TCT 通测检测 TESTING CENTRE TECHNOLOGY

Report No.: TCT150130E003

FCC REPORT

Applicant:	Gainstrong Industry Co., Ltd
Address of Applicant:	3rd Floor, 1st Building, Block E, Minzhu West Industrial Zone, Bao'an Dist., Shenzhen

Equipment Under Test (EUT)

Product Name:	Mini wireless router
Model No.:	oolite-minibox V1.0
Additional Model No.:	MB150R, MB150RU, MiniBox V1.0
Trade mark:	N/A
FCC ID:	2AB5E-MB150RU
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	Jan. 30, 2015
Date of Test:	Feb. 01 – Feb. 03, 2015
Date of report issued:	Feb. 04, 2015
Test Result :	PASS *

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

2 Version

Version No.	Date	Description
00	*Feb. 04, 2015*	*Original*

Prepared by:  ***Date:*** ***Feb. 04, 2015***

Report Clerk

Reviewed by:  ***Date:*** ***Feb. 04, 2015***

EMC Manager

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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
6dB Emission Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Spurious Emission	15.205/15.209	Pass

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

5. General Information

5.1 Client Information

Applicant:	Gainstrong Industry Co.,Ltd
Address of Applicant:	3rd Floor, 1st Building, Block E, Minzhu West Industrial Zone, Bao'an Dist., Shenzhen
Manufacturer:	Gainstrong Industry Co., Ltd
Address of Manufacturer:	3rd Floor, 1st Building, Block E, Minzhu West Industrial Zone, Bao'an Dist., Shenzhen

5.2 General Description of E.U.T.

Product Name:	Mini wireless router
Model No.:	oolite-minibox V1.0
Additional Model No.:	MB150R, MB150RU, MiniBox V1.0,
Trade mark:	N/A
Operation Frequency:	2412MHz~2462MHz (802.11b/802.11g/802.11n(H20)) 2422MHz~2452MHz (802.11n(H40))
Channel numbers:	11 for 802.11b/802.11g/802.11n(H20) 7 for 802.11n(H40)
Channel separation:	5MHz
Modulation technology: (IEEE 802.11b)	Direct Sequence Spread Spectrum (DSSS)
Modulation technology: (IEEE 802.11g/802.11n)	Orthogonal Frequency Division Multiplexing(OFDM)
Data speed (IEEE 802.11b):	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Data speed (IEEE 802.11g):	6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps,54Mbps
Data speed (IEEE 802.11n):	Up to 135Mbps
Antenna Type:	Internal Antenna
Antenna gain:	3 dBi
AC adapter:	--
Power supply:	DC 5V from USB port

Operation Frequency each of channel For 802.11b/g/n(H20)							
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		

Operation Frequency each of channel For 802.11n(H40)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
		4	2427MHz	7	2442MHz		
		5	2432MHz	8	2447MHz		
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:

802.11b/802.11g/802.11n (H20)

Channel	Frequency
The lowest channel	2412MHz
The middle channel	2437MHz
The Highest channel	2462MHz

802.11n (H40)

Channel	Frequency
The lowest channel	2422MHz
The middle channel	2437MHz
The Highest channel	2452MHz

5.3 Measurement uncertainty

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

No.	Item	Uncertainty
1	Conducted Emission	±3.28dB
2	RF power,conducted	±0.12dB
3	Spurious emissions,conducted	±0.11dB
4	All emissions,radiated(<1G)	±4.88dB
5	All emissions,radiated(>1G)	±4.88dB
6	Temperature	±0.5°C
7	Humidity	±2%

5.4 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test mode:	
Operation mode	Keep the EUT in continuous transmitting with modulation
The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

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

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

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

Final Test Mode:

According to ANSI C63.4 standards, the test results are both the “worst case” and “worst setup” 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20) and 13.5 Mbps for 802.11n(H40). Duty cycle setting during the transmission is 98.5% with maximum power setting for all modulations.

5.5 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
Lenovo	Notebook	G485	LB00402300	N/A
FICO	Adapter	JD-050200	N/A	N/A

5.6 Laboratory Facility

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

● **FCC - Registration No.: 572331**

Shenzhen TCT Testing Technology Co., Ltd., Shenzhen EMC Laboratory: Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

● **IC - Registration No.: 10668A-1**

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

● **CNAS - Registration No.: CNAS L6165**

Shenzhen TCT Testing Technology Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6165.

5.7 Laboratory Location

Shenzhen Tongce Testing Lab

Address: 1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China

Tel: 13410377511

Fax: --

5.8 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
1	ESPI Test Receiver	ROHDE&SCHWARZ	ESVD	100008	Sep.17, 2014	Sep.16, 2015
2	Spectrum Analyzer	ROHDE&SCHWARZ	FSEM	848597/001	Sep.17, 2014	Sep.16, 2015
3	Spectrum Analyzer	ROHDE&SCHWARZ	FSU3	1166.1660.03	Sep.17, 2014	Sep.16, 2015
4	Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep.17, 2014	Sep.16, 2015
5	Pre-amplifier	HP	8447D	2727A05017	Sep.17, 2014	Sep.16, 2015
6	Loop antenna	ZHINAN	ZN30900A	12024	Dec.15, 2014	Dec.14, 2015
7	Broadband Antenna	Schwarzbeck	VULB9163	340	Sep.17, 2014	Sep.16, 2015
8	Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep.17, 2014	Sep.16, 2015
9	Loop antenna	ZHINAN	ZN30900A	12024	Dec.15, 2014	Dec.14, 2015
10	Coax cable	TCT	N/A	N/A	Sep.14, 2014	Sep.15, 2015
11	Coax cable	TCT	N/A	N/A	Sep.14, 2014	Sep.15, 2015
12	Coax cable	TCT	N/A	N/A	Sep.14, 2014	Sep.15, 2015
13	Coax cable	TCT	N/A	N/A	Sep.14, 2014	Sep.15, 2015
14	EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A	N/A

Conducted Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
1	EMI Test Receiver	R&S	ESCS30	100139	Sep.17, 2014	Sep.16, 2015
2	LISN-1	AFJ	LS16C	16010947251	Sep.17, 2014	Sep.16, 2015
3	LISN-2	Schwarzbeck	NSLK 8126	8126453	Sep.17, 2014	Sep.16, 2015
4	Coax cable	TCT	N/A	164080	Sep.17, 2014	Sep.16, 2015
5	EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A	N/A

Conducted method test:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
1	Spectrum Analyzer	ROHDE&SCHWARZ	FSU3	200054	Sep.17, 2014	Sep.16, 2015
2	Spectrum Analyzer	Agilent	N9020A	MY49100060	Oct. 22, 2014	Oct. 23, 2015
3	Pulse Power Senor	Anritsu	MA2411B	0917070	Dec. 12 2014	Dec. 11, 2015
4	Power Meter	Anritsu	ML2495A	1005002	Dec. 12 2014	Dec. 11, 2015

6. Test results and Measurement Data

6.1 Antenna requirement:

Standard requirement:	FCC Part15 C Section 15.203 /247(c)

15.203 requirement:

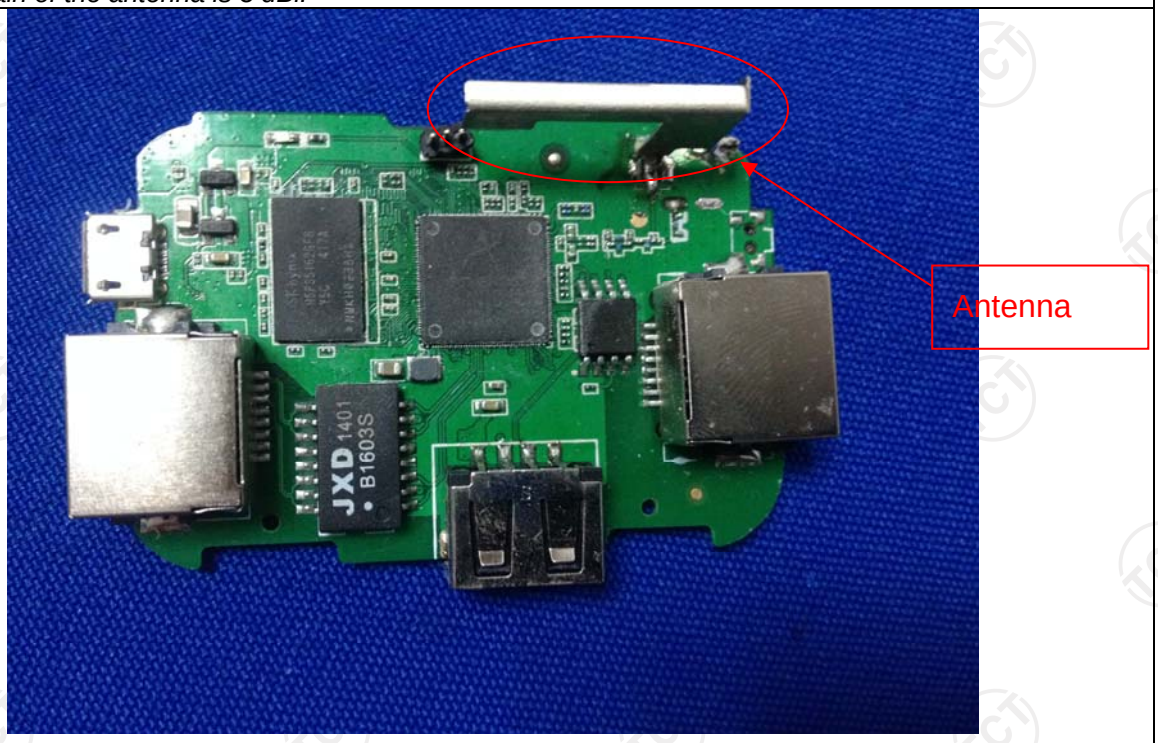
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit 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:

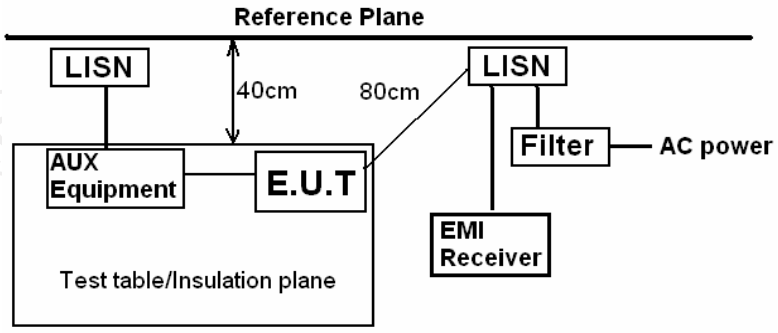
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

E.U.T Antenna:	

The antenna is one built-in smart omnidirectional antenna which cannot replace by end-user, the best case gain of the antenna is 3 dBi.

