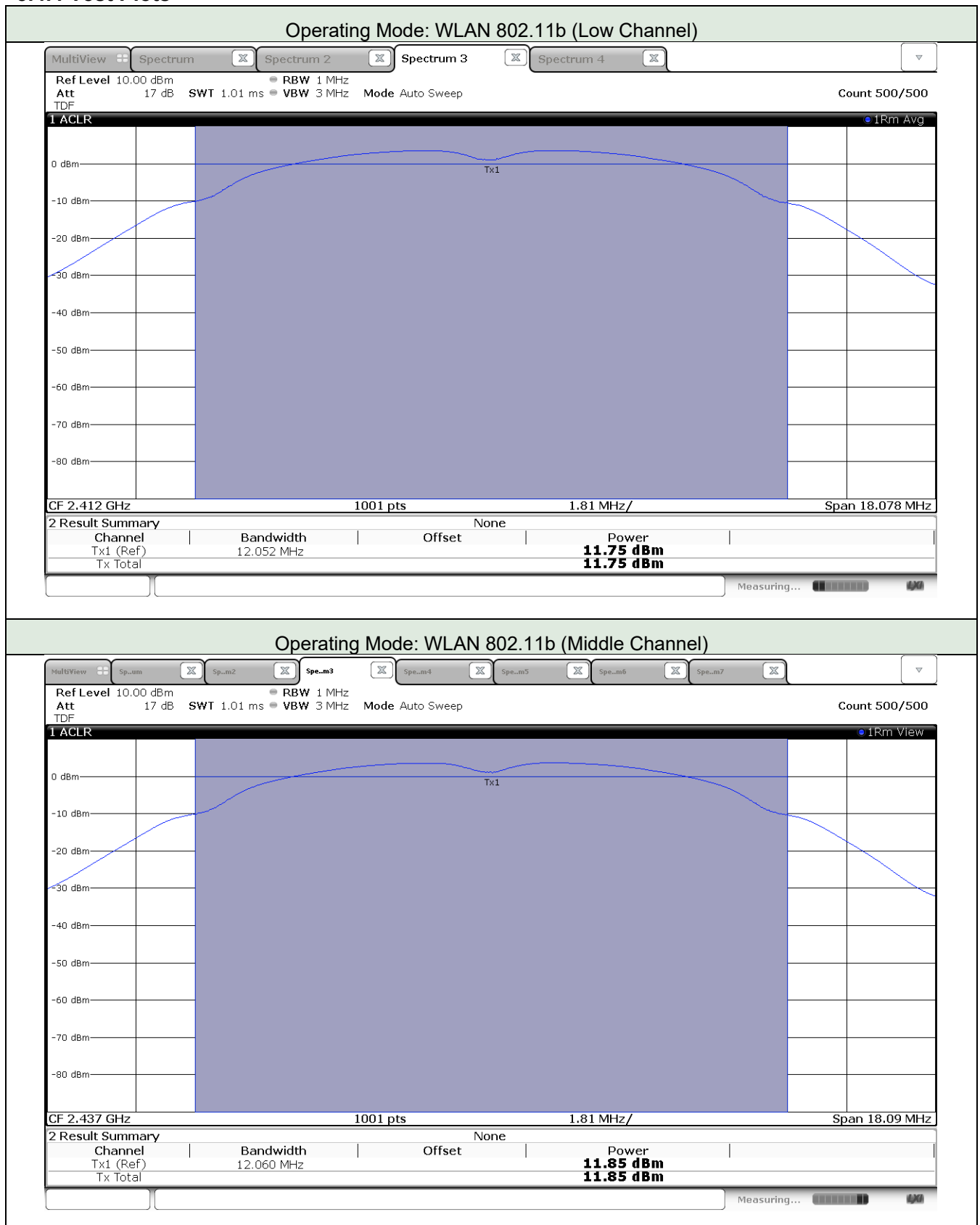
Operating Mode: WLAN 802.11n HT20						
Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	8.62	0.33	8.95	30.00	21.05
Middle	2 437	8.64	0.33	8.97	30.00	21.03
High	2 462	8.60	0.33	8.93	30.00	21.07

Note. 1. Margin = Limit – Total Power Value
 2. Total Power = Measured value + Duty Factor
 3. Duty cycle (x): 0.93
 4 Duty factor (10log 1/x): 0.33 dB

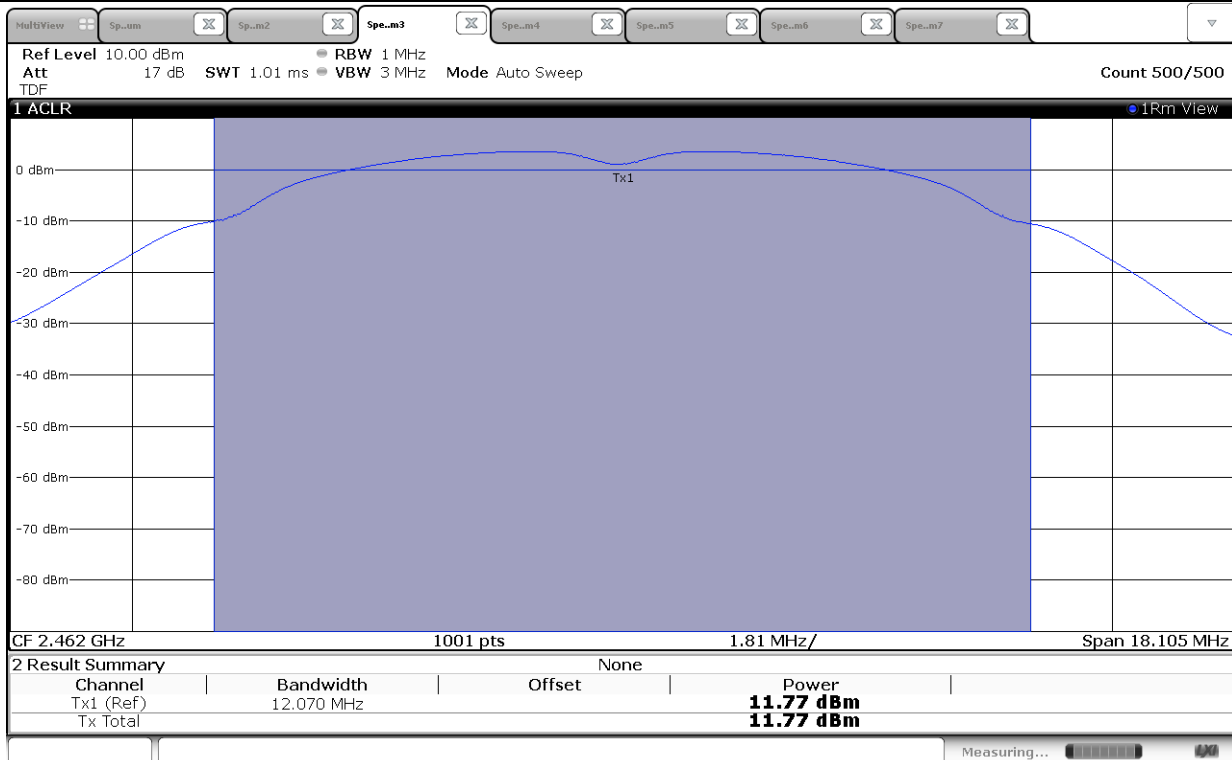
Operating Mode: WLAN 802.11n HT40						
Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2 422	6.26	0.62	6.88	30.00	23.12
Middle	2 437	6.32	0.62	6.94	30.00	23.06
High	2 452	6.26	0.62	6.88	30.00	23.12

Note. 1. Margin = Limit – Total Power Value
 2. Total Power = Measured value + Duty Factor
 3. Duty cycle (x): 0.87
 4 Duty factor (10log 1/x): 0.62 dB

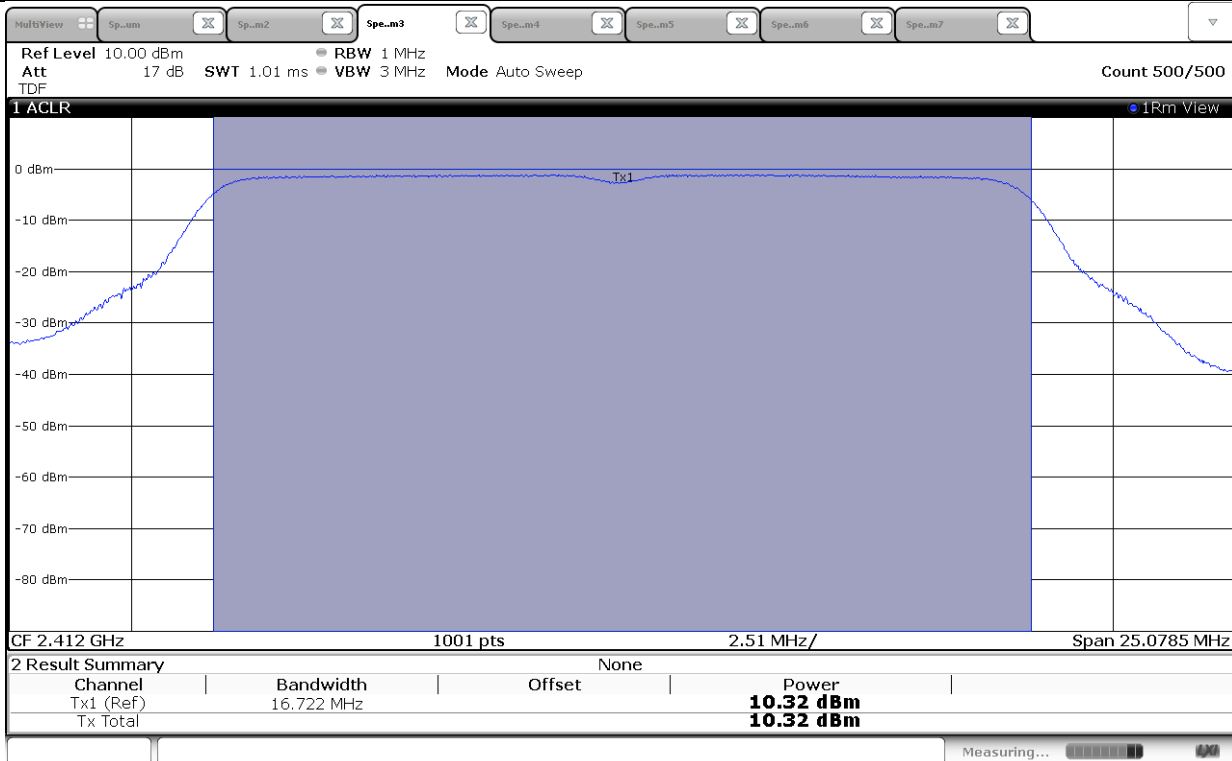
5.4.4 Test Plots



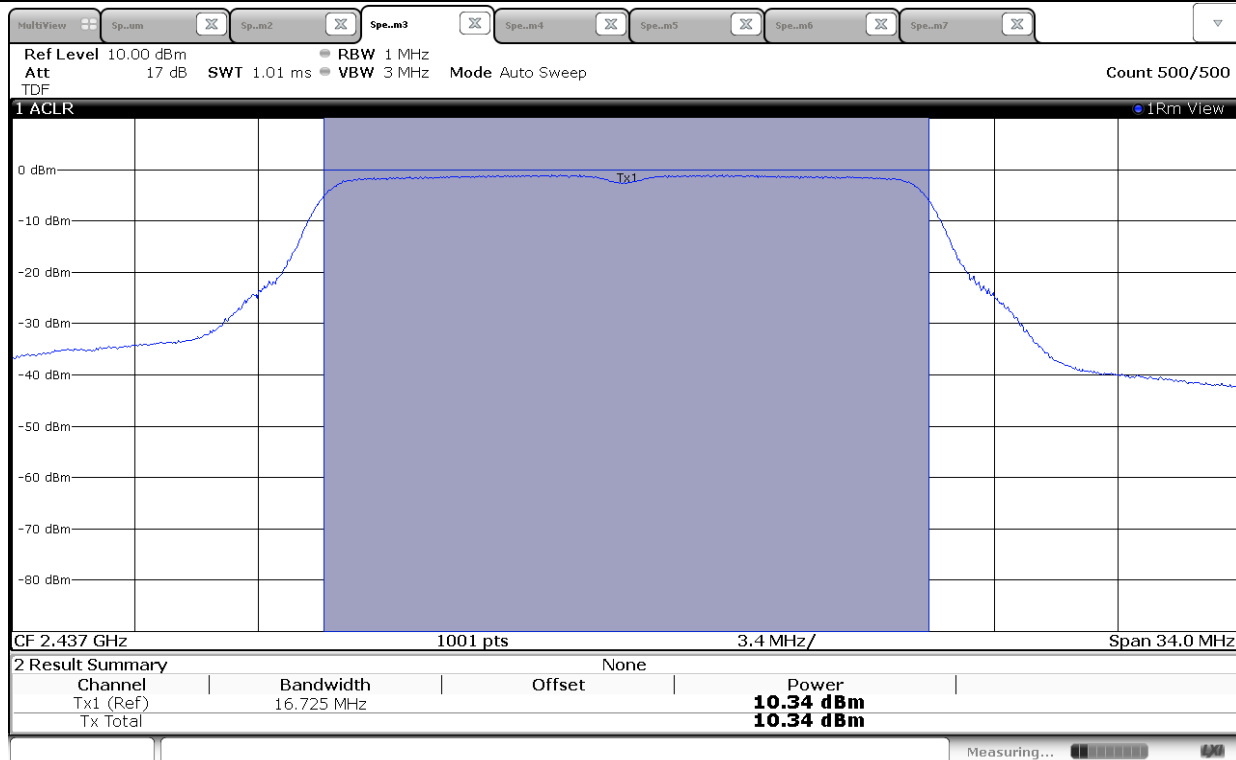
Operating Mode: WLAN 802.11b (High Channel)



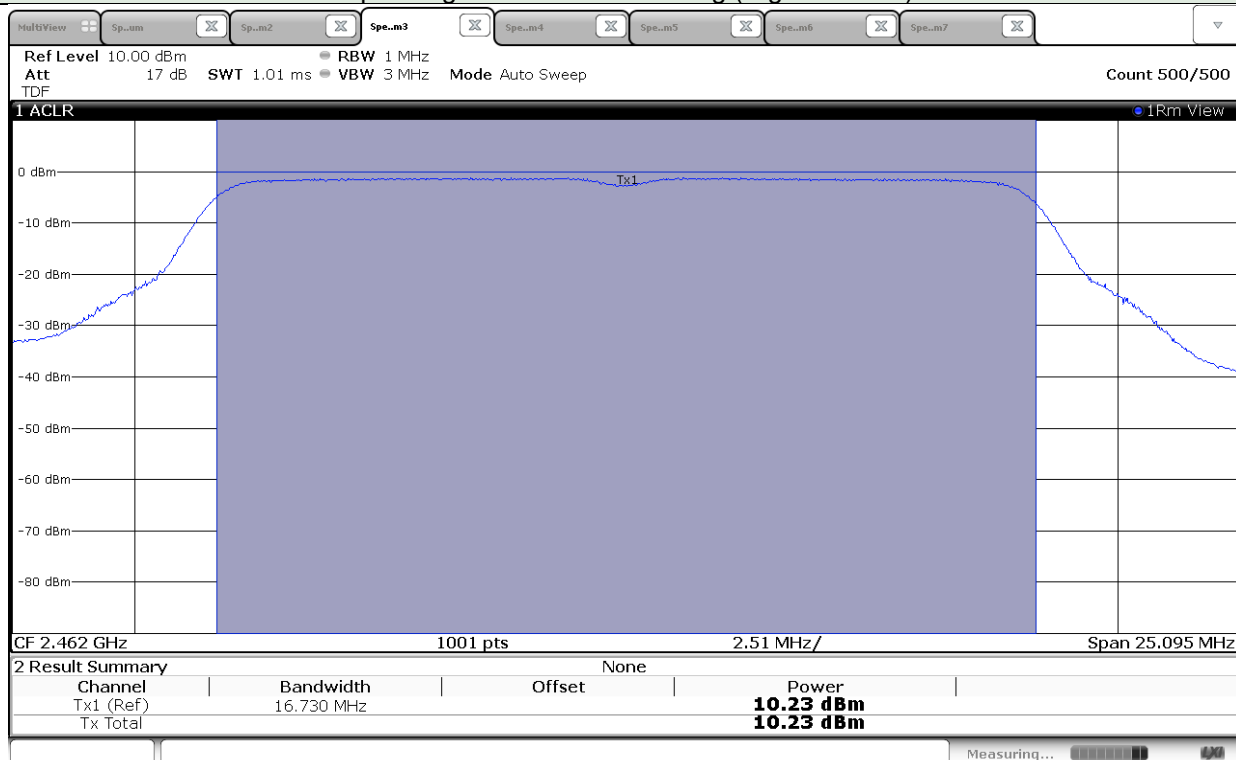
Operating Mode: WLAN 802.11g (Low Channel)



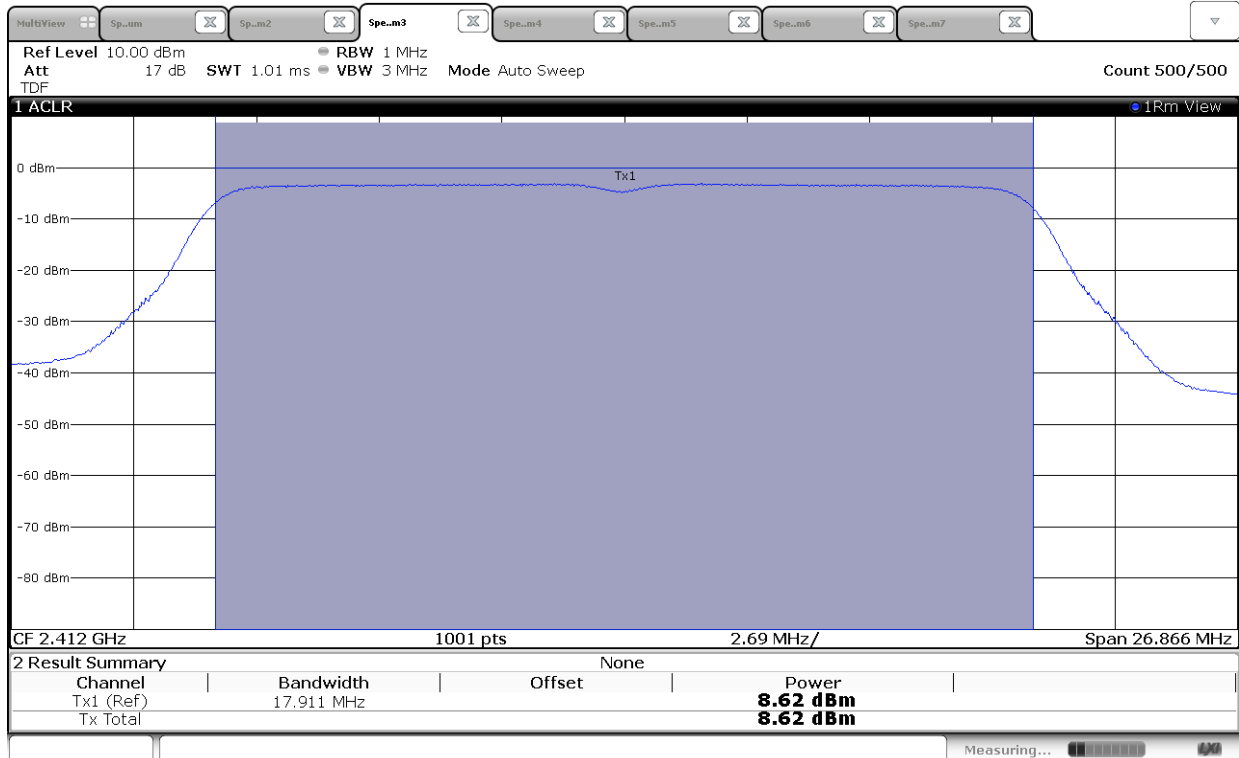
Operating Mode: WLAN 802.11g (Middle Channel)



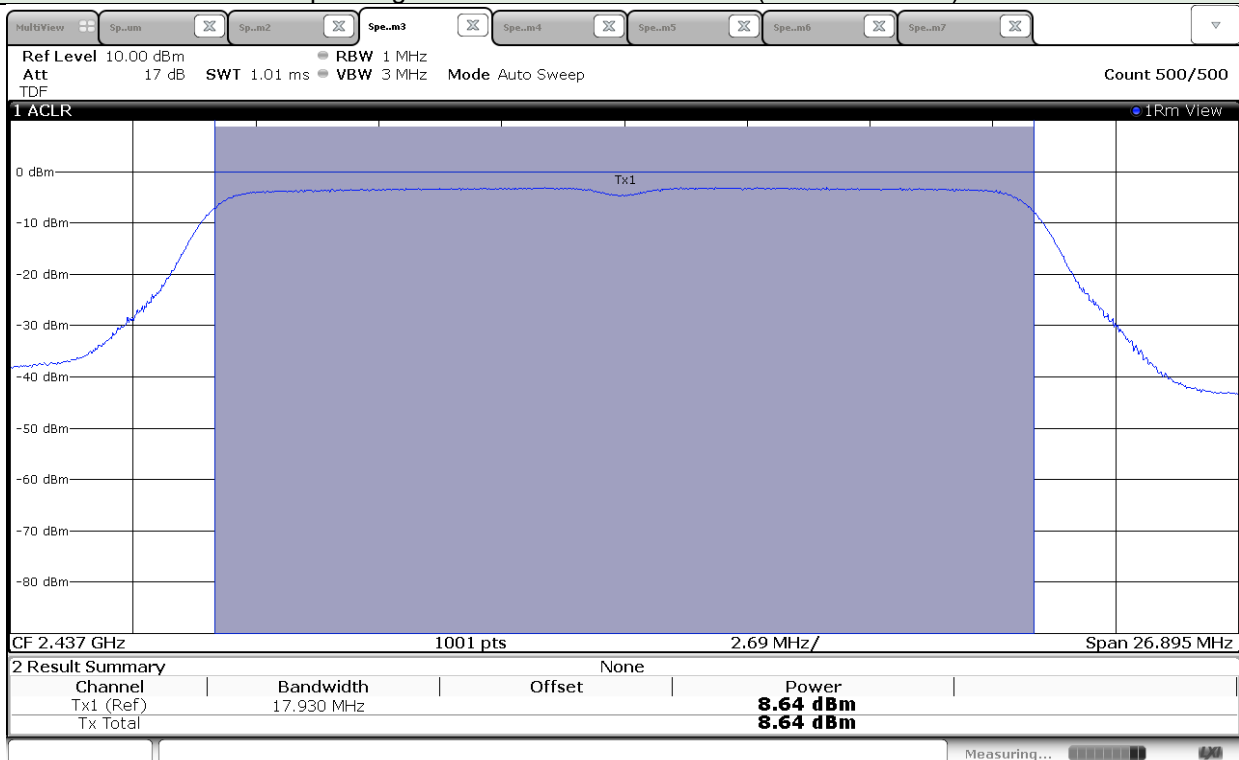
Operating Mode: WLAN 802.11g (High Channel)

