

## 8 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

### 8.1 Applicable Standard

According to FCC §15.247(a) (2),

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 8.2 Test Procedure

According to ANSI C63.10-2013, the steps for the first option are as follows:

- (1) Set RBW = 100 kHz. (2) Set the VBW  $\geq [3 \times \text{RBW}]$ . (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 dB relative to the maximum level measured in the fundamental emission.

### 8.3 Test Equipment List and Details

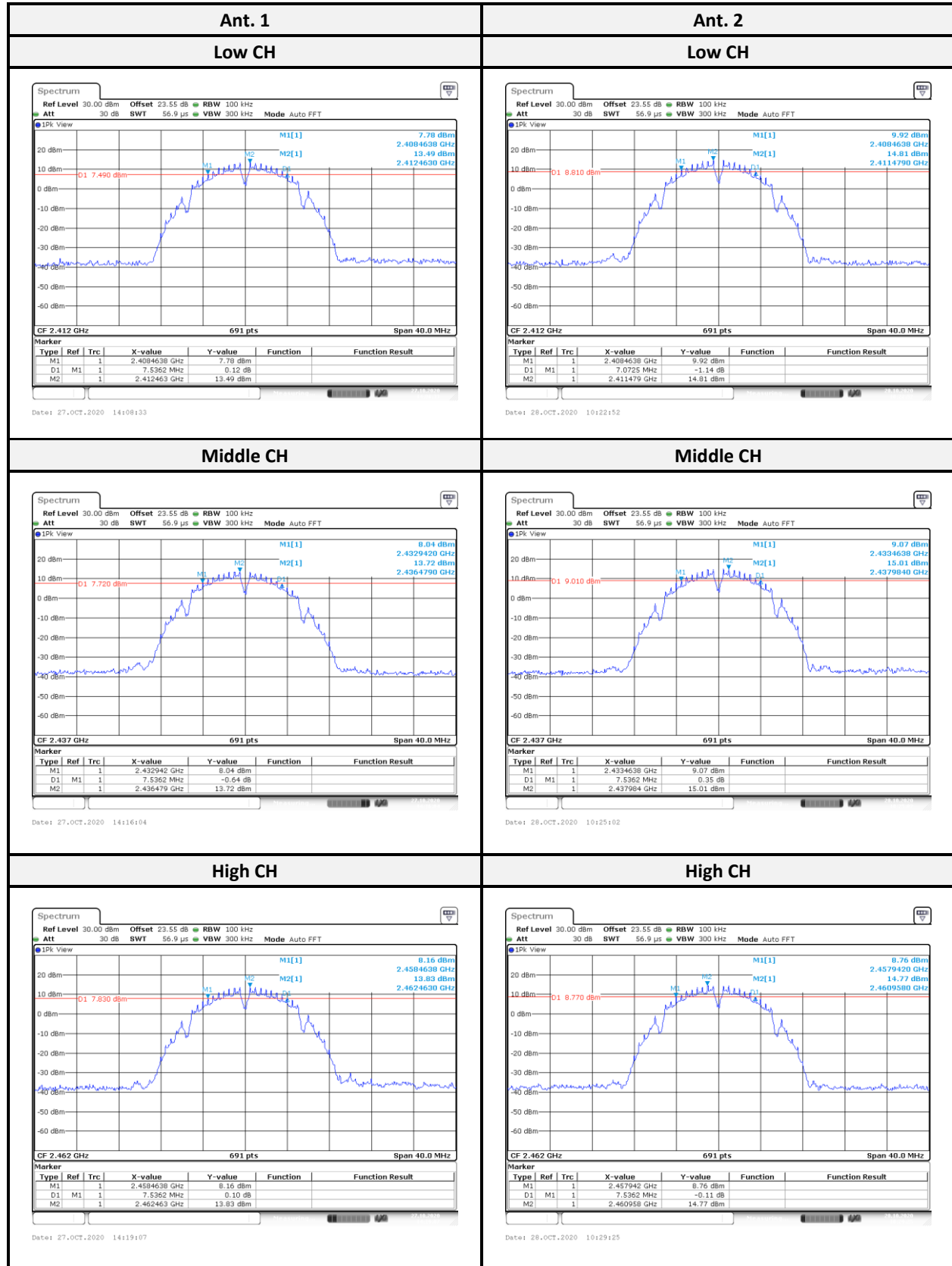
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room(TH-02)</b>					
Spectrum Analyzer	Rohde & Schwarz	FSU26	100406	2020/03/11	2021/03/10
Cable	MTJ	MT40S	620620-MT40S-100	Each use	-

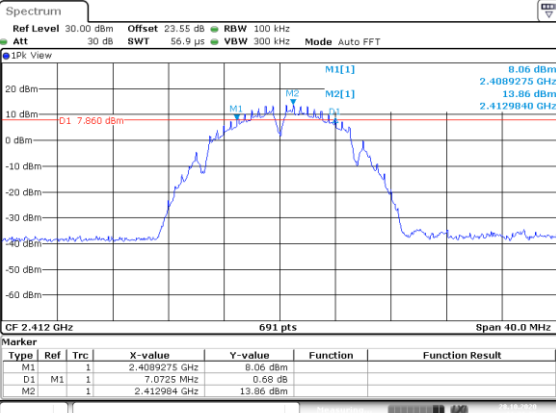
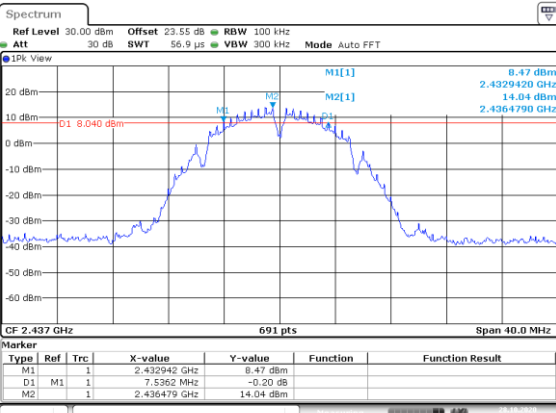
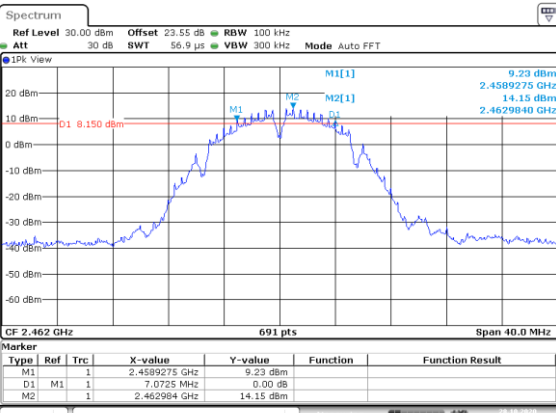
**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

