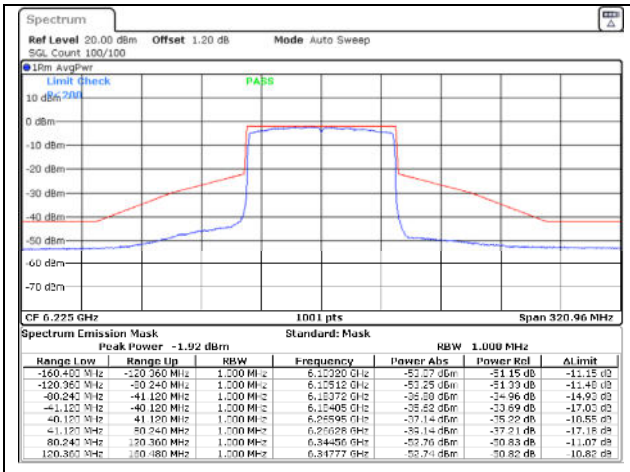
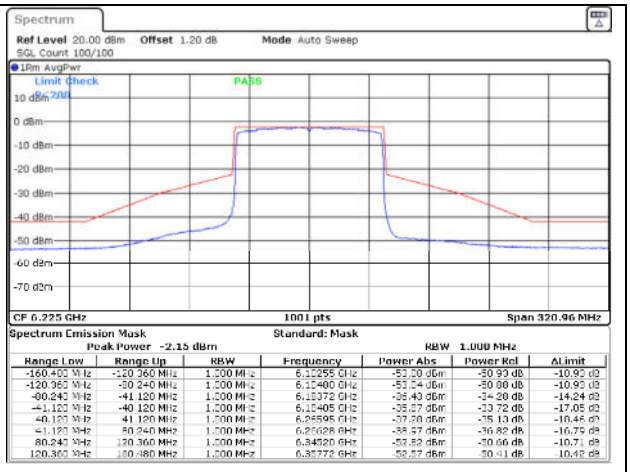
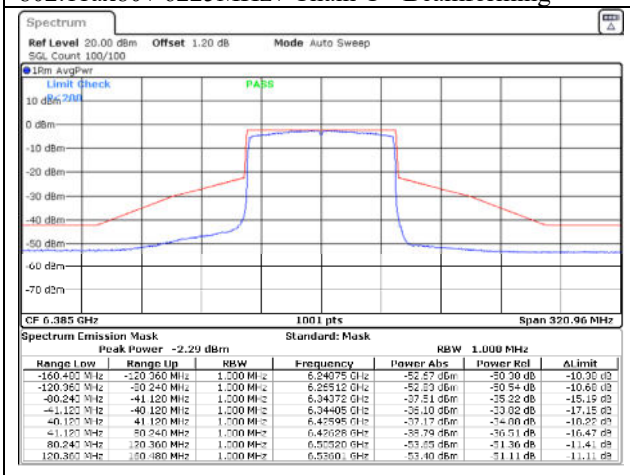


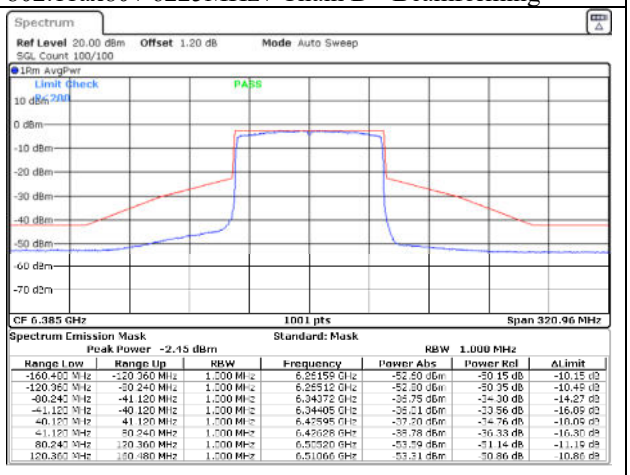
802.11ax80 / 6225MHz / Chain C - Beamforming



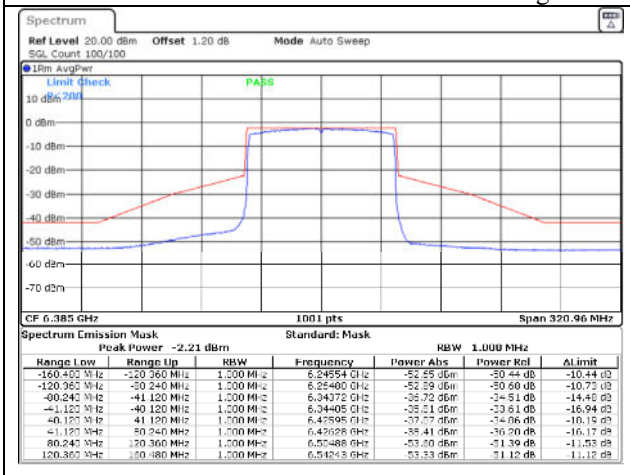
802.11ax80 / 6225MHz / Chain D - Beamforming



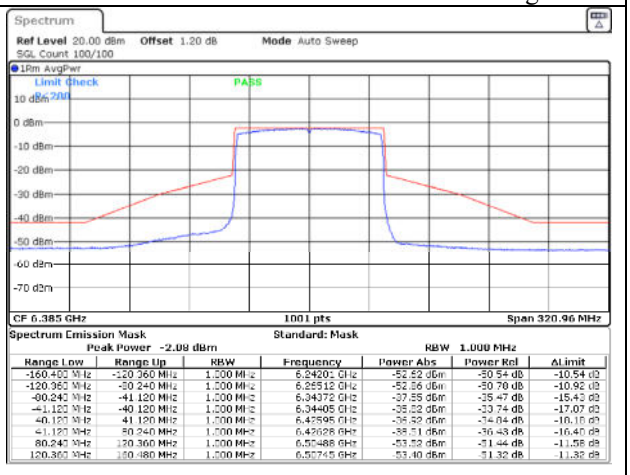
802.11ax80 / 6385MHz / Chain A - Beamforming



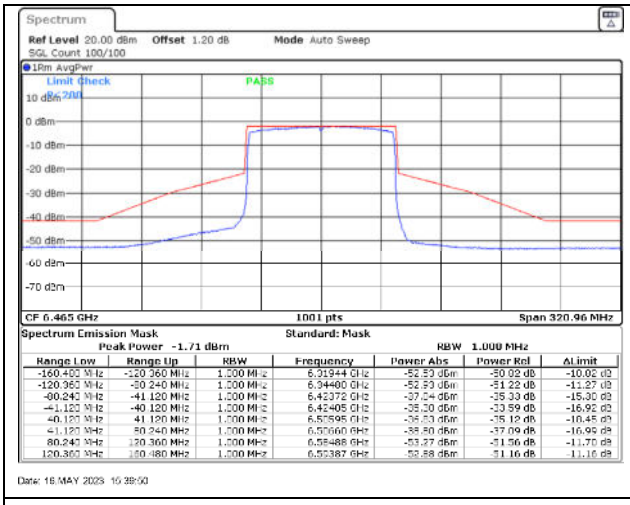
802.11ax80 / 6385MHz / Chain B - Beamforming



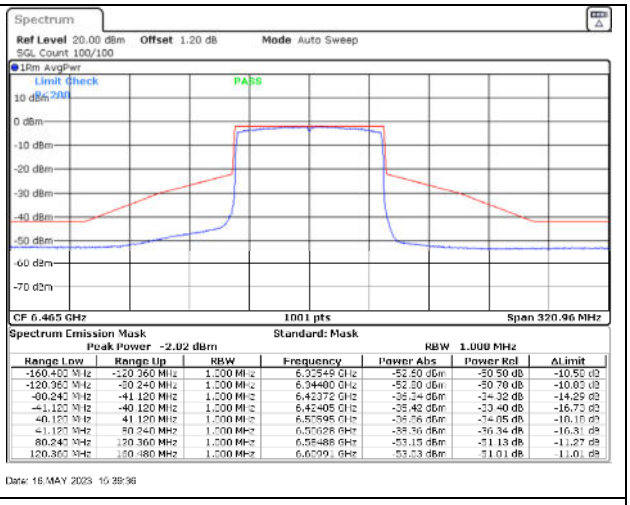
802.11ax80 / 6385MHz / Chain C - Beamforming



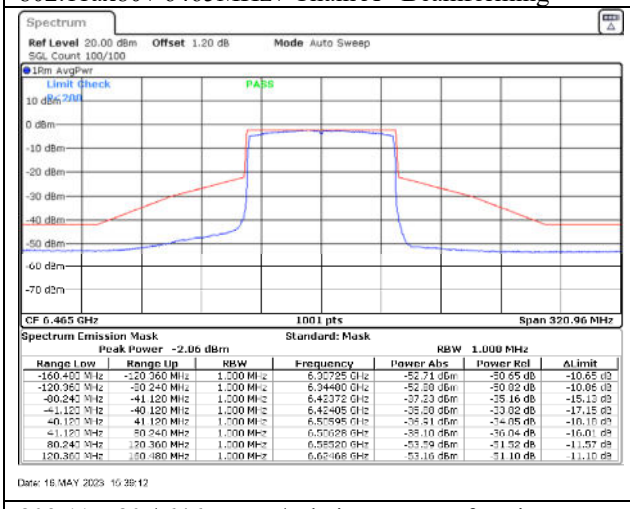
802.11ax80 / 6385MHz / Chain D - Beamforming



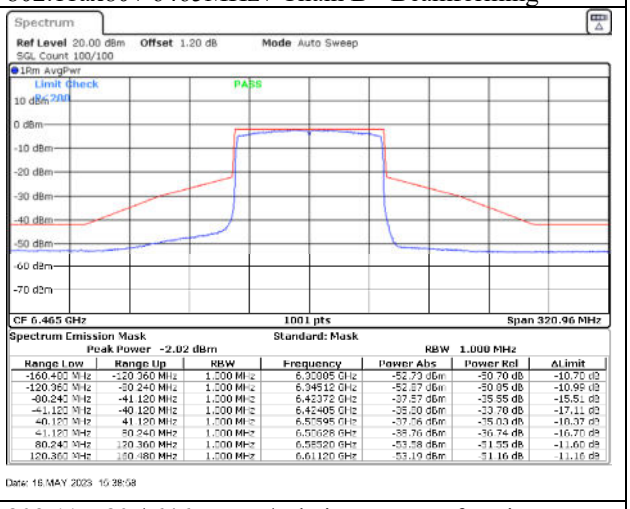
802.11ax80 / 6465MHz / Chain A - Beamforming



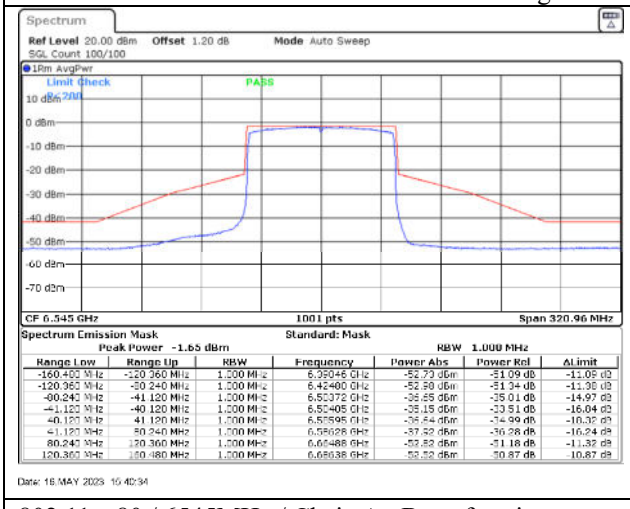
802.11ax80 / 6465MHz / Chain B - Beamforming



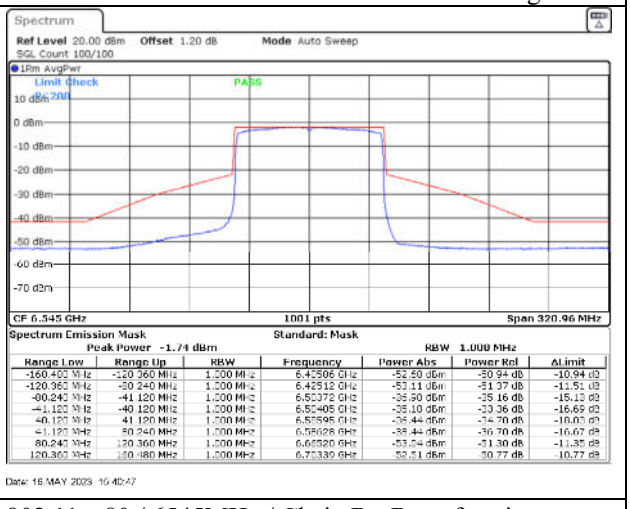
802.11ax80 / 6465MHz / Chain C - Beamforming



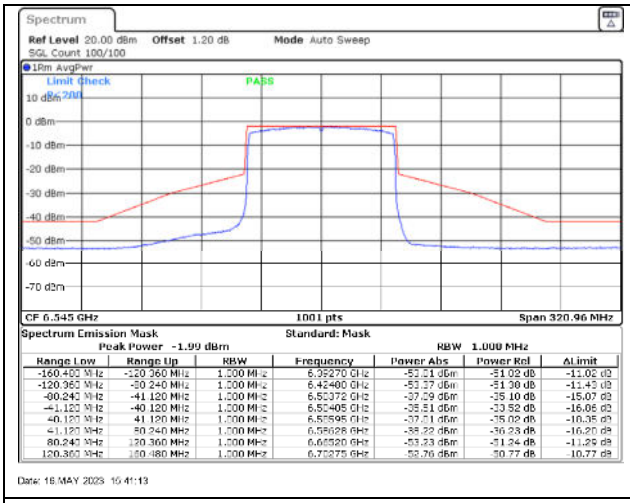
802.11ax80 / 6465MHz / Chain D - Beamforming



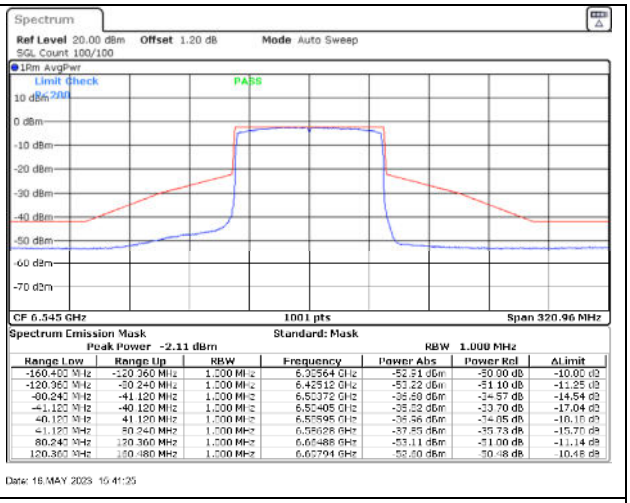
802.11ax80 / 6545MHz / Chain A - Beamforming



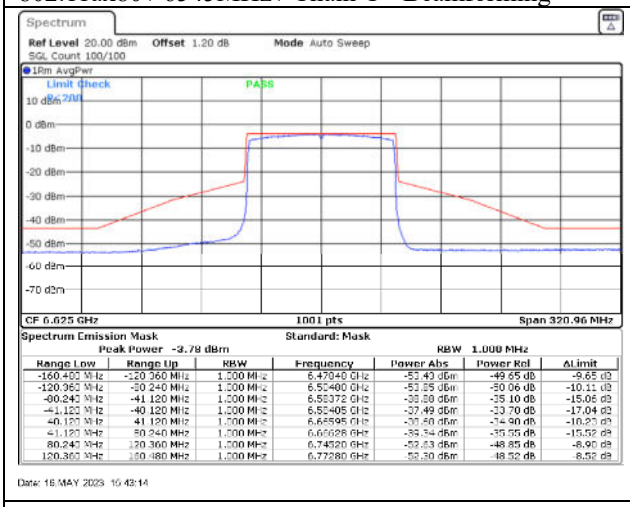
802.11ax80 / 6545MHz / Chain B - Beamforming



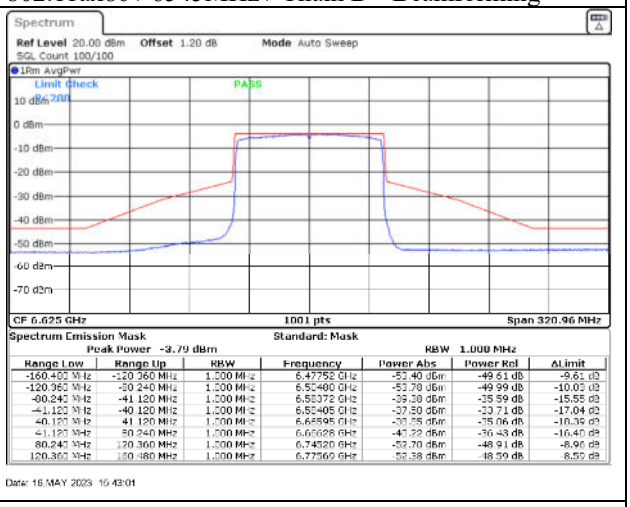
802.11ax80 / 6545MHz / Chain C - Beamforming