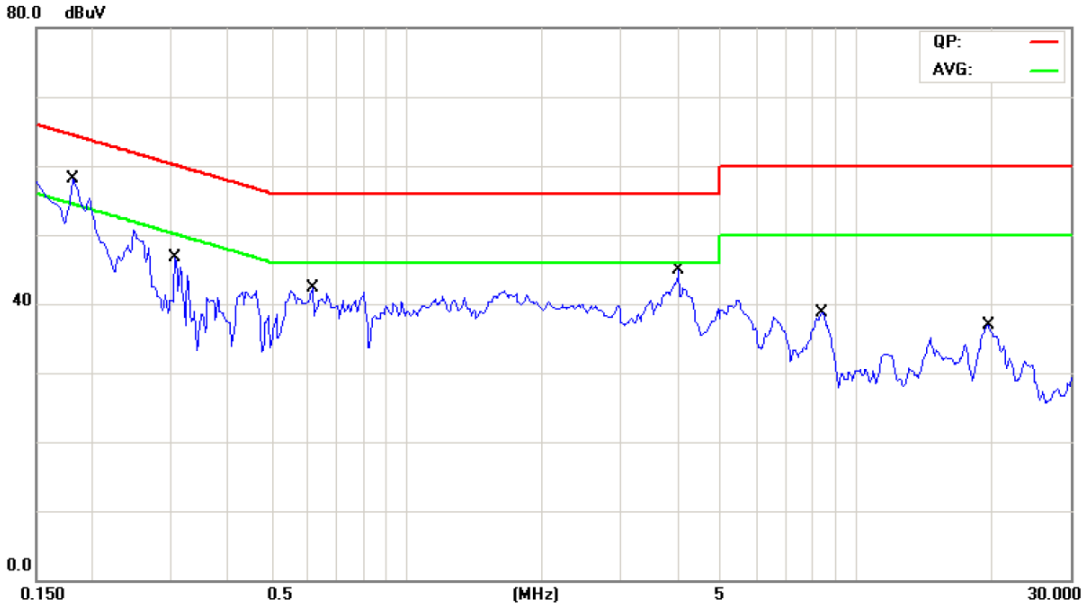


6.2 Conducted Emission

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.4: 2003
Test Frequency Range:	150 kHz to 30 MHz
Class / Severity:	Class B
Receiver setup:	RBW=9 kHz, VBW=30 kHz
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 procedure	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.), which 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 C63.4: 2003 on conducted measurement.
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.4 for details
Test results:	Passed

Measurement Data

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)

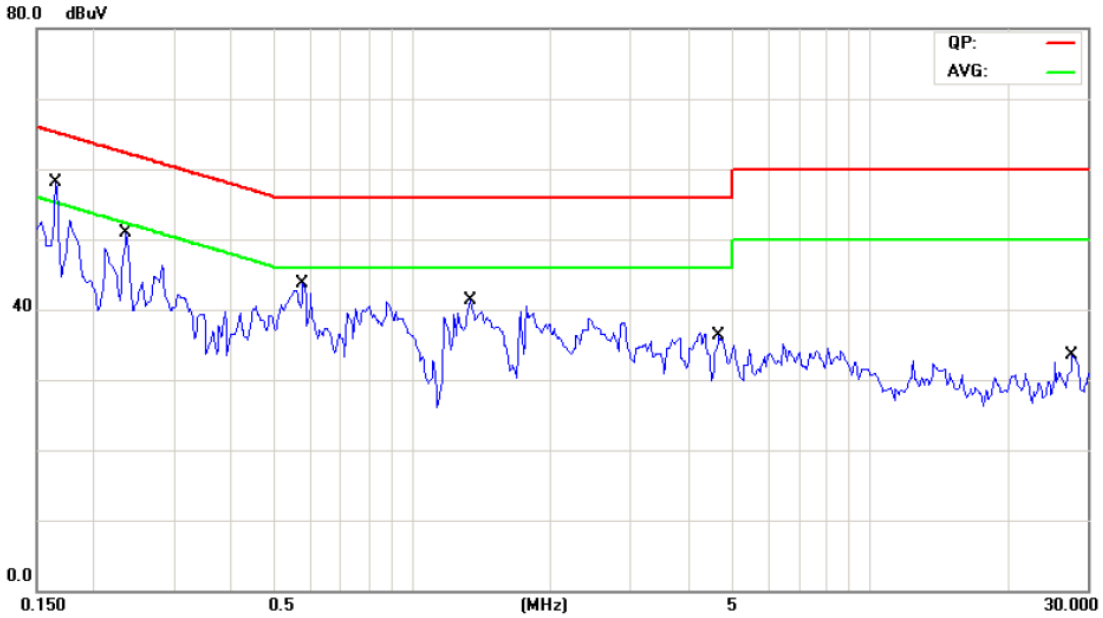


Site Chamber #1 Phase: *N* Temperature: 26 (C)

Limit: FCC PART15 Conduction(QP) Power: AC 120V/60Hz Humidity: 51 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1812	43.15	10.47	53.62	64.43	-10.81	QP	
2		0.1812	25.37	10.47	35.84	54.43	-18.59	AVG	
3		0.3063	30.46	10.26	40.72	60.07	-19.35	QP	
4		0.3063	15.69	10.26	25.95	50.07	-24.12	AVG	
5		0.6188	25.50	10.62	36.12	56.00	-19.88	QP	
6		0.6188	10.40	10.62	21.02	46.00	-24.98	AVG	
7		4.0430	29.00	10.94	39.94	56.00	-16.06	QP	
8		4.0430	15.30	10.94	26.24	46.00	-19.76	AVG	
9		8.4063	24.52	11.04	35.56	60.00	-24.44	QP	
10		8.4063	16.01	11.04	27.05	50.00	-22.95	AVG	
11		19.7344	18.71	11.07	29.78	60.00	-30.22	QP	
12		19.7344	10.29	11.07	21.36	50.00	-28.64	AVG	

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



Site Chamber #1 Phase: *L1* Temperature: 26 (C)

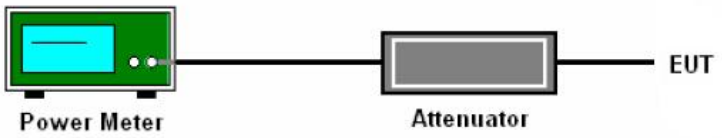
Limit: FCC PART15 Conduction(QP) Power: AC 110V/60Hz Humidity: 51 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1655	36.21	10.60	46.81	65.18	-18.37	QP	
2		0.1655	15.37	10.60	25.97	55.18	-29.21	AVG	
3		0.2359	31.29	10.42	41.71	62.24	-20.53	QP	
4		0.2359	16.09	10.42	26.51	52.24	-25.73	AVG	
5		0.5757	26.25	10.62	36.87	56.00	-19.13	QP	
6	*	0.5757	18.15	10.62	28.77	46.00	-17.23	AVG	
7		1.3375	23.47	10.59	34.06	56.00	-21.94	QP	
8		1.3375	17.11	10.59	27.70	46.00	-18.30	AVG	
9		4.6953	20.13	10.95	31.08	56.00	-24.92	QP	
10		4.6953	15.40	10.95	26.35	46.00	-19.65	AVG	
11		27.7422	12.44	10.70	23.14	60.00	-36.86	QP	
12		27.7422	6.52	10.70	17.22	50.00	-32.78	AVG	

Notes:

1. An initial pre-scan was performed on the line and neutral terminal of the power line with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + Correct Factor
4. * is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

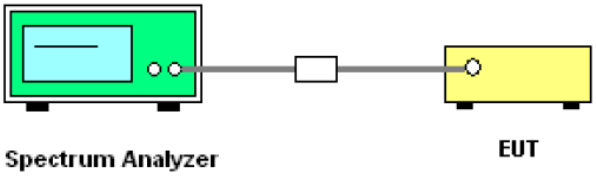
6.3 Conducted Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.4:2003 and KDB558074
Limit:	30dBm
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test procedure:	1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r02. 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Measure the conducted output power and record the results in the test report.
Test results:	Passed

Measurement Data

Test CH	Maximum Conducted Output Power (dBm)				Limit(dBm)	Result
	802.11b	802.11g	802.11n(H20)	802.11n(H40)		
Lowest	17.02	16.53	16.24	16.20	30.00	Pass
Middle	**17.45**	17.24	17.08	16.84		
Highest	16.33	16.43	16.30	16.71		

6.4 Emission Bandwidth

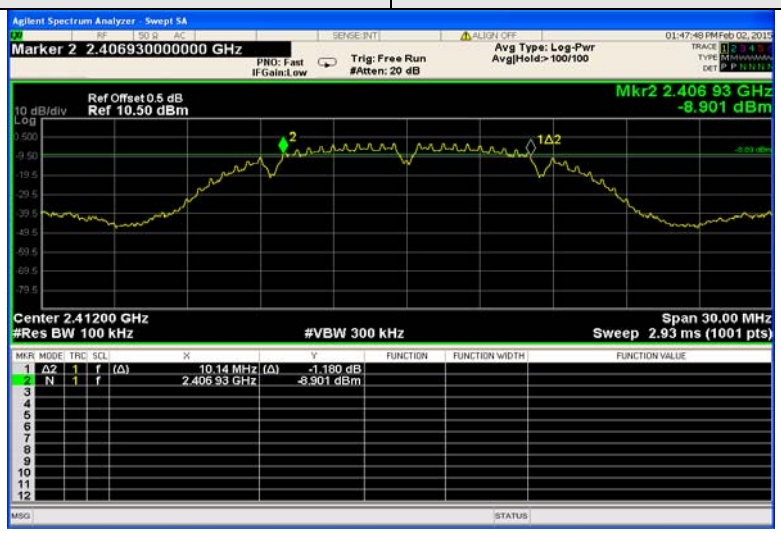
Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.4:2003 and KDB558074
Limit:	>500kHz
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test procedure:	1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v03r02. 2. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v03r02. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz. 5. Measure and record the results in the test report.
Test results:	Passed

Measurement Data

Test CH	6dB Emission Bandwidth (MHz)				Limit(kHz)	Result
	802.11b	802.11g	802.11n(H20)	802.11n(H40)		
Lowest	10.14	16.41	17.61	36.24	>500	Pass
Middle	10.14	16.38	17.61	36.42		
Highest	10.14	16.38	17.55	36.42		

Test plot as follows:

Test mode:	802.11b

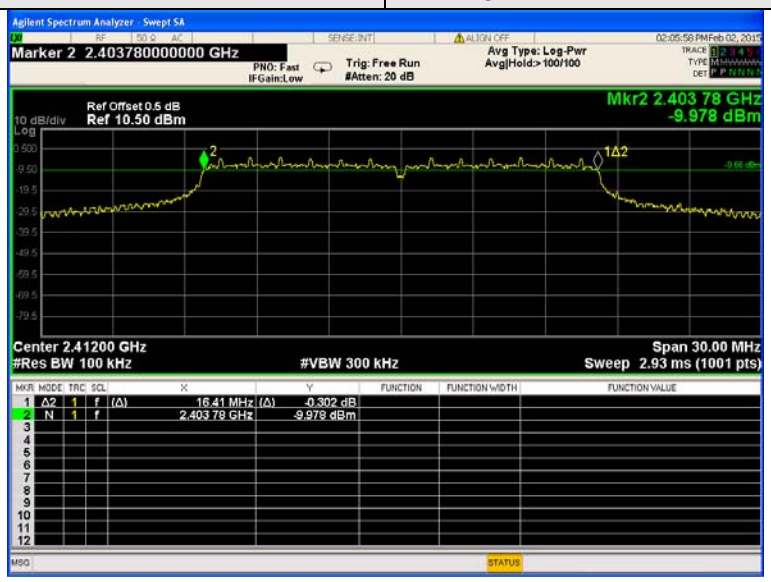


Lowest channel

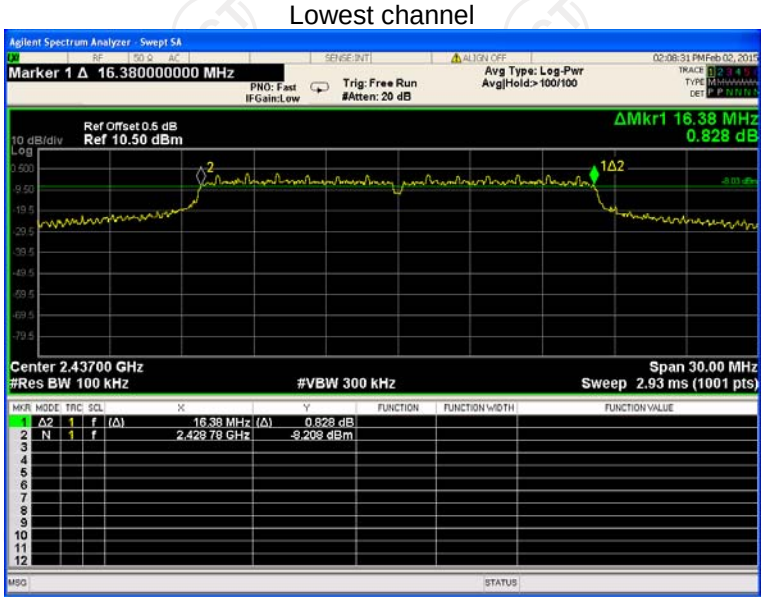
Middle channel

Highest channel

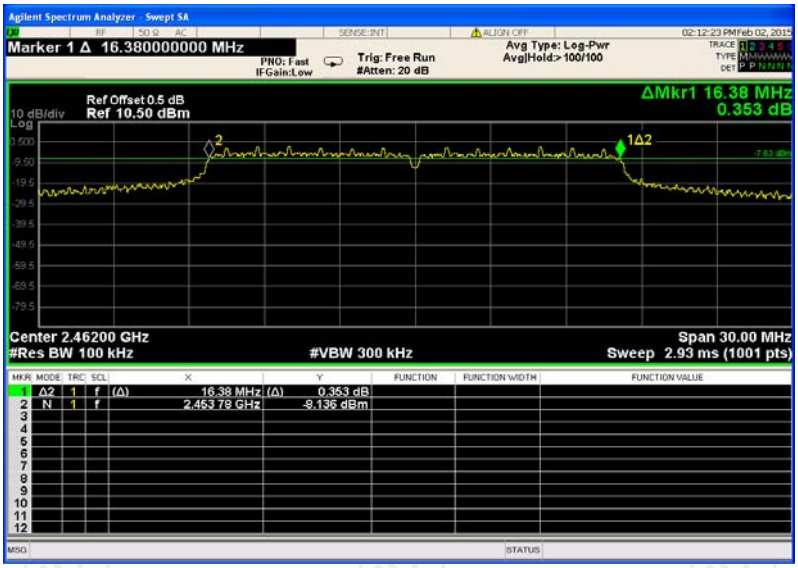
Test mode:	802.11g



Lowest channel

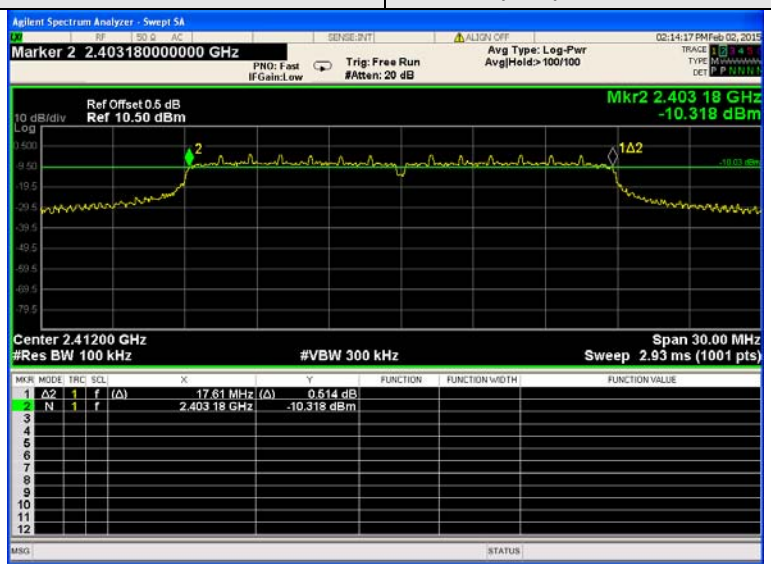


Middle channel

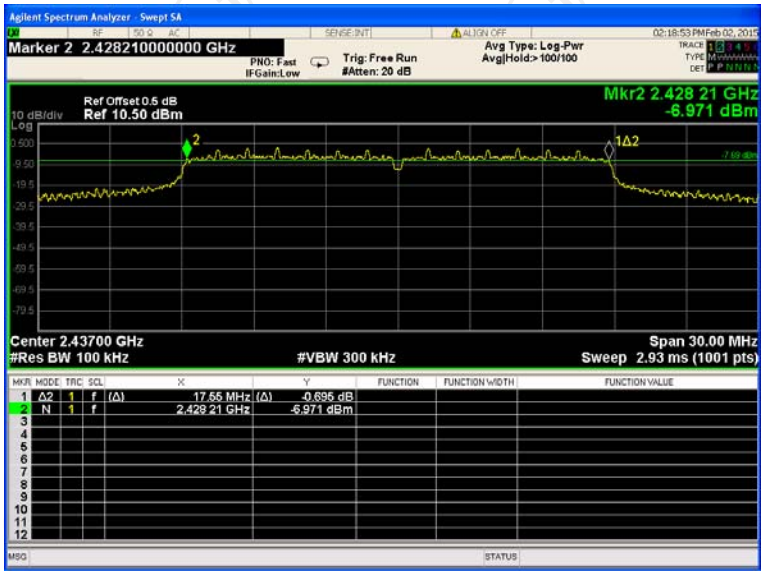


Highest channel

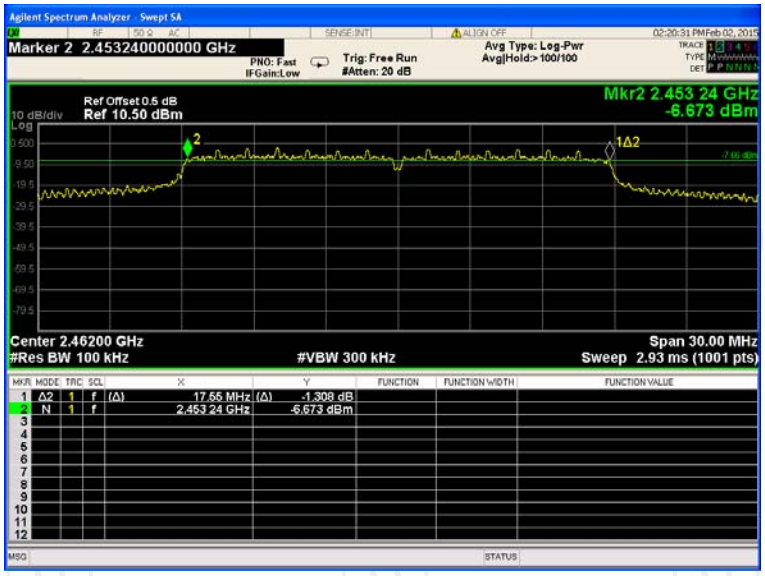
Test mode:	802.11n(H20)



Lowest channel

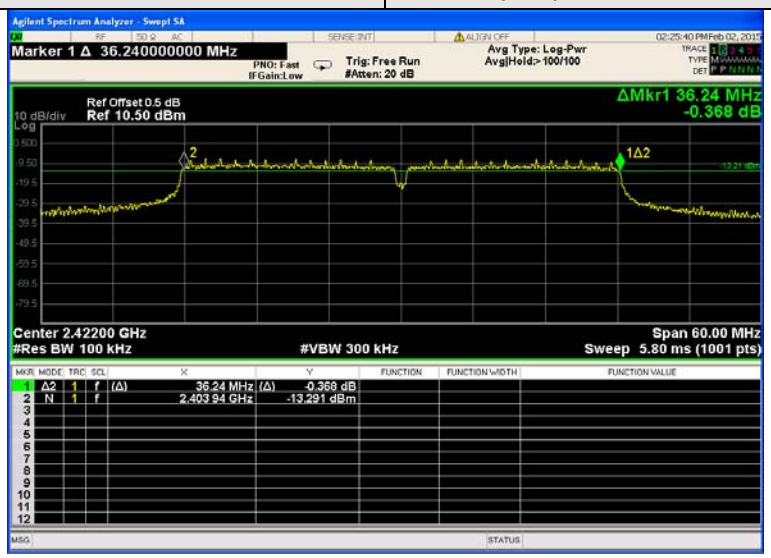


Middle channel

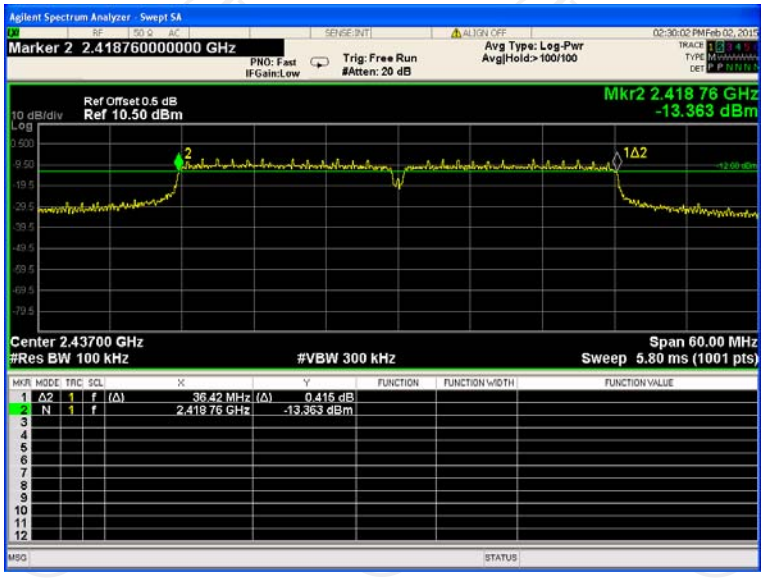


Highest channel

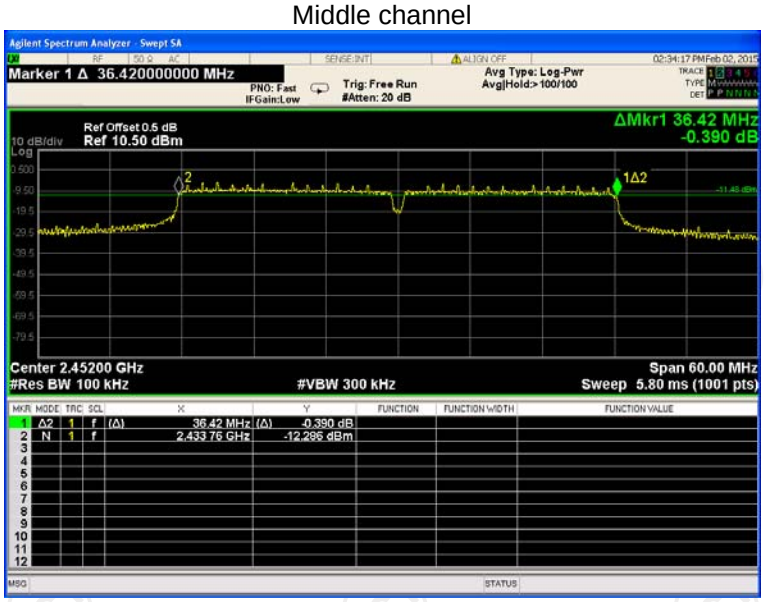
Test mode:	802.11n(H40)



Lowest channel

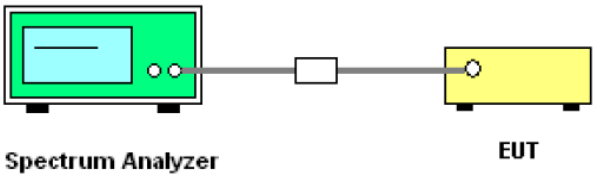


Middle channel



Highest channel

6.5 Power Spectral Density

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	ANSI C63.4:2003 and KDB558074
Limit:	The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No.558074 D01 DTS Meas. Guidance v03r02 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW) 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level. 6. Measure and record the results in the test report.
Test results:	Passed

