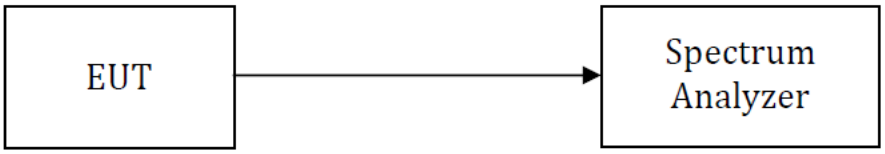
8. Occupied Bandwidth

8.1 Standard and Limit

According to 15.247(a)(2), Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.2 Test Procedure

According to the ANSI 63.10-2013, section 6.9, the emission bandwidth test method as follows.
1) Remove the antenna from the EUT and connect to the spectrum analyzer via a low loss RF cable.
2) Set the spectrum analyzer to any one measured frequency within its operating range.
3) Set RBW = 100kHz, VBW = 300kHz, Sweep = Auto.
4) Set a reference level on the measuring instrument equal to the highest peak value.
5) Measure the frequency difference of two frequencies that were attenuated 6dB from the reference level. Record the frequency difference as the emission bandwidth.
6) Repeat the above procedures until all frequencies measured were complete.



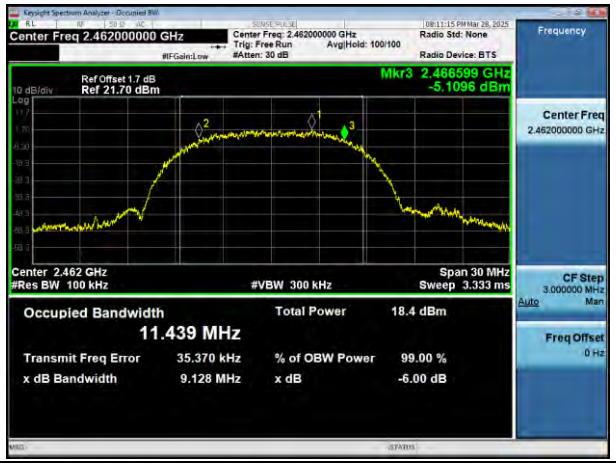
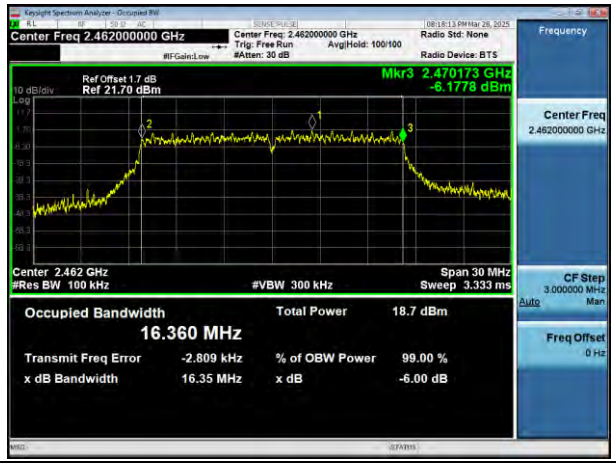
Test Setup Block Diagram

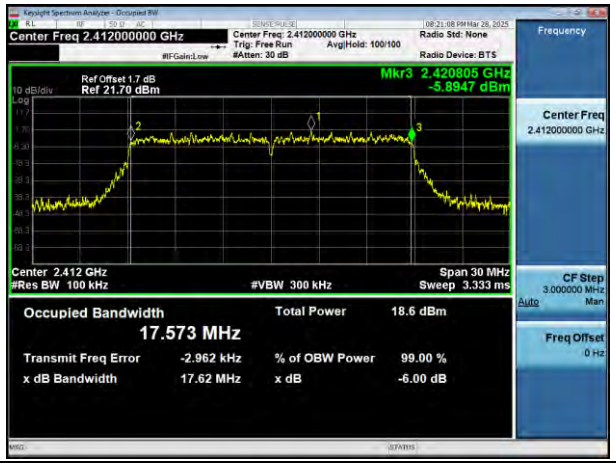
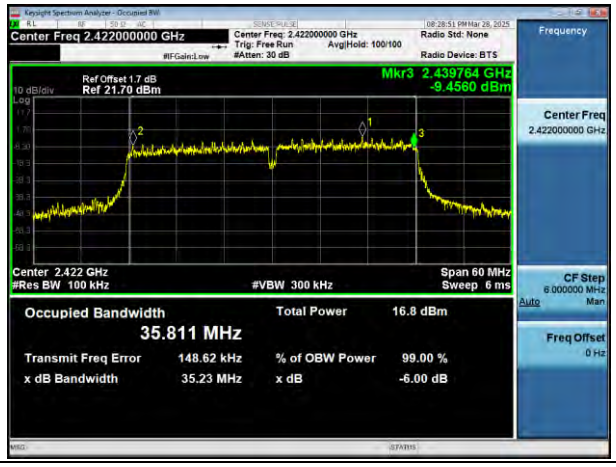
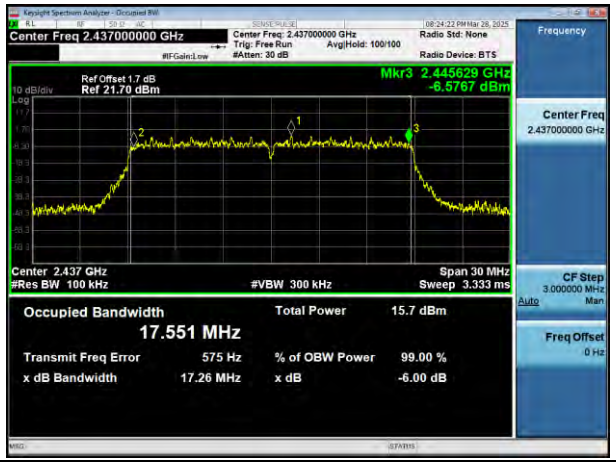
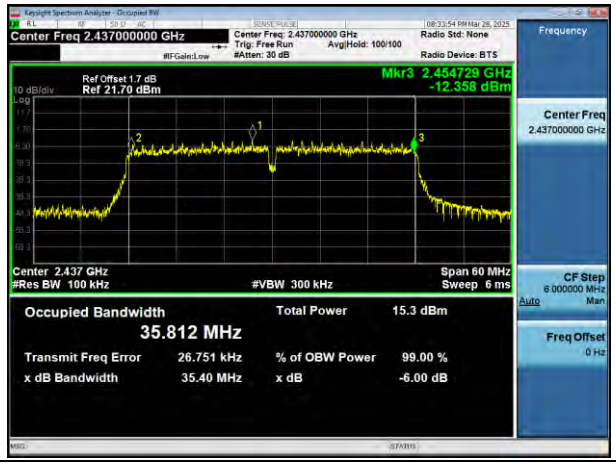
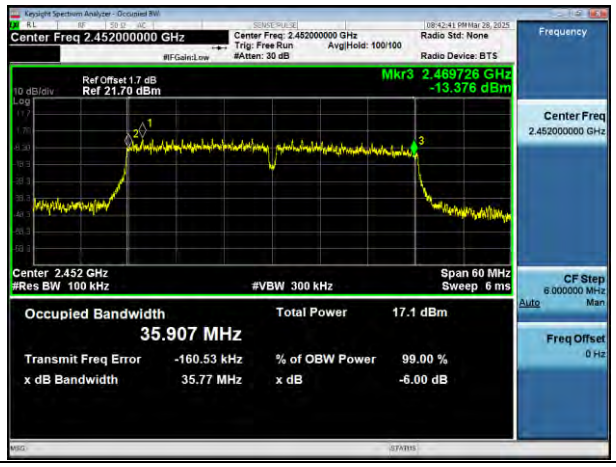
8.3 Test Data and Results

