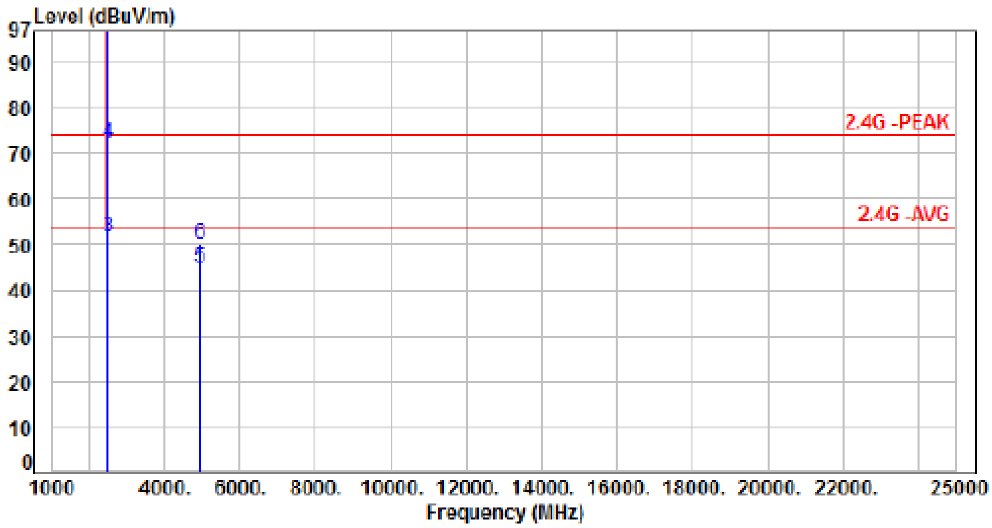
BeamForming

Power	:	AC 120V / 60Hz	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 5, CH11		:	

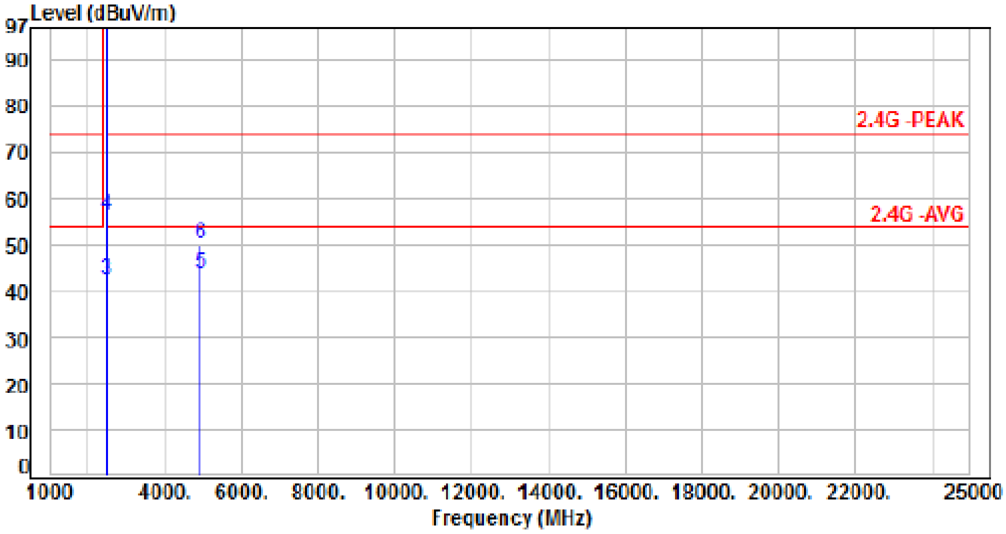


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2462.00	-2.42	116.02	113.60	200.00	-86.40	Average	253	59	P
2	2462.00	-2.42	118.90	116.48	200.00	-83.52	Peak	253	59	P
3	2483.50	-2.35	53.83	51.48	54.00	-2.52	Average	253	59	P
4	2483.50	-2.35	74.65	72.30	74.00	-1.70	Peak	253	59	P
5	4924.00	5.59	39.50	45.09	54.00	-8.91	Average	100	57	P
6	4924.00	5.59	44.56	50.15	74.00	-23.85	Peak	100	57	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

BeamForming

Power	:	AC 120V / 60Hz	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 5, CH11		:	

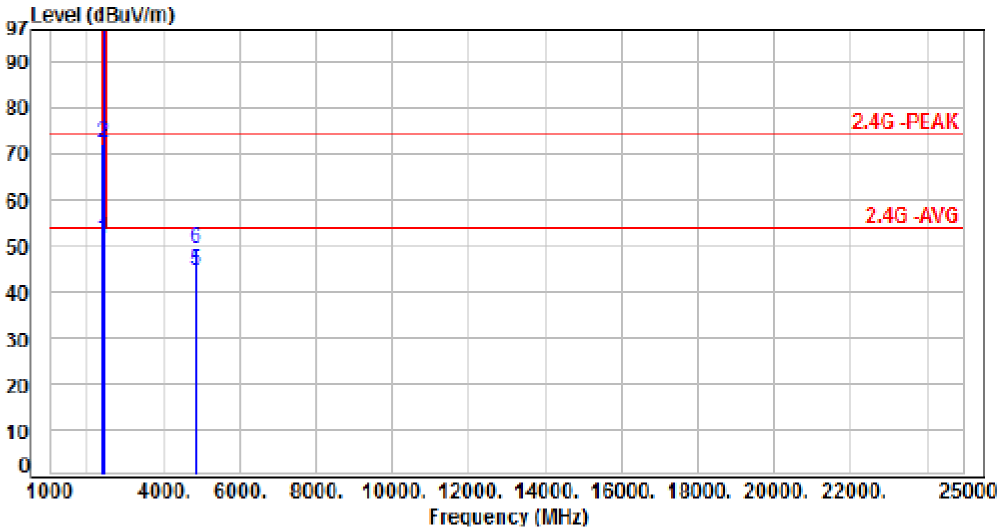


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2462.00	-2.42	100.47	98.05	200.00	-101.95	Average	328	144	P
2	2462.00	-2.42	103.89	101.47	200.00	-98.53	Peak	328	144	P
3	2483.50	-2.35	44.77	42.42	54.00	-11.58	Average	328	144	P
4	2483.50	-2.35	58.77	56.42	74.00	-17.58	Peak	328	144	P
5	4924.00	5.59	38.25	43.84	54.00	-10.16	Average	100	86	P
6	4924.00	5.59	44.41	50.00	74.00	-24.00	Peak	100	86	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

BeamForming

Power	:	AC 120V / 60Hz	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 6, CH03		:	

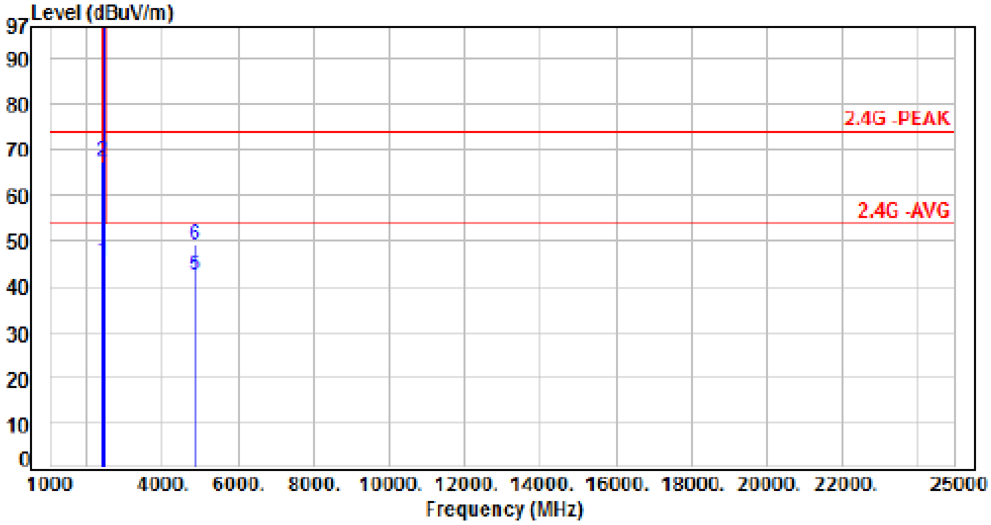


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.22	55.00	51.78	54.00	-2.22	Average	100	338	P
2	2390.00	-3.22	75.38	72.16	74.00	-1.84	Peak	100	338	P
3	2422.00	-2.99	111.36	108.37	200.00	-91.63	Average	100	338	P
4	2422.00	-2.99	118.55	115.56	200.00	-84.44	Peak	100	338	P
5	4844.00	5.38	39.20	44.58	54.00	-9.42	Average	100	71	P
6	4844.00	5.38	44.02	49.40	74.00	-24.60	Peak	100	71	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

BeamForming

Power	:	AC 120V / 60Hz	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 6, CH03		:	

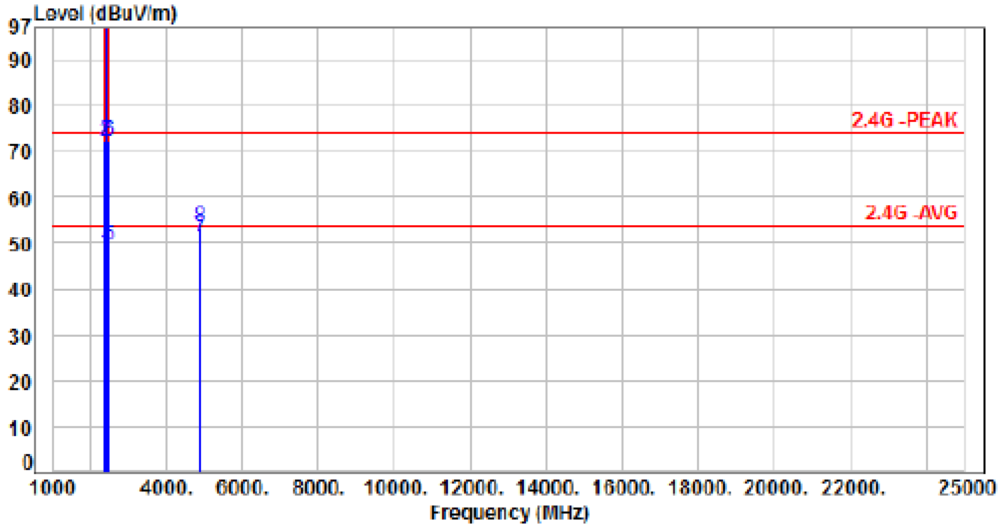


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.22	48.43	45.21	54.00	-8.79	Average	131	107	P
2	2390.00	-3.22	70.81	67.59	74.00	-6.41	Peak	131	107	P
3	2422.00	-2.99	106.88	103.89	200.00	-96.11	Average	131	107	P
4	2422.00	-2.99	109.58	106.59	200.00	-93.41	Peak	131	107	P
5	4844.00	5.38	37.13	42.51	54.00	-11.49	Average	100	89	P
6	4844.00	5.38	43.73	49.11	74.00	-24.89	Peak	100	89	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

BeamForming

Power	:	AC 120V / 60Hz	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 6, CH06		:	

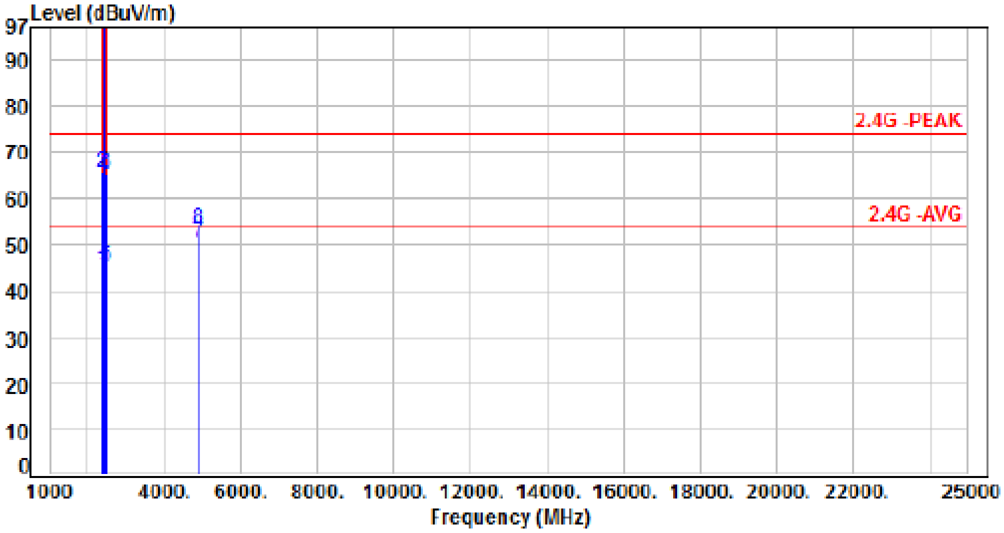


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.22	51.05	47.83	54.00	-6.17	Average	100	353	P
2	2390.00	-3.22	75.44	72.22	74.00	-1.78	Peak	100	353	P
3	2437.00	-2.70	116.07	113.37	200.00	-86.63	Average	100	353	P
4	2437.00	-2.70	118.61	115.91	200.00	-84.09	Peak	100	353	P
5	2483.50	-2.35	51.59	49.24	54.00	-4.76	Average	100	353	P
6	2483.50	-2.35	74.78	72.43	74.00	-1.57	Peak	100	353	P
7	4874.00	5.48	45.66	51.14	54.00	-2.86	Average	100	122	P
8	4874.00	5.48	48.16	53.64	74.00	-20.36	Peak	100	122	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

BeamForming

Power	:	AC 120V / 60Hz	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 6, CH06		:	

