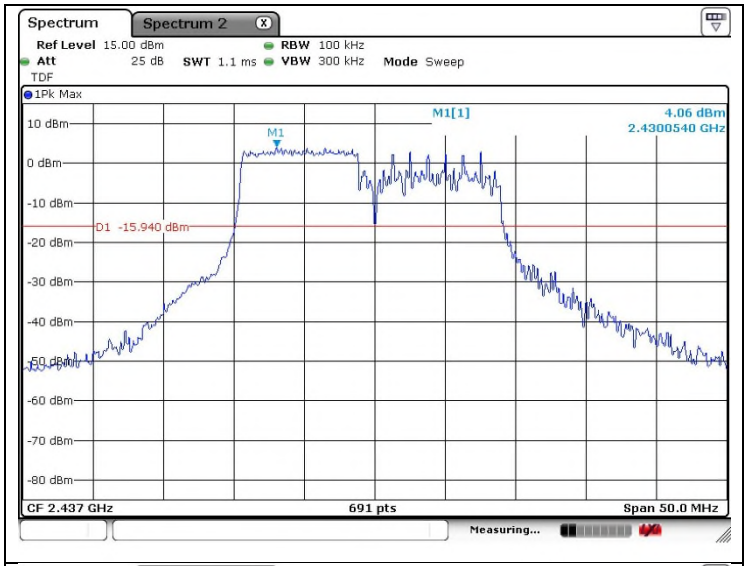
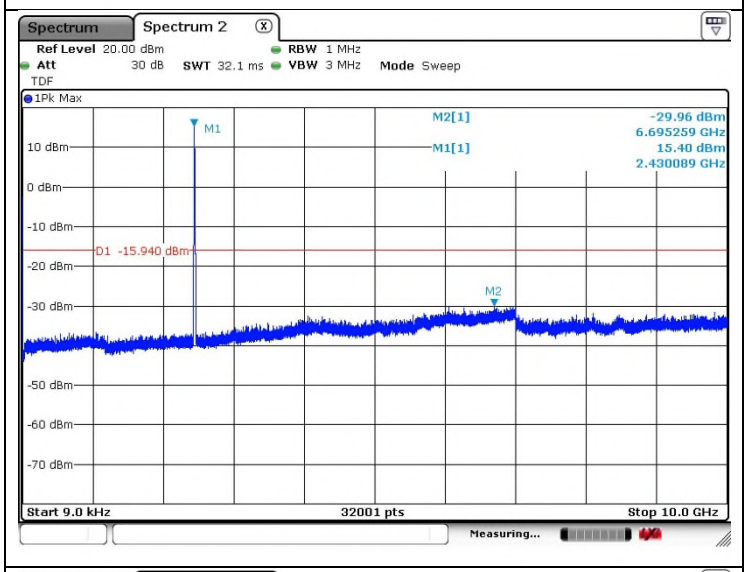
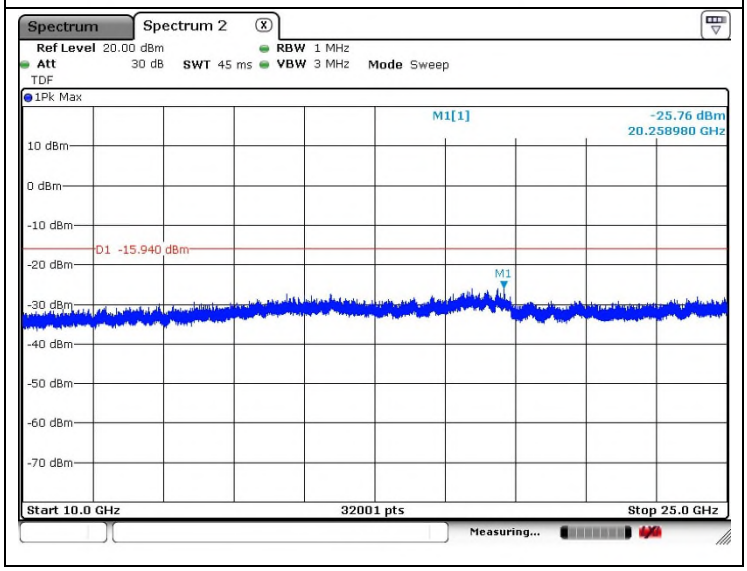
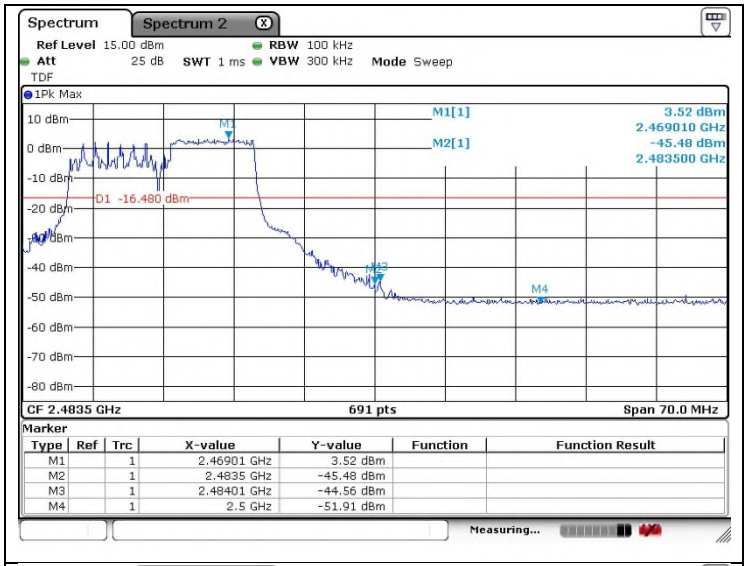
Middle Channel_53 RU