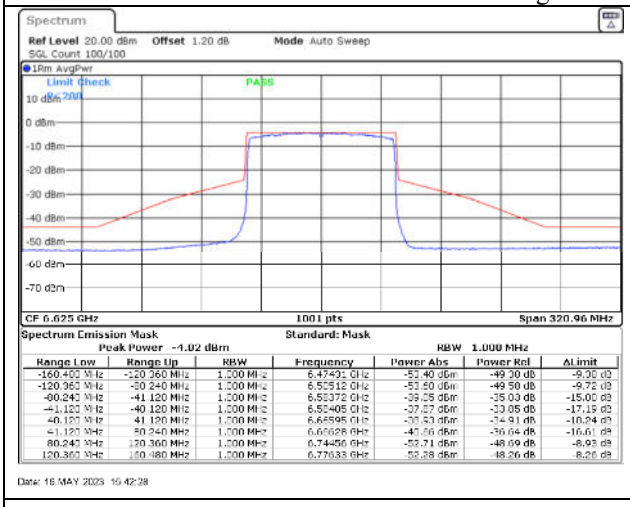
802.11ax80 / 6545MHz / Chain D - Beamforming



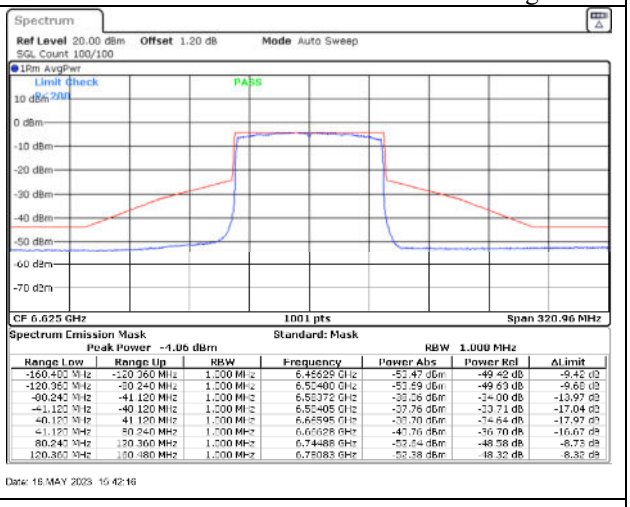
802.11ax80 / 6625MHz / Chain A - Beamforming



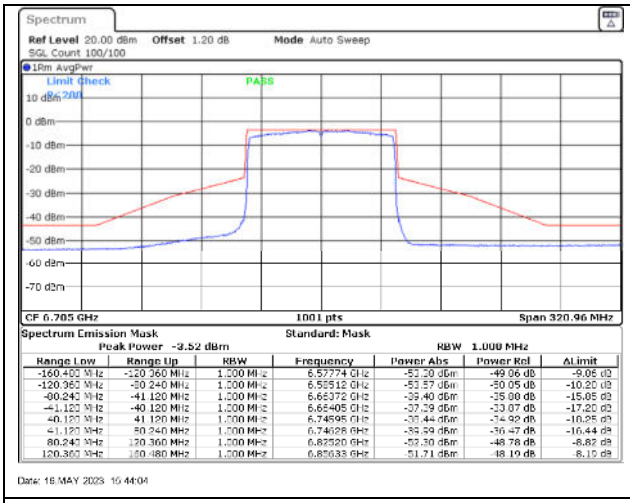
802.11ax80 / 6625MHz / Chain B - Beamforming



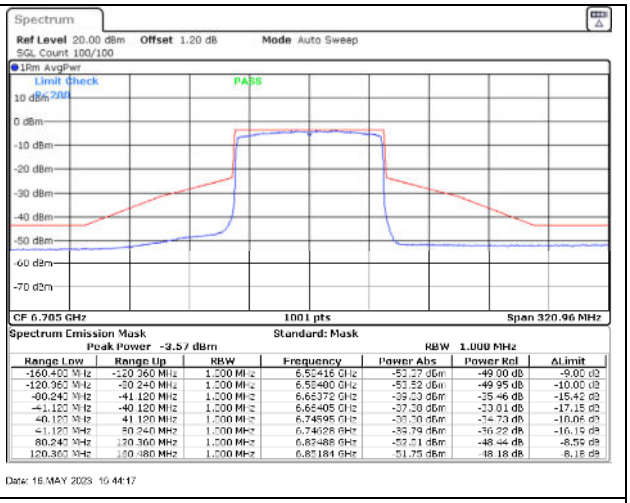
802.11ax80 / 6625MHz / Chain C - Beamforming



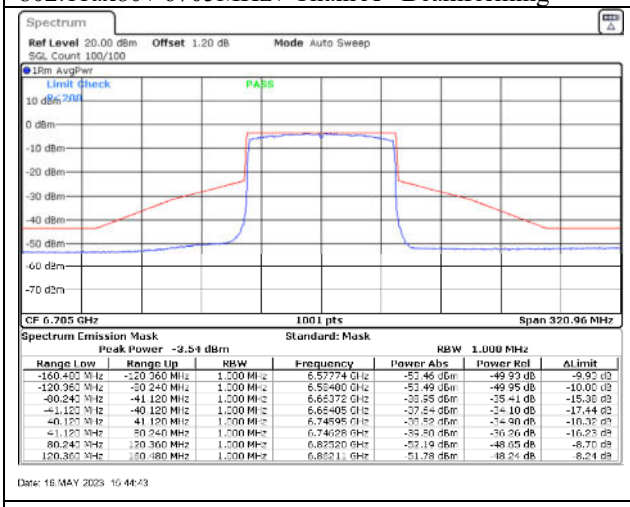
802.11ax80 / 6625MHz / Chain D - Beamforming



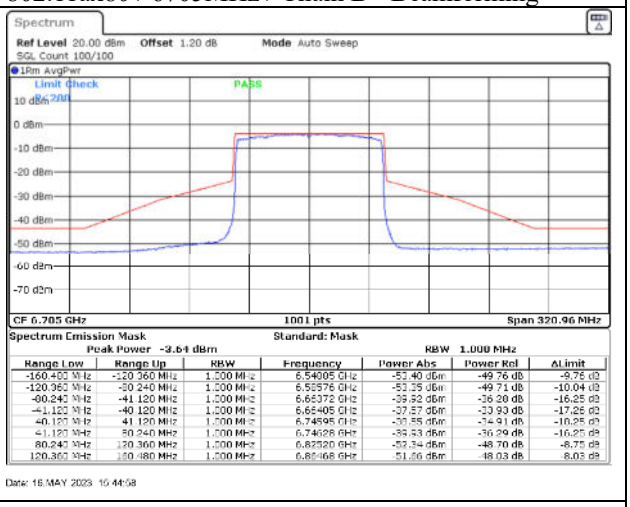
802.11ax80 / 6705MHz / Chain A - Beamforming



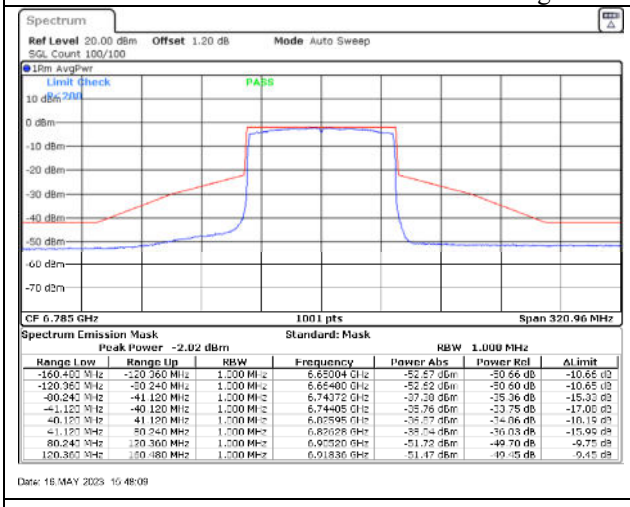
802.11ax80 / 6705MHz / Chain B - Beamforming



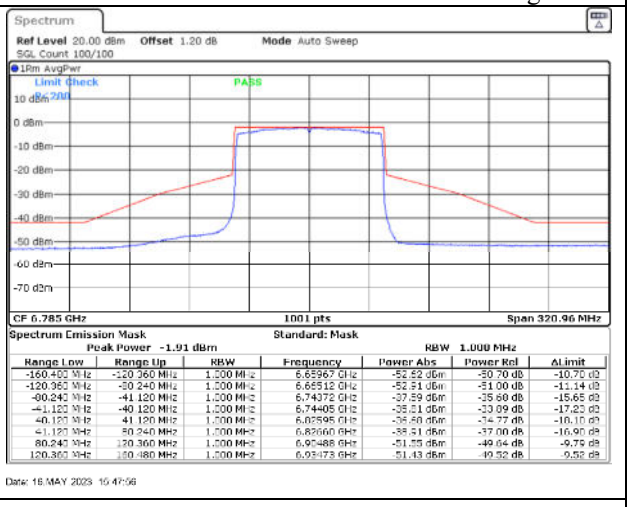
802.11ax80 / 6705MHz / Chain C - Beamforming



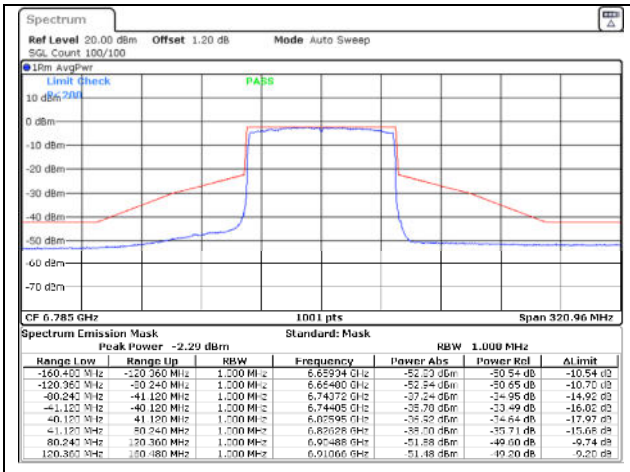
802.11ax80 / 6705MHz / Chain D - Beamforming



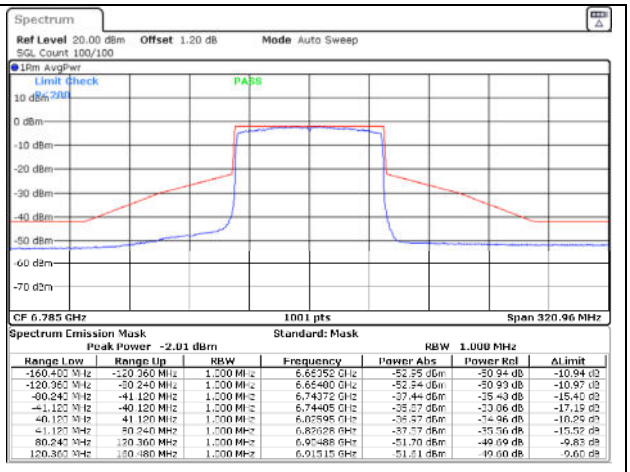
802.11ax80 / 6785MHz / Chain A - Beamforming



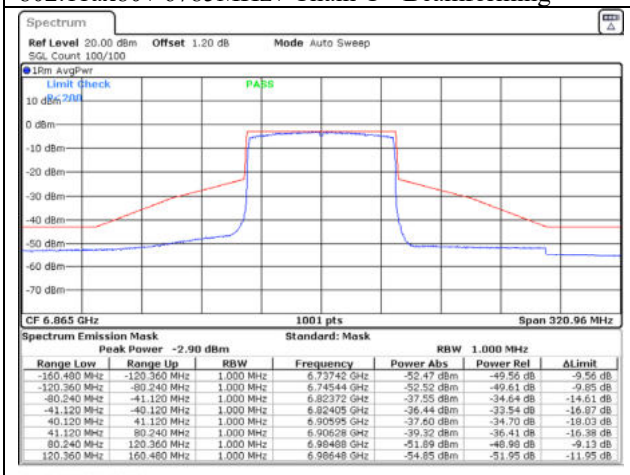
802.11ax80 / 6785MHz / Chain B - Beamforming



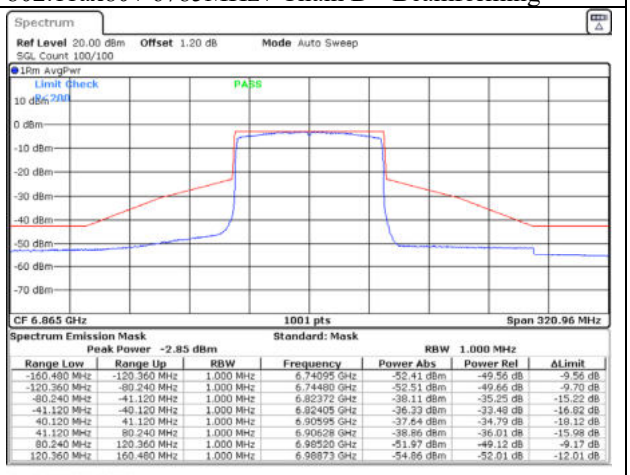
802.11ax80 / 6785MHz / Chain C - Beamforming



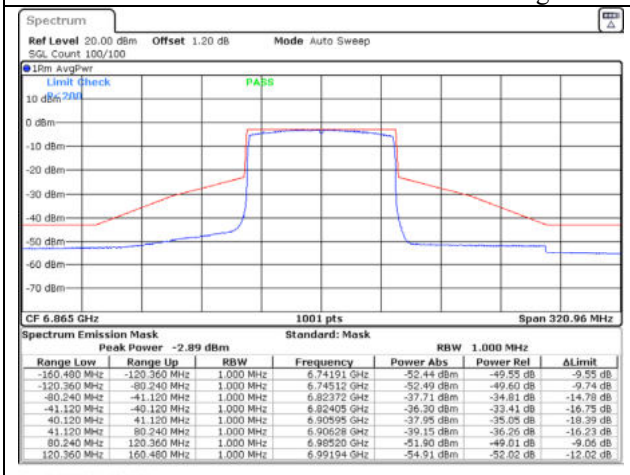
802.11ax80 / 6785MHz / Chain D - Beamforming



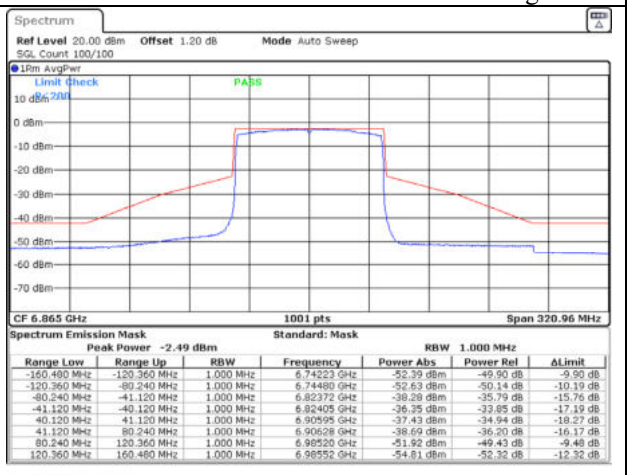
802.11ax80 / 6865MHz / Chain A - Beamforming



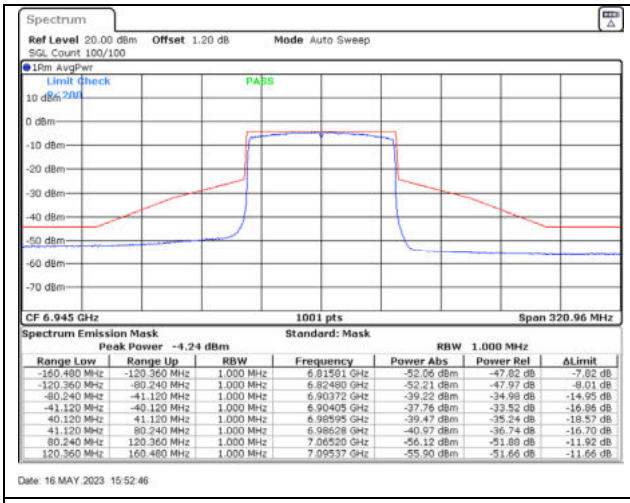
802.11ax80 / 6865MHz / Chain B - Beamforming



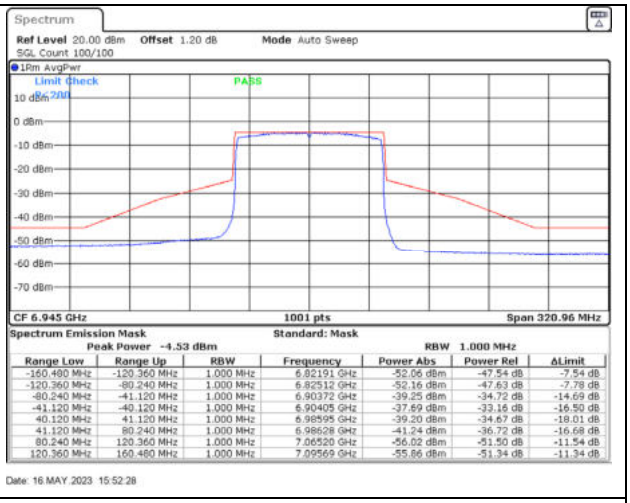
802.11ax80 / 6865MHz / Chain C - Beamforming



