

TEST REPORT

Applicant: Hangzhou Shakaraka Technology Co., Ltd

Address of Applicant: Room 4120, Building 2, No. 1197, Bin' an Road, Binjiang District, Hangzhou City, Zhejiang Province

Manufacturer: Hangzhou Green Palm Technology Co., Ltd.

Address of Manufacturer: Room 412, Building C, Hangzhou Xinxigan, No.198, Mingxing Road, Beigan Street, Xiaoshan District, Hangzhou City, Zhejiang Province

Equipment Under Test (EUT)

Product Name: Pisces outdoor gateway

Model No.: Pisces P100, Pisces P110, Pisces P120, Pisces P130, Pisces P140, Pisces P150, Pisces P160, Pisces P170, Pisces P180, Pisces P190

Trade Mark: Pisces IoT

FCC ID: 2A3AD-PISCESP100

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Date of sample receipt: Sep. 17,2021

Date of Test: Sep. 17,2021-Oct. 20,2021

Date of report issued: Oct. 20,2021

Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



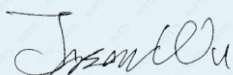
Robinson Luo
Laboratory Manager

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2 Version

Version No.	Date	Description
00	Oct. 20,2021	Original

Prepared By:

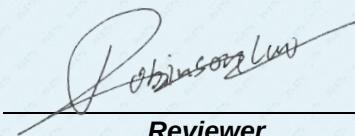


Project Engineer

Date:

Oct. 20,2021

Check By:



Reviewer

Date:

Oct. 20,2021

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4 Test Summary

Test Item	Section	Result
Antenna requirement	FCC part 15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	FCC part 15.207	Pass
Peak Conducted Output Power	FCC part 15.247 (b)(3)	Pass
6dB Bandwidth	FCC part 15.247 (a)(2)	Pass
Power Spectral Density	FCC part 15.247 (e)	Pass
Band Edge	FCC part 15.247(d)	Pass
Spurious Emission	FCC part 15.205/15.209	Pass

Remark: Test according to ANSI C63.10:2013 and RSS-Gen

Pass: The EUT complies with the essential requirements in the standard.

Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	30MHz-200MHz	3.8039dB	(1)
Radiated Emission	200MHz-1GHz	3.9679dB	(1)
Radiated Emission	1GHz-18GHz	4.29dB	(1)
Radiated Emission	18GHz-40GHz	3.30dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	3.44dB	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 General Description of EUT

Product Name:	Pisces outdoor gateway
Model No.:	Pisces P100
Serial model:	Pisces P110, Pisces P120, Pisces P130, Pisces P140, Pisces P150, Pisces P160, Pisces P170, Pisces P180, Pisces P190
Model Declaration:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Test sample(s) ID:	GTSL202109000231-1
Sample(s) Status:	Engineer sample
Hardware Version:	LoRa_WG_V4.4
Software Version:	Pisces Hotspot V1.00
Channel numbers:	802.11b/802.11g /802.11n(HT20): 11
Channel separation:	5MHz
Modulation technology:	802.11b: Direct Sequence Spread Spectrum (DSSS) 802.11g/802.11n(H20): Orthogonal Frequency Division Multiplexing (OFDM)
Antenna Type:	FRP Antenna
Antenna gain:	3.00dBi
Power supply:	DC 5V/1A Form POE Switch
Adapter Information (Auxiliary test provided by the lab):	Mode: TL-SG1005P Input: DC 53.5V, 2.4A

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

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:

Test channel	Frequency (MHz)	
	802.11b/802.11g/802.11n(HT20)	802.11n(HT40)
Lowest channel	2412MHz	/
Middle channel	2437MHz	/
Highest channel	2462MHz	/

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode
<i>Remark: During the test, the dutycycle >98%, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i>	

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:				
Pre-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.				
Mode	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)
Data rate	1Mbps	6Mbps	6.5Mbps	13Mbps

5.3 Description of Support Units

None.

5.4 Deviation from Standards

None.

5.5 Abnormalities from Standard Conditions

None.

5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations: ● FCC—Registration No.: 381383 Designation Number: CN5029 Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. ● IC —Registration No.: 9079A CAB identifier: CN0091 The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. ● NVLAP (LAB CODE:600179-0) Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

5.7 Test Location

All tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

5.8 Additional Instructions

Test Software	Special test command provided by manufacturer
Power level setup	Default

5.9 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:
Conducted testing:

Temperature:	25.2 ° C
Humidity:	51.2 %
Atmospheric pressure:	950-1050mbar

6 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 02 2020	July. 01 2025
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 24 2021	June. 23 2022
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 24 2021	June. 23 2022
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 24 2021	June. 23 2022
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 24 2021	June. 23 2022
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 24 2021	June. 23 2022
9	Coaxial Cable	GTS	N/A	GTS211	June. 24 2021	June. 23 2022
10	Coaxial cable	GTS	N/A	GTS210	June. 24 2021	June. 23 2022
11	Coaxial Cable	GTS	N/A	GTS212	June. 24 2021	June. 23 2022
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 24 2021	June. 23 2022
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 24 2021	June. 23 2022
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 24 2021	June. 23 2022
15	Band filter	Amindeon	82346	GTS219	June. 24 2021	June. 23 2022
16	Power Meter	Anritsu	ML2495A	GTS540	June. 24 2021	June. 23 2022
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 24 2021	June. 23 2022
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 24 2021	June. 23 2022
19	Splitter	Agilent	11636B	GTS237	June. 24 2021	June. 23 2022
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 24 2021	June. 23 2022
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 17 2021	Oct. 16 2022
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 17 2021	Oct. 16 2022
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 17 2021	Oct. 16 2022
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 24 2021	June. 23 2022

Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 24 2021	June. 23 2022
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 24 2021	June. 23 2022
4	ENV216 2-L-V-NETZNACHB.DE	ROHDE&SCHWARZ	ENV216	GTS226	June. 24 2021	June. 23 2022
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 24 2021	June. 23 2022
8	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	June. 24 2021	June. 23 2022
9	ISN	SCHWARZBECK	NTFM 8158	GTS565	June. 24 2021	June. 23 2022
10	High voltage probe	SCHWARZBECK	TK9420	GTS537	July. 09 2021	July. 08 2022

RF Conducted Test:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	June. 24 2021	June. 23 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 24 2021	June. 23 2022
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June. 24 2021	June. 23 2022
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	June. 24 2021	June. 23 2022
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	June. 24 2021	June. 23 2022
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	June. 24 2021	June. 23 2022
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	June. 24 2021	June. 23 2022
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	June. 24 2021	June. 23 2022

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 24 2021	June. 23 2022
2	Barometer	ChangChun	DYM3	GTS255	June. 24 2021	June. 23 2022

7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
15.203 requirement: 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
EUT Antenna:	
<i>The antennas are FRP Antenna, the best case gain of the antennas are 3.00dBi, reference to the appendix II for details</i>	

