

FCC Part 15C

Measurement And Test Report

For

Shenzhen Smart-eye Digital Electronics Co.,Ltd

#6 Northern Area,Shangxue S&t Industrial Park,Bantian,Longgang,Shenzhen

FCC ID: ZCB620GB

Sep. 11, 2015

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: IP Camera
Report Number:	MTI150507002RF
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Reviewed By:	Tim Zhang <i>Tim Zhang</i>
Approved & Authorized By:	Hebe Lee <i>Hebe Lee</i> 
Test Date:	May. 10 - Aug. 18, 2015
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1. Test Certification

Product:	IP Camera
Model No.:	620GB
Applicant:	Shenzhen Smart-eye Digital Electronics Co.,Ltd
Address:	#6 Northern Area,Shangxue S&t Industrial Park,Bantian,Longgang,Shenzhen
Manufacturer:	Shenzhen Smart-eye Digital Electronics Co.,Ltd
Address:	#6 Northern Area,Shangxue S&t Industrial Park,Bantian,Longgang,Shenzhen
Date of Test:	May. 10 – Aug. 18, 2015
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247 KDB 558074 D01 DTS Meas Guidance v03r03

The above equipment has been tested by Shenzhen Microtest Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

2. Test Result Summary

Requirement	CFR 47 Section	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	1§5.247(d)	Pass
Spurious Emission	§15.205/§15.209	Pass

Note:

1. Pass: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

3. EUT Description

Product Name:	IP Camera
Model :	620GB
Additional Model:	621GB,622GB,624GB,625GB,626GB,628GB,629GB,630GB,631GB,750GB,751GB,752GB,780GB,700GB,790GB
Trade Mark:	N/A
Operation Frequency:	2412MHz~2462MHz (802.11b/802.11g/802.11n(H20)) 2422MHz~2452MHz (802.11n(H40))
Channel Separation:	5MHz
Number of Channel:	11 for 802.11b/802.11g/802.11n(H20) 7 for 802.11n(H40)
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 150Mbps
Antenna Type:	Dipole Antenna
Antenna Gain:	3dBi
Power Supply:	DC 5V from AC to DC adapter
Remark:	All the models above are identical in interior structure, electrical circuits and components; just model names are different for marking requirement.

Operation Frequency each of channel For 802.11b/g/n(HT20)

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 (HT40)

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 (HT20)

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

802.11n (HT40)

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

4. Genera Information

4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations

The sample was placed 0.8m 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:

Operation mode:	Keep the EUT in continuous transmitting with modulation
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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.

4.2. Description of Support Units

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

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

5. Facilities and Accreditations

5.1. Facilities

Shenzhen Toby Technology Co., Ltd.
Add.: 10/F.,A Block, Jiada R&D Bldg., No.5 Songpingshan, Road, Science&Technology Park,
Shenzhen, 518057
FCC Registration No.:811562

5.2. Measurement Uncertainty

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

No.	Item	MU
1	Conducted Emission	$\pm 2.56\text{dB}$
2	RF power, conducted	$\pm 0.12\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^\circ\text{C}$
7	Humidity	$\pm 1.0\%$

6. Test Results and Measurement Data

6.1. Antenna requirement

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

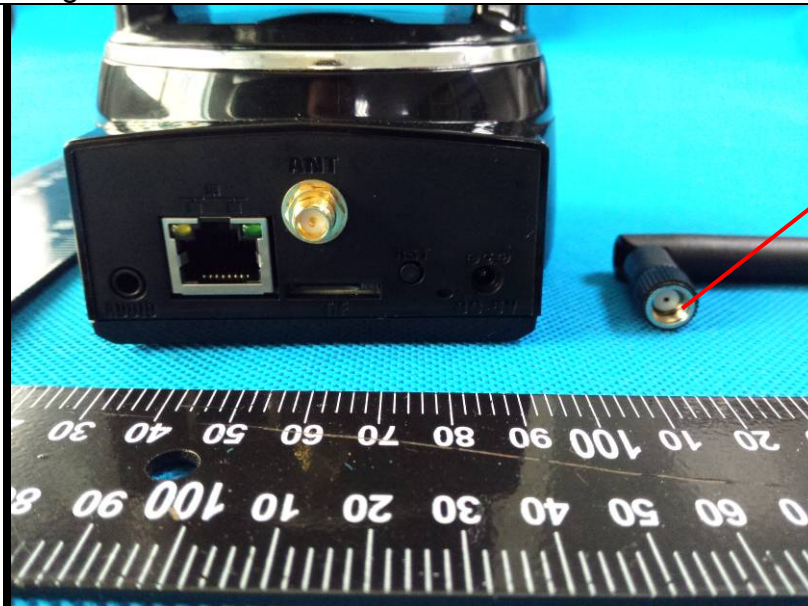
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit 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:	
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The EUT transmitting antennas belongs to Dipole antenna which removable attached, and the best case gain of the antenna is 3dBi for WIFI.



Antenna

6.2. Conducted Emission

6.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207														
Test Method:	ANSI C63.4:2003														
Frequency Range:	150 kHz to 30 MHz														
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
Limits:	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <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> </tbody> </table>	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
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													
Test Setup:	<p><i>Remark:</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>														
Test Mode:	Charging + transmitting with modulation														
Test Procedure:	<ol style="list-style-type: none"> 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2003 on conducted measurement. 														
Test Result:	PASS														

6.2.2. Test Instruments

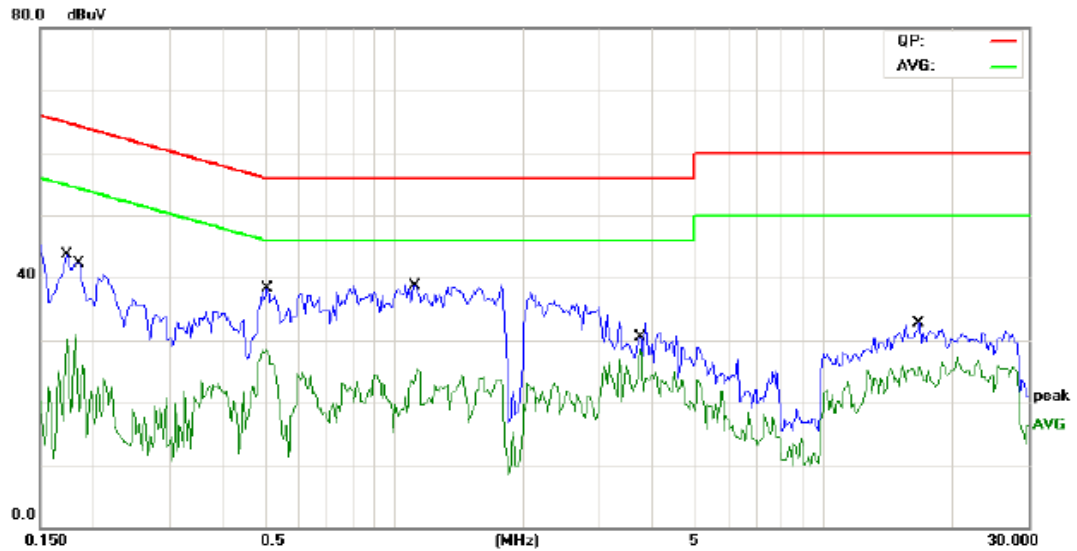
Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCI	100321	2016-08-09
50 Ω Coaxial Switch	Anritsu	MP59B	X10321	2016-08-09
L.I.S.N	R&S	ENV216	101131	2016-08-09
L.I.S.N	SCHWARZBZCK	NNBL 8226-2	8226-2/164	2016-08-09

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

6.2.3. Test data

Please refer to following diagram for individual

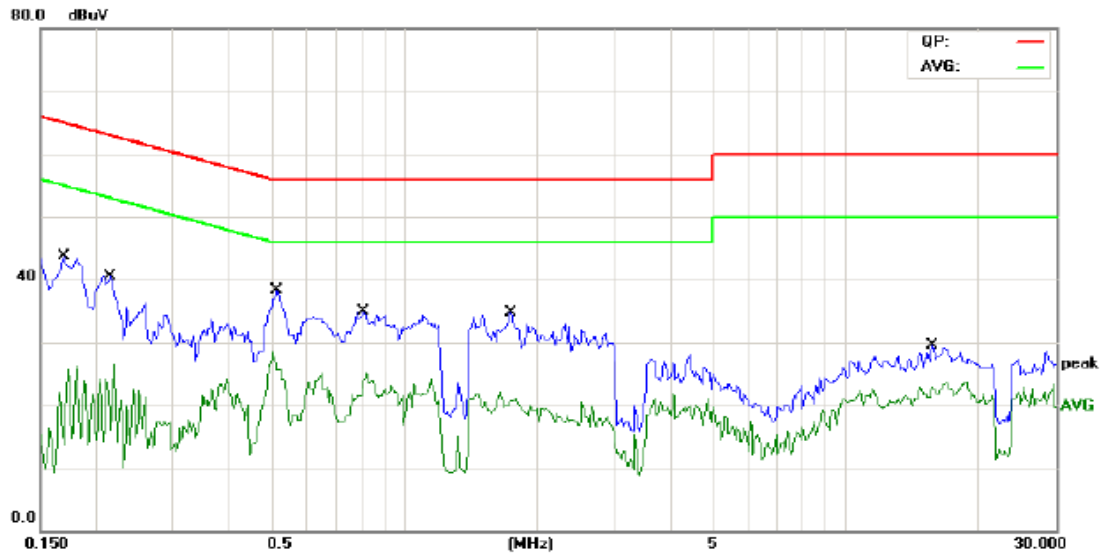
Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



Site Chamber #2 Phase: *L1* Temperature: 25 (C)
 Limit: FCC PART15 Conduction(QP) Power: AC 120V/60Hz Humidity: 52 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1734	26.96	11.48	38.44	64.79	-26.35	QP	
2		0.1734	11.83	11.48	23.31	54.79	-31.48	AVG	
3		0.1825	26.29	11.48	37.77	64.37	-26.60	QP	
4		0.1825	11.97	11.48	23.45	54.37	-30.92	AVG	
5		0.5055	22.32	11.30	33.62	56.00	-22.38	QP	
6	*	0.5055	15.69	11.30	26.99	46.00	-19.01	AVG	
7		1.1292	19.71	11.23	30.94	56.00	-25.06	QP	
8		1.1292	8.46	11.23	19.69	46.00	-26.31	AVG	
9		3.7794	14.86	11.05	25.91	56.00	-30.09	QP	
10		3.7794	4.85	11.05	15.90	46.00	-30.10	AVG	
11		16.7461	13.87	11.25	25.12	60.00	-34.88	QP	
12		16.7461	6.32	11.25	17.57	50.00	-32.43	AVG	

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



Site Chamber #2 Phase: **N** Temperature: 25 (C)
 Limit: FCC PART15 Conduction(QP) Power: AC 120V/60Hz Humidity: 52 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1695	26.64	11.51	38.15	64.98	-26.83	QP	
2		0.1695	10.88	11.51	22.39	54.98	-32.59	AVG	
3		0.2185	22.87	11.47	34.34	62.87	-28.53	QP	
4		0.2185	8.28	11.47	19.75	52.87	-33.12	AVG	
5		0.5172	21.11	11.30	32.41	56.00	-23.59	QP	
6	*	0.5172	14.27	11.30	25.57	46.00	-20.43	AVG	
7		0.8102	17.56	11.20	28.76	56.00	-27.24	QP	
8		0.8102	9.12	11.20	20.32	46.00	-25.68	AVG	
9		1.7437	14.06	11.56	25.62	56.00	-30.38	QP	
10		1.7437	6.43	11.56	17.99	46.00	-28.01	AVG	
11		15.7266	11.51	11.51	23.02	60.00	-36.98	QP	
12		15.7266	5.87	11.51	17.38	50.00	-32.62	AVG	

Note:

Freq. = Emission frequency in MHz

Reading level (dBuV) = Receiver reading

Corr. Factor (dB) = Antenna factor + Cable loss

Measurement (dBuV) = Reading level (dBuV) + Corr. Factor (dB)

Limit (dBuV) = Limit stated in standard

Margin (dB) = Measurement (dBuV) – Limits (dBuV)

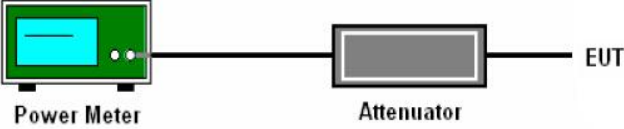
Q.P. =Quasi-Peak

AVG =average

* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

6.3. Conducted Peak Output Power

6.3.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB 558074
Limit:	30dBm
Test Setup:	 <p>The diagram illustrates the test setup. On the left is a green Power Meter. A black line representing an RF cable connects the Power Meter to a grey rectangular Attenuator. Another black line connects the Attenuator to the EUT (Equipment Under Test).</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas Guidance v03r03. 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 with 100% duty cycle. 4. Measure the conducted output power and record the results in the test report.
Test Result:	PASS

