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

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
1/30-3/3/2017
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
1M1705180170-03.A3L

FCC ID:	**A3LETWV521**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	ET-WV521
EUT Type:	Indoor Access Point
FCC Classification:	Unlicensed National Information Infrastructure (UNII)
FCC Rule Part(s):	Part 15.407
Test Procedure(s):	KDB 789033 D02 v01r04, KDB 662911 D01 v02r01

UNII Band	Channel Bandwidth (MHz)	Tx Frequency (MHz)	ANT1		ANT2		MIMO/CDD	
			Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	5180 - 5240	125.314	20.98	121.899	20.86	111.065	20.46
3		5745 - 5825	118.304	20.73	111.944	20.49	124.455	20.95
1	40	5190 - 5230	111.686	20.48	94.842	19.77	87.920	19.44
3		5755 - 5795	106.660	20.28	103.753	20.16	102.369	20.10
1	80	5210	10.593	10.25	11.169	10.48	26.252	14.19
3		5775	39.264	15.94	35.727	15.53	74.992	18.75

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 789033 D02 v01r04. 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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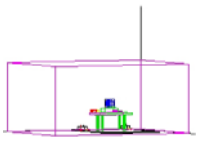
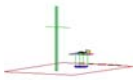


MEASUREMENT REPORT
FCC Part 15.407



§ 2.1033 General Information

APPLICANT:	Samsung Electronics Co., Ltd.
APPLICANT ADDRESS:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
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:	ET-WV521
FCC ID:	A3LETWV521
FCC CLASSIFICATION:	Unlicensed National Information Infrastructure (UNII)
Test Device Serial No.:	20JAN-2, 20JAN-3, 20JAN-5 ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	1/30-3/3/2017
TEST REPORT S/N:	1M1705180170-03.A3L

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.

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.

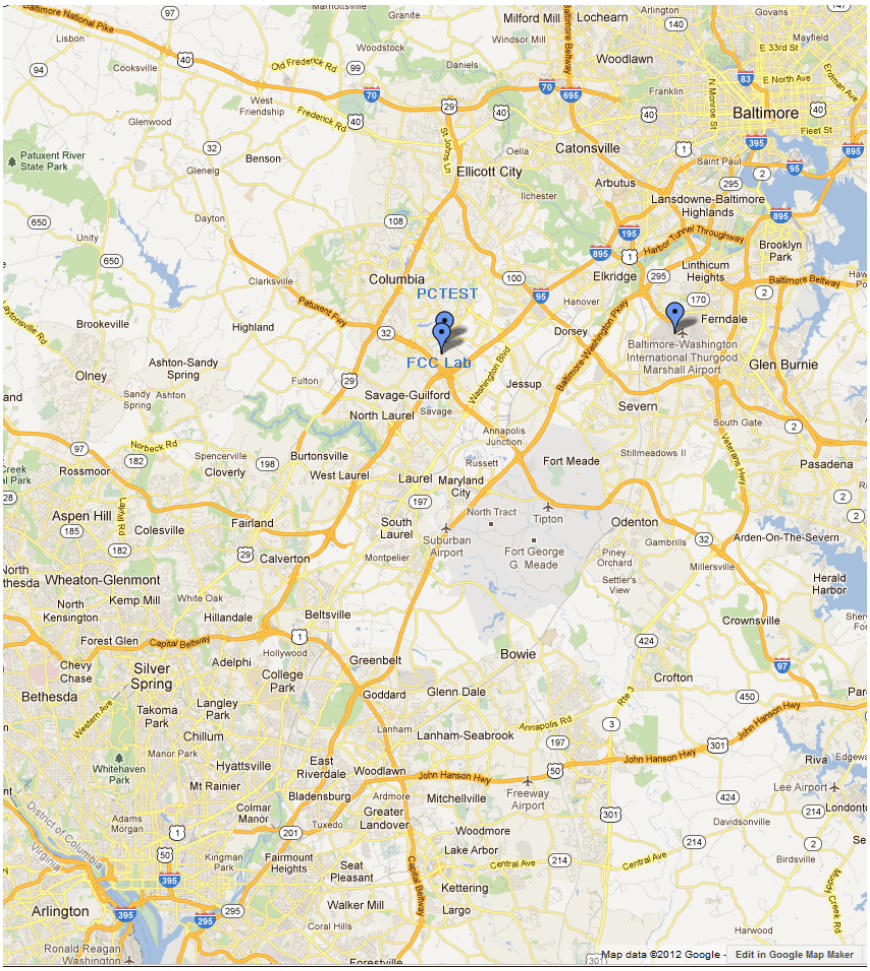


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Indoor Access Point FCC ID: A3LETWV521**. 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:

802.11b/g/n WLAN, 802.11a/n/ac UNII, Bluetooth (LE), Zigbee, Zwave

Band 1		Band 3	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
36	5180	149	5745
:	:	:	:
42	5210	157	5785
:	:	:	:
48	5240	165	5825

Table 2-1. 802.11a / 802.11n / 802.11ac (20MHz) Frequency / Channel Operations

Band 1		Band 3	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
38	5190	151	5755
:	:	:	:
46	5230	159	5795

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

Band 1		Band 3	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
42	5210	155	5775

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

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 v01r04. 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	ANT2	MIMO
5GHz	a	97.7	98.2	N/A
	n (HT20)	98.6	99.0	96.0
	ac (HT20)	98.6	99.0	97.4
	n (HT40)	98.2	98.6	92.2
	ac (HT40)	98.2	98.6	92.2
	ac (HT80)	94.3	93.0	94.2

2. The device employs MIMO technology. Below are the possible configurations.

WiFi Configurations		SISO		SDM		CDD	
		ANT1	ANT2	ANT1	ANT2	ANT1	ANT2
5GHz	11a	✓	✓	×	×	✓	✓
	11n (20MHz)	✓	✓	✓	✓	✓	✓
	11n (40MHz)	✓	✓	✓	✓	✓	✓
	11ac (80MHz)	✓	✓	✓	✓	✓	✓

Table 2-4. Frequency / Channel Operations

✓= Support ; × = NOT Support
SISO = Single Input Single Output
SDM = Spatial Diversity Multiplexing – MIMO function
CDD = Cyclic Delay Diversity - 2Tx Function

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)
13/14.4, 26.28.9, 39/43.3, 52/57.8, 78/86.7, 104/115.6, 117/130, 130/144.4MBps (MIMO n/ac – 20MHz) 156/173Mbps (MIMO ac – 20MHz)
27/30, 54/60, 81/90, 108/120, 162/180, 216/240, 243,270, 270/300Mbps (MIMO n/ac – 40MHz) 324/360, 360/400Mbps (MIMO ac – 40MHz)
58.5/65, 117/130, 175.5/195, 234/260, 351/390, 468/520, 526.5/585, 585/650, 702/780, 780/866.7Mbps (MIMO ac – 80MHz)

3. This device supports simultaneous transmission operation, which allows for two SISO channels to operate independent of one another in the 2.4GHz and 5GHz bands simultaneously on each antenna. The following tables show the worst case configurations determined during testing. The data for these configurations is contained in this test report.

   All 2.4 GHz Antennas transmitting in 2.4GHz mode and All 5 GHz Antennas transmitting in 5GHz mode:

Description	2.4 GHz Emission	5 GHz Emisison
Antenna	ALL	ALL
Channel	6	36
Operating Frequency(MHz)	2437	5180
Data Rate (Mbps)	6	6
Band	WLAN	UNII 1
Mode	802.11g	802.11a

Table 2-5. ALL 2.4GHz ANT & ALL 5GHz ANT

2.3 Test Configuration

The EUT was tested per the guidance of KDB 789033 D02 v01r04. 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.

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 v01r04 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. The EMI Receiver mode of the Agilent MXE was used to perform AC line conducted emissions testing.

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

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.

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

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
-	WL25-1	Conducted Cable Set (25GHz)	4/11/2016	Annual	4/11/2017	WL25-1
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	7/11/2016	Annual	7/11/2017	RE1
Agilent	N9030A	PXA Signal Analyzer (26.5GHz)	7/20/2016	Annual	7/20/2017	MY49432391
Agilent	N9038A	MXE EMI Receiver	4/21/2016	Annual	4/21/2017	MY51210133
Anritsu	MA2411B	Pulse Power Sensor	10/14/2015	Biennial	10/14/2017	846215
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	941001
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	7/30/2015	Biennial	7/30/2017	121034
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	7/6/2016	Annual	7/6/2017	441119
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	7/6/2016	Annual	7/6/2017	441119
Emco	3115	Horn Antenna (1-18GHz)	3/10/2016	Biennial	3/10/2018	9704-5182
EMCO	3160-09	Small Horn (18 - 26.5GHz)	8/23/2016	Biennial	8/23/2018	135427
EMCO	3160-10	Small Horn (26.5 - 40GHz)	8/23/2016	Biennial	8/23/2018	130993
Espec	ESX-2CA	Environmental Chamber	3/4/2016	Annual	3/4/2017	17620
Huber+Suhner	Sucoflex 102A	40GHz Radiated Cable	4/26/2016	Annual	4/26/2017	251425001
Pasternack	NMLC-1	Line Conducted Emissions Cable (NM)	4/28/2015	Biennial	4/28/2017	NMLC-1
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	ESU40	EMI Test Receiver (40GHz)	7/15/2016	Annual	7/15/2017	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	7/27/2016	Annual	7/27/2017	103200
Rohde & Schwarz	TS-PR18	1-18 GHz Pre-Amplifier	3/7/2016	Annual	3/7/2017	100071
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	3/7/2016	Annual	3/7/2017	100040
Rohde & Schwarz	TS-PR40	26.5-40 GHz Pre-Amplifier	3/7/2016	Annual	3/7/2017	100037
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
Sunol Sciences	DRH-118	Horn Antenna	7/1/2015	Biennial	7/1/2017	A060215

Table 6-1. Annual Test Equipment Calibration Schedule

7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.
FCC ID: A3LETWV521
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 4.5.
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.

7.2 26dB Bandwidth Measurement – 802.11a

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 v01r04, 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 v01r04 – 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.

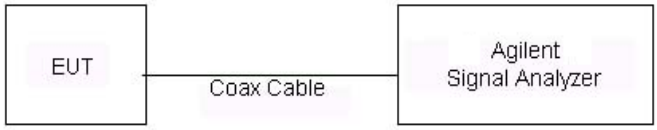


Figure 7-1. Test Instrument & Measurement Setup

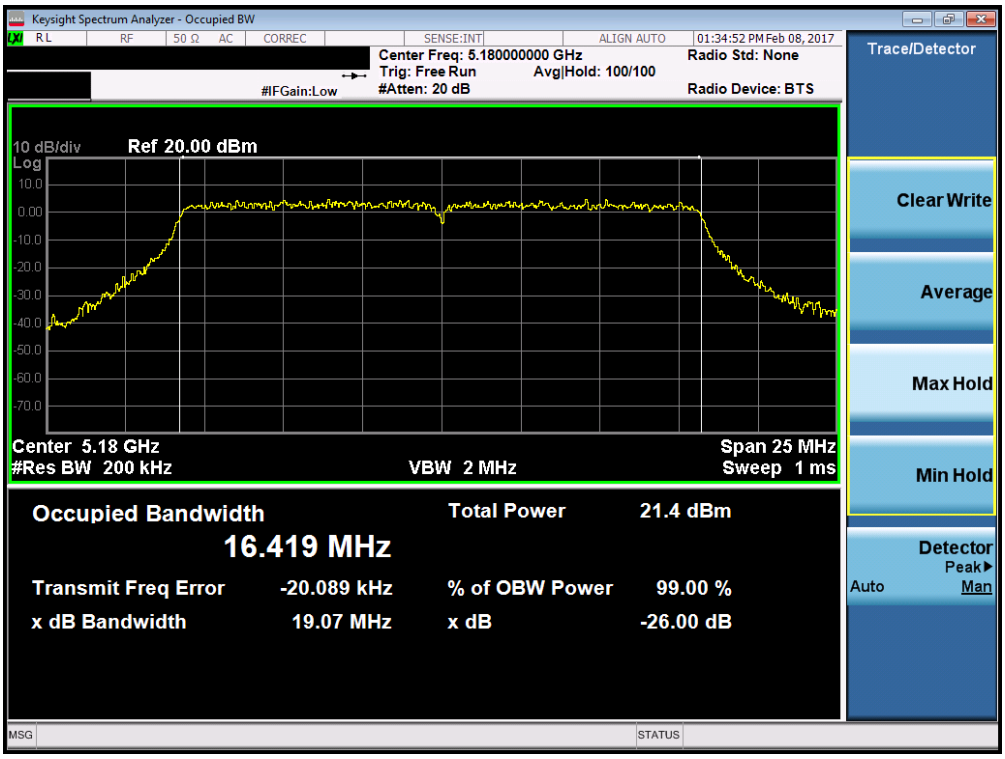
Test Notes

None.