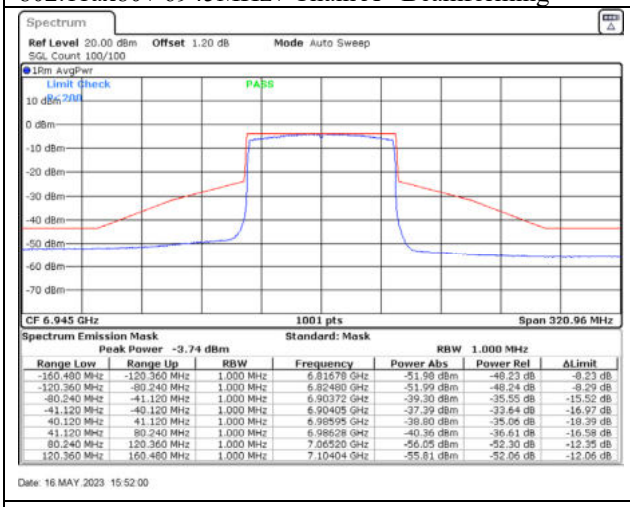
802.11ax80 / 6865MHz / Chain D - Beamforming



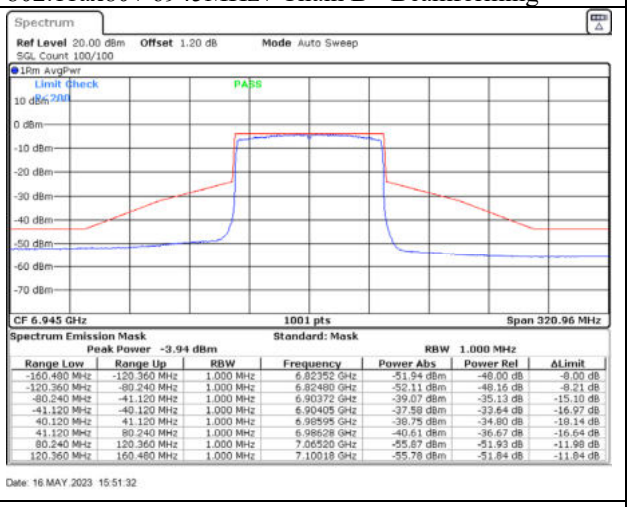
802.11ax80 / 6945MHz / Chain A - Beamforming



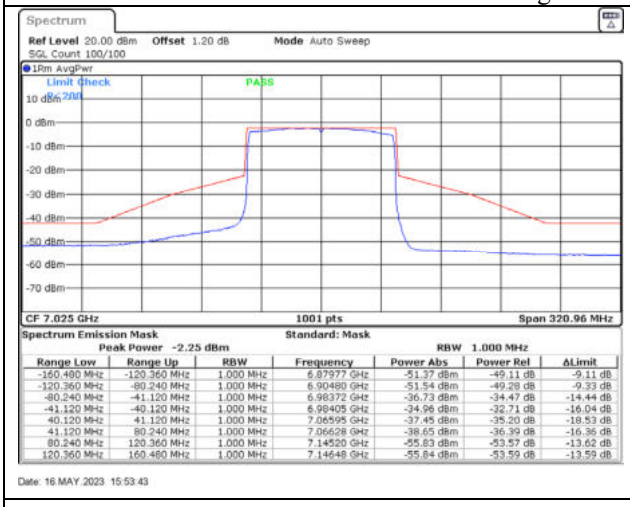
802.11ax80 / 6945MHz / Chain B - Beamforming



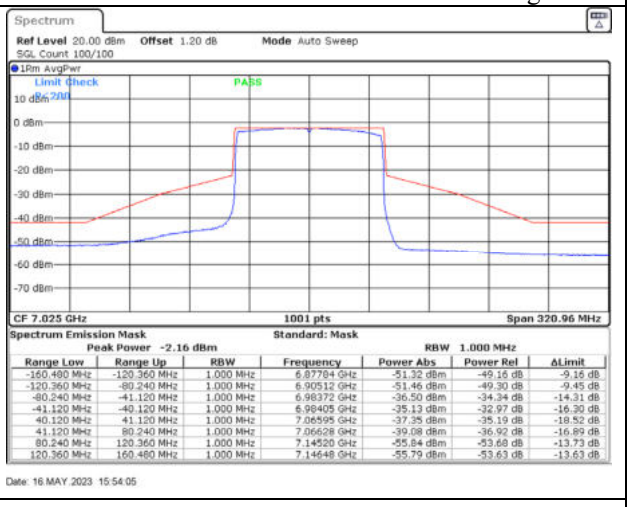
802.11ax80 / 6945MHz / Chain C - Beamforming



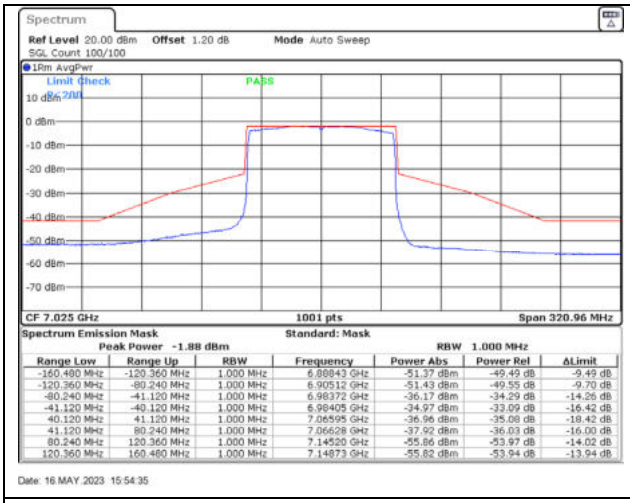
802.11ax80 / 6945MHz / Chain D - Beamforming



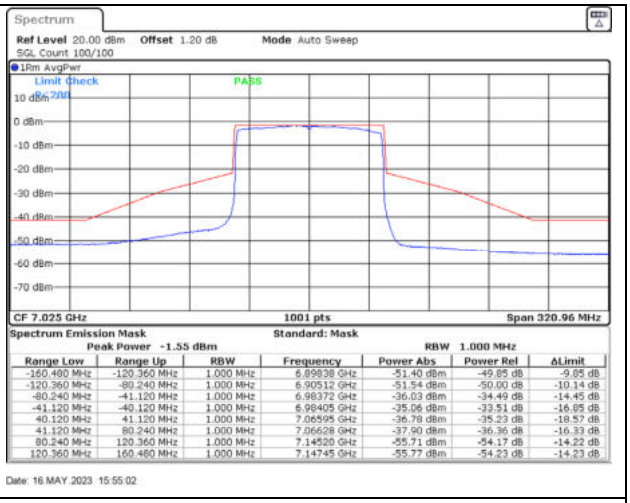
802.11ax80 / 7025MHz / Chain A - Beamforming



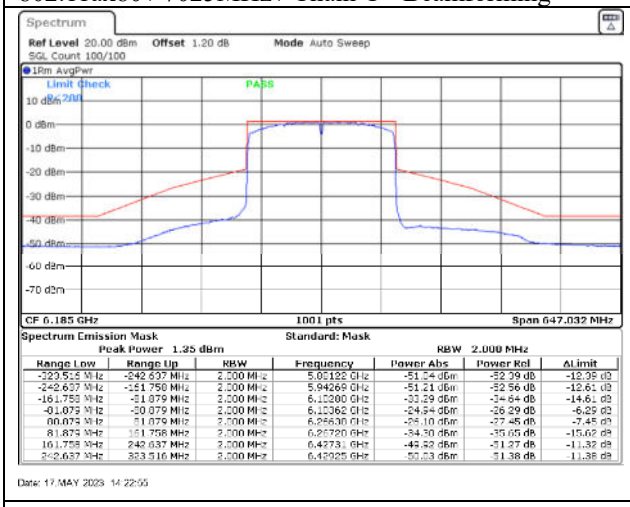
802.11ax80 / 7025MHz / Chain B - Beamforming



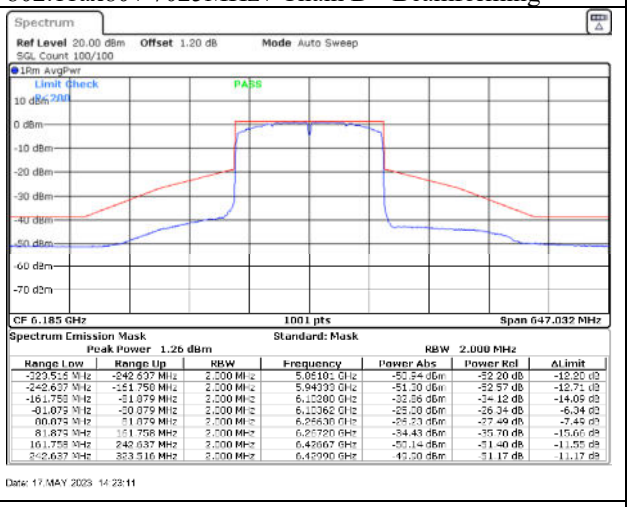
802.11ax80 / 7025MHz / Chain C - Beamforming



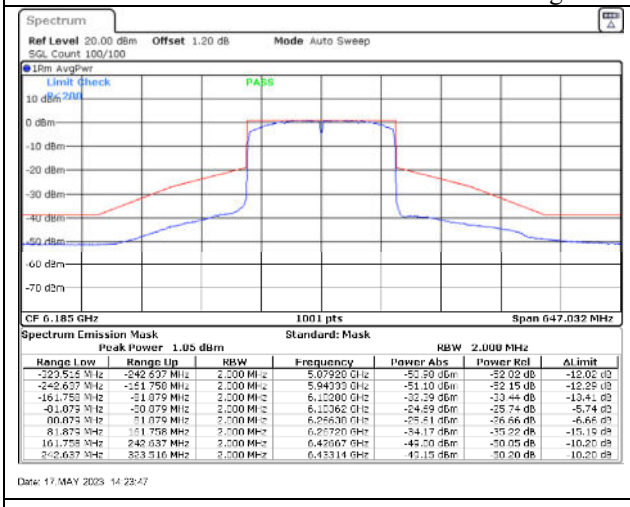
802.11ax80 / 7025MHz / Chain D - Beamforming



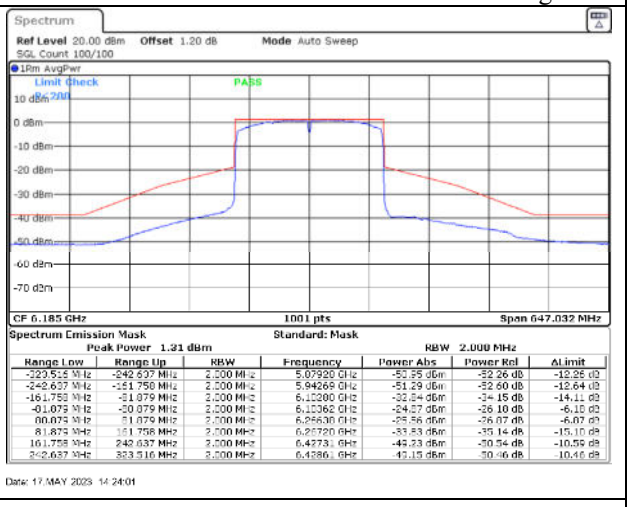
802.11ax160 / 6185MHz / Chain A - Beamforming



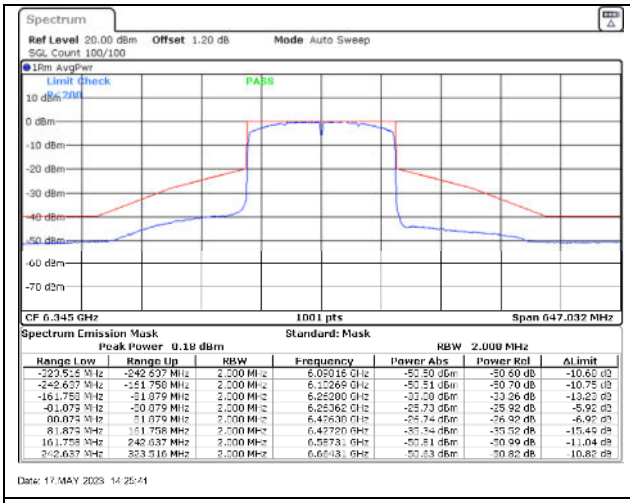
802.11ax160 / 6185MHz / Chain B - Beamforming



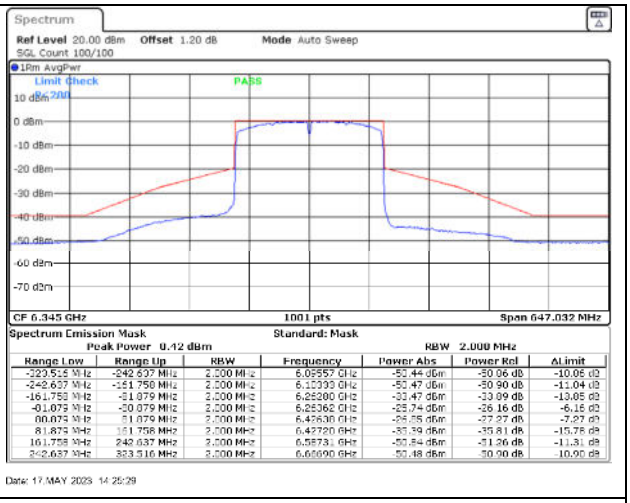
802.11ax160 / 6185MHz / Chain C - Beamforming



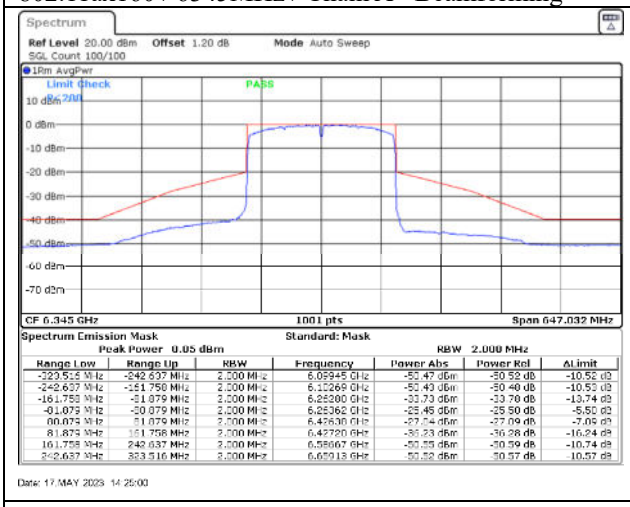
802.11ax160 / 6185MHz / Chain D - Beamforming



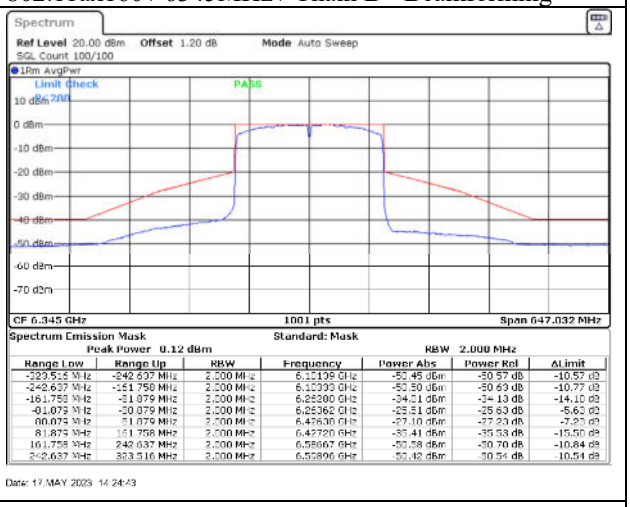
802.11ax160 / 6345MHz / Chain A - Beamforming



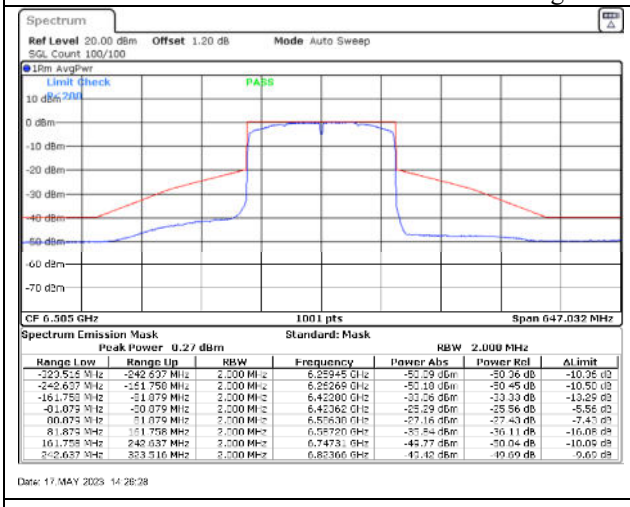
802.11ax160 / 6345MHz / Chain B - Beamforming