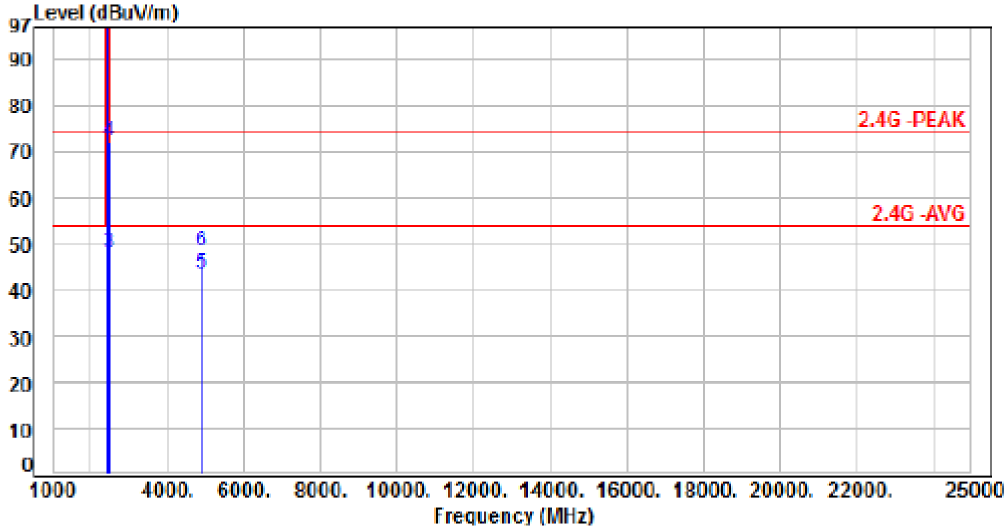


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.22	47.71	44.49	54.00	-9.51	Average	100	103	P
2	2390.00	-3.22	68.96	65.74	74.00	-8.26	Peak	100	103	P
3	2437.00	-2.70	109.70	107.00	200.00	-93.00	Average	100	103	P
4	2437.00	-2.70	111.92	109.22	200.00	-90.78	Peak	100	103	P
5	2483.50	-2.35	47.82	45.47	54.00	-8.53	Average	100	103	P
6	2483.50	-2.35	67.47	65.12	74.00	-8.88	Peak	100	103	P
7	4874.00	5.48	45.17	50.65	54.00	-3.35	Average	108	93	P
8	4874.00	5.48	47.87	53.35	74.00	-20.65	Peak	108	93	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

BeamForming

Power	:	AC 120V / 60Hz	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 6, CH09		:	

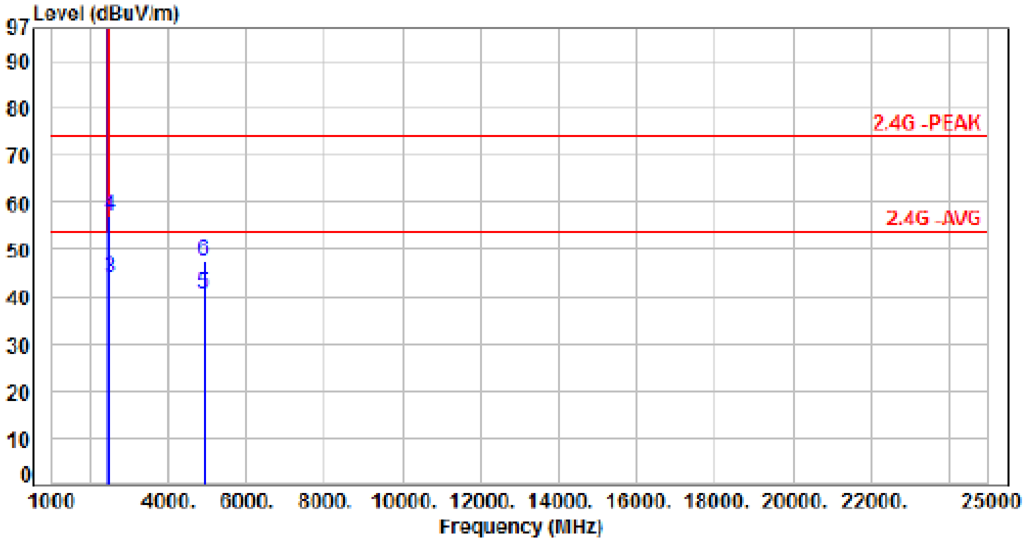


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2452.00	-2.45	108.89	106.44	200.00	-93.56	Average	100	37	P
2	2452.00	-2.45	112.38	109.93	200.00	-90.07	Peak	100	37	P
3	2483.50	-2.35	50.24	47.89	54.00	-6.11	Average	100	37	P
4	2483.50	-2.35	74.54	72.19	74.00	-1.81	Peak	100	37	P
5	4904.00	5.57	38.02	43.59	54.00	-10.41	Average	100	57	P
6	4904.00	5.57	42.82	48.39	74.00	-25.61	Peak	100	57	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

BeamForming

Power	:	AC 120V / 60Hz	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 6, CH09		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2452.00	-2.45	102.98	100.53	200.00	-99.47	Average	100	104	P
2	2452.00	-2.45	106.97	104.52	200.00	-95.48	Peak	100	104	P
3	2483.50	-2.35	46.28	43.93	54.00	-10.07	Average	100	104	P
4	2483.50	-2.35	59.55	57.20	74.00	-16.80	Peak	100	104	P
5	4904.00	5.57	34.92	40.49	54.00	-13.51	Average	100	135	P
6	4904.00	5.57	42.11	47.68	74.00	-26.32	Peak	100	135	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

6.7 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.09000 – 0.11000	16.42000 – 16.42300	399.9 – 410.0	4.500 – 5.250
0.49500 – 0.505**	16.69475 – 16.69525	608.0 – 614.0	5.350 – 5.460
2.17350 – 2.19050	16.80425 – 16.80475	960.0 – 1240.0	7.250 – 7.750
4.12500 – 4.12800	25.50000 – 25.67000	1300.0 – 1427.0	8.025 – 8.500
4.17725 – 4.17775	37.50000 – 38.25000	1435.0 – 1626.5	9.000 – 9.200
4.20725 – 4.20775	73.00000 – 74.60000	1645.5 – 1646.5	9.300 – 9.500
6.21500 – 6.21800	74.80000 – 75.20000	1660.0 – 1710.0	10.600 – 12.700
6.26775 – 6.26825	108.00000 – 121.94000	1718.8 – 1722.2	13.250 – 13.400
6.31175 – 6.31225	123.00000 – 138.00000	2200.0 – 2300.0	14.470 – 14.500
8.29100 – 8.29400	149.90000 – 150.05000	2310.0 – 2390.0	15.350 – 16.200
8.36200 – 8.36600	156.52475 – 156.52525	2483.5 – 2500.0	17.700 – 21.400
8.37625 – 8.38675	156.70000 – 156.90000	2655.0 – 2900.0	22.010 – 23.120
8.41425 – 8.41475	162.01250 – 167.17000	3260.0 – 3267.0	23.600 – 24.000
12.29000 – 12.29300	167.72000 – 173.20000	3332.0 – 3339.0	31.200 – 31.800
12.51975 – 12.52025	240.00000 – 285.00000	3345.8 – 3358.0	36.430 – 36.500
12.57675 – 12.57725	322.00000 – 335.40000	3600.0 – 4400.0	Above 38.6
13.36000 – 13.41000			

**: Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

7. Test of Conducted Spurious Emission

7.1 Test Limit

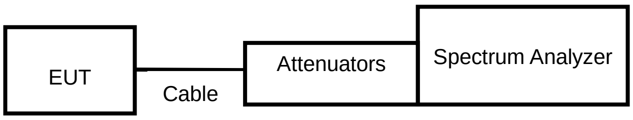
According to the methods defined in ANSI C63.10-2013 Section 11.11.1
Below –30dB of the highest emission level of operating band (In 100 kHz Resolution Bandwidth)

7.2 Test Procedure

According to the methods defined in ANSI C63.10-2013 Section 11.11.2 & 11.11.3

a. The transmitter output was connected to the spectrum analyzer via a low loss cable.
b. Set RBW of spectrum analyzer to 100 KHz and VBW of spectrum analyzer to 300 KHz with convenient frequency span including 100 KHz bandwidth from band edge.
c. Peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 30dB relative to the maximum measured in-band peak PSD level.
d. The band edges was measured and recorded.

7.3 Test Setup Layout

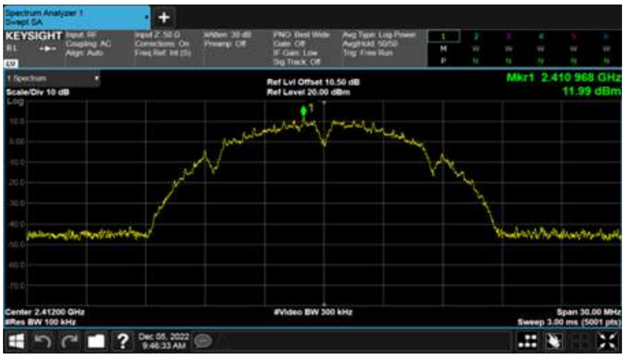


7.4 Test Result and Data

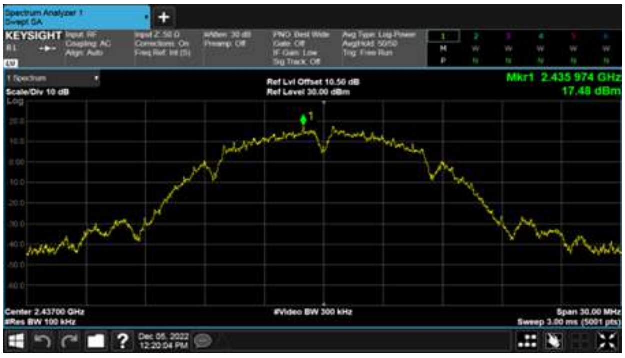
Note: Test plots refers to the following pages.

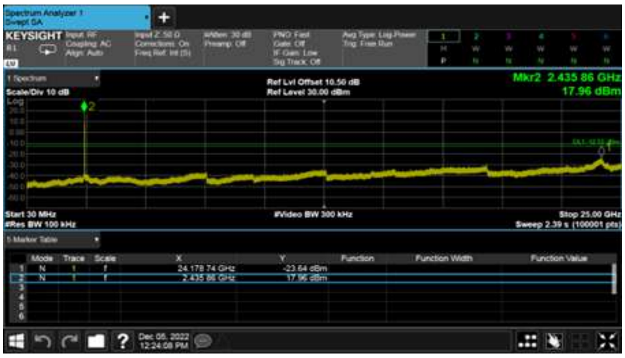
Non BeamForming
ANT A

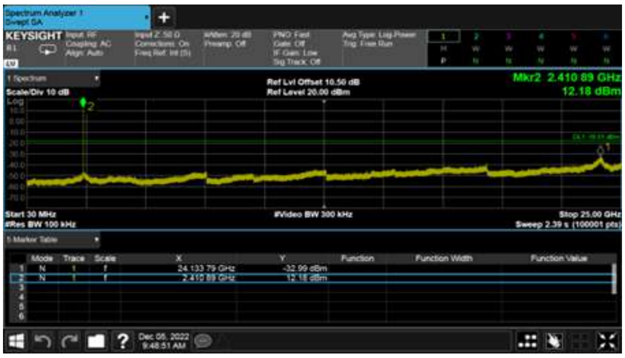
Modulation Type: 802.11b, CH 01



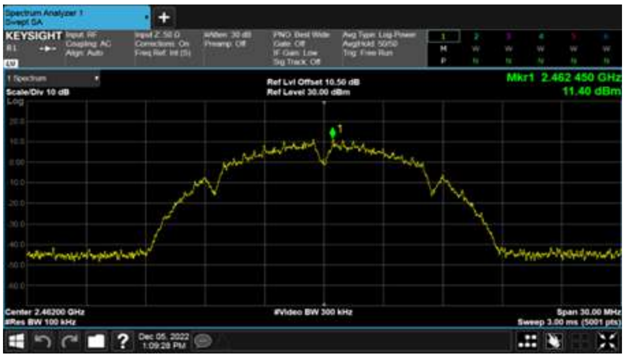
Modulation Type: 802.11b, CH 06

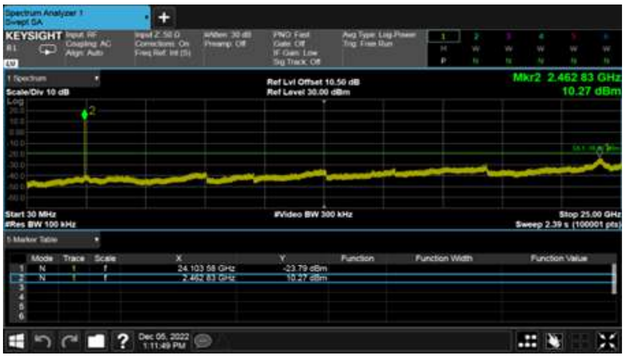






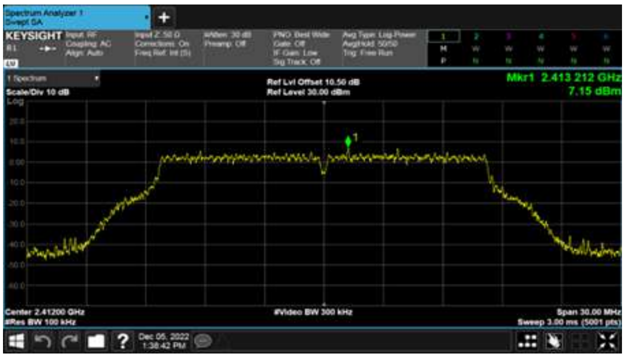
Non BeamForming
ANT A
Modulation Type: 802.11b, CH 11



