

3.5 Contention Based Protocol

3.5.1 Limit of Contention Based Protocol

<FCC 14-30 CFR 15.407>

(d)(6) Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band must employ a contention-based protocol.

FCC KDB 987594 D02 U-NII 6GHz EMC Measurement v03

Unlicensed low-power indoor devices must detect co-channel radio frequency power that is at least -62 dBm or lower. Upon detection of energy in the band, unlicensed low power indoor devices must vacate the channel and stay off the channel as long as detected radio frequency power is equal to or greater than the threshold (-62 dBm). The -62 dBm (or lower) threshold is referenced to a 0 dBi antenna gain. To ensure incumbent operations are reliably detected in the band, low power indoor devices must detect RF energy throughout their intended operating channel. For example, an 802.11 device that plans to transmit a 40 MHz- wide signal (on a primary 20 MHz channel and a secondary 20 MHz channel) must detect energy throughout the entire 40 MHz channel. Additionally, low-power indoor devices must detect co-channel energy with 90% or greater certainty.

Table 1. Criteria to determine number of times detection threshold test may be performed

If	Number of Tests	Placement of Incumbent Transmission
$BW_{EUT} \leq BW_{Inc}$	Once	Tune incumbent and EUT transmissions ($f_{c1} = f_{c2}$)
$BW_{Inc} < BW_{EUT} \leq 2BW_{Inc}$	Once	Incumbent transmission is contained within BW_{EUT}
$2BW_{Inc} < BW_{EUT} \leq 4BW_{Inc}$	Twice. Incumbent transmission is contained within BW_{EUT}	Incumbent transmission is located as closely as possible to the lower edge and upper edge, respectively, of the EUT channel
$BW_{EUT} > 4BW_{Inc}$	Three times	Incumbent transmission is located as closely as possible to the lower edge of the EUT channel, in the middle of EUT channel, and as closely as possible to the upper edge of the EUT channel

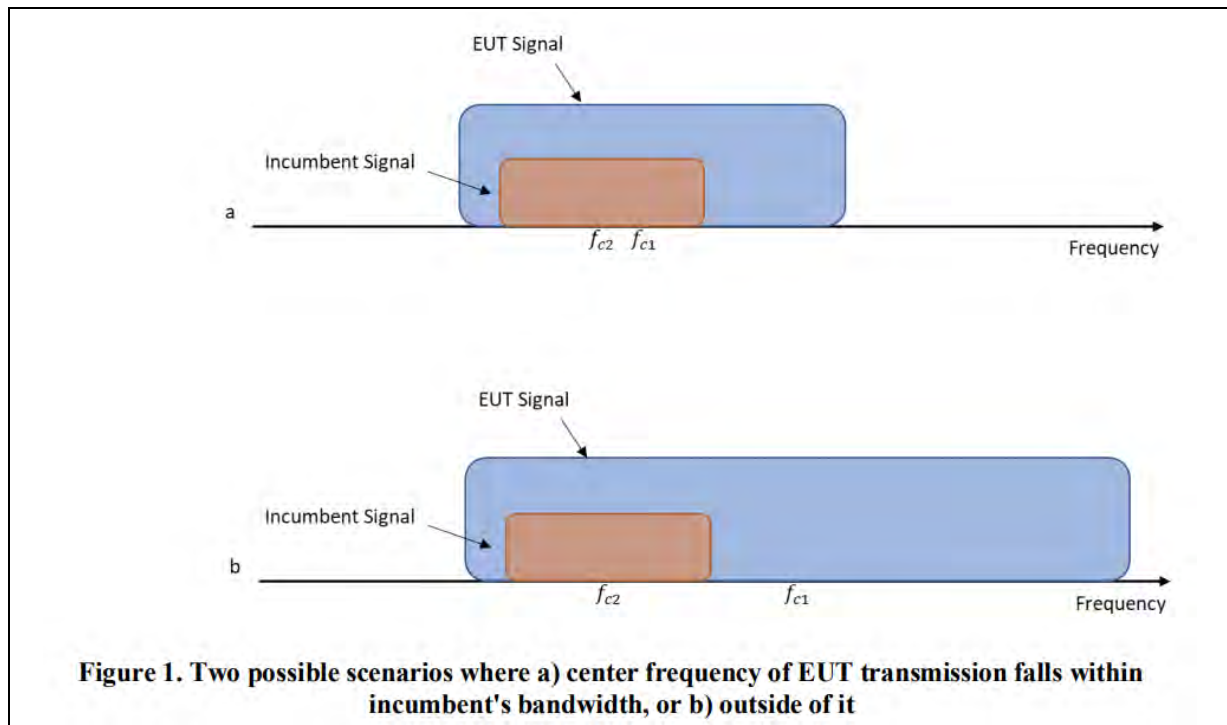
where:

BW_{EUT} : Transmission bandwidth of EUT signal

BW_{Inc} : Transmission bandwidth of the simulated incumbent signal (10 MHz wide AWGN signal)

f_{c1} : Center frequency of EUT transmission

f_{c2} : Center frequency of simulated incumbent signal



3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.5.3 Test Procedures

The testing follows FCC KDB 987594 D02 U-NII 6GHz EMC Measurement v03.

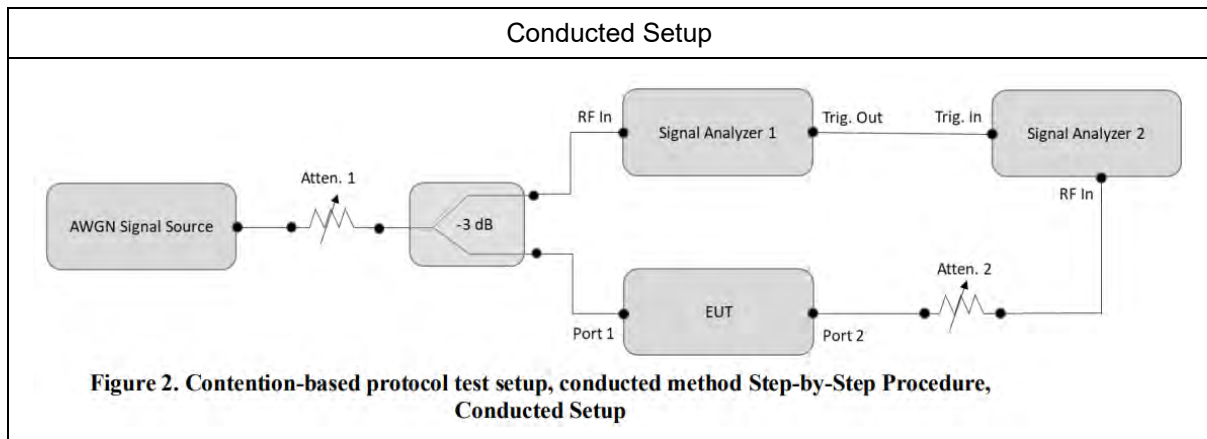
Section I) Contention Based Protocol

Conducted method Step-by-Step Procedure, Conducted Setup

1. Configure the EUT to transmit with a constant duty cycle.
2. Set the operating parameters of the EUT including power level, operating frequency, modulation and bandwidth.
3. 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.
4. Connect the output port of the EUT to the signal analyzer 2, as shown in test setup Figure 2. Ensure that the attenuator 2 provides enough attenuation to not overload the signal analyzer 2 receiver.
5. Monitoring the signal analyzer 2, verify the EUT is operating and transmitting with the parameters set at step two.
6. Using an AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use Table 1 to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.
7. 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 as shown in test setup Figure 2.
8. Transmit the AWGN signal (RF ON) and verify its characteristics on the signal analyzer 1.

9. 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.
10. (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.
11. Refer to Table 1 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 5, choose a different center frequency for the AWGN signal and repeat the process.
12. For the contention-based protocol test where only one channel in each supported sub-band needs to be tested. The narrowest and widest bandwidth in each channel shall be measured EUT was driven in MIMO mode, the interferer level was injected to both chains to monitor the performance, while the interferer level is determined according the lowest antenna gain among both antennas (i.e, lower interferer level).

3.5.4 Test Setup



3.5.5 Support Unit used in test configuration and system

Instrument	Brand Name	Model No.	Characteristics
WLAN AP	ASUS	RT-BE92U	Tri-Band Wi-Fi 7 Extendable Router
Notebook	Acer	N15C1	LAN

3.5.6 Minimum Antenna gain for Contention Based Protocol Test

Antenna Gain	<UNII-5>: -2.2 dBi <UNII-6>: -1.9 dBi <UNII-7>: -1.2 dBi <UNII-8>: -3.1 dBi
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3.5.7 Test Summary of Contention Based Protocol Test

Test Engineer :	Kai Liao	Temperature :	20.4~22.4℃
		Relative Humidity :	48.2~53.2%

Band	Channel Freq. (MHz)	Channel BW (MHz)	Incumbent freq. (MHz)	Injected AWGN Level (dBm)	Detection Rate (%)	Regulated Threshold level (dBm)	Adjusted Power (dBm)	Margin (dB)
UNII Band 5	6135	20	6135	-66.75	100	-62	-64.55	2.55
				Result: Stop Transmission				
				-67.75	< 90	-62	-65.55	3.55
				Result: Minimal Operation				
				-68.75	0	-62	-66.55	4.55
				Result: Normal Operation				
	6185	160	6110	-71.58	100	-62	-69.38	7.38
				Result: Stop Transmission				
				-72.58	< 90	-62	-70.38	8.38
				Result: Minimal Operation				
				-73.58	0	-62	-71.38	9.38
				Result: Normal Operation				
			6185	-66.31	100	-62	-64.11	2.11
				Result: Stop Transmission				
				-69.31	< 90	-62	-67.11	5.11
				Result: Minimal Operation				
				-70.31	0	-62	-68.11	6.11
				Result: Normal Operation				
			6260	-71.43	100	-62	-69.23	7.23
				Result: Stop Transmission				
				-73.43	< 90	-62	-71.23	9.23
				Result: Minimal Operation				
				-74.43	0	-62	-72.23	10.23
				Result: Normal Operation				

Note 1: Adjusted Power = Injected AWGN Level - Minimum antenna gain (-2.2 dBi).

Note 2: The antenna gain has included the path loss between RF connector and antenna.

Note 3: Margin = Regulated Threshold level - Adjusted Power.



Band	Channel Freq. (MHz)	Channel BW (MHz)	Incumbent freq. (MHz)	Injected AWGN Level (dBm)	Detection Rate (%)	Regulated Threshold level (dBm)	Adjusted Power (dBm)	Margin (dB)
UNII Band 6	6455	20	6455	-67.65	100	-62	-65.75	3.75
					Result: Stop Transmission			
				-67.65	< 90	-62	-65.75	3.75
					Result: Minimal Operation			
				-68.65	0	-62	-66.75	4.75
					Result: Normal Operation			
	6505	160	6430	-72.61	100	-62	-70.71	8.71
					Result: Stop Transmission			
				-73.61	< 90	-62	-71.71	9.71
					Result: Minimal Operation			
				-74.61	0	-62	-72.71	10.71
					Result: Normal Operation			
			6505	-68.42	100	-62	-66.52	4.52
					Result: Stop Transmission			
				-69.42	< 90	-62	-67.52	5.52
					Result: Minimal Operation			
				-70.42	0	-62	-68.52	6.52
					Result: Normal Operation			
			6580	-70.27	100	-62	-68.37	6.37
					Result: Stop Transmission			
				-73.27	< 90	-62	-71.37	9.37
					Result: Minimal Operation			
				-74.27	0	-62	-72.37	10.37
					Result: Normal Operation			

Note 1: Adjusted Power = Injected AWGN Level - Minimum antenna gain (-1.9 dBi).

Note 2: The antenna gain has included the path loss between RF connector and antenna.

Note 3: Margin = Regulated Threshold level - Adjusted Power.



Band	Channel Freq. (MHz)	Channel BW (MHz)	Incumbent freq. (MHz)	Injected AWGN Level (dBm)	Detection Rate (%)	Regulated Threshold level (dBm)	Adjusted Power (dBm)	Margin (dB)
UNII Band 7	6695	20	6695	-66.18	100	-62	-64.98	2.98
					Result: Stop Transmission			
				-68.18	< 90	-62	-66.98	4.98
					Result: Minimal Operation			
				-69.18	0	-62	-67.98	5.98
					Result: Normal Operation			
	6665	160	6590	-71.16	100	-62	-69.96	7.96
					Result: Stop Transmission			
				-72.16	< 90	-62	-70.96	8.96
					Result: Minimal Operation			
				-73.16	0	-62	-71.96	9.96
					Result: Normal Operation			
			6665	-67.09	100	-62	-65.89	3.89
					Result: Stop Transmission			
				-70.09	< 90	-62	-68.89	6.89
					Result: Minimal Operation			
				-71.09	0	-62	-69.89	7.89
					Result: Normal Operation			
			6740	-71.97	100	-62	-70.77	8.77
					Result: Stop Transmission			
				-73.97	< 90	-62	-72.77	10.77
					Result: Minimal Operation			
				-74.97	0	-62	-73.77	11.77
					Result: Normal Operation			

Note 1: Adjusted Power = Injected AWGN Level - Minimum antenna gain (-1.2 dBi).