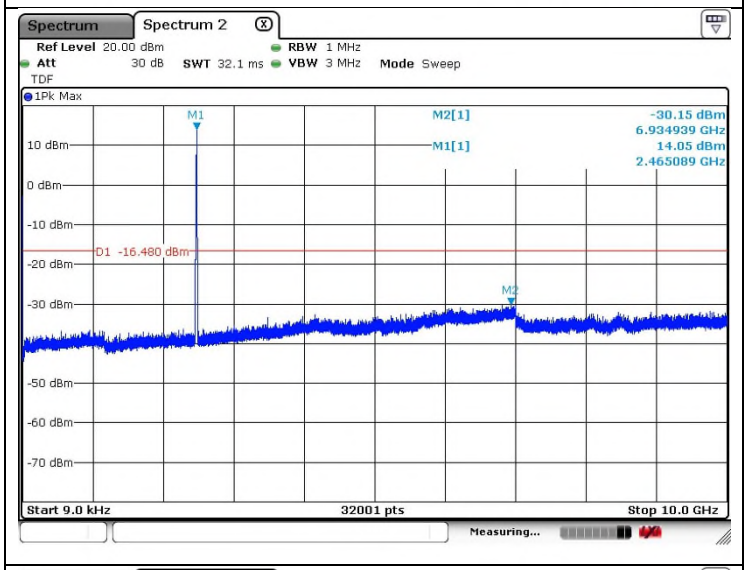


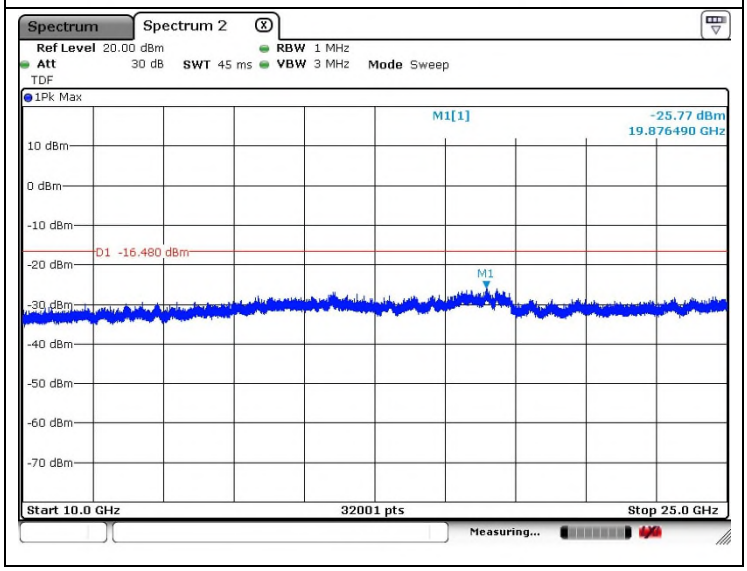




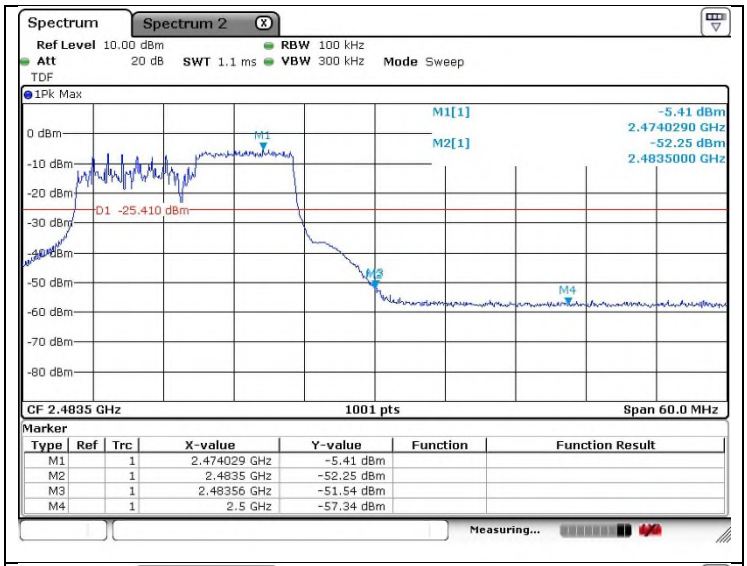
High Channel_54 RU

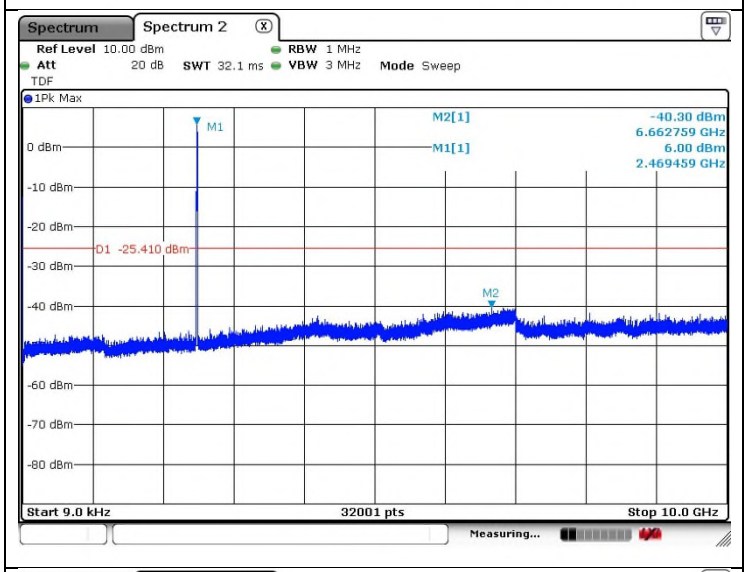


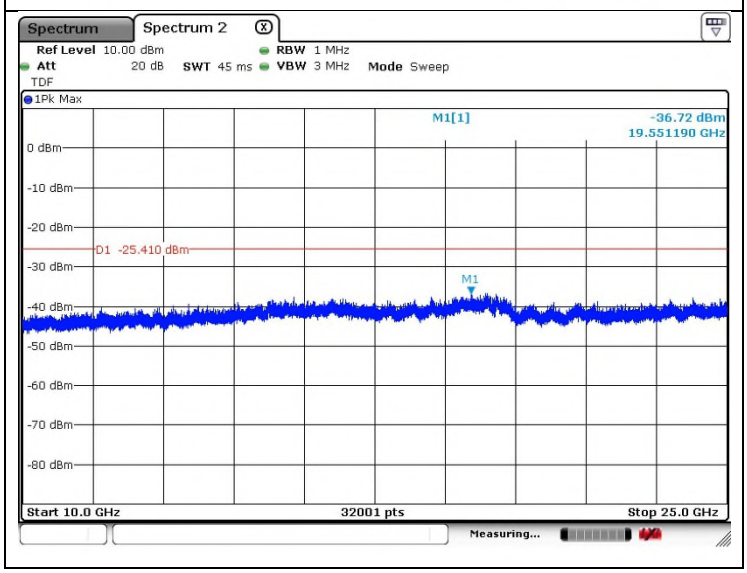




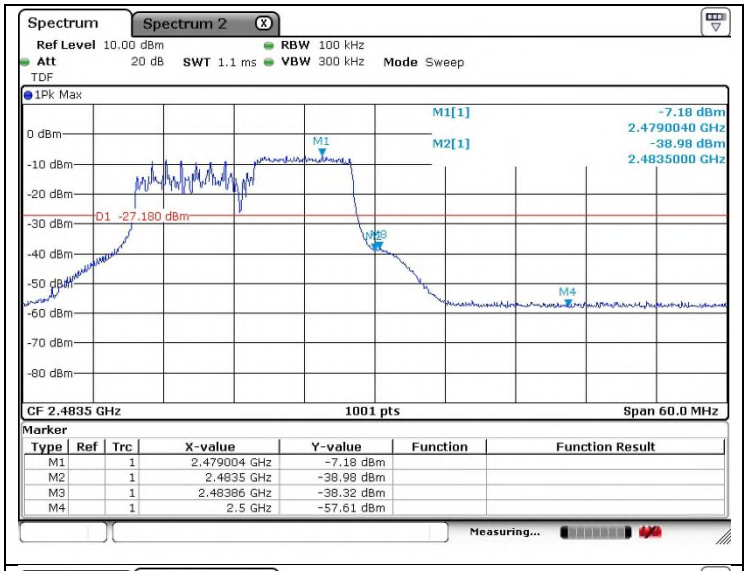
12 Channel_54 RU

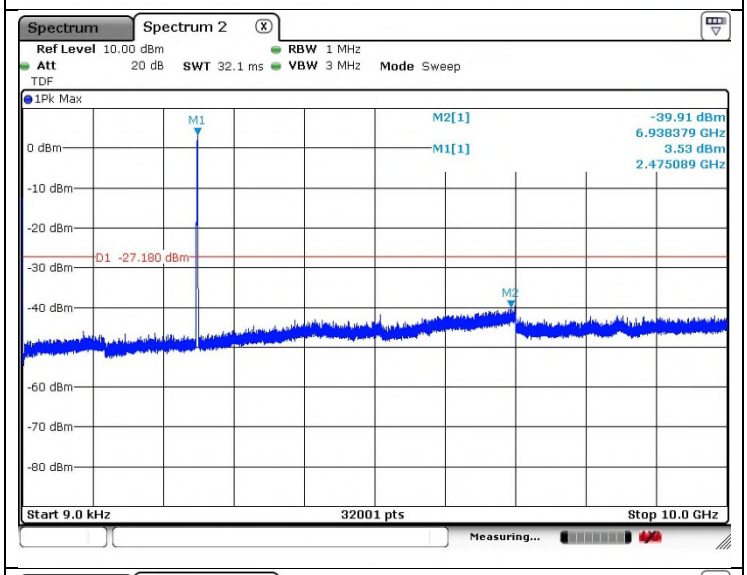


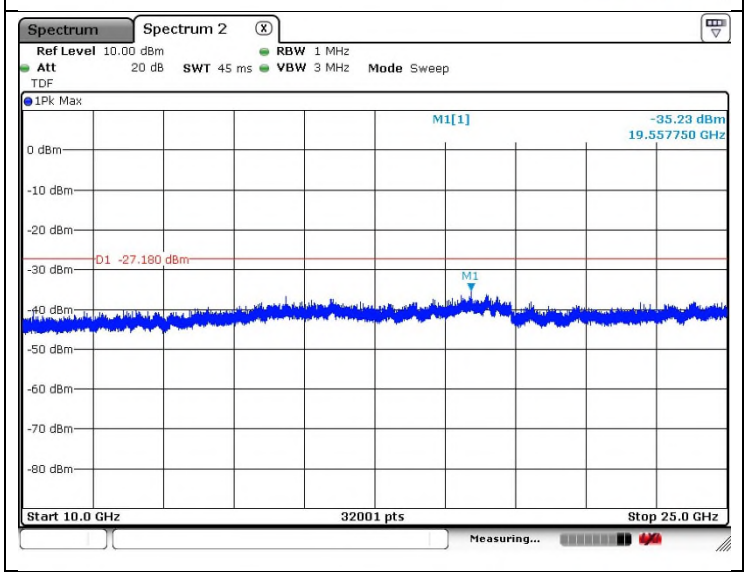




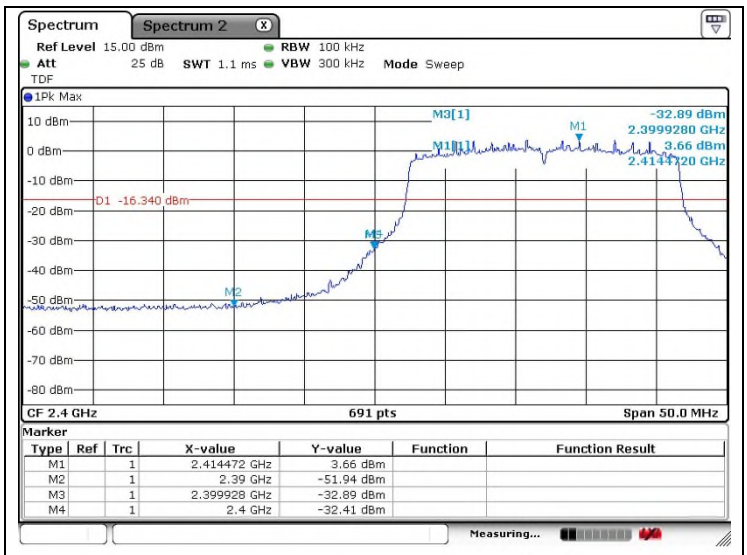
13 Channel_54 RU

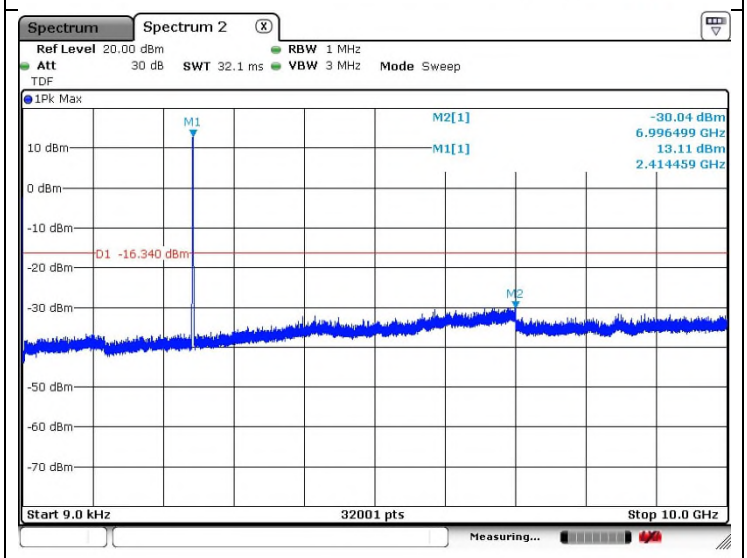


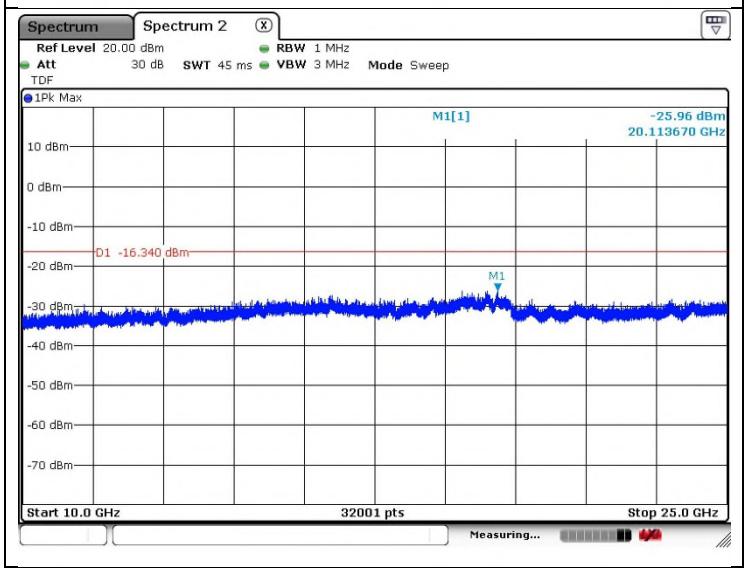




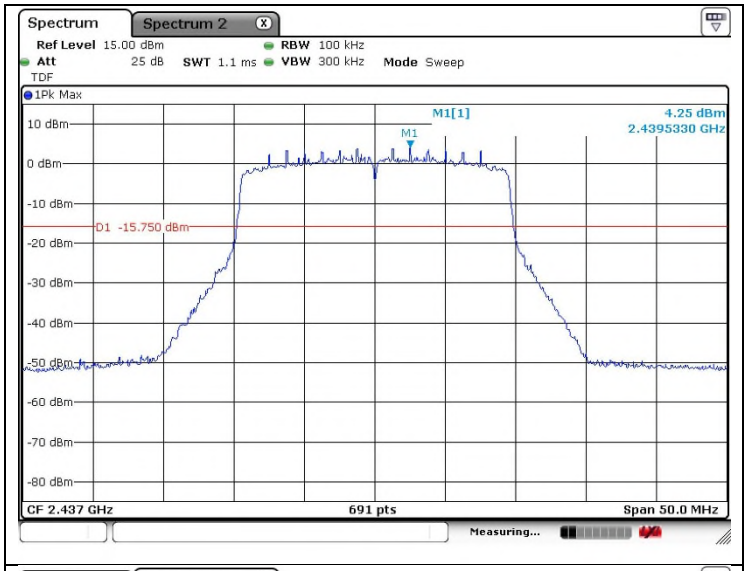
OFDMA: 802.11ax_HE20_SU
Low Channel

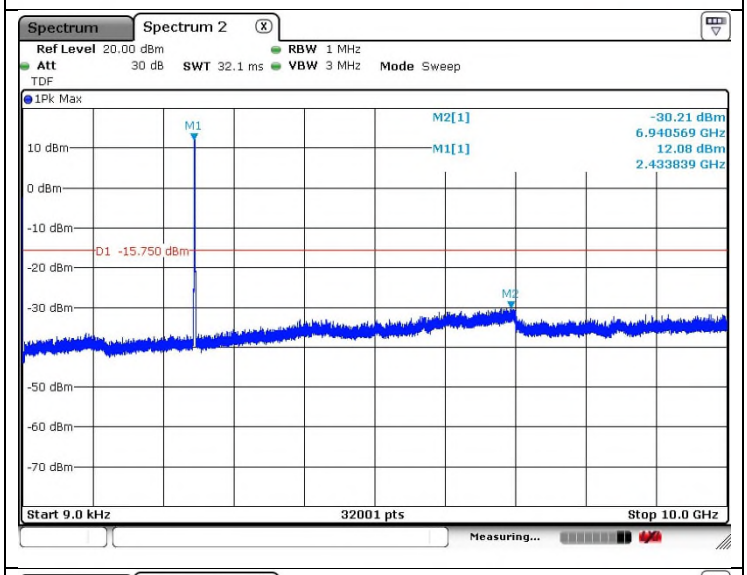


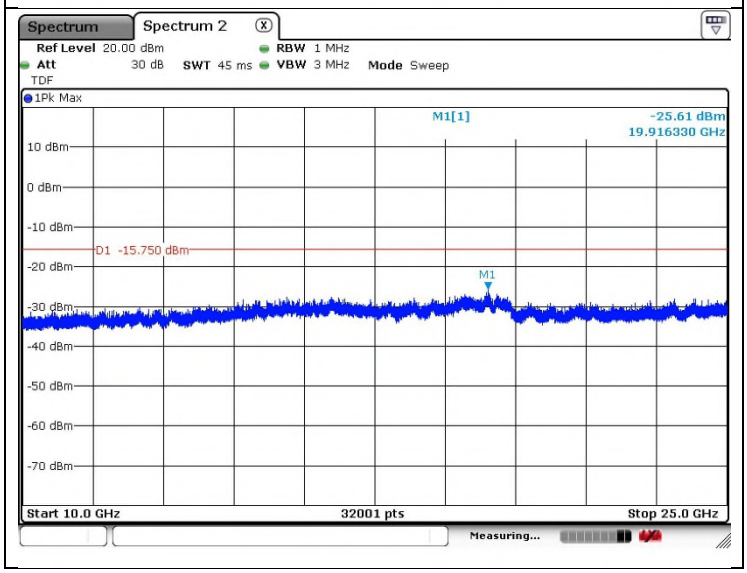




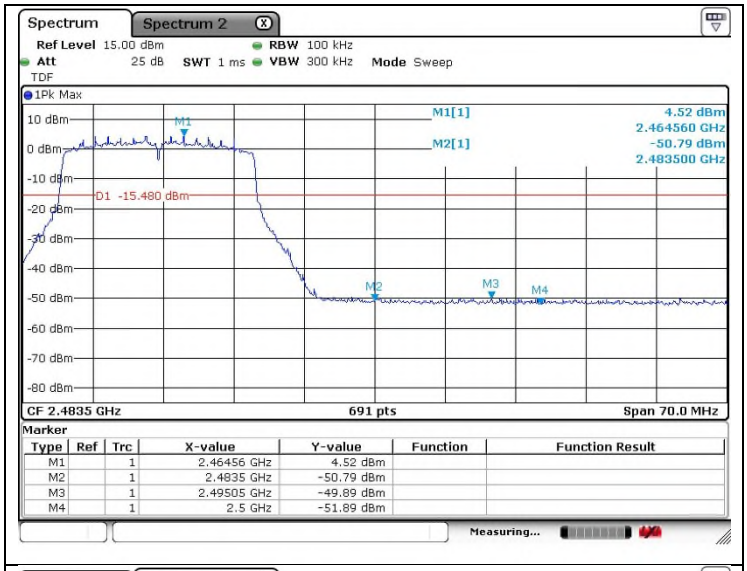
Middle Channel

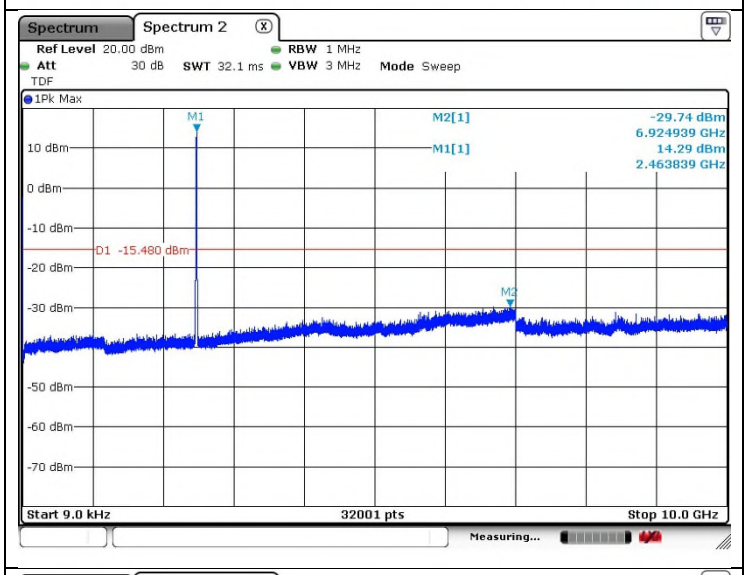


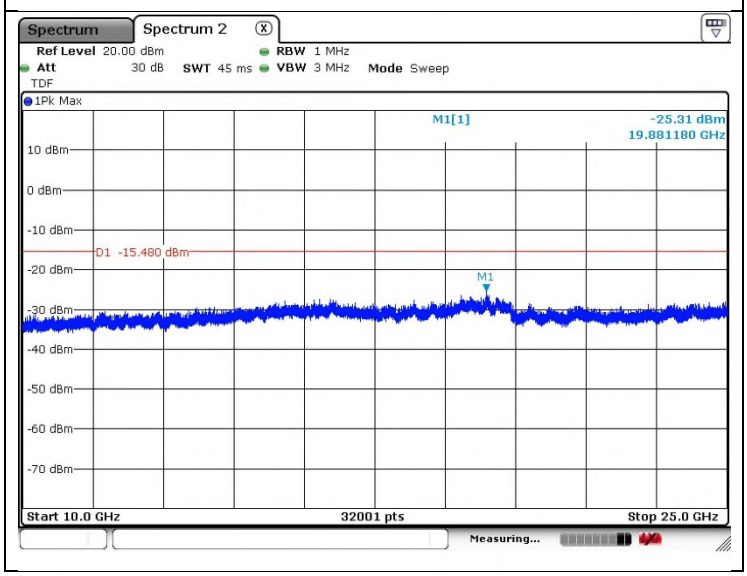




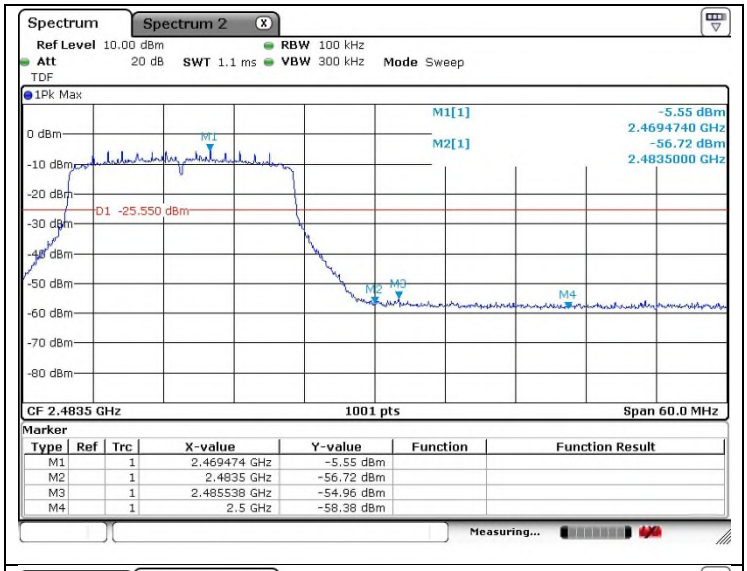
High Channel

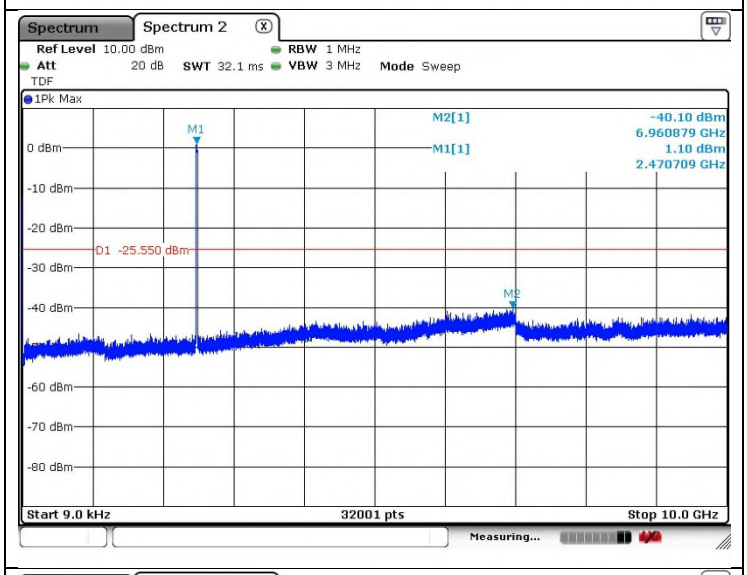


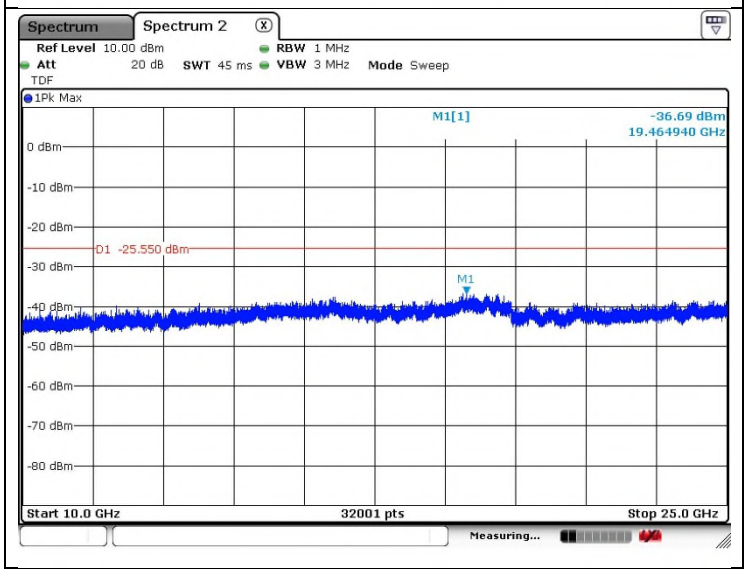




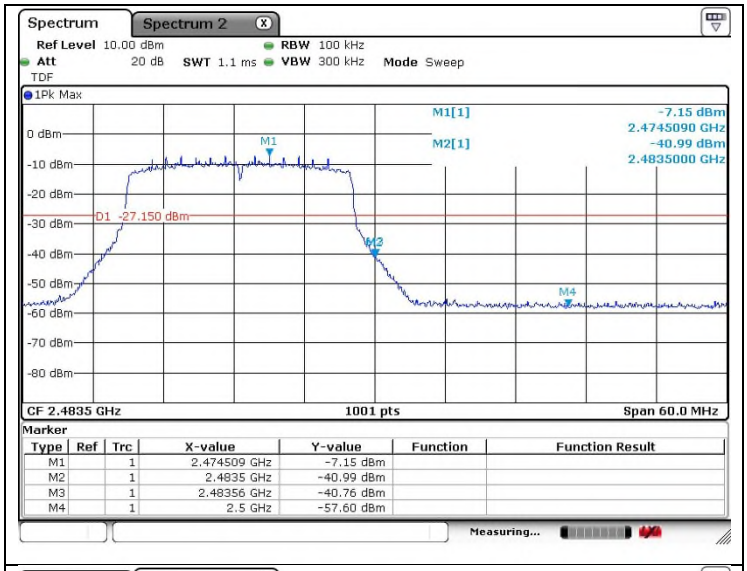
12 Channel

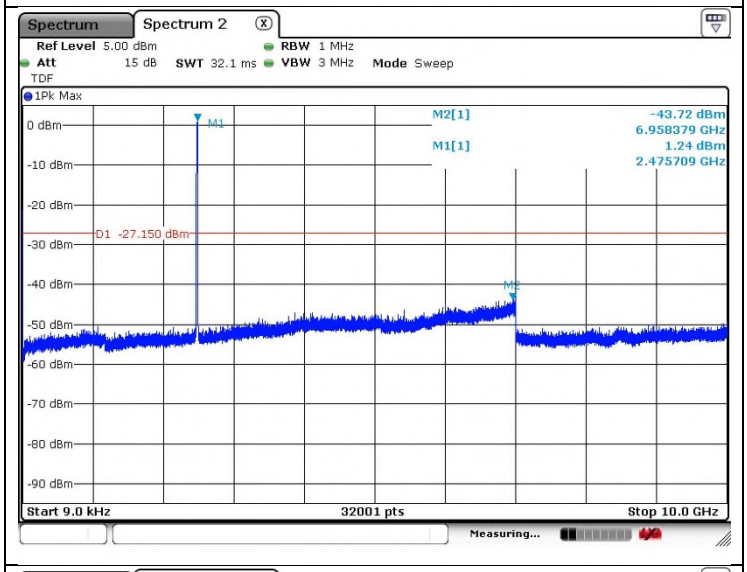

Spectrum
Spectrum 2
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 1.1 ms
VBW 300 kHz
Mode Sweep
TDF
1Pk Max
M1[1] -5.55 dBm 2.4694740 GHz
M2[1] -56.72 dBm 2.4835000 GHz
D1 -25.550 dBm
CF 2.4835 GHz
1001 pts
Span 60.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.469474 GHz -5.55 dBm
M2 1 2.4835 GHz -56.72 dBm
M3 1 2.485538 GHz -54.96 dBm
M4 1 2.5 GHz -58.38 dBm
Measuring...

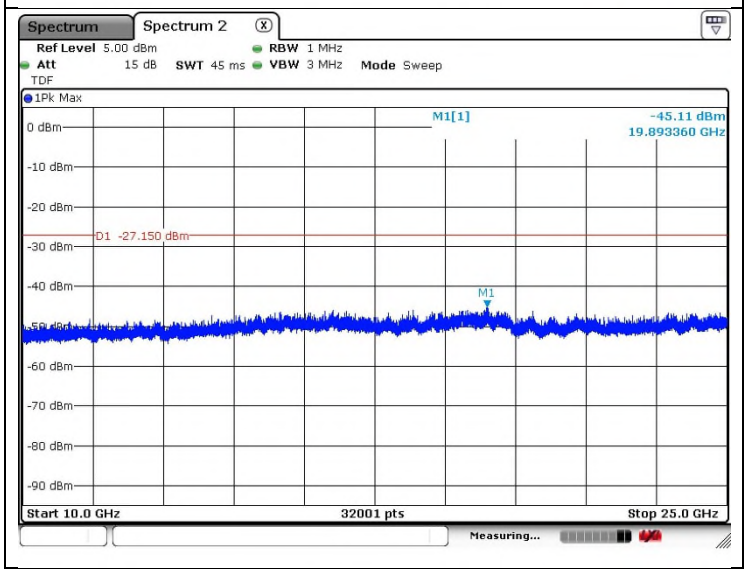

Spectrum
Spectrum 2
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB
SWT 32.1 ms
VBW 3 MHz
Mode Sweep
TDF
1Pk Max
M2[1] -40.10 dBm 6.960879 GHz
M1[1] 1.10 dBm 2.470709 GHz
D1 -25.550 dBm
Start 9.0 kHz
32001 pts
Stop 10.0 GHz
Measuring...


Spectrum
Spectrum 2
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB
SWT 45 ms
VBW 3 MHz
Mode Sweep
TDF
1Pk Max
M1[1] -36.69 dBm 19.464940 GHz
D1 -25.550 dBm
Start 10.0 GHz
32001 pts
Stop 25.0 GHz
Measuring...

13 Channel


Spectrum
Spectrum 2
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 1.1 ms
VBW 300 kHz
Mode Sweep
TDF
1Pk Max
M1[1] -7.15 dBm 2.4745090 GHz
M2[1] -40.99 dBm 2.4835000 GHz
D1 -27.150 dBm
CF 2.4835 GHz
1001 pts
Span 60.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.474509 GHz -7.15 dBm
M2 1 2.4835 GHz -40.99 dBm
M3 1 2.48356 GHz -40.76 dBm
M4 1 2.5 GHz -57.60 dBm
Measuring...


Spectrum
Spectrum 2
Ref Level 5.00 dBm
RBW 1 MHz
Att 15 dB
SWT 32.1 ms
VBW 3 MHz
Mode Sweep
TDF
1Pk Max
M2[1] -43.72 dBm 6.958379 GHz
M1[1] 1.24 dBm 2.475709 GHz
D1 -27.150 dBm
Start 9.0 kHz
32001 pts
Stop 10.0 GHz
Measuring...


Spectrum
Spectrum 2
Ref Level 5.00 dBm
RBW 1 MHz
Att 15 dB
SWT 45 ms
VBW 3 MHz
Mode Sweep
TDF
1Pk Max
M1[1] -45.11 dBm 19.893360 GHz
D1 -27.150 dBm
Start 10.0 GHz
32001 pts
Stop 25.0 GHz
Measuring...

3. 6 ㏈ Bandwidth

3.1. Test Setup

3.2. Limit

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902-928 ㎒, 2 400-2 483.5 ㎒, and 5 725-5 850 ㎒ bands. The minimum 6 ㏈ bandwidth shall be at least 500 ㎑.

3.3. Test Procedure

6 ㏈ Bandwidth

The test follows section 11.8 DTS bandwidth of ANSI C63.10-2013.
Tests performed using section 11.8.1 Option 1.

- Option 1:
1. Set RBW to = 100 ㎑.
2. Set the VBW ≥ [3 x RBW].
3. Detector = peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 ㏈ relative to the maximum level measured in the fundamental emission.

