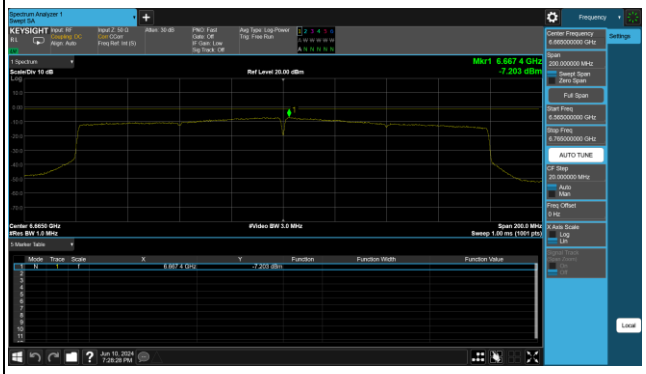
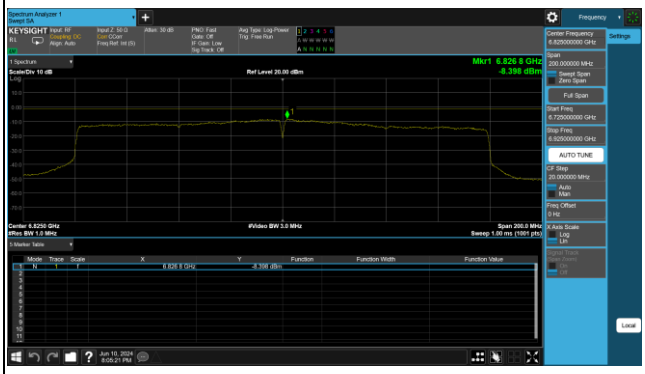
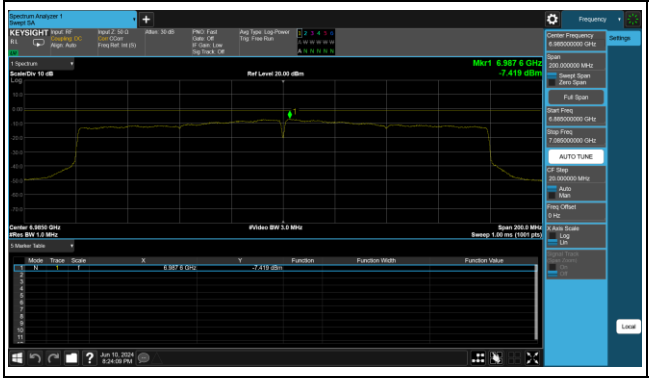
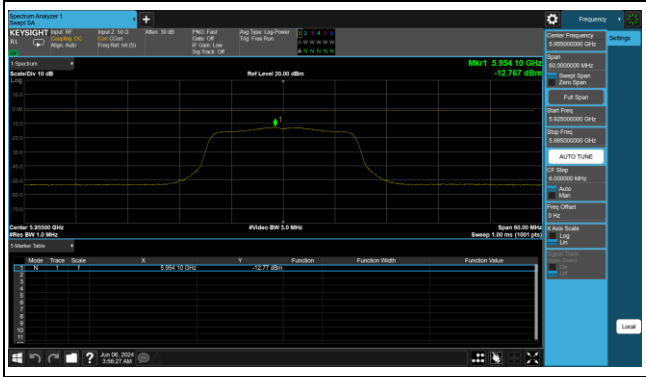
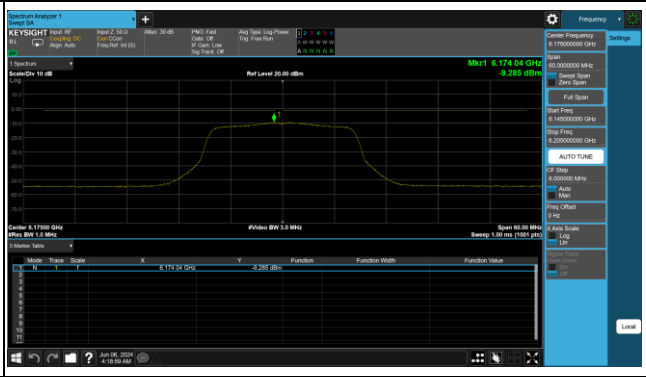
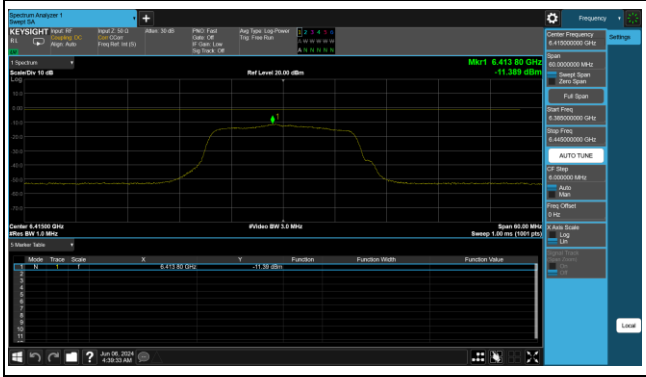
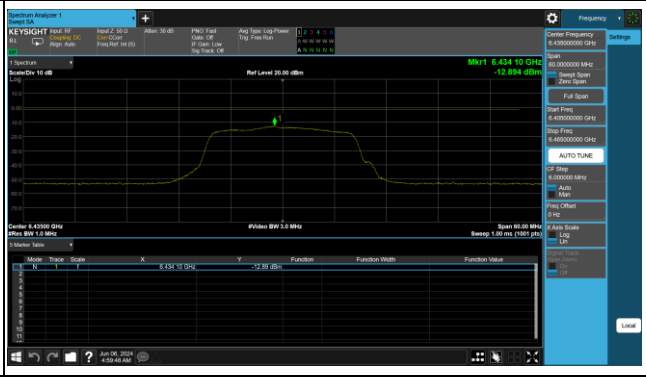
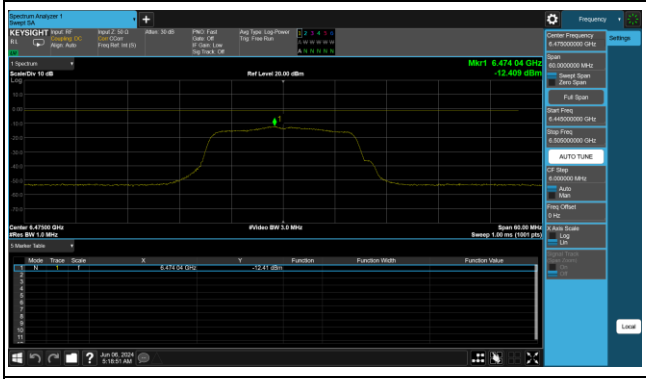
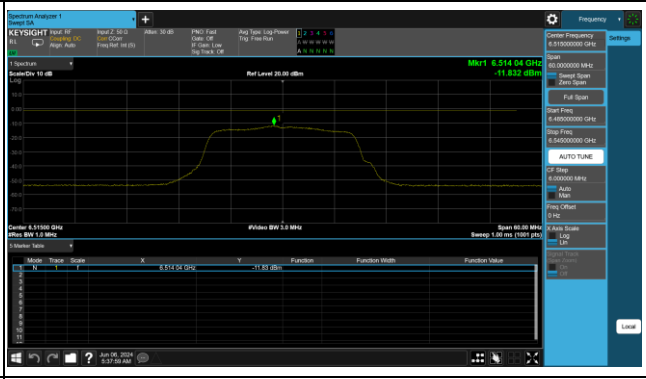
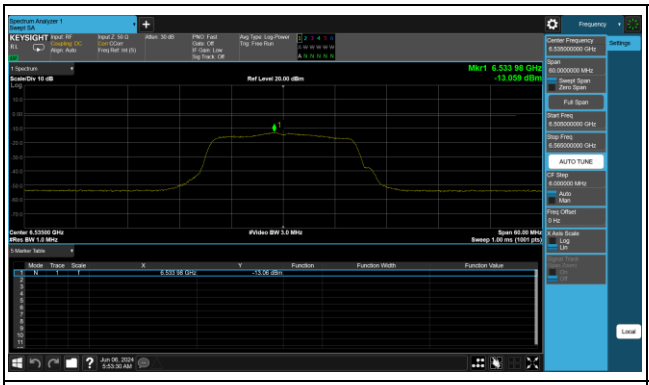
MIMO Antenna 8_802.11ax (HE160)