ANT1:

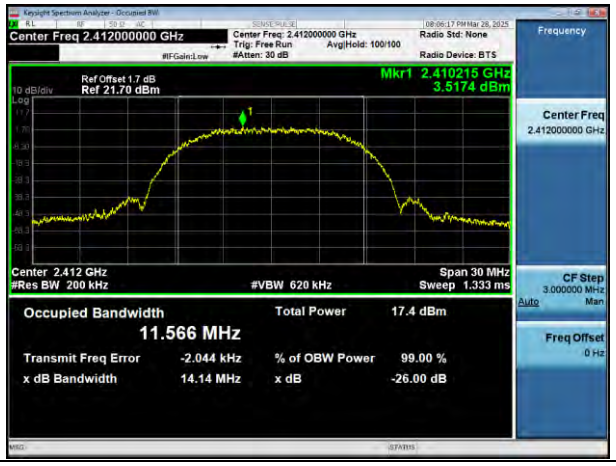
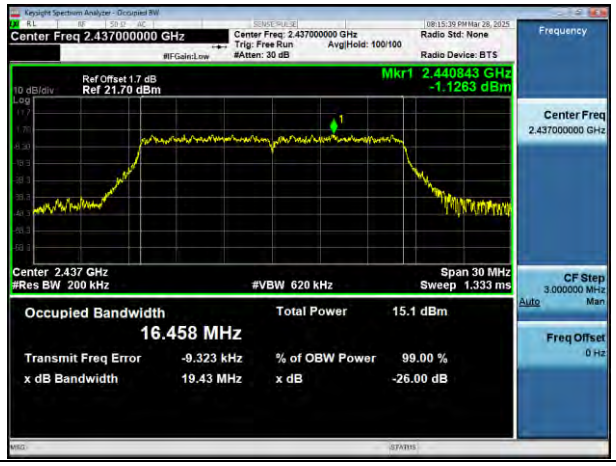
Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	6dB BW Limit (MHz)	Test Result
802.11b	2412	9.446	11.566	0.5	Pass
	2437	9.175	11.482	0.5	Pass
	2462	9.128	11.428	0.5	Pass
802.11g	2412	16.433	16.482	0.5	Pass
	2437	16.373	16.458	0.5	Pass
	2462	16.352	16.416	0.5	Pass
802.11n(HT20)	2412	17.615	17.599	0.5	Pass
	2437	17.257	17.529	0.5	Pass
	2462	17.461	17.591	0.5	Pass
802.11n(HT40)	2422	35.231	35.944	0.5	Pass
	2437	35.404	36.043	0.5	Pass
	2452	35.772	35.957	0.5	Pass

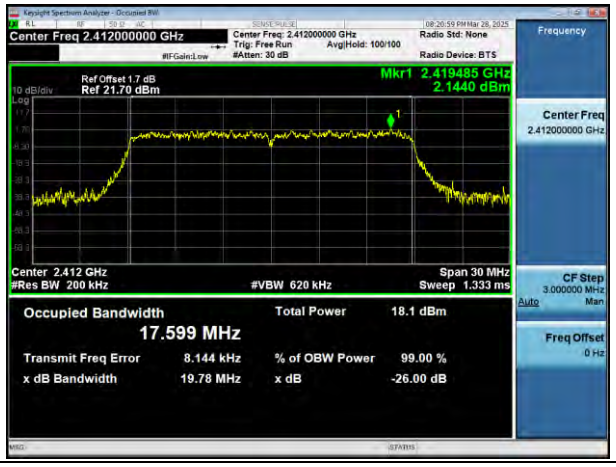
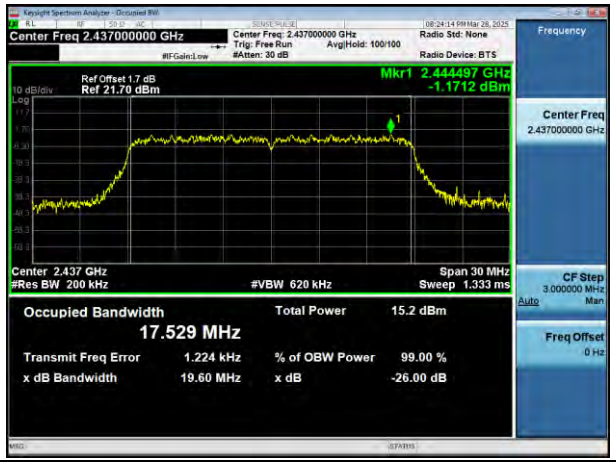
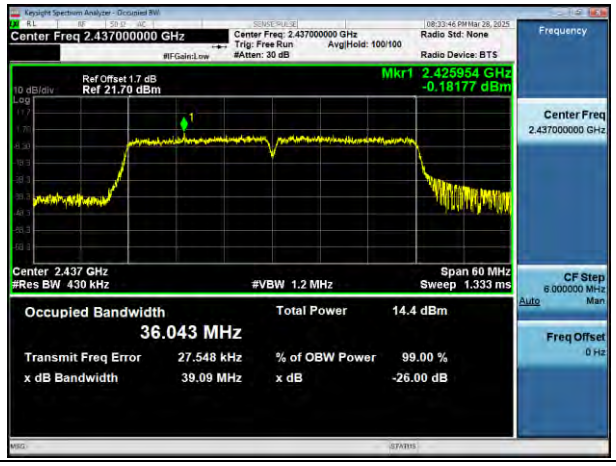
6dB Bandwidth:

802.11b	802.11g
2412MHz	2412MHz
	
2437MHz	2437MHz
	
2462MHz	2462MHz
	

802.11n(HT20)	802.11n(HT40)
2412MHz	2422MHz
	
2437MHz	2437MHz
	
2462MHz	2452MHz
	

99% Bandwidth:

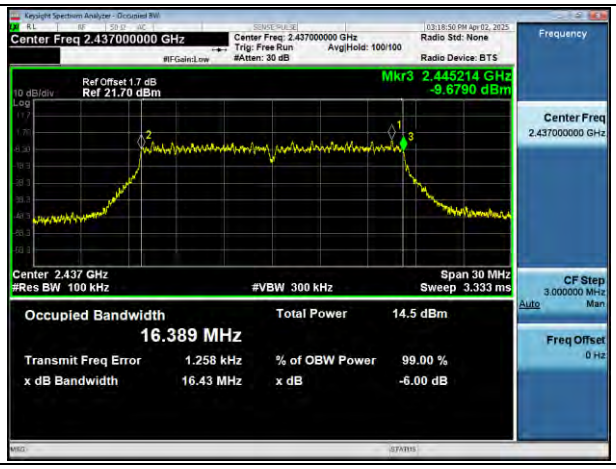
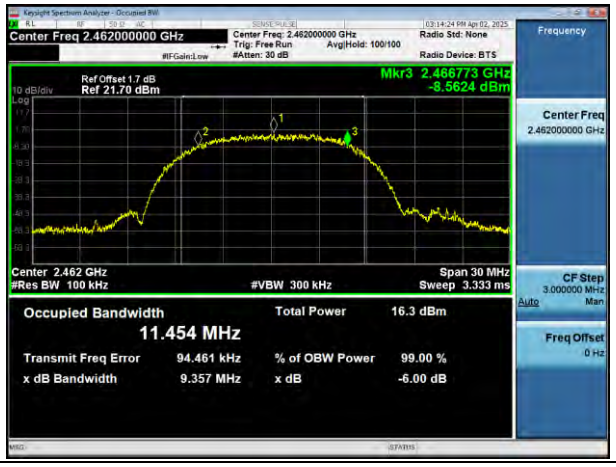
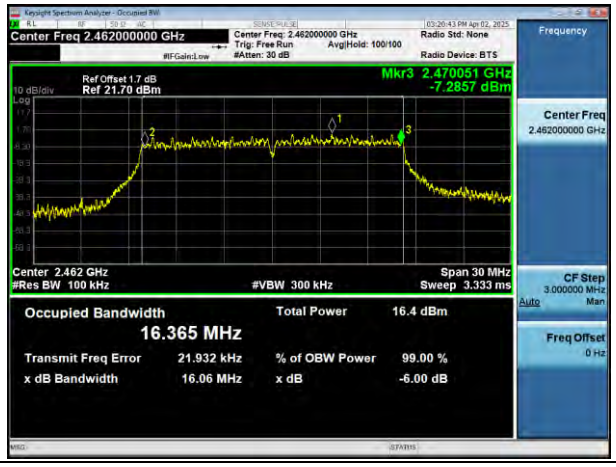
802.11b	802.11g
2412MHz	2412MHz
	
