FCC Test Report

Test report
On Behalf of
Shenzhen Haimeilan Technology Co., LTD.
For
Smart Phone
Model No.: K60, F5 Pro, F50 Pro, K60 Pro, K60E, M13, M13 Pro, M5s Pro, M5s, X5 Pro, F3 Pro, X40, X40 Pro, X40 Edge, F5, Note12 Pro, M6 Pro, I14 Pro max, I15 Pro max, G14 Pro, S22Ultra, S23 Ultra, G22

FCC ID: 2BDI3-K60

Prepared For :	**Shenzhen Haimeilan Technology Co., LTD.** **9V777, East 9th Floor, Building 2, SEG Science Park, Huaqiang North Street, Futian District, Shenzhen, 518000 China**
Prepared By :	**Shenzhen HUAK Testing Technology Co., Ltd.** **1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China**

Date of Test:	**Sept. 13, 2023 ~ Nov. 13, 2023**
Date of Report:	**Nov. 13, 2023**
Report Number:	**HK2308233869-7E**

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Test Result Certification

Applicant's name ..... :	Shenzhen Haimeilan Technology Co., LTD.
Address ..... :	9V777, East 9th Floor, Building 2, SEG Science Park, Huaqiang North Street, Futian District, Shenzhen, 518000 China
Manufacture's Name..... :	Shenzhen Shengkai Technology Co., Ltd.
Address ..... :	4th floor, Building 7, Hongye Industrial Park, Zhujiao Village, Hangcheng Street, Baoan District, Shenzhen, 518000, China
Product description	
Trade Mark:	N/A
Product name..... :	Smart Phone
Model and/or type reference .:	K60, F5 Pro, F50 Pro, K60 Pro, K60E, M13, M13 Pro, M5s Pro, M5s, X5 Pro, F3 Pro, X40, X40 Pro, X40 Edge, F5, Note12 Pro, M6 Pro, I14 Pro max, I15 Pro max, G14 Pro, S22Ultra, S23 Ultra, G22
Standards ..... :	FCC Rules and Regulations Part 15 Subpart C Section 15.247 ANSI C63.10: 2013

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Date of Test ..... :	
Date (s) of performance of tests ..... :	**Sept. 13, 2023 ~ Nov. 13, 2023**
Date of Issue..... :	**Nov. 13, 2023**
Test Result..... :	**Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

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** Modified History **

Revision	Description	Issued Data	Remark
Revision 1.0	Initial Test Report Release	Nov. 13, 2023	Jason Zhou

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1. Test Result Summary

1.1. Test Procedures and Results

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203/§15.247(b)(4)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247(b)(3)	PASS
6dB Emission Bandwidth	§15.247(a)(2)	PASS
Power Spectral Density	§15.247(e)	PASS
Band Edge	§15.247(d)	PASS
Spurious Emission	§15.205/§15.209	PASS

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

1.2. Information of the Test Laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization：

A2LA Accreditation Code is 4781.01.
FCC Designation Number is CN1229.
Canada IC CAB identifier is CN0045.
CNAS Registration Number is L9589.

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1.3. Measurement Uncertainty

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	±2.71dB
2	RF power, conducted	±0.37dB
3	Spurious emissions, conducted	±0.11dB
4	All emissions, radiated(<1G)	±3.90dB
5	All emissions, radiated(>1G)	±4.28dB
6	Temperature	±0.1°C
7	Humidity	±1.0%

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2. EUT Description

2.1. General Description of EUT

Equipment:	Smart Phone
Model Name:	K60
Series Model:	F5 Pro, F50 Pro, K60 Pro, K60E, M13, M13 Pro, M5s Pro, M5s, X5 Pro, F3 Pro, X40, X40 Pro, X40 Edge, F5, Note12 Pro, M6 Pro, I14 Pro max, I15 Pro max, G14 Pro, S22Ultra, S23 Ultra, G22
Model Difference:	All model's the function, software and electric circuit are the same, only with a product color, appearance and model named different. Test sample model: K60.
FCC ID:	2BDI3-K60
Antenna Type:	Internal Antenna
Antenna Gain:	0.6dBi
Operation frequency:	802.11b/g/n 20:2412~2462 MHz 802.11n 40: 2422~2452MHz
Number of Channels:	802.11b/g/n20: 11CH 802.11n 40: 7CH
Modulation Type:	CCK/OFDM/DBPSK/DAPSK
Power Source:	DC 5V From Type-C or DC 3.8V From Battery
Power Rating:	DC 5V From Type-C or DC 3.8V From Battery

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2.2. Carrier Frequency of Channels

Channel List For 802.11b/802.11g/802.11n (HT20)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452	--	--

Channel List For 802.11n (HT40)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
--	--	04	2427	07	2442	--	--
--	--	05	2432	08	2447	--	--
03	2422	06	2437	09	2452	--	--

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

2.3. Operation of EUT During Testing

Operating Mode

The mode is used: Transmitting mode for 802.11b/802.11g/802.11n (HT20)

Low Channel: 2412MHz
Middle Channel: 2437MHz
High Channel: 2462MHz

The mode is used: Transmitting mode for 802.11n (HT40)

Low Channel: 2422MHz
Middle Channel: 2437MHz
High Channel: 2452MHz

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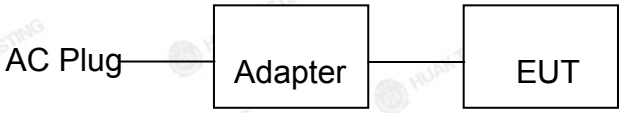
2.4. Description of Test Setup

Operation of EUT during conducted testing and below 1GHz radiation testing:



Operation of EUT during above1GHz radiation testing:

The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. The worst case is X position.

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2.5. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Trade Mark	Model/Type No.	Specification	Remark
1	Smart Phone	N/A	K60	N/A	EUT
2	USB Cable	N/A	N/A	Length:1.02m	Accessory
3	Adapter	N/A	APD5-2	Input: AC 100-240V, 50/60Hz, 0.5A Output: 5VDC, 2.4A	Accessory
4	RF Cable	N/A	N/A	Length:0.1m	Peripheral

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

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3. Genera Information

3.1. Test Environment and Mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations
The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. For the full battery state and The output power to the maximum state.	

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We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	Data rate
802.11b	1Mbps
802.11g	6Mbps
802.11n(H20)	6.5Mbps
802.11n(H40)	13.5Mbps

Final Test Mode:

Operation mode:	Keep the EUT in continuous transmitting with modulation

1. For WIFI function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

2.According to ANSI C63.10 standards, the test results are both the “worst case” and “worst setup” 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20), 13.5Mbps for 802.11n(H40).

3. Mode Test Duty Cycle

Mode	Duty Cycle	Duty Cycle Factor (dB)
802.11b	0.99	-0.04
802.11g	0.98	-0.09
802.11n(H20)	0.98	-0.09
802.11n(H40)	0.96	-0.18

Test plots as follows:

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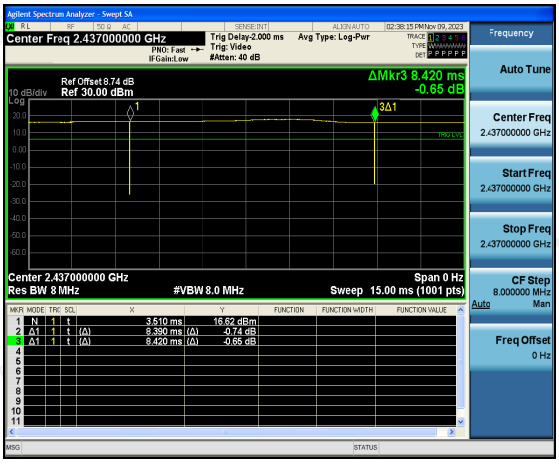
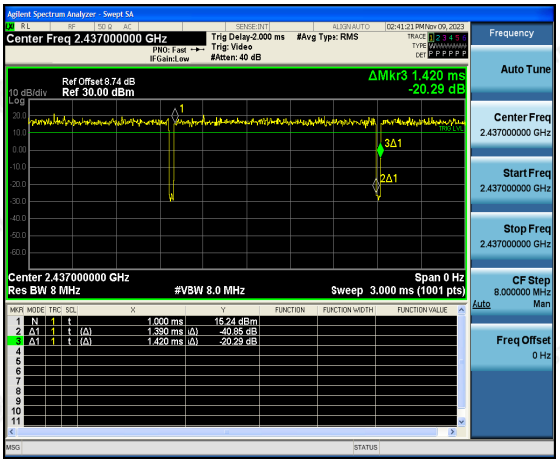
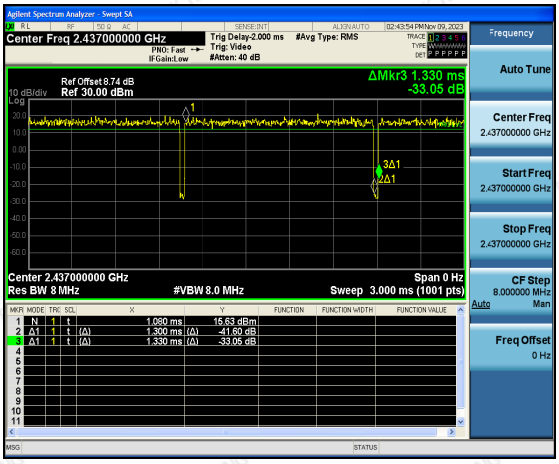
802.11b



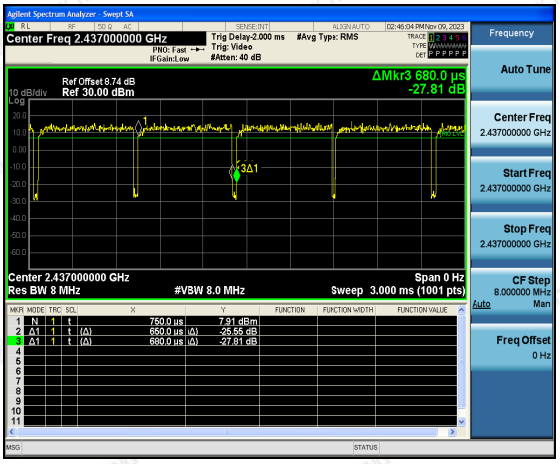
802.11g



802.11n(H20)



802.11n(H40)



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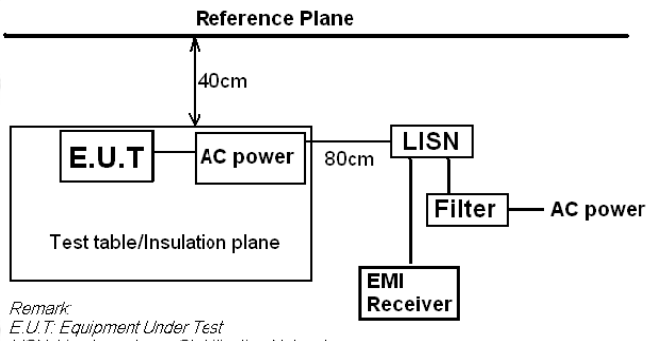
4. Test Results and Measurement Data

4.1. Conducted Emission

Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Frequency Range:</td><td>150 kHz to 30 MHz</td></tr>
<tr><td>Receiver setup:</td><td>RBW=9 kHz, VBW=30 kHz, Sweep time=auto</td></tr>
<tr><td>Limits:</td><td><table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table></td></tr>
<tr><td>Test Setup:</td><td> 

Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m</td></tr>
<tr><td>Test Mode:</td><td>transmitting with modulation</td></tr>
<tr><td>Test Procedure:</td><td>1. The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.
2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).
3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</td></tr>
<tr><td>Test Result:</td><td>PASS</td></tr>
</table>

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Test Instruments

Conducted Emission Shielding Room Test Site (843)					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Receiver	R&S	ESR-7	HKE-005	Feb. 17, 2023	Feb. 16, 2024
LISN	R&S	ENV216	HKE-002	Feb. 17, 2023	Feb. 16, 2024
Coax cable (9KHz-30MHz)	Times	381806-002	N/A	Feb. 17, 2023	Feb. 16, 2024
10dB Attenuator	Schwarzbeck	VTSD9561F	HKE-153	Feb. 17, 2023	Feb. 16, 2024
Conducted test software	Tonscend	TS+ Rev 2.5.0.0	HKE-081	N/A	N/A

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

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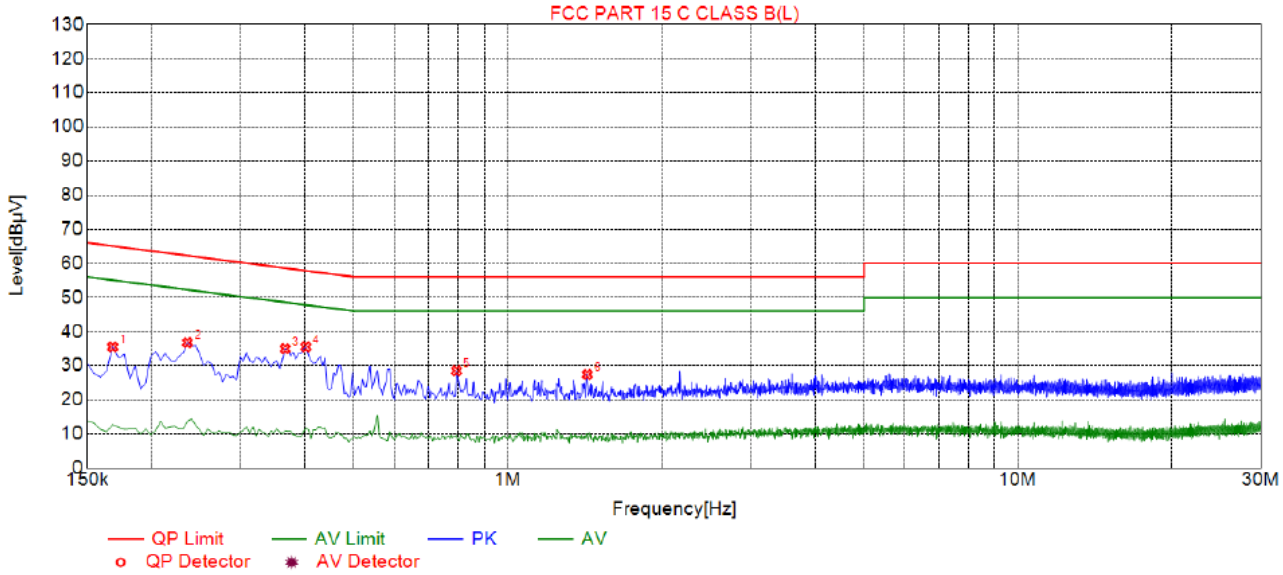
4.2. Test Result

Remark: All the test modes completed for test. only the worst result

Of was reported as below:
Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)