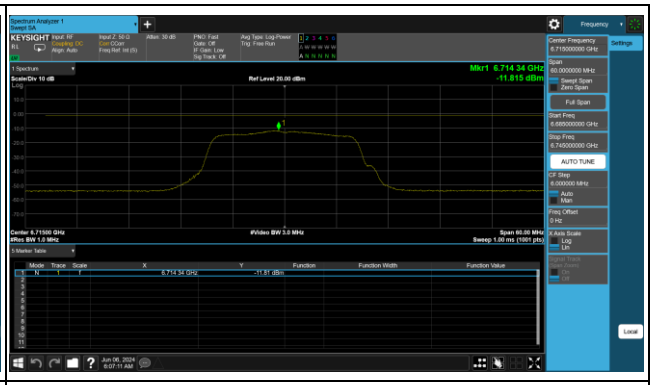
Spectrum Plot	
CH 15	CH 47
	
CH 79	CH 111
	
CH 143	CH 175
	
CH 207	
	

MIMO Antenna 9_802.11a

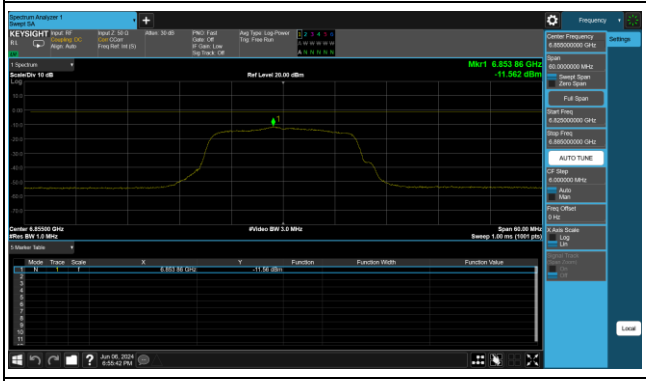
Spectrum Plot	
CH 1	CH 45
	
CH 93	CH 97
	
CH 105	CH 113
	
CH 117	CH 153



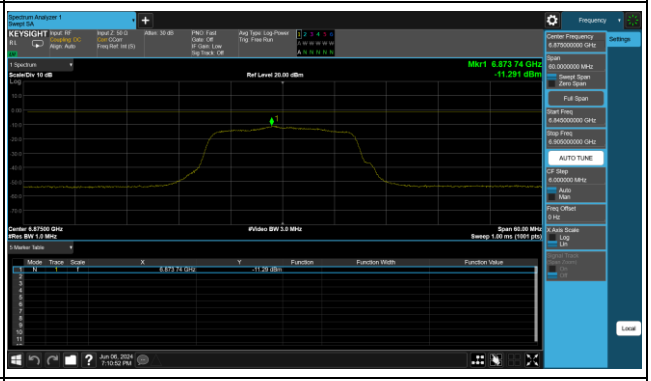
CH 181



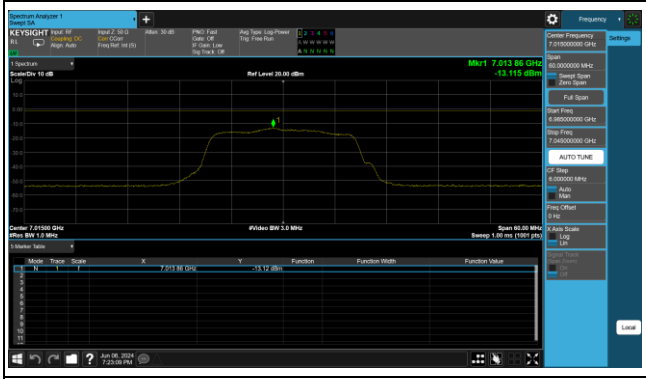
CH 185



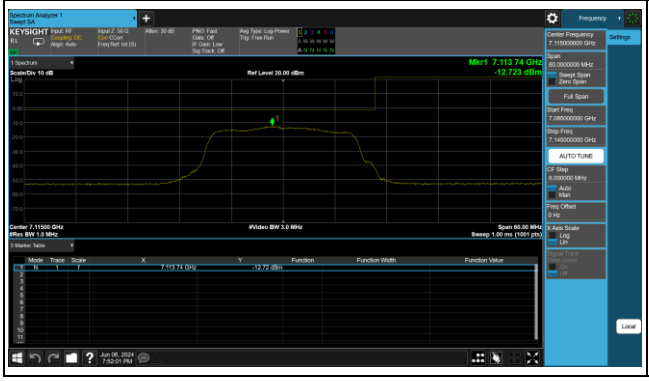
CH 213



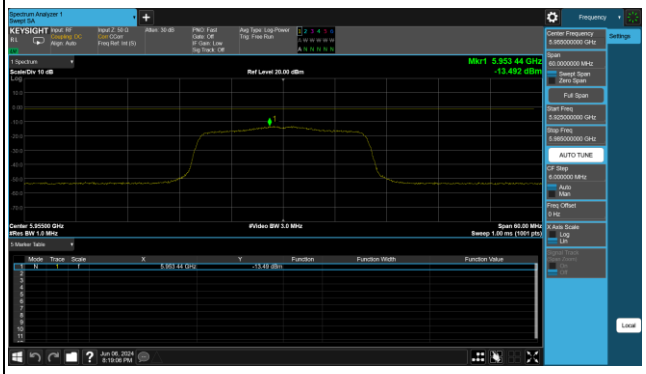
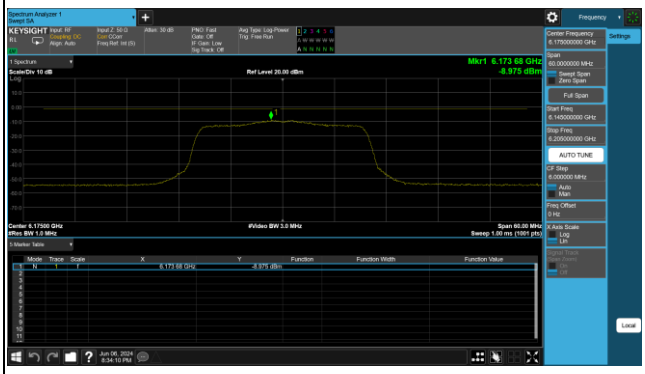
