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MEASUREMENT REPORT
FCC Part 15.407 UNII 802.11a/n/ac

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

Date of Testing:
1/16 - 3/7/2017
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
1M1702280075-05.ZNF

FCC ID: **ZNFM710H**

APPLICANT: **LG Electronics MobileComm U.S.A**

Application Type: Certification
Model: LG-M710H
Additional Model(s): LGM710H, M710H
EUT Type: Portable Handset
FCC Classification: Unlicensed National Information Infrastructure (UNII)
FCC Rule Part(s): Part 15.407
Test Procedure(s): KDB 789033 D02 v01r03

UNII Band	Channel Bandwidth (MHz)	Tx Frequency (MHz)	Conducted Power	
			Max. Power (mW)	Max. Power (dBm)
1	20	5180 - 5240	10.375	10.16
2A		5260 - 5320	10.046	10.02
2C		5500 - 5580	9.840	9.93
2C		5660 - 5700	9.750	9.89
3		5745 - 5825	9.886	9.95
1	40	5190 - 5230	8.375	9.23
2A		5270 - 5310	8.375	9.23
2C		5510 - 5550	7.780	8.91
2C		5670 - 5710	7.870	8.96
3		5755 - 5795	7.691	8.86
1	80	5210	7.798	8.92
2A		5290	8.091	9.08
2C		5530	7.430	8.71
3		5775	7.211	8.58

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 D02 v01r03. 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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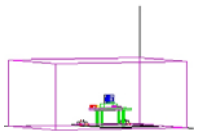
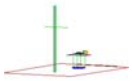


MEASUREMENT REPORT
FCC Part 15.407



§ 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-M710H
FCC ID:	ZNFM710H
FCC CLASSIFICATION:	Unlicensed National Information Infrastructure (UNII)
Test Device Serial No.:	06481, 06358, 06432, 11382, 06432, 11408 ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	1/16 - 3/7/2017
TEST REPORT S/N:	1M1702280075-05.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 39º 10'23" N latitude and 76º 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 C63.4-2014 on January 22, 2015.

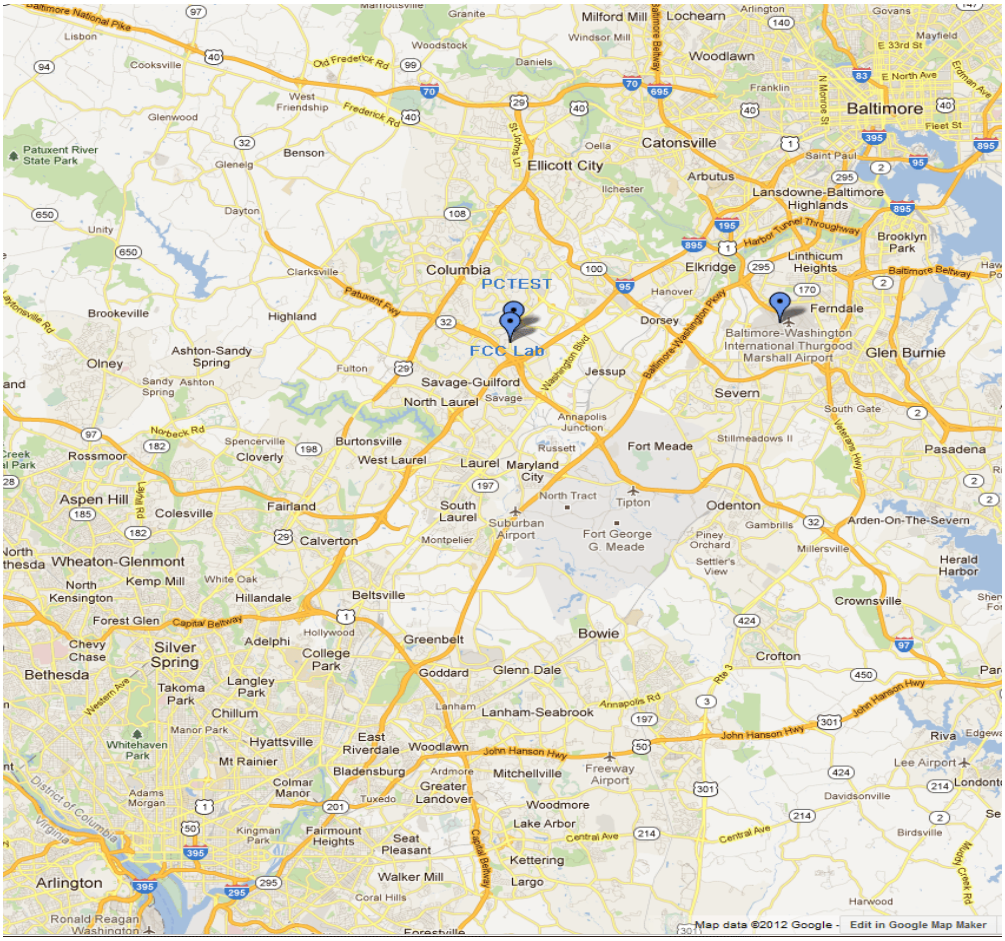

Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **LGE Portable Handset FCC ID: ZNFM710H**. 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 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE), NFC

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 2-1. 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 2-2. 802.11n / 802.11ac (40MHz BW) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
42	5210	58	5290	106	5530	155	5775

Table 2-3. 802.11ac (80MHz BW) Frequency / Channel Operations

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Notes:

1. 5GHz NII operation is possible in 20MHz, and 40MHz, and 80MHz 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 D02 v01r03. 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	99.2
	n (HT20)	99.2
	ac (HT20)	98.3
	n (HT40)	98.7
	ac (HT40)	96.4
	ac (HT80)	93.1

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)

29.3/32.5, 58.5/65, 87.8/97.5, 117/130, 175.5/195, 234/260, 263.3/292.5, 292.5/325, 351/390, 390/433.3 (ac – 80MHz BW)

2.3 Test Configuration

The EUT was tested per the guidance of KDB 789033 D02 v01r03. ANSI C63.10-2013 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 7.2, 7.3, 7.4, and 7.5 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.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 789033 D02 v01r03 were used in the measurement of the EUT**.**

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. 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 7.9.

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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 Figure 5.7 of Clause 5 in ANSI C63.4-2014. A 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. 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 above 1GHz. A 72.4cm high PVC support structure is placed on top of the turntable. A 3" (~7.6cm) sheet of high density polystyrene 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 measurements above 1GHz, a high density expanded polystyrene block is placed on top of the test table to bring the total table height to 1.5m.

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 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, mode of operation, 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.

3.4 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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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 EUT are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2006.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	WL40-1	Conducted Cable Set (40GHz)	4/26/2016	Annual	4/26/2017	WL40-1
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	7/11/2016	Annual	7/11/2017	RE1
Agilent	N9038A	MXE EMI Receiver	4/21/2016	Annual	4/21/2017	MY51210133
Agilent	N9030A	PXA Signal Analyzer (44GHz)	3/1/2016	Annual	3/1/2017	MY52350166
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	941001
Anritsu	MA2411B	Pulse Power Sensor	10/14/2015	Biennial	10/14/2017	846215
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	7/30/2015	Biennial	7/30/2017	121034
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	2/26/2016	Annual	2/26/2017	441112
Emco	3115	Horn Antenna (1-18GHz)	3/10/2016	Biennial	3/10/2018	9704-5182
Emco	3116	Horn Antenna (18 - 40GHz)	3/27/2015	Triennial	3/27/2018	9203-2178
Espec	ESX-2CA	Environmental Chamber	3/4/2016	Annual	3/4/2017	17620
ETS Lindgren	3160-09	18-26.5 GHz Standard Gain Horn	8/23/2016	Biennial	8/23/2018	135427
ETS Lindgren	3160-10	26.5-40 GHz Standard Gain Horn	8/23/2016	Biennial	8/23/2018	130993
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	4/26/2016	Biennial	4/26/2018	125518
Huber+Suhner	Sucoflex 102A	40GHz Radiated Cable	4/26/2016	Annual	4/26/2017	251425001
Narda	EHP-200A	EM Field Probe	3/24/2016	Annual	3/24/2017	170WX50922
Pasternack	NMLC-1	Line Conducted Emissions Cable (NM)	10/14/2016	Annual	10/14/2017	NMLC-1
PCTEST	-	EMC Switch System	7/11/2016	Annual	7/11/2017	NM1
PCTEST	-	EMC Switch System	7/6/2016	Annual	7/6/2017	NM2
Rhode & Schwarz	TS-PR18	Pre-Amplifier	3/7/2016	Annual	3/7/2017	101622
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	3/7/2016	Annual	3/7/2017	100040
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	7/15/2016	Annual	7/15/2017	100348
Rohde & Schwarz	TS-PR40	26.5-40 GHz Pre-Amplifier	3/7/2016	Annual	3/7/2017	100037
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	7/27/2016	Annual	7/27/2017	103200
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/2/2016	Biennial	3/2/2018	N/A
Solar Electronics	8012-50-R-24-BNC	Line Impedance Stabilization Network	7/30/2015	Biennial	7/30/2017	310233
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	3/14/2016	Biennial	3/14/2018	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

Notes:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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7.0 TEST RESULTS

7.1 Summary

Company Name: LG Electronics MobileComm U.S.A
FCC ID: ZNFM710H
Method/System: Unlicensed National Information Infrastructure (UNII)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
N/A	26dB Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
15.407(e)	6dB Bandwidth	>500kHz(5725-5850MHz)		PASS	Section 7.3
15.407 (a.1.iv), (a.2), (a.3)	Maximum Conducted Output Power	Maximum conducted powers must meet the limits detailed in 15.407 (a)		PASS	Section 7.4
15.407 (a.1.iv), (a.2), (a.3)	Maximum Power Spectral Density	Maximum power spectral density must meet the limits detailed in 15.407 (a)		PASS	Section 7.5
15.407(g)	Frequency Stability	N/A		PASS	Section 7.6
15.407(h)	Dynamic Frequency Selection	See DFS Test Report		PASS	See DFS Test Report
15.407(b.1), (2), (3), (4)	Undesirable Emissions	Undesirable emissions must meet the limits detailed in 15.407(b)	RADIATED	PASS	Section 7.7
15.205, 15.407(b.1), (4), (5), (6)	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 7.7, 7.8
15.407	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits	LINE CONDUCTED	PASS	Section 7.9

Table 7-1. 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 4.4.
5) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.1.5.

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7.2 26dB Bandwidth Measurement – 802.11a/n/ac

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 D02 v01r03, 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 D02 v01r03 – 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.

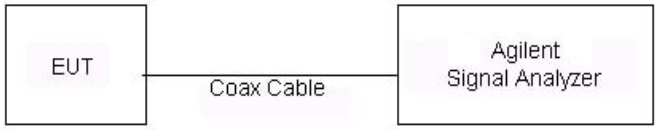

Figure 7-1. Test Instrument & Measurement Setup

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	21.87
	5200	40	a	6	21.62
	5240	48	a	6	21.50
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	22.28
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	22.10
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	22.00
	5190	38	n (40MHz)	13.5/15 (MCS0)	42.14
	5230	46	n (40MHz)	13.5/15 (MCS0)	43.81
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	83.86
Band 2A	5260	52	a	6	21.72
	5280	56	a	6	21.90
	5320	64	a	6	21.61
	5260	52	n (20MHz)	6.5/7.2 (MCS0)	22.07
	5280	56	n (20MHz)	6.5/7.2 (MCS0)	22.49
	5320	64	n (20MHz)	6.5/7.2 (MCS0)	21.98
	5270	54	n (40MHz)	13.5/15 (MCS0)	43.04
	5310	62	n (40MHz)	13.5/15 (MCS0)	43.18
	5290	58	ac (80MHz)	29.3/32.5 (MCS0)	84.29
Band 2C	5500	100	a	6	21.59
	5580	116	a	6	22.33
	5700	140	a	6	21.77
	5500	100	n (20MHz)	6.5/7.2 (MCS0)	22.16
	5580	116	n (20MHz)	6.5/7.2 (MCS0)	21.92
	5700	140	n (20MHz)	6.5/7.2 (MCS0)	22.34
	5510	102	n (40MHz)	13.5/15 (MCS0)	42.42
	5550	110	n (40MHz)	13.5/15 (MCS0)	43.39
	5670	134	n (40MHz)	13.5/15 (MCS0)	43.39
	5530	106	ac (80MHz)	29.3/32.5 (MCS0)	83.90

Table 7-2. Conducted Bandwidth Measurements

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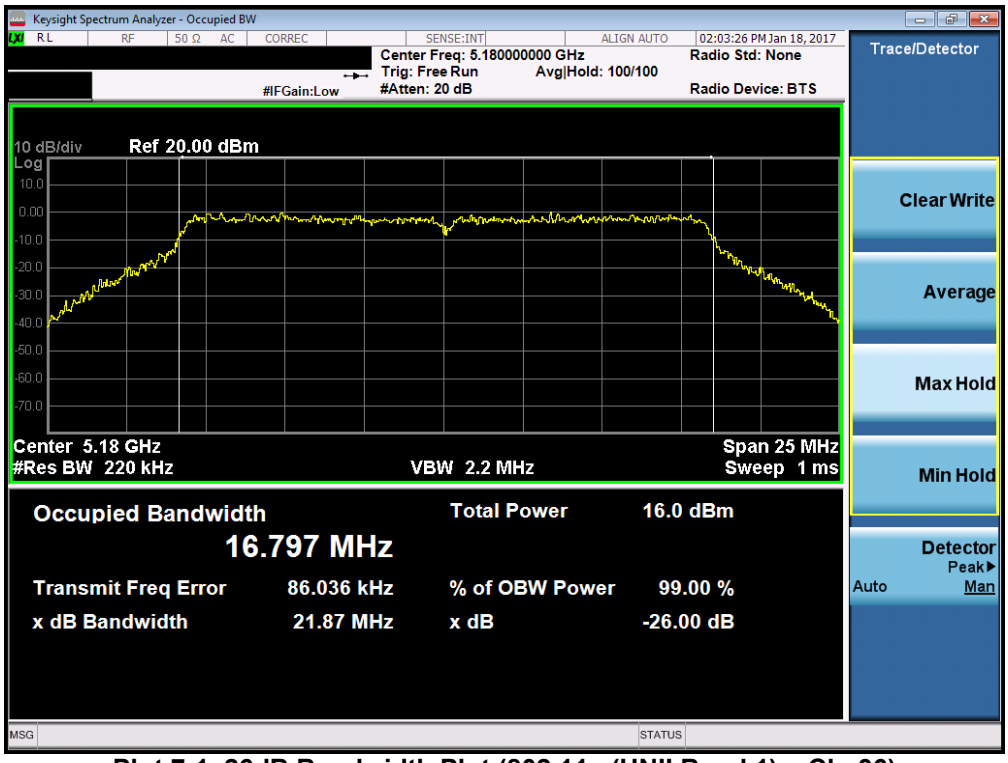
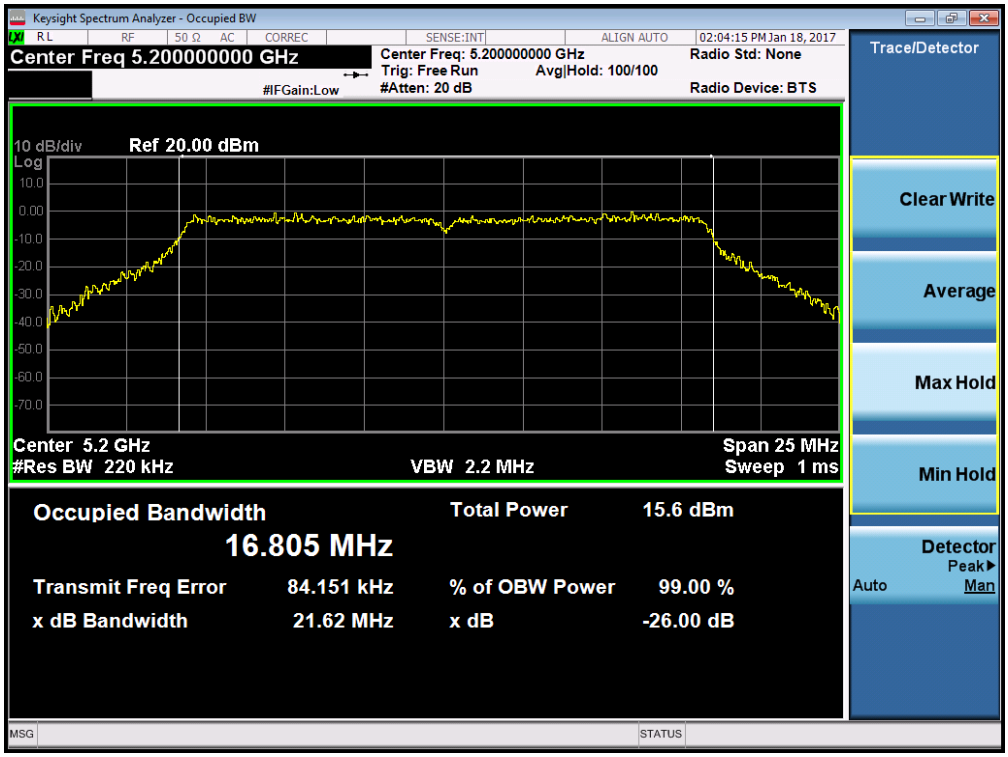


Plot 7-1. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 36)



Plot 7-2. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 40)

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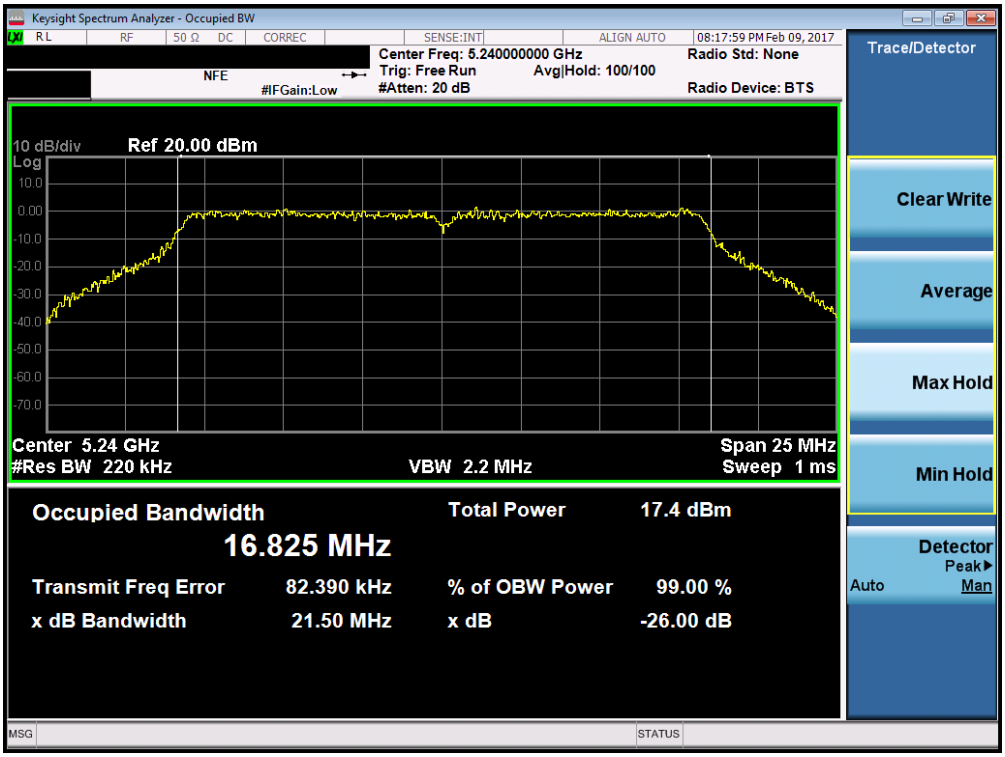

Plot 7-3. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 48)

Plot 7-4. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 36)

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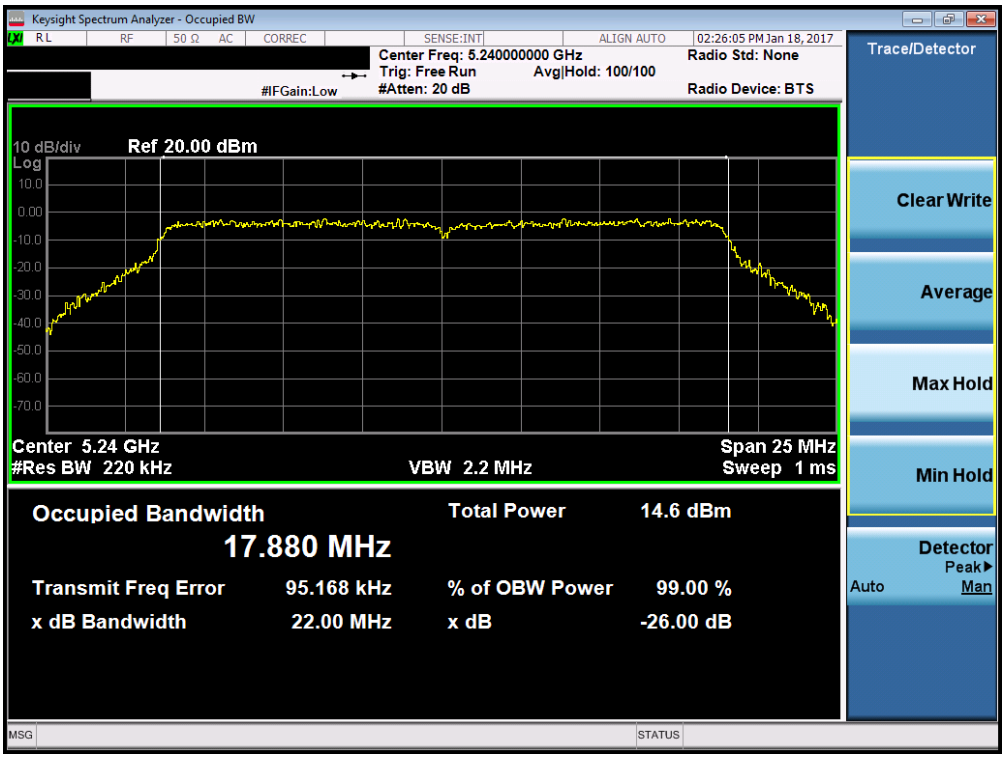
Plot 7-5. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 40)



Plot 7-6. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 48)

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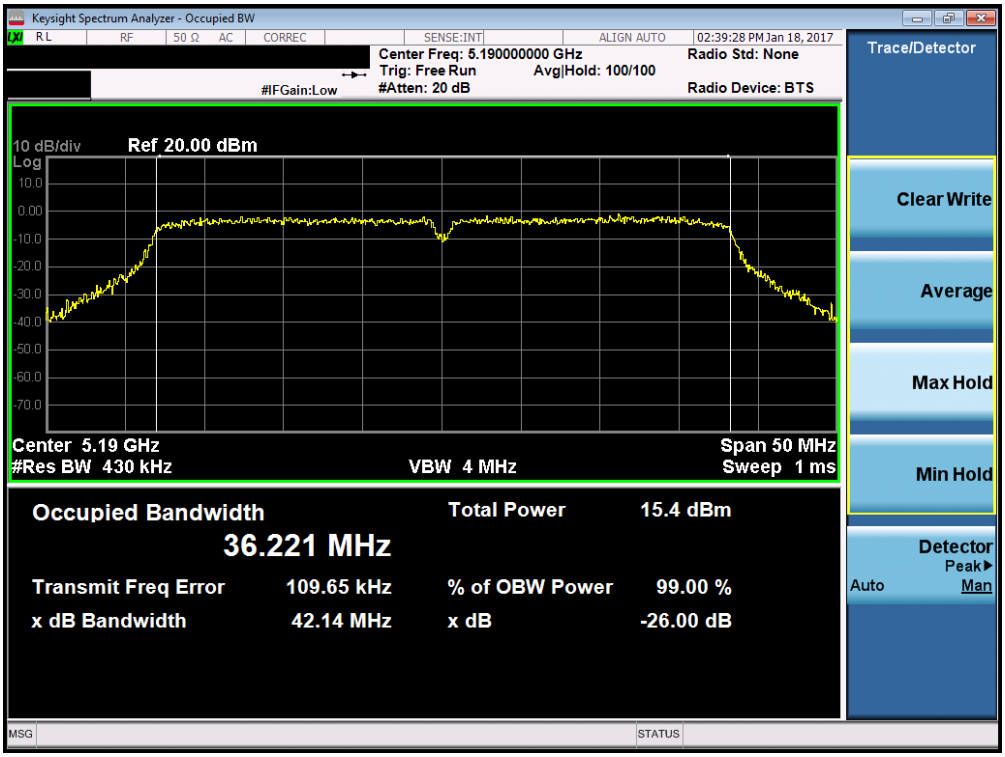
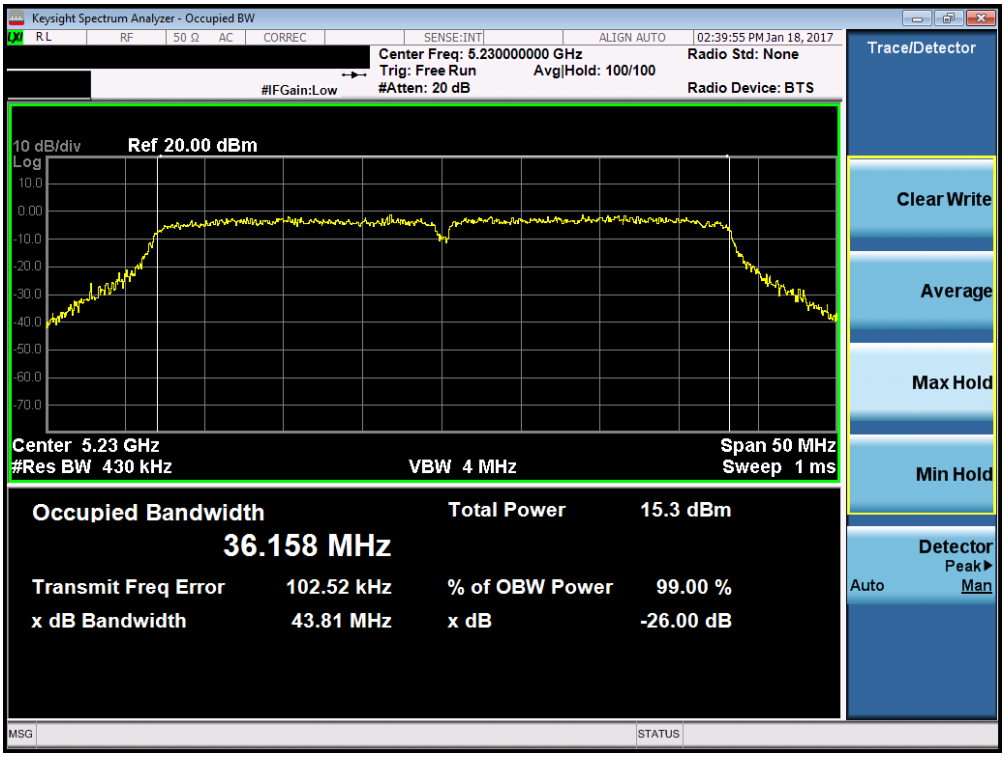


Plot 7-7. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



Plot 7-8. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 46)

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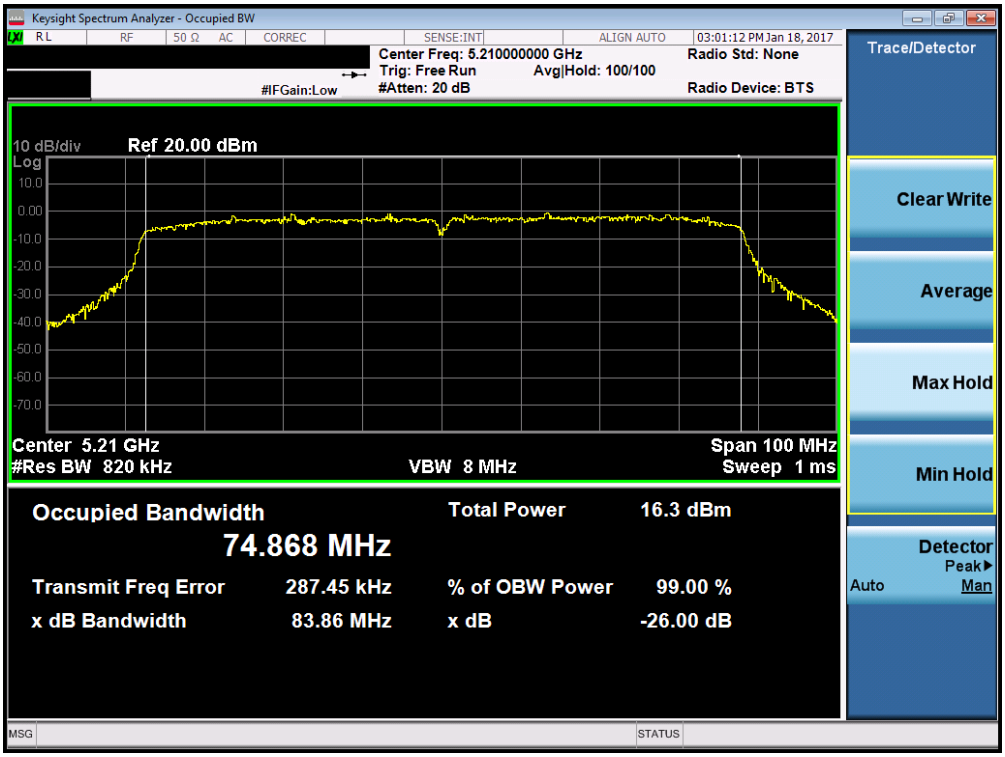
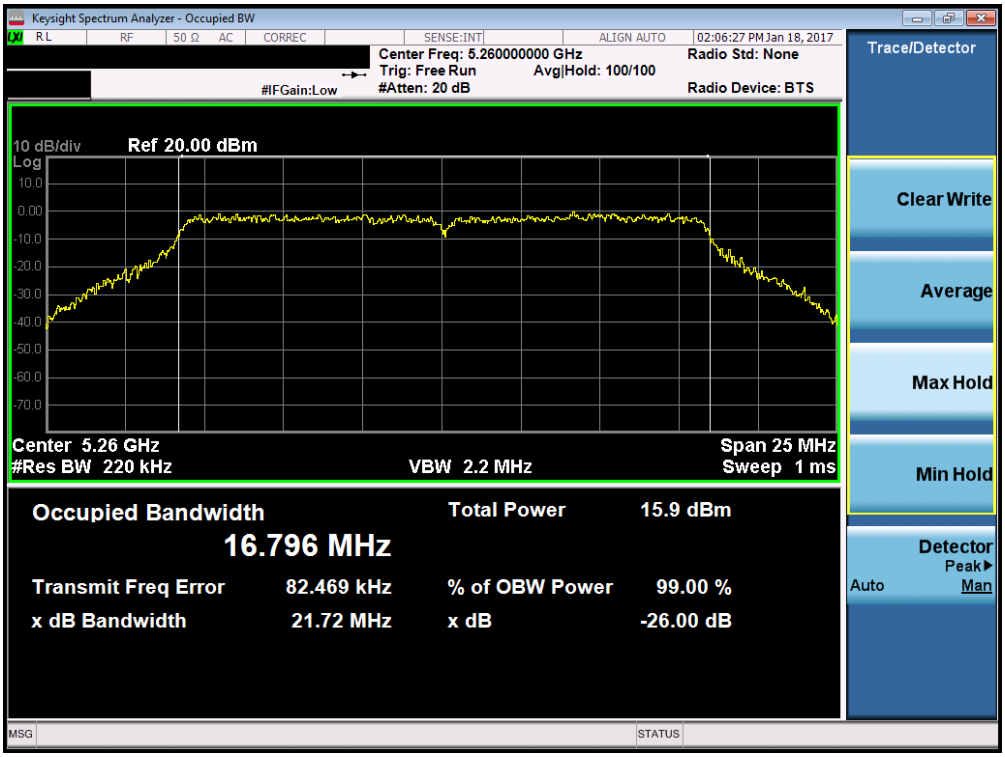


Plot 7-9. 26dB Bandwidth Plot (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)



Plot 7-10. 26dB Bandwidth Plot (802.11a (UNII Band 2A) – Ch. 52)

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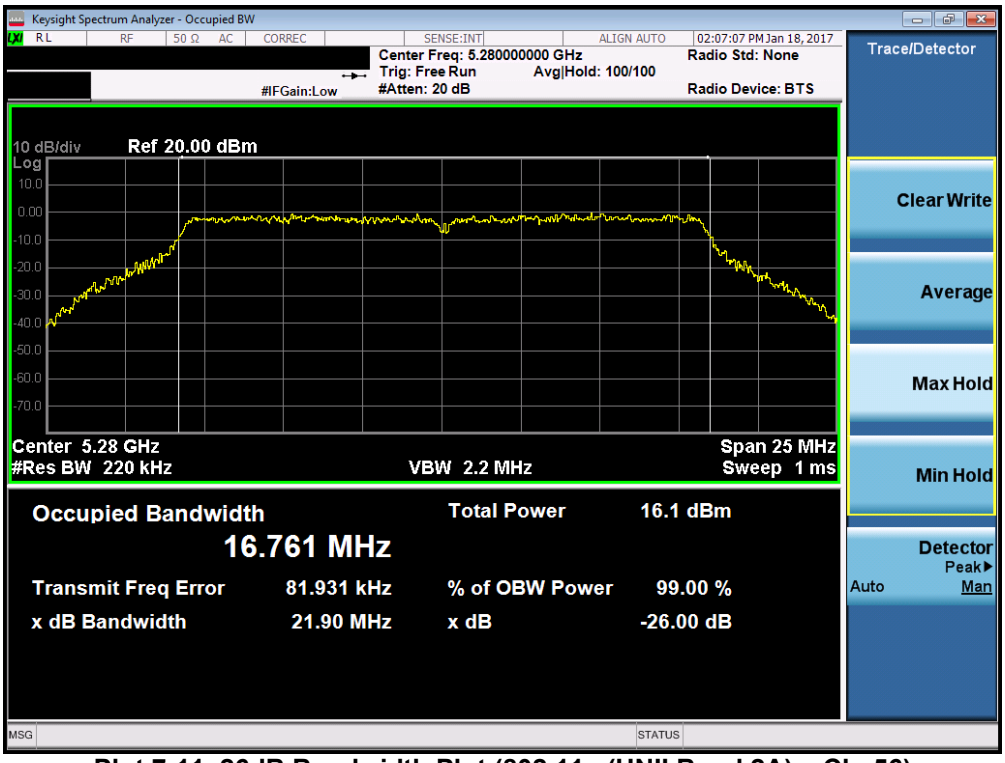
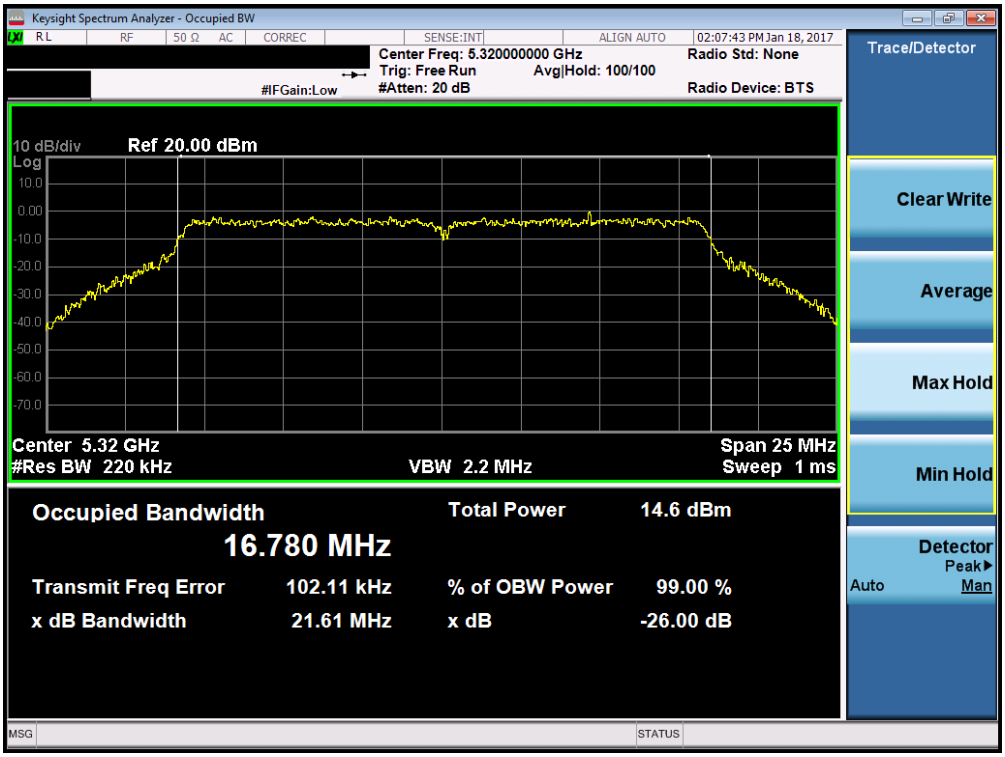


Plot 7-11. 26dB Bandwidth Plot (802.11a (UNII Band 2A) – Ch. 56)



Plot 7-12. 26dB Bandwidth Plot (802.11a (UNII Band 2A) – Ch. 64)

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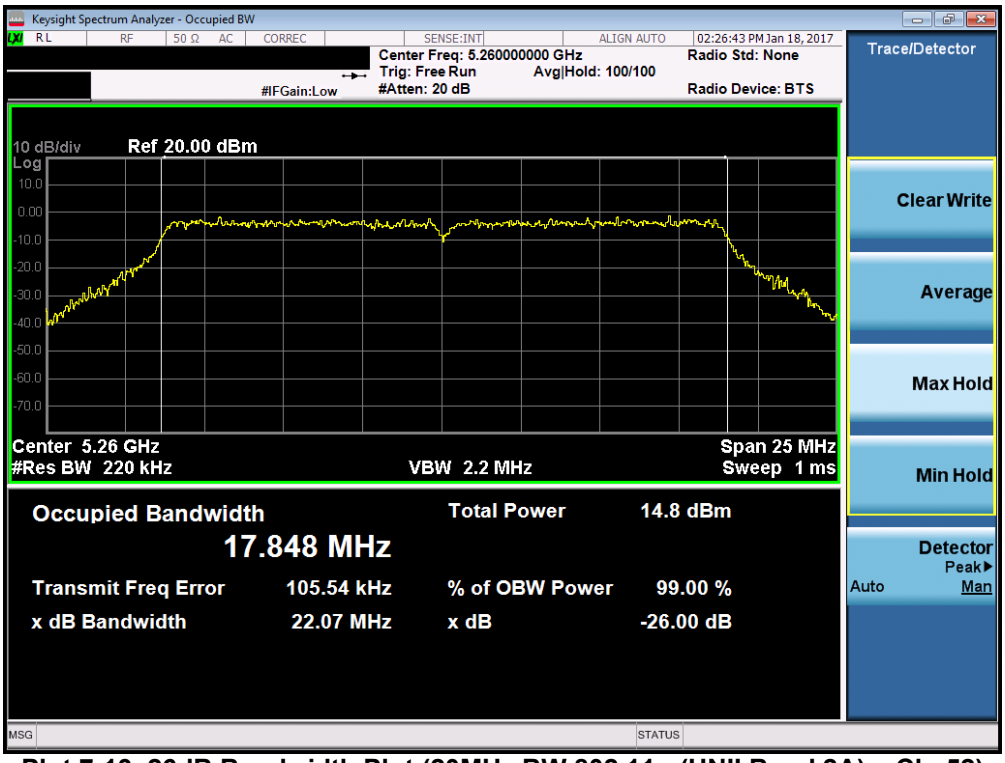
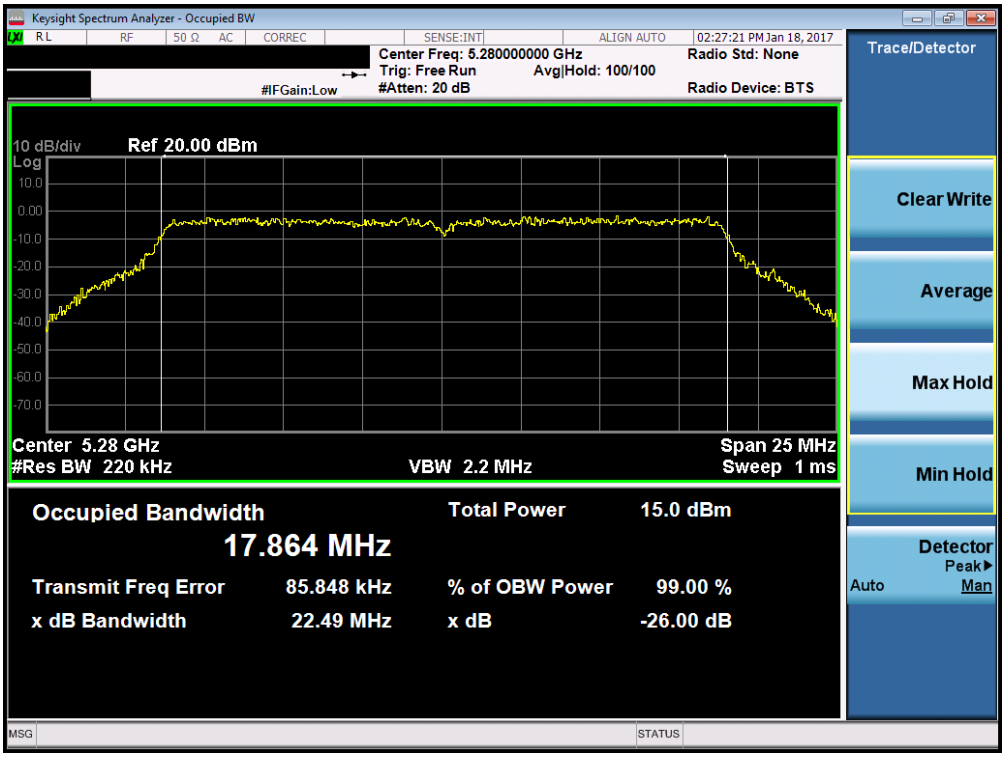


