



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:	 <p>Spectrum Analyzer EUT</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none">1. The testing follows FCC KDB Publication 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

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4.5.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	Jun. 17, 2021
Signal generator	Agilent	N5183A	HKE-071	Jun. 17, 2021
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Jun. 17, 2021
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Jun. 17, 2021

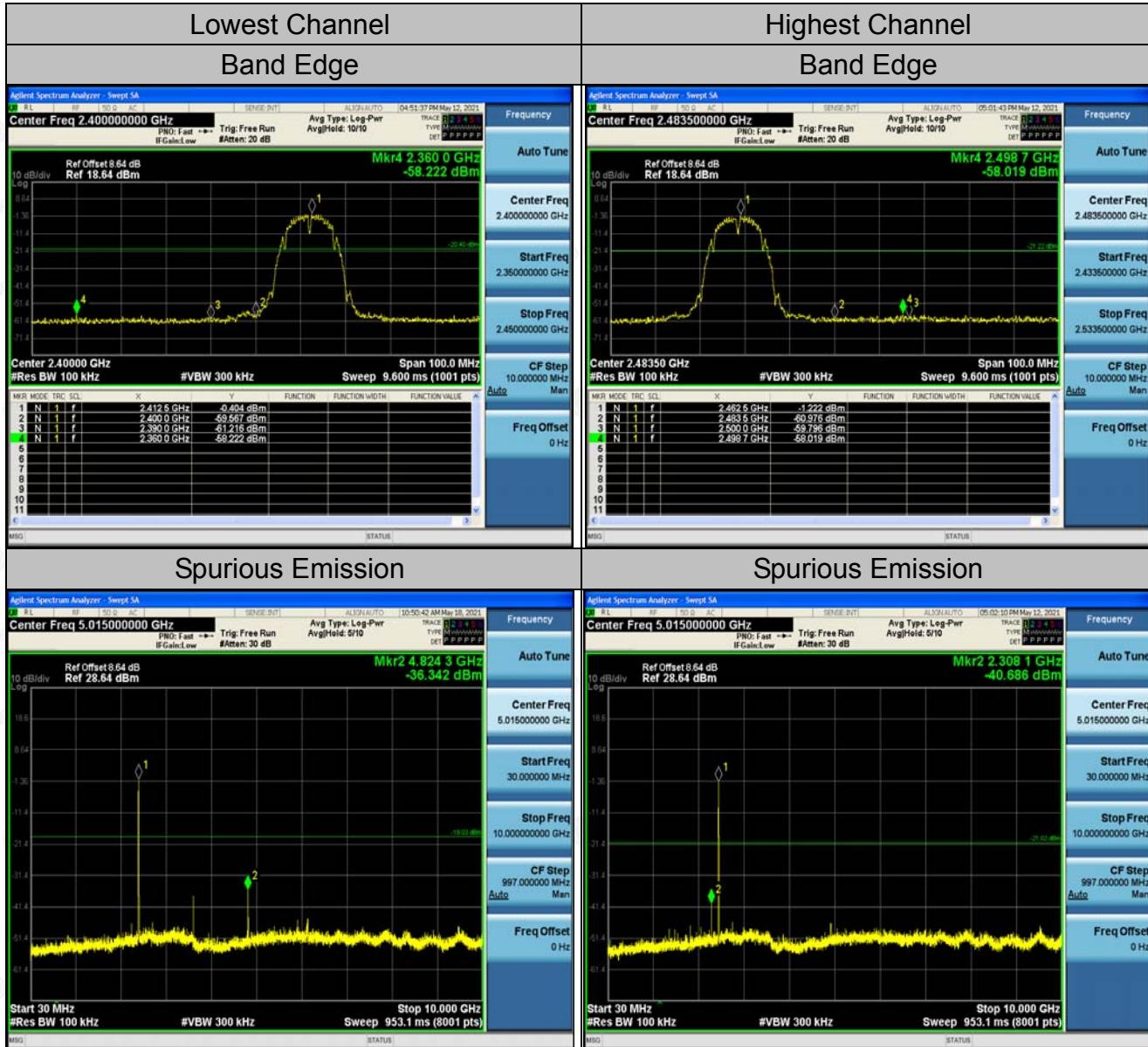
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



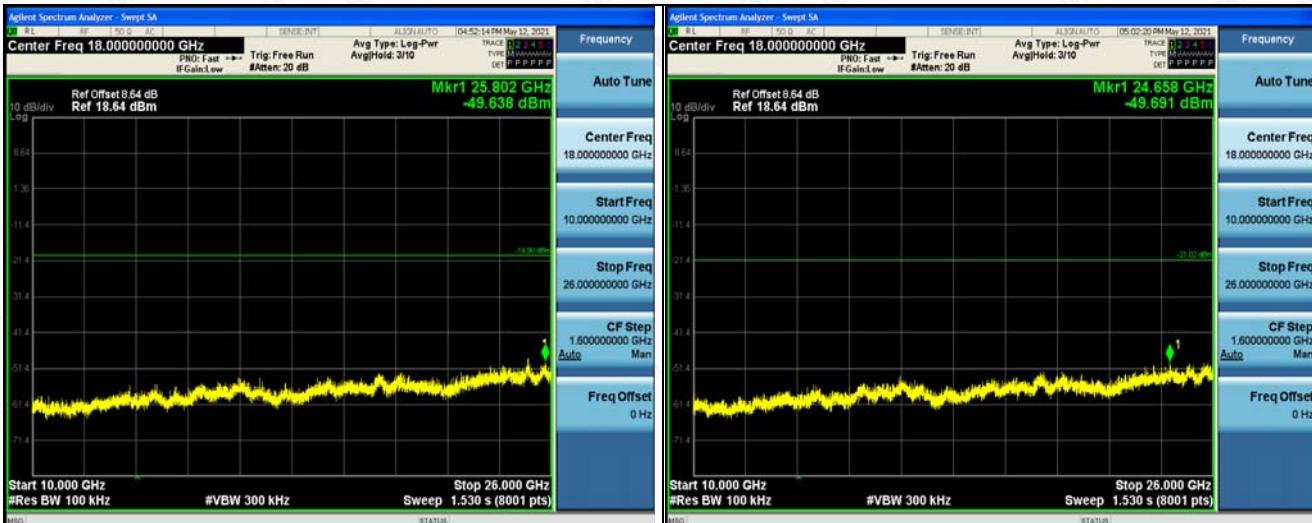
4.5.3. Test Data

Chain 1

802.11b Modulation

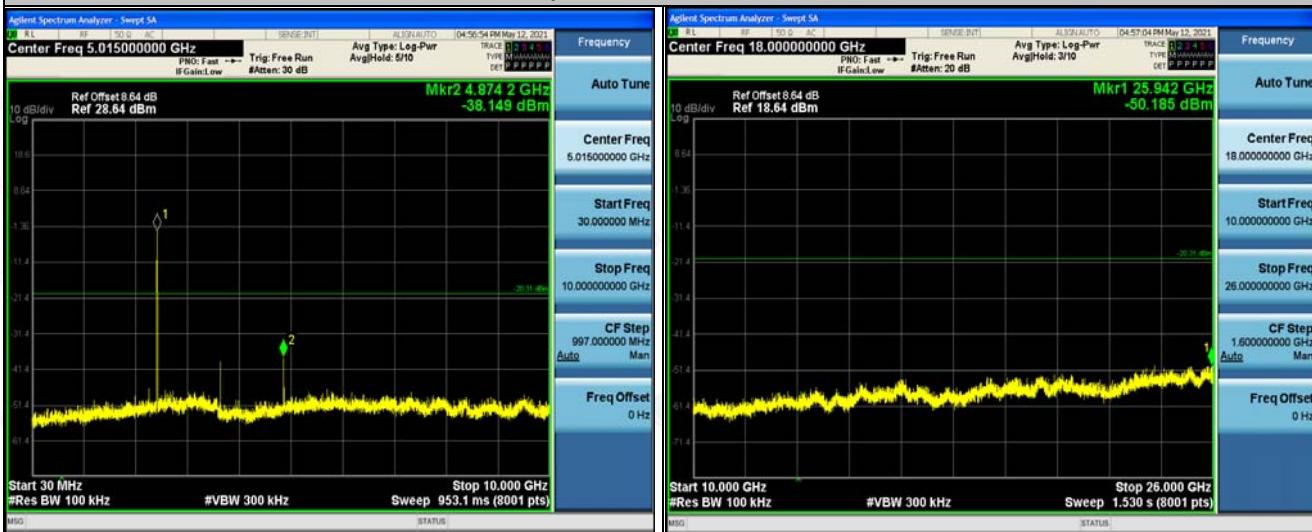


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Middle Channel

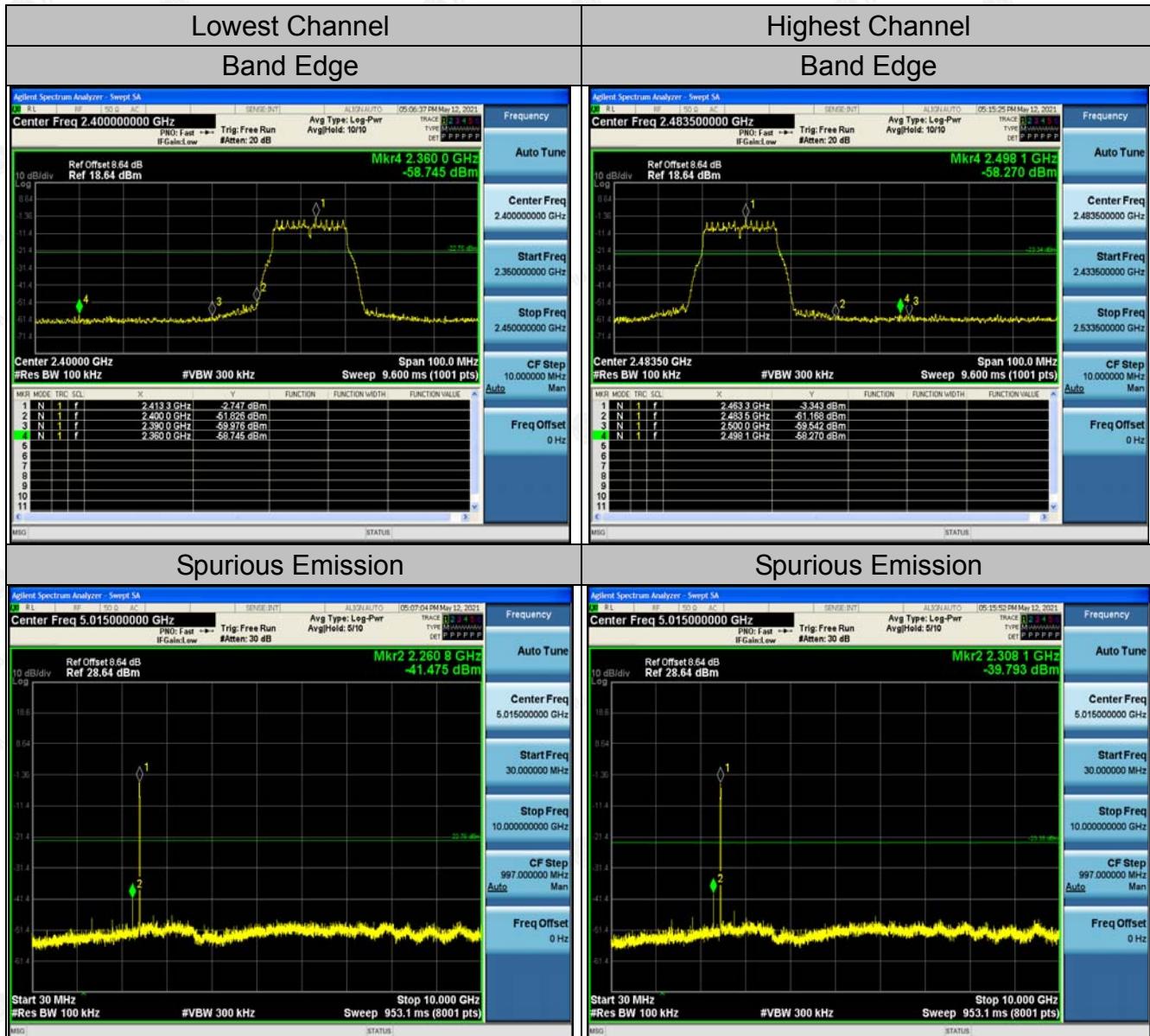
Spurious Emission



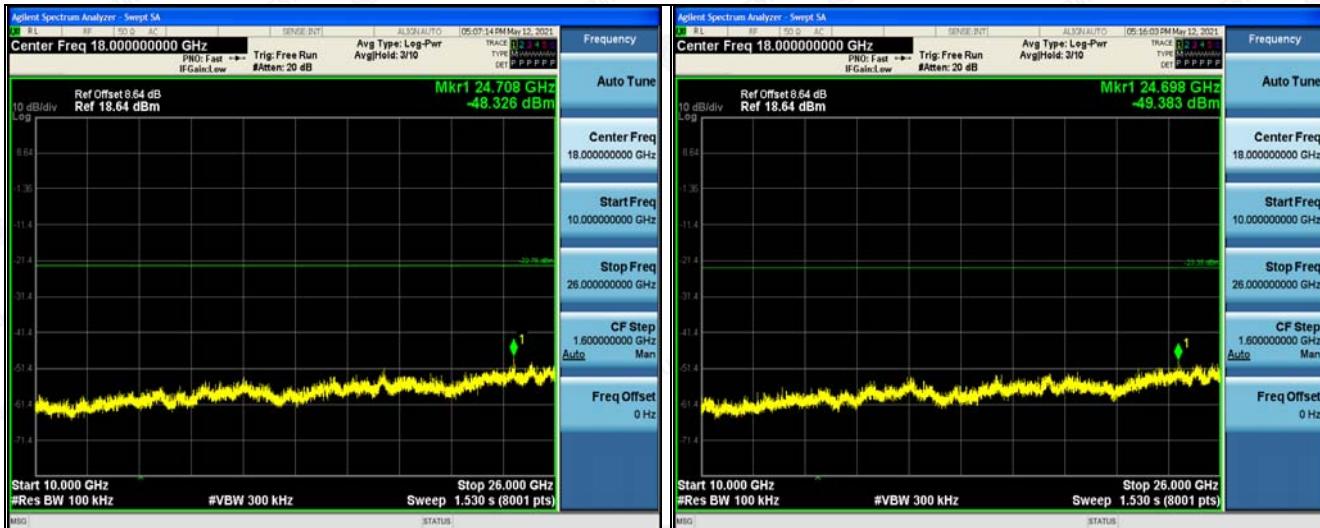
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802.11g Modulation