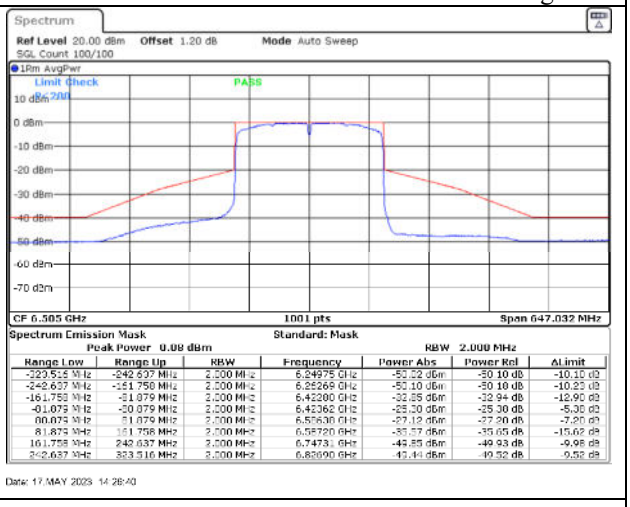
802.11ax160 / 6345MHz / Chain C - Beamforming



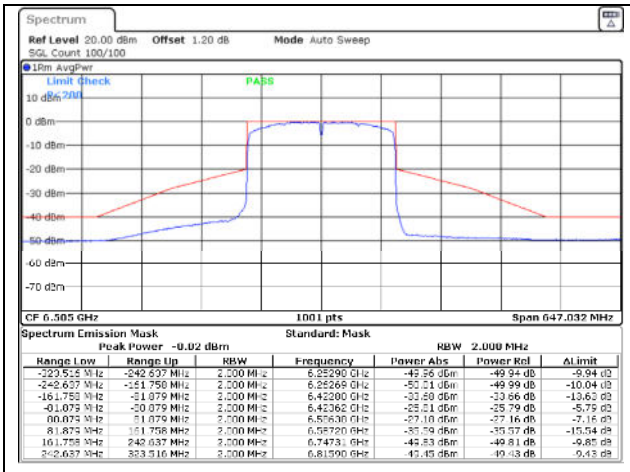
802.11ax160 / 6345MHz / Chain D - Beamforming



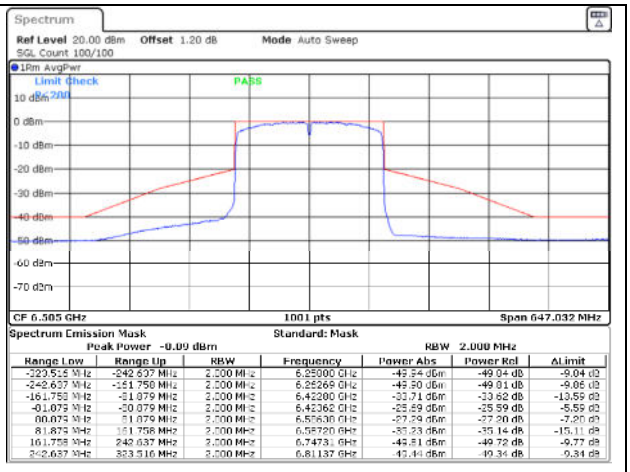
802.11ax160 / 6505MHz / Chain A - Beamforming



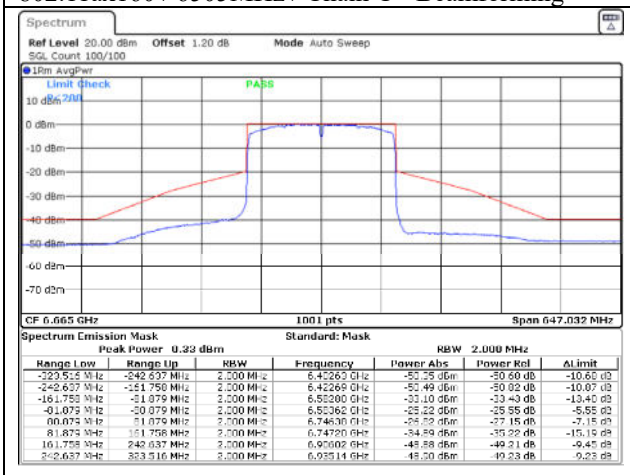
802.11ax160 / 6505MHz / Chain B - Beamforming



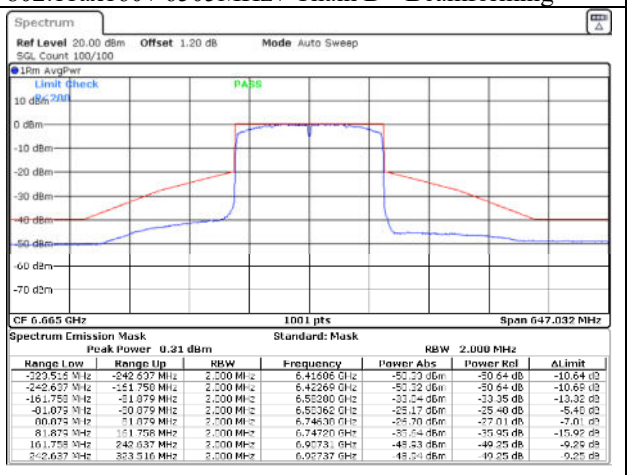
802.11ax160 / 6505MHz / Chain C - Beamforming



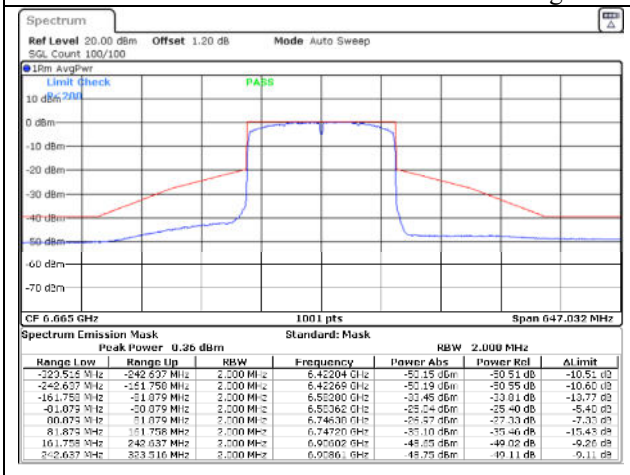
802.11ax160 / 6505MHz / Chain D - Beamforming



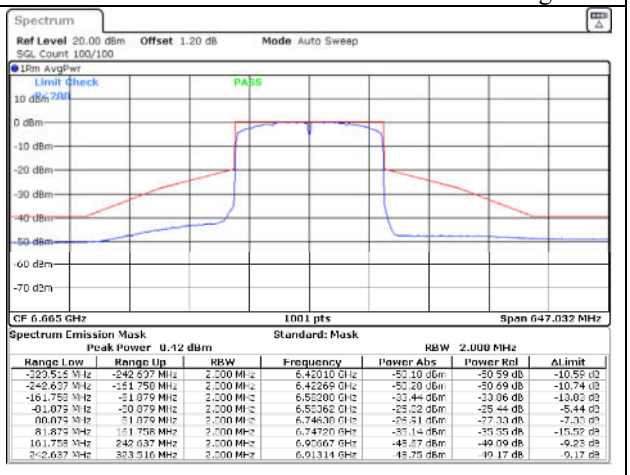
802.11ax160 / 6665MHz / Chain A - Beamforming



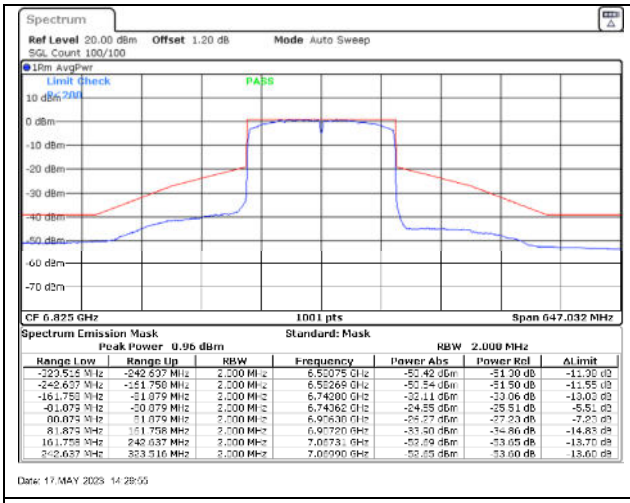
802.11ax160 / 6665MHz / Chain B - Beamforming



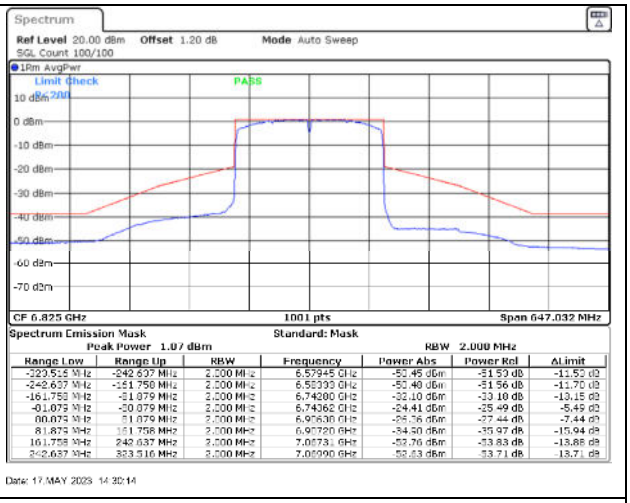
802.11ax160 / 6665MHz / Chain C - Beamforming



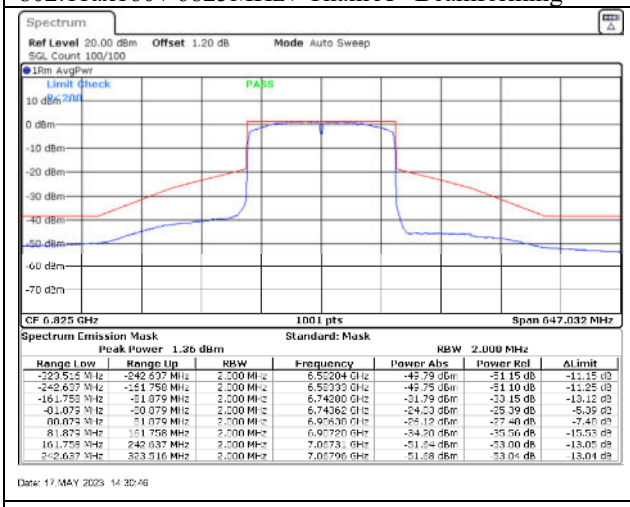
802.11ax160 / 6665MHz / Chain D - Beamforming



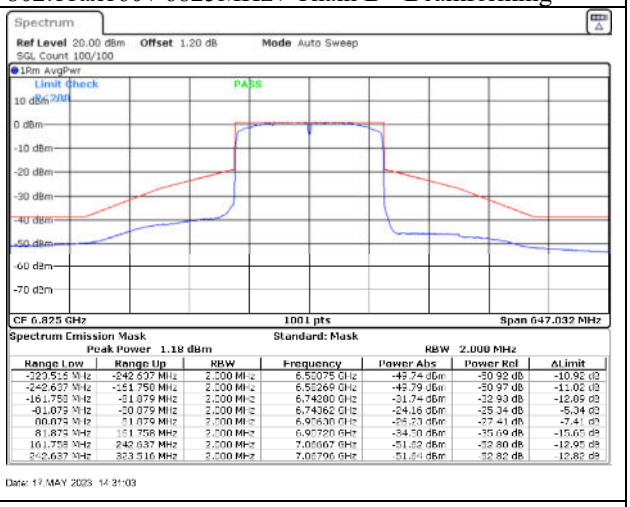
802.11ax160 / 6825MHz / Chain A - Beamforming



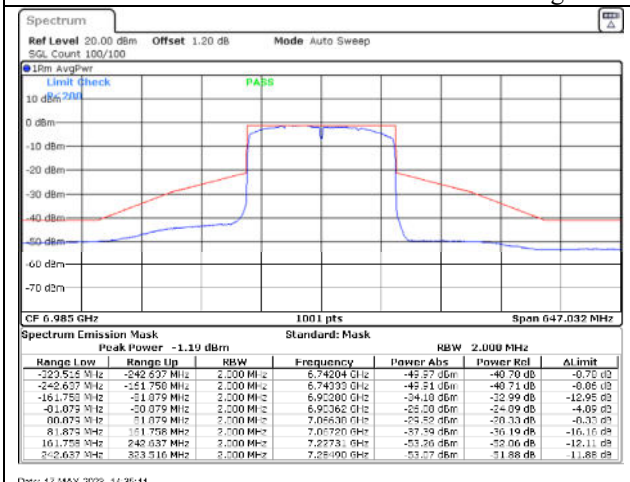
802.11ax160 / 6825MHz / Chain B - Beamforming



802.11ax160 / 6825MHz / Chain C - Beamforming

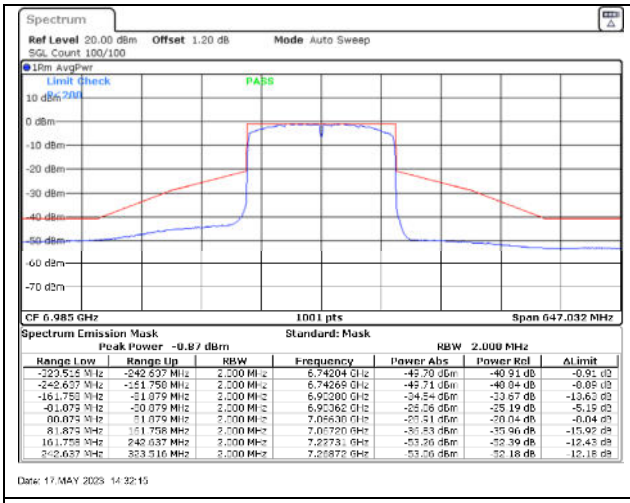
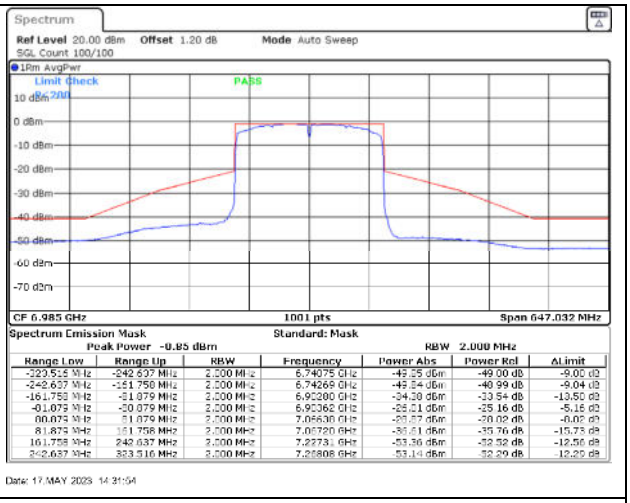


802.11ax160 / 6825MHz / Chain D - Beamforming



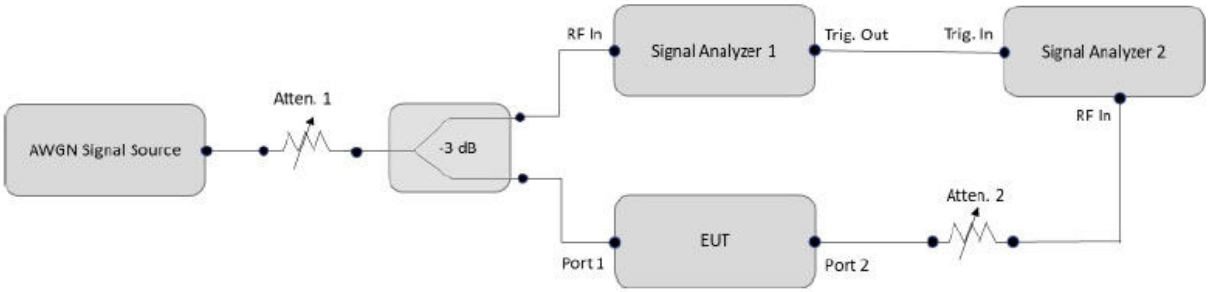
802.11ax160 / 6985MHz / Chain A - Beamforming

802.11ax160 / 6985MHz / Chain B - Beamforming

	
802.11ax160 / 6985MHz / Chain C - Beamforming	802.11ax160 / 6985MHz / Chain D - Beamforming

9. Contention Based Protocol

9.1. Test Setup



9.2. Limits

Unlicensed indoor low-power devices must detect co-channe 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-channek energy with 90 % or greater certainty.

9.3. Test Procedure

1. 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.
2. 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).
3. Determine number of times detection threshold test as following table

Test Items	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 BWEUT
$2xBW_{Inc} < BW_{EUT} \leqq 4xBW_{Inc}$	Twice. (Incumbent transmission is contained within BWEUT)	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

4. 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.
5. 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.
6. Transmit the AWGN signal (RF ON) and verify its characteristics on the signal analyzer 1.
7. 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.
8. (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.
9. 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.