6.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Power Meter	Anritsu	ML2495A	1005002	Dec. 11, 2015
Pulse Power Sensor	Anritsu	MA2411B	0917070	Dec. 11, 2015

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

6.3.3. Test Data

802.11b mode			
Test channel	Maximum Peak Conducted Output Power (dBm)	Limit (dBm)	Result
Lowest	14.92	30.00	Pass
Middle	14.83	30.00	Pass
Highest	14.75	30.00	Pass

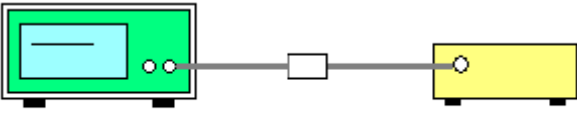
802.11g mode			
Test channel	Maximum Peak Conducted Output Power (dBm)	Limit (dBm)	Result
Lowest	13.94	30.00	Pass
Middle	13.73	30.00	Pass
Highest	13.13	30.00	Pass

802.11n(H20) mode			
Test channel	Maximum Peak Conducted Output Power (dBm)	Limit (dBm)	Result
Lowest	12.16	30.00	Pass
Middle	12.33	30.00	Pass
Highest	12.49	30.00	Pass

802.11n(H40) mode			
Test channel	Maximum Peak Conducted Output Power (dBm)	Limit (dBm)	Result
Lowest	11.07	30.00	Pass
Middle	11.13	30.00	Pass
Highest	11.16	30.00	Pass

6.4. Emission Bandwidth

6.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB 558074
Limit:	>500kHz
Test Setup:	 <p style="text-align: center;">Spectrum Analyzer EUT</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows FCC KDB 558074 D01 DTS Meas Guidance v03r03. 2. Set to the maximum power setting and enable the EUT transmit continuously with 100% duty cycle. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. 4. Measure and record the results in the test report.
Test Result:	PASS

6.4.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4470B	MY41441082	Oct.16, 2015

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

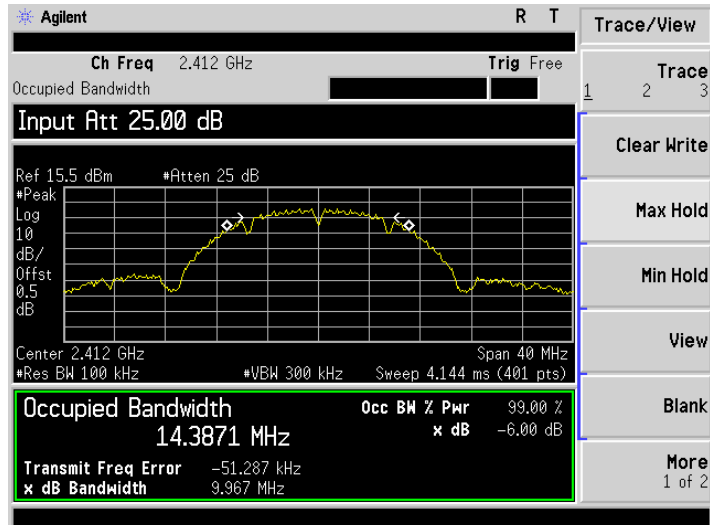
6.4.3. Test data

Test channel	6dB Emission Bandwidth (MHz)			
	802.11b	802.11g	802.11n(H20)	802.11n(H40)
Lowest	9.967	16.636	17.874	36.602
Middle	9.998	16.65	17.871	36.647
Highest	9.948	16.625	17.833	36.624
Limit:	>500k			
Test Result:	PASS			

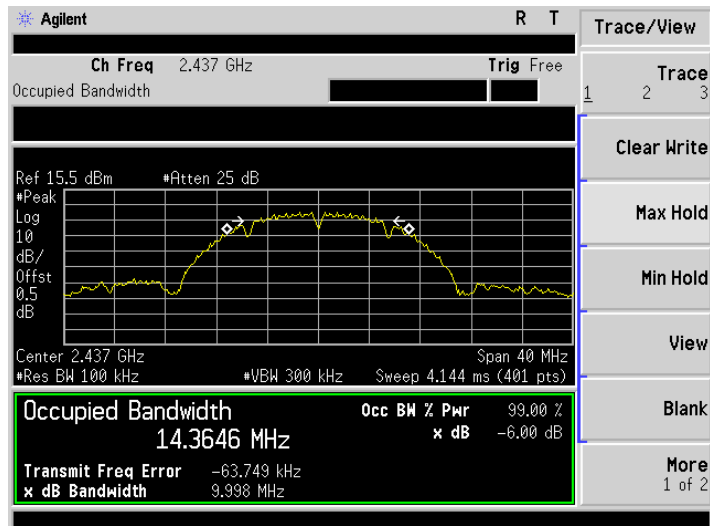
Test plots as follows:

802.11b Modulation

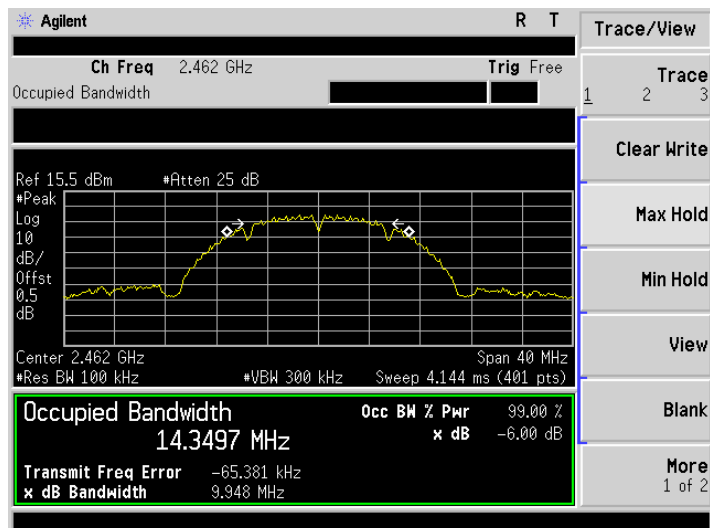
Lowest channel



Middle channel

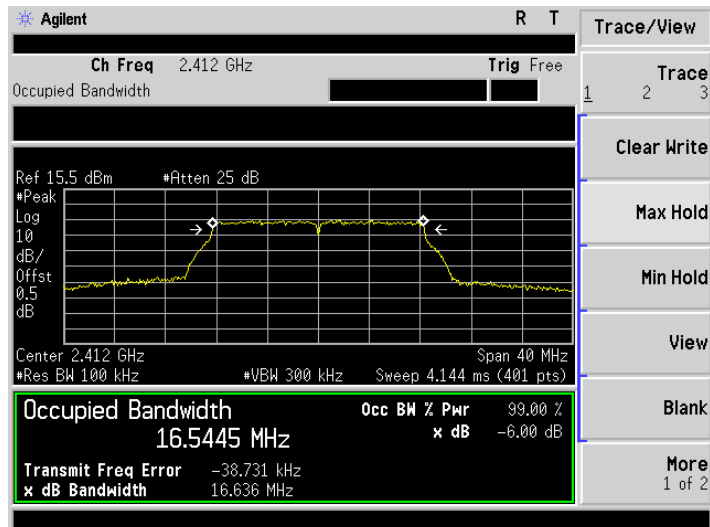


Highest channel

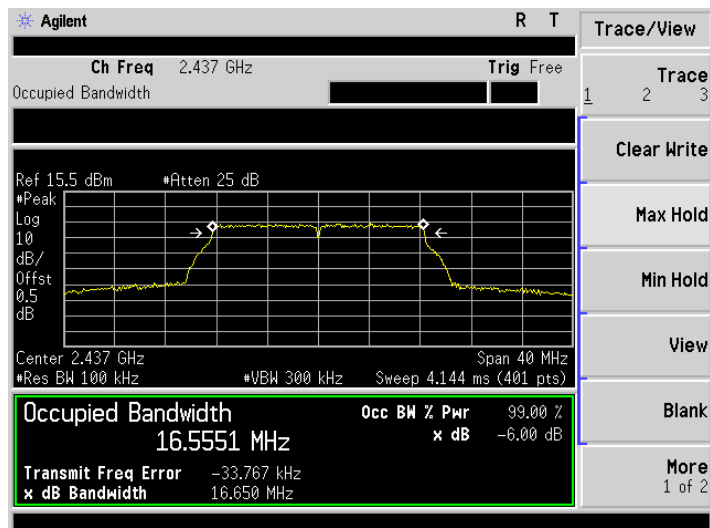


802.11g Modulation

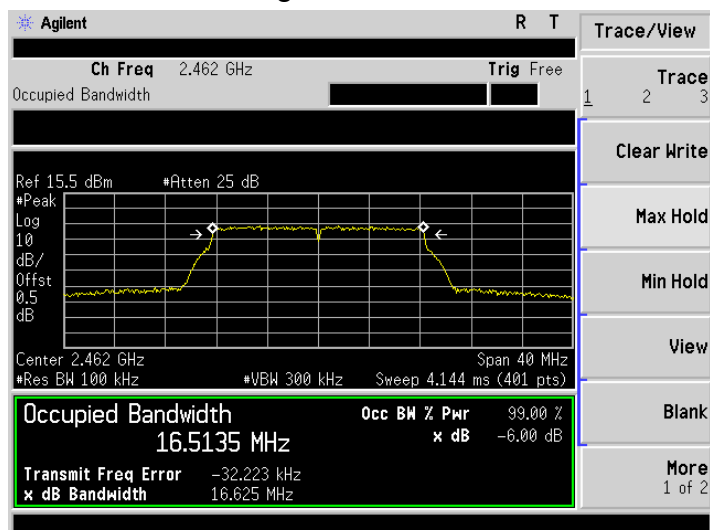
Lowest channel



Middle channel

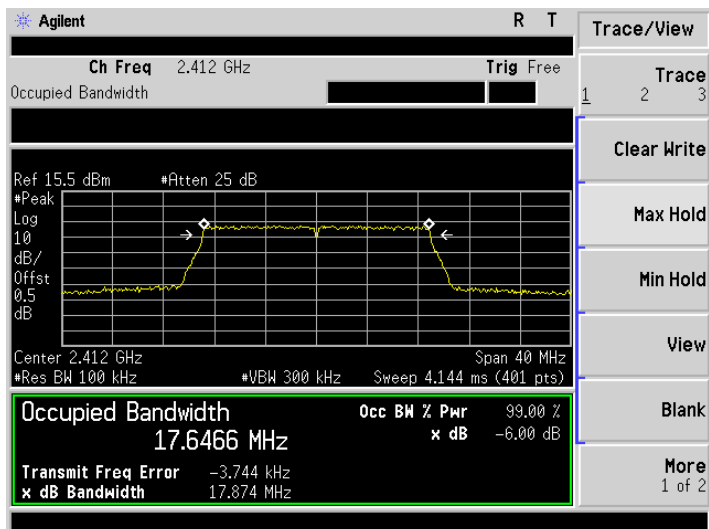


Highest channel

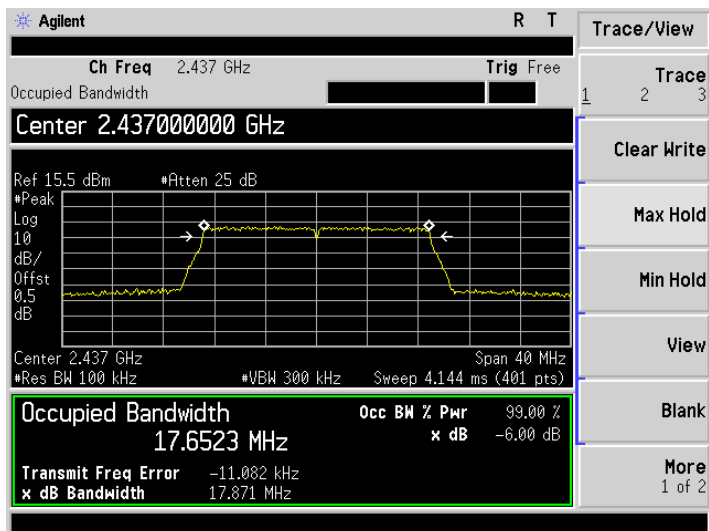


802.11n (HT20) Modulation

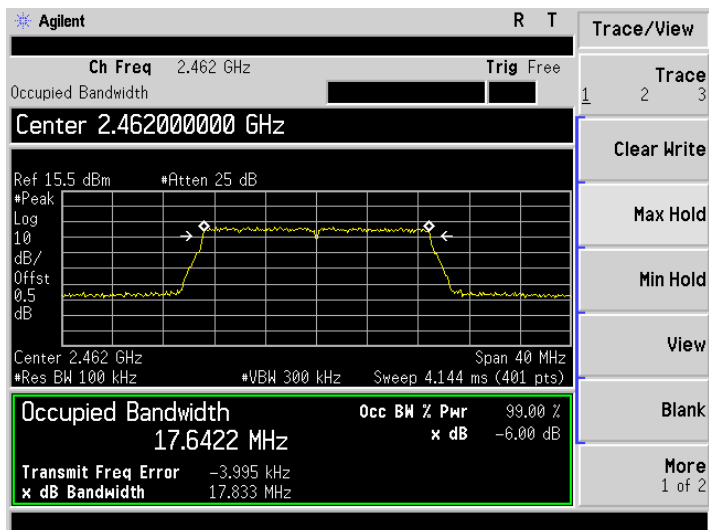
Lowest channel



Middle channel




Highest channel



6.5. Power Spectral Density

6.6. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB 558074
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:	 <p style="text-align: center;">Spectrum Analyzer EUT</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows Measurement Procedure of FCC KDB 558074 D01 DTS Meas Guidance v03r03 2. Set to the maximum power setting and enable the EUT transmit continuously with 100% duty cycle. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$. Video bandwidth $\text{VBW} \geq 3 \times \text{RBW}$. Set the span to at least 1.5 times the DTS BW. 4. Detector = Peak, Sweep time = auto couple, Trace mode = max hold. 5. Use the peak marker function to determine the maximum amplitude within the RBW. 6. Measure and record the results in the test report.
Test Result:	PASS