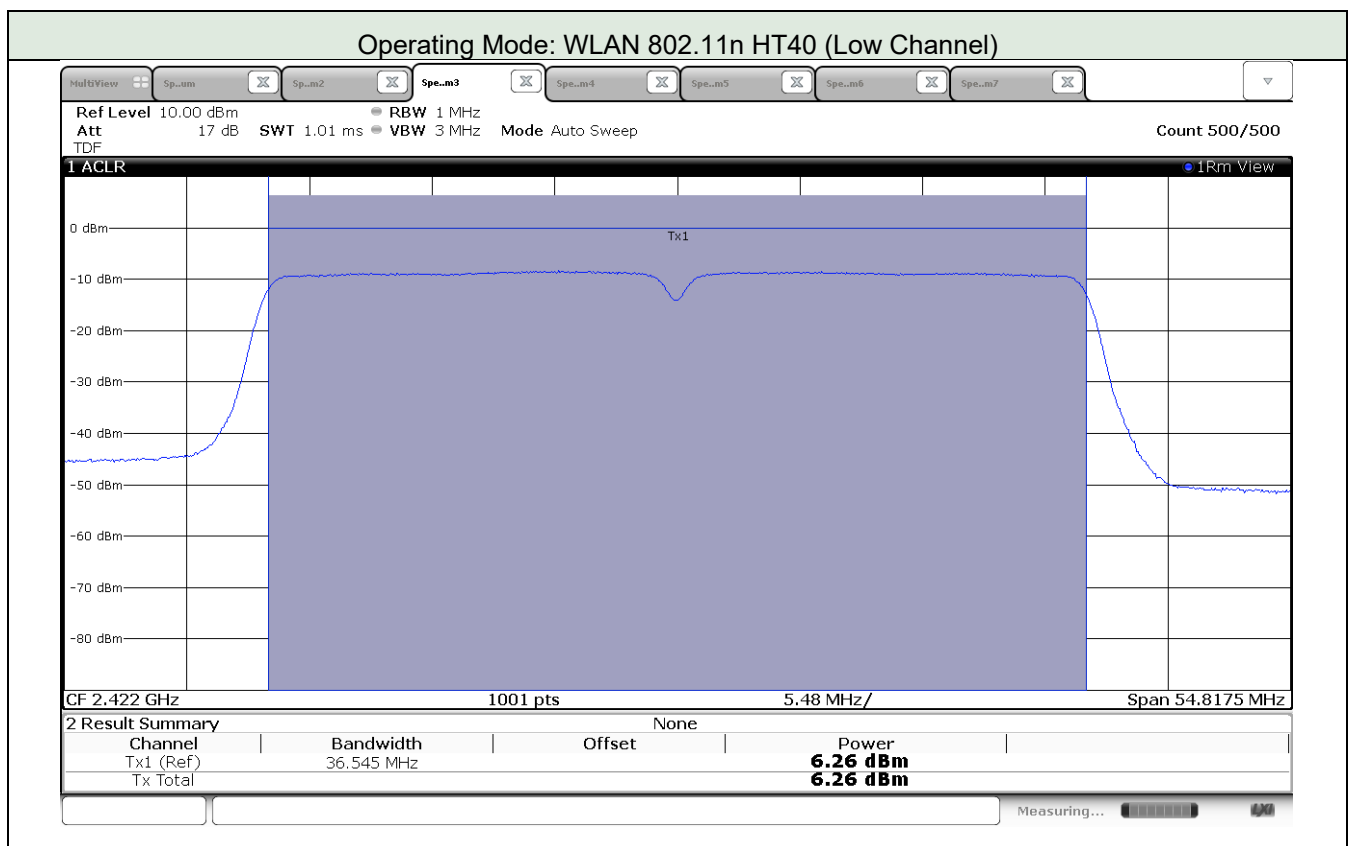
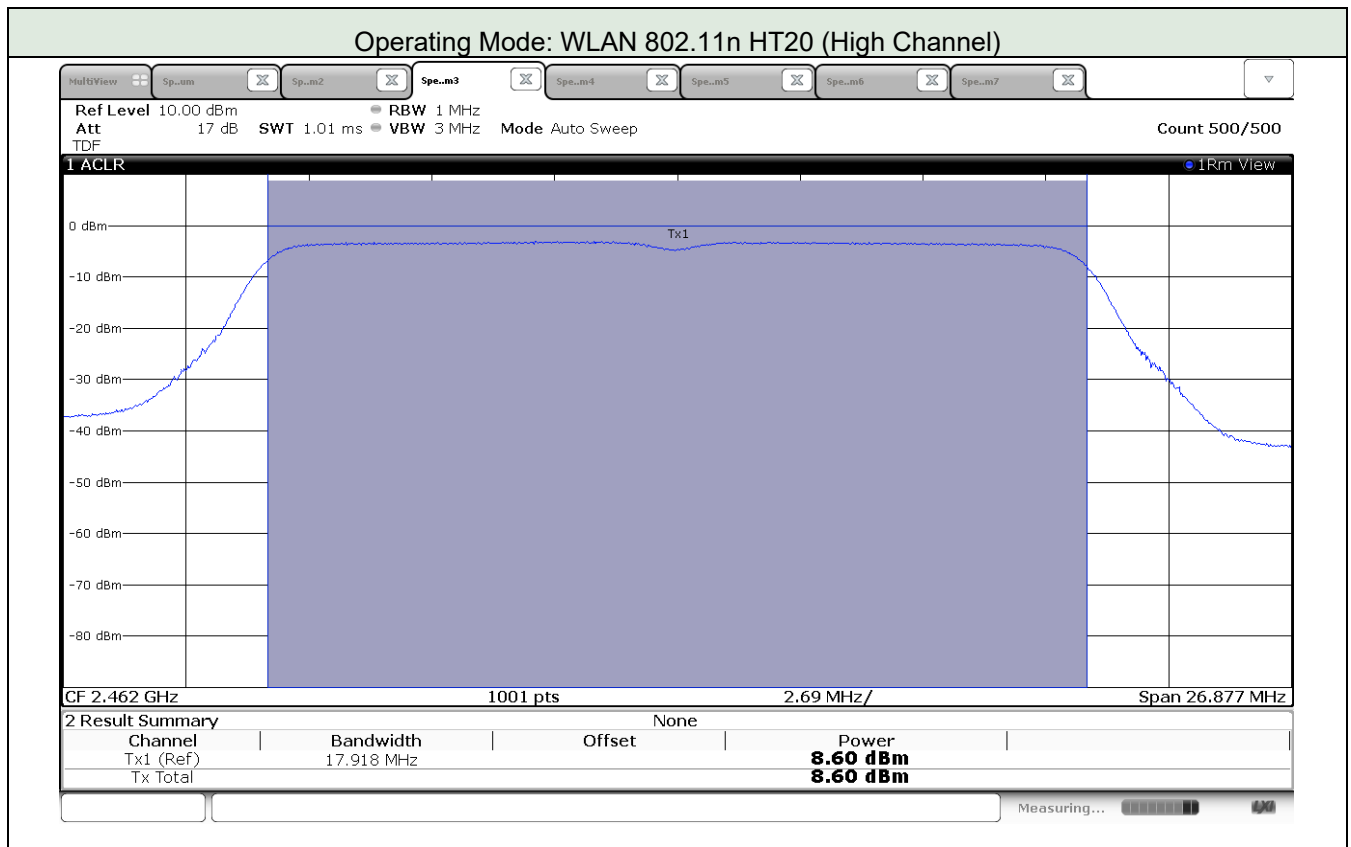


Operating Mode: WLAN 802.11n HT20 (Low Channel)

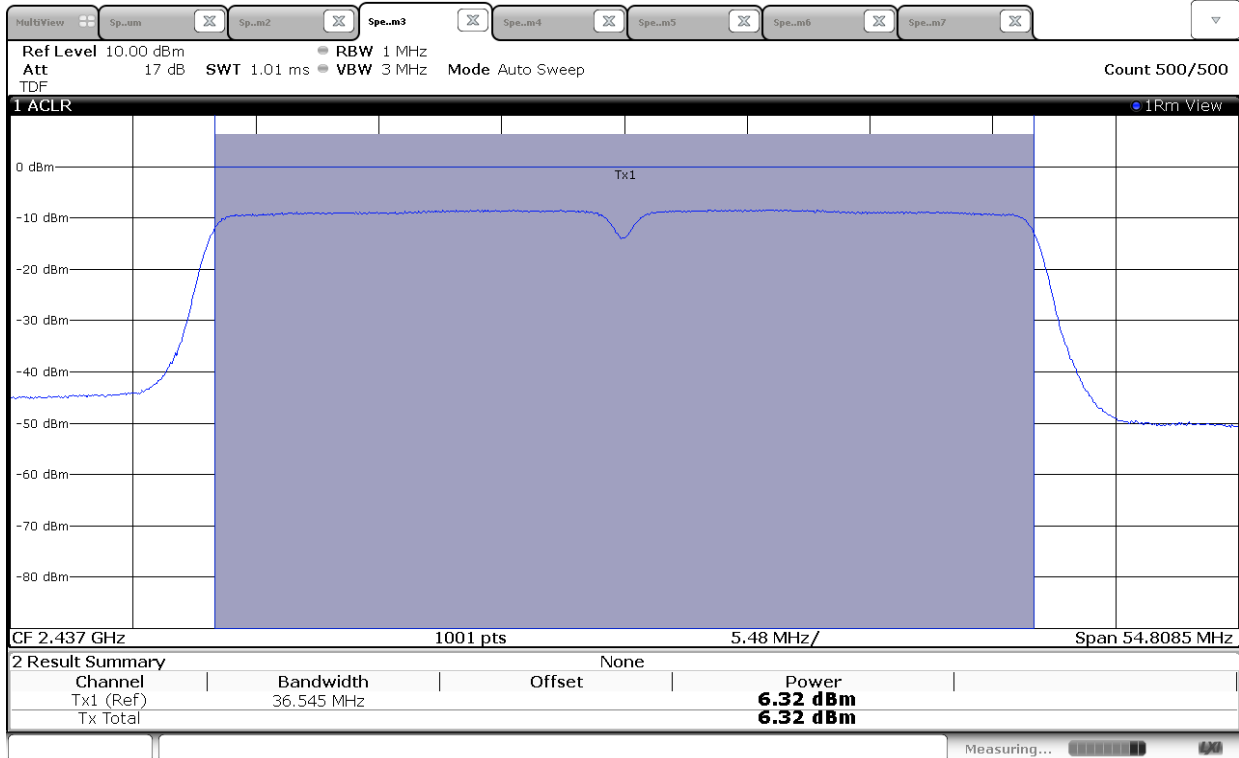


Operating Mode: WLAN 802.11n HT20 (Middle Channel)

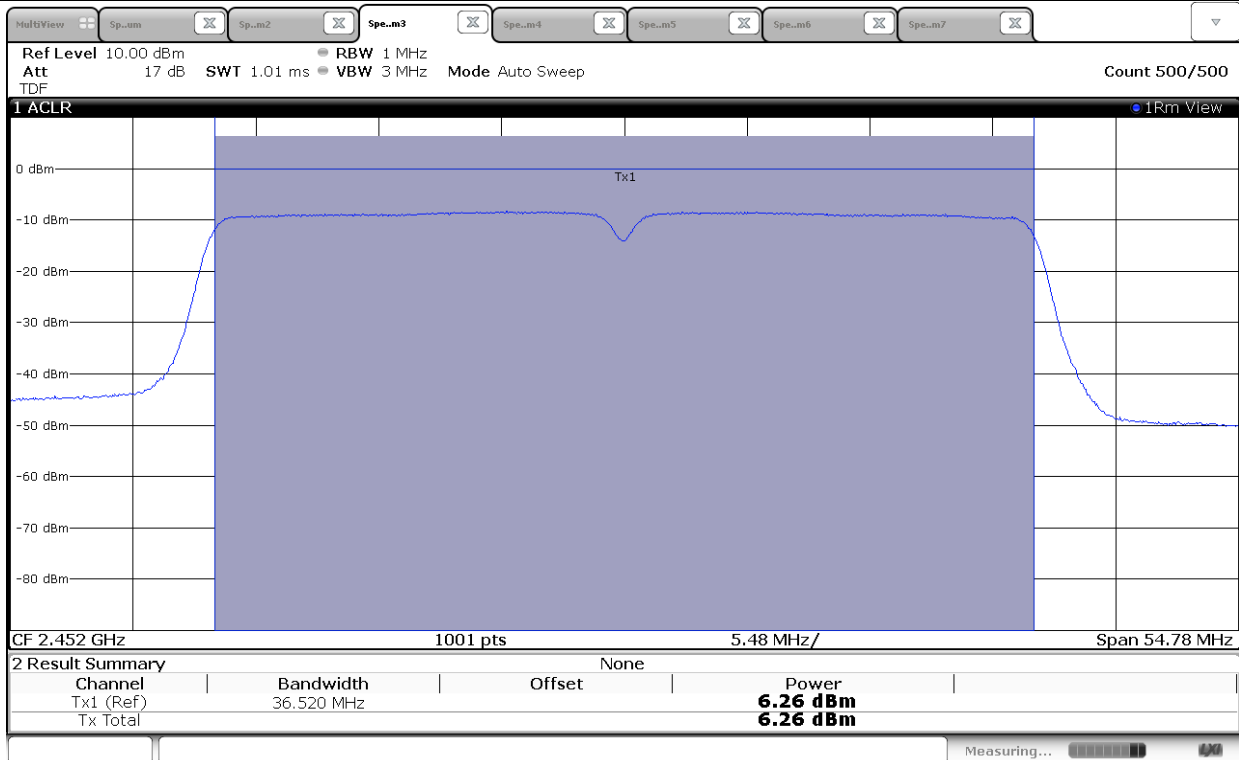




Operating Mode: WLAN 802.11n HT40 (Middle Channel)



Operating Mode: WLAN 802.11n HT40 (High Channel)



5.5 Peak Power Spectral Density

5.5.1 Limit

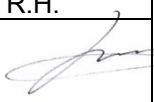
Acc. To section 15.247 and RSS-247 5.2 b), the power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.5.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v05r02: 8.4 Method PKPSD (peak PSD).

The transmitter output is connected to a spectrum analyzer with the RBW set from 3 kHz to 100 kHz,
VBW $\geq$ 3 X RBW, peak detector and max hold.

5.5.3 Test Data

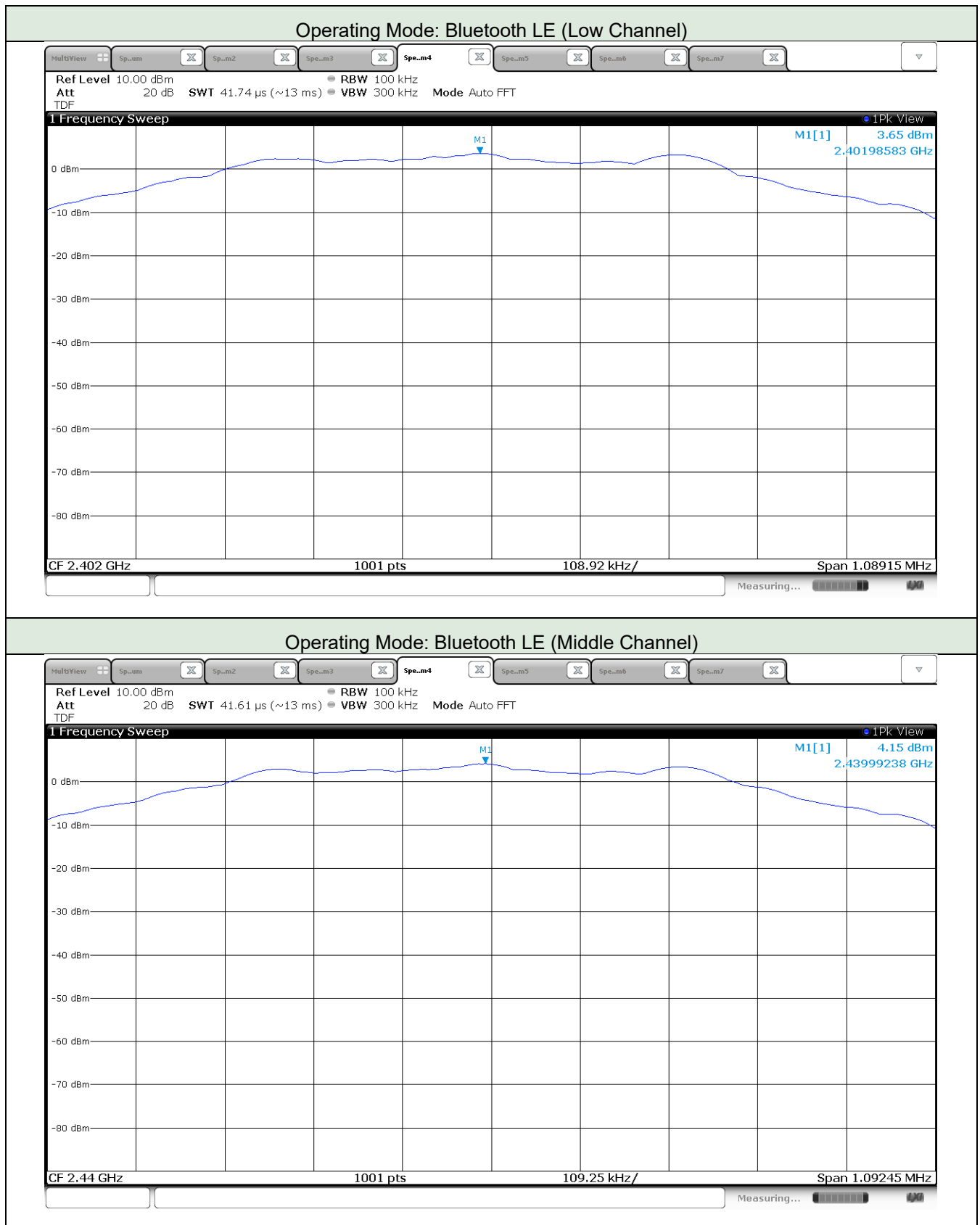
Date of Test		2020-04-07	Temperature	(21.0 ± 0.9) °C
			Relative humidity	(39.0 ± 0.4) % R.H.
Test Result		PASS	Tested by	In-yong, Song 
Operating Mode: Bluetooth LE				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 402	3.65	8	4.35
Middle	2 440	4.15		3.85
High	2 480	3.42		4.58
Operating Mode: WLAN 802.11b				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	1.71	8	6.29
Middle	2 437	1.67		6.63
High	2 462	1.60		6.40
Operating Mode: WLAN 802.11g				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	-0.61	8	8.61
Middle	2 437	-0.76		8.76
High	2 462	-0.83		8.83
Operating Mode: WLAN 802.11n HT20				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	-2.21	8	10.21
Middle	2 437	-2.42		10.42
High	2 462	-2.44		10.44

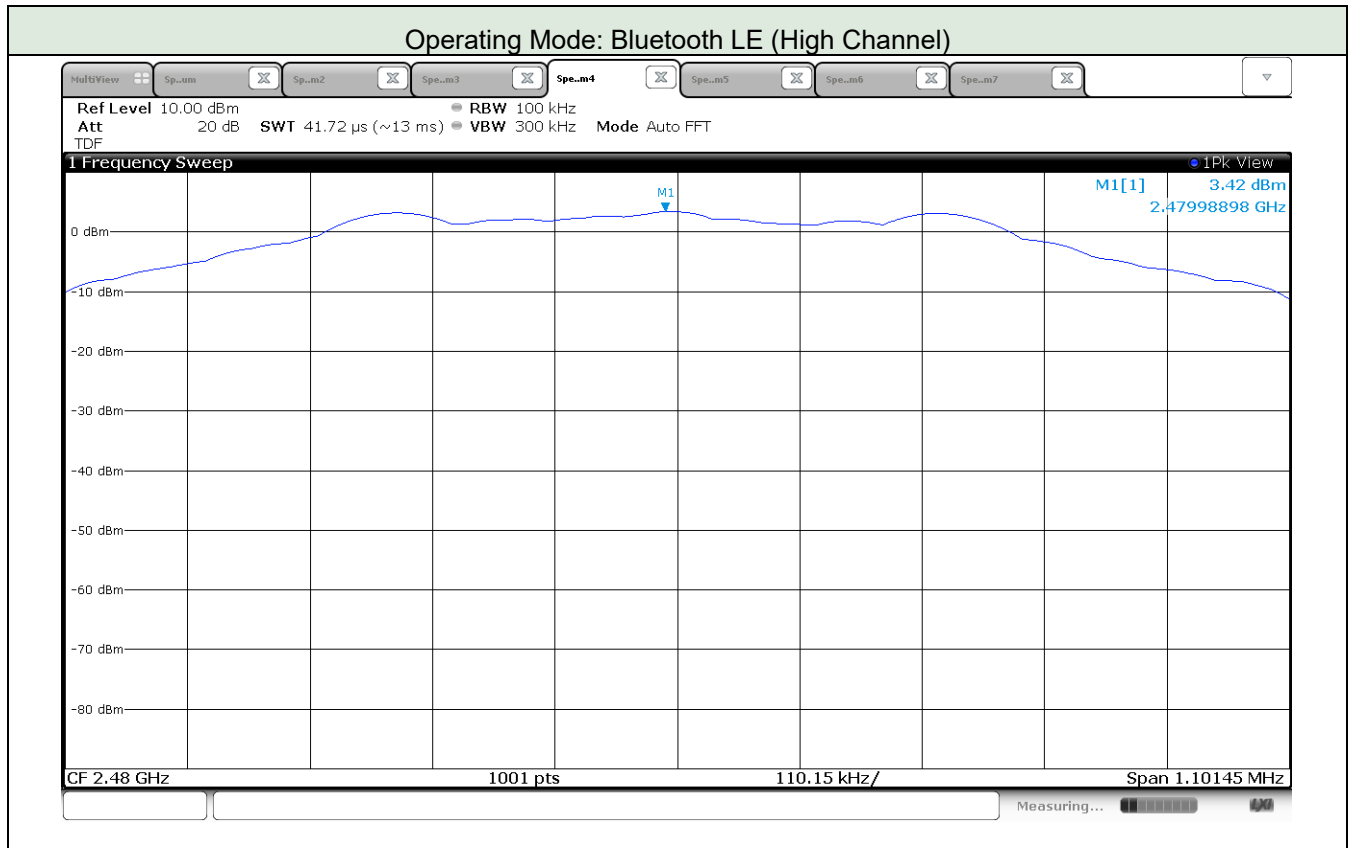
Remark. Margin = Limit – Measured Value

Operating Mode: WLAN 802.11n HT40				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 422	-7.42	8	15.42
Middle	2 437	-7.21		15.21
High	2 452	-7.16		15.16