Measurement Data

Test CH	Power Spectral Density (dBm)				Limit(dBm)	Result
	802.11b	802.11g	802.11n(H20)	802.11n(H40)		
Lowest	-17.13	-18.24	-17.71	-21.45	8.00	Pass
Middle	-18.65	-16.98	-17.70	-20.73		
Highest	-14.88	-16.58	-16.33	-21.16		

Test plot as follows:

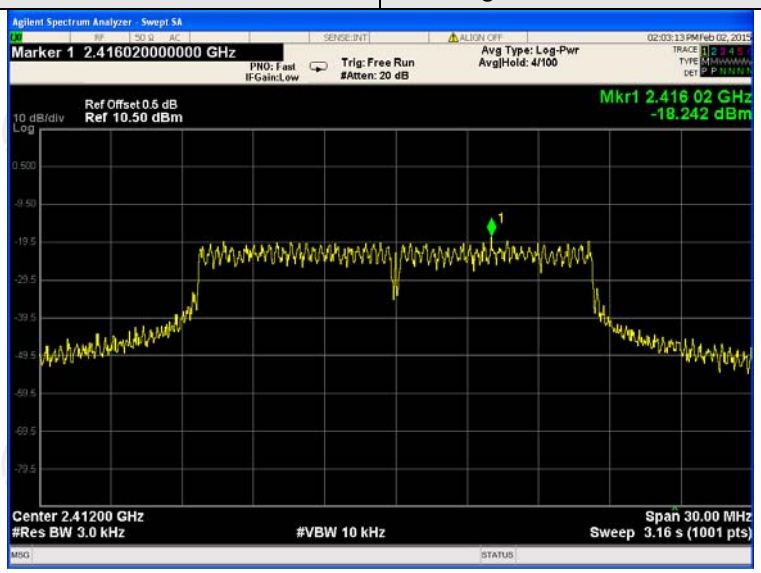
Test mode:	802.11b

Lowest channel

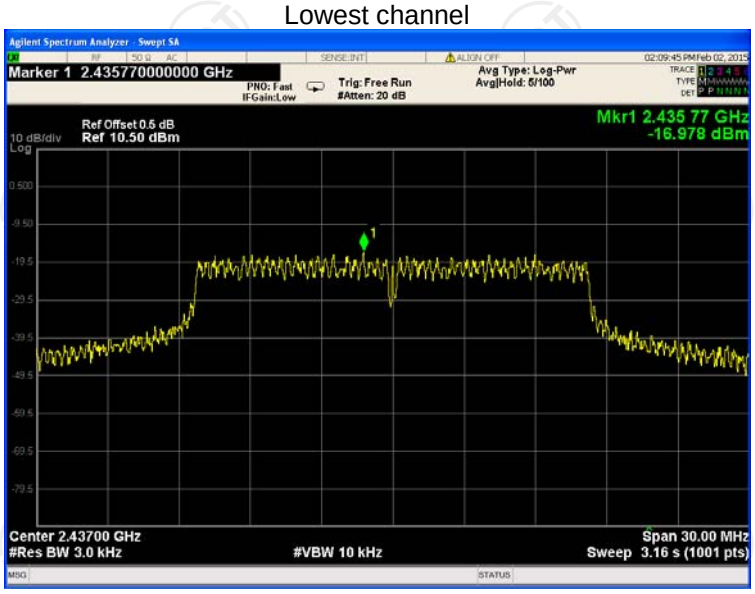
Middle channel

Highest channel

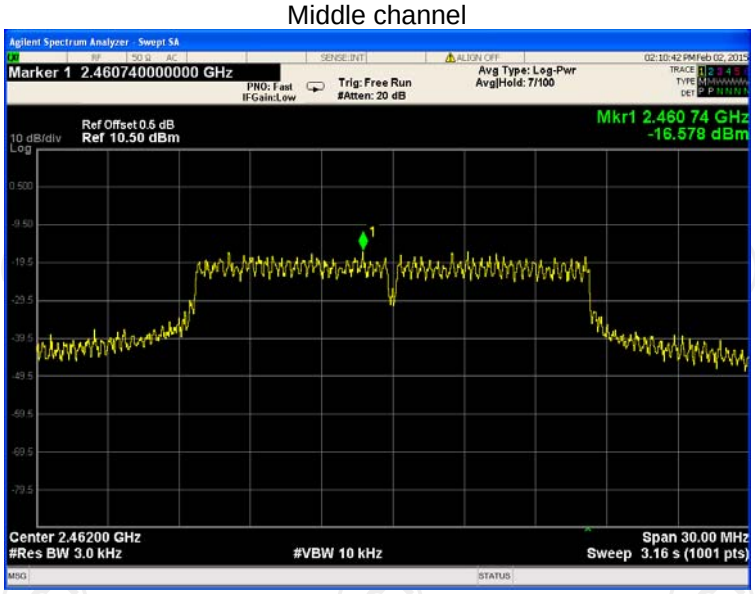
Test mode:	802.11g



Lowest channel

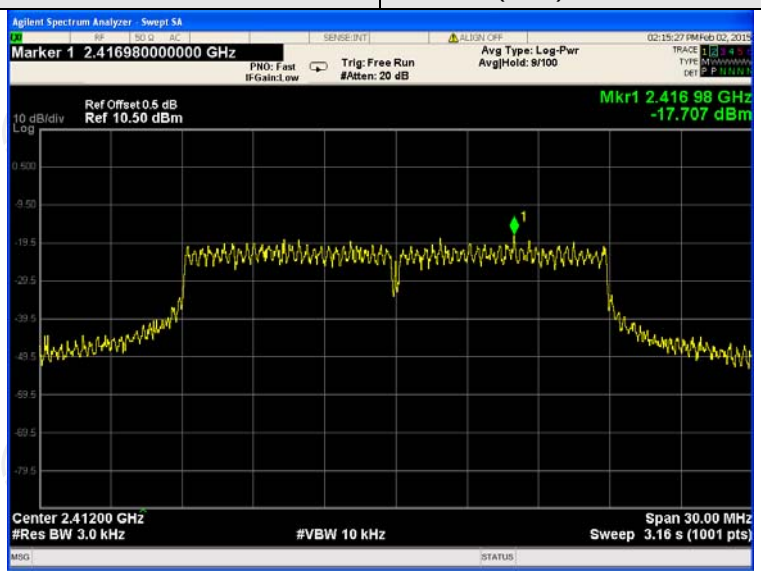


Middle channel

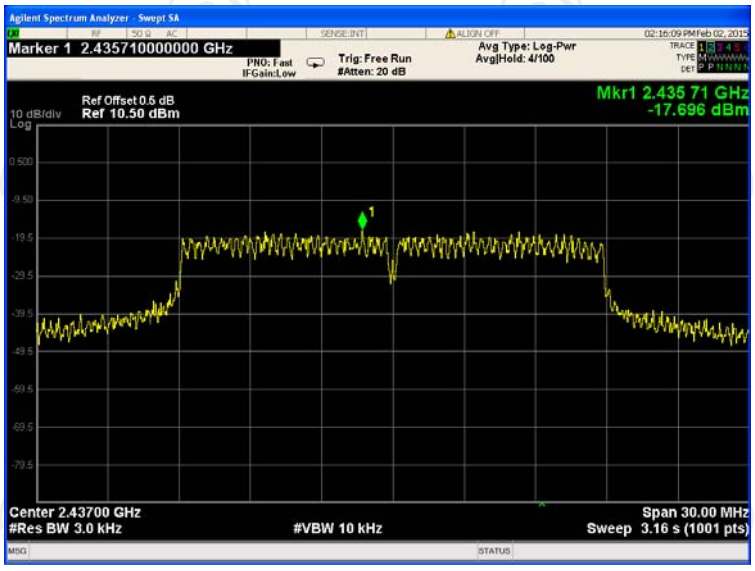


Highest channel

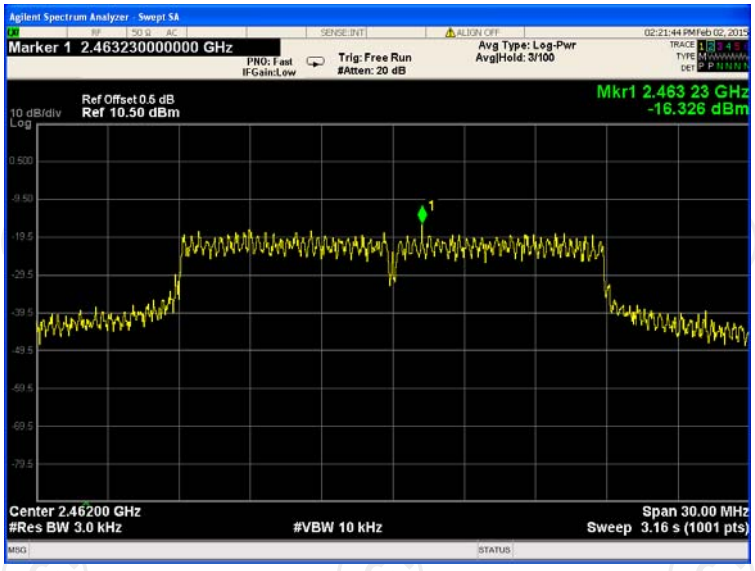
Test mode:	802.11n(H20)