Note 2: The antenna gain has included the path loss between RF connector and antenna.

Note 3: Margin = Regulated Threshold level - Adjusted Power.



Band	Channel Freq. (MHz)	Channel BW (MHz)	Incumbent freq. (MHz)	Injected AWGN Level (dBm)	Detection Rate (%)	Regulated Threshold level (dBm)	Adjusted Power (dBm)	Margin (dB)
UNII Band 8	7015	20	7015	-68.15	100	-62	-65.05	3.05
					Result: Stop Transmission			
				-69.15	< 90	-62	-66.05	4.05
					Result: Minimal Operation			
				-70.15	0	-62	-67.05	5.05
					Result: Normal Operation			
	6985	160	6910	-71.14	100	-62	-68.04	6.04
					Result: Stop Transmission			
				-73.14	< 90	-62	-70.04	8.04
					Result: Minimal Operation			
				-74.14	0	-62	-71.04	9.04
					Result: Normal Operation			
			6985	-67.97	100	-62	-64.87	2.87
					Result: Stop Transmission			
				-68.97	< 90	-62	-65.87	3.87
					Result: Minimal Operation			
				-69.97	0	-62	-66.87	4.87
					Result: Normal Operation			
			7060	-72.15	100	-62	-69.05	7.05
					Result: Stop Transmission			
				-75.15	< 90	-62	-72.05	10.05
					Result: Minimal Operation			
				-76.15	0	-62	-73.05	11.05
					Result: Normal Operation			

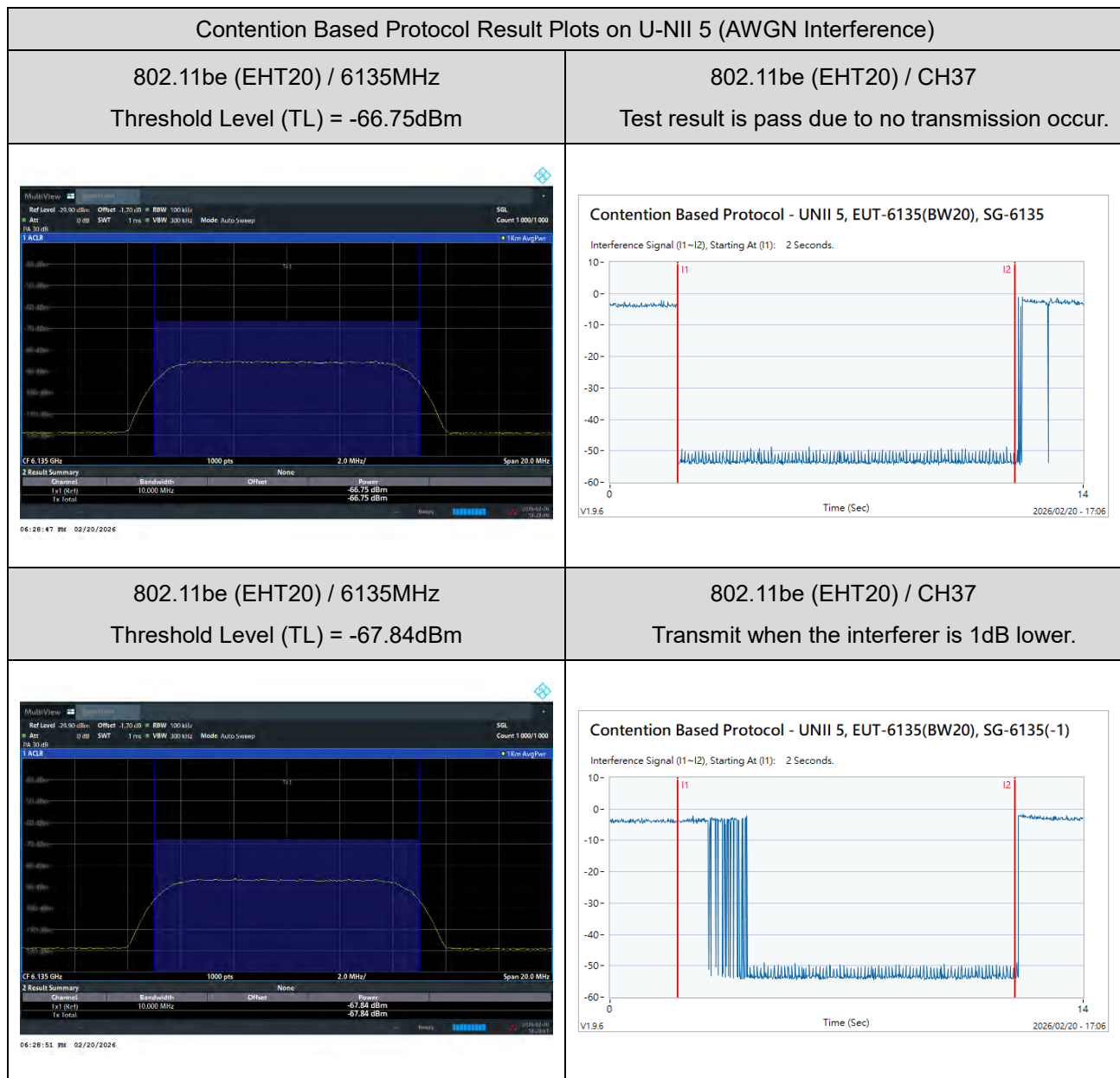
Note 1: Adjusted Power = Injected AWGN Level - Minimum antenna gain (-3.1 dBi).

Note 2: The antenna gain has included the path loss between RF connector and antenna.

Note 3: Margin = Regulated Threshold level - Adjusted Power.



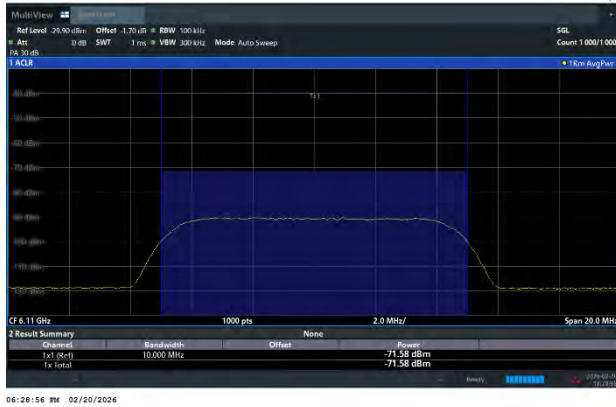
3.5.8 Test Plots of Contention Based Protocol Test



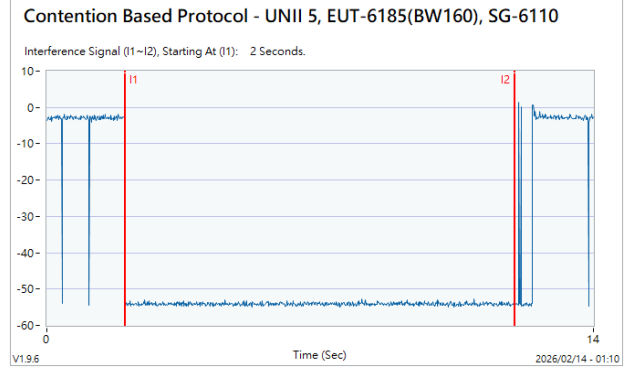


Contention Based Protocol Result Plots on U-NII 5 (AWGN Interference)

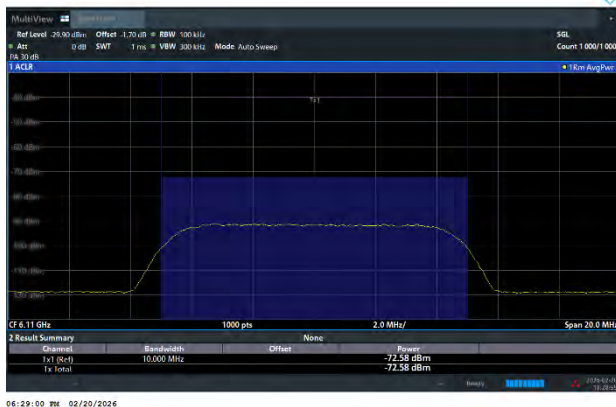
802.11be (EHT160) / 6110MHz (Lower edge)
Threshold Level (TL) = -71.58dBm



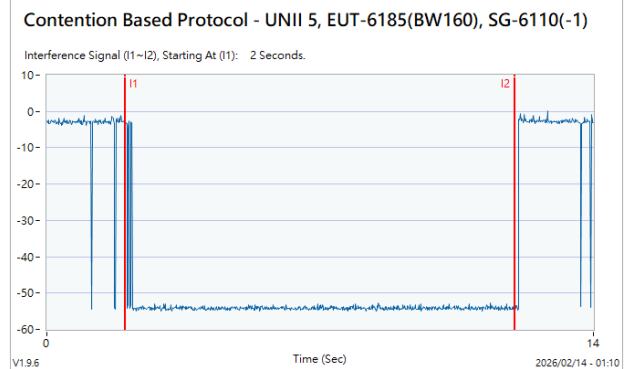
802.11be (EHT160) / CH47 (Lower edge)
Test result is pass due to no transmission occur.

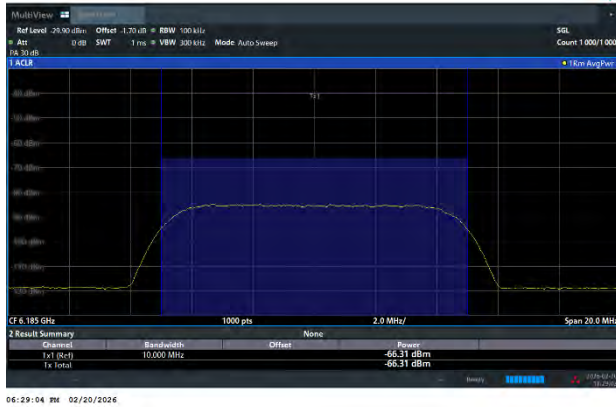


802.11be (EHT160) / 6110MHz (Lower edge)
Threshold Level (TL) = -72.58dBm

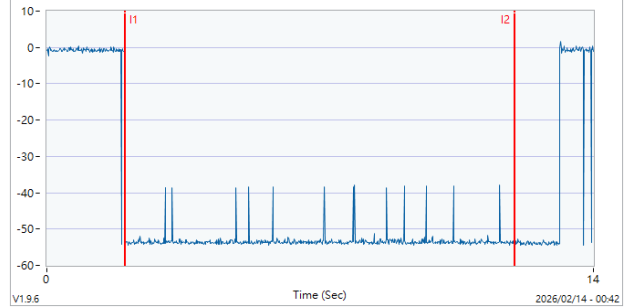
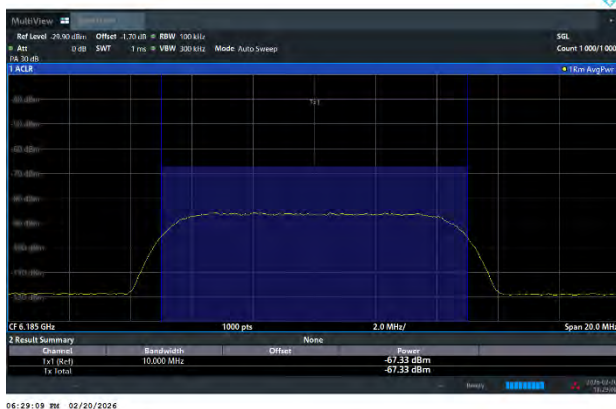


802.11be (EHT160) / CH47 (Lower edge)
Transmit when the interferer is 1dB lower.

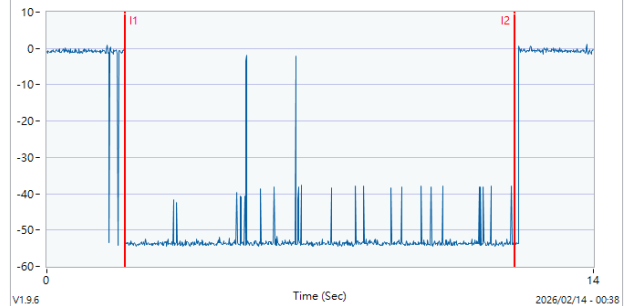


**Contention Based Protocol Result Plots on U-NII 5 (AWGN Interference)****802.11be (EHT160) / 6185MHz (Middle)****Threshold Level (TL) = -66.31dBm****802.11be (EHT160) / CH47 (Middle)****Test result is pass due to no transmission occur.****Contention Based Protocol - UNII 5, EUT-6185(BW160), SG-6185**

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.

