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Report Template Version: V03
Report Template Revision Date: Mar.1st, 2017

Test Report

Report No. :	CQASZ20190500398E-01
Applicant:	UNIONMAN TECHNOLOGY CO., LTD.
Address of Applicant:	No.5 Huitai Road, Huinan High-Tech Industrial Park, Huizhou City, Guangdong, China.
Manufacturer:	UNIONMAN TECHNOLOGY CO., LTD.
Address of Manufacturer:	No.5 Huitai Road, Huinan High-Tech Industrial Park, Huizhou City, Guangdong, China.
Equipment Under Test (EUT):	
Product:	Set-top box
Model No.:	UNT400X
Brand Name:	N/A
FCC ID:	2ATGV-UNT400X
Standards:	47 CFR Part 15, Subpart C
Date of Test:	2019-05-22 to 2019-06-02
Date of Issue:	2019-06-03
Test Result :	**PASS***

Tested By: ***(Daisy Qin)***

Reviewed By: ***(Aaron Ma)***

Approved By: ***(Jack Ai)***

.

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

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CQA, this report can't be reproduced except in full.

1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20190500398E-01	Rev.01	Initial report	2019-06-03

2 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10 2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 2013	PASS
Conducted Peak & Average Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(3)	ANSI C63.10 2013	PASS
6dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(2)	ANSI C63.10 2013	PASS
Power Spectral Density	47 CFR Part 15, Subpart C Section 15.247 (e)	ANSI C63.10 2013	PASS
Radiated Spurious Emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2013	PASS

3 Contents

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4 General Information

4.1 Client Information

Applicant:	UNIONMAN TECHNOLOGY CO., LTD.
Address of Applicant:	No.5 Huitai Road, Huinan High-Tech Industrial Park, Huizhou City, Guangdong, China.
Manufacturer:	UNIONMAN TECHNOLOGY CO., LTD.
Address of Manufacturer:	No.5 Huitai Road, Huinan High-Tech Industrial Park, Huizhou City, Guangdong, China.

4.2 General Description of EUT

Product Name:	Set-top box
Model No.:	UNT400X
Trade Mark:	n/a
Type of Modulation:	EEE 802.11b mode: DSSS(CCK,QPSK, BPSK) IEEE 802.11g mode: OFDM (BPSK/QPSK/16QAM/64QAM) IEEE 802.11n HT20 MHz mode: OFDM (BPSK/QPSK/16QAM/64QAM) IEEE 802.11n HT40 MHz mode: OFDM (BPSK/QPSK/16QAM/64QAM) IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM(256QAM, 64QAM, 16QAM, QPSK, BPSK)
Channel Spacing:	IEEE 802.11b/g/n(HT20):20MHz IEEE 802.11n(HT40):40MHz IEEE 802.11a/n-HT20/ac-VHT20: 20 MHz IEEE 802.11n-HT40/ac-VHT40: 40 MHz IEEE 802.11ac-VHT80/: 80 MHz
Operation Frequency:	

IEEE 802.11b;IEEE 802.11g;IEEE 802.11n HT20

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

IEEE 802.11n HT40

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2422	4	2437	7	2452
2	2427	5	2442		
3	2432	6	2447		

Band	Mode	Frequency Range(MHz)	Number of channels
UNII Band I	IEEE 802.11n/ac 20MHz	5180-5240	4
	IEEE 802.11n/ac 40MHz	5190-5230	2
	IEEE 802.11ac 80MHz	5210	1
UNII Band II-A	IEEE 802.11n/ac 20MHz	5260-5320	4
	IEEE 802.11n/ac 40MHz	5270-5310	2
	IEEE 802.11ac 80MHz	5290	1
UNII Band II-C	IEEE 802.11n/ac 20MHz	5500-5700	11
	IEEE 802.11n/ac 40MHz	5510-5670	5
	IEEE 802.11ac 80MHz	5530-5610	2
UNII Band III	IEEE 802.11n/ac 20MHz	5745-5825	5
	IEEE 802.11n/ac 40MHz	5755-5795	2
	IEEE 802.11ac 80MHz	5775	1

Antenna Type: patch antenna

Antenna:

Frequency Range	Antenna 1	Antenna 2
2400~2483.5MHz	2dBi	2dBi
5150~5350MHz	2dBi	3dBi
5470~5725MHz	2dBi	3dBi
5725~5850MHz	2dBi	3dBi

2.4G Directional gain: 5.01dBi
5G(Band I) Directional gain: 5.52dBi
5G(Band II) Directional gain: 5.52dBi
5G(Band III) Directional gain: 5.52dBi
Note: KDB 662911D01 Multiplr Transmitter Output v02r01
11a,b,g,n,ac uses Antenna 1/ Antenna 2
11n,ac uses MIMO

Power Supply: DC 12V from Adapter Input AC 120V/60Hz

IEEE 802.11b;IEEE 802.11g;IEEE 802.11n HT20					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	6	2437	11	2462
2	2417	7	2442		
3	2422	8	2447		
4	2427	9	2452		
5	2432	10	2457		
IEEE 802.11n HT40					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2422	4	2437	7	2452
2	2427	5	2442		
3	2432	6	2447		

For 802.11b/g/n (HT20,HT40):

Test mode	Low Channel	Middle Channel	High Channel
IEEE 802.11b;IEEE 802.11g;IEEE 802.11n HT20	2412MHz	2437MHz	2462MHz
IEEE 802.11n HT40	2422MHz	2437MHz	2452MHz

Note:

1. Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

2.In radiated measurement,the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on X-plane.

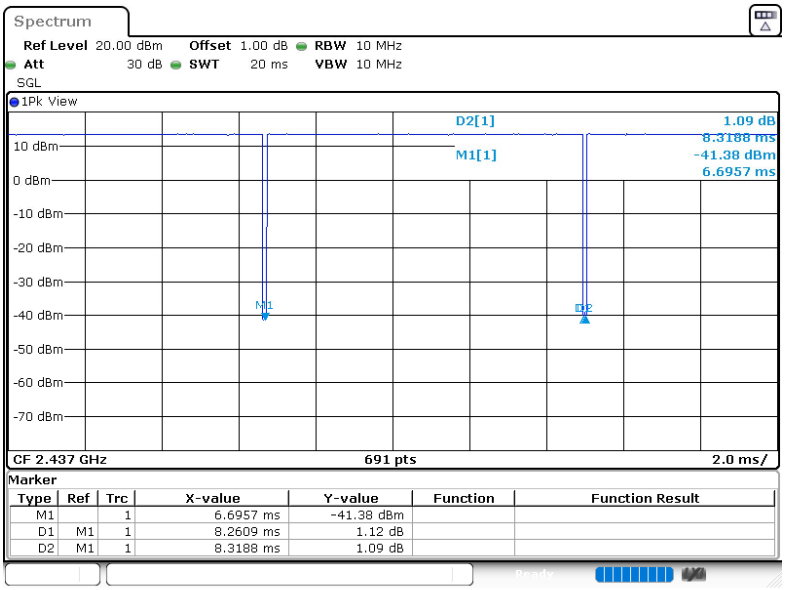
4.3 Duty Cycle

Temperature	25℃	Relative Humidity	55%	Test Voltage	120V/60Hz
Mode	Fre(MHz)	On time(ms)	Total Time(ms)	Duty Cycle	Duty Factor
802.11b	2437	8.26090	8.31880	99.30%	0.00
802.11g	2437	1.37681	1.53623	89.62%	0.48
802.11n HT20	2437	1.28986	1.38406	93.19%	0.31
802.11n HT40	2437	0.64058	0.75942	84.35%	0.74

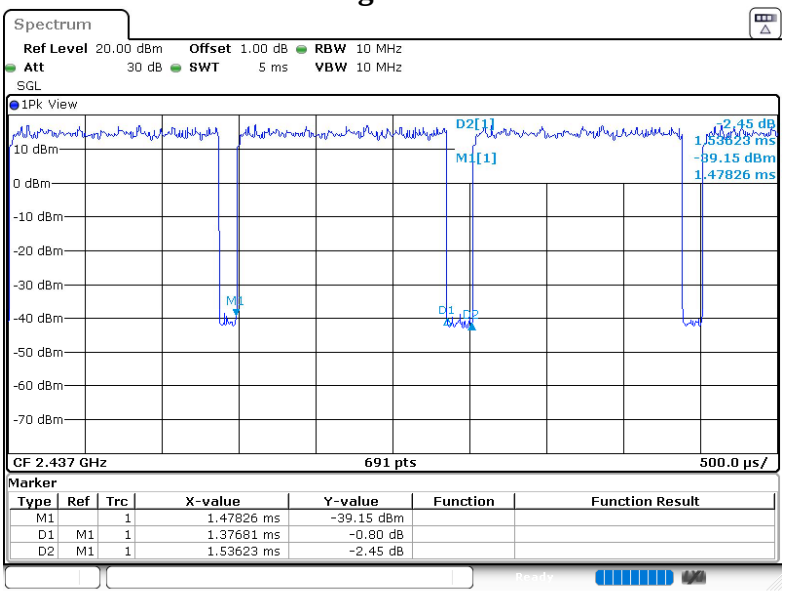
Note:

1. If duty cycle <98 %, the conducted average output power and average power spectral density should be add duty factor.
2. If duty cycle⩾98 %,the EUT is consider to be transmitting continuously,the conducted average output power and average power spectral density no need to add duty factor(consider to be zero).
3. The conducted peak output power and peak power spectral density no need to consider duty factor.
4. The on-time time is transmission duration(T).

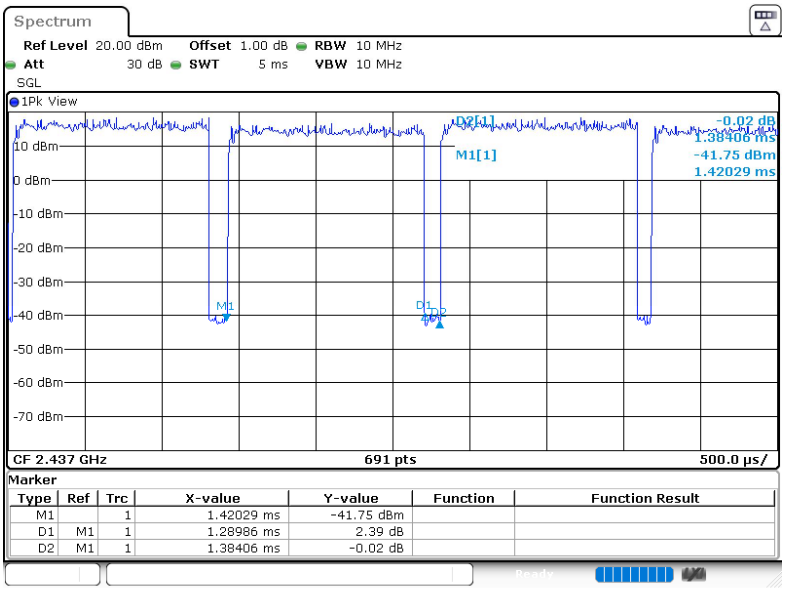
802.11b 2437MHz



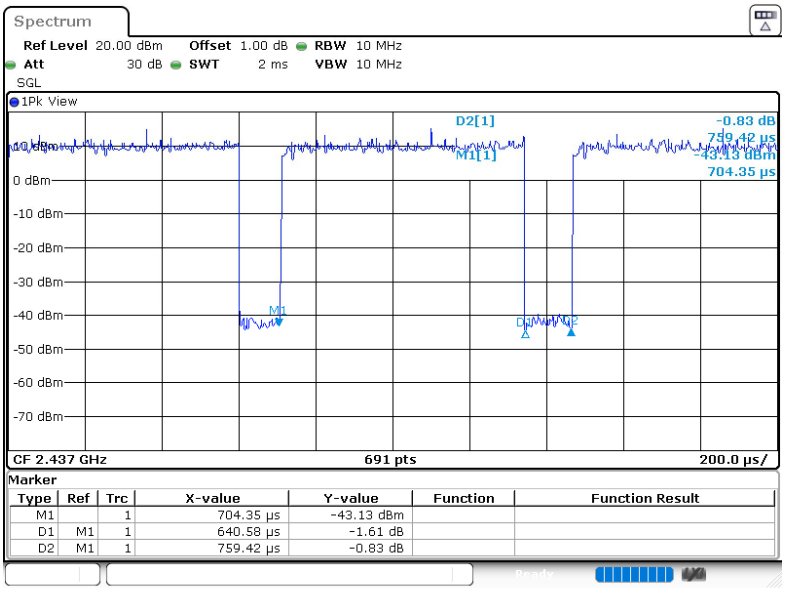
802.11g 2437MHz



802.11n HT20 2437MHz



802.11n HT40 2437MHz



4.4 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Remark	FCC certification
Adapter	Apple	A1265	Provide by lab	DOC

4.5 Test Location

All tests were performed at:

Shenzhen Huaxia Testing Technology Co., Ltd.,

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua New District, Shenzhen, Guangdong, China

4.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L5785)**

CNAS has accredited Shenzhen Huaxia Testing Technology Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **ISED Registration No.: 22984-1**

The 3m Semi-anechoic chamber of Shenzhen Huaxia Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

- **A2LA (Certificate No. 4742.01)**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.

- **FCC Registration No.: 522263**

Shenzhen Huaxia Testing Technology 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 our files. Registration No.:522263

4.7 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate.

The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the **Shenzhen Huaxia Testing Technology Co., Ltd.** quality system acc. to DIN EN ISO/IEC 17025.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CQA laboratory is reported:

No.	Item	Uncertainty	Notes
1	Radiated Emission (Below 1GHz)	±5.12dB	(1)
2	Radiated Emission (Above 1GHz)	±4.60dB	(1)
3	Conducted Disturbance (0.15~30MHz)	±3.34dB	(1)
4	Radio Frequency	3×10^{-8}	(1)
5	Duty cycle	0.6 %.	(1)
6	Occupied Bandwidth	1.1%	(1)
7	RF conducted power	0.86dB	(1)
8	RF power density	0.74	(1)
9	Conducted Spurious emissions	0.86dB	(1)
10	Temperature test	0.8℃	(1)
11	Humidity test	2.0%	(1)
12	Supply voltages	0.5 %.	(1)
13	time	0.6 %.	(1)
14	Frequency Error	5.5 Hz	(1)

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

4.8 Deviation from Standards

None.

4.9 Abnormalities from Standard Conditions

None.

4.10 Other Information Requested by the Customer

None.

