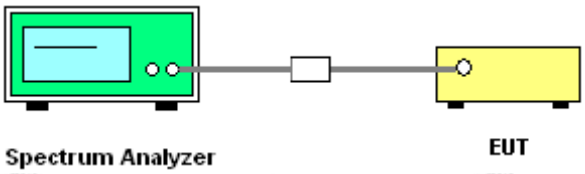
4.5. CONDUCTED BAND EDGE AND SPURIOUS EMISSION MEASUREMENT

4.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074
Limit:	In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d). 5. Measure and record the results in the test report. 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

4.5.2. Test Instruments

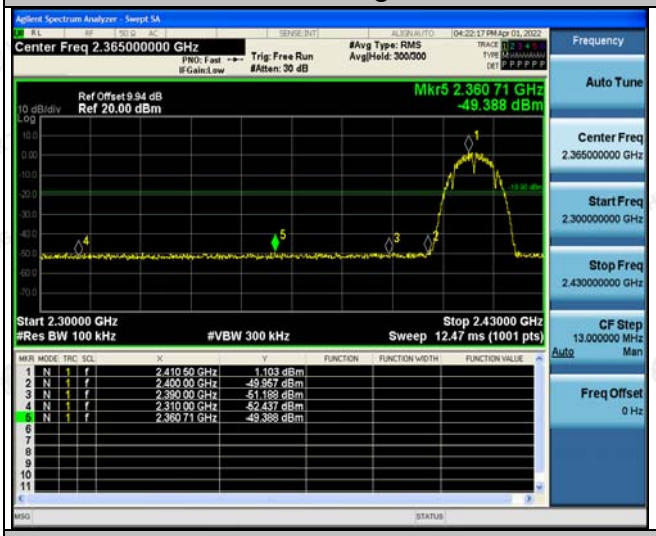
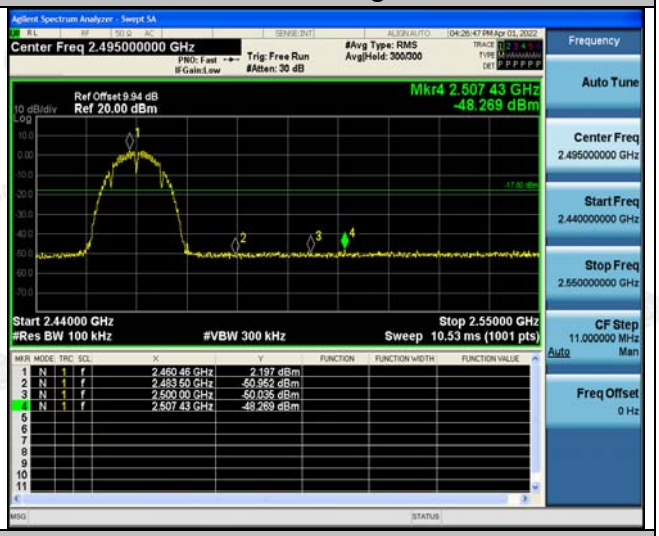
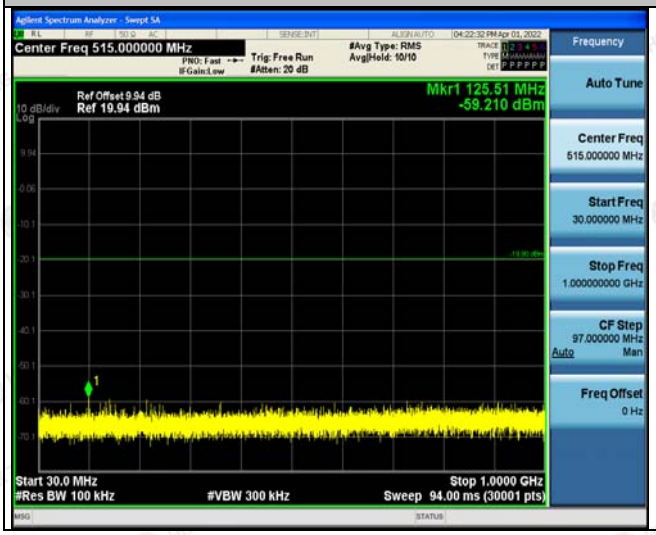
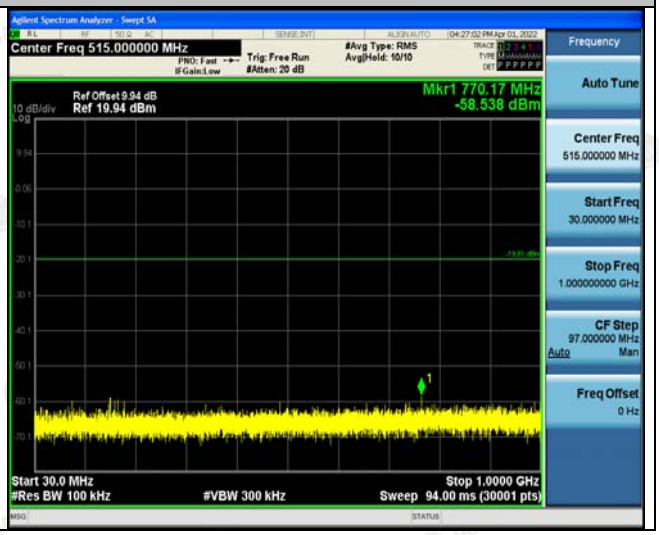
RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023
Signal generator	Agilent	N5183A	HKE-071	Feb. 17, 2023
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Feb. 17, 2023
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Feb. 17, 2023

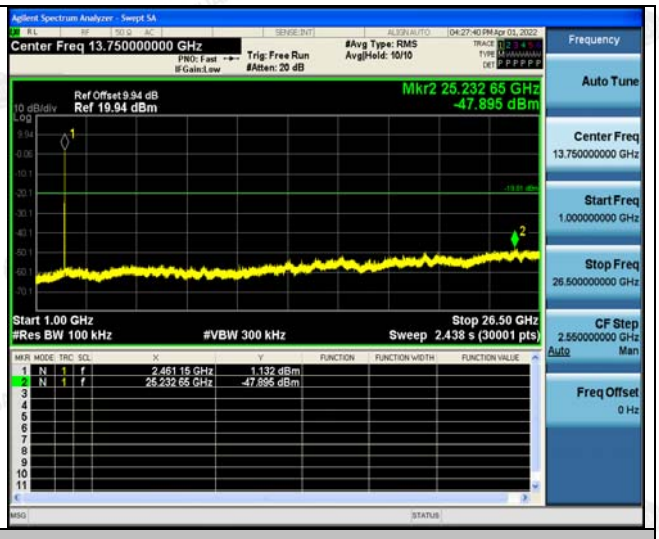
Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

4.5.3. Test Data

Chain 1

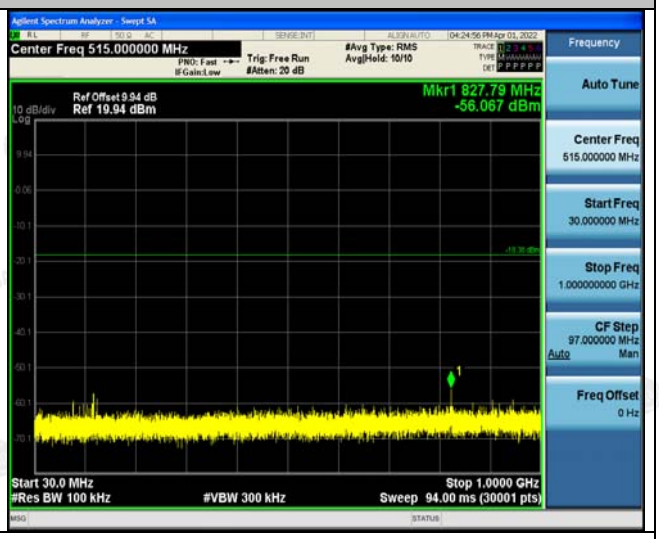
802.11b Modulation

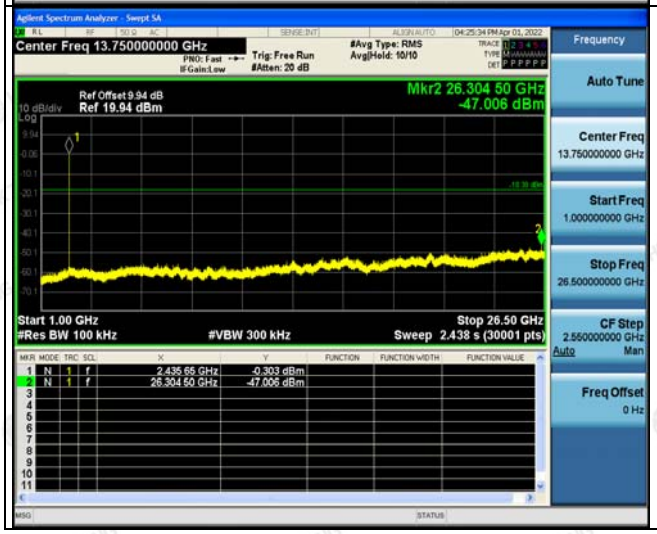
Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission	Spurious Emission
	
	



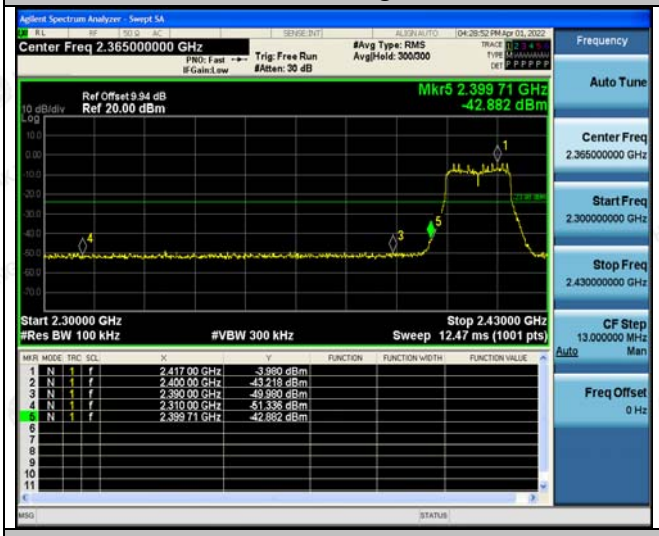
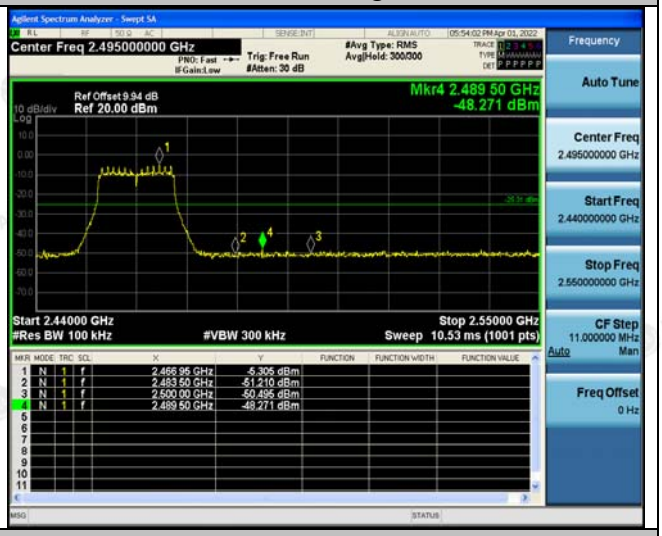
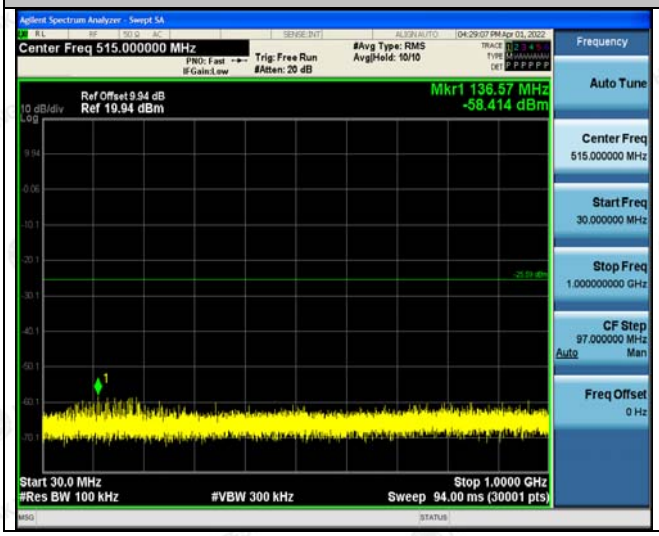
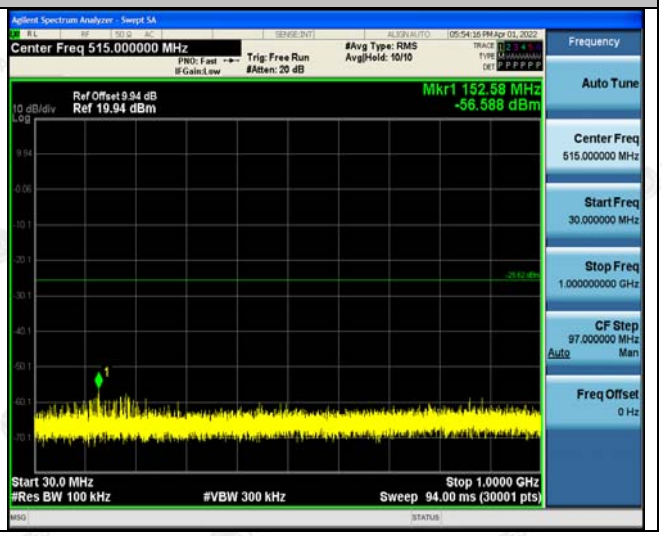
Middle Channel