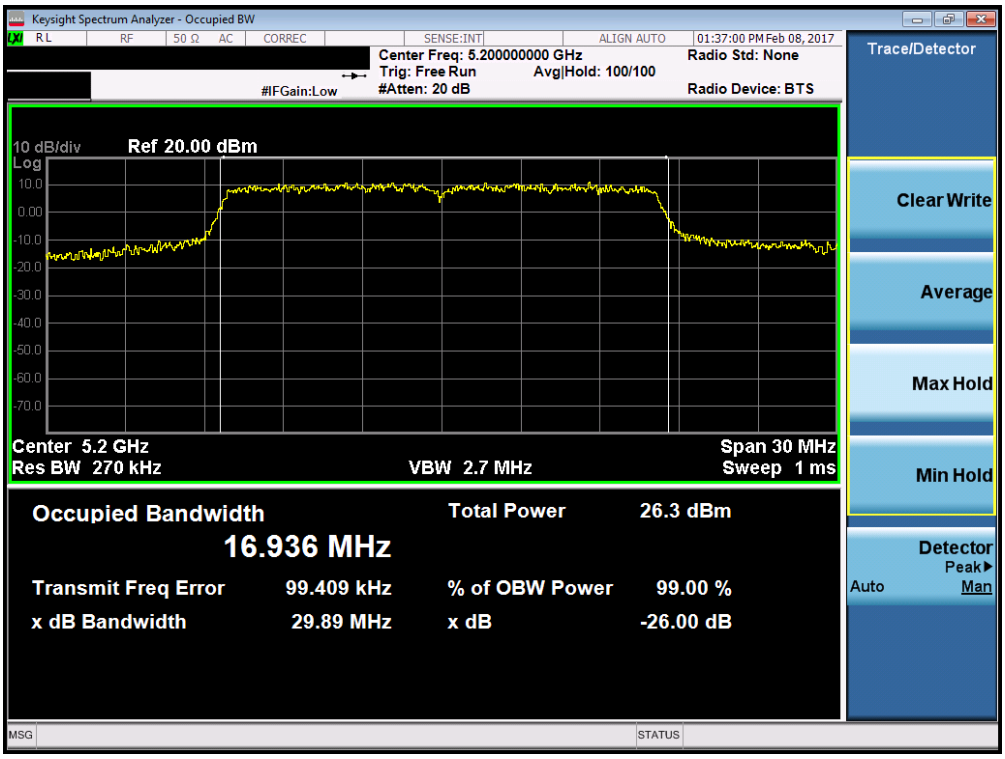
Antenna-1 26 dB Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 26dB Bandwidth
Band 1	5180	36	a	6	19.07
	5200	40	a	6	29.89
	5240	48	a	6	24.85
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	20.09
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	29.98
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	24.72
	5190	38	n (40MHz)	13.5/15 (MCS0)	39.66
	5230	46	n (40MHz)	13.5/15 (MCS0)	47.82
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	87.11

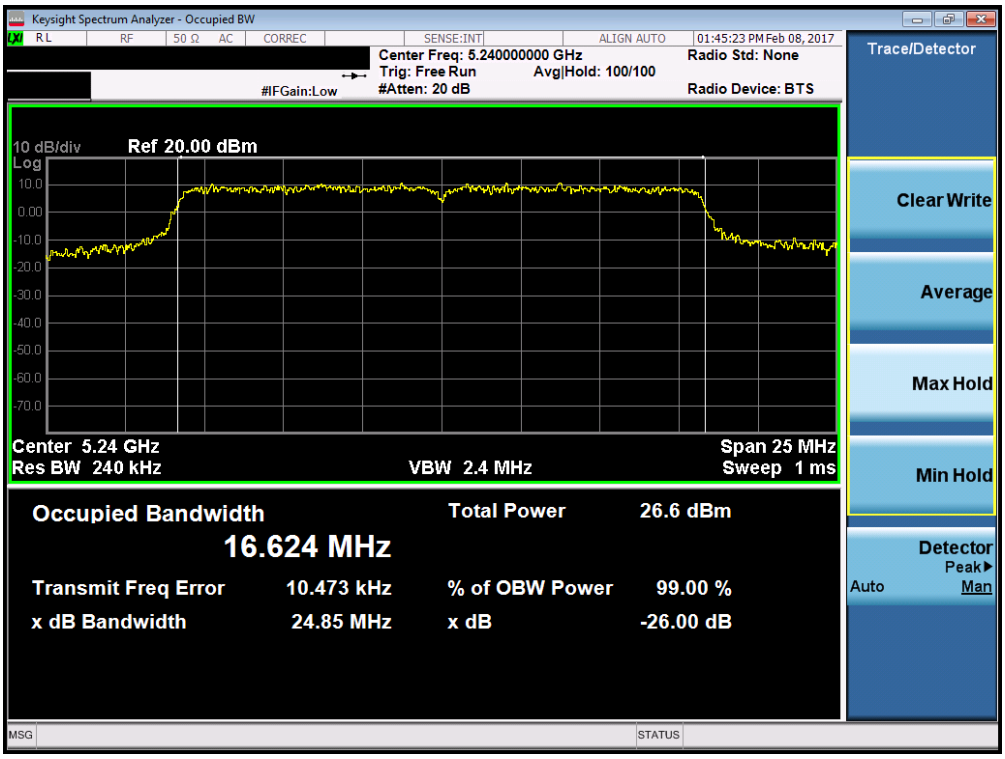
Table 7-2. Conducted Bandwidth Measurements



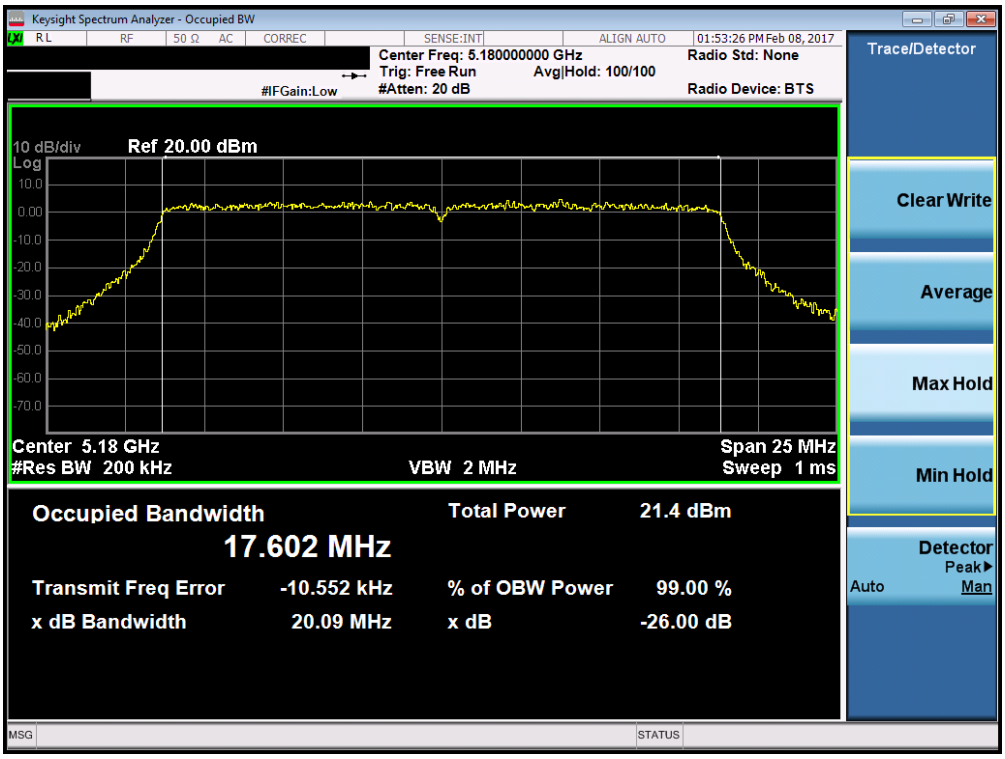
Plot 7-1. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 36)



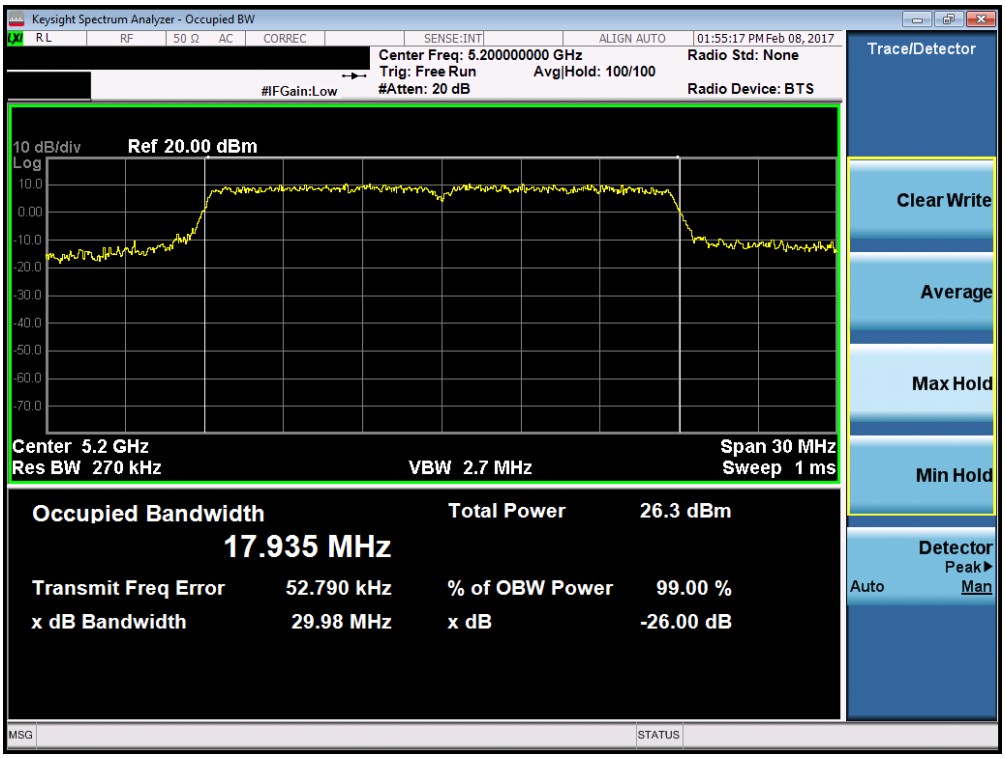
Plot 7-2. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 40)



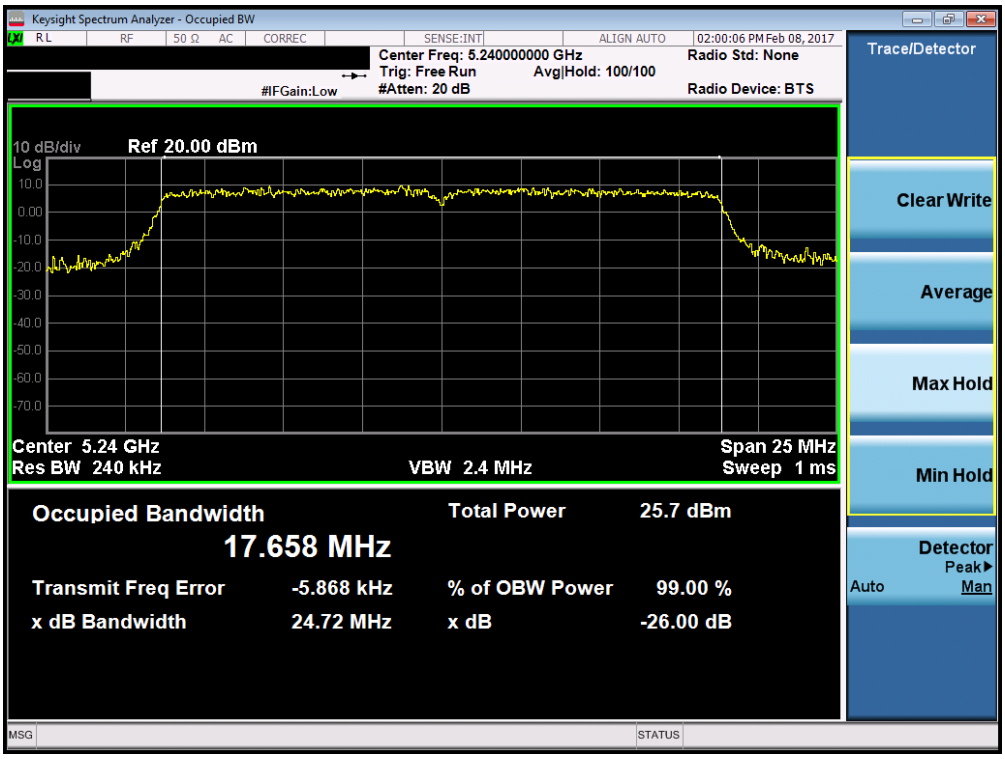
Plot 7-3. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 48)



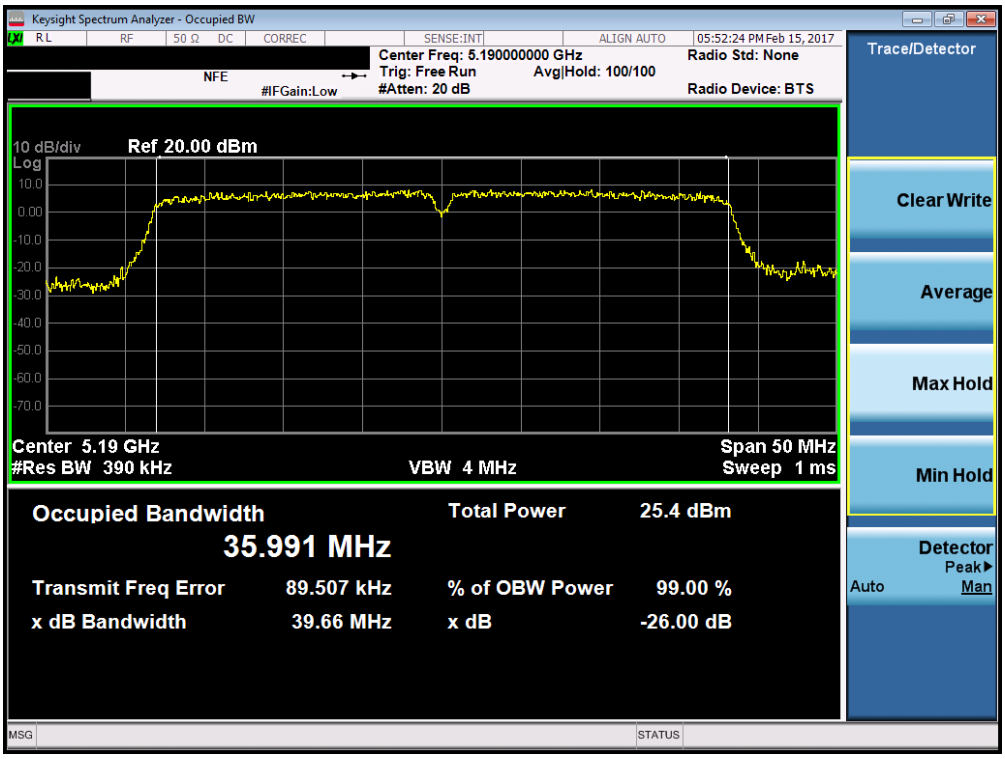
Plot 7-4. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 36)



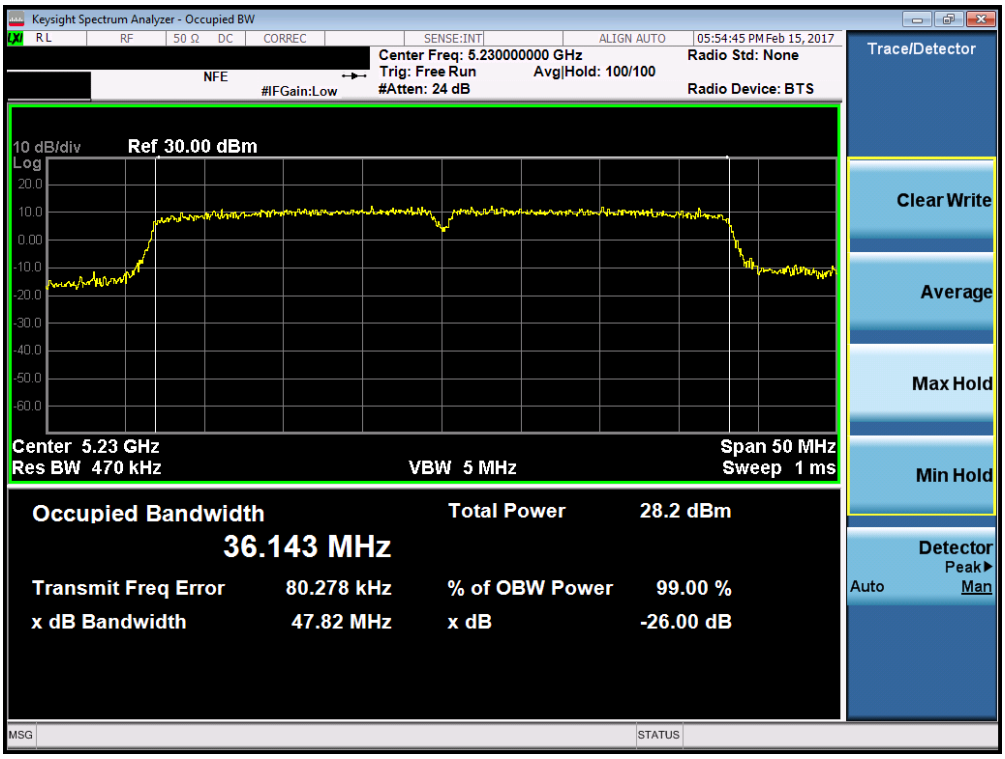
Plot 7-5. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 40)



