

# FCC Test Report

Report No.: AGC02472220301FE05

**FCC ID** : 2AD56HLK-CB103

**APPLICATION PURPOSE** : Original Equipment

**PRODUCT DESIGNATION** : Smart LED strip

**BRAND NAME** : HI-LINK

**MODEL NAME** : HLK-CB103

**APPLICANT** : Shenzhen Hi-Link Electronic CO., Ltd

**DATE OF ISSUE** : May 07, 2022

**STANDARD(S)**  
**TEST PROCEDURE(S)** : FCC Part 15.247

**REPORT VERSION** : V1.0



Attestation of Global Compliance (Shenzhen) Co., Ltd



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**REPORT REVISE RECORD**

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	May 07, 2022	Valid	Initial Release

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**1. VERIFICATION OF CONFORMITY**

<b>Applicant</b>	Shenzhen Hi-Link Electronic CO., Ltd
<b>Address</b>	Room 301, Building 1, 1970 Science & Technology Park, Minzhi Community, Minzhi Street, Longhua District, Shenzhen
<b>Manufacturer</b>	Shenzhen Hi-Link Electronic CO., Ltd
<b>Address</b>	Room 301, Building 1, 1970 Science & Technology Park, Minzhi Community, Minzhi Street, Longhua District, Shenzhen
<b>Factory</b>	Shenzhen Hi-Link Electronic CO., Ltd
<b>Address</b>	Room 301, Building 1, 1970 Science & Technology Park, Minzhi Community, Minzhi Street, Longhua District, Shenzhen
<b>Product Designation</b>	Smart LED strip
<b>Brand Name</b>	HI-LINK
<b>Test Model</b>	HLK-CB103
<b>Date of test</b>	Mar. 11, 2022 to May 06, 2022
<b>Deviation</b>	No any deviation from the test method
<b>Condition of Test Sample</b>	Normal
<b>Test Result</b>	Pass
<b>Report Template</b>	AGCRT-US-BGN/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.247.

Prepared By



Alan Duan  
(Project Engineer)

May 07, 2022

Reviewed By



Calvin Liu  
(Reviewer)

May 07, 2022

Approved By



Max Zhang  
(Authorized Officer)

May 07, 2022

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## 2. GENERAL INFORMATION

### 2.1. PRODUCT DESCRIPTION

The EUT is designed as "Smart LED strip". It is designed by way of utilizing the DSSS and OFDM technology to achieve the system operation.

A major technical description of EUT is described as following

<b>Operation Frequency</b>	2.412GHz~2.462GHz
<b>Output Power (Average)</b>	IEEE 802.11b:14.57dBm; IEEE 802.11g:14.91dBm; IEEE 802.11n(20):12.80dBm; IEEE 802.11n(40):12.59dBm
<b>Output Power (Peak)</b>	IEEE 802.11b:16.71dBm; IEEE 802.11g:19.67dBm; IEEE 802.11n(20):18.98dBm; IEEE 802.11n(40):17.41dBm
<b>Modulation</b>	DSSS(DBPSK/DQPSK/CCK); OFDM(BPSK/QPSK/16-QAM/64-QAM)
<b>Number of channels</b>	11
<b>Hardware Version</b>	HLK-CB103-A-V1.0
<b>Software Version</b>	V2.0.0
<b>Antenna Designation</b>	PCB antenna (Comply with requirements of the FCC part 15.203)
<b>Antenna Gain</b>	1dBi
<b>Power Supply</b>	DC 12V by adapter

### 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	1	2412 MHZ
	2	2417 MHZ
	3	2422 MHZ
	4	2427 MHZ
	5	2432 MHZ
	6	2437 MHZ
	7	2442 MHZ
	8	2447 MHZ
	9	2452 MHZ
	10	2457 MHZ
	11	2462 MHZ

Note: For 20MHZ bandwidth system use Channel 1 to Channel 11. For 40MHZ bandwidth system use Channel 3 to Channel 9

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### 2.3. IEEE 802.11N MODULATION SCHEME

MCS Index	Nss	Modulation	R	NBPSC	NCBPS		NDBPS		Data rate(Mbps)	
					20MHz	40MHz	20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0
6	1	64-QAM	3/4	6	312	648	234	489	58.5	121.5
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPSC	Number of coded bits per single carrier
NCBPS	Number of coded bits per symbol
NDBPS	Number of data bits per symbol
GI	Guard interval

### 2.4. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AD56HLK-CB103** filing to comply with the FCC Part 15 requirements.

### 2.5. TEST METHODOLOGY

KDB 558074 D01 15.247 Meas Guidance v05: Guidance for compliance measurements on Digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules

ANSI C63.10:2013: American National Standard for Testing Unlicensed Wireless Devices

### 2.6. SPECIAL ACCESSORIES

Refer to section 5.2.

### 2.7. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

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## 2.8. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

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### 3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

Item	Measurement Uncertainty
Uncertainty of Conducted Emission for AC Port	$U_c = \pm 2.9 \text{ dB}$
Uncertainty of Radiated Emission below 1GHz	$U_c = \pm 3.8 \text{ dB}$
Uncertainty of Radiated Emission above 1GHz	$U_c = \pm 4.9 \text{ dB}$
Uncertainty of total RF power, conducted	$U_c = \pm 0.8 \text{ dB}$
Uncertainty of RF power density, conducted	$U_c = \pm 2.6 \text{ dB}$
Uncertainty of spurious emissions, conducted	$U_c = \pm 2 \text{ %}$
Uncertainty of Occupied Channel Bandwidth	$U_c = \pm 2 \text{ %}$

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#### 4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel transmitting (TX)
2	Middle channel transmitting (TX)
3	High channel transmitting (TX)

**Note:**  
 Transmit by 802.11b with Date rate (1/2/5.5/11)  
 Transmit by 802.11g with Date rate (6/9/12/18/24/36/48/54)  
 Transmit by 802.11n (20MHz) with Date rate (6.5/13/19.5/26/39/52/58.5/65)  
 Transmit by 802.11n (40MHz) with Date rate (13.5/27/40.5/54/81/108/121.5/135)  
 The test channel for 20MHZ bandwidth system is channel 1, 6 and 11.  
 The test channel for 40MHZ bandwidth system is channel 3, 6 and 9.

**Note:**

1. The EUT has been set to operate continuously on the lowest, middle and highest operation frequency individually, and the EUT is operating at its maximum duty cycle > or equal 98%
2. All modes under which configure applicable have been tested and the worst mode test data recording in the test report, if no other mode data.

#### Software Setting



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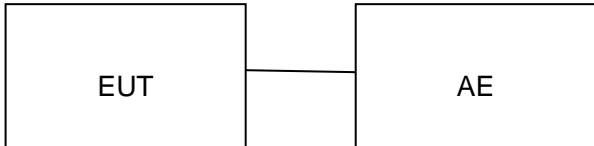
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## 5. SYSTEM TEST CONFIGURATION

### 5.1. CONFIGURATION OF EUT SYSTEM

Configure:



### 5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Smart LED strip	HLK-CB103	2AD56HLK-CB103	
2	Control Box	USB-TTL	N/A	AE
3	Adapter	KE024A-1200200M	Input: AC 100-240V 50/60Hz 0.6A Output: DC 12.0V, 2.0A	Accessory

### 5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247	Output Power	Compliant
§15.247	6 dB Bandwidth	Compliant
§15.247	Conducted Spurious Emission	Compliant
§15.247	Maximum Conducted Output Power Spectral Density	Compliant
§15.209	Radiated Emission	Compliant
§15.247	Band Edges	Compliant
§15.207	Line Conduction Emission	Compliant

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## 6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

## TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
Test Receiver	R&S	ESPI	101206	May 11, 2021	May 10, 2022
Artificial power network	R&S	ESH2-Z5	100086	Jun. 09, 2021	Jun. 08, 2022
Test Software	FARA	EZ-EMC(Ver. AGC-CON03A1)	N/A	N/A	N/A

## TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
Test Receiver	R&S	ESCI	10096	May 11, 2021	May 10, 2022
EXA Signal Analyzer	Agilent	N9010A	MY53470504	Nov. 17, 2021	Nov. 16, 2022
Signal Analyzer	Agilent	N9020A	MY52090123	Sep. 06, 2021	Sep. 05, 2022
2.4GHz Filter	EM Electronics	N/A	N/A	Mar. 23, 2020	Mar. 22, 2022
2.4GHz Filter	EM Electronics	N/A	N/A	Mar. 18, 2022	Mar. 19, 2024
Attenuator	ZHINAN	E-002	N/A	Sep. 03, 2020	Sep. 02, 2022
Horn Antenna	SCHWARZBEC	BBHA9170	768	Oct. 31, 2021	Oct. 30, 2023
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Preamplifier Assembly	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
Wideband Antenna	SCHWARZBECK	VULB9168	VULB9168-49 4	Jan. 08, 2021	Jan. 07, 2023
Test Software	FARA	EZ-EMC(Ver.RA-03A)	N/A	N/A	N/A

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## 7. OUTPUT POWER

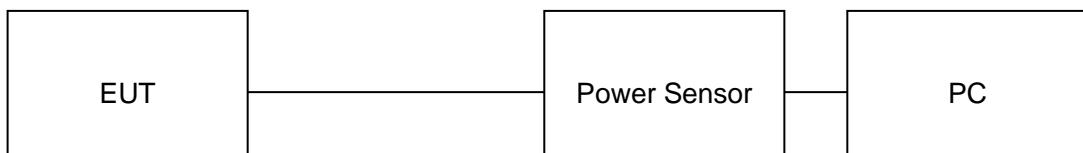
### 7.1. MEASUREMENT PROCEDURE

For average power test:

1. Connect EUT RF output port to power sensor through an RF attenuator.
2. Connect the power sensor to the PC.
3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Record the maximum power from the software.

**Note :** The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements.

### 7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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### 7.3. LIMITS AND MEASUREMENT RESULT

Test Data of Conducted Output Power					
Test Mode	Test Channel (MHz)	Average Power (dBm)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
802.11b	2412	14.41	16.71	≤30	Pass
	2437	14.57	16.39	≤30	Pass
	2462	13.80	16.16	≤30	Pass
802.11g	2412	14.55	19.32	≤30	Pass
	2437	14.91	19.64	≤30	Pass
	2462	14.87	19.67	≤30	Pass
802.11n20	2412	12.80	18.98	≤30	Pass
	2437	12.46	18.72	≤30	Pass
	2462	12.68	18.91	≤30	Pass
802.11n40	2422	12.46	17.27	≤30	Pass
	2437	12.51	17.39	≤30	Pass
	2452	12.59	17.41	≤30	Pass

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## 8. BANDWIDTH

### 8.1. MEASUREMENT PROCEDURE

6dB bandwidth:

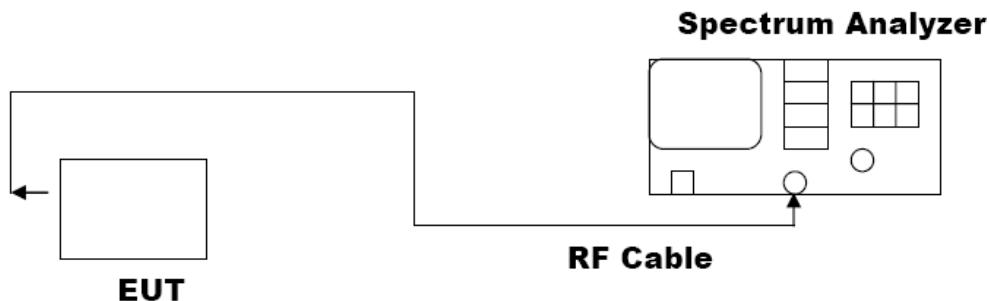
1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 kHz, VBW $\geq$ 3 $\times$ RBW.
4. Set SPA Trace 1 Max hold, then View.

Occupied bandwidth:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel  
The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

### 8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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### 8.3. LIMITS AND MEASUREMENT RESULTS

Test Data of Occupied Bandwidth and DTS Bandwidth					
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-6dB Bandwidth (MHz)	Limits (MHz)	Pass or Fail
802.11b	2412	14.979	9.059	≥0.5	Pass
	2437	14.960	9.080	≥0.5	Pass
	2462	14.957	9.068	≥0.5	Pass
802.11g	2412	17.328	16.368	≥0.5	Pass
	2437	17.277	16.377	≥0.5	Pass
	2462	17.239	16.372	≥0.5	Pass
802.11n20	2412	18.228	17.607	≥0.5	Pass
	2437	18.180	15.125	≥0.5	Pass
	2462	18.173	17.615	≥0.5	Pass
802.11n40	2422	36.252	36.311	≥0.5	Pass
	2437	36.245	36.039	≥0.5	Pass
	2452	36.241	36.316	≥0.5	Pass

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## Test Graphs of Occupied Bandwidth

