

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

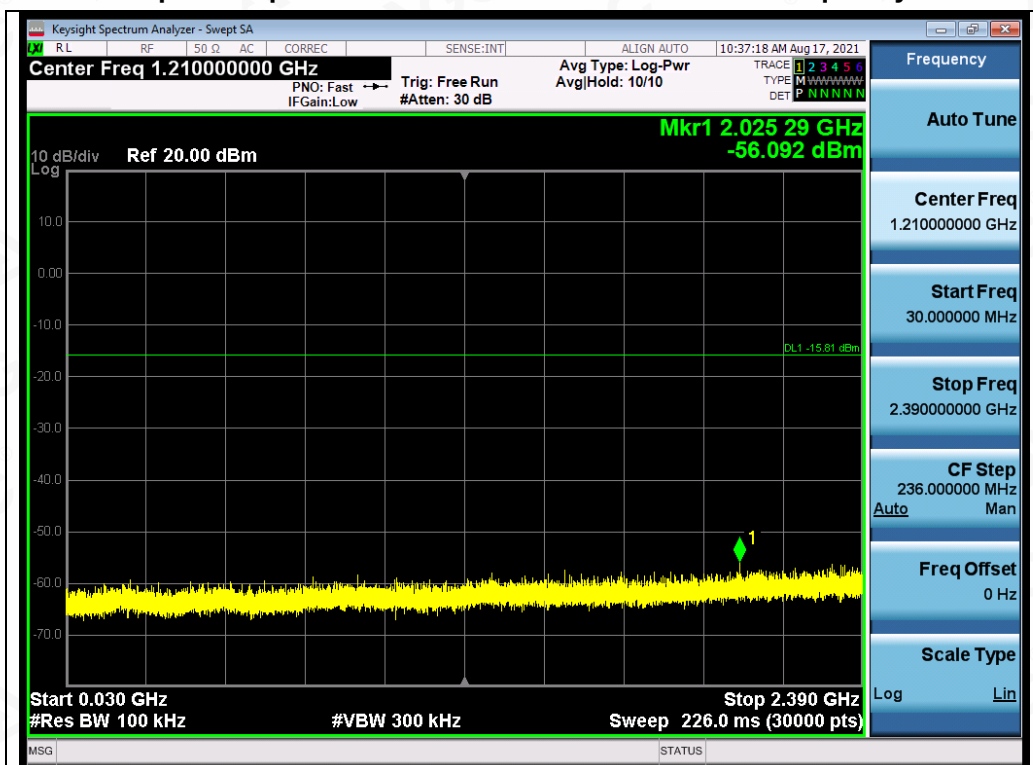
Note: The limits reference level is according to the test plot of -6dB bandwidth.

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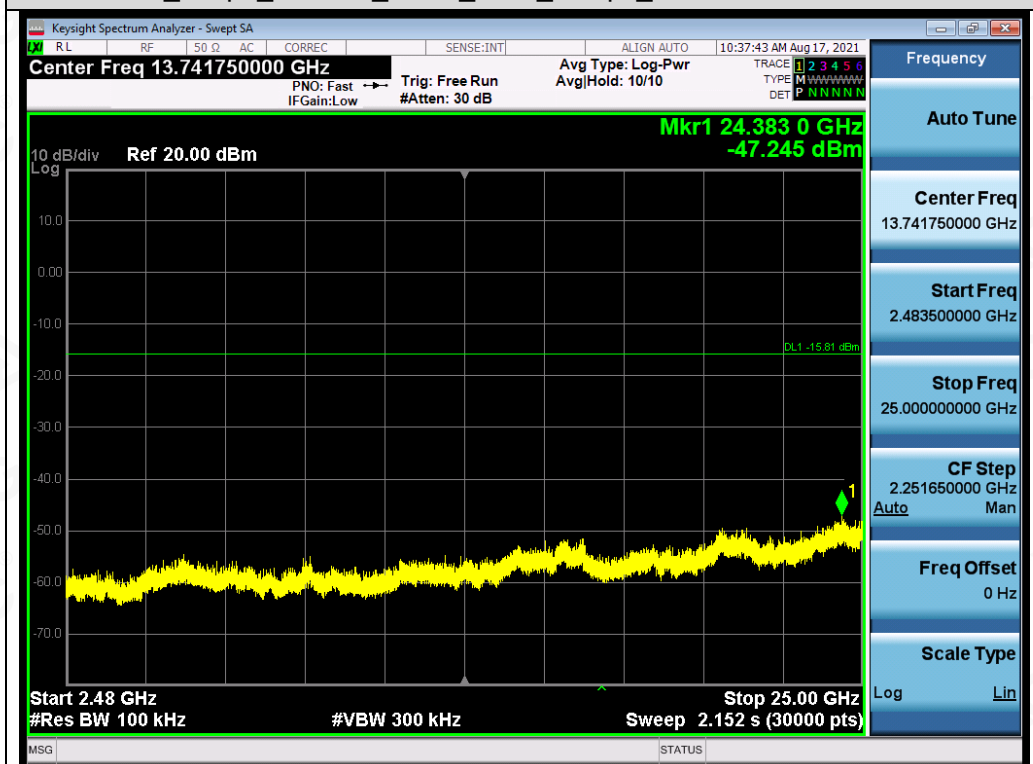
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Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands



Test_Graph_802.11b_ANT1_2412_1Mbps_Lower Band Emissions

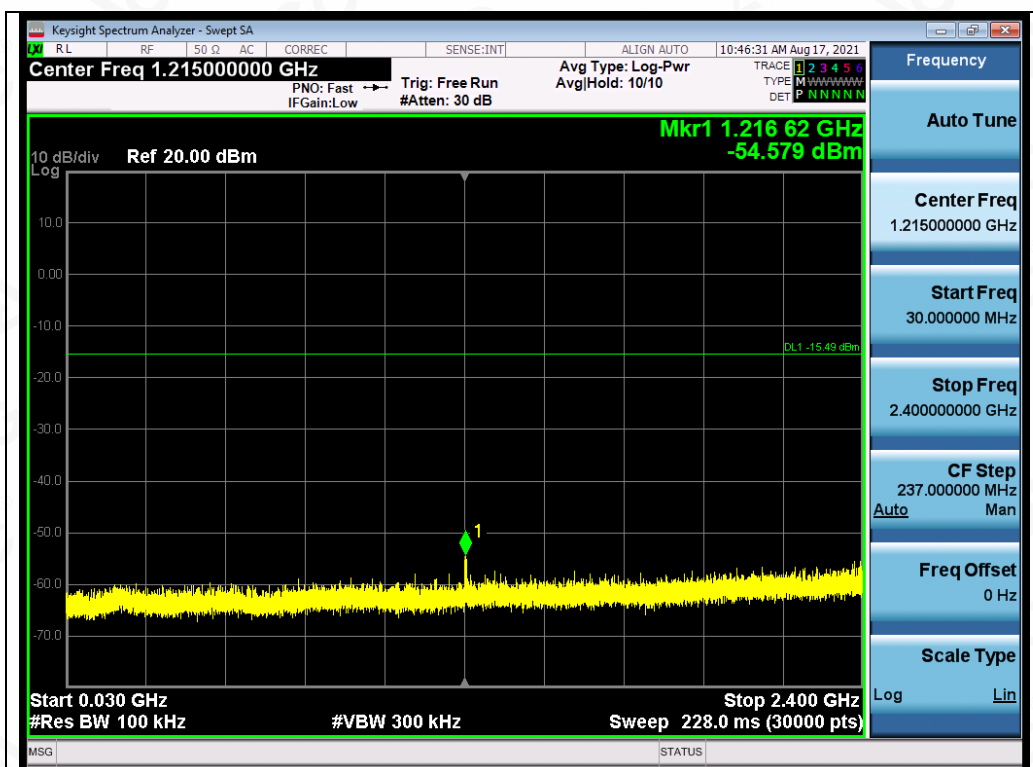


Test_Graph_802.11b_ANT1_2412_1Mbps_Higher Band Emissions

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Test_Graph_802.11b_ANT1_2437_1Mbps_Lower Band Emissions

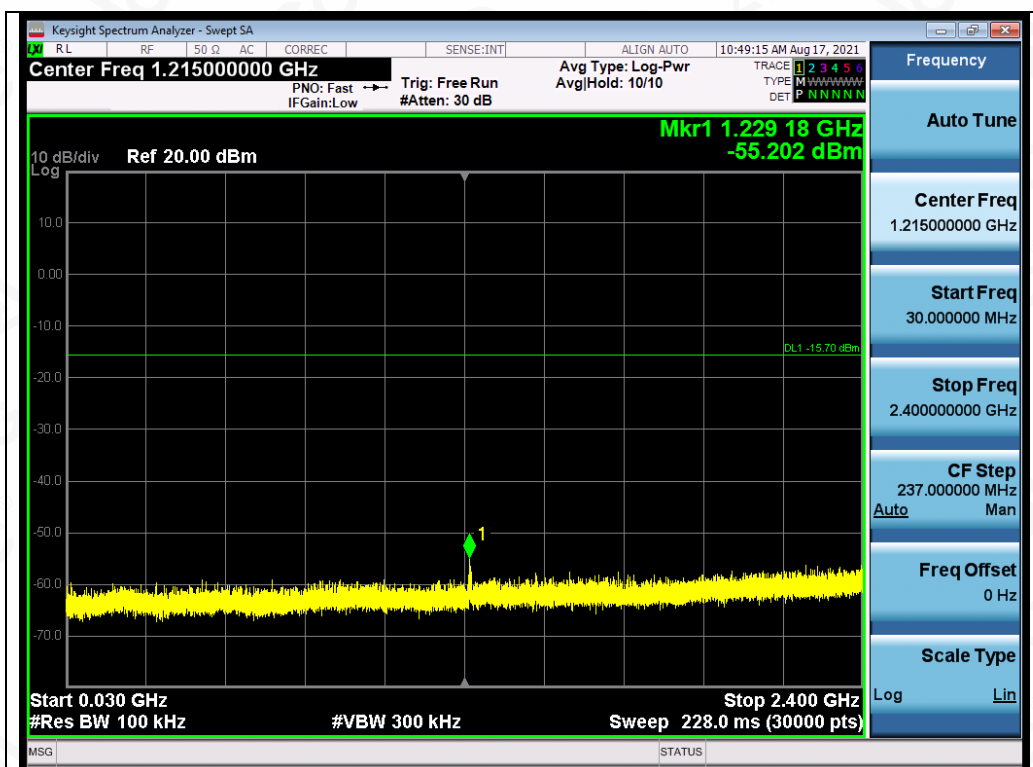


Test_Graph_802.11b_ANT1_2437_1Mbps_Higher Band Emissions

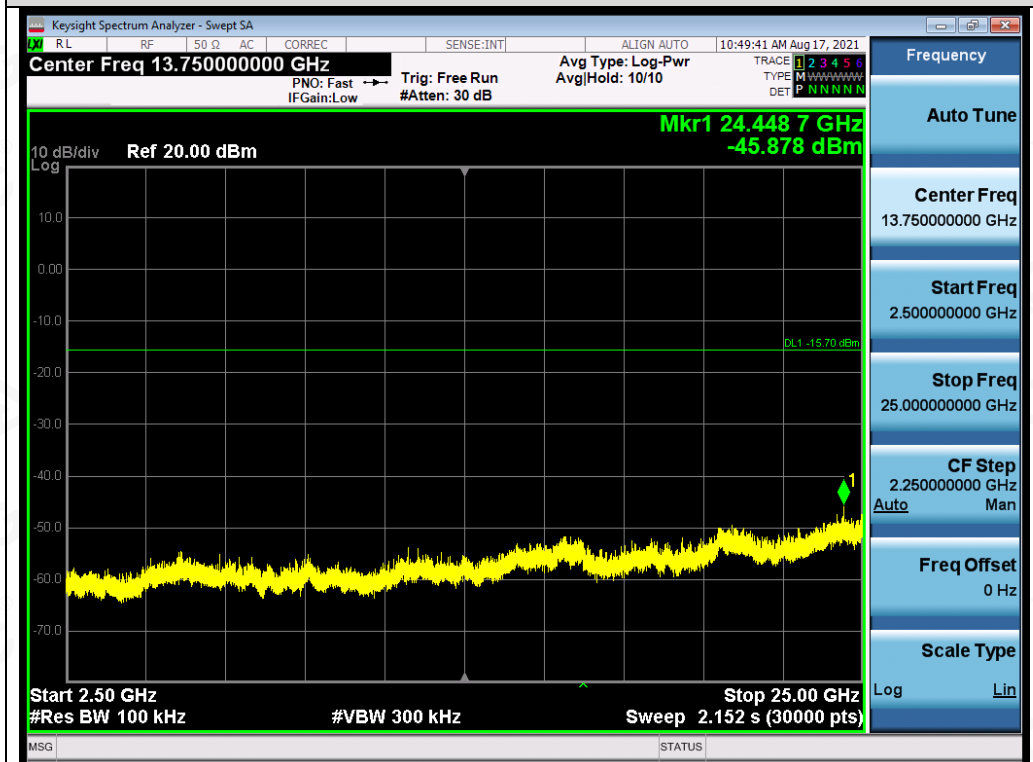
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Test_Graph_802.11b_ANT1_2462_1Mbps_Lower Band Emissions