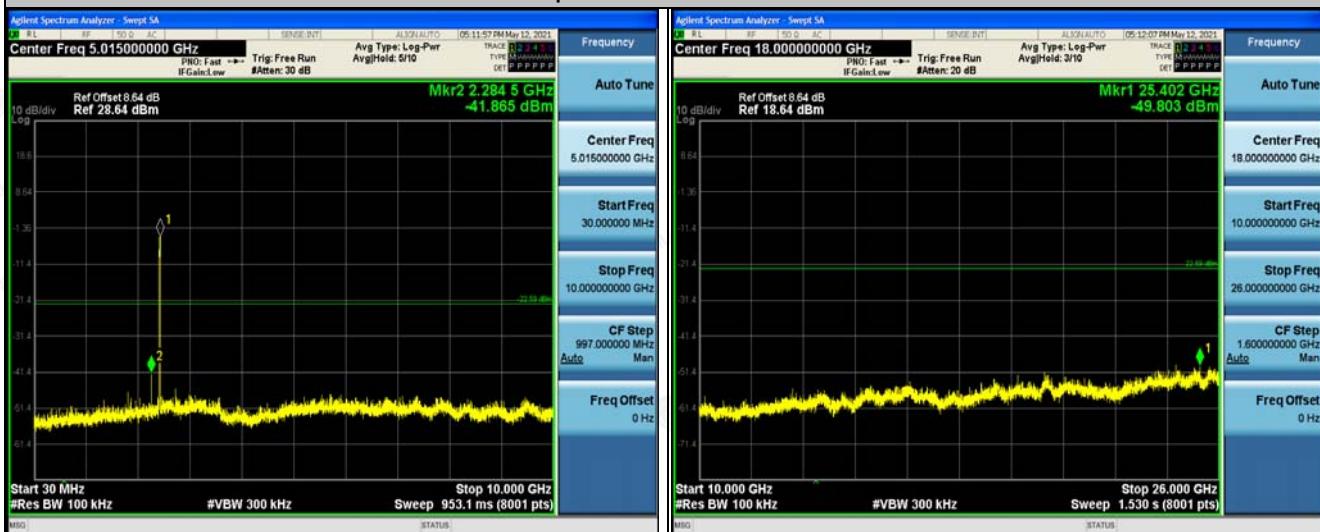


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Middle Channel

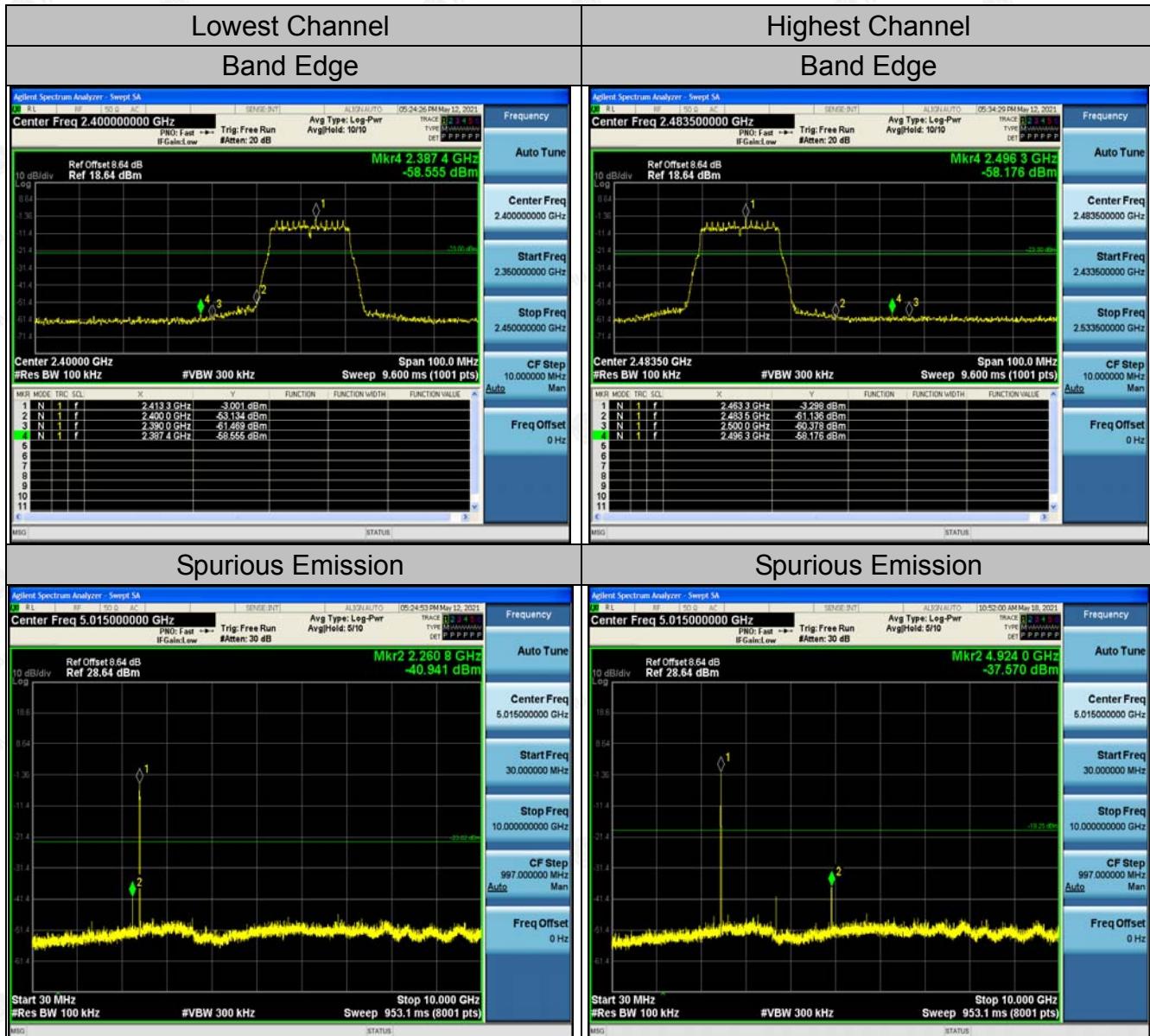
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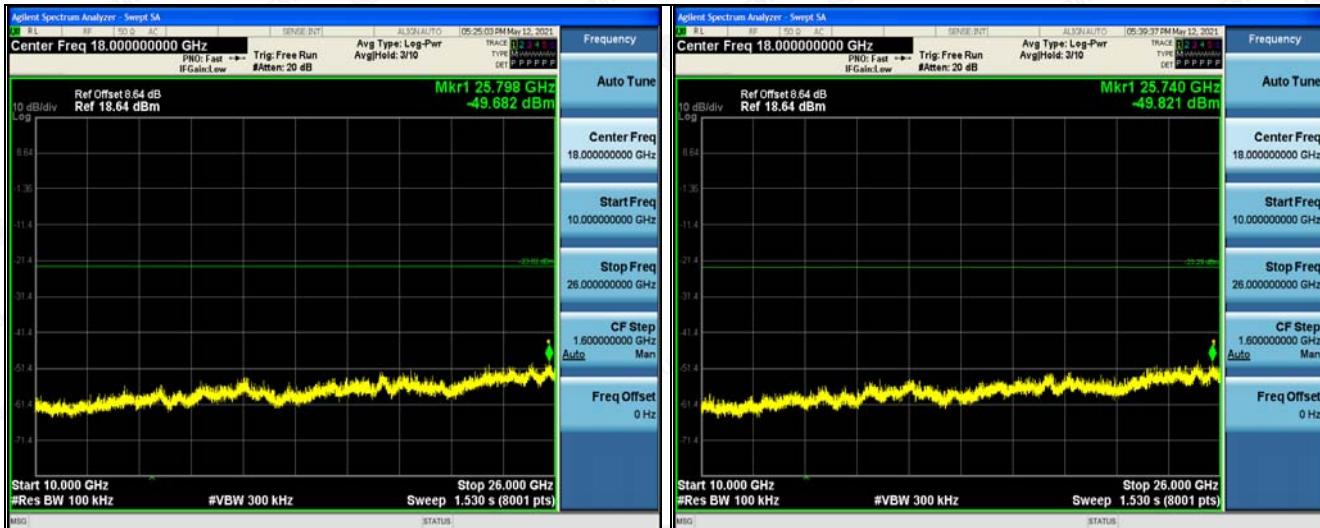
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802.11n (HT20) Modulation



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Middle Channel

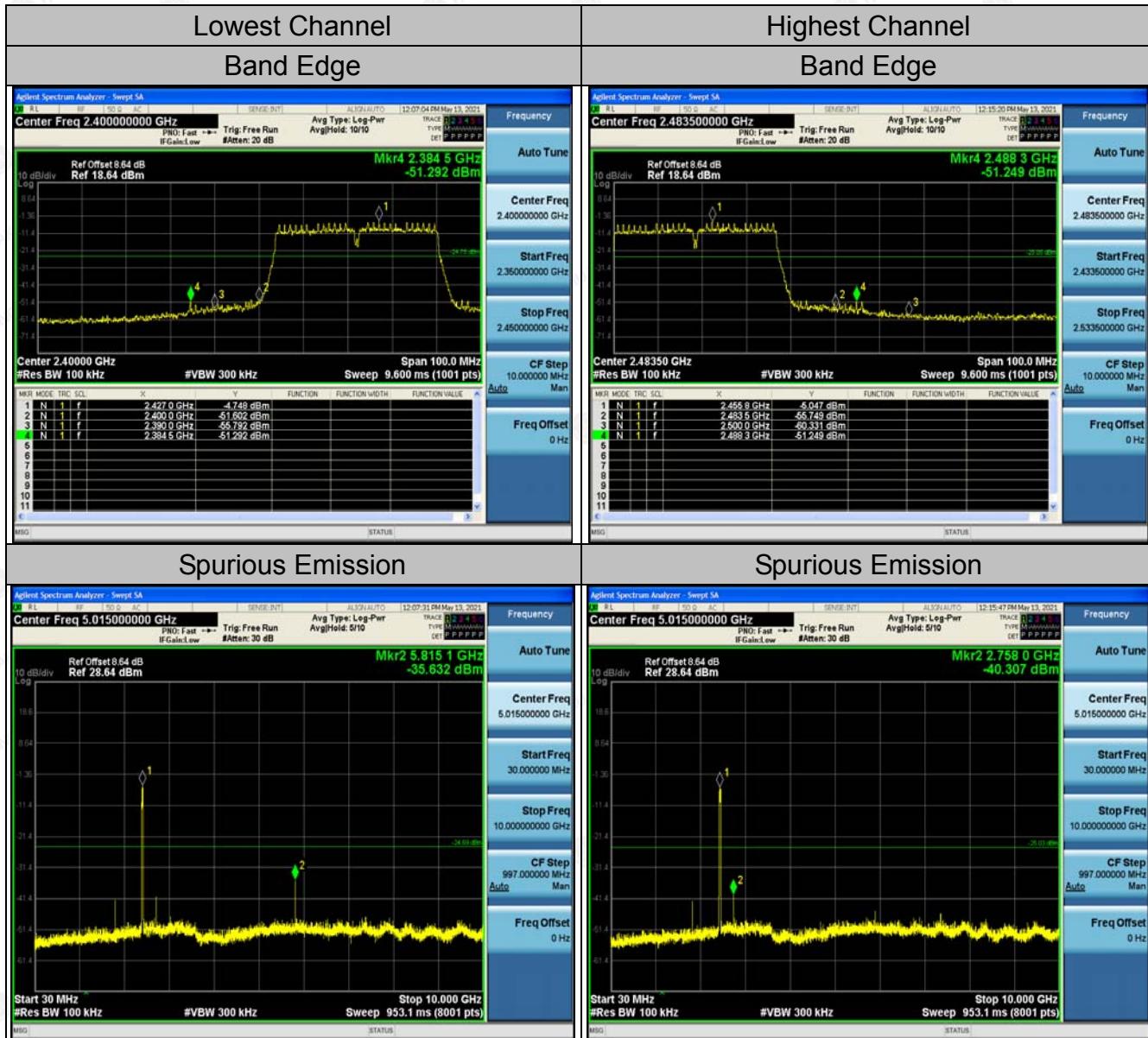
Spurious Emission



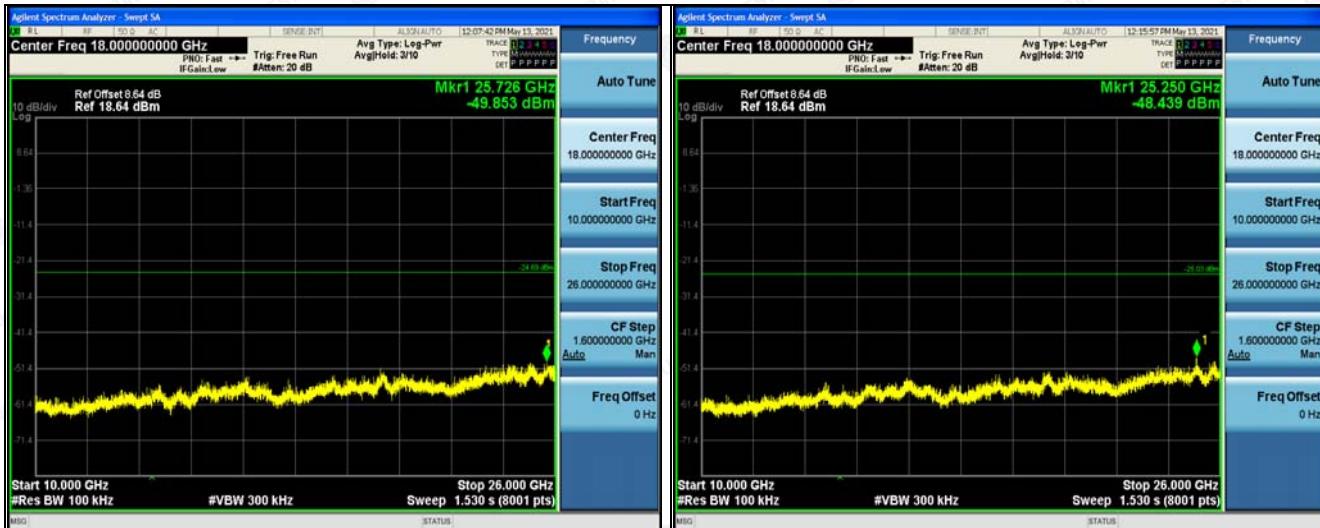
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802.11n (HT40) Modulation