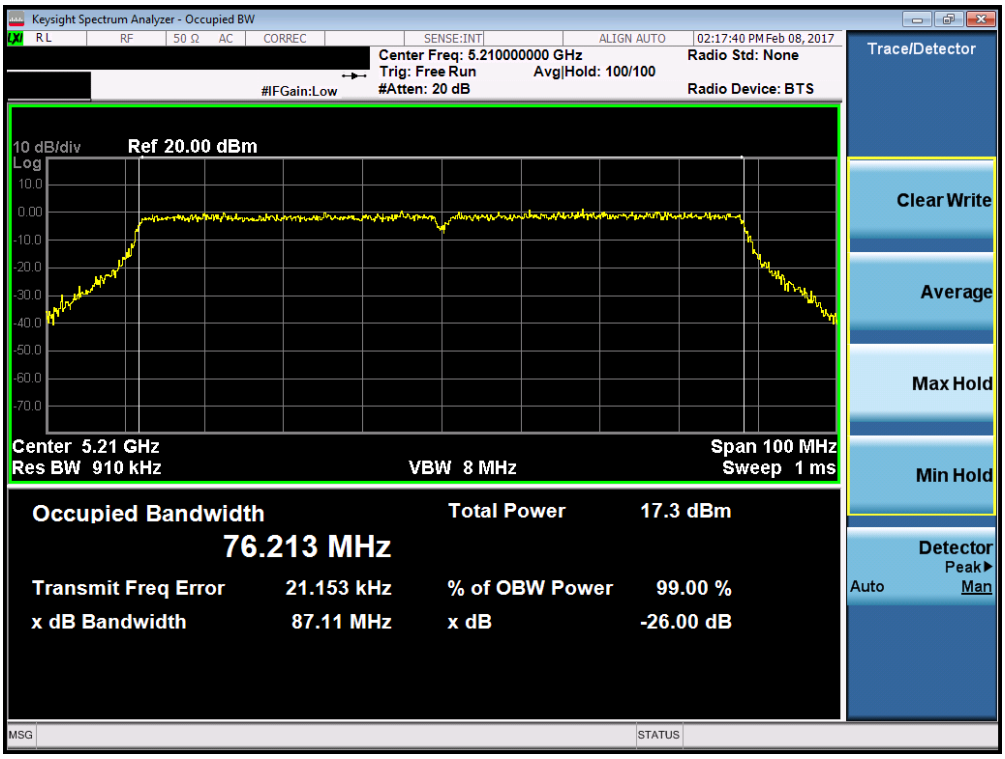
Plot 7-6. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 48)



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)

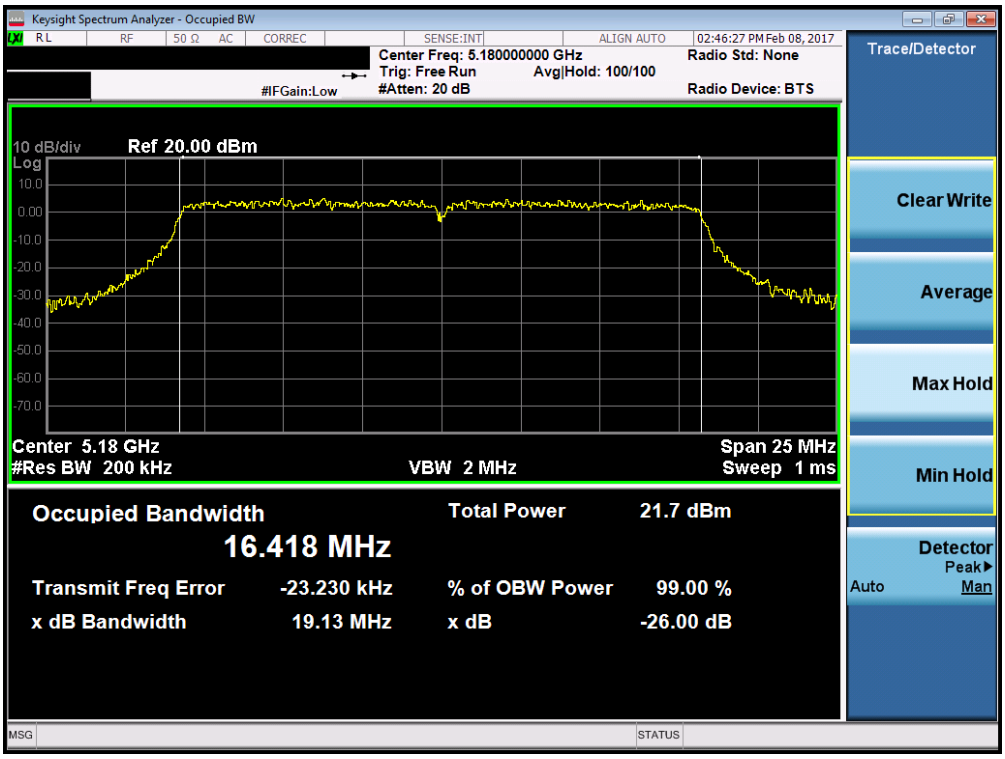


Plot 7-9. 26dB Bandwidth Plot (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)

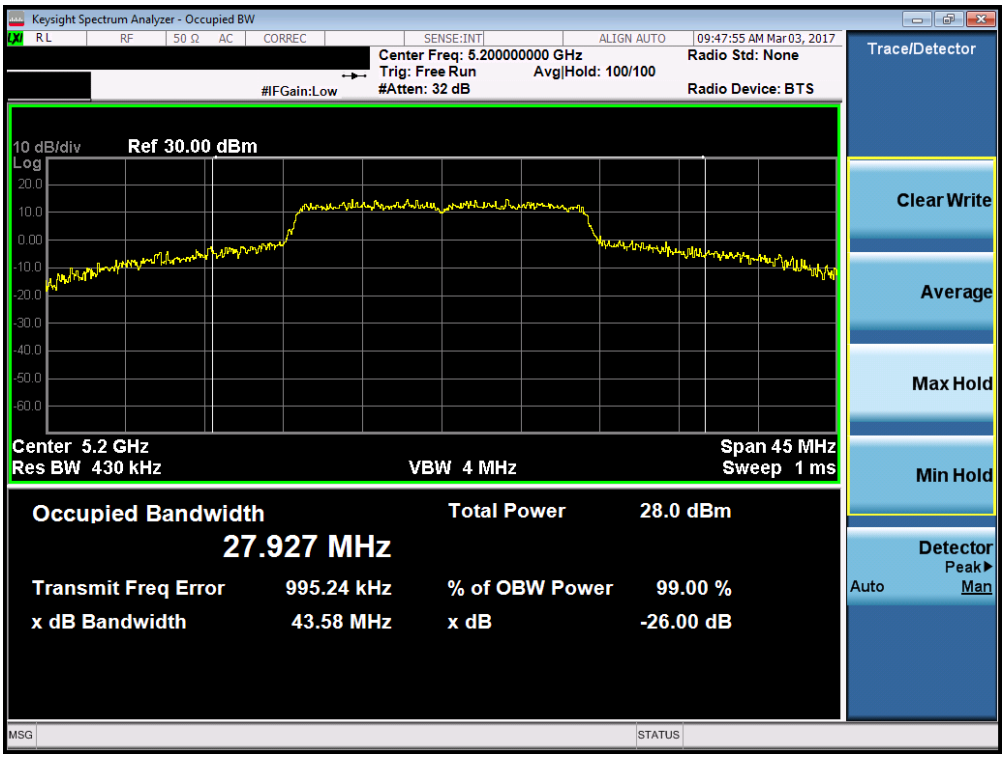
Antenna-2 26dB Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 26dB Bandwidth
Band 1	5180	36	a	6	19.13
	5200	40	a	6	43.58
	5240	48	a	6	34.97
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	22.37
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	43.47
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	43.32
	5190	38	n (40MHz)	13.5/15 (MCS0)	43.50
	5230	46	n (40MHz)	13.5/15 (MCS0)	72.17
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	86.31

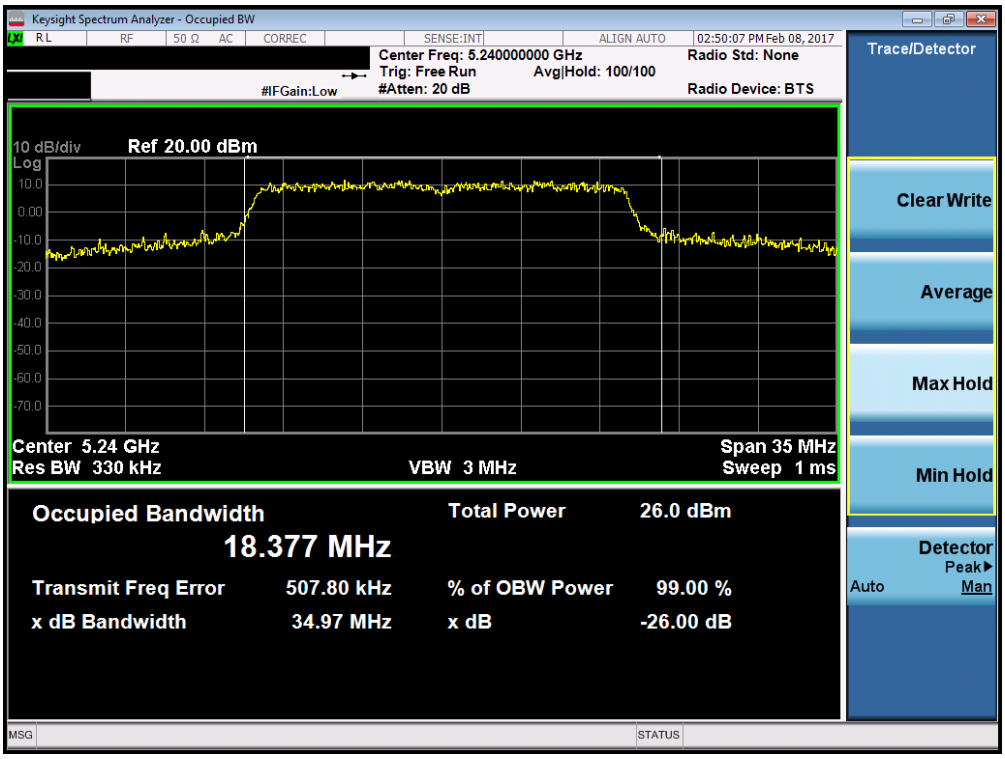
Table 7-3. Conducted Bandwidth Measurements



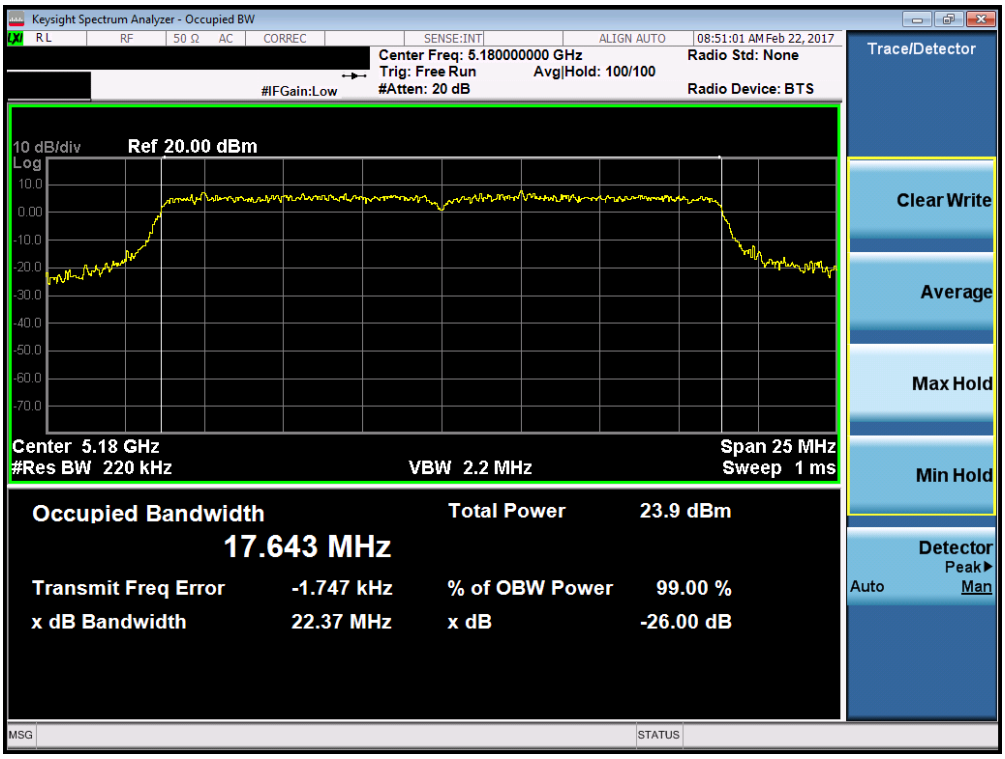
Plot 7-10. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 36)