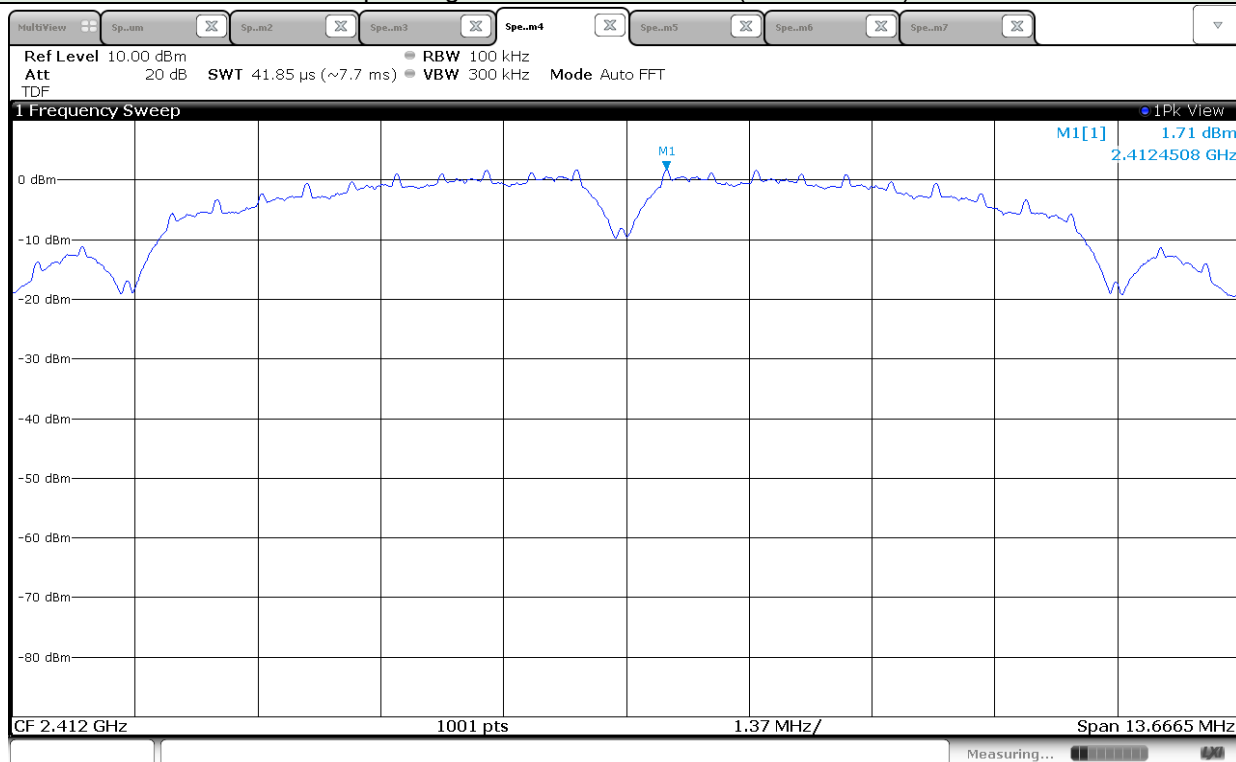
Remark. Margin = Limit – Measured Value

5.5.4 Test Plots

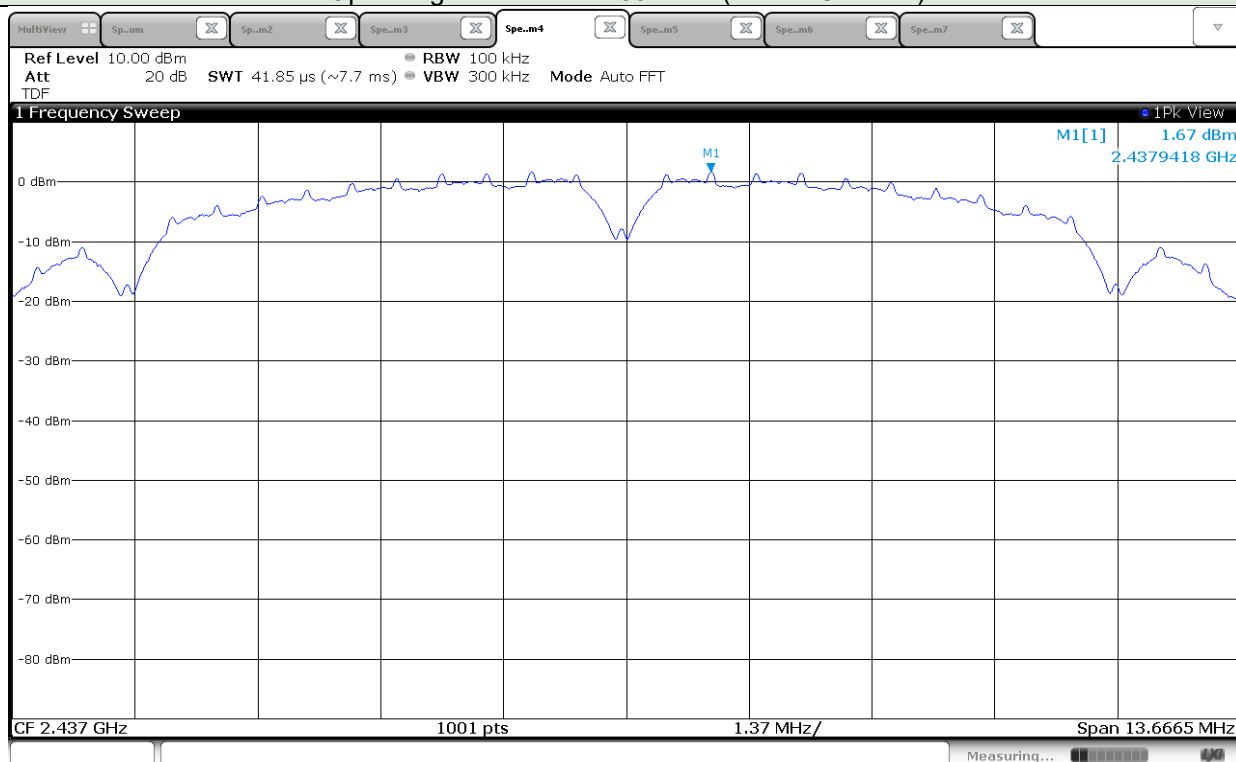




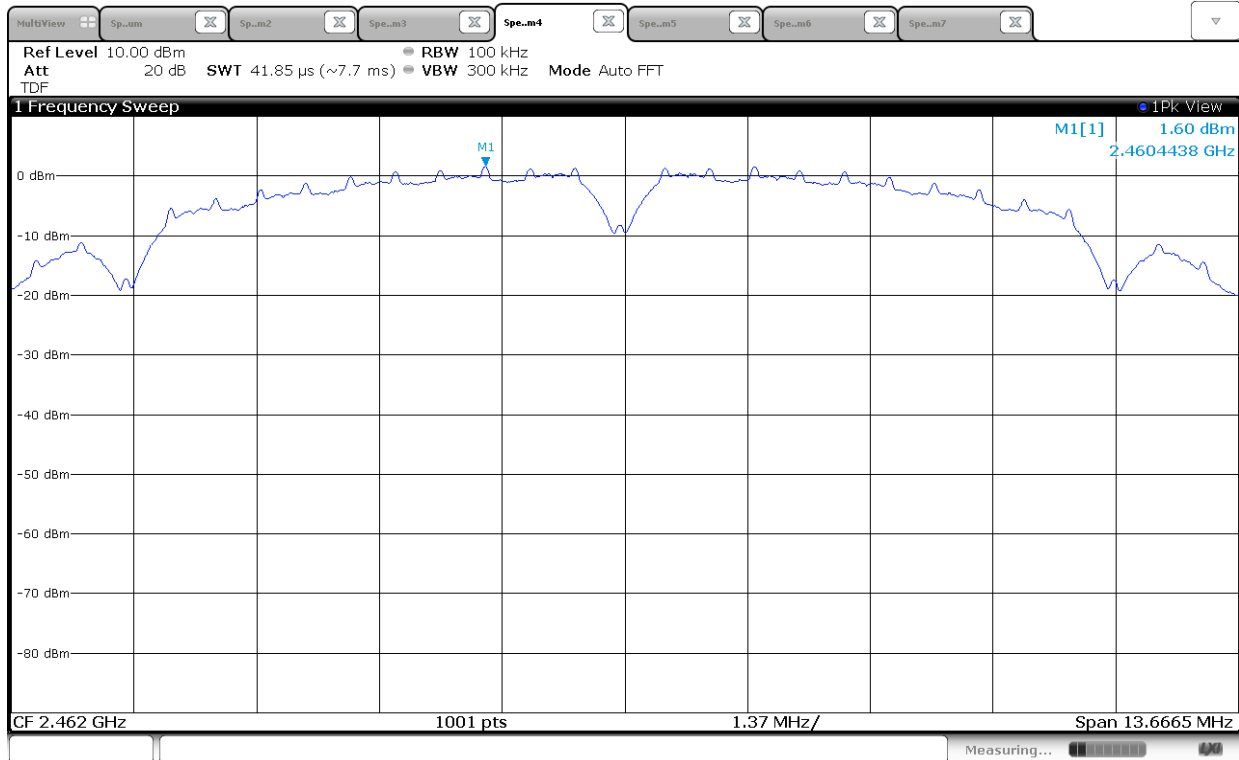
Operating Mode: WLAN 802.11b (Low Channel)



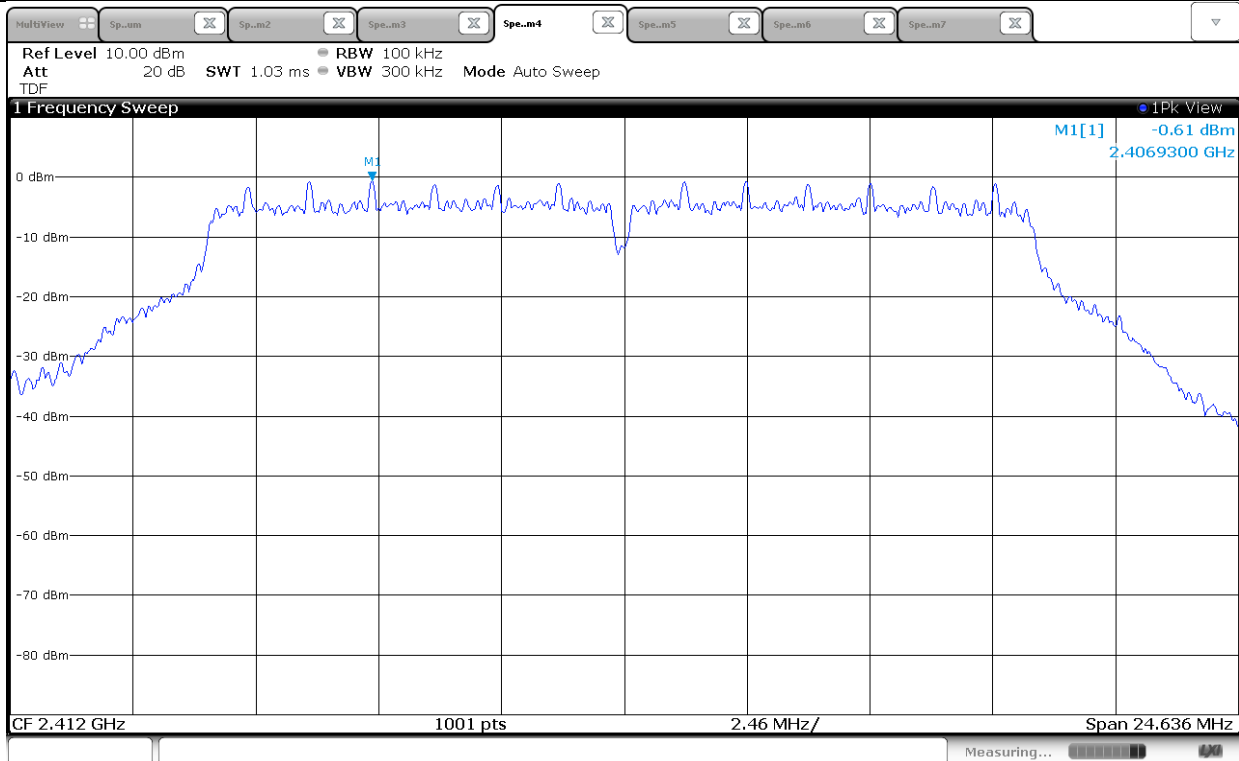
Operating Mode: WLAN 802.11b (Middle Channel)



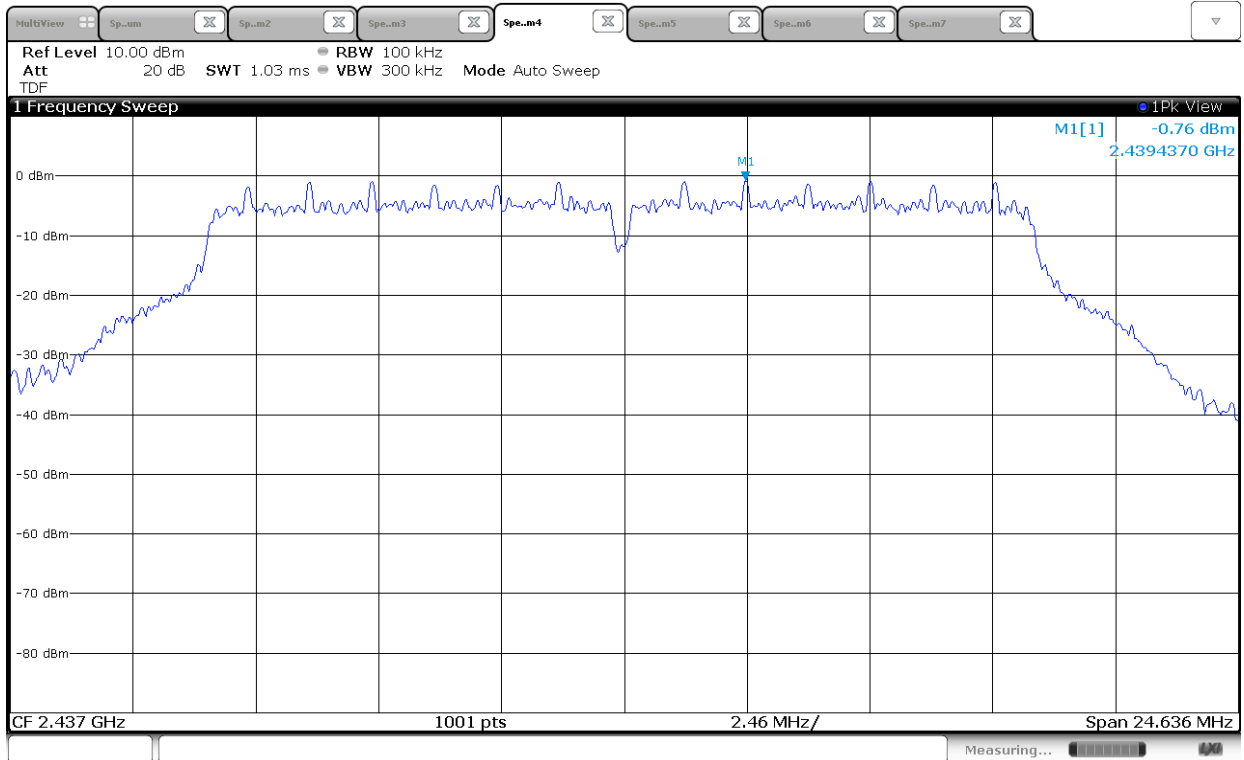
Operating Mode: WLAN 802.11b (High Channel)



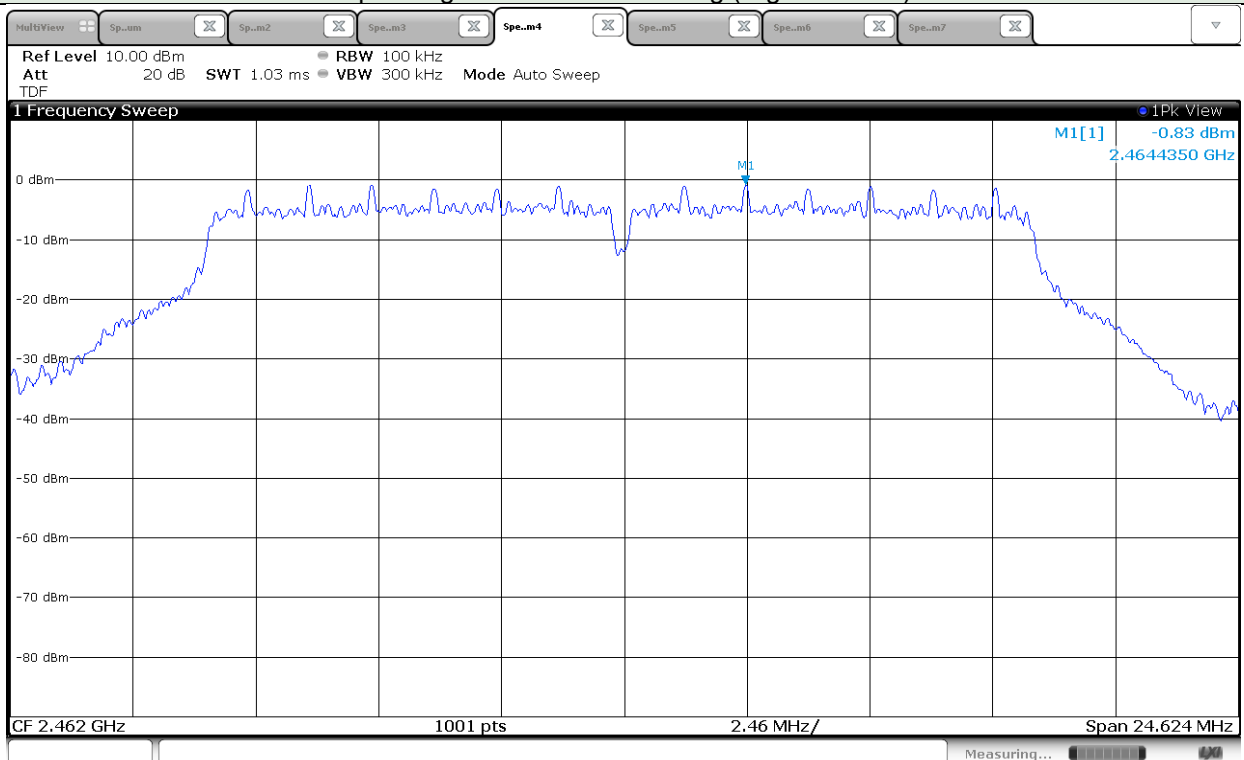
Operating Mode: WLAN 802.11g (Low Channel)



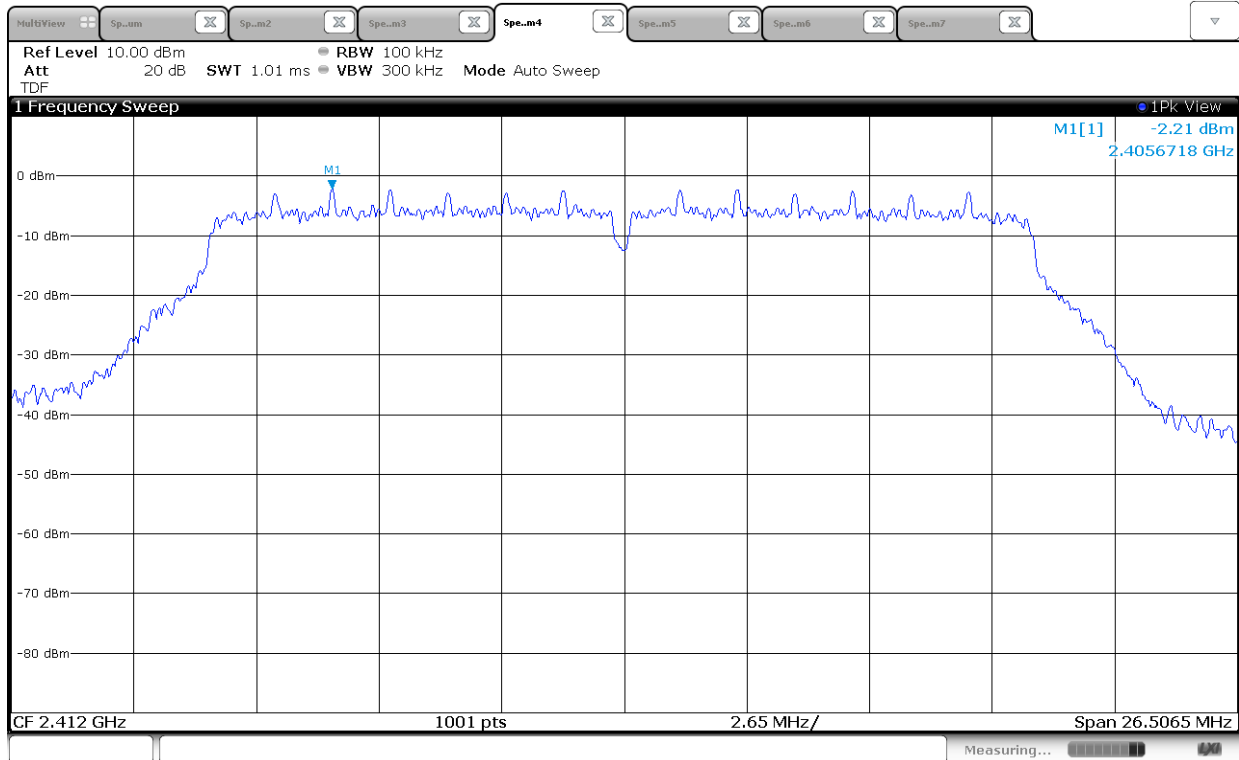
Operating Mode: WLAN 802.11g (Middle Channel)



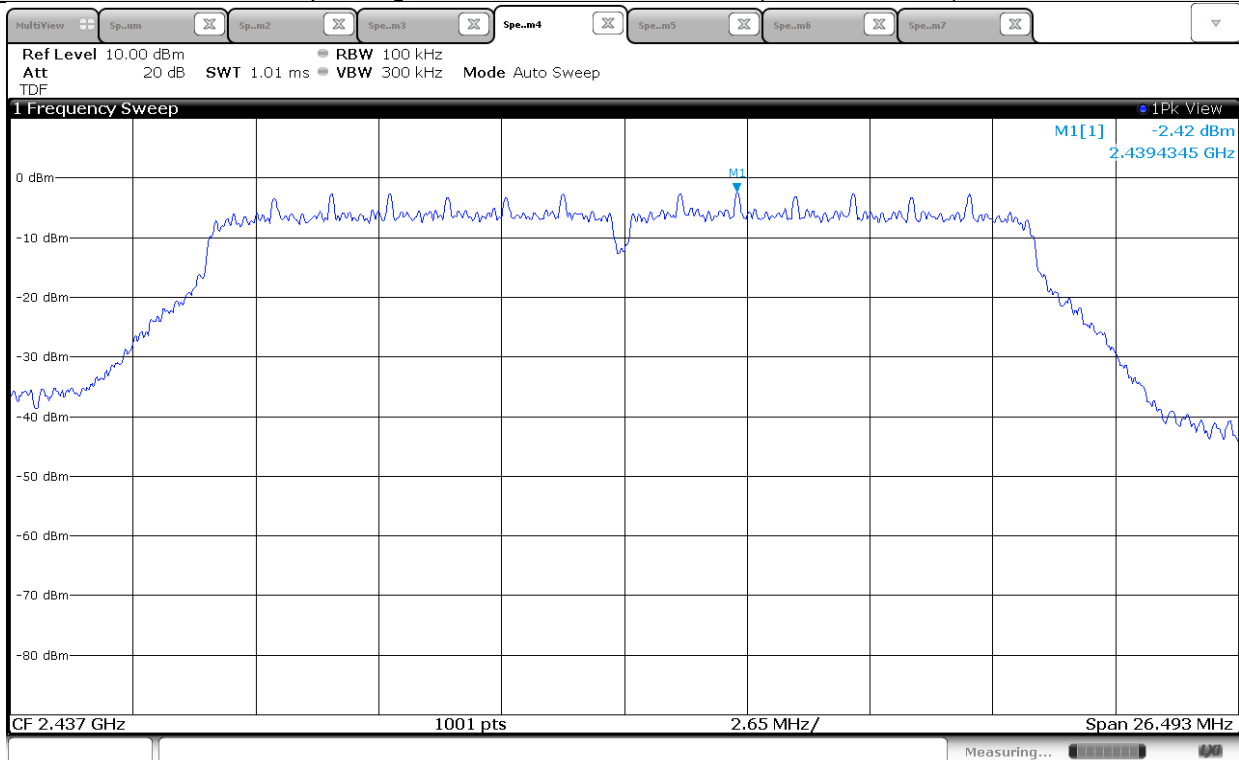
Operating Mode: WLAN 802.11g (High Channel)



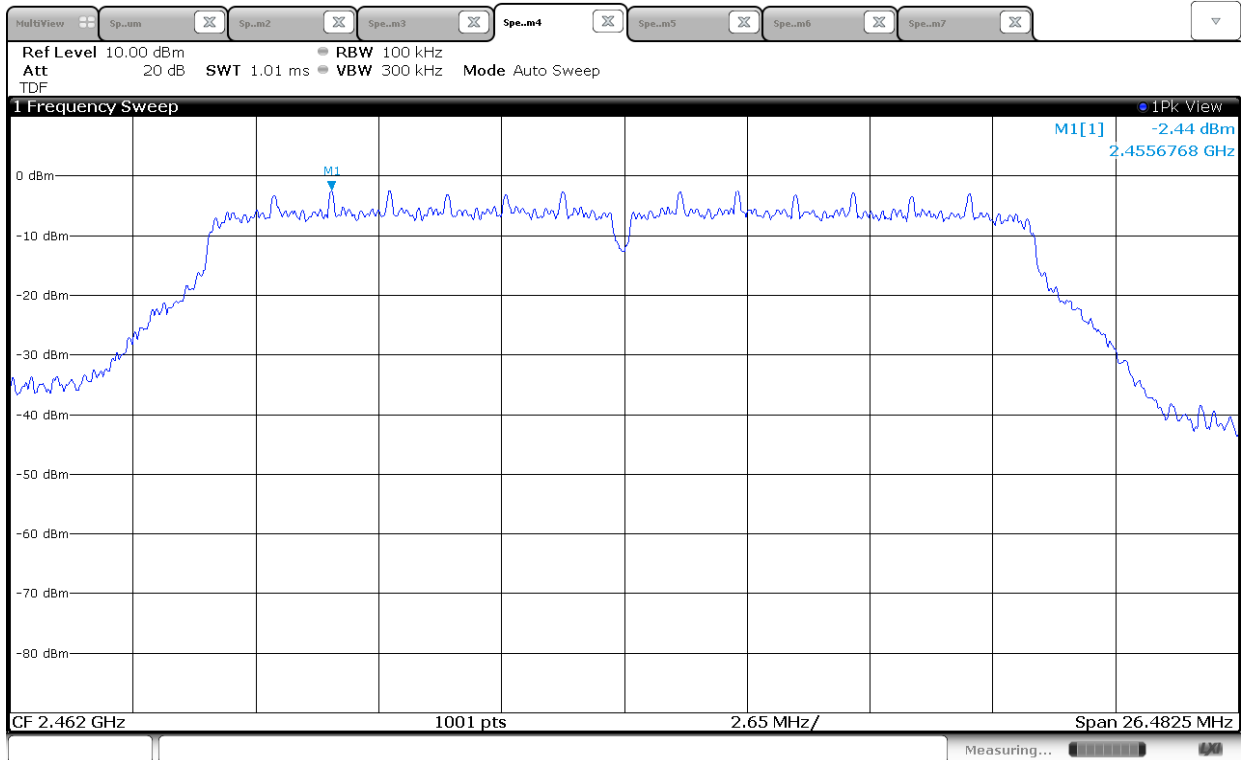
Operating Mode: WLAN 802.11n HT20 (Low Channel)