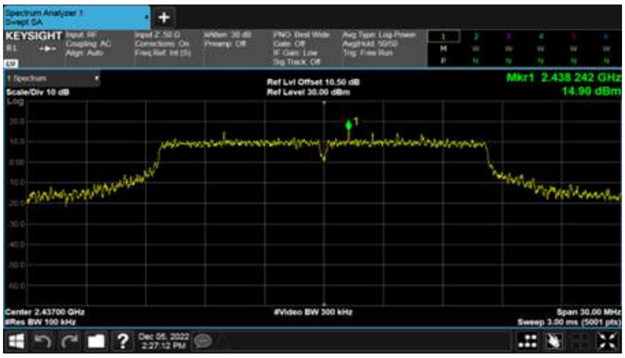


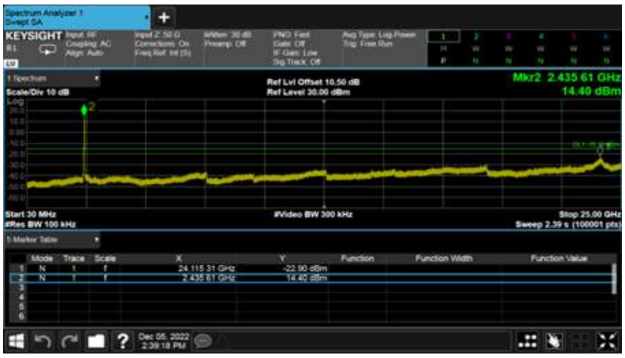
Non BeamForming
ANT A

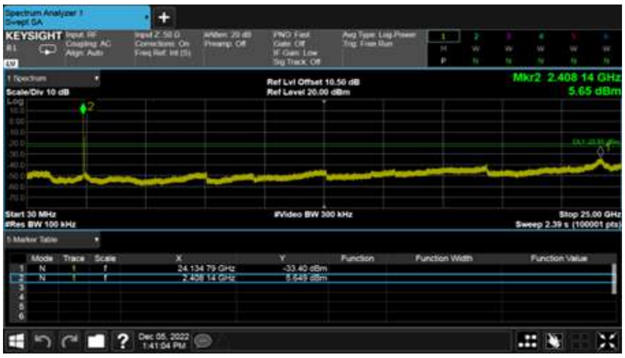
Modulation Type: 802.11g, CH 01



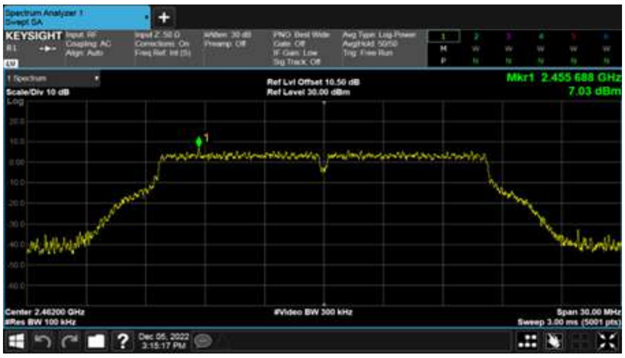
Modulation Type: 802.11g, CH 06

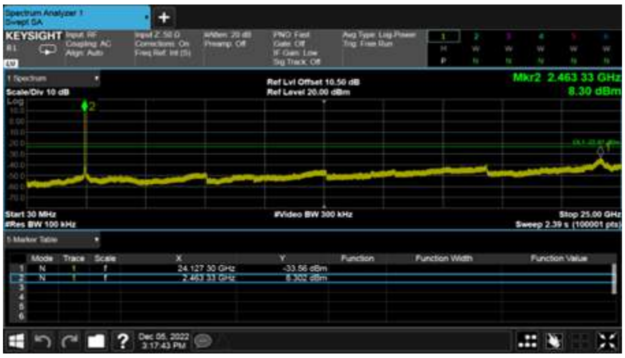




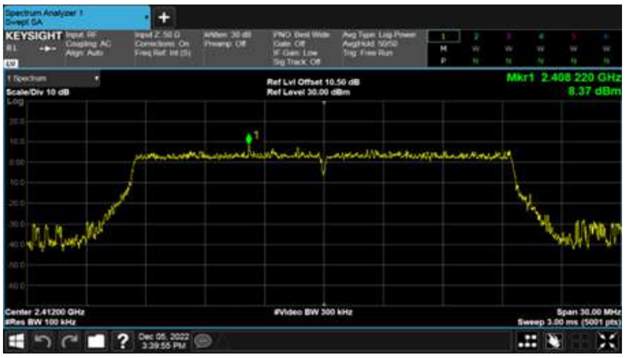


Non BeamForming
ANT A
Modulation Type: 802.11g, CH 11

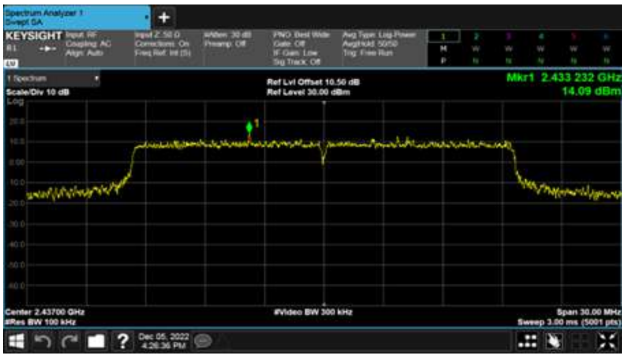


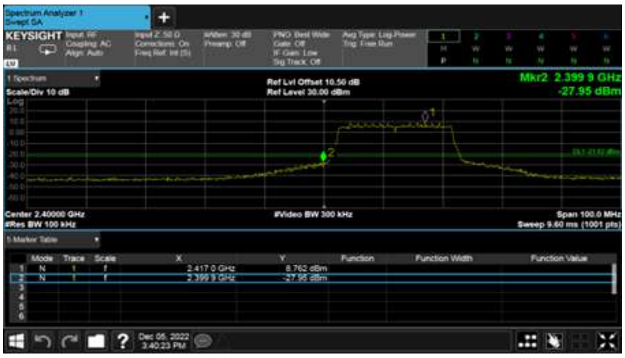


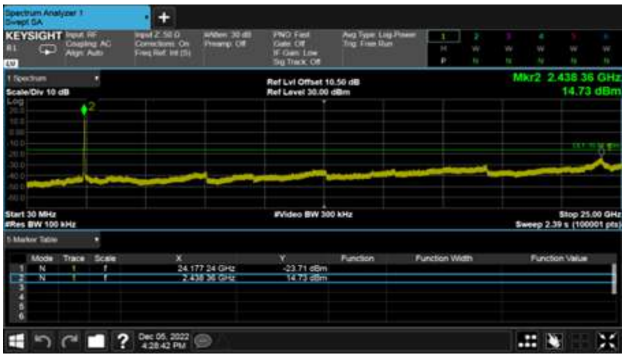
Non BeamForming
ANT A
Modulation Type: 802.11ax HE20, CH01

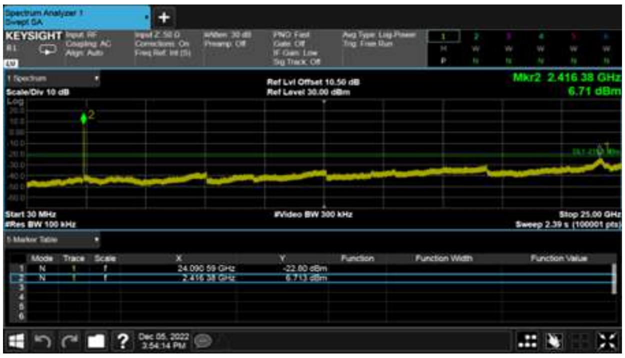


Modulation Type: 802.11ax HE20, CH06

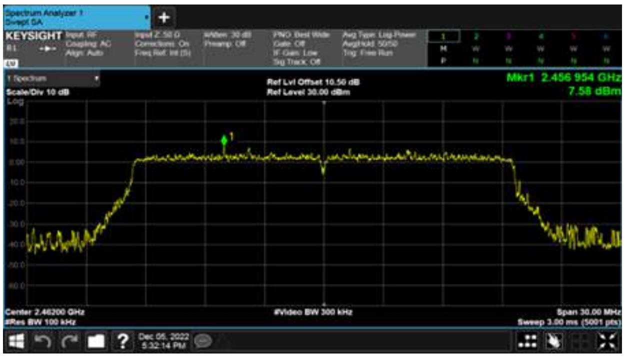


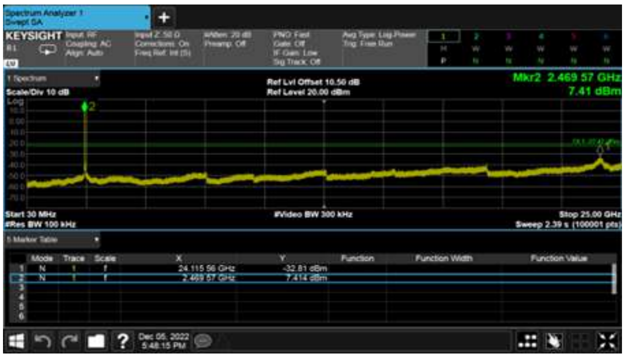






Non BeamForming
ANT A
Modulation Type: 802.11ax HE20, CH11

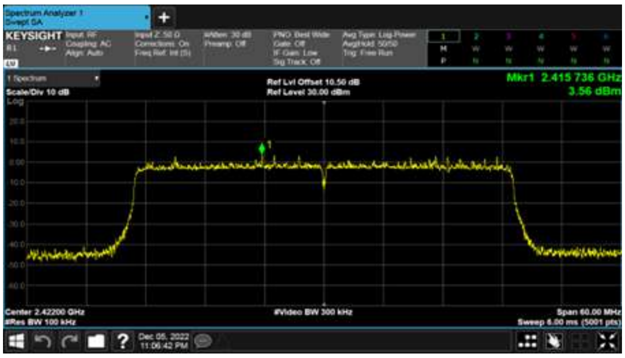




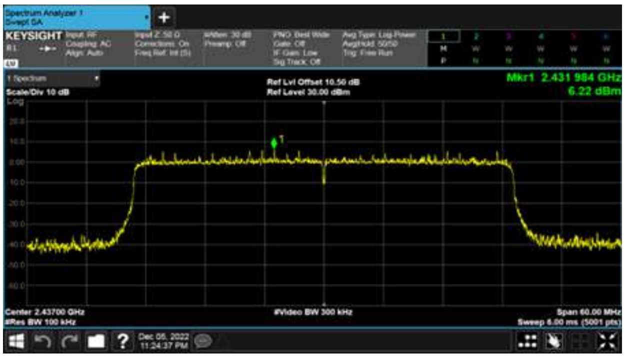
Non BeamForming

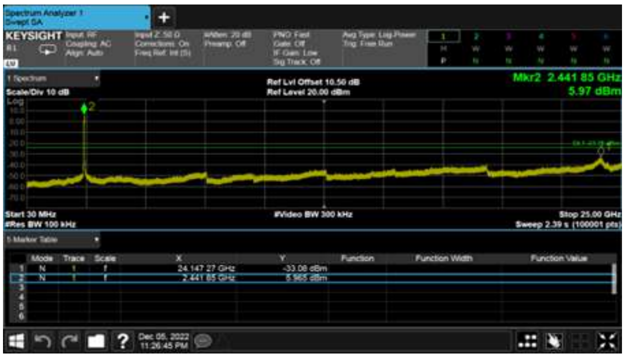
ANT A

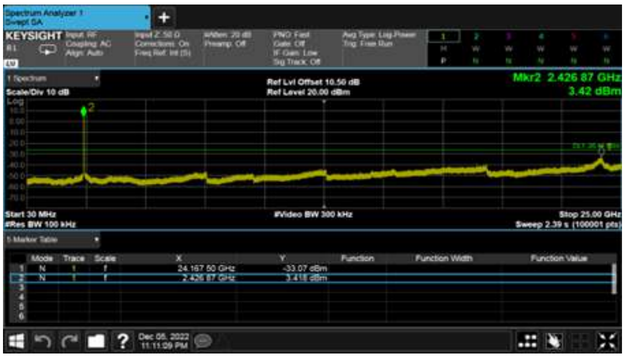
Modulation Type: 802.11ax HE40, CH03



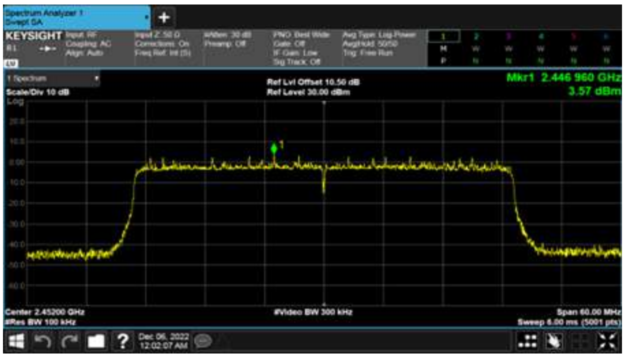
Modulation Type: 802.11ax HE40, CH06

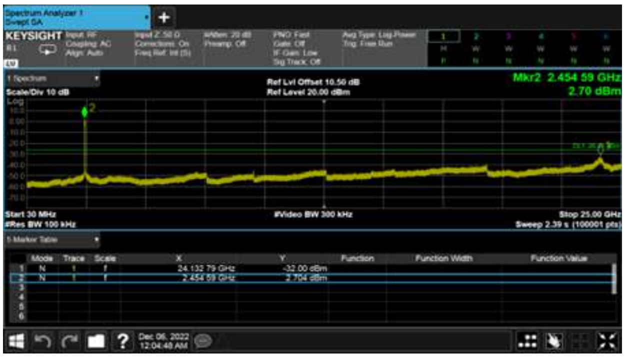






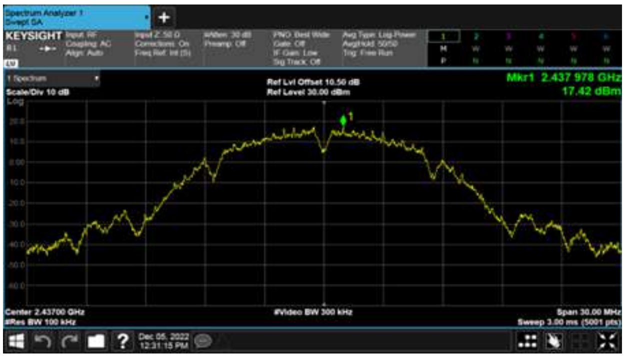
Non BeamForming
ANT A
Modulation Type: 802.11ax HE40, CH09