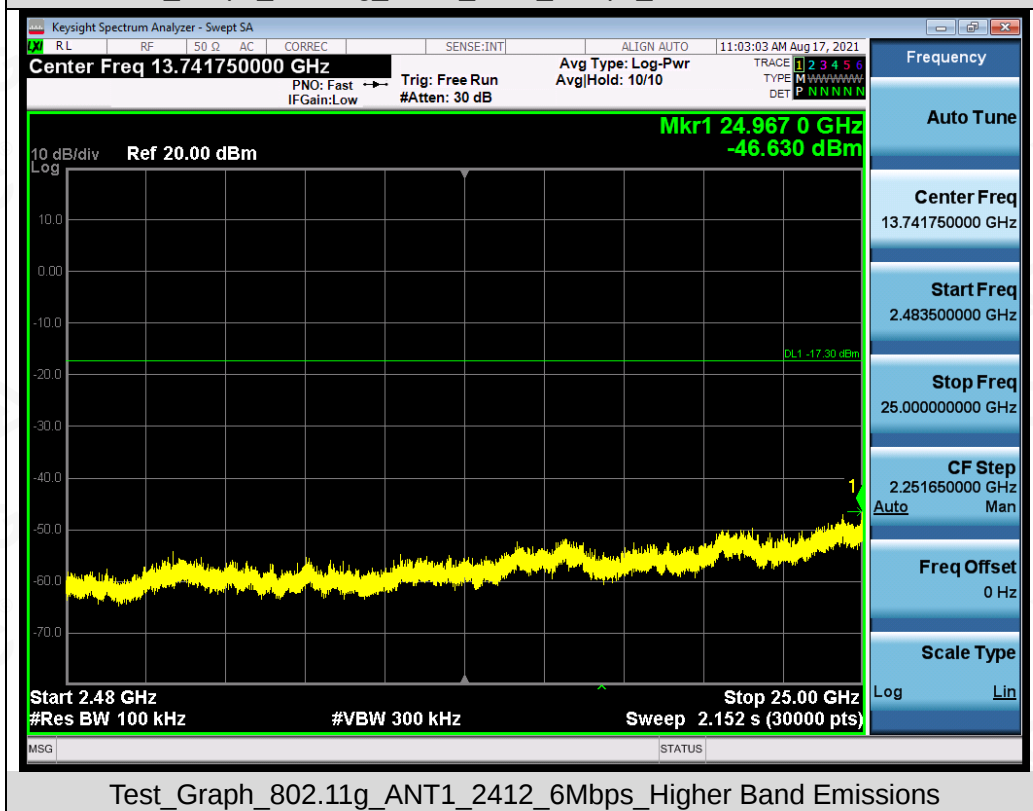
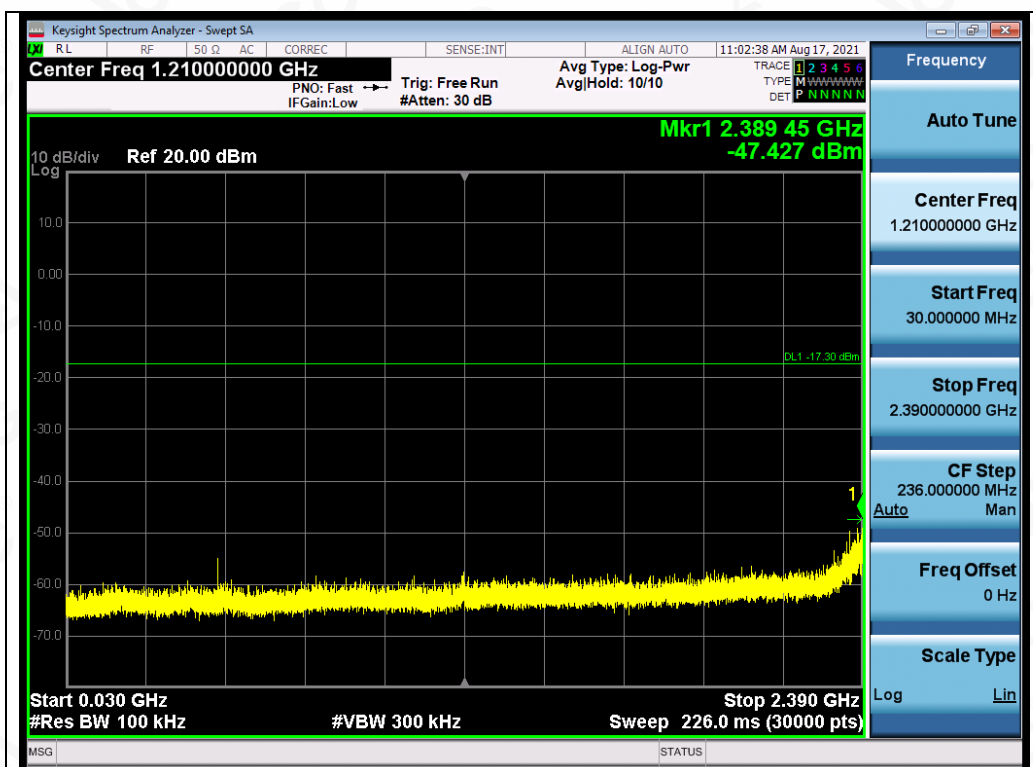


Test_Graph_802.11b_ANT1_2462_1Mbps_Higher Band Emissions

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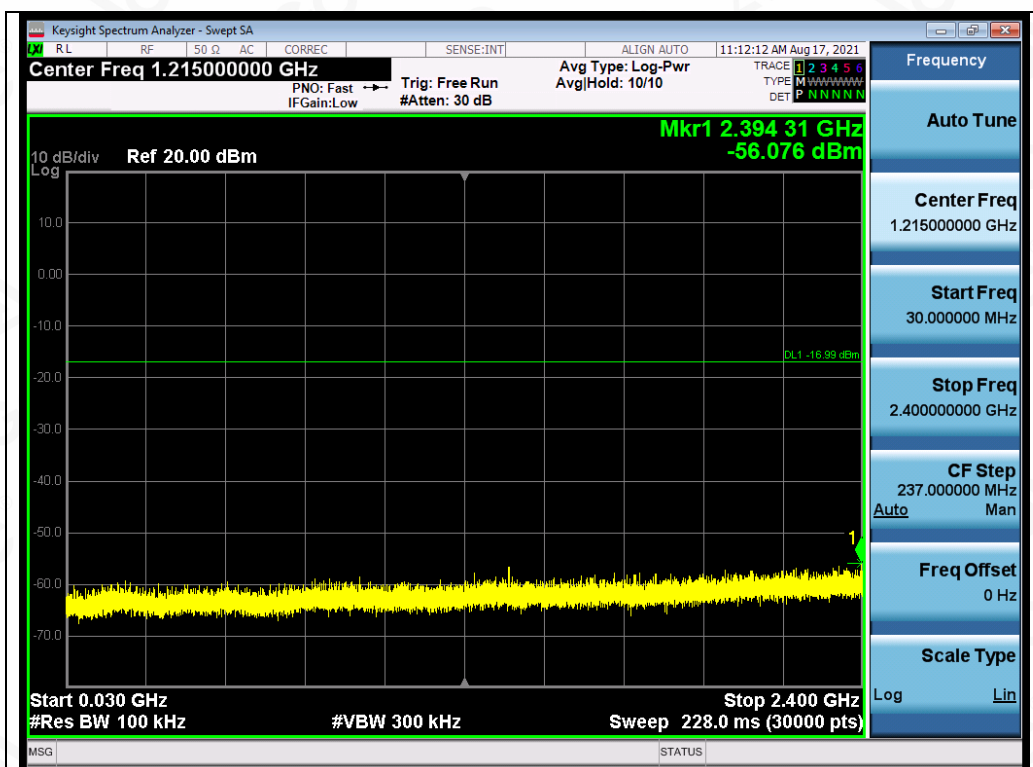




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Test_Graph_802.11g_ANT1_2437_6Mbps_Lower Band Emissions

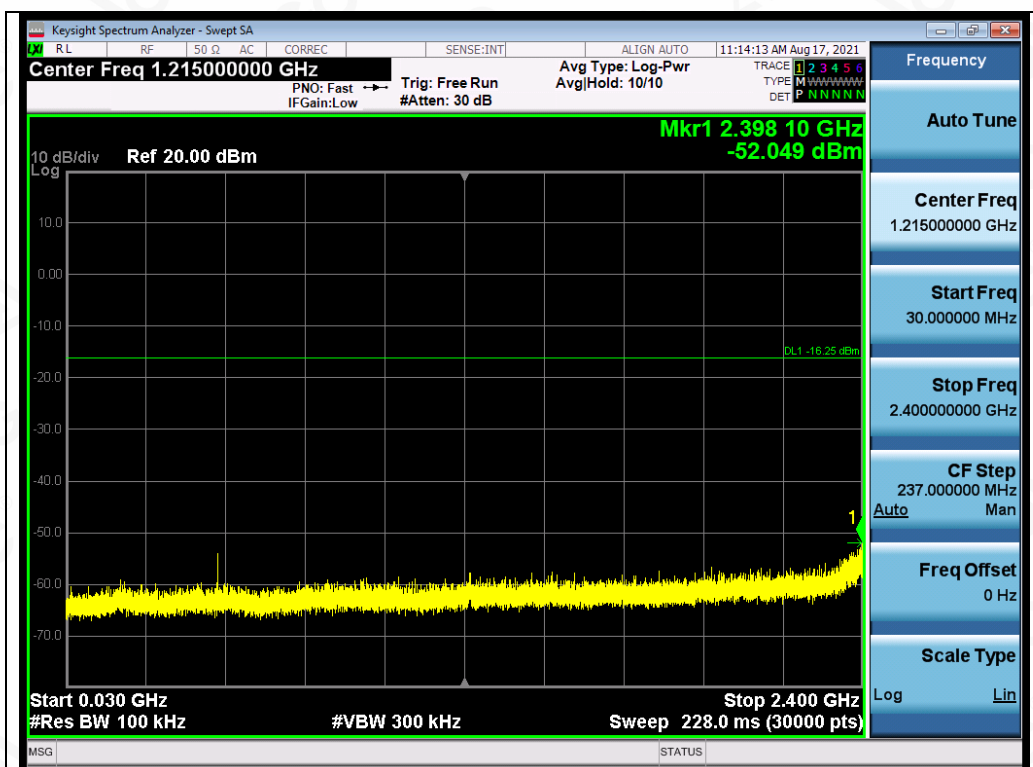


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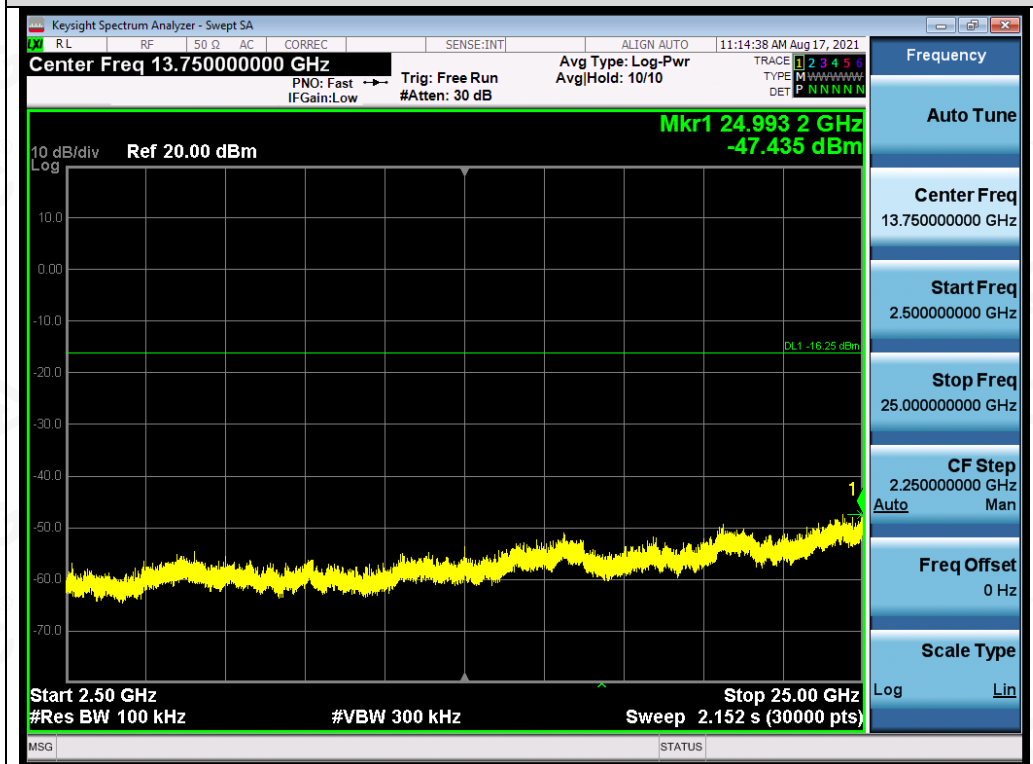
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Test_Graph_802.11g_ANT1_2462_6Mbps_Lower Band Emissions

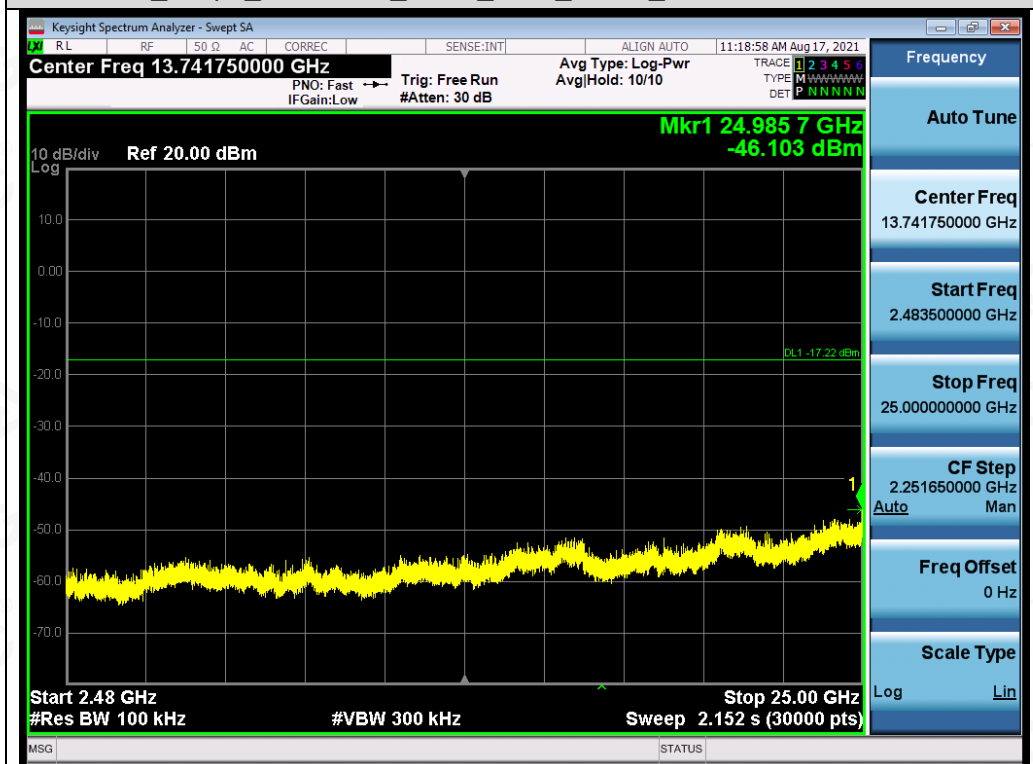
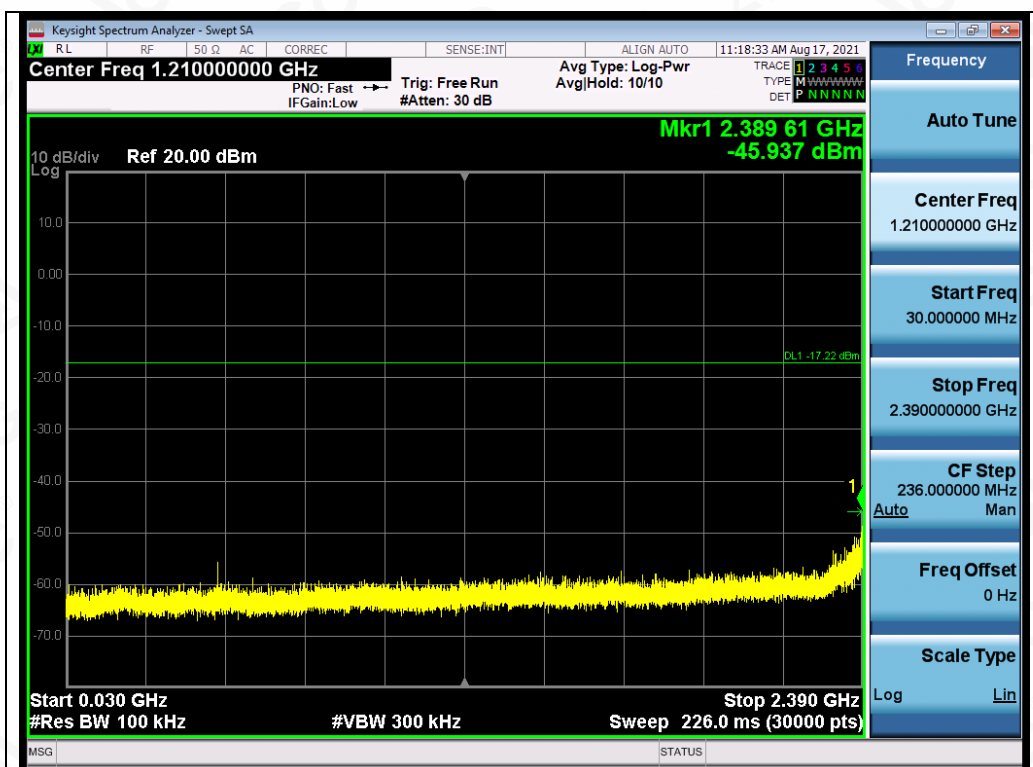


