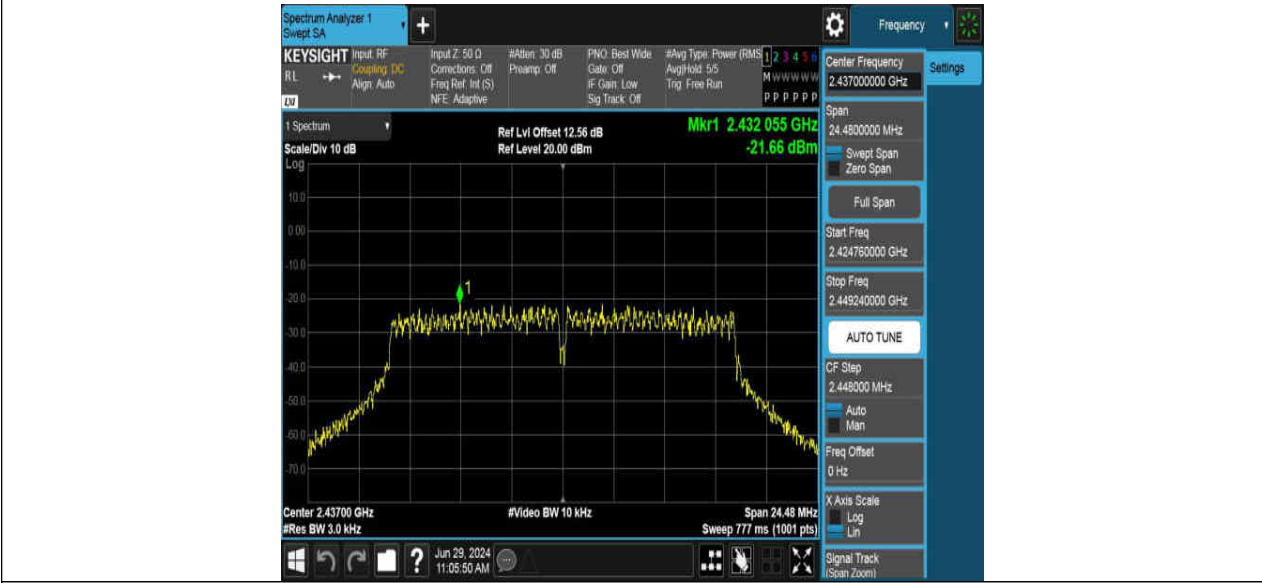
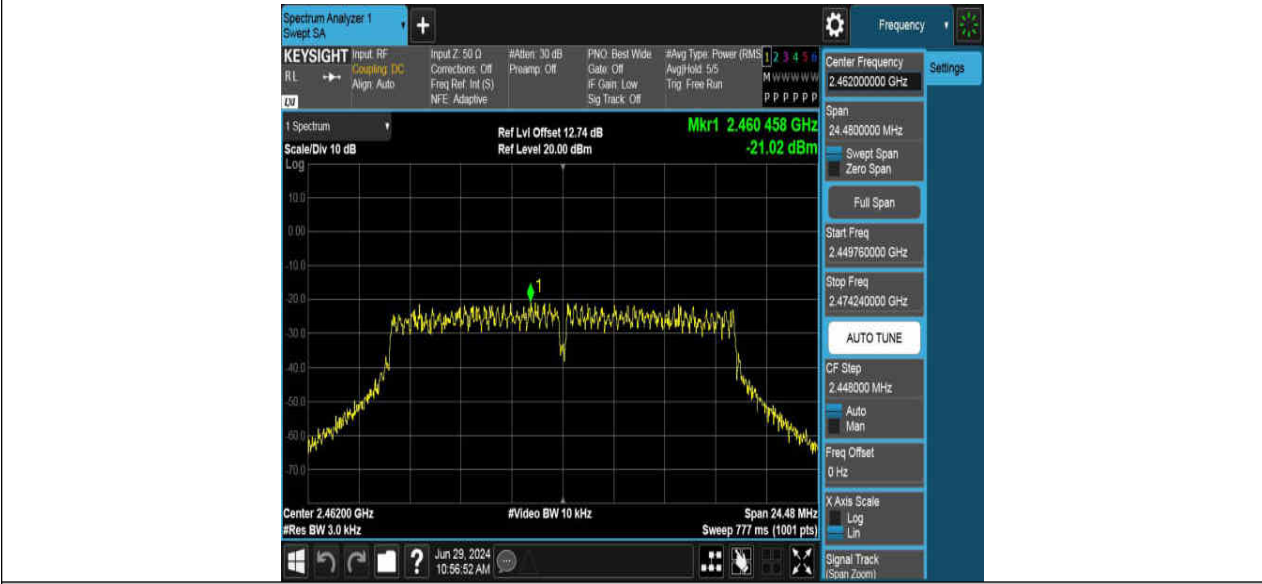


