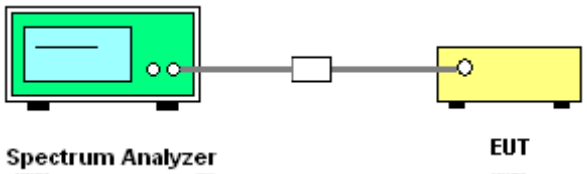
4.4. POWER SPECTRAL DENSITY

4.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB 558074
Limit:	The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows Measurement procedure 10.2 method PKPSD of FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): 3 kHz ≤ RBW ≤ 100 kHz. Video bandwidth VBW ≥ 3 x RBW. Set the span to at least 1.5 times the OBW. 5. Detector = Peak, Sweep time = auto couple. 6. Employ trace averaging (Peak) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level. 7. Measure and record the results in the test report.
Test Result:	PASS

4.4.2. Test Instruments

RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021	Dec. 08, 2022
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Dec. 09, 2021	Dec. 08, 2022
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 09, 2021	Dec. 08, 2022

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

4.4.3. Test data

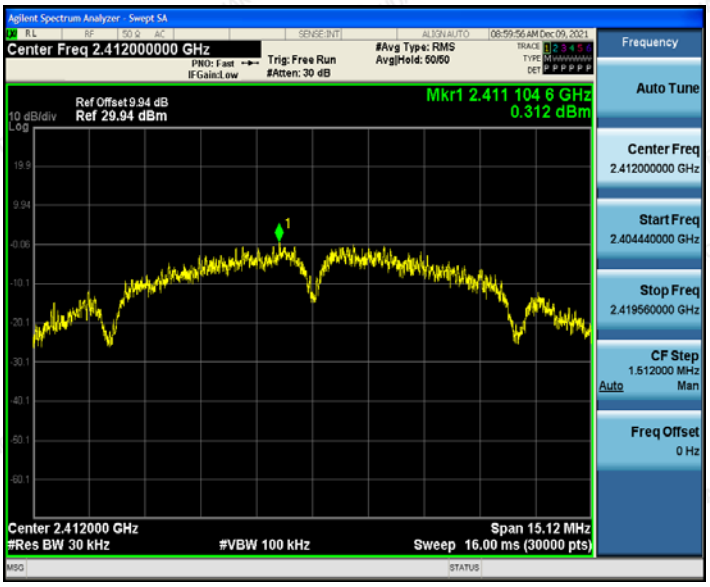
For antenna port 1

EUT Set Mode	Channel	Result (dBm/30kHz)	Result (dBm/3kHz)
802.11b	Lowest	0.31	-9.69
	Middle	-0.1	-10.1
	Highest	2.49	-7.51
802.11g	Lowest	-7.56	-17.56
	Middle	-8.64	-18.64
	Highest	-8.27	-18.27
802.11n(H20)	Lowest	-9.1	-19.1
	Middle	-8.76	-18.76
	Highest	-8.75	-18.75
802.11n(H40)	Lowest	-11.3	-21.3
	Middle	-11.51	-21.51
	Highest	-11.7	-21.7
TX ac(H20)	Lowest	-9.58	-19.58
	Middle	-9.24	-19.24
	Highest	-10.27	-20.27
TX ac(H40)	Lowest	-11.81	-21.81
	Middle	-12.42	-22.42
	Highest	-12.39	-22.39
802.11ax(H20)	Lowest	-9.91	-19.91
	Middle	-9.41	-19.41
	Highest	-9.46	-19.46
802.11ax(H40)	Lowest	-13.21	-23.21
	Middle	-13.12	-23.12
	Highest	-13.76	-23.76
PSD test result (dBm/3kHz)= PSD test result (dBm/30kHz)-10			
limit=8dBm-(direction gain-6dBi)=8-(3+10log2-6)=7.99dBm Limit: 7.99dBm/3kHz			
Test Result:	PASS		

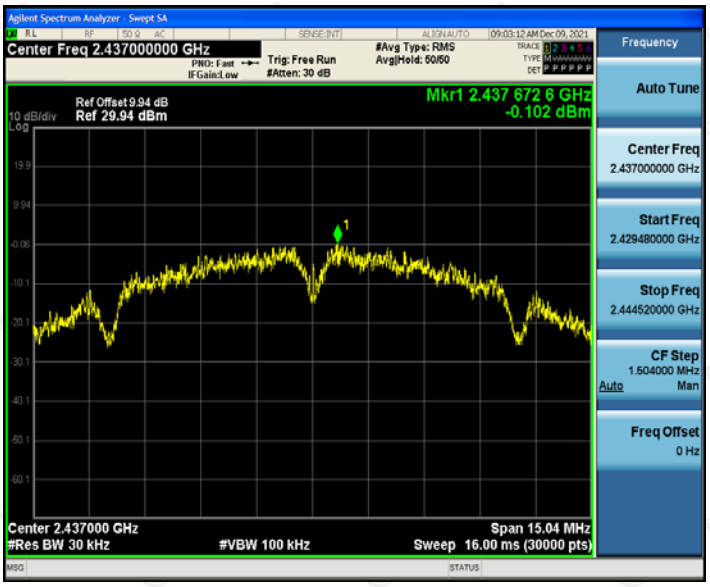
Test plots as follows:

802.11b Modulation

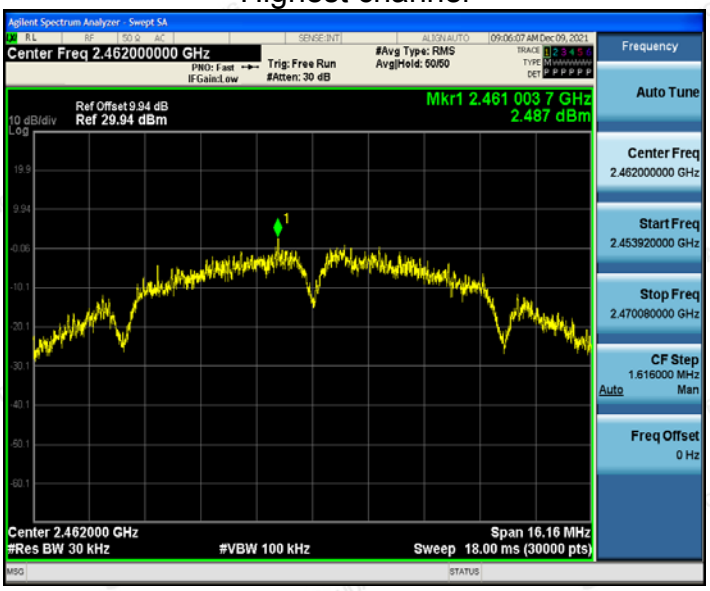
Lowest channel



Middle channel

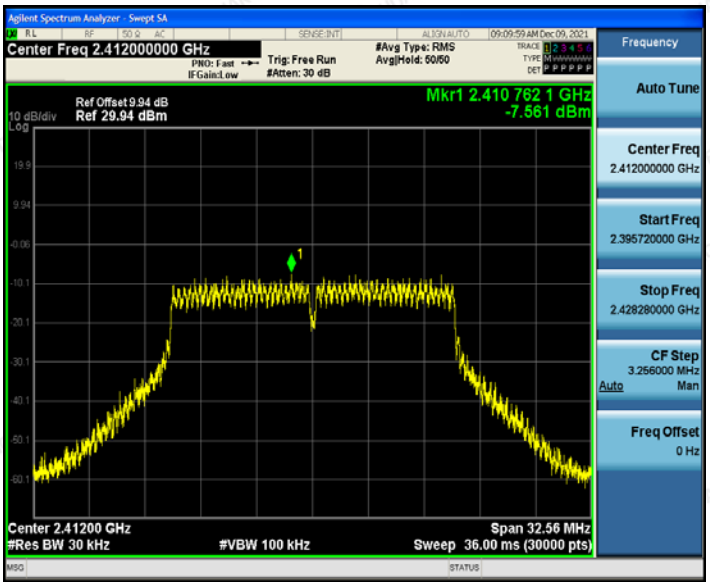


Highest channel

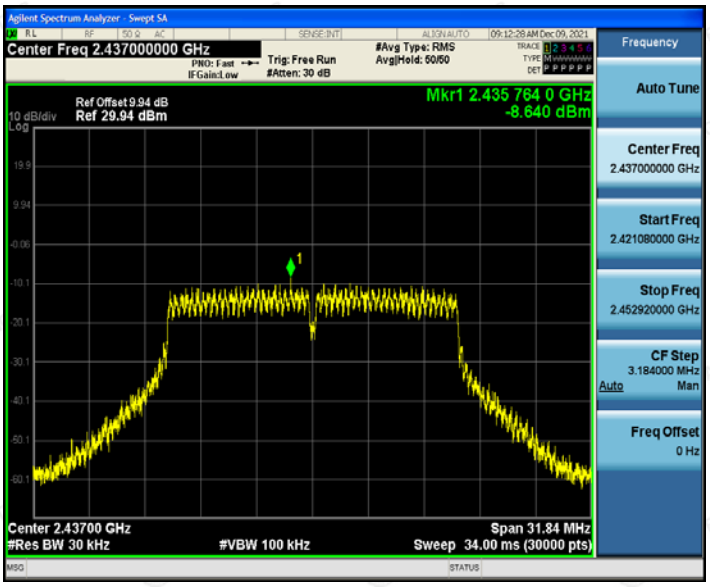


802.11g Modulation

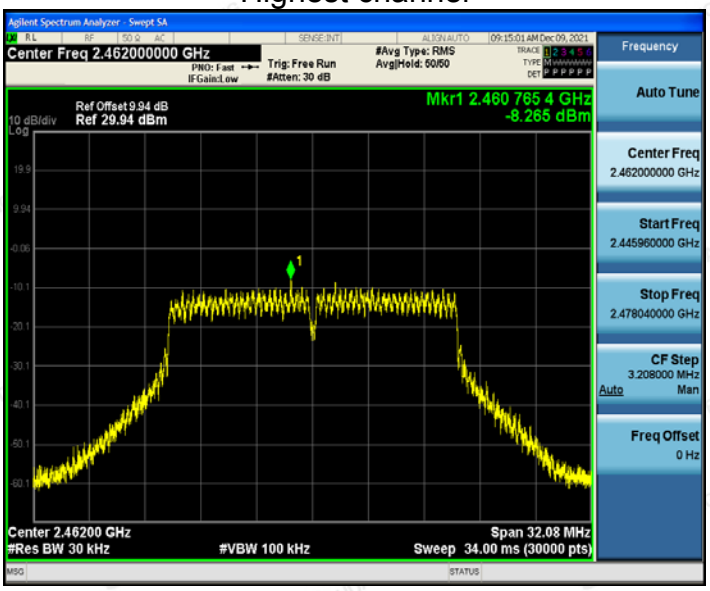
Lowest channel



Middle channel

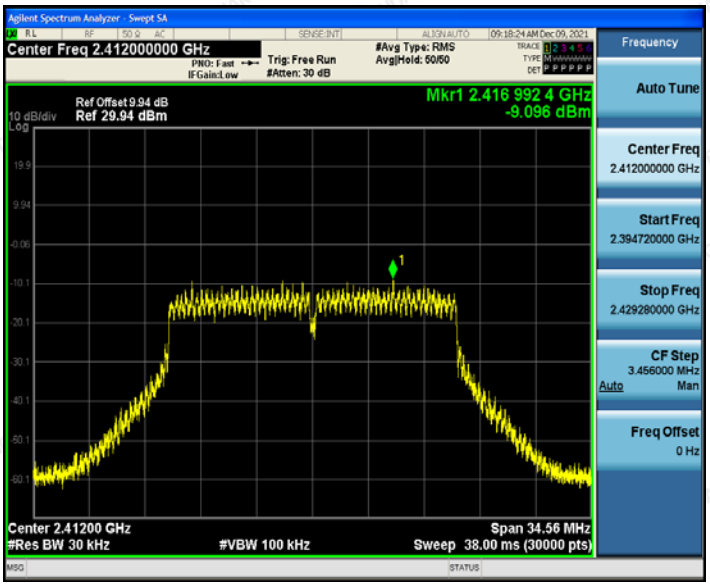


Highest channel

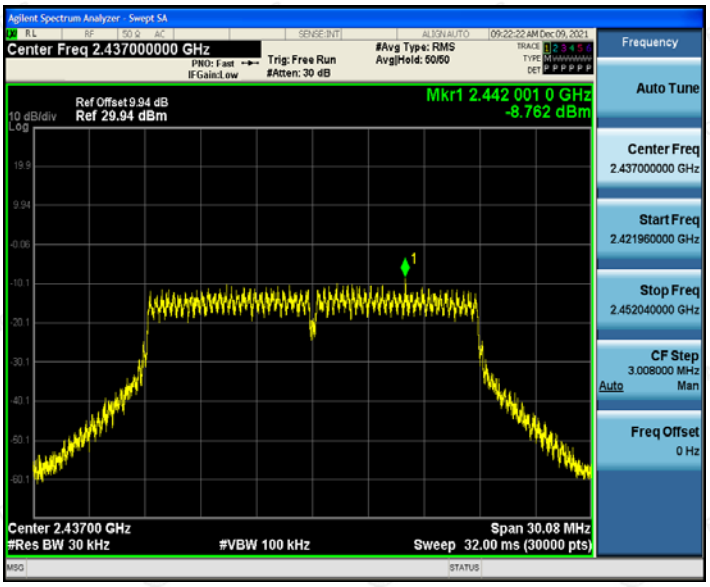


802.11n (HT20) Modulation

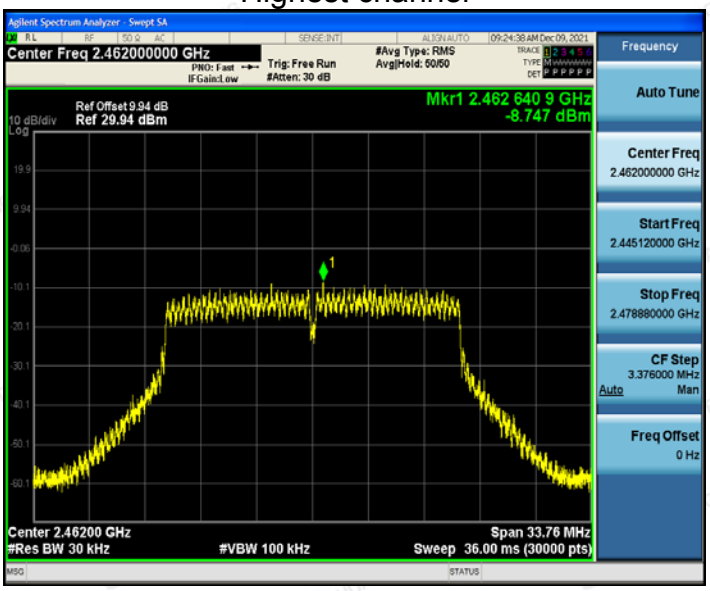
Lowest channel



Middle channel

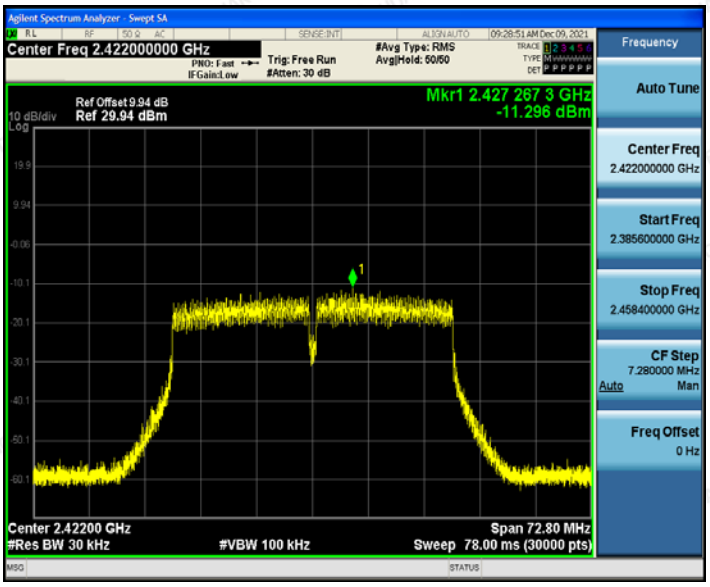


Highest channel

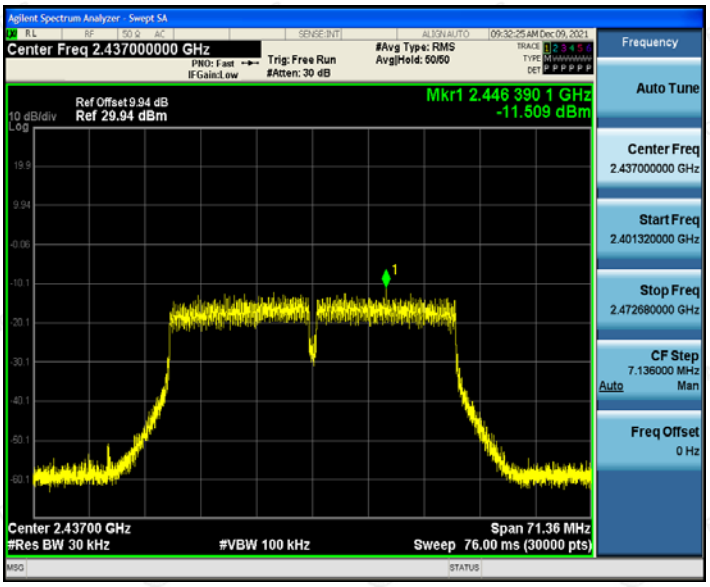


802.11n (HT40) Modulation

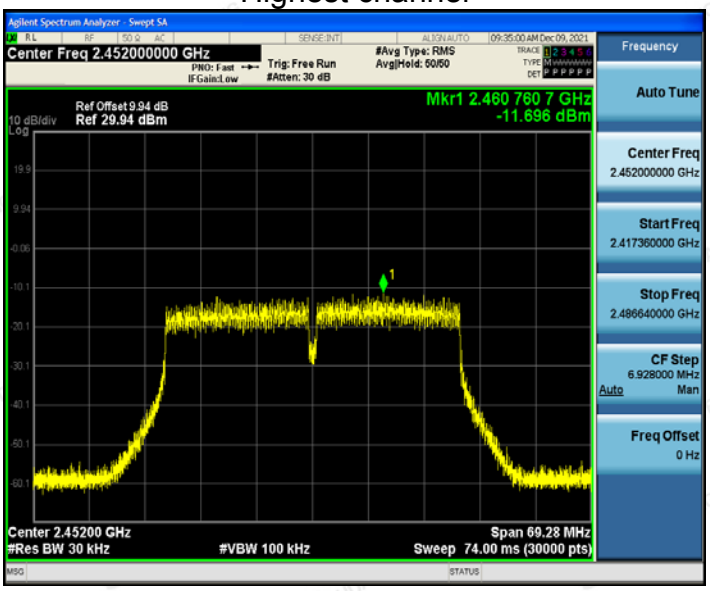
Lowest channel



Middle channel

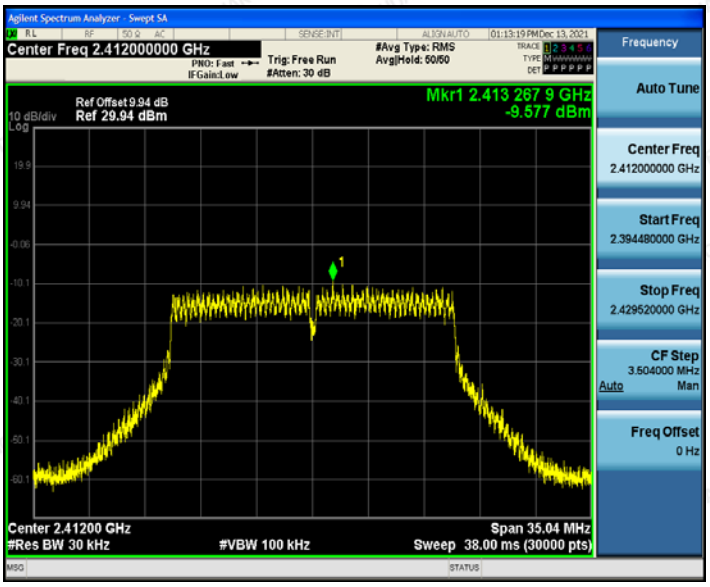


Highest channel

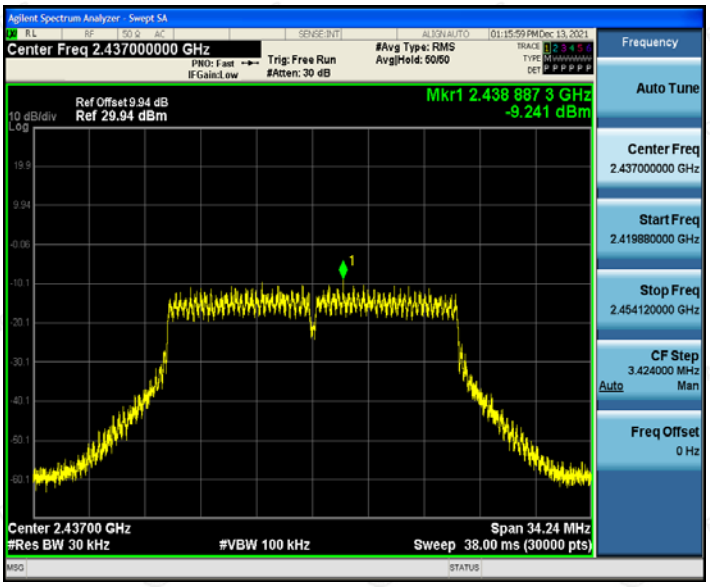


TX ac(HT20) Modulation