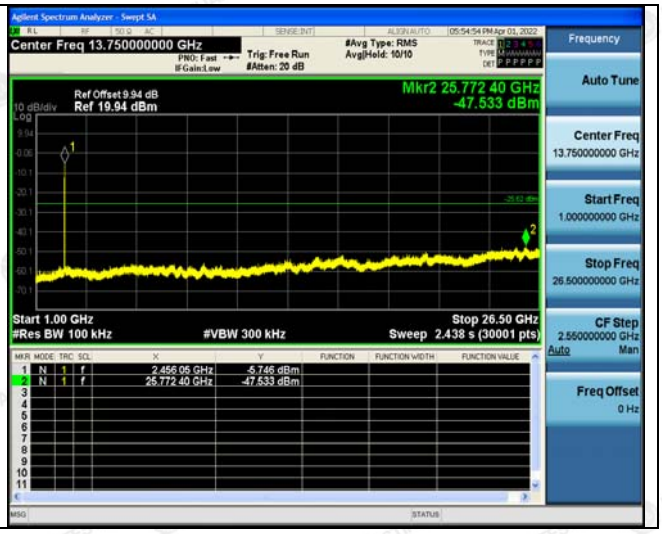
Spurious Emission



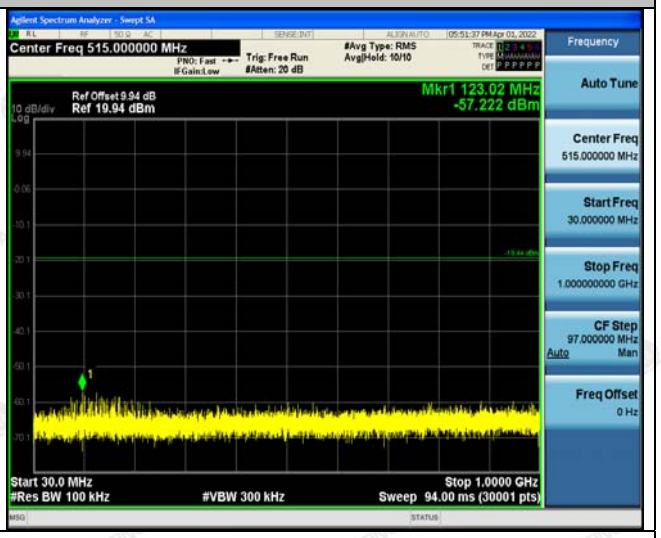


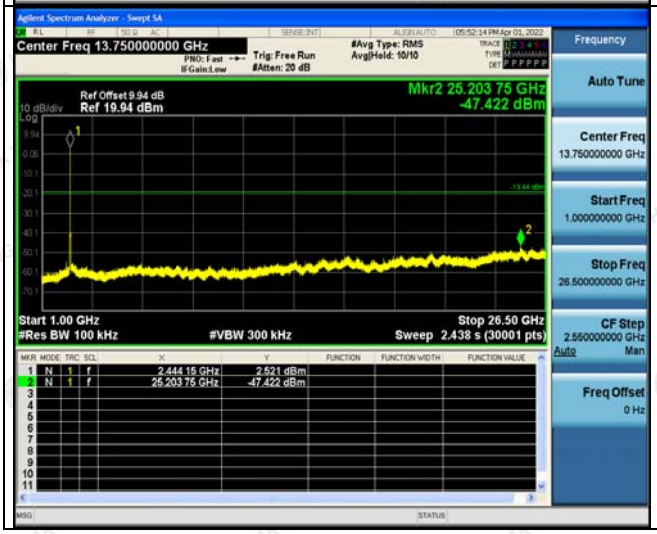
802.11g Modulation

Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission	Spurious Emission
	
	

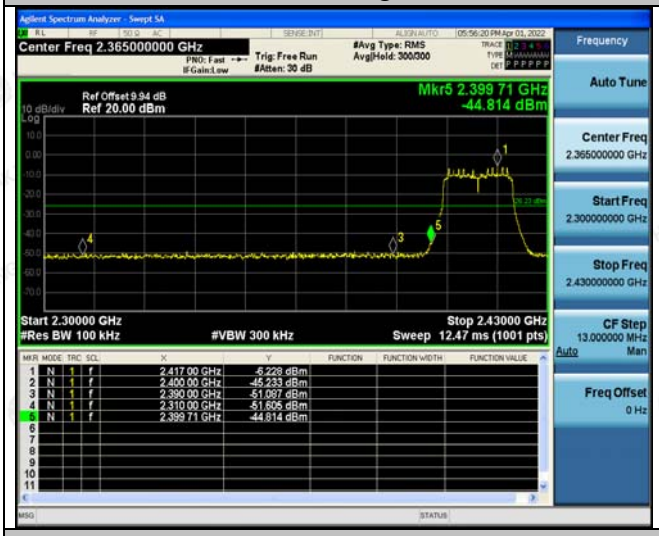
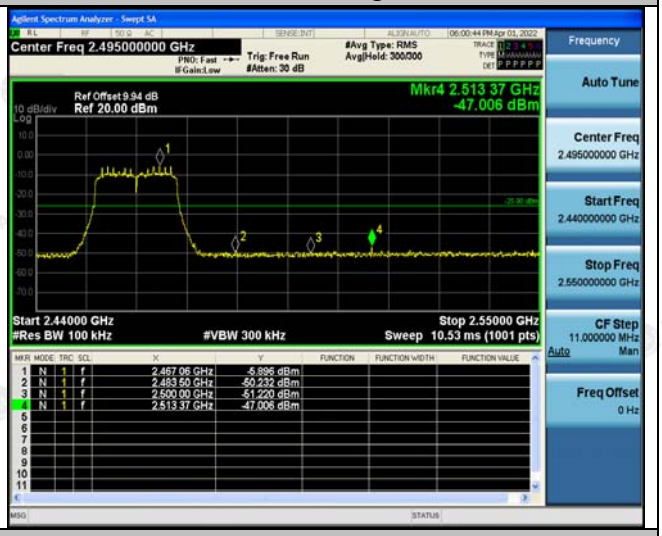
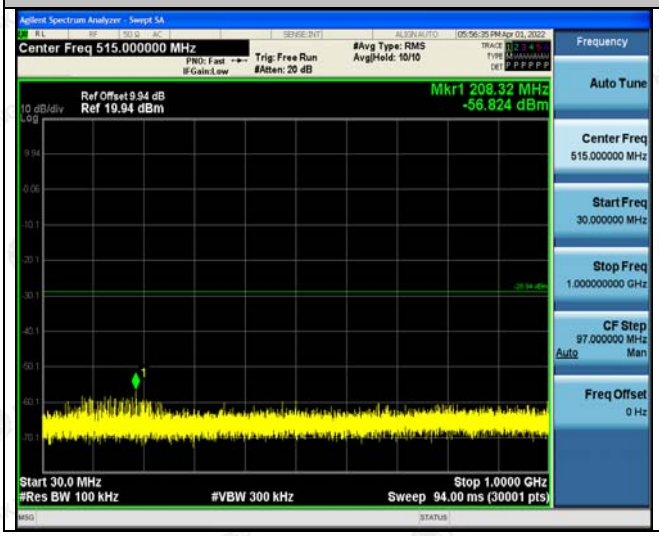
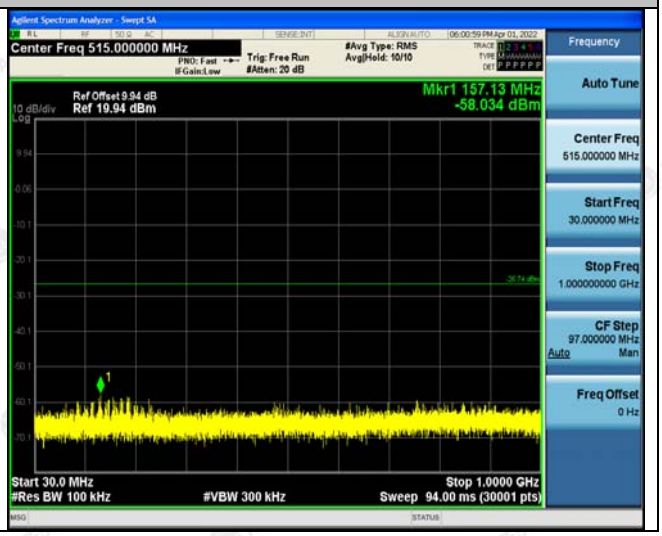