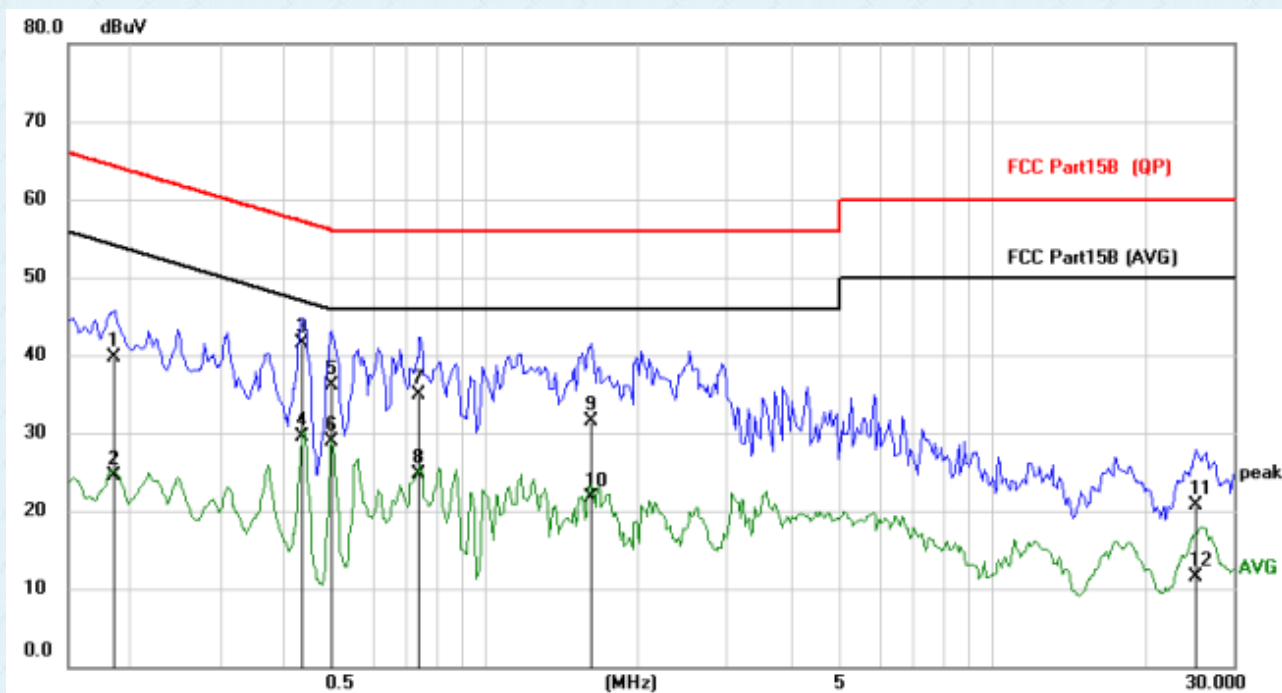
7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207						
Test Method:	ANSI C63.10:2013						
Test Frequency Range:	150KHz to 30MHz						
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto						
Limit:	Frequency range (MHz)		Limit (dBuV)				
			Quasi-peak		Average		
	0.15-0.5		66 to 56*		56 to 46*		
	0.5-5		56		46		
	5-30		60		50		
* Decreases with the logarithm of the frequency.							
Test setup:	Reference Plane Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m						
Test procedure:	1. The E.U.T and simulators are 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.						
Test Instruments:	Refer to section 6.0 for details						
Test mode:	Refer to section 5.2 for details						
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar	
Test voltage:	AC 120V, 60Hz						
Test results:	Pass						

Remark: Both high and low voltages have been tested to show only the worst low voltage test data.

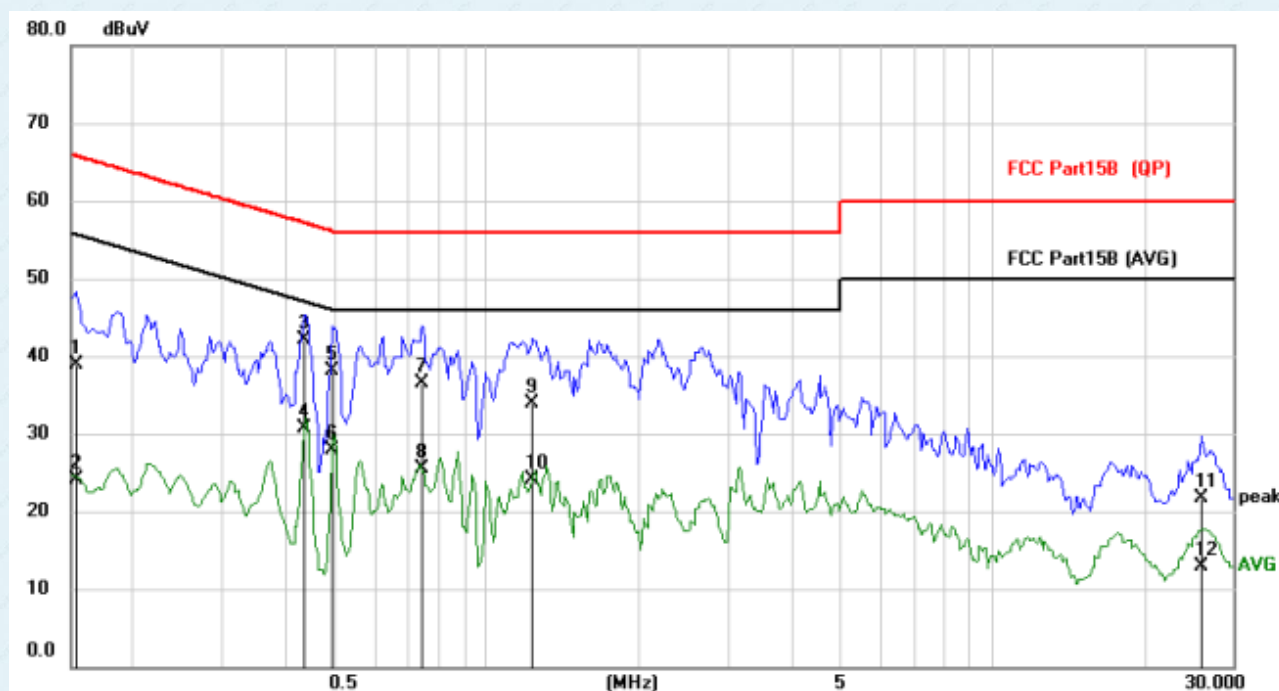
Measurement data

Line:



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	
		MHz	Level	Factor	ment			Detector
			dBuV	dB	dBuV	dBuV	dB	
1		0.1850	28.71	10.92	39.63	64.26	-24.63	QP
2		0.1850	13.53	10.92	24.45	54.26	-29.81	AVG
3	*	0.4347	30.67	10.92	41.59	57.16	-15.57	QP
4		0.4347	18.55	10.92	29.47	47.16	-17.69	AVG
5		0.4971	25.16	10.92	36.08	56.05	-19.97	QP
6		0.4971	17.94	10.92	28.86	46.05	-17.19	AVG
7		0.7428	24.04	10.92	34.96	56.00	-21.04	QP
8		0.7428	13.80	10.92	24.72	46.00	-21.28	AVG
9		1.6203	20.57	10.94	31.51	56.00	-24.49	QP
10		1.6203	10.78	10.94	21.72	46.00	-24.28	AVG
11		25.2066	8.74	11.90	20.64	60.00	-39.36	QP
12		25.2066	-0.39	11.90	11.51	50.00	-38.49	AVG

Neutral:

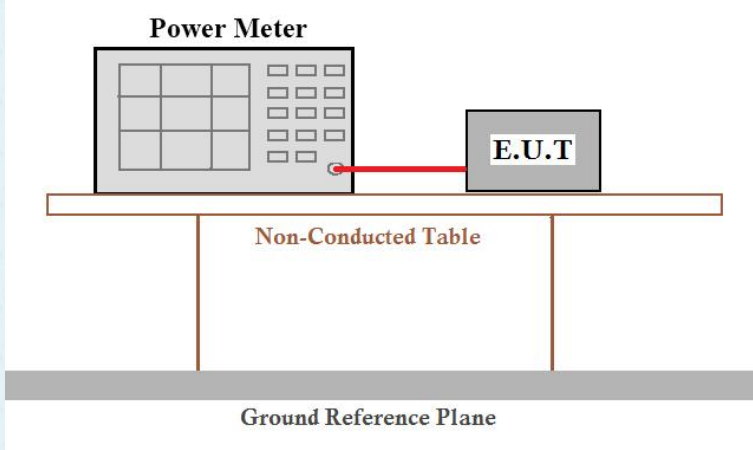


No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	
		MHz	Level	Factor	ment			Detector
			dBuV	dB	dBuV	dBuV	dB	
1		0.1539	28.02	10.92	38.94	65.79	-26.85	QP
2		0.1539	13.19	10.92	24.11	55.79	-31.68	AVG
3	*	0.4347	31.15	10.92	42.07	57.16	-15.09	QP
4		0.4347	19.77	10.92	30.69	47.16	-16.47	AVG
5		0.4932	27.27	10.92	38.19	56.11	-17.92	QP
6		0.4932	17.06	10.92	27.98	46.11	-18.13	AVG
7		0.7467	25.66	10.92	36.58	56.00	-19.42	QP
8		0.7467	14.58	10.92	25.50	46.00	-20.50	AVG
9		1.2303	23.02	10.94	33.96	56.00	-22.04	QP
10		1.2303	13.11	10.94	24.05	46.00	-21.95	AVG
11		25.9515	9.87	11.93	21.80	60.00	-38.20	QP
12		25.9515	0.92	11.93	12.85	50.00	-37.15	AVG