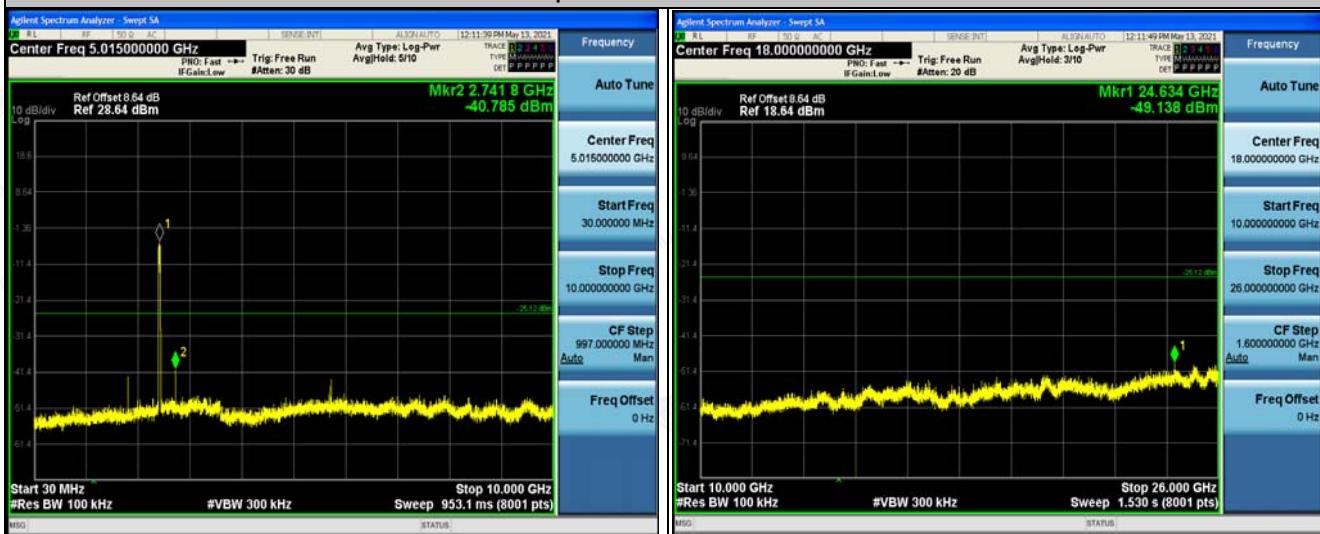


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Middle Channel

Spurious Emission

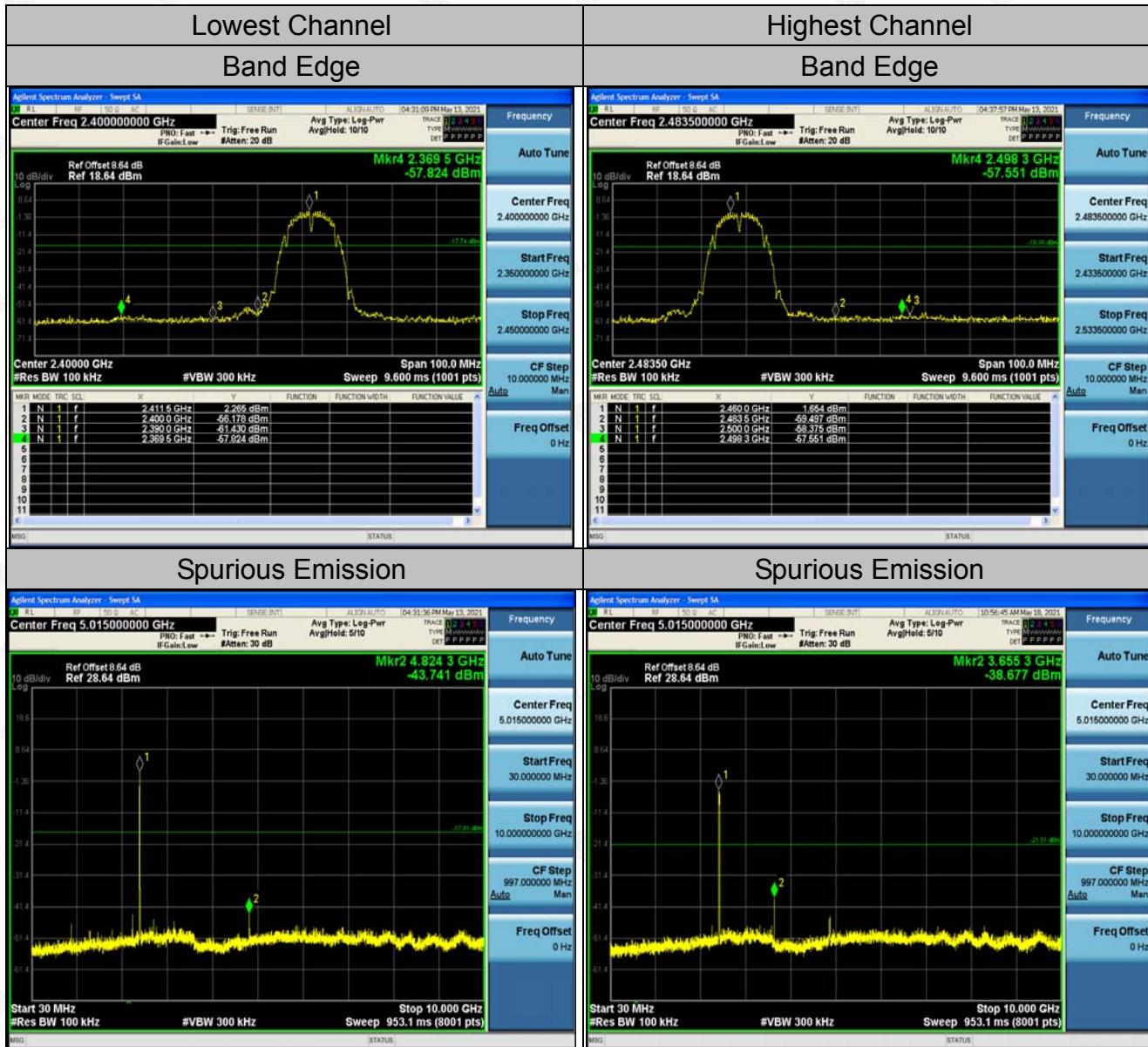


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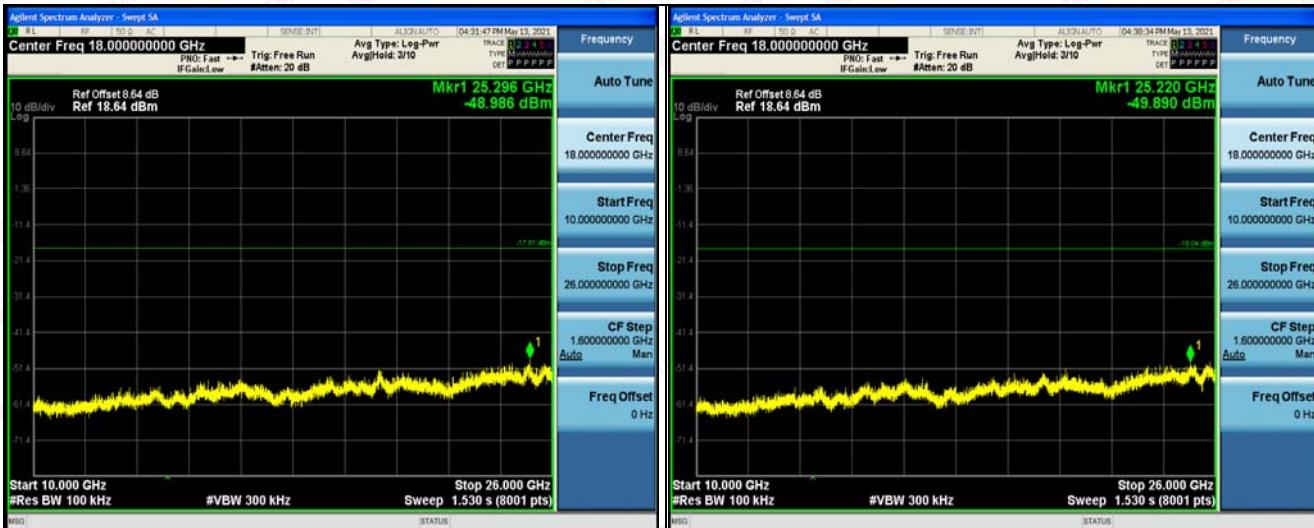


Chain 2

802.11b Modulation

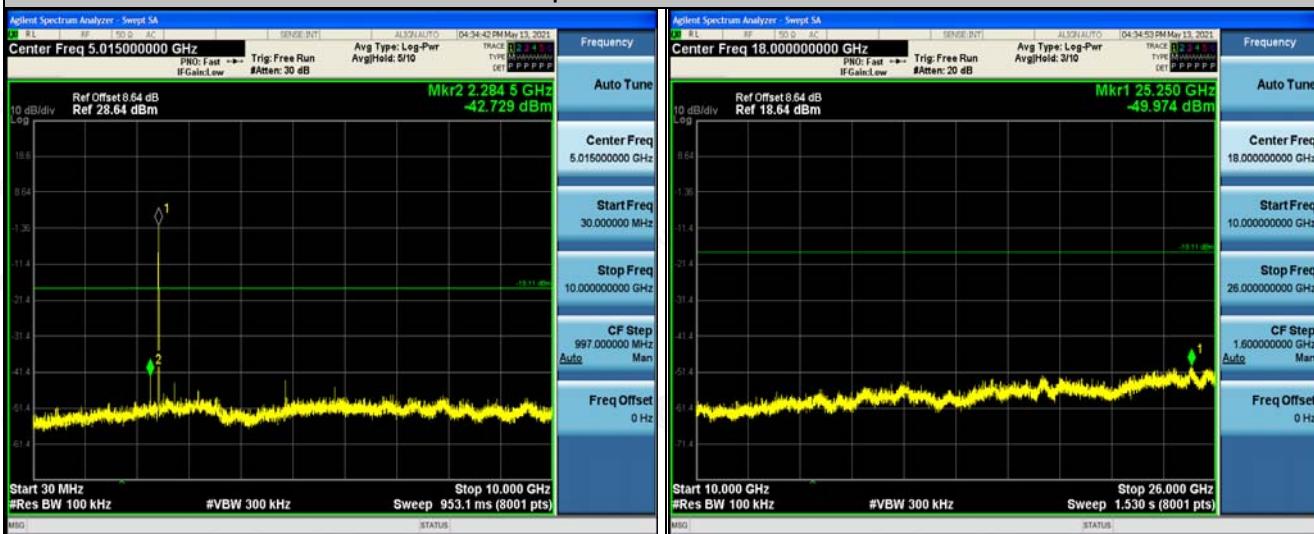


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Middle Channel

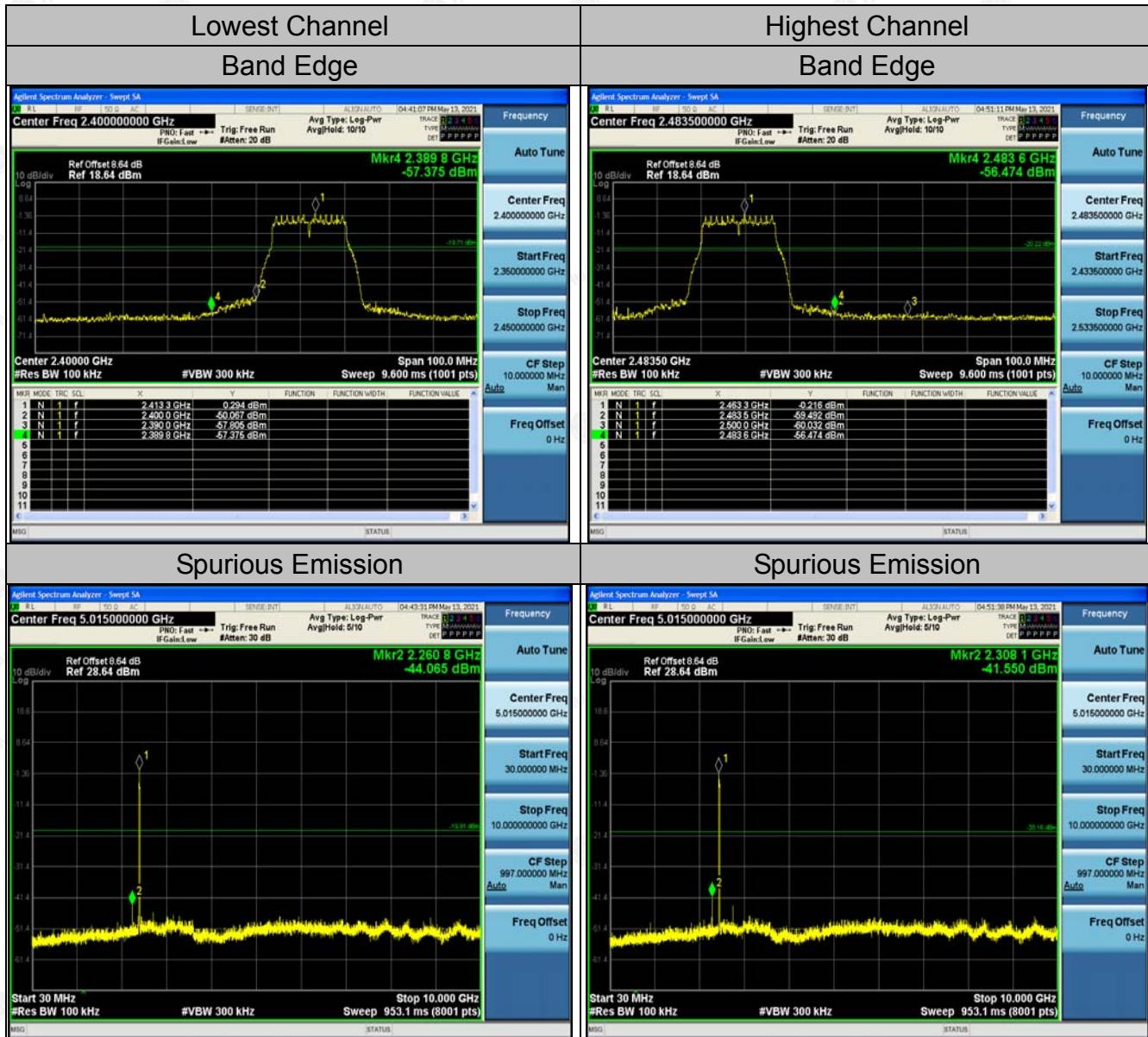
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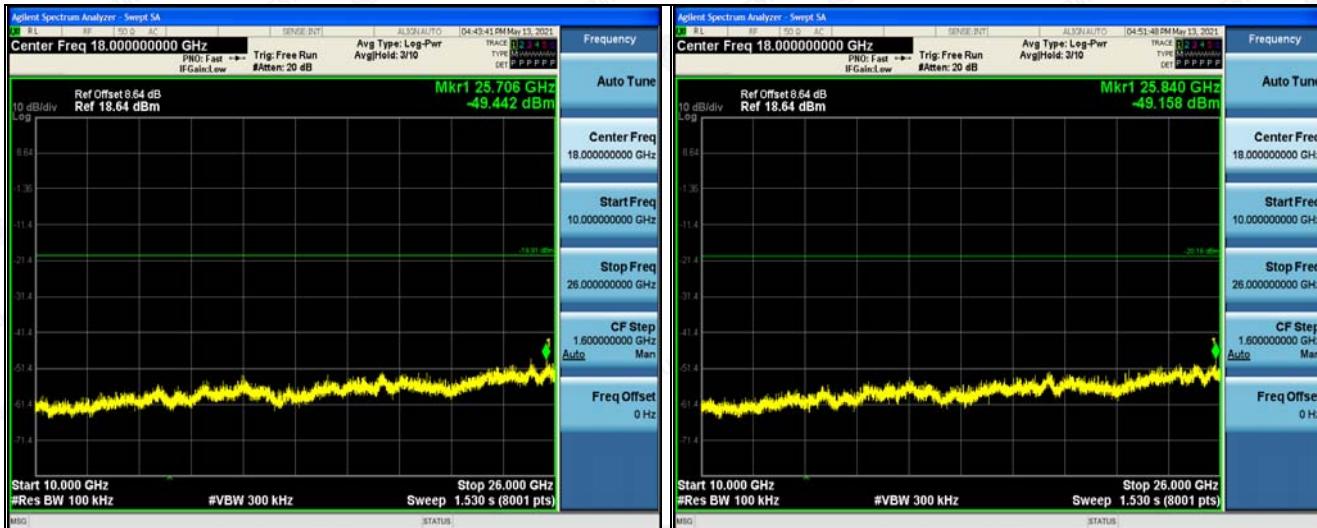
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802.11g Modulation