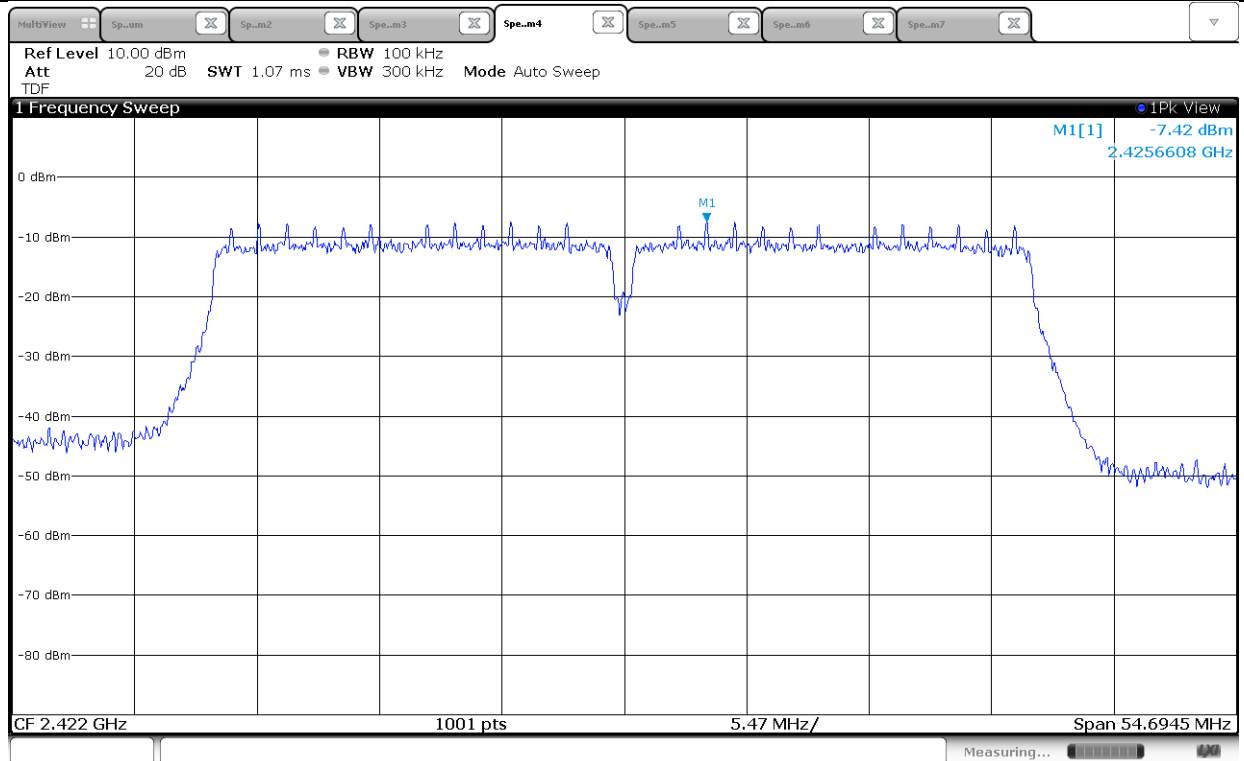
Operating Mode: WLAN 802.11n HT20 (Middle Channel)



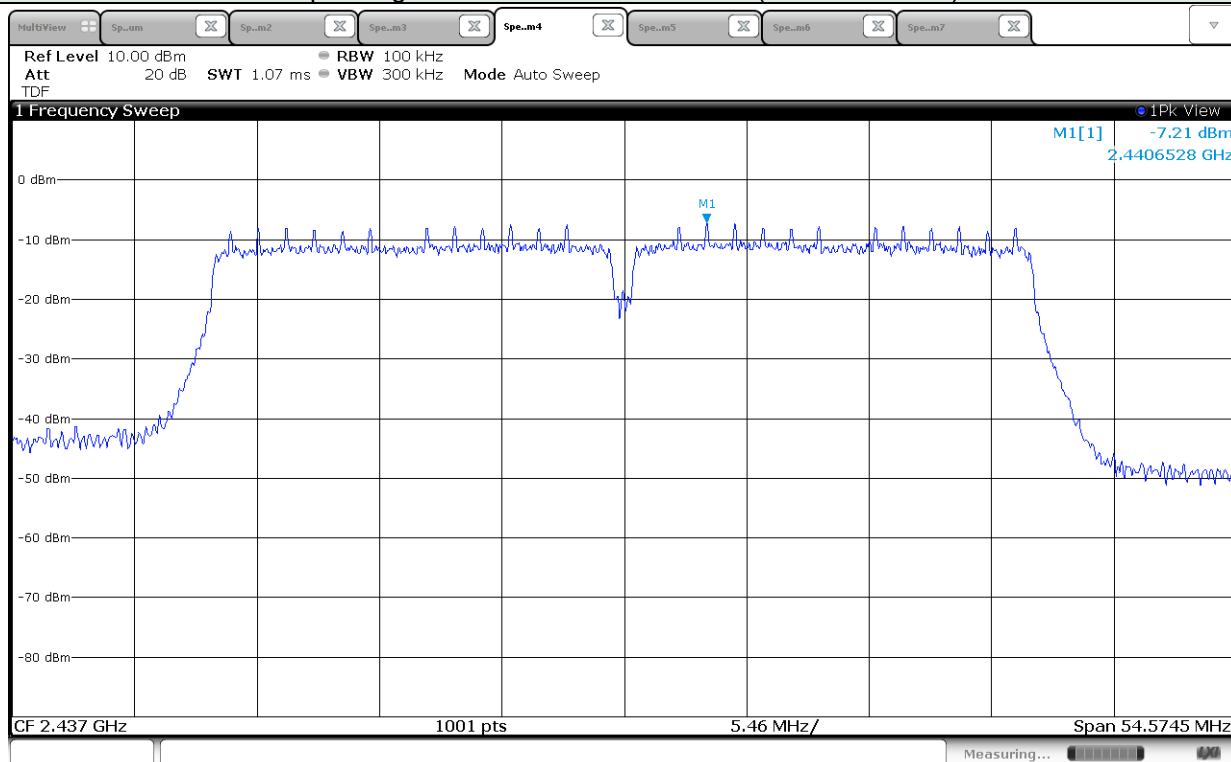
Operating Mode: WLAN 802.11n HT20 (High Channel)



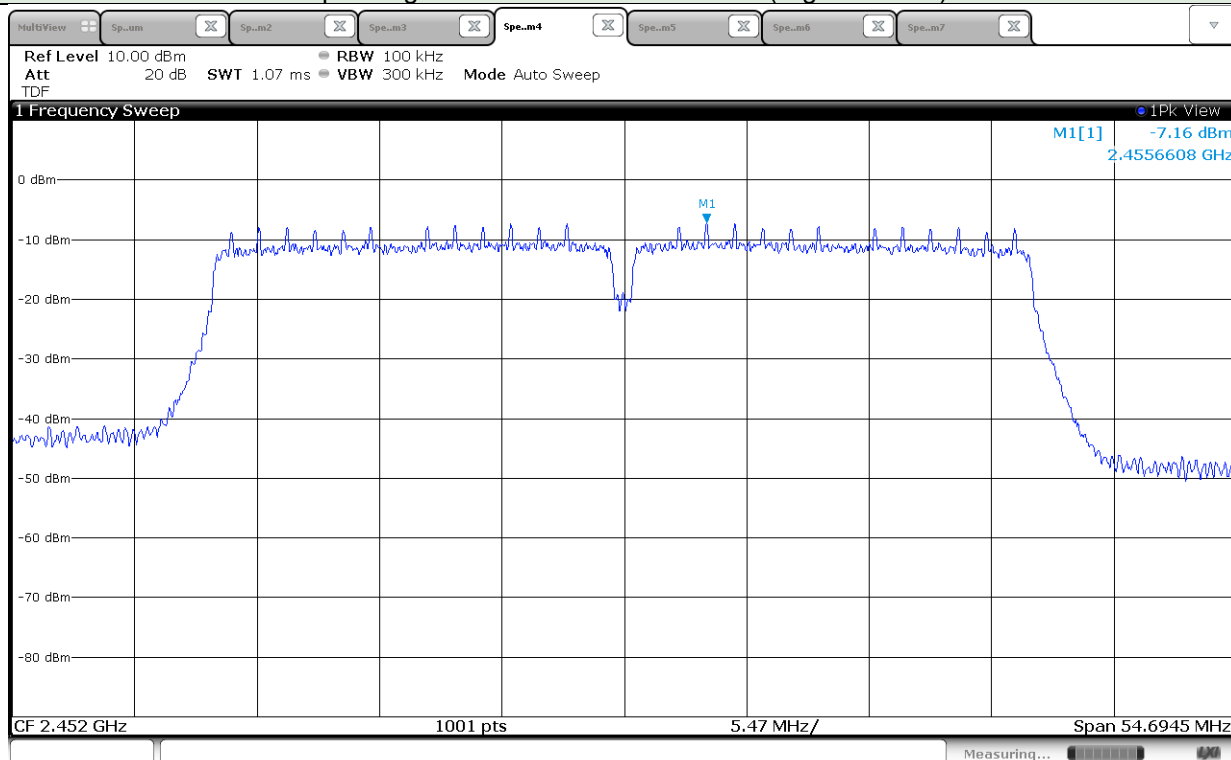
Operating Mode: WLAN 802.11n HT40 (Low Channel)



Operating Mode: WLAN 802.11n HT40 (Middle Channel)



Operating Mode: WLAN 802.11n HT40 (High Channel)



5.6 Out of Band Emission

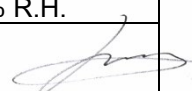
5.6.1 Limit

Acc. To section 15.247(d) and RSS-247 5.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

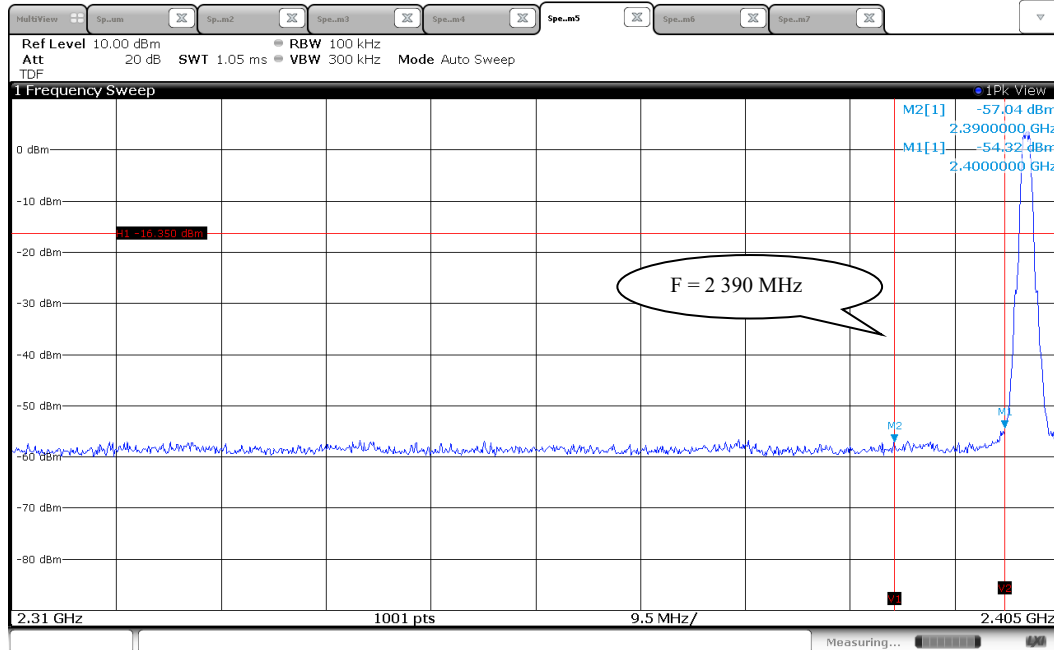
5.6.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas. Guidance v05r02: 8.5 Emissions in non-restricted frequency bands. The transmitter output is connected to a spectrum analyzer with the RBW set to 100 kHz, VBW $\geq 3 \times$ RBW, peak detector and max hold. Measurements utilizing these settings are made of the in-band reference level, band-edge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

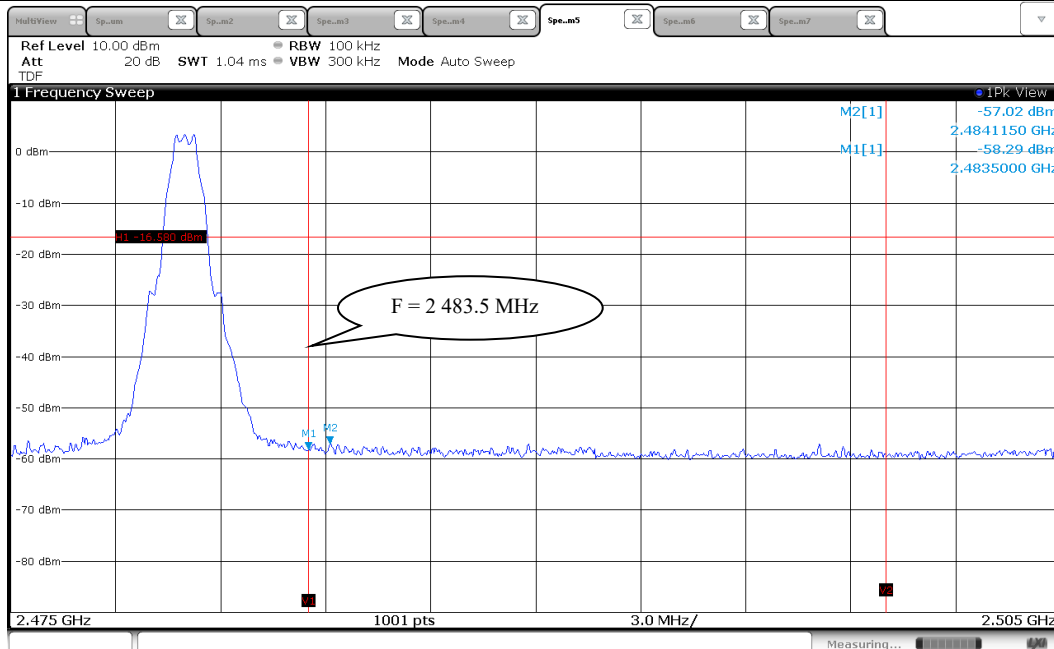
5.6.3 Test Data for Operating mode: Bluetooth LE

Date of Test	2020-04-07	Temperature	(21.0 ± 0.9) °C
		Relative humidity	(39.0 ± 0.4) % R.H.
Test Result	PASS	Tested by	In-yong Song 

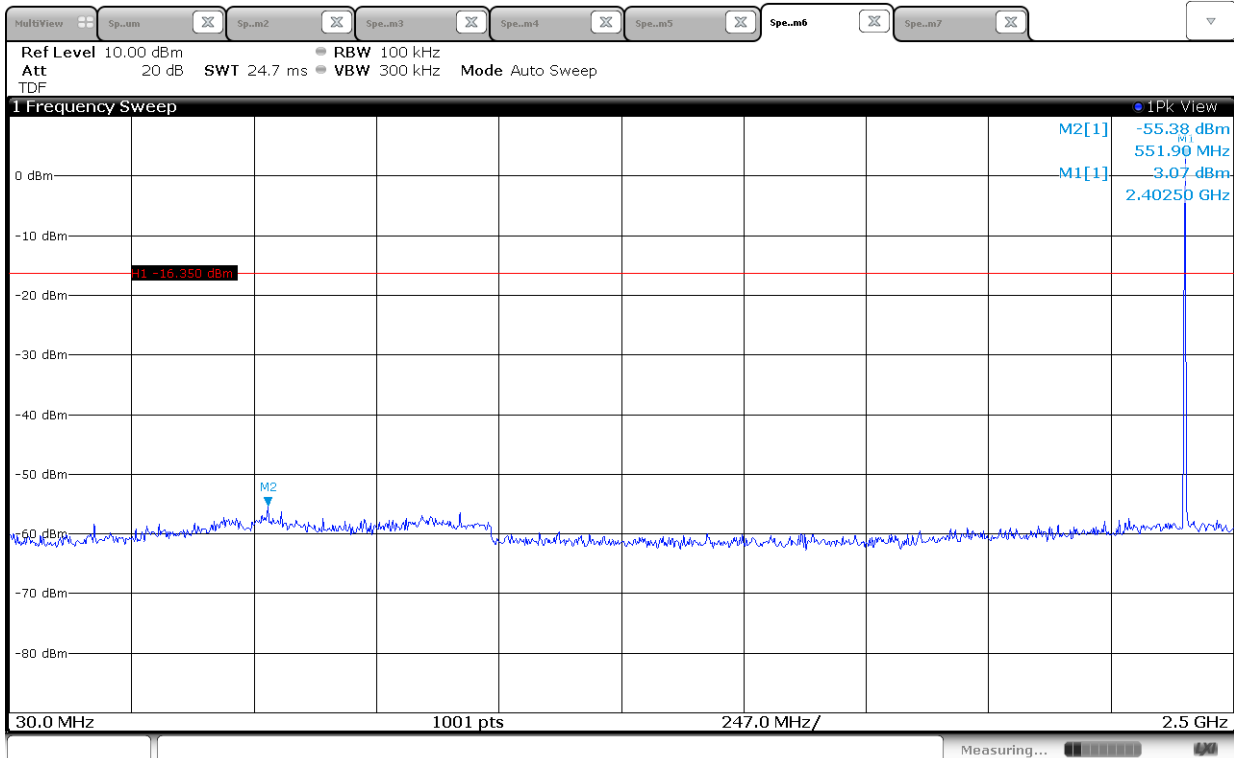
Band-edge and Restricted band – Low channel



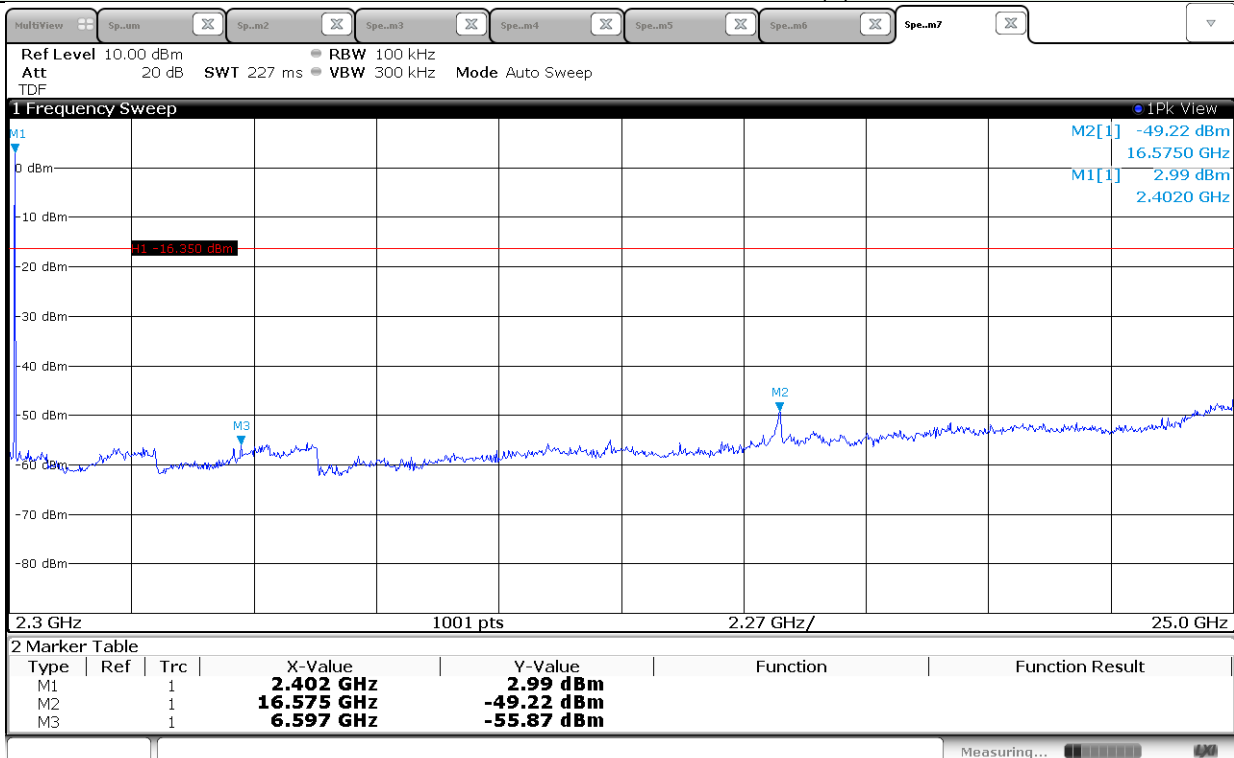
Band-edge and Restricted band – High channel



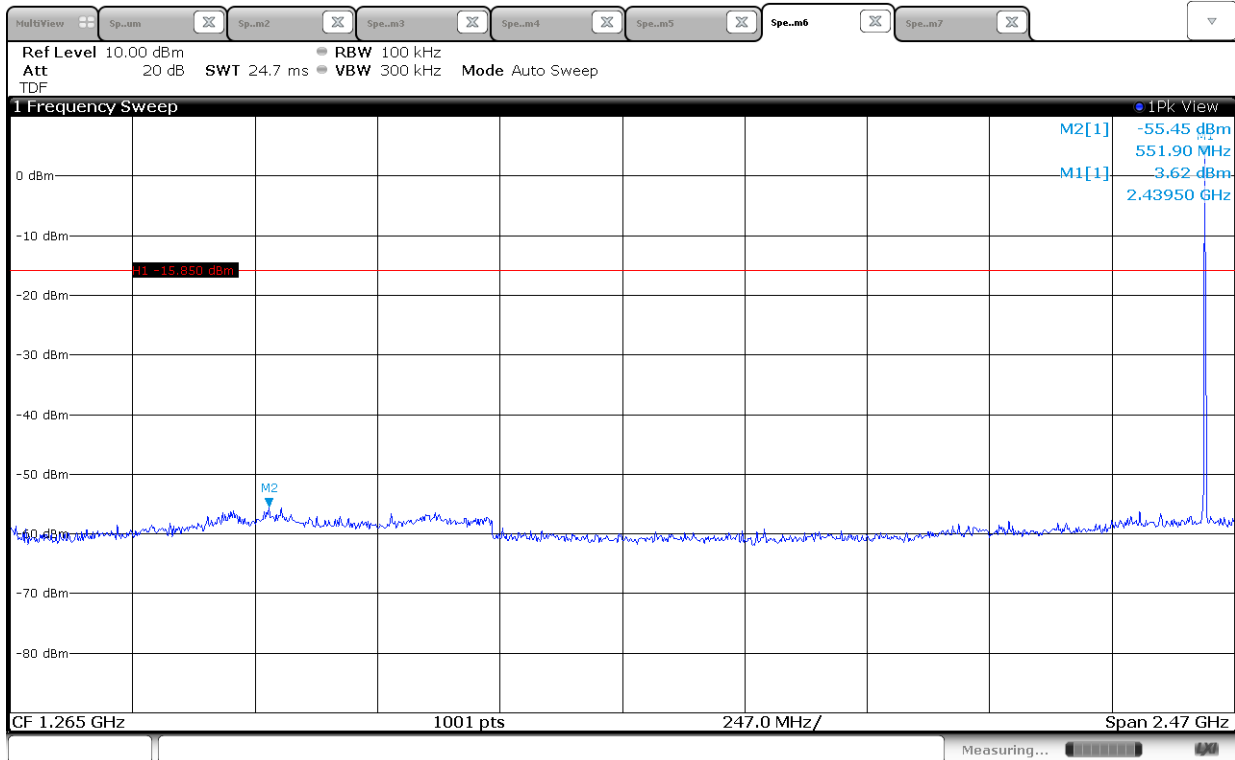
Non-restricted band – Low Channel (1)