Plot 7-13. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 52)



Plot 7-14. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)

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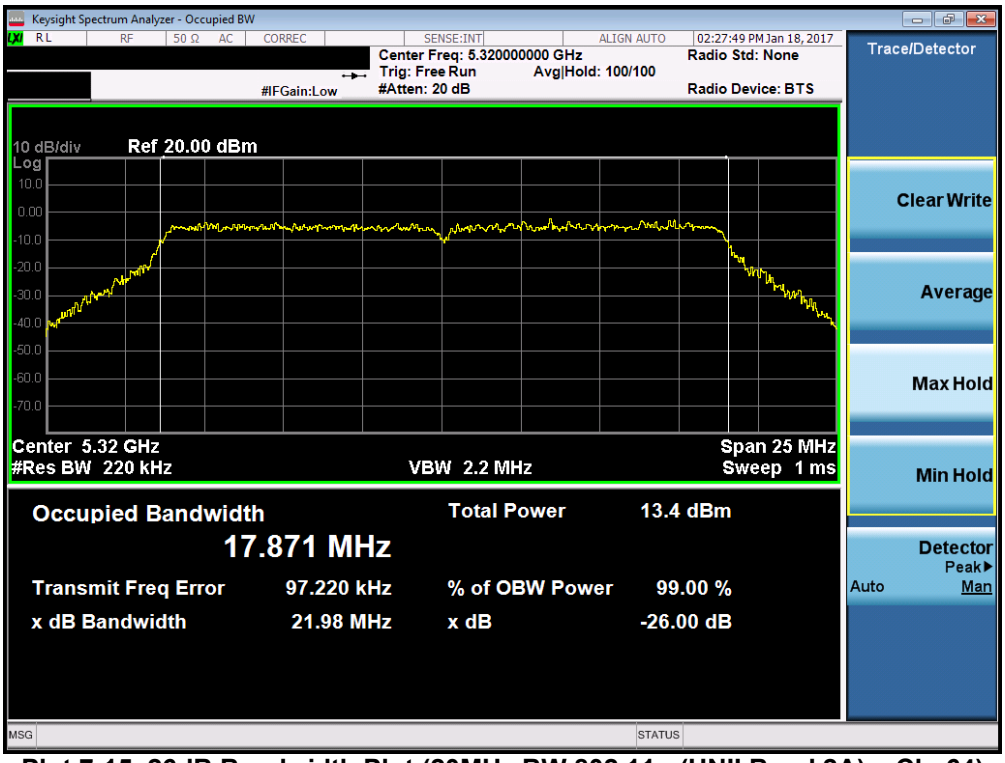
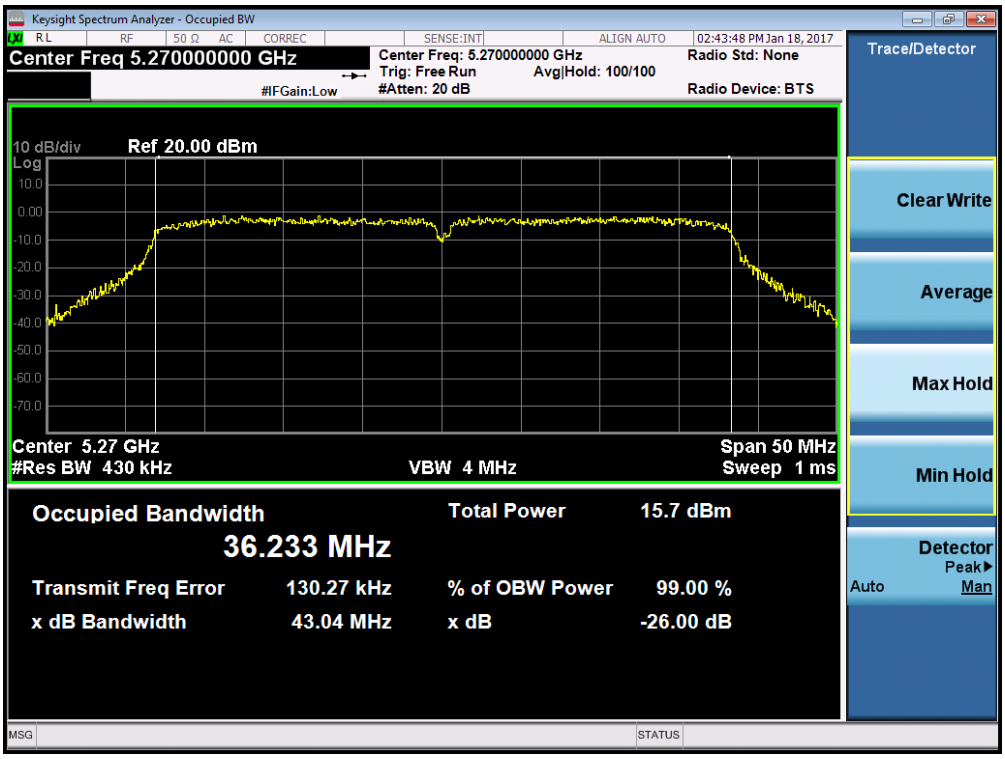


Plot 7-15. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 64)



Plot 7-16. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)

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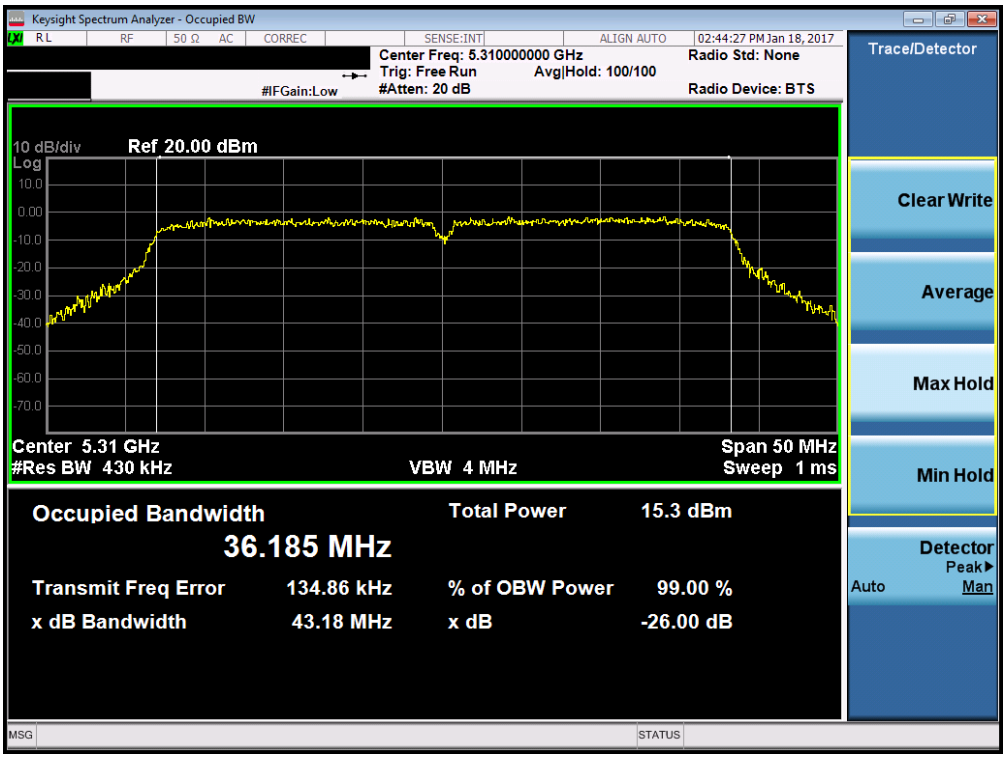
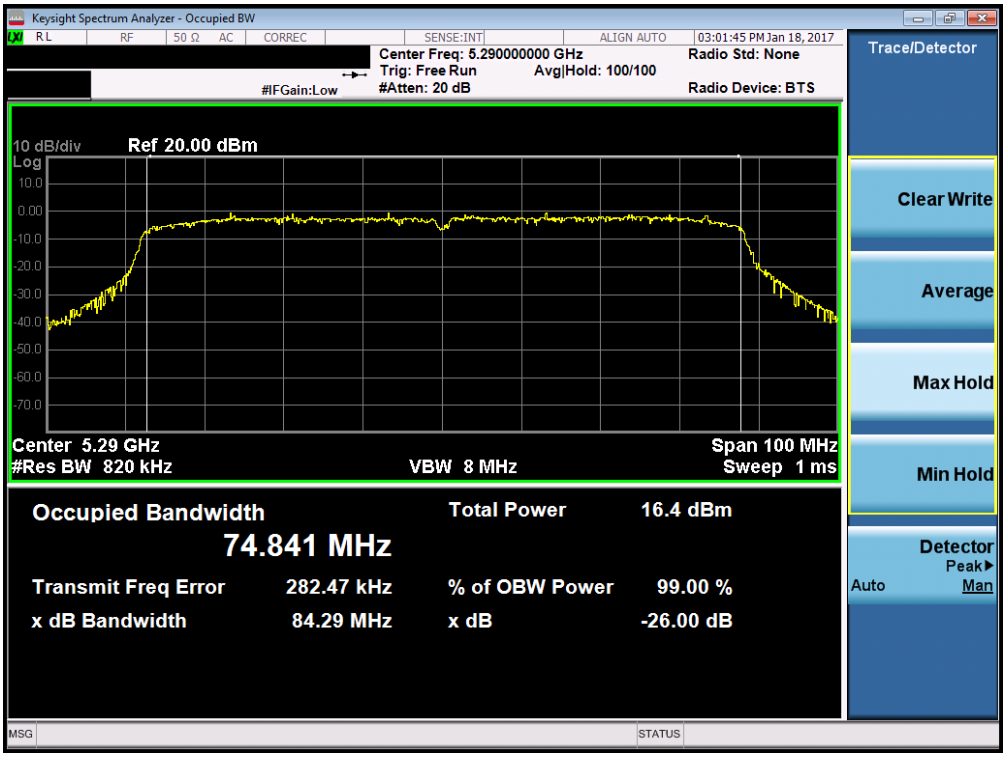


Plot 7-17. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2A) – Ch. 62)



Plot 7-18. 26dB Bandwidth Plot (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)

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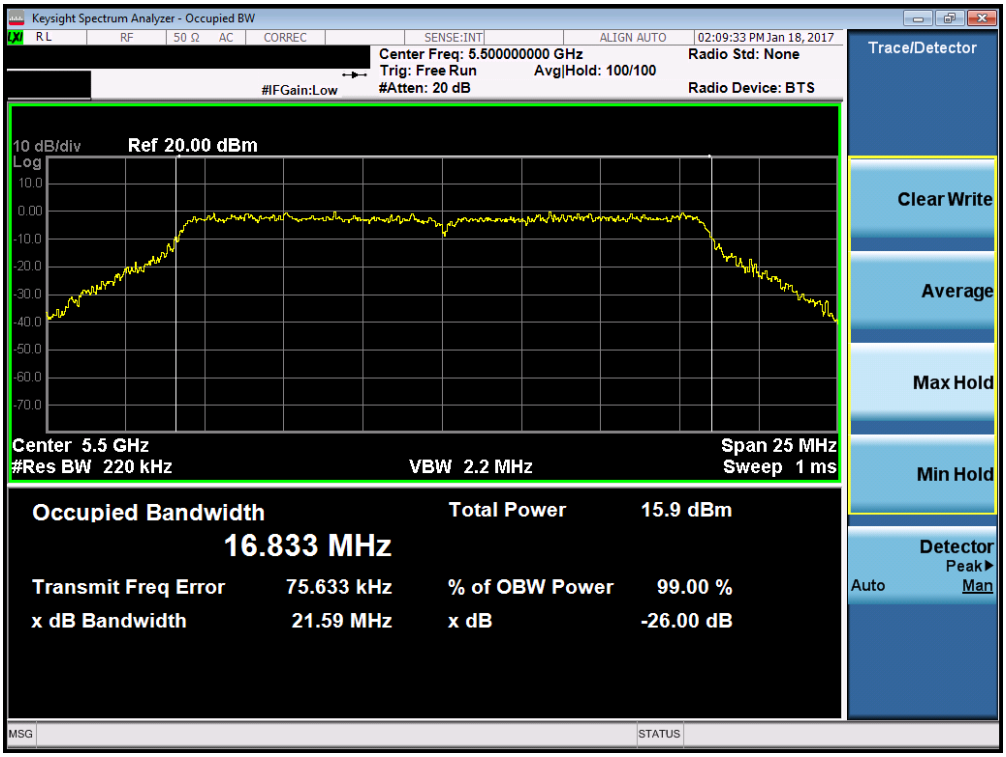
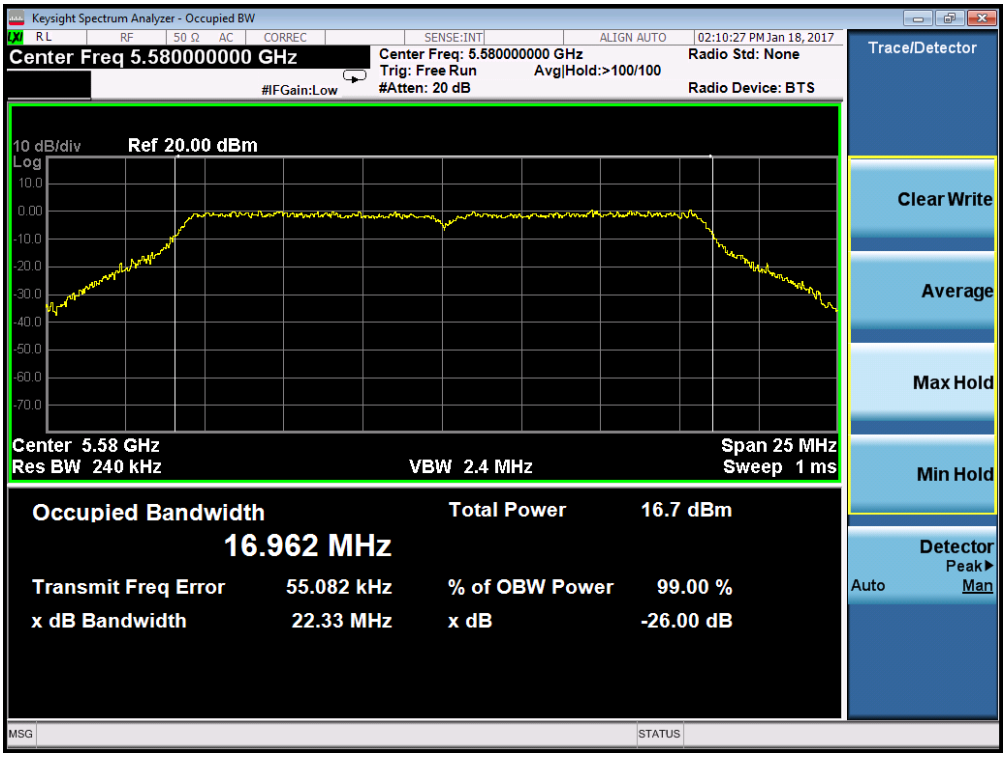


Plot 7-19. 26dB Bandwidth Plot (802.11a (UNII Band 2C) – Ch. 100)



Plot 7-20. 26dB Bandwidth Plot (802.11a (UNII Band 2C) – Ch. 116)

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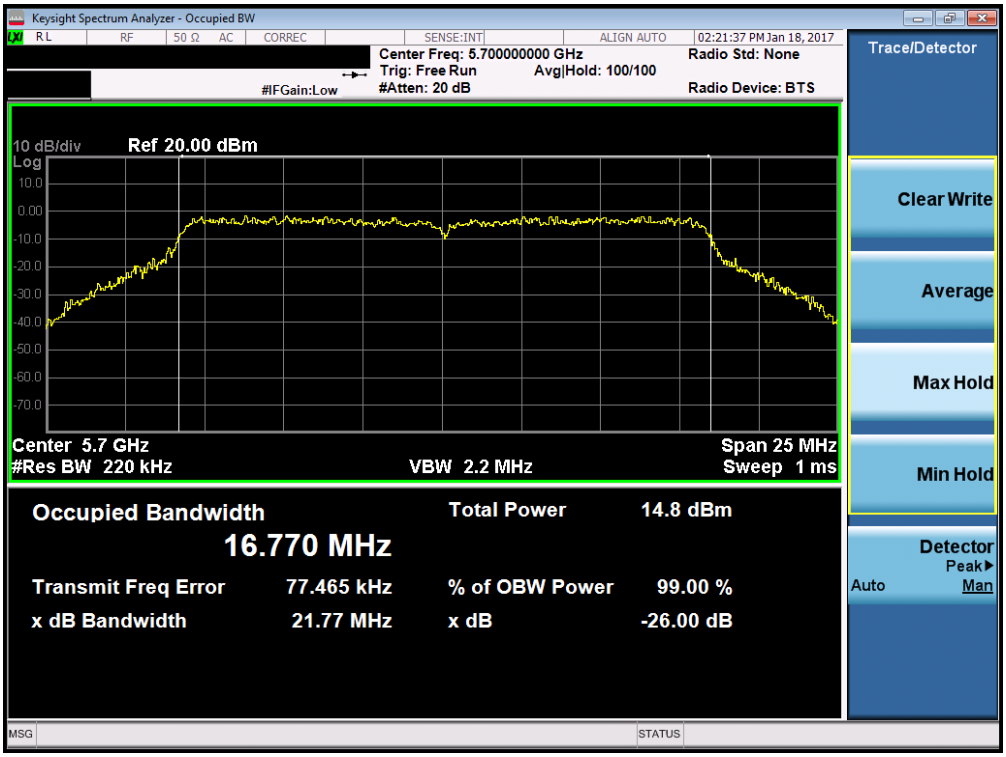
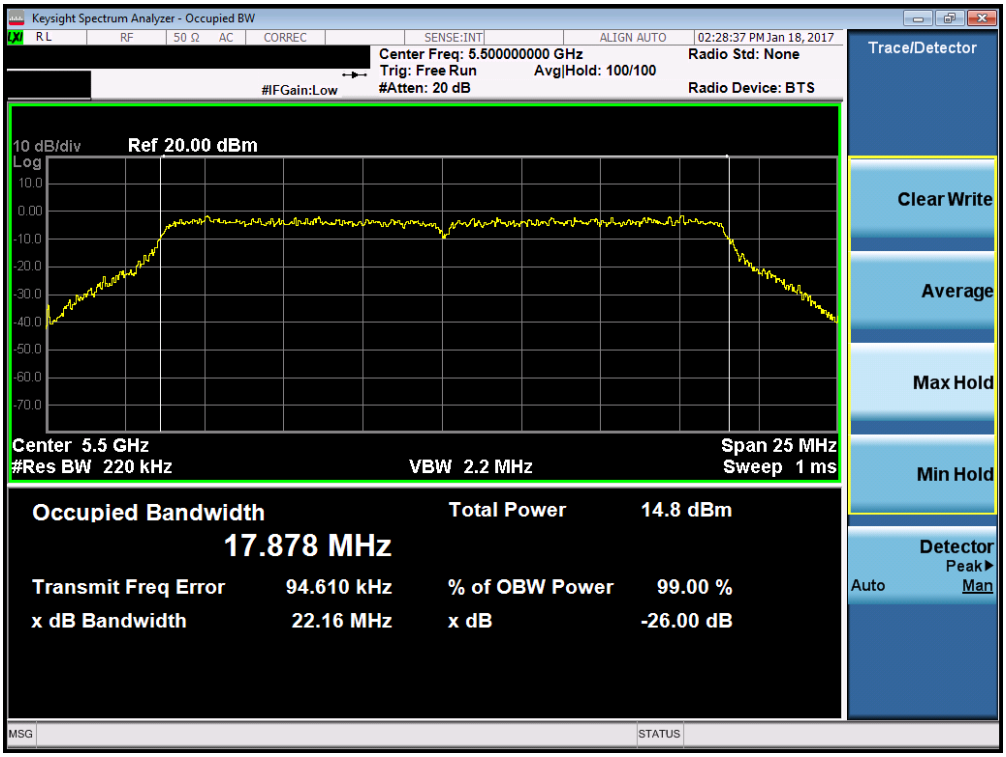


Plot 7-21. 26dB Bandwidth Plot (802.11a (UNII Band 2C) – Ch. 140)



Plot 7-22. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 100)

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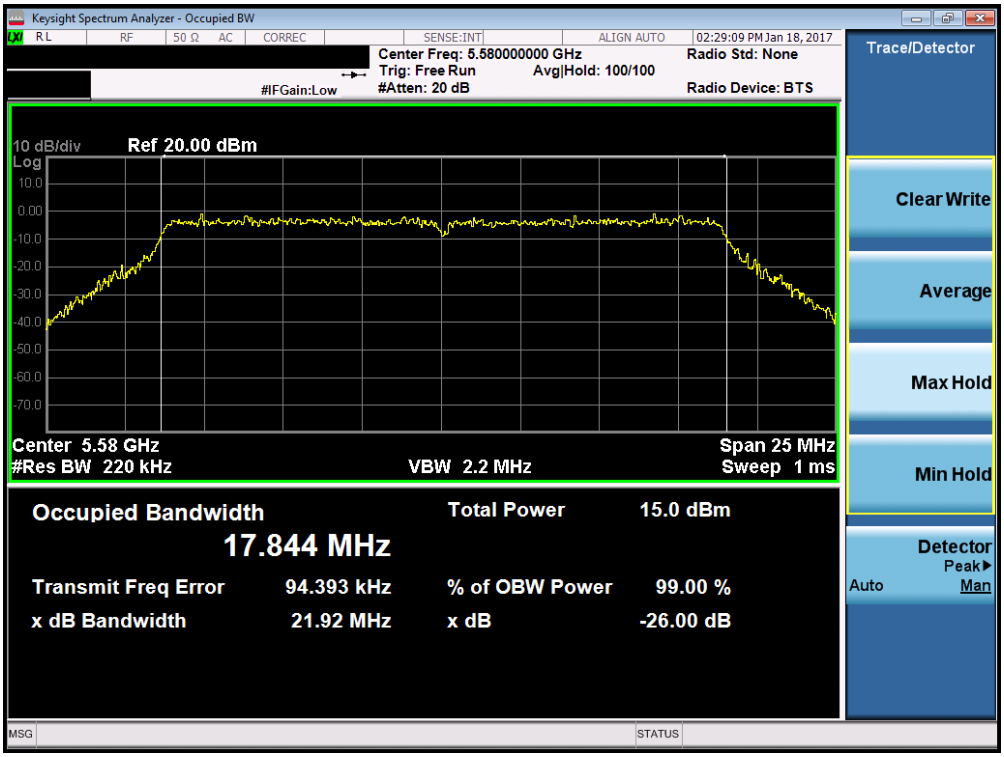
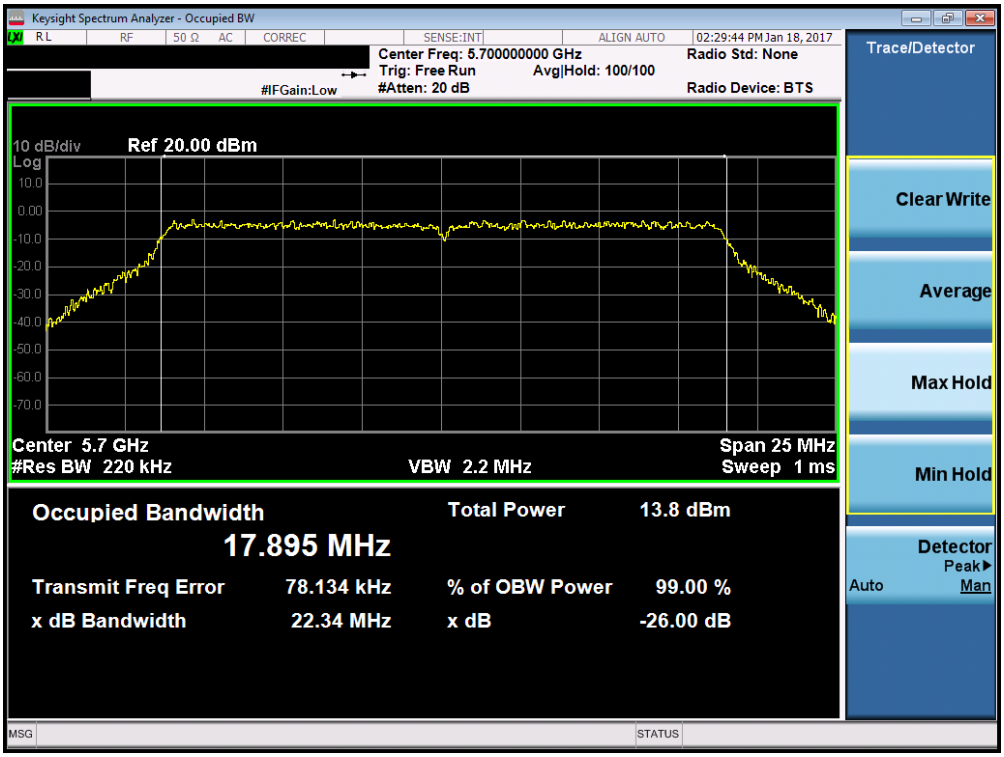


Plot 7-23. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 116)



Plot 7-24. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 140)

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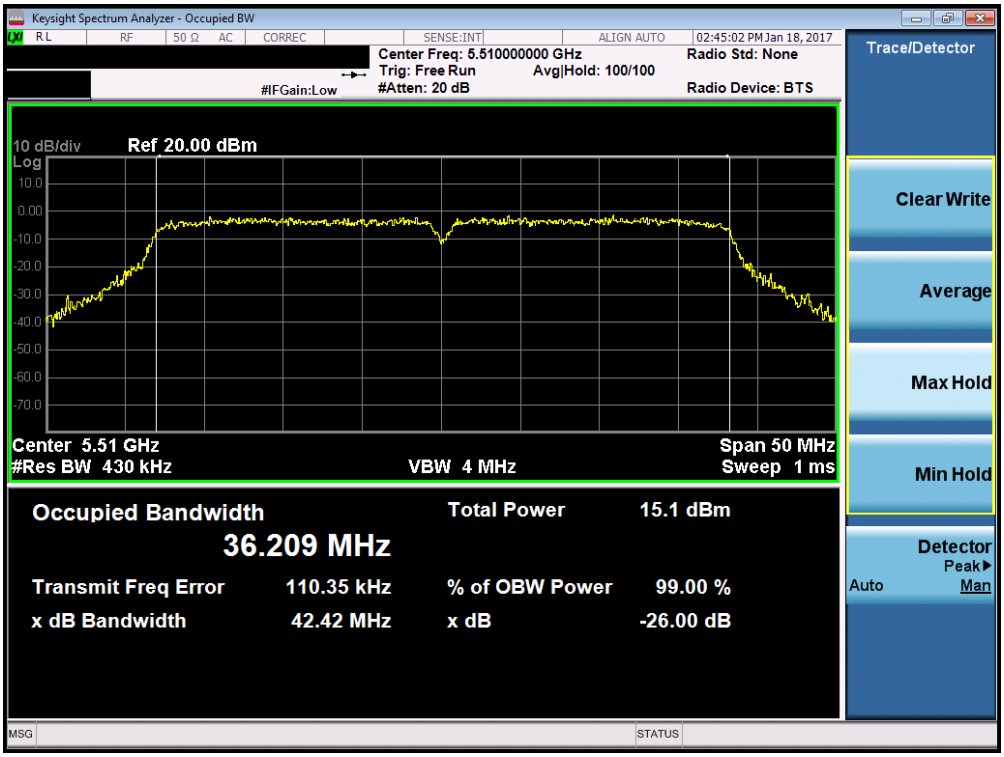
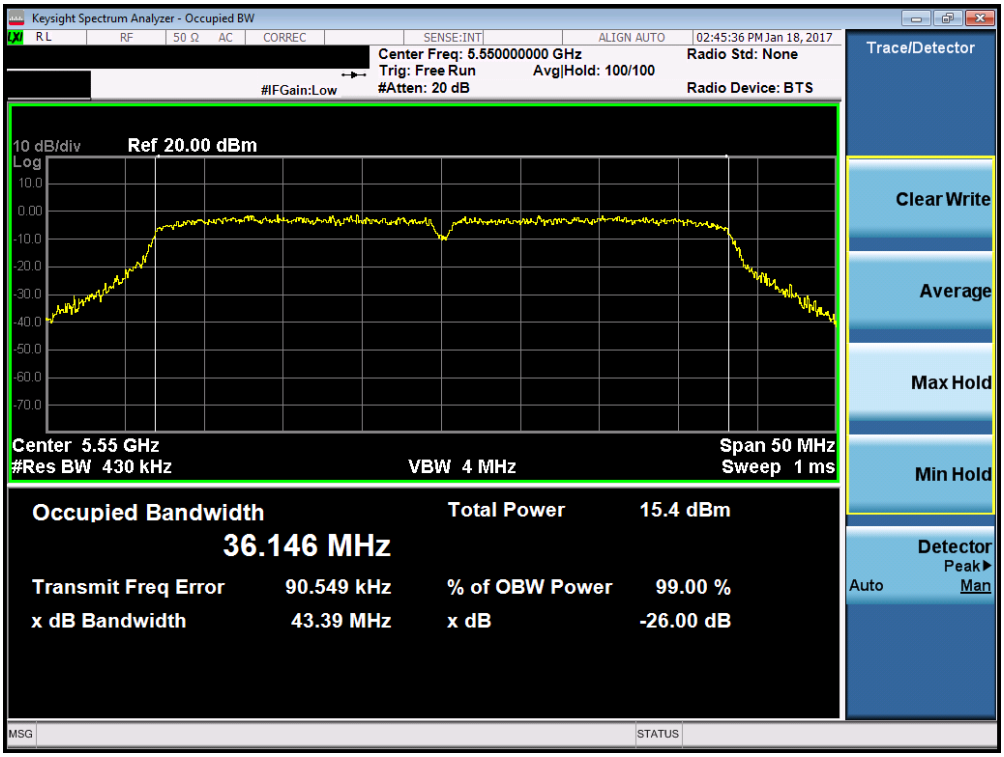


Plot 7-25. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 102)



Plot 7-26. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 110)

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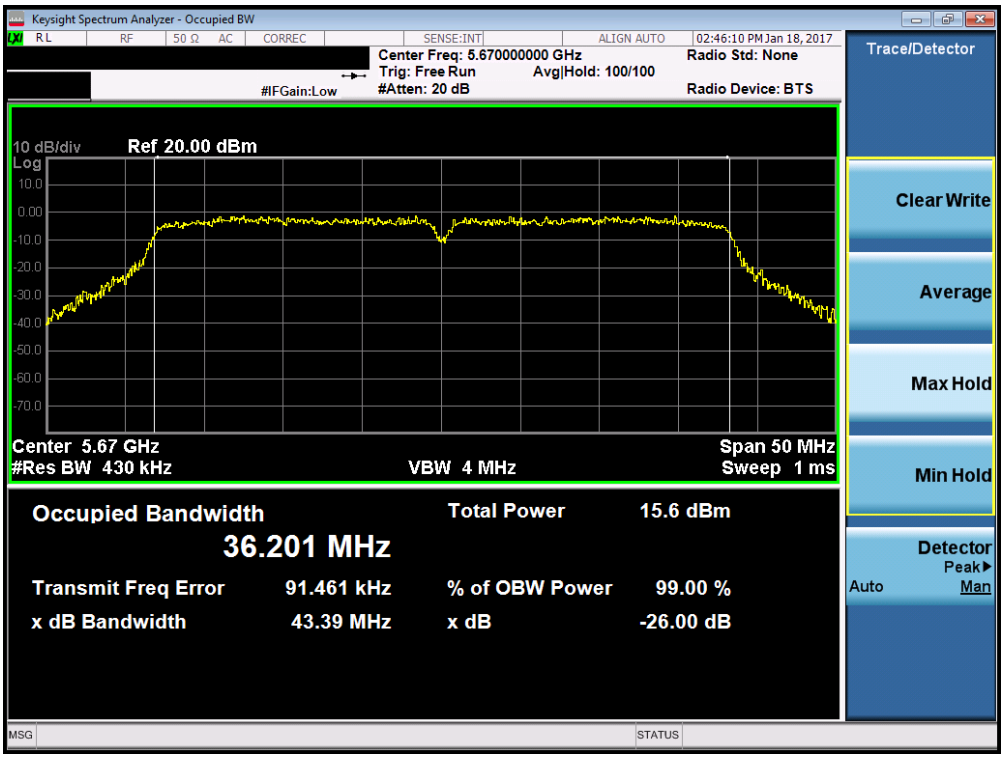
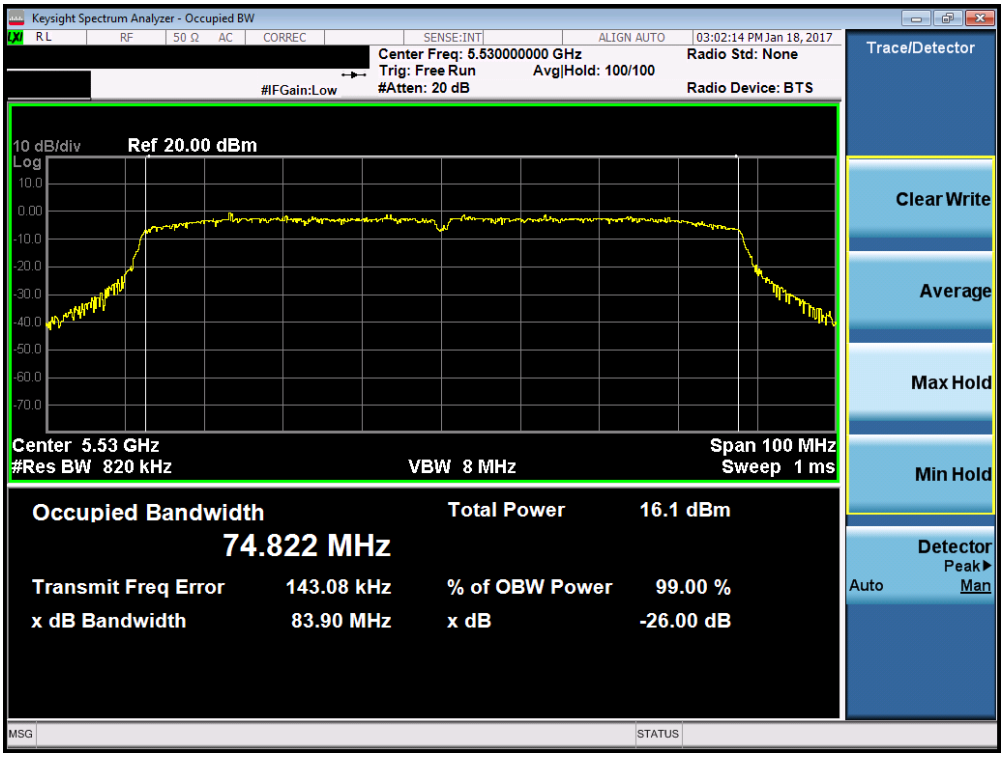


Plot 7-27. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 134)



Plot 7-28. 26dB Bandwidth Plot (80MHz BW 802.11ac (UNII Band 2C) – Ch. 106)

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7.3 6dB Bandwidth Measurement – 802.11a/n/ac

§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 D02 v01r03, 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 v01r03 – 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.

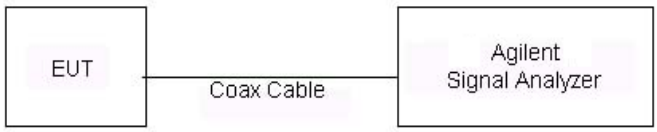

Figure 7-2. Test Instrument & Measurement Setup

Test Notes

None.