11G\_Ant2\_2437

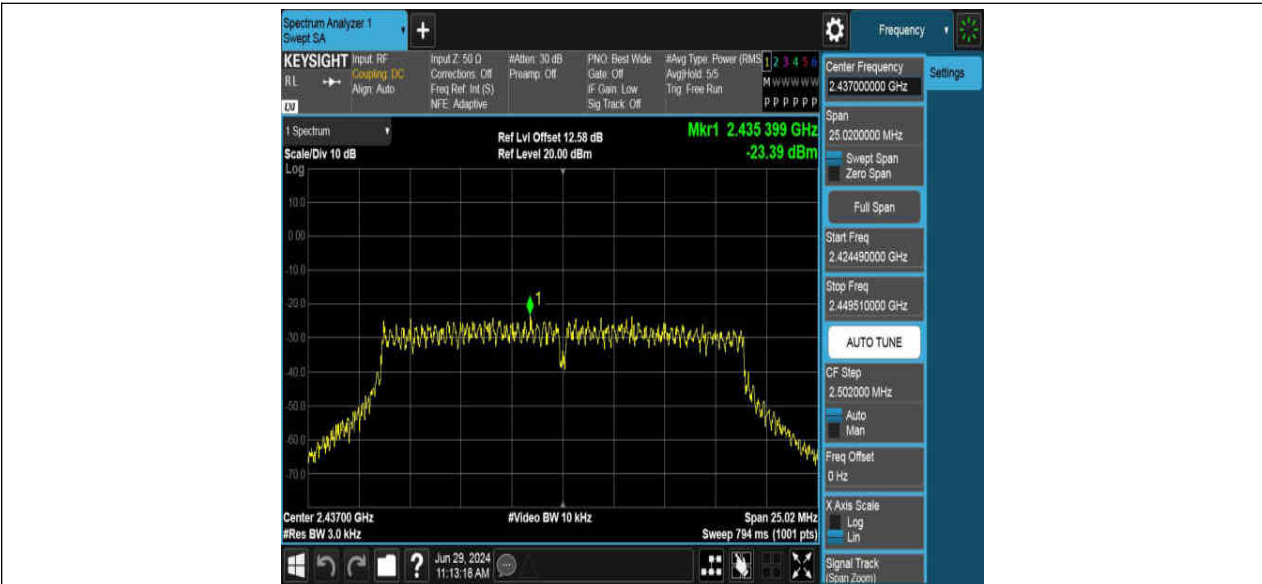


11G\_Ant1\_2462

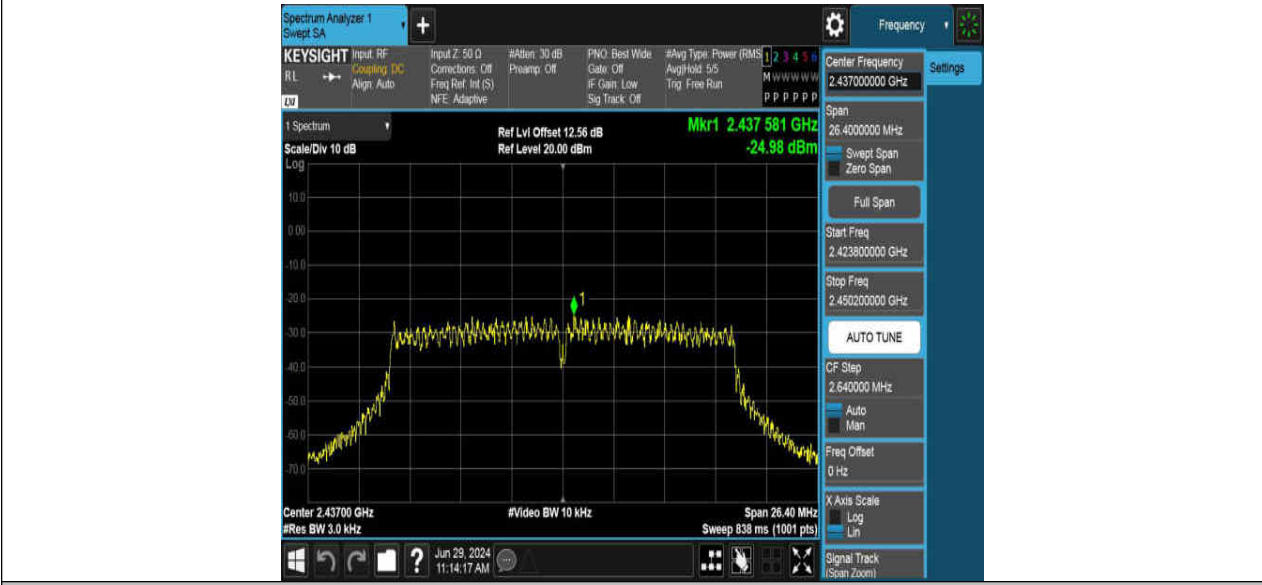


11G\_Ant2\_2462

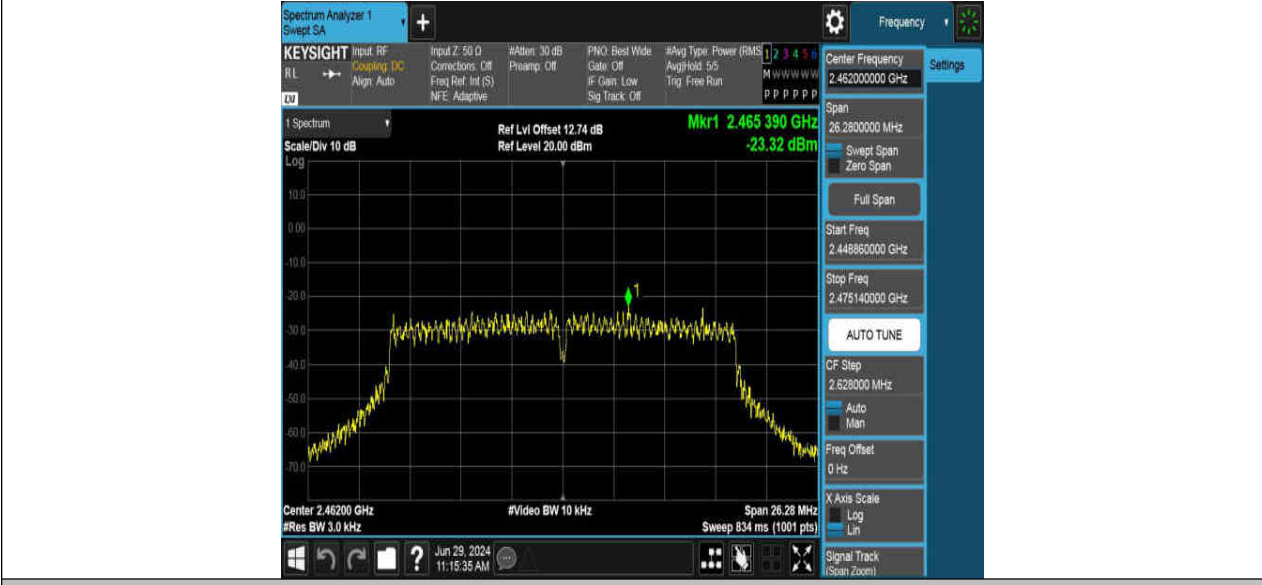




11N20MIMO\_Ant2\_2437



11N20MIMO\_Ant1\_2462

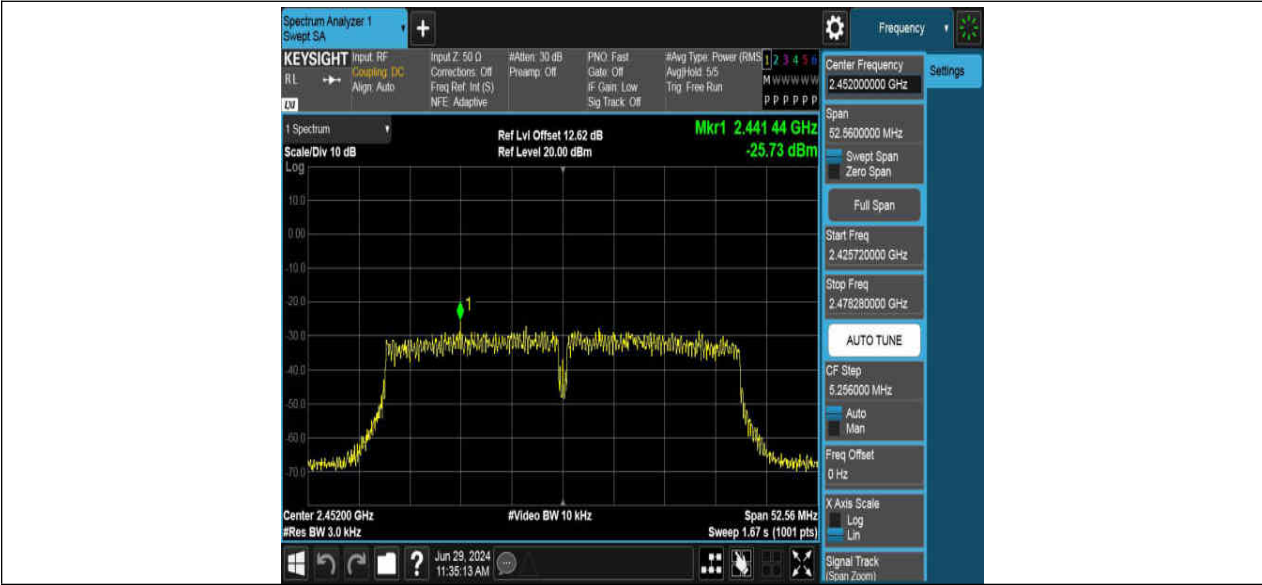


11N20MIMO\_Ant2\_2462









## 12. Conducted Band edge and Spurious Emissions

### 12.1. Block diagram of test setup

Same as section 8.1

### 12.2. Limits

CFR 47 FCC Part15 (15.247) Subpart C ISED RSS-247 ISSUE 3		
Section	Test Item	Limit
CFR 47 FCC §15.247 (d) ISED RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

### 12.3. Test Procedure

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	100 kHz
VBW	$\geq 3 \times \text{RBW}$
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Connect the UUT to the spectrum analyzer and use the following settings:

Use the peak marker function to determine the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100 kHz
VBW	$\geq 3 \times \text{RBW}$
measurement points	$\geq \text{span}/\text{RBW}$
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum amplitude level.

### 12.4. Test result

Test Mode	Ant.	Ch Name	Freq. (MHz)	Ref Level (dBm)	Result (dBm)	Limit (dBm)	Verdict
11B	Ant1	Low	2412	4.71	-41.09	$\leq -15.29$	PASS
	Ant2	Low	2412	3.68	-43.63	$\leq -16.32$	PASS
	Ant1	High	2462	3.11	-47.73	$\leq -16.89$	PASS
	Ant2	High	2462	4.13	-47.29	$\leq -15.87$	PASS
11G	Ant1	Low	2412	-1.56	-40.97	$\leq -21.56$	PASS
	Ant2	Low	2412	-0.60	-38.62	$\leq -20.6$	PASS
	Ant1	High	2462	-3.56	-47.77	$\leq -23.56$	PASS
	Ant2	High	2462	-2.23	-47.03	$\leq -22.23$	PASS
11N20MIMO	Ant1	Low	2412	-3.19	-40.86	$\leq -23.19$	PASS
	Ant2	Low	2412	-5.80	-43.62	$\leq -25.8$	PASS
	Ant1	High	2462	-2.58	-47.68	$\leq -22.58$	PASS

	Ant2	High	2462	-3.70	-47.59	≤-23.7	PASS
11N40MIMO	Ant1	Low	2422	-3.67	-44.25	≤-23.67	PASS
	Ant2	Low	2422	-5.97	-46.31	≤-25.97	PASS
	Ant1	High	2452	-5.46	-46.45	≤-25.46	PASS
	Ant2	High	2452	-6.43	-47.51	≤-26.43	PASS