Test Specification: Line



Suspected List								
NO.	Freq. [MHz]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Reading [dBµV]	Detector	Type
1	0.1680	35.49	20.01	65.06	29.57	15.48	PK	L
2	0.2355	36.77	20.03	62.25	25.48	16.74	PK	L
3	0.3660	34.95	20.04	58.59	23.64	14.91	PK	L
4	0.4020	35.51	20.04	57.81	22.30	15.47	PK	L
5	0.7935	28.48	20.05	56.00	27.52	8.43	PK	L
6	1.4325	27.40	20.10	56.00	28.60	7.30	PK	L

Remark: Margin = Limit – Level
Correction factor = Cable lose + LISN insertion loss
Level=Test receiver reading + correction factor

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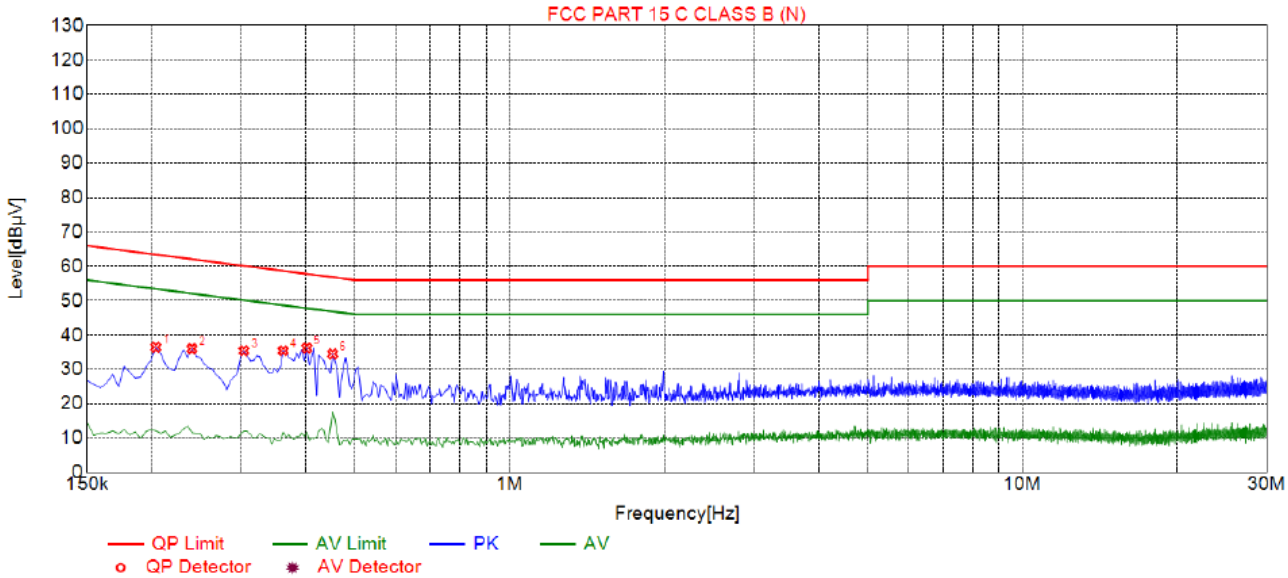
Test Specification: Neutral



Suspected List								
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.2040	36.46	20.04	63.45	26.99	16.42	PK	N
2	0.2400	36.02	20.03	62.10	26.08	15.99	PK	N
3	0.3030	35.42	20.04	60.16	24.74	15.38	PK	N
4	0.3615	35.44	20.04	58.69	23.25	15.40	PK	N
5	0.4020	36.22	20.04	57.81	21.59	16.18	PK	N
6	0.4515	34.50	20.04	56.85	22.35	14.46	PK	N

Remark: Margin = Limit － Level
Correction factor = Cable lose + LISN insertion loss
Level=Test receiver reading + correction factor

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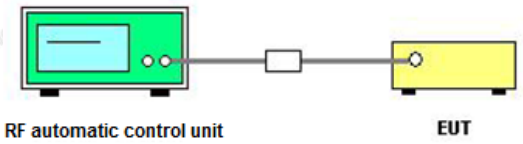
4.3. Maximum Conducted Output Power

Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02
Limit:	30dBm
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 15.247 Meas Guidance v05r02. 2. The RF output of EUT was connected to the RF automatic control unit 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. Measure the Peak output power and record the results in the test report.
Test Result:	PASS

Test Instruments

RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023	Feb. 16, 2024
Power meter	Agilent	E4419B	HKE-085	Feb. 17, 2023	Feb. 16, 2024
Power Sensor	Agilent	E9300A	HKE-086	Feb. 17, 2023	Feb. 16, 2024
RF cable	Times	1-40G	HKE-034	Feb. 17, 2023	Feb. 16, 2024
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Feb. 17, 2023	Feb. 16, 2024

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

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Test Data

Mode	Test Channel	Frequency	Maximum Peak Conducted Output Power	LIMIT
		(MHz)	(dBm)	dBm
802.11b	CH01	2412	19.64	30
802.11b	CH06	2437	16.88	30
802.11b	CH11	2462	16.59	30
802.11g	CH01	2412	16.28	30
802.11g	CH06	2437	19.24	30
802.11g	CH11	2462	19.11	30
802.11n(HT20)	CH01	2412	17.12	30
802.11n(HT20)	CH06	2437	19.17	30
802.11n(HT20)	CH11	2462	19.20	30
802.11n(HT40)	CH03	2422	18.75	30
802.11n(HT40)	CH06	2437	18.57	30
802.11n(HT40)	CH09	2452	19.26	30

Note: 1.The test results including the cable lose.

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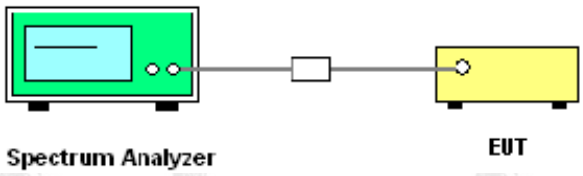
4.4. Emission Bandwidth

Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02
Limit:	>500kHz
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows FCC KDB Publication 558074 D01 15.247 Meas Guidance v05r02. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz. 4. Measure and record the results in the test report.
Test Result:	PASS

Test Instruments

RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023	Feb. 16, 2024
RF cable	Times	1-40G	HKE-034	Feb. 17, 2023	Feb. 16, 2024
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Feb. 17, 2023	Feb. 16, 2024

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

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Test data

Test channel	6dB Emission Bandwidth (MHz)			
	802.11b	802.11g	802.11n(H20)	802.11n(H40)
Lowest	9.08	12.12	16.32	35.44
Middle	9.56	14.40	13.92	25.04
Highest	9.04	15.68	16.36	30.00
Limit:	>500kHz			
Test Result:	PASS			

Test plots as follows:

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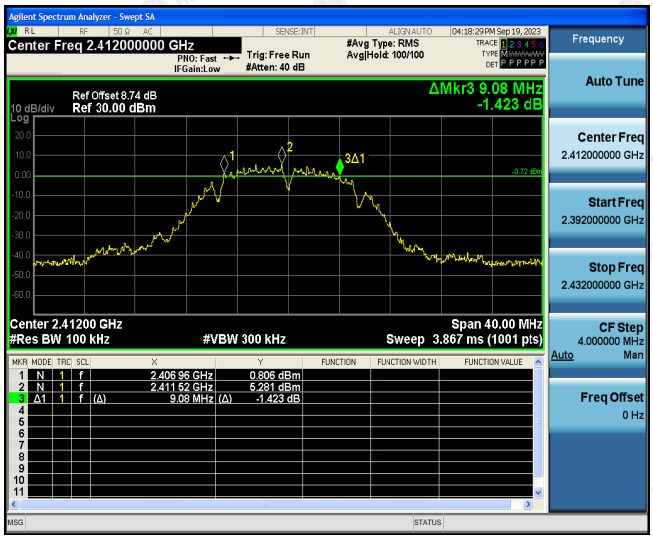
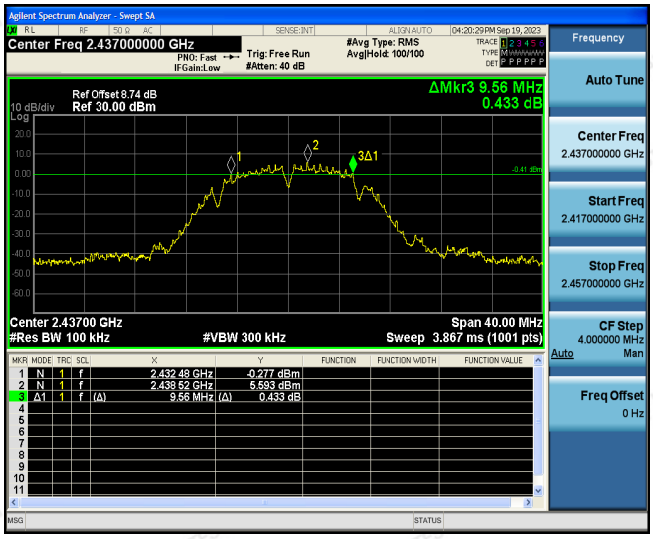
802.11b Modulation

Lowest channel



Middle channel



Highest channel

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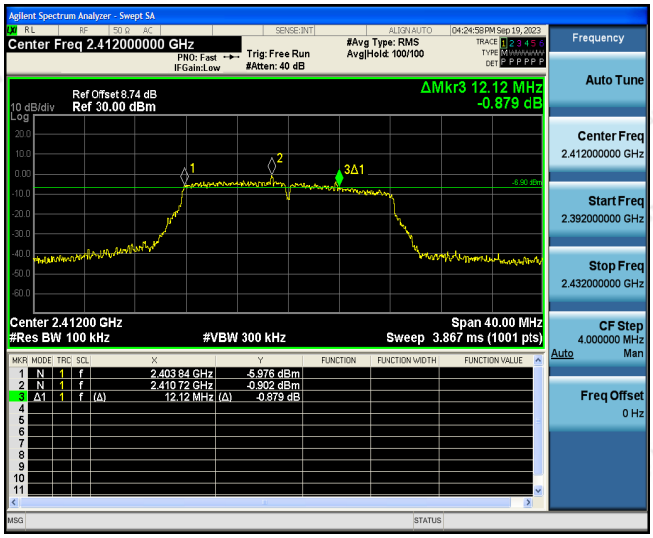
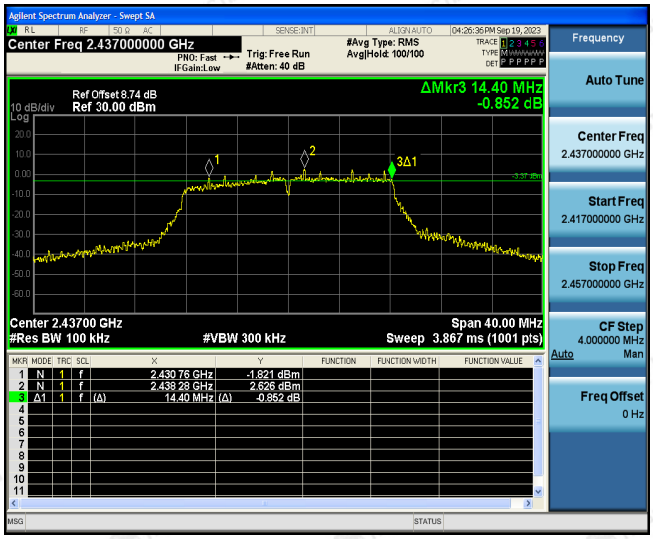
802.11g Modulation

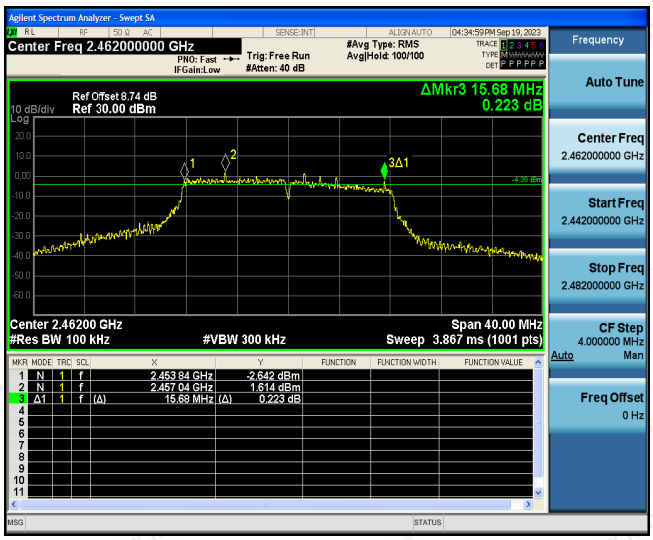
Lowest channel



Middle channel



Highest channel



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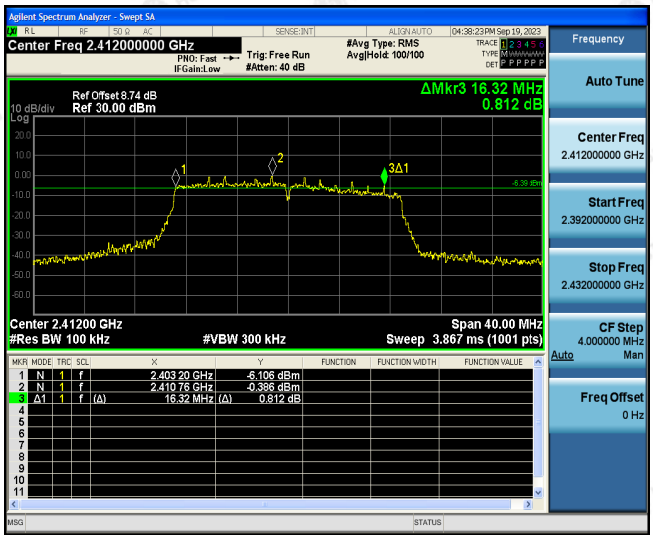
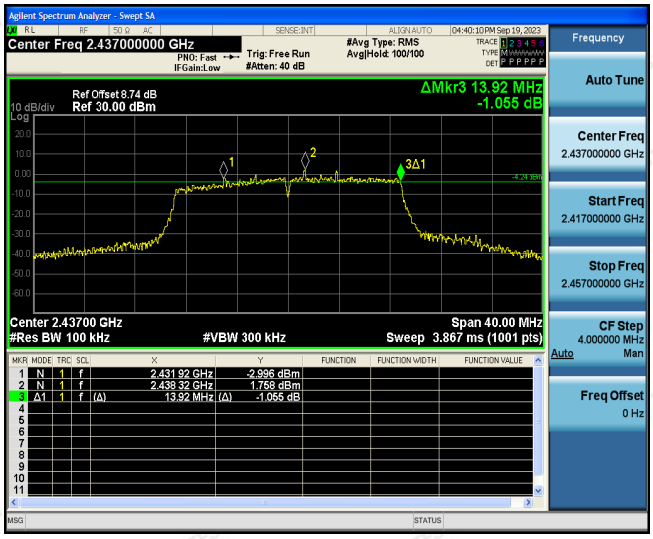
802.11n (HT20) Modulation