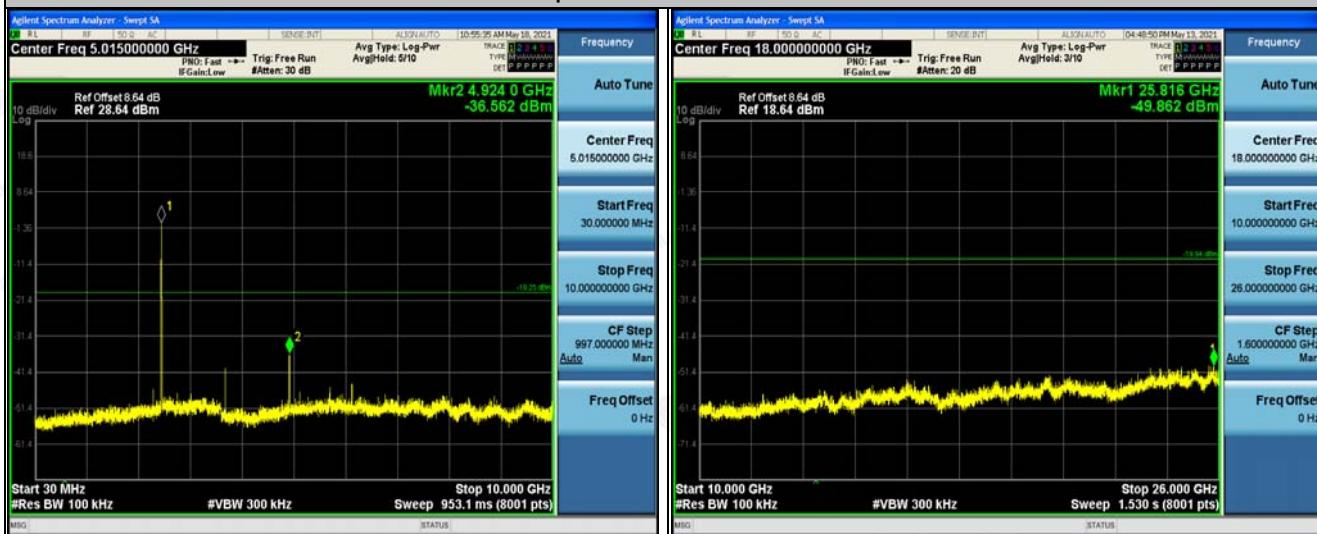


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Middle Channel

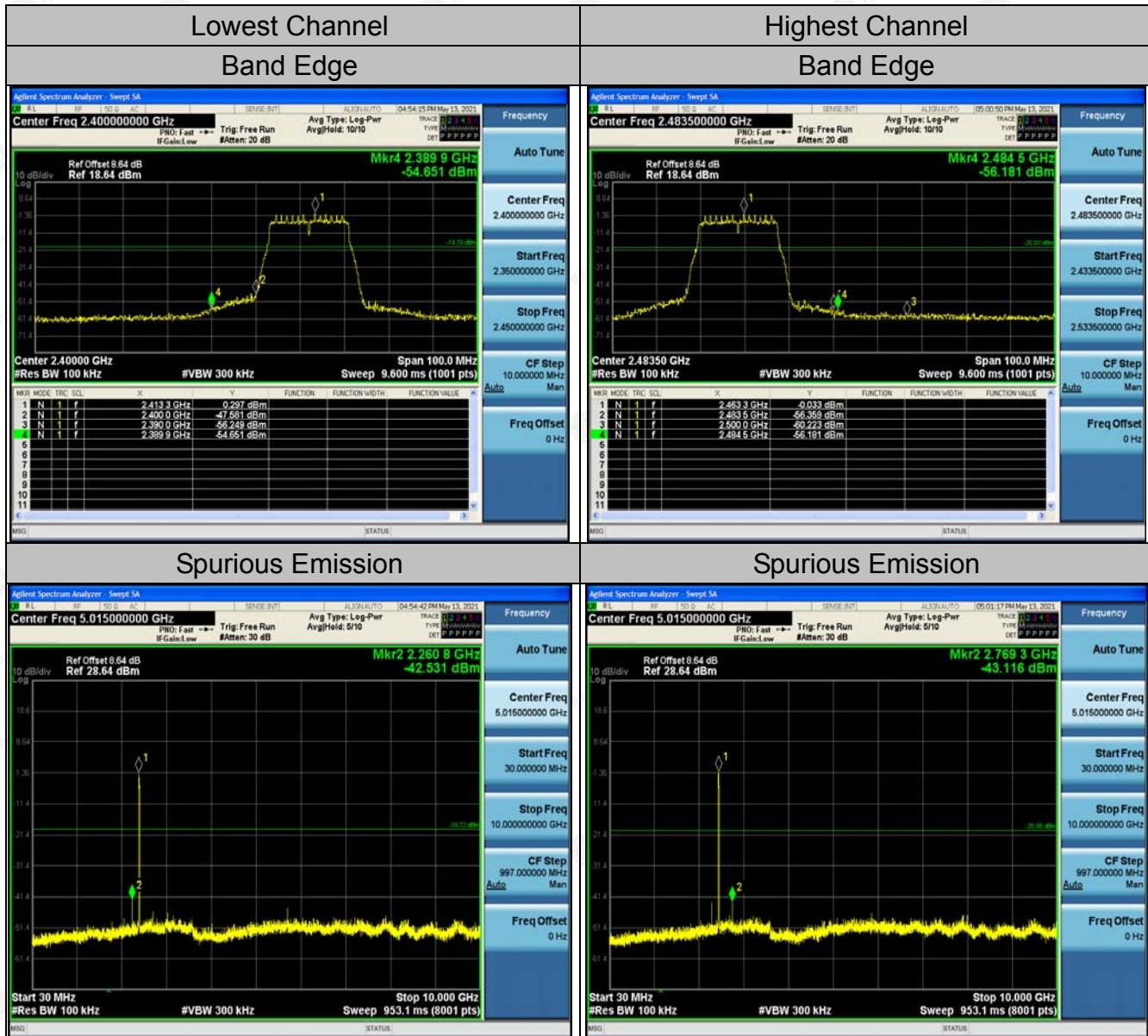
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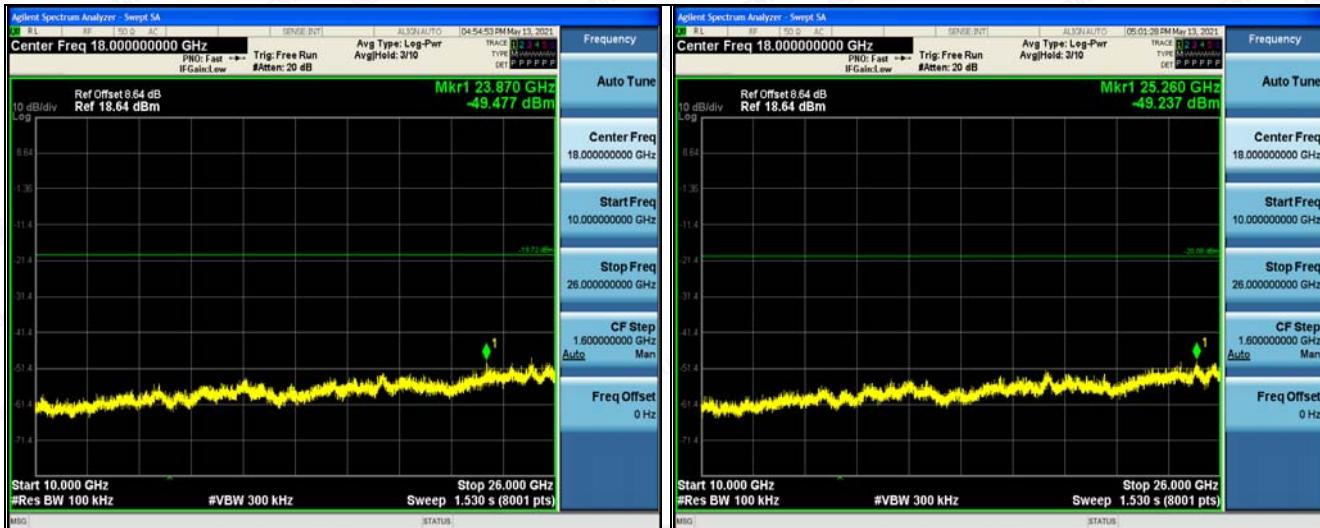
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802.11n (HT20) Modulation

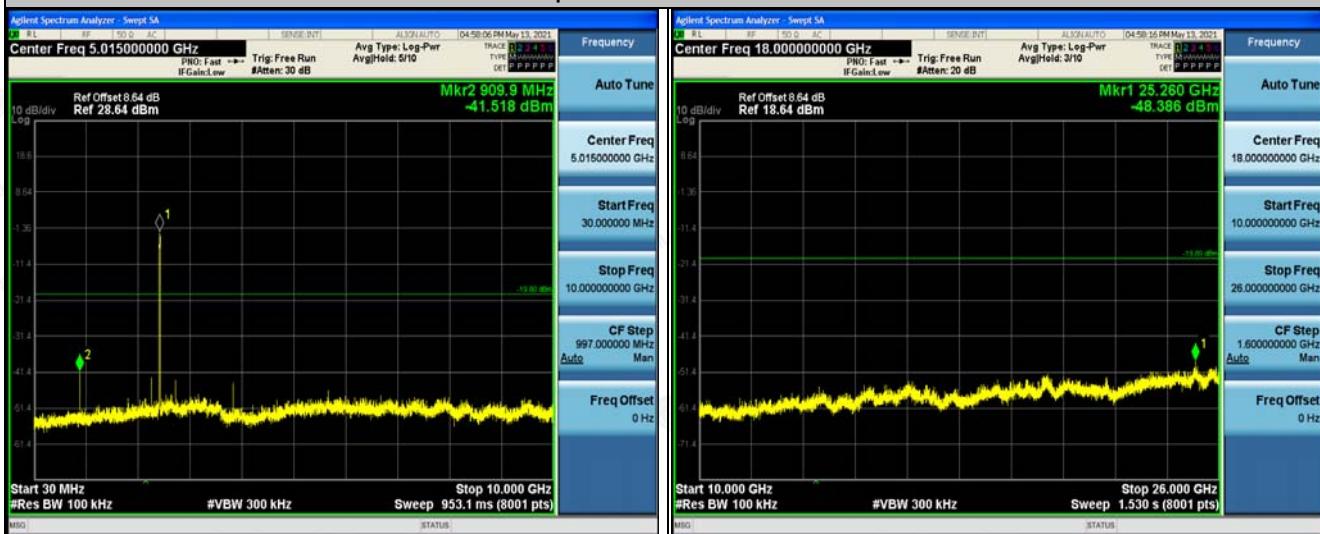


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Middle Channel

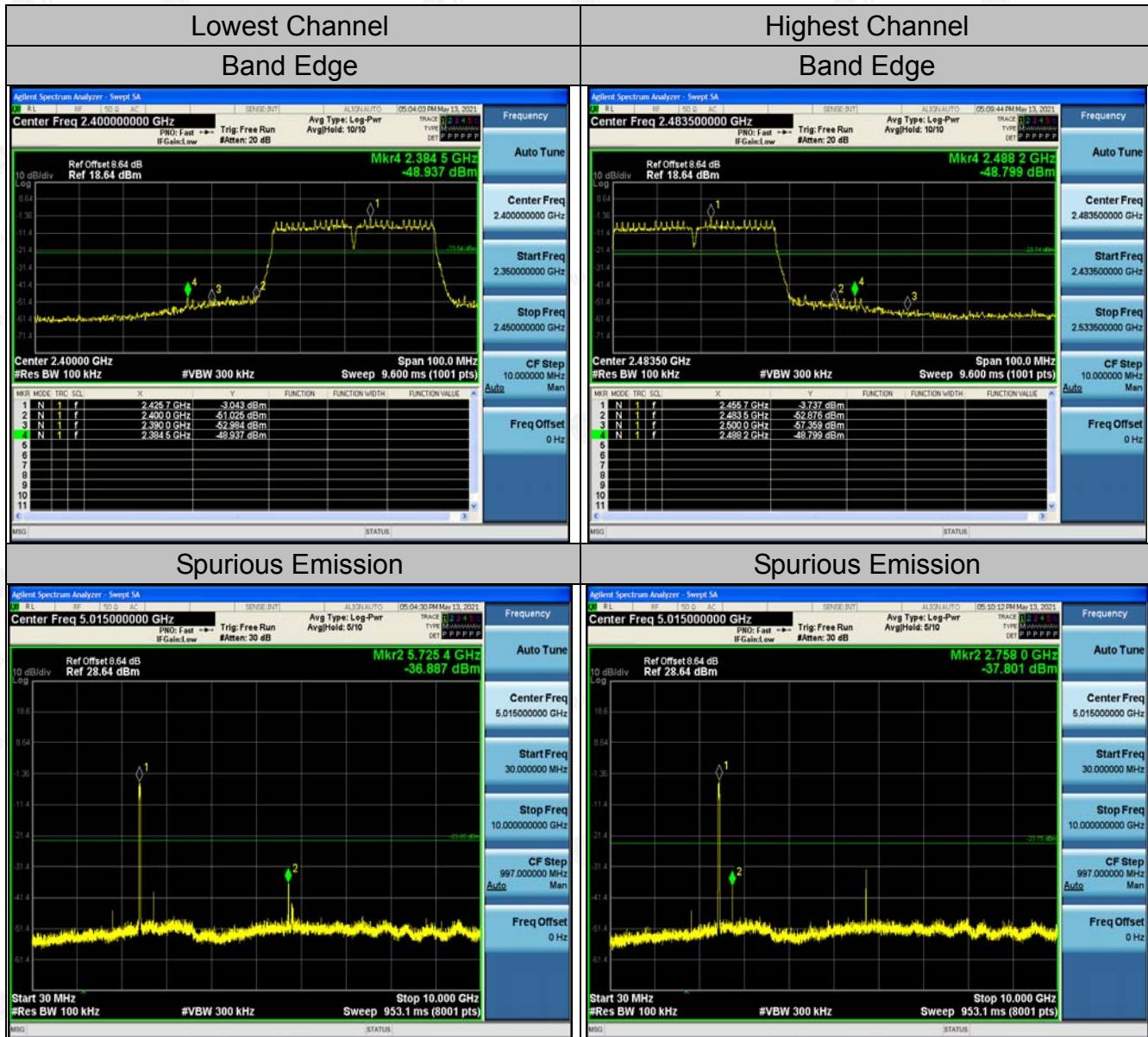
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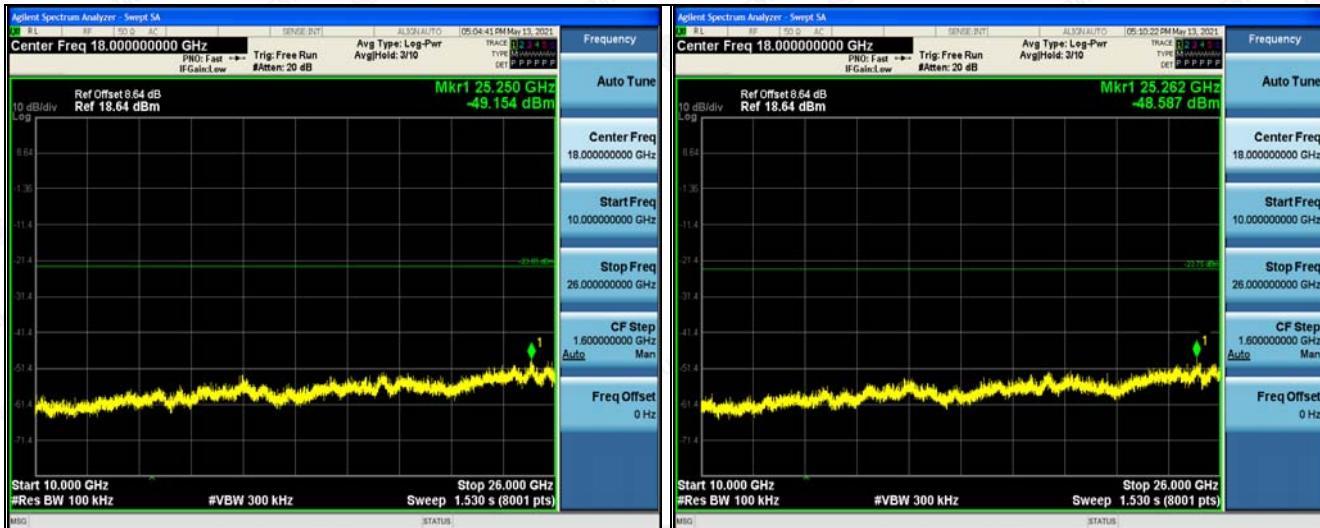
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802.11n (HT40) Modulation