Test Mode	Ant.	Freq. (MHz)	Freq Range (Mhz)	Ref Level (dBm)	Result (dBm)	Limit (dBm)	Verdict
11B	Ant1	2412	30~1000	4.71	-59.44	≤-15.29	PASS
			1000~26500	4.71	-50.63	≤-15.29	PASS
	Ant2	2412	30~1000	3.68	-59.7	≤-16.32	PASS
			1000~26500	3.68	-51.18	≤-16.32	PASS
	Ant1	2437	30~1000	3.63	-60.35	≤-16.37	PASS
			1000~26500	3.63	-50.68	≤-16.37	PASS
	Ant2	2437	30~1000	3.58	-59.63	≤-16.42	PASS
			1000~26500	3.58	-50.45	≤-16.42	PASS
	Ant1	2462	30~1000	3.11	-59.8	≤-16.89	PASS
			1000~26500	3.11	-50.21	≤-16.89	PASS
	Ant2	2462	30~1000	4.13	-59.75	≤-15.87	PASS
			1000~26500	4.13	-50.69	≤-15.87	PASS
11G	Ant1	2412	30~1000	-1.56	-59.81	≤-21.56	PASS
			1000~26500	-1.56	-50.99	≤-21.56	PASS
	Ant2	2412	30~1000	-0.60	-59.56	≤-20.6	PASS
			1000~26500	-0.60	-50.93	≤-20.6	PASS
	Ant1	2437	30~1000	-2.43	-58.91	≤-22.43	PASS
			1000~26500	-2.43	-50.93	≤-22.43	PASS
	Ant2	2437	30~1000	-1.78	-60.17	≤-21.78	PASS
			1000~26500	-1.78	-49.7	≤-21.78	PASS
	Ant1	2462	30~1000	-3.56	-59.98	≤-23.56	PASS
			1000~26500	-3.56	-51.35	≤-23.56	PASS
	Ant2	2462	30~1000	-2.23	-59.12	≤-22.23	PASS
			1000~26500	-2.23	-50.2	≤-22.23	PASS
11N20MIMO	Ant1	2412	30~1000	-3.19	-59.09	≤-23.19	PASS
			1000~26500	-3.19	-51.05	≤-23.19	PASS
	Ant2	2412	30~1000	-5.80	-60.06	≤-25.8	PASS
			1000~26500	-5.80	-51.1	≤-25.8	PASS
	Ant1	2437	30~1000	-3.48	-59.59	≤-23.48	PASS
			1000~26500	-3.48	-50.41	≤-23.48	PASS
	Ant2	2437	30~1000	-4.61	-60.01	≤-24.61	PASS
			1000~26500	-4.61	-51.48	≤-24.61	PASS
	Ant1	2462	30~1000	-2.58	-59.52	≤-22.58	PASS
			1000~26500	-2.58	-51.01	≤-22.58	PASS
	Ant2	2462	30~1000	-3.70	-59.3	≤-23.7	PASS
			1000~26500	-3.70	-50.16	≤-23.7	PASS
11N40MIMO	Ant1	2422	30~1000	-3.67	-59.66	≤-23.67	PASS
			1000~26500	-3.67	-50.72	≤-23.67	PASS
	Ant2	2422	30~1000	-5.97	-59.35	≤-25.97	PASS
			1000~26500	-5.97	-50.51	≤-25.97	PASS
	Ant1	2437	30~1000	-5.29	-58.95	≤-25.29	PASS
			1000~26500	-5.29	-50.05	≤-25.29	PASS
	Ant2	2437	30~1000	-6.22	-60.05	≤-26.22	PASS
			30~1000	-6.22	-60.05	≤-26.22	PASS



