

FCC Part 15E

Measurement and Test Report

For

LM Technologies Ltd.

Unit 19 32-34 Gordon House Road, London NW51LP United Kingdom

FCC ID: VVX808-04XX

FCC Rule(s): FCC Part 15E

Product Description: LM808 WiFi USB Adapter 433Mbps

Tested Model: 808-04xx

Report No.: STR17058201I-1

Tested Date: 2017-05-15 to 2017-07-03

Issued Date: 2017-07-03

Tested By: Jason Su / Engineer

Reviewed By: Silin Chen / EMC Manager

Approved & Authorized By: Jandy So / PSQ Manager

Prepared By:

Jason Su
Silin Chen
Jandy So

Shenzhen SEM.Test Technology Co., Ltd.
1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C. (518101)

Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM.Test Technology Co., Ltd.

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	4
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
1.2 TEST STANDARDS.....	5
1.3 TEST METHODOLOGY.....	5
1.4 TABLE FOR PARAMETERS OF TEST SOFTWARE SETTING	5
1.5 EUT OPERATING DURING TEST	6
1.6 TEST FACILITY	6
1.7 EUT SETUP AND TEST MODE.....	6
1.8 MEASUREMENT UNCERTAINTY	7
1.9 TEST EQUIPMENT LIST AND DETAILS	7
2. SUMMARY OF TEST RESULTS	8
3. RF EXPOSURE	9
3.1 STANDARD APPLICABLE.....	9
3.2 TEST RESULT.....	9
4. ANTENNA REQUIREMENT	10
4.1 STANDARD APPLICABLE.....	10
4.2 EVALUATION INFORMATION	10
5. CONDUCTED EMISSIONS	11
5.1 TEST PROCEDURE.....	11
5.3 BASIC TEST SETUP BLOCK DIAGRAM.....	11
5.4 ENVIRONMENTAL CONDITIONS	12
5.5 TEST RECEIVER SETUP	12
5.6 SUMMARY OF TEST RESULTS/PLOTS	12
5.7 CONDUCTED EMISSIONS TEST DATA.....	12
6. POWER SPECTRAL DENSITY	15
6.1 STANDARD APPLICABLE.....	15
6.2 TEST PROCEDURE.....	15
6.3 ENVIRONMENTAL CONDITIONS	16
6.4 SUMMARY OF TEST RESULTS/PLOTS	16
7. EMISSION BANDWIDTH AND OCCUPIED BANDWIDTH.....	27
7.1 STANDARD APPLICABLE.....	27
7.2 TEST PROCEDURE.....	27
7.3 ENVIRONMENTAL CONDITIONS	29
7.4 SUMMARY OF TEST RESULTS/PLOTS	29
8. MAXIMUM CONDUCTED OUTPUT POWER.....	44
8.1 STANDARD APPLICABLE.....	44
8.2 TEST PROCEDURE.....	44
8.3 ENVIRONMENTAL CONDITIONS	45
8.4 SUMMARY OF TEST RESULTS/PLOTS	45
9. CONDUCTED SPURIOUS EMISSIONS	55
9.1 STANDARD APPLICABLE.....	55
9.2 TEST PROCEDURE.....	55
9.3 ENVIRONMENTAL CONDITIONS	55
9.4 SUMMARY OF TEST RESULTS/PLOTS	55
10. RADIATED SPURIOUS EMISSIONS.....	74
10.1 STANDARD APPLICABLE.....	74
10.2 TEST PROCEDURE.....	74
10.3 TEST RECEIVER SETUP	75
10.4 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	75
10.5 ENVIRONMENTAL CONDITIONS	75
10.6 SUMMARY OF TEST RESULTS/PLOTS	76
11. FREQUENCY STABILITY	100
11.1 STANDARD APPLICABLE.....	100

11.2 TEST PROCEDURE.....	100
11.3 ENVIRONMENTAL CONDITIONS	100
11.4 SUMMARY OF TEST RESULTS/PLOTS	100

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: LM Technologies Ltd.
Address of applicant: Unit 19 32-34 Gordon House Road, London NW51LP United Kingdom

Manufacturer: LM Technologies Ltd.
Address of manufacturer: Unit 19 32-34 Gordon House Road, London NW51LP United Kingdom

General Description of EUT	
Product Name:	LM808 WiFi USB Adapter 433Mbps
Trade Name:	LM Technologies Ltd
Model No.:	808-04xx
Adding Model:	/
Rated Voltage:	USB DC5V
Power Adapter Model:	/
Note: The test data is gathered from a production sample provided by the manufacturer.	

Technical Characteristics of EUT	
Support Standards:	802.11a, 802.11n(HT20/40), 802.11ac-HT80
Frequency Range:	5180-5240MHz, 5745-5825MHz,
RF Output Power:	7.32dBm (Conducted)
Type of Modulation:	QPSK,16QAM, 64QAM, 256QAM
Data Rate:	6-54Mbps, up to 433Mbps
Channel Separation:	20MHz/40MHz/80MHz
Type of Antenna:	Integral
Antenna Gain:	4.7dBi

1.2 Test Standards

The following report is prepared on behalf of the LM Technologies Ltd in accordance with FCC Part 15, Subpart C&E, and section 15.203, 15.205, 15.207, 15.209 and 15.407 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C&E, and section 15.203, 15.205, 15.207, 15.209 and 15.407 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 789033 D02 v01r02 for Unlicensed National Information Infrastructure (U-NII) Devices shall be performed also.

1.4 Table for parameters of Test Software setting

The test utility software used during testing was “MPTool”. During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Mode	Test Frequency (MHz)												
	NCB: 20MHz												
	5180	5200	5240	5260	5300	5320	5500	5580	5700	5720	5745	5785	5825
802.11a 6Mbps	19	19	19	/	/	/	/	/	/	/	15	15	15
802.11n-HT20 MCS0	19	19	19	/	/	/	/	/	/	/	15	15	15
Mode	NCB: 40MHz												
	5190	5230	5270	5310	5510	5550	5670	5710	5755	5795			
802.11n-HT40 MCS0	19	19	/	/	/	/	/	/	15	15			
Mode	NCB: 80MHz												
	5210		5290		5530		5610		5690		5775		
802.11ac-HT80 MCS0/Nss2	19		/		/		/		/		15		

1.5 EUT Operating during test

EUT was programmed to be in continuously transmitting mode. During the test, EUT operation to normal function and programs under WIN XP were executed.

1.6 Test Facility

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

1.7 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11a	5180MHz, 5200MHz, 5240MHz, 5745MHz, 5785MHz, 5825MHz
TM2	802.11n-HT20	5180MHz, 5200MHz, 5240MHz, 5745MHz, 5785MHz, 5825MHz
TM3	802.11n-HT40	5190MHz, 5230MHz, 5755MHz, 5795MHz
TM4	802.11ac-HT80	5210MHz, 5775MHz
Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.		

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Core
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	E445	/

1.8 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.9 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-12	2018-06-11
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-12	2018-06-11
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-12	2018-06-11
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-12	2018-06-11
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203; § 15.405	Antenna Requirement	Compliant
§ 15.207; § 15.407(b)(6)	Conducted Emission	Compliant
§ 15.407(a)(1),(2)	Power Spectral Density	Compliant
§ 15.407(e)	Emission Bandwidth and Occupied Bandwidth	Compliant
§ 15.407(a)(1),(2)	Maximum Conducted Output Power	Compliant
§ 15.407(b)(1),(2),(3)	Conducted Spurious Emission	Compliant
§ 15.205; § 15.407(b)(1),(2),(3)	Radiated Emission	Compliant
§ 15.407(g)	Frequency Stability	Compliant
§ 15.407(h)	Dynamic Frequency Selection (DFS)	N/A

N/A: not applicable

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the SAR Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 15.203, 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 shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

This product has an integral antenna, fulfill the requirement of this section.

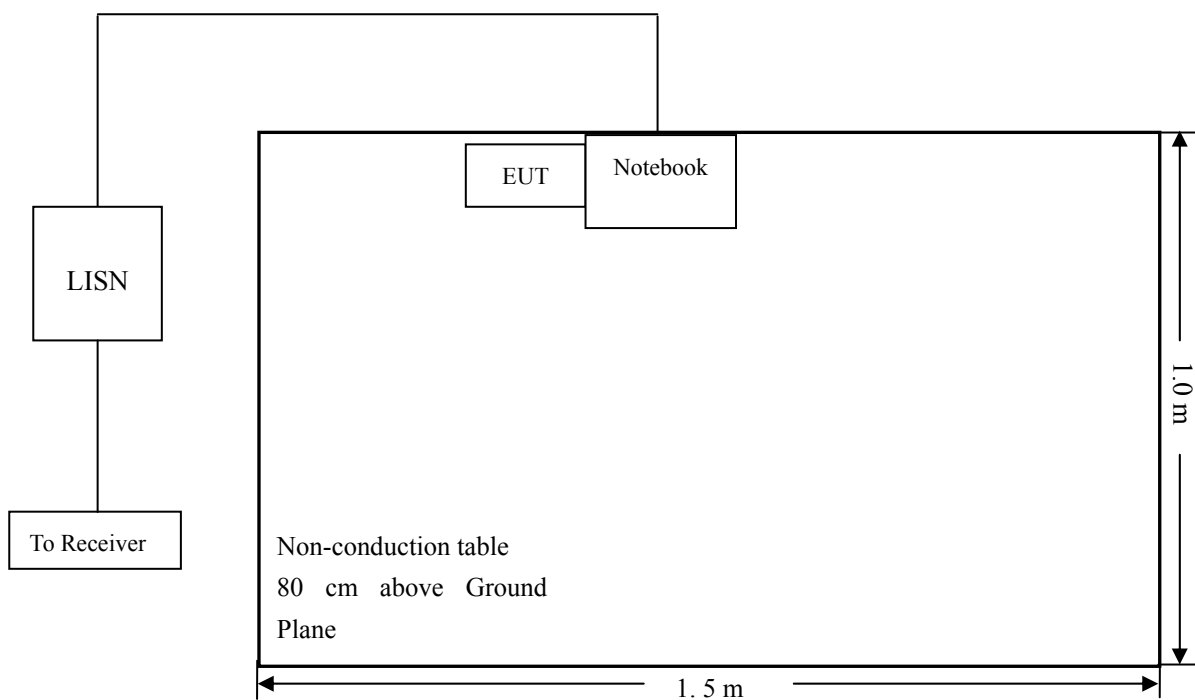
5. Conducted Emissions

5.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

5.3 Basic Test Setup Block Diagram



5.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

5.5 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency 150 kHz
Stop Frequency..... 30 MHz
Sweep Speed Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth 9 kHz
Quasi-Peak Adapter Mode Normal

5.6 Summary of Test Results/Plots

According to the data in section 5.7, the EUT complied with the FCC Part 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

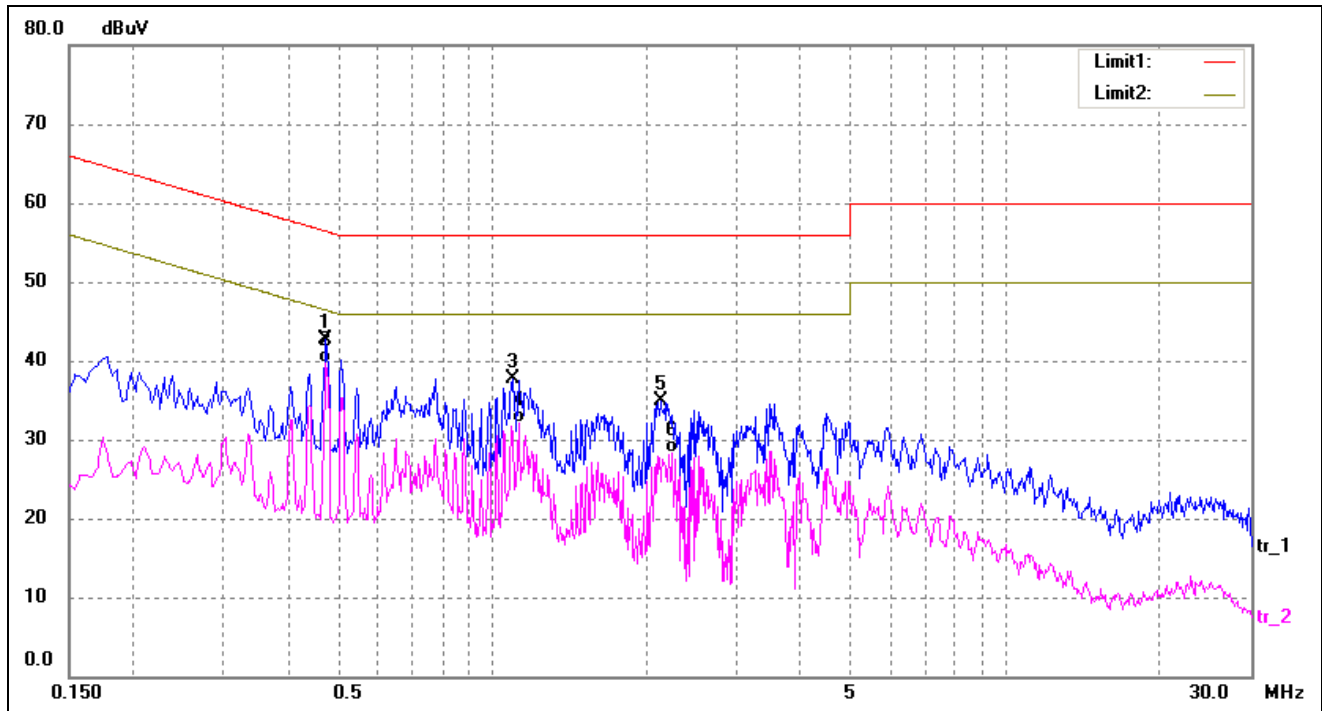
-6.82 dB at 0.4740 MHz in the **Neutral, Average** detector, 0.15-30MHz

5.7 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

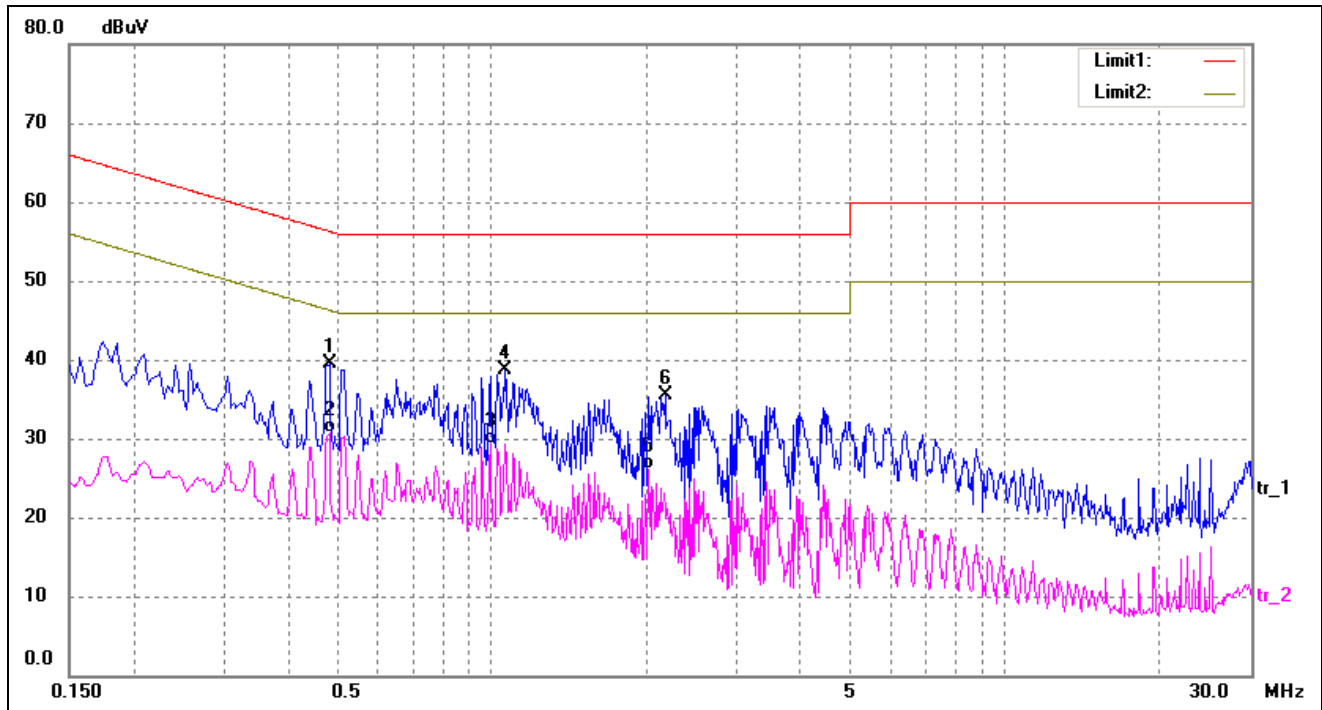
EUT: LM808 WiFi USB Adapter 433Mbps
Tested Model: 808-04xx
Operating Condition: Transmitting
Comment: AC 120V/60Hz; USB 5V

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.4740	32.90	9.80	42.70	56.44	-13.74	peak
2*	0.4740	29.82	9.80	39.62	46.44	-6.82	AVG
3	1.0940	27.93	9.76	37.69	56.00	-18.31	peak
4	1.1260	22.32	9.76	32.08	46.00	-13.92	AVG
5	2.1300	25.13	9.73	34.86	56.00	-21.14	peak
6	2.2380	18.54	9.73	28.27	46.00	-17.73	AVG

Test Specification: Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.4820	29.70	9.80	39.50	56.30	-16.80	peak
2*	0.4820	20.91	9.80	30.71	46.30	-15.59	AVG
3	0.9940	19.63	9.76	29.39	46.00	-16.61	AVG
4	1.0620	28.85	9.76	38.61	56.00	-17.39	peak
5	2.0220	16.46	9.73	26.19	46.00	-19.81	AVG
6	2.1740	25.72	9.73	35.45	56.00	-20.55	peak

6. Power Spectral Density

6.1 Standard Applicable

Section 15.407(a) Power limits:

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

6.2 Test Procedure

According to 789033 D02 General UNII Test Procedures New Rules v01, the following is the measurement procedure.

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth ($< 1 \text{ MHz}$, or $< 500 \text{ kHz}$) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

- a) Set $RBW \geq 1/T$, where T is defined in section II.B.1.a).
- b) Set $VBW \geq 3 RBW$.
- c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500\text{kHz}/RBW)$ to the measured result, whereas $RBW (< 500 \text{ KHz})$ is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
- d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10\log(1\text{MHz}/RBW)$ to the measured result, whereas $RBW (< 1 \text{ MHz})$ is the reduced resolution bandwidth of spectrum analyzer set during measurement.
- e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since $RBW=100 \text{ KHz}$ is available on nearly all spectrum analyzers.

6.3 Environmental Conditions

Temperature:	20° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

6.4 Summary of Test Results/Plots

5150-5250MHz

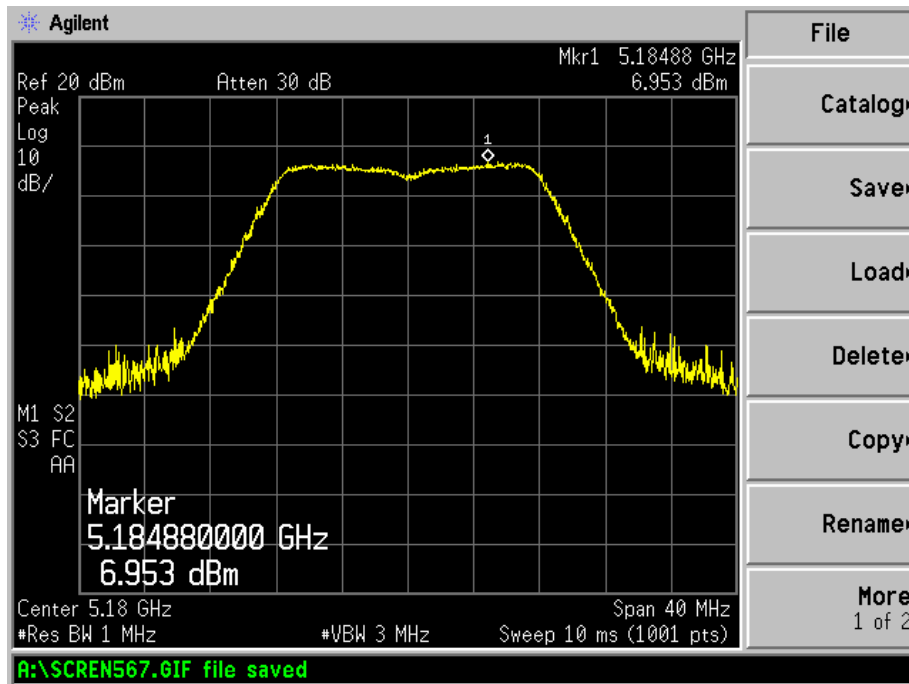
Operating mode	Test Channel	Power Spectral Density dBm/MHz	Limit (dBm/MHz)
802.11a	5180	6.953	11
	5200	5.429	11
	5240	6.415	11
802.11n-HT20	5180	5.561	11
	5200	4.163	11
	5240	5.228	11
802.11n-HT40	5190	2.446	11
	5230	2.882	11
802.11ac-HT80	5210	1.278	11

5725-5850MHz

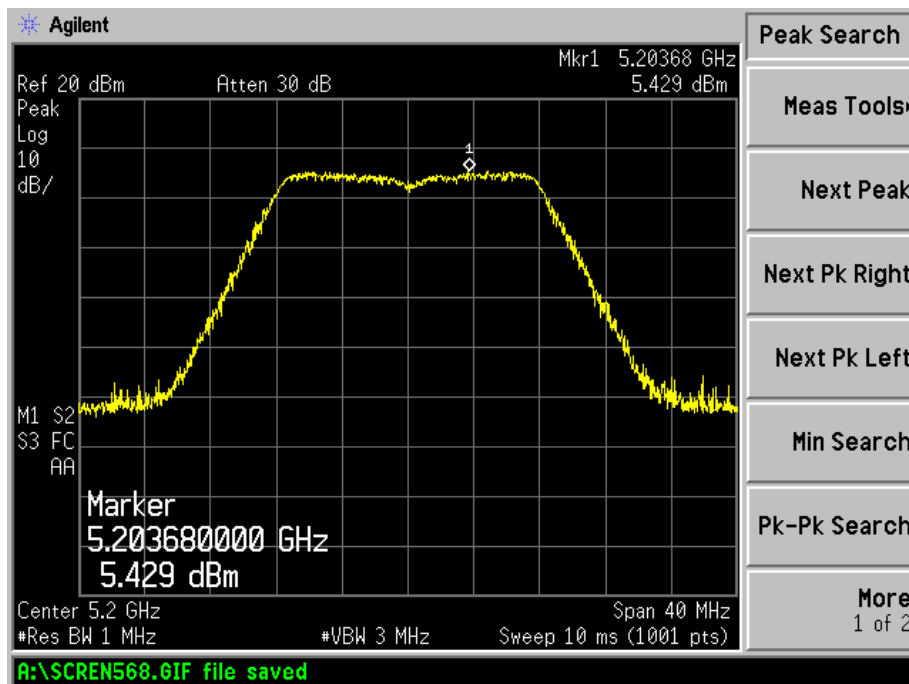
Operating mode	Test Channel	Power Spectral Density dBm/500kHz	Limit (dBm/500kHz)
802.11a	5745	-1.725	30
	5785	-0.217	30
	5825	-0.320	30
802.11n-HT20	5745	-0.276	30
	5785	-1.728	30
	5825	-0.846	30
802.11n-HT40	5755	-5.050	30
	5795	-4.187	30
802.11ac-HT80	5775	-6.094	30