9.4. Test Result of Contention Based Protocol

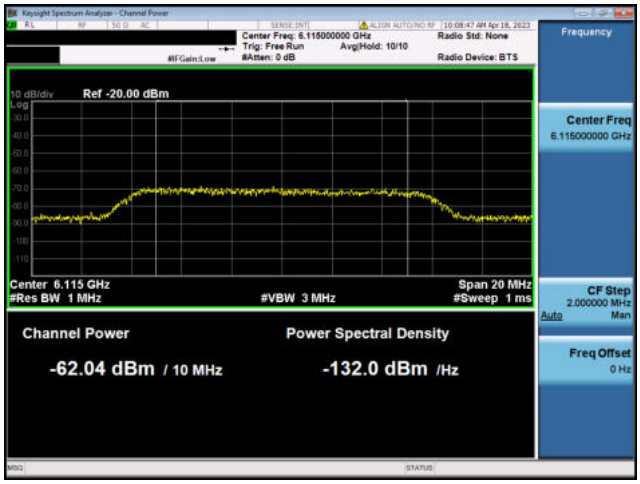
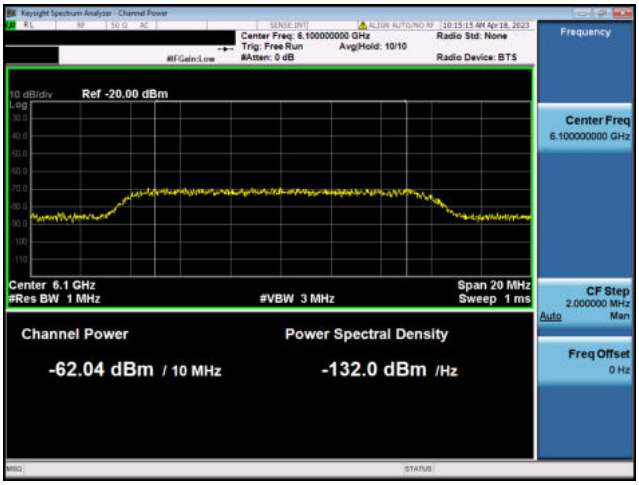
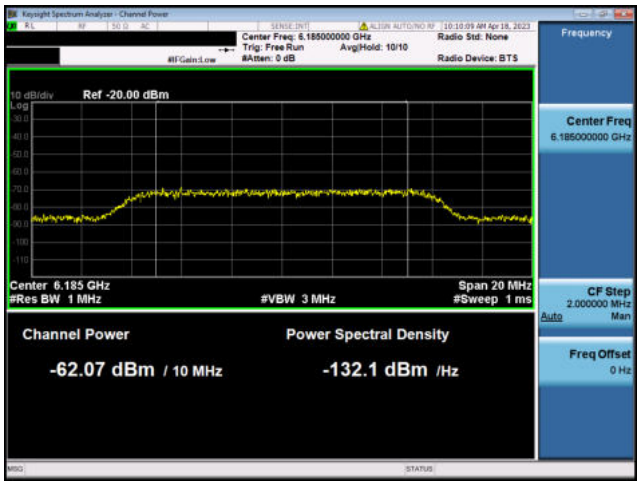
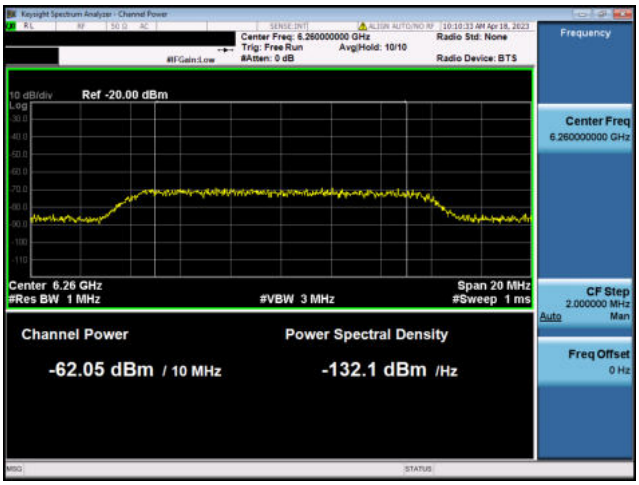
Product : Internet Gateway
Test Item : Contention Based Protocol
Test Date : 2023/04/18

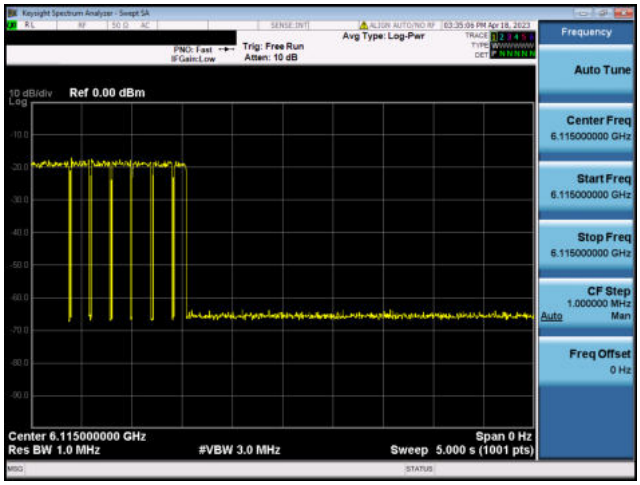
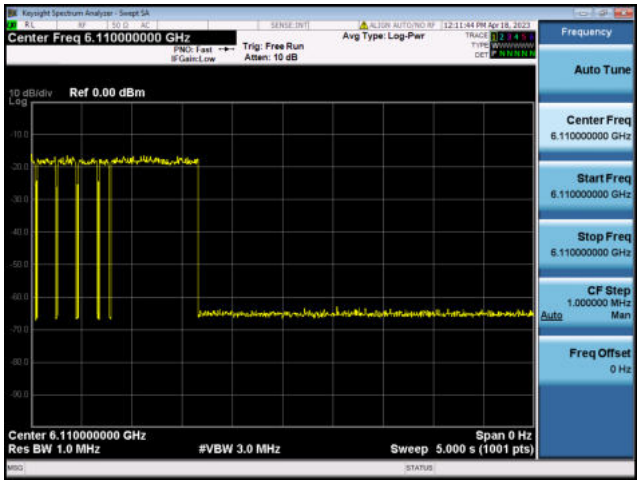
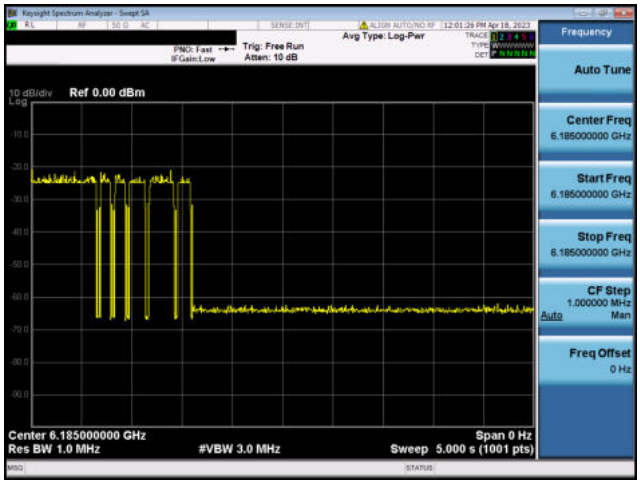
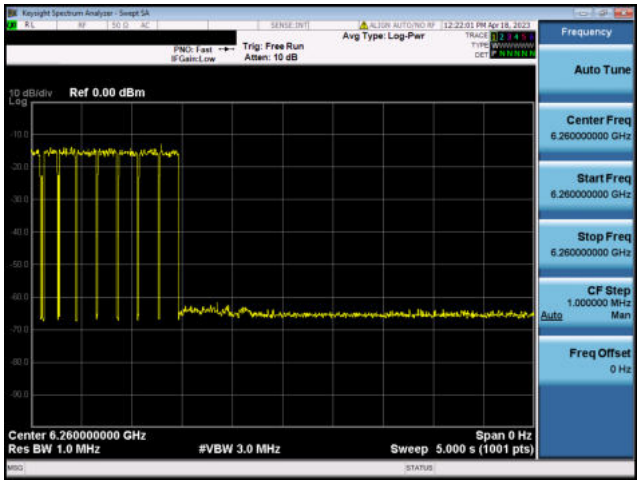
For U-NII-5 band

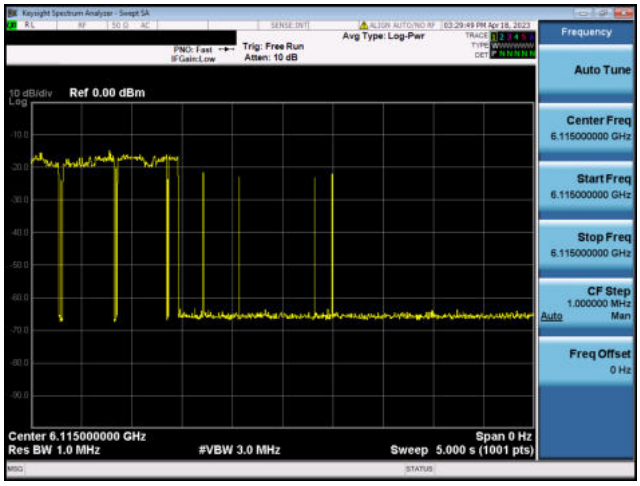
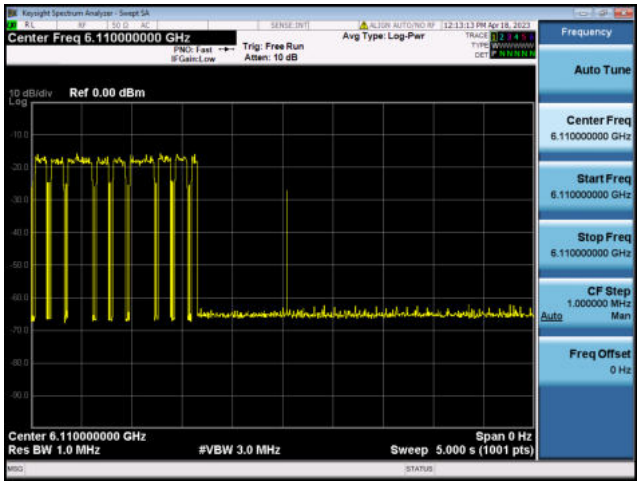
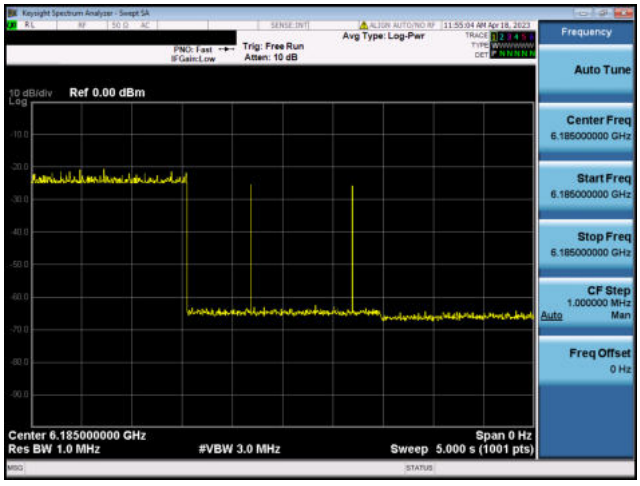
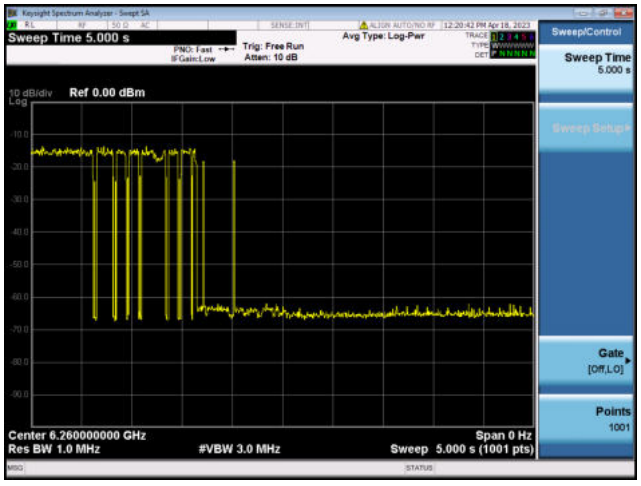
Contention Based Protocol Measurement											
Measurement Mode		Conducted measurement			Device Type		Indoor AP				
The Incumbent Signal (AWGN) Level (dBm)		-62 dBm (at the antenna connector)									
Operation Band	Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Frequency (MHz)	Test Result						
					AWGN Signals Frequency (MHz)	Number of Times	Number of Detected	Detection Rate	Limit	Pass/ Fail	
U-NII 5	802.11ax	20 MHz	33	6115	6115	10	10	100 %	90 %	Pass	
		160 MHz	47	6185	6110	10	10	100 %	90 %	Pass	
					6185	10	10	100 %	90 %	Pass	
					6260	10	10	100 %	90 %	Pass	

Lowest Interference (AWGN) Level Check							
Operation Band	Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Frequency (MHz)	AWGN Signals Frequency (MHz)	Threshold Level (dBm)	EUT Status
U-NII 5	802.11ax	20 MHz	33	6115	6115	-68	OFF
						-69	Minimal
						-71	ON
		160 MHz	47	6185	6110	-67	OFF
						-68	Minimal
						-70	ON
					6185	-64	OFF
						-67	Minimal
						-69	ON
					6260	-67	OFF
						-68	Minimal
						-70	ON

Note:
1. Injected (AWGN) POWER at the antenna connector (dBm) = S.G. (dBm) - Cable loss (dB) - Splitter loss (dB) - lowest antenna gain (dB)
2. Only one chain was performed for testing.
3. The AWGN level is reported for the following conditions:
   - OFF = AWGN level at which no transmission is detected, consistently for a minimum period of 10 seconds.
   - Minimal = AWGN level at which the system begins to trigger the transmission switch-off, albeit not being kept off consistently.
   - ON = AWGN level at which no impact on the transmission is detected, consistently for a minimum period of 10 seconds.

Plots of shows Incumbent signal level	
802.11ax (20MHz) / 6115MHz	802.11ax (160MHz) / 6110MHz (Lower Edge)
	
802.11ax (160MHz) / 6185MHz (Middle)	802.11ax (160MHz) / 6260MHz (Upper Edge)
	

Plots of EUT ceased transmission in the time domain	
802.11ax (20MHz) / 6115MHz	802.11ax (160MHz) / 6185MHz (Lower Edge - 6110 MHz)
	
802.11ax (160MHz) / 6185MHz (Middle - 6185 MHz)	802.11ax (160MHz) / 6185MHz (Upper Edge - 6260 MHz)
	

Plots of Start transmitting	
802.11ax (20MHz) / 6115MHz	802.11ax (160MHz) / 6185MHz (Lower Edge - 6110 MHz)
	
802.11ax (160MHz) / 6185MH (Middle - 6185 MHz)	802.11ax (160MHz) / 6185MHz (Upper Edge - 6260 MHz)
	

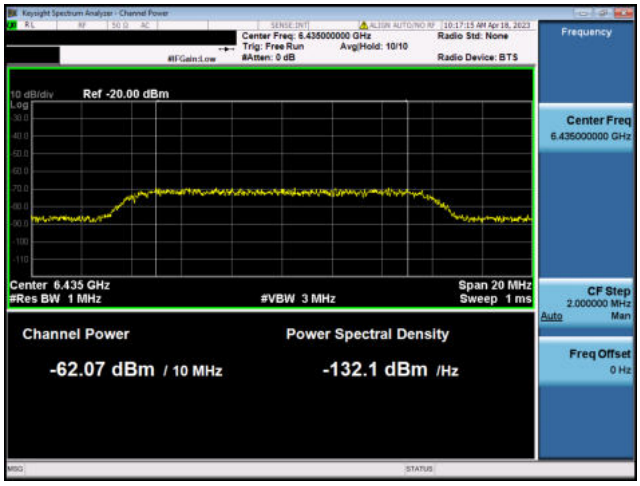
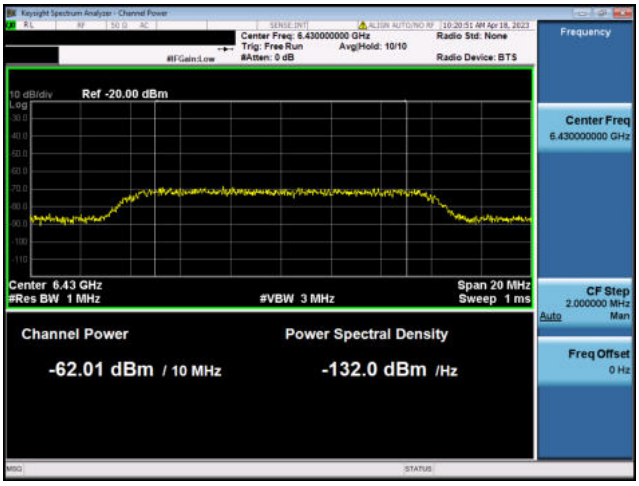
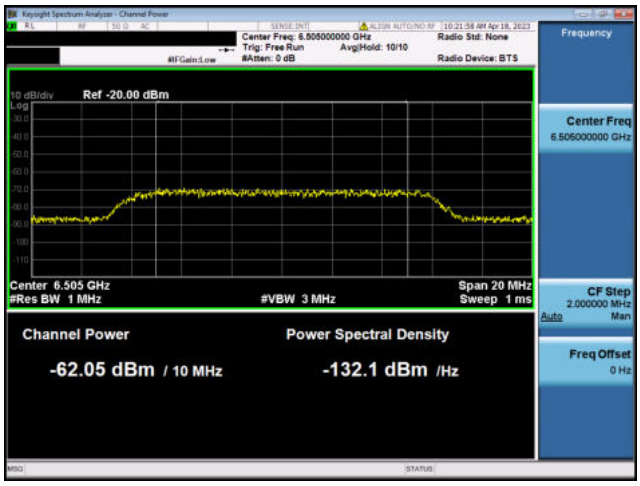
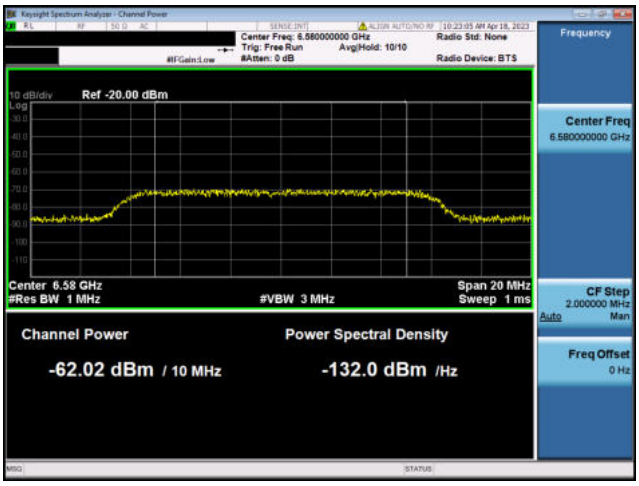
Product : Internet Gateway
Test Item : Contention Based Protocol
Test Date : 2023/04/18