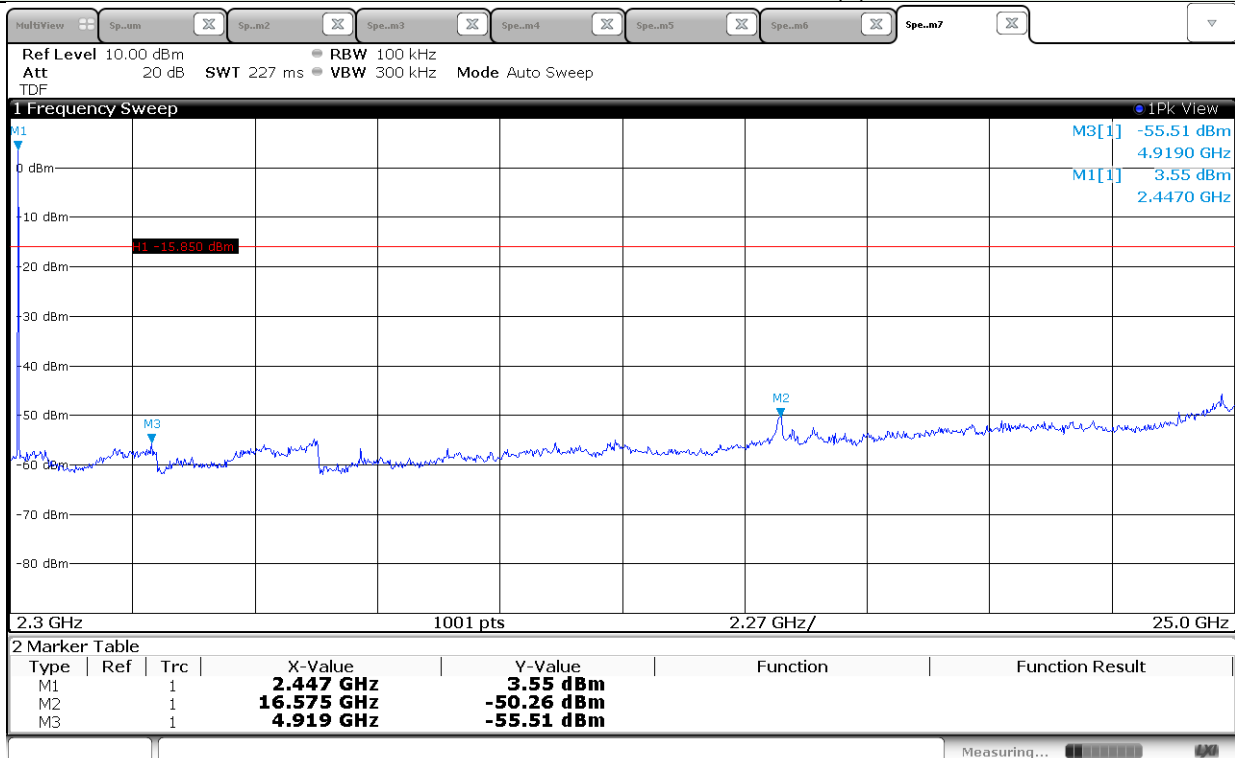
Non-restricted band – Low Channel (2)



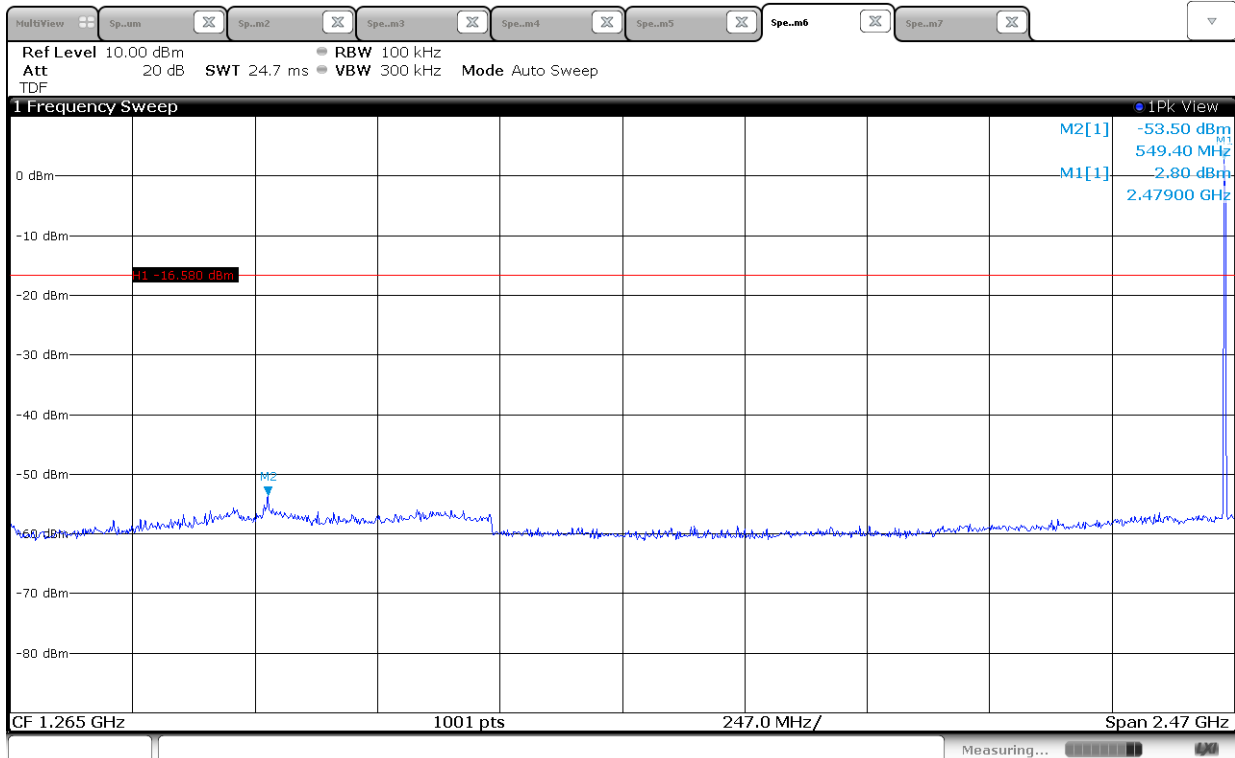
Non-restricted band – Middle Channel (1)



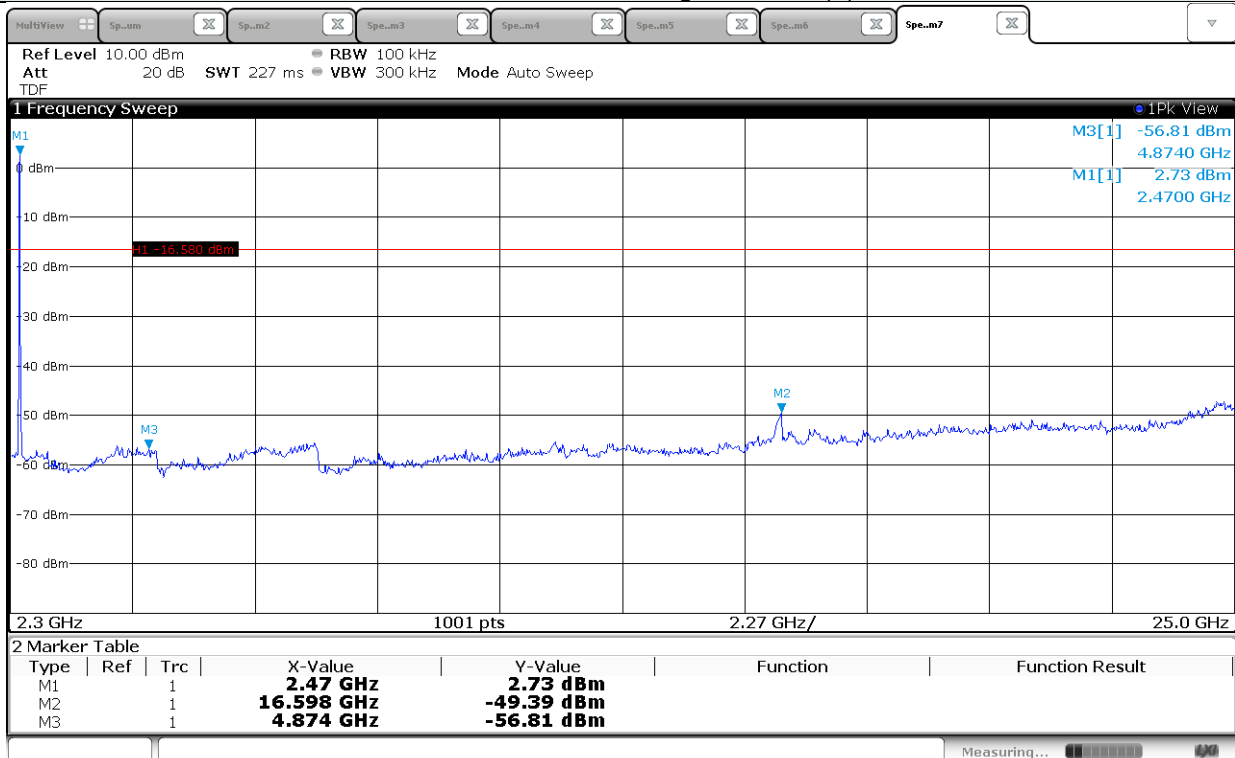
Non-restricted band – Middle Channel (2)



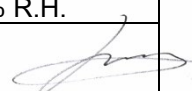
Non-restricted band – High Channel (1)



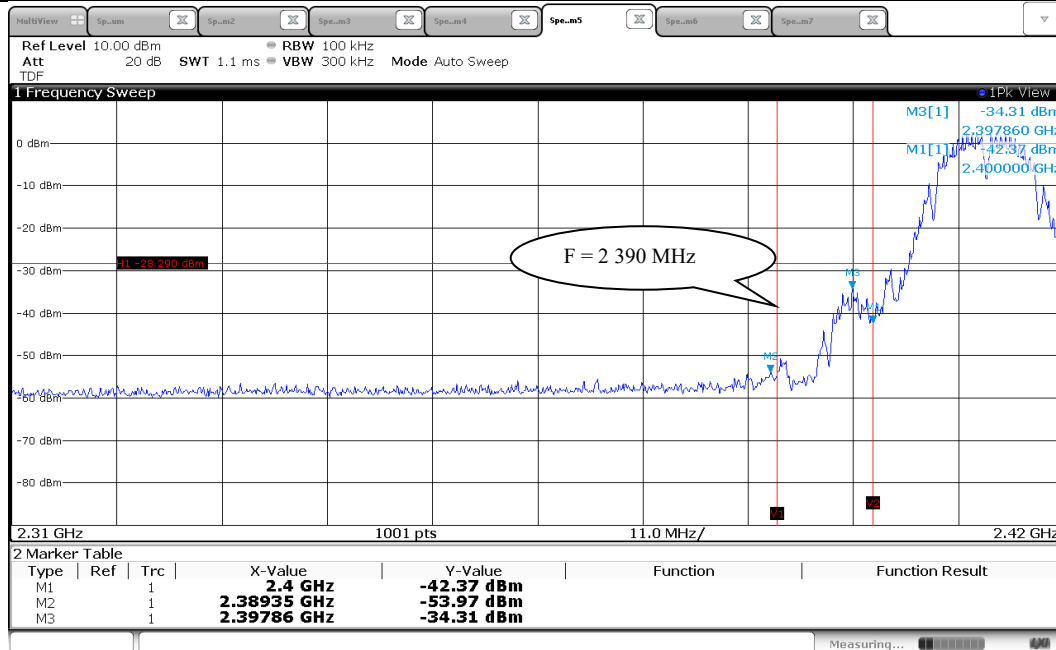
Non-restricted band – High Channel (2)



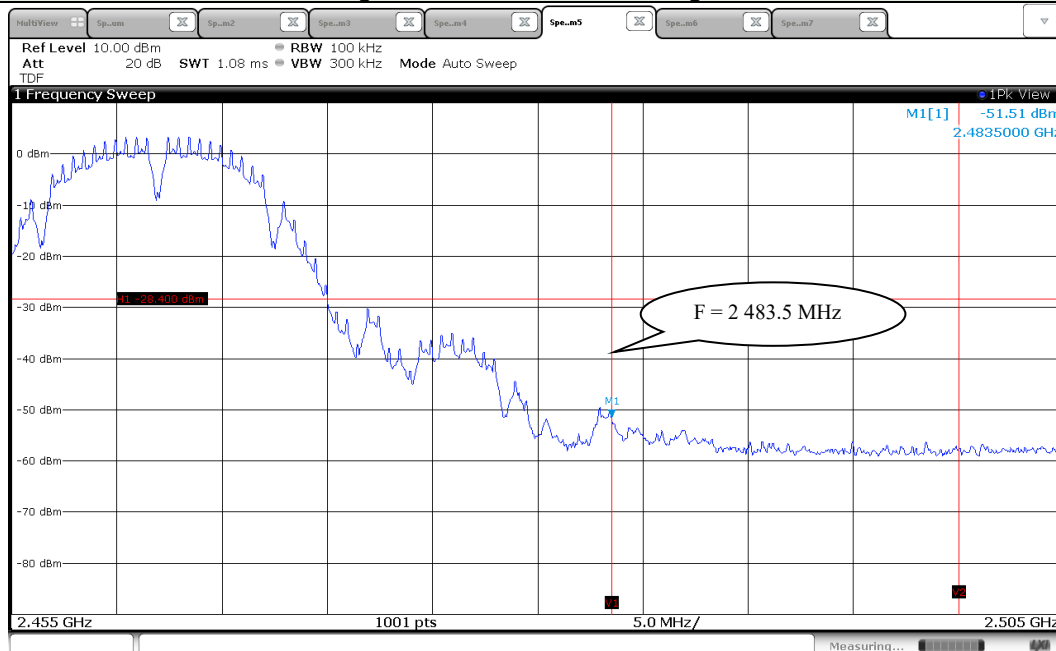
5.6.4 Test Data for Operating mode: WLAN 802.11b

Date of Test	2020-04-07	Temperature	(21.0 ± 0.9) °C
		Relative humidity	(39.0 ± 0.4) % R.H.
Test Result	PASS	Tested by	In-yong Song 

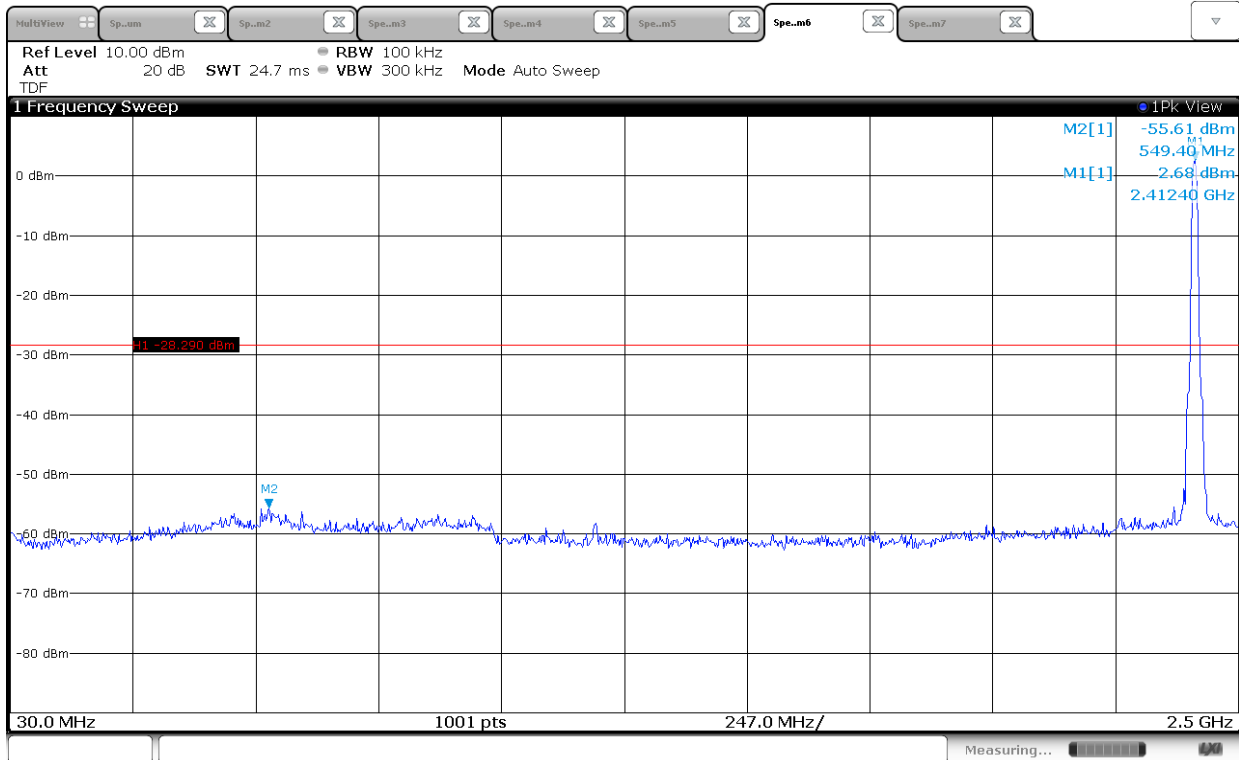
Band-edge and Restricted band – Low channel



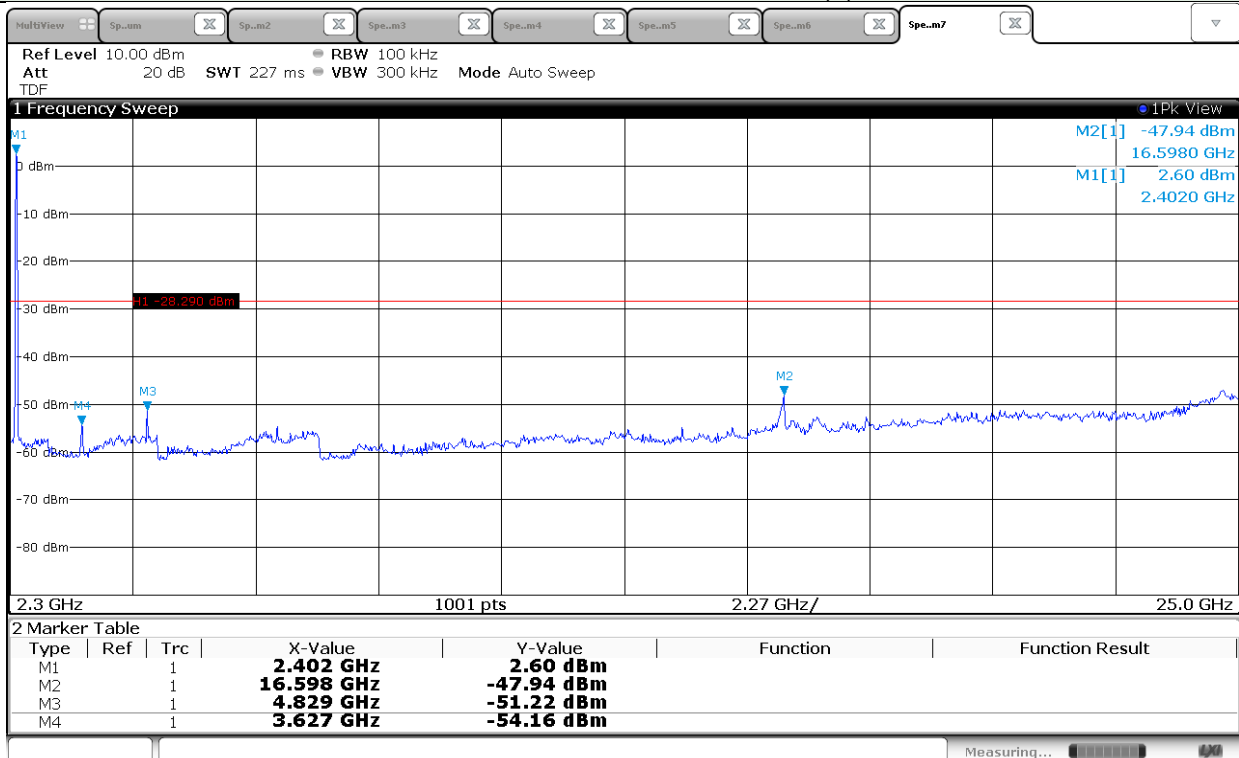
Band-edge and Restricted band – High channel



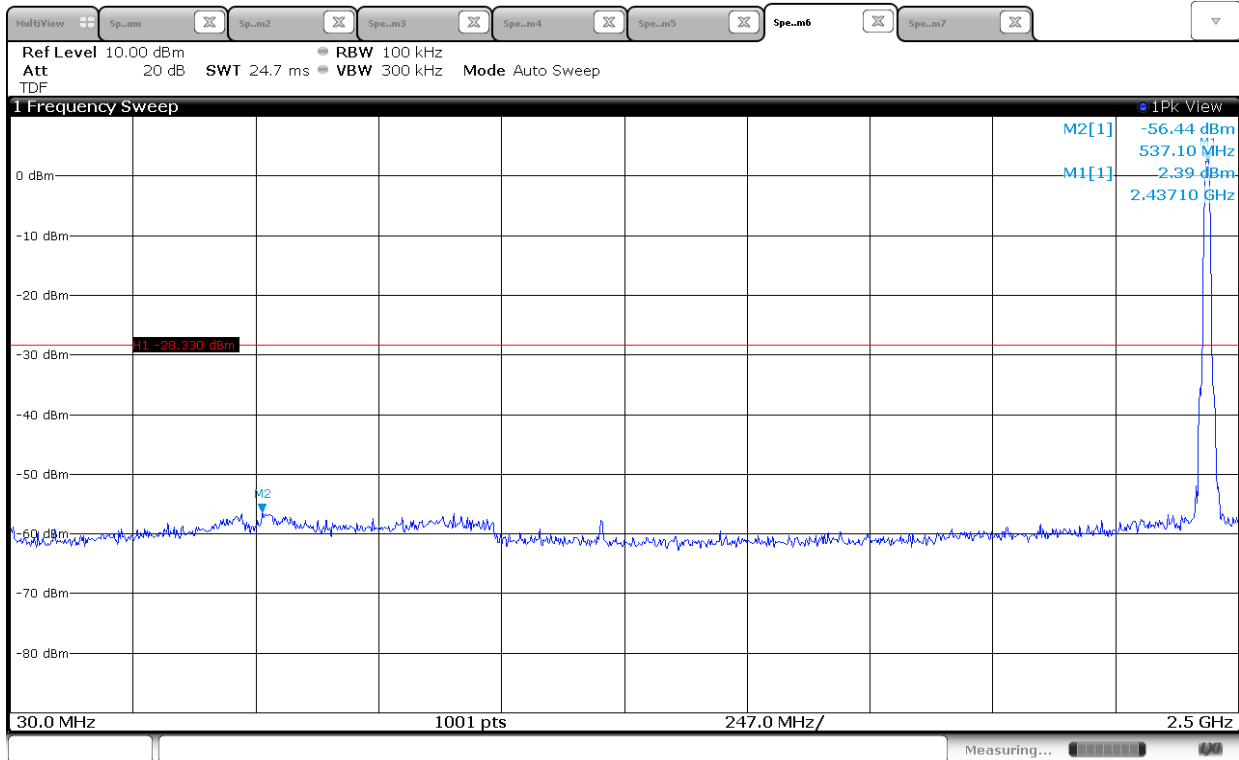
Non-restricted band – Low Channel (1)



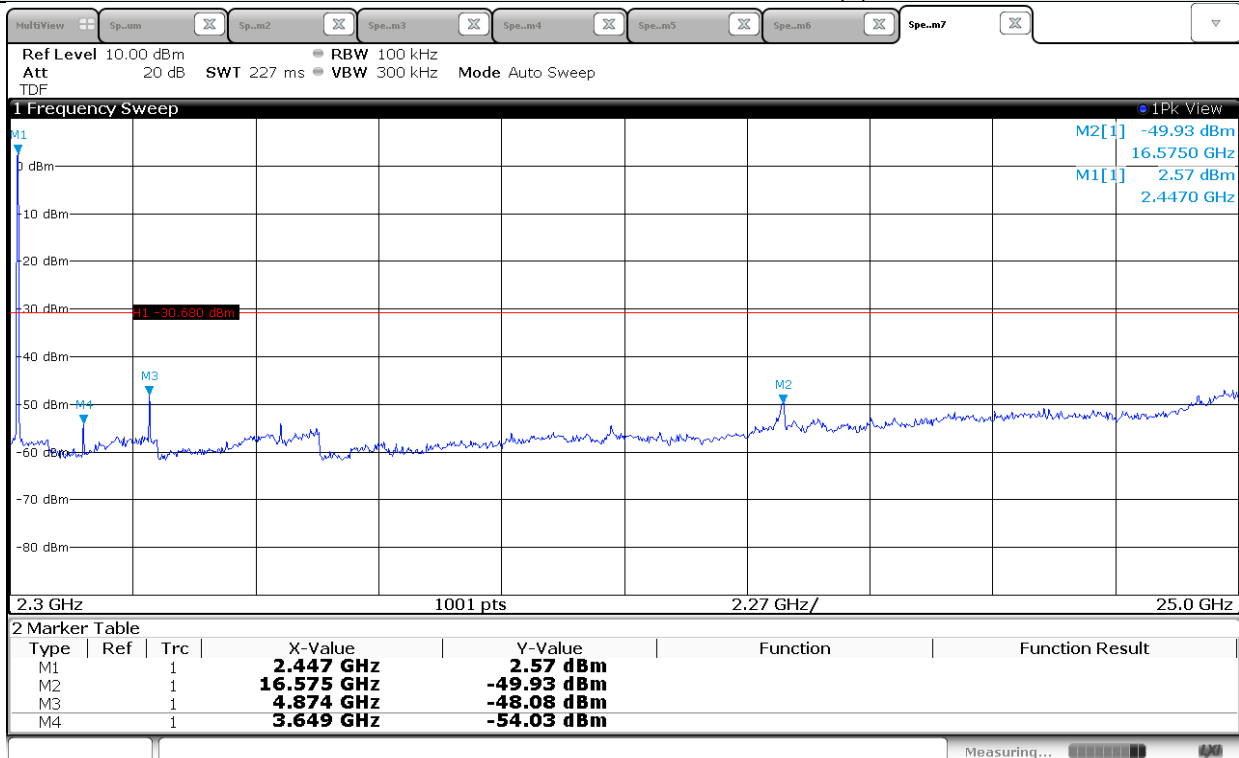
Non-restricted band – Low Channel (2)



