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MEASUREMENT REPORT
FCC Part 15.407 UNII 802.11a/n

Applicant Name:
LG Electronics MobileComm U.S.A
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

Date of Testing:
1/15-2/18/2015
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0Y1501140077.ZNF

FCC ID: ZNFH631

APPLICANT: LG Electronics MobileComm U.S.A

Application Type: Certification
Model(s): LG-MS631, H631TN, LGH631TN, LG-H631TN, MS631, LGMS631
EUT Type: Portable Handset
FCC Classification: Unlicensed National Information Infrastructure (UNII)
FCC Rule Part(s): Part 15.407
Test Procedure(s): KDB 789033 D02 v01 (New Rules)

Mode	UNII Band	Channel Bandwidth (MHz)	Tx Frequency (MHz)	Conducted Power	
				Max. Power (mW)	Max. Power (dBm)
802.11a	1	20	5180 - 5240	35.318	15.48
	2A	20	5260 - 5320	38.107	15.81
	2C	20	5500 - 5580	37.154	15.70
	3	20	5745-5825	29.992	14.77
802.11n	1	20	5180 - 5240	33.806	15.29
	2A	20	5260 - 5320	36.475	15.62
	2C	20	5500 - 5580	36.308	15.60
	3	20	5745-5825	30.339	14.82
802.11n	1	40	5190 - 5230	34.834	15.42
	2A	40	5270 - 5310	33.729	15.28
	2C	40	5510 - 5550	35.318	15.48
	3	40	5755-5795	29.854	14.75

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 789033. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

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TABLE OF CONTENTS

FCC PART 15.407 MEASUREMENT REPORT 3

1.0 INTRODUCTION 4

1.1 SCOPE 4

1.2 PCTEST TEST LOCATION 4

2.0 PRODUCT INFORMATION 5

2.1 EQUIPMENT DESCRIPTION 5

2.2 DEVICE CAPABILITIES 5

2.3 TEST CONFIGURATION 5

2.4 EMI SUPPRESSION DEVICE(S)/MODIFICATIONS 5

2.5 LABELING REQUIREMENTS 5

3.0 DESCRIPTION OF TEST 6

3.1 EVALUATION PROCEDURE 6

3.2 AC LINE CONDUCTED EMISSIONS 6

3.3 RADIATED EMISSIONS 7

4.0 ANTENNA REQUIREMENTS 8

5.0 TEST EQUIPMENT CALIBRATION DATA 9

6.0 TEST RESULTS 10

6.1 SUMMARY 10

6.2 26DB BANDWIDTH MEASUREMENT – 802.11A/N 11

6.3 6DB BANDWIDTH MEASUREMENT – 802.11A/N 26

6.4 UNII OUTPUT POWER MEASUREMENT – 802.11A/N 32

6.5 MAXIMUM POWER SPECTRAL DENSITY – 802.11A/N 35

6.6 FREQUENCY STABILITY 55

6.7 RADIATED SPURIOUS EMISSION MEASUREMENTS 58

6.8 RADIATED BAND EDGE MEASUREMENTS (20MHZ BW) 70

6.9 RADIATED BAND EDGE MEASUREMENTS (40MHZ BW) 79

6.10 RADIATED SPURIOUS EMISSIONS MEASUREMENTS – BELOW 1GHZ & ABOVE 18GHZ 88

6.11 LINE-CONDUCTED TEST DATA 92

7.0 CONCLUSION 98

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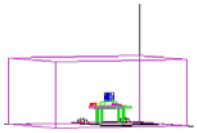
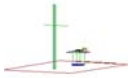


MEASUREMENT REPORT
FCC Part 15.407



§ 2.1033 General Information

APPLICANT:	LG Electronics MobileComm U.S.A
APPLICANT ADDRESS:	1000 Sylvan Avenue Englewood Cliffs, NJ 07632, United States
TEST SITE:	PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS:	7185 Oakland Mills Road, Columbia, MD 21046 USA
FCC RULE PART(S):	Part 15.407
BASE MODEL:	LG-MS631
FCC ID:	ZNFH631
FCC CLASSIFICATION:	Unlicensed National Information Infrastructure (UNII)
Test Device Serial No.:	RF1, Wifi Rad, Wifi Cond. 1, Wifi Cond. 2 ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	1/15-2/18/2015
TEST REPORT S/N:	0Y1501140077.ZNF

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.

- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2 PCTEST Test Location

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (*See Figure 1-1*).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39° 10'23" N latitude and 76° 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on February 15, 2012.

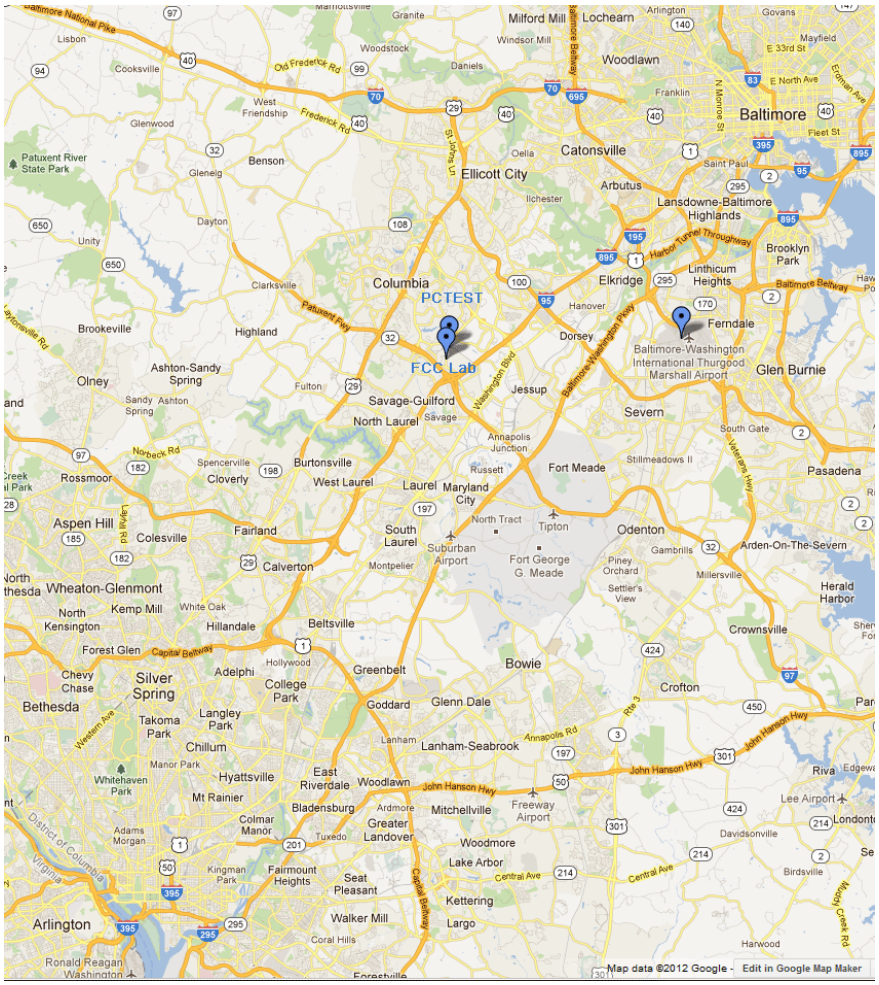

Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFH631**. The test data contained in this report pertains only to the emissions due to the EUT's UNII transmitter.

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n UNII, Bluetooth (1x, EDR, LE), NFC

Note: 5GHz WLAN (DTS/NII) operation is possible in 20MHz, and 40MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section B)2)b) of KDB 789033. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Maximum Achievable Duty Cycles		
802.11 Mode/Band		Duty Cycle [%]
		ANT1
5GHz	a	95.54
	n (HT20)	95.55
	n (HT40)	91.49

2.3 Test Configuration

The LG Portable Handset FCC ID: ZNFH631 was tested per the guidance of KDB 789033. ANSI C63.10-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 6.2, 6.4, 6.5, and 6.6 for antenna port conducted emissions test setups.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.5 Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

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3.0 DESCRIPTION OF TEST

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2009) and the guidance provided in KDB 789033 were used in the measurement of **LG Portable Handset FCC ID: ZNFH631.**

Deviation from measurement procedure……..…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF Enclosures. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 6.11. Automated test software was used to perform the AC line conducted emissions. Automated measurement software utilized is Rohde & Schwarz EMC32, Version 9.15.0.

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3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Clause 5, Figure 5.7 of ANSI C63.4-2009. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. An ETS Lindgren Model 2188 raised turntable is used for radiated measurement. It is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. A 78cm high PVC support structure is placed on top of the turntable. A ¾" (~1.9cm) sheet of high density polyethylene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 0.8 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. For the EUT positioning, "H" is defined with the EUT lying flat on the test surface, "H2" is defined with the EUT standing up on its side, and "V" is defined with the EUT standing upright.

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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."

- The antennas of the Portable Handset are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The **LG Portable Handset FCC ID: ZNFH631** unit complies with the requirement of §15.203.

Band 1		Band 2A		Band 2C		Band 3	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
36	5180	52	5260	100	5500	149	5745
:	:	:	:	:	:	:	:
42	5210	56	5280	116	5580	157	5785
:	:	:	:	:	:	:	:
48	5240	64	5320	140	5700	165	5825

Table 4-1. 802.11a / 802.11n / 802.11ac (20MHz) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
38	5190	54	5270	102	5510	151	5755
:	:	:	:	:	:	:	:
46	5230	62	5310	110	5550		
				:	:		
				134	5670	159	5795

Table 4-2. 802.11n / 802.11ac (40MHz BW) Frequency / Channel Operations

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5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	10/24/2014	Annual	10/24/2015	N/A
-	WL25-1	Conducted Cable Set (25GHz)	10/14/2014	Annual	10/14/2015	N/A
Agilent	8447D	Broadband Amplifier	6/2/2014	Annual	6/2/2015	1937A03348
Agilent	E4448A	PSA (3Hz-50GHz) Spectrum Analyzer	4/16/2014	Annual	4/16/2015	US42510244
Agilent	N9020A	MXA Signal Analyzer	10/27/2014	Annual	10/27/2015	US46470561
Anritsu	ML2495A	Power Meter	10/31/2013	Biennial	10/31/2015	941001
Anritsu	MA2411B	Pulse Sensor	4/8/2014	Biennial	4/8/2016	846215
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	6/26/2013	Biennial	6/26/2015	121034
Emco	3115	Horn Antenna (1-18GHz)	1/30/2014	Biennial	1/30/2016	9704-5182
Emco	3816/2	Line Impedance Stabilization Network	2/12/2013	Biennial	2/12/2015	9709-1077
Espec	ESX-2CA	Environmental Chamber	4/16/2014	Annual	4/16/2015	17620
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	4/8/2014	Biennial	4/8/2016	125518
ETS Lindgren	3160-09	18-26.5 GHz Standard Gain Horn	6/17/2014	Biennial	6/17/2016	135427
ETS Lindgren	3160-10	26.5-40 GHz Standard Gain Horn	6/17/2014	Biennial	6/17/2016	130993
Huber+Suhner	Sucoflex 102A	40GHz Radiated Cable	10/15/2014	Annual	10/15/2015	251425001
K & L	11SH10-6000/T18000	High Pass Filter	12/1/2014	Annual	12/1/2015	1
K & L	11SH10-3075/U18000	High Pass Filter	12/1/2014	Annual	12/1/2015	2
Pasternack	NMLC-1	Line Conducted Emissions Cable (NM)	10/17/2014	Annual	10/17/2015	N/A
Rhode & Schwarz	TS-PR18	Pre-Amplifier	6/12/2014	Annual	6/12/2015	101622
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	3/12/2014	Annual	3/12/2015	100040
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	3/27/2014	Annual	3/27/2015	100342
Rohde & Schwarz	TS-PR40	26.5-40 GHz Pre-Amplifier	5/15/2014	Annual	5/15/2015	100037
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	1/28/2014	Biennial	1/28/2016	A051107
VWR	62344-734	Thermometer with Clock	2/20/2014	Biennial	2/20/2016	140140336

Table 5-1. Annual Test Equipment Calibration Schedule

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6.0 TEST RESULTS

6.1 Summary

Company Name: LG Electronics MobileComm U.S.A
FCC ID: ZNFH631
Method/System: Unlicensed National Information Infrastructure (UNII)
Data Rate(s) Tested: 6, 9, 12, 18, 24, 36, 48, 54Mbps (802.11a)
6.5/7.2, 13/14.4, 19.5/21.7, 26/28.9, 39/43.3, 52/57.8, 58.5/65, 65/72.2 (n – 20MHz)
13.5/15, 27/30, 40.5/45, 54/60, 81/90, 108/120, 121.5/135, 135/150 (n – 40MHz BW)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (TX)					
N/A	26dB Bandwidth	N/A	CONDUCTED	PASS	Section 6.2
15.407(e)	6dB Bandwidth	500kHz		PASS	Section 6.3
15.407 (a)	Maximum Conducted Output Power	< 250mW (Band 1) < Lesser of 250mW or 11+10*log(26dB BW) (Band 2A, 2C) <1W (Band 3)		PASS	Section 6.4
15.407 (a)	Peak Power Spectral Density	< 11 dBm/MHz		PASS	Section 6.5
15.407(g)	Frequency Stability	N/A		PASS	Section 6.6
15.407(h)	Dynamic Frequency Selection	See DFS Test Report		PASS	See DFS Test Report
15.407(b)	Undesirable Emissions	< -27 dBm/MHz EIRP	RADIATED	PASS	Section 6.7
15.205, 15.407(b)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS	Section 6.8, 6.9, 6.10
15.407	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits	LINE CONDUCTED	PASS	Section 6.11

Table 6-1. Summary of Test Results

Notes:

1) All channels, modes, and modulations/data rates were investigated among all UNII bands. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "UNII Automation", Version 3.1.

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6.2 26dB Bandwidth Measurement – 802.11a/n

Test Overview and Limit

The bandwidth at 26dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in KDB 789033, and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26dB bandwidth.

The 26dB bandwidth is used to determine the conducted power limits.

Test Procedure Used

KDB 789033 – Section C

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth
3. VBW $\geq$ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

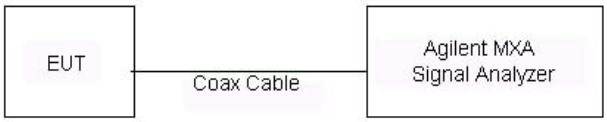

Figure 6-1. Test Instrument & Measurement Setup

Test Notes

None.

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	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	a	6	21.72
	5200	40	a	6	21.84
	5240	48	a	6	22.09
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	22.33
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	22.60
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	22.27
	5190	38	n (40MHz)	13.5/15 (MCS0)	43.46
	5230	46	n (40MHz)	13.5/15 (MCS0)	43.30
Band 2A	5260	52	a	6	21.94
	5280	56	a	6	22.03
	5320	64	a	6	22.11
	5260	52	n (20MHz)	6.5/7.2 (MCS0)	22.10
	5280	56	n (20MHz)	6.5/7.2 (MCS0)	22.34
	5320	64	n (20MHz)	6.5/7.2 (MCS0)	22.65
	5270	54	n (40MHz)	13.5/15 (MCS0)	43.75
	5310	62	n (40MHz)	13.5/15 (MCS0)	43.46
Band 2C	5500	100	a	6	21.98
	5580	116	a	6	21.77
	5700	140	a	6	22.12
	5500	100	n (20MHz)	6.5/7.2 (MCS0)	22.99
	5580	116	n (20MHz)	6.5/7.2 (MCS0)	22.40
	5700	140	n (20MHz)	6.5/7.2 (MCS0)	22.27
	5510	102	n (40MHz)	13.5/15 (MCS0)	43.12
	5550	110	n (40MHz)	13.5/15 (MCS0)	43.35
	5670	134	n (40MHz)	13.5/15 (MCS0)	43.56

Table 6-2. Conducted Bandwidth Measurements

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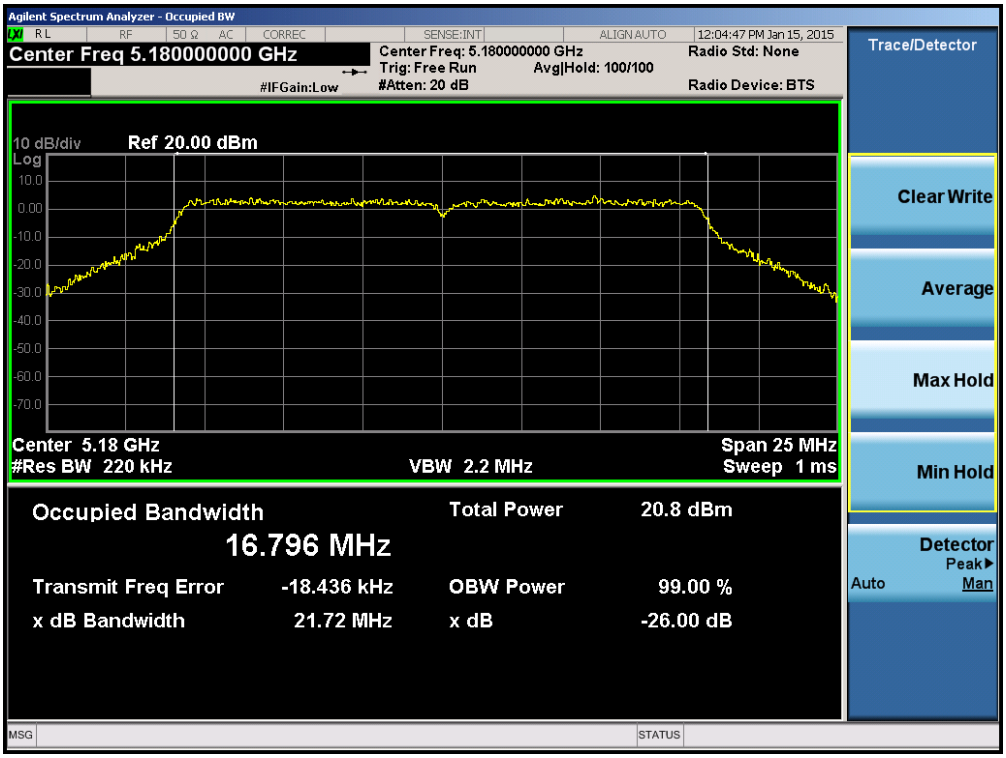
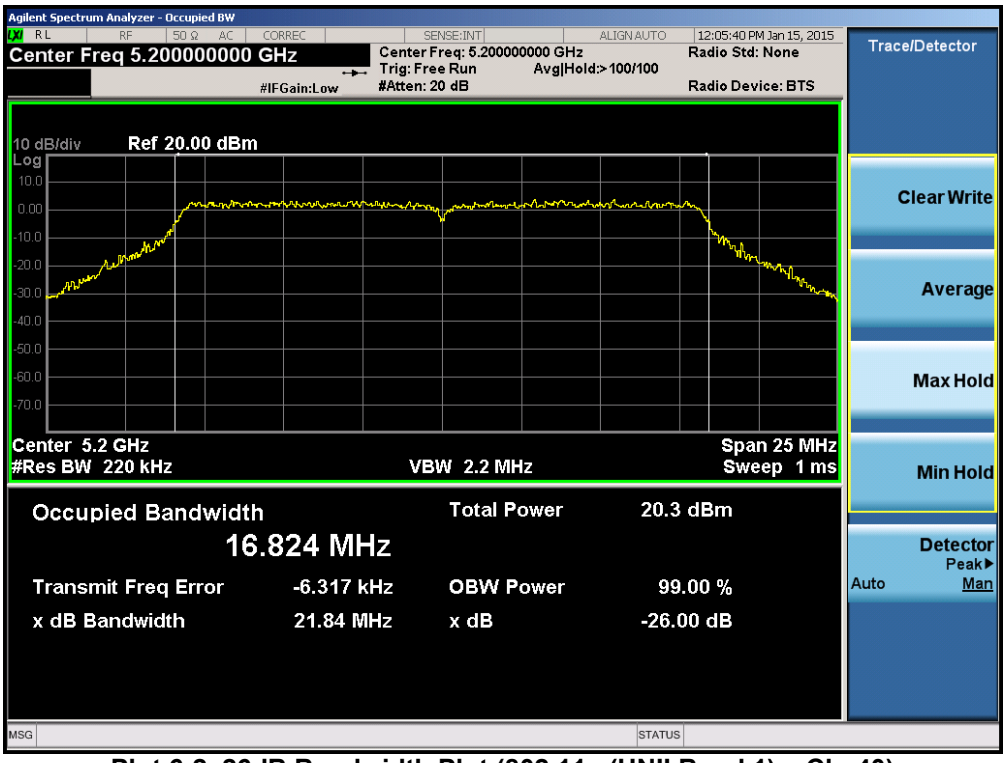


Plot 6-1. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 36)



Plot 6-2. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 40)

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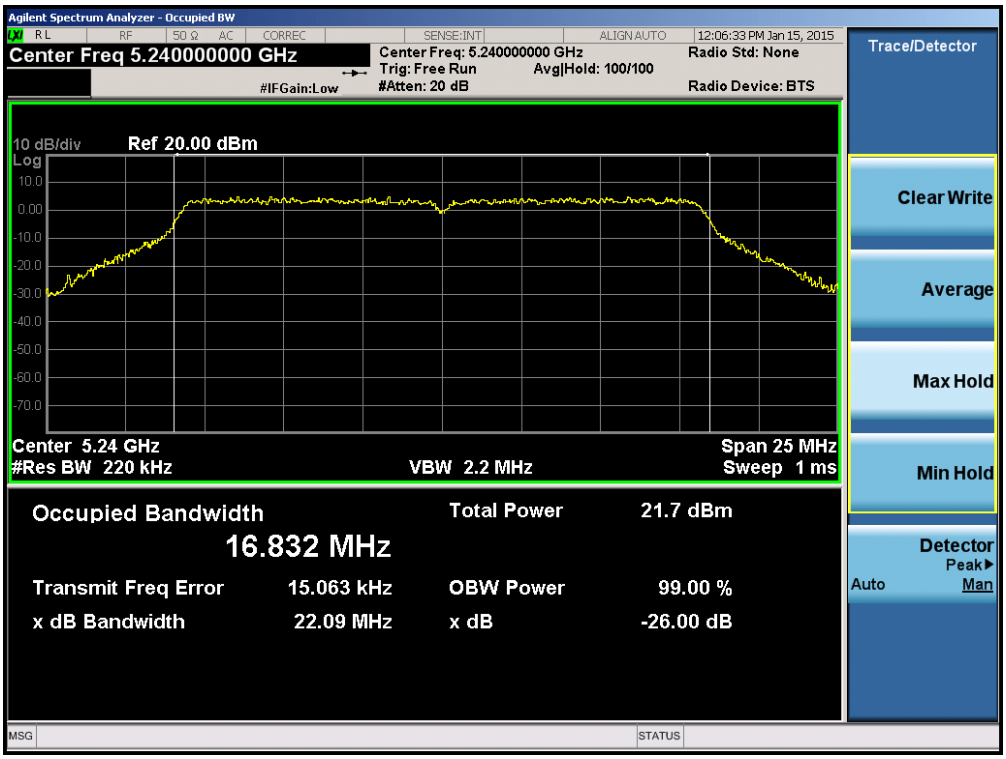
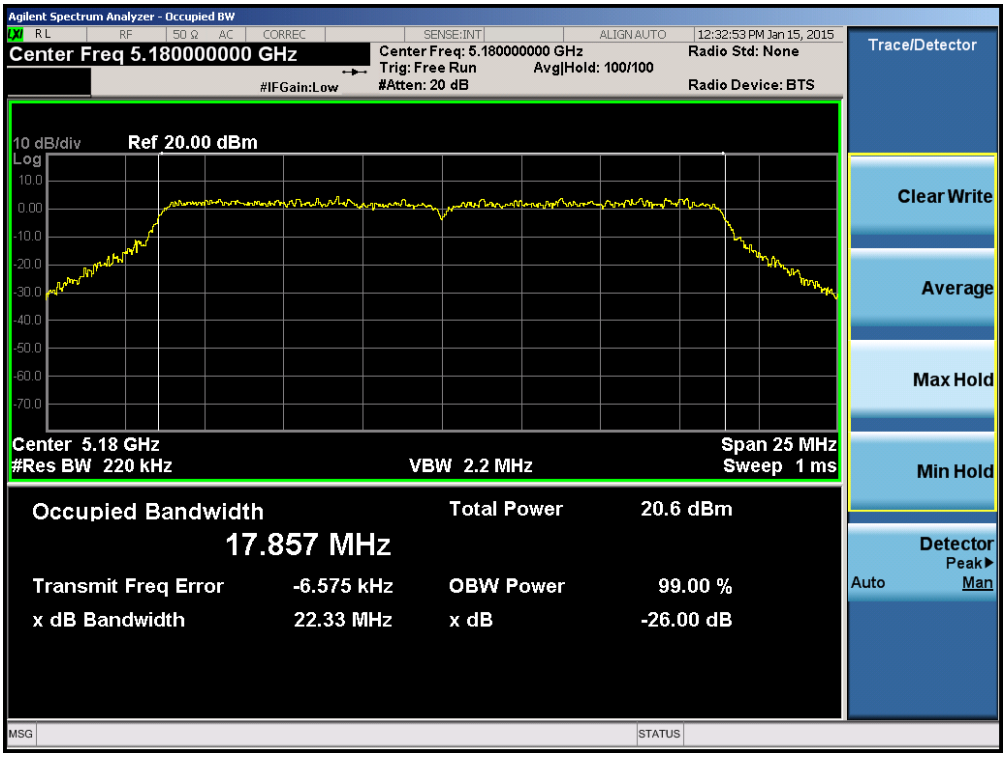


Plot 6-3. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 48)



Plot 6-4. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 36)

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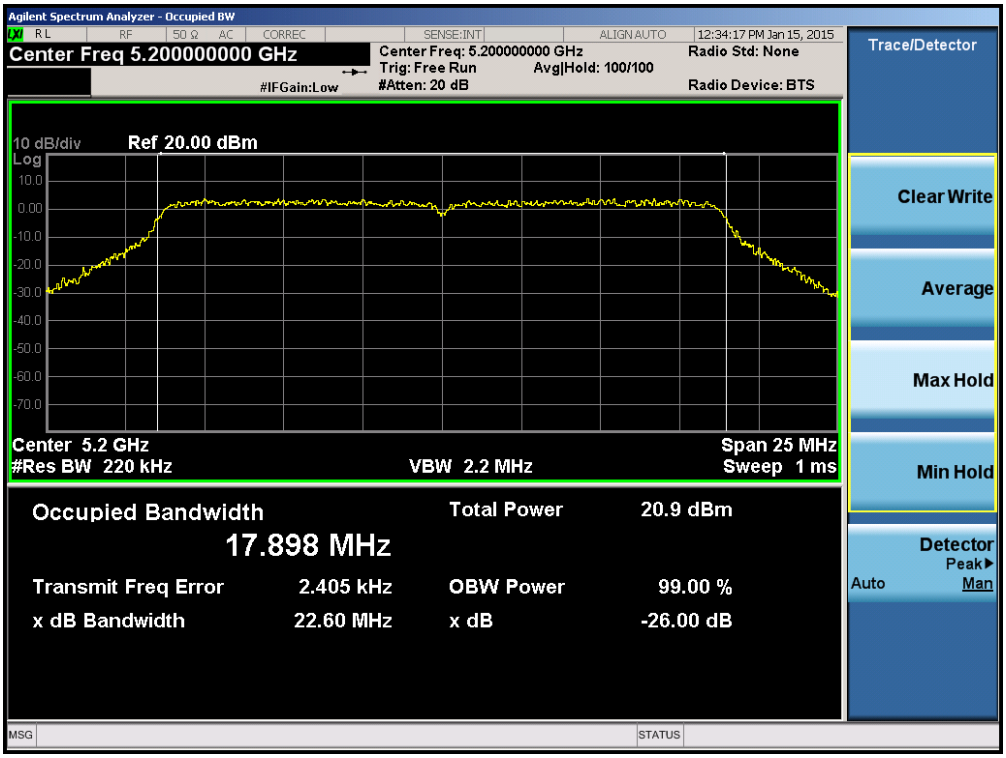
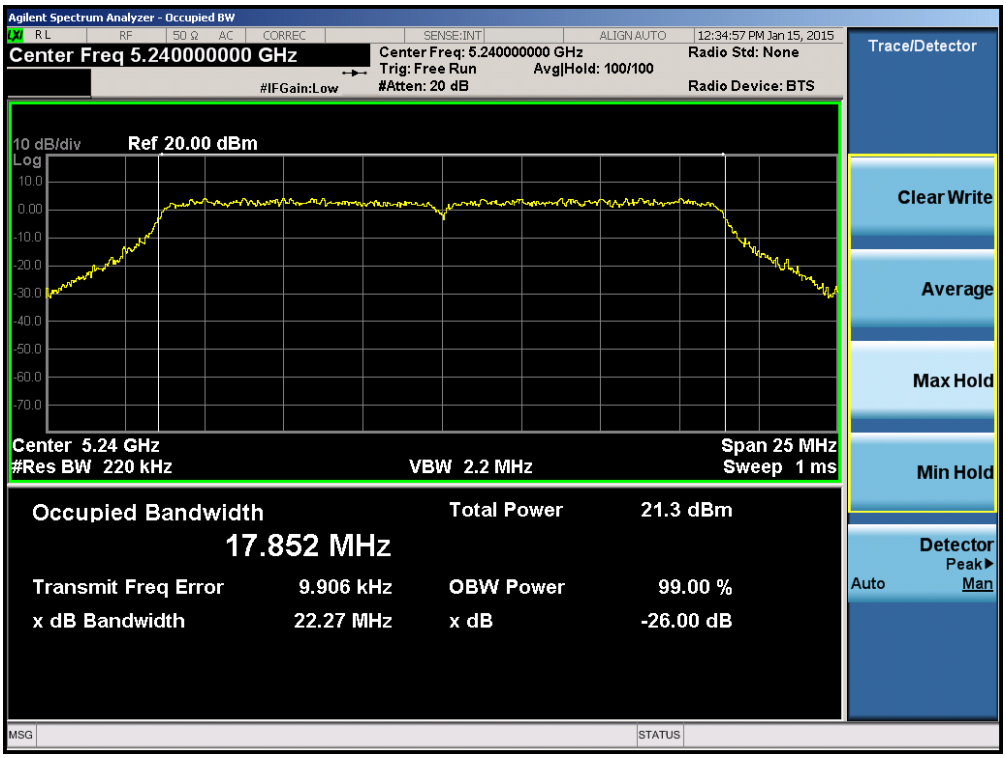


Plot 6-5. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 40)



Plot 6-6. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 48)

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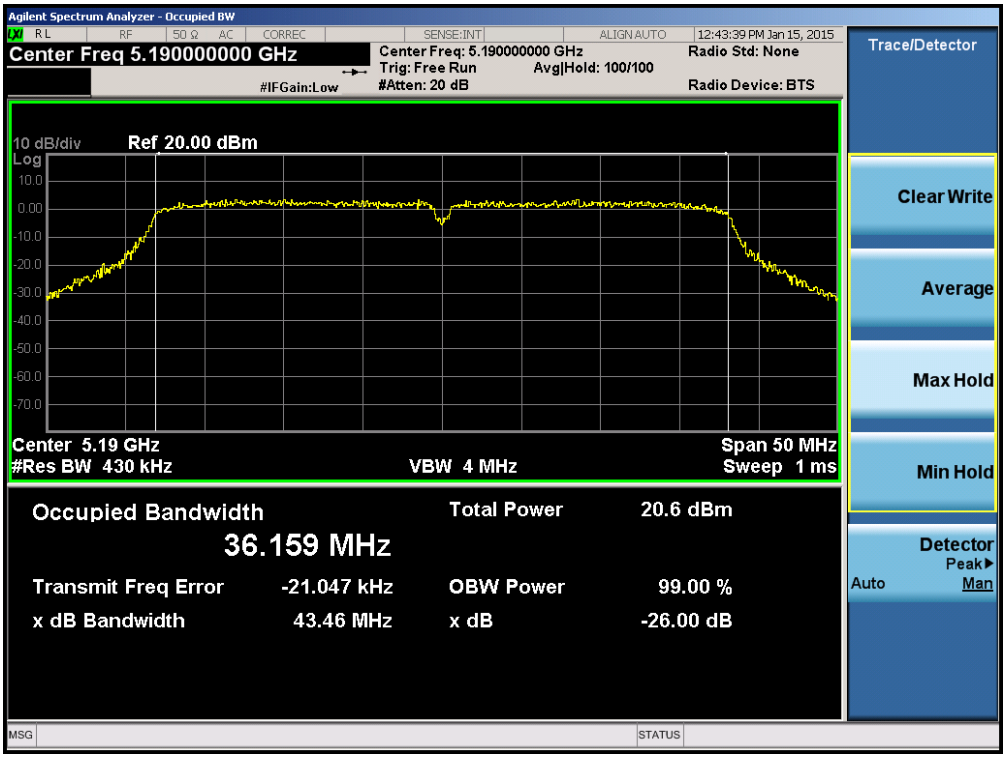
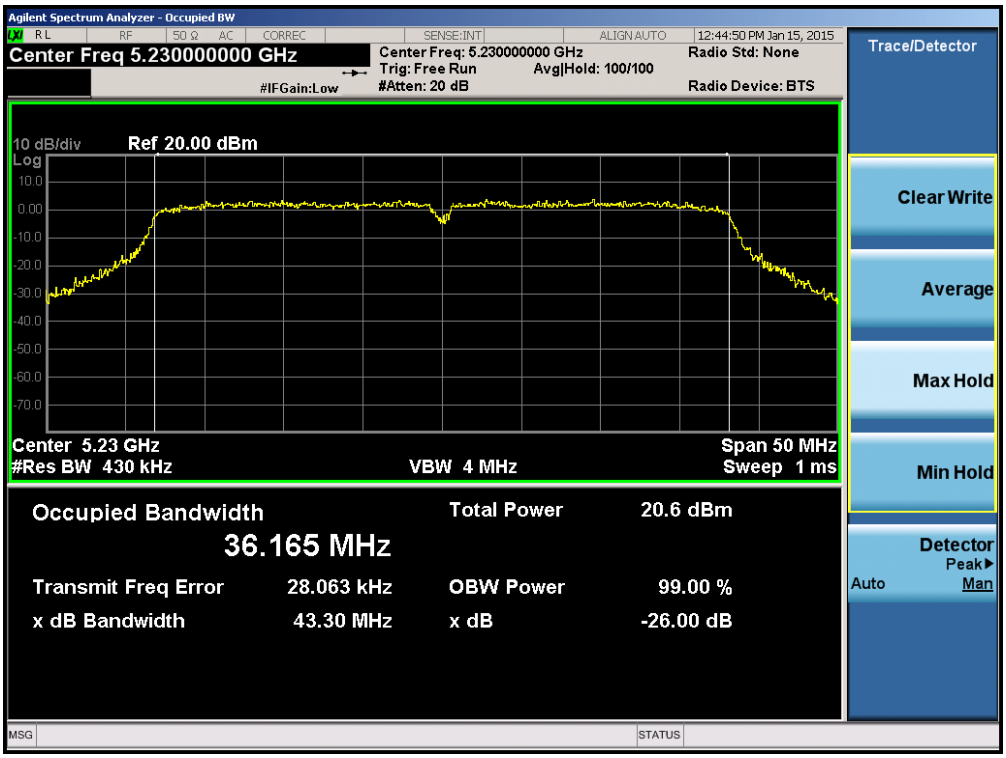


Plot 6-7. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



Plot 6-8. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 46)

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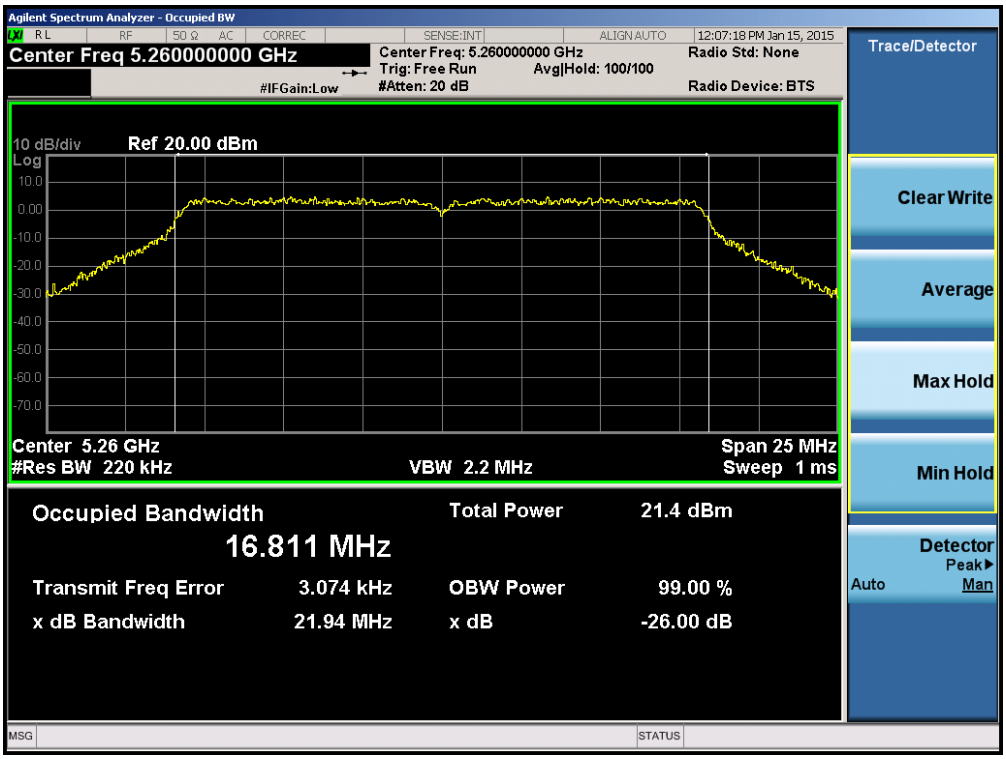
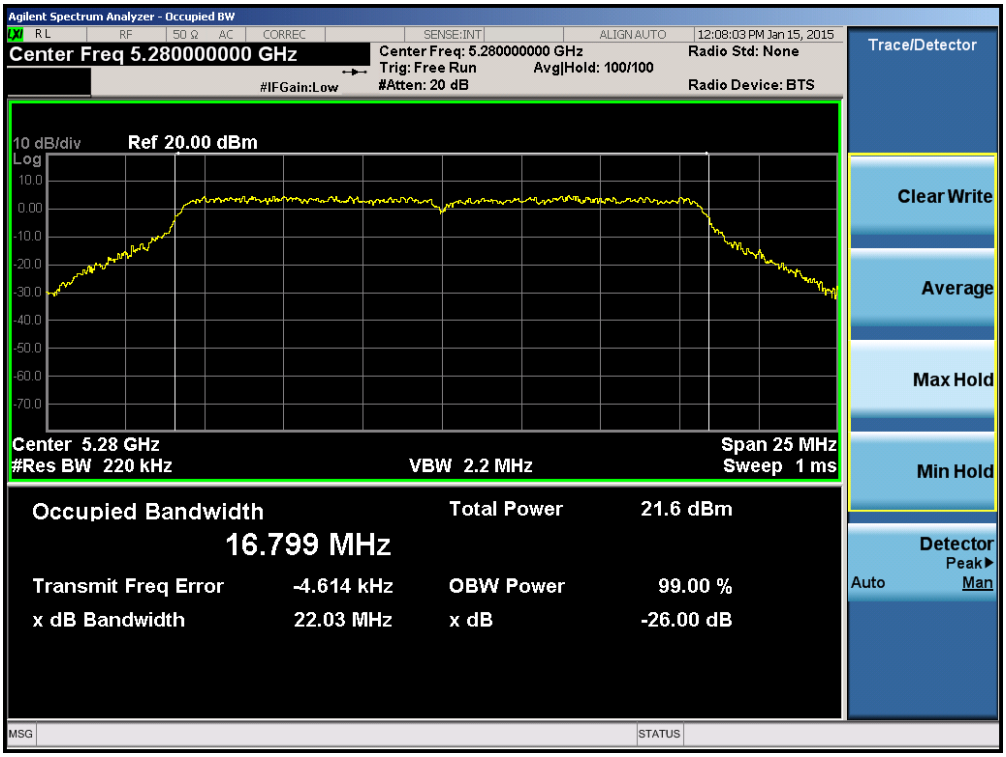