			1000~26500	-6.22	-50.67	≤-26.22	PASS
	Ant1	2452	30~1000	-5.46	-59.07	≤-25.46	PASS
			1000~26500	-5.46	-51.05	≤-25.46	PASS
	Ant2	2452	30~1000	-6.43	-59.89	≤-26.43	PASS
			1000~26500	-6.43	-50.09	≤-26.43	PASS

12.5. Original test data

Reference level





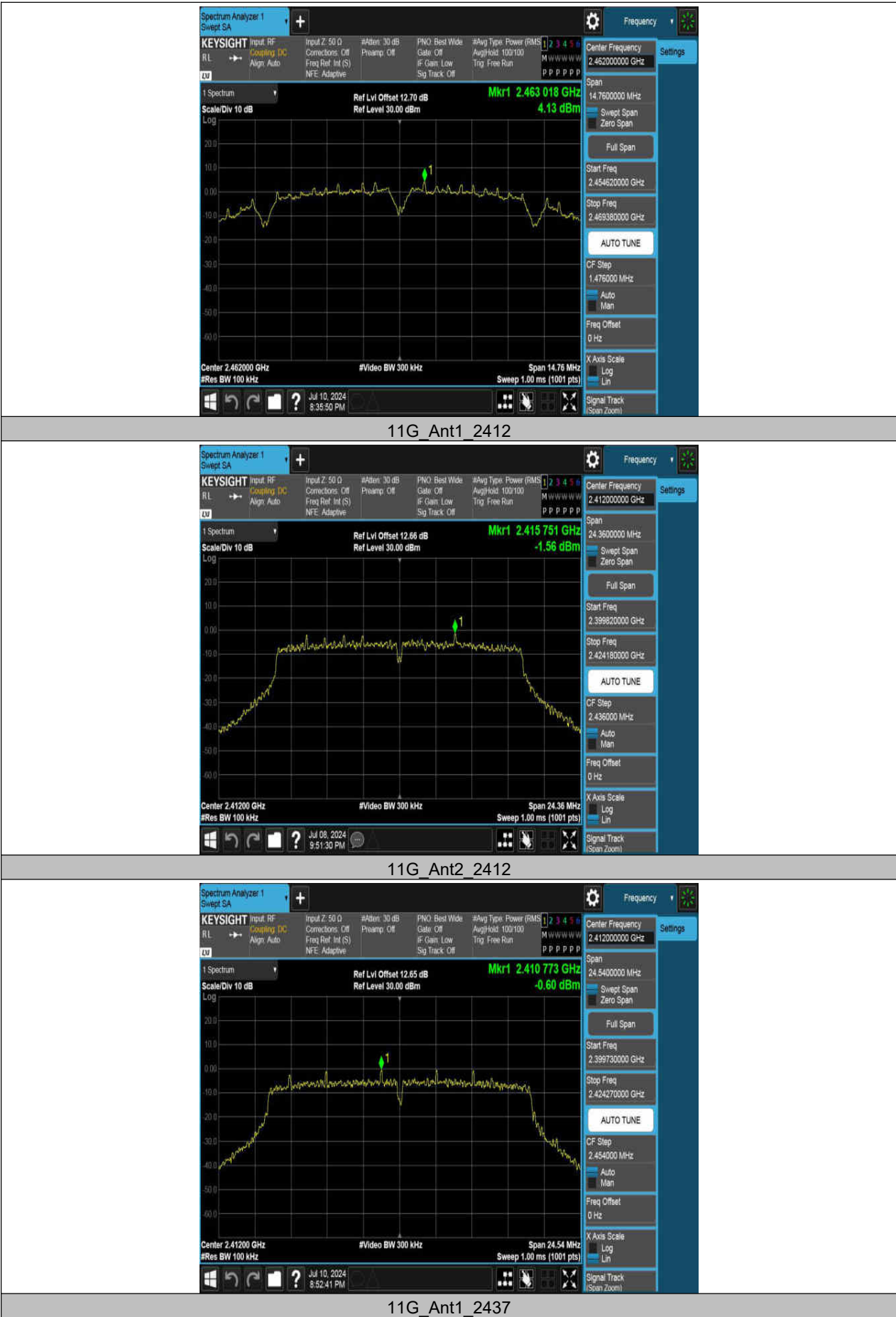
11B\_Ant2\_2437



11B\_Ant1\_2462



11B\_Ant2\_2462









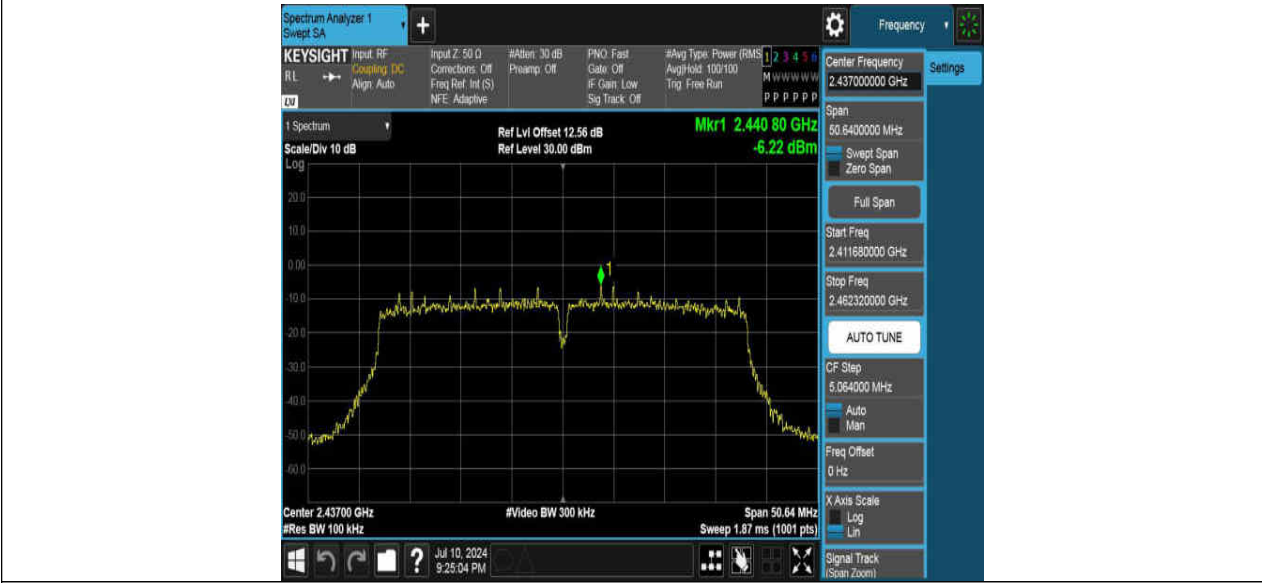




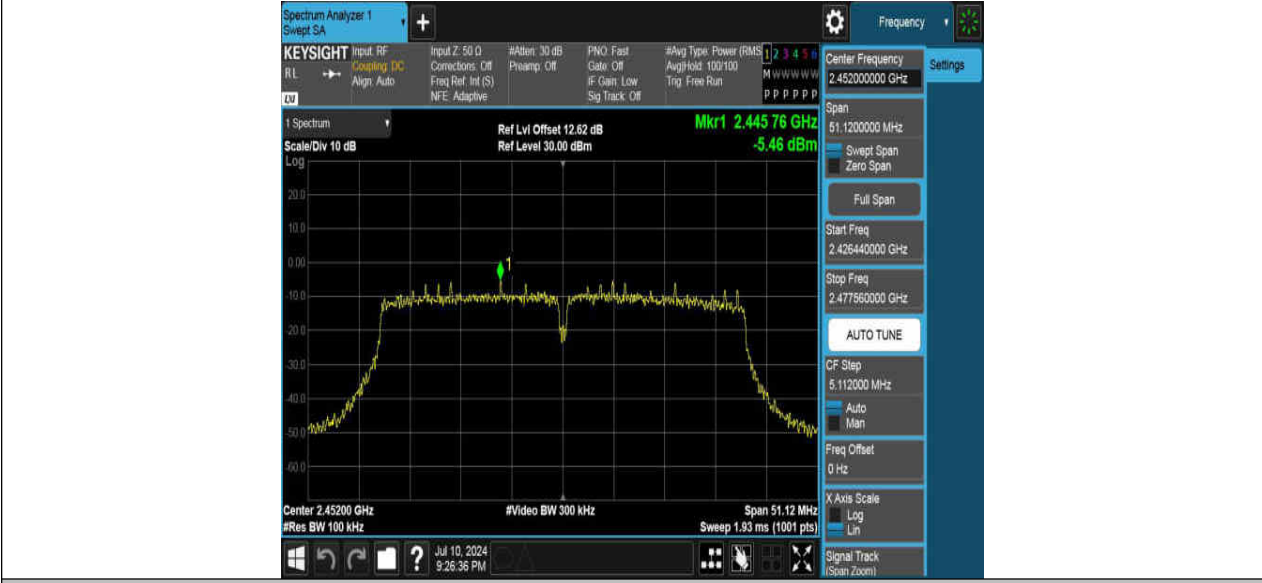




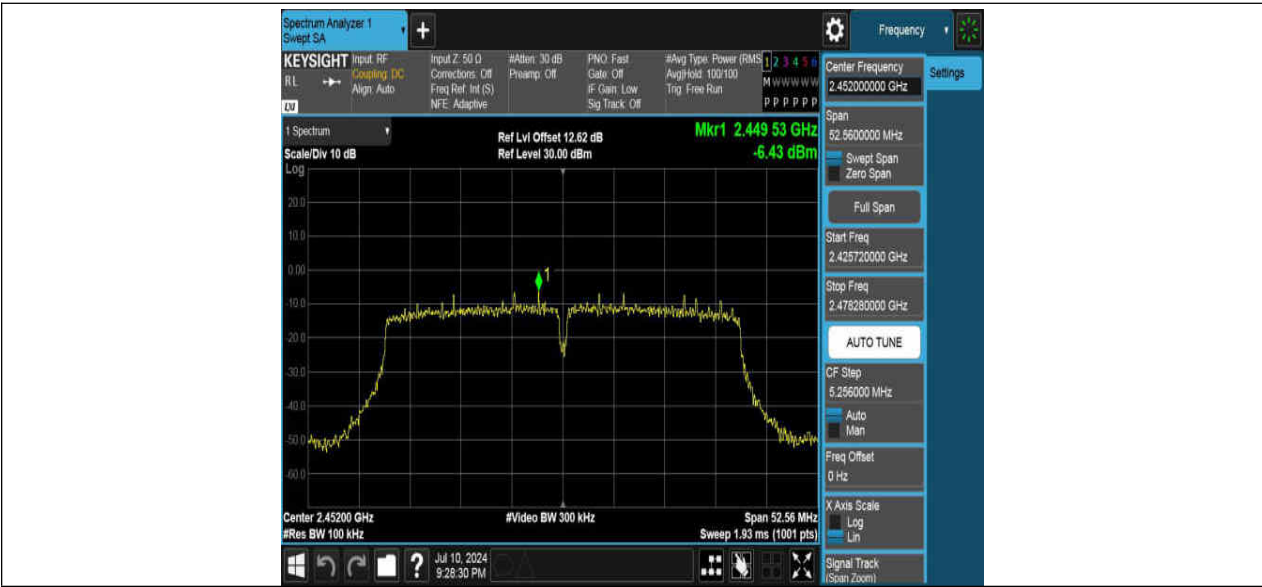
11N40MIMO\_Ant2\_2437



11N40MIMO\_Ant1\_2452



11N40MIMO\_Ant2\_2452



Band edge:

11B\_Ant1\_Low\_2412



11B\_Ant2\_Low\_2412



11B\_Ant1\_High\_2462



11B Ant2 High 2462



11G Ant1 Low 2412



11G Ant2 Low 2412











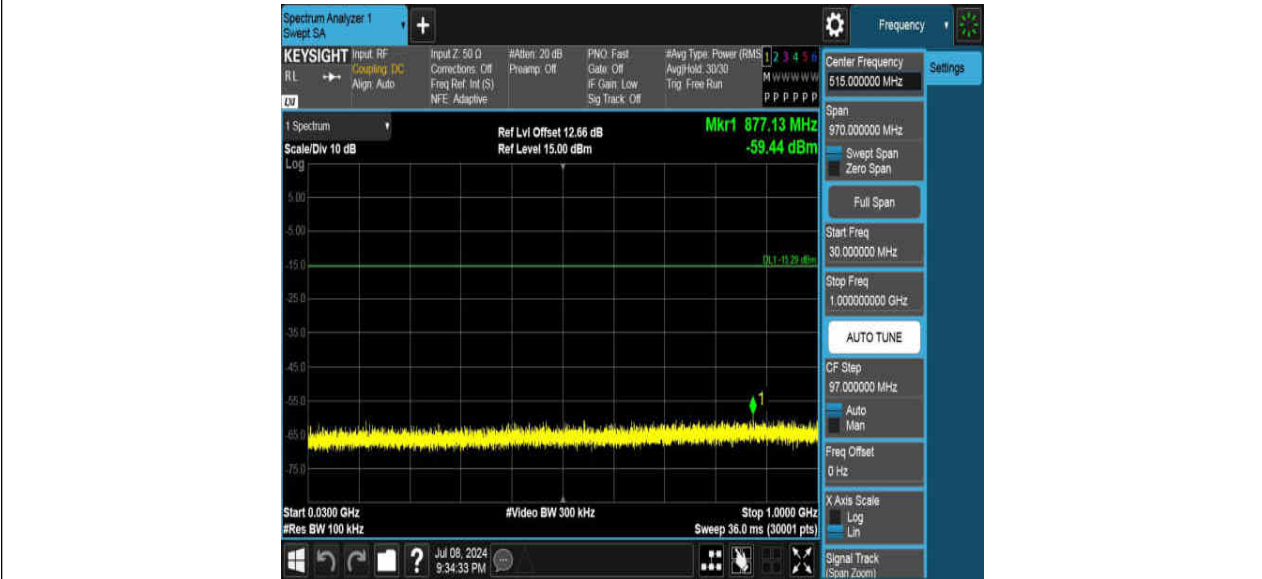


11N40MIMO\_Ant2\_High\_2452



Spurious Emission:

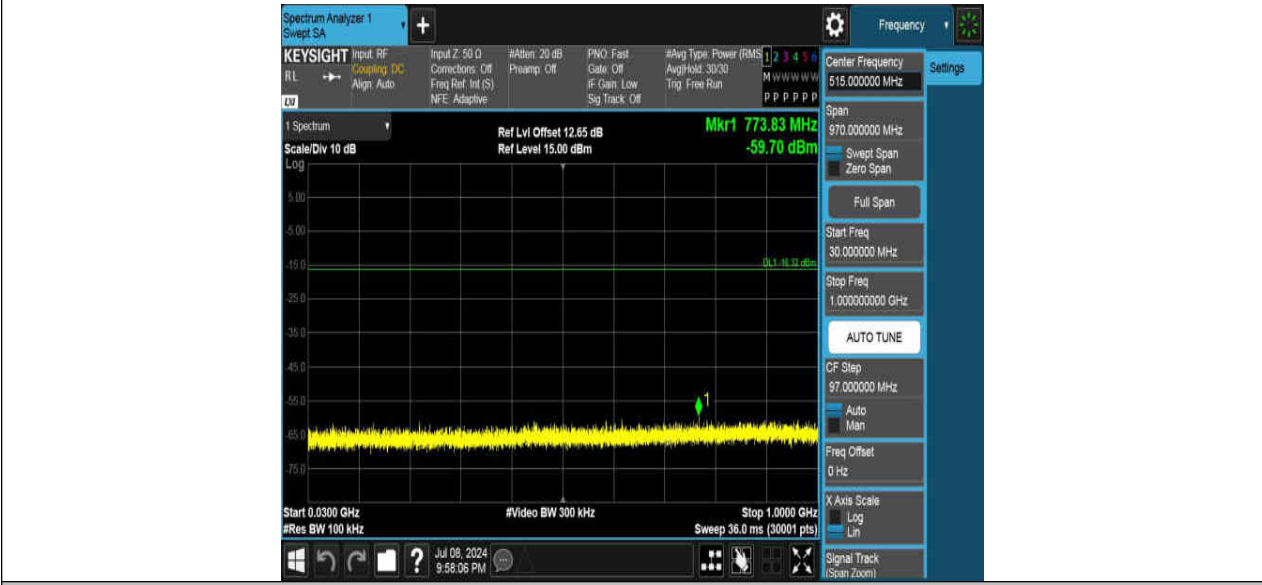
11B\_Ant1\_2412\_30~1000



11B\_Ant1\_2412\_1000~26500



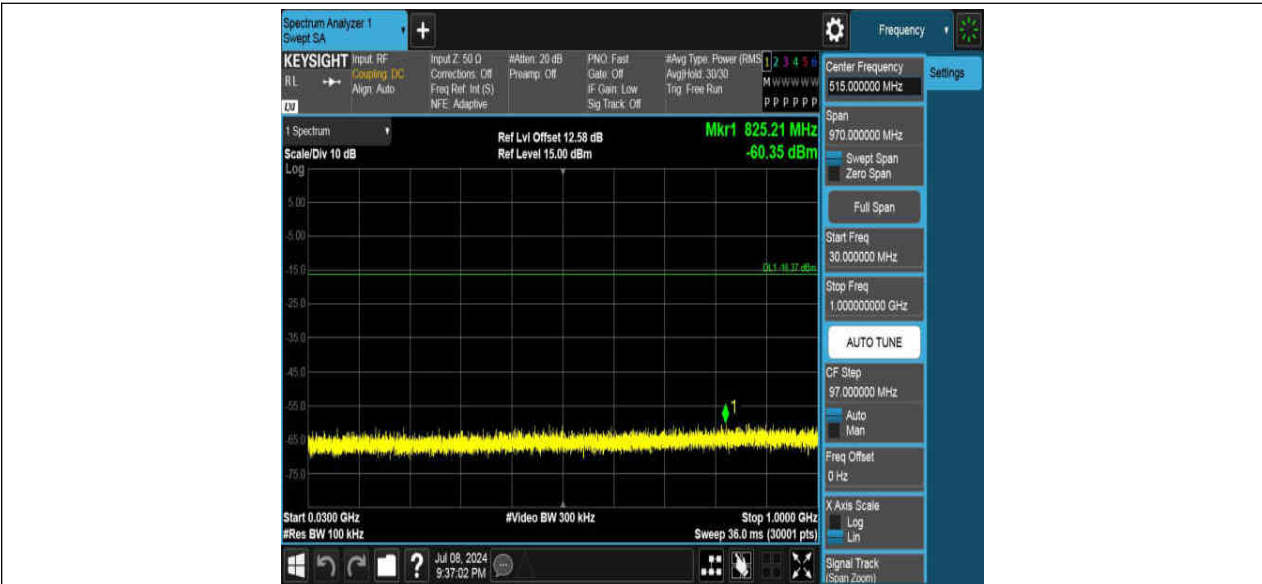
11B\_Ant2\_2412\_30~1000



11B\_Ant2\_2412\_1000~26500



11B\_Ant1\_2437\_30~1000



11B\_Ant1\_2437\_1000~26500

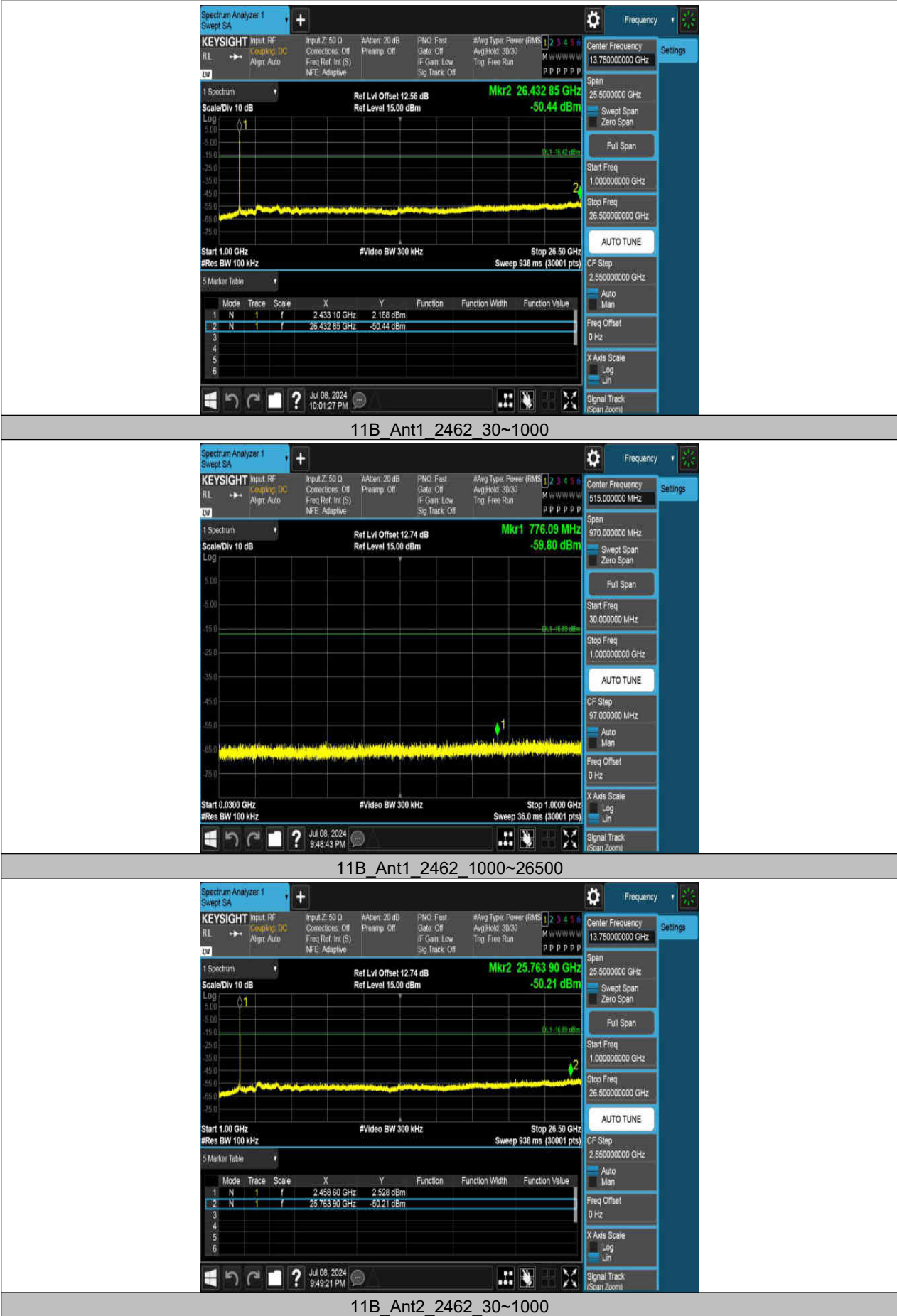


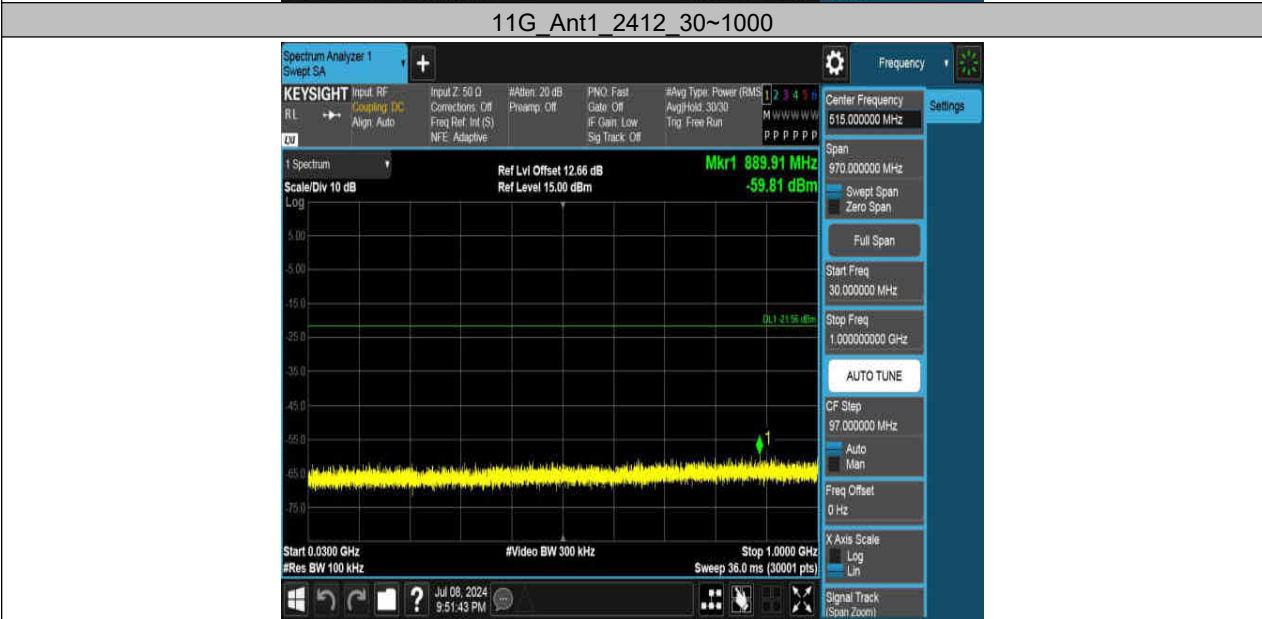
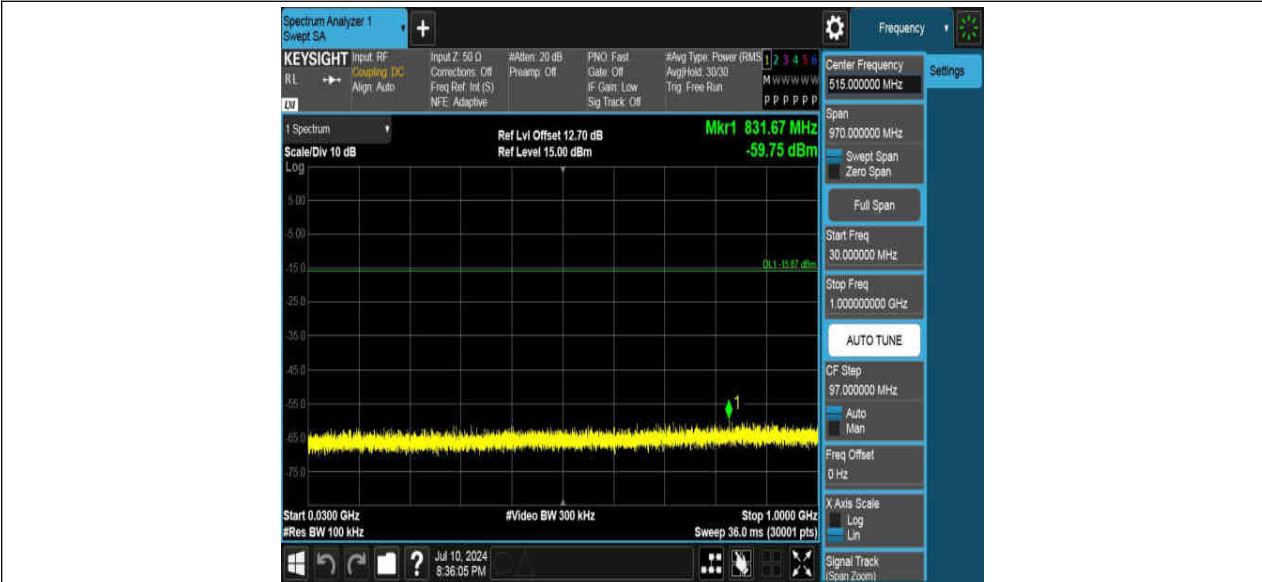
11B\_Ant2\_2437\_30~1000