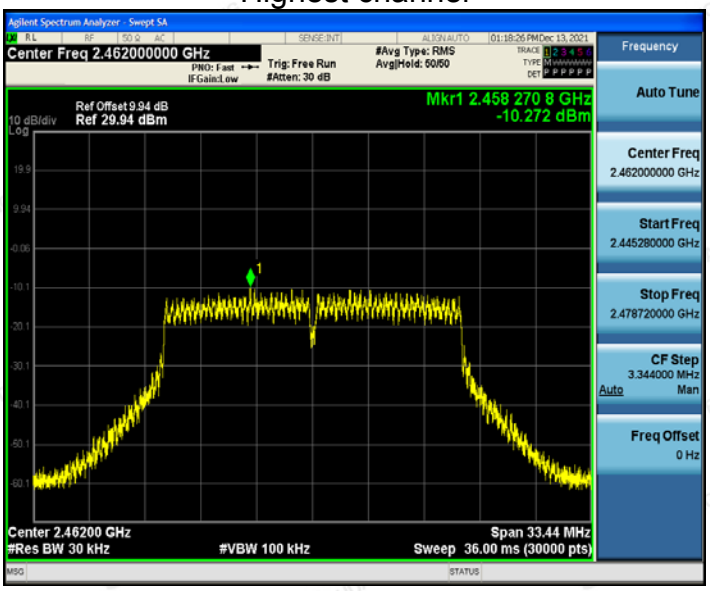
Lowest channel



Middle channel

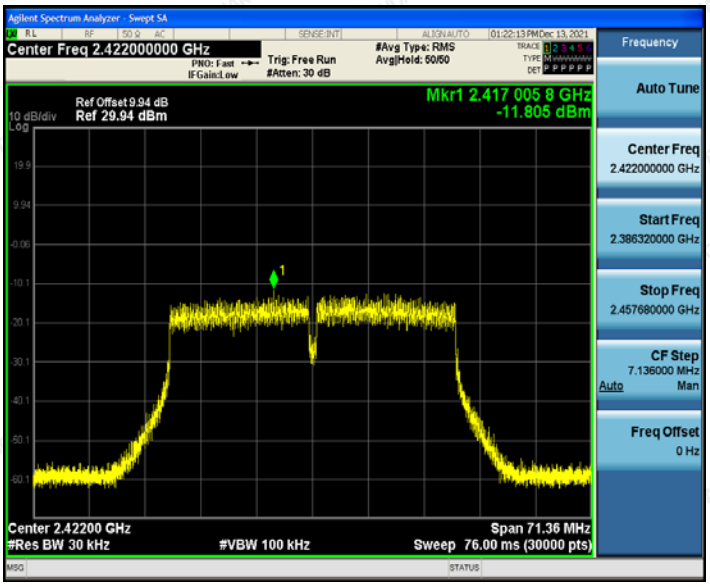


Highest channel

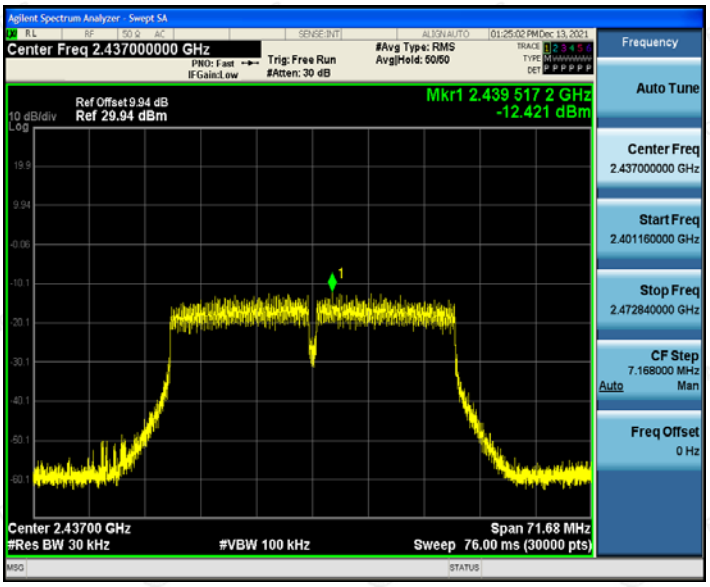


TX ac (HT40) Modulation

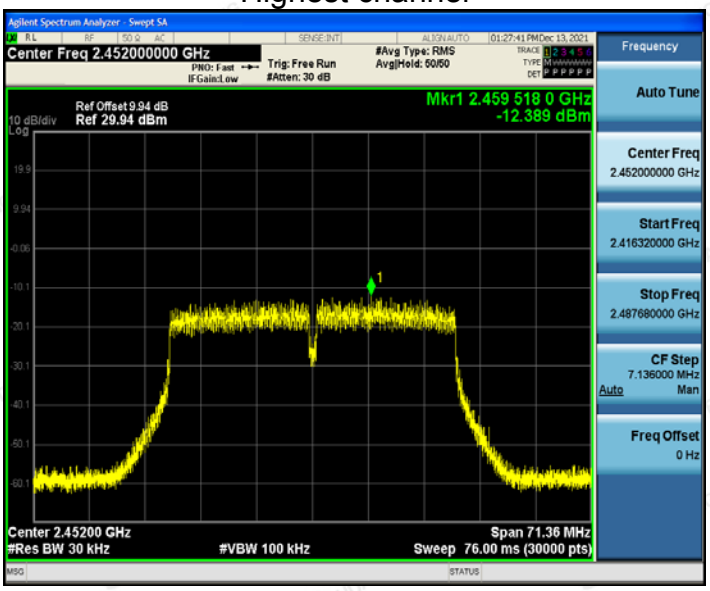
Lowest channel



Middle channel

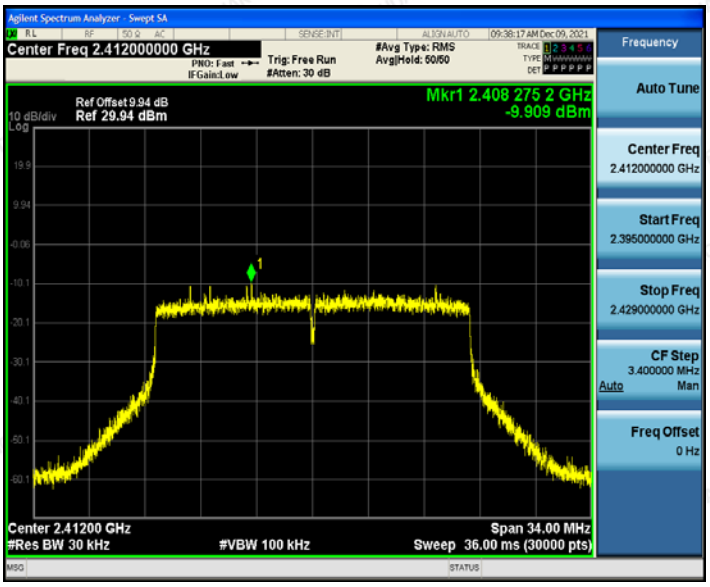


Highest channel

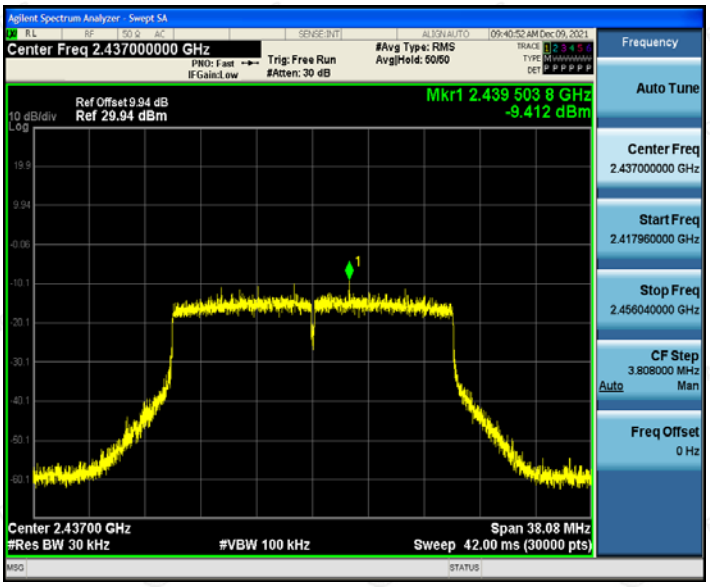


802.11ax(HT20) Modulation

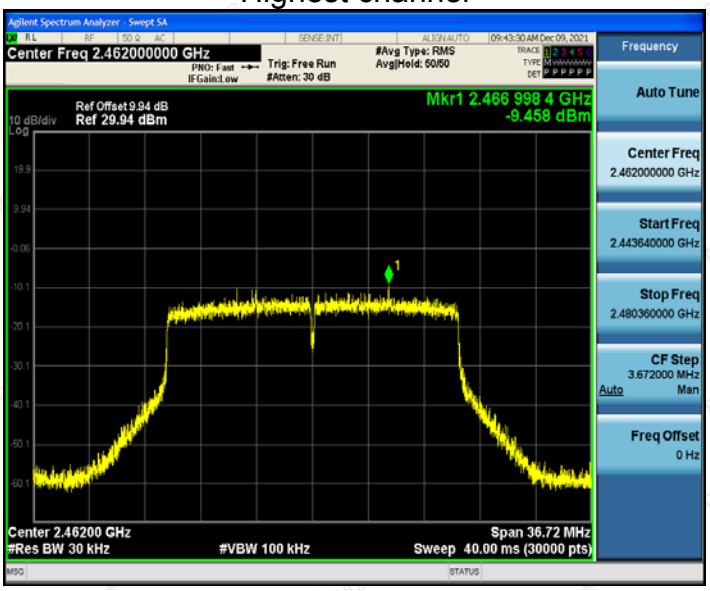
Lowest channel



Middle channel

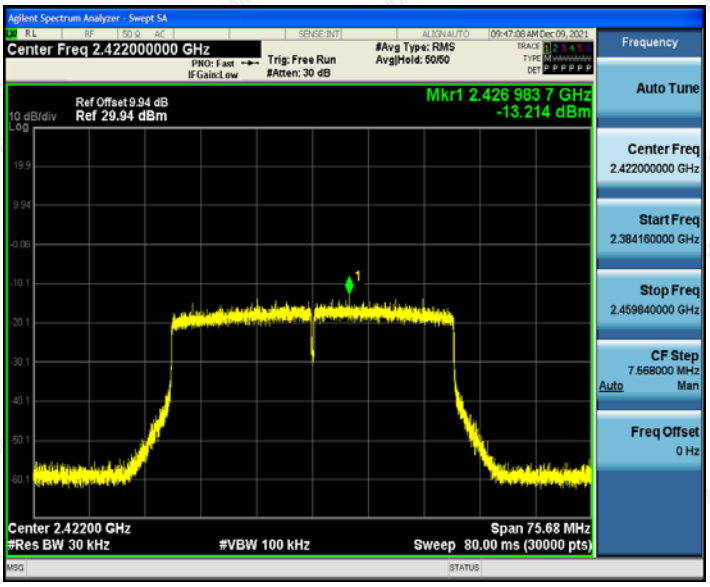


Highest channel

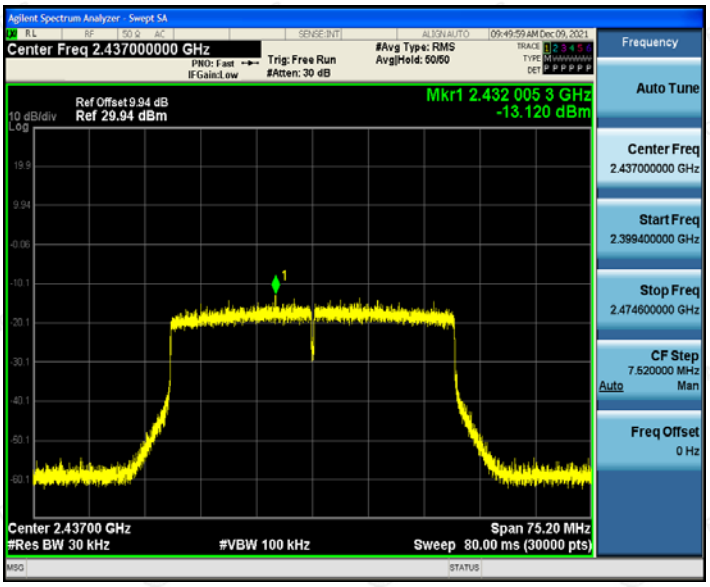


802.11ax (HT40) Modulation

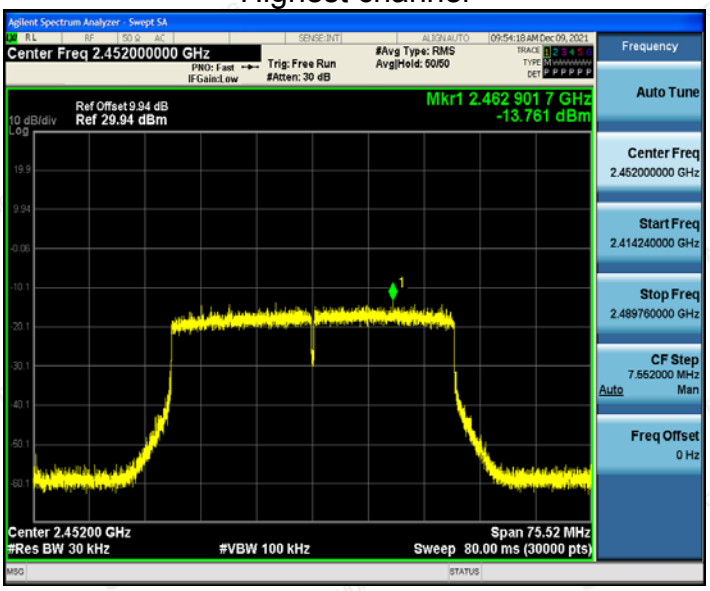
Lowest channel



Middle channel



Highest channel



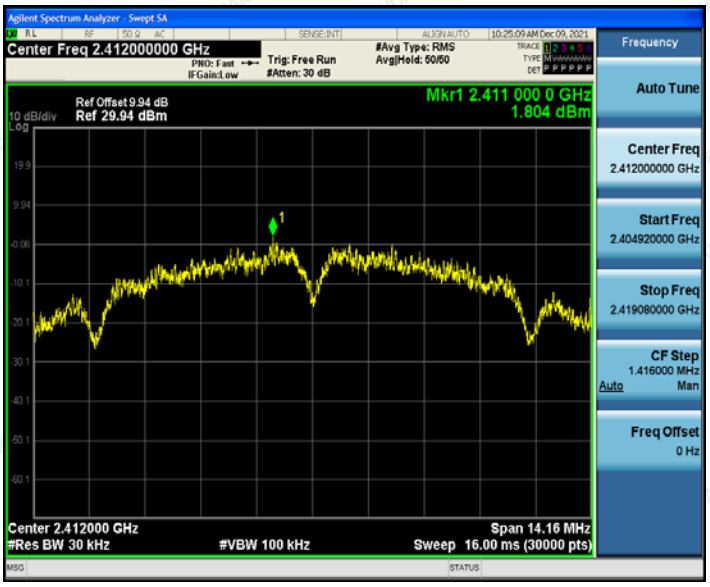
For antenna port 2

EUT Set Mode	Channel	Result (dBm/30kHz)	Result (dBm/3kHz)