Plot 6-9. 26dB Bandwidth Plot (802.11a (UNII Band 2A) – Ch. 52)



Plot 6-10. 26dB Bandwidth Plot (802.11a (UNII Band 2A) – Ch. 56)

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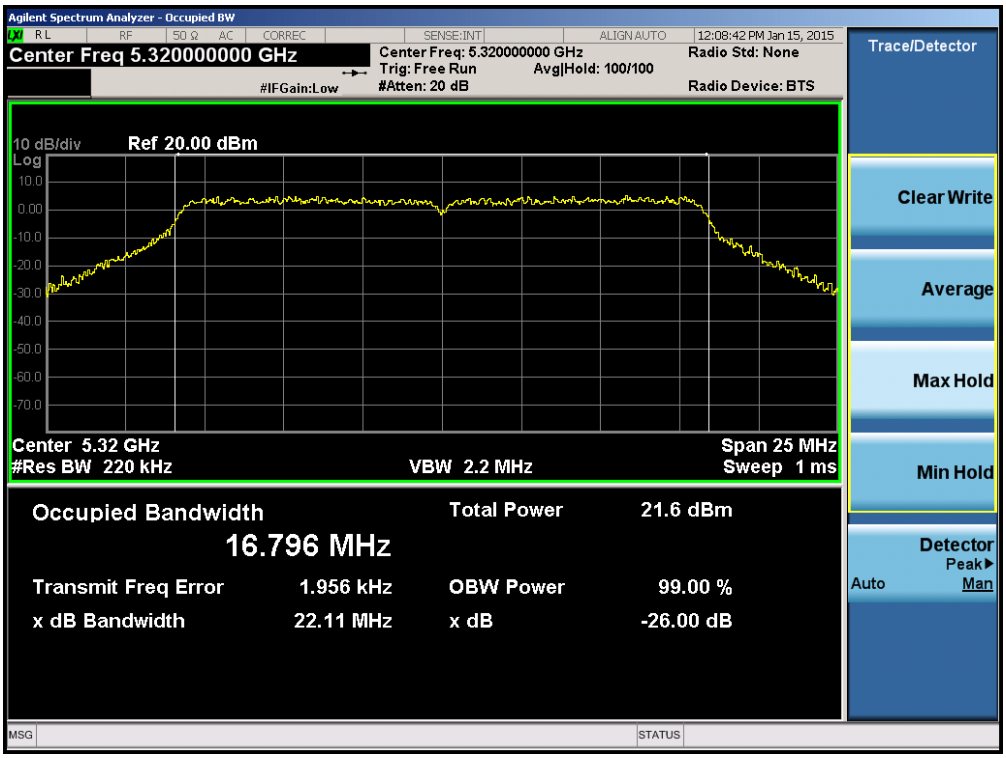
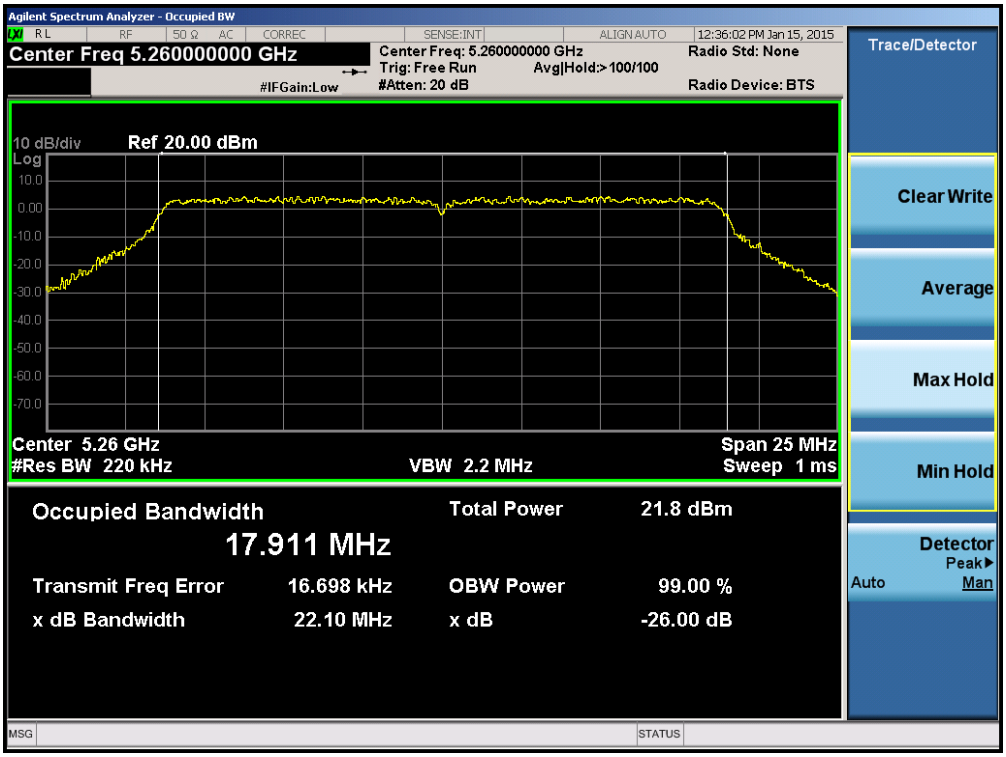


Plot 6-11. 26dB Bandwidth Plot (802.11a (UNII Band 2A) – Ch. 64)



Plot 6-12. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 52)

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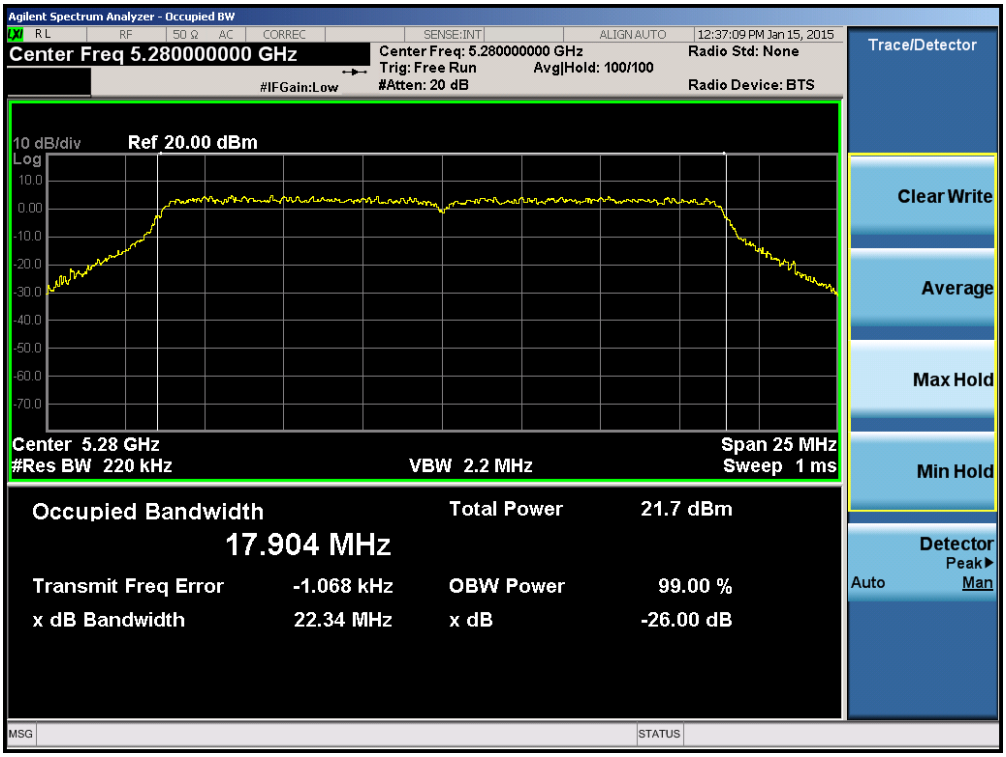
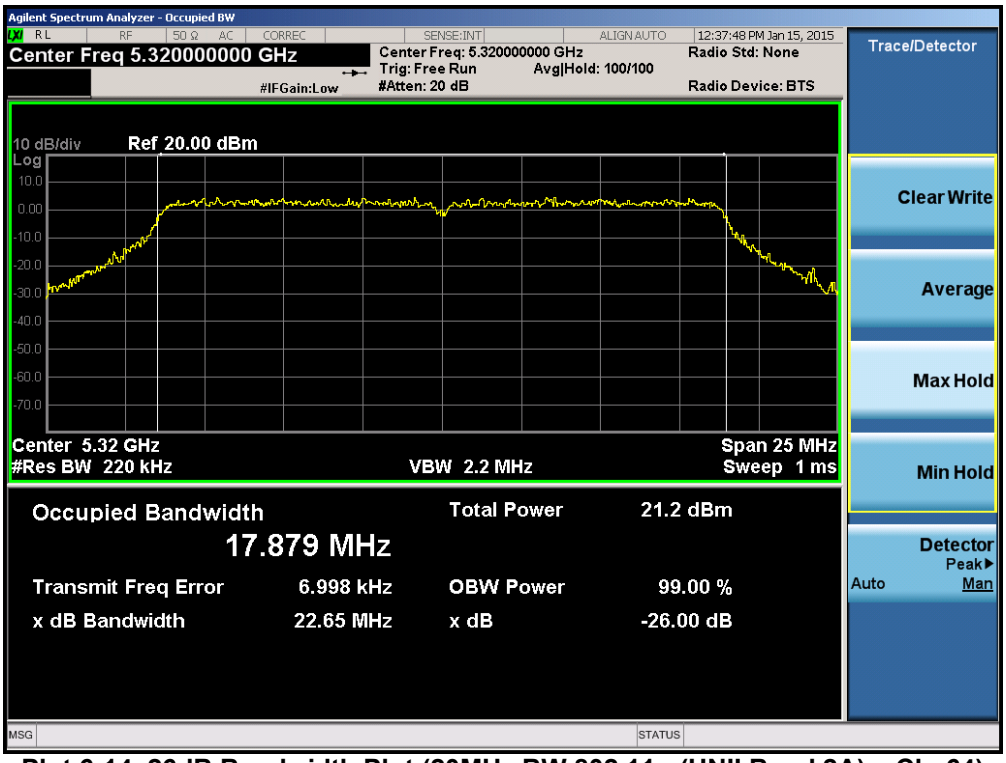


Plot 6-13. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)



Plot 6-14. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 64)

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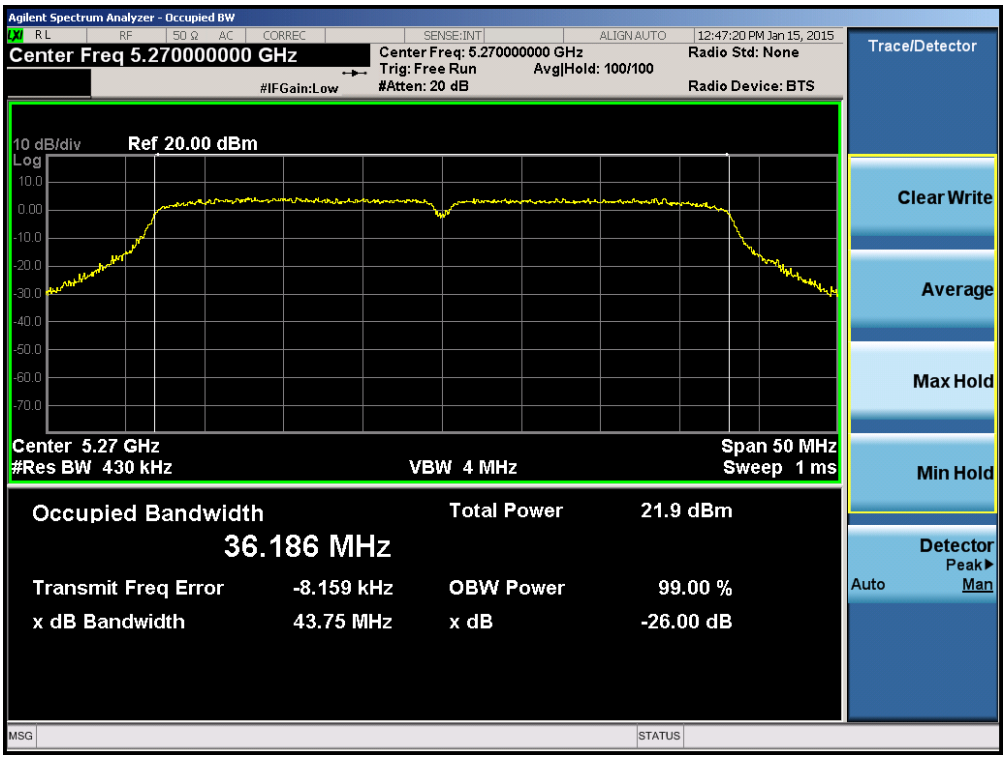
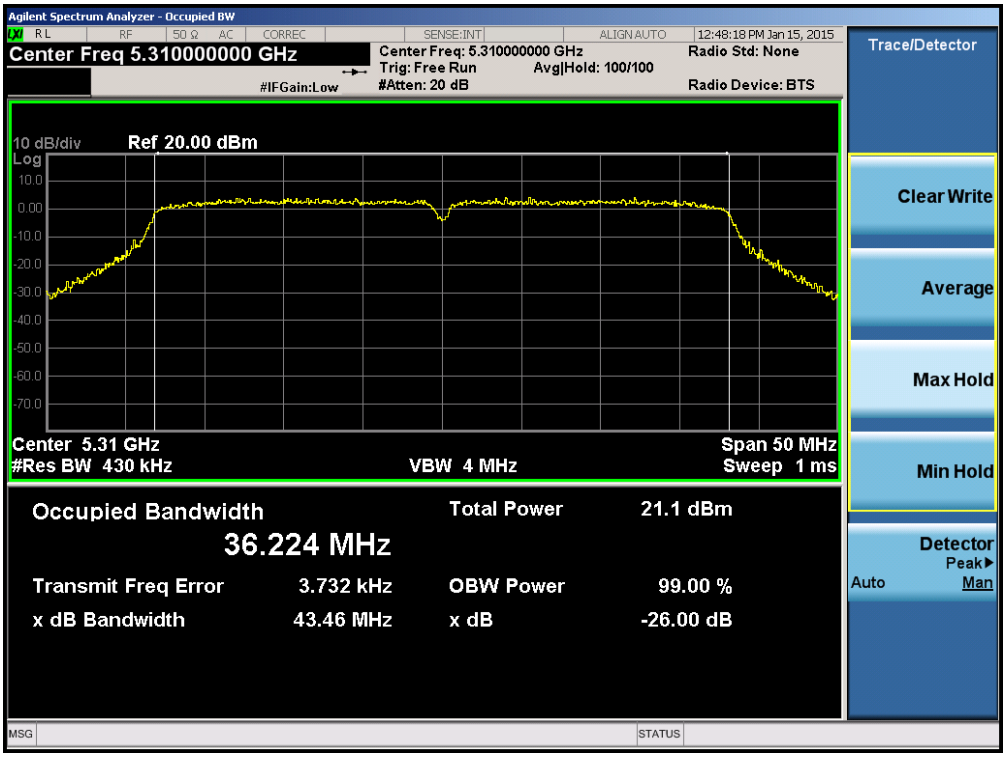


Plot 6-15. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)



Plot 6-16. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2A) – Ch. 62)

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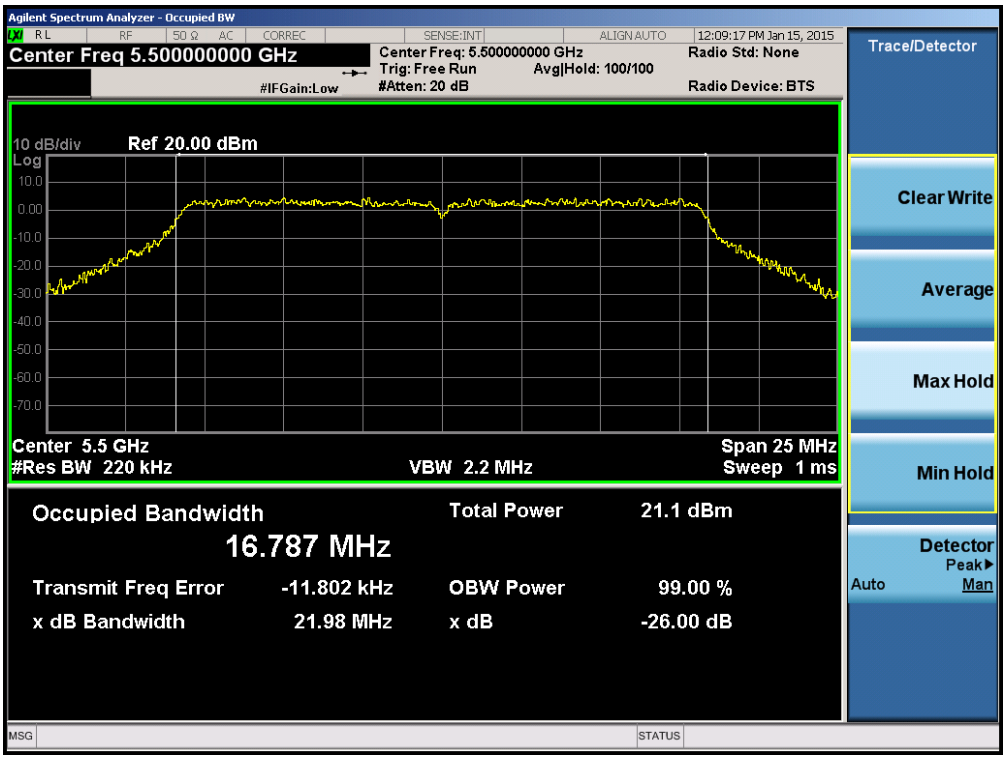
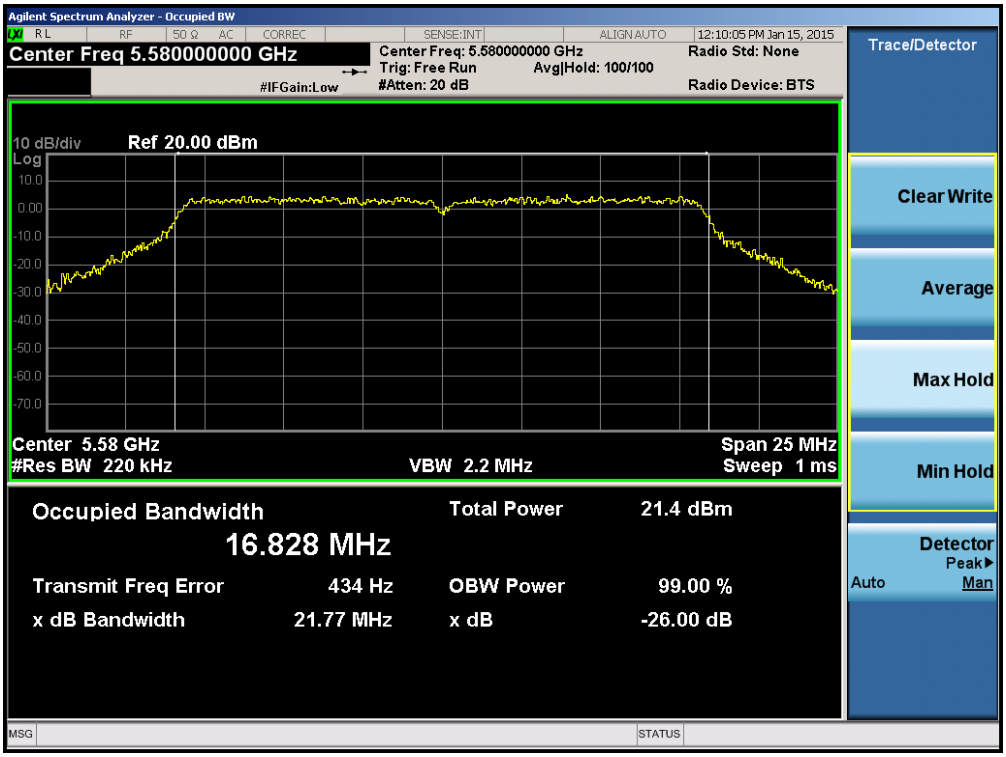


Plot 6-17. 26dB Bandwidth Plot (802.11a (UNII Band 2C) – Ch. 100)



Plot 6-18. 26dB Bandwidth Plot (802.11a (UNII Band 2C) – Ch. 116)

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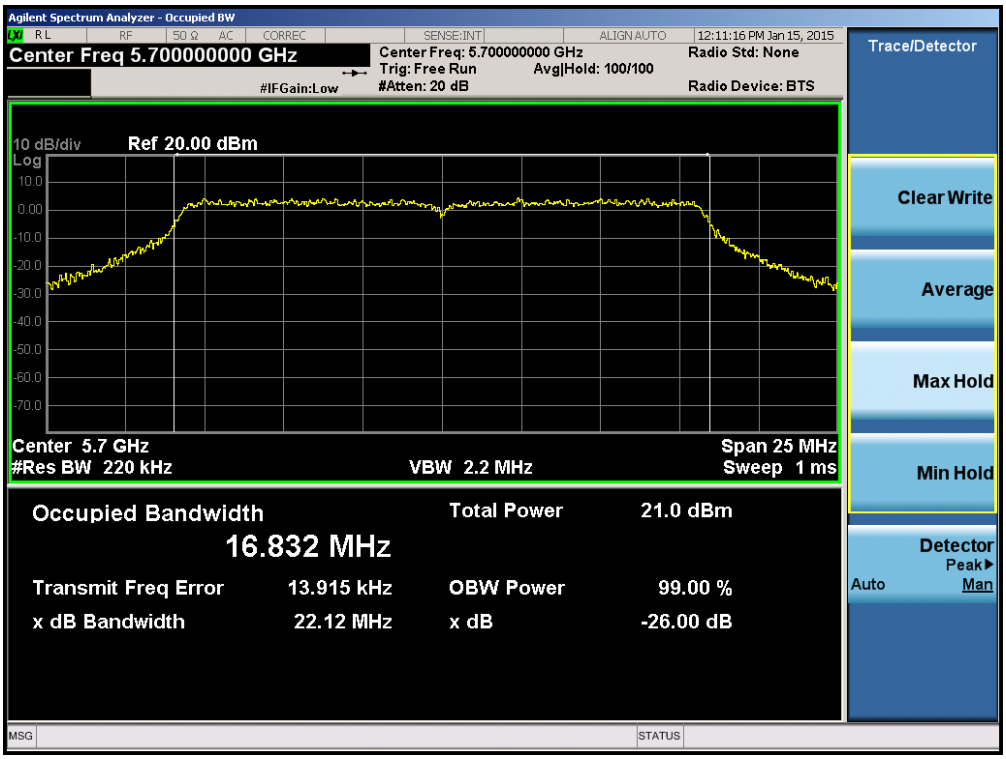
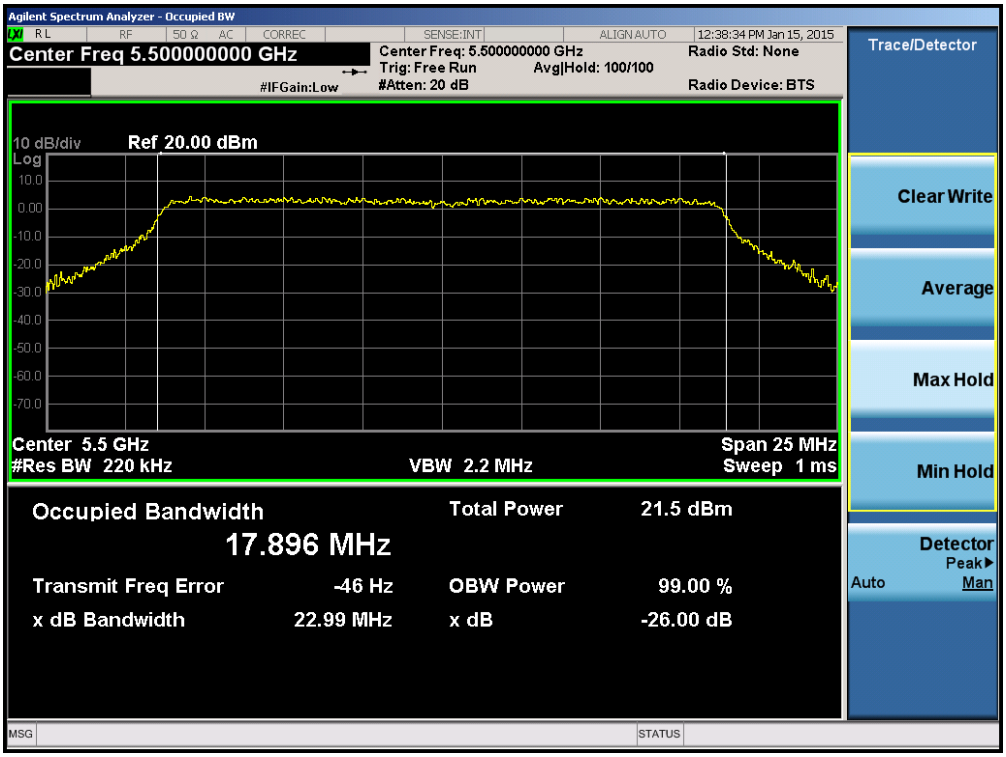


Plot 6-19. 26dB Bandwidth Plot (802.11a (UNII Band 2C) – Ch. 140)



Plot 6-20. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 100)

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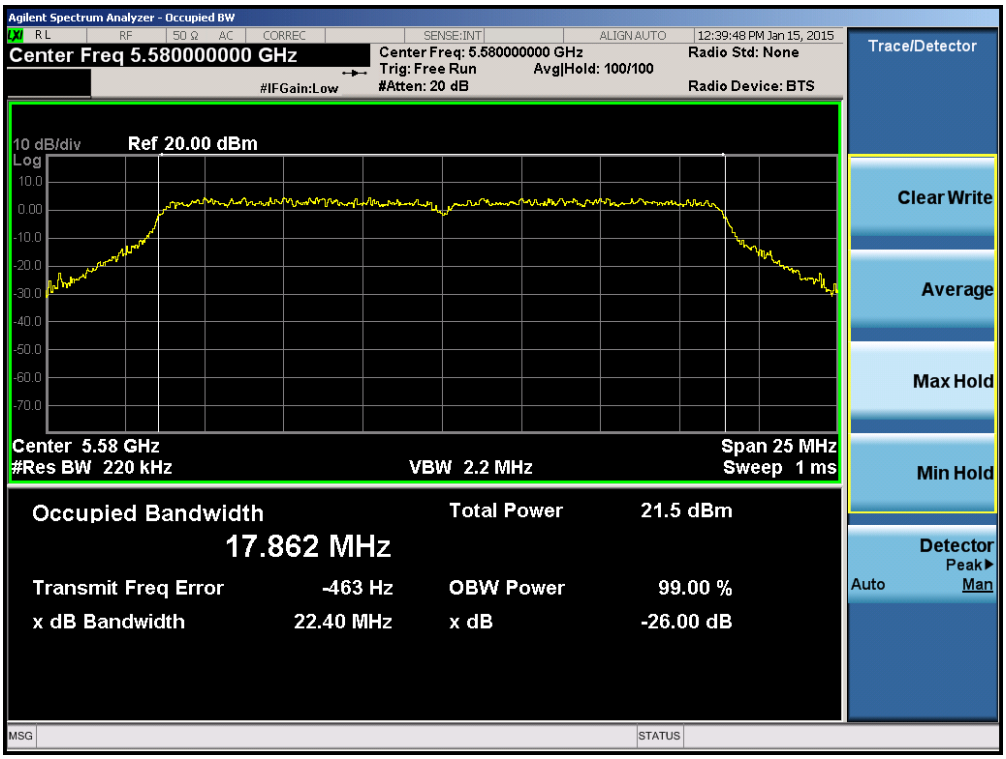
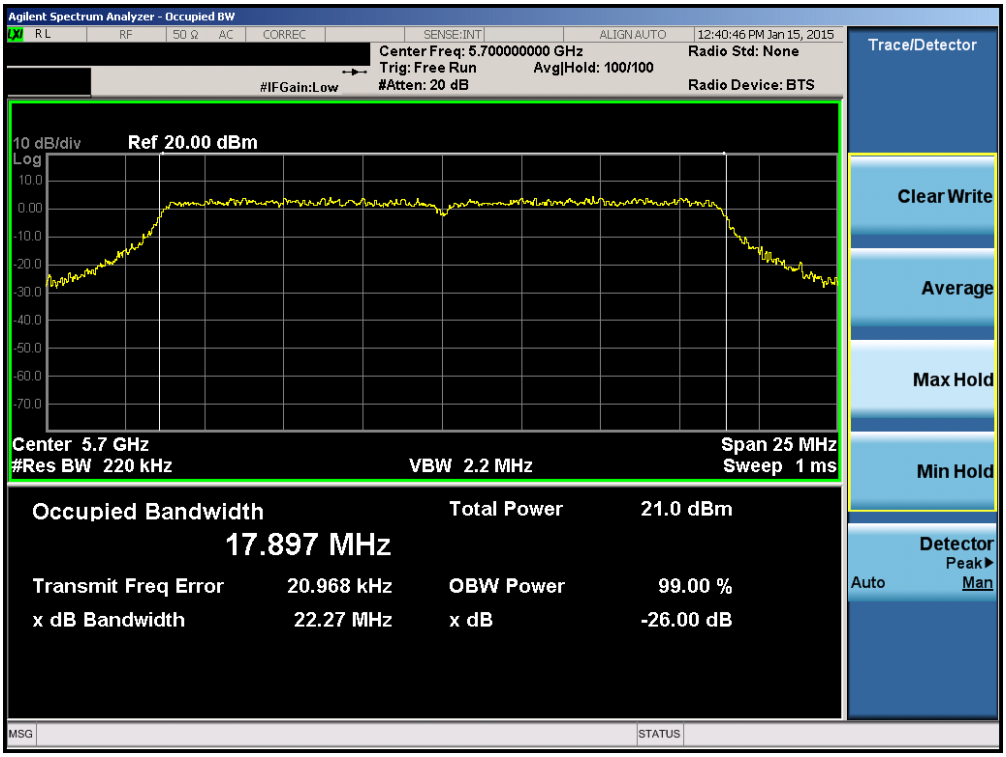


Plot 6-21. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 116)



Plot 6-22. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 140)

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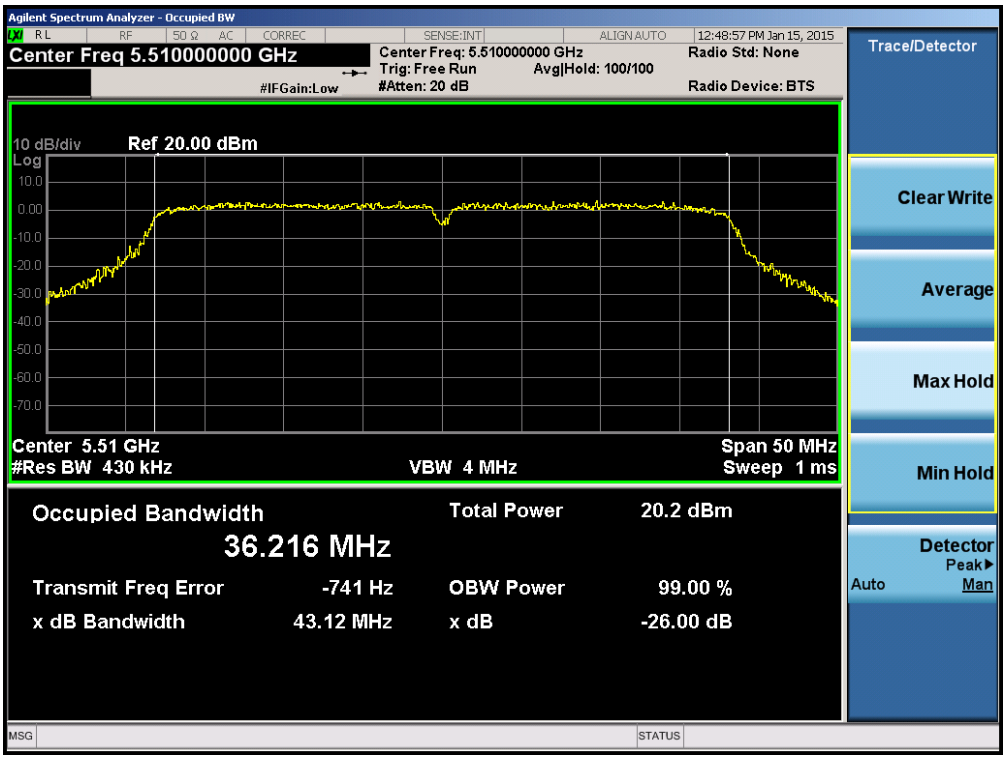
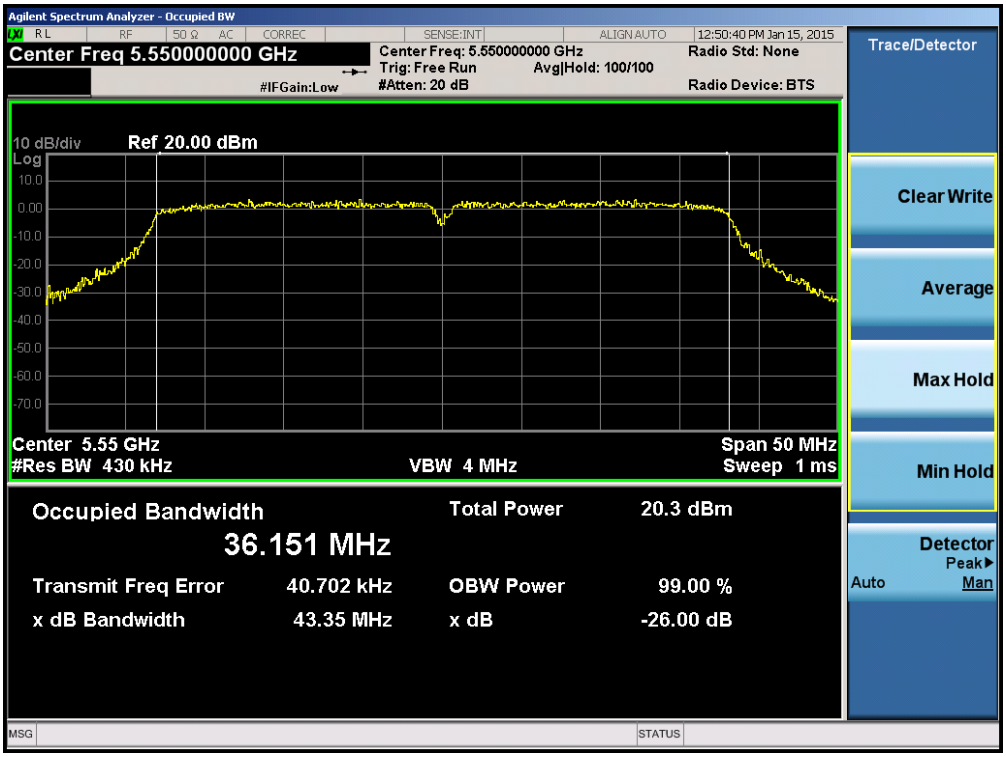


Plot 6-23. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 102)



Plot 6-24. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 110)

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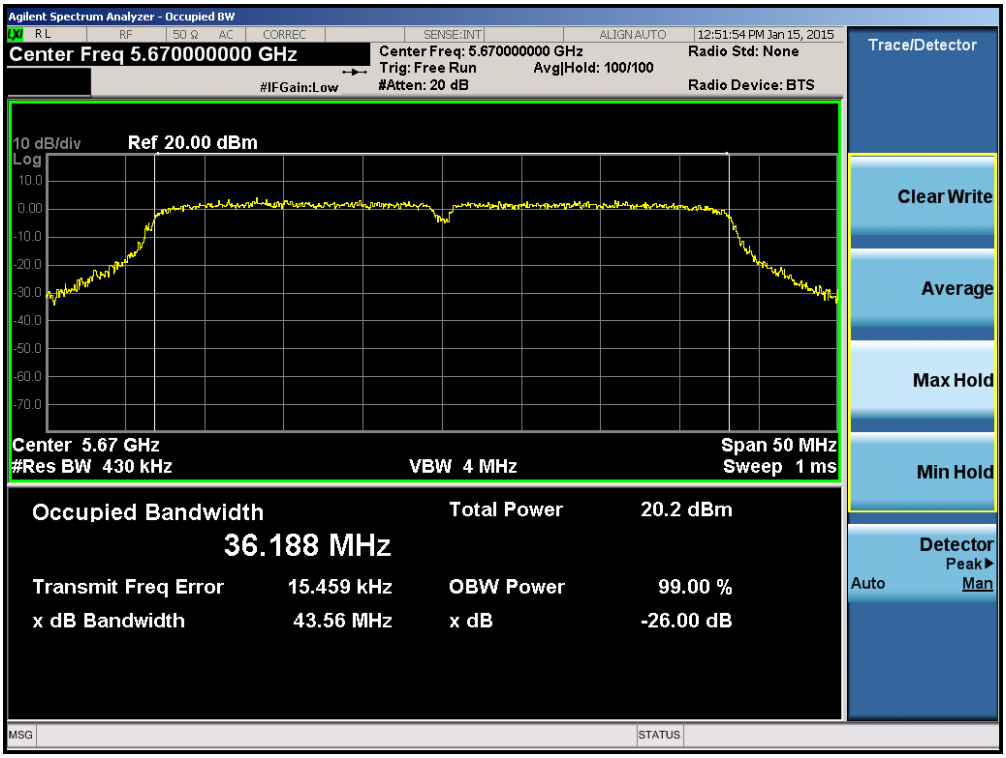

Plot 6-25. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 134)

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6.3 6dB Bandwidth Measurement – 802.11a/n

15.407(e)

Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in KDB 789033, and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 6dB bandwidth.