3.4. Test Results

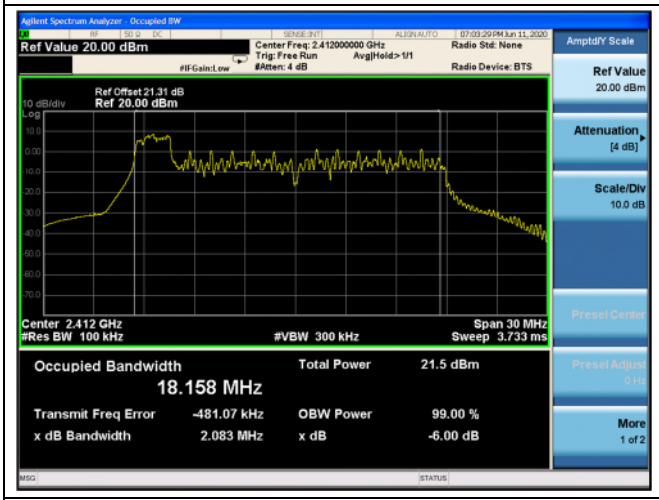
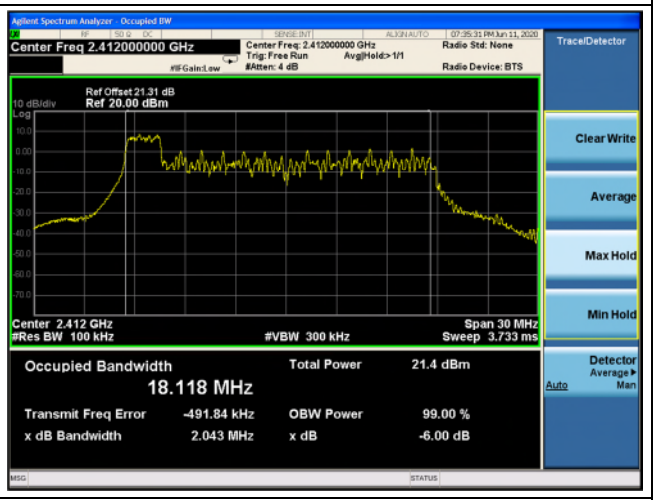
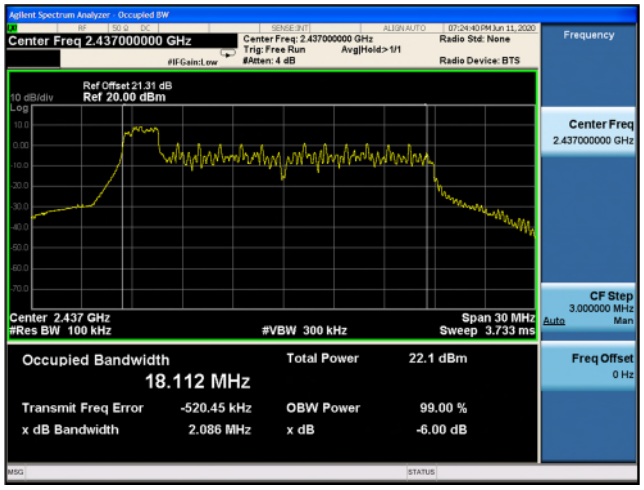
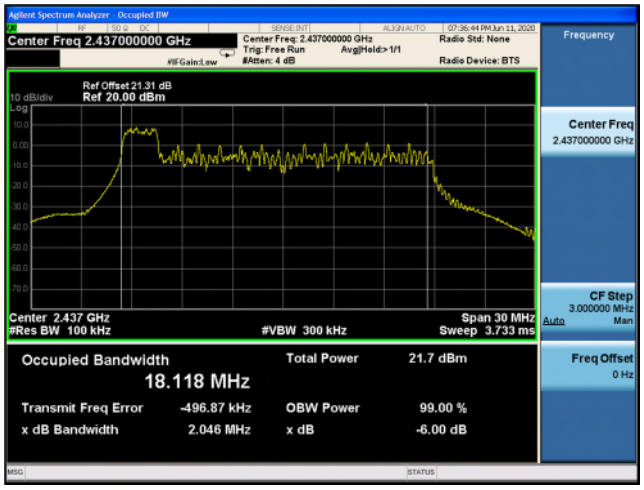
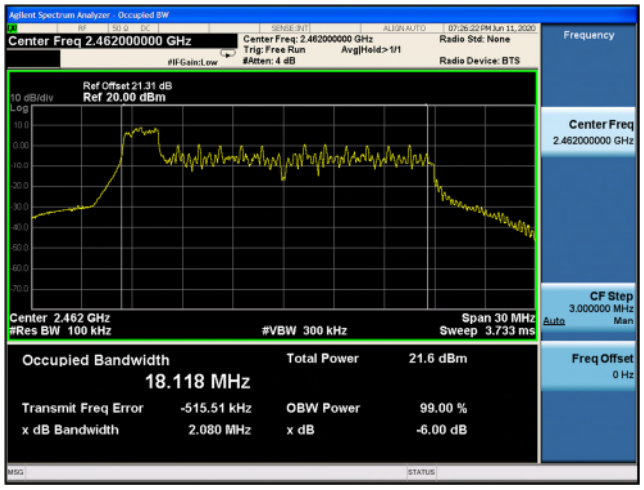
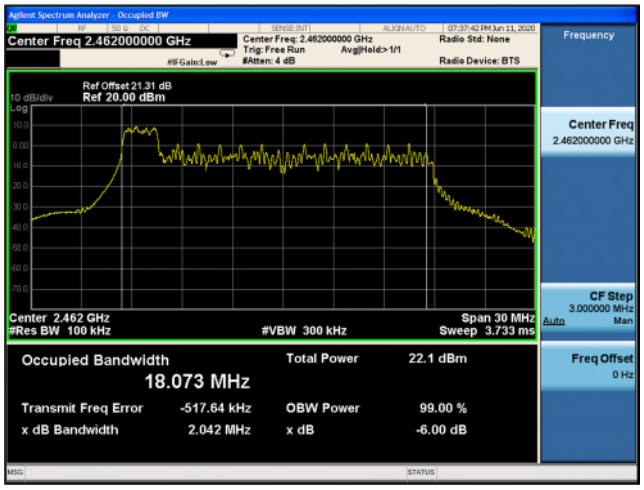
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

OFDMA: 802.11ax_HE20

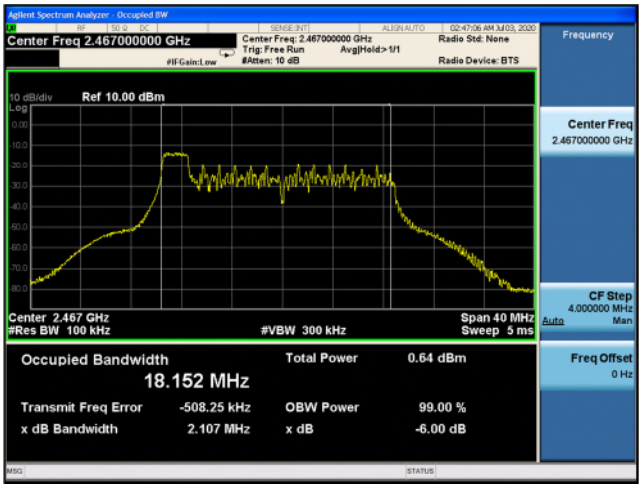
Tones	RU offset	Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)		Minimum Limit (㎑)
				Ant.1	Ant.2	
26T	0	Low	2 412	2.083	2.043	500
		Middle	2 437	2.086	2.046	
		High	2 462	2.080	2.042	
		12	2 467	2.107	2.110	
		13	2 472	2.109	2.107	

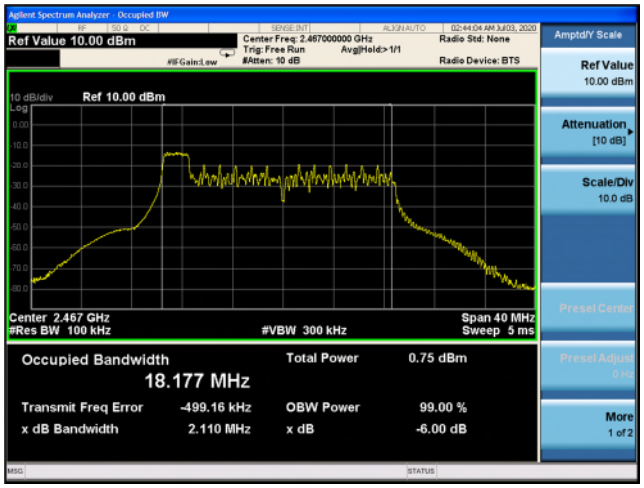
- Test plots

OFDMA: 802.11ax_HE20

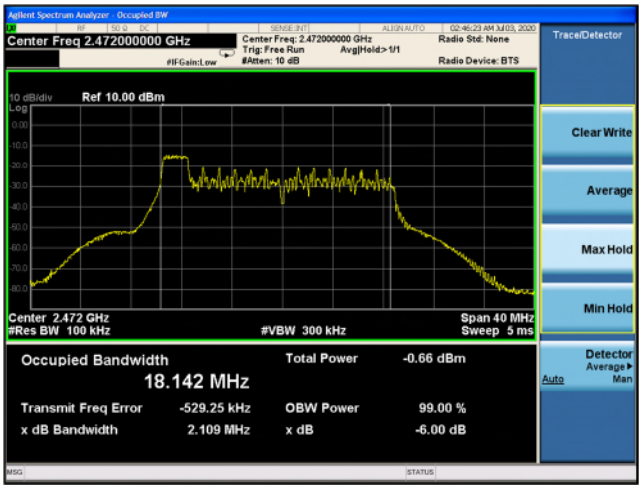
Ant.1	Ant.2
Low channel	
	
Middle channel	
	
High channel	
	

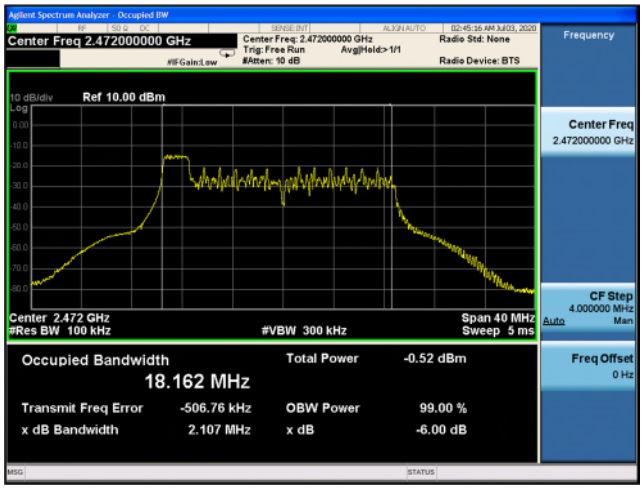
12 channel





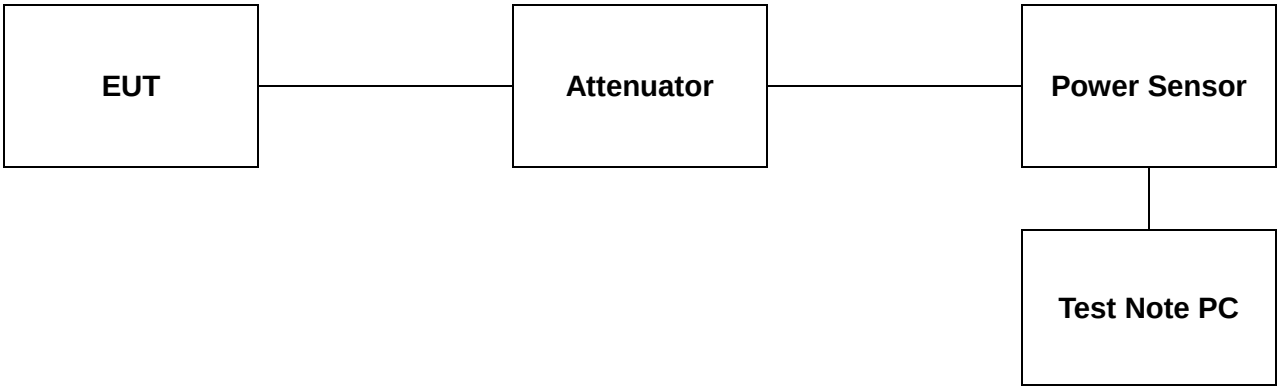
13 channel





4. Maximum Peak Conducted Output Power

4.1. Test Setup



4.2. Limit

According to §15.247(b)(3), for systems using digital modulation in the 902-928 ㎒, 2 400-2 483.5 ㎒, and 5 725-5 850 ㎒ bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 ㏈i. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 ㏈i are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

4.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.
The test follows section 11.9.1.3 of ANSI C63.10-2013.

PKPM1 Peak-reading power meter method
- The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

The test follows section 11.9.2.3.2 of ANSI C63.10-2013.

Method AVGPM-G (Measurement using a gated RF average-reading power meter)
- Alternatively, measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

Test program: (S/W name: R&S Power Viewer, Version: 3.2.0)

1. Initially overall offset for attenuator and cable loss is measured per frequency.
2. Measured offset is inserted in test program in advance of measurement for output power.
3. Power for each frequency (channel) of device is investigated as final result.
4. Final result reported on this section from R&S power viewer program includes with several factors and test program shows only final result.

4.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

OFDMA: 802.11ax_HE20_Ant.1

Channel	Frequency (㎒)	Tones	RU offset	Average Power Result (㏈ m)	Peak Power Result (㏈ m)	Limit (㏈ m)
Low	2 412	26T	0	13.43	25.20	30
			4	13.91	24.33	
			8	13.97	24.35	
		52T	37	13.72	25.10	
			38	13.79	24.35	
			40	14.13	24.31	
		106T	53	14.23	23.21	
			54	14.02	22.34	
		SU	-	13.92	22.29	
Middle	2 437	26T	0	14.41	24.80	
			4	13.91	23.99	
			8	13.57	24.02	
		52T	37	14.48	24.67	
			38	14.11	23.98	
			40	13.68	24.00	
		106T	53	14.42	22.44	
			54	13.98	21.81	
		SU	-	13.97	22.18	
High	2 462	26T	0	14.12	24.40	
			4	13.69	23.78	
			8	13.54	23.79	
		52T	37	14.23	24.40	
			38	13.83	23.76	
			40	13.65	23.73	
		106T	53	14.03	23.21	
			54	13.96	22.35	
		SU	-	13.79	21.86	

Channel	Frequency (㎒)	Tones	RU offset	Average Power Result (㏈m)	Peak Power Result (㏈m)	Limit (㏈m)
12	2 467	26T	0	4.05	15.44	30
			4	4.11	15.44	
			8	3.88	15.48	
		52T	37	4.13	15.47	
			38	4.18	15.40	
			40	4.04	15.35	
		106T	53	4.17	15.40	
			54	4.17	15.44	
		SU	-	4.31	12.02	
13	2 472	26T	0	-5.36	4.81	
			4	-5.59	4.70	
			8	-6.16	4.71	
		52T	37	-5.25	4.83	
			38	-5.50	4.71	
			40	-5.75	4.71	
		106T	53	-5.61	4.84	
			54	-6.05	4.72	
		SU	-	0.93	8.71	

OFDMA: 802.11ax_HE20_Ant.2

Channel	Frequency (㎒)	Tones	RU offset	Average Power Result (㏈ m)	Peak Power Result (㏈ m)	Limit (㏈ m)
Low	2 412	26T	0	13.64	24.61	30
			4	13.70	24.07	
			8	14.02	24.08	
		52T	37	13.81	24.58	
			38	13.66	24.06	
			40	14.03	24.04	
		106T	53	14.15	22.48	
			54	14.25	22.27	
		SU	-	14.02	22.23	
Middle	2 437	26T	0	13.89	25.29	
			4	13.61	24.47	
			8	13.60	24.48	
		52T	37	14.05	25.24	
			38	13.68	24.45	
			40	13.80	24.44	
		106T	53	14.47	23.20	
			54	13.87	22.95	
		SU	-	13.94	21.32	
High	2 462	26T	0	14.60	24.82	
			4	13.71	24.24	
			8	13.53	24.21	
		52T	37	14.66	24.82	
			38	14.00	24.16	
			40	13.64	24.16	
		106T	53	14.63	22.88	
			54	14.10	22.42	
		SU	-	14.19	22.58	

Channel	Frequency (㎒)	Tones	RU offset	Average Power Result (㏈ m)	Peak Power Result (㏈ m)	Limit (㏈ m)
12	2 467	26T	0	4.25	15.70	30
			4	4.30	15.72	
			8	4.33	15.75	
		52T	37	4.38	15.72	
			38	4.48	15.77	
			40	4.45	16.22	
		106T	53	4.49	15.74	
			54	4.63	15.79	
		SU	-	4.70	12.31	
13	2 472	26T	0	2.49	13.98	
			4	2.67	14.01	
			8	2.31	14.01	
		52T	37	2.67	14.05	
			38	2.73	14.02	
			40	2.56	14.01	
		106T	53	2.78	14.01	
			54	2.73	14.27	
		SU	-	2.97	10.92	

OFDMA: 802.11ax_HE20_MIMO

Channel	Frequency (㎒)	Tones	RU offset	Average Power Result (㏈ m)			Limit (㏈ m)
				Ant.1	Ant.2	Ant.1+Ant.2	
Low	2 412	26T	0	13.47	13.76	16.63	30
			4	13.74	13.79	16.78	
			8	13.78	14.10	16.95	
		52T	37	13.71	13.96	16.85	
			38	13.70	13.60	16.66	
			40	13.97	14.06	17.03	
		106T	53	14.10	14.18	17.15	
			54	13.82	14.32	17.09	
		SU	-	14.51	14.56	17.55	
Middle	2 437	26T	0	14.36	14.10	17.24	
			4	13.60	13.80	16.71	
			8	13.43	13.74	16.60	
		52T	37	14.36	14.17	17.28	
			38	14.07	13.67	16.88	
			40	13.53	13.83	16.69	
		106T	53	14.35	14.27	17.32	
			54	13.82	13.97	16.91	
		SU	-	14.72	14.67	17.71	
High	2 462	26T	0	14.36	14.65	17.52	
			4	13.45	13.93	16.71	
			8	13.38	13.65	16.53	
		52T	37	14.24	14.67	17.47	
			38	13.81	13.93	16.88	
			40	13.52	13.75	16.65	
		106T	53	14.01	14.71	17.38	
			54	13.83	14.16	17.01	
		SU	-	14.34	14.70	17.53	

Channel	Frequency (㎒)	Tones	RU offset	Average Power Result (㏈m)			Limit (㏈m)
				Ant.1	Ant.2	Ant.1+Ant.2	
12	2 467	26T	0	2.99	3.50	6.26	30
			4	2.94	3.69	6.34	
			8	2.66	3.43	6.07	
		52T	37	3.16	3.68	6.44	
			38	3.22	3.58	6.41	
			40	2.84	3.56	6.23	
		106T	53	2.82	3.61	6.24	
			54	2.74	3.75	6.28	
		SU	-	1.94	2.73	5.36	
13	2 472	26T	0	-6.50	-4.10	-2.13	
			4	-6.44	-4.00	-2.04	
			8	-6.81	-4.64	-2.58	
		52T	37	-6.09	-4.03	-1.93	
			38	-6.10	-4.05	-1.94	
			40	-6.74	-4.41	-2.41	
		106T	53	-6.25	-7.06	-3.63	
			54	-6.42	-7.25	-3.80	
		SU	-	0.74	1.23	4.00	

Channel	Frequency (㎒)	Tones	RU offset	Peak Power Result (㏈m)			Limit (㏈m)
				Ant.1	Ant.2	Ant.1+Ant.2	
Low	2 412	26T	0	25.08	24.54	27.83	30
			4	24.25	24.08	27.18	
			8	24.26	24.07	27.18	
		52T	37	24.95	24.53	27.76	
			38	24.24	24.05	27.16	
			40	24.21	24.05	27.14	
		106T	53	22.93	22.33	25.65	
			54	21.82	22.25	25.05	
		SU	-	22.28	22.03	25.17	
Middle	2 437	26T	0	24.41	25.14	27.80	
			4	23.81	24.44	27.15	
			8	23.77	24.48	27.15	
		52T	37	24.38	25.22	27.83	
			38	23.83	24.45	27.16	
			40	23.78	24.49	27.16	
		106T	53	22.13	23.12	25.66	
			54	21.94	22.61	25.30	
		SU	-	22.11	22.52	25.33	
High	2 462	26T	0	24.18	24.74	27.48	
			4	23.58	24.16	26.89	
			8	23.62	24.09	26.87	
		52T	37	24.17	24.72	27.46	
			38	23.62	24.11	26.88	
			40	23.61	24.11	26.88	
		106T	53	22.87	22.67	25.78	
			54	22.64	22.46	25.56	
		SU	-	21.62	22.42	25.05	

Channel	Frequency (㎒)	Tones	RU offset	Peak Power Result (㏈m)			Limit (㏈m)
				Ant.1	Ant.2	Ant.1+Ant.2	
12	2 467	26T	0	13.50	14.02	16.78	30
			4	13.59	14.00	16.81	
			8	13.54	14.03	16.80	
		52T	37	13.54	14.01	16.79	
			38	13.54	14.05	16.81	
			40	13.49	13.97	16.75	
		106T	53	12.82	13.90	16.40	
			54	11.94	14.01	16.11	
		SU	-	9.63	10.45	13.07	
13	2 472	26T	0	4.71	7.27	9.19	
			4	4.63	7.25	9.14	
			8	4.84	7.22	9.20	
		52T	37	4.71	7.19	9.13	
			38	4.70	7.22	9.15	
			40	4.71	7.22	9.15	
		106T	53	4.98	4.11	7.58	
			54	4.71	4.09	7.42	
		SU	-	8.60	9.01	11.82	

Remark;

According to KDB 662911 D01 v02r01, Average/Peak power of each port (Ant.1+Ant.2) was combined by using below calculation.