**802.11be (EHT160) / 6185MHz (Middle)****Threshold Level (TL) = -67.33dBm****802.11be (EHT160) / CH47 (Middle)****Transmit when the interferer is 1dB lower.****Contention Based Protocol - UNII 5, EUT-6185(BW160), SG-6185(-1)**

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.

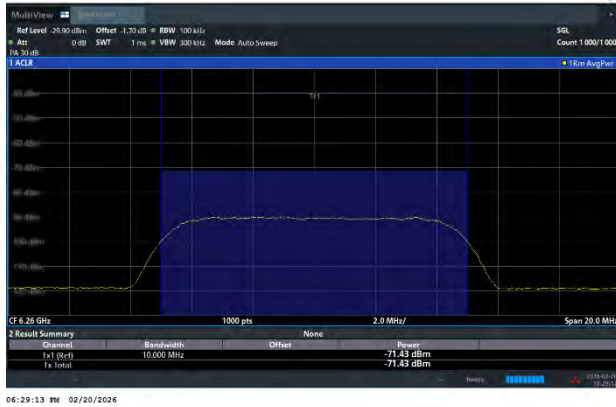




Contention Based Protocol Result Plots on U-NII 5 (AWGN Interference)

802.11be (EHT160) / 6260MHz (Upper edge)

Threshold Level (TL) = -71.43dBm

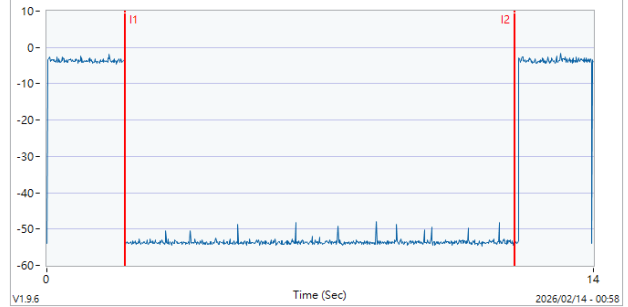


802.11be (EHT160) / CH47 (Upper edge)

Test result is pass due to no transmission occur.

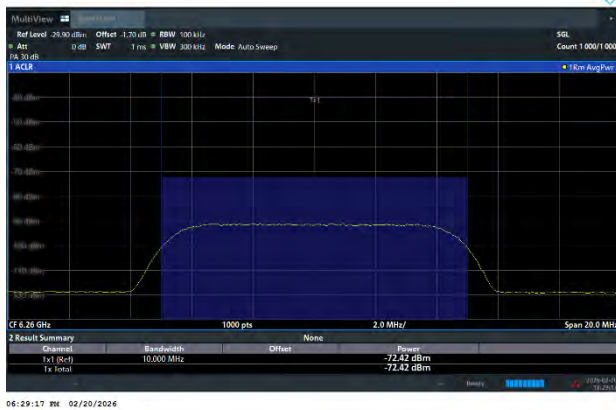
Contention Based Protocol - UNII 5, EUT-6185(BW160), SG-6260

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



802.11be (EHT160) / 6260MHz (Upper edge)

Threshold Level (TL) = -72.42dBm

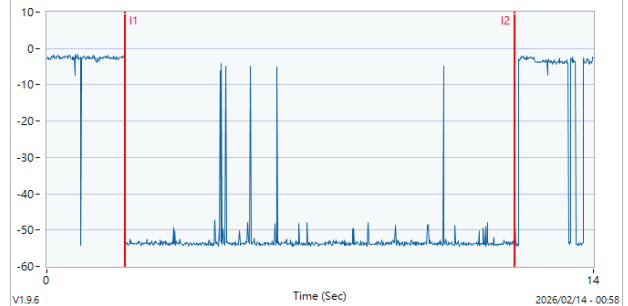


802.11be (EHT160) / CH47 (Upper edge)

Transmit when the interferer is 1dB lower.

Contention Based Protocol - UNII 5, EUT-6185(BW160), SG-6260(-1)

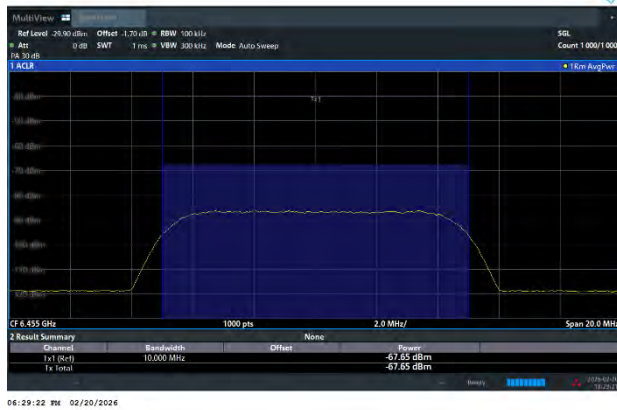
Interference Signal (I1~I2), Starting At (I1): 2 Seconds.





Contention Based Protocol Result Plots on U-NII 6 (AWGN Interference)

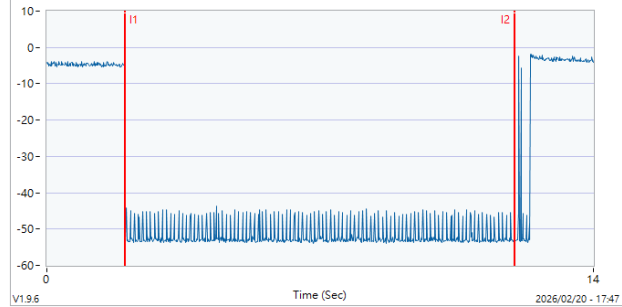
802.11be (EHT20) / 6455MHz
Threshold Level (TL) = -67.65dBm



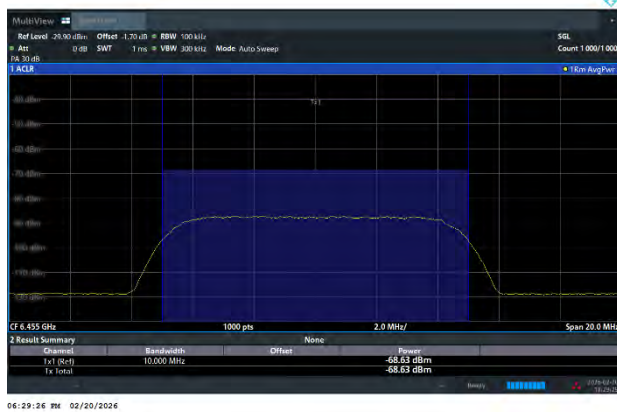
802.11be (EHT20) / CH101
Test result is pass due to no transmission occur.

Contention Based Protocol - UNII 6, EUT-6455(BW20), SG-6455

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



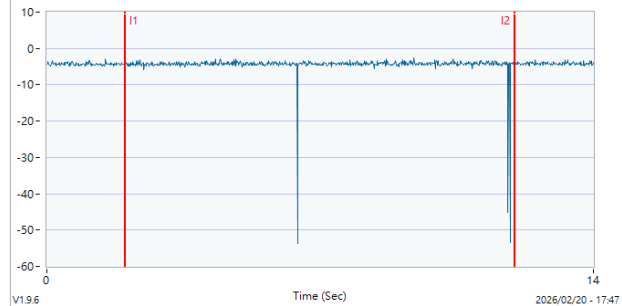
802.11be (EHT20) / 6455MHz
Threshold Level (TL) = -68.63dBm



802.11be (EHT20) / CH101
Transmit when the interferer is 1dB lower.

Contention Based Protocol - UNII 6, EUT-6455(BW20), SG-6455(-1)

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.

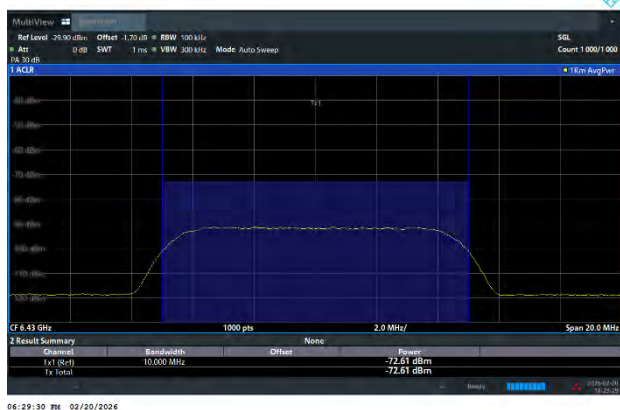




Contention Based Protocol Result Plots on U-NII 6 (AWGN Interference)

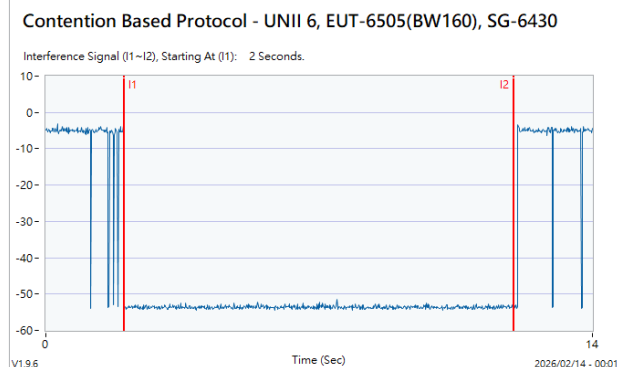
802.11be (EHT160) / 6430MHz (Lower edge)

Threshold Level (TL) = -72.61dBm



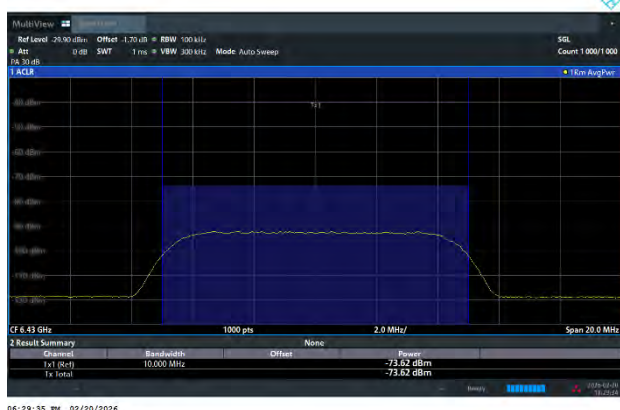
802.11be (EHT160) / CH111 (Lower edge)

Test result is pass due to no transmission occur.



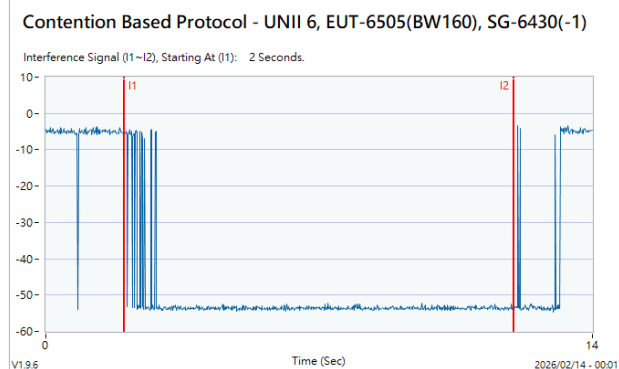
802.11be (EHT160) / 6430MHz (Lower edge)

Threshold Level (TL) = -73.62dBm



802.11be (EHT160) / CH111 (Lower edge)

Transmit when the interferer is 1dB lower.

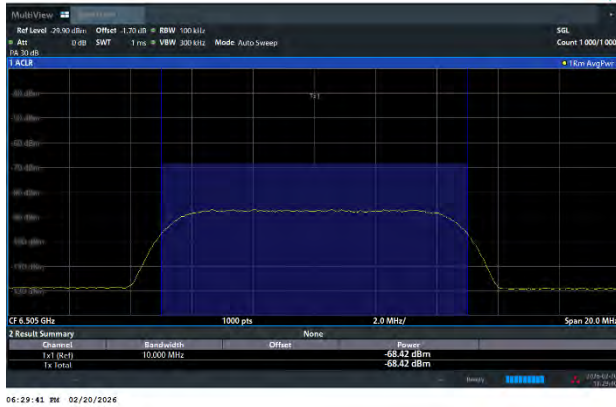




Contention Based Protocol Result Plots on U-NII 6 (AWGN Interference)

802.11be (EHT160) / 6505MHz (Middle)

Threshold Level (TL) = -68.42dBm

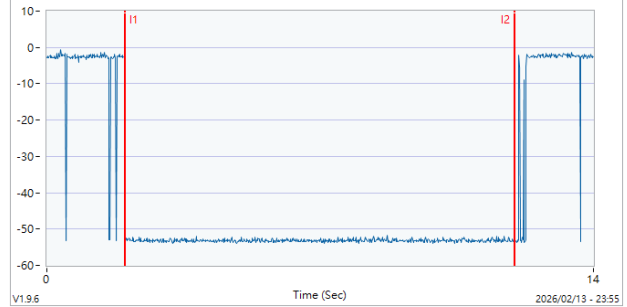


802.11be (EHT160) / CH111 (Middle)

Test result is pass due to no transmission occur.