11B\_Ant2\_2437\_1000~26500



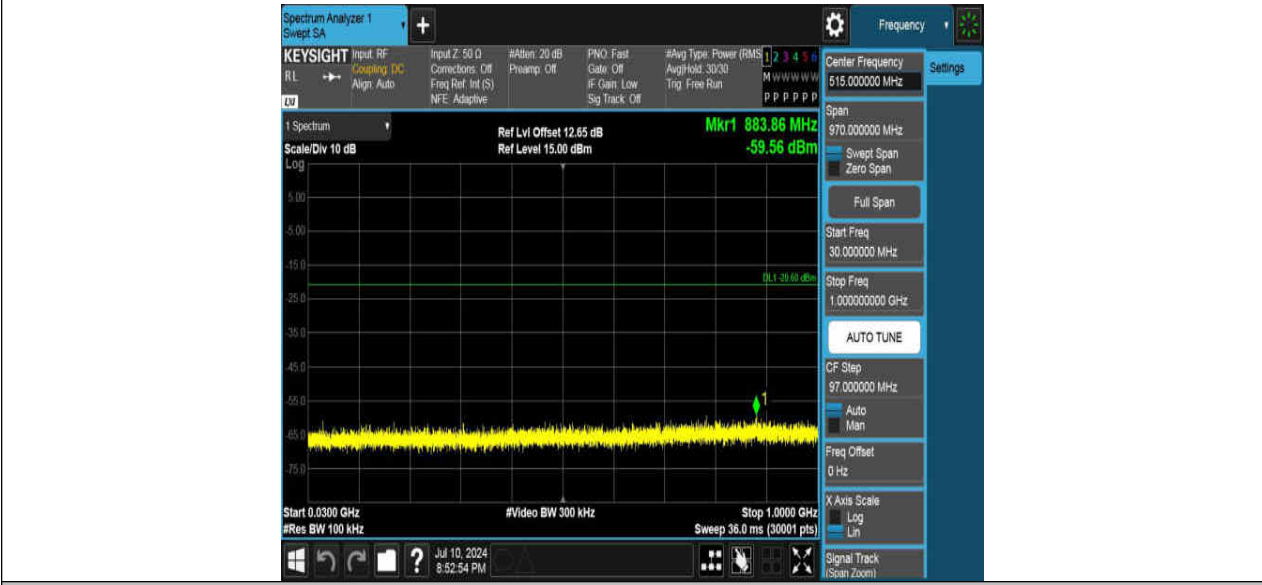








11G\_Ant2\_2412\_30~1000



11G\_Ant2\_2412\_1000~26500



11G\_Ant1\_2437\_30~1000





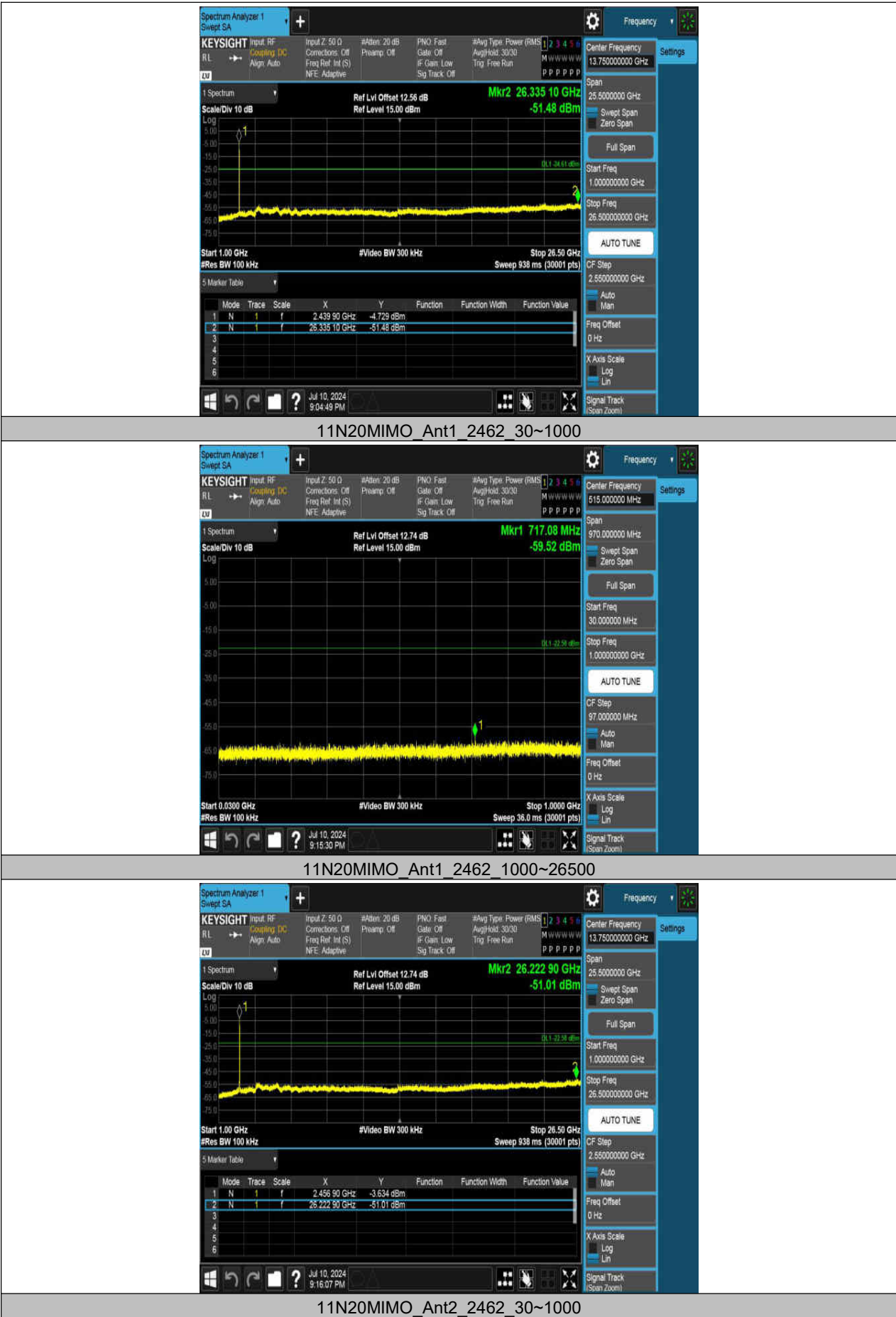




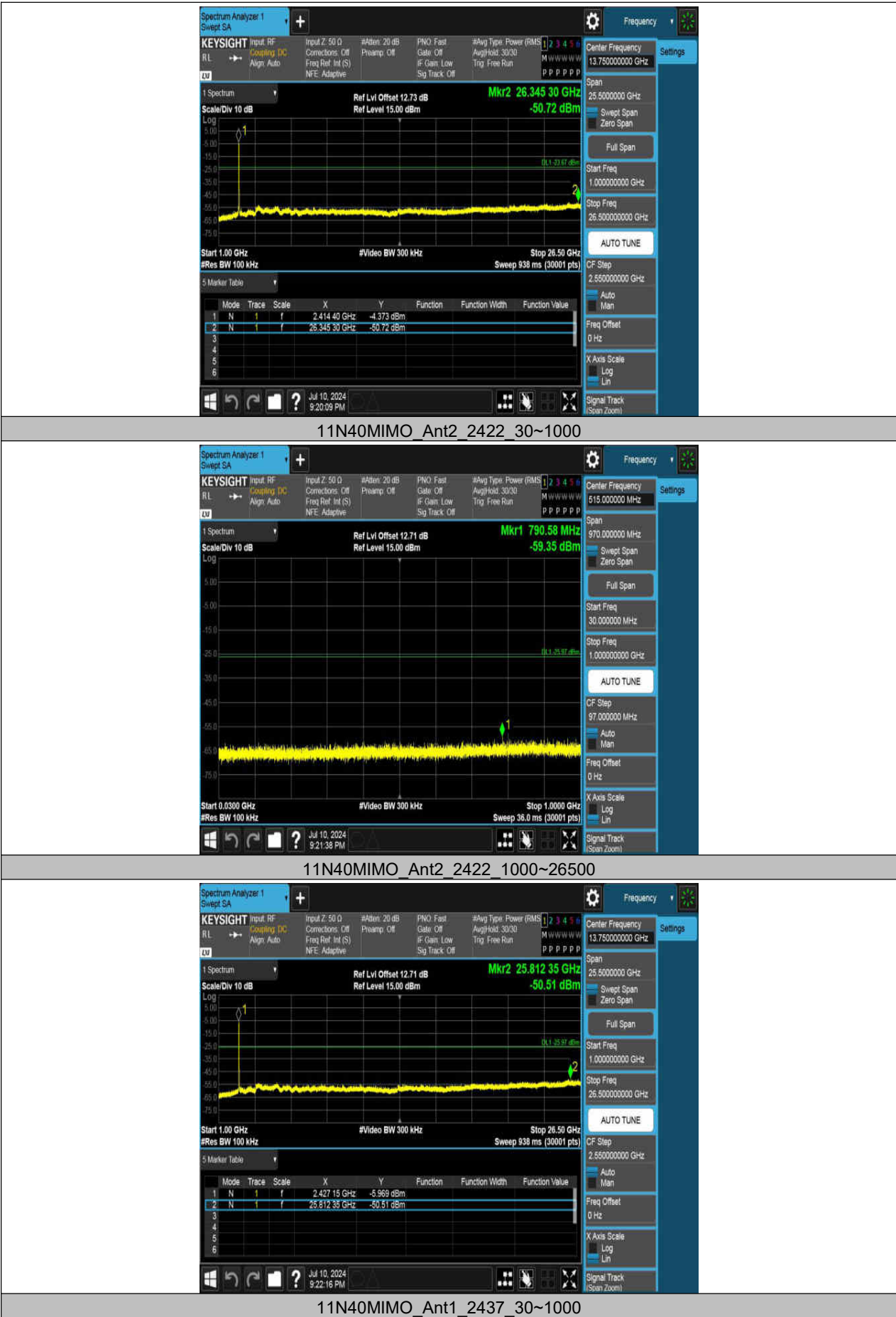






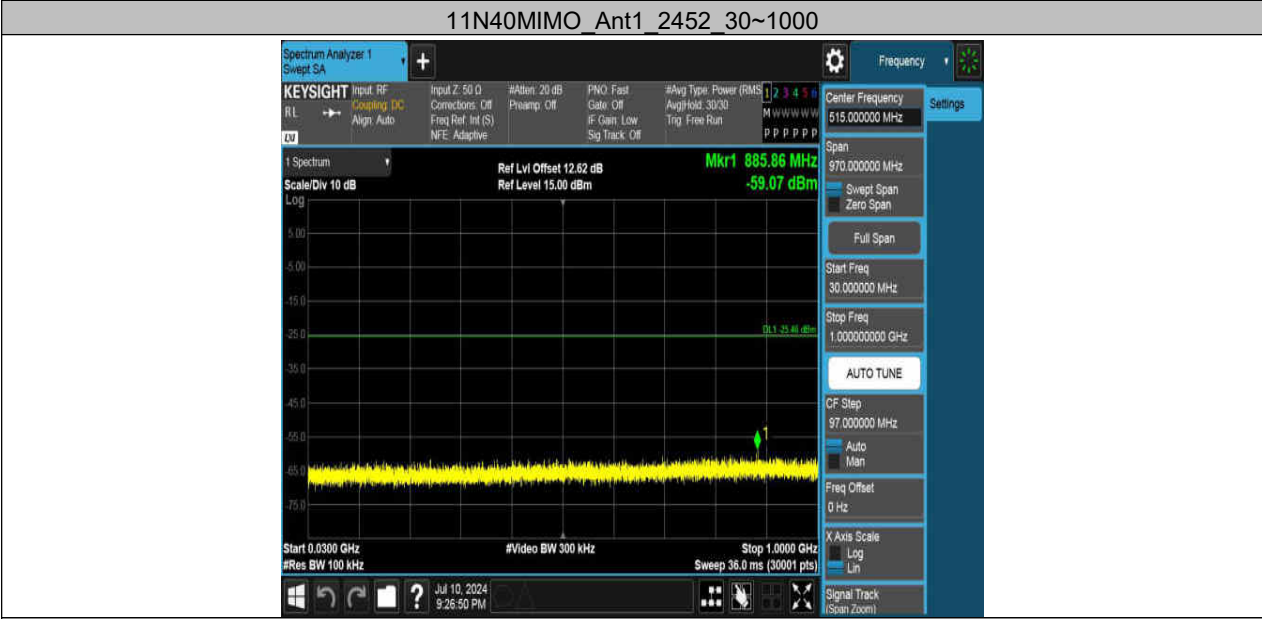












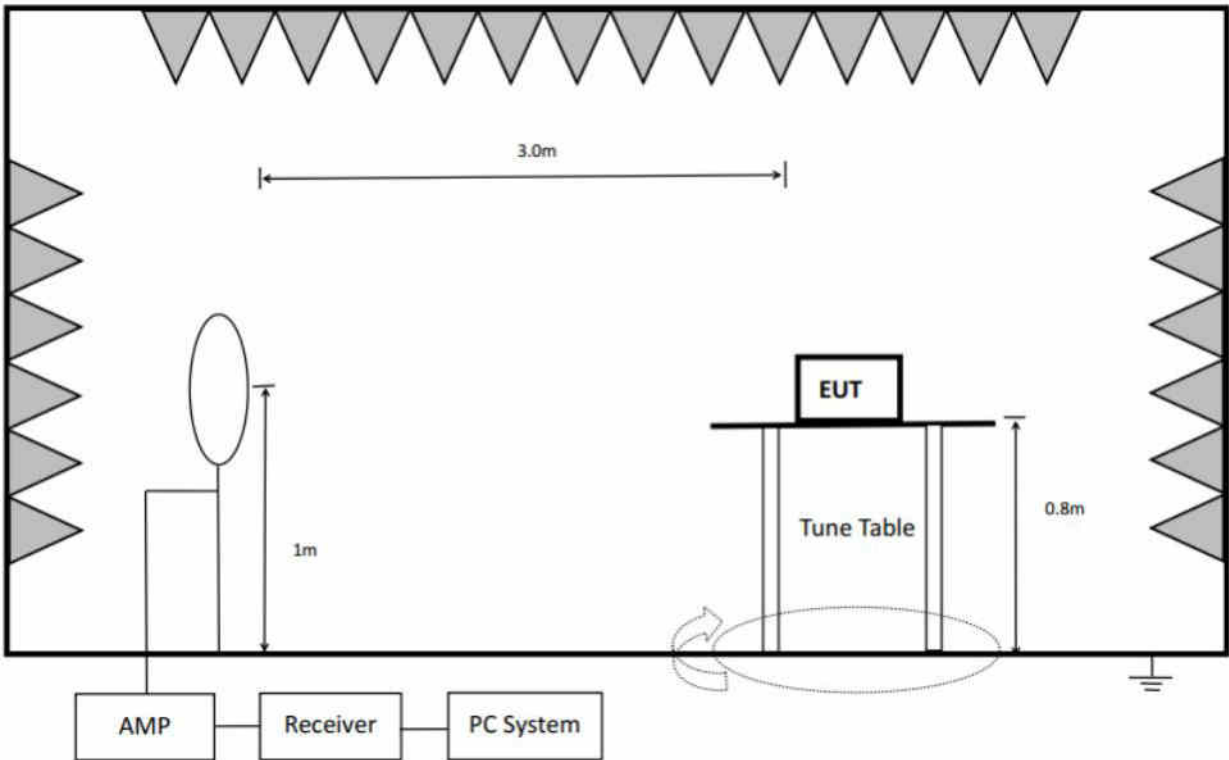




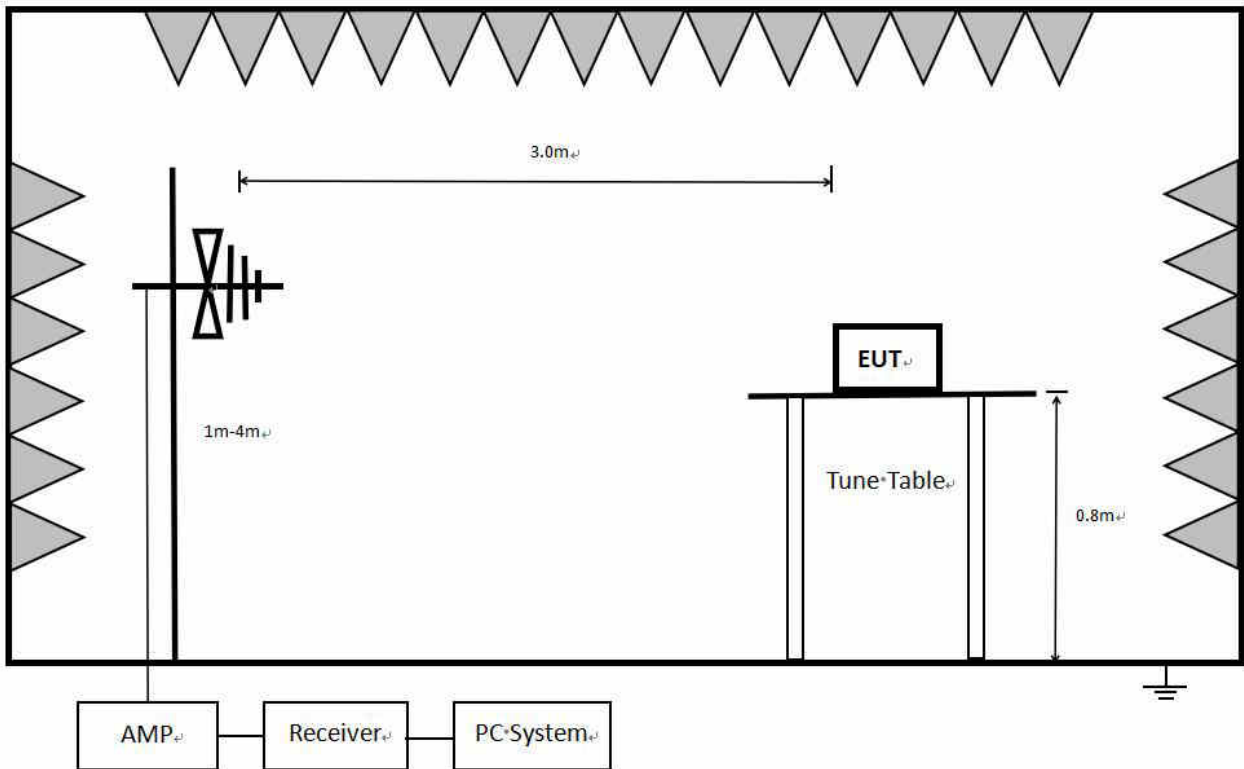
13. Radiated Emission

13.1. Block diagram of test setup

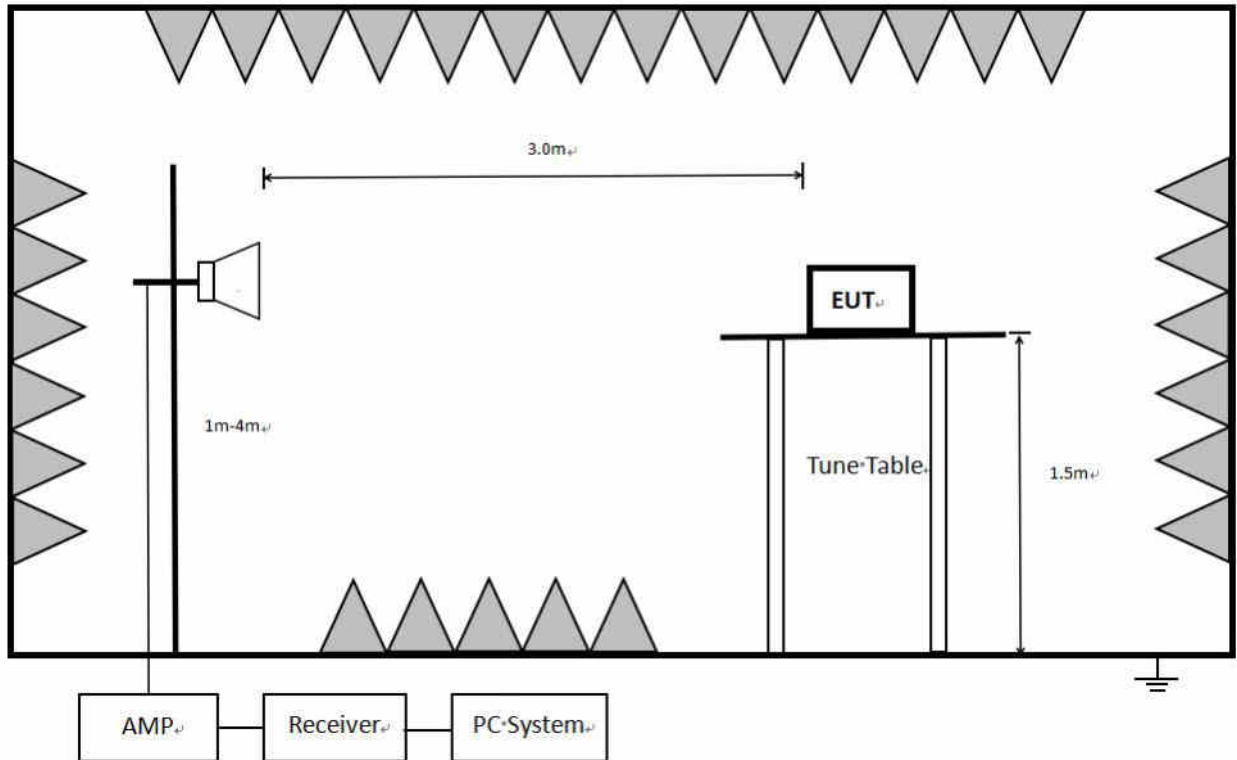
In 3 m Anechoic Chamber, test setup diagram for 9 kHz - 30 MHz:



In 3 m Anechoic Chamber, test setup diagram for 30 MHz - 1 GHz:



In 3 m Anechoic Chamber, test setup diagram for frequency above 1 GHz:



Note: For harmonic emissions test an appropriate high pass filter was inserted in the input port of AMP.

### 13.2. Limit

(1) FCC 15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.1772&4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.2072&4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	( <sup>2</sup> )
13.36-13.41			

<sup>1</sup>Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup>Above 38.6

## (2) FCC 15.209 Limit.

Frequency MHz	Distance Meters	Field Strengths Limit	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
0.009 ~ 0.490	300	2400/F(kHz)	67.6-20log(F)
0.490 ~ 1.705	30	24000/F(kHz)	87.6-20log(F)
1.705 ~ 30.0	30	30	29.54
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216~960	3	200	46.0
960~1000	3	500	54.0
Above 1000	3	74.0 dB( $\mu\text{V}$ )/m (Peak) 54.0 dB( $\mu\text{V}$ )/m (Average)	

Note: (1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

(2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). This paragraph (f) shall not apply to Access BPL devices operating below 30 MHz.

About Restricted bands of operation please refer to RSS-Gen section 8.10 and FCC § 15.205(a).

### 13.3. Test Procedure

Below 30 MHz:

The setting of the spectrum Analyzer

RBW	300 Hz (From 9 kHz to 0.15 MHz)/ 10 kHz (From 0.15 MHz to 30 MHz)
VBW	1 kHz (From 9 kHz to 0.15 MHz)/ 30 kHz (From 0.15 MHz to 30 MHz)
Sweep	Auto