**8.4 Test Results**

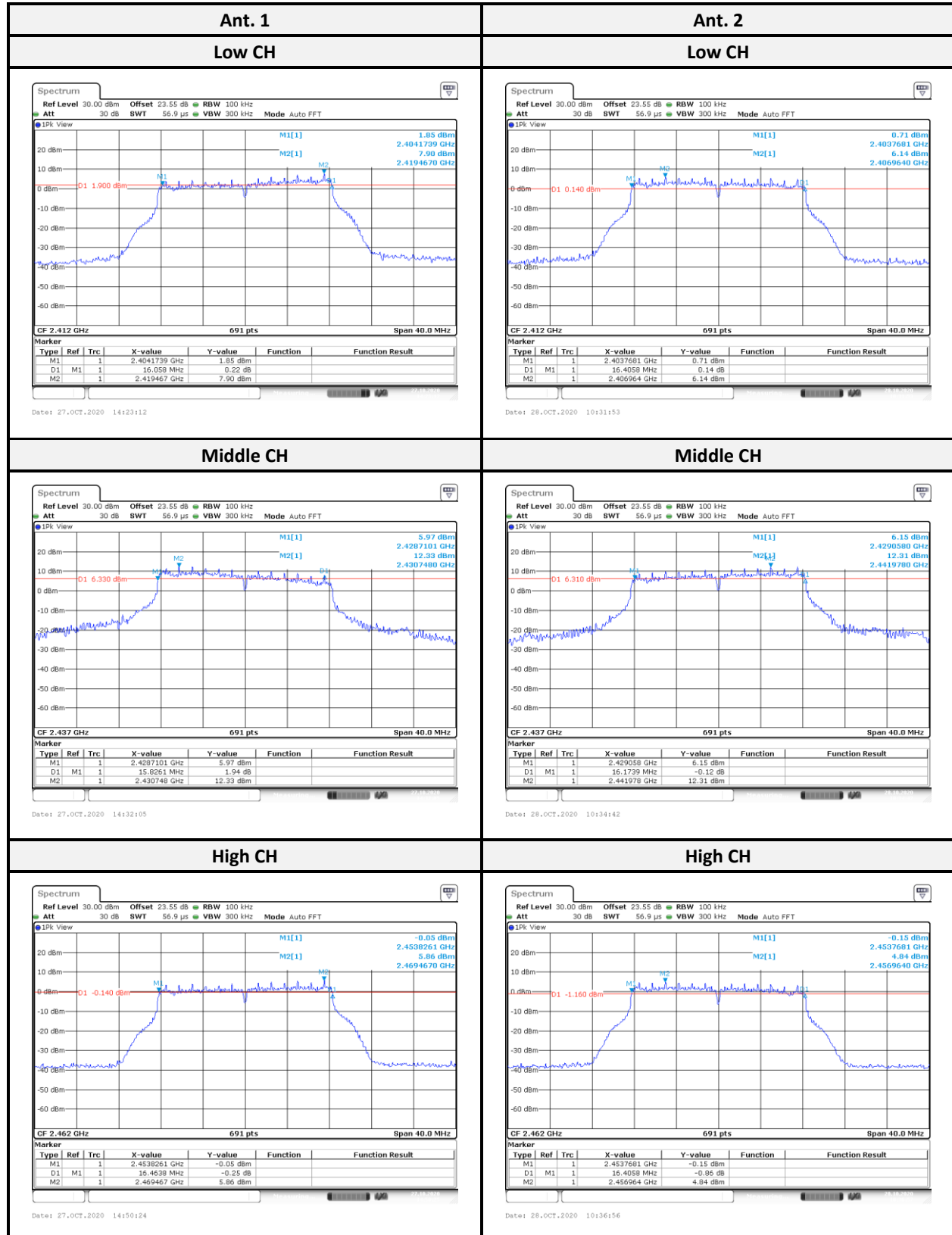
Channel	Frequency (MHz)	6 dB BW (MHz)			6dB Limit (MHz)	Result
		Ant. 1	Ant. 2	Ant. 3		
<b>802.11b mode</b>						
Low	2412	7.54	7.07	7.07	> 0.5	Compliance
Middle	2437	7.54	7.54	7.54	> 0.5	Compliance
High	2462	7.54	7.54	7.07	> 0.5	Compliance
<b>802.11g mode</b>						
Low	2412	16.06	16.41	15.71	> 0.5	Compliance
Middle	2437	15.83	16.17	16.35	> 0.5	Compliance
High	2462	16.46	16.41	15.83	> 0.5	Compliance
<b>802.11ax HE20 mode</b>						
Low	2412	18.90	18.96	17.10	> 0.5	Compliance
Middle	2437	17.10	17.45	18.78	> 0.5	Compliance
High	2462	18.72	18.96	17.16	> 0.5	Compliance
<b>802.11ax HE40 mode</b>						
Low	2422	28.75	37.80	32.58	> 0.5	Compliance
Middle	2437	35.71	36.52	37.33	> 0.5	Compliance
High	2452	38.03	36.06	37.57	> 0.5	Compliance

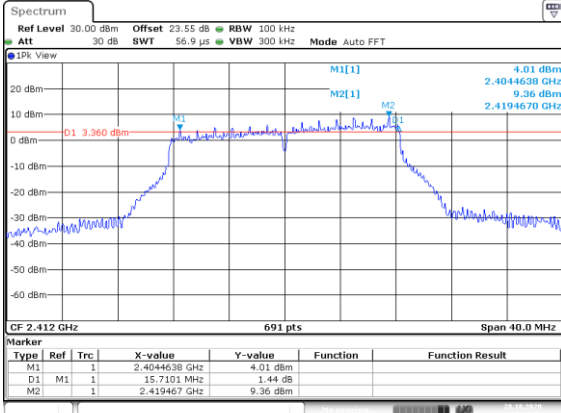
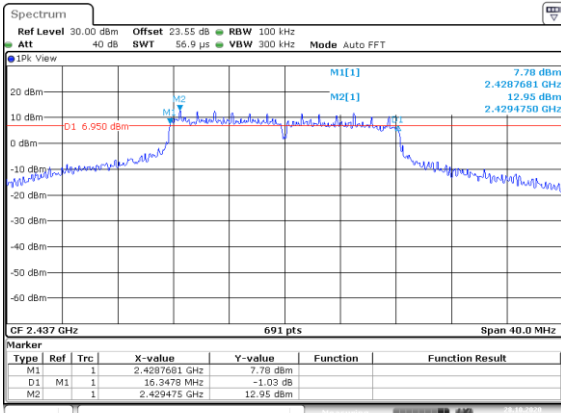
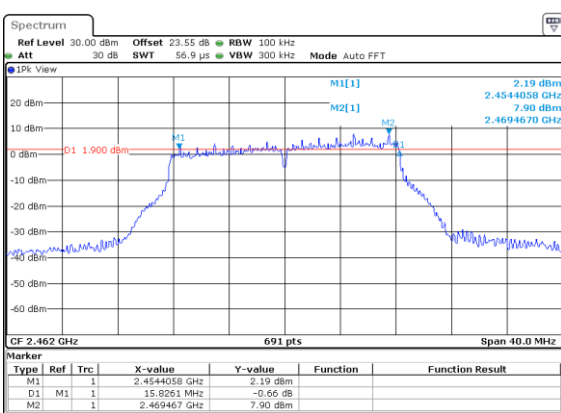
802.11b mode:



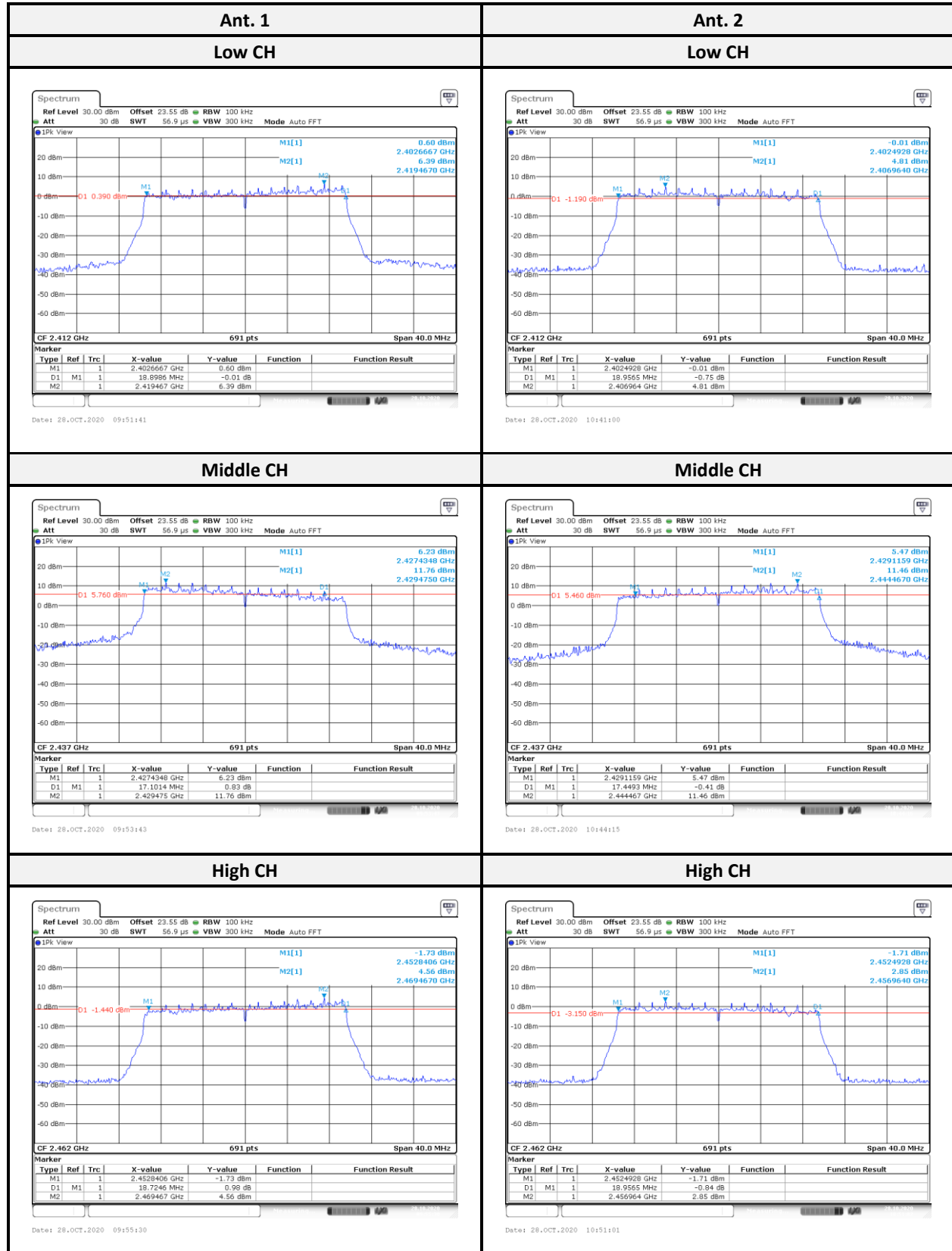
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<p style="text-align: center;"><b>Low CH</b></p>  <p>CF 2.412 GHz 691 pts Span 40.0 MHz</p> <table border="1"> <thead> <tr> <th>Marker</th> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td></td> <td>2.4099275 GHz</td> <td>8.06 dBm</td> <td></td> <td></td> </tr> <tr> <td>D1</td> <td>M1</td> <td>1</td> <td></td> <td>7.0725 MHz</td> <td>0.65 dB</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td></td> <td>2.412984 GHz</td> <td>13.86 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 28.OCT.2020 11:23:35</p>	Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1			2.4099275 GHz	8.06 dBm			D1	M1	1		7.0725 MHz	0.65 dB			M2	1			2.412984 GHz	13.86 dBm			-
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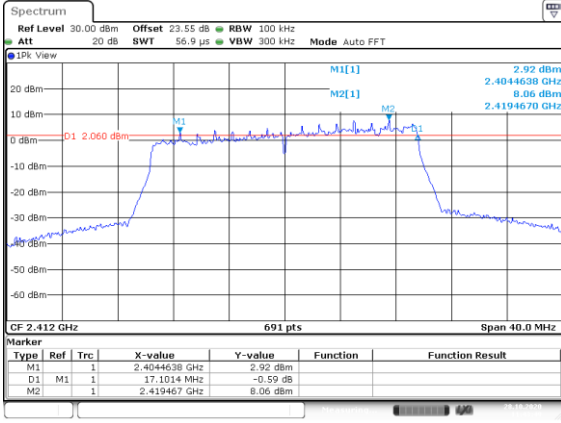
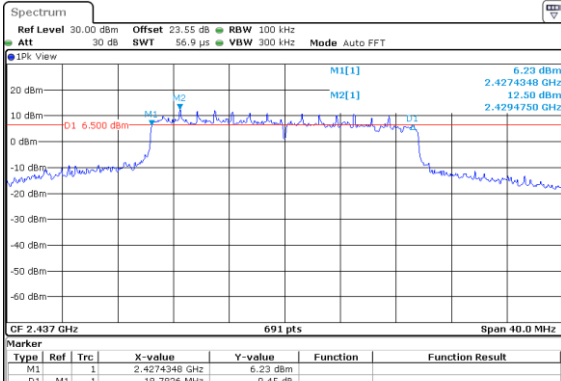
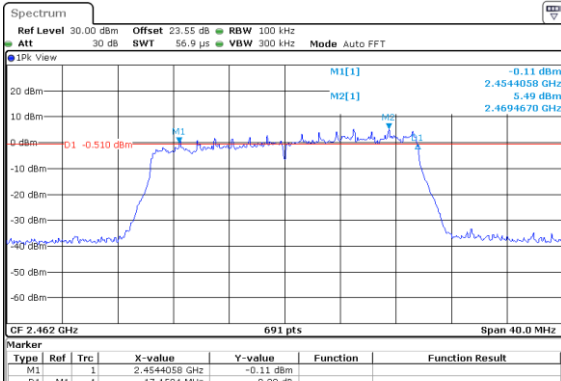
802.11g mode:



Ant. 3	-																																
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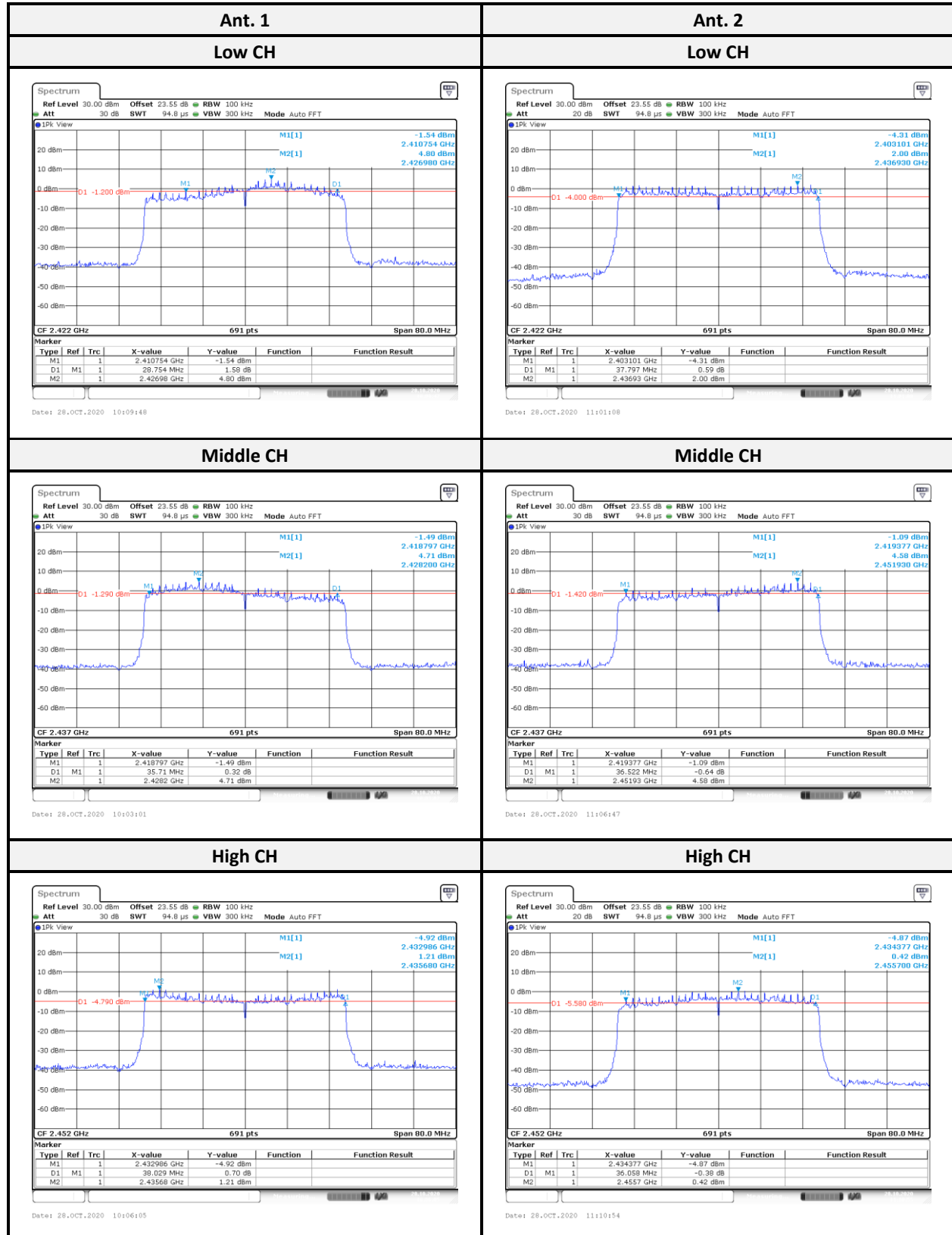
802.11ax HE20 mode:

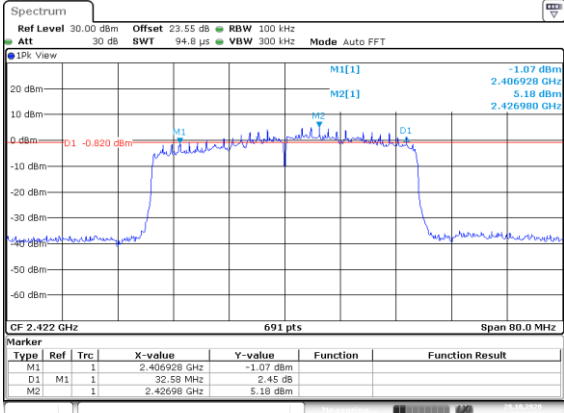
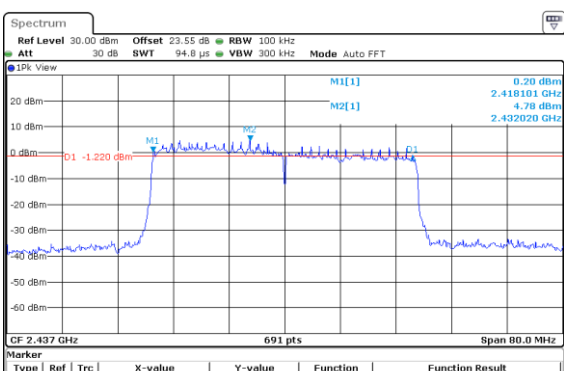
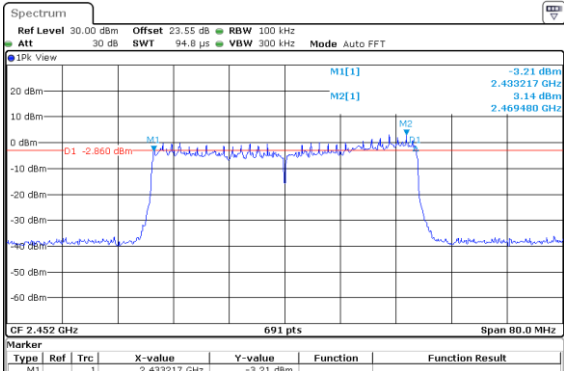