4.11Equipment List

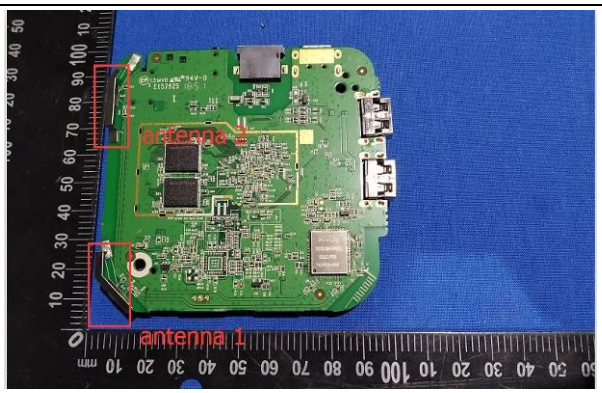
Test Equipment	Manufacturer	Model No.	Instrument No.	Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESR7	CQA-005	2018/9/26	2019/9/25
Spectrum analyzer	R&S	FSU26	CQA-038	2018/10/28	2019/10/27
Preamplifier	MITEQ	AFS4-00010300-18-10P-4	CQA-035	2018/9/26	2019/9/25
Preamplifier	MITEQ	AMF-6D-02001800-29-20P	CQA-036	2018/11/2	2019/11/1
Loop antenna	Schwarzbeck	FMZB1516	CQA-087	2018/10/28	2020/10/27
Bilog Antenna	R&S	HL562	CQA-011	2018/9/26	2020/9/25
Horn Antenna	R&S	HF906	CQA-012	2018/9/26	2020/9/25
Horn Antenna	Schwarzbeck	BBHA 9170	CQA-088	2018/9/26	2020/9/25
Coaxial Cable (Above 1GHz)	CQA	N/A	C019	2018/9/26	2019/9/25
Coaxial Cable (Below 1GHz)	CQA	N/A	C020	2018/9/26	2019/9/25
Antenna Connector	CQA	RFC-01	CQA-080	2018/9/26	2019/9/25
RF cable(9KHz~40GHz)	CQA	RF-01	CQA-079	2018/9/26	2019/9/25
Power Sensor	KEYSIGHT	U2021XA	CQA-30	2018/9/26	2019/9/25
N1918A Power Analysis Manager Power Panel	Agilent	N1918A	CQA-074	2018/9/26	2019/9/25
Power divider	MIDWEST	PWD-2533-02-SMA-79	CQA-067	2018/9/26	2019/9/25
EMI Test Receiver	R&S	ESPI3	CQA-013	2018/9/26	2019/9/25
LISN	R&S	ENV216	CQA-003	2018/11/5	2019/11/4
Coaxial cable	CQA	N/A	CQA-C009	2018/9/26	2019/9/25

Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

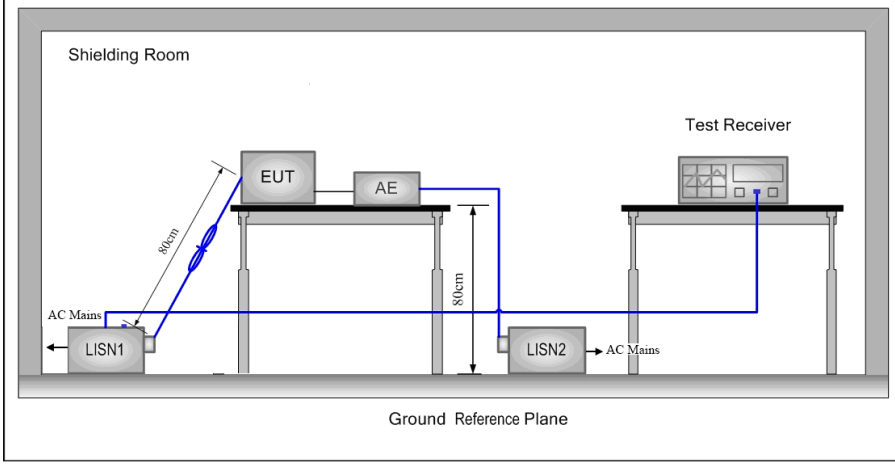
5 Test results and Measurement Data

5.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C 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(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
EUT Antenna:	
The antenna is a PCB antenna. The best case gain of the Antenna Gain 1: 2.4G Antenna gain:2dBi ; 5G Antenna gain:2dBi ;Antenna Gain 2:2.4G Antenna gain: 2dBi ; 5G Antenna gain:3dBi ;	

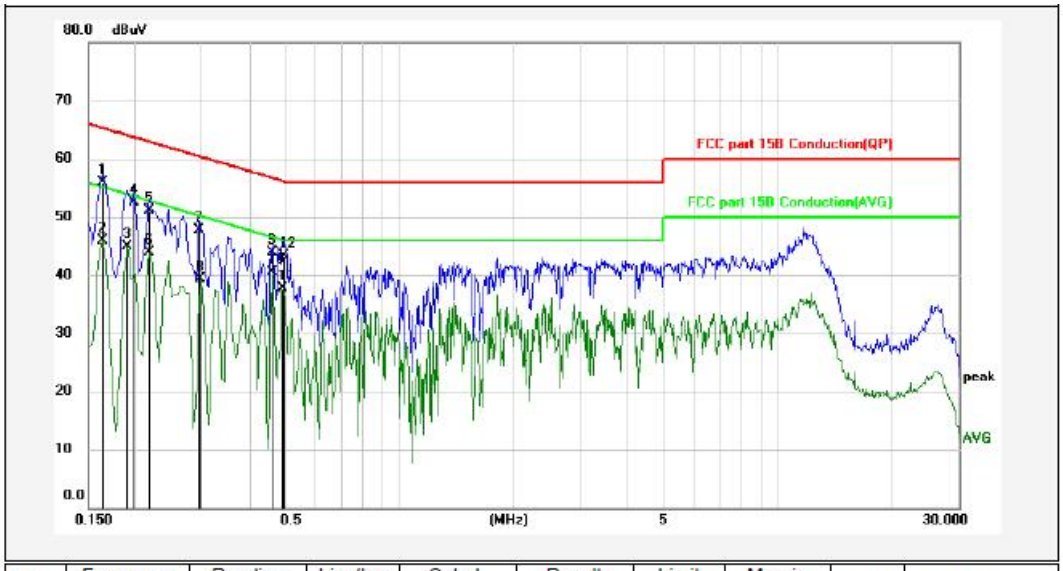
5.2 Conducted Emissions

<table>
<tr><td>Test Requirement:</td><td>47 CFR Part 15C Section 15.207,</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2013</td></tr>
<tr><td>Test Frequency Range:</td><td>150kHz to 30MHz</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr>
<tr><th>Quasi-peak</th><th>Average</th></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>
* Decreases with the logarithm of the frequency.</td></tr>
<tr><td>Test Procedure:</td><td>1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear
impedance. The power cables of all other units of the EUT were
connected to a second LISN 2, which was bonded to the ground reference
plane in the same way as the LISN 1 for the unit being measured. A
multiple socket outlet strip was used to connect multiple power cables to a
single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was
placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) 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>
</table>

Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find at lowest channel is the worst case. Only the worst case is recorded in the report.
Test Voltage:	AC120V/60Hz
Test Results:	Pass

Measurement Data

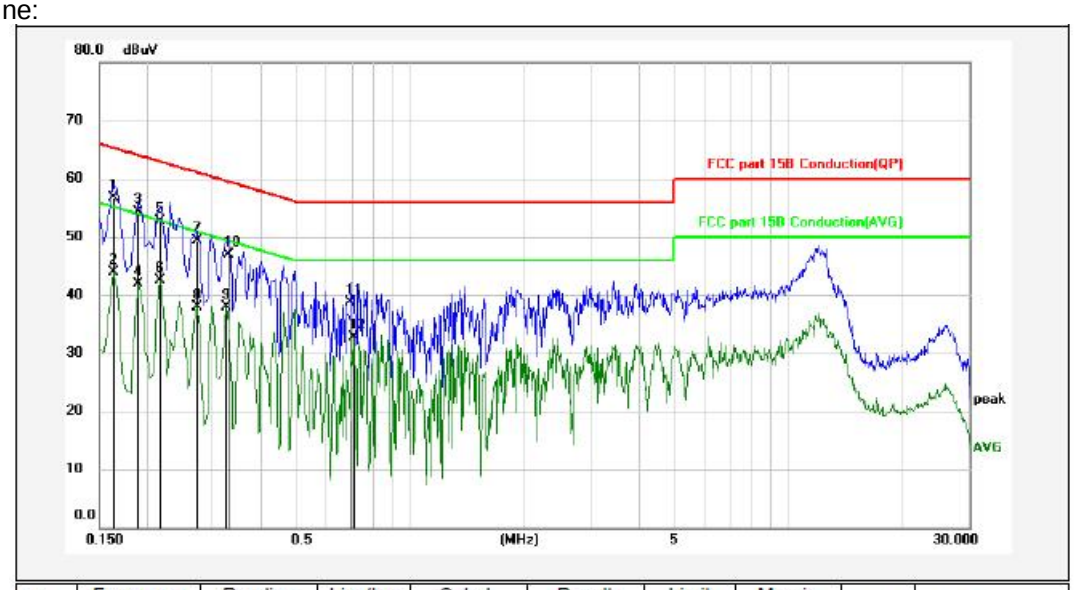
Live Line:



No.	Frequency (MHz)	Reading (dBuV)	Lisn/Isn (dB)	Cab_L (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1635	46.18	9.6	0.22	56.00	65.28	-9.28	QP	
2	0.1635	36.07	9.6	0.22	45.89	55.28	-9.39	AVG	
3	0.1905	35.12	9.6	0.23	44.95	54.01	-9.06	AVG	
4	0.1995	42.77	9.6	0.23	52.60	63.63	-11.03	QP	
5	0.2175	41.27	9.6	0.23	51.10	62.91	-11.81	QP	
6	0.2175	34.16	9.6	0.23	43.99	52.91	-8.92	AVG	
7	0.2940	37.96	9.6	0.24	47.80	60.41	-12.61	QP	
8	0.2985	29.45	9.6	0.24	39.29	50.28	-10.99	AVG	
9	0.4605	34.08	9.58	0.24	43.90	56.68	-12.78	QP	
10	0.4605	30.60	9.58	0.24	40.42	46.68	-6.26	AVG	
11	0.4875	27.92	9.57	0.24	37.73	46.21	-8.48	AVG	
12	0.4920	33.59	9.57	0.24	43.40	56.13	-12.73	QP	

Remarks: 1. Result=Reading+Lisn+Cab_L
2. If the average limit is met when using a quasi-peak detector. the EUT shall be deemed to meet both limits and measurement with average detctor is unnecessary.

Neutral Line:



No.	Frequency (MHz)	Reading (dBuV)	Lisn/Isn (dB)	Cab_L (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1635	46.98	9.6	0.22	56.80	65.28	-8.48	QP	
2	0.1635	33.99	9.6	0.22	43.81	55.28	-11.47	AVG	
3	0.1905	44.57	9.6	0.23	54.40	64.01	-9.61	QP	
4	0.1905	32.13	9.6	0.23	41.96	54.01	-12.05	AVG	
5	0.2175	42.87	9.6	0.23	52.70	62.91	-10.21	QP	
6	0.2175	32.74	9.6	0.23	42.57	52.91	-10.34	AVG	
7	0.2714	39.46	9.6	0.24	49.30	61.07	-11.77	QP	
8	0.2714	28.04	9.6	0.24	37.88	51.07	-13.19	AVG	
9	0.3255	27.97	9.6	0.24	37.81	49.57	-11.76	AVG	
10	0.3300	37.06	9.6	0.24	46.90	59.45	-12.55	QP	
11	0.6945	28.93	9.54	0.23	38.70	56.00	-17.30	QP	
12	0.7080	22.86	9.54	0.23	32.63	46.00	-13.37	AVG	

Remarks: 1. Result=Reading+Lisn+Cab_L
2. If the average limit is met when using a quasi-peak detector. the EUT shall be deemed to meet both limits and measurement with average detctor is unnecessary.

5.3 Conducted Peak Output Power

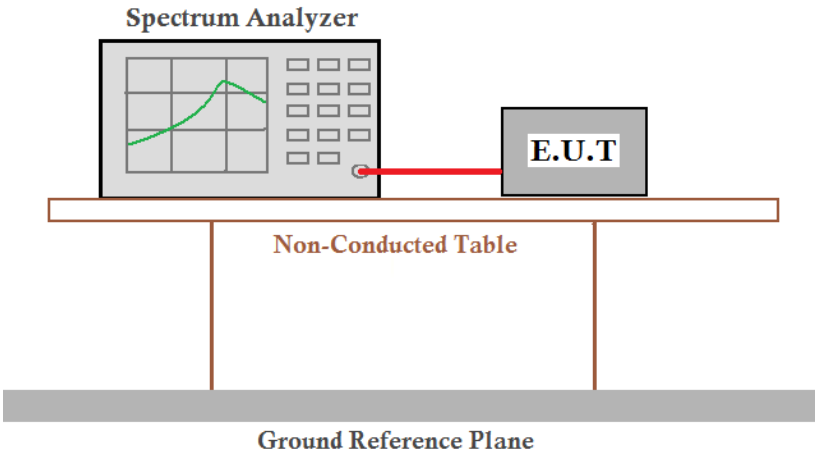
Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10: 2013
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11b; 6Mbps of rate is the worst case of 802.11g ; 6.5Mbps of rate is the worst case of 802.11n(HT20/HT40) ; Only the worst case is recorded in the report.
Limit:	30dBm
Test Results:	Pass

Measurement Data

Test Mode	CH	Conducted Power（dBm）	Limit (dBm)
IEEE 802.11 b (ANT 1)	CH1	15.81	30
	CH6	15.42	30
	CH11	15.50	30
IEEE 802.11 g (ANT 1)	CH1	11.90	30
	CH6	10.36	30
	CH11	10.30	30
IEEE 802.11 b (ANT 2)	CH1	13.72	30
	CH6	13.85	30
	CH11	13.16	30
IEEE 802.11 g (ANT 2)	CH1	8.81	30
	CH6	9.12	30
	CH11	8.46	30
Conclusion：PASS			

Test mode	CH			Conducted Power（dBm）	Limit (dBm)	Result
		ANT 1	ANT 2			
IEEE 802.11 n HT20	CH1	11.11	8.63	13.05	**30**	Pass
	CH7	10.85	8.83	12.96		Pass
	CH11	10.38	8.76	12.65		Pass
IEEE 802.11 n HT40	CH1	8.88	6.71	10.94		Pass
	CH4	7.73	6.43	10.14		Pass
	CH7	7.78	6.60	10.24		Pass

5.4 6dB Occupy Bandwidth

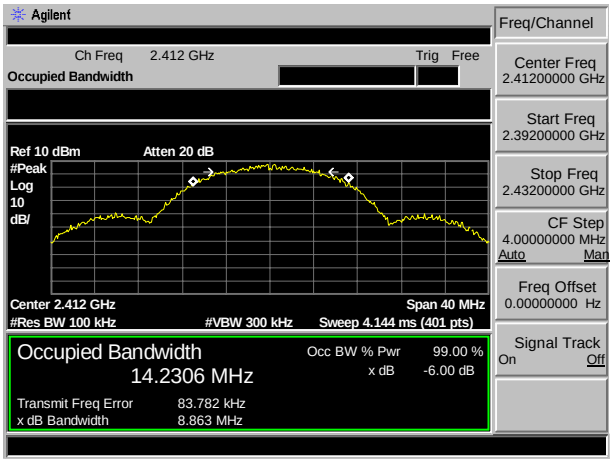
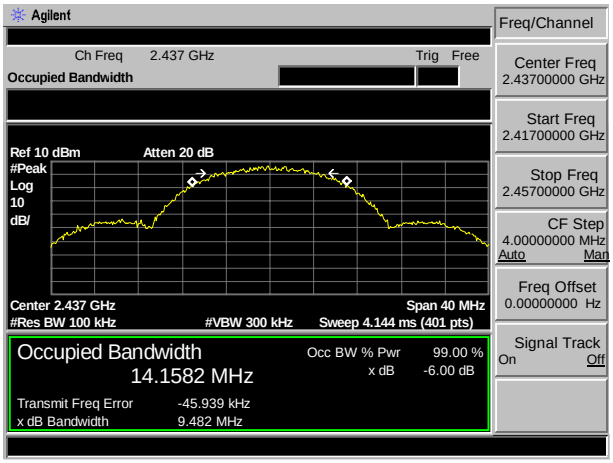
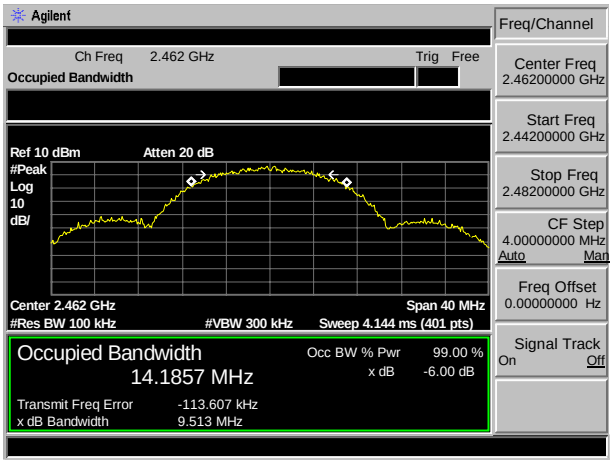
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10: 2013
Test Setup:	 Offset=cable loss+ attenuation factor
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11b; 6Mbps of rate is the worst case of 802.11g ; 6.5Mbps of rate is the worst case of 802.11n(HT20) ,802.11n(HT40)Only the worst case is recorded in the report.
Limit:	≥ 500 kHz
Test Results:	Pass