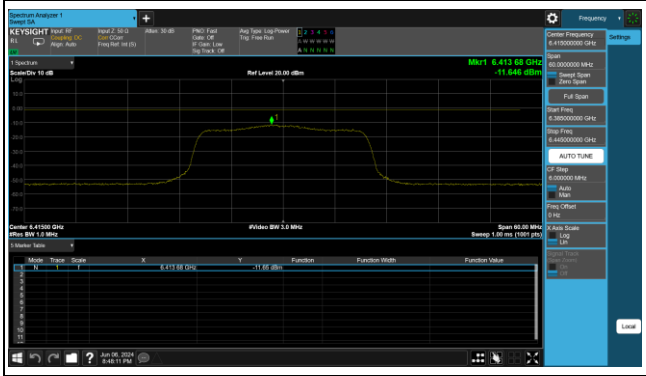
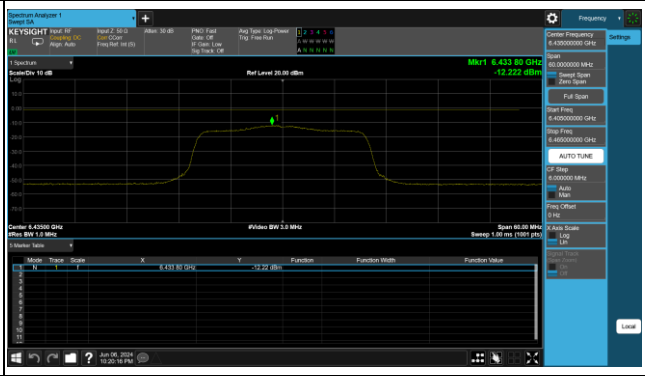
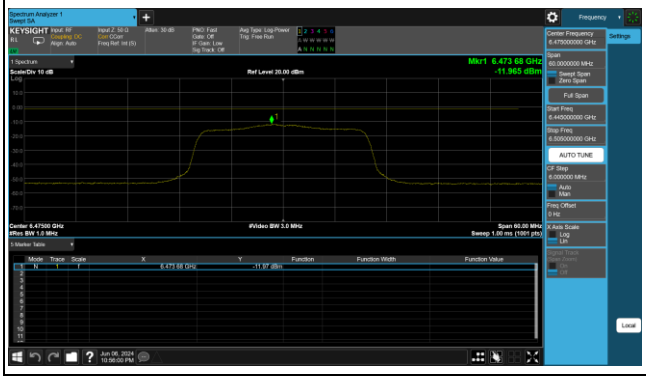
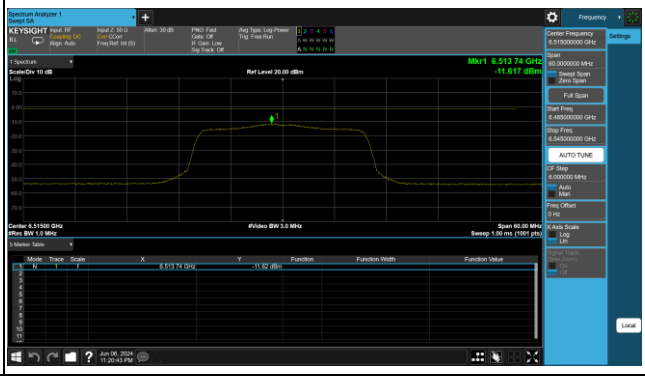
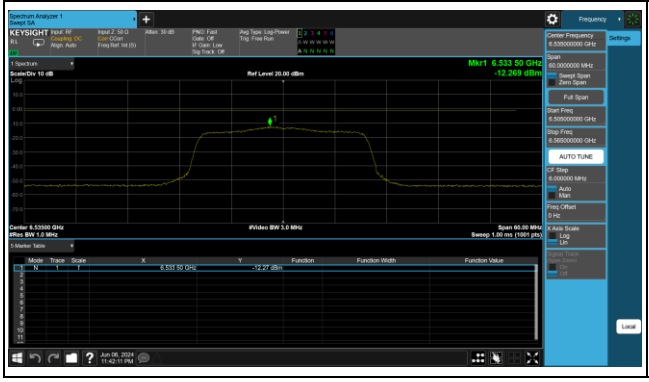
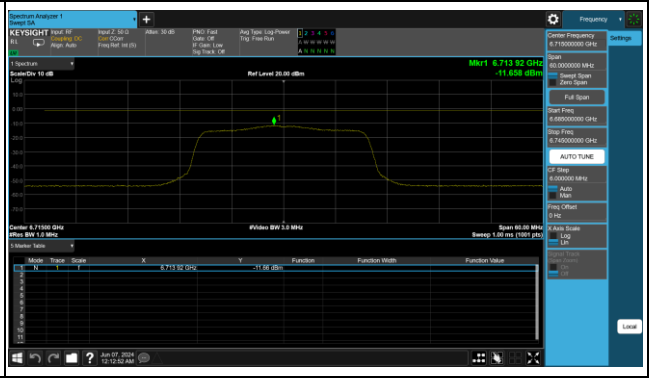
CH 229

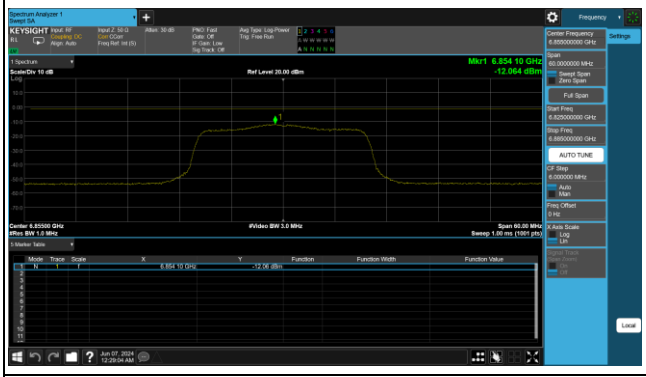
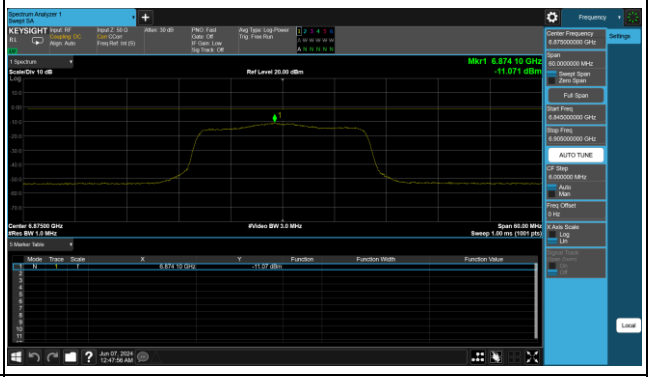
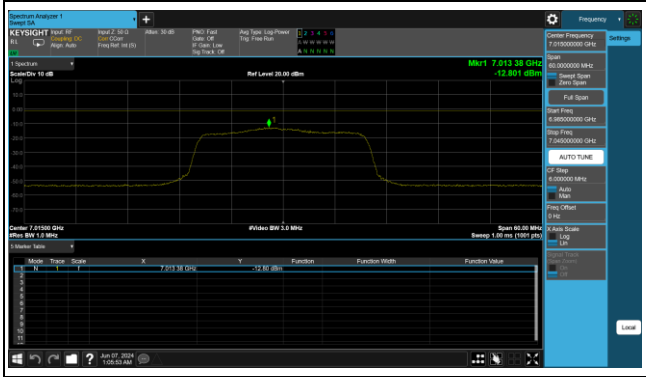
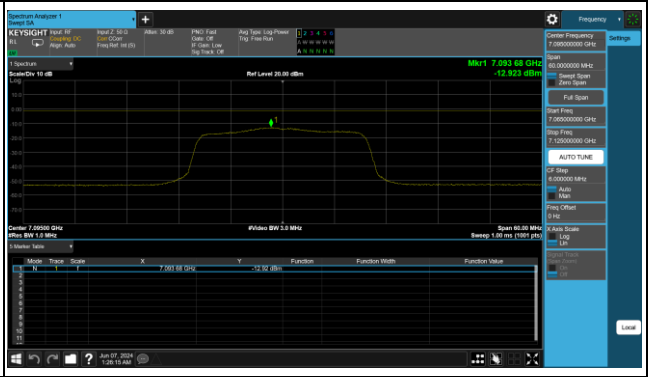
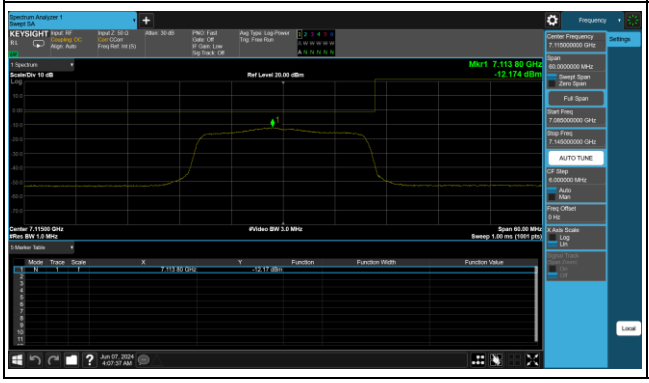