2437MHz	2437MHz
	
2462MHz	2462MHz
	

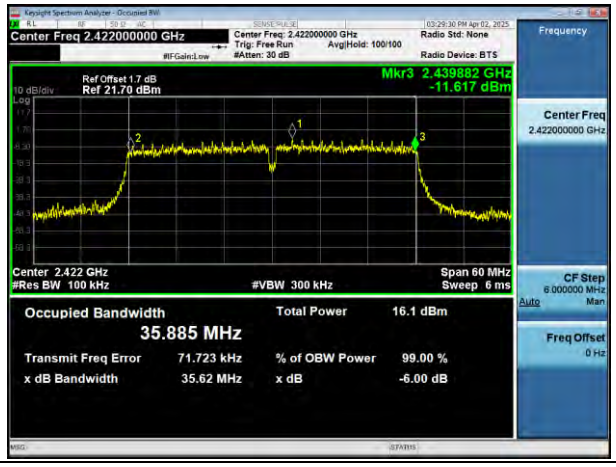
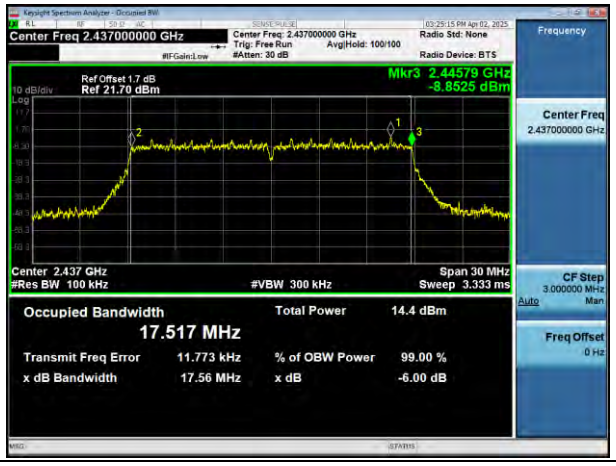
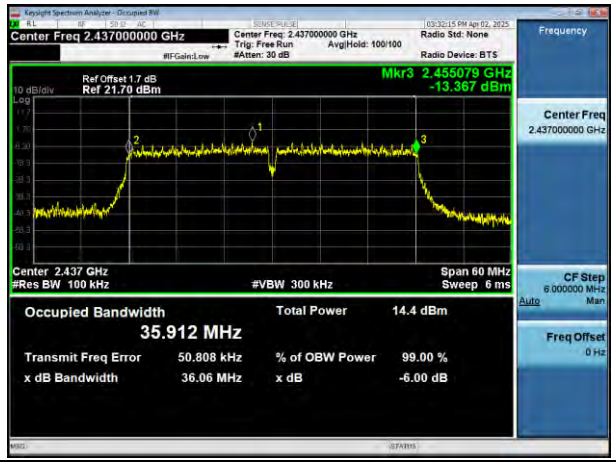
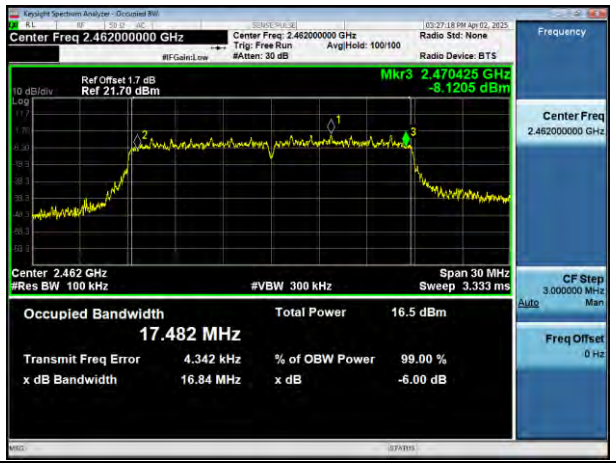
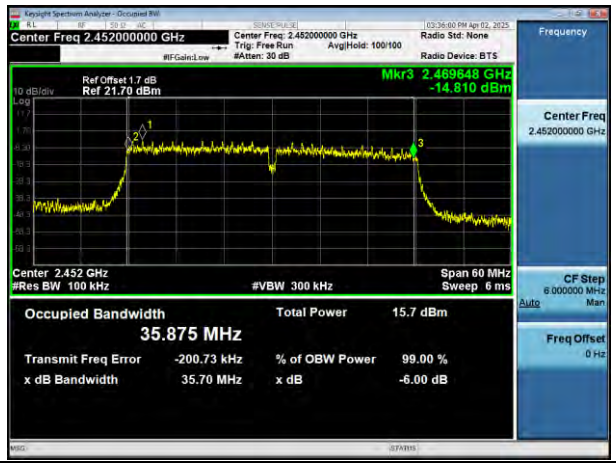
802.11n(HT20)	802.11n(HT40)
2412MHz	2422MHz
	
2437MHz	2437MHz
	
2462MHz	2452MHz
	

ANT2:

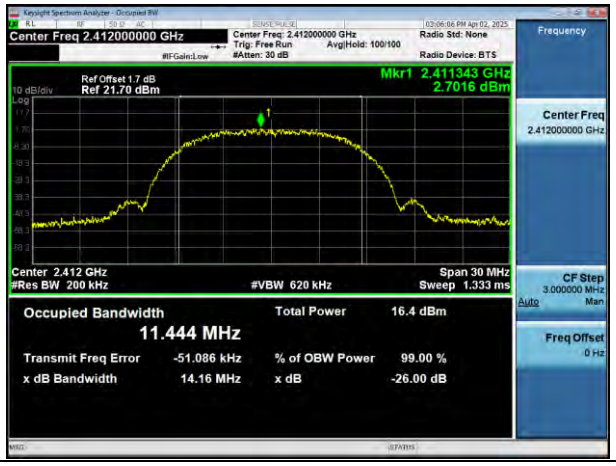
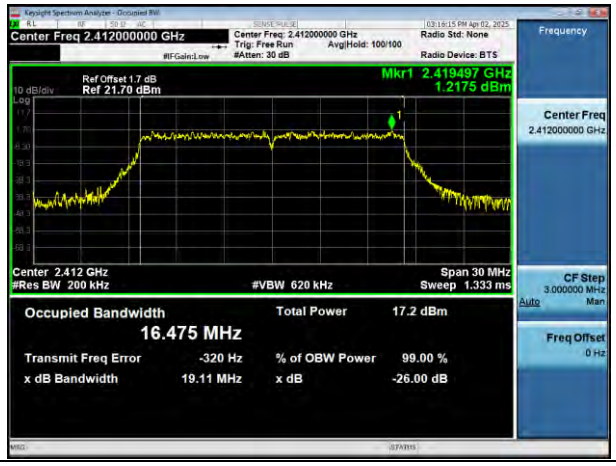
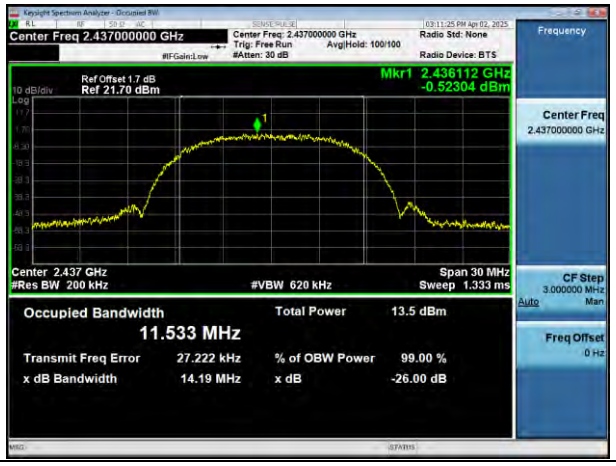
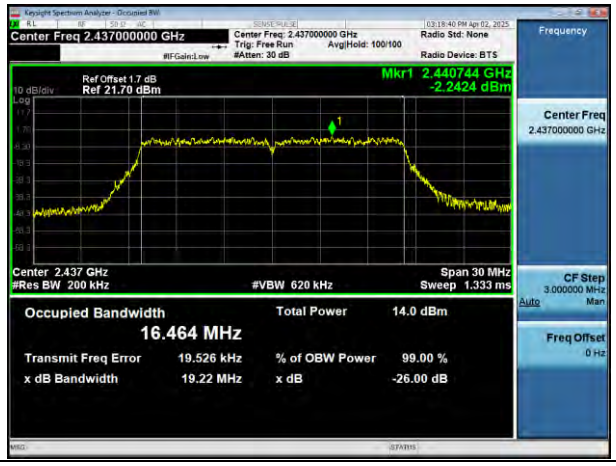
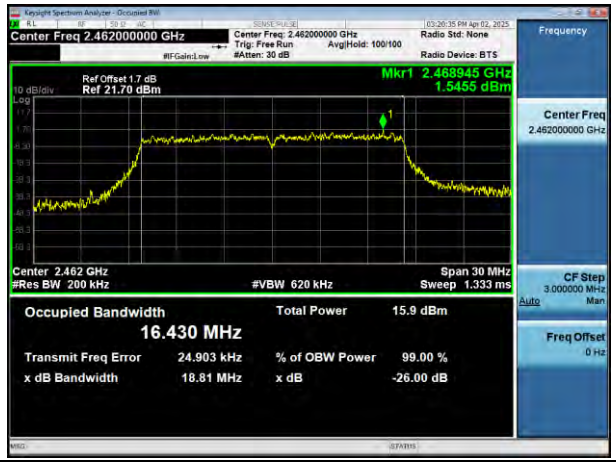
Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	6dB BW Limit (MHz)	Test Result
802.11b	2412	9.052	11.444	0.5	Pass
	2437	9.352	11.533	0.5	Pass
	2462	9.357	11.464	0.5	Pass
802.11g	2412	16.454	16.475	0.5	Pass
	2437	16.425	16.464	0.5	Pass
	2462	16.057	16.43	0.5	Pass
802.11n(HT20)	2412	17.493	17.579	0.5	Pass
	2437	17.557	17.549	0.5	Pass
	2462	16.841	17.519	0.5	Pass
802.11n(HT40)	2422	35.62	36.001	0.5	Pass
	2437	36.056	36.083	0.5	Pass
	2452	35.698	35.94	0.5	Pass

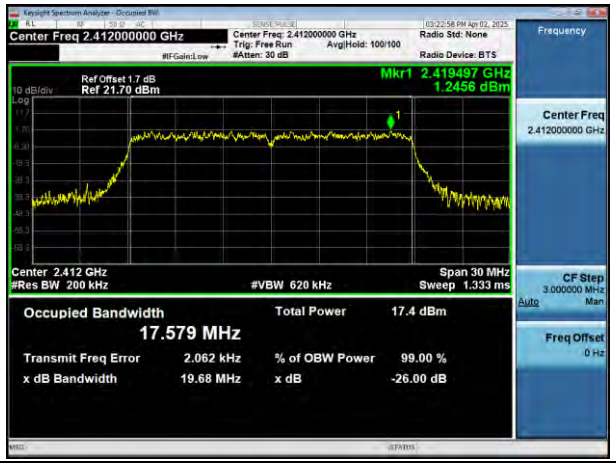
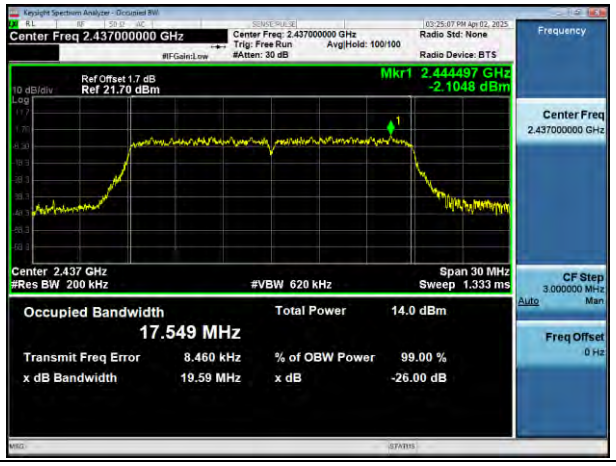
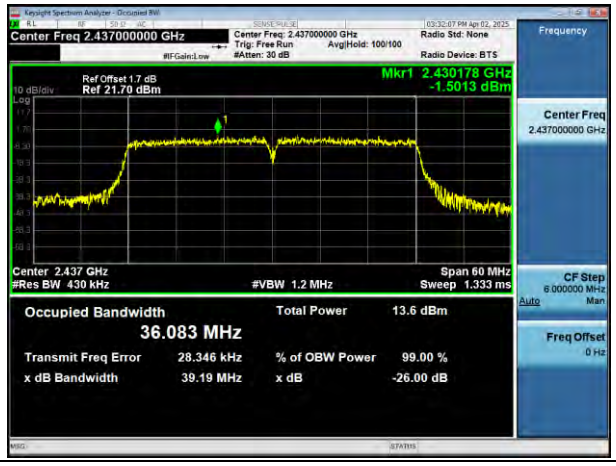
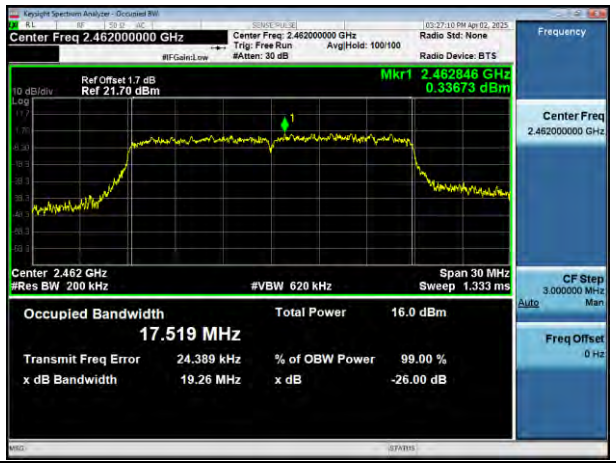
6dB Bandwidth:

802.11b	802.11g
2412MHz	2412MHz
	
2437MHz	2437MHz
	
2462MHz	2462MHz
	

802.11n(HT20)	802.11n(HT40)
2412MHz	2422MHz
	
2437MHz	2437MHz
	
2462MHz	2452MHz
	

99% Bandwidth:

802.11b	802.11g
2412MHz	2412MHz
	
2437MHz	2437MHz
	
2462MHz	2462MHz
	

802.11n(HT20)	802.11n(HT40)
2412MHz	2422MHz
	
2437MHz	2437MHz
	
2462MHz	2452MHz
	

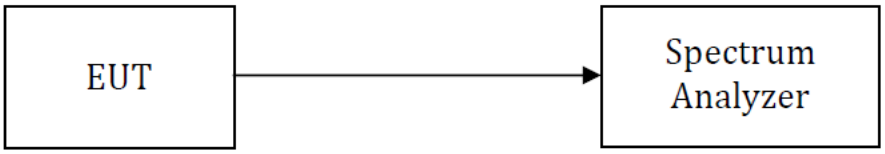
9. Maximum Power Spectral Density

9.1 Standard and Limit

According to FCC 15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

9.2 Test Procedure

1) Remove the antenna from the EUT and connect to the spectrum analyzer via a low loss RF cable.
2) Set the spectrum analyzer to any one measured frequency within its operating range.
3) Set RBW = 3kHz, VBW = 10kHz, Sweep = Auto, Detector = RMS.
4) Measure the highest amplitude appearing on spectral display and mark the value.
5) Repeat above procedures until all frequencies measured were complete.