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

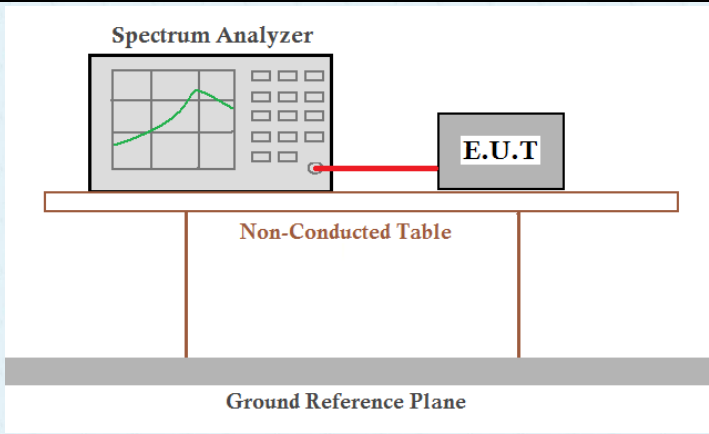
7.3 Conducted Peak Output Power

Test Requirement :	FCC Part15 C Section 15.247 (b)(3)
Test Method :	KDB558074 D01 15.247 Meas Guidance v05r02
Limit:	30dBm
Test setup:	 The diagram illustrates the test setup. A Power Meter is connected to an E.U.T (Equipment Under Test) via a red cable. Both the Power Meter and the E.U.T are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Test CH	Peak Output Power (dBm)			Limit(dBm)	Result
	802.11b	802.11g	802.11n(HT20)		
Lowest	14.86	14.27	14.27	30.00	Pass
Middle	14.76	14.27	14.14		
Highest	14.68	14.28	14.11		

7.4 Channel Bandwidth

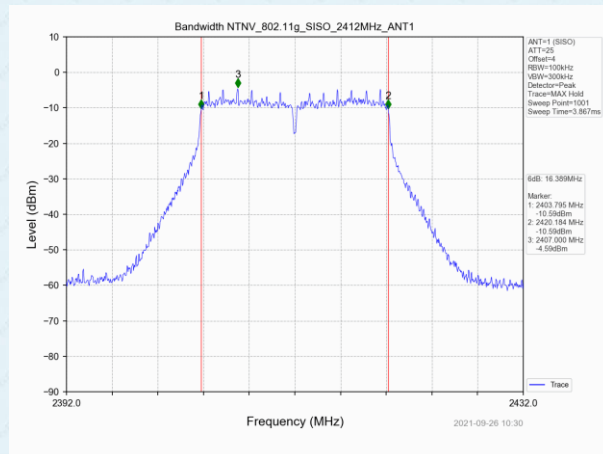
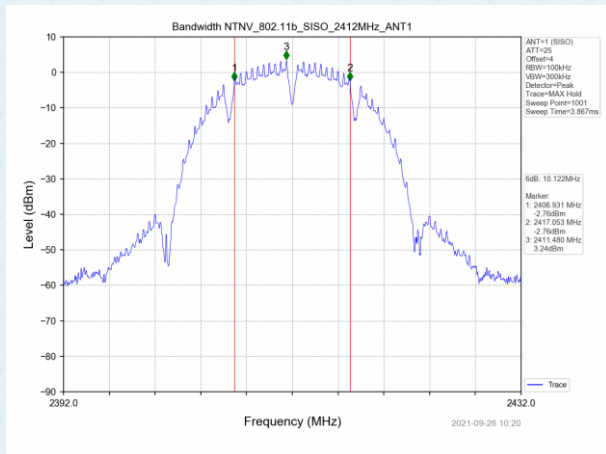
Test Requirement :	FCC Part15 C Section 15.247 (a)(2)
Test Method :	KDB558074 D01 15.247 Meas Guidance v05r02
Limit:	>500KHz
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

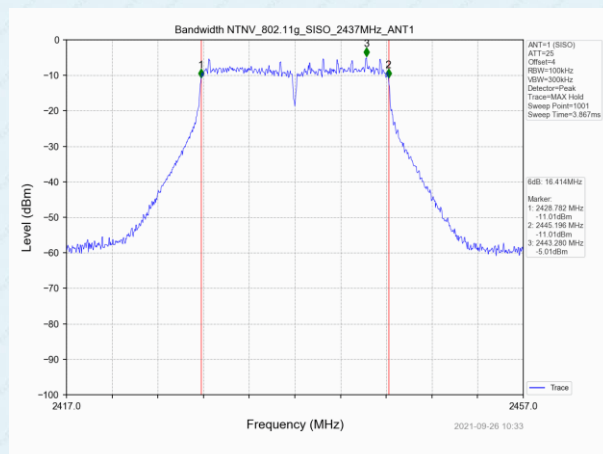
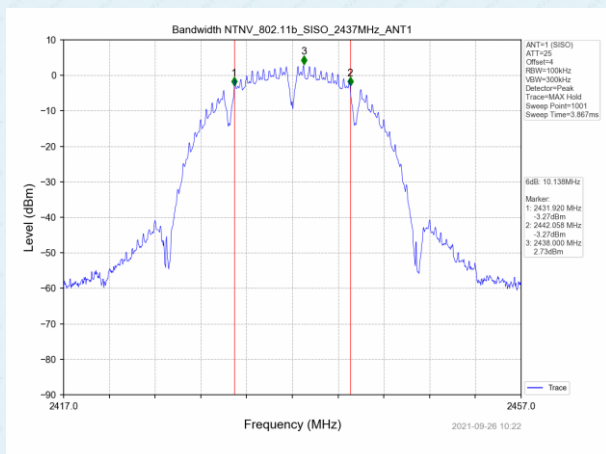
Test CH	Channel Bandwidth (MHz)			Limit(KHz)	Result
	802.11b	802.11g	802.11n(HT20)		
Lowest	10.122	16.389	17.567	>500	Pass
Middle	10.138	16.414	17.383		
Highest	10.133	16.383	17.574		

Test plot as follows:

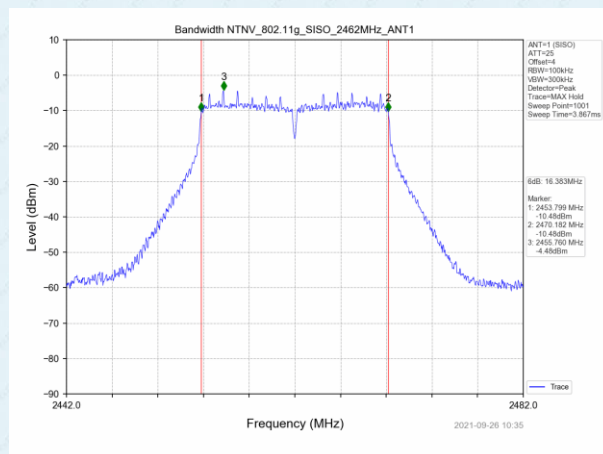
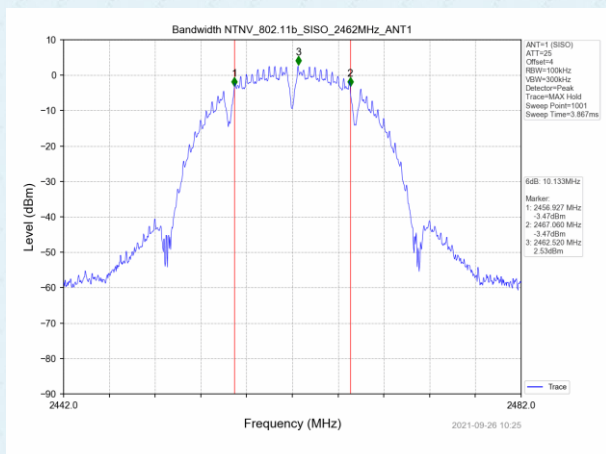
802.11b	802.11g
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Lowest channel