Test Mode: 802.11a

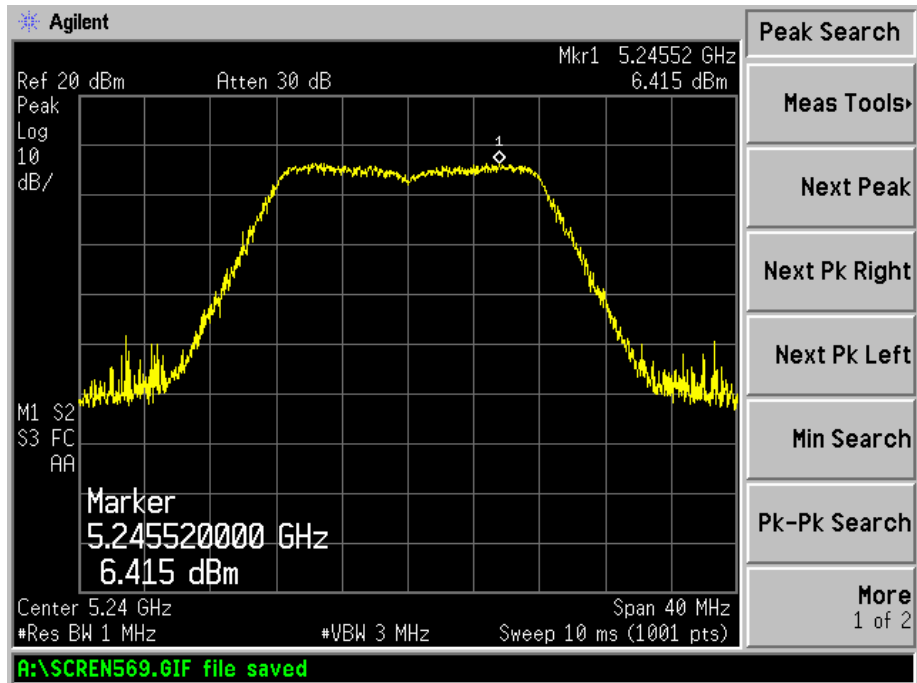
5180MHz



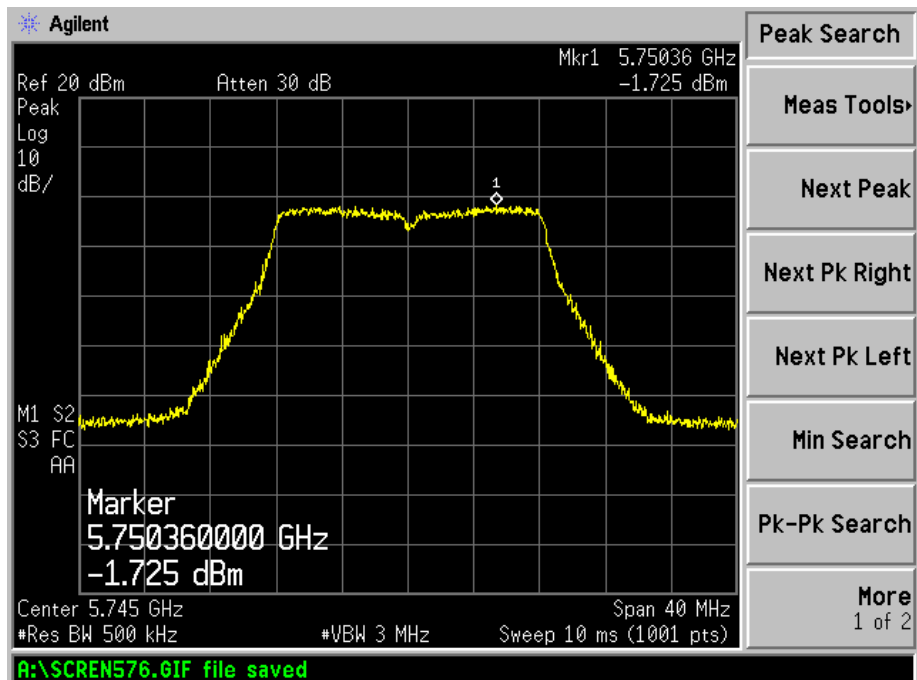
5200MHz



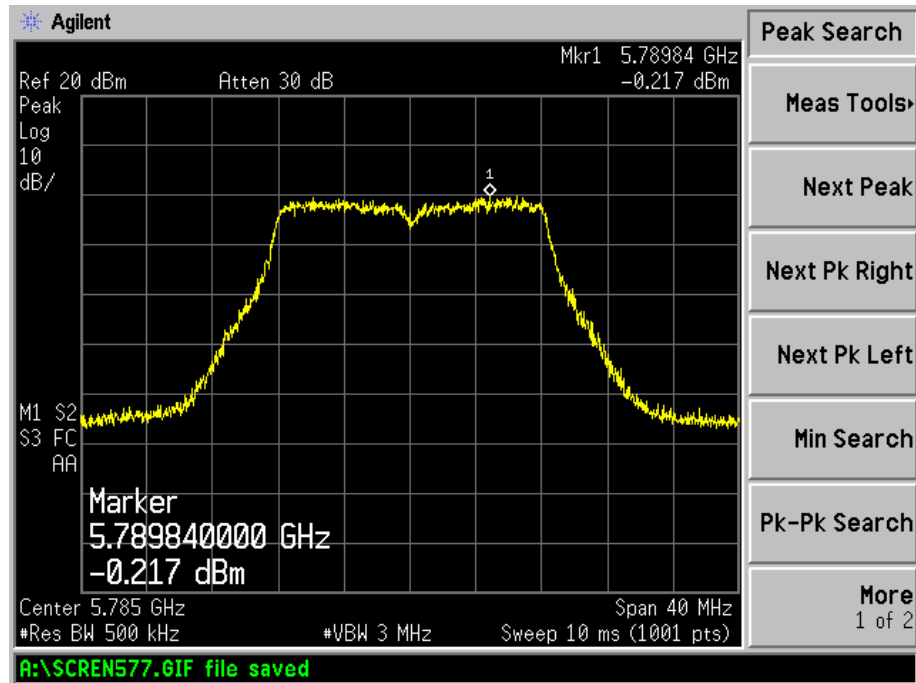
5240MHz



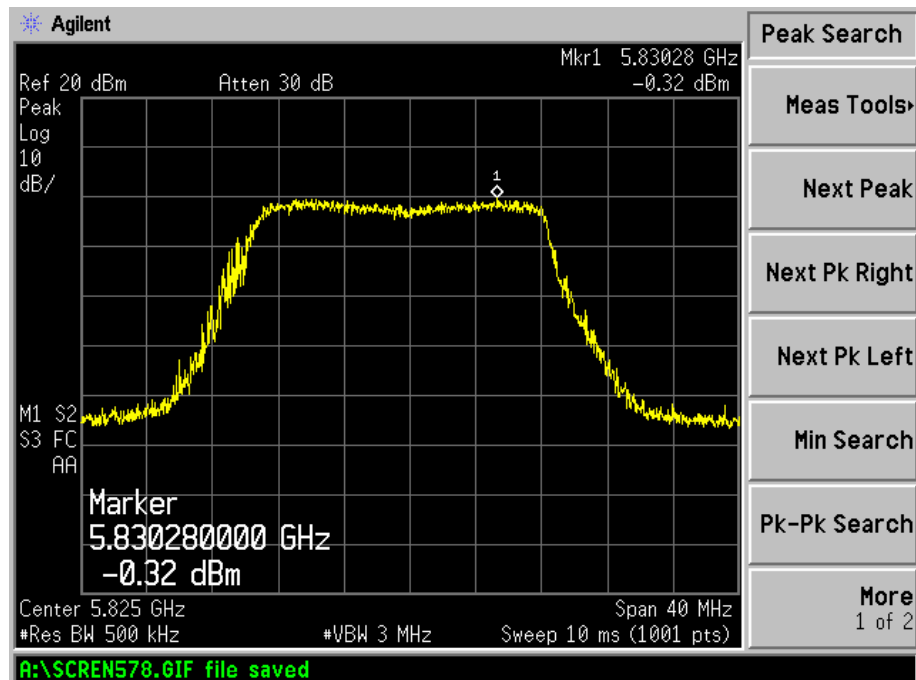
5745MHz



5785MHz

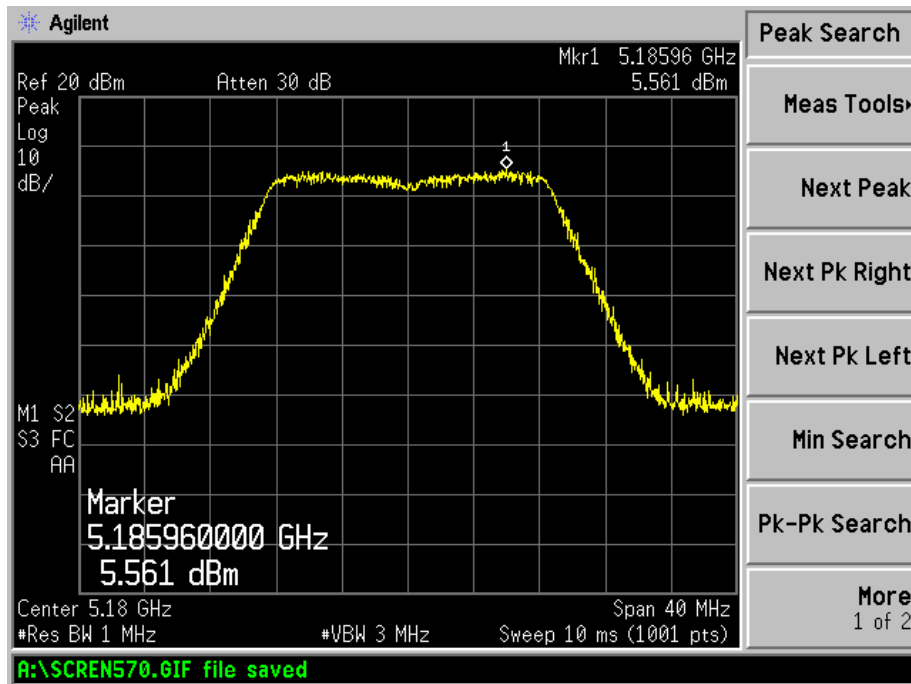


5825MHz

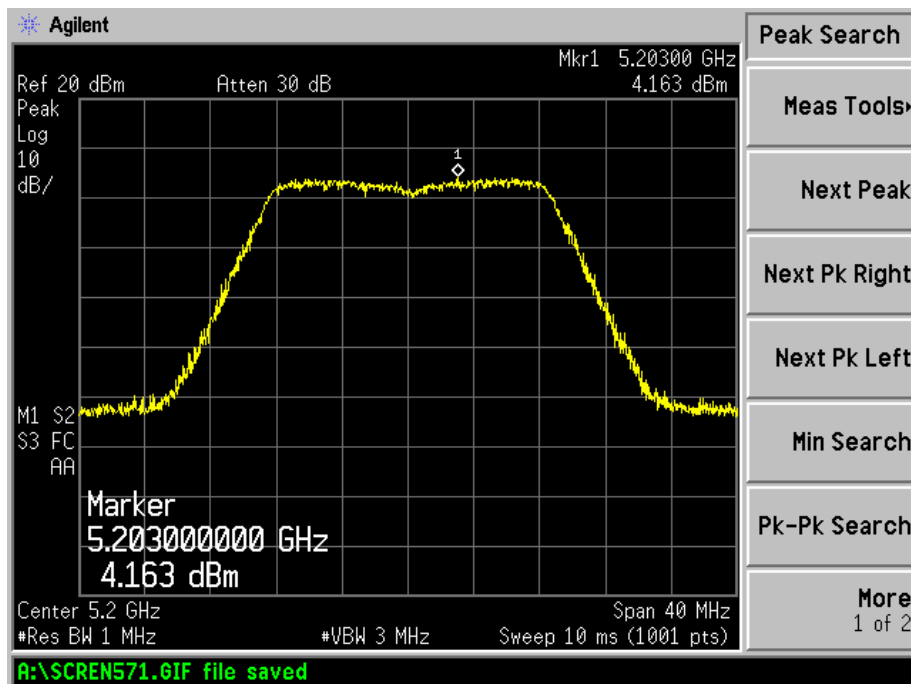


Test Mode: 802.11n-HT20

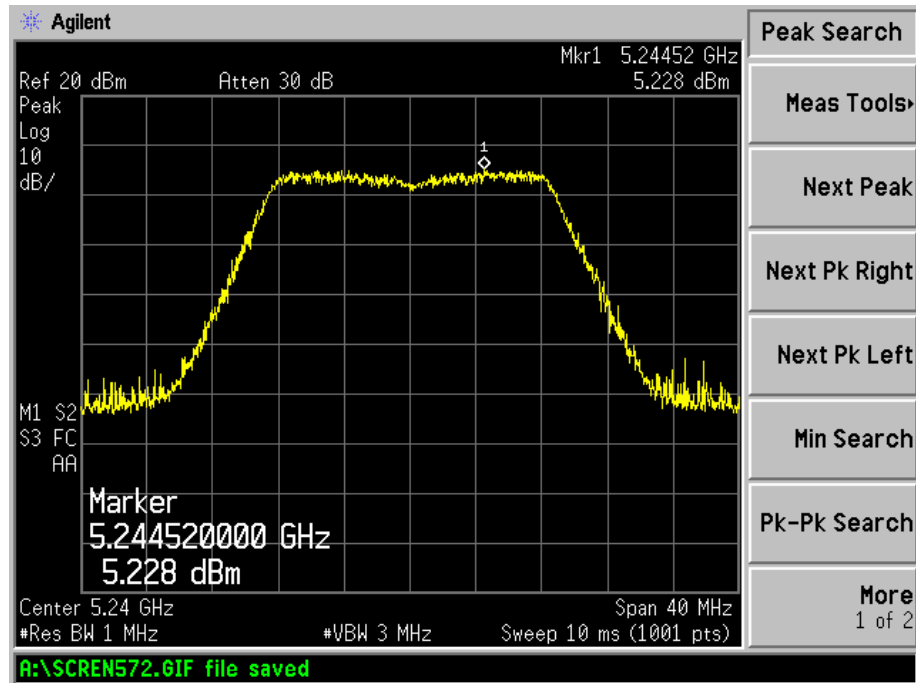
5180MHz



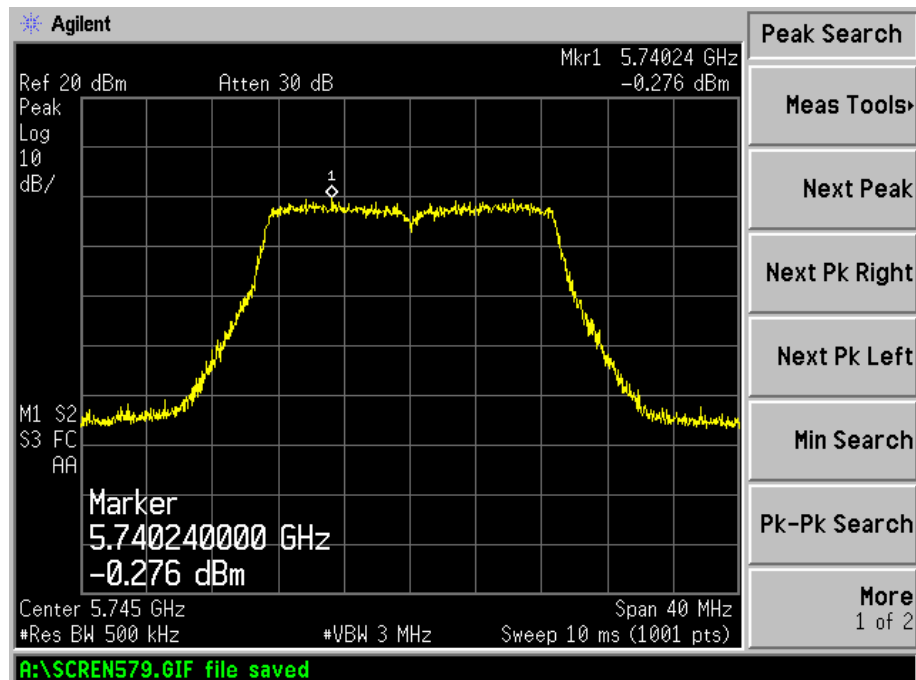
5200MHz



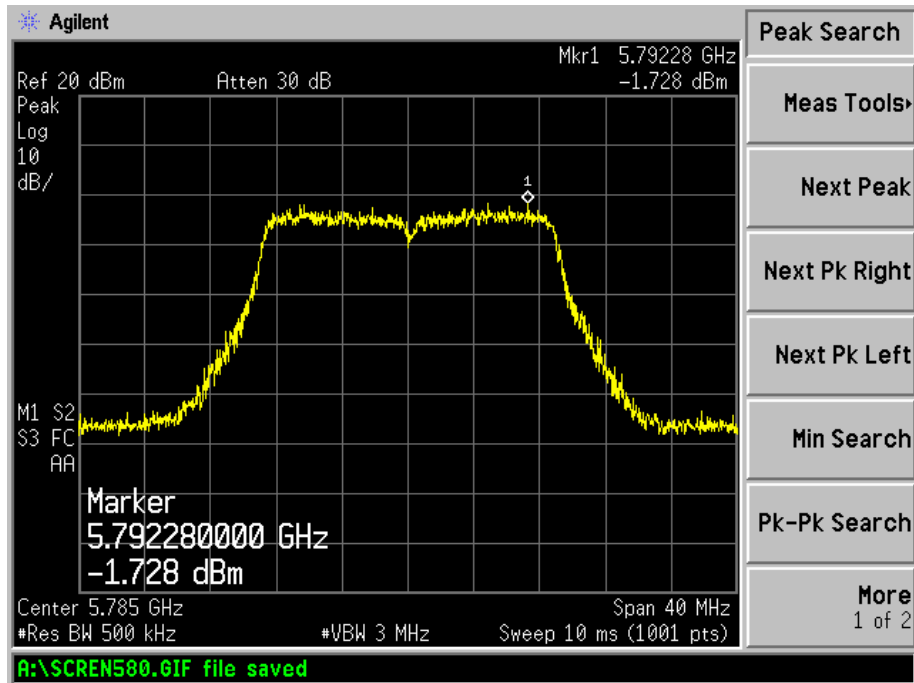
5240MHz



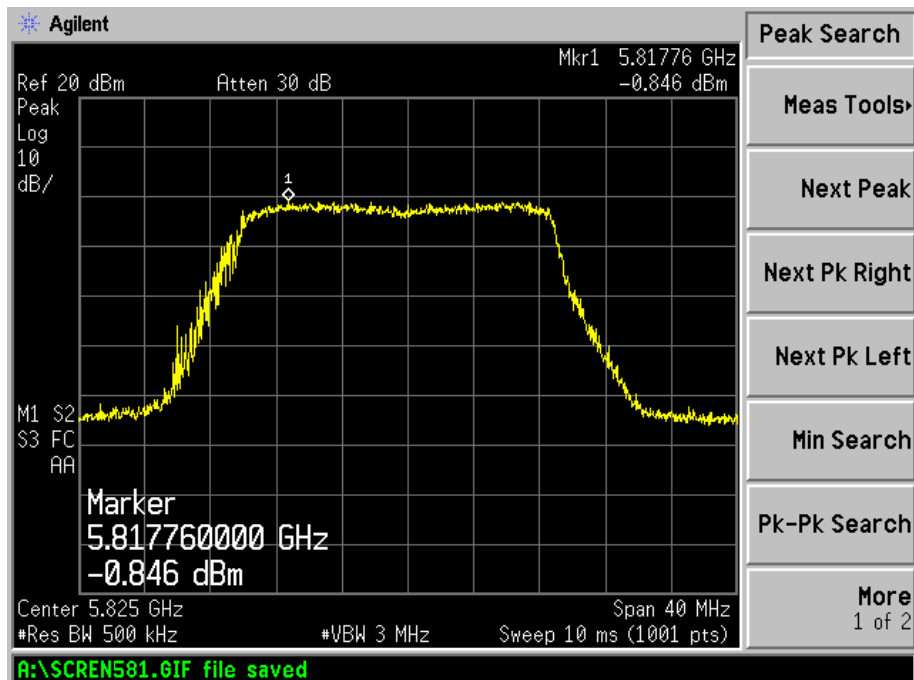
5745MHz



5785MHz

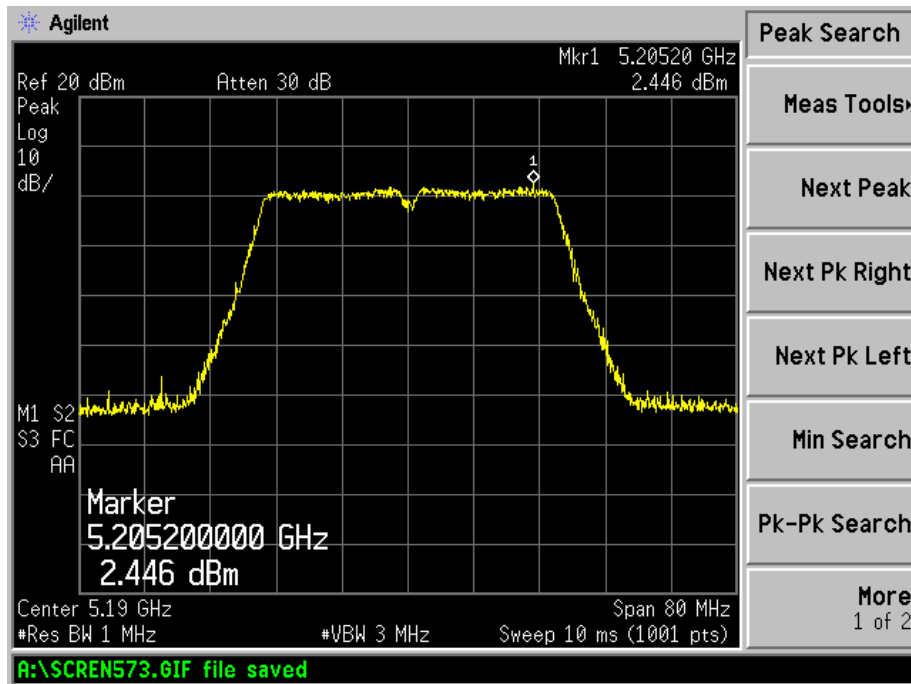


5825MHz

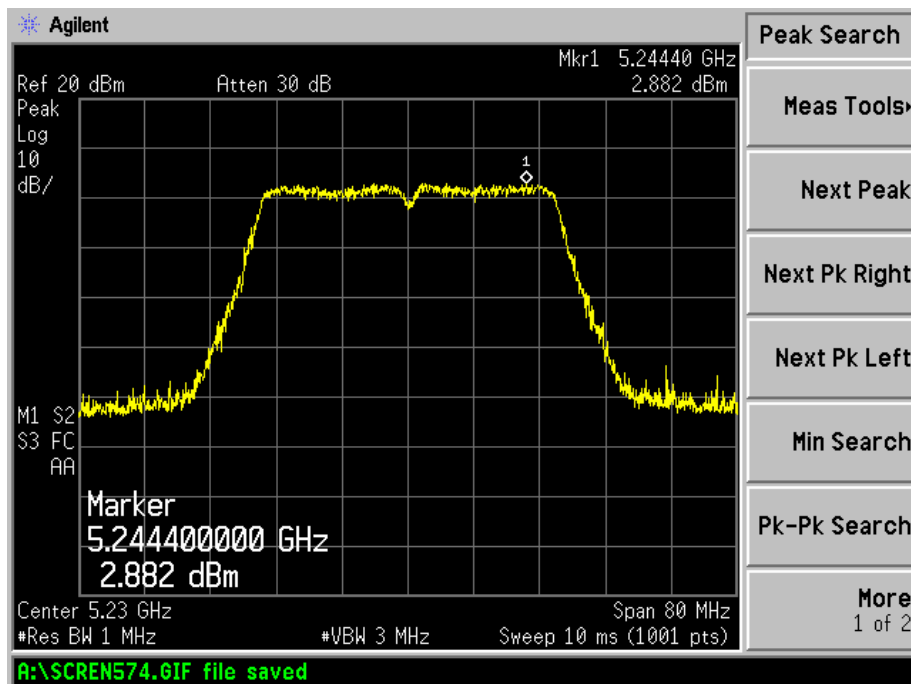


Test Mode: 802.11n-HT40

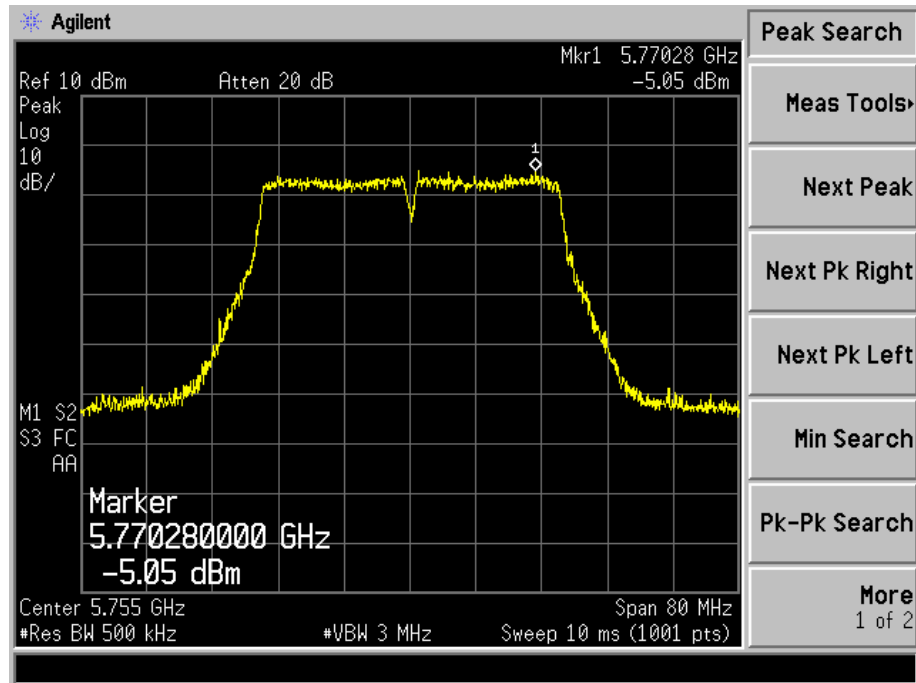
5190MHz



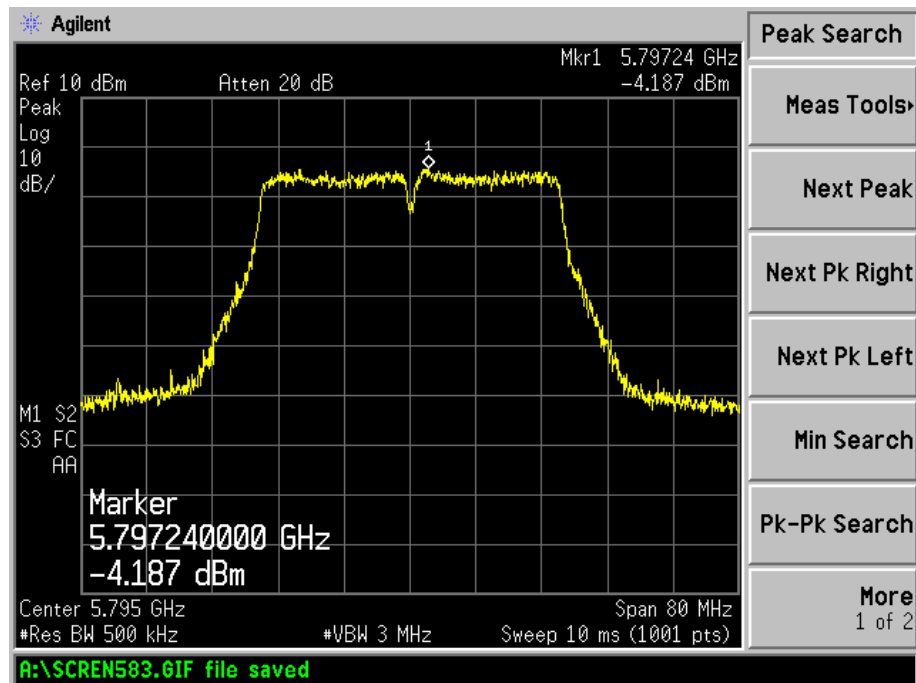
5230MHz



5755MHz

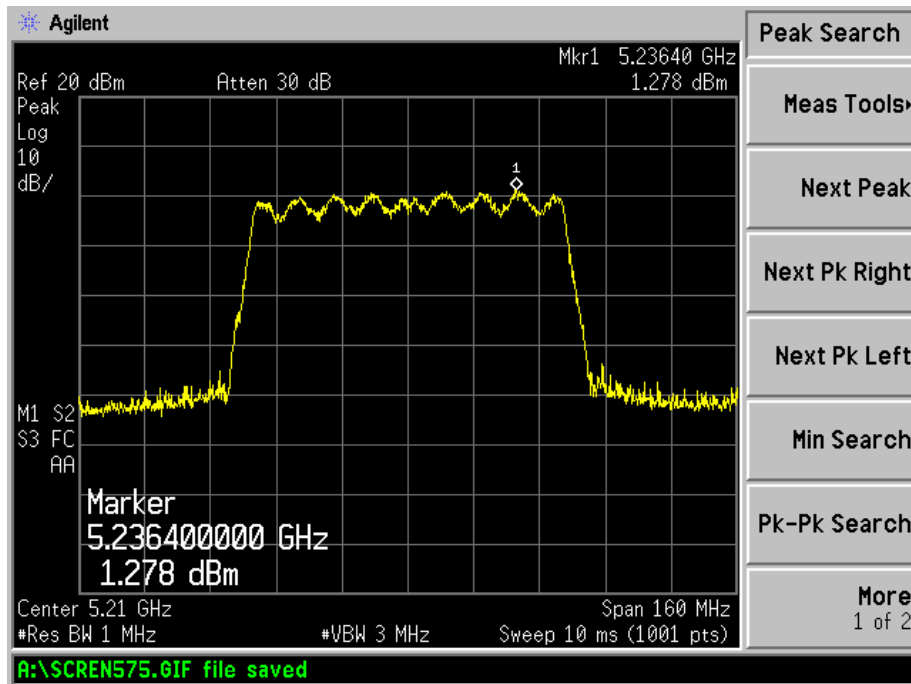


5795MHz

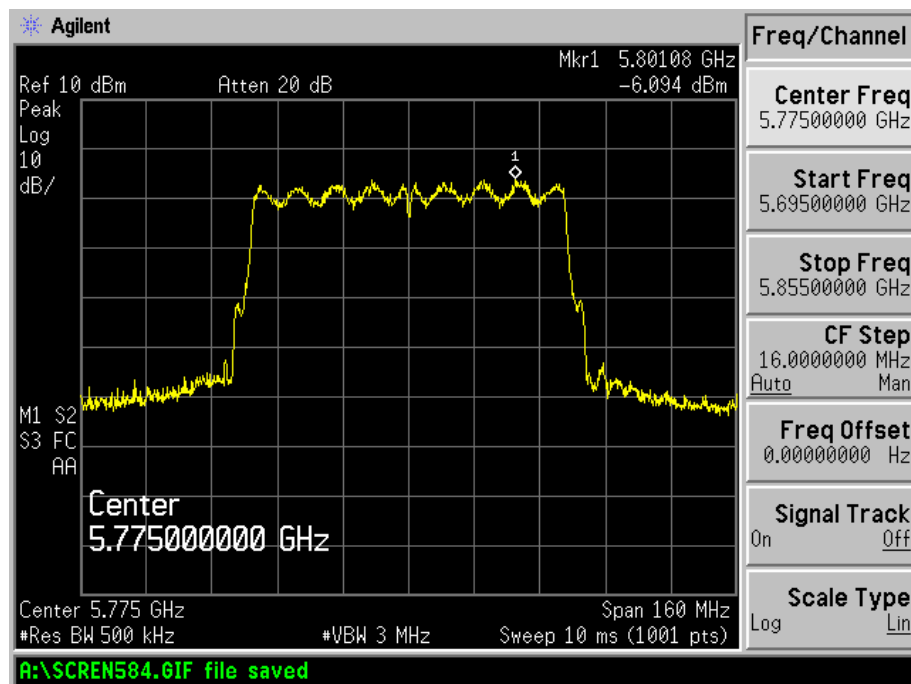


Test Mode: 802.11ac-HT80

5210MHz



5775MHz



7. Emission Bandwidth and Occupied Bandwidth

7.1 Standard Applicable

According to 15.407 (a) and (e)

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

7.2 Test Procedure

According to 789033 D02 v01r02 section C&D, the following is the measurement procedure.

1. Emission Bandwidth (EBW)

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare

this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

D. 99 Percent Occupied Bandwidth

The 99-percent occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99-percent occupied bandwidth is required only as a condition for using the optional band-edge measurement techniques described in section II.G.3.d). Measurements of 99-percent occupied bandwidth may also optionally be used in lieu of the EBW to 789033 D02 v01r02 General UNII Test Procedures New Rules v01 define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in section II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW $\geq 3 \cdot \text{RBW}$
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

7.3 Environmental Conditions

Temperature:	24° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

7.4 Summary of Test Results/Plots

5150-5250MHz

Test Mode	Test Channel MHz	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit MHz
802.11a	5180	24.028	17.0834	Pass
	5200	21.070	16.8021	Pass
	5240	21.766	16.8767	Pass
802.11n-HT20	5180	22.007	17.9928	Pass
	5200	22.214	17.8854	Pass
	5240	21.808	17.8224	Pass
802.11n-HT40	5190	45.222	37.4314	Pass
	5230	43.994	36.8572	Pass
802.11ac-HT80	5210	85.293	75.8079	Pass

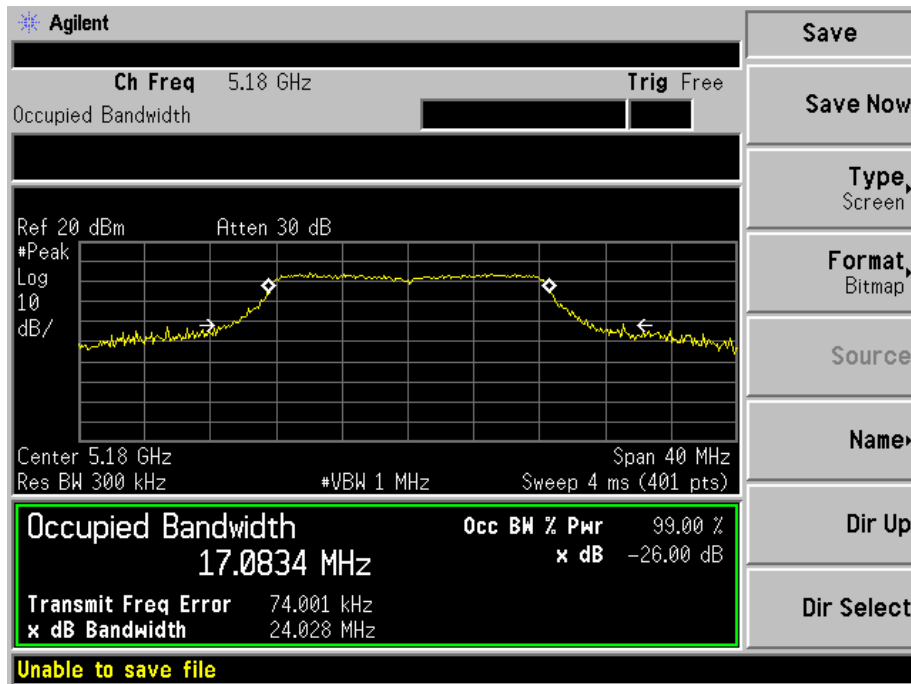
5725-5850MHz

Test Mode	Test Channel MHz	26 dB Bandwidth MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit MHz
802.11a	5745	21.808	16.335	16.8716	≥500
	5785	21.199	16.360	16.7428	≥500
	5805	21.959	17.542	17.8572	≥500
802.11n-HT20	5745	21.953	16.271	17.9819	≥500
	5785	22.280	17.514	17.8993	≥500
	5805	22.211	17.377	17.9127	≥500
802.11n-HT40	5755	44.257	35.687	36.8363	≥500
	5795	44.691	35.345	36.8479	≥500
802.11ac-HT80	5775	83.876	75.866	75.6260	≥500