Test_Graph_802.11g_ANT1_2462_6Mbps_Higher Band Emissions

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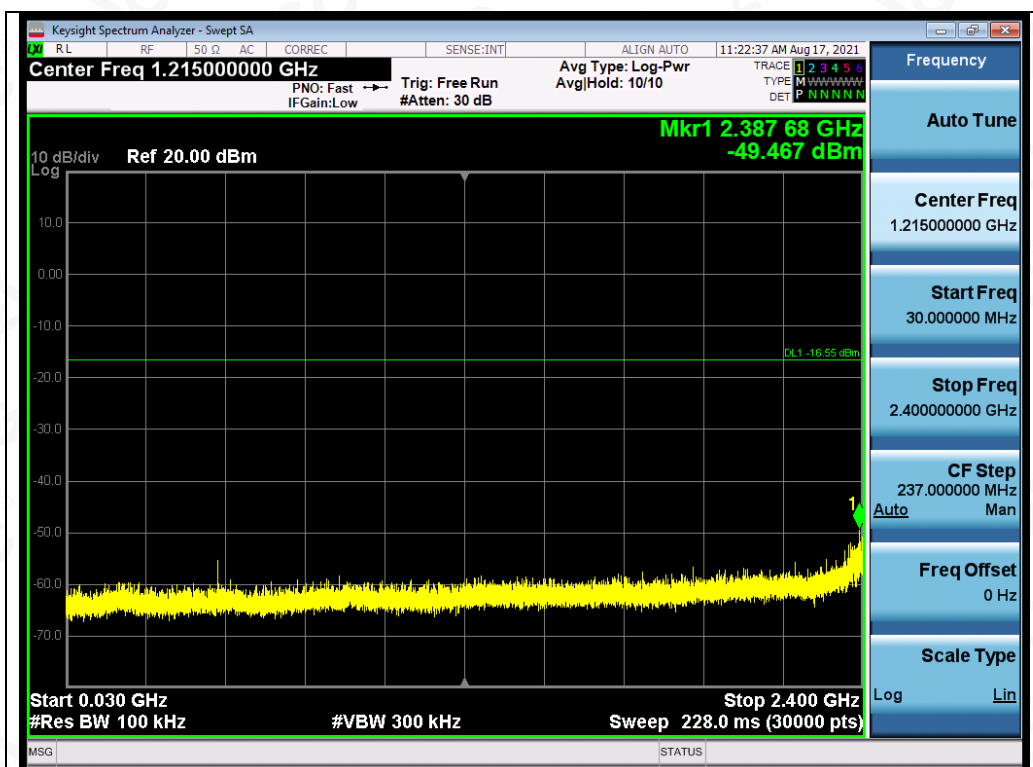




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Test_Graph_802.11n20_ANT1_2437_MCS0_Lower Band Emissions

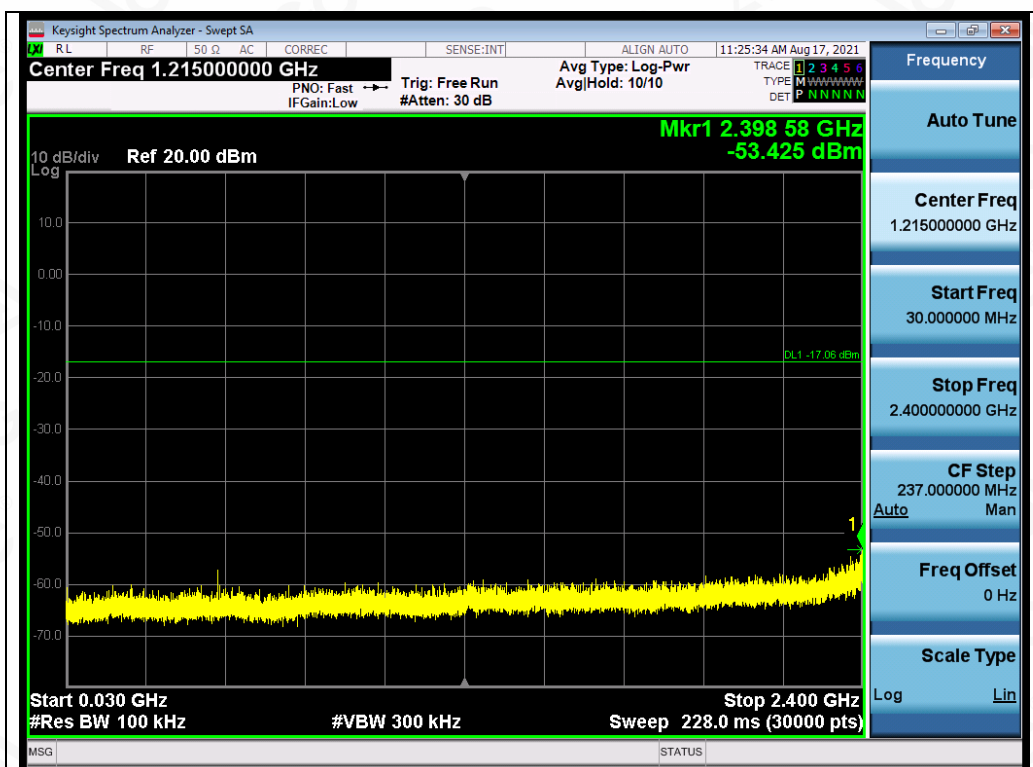


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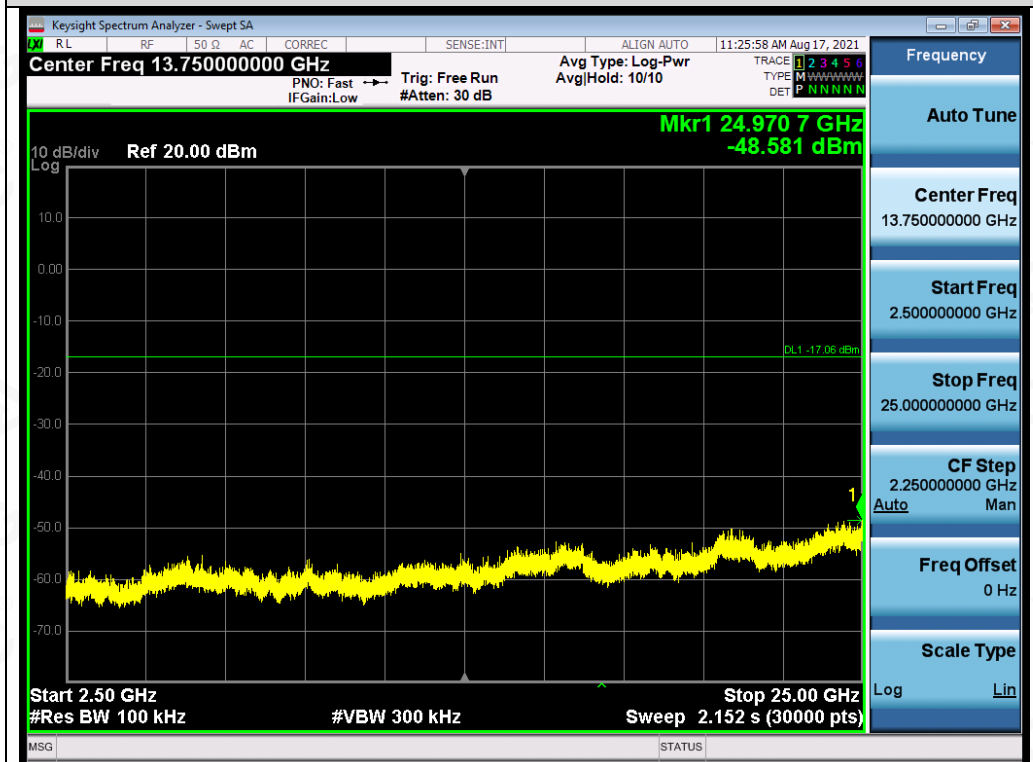
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Test_Graph_802.11n20_ANT1_2462_MCS0_Lower Band Emissions

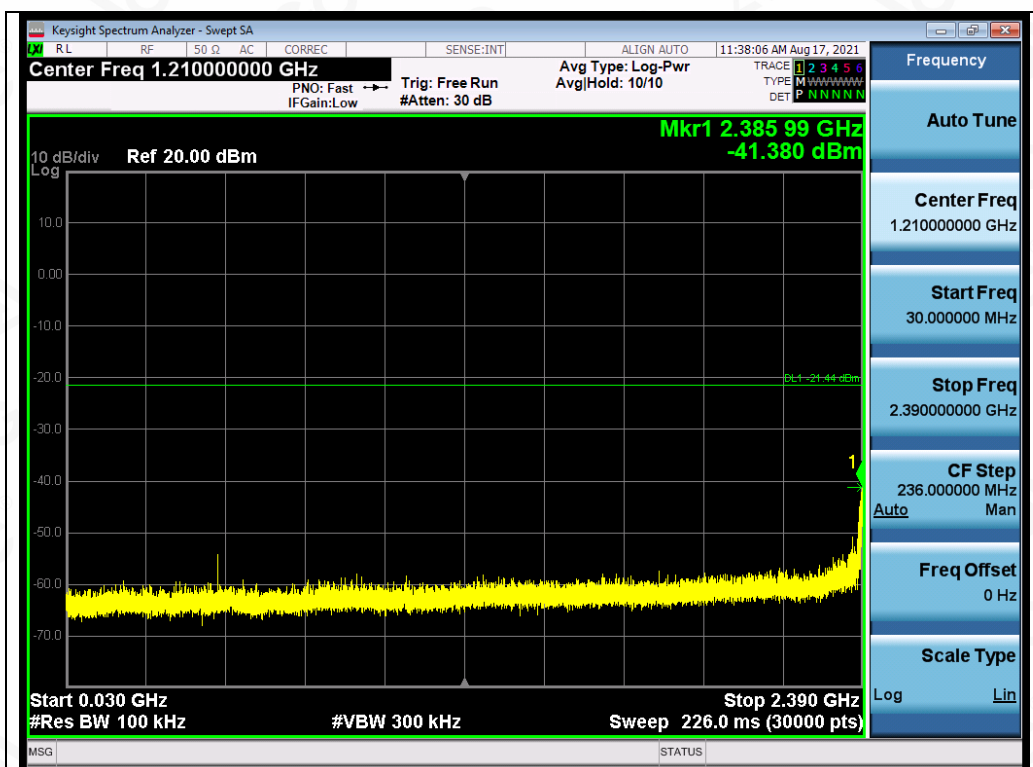


Test_Graph_802.11n20_ANT1_2462_MCS0_Higher Band Emissions

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Test_Graph_802.11n40_ANT1_2422_MCS0_Lower Band Emissions

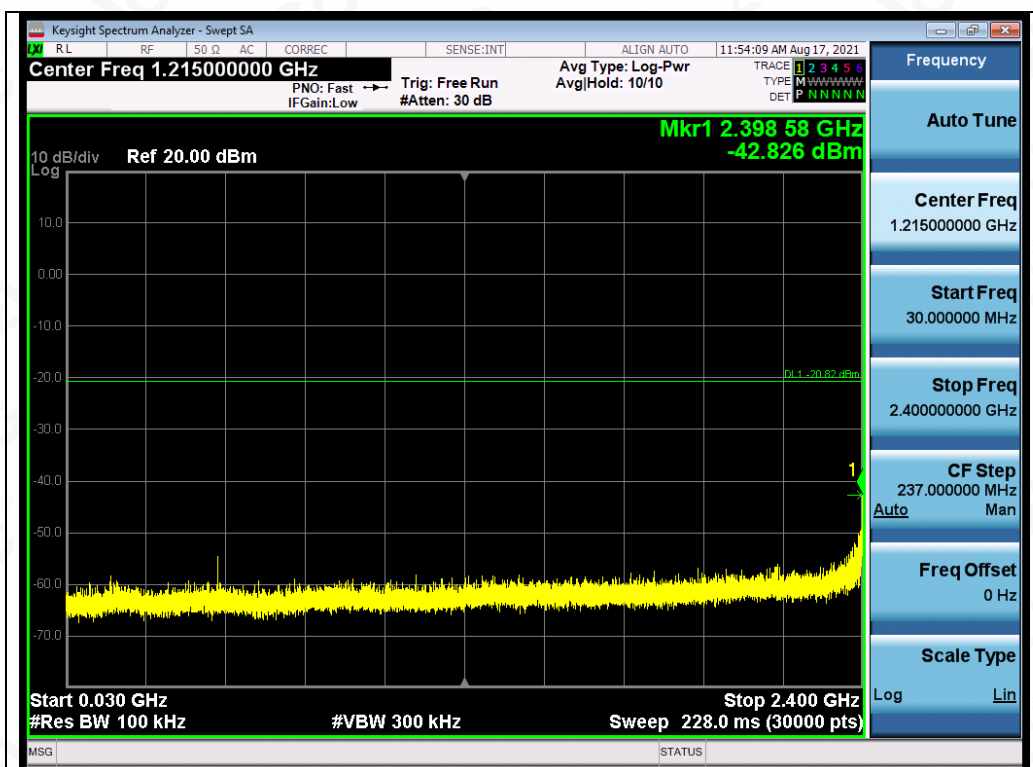


Test_Graph_802.11n40_ANT1_2422_MCS0_Higher Band Emissions

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Test_Graph_802.11n40_ANT1_2437_MCS0_Lower Band Emissions