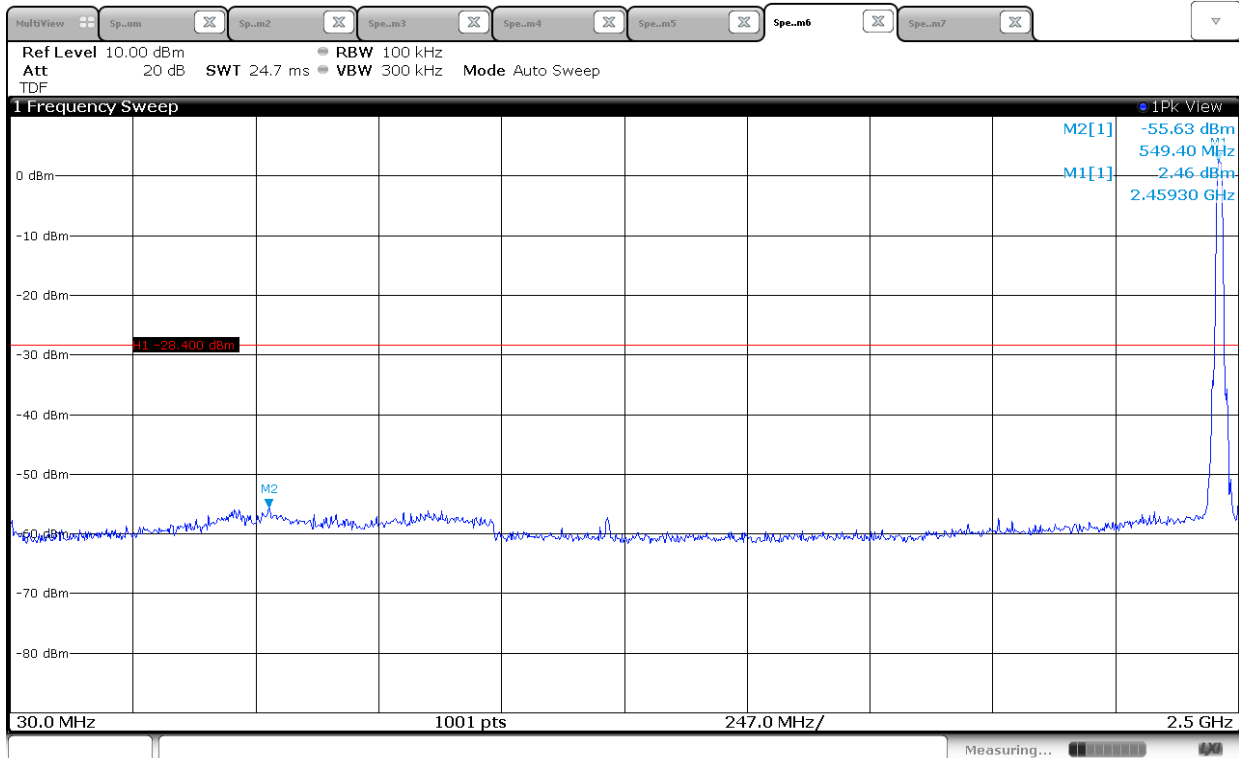
Non-restricted band – Middle Channel (1)



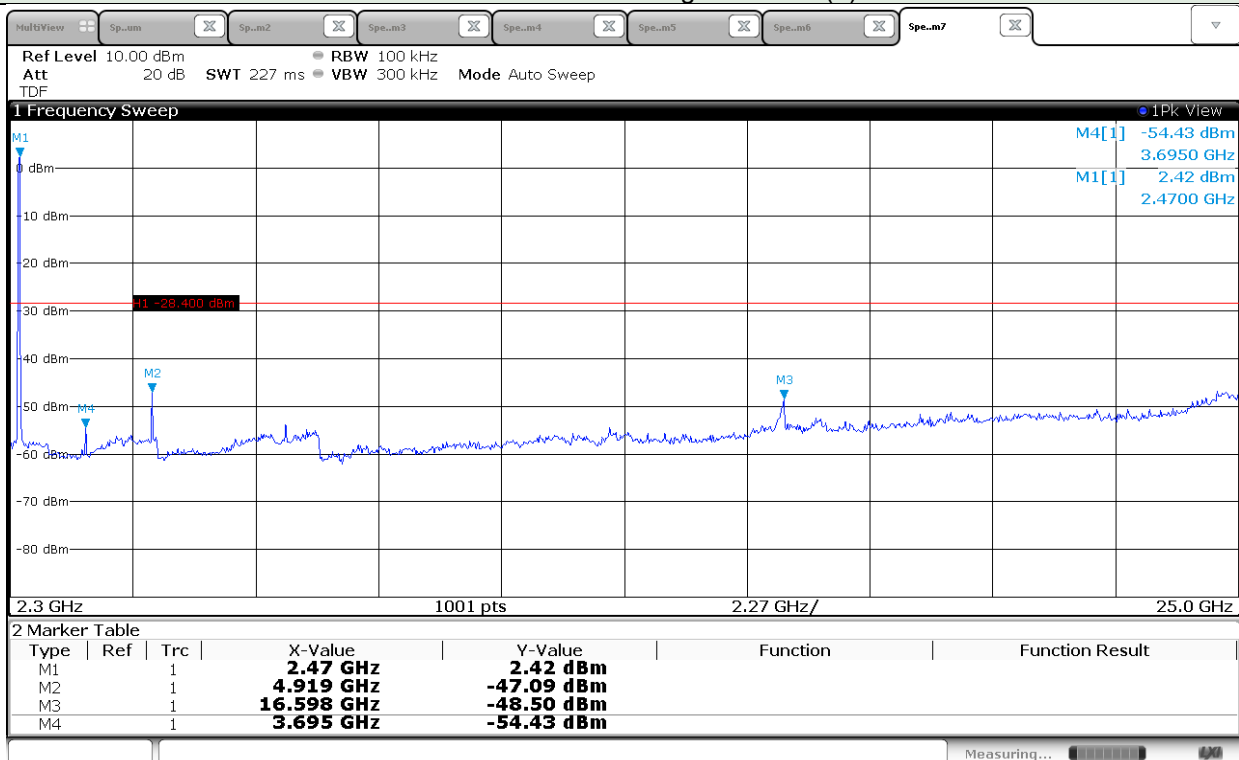
Non-restricted band – Middle Channel (2)



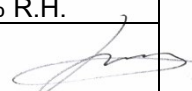
Non-restricted band – High Channel (1)



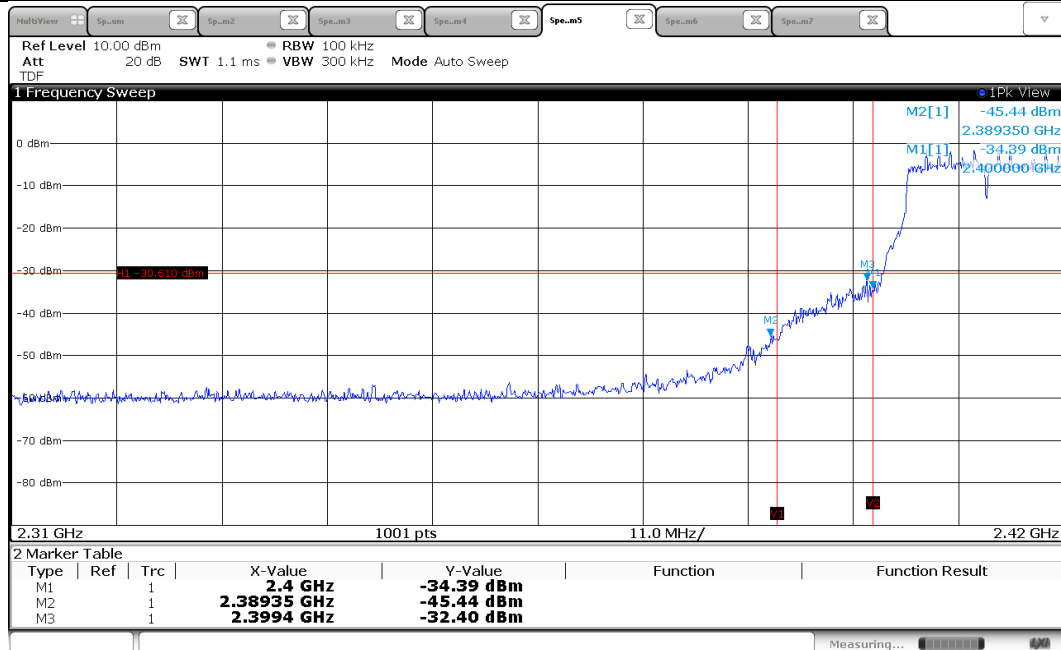
Non-restricted band – High Channel (2)



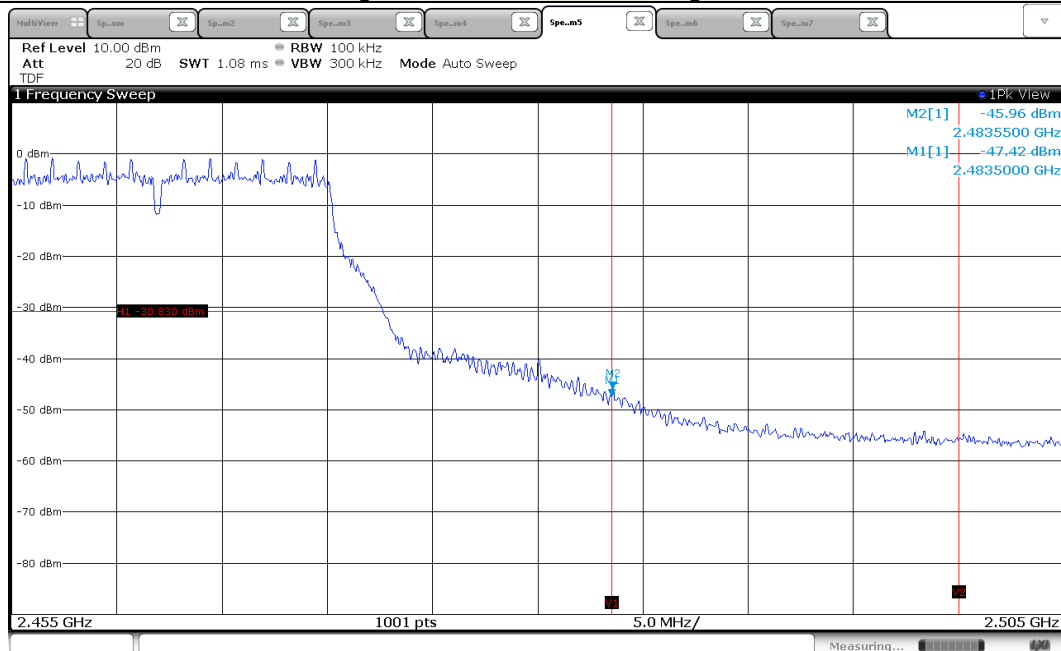
5.6.5 Test Data for Operating mode: WLAN 802.11g

Date of Test	2020-04-07	Temperature	(21.0 ± 0.9) °C
		Relative humidity	(39.0 ± 0.4) % R.H.
Test Result	PASS	Tested by	In-yong Song 

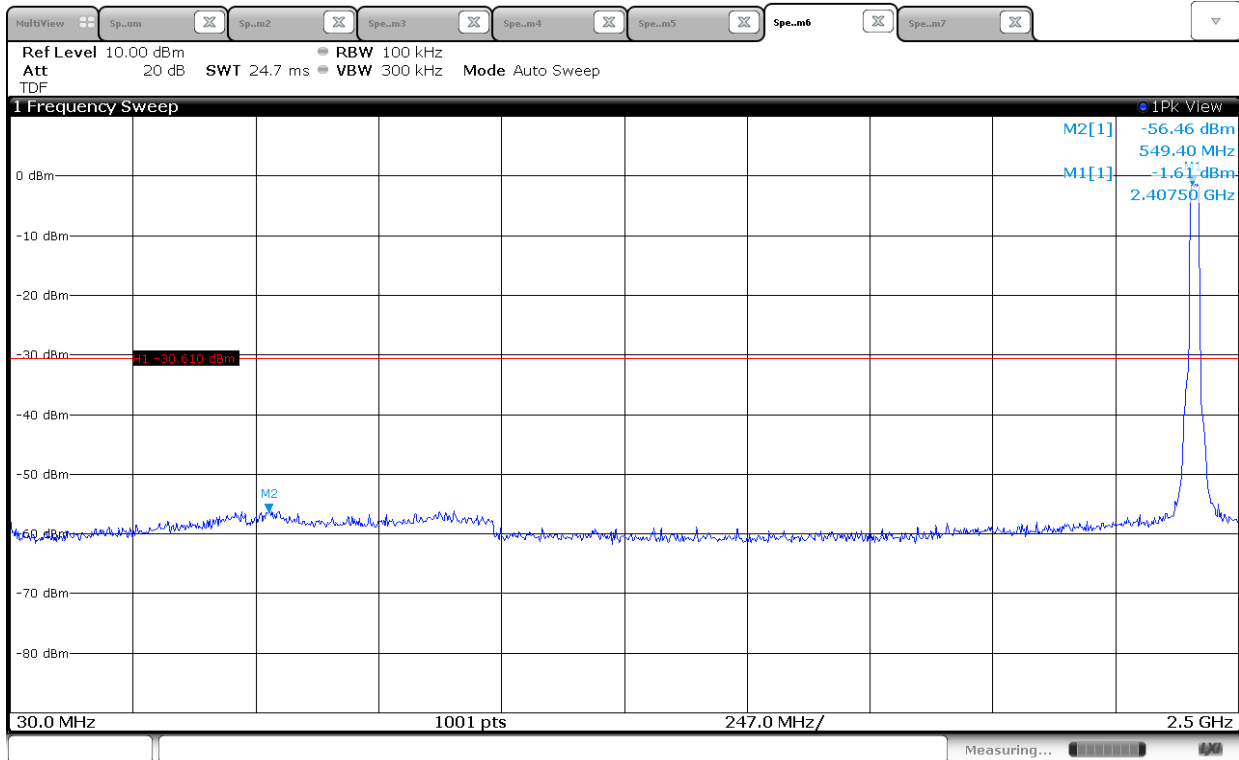
Band-edge and Restricted band – Low channel



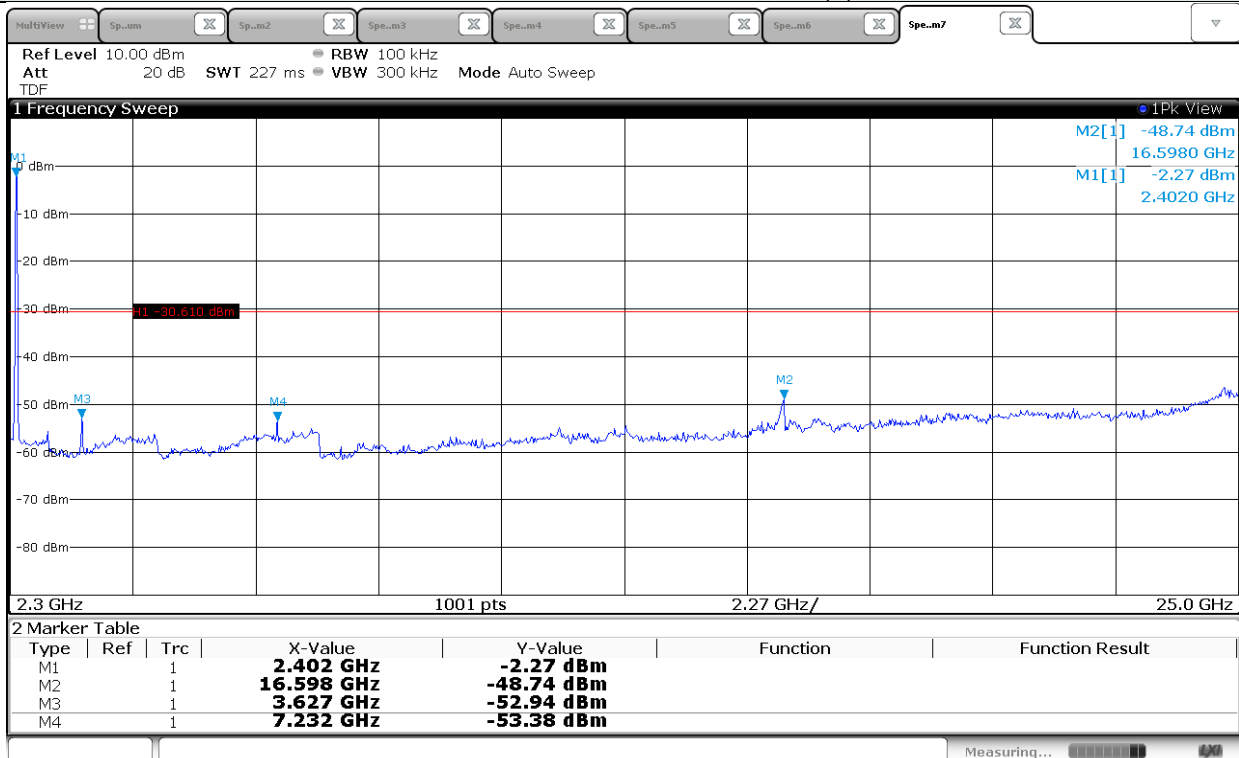
Band-edge and Restricted band – High channel



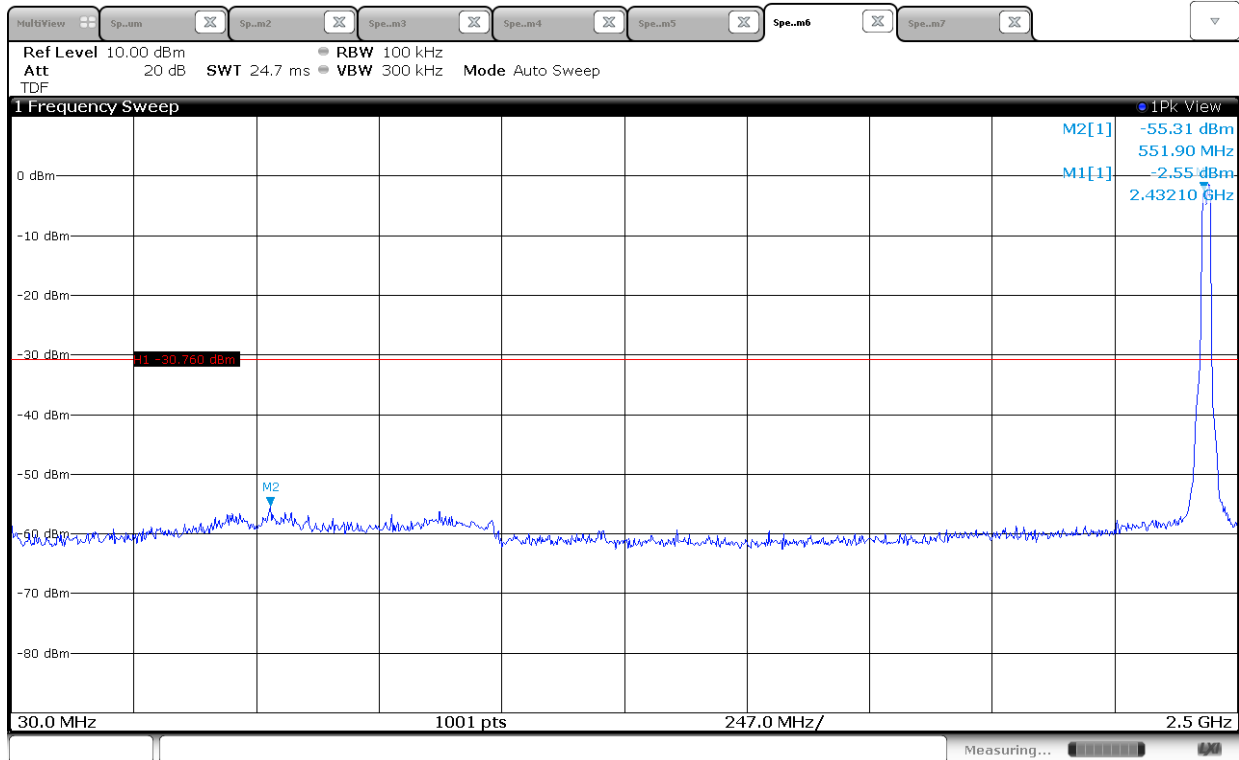
Non-restricted band – Low Channel (1)



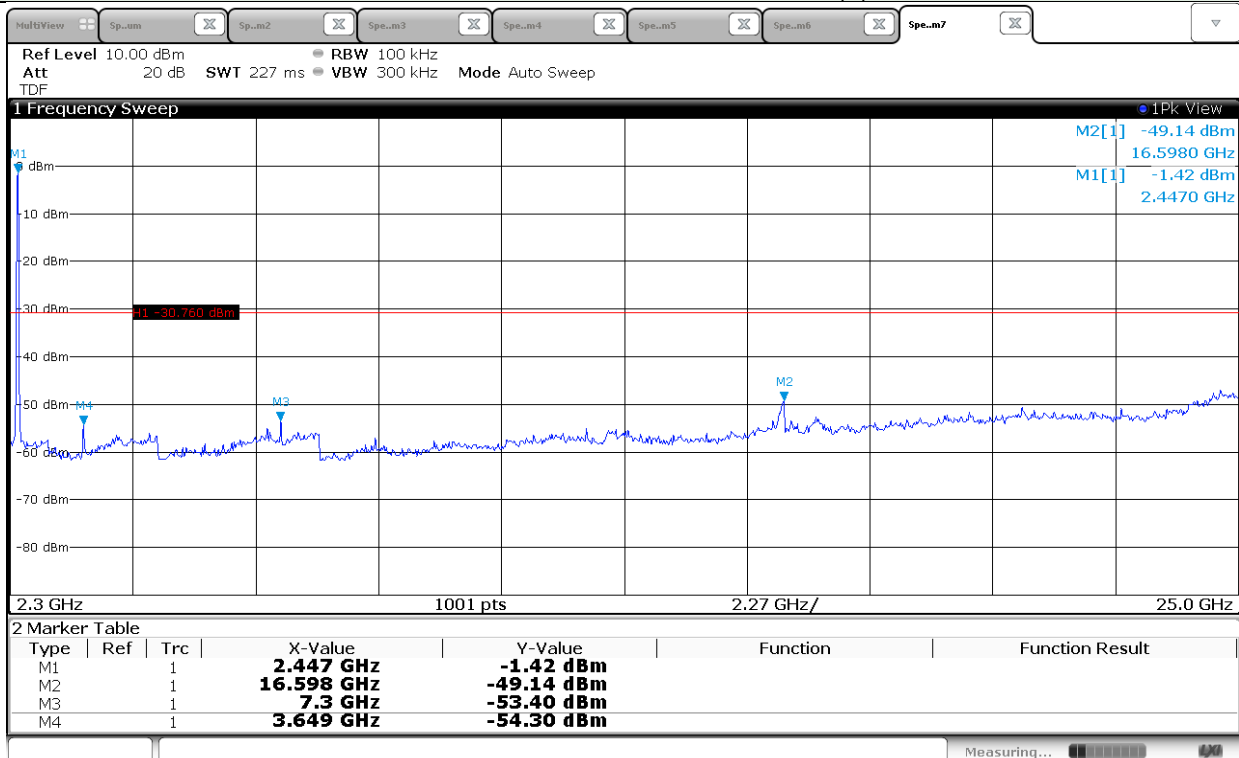
Non-restricted band – Low Channel (2)