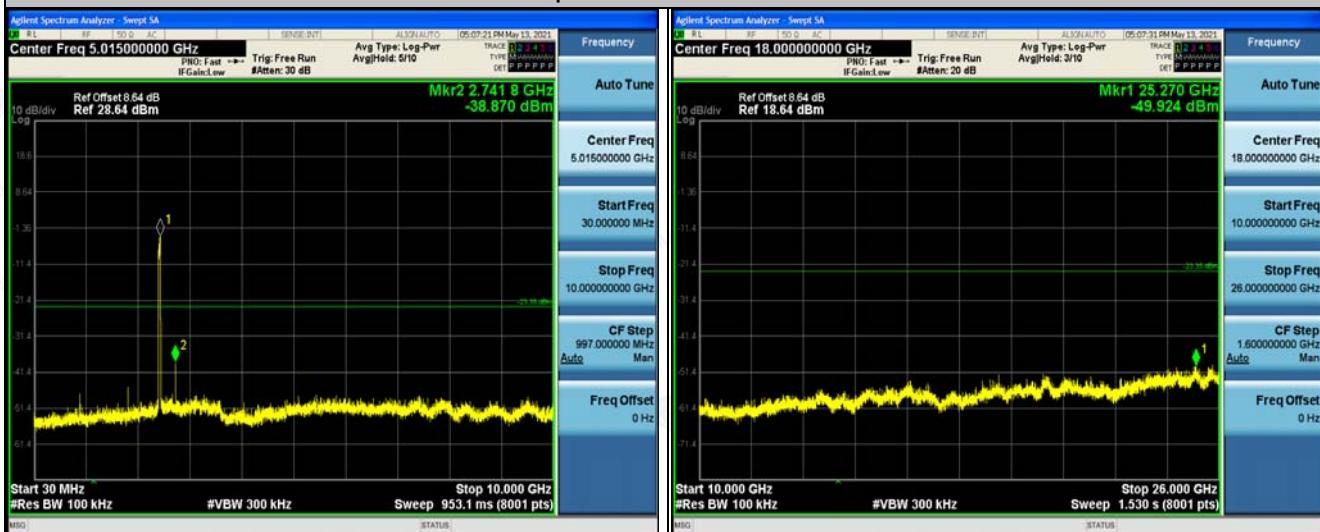


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Middle Channel

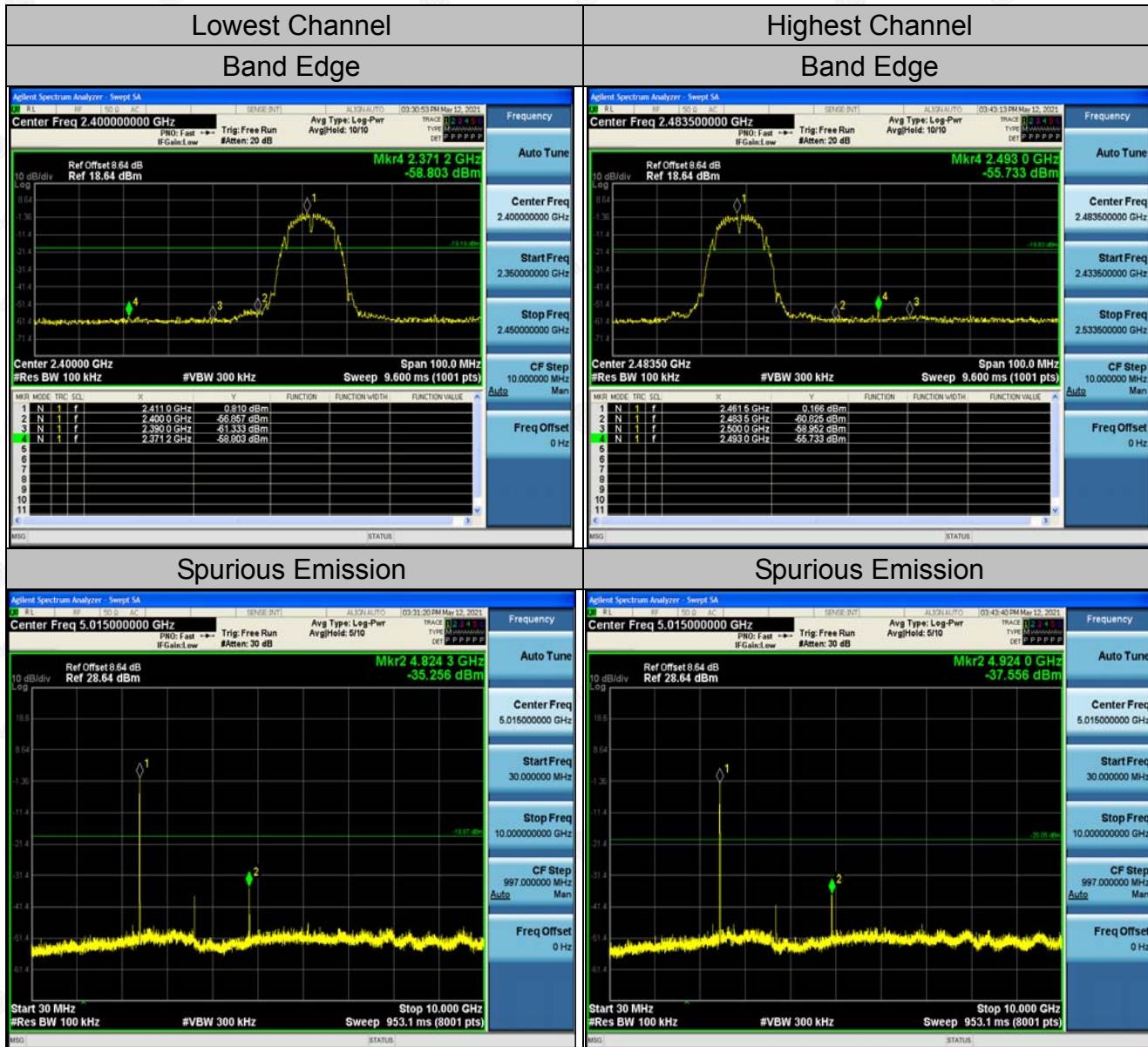
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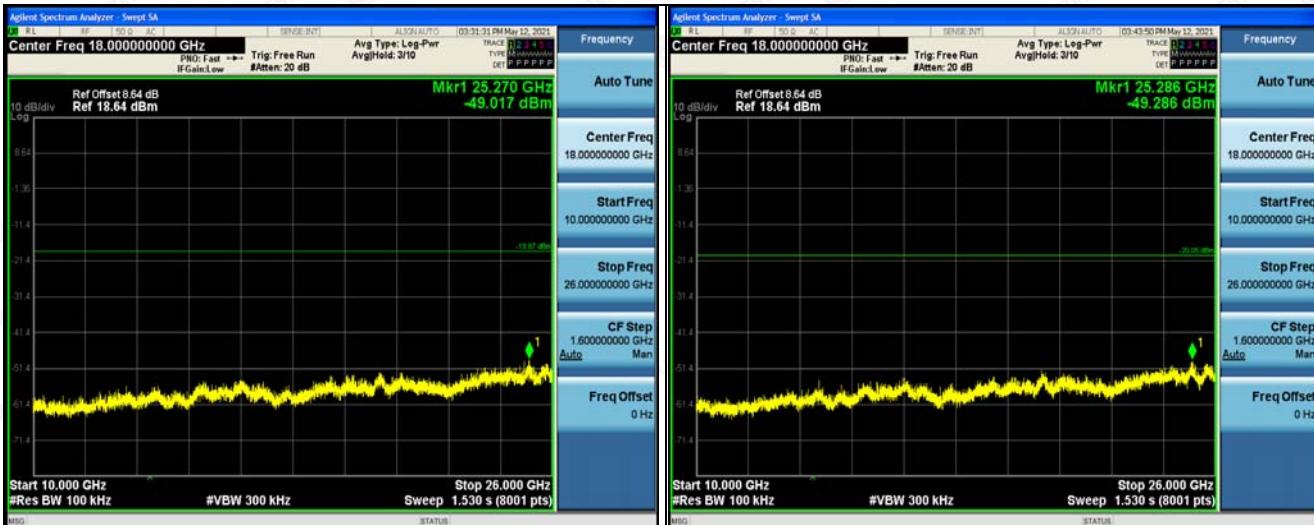
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Chain 3 802.11b Modulation

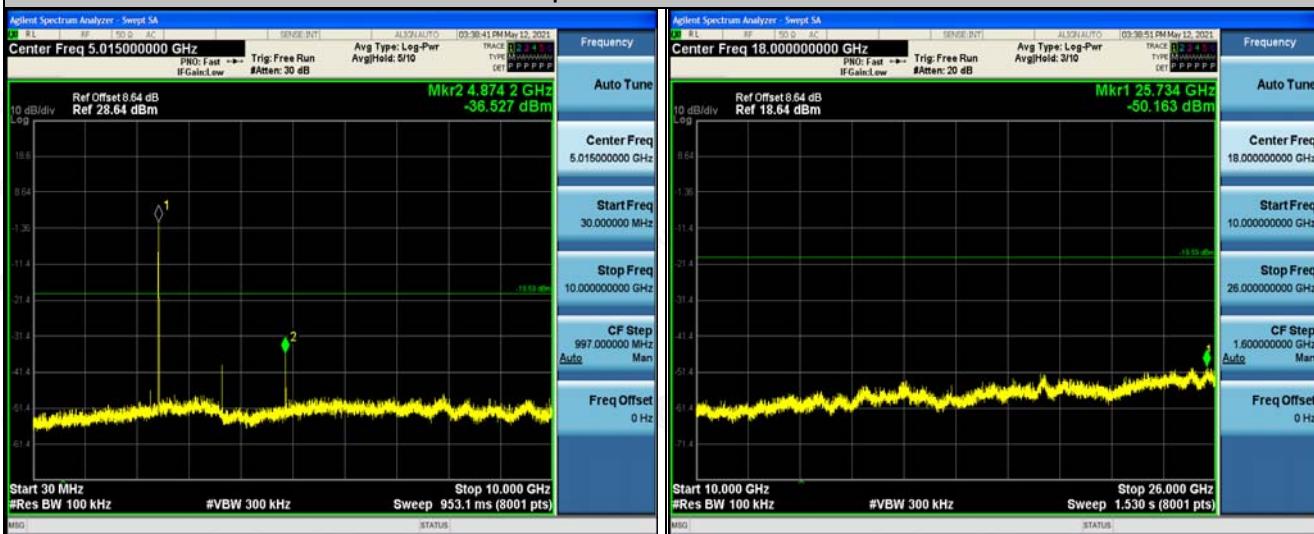


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Middle Channel

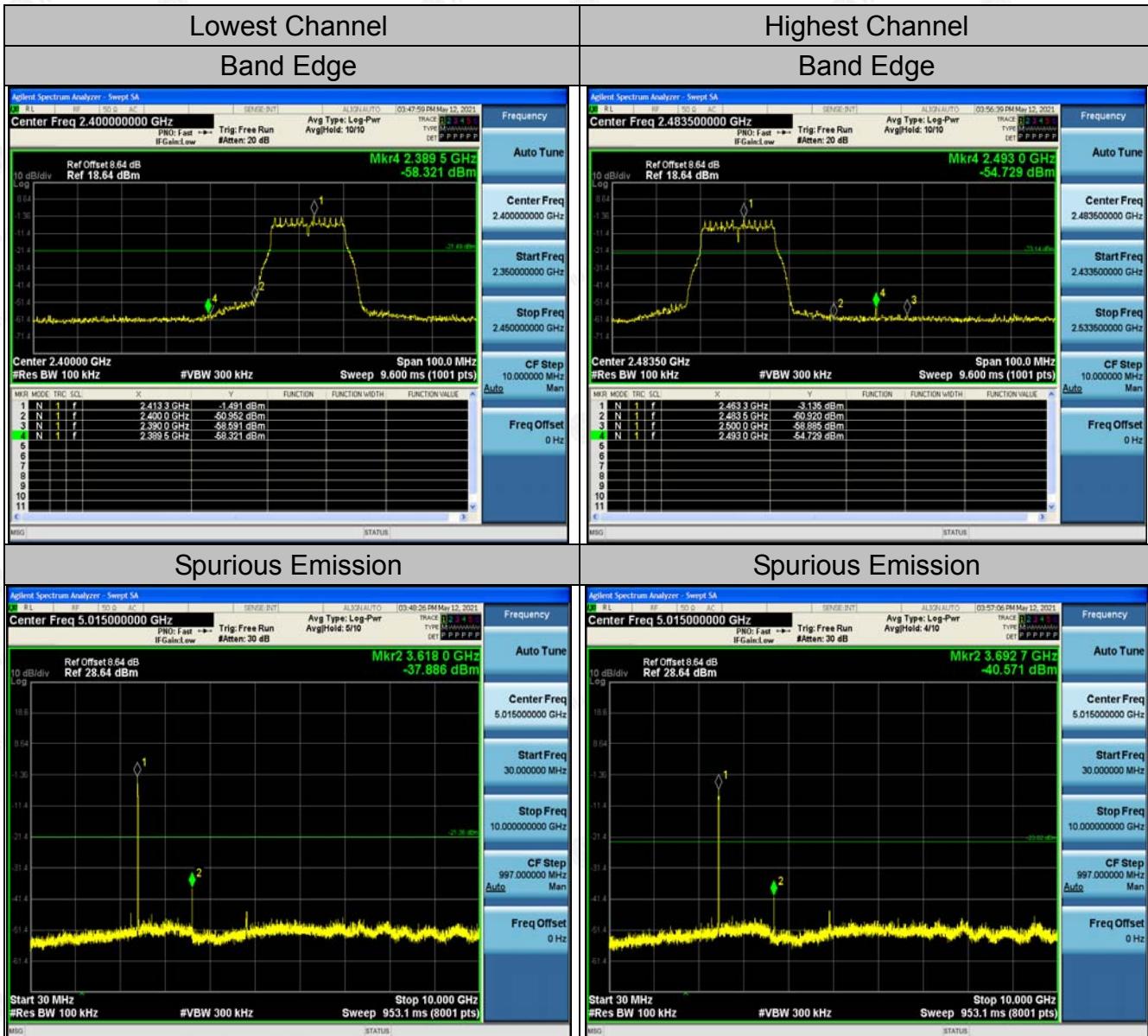
Spurious Emission



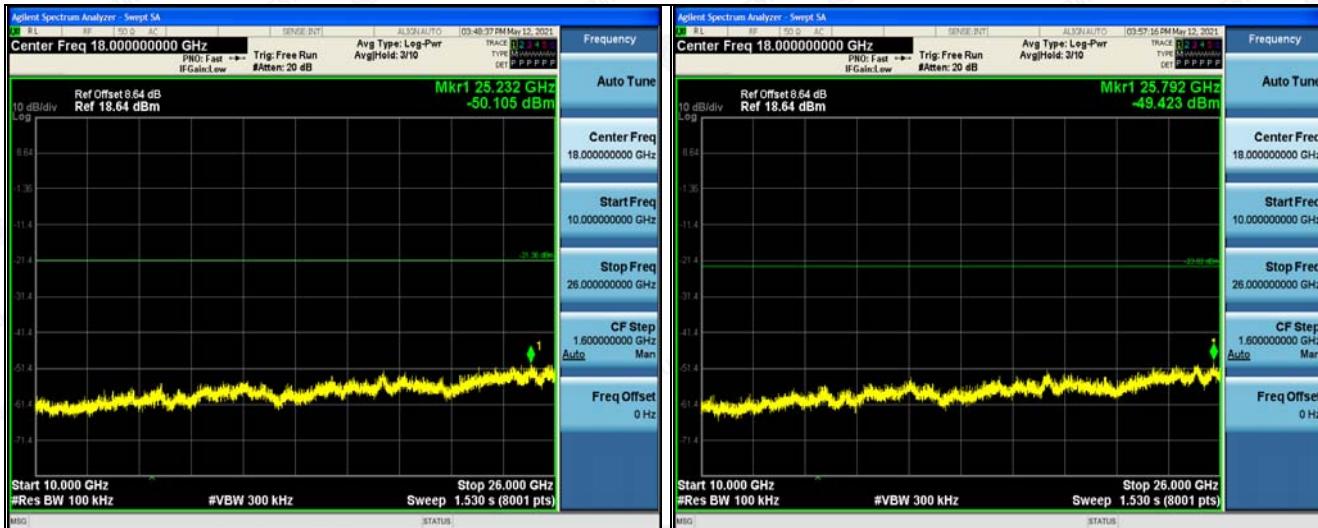
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802.11g Modulation