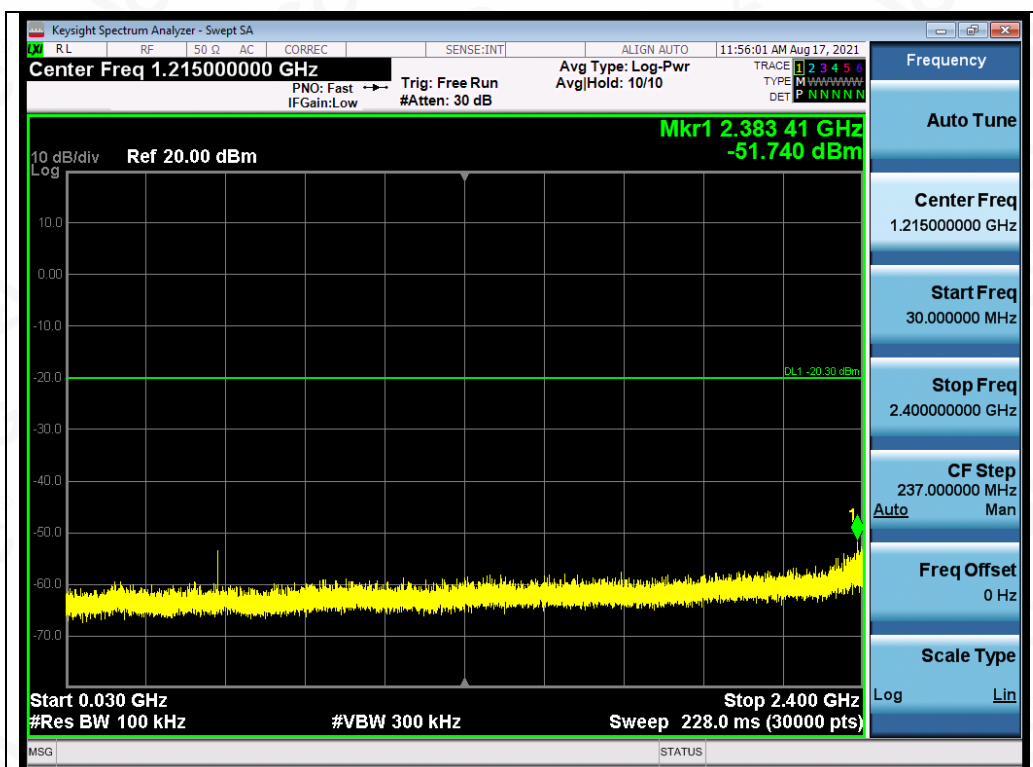


Test_Graph_802.11n40_ANT1_2437_MCS0_Higher Band Emissions

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Test_Graph_802.11n40_ANT1_2452_MCS0_Lower Band Emissions



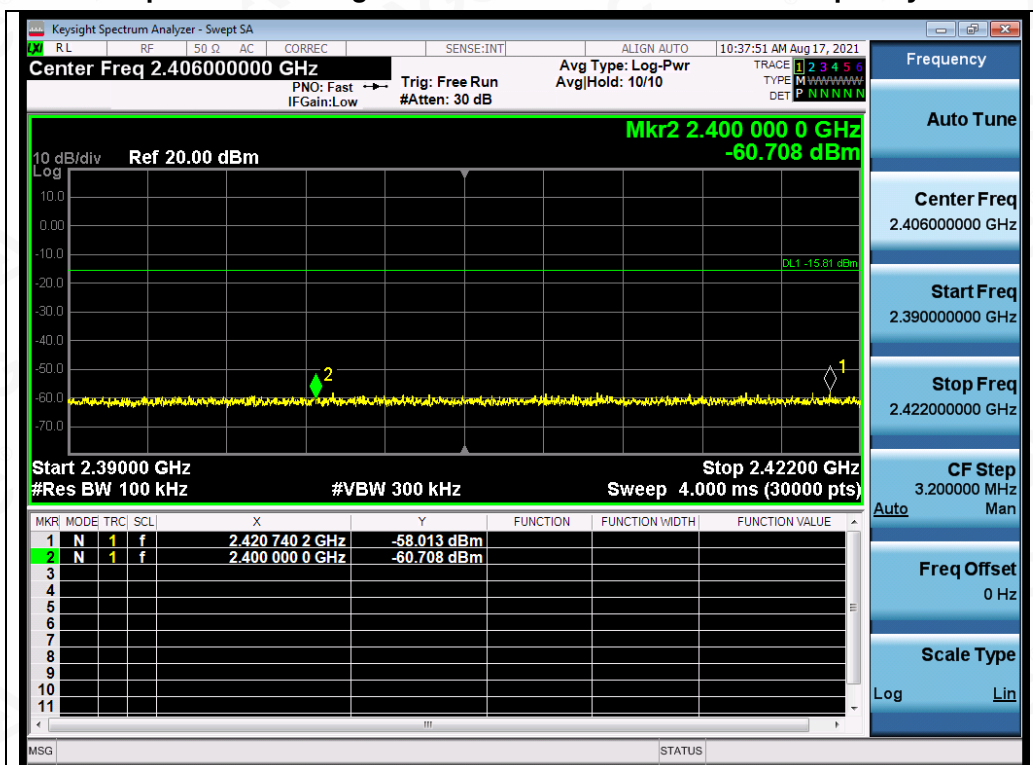
Test_Graph_802.11n40_ANT1_2452_MCS0_Higher Band Emissions

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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

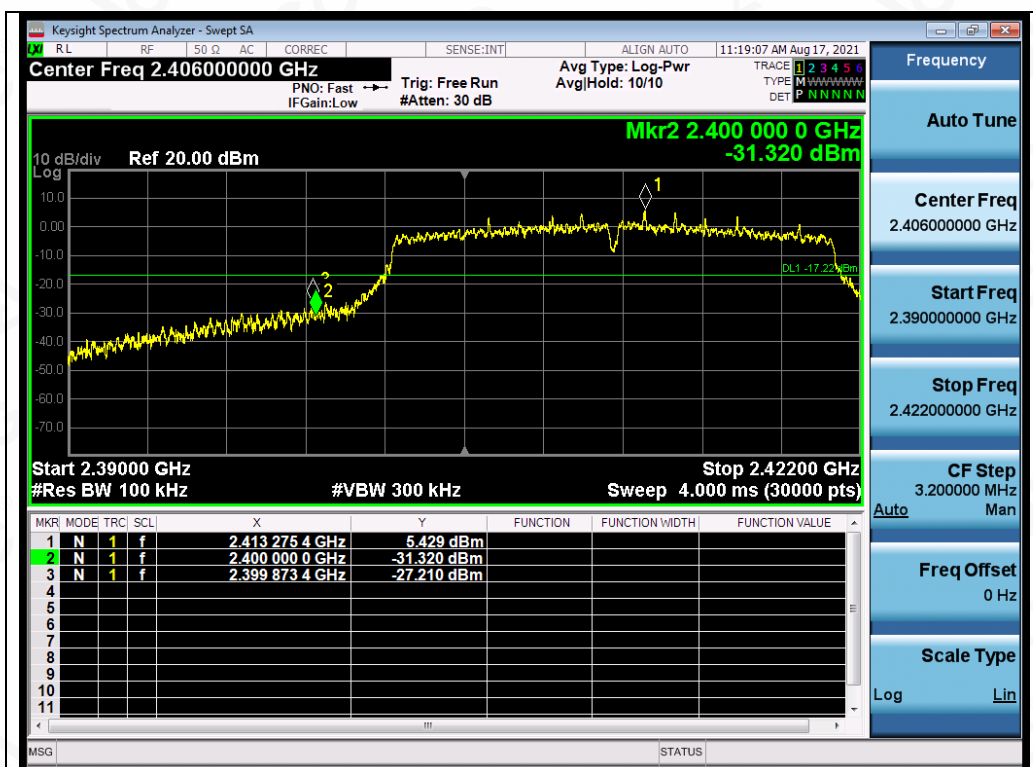


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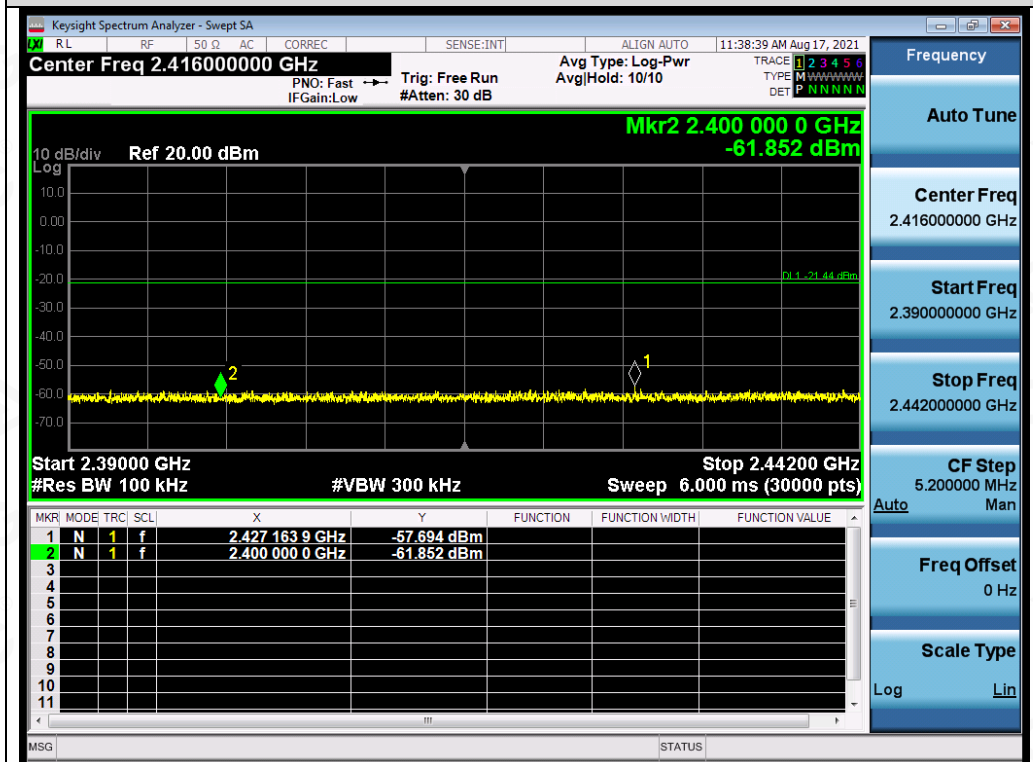
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Test_Graph_802.11n20_ANT1_2412_MCS0_Lower Band Edge Emissions



Test_Graph_802.11n40_ANT1_2422_MCS0_Lower Band Edge Emissions

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Note:

1. Emissions from 2483.5-2500MHz which fall in the restricted bands had been considered with the radiated emission limits specified.
2. All the antennas have been pre-tested, and all modes of each antenna are tested. The In 802.11b, 802.11g mode antenna 1 is the worst case and recorded in the report; For 802.11n mode, the worst case Antenna 1 has more than 3dB margins, so the MIMO mode also compliance the limit.

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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-antenna 1					
Test Mode	Test Channel (MHz)	Power density (dBm/20kHz)	Power density (dBm/3kHz)	Limit (dBm/3kHz)	Pass or Fail
802.11b	2412	4.209	-4.03	≤5.99	Pass
	2437	4.382	-3.857	≤5.99	Pass
	2462	3.720	-4.519	≤5.99	Pass
802.11g	2412	-2.948	-11.187	≤5.99	Pass
	2437	-3.487	-11.726	≤5.99	Pass
	2462	-2.181	-10.42	≤5.99	Pass
802.11n20	2412	-2.679	-10.918	≤5.99	Pass
	2437	-1.925	-10.164	≤5.99	Pass
	2462	-2.222	-10.461	≤5.99	Pass
802.11n40	2422	-7.234	-15.473	≤5.99	Pass
	2437	-5.792	-14.031	≤5.99	Pass
	2452	-5.419	-13.658	≤5.99	Pass

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Test Data of Conducted Output Power Spectral Density-antenna 2					
Test Mode	Test Channel (MHz)	Power density (dBm/20kHz)	Power density (dBm/3kHz)	Limit (dBm/3kHz)	Pass or Fail
802.11b	2412	4.178	-4.061	≤5.99	Pass
	2437	4.755	-3.484	≤5.99	Pass
	2462	5.376	-2.863	≤5.99	Pass
802.11g	2412	-1.426	-9.665	≤5.99	Pass
	2437	-2.402	-10.641	≤5.99	Pass
	2462	-0.784	-9.023	≤5.99	Pass
802.11n20	2412	-2.722	-10.961	≤5.99	Pass
	2437	-2.658	-10.897	≤5.99	Pass
	2462	-1.525	-9.764	≤5.99	Pass
802.11n40	2422	-6.711	-14.95	≤5.99	Pass
	2437	-7.046	-15.285	≤5.99	Pass
	2452	-6.603	-14.842	≤5.99	Pass

Test Data of Conducted Output Power Spectral Density-antenna 1+2					
Test Mode	Test Channel (MHz)	Power density (dBm/20kHz)	Power density (dBm/3kHz)	Limit (dBm/3kHz)	Pass or Fail
802.11n20	2412	0.31	-7.93	≤5.99	Pass
	2437	0.73	-7.50	≤5.99	Pass
	2462	1.15	-7.09	≤5.99	Pass
802.11n40	2422	-3.95	-12.19	≤5.99	Pass
	2437	-3.36	-11.60	≤5.99	Pass
	2452	-2.96	-11.20	≤5.99	Pass

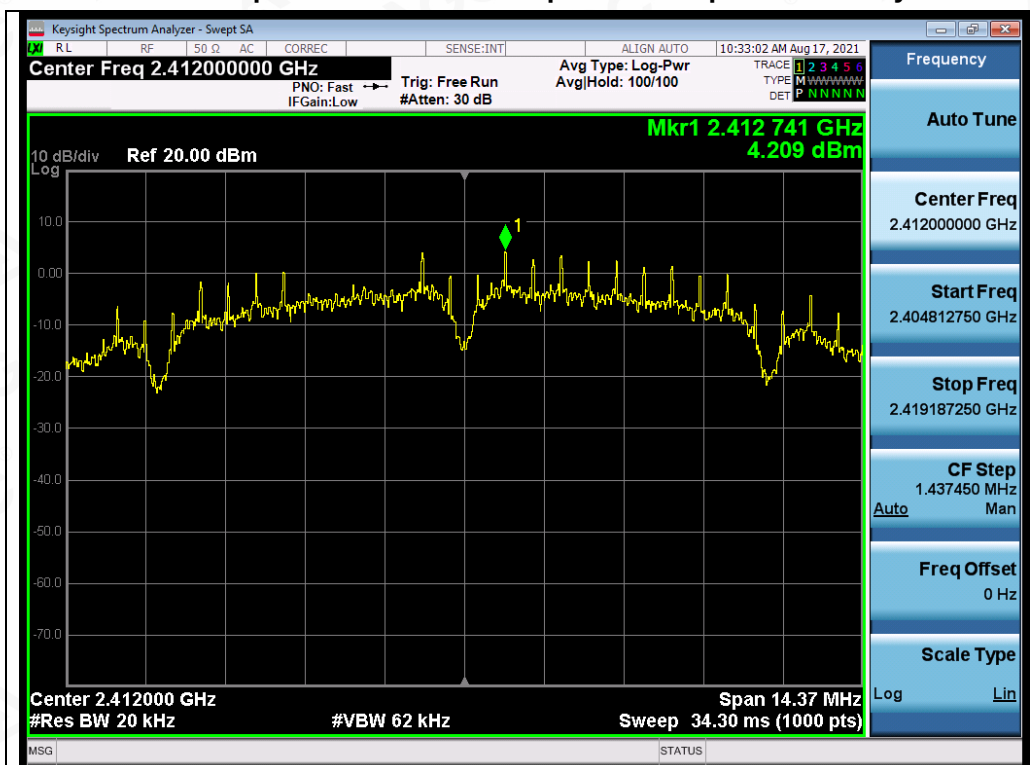
Note: Power density(dBm/3kHz) = Power density(dBm/20kHz) – 10*log(20/3).