Average/Peak power: 10 log {10^(Ant.1 power / 10)+10^(Ant.2 power / 10)}

5. Power Spectral Density

5.1. Test Setup

5.2. Limit

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 �dB m in any 3 ㎑ band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.3. Test Procedure

The measurements are recorded using the PKPSD measurement procedure in section 11.10.2 of ANSI C63.10-2013.

- This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to 3 ㎑ ≤ RBW ≤ 100 ㎑.
4. Set the VBW ≥ [3 x RBW].
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds requirement, then reduce RBW (but no less than 3 ㎑) and repeat.

5.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

OFDMA: 802.11ax_HE20_SISO

Tones	RU offset	Channel	Frequency (MHz)	Measured PSD (dB m/3 kHz)		Limit (dB m/3 kHz)
				Ant.1	Ant.2	
26T	0	Low	2 412	-4.12	-3.06	8
		Middle	2 437	-2.69	-3.69	
		High	2 462	-3.30	-2.91	
		12	2 467	-13.07	-13.22	
		13	2 472	-23.67	-14.30	
	4	Low	2 412	-4.72	-4.67	
		Middle	2 437	-4.36	-4.47	
		High	2 462	-4.67	-4.11	
		12	2 467	-12.36	-13.71	
		13	2 472	-22.56	-14.18	
	8	Low	2 412	-2.93	-3.95	
		Middle	2 437	-4.11	-4.01	
		High	2 462	-5.45	-3.53	
		12	2 467	-12.46	-11.52	
		13	2 472	-24.41	-14.74	
52T	37	Low	2 412	-5.71	-5.61	8
		Middle	2 437	-4.88	-5.50	
		High	2 462	-5.42	-4.96	
		12	2 467	-14.95	-15.06	
		13	2 472	-25.83	-16.24	
	38	Low	2 412	-6.15	-6.13	
		Middle	2 437	-5.95	-6.11	
		High	2 462	-6.71	-6.09	
		12	2 467	-14.65	-14.75	
		13	2 472	-25.61	-16.29	
	40	Low	2 412	-4.97	-4.93	
		Middle	2 437	-5.37	-5.07	
		High	2 462	-5.70	-5.23	
		12	2 467	-13.88	-14.02	
		13	2 472	-25.26	-15.79	

Tones	RU offset	Channel	Frequency (㎒)	Measured PSD (㏈ m/3 ㎑)		Limit (㏈ m/3 ㎑)
				Ant.1	Ant.2	
106T	53	Low	2 412	-8.37	-8.72	8
		Middle	2 437	-8.19	-7.57	
		High	2 462	-8.98	-8.15	
		12	2 467	-17.64	-18.32	
		13	2 472	-29.19	-20.00	
	54	Low	2 412	-9.32	-9.00	
		Middle	2 437	-9.05	-9.24	
		High	2 462	-9.73	-9.08	
		12	2 467	-17.75	-17.99	
		13	2 472	-29.31	-19.49	
SU	-	Low	2 412	-11.10	-11.46	8
		Middle	2 437	-10.36	-11.03	
		High	2 462	-10.95	-10.96	
		12	2 467	-21.23	-20.47	
		13	2 472	-24.35	-21.62	

OFDMA: 802.11ax_HE20_MIMO

Tones	RU offset	Channel	Frequency (㎒)	Measured PSD (㏈ m/3 ㎑)			Limit (㏈ m/3 ㎑)
				Ant.1	Ant.2	Ant.1+Ant.2	
26T	0	Low	2 412	-3.79	-3.43	-0.60	8
		Middle	2 437	-3.18	-3.68	-0.41	
		High	2 462	-3.54	-3.43	-0.47	
		12	2 467	-13.82	-14.02	-10.91	
		13	2 472	-23.94	-24.70	-21.29	
	4	Low	2 412	-4.48	-4.63	-1.54	
		Middle	2 437	-4.67	-4.54	-1.59	
		High	2 462	-4.92	-3.32	-1.04	
		12	2 467	-14.25	-13.91	-11.07	
		13	2 472	-24.35	-21.27	-19.53	
	8	Low	2 412	-4.07	-4.48	-1.26	
		Middle	2 437	-4.60	-4.81	-1.69	
		High	2 462	-4.94	-5.00	-1.96	
		12	2 467	-13.92	-14.31	-11.10	
		13	2 472	-23.98	-22.13	-19.95	
52T	37	Low	2 412	-6.10	-5.92	-3.00	8
		Middle	2 437	-5.37	-5.79	-2.56	
		High	2 462	-6.12	-5.19	-2.62	
		12	2 467	-16.05	-16.00	-13.01	
		13	2 472	-25.86	-23.47	-21.49	
	38	Low	2 412	-6.97	-4.04	-2.25	
		Middle	2 437	-6.72	-4.15	-2.24	
		High	2 462	-7.10	-3.81	-2.14	
		12	2 467	-16.18	-13.55	-11.66	
		13	2 472	-25.99	-20.87	-19.71	
	40	Low	2 412	-6.99	-6.18	-3.56	
		Middle	2 437	-7.31	-6.95	-4.12	
		High	2 462	-7.59	-7.09	-4.32	
		12	2 467	-16.85	-16.08	-13.44	
		13	2 472	-27.04	-24.11	-22.32	

Tones	RU offset	Channel	Frequency (㎒)	Measured PSD (㏈ m/3 ㎑)			Limit (㏈ m/3 ㎑)
				Ant.1	Ant.2	Ant.1+Ant.2	
106T	53	Low	2 412	-8.81	-8.44	-5.61	8
		Middle	2 437	-8.79	-8.24	-5.50	
		High	2 462	-9.13	-8.05	-5.55	
		12	2 467	-19.64	-18.54	-16.04	
		13	2 472	-29.38	-29.36	-23.36	
	54	Low	2 412	-10.00	-6.53	-4.92	
		Middle	2 437	-10.01	-6.77	-5.08	
		High	2 462	-10.35	-6.67	-5.12	
		12	2 467	-19.82	-16.37	-14.75	
		13	2 472	-29.72	-27.02	-25.15	
SU	-	Low	2 412	-11.65	-10.63	-8.10	8
		Middle	2 437	-11.41	-10.91	-8.14	
		High	2 462	-11.61	-11.18	-8.38	
		12	2 467	-22.94	-22.78	-19.85	
		13	2 472	-24.81	-23.67	-21.19	

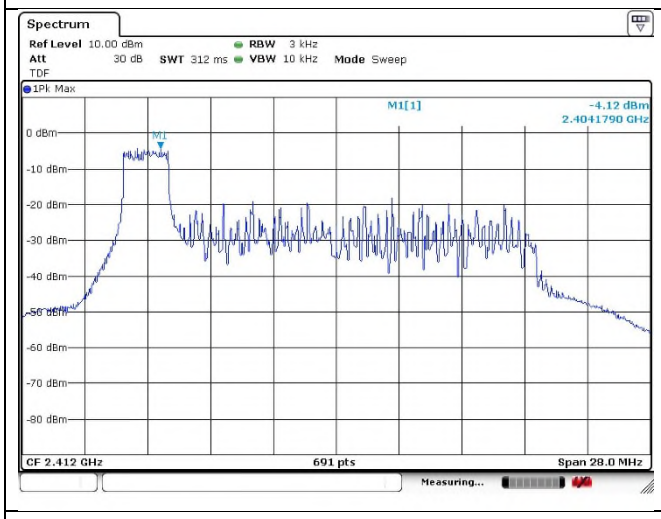
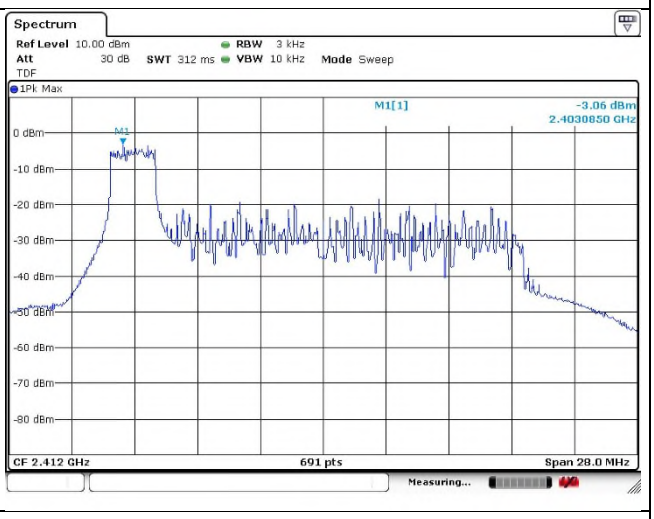
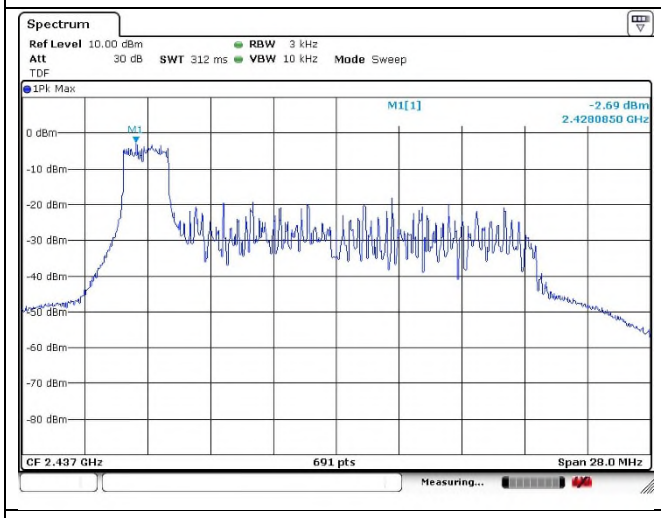
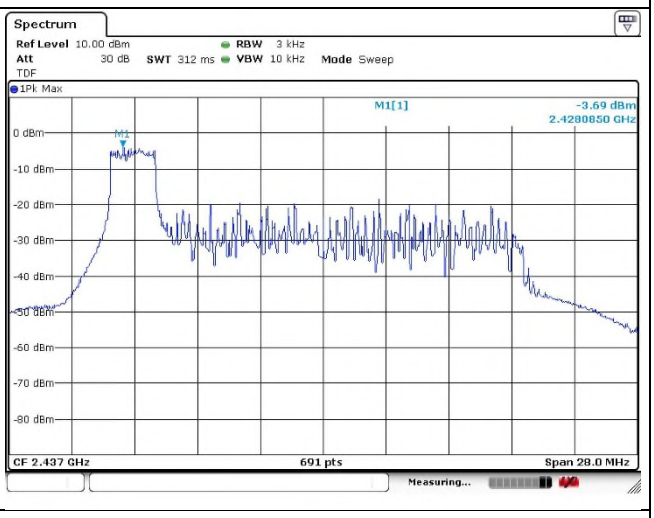
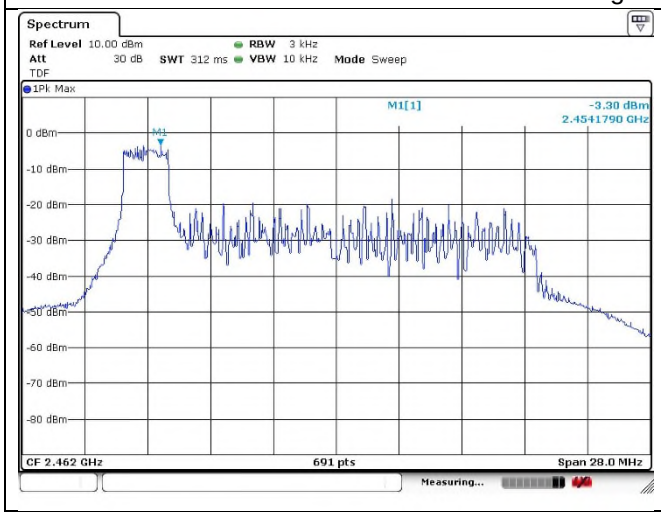
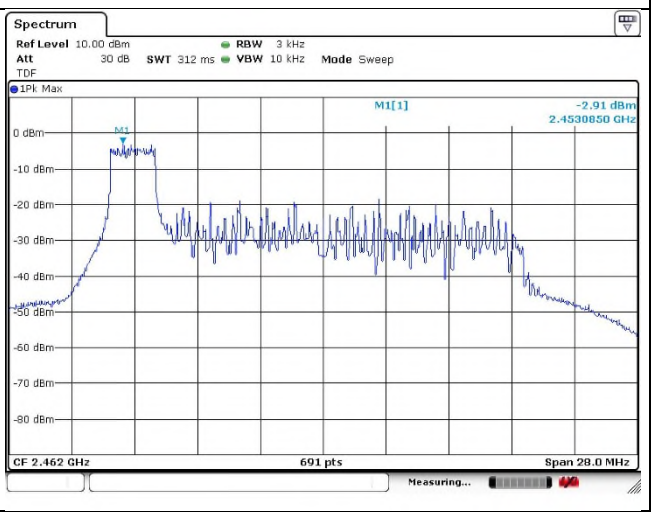
Remark;

According to KDB 662911 D01 v02r01, power spectral density of each port (Ant.1 + Ant.2) was combined by using below calculation.

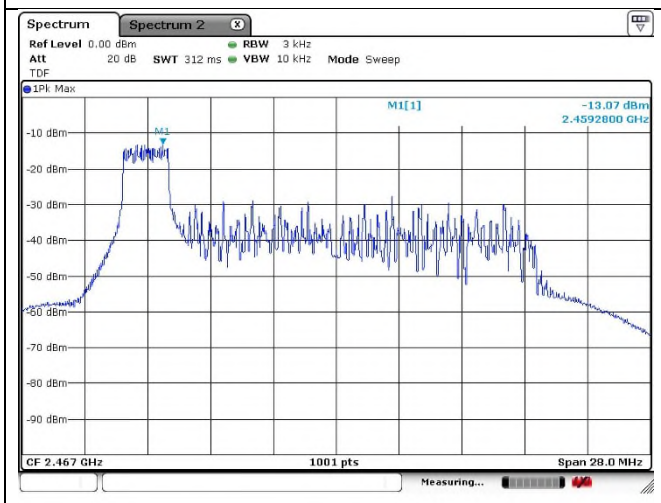
PSD: 10 log {10^(Ant.1 PSD / 10)+10^(Ant. 2 PSD / 10)}