Ant. 3	-
<p style="text-align: center;"><b>Low CH</b></p>  <p style="text-align: center;">Date: 28.OCT.2020 11:43:50</p>	-
<p style="text-align: center;"><b>Middle CH</b></p>  <p style="text-align: center;">Date: 28.OCT.2020 11:46:17</p>	-
<p style="text-align: center;"><b>High CH</b></p>  <p style="text-align: center;">Date: 28.OCT.2020 11:48:04</p>	-



802.11ax HE40 mode:



Ant. 3	-																																
<p align="center"><b>Low CH</b></p>	-																																
 <p><b>Spectrum</b>          Ref Level 30.00 dBm Offset 23.55 dB RBW 100 kHz          Att 30 dB SWT 94.8 μs VBW 300 kHz Mode Auto FFT</p> <p>CF 2.422 GHz 691 pts Span 80.0 MHz</p> <table border="1"> <thead> <tr> <th>Marker</th> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td></td> <td>2.406928 GHz</td> <td>-1.07 dBm</td> <td></td> <td></td> </tr> <tr> <td>D1</td> <td>M1</td> <td>1</td> <td></td> <td>30.58 MHz</td> <td>-2.45 dB</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td></td> <td>2.42698 GHz</td> <td>5.18 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 28.OCT.2020 13:22:17</p>	Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1			2.406928 GHz	-1.07 dBm			D1	M1	1		30.58 MHz	-2.45 dB			M2	1			2.42698 GHz	5.18 dBm			-
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Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result																										
M1	1			2.418101 GHz	0.20 dBm																												
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## 9 FCC §15.247(b) (3) – Maximum Output Power

### 9.1 Applicable Standard

According to FCC §15.247(b) (3),

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz 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.

### 9.2 Test Procedure

- (1) Place the EUT on a bench and set it in transmitting mode.
- (2) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to measuring equipment.
- (3). Add a correction factor to the display.

### 9.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room(TH-02)</b>					
USB Wideband Power Sensor	Agilent	U2021XA	MY52500008	2020/01/06	2021/01/05
Cable	MTJ	MT40S	620620-MT40S-100	Each use	-

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

**9.4 Test Results**

Channel	Frequency (MHz)	Maximum Peak Output Power (dBm)				Maximum Peak Output Power (W)	Limit (dBm)	Result
		Ant. 1	Ant. 2	Ant. 3	Sum			
<b>802.11b mode</b>								
Low	2412	21.73	21.62	21.84	26.50	0.4467	30	Compliance
Middle	2437	22.01	22.83	22.26	27.15	0.5188	30	Compliance
High	2462	21.78	22.54	22.39	27.02	0.5035	30	Compliance
<b>802.11g mode</b>								
Low	2412	18.42	18.15	19.58	23.53	0.2254	30	Compliance
Middle	2437	23.08	22.54	23.91	27.98	0.6281	30	Compliance
High	2462	17.21	16.84	18.59	22.39	0.1734	30	Compliance
<b>802.11n HT20 mode</b>								
Low	2412	17.22	16.68	18.16	22.17	0.1648	30	Compliance
Middle	2437	22.15	22.36	22.98	27.28	0.5346	30	Compliance
High	2462	15.26	14.58	16.21	20.17	0.1040	30	Compliance
<b>802.11n HT40 mode</b>								
Low	2422	17.02	16.23	18.16	21.98	0.1578	30	Compliance
Middle	2437	17.65	17.51	18.94	22.85	0.1928	30	Compliance
High	2452	14.88	14.37	15.89	19.86	0.0968	30	Compliance
<b>802.11ax HE20 mode</b>								
Low	2412	17.41	16.88	18.45	22.40	0.1738	30	Compliance
Middle	2437	22.33	22.54	23.22	27.48	0.5598	30	Compliance
High	2462	15.48	14.76	16.43	20.38	0.1091	30	Compliance
<b>802.11ax HE40 mode</b>								
Low	2422	17.15	16.58	18.38	22.21	0.1663	30	Compliance
Middle	2437	17.85	17.71	19.11	23.04	0.2014	30	Compliance
High	2452	15.05	14.51	16.04	20.02	0.1005	30	Compliance

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## 10 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

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### 10.1 Applicable Standard

According to FCC §15.247(d),

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### 10.2 Test Procedure

- (1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- (2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- (3) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- (4) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

**10.3 Test Equipment List and Details**

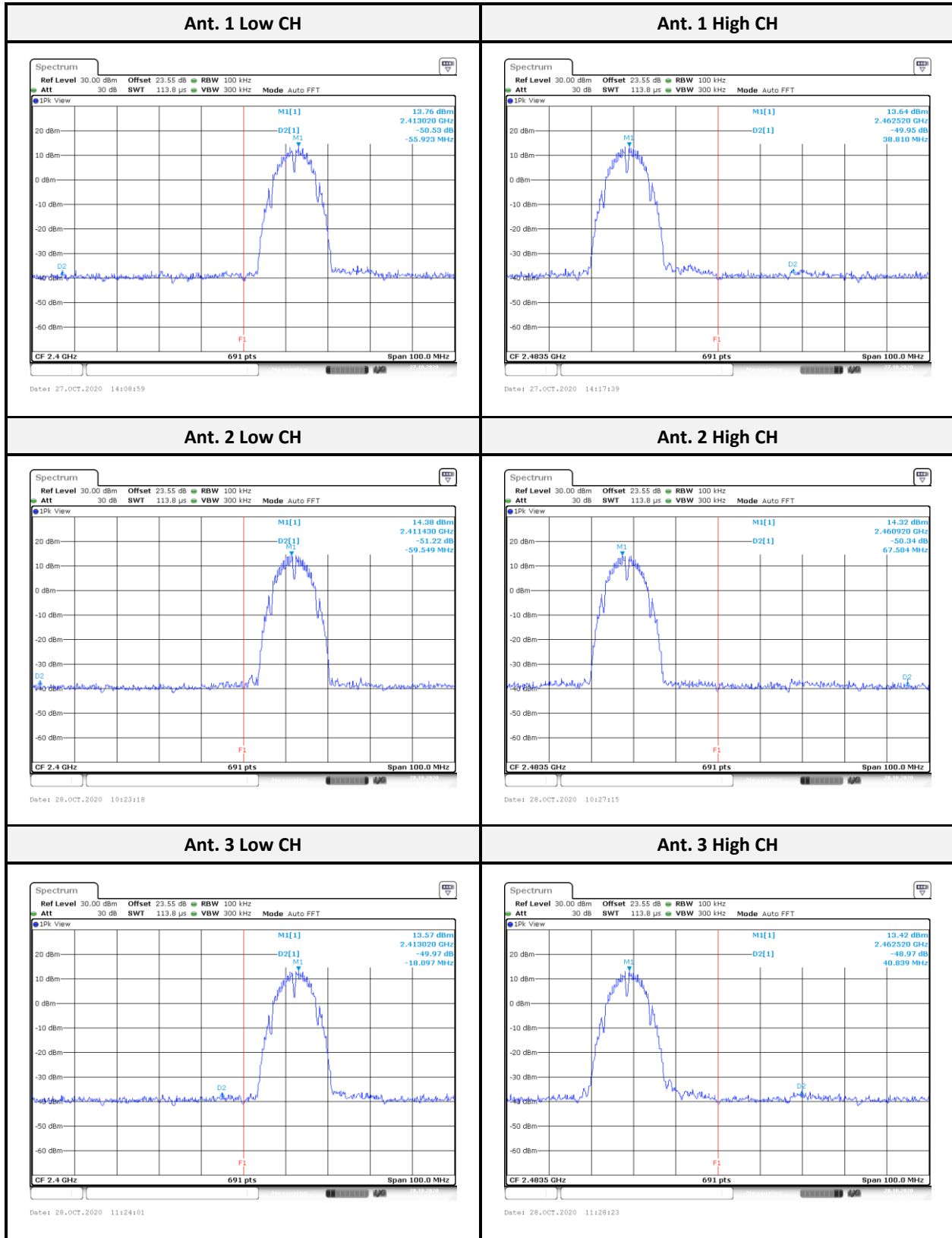
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room(TH-02)</b>					
Spectrum Analyzer	Rohde & Schwarz	FSU26	100406	2020/03/11	2021/03/10
Cable	MTJ	MT40S	620620-MT40S-100	Each use	-

*\*Statement of Traceability: The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