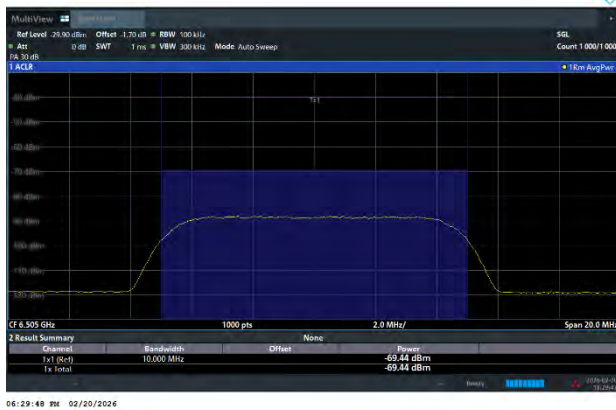
Contention Based Protocol - UNII 6, EUT-6505(BW160), SG-6505

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



802.11be (EHT160) / 6505MHz (Middle)

Threshold Level (TL) = -69.44dBm

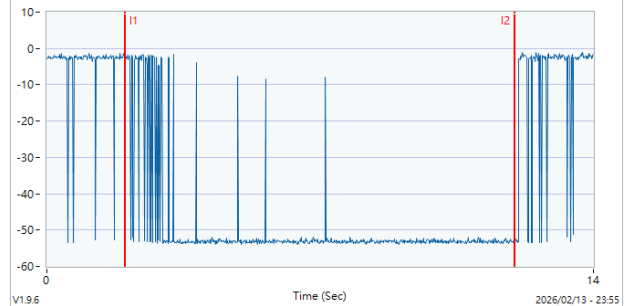


802.11be (EHT160) / CH111 (Middle)

Transmit when the interferer is 1dB lower.

Contention Based Protocol - UNII 6, EUT-6505(BW160), SG-6505(-1)

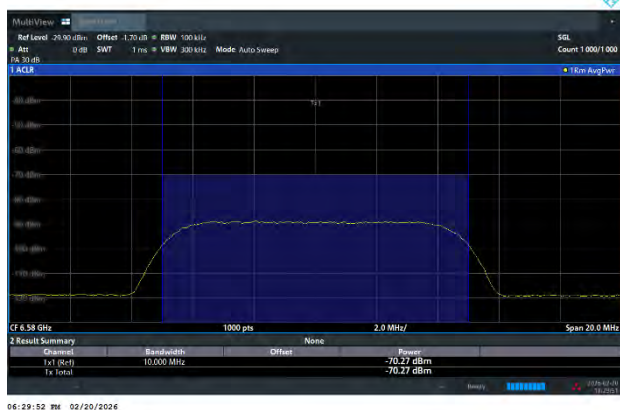
Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



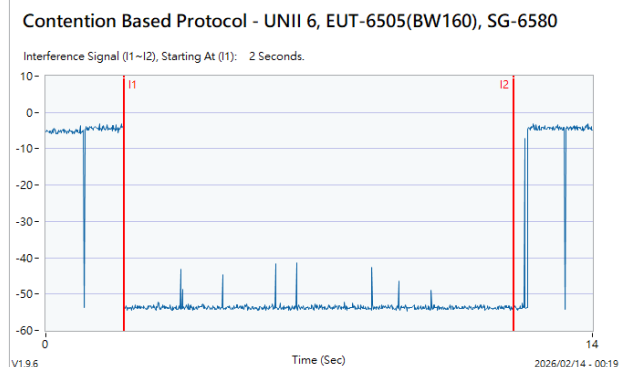


Contention Based Protocol Result Plots on U-NII 6 (AWGN Interference)

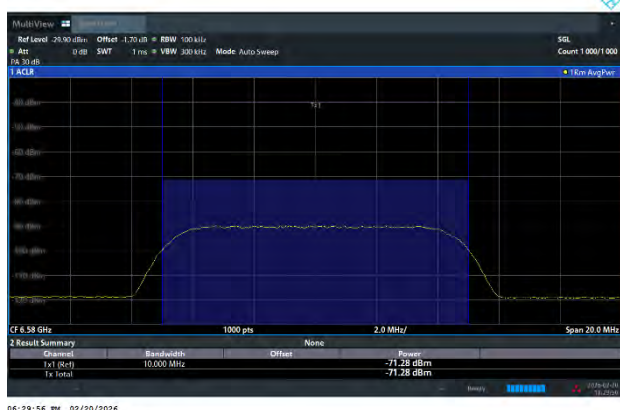
802.11be (EHT160) / 6580MHz (Upper edge)
Threshold Level (TL) = -70.27dBm



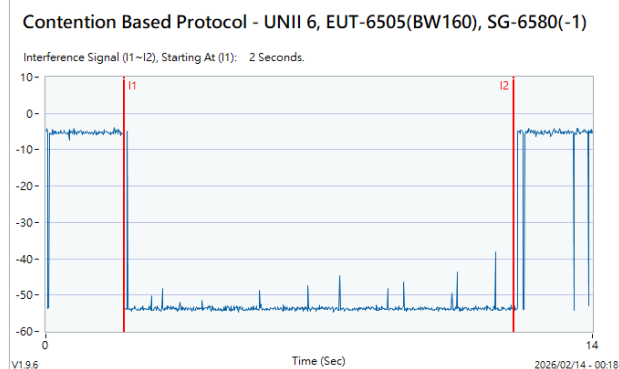
802.11be (EHT160) / CH111 (Upper edge)
Test result is pass due to no transmission occur.



802.11be (EHT160) / 6580MHz (Upper edge)
Threshold Level (TL) = -71.28dBm



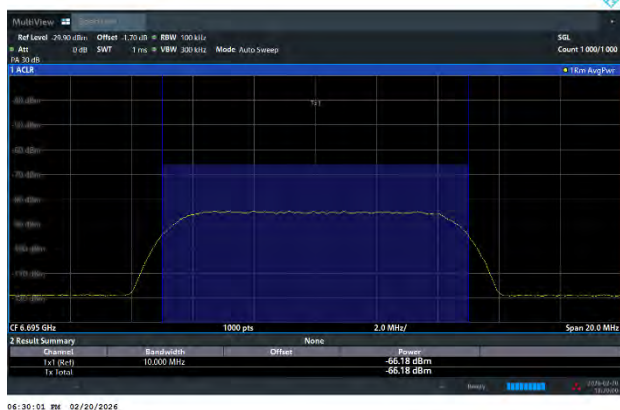
802.11be (EHT160) / CH111 (Upper edge)
Transmit when the interferer is 1dB lower.



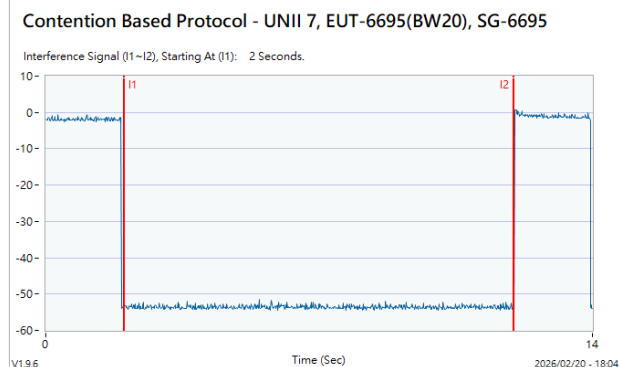


Contention Based Protocol Result Plots on U-NII 7 (AWGN Interference)

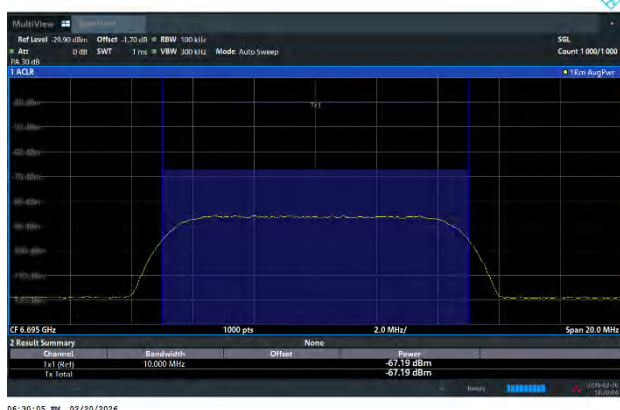
802.11be (EHT20) / 6695MHz
Threshold Level (TL) = -66.18dBm



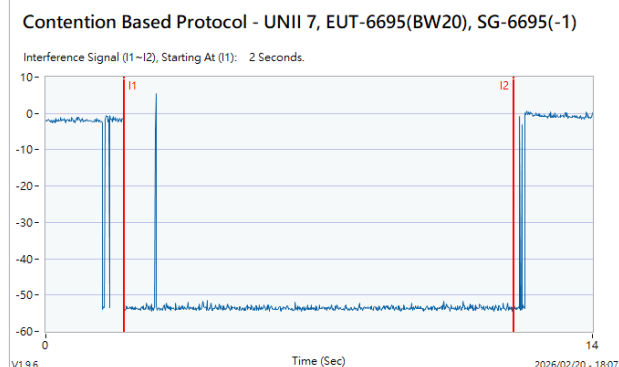
802.11be (EHT20) / CH149
Test result is pass due to no transmission occur.



802.11be (EHT20) / 6695MHz
Threshold Level (TL) = -67.19dBm



802.11be (EHT20) / CH149
Transmit when the interferer is 1dB lower.

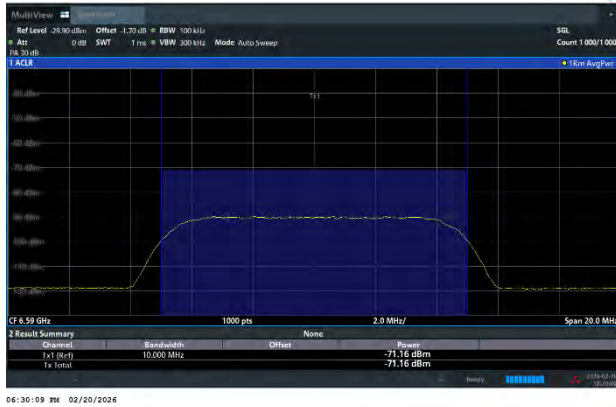




Contention Based Protocol Result Plots on U-NII 7 (AWGN Interference)

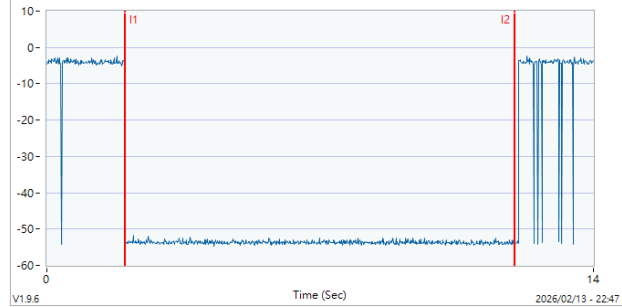
802.11be (EHT160) / 6590MHz (Lower edge)
Threshold Level (TL) = -71.16dBm

802.11be (EHT160) / CH143 (Lower edge)
Test result is pass due to no transmission occur.