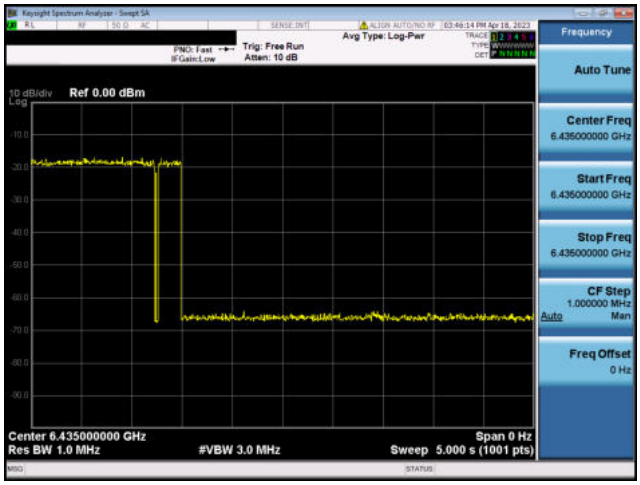
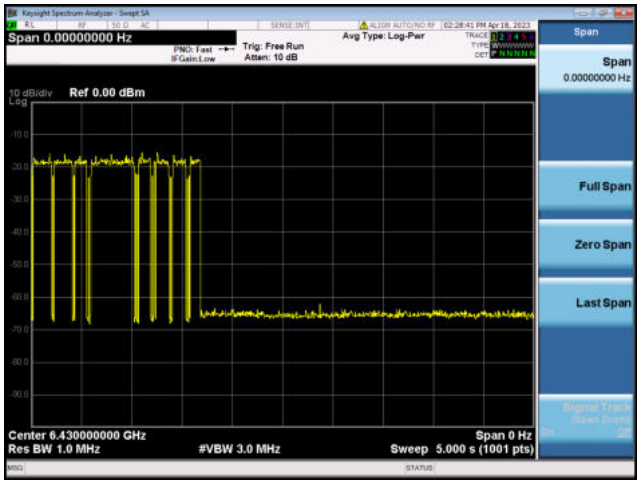
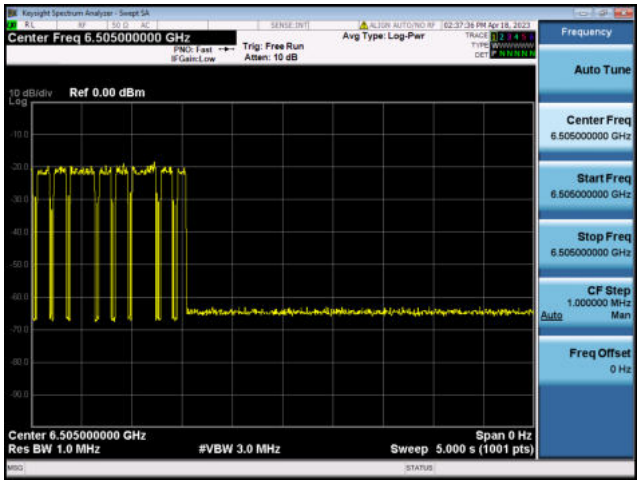
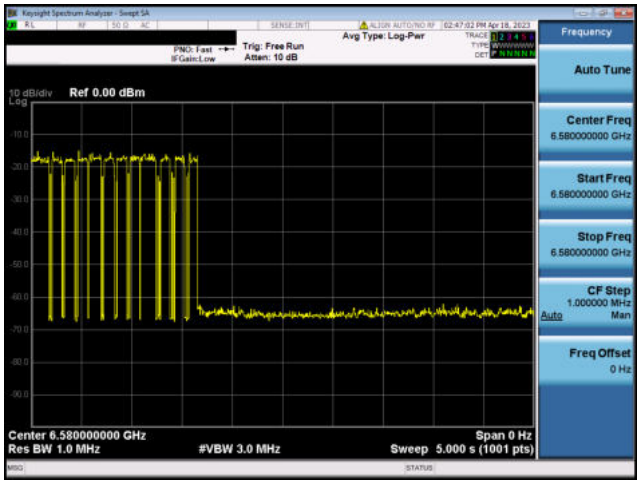
For U-NII-6 band

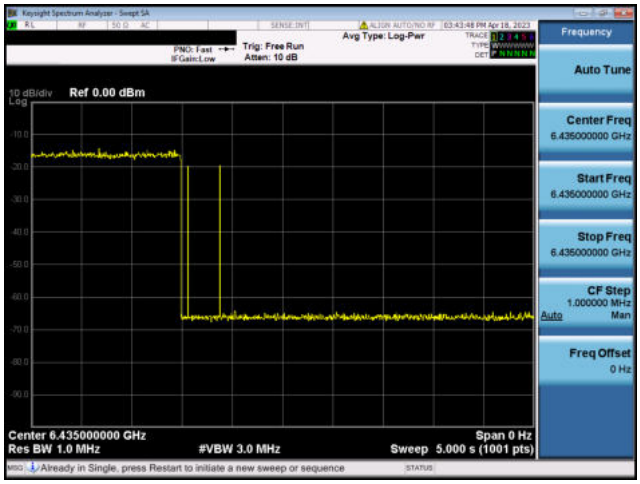
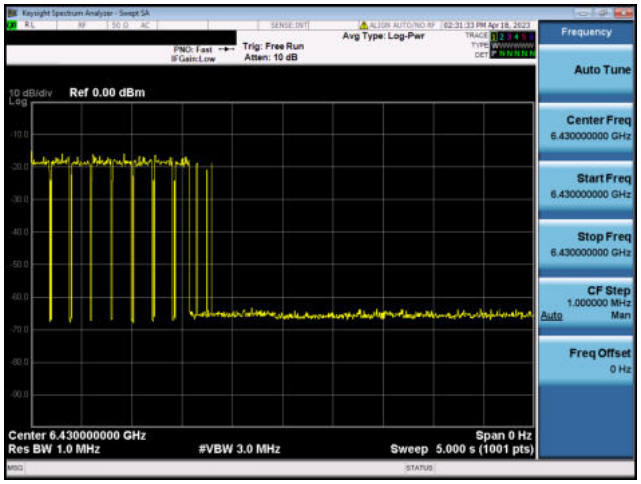
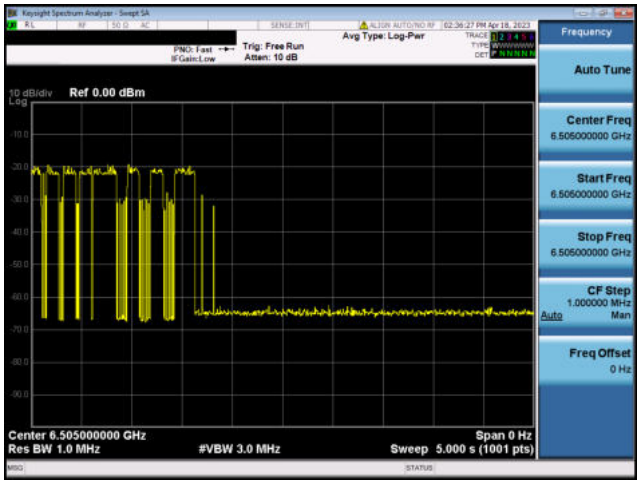
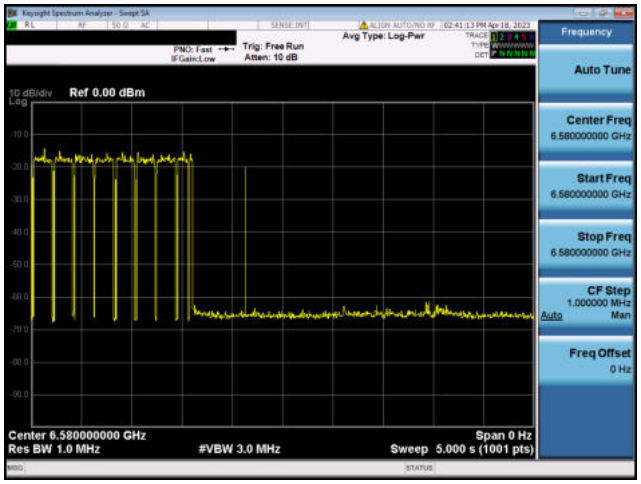
Contention Based Protocol Measurement										
Measurement Mode		Conducted measurement			Device Type		Indoor AP			
The Incumbent Signal (AWGN) Level (dBm)		-62 dBm (at the antenna connector)								
Operation Band	Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Frequency (MHz)	Test Result					
					AWGN Signals Frequency (MHz)	Number of Times	Number of Detected	Detection Rate	Limit	Pass/ Fail
U-NII 6	802.11ax	20 MHz	97	6435	6435	10	10	100 %	90 %	Pass
		160 MHz	111	6505	6430	10	10	100 %	90 %	Pass
					6505	10	10	100 %	90 %	Pass
					6580	10	10	100 %	90 %	Pass

Lowest Interference (AWGN) Level Check							
Operation Band	Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Frequency (MHz)	AWGN Signals Frequency (MHz)	Threshold Level (dBm)	EUT Status
U-NII 6	802.11ax	20 MHz	97	6435	6435	-72	OFF
						-73	Minimal
						-75	ON
		160 MHz	111	6505	6430	-69	OFF
						-70	Minimal
						-72	ON
					6505	-65	OFF
						-66	Minimal
						-68	ON
					6580	-70	OFF
						-71	Minimal
						-73	ON

Note:
1. Injected (AWGN) POWER at the antenna connector (dBm) = S.G. (dBm) - Cable loss (dB) - Splitter loss (dB) - lowest antenna gain (dB)
2. Only one chain was performed for testing.
3. The AWGN level is reported for the following conditions:
   - OFF = AWGN level at which no transmission is detected, consistently for a minimum period of 10 seconds.
   - Minimal = AWGN level at which the system begins to trigger the transmission switch-off, albeit not being kept off consistently.
   - ON = AWGN level at which no impact on the transmission is detected, consistently for a minimum period of 10 seconds.

Plots of shows Incumbent signal level	
802.11ax (20MHz) / 6435MHz	802.11ax (160MHz) / 6430MHz(Lower Edge)
	
802.11ax (160MHz) / 6505 MHz (Middle)	802.11ax (160MHz) / 6580MHz (Upper Edge)
	

Plots of EUT ceased transmission in the time domain	
802.11ax (20MHz) / 6435MHz	802.11ax (160MHz) / 6505MHz (Lower Edge - 6430MHz)
	
802.11ax (160MHz) / 6505MHz (Middle - 6505MHz)	802.11ax (160MHz) / 6505MHz (Upper Edge - 6580MHz)
	

Plots of Start transmitting	
802.11ax (20MHz) / 6435MHz	802.11ax (160MHz) / 6505MHz (Lower Edge - 6430MHz)
	
802.11ax (160MHz) / 6505MHz (Middle - 6505MHz)	802.11ax (160MHz) / 6505MHz (Upper Edge - 6580MHz)
	

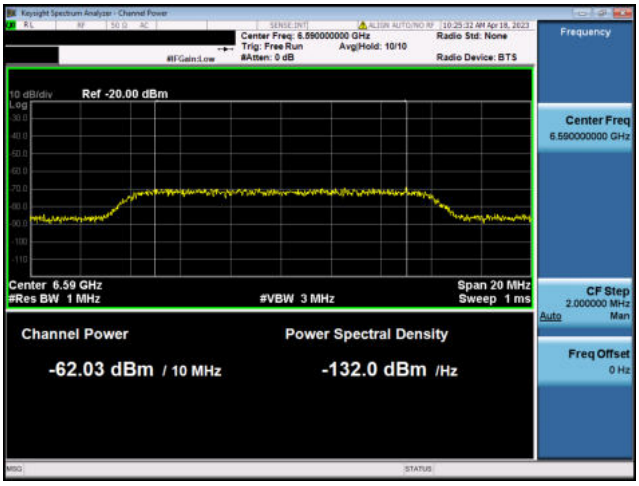
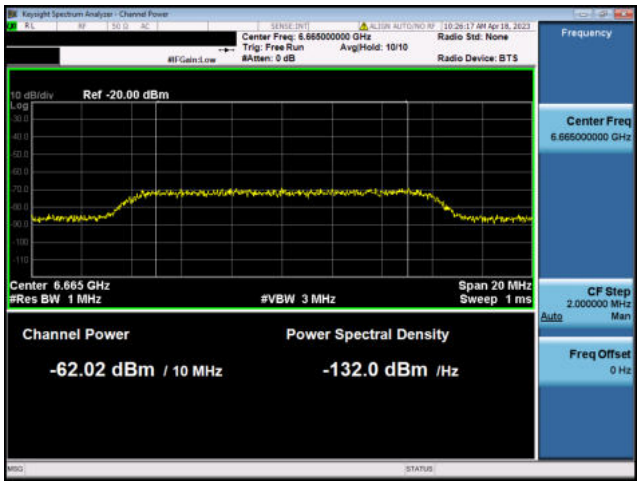
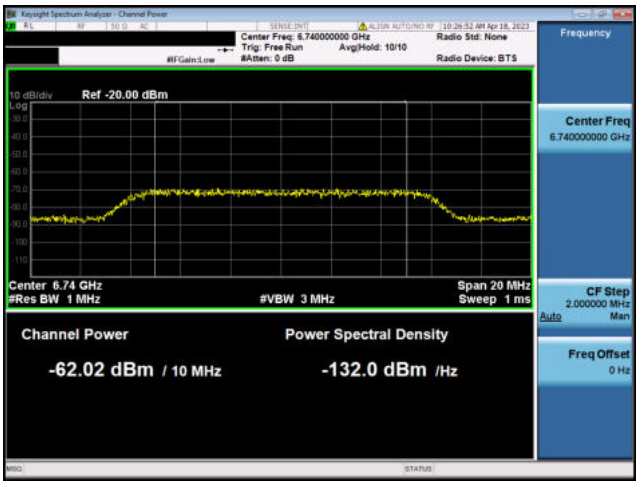
Product : Internet Gateway
Test Item : Contention Based Protocol
Test Date : 2023/04/18