802.11b	Lowest	1.8	-8.2
	Middle	-0.36	-10.36
	Highest	3.96	-6.04
802.11g	Lowest	-6.93	-16.93
	Middle	-7.59	-17.59
	Highest	-7.21	-17.21
802.11n(H20)	Lowest	-7.78	-17.78
	Middle	-6.21	-16.21
	Highest	-8.07	-18.07
802.11n(H40)	Lowest	-10.47	-20.47
	Middle	-10.03	-20.03
	Highest	-10.46	-20.46
TX ac(H20)	Lowest	-11.56	-21.56
	Middle	-11.33	-21.33
	Highest	-10.98	-20.98
TX ac(H40)	Lowest	-13.71	-23.71
	Middle	-14.14	-24.14
	Highest	-13.23	-23.23
802.11ax(H20)	Lowest	-8.27	-18.27
	Middle	-8.78	-18.78
	Highest	-7.27	-17.27
802.11ax(H40)	Lowest	-11.92	-21.92
	Middle	-12.04	-22.04
	Highest	-10.78	-20.78
PSD test result (dBm/3kHz)= PSD test result (dBm/30kHz)-10			
limit=8dBm-(direction gain-6dBi)=8-(3+10log2-6)=7.99dBm Limit: 7.99dBm/3kHz			
Test Result:	PASS		

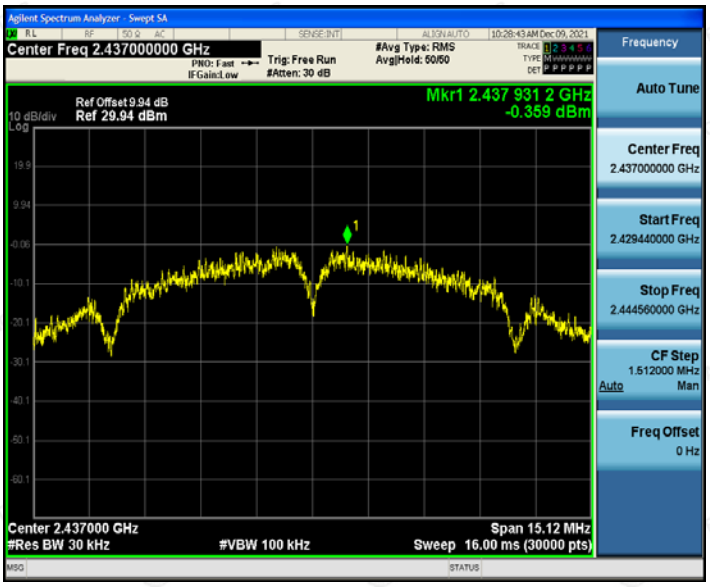
Test plots as follows:

802.11b Modulation

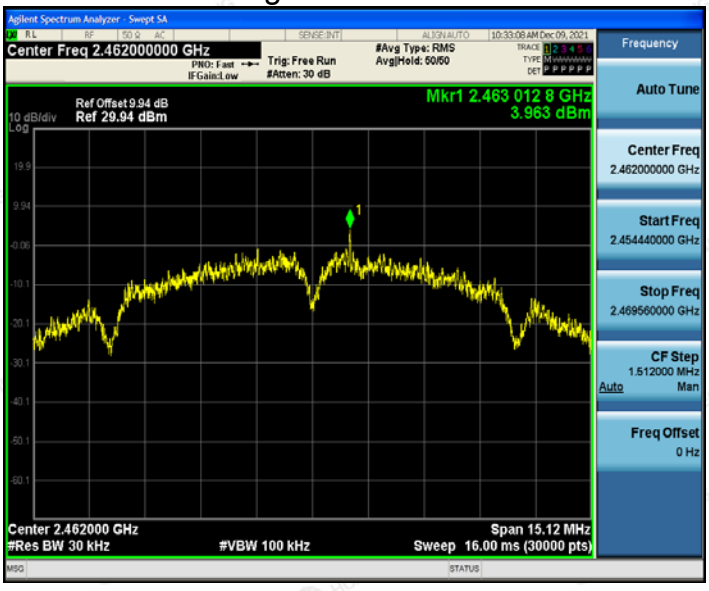
Lowest channel



Middle channel

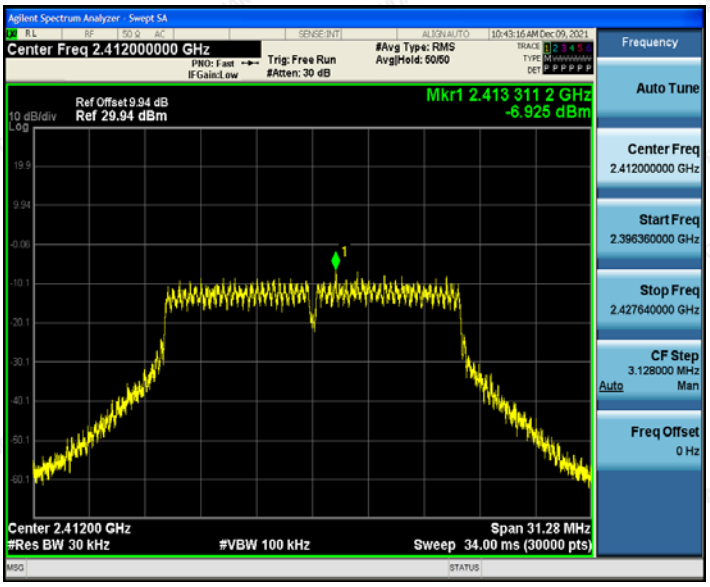


Highest channel

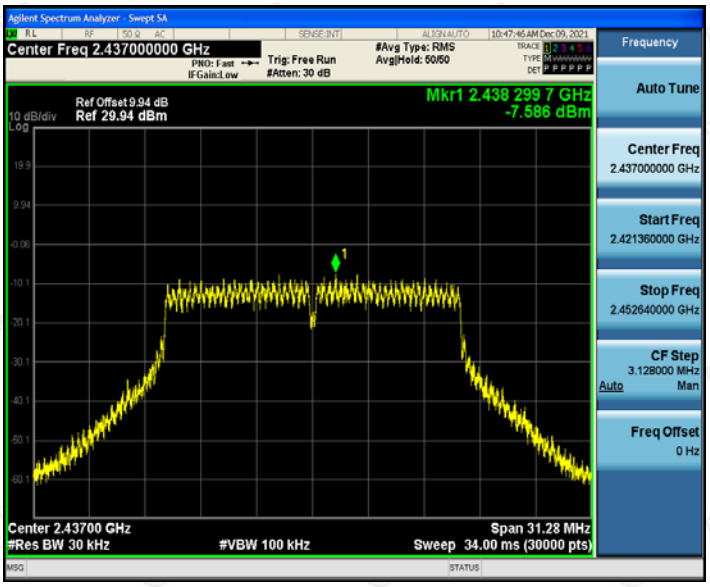


802.11g Modulation

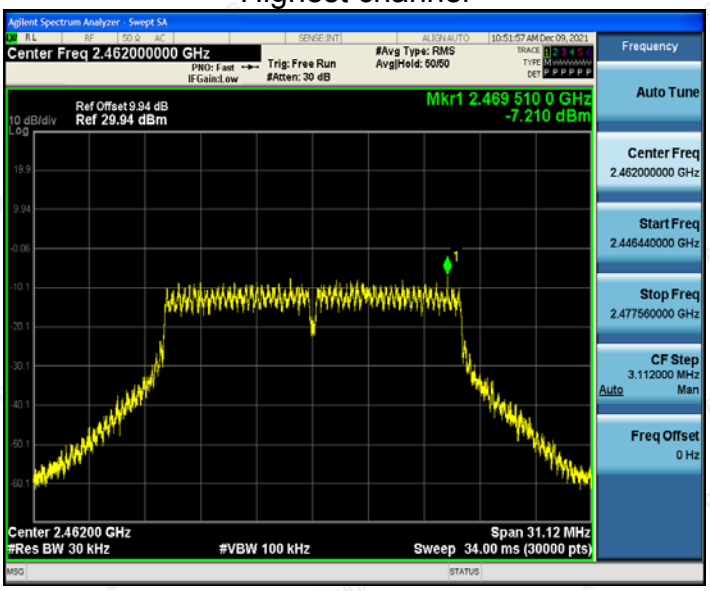
Lowest channel



Middle channel

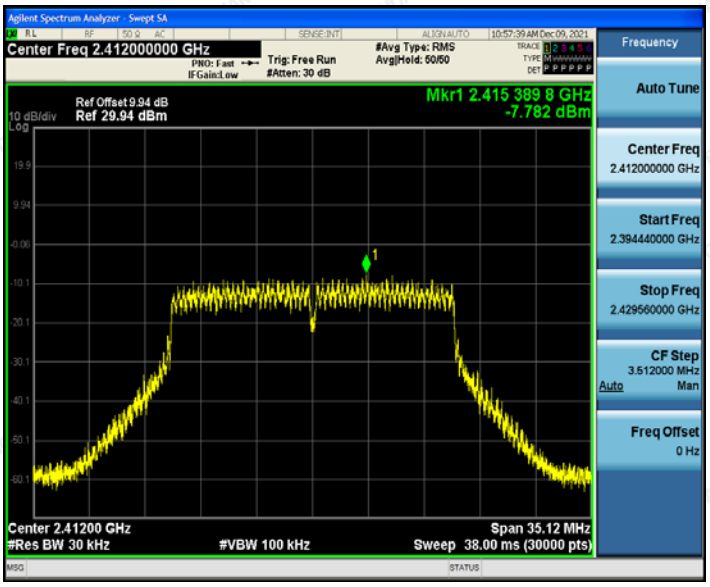


Highest channel

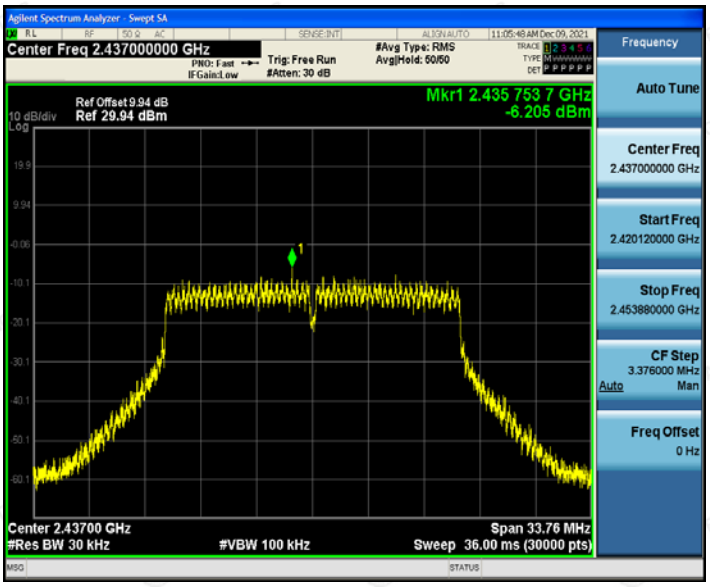


802.11n (HT20) Modulation

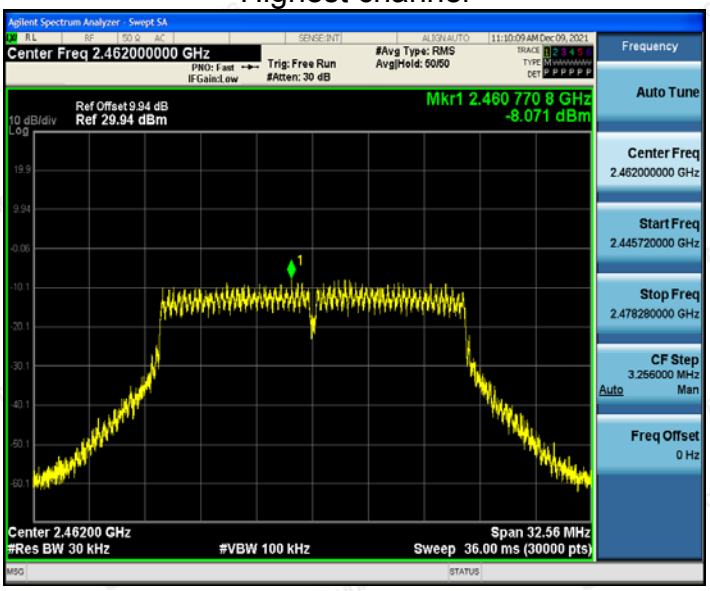
Lowest channel



Middle channel

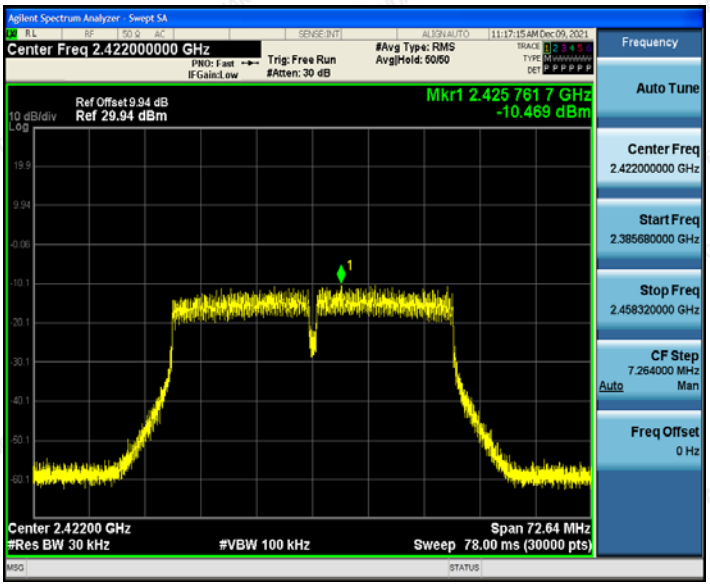


Highest channel

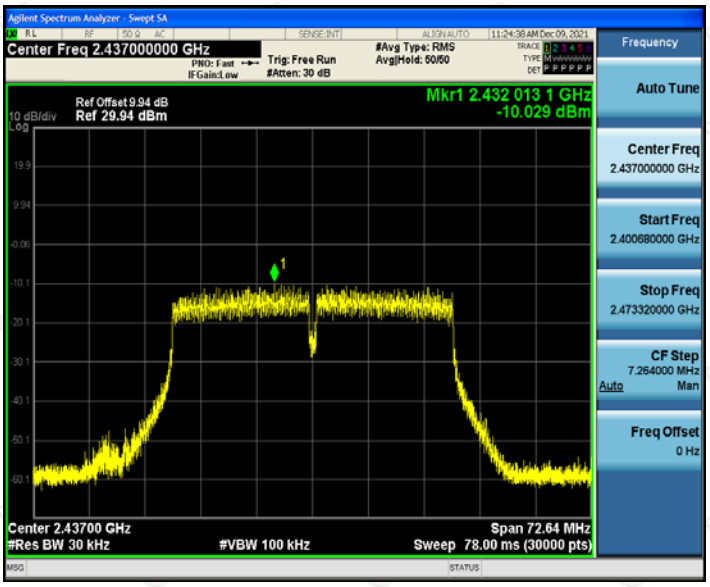


802.11n (HT40) Modulation

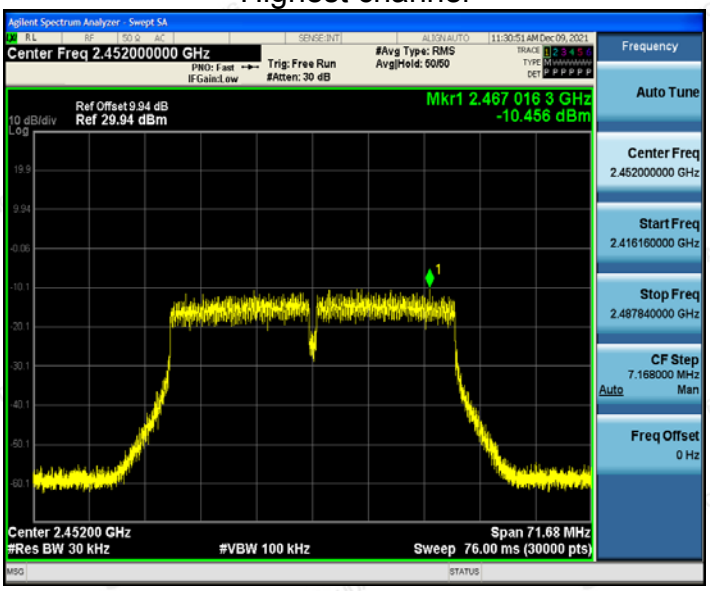
Lowest channel



Middle channel

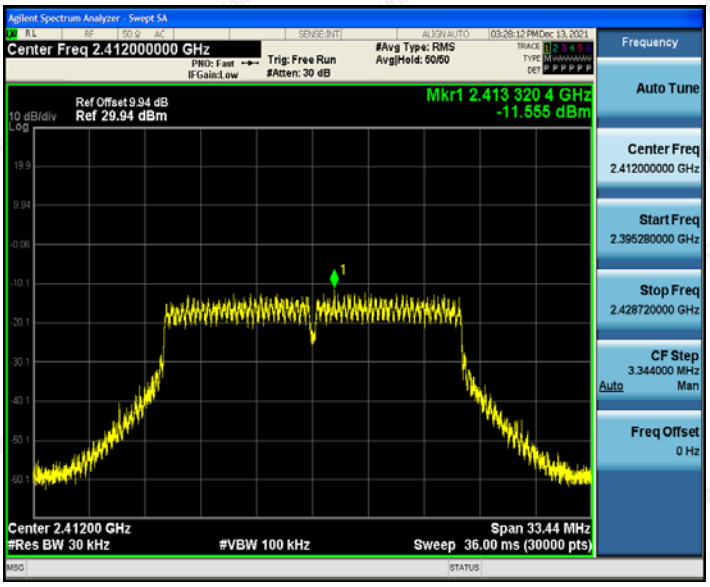


Highest channel

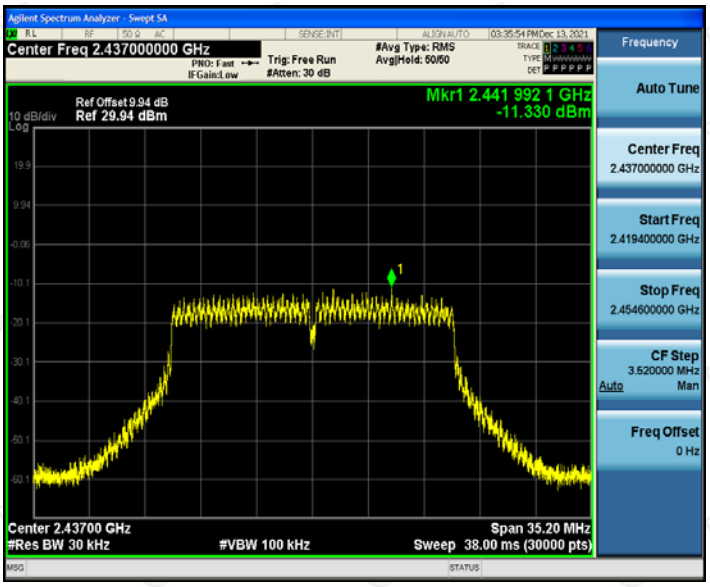


TX ac(HT20) Modulation

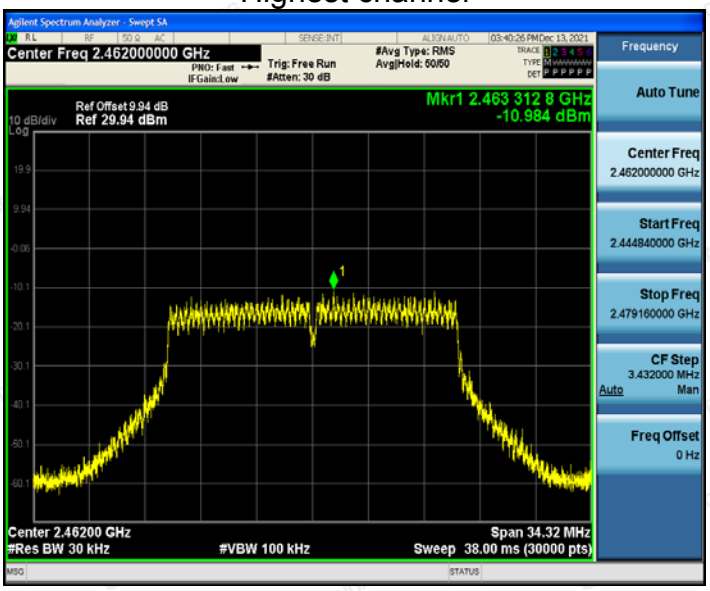
Lowest channel



Middle channel