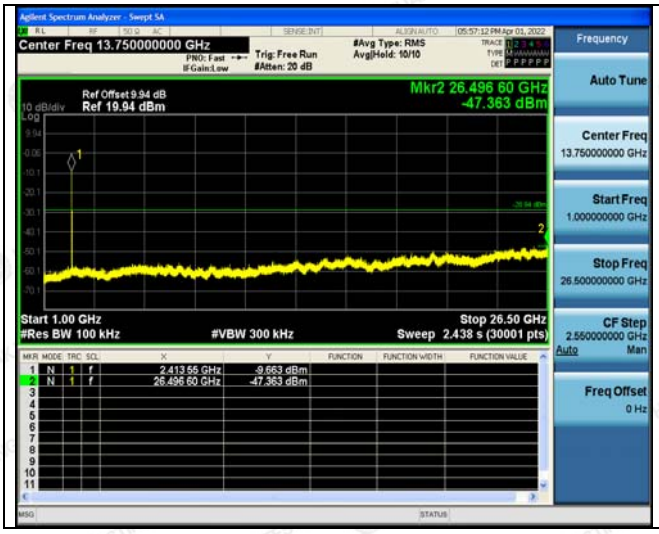
Middle Channel
Spurious Emission

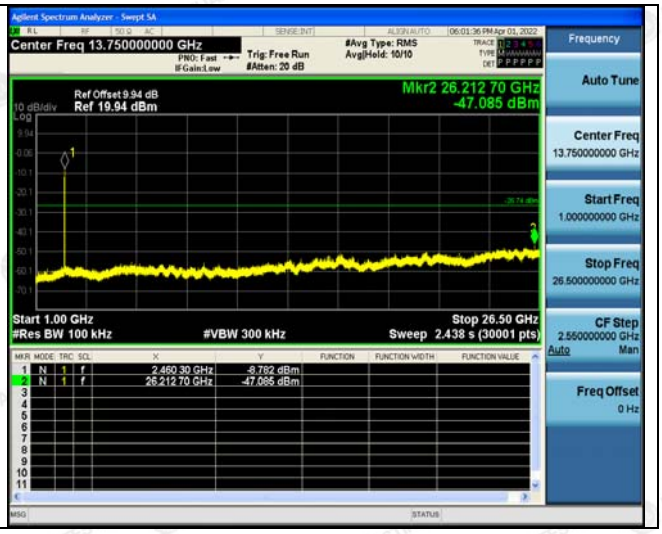




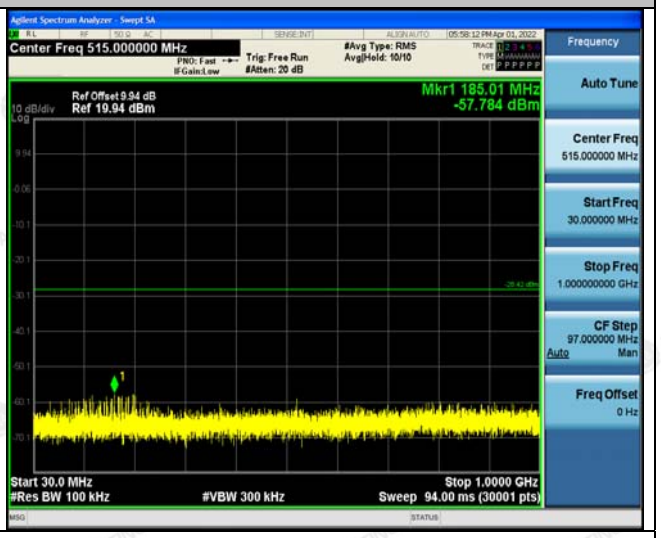
802.11n (HT20) Modulation

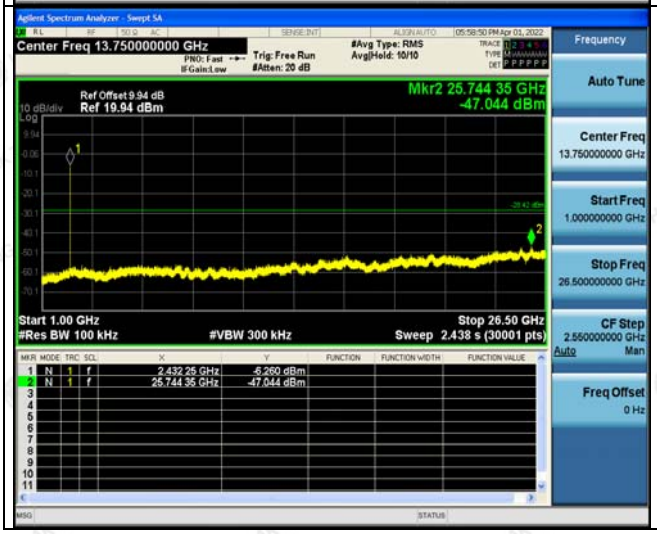
Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission	Spurious Emission
	
	



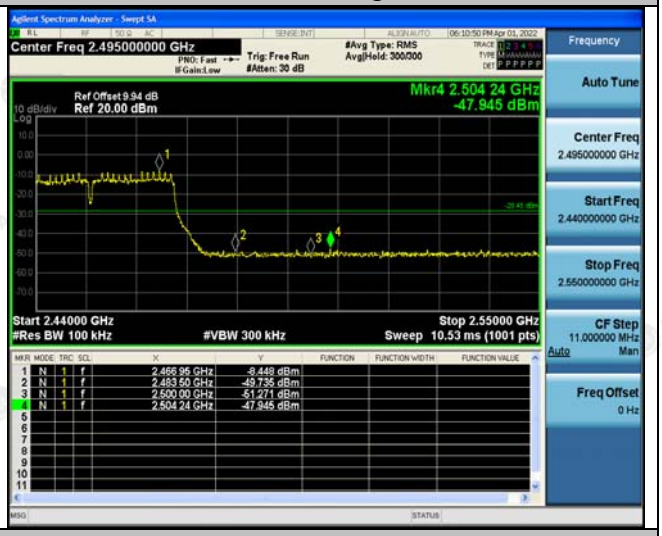
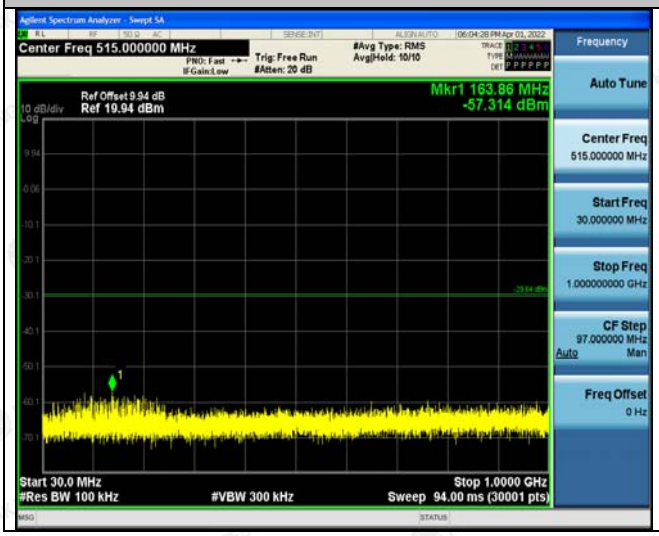
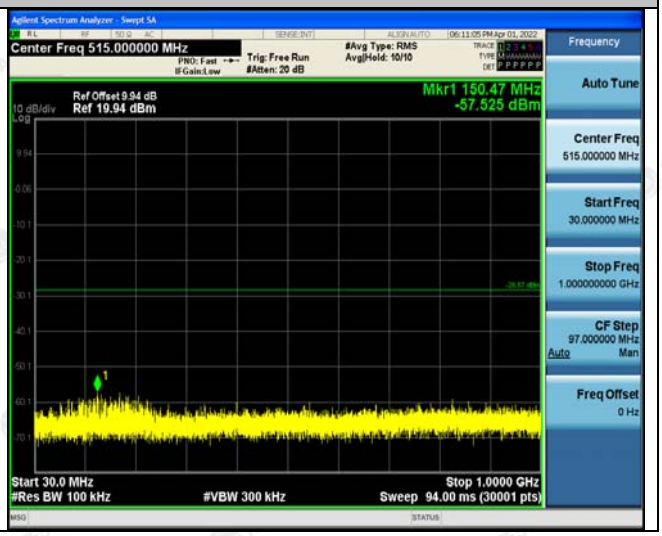


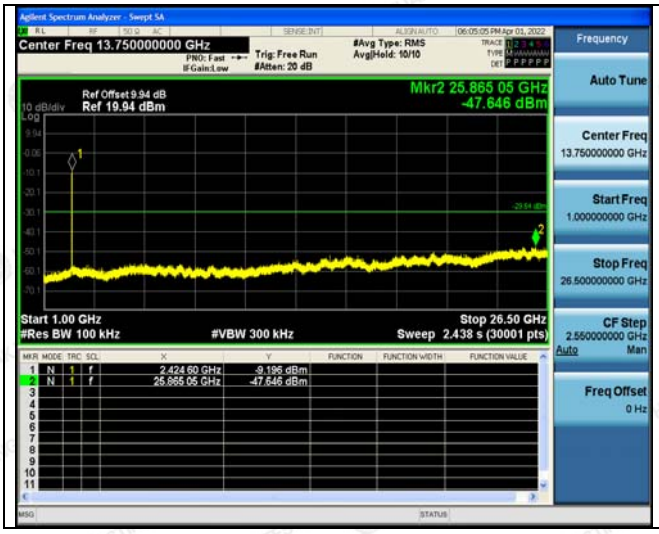
Middle Channel
Spurious Emission



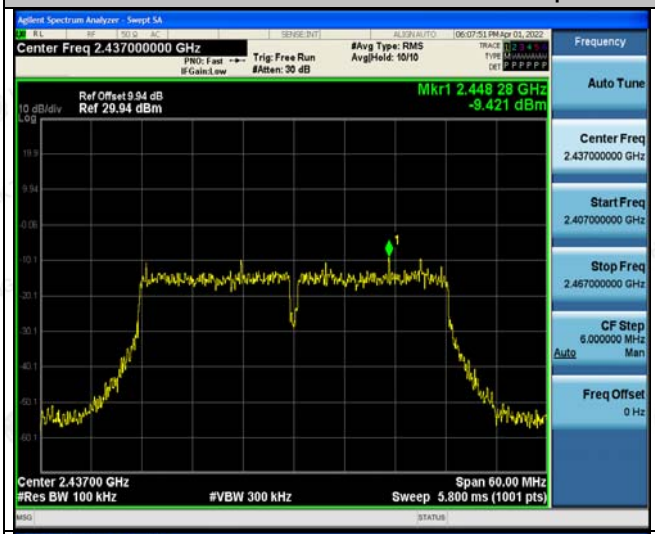


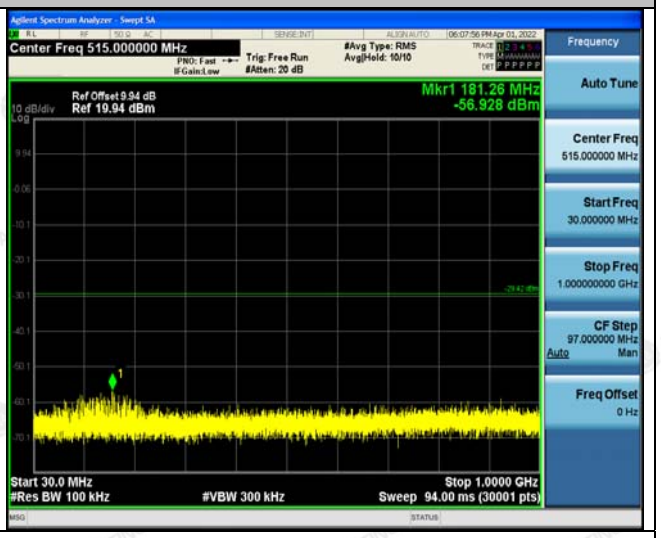
802.11n (HT40) Modulation

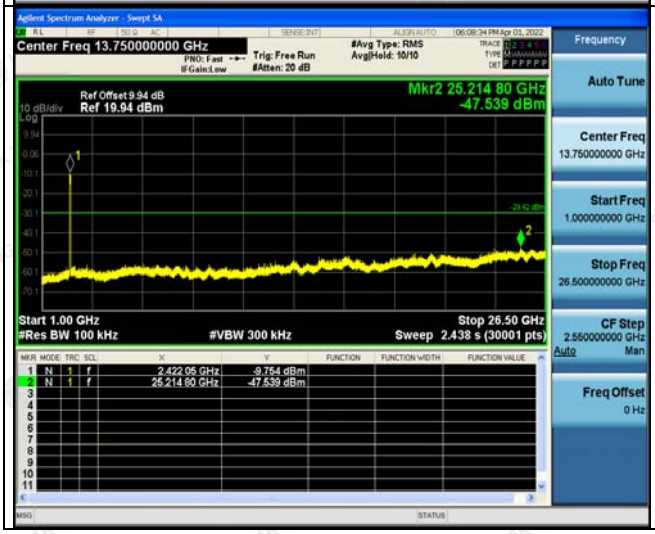
Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission	Spurious Emission
	
	



