Test Report (WIFI)

Applicant:	Shanghai Notion Information Technology CO. LTD
Address of Applicant:	Floor 5,Building 5,NO 289,Bisheng Rd, Pudong district, Shanghai, China
Manufacturer/Factory:	Shanghai Notion Information Technology CO. LTD
Address of Manufacturer/Factory:	Floor 5,Building 5,NO 289,Bisheng Rd, Pudong district, Shanghai, China

Equipment Under Test (EUT)

Product Name:	IDU/Dual-band WiFi Router
Model No.:	R0112A/MU261-Combo
FCC ID:	2AR45-R0112A
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	July 23, 2019
Date of Test:	July 24-August 06, 2019
Date of report issued:	August 06, 2019
Test Result :	PASS *

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

Authorized Signature:

Robinson Lo
Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	*August 06, 2019*	*Original*

Prepared By:	Tiger. Chen	***Date:***	*August 06, 2019*
	Project Engineer		
Check By:	Robinson Lo	***Date:***	*August 06, 2019*
	Reviewer		

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(3)	Pass
Channel Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Spurious Emission	15.205/15.209	Pass

Remarks:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *Test according to ANSI C63.10:2013*

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	± 4.64dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.64dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 3.68dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	± 3.44dB	(1)
RF conducted power measurement	30M~26.5G	0.65dB	(1)
Conducted Emission	30M~26.5G	2.8dB	(1)
PSD measurement	30M~26.5G	1.31dB	(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:	IDU/Dual-band WiFi Router
Model No.:	R0112A/MU261-Combo
Serial No.:	IU0519041000035
Hardware Version:	IU05_1_10
Software Version:	IU05_N13_Combo_V002
Test sample(s) ID:	GTS201907000147-1
Sample(s) Status:	Engineer sample
Operation Frequency:	2412MHz~2462MHz(802.11b/g/n(HT20)) 2422MHz~2452MHz(802.11n(HT40))
Channel Numbers:	802.11b/802.11g /802.11n(HT20): 11 802.11n(HT40):7
Channel Separation:	5MHz
Modulation Technology:	802.11b: Direct Sequence Spread Spectrum (DSSS) 802.11g/802.11n: Orthogonal Frequency Division Multiplexing (OFDM) MIMO: 802.11n SISO: 802.11b/g
Antenna Type:	PCB Antenna
Antenna Gain:	2dBi(Declare by applicant)
Power Supply:	Adapter Power Model:LSD-D24V075F Input: AC 100-240V, 50/60Hz, 0.75A Output: DC 24V, 750mA

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	2422MHz
Middle channel	2437MHz	2437MHz
Highest channel	2462MHz	2452MHz

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode

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.

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 Test Facility

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

● **FCC —Registration No.: 381383**

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. Registration 381383.

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.
Address: No. 301-309, 3/F, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102
Tel: 0755-27798480
Fax: 0755-27798960

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. 03 2015	July. 02 2020
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. 26 2019	June. 25 2020
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 26 2019	June. 25 2020
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 26 2019	June. 25 2020
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 26 2019	June. 25 2020
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 26 2019	June. 25 2020
9	Coaxial Cable	GTS	N/A	GTS211	June. 26 2019	June. 25 2020
10	Coaxial cable	GTS	N/A	GTS210	June. 26 2019	June. 25 2020
11	Coaxial Cable	GTS	N/A	GTS212	June. 26 2019	June. 25 2020
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 26 2019	June. 25 2020
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 26 2019	June. 25 2020
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 26 2019	June. 25 2020
15	Band filter	Amindeon	82346	GTS219	June. 26 2019	June. 25 2020
16	Power Meter	Anritsu	ML2495A	GTS540	June. 26 2019	June. 25 2020
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 26 2019	June. 25 2020
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 26 2019	June. 25 2020
19	Splitter	Agilent	11636B	GTS237	June. 26 2019	June. 25 2020
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 26 2019	June. 25 2020
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 20 2018	Oct. 19 2019
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 20 2018	Oct. 19 2019
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 20 2018	Oct. 19 2019
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 26 2019	June. 25 2020

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. 26 2019	June. 25 2020
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 26 2019	June. 25 2020
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June. 26 2019	June. 25 2020
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. 26 2019	June. 25 2020
8	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	June. 26 2019	June. 25 2020
9	ISN	SCHWARZBECK	NTFM 8158	GTD565	June. 26 2019	June. 25 2020

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. 26 2019	June. 25 2020
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 26 2019	June. 25 2020
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June. 26 2019	June. 25 2020
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	June. 26 2019	June. 25 2020
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	June. 26 2019	June. 25 2020
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	June. 26 2019	June. 25 2020
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	June. 26 2019	June. 25 2020
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	June. 26 2019	June. 25 2020

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. 26 2019	June. 25 2020
2	Barometer	ChangChun	DYM3	GTS255	June. 26 2019	June. 25 2020

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:	
The antenna is PCB antenna, the best case gain of the antenna is 2dBi, reference to the appendix II for details	

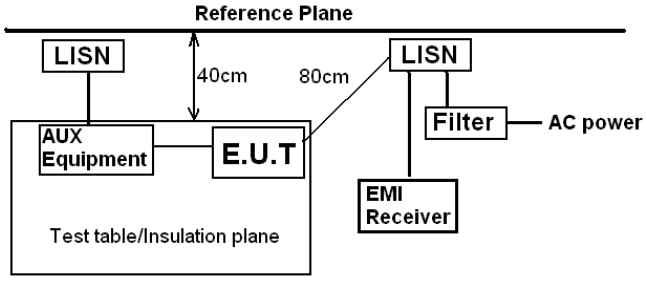
7.2 Conducted Emissions

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.

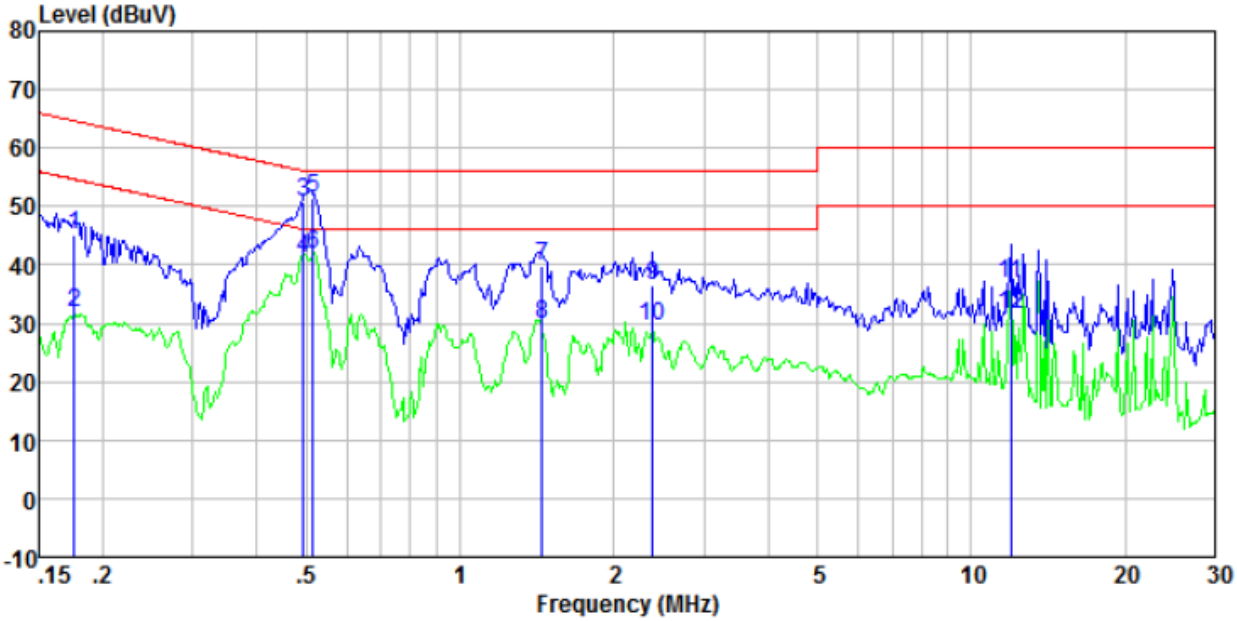
Test setup:



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

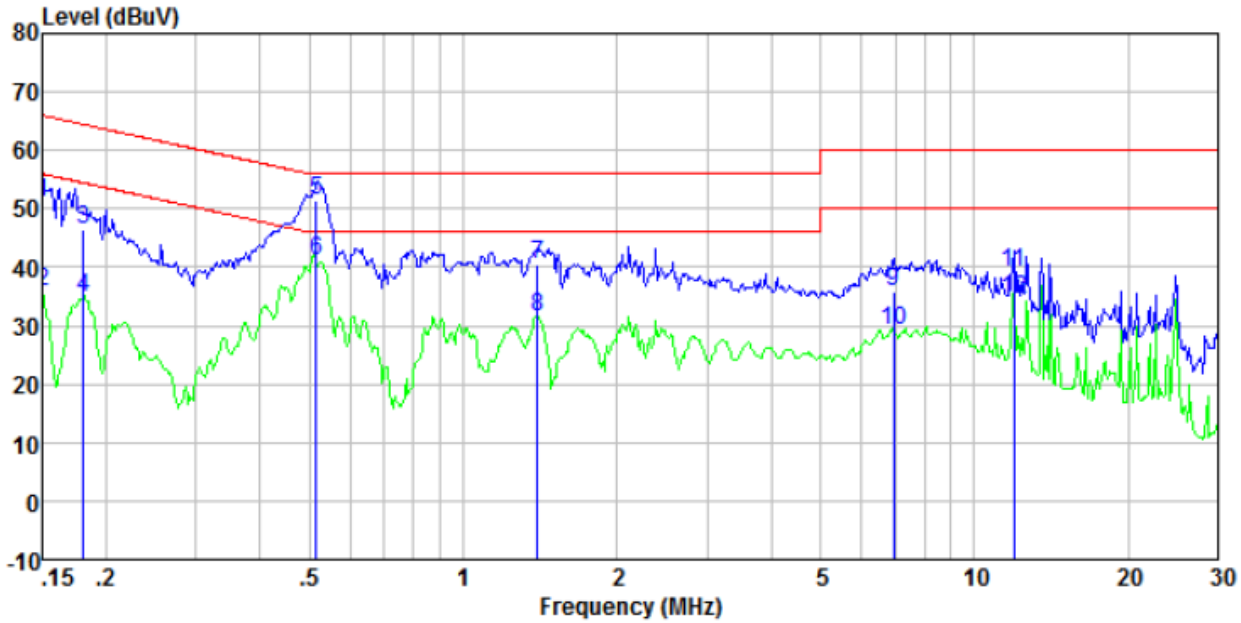
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Measurement data
Line:



Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.18	44.78	0.40	0.09	45.27	64.68	-19.41	QP
0.18	31.50	0.40	0.09	31.99	54.68	-22.69	Average
0.49	50.48	0.32	0.11	50.91	56.10	-5.19	QP
0.49	40.64	0.32	0.11	41.07	46.10	-5.03	Average
0.52	51.06	0.31	0.11	51.48	56.00	-4.52	QP
0.52	41.30	0.31	0.11	41.72	46.00	-4.28	Average
1.45	39.33	0.20	0.16	39.69	56.00	-16.31	QP
1.45	29.65	0.20	0.16	30.01	46.00	-15.99	Average
2.38	36.18	0.20	0.18	36.56	56.00	-19.44	QP
2.38	29.13	0.20	0.18	29.51	46.00	-16.49	Average
11.93	36.57	0.20	0.20	36.97	60.00	-23.03	QP
11.93	31.28	0.20	0.20	31.68	50.00	-18.32	Average

Neutral:

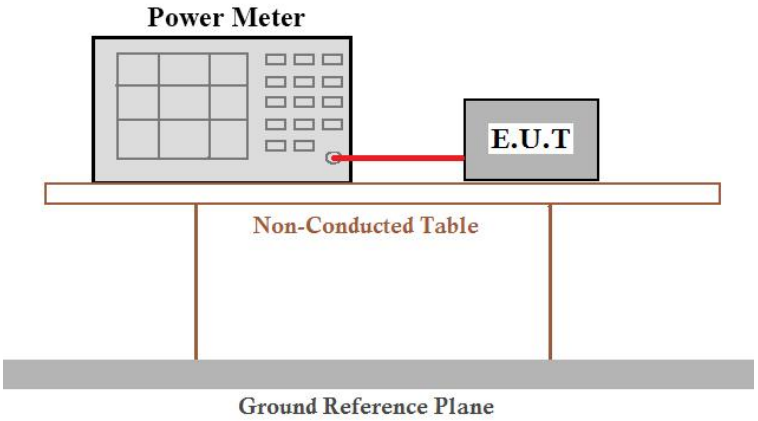


Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.15	50.50	0.40	0.07	50.97	66.00	-15.03	QP
0.15	35.42	0.40	0.07	35.89	56.00	-20.11	Average
0.18	46.06	0.40	0.10	46.56	64.46	-17.90	QP
0.18	34.17	0.40	0.10	34.67	54.46	-19.79	Average
0.52	51.09	0.31	0.11	51.51	56.00	-4.49	QP
0.52	40.60	0.31	0.11	41.02	46.00	-4.98	Average
1.40	40.26	0.20	0.16	40.62	56.00	-15.38	QP
1.40	31.23	0.20	0.16	31.59	46.00	-14.41	Average
6.95	35.53	0.20	0.18	35.91	60.00	-24.09	QP
6.95	28.75	0.20	0.18	29.13	50.00	-20.87	Average
11.93	38.60	0.20	0.20	39.00	60.00	-21.00	QP
11.93	34.03	0.20	0.20	34.43	50.00	-15.57	Average

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

7.3 Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB558074 D01 DTS Meas Guidance V05r02 KDB662911D01 Multiple Transmitter Output v02r01
Limit:	30dBm
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

ANT 1:

Test CH	Peak Output Power (dBm)				Limit(dBm)	Result
	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)		
Lowest	18.30	17.79	17.37	17.60	30.00	Pass
Middle	18.01	18.04	17.63	17.59		
Highest	18.30	17.72	17.47	17.00		

ANT 2:

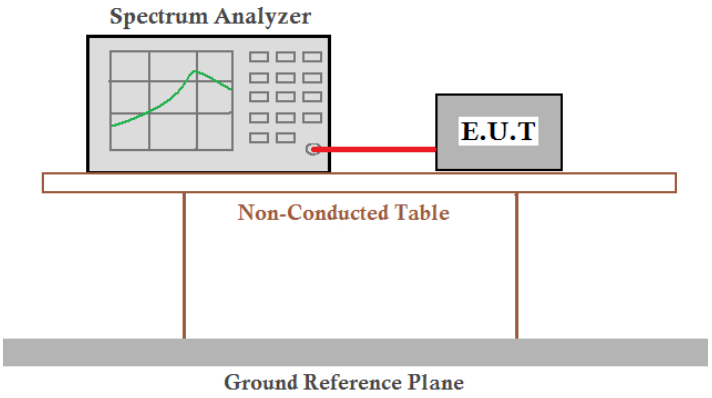
Test CH	Peak Output Power (dBm)				Limit(dBm)	Result
	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)		
Lowest	18.61	17.89	17.40	17.59	30.00	Pass
Middle	18.79	17.54	17.69	17.56		
Highest	18.22	17.87	17.53	17.16		

MIM0:

Modulation	Test CH	Peak Output Power (dBm)		Sum Output Power (dBm)	Limit (dBm)	Result
802.11n(HT20)	Lowest	ANT 1	17.37	20.40	30	Pass
		ANT 2	17.40			
	Middle	ANT 1	17.63	20.67		
		ANT 2	17.69			
	Highest	ANT 1	17.47	20.51		
		ANT 2	17.53			
802.11n(HT40)	Lowest	ANT 1	17.60	20.61	30	Pass
		ANT 2	17.59			
	Middle	ANT 1	17.59	20.59		
		ANT 2	17.56			
	Highest	ANT 1	17.00	20.09		
		ANT 2	17.16			

Note: transmit signals are completely un*correlated*,
Directional gain = 2dBi

7.4 Channel Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB558074 D01 DTS Meas Guidance V05r02 KDB662911D01 Multiple Transmitter Output v02r01
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

ANT 1:

Test CH	Channel Bandwidth (MHz)				Limit(KHz)	Result
	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)		
Lowest	9.103	13.85	15.05	28.84	>500	Pass
Middle	10.09	15.13	15.11	35.79		
Highest	9.106	15.07	15.10	23.88		

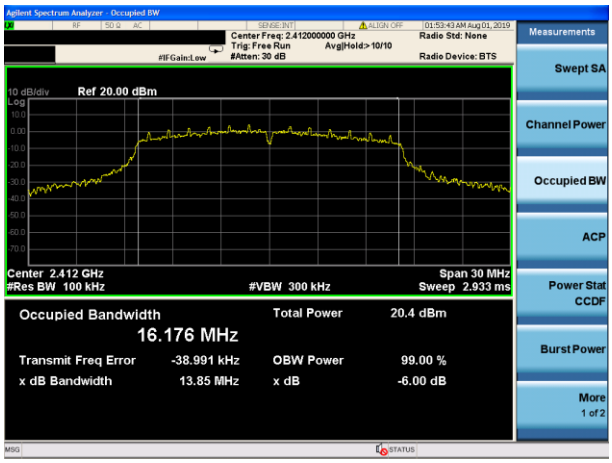
ANT 2:

Test CH	Channel Bandwidth (MHz)				Limit(KHz)	Result
	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)		
Lowest	9.106	13.86	15.05	28.84	>500	Pass
Middle	10.09	15.13	15.16	35.78		
Highest	9.111	13.87	15.08	23.88		

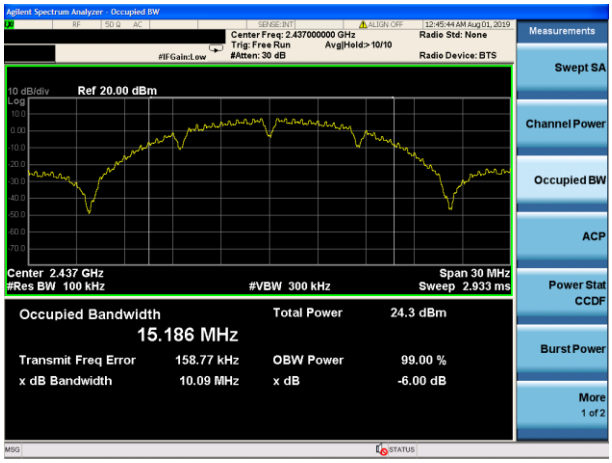
Test plot as follows:

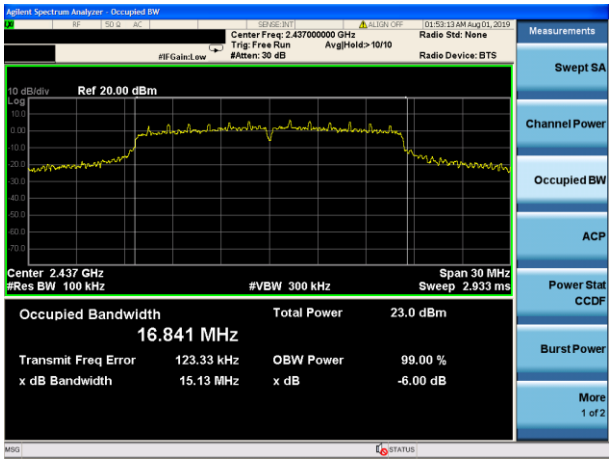
ANT 1:

Test mode:	802.11b	Test mode:	802.11g

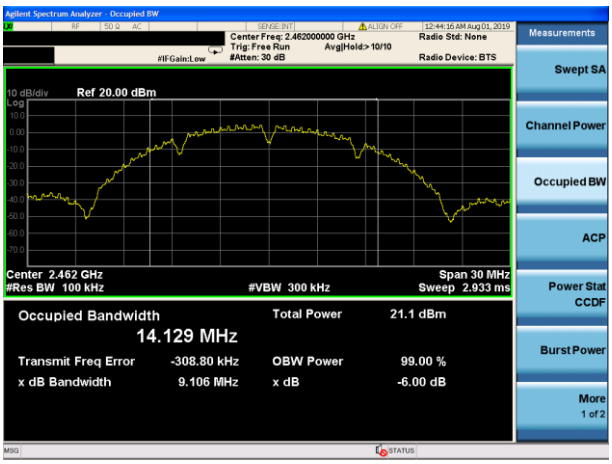


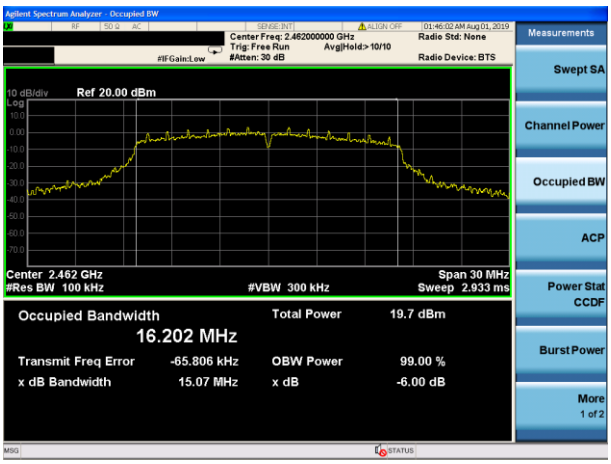
Lowest channel





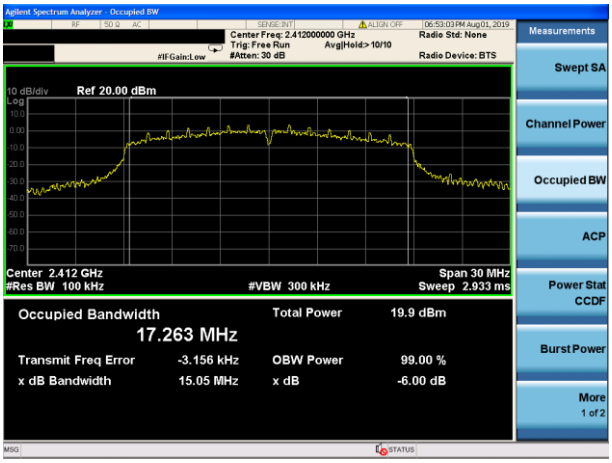
Middle channel

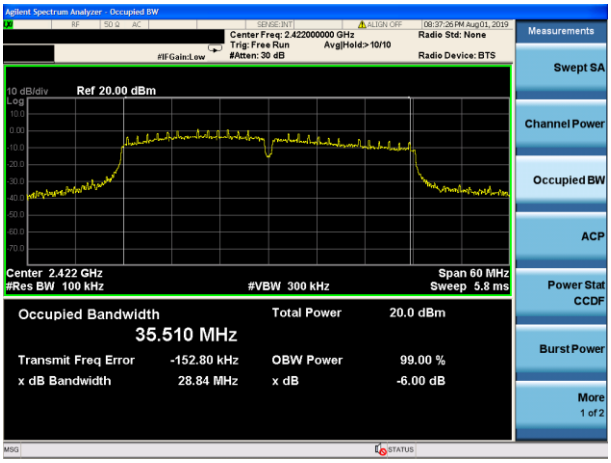




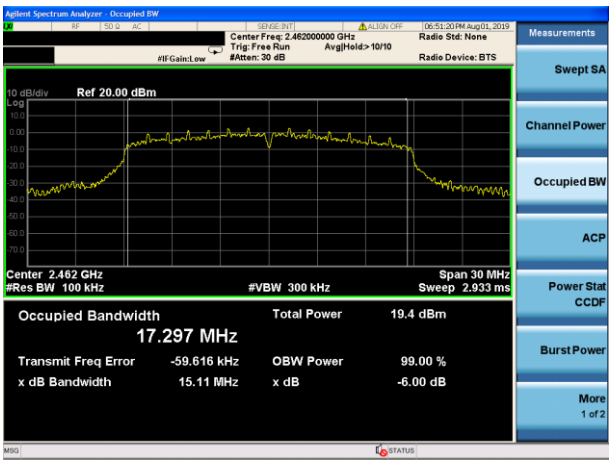
Highest channel

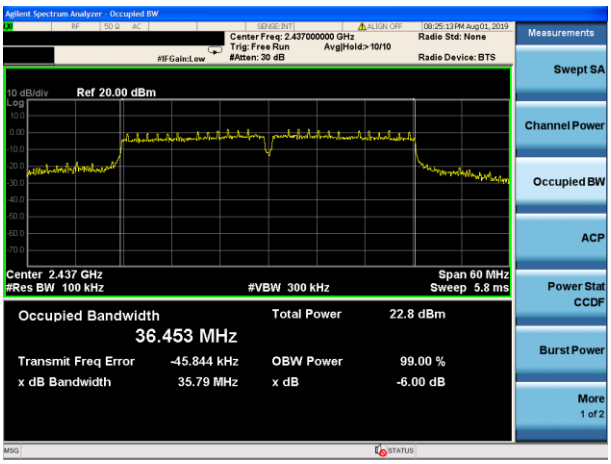
Test mode:	802.11n(HT20)	Test mode:	802.11n(HT40)



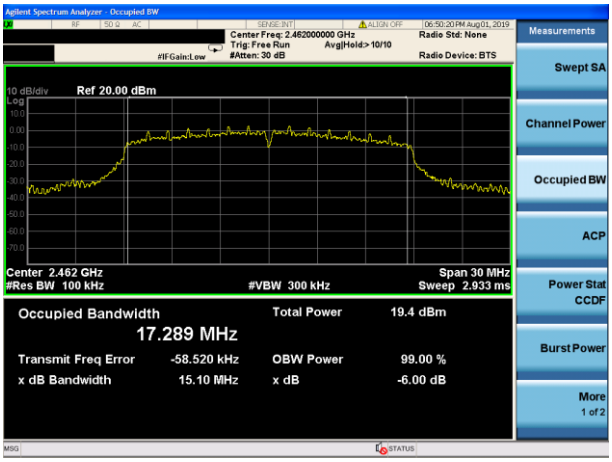


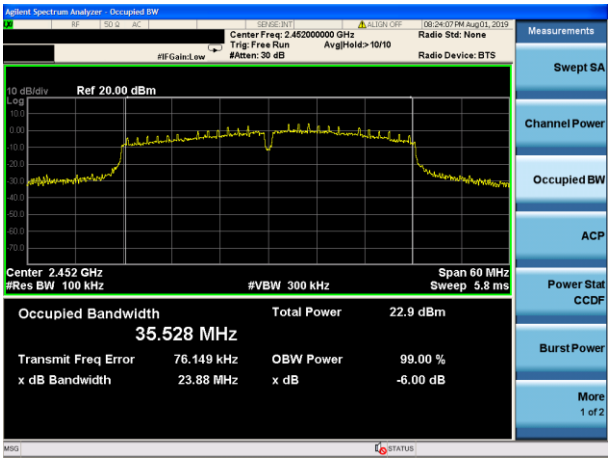
Lowest channel





Middle channel

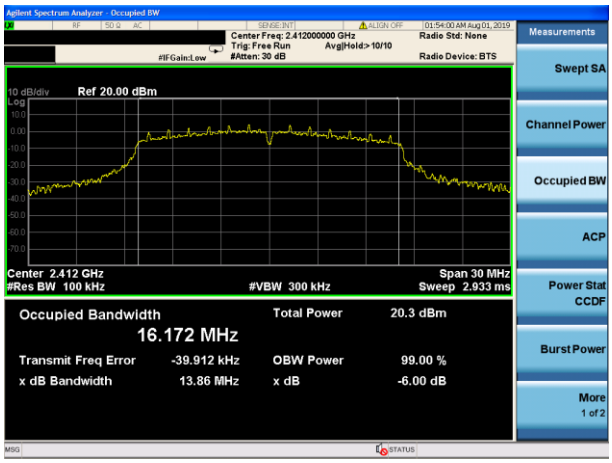




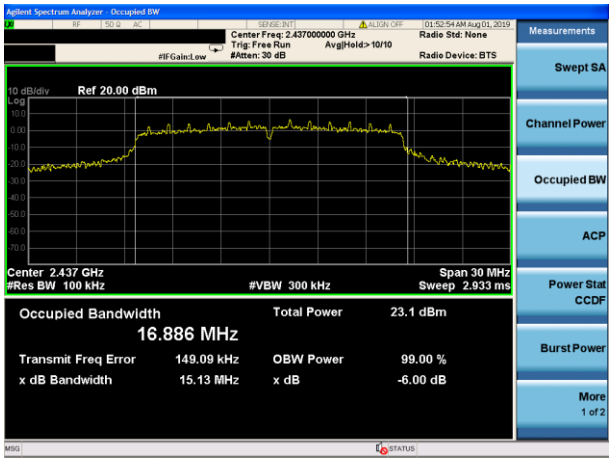
Highest channel

ANT 2:

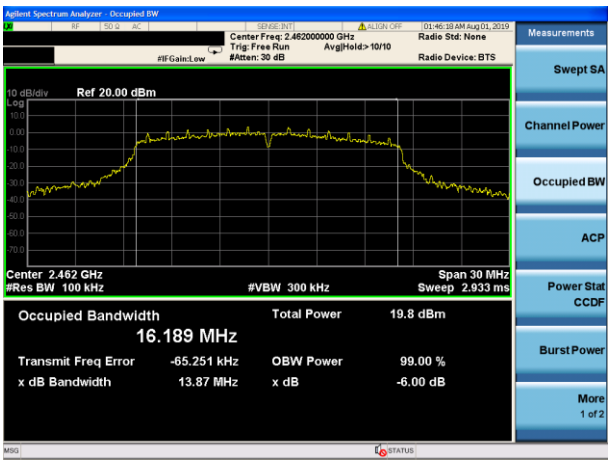
Test mode:	802.11b	Test mode:	802.11g



Lowest channel

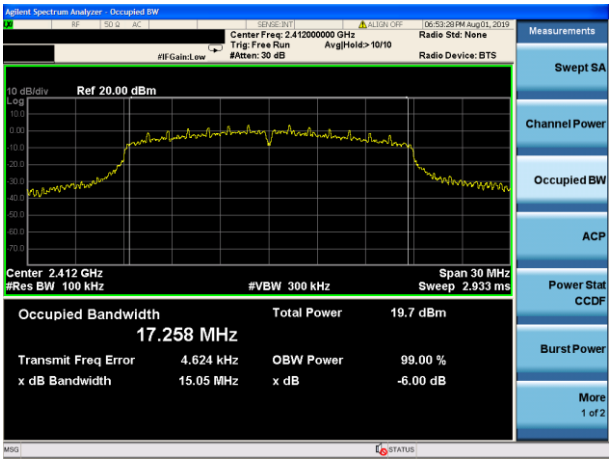


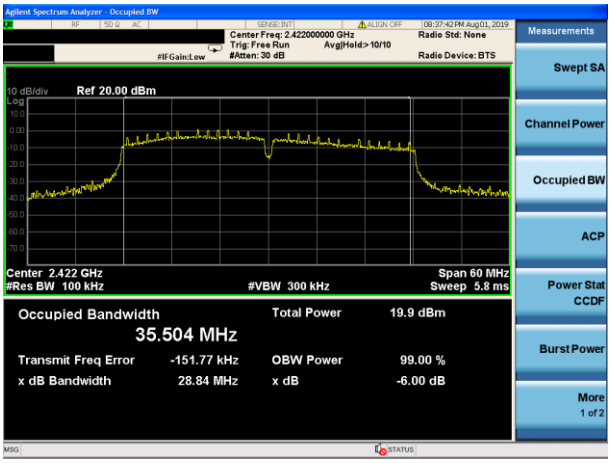
Middle channel



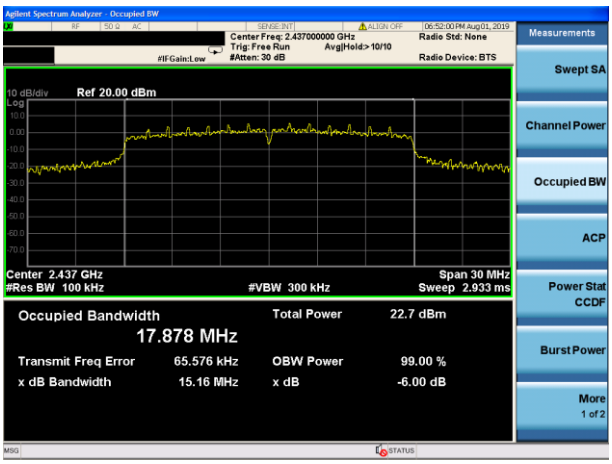
Highest channel

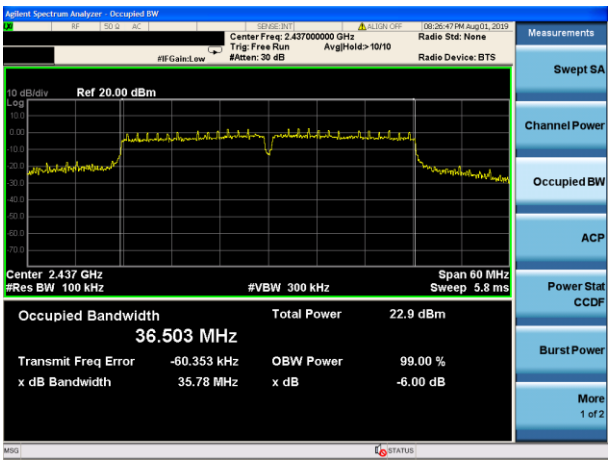
Test mode:	802.11n(HT20)	Test mode:	802.11n(HT40)



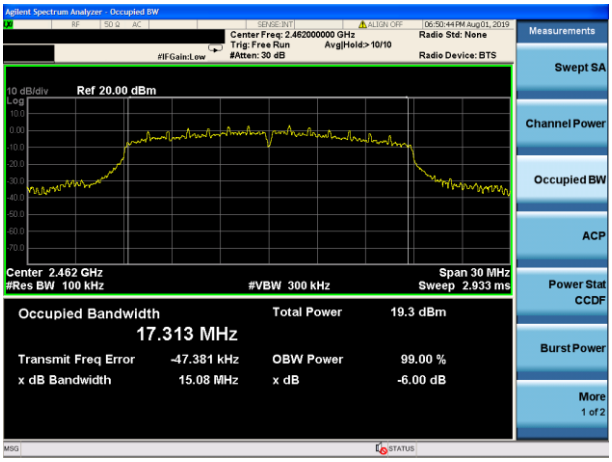


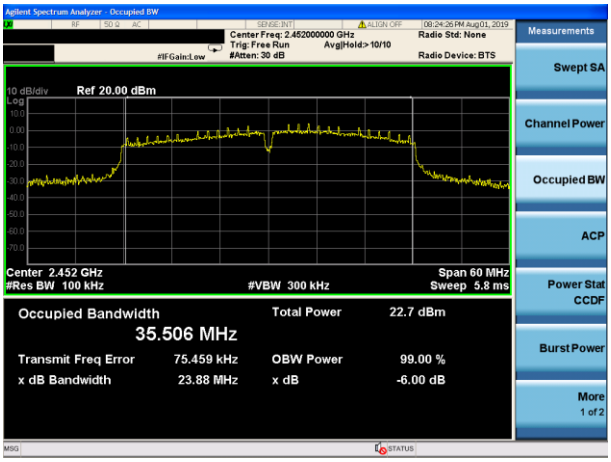
Lowest channel





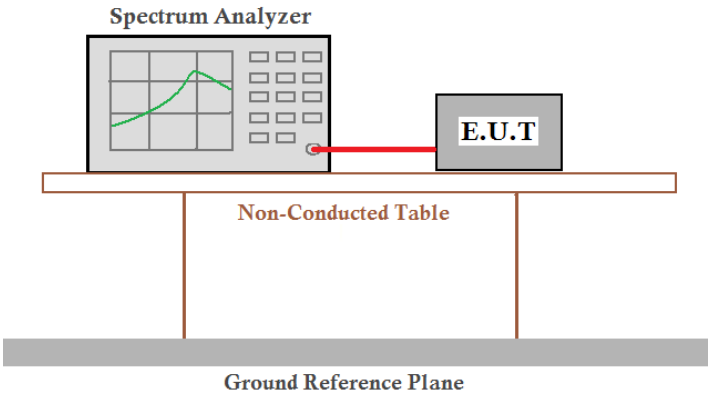
Middle channel





Highest channel

7.5 Power Spectral Density

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB558074 D01 DTS 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