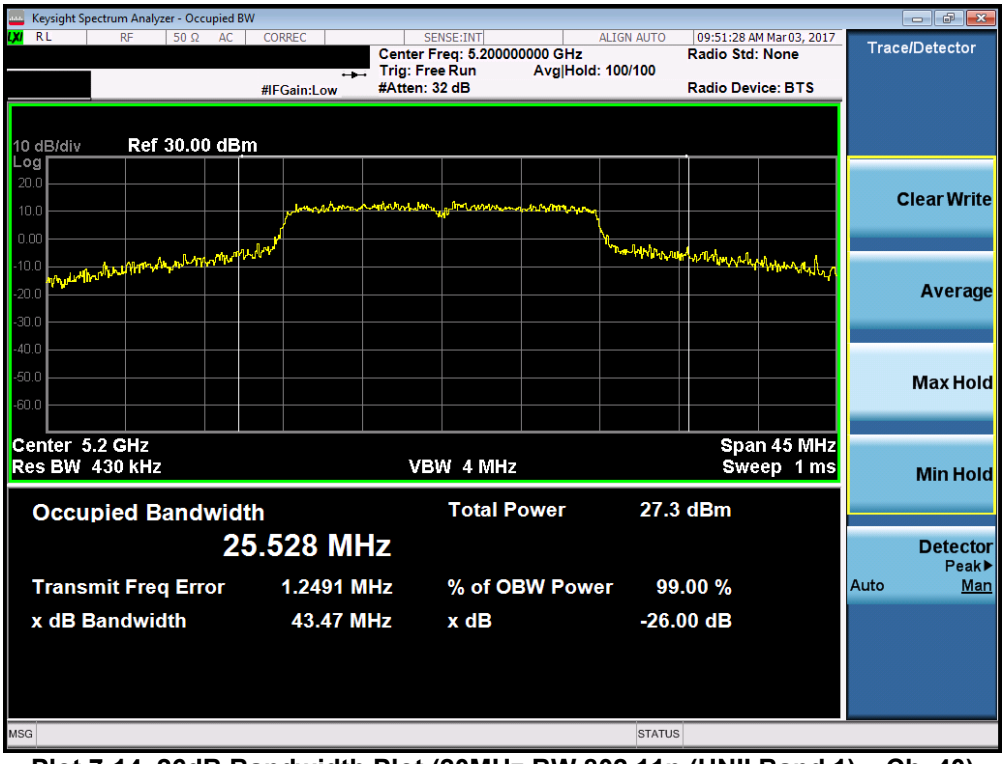
Plot 7-11. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 40)



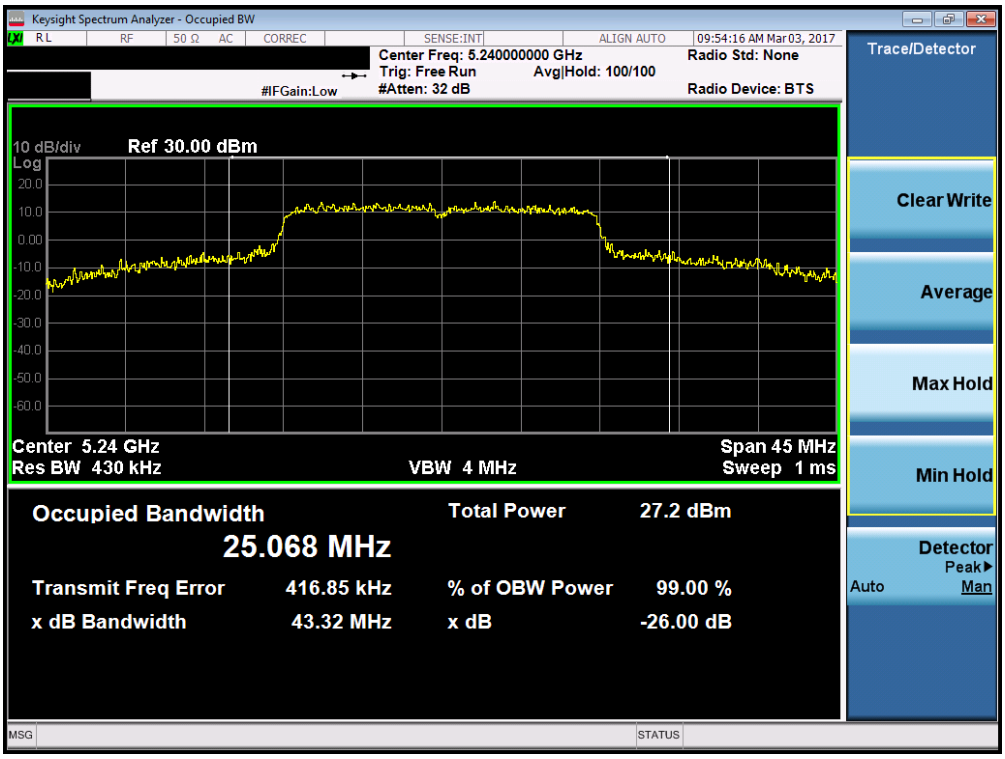
Plot 7-12. 26dB Bandwidth Plot (802.11a (UNII Band 1) – Ch. 48)



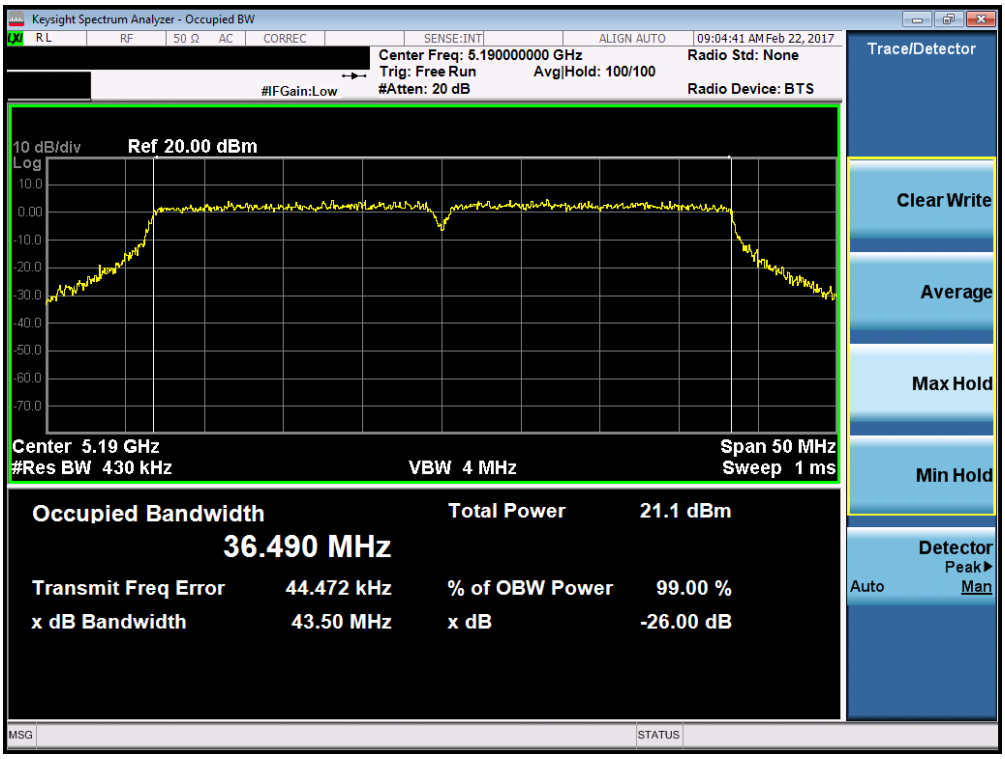
Plot 7-13. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 36)



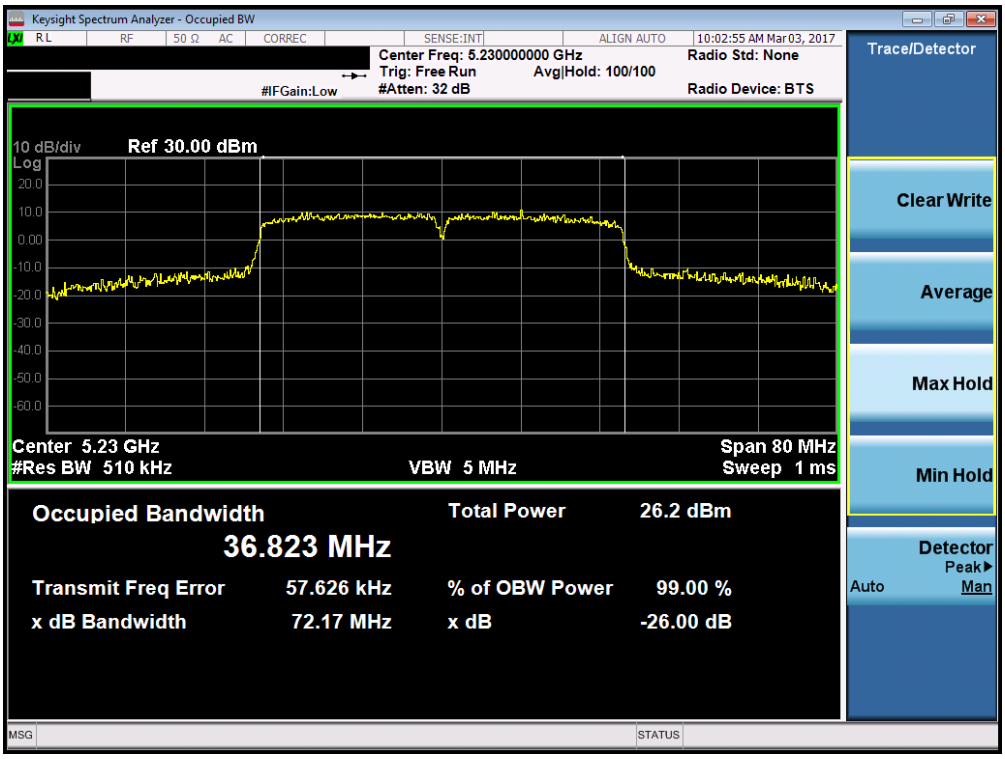
Plot 7-14. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 40)



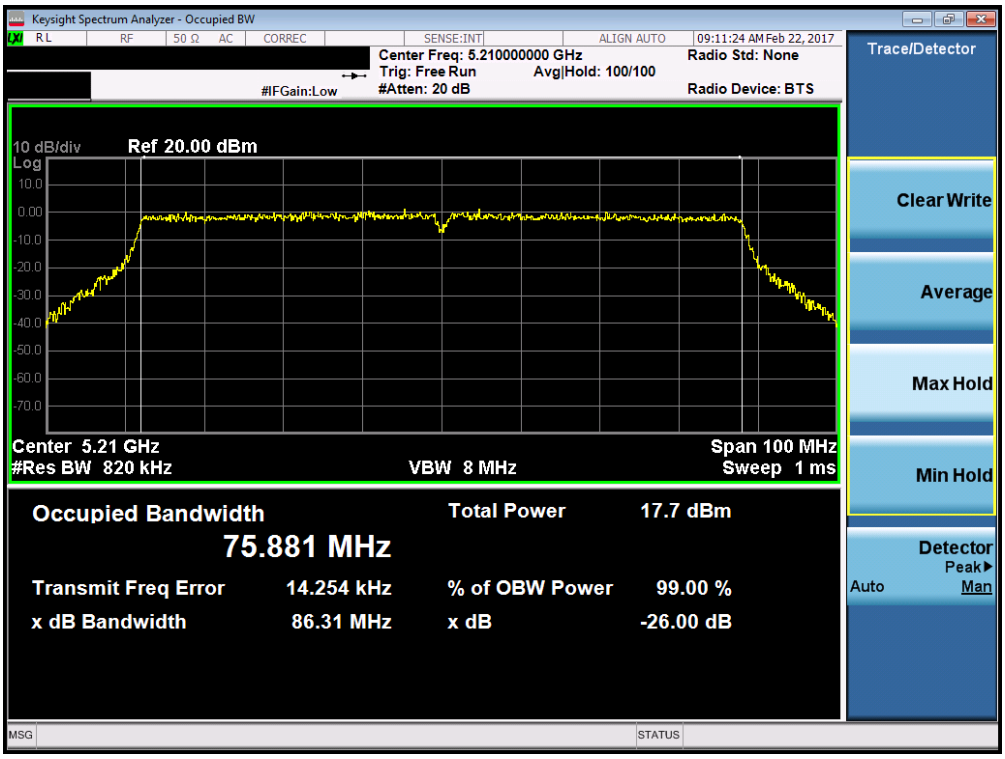
Plot 7-15. 26dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 48)



Plot 7-16. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



Plot 7-17. 26dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 46)



Plot 7-18. 26dB Bandwidth Plot (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)

7.3 6dB Bandwidth Measurement – 802.11a

§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 v01r04, 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 v01r04 – 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.

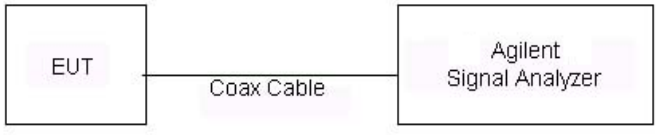


Figure 7-2. Test Instrument & Measurement Setup

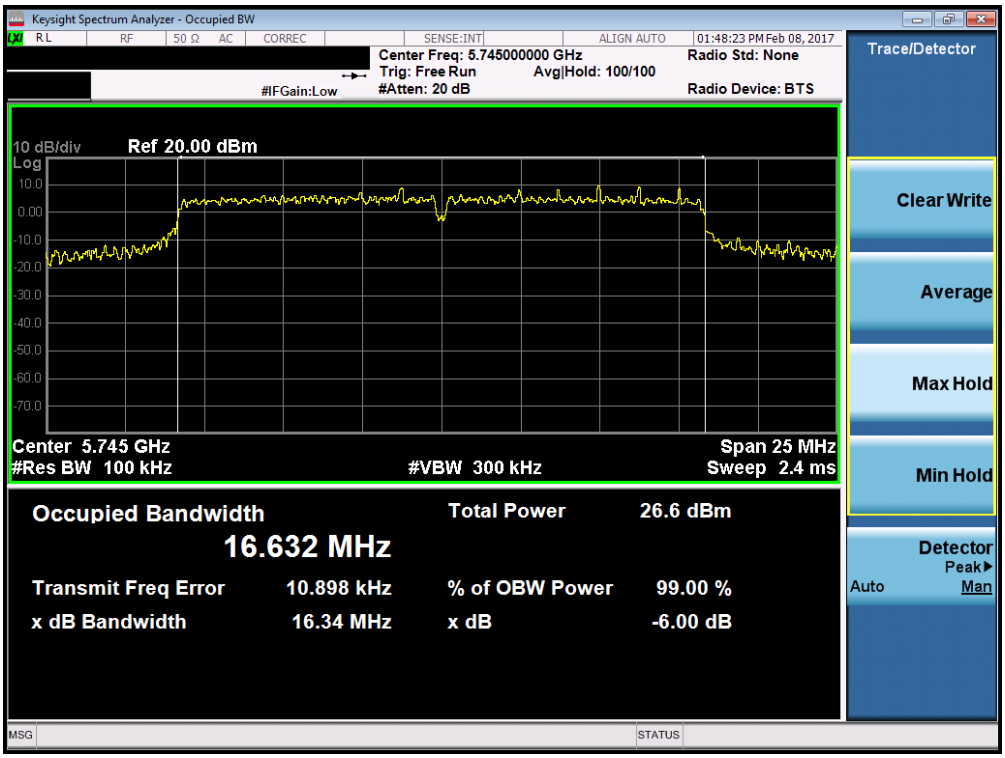
Test Notes

None.