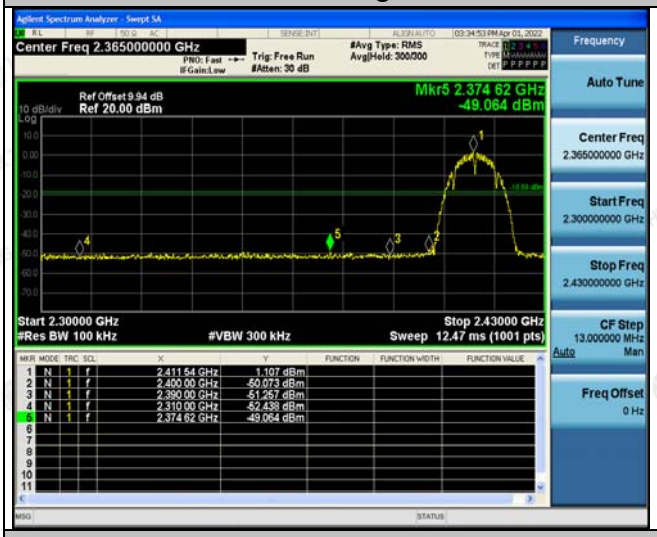
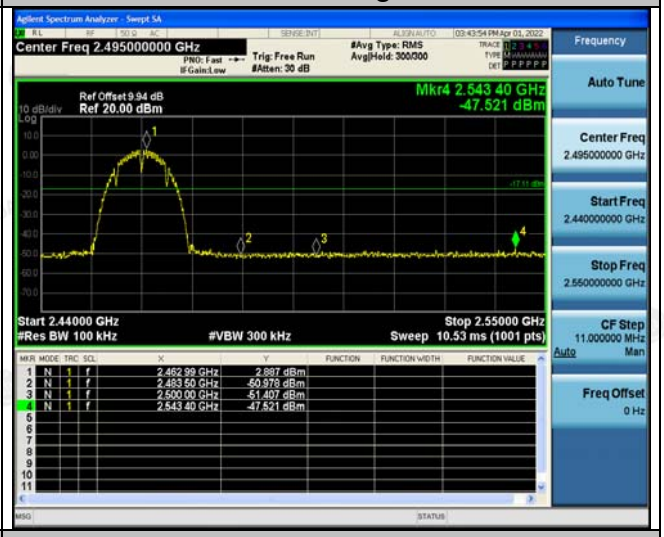
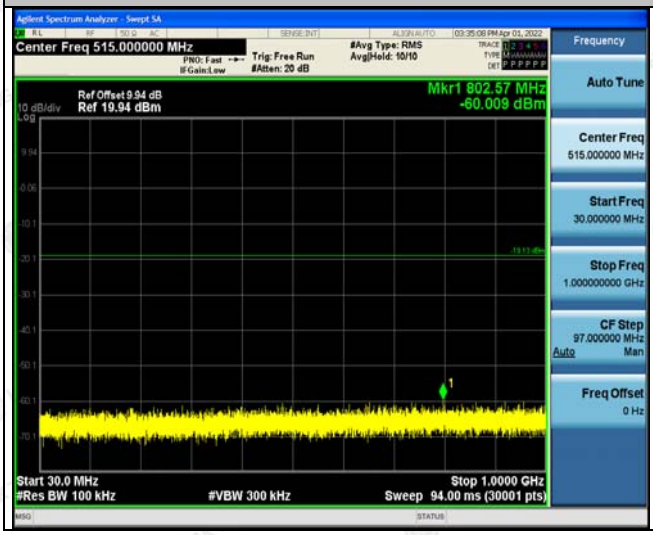
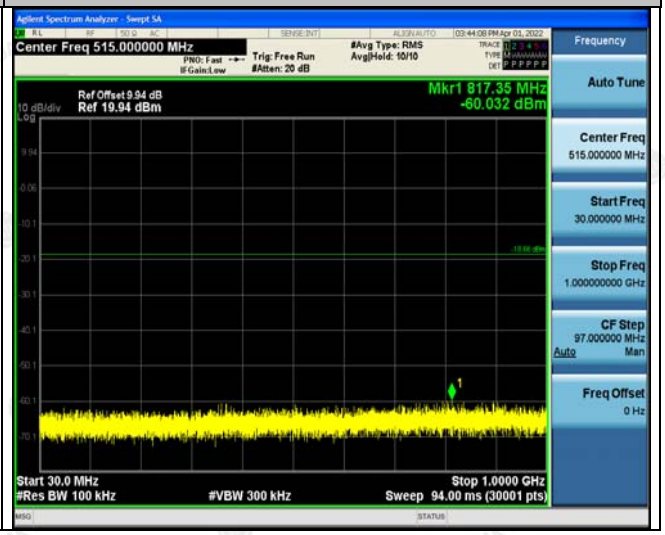
Middle Channel
Spurious Emission

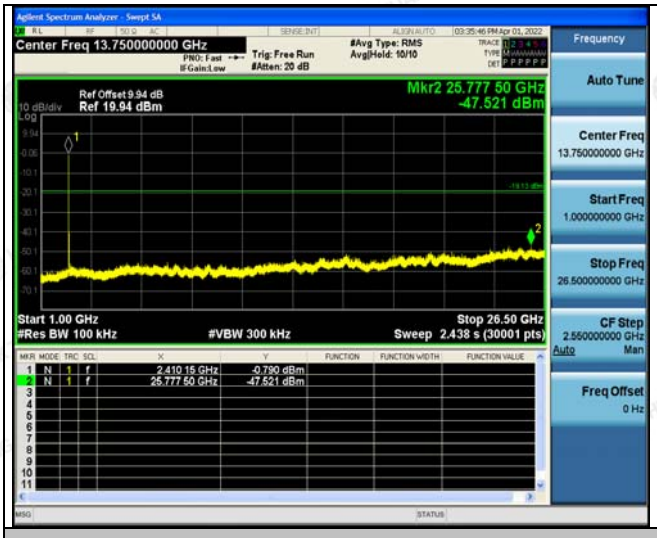


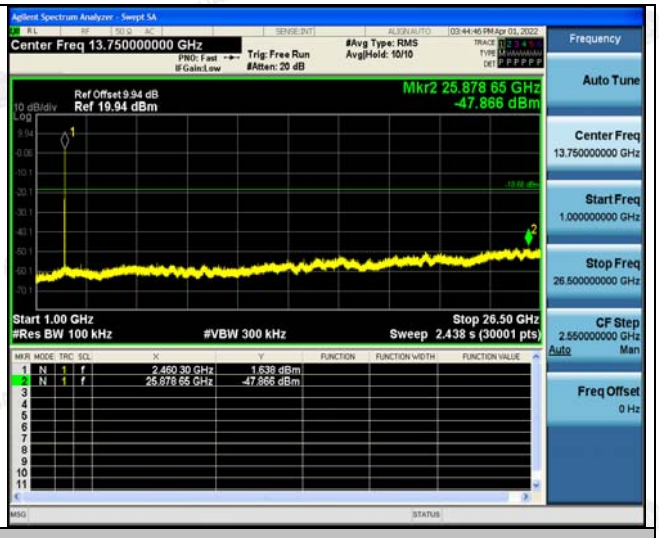




Chain 2
802.11b Modulation

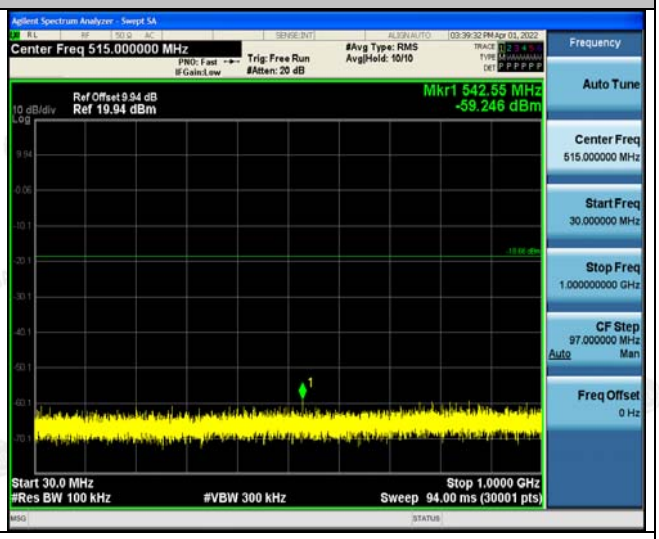
Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission	Spurious Emission
	
	



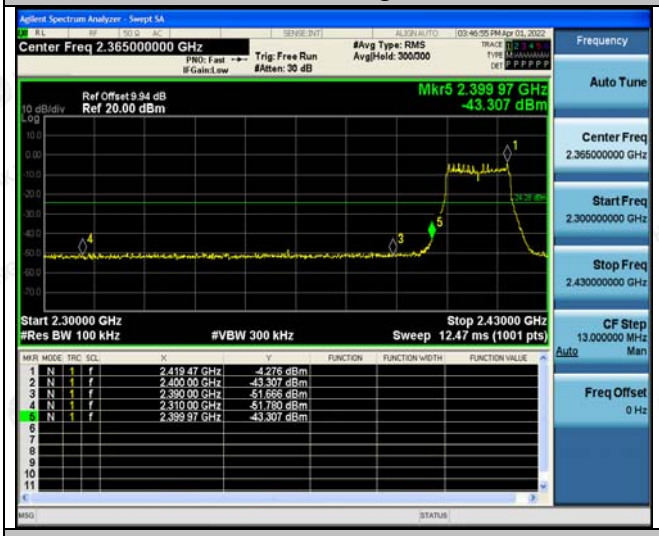
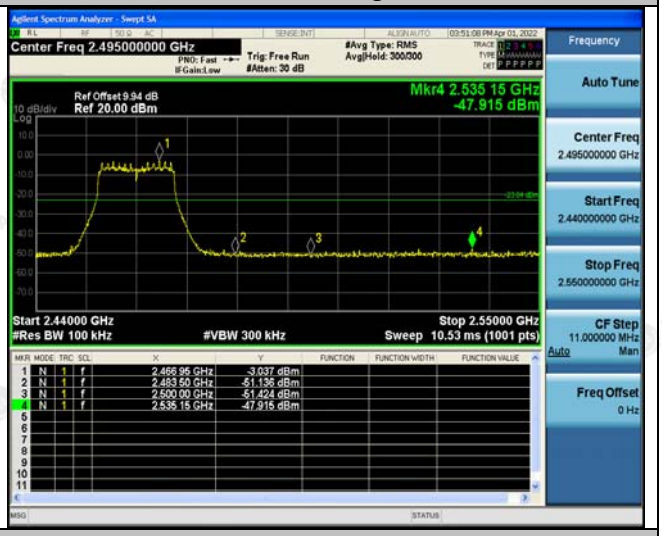
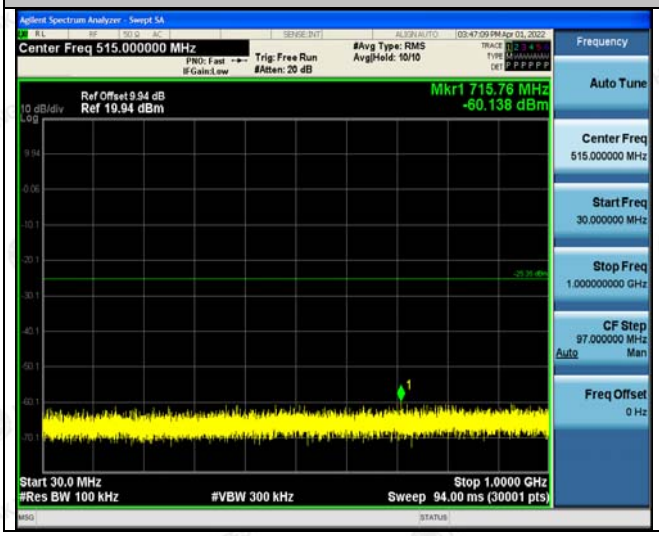
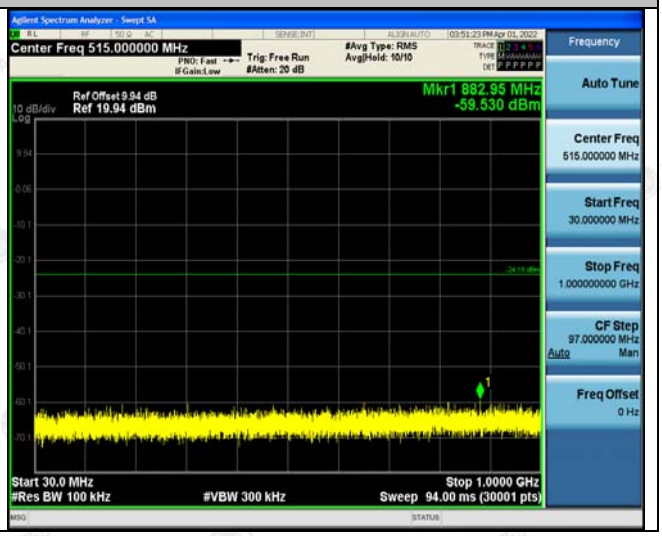