6.6.1. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4470B	MY41441082	Oct.16, 2015

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

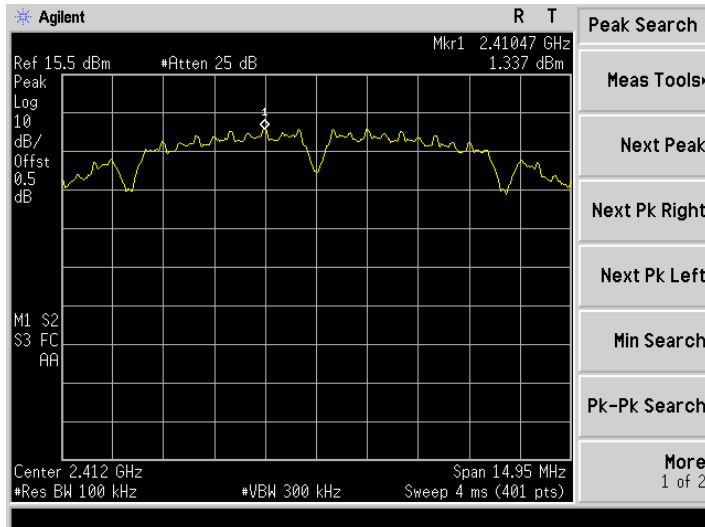
6.6.2. Test data

Test channel	AVG Power Spectral Density (dBm/100kHz)			
	802.11b	802.11g	802.11n(H20)	802.11n(H40)
Lowest	1.337	-4.625	-6.238	-10.09
Middle	1.044	-5.115	-5.047	-10.33
Highest	0.355	-5.36	-5.284	-11.11
Limit:	8dBm/3kHz			
Test Result:	PASS			

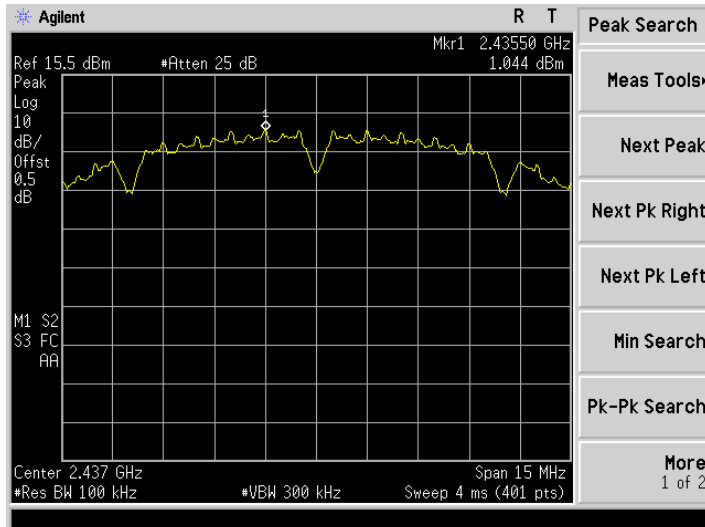
Test plots as follows:

802.11b Modulation

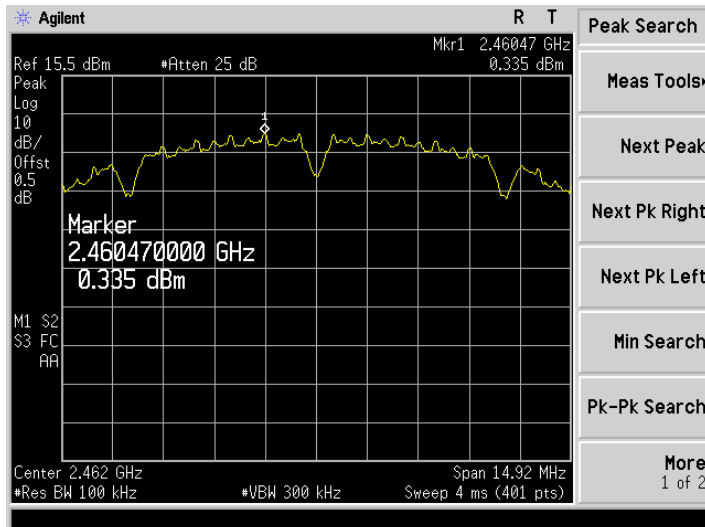
Lowest channel



Middle channel

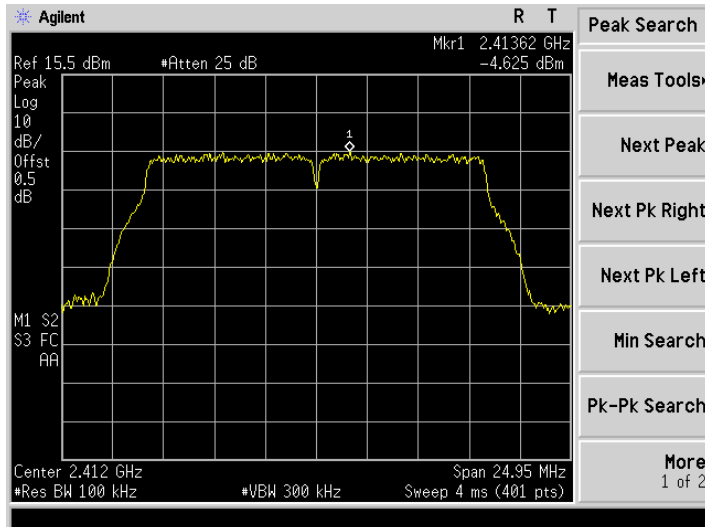


Highest channel

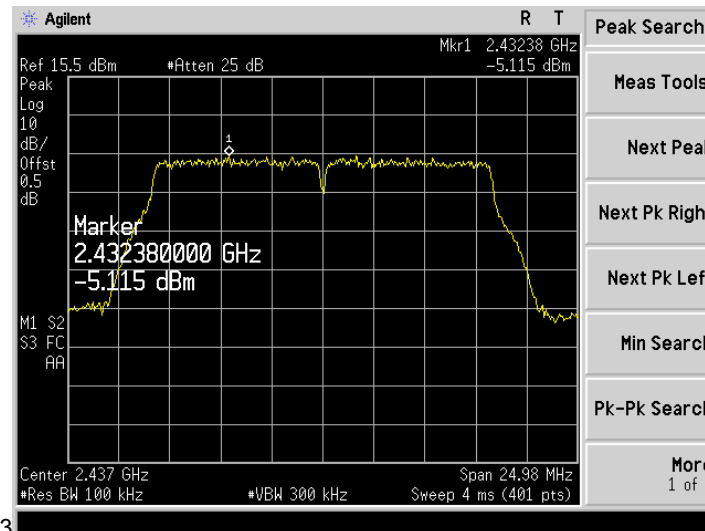


802.11g Modulation

Lowest channel

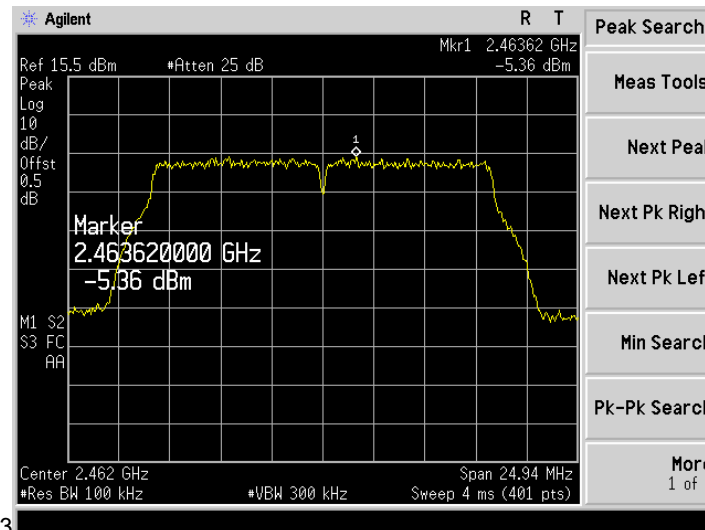


Middle channel



3

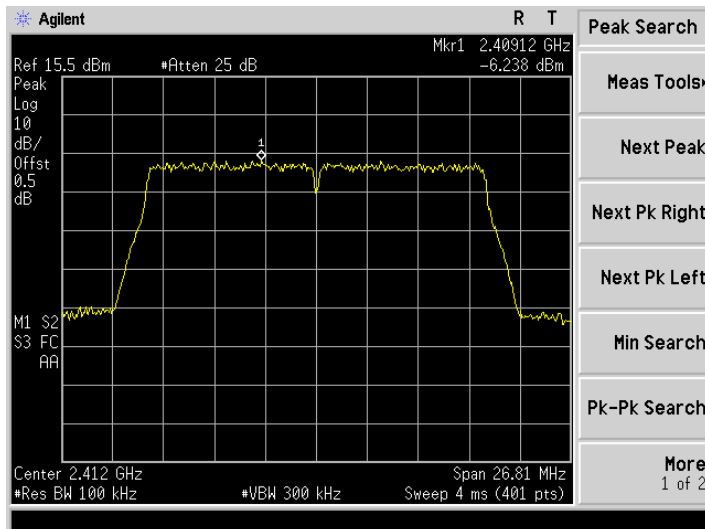
Highest channel



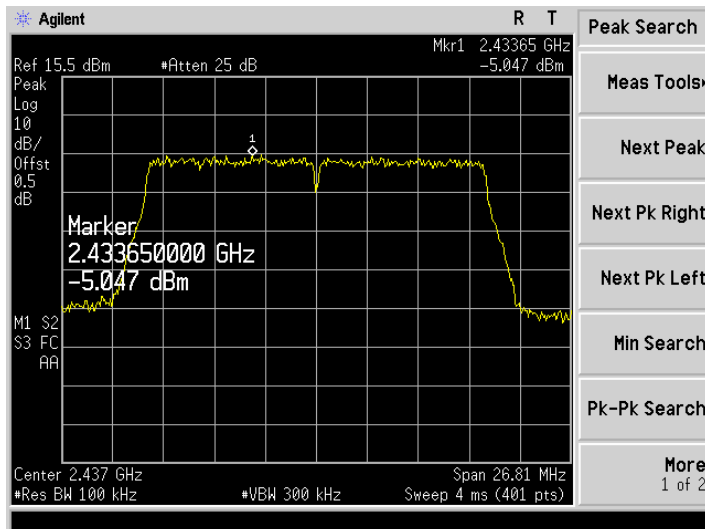
3

802.11n (HT20) Modulation

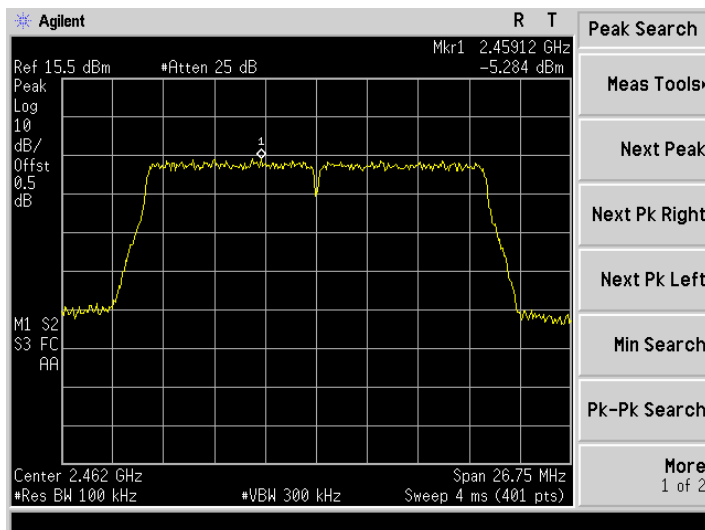
Lowest channel



Middle channel

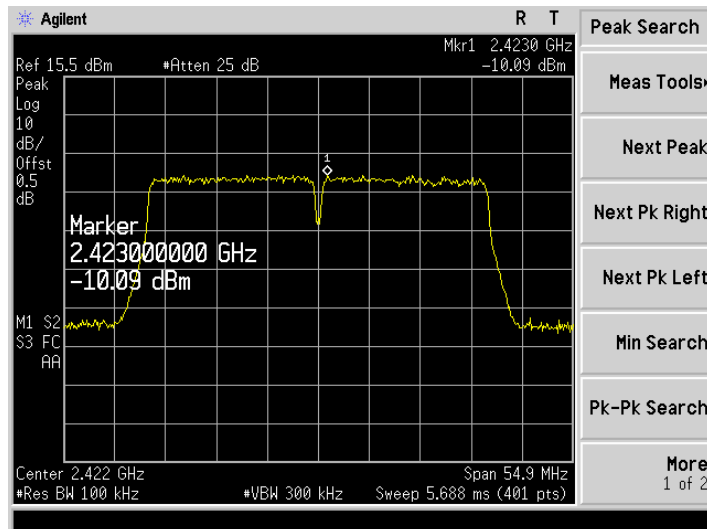


Highest channel

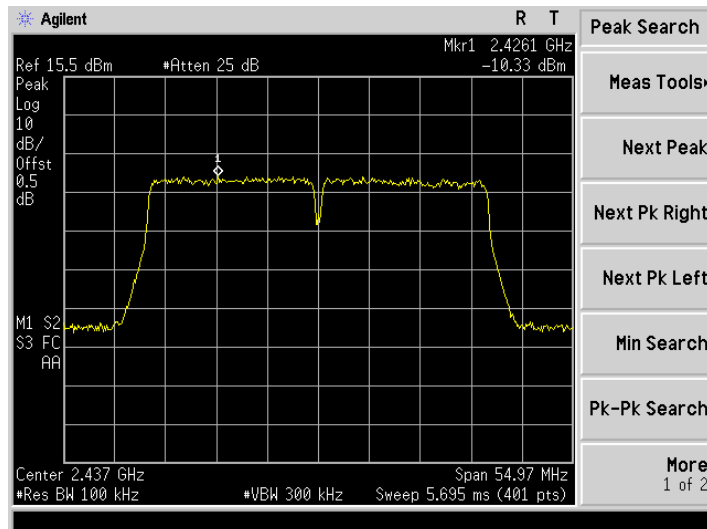


802.11n (HT40) Modulation

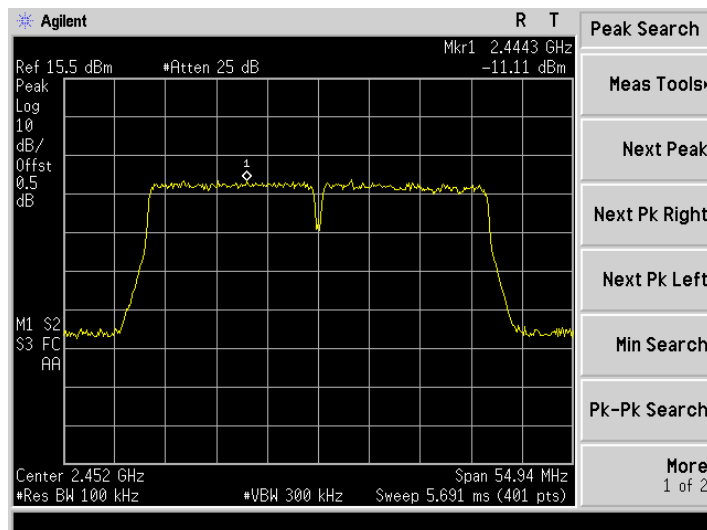
Lowest channel



Middle channel




Highest channel



6.7. Conducted Band Edge and Spurious Emission Measurement

6.7.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB 558074
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:	 <p style="text-align: center;">Spectrum Analyzer EUT</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows FCC KDB 558074 D01 DTS Meas Guidance v03r03. 2. Set to the maximum power setting and enable the EUT transmit continuously with 100% duty cycle. 3. 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. 4. Measure and record the results in the test report. 5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

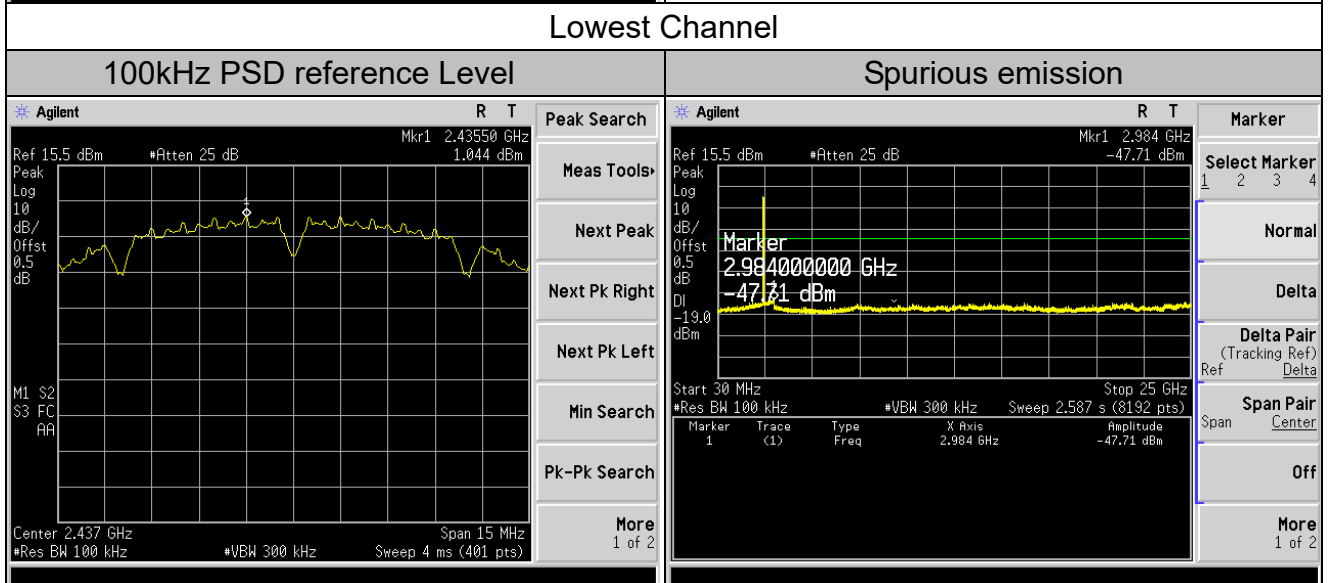
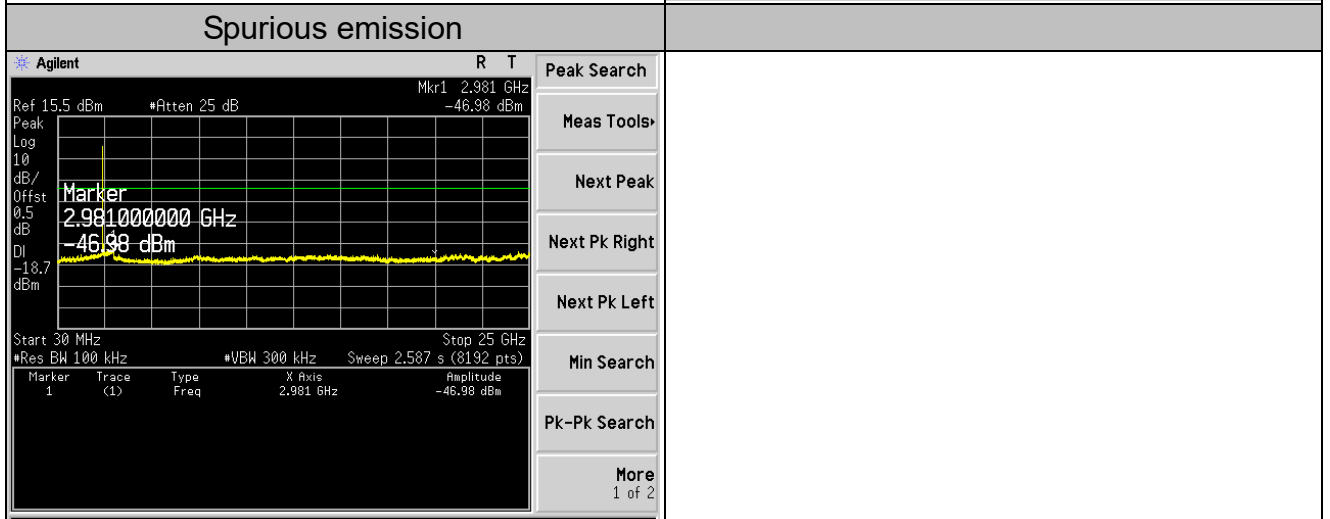
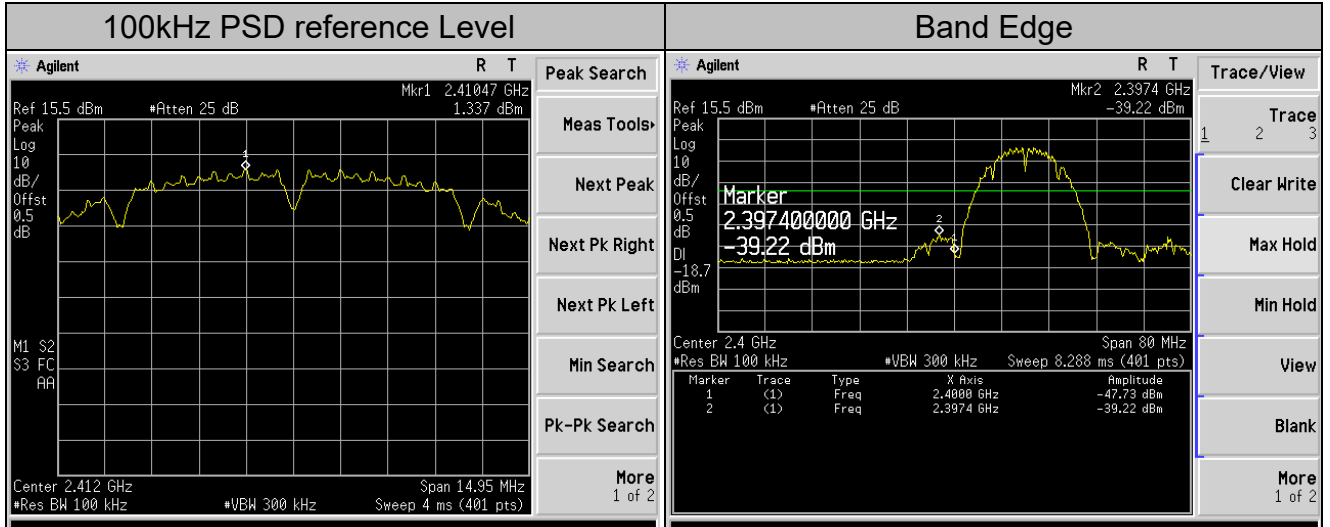
6.7.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4470B	MY41441082	Oct. 16, 2015