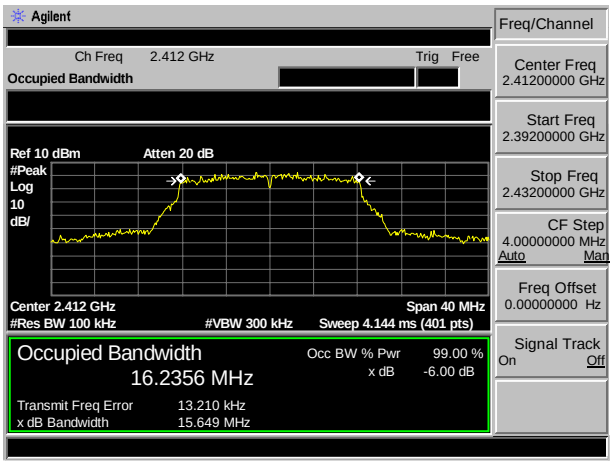
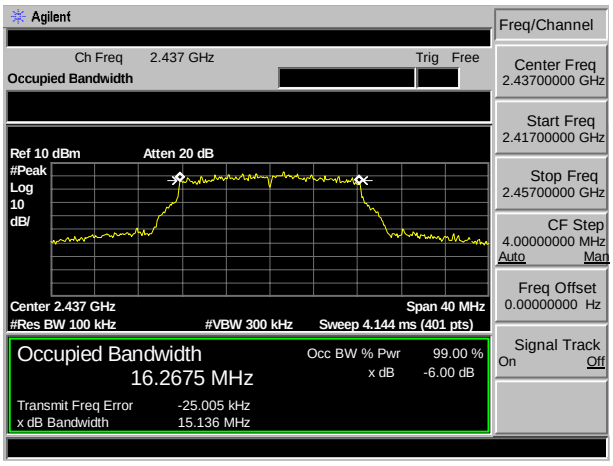
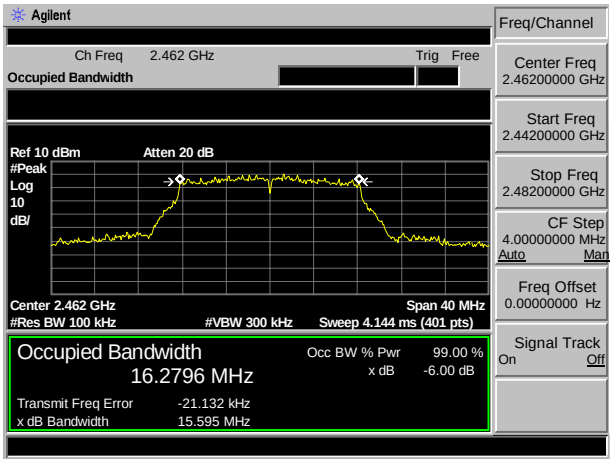
Measurement Data

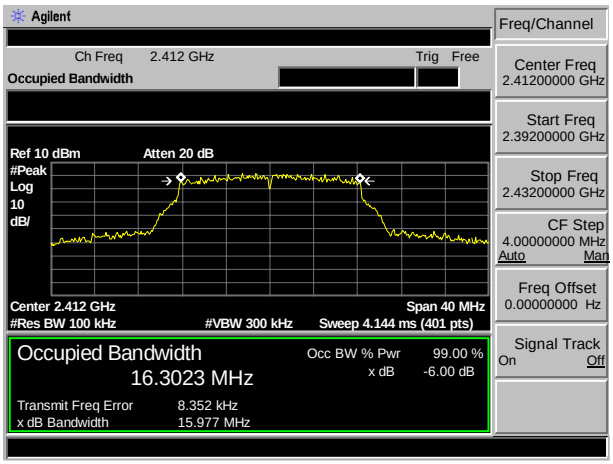
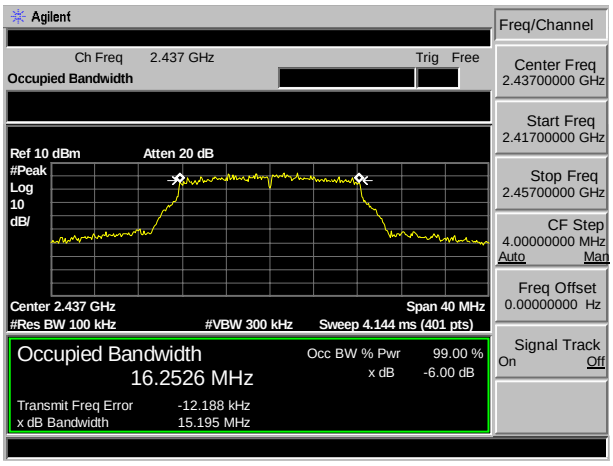
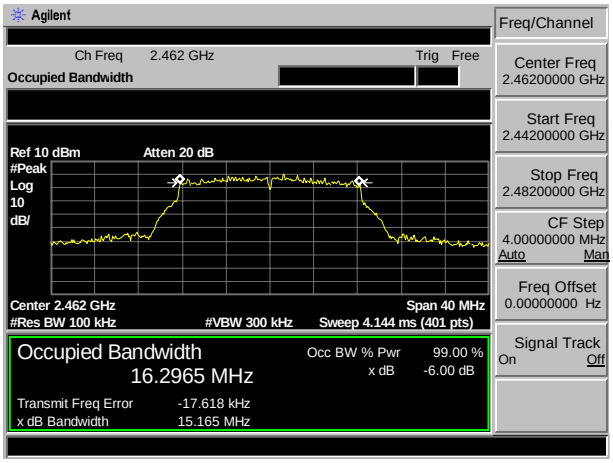
Test Mode	CH	6dB bandwidth （MHz）	20dB bandwidth （MHz）	Limit (KHz)
IEEE 802.11 b (ANT 1)	CH1	8.863	16.261	>500
	CH6	9.482	16.380	>500
	CH11	9.513	16.255	>500
IEEE 802.11 g (ANT 1)	CH1	15.649	18.308	>500
	CH6	15.136	18.271	>500
	CH11	15.595	18.434	>500
IEEE 802.11 n HT 20(ANT 1)	CH1	15.977	18.312	>500
	CH6	15.195	18.327	>500
	CH11	15.165	18.202	>500
IEEE 802.11 n HT 40(ANT 1)	CH1	35.115	39.244	>500
	CH4	35.078	39.473	>500
	CH7	35.072	39.556	>500
Conclusion：PASS				

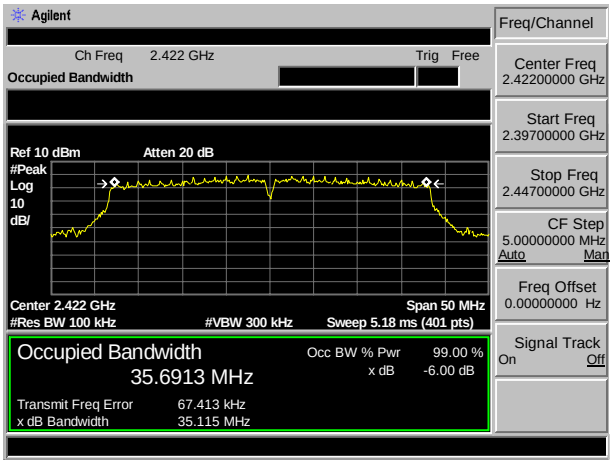
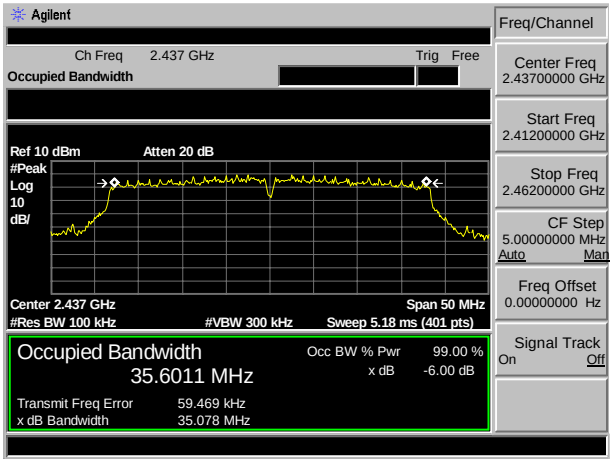
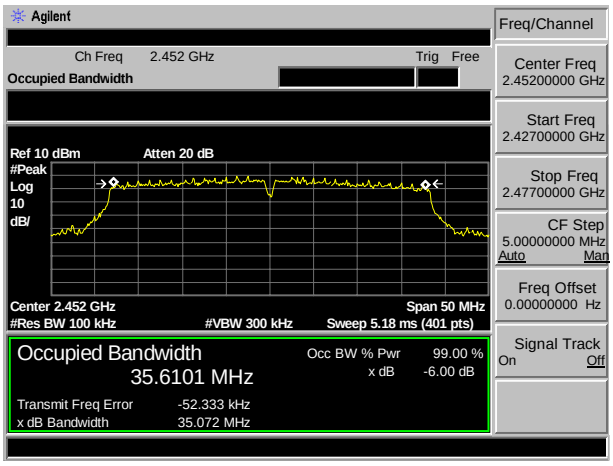
Test Mode	CH	6dB bandwidth（MHz）	20dB bandwidth（MHz）	Limit (KHz)
IEEE 802.11 b (ANT 2)	CH1	9.055	16.224	>500
	CH6	9.619	16.209	>500
	CH11	9.538	16.369	>500
IEEE 802.11 g (ANT 2)	CH1	15.136	18.437	>500
	CH6	15.689	18.627	>500
	CH11	15.839	18.254	>500
IEEE 802.11 n HT 20(ANT 2)	CH1	15.197	18.289	>500
	CH6	14.985	18.306	>500
	CH11	15.166	18.354	>500
IEEE 802.11 n HT 40(ANT 2)	CH1	35.125	39.233	>500
	CH4	35.066	39.548	>500
	CH7	35.055	39.572	>500
Conclusion：PASS				

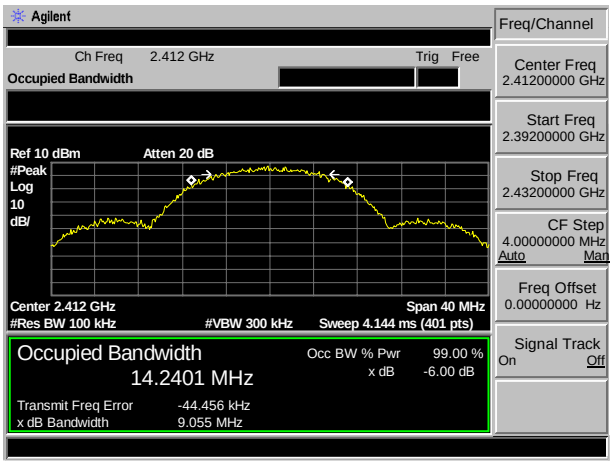
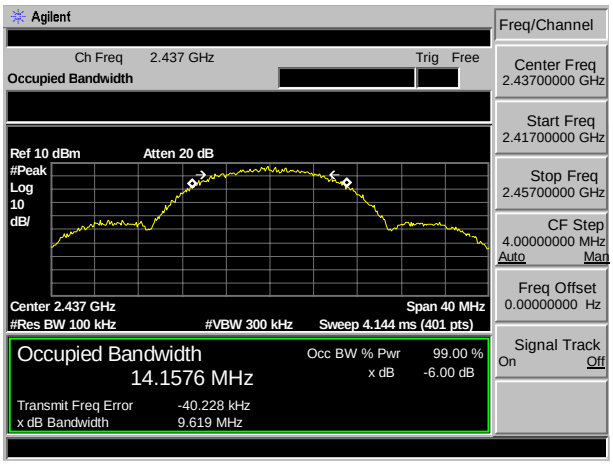
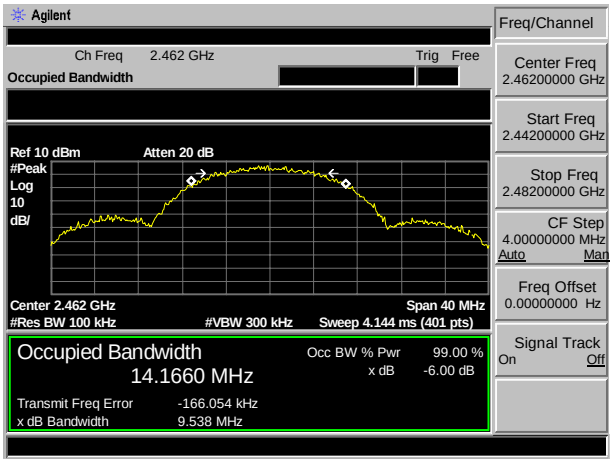
Test plot as follows:

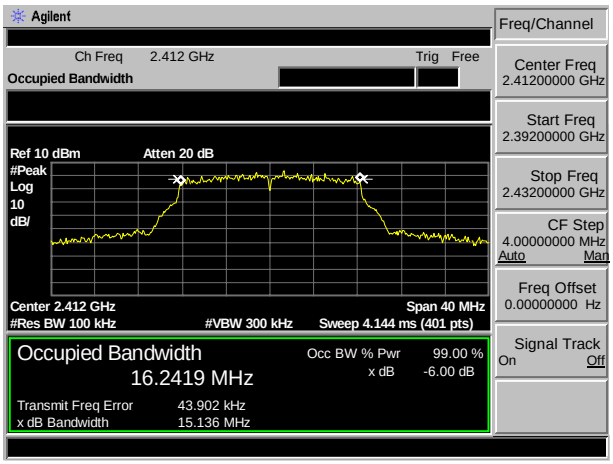
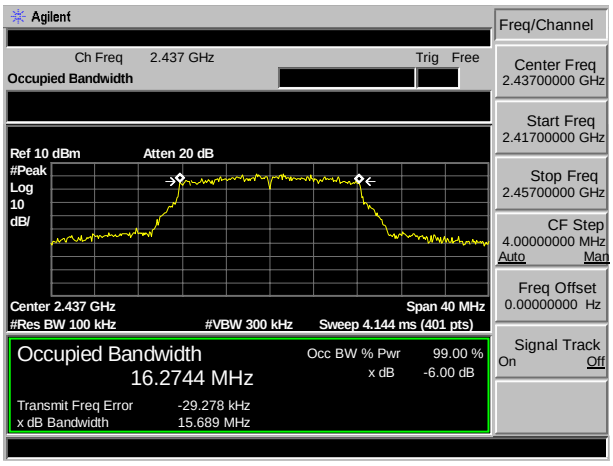
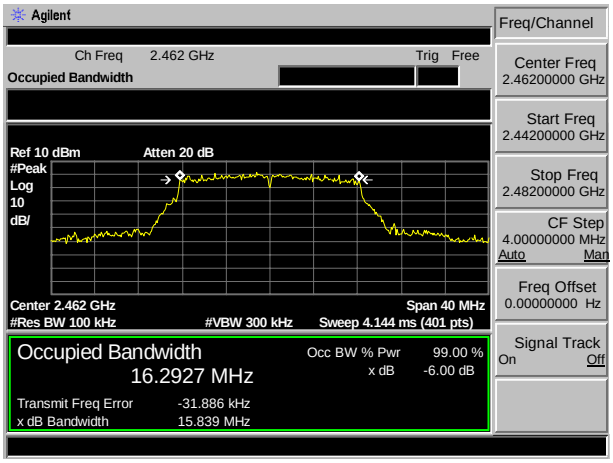
Graphs_6dB Occupy Bandwidth	
IEEE 802.11b 2412MHz （ANT 1）	
IEEE 802.11b 2437MHz （ANT 1）	
IEEE 802.11b 2462MHz （ANT 1）	