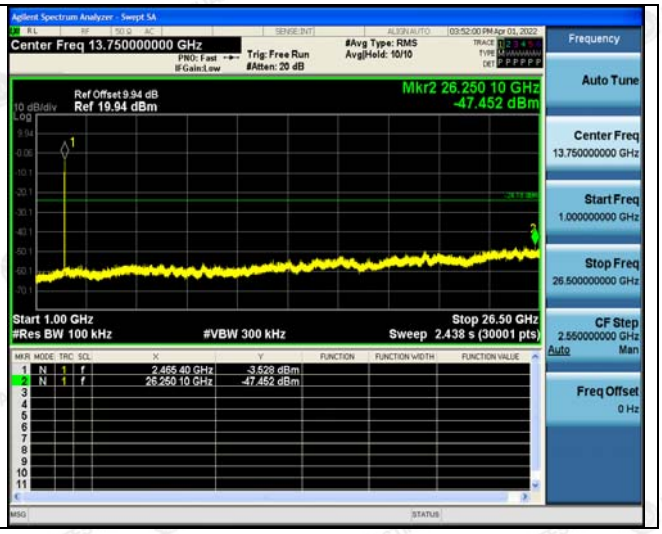
Middle Channel

Spurious Emission

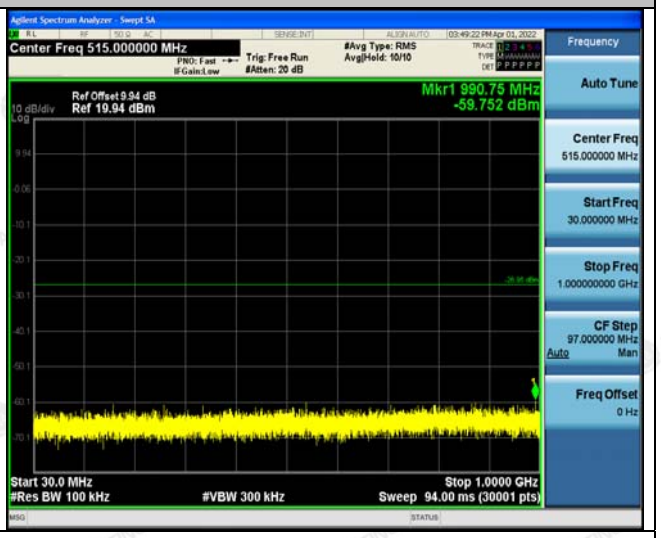


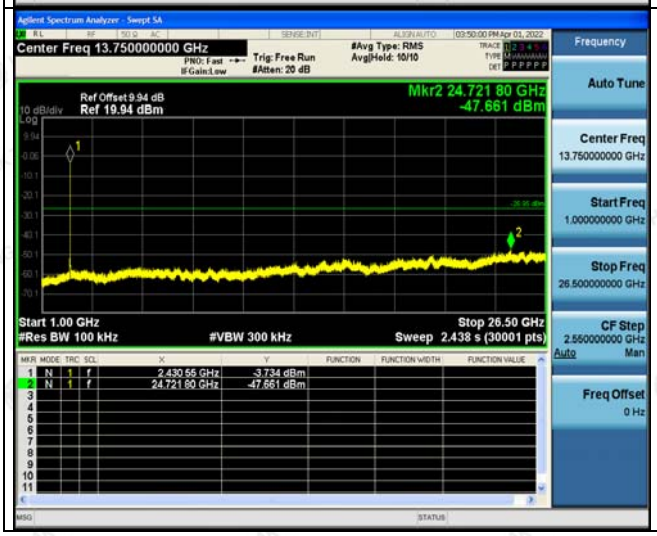
802.11g Modulation

Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission	Spurious Emission
	
	

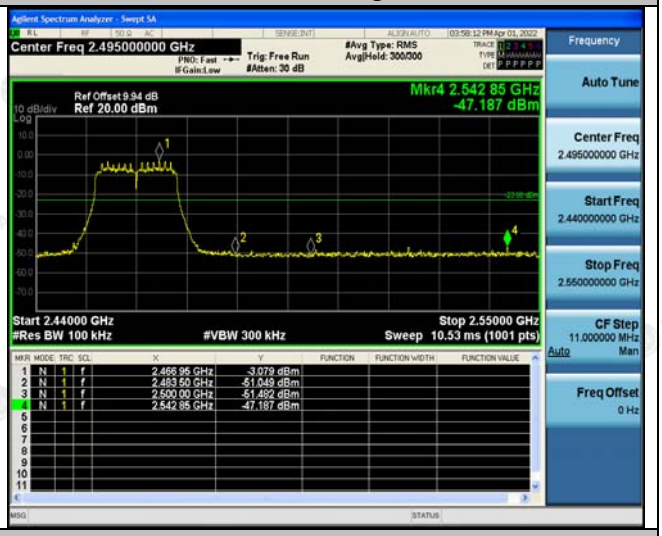
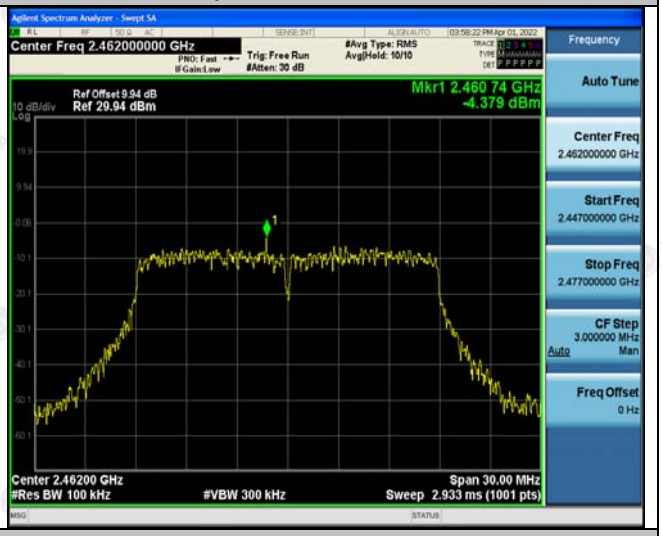
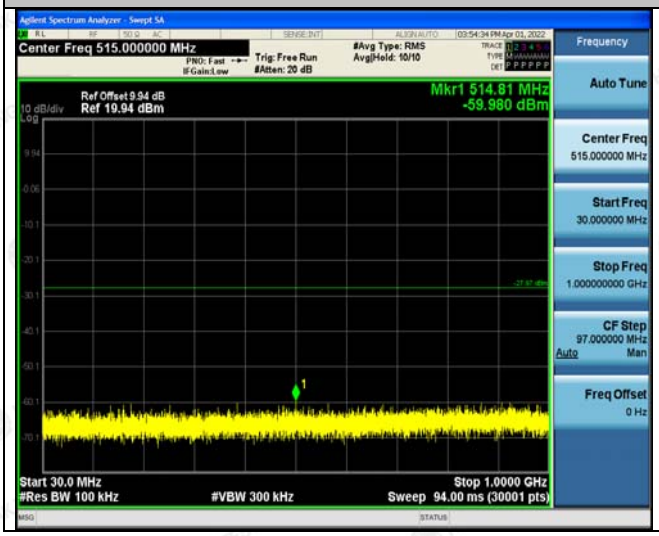
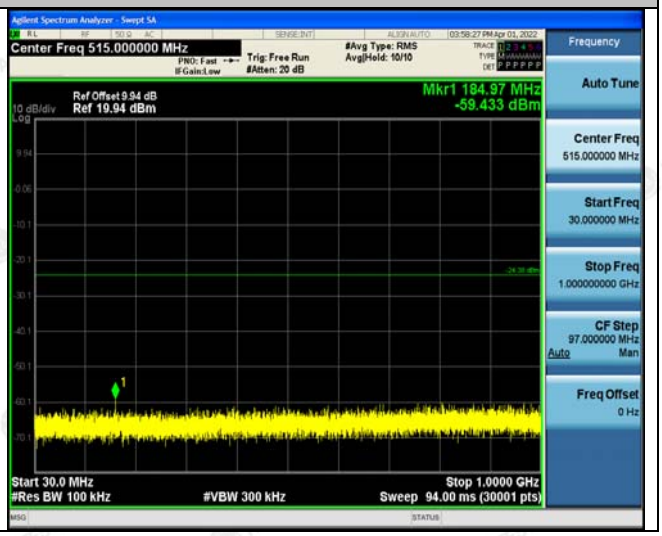


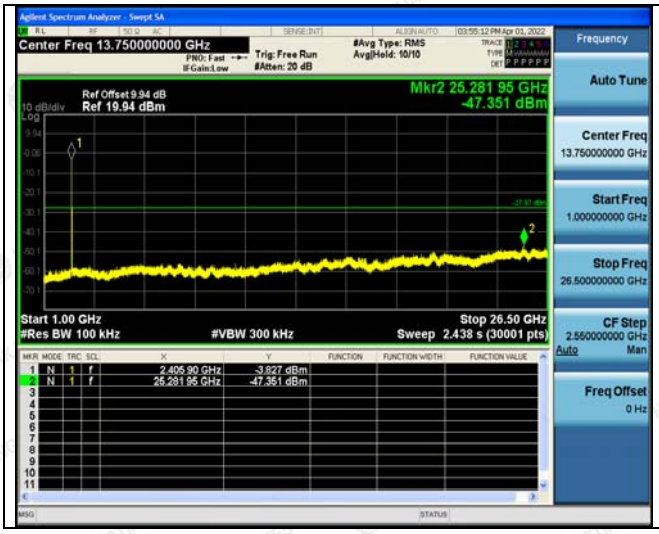
Middle Channel
Spurious Emission

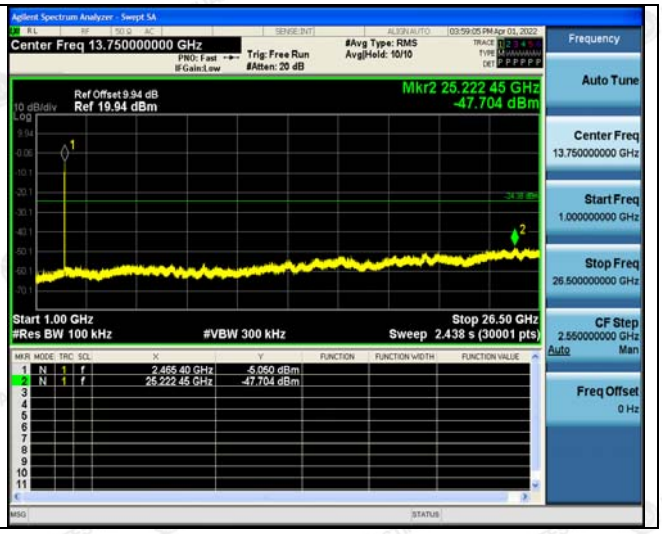




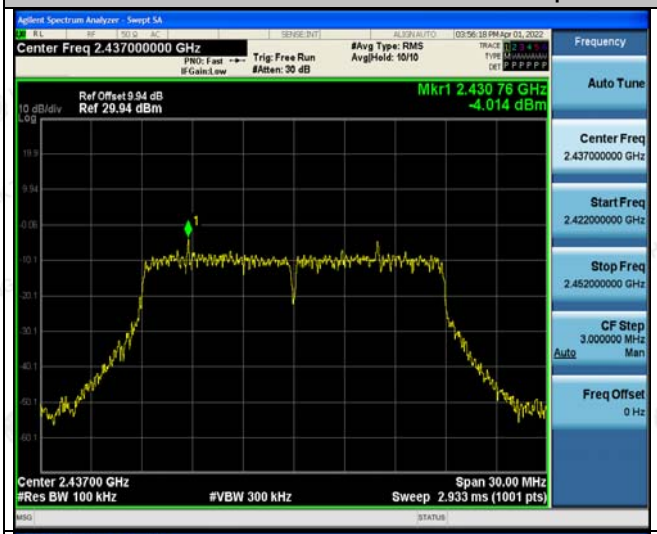
802.11n (HT20) Modulation

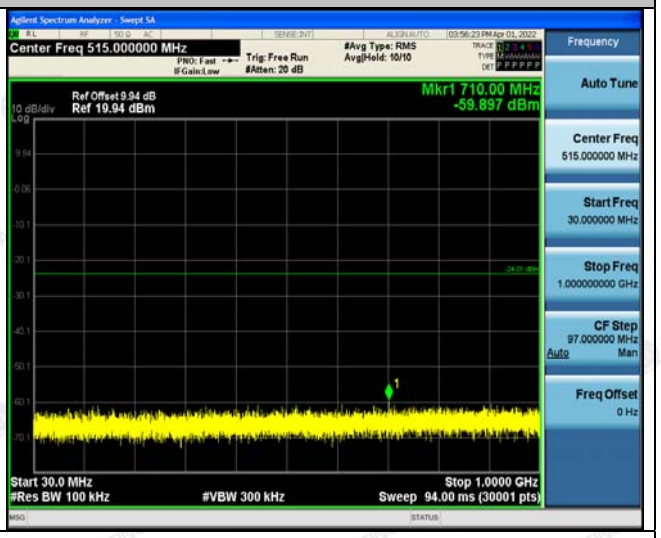
Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission	Spurious Emission
	