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

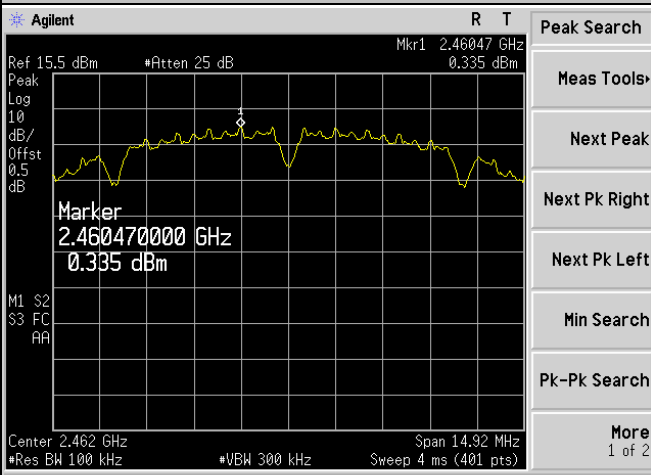
6.7.3. Test Data

802.11b Modulation

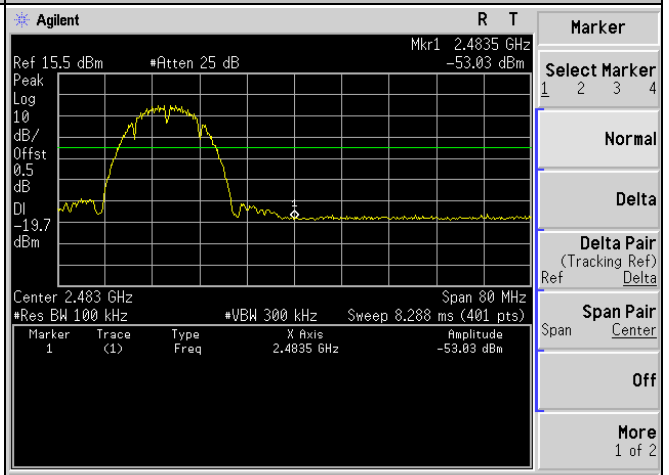


Middle Channel

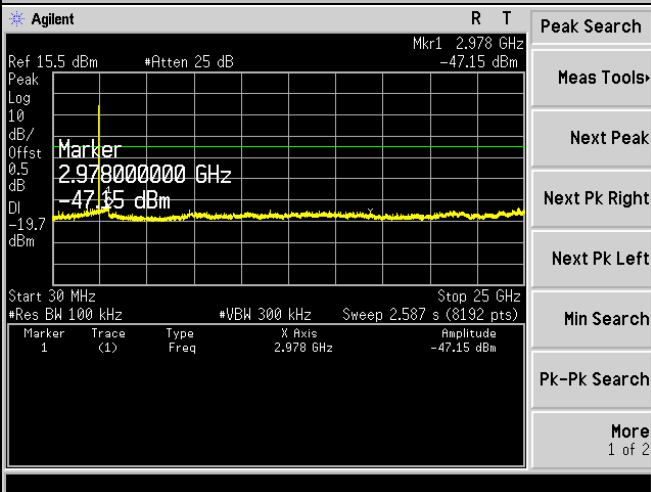
100kHz PSD reference Level



Band Edge

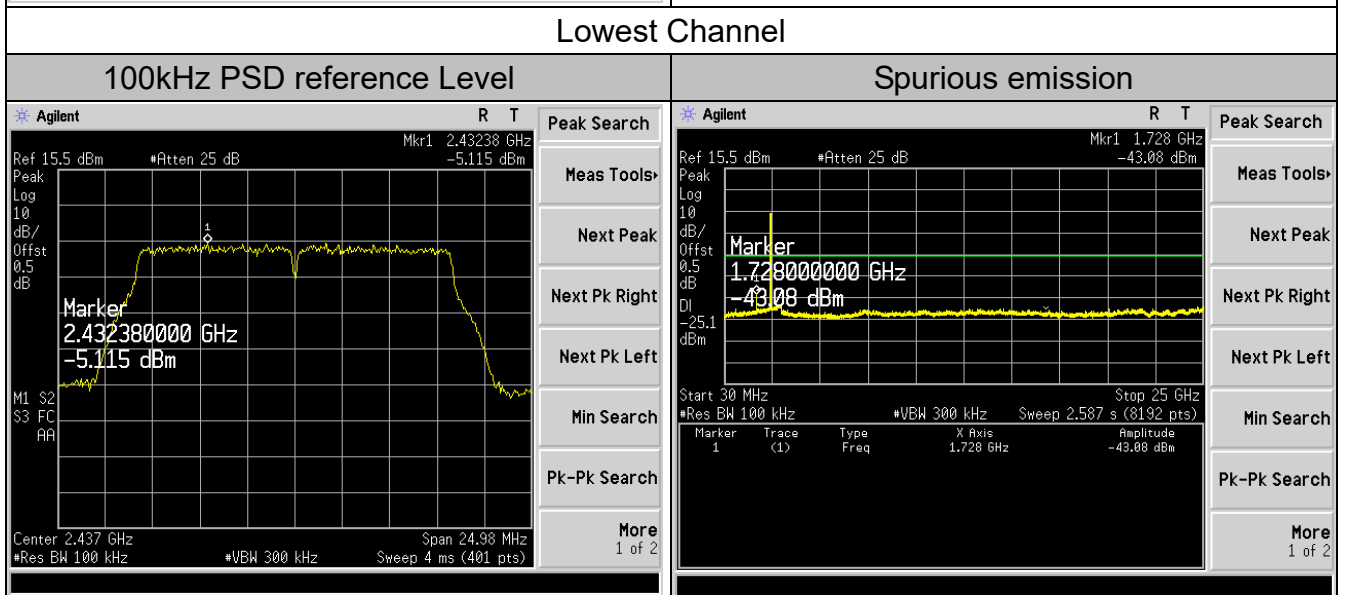
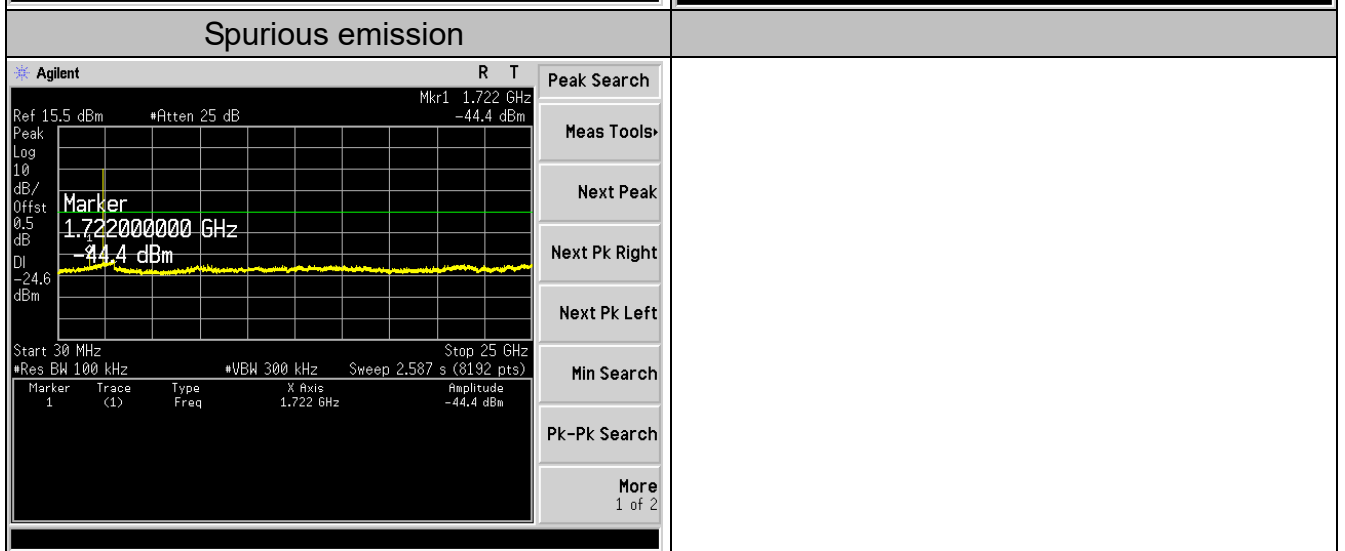
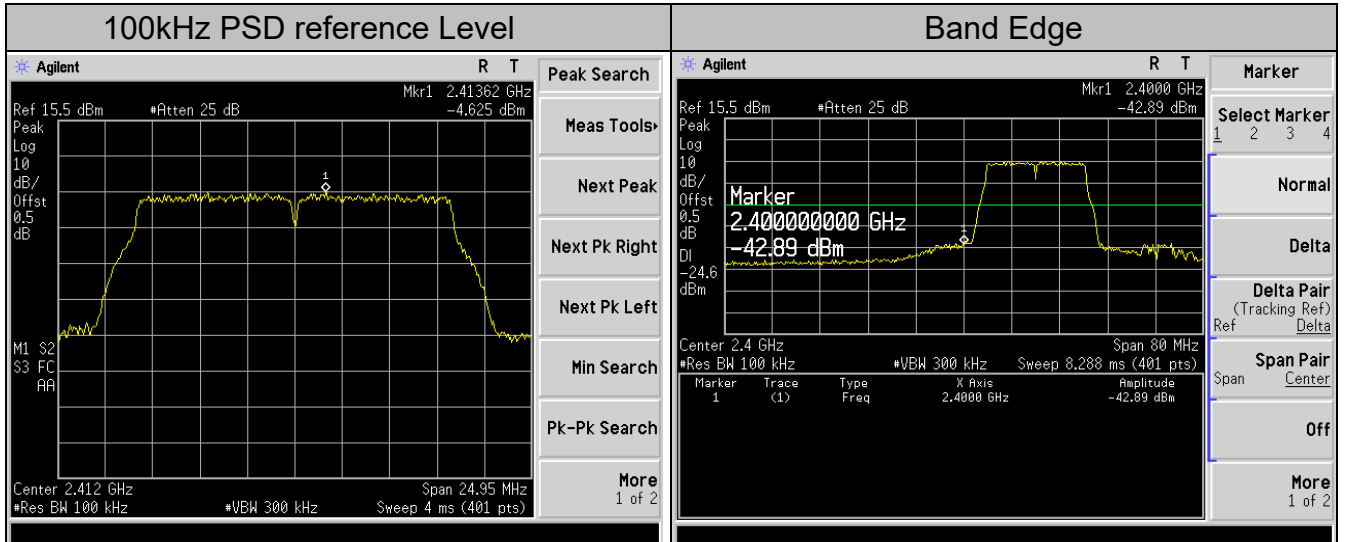