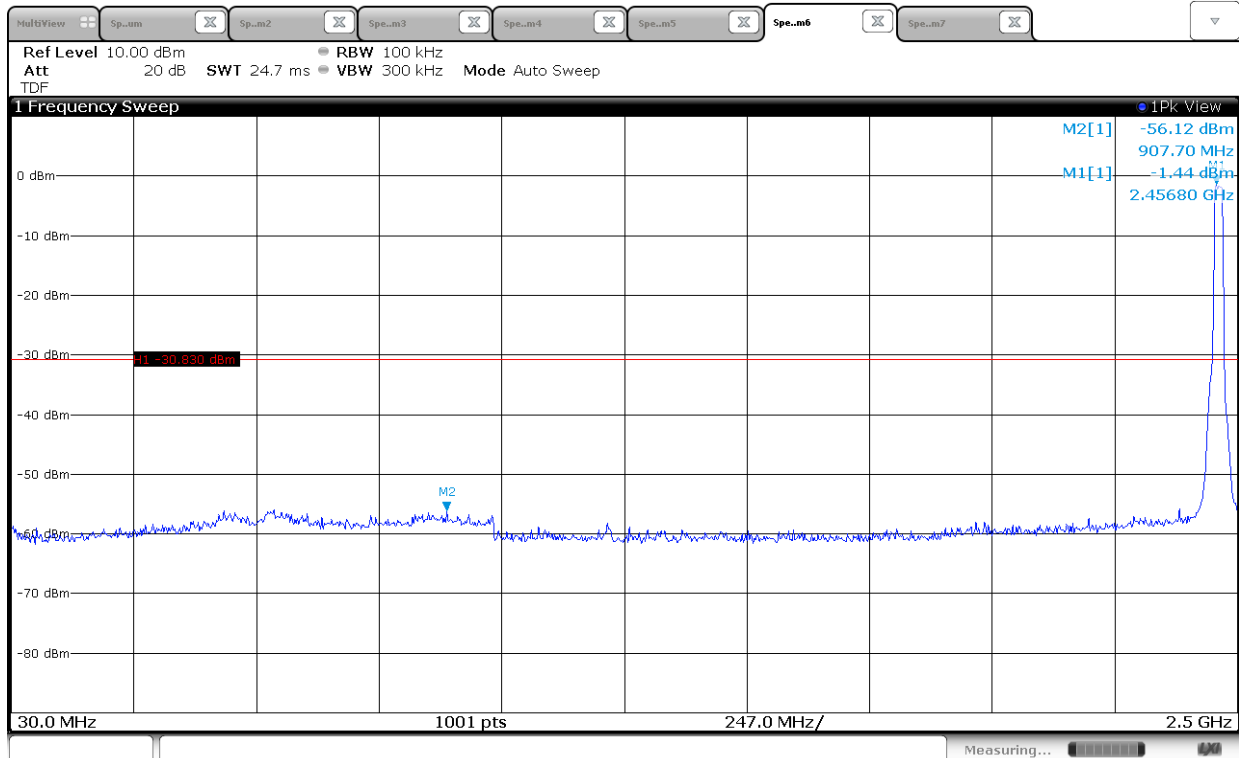
Non-restricted band – Middle Channel (1)



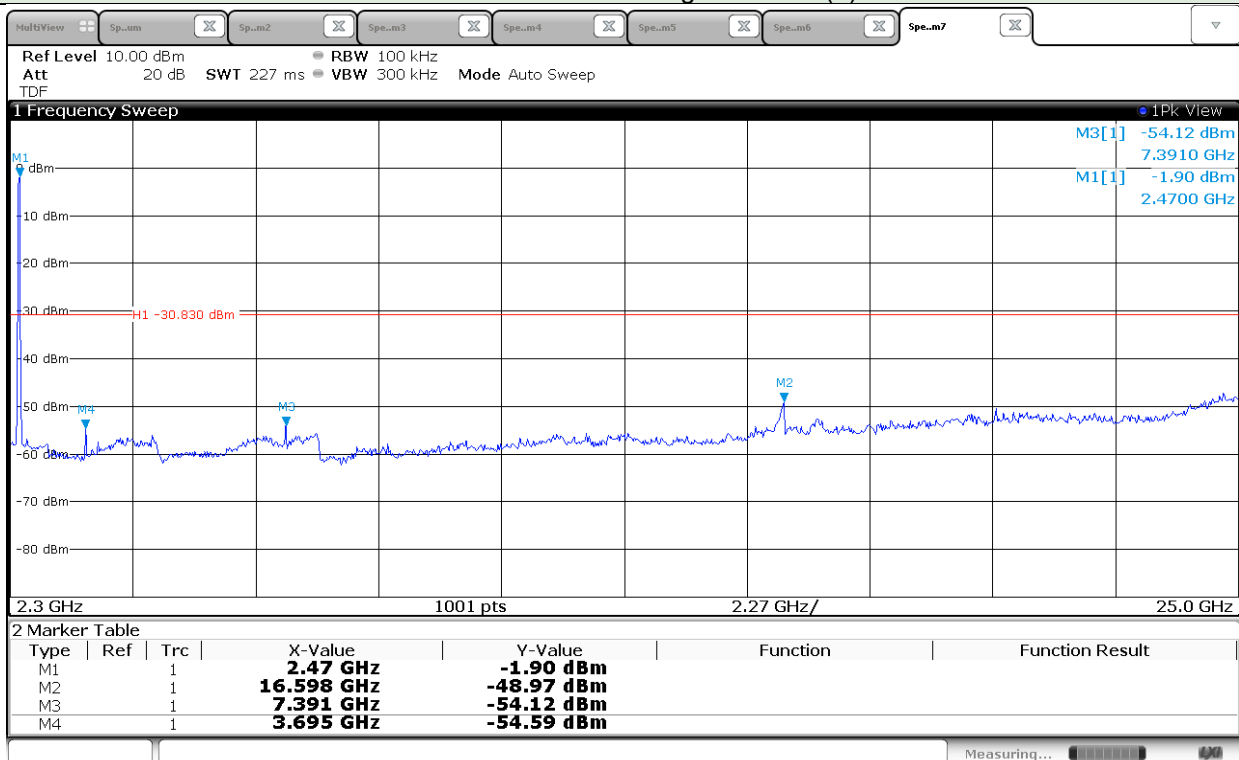
Non-restricted band – Middle Channel (2)



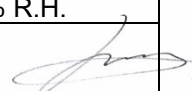
Non-restricted band – High Channel (1)



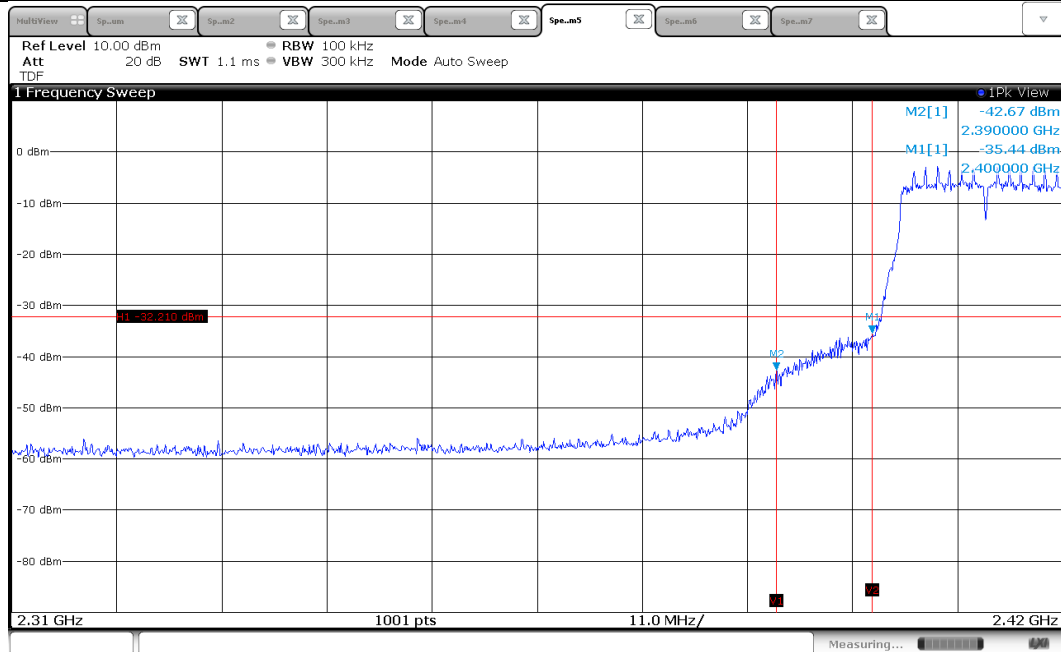
Non-restricted band – High Channel (2)



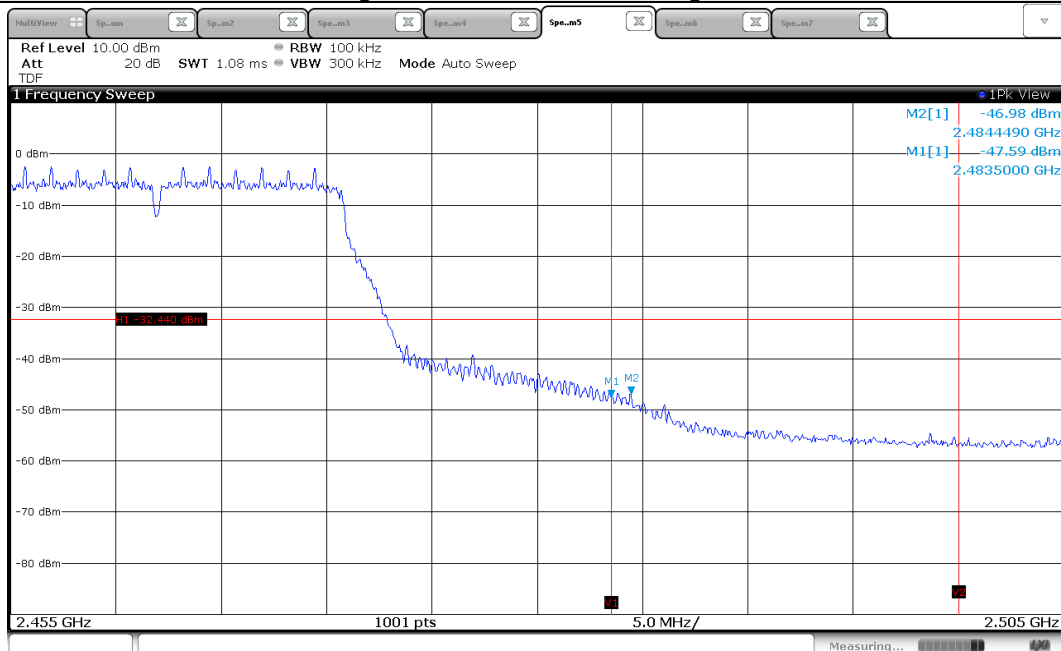
5.6.6 Test Data for Operating mode: WLAN 802.11n HT20

Date of Test	2020-04-07	Temperature	(21.0 ± 0.9) °C
		Relative humidity	(39.0 ± 0.4) % R.H.
Test Result	PASS	Tested by	In-yong Song 

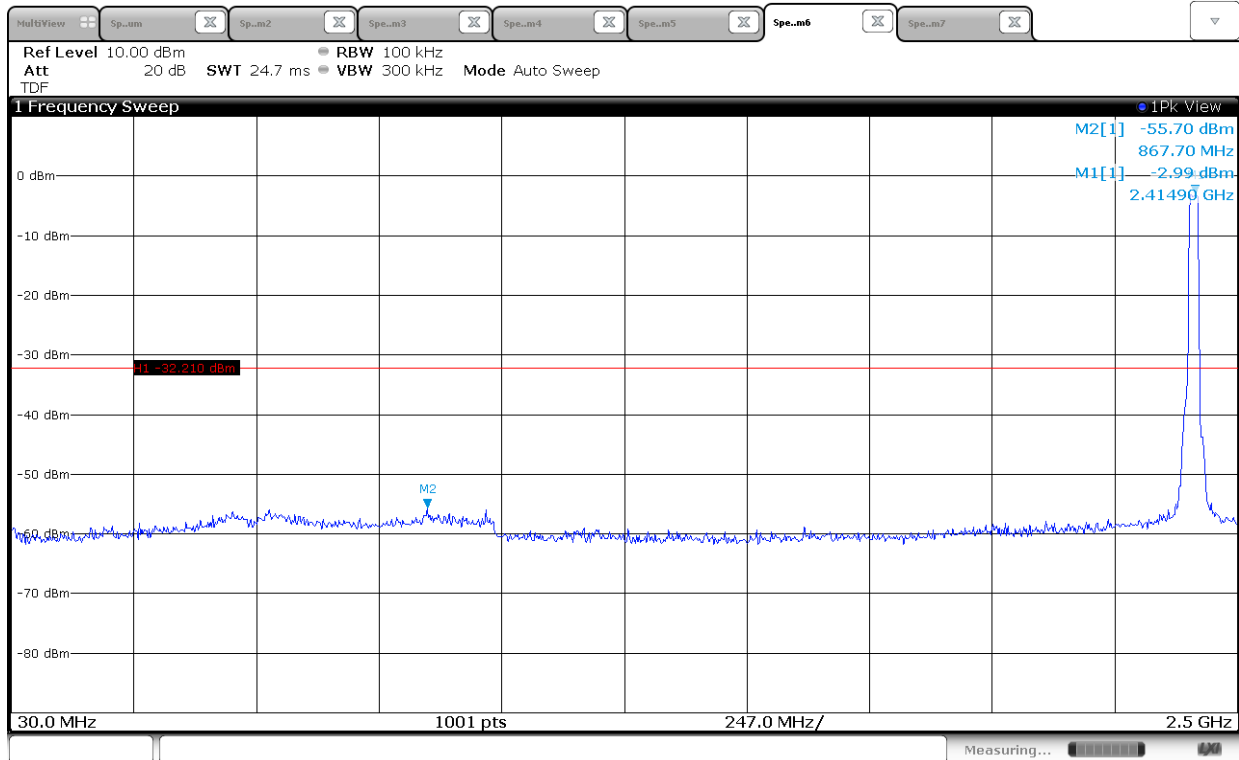
Band-edge and Restricted band – Low channel



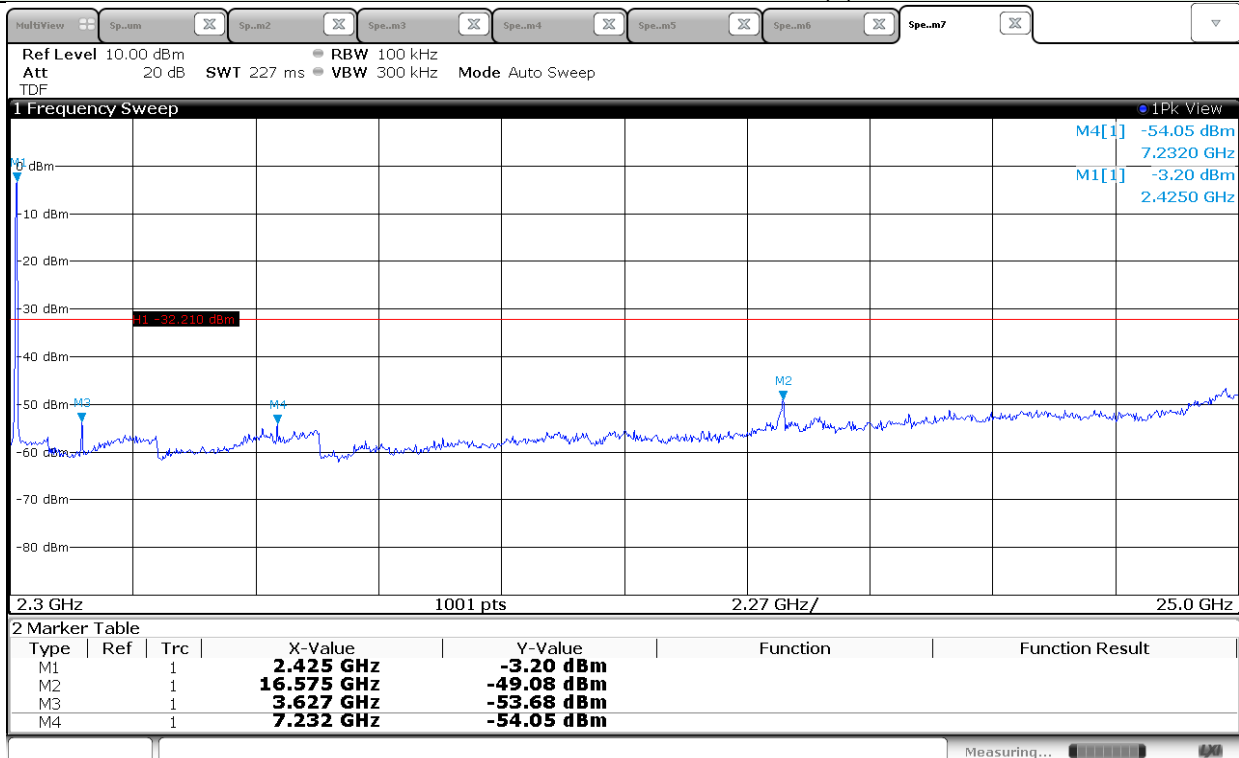
Band-edge and Restricted band – High channel



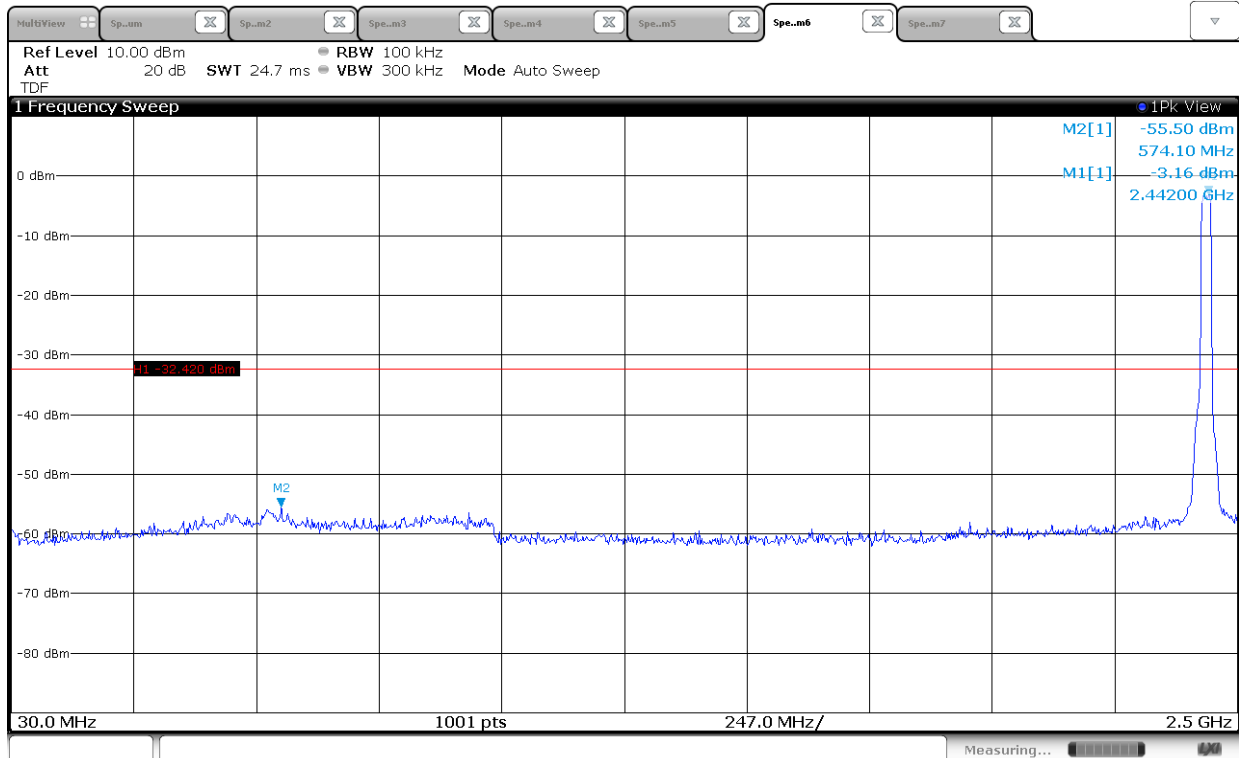
Non-restricted band – Low Channel (1)



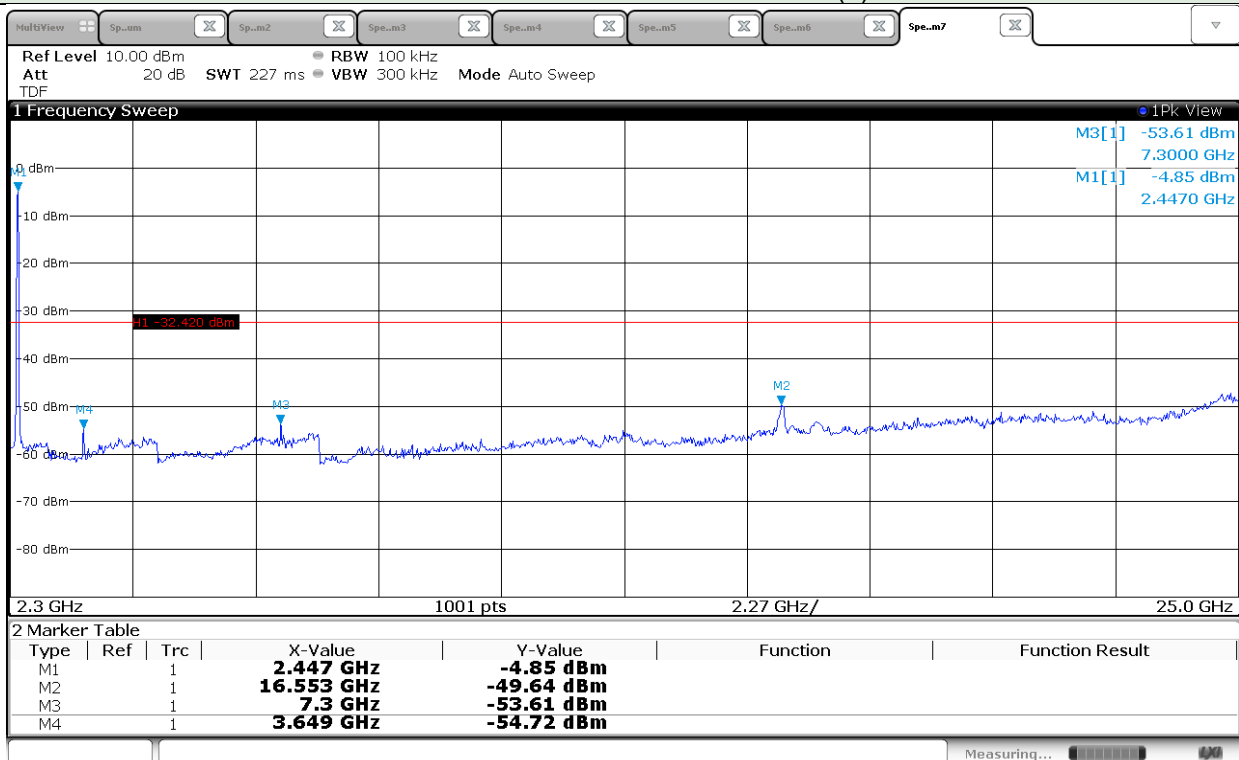
Non-restricted band – Low Channel (2)



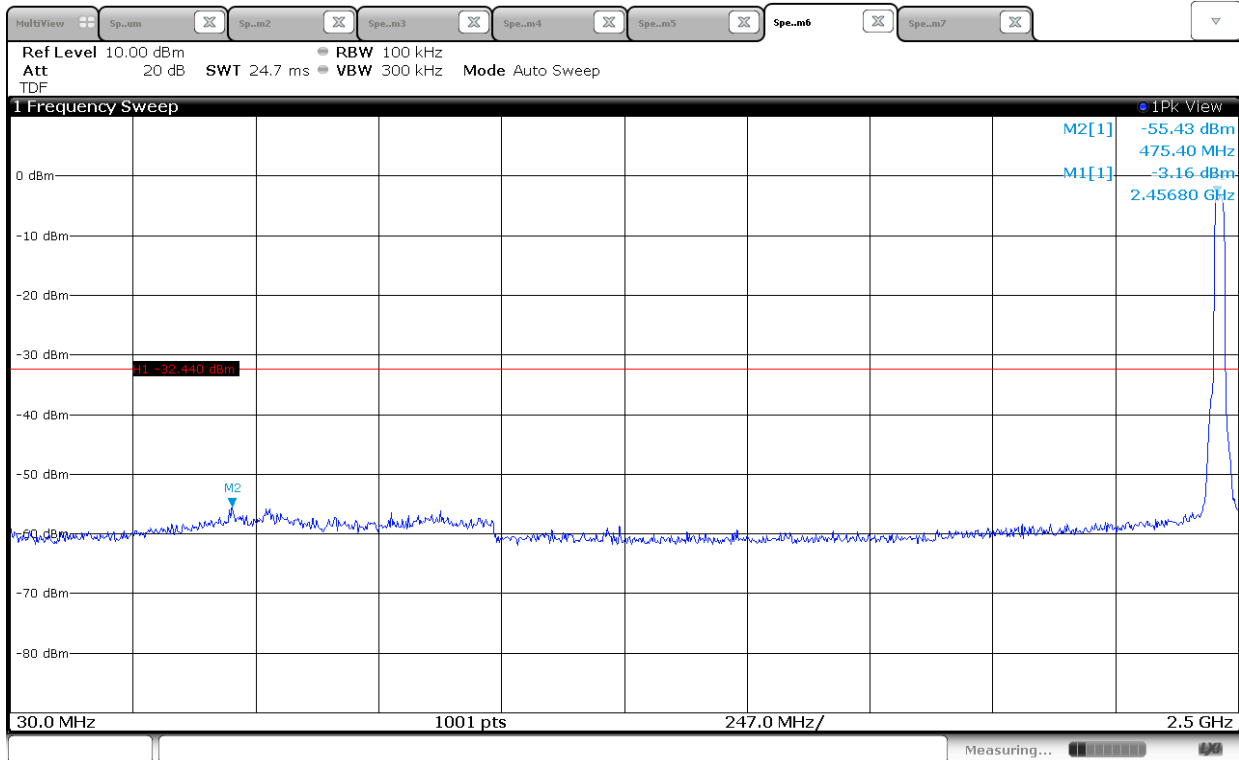
Non-restricted band – Middle Channel (1)