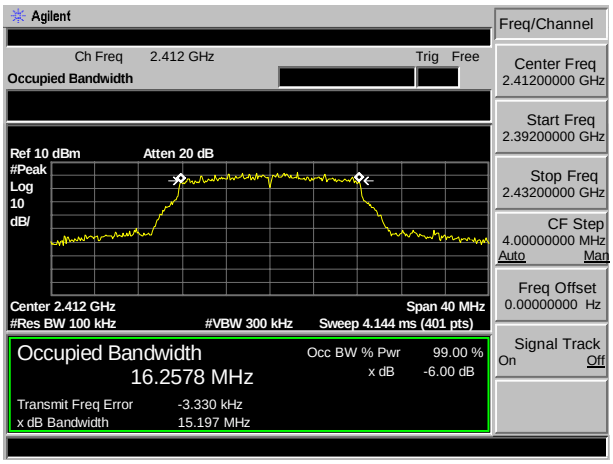
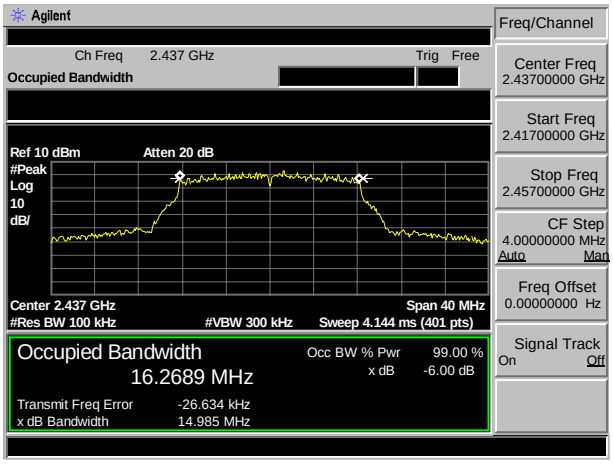
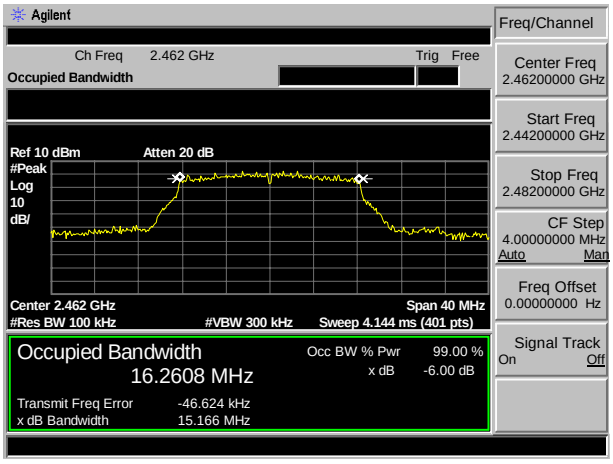
IEEE 802.11g 2412MHz （ANT 1）	
IEEE 802.11g 2437MHz （ANT 1）	
IEEE 802.11g 2462MHz （ANT 1）	

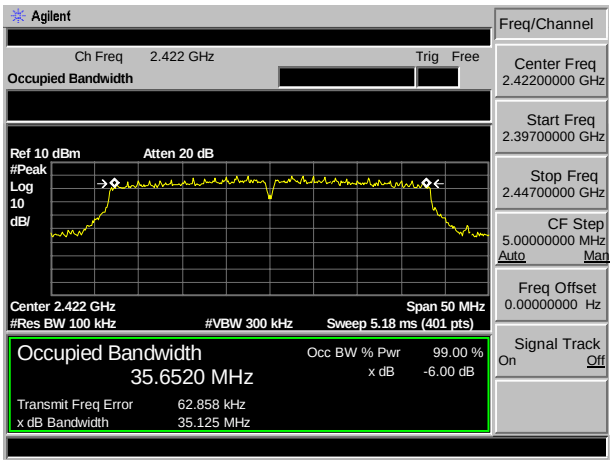
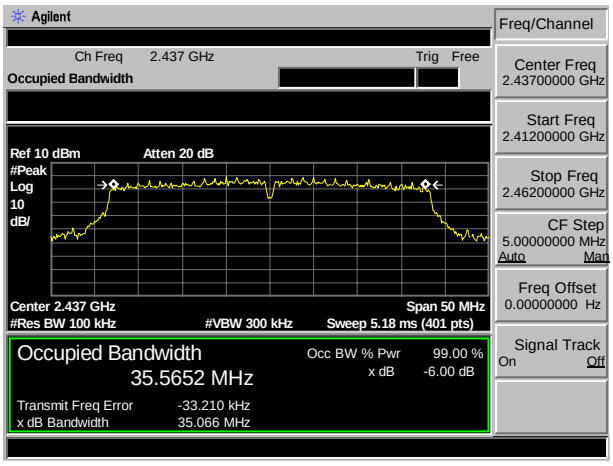
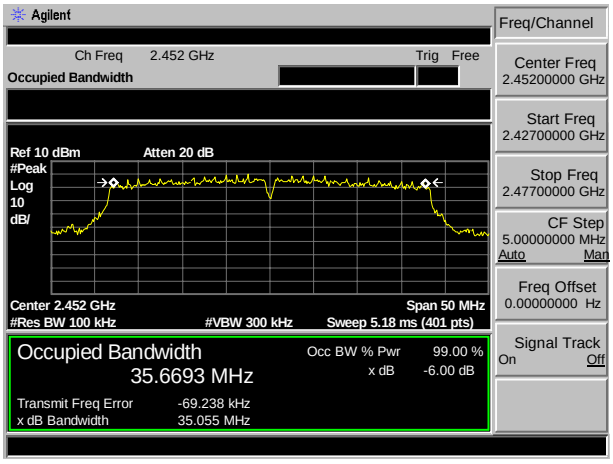
IEEE 802.11n HT20 2412MHz （ANT 1）	
IEEE 802.11n HT20 2437MHz （ANT 1）	
IEEE 802.11n HT20 2462MHz （ANT 1）	

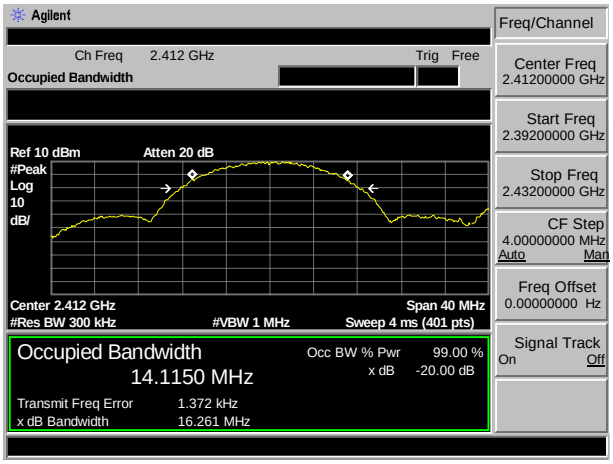
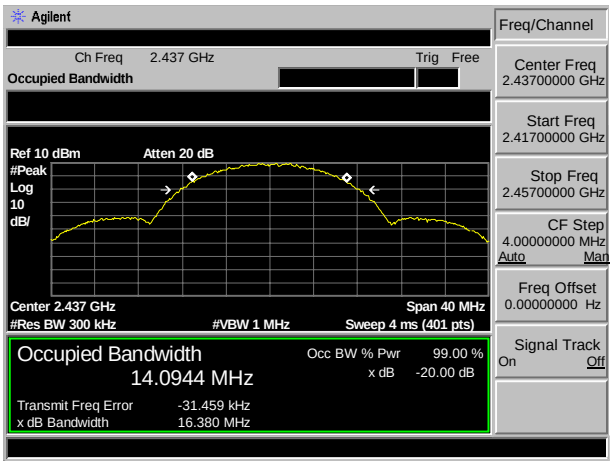
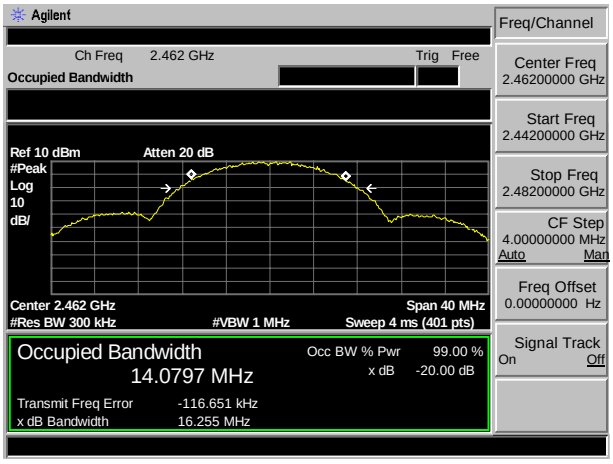
IEEE 802.11n HT40 2422MHz （ANT 1）	
IEEE 802.11n HT40 2437MHz （ANT 1）	
IEEE 802.11n HT40 2452MHz （ANT 1）	

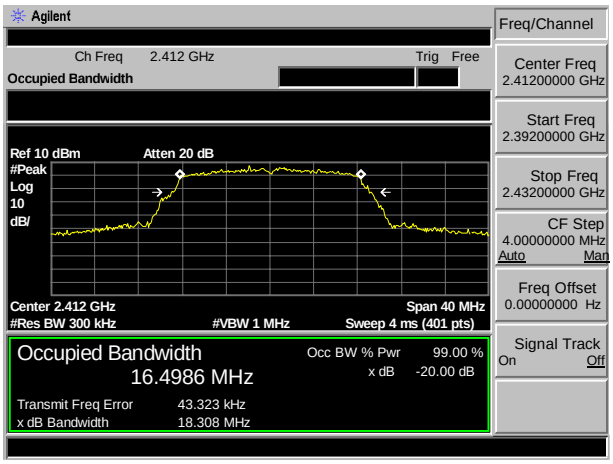
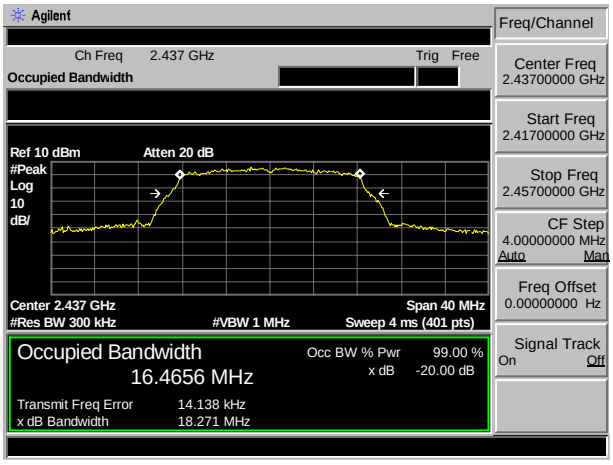
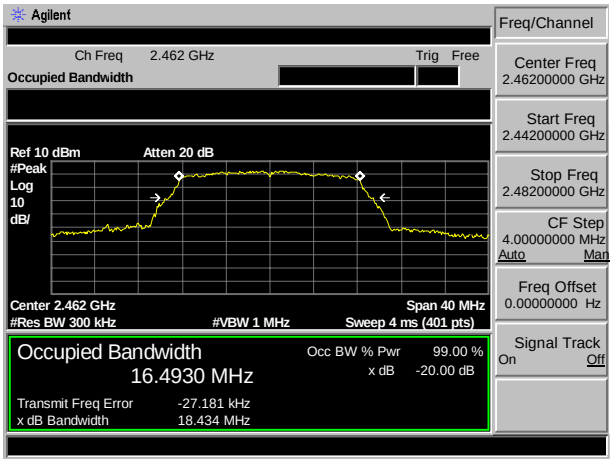
IEEE 802.11b 2412MHz （ANT 2）	
IEEE 802.11b 2437MHz （ANT 2）	
IEEE 802.11b 2462MHz （ANT 2）	

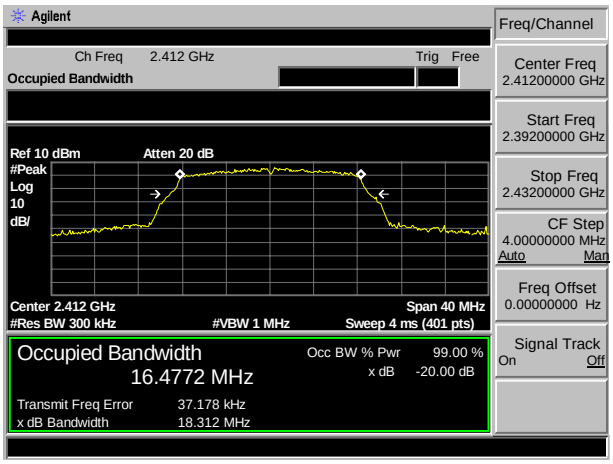
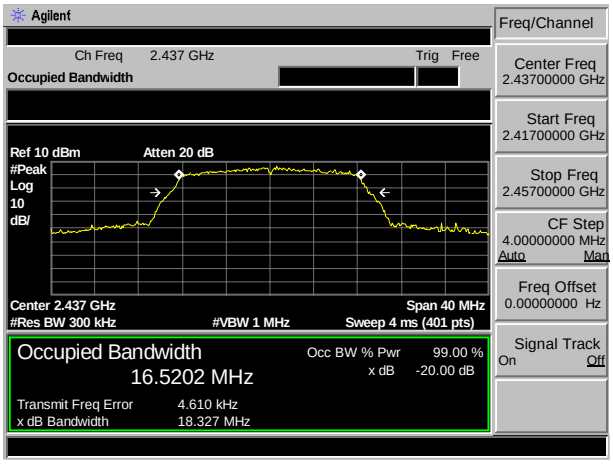
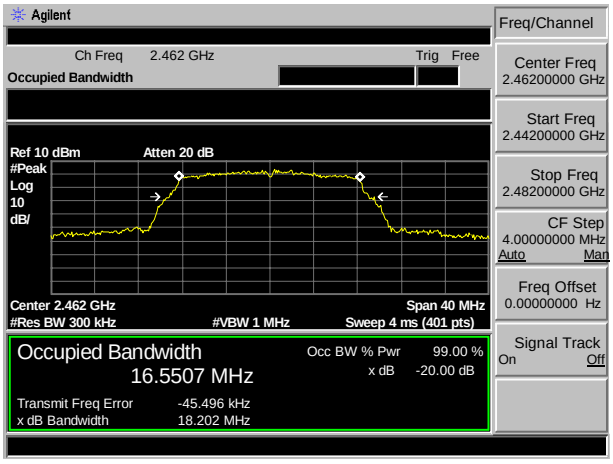
IEEE 802.11g 2412MHz （ANT 2）	
IEEE 802.11g 2437MHz （ANT 2）	
IEEE 802.11g 2462MHz （ANT 2）	

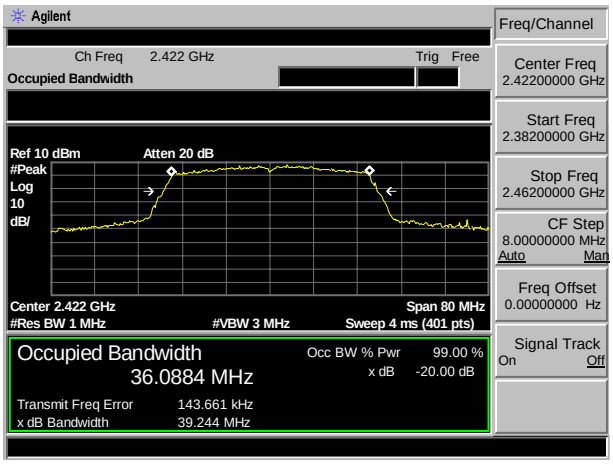
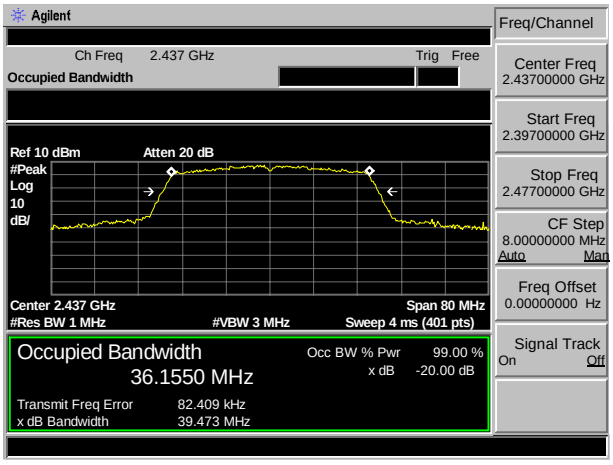
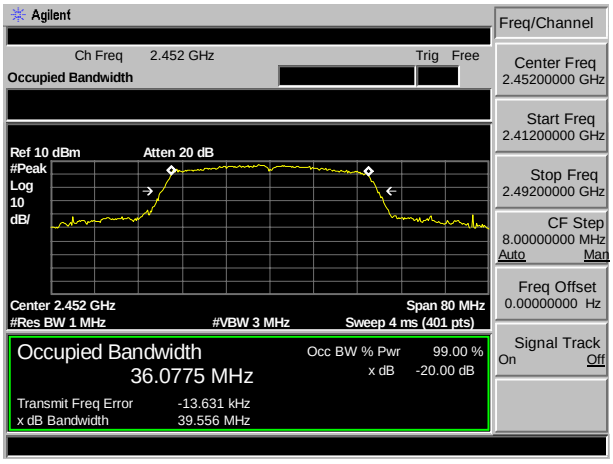
IEEE 802.11n HT20 2412MHz （ANT 2）	
IEEE 802.11n HT20 2437MHz （ANT 2）	
IEEE 802.11n HT20 2462MHz （ANT 2）	