	

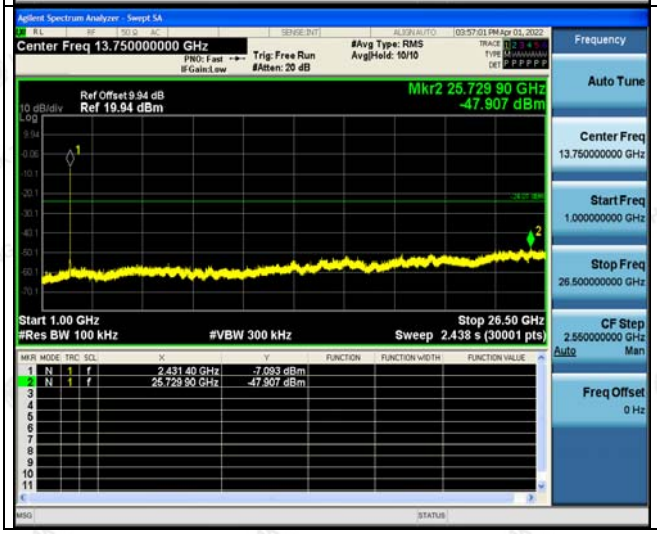




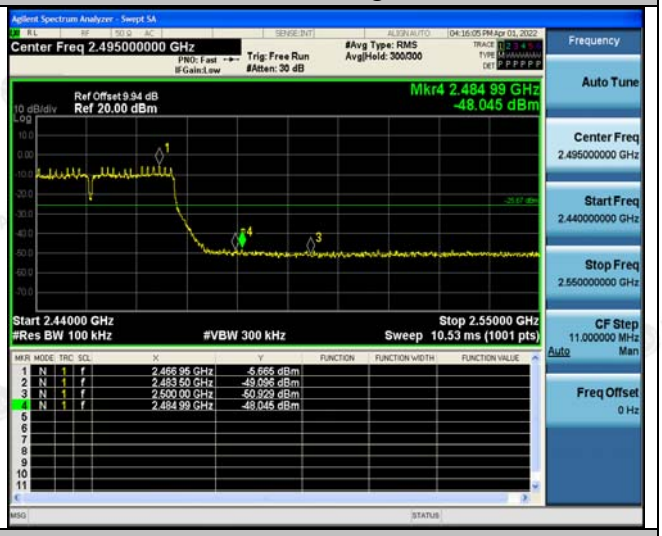
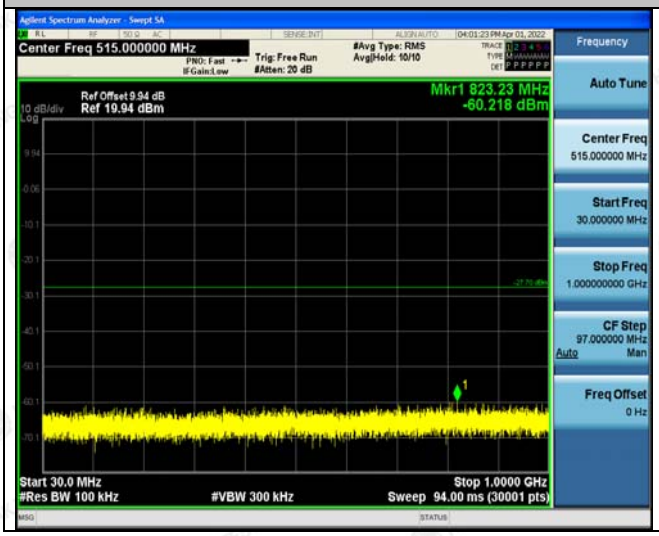
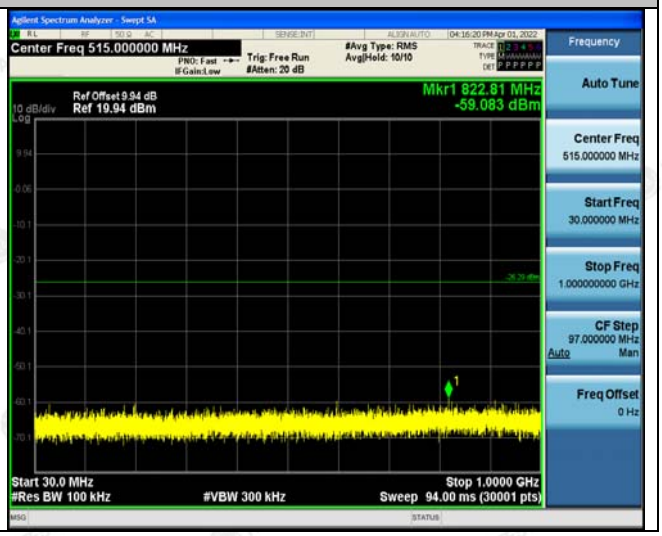
Middle Channel
Spurious Emission

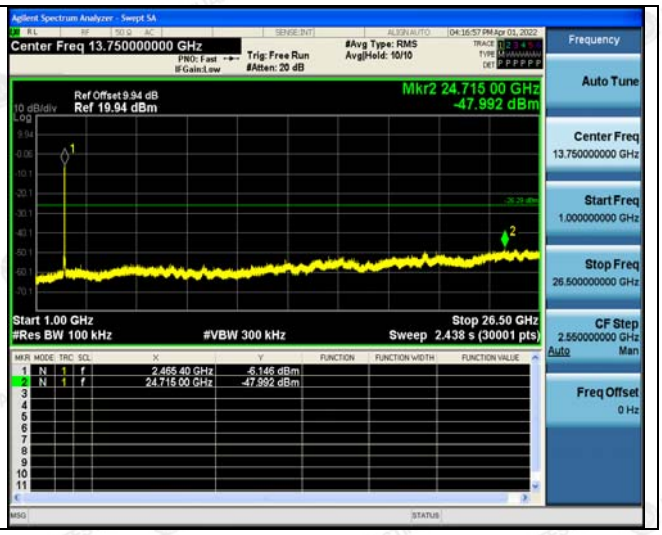






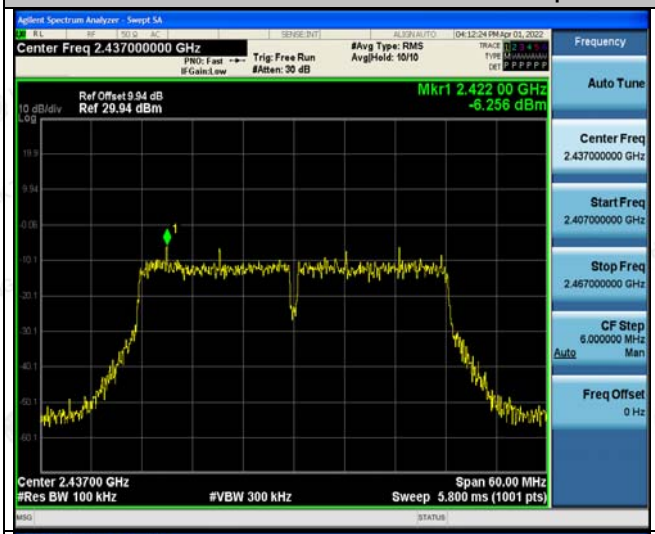
802.11n (HT40) Modulation

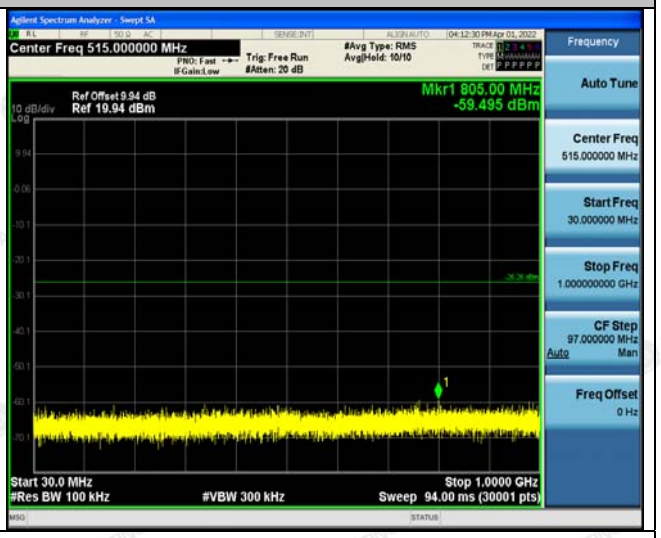
Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious Emission	Spurious Emission
	
	

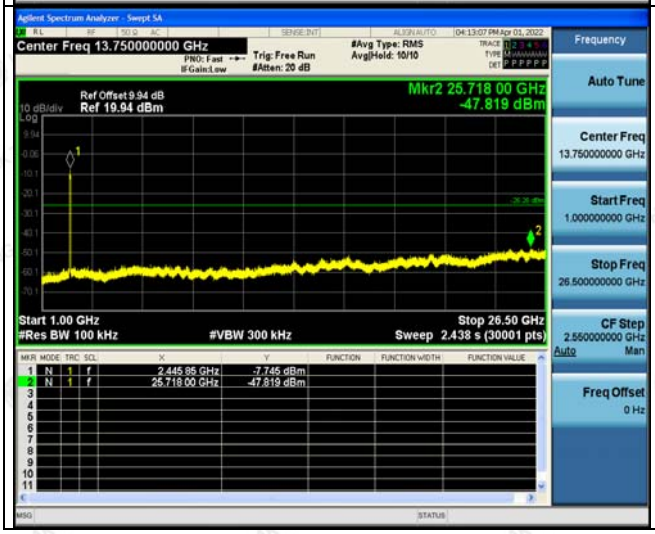


Middle Channel

Spurious Emission

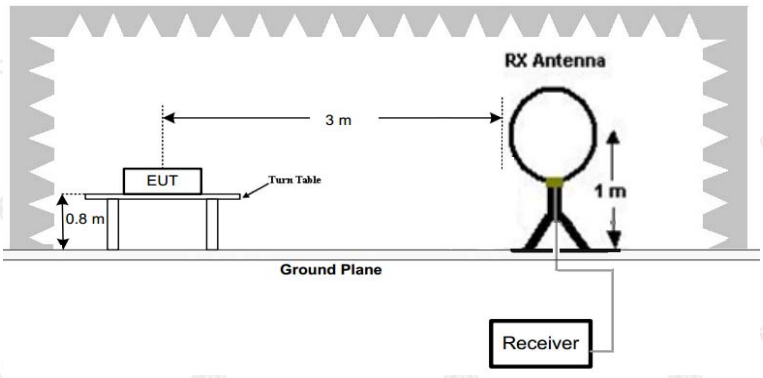






4.6. RADIATED SPURIOUS EMISSION MEASUREMENT

4.6.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2013</td></tr>
<tr><td>Frequency Range:</td><td>9 kHz to 25 GHz</td></tr>
<tr><td>Measurement Distance:</td><td>3 m</td></tr>
<tr><td>Antenna Polarization:</td><td>Horizontal & Vertical</td></tr>
<tr><td>Operation mode:</td><td>Transmitting mode with modulation</td></tr>
<tr><td>Receiver Setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>9kHz- 150kHz</td><td>Quasi-peak</td><td>200Hz</td><td>1kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>150kHz-30MHz</td><td>Quasi-peak</td><td>9kHz</td><td>30kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Field Strength (microvolts/meter)</td><td>Measurement Distance (meters)</td></tr>
<tr><td>0.009-0.490</td><td>2400/F(KHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(KHz)</td><td>30</td></tr>
<tr><td>1.705-30</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
<table>
<tr><td>Frequency</td><td>Field Strength (microvolts/meter)</td><td>Measurement Distance (meters)</td><td>Detector</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>3</td><td>Average</td></tr>
<tr><td>5000</td><td>3</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>For radiated emissions below 30MHz
 