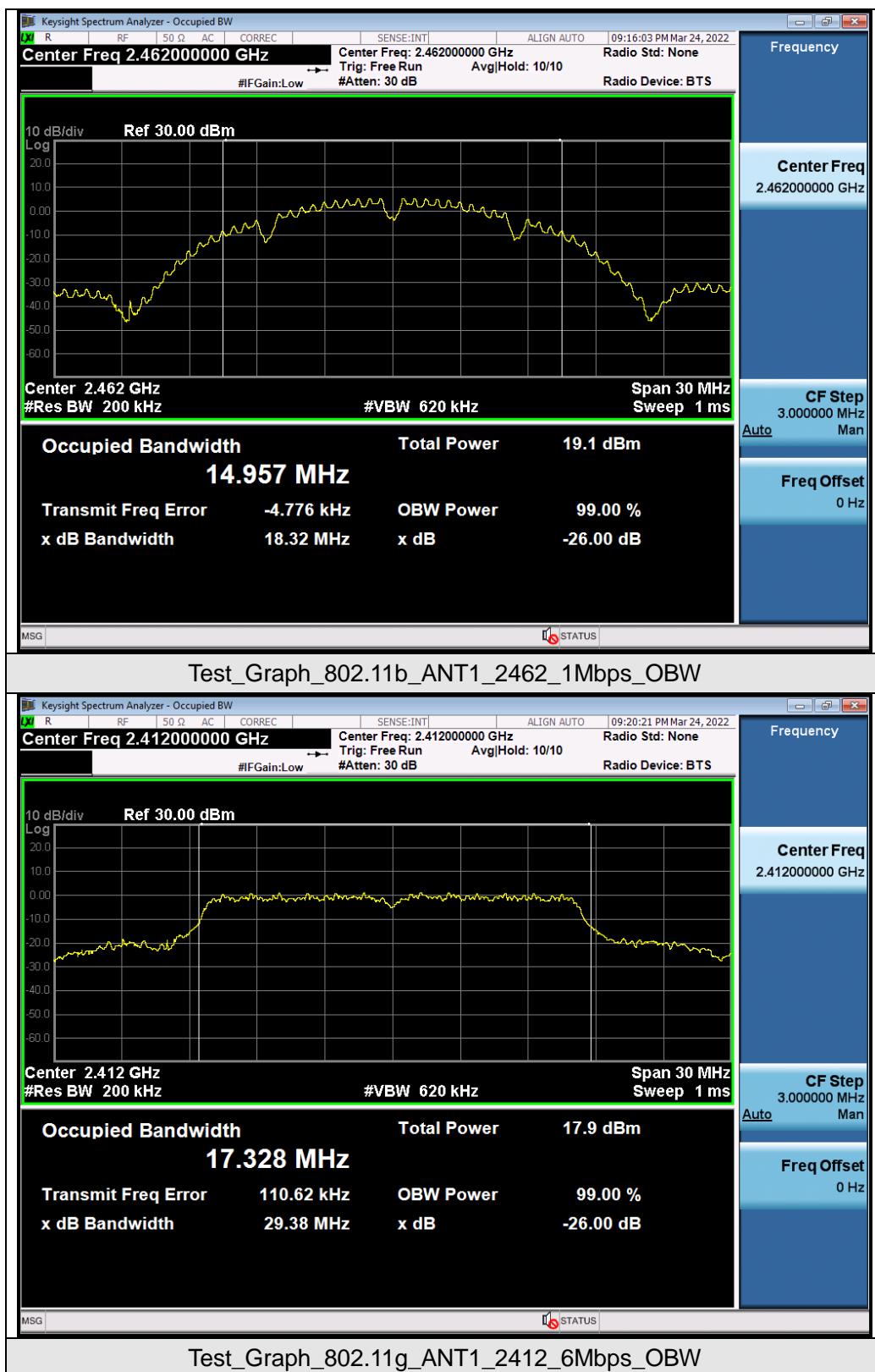


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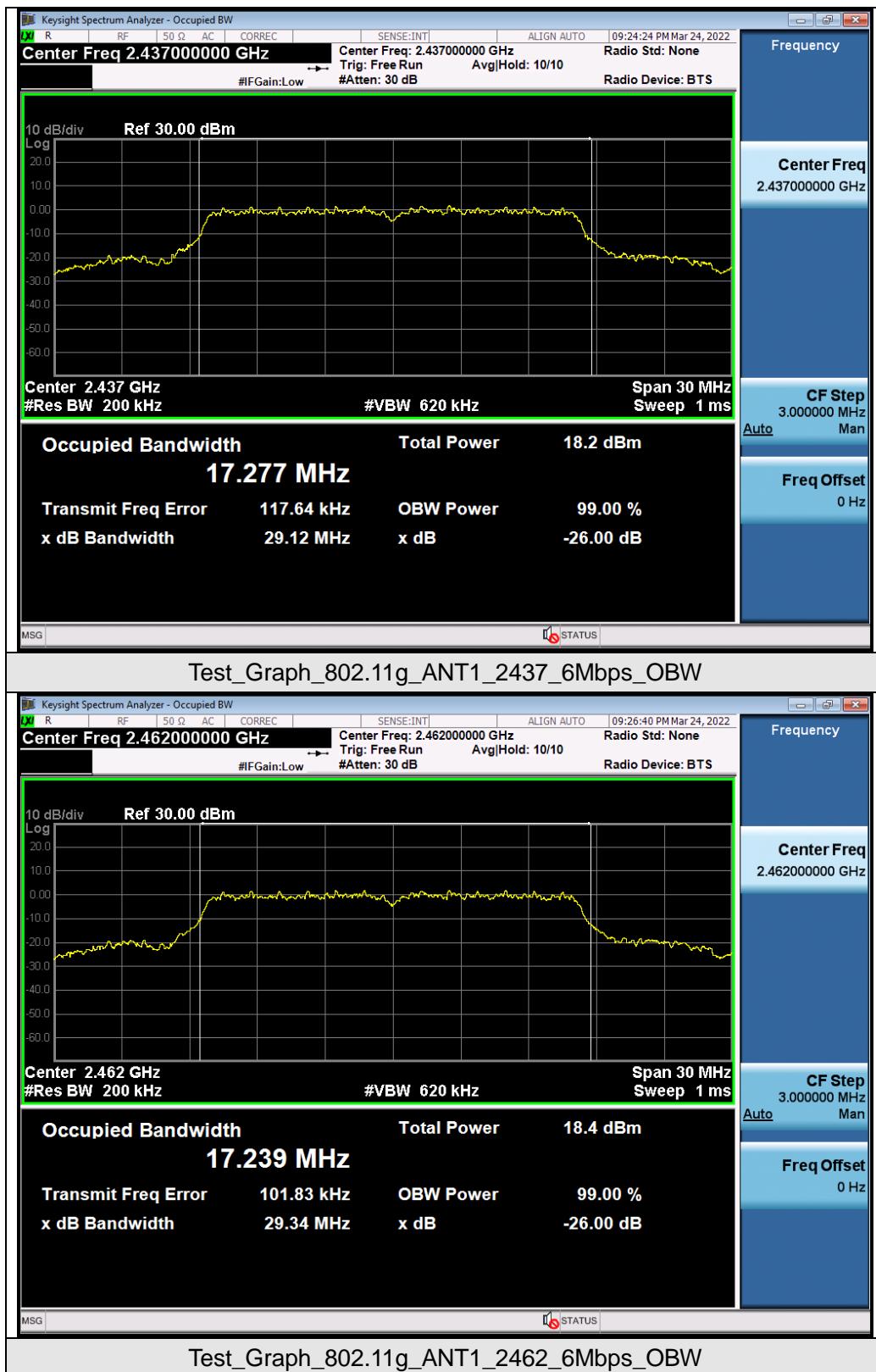


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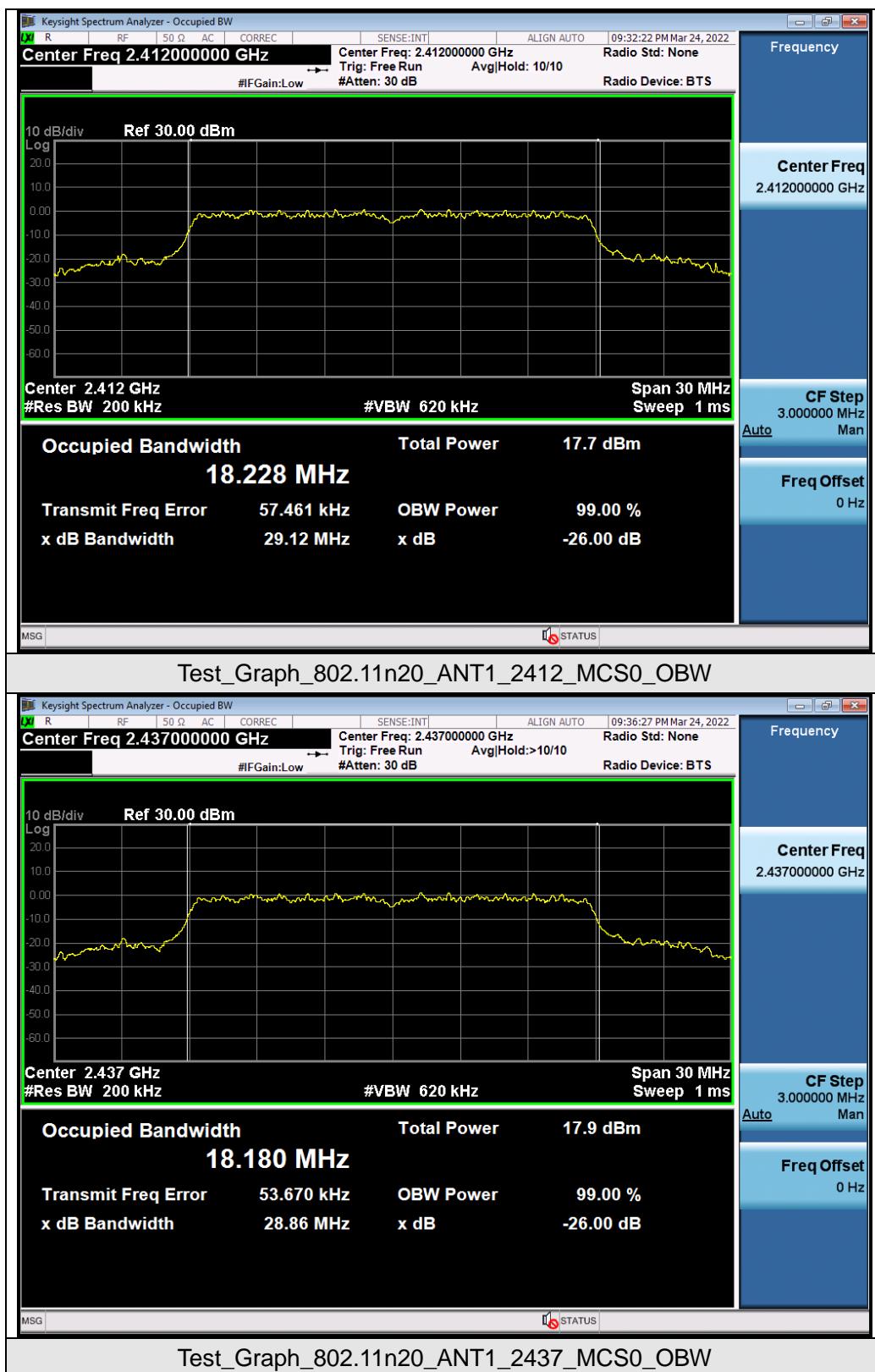


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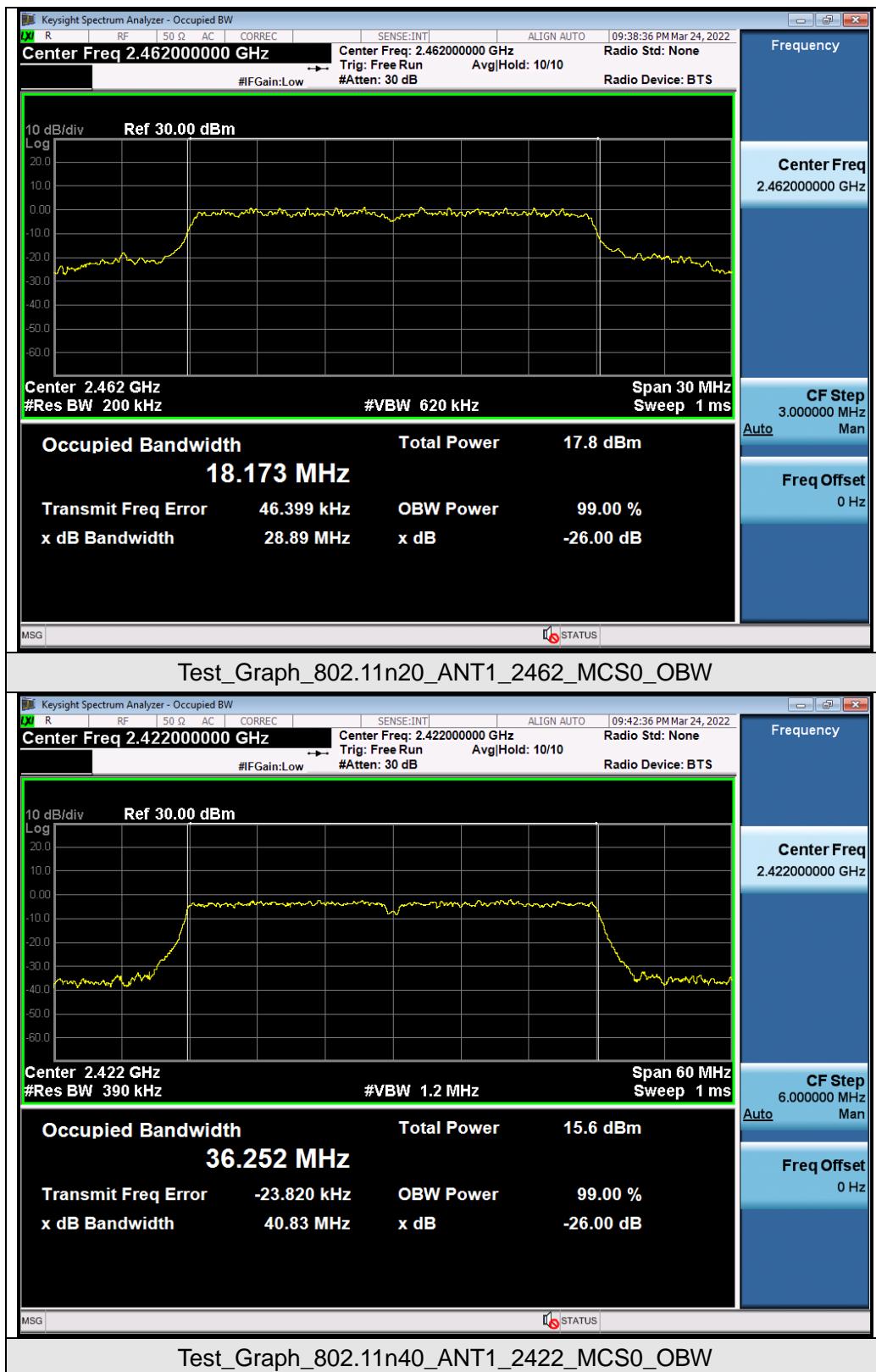