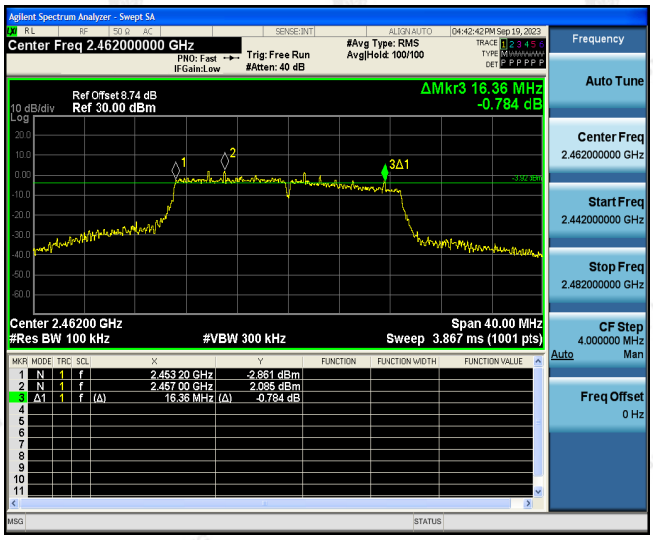
Lowest channel



Middle channel



Highest channel



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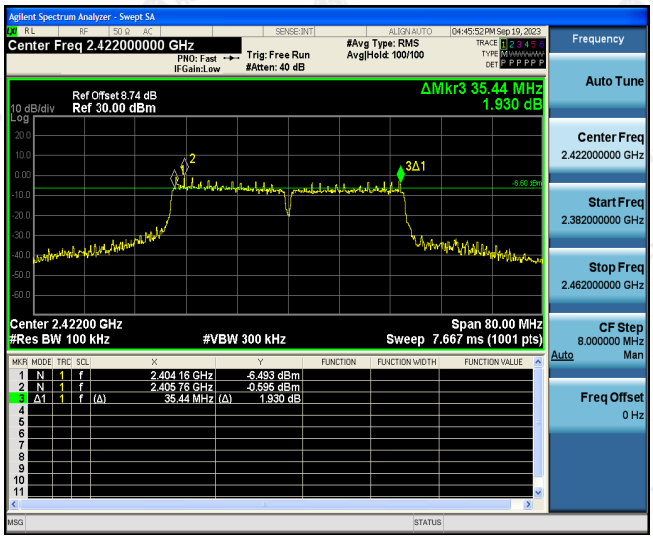
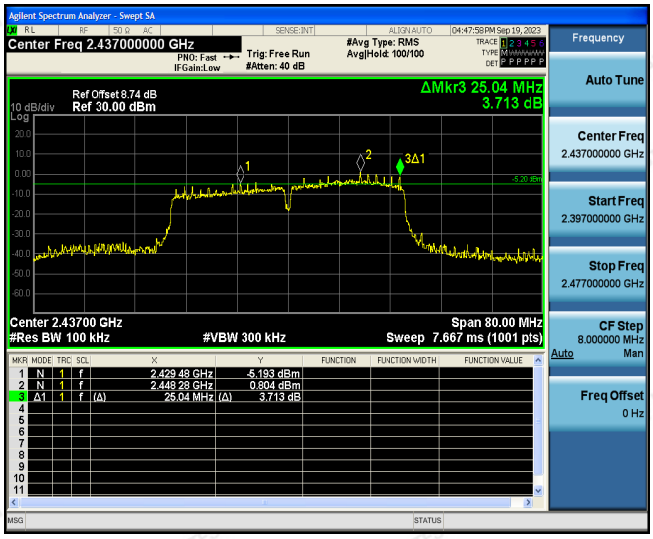
802.11n (HT40) Modulation

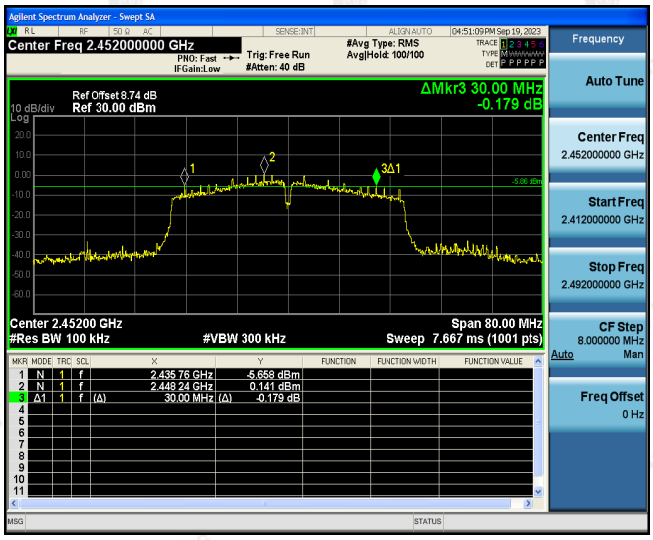
Lowest channel



Middle channel



Highest channel



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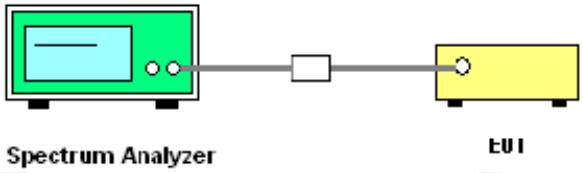
4.5. Power Spectral Density

Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02
Limit:	The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows Measurement procedure 10.2 method PKPSD of 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. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): 3 kHz ≤ RBW ≤ 100 kHz. Video bandwidth VBW ≥ 3 x RBW. Set the span to at least 1.5 times the OBW. 5. Detector = Peak, Sweep time = auto couple. 6. Employ trace averaging (Peak) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level. 7. Measure and record the results in the test report.
Test Result:	PASS

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Test Instruments

RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023	Feb. 16, 2024
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Feb. 17, 2023	Feb. 16, 2024
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Feb. 17, 2023	Feb. 16, 2024
RF test software	Tonscend	JS1120-B Version 2.6	HKE-083	N/A	N/A

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

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Test data

EUT Set Mode	Channel	Test Result (dBm/30kHz)	Result (dBm/3kHz)
802.11b	Lowest	2.93	-7.07
	Middle	0.98	-9.02
	Highest	1.46	-8.54
802.11g	Lowest	-5.47	-15.47
	Middle	-2.91	-12.91
	Highest	-3.56	-13.56
802.11n(H20)	Lowest	-4.22	-14.22
	Middle	-2.54	-12.54
	Highest	-3.18	-13.18
802.11n(H40)	Lowest	-6.72	-16.72
	Middle	-4.72	-14.72
	Highest	-4.54	-14.54
PSD test result (dBm/3kHz)= PSD test result (dBm/30kHz)-10			
Limit: 8dBm/3kHz			
Test Result:	PASS		

Test plots as follows:

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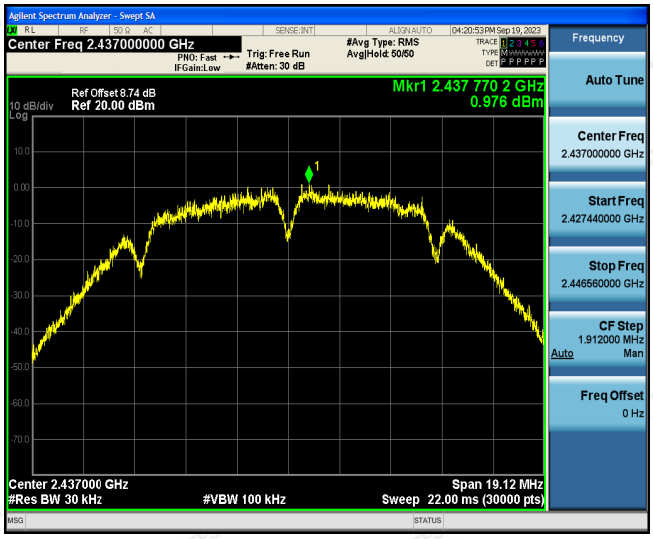
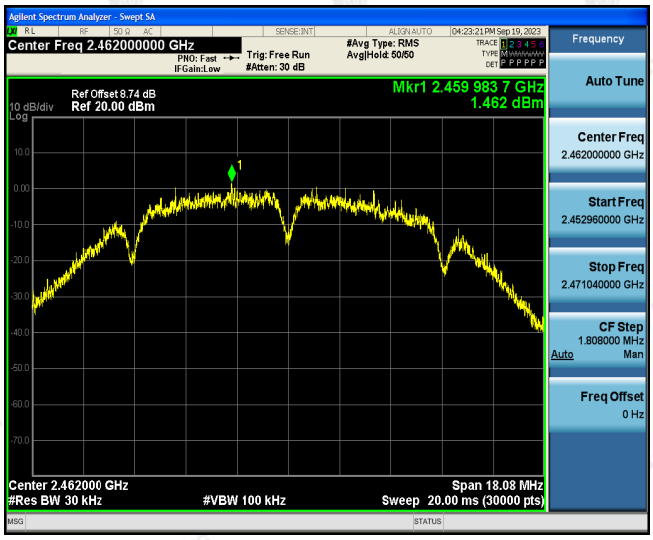
802.11b Modulation

Lowest channel

Middle channel



Highest channel



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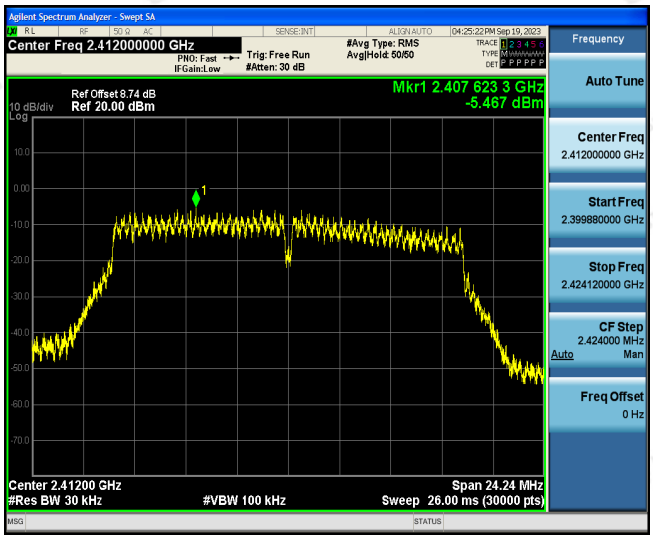
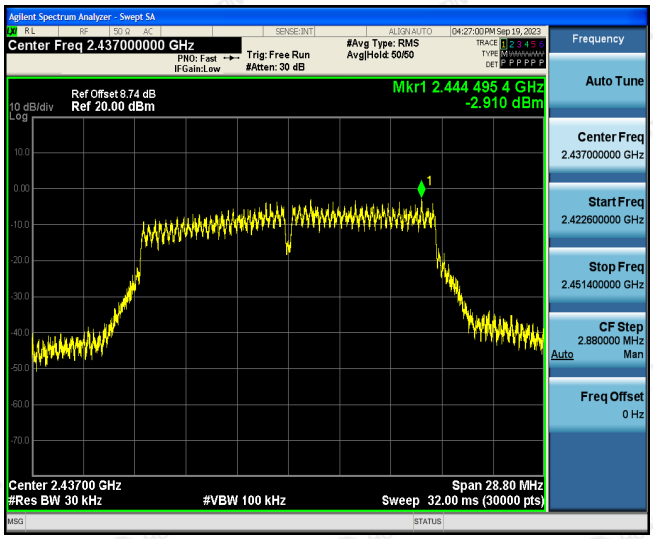
802.11g Modulation

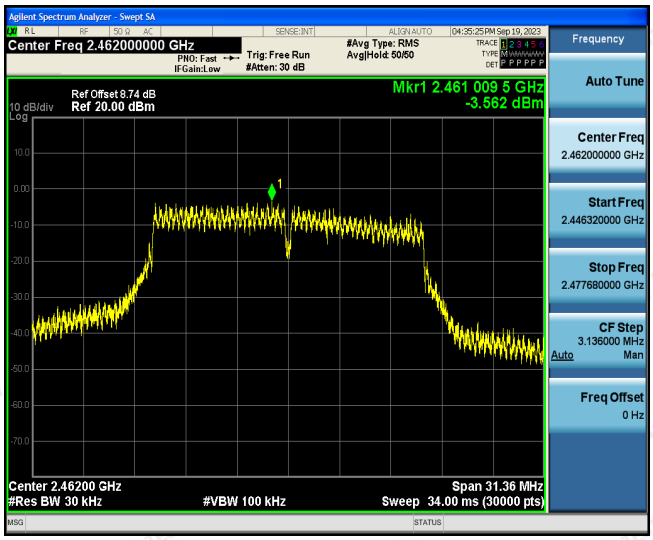
Lowest channel



Middle channel



Highest channel



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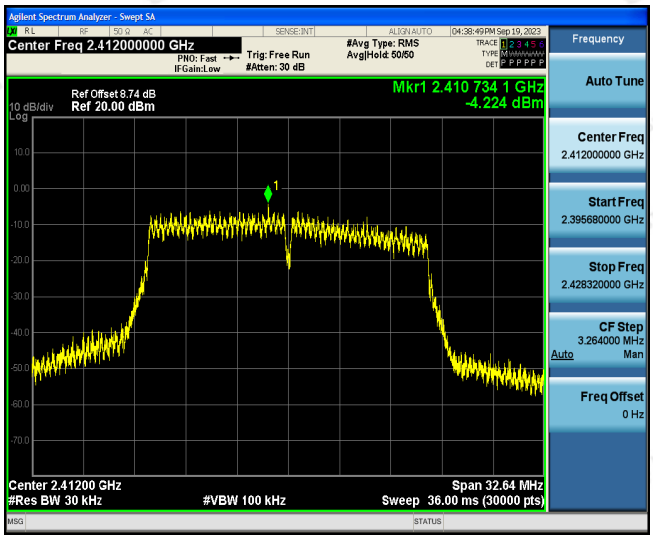
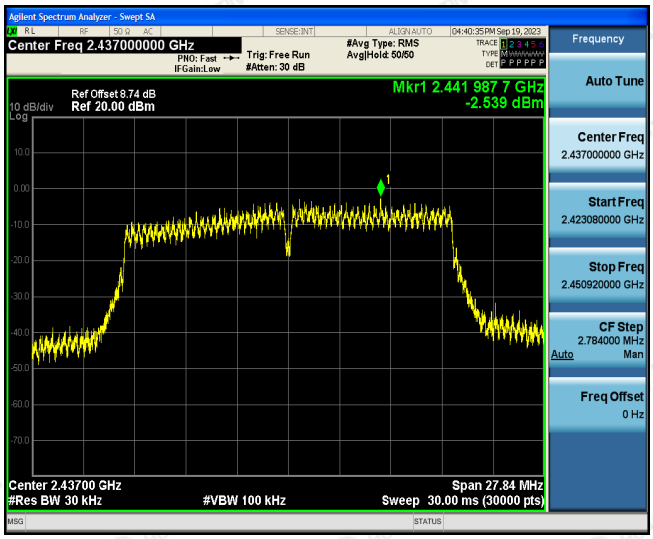
802.11n (HT20) Modulation