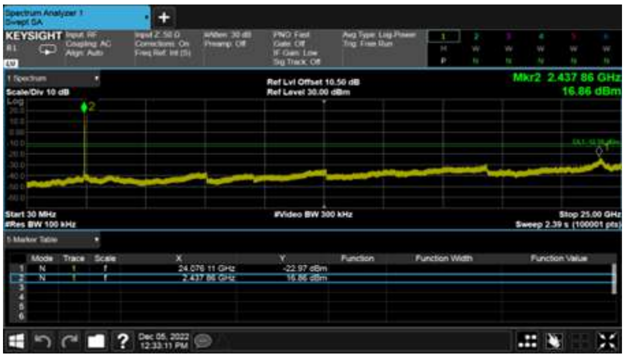


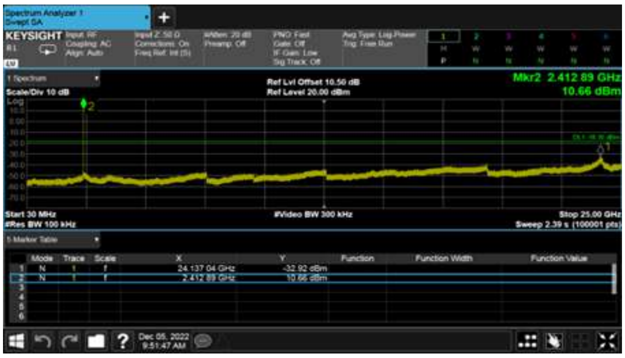


Non BeamForming
ANT B
Modulation Type: 802.11b, CH 01

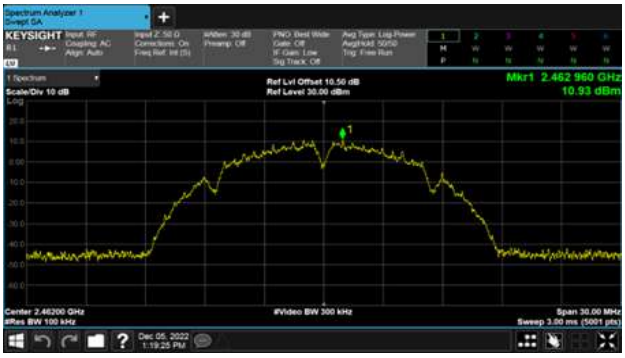
Modulation Type: 802.11b, CH 06

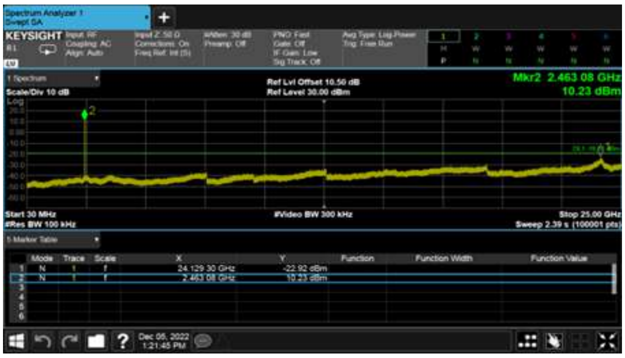






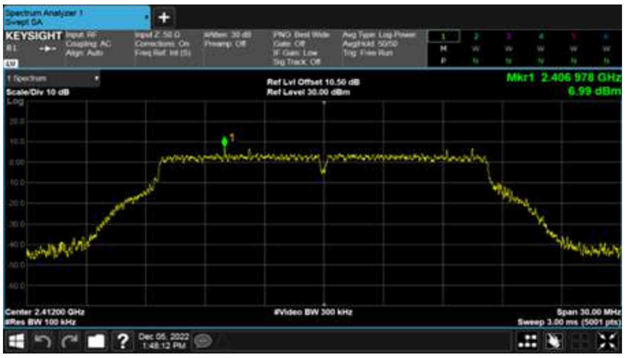
Non BeamForming
ANT B
Modulation Type: 802.11b, CH 11