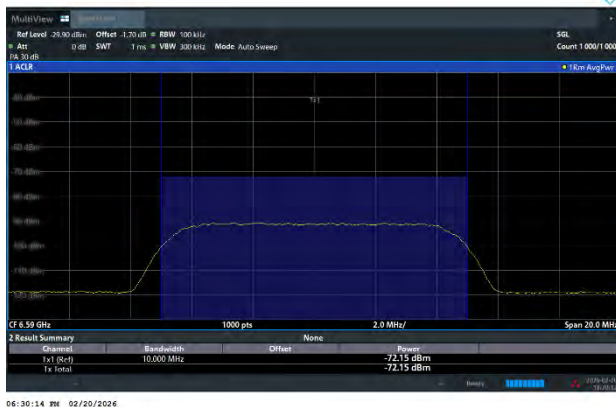
Contention Based Protocol - UNII 7, EUT-6665(BW160), SG-6590

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



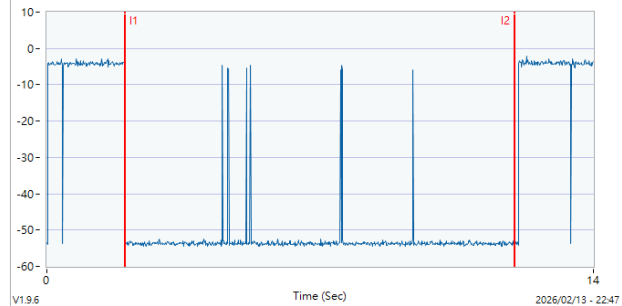
802.11be (EHT160) / 6590MHz (Lower edge)
Threshold Level (TL) = -72.15dBm

802.11be (EHT160) / CH143 (Lower edge)
Transmit when the interferer is 1dB lower.



Contention Based Protocol - UNII 7, EUT-6665(BW160), SG-6590(-1)

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.

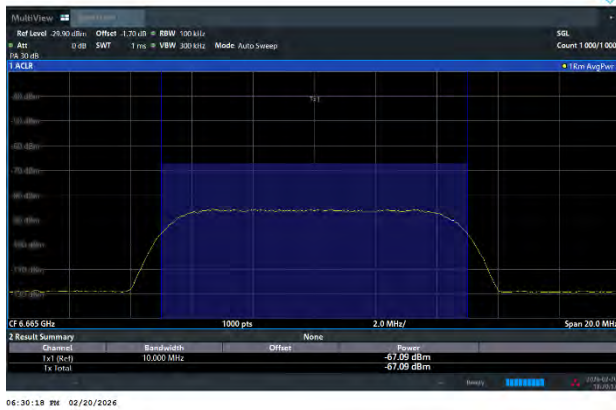




Contention Based Protocol Result Plots on U-NII 7 (AWGN Interference)

802.11be (EHT160) / 6665MHz (Middle)

Threshold Level (TL) = -67.09dBm

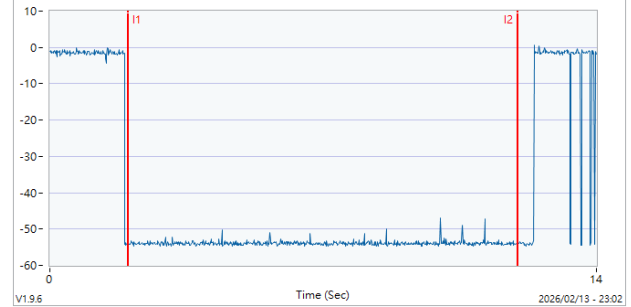


802.11be (EHT160) / CH143 (Middle)

Test result is pass due to no transmission occur.

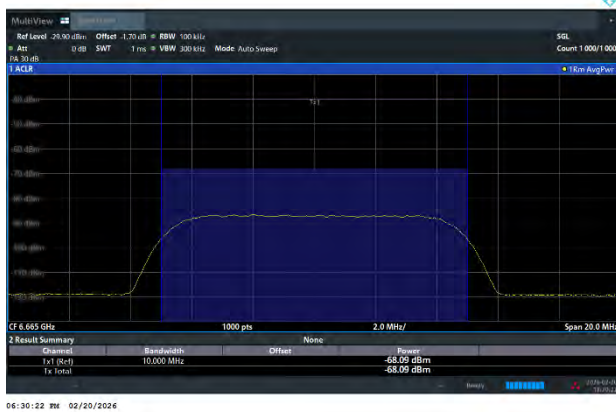
Contention Based Protocol - UNII 7, EUT-6665(BW160), SG-6665

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



802.11be (EHT160) / 6665MHz (Middle)

Threshold Level (TL) = -68.09dBm

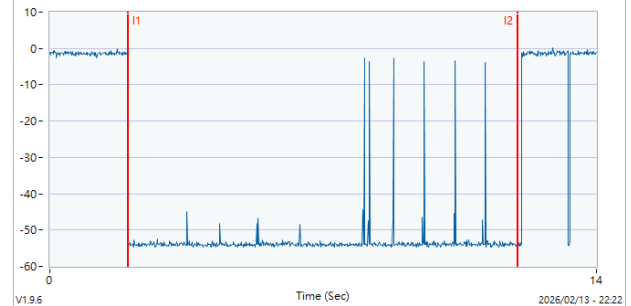


802.11be (EHT160) / CH143 (Middle)

Transmit when the interferer is 1dB lower.

Contention Based Protocol - UNII 7, EUT-6665(BW160), SG-6665(-1)

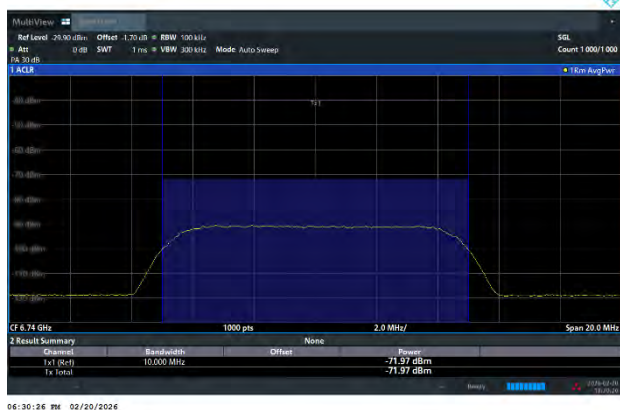
Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



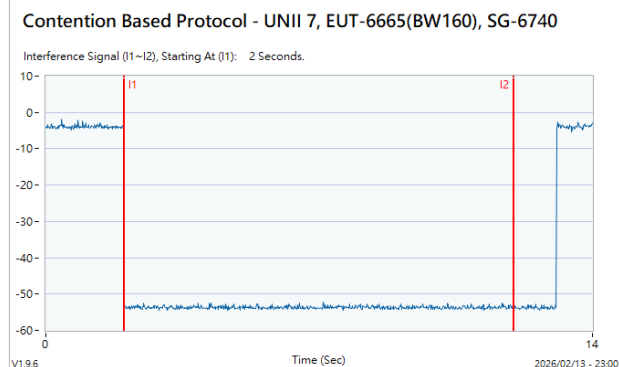


Contention Based Protocol Result Plots on U-NII 7 (AWGN Interference)

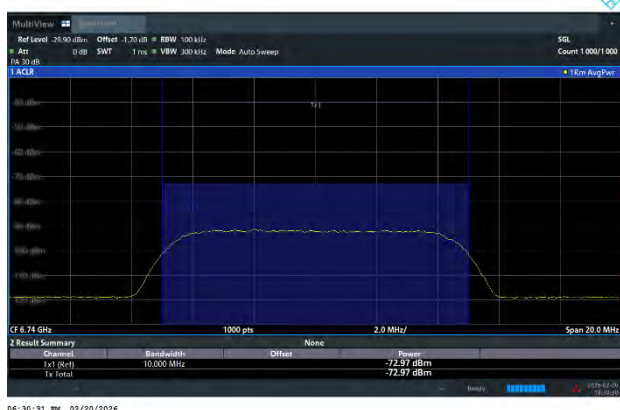
802.11be (EHT160) / 6740MHz (Upper edge)
Threshold Level (TL) = -71.97dBm



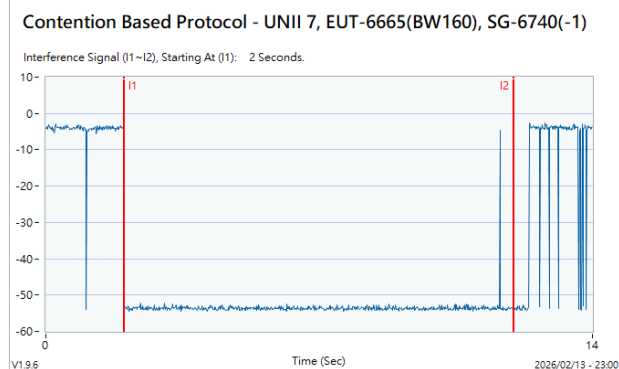
802.11be (EHT160) / CH143 (Upper edge)
Test result is pass due to no transmission occur.



802.11be (EHT160) / 6740MHz (Upper edge)
Threshold Level (TL) = -72.97dBm



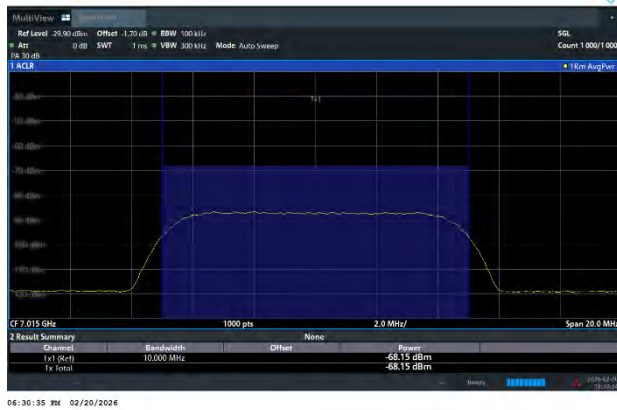
802.11be (EHT160) / CH143 (Upper edge)
Transmit when the interferer is 1dB lower.





Contention Based Protocol Result Plots on U-NII 8 (AWGN Interference)

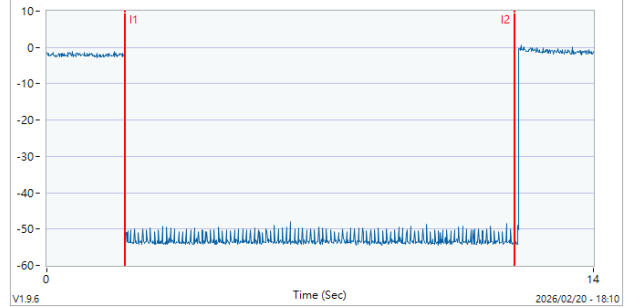
802.11be (EHT20) / 7015MHz
Threshold Level (TL) = -68.15dBm



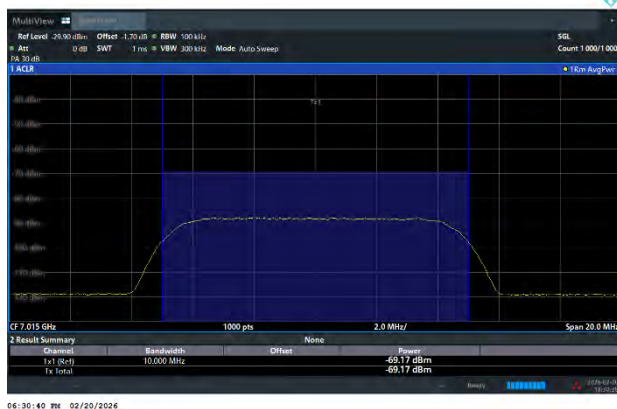
802.11be (EHT20) / CH213
Test result is pass due to no transmission occur.

Contention Based Protocol - UNII 8, EUT-7015(BW20), SG-7015

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



802.11be (EHT20) / 7015MHz
Threshold Level (TL) = -69.17dBm

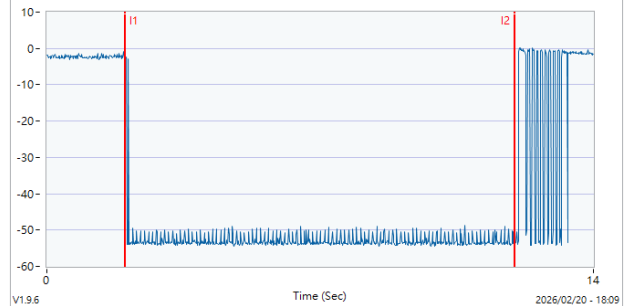


802.11be (EHT20) / CH213

Transmit when the interferer is 1dB lower.