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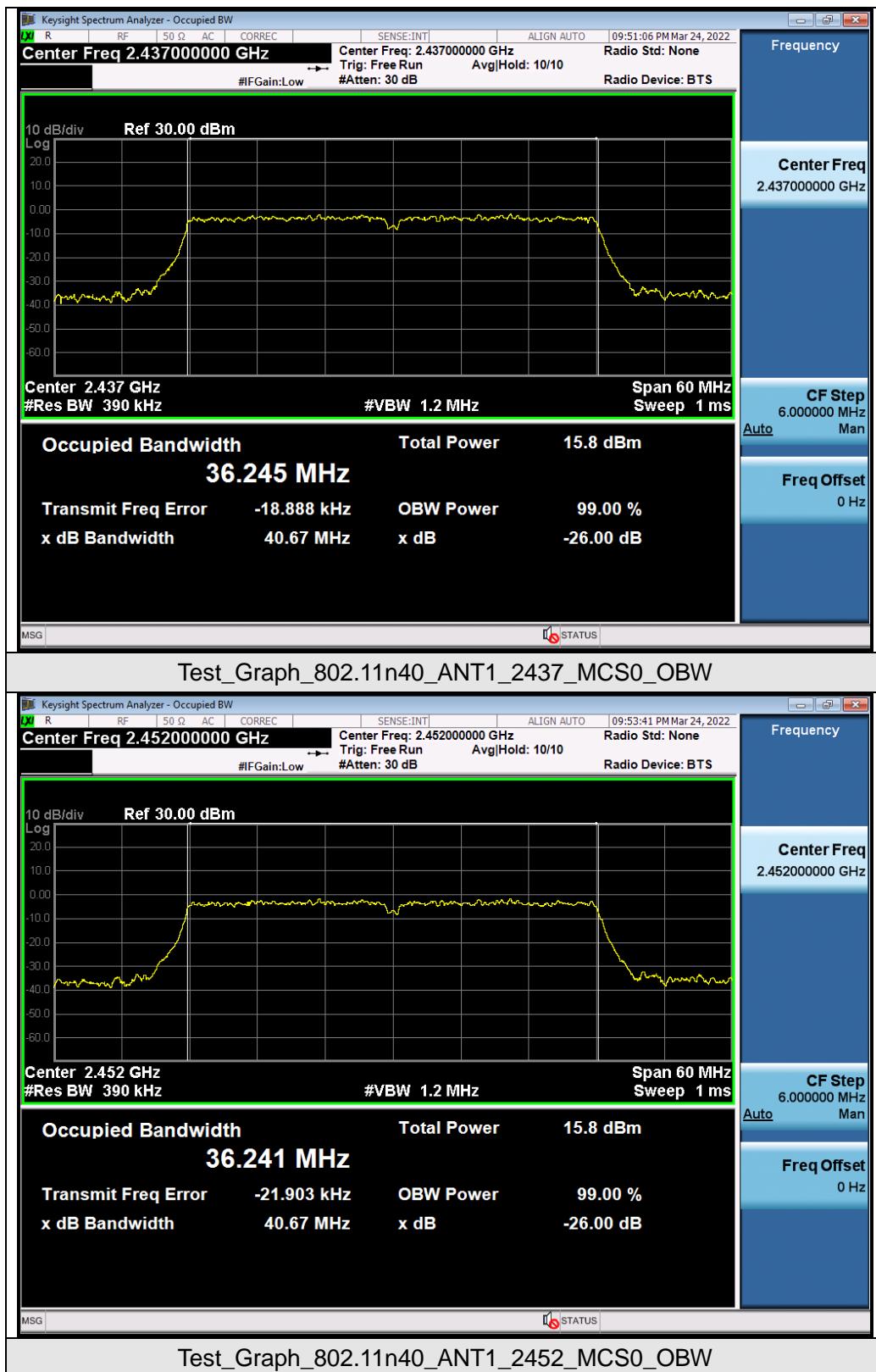


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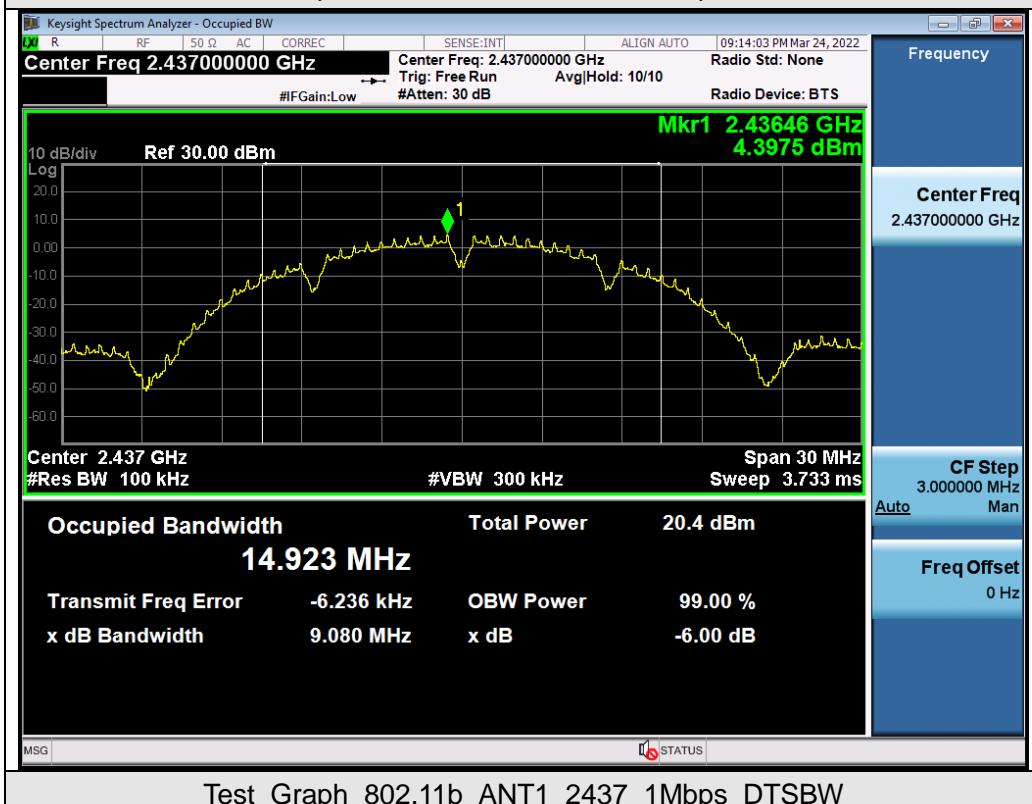
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## Test Graphs of DTS Bandwidth



Test\_Graph\_802.11b\_ANT1\_2412\_1Mbps\_DTSBW



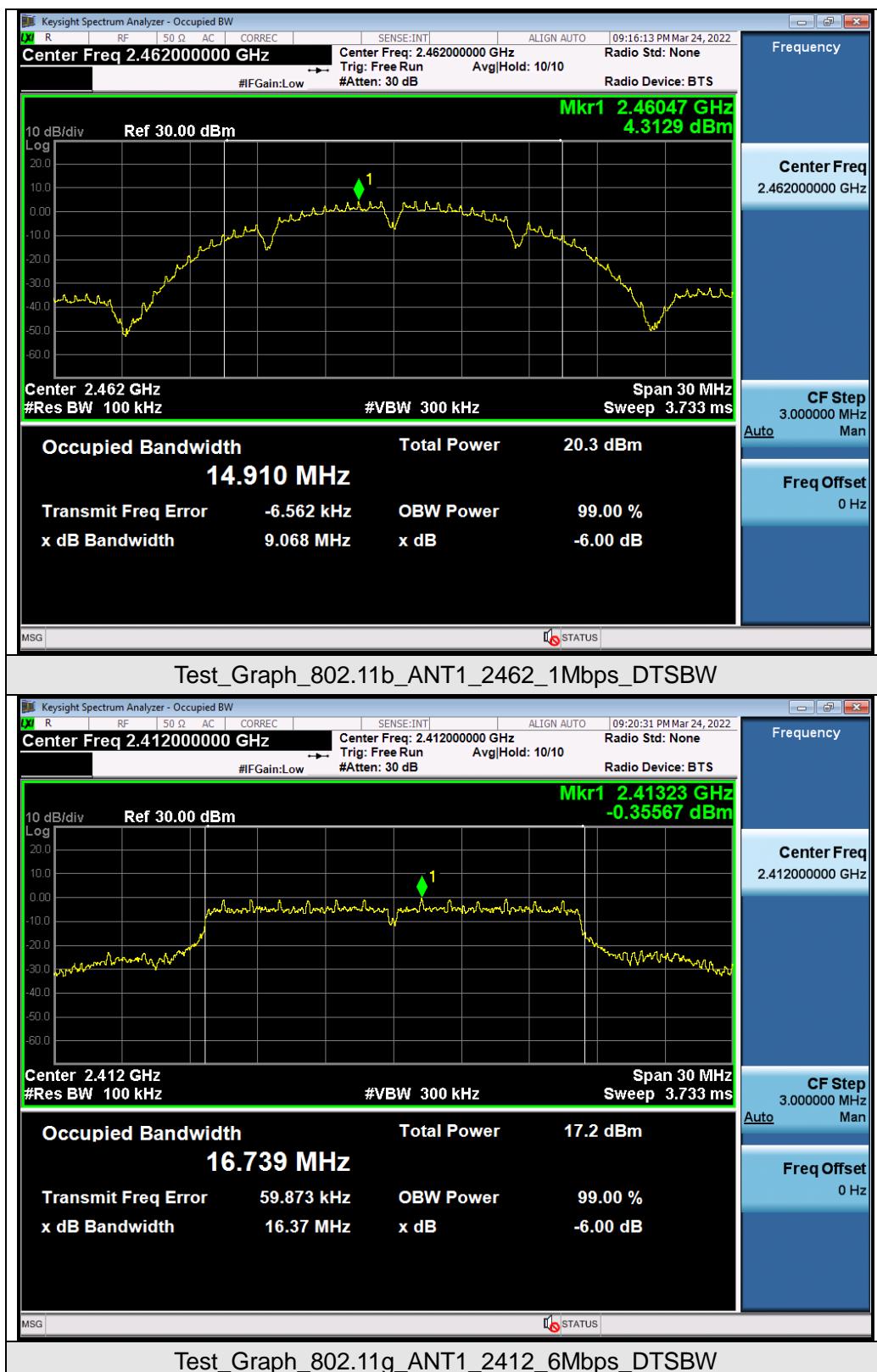
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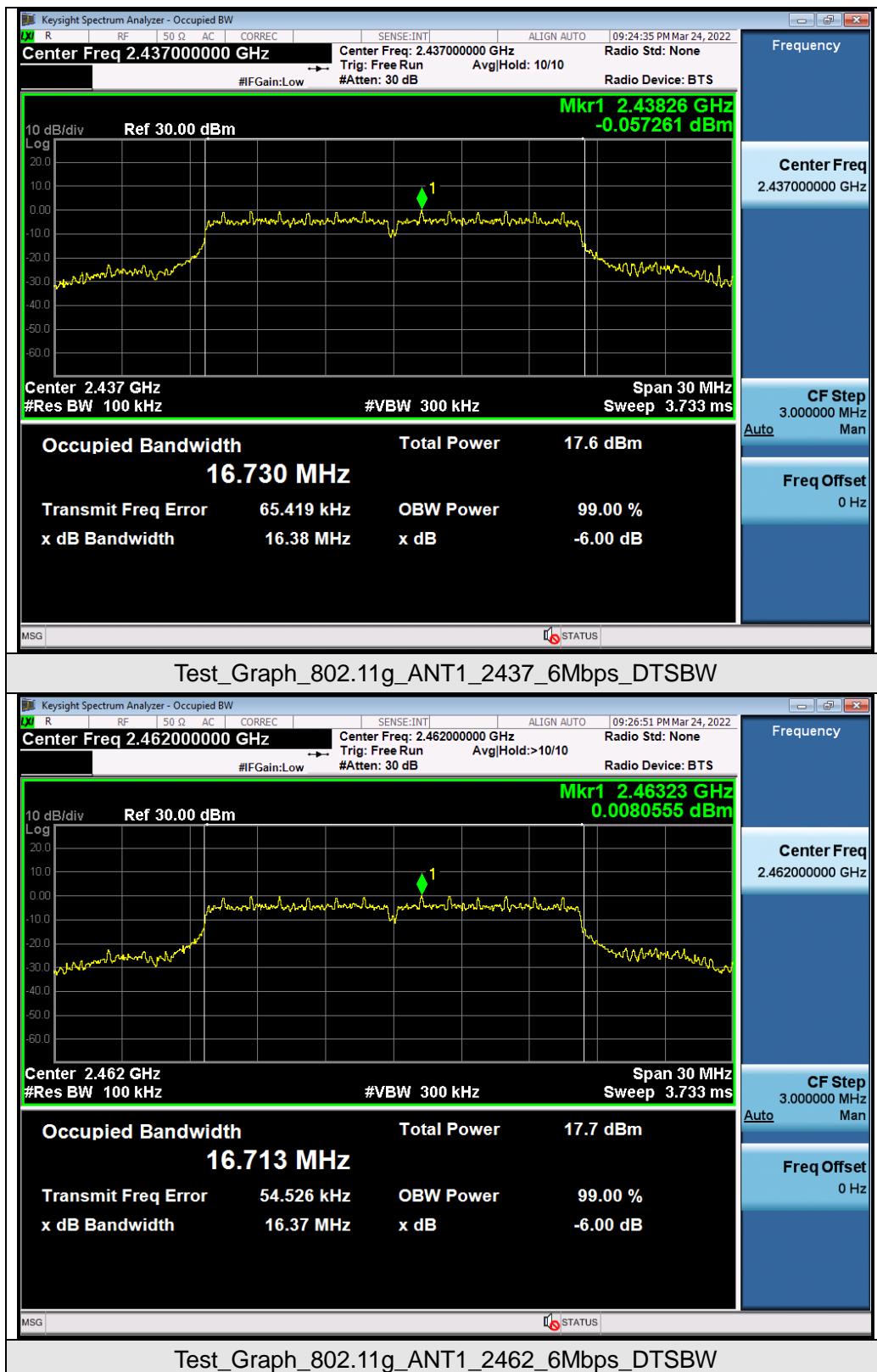