In the 5.725 – 5.850GHz band, the 6dB bandwidth must be ≥ 500 kHz.

Test Procedure Used

KDB 789033 D02 v01 – Section C

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 100 kHz
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

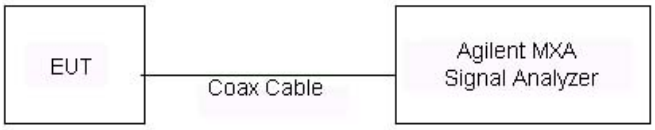

Figure 6-2. Test Instrument & Measurement Setup

Test Notes

None.

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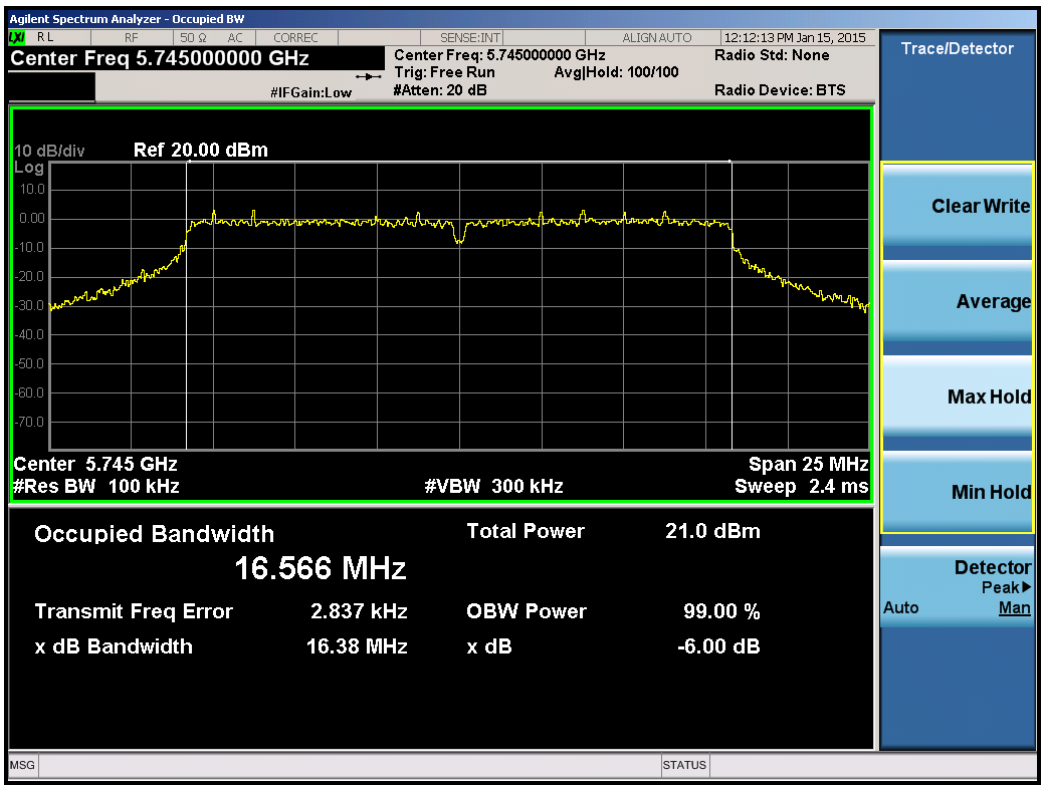
6 dB Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 6dB Bandwidth [MHz]
Band 3	5745	149	a	6	16.38
	5785	157	a	6	16.39
	5825	165	a	6	16.40
	5745	149	n (20MHz)	6.5/7.2 (MCS0)	17.61
	5785	157	n (20MHz)	6.5/7.2 (MCS0)	17.61
	5825	165	n (20MHz)	6.5/7.2 (MCS0)	17.65
	5755	151	n (40MHz)	13.5/15 (MCS0)	35.14
	5795	159	n (40MHz)	13.5/15 (MCS0)	35.16

Table 6-3. Conducted Bandwidth Measurements



Plot 6-26. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 149)

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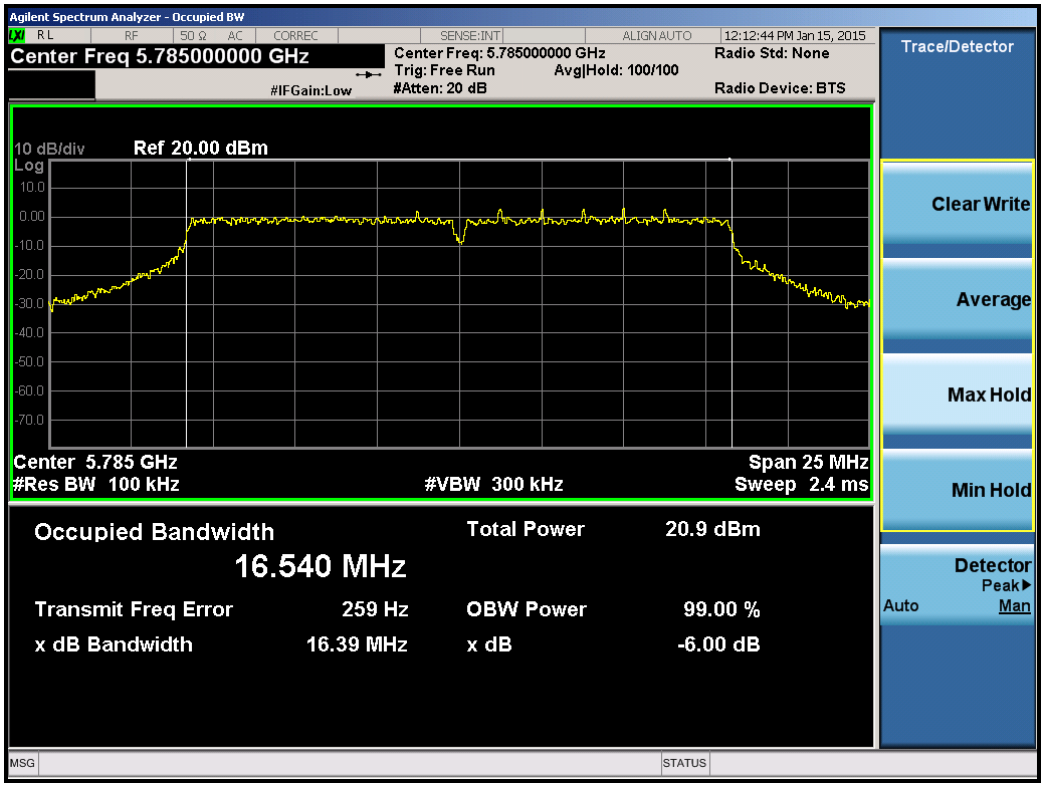
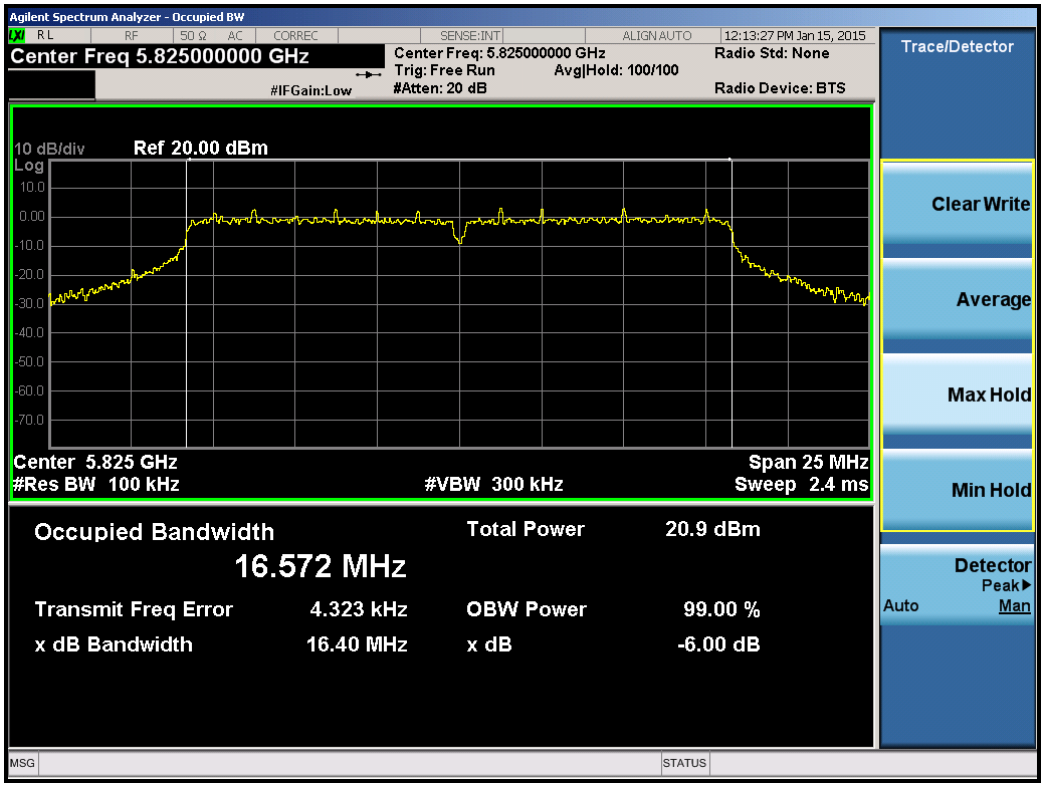


Plot 6-27. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 157)



Plot 6-28. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 165)

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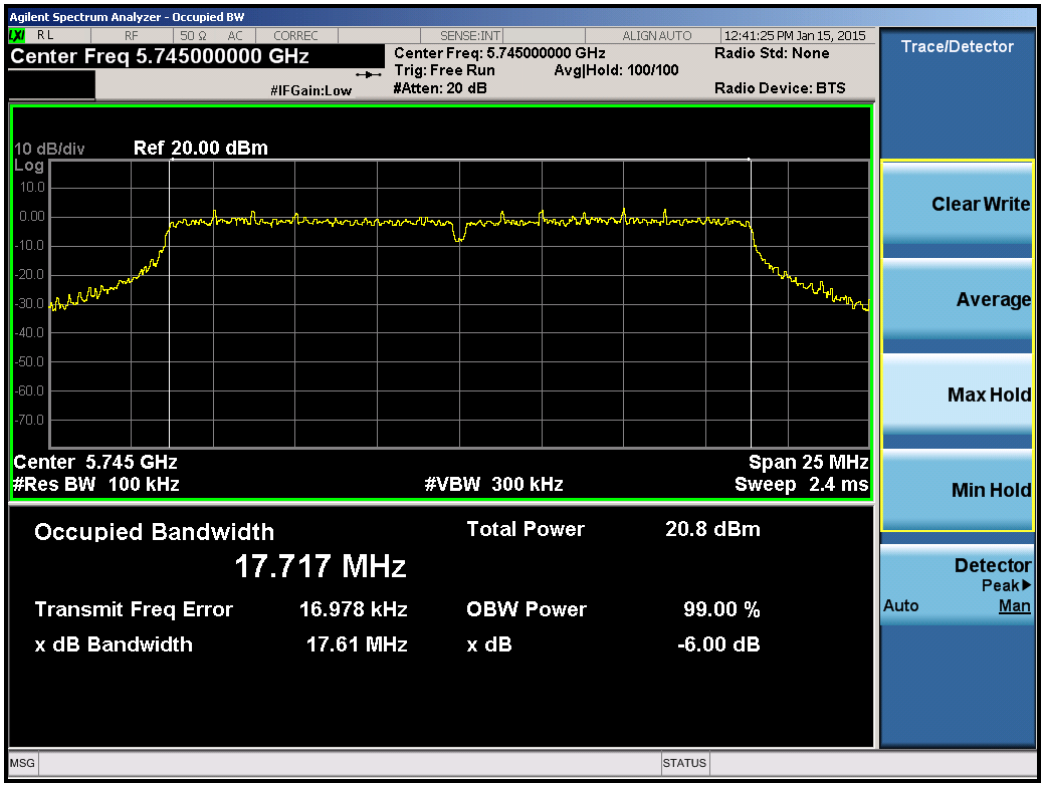
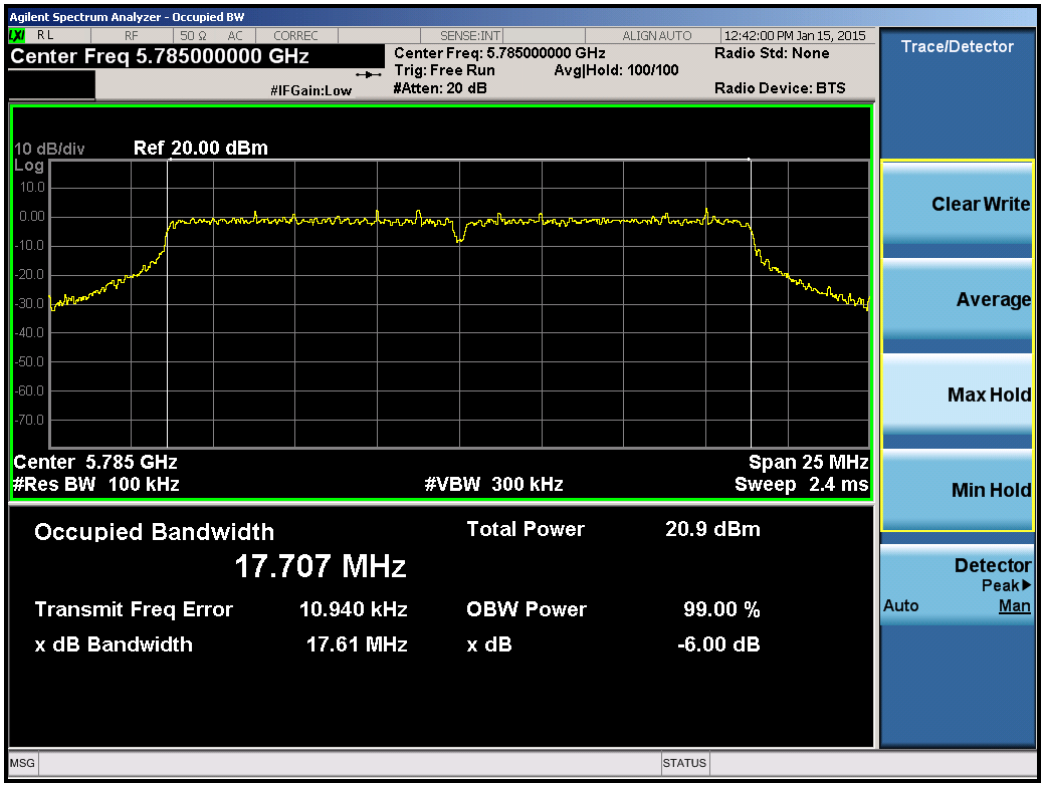


Plot 6-29. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 149)



Plot 6-30. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 157)

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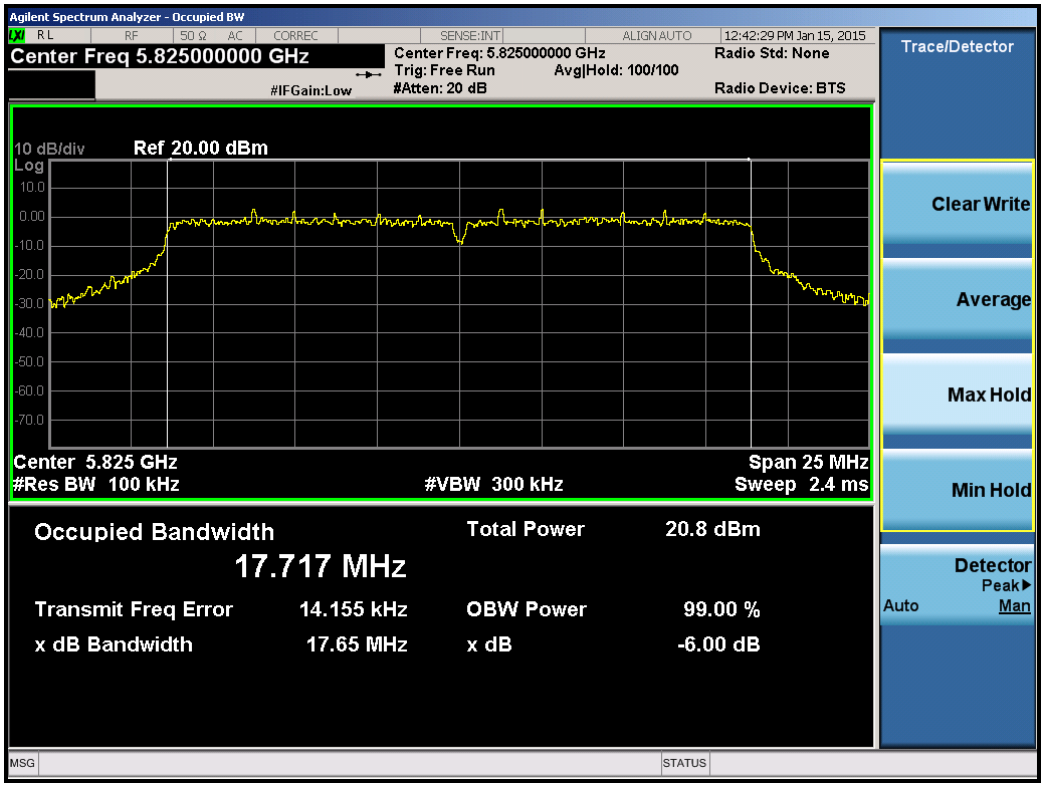
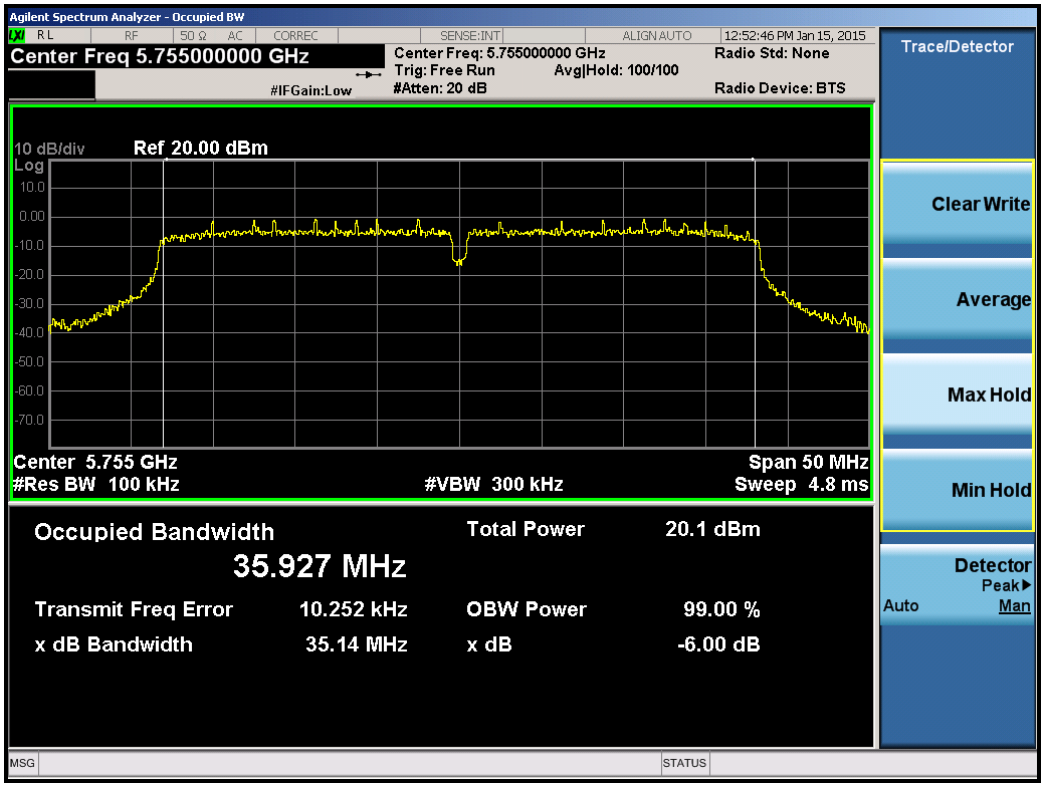


Plot 6-31. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 165)



Plot 6-32. 6dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 151)

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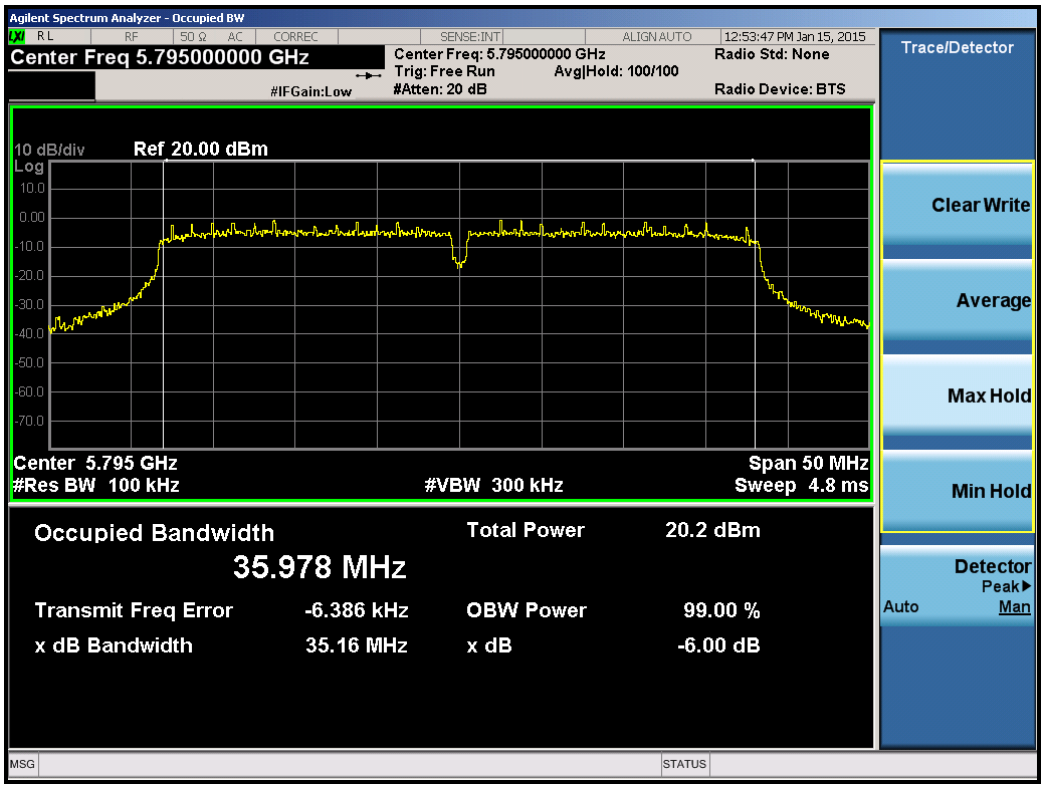

Plot 6-33. 6dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 159)

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6.4 UNII Output Power Measurement – 802.11a/n

§15.407 (a)

Test Overview and Limits

A transmitter antenna terminal of the EUT is connected to the input of an RF pulse power sensor. Measurement is made using a broadband average power meter while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in KDB 789033, and at the appropriate frequencies.

In the 5.15 – 5.25GHz band, the maximum permissible conducted output power is 250mW (23.98dBm).

In the 5.25 – 5.35GHz band, the maximum permissible conducted output power is the lesser of 250mW (23.98dBm) and 11 dBm + $10\log_{10}$(26dB BW) = 11 dBm + $10\log_{10}$(21.94) = 24.41dBm.

In the 5.47 – 5.725GHz band, the maximum permissible conducted output power is the lesser of 250mW (23.98dBm) and 11 dBm + $10\log_{10}$(26dB BW) = 11 dBm + $10\log_{10}$(21.77) = 24.38dBm.

In the 5.725-5.825GHz band, the maximum permissible conducted power output is 1W (30dBm).

Test Procedure Used

KDB 789033– Section E)3)b) Method PM-G

Test Settings

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

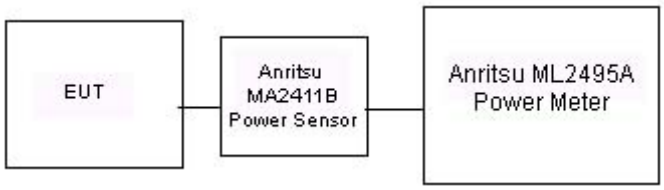

Figure 6-3. Test Instrument & Measurement Setup

Test Notes

None

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Mode	Freq [MHz]	Channel	Detector	802.11a Conducted Power [dBm]							
				Data Rate [Mbps]							
				6	9	12	18	24	36	48	54
802.11a	5180	36*	AVG	15.44	15.26	15.16	15.18	15.17	15.31	15.20	15.27
802.11a	5200	40	AVG	15.33	15.13	15.00	15.06	15.09	15.24	15.11	15.16
802.11a	5220	44	AVG	15.48	15.25	15.20	15.16	15.19	15.32	15.25	15.32
802.11a	5240	48*	AVG	15.45	15.26	15.14	15.25	15.20	15.26	15.19	15.35
802.11a	5260	52*	AVG	15.77	15.63	15.71	15.63	15.65	15.57	15.47	15.55
802.11a	5280	56	AVG	15.81	15.58	15.76	15.64	15.65	15.64	15.55	15.58
802.11a	5300	60	AVG	15.60	15.45	15.50	15.39	15.53	15.42	15.29	15.36
802.11a	5320	64*	AVG	15.66	15.46	15.63	15.50	15.56	15.49	15.31	15.46
802.11a	5500	100	AVG	15.70	15.19	15.14	15.39	15.41	15.25	15.23	15.36
802.11a	5520	104*	AVG	15.59	15.06	15.04	15.27	15.23	15.14	15.12	15.27
802.11a	5540	108	AVG	15.51	14.99	14.88	15.27	15.26	15.08	14.97	15.20
802.11a	5560	112	AVG	15.36	14.88	14.83	15.08	15.09	14.98	14.91	15.06
802.11a	5580	116*	AVG	15.37	14.85	14.85	15.02	15.07	14.91	14.91	15.03
802.11a	5660	132	AVG	15.35	14.82	14.88	15.04	15.07	14.92	14.87	14.99
802.11a	5680	136*	AVG	15.23	14.70	14.66	14.90	14.96	14.85	14.84	14.82
802.11a	5700	140	AVG	15.22	14.77	14.65	14.90	14.99	14.82	14.78	14.98
802.11a	5745	149*	AVG	14.77	14.12	14.17	14.25	14.16	14.19	14.07	14.06
802.11a	5765	153	AVG	14.69	14.04	14.14	14.20	14.09	14.12	13.94	14.04
802.11a	5785	157*	AVG	14.60	13.88	14.02	14.11	13.92	14.02	13.91	13.86
802.11a	5805	161	AVG	14.63	14.03	14.10	14.18	14.03	14.02	13.97	13.87
802.11a	5825	165*	AVG	14.74	14.06	14.15	14.20	14.12	14.14	14.04	14.01

Table 6-4. 802.11a (UNII) Maximum Conducted Output Power

Mode	Freq [MHz]	Channel	Detector	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
				Data Rate [Mbps]							
				6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	AVG	15.29	14.92	14.98	14.93	14.97	15.03	15.01	15.13
802.11n	5200	40	AVG	15.20	14.83	14.86	14.79	14.95	14.91	14.87	14.98
802.11n	5220	44	AVG	15.28	14.93	14.99	14.86	14.93	15.01	15.06	15.14
802.11n	5240	48	AVG	15.19	14.83	14.89	14.89	14.83	14.93	14.93	15.06
802.11n	5260	52	AVG	15.62	15.49	15.53	15.49	15.48	15.37	15.40	15.43
802.11n	5280	56	AVG	15.56	15.35	15.47	15.44	15.39	15.30	15.36	15.35
802.11n	5300	60	AVG	15.46	15.31	15.30	15.31	15.33	15.17	15.26	15.31
802.11n	5320	64	AVG	15.55	15.39	15.43	15.38	15.37	15.30	15.37	15.34
802.11n	5500	100	AVG	15.60	15.39	15.40	15.20	15.35	15.18	15.26	15.23
802.11n	5520	104	AVG	15.47	15.25	15.20	15.15	15.19	15.00	15.09	15.16
802.11n	5540	108	AVG	15.45	15.25	15.30	15.04	15.18	14.98	15.12	15.16
802.11n	5560	112	AVG	15.34	15.15	15.08	14.91	15.08	14.91	15.07	14.96
802.11n	5580	116	AVG	15.23	15.03	15.05	14.85	14.96	14.84	14.94	14.87
802.11n	5660	132	AVG	15.20	15.08	15.06	14.82	14.98	14.71	14.91	14.87
802.11n	5680	136	AVG	15.22	15.03	15.03	14.86	14.97	14.78	14.91	14.84
802.11n	5700	140	AVG	15.27	15.08	15.08	14.88	14.99	14.82	14.92	14.87
802.11n	5745	149	AVG	14.82	14.25	14.22	14.27	14.19	14.05	14.10	14.19
802.11n	5765	153	AVG	14.79	14.25	14.21	14.19	14.17	14.00	14.02	14.18
802.11n	5785	157	AVG	14.55	13.94	13.99	14.00	13.97	13.84	13.82	13.87
802.11n	5805	161	AVG	14.68	14.13	14.06	14.15	13.98	13.90	13.88	13.99
802.11n	5825	165	AVG	14.60	14.07	14.06	14.10	13.90	13.87	13.91	13.98

Table 6-5. 20MHz BW 802.11n (UNII) Maximum Conducted Output Power

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Mode	Freq [MHz]	Channel	Detector	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
				Data Rate [Mbps]							
				13.5	27	40.5	54	81	108	121.5	135
802.11n	5190	38	AVG	15.31	15.30	15.33	15.42	15.20	15.24	15.17	15.24
802.11n	5230	46	AVG	15.16	15.12	15.26	15.31	15.01	15.08	15.03	15.06
802.11n	5270	54	AVG	15.28	15.17	15.14	15.16	15.12	15.18	15.12	15.10
802.11n	5310	62	AVG	15.01	14.88	14.79	14.89	14.82	14.91	14.92	14.75
802.11n	5510	102	AVG	15.44	14.97	15.01	15.02	14.87	14.17	13.74	13.16
802.11n	5550	110	AVG	15.48	15.00	15.03	15.08	14.89	14.14	13.71	13.20
802.11n	5670	134	AVG	15.32	14.81	14.90	14.88	14.81	13.97	13.71	13.02
802.11n	5755	151	AVG	14.75	14.70	14.71	14.73	14.66	14.60	14.35	14.30
802.11n	5795	159	AVG	14.68	14.65	14.63	14.66	14.61	13.93	13.90	13.91

Table 6-6. 40MHz BW 802.11n (UNII) Maximum Conducted Output Power

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6.5 Maximum Power Spectral Density – 802.11a/n

§15.407(a)

Test Overview and Limit

The spectrum analyzer was connected to the antenna terminal while the EUT was operating at its maximum duty cycle, at its maximum power control level, as defined in KDB 789033, and at the appropriate frequencies. Method SA-1, as defined in KDB 789033 v01r04, was used to measure the power spectral density.

In the 5.15 – 5.25GHz band, the maximum permissible power spectral density is 11dBm/MHz.

In the 5.25 – 5.35GHz, 5.47 – 5.725GHz bands, the maximum permissible power spectral density is 11dBm/MHz.

Test Procedure Used

KDB 789033 – Section F

Test Settings

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire emission bandwidth of the signal
3. RBW = 1MHz
4. VBW = 3MHz
5. Number of sweep points ≥ 2 x (span/RBW)
6. Sweep time = auto
7. Detector = power averaging (RMS)
8. Trigger was set to free run since the EUT was operating at a duty cycle ≥ 98%
9. Trace was averaged over 100 sweeps
10. The peak search function of the spectrum analyzer was used to find the peak of the spectrum.