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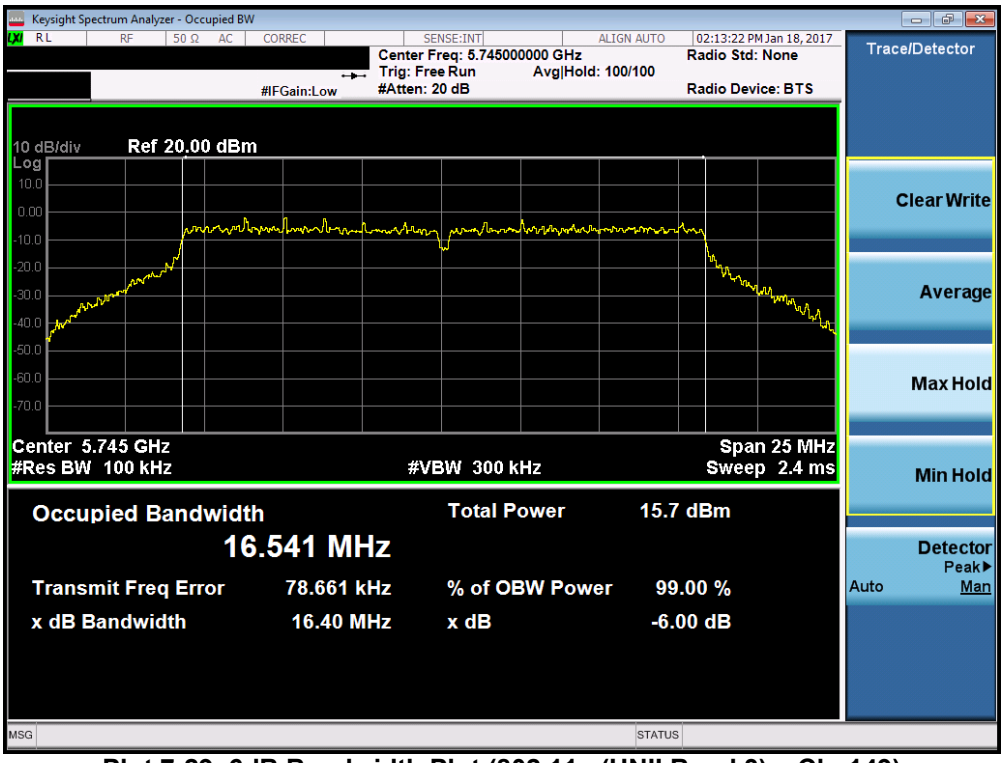
Antenna-1 6 dB Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 6dB Bandwidth [MHz]
Band 3	5745	149	a	6	16.40
	5785	157	a	6	16.44
	5825	165	a	6	16.38
	5745	149	n (20MHz)	6.5/7.2 (MCS0)	17.62
	5785	157	n (20MHz)	6.5/7.2 (MCS0)	17.60
	5825	165	n (20MHz)	6.5/7.2 (MCS0)	17.65
	5755	151	n (40MHz)	13.5/15 (MCS0)	35.54
	5795	159	n (40MHz)	13.5/15 (MCS0)	35.80
	5775	155	ac (80MHz)	29.3/32.5 (MCS0)	75.20

Table 7-3. Conducted Bandwidth Measurements



Plot 7-29. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 149)

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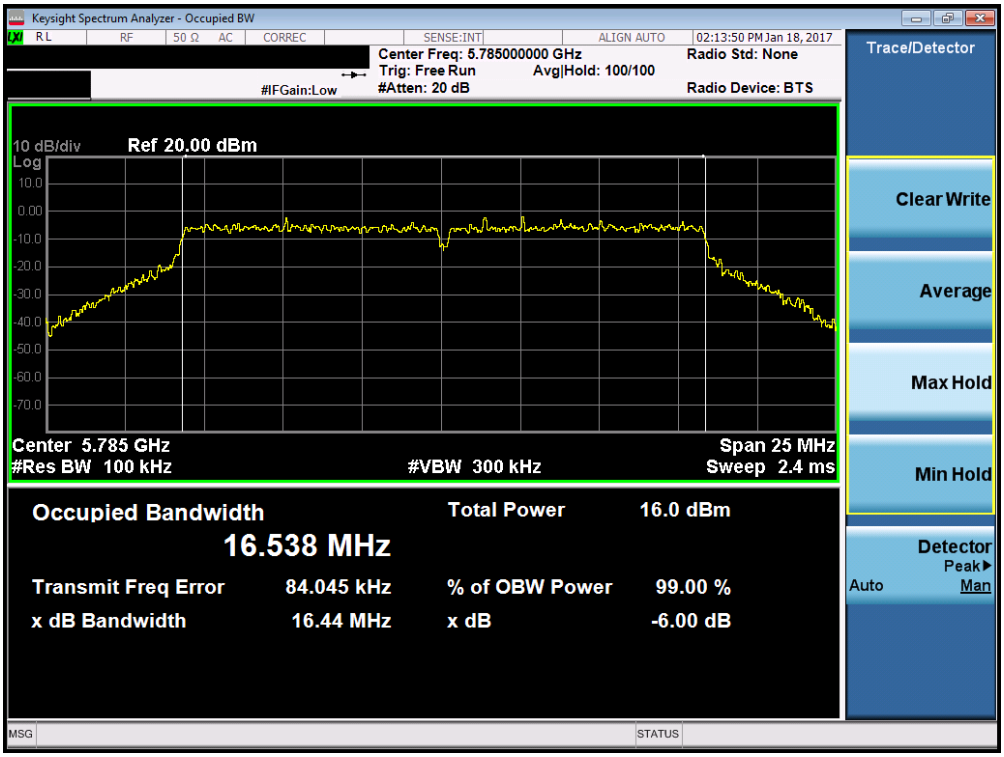
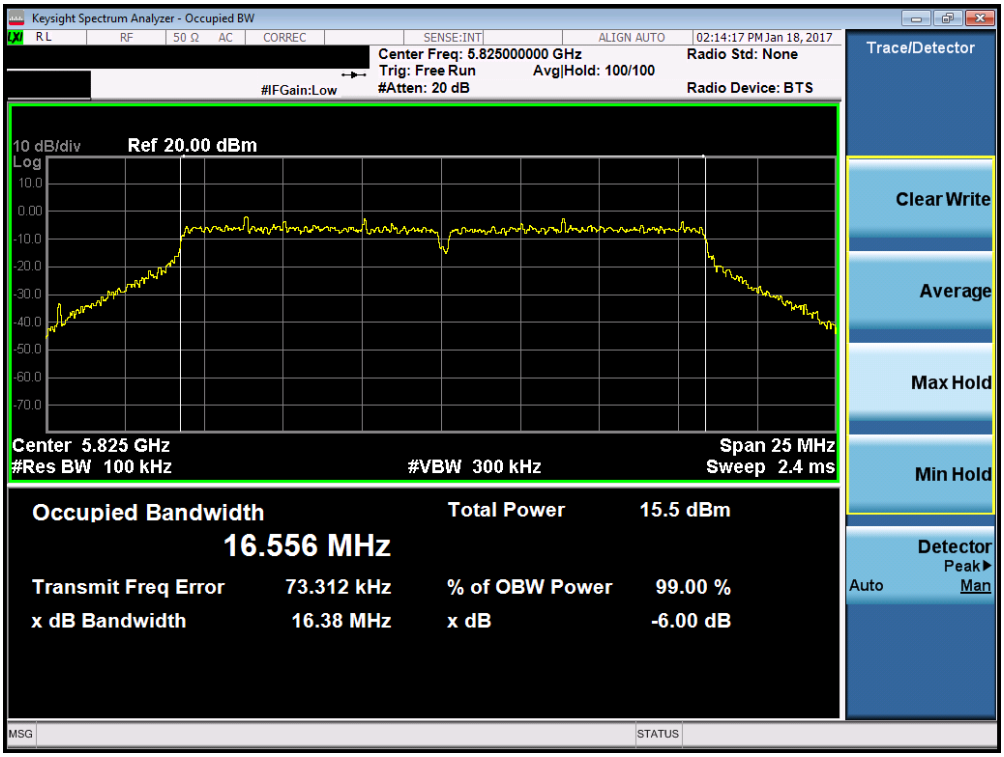


Plot 7-30. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 157)



Plot 7-31. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 165)

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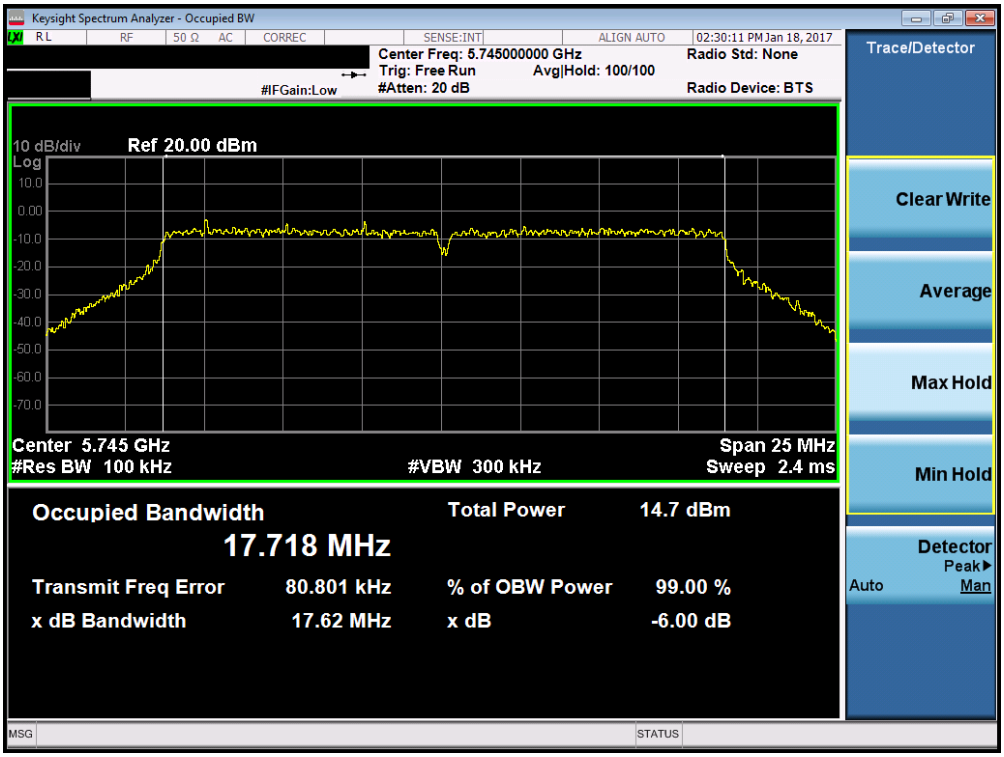
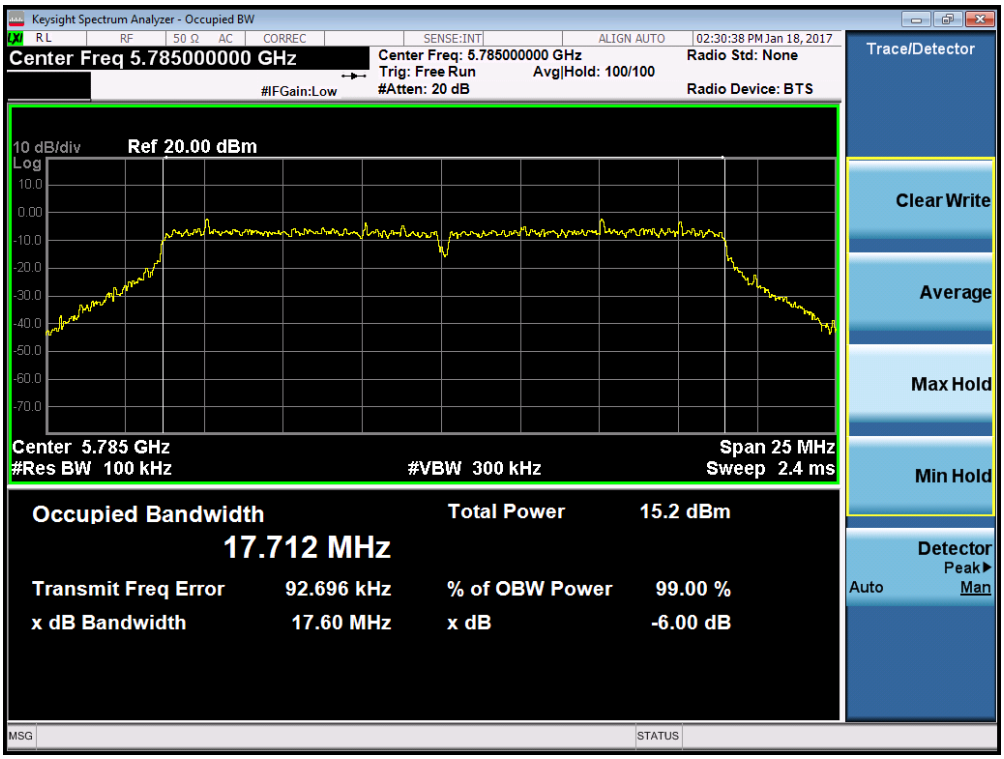


Plot 7-32. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 149)



Plot 7-33. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 157)

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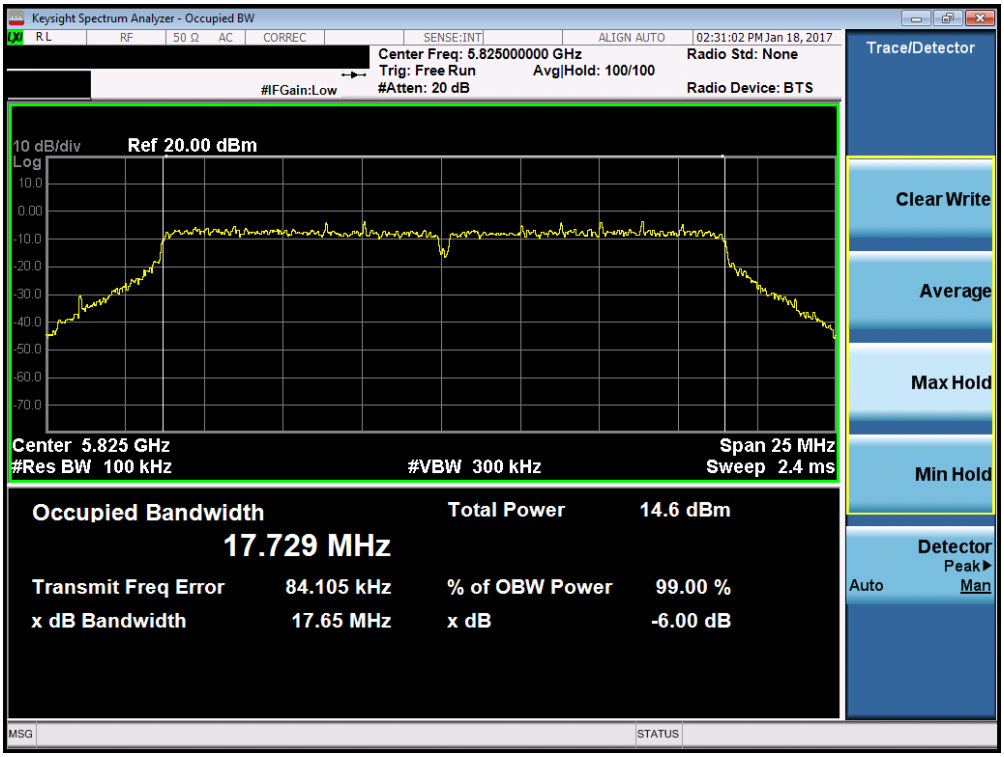
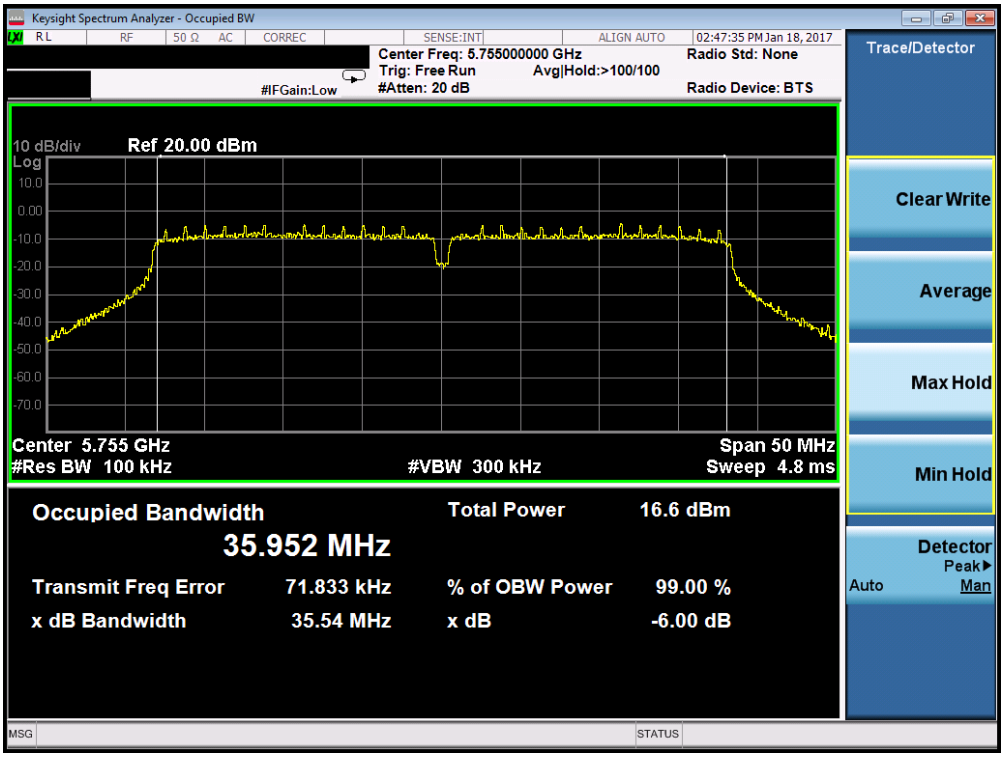


Plot 7-34. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 165)



Plot 7-35. 6dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 151)

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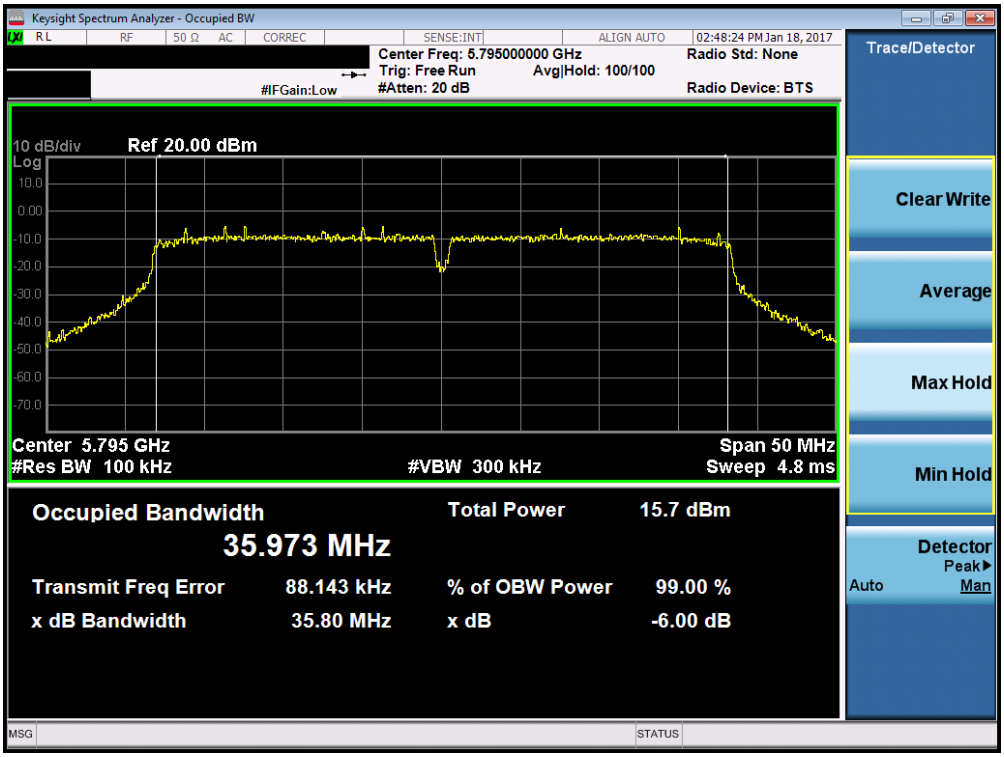
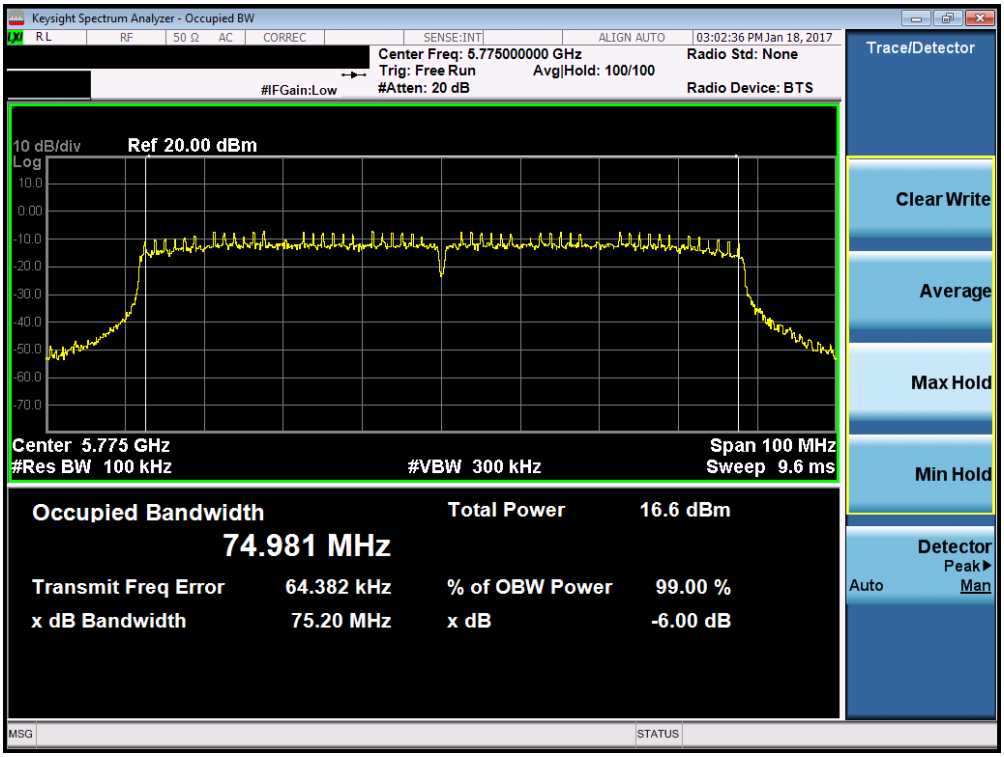


Plot 7-36. 6dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 159)



Plot 7-37. 6dB Bandwidth Plot (80MHz BW 802.11ac (UNII Band 3) – Ch. 155)

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7.4 UNII Output Power Measurement – 802.11a/n/ac

§15.407(a.1.iv) §15.407(a.2) §15.407(a.3)

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 D02 v01r03, 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 + 10log$_{10}$(26dB BW) = 11 dBm + 10log$_{10}$(21.61) = 24.35dBm.

In the 5.47 – 5.725GHz band, the maximum permissible conducted output power is the lesser of 250mW (23.98dBm) and 11 dBm + 10log$_{10}$(26dB BW) = 11 dBm + 10log$_{10}$(21.59) = 24.34dBm.

In the 5.725 – 5.850GHz band, the maximum permissible conducted output power is 1W (30dBm).

Test Procedure Used

KDB 789033 D02 v01r03 – 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.

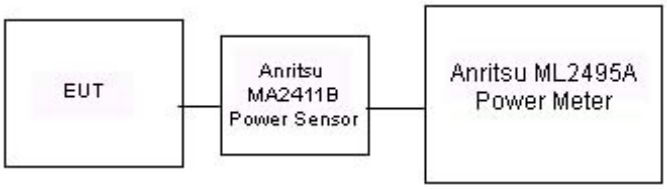

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

None

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Freq [MHz]	Channel	Detector	5GHz (20MHz) Conducted Power [dBm]		
			IEEE Transmission Mode		
			802.11a	802.11n	802.11ac
5180	36	AVG	10.03	9.05	9.74
5200	40	AVG	10.16	9.06	9.62
5220	44	AVG	10.14	9.11	9.61
5240	48	AVG	9.97	8.92	9.54
5260	52	AVG	10.02	8.93	9.71
5280	56	AVG	9.99	9.01	9.52
5300	60	AVG	9.39	7.98	8.67
5320	64	AVG	9.02	7.95	8.69
5500	100	AVG	9.93	9.04	9.26
5520	104	AVG	9.88	8.72	9.23
5540	108	AVG	9.92	8.77	9.32
5560	112	AVG	9.98	8.74	9.34
5580	116	AVG	9.91	8.77	9.26
5660	132	AVG	9.89	8.79	9.27
5680	136	AVG	9.06	8.06	8.33
5700	140	AVG	9.18	7.91	8.31
5745	149	AVG	9.77	8.79	9.24
5765	153	AVG	9.94	8.91	9.25
5785	157	AVG	9.95	8.87	9.14
5805	161	AVG	9.89	8.76	9.14
5825	165	AVG	9.74	8.74	9.17

Table 7-4. 20MHz BW (UNII) Maximum Conducted Output Power

Freq [MHz]	Channel	Detector	5GHz (40MHz) Conducted Power [dBm]	
			IEEE Transmission Mode	
			802.11n	802.11ac
5190	38	AVG	9.23	9.19
5230	46	AVG	9.21	9.19
5270	54	AVG	9.23	8.86
5310	62	AVG	9.13	8.75
5510	102	AVG	8.84	8.42
5550	110	AVG	8.91	8.21
5670	134	AVG	8.96	8.30
5755	151	AVG	8.86	8.32
5795	159	AVG	8.83	8.26

Table 7-5. 40MHz BW (UNII) Maximum Conducted Output Power

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5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	Detector	IEEE Transmission Mode
			802.11ac
5210	42	AVG	8.92
5290	58	AVG	9.08
5530	106	AVG	8.71
5775	155	AVG	8.58

Table 7-6. 80MHz BW (UNII) Maximum Conducted Output Power

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7.5 Maximum Power Spectral Density – 802.11a/n/ac

§15.407(a.1.iv) §15.407(a.2) §15.407(a.3)

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 D02 v01r03, and at the appropriate frequencies. Method SA-1, as defined in KDB 789033 D02 v01r03, was used to measure the power spectral density.

In the 5.15 – 5.25GHz, 5.25 – 5.35GHz, 5.47 – 5.725GHz bands, the maximum permissible power spectral density is 11dBm/MHz.

In the 5.725 – 5.850GHz band, the maximum permissible power spectral density is 30dBm/500kHz.

Test Procedure Used

KDB 789033 D02 v01r03 – 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 $\geq$ 2 x (span/RBW)
6. Sweep time = auto
7. Detector = power averaging (RMS)
8. Trigger was set to free run for all modes
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.

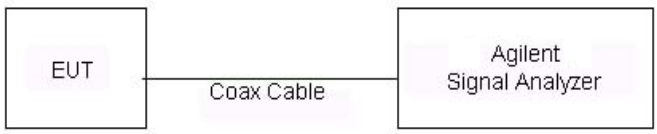

Figure 7-4. Test Instrument & Measurement Setup

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	-0.91	11.0	-11.91	Pass
	5200	40	a	6	-1.33	11.0	-12.33	Pass
	5240	48	a	6	0.57	11.0	-10.43	Pass
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	-2.22	11.0	-13.22	Pass
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	-2.59	11.0	-13.59	Pass
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	-2.44	11.0	-13.44	Pass
	5190	38	n (40MHz)	13.5/15 (MCS0)	-4.74	11.0	-15.74	Pass
	5230	46	n (40MHz)	13.5/15 (MCS0)	-4.91	11.0	-15.91	Pass
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	-7.51	11.0	-18.51	Pass
Band 2A	5260	52	a	6	-0.91	11.0	-11.91	Pass
	5280	56	a	6	-1.03	11.0	-12.03	Pass
	5320	64	a	6	-2.38	11.0	-13.38	Pass
	5260	52	n (20MHz)	6.5/7.2 (MCS0)	-2.33	11.0	-13.33	Pass
	5280	56	n (20MHz)	6.5/7.2 (MCS0)	-2.25	11.0	-13.25	Pass
	5320	64	n (20MHz)	6.5/7.2 (MCS0)	-3.64	11.0	-14.64	Pass
	5270	54	n (40MHz)	13.5/15 (MCS0)	-4.66	11.0	-15.66	Pass
	5310	62	n (40MHz)	13.5/15 (MCS0)	-4.82	11.0	-15.82	Pass
	5290	58	ac (80MHz)	29.3/32.5 (MCS0)	-7.49	11.0	-18.49	Pass
Band 2C	5500	100	a	6	-1.25	11.0	-12.25	Pass
	5580	116	a	6	-1.07	11.0	-12.07	Pass
	5700	140	a	6	-2.43	11.0	-13.43	Pass
	5500	100	n (20MHz)	6.5/7.2 (MCS0)	-2.53	11.0	-13.53	Pass
	5580	116	n (20MHz)	6.5/7.2 (MCS0)	-2.21	11.0	-13.21	Pass
	5700	140	n (20MHz)	6.5/7.2 (MCS0)	-3.22	11.0	-14.22	Pass
	5510	102	n (40MHz)	13.5/15 (MCS0)	-5.10	11.0	-16.10	Pass
	5550	110	n (40MHz)	13.5/15 (MCS0)	-5.20	11.0	-16.20	Pass
	5670	134	n (40MHz)	13.5/15 (MCS0)	-4.92	11.0	-15.92	Pass
	5530	106	ac (80MHz)	29.3/32.5 (MCS0)	-7.82	11.0	-18.82	Pass

Table 7-7. Bands 1, 2A, 2C Conducted Power Spectral Density Measurements

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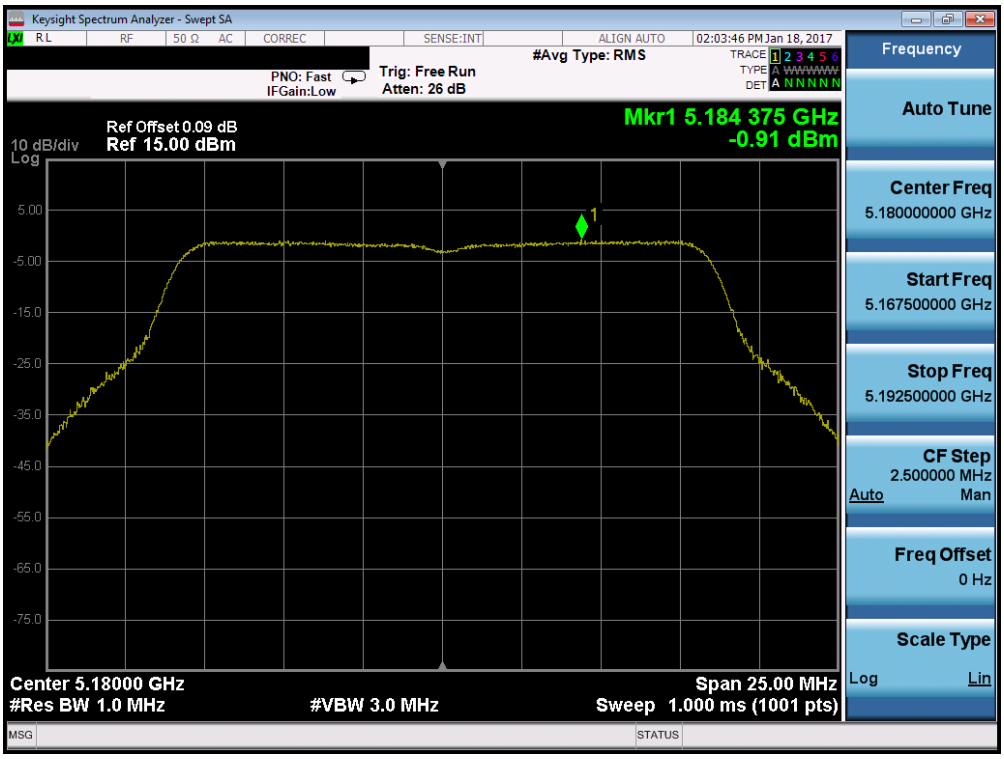
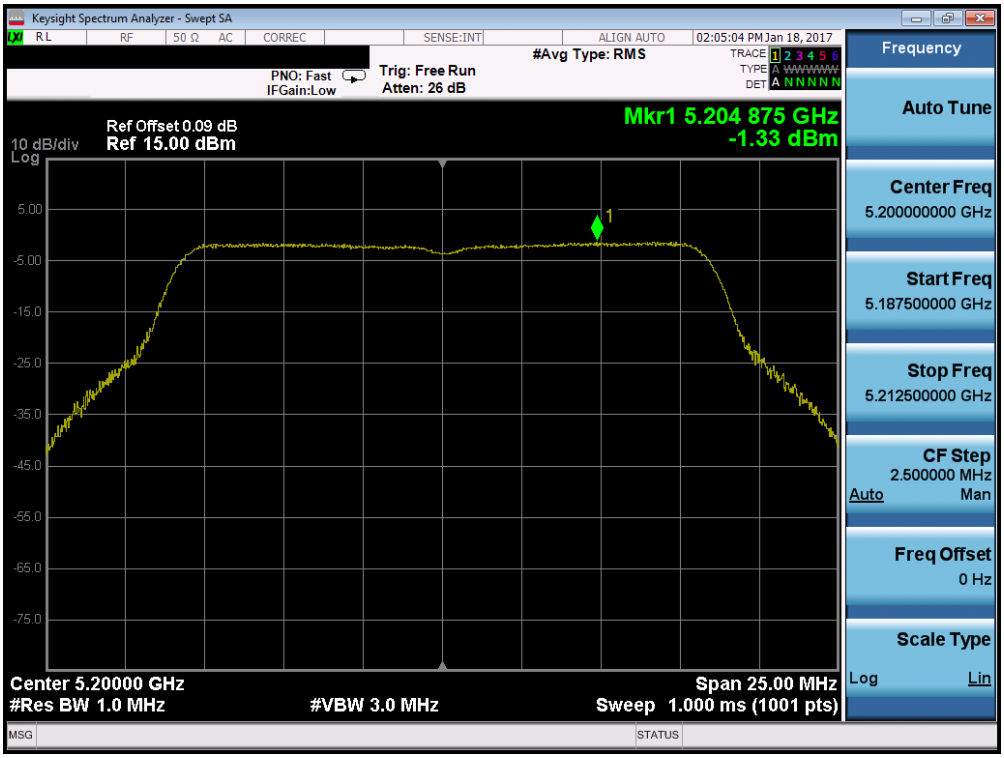


Plot 7-38. Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 36)



Plot 7-39. Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 40)

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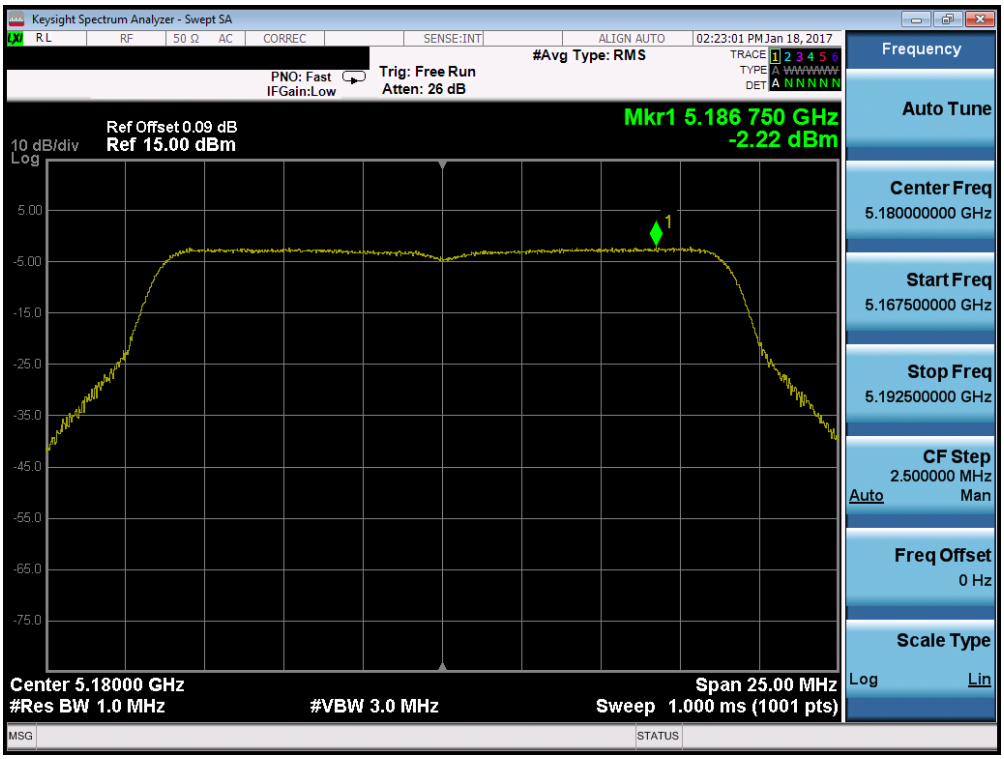
Plot 7-40. Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 48)



Plot 7-41. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 36)

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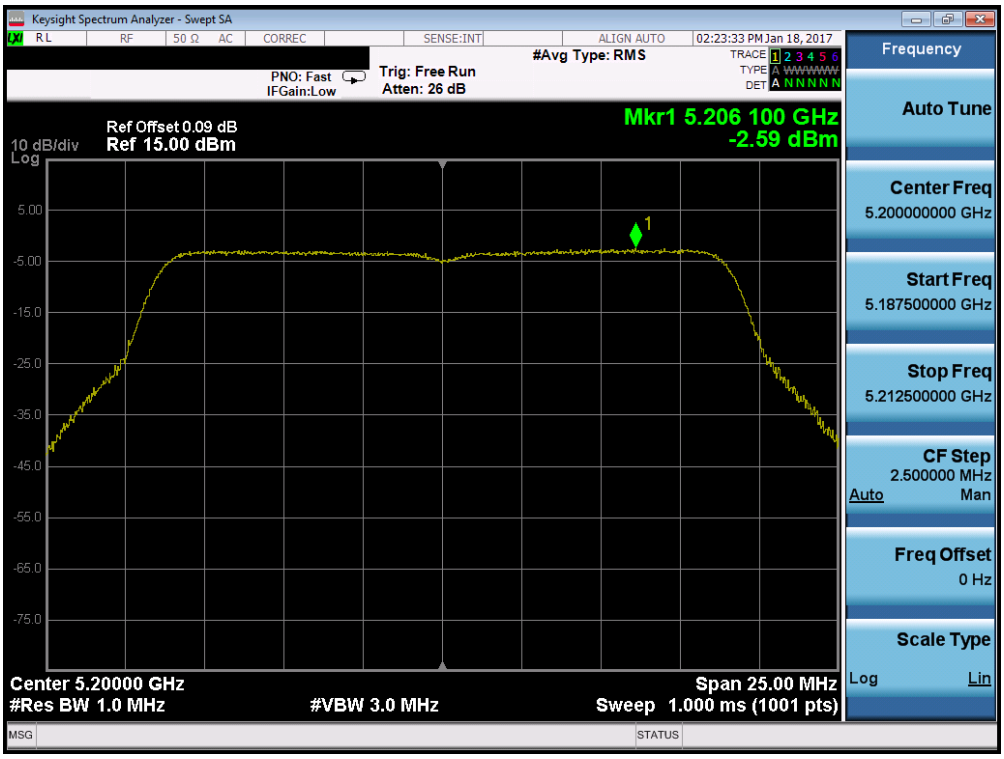

Plot 7-42. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 40)

Plot 7-43. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 48)