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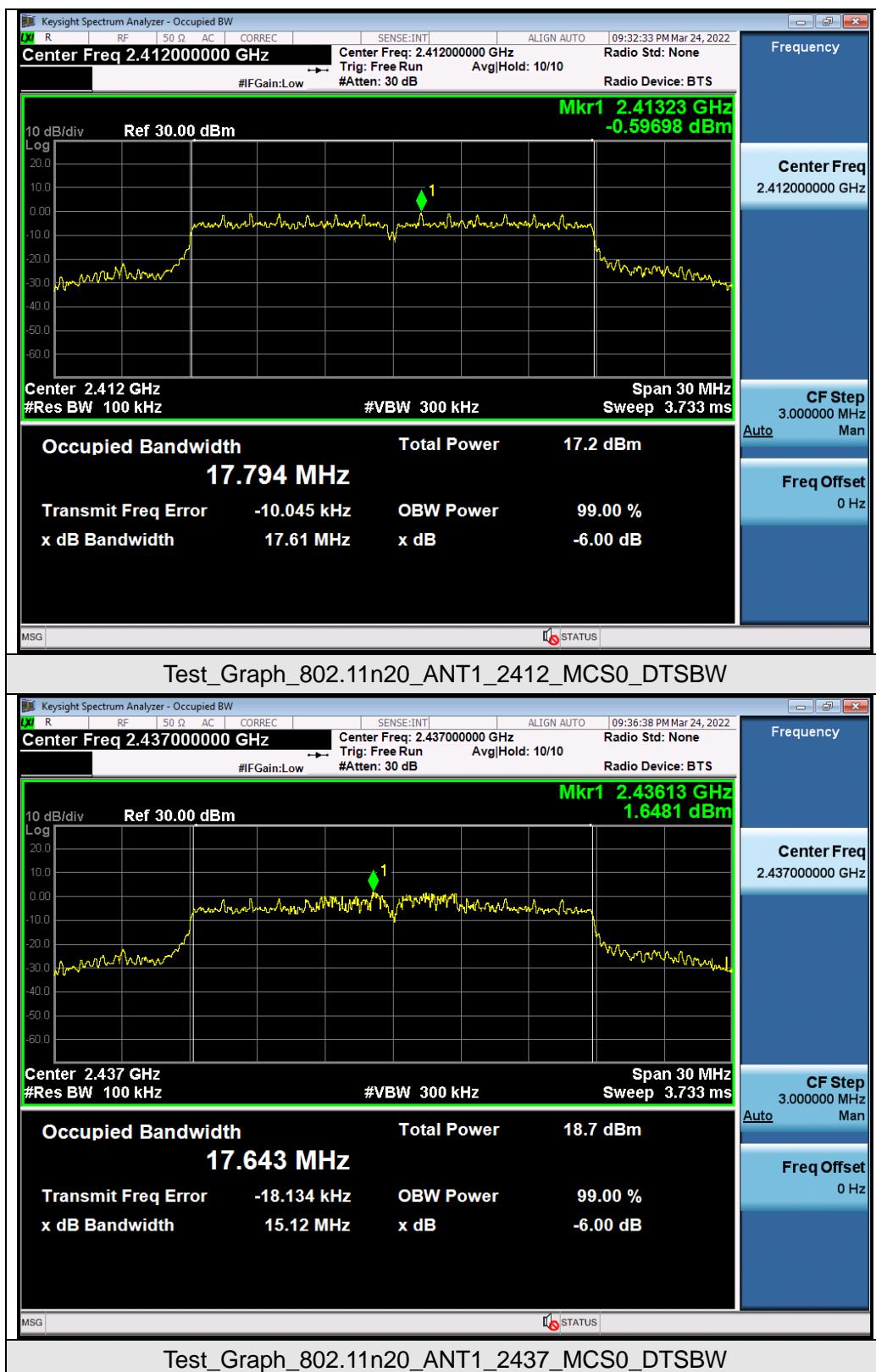


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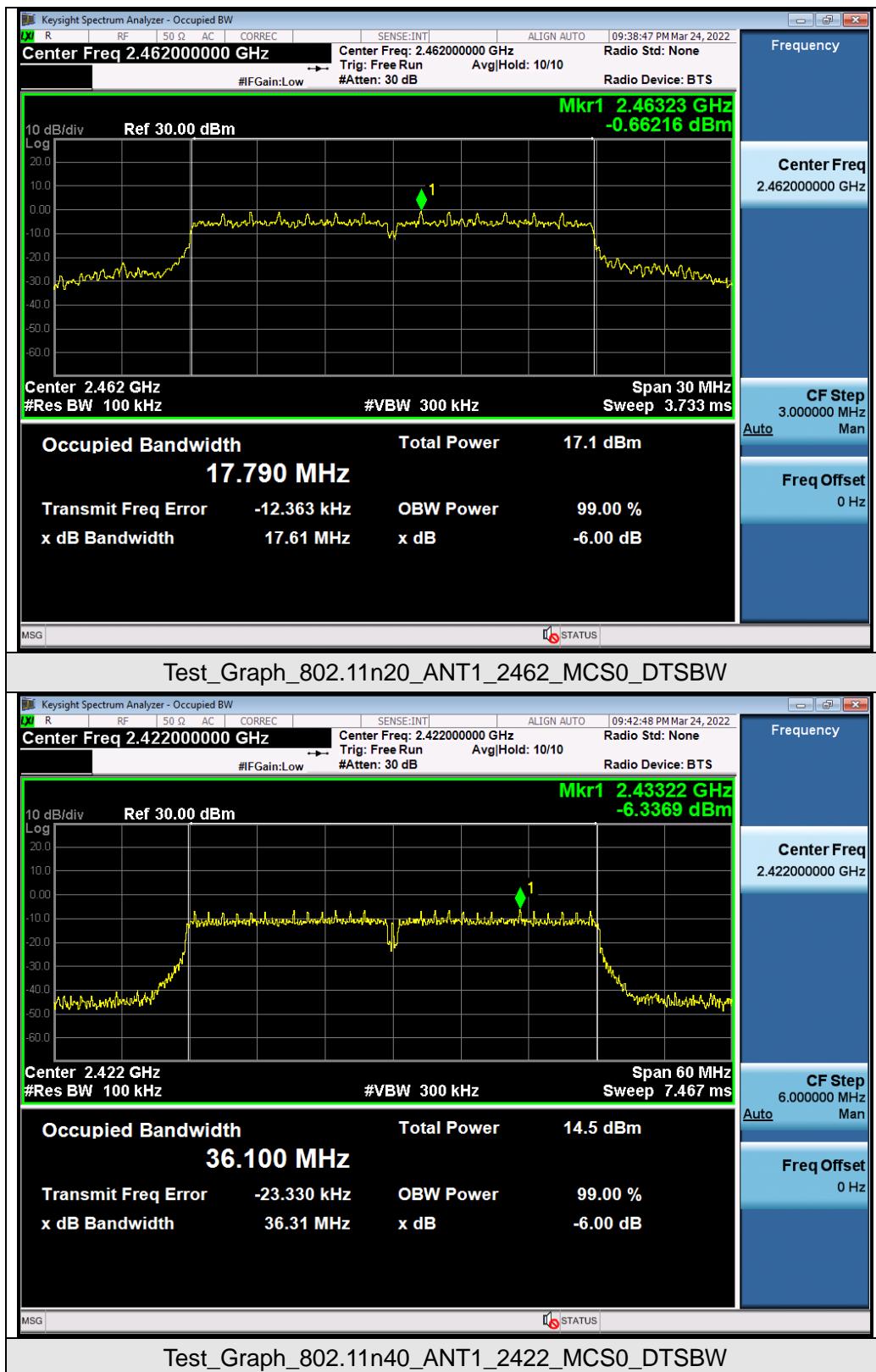


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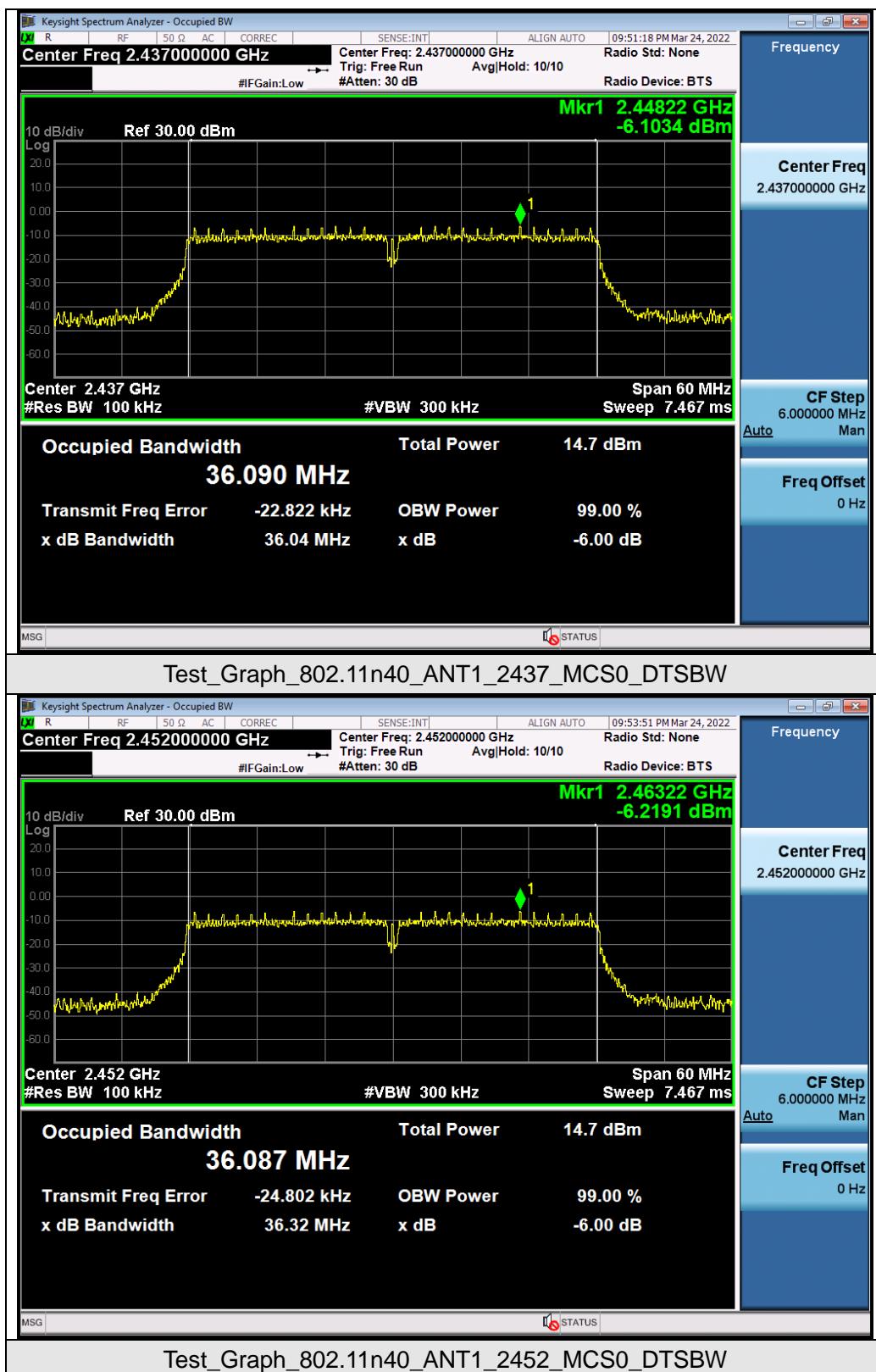


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## 9. CONDUCTED SPURIOUS EMISSION

### 9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements. Owing to satisfy the requirements of the number of measurement points, we set the RBW=1MHz, VBW>RBW, scan up through 10th harmonic, and consider the tested results as the worst case, if the tested results conform to the requirement, we can deem that the real tested results(set the RBW=100KHz, VBW>RBW) are conform to the requirement.

### 9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2.

### 9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.

### 9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	Measurement Result	
	Test Data	Criteria
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a))	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -20dBc than the limit Specified on the TOP Channel	PASS

Note: The limits reference level is according to the test plot of -6dB bandwidth.

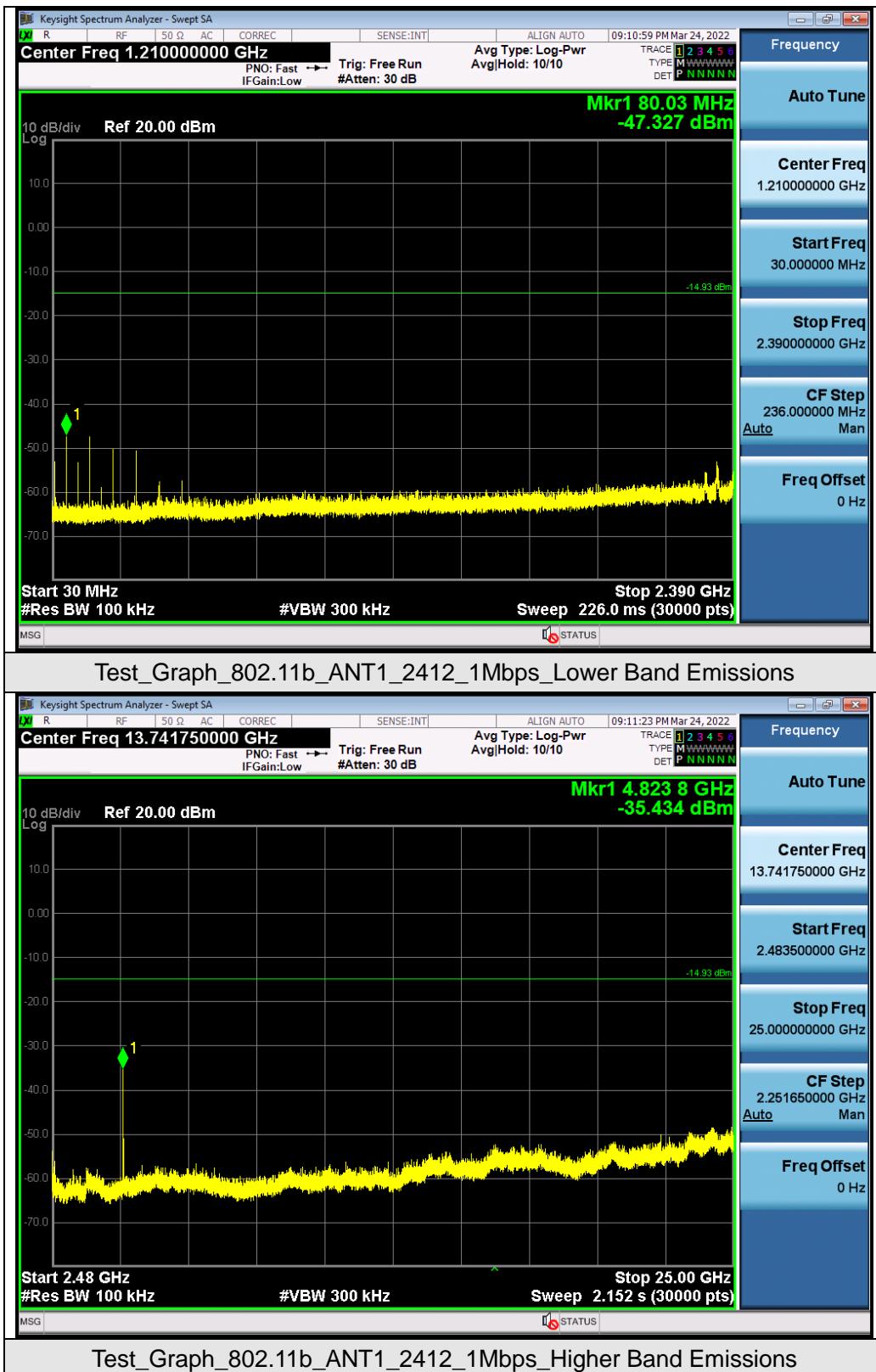
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### Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands