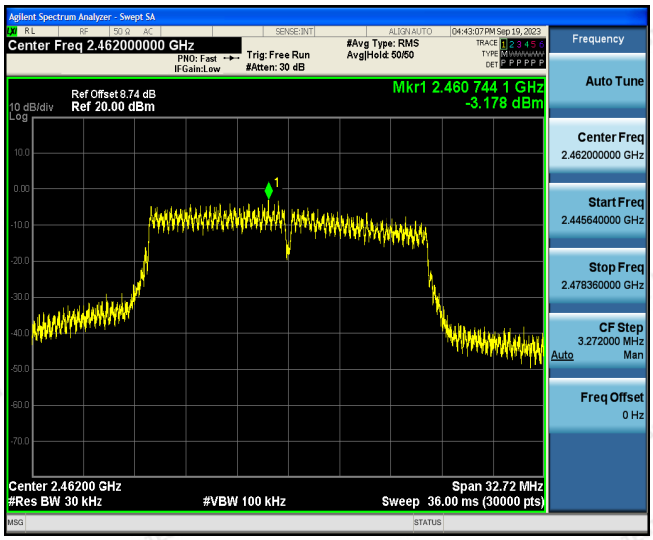
Lowest channel



Middle channel



Highest channel



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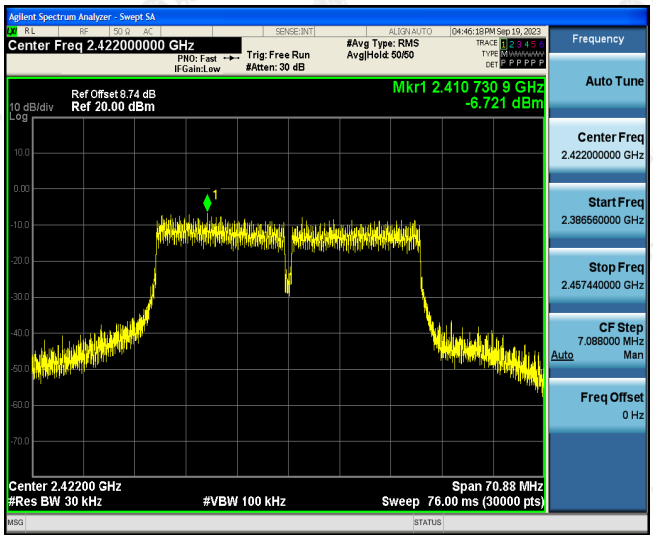
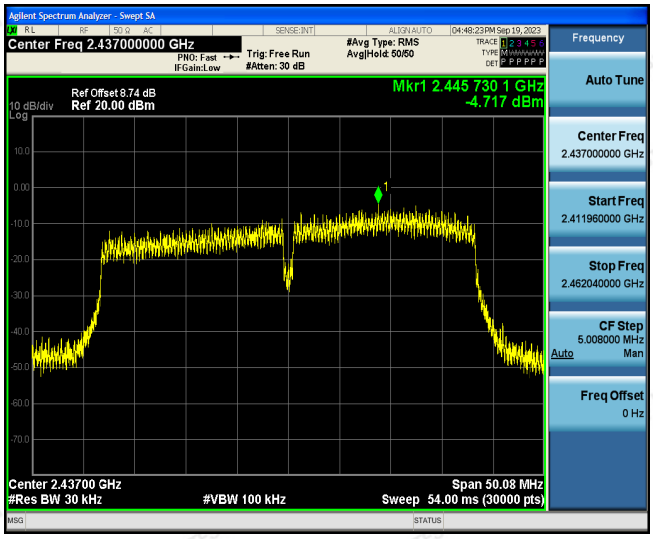
802.11n (HT40) Modulation

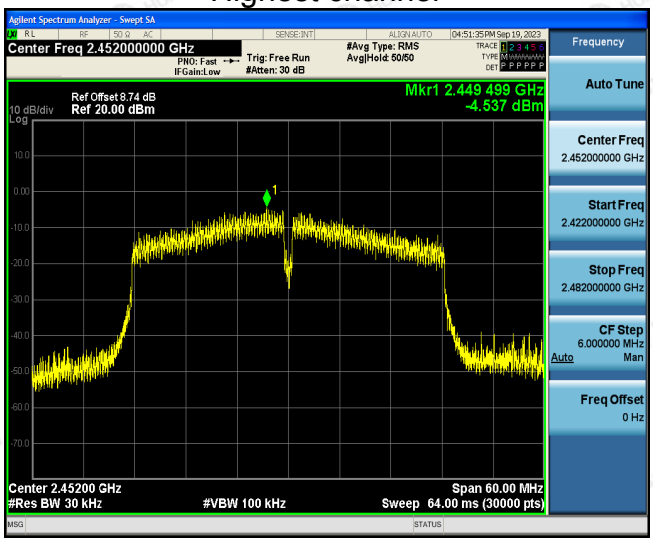
Lowest channel



Middle channel



Highest channel



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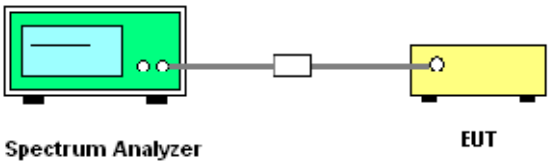
4.6. Conducted Band Edge and Spurious Emission Measurement

Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02
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 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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Test Instruments

RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023	Feb. 16, 2024
High pass filter unit	Tonscend	JS0806-F	HKE-055	Feb. 17, 2023	Feb. 16, 2024
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Feb. 17, 2023	Feb. 16, 2024
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Feb. 17, 2023	Feb. 16, 2024
RF test software	Tonscend	JS1120-B Version 2.6	HKE-083	N/A	N/A

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

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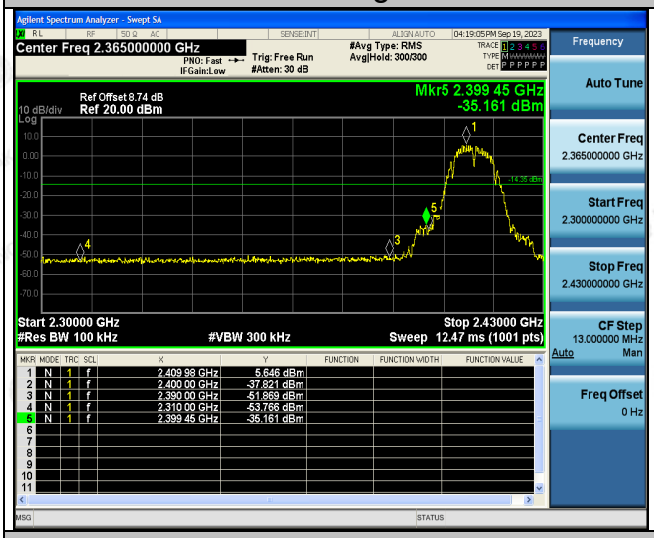
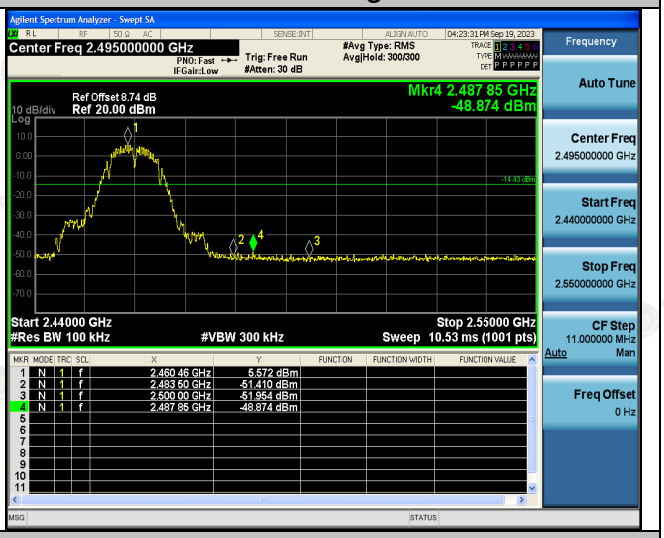
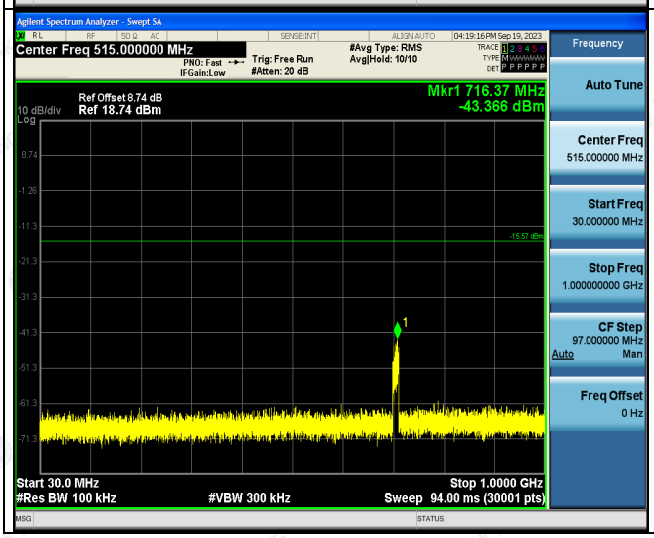
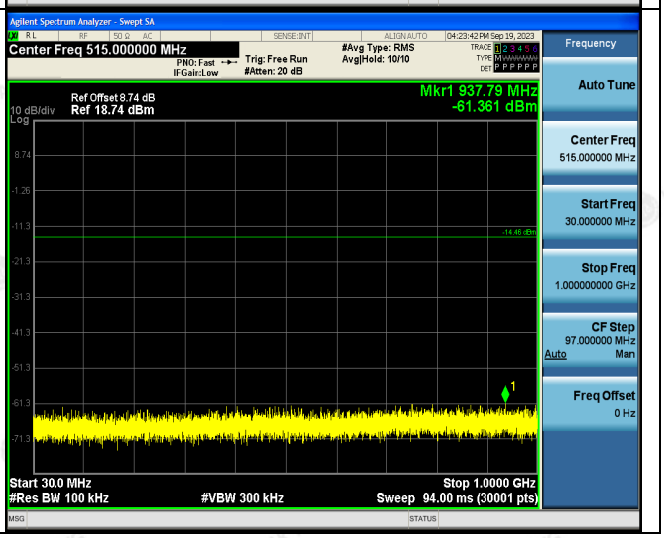
Test Data

802.11b Modulation

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

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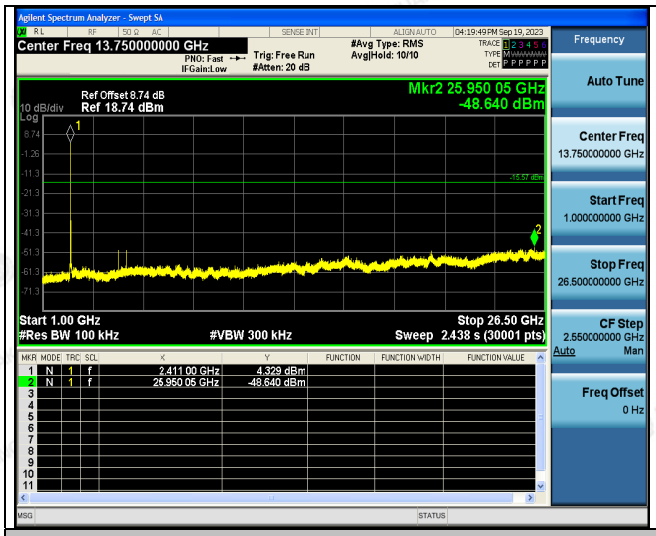
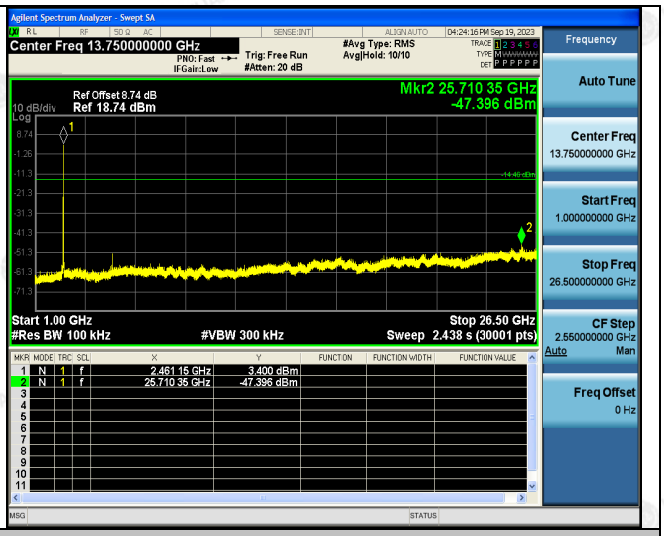
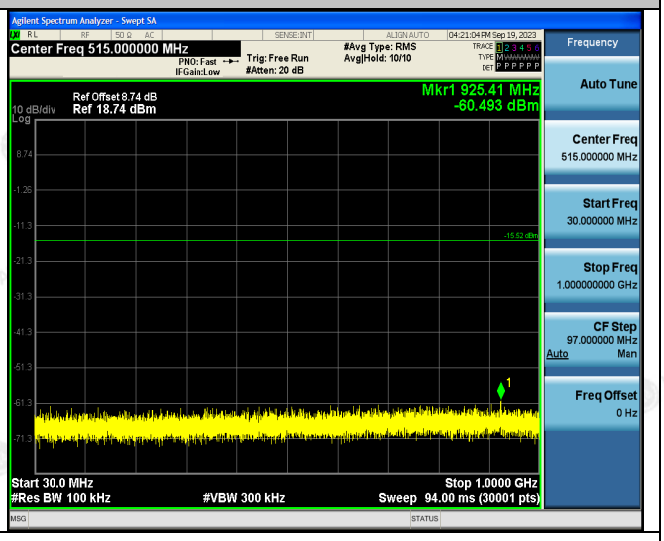
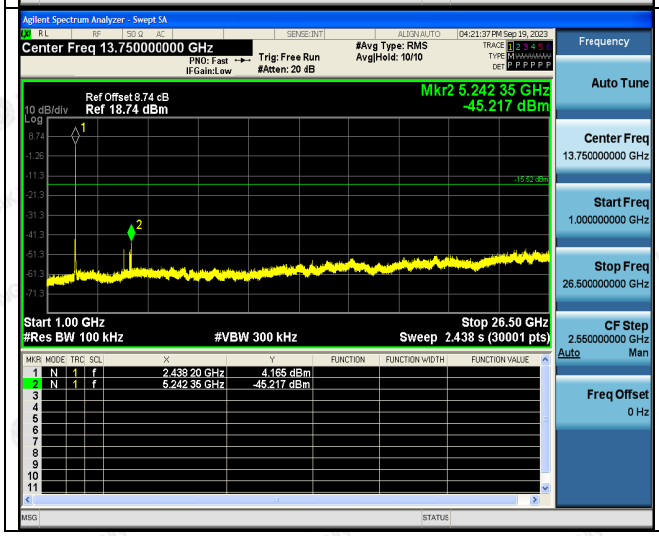