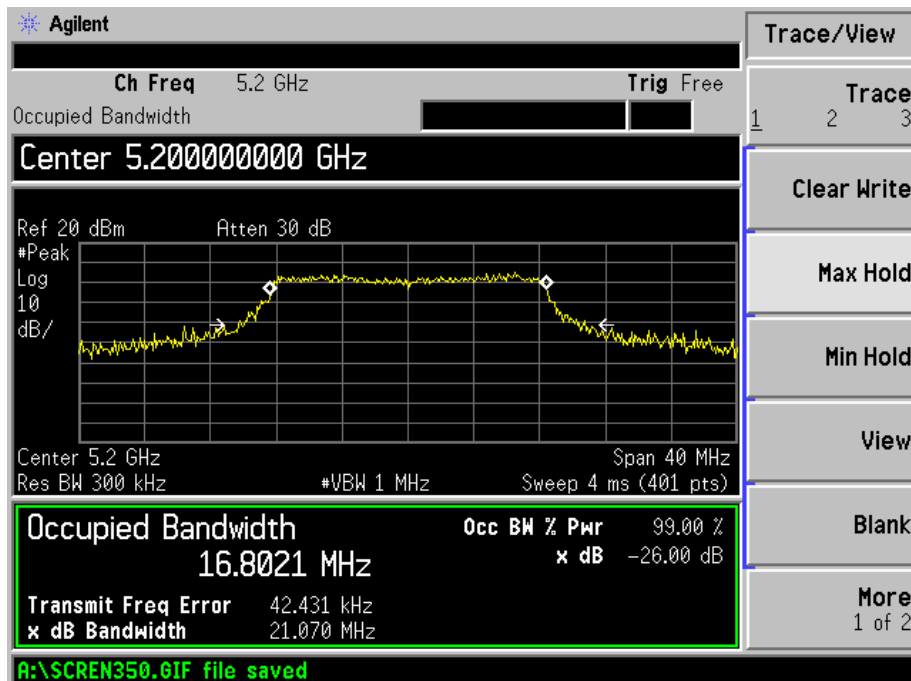
5150-5250MHz

Test mode: 802.11a

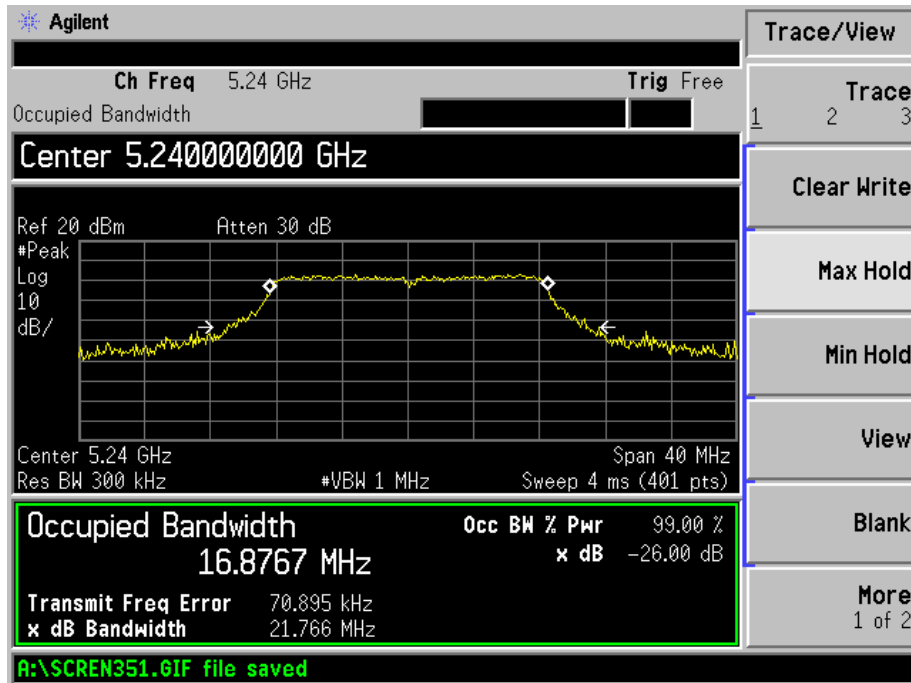
5180MHz



5200MHz

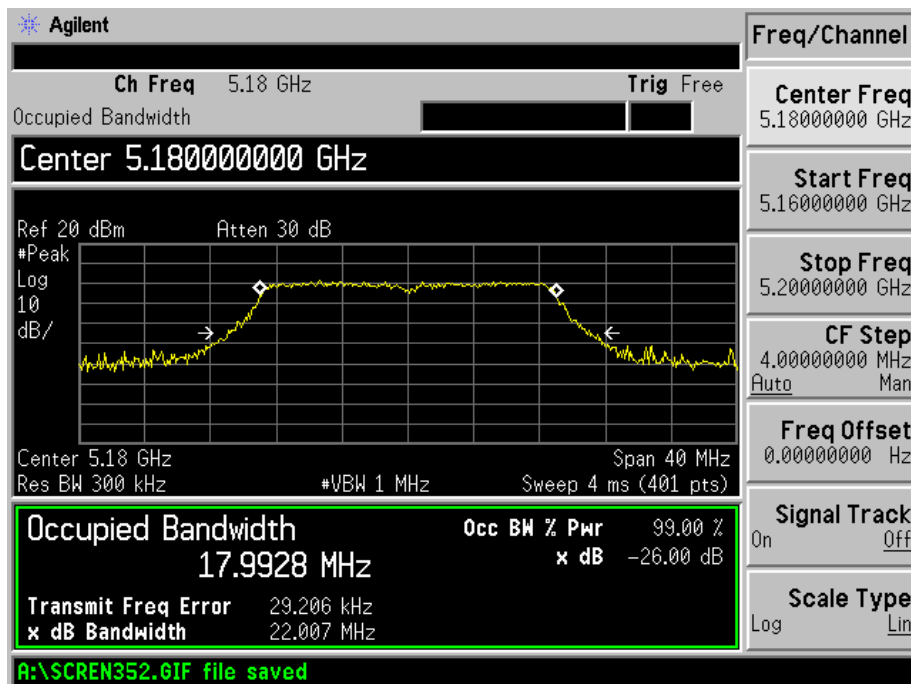


5240MHz

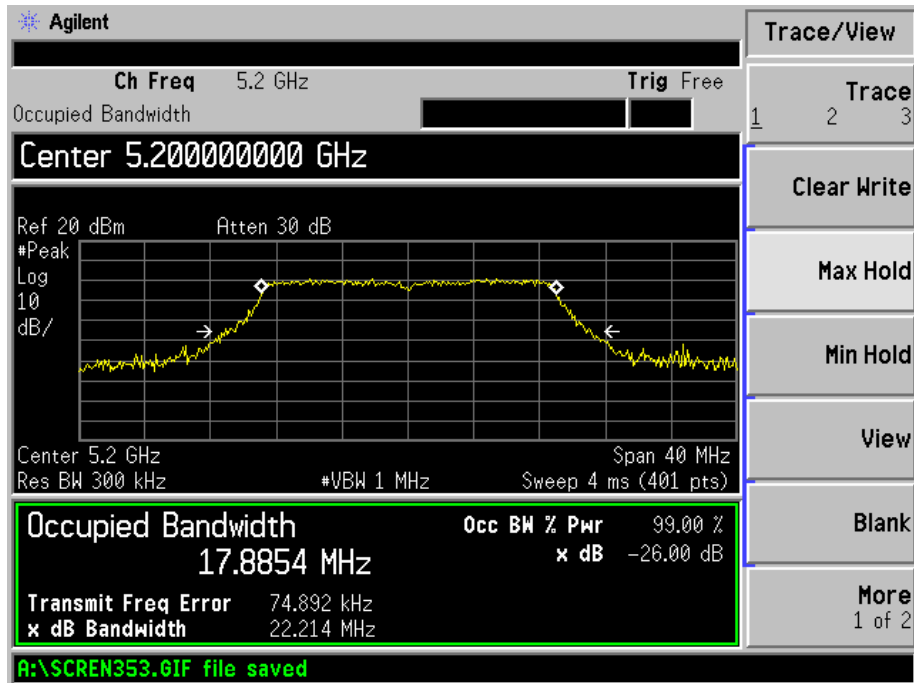


Test mode: 802.11n-HT20

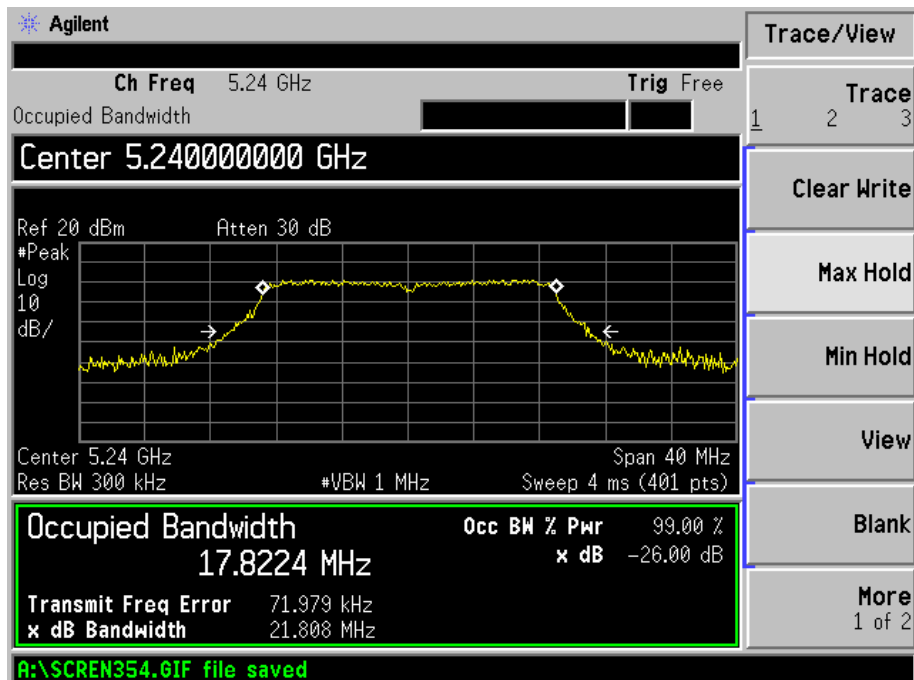
5180MHz



5200MHz

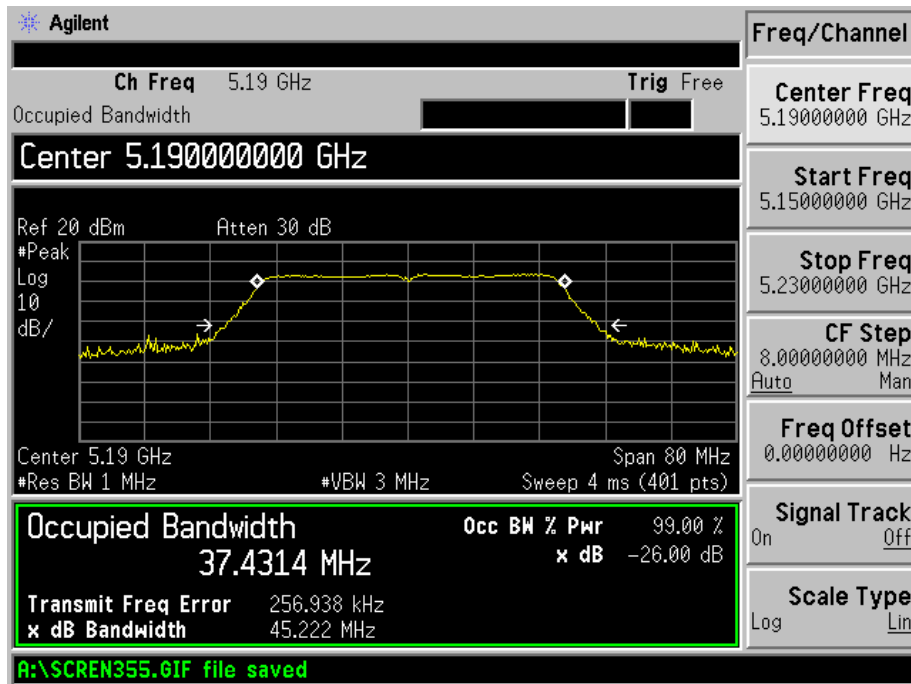


5240MHz

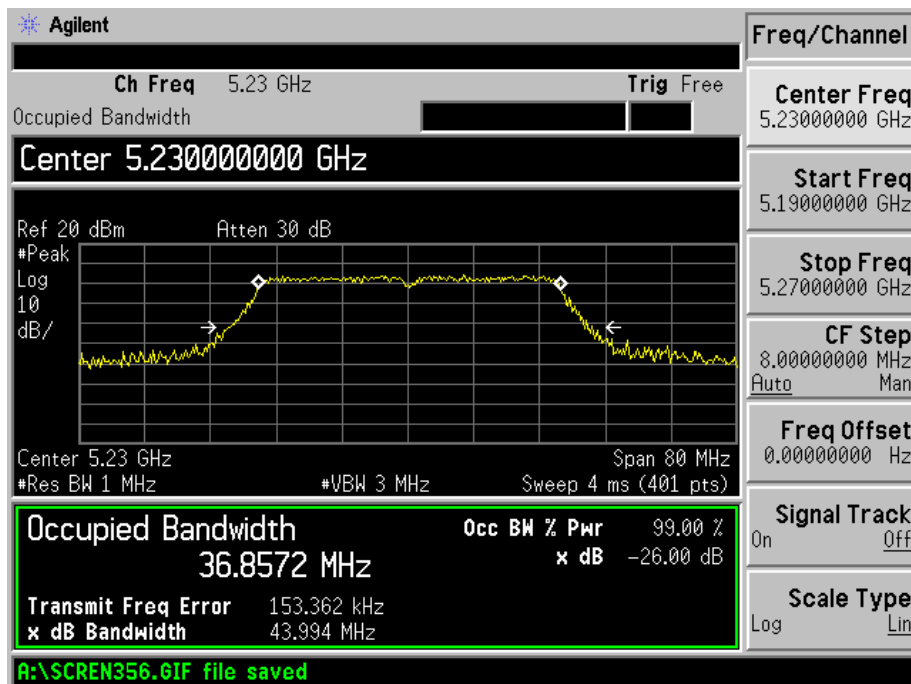


Test mode: 802.11n-HT40

5190MHz

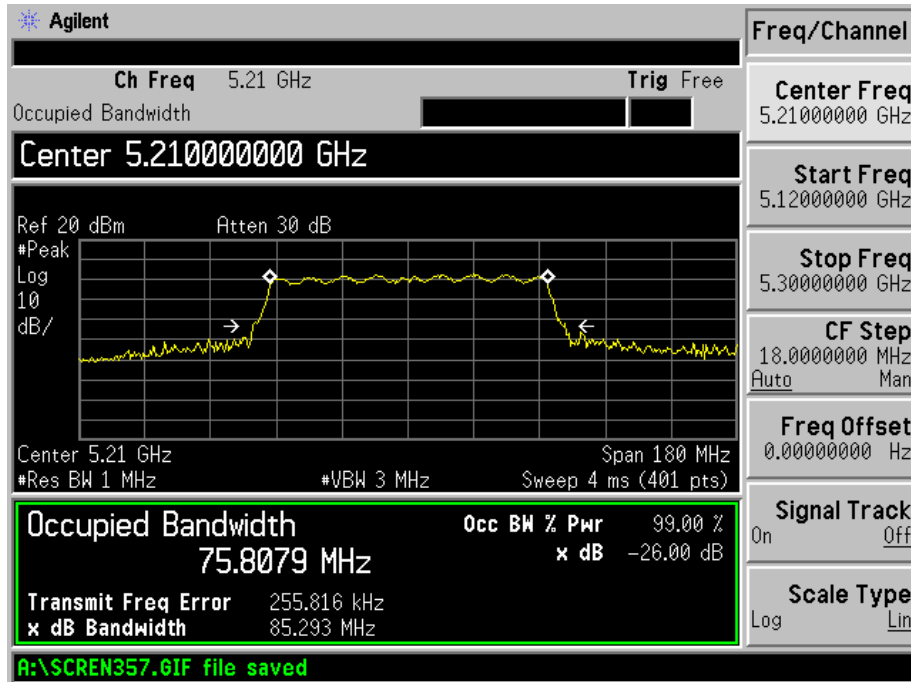


5230MHz



Test mode: 802.11ac-HT80

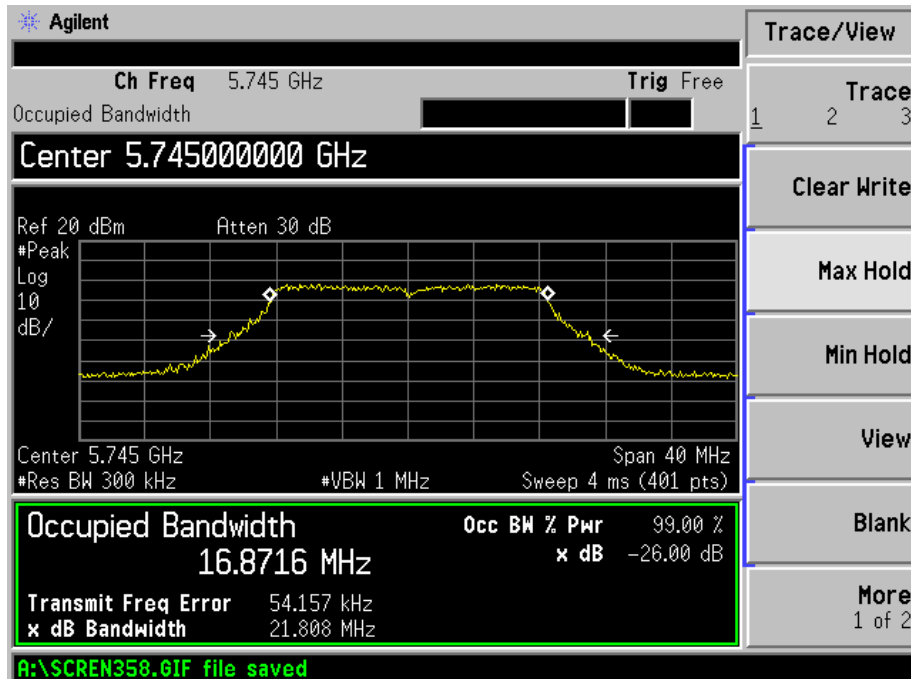
5210MHz

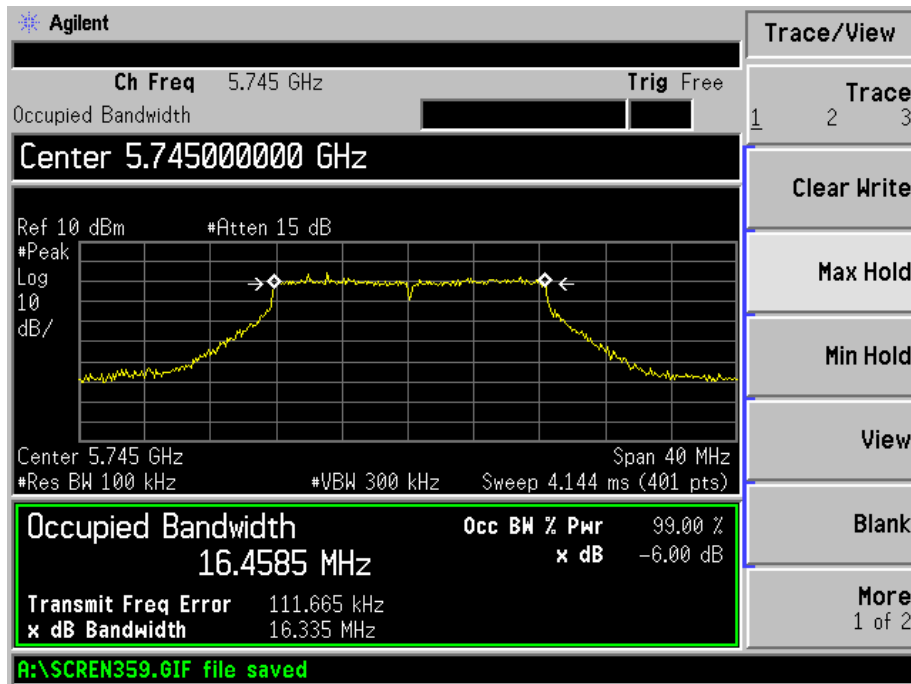


5725-5850MHz

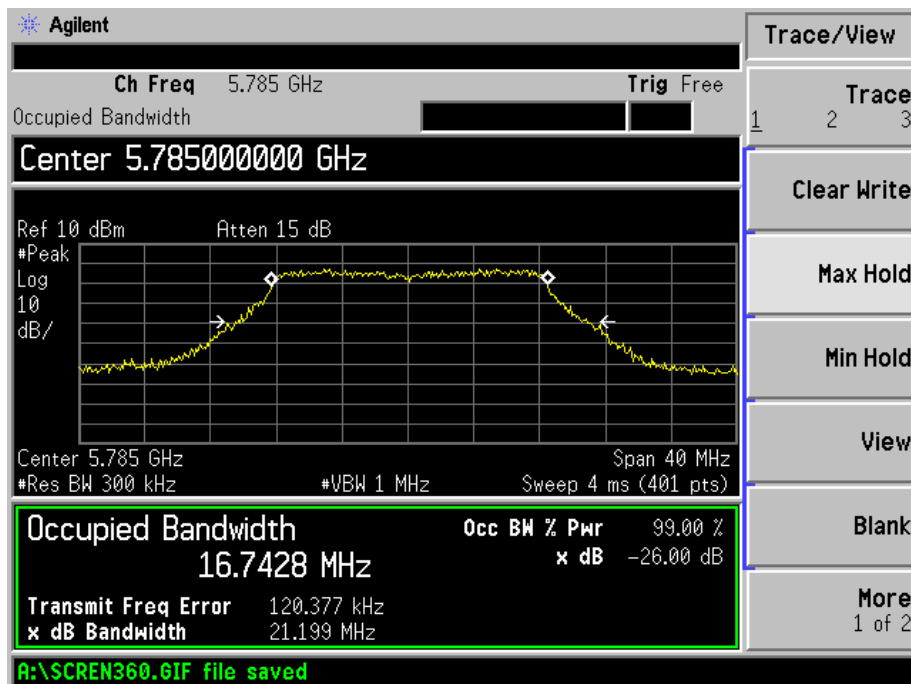
Test mode: 802.11a

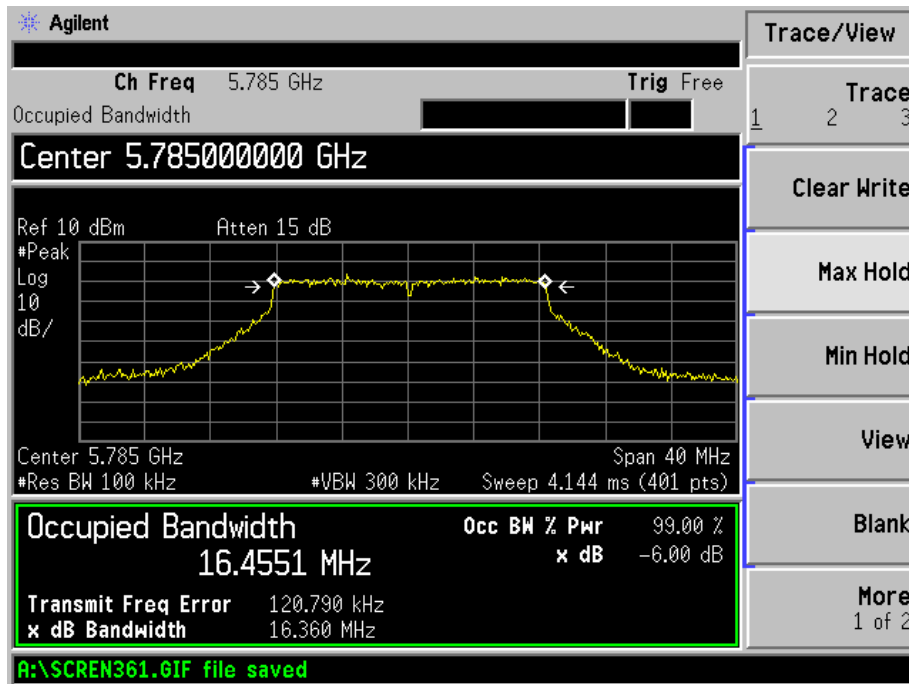
5745MHz



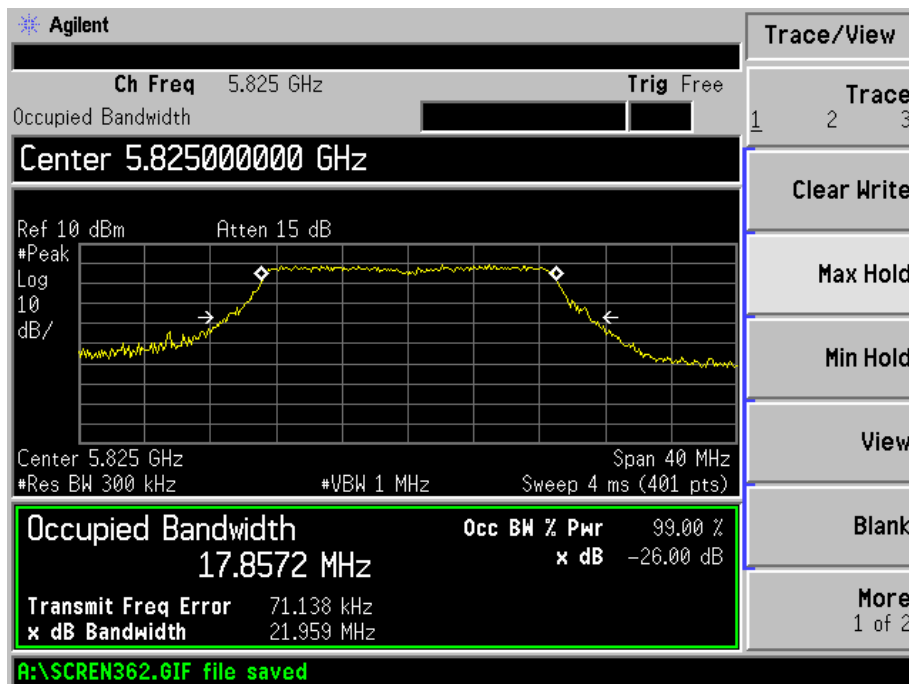


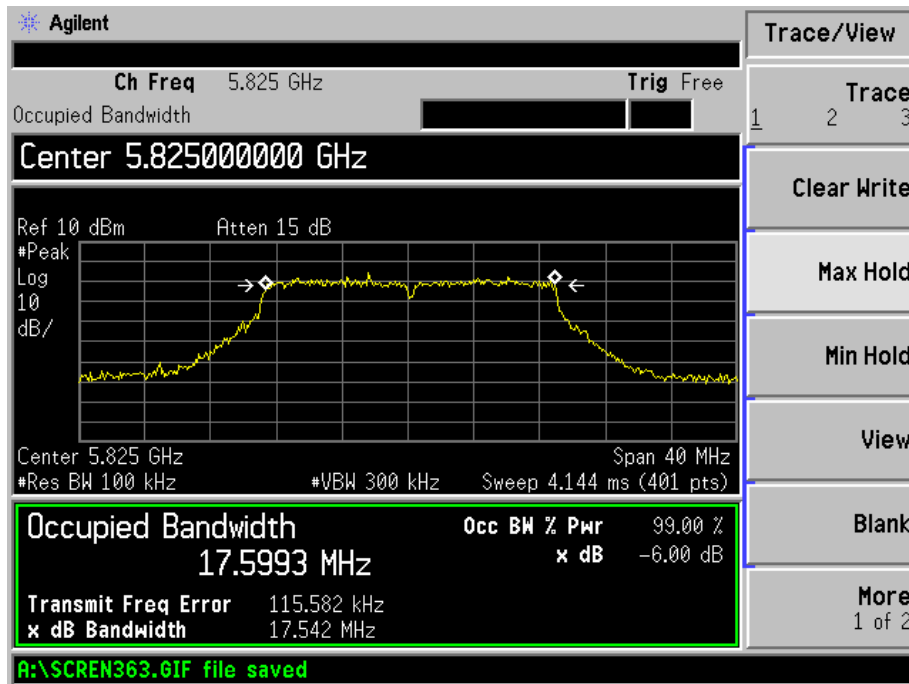
5785MHz





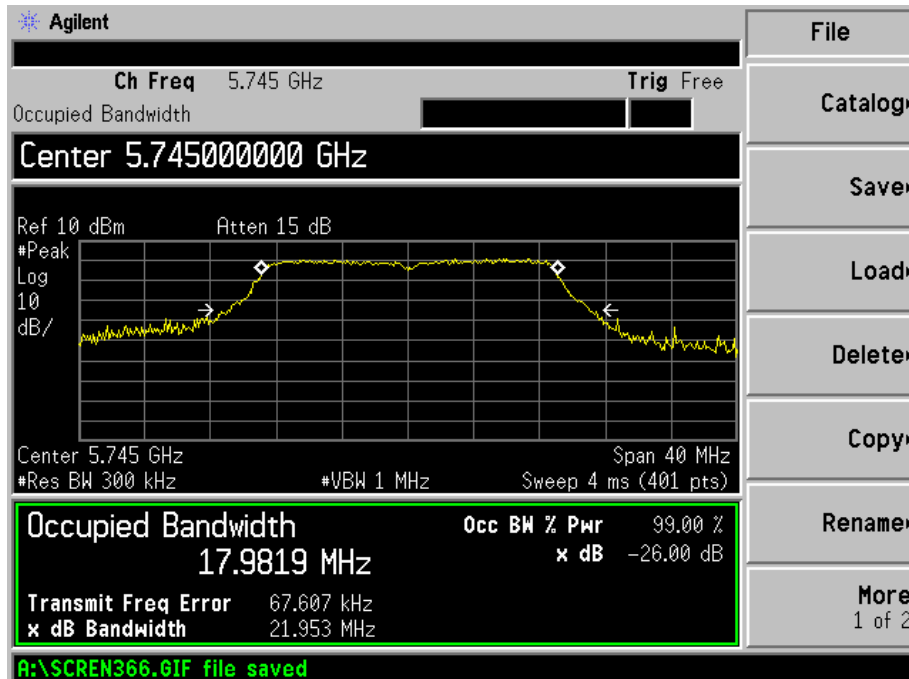
5805MHz

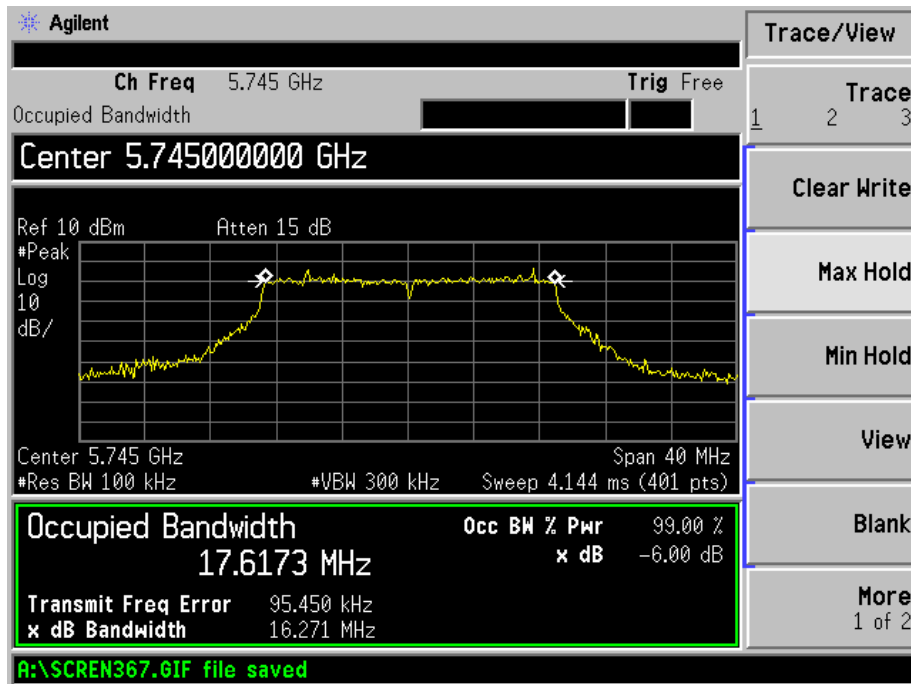




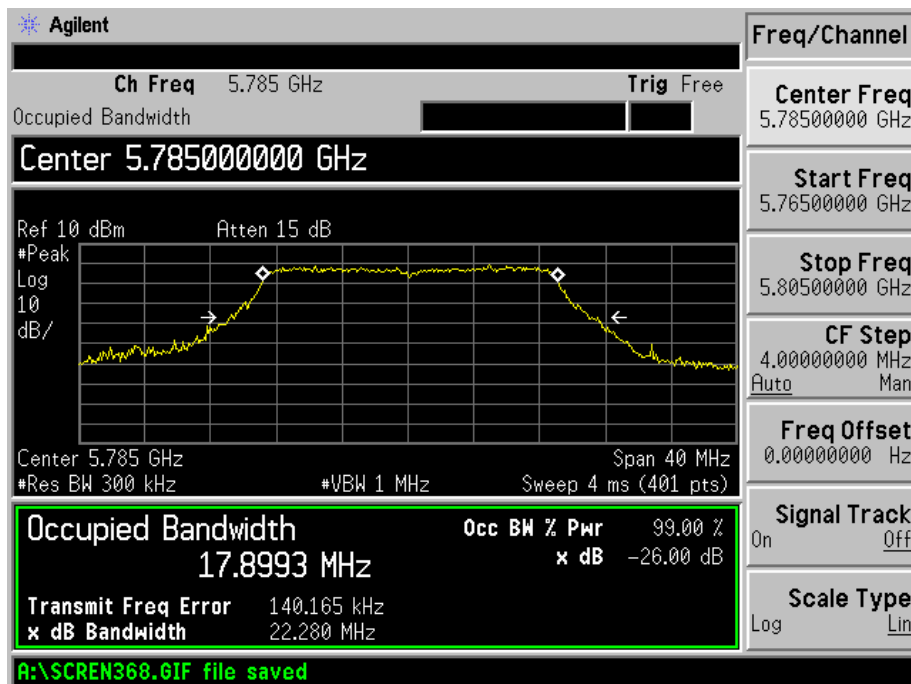
Test mode: 802.11-HT20

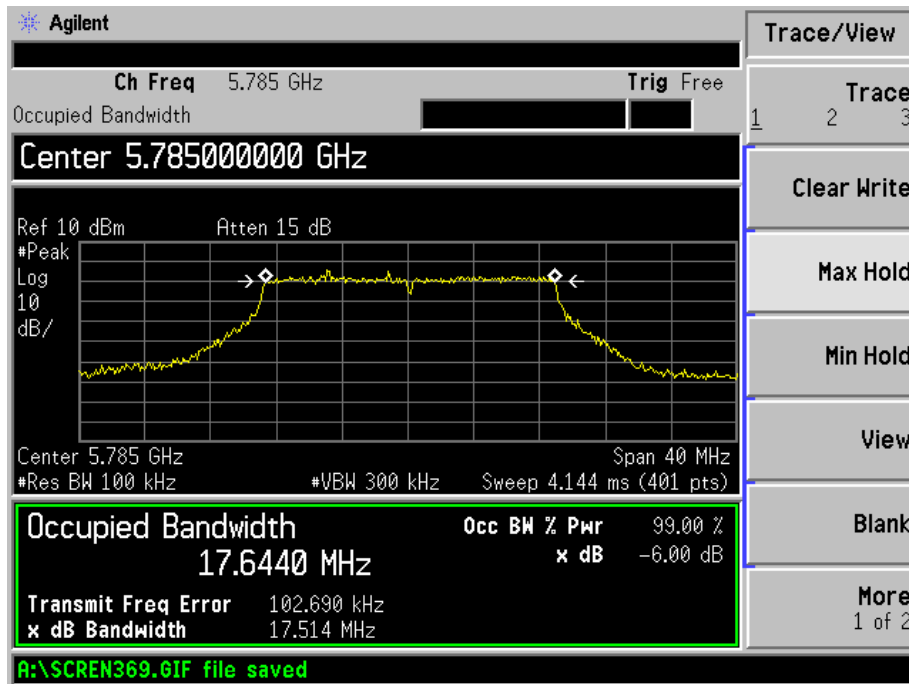
5745MHz



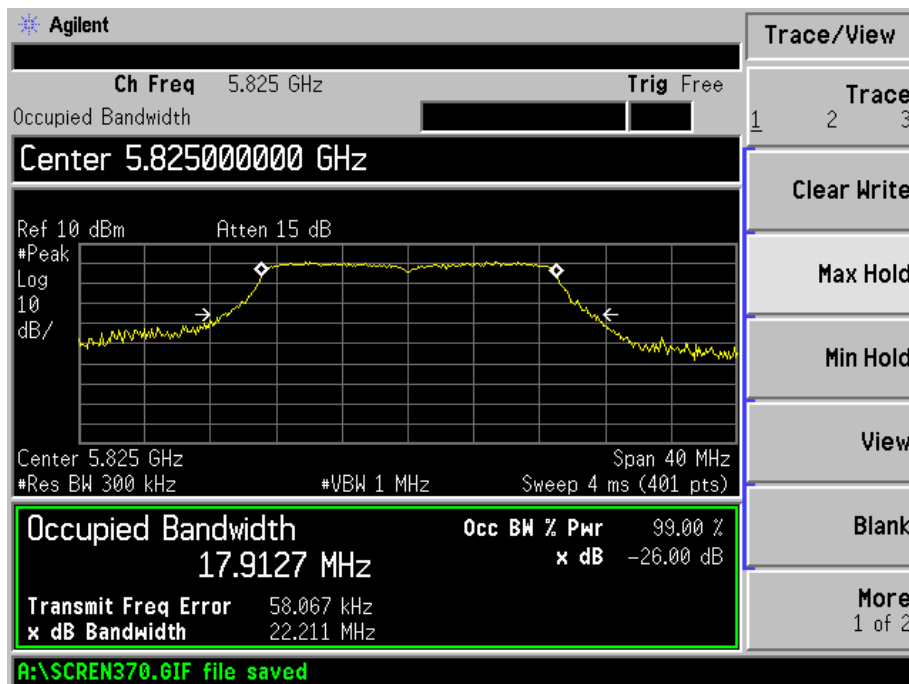


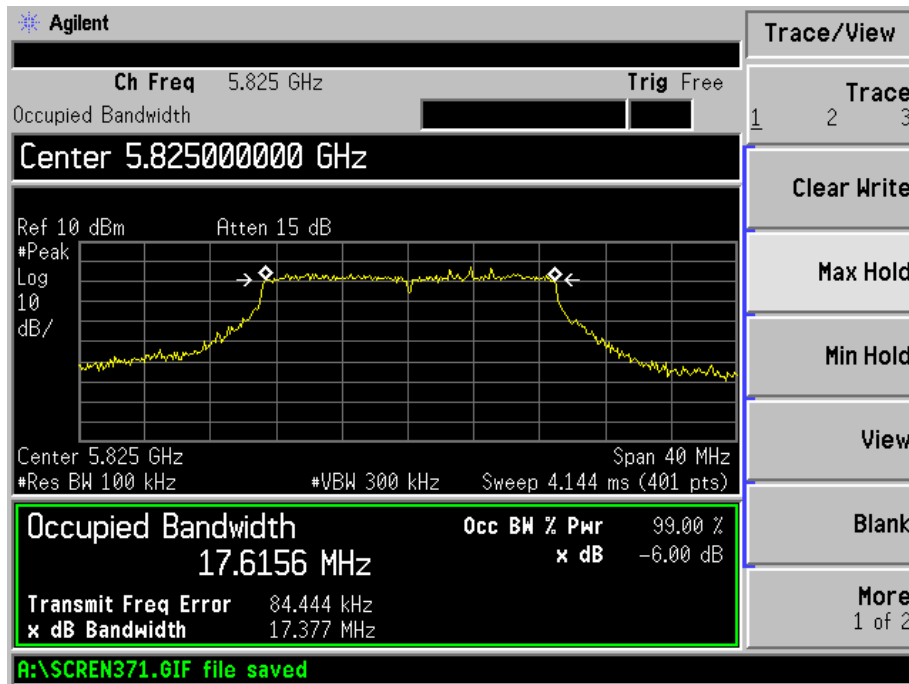
5785MHz



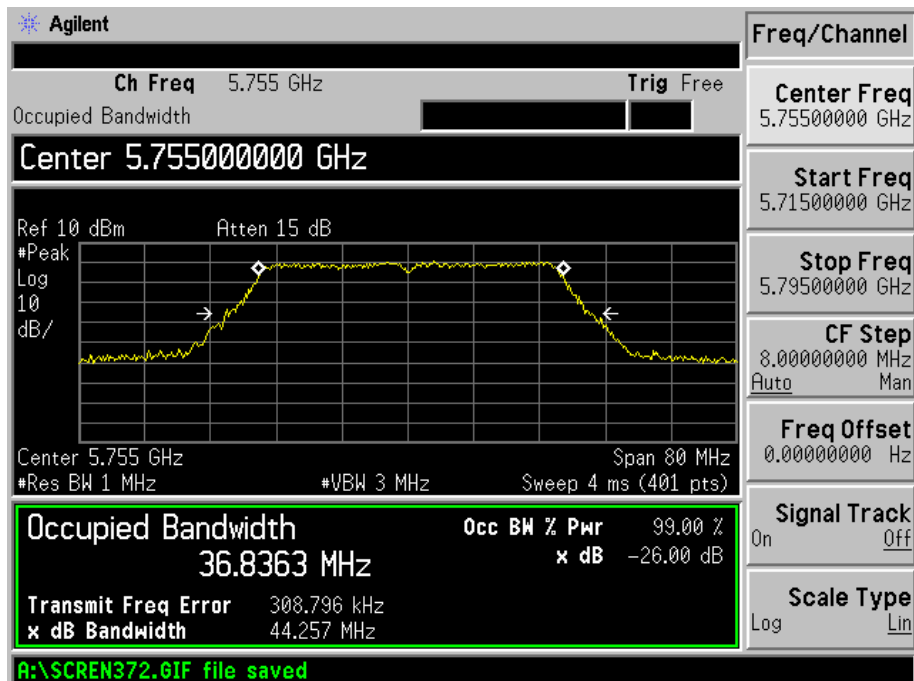


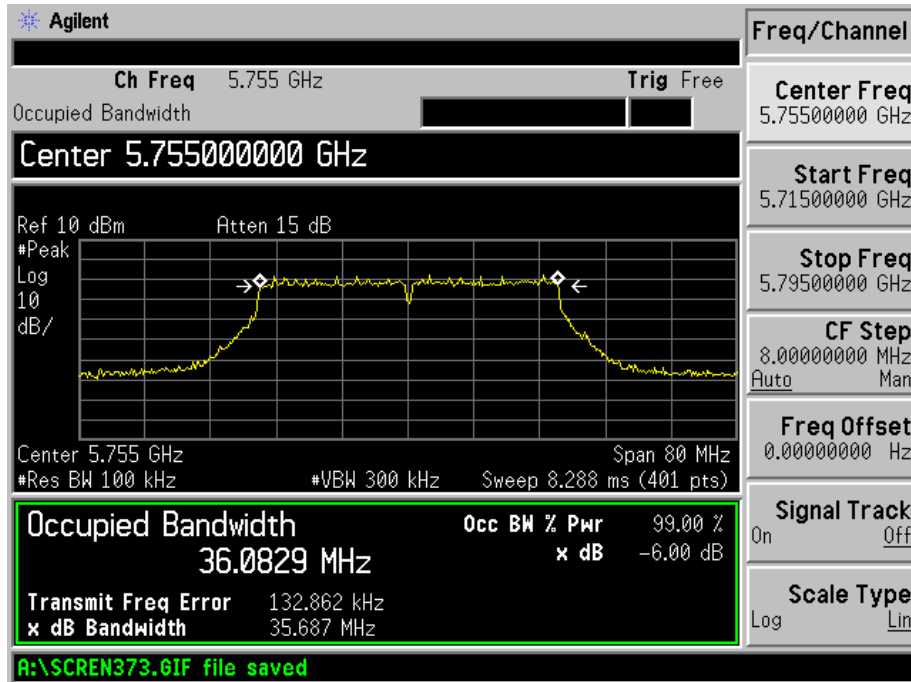
5805MHz



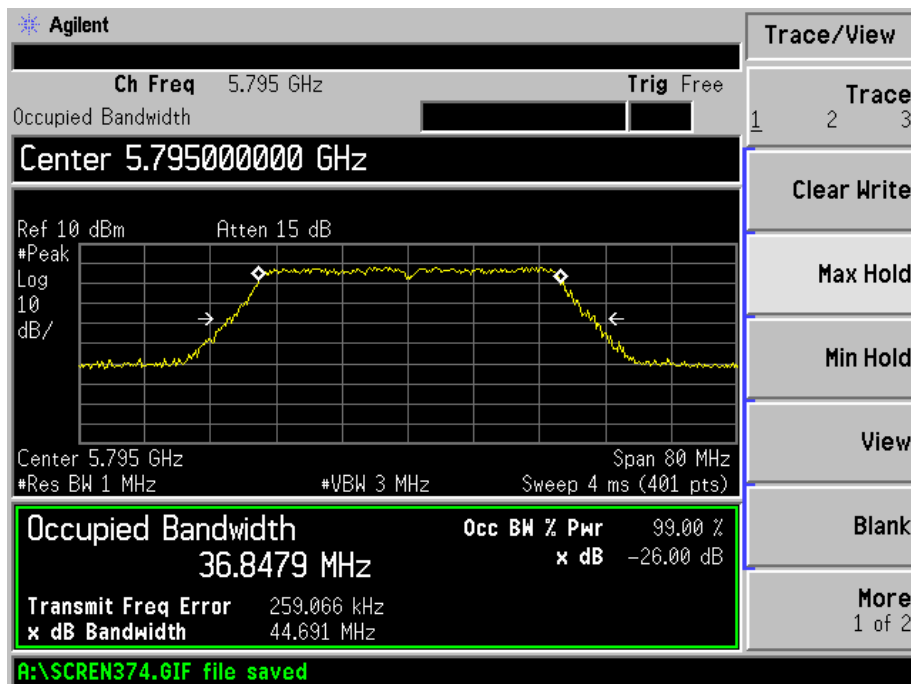


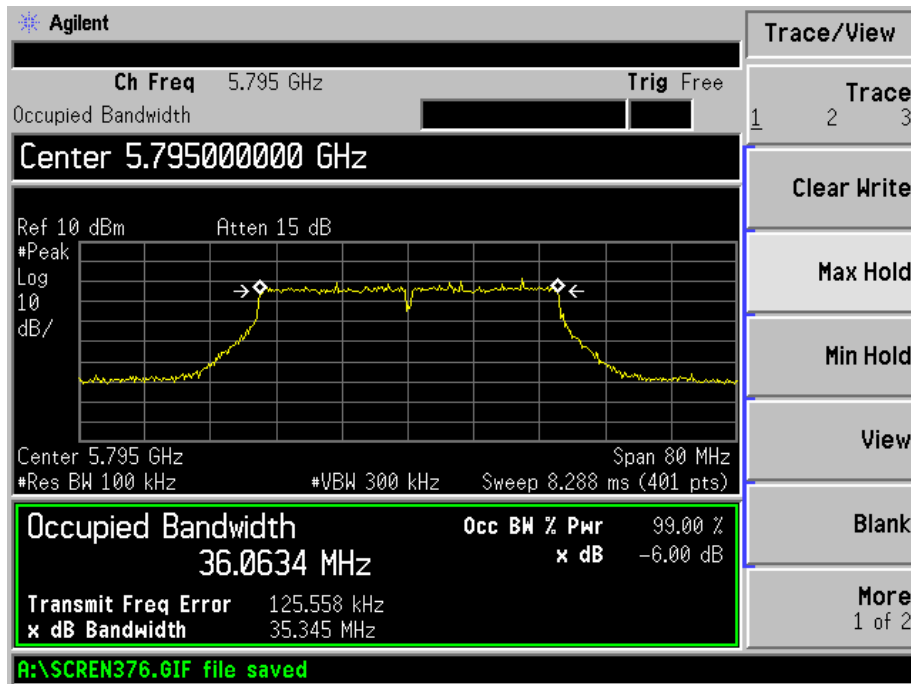
Test mode: 802.11n-HT40
5755MHz





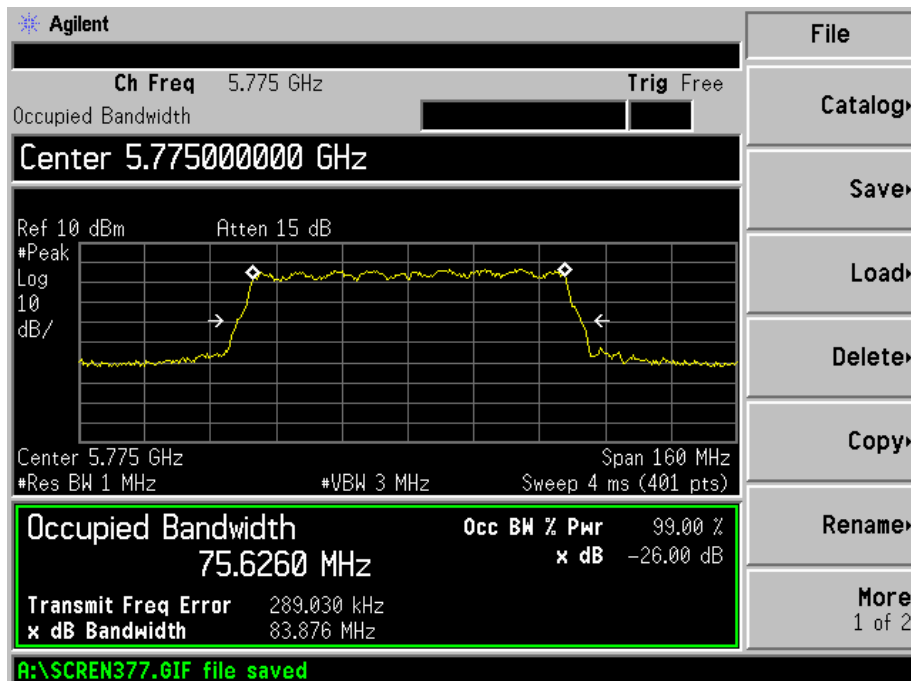
5795MHz

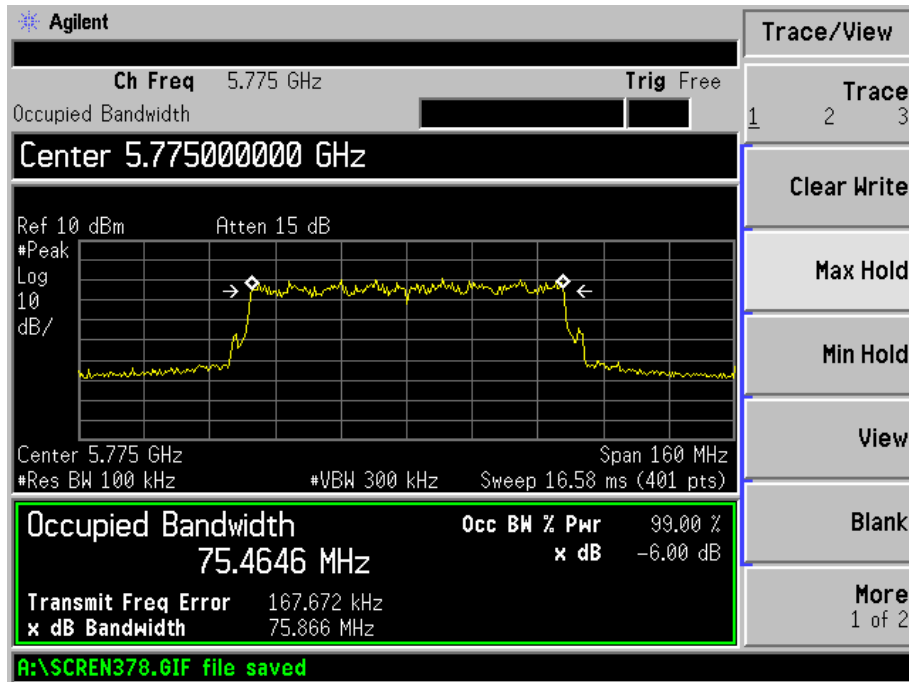




Test mode: 802.11ac-HT80

5775MHz





8. Maximum Conducted Output Power

8.1 Standard Applicable

Section 15.407(a) Power limits:

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

8.2 Test Procedure

According to KDB789033 D02 v01r02 section E, the following is the measurement procedure.