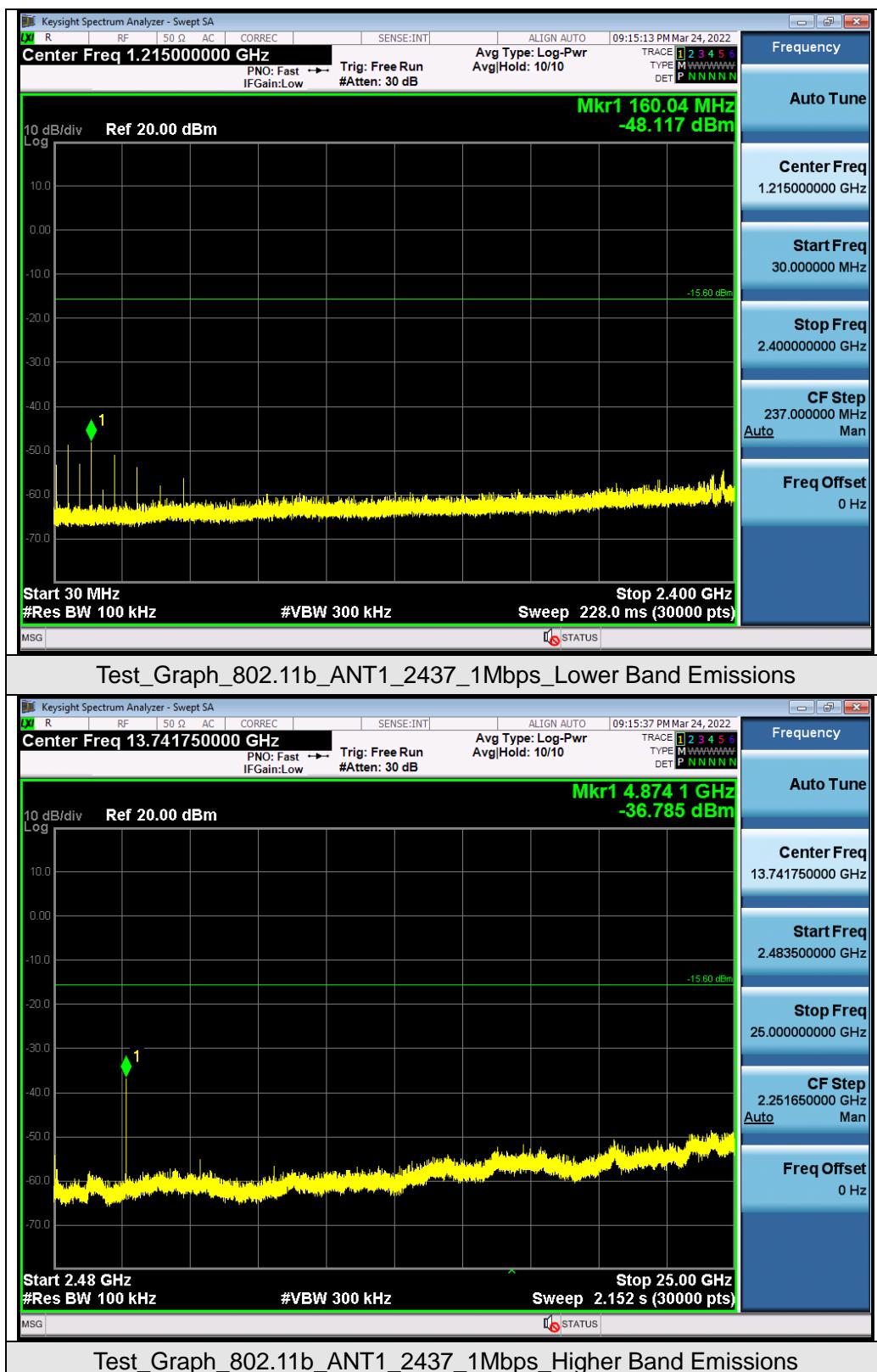


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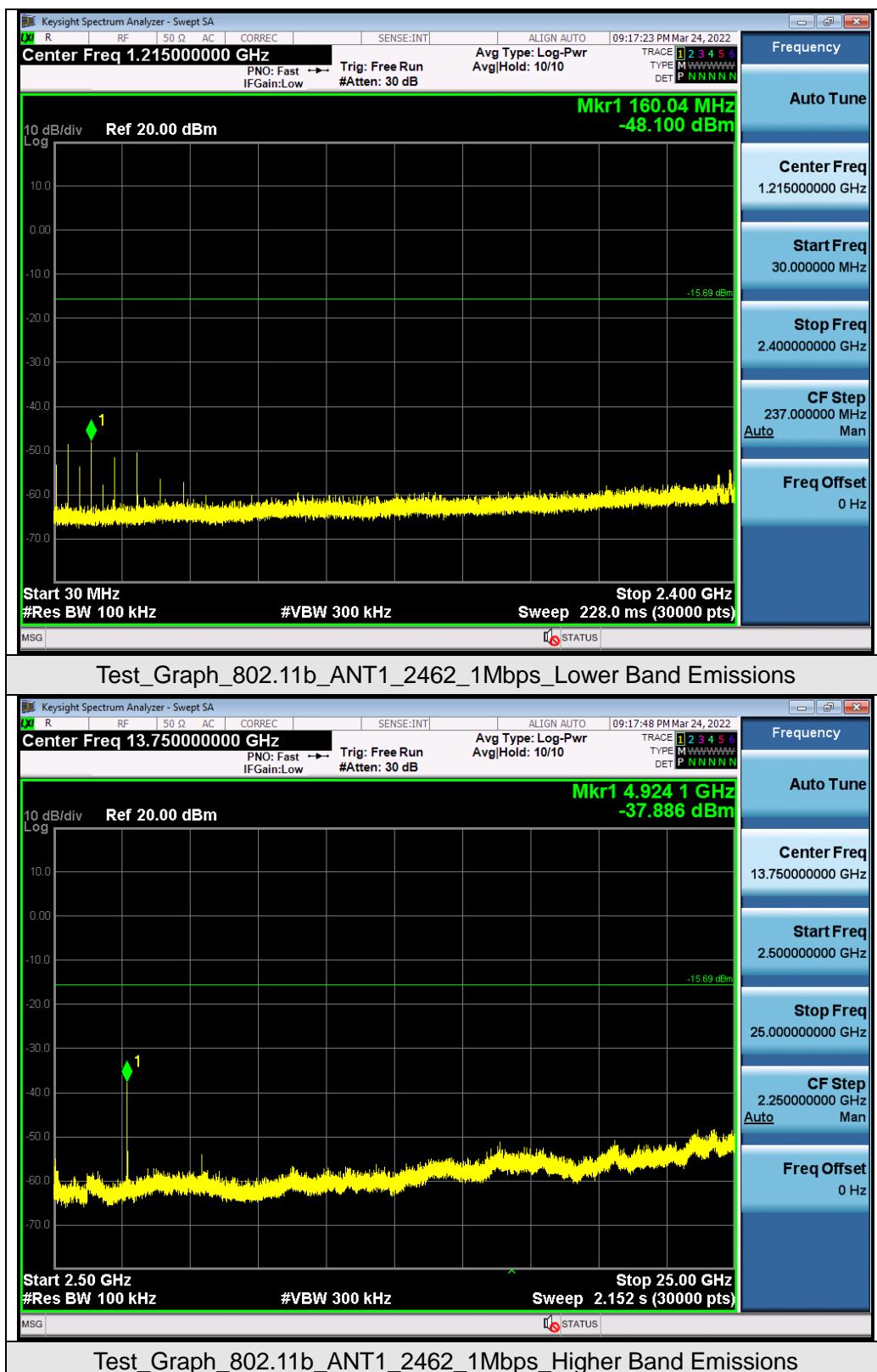


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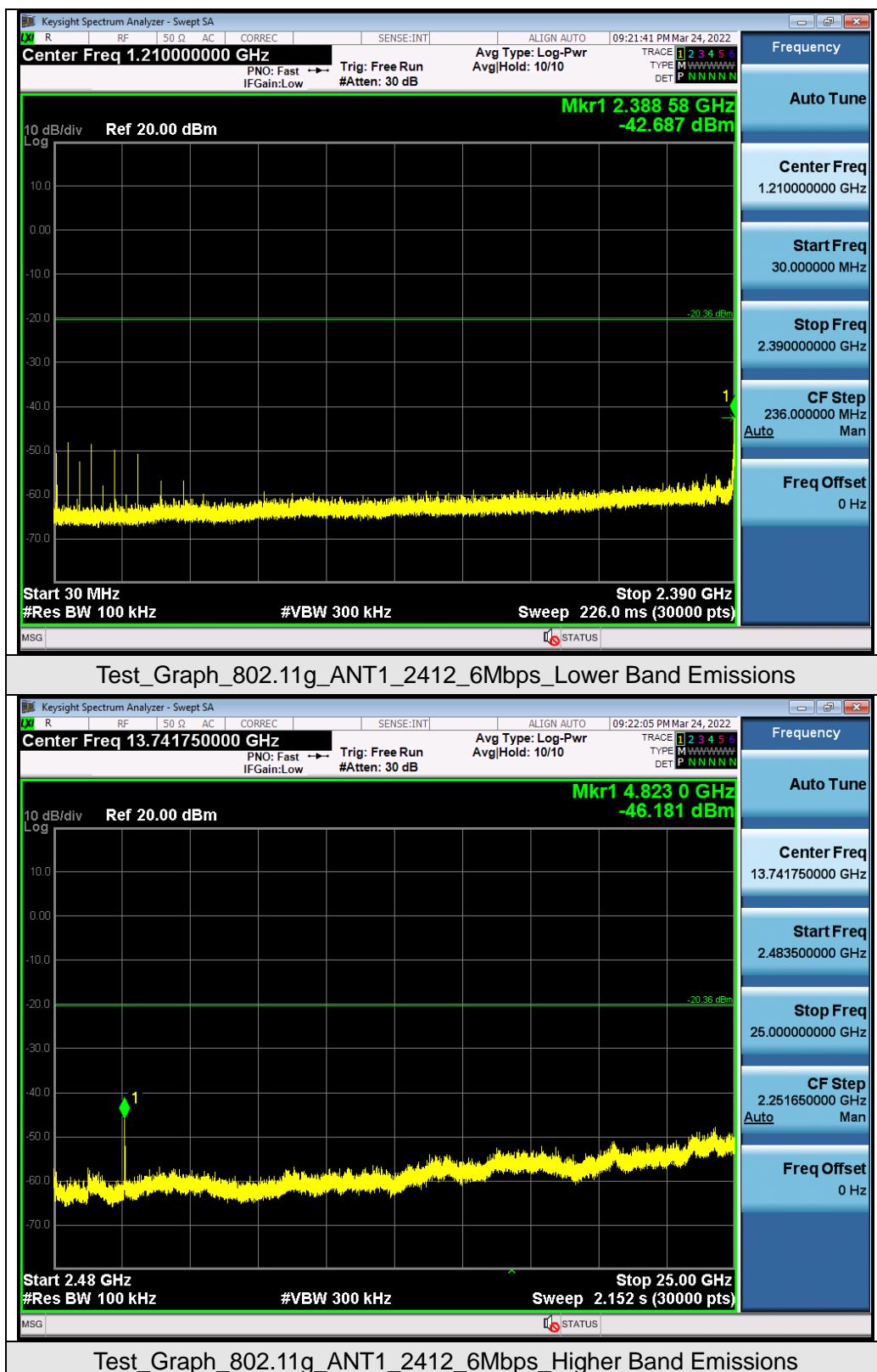


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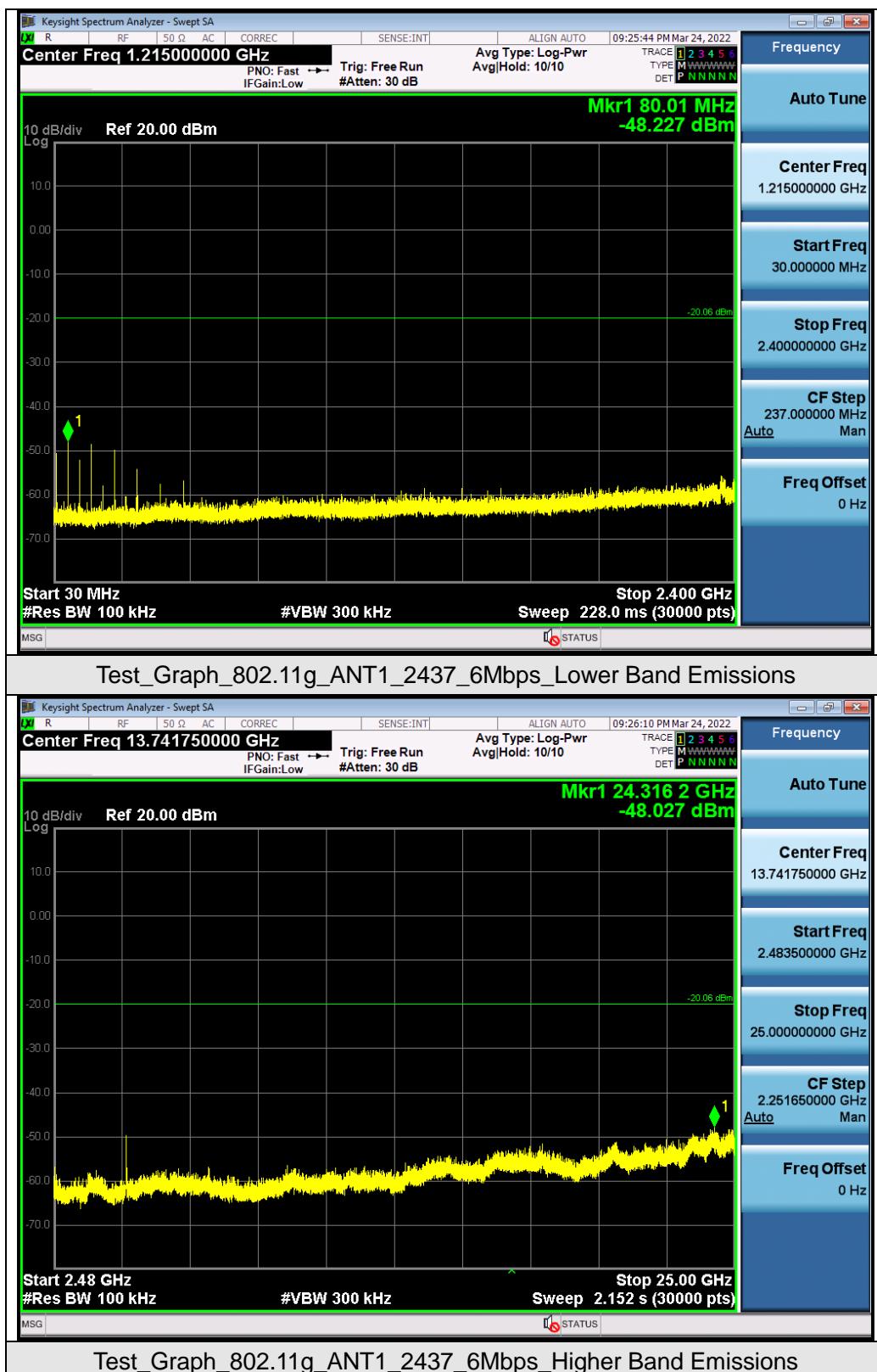