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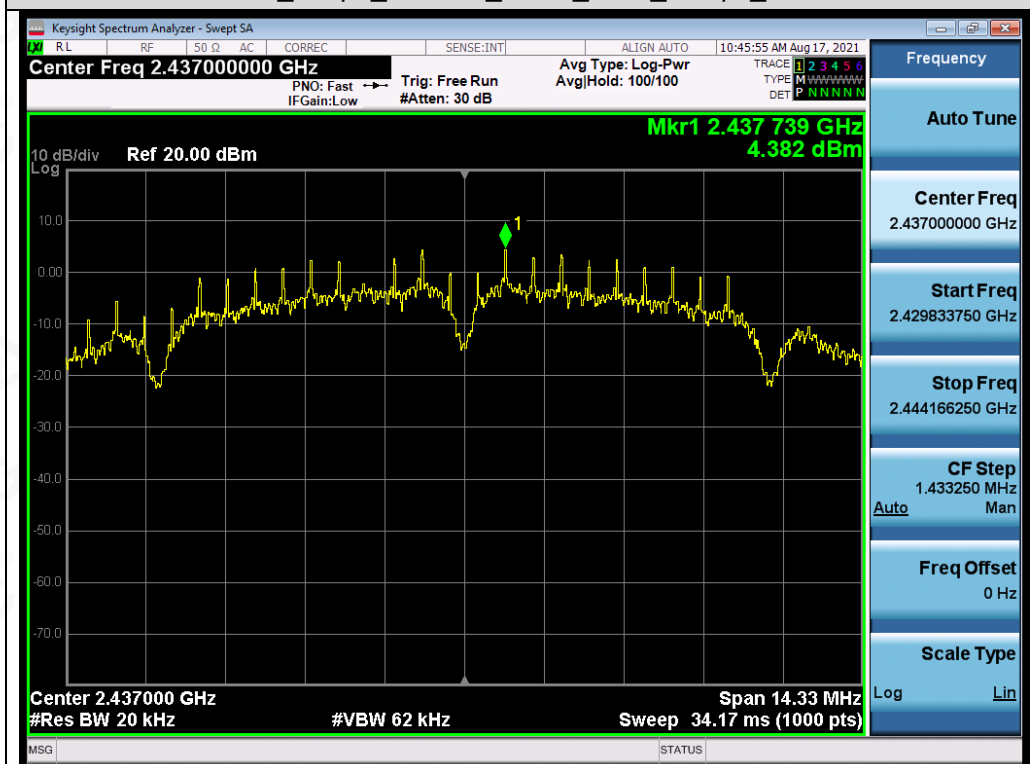
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Test Graphs of Conducted Output Power Spectral Density



Test_Graph_802.11b_ANT1_2412_1Mbps_PSD



Test_Graph_802.11b_ANT1_2437_1Mbps_PSD

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Test_Graph_802.11b_ANT1_2462_1Mbps_PSD

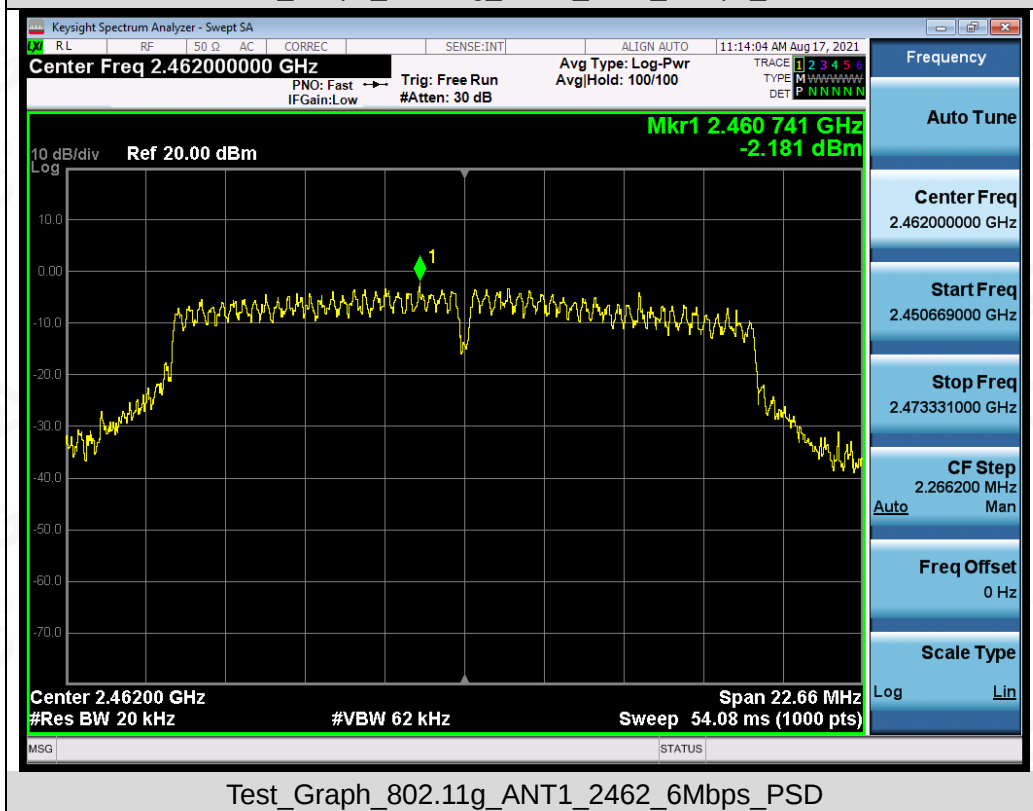
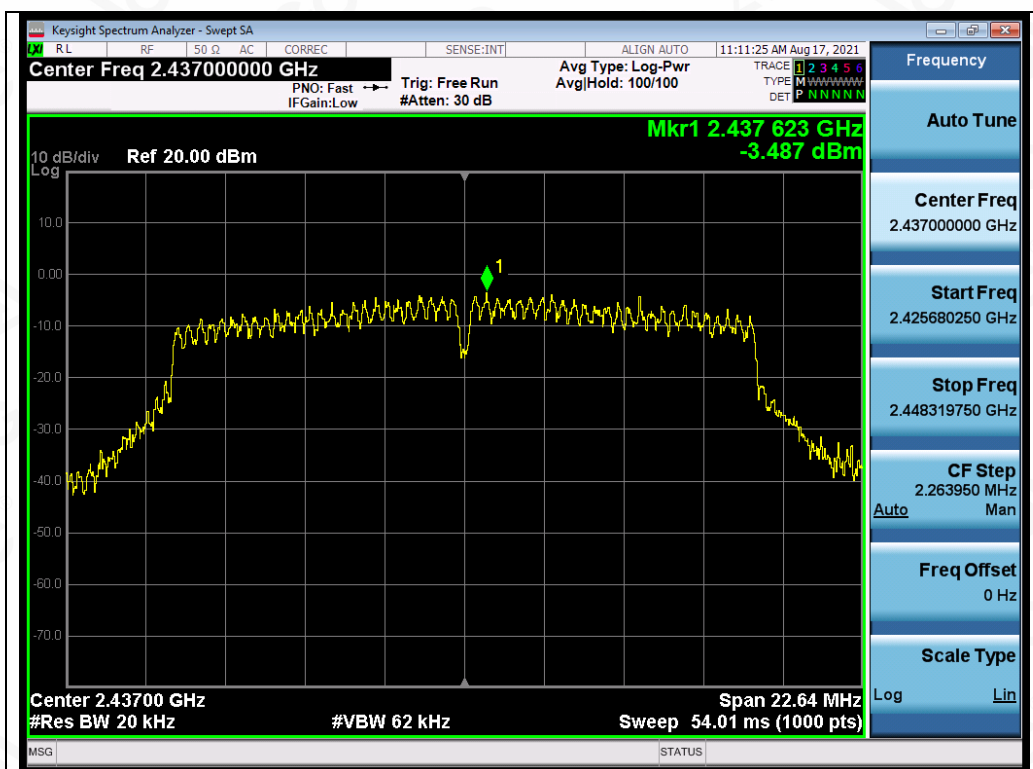


Test_Graph_802.11g_ANT1_2412_6Mbps_PSD

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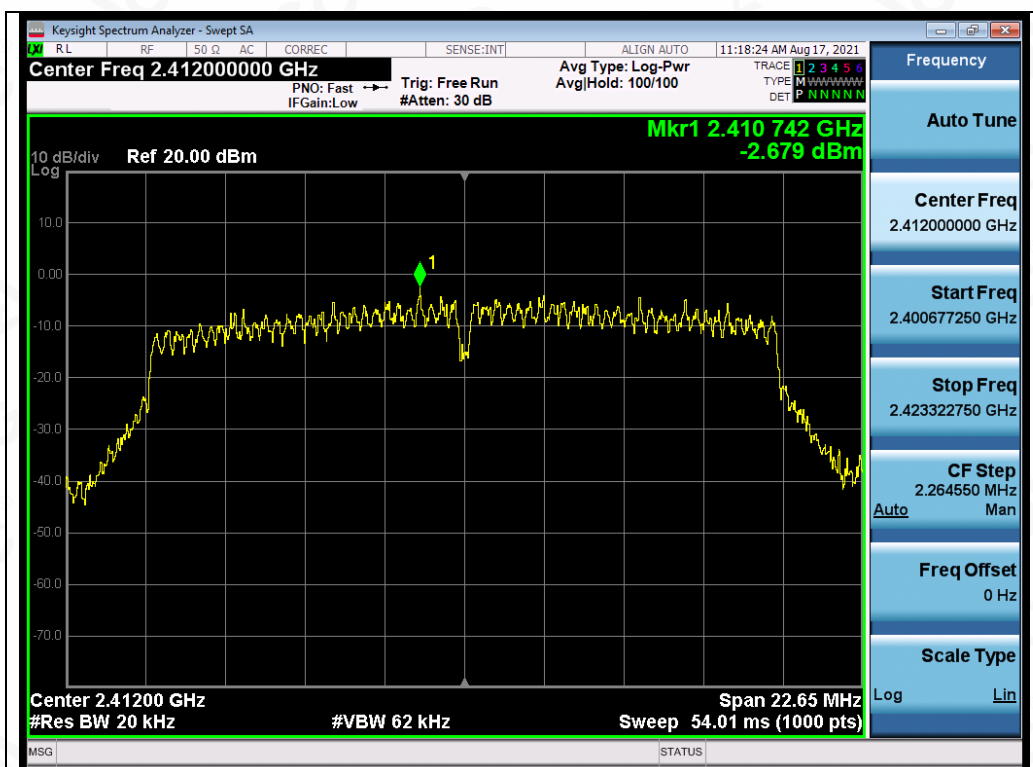




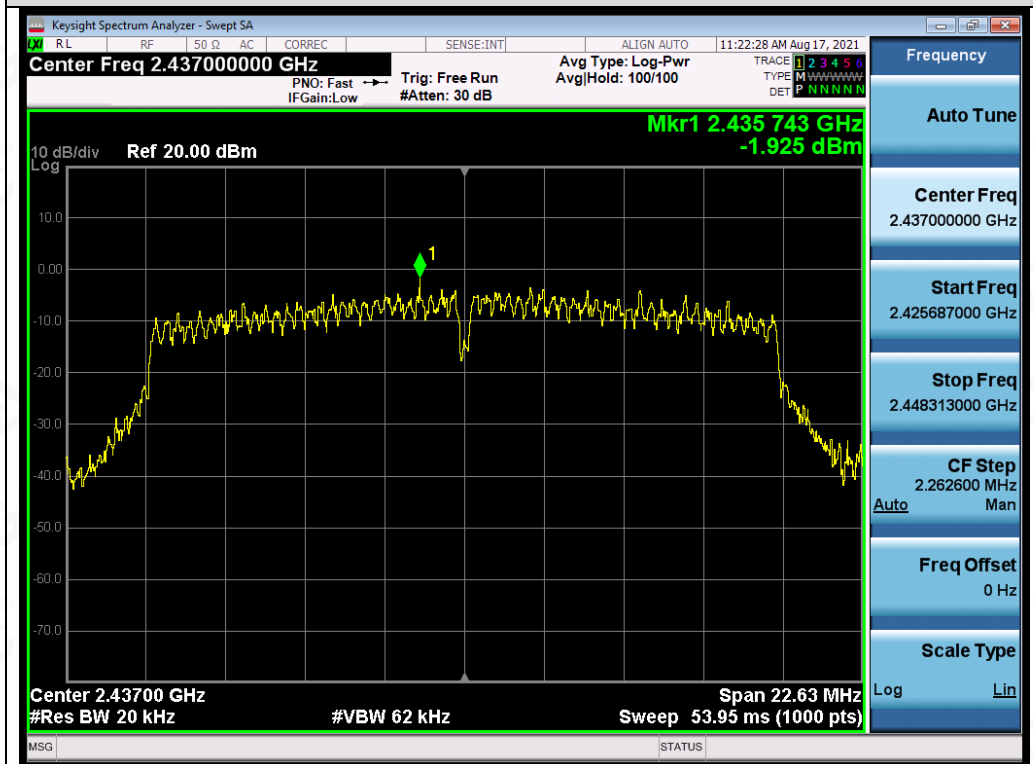
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Test_Graph_802.11n20_ANT1_2412_MCS0_PSD