Lowest channel

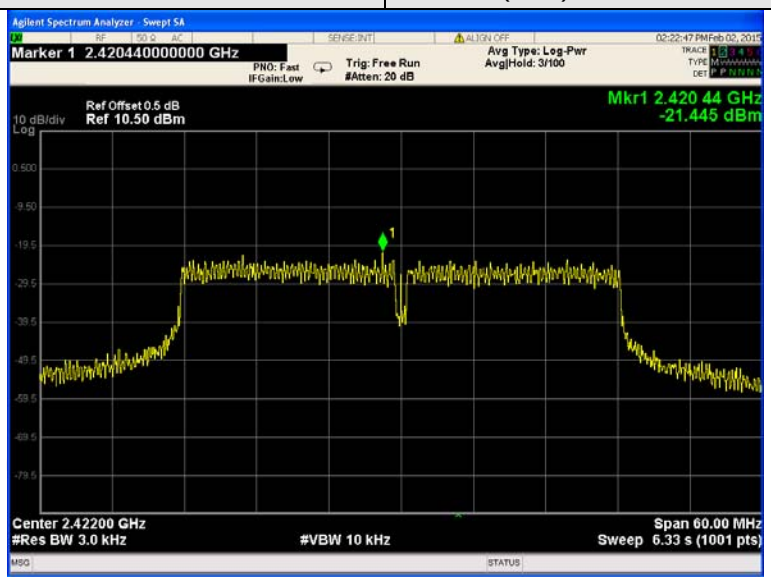


Middle channel

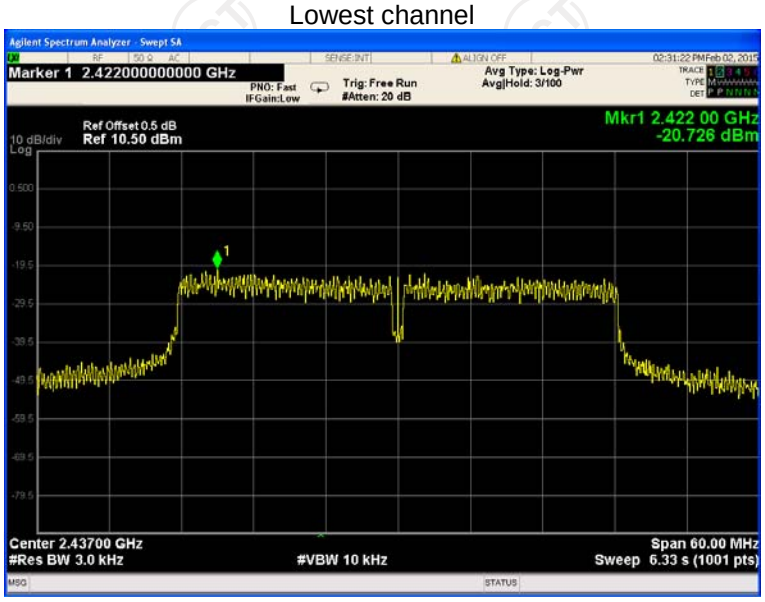


Highest channel

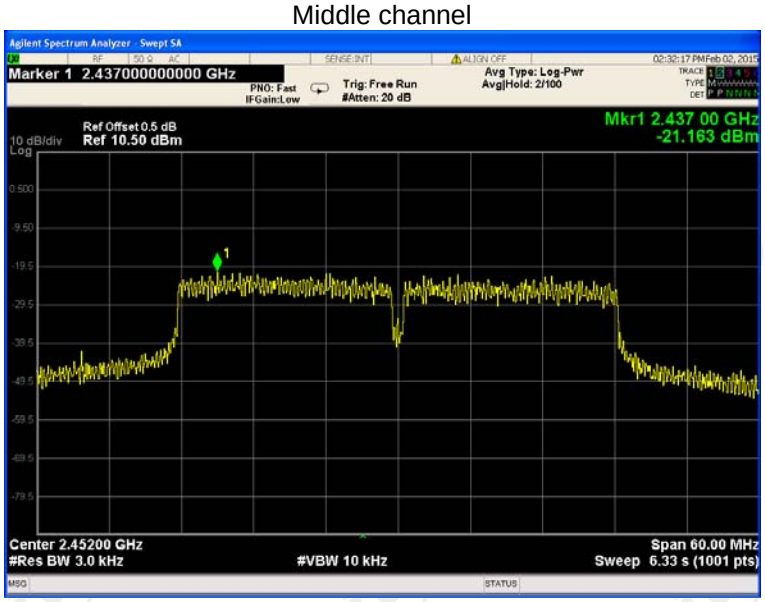
Test mode:	802.11n(H40)



Lowest channel



Middle channel



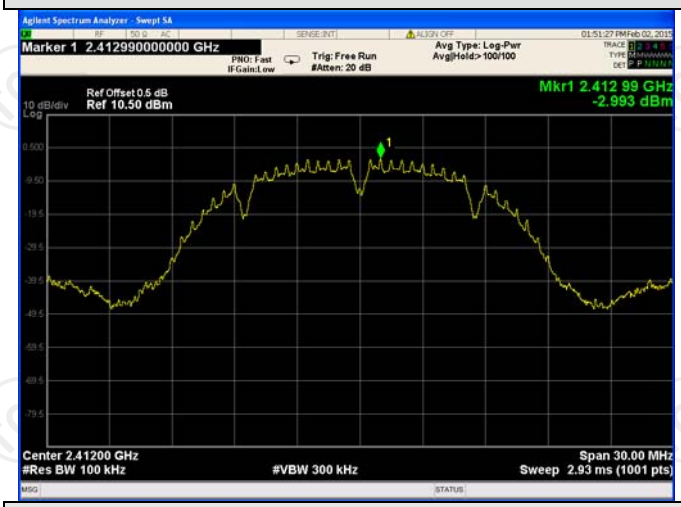
Highest channel

6.6 Conducted Band Edges and Spurious Emission Measurement

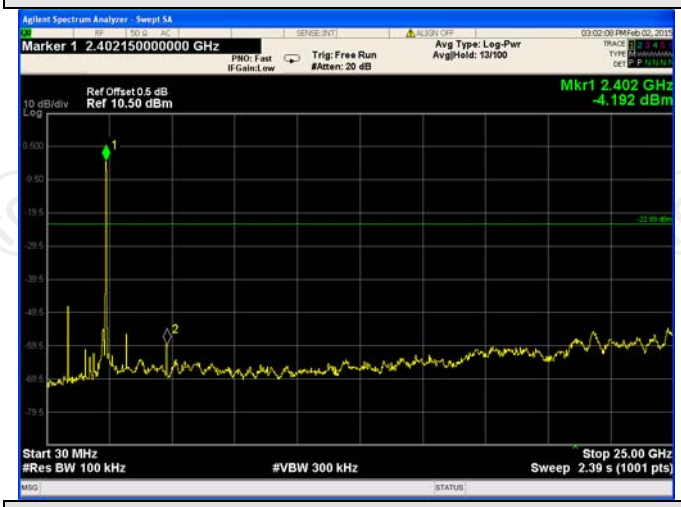
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.4:2003 and KDB558074
Limit:	In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test procedure:	1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d). 5. Measure and record the results in the test report. 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test results:	Passed

Test plot as follows:

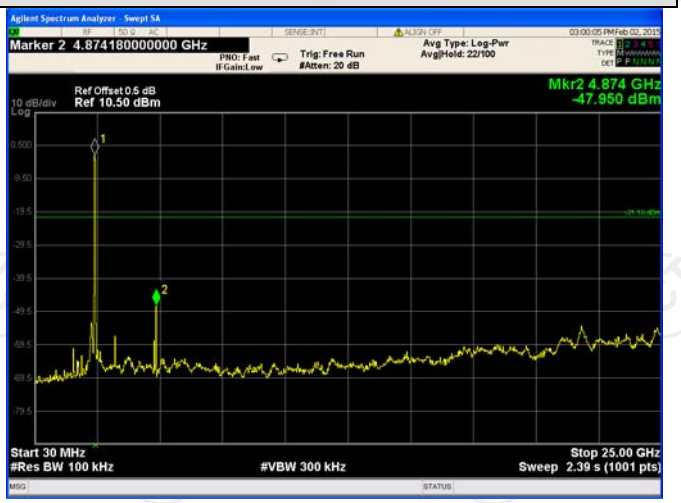
Test mode:	802.11b Band Edge
100kHz PSD reference Level	Low Channel Plot



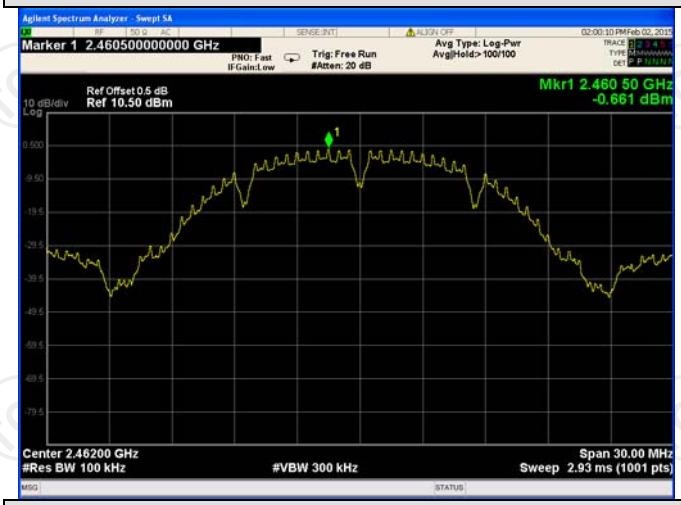
Spurious emission	



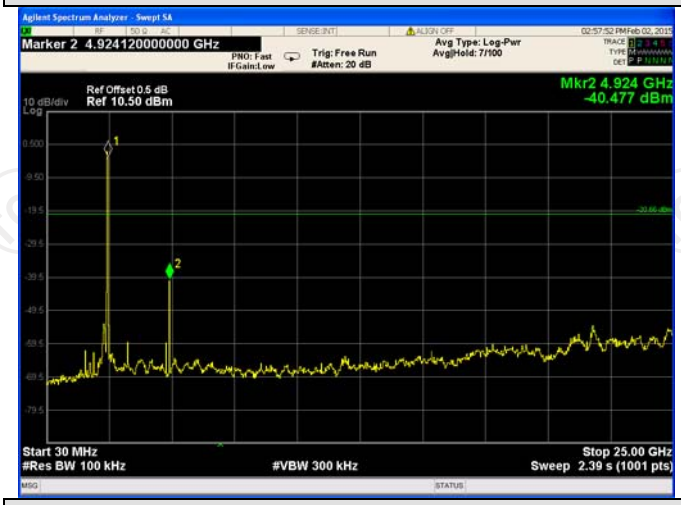
Test mode:	802.11b Spurious emission
100kHz PSD reference Level	Middle Channel Plot



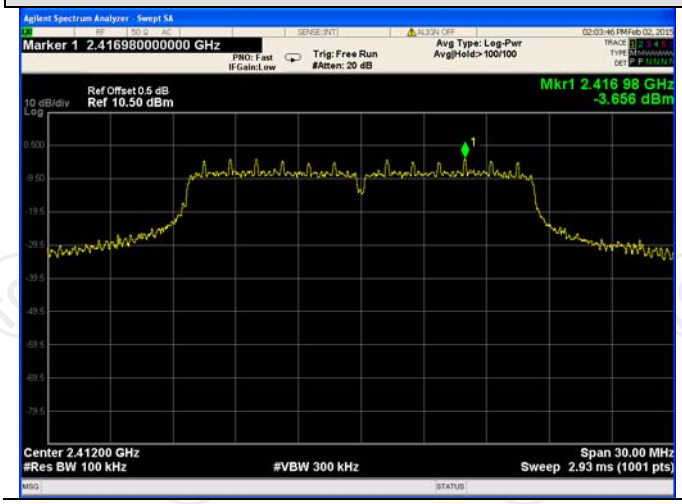
Test mode:	802.11b Band Edge
100kHz PSD reference Level	High Channel Plot



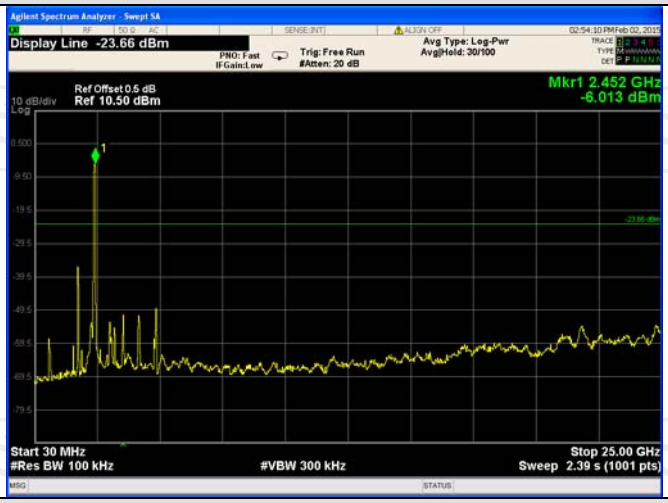
Spurious emission	



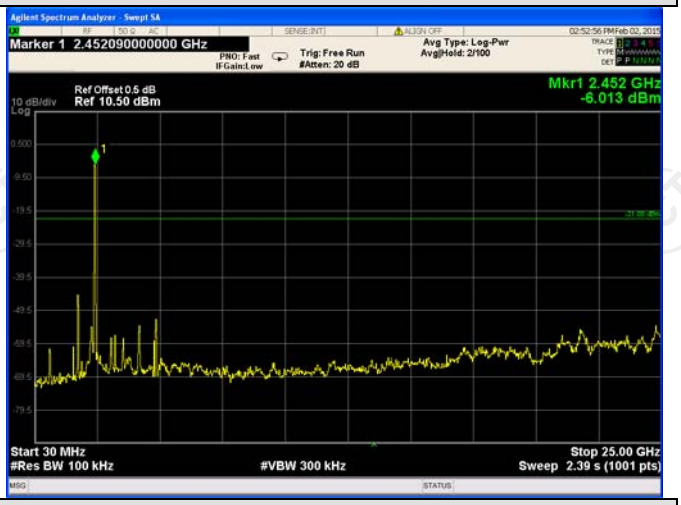
Test mode:	802.11g Band Edge
100kHz PSD reference Level	Low Channel Plot