Spurious emission



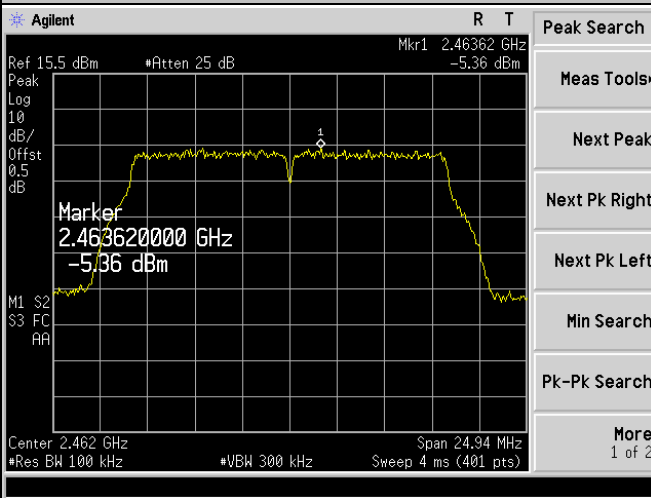
Highest Channel

802.11g Modulation

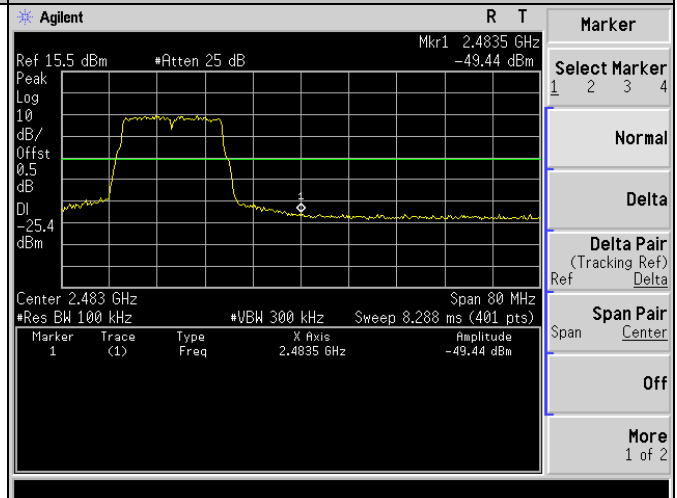


Middle Channel

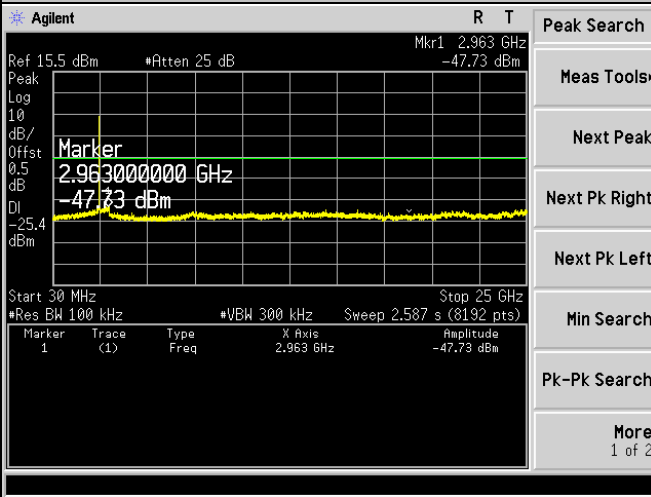
100kHz PSD reference Level



Band Edge

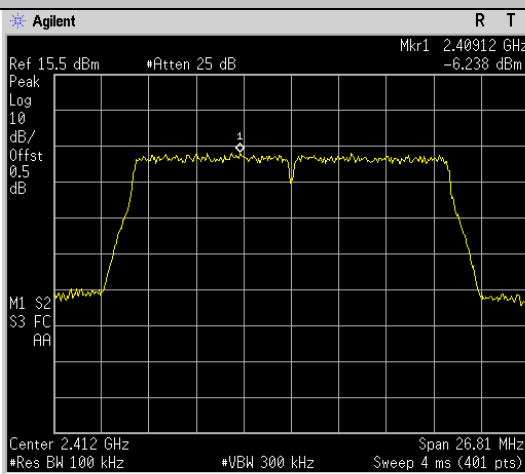
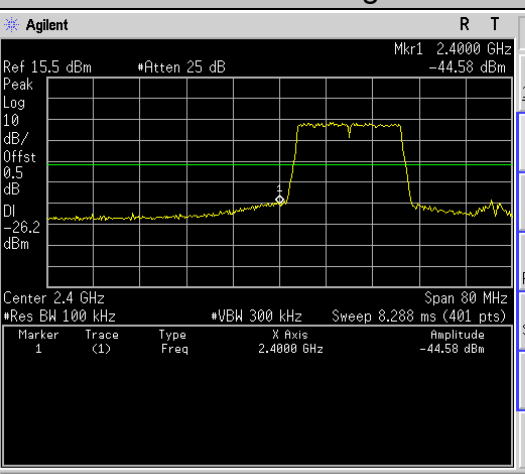
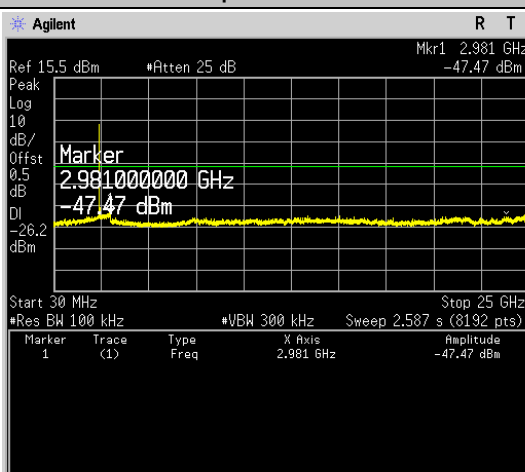
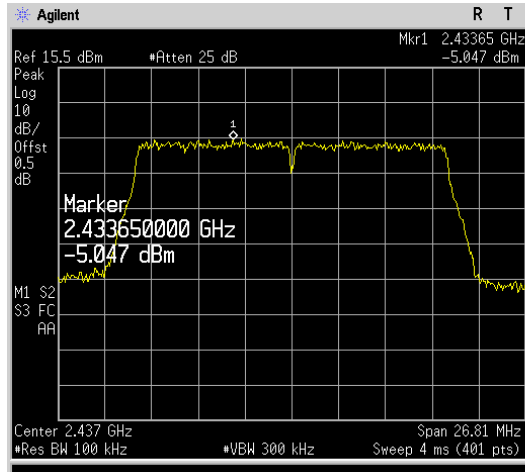
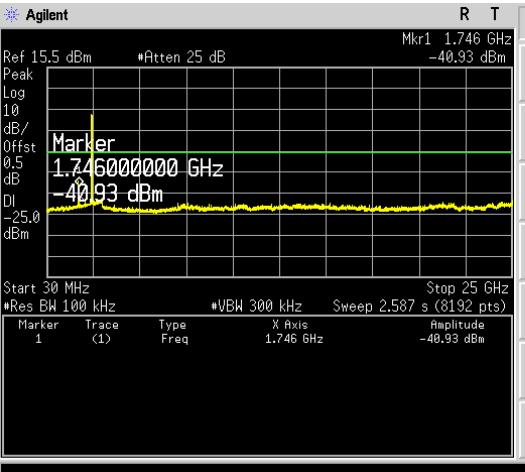


Spurious emission

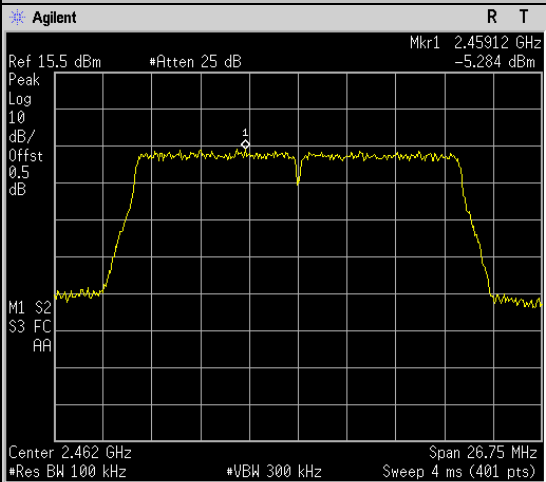


Highest Channel

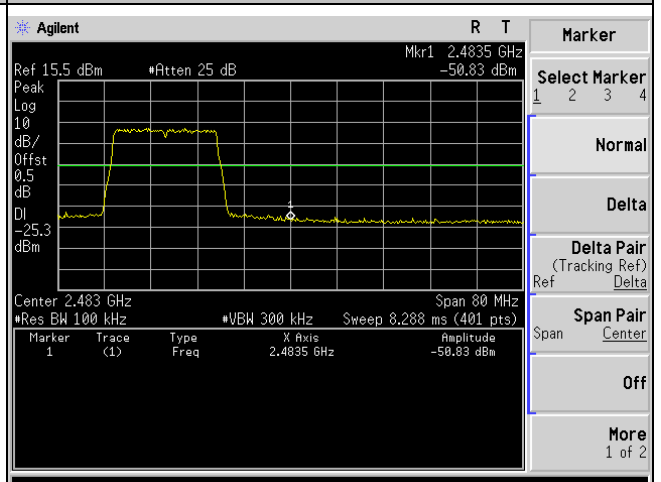
802.11n (HT20) Modulation

<h3 style="text-align: center;">100kHz PSD reference Level</h3>  <p>Agilent R T Ref 15.5 dBm #Atten 25 dB Mkr1 2.40912 GHz Peak -6.238 dBm Log 10 dB/ Offst 0.5 dB DI -26.2 dBm M1 S2 S3 FC AA Center 2.412 GHz Span 26.81 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 4 ms (401 pts)</p> <p>Peak Search Meas Tools Next Peak Next Pk Right Next Pk Left Min Search Pk-Pk Search More 1 of 2</p>	<h3 style="text-align: center;">Band Edge</h3>  <p>Agilent R T Ref 15.5 dBm #Atten 25 dB Mkr1 2.4000 GHz Peak -44.58 dBm Log 10 dB/ Offst 0.5 dB DI -26.2 dBm Center 2.4 GHz Span 80 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 8.288 ms (401 pts)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>(1)</td> <td>Freq</td> <td>2.4000 GHz</td> <td>-44.58 dBm</td> </tr> </tbody> </table> <p>Select Marker 1 2 3 4 Normal Delta Delta Pair (Tracking Ref) Ref Delta Span Pair Span Center Off More 1 of 2</p>	Marker	Trace	Type	X Axis	Amplitude	1	(1)	Freq	2.4000 GHz	-44.58 dBm
Marker	Trace	Type	X Axis	Amplitude							
1	(1)	Freq	2.4000 GHz	-44.58 dBm							
<h3>Spurious emission</h3>											
 <p>Agilent R T Ref 15.5 dBm #Atten 25 dB Mkr1 2.981 GHz Peak -47.47 dBm Log 10 dB/ Offst 0.5 dB DI -26.2 dBm Start 30 MHz Stop 25 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.587 s (8192 pts)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>(1)</td> <td>Freq</td> <td>2.981 GHz</td> <td>-47.47 dBm</td> </tr> </tbody> </table> <p>Peak Search Meas Tools Next Peak Next Pk Right Next Pk Left Min Search Pk-Pk Search More 1 of 2</p>	Marker	Trace	Type	X Axis	Amplitude	1	(1)	Freq	2.981 GHz	-47.47 dBm	
Marker	Trace	Type	X Axis	Amplitude							
1	(1)	Freq	2.981 GHz	-47.47 dBm							
<h3>Lowest Channel</h3>											
<h3 style="text-align: center;">100kHz PSD reference Level</h3>  <p>Agilent R T Ref 15.5 dBm #Atten 25 dB Mkr1 2.43365 GHz Peak -5.047 dBm Log 10 dB/ Offst 0.5 dB DI -25.0 dBm M1 S2 S3 FC AA Center 2.437 GHz Span 26.81 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 4 ms (401 pts)</p> <p>Peak Search Meas Tools Next Peak Next Pk Right Next Pk Left Min Search Pk-Pk Search More 1 of 2</p>	<h3 style="text-align: center;">Spurious emission</h3>  <p>Agilent R T Ref 15.5 dBm #Atten 25 dB Mkr1 1.746 GHz Peak -40.93 dBm Log 10 dB/ Offst 0.5 dB DI -25.0 dBm Start 30 MHz Stop 25 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.587 s (8192 pts)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>(1)</td> <td>Freq</td> <td>1.746 GHz</td> <td>-40.93 dBm</td> </tr> </tbody> </table> <p>Peak Search Meas Tools Next Peak Next Pk Right Next Pk Left Min Search Pk-Pk Search More 1 of 2</p>	Marker	Trace	Type	X Axis	Amplitude	1	(1)	Freq	1.746 GHz	-40.93 dBm
Marker	Trace	Type	X Axis	Amplitude							
1	(1)	Freq	1.746 GHz	-40.93 dBm							
<h3>Middle Channel</h3>											

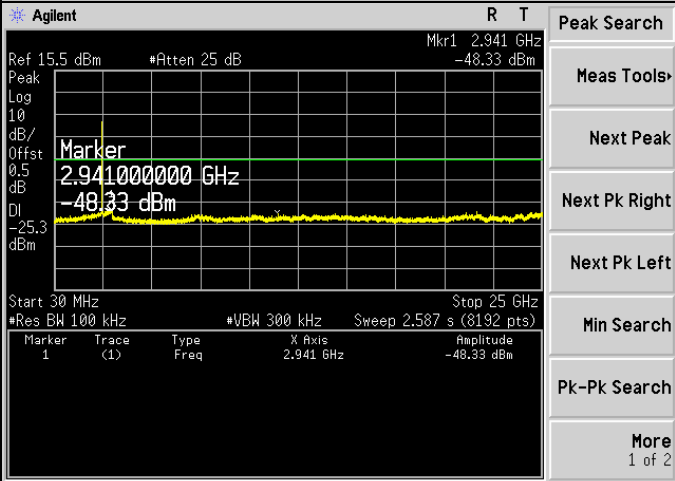
100kHz PSD reference Level



Band Edge

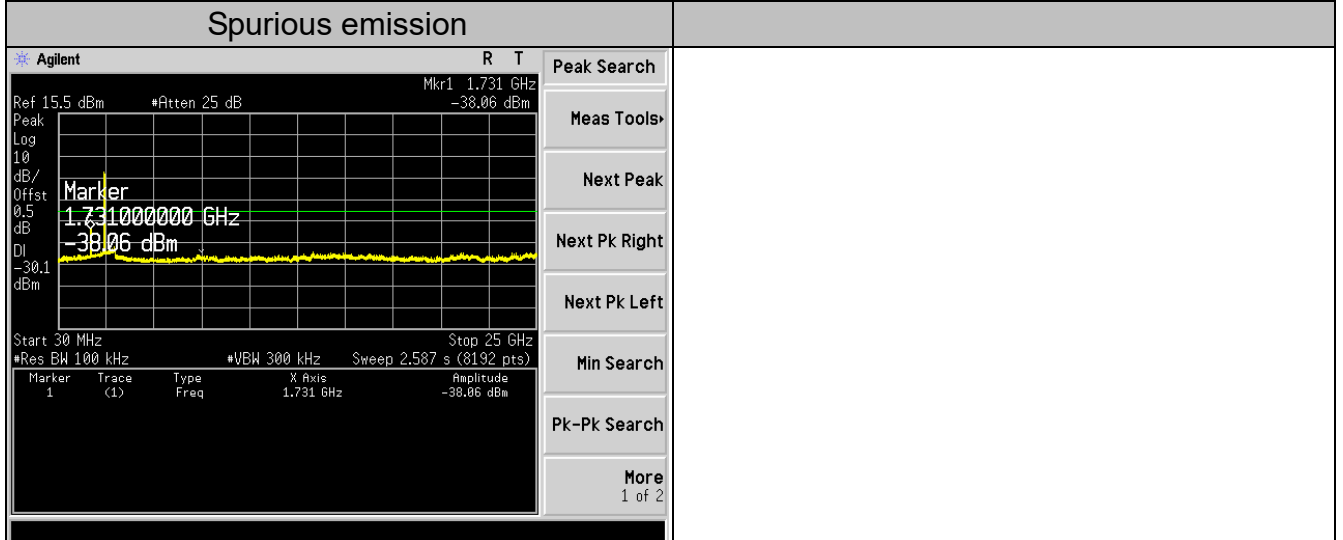
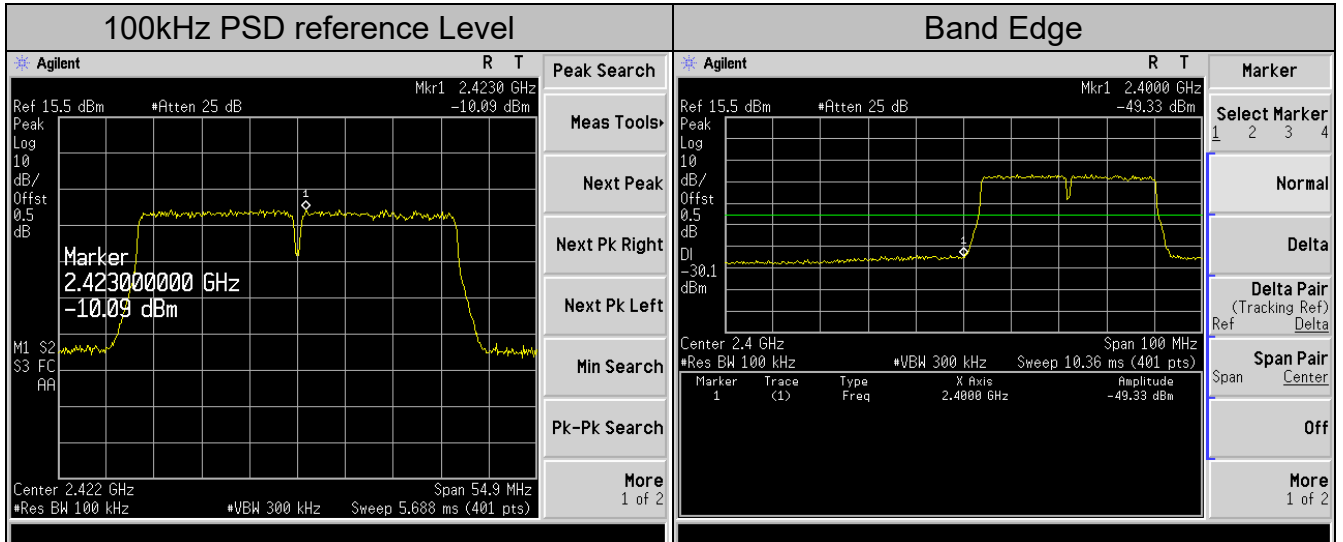