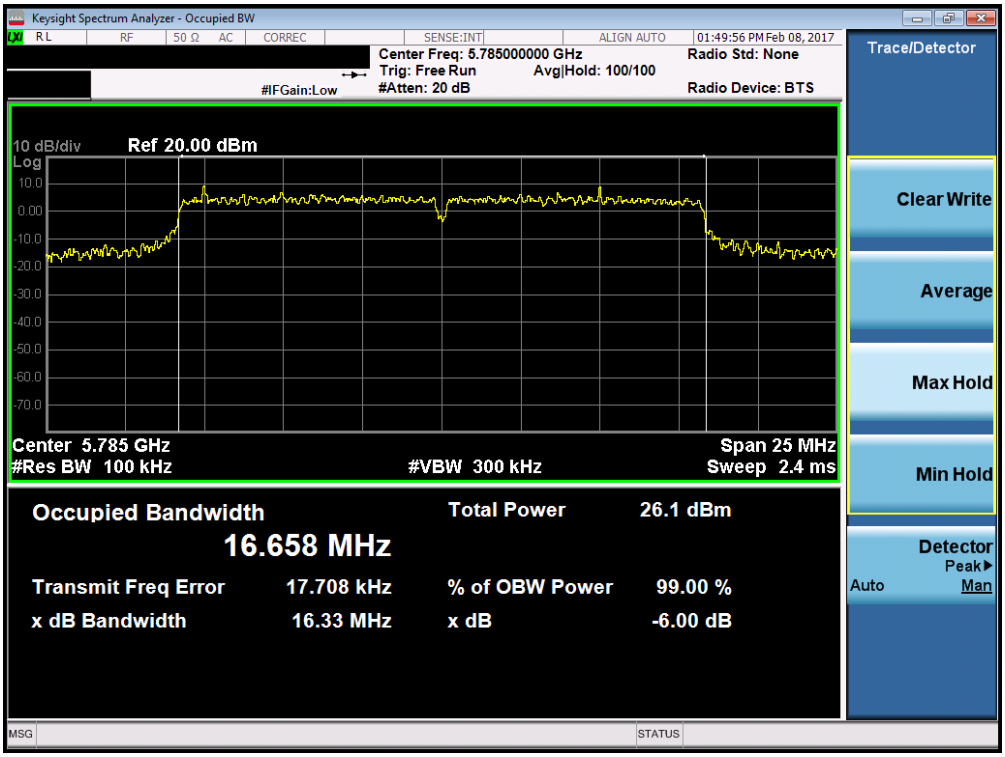
Antenna-1 6 dB Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 6dB Bandwidth [MHz]
Band 3	5745	149	a	6	16.34
	5785	157	a	6	16.33
	5825	165	a	6	16.34
	5745	149	n (20MHz)	6.5/7.2 (MCS0)	17.54
	5785	157	n (20MHz)	6.5/7.2 (MCS0)	17.61
	5825	165	n (20MHz)	6.5/7.2 (MCS0)	17.64
	5755	151	n (40MHz)	13.5/15 (MCS0)	32.82
	5795	159	n (40MHz)	13.5/15 (MCS0)	35.05
	5775	155	ac (80MHz)	29.3/32.5 (MCS0)	75.43

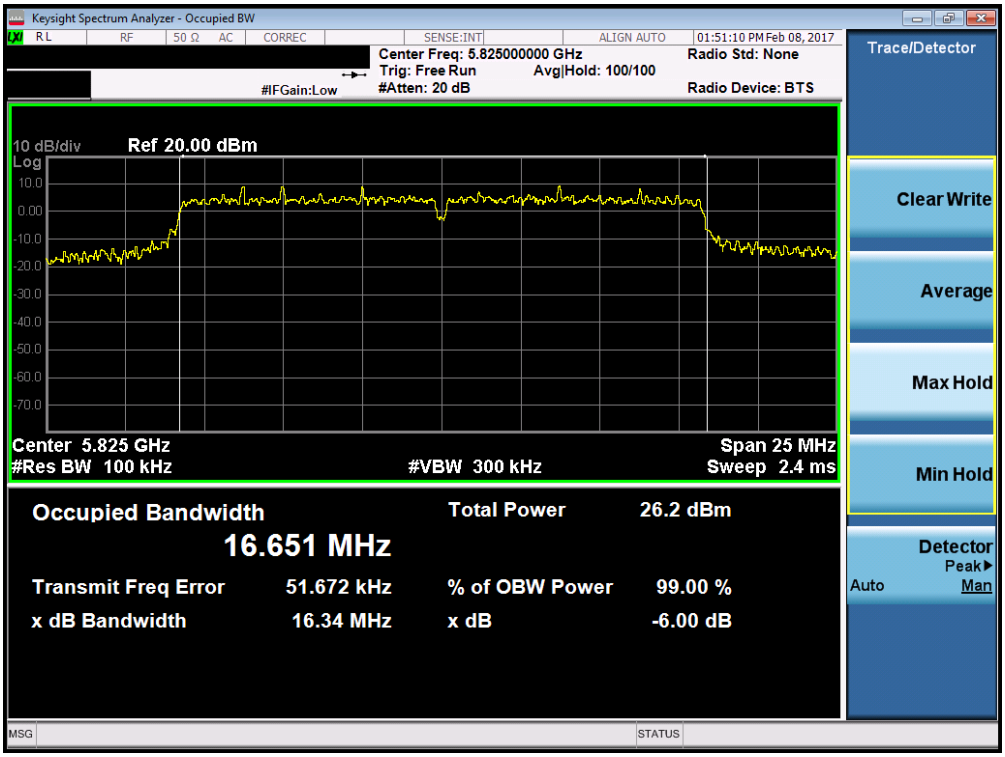
Table 7-4. Conducted Bandwidth Measurements



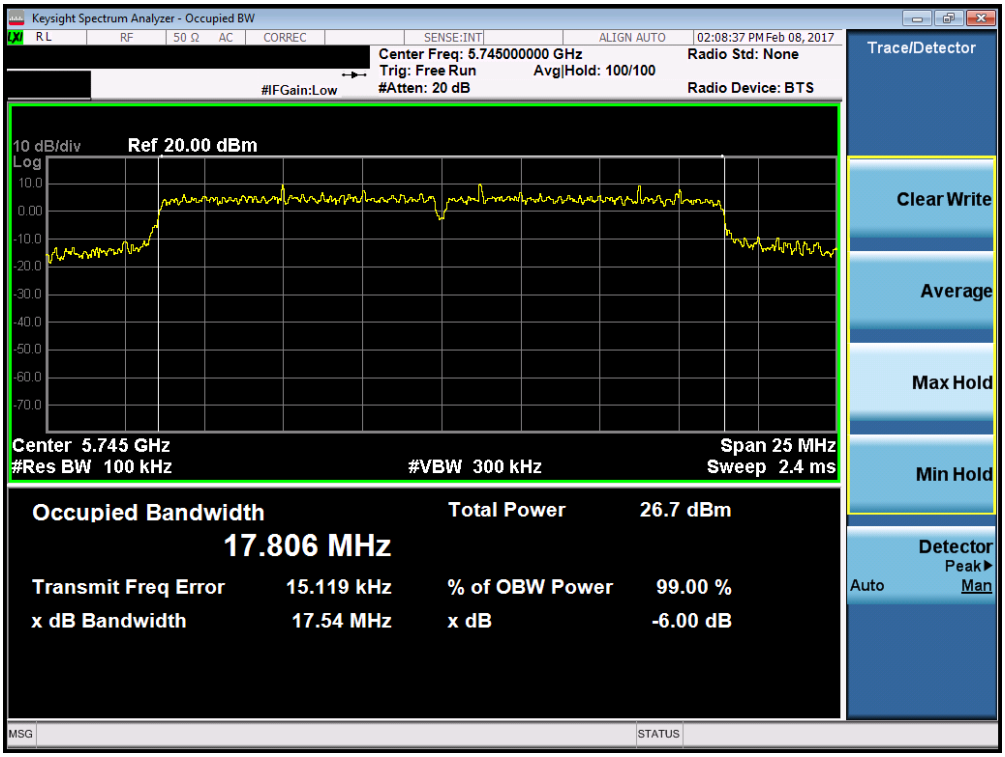
Plot 7-19. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 149)



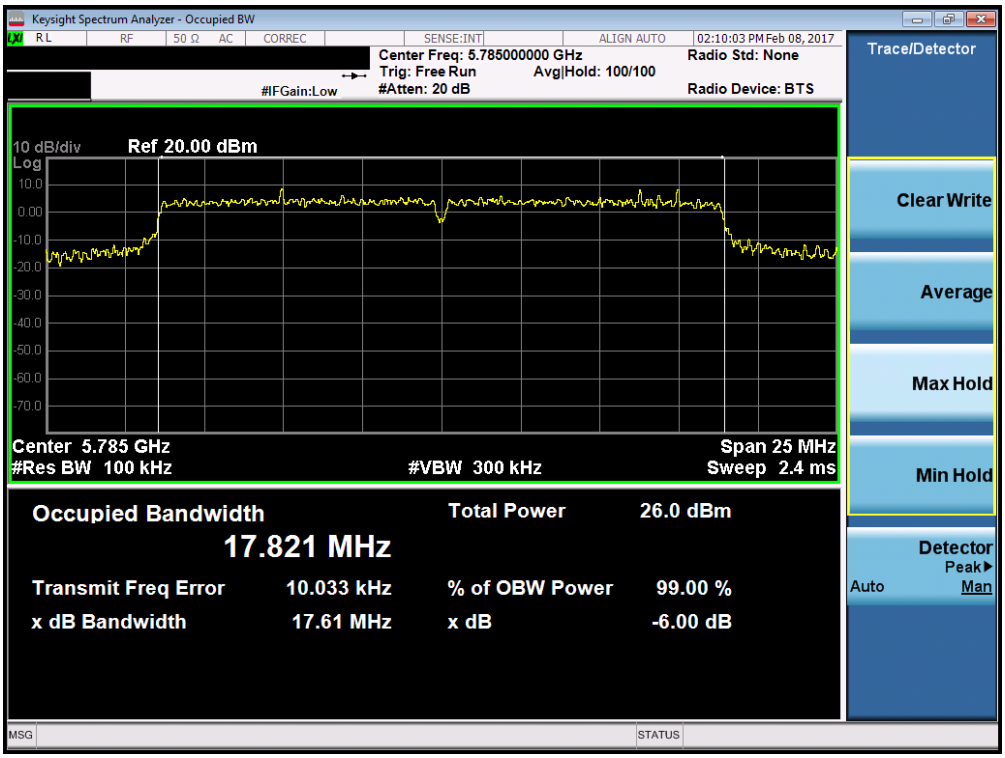
Plot 7-20. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 157)



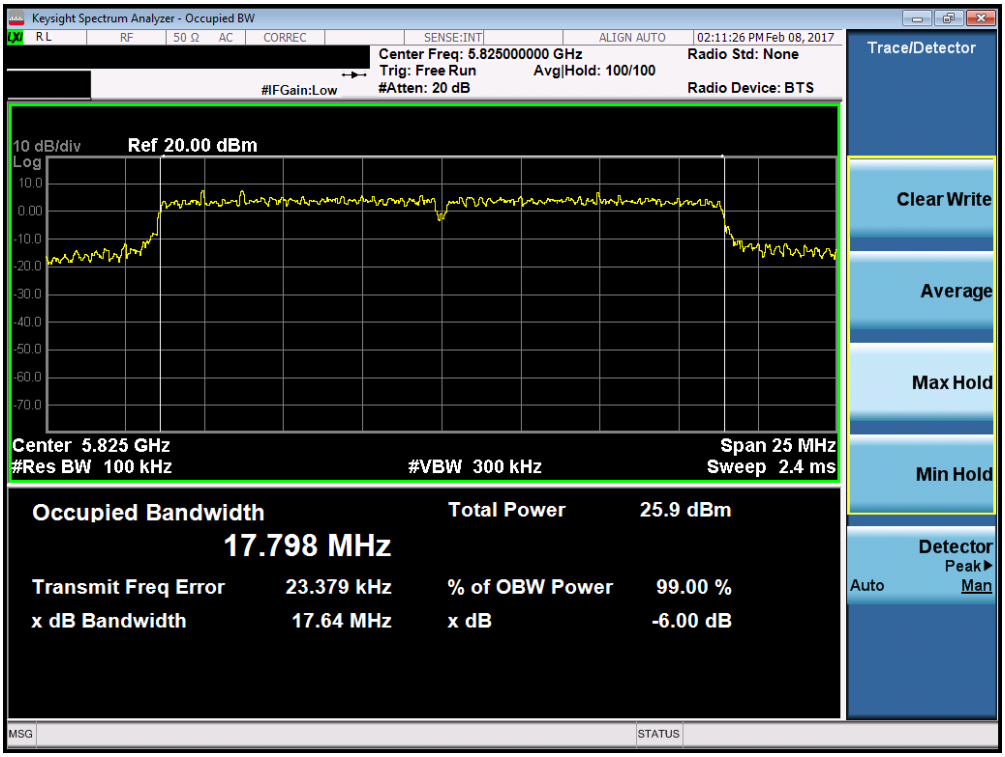
Plot 7-21. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 165)



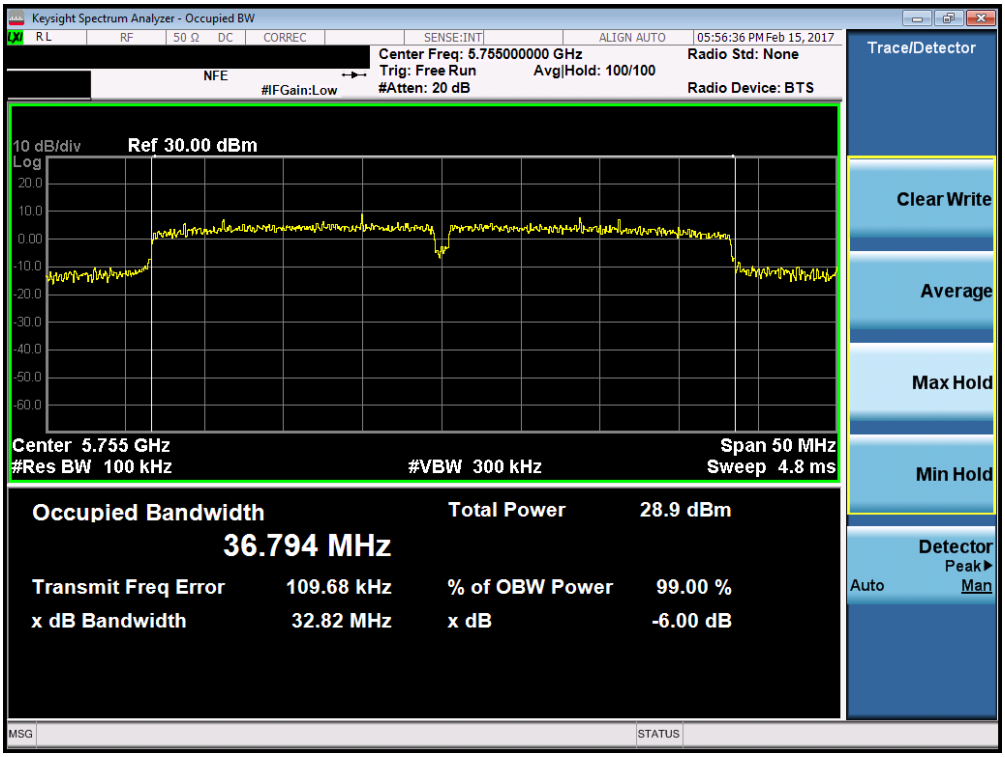
Plot 7-22. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 149)