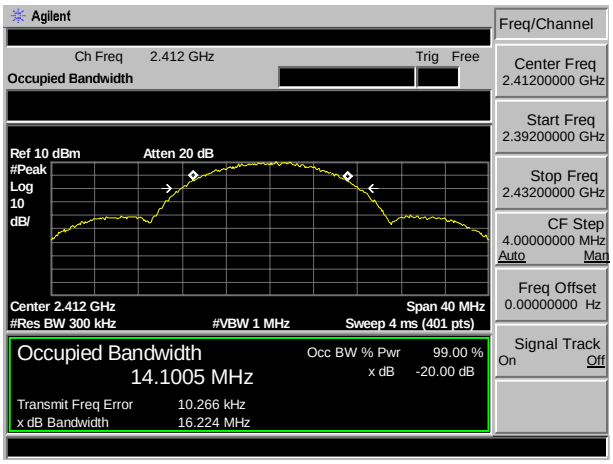
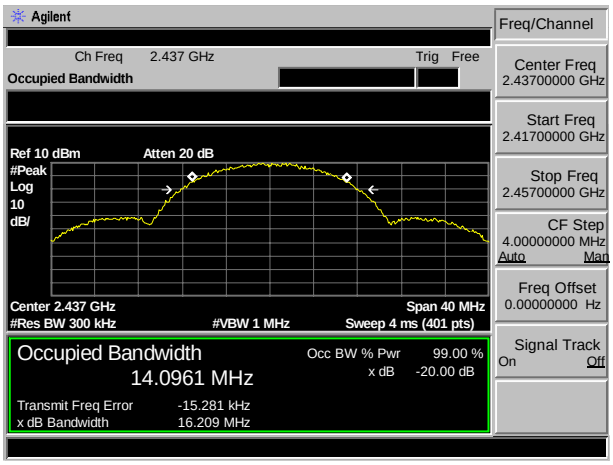
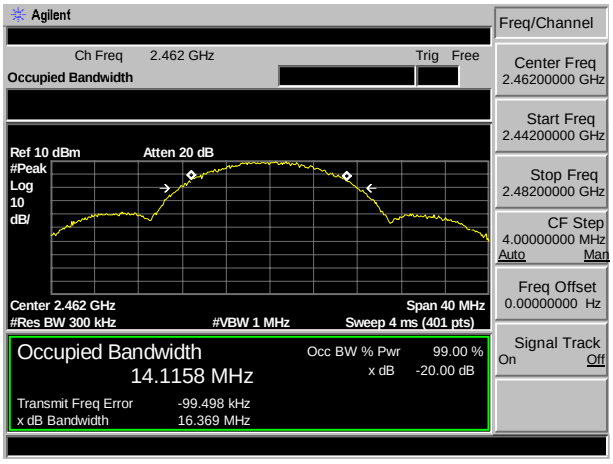
IEEE 802.11n HT40 2422MHz （ANT 2）	
IEEE 802.11n HT40 2437MHz （ANT 2）	
IEEE 802.11n HT40 2452MHz （ANT 2）	

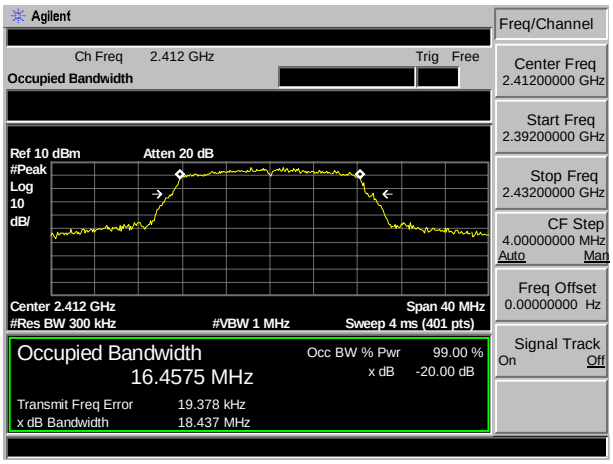
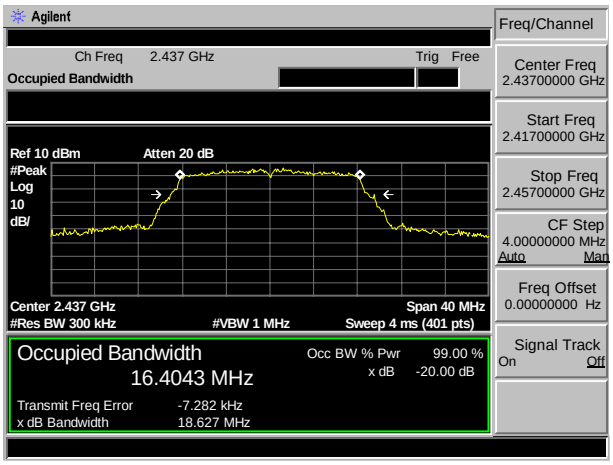
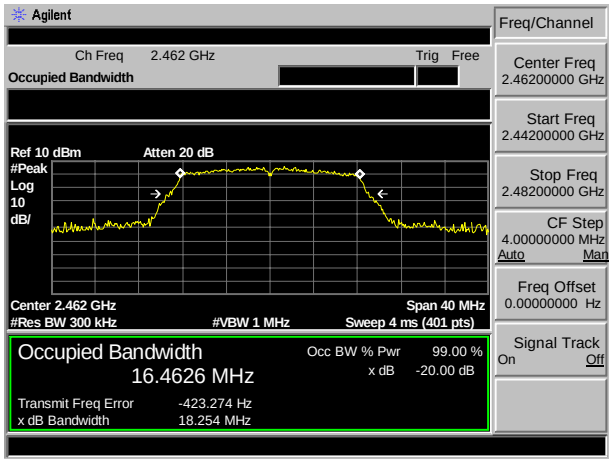
Graphs_20dB Bandwidth	
IEEE 802.11b 2412MHz (ANT 1)	
IEEE 802.11b 2437MHz (ANT 1)	
IEEE 802.11b 2462MHz (ANT 1)	

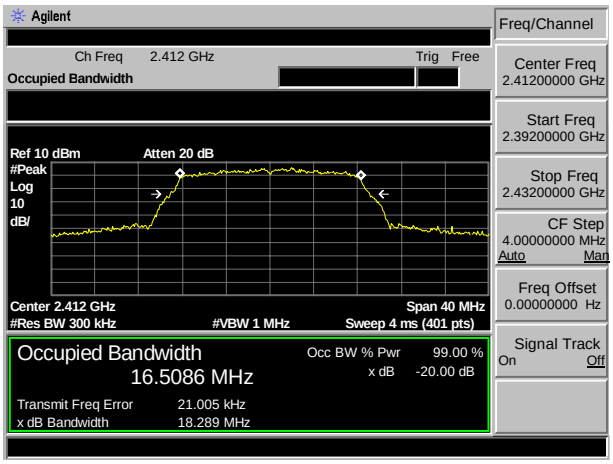
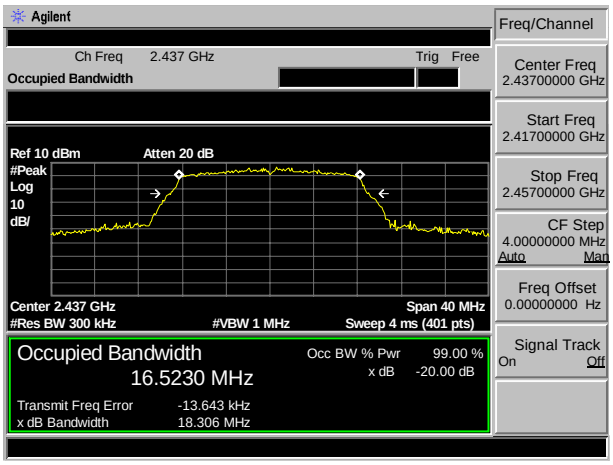
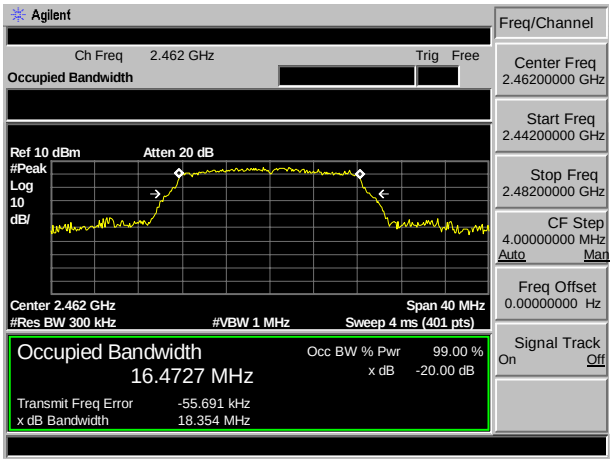
IEEE 802.11g 2412MHz (ANT 1)	
IEEE 802.11g 2437MHz (ANT 1)	
IEEE 802.11g 2462MHz (ANT 1)	

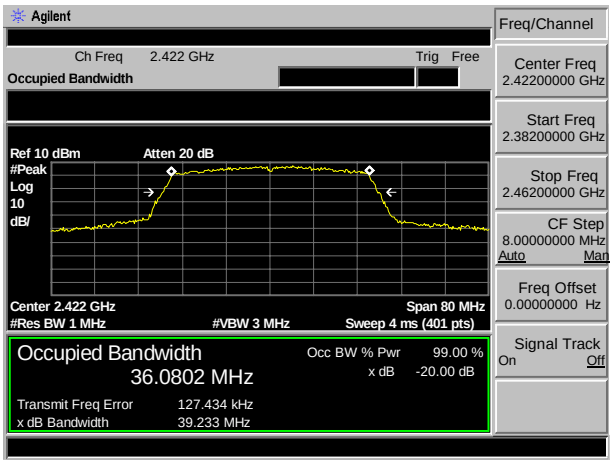
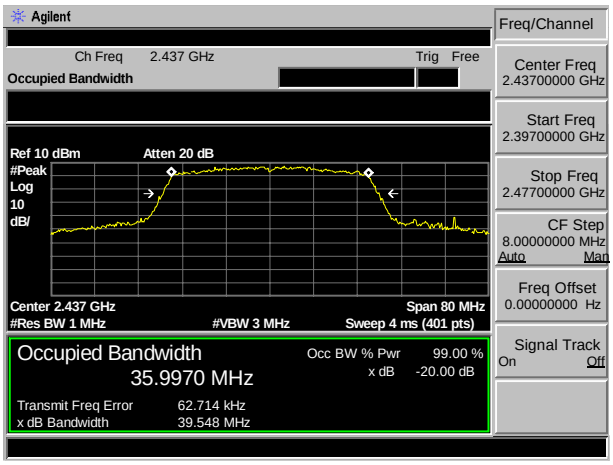
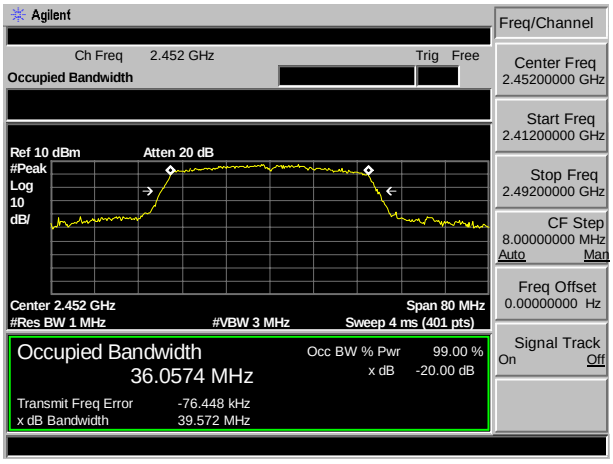
IEEE 802.11n HT20 2412MHz (ANT 1)	
IEEE 802.11n HT20 2437MHz (ANT 1)	
IEEE 802.11n HT20 2462MHz (ANT 1)	

IEEE 802.11n HT40 2422MHz (ANT 1)	
IEEE 802.11n HT40 2437MHz (ANT 1)	
IEEE 802.11n HT40 2452MHz (ANT 1)	

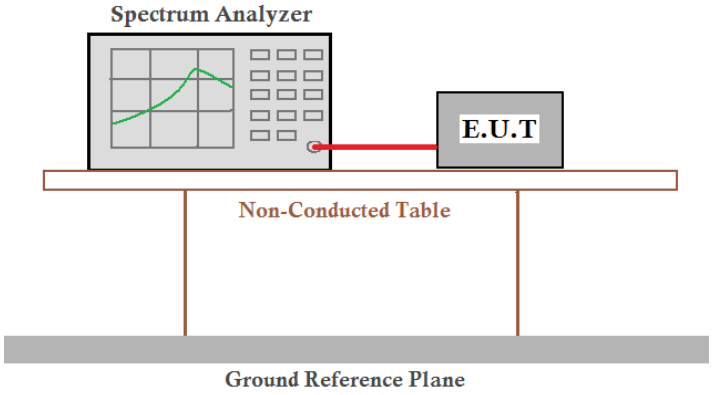
IEEE 802.11b 2412MHz (ANT 2)	
IEEE 802.11b 2437MHz (ANT 2)	
IEEE 802.11b 2462MHz (ANT 2)	

IEEE 802.11g 2412MHz (ANT 2)	
IEEE 802.11g 2437MHz (ANT 2)	
IEEE 802.11g 2462MHz (ANT 2)	

IEEE 802.11n HT20 2412MHz (ANT 2)	
IEEE 802.11n HT20 2437MHz (ANT 2)	
IEEE 802.11n HT20 2462MHz (ANT 2)	

IEEE 802.11n HT40 2422MHz (ANT 2)	
IEEE 802.11n HT40 2437MHz (ANT 2)	
IEEE 802.11n HT40 2452MHz (ANT 2)	