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

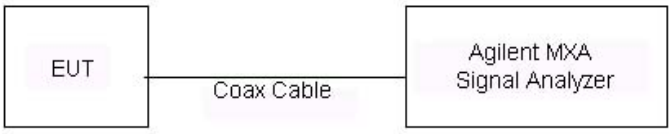

Figure 6-4. Test Instrument & Measurement Setup

Test Notes

None

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	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Power Density [dBm]	Max Permissible Power Density [dBm/MHz]	Margin [dB]	Pass / Fail
Band 1	5180	36	a	6	3.24	11.0	-7.76	Pass
	5200	40	a	6	2.76	11.0	-8.24	Pass
	5240	48	a	6	3.49	11.0	-7.51	Pass
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	2.75	11.0	-8.25	Pass
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	2.65	11.0	-8.35	Pass
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	3.13	11.0	-7.87	Pass
	5190	38	n (40MHz)	13.5/15 (MCS0)	-0.44	11.0	-11.44	Pass
	5230	46	n (40MHz)	13.5/15 (MCS0)	-0.42	11.0	-11.42	Pass
Band 2A	5260	52	a	6	3.65	11.0	-7.35	Pass
	5280	56	a	6	3.66	11.0	-7.35	Pass
	5320	64	a	6	3.64	11.0	-7.36	Pass
	5260	52	n (20MHz)	6.5/7.2 (MCS0)	3.22	11.0	-7.78	Pass
	5280	56	n (20MHz)	6.5/7.2 (MCS0)	3.12	11.0	-7.88	Pass
	5320	64	n (20MHz)	6.5/7.2 (MCS0)	3.25	11.0	-7.75	Pass
	5270	54	n (40MHz)	13.5/15 (MCS0)	-0.17	11.0	-11.17	Pass
	5310	62	n (40MHz)	13.5/15 (MCS0)	-0.79	11.0	-11.79	Pass
Band 2C	5500	100	a	6	3.54	11.0	-7.46	Pass
	5580	116	a	6	3.71	11.0	-7.29	Pass
	5700	140	a	6	3.04	11.0	-7.96	Pass
	5500	100	n (20MHz)	6.5/7.2 (MCS0)	2.86	11.0	-8.14	Pass
	5580	116	n (20MHz)	6.5/7.2 (MCS0)	3.12	11.0	-7.88	Pass
	5700	140	n (20MHz)	6.5/7.2 (MCS0)	2.70	11.0	-8.30	Pass
	5510	102	n (40MHz)	13.5/15 (MCS0)	-1.18	11.0	-12.18	Pass
	5550	110	n (40MHz)	13.5/15 (MCS0)	-1.15	11.0	-12.15	Pass
	5670	134	n (40MHz)	13.5/15 (MCS0)	-1.00	11.0	-12.00	Pass

Table 6-7. Conducted Power Spectral Density Measurements

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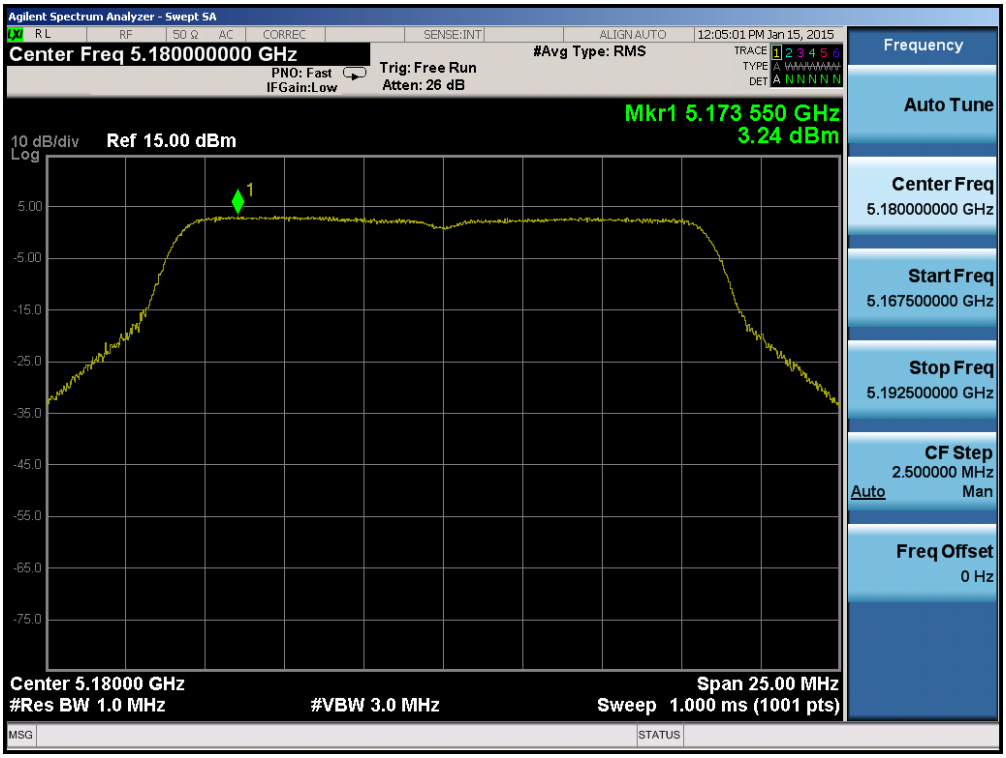
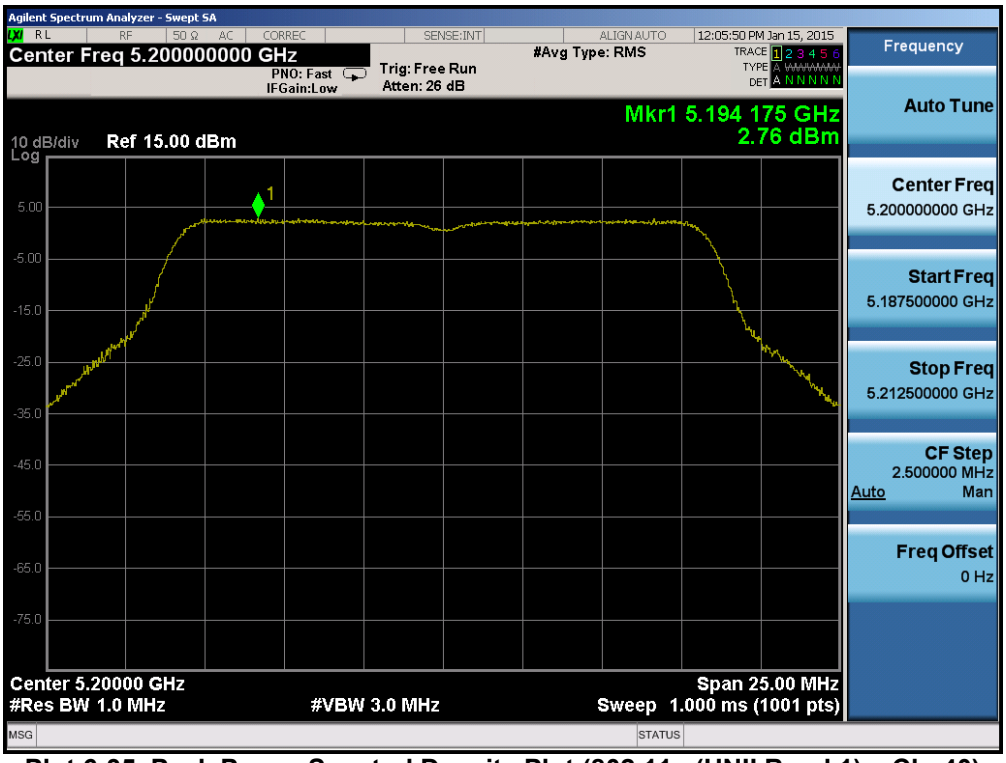


Plot 6-34. Peak Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 36)



Plot 6-35. Peak Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 40)

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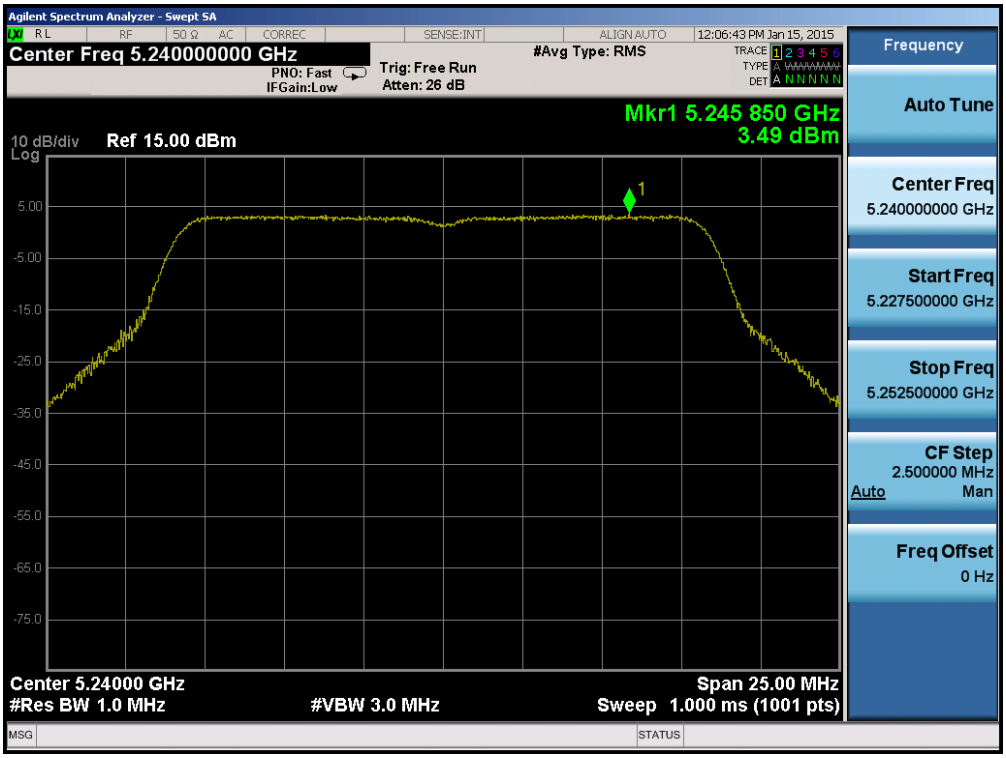
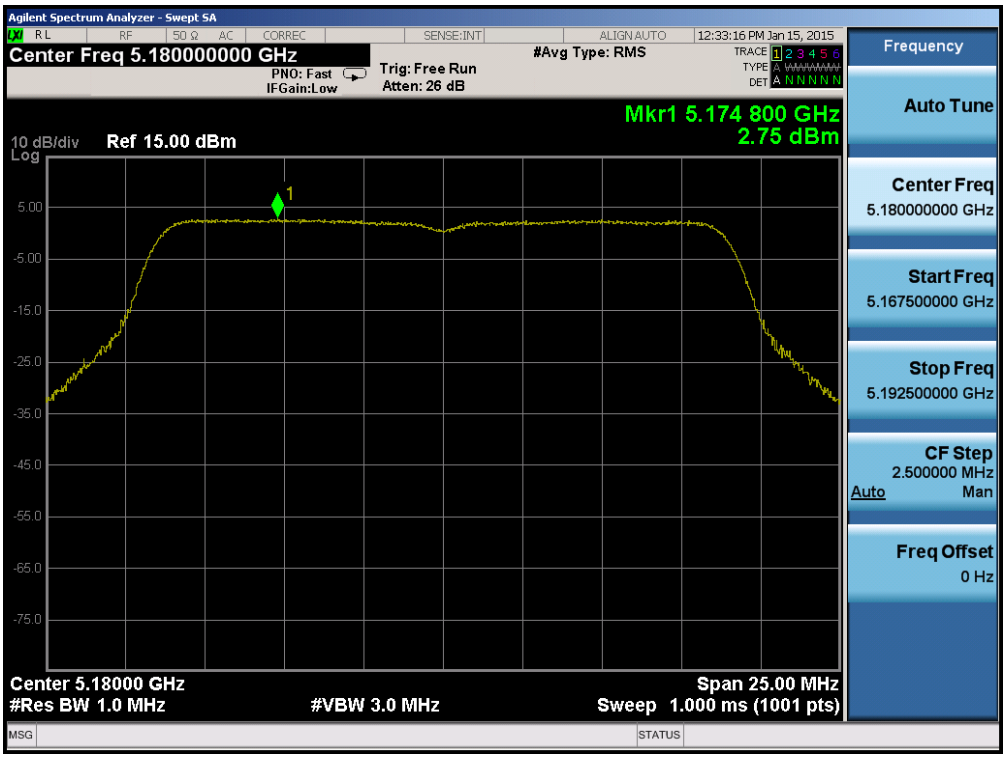


Plot 6-36. Peak Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 48)



Plot 6-37. Peak Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 36)

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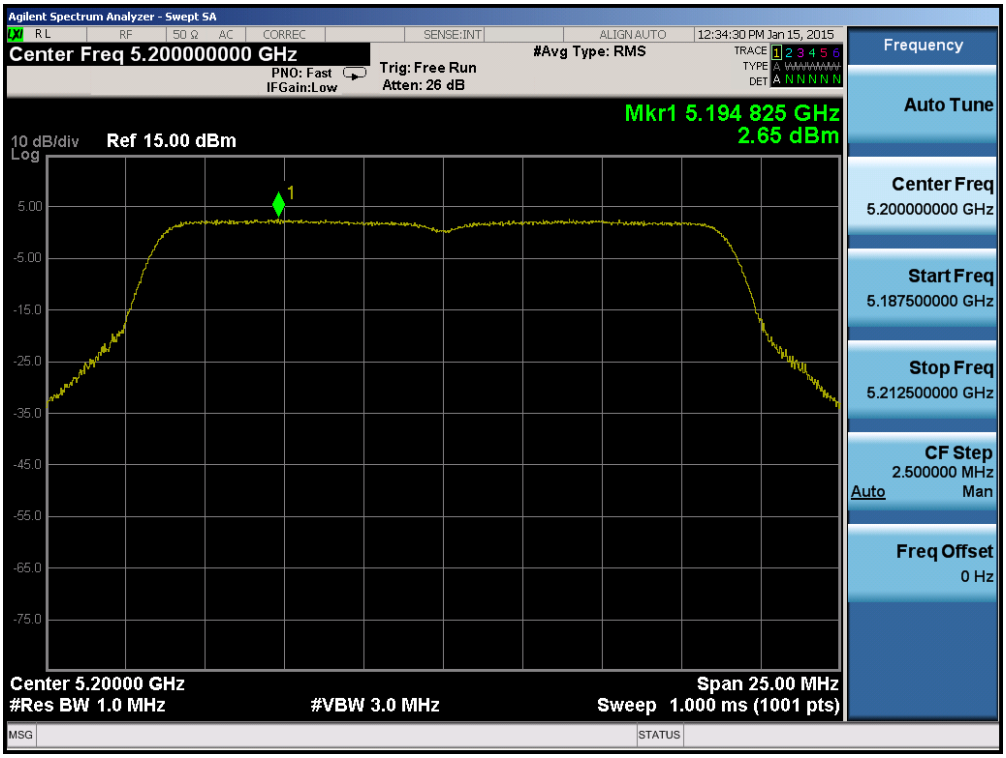
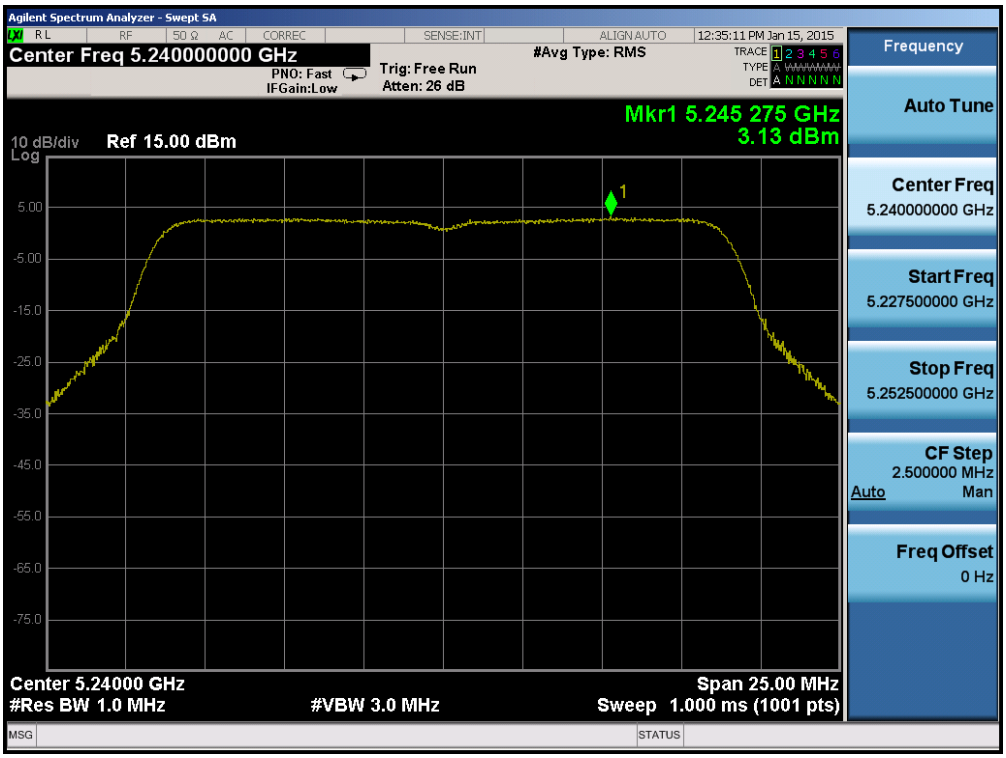


Plot 6-38. Peak Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 40)



Plot 6-39. Peak Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 48)

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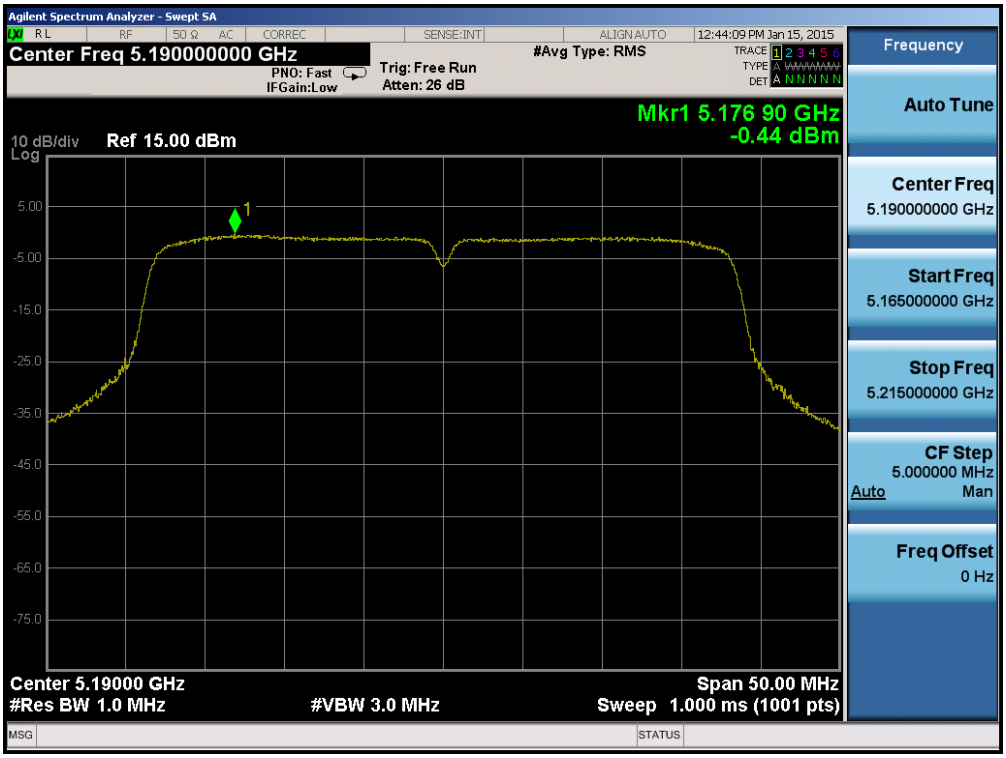
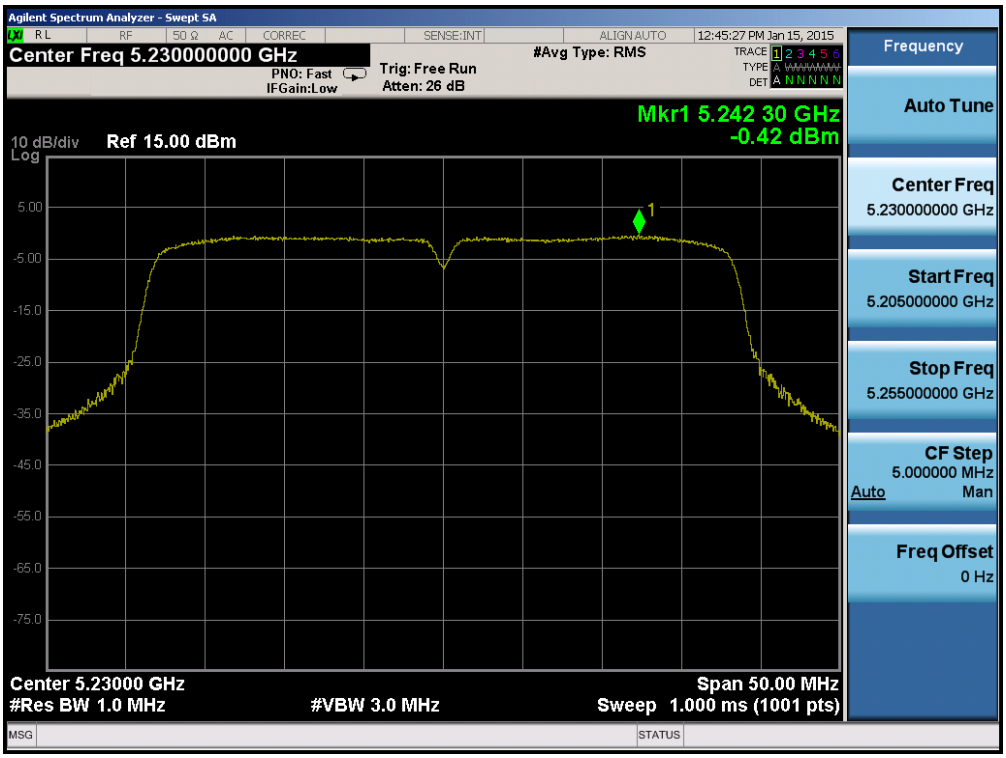


Plot 6-40. Peak Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



Plot 6-41. Peak Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 46)

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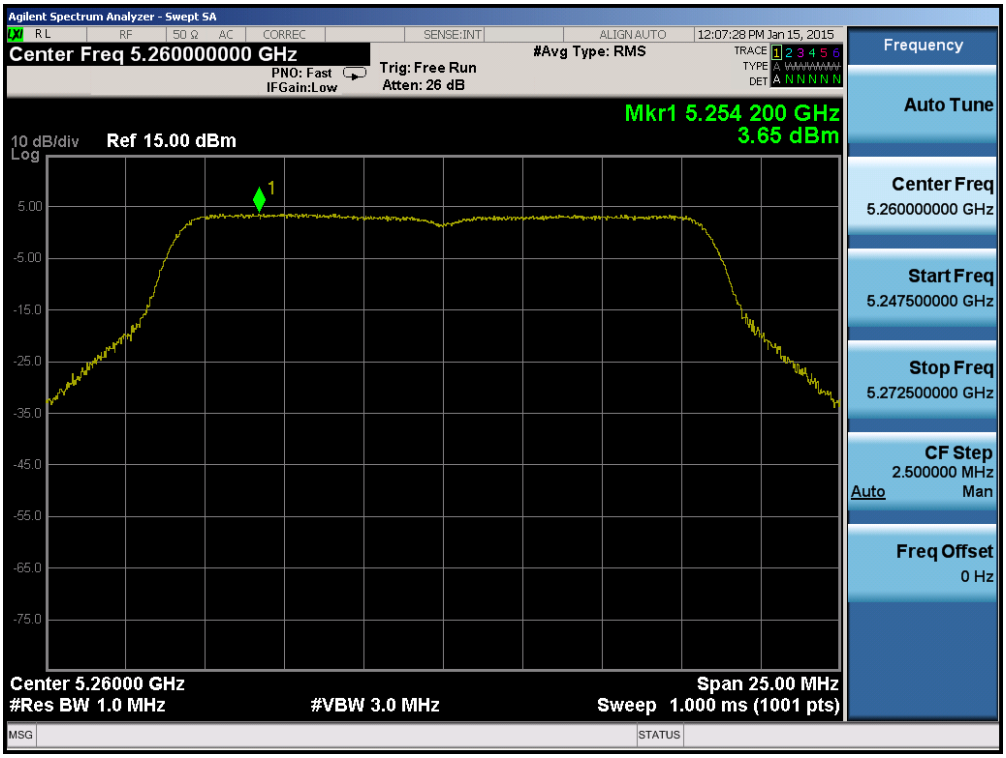
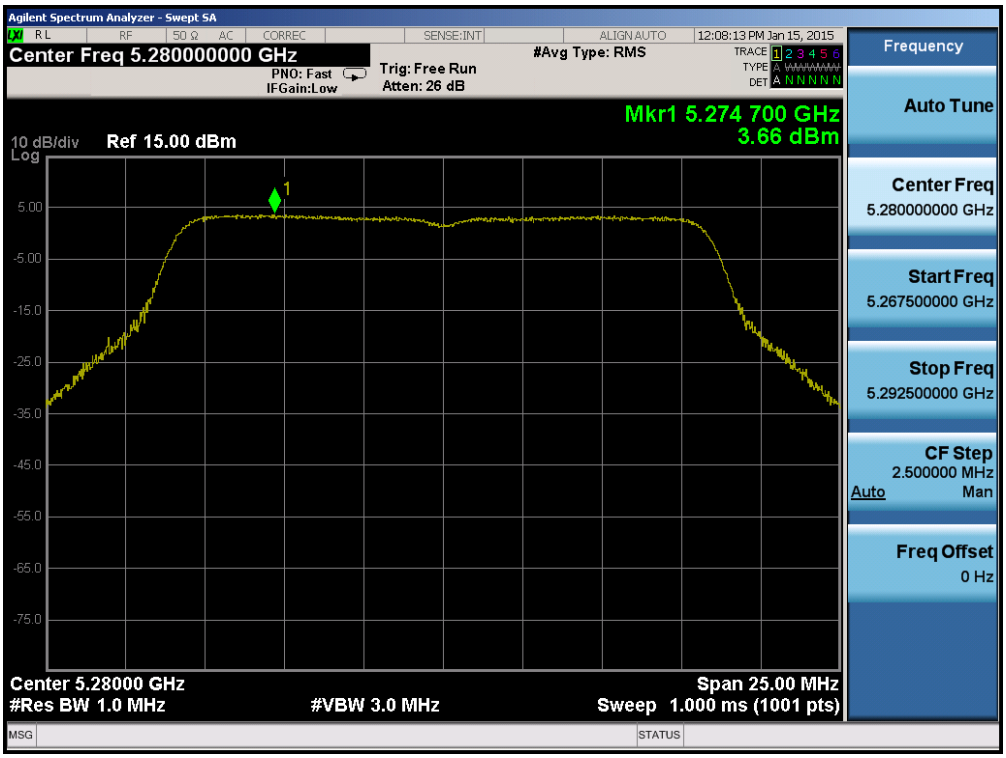


Plot 6-42. Peak Power Spectral Density Plot (802.11a (UNII Band 2A) – Ch. 52)



Plot 6-43. Peak Power Spectral Density Plot (802.11a (UNII Band 2A) – Ch. 56)

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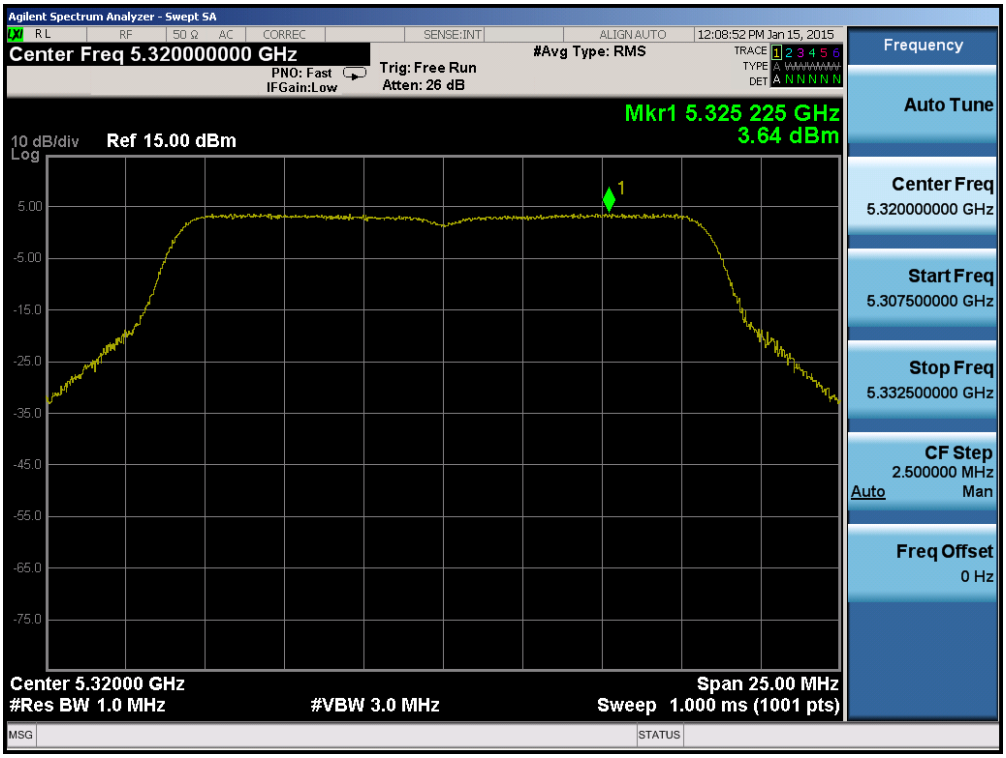
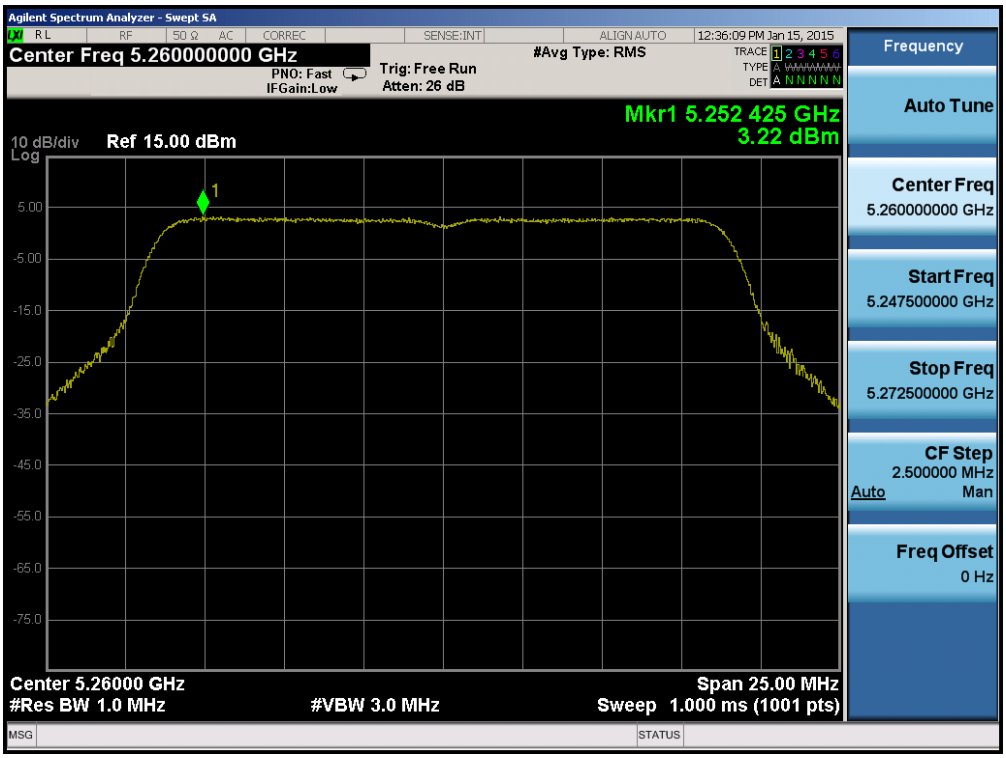


Plot 6-44. Peak Power Spectral Density Plot (802.11a (UNII Band 2A) – Ch. 64)



Plot 6-45. Peak Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 52)

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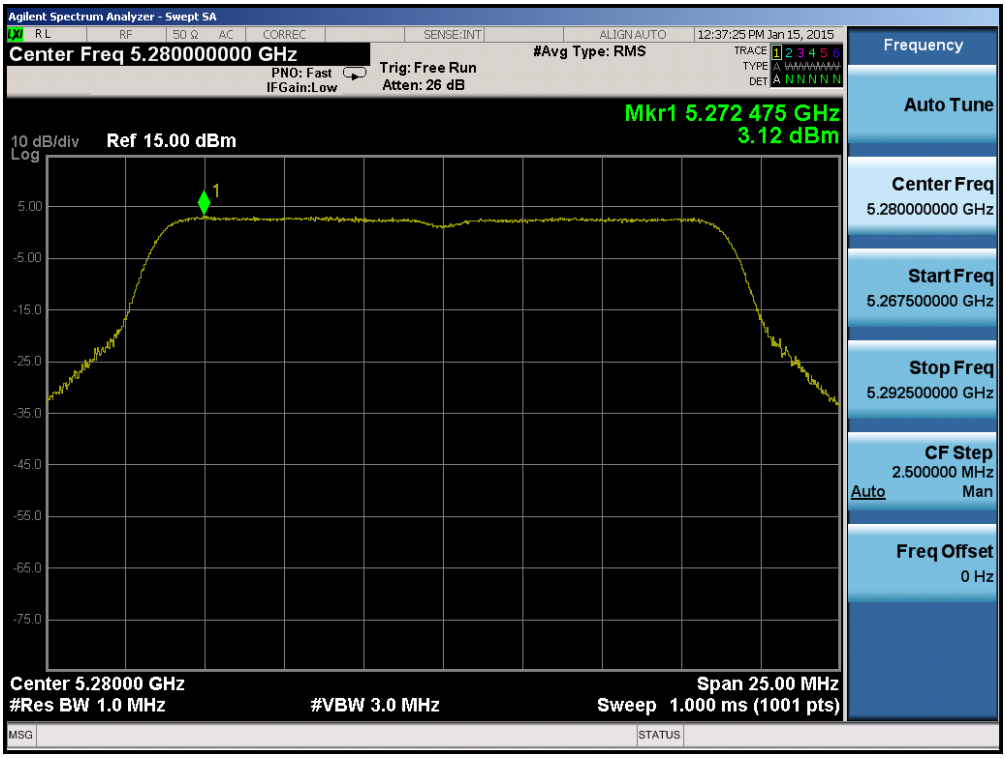
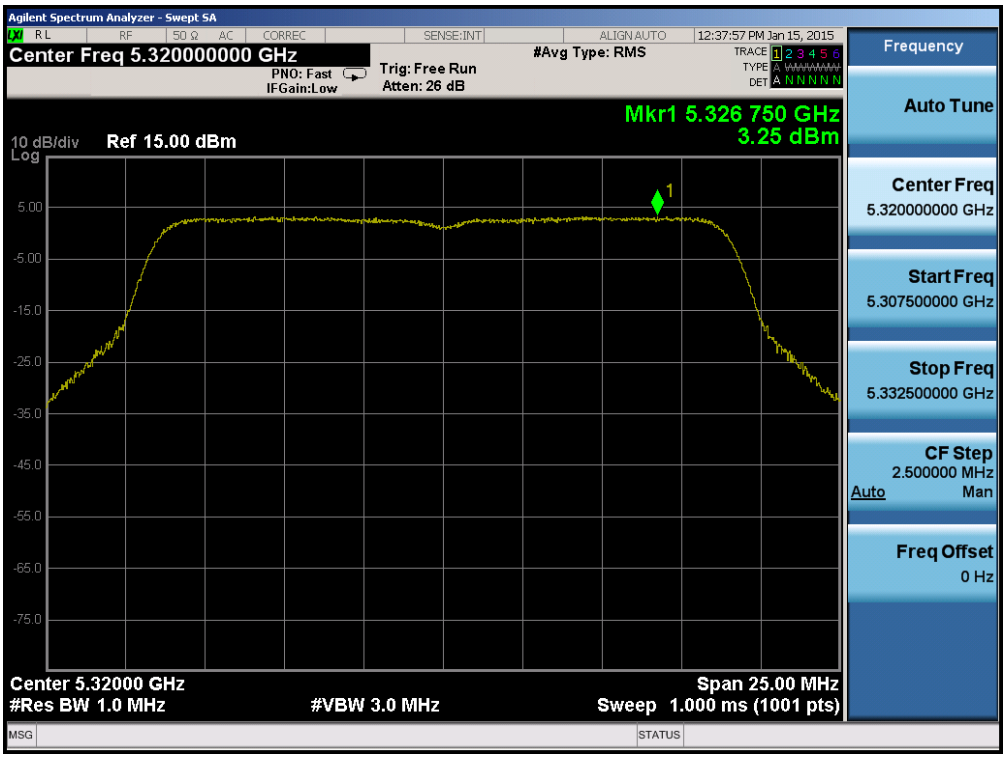


Plot 6-46. Peak Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)



Plot 6-47. Peak Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 64)

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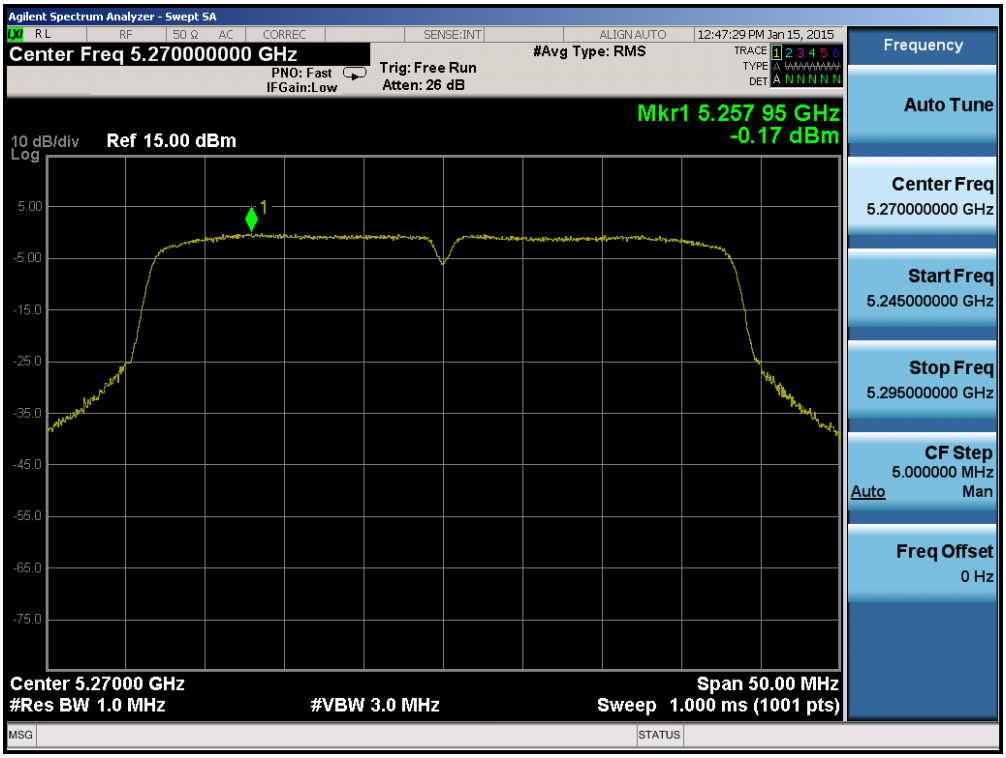
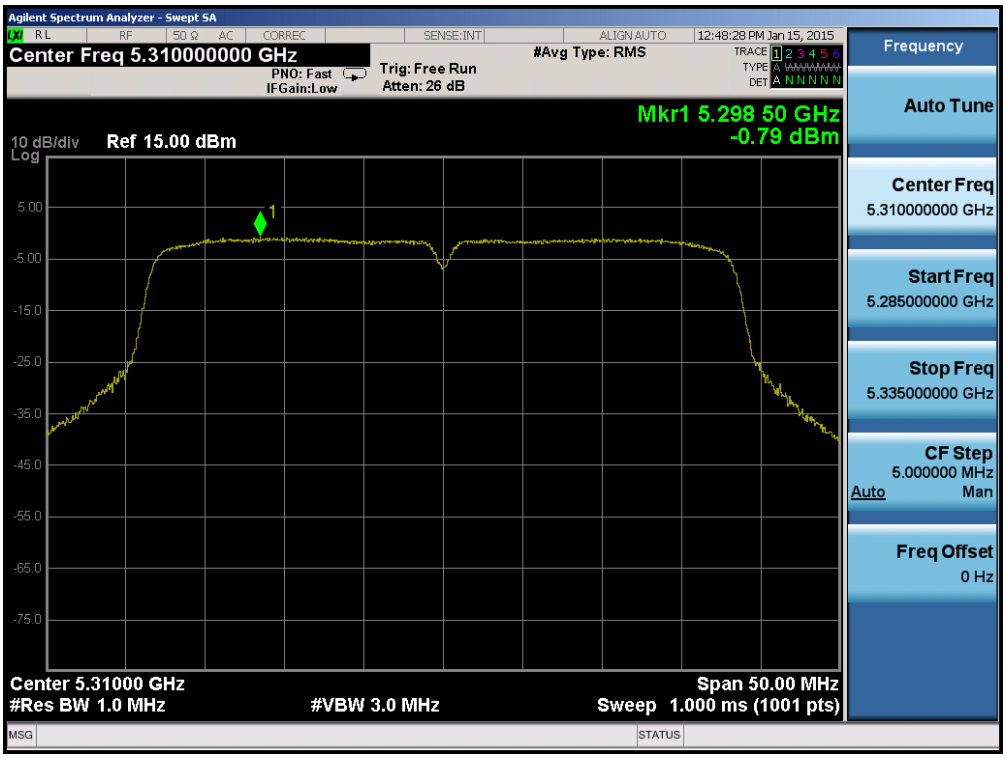


Plot 6-48. Peak Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)



Plot 6-49. Peak Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2A) – Ch. 62)