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013

2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm meter above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of 1 meter height antenna tower.

5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

6. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT

measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open field site. Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.

Below 1 GHz and above 30 MHz:

The setting of the spectrum Analyzer

RBW	100 kHz
VBW	300 kHz
Sweep	Auto
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

Above 1 GHz:

RBW	1 MHz
VBW	PEAK: 3 MHz AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 1.5m above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement above 1GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.

6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for AVG measurements. For the Duty Cycle please refer to clause 8.1.ON TIME AND DUTY CYCLE.

7. Restriction band: Investigated frequency range from 2310 MHz to 2430 MHz and 2445 MHz to 2500 MHz, 2310 MHz to 2450 MHz and 2425 MHz to 2500MHz.

All restriction band should comply with 15.209, other emission should be at least 20 dB below the fundamental.



Note 1: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

Note 2: The EUT does not support simultaneous transmission.

Note 3: The EUT was fully exercised with external accessories during the test. In the case of multiple accessory external ports, an external accessory shall be connected to one of each type of port.

### **13.4. Results**

Pass. (See below detailed test result)

All the emissions except fundamental emission from 9 kHz to 25 GHz were comply with 15.209 limits.

Note1: According exploratory test, the emission levels are 20 dB below the limit detected from 9 kHz to 30 MHz, so the final test was performed with frequency range from 30 MHz to 26 GHz and recorded in below.

Note2: For emissions below 1 GHz, according exploratory explorer test, when change Tx mode and channel, have no distinct influence on emissions level, so for emissions below 1 GHz, the final test was only performed with EUT working in 11n HT40 mode.