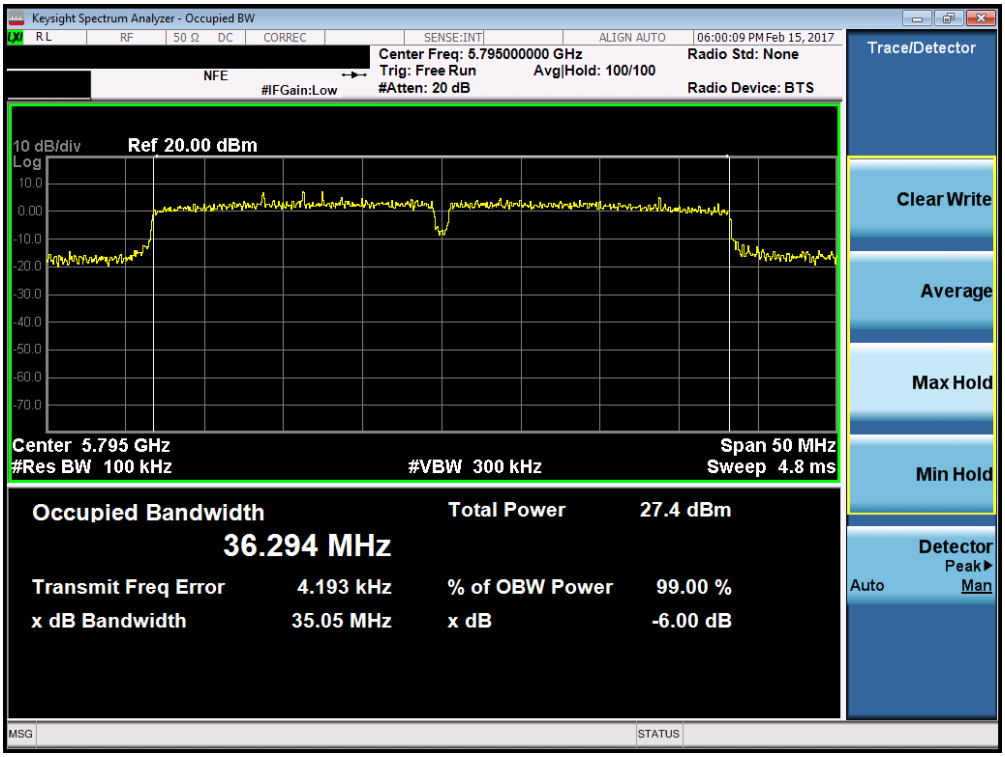
Plot 7-23. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 157)



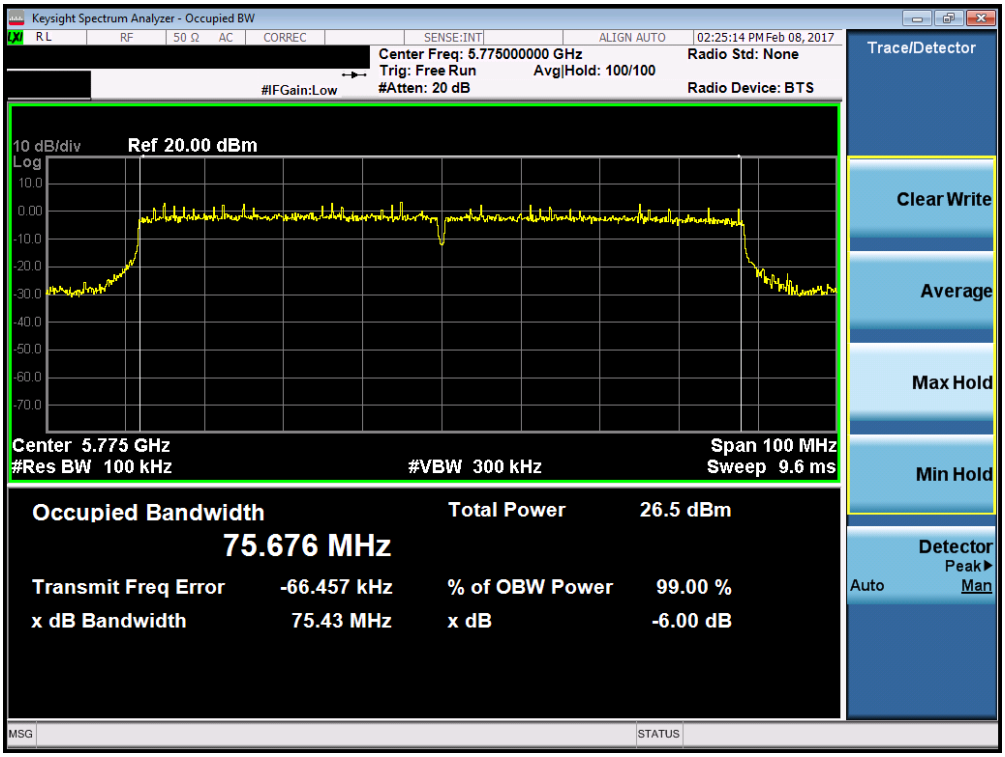
Plot 7-24. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 165)



Plot 7-25. 6dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 151)



Plot 7-26. 6dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 159)

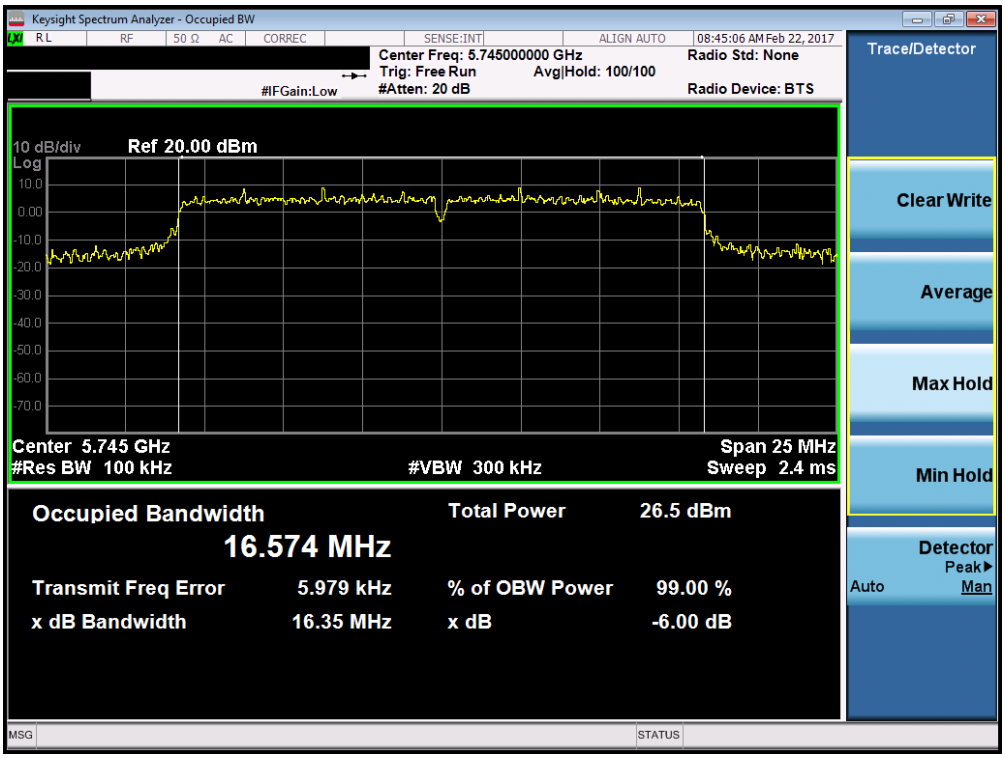


Plot 7-27. 6dB Bandwidth Plot (80MHz BW 802.11ac (UNII Band 3) – Ch. 155)

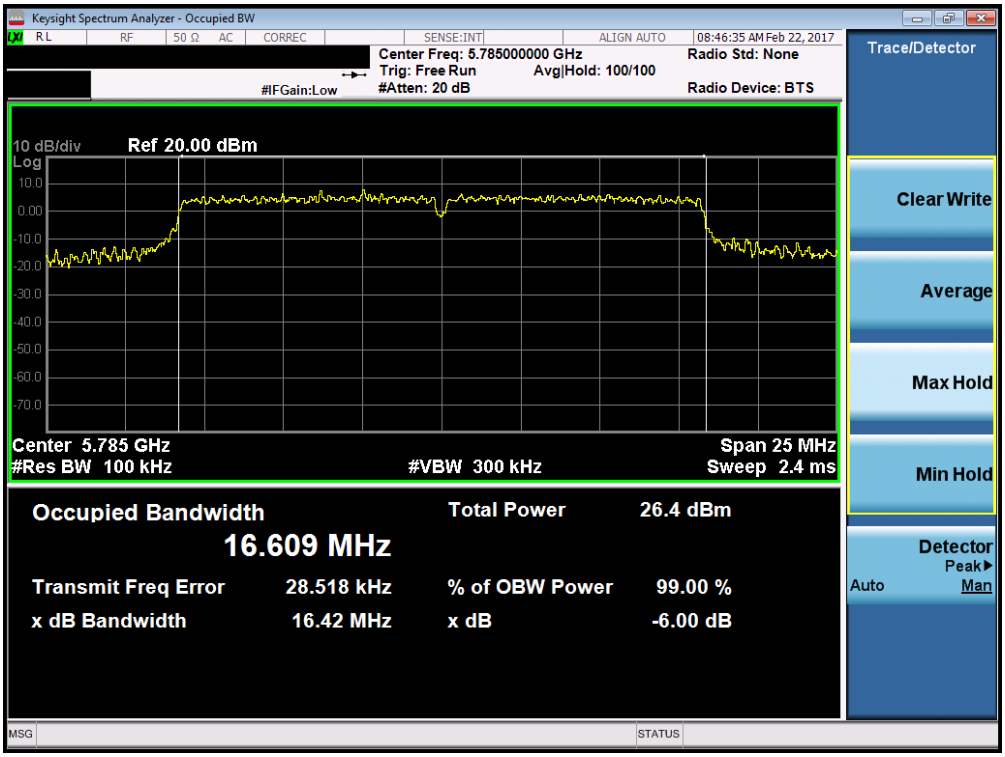
Antenna-2 6dB Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 6dB Bandwidth [MHz]
Band 3	5745	149	a	6	16.35
	5785	157	a	6	16.42
	5825	165	a	6	16.34
	5745	149	n (20MHz)	6.5/7.2 (MCS0)	17.61
	5785	157	n (20MHz)	6.5/7.2 (MCS0)	17.60
	5825	165	n (20MHz)	6.5/7.2 (MCS0)	17.70
	5755	151	n (40MHz)	13.5/15 (MCS0)	36.45
	5795	159	n (40MHz)	13.5/15 (MCS0)	36.49
	5775	155	ac (80MHz)	29.3/32.5 (MCS0)	76.48

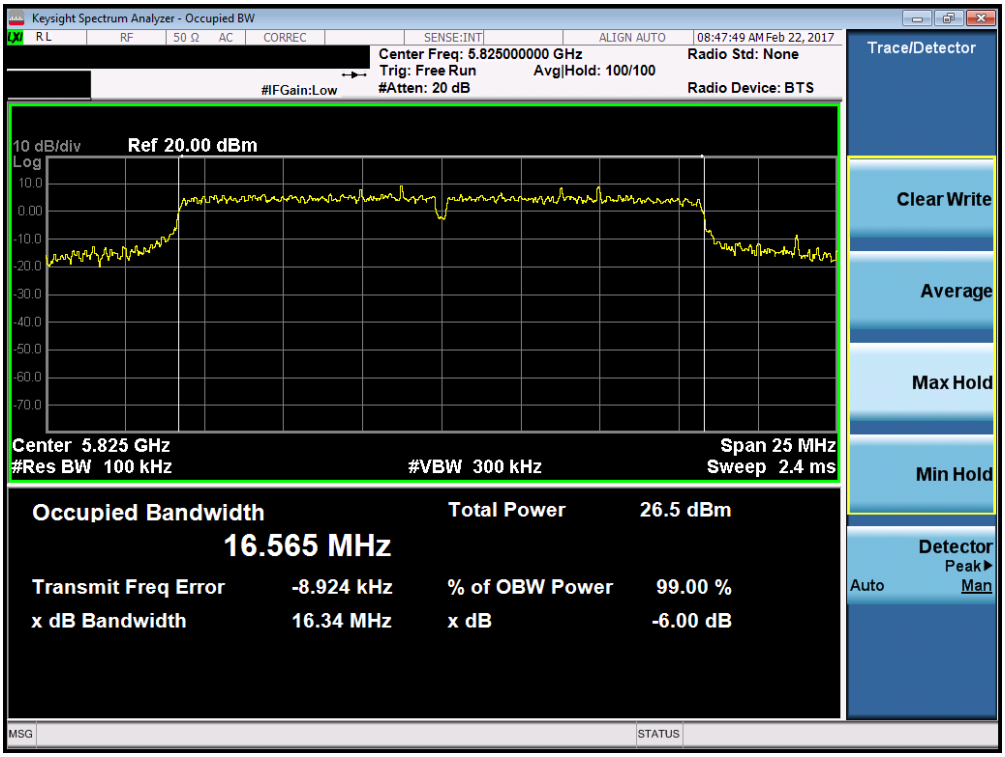
Table 7-5. Conducted Bandwidth Measurements