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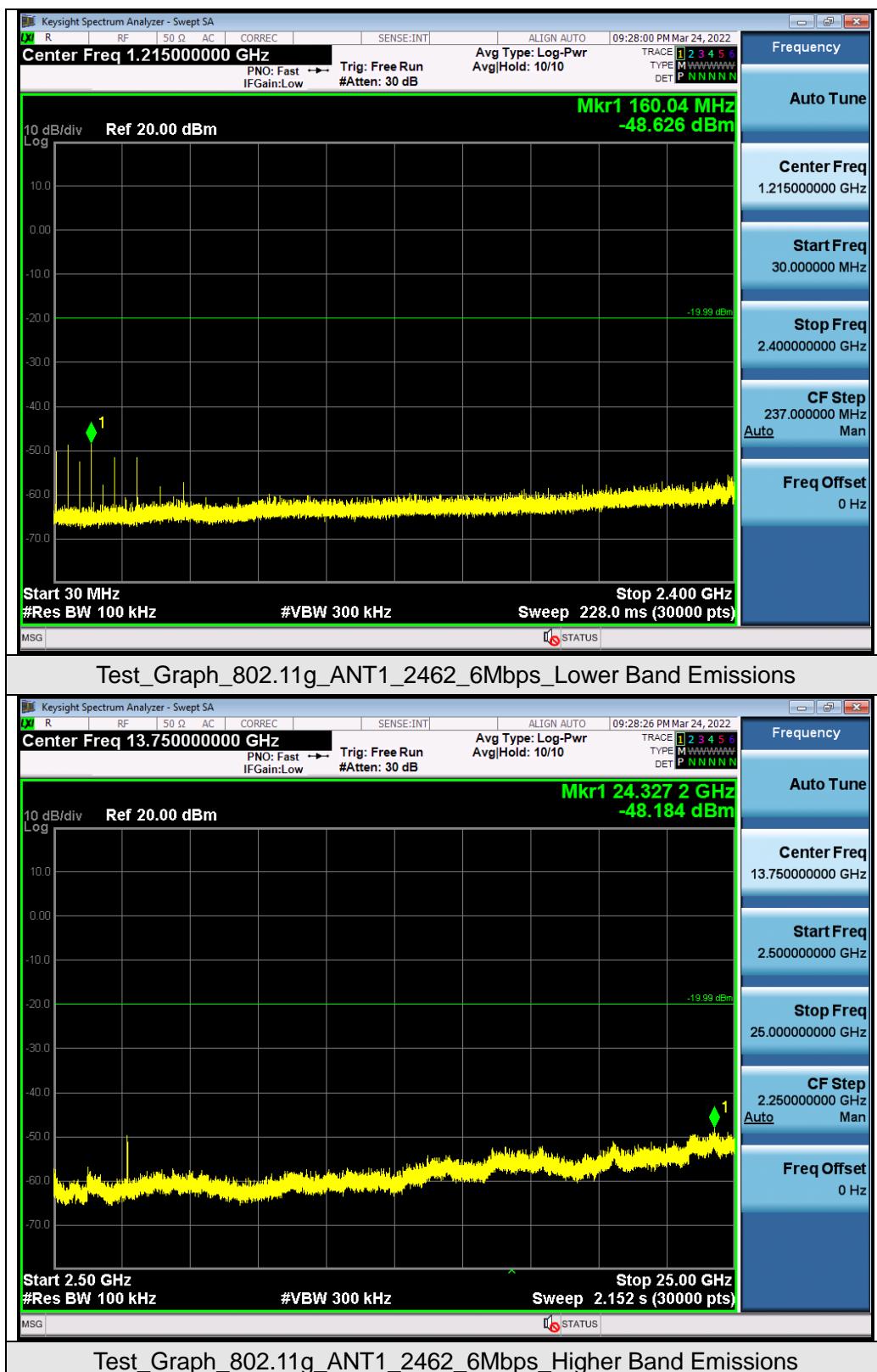


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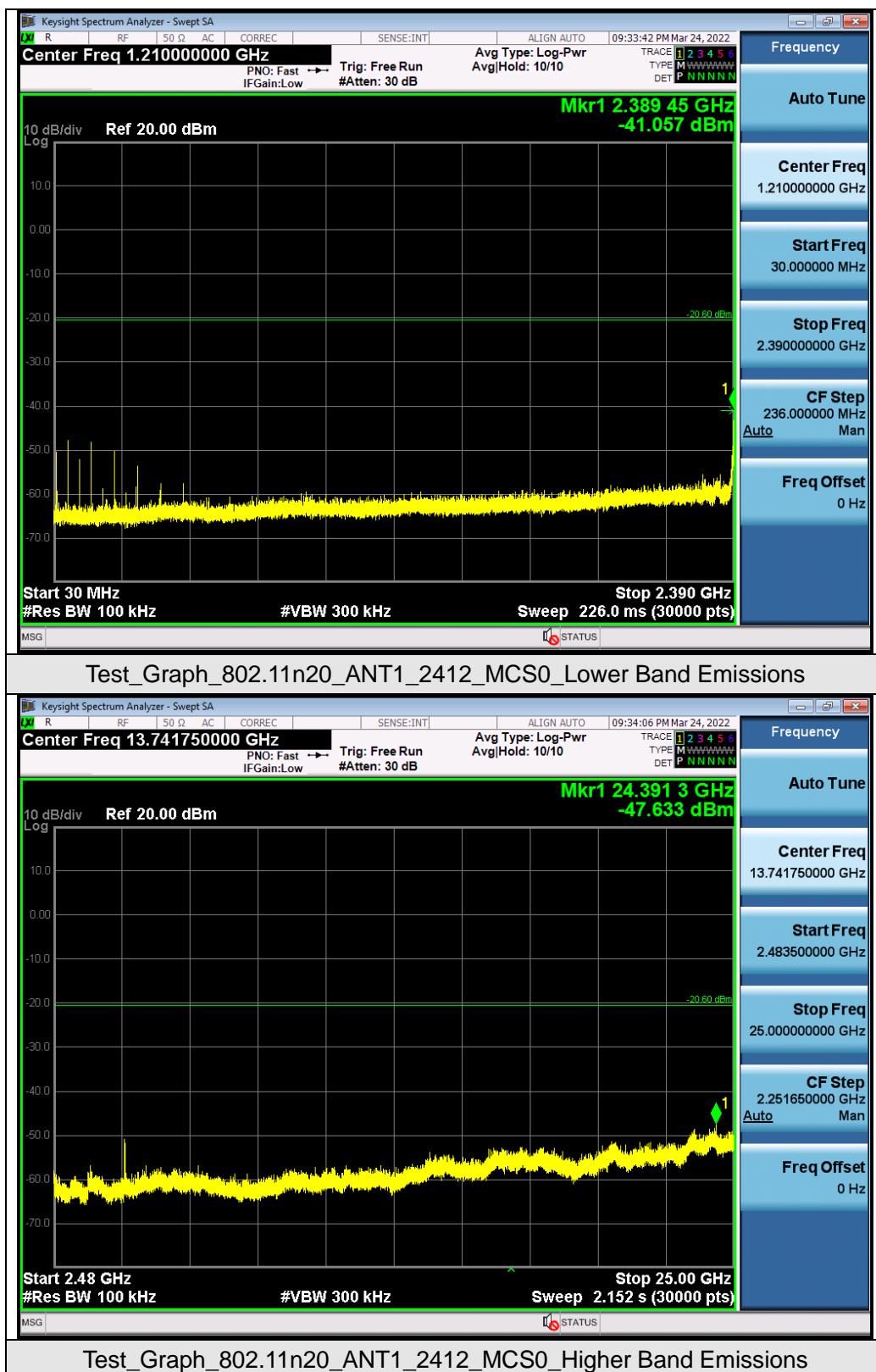


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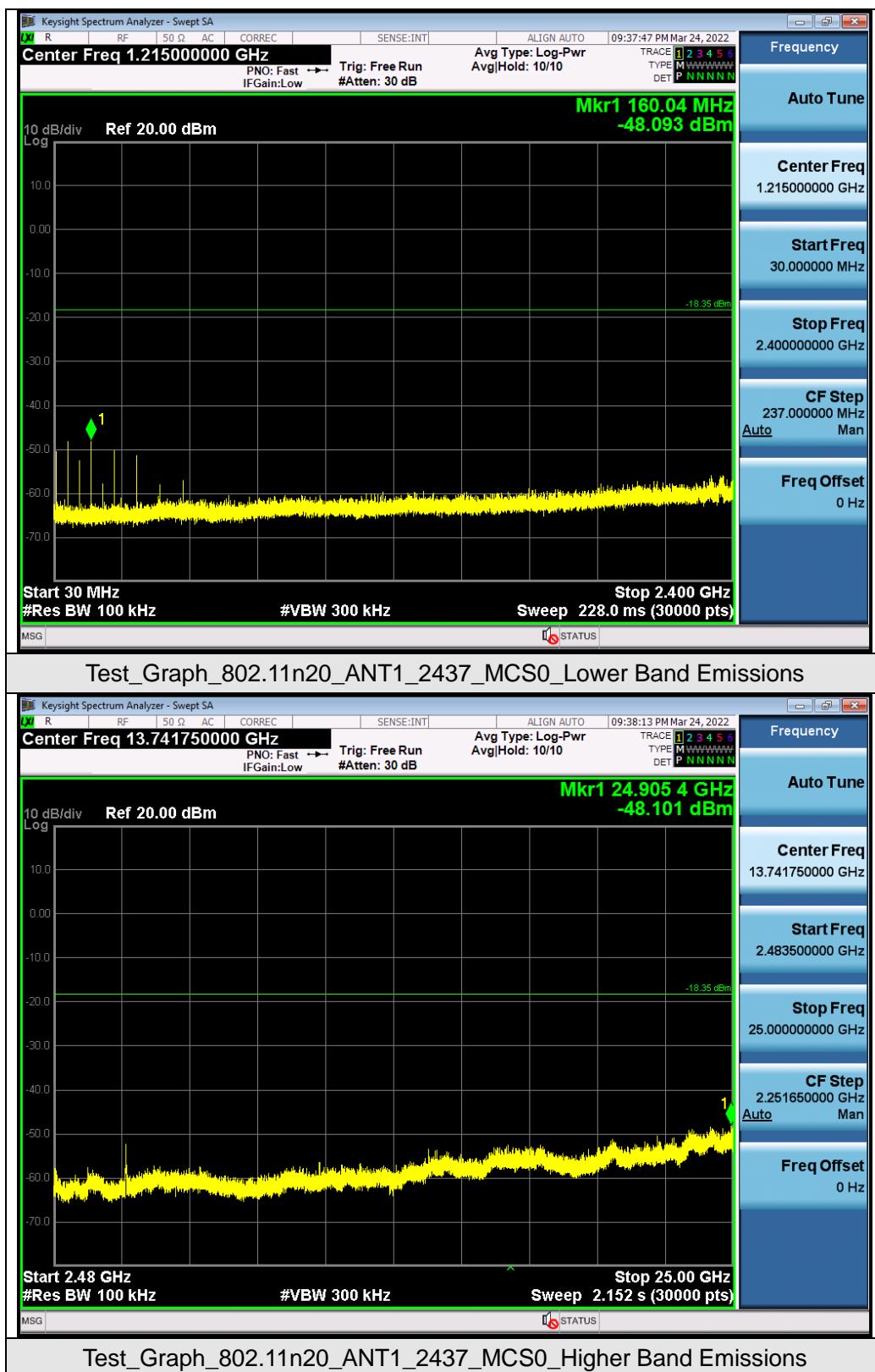