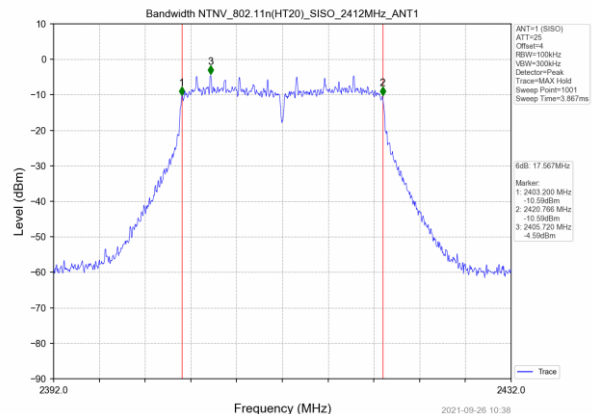


Middle channel

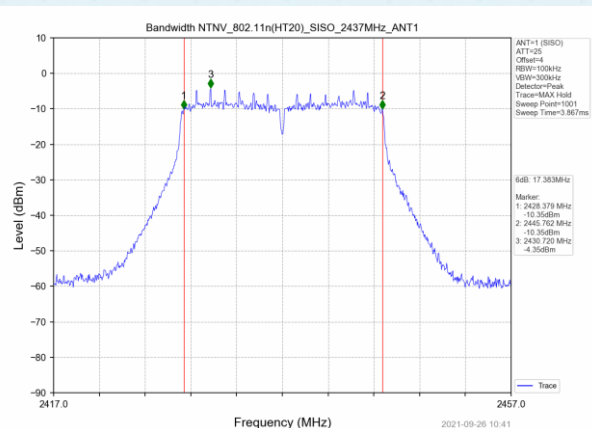


Highest channel

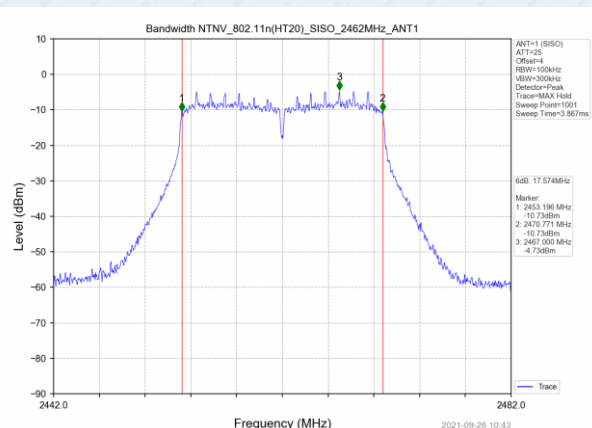
802.11n(HT20)



Lowest channel

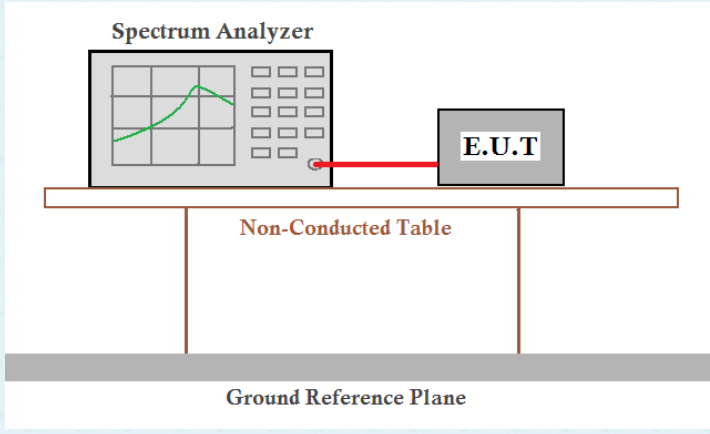


Middle channel



Highest channel

7.5 Power Spectral Density

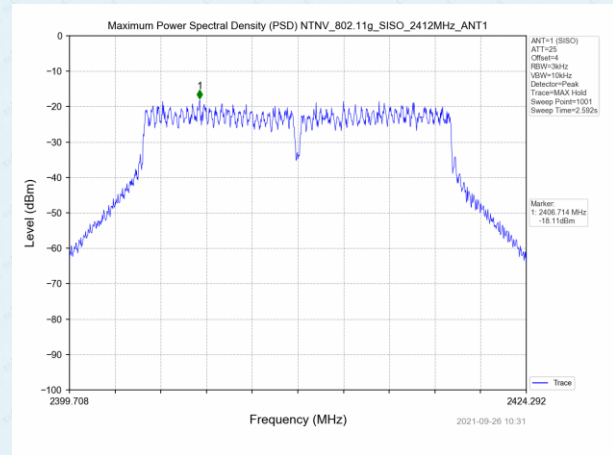
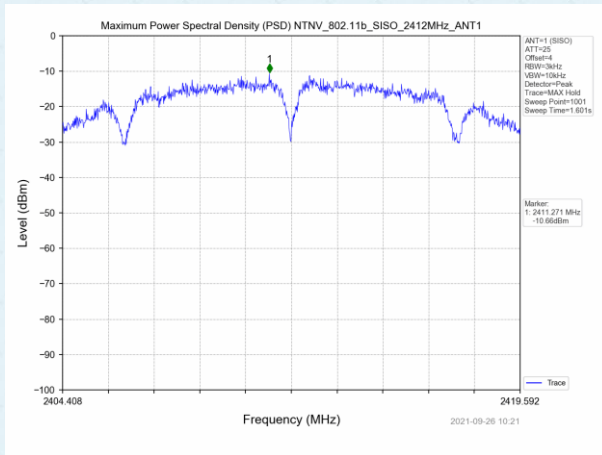
Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB558074 D01 15.247 Meas Guidance v05r02
Limit:	8dBm/3kHz
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

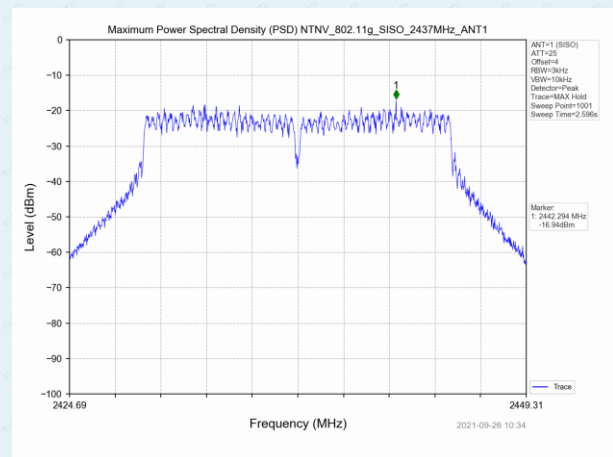
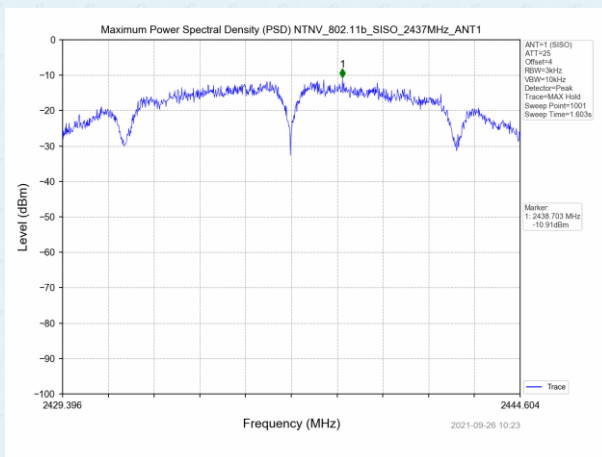
Test CH	Power Spectral Density (dBm/3kHz)			Limit (dBm/3kHz)	Result
	802.11b	802.11g	802.11n(HT20)		
Lowest	-10.66	-18.11	-17.76	8.00	Pass
Middle	-10.91	-16.94	-18.31		
Highest	-11.54	-19.39	-19.00		

Test plot as follows:

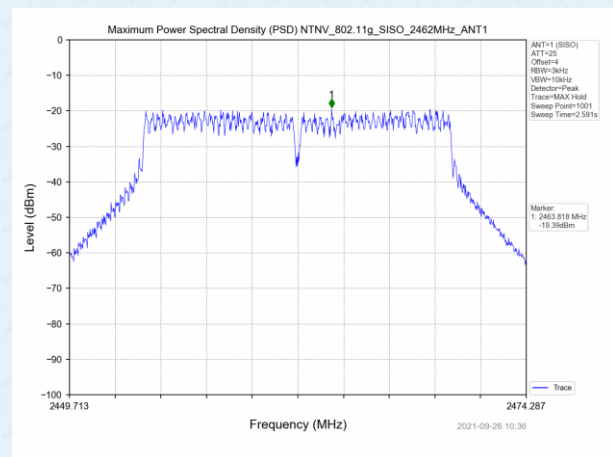
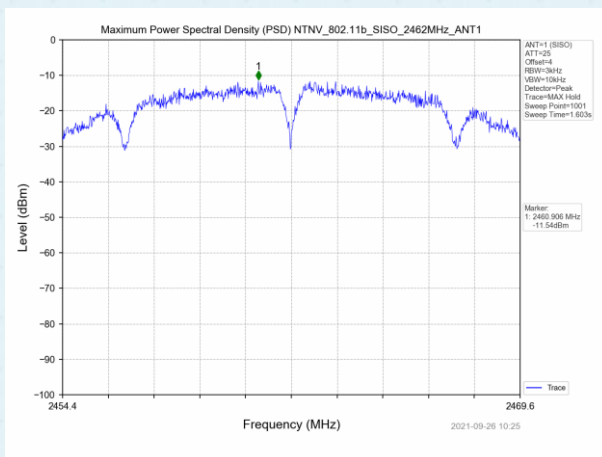
802.11b		802.11b	
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Lowest channel

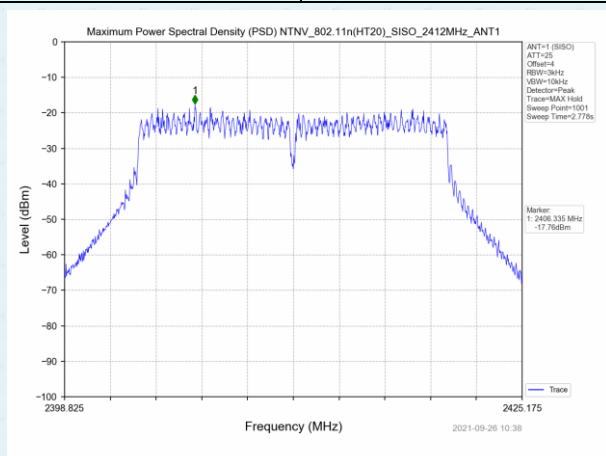


Middle channel

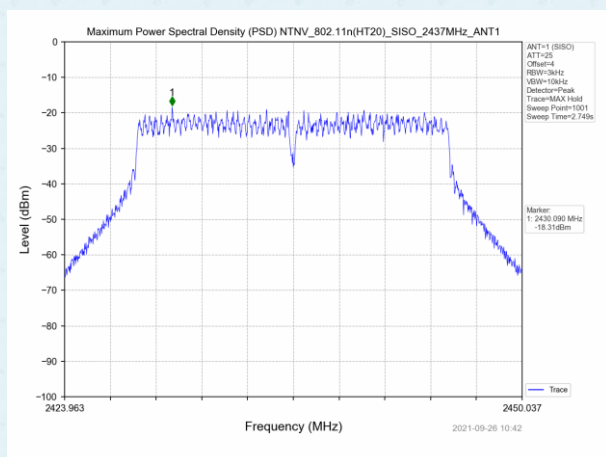


Highest channel

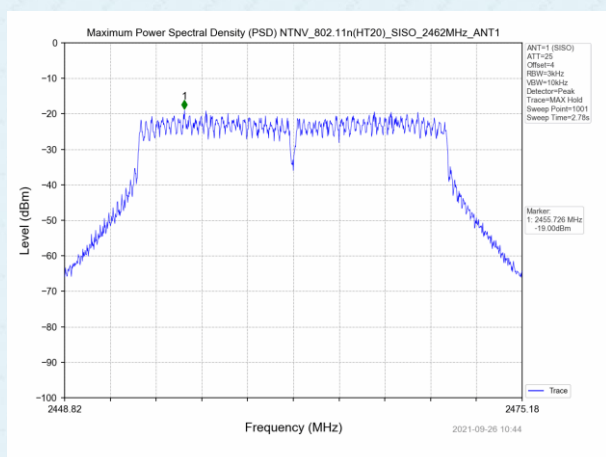
802.11n(HT20)			
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Lowest channel