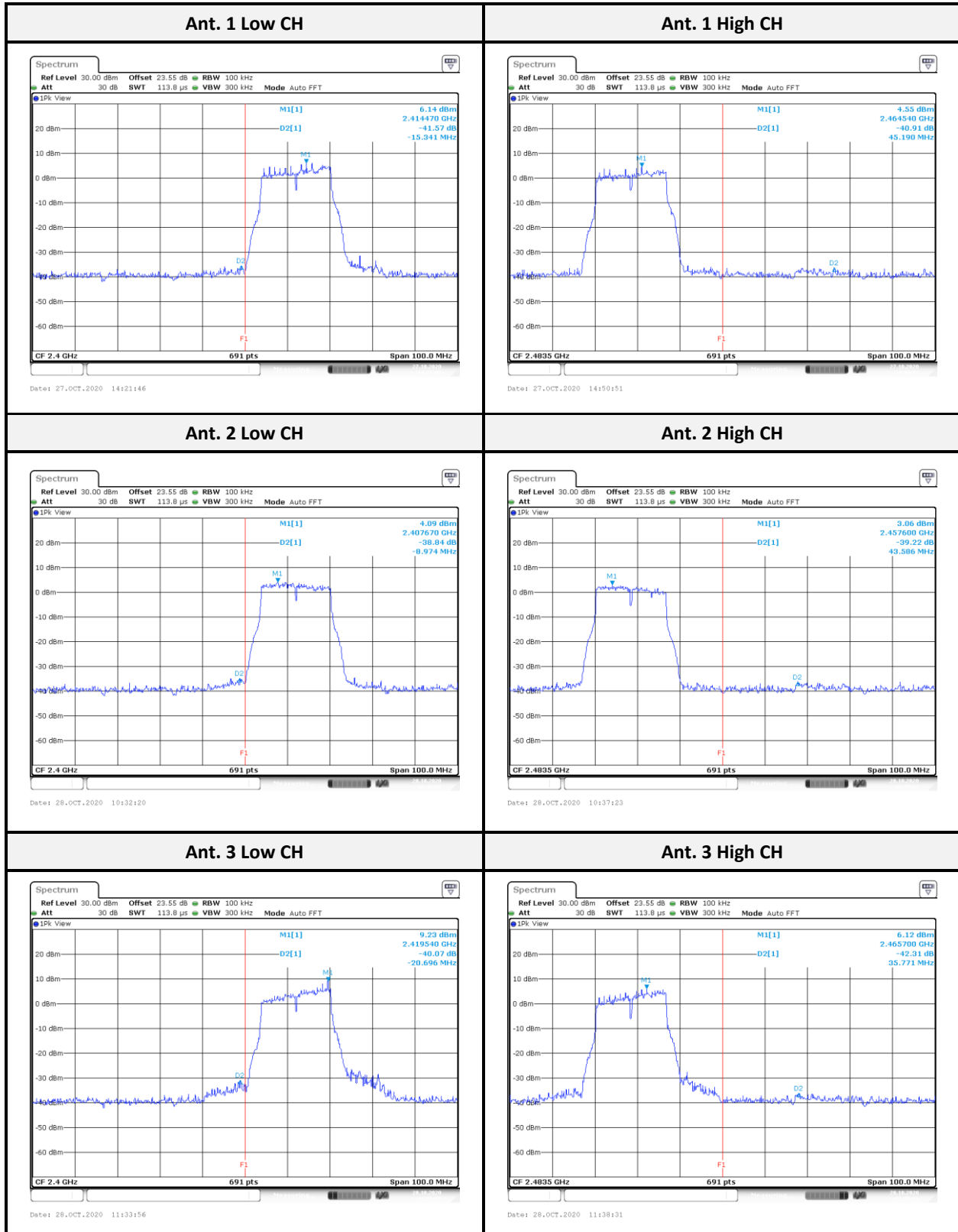
**10.4 Test Results**

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)			Limit (dBc)	Result
		Ant. 1	Ant. 2	Ant. 3		
<b>802.11b mode</b>						
Low	2412	50.53	51.22	49.97	≥ 20	Compliance
High	2462	49.95	50.34	48.97	≥ 20	Compliance
<b>802.11g mode</b>						
Low	2412	41.57	38.84	40.07	≥ 20	Compliance
High	2462	40.91	39.22	42.31	≥ 20	Compliance
<b>802.11ax HE20 mode</b>						
Low	2412	39.76	38.43	40.81	≥ 20	Compliance
High	2462	39.55	38.5	41.1	≥ 20	Compliance
<b>802.11ax HE40 mode</b>						
Low	2422	41.29	38.03	40.56	≥ 20	Compliance
High	2452	46.15	45.6	38.42	≥ 20	Compliance

802.11b mode:

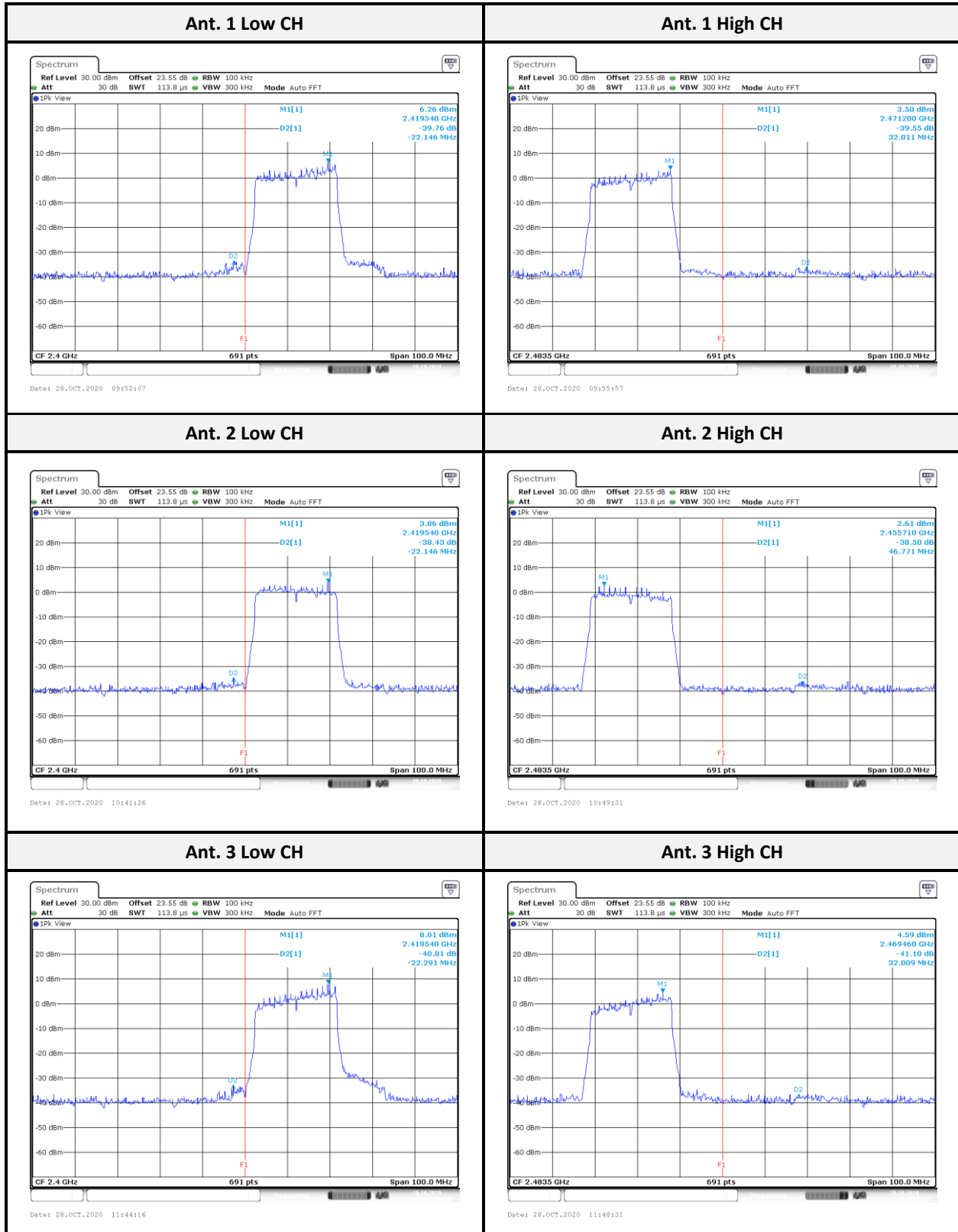


802.11g mode:

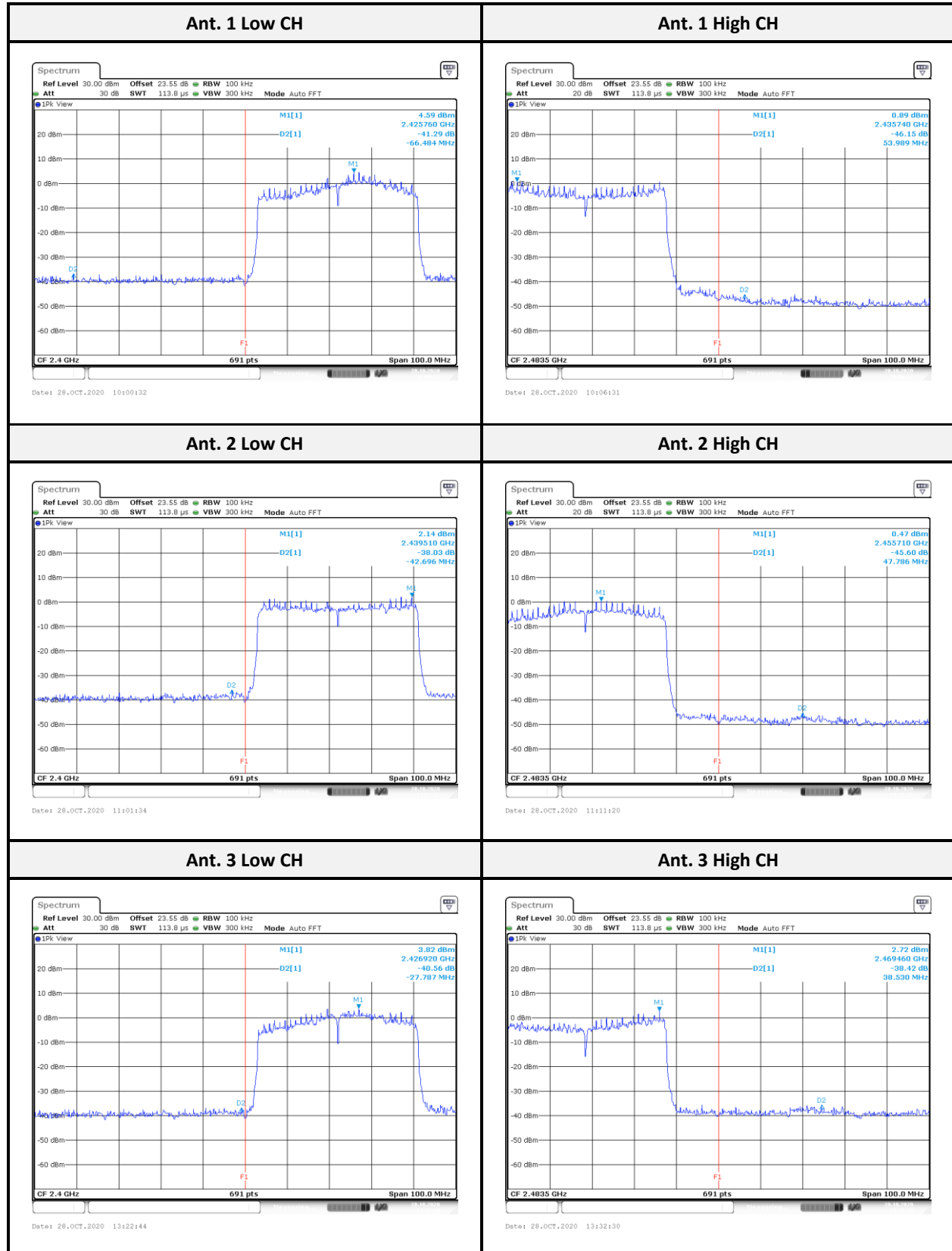




802.11ax HE20 mode:



802.11ax HE40 mode:



## 11 FCC §15.247(e) – Power Spectral Density

### 11.1 Applicable Standard

According to FCC §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 dBm in any 3 kHz 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.

### 11.2 Test Procedure

According to ANSI C63.10-2013,

- (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  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- (4) Set the VBW  $\geq [3 \times \text{RBW}]$ . (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 kHz) and repeat.

### 11.3 Test Equipment List and Details

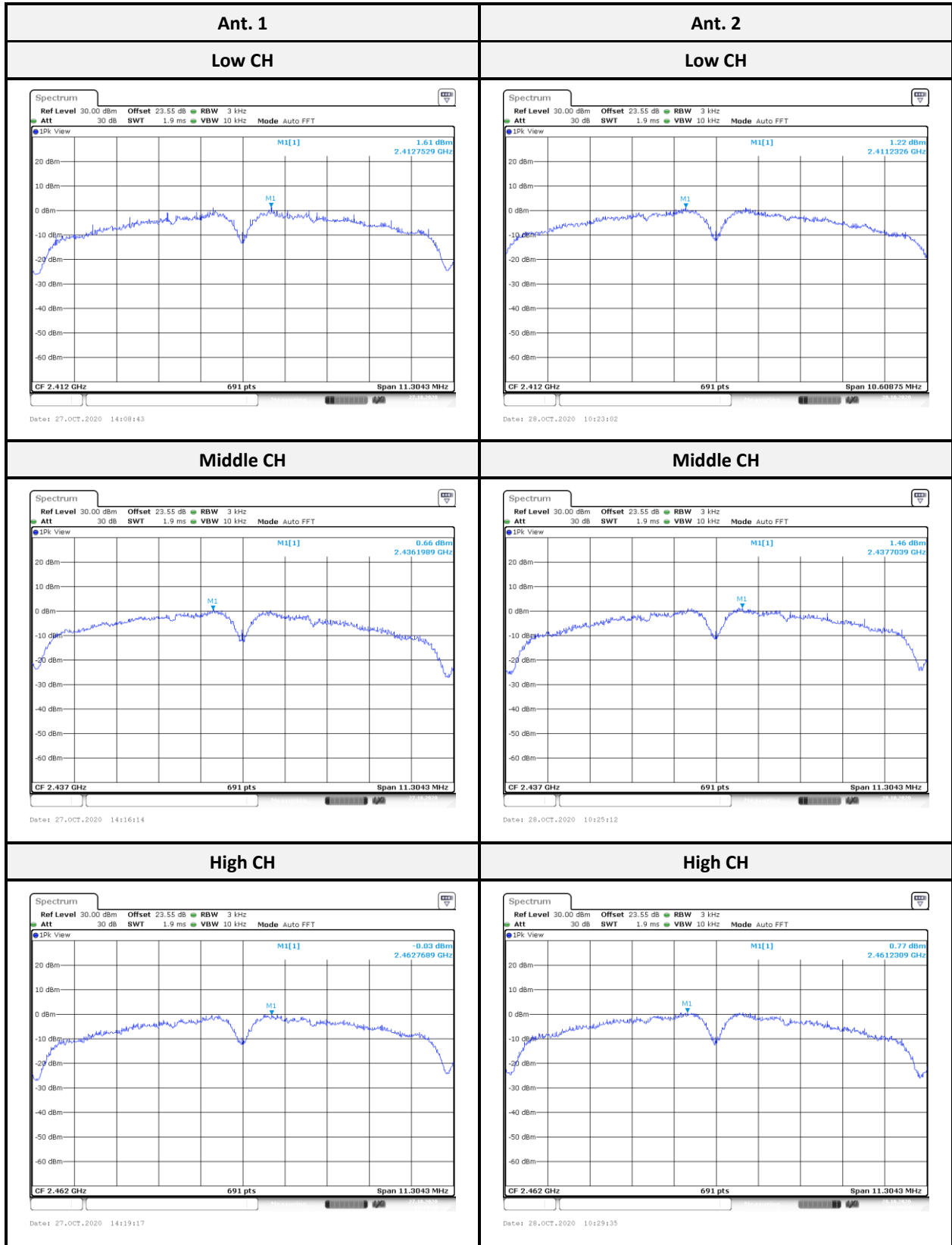
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
<b>Conducted Room(TH-02)</b>					
Spectrum Analyzer	Rohde & Schwarz	FSU26	100406	2020/03/11	2021/03/10
Cable	MTJ	MT40S	620620-MT40S-100	Each use	-