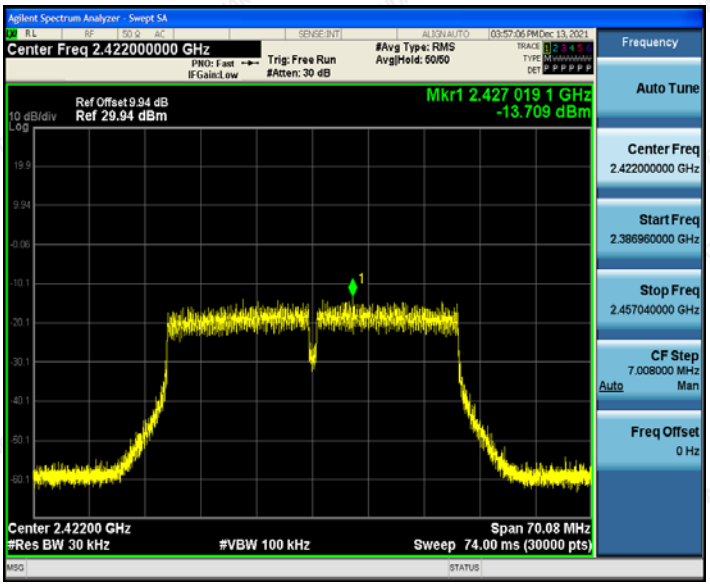


Highest channel

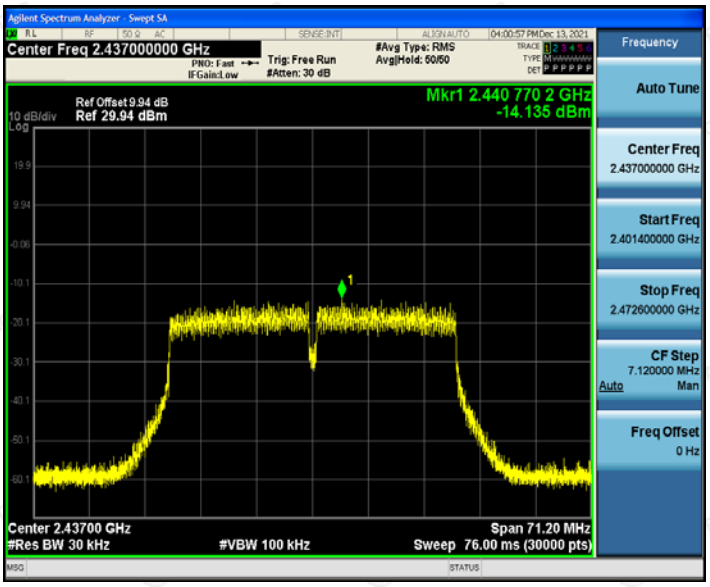


TX ac (HT40) Modulation

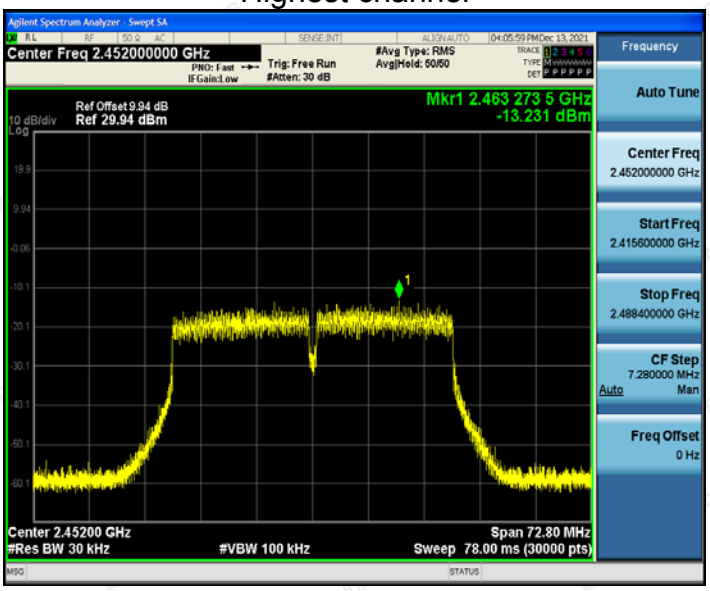
Lowest channel



Middle channel

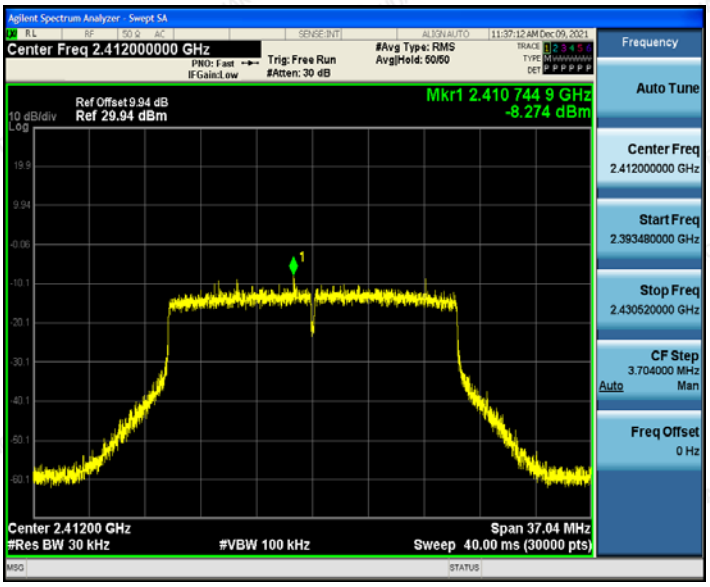


Highest channel

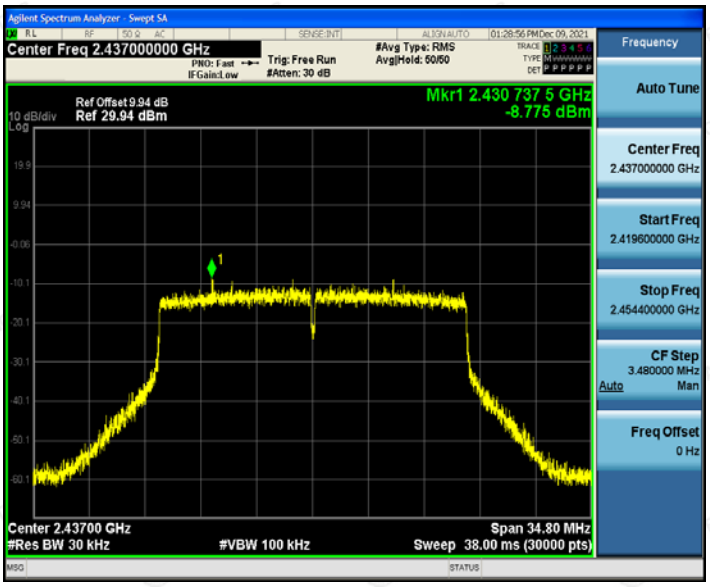


802.11ax(HT20) Modulation

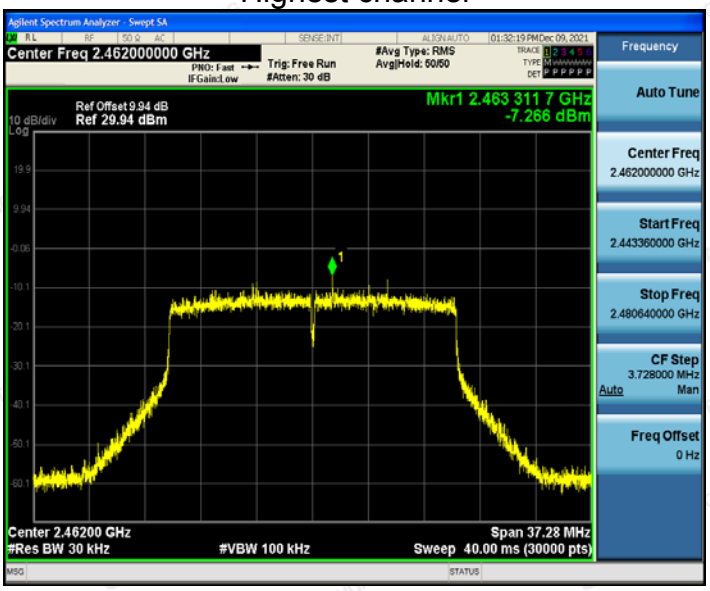
Lowest channel



Middle channel

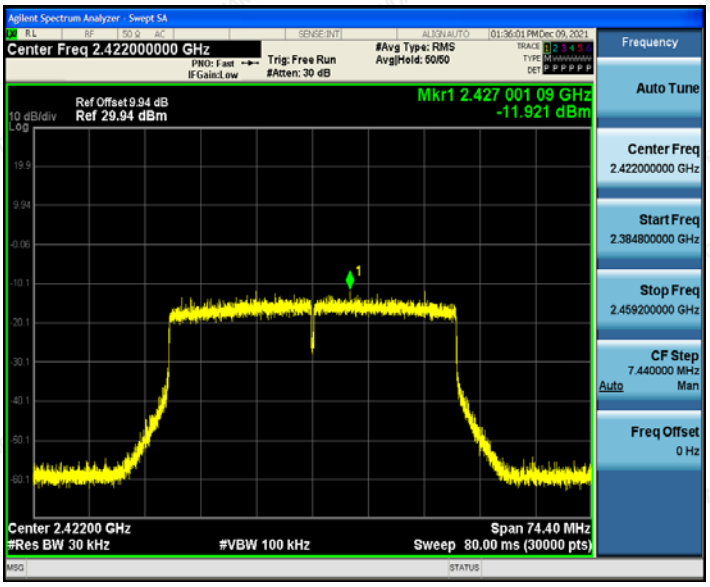


Highest channel

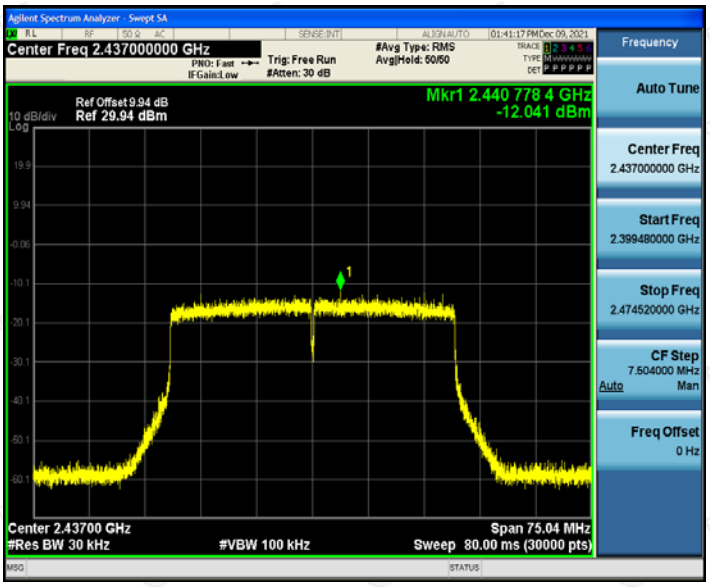


802.11ax (HT40) Modulation

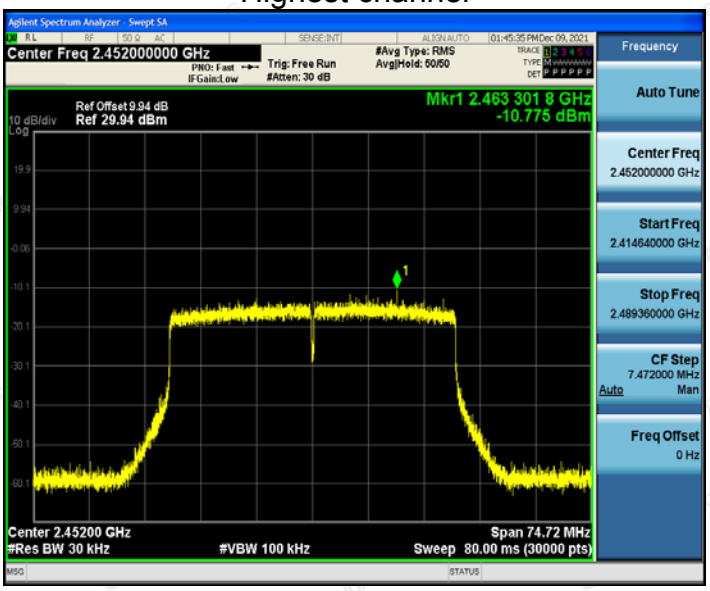
Lowest channel



Middle channel



Highest channel



For MIMO antenna port 1+antenna port 2			
Frequency	**Power Density (dBm)**	**Limit (dBm)**	**Result**
TX 802.11n/HT20 Mode			
2412 MHz	-15.38	7.99	**PASS**
2437 MHz	-14.29	7.99	**PASS**
2462 MHz	-15.39	7.99	**PASS**
TX 802.11n/HT40 Mode			
2422 MHz	-17.85	7.99	**PASS**