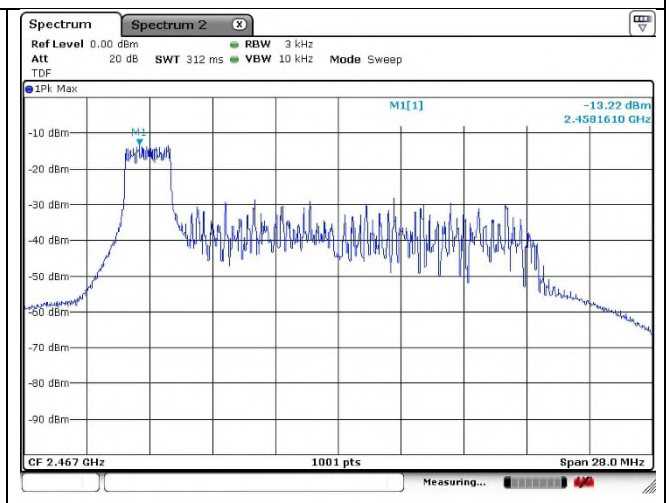
- Test plots_SISO

26T_0 RU

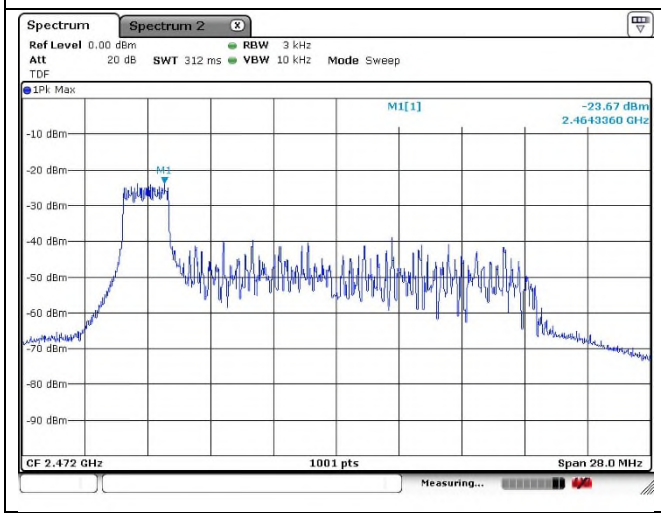
Ant.1	Ant.2
Low channel	
	
Middle channel	
	
High channel	
	

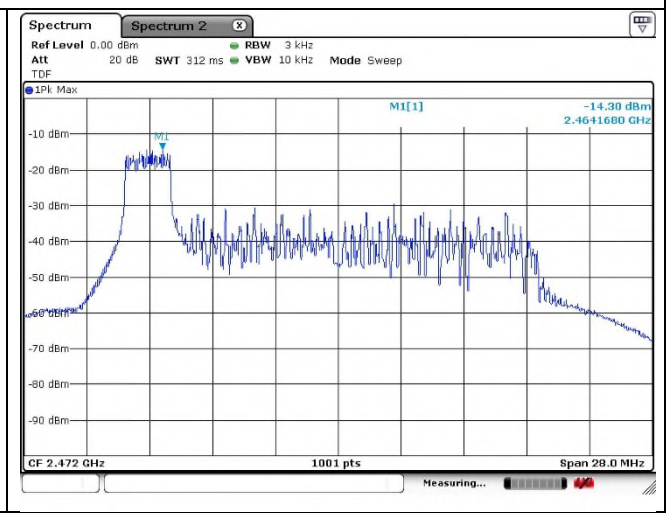
12 channel





13 channel

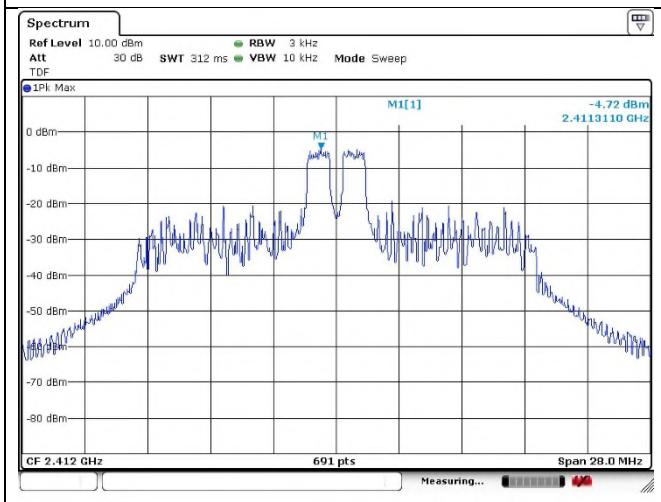


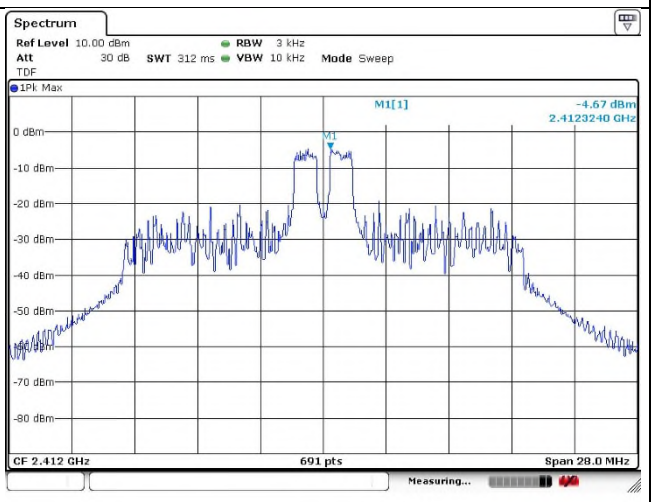


26T_4 RU

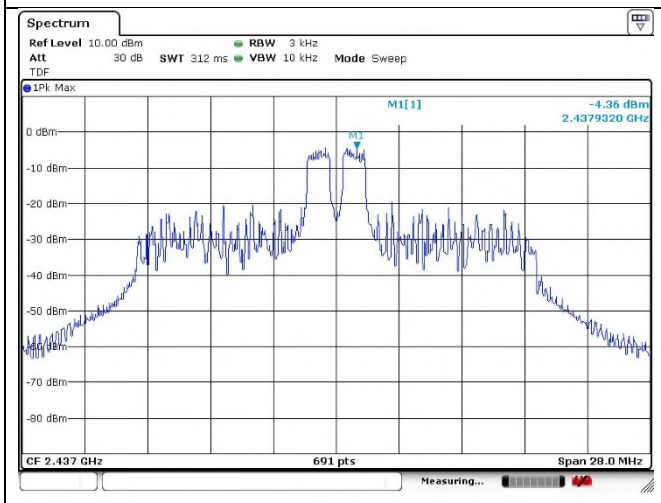
Ant.1 **Ant.2**

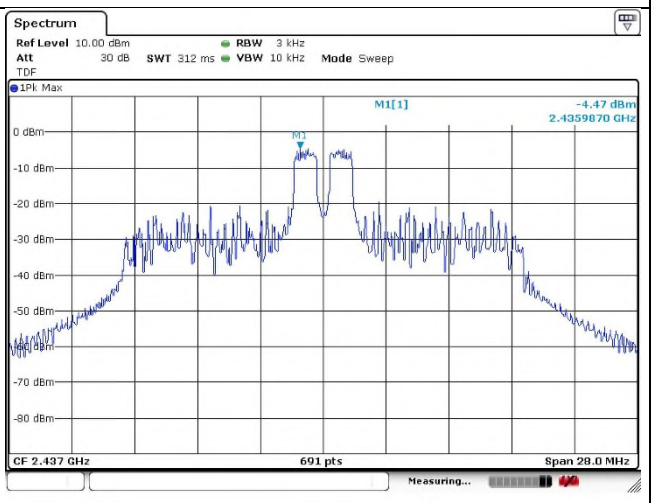
Low channel



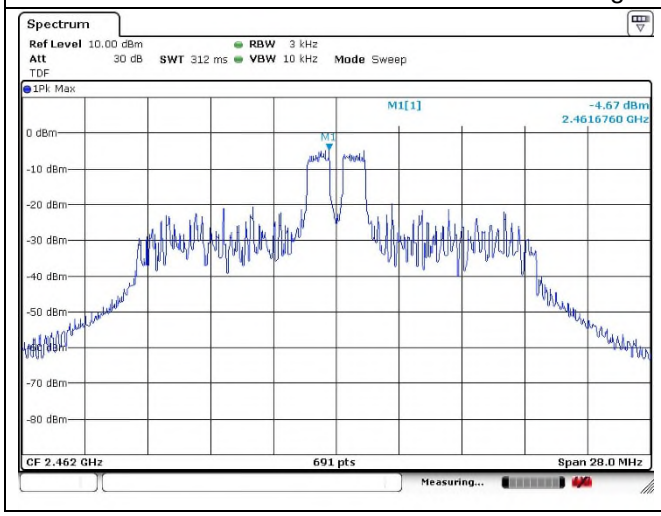


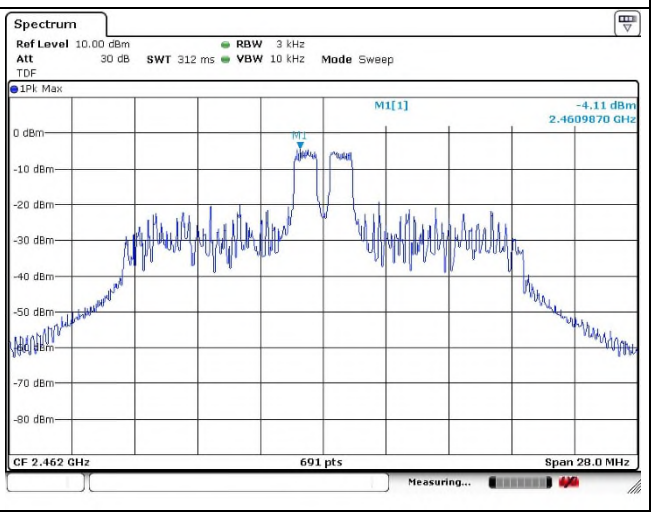
Middle channel



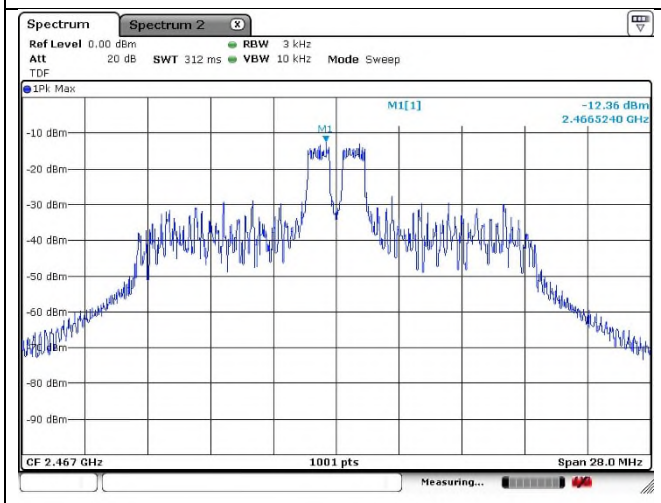


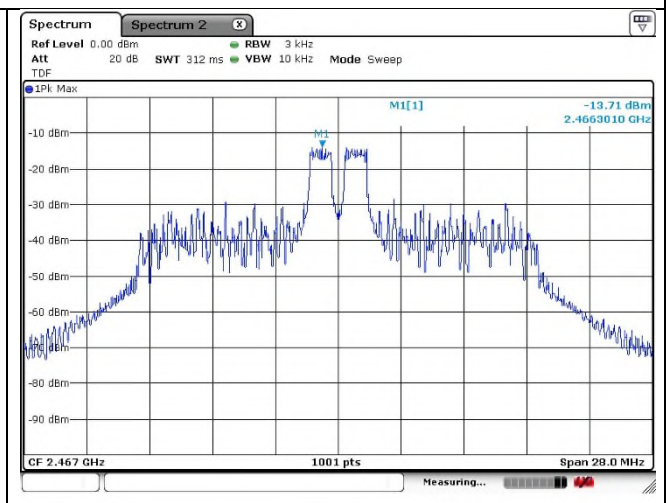
High channel



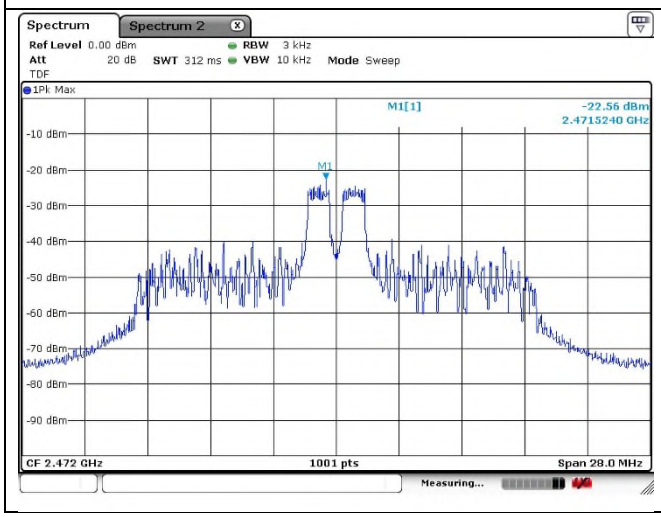


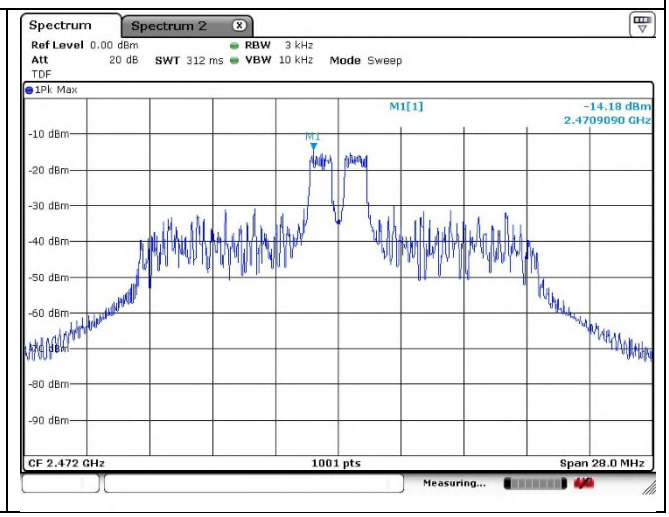
12 channel





13 channel

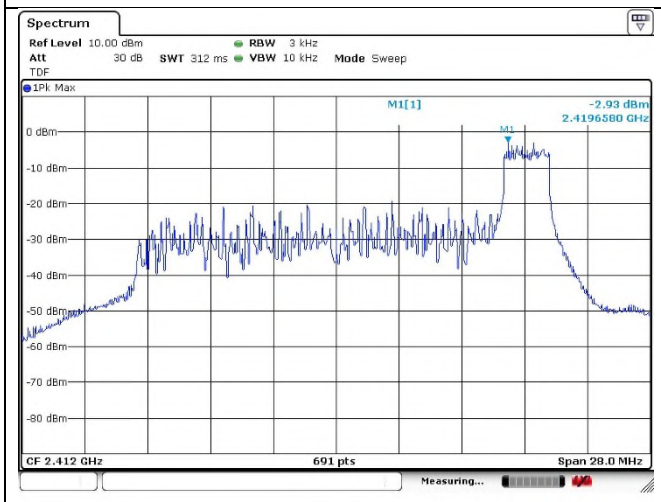


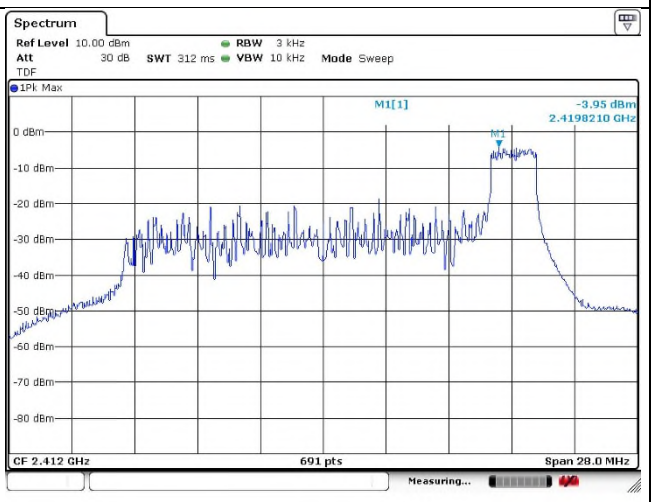


26T_8 RU

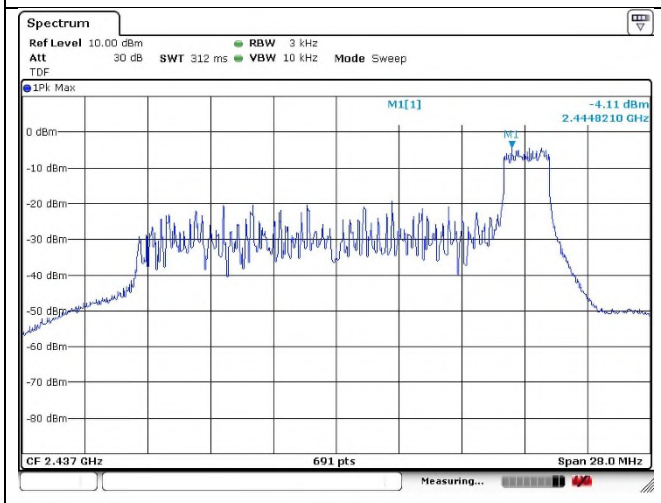
Ant.1 **Ant.2**

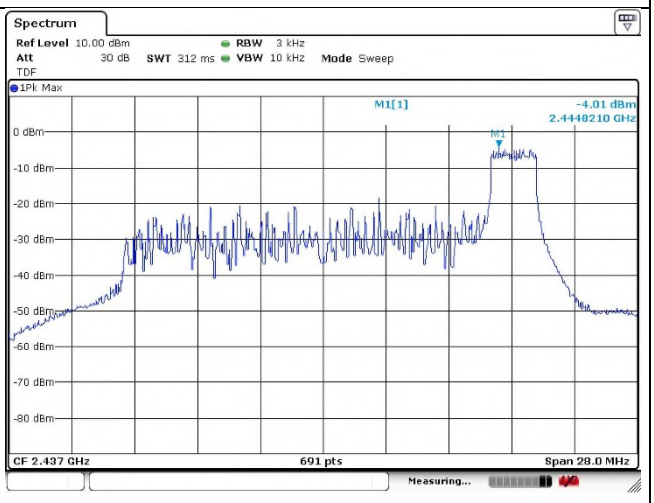
Low channel



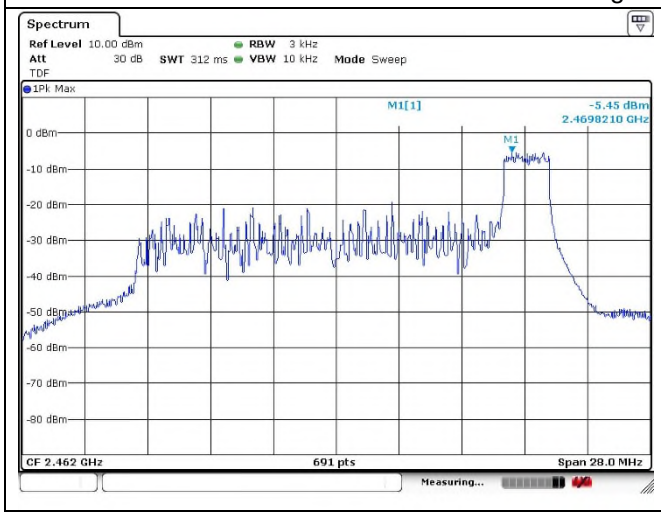


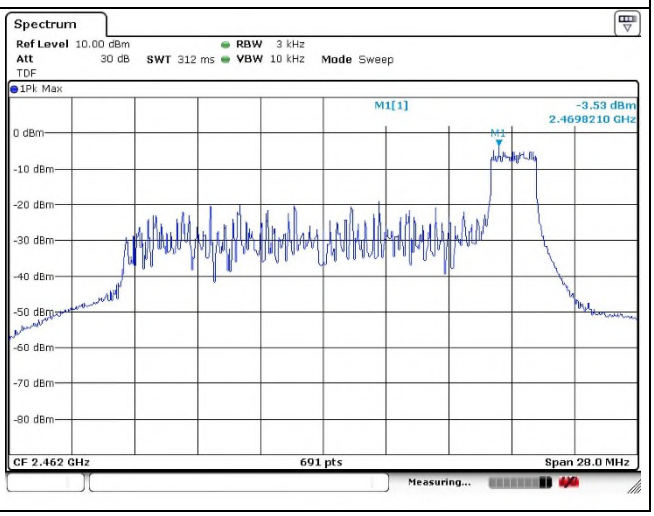