Middle Channel

Spurious Emission





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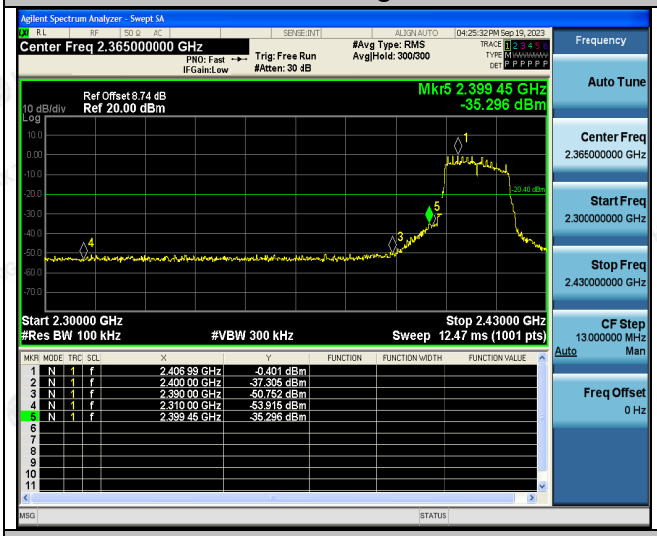
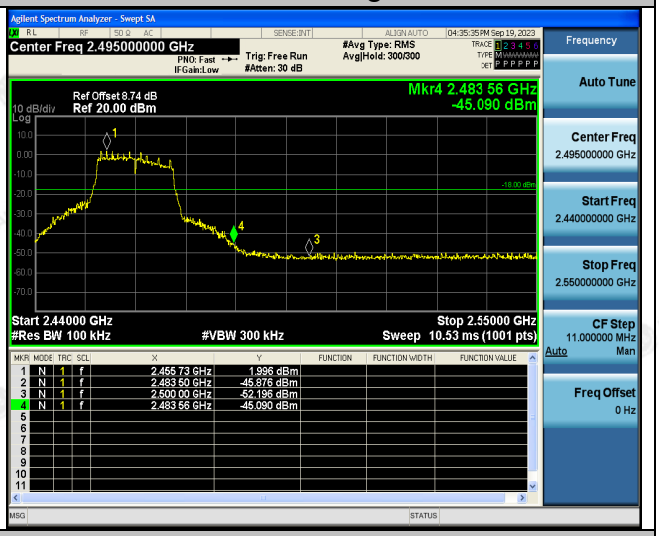
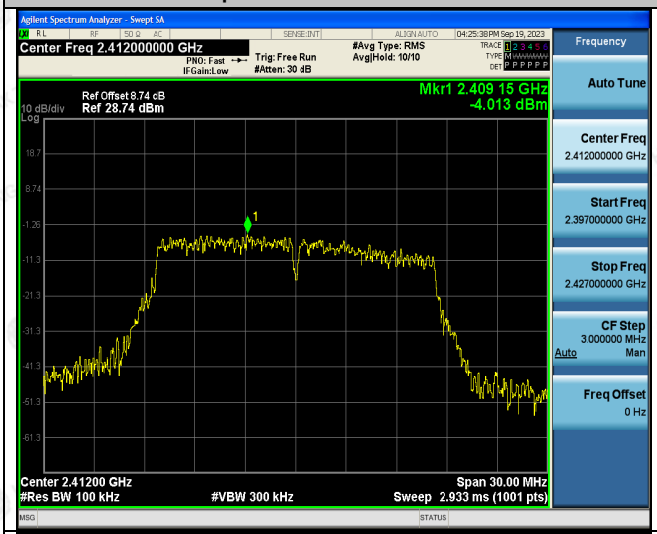
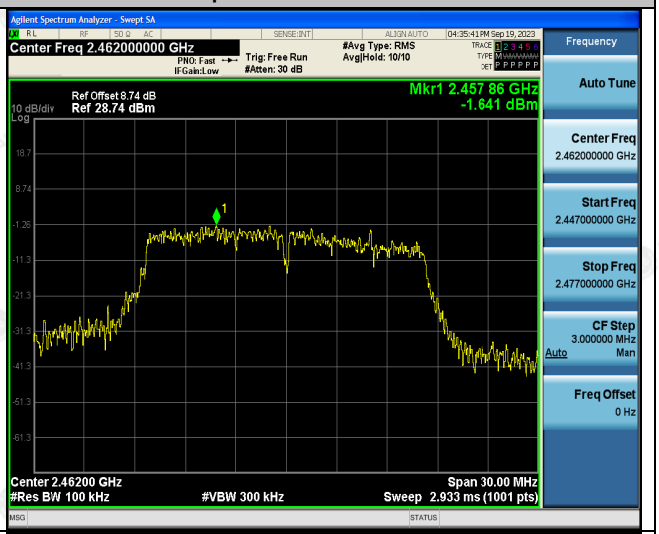
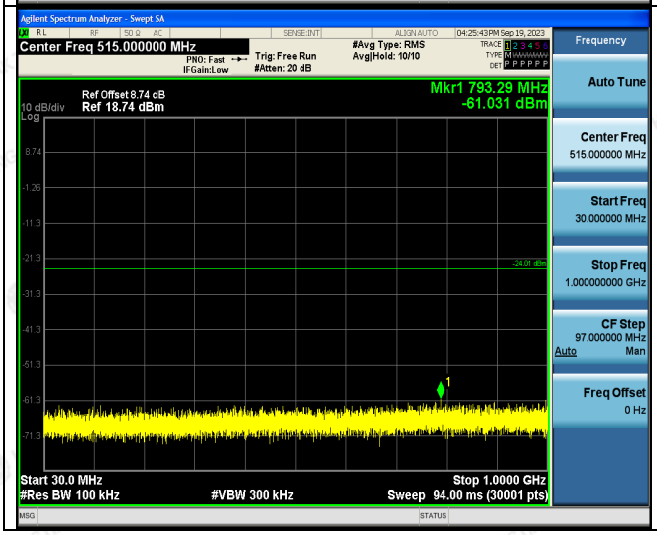
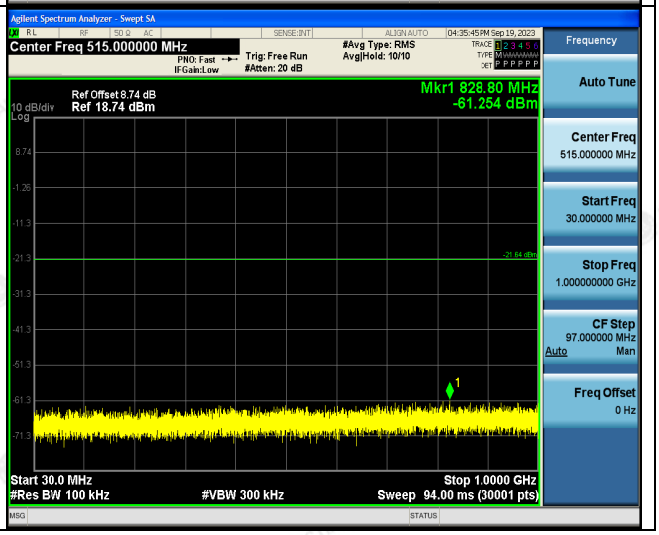
802.11g Modulation

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

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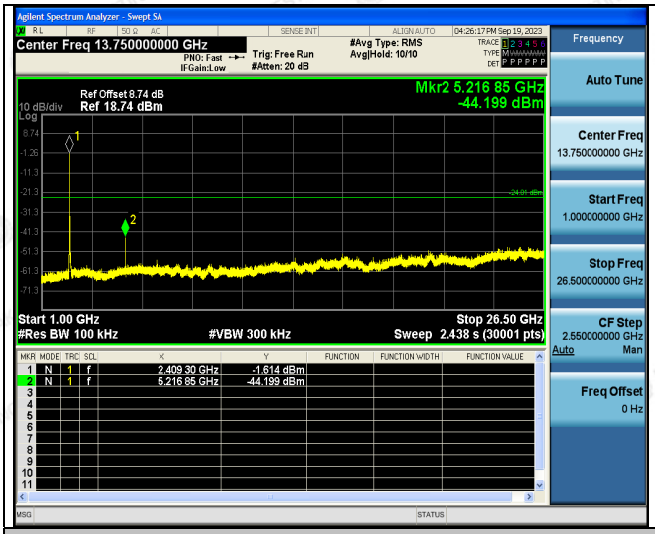
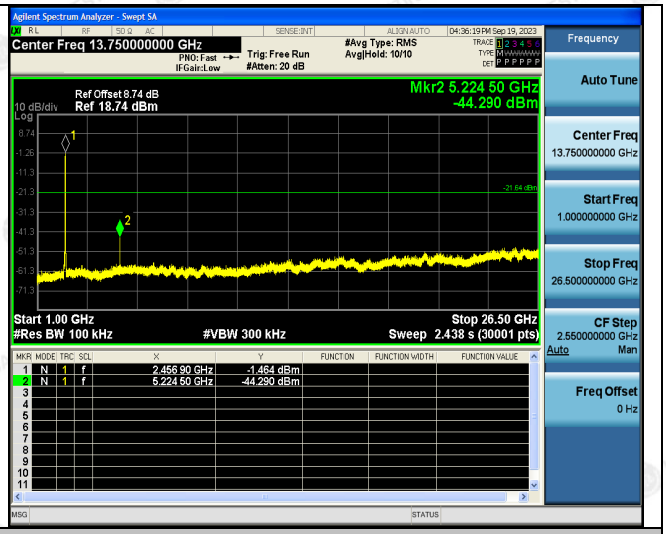
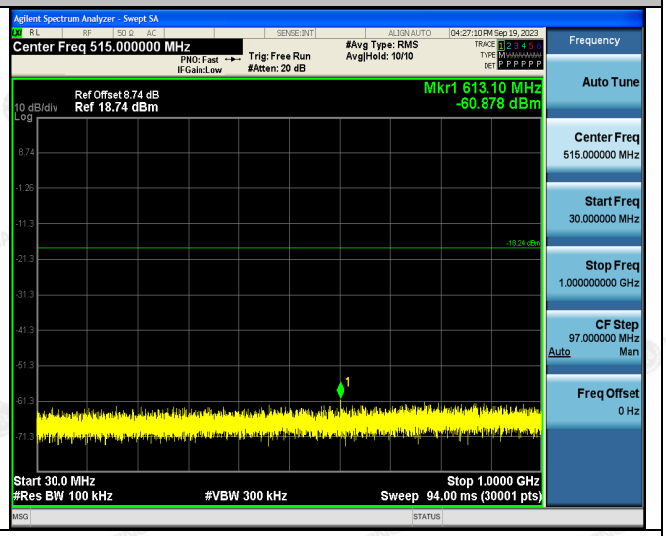
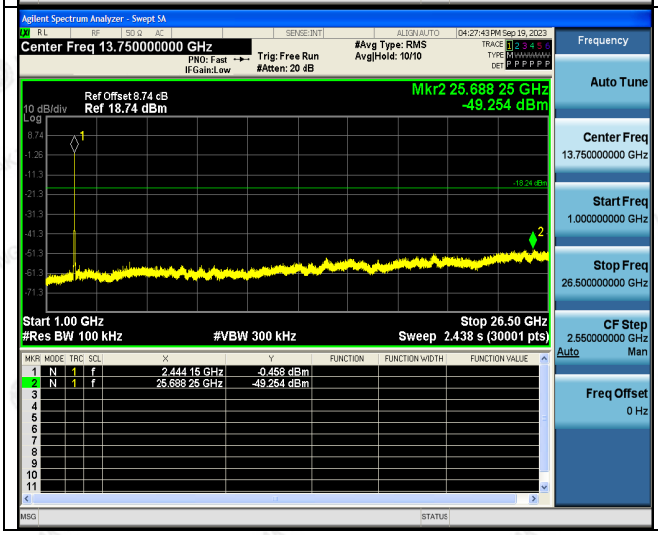