5.5 Power Spectral Density

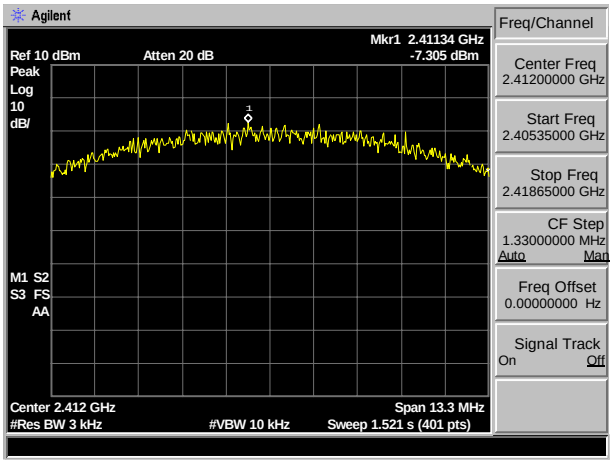
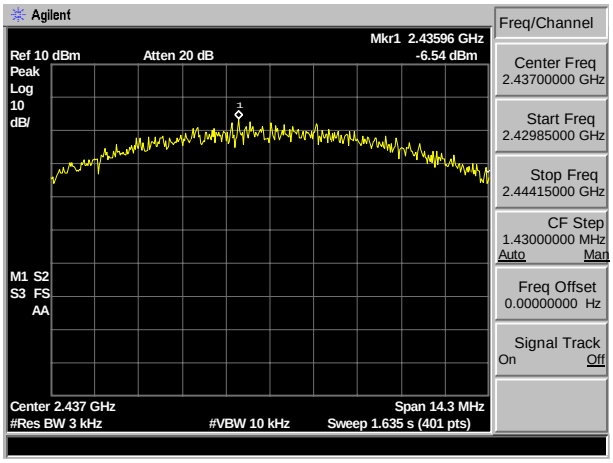
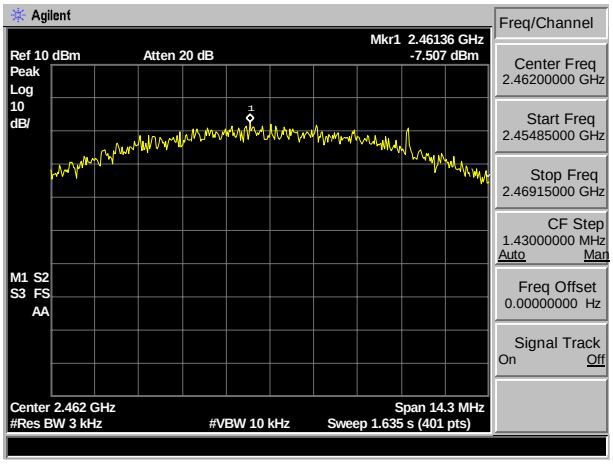
Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10: 2013
Test Setup:	 Offset=cable loss+ attenuation factor
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11b; 6Mbps of rate is the worst case of 802.11g ; 6.5Mbps of rate is the worst case of 802.11n(HT20/HT40) ; Only the worst case is recorded in the report.
Limit:	≤8.00dBm/3kHz
Test Results:	Pass

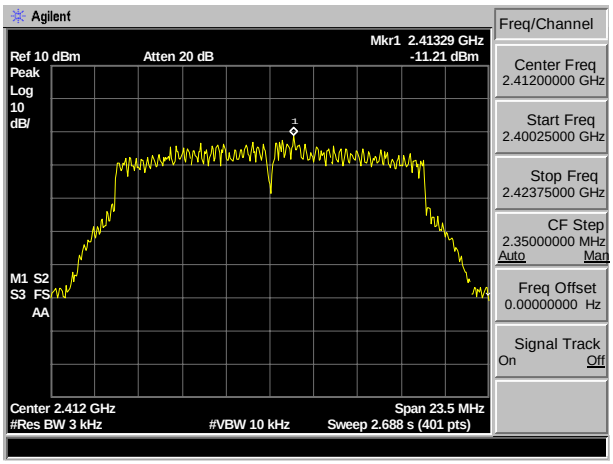
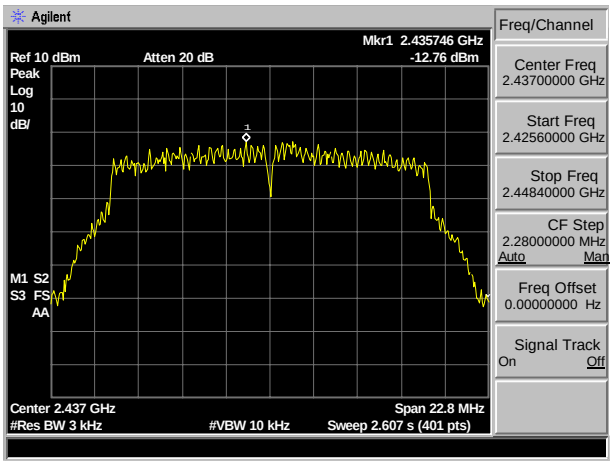
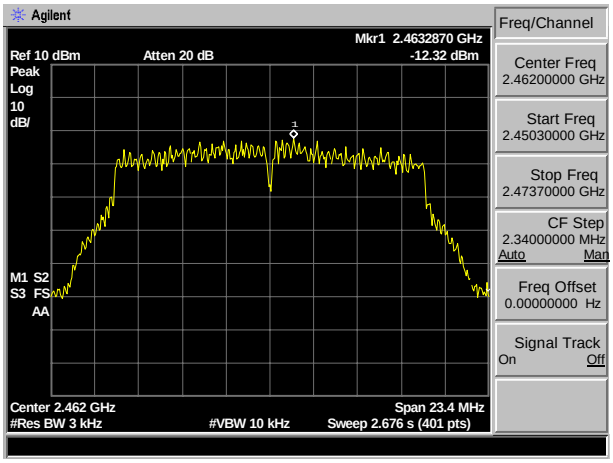
Measurement Data

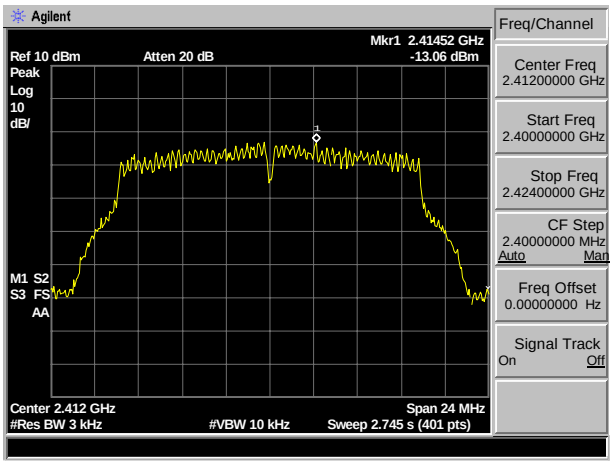
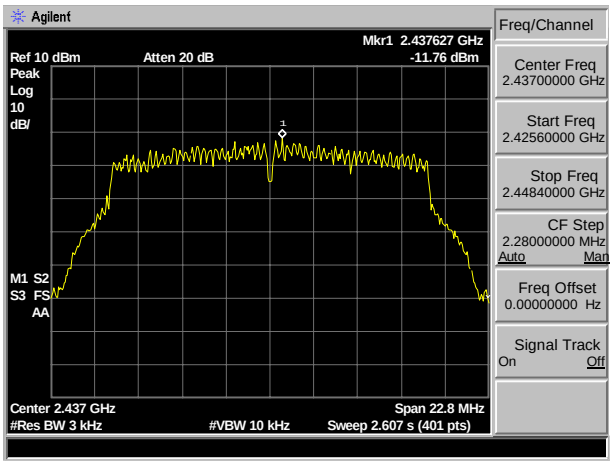
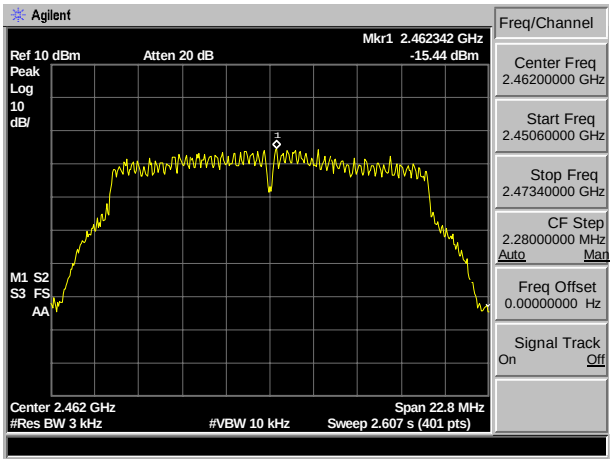
Test Mode	CH	Power density (dBm/3kHz)	Limit (dBm/3kHz)
IEEE 802.11 b (ANT 1)	CH1	-7.305	8
	CH6	-6.540	8
	CH11	-7.507	8
IEEE 802.11 g (ANT 1)	CH1	-11.21	8
	CH6	-12.76	8
	CH11	-12.32	8
IEEE 802.11 b (ANT 2)	CH1	-7.273	8
	CH6	-6.713	8
	CH11	-6.698	8
IEEE 802.11 g (ANT 2)	CH1	-11.05	8
	CH6	-12.67	8
	CH11	-12.67	8
Conclusion：PASS			

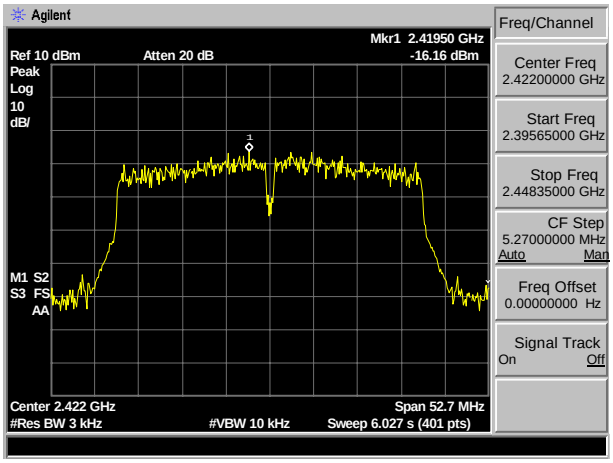
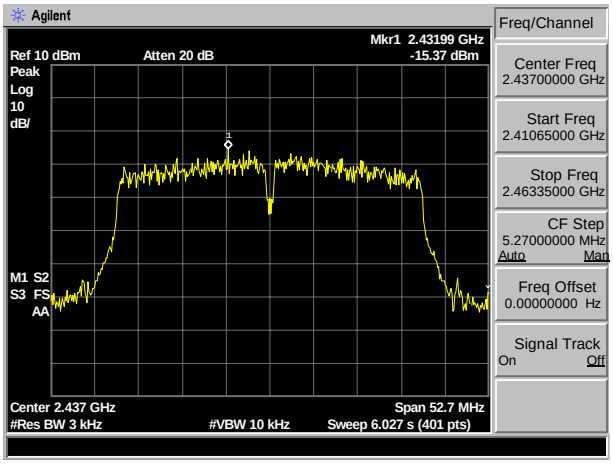
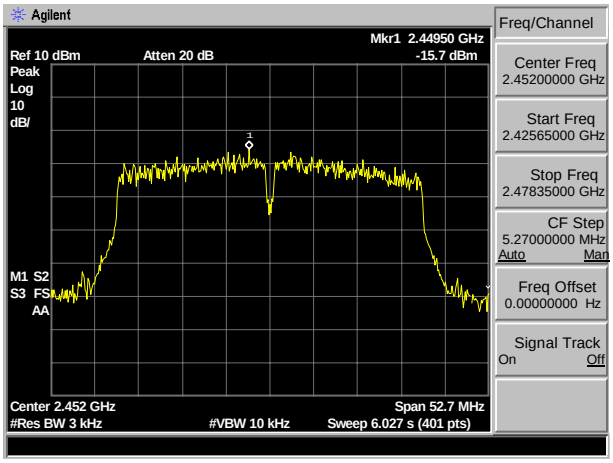
Test Mode	CH				Limit (dBm/3kHz)	Result
		ANT 1	ANT 2	Power density (dBm/3 kHz）		
IEEE 802.11n (HT20)	CH1	-13.06	-12.38	-9.71	**8**	Pass
	CH6	-11.76	-12.55	-9.10		Pass
	CH11	-15.44	-13.11	-11.08		Pass
IEEE 802.11n (HT40)	CH1	-16.16	-16.57	-13.37		Pass
	CH4	-15.37	-16.42	-12.84		Pass
	CH7	-15.70	-16.21	-12.92		Pass
Conclusion：PASS						

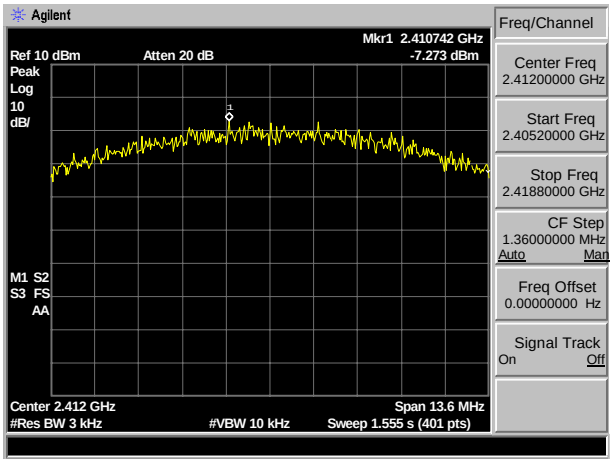
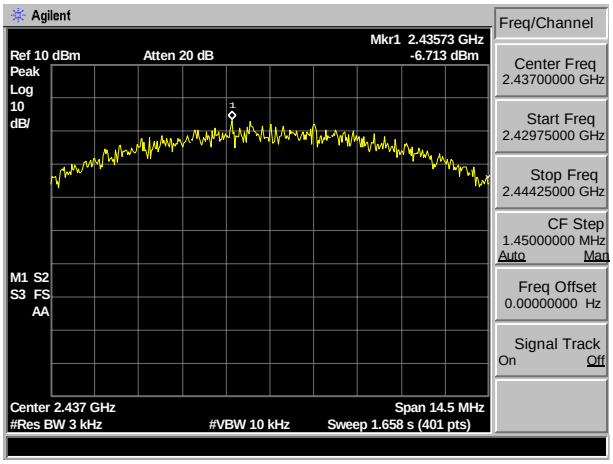
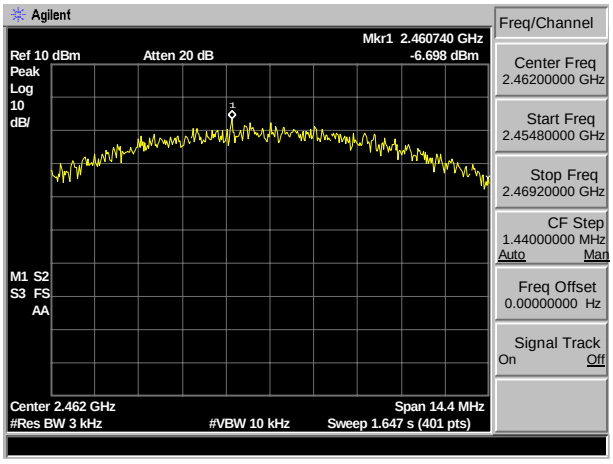
Test plot as follows:

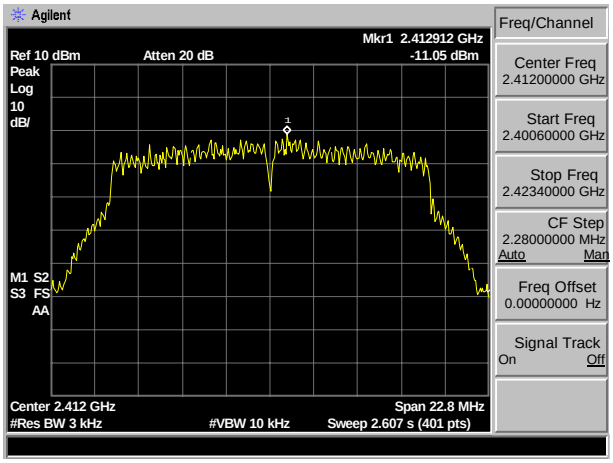
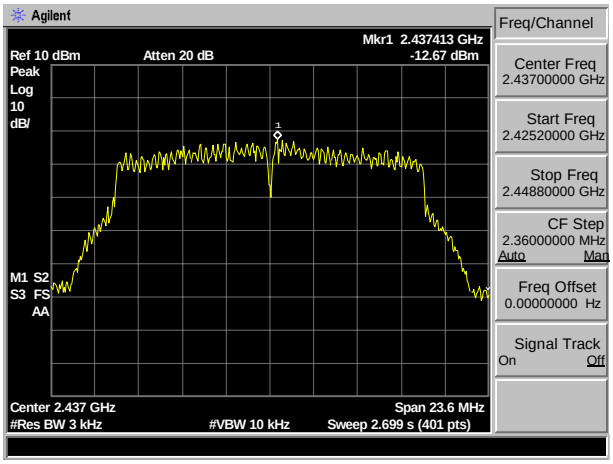
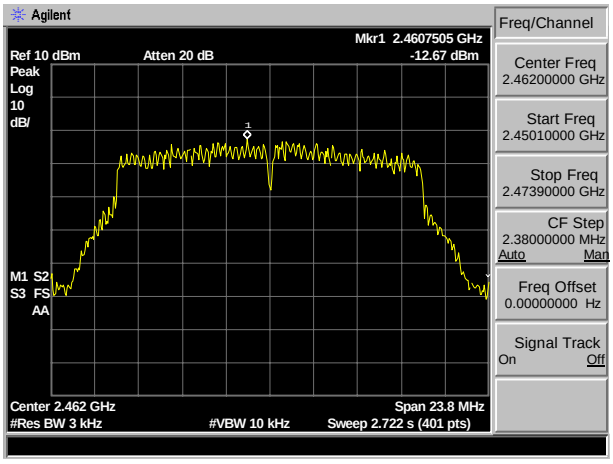
Graphs	
IEEE 802.11b 2412MHz (ANT 1)	
IEEE 802.11b 2437MHz (ANT 1)	
IEEE 802.11b 2462MHz (ANT 1)	