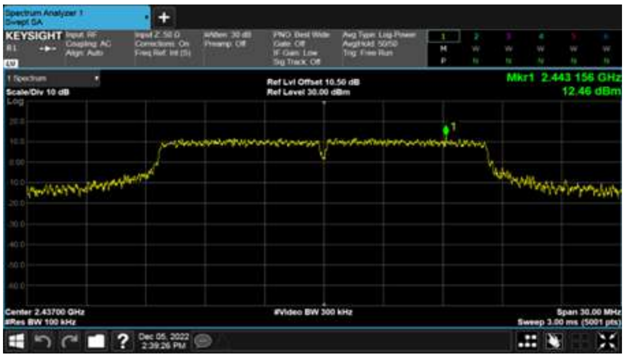


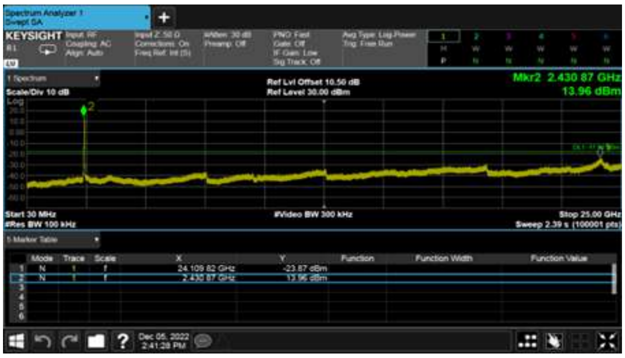
Non BeamForming
ANT B

Modulation Type: 802.11g, CH 01

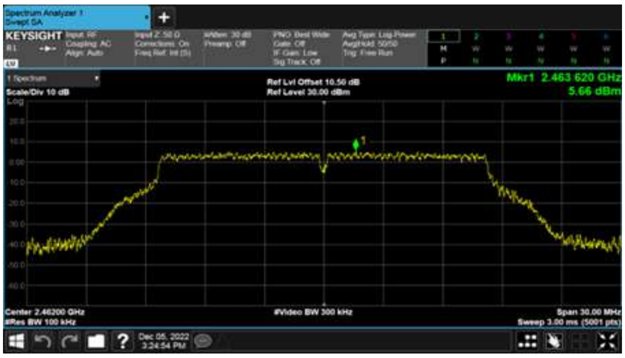


Modulation Type: 802.11g, CH 06



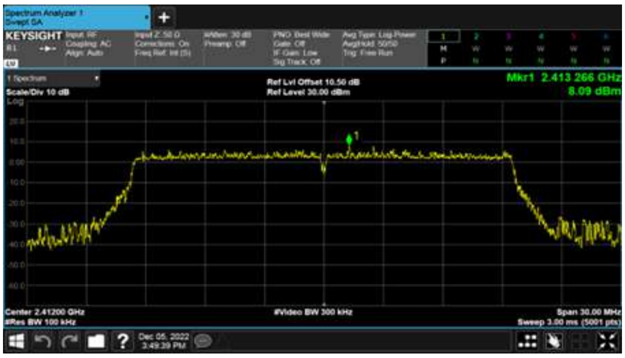


Non BeamForming
ANT B
Modulation Type: 802.11g, CH 11

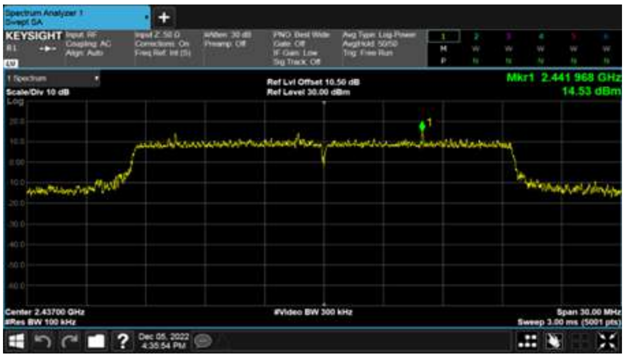


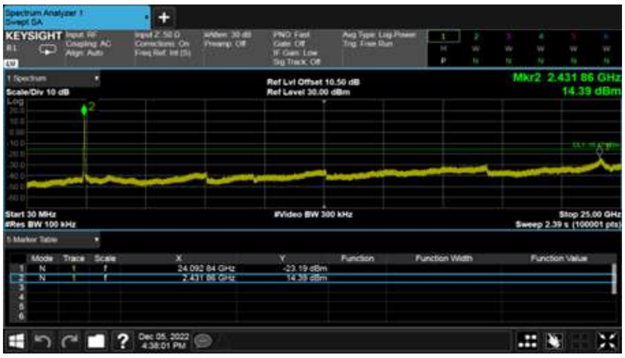
Non BeamForming
ANT B

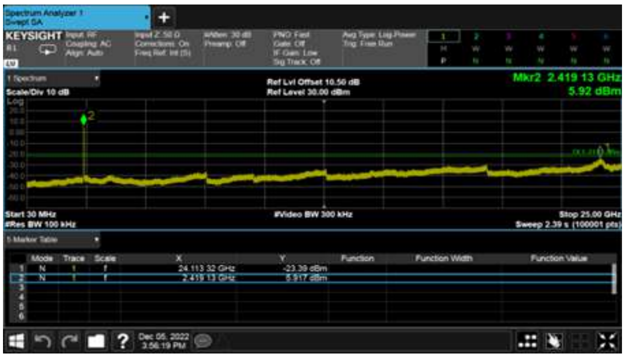
Modulation Type: 802.11ax HE20, CH01



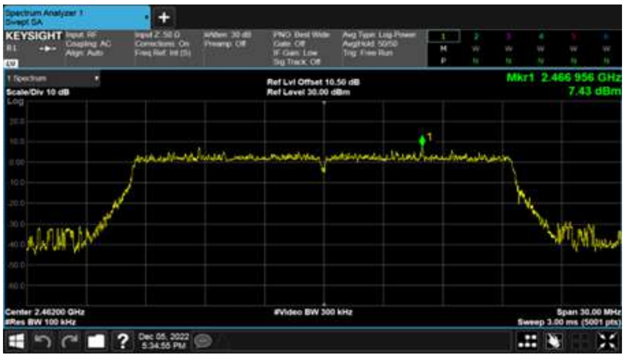
Modulation Type: 802.11ax HE20, CH06

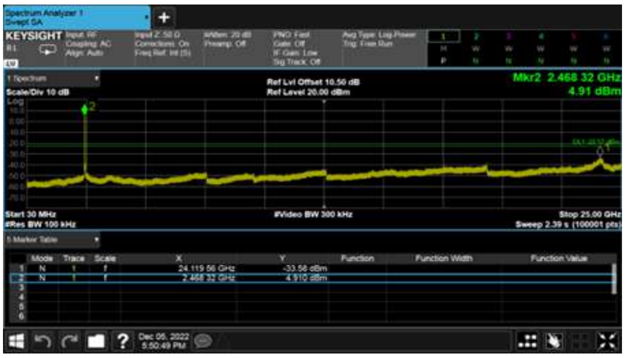




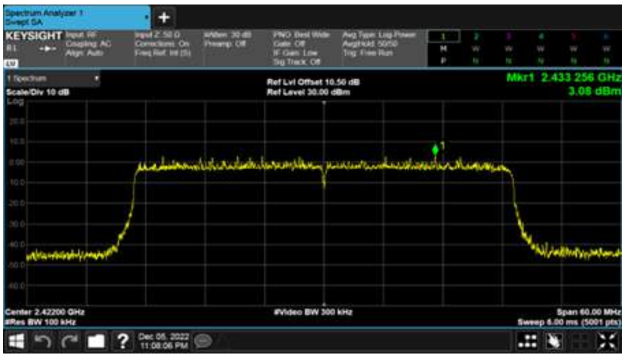


Non BeamForming
ANT B
Modulation Type: 802.11ax HE20, CH11

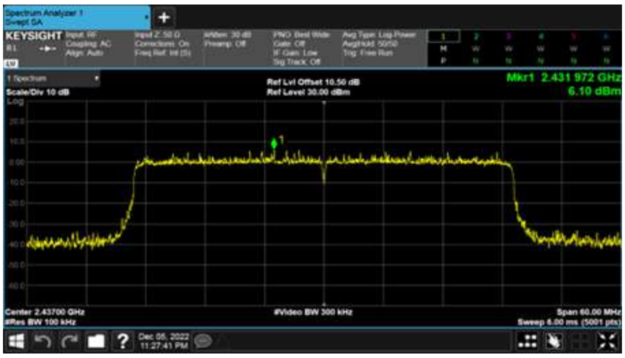


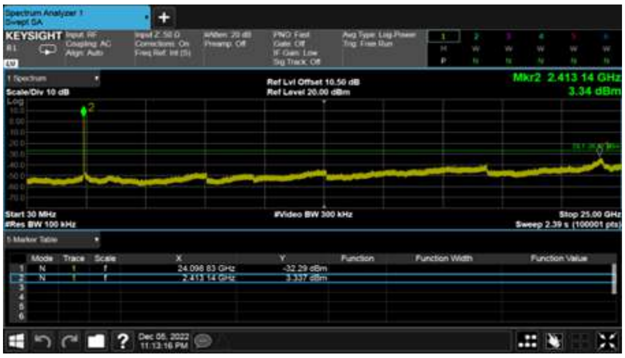


Non BeamForming
ANT B
Modulation Type: 802.11ax HE40, CH03

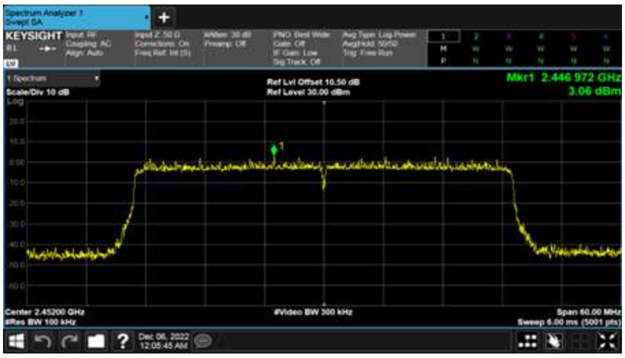


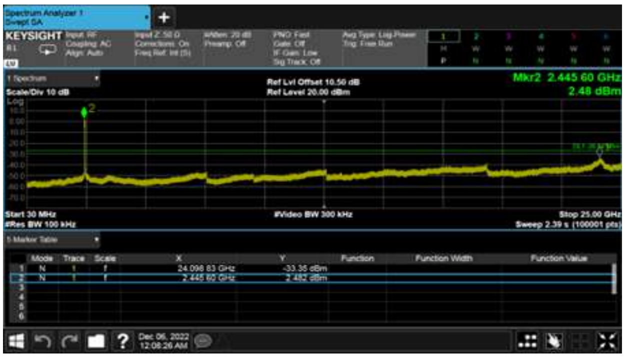
Modulation Type: 802.11ax HE40, CH06



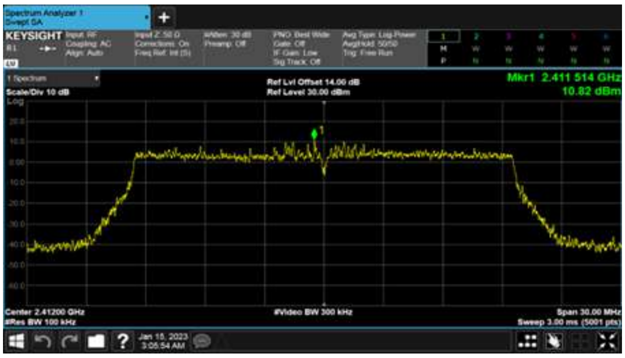


Non BeamForming
ANT B
Modulation Type: 802.11ax HE40, CH09

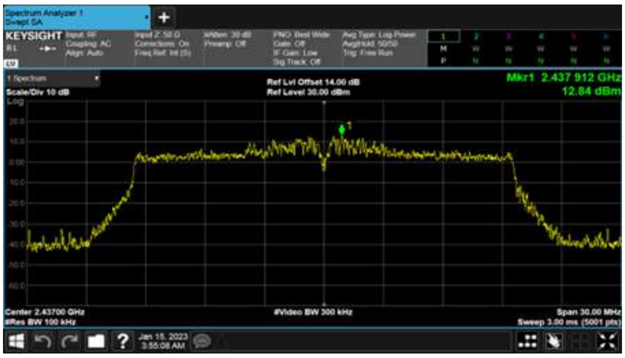


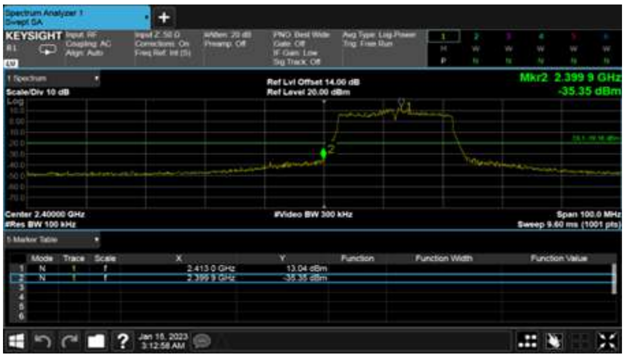


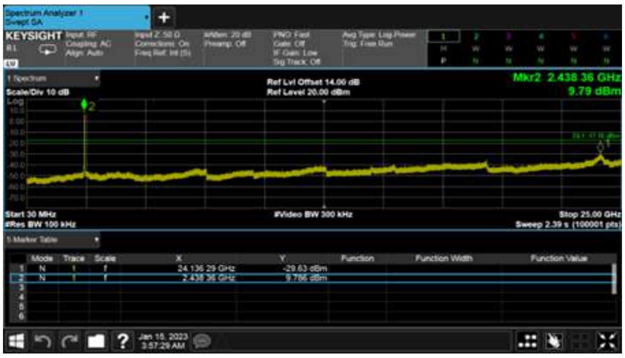
BeamForming
ANT A
Modulation Type: 802.11ax HE20, CH01

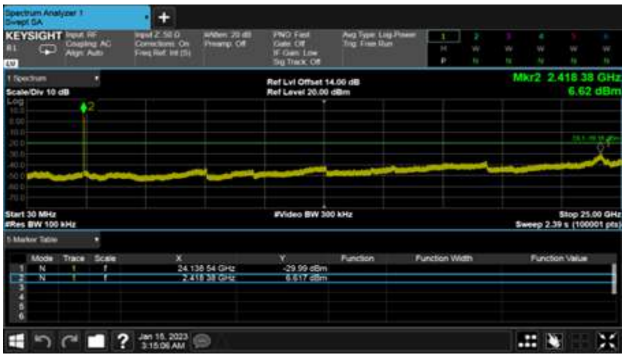


Modulation Type: 802.11ax HE20, CH06

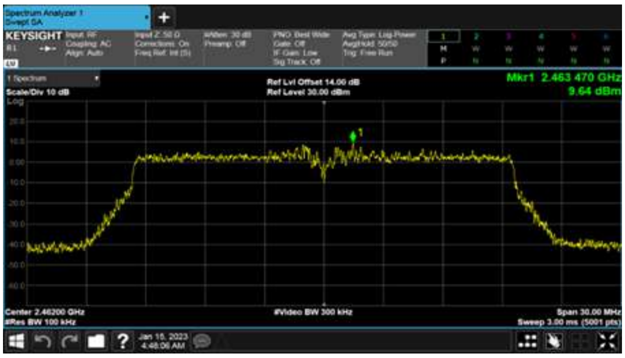




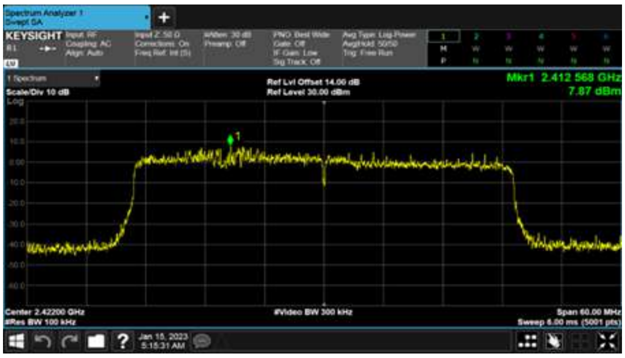




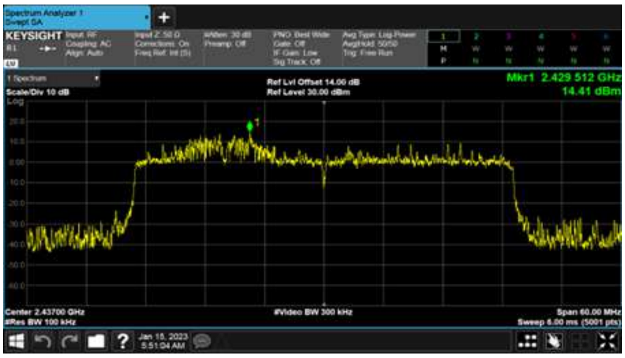
BeamForming
ANT A
Modulation Type: 802.11ax HE20, CH11

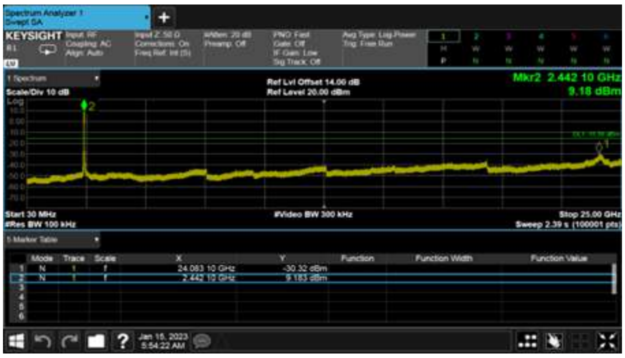


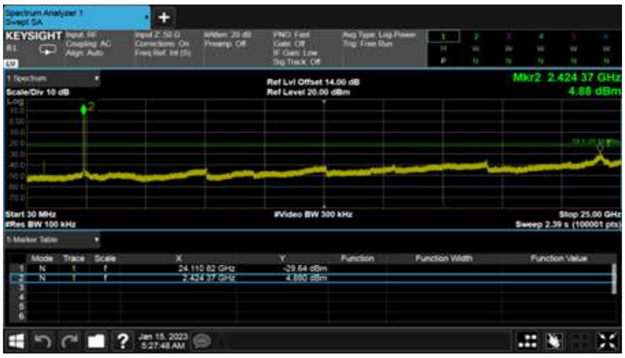
BeamForming
ANT A
Modulation Type: 802.11ax HE40, CH03



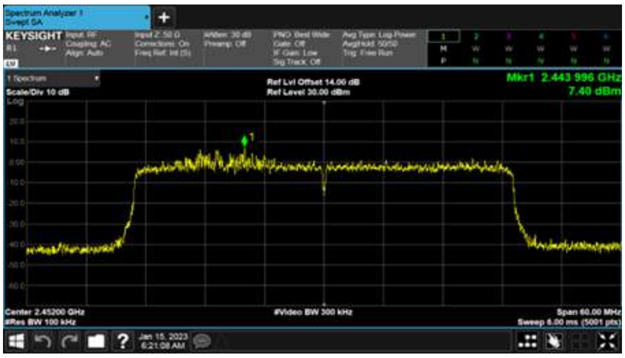
Modulation Type: 802.11ax HE40, CH06

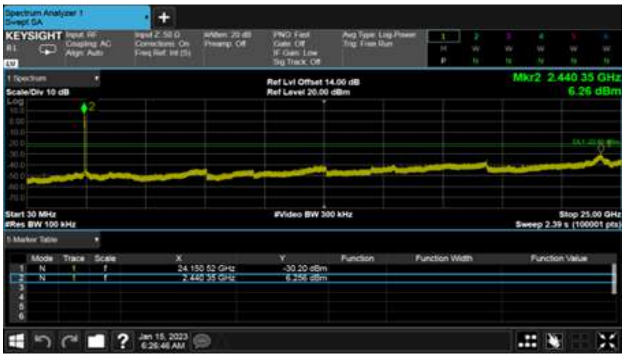






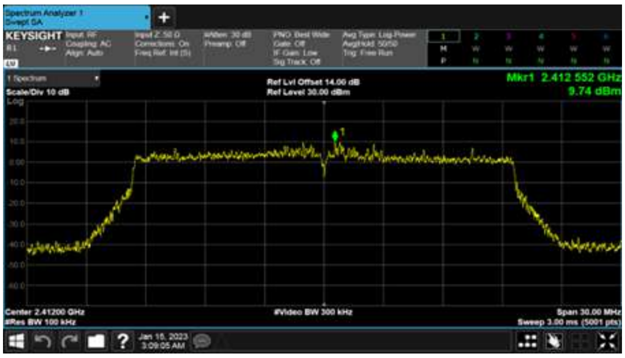
BeamForming
ANT A
Modulation Type: 802.11ax HE40, CH09