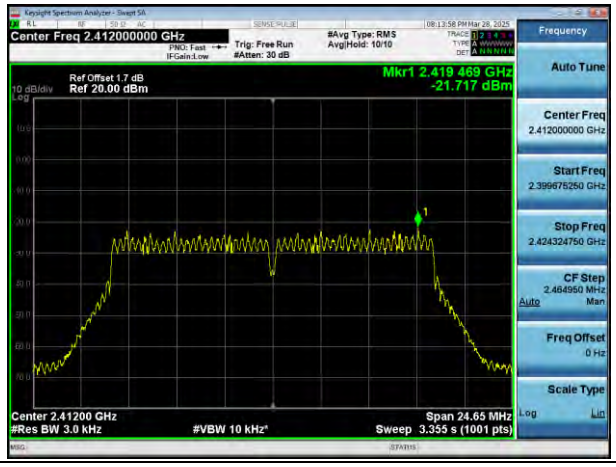
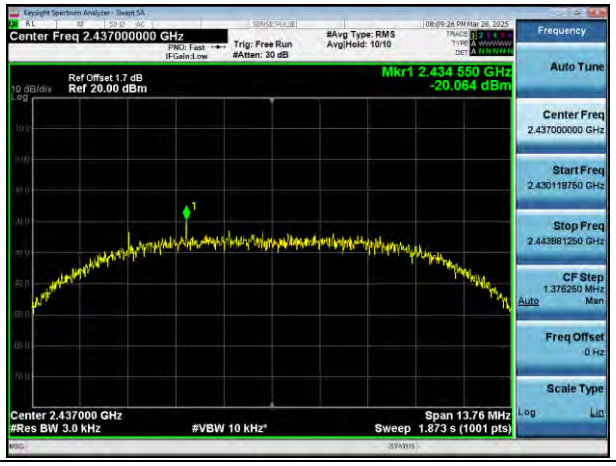
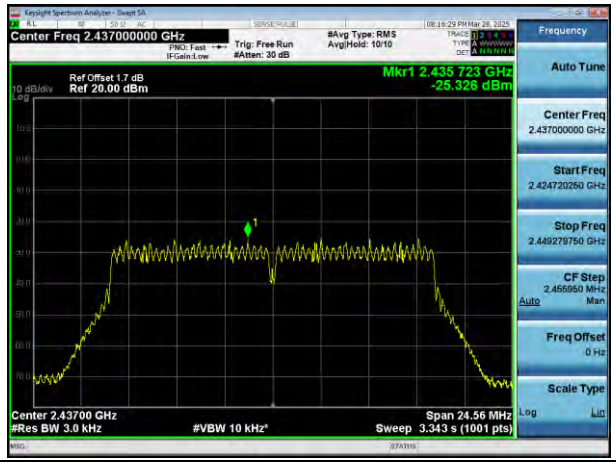
Test Setup Block Diagram

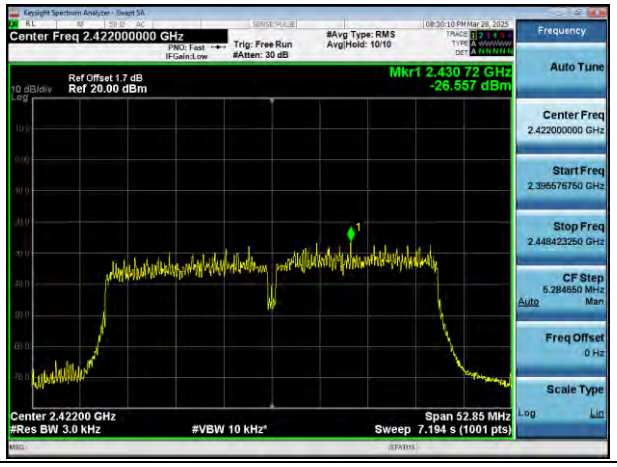
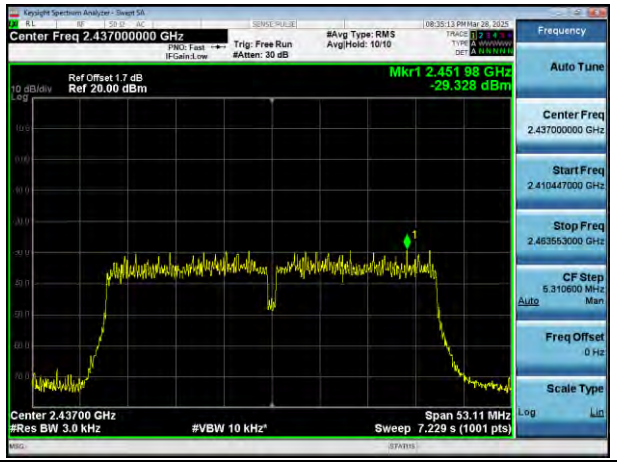
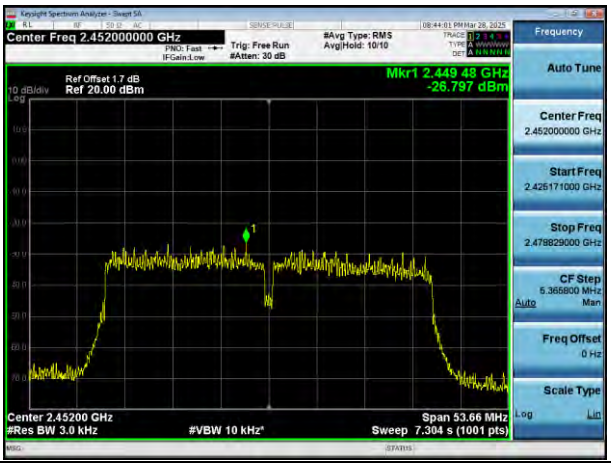
9.3 Test Data and Results

ANT1:

Test Mode	Test Channel (MHz)	Conducted PSD (dBm/3kHz)	Duty Factor (dB)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Test Result
802.11b	2412	-19.09	0.47	-18.62	8	Pass
	2437	-20.06	0.47	-19.59	8	Pass
	2462	-19.08	0.46	-18.62	8	Pass
802.11g	2412	-21.72	1.83	-19.89	8	Pass
	2437	-25.33	1.83	-23.5	8	Pass
	2462	-22.1	1.83	-20.27	8	Pass
802.11n(HT20)	2412	-21.43	2.06	-19.37	8	Pass
	2437	-24.67	2.06	-22.61	8	Pass
	2462	-22.49	2.09	-20.4	8	Pass
802.11n(HT40)	2422	-26.56	2.96	-23.6	8	Pass
	2437	-29.33	3.01	-26.32	8	Pass
	2452	-26.8	3.01	-23.79	8	Pass