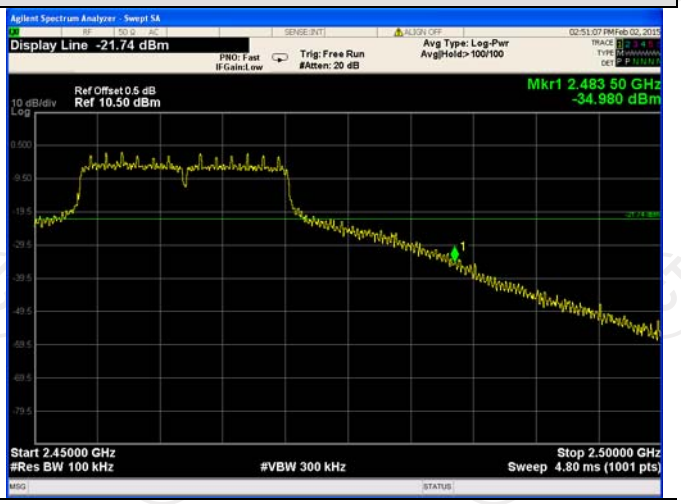
Spurious emission	

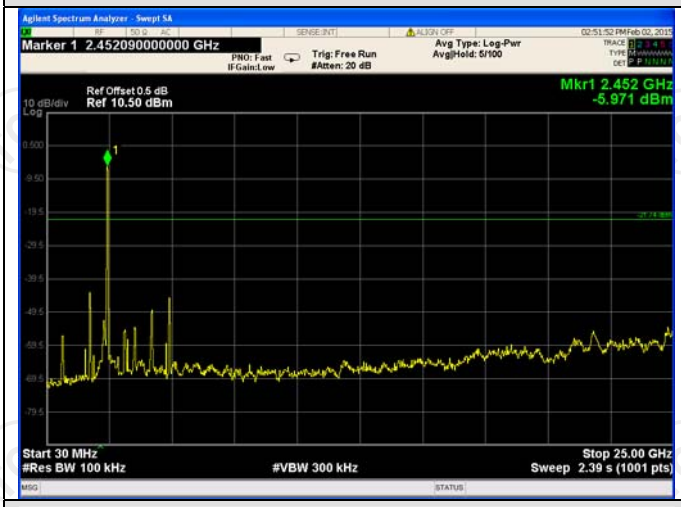
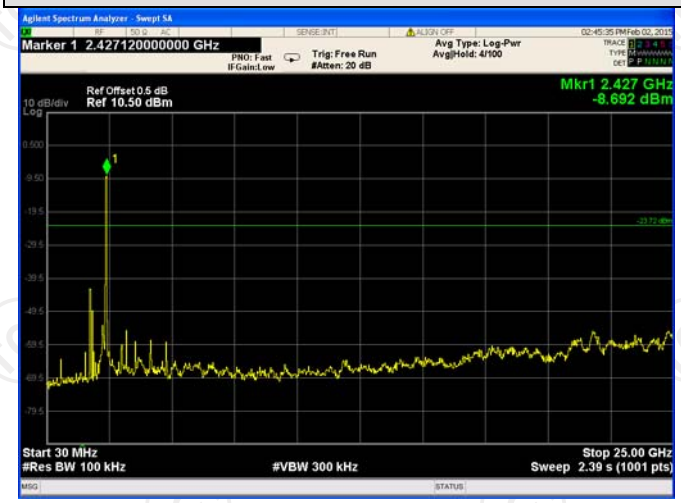


Test mode:	802.11g Spurious emission
100kHz PSD reference Level	Middle Channel Plot

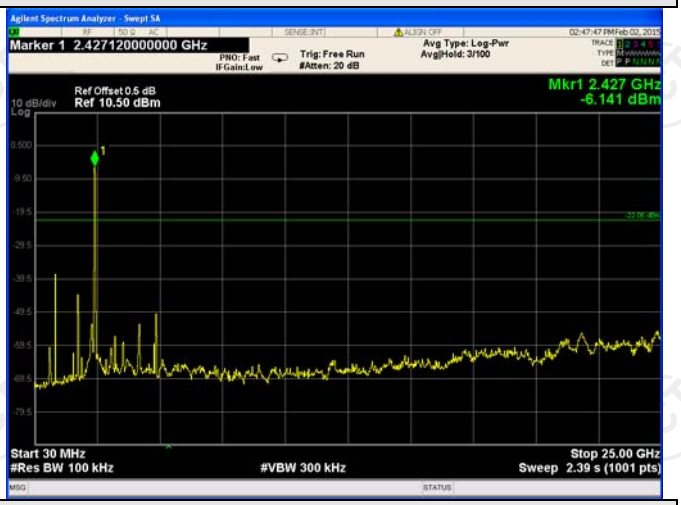


Test mode:	802.11g Band Edge
100kHz PSD reference Level	High Channel Plot

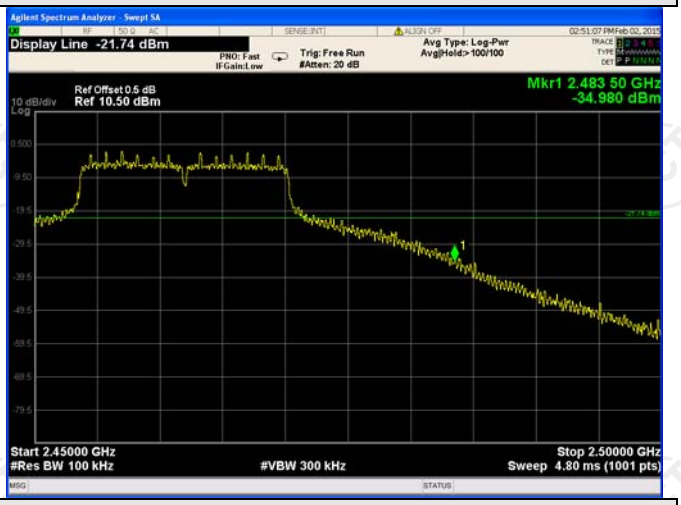


Spurious emission	
	
Test mode:	802.11n(HT20) Band Edge
100kHz PSD reference Level	Low Channel Plot
	
Spurious emission	
	

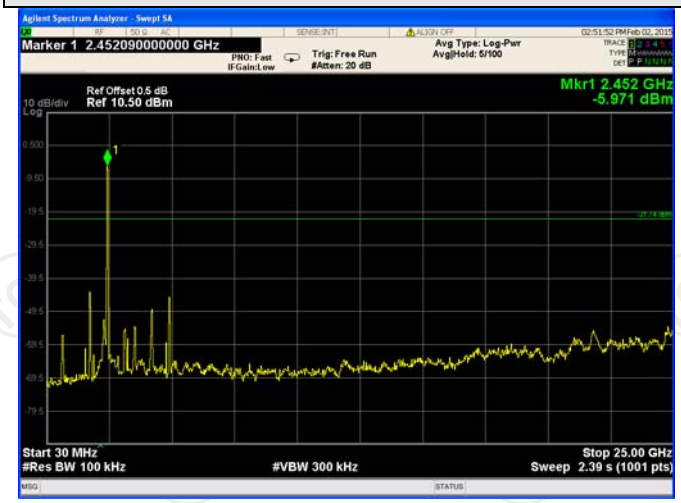
Test mode:	802.11n(HT20) Spurious emission
100kHz PSD reference Level	Middle Channel Plot



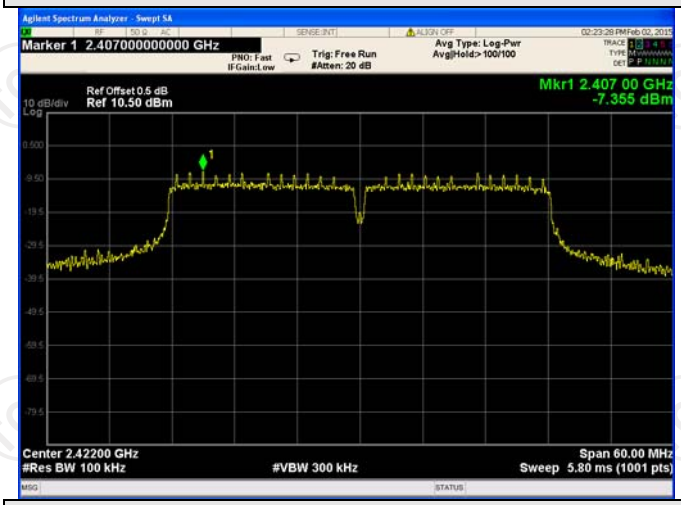
Test mode:	802.11n(HT20) Band Edge
100kHz PSD reference Level	High Channel Plot



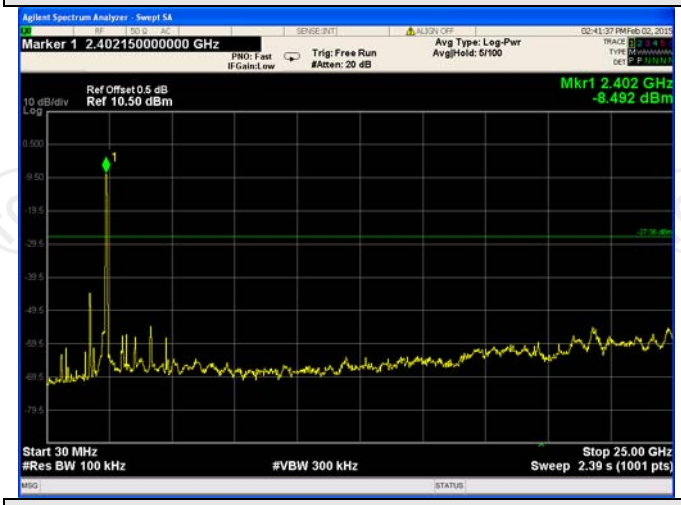
Spurious emission	



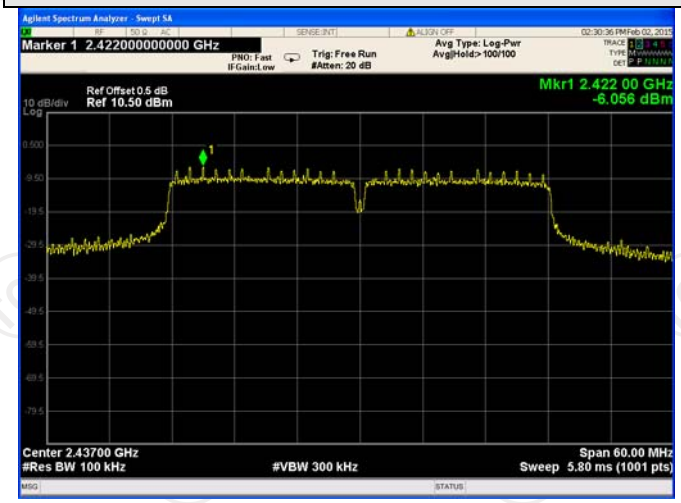
Test mode:	802.11n(HT40) Band Edge
100kHz PSD reference Level	Low Channel Plot