Middle Channel

Spurious Emission





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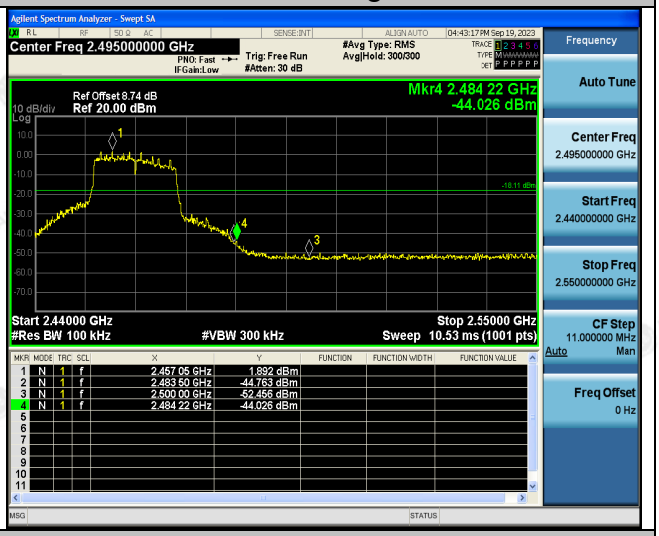
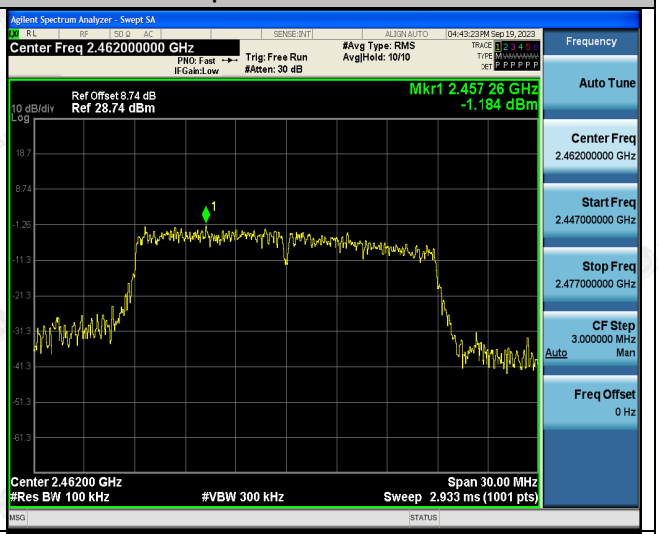
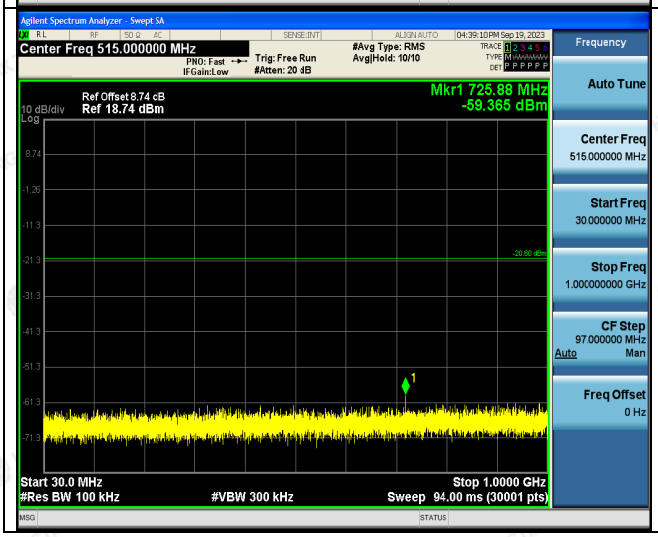
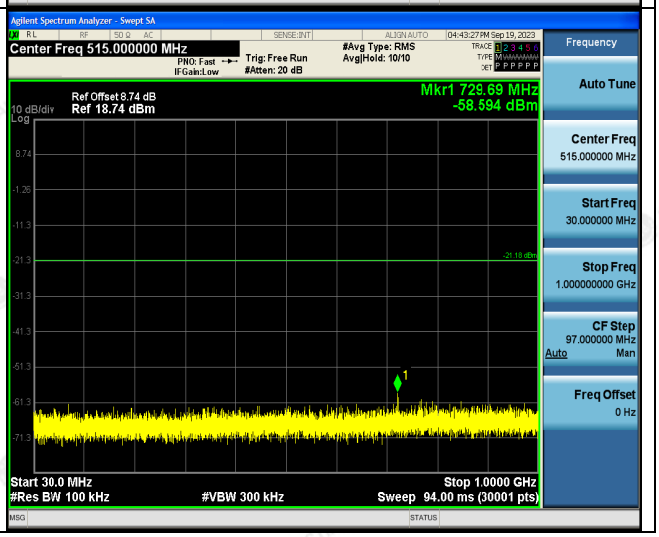
802.11n (HT20) Modulation

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

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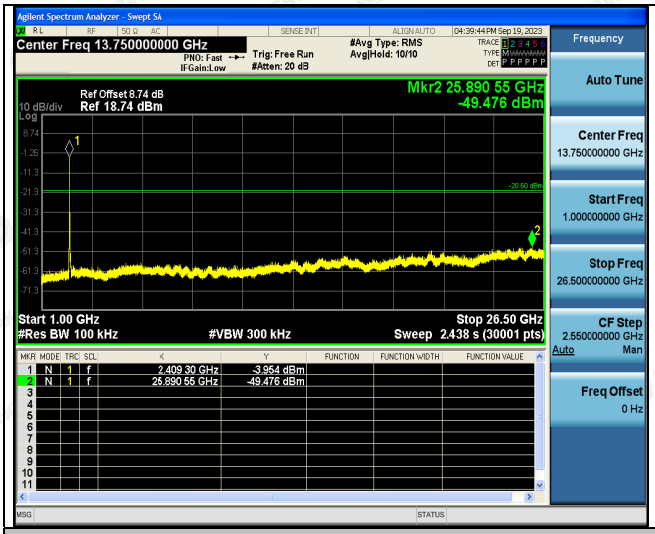
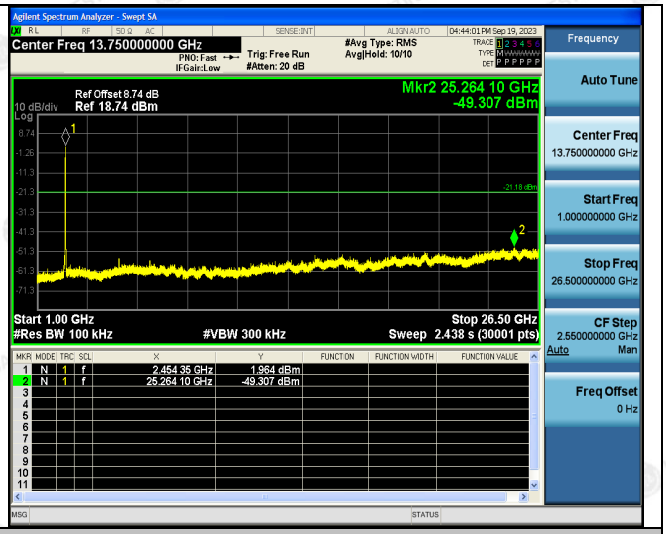
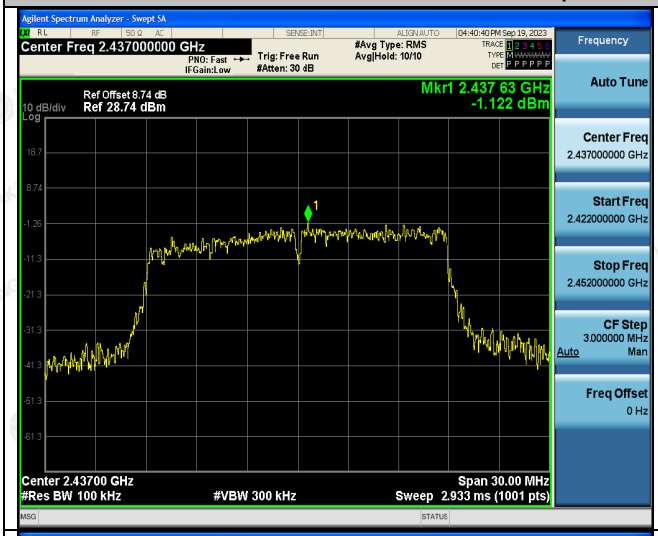
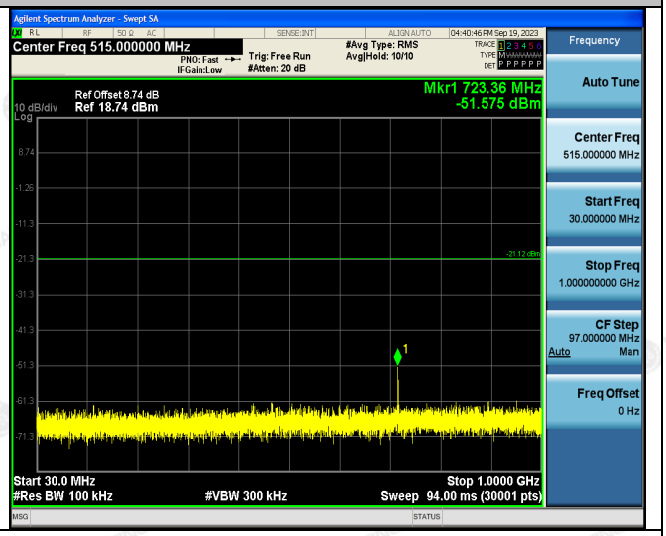


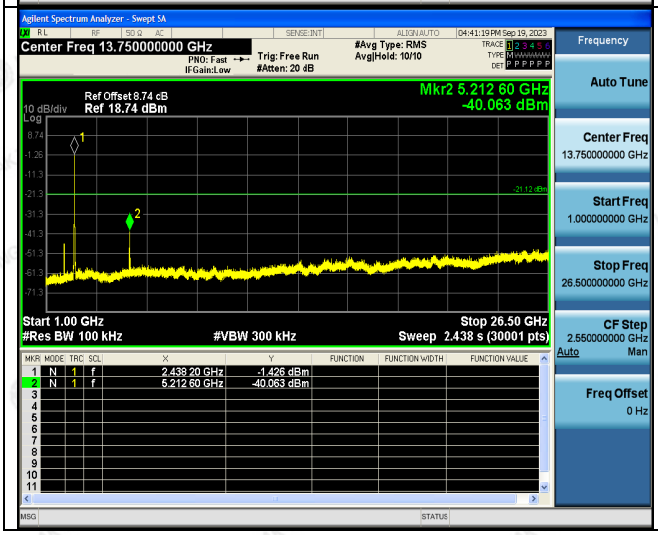


Middle Channel

Spurious Emission







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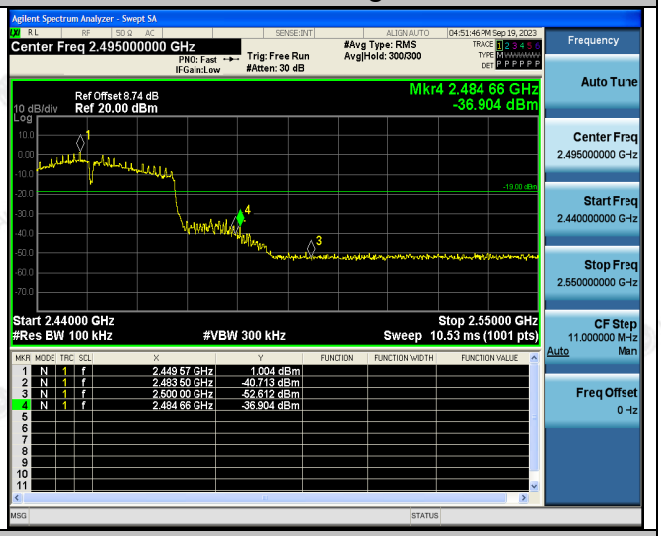
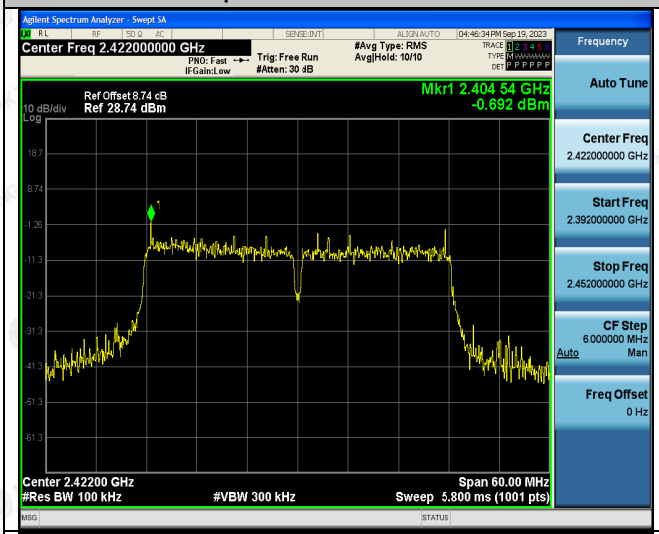
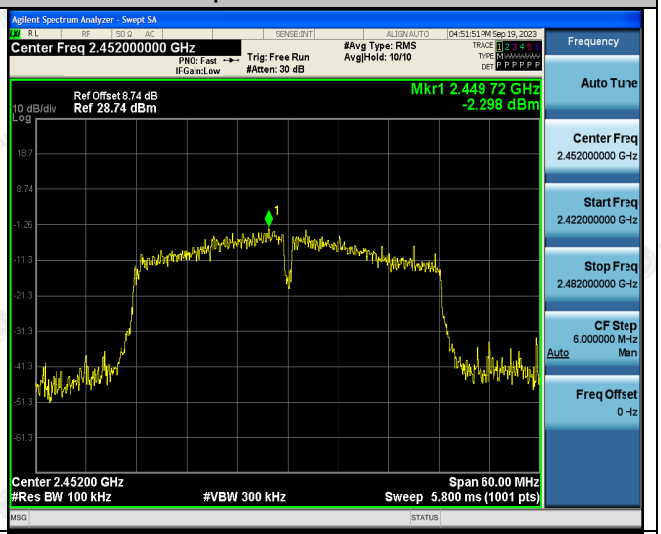
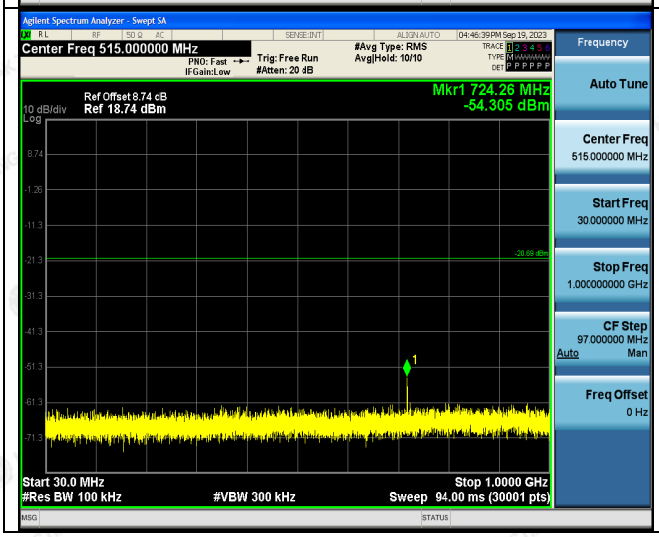
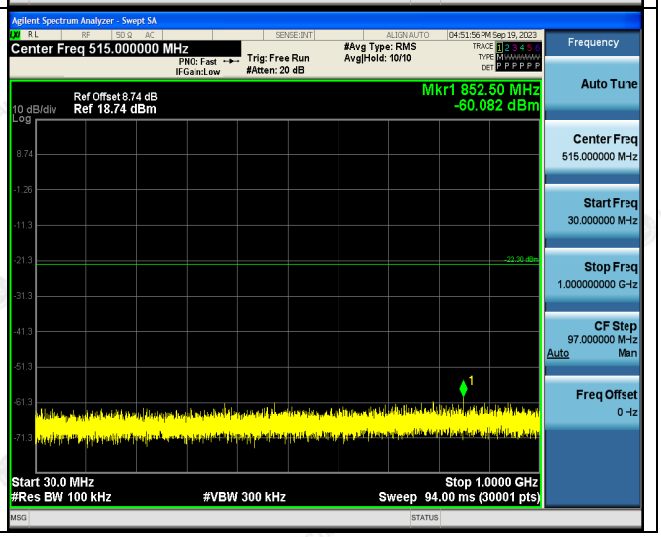
802.11n (HT40) Modulation