Middle channel



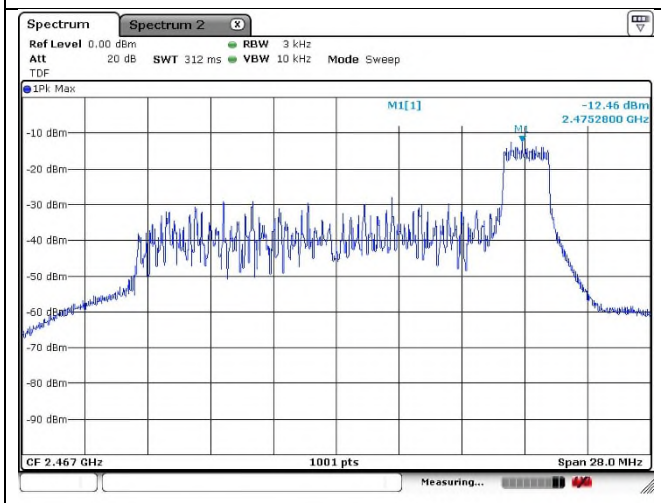


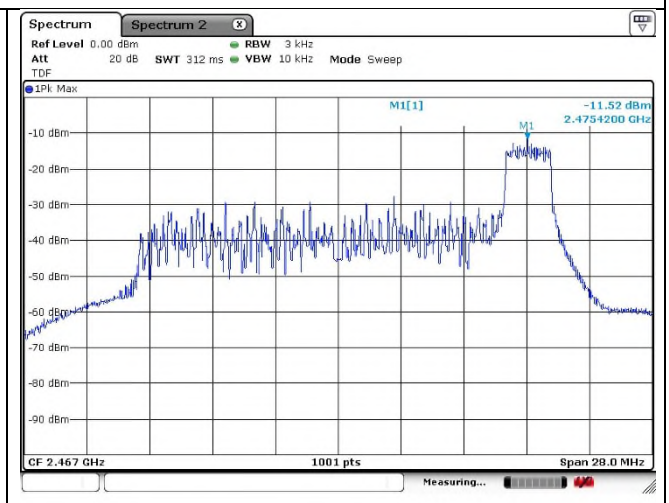
High channel



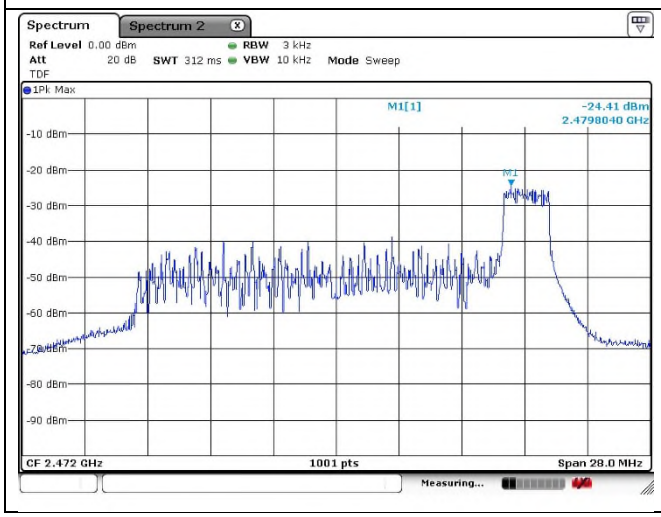


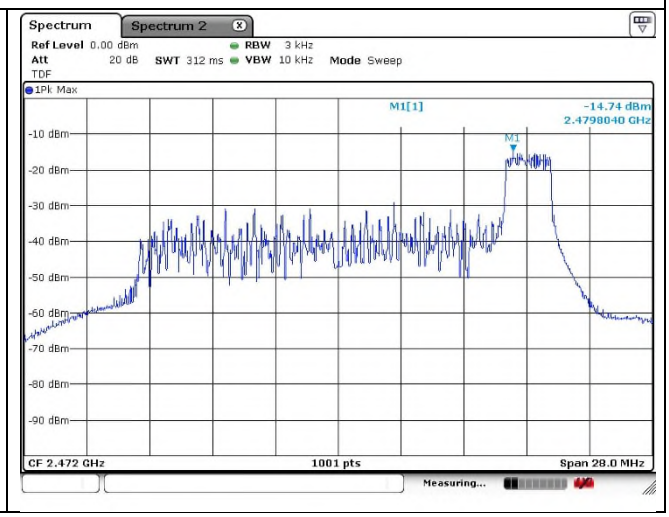
12 channel





13 channel

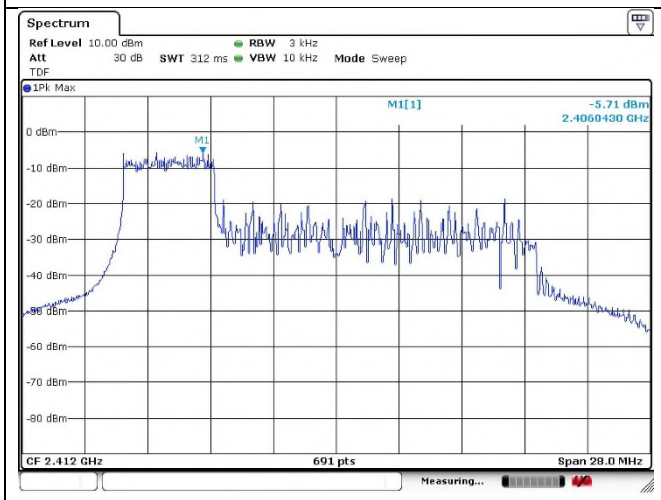


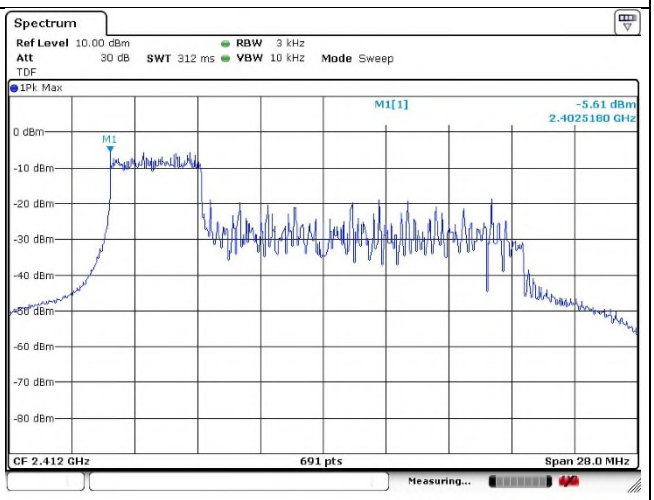


52T_37 RU

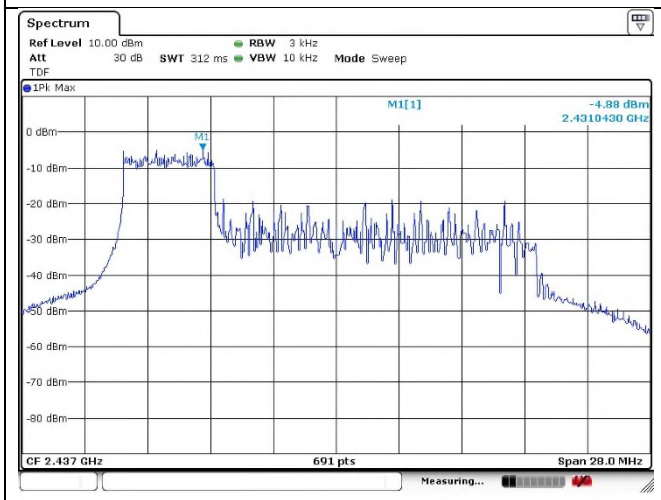
Ant.1 **Ant.2**

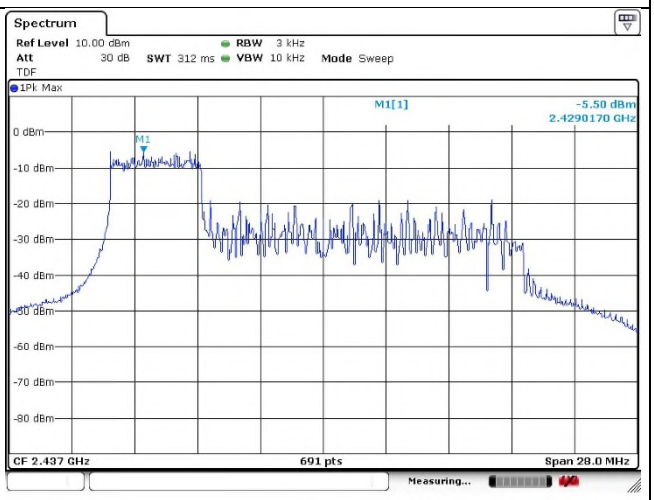
Low channel



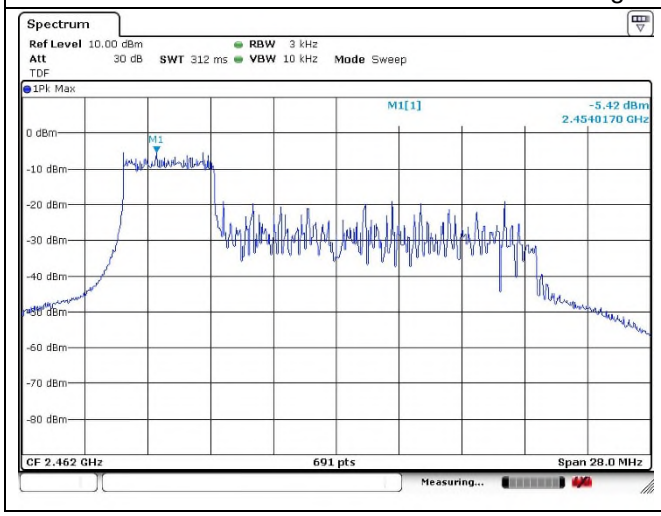


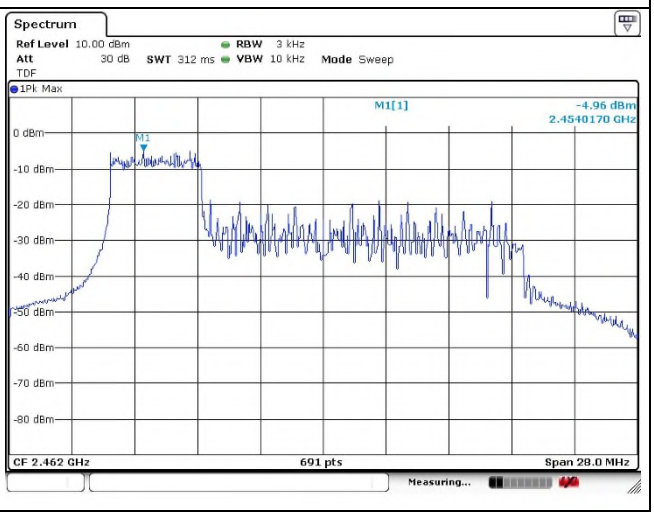
Middle channel



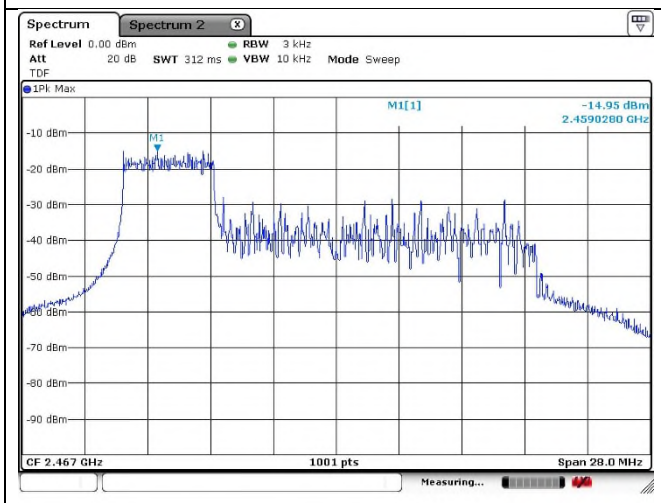


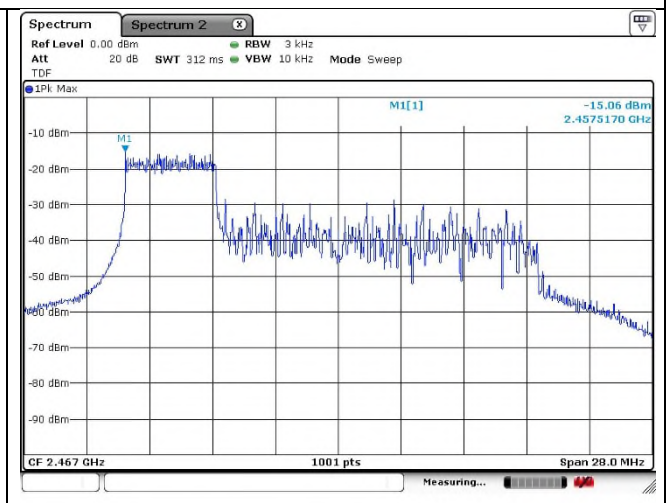
High channel



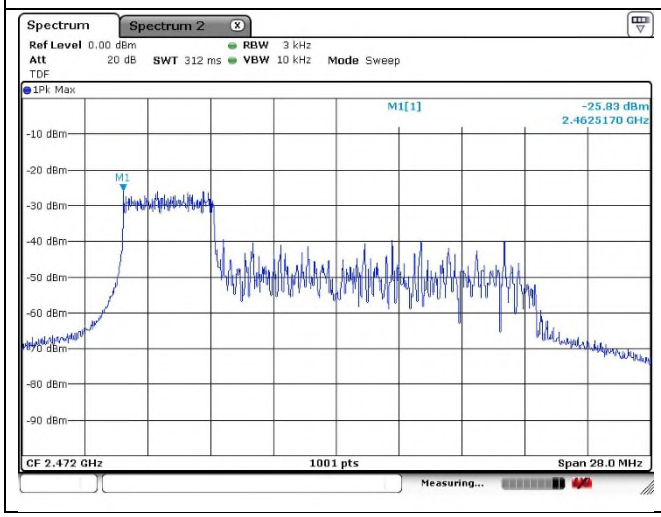


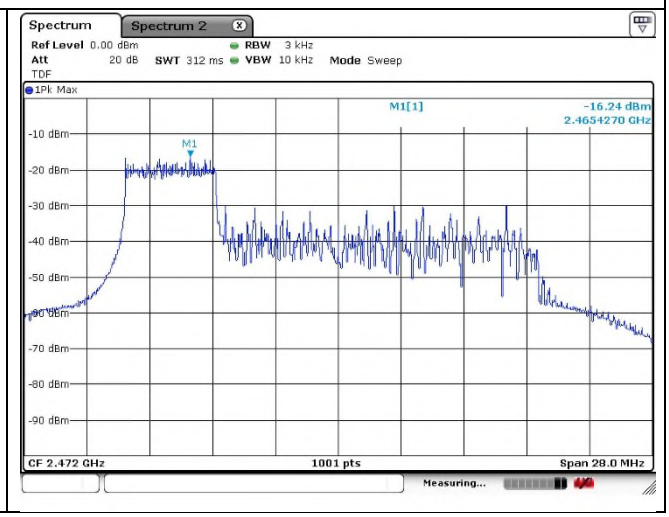
12 channel





13 channel

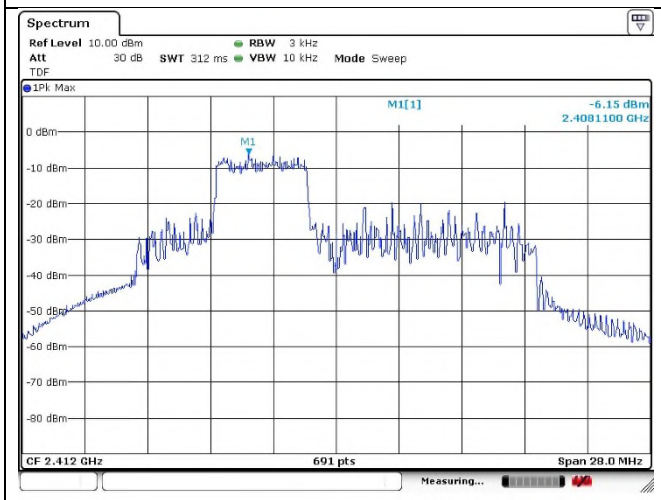


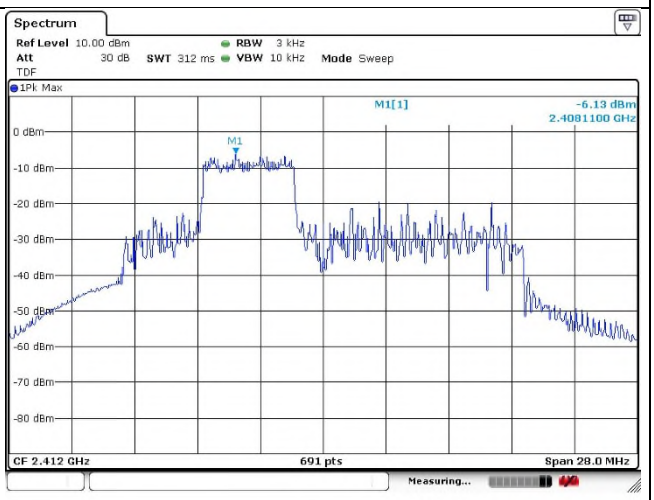


52T_38 RU

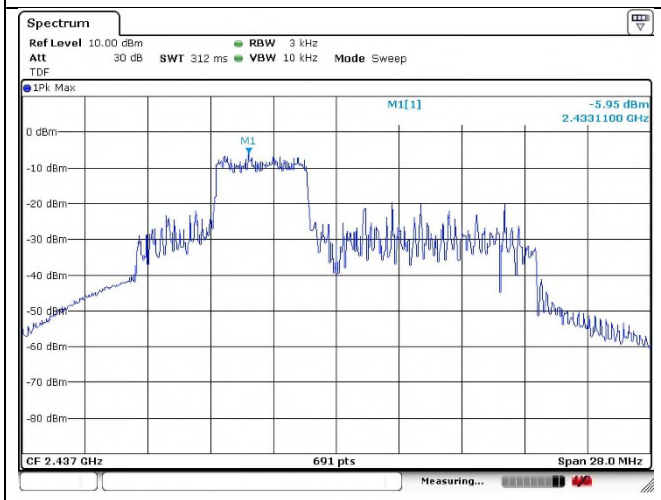
Ant.1 **Ant.2**

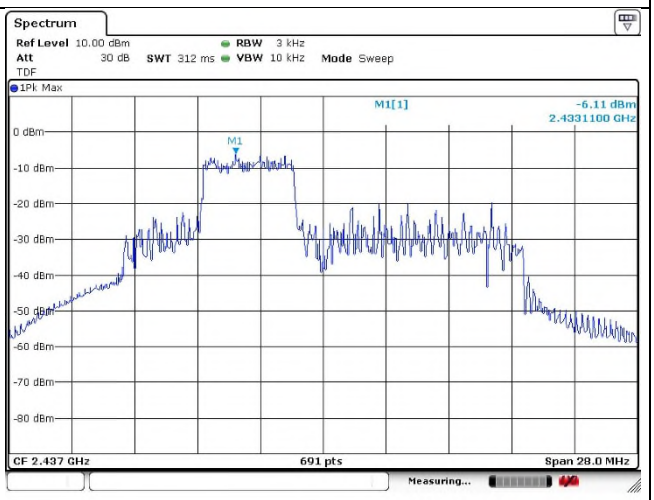
Low channel



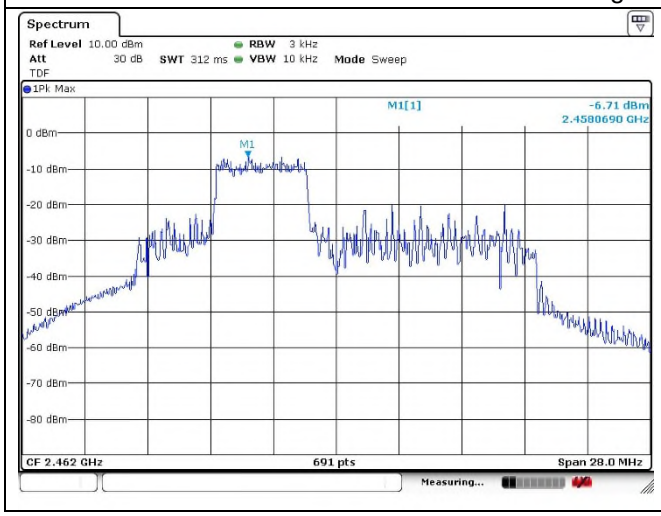


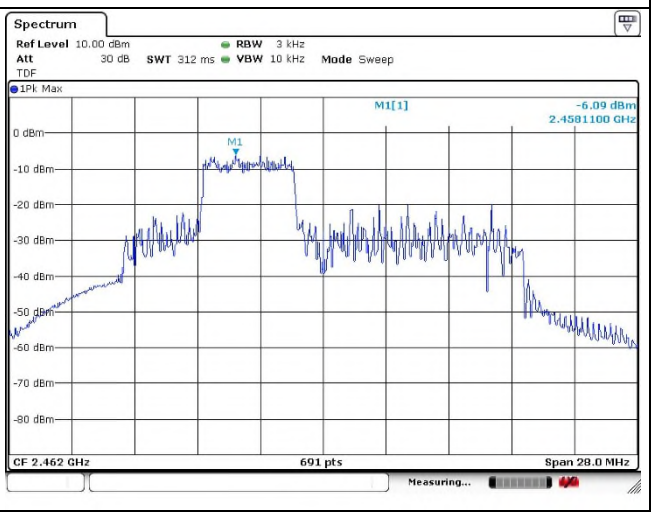