2437 MHz	-17.70	7.99	**PASS**
2452 MHz	-18.03	7.99	**PASS**
TX ac/HT20 Mode			
2412 MHz	-17.45	7.99	**PASS**
2437 MHz	-17.15	7.99	**PASS**
2462 MHz	-17.60	7.99	**PASS**
TX ac/HT40 Mode			
2422 MHz	-19.65	7.99	**PASS**
2437 MHz	-20.19	7.99	**PASS**
2452 MHz	-19.78	7.99	**PASS**
TX 802.11ax/HT20 Mode			
2412 MHz	-16.00	7.99	**PASS**
2437 MHz	-16.07	7.99	**PASS**
2462 MHz	-15.22	7.99	**PASS**
TX 802.11ax/HT40 Mode			
2422 MHz	-19.51	7.99	**PASS**
2437 MHz	-19.54	7.99	**PASS**
2452 MHz	-19.01	7.99	**PASS**
Note: 1 According to KDB 662911, Result power = $10\log(10^{(ant1/10)}+10^{(ant2/10)})$. 2 Result unit: W, The end result is converted to units of dBm. limit=8dBm-(direction gain-6dBi)=8-(3+10log2-6)=7.99dBm			

Note: This product supports antenna 1 and antenna 2 launch, but only support 802.11 n/TX ac/802.11ax for MIMO mode, not support 802.11 b and 802.11 g for MIMO mode.