Contention Based Protocol - UNII 8, EUT-7015(BW20), SG-7015(-1)

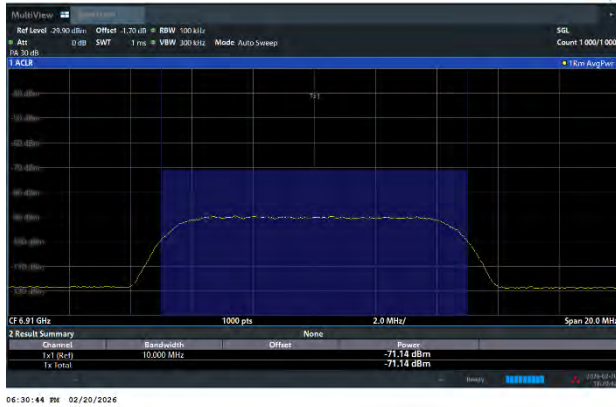
Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



Contention Based Protocol Result Plots on U-NII 8 (AWGN Interference)

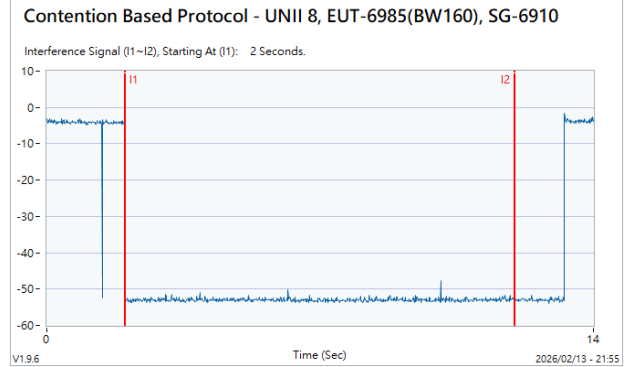
802.11be (EHT160) / 6910MHz (Lower edge)

Threshold Level (TL) = -71.14dBm



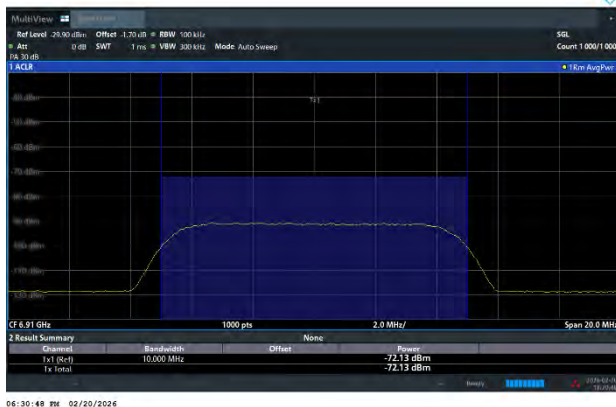
802.11be (EHT160) / CH207 (Lower edge)

Test result is pass due to no transmission occur.



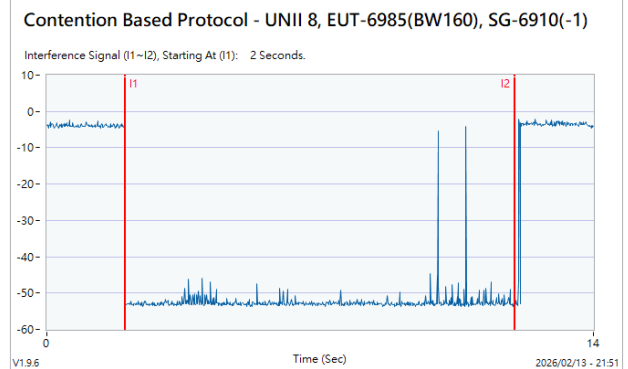
802.11be (EHT160) / 6910MHz (Lower edge)

Threshold Level (TL) = -72.13dBm



802.11be (EHT160) / CH207 (Lower edge)

Transmit when the interferer is 1dB lower.

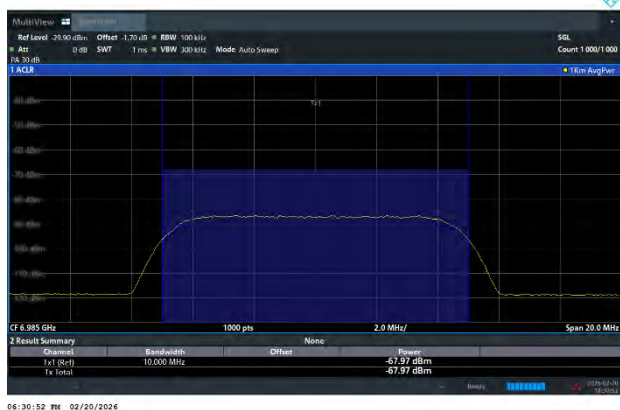




Contention Based Protocol Result Plots on U-NII 8 (AWGN Interference)

802.11be (EHT160) / 6985MHz (Middle)

Threshold Level (TL) = -67.97dBm

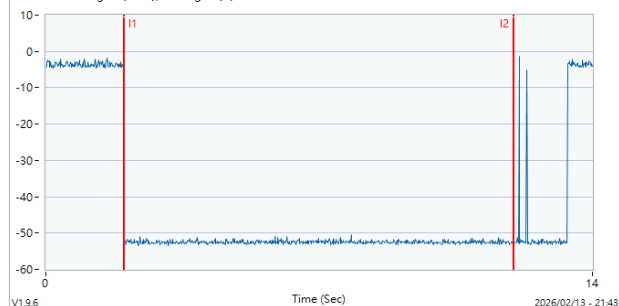


802.11be (EHT160) / CH207 (Middle)

Test result is pass due to no transmission occur.

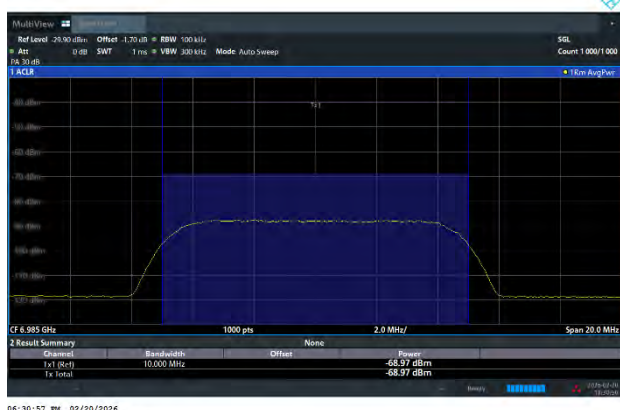
Contention Based Protocol - UNII 8, EUT-6985(BW160), SG-6985

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.



802.11be (EHT160) / 6985MHz (Middle)

Threshold Level (TL) = -68.97dBm

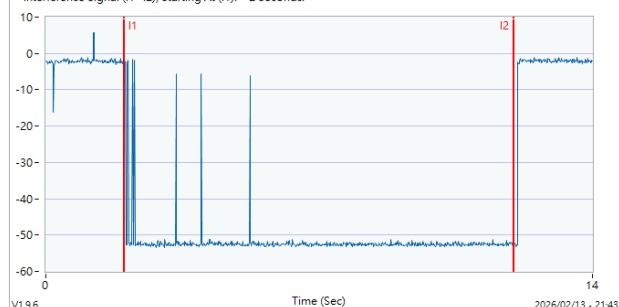


802.11be (EHT160) / CH207 (Middle)

Transmit when the interferer is 1dB lower.

Contention Based Protocol - UNII 8, EUT-6985(BW160), SG-6985(-1)

Interference Signal (I1~I2), Starting At (I1): 2 Seconds.

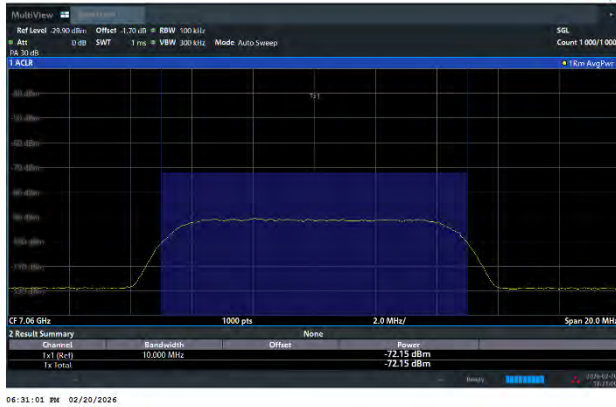




Contention Based Protocol Result Plots on U-NII 8 (AWGN Interference)

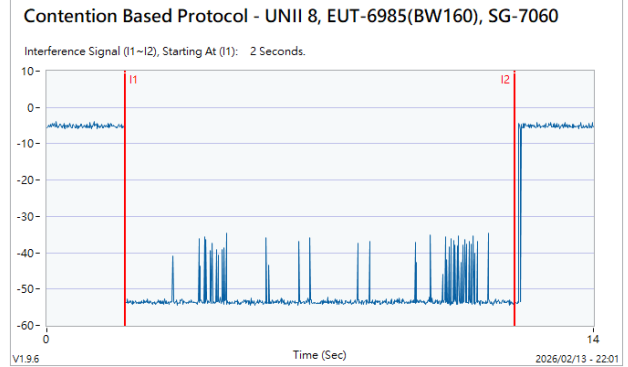
802.11be (EHT160) / 7060MHz (Upper edge)

Threshold Level (TL) = -72.15dBm



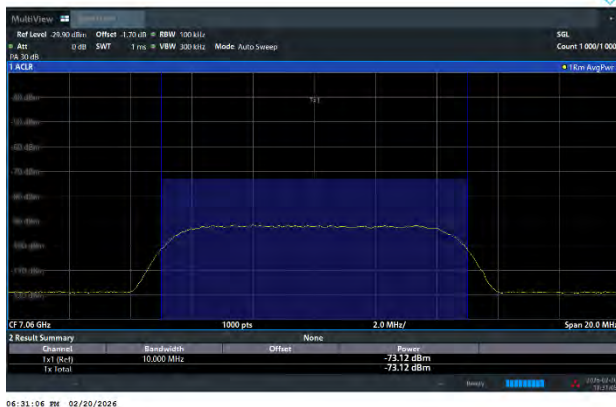
802.11be (EHT160) / CH207 (Upper edge)

Test result is pass due to no transmission occur.



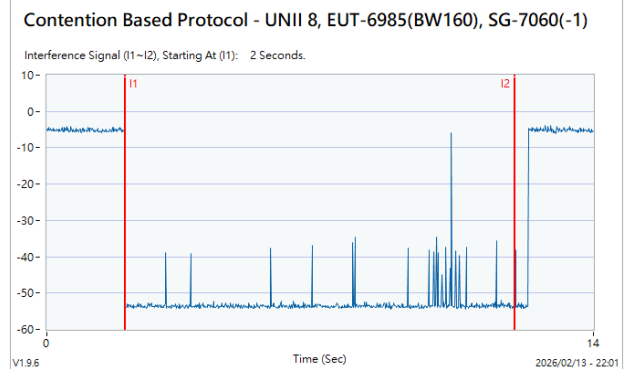
802.11be (EHT160) / 7060MHz (Upper edge)

Threshold Level (TL) = -73.12dBm



802.11be (EHT160) / CH207 (Upper edge)

Transmit when the interferer is 1dB lower.



**CBP verify with frequency domain plots**

The device does not support channel puncturing with regards to Contention Based Protocol.

The device does not support bandwidth reduction with regards to Contention Based Protocol.

The entire bandwidth 160MHz stops transmission after the incumbent signal appears.

Before incumbent injected on 160MHz channel



After 10MHz incumbent injected on center of channel, the entire 160MHz bandwidth stops transmission.



After 10MHz incumbent injected on bottom of channel, the entire 160MHz bandwidth stops transmission.



After 10MHz incumbent injected on top of channel, the entire 160MHz bandwidth stops transmission.



3.6 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.6.1 Limit of Unwanted Emissions

- (1) For transmitters operating within the 5.925-7.125 GHz band: Any emissions outside of the 5.925-7.125 GHz band must not exceed an e.i.r.p. of -27 dBm/MHz.

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27 (RMS)	68.2
- 7 (Peak)	88.2

According 987594 D02 U-NII 6GHz EMC Measurement v01 section G:

Unwanted emissions outside of restricted bands are measured with a RMS detector.

In addition, 15.35(b) applies where the peak emissions must be limited to no more than 20 dB above the average limit

- (2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table:

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

Note: The following formula is used to convert the EIRP to field strength.

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts)}$$

3.6.2 Measuring Instruments

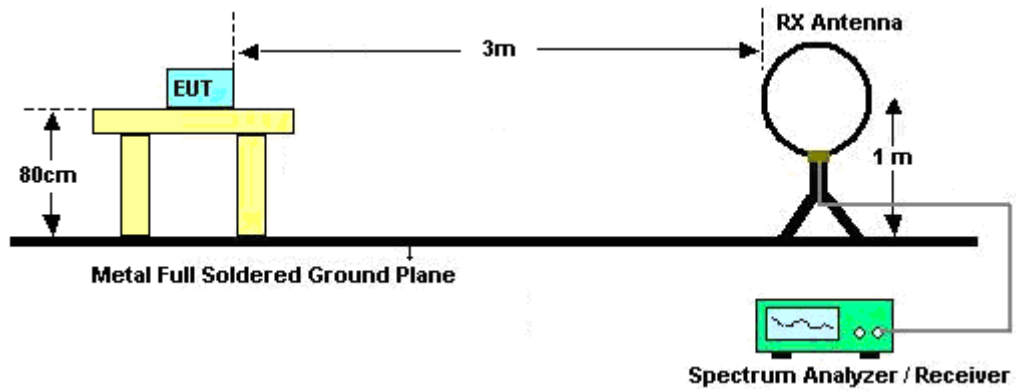
Please refer to the measuring equipment list in this test report.