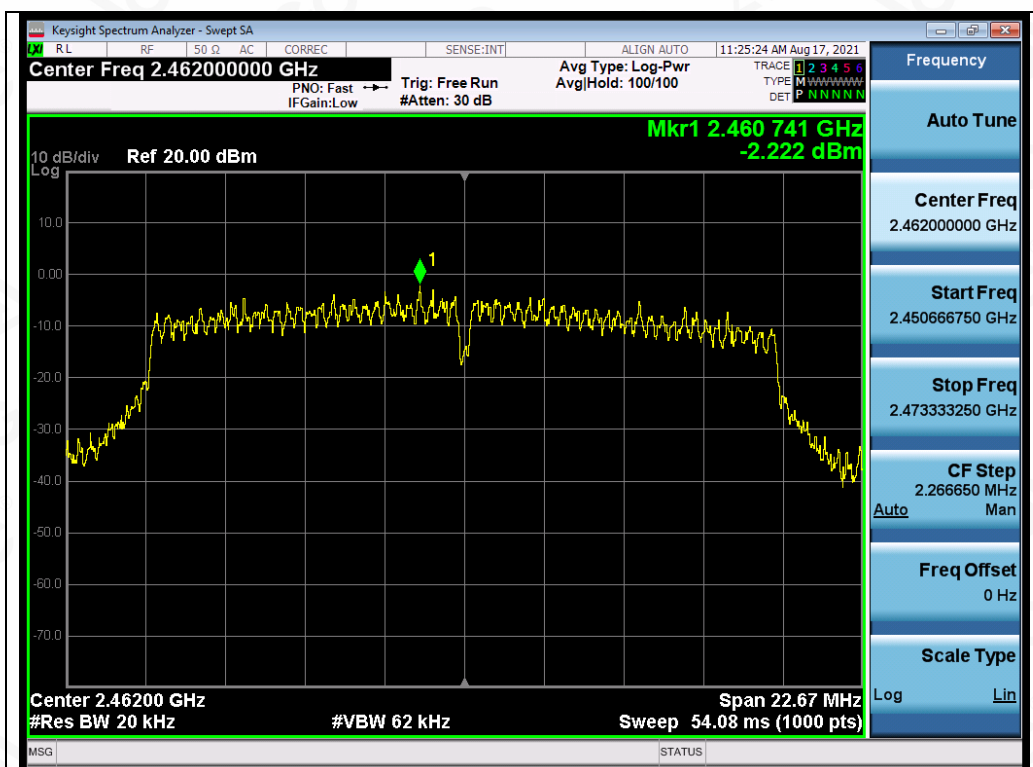


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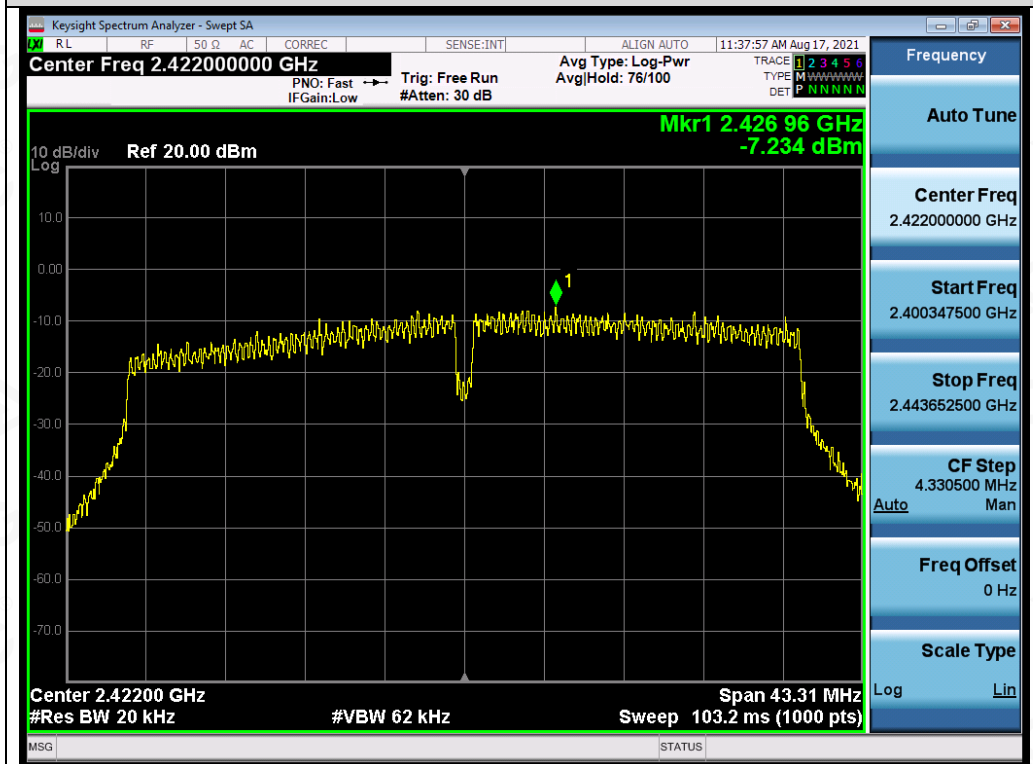
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Test_Graph_802.11n20_ANT1_2462_MCS0_PSD

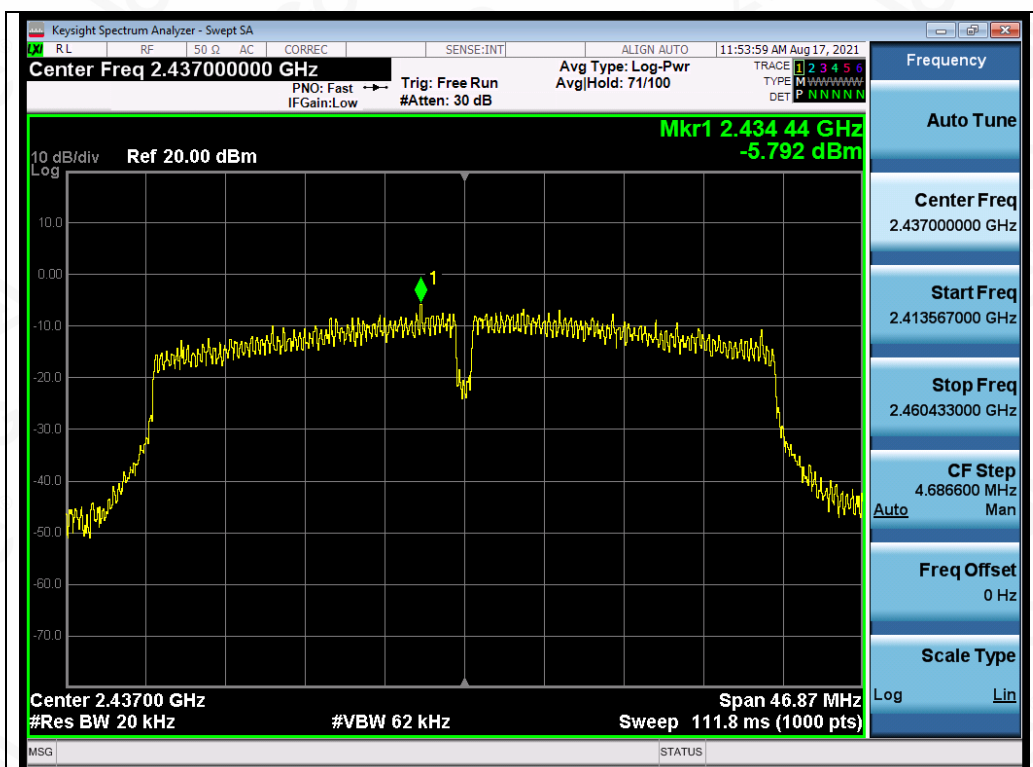


Test_Graph_802.11n40_ANT1_2422_MCS0_PSD

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Test_Graph_802.11n40_ANT1_2437_MCS0_PSD

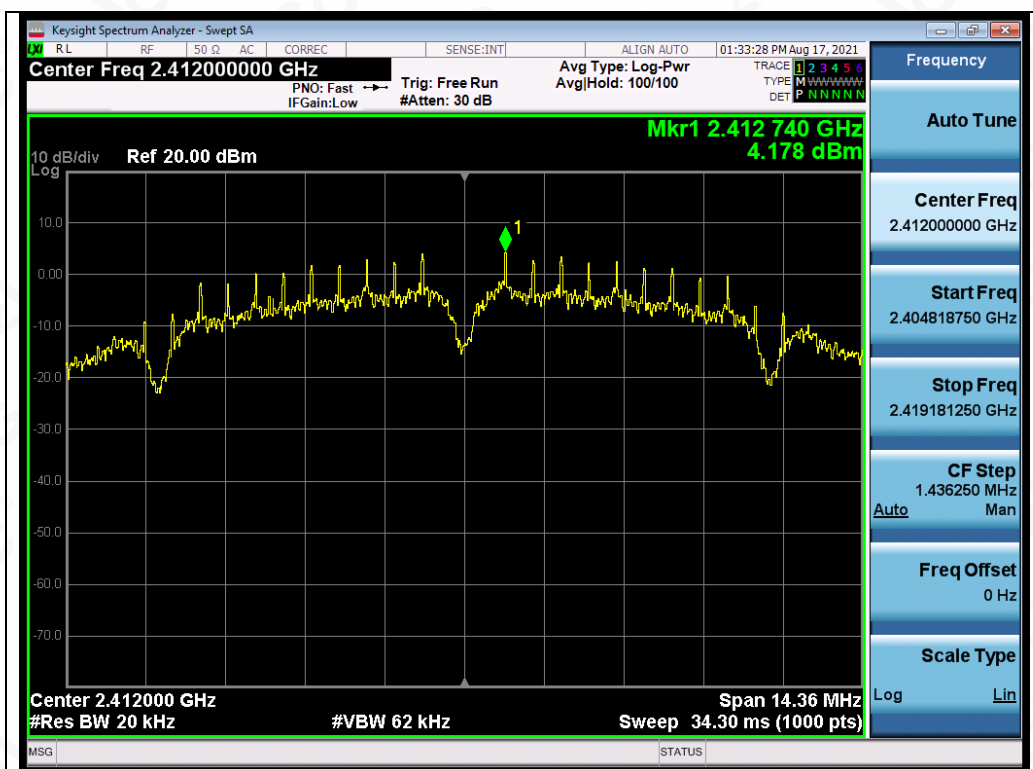


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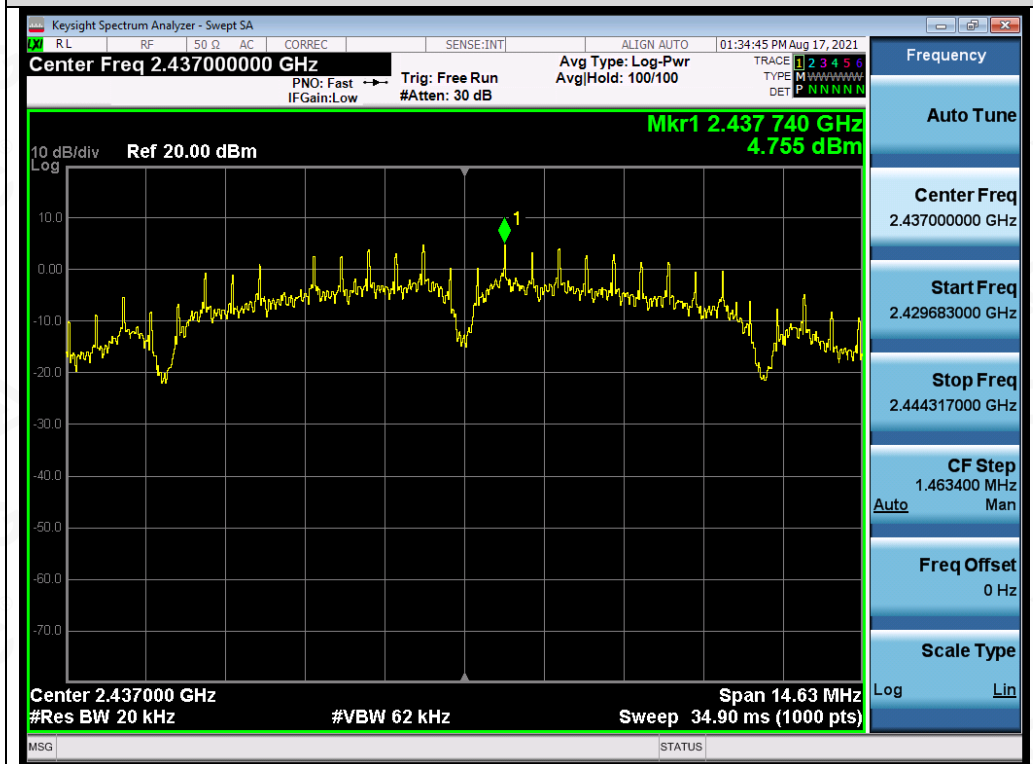
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Test_Graph_802.11b_ANT2_2412_1Mbps_PSD

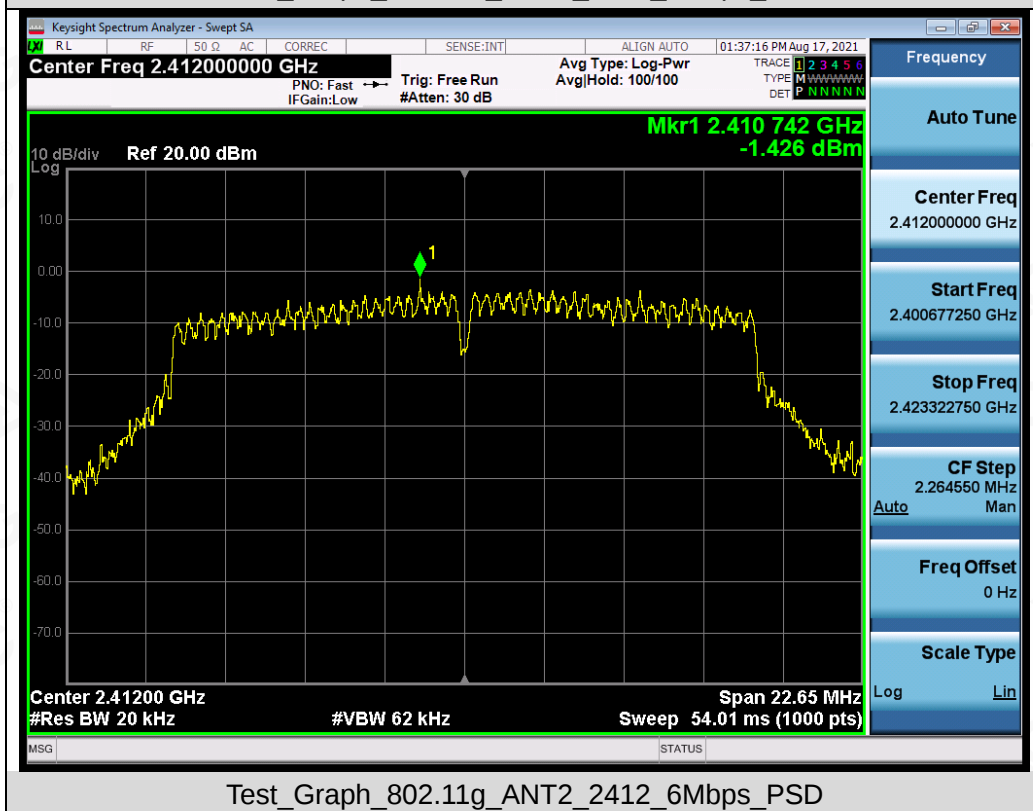
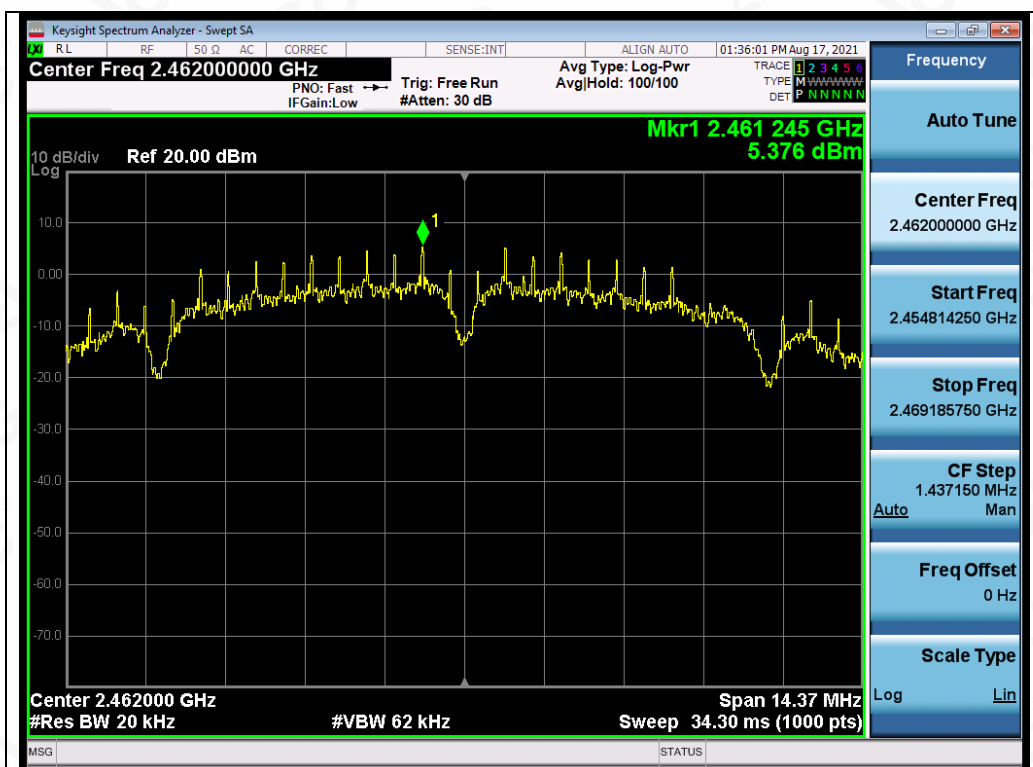