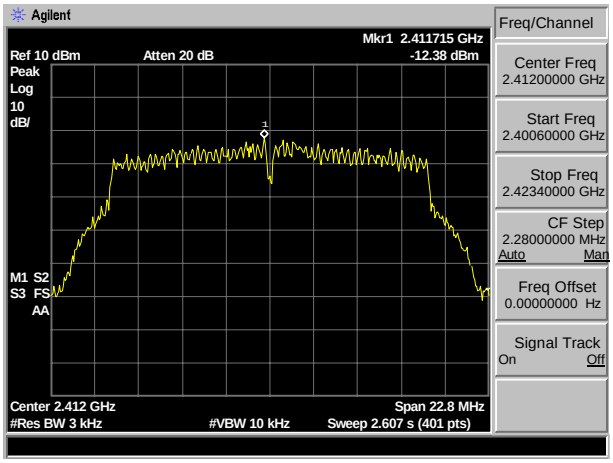
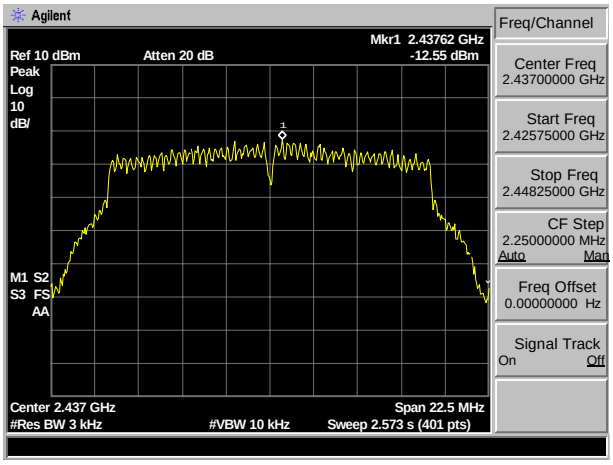
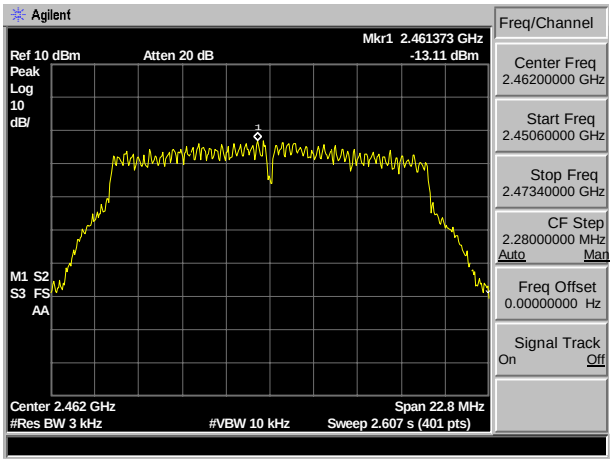
IEEE 802.11g 2412MHz (ANT 1)	
IEEE 802.11g 2437MHz (ANT 1)	
IEEE 802.11g 2462MHz (ANT 1)	

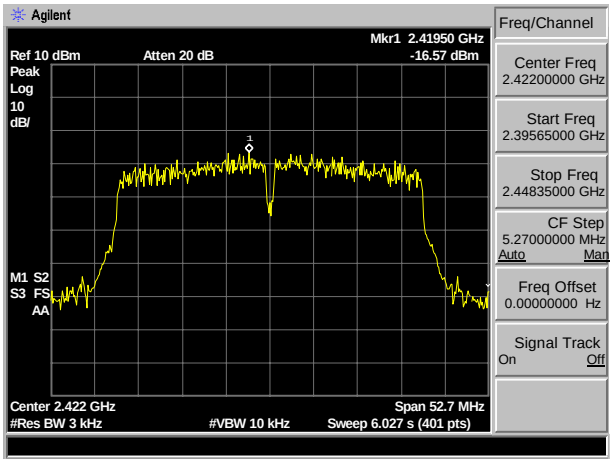
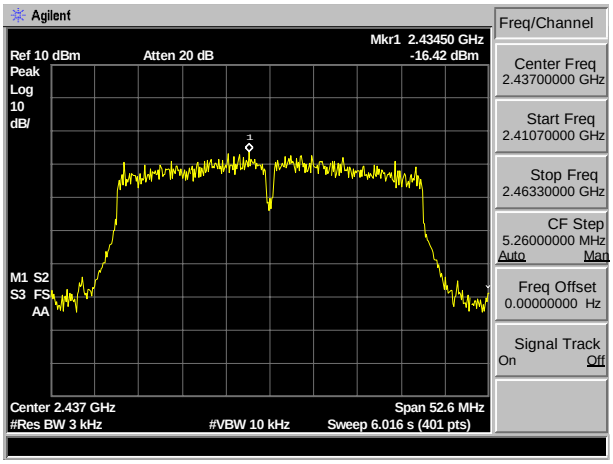
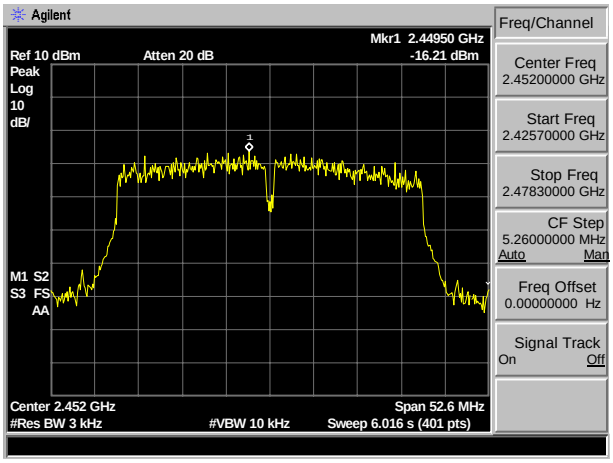
IEEE 802.11n HT20 2412MHz (ANT 1)	
IEEE 802.11n HT20 2437MHz (ANT 1)	
IEEE 802.11n HT20 2462MHz (ANT 1)	

IEEE 802.11n HT40 2422MHz (ANT 1)	
IEEE 802.11n HT40 2437MHz (ANT 1)	
IEEE 802.11n HT40 2452MHz (ANT 1)	

IEEE 802.11b 2412MHz (ANT 2)	
IEEE 802.11b 2437MHz (ANT 2)	
IEEE 802.11b 2462MHz (ANT 2)	

IEEE 802.11g 2412MHz (ANT 2)	
IEEE 802.11g 2437MHz (ANT 2)	
IEEE 802.11g 2462MHz (ANT 2)	

IEEE 802.11n HT20 2412MHz (ANT 2)	
IEEE 802.11n HT20 2437MHz (ANT 2)	
IEEE 802.11n HT20 2462MHz (ANT 2)	

IEEE 802.11n HT40 2422MHz (ANT 2)	
IEEE 802.11n HT40 2437MHz (ANT 2)	
IEEE 802.11n HT40 2452MHz (ANT 2)	

5.6 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205
Test Method:	ANSI C63.10 2013
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Limit:

Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak
emission level radiated by the device.

Test Setup:	

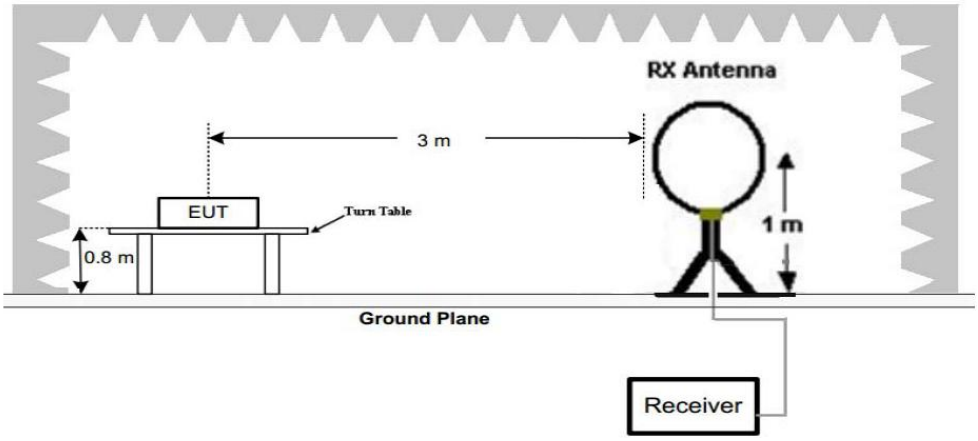


Figure 1. Below 30MHz

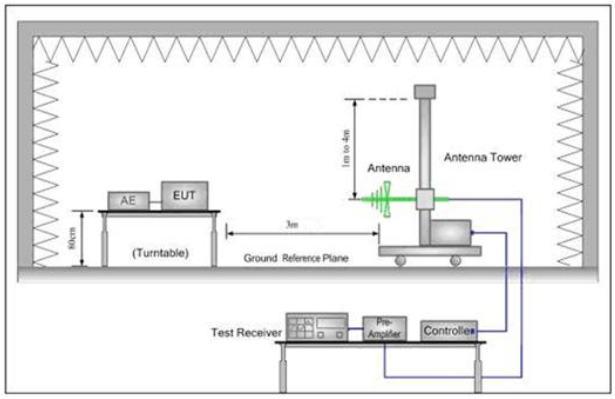


Figure 2. 30MHz to 1GHz

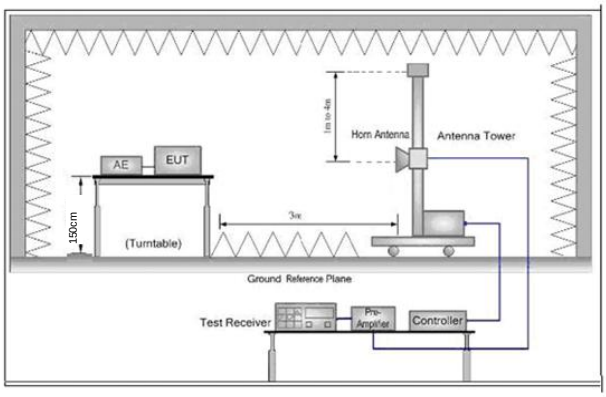


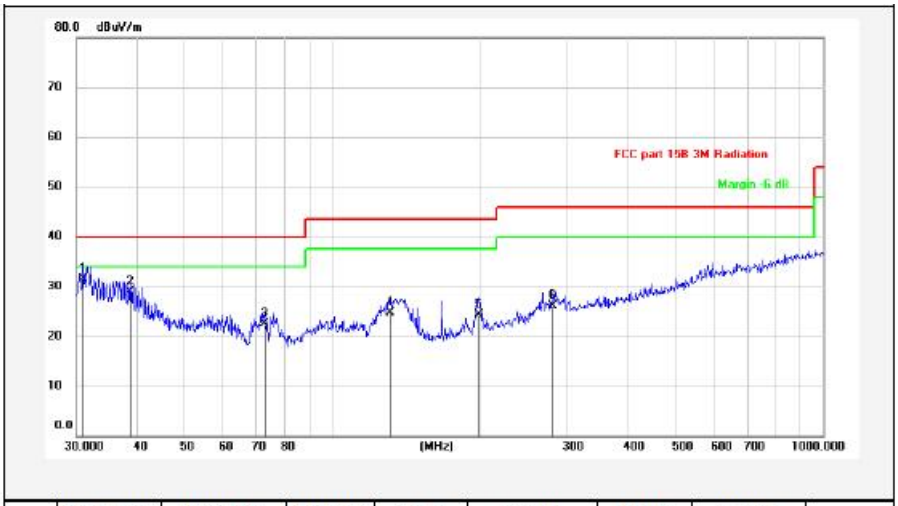
Figure 3. Above 1 GHz

Test Procedure:	a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. Note: For the radiated emission test above 1GHz: Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. 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. b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. c. 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.

	d. 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(for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. 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. g. Test the EUT in the lowest channel ,the middle channel ,the Highest channel h. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Transmitting mode.
Final Test Mode:	Pretest the EUT at Transmitting mode Through Pre-scan, 802.11b,802.11g M,802.11n(HT20,HT40) find the 1Mbps of rate of 802.11b at lowest channel is the worst case. Only the worst case is recorded in the report.
Test Results:	Pass

5.6.1 Radiated emission below 1GHz

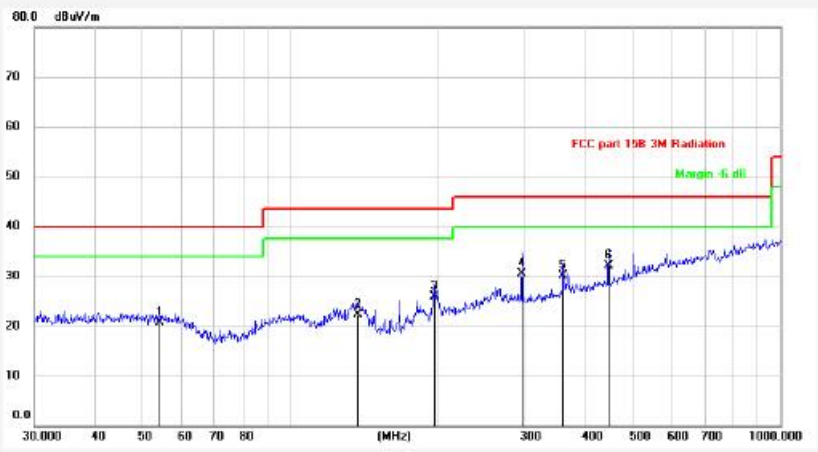
30MHz~1GHz		
Test mode:	Transmitting	Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Cable (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	31.0706	19.52	11.18	0.9	31.60	40.00	-8.40	QP
2	38.6160	16.00	11.9	1	28.90	40.00	-11.10	QP
3	72.5916	13.76	7.43	1.31	22.50	40.00	-17.50	QP
4	131.2965	15.01	8	1.69	24.70	43.50	-18.80	QP
5	198.5880	12.12	10.23	1.95	24.30	43.50	-19.20	QP
6	281.0075	10.83	12.89	2.38	26.10	46.00	-19.90	QP

Remarks:1. Result=Reading+Antenna+Cable
2. If Peak Result complies with QP Limit, QP Result is deemed to comply with QP Limit.

Test mode:	Transmitting	Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Cable (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	54.2610	7.72	11.92	1.16	20.80	40.00	-19.20	QP
2	137.4202	13.07	7.51	1.72	22.30	43.50	-21.20	QP
3	196.5098	13.93	10.13	1.94	26.00	43.50	-17.50	QP
4	297.2241	14.75	13.41	2.44	30.60	46.00	-15.40	QP
5	360.4476	12.75	14.71	2.64	30.10	46.00	-15.90	QP
6	446.4141	12.87	16.43	2.9	32.20	46.00	-13.80	QP

Remarks:1. Result=Reading+Antenna+Cable
2. If Peak Result complies with QP Limit, QP Result is deemed to comply with QP Limit.