CH 233



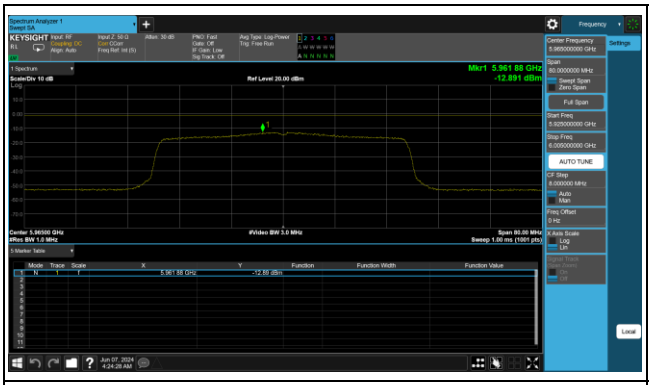
MIMO Antenna 9_802.11ax (HE20)

Spectrum Plot	
CH 1	CH 45
	
CH 93	CH 97
	
CH 105	CH 113
	
CH 117	CH 153
	

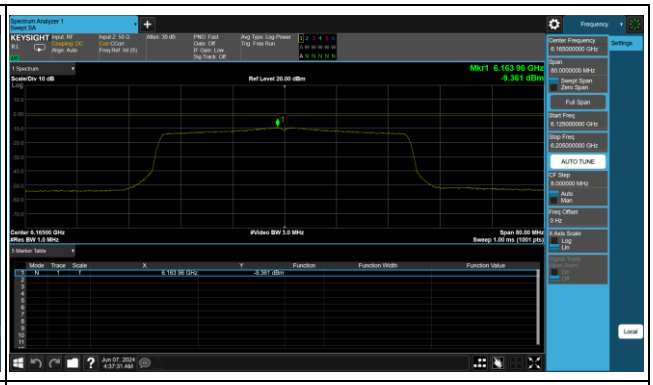
CH 181	CH 185
	
CH 213	**CH 229**
	
CH 233	
	

MIMO Antenna 9_802.11ax (HE40)