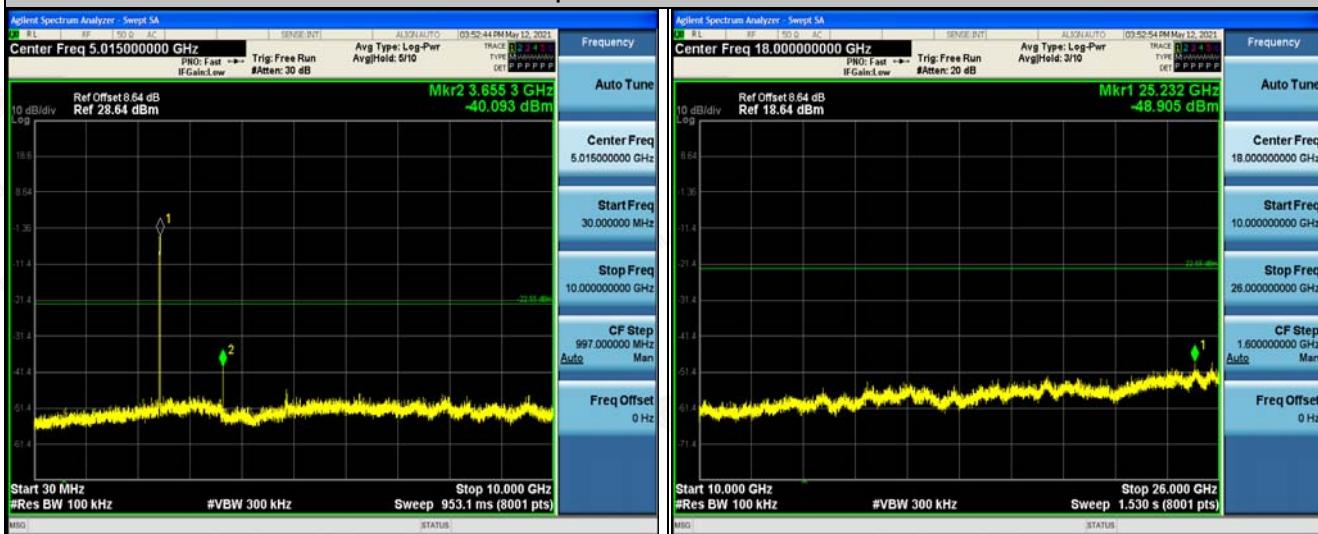


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Middle Channel

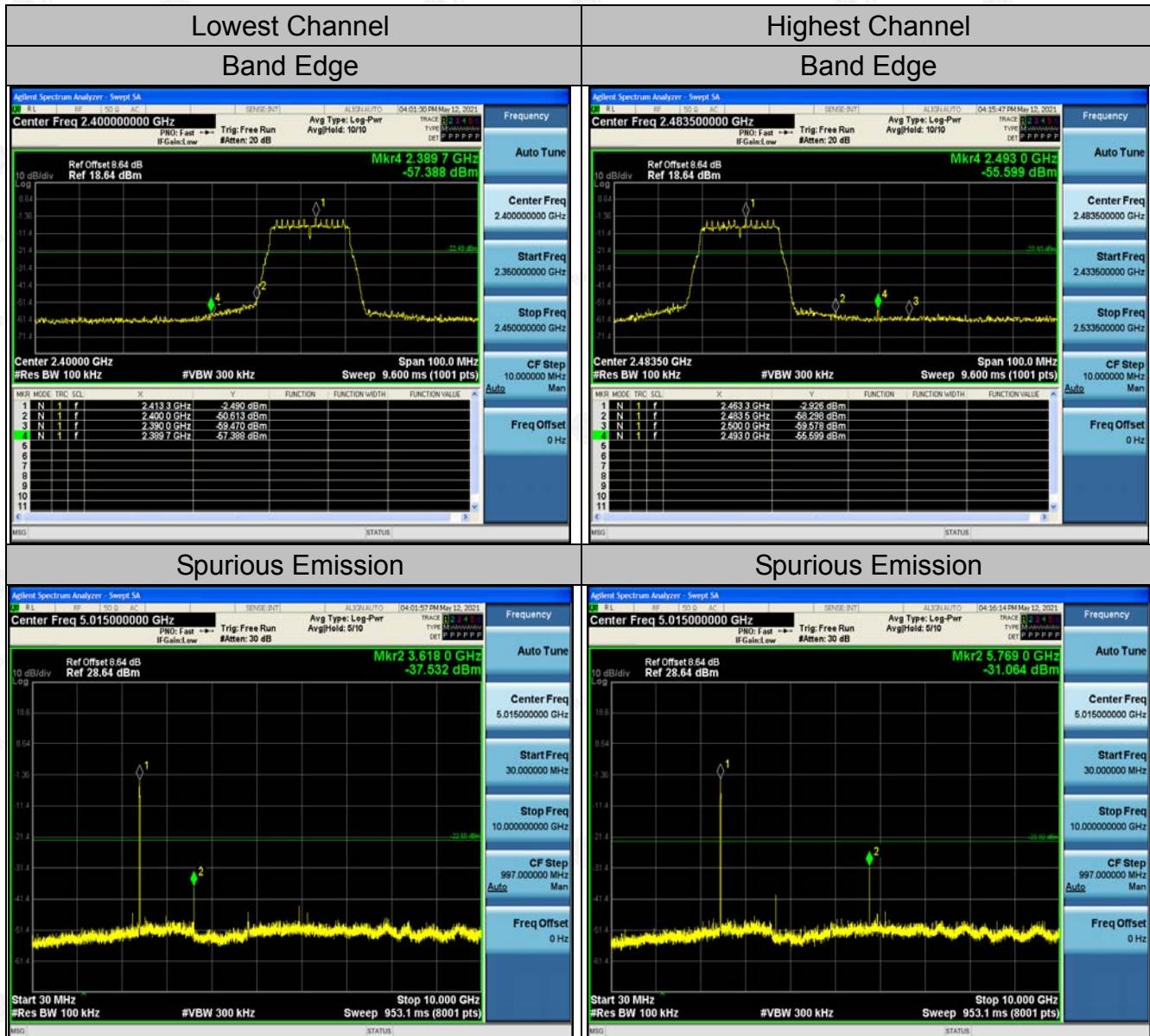
Spurious Emission



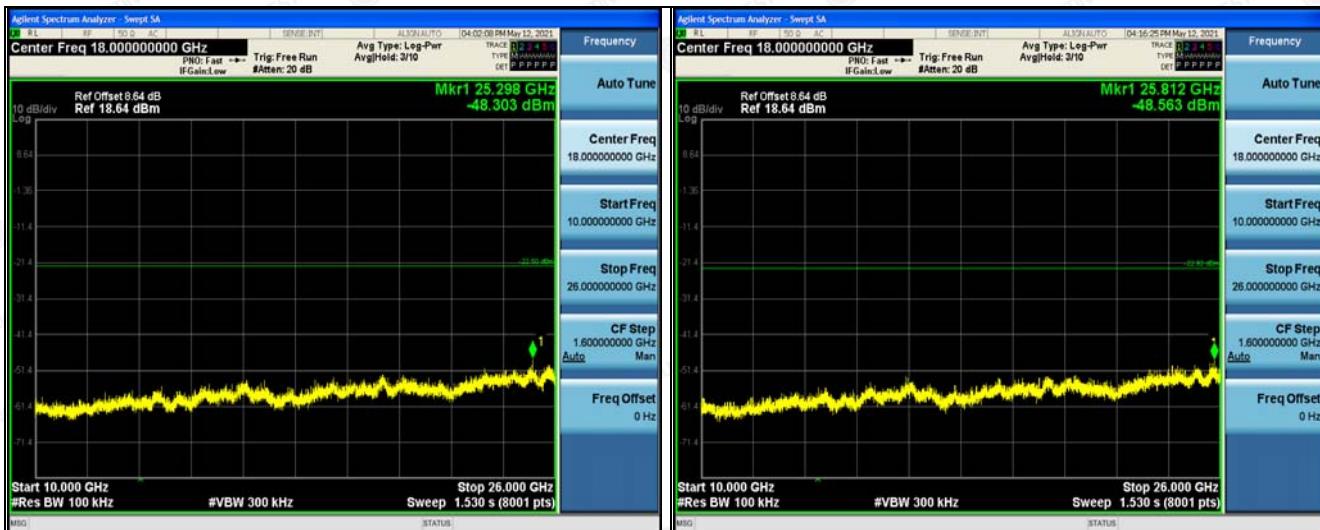
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802.11n (HT20) Modulation

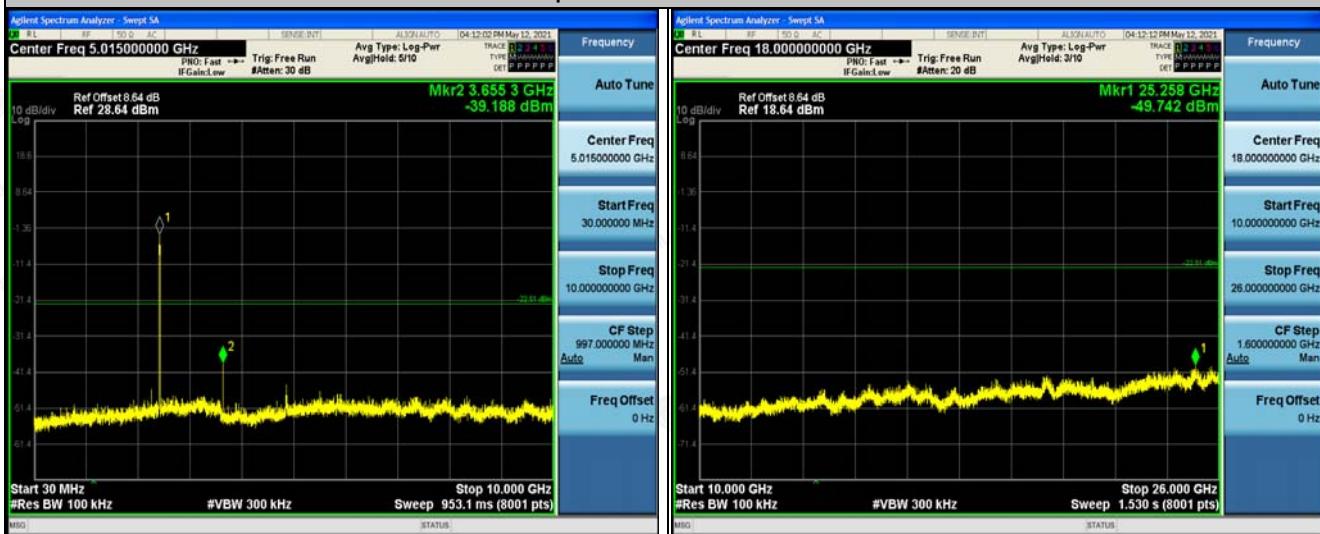


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Middle Channel

Spurious Emission



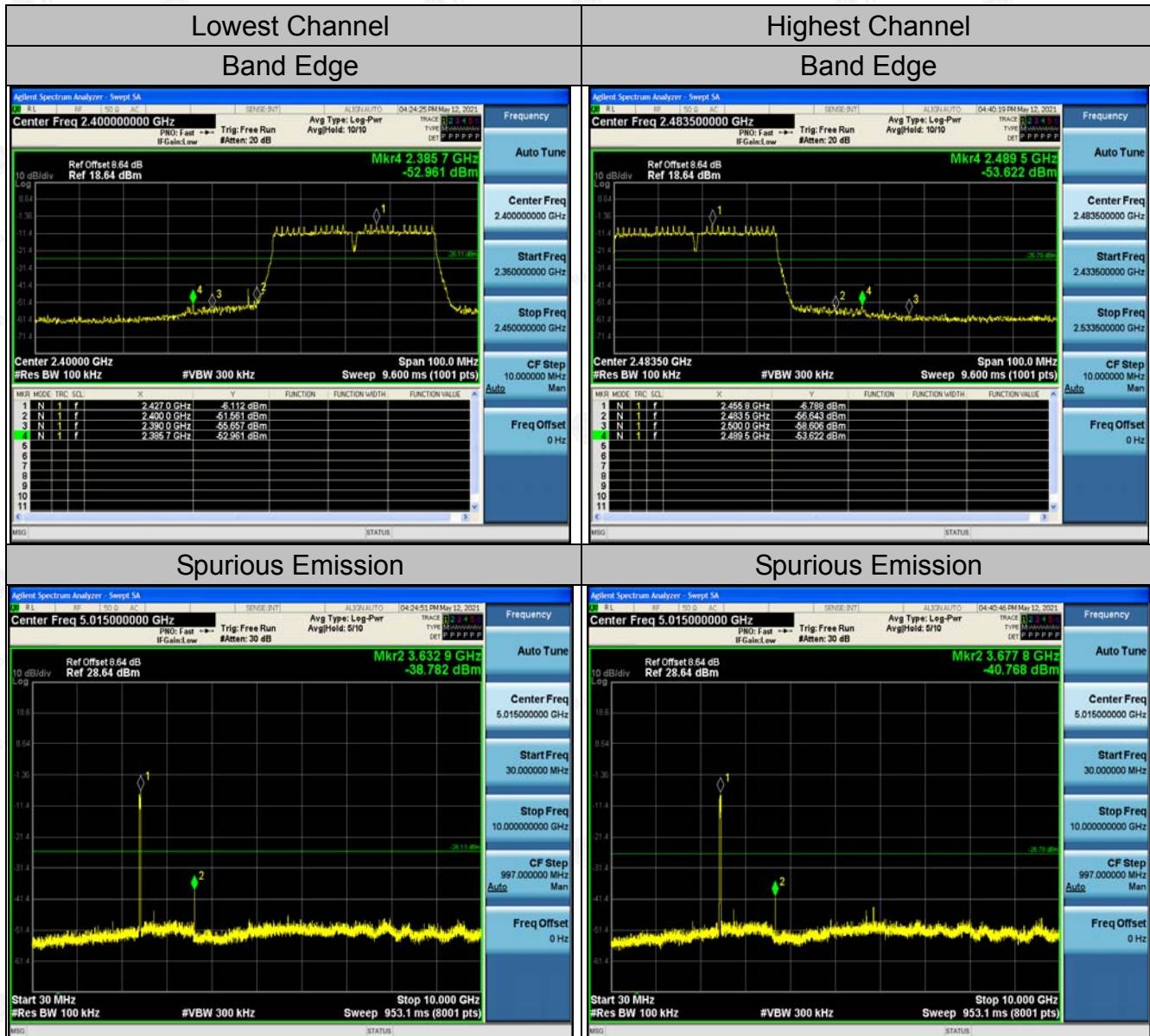
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HUAK Testing Lab TEL : +86-755 2302 9901 FAX : +86-755 2302 9901 E-mail : service@cer-mark.com

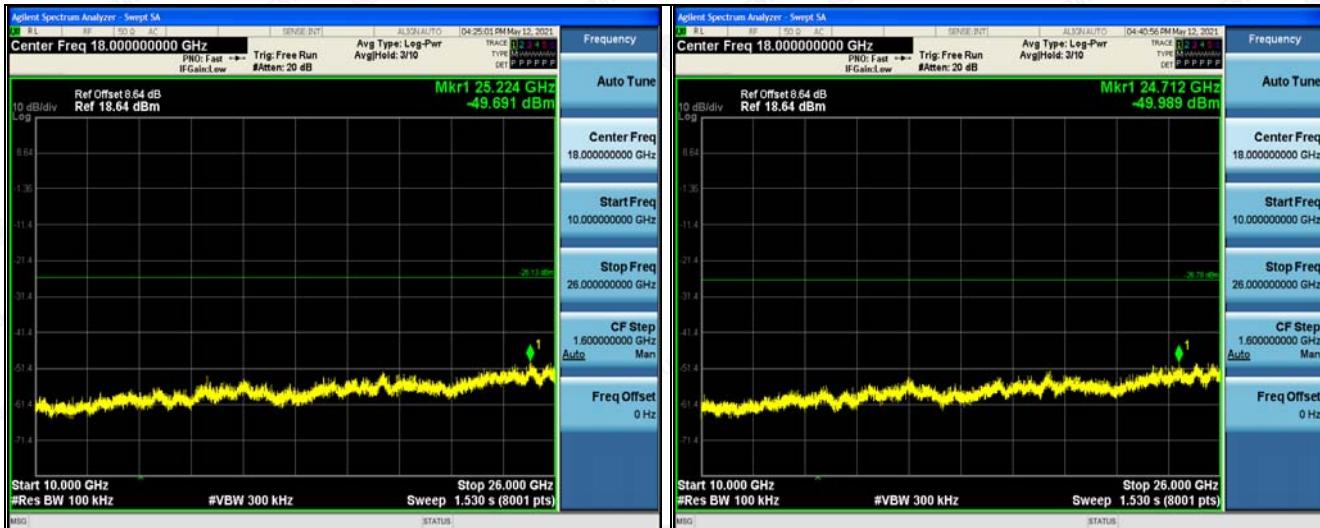
1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