30MHz to 1GHz</td></tr>
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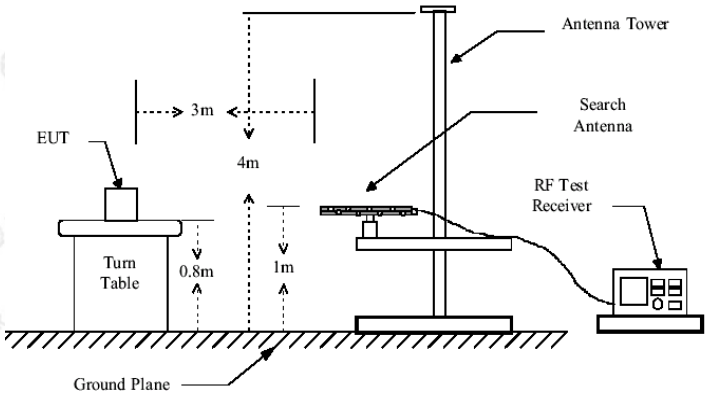
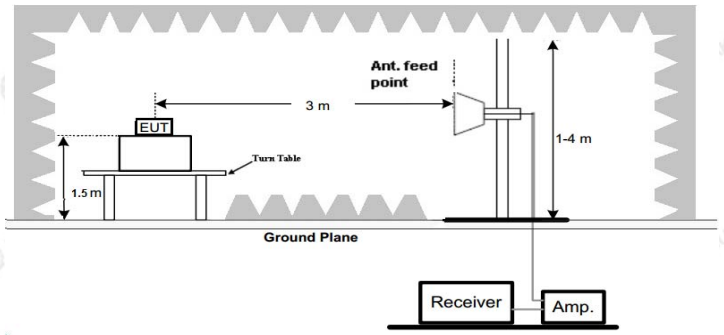
<table>
<tr>
<td></td>
<td>


Above 1GHz


</td>
</tr>
<tr>
<td>Test Procedure:</td>
<td>1. For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.
2. For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions.</td>
</tr>
</table>

	The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. 3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level. 4. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported. 5. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥RBW; Sweep = auto; Detector function = peak; Trace = max hold; (3) Set RBW = 1 MHz, VBW= 3MHz for f 1 GHz for peak measurement. 6. For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
Test results:	PASS

4.6.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Receiver	R&S	ESCI-7	HKE-010	Feb. 17, 2023
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023
Preamplifier	EMCI	EMC051845SE	HKE-015	Feb. 17, 2023
Preamplifier	Agilent	83051A	HKE-016	Feb. 17, 2023
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Feb. 17, 2023
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Feb. 17, 2023
Horn antenna	Schwarzbeck	9120D	HKE-013	Feb. 17, 2023
Antenna Mast	Keleto	CC-A-4M	N/A	N/A
Position controller	Taiwan MF	MF7802	HKE-011	Feb. 17, 2023
Radiated test software	Tonscend	TS+ Rev 2.5.0.0	N/A	N/A
RF cable (9KHz-1GHz)	Times	381806-001	N/A	N/A
RF cable	Times	1-40G	HKE-034	Feb. 17, 2023
High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	Feb. 17, 2023
RF Cable	Times	1-18G	HKE-099	Feb. 17, 2023

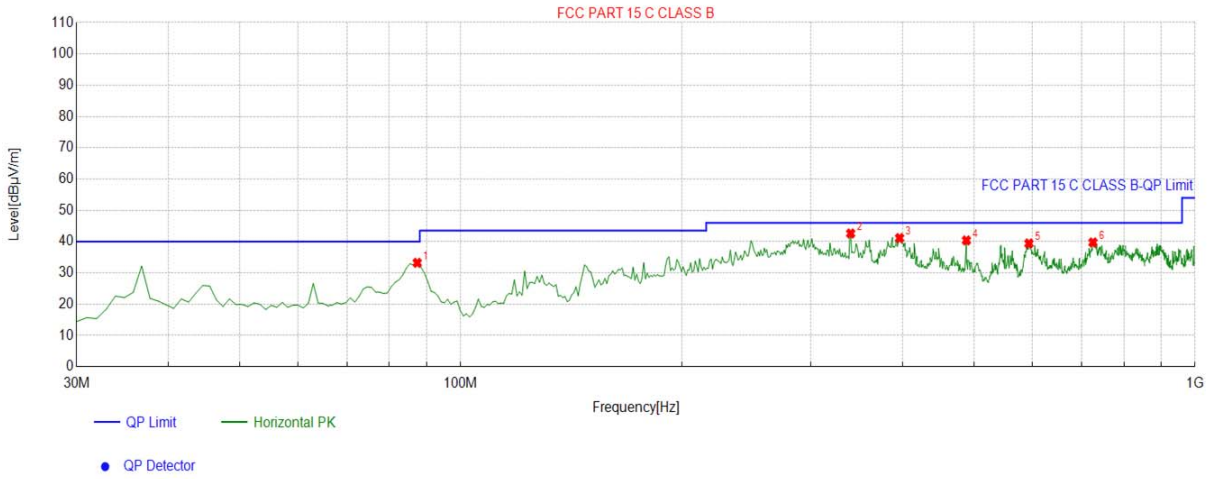
Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

4.6.3. Test Data

Please refer to following diagram for individual
Below 1GHz

test mode: TX 802.11b 2412MHz
All the test modes completed for test. The worst case of Radiated Emission; the test data of this mode was reported.

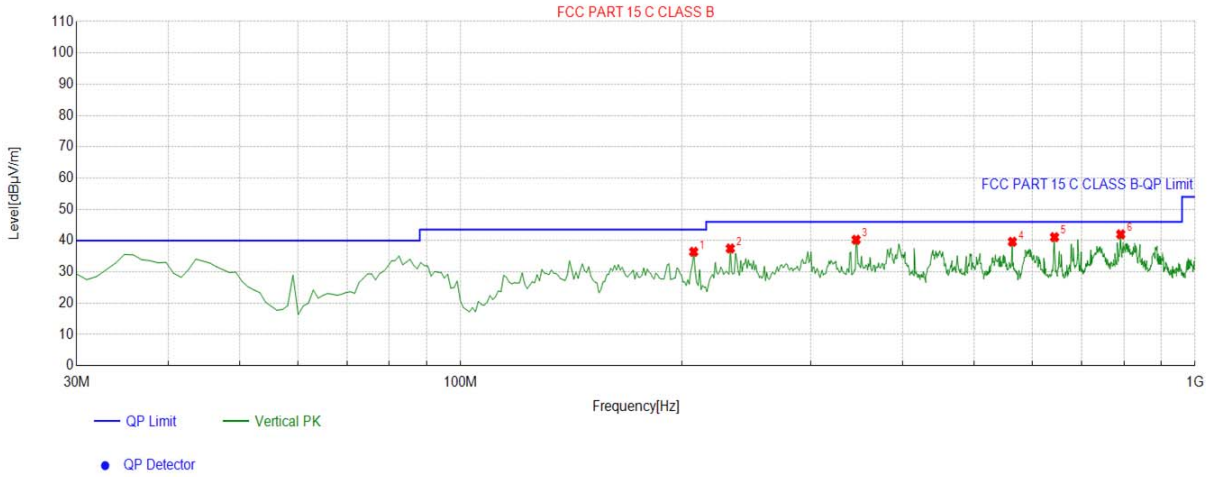
Horizontal



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	87.2873	-17.72	50.93	33.21	40.00	6.79	100	346	Horizontal
2	339.7397	-11.64	54.23	42.59	46.00	3.41	100	151	Horizontal
3	396.0561	-10.50	51.63	41.13	46.00	4.87	100	349	Horizontal
4	488.2983	-8.53	48.91	40.38	46.00	5.62	100	44	Horizontal
5	594.1341	-6.50	45.90	39.40	46.00	6.60	100	270	Horizontal
6	726.1862	-4.60	44.32	39.72	46.00	6.28	100	195	Horizontal

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Vertical



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	207.6877	-14.86	51.27	36.41	43.50	7.09	100	4	Vertical
2	232.9329	-14.18	51.65	37.47	46.00	8.53	100	145	Vertical
3	345.5656	-11.67	51.93	40.26	46.00	5.74	100	256	Vertical
4	564.0340	-6.57	46.19	39.62	46.00	6.38	100	153	Vertical
5	643.6537	-5.71	46.81	41.10	46.00	4.90	100	30	Vertical
6	792.2122	-3.24	45.23	41.99	46.00	4.01	100	236	Vertical

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Harmonics and Spurious Emissions

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBµV/m)	Limit@3m (dBµV/m)
--	--	--
--	--	--
--	--	--
--	--	--

Note:*1. Emission Level=Reading+ Cable loss+ Antenna factor-Amp factor.*

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement.

Above 1GHz

RADIATED EMISSION TEST

LOW CH1 (802.11b Mode)/2412
All modes of operation were investigated and the worst-case of Antenna 1 are reported.

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4824	59.44	-3.64	55.8	74	-18.2	peak
4824	43.89	-3.64	40.25	54	-13.75	AVG
7236	53.59	-0.95	52.64	74	-21.36	peak
7236	42.68	-0.95	41.73	54	-12.27	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4824	59.91	-3.64	56.27	74	-17.73	peak
4824	45.46	-3.64	41.82	54	-12.18	AVG
7236	56.81	-0.95	55.86	74	-18.14	peak
7236	39.91	-0.95	38.96	54	-15.04	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

MID CH6 (802.11b Mode)/2437

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4874	62.35	-3.51	58.84	74	-15.16	peak
4874	45.32	-3.51	41.81	54	-12.19	AVG
7311	54.38	-0.82	53.56	74	-20.44	peak
7311	38.93	-0.82	38.11	54	-15.89	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4874	60.41	-3.51	56.9	74	-17.1	peak
4874	43.06	-3.51	39.55	54	-14.45	AVG
7311	53.82	-0.82	53	74	-21	peak
7311	39.43	-0.82	38.61	54	-15.39	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

HIGH CH11 (802.11b Mode)/2462

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4924	59.56	-3.43	56.13	74	-17.87	peak
4924	43.08	-3.43	39.65	54	-14.35	AVG
7386	53.05	-0.75	52.3	74	-21.7	peak
7386	39.89	-0.75	39.14	54	-14.86	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4924	59.89	-3.43	56.46	74	-17.54	peak
4924	42.03	-3.43	38.6	54	-15.4	AVG
7386	55.21	-0.75	54.46	74	-19.54	peak
7386	39.53	-0.75	38.78	54	-15.22	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency; “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

LOW CH1 (802.11g Mode)/2412
All modes of operation were investigated and the worst-case of Antenna 1 are reported.