Note: Total PSD = Conducted PSD + Duty Factor

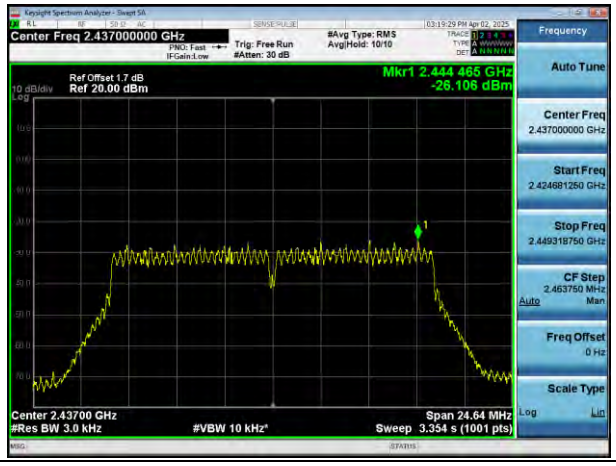
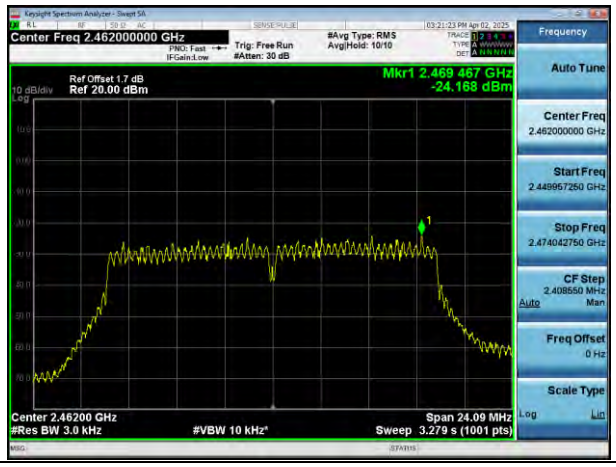
802.11b	802.11g
2412MHz	2412MHz
	
2437MHz	2437MHz
	
2462MHz	2462MHz
	

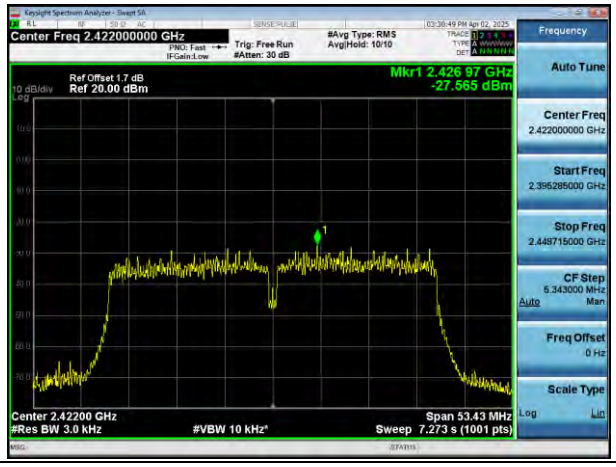
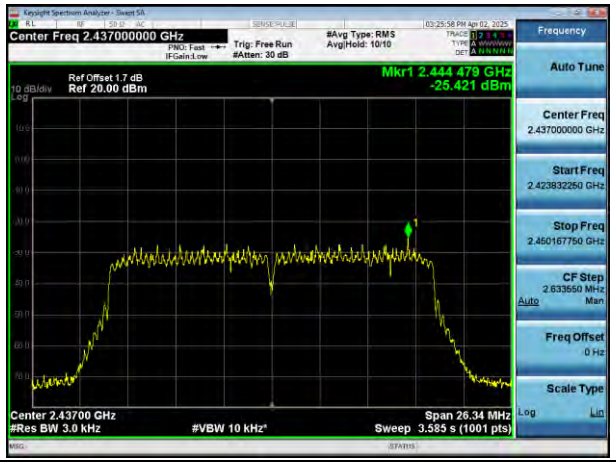
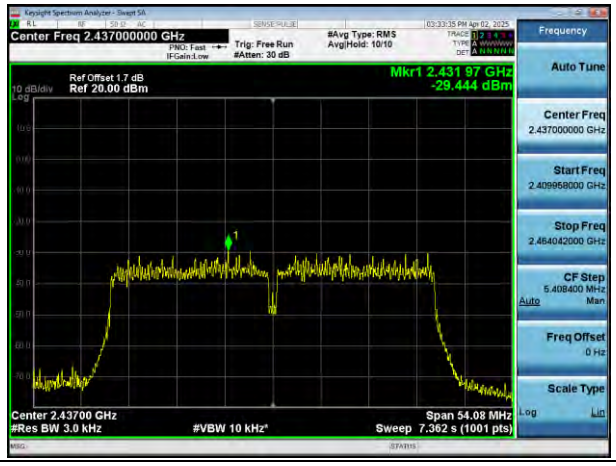
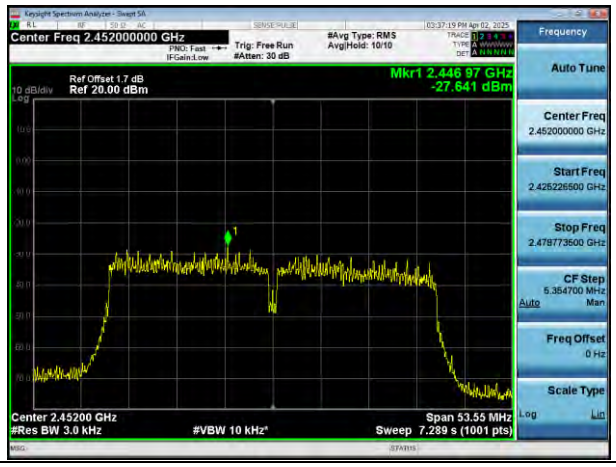
802.11n(HT20)	802.11n(HT40)
2412MHz	2422MHz
	
2437MHz	2437MHz
	
2462MHz	2452MHz
	

ANT2:

Test Mode	Test Channel (MHz)	Conducted PSD (dBm/3kHz)	Duty Factor (dB)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Test Result
802.11b	2412	-21.79	0.42	-21.37	8	Pass
	2437	-24.77	0.42	-24.35	8	Pass
	2462	-22.29	0.41	-21.88	8	Pass
802.11g	2412	-22.54	1.83	-20.71	8	Pass
	2437	-26.11	1.83	-24.28	8	Pass
	2462	-24.17	1.83	-22.34	8	Pass
802.11n(HT20)	2412	-21.71	2.06	-19.65	8	Pass
	2437	-25.42	2.06	-23.36	8	Pass
	2462	-23.69	2.06	-21.63	8	Pass
802.11n(HT40)	2422	-27.57	3.01	-24.56	8	Pass
	2437	-29.44	3.01	-26.43	8	Pass
	2452	-27.64	3.01	-24.63	8	Pass

Note: Total PSD = Conducted PSD + Duty Factor

802.11b	802.11g
2412MHz	2412MHz
	
2437MHz	2437MHz
	
2462MHz	2462MHz
	

802.11n(HT20)	802.11n(HT40)
2412MHz	2422MHz
	
2437MHz	2437MHz
	
2462MHz	2452MHz
	

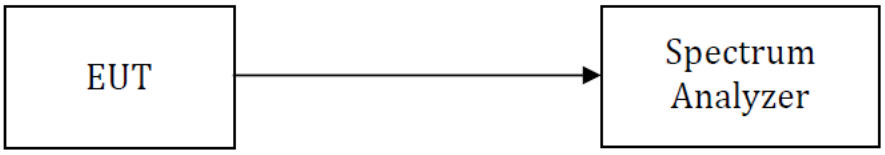
10. Band-edge Emission(Conducted)

10.1 Standard and Limit

According to §15.247(d), 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 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) (see § 15.205(c)).