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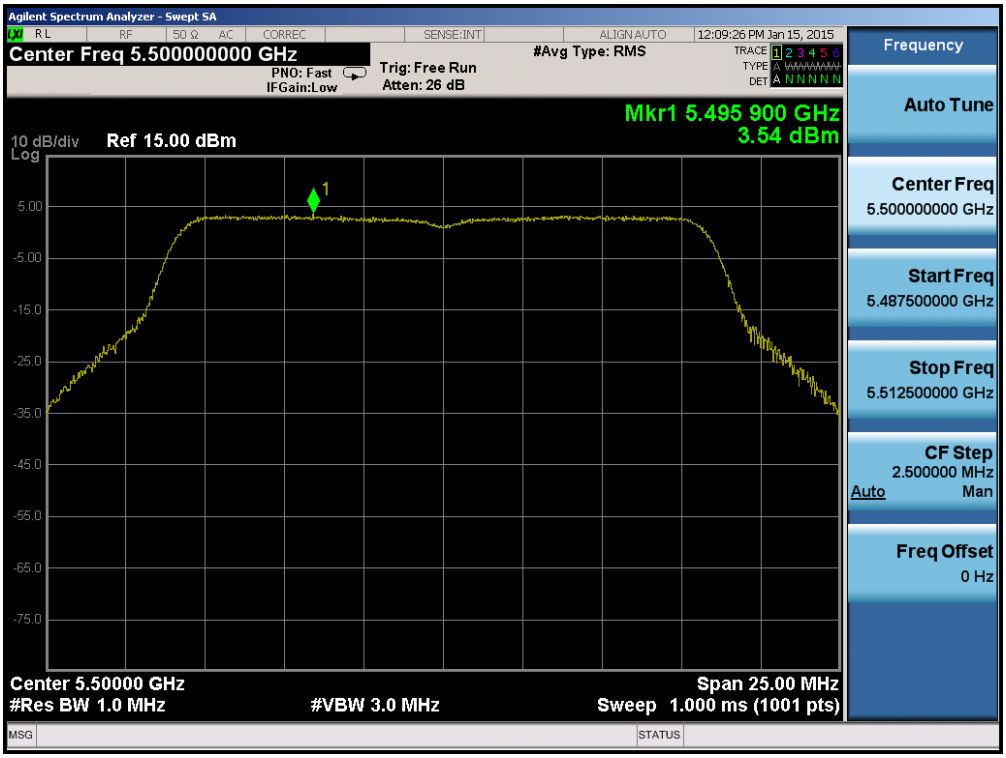
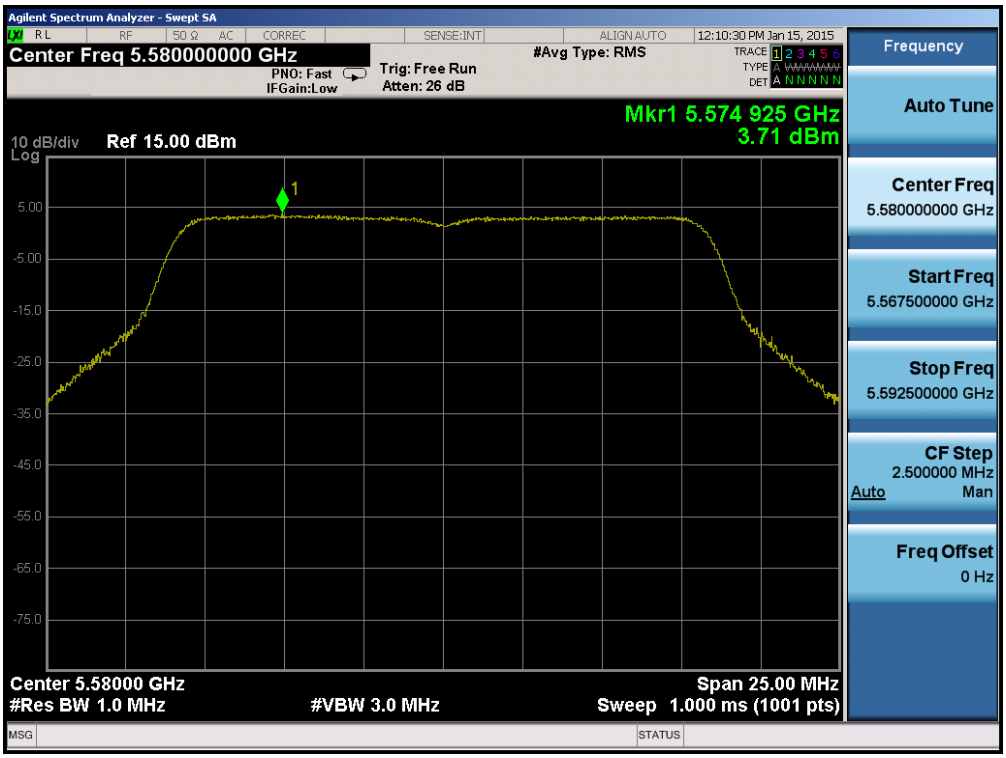


Plot 6-50. Peak Power Spectral Density Plot (802.11a (UNII Band 2C) – Ch. 100)



Plot 6-51. Peak Power Spectral Density Plot (802.11a (UNII Band 2C) – Ch. 116)

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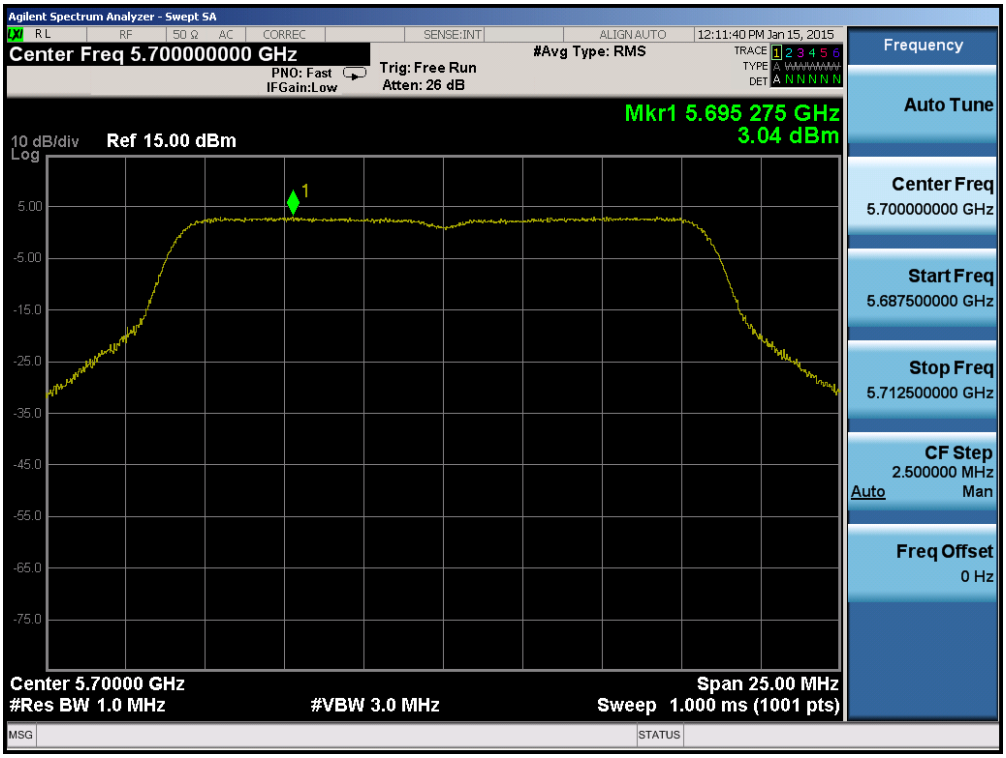
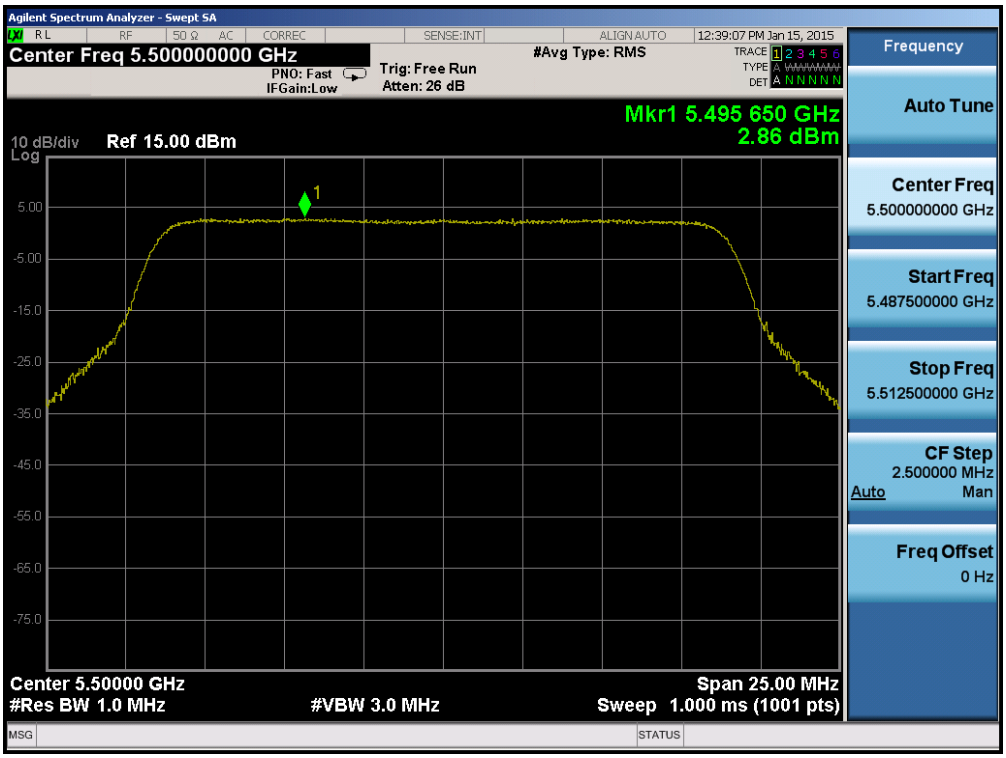


Plot 6-52. Peak Power Spectral Density Plot (802.11a (UNII Band 2C) – Ch. 140)



Plot 6-53. Peak Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 100)

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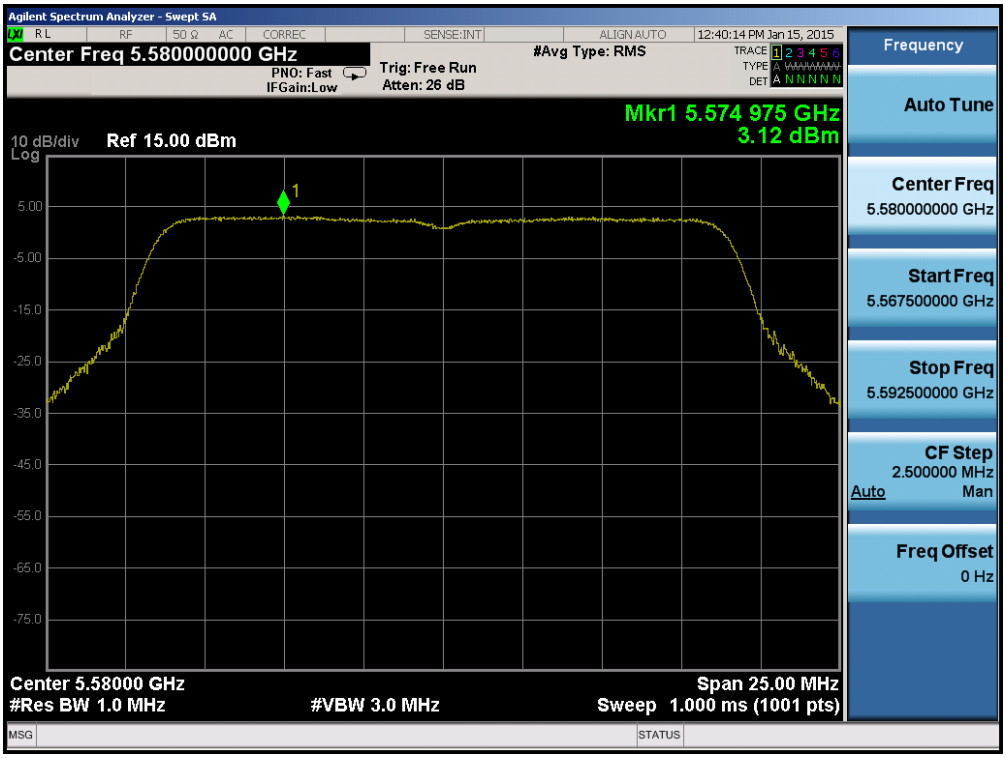
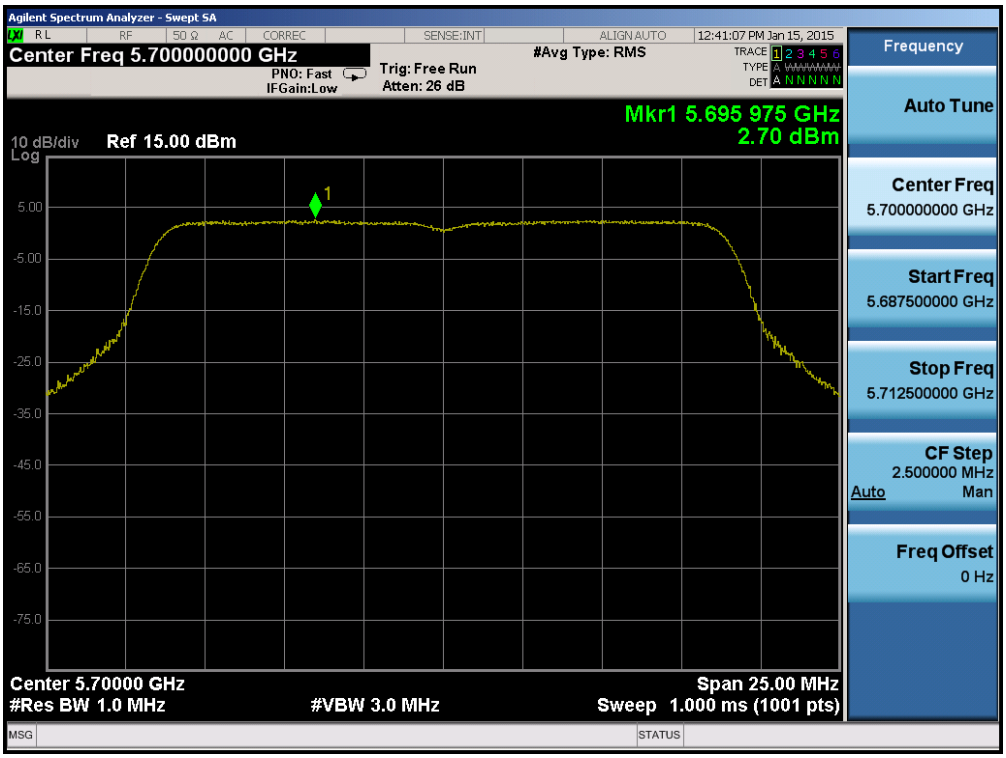


Plot 6-54. Peak Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 116)



Plot 6-55. Peak Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 140)

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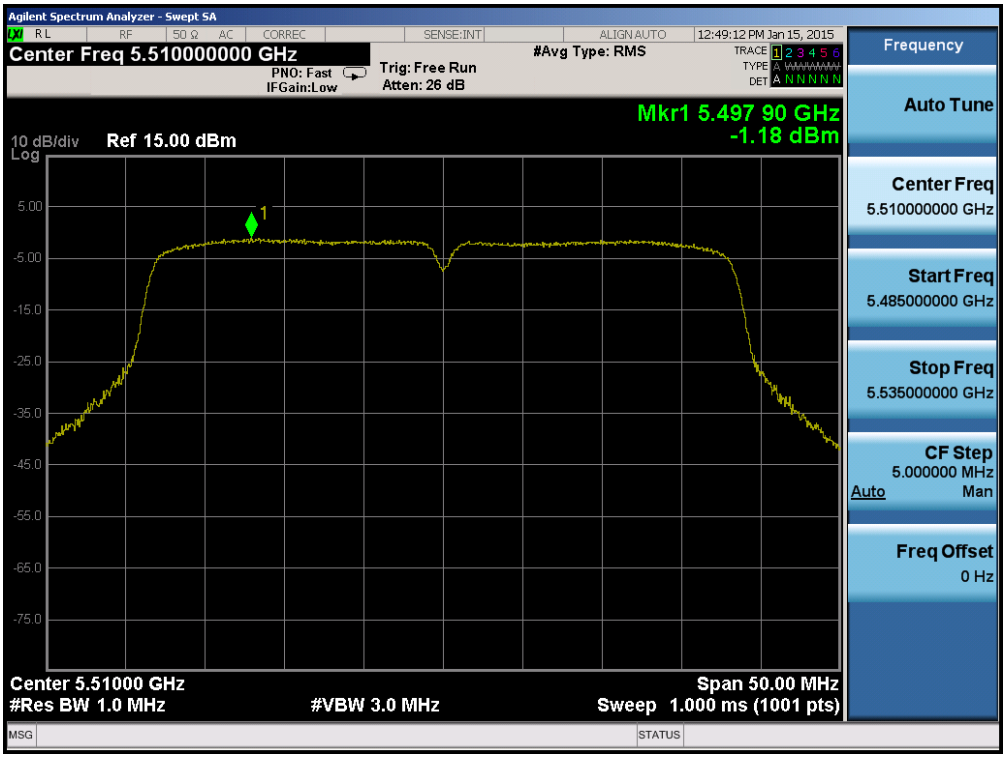
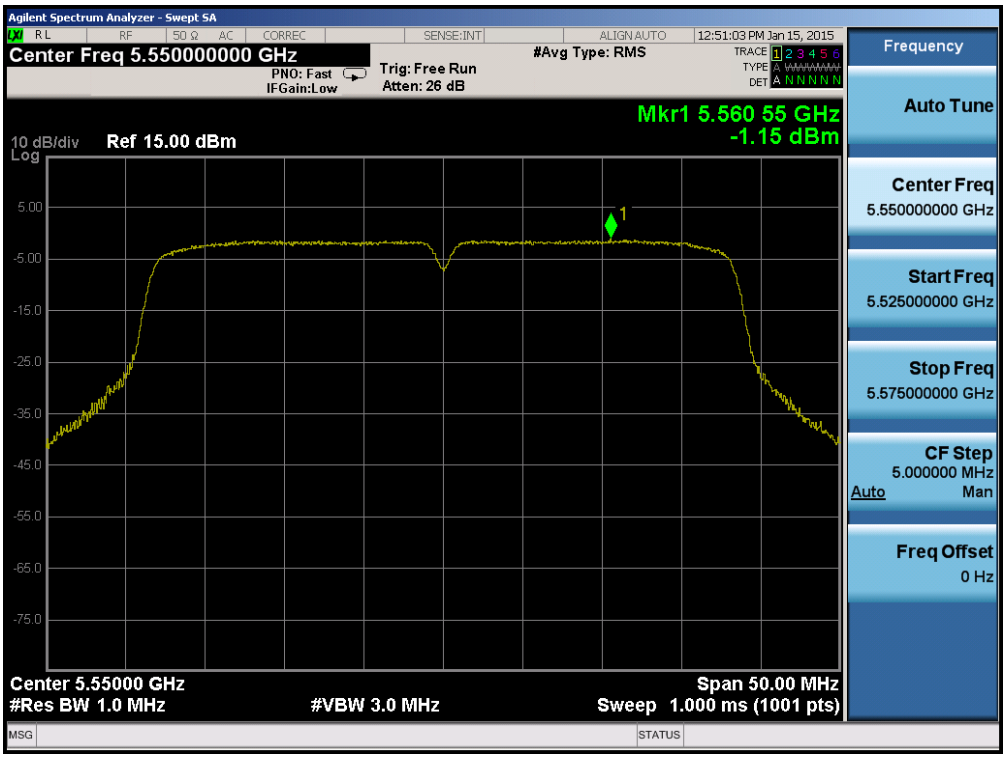


Plot 6-56. Peak Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 102)



Plot 6-57. Peak Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 110)

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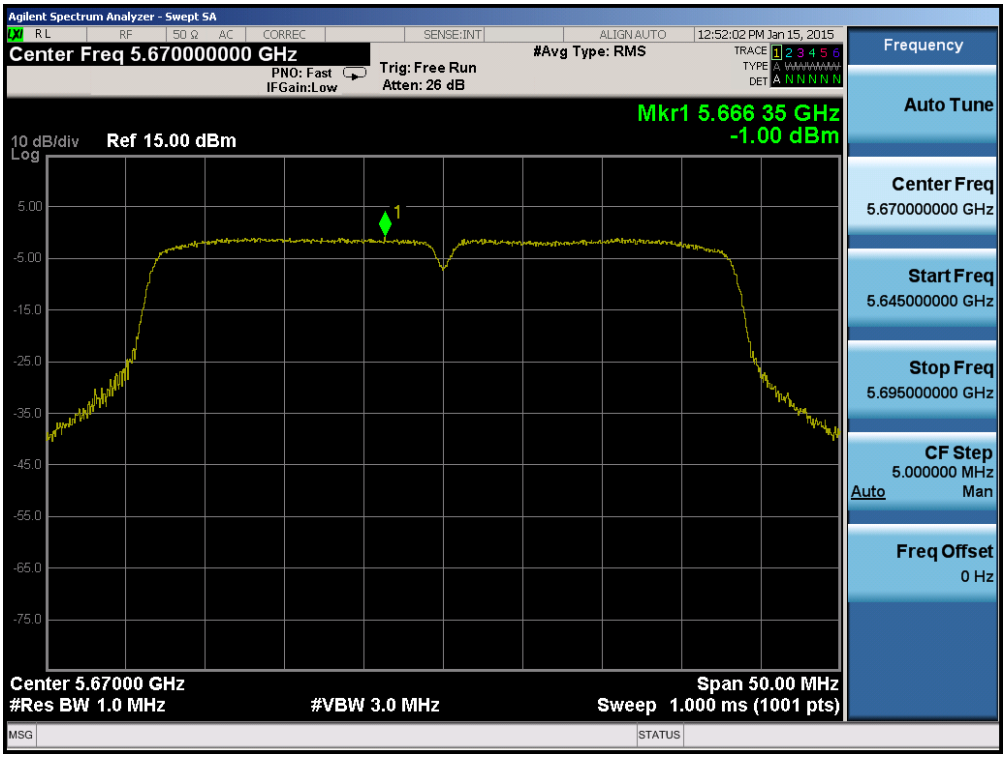

Plot 6-58. Peak Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 134)

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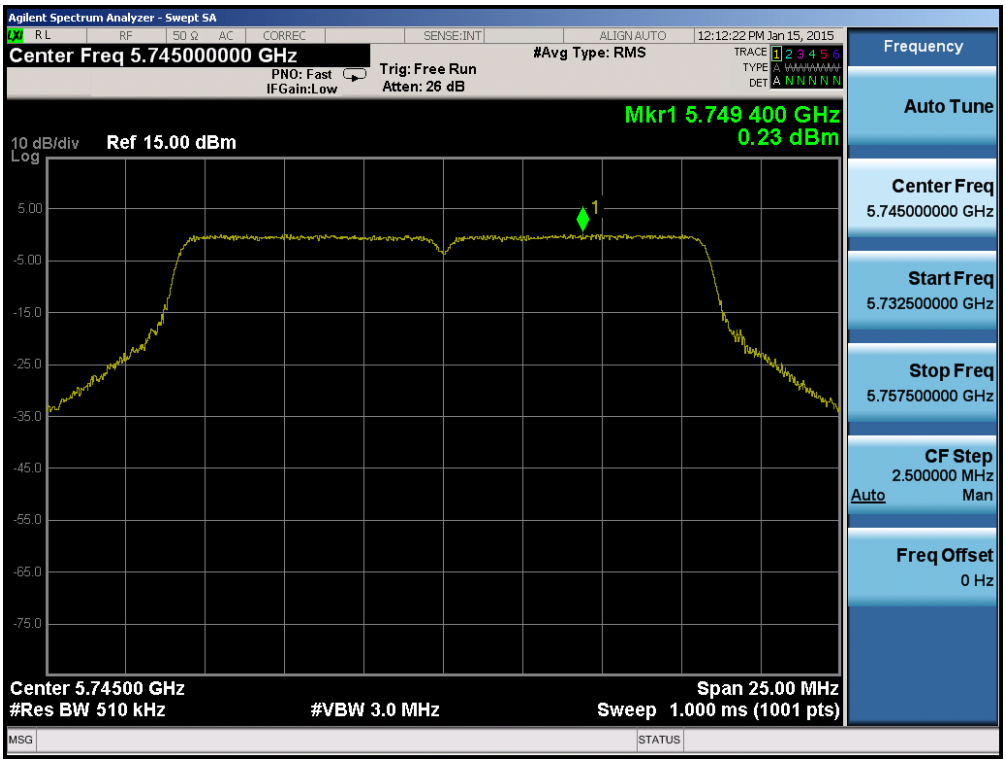
	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Power Density [dBm]	Max Permissible Power Density [dBm/500kHz]	Margin [dB]	Pass / Fail
Band 3	5745	149	a	6	0.23	30.0	-29.77	Pass
	5785	157	a	6	0.27	30.0	-29.73	Pass
	5825	165	a	6	0.20	30.0	-29.80	Pass
	5745	149	n (20MHz)	6.5/7.2 (MCS0)	-0.32	30.0	-30.32	Pass
	5785	157	n (20MHz)	6.5/7.2 (MCS0)	-0.17	30.0	-30.17	Pass
	5825	165	n (20MHz)	6.5/7.2 (MCS0)	-0.38	30.0	-30.38	Pass
	5755	151	n (40MHz)	13.5/15 (MCS0)	-4.16	30.0	-34.16	Pass
	5795	159	n (40MHz)	13.5/15 (MCS0)	-4.18	30.0	-34.18	Pass

Table 6-8. Band 3 Conducted Power Spectral Density Measurements



Plot 6-59. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 149)

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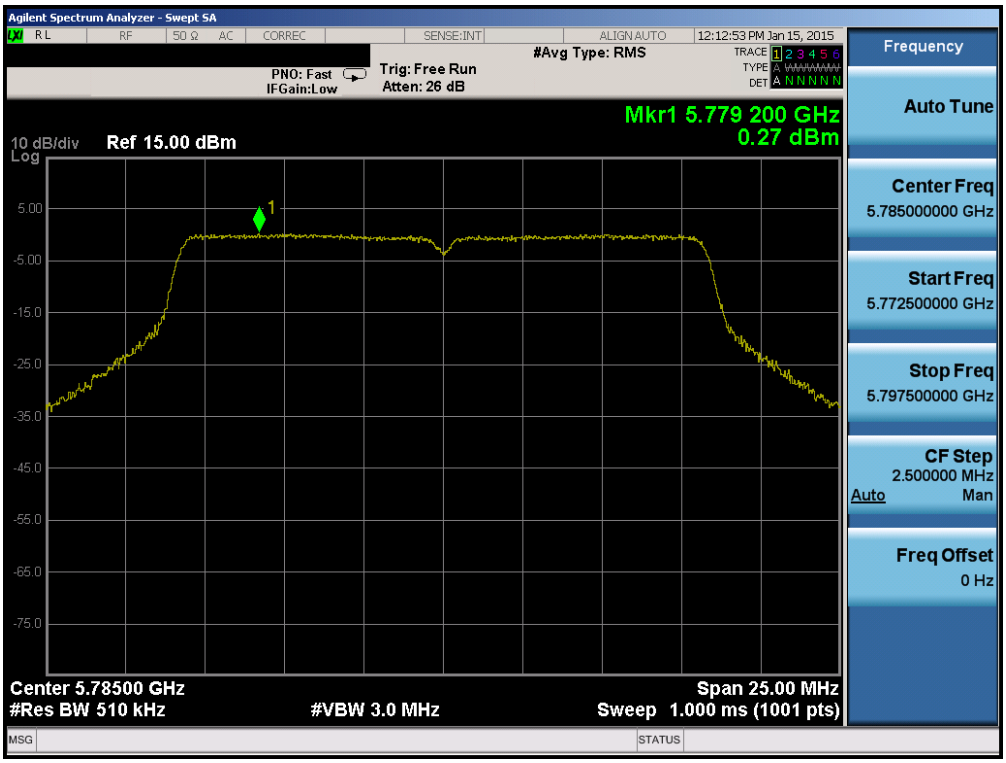
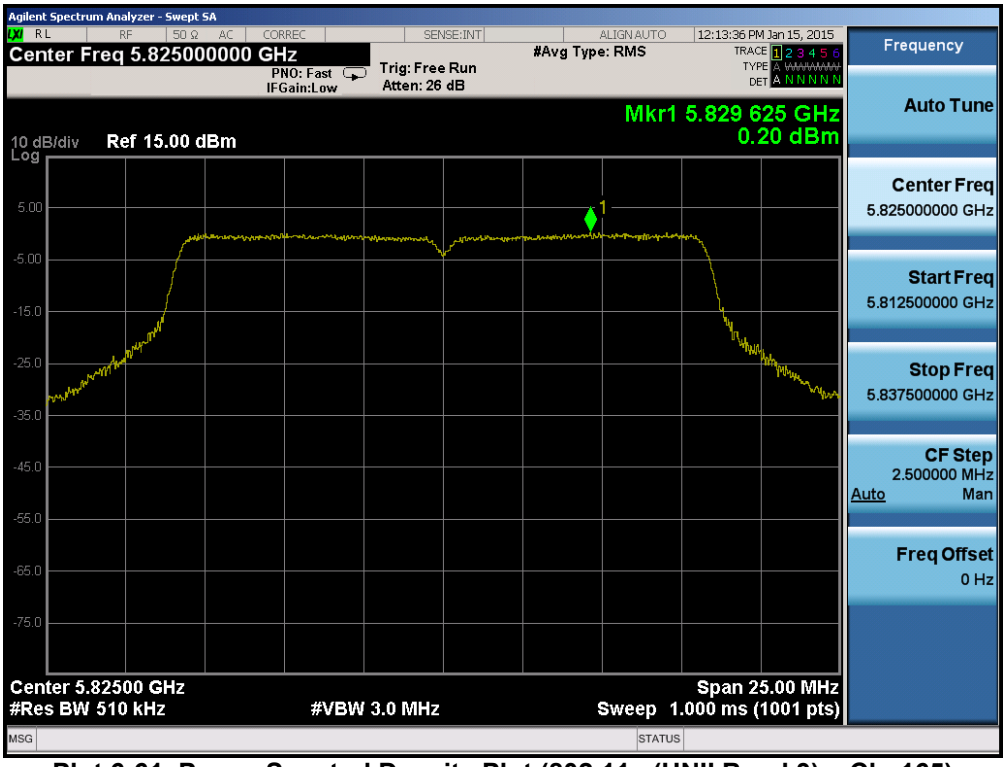


Plot 6-60. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 157)



Plot 6-61. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 165)

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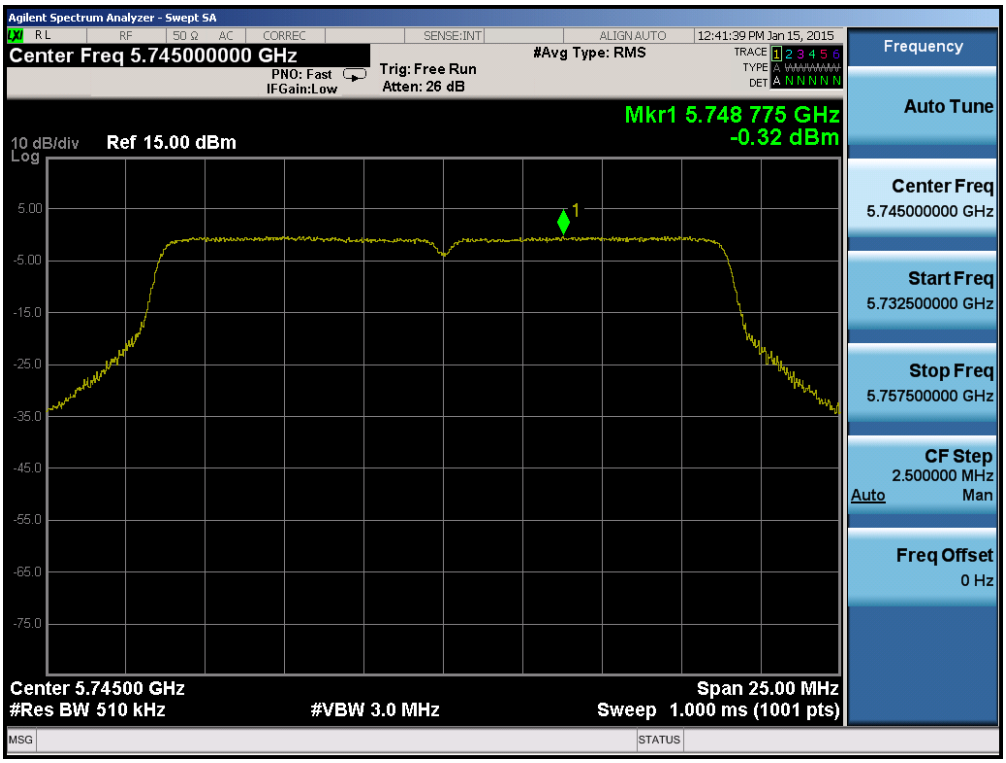
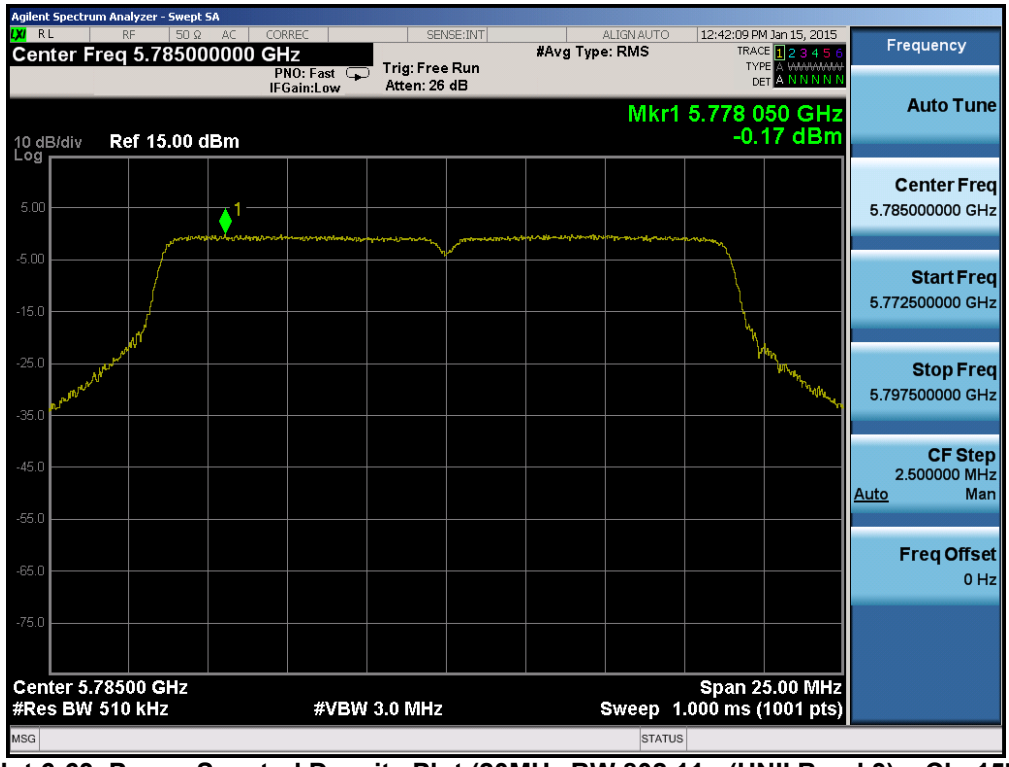


Plot 6-62. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 149)



Plot 6-63. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 157)

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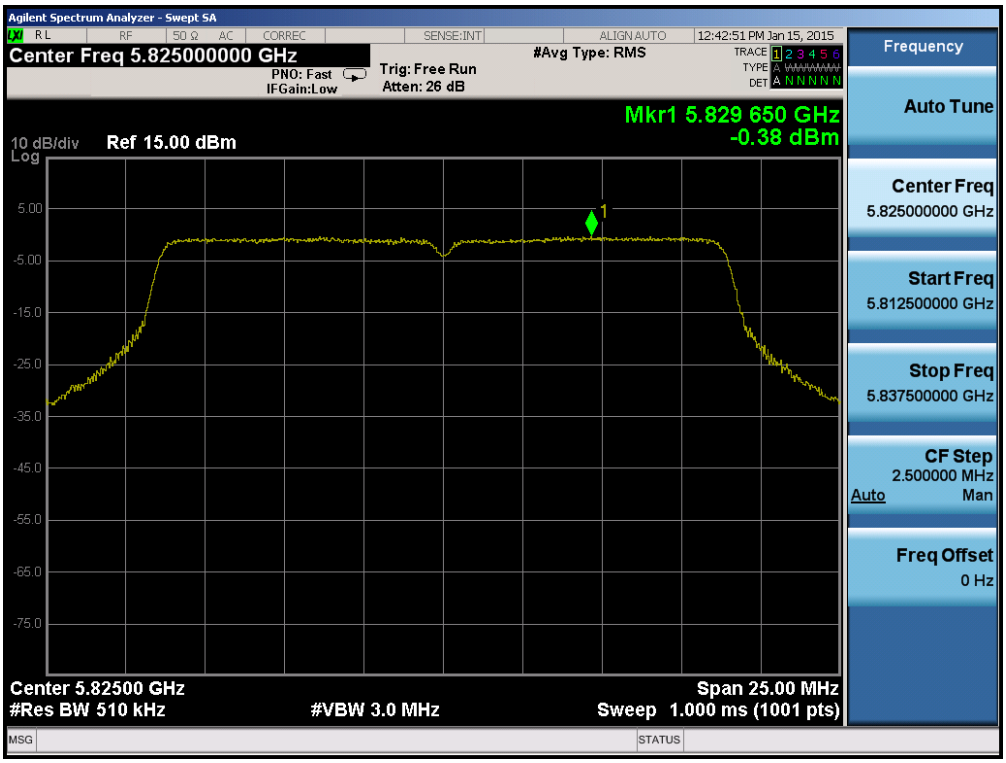
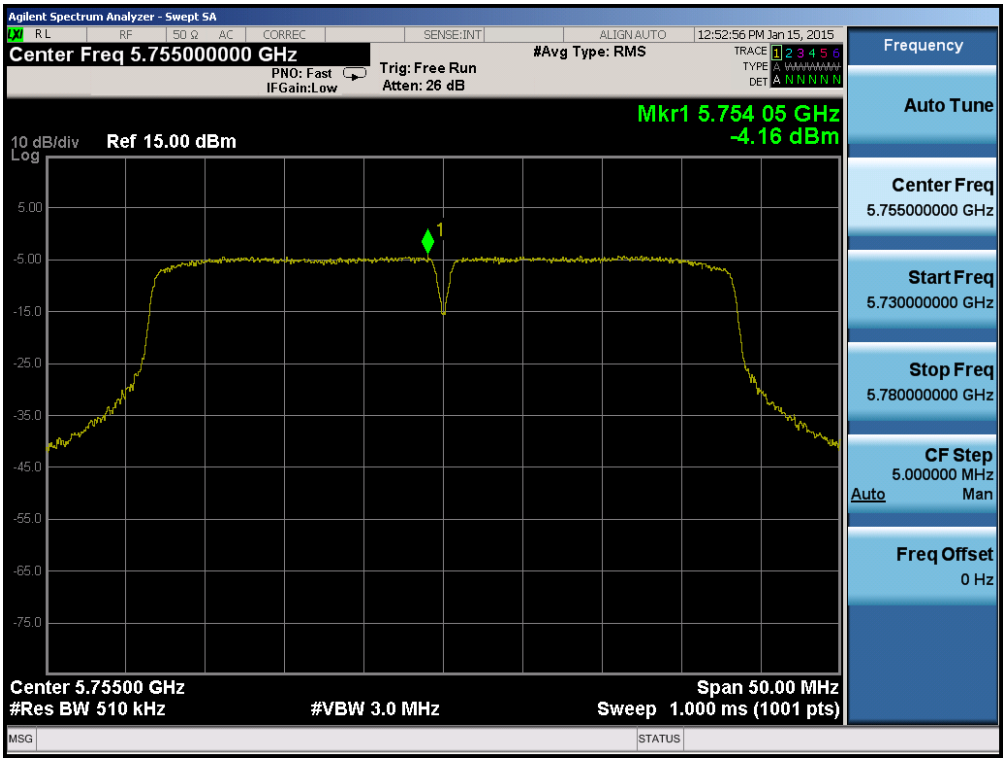


Plot 6-64. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 165)



Plot 6-65. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 151)

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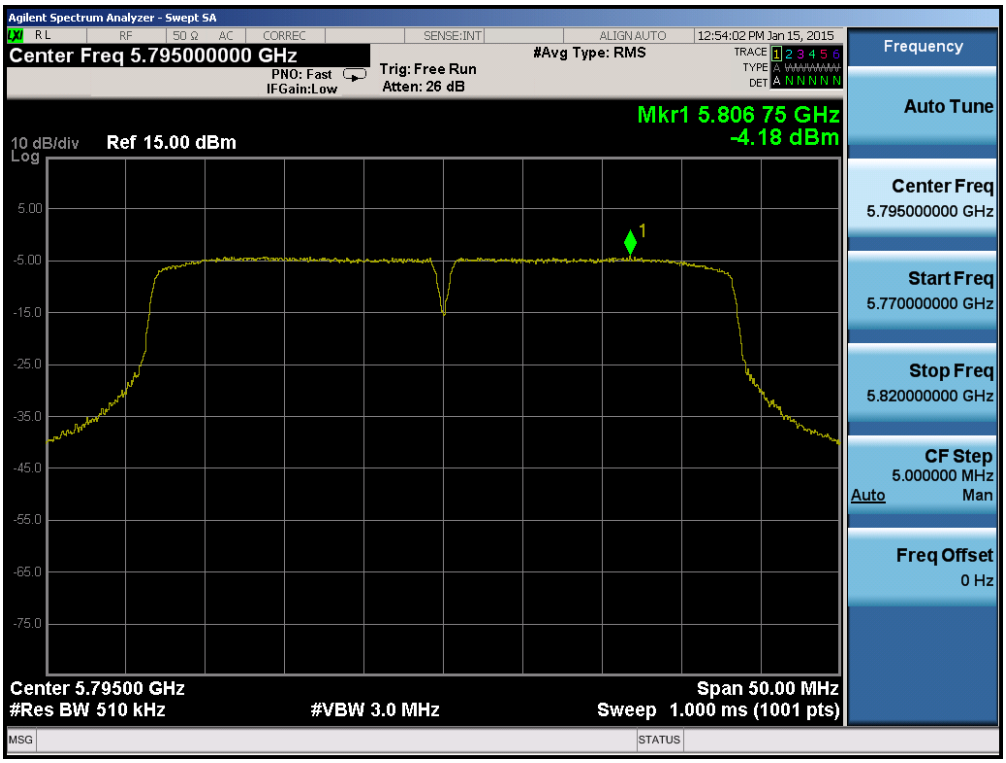

Plot 6-66. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 159)

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6.6 Frequency Stability

§15.407(g)

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -30°C and +50°C. The temperature was incremented by 10° intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded. Data for the worst case channel is shown below.