Test_Graph_802.11b_ANT2_2437_1Mbps_PSD

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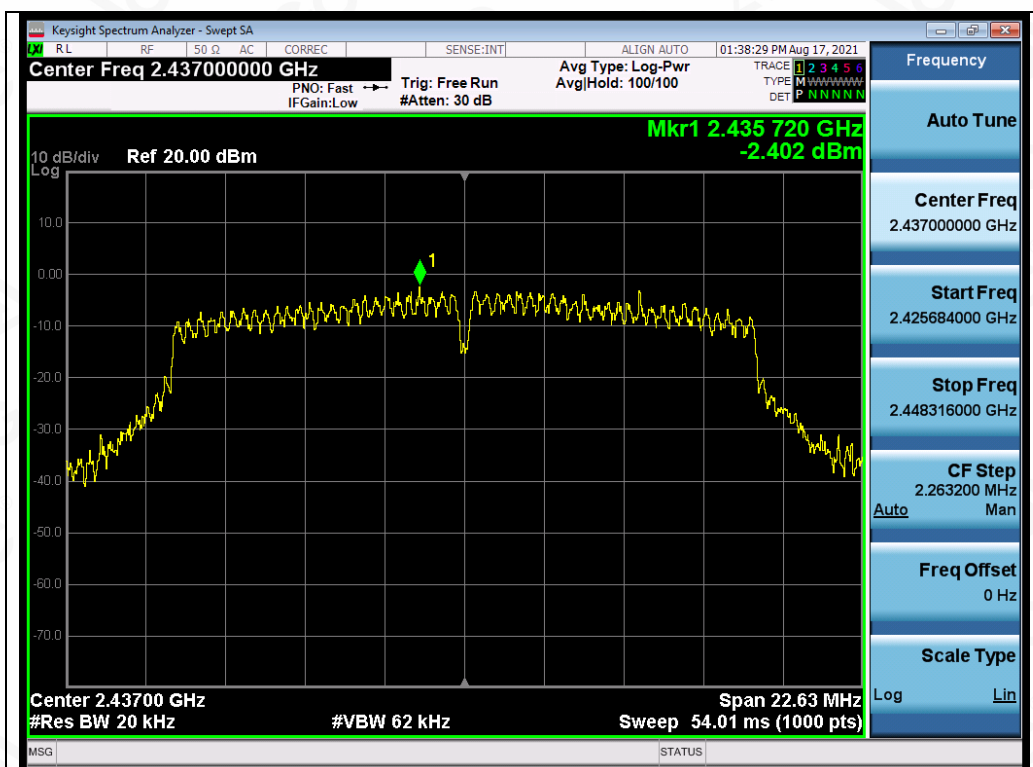




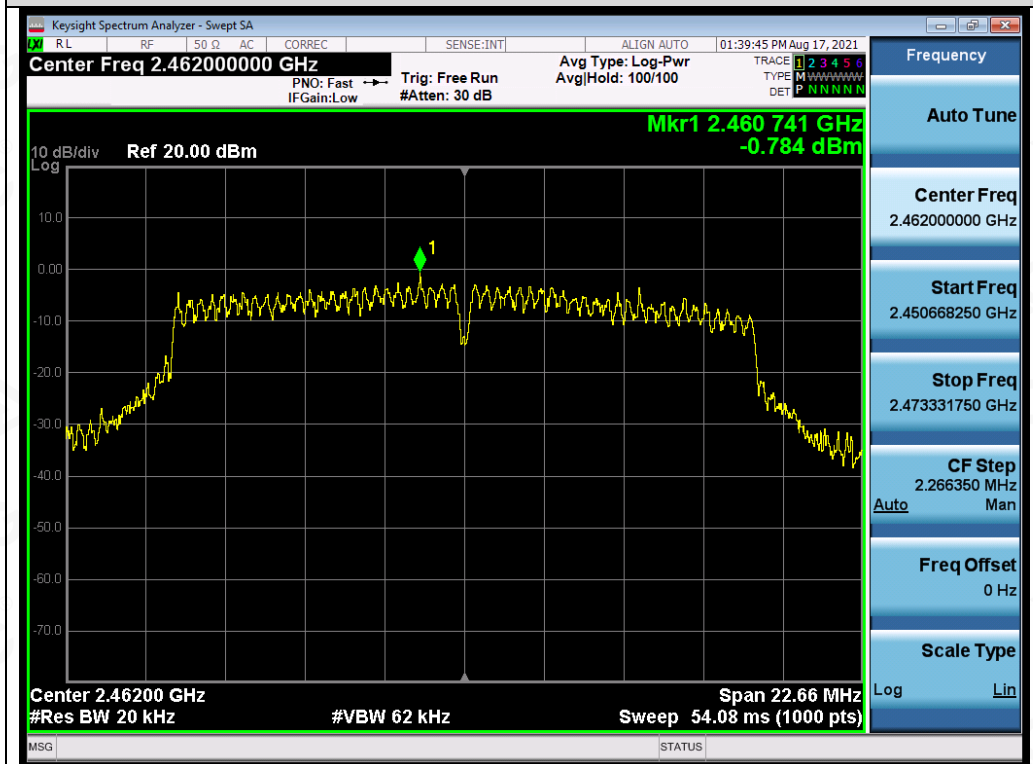
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Test_Graph_802.11g_ANT2_2437_6Mbps_PSD

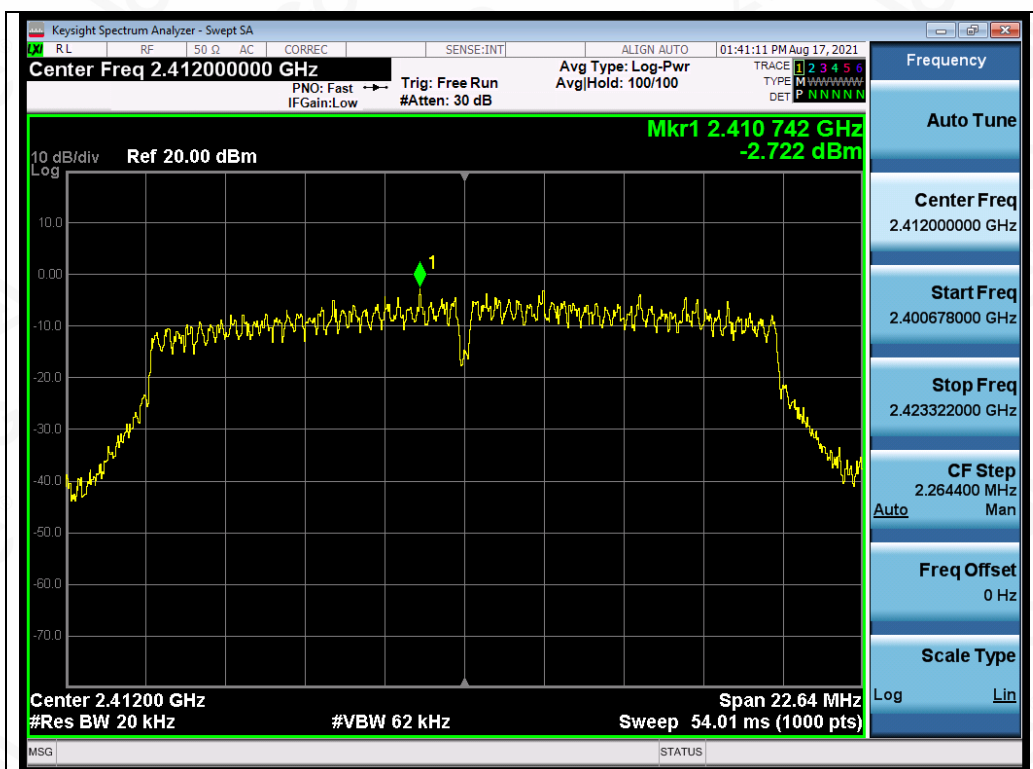


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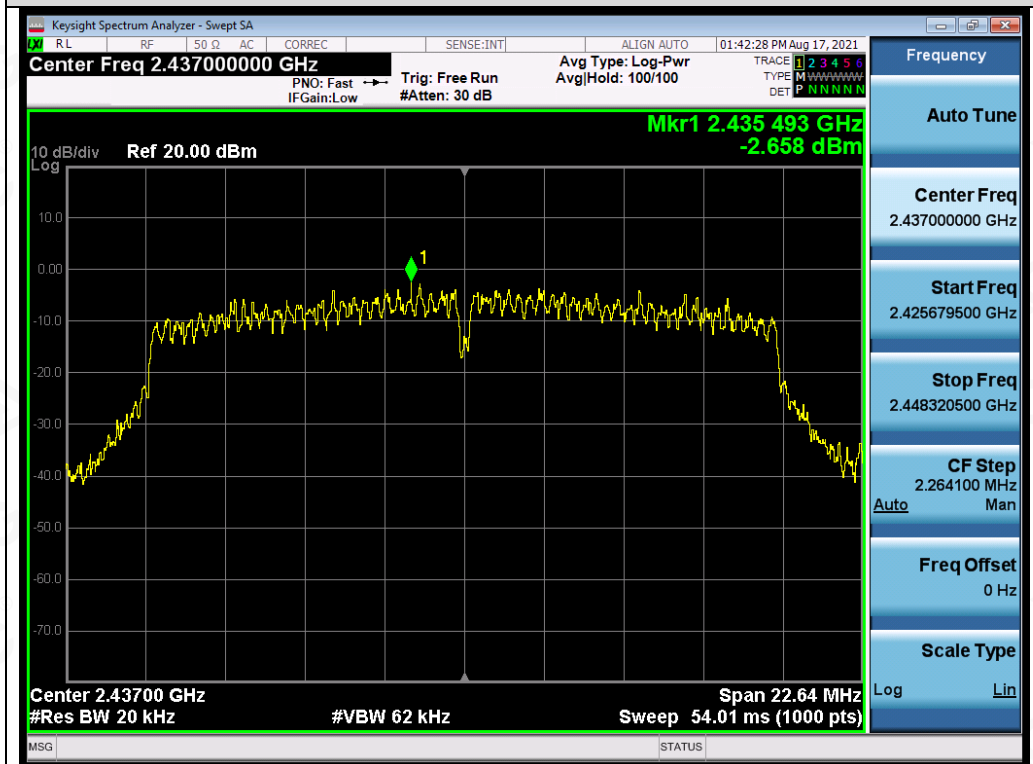
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Test_Graph_802.11n20_ANT2_2412_MCS0_PSD

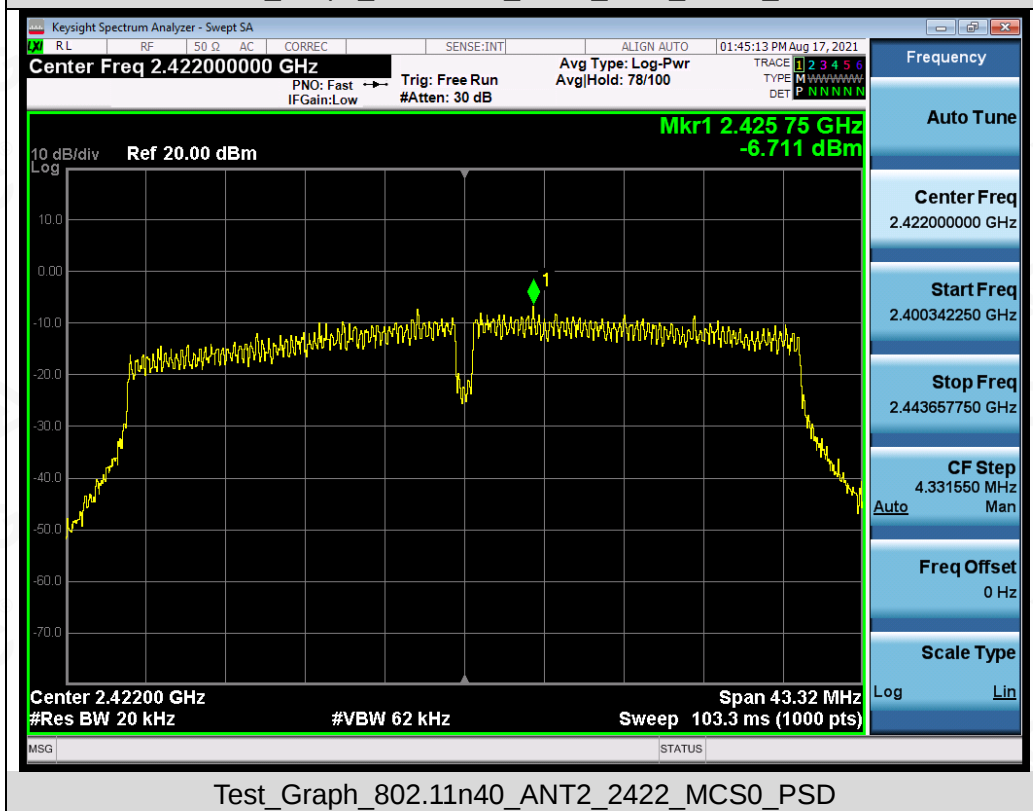
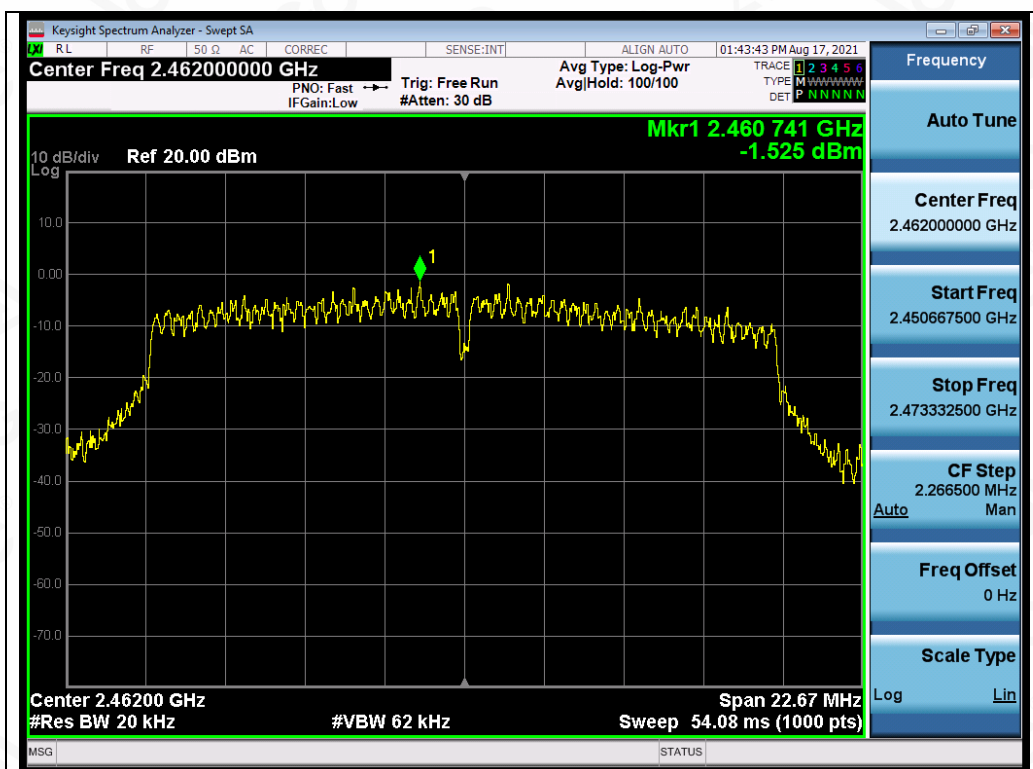