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4824	61.94	-3.64	58.3	74	-15.7	peak
4824	44.41	-3.64	40.77	54	-13.23	AVG
7236	57.08	-0.95	56.13	74	-17.87	peak
7236	40.79	-0.95	39.84	54	-14.16	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4824	59.77	-3.64	56.13	74	-17.87	peak
4824	42.75	-3.64	39.11	54	-14.89	AVG
7236	52.31	-0.95	51.36	74	-22.64	peak
7236	41.13	-0.95	40.18	54	-13.82	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

MID CH6 (802.11g Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	60.58	-3.51	57.07	74	-16.93	peak
4874	46.93	-3.51	43.42	54	-10.58	AVG
7311	53.29	-0.82	52.47	74	-21.53	peak
7311	39.92	-0.82	39.1	54	-14.9	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	61.62	-3.51	58.11	74	-15.89	peak
4874	39.7	-3.51	36.19	54	-17.81	AVG
7311	56.94	-0.82	56.12	74	-17.88	peak
7311	37.07	-0.82	36.25	54	-17.75	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

HIGH CH11 (802.11g Mode)/2462

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	61.93	-3.43	58.5	74	-15.5	peak
4924	39.19	-3.43	35.76	54	-18.24	AVG
7386	57.63	-0.75	56.88	74	-17.12	peak
7386	36.21	-0.75	35.46	54	-18.54	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	59.04	-3.43	55.61	74	-18.39	peak
4924	42.17	-3.43	38.74	54	-15.26	AVG
7386	54.13	-0.75	53.38	74	-20.62	peak
7386	40.48	-0.75	39.73	54	-14.27	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency; “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

MIMO:

LOW CH1 (802.11n/H20 Mode)/2412

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	57.48	-3.64	53.84	74	-20.16	peak
4824	42.8	-3.64	39.16	54	-14.84	AVG
7236	55.14	-0.95	54.19	74	-19.81	peak
7236	42.54	-0.95	41.59	54	-12.41	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	60.31	-3.64	56.67	74	-17.33	peak
4824	44.9	-3.64	41.26	54	-12.74	AVG
7236	54.07	-0.95	53.12	74	-20.88	peak
7236	42.33	-0.95	41.38	54	-12.62	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

MID CH6 (802.11n/H20 Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874.00	59.75	-3.51	56.24	74.00	-17.76	peak
4874.00	46.71	-3.51	43.20	54.00	-10.80	AVG
7311.00	56.65	-0.82	55.83	74.00	-18.17	peak
7311.00	43.37	-0.82	42.55	54.00	-11.45	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874.00	57.67	-3.51	54.16	74.00	-19.84	peak
4874.00	42.86	-3.51	39.35	54.00	-14.65	AVG
7311.00	54.52	-0.82	53.70	74.00	-20.30	peak
7311.00	40.47	-0.82	39.65	54.00	-14.35	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

HIGH CH11 (802.11n/H20 Mode)/2462

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	62.34	-3.43	58.91	74	-15.09	peak
4924	41.65	-3.43	38.22	54	-15.78	AVG
7386	56.90	-0.75	56.15	74	-17.85	peak
7386	40.66	-0.75	39.91	54	-14.09	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	63.91	-3.43	60.48	74	-13.52	peak
4924	39.43	-3.43	36	54	-18	AVG
7386	55.54	-0.75	54.79	74	-19.21	peak
7386	37.81	-0.75	37.06	54	-16.94	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

LOW CH3 (802.11n/H40 Mode)/2422

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4844	57.96	-3.63	54.33	74	-19.67	peak
4844	42.99	-3.63	39.36	54	-14.64	AVG
7266	55.60	-0.94	54.66	74	-19.34	peak
7266	41.82	-0.94	40.88	54	-13.12	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4844	58.93	-3.63	55.3	74	-18.7	peak
4844	44.02	-3.63	40.39	54	-13.61	AVG
7266	57.28	-0.94	56.34	74	-17.66	peak
7266	37.16	-0.94	36.22	54	-17.78	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

MID CH6 (802.11n/H40 Mode)/2437

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4874	59.53	-3.51	56.02	74	-17.98	peak
4874	46.02	-3.51	42.51	54	-11.49	AVG
7311	58.18	-0.82	57.36	74	-16.64	peak
7311	44.42	-0.82	43.6	54	-10.4	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4874	60.65	-3.51	57.14	74	-16.86	peak
4874	41.68	-3.51	38.17	54	-15.83	AVG
7311	54.94	-0.82	54.12	74	-19.88	peak
7311	38.89	-0.82	38.07	54	-15.93	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

HIGH CH9 (802.11n/H40 Mode)/2452

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4904	57.67	-3.43	54.24	74	-19.76	peak
4904	43.69	-3.43	40.26	54	-13.74	AVG
7356	54.52	-0.75	53.77	74	-20.23	peak
7356	40.89	-0.75	40.14	54	-13.86	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4904	57.2	-3.43	53.77	74	-20.23	peak
4904	47.49	-3.43	44.06	54	-9.94	AVG
7356	57.25	-0.75	56.5	74	-17.5	peak
7356	40.36	-0.75	39.61	54	-14.39	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency; “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

Test Result of Radiated Spurious at Band edges

Operation Mode:
802.11b Mode TX CH Low (2412MHz)
All modes of operation were investigated and the worst-case of Antenna 1 are reported.

Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310	57.08	-5.81	51.27	74	-22.73	peak
2310	/	-5.81	/	54	/	AVG
2390	60.13	-5.84	54.29	74	-19.71	peak
2390	51.62	-5.84	45.78	54	-8.22	AVG
2400	60.21	-5.84	54.37	74	-19.63	peak
2400	46.3	-5.84	40.46	54	-13.54	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310	55.89	-5.81	50.08	74	-23.92	peak
2310	/	-5.81	/	54	/	AVG
2390	61.3	-5.84	55.46	74	-18.54	peak
2390	46.41	-5.84	40.57	54	-13.43	AVG
2400	59.77	-5.84	53.93	74	-20.07	peak
2400	46.15	-5.84	40.31	54	-13.69	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	57.24	-5.65	51.59	74	-22.41	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	53.29	-5.65	47.64	74	-26.36	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	56.58	-5.65	50.93	74	-23.07	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.23	-5.65	49.58	74	-24.42	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

Operation Mode: 802.11g Mode TX CH Low (2412MHz)
All modes of operation were investigated and the worst-case of Antenna 1 are reported.

Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310	54.87	-5.81	49.06	74	-24.94	peak
2310	/	-5.81	/	54	/	AVG
2390	60.96	-5.84	55.12	74	-18.88	peak
2390	45.33	-5.84	39.49	54	-14.51	AVG
2400	60.04	-5.84	54.2	74	-19.8	peak
2400	41.77	-5.84	35.93	54	-18.07	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310	55.65	-5.81	49.84	74	-24.16	peak
2310	/	-5.81	/	54	/	AVG
2390	61.39	-5.84	55.55	74	-18.45	peak
2390	45.38	-5.84	39.54	54	-14.46	AVG
2400	59.38	-5.84	53.54	74	-20.46	peak
2400	44.4	-5.84	38.56	54	-15.44	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	56.68	-5.65	51.03	74	-22.97	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	53.09	-5.65	47.44	74	-26.56	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	56.05	-5.65	50.4	74	-23.6	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	51.76	-5.65	46.11	74	-27.89	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

MIMO:

Operation Mode: 802.11n/H20 Mode TX CH Low (2412MHz)

Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310	54.77	-5.81	48.96	74	-25.04	peak
2310	/	-5.81	/	54	/	AVG
2390	59.51	-5.84	53.67	74	-20.33	peak
2390	48.88	-5.84	43.04	54	-10.96	AVG
2400	60.05	-5.84	54.21	74	-19.79	peak
2400	44.57	-5.84	38.73	54	-15.27	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310	54.68	-5.81	48.87	74	-25.13	peak
2310	/	-5.81	/	54	/	AVG
2390	62.08	-5.84	56.24	74	-17.76	peak
2390	45.5	-5.84	39.66	54	-14.34	AVG
2400	59.04	-5.84	53.2	74	-20.8	peak
2400	40.6	-5.84	34.76	54	-19.24	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	56.35	-5.65	50.7	74	-23.3	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.94	-5.65	50.29	74	-23.71	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	55.89	-5.65	50.24	74	-23.76	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	53.29	-5.65	47.64	74	-26.36	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

Operation Mode: 802.11n/H40 Mode TX CH Low (2422MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	56.67	-5.81	50.86	74	-23.14	peak
2310	/	-5.81	/	54	/	AVG
2390	61.46	-5.84	55.62	74	-18.38	peak
2390	46.69	-5.84	40.85	54	-13.15	AVG
2400	61.28	-5.84	55.44	74	-18.56	peak
2400	43.89	-5.84	38.05	54	-15.95	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	57.25	-5.81	51.44	74	-22.56	peak
2310	/	-5.81	/	54	/	AVG
2390	63.18	-5.84	57.34	74	-16.66	peak
2390	46.48	-5.84	40.64	54	-13.36	AVG
2400	60.48	-5.84	54.64	74	-19.36	peak
2400	42.86	-5.84	37.02	54	-16.98	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Operation Mode: TX CH High (2452MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	55.1	-5.65	49.45	74	-24.55	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	53.34	-5.65	47.69	74	-26.31	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	56.29	-5.65	50.64	74	-23.36	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	53.84	-5.65	48.19	74	-25.81	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

4.7. ANTENNA REQUIREMENT

Standard Applicable
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247, if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

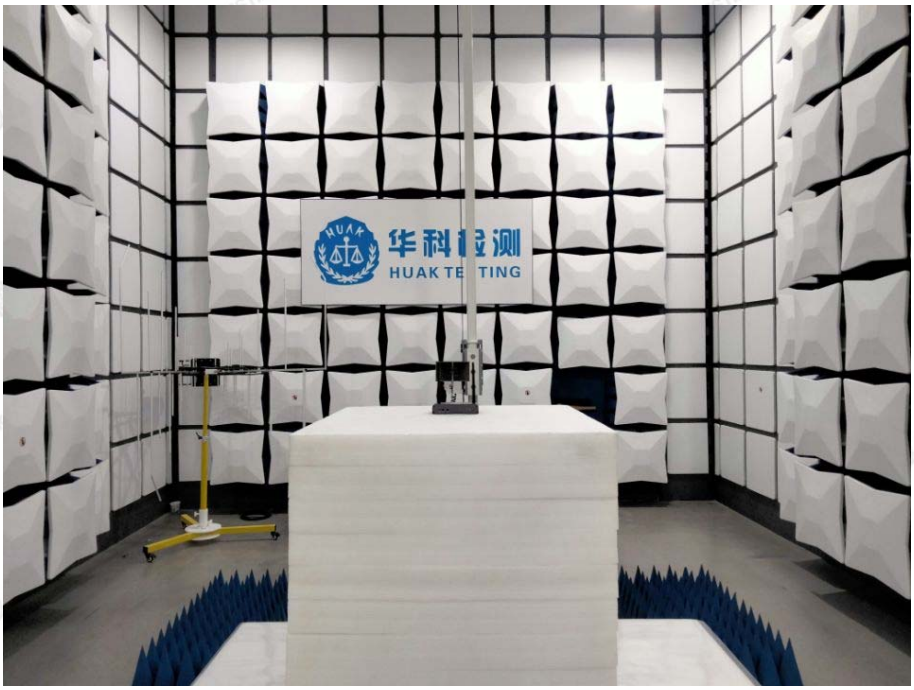
Refer to statement below for compliance.
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction
The antenna used in this product is a External Antenna, which have non-standard antenna jack. It conforms to the standard requirements. and the best case gain of the antenna is Antenna port 1:2.45dBi and Antenna port 2:2.45dBi.

ANTENNA

5. PHOTOGRAPH OF TEST

Radiated Emission



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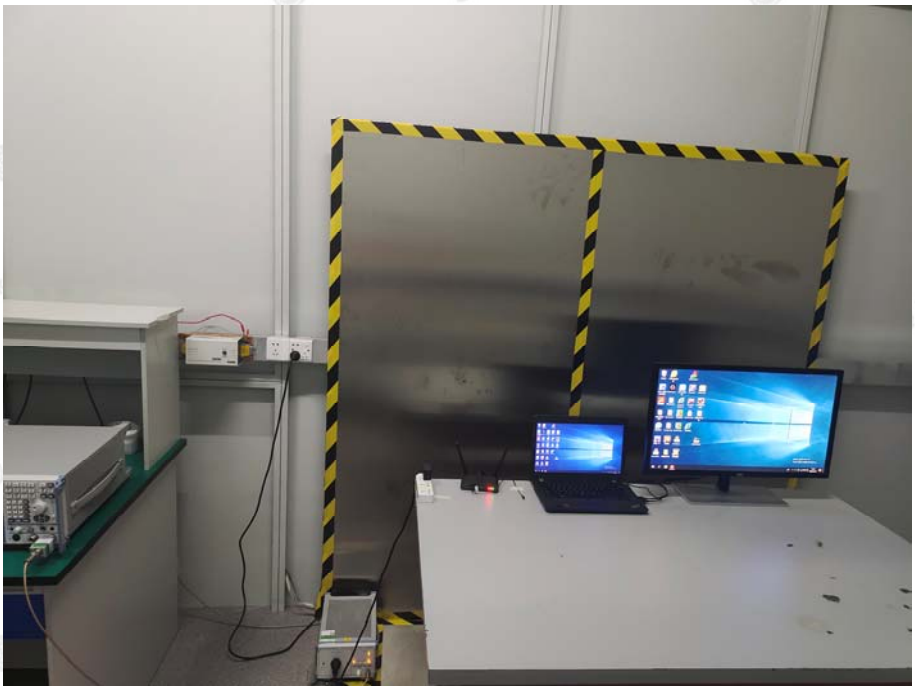
Conducted Emission



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6. PHOTOS OF THE EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos.

----------End of report----------

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