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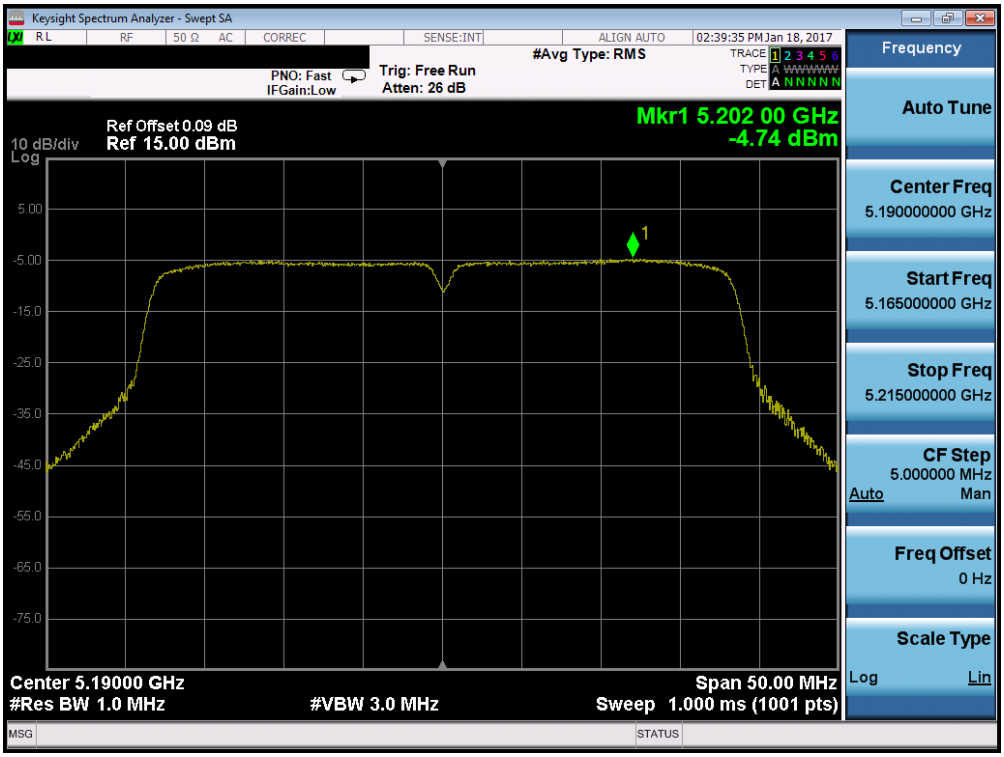
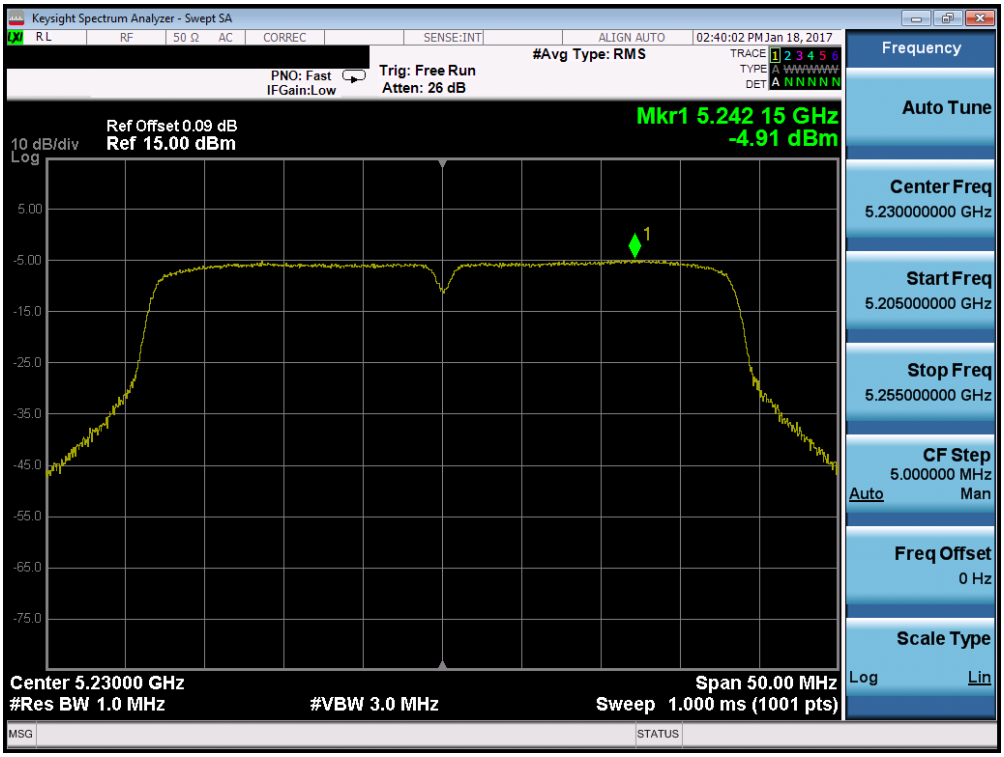


Plot 7-44. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



Plot 7-45. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 46)

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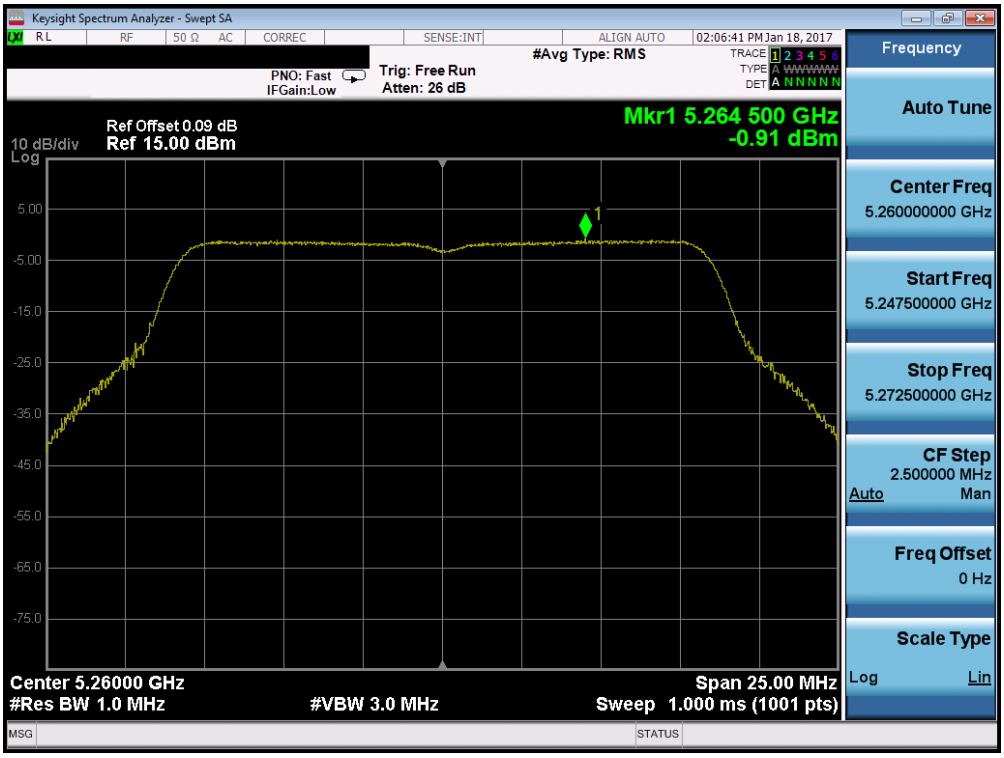
Plot 7-46. Power Spectral Density Plot (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)



Plot 7-47. Power Spectral Density Plot (802.11a (UNII Band 2A) – Ch. 52)

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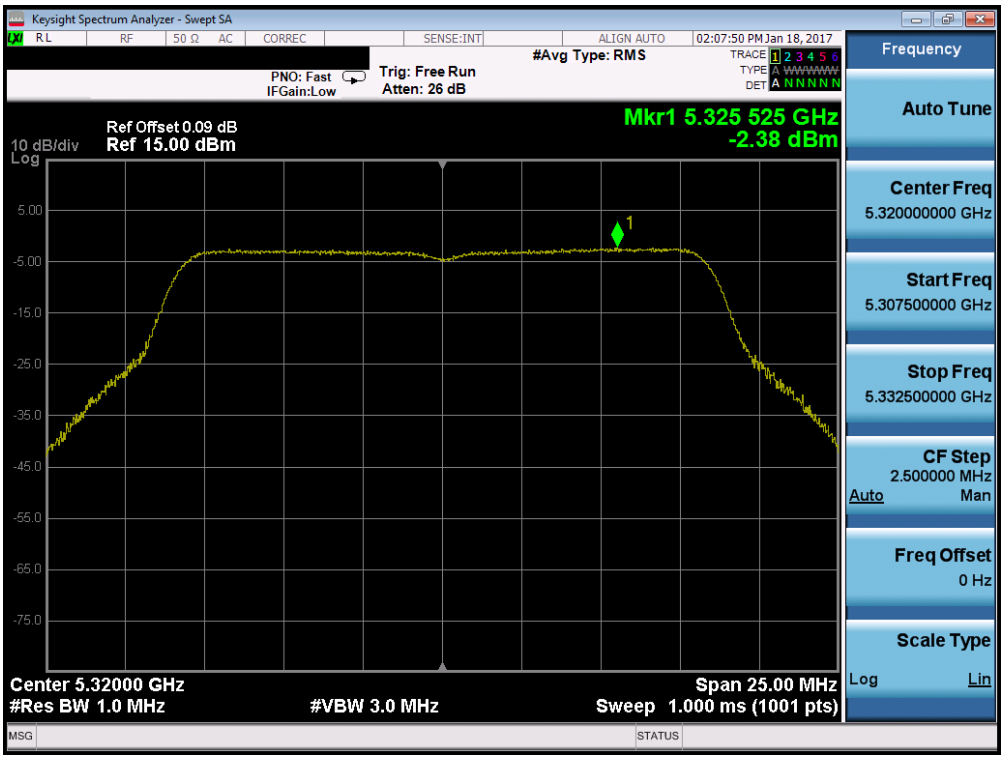
Plot 7-48. Power Spectral Density Plot (802.11a (UNII Band 2A) – Ch. 56)



Plot 7-49. Power Spectral Density Plot (802.11a (UNII Band 2A) – Ch. 64)

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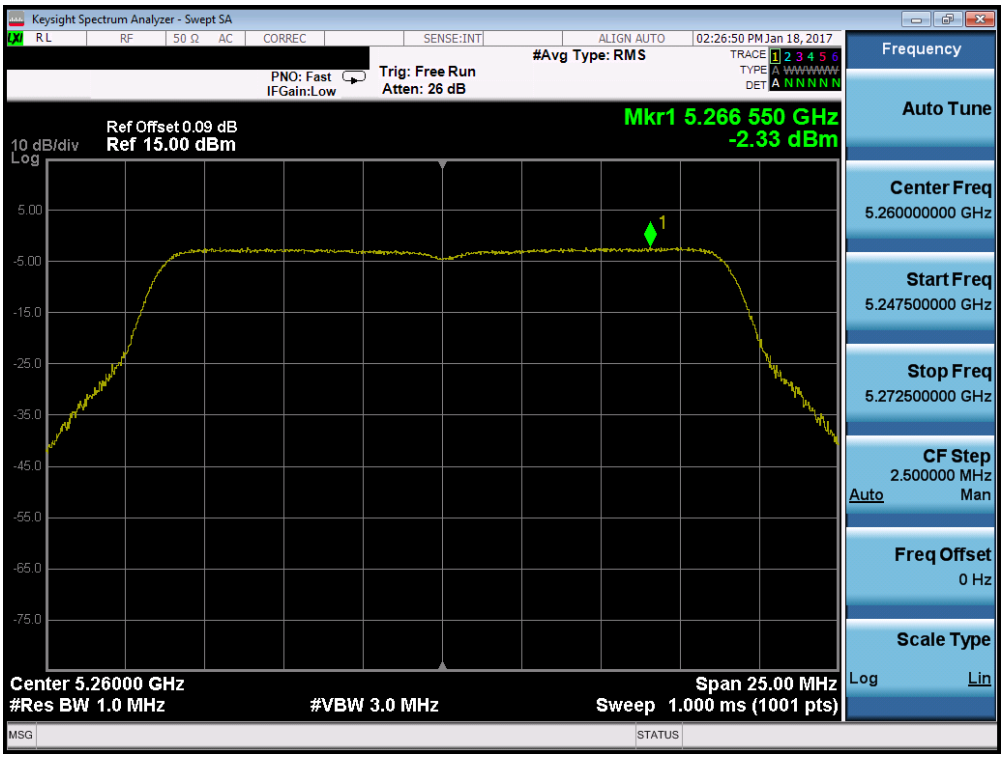

Plot 7-50. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 52)

Plot 7-51. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)

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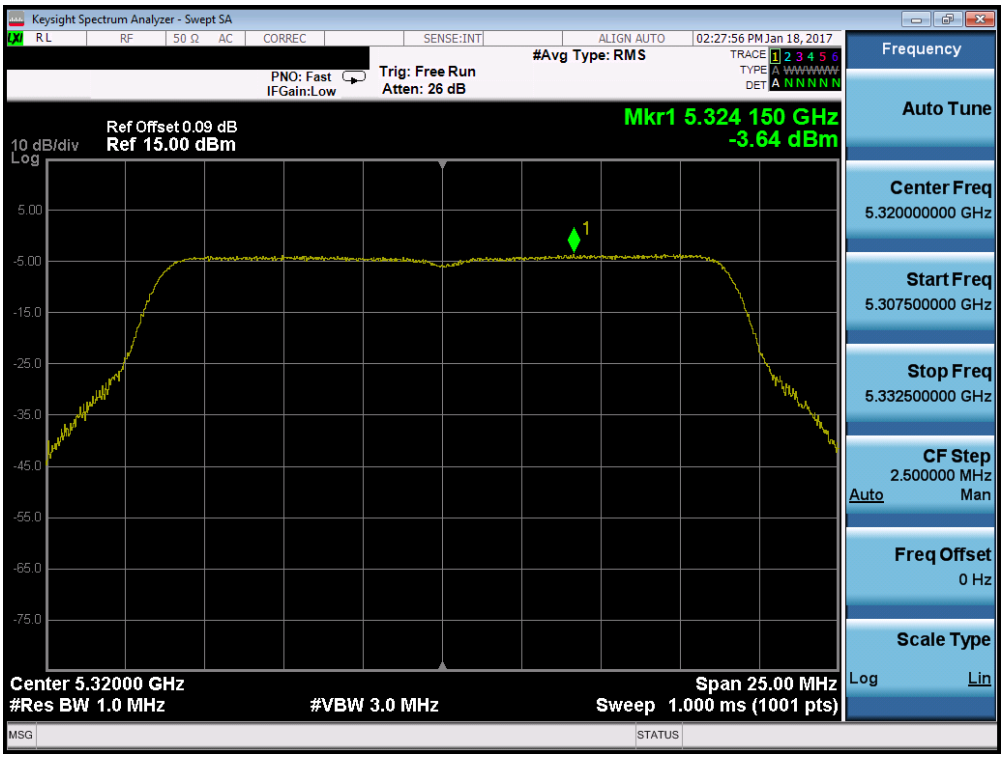
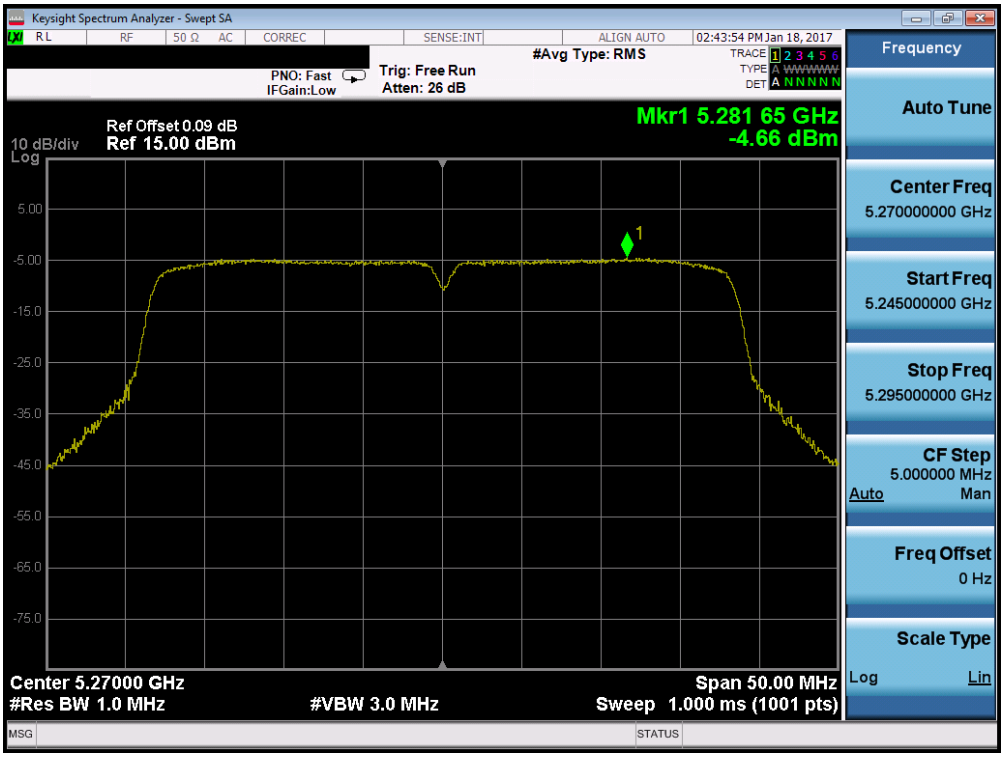


Plot 7-52. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2A) – Ch. 64)



Plot 7-53. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)

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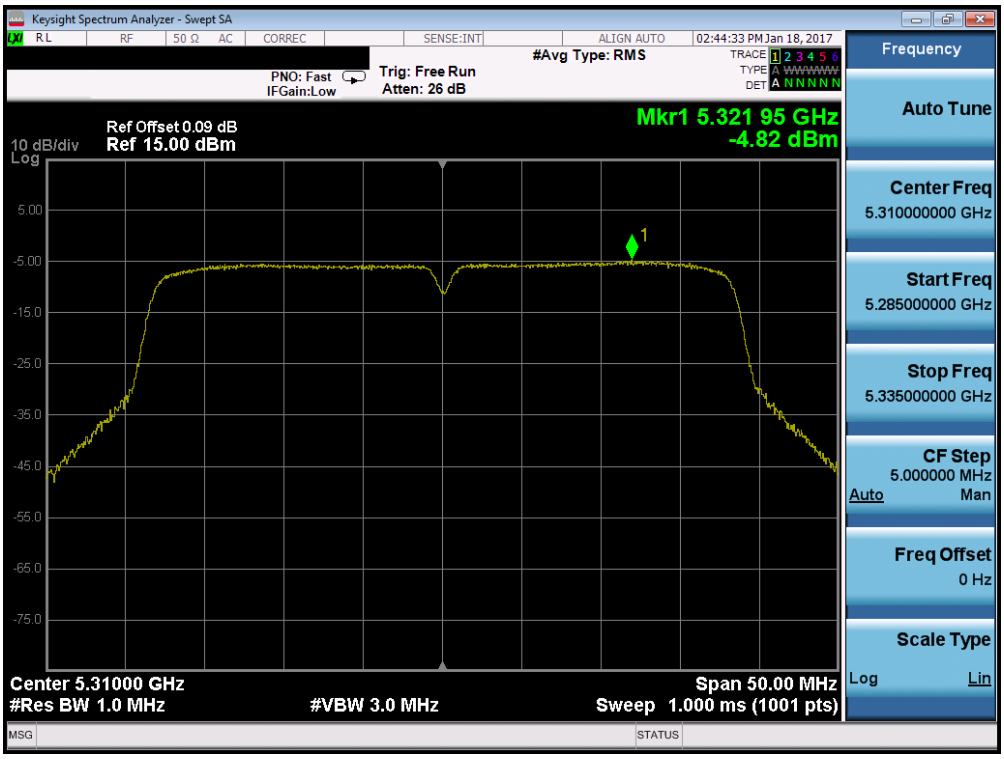

Plot 7-54. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2A) – Ch. 62)

Plot 7-55. Power Spectral Density Plot (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)

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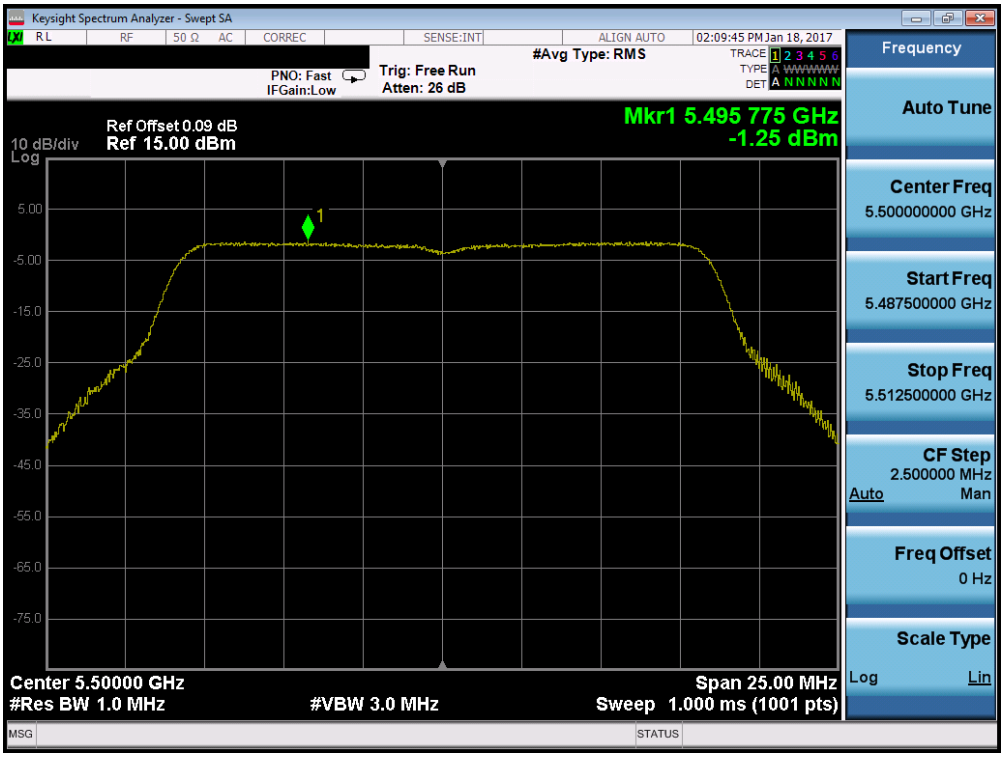
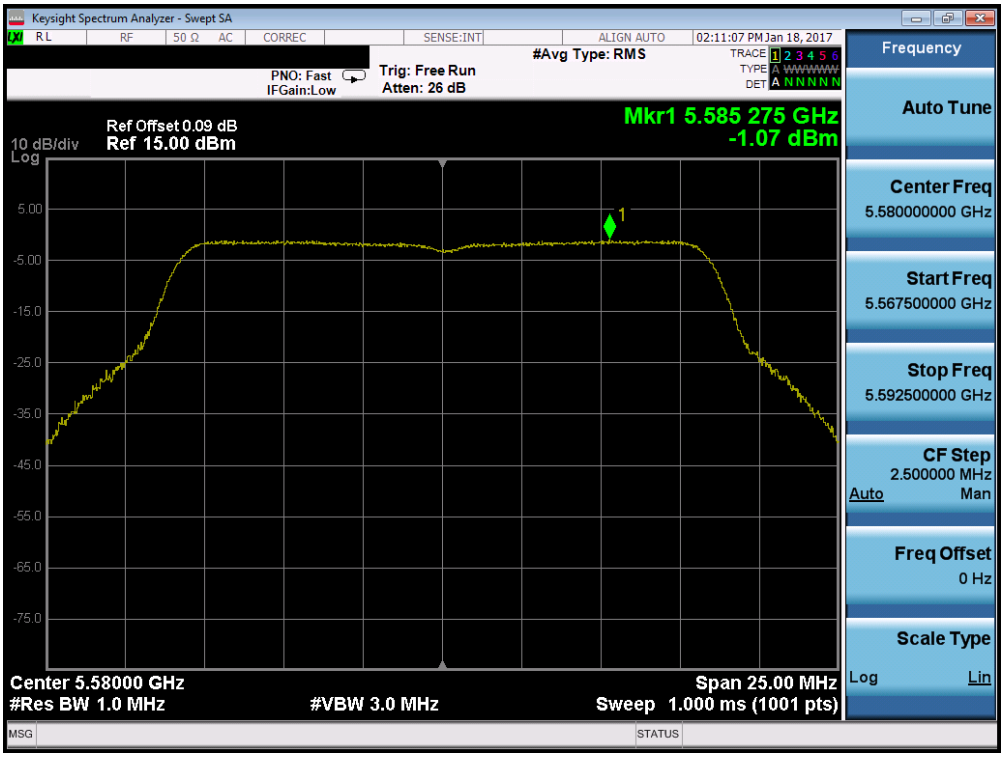


Plot 7-56. Power Spectral Density Plot (802.11a (UNII Band 2C) – Ch. 100)



Plot 7-57. Power Spectral Density Plot (802.11a (UNII Band 2C) – Ch. 116)

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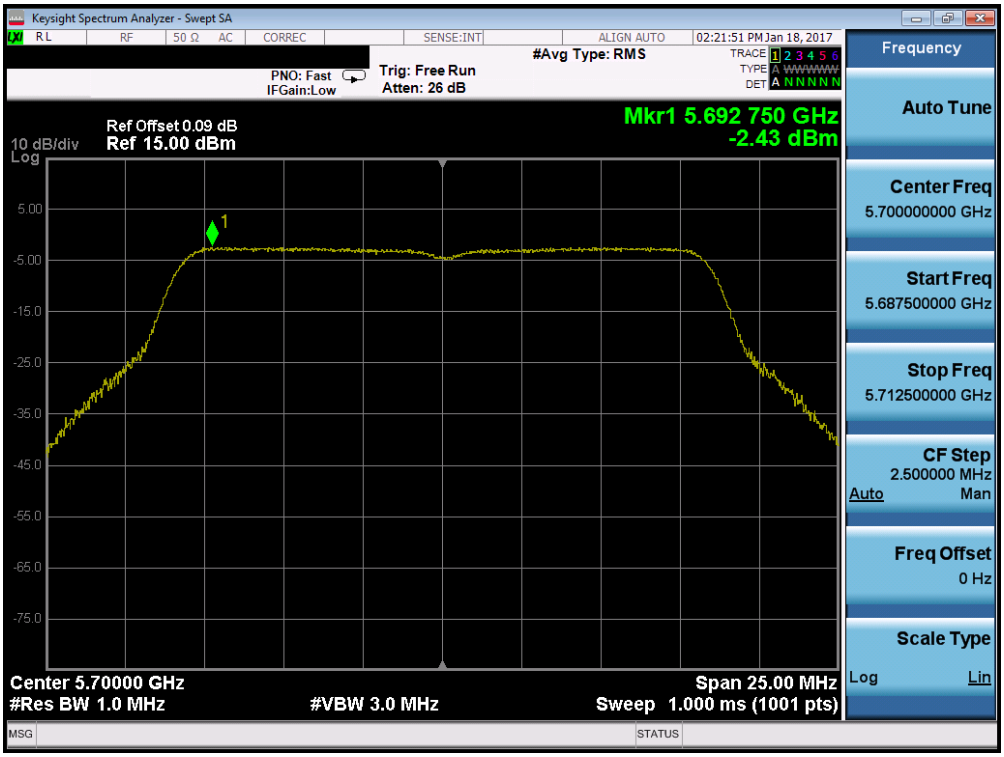
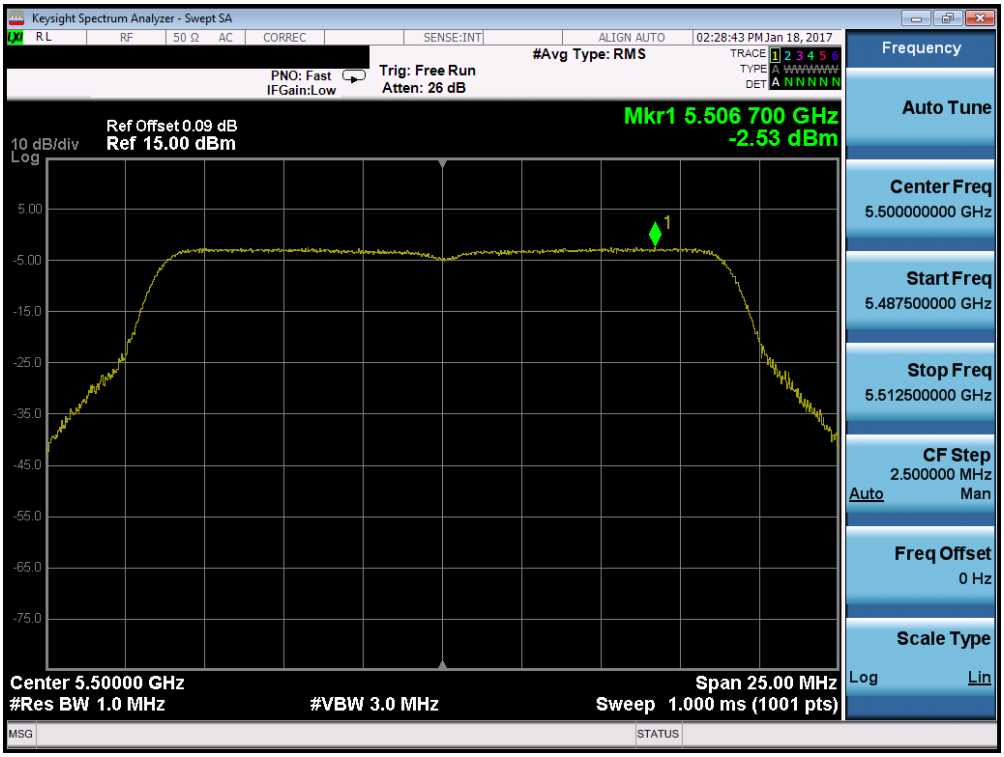


Plot 7-58. Power Spectral Density Plot (802.11a (UNII Band 2C) – Ch. 140)



Plot 7-59. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 100)

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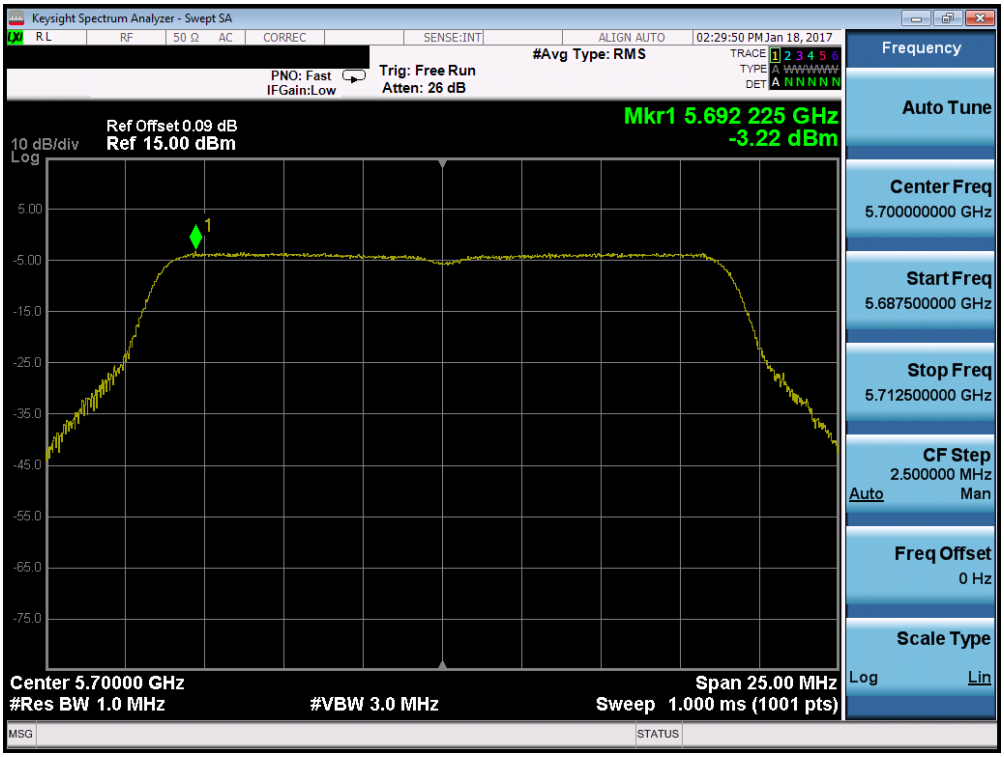
Plot 7-60. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 116)



Plot 7-61. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 2C) – Ch. 140)

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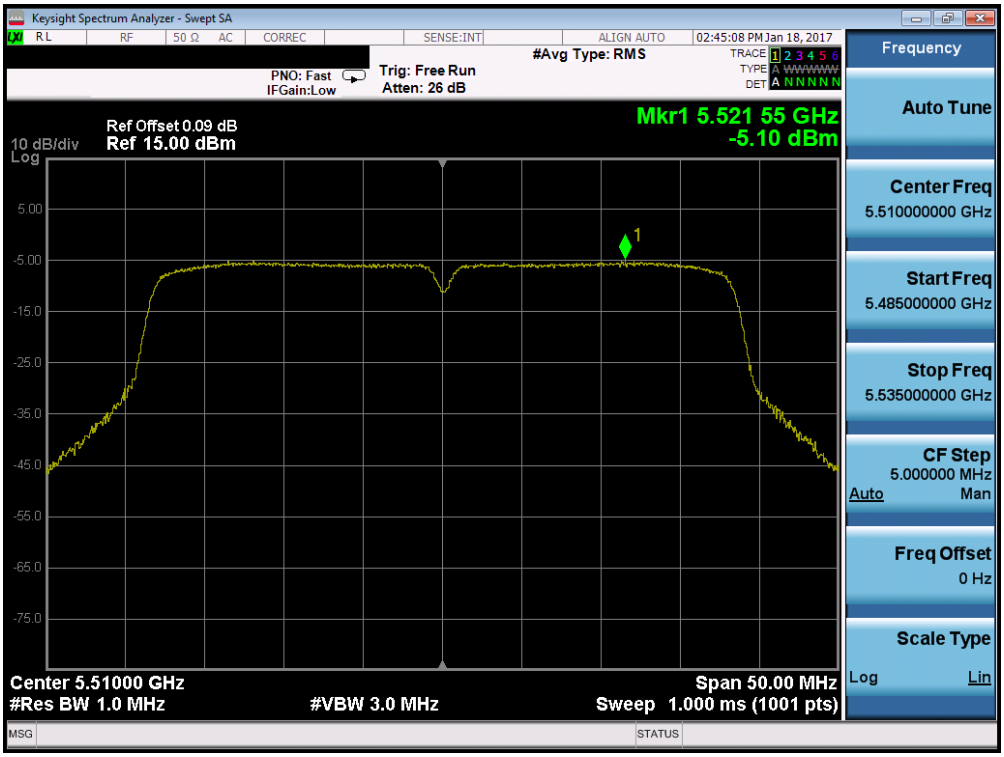
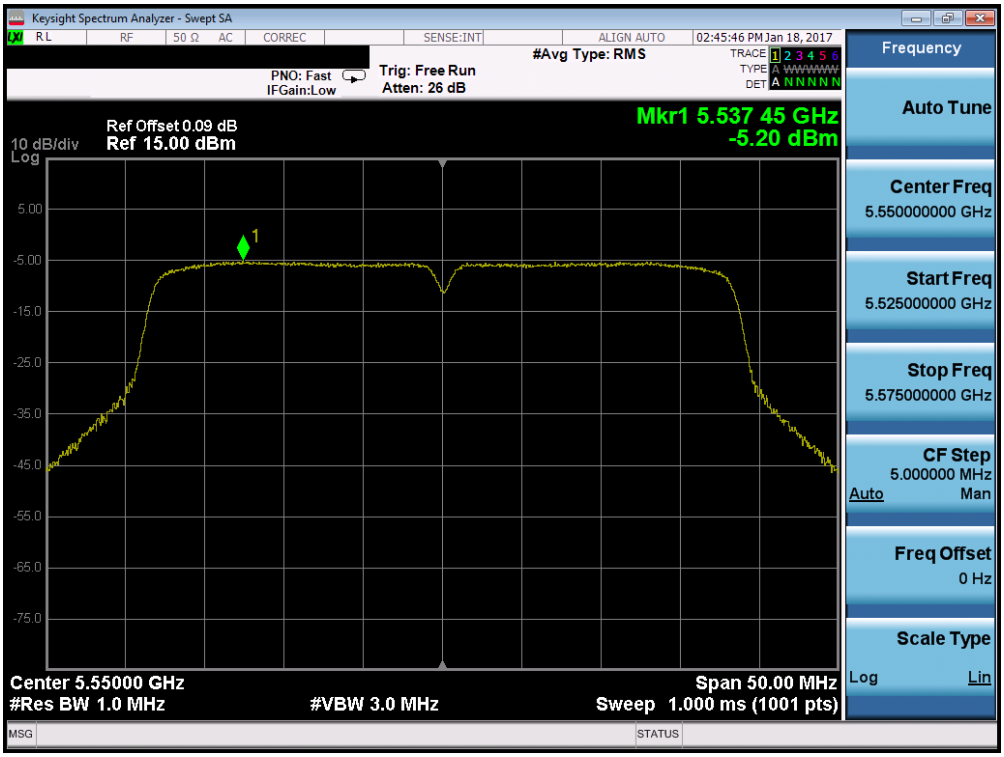


Plot 7-62. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 102)



Plot 7-63. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 110)

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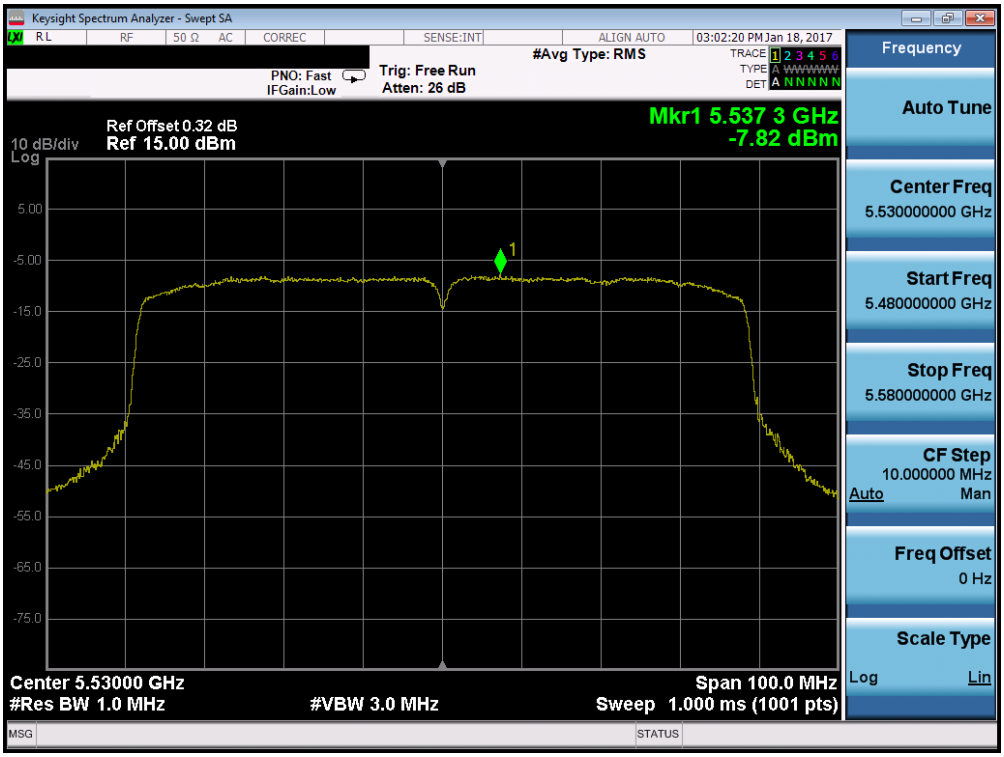
Plot 7-64. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 2C) – Ch. 134)



Plot 7-65. Power Spectral Density Plot (80MHz BW 802.11ac (UNII Band 2C) – Ch. 106)