802.11n (HT40) Modulation

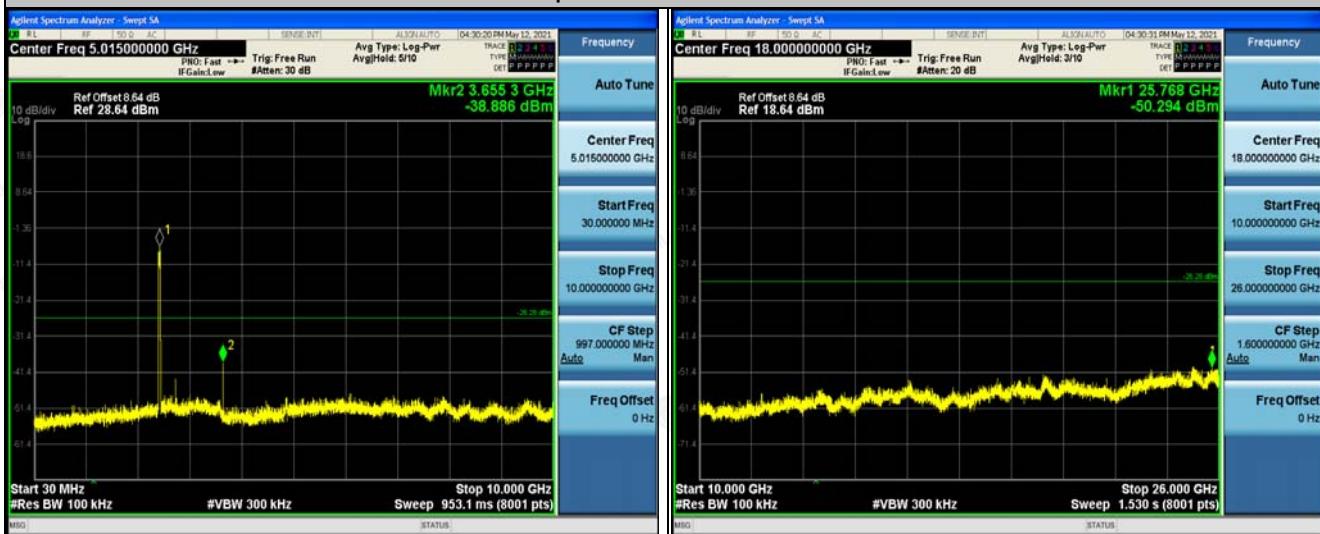


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Middle Channel

Spurious Emission

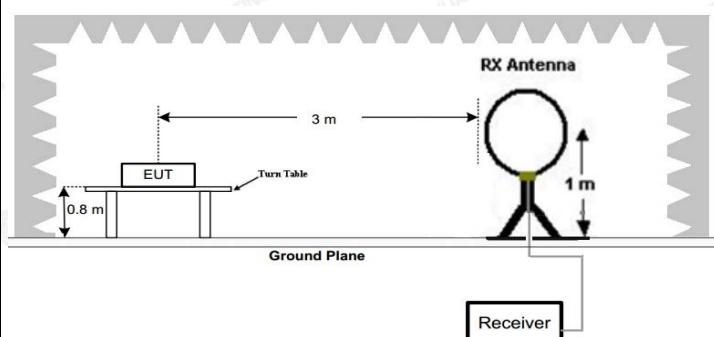


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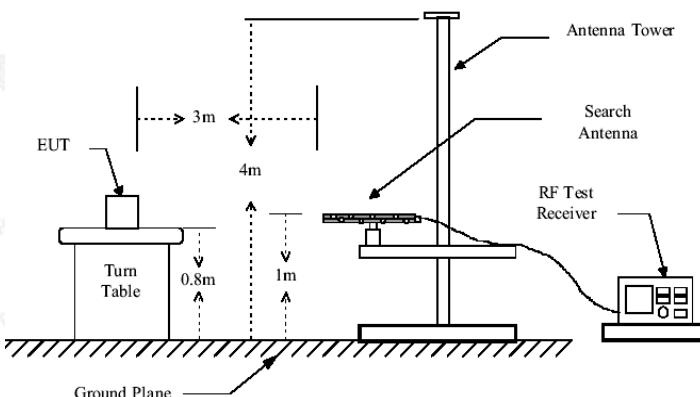


4.6. RADIATED SPURIOUS EMISSION MEASUREMENT

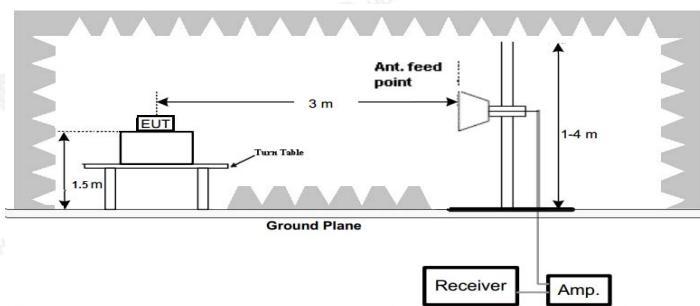
4.6.1. Test Specification

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

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Above 1GHz

**Test Procedure:**

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.



Test Procedure:	<p>The final measurement antenna elevation shall be that which maximizes the emissions. 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.</p> <p>3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</p> <p>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.</p> <p>5. Use the following spectrum analyzer settings:</p> <ul style="list-style-type: none">(1) Span shall wide enough to fully capture the emission being measured;(2) Set RBW=100 kHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;(3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement. <p>For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. $VBW \geq 1/T$, 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.</p>
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	Jun. 17, 2021
Spectrum analyzer	Agilent	N9020A	HKE-048	Jun. 17, 2021
Preamplifier	EMCI	EMC051845S E	HKE-015	Jun. 17, 2021
Preamplifier	Agilent	83051A	HKE-016	Jun. 17, 2021
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Jun. 17, 2021
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Jun. 17, 2021
Horn antenna	Schwarzbeck	9120D	HKE-013	Jun. 17, 2021
Antenna Mast	Keleto	CC-A-4M	N/A	N/A
Position controller	Taiwan MF	MF7802	HKE-011	Jun. 17, 2021
Radiated test software	Tonscend	TS+ Rev 2.5.0.0	HKE-082	N/A
RF cable (9KHz-1GHz)	Times	381806-001	N/A	N/A
RF cable	Times	1-40G	HKE-034	Jun. 17, 2021
High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	Jun. 17, 2021
RF Cable	Times	1-18G	HKE-099	Jun. 17, 2021

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



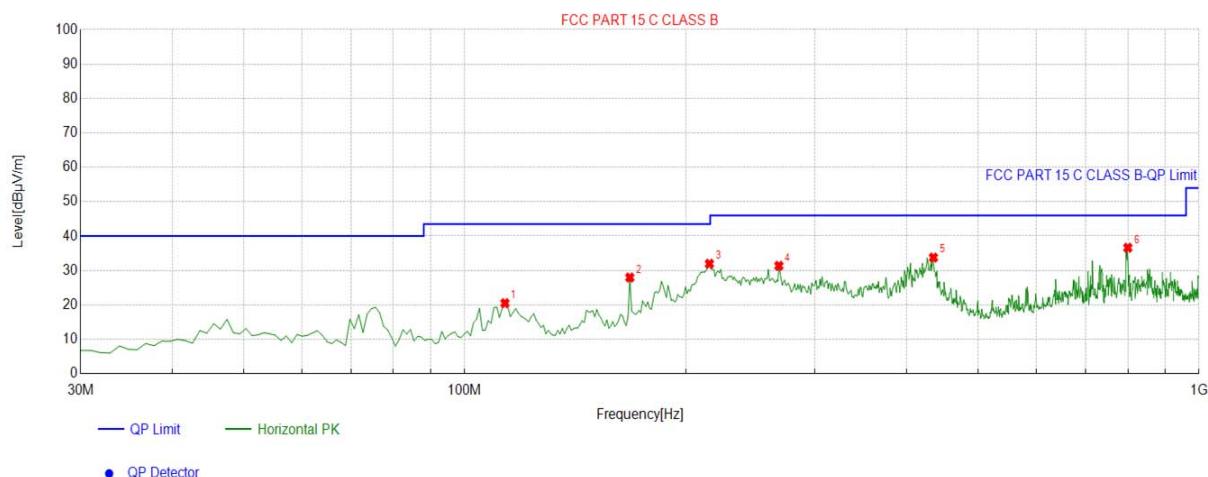
4.6.3. Test Data

Please refer to following diagram for individual
Below 1GHz

test mode: TX 802.11b 2412MHz

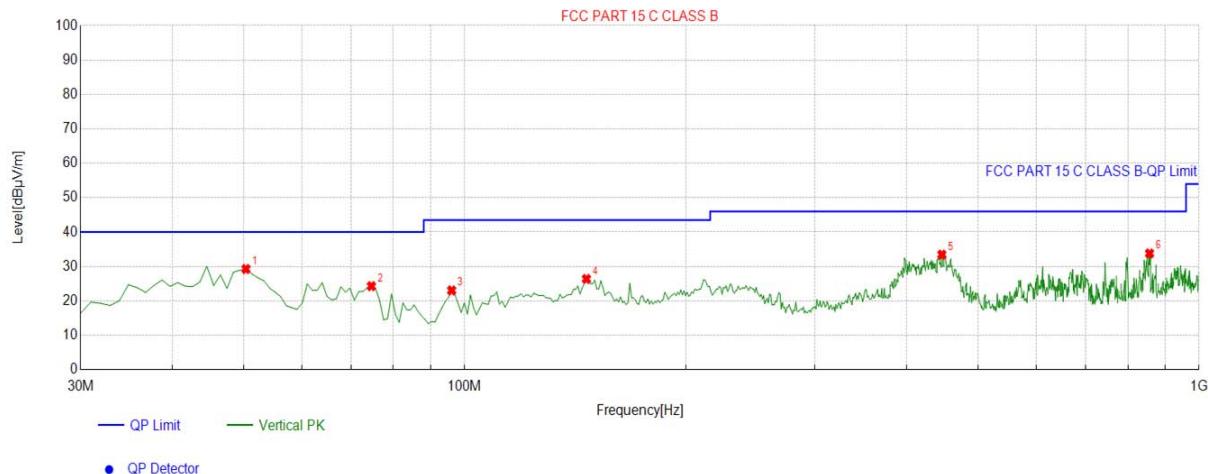
All the test modes completed for test. The worst case of Radiated Emission; the test data of this mode was reported.

Horizontal



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	113.5035	-16.02	36.52	20.50	43.50	23.00	100	316	Horizontal
2	167.8779	-17.50	45.45	27.95	43.50	15.55	100	268	Horizontal
3	215.4555	-14.67	46.61	31.94	43.50	11.56	100	280	Horizontal
4	267.8879	-13.63	44.98	31.35	46.00	14.65	100	288	Horizontal
5	434.8949	-9.64	43.39	33.75	46.00	12.25	100	110	Horizontal
6	799.9800	-3.12	39.73	36.61	46.00	9.39	100	23	Horizontal

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

**Vertical**

Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	50.3904	-13.71	42.97	29.26	40.00	10.74	100	88	Vertical
2	74.6647	-18.51	42.79	24.28	40.00	15.72	100	294	Vertical
3	96.0260	-16.06	39.10	23.04	43.50	20.46	100	310	Vertical
4	146.5165	-19.02	45.40	26.38	43.50	17.12	100	1	Vertical
5	446.5465	-9.14	42.58	33.44	46.00	12.56	100	195	Vertical
6	856.2963	-2.54	36.33	33.79	46.00	12.21	100	3	Vertical

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

Harmonics and Spurious Emissions**Frequency Range (9kHz-30MHz)**

Frequency (MHz)	Level@3m (dB μ V/m)	Limit@3m (dB μ V/m)
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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 (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4824	62.38	-3.64	58.74	74	-15.26	peak
4824	46.03	-3.64	42.39	54	-11.61	AVG
7236	55.19	-0.95	54.24	74	-19.76	peak
7236	40.69	-0.95	39.74	54	-14.26	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4824	61.38	-3.64	57.74	74	-16.26	peak
4824	46.11	-3.64	42.47	54	-11.53	AVG
7236	54.64	-0.95	53.69	74	-20.31	peak
7236	42.65	-0.95	41.7	54	-12.3	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



MID CH6 (802.11b Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4874	62.02	-3.51	58.51	74	-15.49	peak
4874	43.59	-3.51	40.08	54	-13.92	AVG
7311	57.08	-0.82	56.26	74	-17.74	peak
7311	35.96	-0.82	35.14	54	-18.86	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4874	60.46	-3.51	56.95	74	-17.05	peak
4874	40.77	-3.51	37.26	54	-16.74	AVG
7311	53.82	-0.82	53	74	-21	peak
7311	40.41	-0.82	39.59	54	-14.41	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



HIGH CH11 (802.11b Mode)/2462

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4924	60.45	-3.43	57.02	74	-16.98	
4924	41.17	-3.43	37.74	54	-16.26	AVG
7386	53.18	-0.75	52.43	74	-21.57	peak
7386	40.76	-0.75	40.01	54	-13.99	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4924	60.75	-3.43	57.32	74	-16.68	
4924	42.47	-3.43	39.04	54	-14.96	AVG
7386	51.39	-0.75	50.64	74	-23.36	peak
7386	36.76	-0.75	36.01	54	-17.99	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 73.16dB μ V/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dB μ V/m(PK Value) <54 dB μ V/m(AV Limit), the Average Detected not need to completed.
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LOW CH1 (802.11g Mode)/2412

All modes of operation were investigated and the worst-case of Antenna 1 are reported.

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4824	61.72	-3.64	58.08	74	-15.92	peak
4824	40.95	-3.64	37.31	54	-16.69	AVG
7236	50.19	-0.95	49.24	74	-24.76	peak
7236	41.74	-0.95	40.79	54	-13.21	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4824	60.97	-3.64	57.33	74	-16.67	peak
4824	40.65	-3.64	37.01	54	-16.99	AVG
7236	54.22	-0.95	53.27	74	-20.73	peak
7236	41.73	-0.95	40.78	54	-13.22	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



MID CH6 (802.11g Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4874	61.77	-3.51	58.26	74	-15.74	peak
4874	48.23	-3.51	44.72	54	-9.28	AVG
7311	51.76	-0.82	50.94	74	-23.06	peak
7311	43.08	-0.82	42.26	54	-11.74	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4874	62.43	-3.51	58.92	74	-15.08	peak
4874	42.16	-3.51	38.65	54	-15.35	AVG
7311	50.67	-0.82	49.85	74	-24.15	peak
7311	39.72	-0.82	38.9	54	-15.1	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



HIGH CH11 (802.11g Mode)/2462

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4924	60.96	-3.43	57.53	74	-16.47	
4924	42.86	-3.43	39.43	54	-14.57	AVG
7386	52.01	-0.75	51.26	74	-22.74	peak
7386	36.36	-0.75	35.61	54	-18.39	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4924	59.08	-3.43	55.65	74	-18.35	
4924	45.28	-3.43	41.85	54	-12.15	AVG
7386	50.06	-0.75	49.31	74	-24.69	peak
7386	40.19	-0.75	39.44	54	-14.56	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 73.16dB μ V/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dB μ V/m(PK Value) <54 dB μ V/m(AV Limit), the Average Detected not need to completed.