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

**11.4 Test Results**

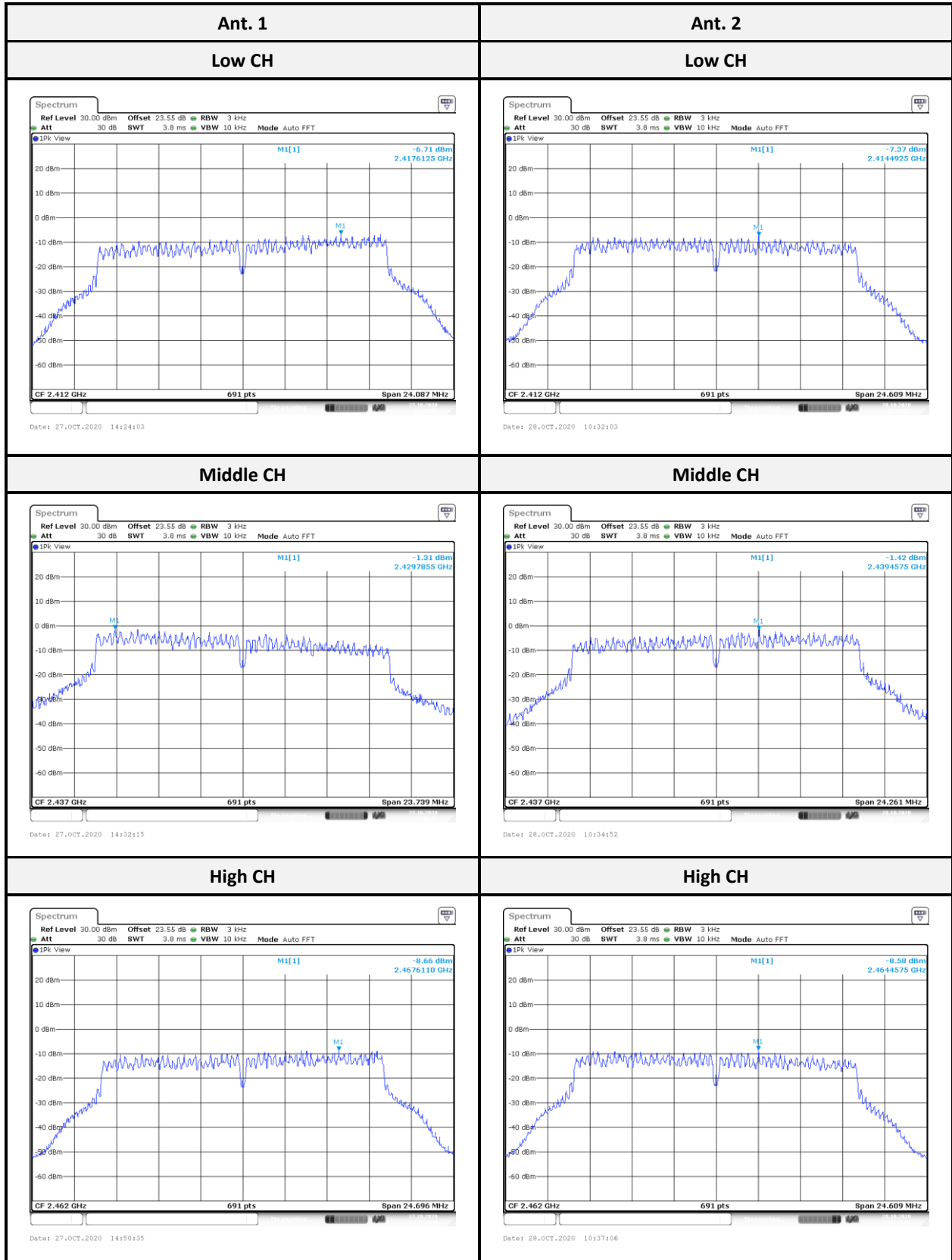
Channel	Frequency (MHz)	PSD (dBm/3 kHz)				Limit (dBm/3 kHz)	Result
		Ant. 1	Ant. 2	Ant. 3	Sum.		
<b>802.11b mode</b>							
Low	2412	1.76	1.37	1.43	6.29	8	Compliance
Middle	2437	0.81	1.61	0.89	5.89	8	Compliance
High	2462	0.12	0.92	1.52	5.66	8	Compliance
<b>802.11g mode</b>							
Low	2412	-6.55	-7.21	-4.62	-1.21	8	Compliance
Middle	2437	-1.15	-1.26	-1.66	3.42	8	Compliance
High	2462	-8.50	-8.42	-5.93	-2.67	8	Compliance
<b>802.11ax HE20 mode</b>							
Low	2412	-7.68	-7.49	-7.05	-2.62	8	Compliance
Middle	2437	-0.97	-3.17	-0.58	3.34	8	Compliance
High	2462	-10.23	-9.15	-9.64	-4.88	8	Compliance
<b>802.11ax HE40 mode</b>							
Low	2422	-11.06	-12.42	-9.68	-6.14	8	Compliance
Middle	2437	-9.93	-10.63	-9.41	-5.19	8	Compliance
High	2452	-12.82	-13.55	-12.82	-8.28	8	Compliance

802.11b mode:



<p style="text-align: center;"><b>Ant. 3</b></p>	<p style="text-align: center;">-</p>
<p style="text-align: center;"><b>Low CH</b></p>	<p style="text-align: center;">-</p>
	<p style="text-align: center;">-</p>
<p style="text-align: center;"><b>Middle CH</b></p>	<p style="text-align: center;">-</p>
	<p style="text-align: center;">-</p>
<p style="text-align: center;"><b>High CH</b></p>	<p style="text-align: center;">-</p>
	<p style="text-align: center;">-</p>

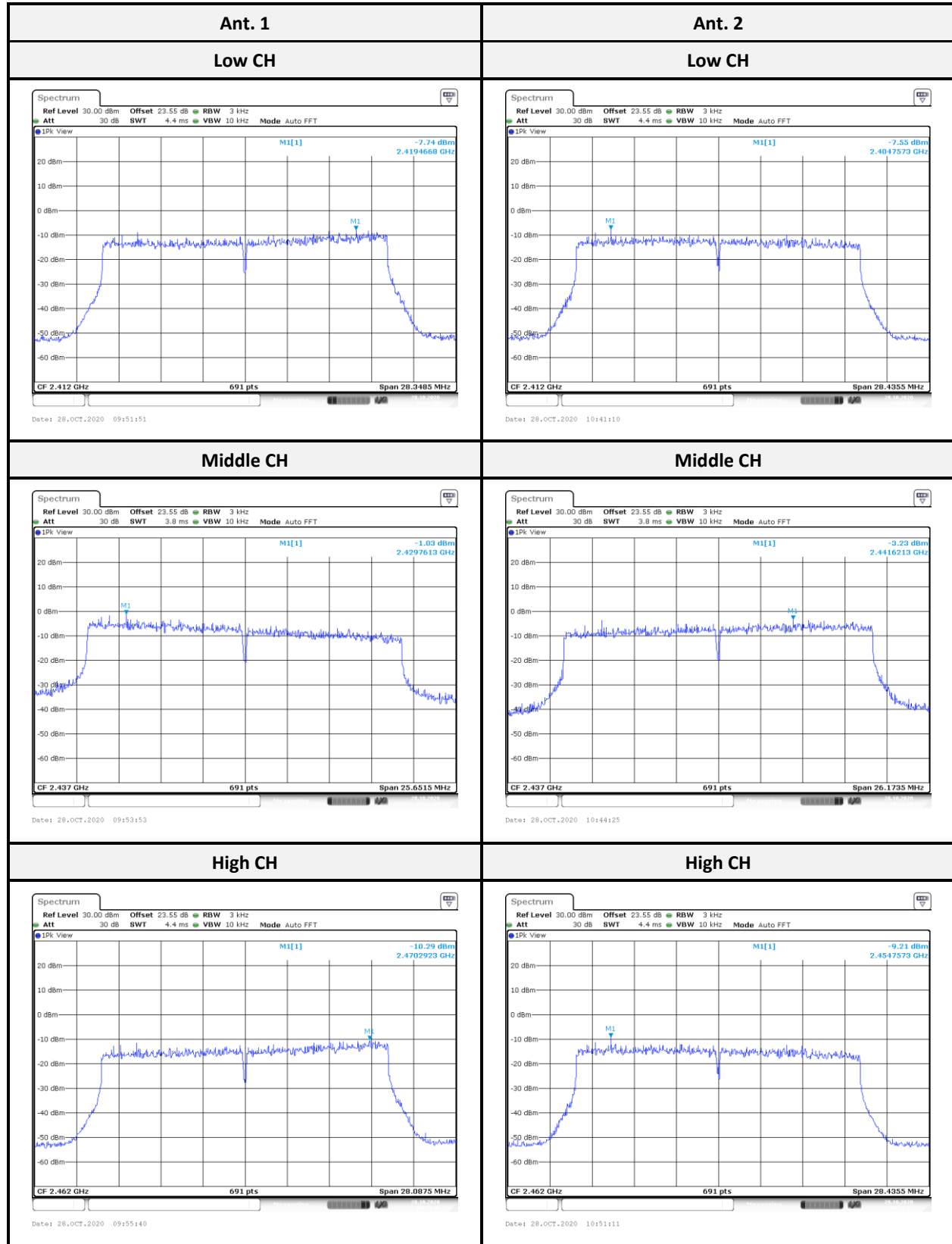
802.11g mode:



<b>Ant. 3</b>	-
<b>Low CH</b>	-
<p>Spectrum          Ref Level 30.00 dBm Offset 23.55 dB RBW 3 kHz          Att 30 dB SWT 3.8 ms VBW 10 kHz Mode Auto FFT          1Pk View          MI[1] -4.78 dBm          2.414895 GHz          CF 2.412 GHz 691 pts Span 23.565 MHz          Date: 28.OCT.2020 11:33:40</p>	-
<b>Middle CH</b>	-
<p>Spectrum          Ref Level 30.00 dBm Offset 23.55 dB RBW 3 kHz          Att 40 dB SWT 3.8 ms VBW 10 kHz Mode Auto FFT          1Pk View          MI[1] -1.82 dBm          2.4394840 GHz          CF 2.437 GHz 691 pts Span 24.522 MHz          Date: 28.OCT.2020 11:36:07</p>	-
<b>High CH</b>	-
<p>Spectrum          Ref Level 30.00 dBm Offset 23.55 dB RBW 3 kHz          Att 30 dB SWT 3.8 ms VBW 10 kHz Mode Auto FFT          1Pk View          MI[1] -6.09 dBm          2.4644735 GHz          CF 2.462 GHz 691 pts Span 23.739 MHz          Date: 28.OCT.2020 11:38:15</p>	-