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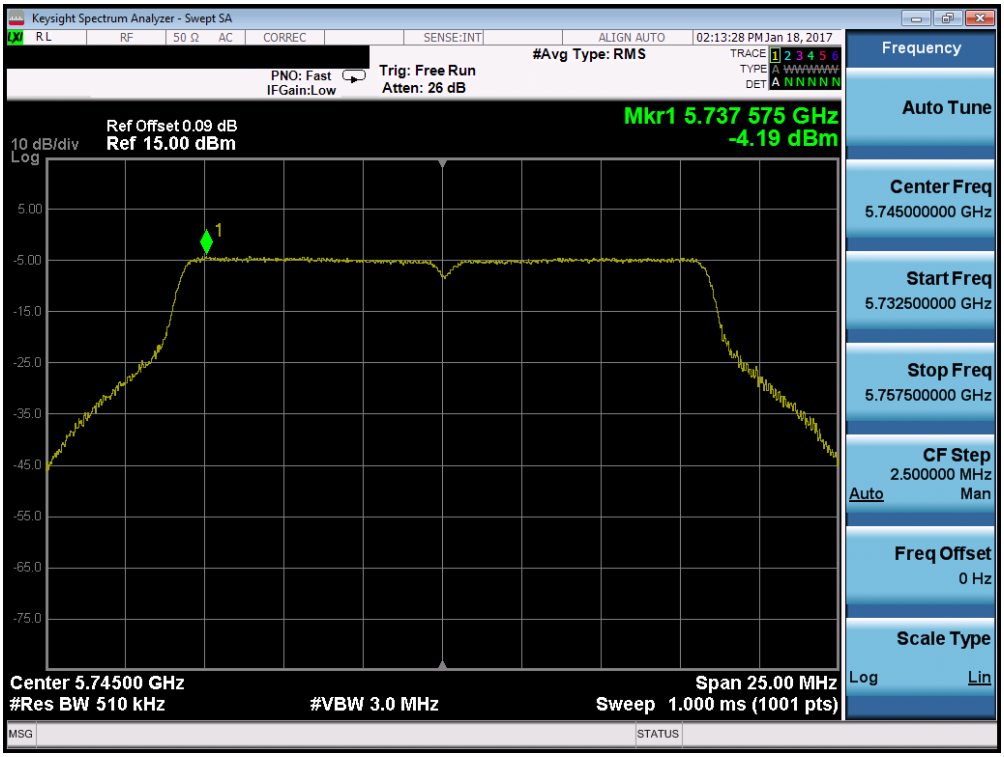
	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Power Density [dBm]	Max Permissible Power Density [dBm/500kHz]	Margin [dB]	Pass / Fail
Band 3	5745	149	a	6	-4.19	30.0	-34.19	Pass
	5785	157	a	6	-3.81	30.0	-33.81	Pass
	5825	165	a	6	-4.44	30.0	-34.44	Pass
	5745	149	n (20MHz)	6.5/7.2 (MCS0)	-5.59	30.0	-35.59	Pass
	5785	157	n (20MHz)	6.5/7.2 (MCS0)	-5.05	30.0	-35.05	Pass
	5825	165	n (20MHz)	6.5/7.2 (MCS0)	-5.64	30.0	-35.64	Pass
	5755	151	n (40MHz)	13.5/15 (MCS0)	-7.83	30.0	-37.83	Pass
	5795	159	n (40MHz)	13.5/15 (MCS0)	-7.73	30.0	-37.73	Pass
	5775	155	ac (80MHz)	29.3/32.5 (MCS0)	-7.66	30.0	-37.66	Pass

Table 7-8. Band 3 Conducted Power Spectral Density Measurements



Plot 7-66. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 149)

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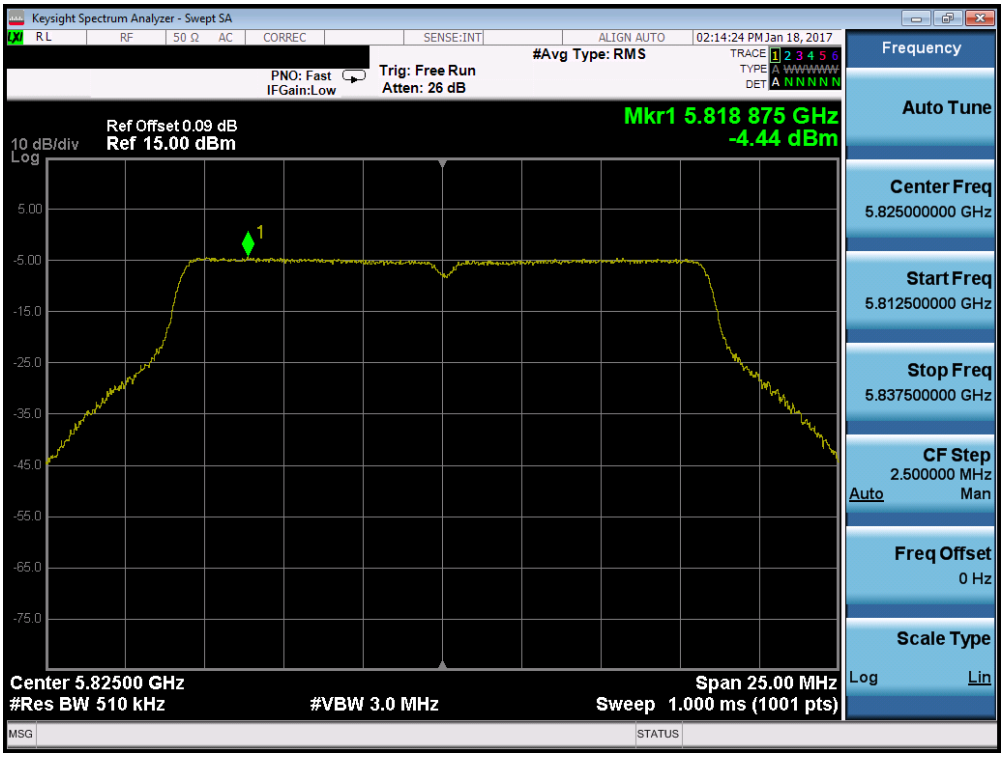
Plot 7-67. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 157)



Plot 7-68. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 165)

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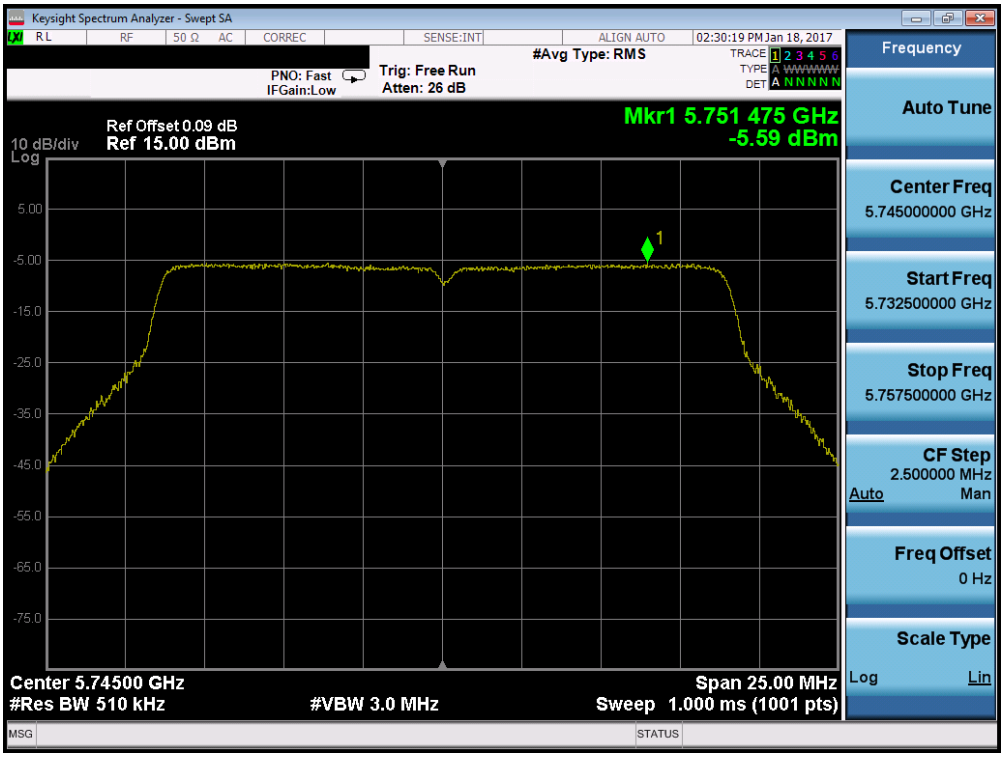

Plot 7-69. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 149)

Plot 7-70. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 157)

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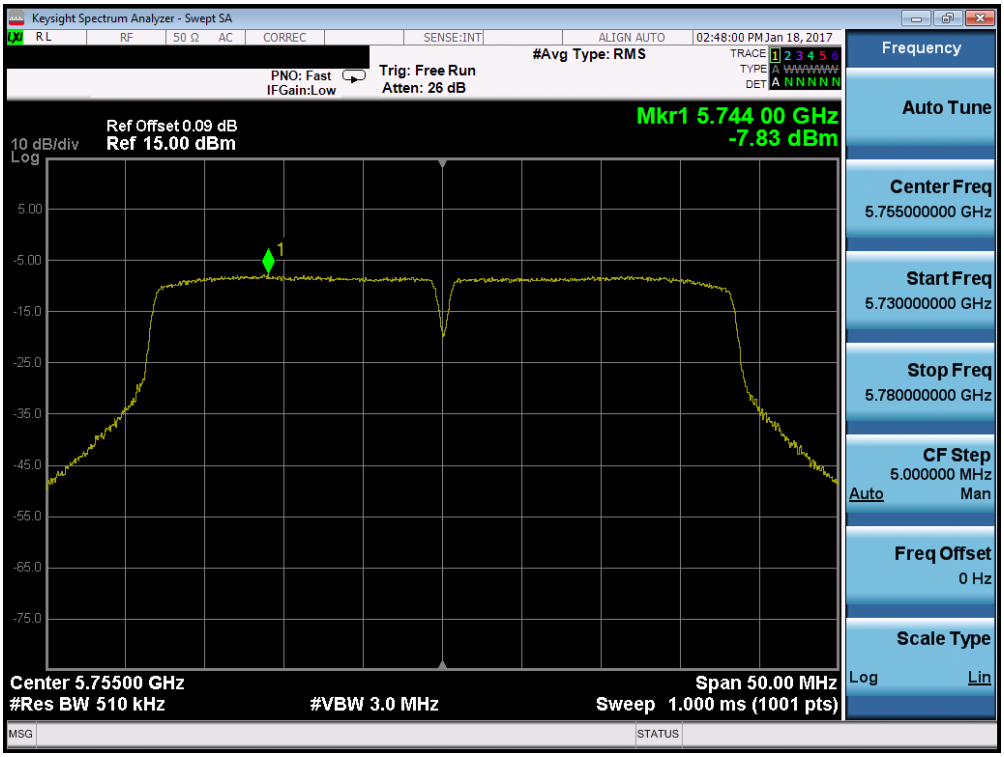
Plot 7-71. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 165)



Plot 7-72. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 151)

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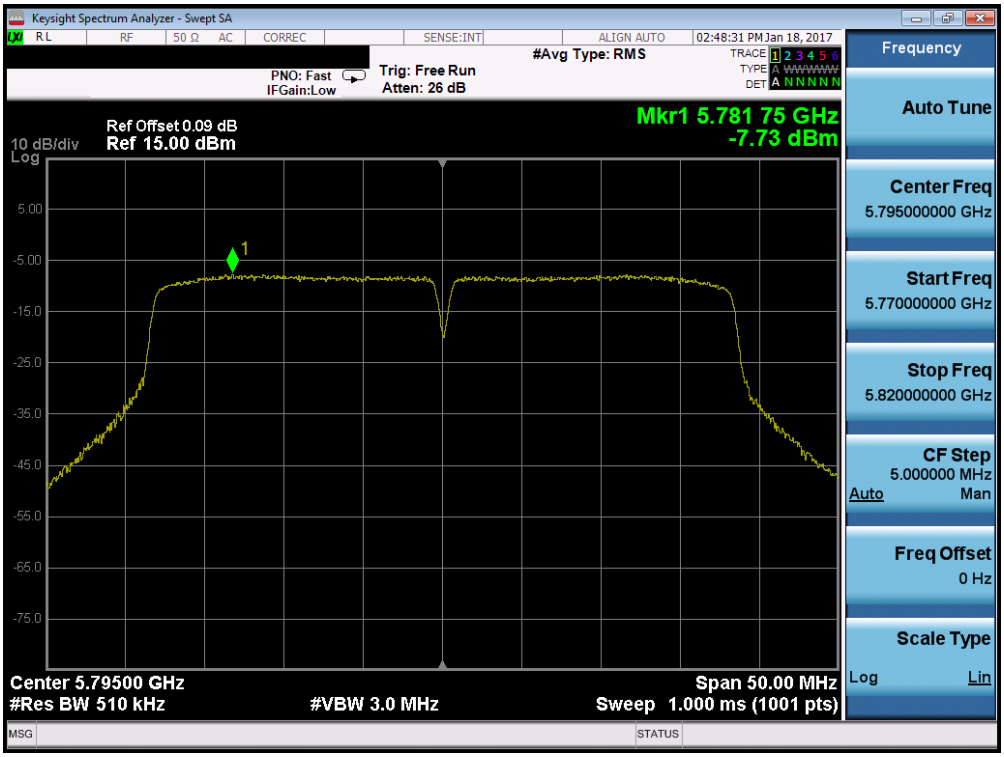
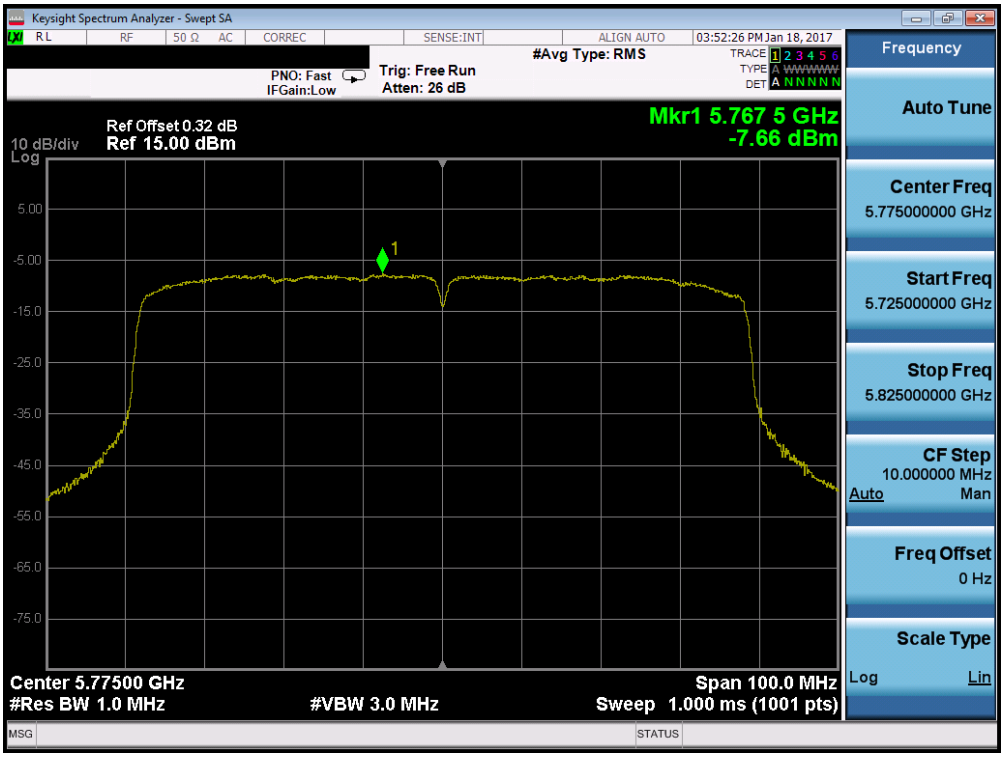


Plot 7-73. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 159)



Plot 7-74. Power Spectral Density Plot (80MHz BW 802.11ac (UNII Band 3) – Ch. 155)

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7.6 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)	5,179,999,994	-6	-0.00000011
100 %		- 30	5,179,999,831	-169	-0.00000327
100 %		- 20	5,179,999,989	-11	-0.00000021
100 %		- 10	5,179,999,952	-48	-0.00000092
100 %		0	5,179,999,978	-22	-0.00000042
100 %		+ 10	5,179,999,907	-93	-0.00000179
100 %		+ 20	5,179,999,824	-176	-0.00000341
100 %		+ 30	5,179,999,879	-121	-0.00000234
100 %		+ 40	5,179,999,847	-153	-0.00000296
100 %		+ 50	5,179,999,850	-150	-0.00000289
BATT. ENDPOINT	3.45	+ 20	5,179,999,889	-111	-0.00000214

Table 7-9. 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 -30ºC and +50ºC. The temperature was incremented by 10º 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 (ºC)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	5,259,999,982	-18	-0.00000034
100 %		- 30	5,259,999,966	-34	-0.00000065
100 %		- 20	5,259,999,982	-18	-0.00000034
100 %		- 10	5,259,999,847	-153	-0.00000290
100 %		0	5,259,999,849	-151	-0.00000288
100 %		+ 10	5,259,999,931	-69	-0.00000130
100 %		+ 20	5,259,999,883	-117	-0.00000222
100 %		+ 30	5,259,999,932	-68	-0.00000129
100 %		+ 40	5,259,999,945	-55	-0.00000105
100 %		+ 50	5,259,999,823	-177	-0.00000337
BATT. ENDPOINT	3.45	+ 20	5,259,999,840	-160	-0.00000303

Table 7-10. 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)	5,499,999,869	-131	-0.00000238
100 %		- 30	5,499,999,837	-163	-0.00000296
100 %		- 20	5,499,999,961	-39	-0.00000072
100 %		- 10	5,499,999,807	-193	-0.00000351
100 %		0	5,499,999,949	-51	-0.00000093
100 %		+ 10	5,499,999,978	-22	-0.00000039
100 %		+ 20	5,499,999,814	-186	-0.00000338
100 %		+ 30	5,499,999,997	-3	-0.00000006
100 %		+ 40	5,499,999,825	-175	-0.00000318
100 %		+ 50	5,499,999,829	-171	-0.00000311
BATT. ENDPOINT	3.45	+ 20	5,499,999,993	-7	-0.00000012

Table 7-11. 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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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: 5,745,000,000 Hz

CHANNEL: 149

REFERENCE VOLTAGE: 3.85 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	5,744,999,911	-89	-0.00000156
100 %		- 30	5,744,999,855	-145	-0.00000253
100 %		- 20	5,744,999,890	-110	-0.00000191
100 %		- 10	5,744,999,855	-145	-0.00000253
100 %		0	5,744,999,864	-136	-0.00000237
100 %		+ 10	5,744,999,822	-178	-0.00000310
100 %		+ 20	5,744,999,849	-151	-0.00000263
100 %		+ 30	5,744,999,979	-21	-0.00000037
100 %		+ 40	5,744,999,842	-158	-0.00000275
100 %		+ 50	5,744,999,850	-150	-0.00000262
BATT. ENDPOINT	3.45	+ 20	5,744,999,841	-159	-0.00000277

Table 7-12. Frequency Stability Measurements for UNII Band 3 (Ch. 149)

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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7.7 Radiated Spurious Emission Measurements – Above 1GHz

§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 D02 v01r03, and at the appropriate frequencies. All channels, modes (e.g. 802.11a, 802.11n (20MHz BW), 802.11n (40MHz BW), and 802.11ac (80MHz)), 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.

For transmitters operating in the 5.15-5.25 GHz and 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of −27 dBm/MHz.

For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

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 7-13 per Section 15.209.

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

Table 7-13. Radiated Limits

Test Procedures Used

KDB 789033 D02 v01r03 – 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

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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

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.

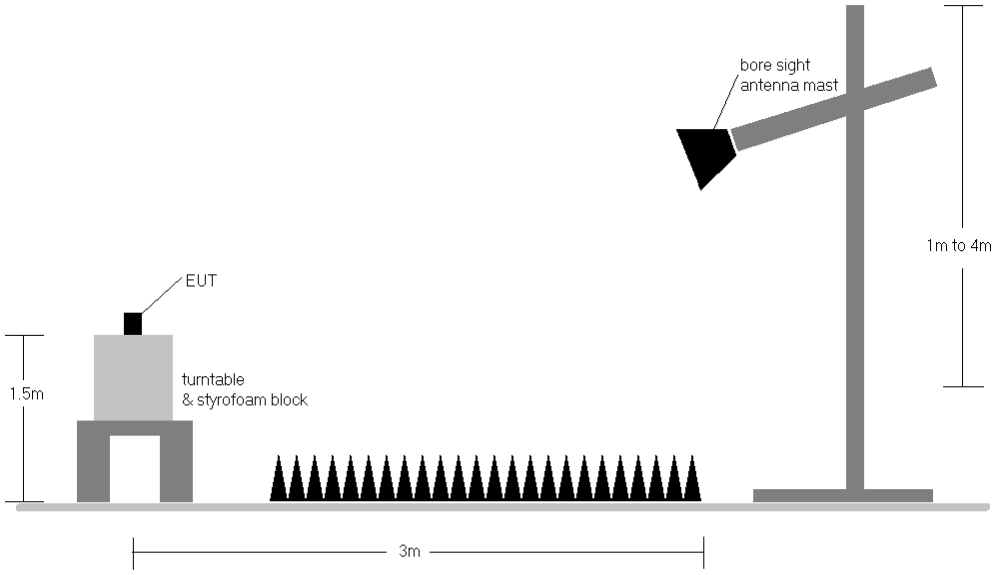

Figure 7-5. Test Instrument & Measurement Setup

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Test Notes

1. All radiated spurious emissions levels were measured in a radiated test setup per the guidance of KDB 789033 D02 v01r03 Section G.
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 7-13.
3. All spurious emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-13. 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.
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 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. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. Any emissions found to be within 20dB of the limit are fully investigated and the results are shown in this section. Rohde & Schwarz EMC32, Version 9.15.00 automated test software was used to perform the Radiated Spurious Emissions Pre-Scan testing.
9. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

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 7.7 was calculated using the formula:

  Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

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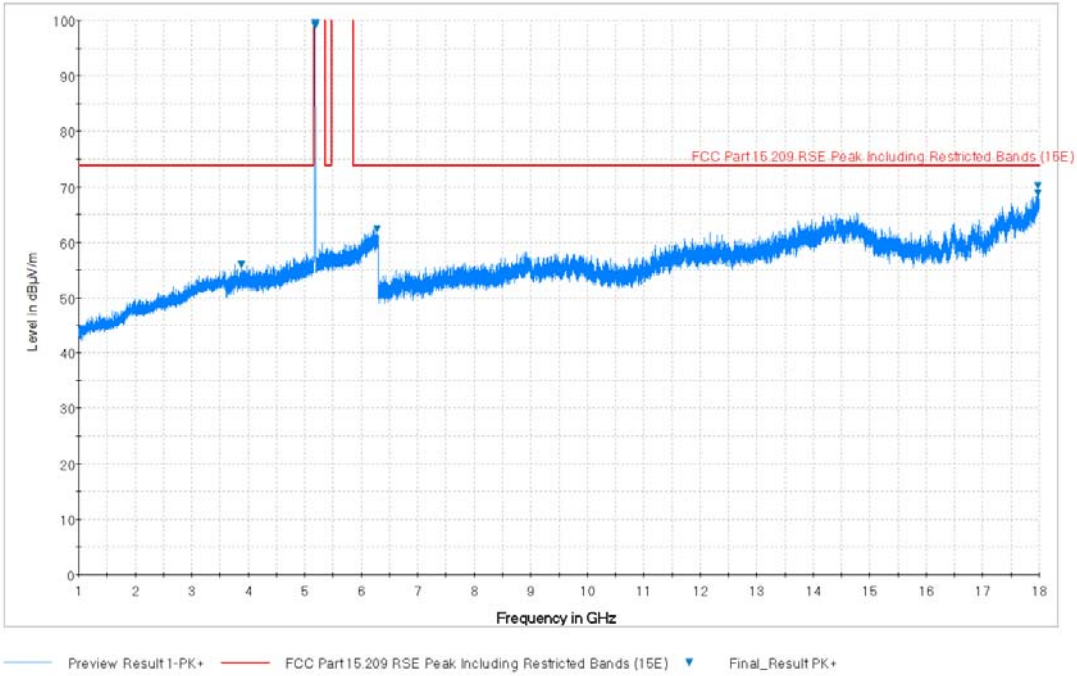
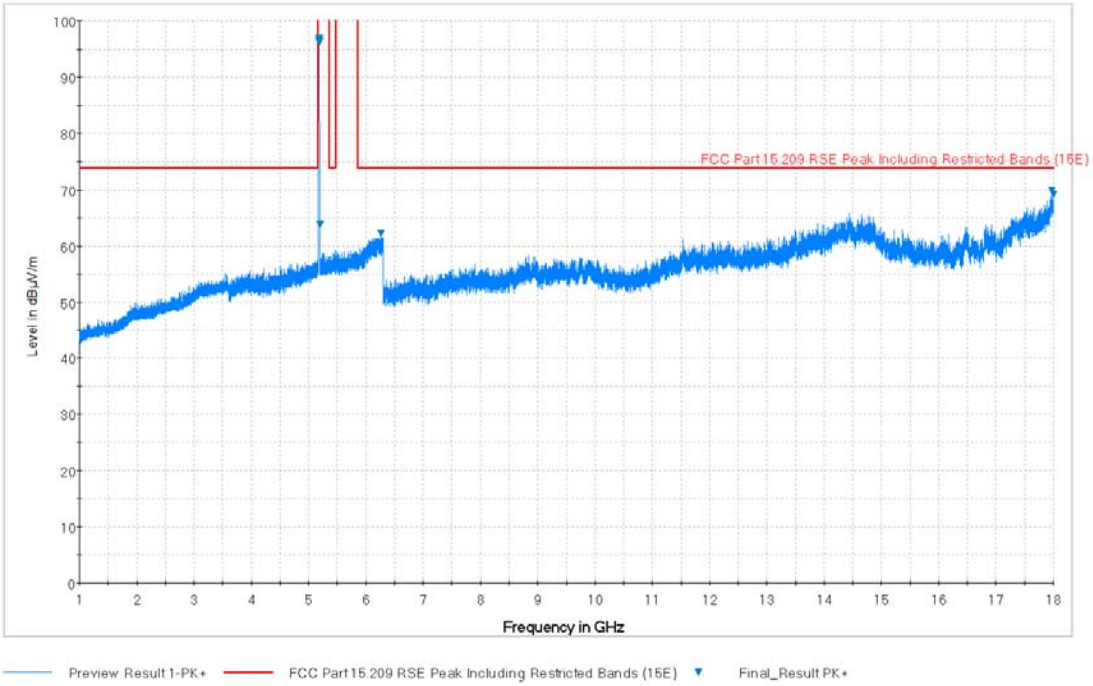
7.7.1 Radiated Spurious Emission Measurements



Plot 7-75. Radiated Spurious Plot above 1GHz (802.11a – U1 Ch. 40, Ant. Pol. H)



Plot 7-76. Radiated Spurious Plot above 1GHz (802.11a – U1 Ch. 40, Ant. Pol. V)

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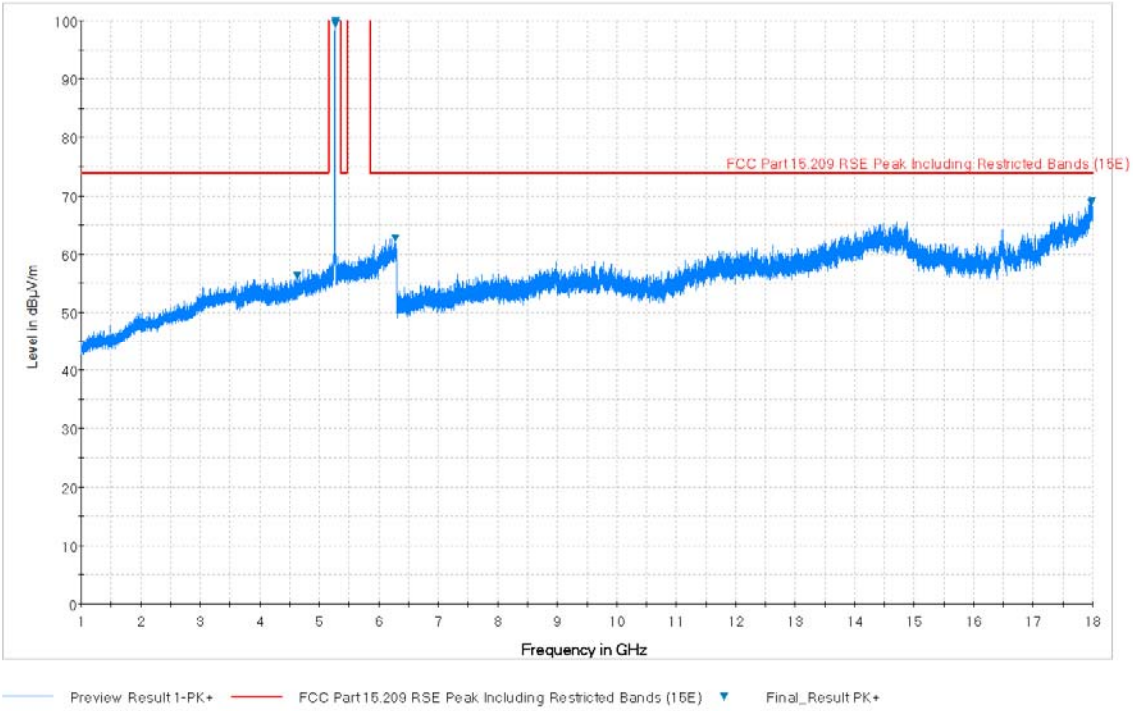
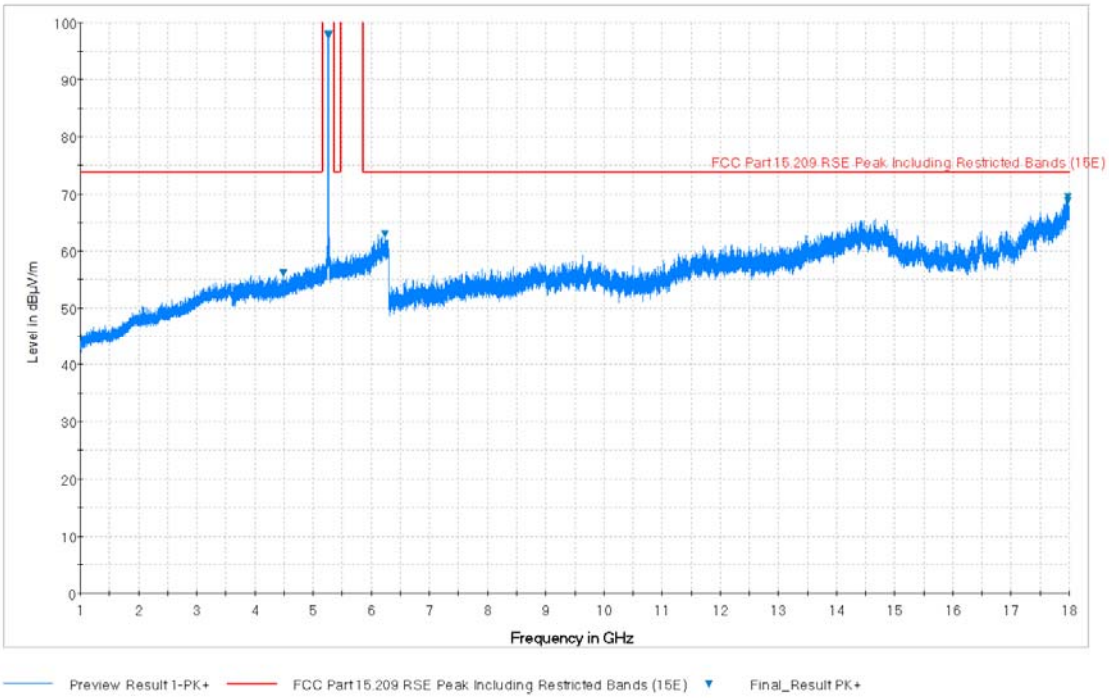


Plot 7-77. Radiated Spurious Plot above 1GHz (802.11a – U2A Ch. 56, Ant. Pol. H)



Plot 7-78. Radiated Spurious Plot above 1GHz (802.11a – U2A Ch. 56, Ant. Pol. V)

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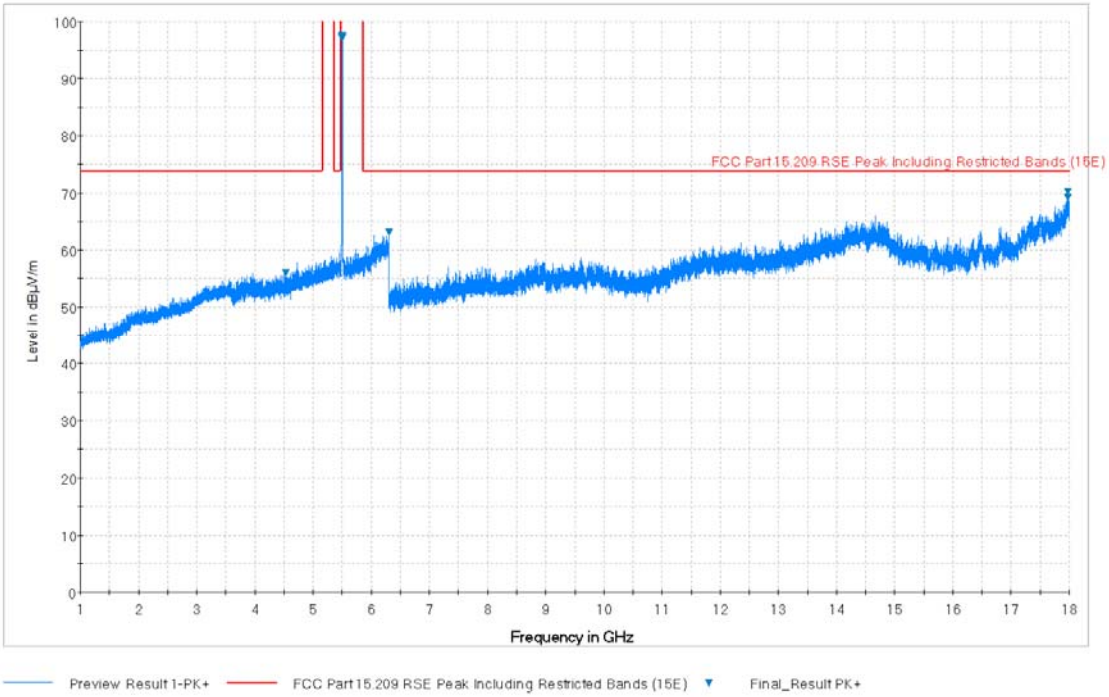
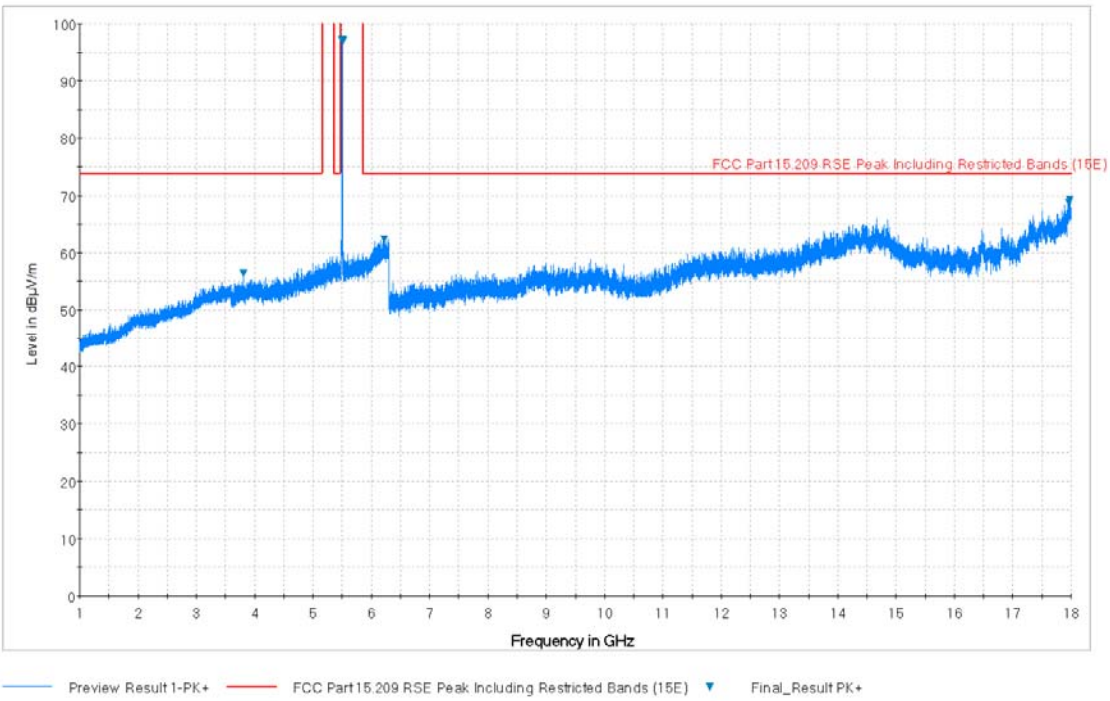


Plot 7-79. Radiated Spurious Plot above 1GHz (802.11a – U2C Ch. 116, Ant. Pol. H)



Plot 7-80. Radiated Spurious Plot above 1GHz (802.11a – U2C Ch. 116, Ant. Pol. V)

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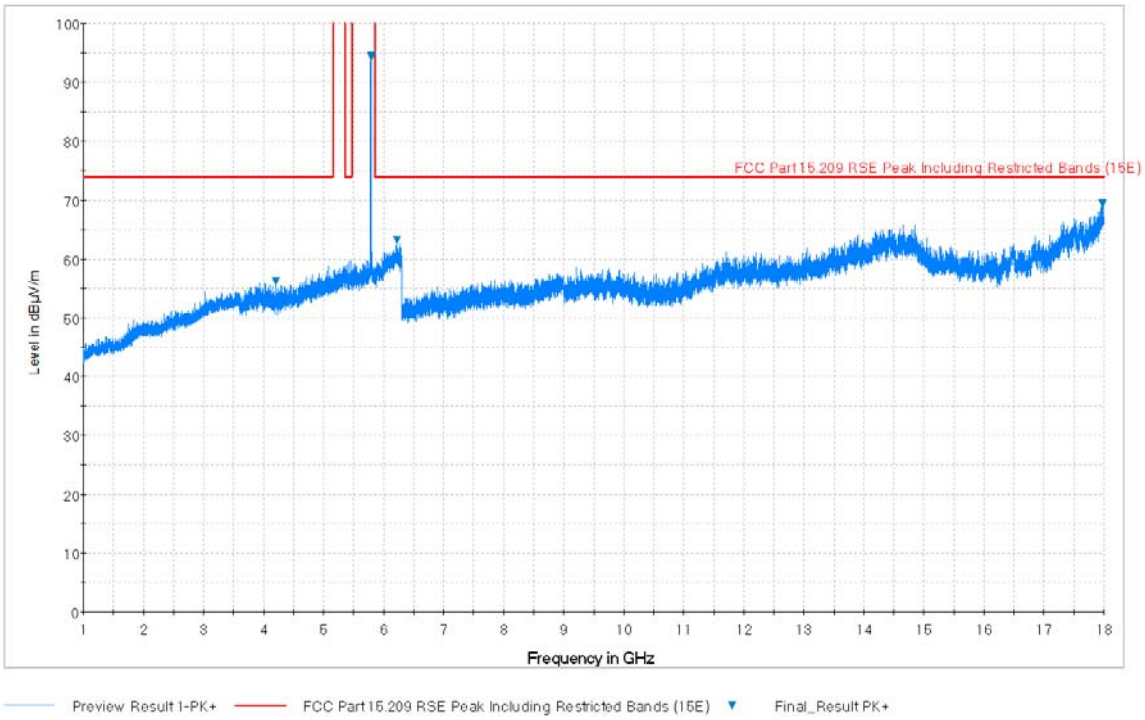
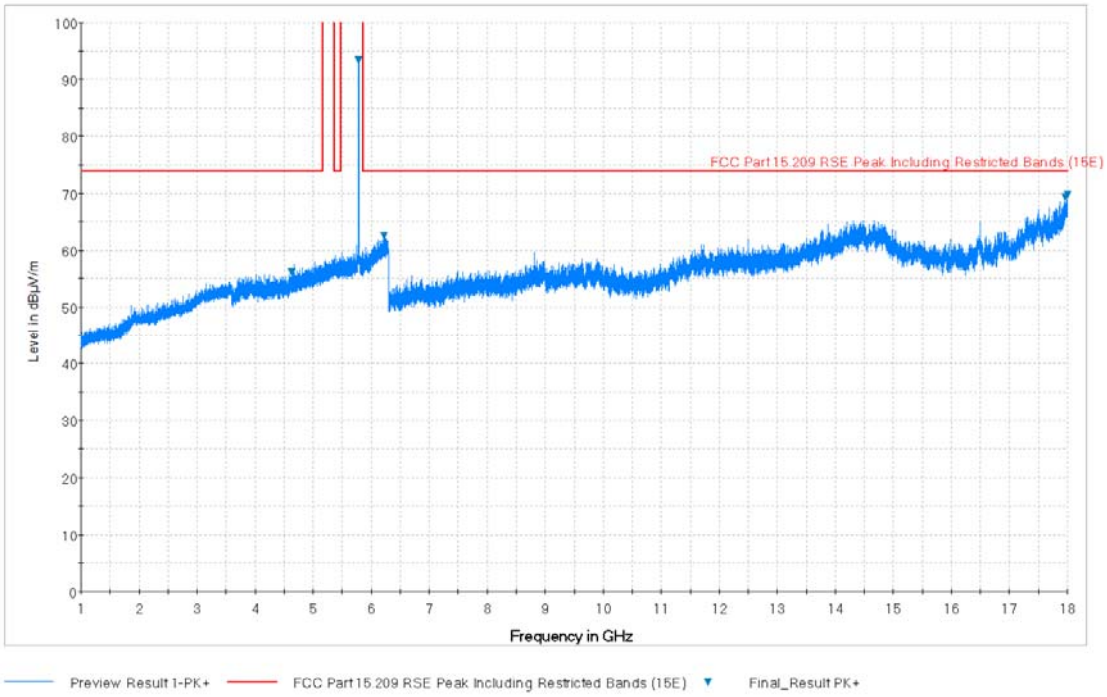