3.6.3 Test Procedures

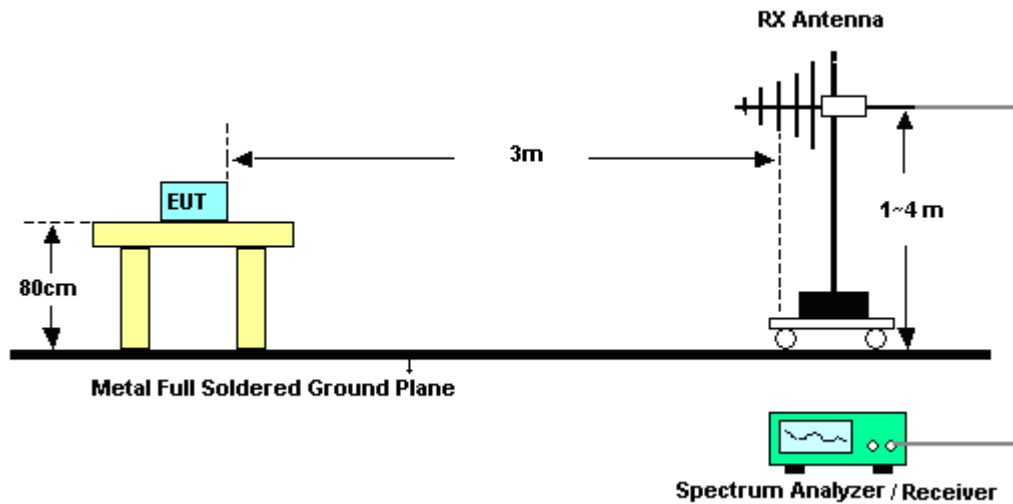
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section G) Unwanted emissions measurement.
(1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold(2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW $\geq$ 3 MHz
 - Detector = Peak
 - Sweep time = auto
 - Trace mode = max hold(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
 - RBW = 1 MHz
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT is set 3 meters away from the receiving antenna which is mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT is arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-”.
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as “-”.

3.6.4 Test Setup

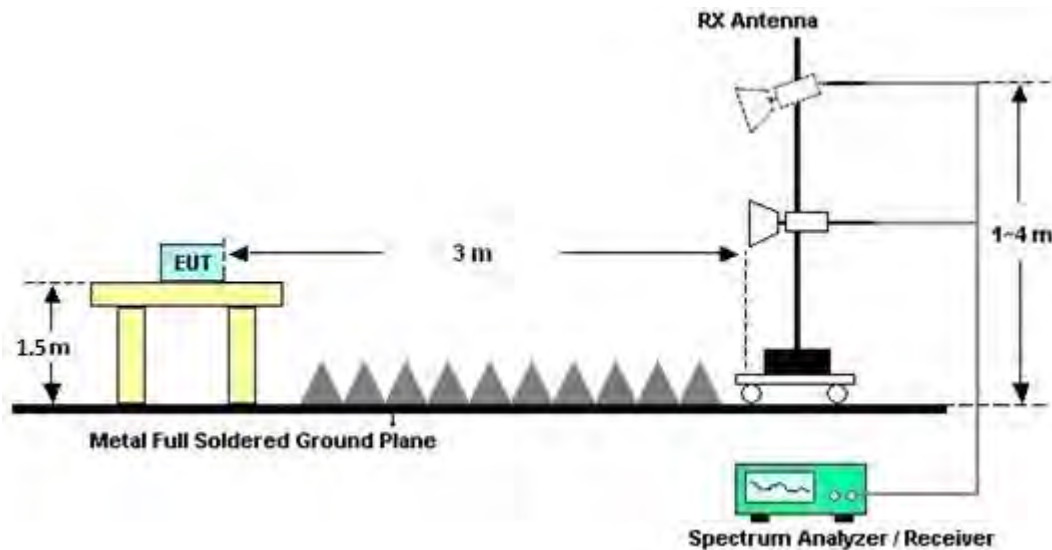
For radiated emissions below 30MHz



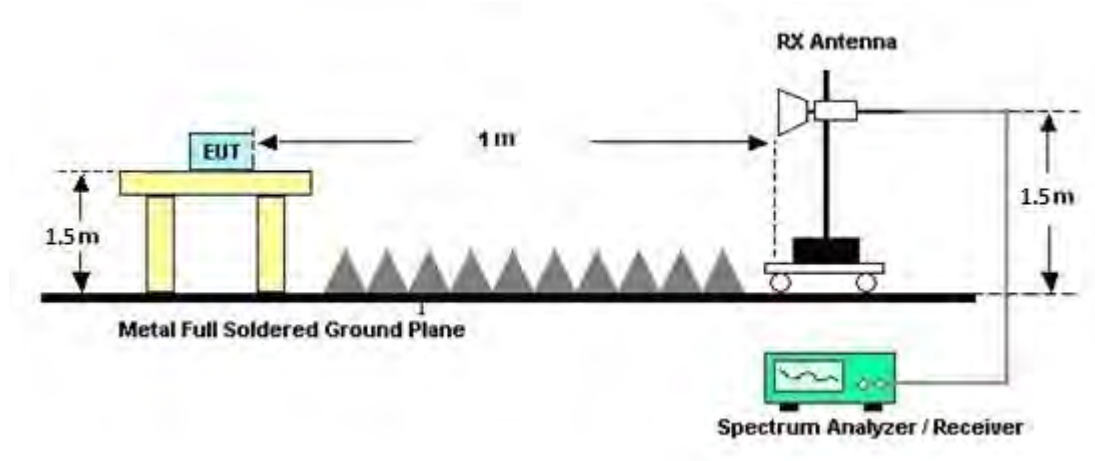
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.6.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.6.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.

3.6.7 Duty Cycle

Please refer to Appendix C.

3.6.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix B.

3.7 AC Conducted Emission Measurement

3.7.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

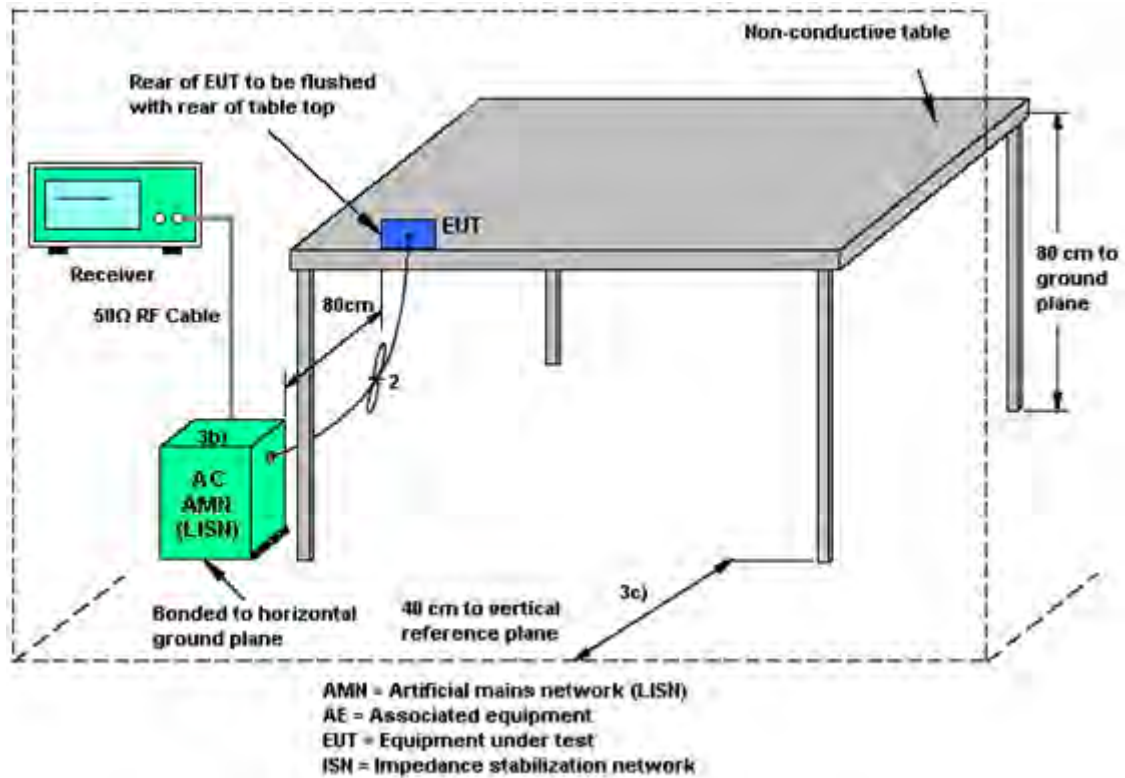
3.7.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.7.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.7.4 Test Setup



3.7.5 Test Result of AC Conducted Emission

Please refer to Appendix A.



3.8 Antenna Requirements

3.8.1 Standard Applicable

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

3.8.2 Antenna Anti-Replacement Construction

b) Unique (non-standard) antenna connector.

(3) Use of a standard connector is also allowed if the connector is within the transmitter enclosure and can only be accessed by disassembly of the transmitter, where such disassembly is not normally required. The user manual must not show that user has access to the connector.