- (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- (ii) Set RBW = 1 MHz.
- (iii) Set VBW $\geq$ 3 MHz.
- (iv) Number of points in sweep $\geq$ 2 Span / RBW. (This ensures that bin-to-bin spacing is $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)
- (v) Sweep time = auto.

- (vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- (vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle $\geq$ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
- (viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- (ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

8.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	65%
ATM Pressure:	1011 mbar

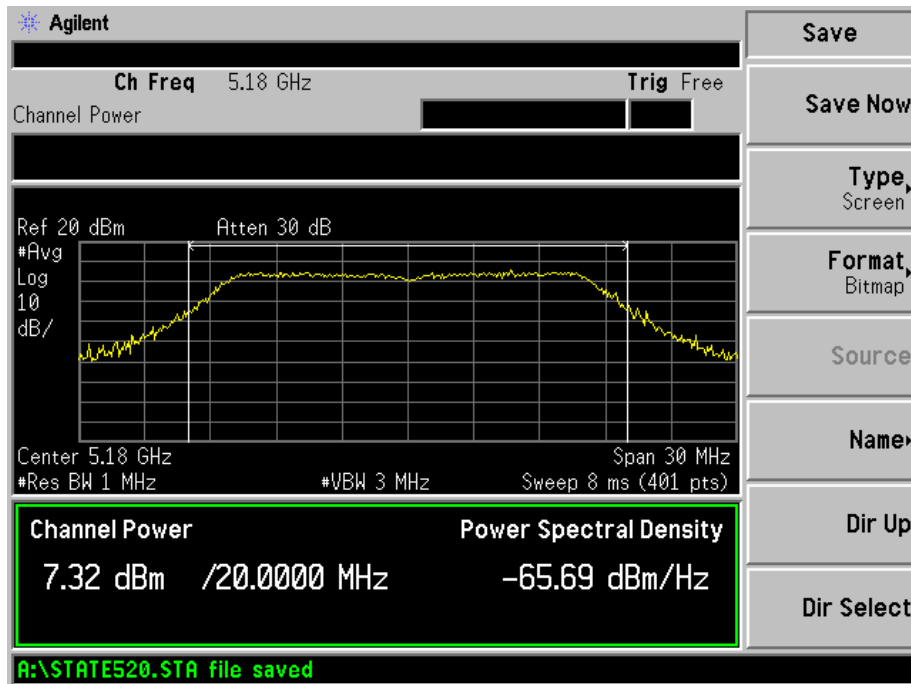
8.4 Summary of Test Results/Plots

For the frequency band 5.18-5.24GHz, 5745-5825GHz

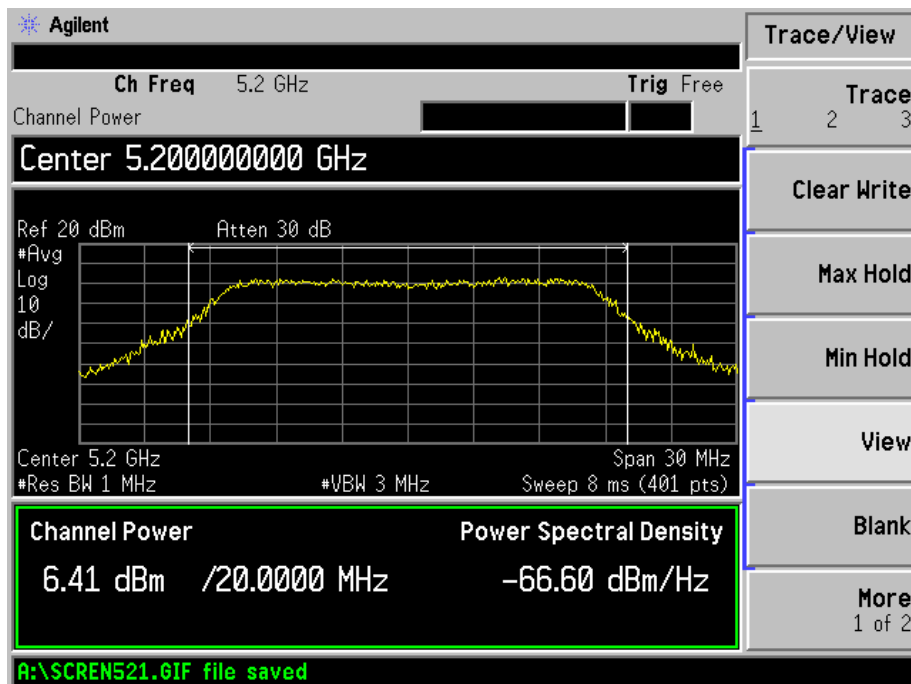
Test mode	Frequency MHz	Output Power dBm	Output Power mW	Limit mW
802.11a	5180	7.32	5.395	250
	5200	6.41	4.375	250
	5240	6.34	4.305	250
	5745	6.19	4.159	1000
	5785	6.63	4.603	1000
	5825	6.42	4.385	1000
802.11n-HT20	5180	6.36	4.325	250
	5200	6.34	4.305	250
	5240	6.38	4.345	250
	5745	5.85	3.846	1000
	5785	5.93	3.917	1000
	5825	5.74	3.750	1000
802.11n-HT40	5190	5.76	3.767	250
	5230	5.42	3.483	250
	5755	6.59	4.560	1000
	5795	5.96	3.945	1000
802.11ac-HT80	5210	5.90	3.890	250
	5775	6.09	4.064	1000

Test Mode: 802.11a

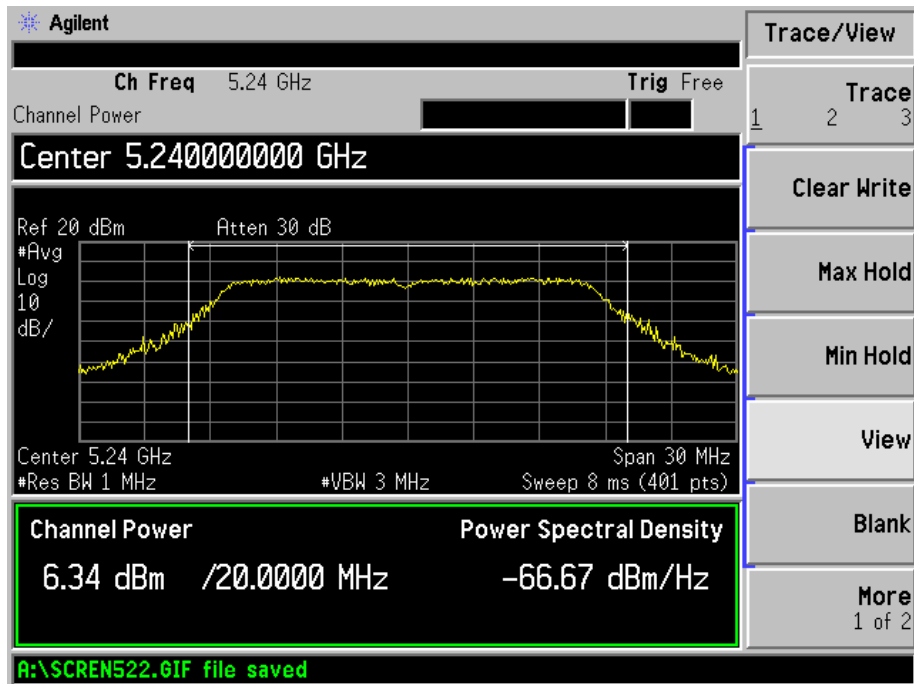
5180MHz



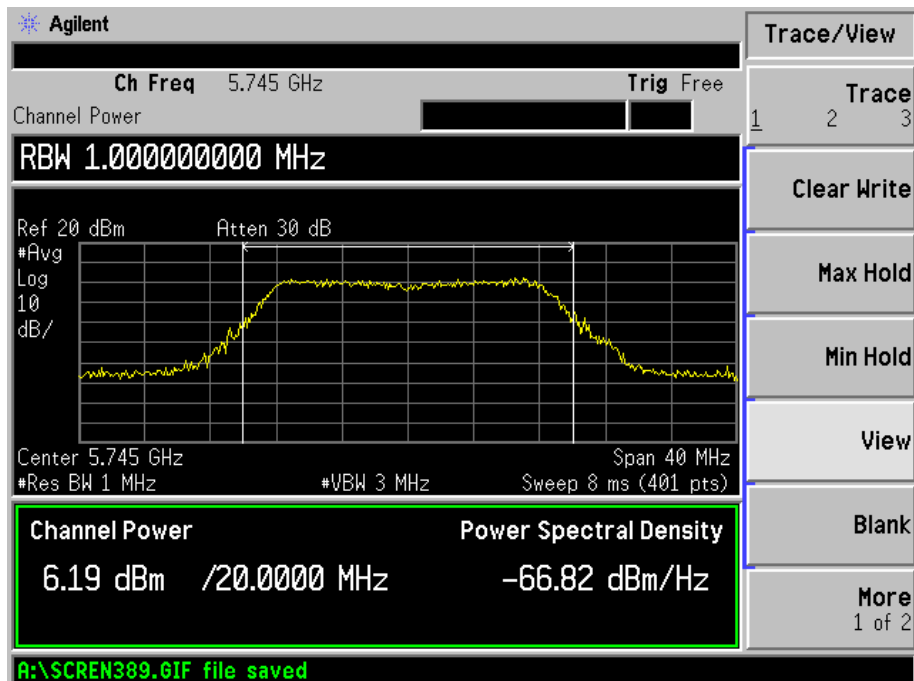
5200MHz



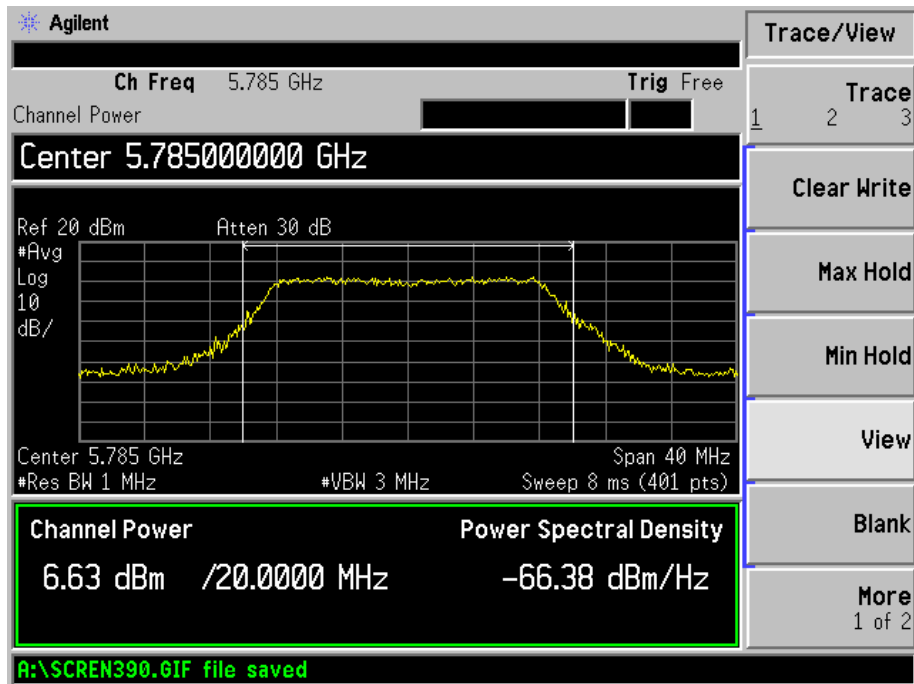
5240MHz



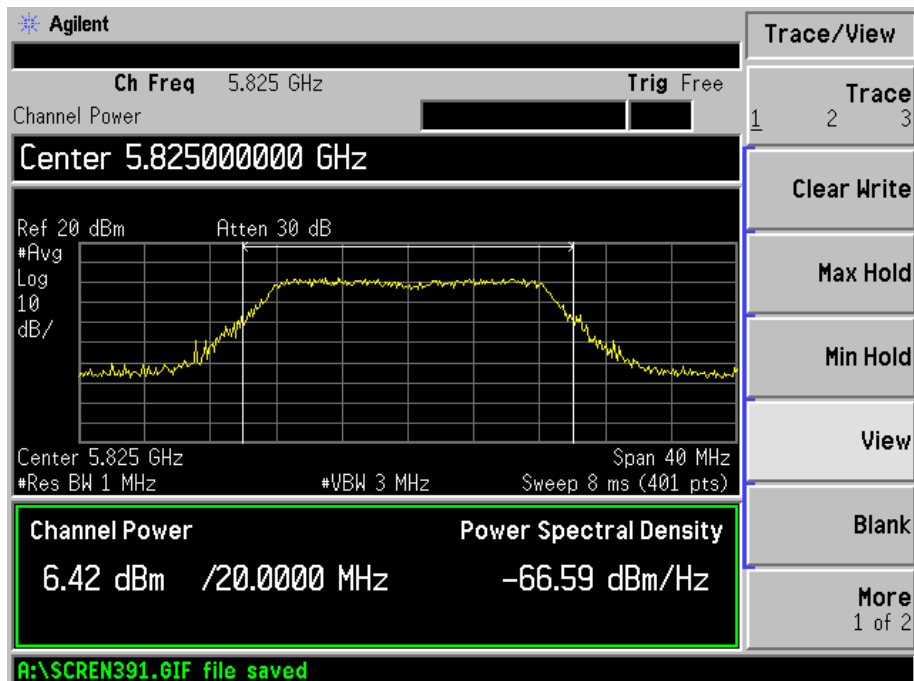
5745MHz



5785MHz

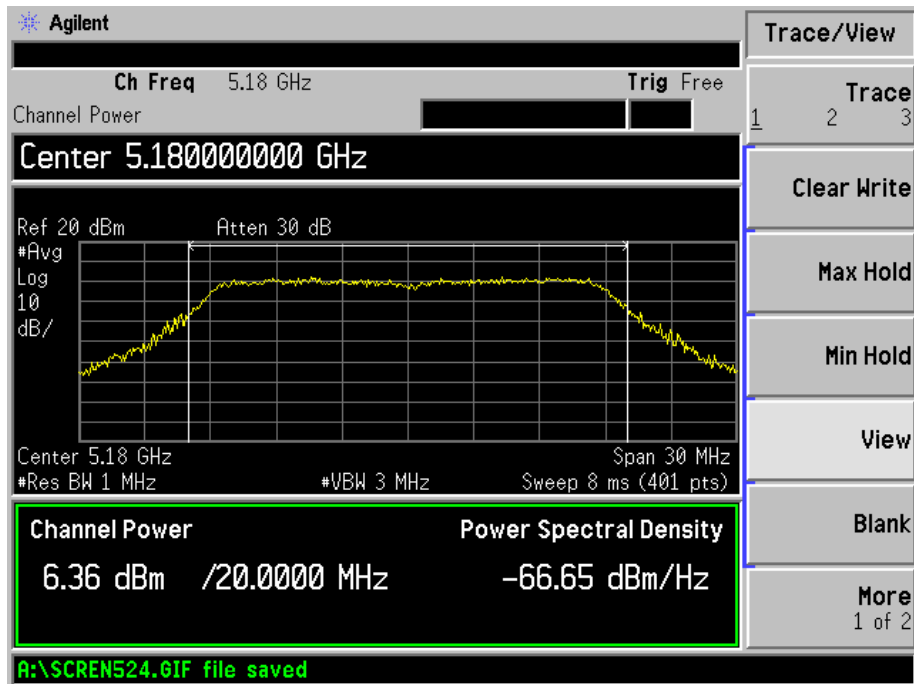


5825MHz

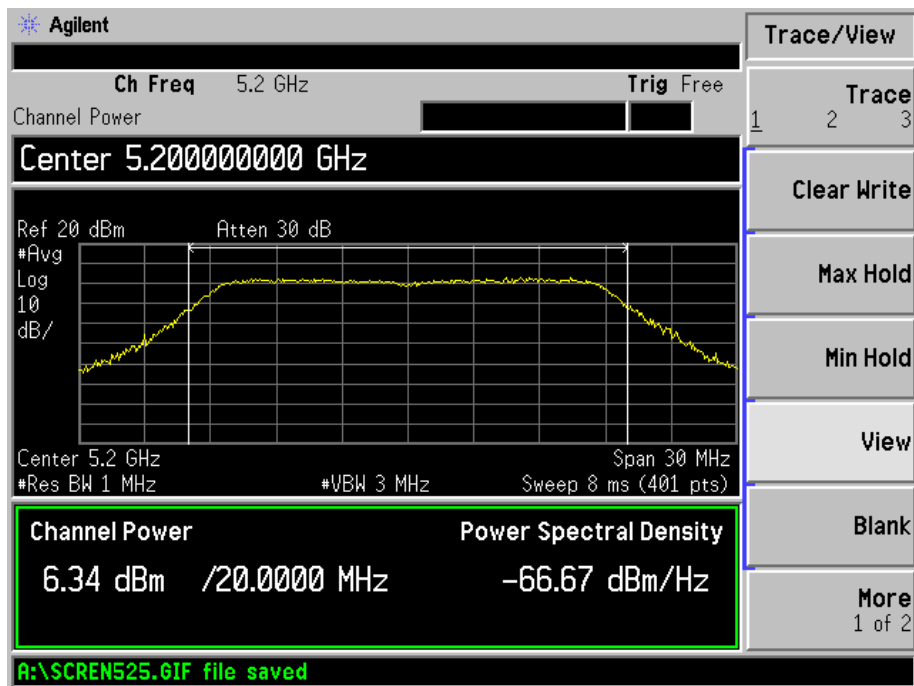


Test Mode: 802.11n-HT20

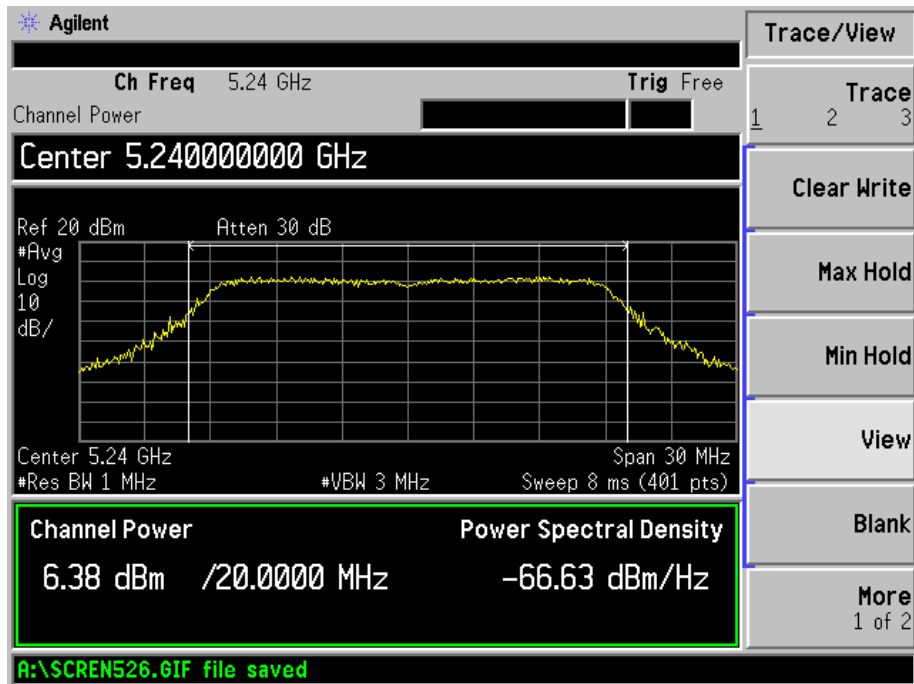
5180MHz



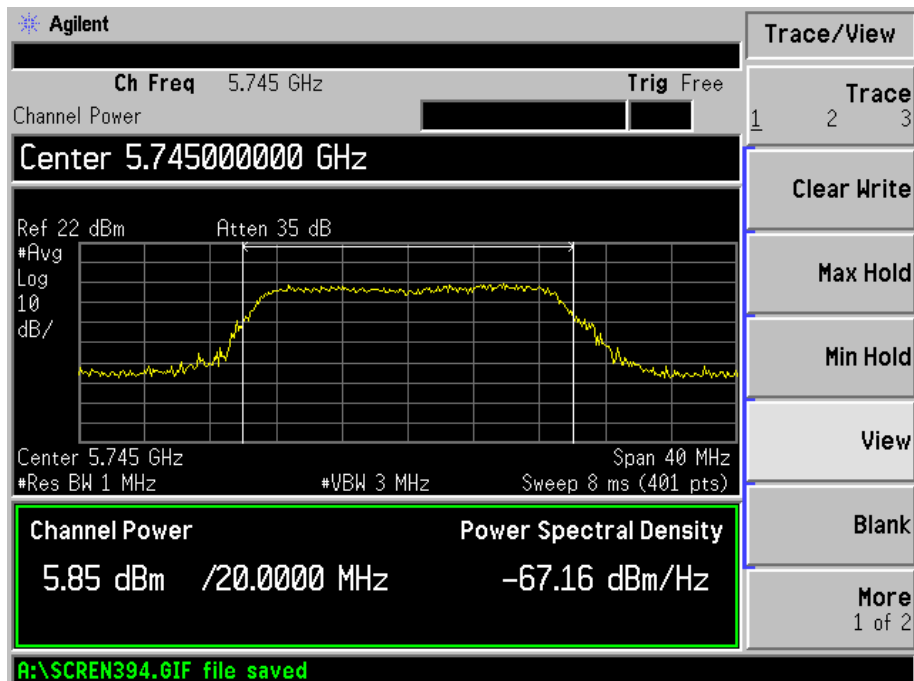
5200MHz



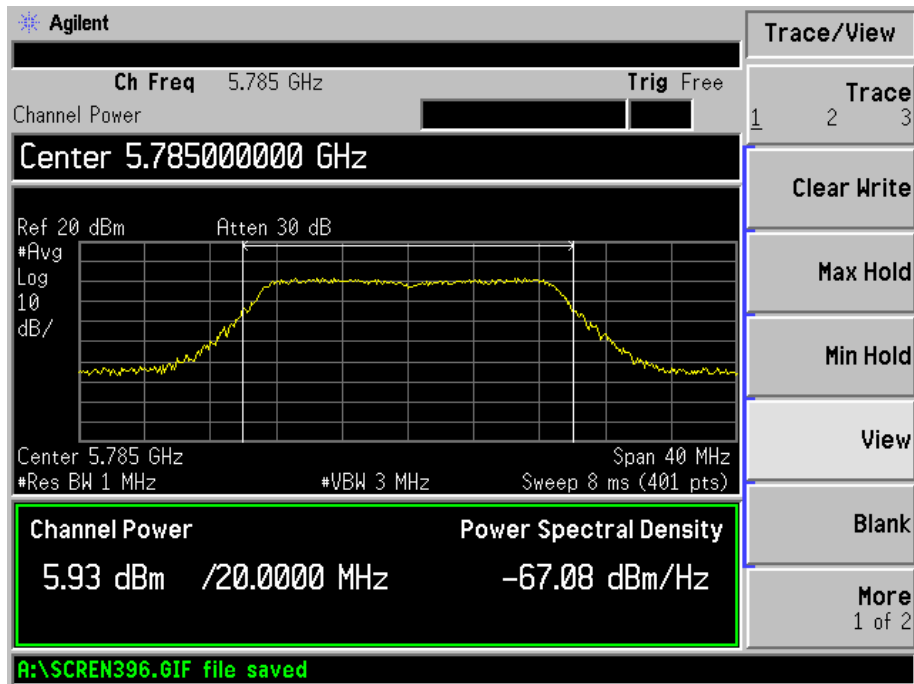
5240MHz



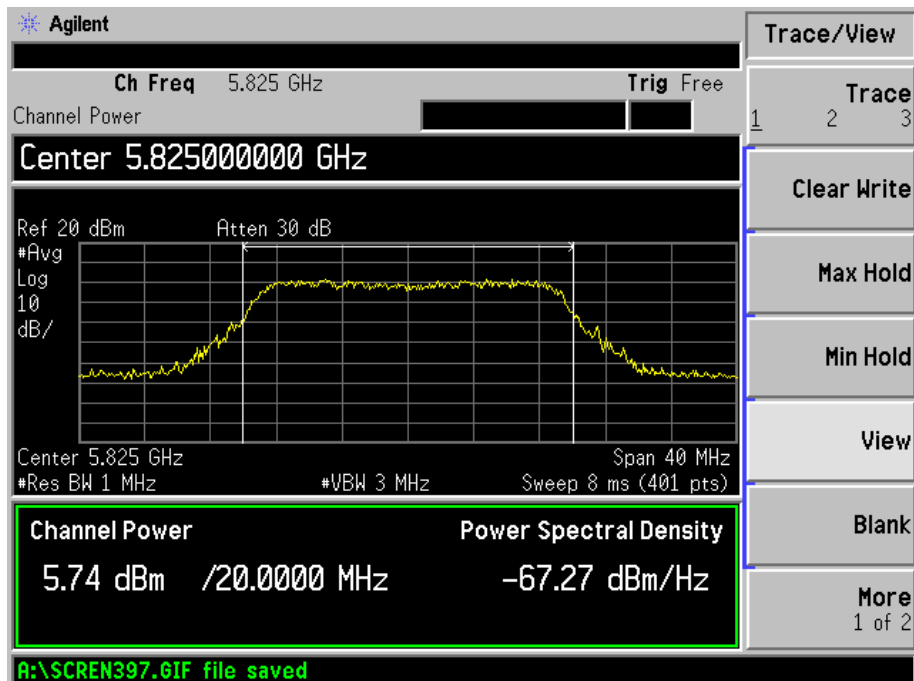
5745MHz



5785MHz

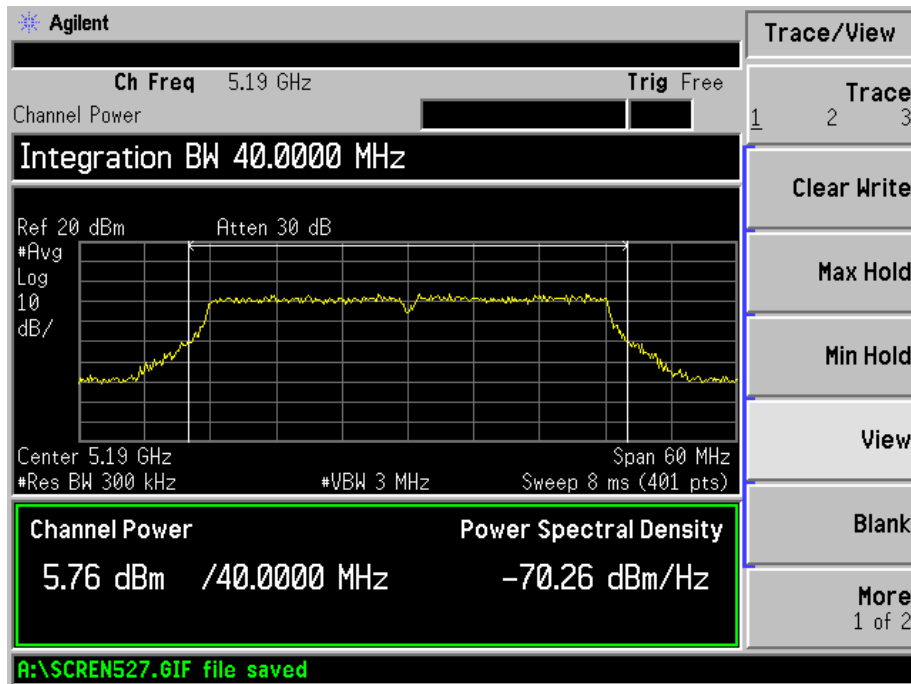


5825MHz

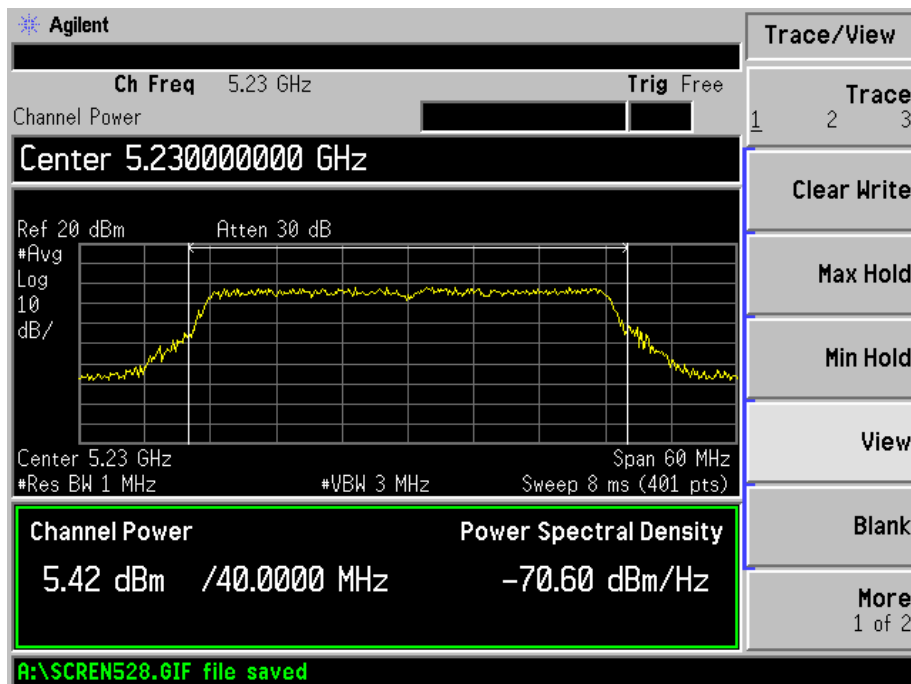


Test Mode: 802.11n-HT40

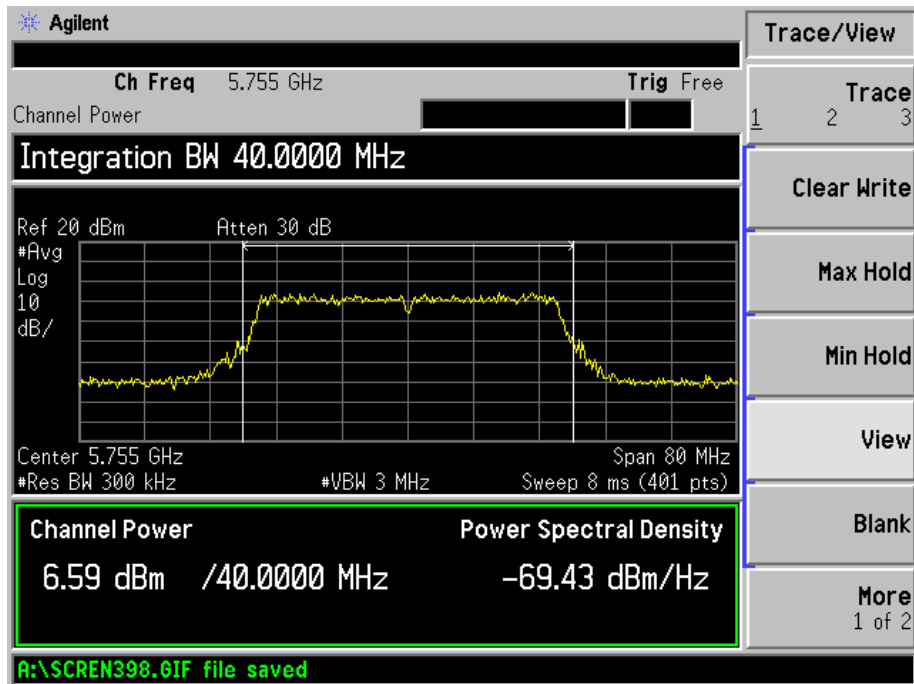
5190MHz



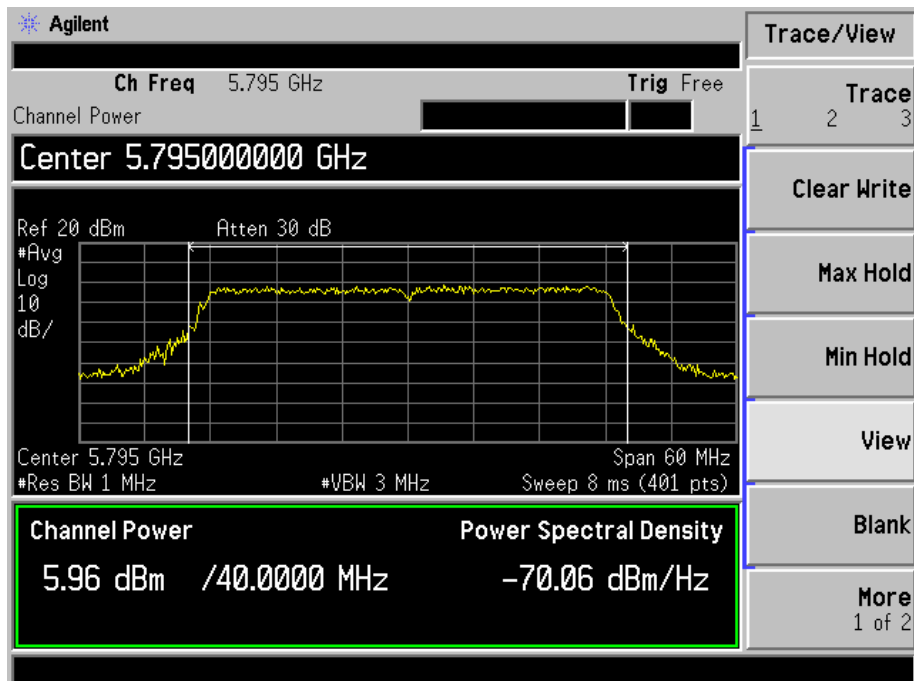
5230MHz



5755MHz

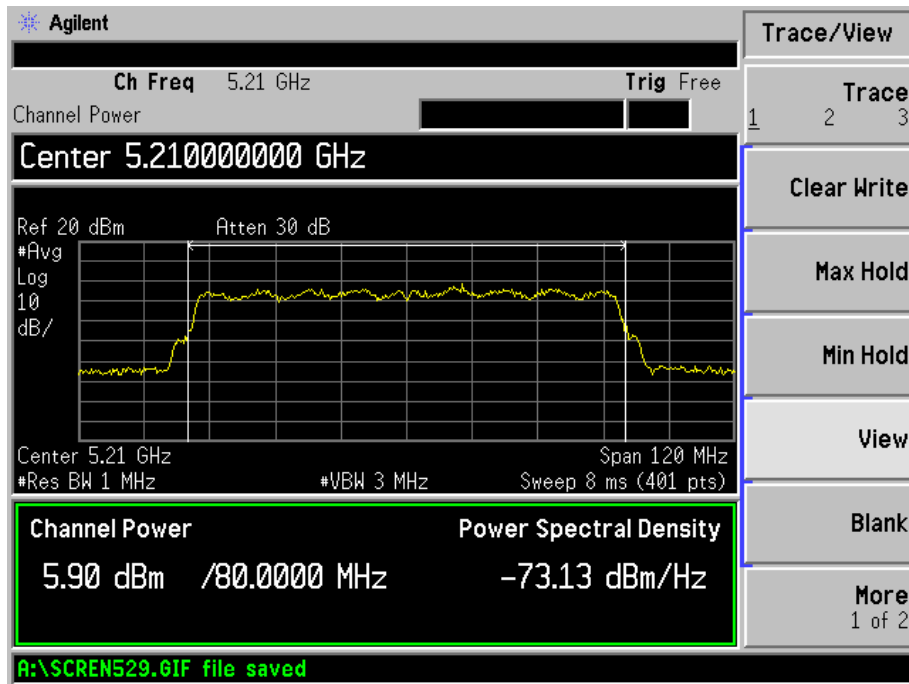


5795MHz

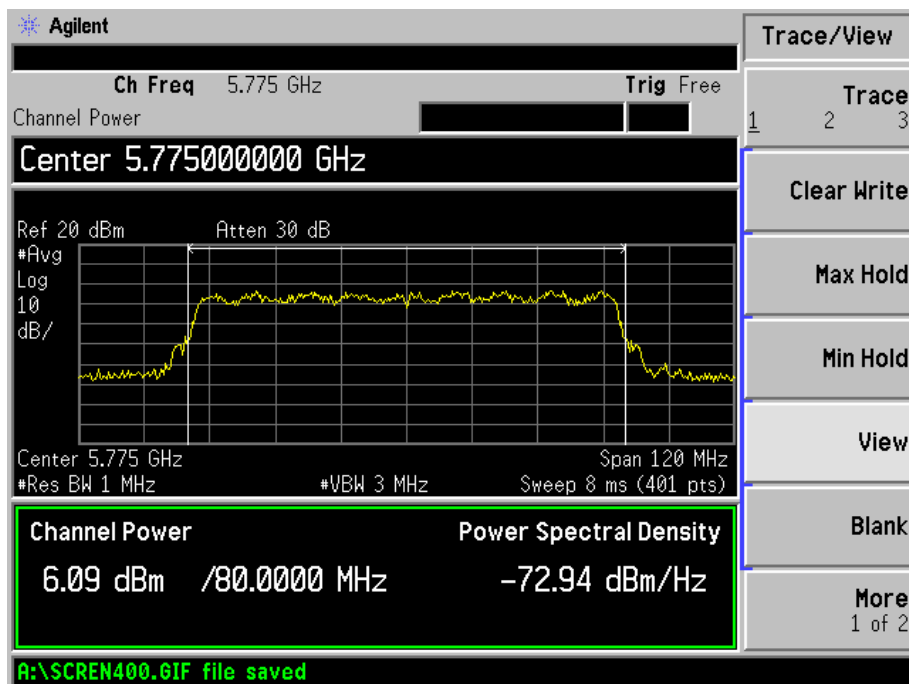


Test Mode: 802.11ac-HT80

5210MHz



5775MHz



9. Conducted Spurious Emissions

9.1 Standard Applicable

According to §15.407 (b) (b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

9.2 Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer via a RF combiner.
2. Set the spectrum analyzer as RBW = 100kHz/1MHz, VBW=300kHz/3MHz, Sweep = auto
3. Set the Lowest, Middle and Highest Transmitting Channel, observed the outside band of 30MHz to 40GHz, then mark the higher-level emission for comparing with the FCC rules.