Plot 7-81. Radiated Spurious Plot above 1GHz (802.11a – U3 Ch. 157, Ant. Pol. H)



Plot 7-82. Radiated Spurious Plot above 1GHz (802.11a – U3 Ch. 157, Ant. Pol. V)

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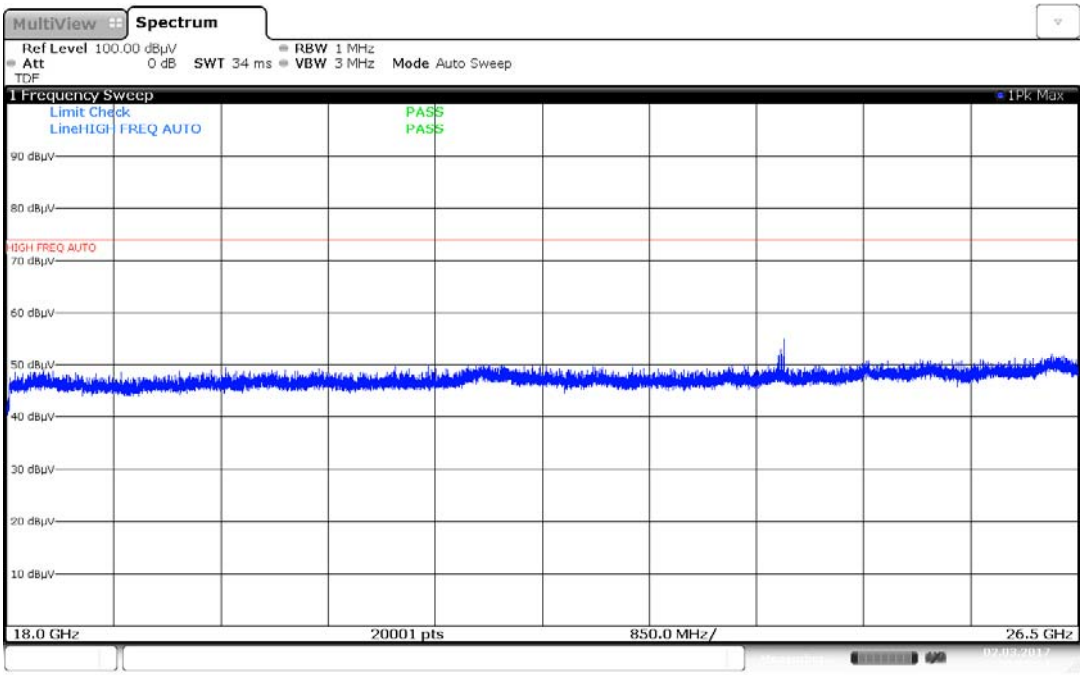
Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209



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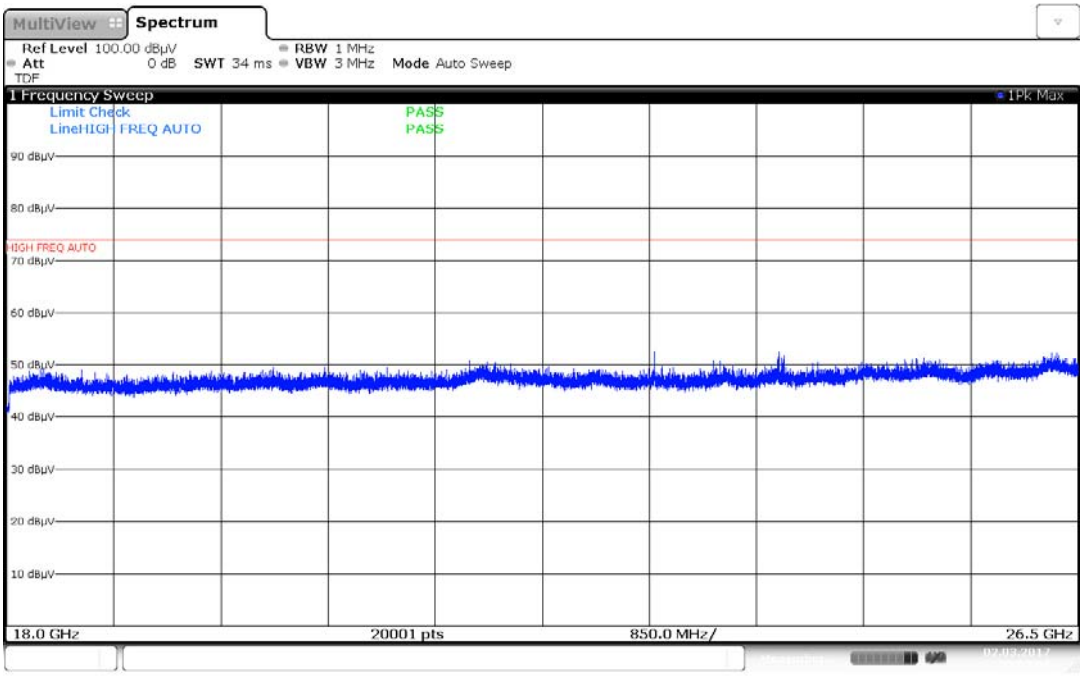
Plot 7-83. Radiated Spurious Plot 18GHz - 26.5GHz (802.11a – Ant. Pol. H)



20:30:06 02.03.2017

Plot 7-84. Radiated Spurious Plot above 18GHz - 26.5GHz (802.11a – Ant. Pol. V)

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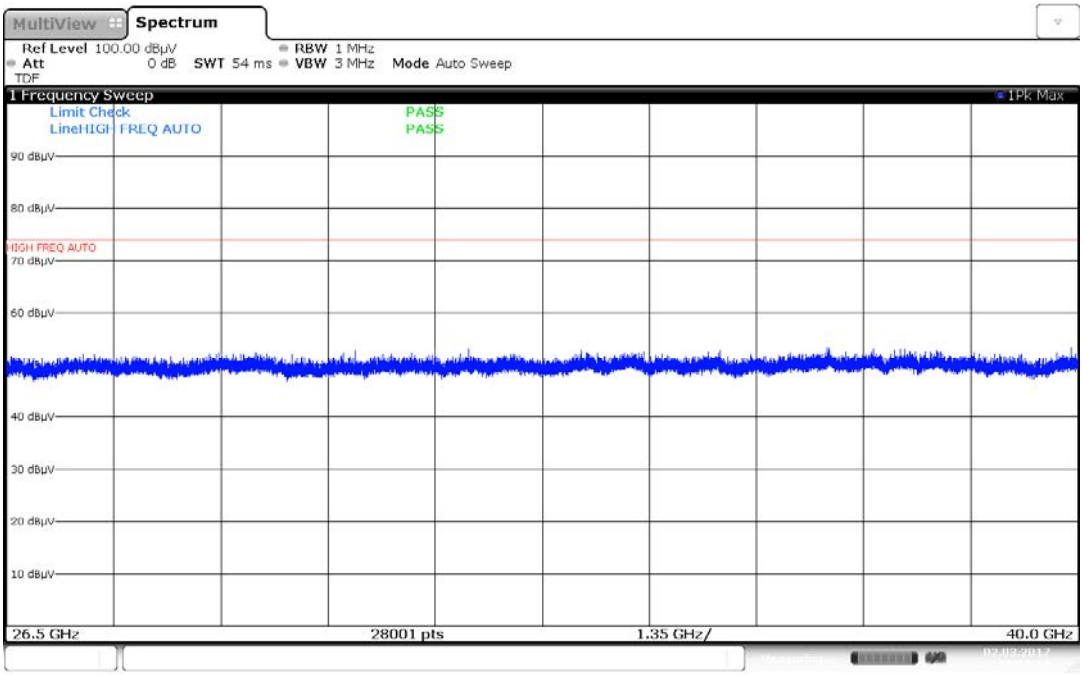
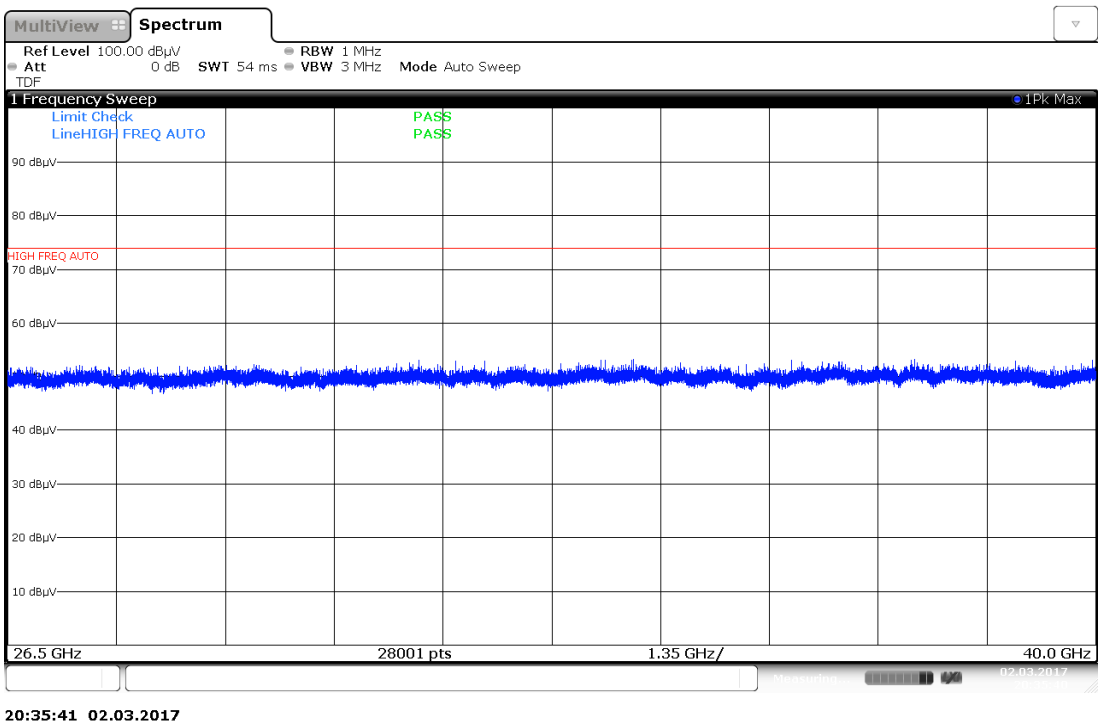
Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209



Plot 7-85. Radiated Spurious Plot 26.5GHz - 40GHz (802.11a – Ant. Pol. H)



Plot 7-86. Radiated Spurious Plot above 26.5GHz - 40GHz (802.11a – Ant. Pol. V)

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Radiated Spurious Emission Measurements

§15.247(d) §15.205 & §15.209

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

	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10360.00	Peak	H	-	-	-59.62	11.76	0.00	59.14	68.20	-9.06
*	15540.00	Average	H	-	-	-73.70	17.60	0.00	50.90	53.98	-3.08
*	15540.00	Peak	H	-	-	-59.90	17.60	0.00	64.70	73.98	-9.28
*	20720.00	Average	H	100	296	-76.74	8.13	-9.54	28.85	53.98	-25.13
*	20720.00	Peak	H	100	296	-64.44	8.13	-9.54	41.15	73.98	-32.83
	25900.00	Peak	H	-	-	-64.18	8.50	-9.54	41.78	68.20	-26.42

Table 7-14. 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]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10400.00	Peak	H	-	-	-59.29	11.47	0.00	59.18	68.20	-9.02
*	15600.00	Average	H	-	-	-73.91	17.43	0.00	50.52	53.98	-3.46
*	15600.00	Peak	H	-	-	-61.09	17.43	0.00	63.34	73.98	-10.64
*	20800.00	Average	H	100	313	-76.19	8.16	-9.54	29.42	53.98	-24.56
*	20800.00	Peak	H	100	313	-65.26	8.16	-9.54	40.35	73.98	-33.63
	26000.00	Peak	H	-	-	-64.31	8.52	-9.54	41.67	68.20	-26.53

Table 7-15. 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]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10480.00	Peak	H	-	-	-59.26	11.81	0.00	59.55	68.20	-8.65
*	15720.00	Average	H	-	-	-74.20	18.05	0.00	50.85	53.98	-3.13
*	15720.00	Peak	H	-	-	-60.61	18.05	0.00	64.44	73.98	-9.54
*	20960.00	Average	H	100	294	-75.57	8.12	-9.54	30.01	53.98	-23.97
*	20960.00	Peak	H	100	294	-65.76	8.12	-9.54	39.82	73.98	-34.16
	26200.00	Peak	H	-	-	-63.58	8.62	-9.54	42.50	68.20	-25.70

Table 7-16. 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]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10520.00	Peak	H	-	-	-59.07	11.90	0.00	59.83	68.20	-8.37
*	15780.00	Average	H	-	-	-73.01	16.92	0.00	50.91	53.98	-3.07
*	15780.00	Peak	H	-	-	-60.25	16.92	0.00	63.67	73.98	-10.31
*	21040.00	Average	H	100	307	-75.45	8.10	-9.54	30.11	53.98	-23.87
*	21040.00	Peak	H	100	307	-64.62	8.10	-9.54	40.94	73.98	-33.04
	26300.00	Peak	H	-	-	-63.37	8.76	-9.54	42.85	68.20	-25.35

Table 7-17. 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]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	10560.00	Peak	H	-	-	-59.55	11.69	0.00	59.14	68.20	-9.06
*	15840.00	Average	H	-	-	-73.72	17.04	0.00	50.32	53.98	-3.66
*	15840.00	Peak	H	-	-	-60.52	17.04	0.00	63.52	73.98	-10.46
*	21120.00	Average	H	100	314	-74.44	8.09	-9.54	31.10	53.98	-22.88
*	21120.00	Peak	H	100	314	-65.01	8.09	-9.54	40.53	73.98	-33.45
	26400.00	Peak	H	-	-	-63.91	8.99	-9.54	42.54	68.20	-25.66

Table 7-18. 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]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	10640.00	Average	H	-	-	-71.36	12.24	0.00	47.88	53.98	-6.10
*	10640.00	Peak	H	-	-	-59.23	12.24	0.00	60.01	73.98	-13.97
*	15960.00	Average	H	-	-	-73.90	17.22	0.00	50.32	53.98	-3.65
*	15960.00	Peak	H	-	-	-60.83	17.22	0.00	63.39	73.98	-10.58
*	21280.00	Average	H	100	104	-75.56	8.07	-9.54	29.97	53.98	-24.01
*	21280.00	Peak	H	100	104	-65.10	8.07	-9.54	40.43	73.98	-33.55
	26600.00	Peak	H	-	-	-46.15	-8.30	-9.54	43.01	68.20	-25.19

Table 7-19. 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]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11000.00	Average	H	133	82	-71.10	13.01	0.00	48.91	53.98	-5.07
*	11000.00	Peak	H	133	82	-58.73	13.01	0.00	61.28	73.98	-12.70
	16500.00	Peak	H	-	-	-62.56	20.25	0.00	64.69	68.20	-3.51
	22000.00	Peak	H	100	310	-65.40	8.35	-9.54	40.40	68.20	-27.80
	27500.00	Peak	H	-	-	-46.40	-8.93	-9.54	42.13	68.20	-26.07

Table 7-20. 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]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11160.00	Average	H	-	-	-71.00	13.64	0.00	49.64	53.98	-4.34
*	11160.00	Peak	H	-	-	-59.22	13.64	0.00	61.42	73.98	-12.56
	16740.00	Peak	H	-	-	-60.99	18.21	0.00	64.22	68.20	-3.98
*	22320.00	Average	H	100	270	-75.93	8.20	-9.54	29.73	53.98	-24.25
*	22320.00	Peak	H	100	270	-65.08	8.20	-9.54	40.58	73.98	-33.40
	27900.00	Peak	H	-	-	-45.85	-9.24	-9.54	42.37	68.20	-25.83

Table 7-21. 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]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11400.00	Average	H	113	69	-70.66	14.01	0.00	50.35	53.98	-3.63
*	11400.00	Peak	H	113	69	-58.92	14.01	0.00	62.09	73.98	-11.89
	17100.00	Peak	H	-	-	-62.46	20.65	0.00	65.19	68.20	-3.01
*	22800.00	Average	H	100	137	-75.53	8.29	-9.54	30.21	53.98	-23.77
*	22800.00	Peak	H	100	137	-65.63	8.29	-9.54	40.11	73.98	-33.87
	28500.00	Peak	H	-	-	-46.25	-9.03	-9.54	42.18	68.20	-26.02

Table 7-22. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5745MHz
Channel: 149

	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11490.00	Average	H	110	238	-71.03	14.32	0.00	50.29	53.98	-3.69
*	11490.00	Peak	H	110	238	-59.44	14.32	0.00	61.88	73.98	-12.10
	17235.00	Peak	H	-	-	-63.68	21.26	0.00	64.58	68.20	-3.62
*	22980.00	Average	H	100	138	-75.80	8.19	-9.54	29.85	53.98	-24.13
*	22980.00	Peak	H	100	138	-65.94	8.19	-9.54	39.71	73.98	-34.27
	28725.00	Peak	H	-	-	-46.17	-9.45	-9.54	41.84	68.20	-26.36

Table 7-23. 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: 5785MHz
Channel: 157

	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11570.00	Average	H	100	86	-71.56	14.61	0.00	50.05	53.98	-3.93
*	11570.00	Peak	H	100	86	-58.73	14.61	0.00	62.88	73.98	-11.10
	17355.00	Peak	H	-	-	-64.85	22.75	0.00	64.90	68.20	-3.30
	23140.00	Peak	H	100	220	-65.50	8.47	-9.54	40.42	68.20	-27.78
	28925.00	Peak	H	-	-	-46.65	-9.71	-9.54	41.10	68.20	-27.10

Table 7-24. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 & 3 Meters
Operating Frequency: 5825MHz
Channel: 165

	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11650.00	Average	H	100	92	-72.00	14.87	0.00	49.87	53.98	-4.11
*	11650.00	Peak	H	100	92	-58.54	14.87	0.00	63.33	73.98	-10.65
	17475.00	Peak	H	-	-	-65.00	23.13	0.00	65.13	68.20	-3.07
	23300.00	Peak	H	-	-	-65.32	8.60	-9.54	40.74	68.20	-27.46
	29125.00	Peak	H	-	-	-44.75	-9.93	-9.54	42.78	68.20	-25.42

Table 7-25. Radiated Measurements

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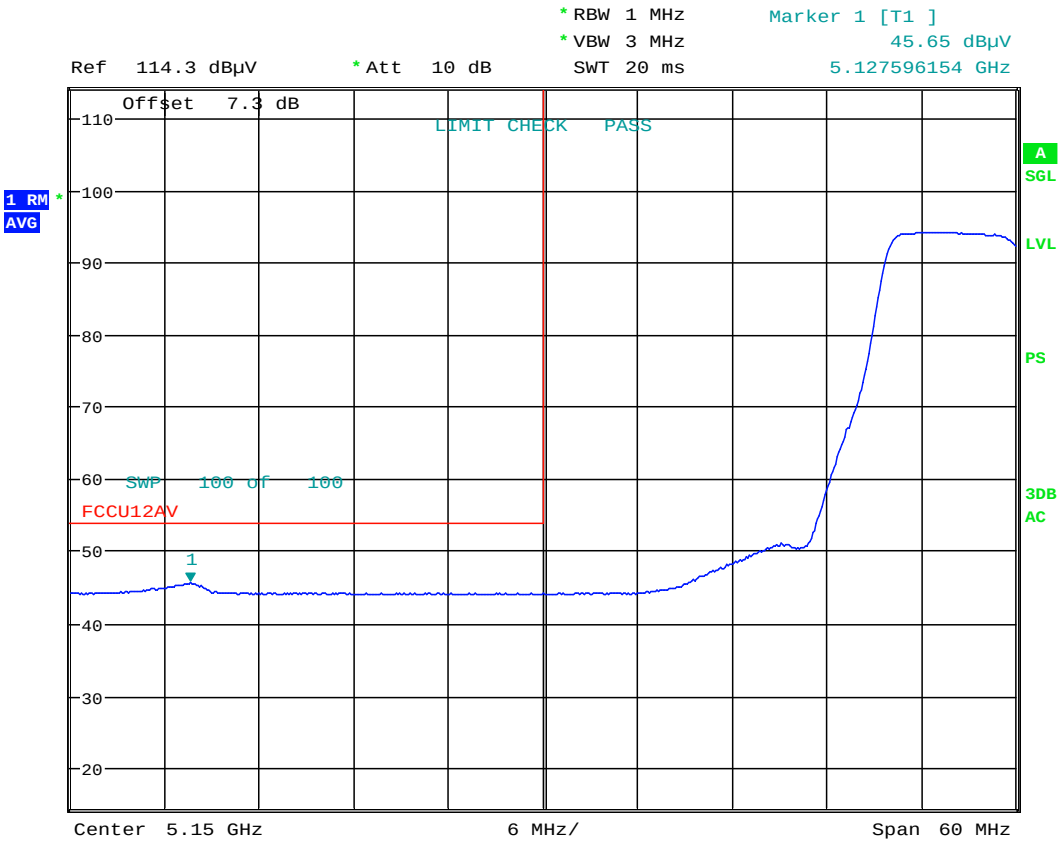
7.7.2 Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 13:06:47

Plot 7-87. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

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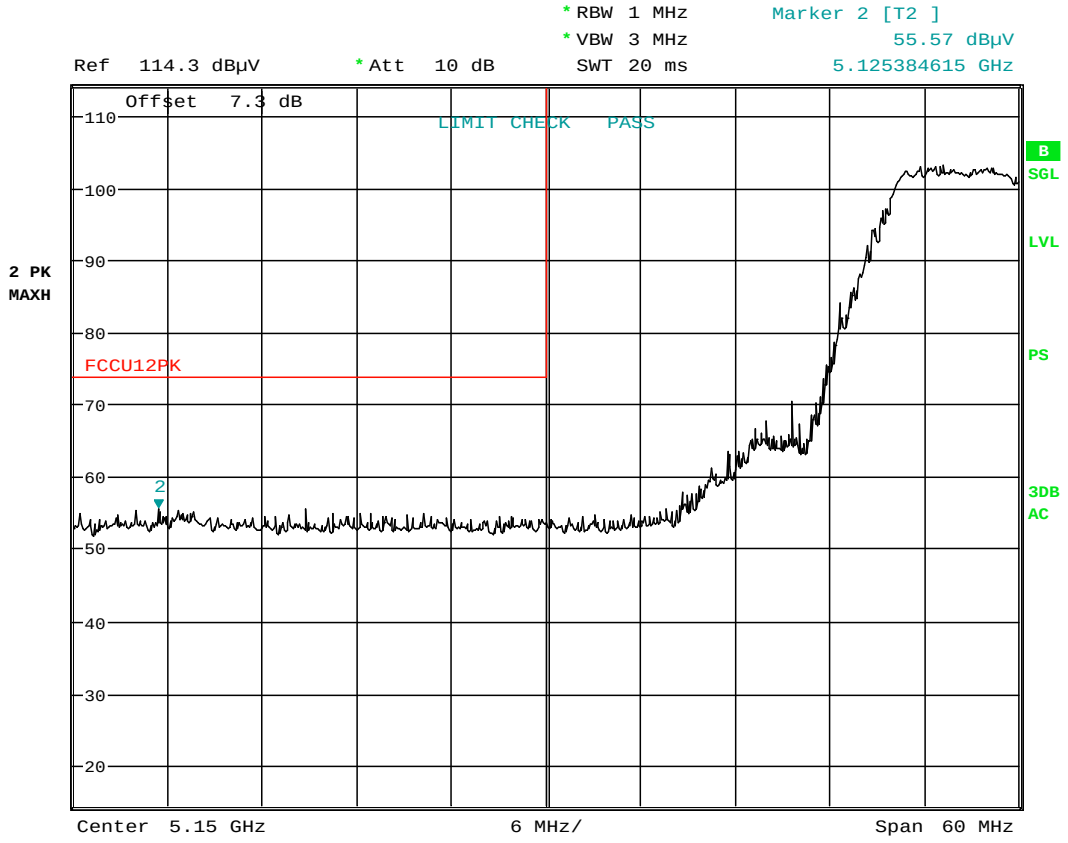

Date: 15.FEB.2017 13:07:03

Plot 7-88. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

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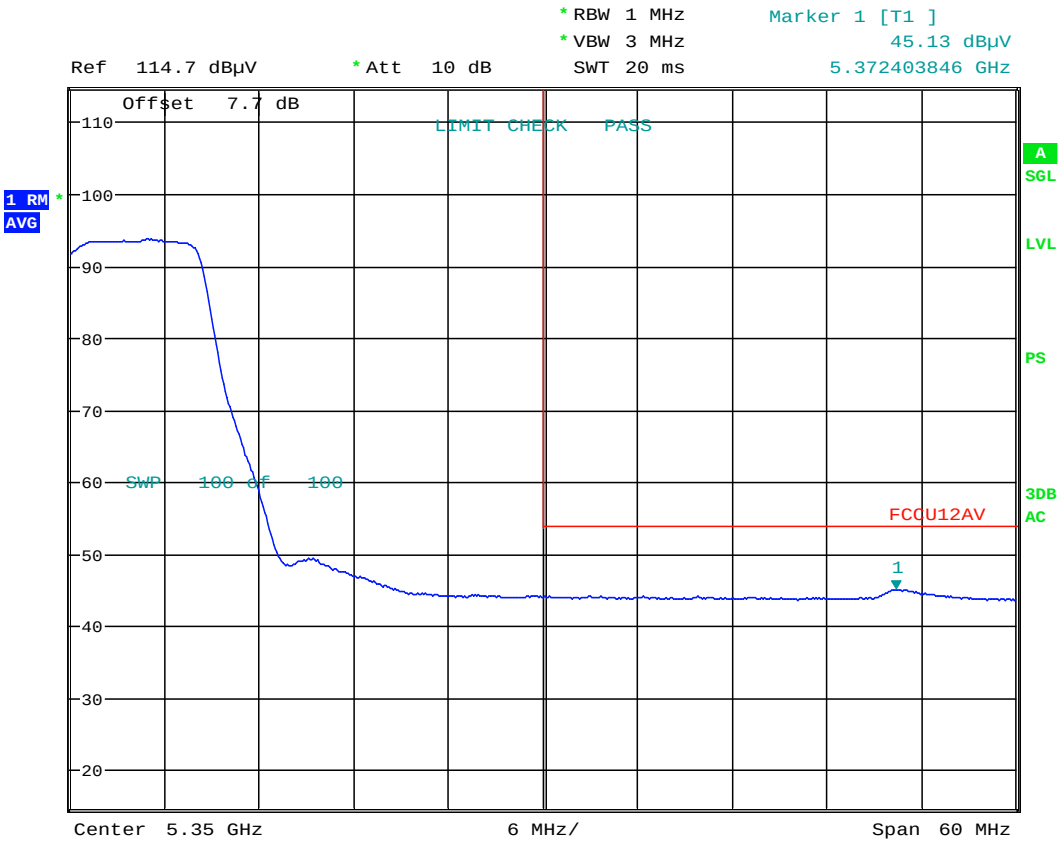
Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 13:20:23

Plot 7-89. Radiated Restricted Upper Band Edge Plot (Average – UNII Band 2A)

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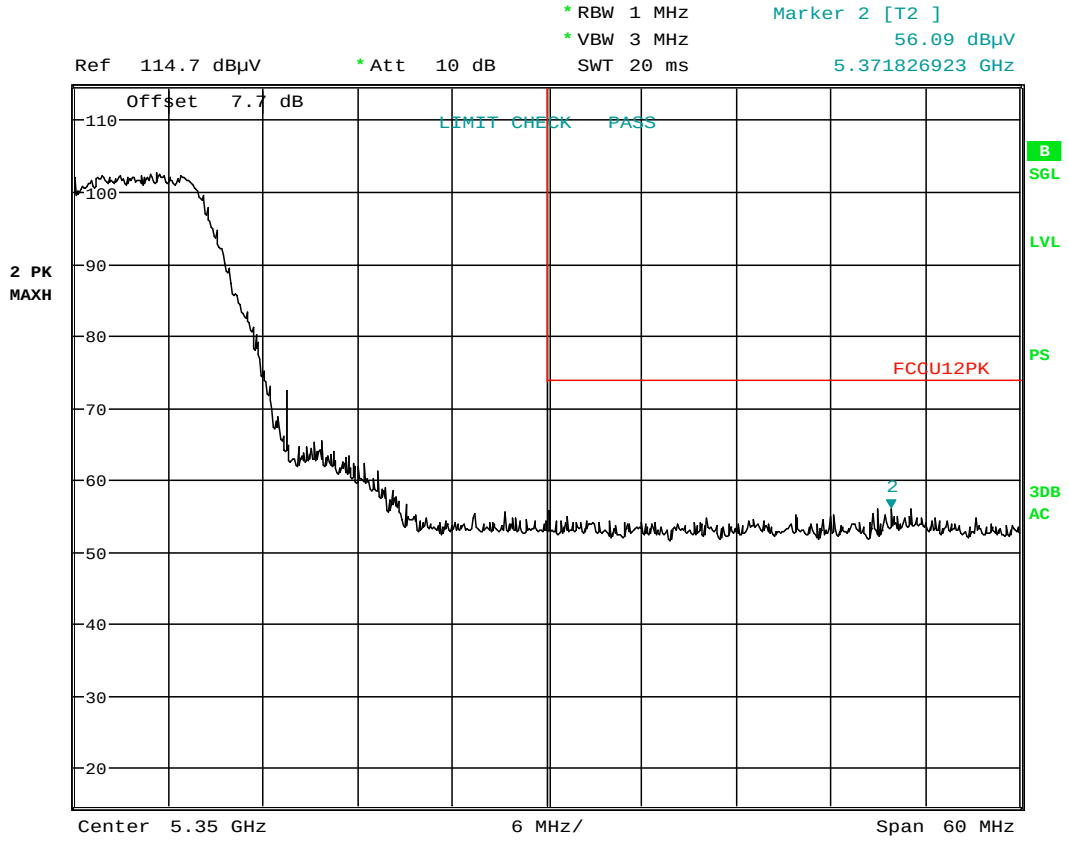

Date: 15.FEB.2017 13:20:34

Plot 7-90. Radiated Restricted Upper Band Edge Plot (Peak – UNII Band 2A)

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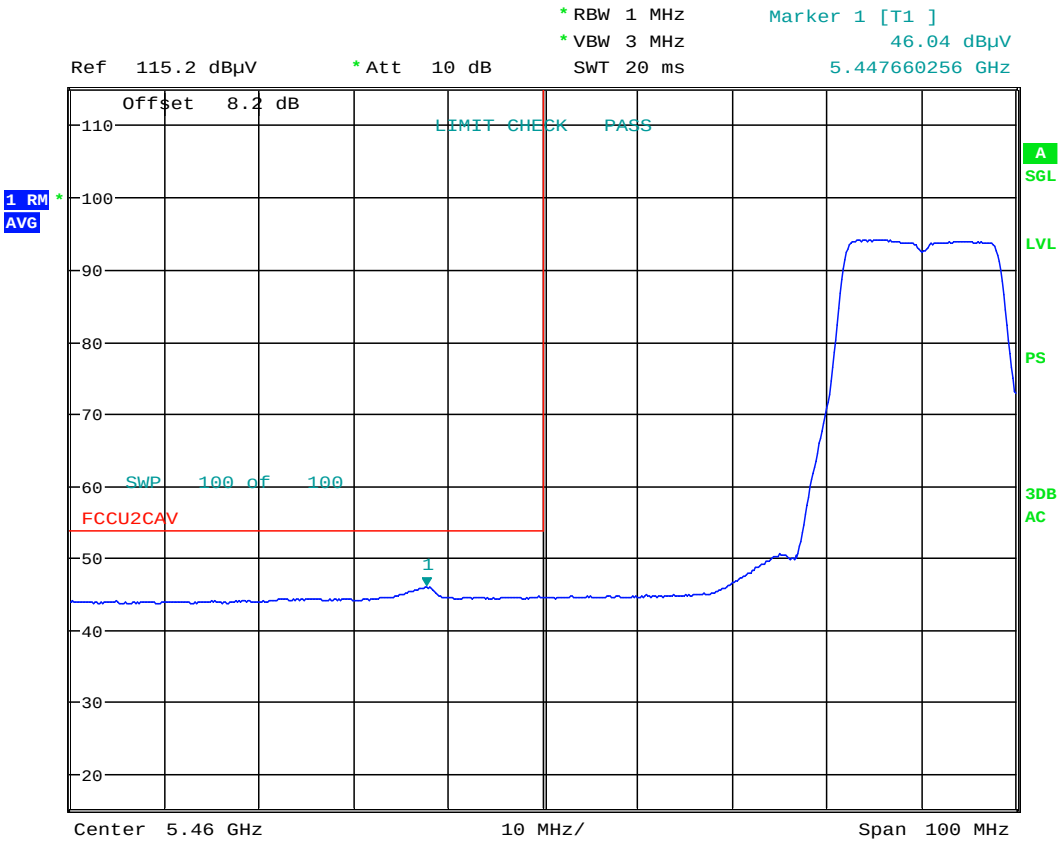
Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 13:29:24

Plot 7-91. Radiated Restricted Lower Band Edge Plot (Average– UNII Band 2C)

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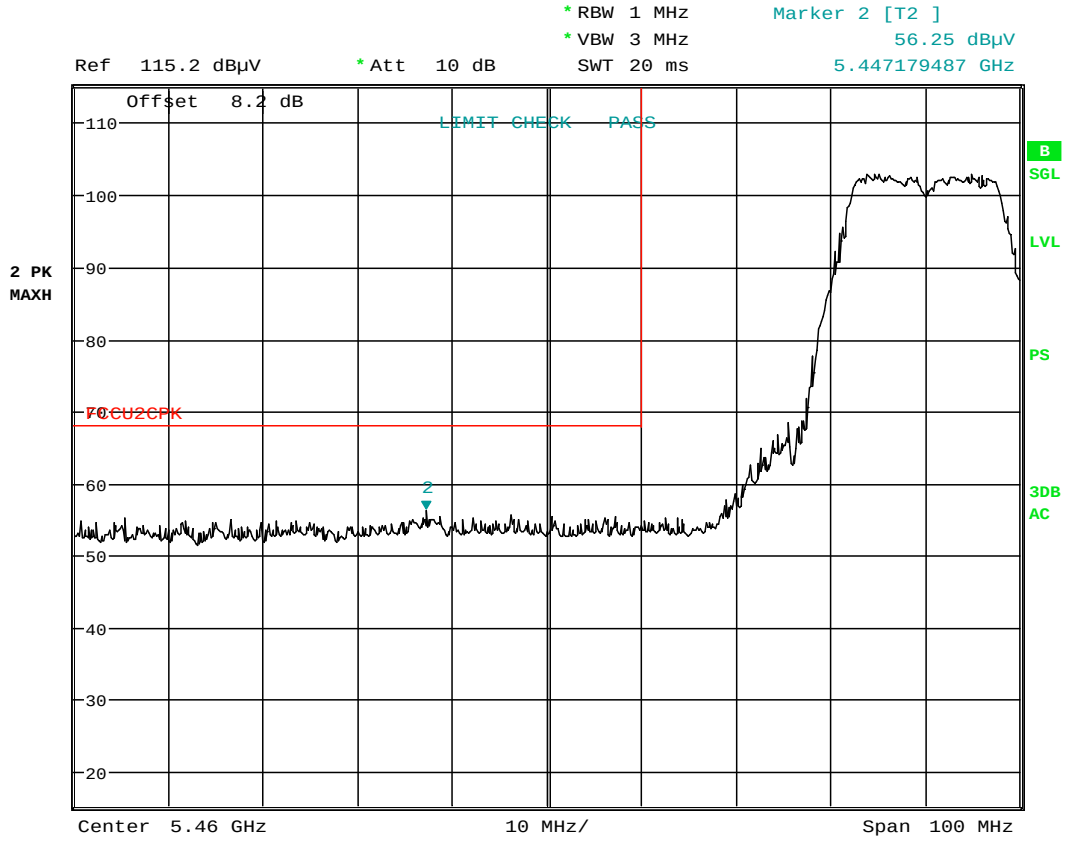

Date: 15.FEB.2017 13:29:35

Plot 7-92. Radiated Restricted Lower Band Edge Plot (Peak– UNII Band 2C)

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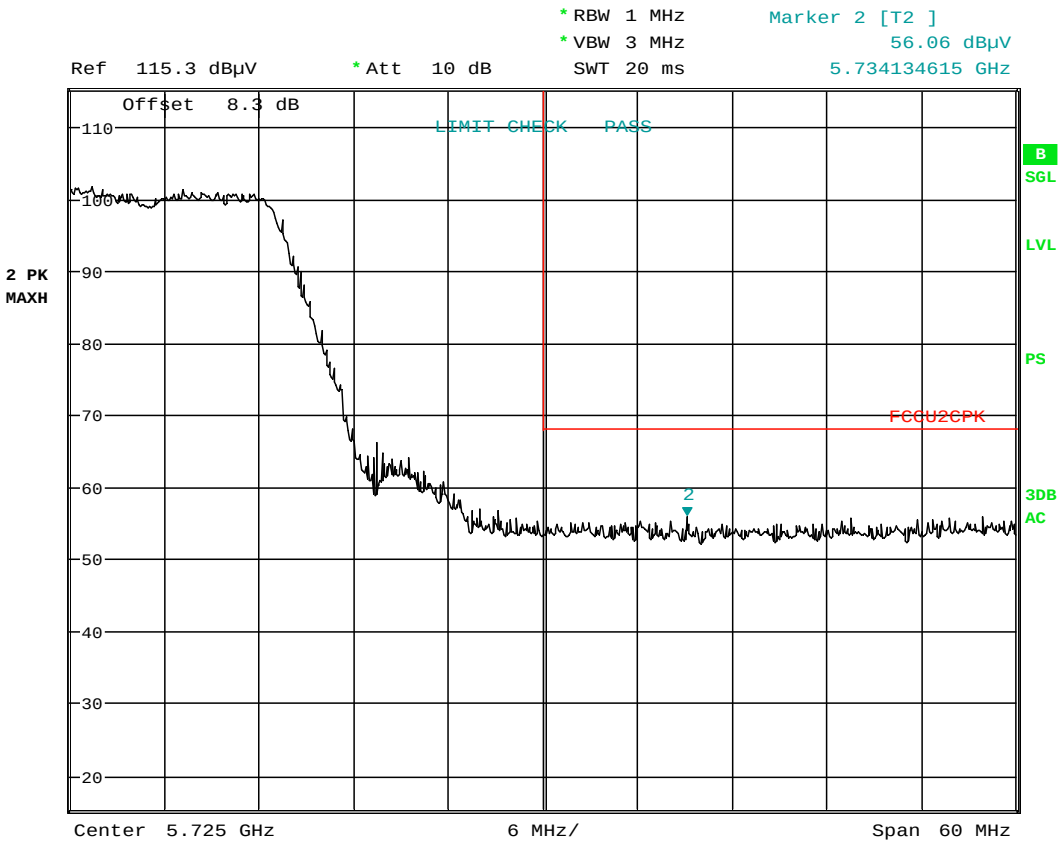
Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 13:36:18