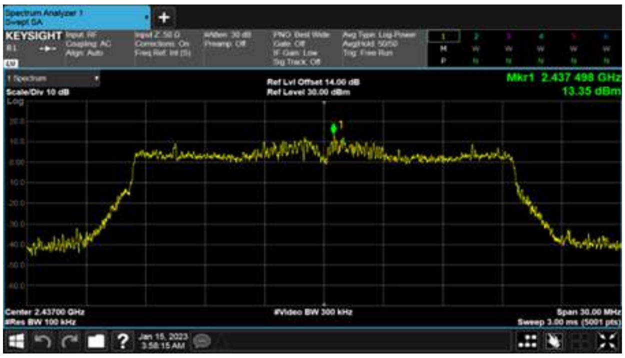


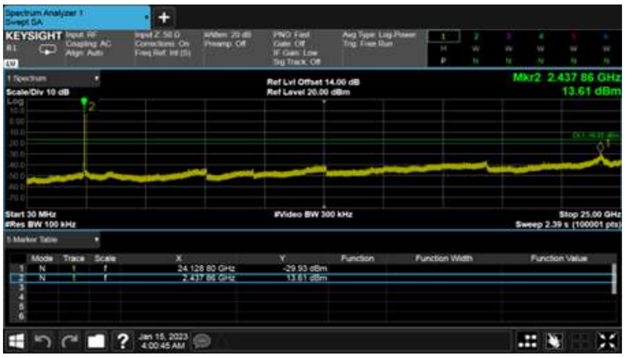
BeamForming
ANT B

Modulation Type: 802.11ax HE20, CH01

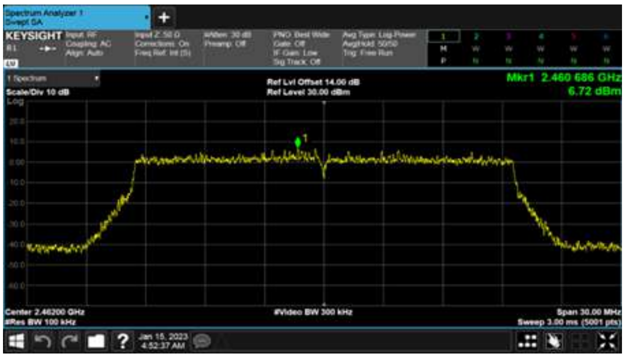


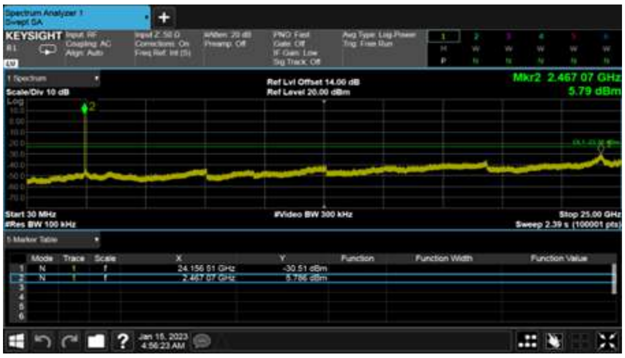
Modulation Type: 802.11ax HE20, CH06





BeamForming
ANT B
Modulation Type: 802.11ax HE20, CH11

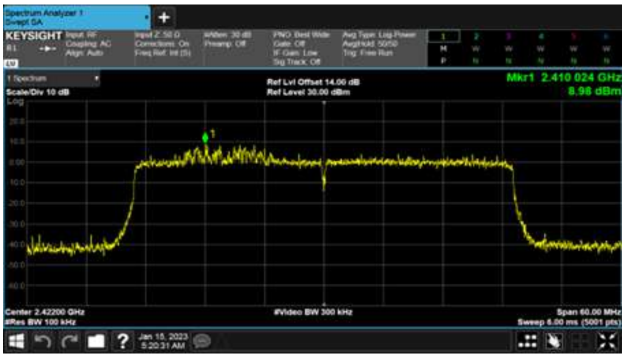




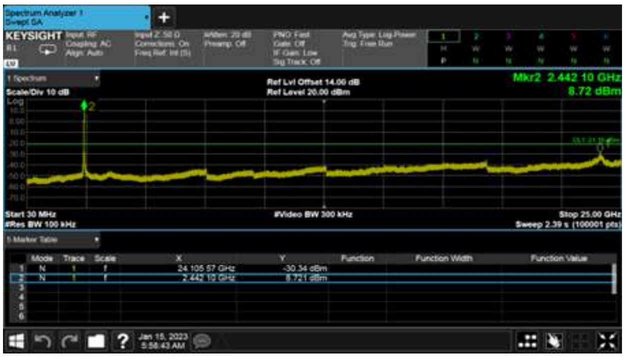
BeamForming

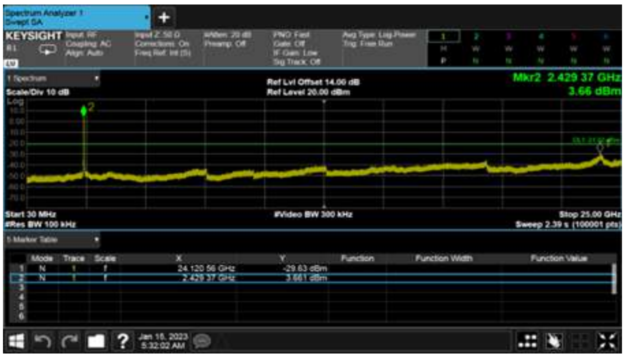
ANT B

Modulation Type: 802.11ax HE40, CH03

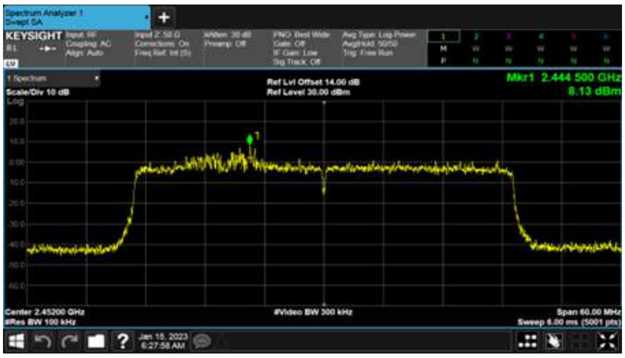


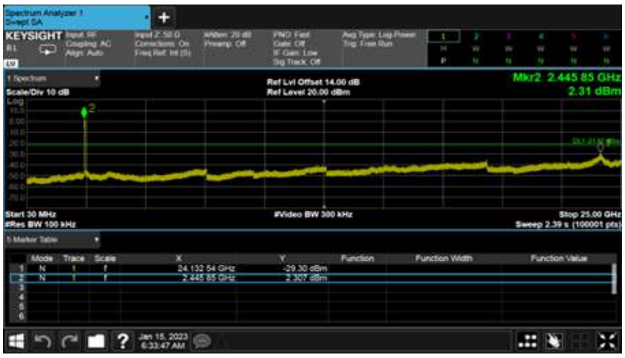
Modulation Type: 802.11ax HE40, CH06





BeamForming
ANT B
Modulation Type: 802.11ax HE40, CH09





8. On Time, Duty Cycle and Measurement methods

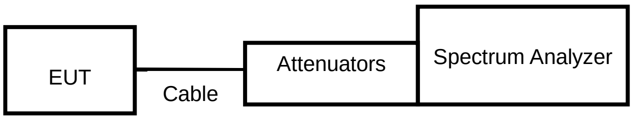
8.1 Test Limit

None; for reporting purposes only.

8.2 Test Procedure

According to the methods defined in ANSI C63.10-2013 Section 11.6
Zero-Span Spectrum Analyzer Method.

8.3 Test Setup Layout



8.4 Test Result and Data

Non BeamForming			
Modulation Type	On Time (msec)	Period Time (msec)	Duty Cycle (%)
11b,1M	12.45	13.06	95.33%
11g,6M	2.07	2.17	95.44%
11ax HE20	1.49	1.52	98.16%
11ax HE40	0.78	0.80	96.61%

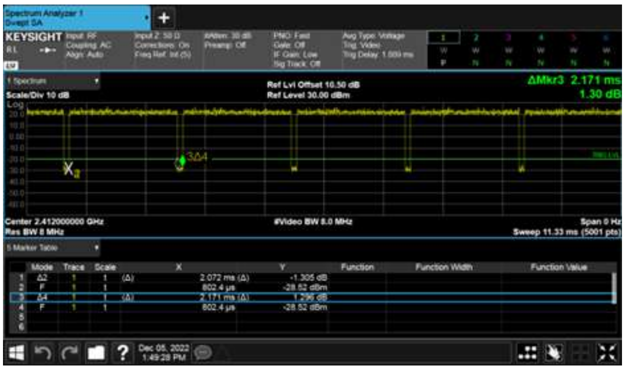
BeamForming			
Modulation Type	On Time (msec)	Period Time (msec)	Duty Cycle (%)
11ax HE20	7.46	8.84	84.39%
11ax HE40	7.50	8.97	83.63%

Non BeamForming

Modulation Type: 802.11b(1Mbps)

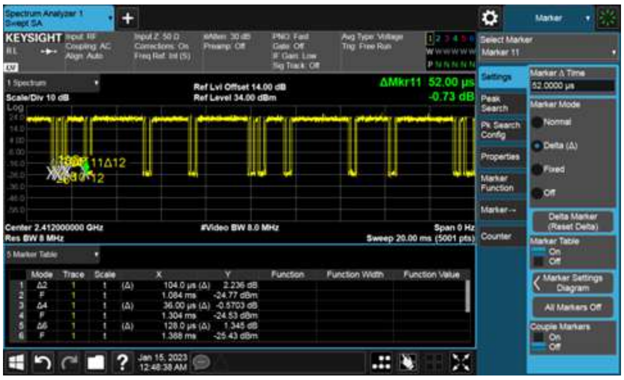
Modulation Type: 802.11ax HE40(14.6Mbps)

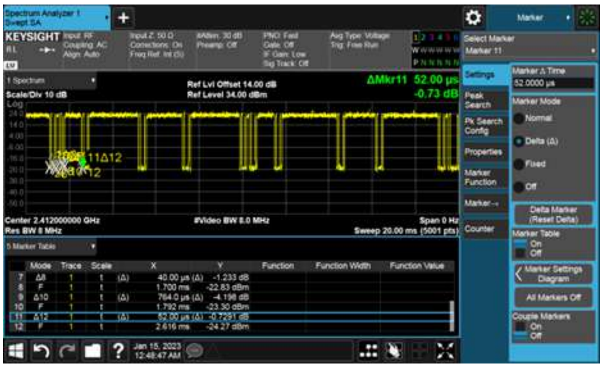
Modulation Type: 802.11g(6Mbps)



Modulation Type: 802.11ax HE20(7.3Mbps)

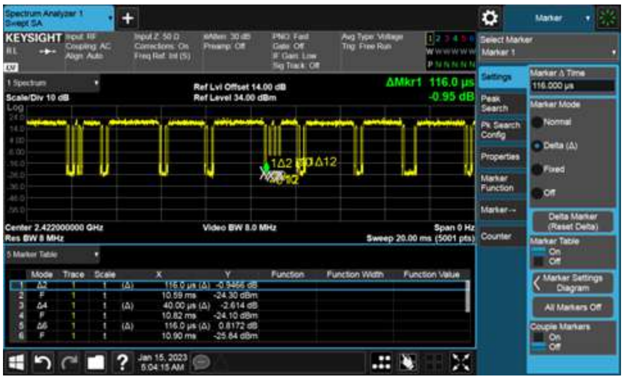
BeamForming
Modulation Type: 802.11ax HE20(7.3Mbps)

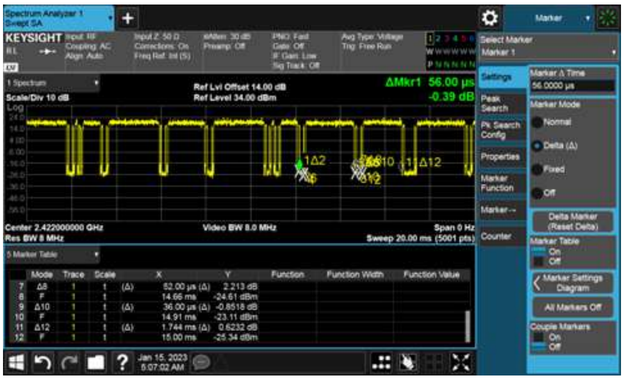


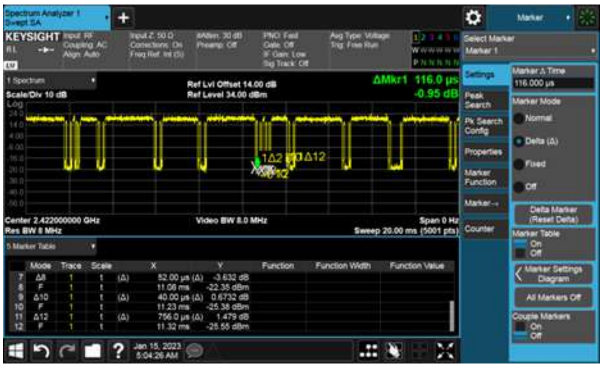


BeamForming

Modulation Type: 802.11ax HE40(14.6Mbps)







9. 6dB Bandwidth Measurement Data

9.1 Test Limit

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

9.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 11.8

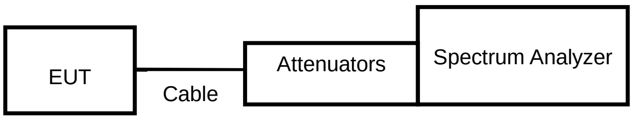
a. The transmitter output was connected to the spectrum analyzer.

b. Set RBW of spectrum analyzer to 100 KHz and VBW to 300 KHz.

c. The 6 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

d. The 6dB Bandwidth was measured and recorded.