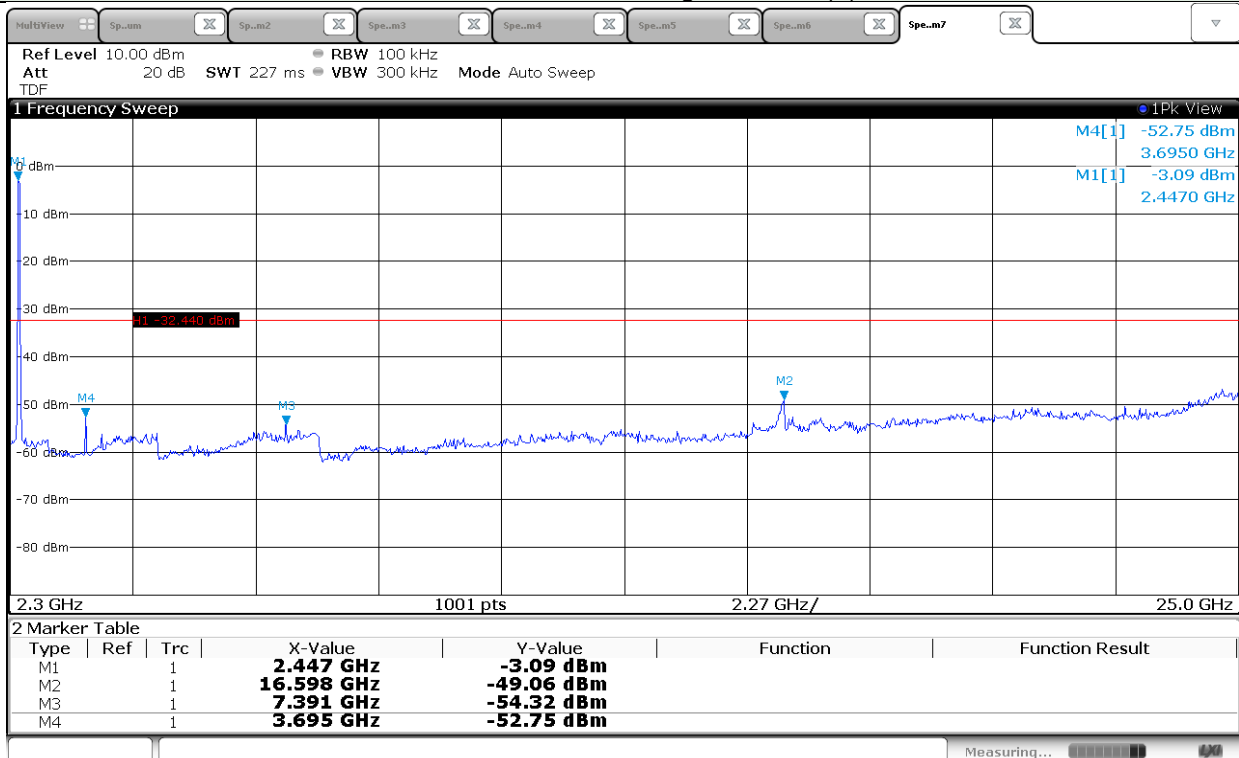
Non-restricted band – Middle Channel (2)



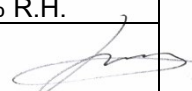
Non-restricted band – High Channel (1)



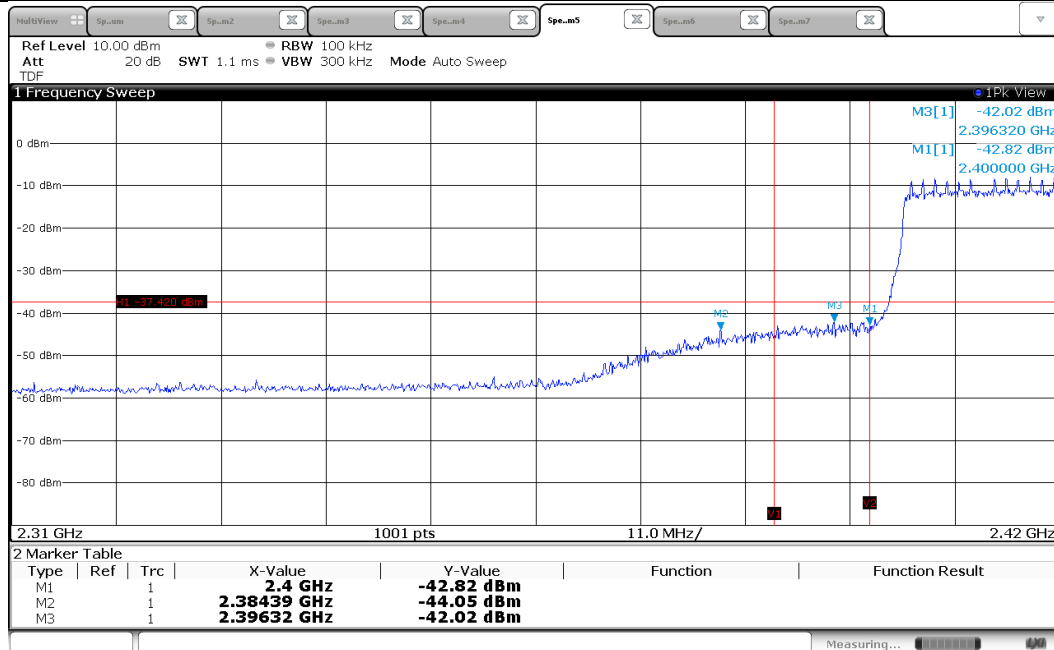
Non-restricted band – High Channel (2)



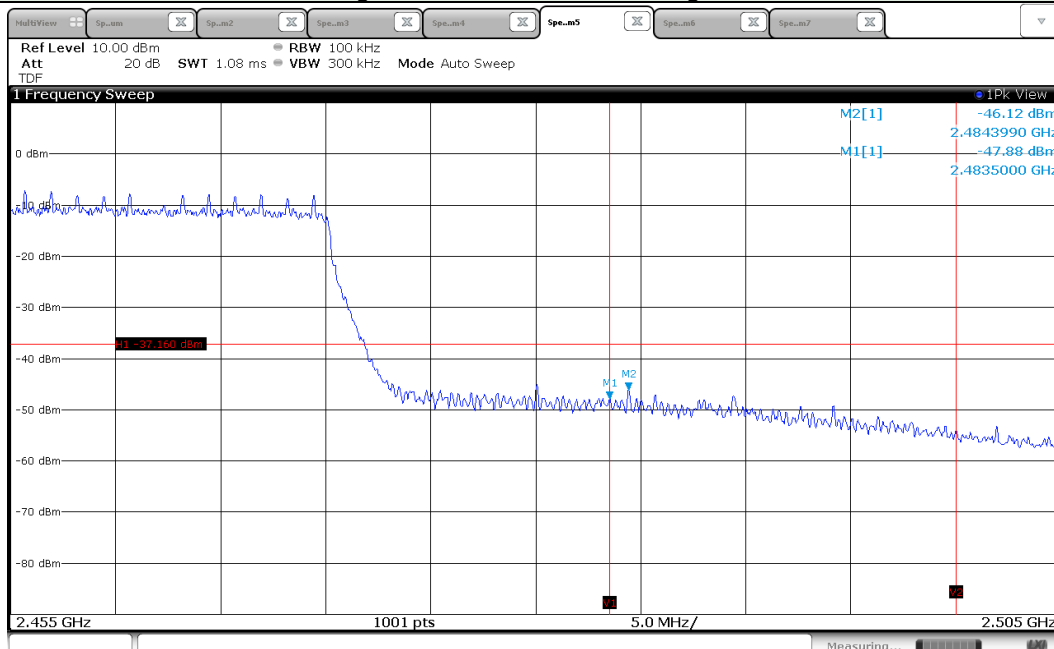
5.6.7 Test Data for Operating mode: WLAN 802.11n HT40

Date of Test	2020-04-07	Temperature	(21.0 ± 0.9) °C
		Relative humidity	(39.0 ± 0.4) % R.H.
Test Result	PASS	Tested by	In-yong Song 

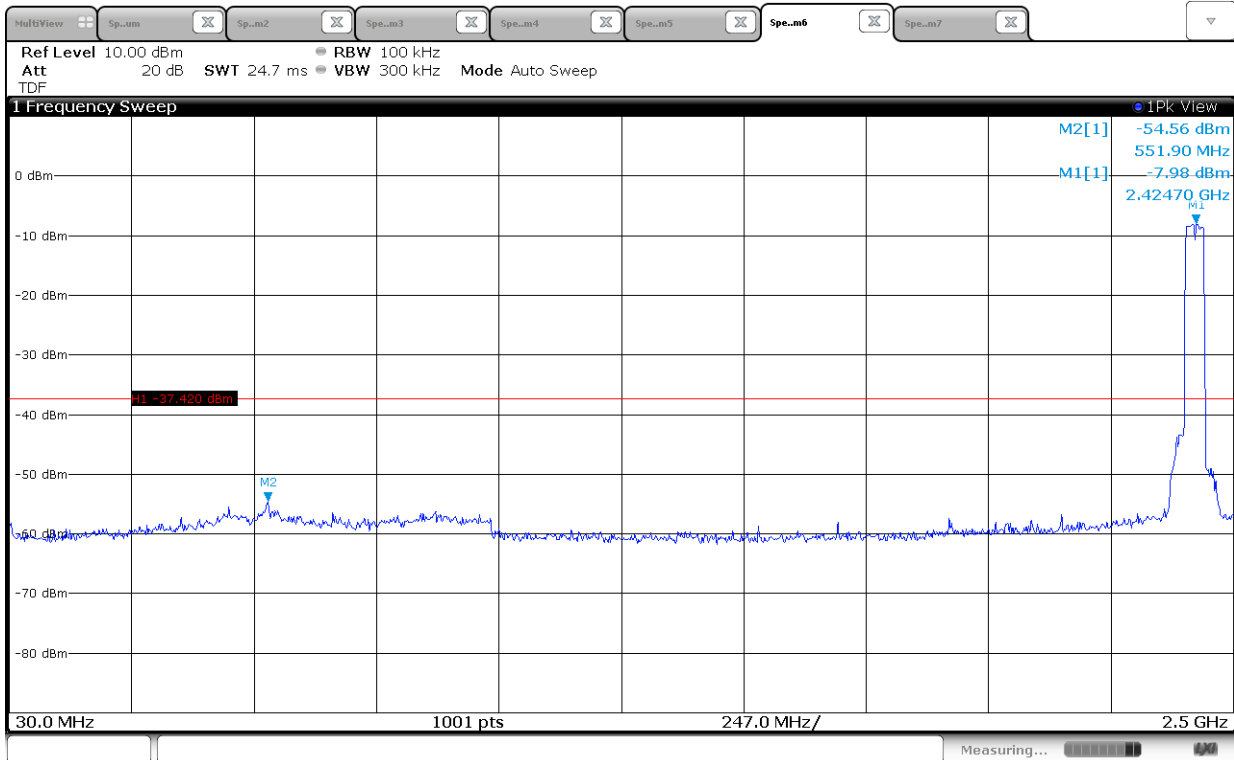
Band-edge and Restricted band – Low channel



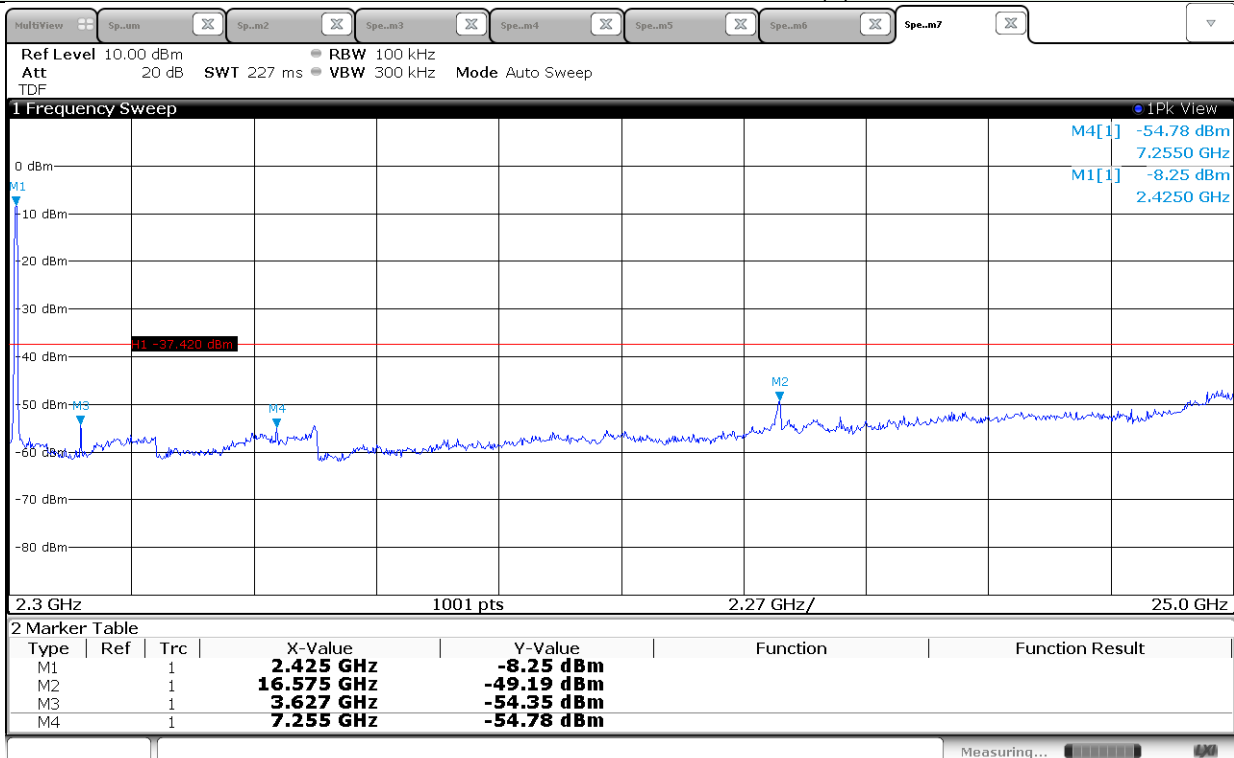
Band-edge and Restricted band – High channel



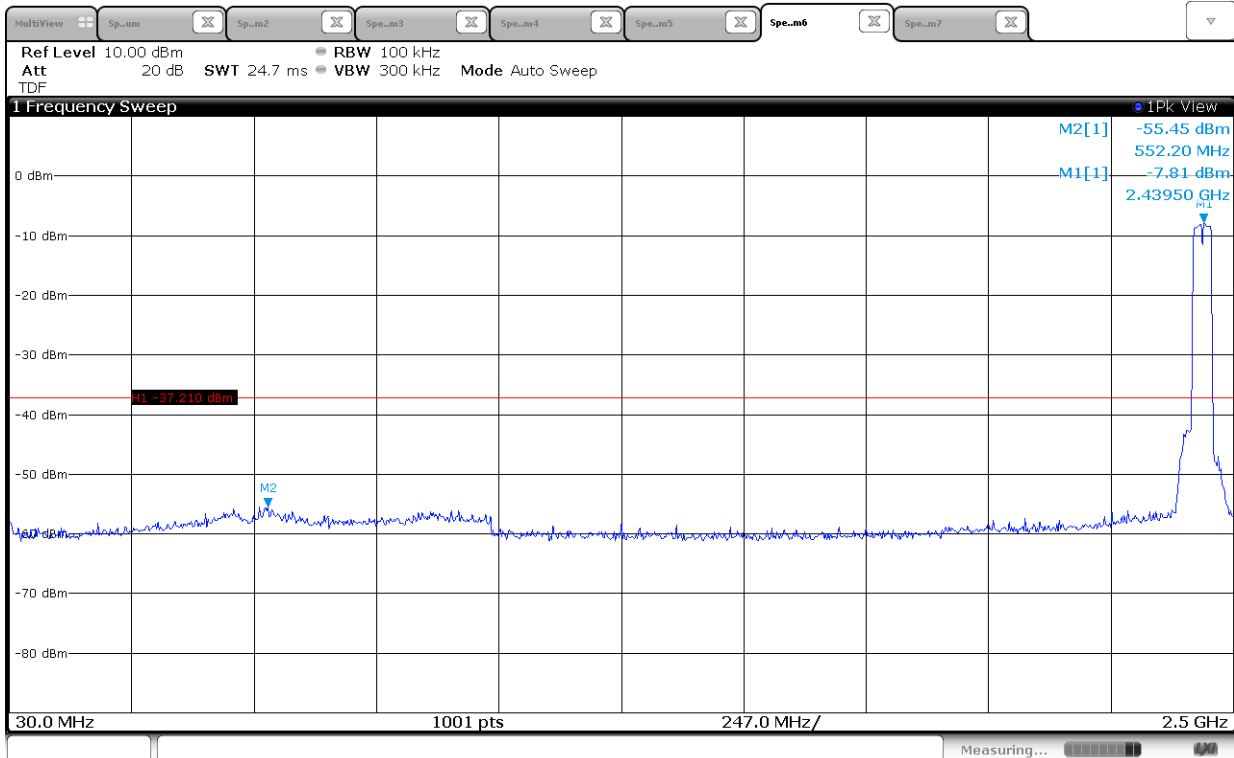
Non-restricted band – Low Channel (1)



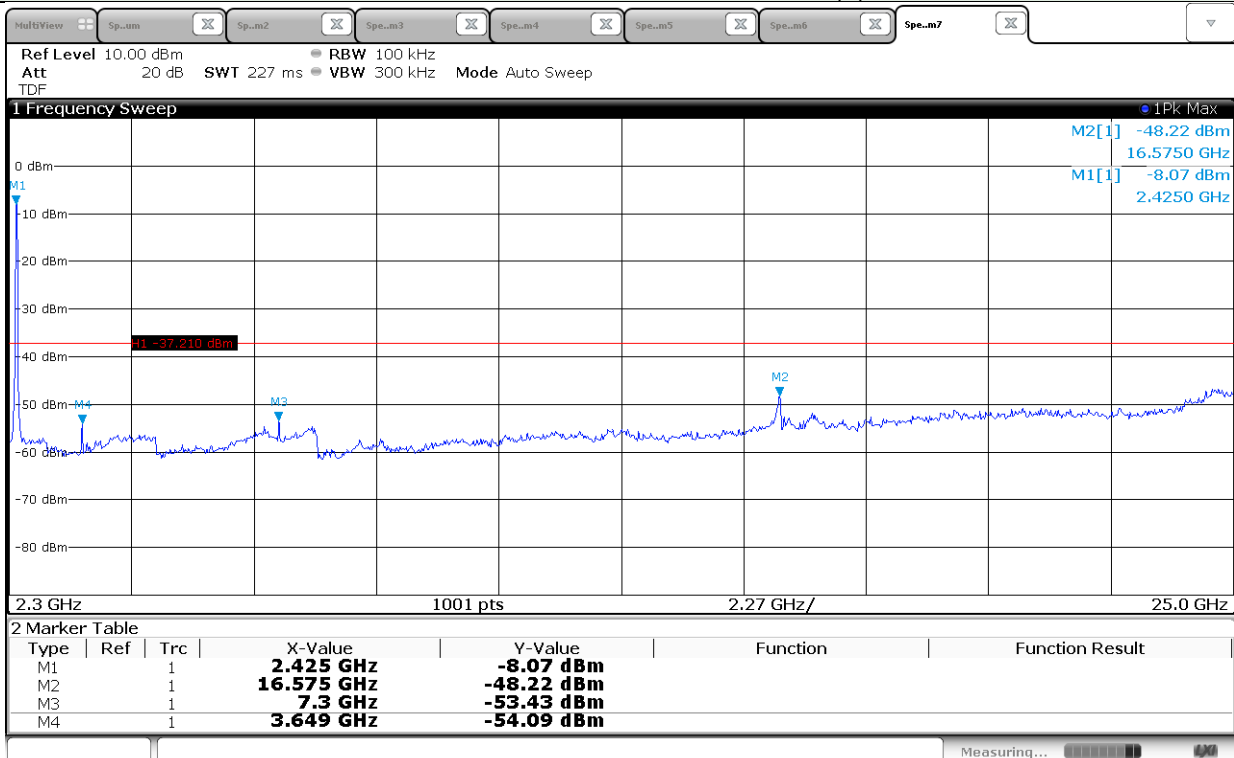
Non-restricted band – Low Channel (2)



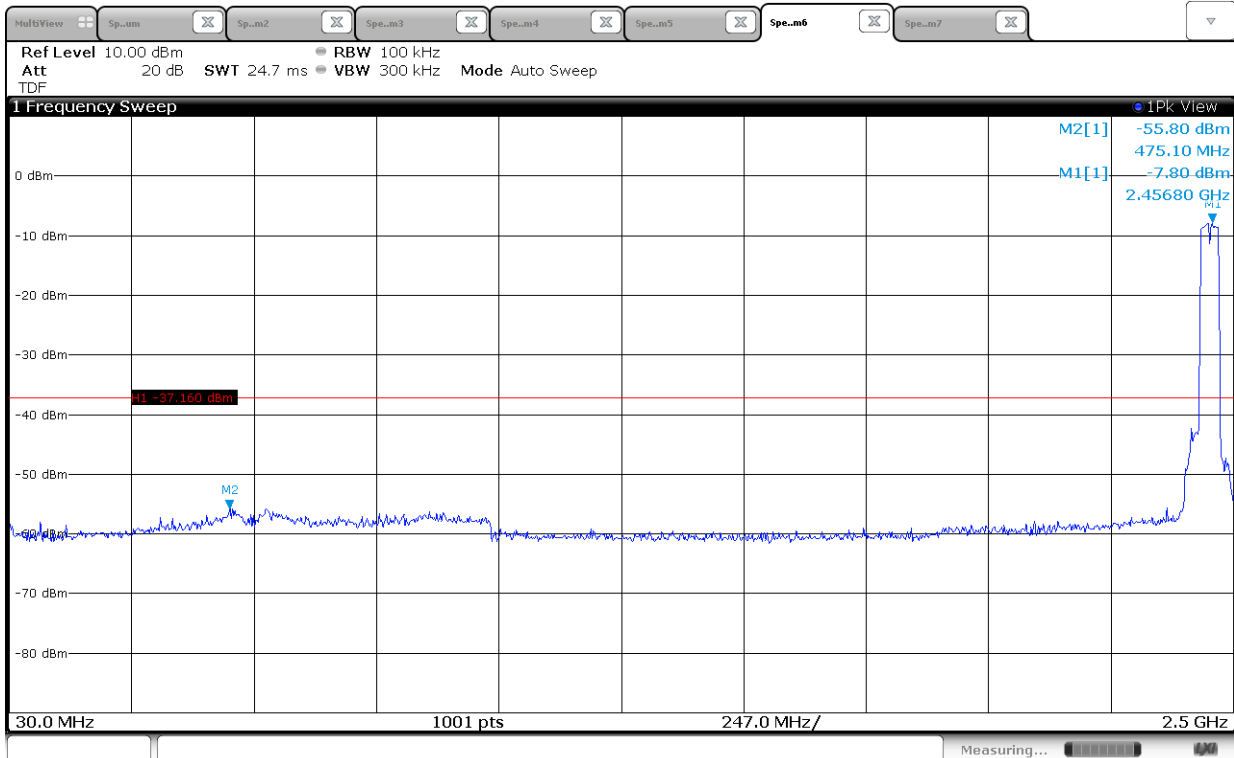
Non-restricted band – Middle Channel (1)



Non-restricted band – Middle Channel (2)



Non-restricted band – High Channel (1)



Non-restricted band – High Channel (2)