OPERATING FREQUENCY: 5,180,000,000 Hz

CHANNEL: 36

REFERENCE VOLTAGE: 3.85 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	5,179,999,984	-16	-0.00000031
100 %		- 30	5,179,999,983	-17	-0.00000033
100 %		- 20	5,180,000,016	16	0.00000031
100 %		- 10	5,179,999,989	-11	-0.00000021
100 %		0	5,180,000,020	20	0.00000039
100 %		+ 10	5,179,999,990	-10	-0.00000019
100 %		+ 20	5,179,999,985	-15	-0.00000029
100 %		+ 30	5,180,000,010	10	0.00000019
100 %		+ 40	5,180,000,017	17	0.00000033
100 %		+ 50	5,179,999,994	-6	-0.00000012
BATT. ENDPOINT	3.45	+ 20	5,179,999,996	-4	-0.00000008

Table 6-9. Frequency Stability Measurements for UNII Band 1 (Ch. 36)

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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Frequency Stability
§15.407(g)

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -30°C and +50°C. The temperature was incremented by 10° intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded. Data for the worst case channel is shown below.

OPERATING FREQUENCY: 5,260,000,000 Hz

CHANNEL: 52

REFERENCE VOLTAGE: 3.85 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	5,259,999,999	-1	-0.00000002
100 %		- 30	5,260,000,009	9	0.00000017
100 %		- 20	5,260,000,000	0	0.00000000
100 %		- 10	5,259,999,986	-14	-0.00000027
100 %		0	5,260,000,005	5	0.00000010
100 %		+ 10	5,259,999,998	-2	-0.00000004
100 %		+ 20	5,260,000,003	3	0.00000006
100 %		+ 30	5,260,000,004	4	0.00000008
100 %		+ 40	5,260,000,007	7	0.00000013
100 %		+ 50	5,260,000,012	12	0.00000023
BATT. ENDPOINT	3.45	+ 20	5,260,000,003	3	0.00000006

Table 6-10. Frequency Stability Measurements for UNII Band 2A (Ch. 52)

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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Frequency Stability
§15.407(g)

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -30°C and +50°C. The temperature was incremented by 10° intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded. Data for the worst case channel is shown below.

OPERATING FREQUENCY: 5,500,000,000 Hz

CHANNEL: 100

REFERENCE VOLTAGE: 3.85 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	5,499,999,982	-18	-0.00000033
100 %		- 30	5,500,000,013	13	0.00000024
100 %		- 20	5,499,999,986	-14	-0.00000025
100 %		- 10	5,500,000,003	3	0.00000005
100 %		0	5,499,999,997	-3	-0.00000005
100 %		+ 10	5,499,999,989	-11	-0.00000020
100 %		+ 20	5,499,999,997	-3	-0.00000005
100 %		+ 30	5,499,999,997	-3	-0.00000005
100 %		+ 40	5,500,000,009	9	0.00000016
100 %		+ 50	5,500,000,006	6	0.00000011
BATT. ENDPOINT	3.45	+ 20	5,500,000,018	18	0.00000033

Table 6-11. Frequency Stability Measurements for UNII Band 2C (Ch. 100)

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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6.7 Radiated Spurious Emission Measurements

§15.407(b) §15.205 §15.209

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in KDB 789033, and at the appropriate frequencies. All channels, modes (e.g. 802.11a, 802.11n (20MHz BW) and 802.11n (40MHz BW)), and modulations/data rates were investigated among all UNII bands. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 6-12 per Section 15.209.

Frequency	Field Strength [μV/m]	Measured Distance [Meters]
Above 960.0 MHz	500	3

Table 6-12. Radiated Limits

Test Procedures Used

KDB 789033 – Section G

Test Settings

Average Measurements above 1GHz (Method AD)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points = 1001 (Number of points must be ≥ 2 x span/RBW)
6. Averaging type = power (RMS)
7. Sweep time = auto couple
8. Trace was averaged over 100 sweeps

Peak Measurements above 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Peak Measurements below 1GHz

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1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = 120kHz
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

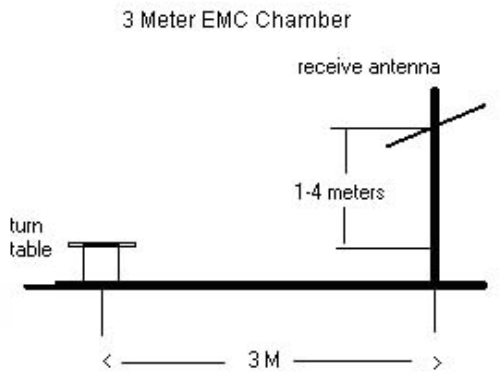

Figure 6-5. Test Instrument & Measurement Setup

Test Notes

1. All radiated spurious emissions levels were measured in a radiated test setup per the guidance of KDB 789033..
2. All emissions that lie in the restricted bands (denoted by a * next to the frequency) specified in §15.205 are below the limit shown in Table 6-12.
3. All spurious emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 6-11. All spurious emissions that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz. At a distance of 3 meters, the field strength limit in dBμV/m can be determined by adding a "conversion" factor of 95.2dB to the EIRP limit of -27dBm/MHz to obtain the limit for out of band spurious emissions of 68.2dBμV/m.
4. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
5. This unit was tested with its standard battery (Model: BL-51YF).
6. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are

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reported however emissions whose levels were not within 20dB of the respective limits were not reported.

7. Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
8. Radiated spurious emissions pre-scan plots are also reported at the beginning of the next section. The plots apply the appropriate system corrections, however, they do not show the fully maximized spectrum. The plots are only included for the purposes of identifying spurious emissions requiring further investigation. Rohde & Schwarz EMC32, Version 9.15.00 automated test software was used to perform the Radiated Spurious Emissions Pre-Scan testing.

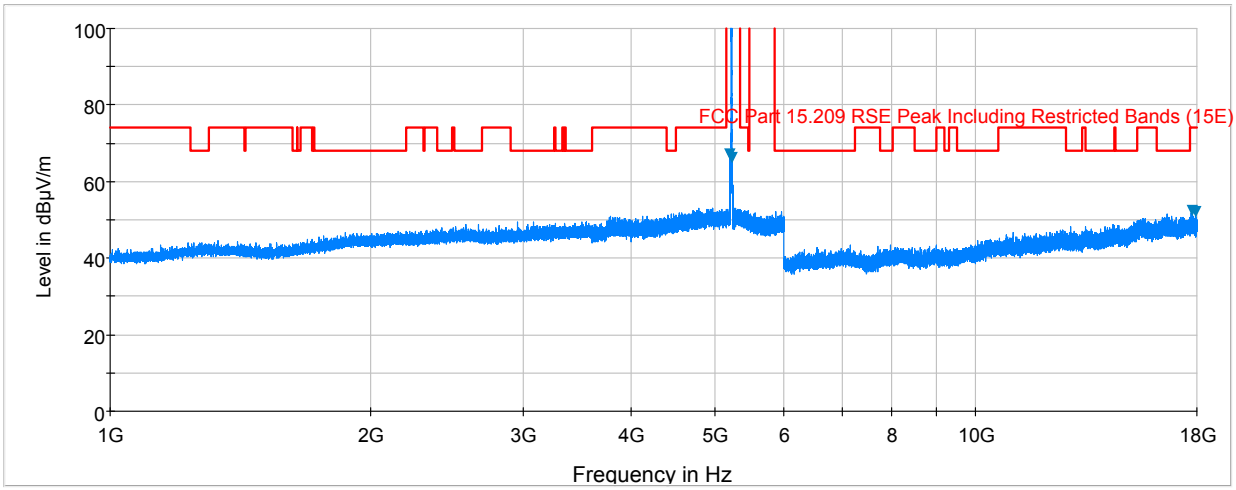
Sample Calculations

Determining Spurious Emissions Levels

- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

Radiated Band Edge Measurement Offset

- The amplitude offset shown in the radiated restricted band edge plots in Section 6.8 was calculated using the formula:
  Offset (dB) = (Antenna Factor + Cable Loss + 10 dB Attenuator) – Preamplifier Gain



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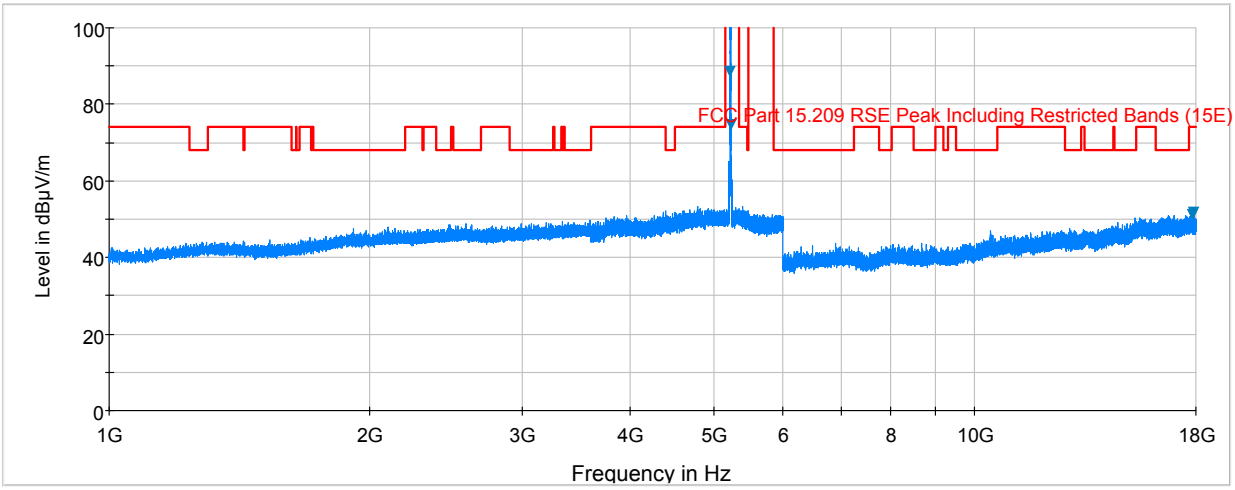
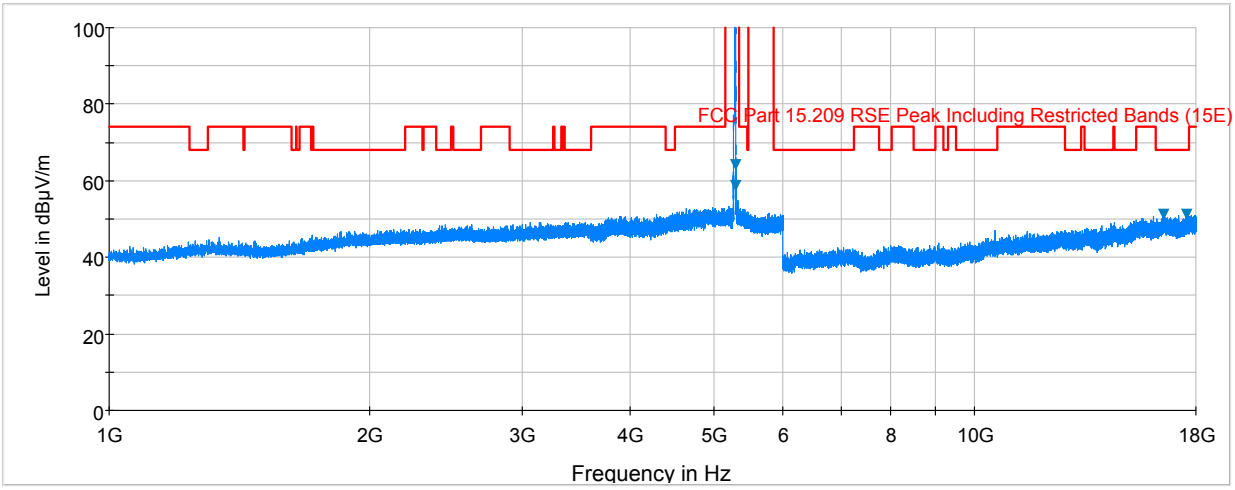
Plot 6-67. Radiated Spurious Plot above 1GHz (802.11a – U1, Ant. Pol. H)



Plot 6-68. Radiated Spurious Plot above 1GHz (802.11a – U1, Ant. Pol. V)



Plot 6-69. Radiated Spurious Plot above 1GHz (802.11a – U2A, Ant. Pol. H)

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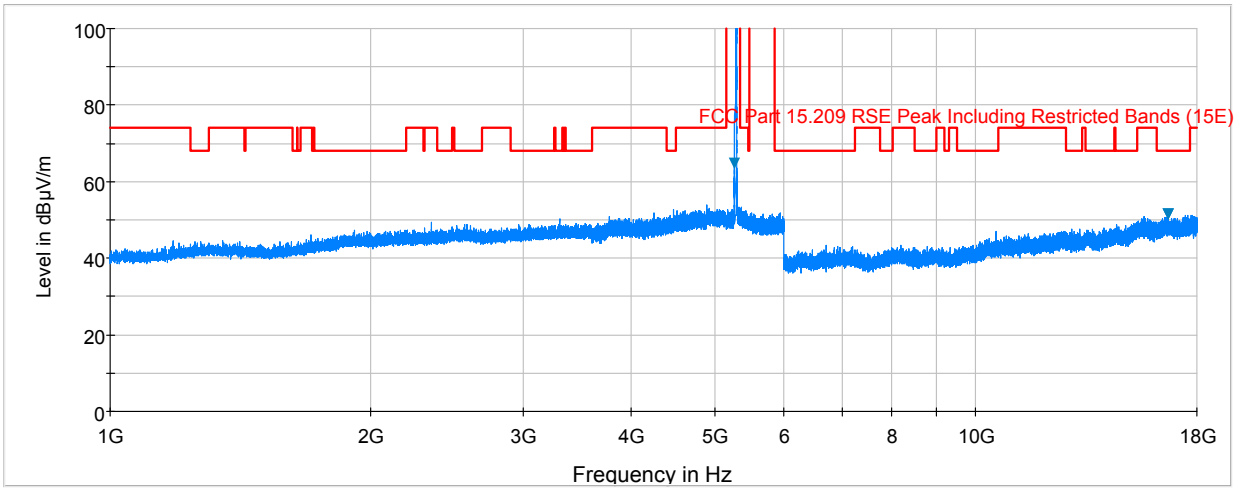
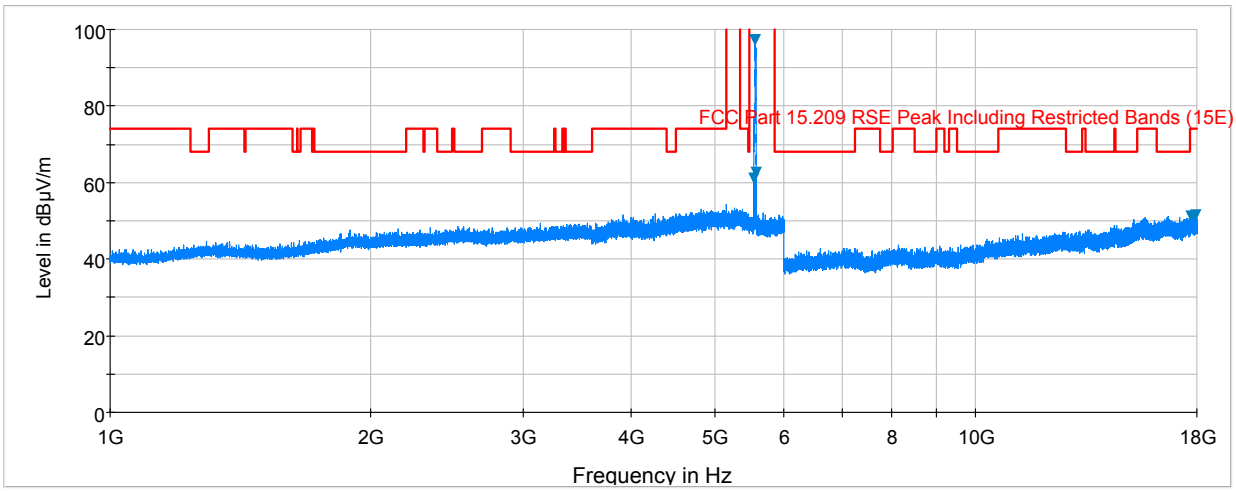


Plot 6-70. Radiated Spurious Plot above 1GHz (802.11a – U2A, Ant. Pol. V)



Plot 6-71. Radiated Spurious Plot above 1GHz (802.11a – U2C, Ant. Pol. H)

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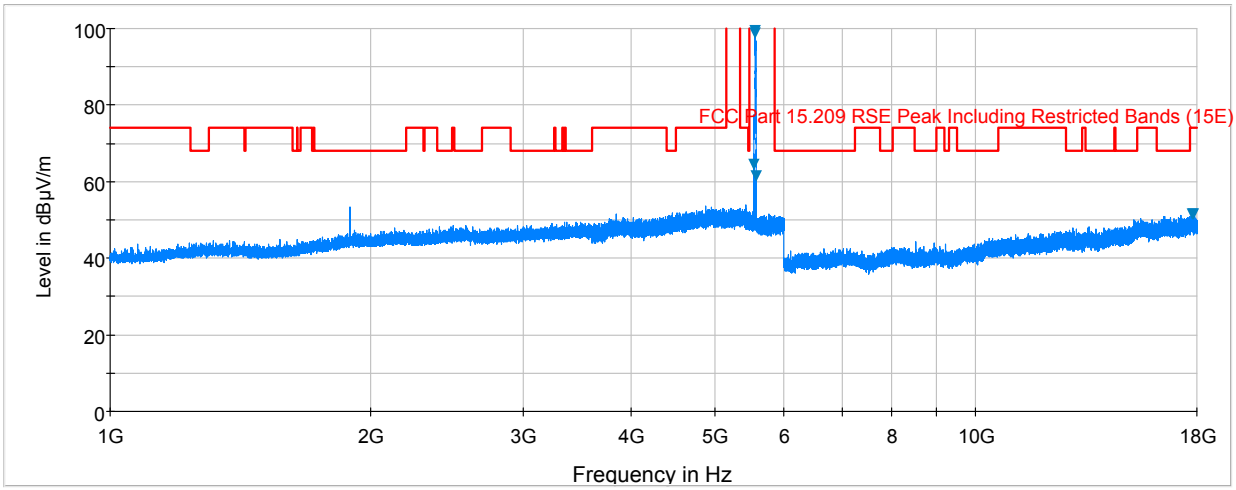
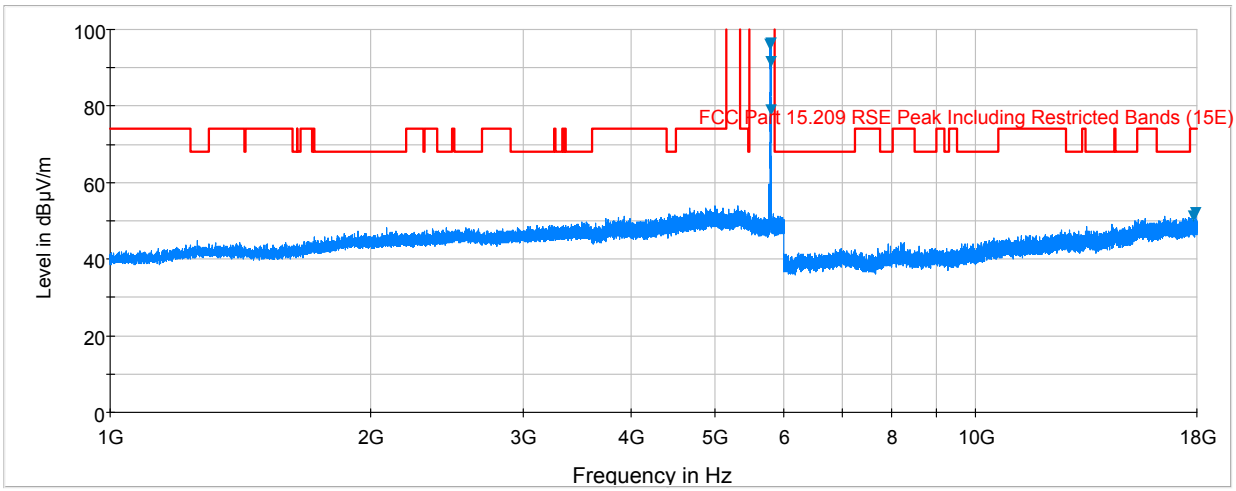


Plot 6-72. Radiated Spurious Plot above 1GHz (802.11a – U2C, Ant. Pol. V)



Plot 6-73. Radiated Spurious Plot above 1GHz (802.11a – U3, Ant. Pol. H)

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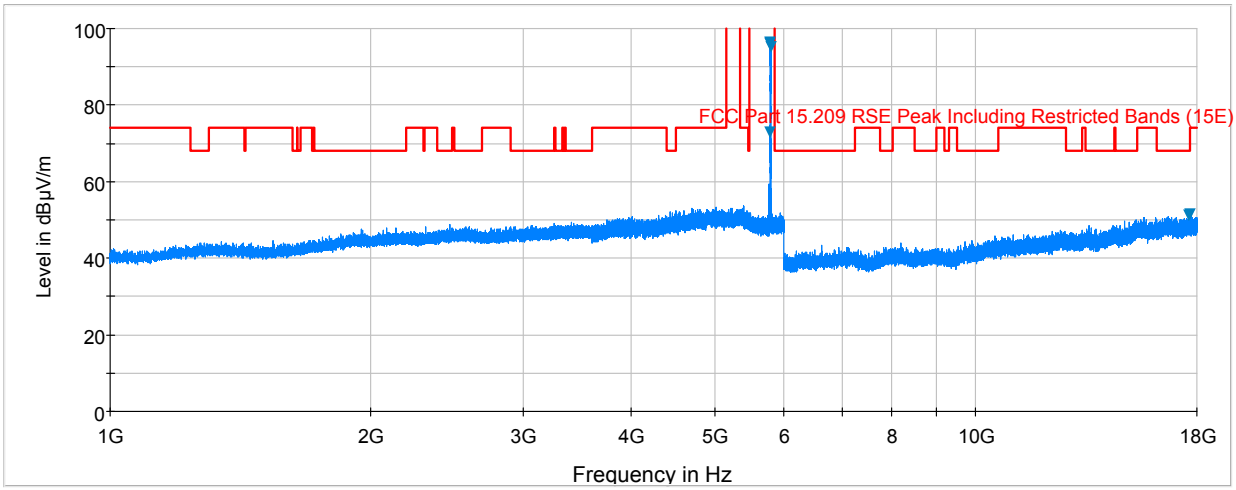

Plot 6-74. Radiated Spurious Plot above 1GHz (802.11a – U3, Ant. Pol. V)

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Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5180MHz
Channel: 36

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10360.00	-96.93	Peak	H	46.55	0.00	56.62	68.20	-11.58
*	15540.00	-109.42	Average	H	49.22	0.00	46.80	53.98	-7.18
*	15540.00	-97.42	Peak	H	49.22	0.00	58.80	73.98	-15.18
*	20720.00	-109.43	Average	H	44.20	-9.54	32.22	53.98	-21.76
*	20720.00	-92.87	Peak	H	44.20	-9.54	48.78	73.98	-25.20
	25900.00	-95.44	Peak	H	45.08	-9.54	47.09	68.20	-21.11

Table 6-13. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5200MHz
Channel: 40

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10400.00	-98.20	Peak	H	46.56	0.00	55.37	68.20	-12.83
*	15600.00	-109.85	Average	H	49.31	0.00	46.46	53.98	-7.52
*	15600.00	-98.69	Peak	H	49.31	0.00	57.62	73.98	-16.36
*	20800.00	-104.80	Average	H	44.20	-9.54	36.86	53.98	-17.12
*	20800.00	-96.80	Peak	H	44.20	-9.54	44.86	73.98	-29.12
	26000.00	-101.02	Peak	H	45.11	-9.54	41.55	68.20	-26.65

Table 6-14. Radiated Measurements

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Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5240MHz
Channel: 48

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10480.00	-97.62	Peak	H	46.58	0.00	55.96	68.20	-12.24
*	15720.00	-110.13	Average	H	49.58	0.00	46.45	53.98	-7.53
*	15720.00	-98.54	Peak	H	49.58	0.00	58.04	73.98	-15.94
*	20960.00	-106.01	Average	H	44.19	-9.54	35.63	53.98	-18.35
*	20960.00	-97.08	Peak	H	44.19	-9.54	44.56	73.98	-29.42
	26200.00	-97.24	Peak	H	44.95	-9.54	45.17	68.20	-23.03

Table 6-15. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5260MHz
Channel: 52

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10520.00	-97.39	Peak	H	46.59	0.00	56.20	68.20	-12.00
*	15780.00	-109.17	Average	H	49.80	0.00	47.63	53.98	-6.35
*	15780.00	-97.89	Peak	H	49.80	0.00	58.91	73.98	-15.07
*	21040.00	-106.52	Average	H	44.18	-9.54	35.11	53.98	-18.86
*	21040.00	-97.60	Peak	H	44.18	-9.54	44.03	73.98	-29.94
	26300.00	-96.40	Peak	H	44.95	-9.54	46.00	68.20	-22.20

Table 6-16. Radiated Measurements

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Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5280MHz
Channel: 56

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10560.00	-97.33	Peak	H	46.61	0.00	56.28	68.20	-11.92
*	15840.00	-110.19	Average	H	50.04	0.00	46.85	53.98	-7.13
*	15840.00	-98.87	Peak	H	50.04	0.00	58.17	73.98	-15.81
*	21120.00	-106.58	Average	H	44.17	-9.54	35.05	53.98	-18.93
*	21120.00	-96.45	Peak	H	44.17	-9.54	45.18	73.98	-28.80
	26400.00	-95.01	Peak	H	45.01	-9.54	47.45	68.20	-20.75

Table 6-17. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5320MHz
Channel: 64

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	10640.00	-109.29	Average	H	46.64	0.00	44.35	53.98	-9.63
*	10640.00	-97.13	Peak	H	46.64	0.00	56.51	73.98	-17.47
*	15960.00	-109.80	Average	H	50.49	0.00	47.69	53.98	-6.29
*	15960.00	-98.55	Peak	H	50.49	0.00	58.94	73.98	-15.04
*	21280.00	-108.17	Average	H	44.18	-9.54	33.46	53.98	-20.51
*	21280.00	-98.35	Peak	H	44.18	-9.54	43.28	73.98	-30.69
	26600.00	-118.05	Peak	H	47.61	-9.54	27.01	68.20	-41.19

Table 6-18. Radiated Measurements

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Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5500MHz
Channel: 100

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11000.00	-109.70	Average	H	46.98	0.00	44.28	53.98	-9.70
*	11000.00	-97.40	Peak	H	46.98	0.00	56.58	73.98	-17.40
	16500.00	-98.41	Peak	H	52.45	0.00	61.04	68.20	-7.17
	22000.00	-96.22	Peak	H	44.47	-9.54	45.71	68.20	-22.49
	27500.00	-112.19	Peak	H	47.92	-9.54	33.19	68.20	-35.01

Table 6-19. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5580MHz
Channel: 116

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11160.00	-109.64	Average	H	47.20	0.00	44.57	53.98	-9.41
*	11160.00	-97.45	Peak	H	47.20	0.00	56.76	73.98	-17.22
	16740.00	-98.62	Peak	H	53.73	0.00	62.11	68.20	-6.09
*	22320.00	-108.78	Average	H	44.59	-9.54	33.27	53.98	-20.71
*	22320.00	-99.60	Peak	H	44.59	-9.54	42.45	73.98	-31.53
	27900.00	-111.92	Peak	H	48.09	-9.54	33.63	68.20	-34.57

Table 6-20. Radiated Measurements

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Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	1 & 3 Meters
Operating Frequency:	5700MHz
Channel:	140

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Ant. Pol. [H/V]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11400.00	-110.37	Average	H	47.64	0.00	44.27	53.98	-9.70
*	11400.00	-97.44	Peak	H	47.64	0.00	57.20	73.98	-16.77
	17100.00	-98.31	Peak	H	54.67	0.00	63.36	68.20	-4.84
*	22800.00	-110.60	Average	H	44.62	-9.54	31.48	53.98	-22.50
*	22800.00	-100.32	Peak	H	44.62	-9.54	41.76	73.98	-32.22
	28500.00	-107.89	Peak	H	48.35	-9.54	37.92	68.20	-30.28

Table 6-21. Radiated Measurements

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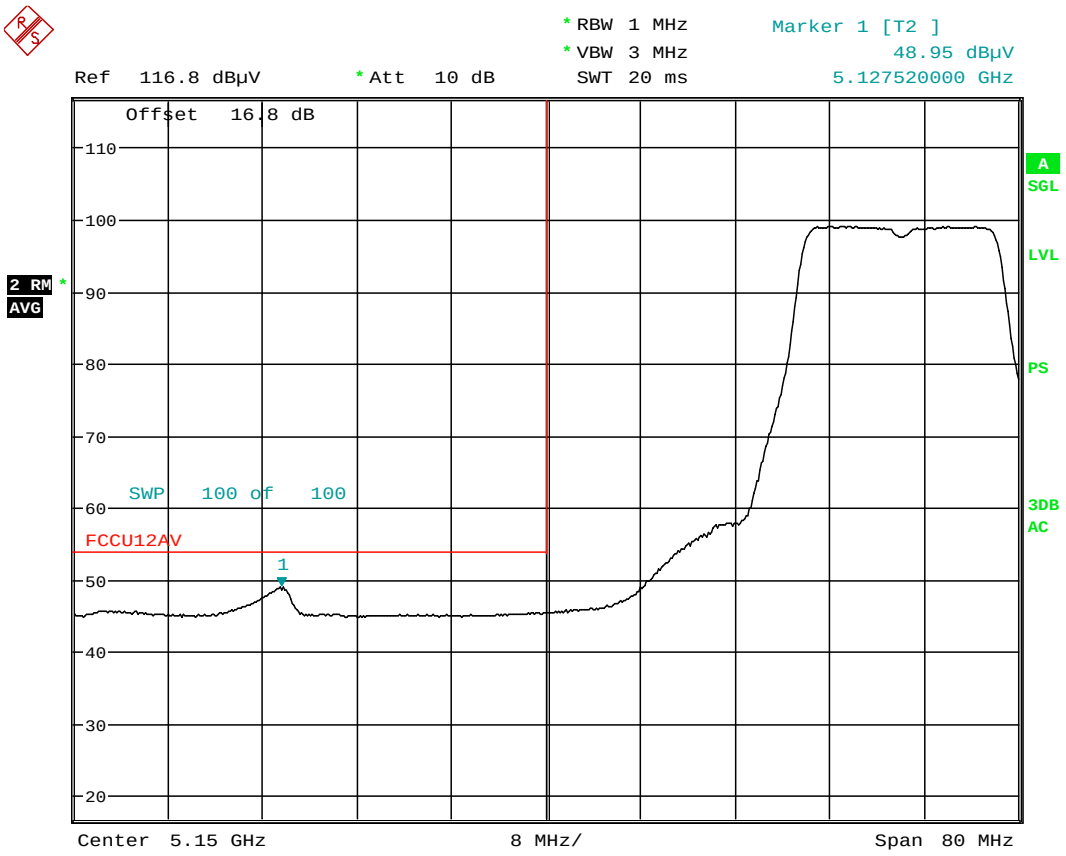
6.8 Radiated Band Edge Measurements (20MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	5180MHz
Channel:	36



Date: 16.JAN.2015 11:15:09

Plot 6-75. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

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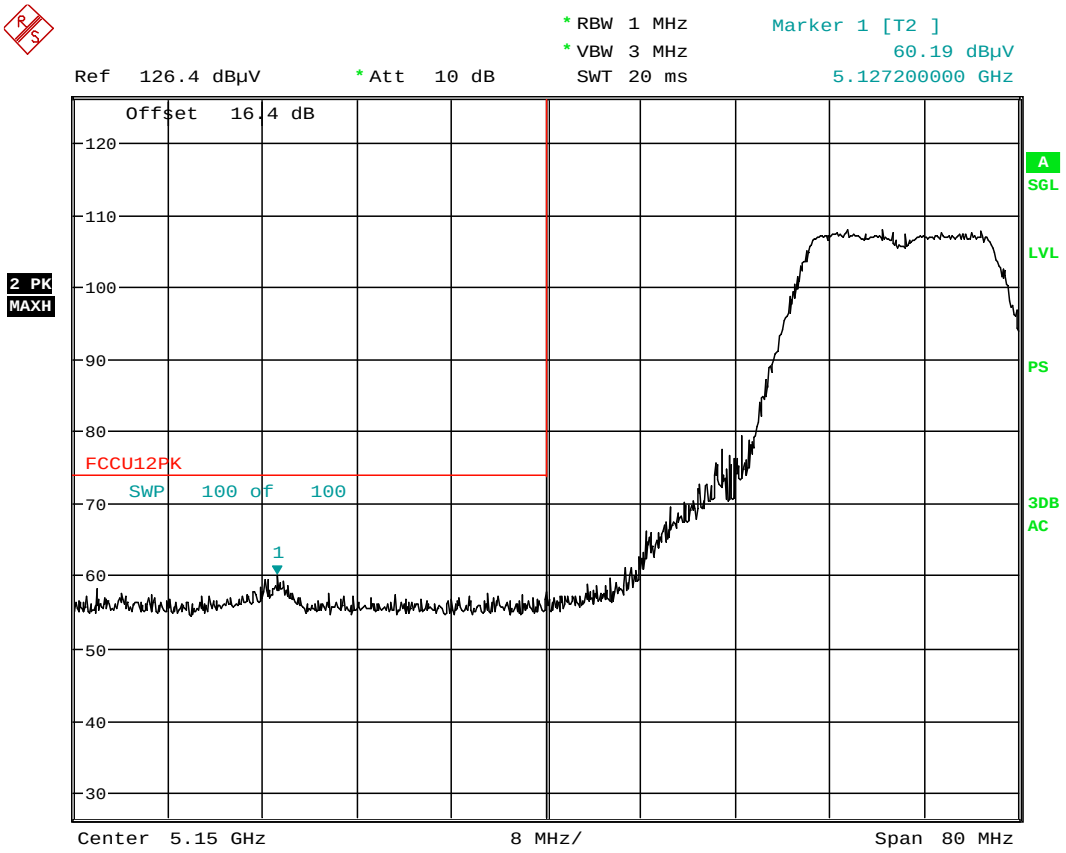
Radiated Band Edge Measurements (20MHz BW)