Plot 7-93. Radiated Upper Band Edge Plot (Peak – UNII Band 2C)

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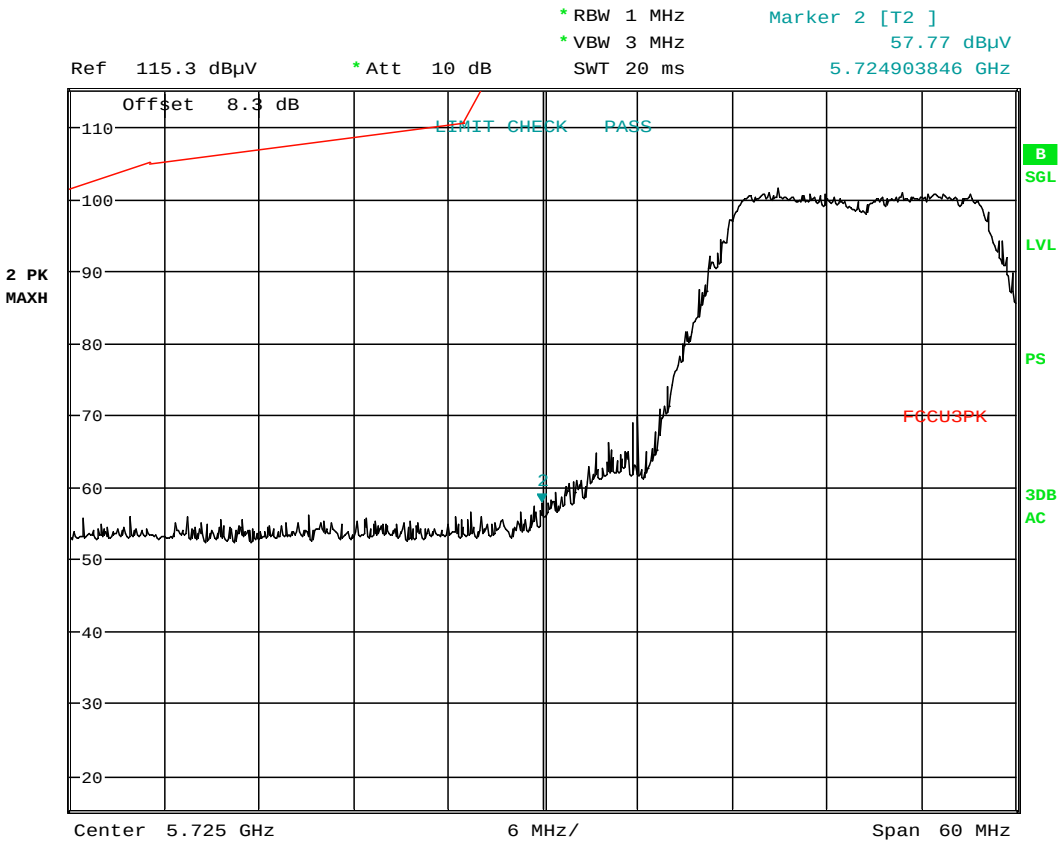
Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 13:40:56

Plot 7-94. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

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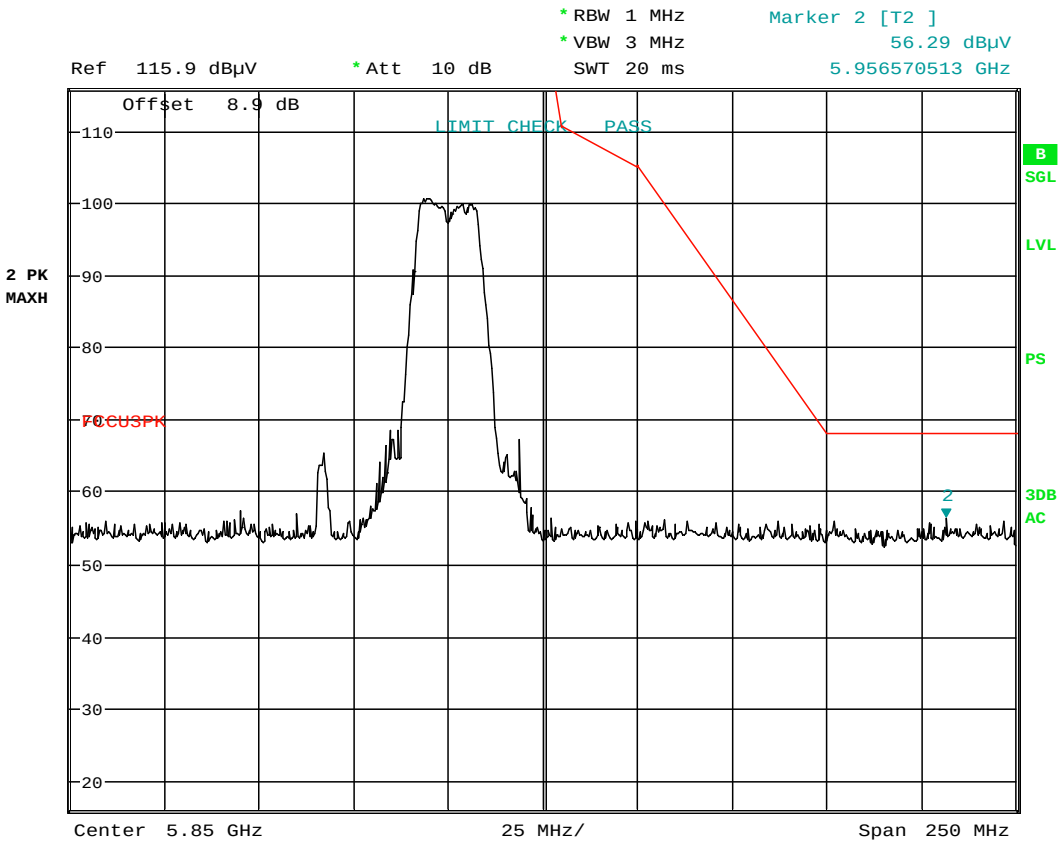
Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 13:44:48

Plot 7-95. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

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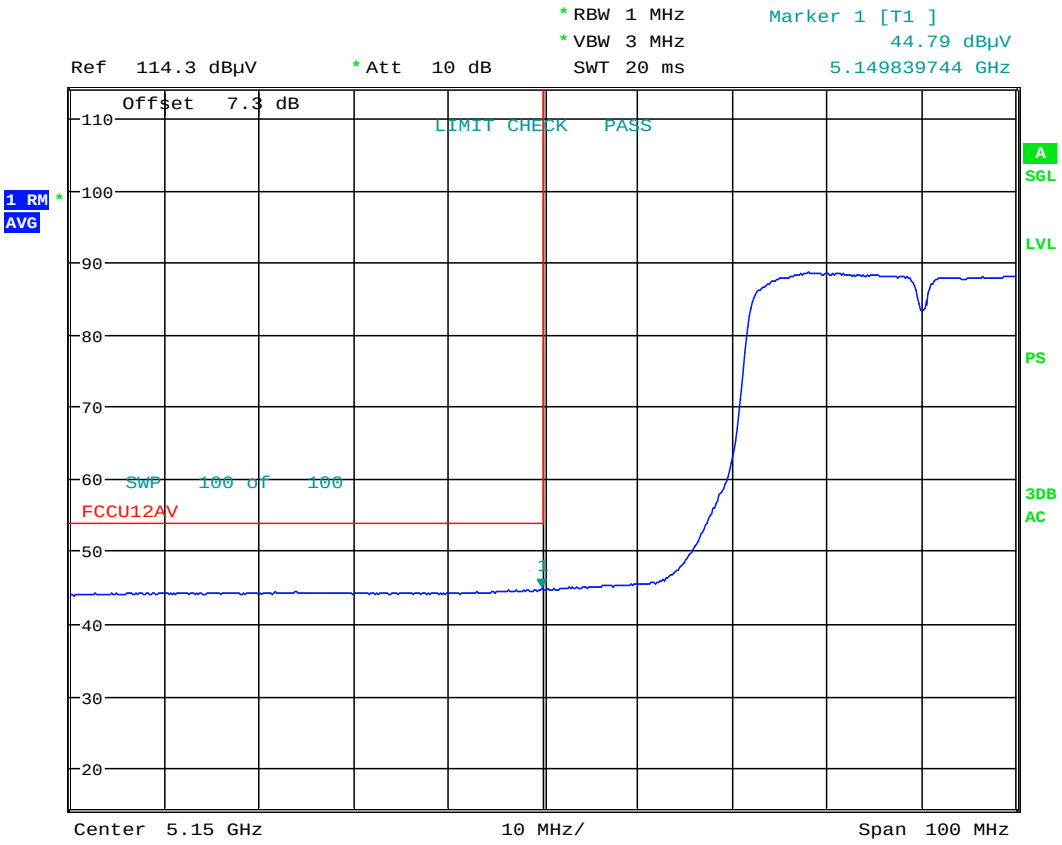
7.7.3 Radiated Band Edge Measurements (40MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 13:57:46

Plot 7-96. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

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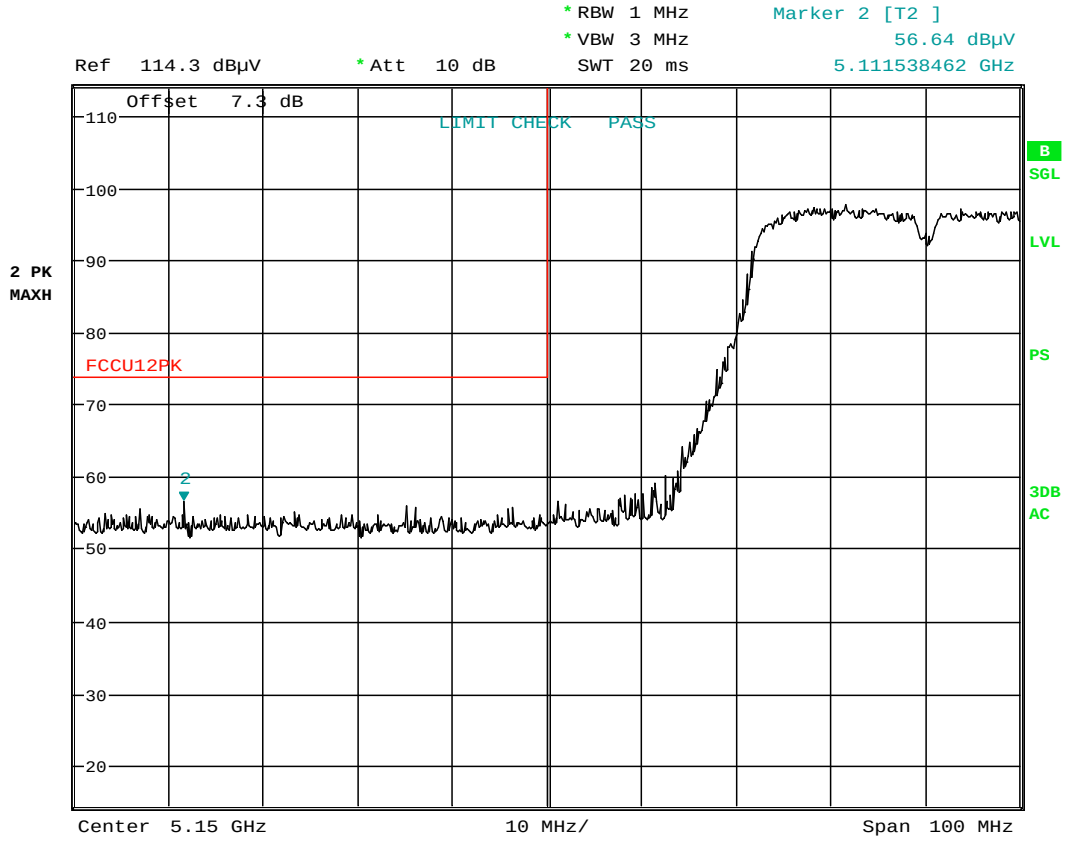

Date: 15.FEB.2017 13:57:58

Plot 7-97. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

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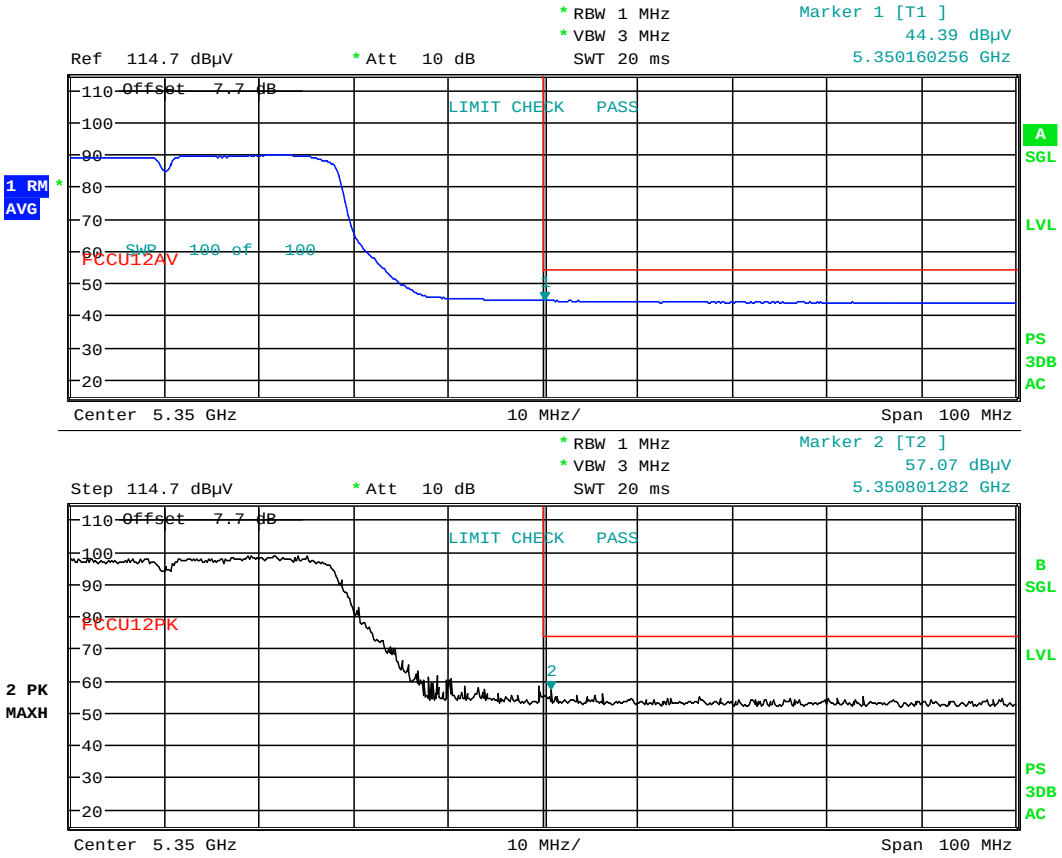
Radiated Band Edge Measurements (40MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 14:06:08

Plot 7-98. Radiated Restricted Upper Band Edge Plot (Average & Peak – UNII Band 2A)

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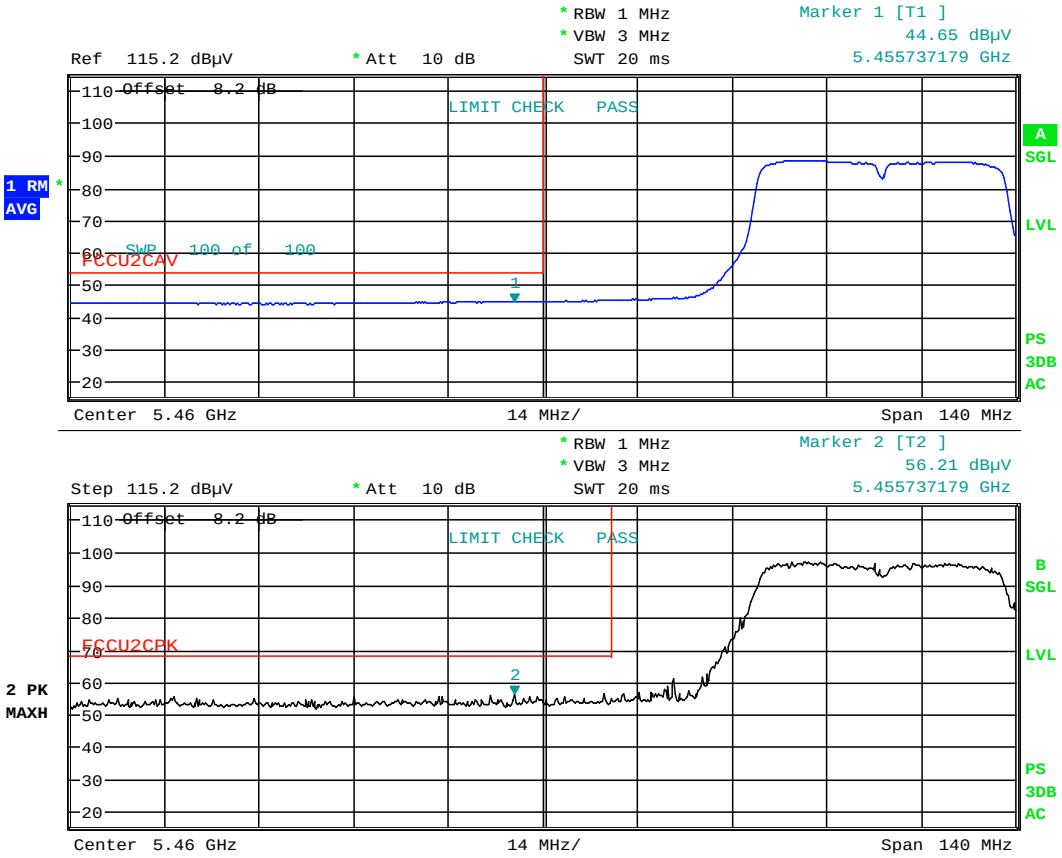
Radiated Band Edge Measurements (40MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 14:14:35

Plot 7-99. Radiated Restricted Lower Band Edge Plot (Average & Peak – UNII Band 2C)

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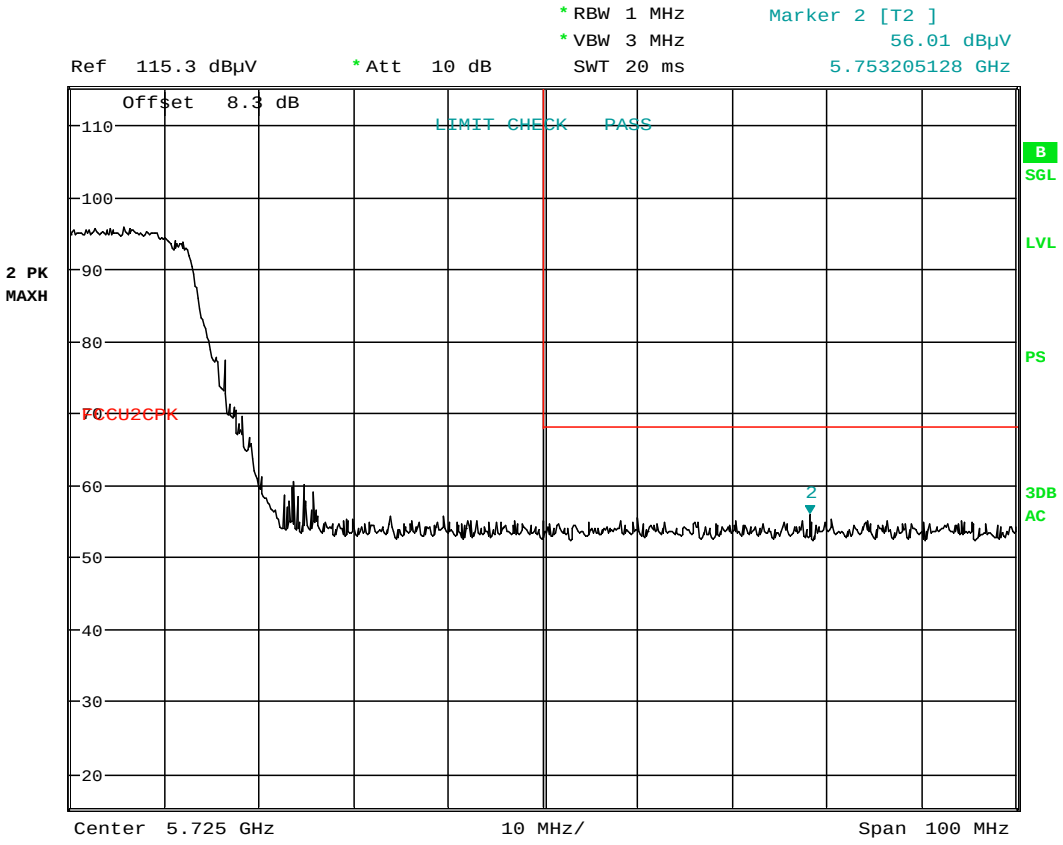
Radiated Band Edge Measurements (40MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 14:20:20

Plot 7-100. Radiated Upper Band Edge Plot (Peak – UNII Band 2C)

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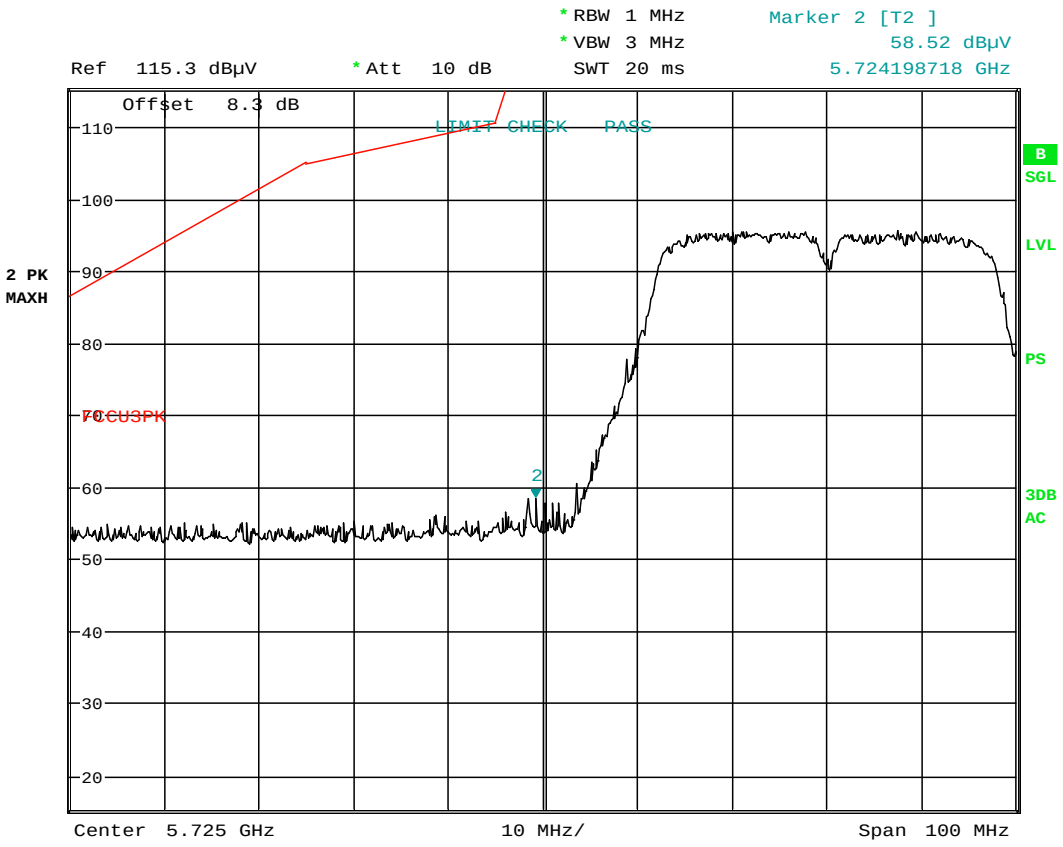
Radiated Band Edge Measurements (40MHz BW)

§15.407(b.1)(b.2) §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: 15.FEB.2017 14:26:13

Plot 7-101. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

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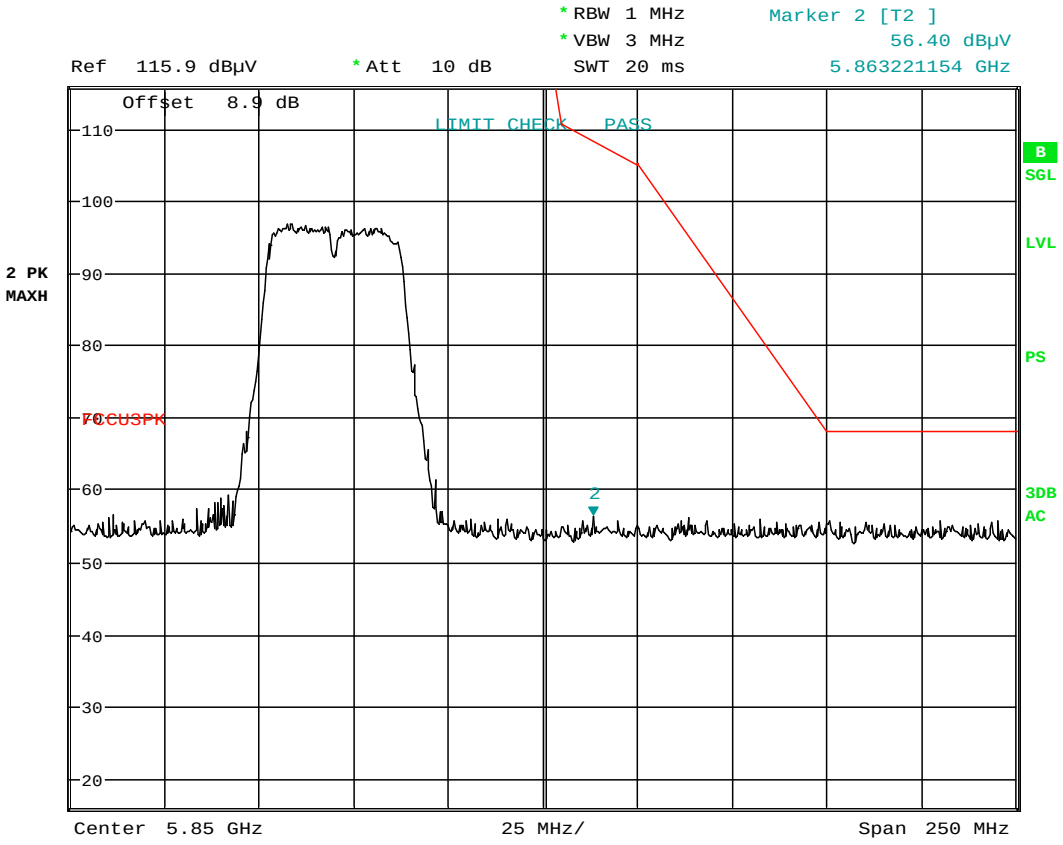
Radiated Band Edge Measurements (40MHz BW)

§15.407(b.1)(b.2) §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



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Plot 7-102. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

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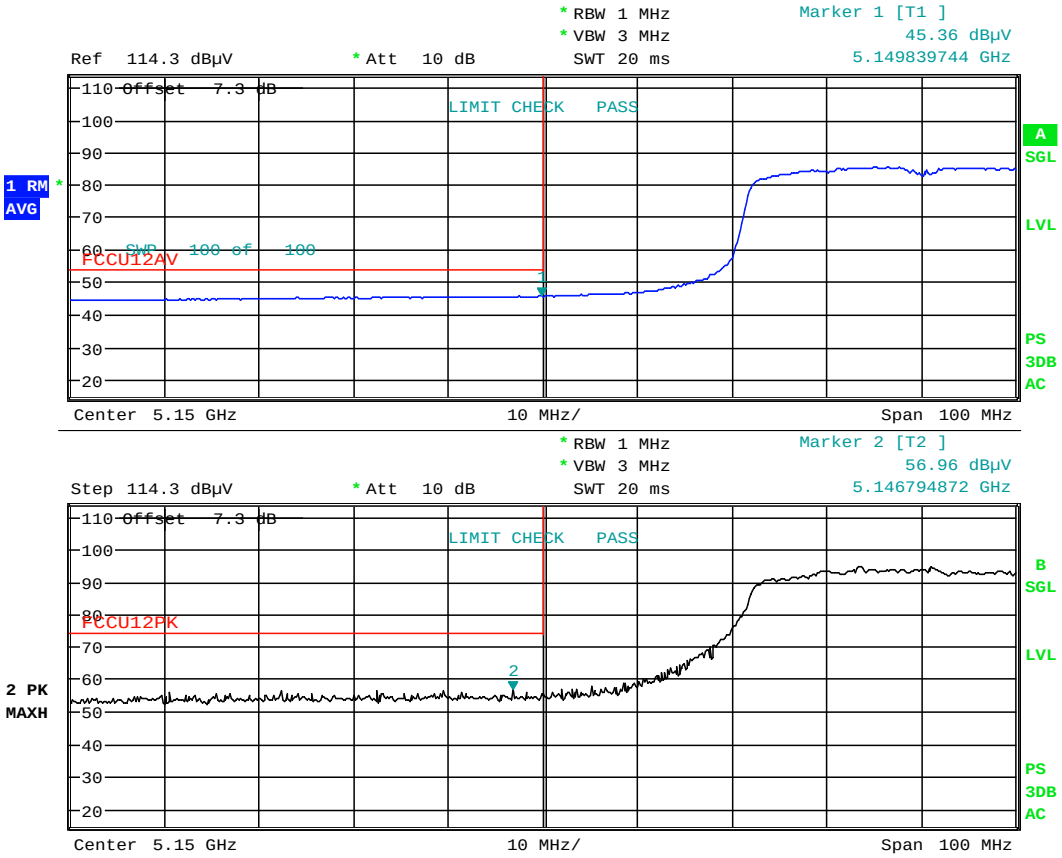
7.7.4 Radiated Band Edge Measurements (80MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11n (80MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5210MHz
Channel:	42



Date: 15.FEB.2017 14:39:59

Plot 7-103. Radiated Restricted Lower Band Edge Plot (Average & Peak – UNII Band 1)

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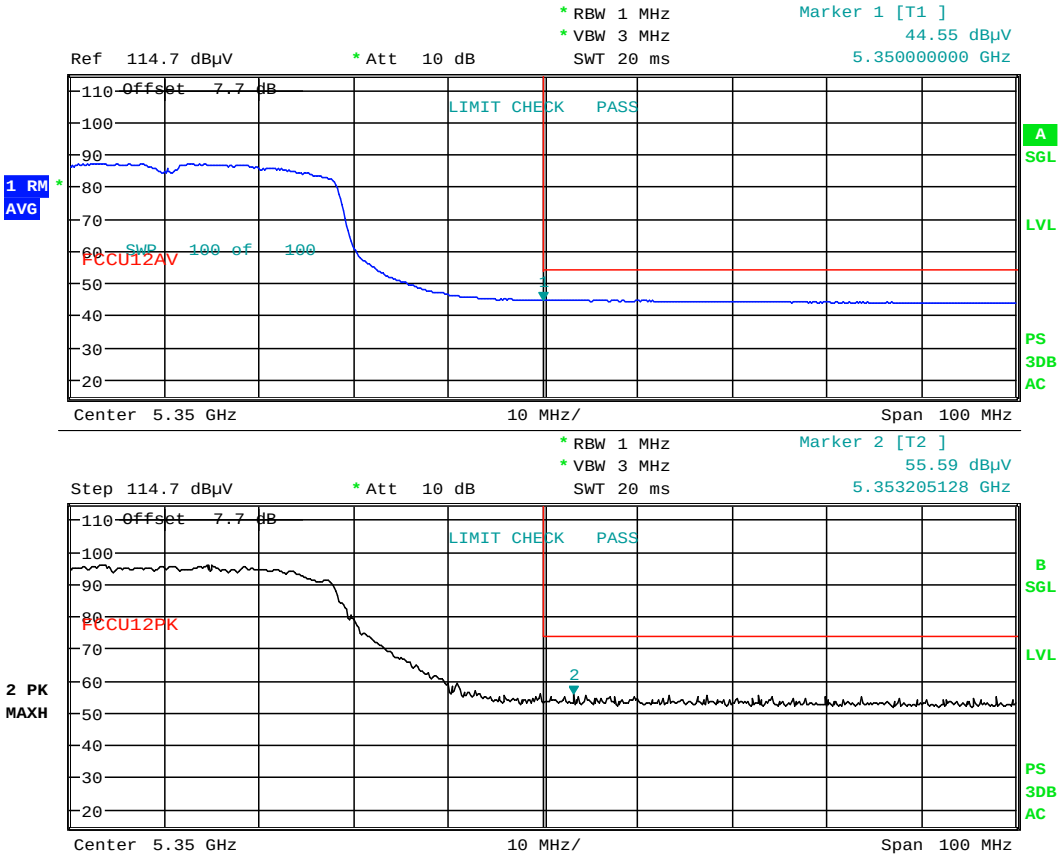
Radiated Band Edge Measurements (80MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ac (80MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5290MHz
Channel:	58



Date: 15.FEB.2017 14:46:04

Plot 7-104. Radiated Restricted Upper Band Edge Plot (Average & Peak – UNII Band 2A)

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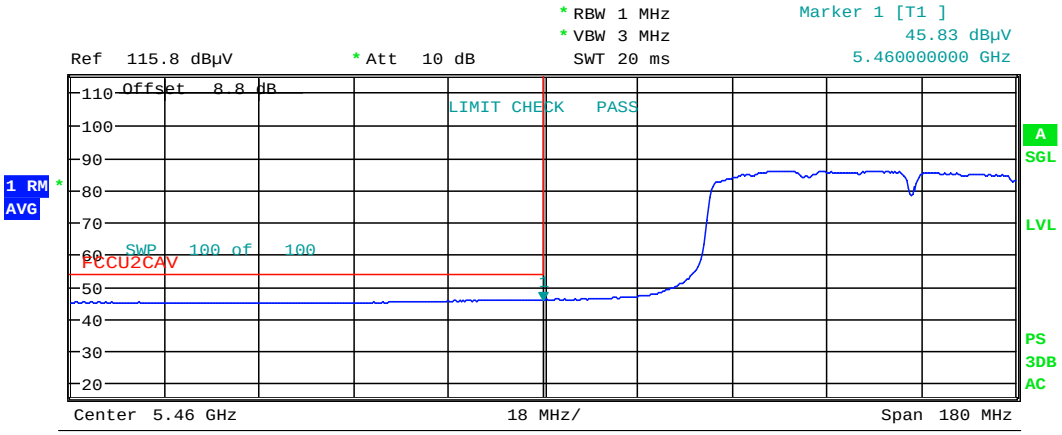
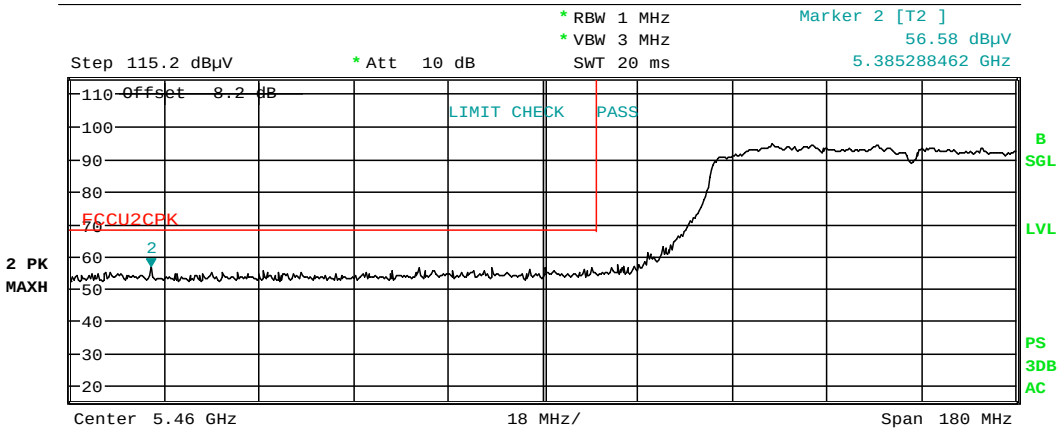
Radiated Band Edge Measurements (80MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ac (80MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5530MHz
Channel:	106





Date: 15.FEB.2017 14:55:29

Plot 7-105. Radiated Restricted Lower Band Edge Plot (Average & Peak – UNII Band 2C)

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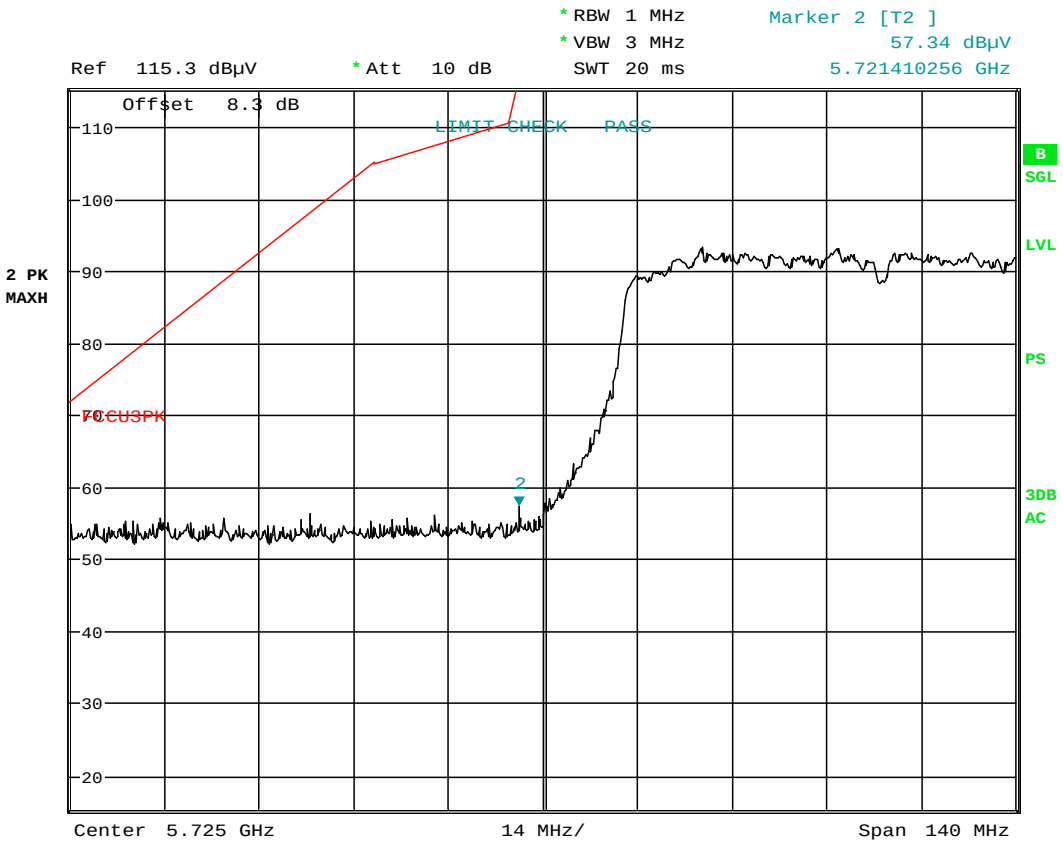
Radiated Band Edge Measurements (80MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ac (80MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5775MHz
Channel:	155



Date: 15.FEB.2017 15:00:01

Plot 7-106. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

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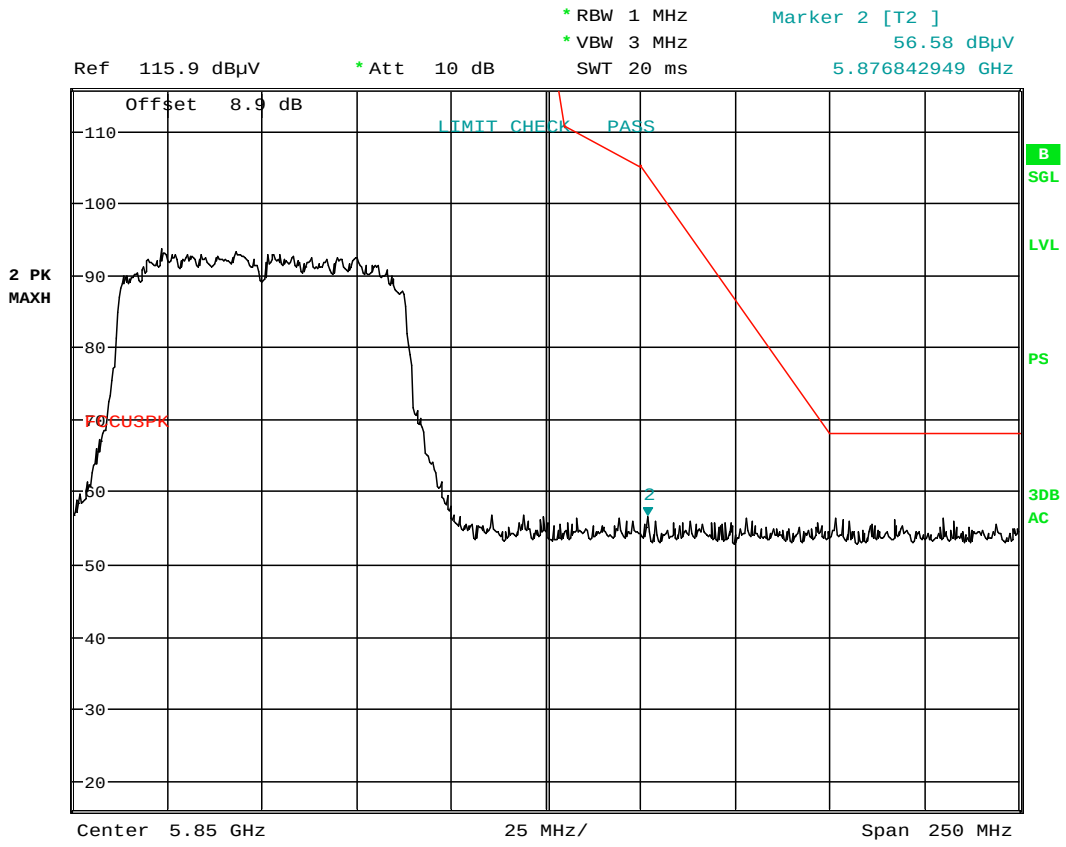
Radiated Band Edge Measurements (80MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ac (80MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5775MHz
Channel:	155



Date: 15.FEB.2017 15:00:13

Plot 7-107. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

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7.8 Radiated Spurious Emissions Measurements – Below 1GHz

§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 7-26 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 7-26. Radiated Limits

Test Procedures Used

ANSI C63.10-2013

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 diagrams below.