Middle channel



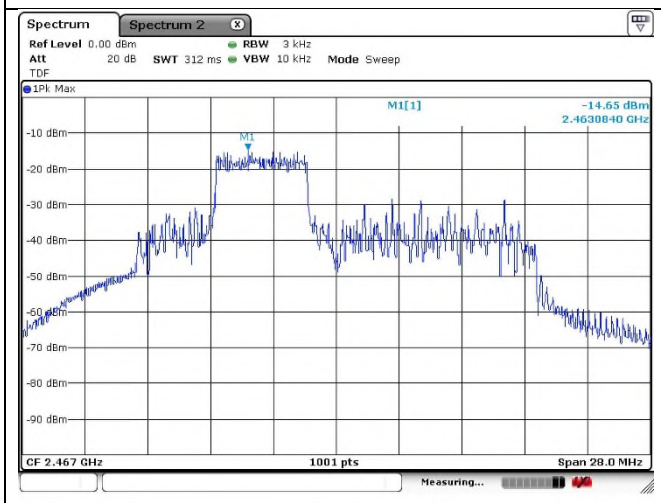


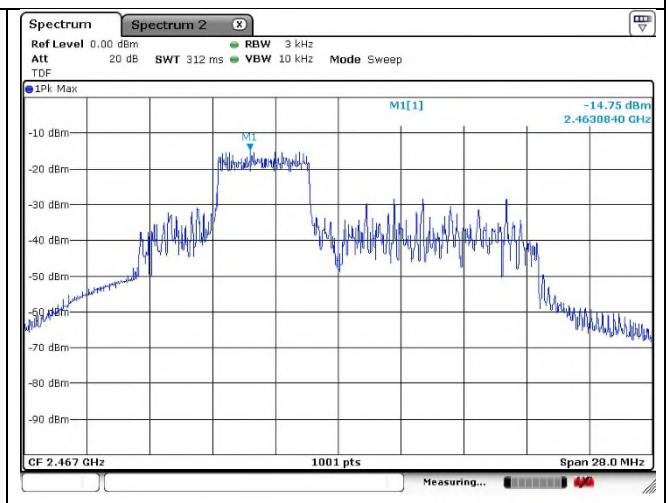
High channel



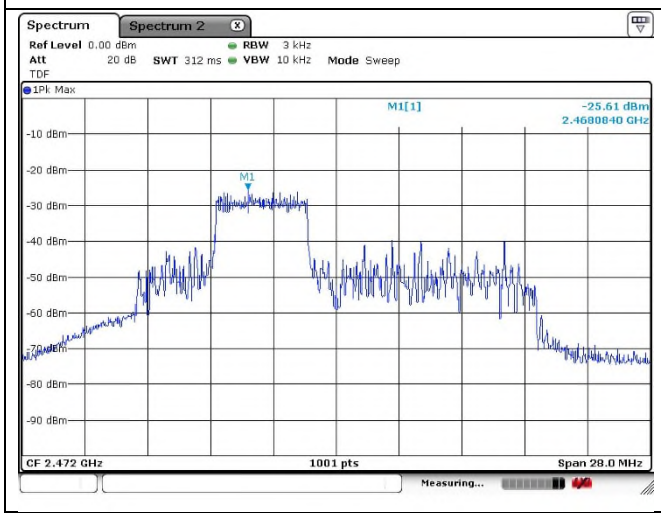


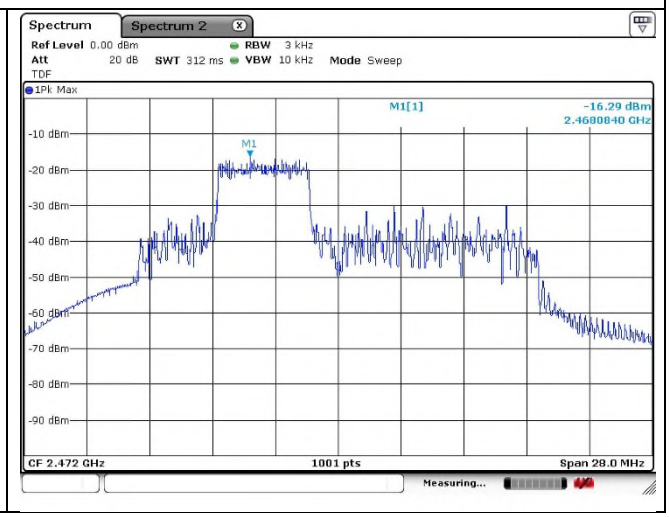
12 channel





13 channel

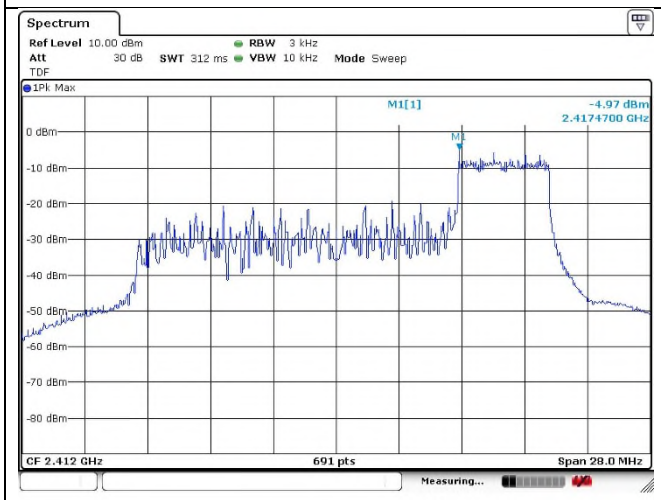


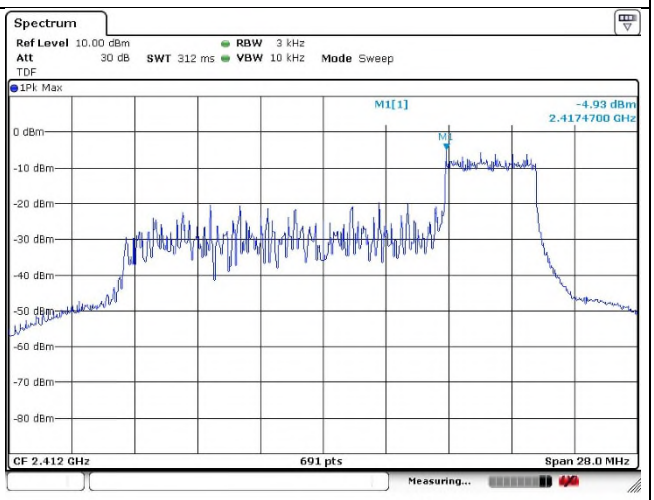


52T_40 RU

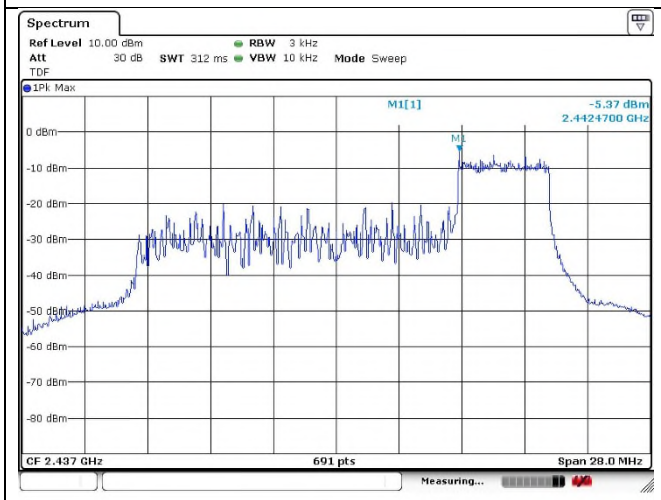
Ant.1 **Ant.2**

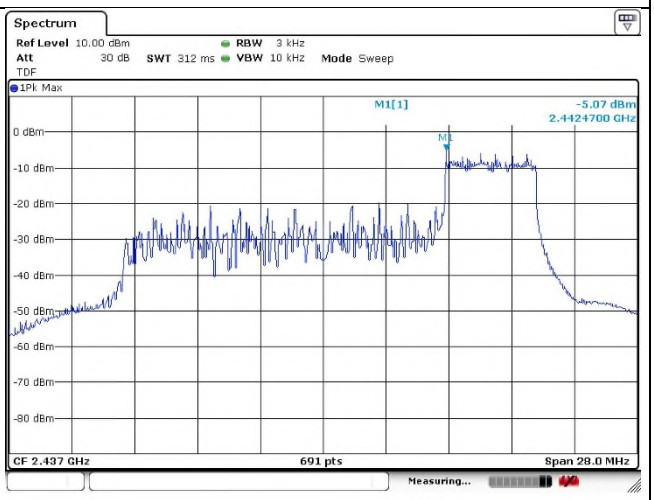
Low channel



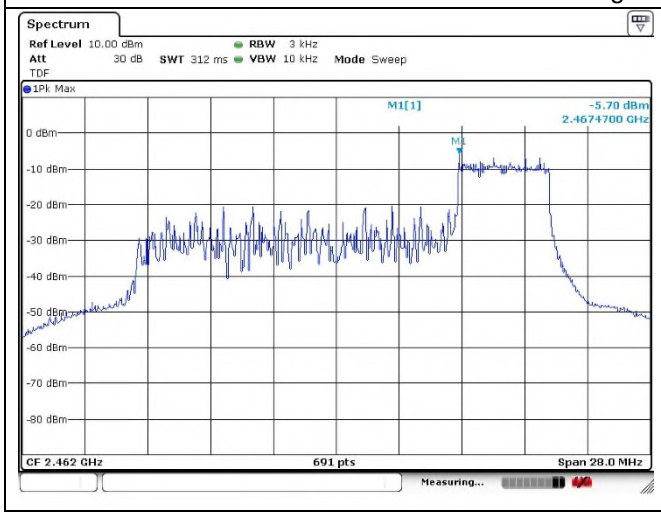


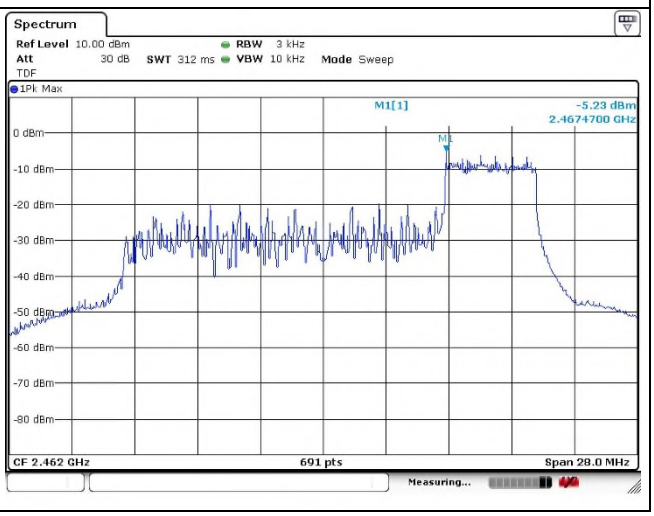
Middle channel



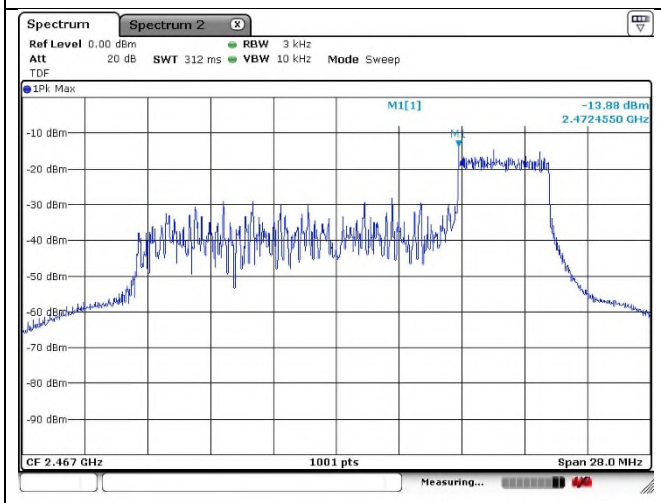


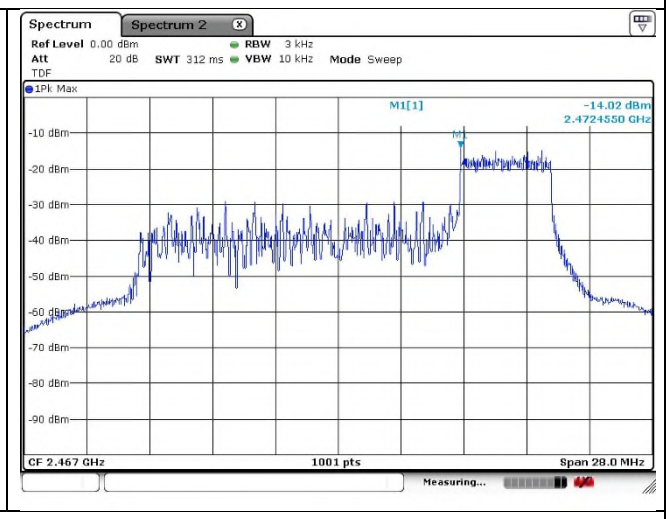
High channel



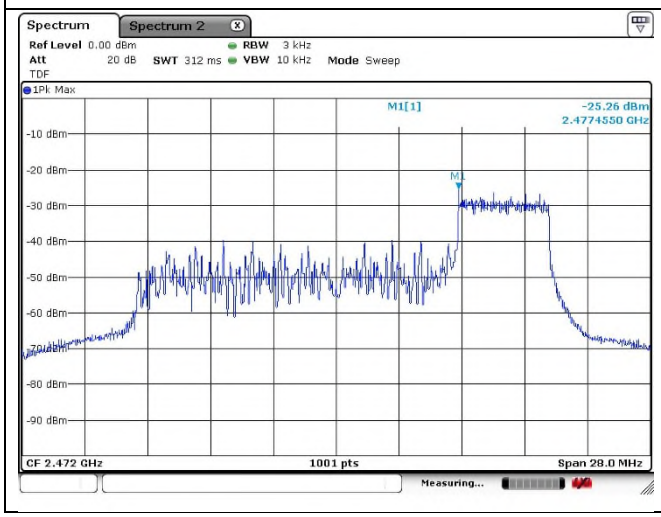


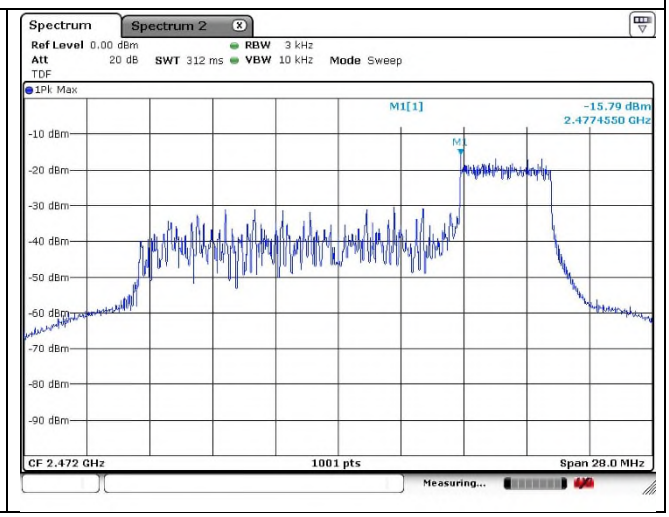
12 channel





13 channel

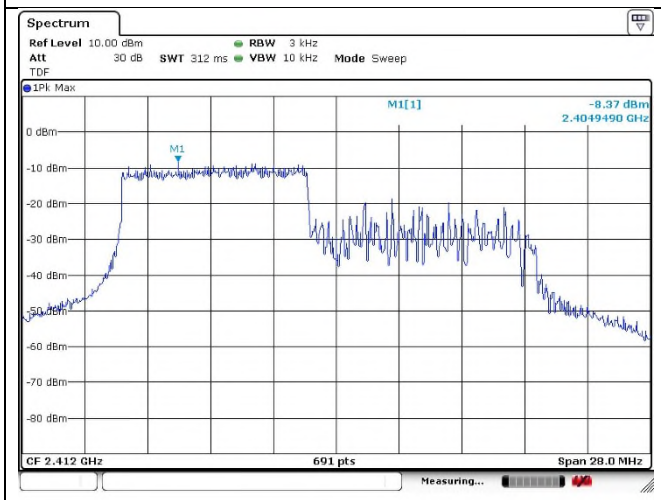


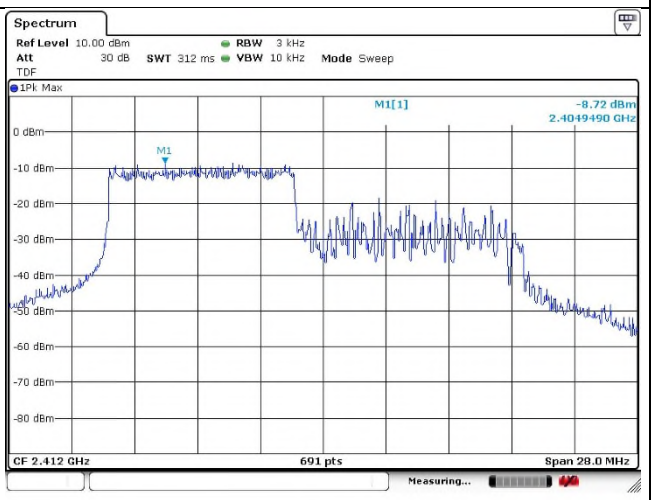


106T_53 RU

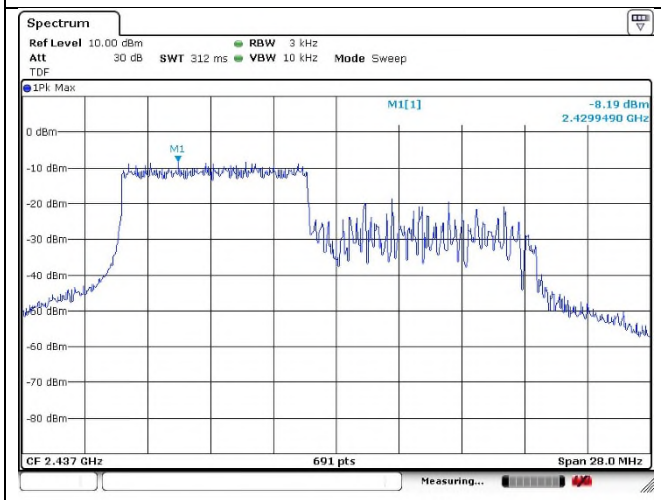
Ant.1 **Ant.2**

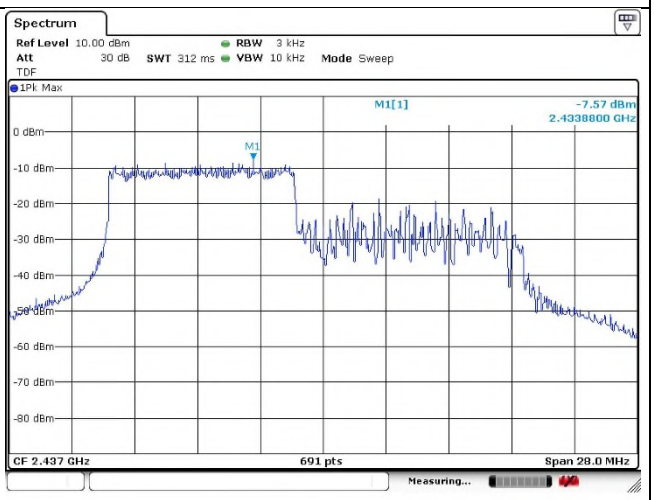
Low channel



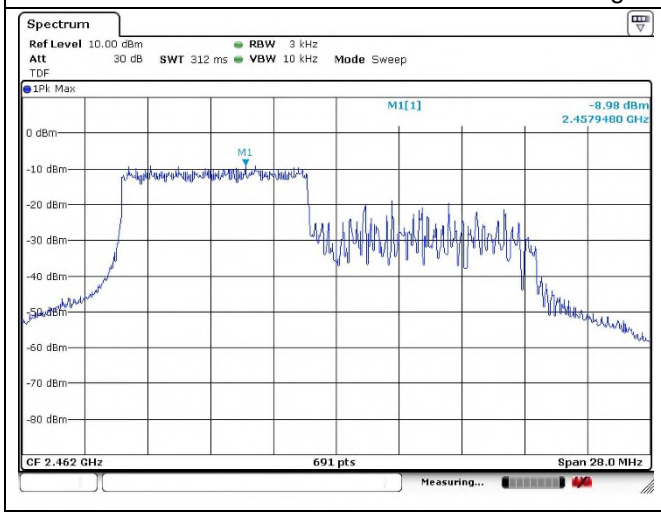


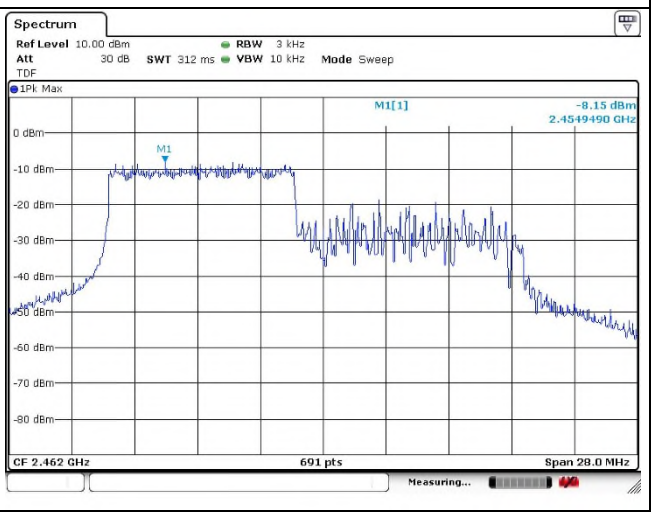
Middle channel