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

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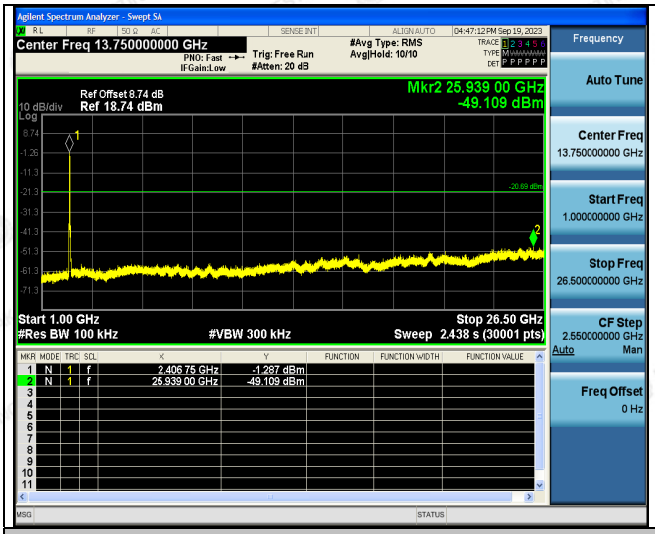
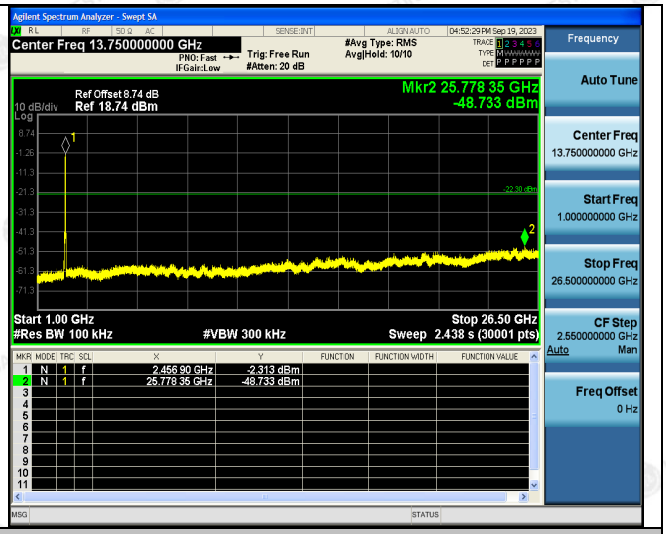
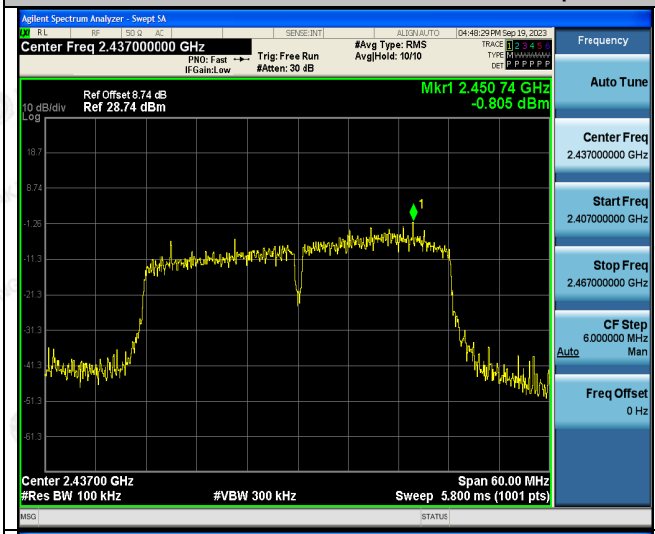
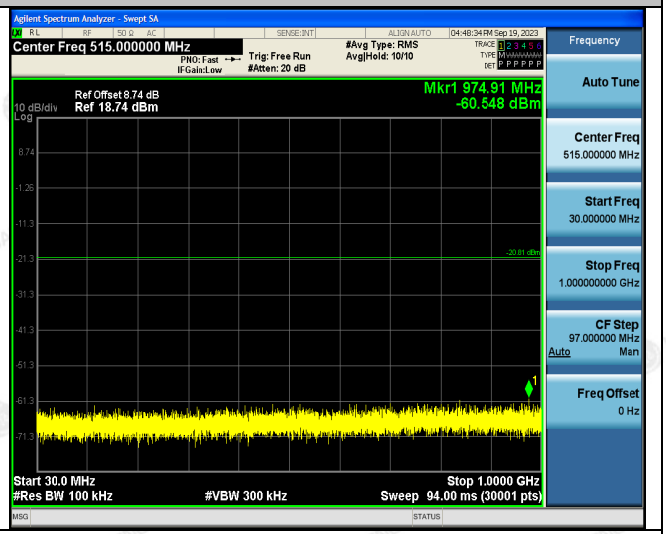


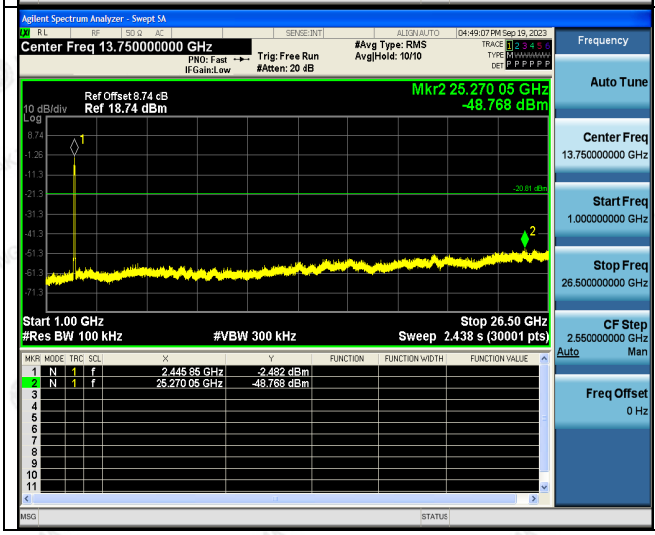


Middle Channel

Spurious Emission







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4.7. Radiated Spurious Emission Measurement

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-peak	200Hz	1kHz	Quasi-peak Value
150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	Average Value

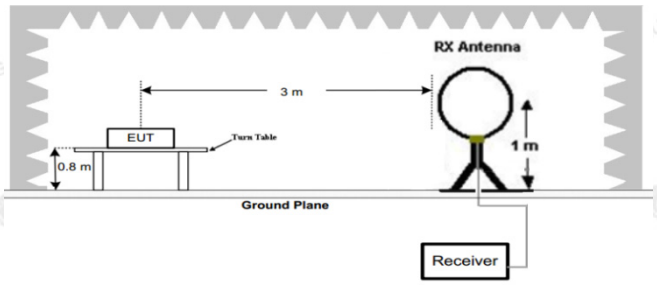
Limit:

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)	Measurement Distance (meters)	Detector
Above 1GHz	500	3	Average
	5000	3	Peak

Test setup:

For radiated emissions below 30MHz



30MHz to 1GHz

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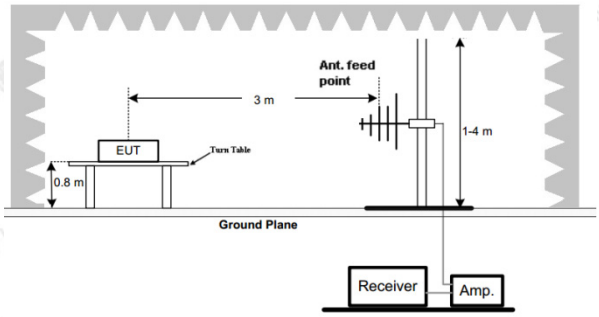
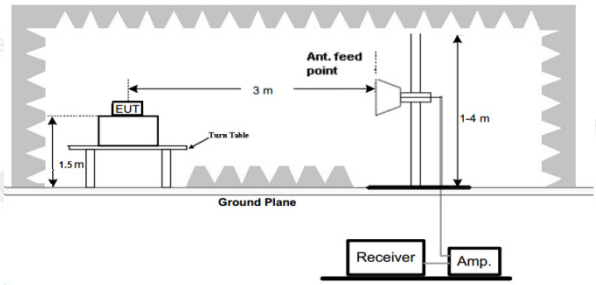
	 Above 1GHz 
Test Procedure:	1. For the radiated emission test below 1GHz: The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst 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.

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	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. 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=120 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

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Test Instruments

Radiated Emission Test Site (966)					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Receiver	R&S	ESR-7	HKE-010	Feb. 17, 2023	Feb. 16, 2024
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023	Feb. 16, 2024
Spectrum analyzer	R&S	FSP40	HKE-025	Feb. 17, 2023	Feb. 16, 2024
High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	Feb. 17, 2023	Feb. 16, 2024
Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Feb. 17, 2023	Feb. 16, 2024
Preamplifier	EMCI	EMC051845SE	HKE-015	Feb. 17, 2023	Feb. 16, 2024
Preamplifier	Agilent	83051A	HKE-016	Feb. 17, 2023	Feb. 16, 2024
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Feb. 17, 2023	Feb. 16, 2024
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Feb. 17, 2023	Feb. 16, 2024
Horn antenna	Schwarzbeck	9120D	HKE-013	Feb. 17, 2023	Feb. 16, 2024
High pass filter unit	Tonscend	JS0806-F	HKE-055	Feb. 17, 2023	Feb. 16, 2024
Antenna Mast	Keleto	CC-A-4M	N/A	N/A	N/A
Position controller	Taiwan MF	MF7802	HKE-011	Feb. 17, 2023	Feb. 16, 2024
Radiated test software	Tonscend	TS+ Rev 2.5.0.0	HKE-082	N/A	N/A
RF cable	Times	9kHz-1GHz	HKE-117	Feb. 17, 2023	Feb. 16, 2024
RF cable	Times	1-40G	HKE-034	Feb. 17, 2023	Feb. 16, 2024
Horn Antenna	Schewarzbeck	BBHA 9170	HKE-017	Feb. 17, 2023	Feb. 16, 2024

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

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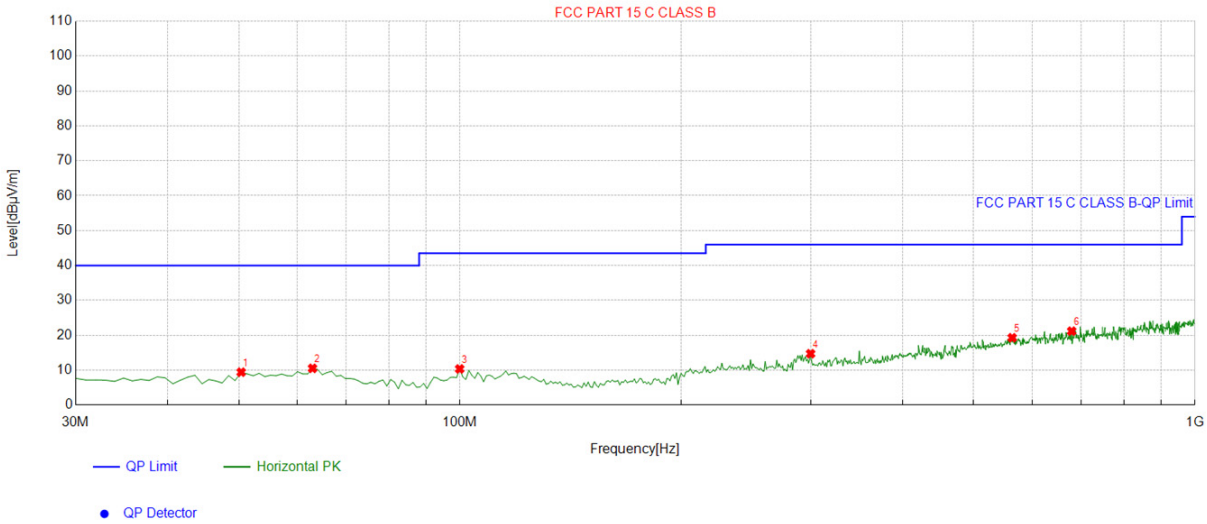
Test Data

All the test modes completed for test. only the worst result of (802.11b at 2412MHz) was reported as below:

Below 1GHz

Horizontal



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	50.39039	-14.55	23.97	9.42	40.00	30.58	100	274	Horizontal
2	63.013013	-14.38	24.90	10.52	40.00	29.48	100	246	Horizontal
3	99.90991	-15.13	25.49	10.36	43.50	33.14	100	20	Horizontal
4	299.92993	-11.91	26.63	14.72	46.00	31.28	100	244	Horizontal
5	564.03403	-5.86	25.15	19.29	46.00	26.71	100	47	Horizontal
6	679.57958	-4.06	25.24	21.18	46.00	24.82	100	80	Horizontal

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

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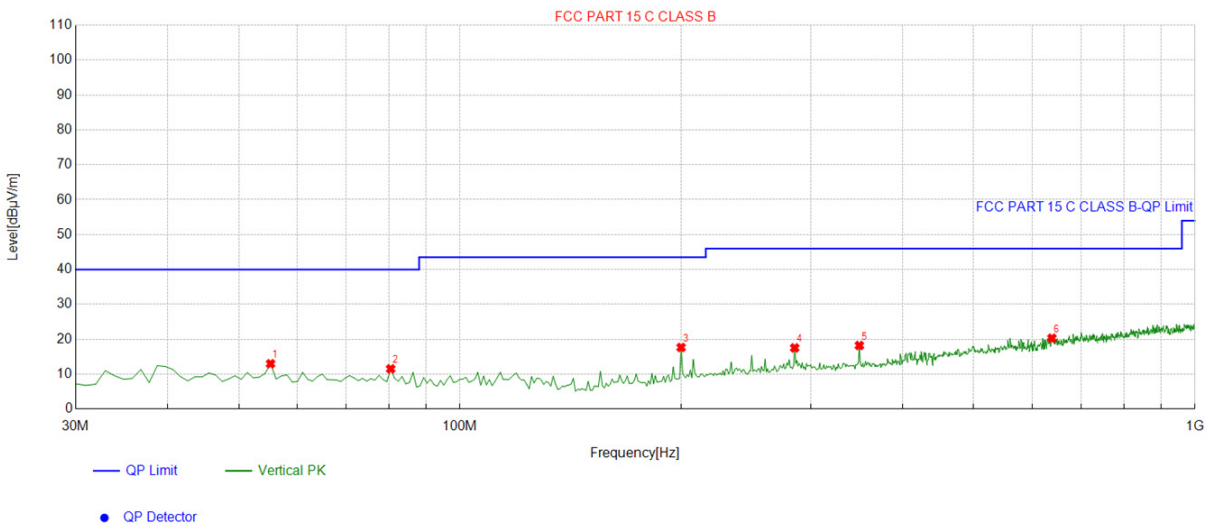
Vertical



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	55.245245	-14.32	27.31	12.99	40.00	27.01	100	170	Vertical
2	80.49049	-17.44	28.96	11.52	40.00	28.48	100	148	Vertical
3	199.91992	-15.27	32.93	17.66	43.50	25.84	100	115	Vertical
4	285.36536	-12.57	30.10	17.53	46.00	28.47	100	280	Vertical
5	349.44944	-11.23	29.45	18.22	46.00	27.78	100	313	Vertical
6	638.79879	-4.45	24.76	20.31	46.00	25.69	100	84	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 (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.