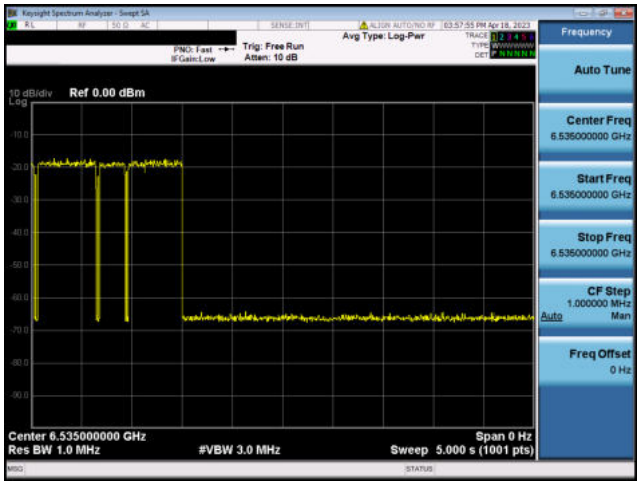
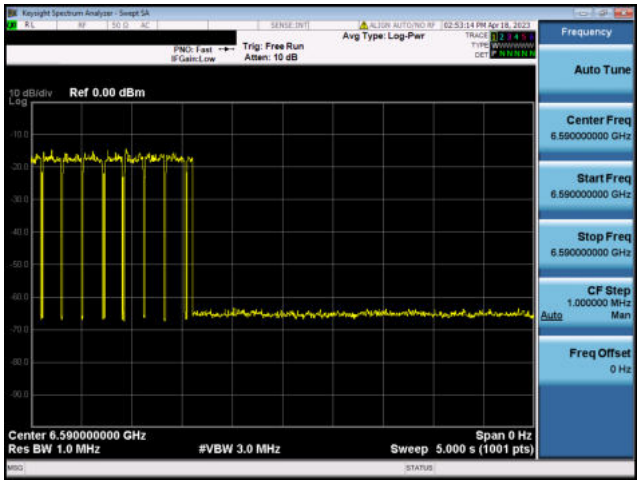
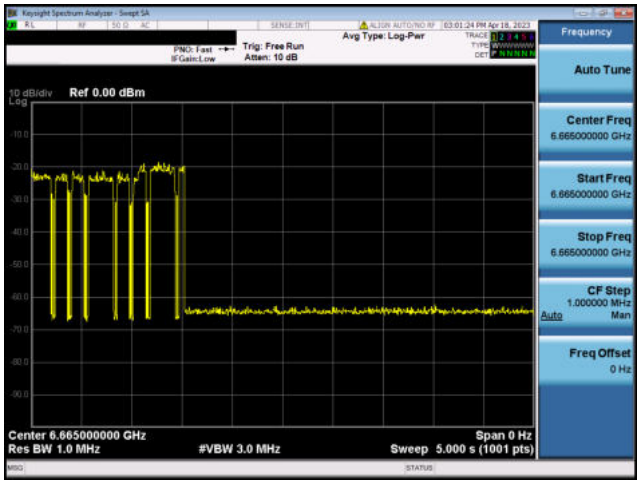
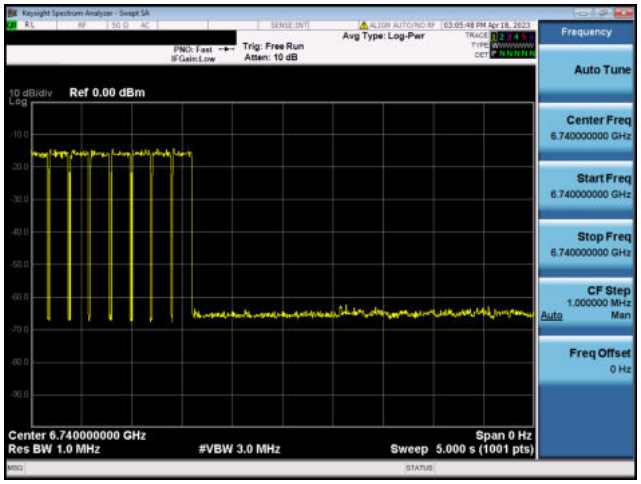
For U-NII-7 band

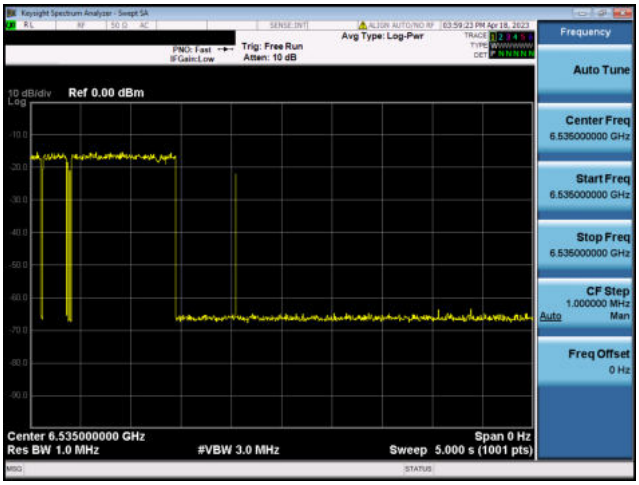
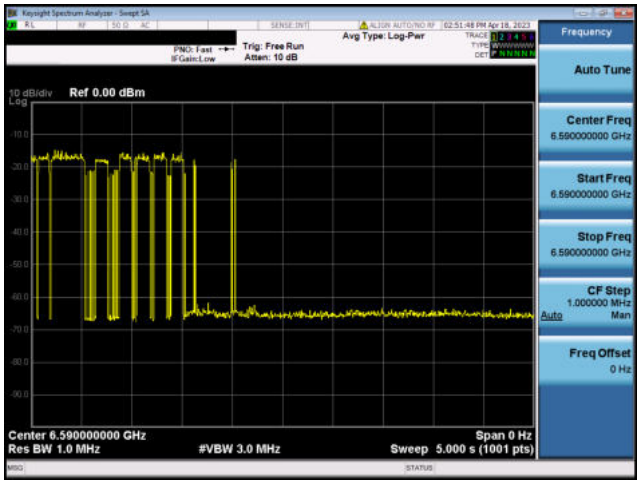
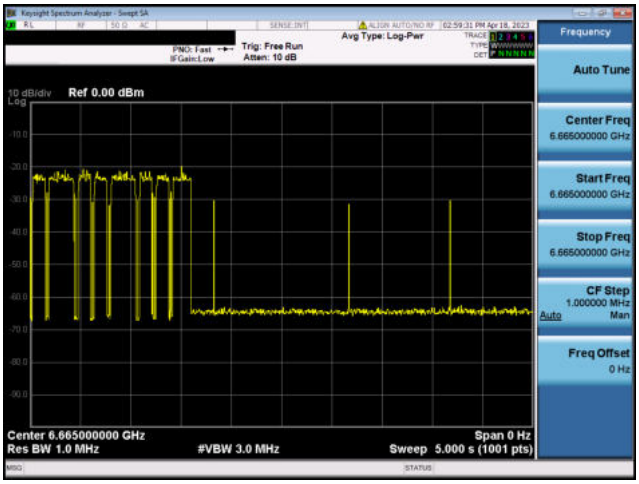
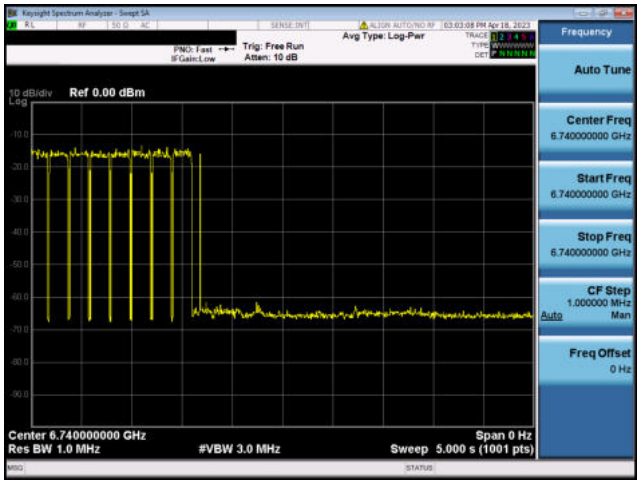
Contention Based Protocol Measurement										
Measurement Mode		Conducted measurement			Device Type		Indoor AP			
The Incumbent Signal (AWGN) Level (dBm)		-62 dBm (at the antenna connector)								
Operation Band	Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Frequency (MHz)	Test Result					
					AWGN Signals Frequency (MHz)	Number of Times	Number of Detected	Detection Rate	Limit	Pass/ Fail
U-NII 7	802.11ax	20 MHz	117	6535	6535	10	10	100 %	90 %	Pass
		160 MHz	143	6665	6590	10	10	100 %	90 %	Pass
					6665	10	10	100 %	90 %	Pass
					6740	10	10	100 %	90 %	Pass

Lowest Interference (AWGN) Level Check							
Operation Band	Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Frequency (MHz)	AWGN Signals Frequency (MHz)	Threshold Level (dBm)	EUT Status
U-NII 7	802.11ax	20 MHz	117	6535	6535	-72	OFF
						-73	Minimal
						-75	ON
		160 MHz	143	6665	6590	-69	OFF
						-70	Minimal
						-72	ON
					6665	-67	OFF
						-68	Minimal
						-70	ON
					6740	-69	OFF
						-70	Minimal
						-72	ON

Note:
1. Injected (AWGN) POWER at the antenna connector (dBm) = S.G. (dBm) - Cable loss (dB) - Splitter loss (dB) - lowest antenna gain (dB)
2. Only one chain was performed for testing.
3. The AWGN level is reported for the following conditions:
   - OFF = AWGN level at which no transmission is detected, consistently for a minimum period of 10 seconds.
   - Minimal = AWGN level at which the system begins to trigger the transmission switch-off, albeit not being kept off consistently.
   - ON = AWGN level at which no impact on the transmission is detected, consistently for a minimum period of 10 seconds.

Plots of shows Incumbent signal level	
802.11ax (20MHz) / 6535MHz	802.11ax (160MHz) / 6590MHz (Lower Edge)
	
802.11ax (160MHz) / 6665MHz (Middle)	802.11ax (160MHz) / 6740MHz (Upper Edge)
	

Plots of EUT ceased transmission in the time domain	
802.11ax (20MHz) / 6535MHz	802.11ax (160MHz) / 6665MHz (Lower Edge - 6590 MHz)
	
802.11ax (160MHz) / 6665MHz (Middle - 6665MHz)	802.11ax (160MHz) / 6665MHz (Upper Edge - 6740MHz)
	

Plots of Start transmitting	
802.11ax (20MHz) / 6535MHz	802.11ax (160MHz) / 6665MHz (Lower Edge - 6590 MHz)
	
802.11ax (160MHz) / 6665MHz (Middle - 6665MHz)	802.11ax (160MHz) / 6665MHz (Upper Edge - 6740MHz)
	

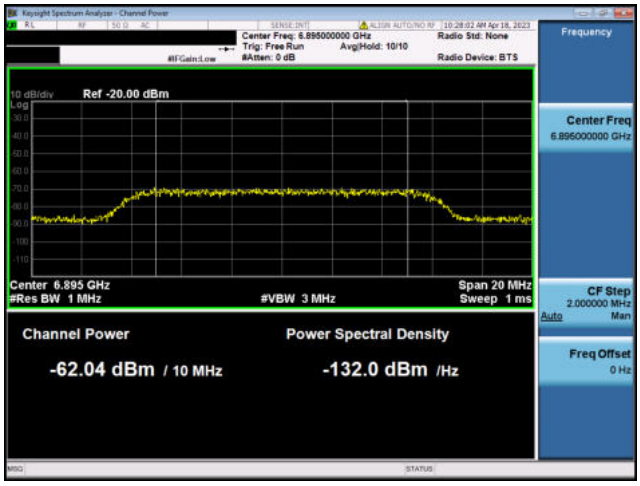
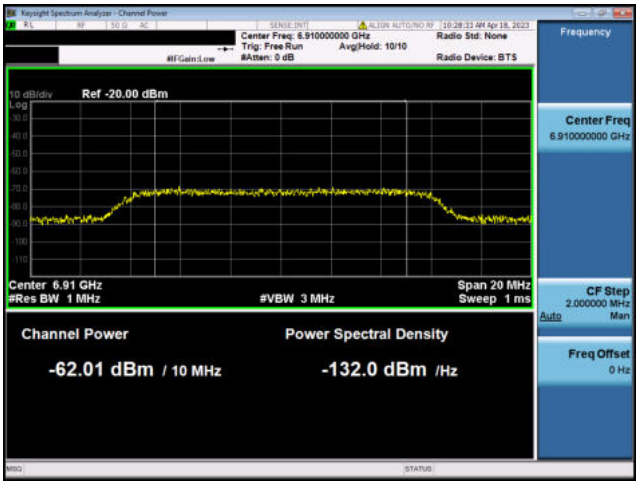
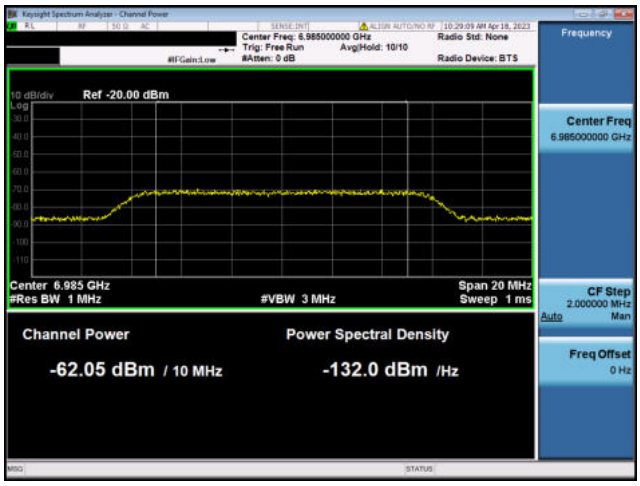
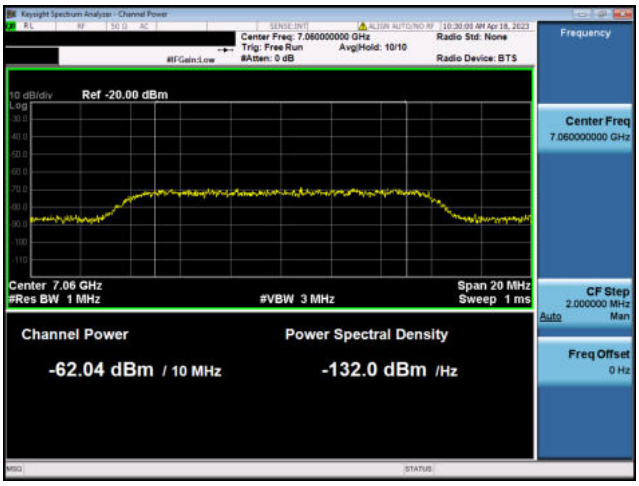
Product : Internet Gateway
Test Item : Contention Based Protocol
Test Date : 2023/04/18

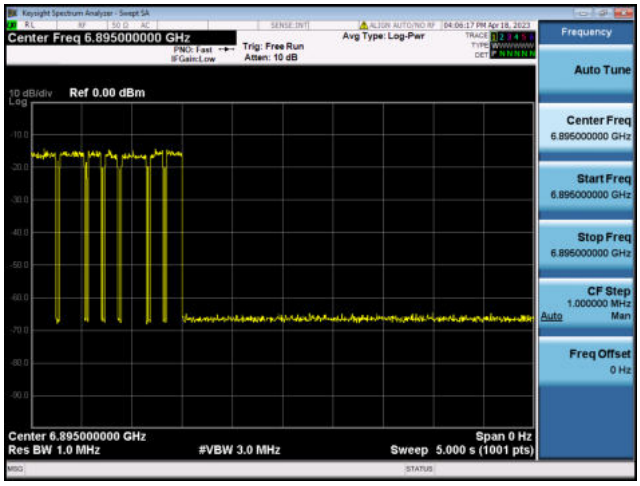
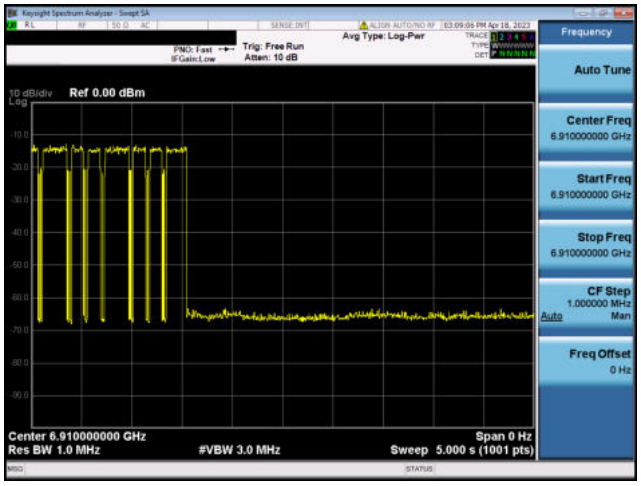
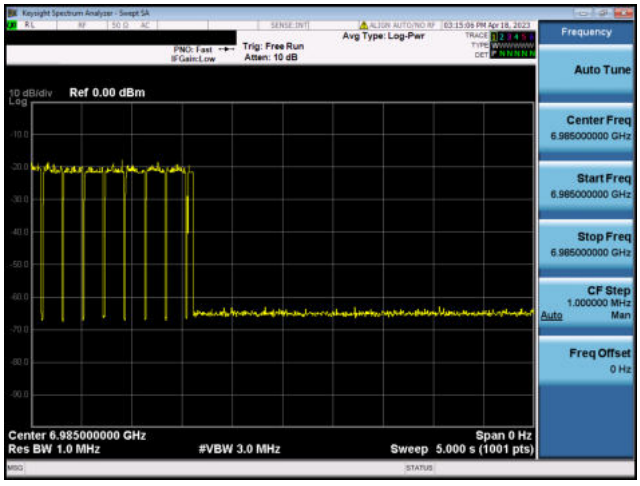
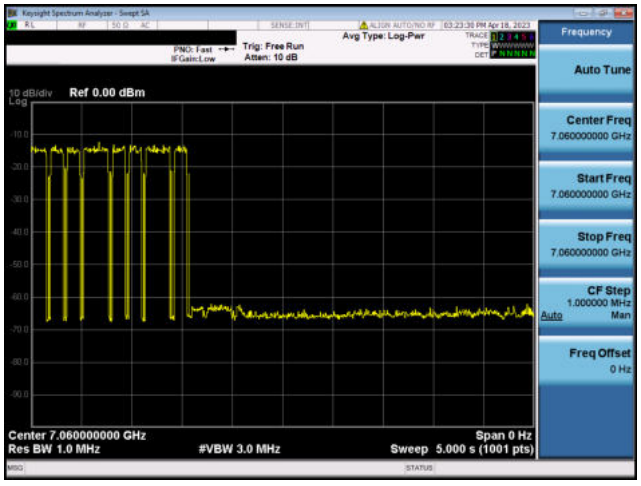
For U-NII-8 band