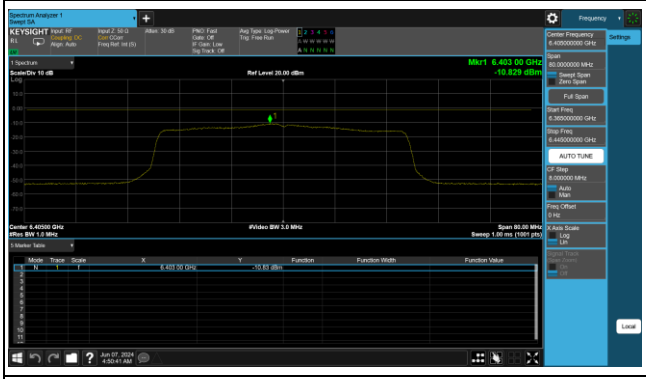
Spectrum Plot	
CH 3	CH 43



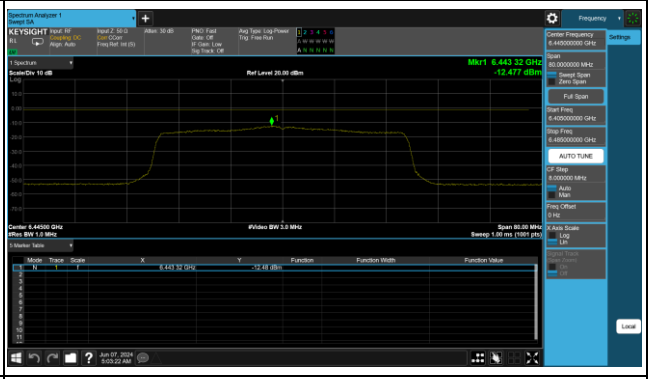
CH 91



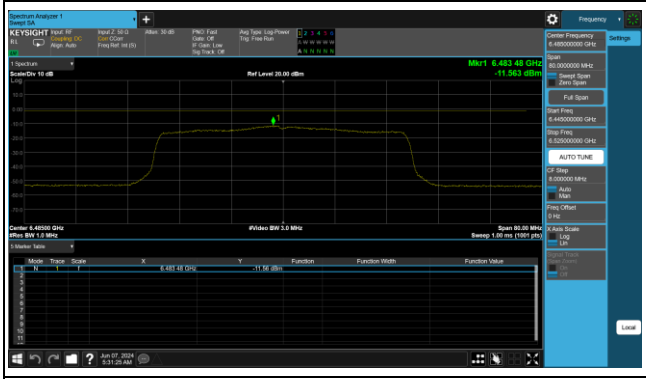
CH 99



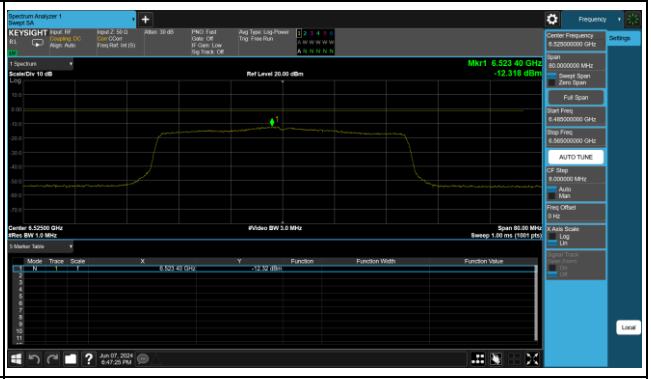
CH 107



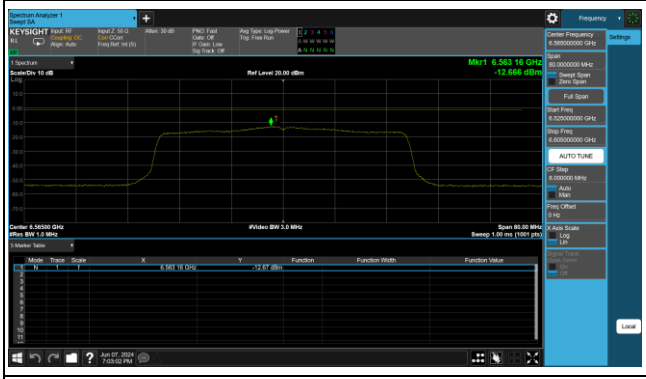
CH 115



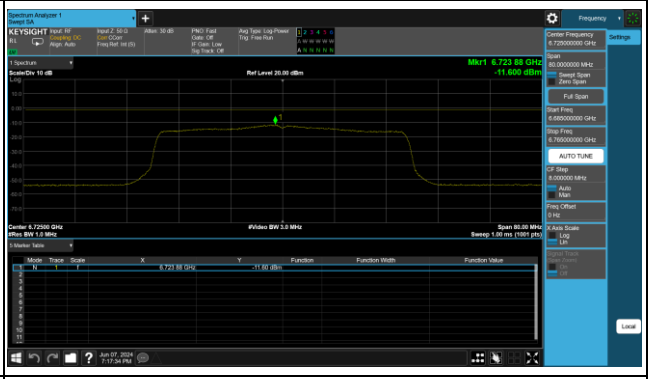
CH 123



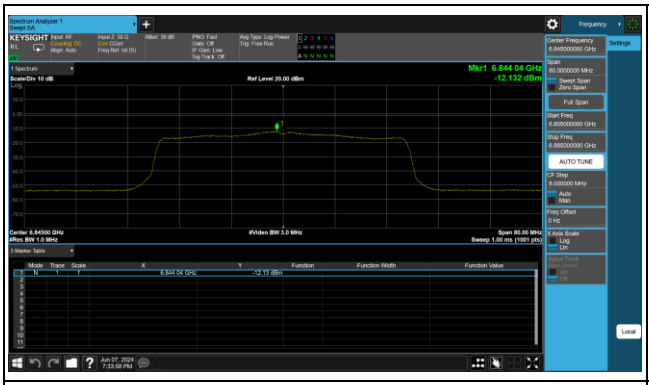
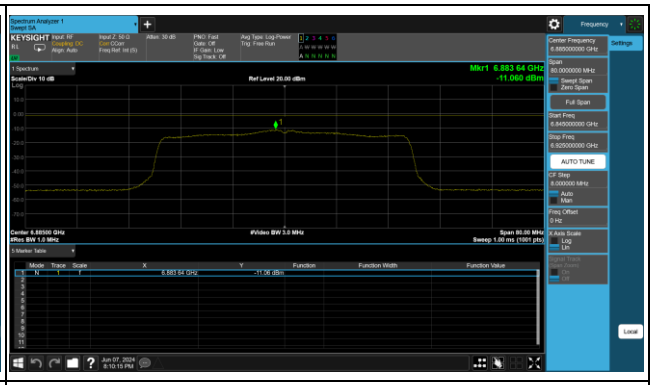
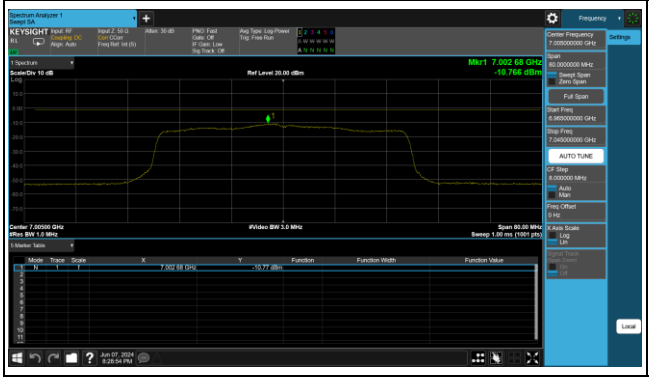
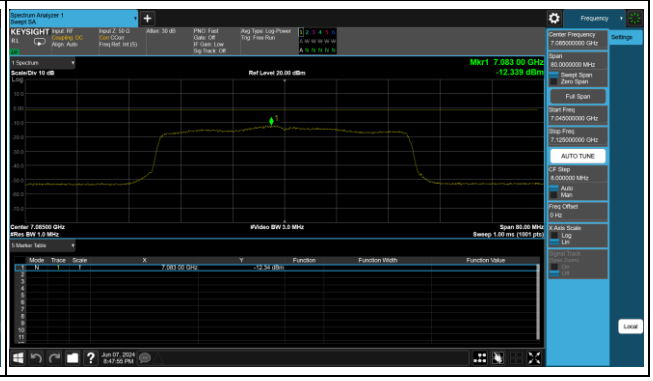
CH 155



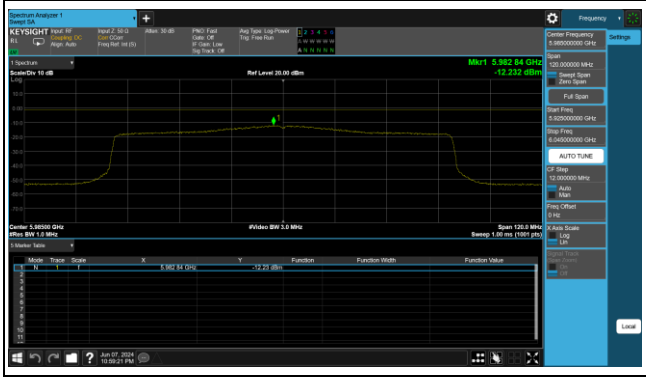
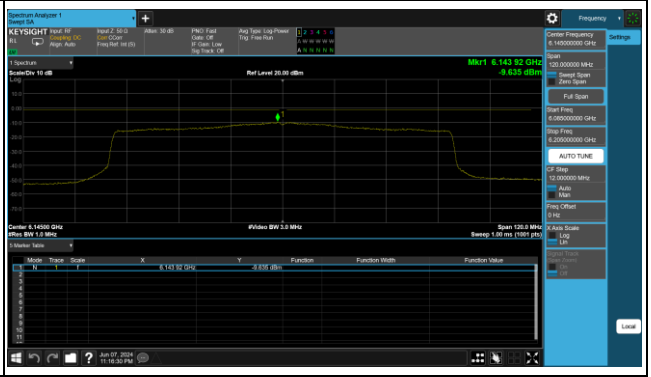
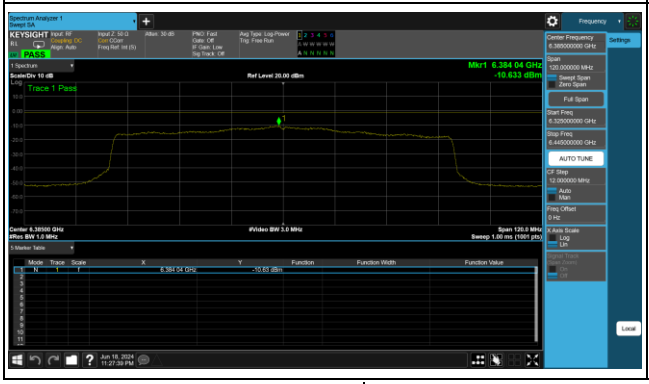
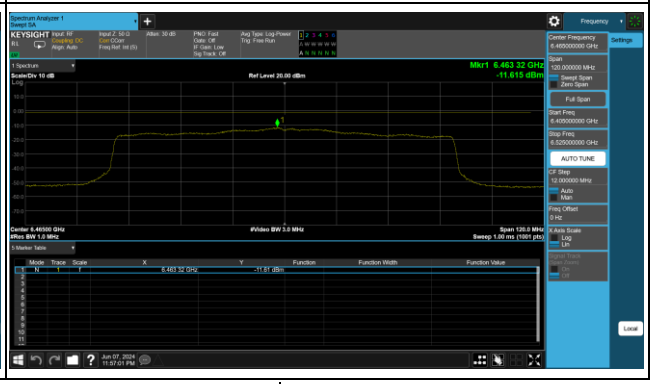
CH 179