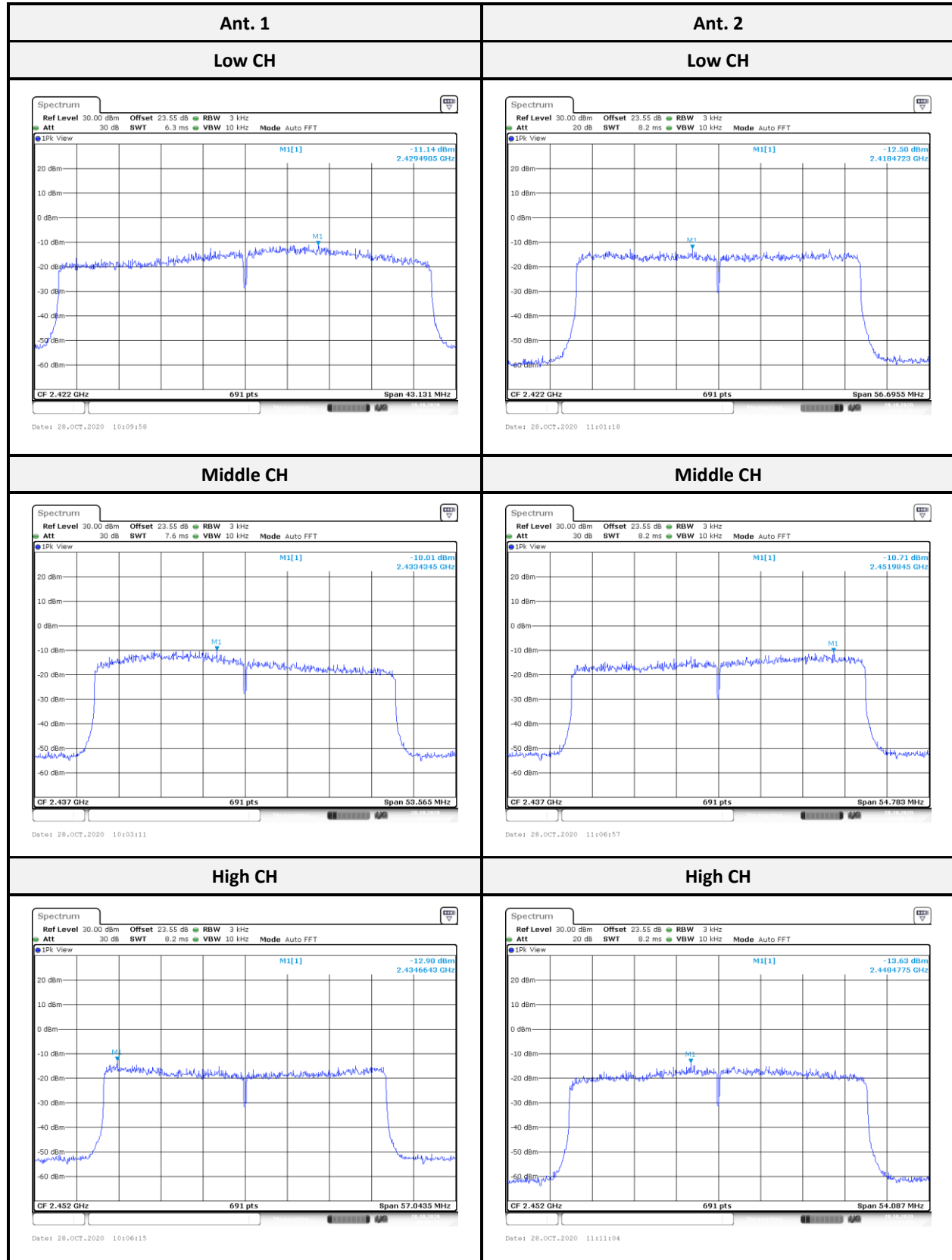


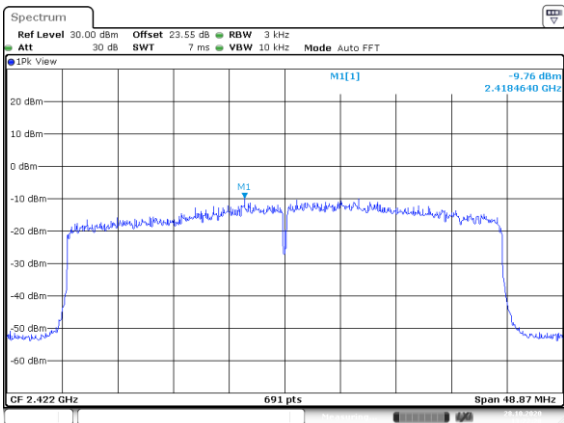
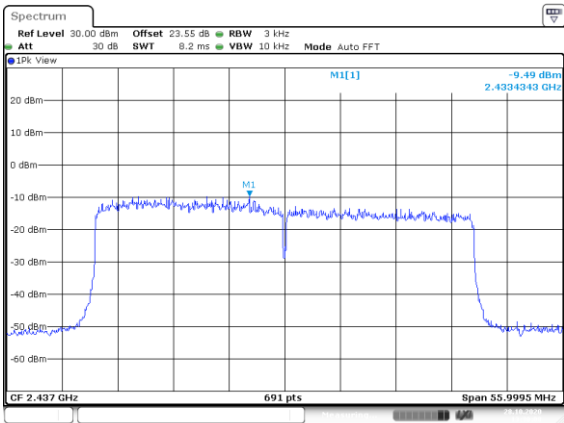
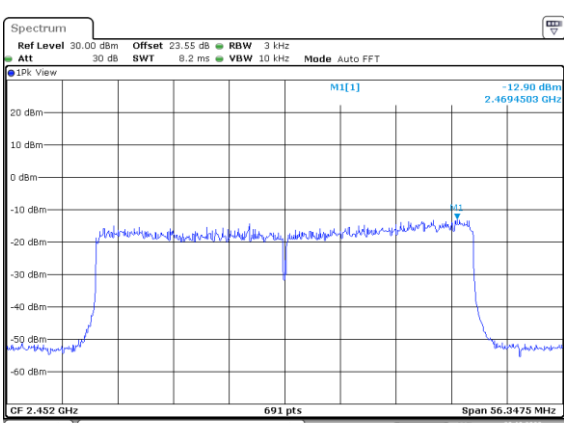
802.11ax HE20 mode:



<b>Ant. 3</b>	-
<b>Low CH</b>	-
<p>Spectrum          Ref Level 30.00 dBm Offset 23.55 dB RBW 3 kHz          Att 20 dB SWT 3.8 ms VBW 10 kHz Mode Auto FFT          1Pk View          M1[1] -7.11 dBm          2.4194613 GHz          CF 2.412 GHz 691 pts Span 25.6515 MHz          Date: 28.OCT.2020 11:44:00</p>	-
<b>Middle CH</b>	-
<p>Spectrum          Ref Level 30.00 dBm Offset 23.55 dB RBW 3 kHz          Att 30 dB SWT 4.4 ms VBW 10 kHz Mode Auto FFT          1Pk View          M1[1] -0.64 dBm          2.4297828 GHz          CF 2.437 GHz 691 pts Span 28.1745 MHz          Date: 28.OCT.2020 11:46:27</p>	-
<b>High CH</b>	-
<p>Spectrum          Ref Level 30.00 dBm Offset 23.55 dB RBW 3 kHz          Att 30 dB SWT 3.8 ms VBW 10 kHz Mode Auto FFT          1Pk View          M1[1] -9.70 dBm          2.4675868 GHz          CF 2.462 GHz 691 pts Span 25.7385 MHz          Date: 28.OCT.2020 11:48:14</p>	-

802.11ax HE40 mode:



<b>Ant. 3</b>	-
<b>Low CH</b>	-
 <p>Spectrum          Ref Level 30.00 dBm Offset 23.55 dB RBW 3 kHz          Att 30 dB SWT 7 ms VBW 10 kHz Mode Auto FFT          Lpk View          MI[1] -9.76 dBm          2.4184640 GHz          CF 2.422 GHz 691 pts Span 48.87 MHz          Date: 28.OCT.2020 13:22:27</p>	-
<b>Middle CH</b>	-
 <p>Spectrum          Ref Level 30.00 dBm Offset 23.55 dB RBW 3 kHz          Att 30 dB SWT 8.2 ms VBW 10 kHz Mode Auto FFT          Lpk View          MI[1] -9.49 dBm          2.4334343 GHz          CF 2.437 GHz 691 pts Span 55.9995 MHz          Date: 28.OCT.2020 13:30:09</p>	-
<b>High CH</b>	-
 <p>Spectrum          Ref Level 30.00 dBm Offset 23.55 dB RBW 3 kHz          Att 30 dB SWT 8.2 ms VBW 10 kHz Mode Auto FFT          Lpk View          MI[1] -12.90 dBm          2.4694503 GHz          CF 2.452 GHz 691 pts Span 56.3475 MHz          Date: 28.OCT.2020 13:32:14</p>	-

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