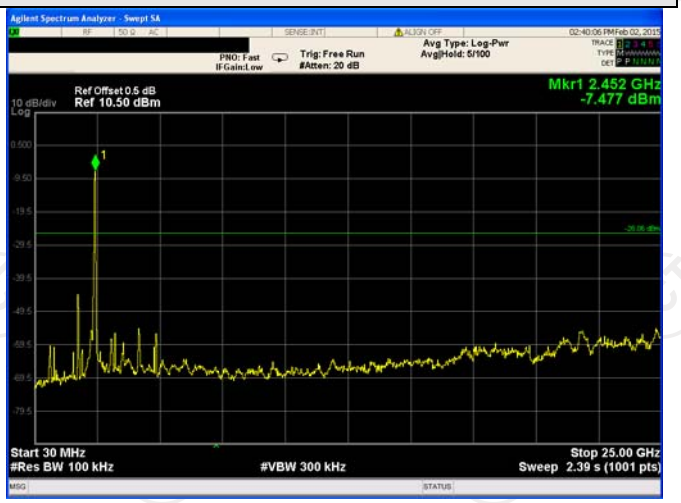


Spurious emission	

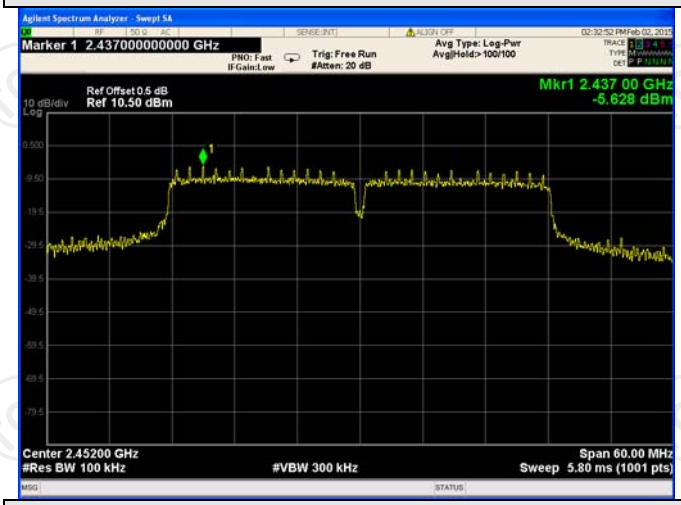


Test mode:	802.11n(HT40) Spurious emission
100kHz PSD reference Level	Middle Channel Plot

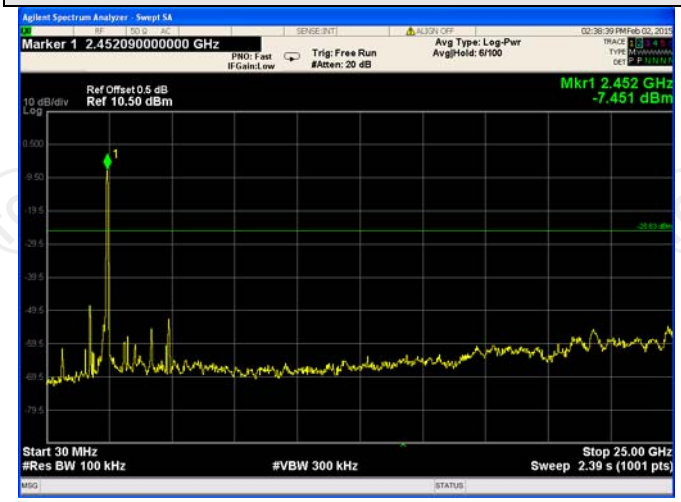




Test mode:	802.11n(HT40) Band Edge
100kHz PSD reference Level	High Channel Plot

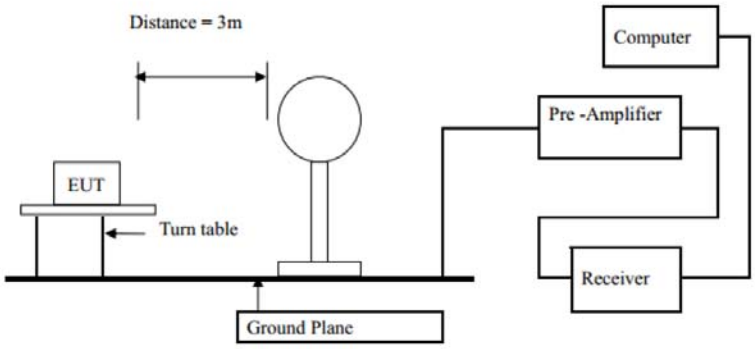
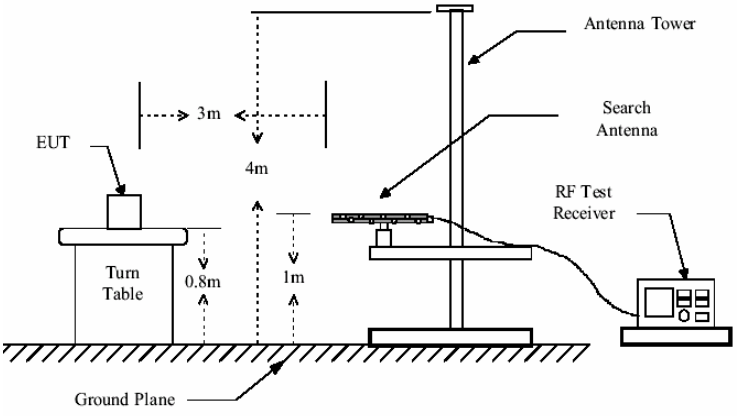
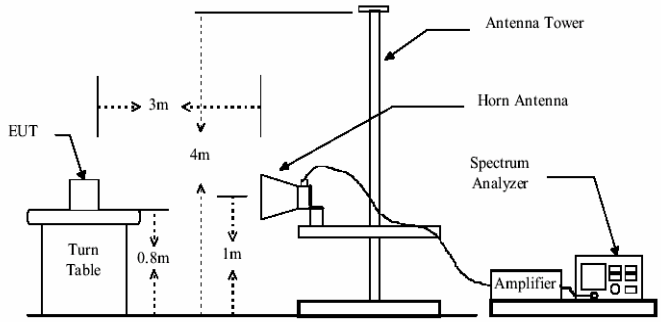


Spurious emission	



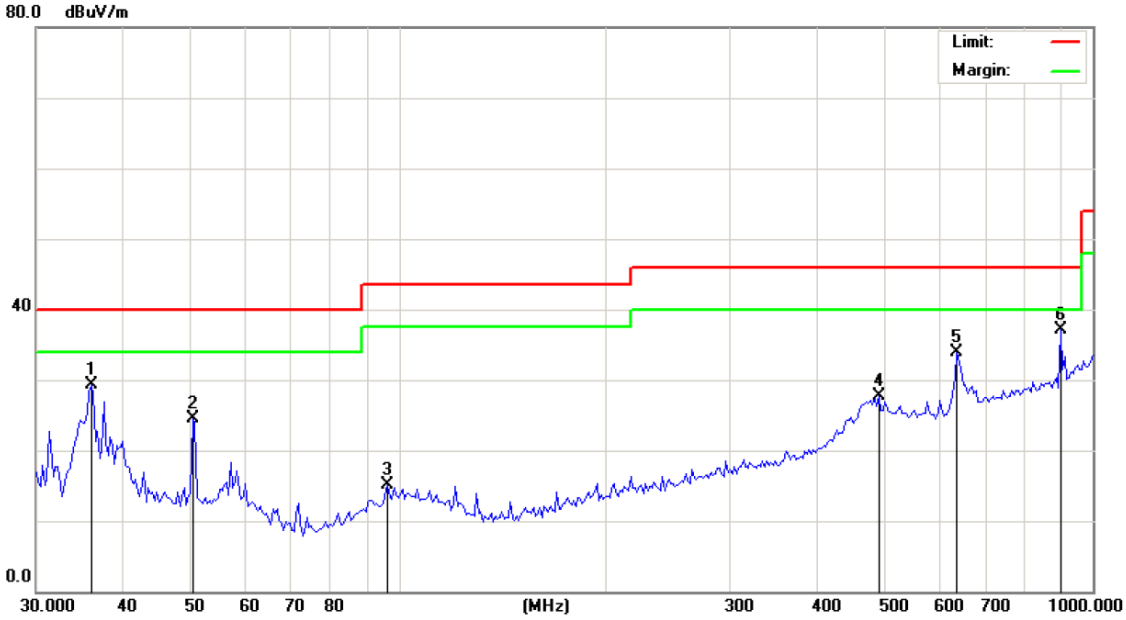
6.7 Radiated Band Edges and Spurious Emission Measurement

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.4:2003</td></tr>
<tr><td>Test Frequency Range:</td><td>9KHz to 25GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td>30MHz-88MHz</td><td>40.0</td><td>Quasi-peak Value</td></tr>
<tr><td>88MHz-216MHz</td><td>43.5</td><td>Quasi-peak Value</td></tr>
<tr><td>216MHz-960MHz</td><td>46.0</td><td>Quasi-peak Value</td></tr>
<tr><td>960MHz-1GHz</td><td>54.0</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>54.0</td><td>Average Value</td></tr>
<tr><td>74.0</td><td>Peak Value</td></tr>
</table>
</td></tr>
<tr><td>Test Procedure:</td><td>1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings:
(1) Span shall wide enough to fully capture the emission being measured;
(2) Set RBW=100 kHz for f < 1 GHz; VBW ≥RBW; Sweep = auto; Detector function = peak; Trace = max hold;
(3) Set RBW = 1 MHz, VBW= 3MHz for f 1 GHz for peak measurement.
For average measurement:
• VBW = 10 Hz, when duty cycle is no less than 98 percent.
• VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.</td></tr>
</table>

Test setup:	For radiated emissions below 30MHz  30MHz to 1GHz  Above 1GHz 
Test Instruments:	Refer to section 4.7for details
Test results:	Passed
Remark:	1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 2. 9 kHz to 30MHz is too low, the emission levels are 20 dB below the limit value, so only shows the data of above 30MHz in this report. 3. Above 13G the signal is too low, which is much less than the limit, no necessary take down the records

Below 1GHz

Horizontal ：



Site

Polarization: ***Horizontal***

Temperature: 23

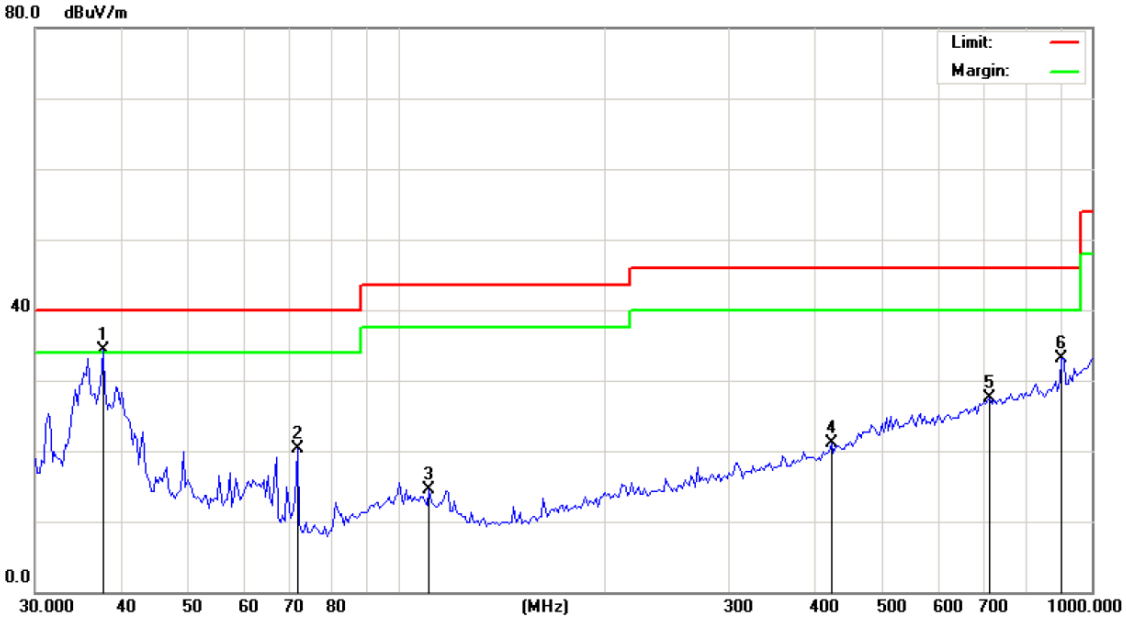
Limit: FCC Part 15B Class B RE_3 m

Power: AC 120V

Humidity: 52 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		36.0140	42.23	-12.97	29.26	40.00	-10.74	peak		0	
2		50.4614	36.51	-12.07	24.44	40.00	-15.56	peak		0	
3		96.3230	27.03	-12.00	15.03	43.50	-28.47	peak		0	
4		491.7700	31.04	-3.24	27.80	46.00	-18.20	peak		0	
5		637.7947	34.97	-1.15	33.82	46.00	-12.18	peak		0	
6	*	899.9577	34.47	2.67	37.14	46.00	-8.86	peak		0	