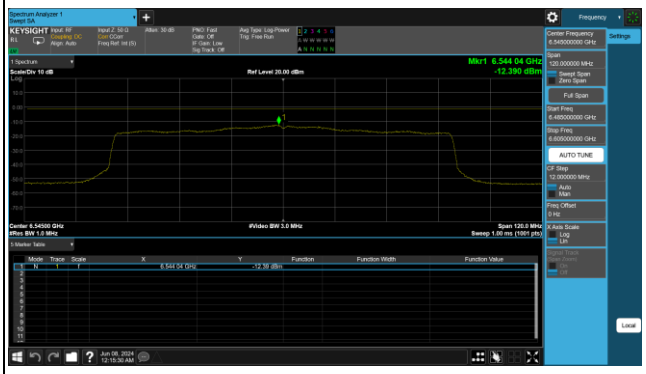
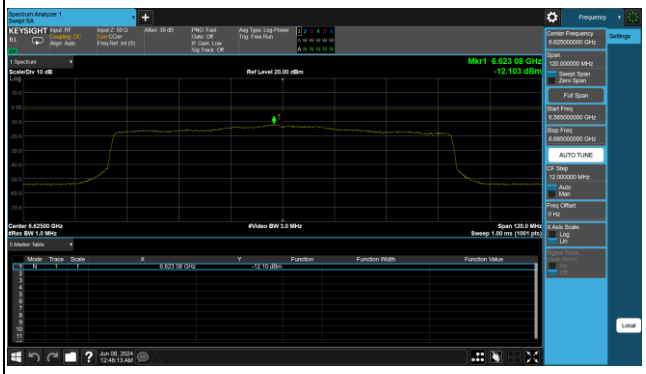
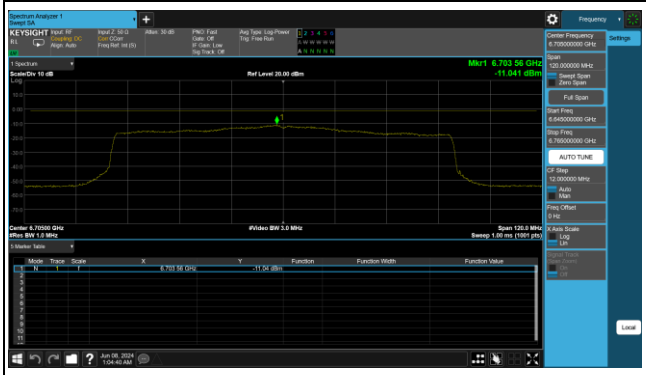
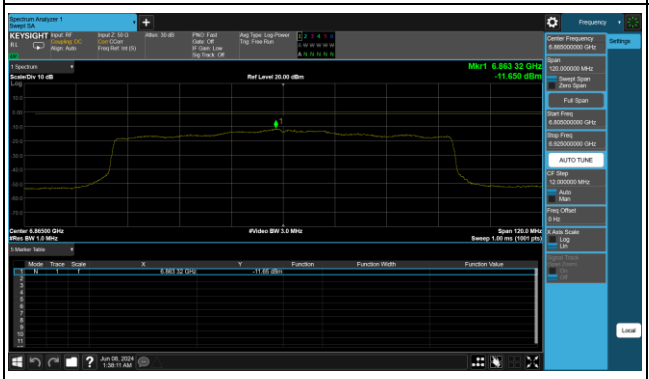
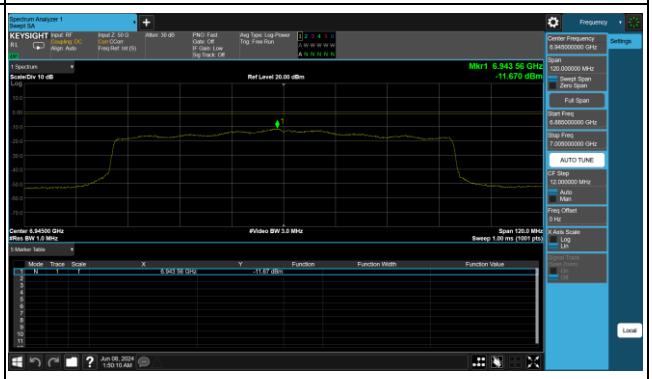
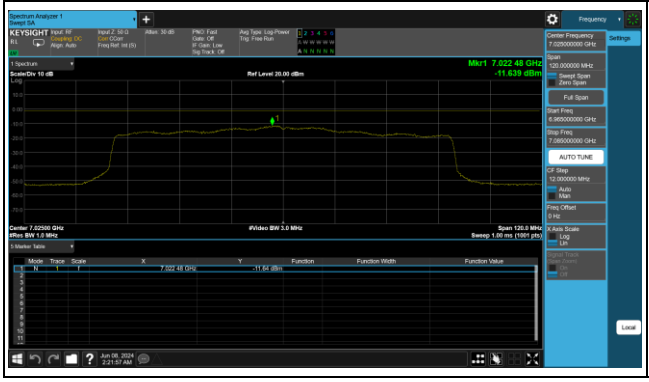


CH 187

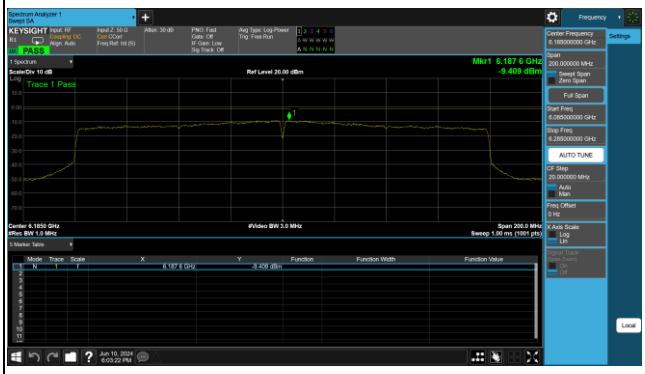
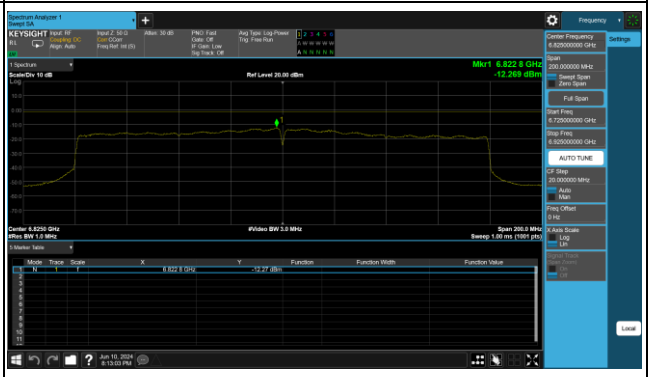
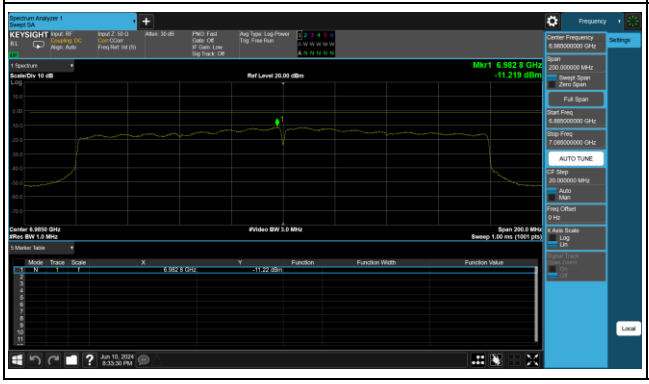
	
CH 211	CH 227
	

MIMO Antenna 9_802.11ax (HE80)

Spectrum Plot	
CH 7	CH 39
	
CH 87	CH 103
	

CH 119	CH 135
	
CH 151	CH 167
	
CH 183	CH 199
	
CH 215	
	

MIMO Antenna 9_802.11ax (HE160)

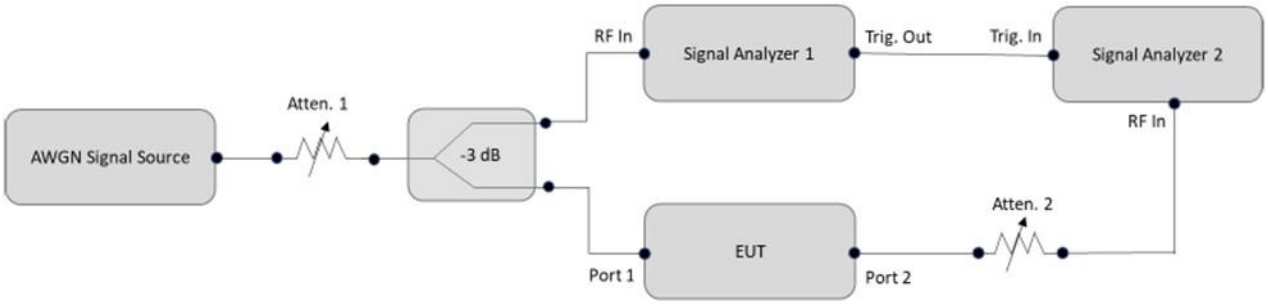
Spectrum Plot	
CH 15	CH 47
	
CH 79	CH 111
	
CH 143	CH 175
	
CH 207	
	

1.6 Contention Based Protocol Measurement

1.6.1 Limits of Contention Based Protocol Measurement

Unlicensed indoor low-power devices must detect co-channel radio frequency power that is at least -62 dBm (The threshold is referenced to a 0 dBi antenna gain.) or lower. Additionally, indoor low-power devices must detect co-channel energy with 90% or greater certainty.