Note3: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

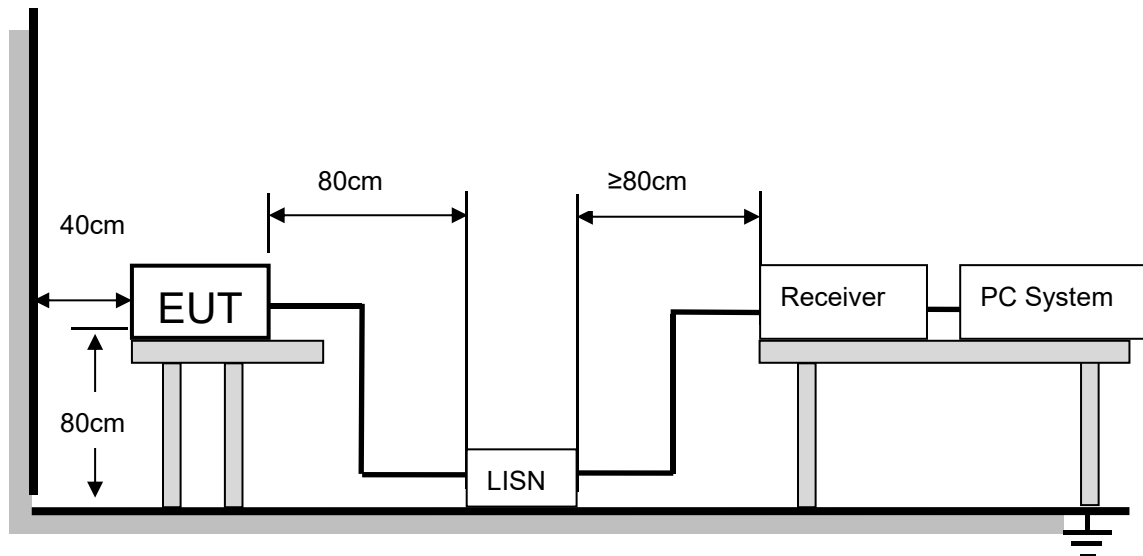
### **13.5. Original test data**

Below 1 GHz and above 30 MHz test data Refer to appendix A

Above 1 GHz test data Refer to appendix B

## 14. AC Power Line Conducted Emissions

### 14.1. Block diagram of test setup



The EUT is put on a table of non-conducting material that is 80 cm high. The vertical conducting wall of shielding is located 40 cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through an Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10-2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9 kHz.

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

### 14.2. Limits

Please refer to CFR 47 FCC § 15.207 (a) and ISSED RSS-Gen Clause 8.8.

Frequency (MHz)	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note 1: \* Decreasing linearly with logarithm of frequency.

Note 2: The lower limit shall apply at the transition frequencies.

### 14.3. Test procedure

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 10.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.

All support equipment power received from a second LISN.

Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150 kHz to 30 MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in clause 2.4 were scanned during the preliminary test.

After the preliminary scan, we found the test mode producing the highest emission level.

The EUT configuration and worse cable configuration of the above highest emission levels were recorded for reference of the final test.

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Neutral and Line, recording at least the six highest emissions.

Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

The bandwidth of test receiver is set at 9 kHz.

#### **14.4. Test result**

According to 15.207&RSS-GEN Clause 8.8, power Line Conducted Emission is not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.