9.3 Test Setup Layout



9.4 Test Result and Data

Non BeamForming

Modulation Type	Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Limit (MHz)
			ANT A	ANT B	
11b	1	2412	7.09	7.11	0.5
	6	2437	7.08	7.08	0.5
	11	2462	7.10	7.10	0.5
11g	1	2412	16.43	16.39	0.5
	6	2437	16.39	16.35	0.5
	11	2462	16.42	16.39	0.5
11ax HE20	1	2412	19.03	19.01	0.5
	6	2437	18.98	18.94	0.5
	11	2462	19.01	19.00	0.5
11ax HE40	3	2422	37.62	37.56	0.5
	6	2437	37.03	37.54	0.5
	9	2452	37.57	37.55	0.5

BeamForming

Modulation Type	Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Limit (MHz)
			ANT A	ANT B	
11ax HE20	1	2412	15.06	15.09	0.5
	6	2437	15.09	16.55	0.5
	11	2462	16.07	17.70	0.5
11ax HE40	3	2422	10.99	8.59	0.5
	6	2437	8.59	22.53	0.5
	9	2452	17.05	25.82	0.5

Non BeamForming
ANT A

Modulation Type: 802.11b
CH01

Modulation Type: 802.11g
CH01

CH06

CH06

CH11

CH11

Non BeamForming
ANT A

Modulation Type: 802.11ax HE20
CH01

Modulation Type: 802.11ax HE40
CH03

CH06

CH06

CH11

CH09

Non BeamForming
ANT B

Modulation Type: 802.11b
CH01

Modulation Type: 802.11g
CH01

CH06 (802.11b)

CH06 (802.11g)

CH11 (802.11b)

CH11 (802.11g)

Non BeamForming
ANT B

Modulation Type: 802.11ax HE20
CH01

Modulation Type: 802.11ax HE40
CH03

CH06

CH06

CH11

CH09

BeamForming

ANT A

Modulation Type: 802.11ax HE20

CH01

Modulation Type: 802.11ax HE40

CH03

CH06

CH06

CH11

CH09

BeamForming
ANT B

Modulation Type: 802.11ax HE20
CH01

Modulation Type: 802.11ax HE40
CH03

CH06

CH06

CH11

CH09

10. Maximum Average Output Power

10.1 Test Limit

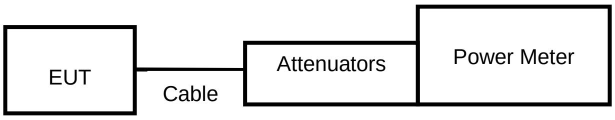
The Maximum Average Output Power Measurement is 30dBm.
If transmitting antennas of directional gain greater than 6 dBi are used, the average output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi

10.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 11.9.2.3.2

The antenna port (RF output) of the EUT was connected to the input (RF input) of a power meter. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

10.3 Test Setup Layout



10.4 Test Result and Data

Non Beamforming

Setting	Modulation Mode	Channel	Frequency (MHz)	Conducted(average) output power (dBm)		Total AV power (dBm)	Total AV power (mW)	Powe Limit (dBm)
				ANT A	ANT B			
75	11b	1	2412	19.78	19.63	22.72	186.894	30.00
100		6	2437	25.67	25.54	28.62	727.074	30.00
73		11	2462	19.34	18.90	22.14	163.526	30.00
74	11g	1	2412	18.91	19.03	21.98	157.787	30.00
104		6	2437	25.74	26.15	28.96	787.071	30.00
78		11	2462	19.61	19.62	22.63	183.033	30.00
79	11ax HE20	1	2412	20.33	20.49	23.42	219.838	30.00
103		6	2437	25.90	25.98	28.95	785.323	30.00
76		11	2462	19.55	19.45	22.51	178.262	30.00
70	11ax HE40	3	2422	19.27	18.33	21.84	152.605	30.00
81		6	2437	20.93	20.89	23.92	246.624	30.00
69		9	2452	17.92	17.77	20.86	121.785	30.00

Beamforming

Setting	Modulation Mode	Channel	Frequency (MHz)	Conducted(average) output power (dBm)		Total AV power (dBm)	Total AV power (mW)	Powe Limit (dBm)
				ANT A	ANT B			
74	11ax HE20	1	2412	19.70	19.54	22.63	183.275	30.00
82		6	2437	21.17	20.63	23.92	246.529	30.00
68		11	2462	18.17	17.84	21.02	126.428	30.00
71	11ax HE40	3	2422	19.03	19.02	22.04	159.783	30.00
89		6	2437	23.24	23.13	26.20	416.452	30.00
60		9	2452	16.55	15.96	19.28	84.631	30.00

11. Power Spectral Density

11.1 Test Limit

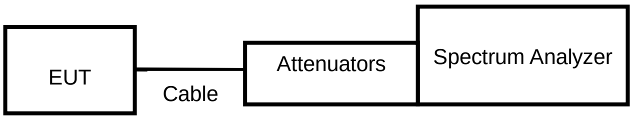
The Maximum of Power Spectral Density Measurement is 8dBm.

If transmitting antennas of directional gain greater than 6 dBi are used, the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi

11.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 11.10

11.3 Test Setup Layout



11.4 Test Result and Data

Non Beamforming

Modulation Type	Channel	Frequency (MHz)	Maximum Power Density of 3KHz Bandwidth(dBm) ANT A	Maximum Power Density of 3KHz Bandwidth(dBm) ANT B	Sum chain (dBm)	Duty Cycle CF(dB)	Total PSD (dBm)	Limit (dBm)
11b	1	2412	-11.000	-10.806	-7.89	0.21	-7.68	8.00
	6	2437	-5.057	-5.031	-2.03	0.21	-1.82	8.00
	11	2462	-10.921	-11.487	-8.18	0.21	-7.97	8.00
11g	1	2412	-10.959	-12.456	-8.63	0.20	-8.43	8.00
	6	2437	-4.542	-4.820	-1.67	0.20	-1.47	8.00
	11	2462	-10.803	-11.862	-8.29	0.20	-8.09	8.00
11ax HE20	1	2412	-10.644	-11.507	-8.04	0.00	-8.04	8.00
	6	2437	-5.017	-5.997	-2.47	0.00	-2.47	8.00
	11	2462	-11.070	-12.436	-8.69	0.00	-8.69	8.00

Modulation Type	Channel	Frequency (MHz)	Maximum Power Density of 100KHz Bandwidth(dBm)		Sum chain (dBm)	Duty Cycle CF(dB)	Total PSD (dBm)	Limit (dBm)
11ax HE40	3	2422	-6.073	-5.979	-3.02	0.15	-2.87	8.00
	6	2437	-3.674	-3.463	-0.56	0.15	-0.41	8.00
	9	2452	-6.521	-6.442	-3.47	0.15	-3.32	8.00

Beamforming

Modulation Type	Channel	Frequency (MHz)	Maximum Power Density of 3KHz Bandwidth(dBm)		Sum chain (dBm)	Duty Cycle CF(dB)	Total PSD (dBm)	Limit (dBm)
			ANT A	ANT B				
11ax HE20	1	2412	-14.970	-15.219	-12.08	0.74	-11.34	8.00
	6	2437	-14.612	-15.117	-11.85	0.74	-11.11	8.00
	11	2462	-16.599	-17.555	-14.04	0.74	-13.30	8.00

Modulation Type	Channel	Frequency (MHz)	Maximum Power Density of 100KHz Bandwidth(dBm)		Sum chain (dBm)	Duty Cycle CF(dB)	Total PSD (dBm)	Limit (dBm)
11ax HE40	3	2422	-4.292	-4.547	-1.41	0.78	-0.63	8.00
	6	2437	-1.886	-2.019	1.06	0.78	1.84	8.00
	9	2452	-7.788	-7.254	-4.50	0.78	-3.72	8.00

Non BeamForming
ANT A

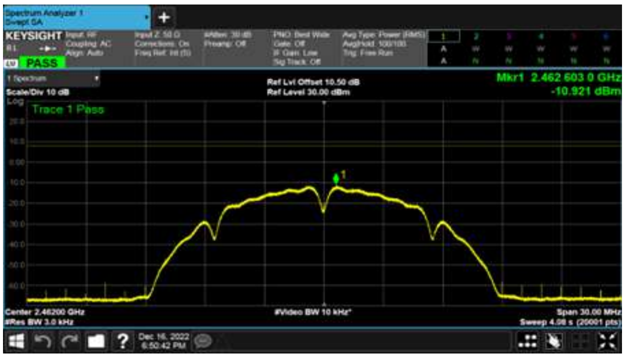
Modulation Type: 802.11b
CH01

Modulation Type: 802.11g
CH01

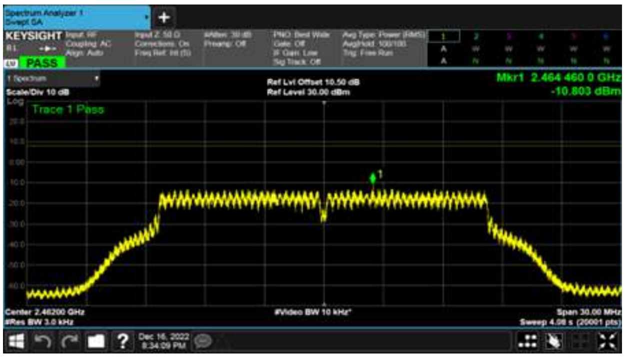
CH06

CH06

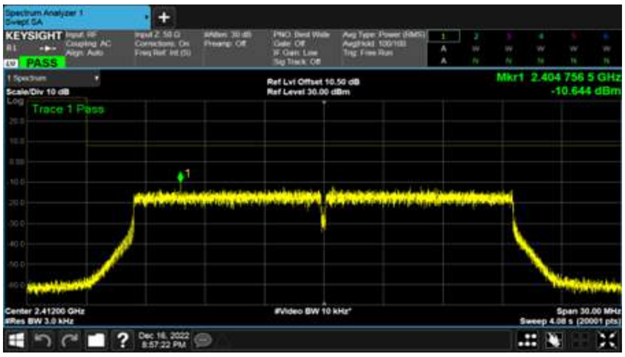
CH11



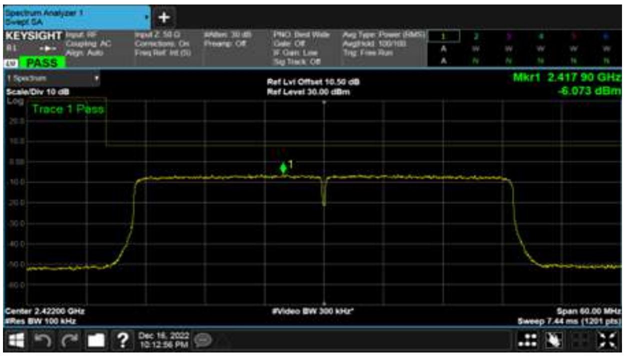
CH11



Non BeamForming
ANT A
Modulation Type: 802.11ax HE20
CH01



Modulation Type: 802.11ax HE40
CH03



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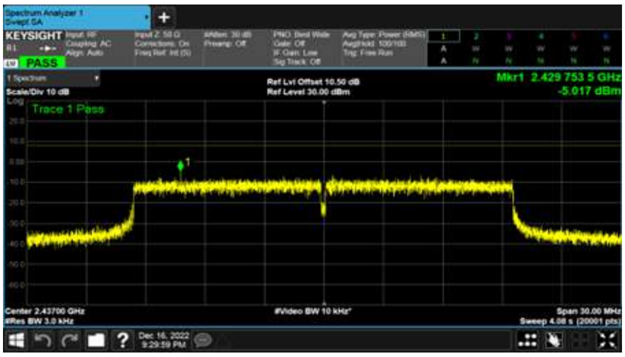

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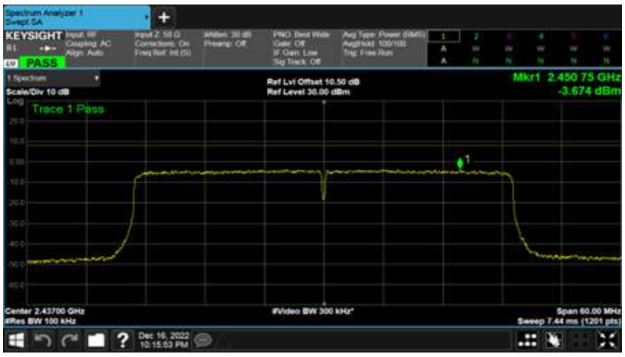

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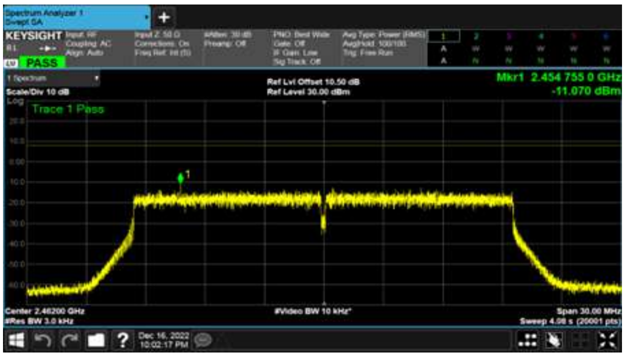

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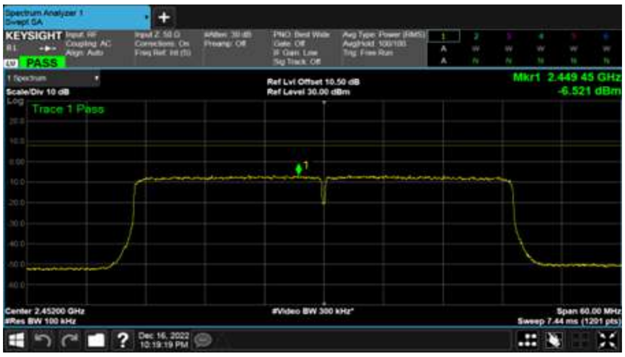
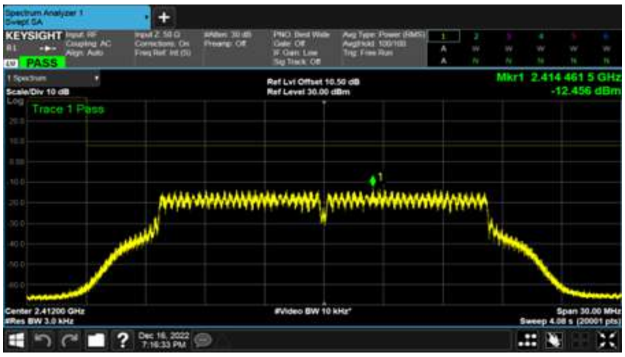