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Above 1GHz

Radiated Emission Test

LOW CH1 (802.11b Mode)/2412

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	56.44	-3.64	52.8	74	-21.2	peak
4824	45.97	-3.64	42.33	54	-11.67	AVG
7236	53.22	-0.95	52.27	74	-21.73	peak
7236	42.57	-0.95	41.62	54	-12.38	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	56.24	-3.64	52.6	74	-21.4	peak
4824	40.56	-3.64	36.92	54	-17.08	AVG
7236	53.81	-0.95	52.86	74	-21.14	peak
7236	37.89	-0.95	36.94	54	-17.06	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

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MID CH6 (802.11b Mode)/2437

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	56.55	-3.51	53.04	74	-20.96	peak
4874	44.93	-3.51	41.42	54	-12.58	AVG
7311	51.84	-0.82	51.02	74	-22.98	peak
7311	43.14	-0.82	42.32	54	-11.68	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	55.42	-3.51	51.91	74	-22.09	peak
4874	43.96	-3.51	40.45	54	-13.55	AVG
7311	53.59	-0.82	52.77	74	-21.23	peak
7311	40.09	-0.82	39.27	54	-14.73	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

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HIGH CH11 (802.11b Mode)/2462

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	53.19	-3.43	49.76	74	-24.24	peak
4924	43.35	-3.43	39.92	54	-14.08	AVG
7386	52.31	-0.75	51.56	74	-22.44	peak
7386	41.82	-0.75	41.07	54	-12.93	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	55.57	-3.43	52.14	74	-21.86	peak
4924	44.25	-3.43	40.82	54	-13.18	AVG
7386	52.43	-0.75	51.68	74	-22.32	peak
7386	43.96	-0.75	43.21	54	-10.79	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit

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 Fundamental73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54dBuV/m(AV Limit), the Average Detected not need to completed.

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LOW CH1 (802.11g Mode)/2412

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	53.33	-3.64	49.69	74	-24.31	peak
4824	40.74	-3.64	37.1	54	-16.9	AVG
7236	51.56	-0.95	50.61	74	-23.39	peak
7236	39.24	-0.95	38.29	54	-15.71	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	54.89	-3.64	51.25	74	-22.75	peak
4824	43.07	-3.64	39.43	54	-14.57	AVG
7236	52.87	-0.95	51.92	74	-22.08	peak
7236	40.56	-0.95	39.61	54	-14.39	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

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MID CH6 (802.11g Mode)/2437

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	53.98	-3.51	50.47	74	-23.53	peak
4874	43.03	-3.51	39.52	54	-14.48	AVG
7311	51.51	-0.82	50.69	74	-23.31	peak
7311	41.43	-0.82	40.61	54	-13.39	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	53.19	-3.51	49.68	74	-24.32	peak
4874	43.77	-3.51	40.26	54	-13.74	AVG
7311	50.36	-0.82	49.54	74	-24.46	peak
7311	41.18	-0.82	40.36	54	-13.64	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

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HIGH CH11 (802.11g Mode)/2462

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	54.86	-3.43	51.43	74	-22.57	peak
4924	46.96	-3.43	43.53	54	-10.47	AVG
7386	53.57	-0.75	52.82	74	-21.18	peak
7386	42.32	-0.75	41.57	54	-12.43	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	53.77	-3.43	50.34	74	-23.66	peak
4924	41.06	-3.43	37.63	54	-16.37	AVG
7386	50.64	-0.75	49.89	74	-24.11	peak
7386	40.41	-0.75	39.66	54	-14.34	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

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 Fundamental73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54dBuV/m(AV Limit), the Average Detected not need to completed.

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LOW CH1 (802.11n/H20 Mode)/2412

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	52.94	-3.64	49.3	74	-24.7	peak
4824	44.92	-3.64	41.28	54	-12.72	AVG
7236	51.37	-0.95	50.42	74	-23.58	peak
7236	41.61	-0.95	40.66	54	-13.34	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	53.67	-3.64	50.03	74	-23.97	peak
4824	44.51	-3.64	40.87	54	-13.13	AVG
7236	52.82	-0.95	51.87	74	-22.13	peak
7236	41.74	-0.95	40.79	54	-13.21	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

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MID CH6 (802.11n/H20 Mode)/2437

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	53.17	-3.51	49.66	74.00	-24.34	peak
4874	45.24	-3.51	41.73	54.00	-12.27	AVG
7311	51.51	-0.82	50.69	74.00	-23.31	peak
7311	40.54	-0.82	39.72	54.00	-14.28	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	55.36	-3.51	51.85	74.00	-22.15	peak
4874	42.73	-3.51	39.22	54.00	-14.78	AVG
7311	52.86	-0.82	52.04	74.00	-21.96	peak
7311	40.31	-0.82	39.49	54.00	-14.51	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit						

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HIGH CH11 (802.11n/H20 Mode)/2462

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	54.75	-3.43	51.32	74	-22.68	peak
4924	43.68	-3.43	40.25	54	-13.75	AVG
7386	53.67	-0.75	52.92	74	-21.08	peak
7386	41.73	-0.75	40.98	54	-13.02	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	55.09	-3.43	51.66	74	-22.34	peak
4924	41.53	-3.43	38.1	54	-15.9	AVG
7386	52.51	-0.75	51.76	74	-22.24	peak
7386	40.46	-0.75	39.71	54	-14.29	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

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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	55.72	-3.63	52.09	74	-21.91	peak
4844	46.66	-3.63	43.03	54	-10.97	AVG
7266	52.72	-0.94	51.78	74	-22.22	peak
7266	41.21	-0.94	40.27	54	-13.73	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4844	54.75	-3.63	51.12	74	-22.88	peak
4844	46.51	-3.63	42.88	54	-11.12	AVG
7266	51.92	-0.94	50.98	74	-23.02	peak
7266	42.14	-0.94	41.2	54	-12.8	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

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MID CH6 (802.11n/H40 Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	53.73	-3.51	50.22	74	-23.78	peak
4874	42.94	-3.51	39.43	54	-14.57	AVG
7311	52.47	-0.82	51.65	74	-22.35	peak
7311	39.12	-0.82	38.3	54	-15.7	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	52.15	-3.51	48.64	74	-25.36	peak
4874	43.94	-3.51	40.43	54	-13.57	AVG
7311	50.49	-0.82	49.67	74	-24.33	peak
7311	42.25	-0.82	41.43	54	-12.57	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

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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	56.47	-3.43	53.04	74	-20.96	peak
4904	42.61	-3.43	39.18	54	-14.82	AVG
7356	52.17	-0.75	51.42	74	-22.58	peak
7356	41.43	-0.75	40.68	54	-13.32	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4904	53.26	-3.43	49.83	74	-24.17	peak
4904	42.91	-3.43	39.48	54	-14.52	AVG
7356	51.62	-0.75	50.87	74	-23.13	peak
7356	40.73	-0.75	39.98	54	-14.02	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

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.

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Test Result of Radiated Spurious at Band edges

Operation Mode:

802.11b Mode TX CH Low (2412MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	54.05	-5.81	48.24	74	-25.76	peak
2310.00	41.19	-5.81	35.38	54	-18.62	AVG
2390.00	50.95	-5.84	45.11	74	-28.89	peak
2390.00	38.22	-5.84	32.38	54	-21.62	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	56.22	-5.81	50.41	74	-23.59	peak
2310.00	43.48	-5.81	37.67	54	-16.33	AVG
2390.00	52.34	-5.84	46.5	74	-27.5	peak
2390.00	41.34	-5.84	35.5	54	-18.5	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

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Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	53.91	-5.81	48.1	74	-25.9	peak
2483.50	41.78	-5.81	35.97	54	-18.03	AVG
2500.00	51.37	-6.06	45.31	74	-28.69	peak
2500.00	39.55	-6.06	33.49	54	-20.51	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	55.59	-5.81	49.78	74	-24.22	peak
2483.50	43.26	-5.81	37.45	54	-16.55	AVG
2500.00	52.48	-6.06	46.42	74	-27.58	peak
2500.00	40.22	-6.06	34.16	54	-19.84	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

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Operation Mode: 802.11g Mode TX CH Low (2412MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	53.71	-5.81	47.9	74	-26.1	peak
2310.00	42.51	-5.81	36.7	54	-17.3	AVG
2390.00	51.03	-5.84	45.19	74	-28.81	peak
2390.00	39.67	-5.84	33.83	54	-20.17	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	54.93	-5.81	49.12	74	-24.88	peak
2310.00	43.65	-5.81	37.84	54	-16.16	AVG
2390.00	50.11	-5.84	44.27	74	-29.73	peak
2390.00	41.66	-5.84	35.82	54	-18.18	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

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Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	54.39	-5.65	48.74	74	-25.26	peak
2483.50	44.16	-5.65	38.51	54	-15.49	AVG
2500.00	52.78	-5.65	47.13	74	-26.87	peak
2500.00	43.07	-5.65	37.42	54	-16.58	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	56.06	-5.65	50.41	74	-23.59	peak
2483.50	44.23	-5.65	38.58	54	-15.42	AVG
2500.00	52.71	-5.65	47.06	74	-26.94	peak
2500.00	42.49	-5.65	36.84	54	-17.16	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

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

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	55.87	-5.81	50.06	74	-23.94	peak
2310.00	42.78	-5.81	36.97	54	-17.03	AVG
2390.00	53.27	-5.84	47.43	74	-26.57	peak
2390.00	40.67	-5.84	34.83	54	-19.17	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	54.54	-5.81	48.73	74	-25.27	peak
2310.00	44.18	-5.81	38.37	54	-15.63	AVG
2390.00	52.73	-5.84	46.89	74	-27.11	peak
2390.00	41.88	-5.84	36.04	54	-17.96	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

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Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	53.48	-5.65	47.83	74	-26.17	peak
2483.50	43.72	-5.65	38.07	54	-15.93	AVG
2500.00	51.01	-5.65	45.36	74	-28.64	peak
2500.00	41.34	-5.65	35.69	54	-18.31	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	54.46	-5.65	48.81	74	-25.19	peak
2483.50	43.34	-5.65	37.69	54	-16.31	AVG
2500.00	53.77	-5.65	48.12	74	-25.88	peak
2500.00	41.52	-5.65	35.87	54	-18.13	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

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

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	55.32	-5.81	49.51	74	-24.49	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	52.08	-5.84	46.24	74	-27.76	peak
2390.00	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	54.12	-5.81	48.31	74	-25.69	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	52.77	-5.84	46.93	74	-27.07	peak
2390.00	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

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Operation Mode: TX CH High (2452MHz)

Horizontal

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	53.69	-5.65	48.04	74	-25.96	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	50.47	-5.65	44.82	74	-29.18	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	55.24	-5.65	49.59	74	-24.41	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	51.79	-5.65	46.14	74	-27.86	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

Remark:
1. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.
2. In restricted bands of operation, the spurious emissions below the permissible value more than 20dB.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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4.8. 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 than6dBi 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 Internal Antenna, need professional installation. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 0.6dBi.

Antenna

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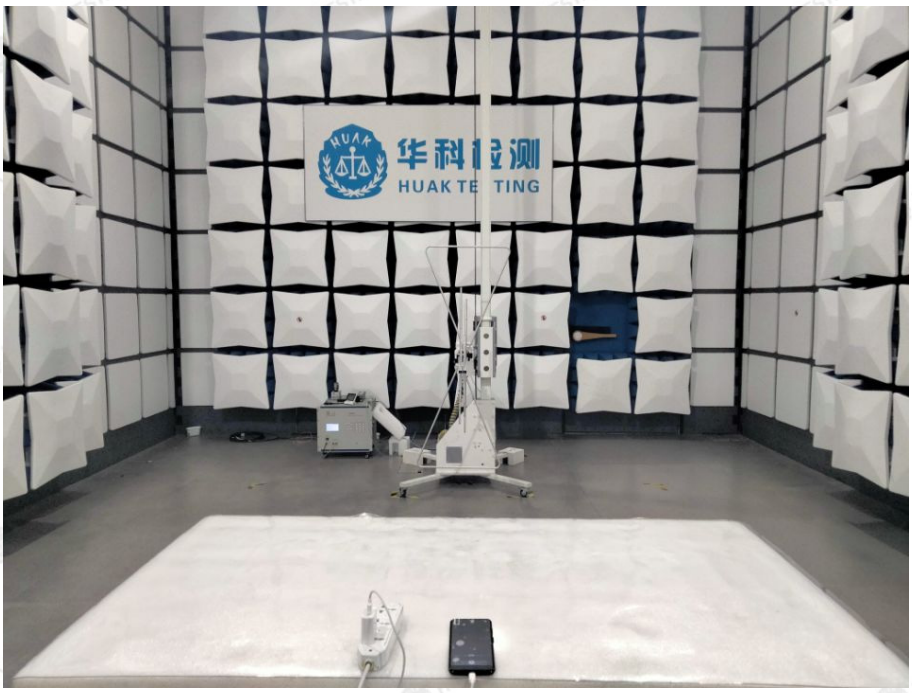
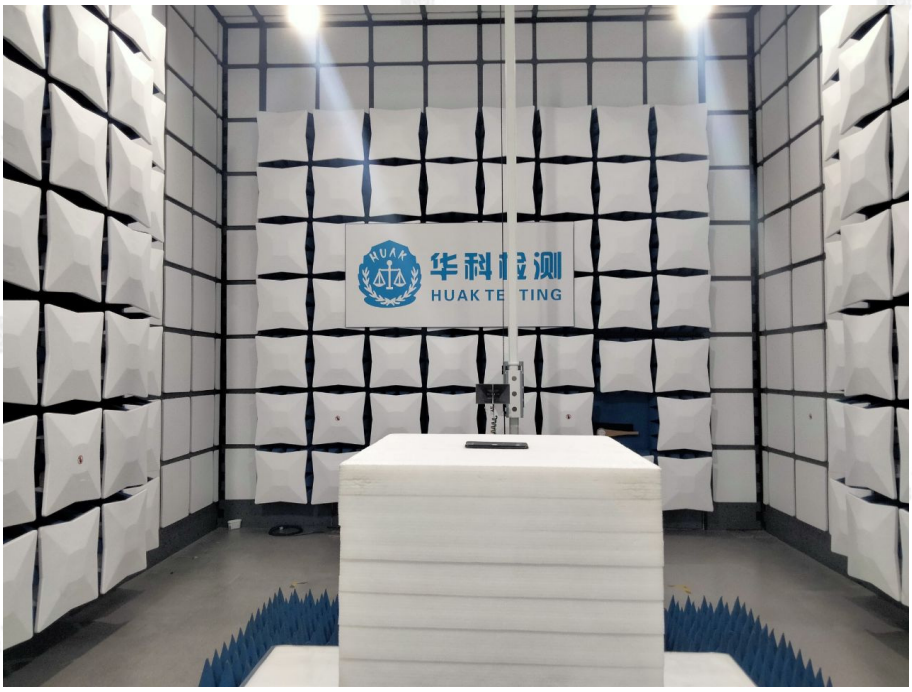
5. Photograph of Test

Radiated Emissions





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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 test report---------

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