1.6.2 Test Setup



1.6.3 Test Procedure

a. Set the signal analyzer center frequency to the nominal EUT channel center frequency. The span range of the signal analyzer shall be between two times and five times the OBW of the EUT. Connect the output port of the EUT to the signal analyzer 2. Ensure that the attenuator 2 provides enough attenuation to not overload the signal analyzer 2 receiver.
b. Monitoring the signal analyzer 2, verify the EUT is operating and transmitting with the parameters (set as following section 4.7.5 EUT operating condition).
c. Determine number of times detection threshold test as following table,

If	Number of Tests	Placement of Incumbent Transmission
$BW_{EUT} \leqq BW_{Inc}$	Once	Same as EUT transmission
$BW_{Inc} < BW_{EUT} \leqq 2xBW_{Inc}$	Once	Contained within BW_{EUT}
$2xBW_{Inc} < BW_{EUT} \leqq 4xBW_{Inc}$	Twice. (Incumbent transmission is contained within BW_{EUT})	Closely to the lower edge and upper edge of the EUT Channel
$BW_{EUT} > 4xBW_{Inc}$	Three times	Closely to the lower edge ,in the middle and upper edge of the EUT Channel

d. Using an AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use step c table to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.
e. Set the AWGN signal power to an extremely low level (more than 20 dB below the -62 dBm threshold). Connect the AWGN signal source, via a 3-dB splitter, to the signal analyzer 1 and the EUT.
f. Transmit the AWGN signal (RF ON) and verify its characteristics on the signal analyzer 1.
g. Monitor the signal analyzer 2 to verify if the AWGN signal has been detected and the EUT has ceased transmission. If the EUT continues to transmit, then incrementally increase the AWGN signal power level until the EUT stops transmitting.
h. (Including all losses in the RF paths) Determine and record the AWGN signal power level (at the EUT's antenna port) at which the EUT ceased transmission. Repeat the procedure at least 10 times to verify the EUT can detect an AWGN signal with 90% (or better) level of certainty.
i. Refer to step c table to determine number of times the detection threshold testing needs to be repeated. If testing is required more than once, then go back to step d, choose a different center frequency for the AWGN signal and repeat the process.

1.6.4 EUT Operating Condition

Set the EUT to transmit with a constant duty cycle and relative operating parameters which including power level, operating frequency,modulation and bandwidth.

1.6.5 Test Results

UNII Band 5:

Contention Based Protocol Measurement										
Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Freq. (MHz)	Injected Signal (AWGN)		Antenna Gain (dBi)	Path Loss (dB)	Adjusted Power (dBi)	Detection Limit	EUT TX Status
				Freq. (MHz)	Power (dBm)					
802.11ax	20	45	6175	6175	-83.00	-0.82	2.5	-79.68	-62	OFF
					-85.00	-0.82	2.5	-81.68	-62	Minimal
					-86.00	-0.82	2.5	-82.68	-62	ON

Note: Adjusted Power = Injected Signal (AWGN) Power - Antenna Gain + Path Loss

Contention Based Protocol Detection Probability															
Operation Mode	Channel Bandwidth (MHz)	AWGN Signal Freq. (MHz)	#01	#02	#03	#04	#05	#06	#07	#08	#09	#10	Detection Probability	Detection Limit	Test Result
802.11ax	20	6175	v	v	v	v	v	v	v	v	v	v	100%	90%	Pass

UNII Band 6:

Contention Based Protocol Measurement										
Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Freq. (MHz)	Injected Signal (AWGN)		Antenna Gain (dBi)	Path Loss (dB)	Adjusted Power (dBi)	Detection Limit	EUT TX Status
				Freq. (MHz)	Power (dBm)					
802.11ax	20	105	6475	6475	-88.00	-7.91	2.5	-77.59	-62	OFF
					-90.00	-7.91	2.5	-79.59	-62	Minimal
					-91.00	-7.91	2.5	-80.59	-62	ON

Note: Adjusted Power = Injected Signal (AWGN) Power - Antenna Gain + Path Loss

Contention Based Protocol Detection Probability															
Operation Mode	Channel Bandwidth (MHz)	AWGN Signal Freq. (MHz)	#01	#02	#03	#04	#05	#06	#07	#08	#09	#10	Detection Probability	Detection Limit	Test Result
802.11ax	20	6475	v	v	v	v	v	v	v	v	v	v	100%	90%	Pass

UNII Band 7:

Contention Based Protocol Measurement										
Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Freq. (MHz)	Injected Signal (AWGN)		Antenna Gain (dBi)	Path Loss (dB)	Adjusted Power (dBi)	Detection Limit	EUT TX Status
				Freq. (MHz)	Power (dBm)					
802.11ax	20	153	6715	6715	-79.00	-5.07	2.5	-71.43	-62	OFF
					-86.00	-5.07	2.5	-78.43	-62	Minimal
					-87.00	-5.07	2.5	-79.43	-62	ON

Note: Adjusted Power = Injected Signal (AWGN) Power - Antenna Gain + Path Loss

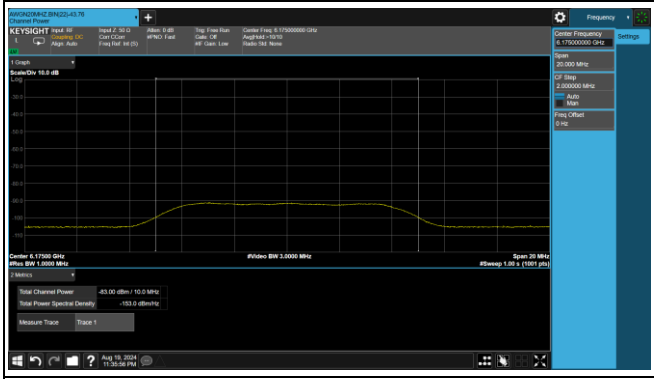
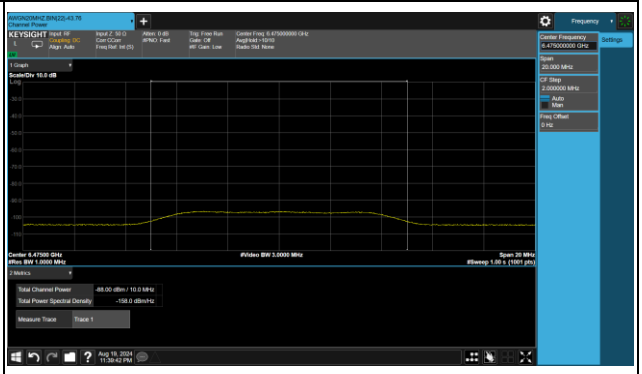
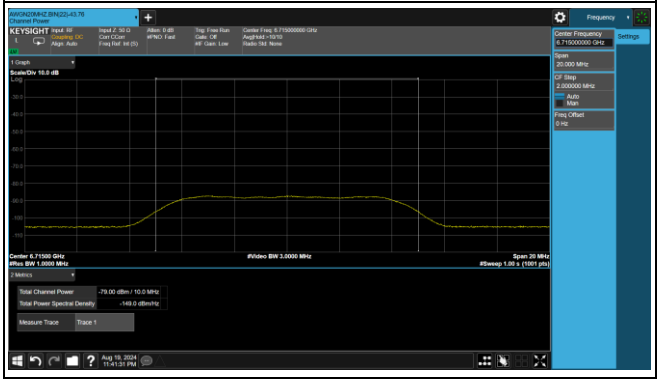
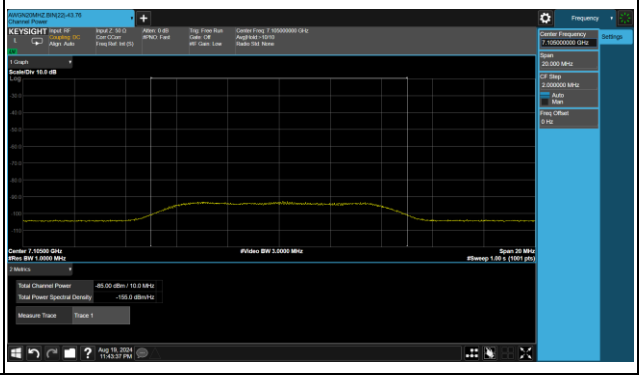
Contention Based Protocol Detection Probability														
Operation Mode	Channel Bandwidth (MHz)	AWGN Signal Freq. (MHz)	#01	#02	#03	#04	#05	#06	#07	#08	#09	#10	Detection Probability	Detection Limit	Test Result
802.11ax	20	6695	v	v	v	v	v	v	v	v	v	v	100%	90%	Pass