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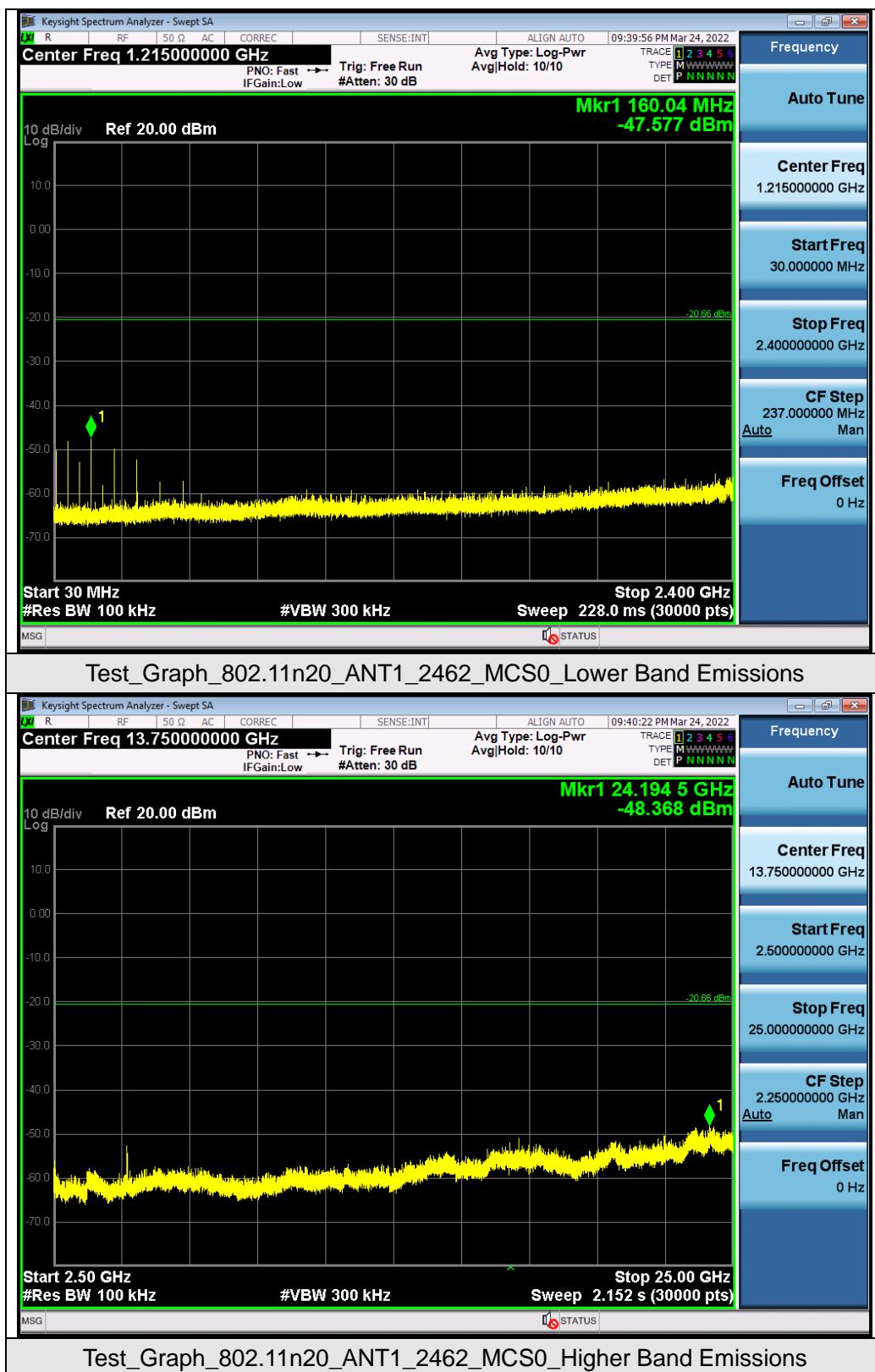


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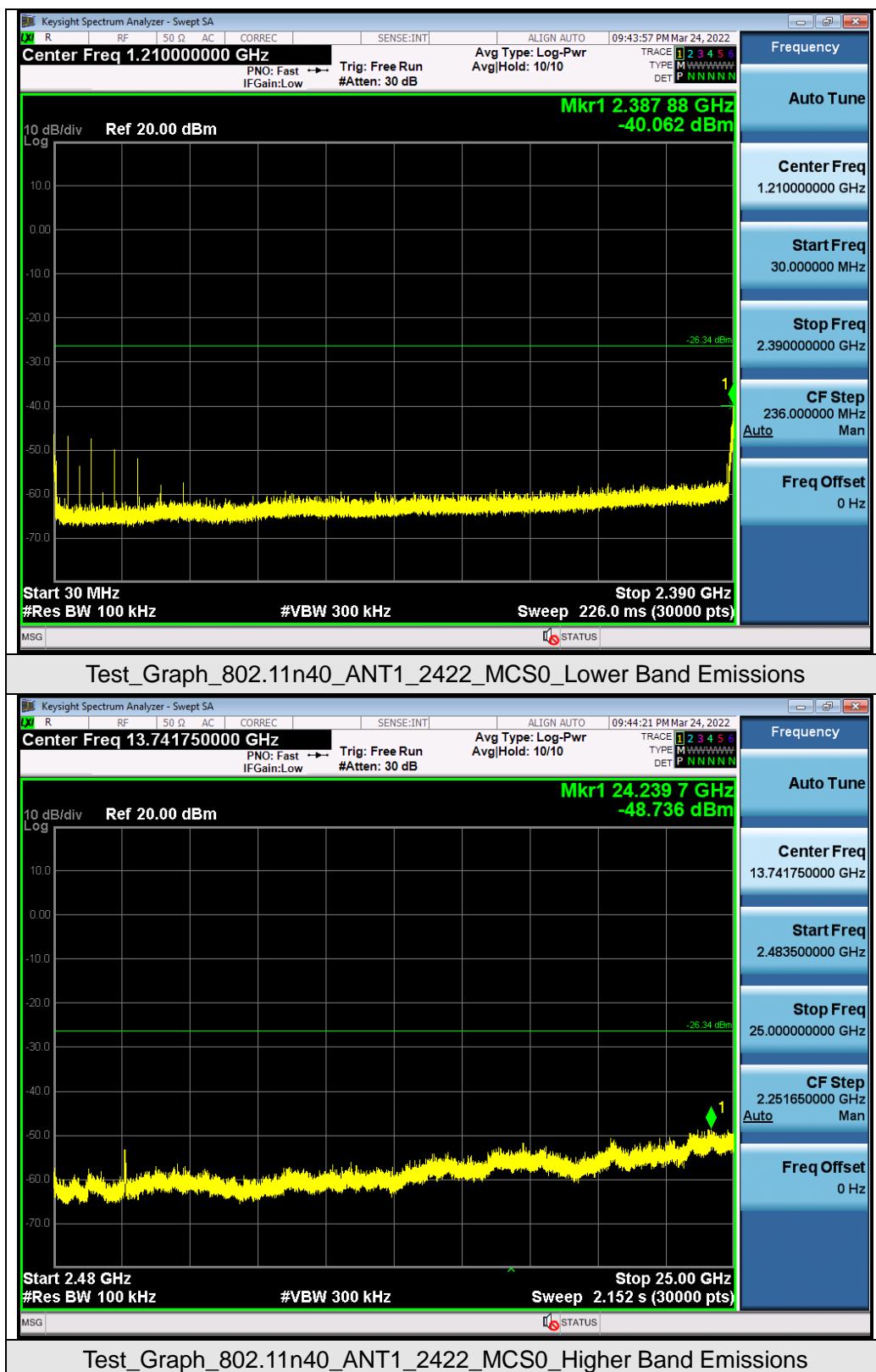


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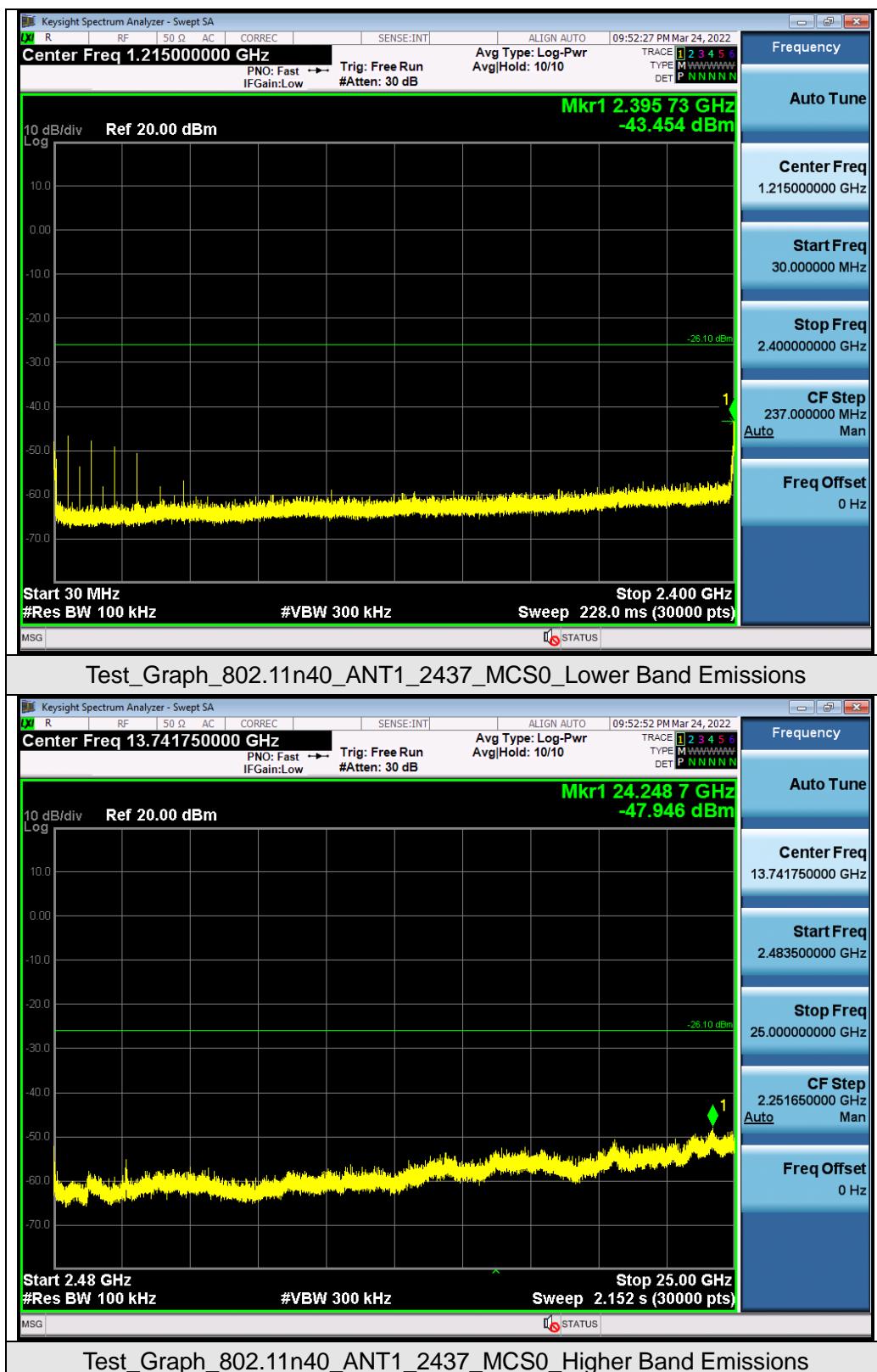


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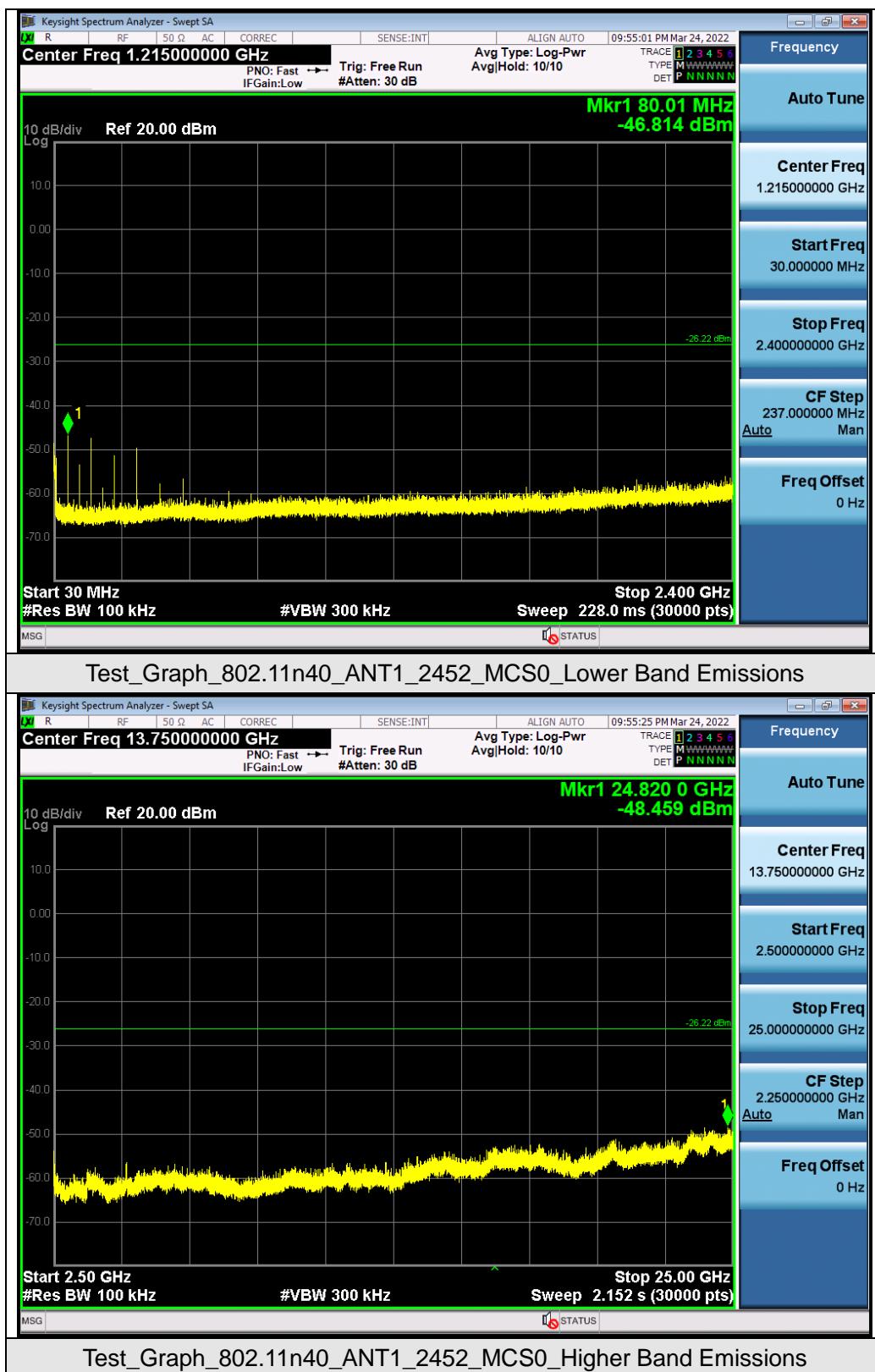