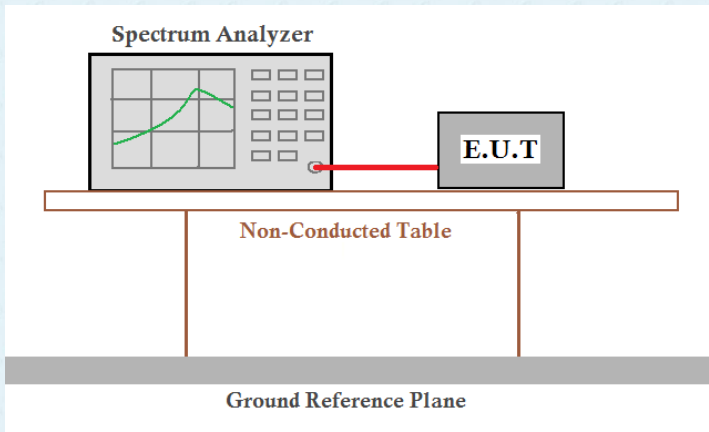
Middle channel



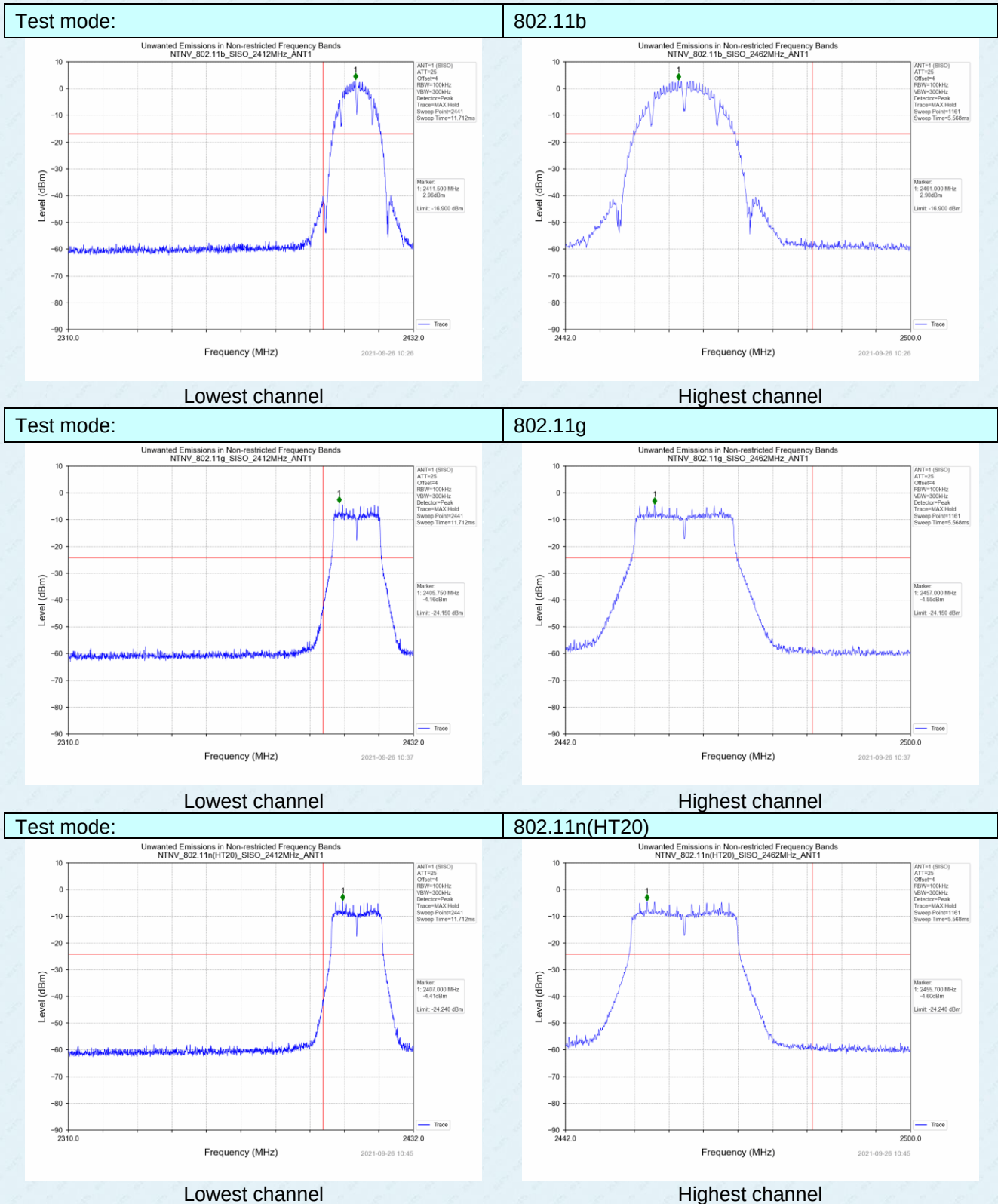
Highest channel

7.6 Band edges

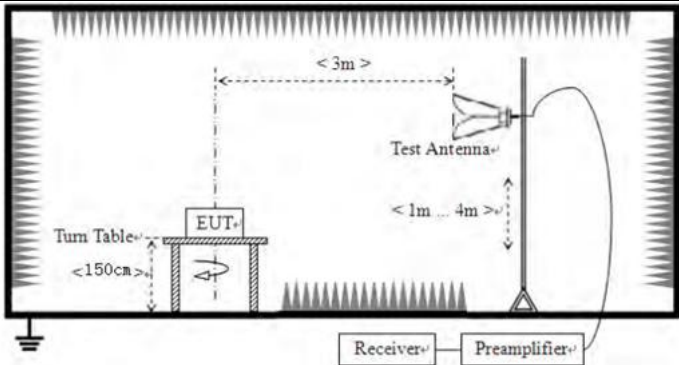
7.6.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074 D01 15.247 Meas Guidance v05r02
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs and sits on a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Test plot as follows:



7.6.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10: 2013				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Average	1MHz	3MHz	Average
Limit:	Frequency		Limit (dBuV/m @3m)		Value
	Above 1GHz		54.00		Average
			74.00		Peak
Test setup:					
Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. 7. The radiation measurements are performed in X, Y, Z axis positioning. And found the Y axis positioning which it is worse case, only the test worst case mode is recorded in the report.				
Test Instruments:	Refer to section 6.0 for details				
Test mode:	Refer to section 5.2 for details				
Test results:	Pass				

Measurement data:

Test mode:	802.11b	Test channel:	Lowest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2390	64.35	-5.68	58.67	74.00	-15.33	Horizontal
2390	64.33	-5.68	58.65	74.00	-15.35	Vertical

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

Average value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2390	45.79	-5.68	40.11	54.00	-13.89	Horizontal
2390	45.62	-5.68	39.94	54.00	-14.06	Vertical

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

Test mode:	802.11b	Test channel:	Highest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	64.42	-5.85	58.57	74.00	-15.43	Horizontal
2483.5	64.23	-5.65	58.58	74.00	-15.42	Vertical

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

Average value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	45.33	-5.85	39.48	54.00	-14.52	Horizontal
2483.5	45.20	-5.65	39.55	54.00	-14.45	Vertical

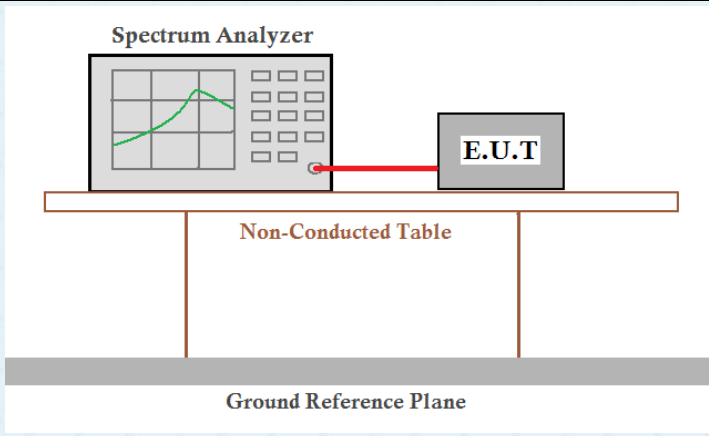
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Remarks:

1. Only the worst case Main Antenna test data.
2. The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.
3. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
4. The emission levels of other frequencies are very lower than the limit and not show in test report.
5. During the test, pre-scan the 802.11b/802.11g/802.11n (H20) modulation, and found the 802.11b modulation which it is worse case.

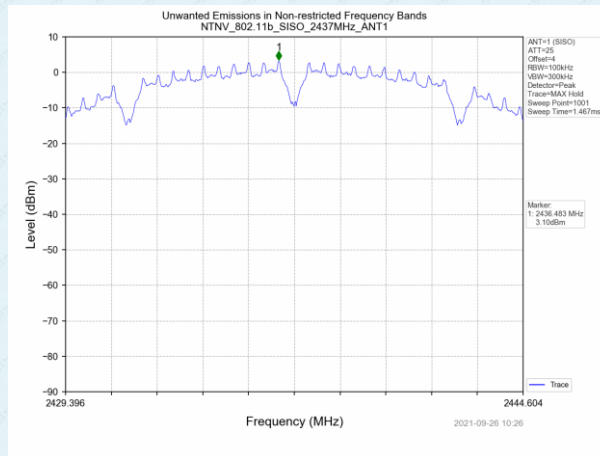
7.7 Spurious Emission

7.7.1 Conducted Emission Method

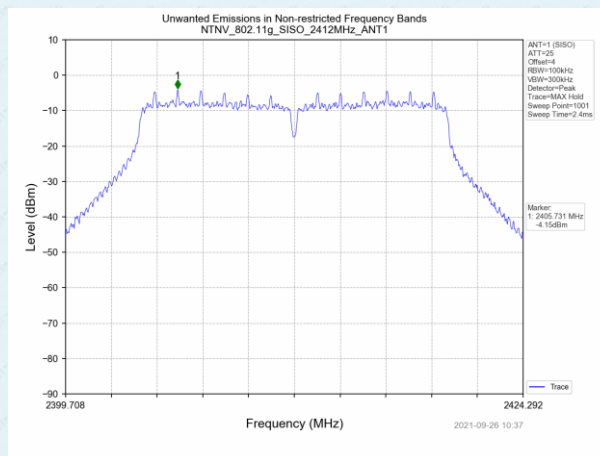
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074 D01 15.247 Meas Guidance v05r02
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which sits on a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Test plot as follows:

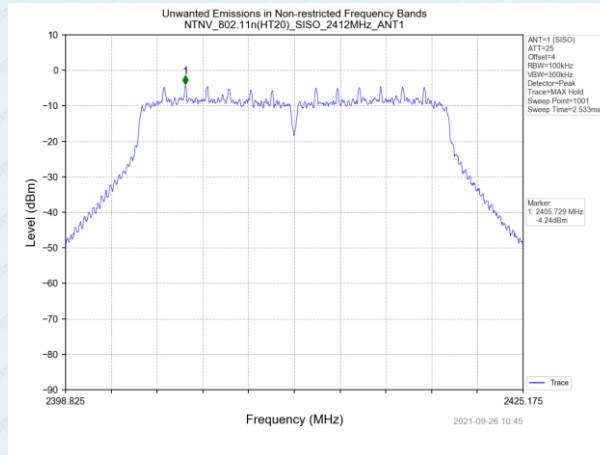
Reference



802.11b



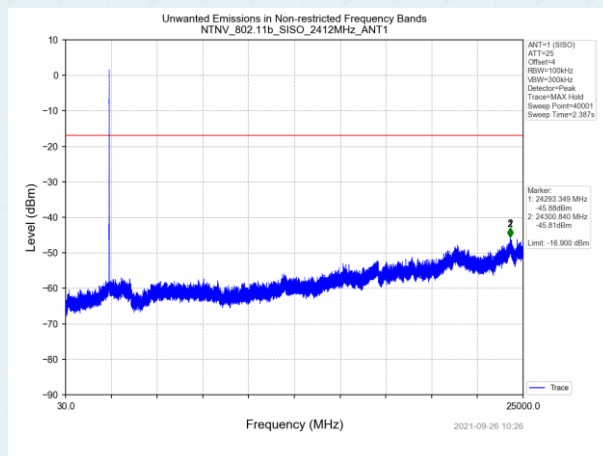
802.11g



802.11n(HT20)