5.6.2 Transmitter emission above 1GHz

Test mode: ANT 1		802.11b(1Mbps)		Test channel:		Lowest	
Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
4824.000	53.54	-4.26	49.28	74	-24.72	peak	H
4824.000	36.59	-4.26	32.33	54	-21.67	AVG	H
7236.000	51.06	1.18	52.24	74	-21.76	peak	H
7236.000	37.95	1.18	39.13	54	-14.87	AVG	H
4824.000	55.76	-4.26	51.50	74	-22.50	peak	V
4824.000	39.81	-4.26	35.55	54	-18.45	AVG	V
7236.000	50.46	1.18	51.64	74	-22.36	peak	V
7236.000	36.77	1.18	37.95	54	-16.05	AVG	V

Test mode: ANT 1		802.11b(1Mbps)		Test channel:		Middle	
Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
4874.000	52.63	-4.12	48.51	74	-25.49	peak	H
4874.000	36.31	-4.12	32.19	54	-21.81	AVG	H
7311.000	49.61	1.46	51.07	74	-22.93	peak	H
7311.000	35.16	1.46	36.62	54	-17.38	AVG	H
4874.000	52.32	-4.12	48.20	74	-25.80	peak	V
4874.000	36.04	-4.12	31.92	54	-22.08	AVG	V
7311.000	48.50	1.46	49.96	74	-24.04	peak	V
7311.000	35.74	1.46	37.20	54	-16.80	AVG	V

Test mode: ANT 1		802.11b(1Mbps)		Test channel:		Highest	
Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
4924.000	52.31	-4.03	48.28	74	-25.72	peak	H
4924.000	37.72	-4.03	33.69	54	-20.31	AVG	H
7386.000	50.18	1.66	51.84	74	-22.16	peak	H
7386.000	36.64	1.66	38.30	54	-15.70	AVG	H
4924.000	53.40	-4.03	49.37	74	-24.63	peak	V
4924.000	38.53	-4.03	34.50	54	-19.50	AVG	V
7386.000	49.89	1.66	51.55	74	-22.45	peak	V
7386.000	36.45	1.66	38.11	54	-15.89	AVG	V

Remark:

1) The 1Mbps of rate of ANT 1 802.11b is the worst case.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

   Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

3) Scan from 9kHz to 25GHz,The disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

5.7 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205
Test Method:	ANSI C63.10 2013
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)
Limit:	

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test Setup:

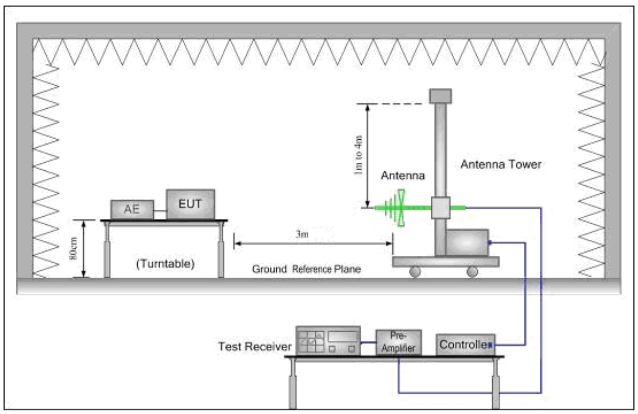


Figure 1. 30MHz to 1GHz

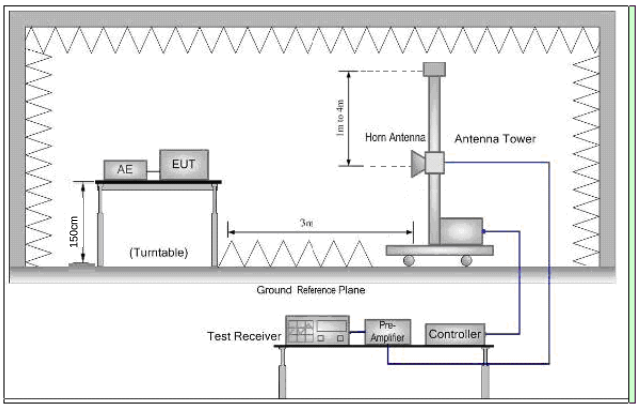


Figure 2. Above 1 GHz

Test Procedure:

a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
Note: For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. 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.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. 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. d. 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel g. Test the EUT in the lowest channel , the Highest channel h. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Transmitting mode.
Final Test Mode:	Pretest the EUT at Transmitting mode Through Pre-scan, 802.11b,802.11g M,802.11n(HT20,HT40) find the 802.11n HT40 is the worst case. Only the worst case is recorded in the report.
Test Results:	Pass

Test data:

Test mode: ANT 1		802.11n HT40		Test channel:		Lowest	
Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
2310.000	53.54	-4.26	49.28	74	-24.72	peak	H
2310.000	36.59	-4.26	32.33	54	-21.67	AVG	H
2390.000	51.06	1.18	52.24	74	-21.76	peak	H
2390.000	37.95	1.18	39.13	54	-14.87	AVG	H
2310.000	55.76	-4.26	51.50	74	-22.50	peak	V
2310.000	39.81	-4.26	35.55	54	-18.45	AVG	V
2390.000	50.46	1.18	51.64	74	-22.36	peak	V
2390.000	36.77	1.18	37.95	54	-16.05	AVG	V

Test mode: ANT 1		802.11n HT40		Test channel:		Highest	
Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
2483.500	58.31	-4.03	48.28	74	-19.72	peak	H
2483.500	44.72	-4.03	33.69	54	-14.31	AVG	H
2500.000	45.18	1.66	51.84	74	-27.16	peak	H
2500.000	31.64	1.66	38.30	54	-20.70	AVG	H
2483.500	59.40	-4.03	49.37	74	-18.63	peak	V
2483.500	44.53	-4.03	34.50	54	-13.50	AVG	V
2500.000	45.89	1.66	51.55	74	-27.45	peak	V
2500.000	31.45	1.66	38.11	54	-20.89	AVG	V

Remark:

1) The ANT 1 802.11n HT40 is the worst case.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

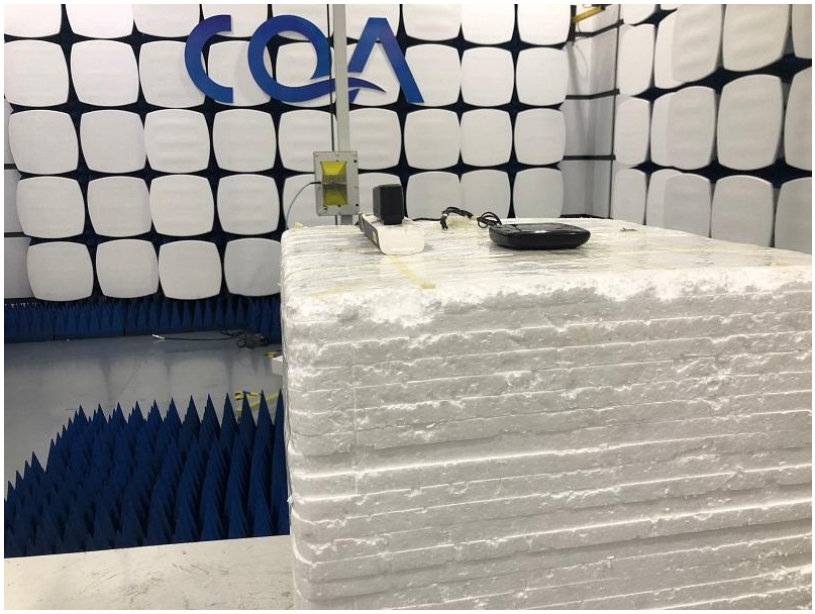
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

6 Photographs - EUT Test Setup

6.1 Radiated Spurious Emission

30MHz~1GHz:

Above 1GHz:

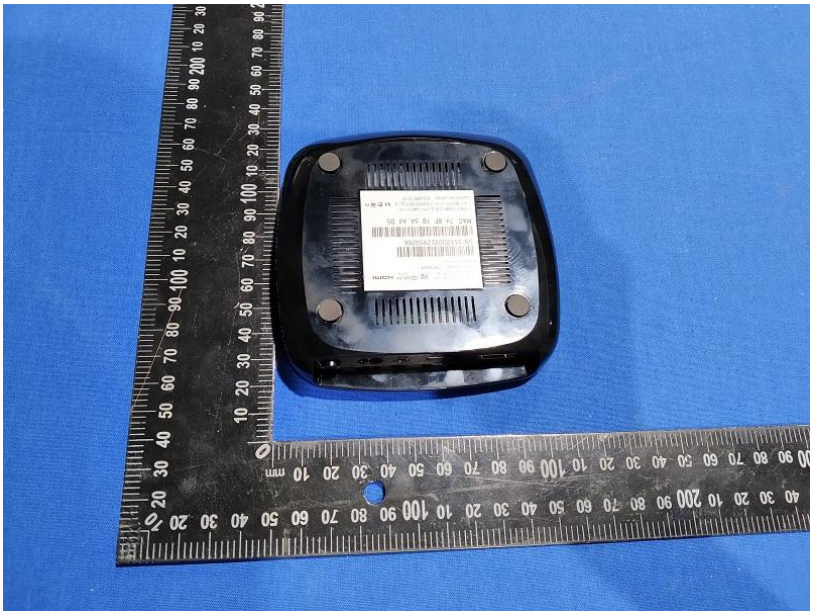


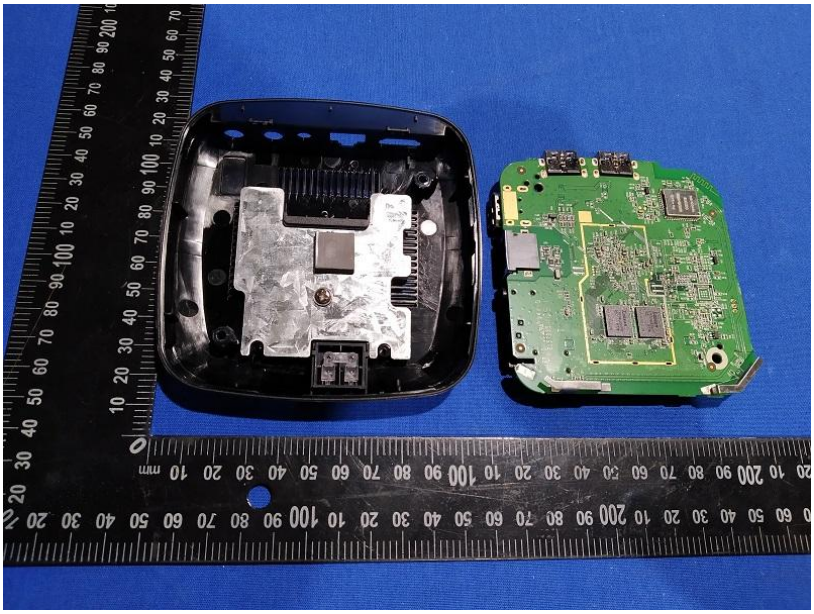
6.2 Conducted Emission

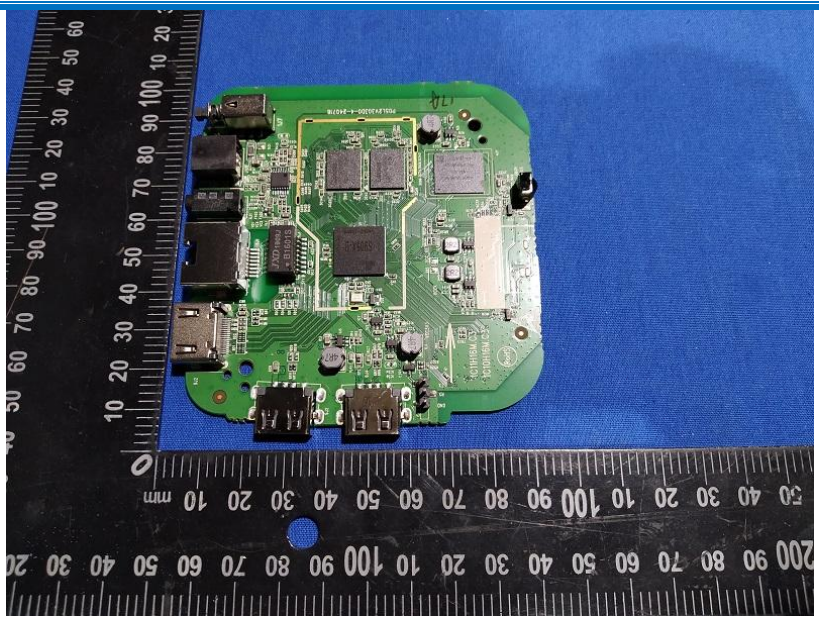
7 Photographs - EUT Constructional Details

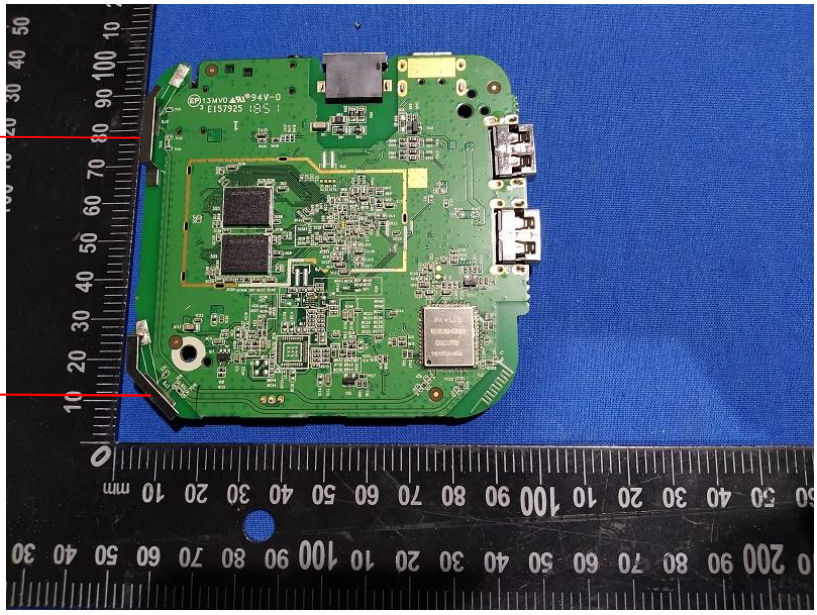
Test model No.:

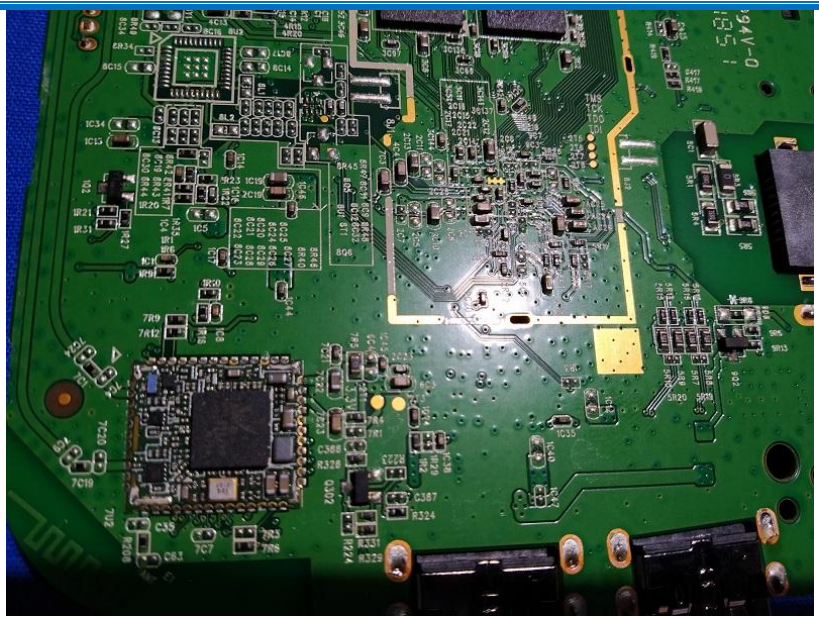
한국TV








2.4G/5G
Antenna 2
2.4G/5G
Antenna 1



THE END