Test_Graph_802.11n20_ANT2_2437_MCS0_PSD

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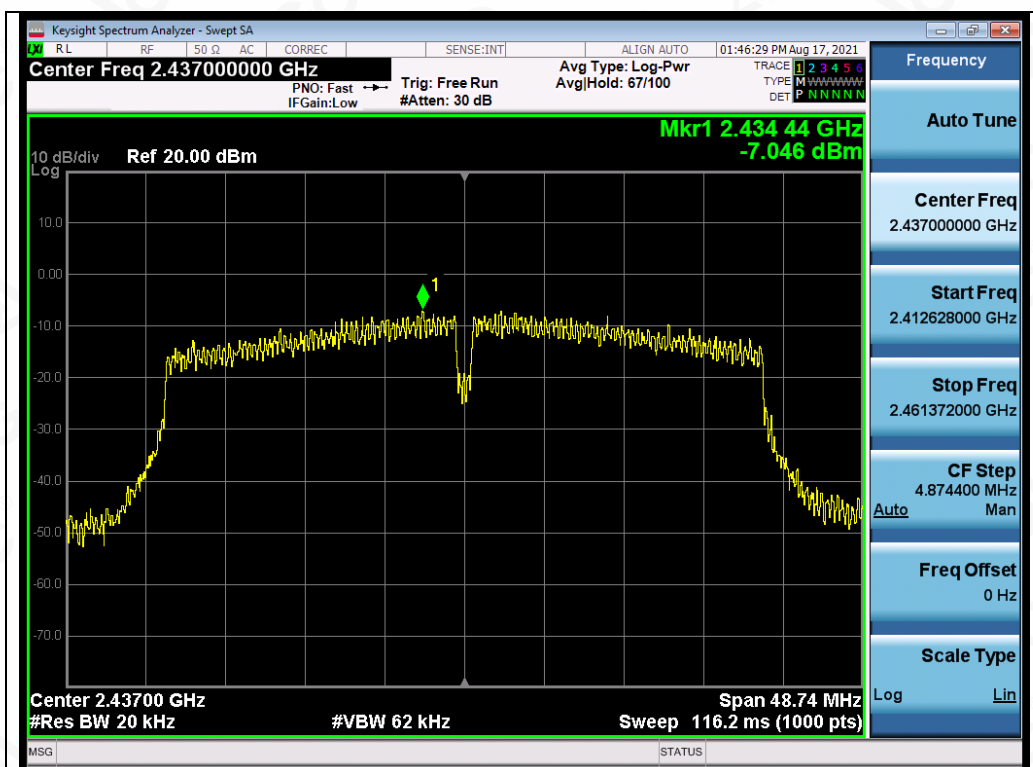




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Test_Graph_802.11n40_ANT2_2437_MCS0_PSD



Test_Graph_802.11n40_ANT2_2452_MCS0_PSD

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11. RADIATED EMISSION

11.1. MEASUREMENT PROCEDURE

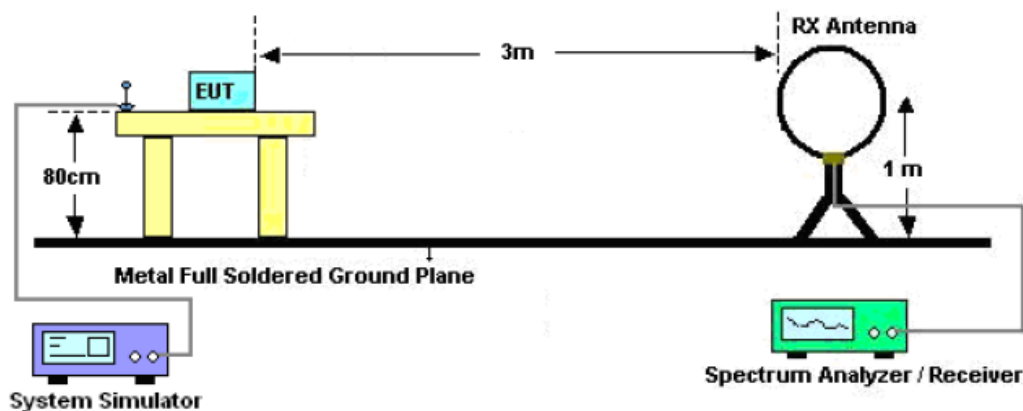
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

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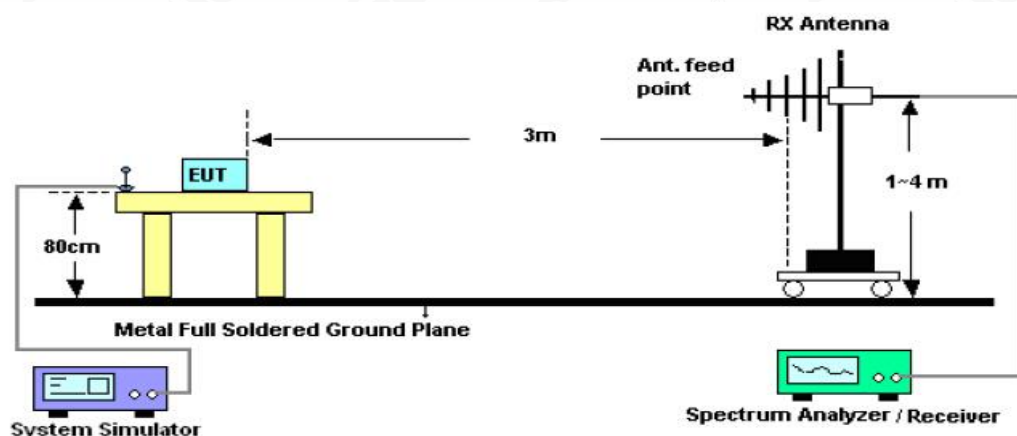


11.2. TEST SETUP

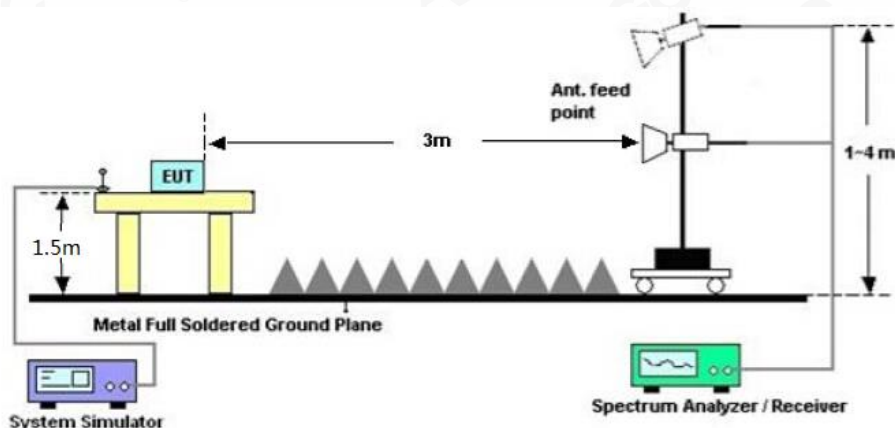
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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11.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested for restricted band radiated emission, the test records reported below are the worst result compared to other modes.

11.4. TEST RESULT

Radiated emission below 30MHz

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

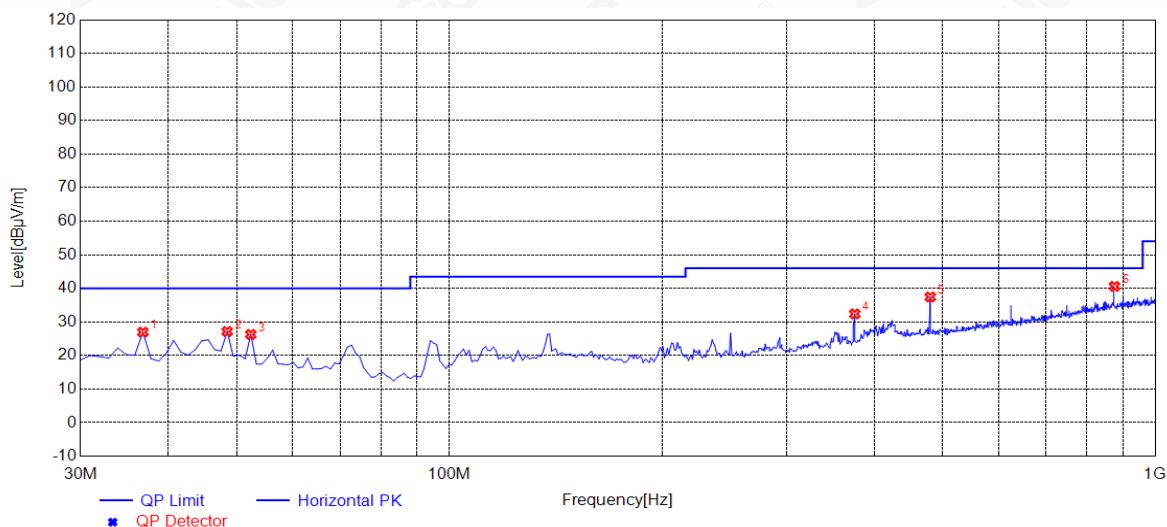
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Radiated emission from 30MHz to 1000MHz

EUT	AC2100 Dual Band Wi-Fi Repeater	Model Name	RSD0623
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHz	Antenna	Horizontal



NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	36.7900	26.96	11.16	40.00	13.04	100	24	Horizontal
2	48.4300	27.15	11.71	40.00	12.85	100	275	Horizontal
3	52.3100	26.29	11.49	40.00	13.71	100	351	Horizontal
4	375.3200	32.39	18.82	46.00	13.61	100	182	Horizontal
5	480.0800	37.43	21.72	46.00	8.57	100	98	Horizontal
6	875.8400	40.58	29.68	46.00	5.42	100	32	Horizontal

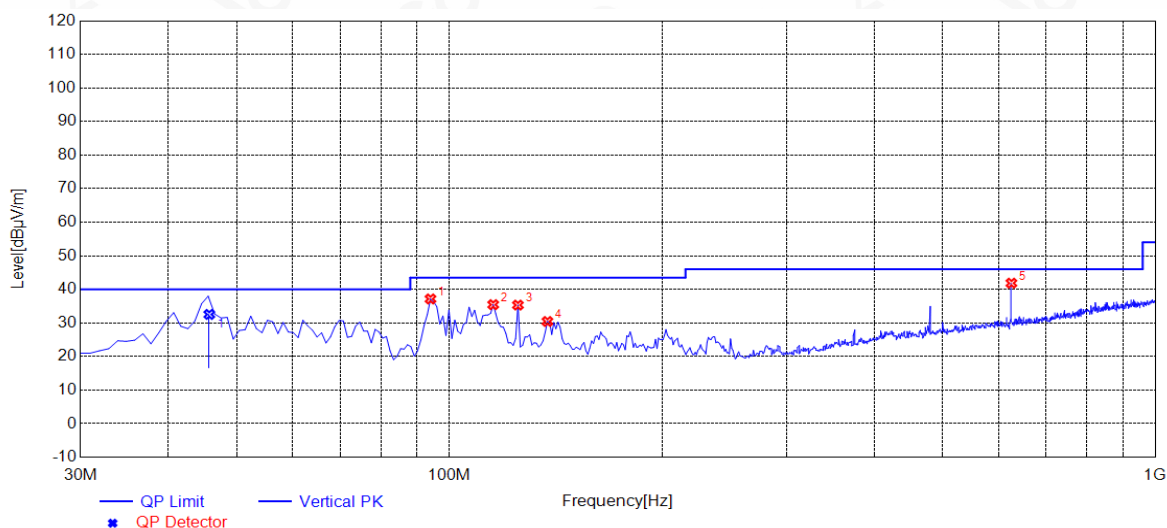
RESULT: PASS

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EUT	AC2100 Dual Band Wi-Fi Repeater	Model Name	RSD0623
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHz	Antenna	Vertical



Peak data list

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	94.0200	37.14	8.92	43.50	6.36	100	59	Vertical
2	115.3600	35.44	12.99	43.50	8.06	100	153	Vertical
3	125.0600	35.31	13.81	43.50	8.19	100	357	Vertical
4	137.6700	30.43	14.71	43.50	13.07	100	51	Vertical
5	625.5800	41.85	24.78	46.00	4.15	100	2	Vertical

QP data list

NO.	Freq. [MHz]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	45.6857	11.79	32.53	40.00	7.47	120	80	Vertical

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

3. All test modes had been pre-tested. The 802.11b of antenna 2 at low channel is the worst case and recorded in the report.

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Radiated emission above 1GHz

EUT	AC2100 Dual Band Wi-Fi Repeater	Model Name	RSD0623
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHz	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4824.000	56.28	0.08	56.36	74	-17.64	peak
4824.000	46.23	0.08	46.31	54	-7.69	AVG
7236.000	51.07	2.21	53.28	74	-20.72	peak
7236.000	42.39	2.21	44.6	54	-9.4	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	AC2100 Dual Band Wi-Fi Repeater	Model Name	RSD0623
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHz	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4824.000	56.29	0.08	56.37	74	-17.63	peak
4824.000	45.37	0.08	45.45	54	-8.55	AVG
7236.000	51.27	2.21	53.48	74	-20.52	peak
7236.000	40.96	2.21	43.17	54	-10.83	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT	AC2100 Dual Band Wi-Fi Repeater	Model Name	RSD0623
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHz	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4874.000	57.24	0.14	57.38	74	-16.62	peak
4874.000	46.99	0.14	47.13	54	-6.87	AVG
7311.000	52.67	2.36	55.03	74	-18.97	peak
7311.000	43.25	2.36	45.61	54	-8.39	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	AC2100 Dual Band Wi-Fi Repeater	Model Name	RSD0623
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHz	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4874.000	56.37	0.14	56.51	74	-17.49	peak
4874.000	46.18	0.14	46.32	54	-7.68	AVG
7311.000	50.27	2.36	52.63	74	-21.37	peak
7311.000	40.58	2.36	42.94	54	-11.06	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT	AC2100 Dual Band Wi-Fi Repeater	Model Name	RSD0623
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2462MHz	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4924.000	54.28	0.22	54.5	74	-19.5	peak
4924.000	43.16	0.22	43.38	54	-10.62	AVG
7386.000	49.57	2.64	52.21	74	-21.79	peak
7386.000	40.02	2.64	42.66	54	-11.34	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	AC2100 Dual Band Wi-Fi Repeater	Model Name	RSD0623
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2462MHz	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4924.000	57.16	0.22	57.38	74	-16.62	peak
4924.000	48.34	0.22	48.56	54	-5.44	AVG
7386.000	52.49	2.64	55.13	74	-18.87	peak
7386.000	42.37	2.64	45.01	54	-8.99	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

All test modes had been pre-tested. The 802.11b mode of antenna 2 is the worst case and recorded in the report.

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