§15.407(b) §15.205 §15.209



Date: 16.JAN.2015 11:16:03

Plot 6-76. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

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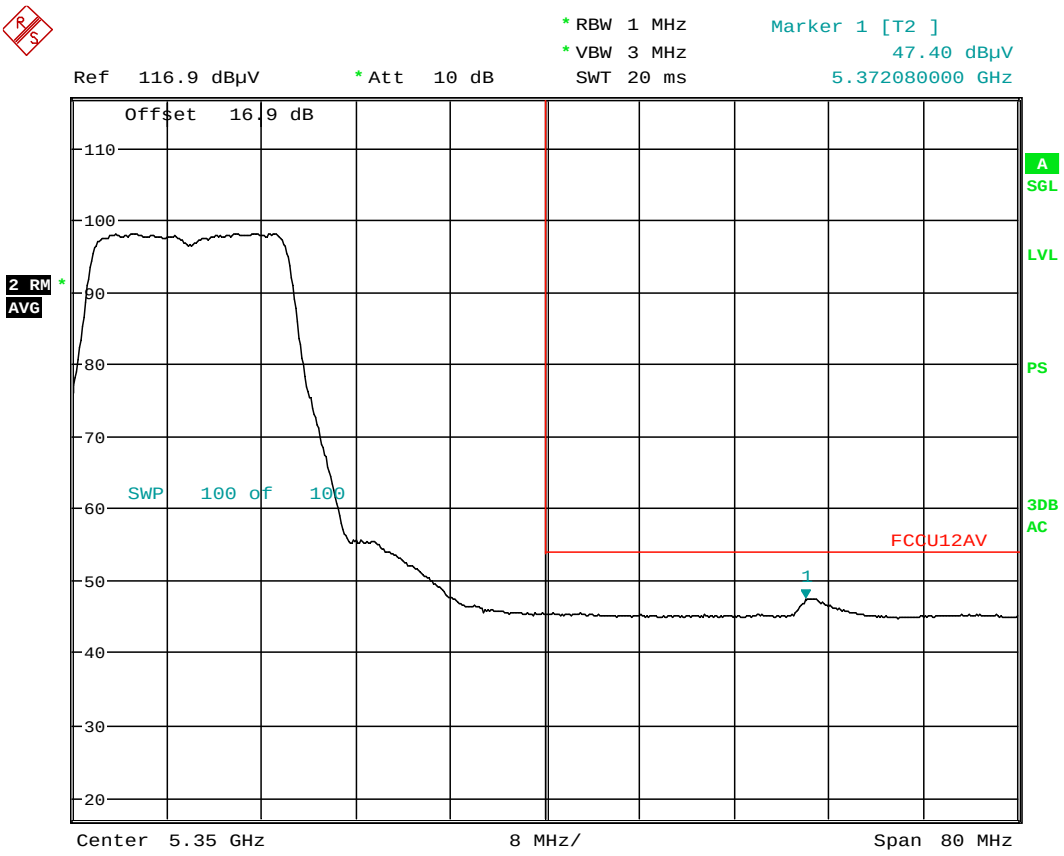
Radiated Band Edge Measurements (20MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	5320MHz
Channel:	64



Date: 16.JAN.2015 11:21:39

Plot 6-77. Radiated Restricted Upper Band Edge Plot (Average – UNII Band 2A)

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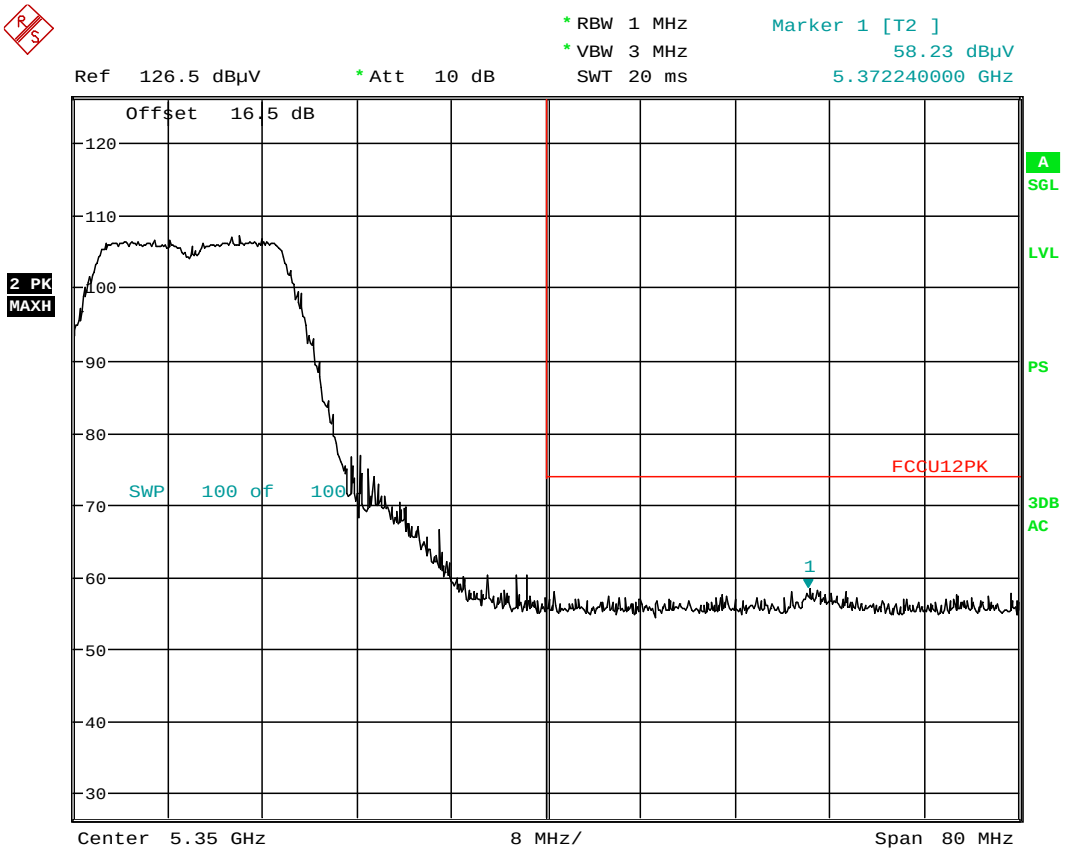
Radiated Band Edge Measurements (20MHz BW)

§15.407(b) §15.205 §15.209



Date: 16.JAN.2015 11:22:33

Plot 6-78. Radiated Restricted Upper Band Edge Plot (Peak – UNII Band 2A)

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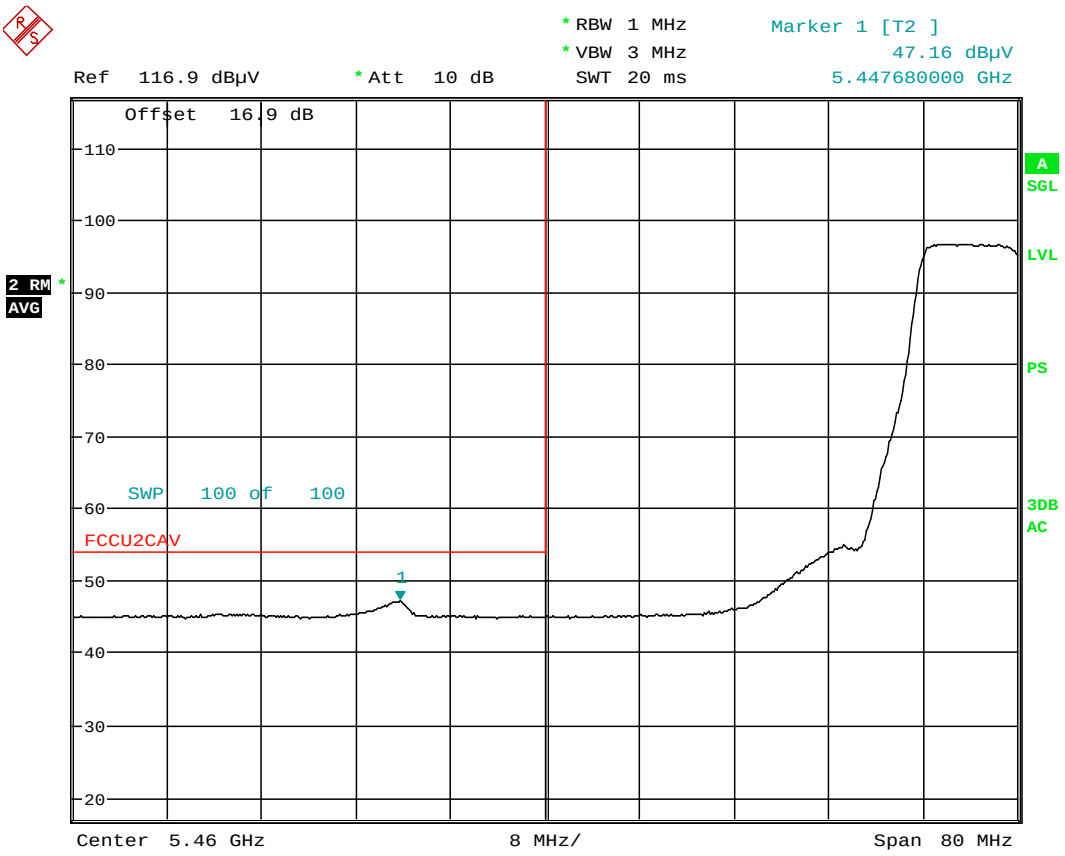
Radiated Band Edge Measurements (20MHz BW)
§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	5500MHz
Channel:	100



Date: 16.JAN.2015 11:27:12

Plot 6-79. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 2C)

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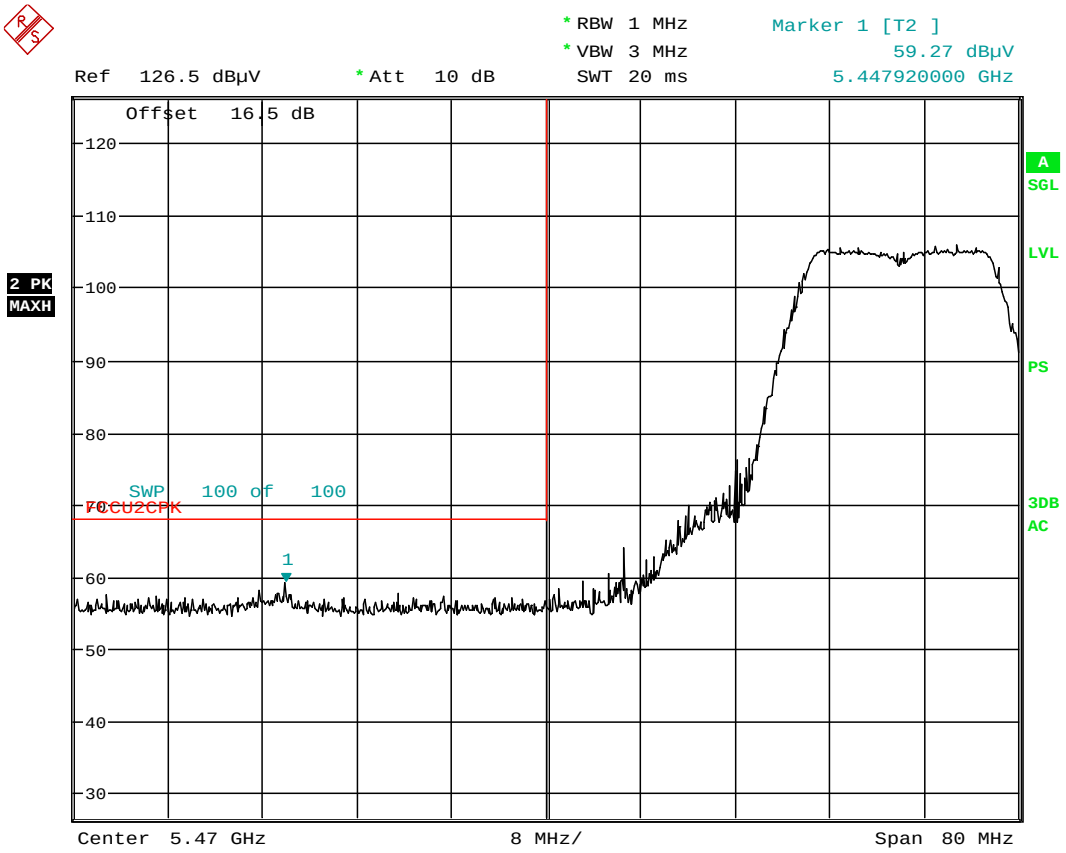
Radiated Band Edge Measurements (20MHz BW)

§15.407(b) §15.205 §15.209



Date: 16.JAN.2015 11:28:42

Plot 6-80. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 2C)

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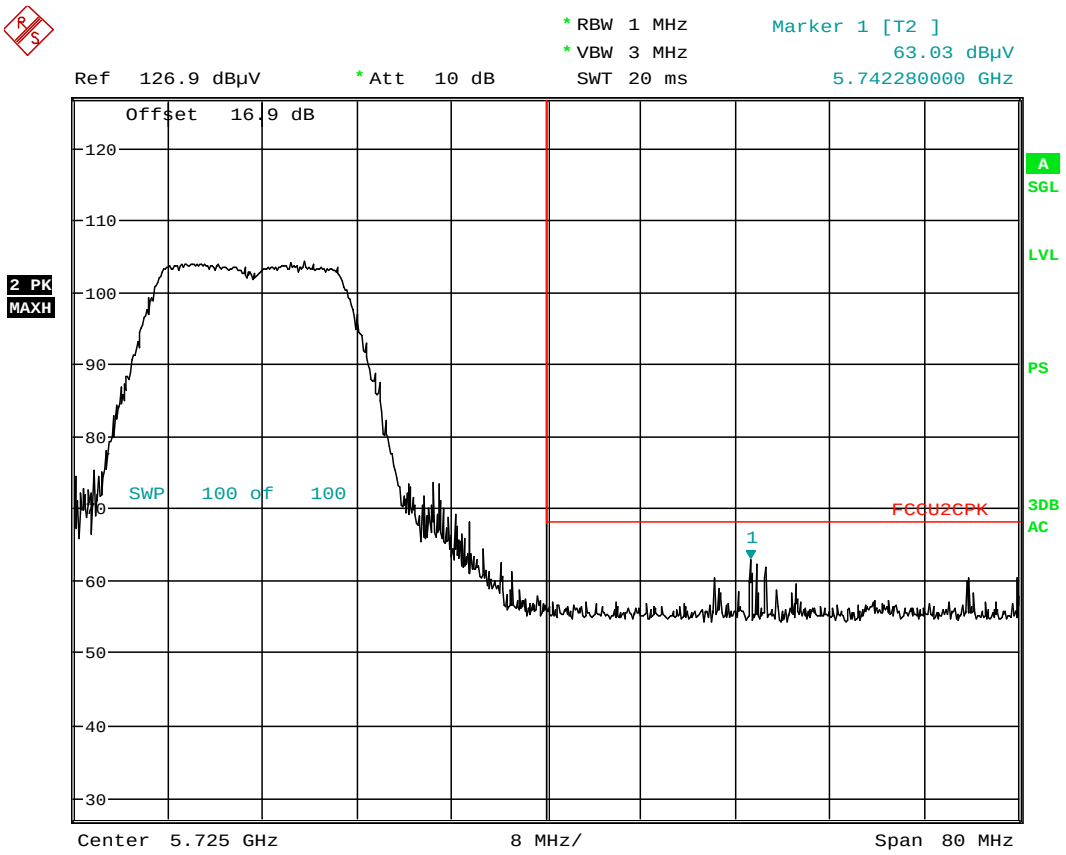
Radiated Band Edge Measurements (20MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	5700MHz
Channel:	140



Date: 16.JAN.2015 11:53:43

Plot 6-81. Radiated Upper Band Edge Plot (Peak – UNII Band 2C)

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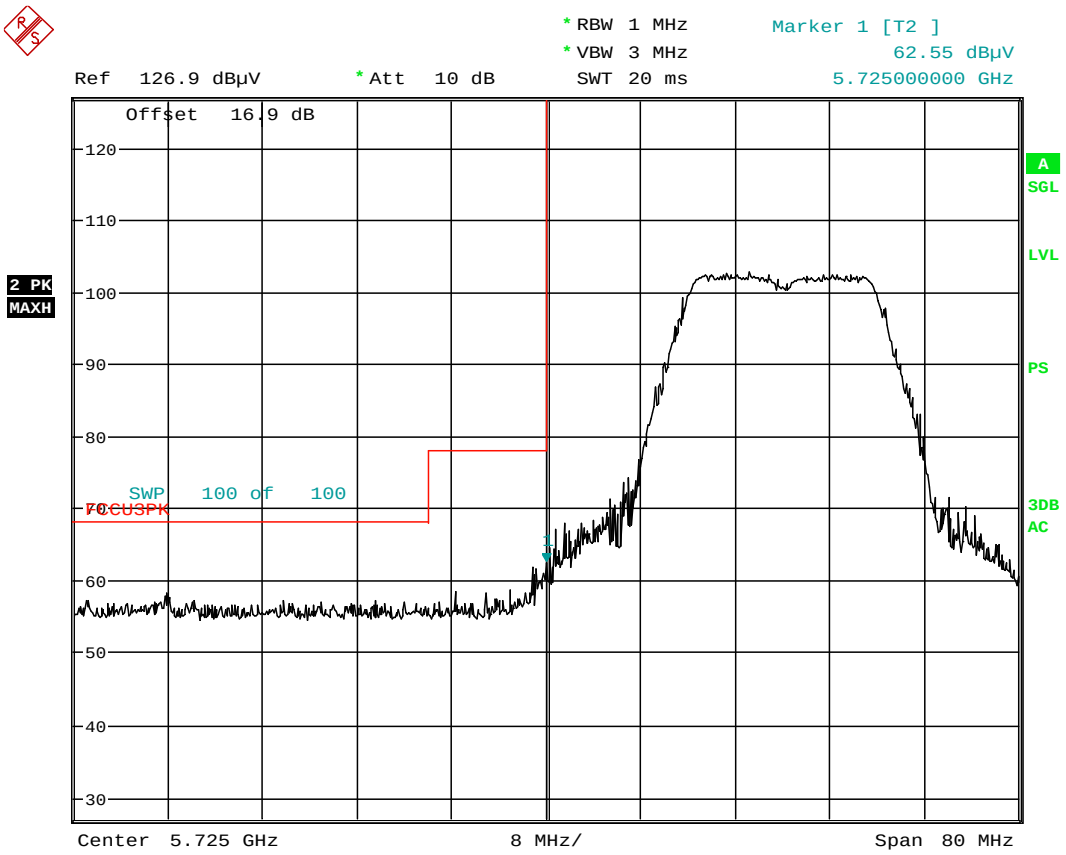
Radiated Band Edge Measurements (20MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	5745MHz
Channel:	149



Date: 20.JAN.2015 06:50:29

Plot 6-82. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

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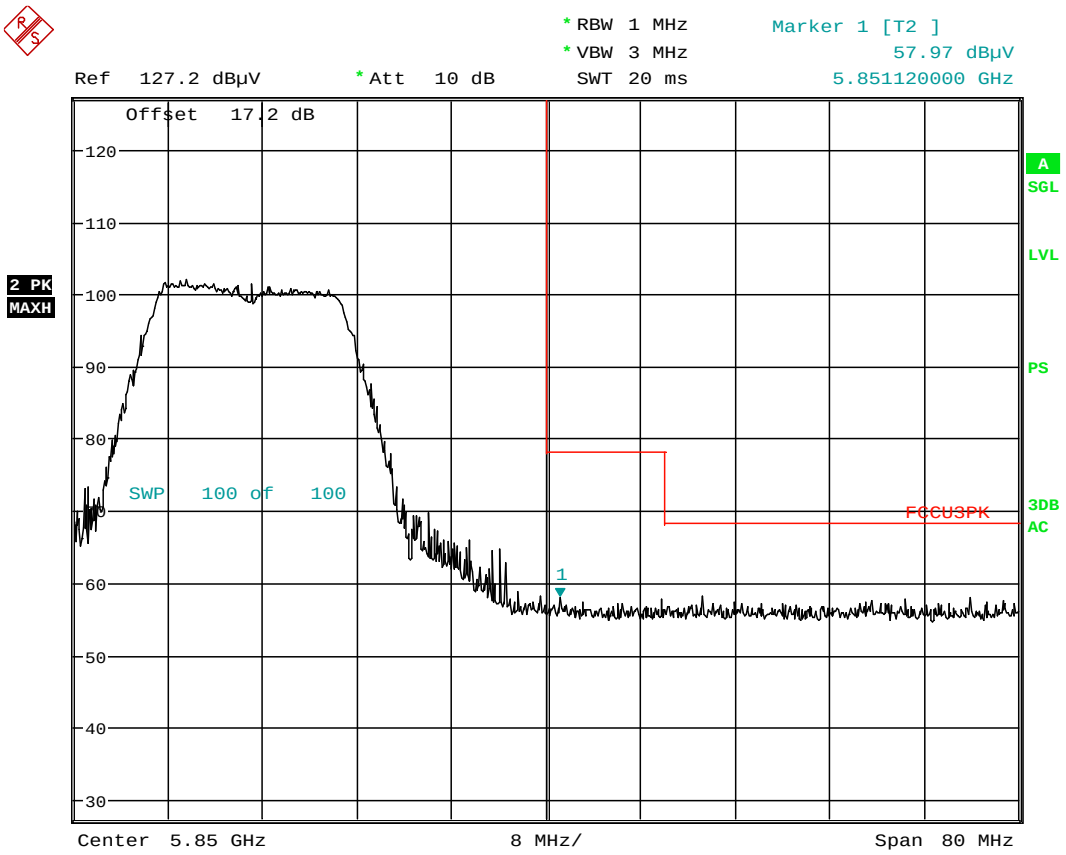
Radiated Band Edge Measurements (20MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	5825MHz
Channel:	165



Date: 20.JAN.2015 06:57:28

Plot 6-83. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

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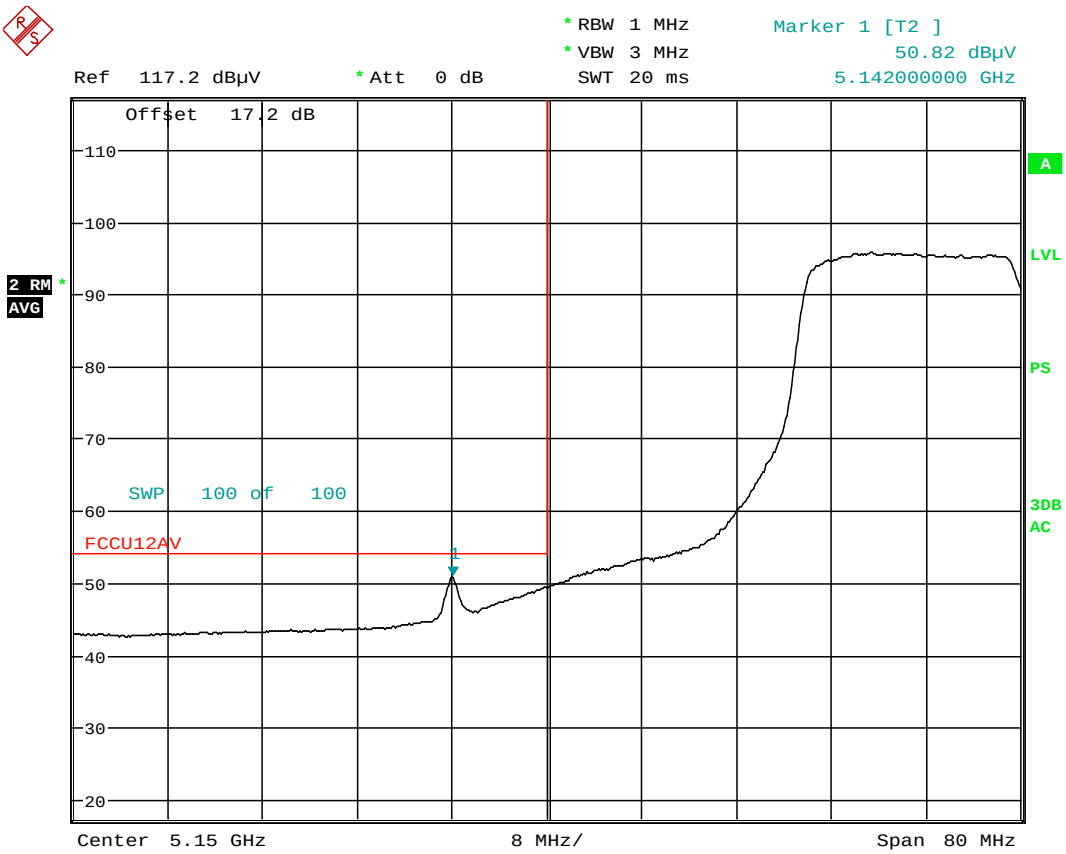
6.9 Radiated Band Edge Measurements (40MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11n (40MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5190MHz
Channel:	38



Date: 20.JAN.2015 06:09:19

Plot 6-84. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

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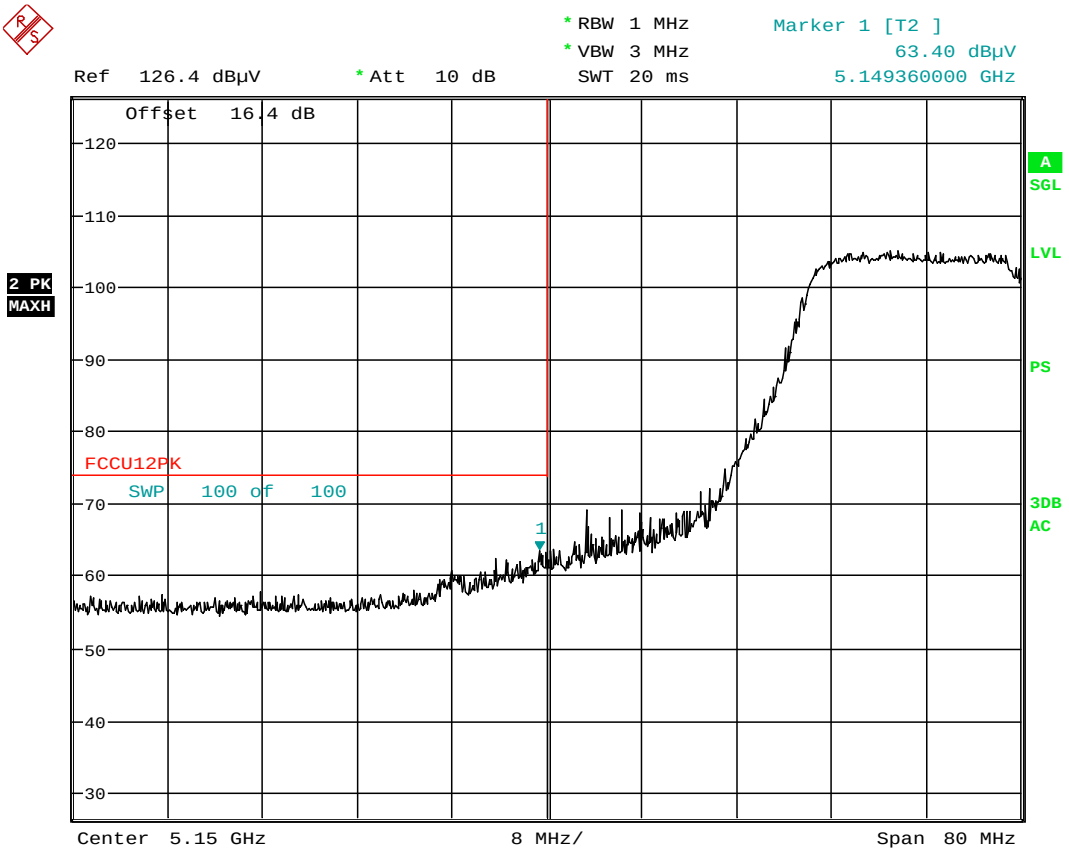
Radiated Band Edge Measurements (40MHz BW)

§15.407(b) §15.205 §15.209



Date: 20.JAN.2015 06:09:59

Plot 6-85. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

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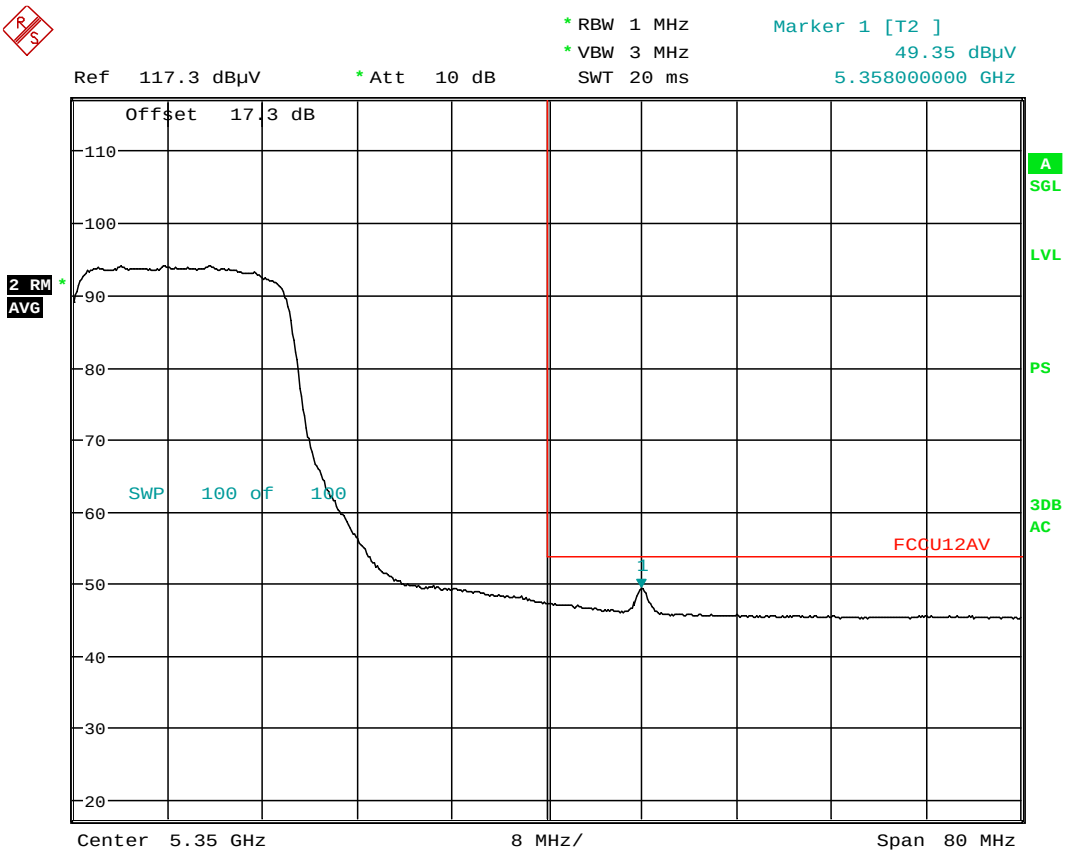
Radiated Band Edge Measurements (40MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11n (40MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5310MHz
Channel:	62



Date: 20.JAN.2015 06:14:10

Plot 6-86. Radiated Restricted Upper Band Edge Plot (Average – UNII Band 2A)

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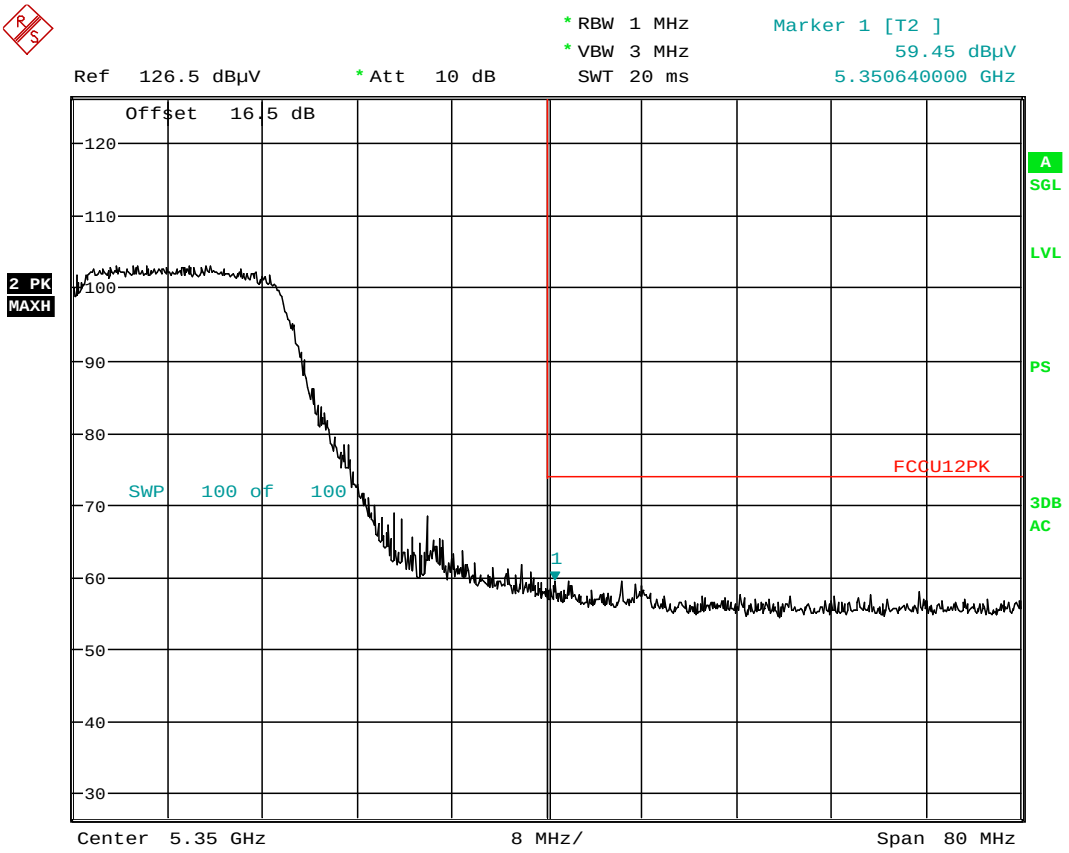
Radiated Band Edge Measurements (40MHz BW)

§15.407(b) §15.205 §15.209



Date: 20.JAN.2015 06:14:57

Plot 6-87. Radiated Restricted Upper Band Edge Plot (Peak – UNII Band 2A)

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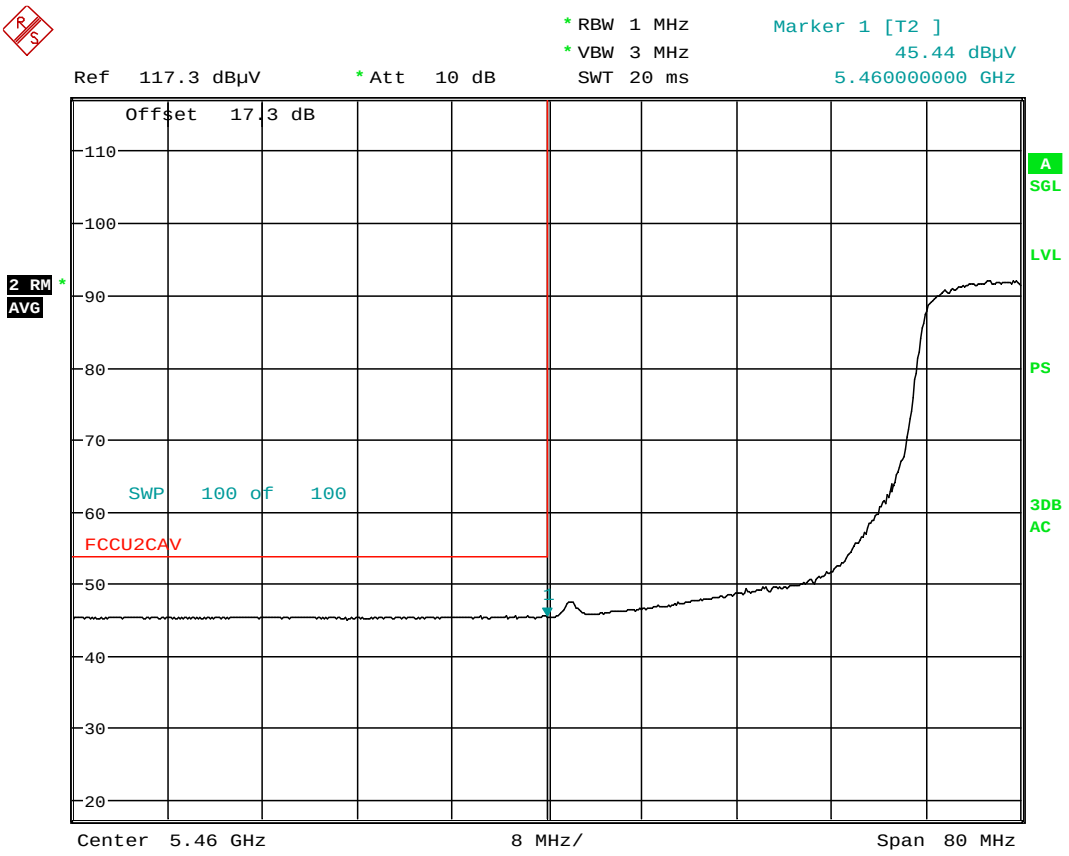
Radiated Band Edge Measurements (40MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11n (40MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5510MHz
Channel:	102



Date: 20.JAN.2015 06:19:14

Plot 6-88. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 2C)

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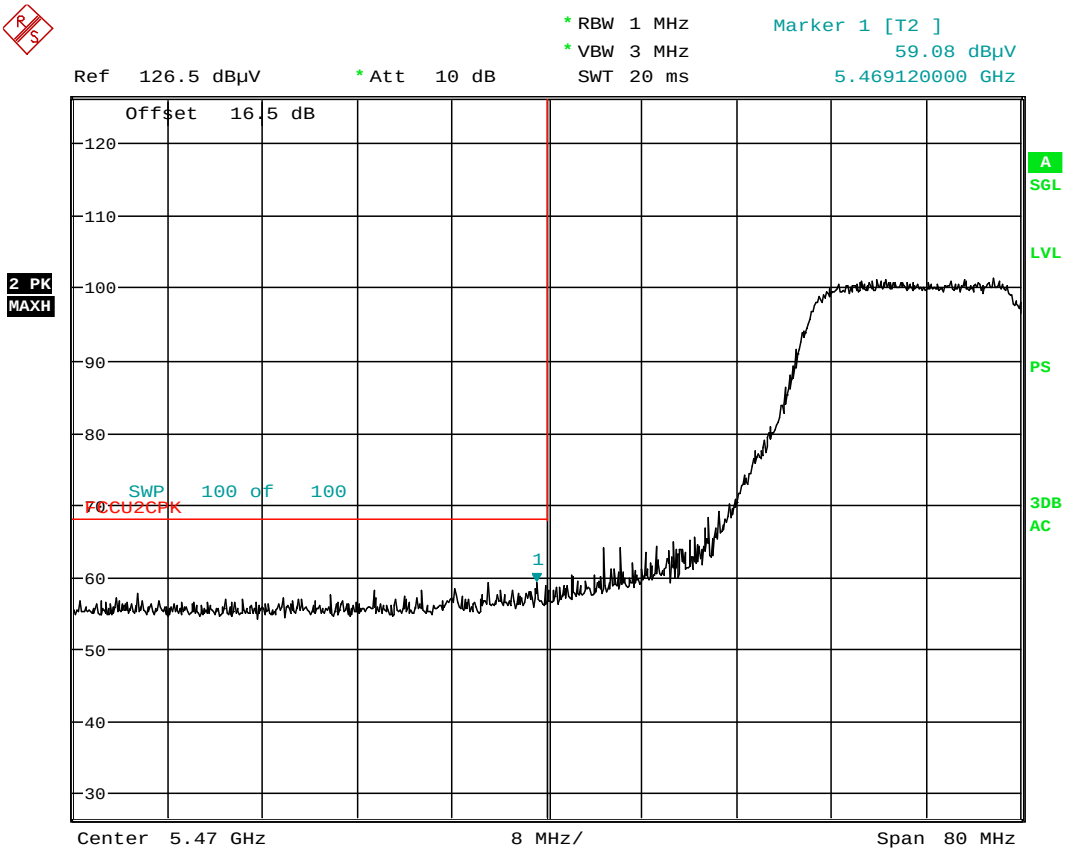
Radiated Band Edge Measurements (40MHz BW)