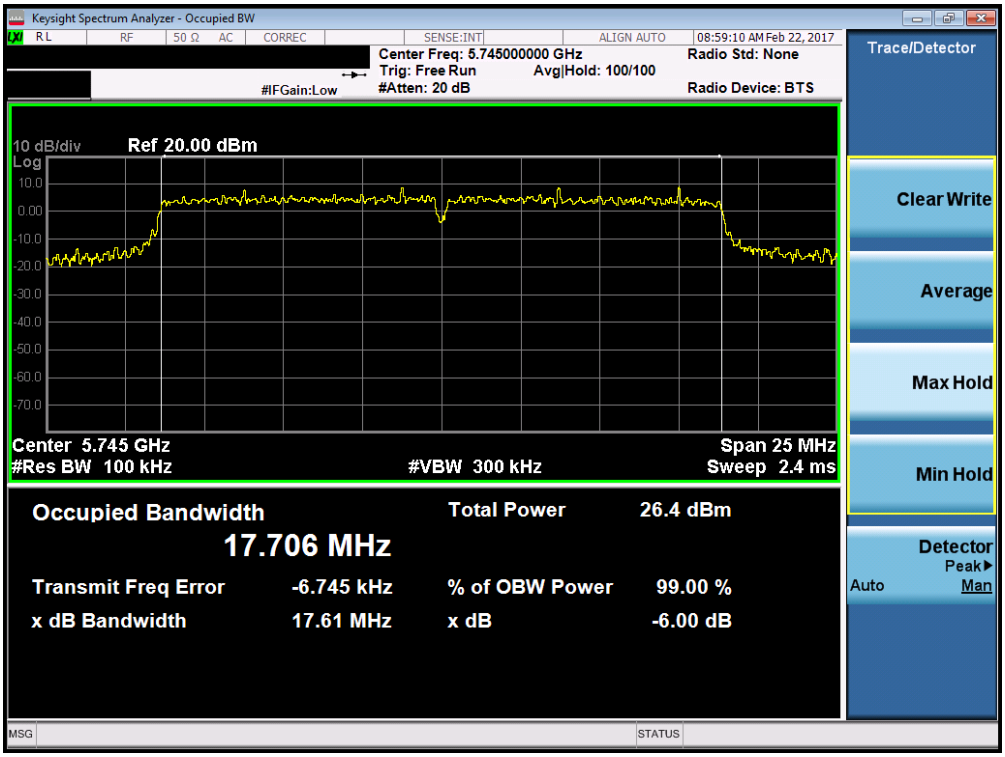
Plot 7-28. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 149)



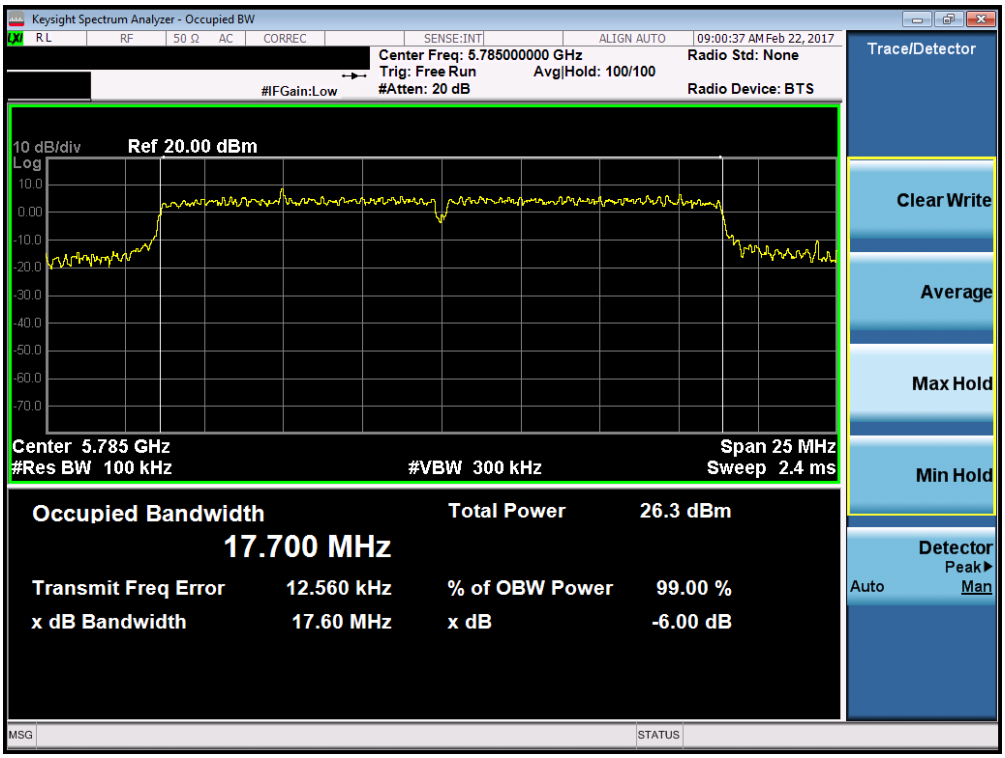
Plot 7-29. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 157)



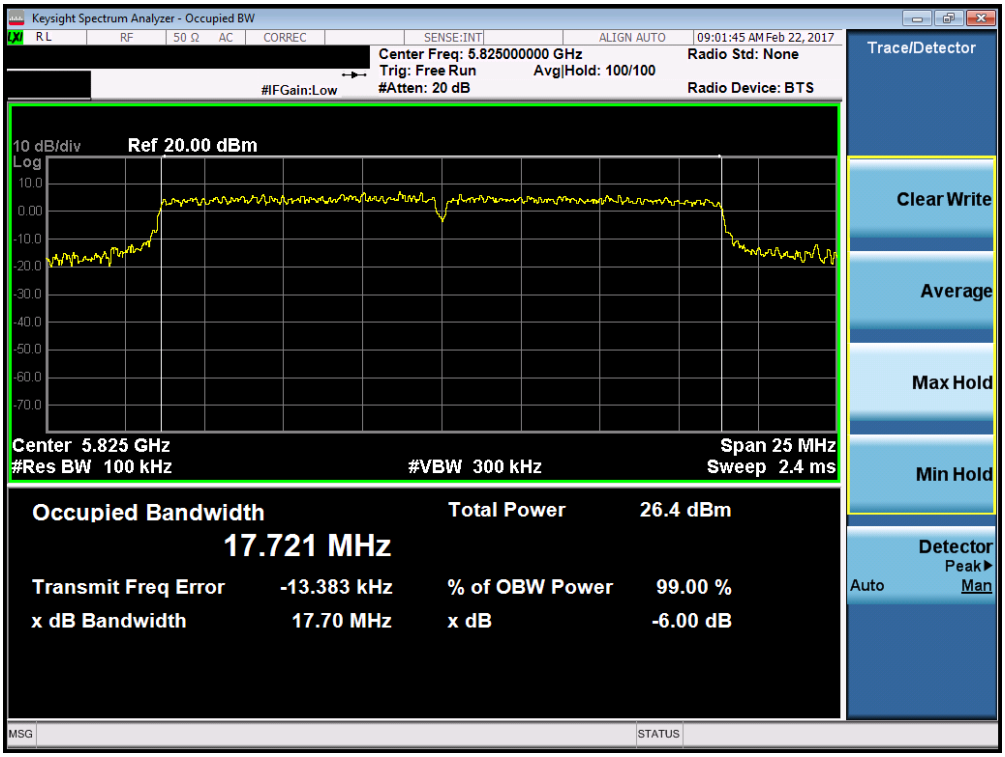
Plot 7-30. 6dB Bandwidth Plot (802.11a (UNII Band 3) – Ch. 165)



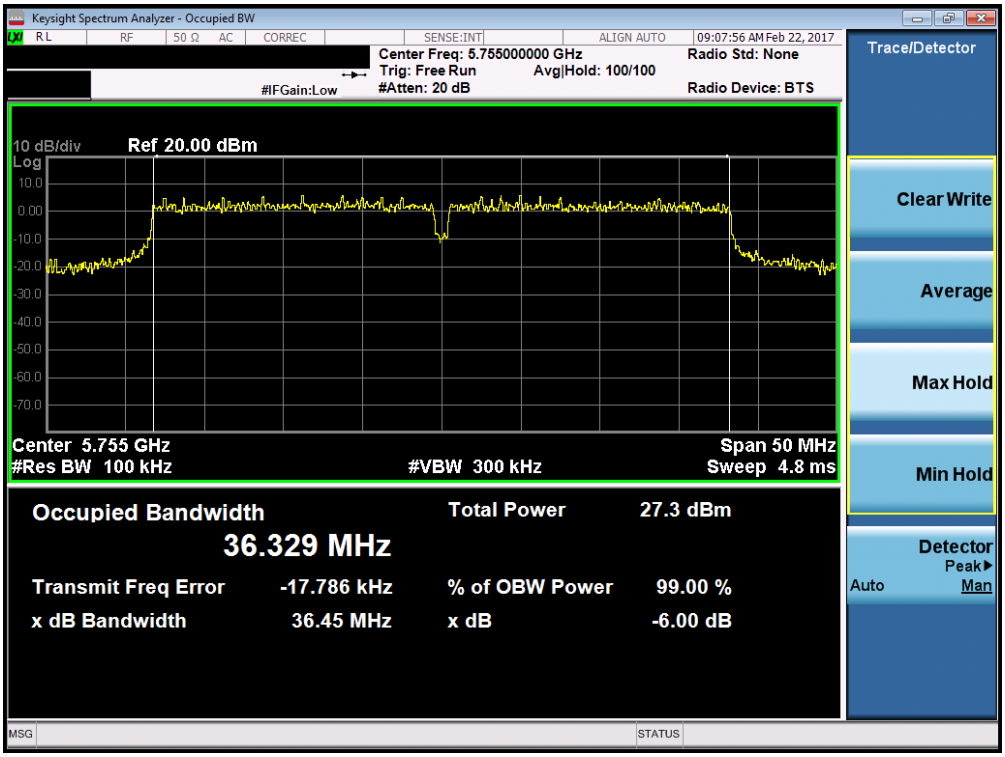
Plot 7-31. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 149)



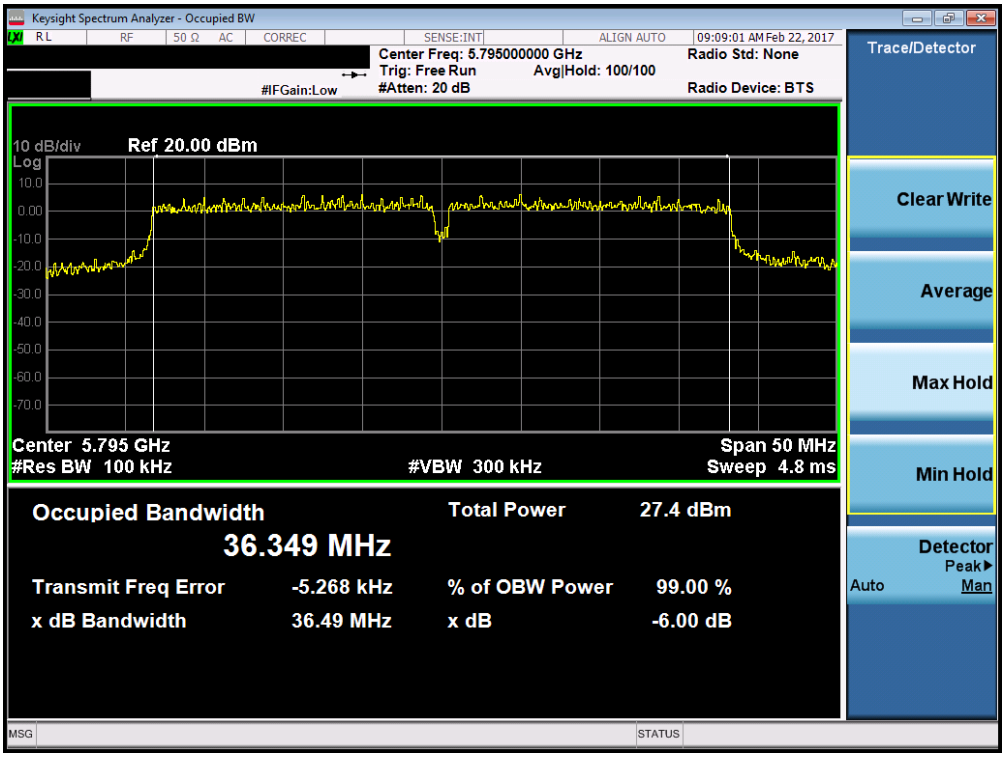
Plot 7-32. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 157)



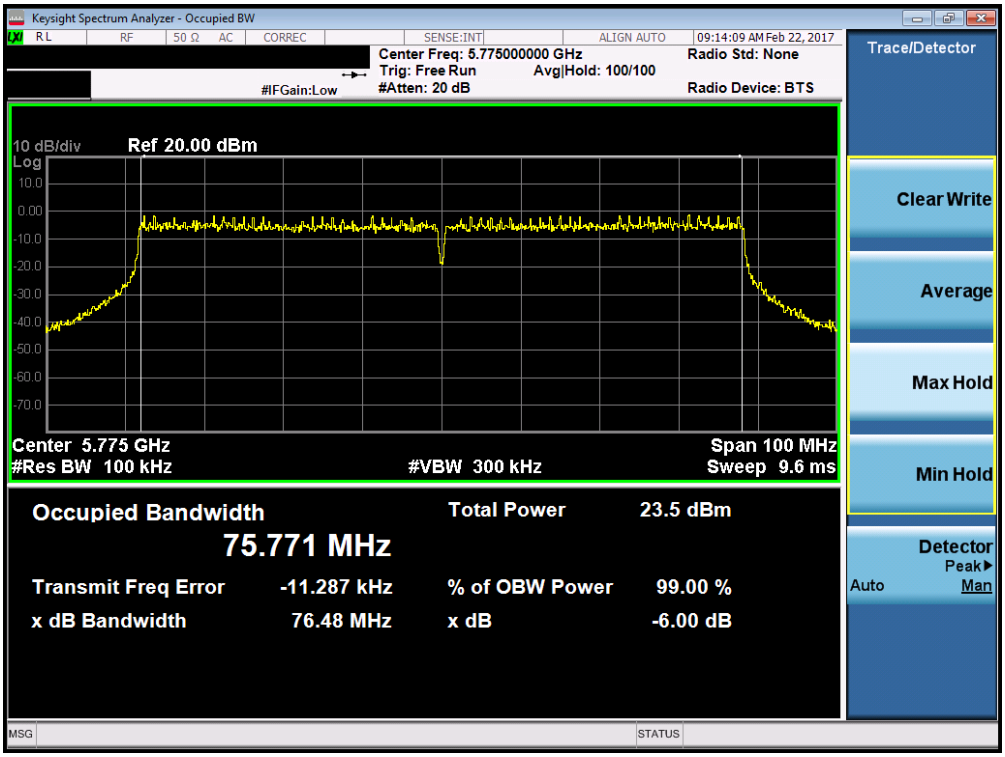
Plot 7-33. 6dB Bandwidth Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 165)



Plot 7-34. 6dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 151)



Plot 7-35. 6dB Bandwidth Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 159)



Plot 7-36. 6dB Bandwidth Plot (80MHz BW 802.11ac (UNII Band 3) – Ch. 155)

7.4 UNII Output Power Measurement – 802.11a

§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 v01r04, and at the appropriate frequencies.