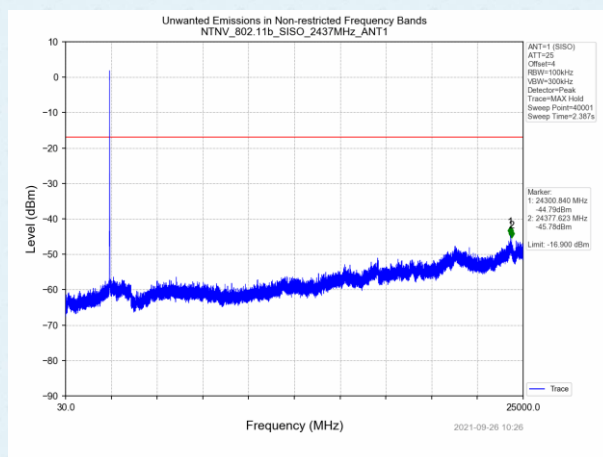
802.11b

Lowest channel



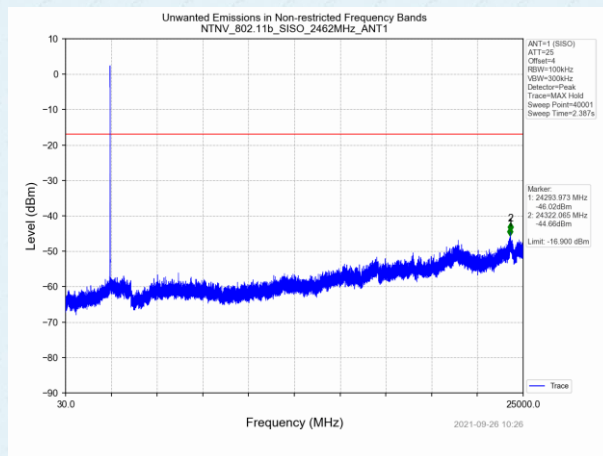
30MHz~25GHz

Middle channel



30MHz~25GHz

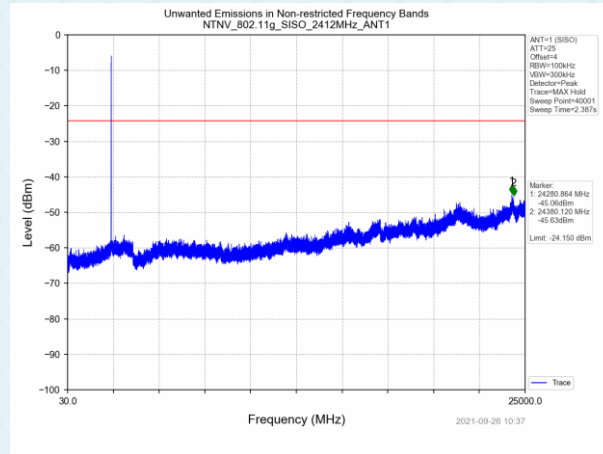
Highest channel



30MHz~25GHz

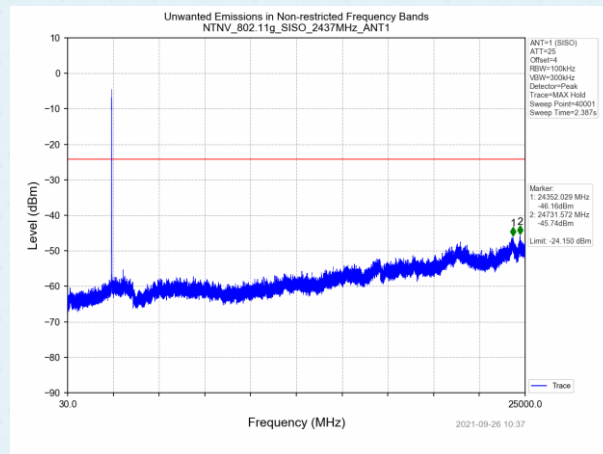
802.11g

Lowest channel



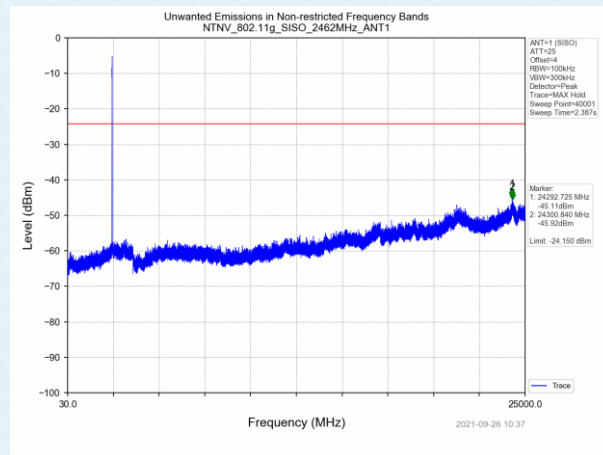
30MHz~25GHz

Middle channel



30MHz~25GHz

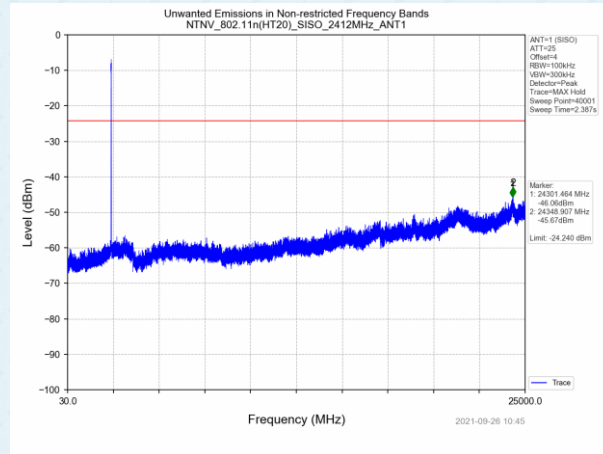
Highest channel



30MHz~25GHz

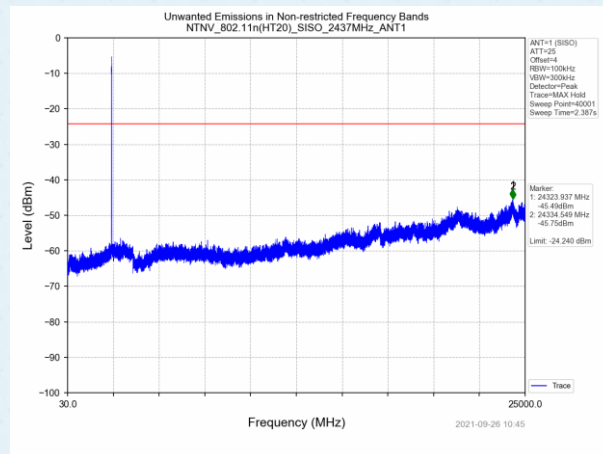
802.11n(HT20)