§15.407(b) §15.205 §15.209



Date: 20.JAN.2015 06:20:17

Plot 6-89. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 2C)

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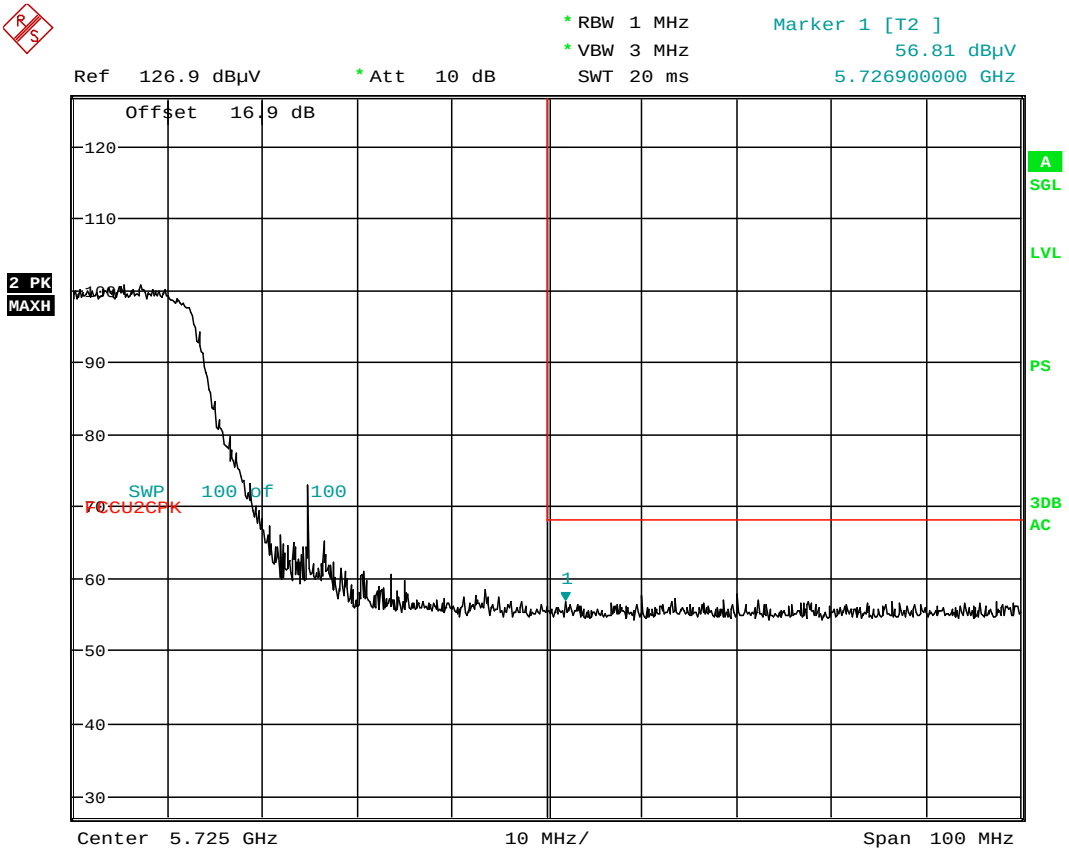
Radiated Band Edge Measurements (40MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11n (40MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5670MHz
Channel:	134



Date: 20.JAN.2015 06:32:50

Plot 6-90. Radiated Upper Band Edge Plot (Peak – UNII Band 2C)

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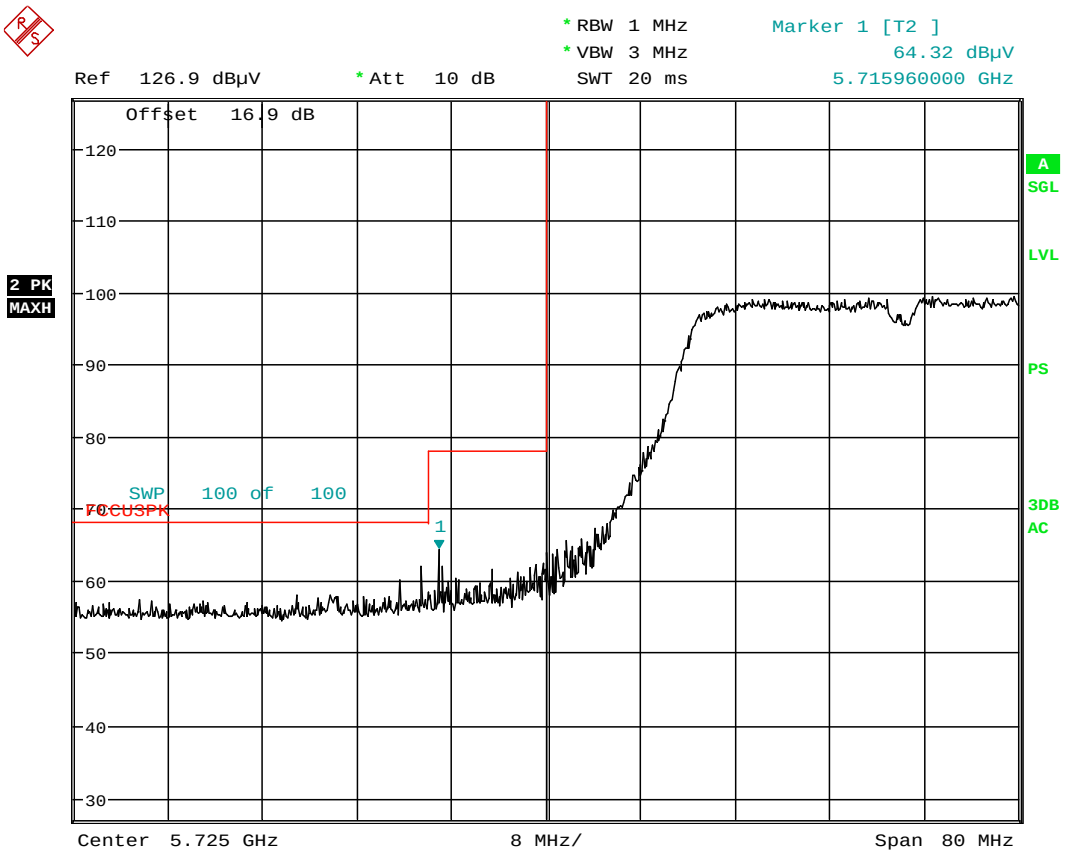
Radiated Band Edge Measurements (40MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11n (40MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5755MHz
Channel:	151



Date: 20.JAN.2015 06:37:50

Plot 6-91. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

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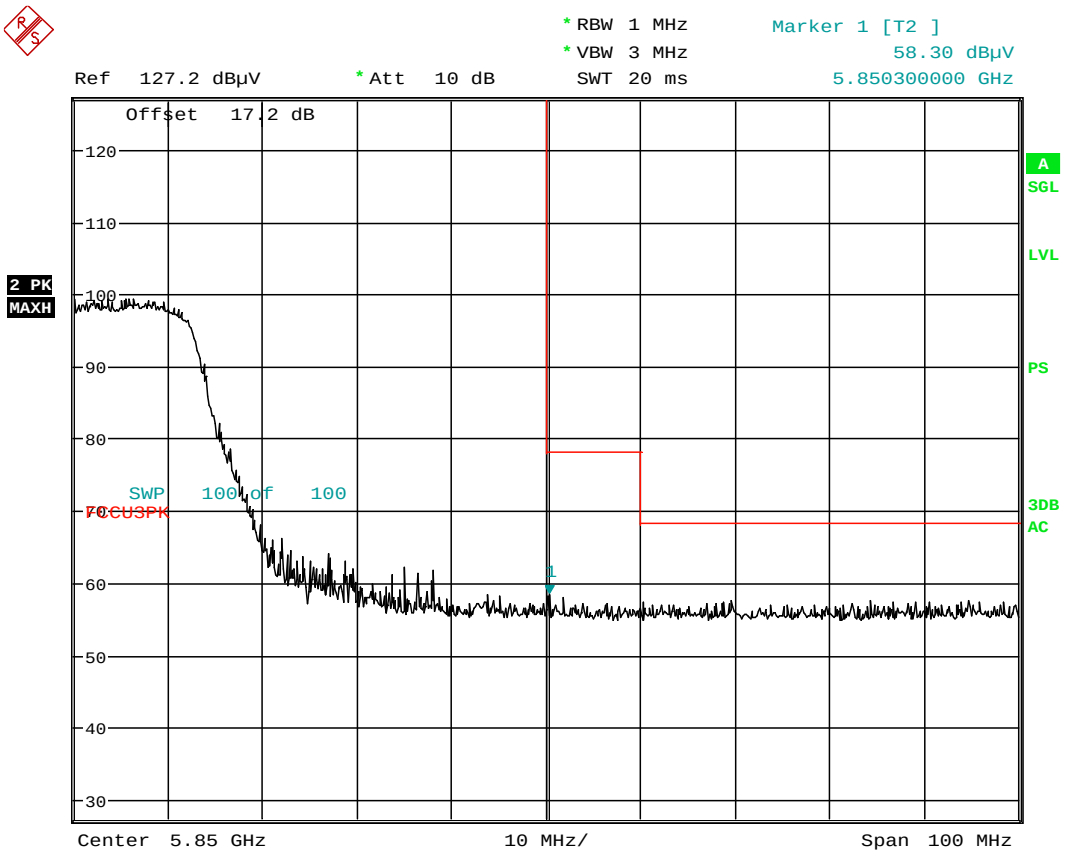
Radiated Band Edge Measurements (40MHz BW)

§15.407(b) §15.205 §15.209

Worst Case Mode:	802.11n (40MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5795MHz
Channel:	159



Date: 20.JAN.2015 06:42:22

Plot 6-92. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

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6.10 Radiated Spurious Emissions Measurements – Below 1GHz & Above 18GHz §15.209

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 6-22 per Section 15.209.

Frequency	Field Strength [µV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 6-22. Radiated Limits

Test Procedures Used

ANSI C63.4-2009

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

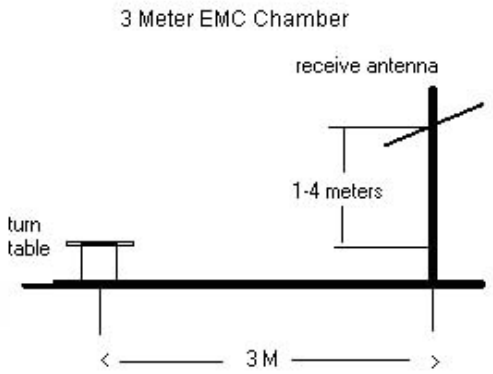

Figure 6-6. Test Instrument & Measurement Setup

Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 6-10.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested with its standard battery (Model: BL-51YF).
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. No spurious emissions were detected within 20dB of the limit below 30MHz.
8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.

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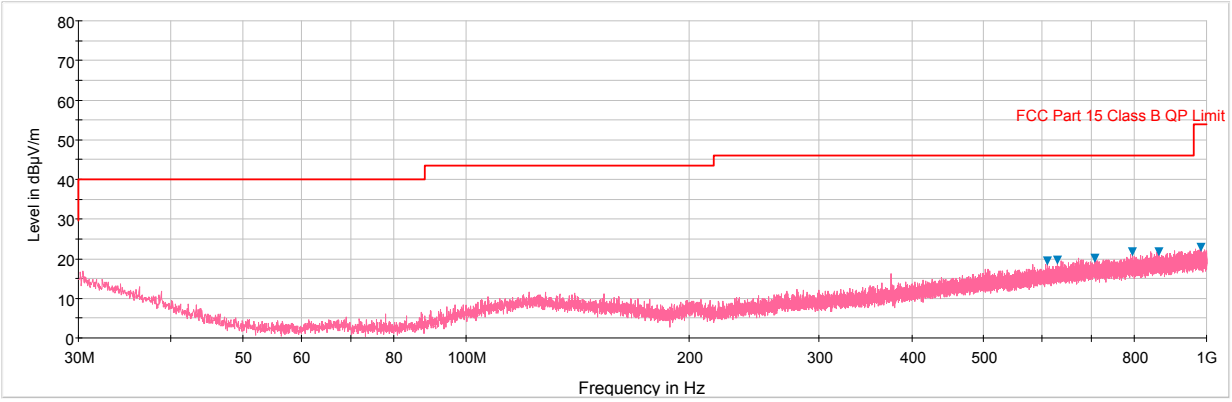
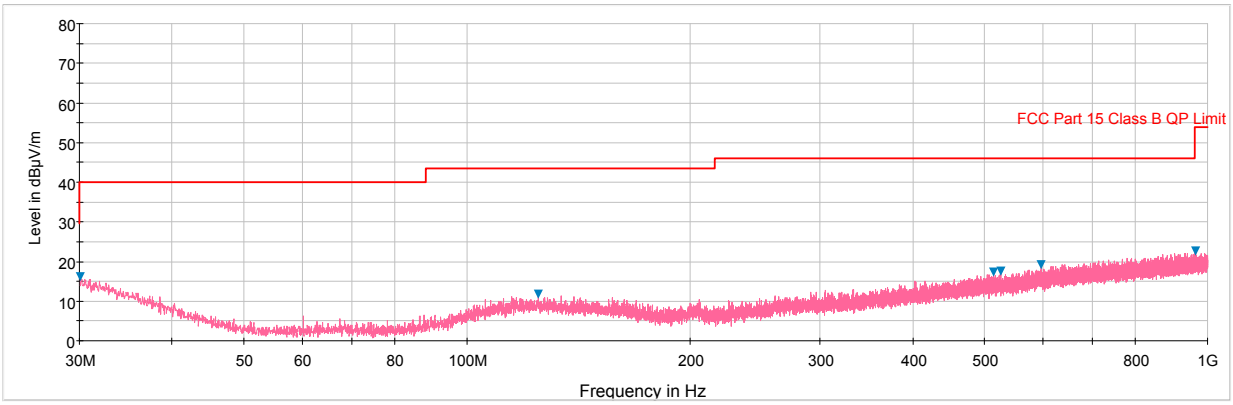
Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



Plot 6-93. Radiated Spurious Plot below 1GHz (802.11a – U3, Ant. Pol. H)



Plot 6-94. Radiated Spurious Plot below 1GHz (802.11a – U3, Ant. Pol. V)

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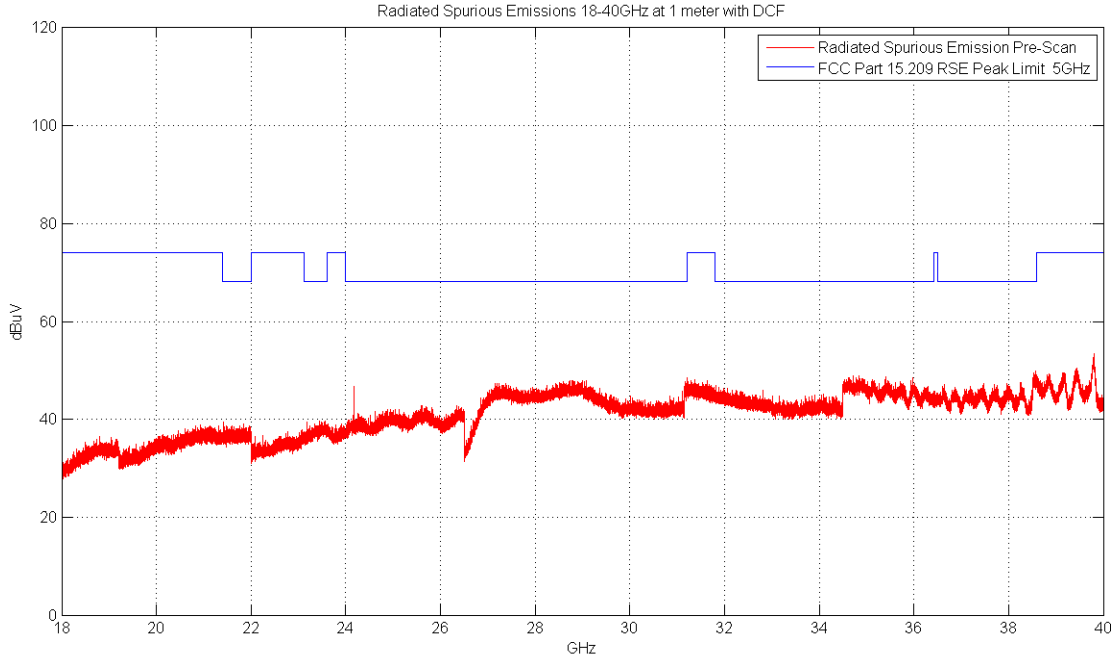
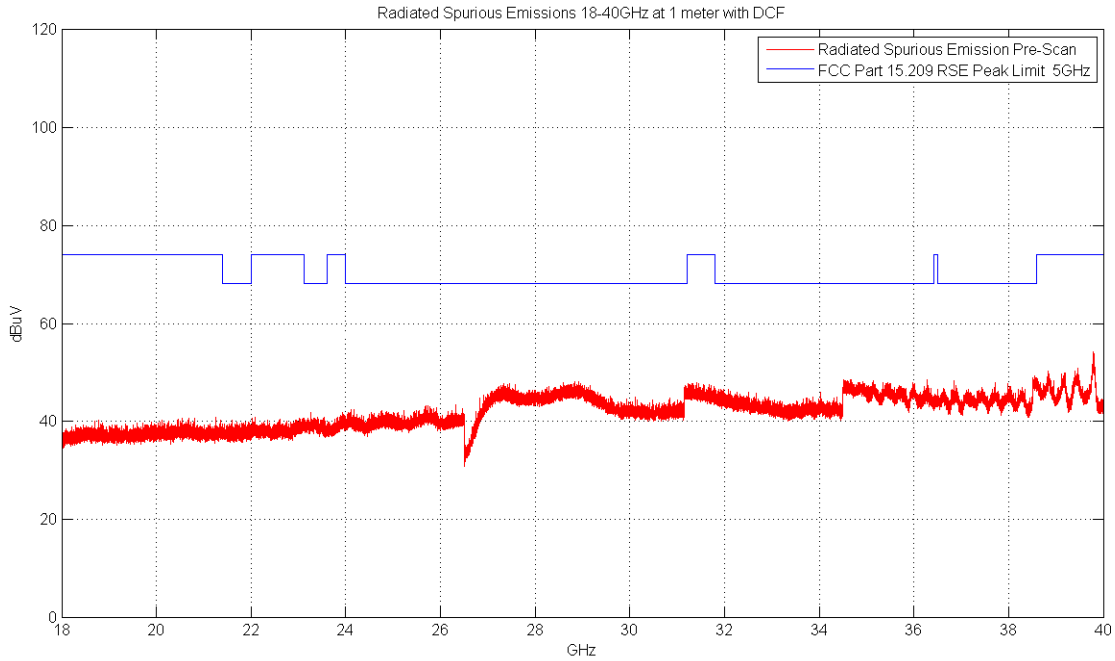
Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209



Plot 6-95. Radiated Spurious Plot above 18GHz (802.11a – Ant. Pol. H)



Plot 6-96. Radiated Spurious Plot above 18GHz (802.11a – Ant. Pol. V)

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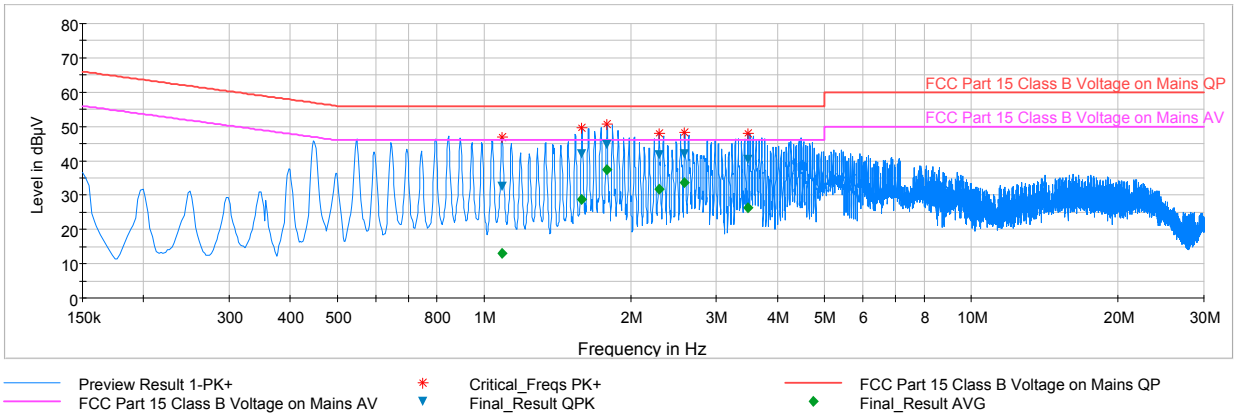
6.11 Line-Conducted Test Data

§15.407



Plot 6-97. Line Conducted Plot with 802.11a UNII Band 1 (L1)

Frequency MHz	Line	Corr. dB	QuasiPeak dBµV	Limit dBµV	Margin dB	Average dBµV	Limit dBµV	Margin dB
1.088	L1	0.1	32.58	56.00	23.42	13.00	46.00	33.00
1.588	L1	0.1	42.16	56.00	13.84	28.77	46.00	17.23
1.788	L1	0.1	44.75	56.00	11.25	37.51	46.00	8.49
2.288	L1	0.1	41.75	56.00	14.25	31.60	46.00	14.40
2.580	L1	0.1	41.91	56.00	14.09	33.52	46.00	12.48
3.476	L1	0.2	40.47	56.00	15.53	26.20	46.00	19.80

Table 6-23. Line Conducted Data with 802.11a UNII Band 1 (L1)

Notes:

1. All modes of operation, data rates, and test channels were investigated and the worst-case emissions are reported in 802.11a mode using 6Mbps on Channel 36. The emissions found were not affected by the choice of channel used during testing.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 of the Title 47 CFR.
3. L1 = Phase; N = Neutral
4. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
5. QP/AV Level (dBµV) = QP/AV Analyzer/Receiver Level (dBµV) + Corr. (dB)
6. Margin (dB) = QP/AVLimit (dBµV) - QP/AV Level (dBµV)
7. Traces shown in plot are made using a peak detector.
8. Deviations to the Specifications: None.

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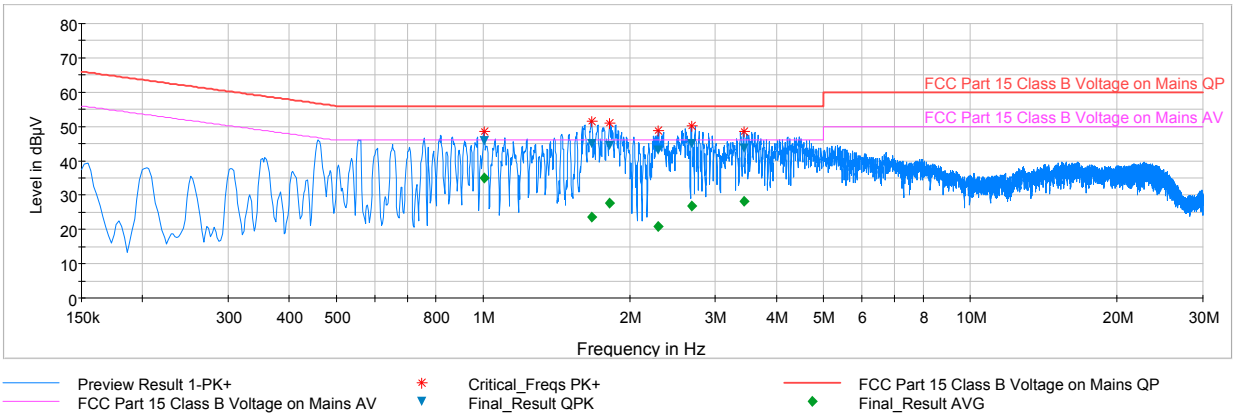
Line-Conducted Test Data

§15.407



Plot 6-98. Line Conducted Plot with 802.11a UNII Band 1 (N)

Frequency MHz	Line	Corr. dB	QuasiPeak dBµV	Limit dBµV	Margin dB	Average dBµV	Limit dBµV	Margin dB
1.005	N	0.1	45.75	56.00	10.25	34.99	46.00	11.01
1.671	N	0.2	45.13	56.00	10.87	23.47	46.00	22.53
1.820	N	0.2	44.36	56.00	11.64	27.57	46.00	18.43
2.290	N	0.2	43.11	56.00	12.89	20.96	46.00	25.04
2.677	N	0.2	44.89	56.00	11.11	26.75	46.00	19.25
3.428	N	0.2	43.69	56.00	12.31	28.12	46.00	17.88

Table 6-24. Line Conducted Data with 802.11a UNII Band 1 (N)

Notes:

1. All modes of operation, data rates, and test channels were investigated and the worst-case emissions are reported in 802.11a mode using 6Mbps on Channel 36. The emissions found were not affected by the choice of channel used during testing.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 of the Title 47 CFR.
3. L1 = Phase; N = Neutral
4. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
5. QP/AV Level (dBµV) = QP/AV Analyzer/Receiver Level (dBµV) + Corr. (dB)
6. Margin (dB) = QP/AVLimit (dBµV) - QP/AV Level (dBµV)
7. Traces shown in plot are made using a peak detector.
8. Deviations to the Specifications: None.

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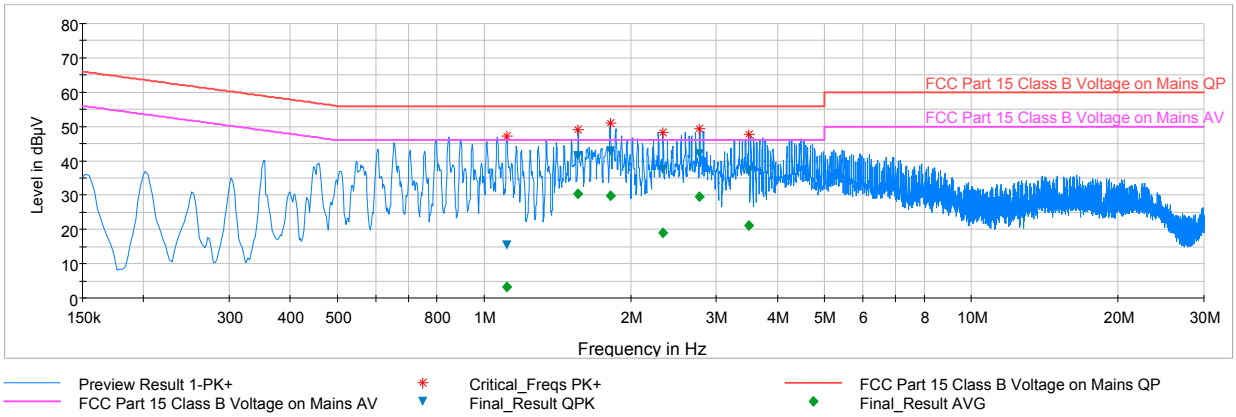
Line-Conducted Test Data

§15.407



Plot 6-99. Line Conducted Plot with 802.11a UNII Band 2A (L1)

Frequency MHz	Line	Corr. dB	QuasiPeak dBµV	Limit dBµV	Margin dB	Average dBµV	Limit dBµV	Margin dB
1.115	L1	0.1	15.57	56.00	40.43	3.26	46.00	42.74
1.561	L1	0.1	41.62	56.00	14.38	30.33	46.00	15.67
1.815	L1	0.1	42.75	56.00	13.25	29.73	46.00	16.27
2.330	L1	0.1	37.44	56.00	18.56	18.87	46.00	27.13
2.769	L1	0.2	42.04	56.00	13.96	29.51	46.00	16.49
3.491	L1	0.2	36.77	56.00	19.23	21.11	46.00	24.89

Table 6-25. Line Conducted Data with 802.11a UNII Band 2A (L1)

Notes:

1. All modes of operation, data rates, and test channels were investigated and the worst-case emissions are reported in 802.11a mode using 6Mbps on Channel 52. The emissions found were not affected by the choice of channel used during testing.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 of the Title 47 CFR.
3. L1 = Phase; N = Neutral
4. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
5. QP/AV Level (dBµV) = QP/AV Analyzer/Receiver Level (dBµV) + Corr. (dB)
6. Margin (dB) = QP/AVLimit (dBµV) - QP/AV Level (dBµV)
7. Traces shown in plot are made using a peak detector.
8. Deviations to the Specifications: None.

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Line-Conducted Test Data

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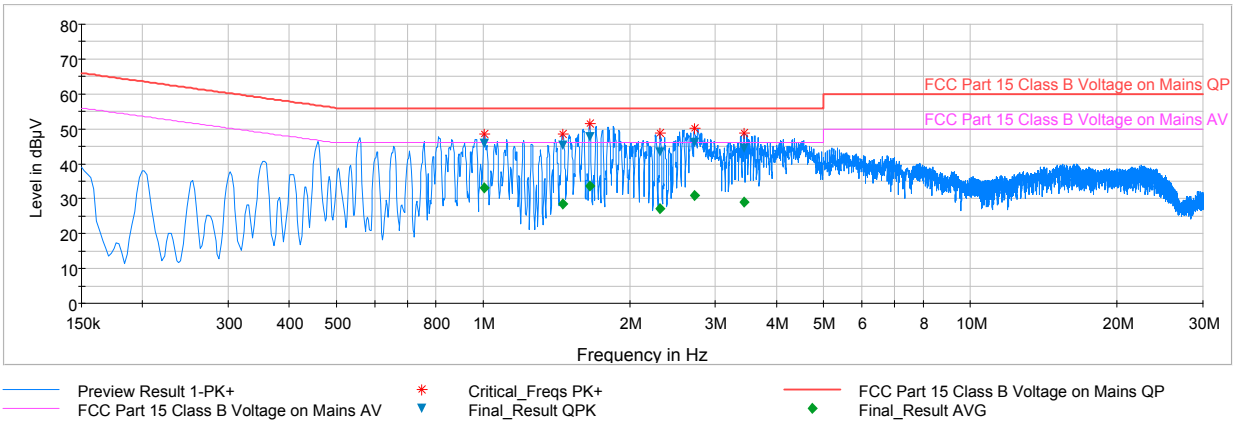

Plot 6-100. Line Conducted Plot with 802.11a UNII Band 2A (N)

Frequency	Line	Corr.	QuasiPeak	Limit	Margin	Average	Limit	Margin
MHz		dB	dBµV	dBµV	dB	dBµV	dBµV	dB
1.005	N	0.1	45.95	56.00	10.05	33.19	46.00	12.81
1.457	N	0.1	45.29	56.00	10.71	28.56	46.00	17.44
1.655	N	0.2	47.66	56.00	8.34	33.74	46.00	12.26
2.308	N	0.2	43.35	56.00	12.65	27.02	46.00	18.98
2.717	N	0.2	46.20	56.00	9.80	30.91	46.00	15.09
3.431	N	0.2	44.44	56.00	11.56	28.97	46.00	17.03

Table 6-26. Line Conducted Data with 802.11a UNII Band 2A (N)

Notes:

1. All modes of operation, data rates, and test channels were investigated and the worst-case emissions are reported in 802.11a mode using 6Mbps on Channel 52. The emissions found were not affected by the choice of channel used during testing.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 of the Title 47 CFR.
3. L1 = Phase; N = Neutral
4. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
5. QP/AV Level (dBµV) = QP/AV Analyzer/Receiver Level (dBµV) + Corr. (dB)
6. Margin (dB) = QP/AVLimit (dBµV) - QP/AV Level (dBµV)
7. Traces shown in plot are made using a peak detector.
8. Deviations to the Specifications: None.

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Line-Conducted Test Data

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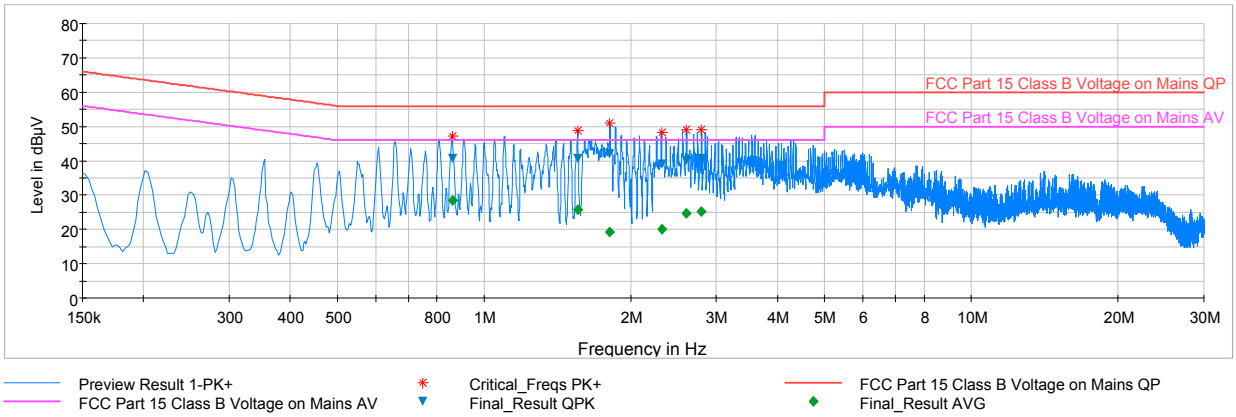

Plot 6-101. Line Conducted Plot with 802.11a UNII Band 2C (L1)

Frequency MHz	Line	Corr. dB	QuasiPeak dBµV	Limit dBµV	Margin dB	Average dBµV	Limit dBµV	Margin dB
0.861	L1	0.1	40.79	56.00	15.21	28.44	46.00	17.56
1.556	L1	0.1	40.64	56.00	15.36	25.81	46.00	20.19
1.813	L1	0.1	42.05	56.00	13.95	19.13	46.00	26.87
2.312	L1	0.1	39.06	56.00	16.94	20.01	46.00	25.99
2.605	L1	0.1	40.25	56.00	15.75	24.73	46.00	21.27
2.794	L1	0.2	40.55	56.00	15.45	25.35	46.00	20.65

Table 6-27. Line Conducted Plot with 802.11a UNII Band 2C (L1)

Notes:

1. All modes of operation, data rates, and test channels were investigated and the worst-case emissions are reported in 802.11a mode using 6Mbps on Channel 100. The emissions found were not affected by the choice of channel used during testing.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 of the Title 47 CFR.
3. L1 = Phase; N = Neutral
4. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
5. QP/AV Level (dBµV) = QP/AV Analyzer/Receiver Level (dBµV) + Corr. (dB)
6. Margin (dB) = QP/AVLimit (dBµV) - QP/AV Level (dBµV)
7. Traces shown in plot are made using a peak detector.
8. Deviations to the Specifications: None.

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Line-Conducted Test Data

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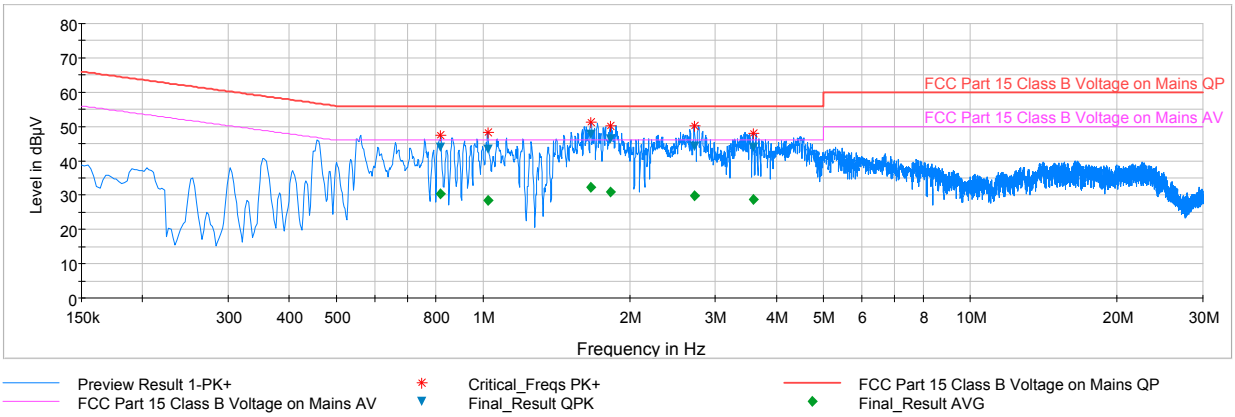

Plot 6-102. Line Conducted Plot with 802.11a UNII Band 2C (N)

Frequency MHz	Line	Corr. dB	QuasiPeak dBµV	Limit dBµV	Margin dB	Average dBµV	Limit dBµV	Margin dB
0.818	N	0.1	43.88	56.00	12.12	30.47	46.00	15.53
1.023	N	0.1	43.45	56.00	12.55	28.47	46.00	17.53
1.664	N	0.2	47.77	56.00	8.23	32.26	46.00	13.74
1.822	N	0.2	46.30	56.00	9.70	30.96	46.00	15.04
2.711	N	0.2	44.16	56.00	11.84	29.83	46.00	16.17
3.581	N	0.2	43.91	56.00	12.09	28.81	46.00	17.19

Table 6-28. Line Conducted Data with 802.11a UNII Band 2C (N)

Notes:

1. All modes of operation, data rates, and test channels were investigated and the worst-case emissions are reported in 802.11a mode using 6Mbps on Channel 100. The emissions found were not affected by the choice of channel used during testing.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 of the Title 47 CFR.
3. L1 = Phase; N = Neutral
4. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
5. QP/AV Level (dBµV) = QP/AV Analyzer/Receiver Level (dBµV) + Corr. (dB)
6. Margin (dB) = QP/AVLimit (dBµV) - QP/AV Level (dBµV)
7. Traces shown in plot are made using a peak detector.
8. Deviations to the Specifications: None.

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7.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFH631** is in compliance with Part 15E of the FCC Rules.

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