UNII Band 8:

Contention Based Protocol Measurement										
Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Freq. (MHz)	Injected Signal (AWGN)		Antenna Gain (dBi)	Path Loss (dB)	Adjusted Power (dBi)	Detection Limit	EUT TX Status
				Freq. (MHz)	Power (dBm)					
802.11ax	20	213	7015	7015	-85.00	-2.55	2.5	-79.95	-62	OFF
					-87.00	-2.55	2.5	-81.95	-62	Minimal
					-88.00	-2.55	2.5	-82.95	-62	ON

Note: Adjusted Power = Injected Signal (AWGN) Power - Antenna Gain + Path Loss

Contention Based Protocol Detection Probability														
Operation Mode	Channel Bandwidth (MHz)	AWGN Signal Freq. (MHz)	#01	#02	#03	#04	#05	#06	#07	#08	#09	#10	Detection Probability	Detection Limit	Test Result
802.11ax	20	6995	v	v	v	v	v	v	v	v	v	v	100%	90%	Pass

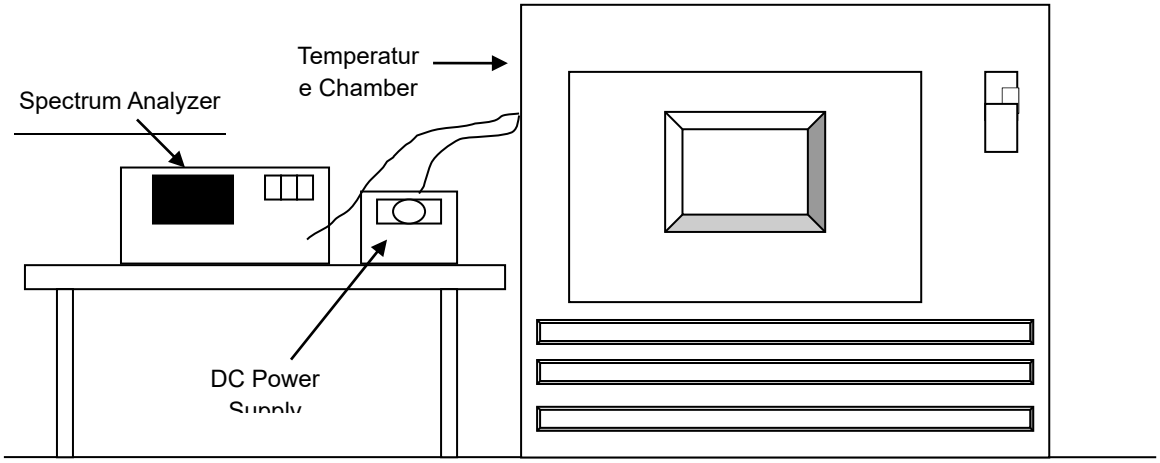
Plots of Incumbent signal (AWGN) Level	
UNII Band 5 / CH45	**UNII Band 6 / CH105**
	
UNII Band 7 / CH153	**UNII Band 8 / CH213**
	

1.7 Frequency Stability

1.7.1 Limits of Frequency Stability Measurement

The frequency of the carrier signal shall be maintained within band of operation

1.7.2 Test Setup



1.7.3 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.

b. Turn the EUT on and couple its output to a spectrum analyzer.

c. Turn the EUT off and set the chamber to the highest temperature specified.

d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.

e. Repeat step d with every 10 degrees reduction until the lowest temperature achieved.

f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

1.7.4 Deviation from Test Standard

No deviation.

1.7.5 EUT Operating Condition

Set the EUT transmit at un-modulation mode to test frequency stability.

1.7.6 Test Results

Under control of Indoor AP:

Frequency Stability Versus Temp.									
Operating Frequency: 5955MHz									
Temp. (℃)	Power Supply (Adapter)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result
50	3.85	5954.9833	Pass	5954.9825	Pass	5954.9829	Pass	5954.9858	Pass
40	3.85	5954.9869	Pass	5954.9823	Pass	5954.9833	Pass	5954.9825	Pass
30	3.85	5955.0094	Pass	5955.0088	Pass	5955.0082	Pass	5955.0127	Pass
20	3.85	5955.0188	Pass	5955.0205	Pass	5955.0186	Pass	5955.0177	Pass
10	3.85	5955.011	Pass	5955.0081	Pass	5955.0121	Pass	5955.0124	Pass
0	3.85	5954.9922	Pass	5954.9898	Pass	5954.9924	Pass	5954.9915	Pass
-10	3.85	5954.9984	Pass	5954.9995	Pass	5954.996	Pass	5954.9957	Pass
-20	3.85	5954.9811	Pass	5954.9804	Pass	5954.9776	Pass	5954.9795	Pass

Frequency Stability Versus Voltage									
Operating Frequency: 5955MHz									
Temp. (℃)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result	Measured Frequency (MHz)	Result
20	4.35	5955.0188	Pass	5955.0205	Pass	5955.0181	Pass	5955.0177	Pass
	3.85	5955.0188	Pass	5955.0205	Pass	5955.0186	Pass	5955.0177	Pass
	3.40	5955.0194	Pass	5955.0202	Pass	5955.0175	Pass	5955.0187	Pass

1.8 Operational Restrictions for 6 GHz U-NII Devices

1.8.1 Limits of Operational Restrictions for 6 GHz U-NII Devices

(1) Operation of indoor access points in the 5.925-7.125 GHz band is prohibited on oil platforms, cars, trains, boats, and aircraft, except that indoor access points are permitted to operate in the 5.925-6.425 GHz bands in large aircraft while flying above 10,000 feet.
(2) Operation of transmitters in the 5.925-7.125 GHz band is prohibited for control of or communications with unmanned aircraft systems.
(3) Transmitters operating under indoor access points are limited to indoor locations.
(4) In the 5.925-7.125 GHz band, indoor access points must bear the following statement in a conspicuous location on the device and in the user's manual: FCC regulations restrict operation of this device to indoor use only. The operation of this device is prohibited on oil platforms, cars, trains, boats, and aircraft, except that operation of this device is permitted in large aircraft while flying above 10,000 feet.
(5) In the 5.925-7.125 GHz band, Access points may connect to other access points or subordinate devices.
(6) Indoor access points, operating in the 5.925-7.125 GHz band must employ a contention-based protocol.

1.8.2 Test Setup

N/A

1.8.3 Test Instruments

N/A

1.8.4 Test Procedure

N/A.

1.8.5 Test Results

Device is an client device under the control of a low power indoor access point. Please refer to the declaration letter exhibit supplied within this application.

--END--