4.5. CONDUCTED BAND EDGE AND SPURIOUS EMISSION MEASUREMENT

4.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074
Limit:	In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d). 5. Measure and record the results in the test report. 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

4.5.2. Test Instruments

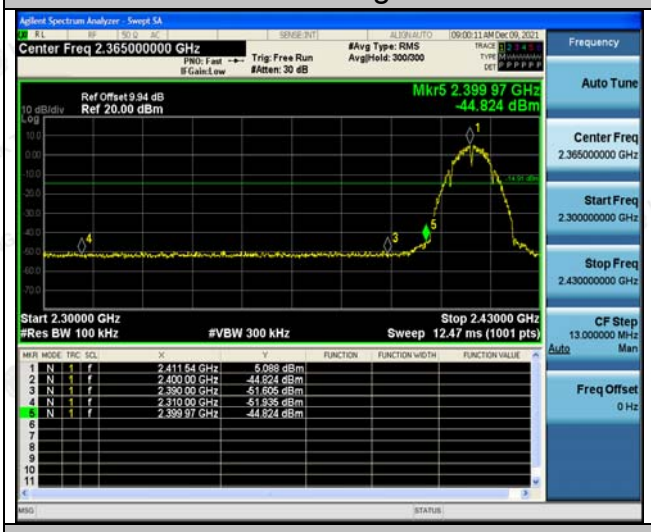
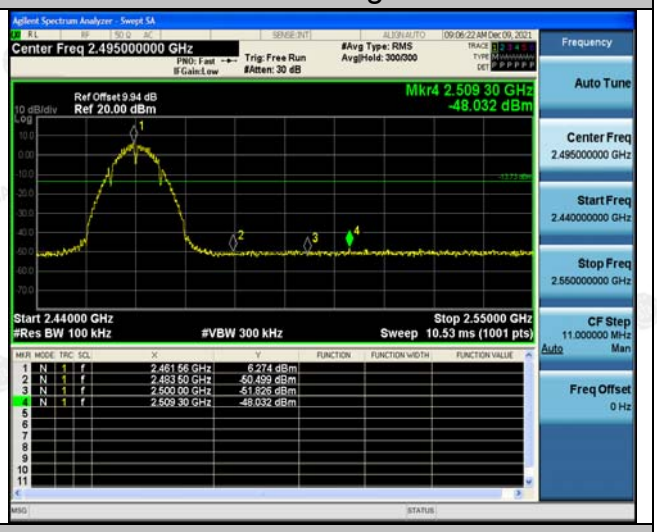
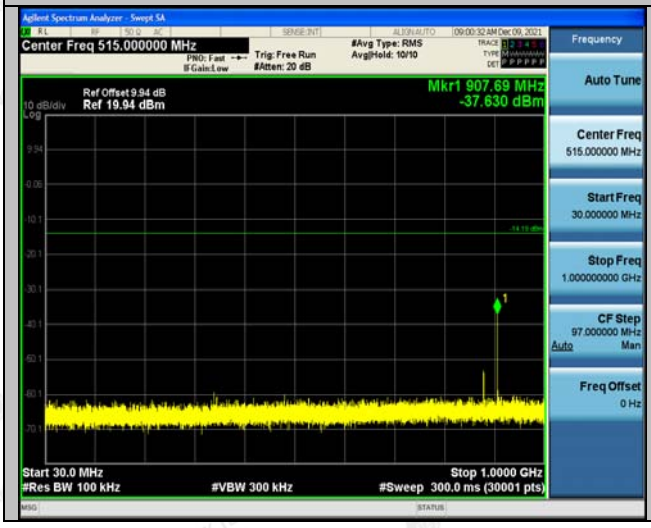
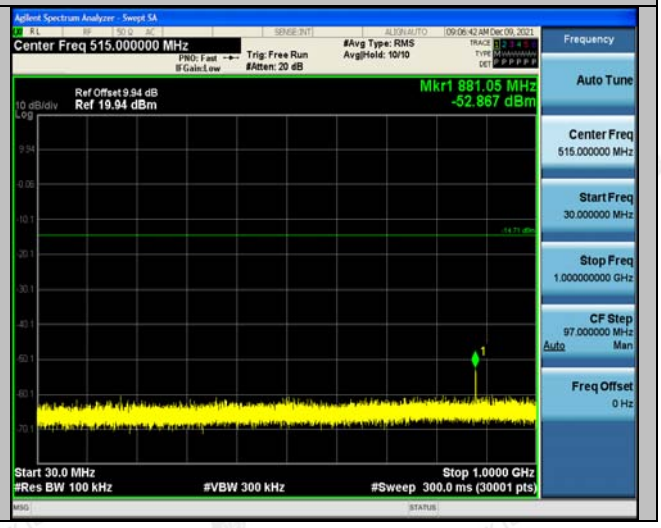
RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021	Dec. 08, 2022
Signal generator	Agilent	N5183A	HKE-071	Dec. 09, 2021	Dec. 08, 2022
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Dec. 09, 2021	Dec. 08, 2022
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 09, 2021	Dec. 08, 2022

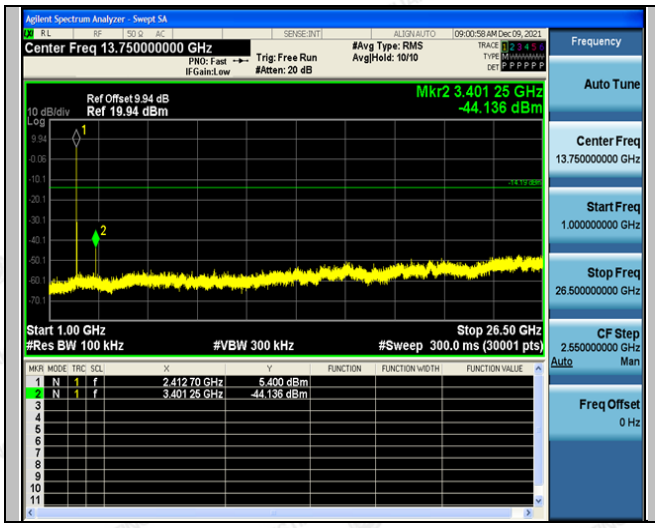
Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

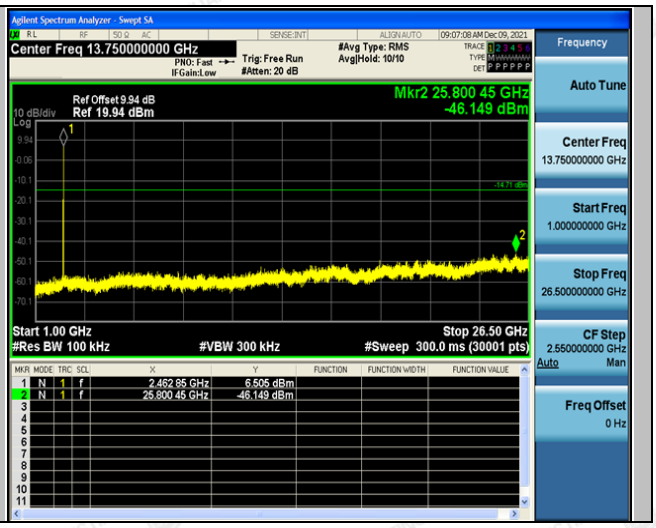
4.5.3. Test Data

Chain 1

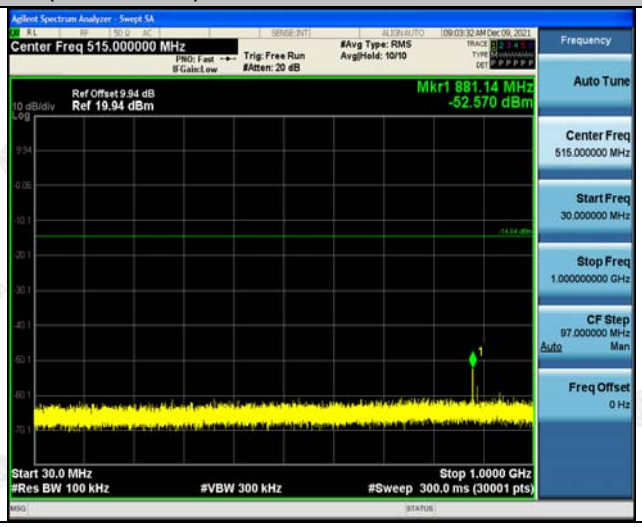
802.11b Modulation

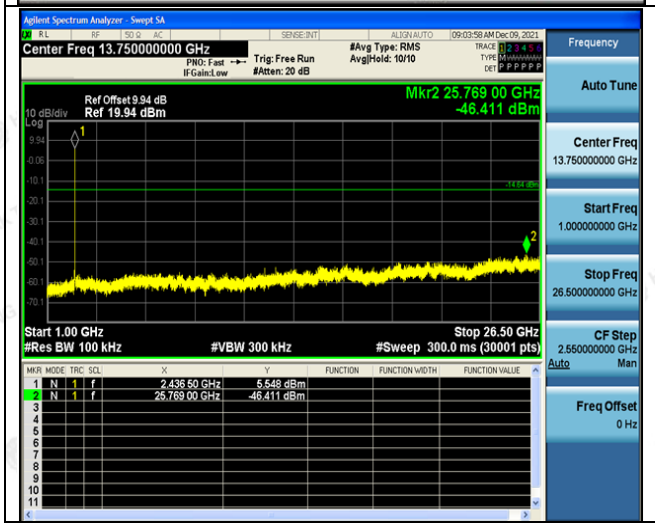
Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission(2412MHz)	Spurious Emission(2462MHz)
	
	



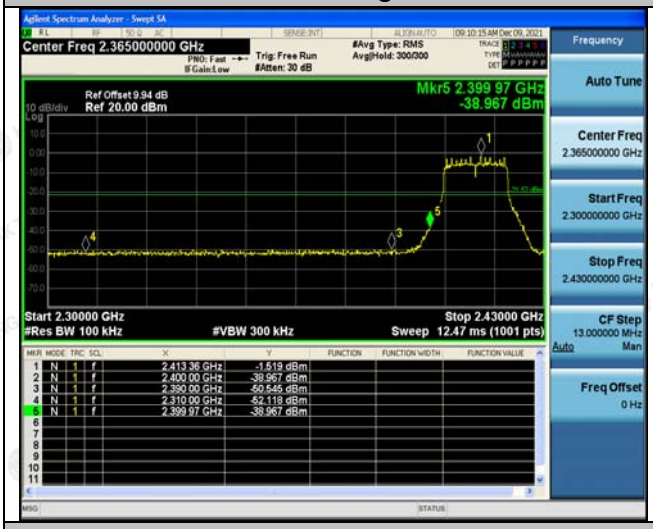
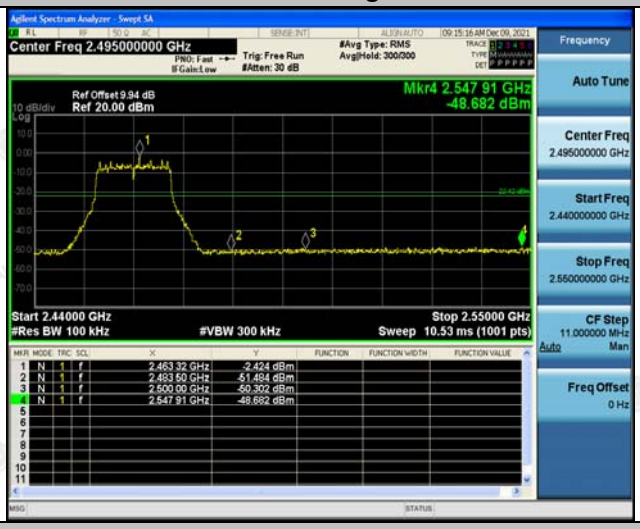


Spurious Emission(2437MHz)





802.11g Modulation

Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission(2412MHz)	Spurious Emission(2462MHz)