Non BeamForming
ANT B

Modulation Type: 802.11b
CH01

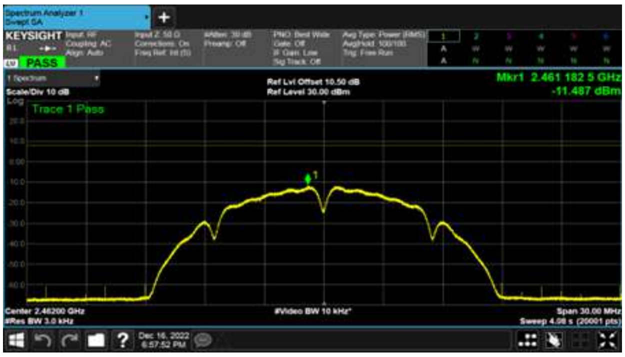
Modulation Type: 802.11g
CH01



CH06

CH06

CH11



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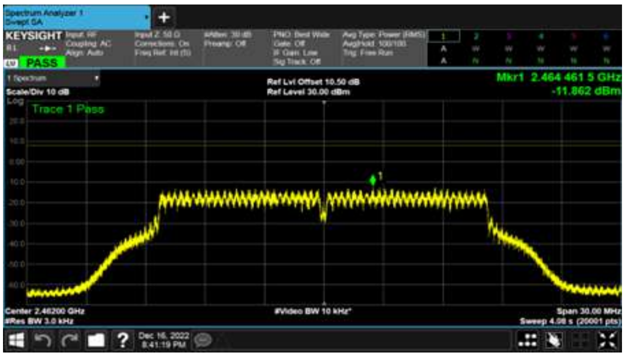
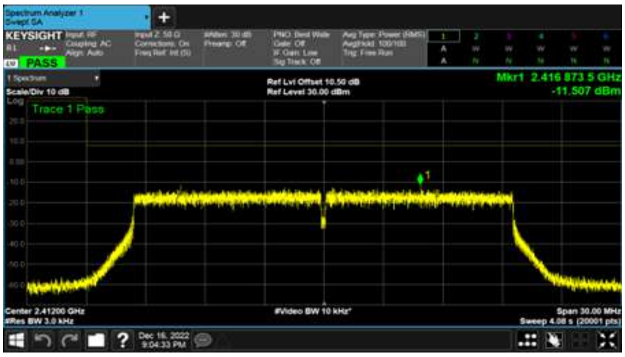
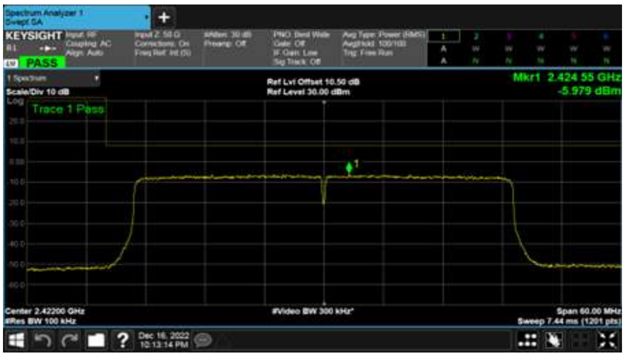


Non BeamForming
ANT B

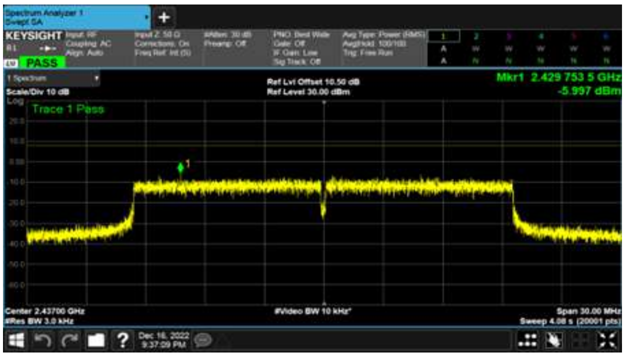
Modulation Type: 802.11ax HE20
CH01



Modulation Type: 802.11ax HE40
CH03



CH06



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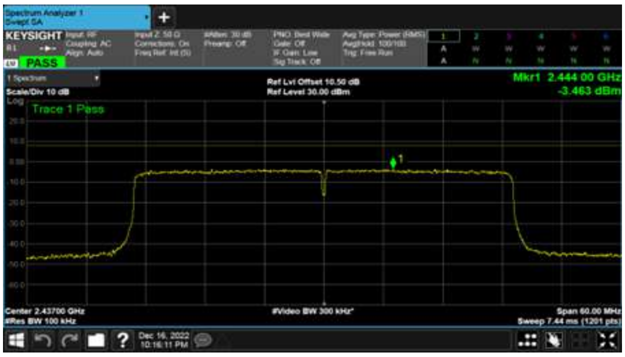

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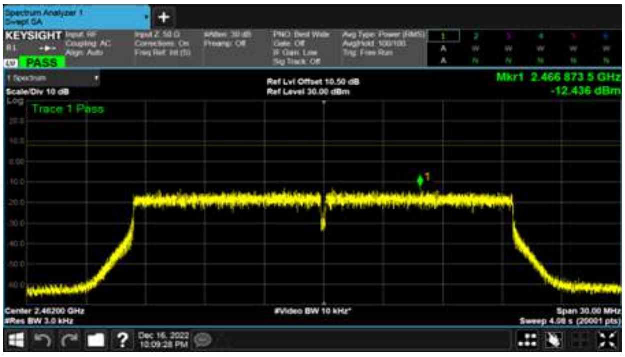
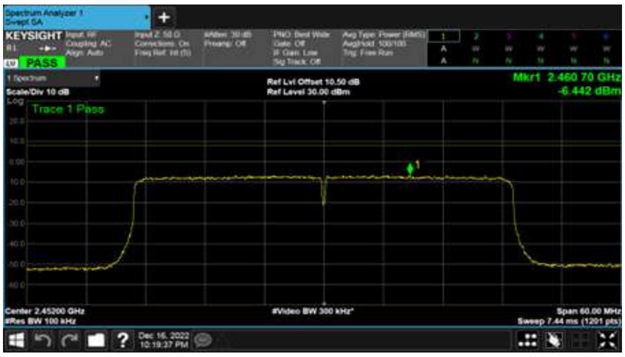


CH09

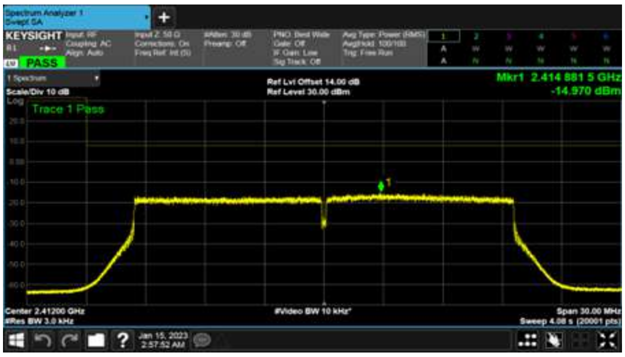


BeamForming

ANT A

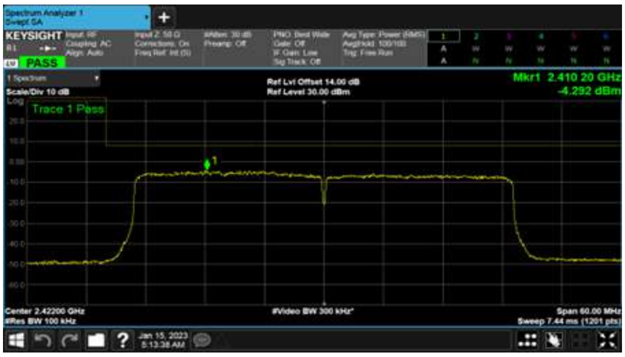
Modulation Type: 802.11ax HE20

CH01

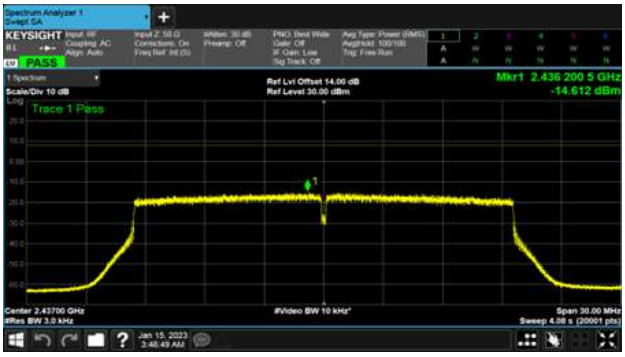


Modulation Type: 802.11ax HE40

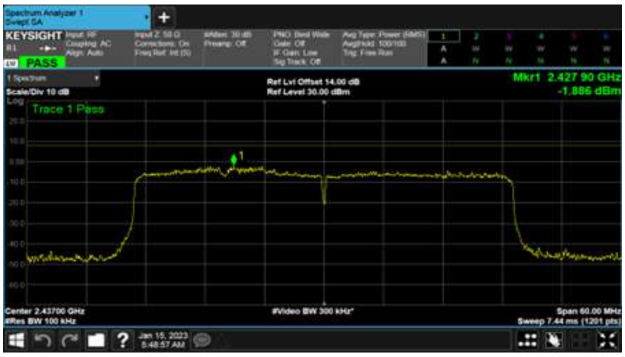
CH03



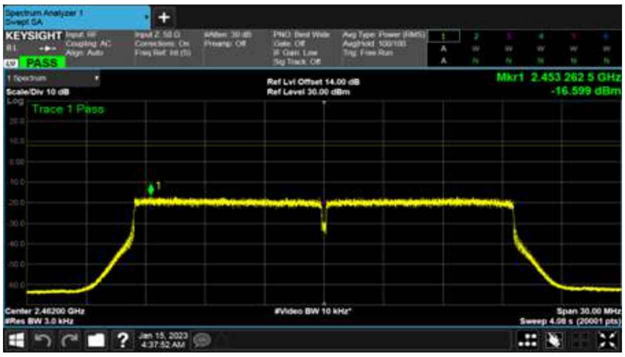
CH06



CH06



CH11



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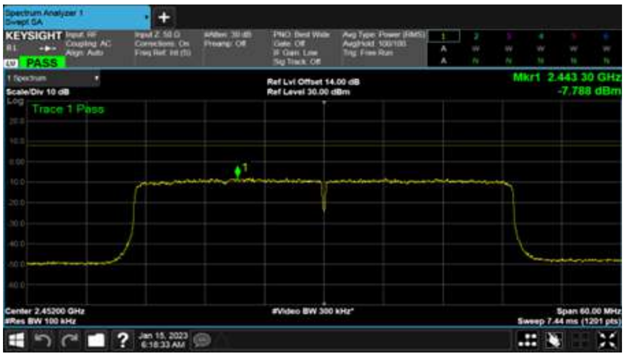
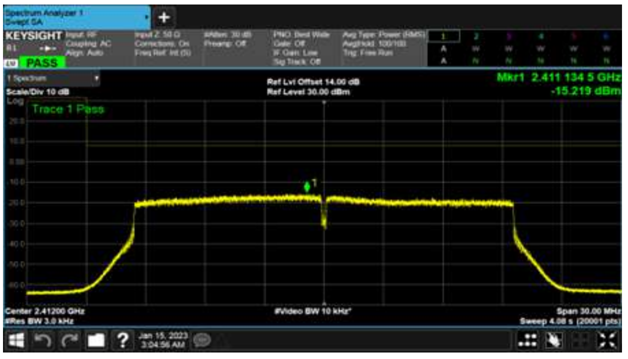
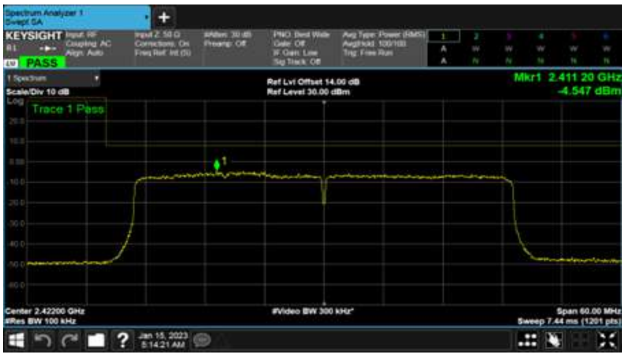


BeamForming
ANT B

Modulation Type: 802.11ax HE20
CH01

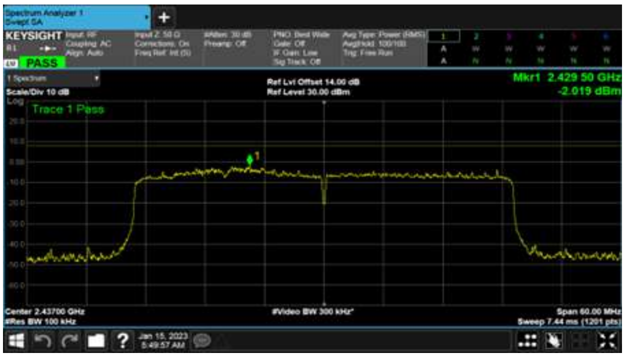


Modulation Type: 802.11ax HE40
CH03



CH06

CH06



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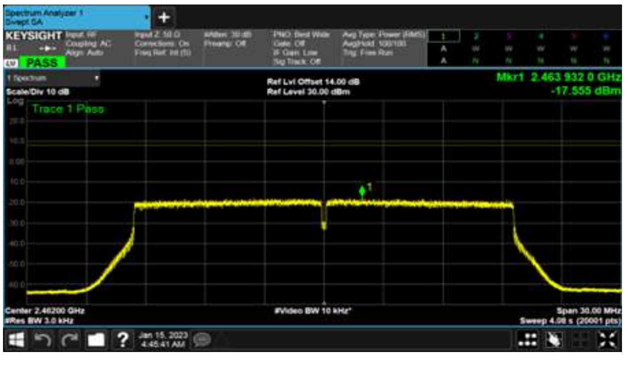

CH09