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9kHz~30MHz	May 06, 2025	Nov. 29, 2025~ Feb. 26, 2026	May 05, 2026	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	37059 & 01	30MHz~1GHz	Mar. 01, 2025	Nov. 29, 2025~ Feb. 26, 2026	Feb. 28, 2026	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02294	1GHz~18GHz	Jun. 06, 2025	Nov. 29, 2025~ Feb. 26, 2026	Jun. 05, 2026	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	1225	18GHz~40GHz	Jul. 02, 2025	Nov. 29, 2025~ Feb. 26, 2026	Jul. 01, 2026	Radiation (03CH15-HY)
Amplifier	EMEC	EM1G18G	060837	1GHz~18GHz	Feb. 13, 2025	Nov. 29, 2025~ Feb. 09, 2026	Feb. 12, 2026	Radiation (03CH15-HY)
Amplifier	EMEC	EM1G18G	060837	1GHz~18GHz	Feb. 10, 2026	Feb. 10, 2026~ Feb. 26, 2026	Feb. 09, 2027	Radiation (03CH15-HY)
Preamplifier	EM Electronics	EM01G18G	060802	1GHz~18GHz	Feb. 14, 2025	Nov. 29, 2025~ Feb. 10, 2026	Feb. 13, 2026	Radiation (03CH15-HY)
Preamplifier	EM Electronics	EM01G18G	060802	1GHz~18GHz	Feb. 11, 2026	Feb. 11, 2026~ Feb. 26, 2026	Feb. 10, 2027	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	May 26, 2025	Nov. 29, 2025~ Feb. 26, 2026	May 25, 2026	Radiation (03CH15-HY)
Preamplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 24, 2024	Nov. 29, 2025~ Dec. 17, 2025	Dec. 23, 2025	Radiation (03CH15-HY)
Preamplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 18, 2025	Dec. 18, 2025~ Feb. 26, 2026	Dec. 17, 2026	Radiation (03CH15-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY53290045	20Hz~8.4GHz	Apr. 21, 2025	Nov. 29, 2025~ Feb. 26, 2026	Apr. 20, 2026	Radiation (03CH15-HY)
Spectrum Analyzer	Keysight	N9010B	MY60241058	10Hz~44Gz	Jul. 15, 2025	Nov. 29, 2025~ Feb. 26, 2026	Jul. 14, 2026	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY519228/2, 803950/2,508 407/2E	30MHz~40GHz	Sep. 24, 2025	Nov. 29, 2025~ Feb. 26, 2026	Sep. 23, 2026	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804011/2,804 012/2	18-40G	Dec. 31, 2024	Nov. 29, 2025~ Dec. 17, 2025	Dec. 30, 2025	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804011/2,804 012/2	18-40G	Dec. 18, 2025	Dec. 18, 2025~ Feb. 26, 2026	Dec. 17, 2026	Radiation (03CH15-HY)
Hygrometer	TECPEL	DTM-302	SN2	N/A	Aug. 26, 2025	Nov. 29, 2025~ Feb. 26, 2026	Aug. 25, 2026	Radiation (03CH15-HY)
Filter	wright	WLJ4-1000-15 30-6000-40ST	SN4	1.53GHz Low Pass Filter	Jun. 03, 2025	Nov. 29, 2025~ Feb. 26, 2026	Jun. 02, 2026	Radiation (03CH15-HY)
Filter	wright	WHKX8-5872. 5-6750-18000- 40ST	SN6	6.75GHz High Pass Filter	Jun. 03, 2025	Nov. 29, 2025~ Feb. 26, 2026	Jun. 02, 2026	Radiation (03CH15-HY)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Nov. 29, 2025~ Feb. 26, 2026	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Nov. 29, 2025~ Feb. 26, 2026	N/A	Radiation (03CH15-HY)
Software	Audix	E3_V9_23062 1	RK-002394	N/A	N/A	Nov. 29, 2025~ Feb. 26, 2026	N/A	Radiation (03CH15-HY)
Hygrometer	TECEPEL	DTM-303A	TP201996	N/A	Nov. 04, 2025	Dec. 30, 2025~ Feb. 25, 2026	Nov. 03, 2026	Conducted (TH05-HY)
USB Power Sensor	DARE	RPR3008W	RPR8W-2301 0013 (NO:100)	10MHz~8GHz	Jul. 18, 2025	Dec. 30, 2025~ Feb. 25, 2026	Jul. 17, 2026	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 29, 2025	Dec. 30, 2025~ Feb. 25, 2026	Aug. 28, 2026	Conducted (TH05-HY)
Switch Control Mainframe	E-Instument	ETF-1405-0	EC1900067 (BOX7)	N/A	Jul. 02, 2025	Dec. 30, 2025~ Feb. 25, 2026	Jul. 01, 2026	Conducted (TH05-HY)
Software	Sporton	BTWIFI_Final_ version_24051 3	N/A	Conducted Other Test Item	N/A	Dec. 30, 2025~ Feb. 25, 2026	N/A	Conducted (TH05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	9561-F N00373	9kHz~200MHz	Oct. 20, 2025	Feb. 10, 2026	Oct. 19, 2026	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Mar. 03, 2025	Feb. 10, 2026	Mar. 02, 2026	Conduction (CO07-HY)
Two-Line V-Network	TESEQ	NNB 51	45051	N/A	Mar. 24, 2025	Feb. 10, 2026	Mar. 23, 2026	Conduction (CO07-HY)
Four-Line V-Network	TESEQ	NNB 52	36122	N/A	Mar. 26, 2025	Feb. 10, 2026	Mar. 25, 2026	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102317	9kHz~3.6GHz	Oct. 21, 2025	Feb. 10, 2026	Oct. 20, 2026	Conduction (CO07-HY)
AC Power Source	ACPOWER	AFC-11003G	F317040033	N/A	N/A	Feb. 10, 2026	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Feb. 10, 2026	N/A	Conduction (CO07-HY)
Signal Generator	Rohde & Schwarz	SMW200A	111391	100kHz~7.5GHz	Dec. 31, 2025	Feb. 13, 2026~ Feb. 20, 2026	Dec. 30, 2026	CBP (DF02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV3013	101550	10Hz~13.6GHz	Dec. 26, 2025	Feb. 13, 2026~ Feb. 20, 2026	Dec. 25, 2026	CBP (DF02-HY)
Power Divider	Woken	3Way SMA Power Divider Rated to 20W	STI08-0010(# 4)	2GHz~8GHz	Jul. 15, 2025	Feb. 13, 2026~ Feb. 20, 2026	Jul. 14, 2026	CBP (DF02-HY)
Power Divider	Woken	2Way Divider	DCMB1KW7A 1	0.5GHz~18GHz	Jul. 15, 2025	Feb. 13, 2026~ Feb. 20, 2026	Jul. 14, 2026	CBP (DF02-HY)
Coupler	Woken	10dB 30W SMA	DOM5CIW3A 1	0.5~18GHz	Jul. 15, 2025	Feb. 13, 2026~ Feb. 20, 2026	Jul. 14, 2026	CBP (DF02-HY)
Software	Sporton	Test Tools	N/A	Ver 1.9.6	N/A	Feb. 13, 2026~ Feb. 20, 2026	N/A	CBP (DF02-HY)



5 Measurement Uncertainty

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.7 dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	6.50 dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.30 dB
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Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.50 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.90 dB
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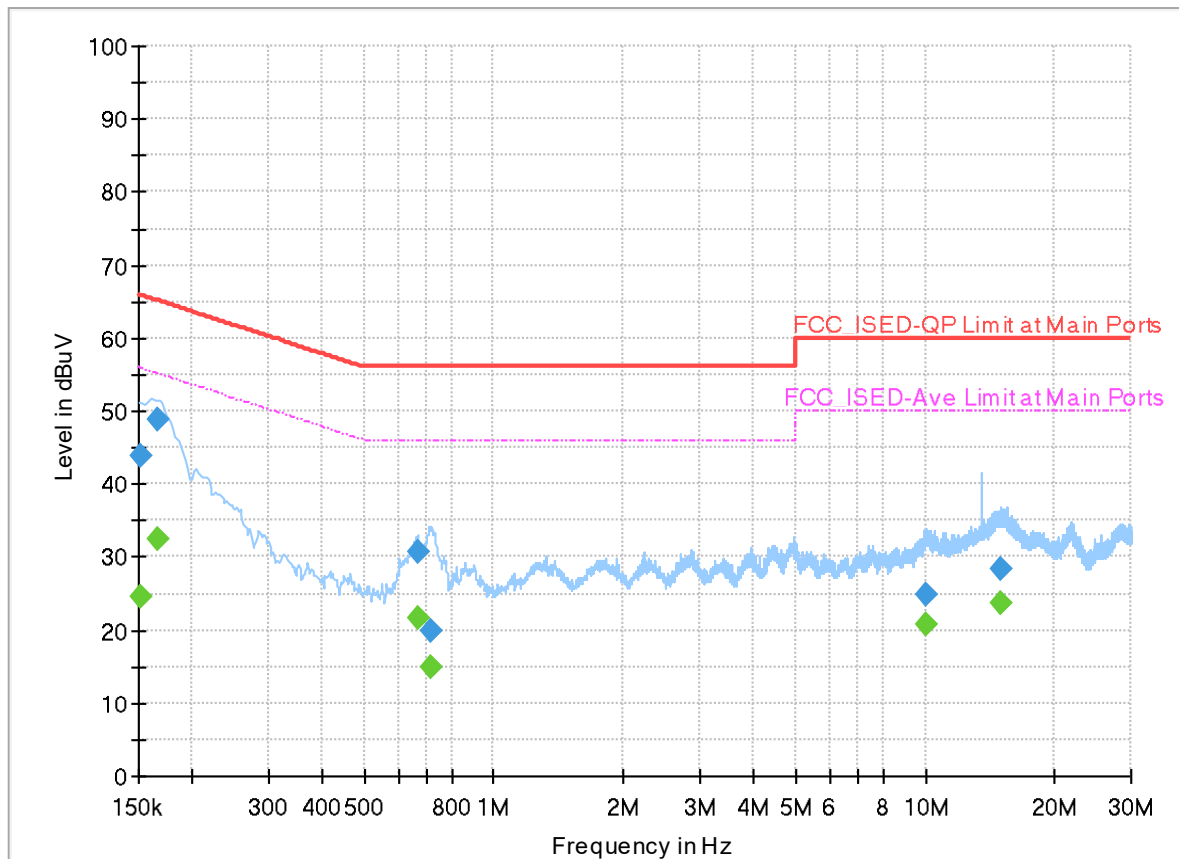
Appendix A. AC Conducted Emission Test Results

Test Engineer :	Brian Chen	Temperature :	23~26℃
		Relative Humidity :	45~55%

EUT Information

Test Mode : Mode 2
 Test Voltage : 120Vac/60Hz
 Phase : Line

Full Spectrum



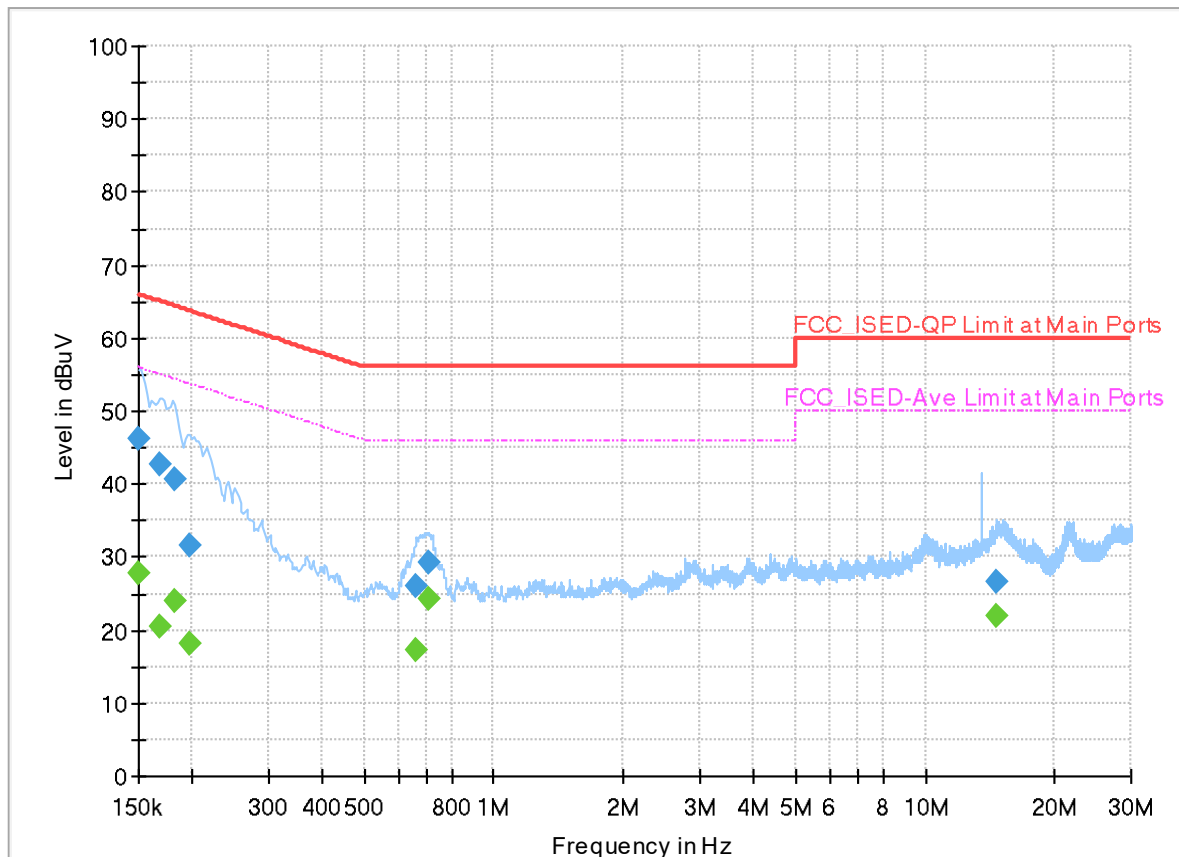
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	24.55	55.88	31.33	L1	ON	20.1
0.152250	43.77	---	65.88	22.11	L1	ON	20.1
0.165750	---	32.58	55.17	22.59	L1	ON	20.1
0.165750	48.75	---	65.17	16.42	L1	ON	20.1
0.665250	---	21.71	46.00	24.29	L1	ON	20.0
0.665250	30.73	---	56.00	25.27	L1	ON	20.0
0.717000	---	14.88	46.00	31.12	L1	ON	20.0
0.717000	19.88	---	56.00	36.12	L1	ON	20.0
10.086000	---	20.82	50.00	29.18	L1	ON	20.4
10.086000	24.83	---	60.00	35.17	L1	ON	20.4
14.995500	---	23.56	50.00	26.44	L1	ON	20.6
14.995500	28.29	---	60.00	31.71	L1	ON	20.6

EUT Information

Test Mode : Mode 2
Test Voltage : 120Vac/60Hz
Phase : Neutral

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.150000	---	27.87	56.00	28.13	N	ON	20.2
0.150000	46.20	---	66.00	19.80	N	ON	20.2
0.168000	---	20.46	55.06	34.60	N	ON	20.1
0.168000	42.77	---	65.06	22.29	N	ON	20.1
0.181500	---	24.02	54.42	30.40	N	ON	20.1
0.181500	40.65	---	64.42	23.77	N	ON	20.1
0.197250	---	18.16	53.73	35.57	N	ON	20.1
0.197250	31.48	---	63.73	32.25	N	ON	20.1
0.663000	---	17.11	46.00	28.89	N	ON	20.0
0.663000	26.08	---	56.00	29.92	N	ON	20.0
0.708000	---	24.40	46.00	21.60	N	ON	20.0
0.708000	29.37	---	56.00	26.63	N	ON	20.0
14.644500	---	22.05	50.00	27.95	N	ON	20.6
14.644500	26.47	---	60.00	33.53	N	ON	20.6