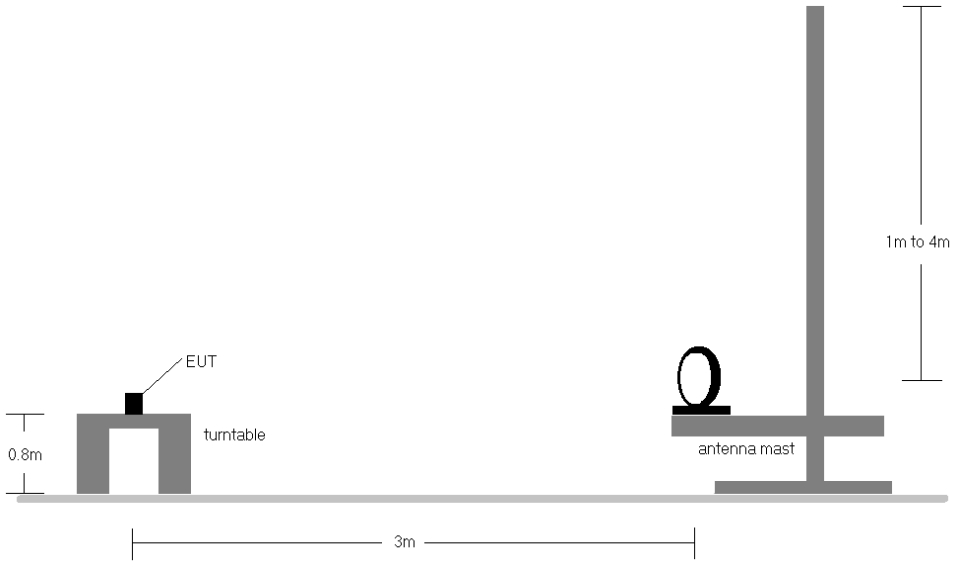

Figure 7-6. Radiated Test Setup < 30MHz

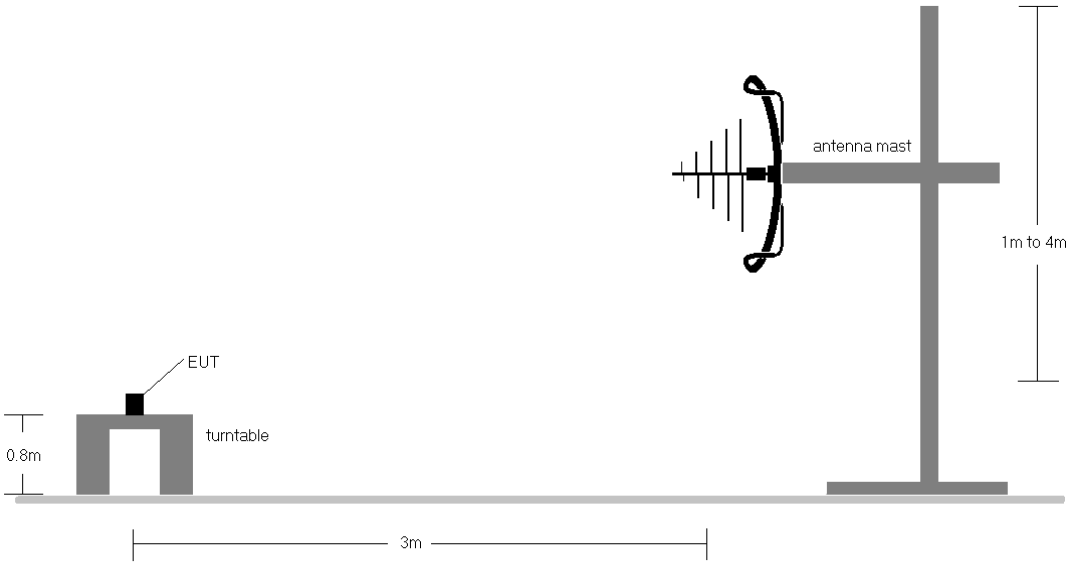

Figure 7-7. Radiated Test Setup < 1GHz

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Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-26.
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.
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.
9. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.

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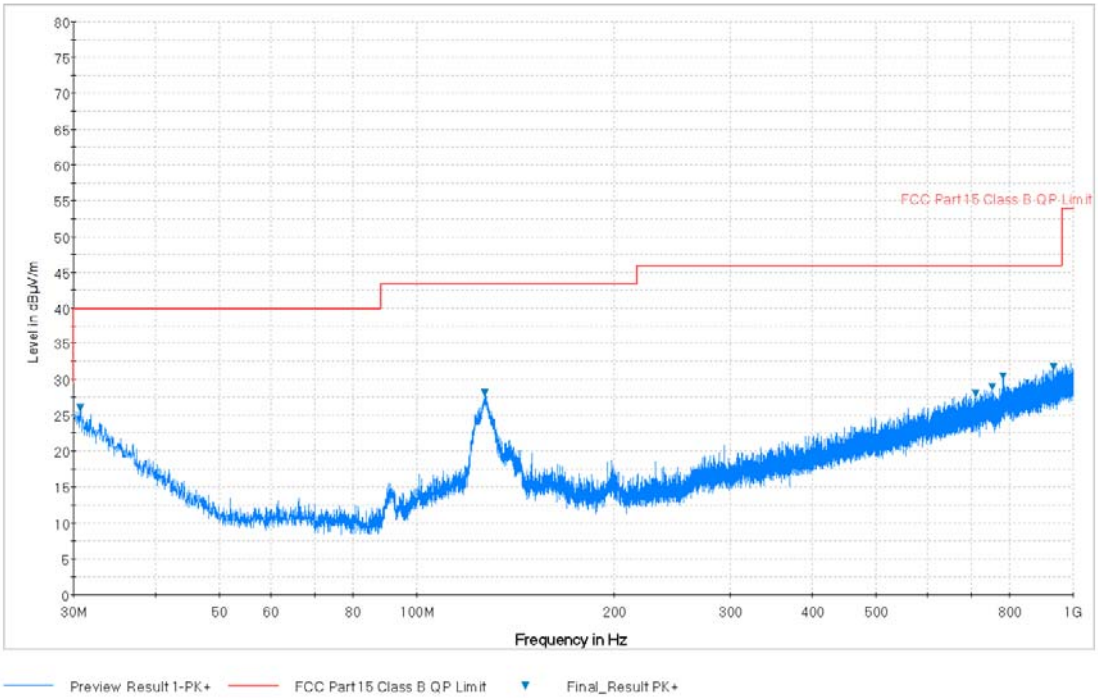
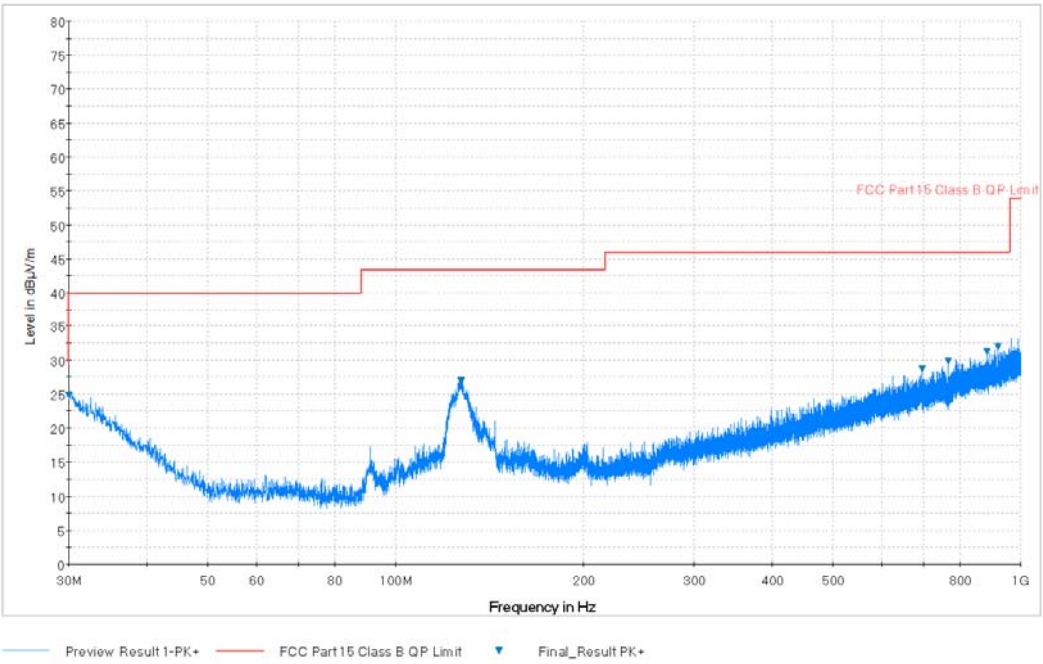
Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



Plot 7-108. Radiated Spurious Plot below 1GHz (802.11a – U3 Ch. 157, Ant. Pol. H)



Plot 7-109. Radiated Spurious Plot below 1GHz (802.11a – U3 Ch. 157, Ant. Pol. V)

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7.9 Line-Conducted Test Data

§15.407

Test Overview and Limit

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN 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 conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

All conducted emissions must not exceed the limits shown in the table below, per Section 15.207.

Frequency of emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

Table 7-27. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2013, Section 6.2

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = RMS
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.

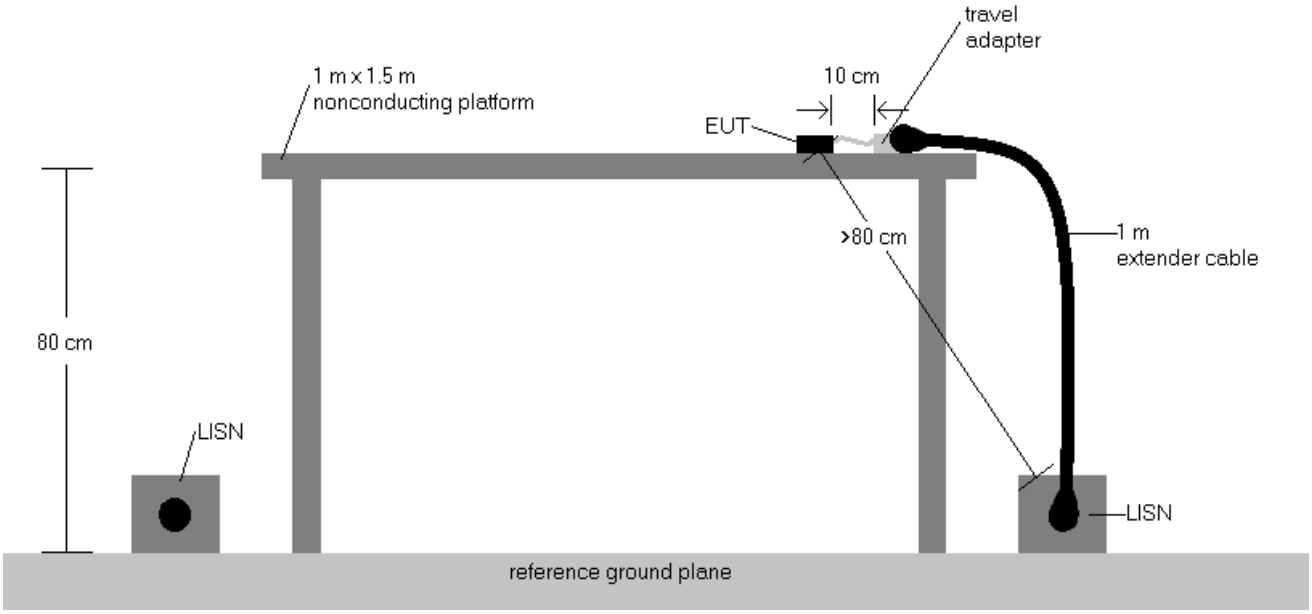

Figure 7-8. Test Instrument & Measurement Setup

Test Notes

1. All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
2. The limit for an intentional radiator from 150kHz to 30MHz are specified in 15.207.
3. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
4. QP/AV Level (dBμV) = QP/AV Analyzer/Receiver Level (dBμV) + Corr. (dB)
5. Margin (dB) = QP/AV Limit (dBμV) - QP/AV Level (dBμV)
6. Traces shown in plot are made using a peak detector.
7. Deviations to the Specifications: None.

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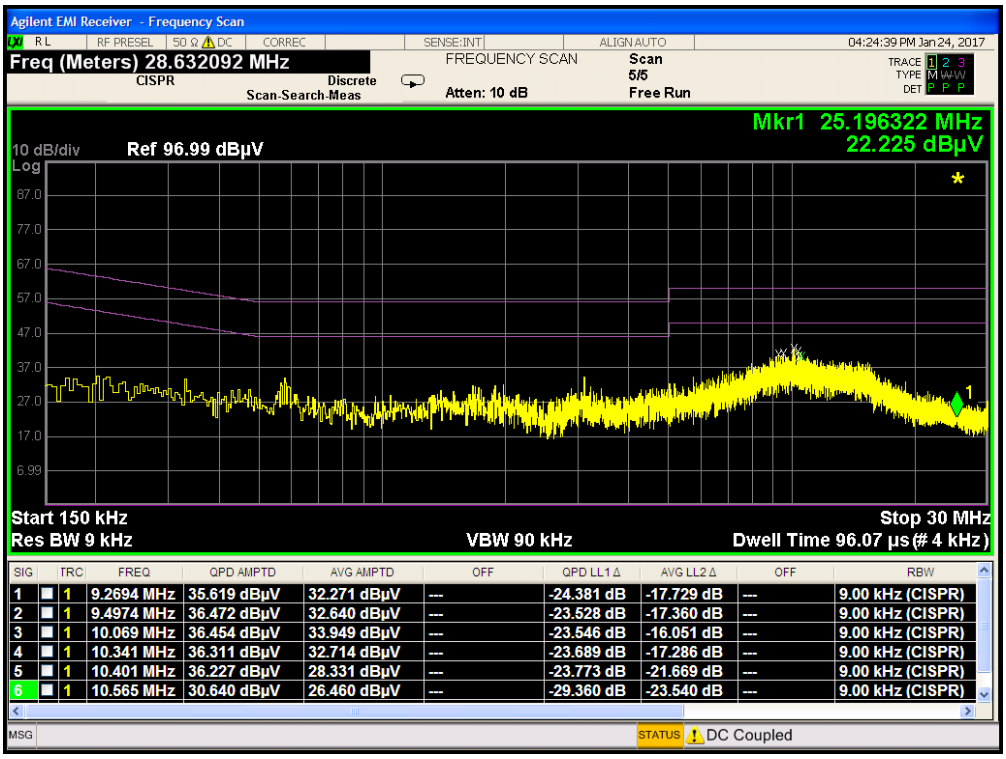
Line-Conducted Test Data

§15.407



SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	1	9.2694 MHz	35.619 dBµV	32.271 dBµV	---	-24.381 dB	-17.729 dB	---	9.00 kHz (CISPR)
2	1	9.4974 MHz	36.472 dBµV	32.640 dBµV	---	-23.528 dB	-17.360 dB	---	9.00 kHz (CISPR)
3	1	10.069 MHz	36.454 dBµV	33.949 dBµV	---	-23.546 dB	-16.051 dB	---	9.00 kHz (CISPR)
4	1	10.341 MHz	36.311 dBµV	32.714 dBµV	---	-23.689 dB	-17.286 dB	---	9.00 kHz (CISPR)
5	1	10.401 MHz	36.227 dBµV	28.331 dBµV	---	-23.773 dB	-21.669 dB	---	9.00 kHz (CISPR)
6	1	10.565 MHz	30.640 dBµV	26.460 dBµV	---	-29.360 dB	-23.540 dB	---	9.00 kHz (CISPR)

Plot 7-110. Line Conducted Plot with 802.11a UNII Band 1 (L1)

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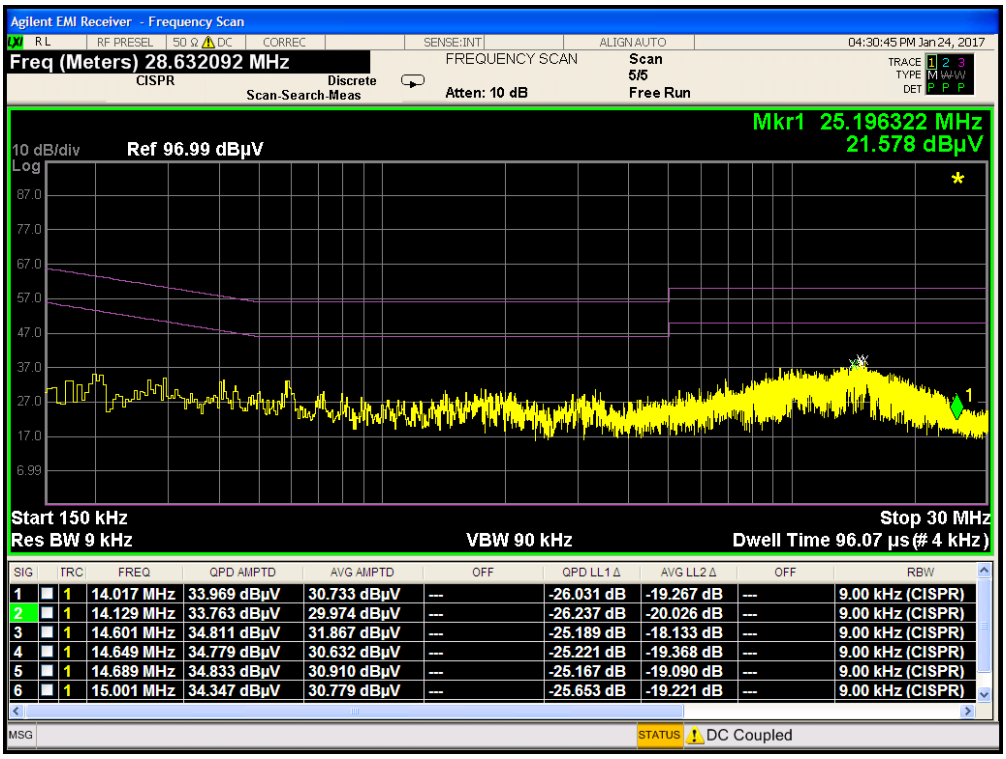

Plot 7-111. Line Conducted Plot with 802.11a UNII Band 1 (N)

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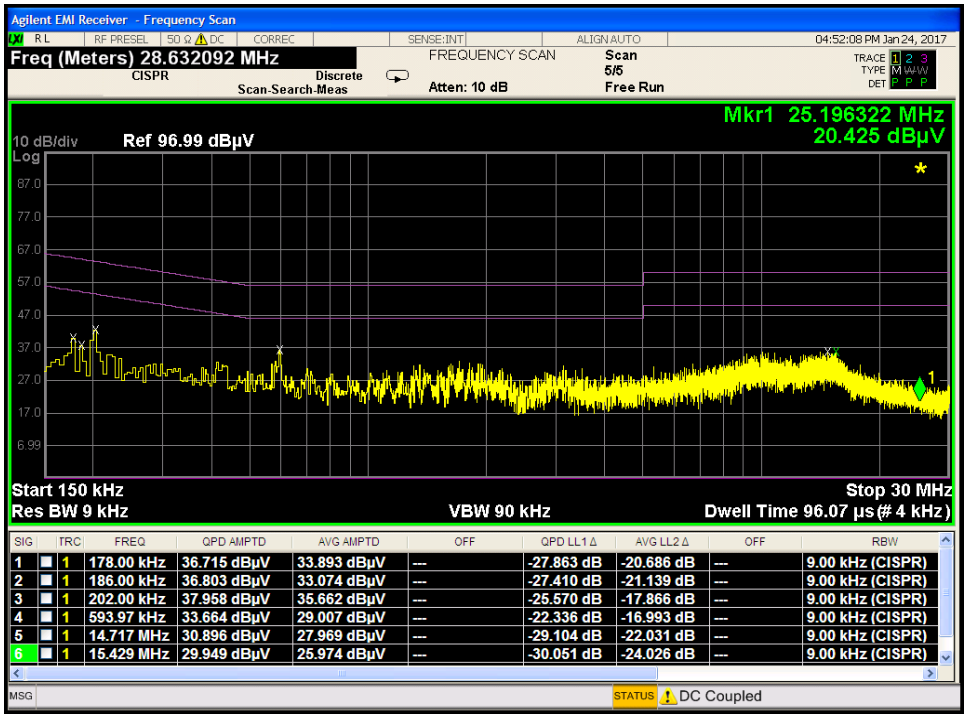
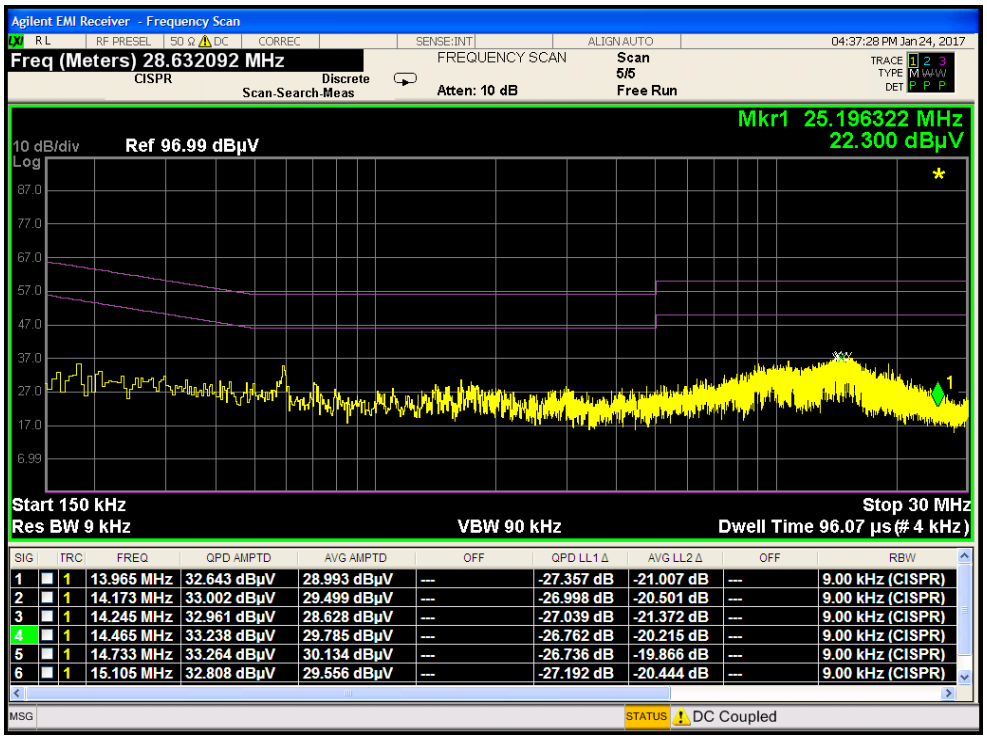
Line-Conducted Test Data

§15.407



SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	1	178.00 kHz	36.715 dBµV	33.893 dBµV	---	-27.863 dB	-20.686 dB	---	9.00 kHz (CISPR)
2	1	186.00 kHz	36.803 dBµV	33.074 dBµV	---	-27.410 dB	-21.139 dB	---	9.00 kHz (CISPR)
3	1	202.00 kHz	37.958 dBµV	35.662 dBµV	---	-25.570 dB	-17.866 dB	---	9.00 kHz (CISPR)
4	1	593.97 kHz	33.664 dBµV	29.007 dBµV	---	-22.336 dB	-16.993 dB	---	9.00 kHz (CISPR)
5	1	14.717 MHz	30.896 dBµV	27.969 dBµV	---	-29.104 dB	-22.031 dB	---	9.00 kHz (CISPR)
6	1	15.429 MHz	29.949 dBµV	25.974 dBµV	---	-30.051 dB	-24.026 dB	---	9.00 kHz (CISPR)

Plot 7-112. Line Conducted Plot with 802.11a UNII Band 2A (L1)



SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	1	13.965 MHz	32.643 dBµV	28.993 dBµV	---	-27.357 dB	-21.007 dB	---	9.00 kHz (CISPR)
2	1	14.173 MHz	33.002 dBµV	29.499 dBµV	---	-26.998 dB	-20.501 dB	---	9.00 kHz (CISPR)
3	1	14.245 MHz	32.961 dBµV	28.628 dBµV	---	-27.039 dB	-21.372 dB	---	9.00 kHz (CISPR)
4	1	14.465 MHz	33.238 dBµV	29.785 dBµV	---	-26.762 dB	-20.215 dB	---	9.00 kHz (CISPR)
5	1	14.733 MHz	33.264 dBµV	30.134 dBµV	---	-26.736 dB	-19.866 dB	---	9.00 kHz (CISPR)
6	1	15.105 MHz	32.808 dBµV	29.556 dBµV	---	-27.192 dB	-20.444 dB	---	9.00 kHz (CISPR)

Plot 7-113. Line Conducted Plot with 802.11a UNII Band 2A (N)

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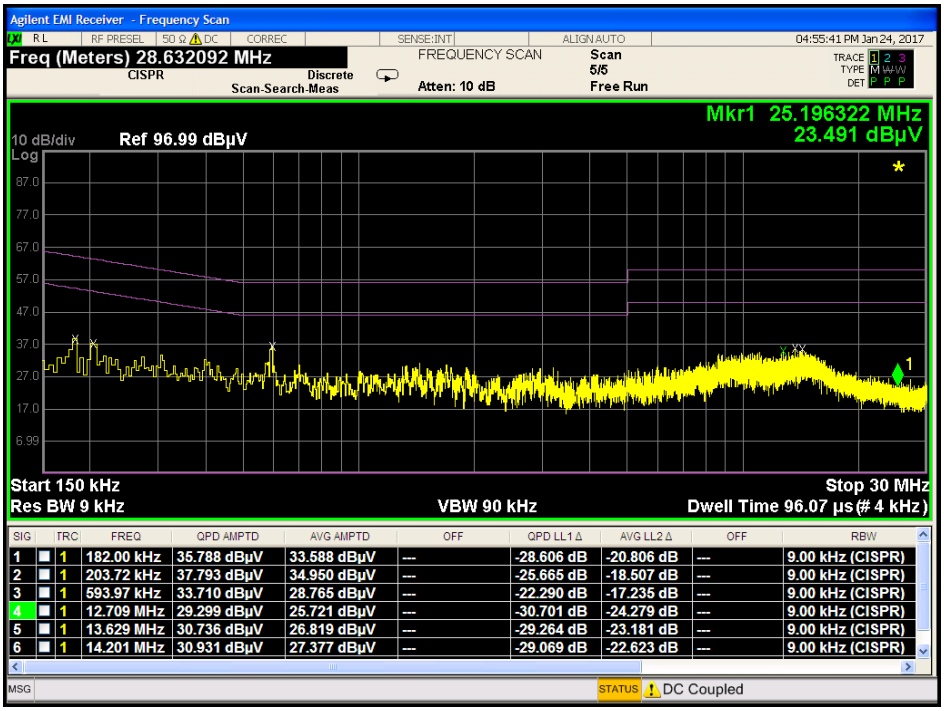
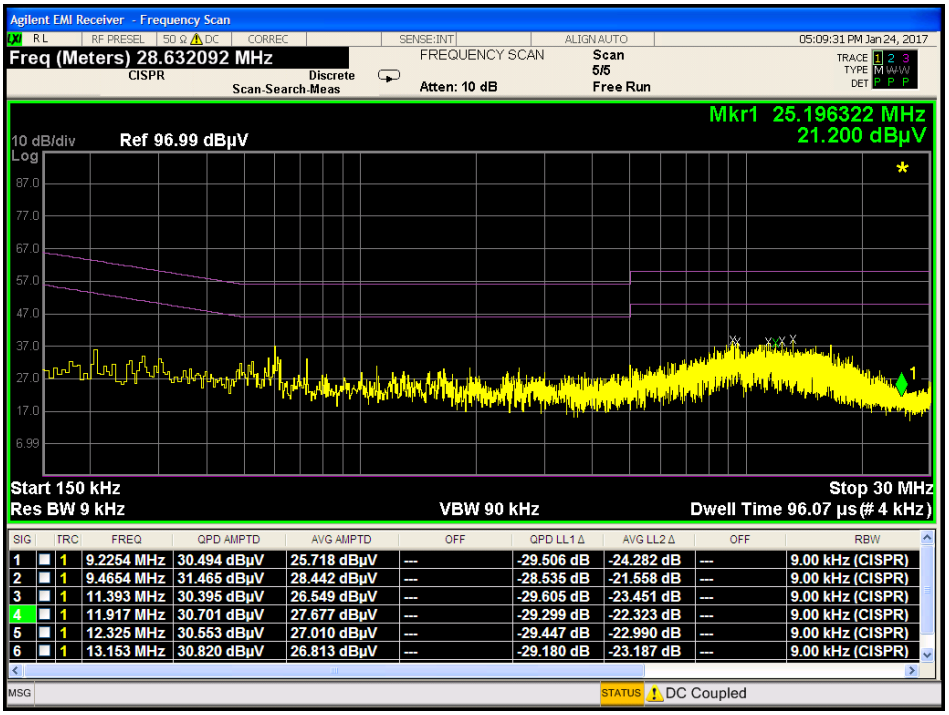
Line-Conducted Test Data

§15.407



Plot 7-114. Line Conducted Plot with 802.11a UNII Band 2C (L1)



Plot 7-115. Line Conducted Plot with 802.11a UNII Band 2C (N)

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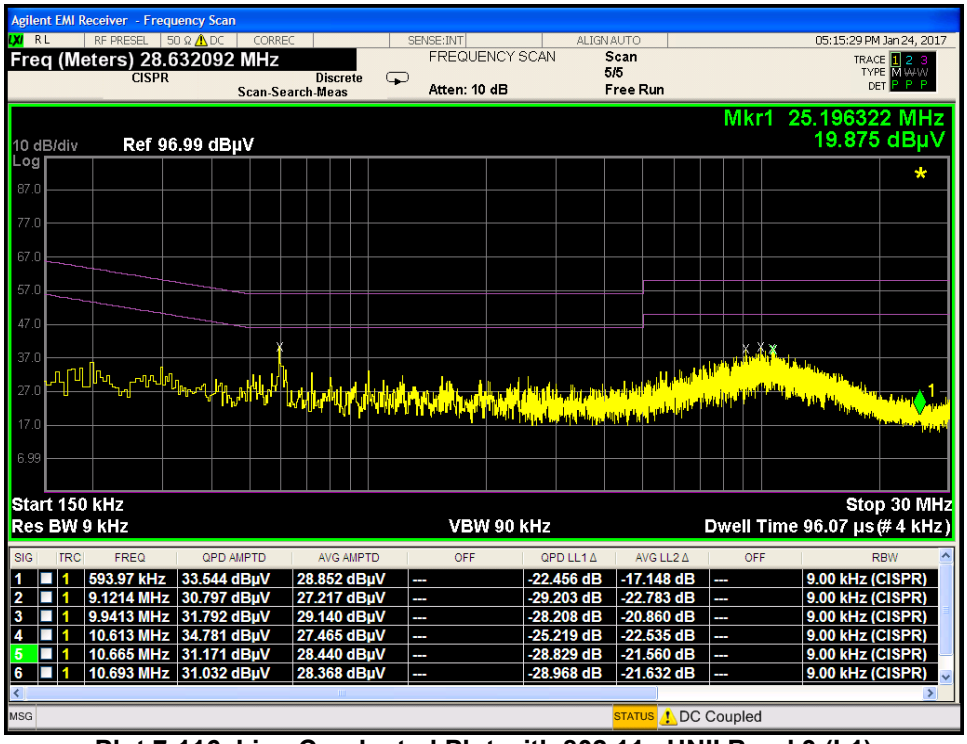
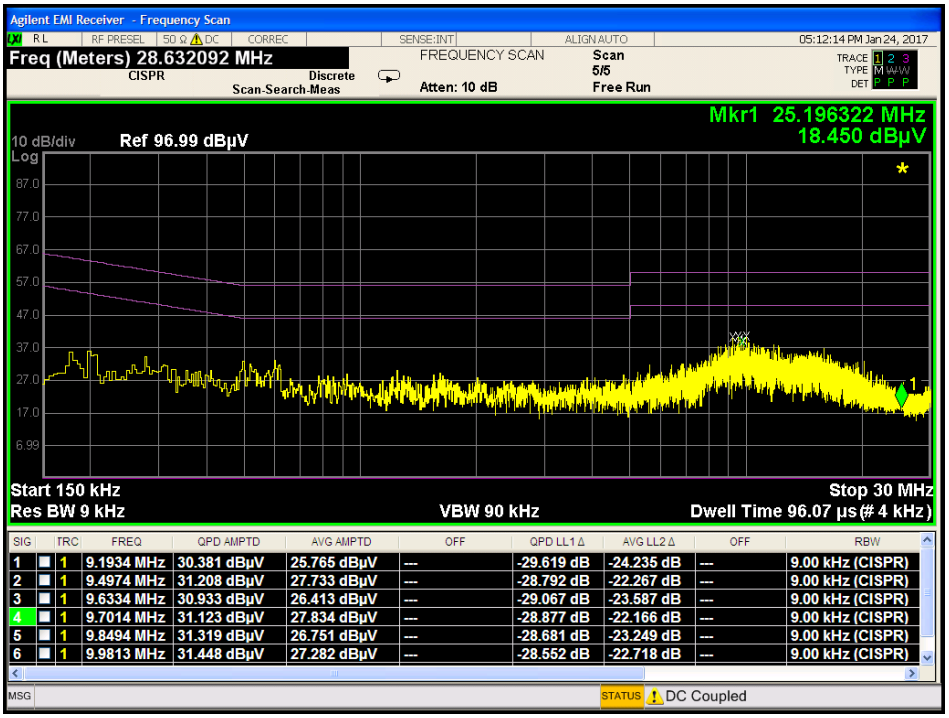
Line-Conducted Test Data

§15.407



SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	1	593.97 kHz	33.544 dBµV	28.852 dBµV	---	-22.456 dB	-17.148 dB	---	9.00 kHz (CISPR)
2	1	9.1214 MHz	30.797 dBµV	27.217 dBµV	---	-29.203 dB	-22.783 dB	---	9.00 kHz (CISPR)
3	1	9.9413 MHz	31.792 dBµV	29.140 dBµV	---	-28.208 dB	-20.860 dB	---	9.00 kHz (CISPR)
4	1	10.613 MHz	34.781 dBµV	27.465 dBµV	---	-25.219 dB	-22.535 dB	---	9.00 kHz (CISPR)
5	1	10.665 MHz	31.171 dBµV	28.440 dBµV	---	-28.829 dB	-21.560 dB	---	9.00 kHz (CISPR)
6	1	10.693 MHz	31.032 dBµV	28.368 dBµV	---	-28.968 dB	-21.632 dB	---	9.00 kHz (CISPR)

Plot 7-116. Line Conducted Plot with 802.11a UNII Band 3 (L1)



SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	1	9.1934 MHz	30.381 dBµV	25.765 dBµV	---	-29.619 dB	-24.235 dB	---	9.00 kHz (CISPR)
2	1	9.4974 MHz	31.208 dBµV	27.733 dBµV	---	-28.792 dB	-22.267 dB	---	9.00 kHz (CISPR)
3	1	9.6334 MHz	30.933 dBµV	26.413 dBµV	---	-29.067 dB	-23.587 dB	---	9.00 kHz (CISPR)
4	1	9.7014 MHz	31.123 dBµV	27.834 dBµV	---	-28.877 dB	-22.166 dB	---	9.00 kHz (CISPR)
5	1	9.8494 MHz	31.319 dBµV	26.751 dBµV	---	-28.681 dB	-23.249 dB	---	9.00 kHz (CISPR)
6	1	9.9813 MHz	31.448 dBµV	27.282 dBµV	---	-28.552 dB	-22.718 dB	---	9.00 kHz (CISPR)

Plot 7-117. Line Conducted Plot with 802.11a UNII Band 3 (N)

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8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **LGE Portable Handset FCC ID: ZNFM710H** is in compliance with Part 15E of the FCC Rules.

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