Vertical ：



Site Polarization: ***Vertical*** Temperature: 23

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	37.5648	47.02	-12.78	34.24	40.00	-5.76	peak		0	
2		71.7054	36.87	-16.47	20.40	40.00	-19.60	peak		0	
3		110.8581	26.58	-12.13	14.45	43.50	-29.05	peak		0	
4		421.3287	26.54	-5.50	21.04	46.00	-24.96	peak		0	
5		713.6917	27.14	0.31	27.45	46.00	-18.55	peak		0	
6		906.3041	30.24	2.89	33.13	46.00	-12.87	peak		0	

Note: Measurements were conducted in all three channels (high, middle, low), and the worst case (11b Middle channel) was submitted only. •

Above 1GHz

IEEE 802.11b mode: Low channel: 2412 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
2387.50	H	65.82	---	-4.20	61.62	---	74.00	54.00	-12.38
2387. 50	H	---	50.31	-4.20	---	46.11	74.00	54.00	-7.89
4824.00	H	46.20	---	-3.94	42.26	---	74.00	54.00	-11.74
7236.00	H	45.00	---	0.52	45.52	---	74.00	54.00	-8.48
---	---	---	---	---	---	---	---	---	---
2387.50	V	68.23	---	-4.20	64.03	---	74.00	54.00	-9.97
2387.50	V	---	51.74	-4.20	---	47.54	74.00	54.00	-6.46
4824.00	V	48.42	---	-3.94	44.48	---	74.00	54.00	-9.52
7236.00	V	45.47	---	0.52	45.99	---	74.00	54.00	-8.01
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IEEE 802.11b mode: Middle channel: 2437 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
4874.00	H	48.78	---	-3.98	44.8	---	74.00	54.00	-9.2
7311.00	H	46.20	---	0.57	46.77	---	74.00	54.00	-7.23
---	---	---	---	---	---	---	---	---	---
4874.00	V	49.64	---	-3.98	45.66	---	74.00	54.00	-8.34
7311.00	V	48.21	---	0.57	48.78	---	74.00	54.00	-5.22
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IEEE 802.11b mode: High channel: 2462 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
2486.58	H	65.43	---	-2.38	63.05	---	74.00	54.00	-10.95
2486.58	H	---	51.56	-2.38	---	49.18	74.00	54.00	-4.82
4924.00	H	50.76	---	-3.98	46.78	---	74.00	54.00	-7.22
7386.00	H	47.42	---	0.57	47.99	---	74.00	54.00	-6.01
---	---	---	---	---	---	---	---	---	---
2483.51	V	69.63	---	-2.38	67.25	---	74.00	54.00	-6.75
2483.51	V	---	50.22	-2.38	---	47.84	74.00	54.00	-6.16
4924.00	V	50.97	---	-3.98	46.99	---	74.00	54.00	-7.01
7386.00	V	46.29	---	0.57	46.86	---	74.00	54.00	-7.14
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Notes: 1) Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.

2) Radiated emissions measured in frequencies above 1GHz were made with peak detector and Average (AV) detector.

3) Average test would be performed if the peak readings were greater than the average limit.

4) Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

5) Emission Level=Peak (AV) Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

6) Margin (dB) = Emission Level (Peak) (dBuV/m)-Average limit (dBuV/m)

IEEE 802.11g mode: Low channel: 2412 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
2389.98	H	73.22	---	-4.20	69.02	---	74.00	54.00	-7.63
2389.98	H	---	52.44	-4.20	---	48.24	74.00	54.00	-5.76
4824.00	H	51.32	---	-3.94	47.38	---	74.00	54.00	-6.62
7236.00	H	49.64	---	0.52	50.16	---	74.00	54.00	-3.84
---	---	---	---	---	---	---	---	---	---
2389.98	V	70.20	---	-4.20	66	---	74.00	54.00	12
2389.98	V	---	49.35	-4.20	---	45.15	74.00	54.00	-8.85
4824.00	V	50.78	---	-3.94	46.84	---	74.00	54.00	-7.16
7236.00	V	44.32	---	0.52	44.84	---	74.00	54.00	-9.16
---	---	---	---	---	---	---	---	---	---

IEEE 802.11g mode: Middle channel: 2437 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
4874.00	H	51.45	---	-3.98	47.47	---	74.00	54.00	-6.53
7311.00	H	44.78	---	0.57	45.35	---	74.00	54.00	-8.65
---	---	---	---	---	---	---	---	---	---
4874.00	V	51.63	---	-3.98	47.65	---	74.00	54.00	-6.35
7311.00	V	48.21	---	0.57	48.78	---	74.00	54.00	-5.22
---	---	---	---	---	---	---	---	---	---

IEEE 802.11g mode: High channel: 2462 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
2488.34	H	67.63	---	-2.38	65.25	---	74.00	54.00	-8.75
2488.34	H	---	50.78	-2.38	---	48.4	74.00	54.00	-5.6
4924.00	H	51.56	---	-3.98	47.58	---	74.00	54.00	-6.42
7386.00	H	45.72	---	0.57	46.29	---	74.00	54.00	-7.71
---	---	---	---	---	---	---	---	---	---
2488.34	V	69.87	---	-2.38	67.49	---	74.00	54.00	-6.51
2488.34	V	---	51.30	-2.38	---	48.92	74.00	54.00	-5.08
4924.00	V	50.72	---	-3.98	46.74	---	74.00	54.00	-7.26
7386.00	V	45.32	---	0.57	45.89	---	74.00	54.00	-8.11
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Notes: 1) Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.

2) Radiated emissions measured in frequencies above 1GHz were made with peak detector and Average (AV) detector.

3) Average test would be performed if the peak readings were greater than the average limit.

4) Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

5) Emission Level=Peak (AV) Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

6) Margin (dB) = Emission Level (Peak) (dBuV/m)-Average limit (dBuV/m)

IEEE 802.11n(HT20) mode: Low channel: 2412 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
2388.01	H	70.20	---	-4.20	66	---	74.00	54.00	-8.00
2388.01	H	---	51.32	-4.20	---	47.12	74.00	54.00	-6.88
4824.00	H	48.52	---	-3.94	44.58	---	74.00	54.00	-9.42
7236.00	H	46.46	---	0.52	46.98	---	74.00	54.00	-7.02
---	---	---	---	---	---	---	---	---	---
2388.01	V	70.43	---	-4.20	66.23	---	74.00	54.00	-7.77
2388.01	V	---	50.92	-4.20	---	46.72	74.00	54.00	-7.28
4824.00	V	49.59	---	-3.94	45.65	---	74.00	54.00	-8.35
7236.00	V	45.50	---	0.52	46.02	---	74.00	54.00	-7.98
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IEEE 802.11n(HT20) mode: Middle channel: 2437 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
4874.00	H	49.70	---	-3.98	45.72	---	74.00	54.00	-8.28
7311.00	H	45.88	---	0.57	46.45	---	74.00	54.00	-7.55
---	---	---	---	---	---	---	---	---	---
4874.00	V	50.82	---	-3.98	46.84	---	74.00	54.00	-7.16
7311.00	V	46.06	---	0.57	46.63	---	74.00	54.00	-7.37
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IEEE 802.11n(HT20) mode: High channel: 2462 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
2493.51	H	68.96	---	-2.38	66.58	---	74.00	54.00	-7.42
2493.51	H	---	50.30	-2.38	---	47.92	74.00	54.00	-6.08
4924.00	H	51.34	---	-3.98	47.36	---	74.00	54.00	-6.64
7386.00	H	46.53	---	0.57	47.1	---	74.00	54.00	-6.90
---	---	---	---	---	---	---	---	---	---
2493.51	V	69.63	---	-2.38	67.25	---	74.00	54.00	-6.75
2493.51	V	---	50.22	-2.38	---	47.84	74.00	54.00	-6.16
4924.00	V	50.97	---	-3.98	46.99	---	74.00	54.00	-7.01
7386.00	V	46.29	---	0.57	46.86	---	74.00	54.00	-7.14
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Notes: 1) Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.

2) Radiated emissions measured in frequencies above 1GHz were made with peak detector and Average (AV) detector.

3) Average test would be performed if the peak readings were greater than the average limit.

4) Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

5) Emission Level=Peak (AV) Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

6) Margin (dB) = Emission Level (Peak) (dBuV/m)-Average limit (dBuV/m)

IEEE 802.11n(HT40) mode: Low channel: 2422 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
2389.98	H	73.53	---	-4.20	69.33	---	74.00	54.00	-4.67
2389.98	H	---	54.56	-4.20	---	50.36	74.00	54.00	-3.64
4844.00	H	52.75	---	-3.94	48.81	---	74.00	54.00	-5.19
7266.00	H	47.63	---	0.52	48.15	---	74.00	54.00	-5.85
---	---	---	---	---	---	---	---	---	---
2389.98	V	71.43	---	-4.20	67.23	---	74.00	54.00	-6.77
2389.98	V	---	51.79	-4.20	---	47.59	74.00	54.00	-6.41
4844.00	V	52.62	---	-3.94	47.07	---	74.00	54.00	-6.93
7266.00	V	47.53	---	0.52	46.72	---	74.00	54.00	-7.28
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IEEE 802.11n(HT40) mode: Middle channel: 2437 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
4874.00	H	53.55	---	-3.98	49.57	---	74.00	54.00	-4.43
7311.00	H	49.32	---	0.57	49.89	---	74.00	54.00	-4.11
---	---	---	---	---	---	---	---	---	---
4874.00	V	52.35	---	-3.98	48.37	---	74.00	54.00	-5.63
7311.00	V	47.32	---	0.57	47.89	---	74.00	54.00	-6.11
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IEEE 802.11n(H40) mode: High channel: 2452 MHz

Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
2493.51	H	72.37	---	-2.38	69.99	---	74.00	54.00	-4.01
2493.51	H	---	51.08	-2.38	---	48.7	74.00	54.00	-5.3
4904.00	H	53.24	---	-3.98	49.26	---	74.00	54.00	-4.74
7356.00	H	48.52	---	0.57	49.09	---	74.00	54.00	-4.91
---	---	---	---	---	---	---	---	---	---
2493.51	V	72.01	---	-2.38	69.63	---	74.00	54.00	-4.37
2493.51	V	---	50.55	-2.38	---	48.17	74.00	54.00	-5.83
4904.00	V	53.56	---	-3.98	49.58	---	74.00	54.00	-4.42
7356.00	V	46.92	---	0.57	47.49	---	74.00	54.00	-6.51
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Notes: 1) Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.

2) Radiated emissions measured in frequencies above 1GHz were made with peak detector and Average (AV) detector.

3) Average test would be performed if the peak readings were greater than the average limit.

4) Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

5) Emission Level=Peak (AV) Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

6) Margin (dB) = Emission Level (Peak) (dBuV/m)-Average limit (dBuV/m)

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