9.3 Environmental Conditions

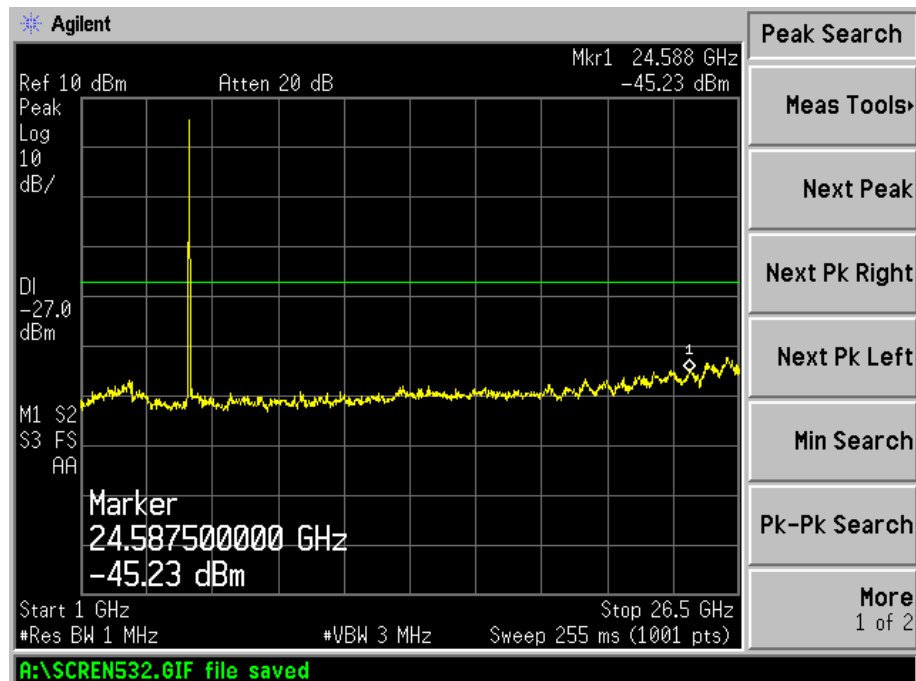
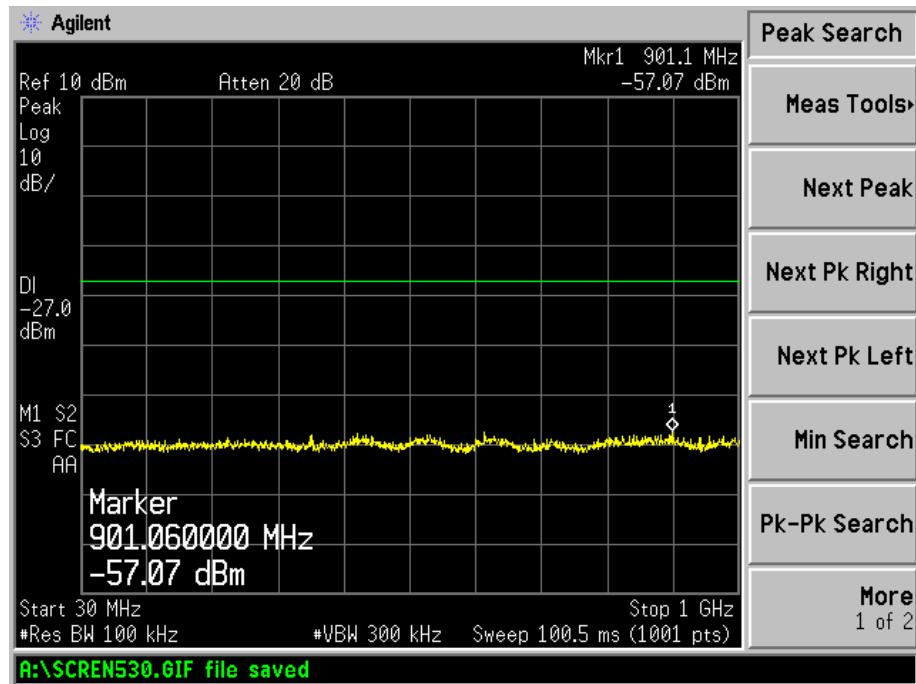
Temperature:	21° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

9.4 Summary of Test Results/Plots

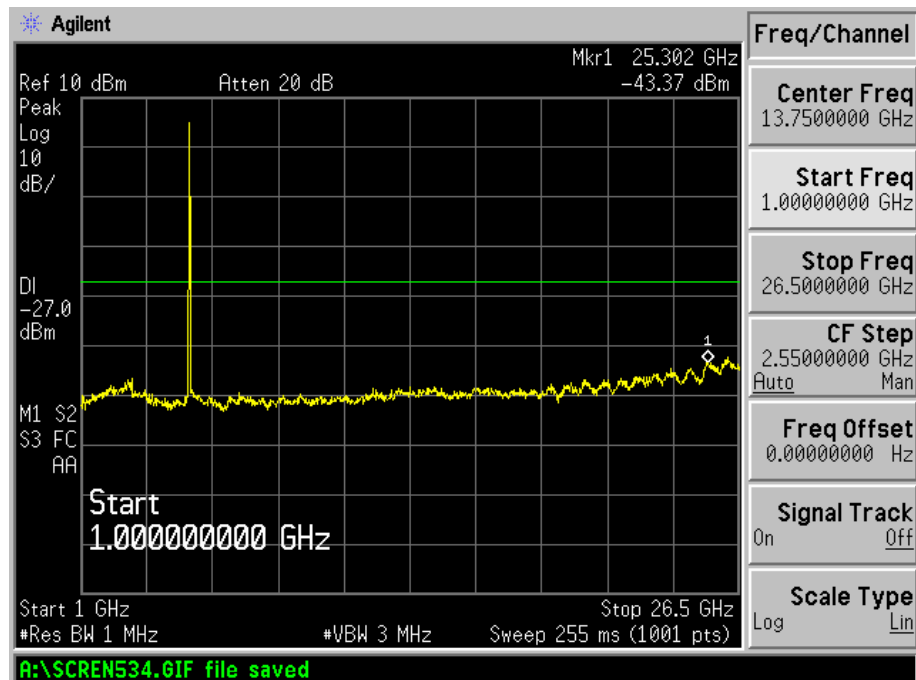
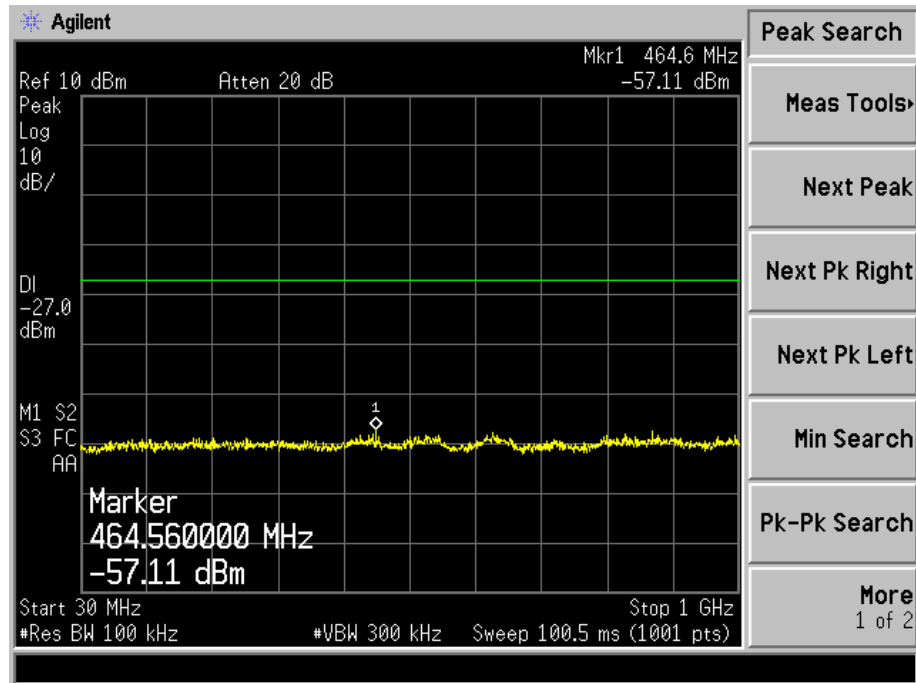
Emissions above 26.5GHz are attenuated more than 20dB below the permissible limits and test data are not reported.

802.11a

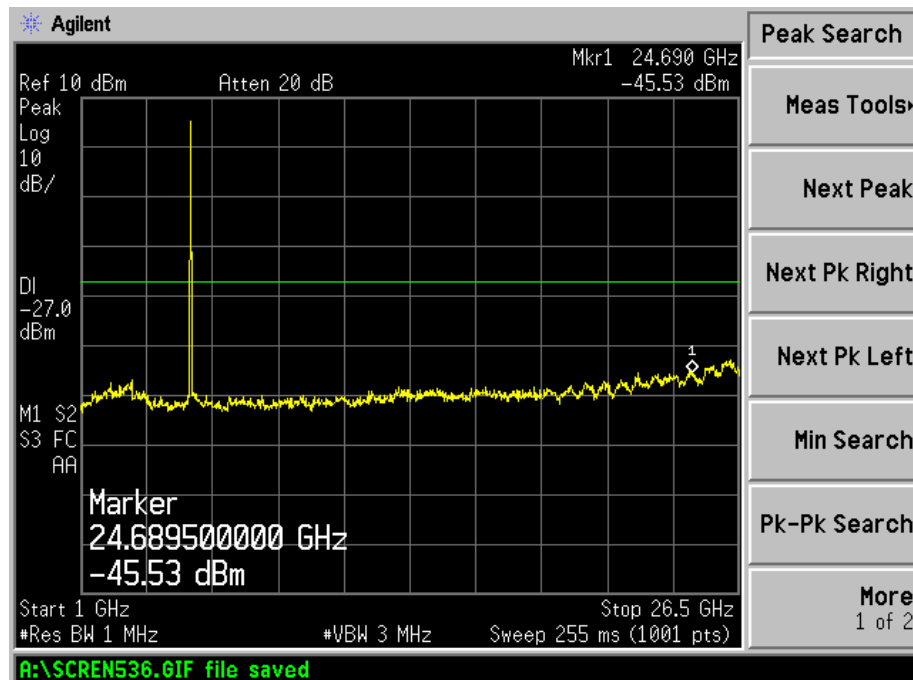
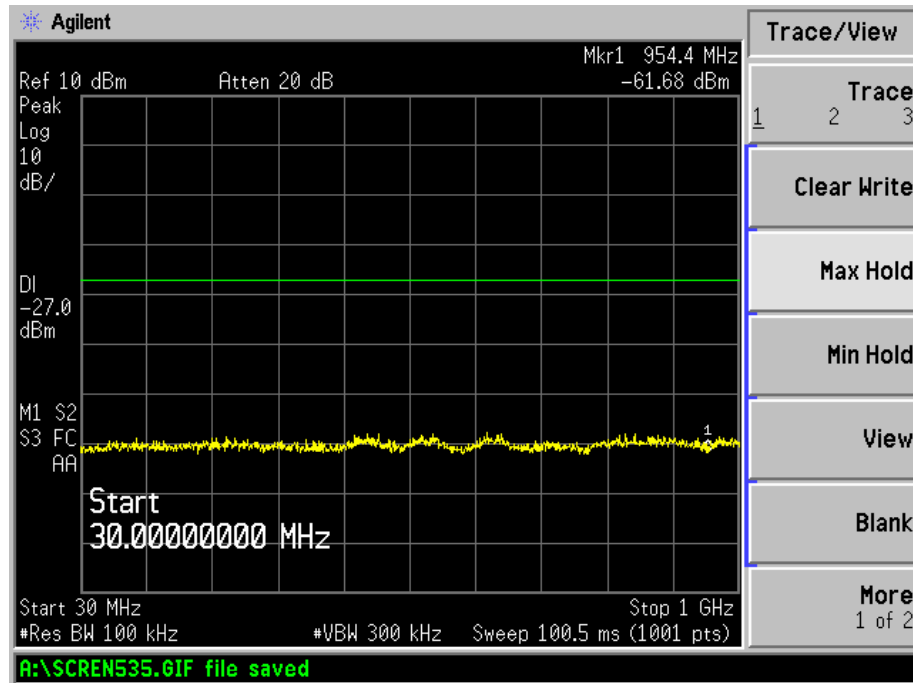
5180MHz



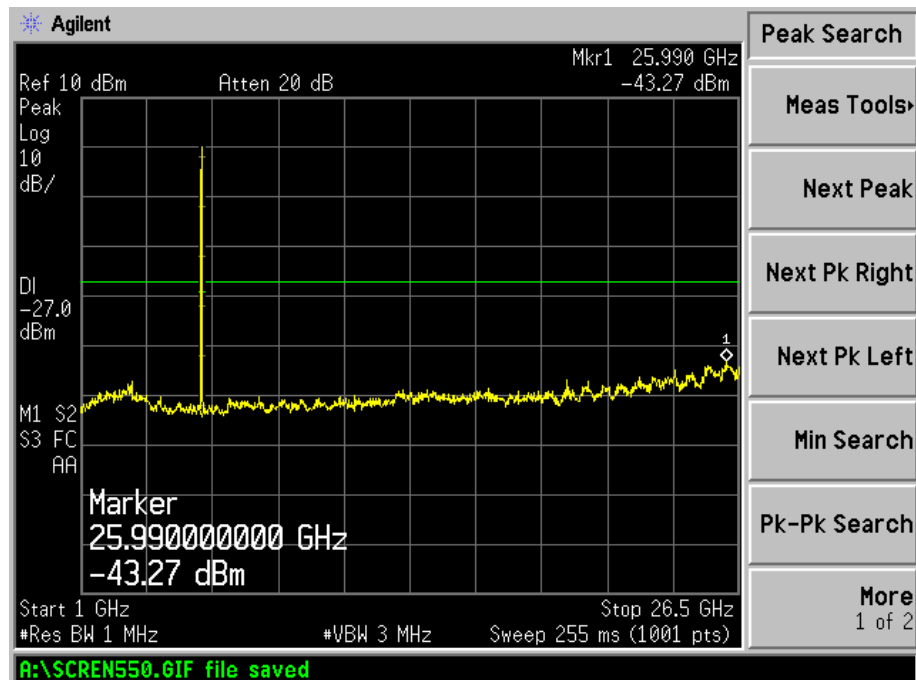
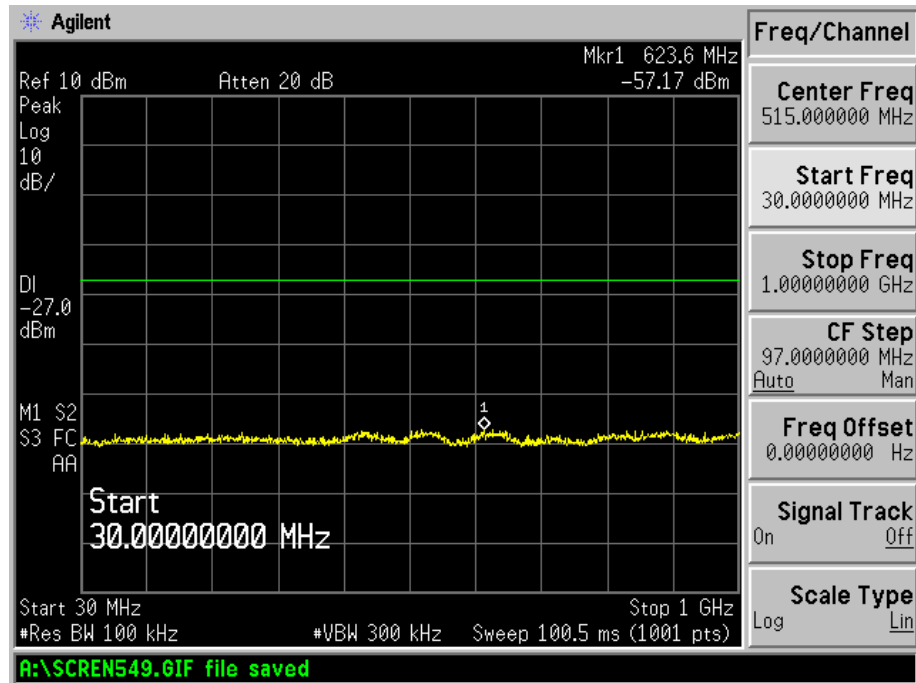
5200MHz



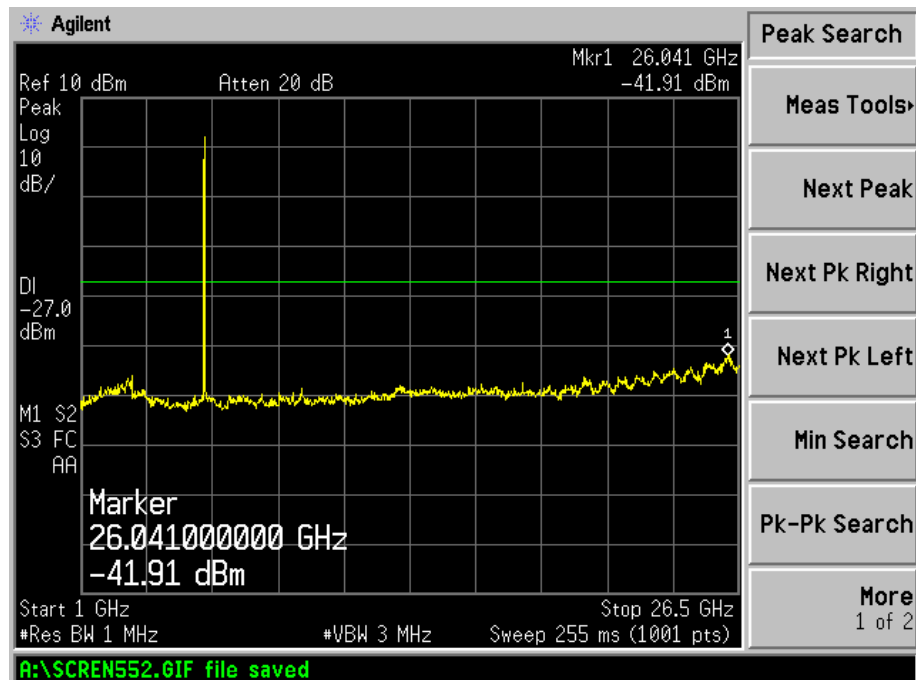
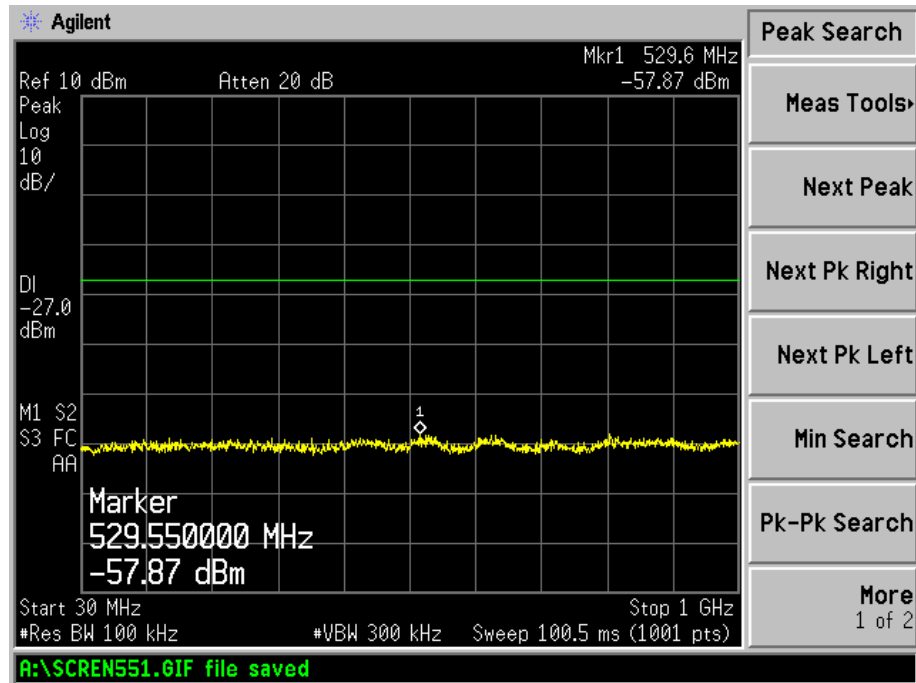
5240MHz



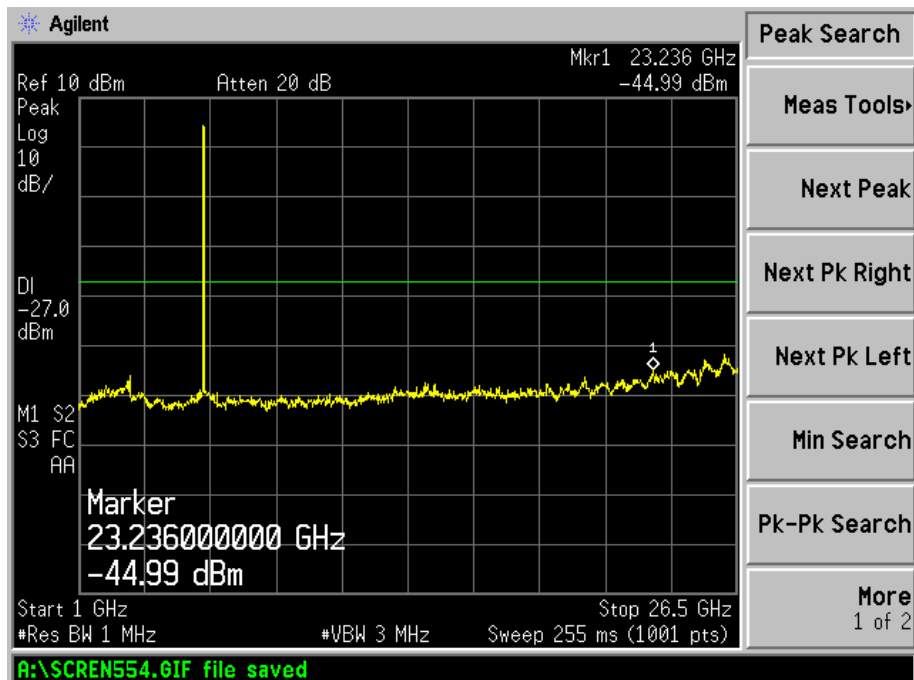
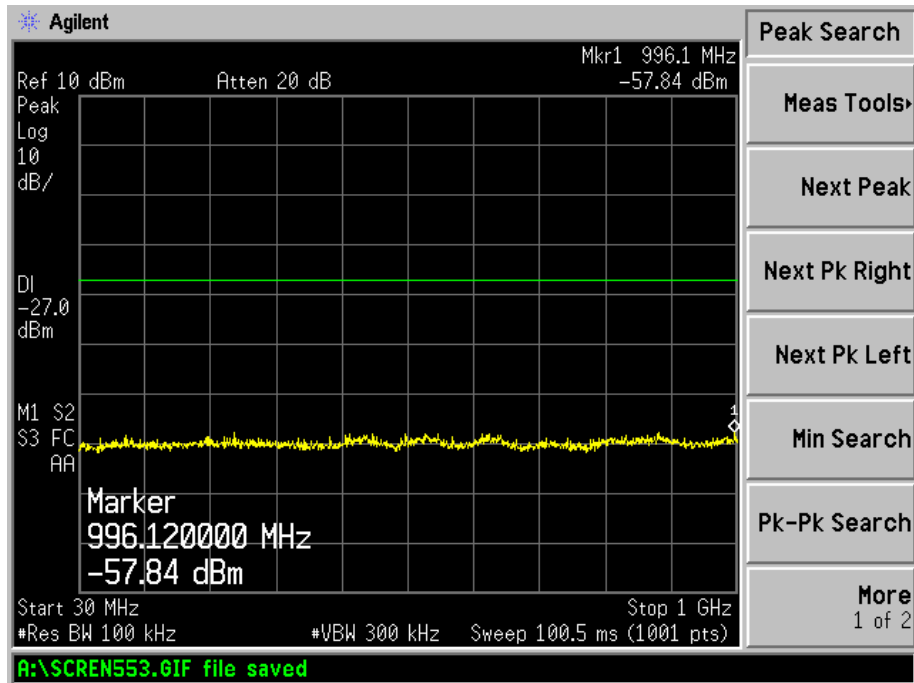
5745MHz



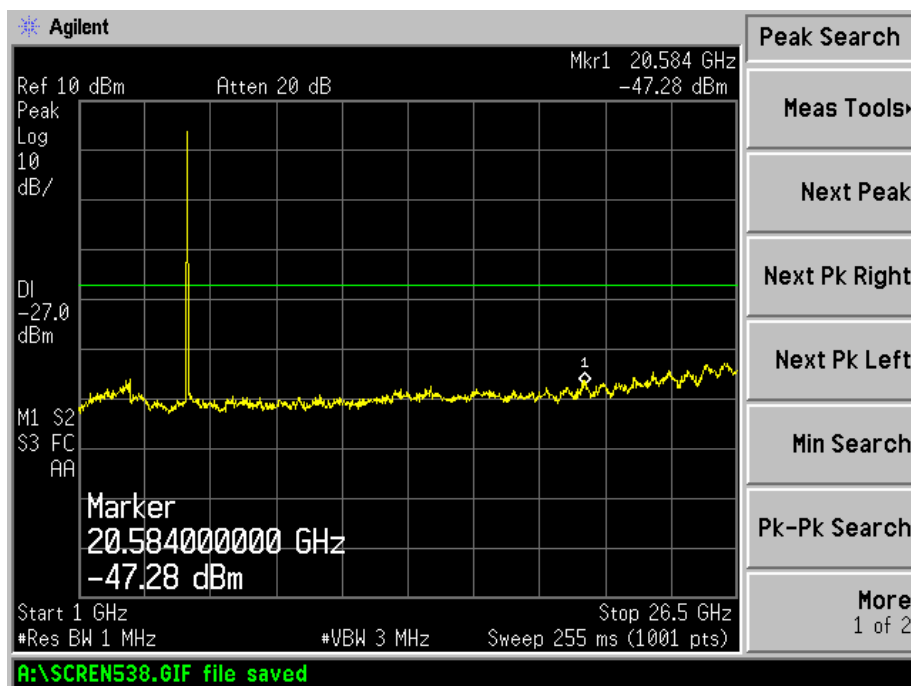
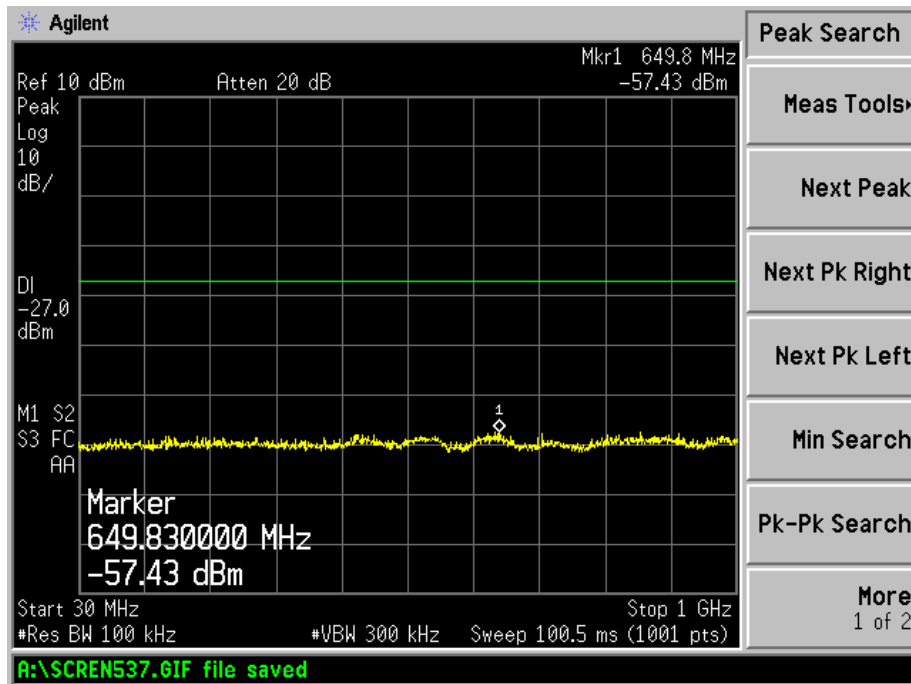
5785MHz



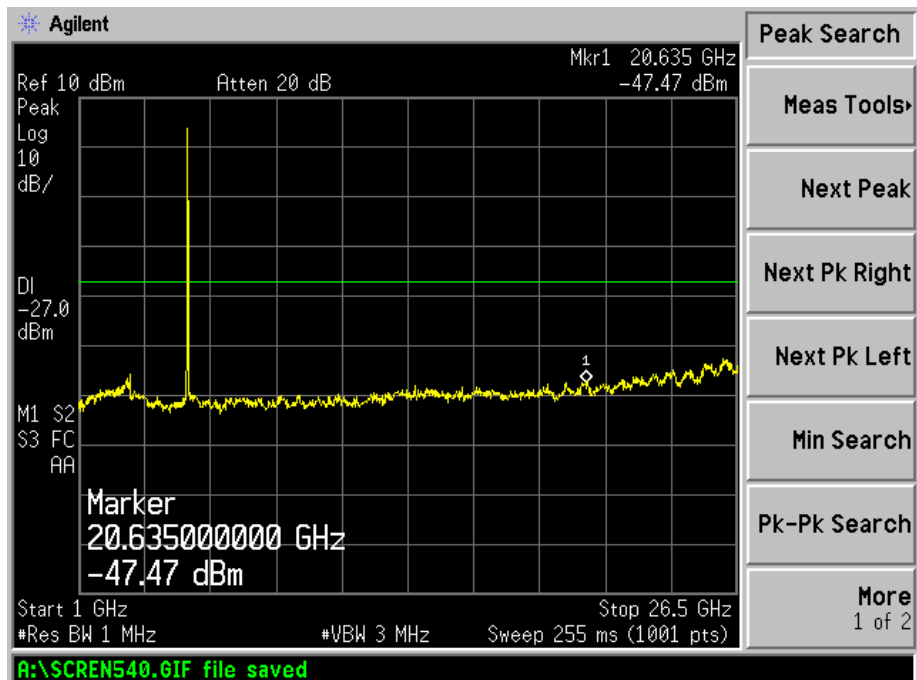
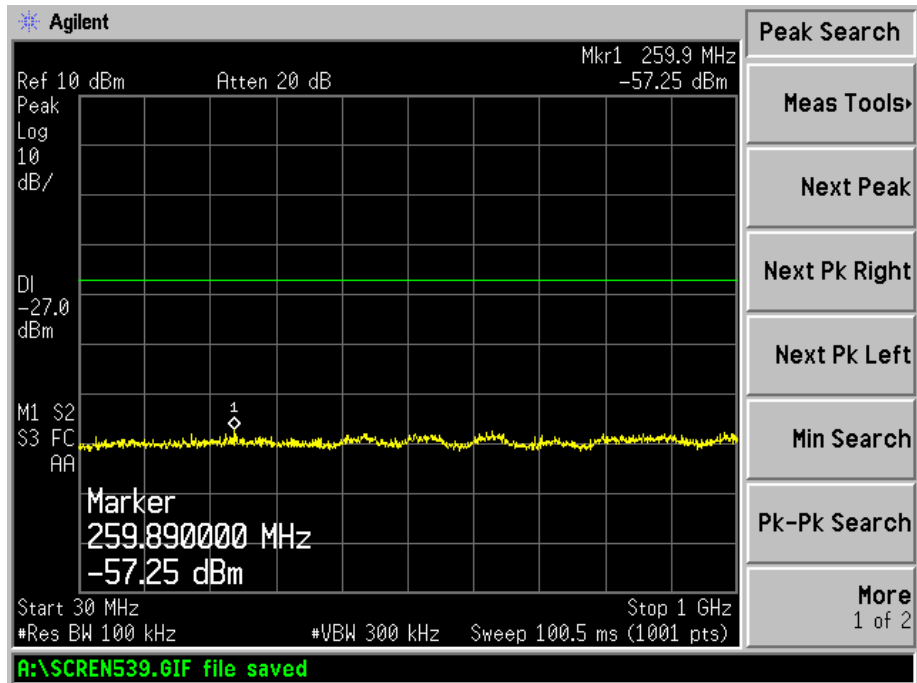
5825MHz