10.2 Test Procedure

Test is conducting under the description of ANSI C63.10 - 2013 section 6.10.
1) Remove the antenna from the EUT and connect to the spectrum analyzer via a low loss RF cable.
2) Set the spectrum analyzer to any one measured frequency within its operating range.
3) Set RBW = 100kHz, VBW = 300kHz, Sweep = Auto, Detector = Peak.
4) Measure the highest amplitude appearing on spectral display and set it as a reference level.
5) Set a convenient frequency span including 100 kHz bandwidth from band edge.
6) Measure the emission and marking the edge frequency.
7) Repeat above procedures until all frequencies measured were complete.



Test Setup Block Diagram

10.3 Test Data and Results

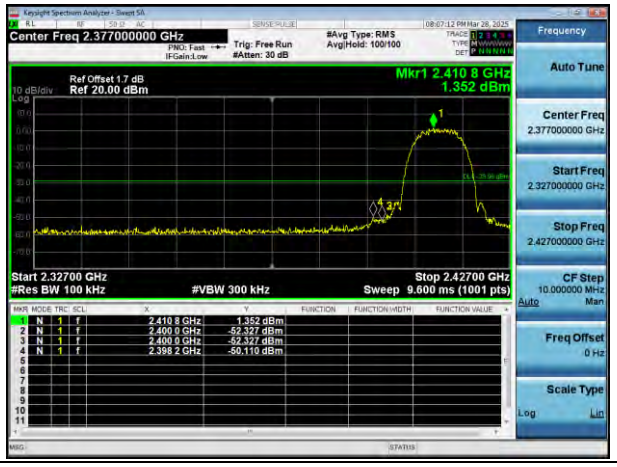
ANT1:

Test Mode	Band-edge	Test Channel (MHz)	Max. Value (dBc)	Limit (dBc)	Test Result
802.11b	Lowest	2412	-51.14	-30	Pass
	Highest	2462	-56.82	-30	Pass
802.11g	Lowest	2412	-39.53	-30	Pass
	Highest	2462	-44.99	-30	Pass
802.11n(HT20)	Lowest	2412	-38.15	-30	Pass
	Highest	2462	-45.55	-30	Pass
802.11n(HT40)	Lowest	2422	-35.68	-30	Pass
	Highest	2452	-41.06	-30	Pass

802.11b Lowest

Reference Power

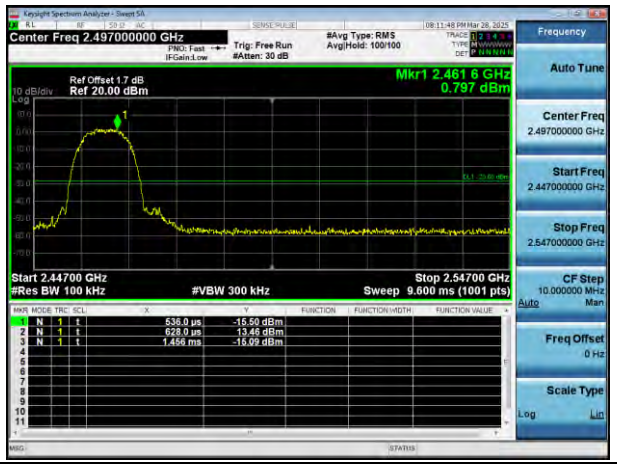
Band-edge Emission



802.11b Highest

Reference Power

Band-edge Emission



802.11g Lowest

Reference Power

Band-edge Emission

802.11g Highest

Reference Power

Band-edge Emission

802.11n(HT20) Lowest

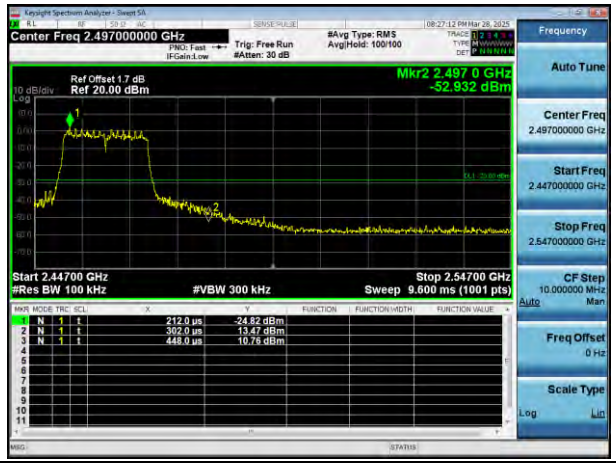
Reference Power

Band-edge Emission

802.11n(HT20) Highest

Reference Power

Band-edge Emission



802.11n(HT40) Lowest

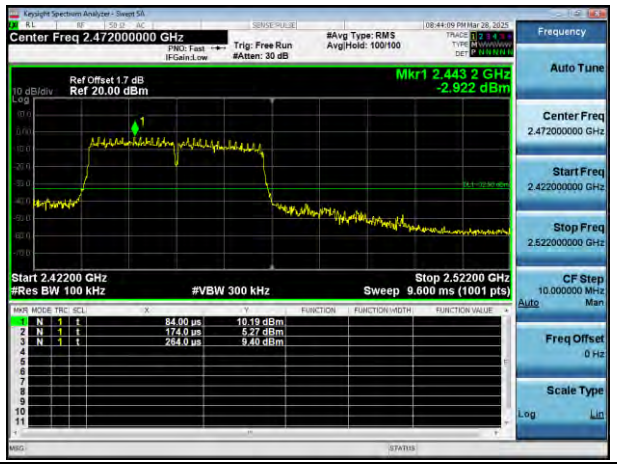
Reference Power

Band-edge Emission

802.11n(HT40) Highest

Reference Power

Band-edge Emission



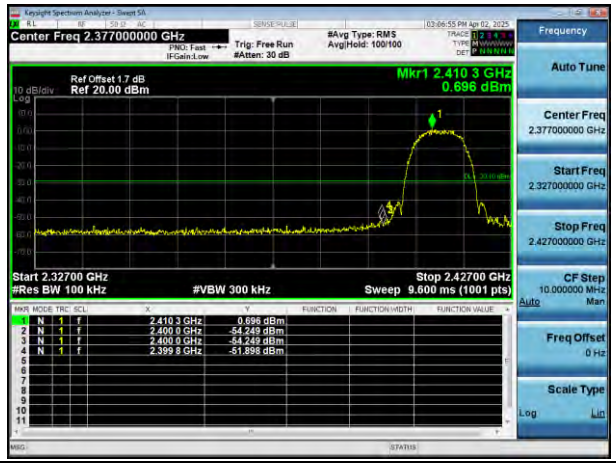
ANT2:

Test Mode	Band-edge	Test Channel (MHz)	Max. Value (dBc)	Limit (dBc)	Test Result
802.11b	Lowest	2412	-52.79	-30	Pass
	Highest	2462	-55.18	-30	Pass
802.11g	Lowest	2412	-37.03	-30	Pass
	Highest	2462	-46.18	-30	Pass
802.11n(HT20)	Lowest	2412	-38.23	-30	Pass
	Highest	2462	-43.86	-30	Pass
802.11n(HT40)	Lowest	2422	-35.76	-30	Pass
	Highest	2452	-44.67	-30	Pass