Spurious emission

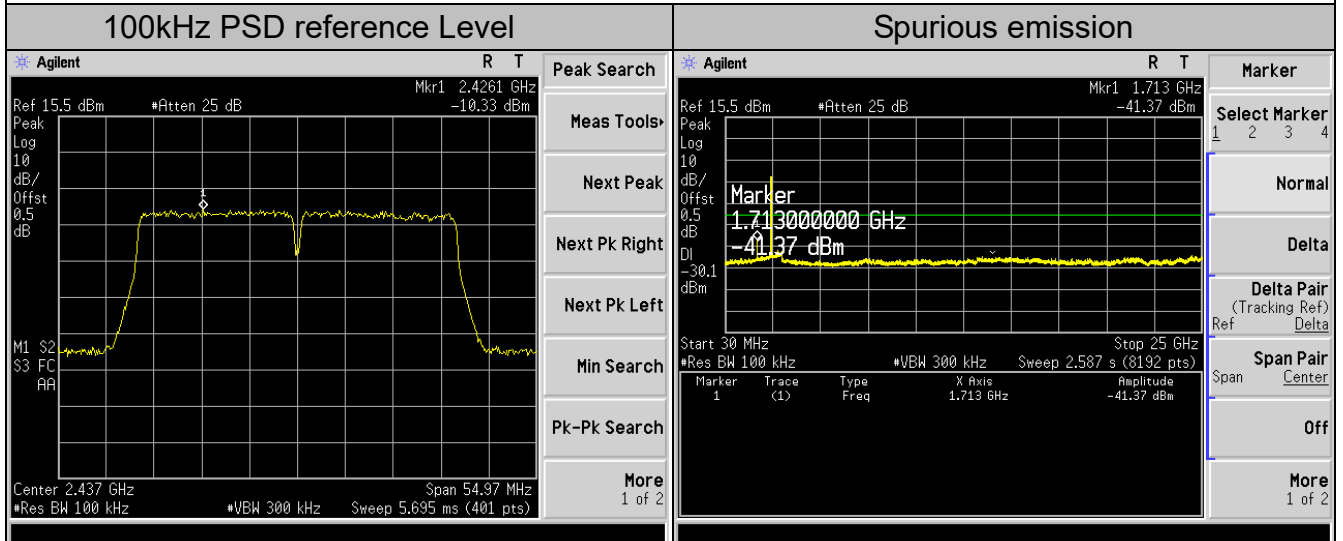


Highest Channel

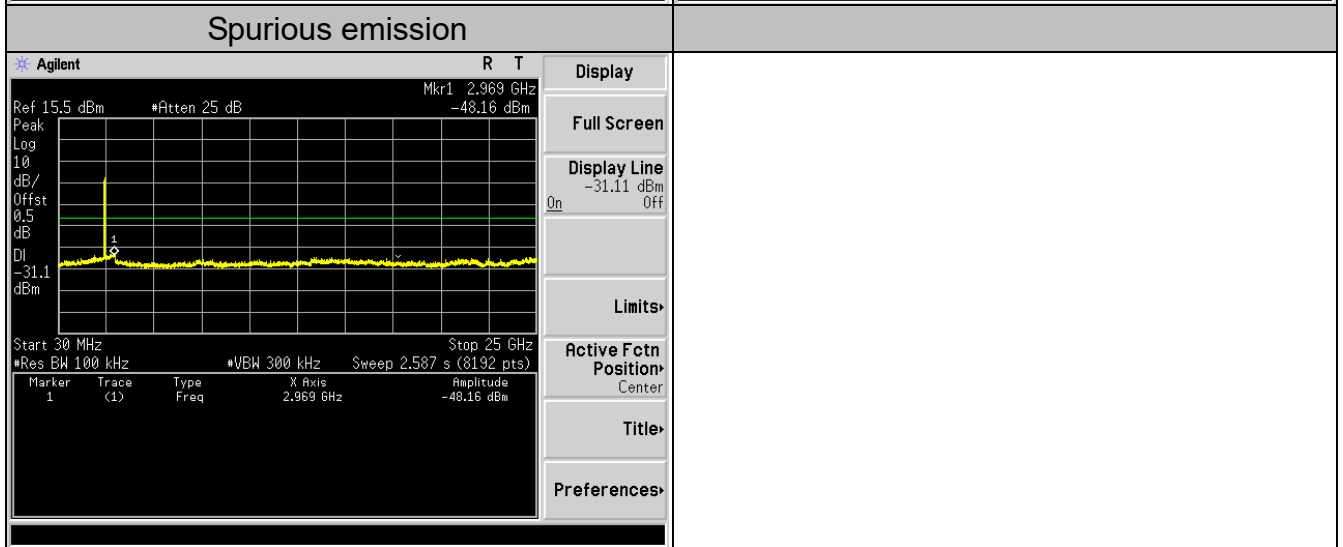
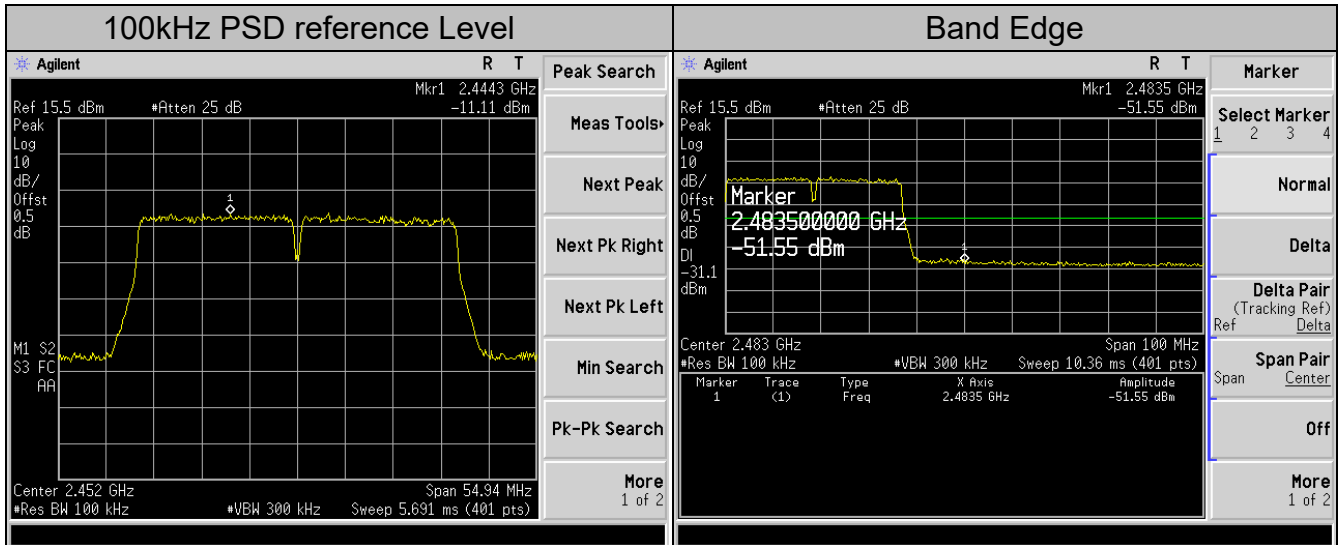
802.11n (HT40) Modulation



Lowest Channel



Middle Channel

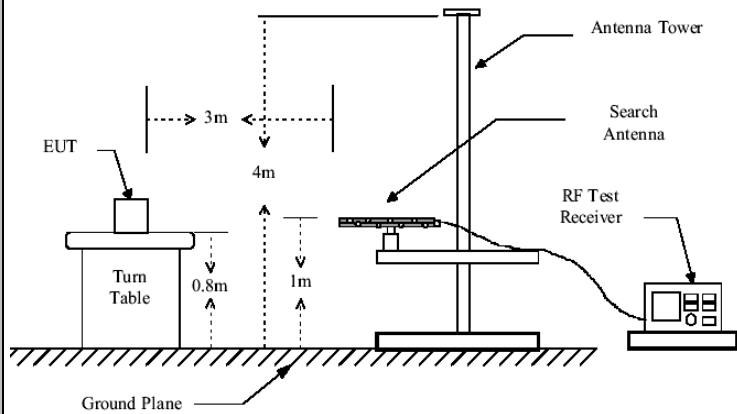


Highest Channel

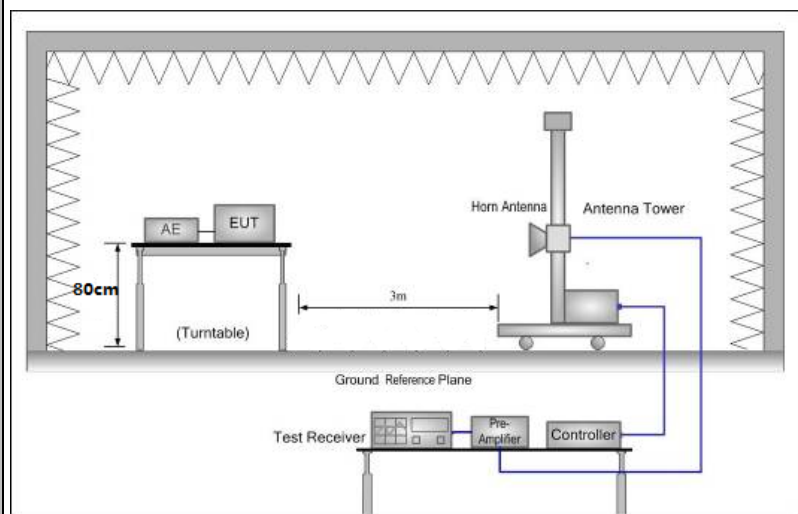
6.8. Radiated Spurious Emission Measurement

6.8.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.4: 2003				
Frequency Range:	9 kHz to 25 GHz				
Measurement Distance:	3 m				
Antenna Polarization:	Horizontal & Vertical				
Operation mode:	Transmitting mode with modulation				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
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:				
<p>For radiated emissions below 30MHz</p> <p>Distance = 3m</p> <p>EUT</p> <p>Turn table</p> <p>Ground Plane</p> <p>Computer</p> <p>Pre -Amplifier</p> <p>Receiver</p>					
30MHz to 1GHz					



Above 1GHz



Test Procedure:

1. The testing follows FCC KDB 558074 D01 DTS Meas Guidance v03r03.
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: $\text{Antenna Factor} + \text{Cable Loss} + \text{Read Level} - \text{Preamp Factor} = \text{Level}$

Test results:

PASS

6.8.2. Test Instruments

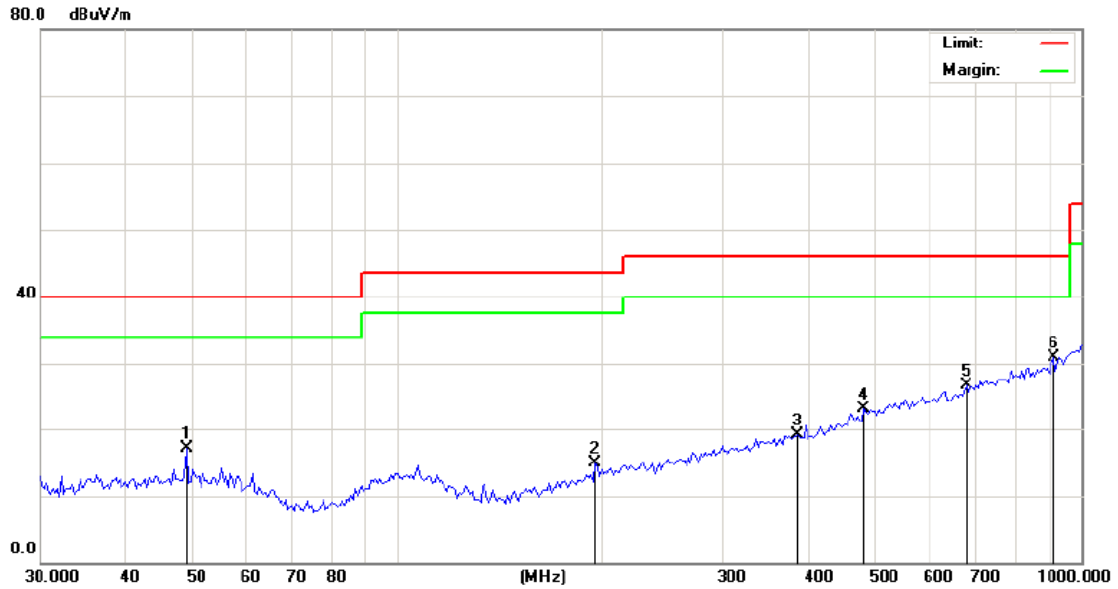
Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
ESPI Test Receiver	ROHDE&SCHW ARZ	ESVD	100008	Sep.16 , 2015
Spectrum Analyzer	ROHDE&SCHW ARZ	FSEM	848597/001	Sep.16 , 2015
Spectrum Analyzer	Agilent	N9020A	MY49100060	Oct. 21, 2015
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep.16 , 2015
Pre-amplifier	HP	8447D	2727A05017	Sep.16 , 2015
Loop antenna	ZHINAN	ZN30900A	12024	Dec.14 , 2015
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep.16 , 2015
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep.16 , 2015
Horn Antenna	Schwarzbeck	BBHA 9170	373	Sep.16 , 2015
Coax cable	TOBY	RE-low-01	N/A	Sep.15 , 2015
Coax cable	TOBY	RE-high-02	N/A	Sep.15 , 2015
Coax cable	TOBY	RE-low-03	N/A	Sep.15 , 2015
Coax cable	TOBY	RE-High-04	N/A	Sep.15 , 2015
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

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

6.8.3. Test Data

Please refer to following diagram for individual
Below 1GHz

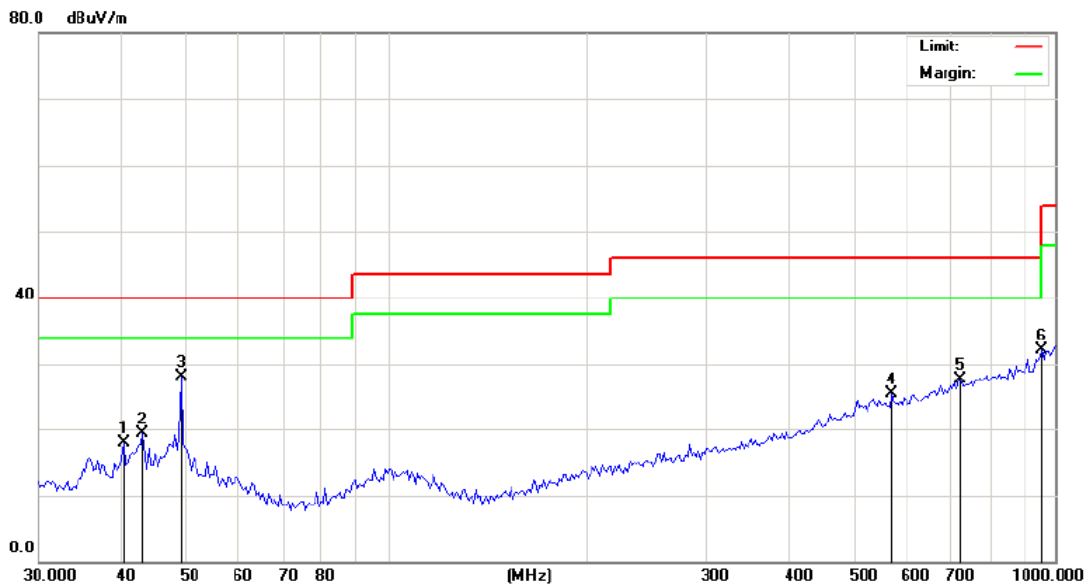
Horizontal:



Site: Polarization: *Horizontal* Temperature: 25
 Limit: FCC Part 15B Class B RE 3 m Power: Humidity: 56 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1		49.0627	29.24	-12.08	17.16	40.00	-22.84	QP	0	
2		194.4985	27.02	-12.06	14.96	43.50	-28.54	QP	0	
3		384.5447	25.53	-6.51	19.02	46.00	-26.98	QP	0	
4		481.5112	26.65	-3.56	23.09	46.00	-22.91	QP	0	
5		679.4346	27.04	-0.29	26.75	46.00	-19.25	QP	0	
6	*	912.6953	27.76	3.10	30.86	46.00	-15.14	QP	0	

Vertical:



Site: Polarization: **Vertical** Temperature: 25
 Limit: FCC Part 15B Class B RE_3 m Power: Humidity: 56 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1		40.2995	30.30	-12.47	17.83	40.00	-22.17	QP	0	
2		42.9305	31.55	-12.34	19.21	40.00	-20.79	QP	0	
3	*	49.0627	40.14	-12.08	28.06	40.00	-11.94	QP	0	
4		569.9688	27.69	-2.24	25.45	46.00	-20.55	QP	0	
5		723.7930	27.22	0.45	27.67	46.00	-18.33	QP	0	
6		958.7135	27.48	4.66	32.14	46.00	-13.86	QP	0	

Note: 1. The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

2. Measurements were conducted in all modes, and the worst case mode (802.11b, Highest channel) was submitted only.

Above 1GHz

Modulation Type: 802.11b

Low channel: 2412 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
2390	H	50.87	---	-4.2	46.67	---	74	54	-7.33
4824	H	51.38	---	0.75	52.13	---	74	54	-1.87
7236	H	42.76	---	9.87	52.63	---	74	54	-1.37
---	H	---	---	---	---	---	---	---	---
2390	V	54.62	---	-4.2	50.42	---	74	54	-3.58
4824	V	49.57	---	0.75	50.32	---	74	54	-3.68
7236	V	41.46	---	9.87	51.33	---	74	54	-2.67
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4874	H	50.91	---	0.97	51.88	---	74	54	-2.12
7311	H	42.76	---	9.83	52.59	---	74	54	-1.41
---	H	---	---	---	---	---	---	---	---
4874	V	49.62	---	0.97	50.59	---	74	54	-3.41
7311	V	39.92	---	9.83	49.75	---	74	54	-4.25
---	V	---	---	---	---	---	---	---	---

High channel: 2462 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
2483.5	H	48.15	---	-4.2	43.95	---	74	54	-10.05
4924	H	49.5	---	1.18	50.46	---	74	54	-3.54
7386	H	39.7	---	10.07	50.64	---	74	54	-3.36
---	H	---	---	---	---	---	---	---	---
2483.5	V	51.58	---	-4.2	47.38	---	74	54	-6.62
4924	V	49.16	---	1.18	51.33	---	74	54	-2.67
7386	V	41.03	---	10.07	50.33	---	74	54	-3.67
---	V	---	---	---	---	---	---	---	---

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
5. 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.

Modulation Type: 802.11g

Low channel: 2412 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB μ V)	AV reading (dB μ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB μ V/m)	AV limit (dB μ V/m)	Margin (dB)
					Peak (dB μ V/m)	AV (dB μ V/m)			
2390	H	52.76	---	-4.2	48.56	---	74	54	-5.44
4824	H	50.47	---	0.75	51.22	---	74	54	-2.78
7236	H	40.91	---	9.87	50.78	---	74	54	-3.22
---	H	---	---	---	---	---	---	---	---
2390	V	51.51	---	-4.2	47.31	---	74	54	-6.69
4824	V	47.29	---	0.75	48.04	---	74	54	-5.96
7236	V	41.13	---	9.87	51	---	74	54	-3
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB μ V)	AV reading (dB μ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB μ V/m)	AV limit (dB μ V/m)	Margin (dB)
					Peak (dB μ V/m)	AV (dB μ V/m)			
4874	H	48.22	---	0.97	49.19	---	74	54	-4.81
7311	H	39.55	---	9.83	49.38	---	74	54	-4.62
---	H	---	---	---	---	---	---	---	---
4874	V	44.08	---	0.97	45.05	---	74	54	-8.95
7311	V	41	---	9.83	50.83	---	74	54	-3.17
---	V	---	---	---	---	---	---	---	---

High channel: 2462 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB μ V)	AV reading (dB μ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB μ V/m)	AV limit (dB μ V/m)	Margin (dB)
					Peak (dB μ V/m)	AV (dB μ V/m)			
2483.5	H	50.1	---	-4.2	45.9	---	74	54	-8.1
4924	H	46.53	---	1.18	50.46	---	74	54	-3.54
7386	H	40.48	---	10.07	50.64	---	74	54	-3.36
---	H	---	---	---	---	---	---	---	---
2483.5	V	47.58	---	-4.2	43.38	---	74	54	-10.62
4924	V	45.48	---	1.18	51.33	---	74	54	-2.67
7386	V	39.09	---	10.07	50.33	---	74	54	-3.67
---	V	---	---	---	---	---	---	---	---

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dB μ V/m)-Average limit (dB μ V/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
5. 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.

Modulation Type: 802.11n (HT20)

Low channel: 2412 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
					Peak (dBµV/m)	AV (dBµV/m)			
2390	H	53.9	---	-4.2	49.7	---	74	54	-4.3
4824	H	50.75	---	0.75	51.5	---	74	54	-2.5
7236	H	39.91	---	9.87	49.78	---	74	54	-4.22
---	H	---	---	---	---	---	---	---	---
2390	V	57.07	---	-4.2	52.87	---	74	54	-1.13
4824	V	45.86	---	0.75	46.61	---	74	54	-7.39
7236	V	41.25	---	9.87	51.12	---	74	54	-2.88
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
					Peak (dBµV/m)	AV (dBµV/m)			
4874	H	48.1	---	0.97	49.07	---	74	54	-4.93
7311	H	40.62	---	9.83	50.45	---	74	54	-3.55
---	H	---	---	---	---	---	---	---	---
4874	V	44.61	---	0.97	45.58	---	74	54	-8.42
7311	V	39.34	---	9.83	49.17	---	74	54	-4.83
---	V	---	---	---	---	---	---	---	---

High channel: 2462 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
					Peak (dBµV/m)	AV (dBµV/m)			
2483.5	H	49.42	---	-4.2	45.22	---	74	54	-8.78
4924	H	46.07	---	1.18	50.46	---	74	54	-3.54
7386	H	39.94	---	10.07	50.64	---	74	54	-3.36
---	H	---	---	---	---	---	---	---	---
2483.5	V	48.14	---	-4.2	43.94	---	74	54	-10.06
4924	V	45.18	---	1.18	51.33	---	74	54	-2.67
7386	V	39.97	---	10.07	50.33	---	74	54	-3.67
---	V	---	---	---	---	---	---	---	---

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBµV/m)-Average limit (dBµV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
5. 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.

Modulation Type: 802.11n (HT40)

Low channel: 2422 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
2390	H	55.01	---	-4.2	50.81	---	74	54	-3.19
4844	H	46.31	---	0.75	47.06	---	74	54	-6.94
7266	H	40	---	9.87	49.87	---	74	54	-4.13
---	H	---	---	---	---	---	---	---	---
2390	V	56.85	---	-4.2	52.65	---	74	54	-1.35
4844	V	43.22	---	0.75	43.97	---	74	54	-10.03
7266	V	41.54	---	9.87	51.41	---	74	54	-2.59
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4874	H	43.99	---	0.97	44.96	---	74	54	-9.04
7311	H	39.37	---	9.83	49.2	---	74	54	-4.8
---	H	---	---	---	---	---	---	---	---
4874	V	41.96	---	0.97	42.93	---	74	54	-11.07
7311	V	39.54	---	9.83	49.37	---	74	54	-4.63
---	V	---	---	---	---	---	---	---	---

High channel: 2452 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
2483.5	H	44.5	---	-4.2	40.3	---	74	54	-13.7
4904	H	42.27	---	1.18	50.46	---	74	54	-3.54
7356	H	40.08	---	10.07	50.64	---	74	54	-3.36
---	H	---	---	---	---	---	---	---	---
2483.5	V	47.72	---	-4.2	43.52	---	74	54	-10.48
4904	V	42.34	---	1.18	51.33	---	74	54	-2.67
7356	V	40.56	---	10.07	50.33	---	74	54	-3.67
---	V	---	---	---	---	---	---	---	---

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
5. 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.

*******END OF REPORT*******