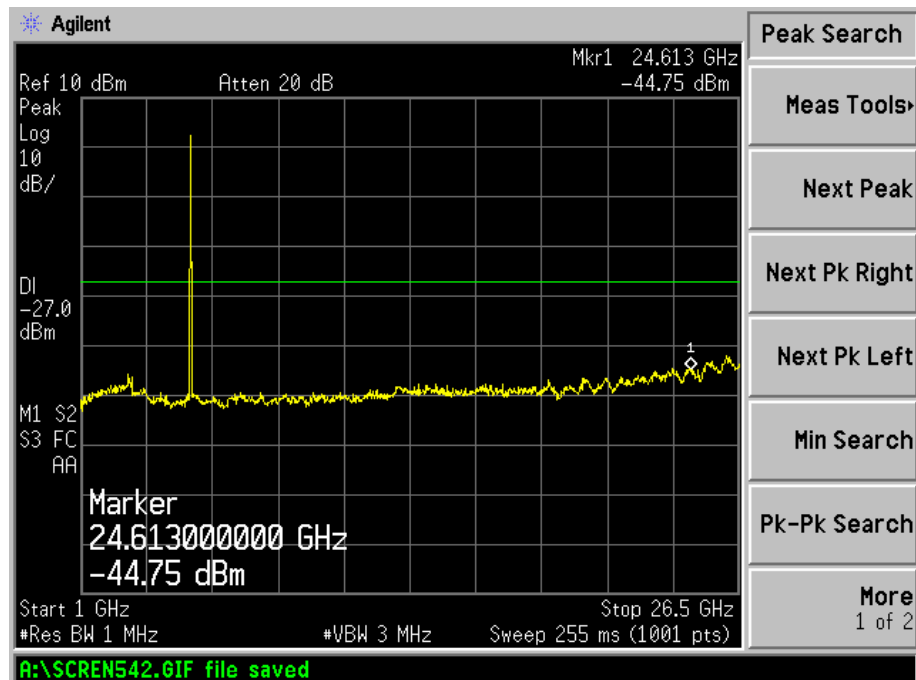
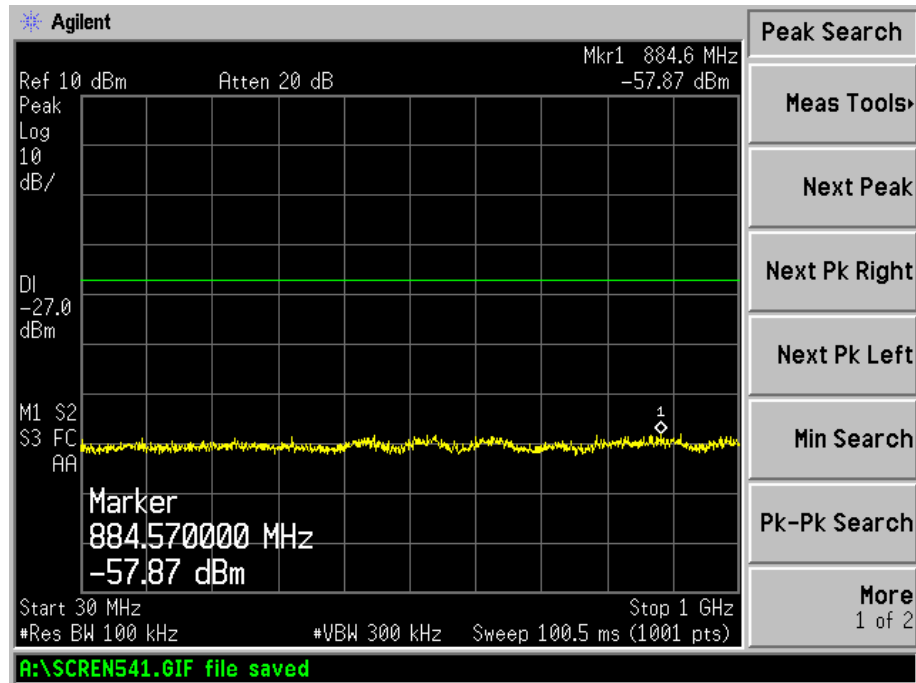
802.11n HT20 5180MHz



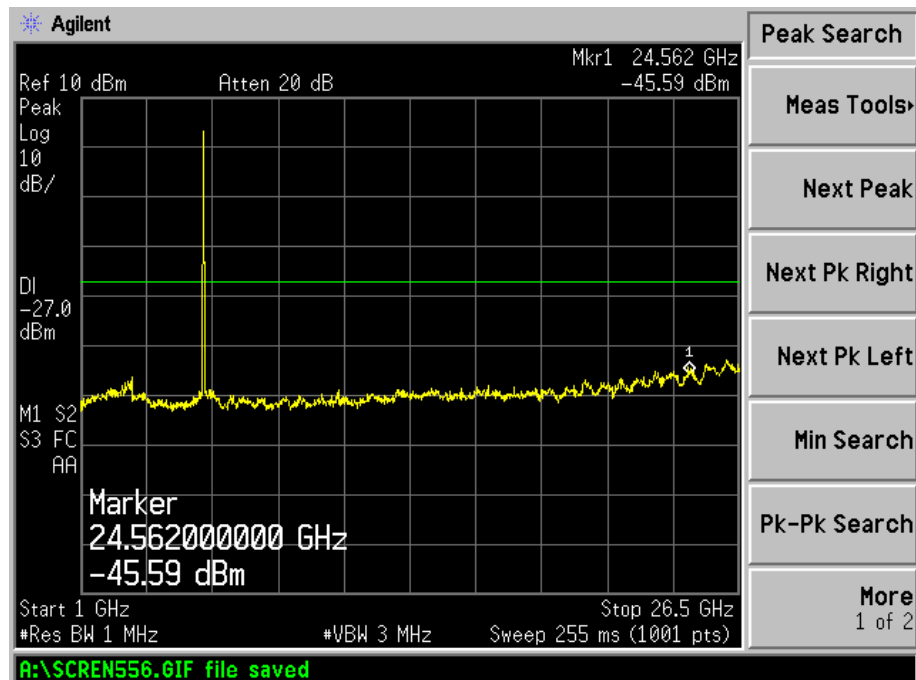
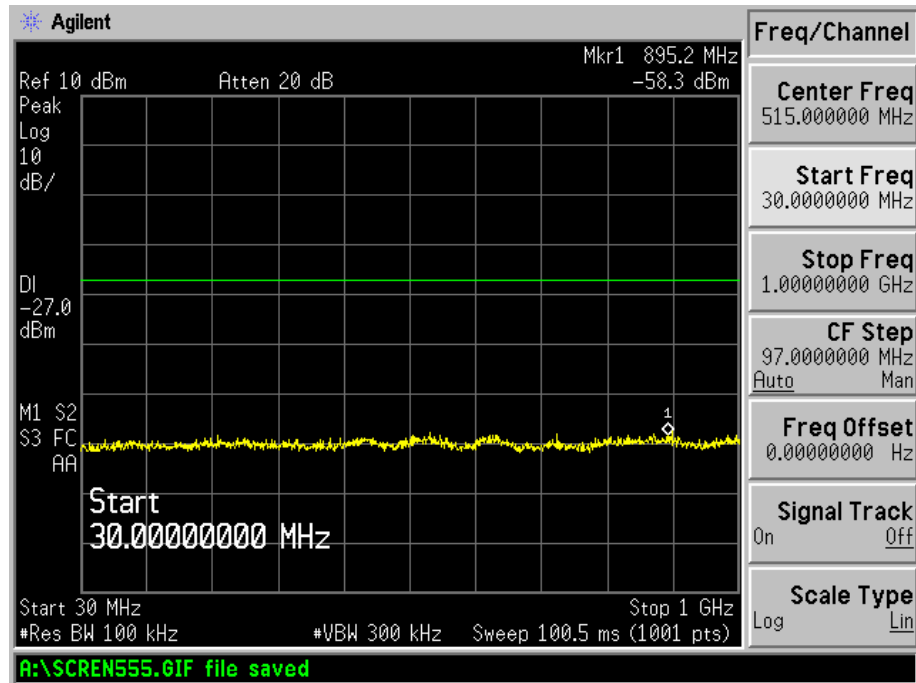
5200MHz



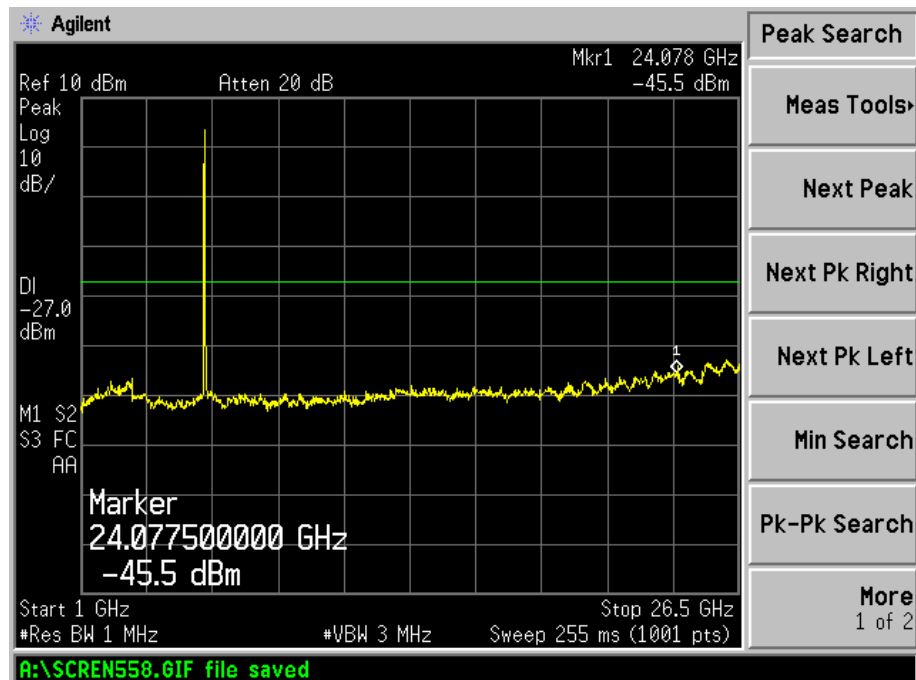
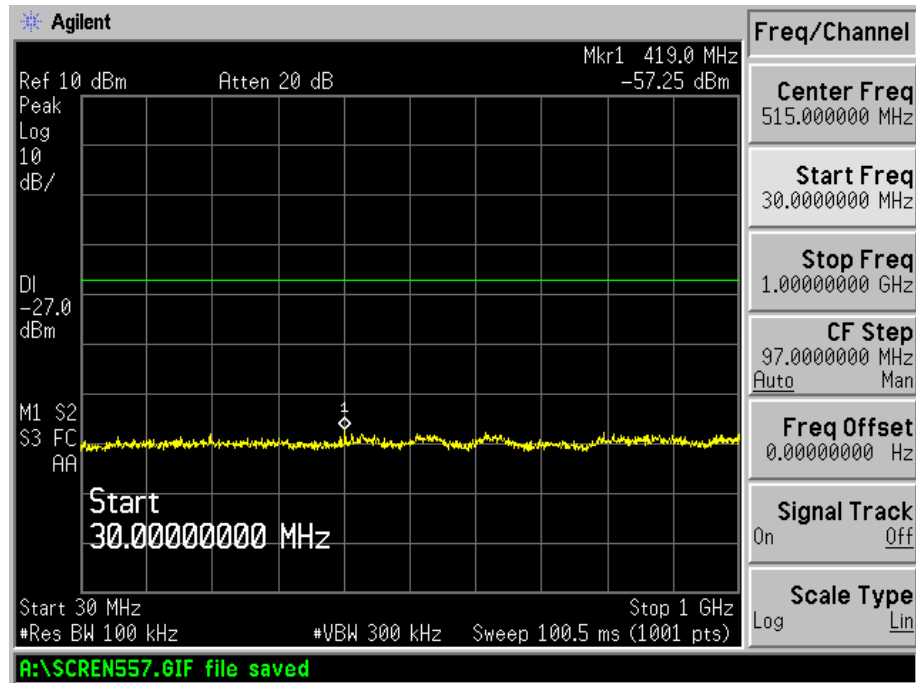
5240MHz



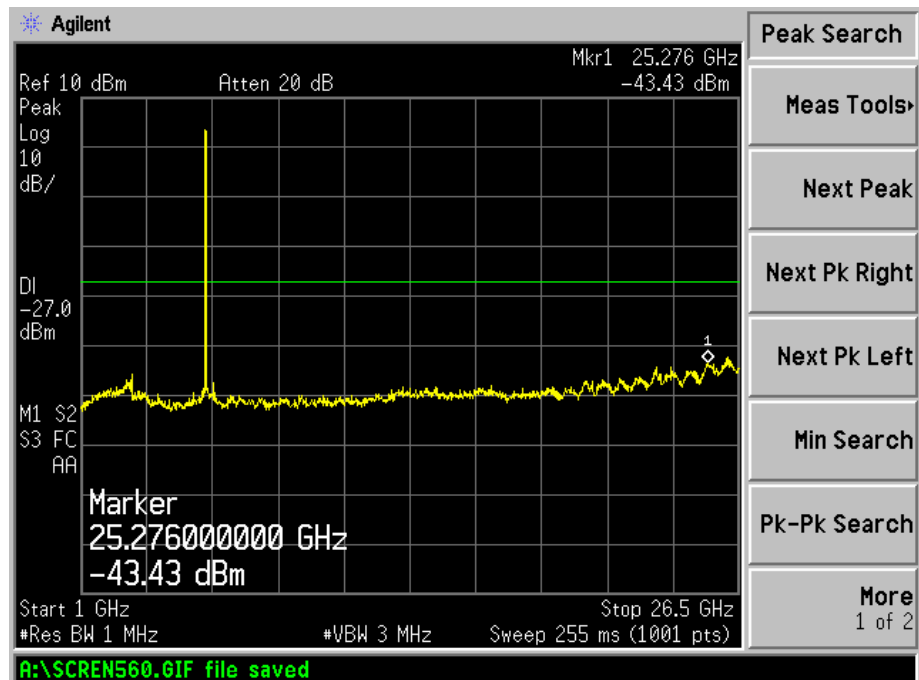
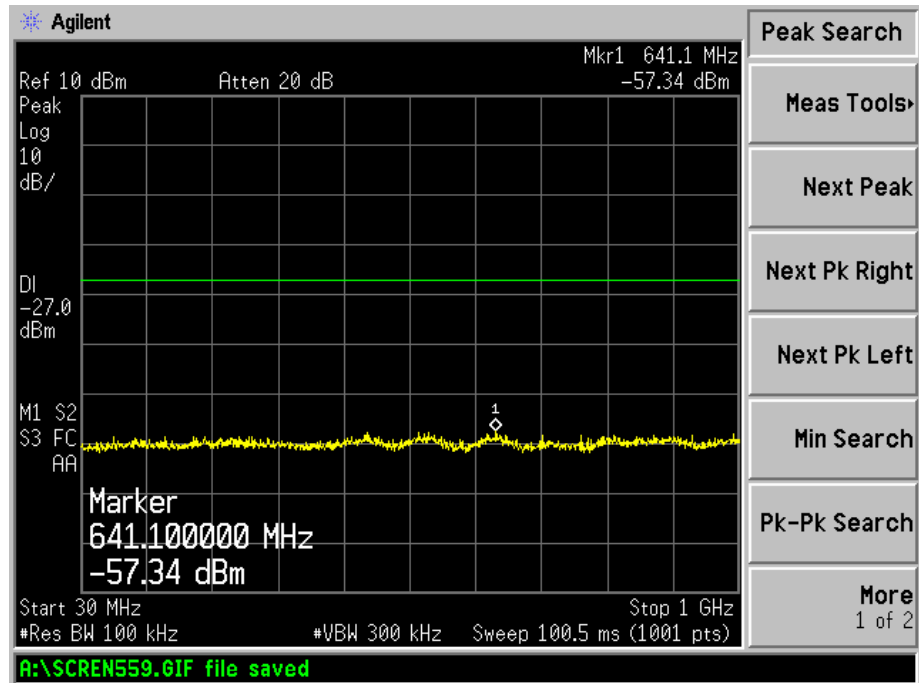
5745MHz



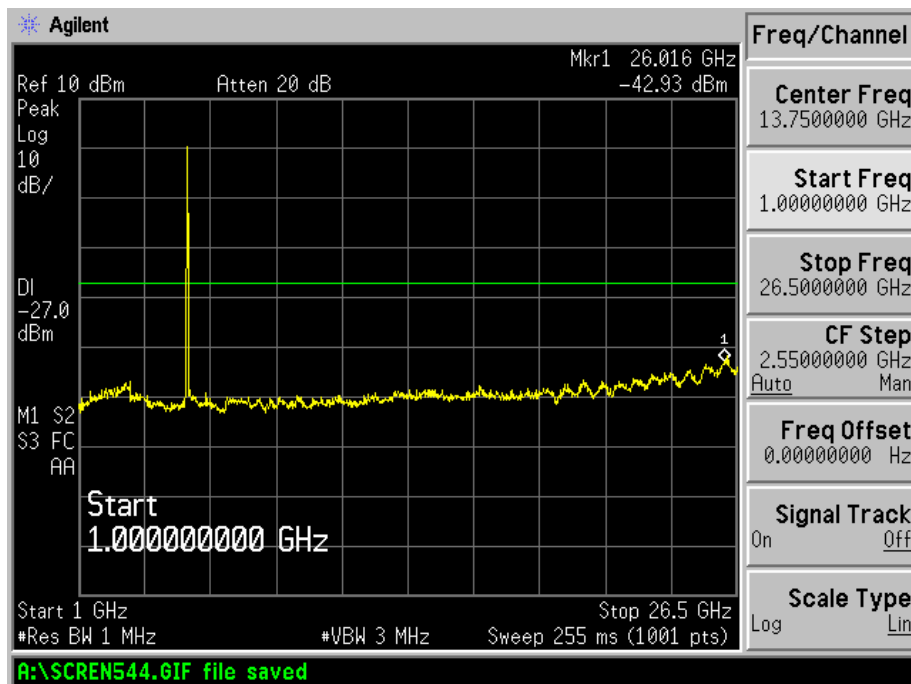
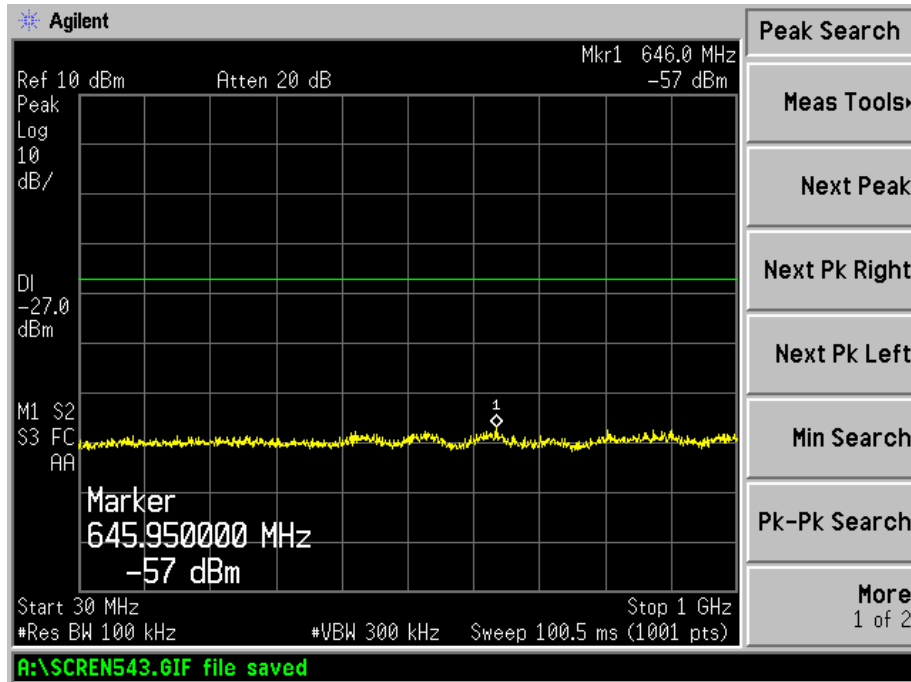
5785MHz



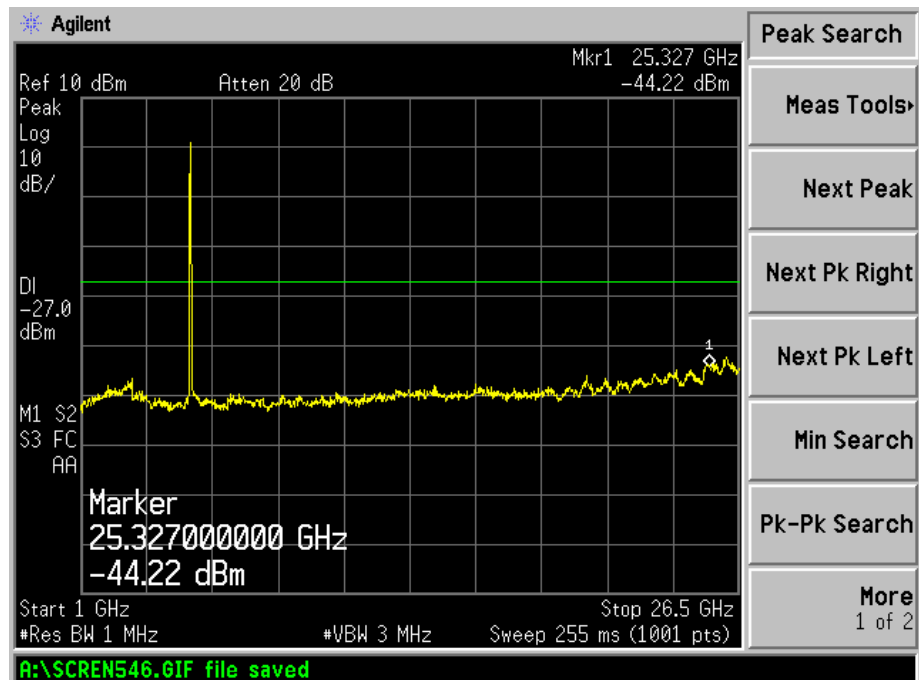
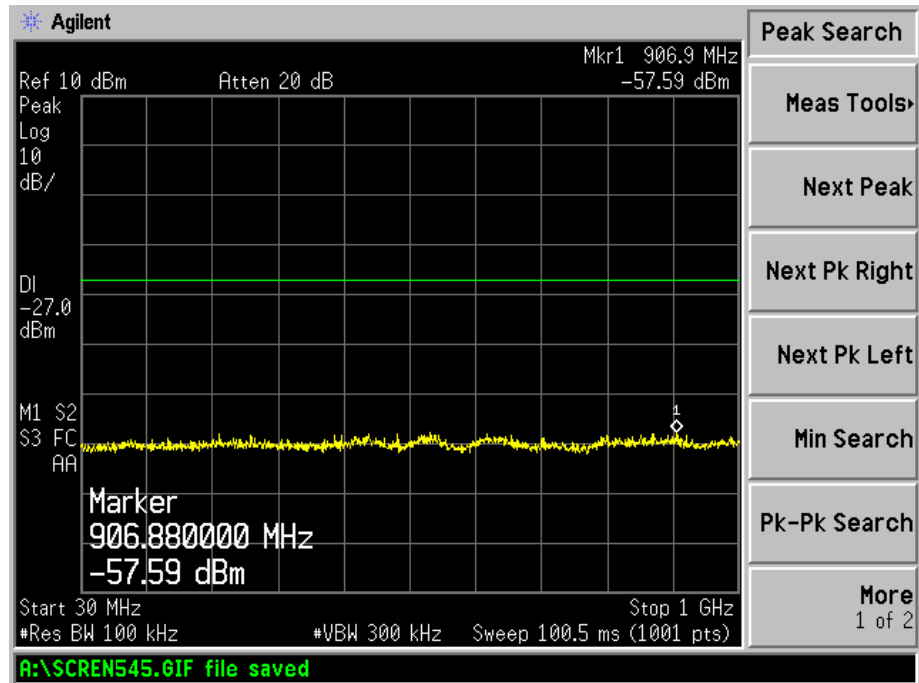
5825MHz



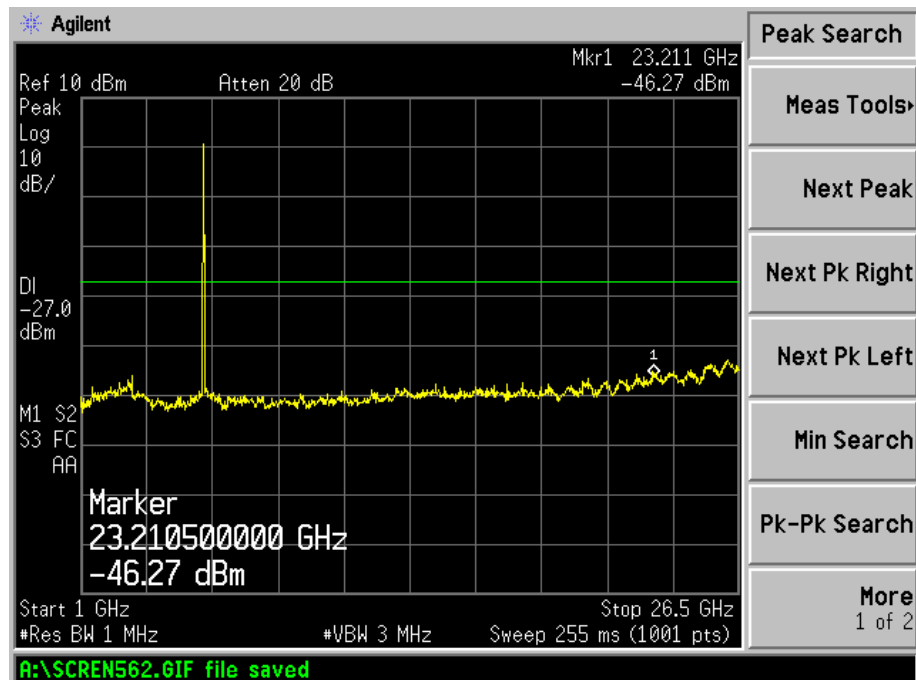
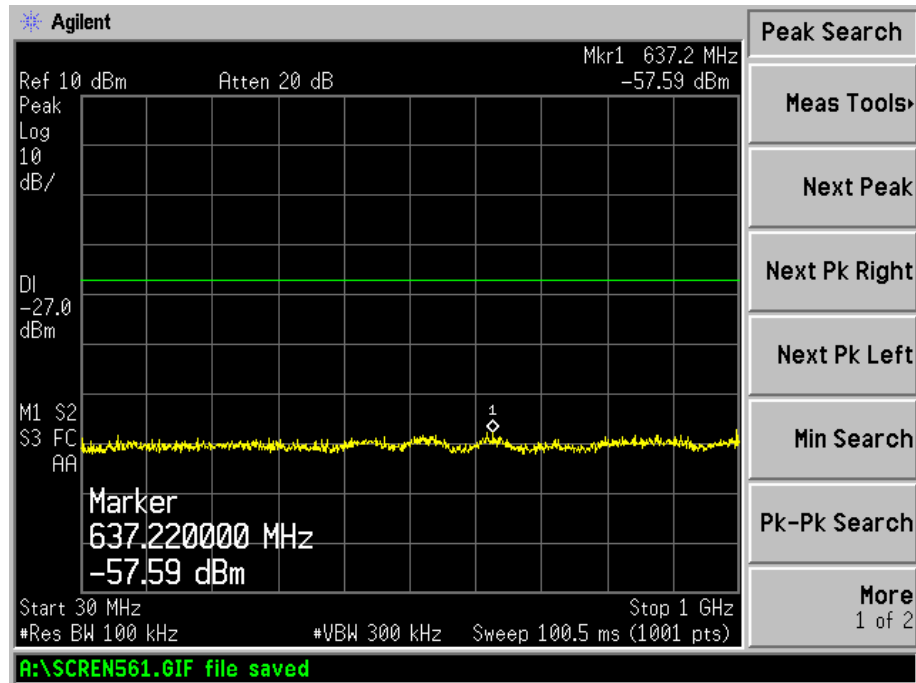
802.11n-HT40 5190MHz



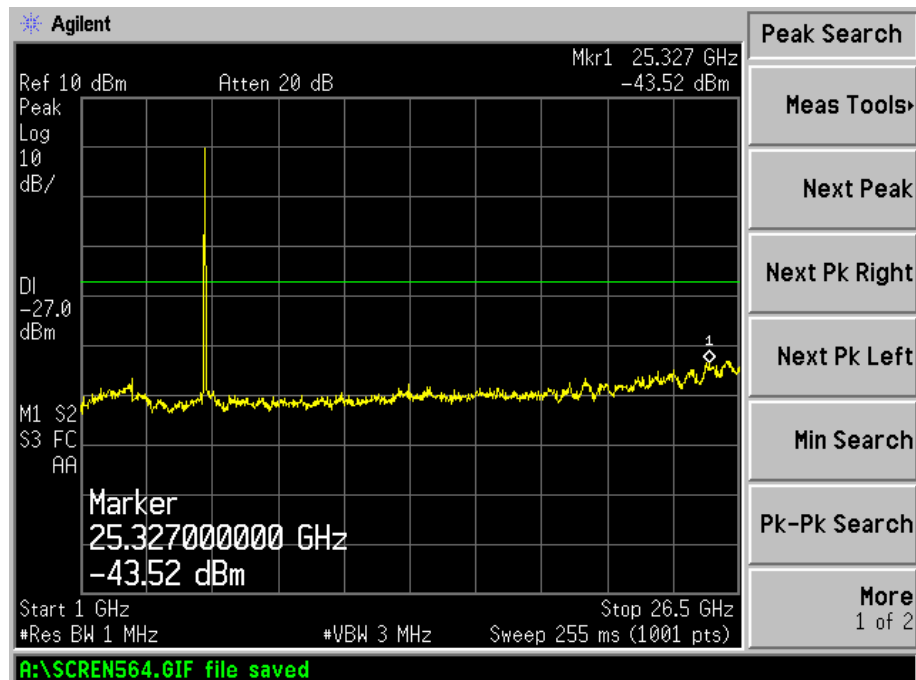
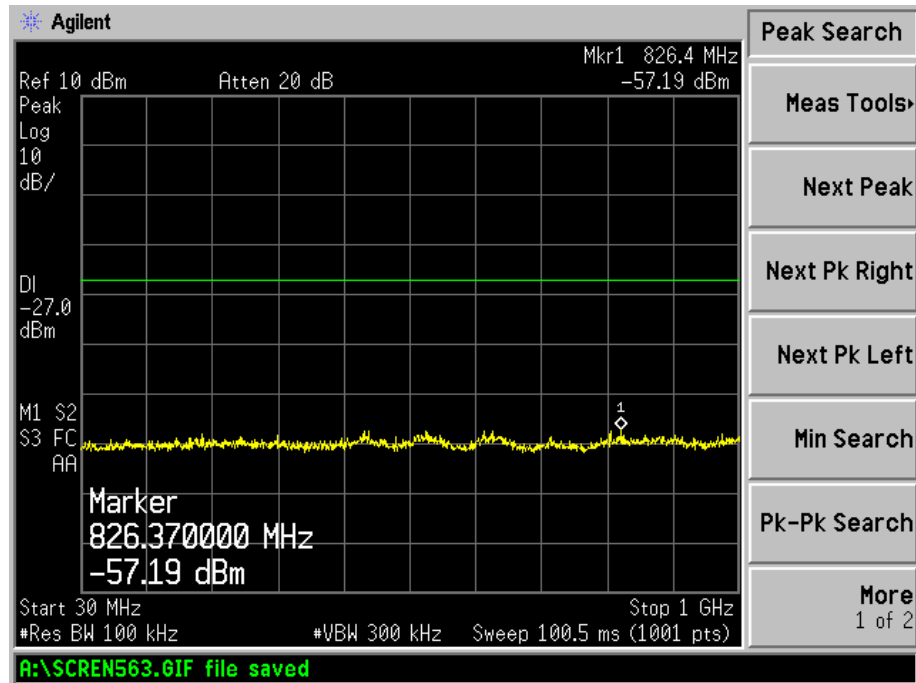
5230MHz



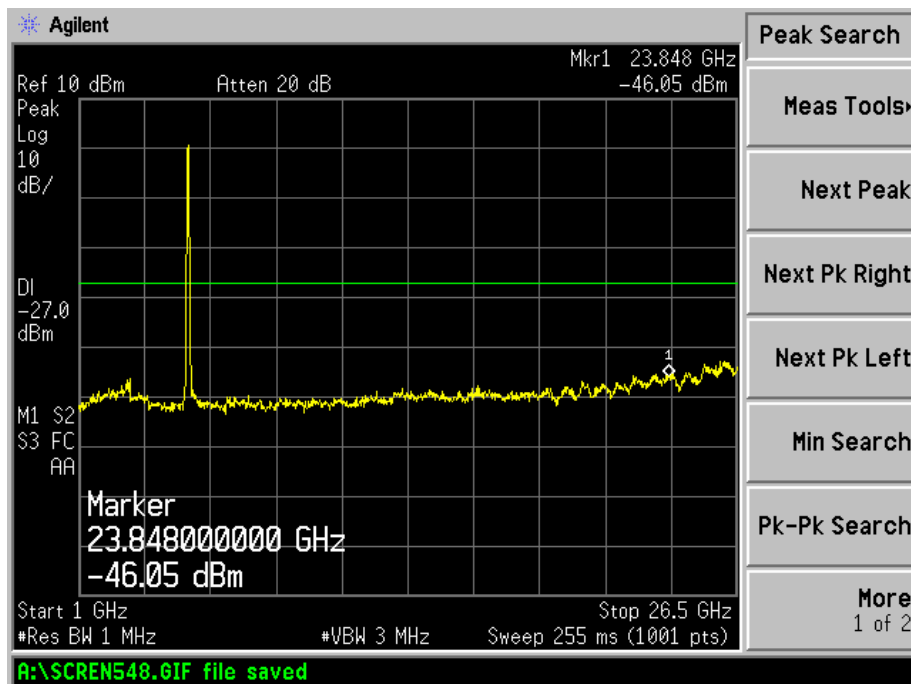
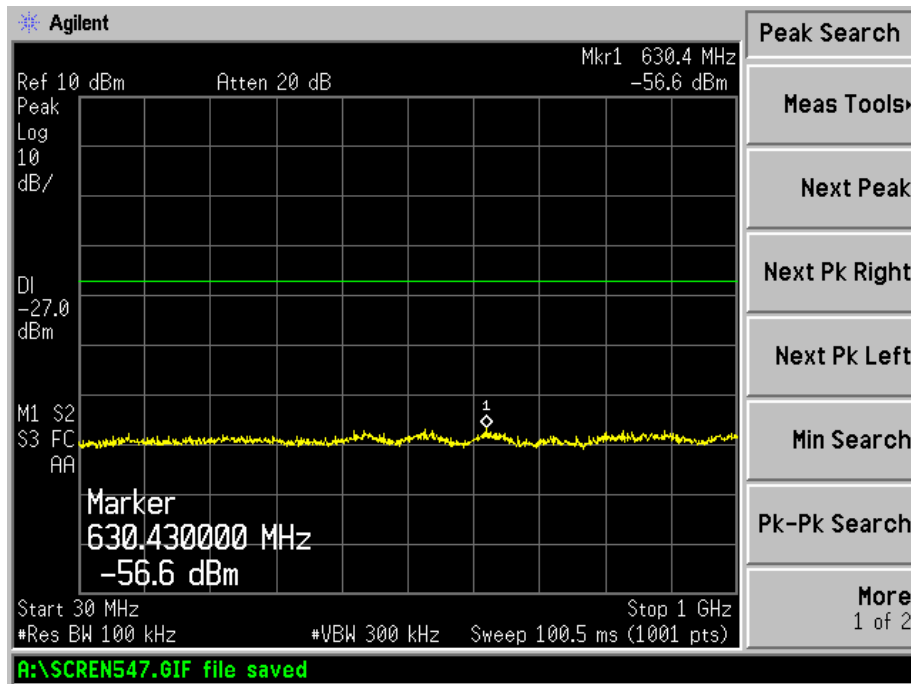
5755MHz



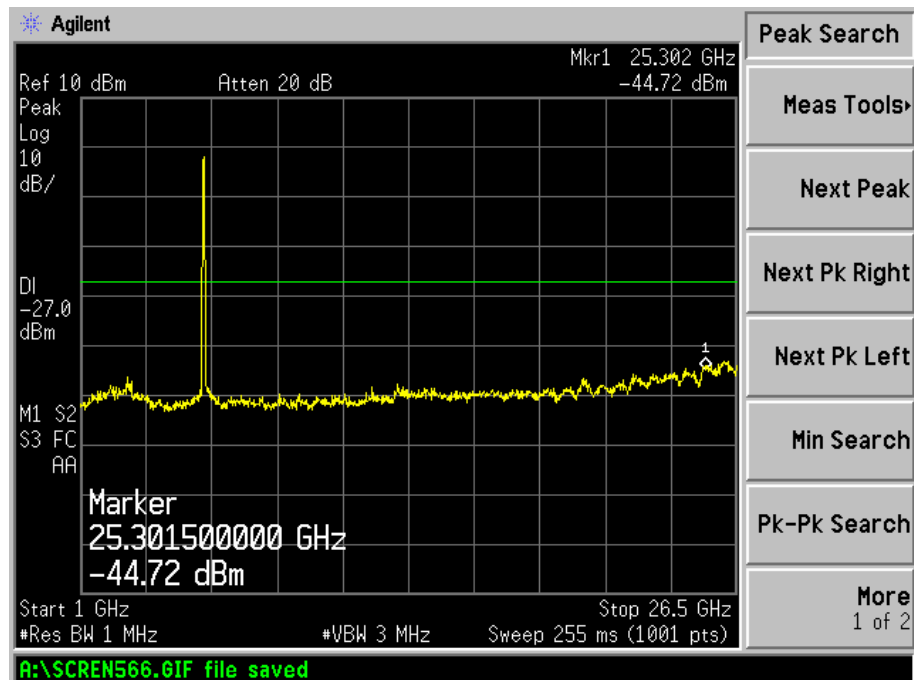
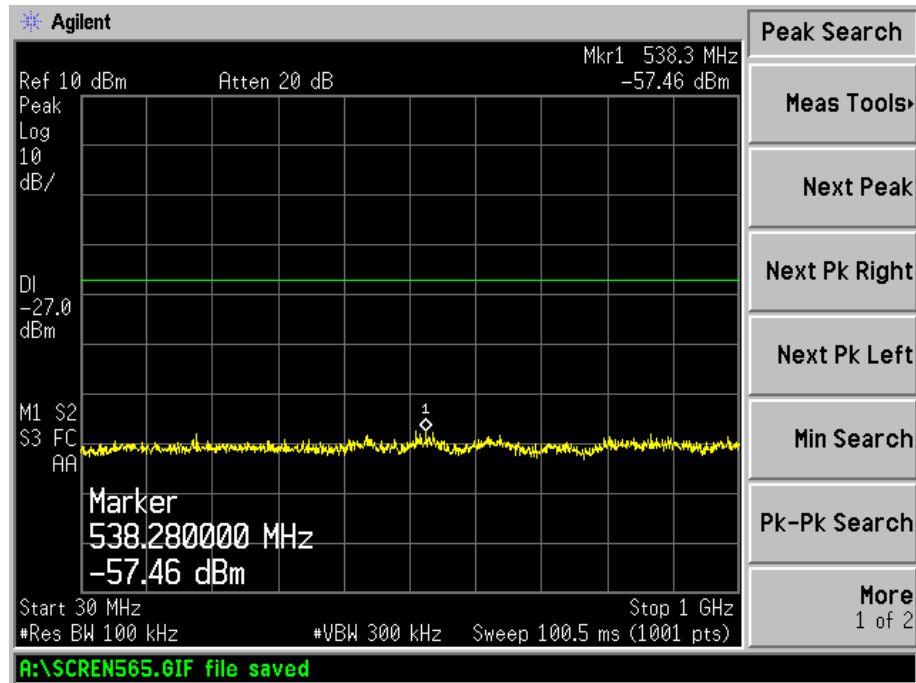
5795MHz



802.11ac-HT80 5210MHz



5775MHz



10. Radiated Spurious Emissions

10.1 Standard Applicable

According to §15.407(b)(6), Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209.