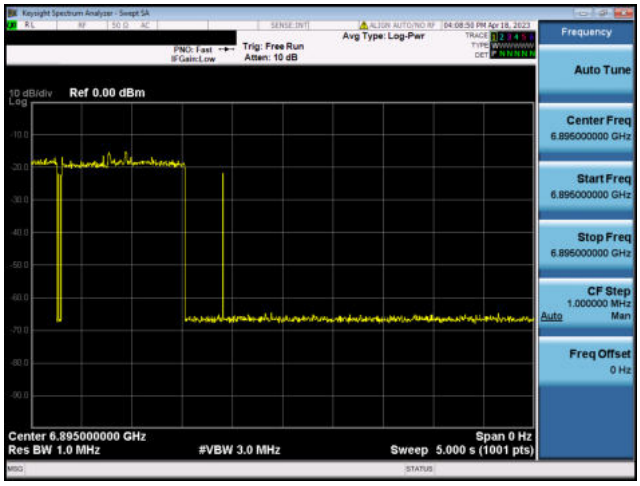
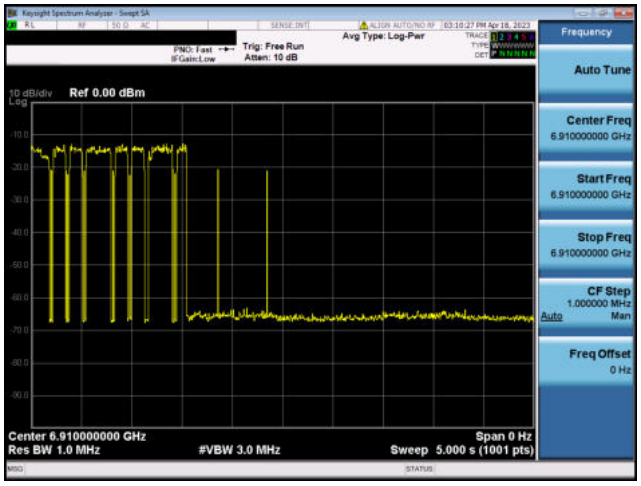
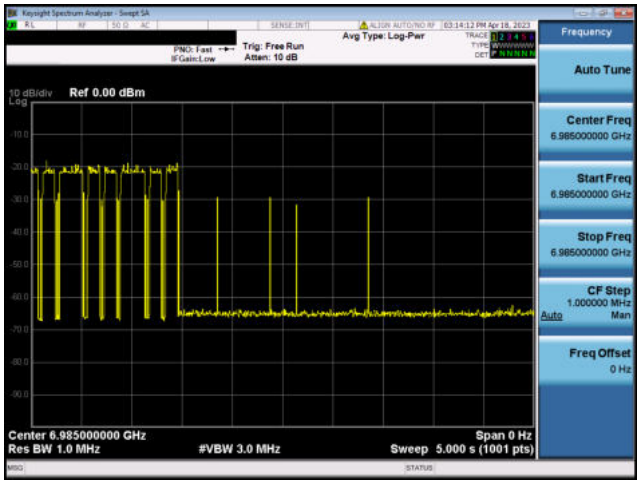
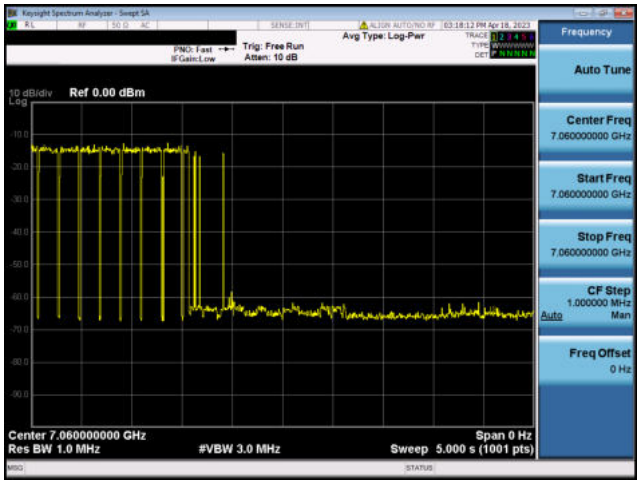
Contention Based Protocol Measurement										
Measurement Mode		Conducted measurement			Device Type		Indoor AP			
The Incumbent Signal (AWGN) Level (dBm)		-62 dBm (at the antenna connector)								
					Test Result					
Operation Band	Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Frequency (MHz)	AWGN Signals Frequency (MHz)	Number of Times	Number of Detected	Detection Rate	Limit	Pass/ Fail
U-NII 8	802.11ax	20 MHz	189	6895	6895	10	10	100 %	90 %	Pass
		160 MHz	207	6985	6910	10	10	100 %	90 %	Pass
					6985	10	10	100 %	90 %	Pass
					7060	10	10	100 %	90 %	Pass

Lowest Interference (AWGN) Level Check							
Operation Band	Operation Mode	Channel Bandwidth (MHz)	Channel Number	Channel Frequency (MHz)	AWGN Signals Frequency (MHz)	Threshold Level (dBm)	EUT Status
U-NII 8	802.11ax	20 MHz	189	6895	6895	-73	OFF
						-74	Minimal
						-76	ON
		160 MHz	207	6985	6910	-70	OFF
						-71	Minimal
						-73	ON
					6985	-67	OFF
						-68	Minimal
						-70	ON
					7060	-71	OFF
						-72	Minimal
						-74	ON

Note:
1. Injected (AWGN) POWER at the antenna connector (dBm) = S.G. (dBm) - Cable loss (dB) - Splitter loss (dB) - lowest antenna gain (dB)
2. Only one chain was performed for testing.
3. The AWGN level is reported for the following conditions:
   - OFF = AWGN level at which no transmission is detected, consistently for a minimum period of 10 seconds.
   - Minimal = AWGN level at which the system begins to trigger the transmission switch-off, albeit not being kept off consistently.
   - ON = AWGN level at which no impact on the transmission is detected, consistently for a minimum period of 10 seconds.

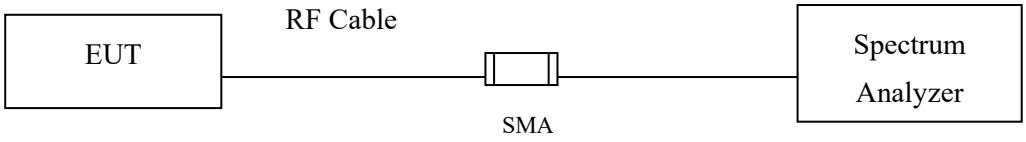
Plots of shows Incumbent signal level	
802.11ax (20MHz) / 6895MHz	802.11ax (160MHz) / 6910MHz (Lower Edge)
	
802.11ax (160MHz) / 6985MHz (Middle)	802.11ax (160MHz) / 7060MHz (Upper Edge)
	

Plots of EUT ceased transmission in the time domain	
802.11ax (20MHz) / 6895MHz	802.11ax (160MHz) / 6985MHz (Lower Edge - 6910MHz)
	
802.11ax (160MHz) / 6985MHz (Middle - 6985MHz)	802.11ax (160MHz) / 6985MHz (Upper Edge - 7060MHz)
	

Plots of Start transmitting	
802.11ax (20MHz) / 6895MHz	802.11ax (160MHz) / 6985MHz (Lower Edge - 6910MHz)
	
802.11ax (160MHz) / 6985MHz (Middle - 6985MHz)	802.11ax (160MHz) / 6985MHz (Upper Edge - 7060MHz)
	

10. Duty Cycle

10.1. Test Setup



10.2. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to U-NII test procedure of KDB789033 for compliance to FCC 47CFR 15.407 requirements.

10.3. Test Result of Duty Cycle

Product : Internet Gateway
Test Item : Duty Cycle
Test Date : 2023/04/17

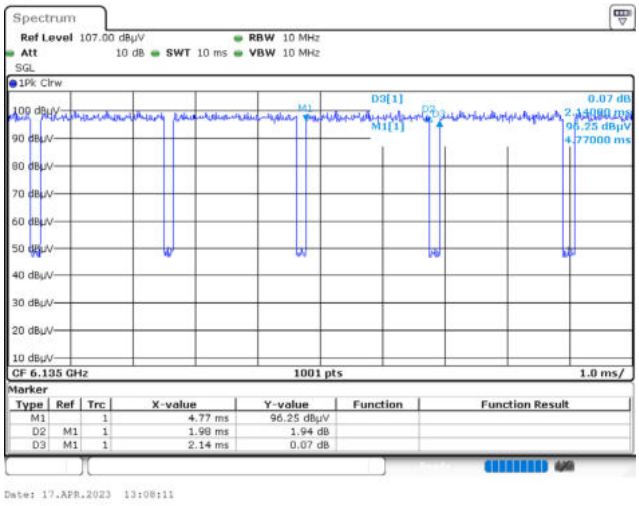
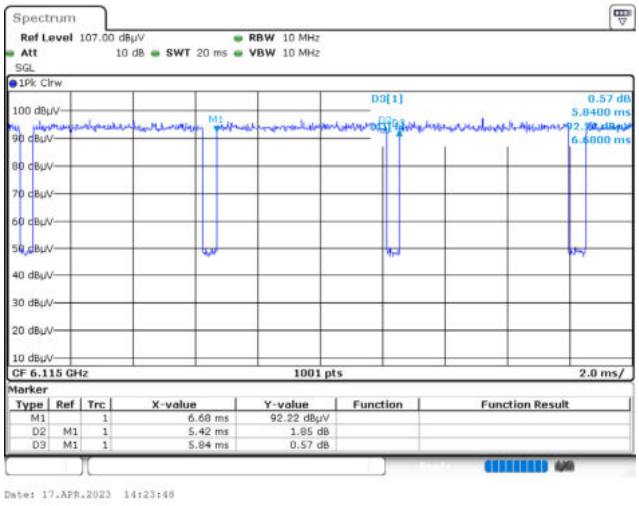
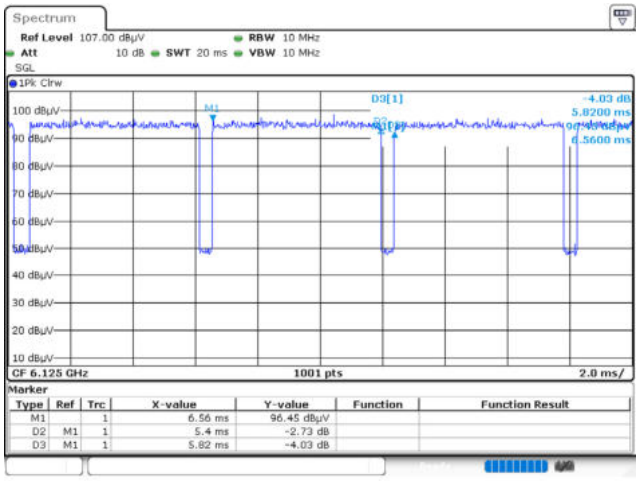
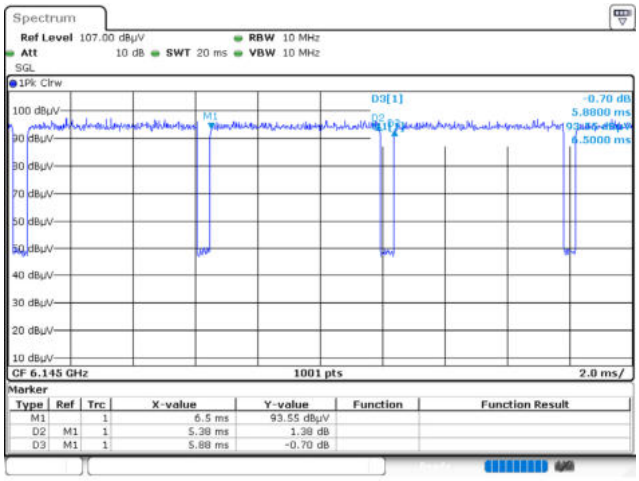
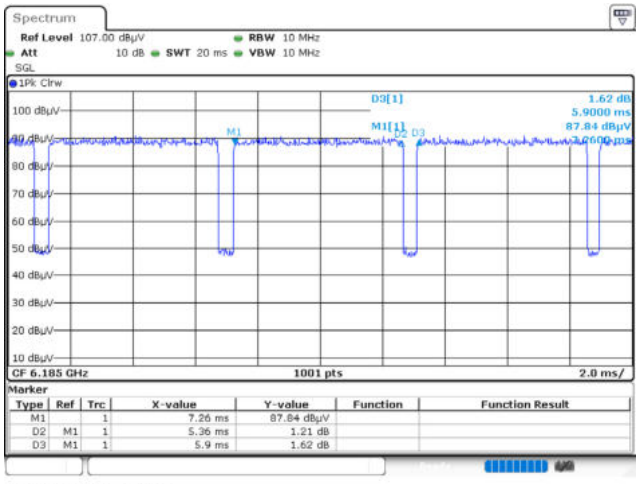
CDD

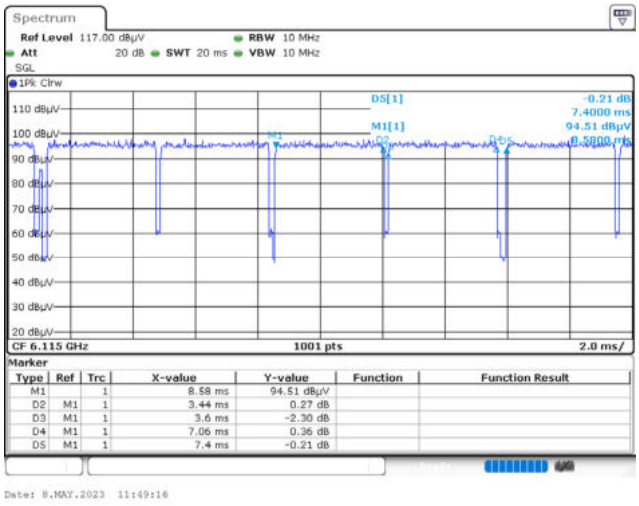
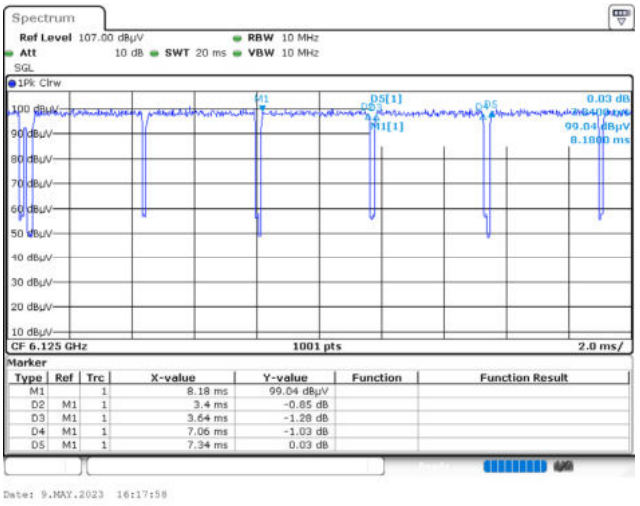
Mode	Time On (ms)	Time On + Time Off (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11a	1.9800	2.1400	92.52	0.34
802.11ax-20 MHz	5.4200	5.8400	92.81	0.32
802.11ax-40 MHz	5.4000	5.8200	92.78	0.33
802.11ax-80 MHz	5.3800	5.8800	91.50	0.39
802.11ax-160 MHz	5.3600	5.9000	90.85	0.42

Beamforming

Mode	Time On (ms)	Time On + Time Off (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11ax-20 MHz	6.9000	7.4000	93.24	0.30
802.11ax-40 MHz	6.8200	7.3400	92.92	0.32
802.11ax-80 MHz	7.2800	7.9200	91.92	0.37
802.11ax-160 MHz	7.9200	8.2400	96.12	0.17

Note:
Offset = 20 log(1/duty cycle)
Accotding to KDB 789033
If power averaging (rms) mode was used in step (iv) above, the correction factor is 10 log (1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 %, then 3 dB must be added to the measured emission levels.
If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log (1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 %, then 6 dB must be added to the measured emission levels.

802.11a / 6135MHz - CDD	802.11ax (20MHz) / 6115MHz - CDD
	
802.11ax (40MHz) / 6125MHz - CDD	802.11ax (80MHz) / 6145MHz - CDD
	
802.11ax (160MHz) / 6185MHz - CDD	
	N/A

802.11ax (20MHz) / 6115MHz - Beamforming	802.11ax (40MHz) / 6125MHz - Beamforming
	
802.11ax (80MHz) / 6145MHz - Beamforming	802.11ax (160MHz) / 6185MHz - Beamforming