ANT 1:

Test CH	Power Spectral Density (dBm/3kHz)				Limit (dBm/3kHz)	Result
	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)		
Lowest	2.937	-11.706	-12.847	-14.263	8.00	Pass
Middle	3.648	-10.019	-10.127	-13.390		
Highest	1.316	-12.882	-12.542	-11.937		

ANT 2:

Test CH	Power Spectral Density (dBm/3kHz)				Limit (dBm/3kHz)	Result
	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)		
Lowest	3.347	-12.147	-12.097	-14.476	8.00	Pass
Middle	3.929	-10.409	-8.811	-13.636		
Highest	2.088	-13.176	-12.697	-12.056		

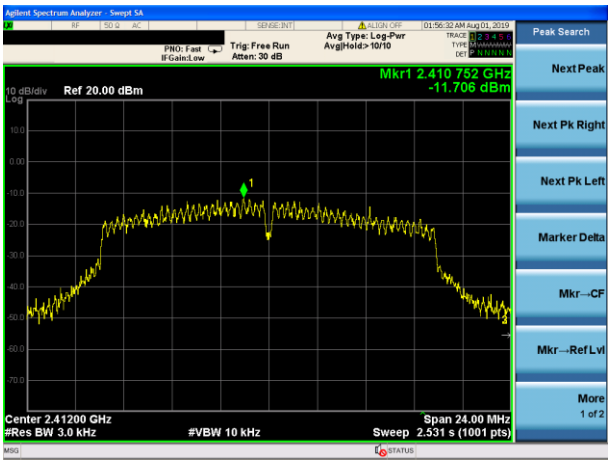
MIM0:

Modulation	Test CH	Power Spectral Density (dBm)		Sum Output (dBm)	Limit (dBm/3kHz)	Result
802.11n(HT20)	Lowest	ANT 1	-12.847	-9.45	8	Pass
		ANT 2	-12.097			
	Middle	ANT 1	-10.127	-6.41		
		ANT 2	-8.811			
	Highest	ANT 1	-12.542	-9.61		
		ANT 2	-12.697			
802.11n(HT40)	Lowest	ANT 1	-14.263	-11.36	8	Pass
		ANT 2	-14.476			
	Middle	ANT 1	-13.390	-10.50		
		ANT 2	-13.636			
	Highest	ANT 1	-11.937	-8.99		
		ANT 2	-12.056			

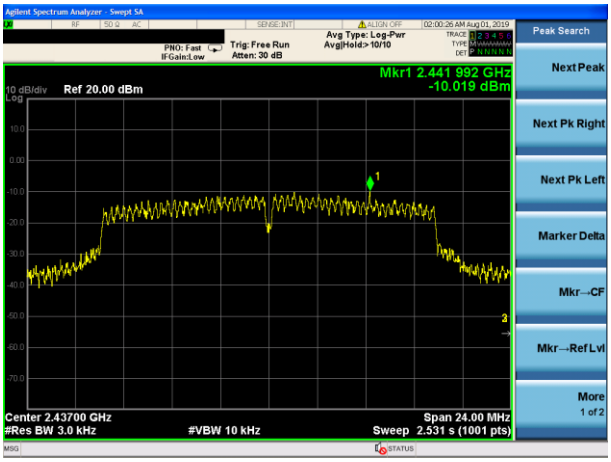
Test plot as follows:

ANT 1:

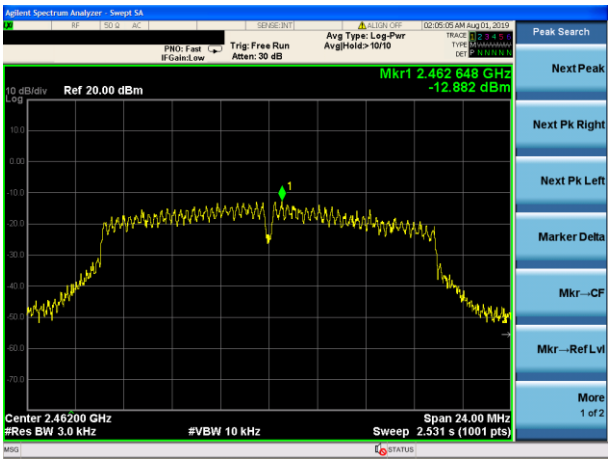
Test mode:	802.11b	Test mode:	802.11g



Lowest channel

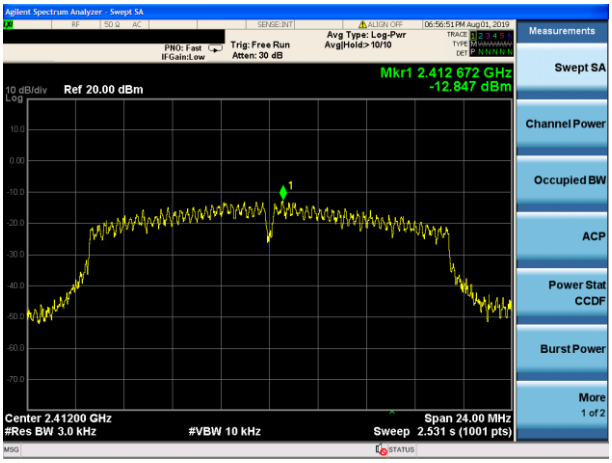


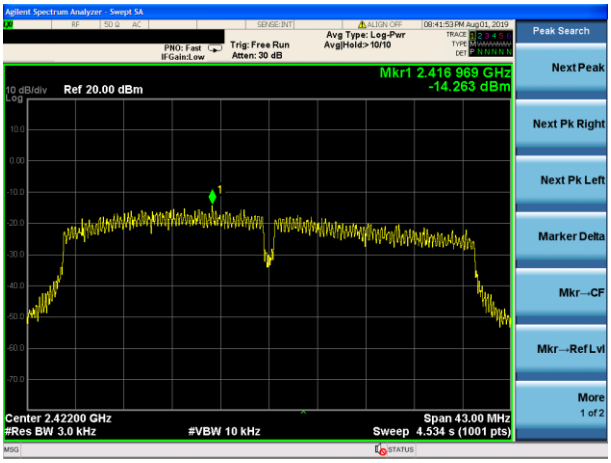
Middle channel



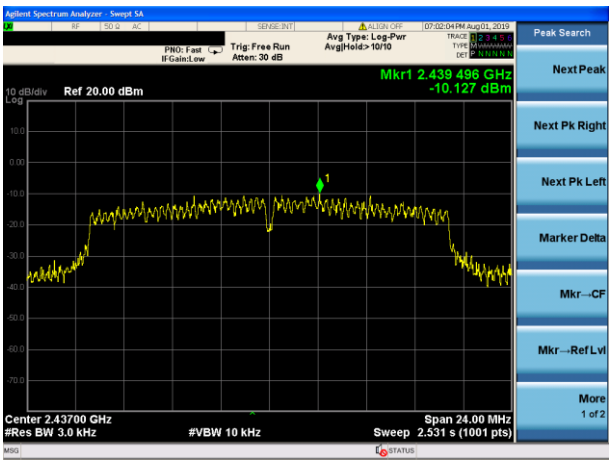
Highest channel

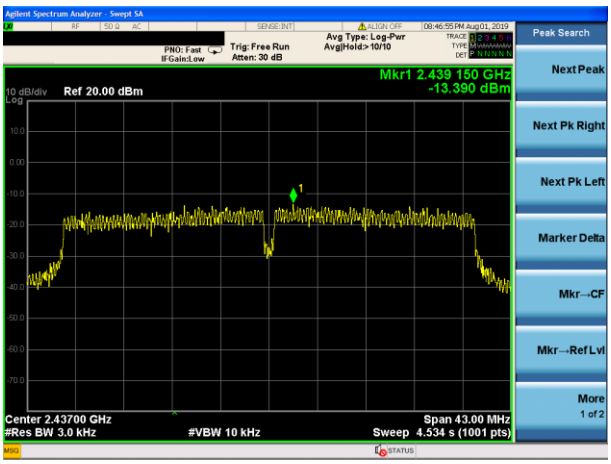
Test mode:	802.11n(HT20)	Test mode:	802.11n(HT40)



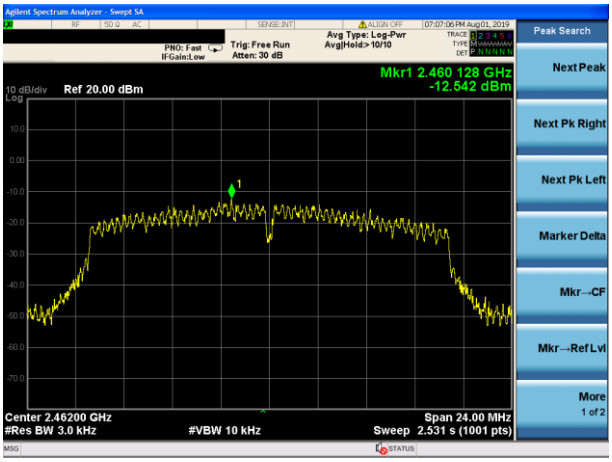


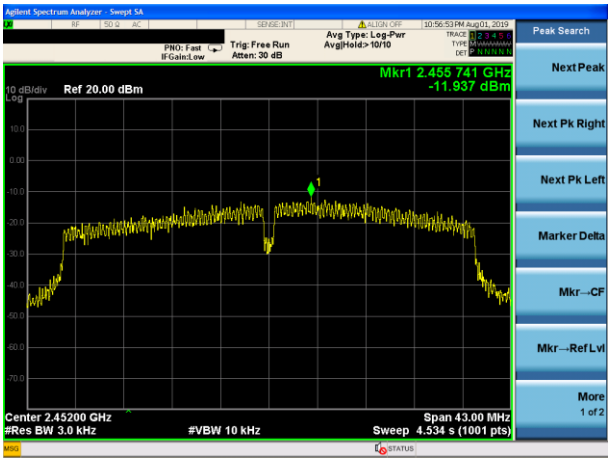
Lowest channel





Middle channel

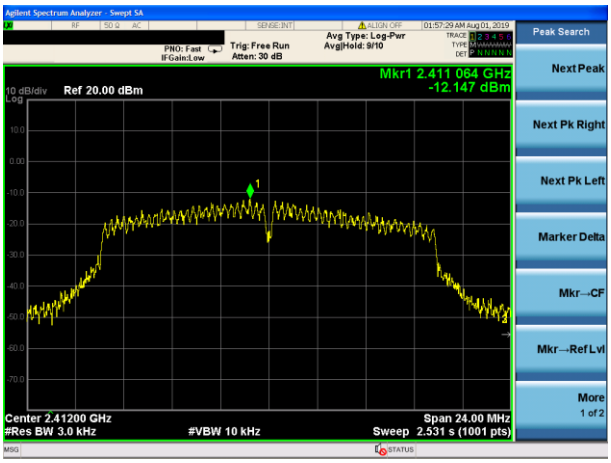




Highest channel

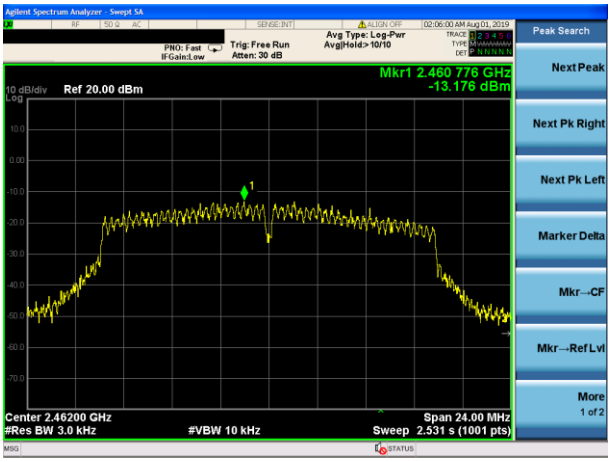
ANT 2:

Test mode:	802.11b	Test mode:	802.11g



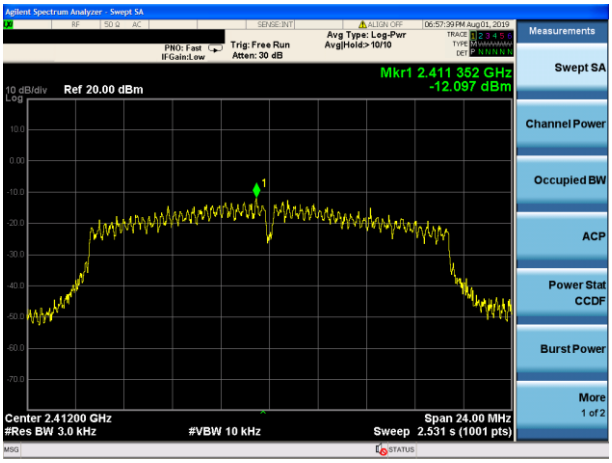
Lowest channel

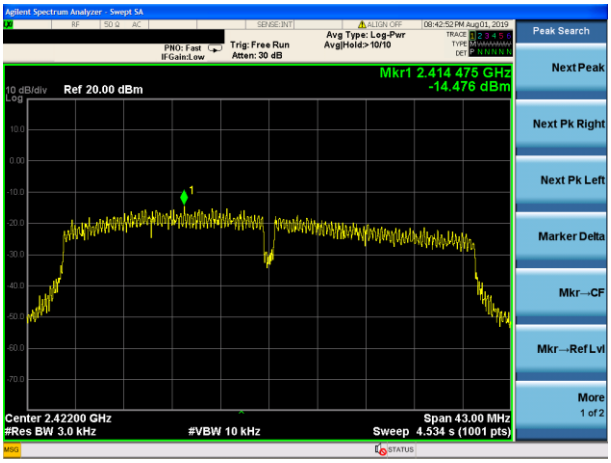
Middle channel



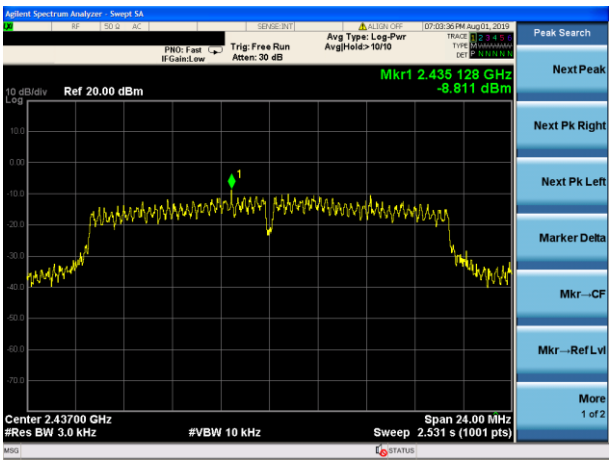
Highest channel

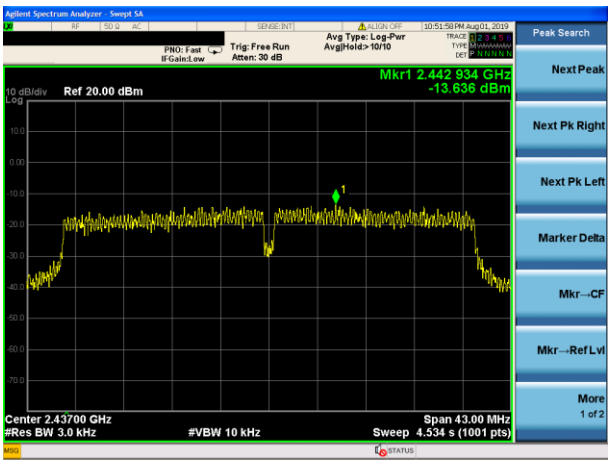
Test mode:	802.11n(HT20)	Test mode:	802.11n(HT40)



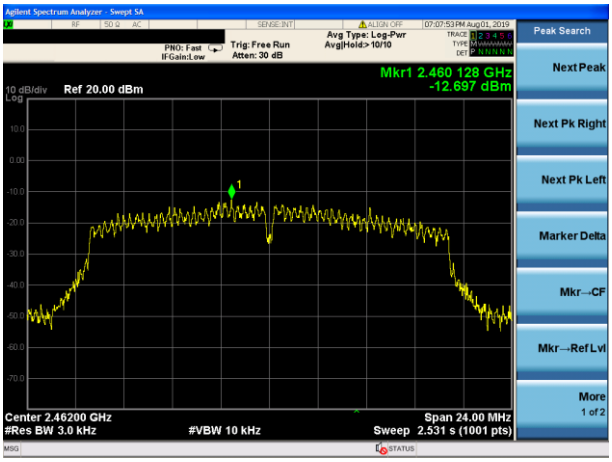


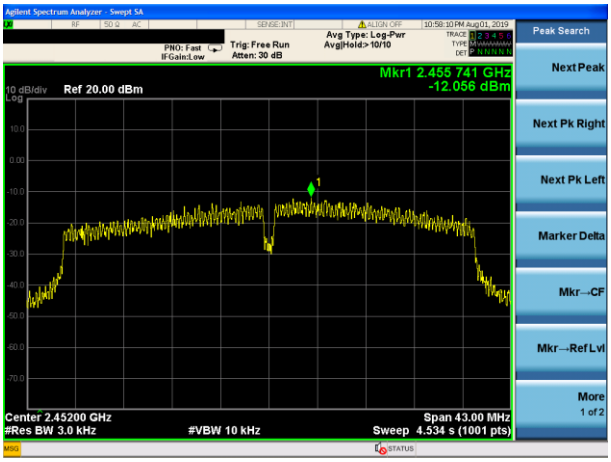
Lowest channel





Middle channel

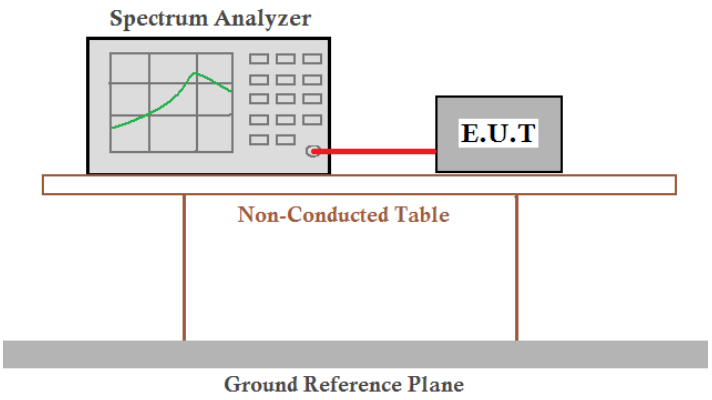




Highest channel

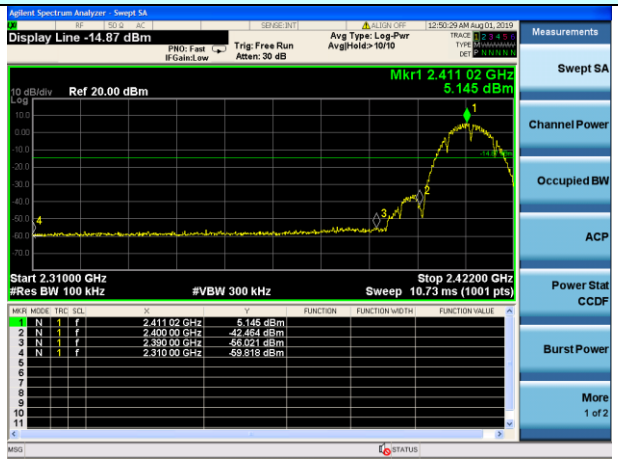
7.6 Band edges

7.6.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074 D01 DTS 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:	
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:

ANT 1:

Test mode:	802.11b
	
Lowest channel	Highest channel

Test mode:	802.11g
Lowest channel	Highest channel

Test mode:	802.11n(HT20)

Lowest channel

Highest channel

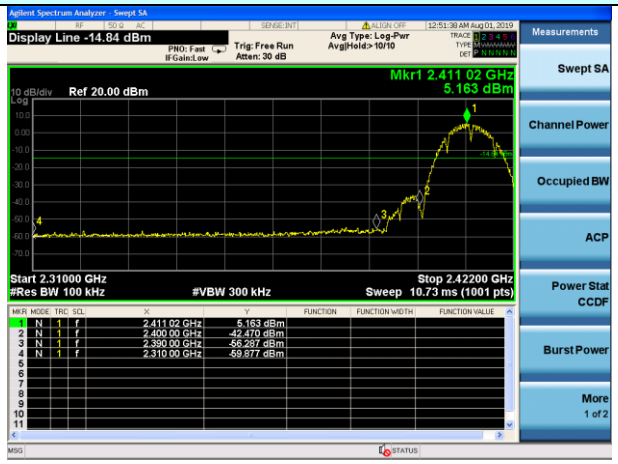
Test mode:	802.11n(HT40)

Lowest channel

Highest channel

ANT 2:

Test mode:	802.11b



Lowest channel

Highest channel

Test mode:	802.11g

Lowest channel

Highest channel