According to §15.407(b)(7), The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

789033 D02 v01r02 General UNII Test Procedures New Rules v01

If radiated measurements are performed, field strength is then converted to EIRP as follows:

$$\text{EIRP} = ((E \cdot d)^2) / 30$$

where:

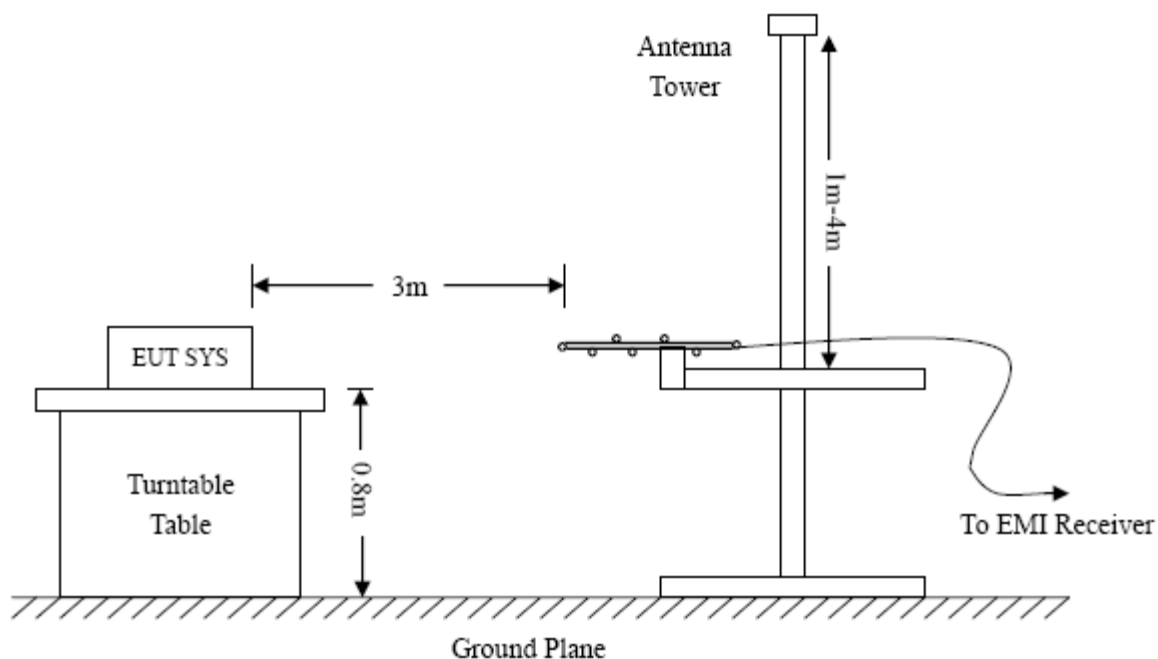
- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotropically radiated power in watts.

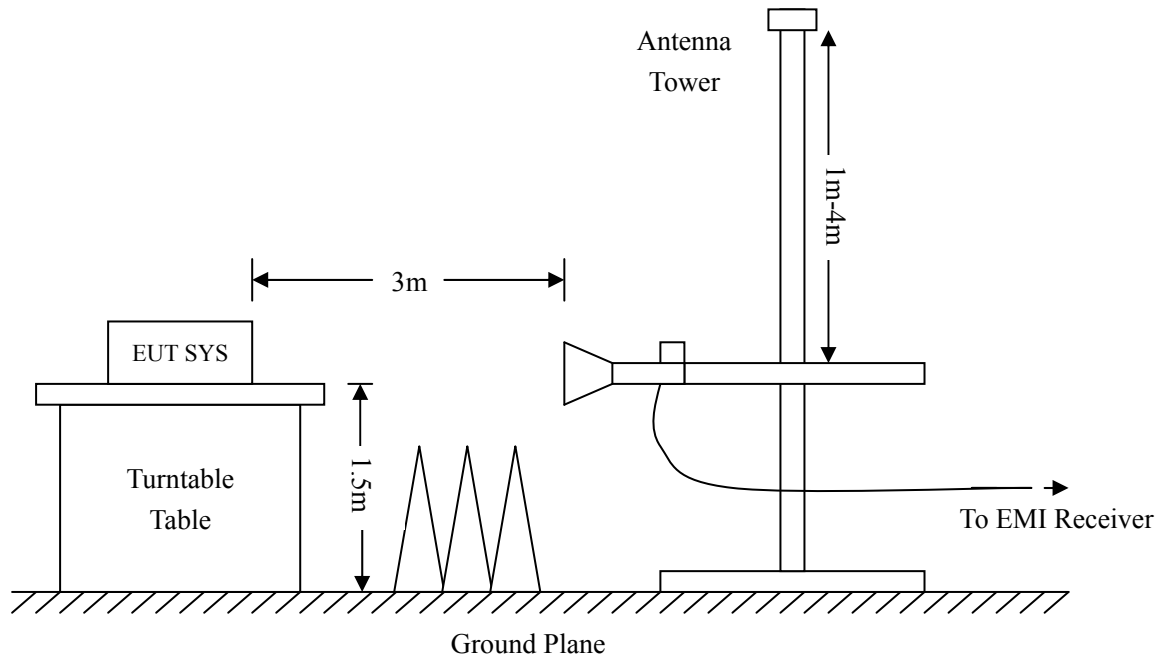
10.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.407(b)(6) and FCC Part 15.209 Limit..

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.





10.3 Test Receiver Setup

During the radiated emission test for above 1GHz, the test receiver was set with the following configurations:

For peak detector:

RBW = 1000kHz, VBW = 3000kHz, Sweep Time = Auto

For average detector:

RBW = 1000kHz, VBW = 10Hz, Sweep Time = Auto

10.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

10.5 Environmental Conditions

Temperature:	22° C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

10.6 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.407(b)(6) standards, and had the worst margin of:

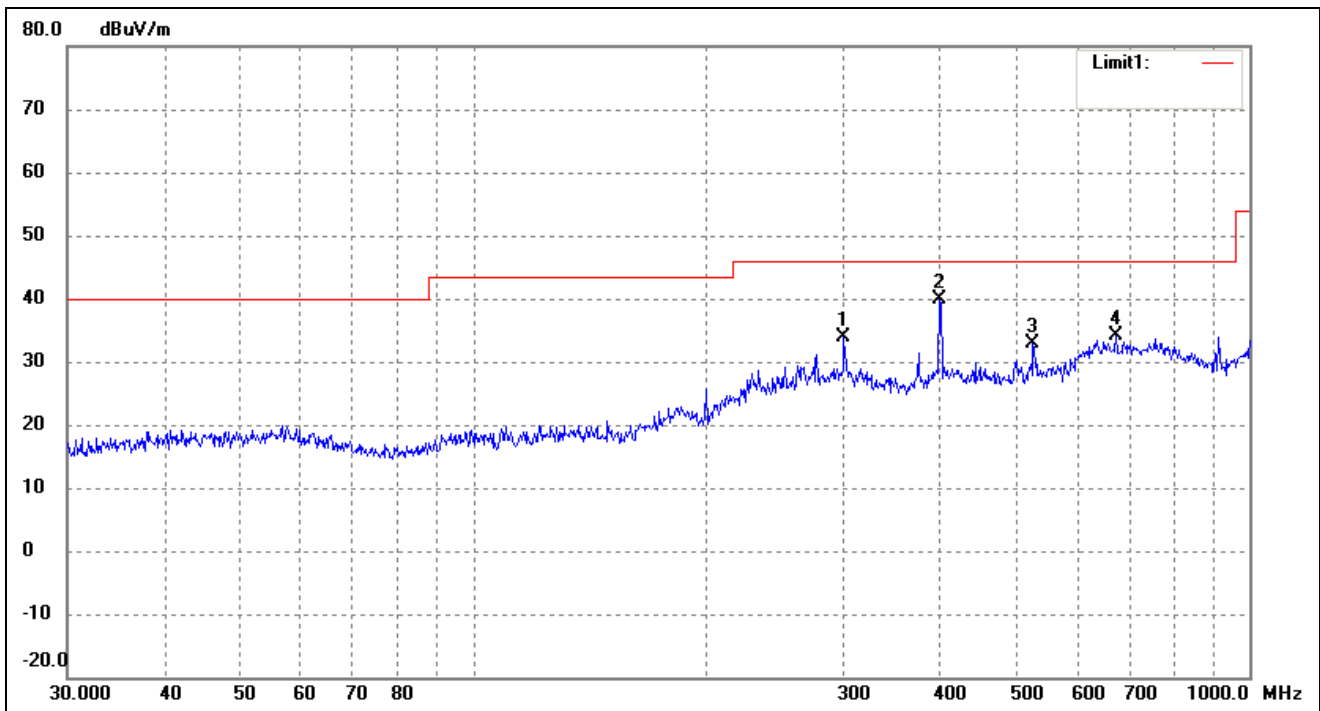
Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

For 802.11a_worst case

Spurious Emission From 30 MHz to 1 GHz

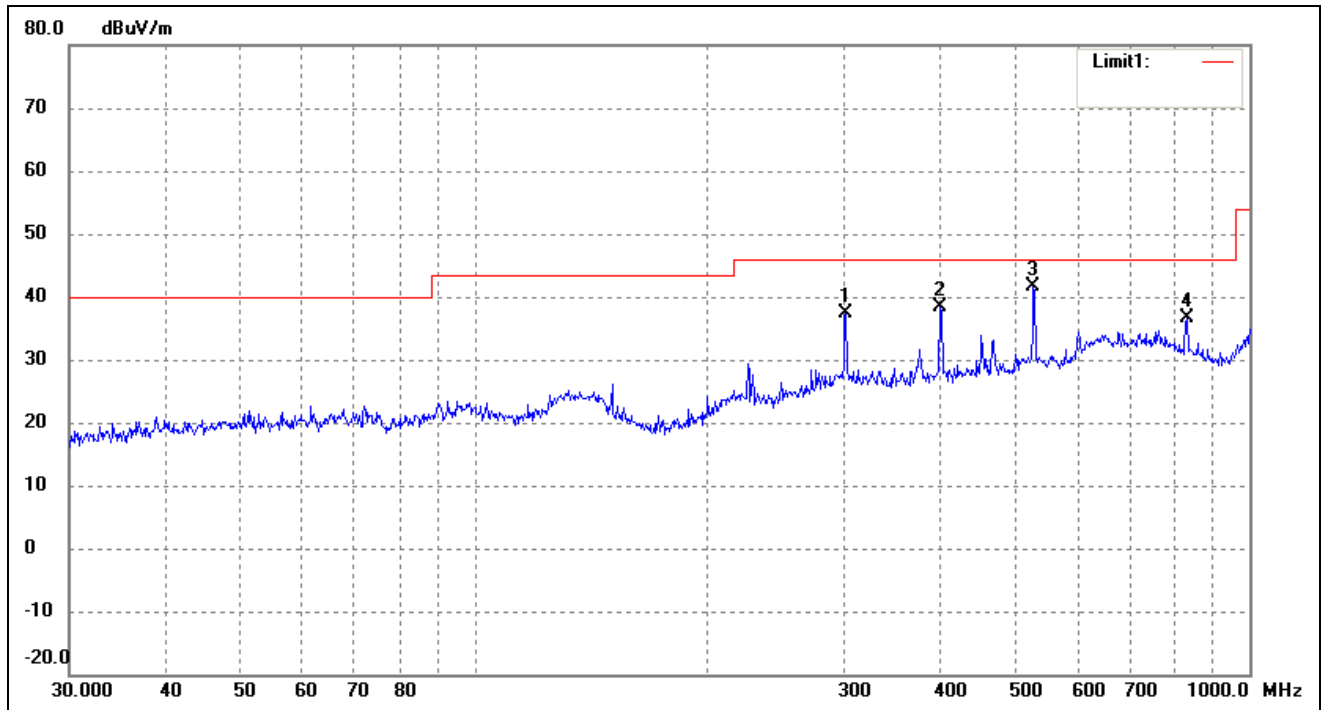
Test mode: Transmitting Low Channel

Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	300.3673	21.92	11.95	33.87	46.00	-12.13	190	100	peak
2	399.0302	27.36	12.64	40.00	46.00	-6.00	254	100	peak
3	526.3967	19.07	13.87	32.94	46.00	-13.06	96	100	peak
4	672.8445	15.92	18.29	34.21	46.00	-11.79	189	100	peak

Test Specification: Vertical

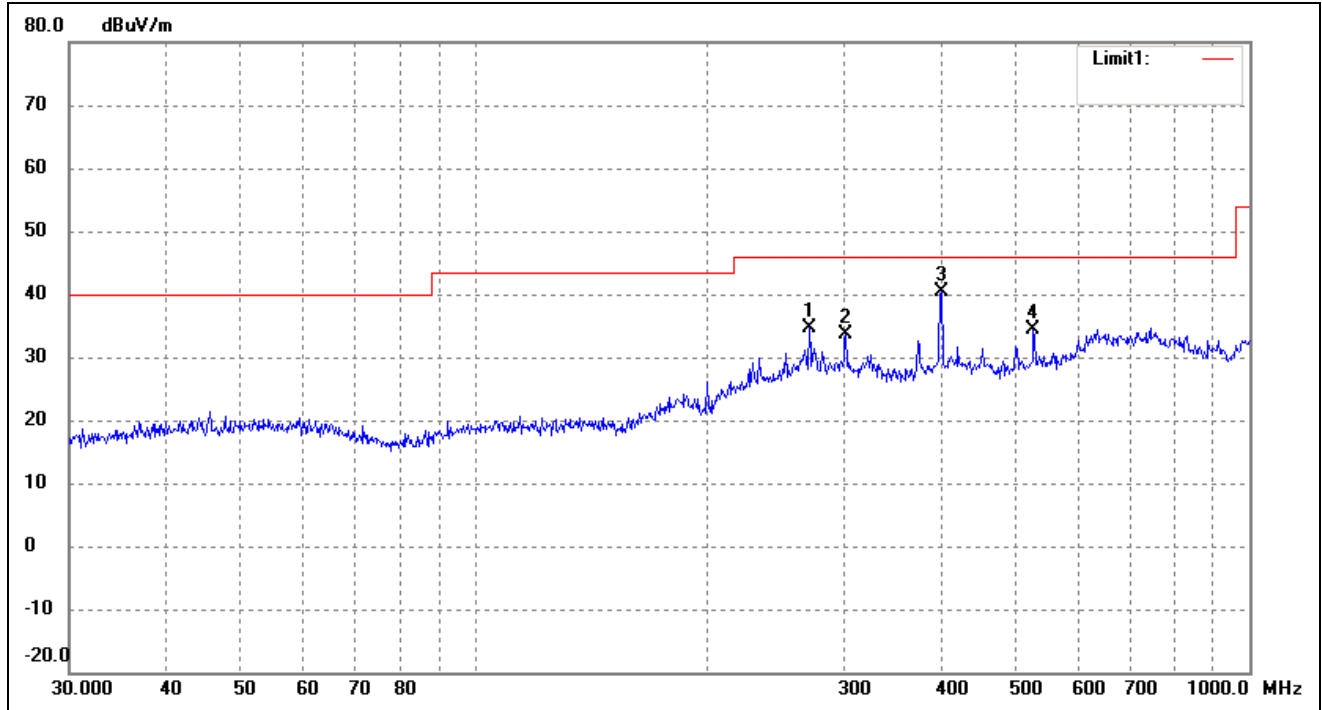


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	301.4224	25.39	11.94	37.33	46.00	-8.67	212	100	peak
2	399.0302	25.62	12.64	38.26	46.00	-7.74	216	100	peak
3	526.3967	27.88	13.87	41.75	46.00	-4.25	55	100	peak
4	830.4002	20.79	15.86	36.65	46.00	-9.35	250	100	peak

For 802.11n-HT20_worst case

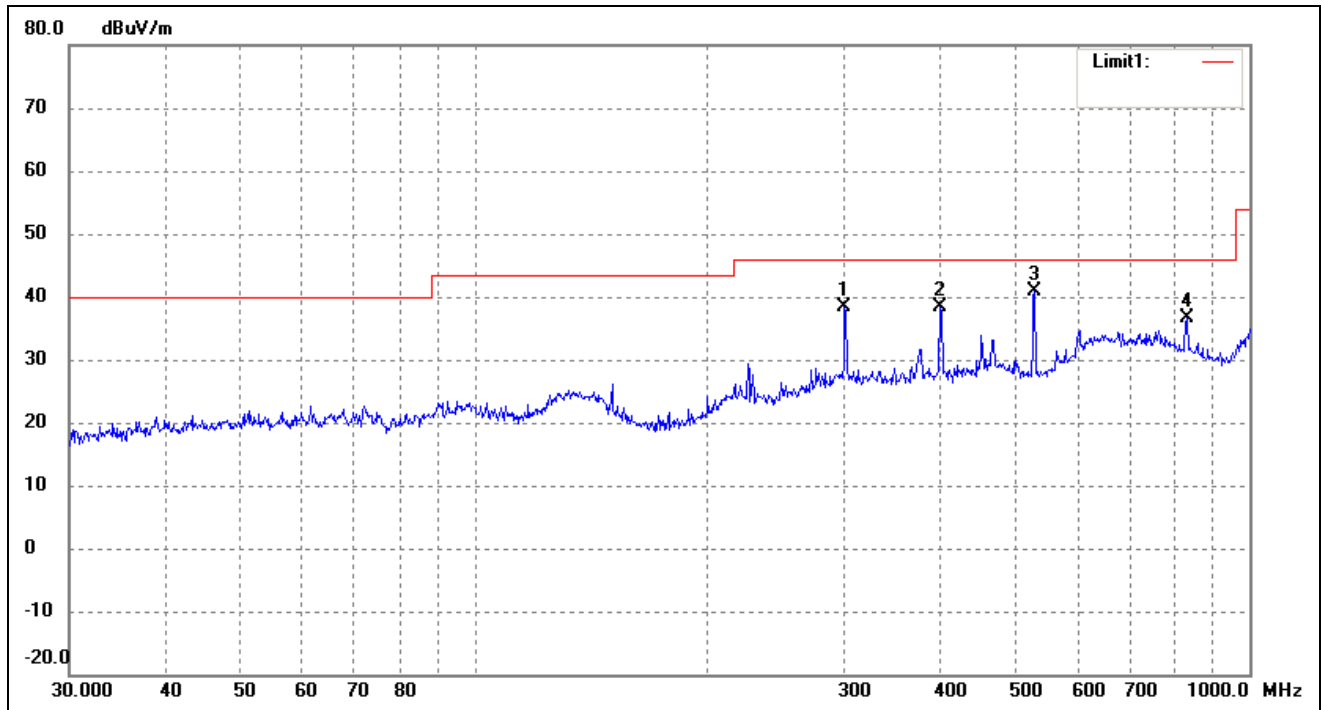
Test mode: Transmitting Low Channel

Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	270.3748	24.30	10.44	34.74	46.00	-11.26	160	100	peak
2	301.4224	21.66	11.94	33.60	46.00	-12.40	157	100	peak
3	400.4319	27.76	12.67	40.43	46.00	-5.57	70	100	peak
4	526.3967	20.44	13.87	34.31	46.00	-11.69	150	100	peak

Test Specification: Vertical

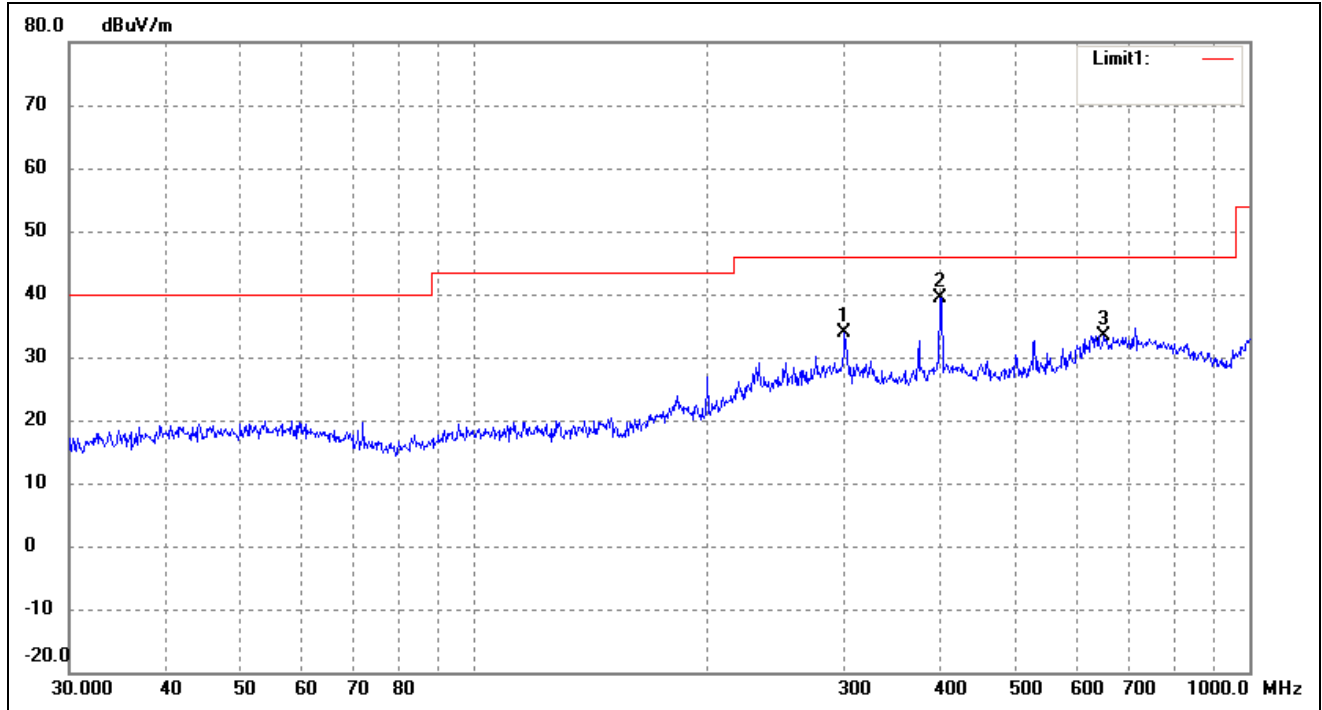


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	300.3673	26.42	11.95	38.37	46.00	-7.63	293	100	peak
2	399.0302	25.62	12.64	38.26	46.00	-7.74	100	100	peak
3	528.2458	26.98	13.86	40.84	46.00	-5.16	119	100	peak
4	830.4002	20.79	15.86	36.65	46.00	-9.35	102	100	peak

802.11n-HT40_worst case

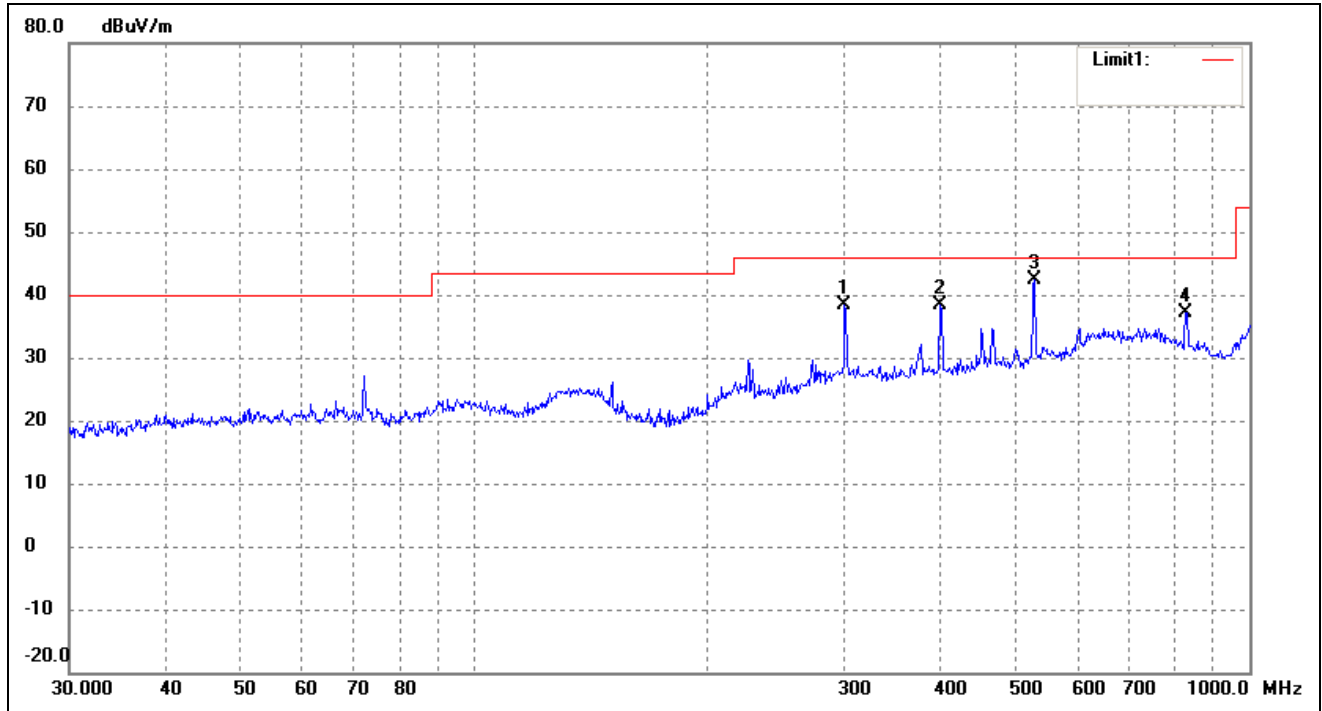
Test mode: Transmitting Low Channel

Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	300.3673	22.00	11.95	33.95	46.00	-12.05	243	100	peak
2	399.0302	26.85	12.64	39.49	46.00	-6.51	95	100	peak
3	649.6597	15.63	17.84	33.47	46.00	-12.53	151	100	peak

Test Specification: Vertical

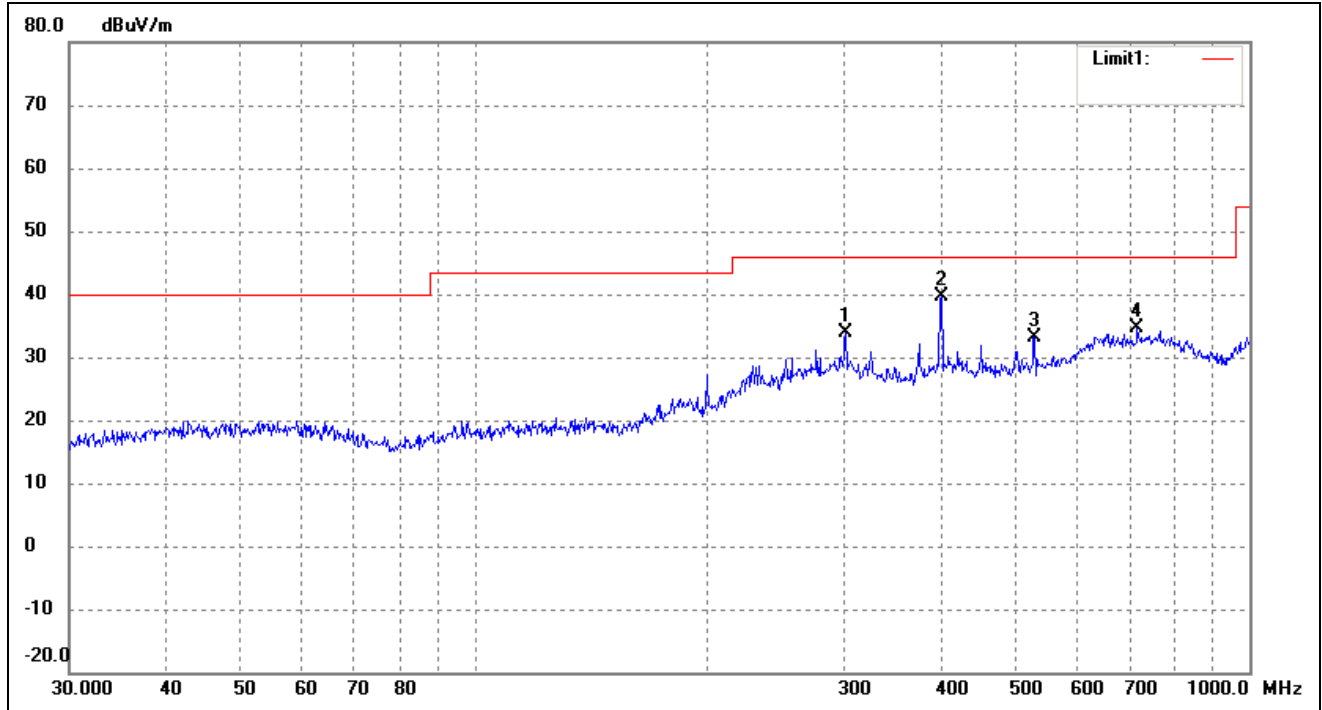


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	300.3673	26.42	11.95	38.37	46.00	-7.63	245	100	peak
2	399.0302	25.81	12.64	38.45	46.00	-7.55	304	100	peak
3	528.2458	28.48	13.86	42.34	46.00	-3.66	82	100	peak
4	827.4934	21.39	15.80	37.19	46.00	-8.81	221	100	peak

802.11ac-HT80_worst case

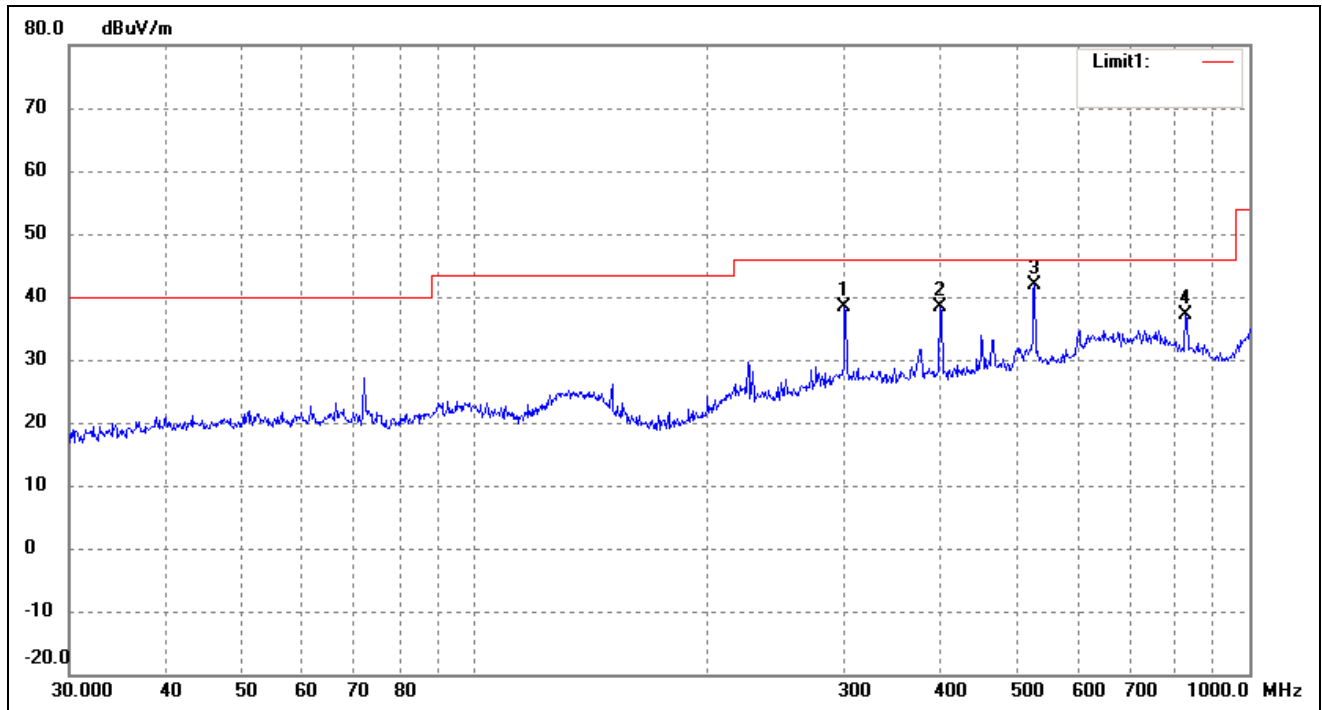
Test mode: Transmitting Low Channel

Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	301.4224	21.98	11.94	33.92	46.00	-12.08	91	100	peak
2	400.4319	26.97	12.67	39.64	46.00	-6.36	134	100	peak
3	528.2458	19.35	13.86	33.21	46.00	-12.79	56	100	peak
4	716.6820	17.01	17.70	34.71	46.00	-11.29	112	100	peak