MIMO:

LOW CH1 (802.11n/H20 Mode)/2412

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4824	60.52	-3.64	56.88	74	-17.12	peak
4824	46.33	-3.64	42.69	54	-11.31	AVG
7236	54.68	-0.95	53.73	74	-20.27	peak
7236	40.11	-0.95	39.16	54	-14.84	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4824	60.87	-3.64	57.23	74	-16.77	peak
4824	46.01	-3.64	42.37	54	-11.63	AVG
7236	54.96	-0.95	54.01	74	-19.99	peak
7236	39.08	-0.95	38.13	54	-15.87	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



MID CH6 (802.11n/H20 Mode)/2437

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dB μ V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	
4874.00	61.49	-3.51	57.98	74.00	-16.02	peak
4874.00	39.86	-3.51	36.35	54.00	-17.65	AVG
7311.00	50.12	-0.82	49.30	74.00	-24.70	peak
7311.00	41.56	-0.82	40.74	54.00	-13.26	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dB μ V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	
4874.00	60.22	-3.51	56.71	74.00	-17.29	peak
4874.00	44.55	-3.51	41.04	54.00	-12.96	AVG
7311.00	53.03	-0.82	52.21	74.00	-21.79	peak
7311.00	39.56	-0.82	38.74	54.00	-15.26	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



HIGH CH11 (802.11n/H20 Mode)/2462

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4924	59.29	-3.43	55.86	74	-18.14	peak
4924	40.62	-3.43	37.19	54	-16.81	AVG
7386	50.38	-0.75	49.63	74	-24.37	peak
7386	41.42	-0.75	40.67	54	-13.33	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4924	62.54	-3.43	59.11	74	-14.89	peak
4924	41.71	-3.43	38.28	54	-15.72	AVG
7386	50.69	-0.75	49.94	74	-24.06	peak
7386	38.06	-0.75	37.31	54	-16.69	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



LOW CH3 (802.11n/H40 Mode)/2422

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4844	59.81	-3.63	56.18	74	-17.82	peak
4844	44.25	-3.63	40.62	54	-13.38	AVG
7266	50.61	-0.94	49.67	74	-24.33	peak
7266	45.13	-0.94	44.19	54	-9.81	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4844	61.71	-3.63	58.08	74	-15.92	peak
4844	45.37	-3.63	41.74	54	-12.26	AVG
7266	51.92	-0.94	50.98	74	-23.02	peak
7266	41.61	-0.94	40.67	54	-13.33	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



MID CH6 (802.11n/H40 Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4874	58.28	-3.51	54.77	74	-19.23	peak
4874	46.13	-3.51	42.62	54	-11.38	AVG
7311	51.79	-0.82	50.97	74	-23.03	peak
7311	42.77	-0.82	41.95	54	-12.05	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4874	61.15	-3.51	57.64	74	-16.36	peak
4874	41.25	-3.51	37.74	54	-16.26	AVG
7311	52.41	-0.82	51.59	74	-22.41	peak
7311	36.55	-0.82	35.73	54	-18.27	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



HIGH CH9 (802.11n/H40 Mode)/2452

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4904	60.15	-3.43	56.72	74	-17.28	peak
4904	41.72	-3.43	38.29	54	-15.71	AVG
7356	51.26	-0.75	50.51	74	-23.49	peak
7356	40.17	-0.75	39.42	54	-14.58	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
4904	60.03	-3.43	56.6	74	-17.4	peak
4904	44.34	-3.43	40.91	54	-13.09	AVG
7356	53.64	-0.75	52.89	74	-21.11	peak
7356	40.92	-0.75	40.17	54	-13.83	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 73.16dB μ V/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dB μ V/m(PK Value) <54 dB μ V/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 (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2310	59.09	-5.81	53.28	74	-20.72	peak
2310	/	-5.81	/	54	/	AVG
2390	63.22	-5.84	57.38	74	-16.62	peak
2390	53.33	-5.84	47.49	54	-6.51	AVG
2400	63.68	-5.84	57.84	74	-16.16	peak
2400	46.87	-5.84	41.03	54	-12.97	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2310	57.34	-5.81	51.53	74	-22.47	peak
2310	/	-5.81	/	54	/	AVG
2390	61.19	-5.84	55.35	74	-18.65	peak
2390	46.68	-5.84	40.84	54	-13.16	AVG
2400	61.25	-5.84	55.41	74	-18.59	peak
2400	45.95	-5.84	40.11	54	-13.89	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Operation Mode: TX CH High (2462MHz)

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2483.50	58.25	-5.65	52.6	74	-21.4	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	53.04	-5.65	47.39	74	-26.61	peak
2500.00	/	-5.65	/	54	/	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2483.50	56.59	-5.65	50.94	74	-23.06	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	57.77	-5.65	52.12	74	-21.88	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 (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2310	55.61	-5.81	49.8	74	-24.2	peak
2310	/	-5.81	/	54	/	AVG
2390	63.32	-5.84	57.48	74	-16.52	peak
2390	52.02	-5.84	46.18	54	-7.82	AVG
2400	61.37	-5.84	55.53	74	-18.47	peak
2400	48.56	-5.84	42.72	54	-11.28	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2310	56.63	-5.81	50.82	74	-23.18	peak
2310	/	-5.81	/	54	/	AVG
2390	59.49	-5.84	53.65	74	-20.35	peak
2390	48.07	-5.84	42.23	54	-11.77	AVG
2400	61.97	-5.84	56.13	74	-17.87	peak
2400	45.73	-5.84	39.89	54	-14.11	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Operation Mode: TX CH High (2462MHz)

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2483.50	58.28	-5.65	52.63	74	-21.37	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.24	-5.65	49.59	74	-24.41	peak
2500.00	/	-5.65	/	54	/	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2483.50	51.31	-5.65	45.66	74	-28.34	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.02	-5.65	49.37	74	-24.63	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 (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2310	55.78	-5.81	49.97	74	-24.03	peak
2310	/	-5.81	/	54	/	AVG
2390	60.13	-5.84	54.29	74	-19.71	peak
2390	46.81	-5.84	40.97	54	-13.03	AVG
2400	61.24	-5.84	55.4	74	-18.6	peak
2400	47.16	-5.84	41.32	54	-12.68	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2310	54.36	-5.81	48.55	74	-25.45	peak
2310	/	-5.81	/	54	/	AVG
2390	61.28	-5.84	55.44	74	-18.56	peak
2390	46.63	-5.84	40.79	54	-13.21	AVG
2400	64.61	-5.84	58.77	74	-15.23	peak
2400	45.79	-5.84	39.95	54	-14.05	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Operation Mode: TX CH High (2462MHz)

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2483.50	53.41	-5.65	47.76	74	-26.24	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	52.06	-5.65	46.41	74	-27.59	peak
2500.00	/	-5.65	/	54	/	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2483.50	55.42	-5.65	49.77	74	-24.23	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	54.08	-5.65	48.43	74	-25.57	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 (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2310	58.32	-5.81	52.51	74	-21.49	peak
2310	/	-5.81	/	54	/	AVG
2390	62.55	-5.84	56.71	74	-17.29	peak
2390	48.81	-5.84	42.97	54	-11.03	AVG
2400	61.29	-5.84	55.45	74	-18.55	peak
2400	49.12	-5.84	43.28	54	-10.72	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2310	58.89	-5.81	53.08	74	-20.92	peak
2310	/	-5.81	/	54	/	AVG
2390	60.11	-5.84	54.27	74	-19.73	peak
2390	47.27	-5.84	41.43	54	-12.57	AVG
2400	61.25	-5.84	55.41	74	-18.59	peak
2400	46.75	-5.84	40.91	54	-13.09	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Operation Mode: TX CH High (2452MHz)

Horizontal:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2483.50	56.67	-5.65	51.02	74	-22.98	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	53.48	-5.65	47.83	74	-26.17	peak
2500.00	/	-5.65	/	54	/	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type
2483.50	53.77	-5.65	48.12	74	-25.88	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	54.01	-5.65	48.36	74	-25.64	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.



5. ANTENNA REQUIREMENT

Standard Applicable

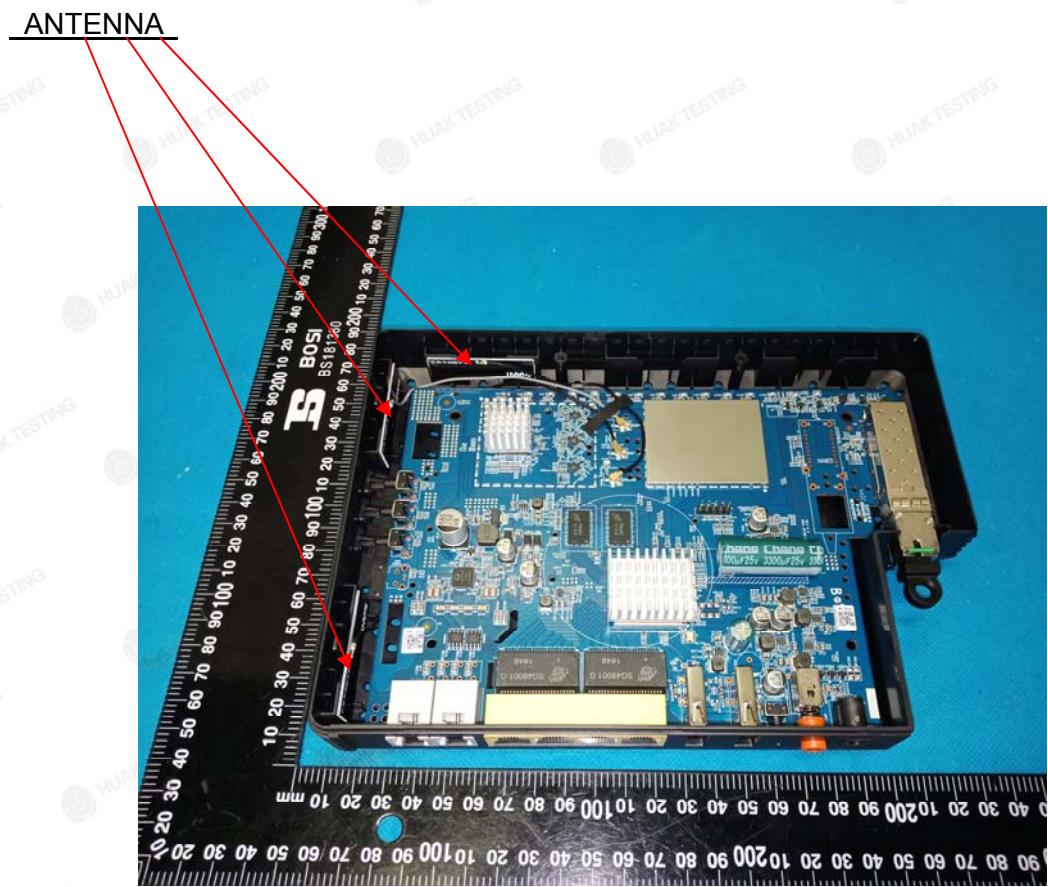
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247, if transmitting antennas of directional gain 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

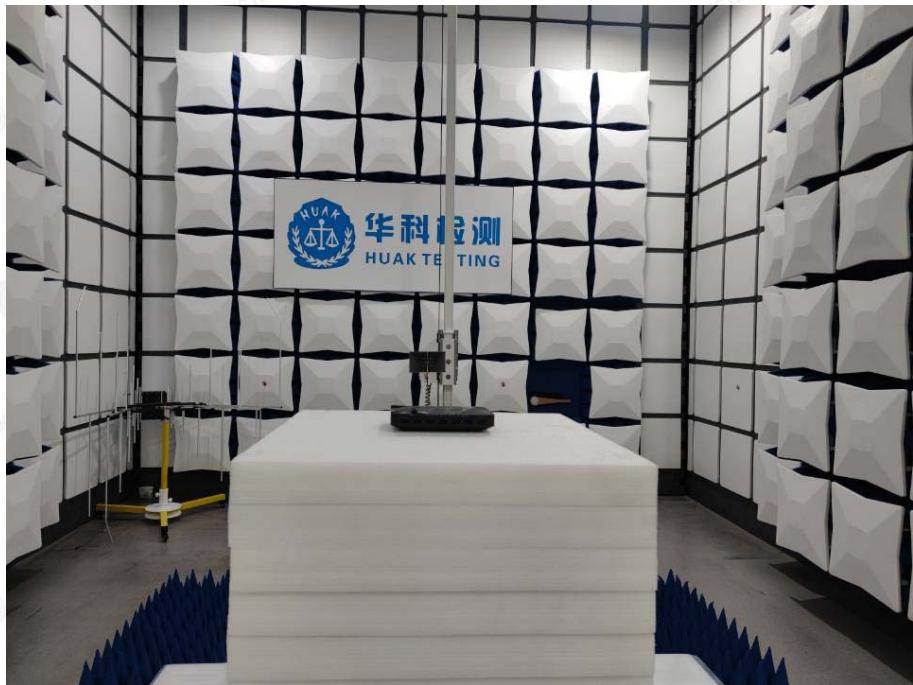
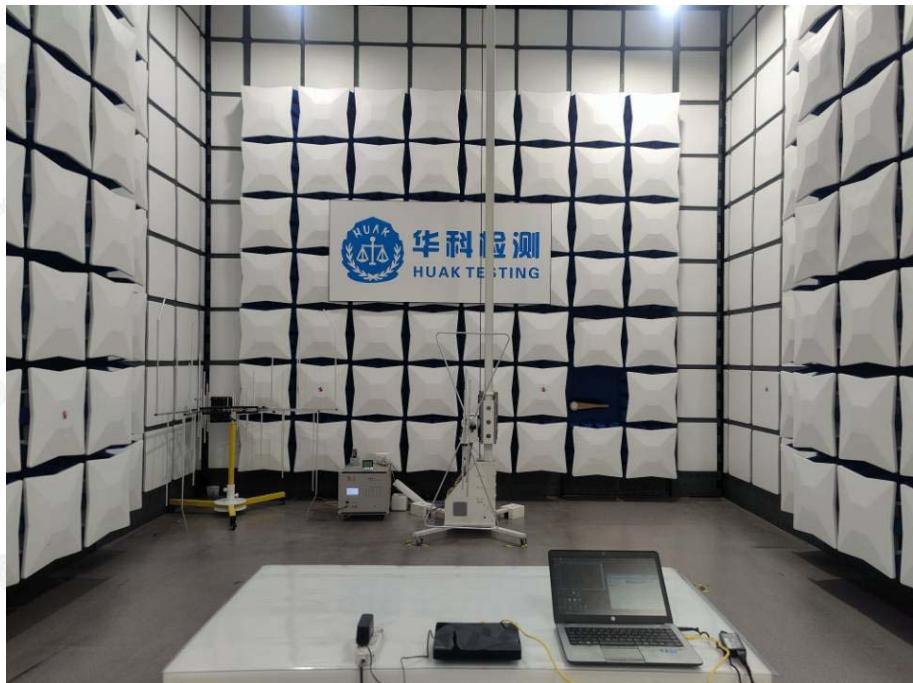
The antenna used for test in this product is a Internal Antenna, need professional installation, It conforms to the standard requirements. The gain of Antenna 1, Antenna 2 and Antenna 3 is 3dBi.





6. PHOTOGRAPH OF TEST

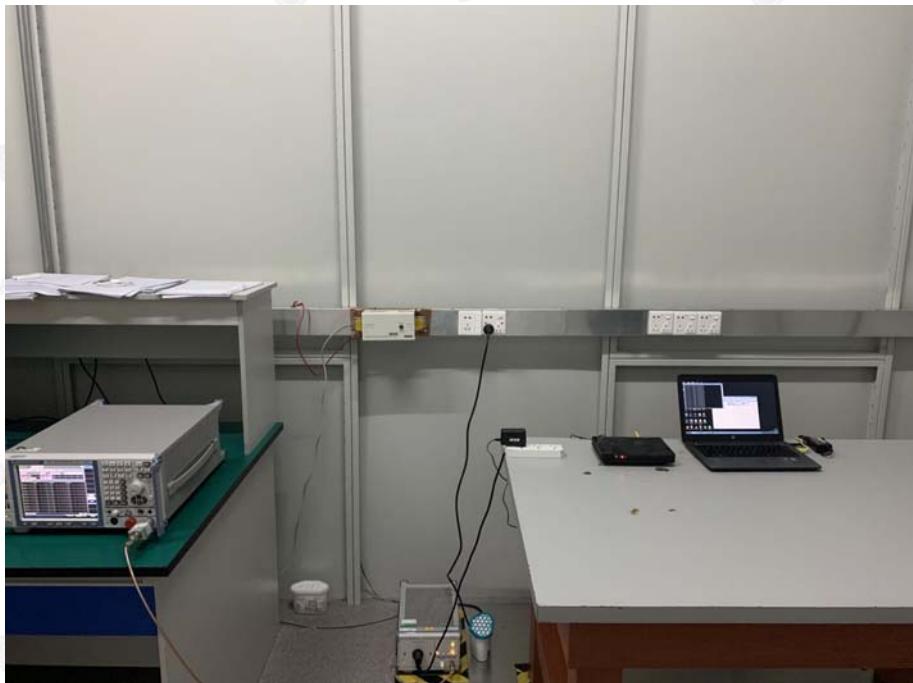
Radiated Emission



The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by HUAK, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.cer-mark.com>

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**Conducted Emission**

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7. PHOTOS OF THE EUT

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

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