Lowest channel



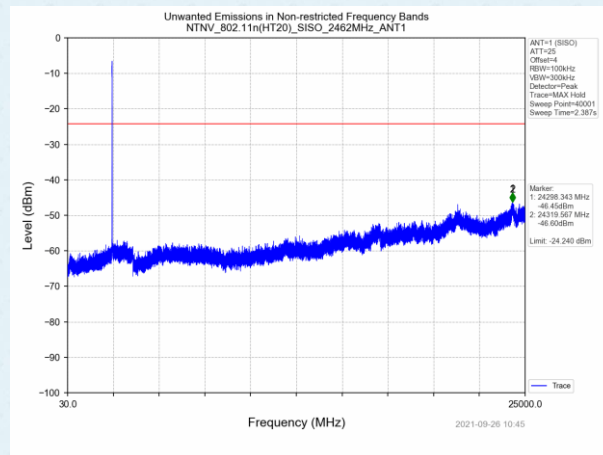
30MHz~25GHz

Middle channel



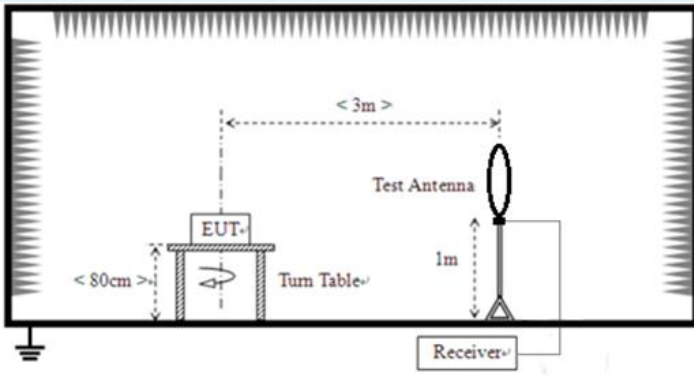
30MHz~25GHz

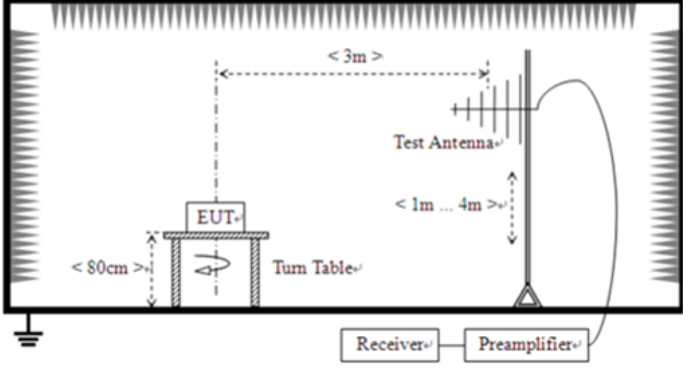
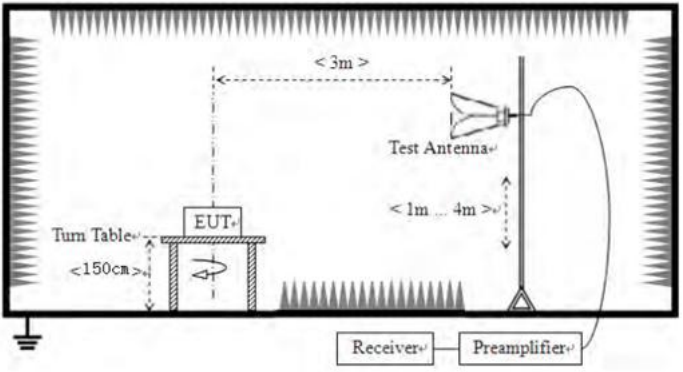
Highest channel



30MHz~25GHz

7.7.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10: 2013				
Test Frequency Range:	9kHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Limit (uV/m)		Value	Measurement Distance
	0.009MHz-0.490MHz	2400/F(KHz)		QP	300m
	0.490MHz-1.705MHz	24000/F(KHz)		QP	300m
	1.705MHz-30MHz	30		QP	30m
	30MHz-88MHz	100		QP	3m
	88MHz-216MHz	150		QP	
	216MHz-960MHz	200		QP	
	960MHz-1GHz	500		QP	
	Above 1GHz	500		Average	
		5000		Peak	
Test setup:	For radiated emissions from 9kHz to 30MHz				
					
	For radiated emissions from 30MHz to 1GHz				

	 For radiated emissions above 1GHz 
Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details

Test voltage:	AC120V 60Hz					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Remarks:

1. Only the worst case Main Antenna test data.
2. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

Measurement data:

■ **9kHz~30MHz**

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o) & RSS-Gen 6.13, the test result no need to reported.

■ Below 1-25GHz

Pre-scan all test modes, found worst case at 802.11b 2437MHz, and so only show the test result of 802.11b 2437MHz

Horizontal:



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over
		MHz	Level	Factor	ment		
			dBuV	dB	dBuV/m	dB/m	dB
1		56.5929	41.17	-18.66	22.51	40.00	-17.49
2		84.9995	43.43	-21.06	22.37	40.00	-17.63
3		119.8556	53.86	-19.91	33.95	43.50	-9.55
4	*	150.5378	52.40	-17.55	34.85	43.50	-8.65
5		207.8501	53.67	-19.88	33.79	43.50	-9.71
6		295.1469	44.89	-18.45	26.44	46.00	-19.56

Measurement = Receiver Read level + Correct Factor

Vertical:



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		45.2166	52.26	-18.28	33.98	40.00	-6.02	QP
2	*	58.8185	52.86	-18.71	34.15	40.00	-5.85	QP
3		86.5029	53.03	-21.14	31.89	40.00	-8.11	QP
4		118.6014	56.32	-19.95	36.37	43.50	-7.13	QP
5		191.0738	50.21	-19.92	30.29	43.50	-13.21	QP
6		297.2241	38.70	-18.45	20.25	46.00	-25.75	QP

Measurement = Receiver Read level + Correct Factor

■ Above 1-25GHz

Note: During the test, pre-scan the 802.11b/802.11g/802.11n (H20) modulation, and found the 802.11b modulation which it is worse case.

Test mode:	802.11b	Test channel:	Lowest
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Peak value:

Frequency (MHz)	Read Level (dBUV)	Factor(dB)	Level (dBUV/m)	Limit Line (dBUV/m)	Over Limit (dB)	polarization
4824	62.33	-3.67	58.66	74.00	-15.34	Vertical
7236	59.97	-0.90	59.07	74.00	-14.93	Vertical
4824	61.59	-3.67	57.92	74.00	-16.08	Horizontal
7236	59.88	-0.90	58.98	74.00	-15.02	Horizontal
---	---	---	---	---	---	---
---	---	---	---	---	---	---

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

Average value:

Frequency (MHz)	Read Level (dBUV)	Factor(dB)	Level (dBUV/m)	Limit Line (dBUV/m)	Over Limit (dB)	polarization
4824	46.33	-3.64	42.69	54.00	-11.31	Vertical
7236	45.07	-0.90	44.17	54.00	-9.83	Vertical
4824	46.21	-3.64	42.57	54.00	-11.43	Horizontal
7236	45.10	-0.90	44.20	54.00	-9.80	Horizontal
---	---	---	---	---	---	---
---	---	---	---	---	---	---

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

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.

Test mode:	802.11b	Test channel:	Middle
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4874	62.35	-3.53	58.82	74.00	-15.18	Vertical
7311	59.52	-0.85	58.67	74.00	-15.33	Vertical
4874	61.71	-3.53	58.18	74.00	-15.82	Horizontal
7311	59.33	-0.85	58.48	74.00	-15.52	Horizontal
---	---	---	---	---	---	---
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Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Average value:

Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4874	46.03	-3.53	42.50	54.00	-11.50	Vertical
7311	45.19	-0.85	44.34	54.00	-9.66	Vertical
4874	46.22	-3.53	42.69	54.00	-11.31	Horizontal
7311	45.37	-0.85	44.52	54.00	-9.48	Horizontal
---	---	---	---	---	---	---
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Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.

Test mode:	802.11b	Test channel:	Highest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4924	62.38	-3.49	58.89	74.00	-15.11	Vertical
7386	58.93	-0.78	58.15	74.00	-15.85	Vertical
4924	61.96	-3.49	58.47	74.00	-15.53	Horizontal
7386	58.22	-0.78	57.44	74.00	-16.56	Horizontal
---	---	---	---	---	---	---
---	---	---	---	---	---	---

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

Average value:

Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4924	45.97	-3.49	42.48	54.00	-11.52	Vertical
7386	44.28	-0.78	43.50	54.00	-10.50	Vertical
4924	45.83	-3.49	42.34	54.00	-11.66	Horizontal
7386	44.51	-0.78	43.73	54.00	-10.27	Horizontal
---	---	---	---	---	---	---
---	---	---	---	---	---	---

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

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.

8 Test Setup Photo

Reference to the **appendix I** for details.

9 EUT Constructional Details

Reference to the **appendix II** for details.

-----End-----