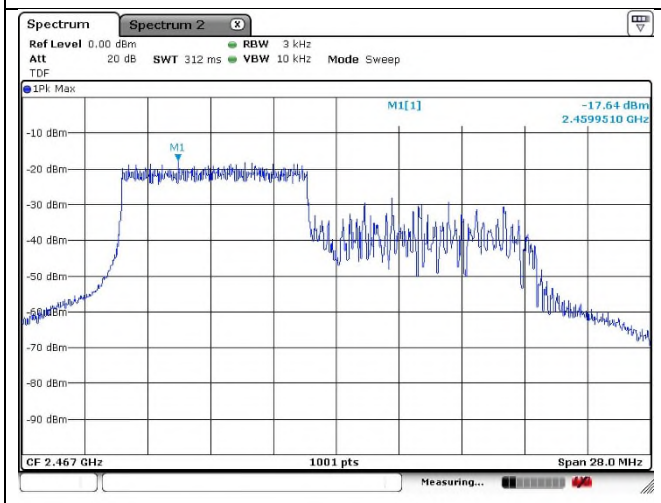


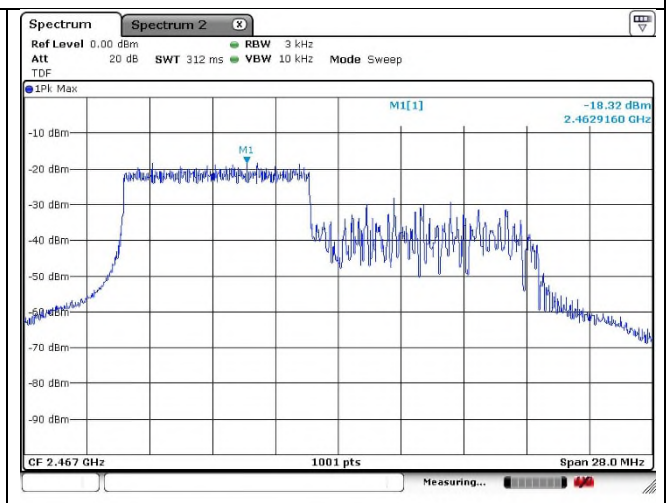
High channel



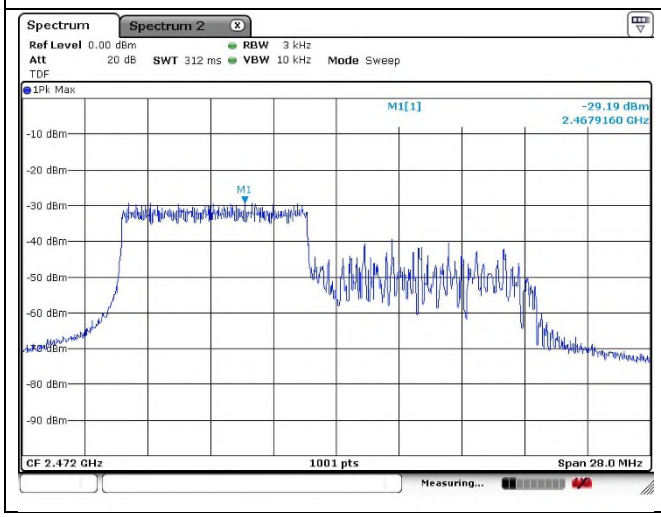


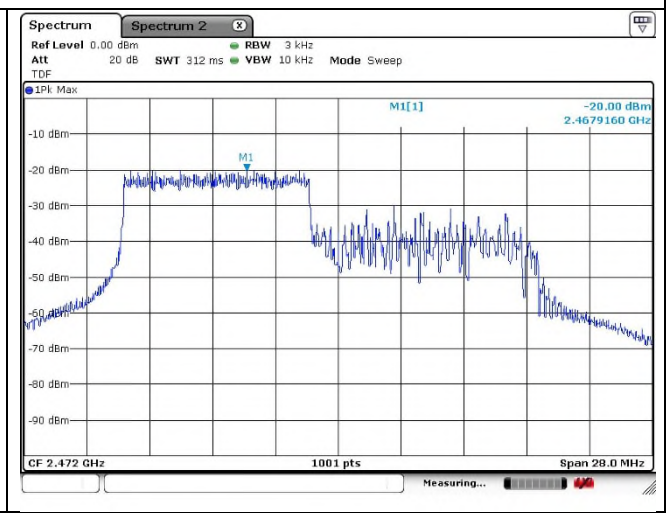
12 channel





13 channel

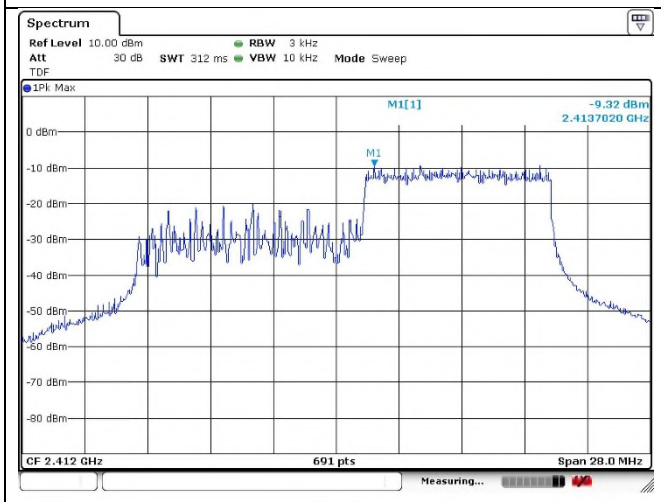


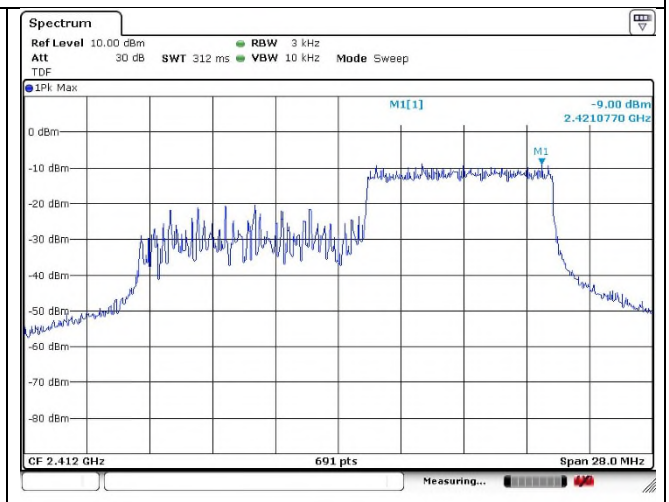


106T_54 RU

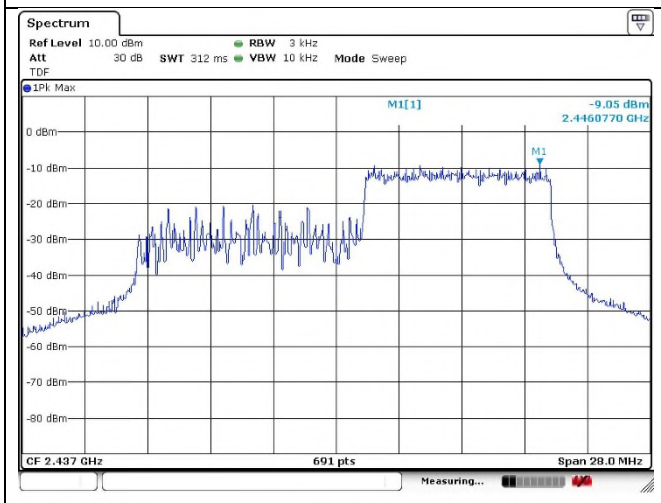
Ant.1 **Ant.2**

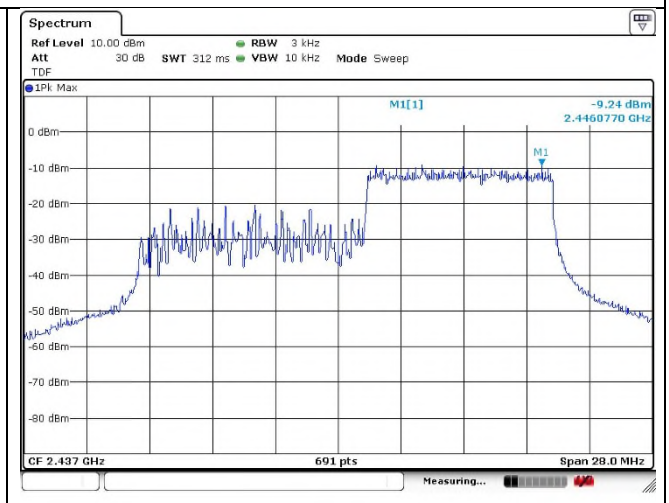
Low channel



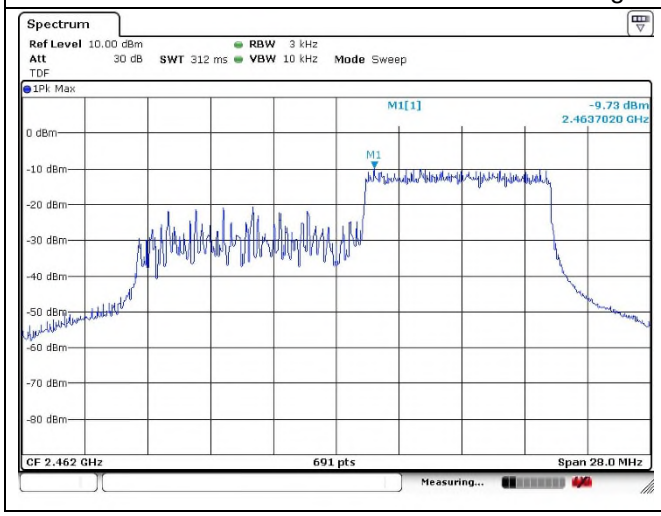


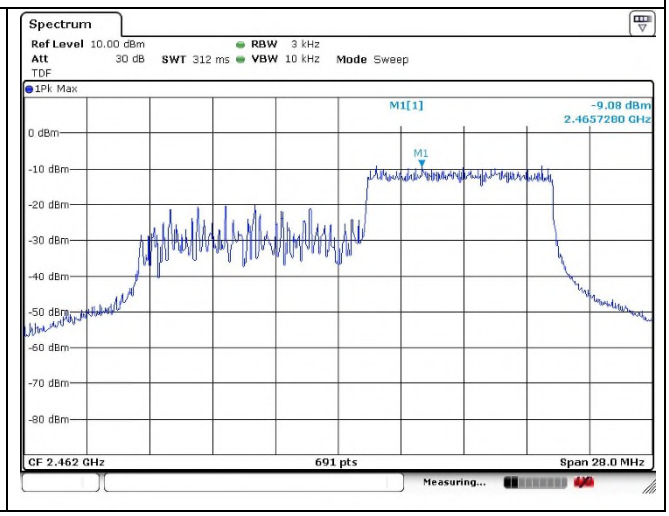
Middle channel



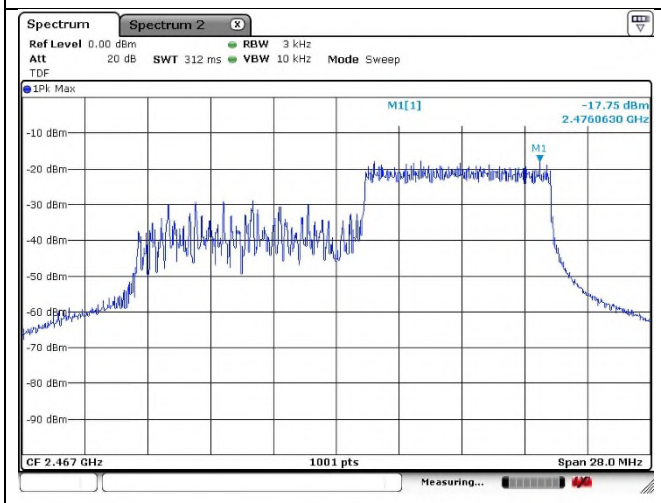


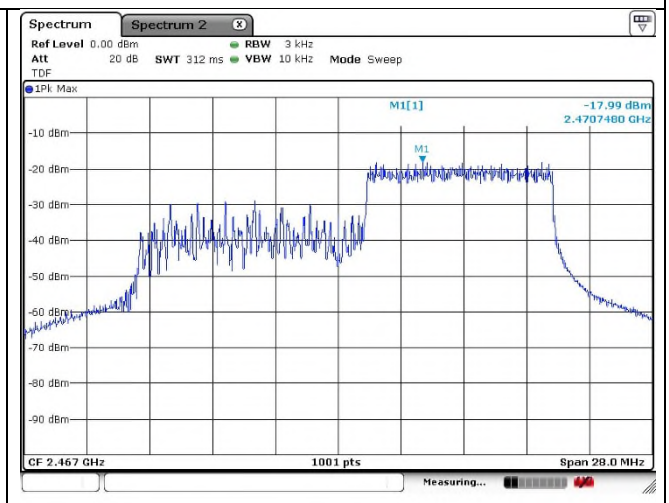
High channel



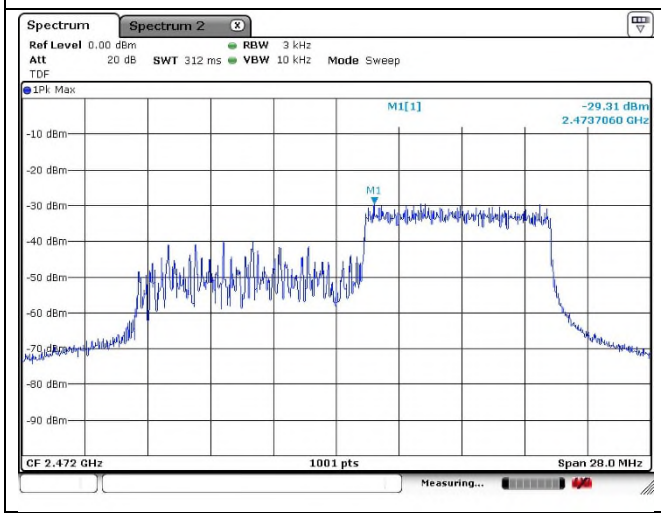


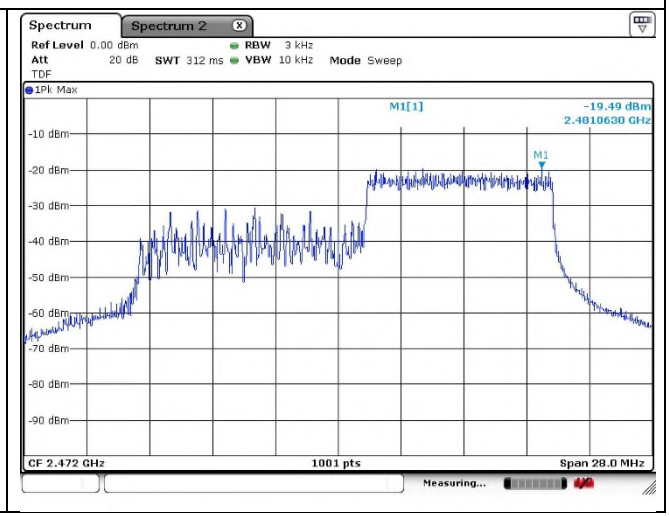
12 channel





13 channel

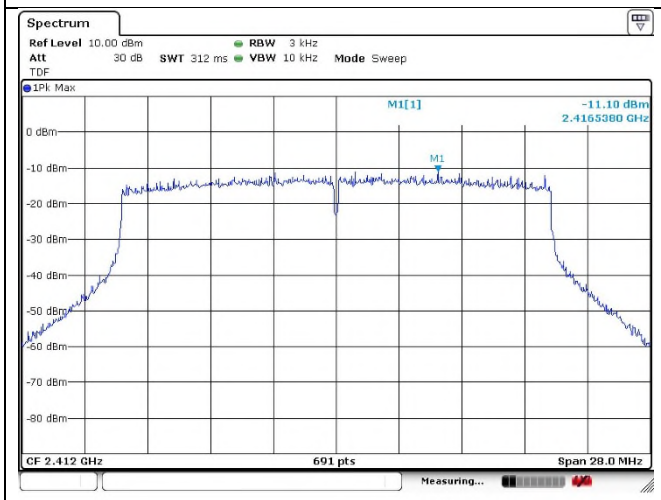


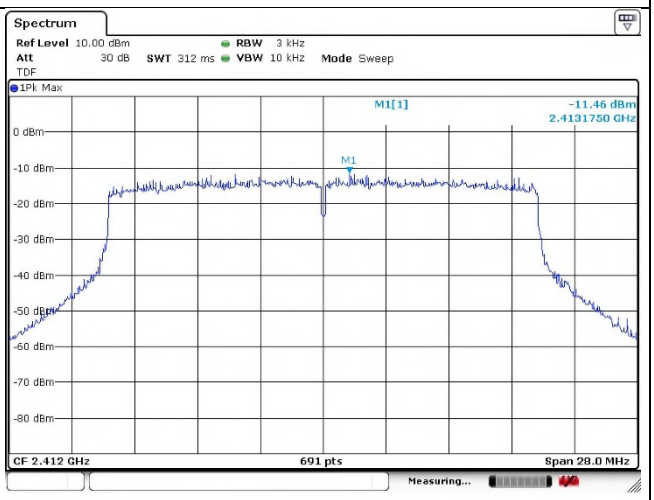


SU

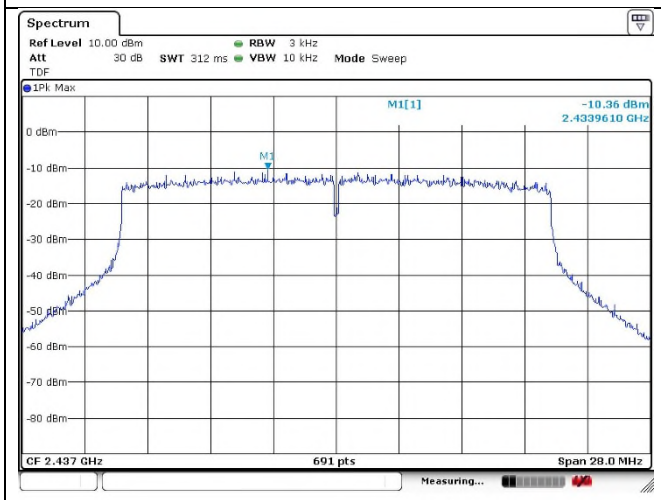
Ant.1 **Ant.2**

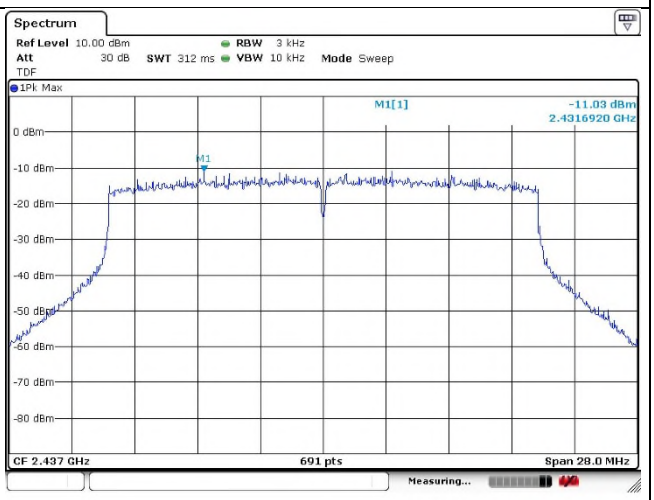
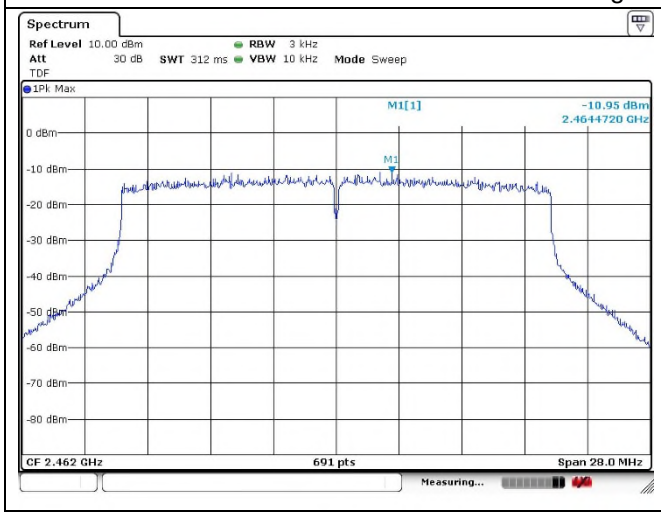
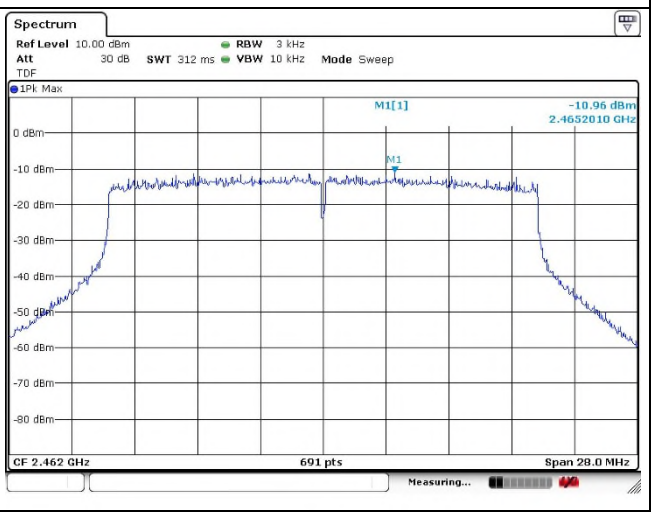
Low channel





Middle channel





High channel