Test Specification: Vertical



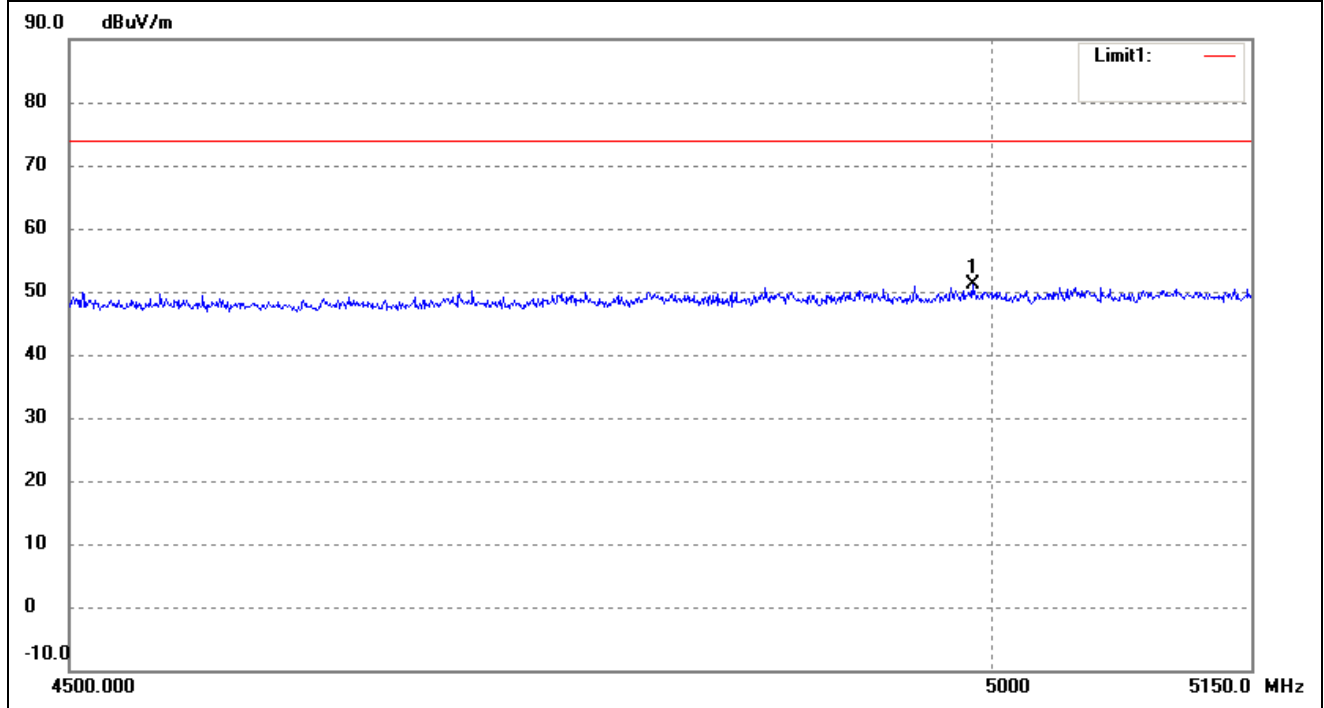
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	300.3673	26.42	11.95	38.37	46.00	-7.63	57	100	peak
2	399.0302	25.68	12.64	38.32	46.00	-7.68	152	100	peak
3	528.2458	27.98	13.86	41.84	46.00	-4.16	144	100	peak
4	827.4934	21.33	15.80	37.13	46.00	-8.87	144	100	peak

For 802.11a

Spurious Emission above 1GHz

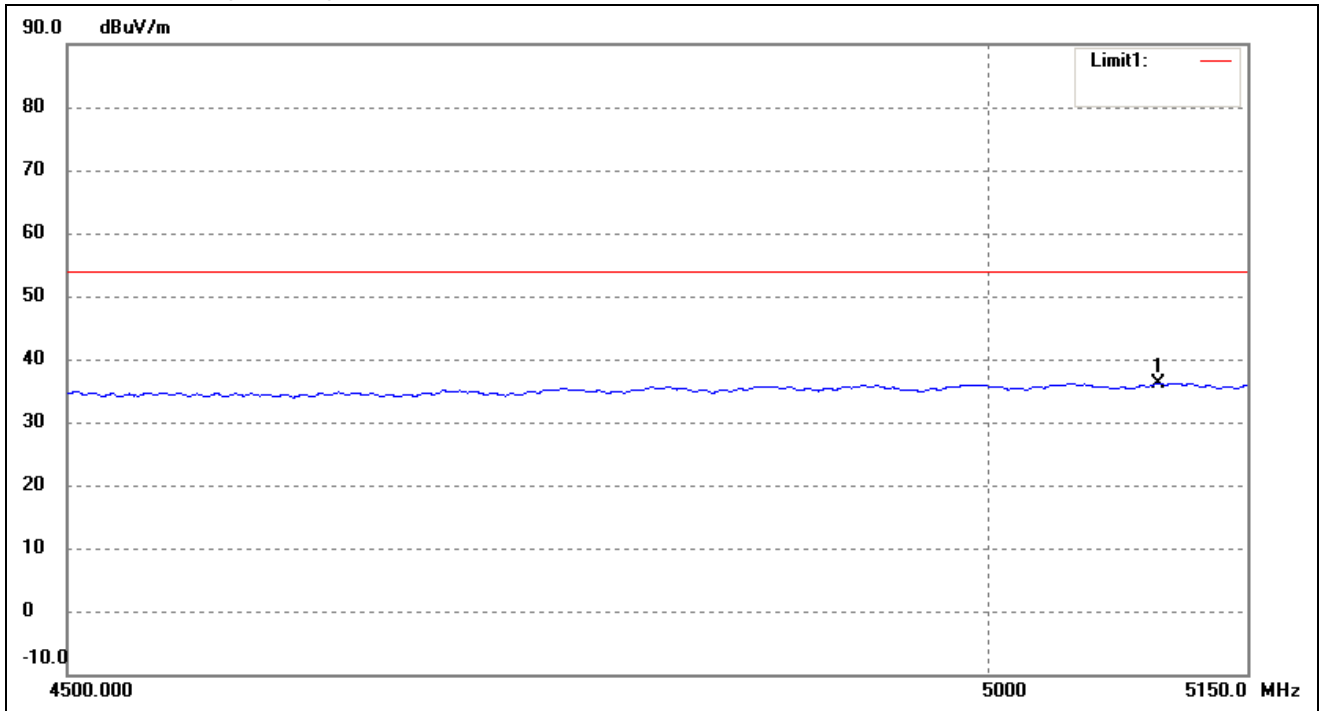
For the frequency band 5.18-5.24GHz(802.11a)

Restricted Bandedge Peak



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	4988.602	51.74	-0.52	51.22	74.00	-22.78	95	100	peak

Restricted Bandedge Average



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	5097.462	36.44	-0.25	36.19	54.00	-17.81	123	100	AVG

Note: this EUT was tested in the low, high channel and the worst case position data was reported.

Harmonics And Spurious Emissions

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Low Channel (5180MHz)										
15540	PK	48.24	185	V	40.7	10.9	39.6	60.24	74	-13.76
15540	PK	46.12	235	H	40.7	10.9	39.6	58.12	74	-15.88
15540	AV	35.52	119	V	40.7	10.9	39.6	47.52	54	-6.48
15540	AV	35.92	170	H	40.7	10.9	39.6	47.92	54	-6.08
High Channel (5240MHz)										
15720	PK	45.15	285	V	40.7	10.9	39.6	57.15	74	-16.85
15720	PK	44.65	132	H	40.7	10.9	39.6	56.65	74	-17.35
15720	AV	38.18	121	V	40.7	10.9	39.6	50.18	54	-3.82
15720	AV	34.36	206	H	40.7	10.9	39.6	46.36	54	-7.64

Out of Band edge

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-42.28	-27
Highest	Above 5350	-44.15	-27
Note: the data just list the worst cases			

For the frequency band 5.745-5.825GHz (802.11a)

Harmonics And Spurious Emissions

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Low Channel (5745MHz)										
11490	PK	45.24	155	V	38.9	9.8	40.1	53.84	74	-20.16
11490	PK	48.65	171	H	38.9	9.8	40.1	57.25	74	-16.75
11490	AV	35.19	151	V	38.9	9.8	40.1	43.79	54	-10.21
11490	AV	36.28	216	H	38.9	9.8	40.1	44.88	54	-9.12
High Channel (5825MHz)										
11610	PK	48.18	158	V	38.9	9.8	40.1	56.78	74	-17.22
11610	PK	46.28	308	H	38.9	9.8	40.1	54.88	74	-19.12
11610	AV	34.29	285	V	38.9	9.8	40.1	42.89	54	-11.11
11610	AV	37.28	246	H	38.9	9.8	40.1	45.88	54	-8.12

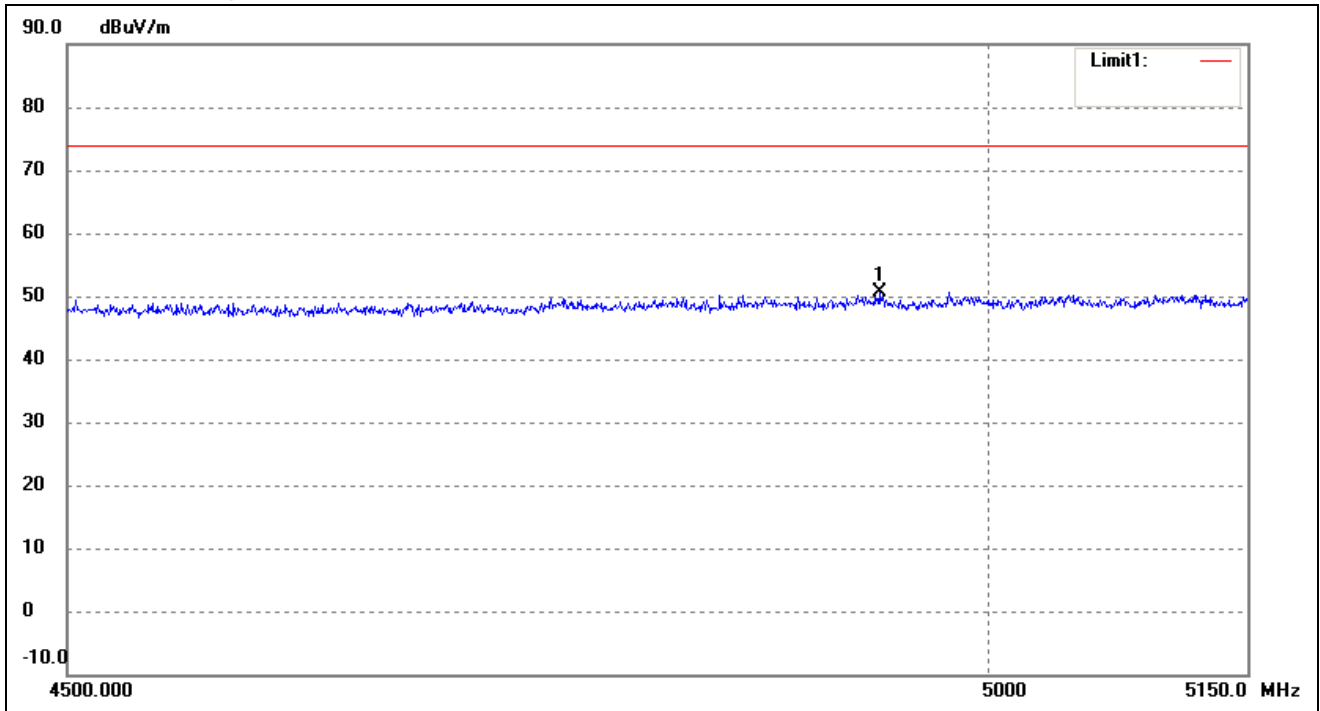
Out of Band edge

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5715	-45.85	-27
	5715 to 5725	-43.18	-17
Highest	5850 to 5860	-43.26	-17
	Above 5860	-48.58	-27
Note: the data just list the worst cases			

802.11n HT20

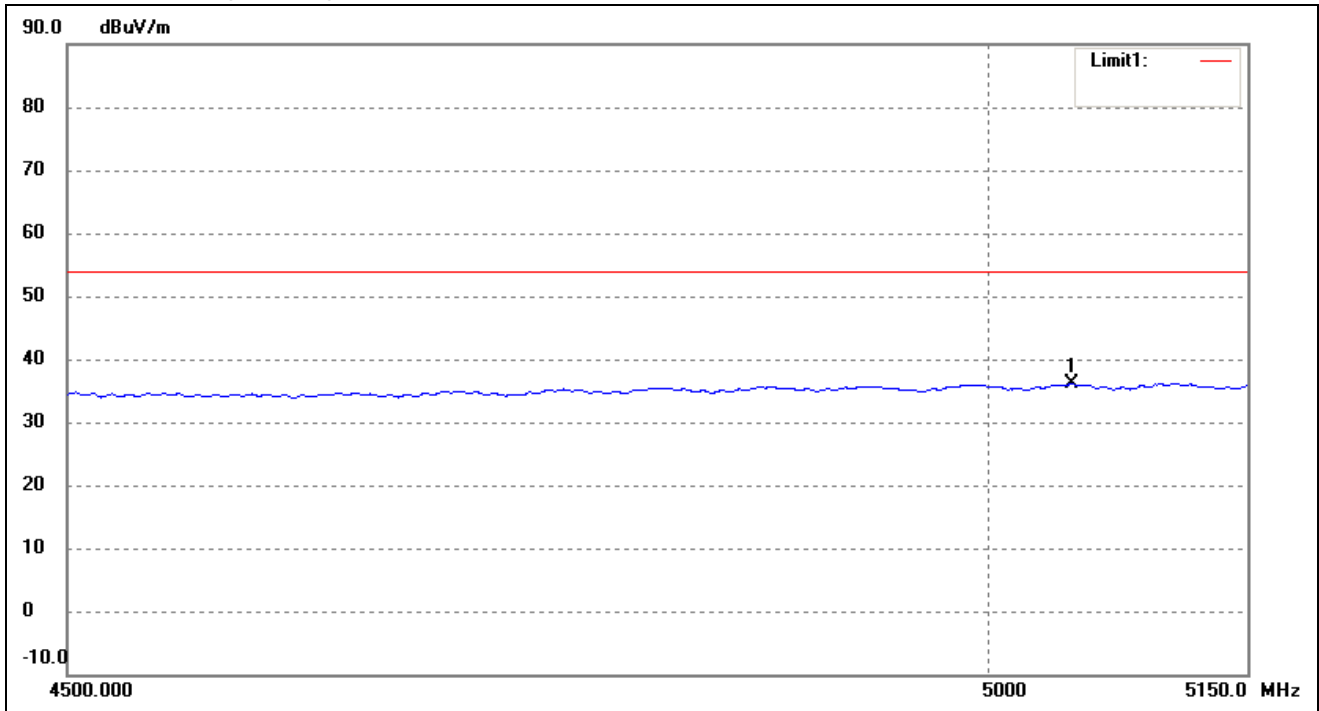
For the frequency band 5.18-5.24GHz(802.11n HT20)

Restricted Bandedge Peak



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	4937.711	51.20	-0.65	50.55	74.00	-23.45	101	100	peak

Restricted Bandedge Average



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	5047.503	36.45	-0.37	36.08	54.00	-17.92	83	100	AVG

Note: this EUT was tested in the low, high channel and the worst case position data was reported.

Harmonics And Spurious Emissions

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Low Channel (5180MHz)										
15540	PK	48.15	185	V	40.7	10.9	39.6	60.15	74	-13.85
15540	PK	46.95	235	H	40.7	10.9	39.6	58.95	74	-15.05
15540	AV	35.15	119	V	40.7	10.9	39.6	47.15	54	-6.85
15540	AV	35.26	170	H	40.7	10.9	39.6	47.26	54	-6.74
High Channel (5240MHz)										
15720	PK	45.15	285	V	40.7	10.9	39.6	57.15	74	-16.85
15720	PK	44.26	132	H	40.7	10.9	39.6	56.26	74	-17.74
15720	AV	38.19	121	V	40.7	10.9	39.6	50.19	54	-3.81
15720	AV	34.26	206	H	40.7	10.9	39.6	46.26	54	-7.74

Out of Band edge

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-42.78	-27
Highest	Above 5350	-44.25	-27
Note: the data just list the worst cases			

For the frequency band 5.745-5.825GHz (802.11n HT20)

Harmonics And Spurious Emissions

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Low Channel (5725MHz)										
11490	PK	45.65	155	V	38.9	9.8	40.1	54.25	74	-19.75
11490	PK	48.18	171	H	38.9	9.8	40.1	56.78	74	-17.22
11490	AV	35.81	151	V	38.9	9.8	40.1	44.41	54	-9.59
11490	AV	36.36	216	H	38.9	9.8	40.1	44.96	54	-9.04
High Channel (5825MHz)										
11610	PK	48.15	158	V	38.9	9.8	40.1	56.75	74	-17.25
11610	PK	46.17	308	H	38.9	9.8	40.1	54.77	74	-19.23
11610	AV	34.27	285	V	38.9	9.8	40.1	42.87	54	-11.13
11610	AV	37.26	246	H	38.9	9.8	40.1	45.86	54	-8.14

Out of Band edge

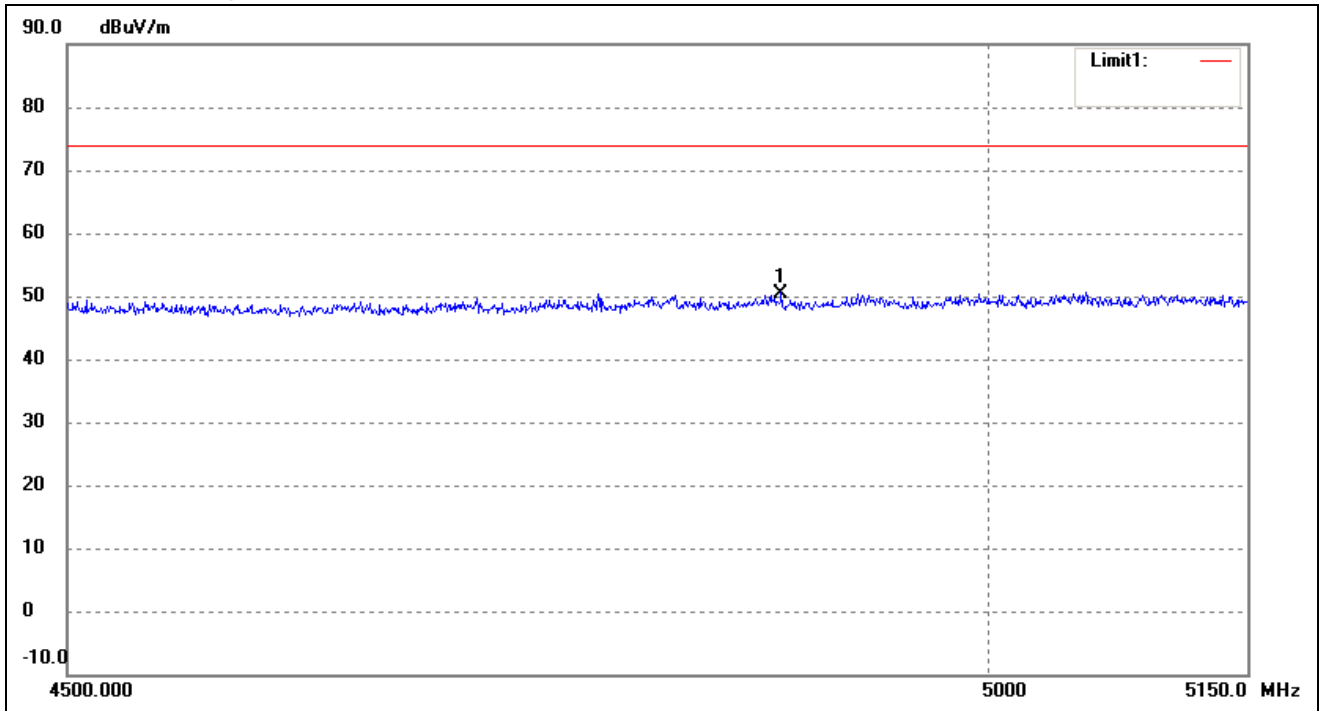
Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5715	-45.76	-27
	5715 to 5725	-44.29	-17
Highest	5850 to 5860	-43.72	-17
	Above 5860	-48.54	-27

Note: the data just list the worst cases

802.11n-HT40

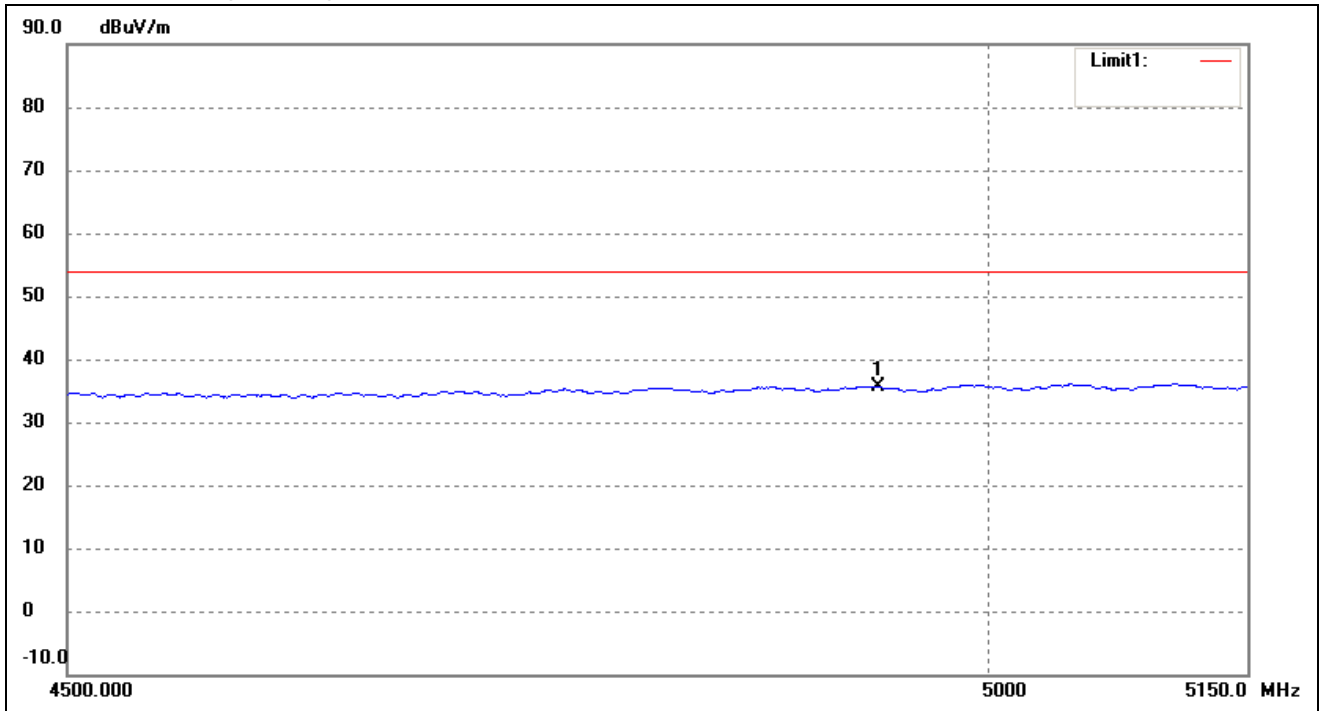
For the frequency band 5.19-5.23GHz(802.11n-HT40)

Restricted Bandedge Peak



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	4882.726	51.28	-0.78	50.50	74.00	-23.50	269	100	peak

Restricted Bandedge Average



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	4937.045	36.35	-0.65	35.70	54.00	-18.30	353	100	AVG

Note: this EUT was tested in the low, high channel and the worst case position data was reported.

Harmonics And Spurious Emissions

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Low Channel (5190MHz)										
15540	PK	48.11	360	V	40.7	10.9	39.6	60.11	74	-13.89
15540	PK	46.25	360	H	40.7	10.9	39.6	58.25	74	-15.75
15540	AV	30.62	360	V	40.7	10.9	39.6	42.62	54	-11.38
15540	AV	31.29	360	H	40.7	10.9	39.6	43.29	54	-10.71
High Channel (5230MHz)										
15720	PK	49.15	360	V	40.7	10.9	39.6	61.15	74	-12.85
15720	PK	48.36	360	H	40.7	10.9	39.6	60.36	74	-13.64
15720	AV	33.68	360	V	40.7	10.9	39.6	45.68	54	-8.32
15720	AV	31.98	360	H	40.7	10.9	39.6	43.98	54	-10.02

Out of Band edge

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-47.15	-27
Highest	Above 5350	-44.82	-27
Note: the data just list the worst cases			

For the frequency band 5.755-5.795GHz (802.11n-HT40)

Harmonics And Spurious Emissions

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Low Channel (5755MHz)										
11490	PK	50.85	360	V	38.9	9.8	40.1	59.45	74	-14.55
11490	PK	52.19	360	H	38.9	9.8	40.1	60.79	74	-13.21
11490	AV	32.98	360	V	38.9	9.8	40.1	41.58	54	-12.42
11490	AV	33.87	360	H	38.9	9.8	40.1	42.47	54	-11.53
High Channel (5795MHz)										
11610	PK	52.65	360	V	38.9	9.8	40.1	59.45	74	-14.55
11610	PK	51.29	360	H	38.9	9.8	40.1	60.79	74	-13.21
11610	AV	33.55	360	V	38.9	9.8	40.1	41.58	54	-12.42
11610	AV	32.79	360	H	38.9	9.8	40.1	42.47	54	-11.53

Out of Band edge

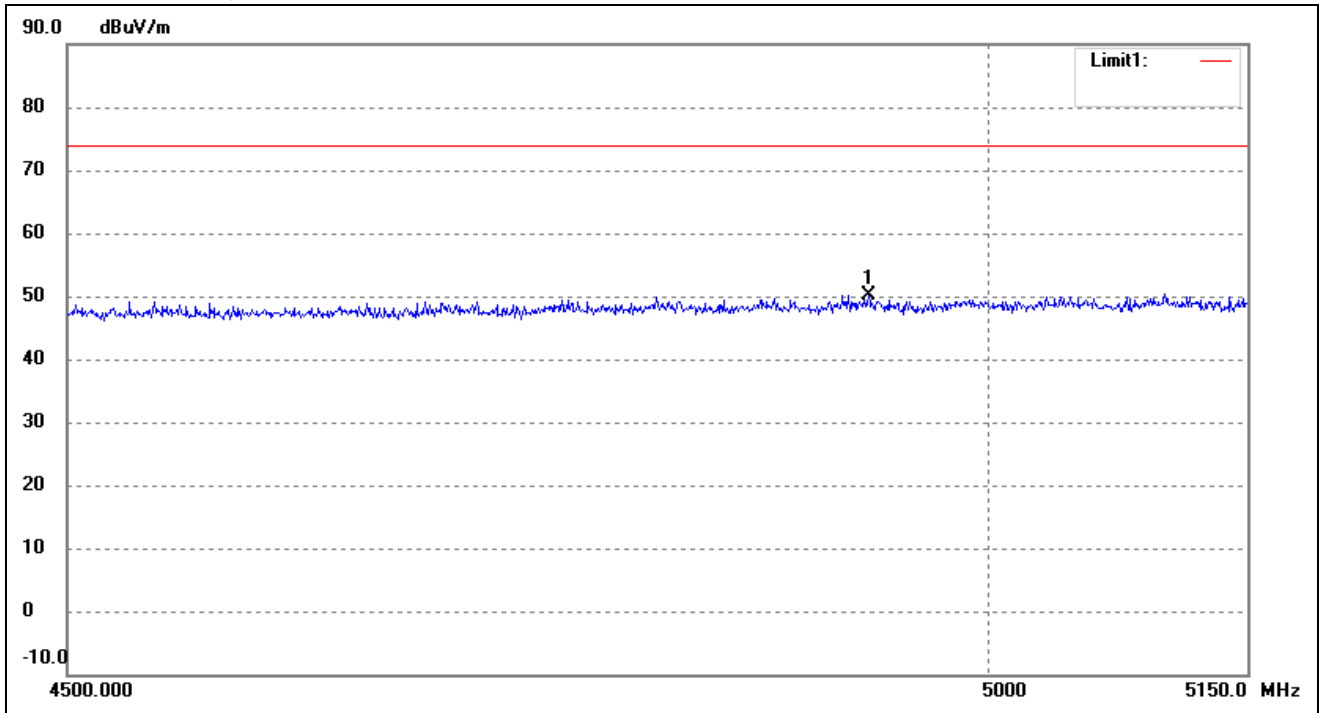
Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5715	-46.58	-27
	5715 to 5725	-45.58	-17
Highest	5850 to 5860	-46.19	-17
	Above 5860	-45.28	-27

Note: the data just list the worst cases

802.11ac-HT80

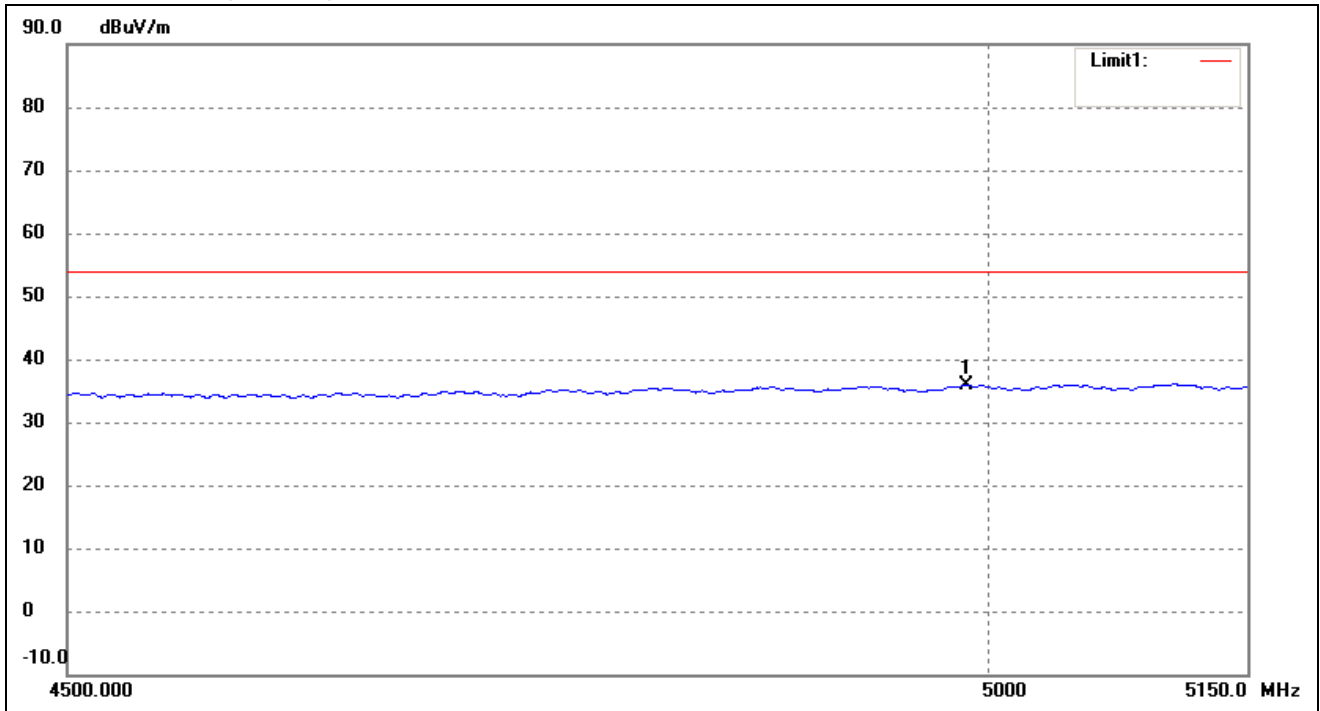
For the frequency band 5.21GHz(802.11ac-HT80)

Restricted Bandedge Peak



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	4931.719	50.79	-0.66	50.13	74.00	-23.87	65	100	peak

Restricted Bandedge Average



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	4987.256	36.41	-0.52	35.89	54.00	-18.11	155	100	AVG

Note: this EUT was tested in the low, high channel and the worst case position data was reported.

Harmonics And Spurious Emissions

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Channel (5210MHz)										
15540	PK	46.88	360	V	40.7	10.9	39.6	58.88	74	-15.12
15540	PK	45.15	360	H	40.7	10.9	39.6	57.15	74	-16.85
15540	AV	30.54	360	V	40.7	10.9	39.6	42.54	54	-11.46
15540	AV	29.99	360	H	40.7	10.9	39.6	41.99	54	-12.01

Out of Band edge

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-44.95	-27
Highest	Above 5350	-45.25	-27

Note: the data just list the worst cases

For the frequency band 5.775GHz (802.11ac-HT80)

Harmonics And Spurious Emissions

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Channel (5725MHz)										
11490	PK	49.29	360	V	38.9	9.8	40.1	57.89	74	-16.11
11490	PK	49.39	360	H	38.9	9.8	40.1	57.99	74	-16.01
11490	AV	31.52	360	V	38.9	9.8	40.1	40.12	54	-13.88
11490	AV	30.79	360	H	38.9	9.8	40.1	39.39	54	-14.61

Out of Band edge

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5715	-46.89	-27
	5715 to 5725	-44.65	-17
Highest	5850 to 5860	-46.28	-17
	Above 5860	-45.18	-27

Note: the data just list the worst cases

Note: Testing is carried out with frequency rang 30MHz to 40GHz, which above 3th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

11. Frequency Stability

11.1 Standard Applicable

According to §15.407(g), Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

11.2 Test Procedure

According to §2.1055, the following test procedure was performed.

The Frequency Stability is measured directly with a Frequency Domain Analyzer. Frequency Deviation in ppm is calculated from the measured peak to peak value.

The Carrier Frequency Stability over Power Supply Voltage and over Temperature is measured with a Frequency Domain Analyzer in histogram mode

Temperature:	Supply Voltage
20°C	DC 4.25-5.5V
-30°C to +50°C	Normal

11.3 Environmental Conditions

Temperature:	20°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

11.4 Summary of Test Results/Plots

5150-5250MHz

802.11a

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	5.0	179	0.0344
40	5.0	188	0.0362
30	5.0	135	0.0260
20	5.0	136	0.0262
10	5.0	159	0.0306
0	5.0	132	0.0254
-10	5.0	151	0.0290
-20	5.0	178	0.0342
-30	5.0	149	0.0287

802.11n_HT20

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	5.0	159	0.0306
40	5.0	158	0.0304
30	5.0	107	0.0206
20	5.0	108	0.0208
10	5.0	139	0.0267
0	5.0	142	0.0273
-10	5.0	189	0.0363
-20	5.0	188	0.0362
-30	5.0	121	0.0233

802.11n_HT40

Reference Frequency(Middle Channel): 5230 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	5.0	128	0.0245
40	5.0	168	0.0321
30	5.0	118	0.0226
20	5.0	117	0.0224
10	5.0	126	0.0241
0	5.0	168	0.0321
-10	5.0	148	0.0283
-20	5.0	136	0.0260
-30	5.0	161	0.0308

802.11ac_HT80

Reference Frequency(Fixed Channel): 5210 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	5.0	159	0.0305
40	5.0	178	0.0342
30	5.0	168	0.0322
20	5.0	128	0.0246
10	5.0	165	0.0317
0	5.0	157	0.0301
-10	5.0	158	0.0303
-20	5.0	136	0.0261
-30	5.0	157	0.0301

5725-5850MHz

802.11a

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	5.0	178	0.0308
40	5.0	165	0.0285
30	5.0	125	0.0216
20	5.0	165	0.0285
10	5.0	118	0.0204
0	5.0	158	0.0273
-10	5.0	136	0.0235
-20	5.0	121	0.0209
-30	5.0	138	0.0239

802.11n_HT20

Reference Frequency(Middle Channel): 5785MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	5.0	142	0.0245
40	5.0	126	0.0218
30	5.0	156	0.0270
20	5.0	171	0.0296
10	5.0	156	0.0270
0	5.0	121	0.0209
-10	5.0	168	0.0290
-20	5.0	122	0.0211
-30	5.0	146	0.0252

802.11n_HT40

Reference Frequency(Fixed Channel): 5755 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	5.0	118	0.0205
40	5.0	128	0.0222
30	5.0	165	0.0287
20	5.0	198	0.0344
10	5.0	125	0.0217
0	5.0	159	0.0276
-10	5.0	165	0.0287
-20	5.0	138	0.0240
-30	5.0	187	0.0325

802.11ac_HT80

Reference Frequency(Fixed Channel): 5775 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	5.0	185	0.0320
40	5.0	198	0.0343
30	5.0	157	0.0272
20	5.0	168	0.0291
10	5.0	184	0.0319
0	5.0	175	0.0303
-10	5.0	176	0.0305
-20	5.0	187	0.0324
-30	5.0	158	0.0274

So, Frequency Stability Versus Input Voltage is:

5150-5250MHz

802.11a

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.25	134	0.0258
	5.0	136	0.0262
	5.5	138	0.0265

802.11n_HT20

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.25	115	0.0221
	5.0	108	0.0208
	5.5	115	0.0221

802.11n_HT40

Reference Frequency(Middle Channel): 5230 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.25	118	0.0226
	5.0	117	0.0224
	5.5	117	0.0224

802.11ac_HT80

Reference Frequency(Fix Channel): 5210 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.25	135	0.0259
	5.0	128	0.0246
	5.5	137	0.0263

5725-5850MHz

802.11a

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.25	168	0.0290
	5.0	165	0.0285
	5.5	165	0.0285

802.11n_HT20

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.25	175	0.0303
	5.0	171	0.0296
	5.5	175	0.0303

802.11n_HT40

Reference Frequency(Fixed Channel): 5755 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.25	185	0.0321
	5.0	198	0.0344
	5.5	198	0.0344

802.11ac_HT80

Reference Frequency(Fixed Channel): 5775MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.25	174	0.0301
	5.0	168	0.0291
	5.5	171	0.0296

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