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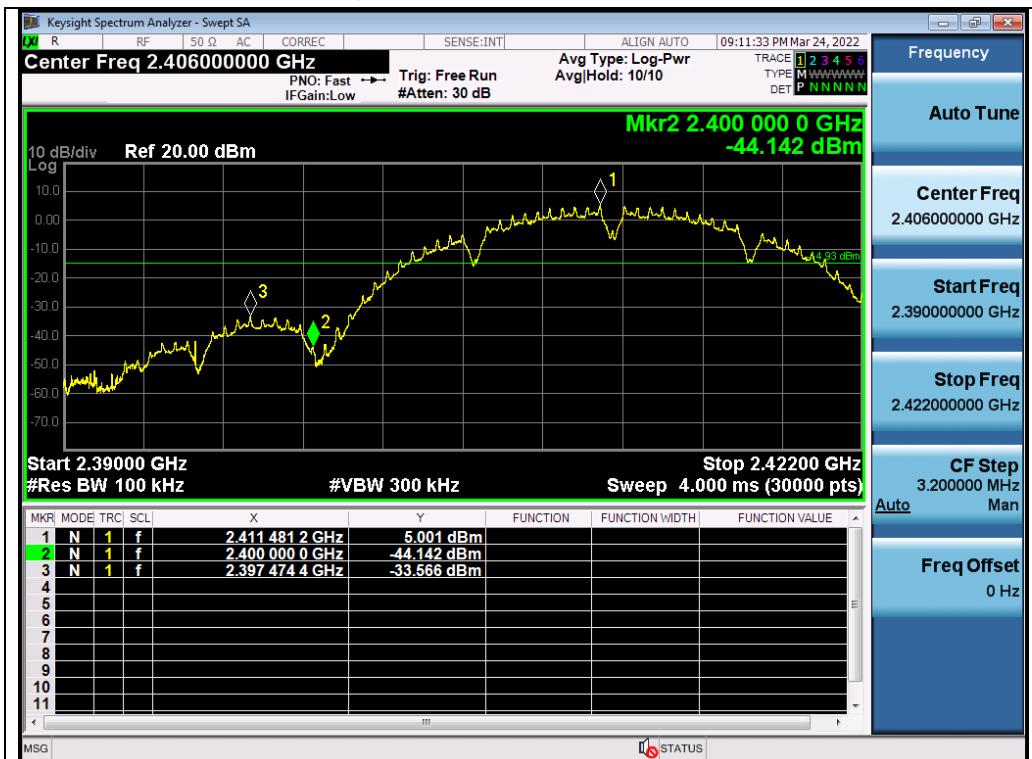
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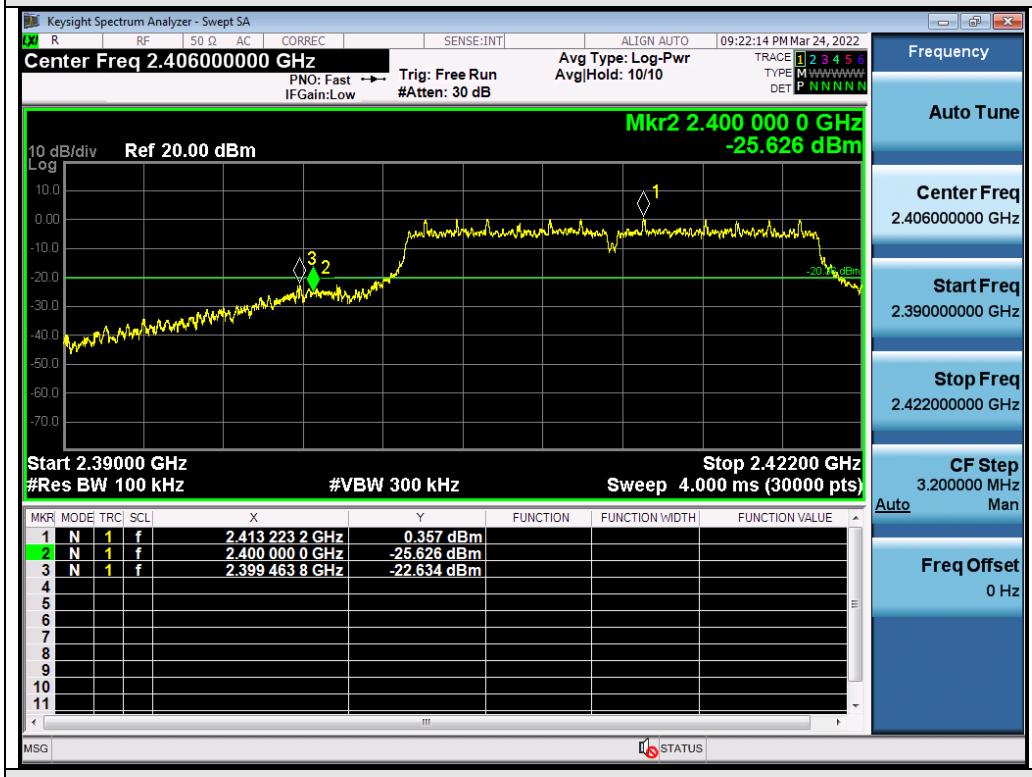
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## Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands



Test\_Graph\_802.11b\_ANT1\_2412\_1Mbps\_Lower Band Edge Emissions



Test\_Graph\_802.11g\_ANT1\_2412\_6Mbps\_Lower Band Edge Emissions

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Note: Emissions from 2483.5-2500MHz which fall in the restricted bands had been considered with the radiated emission limits specified.

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## 10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

### 10.1 MEASUREMENT PROCEDURE

- (1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- (2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- (3). Set SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the ANSI C63.10 (2013) item 11.10 was used in this testing.

### 10.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer to Section 8.2.

### 10.3 MEASUREMENT EQUIPMENT USED

Refer to Section 6.

### 10.4 LIMITS AND MEASUREMENT RESULT

Test Data of Conducted Output Power Spectral Density					
Test Mode	Test Channel (MHz)	Power density (dBm/20kHz)	Power density (dBm/3kHz)	Limit (dBm/3kHz)	Pass or Fail
802.11b	2412	0.171	-8.068	≤ -8	Pass
	2437	0.533	-7.706	≤ -8	Pass
	2462	-1.136	-9.375	≤ -8	Pass
802.11g	2412	-5.747	-13.986	≤ -8	Pass
	2437	-5.455	-13.694	≤ -8	Pass
	2462	-5.445	-13.684	≤ -8	Pass
802.11n20	2412	-6.465	-14.704	≤ -8	Pass
	2437	-6.473	-14.712	≤ -8	Pass
	2462	-6.495	-14.734	≤ -8	Pass
802.11n40	2422	-11.256	-19.495	≤ -8	Pass
	2437	-11.004	-19.243	≤ -8	Pass
	2452	-11.117	-19.356	≤ -8	Pass

Note: Power density(dBm/3kHz) = Power density(dBm/20kHz) – 10\*log(20/3).

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## Test Graphs of Conducted Output Power Spectral Density

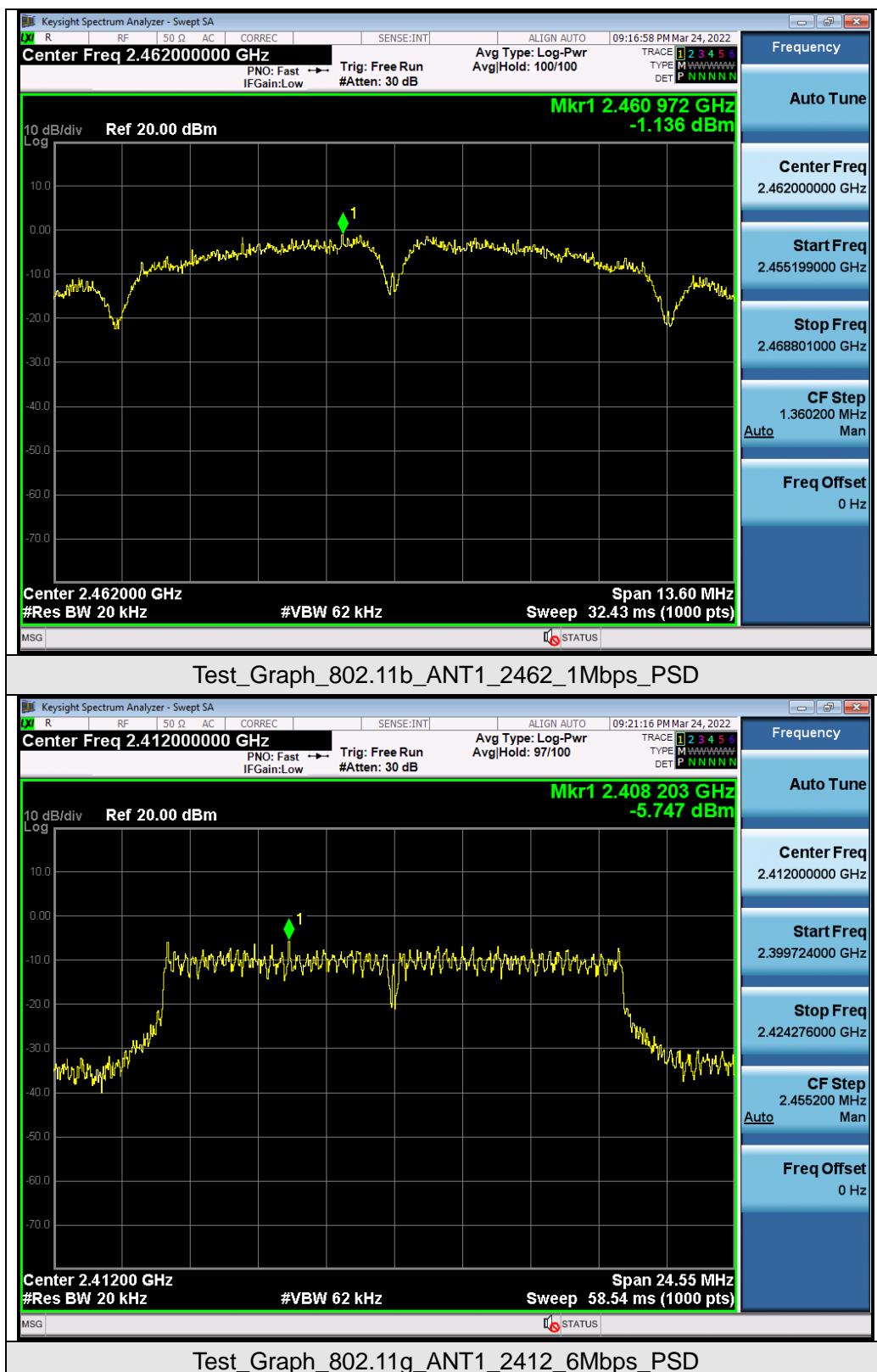


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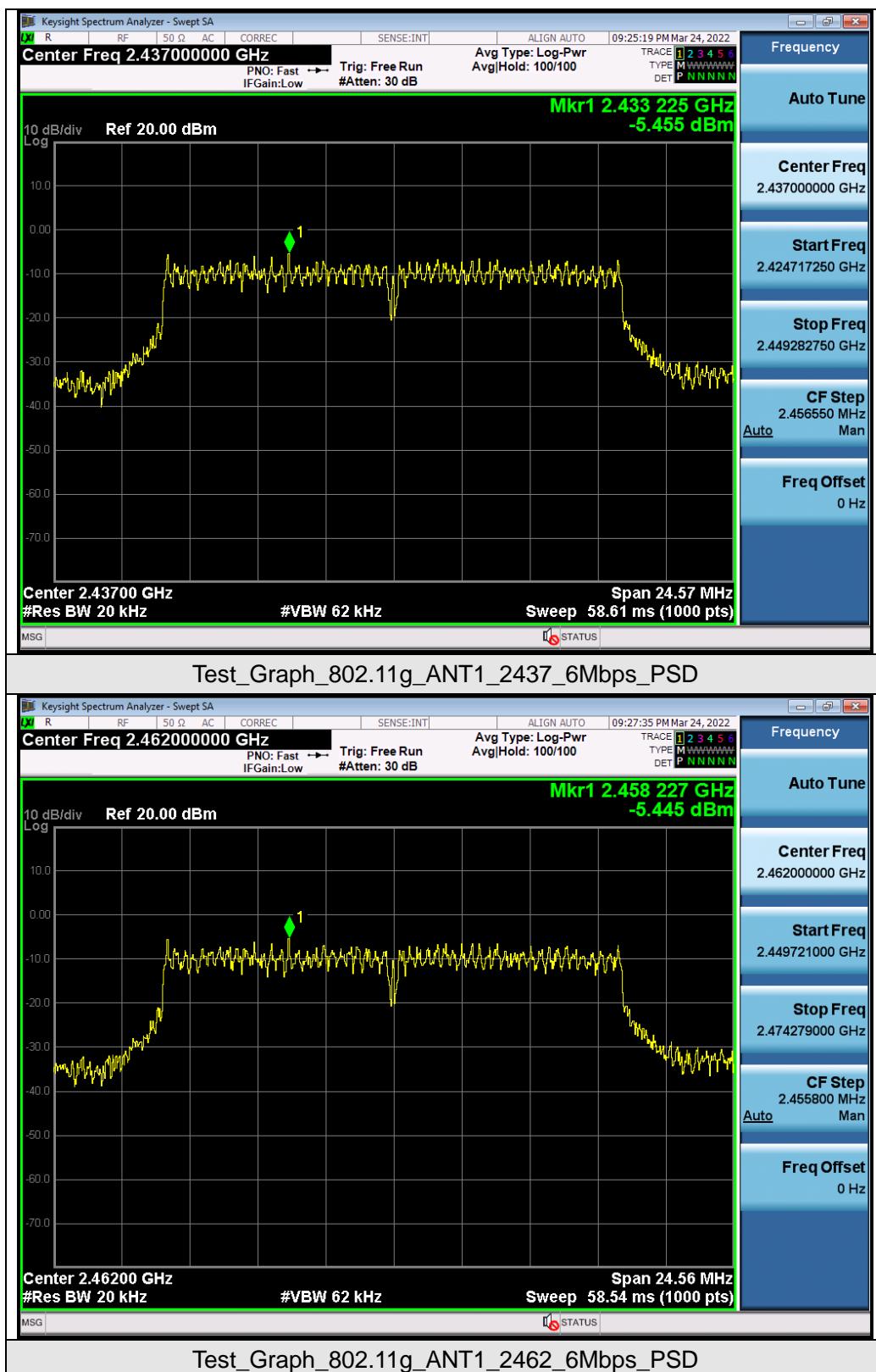


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