802.11b Lowest

Reference Power

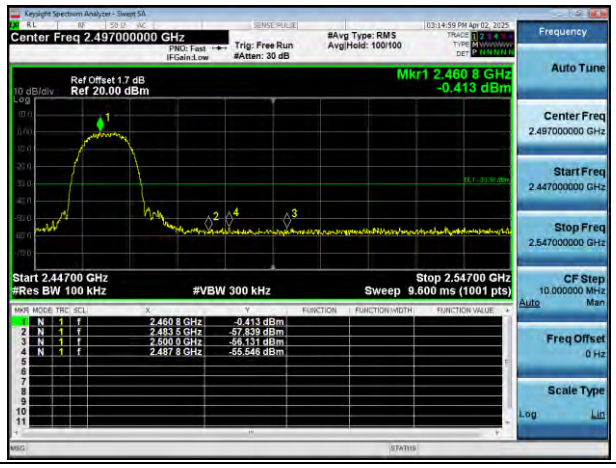
Band-edge Emission



802.11b Highest

Reference Power

Band-edge Emission



802.11g Lowest

Reference Power

Band-edge Emission

802.11g Highest

Reference Power

Band-edge Emission

802.11n(HT20) Lowest

Reference Power

Band-edge Emission

802.11n(HT20) Highest

Reference Power

Band-edge Emission

802.11n(HT40) Lowest

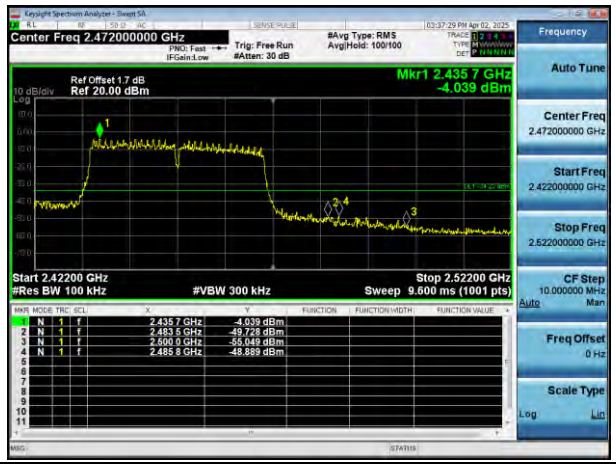
Reference Power

Band-edge Emission

802.11n(HT40) Highest

Reference Power

Band-edge Emission



11. Conducted RF Spurious Emissions

11.1 Standard and Limit

According to §15.247(d), 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 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) (see § 15.205(c)).

11.2 Test Procedure

Test is conducting under the description of ANSI C63.10 - 2013 section 6.7.
1) Remove the antenna from the EUT and connect to the spectrum analyzer via a low loss RF cable.
2) Set the spectrum analyzer to any one measured frequency within its operating range.
3) Set RBW = 100kHz, VBW = 300kHz, Sweep = Auto, Detector = Peak.
4) Measure the highest amplitude appearing on spectral display and set it as a reference level.
5) Measure the spurious emissions with frequency range from 9kHz to 26.5GHz.
6) Repeat above procedures until all measured frequencies were complete.

Test Setup Block Diagram

11.3 Test Data and Results

Note: The measurement frequency range is from 9kHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions measurement data.

ANT1:

802.11b Lowest

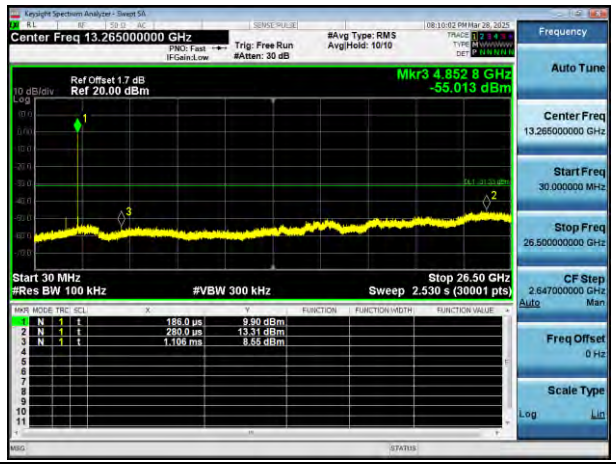
Reference Power

Spurious Emissions

802.11b Middle

Reference Power

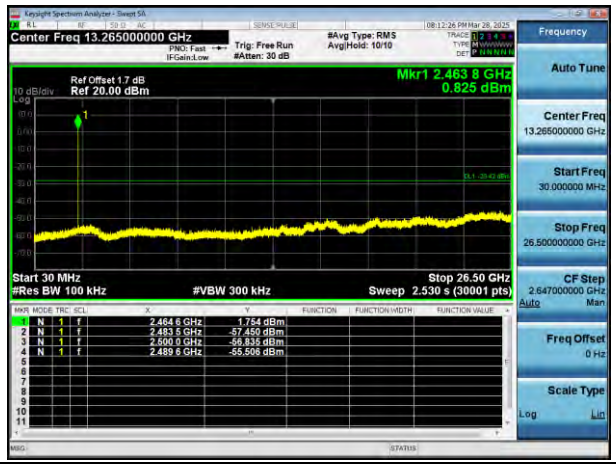
Spurious Emissions



802.11b Highest

Reference Power

Spurious Emissions



802.11g Lowest

Reference Power

Spurious Emissions

802.11g Middle

Reference Power

Spurious Emissions

802.11g Highest

Reference Power

Spurious Emissions

802.11n(HT20) Lowest

Reference Power

Spurious Emissions

802.11n(HT20) Middle

Reference Power

Spurious Emissions

802.11n(HT20) Highest

Reference Power

Spurious Emissions

802.11n(HT40) Lowest

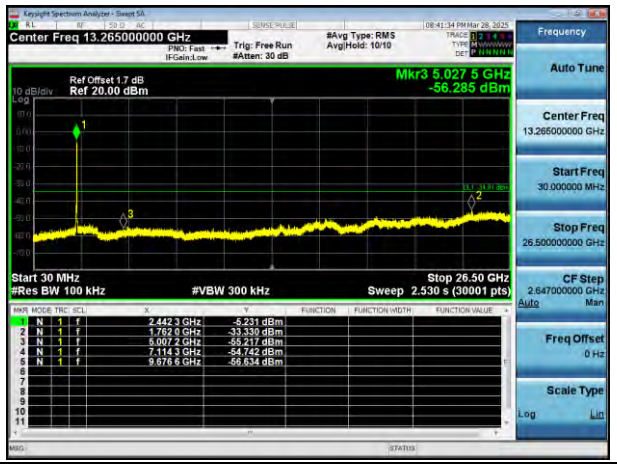
Reference Power

Spurious Emissions

802.11n(HT40) Middle

Reference Power

Spurious Emissions



802.11n(HT40) Highest

Reference Power

Spurious Emissions

ANT2:

802.11b Lowest

Reference Power

Spurious Emissions

802.11b Middle

Reference Power

Spurious Emissions

802.11b Highest

Reference Power

Spurious Emissions

802.11g Lowest

Reference Power

Spurious Emissions

802.11g Middle

Reference Power

Spurious Emissions

802.11g Highest

Reference Power

Spurious Emissions

802.11n(HT20) Lowest

Reference Power

Spurious Emissions

802.11n(HT20) Middle

Reference Power

Spurious Emissions

802.11n(HT20) Highest

Reference Power

Spurious Emissions

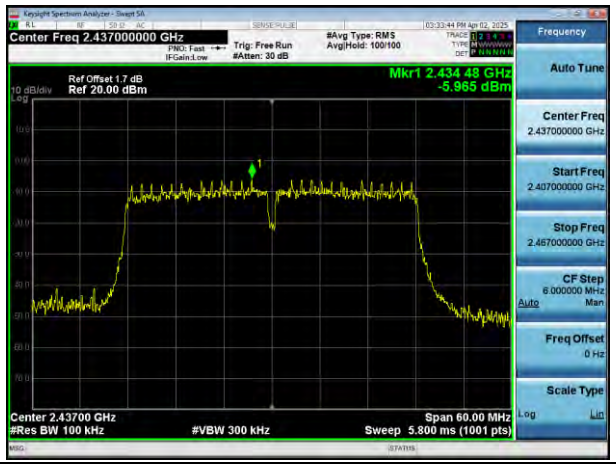
802.11n(HT40) Lowest

Reference Power

Spurious Emissions

802.11n(HT40) Middle

Reference Power



Spurious Emissions

802.11n(HT40) Highest

Reference Power

Spurious Emissions

******* END OF REPORT *******