In the 5.15 – 5.25GHz and 5.725 – 5.850GHz bands, the maximum permissible conducted output power is 1W (30dBm).

Test Procedure Used

KDB 789033 D02 v01r04 – Section E)3)b) Method PM-G
KDB 662911 v02r01 – Section E)1) Measure-and-Sum Technique

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.

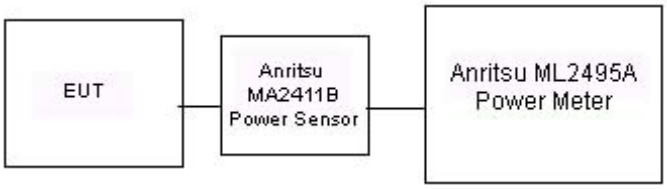


Figure 7-3. Test Instrument & Measurement Setup

Test Notes

None

Antenna-1 Conducted Output Power Measurements

Freq [MHz]	Channel	Detector	5GHz (20MHz) Conducted Power [dBm]		
			IEEE Transmission Mode		
			802.11a	802.11n	802.11ac
5180	36	AVG	18.15	18.20	18.18
5200	40	AVG	20.89	20.88	20.90
5220	44	AVG	20.95	20.98	20.97
5240	48	AVG	20.17	20.16	20.18
5745	149	AVG	20.73	20.70	20.67
5785	157	AVG	20.61	20.59	20.58
5825	165	AVG	20.34	20.28	20.31

Table 7-6. 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	14.33	14.38
5230	46	AVG	20.48	20.45
5755	151	AVG	19.26	19.30
5795	159	AVG	20.28	20.19

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

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	Detector	IEEE Transmission Mode
			802.11ac
5210	42	AVG	10.25
5775	155	AVG	15.94

Table 7-8. 80MHz BW (UNII) Maximum Conducted Output Power

Antenna-2 Conducted Output Power Measurements

Freq [MHz]	Channel	Detector	20MHz) Conducted Power	
			IEEE Transmission Mode	
			802.11a	802.11n
5180	36	AVG	18.48	18.29
5200	40	AVG	20.85	20.85
5220	44	AVG	20.83	20.79
5240	48	AVG	20.86	20.82
5745	149	AVG	20.47	20.42
5785	157	AVG	20.49	20.39
5825	165	AVG	20.30	20.28

Table 7-9. 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	14.48	14.52
5230	46	AVG	19.77	19.62
5755	151	AVG	19.21	19.03
5795	159	AVG	20.16	20.01

Table 7-10. 40MHz BW (UNII) Maximum Conducted Output Power

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	Detector	IEEE Transmission Mode
			802.11ac
5210	42	AVG	10.48
5775	155	AVG	15.53

Table 7-11. 80MHz BW (UNII) Maximum Conducted Output Power

MIMO Maximum Conducted Output Power Measurements

Freq [MHz]	Channel	Detector	Directional Gain [dBi]	5GHz (20MHz) Conducted Power [dBm]			Max Permissible Conducted Power [dBm]	Adjusted Limit [dBm]	Margin [dB]
				IEEE Transmission Mode					
				ANT1	ANT2	MIMO			
5180	36	AVG	6.31	16.28	16.21	19.26	30.00	29.69	-10.43
5200	40	AVG	6.31	17.05	17.33	20.20	30.00	29.69	-9.49
5220	44	AVG	6.31	17.13	17.27	20.21	30.00	29.69	-9.48
5240	48	AVG	6.31	16.81	17.40	20.13	30.00	29.69	-9.56
5745	149	AVG	6.06	17.98	17.67	20.84	30.00	29.94	-9.10
5785	157	AVG	6.06	17.89	17.70	20.81	30.00	29.94	-9.13
5825	165	AVG	6.06	17.53	17.60	20.58	30.00	29.94	-9.36

Table 7-12. MIMO 20MHz BW 802.11n (UNII) Maximum Conducted Output Power

Freq [MHz]	Channel	Detector	Directional Gain [dBi]	GHz (20MHz) Conducted Power [dBm			Max Permissible Conducted Power [dBm]	Adjusted Limit [dBm]	Margin [dB]
				IEEE Transmission Mode					
				ANT1	ANT2	MIMO			
5180	36	AVG	6.31	16.29	16.43	19.37	30.00	29.69	-10.32
5200	40	AVG	6.31	17.16	17.45	20.32	30.00	29.69	-9.37
5220	44	AVG	6.31	17.30	17.41	20.37	30.00	29.69	-9.32
5240	48	AVG	6.31	17.38	17.51	20.46	30.00	29.69	-9.23
5745	149	AVG	6.06	18.14	17.73	20.95	30.00	29.94	-8.99
5785	157	AVG	6.06	18.01	17.69	20.86	30.00	29.94	-9.08
5825	165	AVG	6.06	17.62	17.66	20.65	30.00	29.94	-9.29

Table 7-13. MIMO 20MHz BW 802.11ac (UNII) Maximum Conducted Output Power

Freq [MHz]	Channel	Detector	Directional Gain [dBi]	5GHz (40MHz) Conducted Power [dBm]			Max Permissible Conducted Power [dBm]	Adjusted Limit [dBm]	Margin [dB]
				IEEE Transmission Mode					
				ANT1	ANT2	MIMO			
5190	38	AVG	6.31	13.31	13.59	16.46	30.00	29.69	-13.23
5230	46	AVG	6.31	16.36	16.50	19.44	30.00	29.69	-10.25
5755	151	AVG	6.06	17.20	16.98	20.10	30.00	29.94	-9.84
5795	159	AVG	6.06	17.07	16.97	20.03	30.00	29.94	-9.91

Table 7-14. MIMO 40MHz BW 802.11n (UNII) Maximum Conducted Output Power

Freq [MHz]	Channel	Detector	Directional Gain [dBi]	5GHz (40MHz) Conducted Power [dBm]			Max Permissible Conducted Power [dBm]	Adjusted Limit [dBm]	Margin [dB]
				IEEE Transmission Mode					
				ANT1	ANT2	MIMO			
5190	38	AVG	6.31	13.26	13.50	16.39	30.00	29.69	-13.30
5230	46	AVG	6.31	16.35	16.43	19.40	30.00	29.69	-10.29
5755	151	AVG	6.06	17.09	16.94	20.03	30.00	29.94	-9.91
5795	159	AVG	6.06	17.05	16.96	20.02	30.00	29.94	-9.92

Table 7-15. MIMO 40MHz BW 802.11ac (UNII) Maximum Conducted Output Power

Freq [MHz]	Channel	Detector	Directional Gain [dBi]	5GHz (80MHz) Conducted Power [dBm]			Max Permissible Conducted Power [dBm]	Adjusted Limit [dBm]	Margin [dB]
				IEEE Transmission Mode					
				ANT1	ANT2	MIMO			
5210	42	AVG	6.31	11.07	11.29	14.19	30.00	29.69	-15.50
5775	155	AVG	6.06	15.94	15.53	18.75	30.00	29.94	-11.19

Table 7-16. MIMO 80MHz BW 802.11ac (UNII) Maximum Conducted Output Power

Note:

Per KDB 662911 v02r01 Section E)1), the conducted powers at Antenna 1 and Antenna 2 were first measured separately during MIMO transmission as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Per KDB 662911 v02r01, Section F)2), the directional gain is calculated using the following formula, where Gn is the gain of the nth antenna and Nant, the total number of antennas used.

$$\text{Directional gain} = 10\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]\ \text{dBi}$$

The Power Density limits were then adjusted using the following formula:

Max permissible power density – [6-(Directional gain)]

Sample MIMO Calculation:

At 5180MHz in 802.11n (20MHz BW) mode, the average conducted output power was measured to be 16.28 dBm for Antenna-1 and 16.21 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(16.28 dBm + 16.21 dBm) = (42.46 mW + 41.78 mW) = 84.24 mW = 19.26 dBm

7.5 Maximum Power Spectral Density – 802.11a

§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 v01r04, and at the appropriate frequencies. Method SA-1, as defined in KDB 789033 D02 v01r04, was used to measure the power spectral density.

In the 5.15 – 5.25GHz, the maximum permissible power spectral density is 17dBm/MHz.

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

Test Procedure Used

KDB 789033 D02 v01r04 – Section F
KDB 662911 v02r01 – Section E)2) Measure-and-Sum Technique

Test Settings

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire emission bandwidth of the signal
3. RBW = 1MHz
4. VBW = 3MHz
5. Number of sweep points ≥ 2 x (span/RBW)
6. Sweep time = auto
7. Detector = power averaging (RMS)
8. Trigger was set to free run 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.

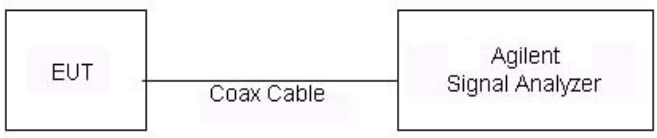


Figure 7-4. Test Instrument & Measurement Setup

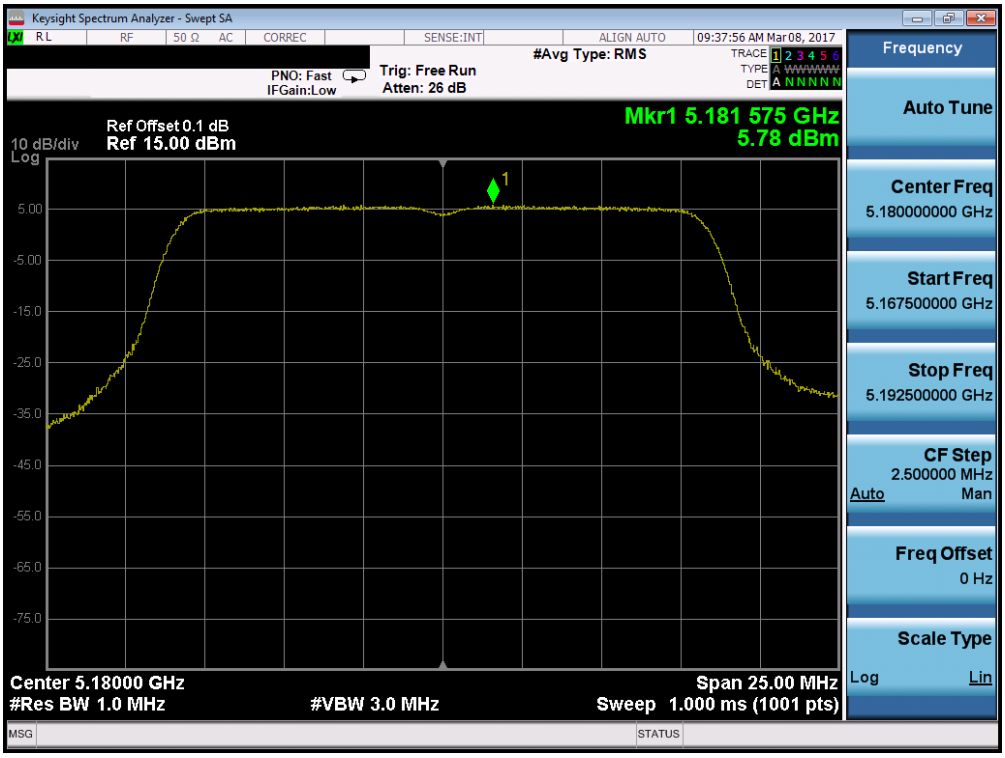
Test Notes

None

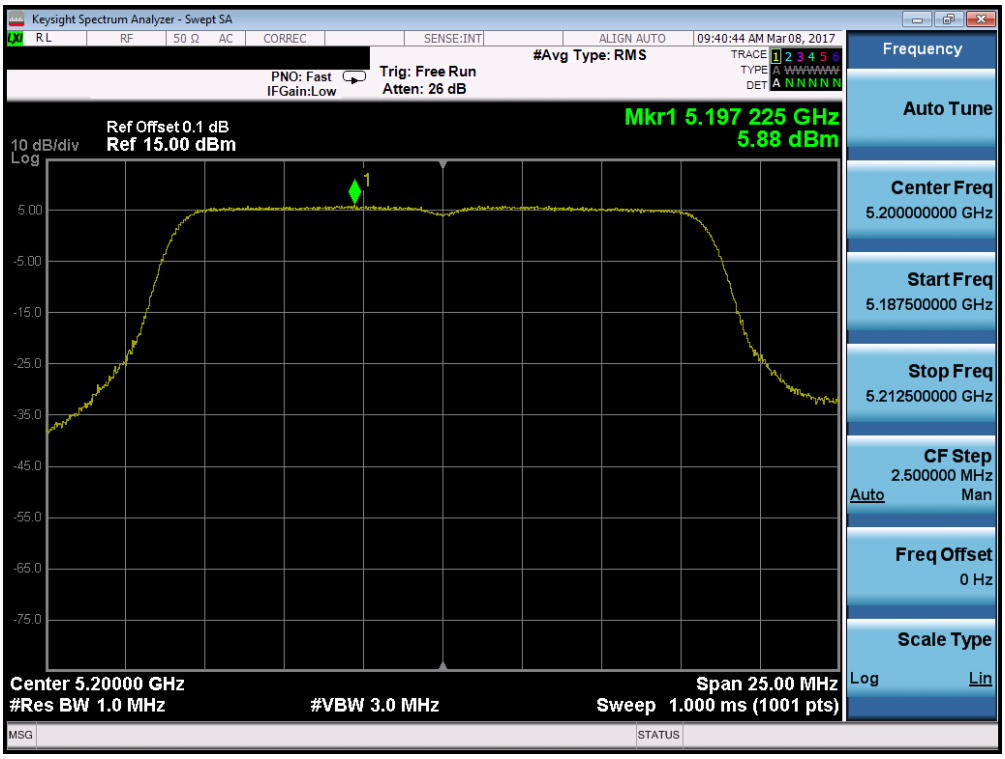
Antenna-1 Power Spectral Density Measurements

	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	4.53	17.0	-12.47	Pass
	5200	40	a	6	9.00	17.0	-8.00	Pass
	5240	48	a	6	9.43	17.0	-7.57	Pass
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	4.09	17.0	-12.91	Pass
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	8.69	17.0	-8.31	Pass
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	8.30	17.0	-8.70	Pass
	5190	38	n (40MHz)	13.5/15 (MCS0)	5.55	17.0	-11.45	Pass
	5230	46	n (40MHz)	13.5/15 (MCS0)	8.35	17.0	-8.65	Pass
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	-7.56	17.0	-24.56	Pass

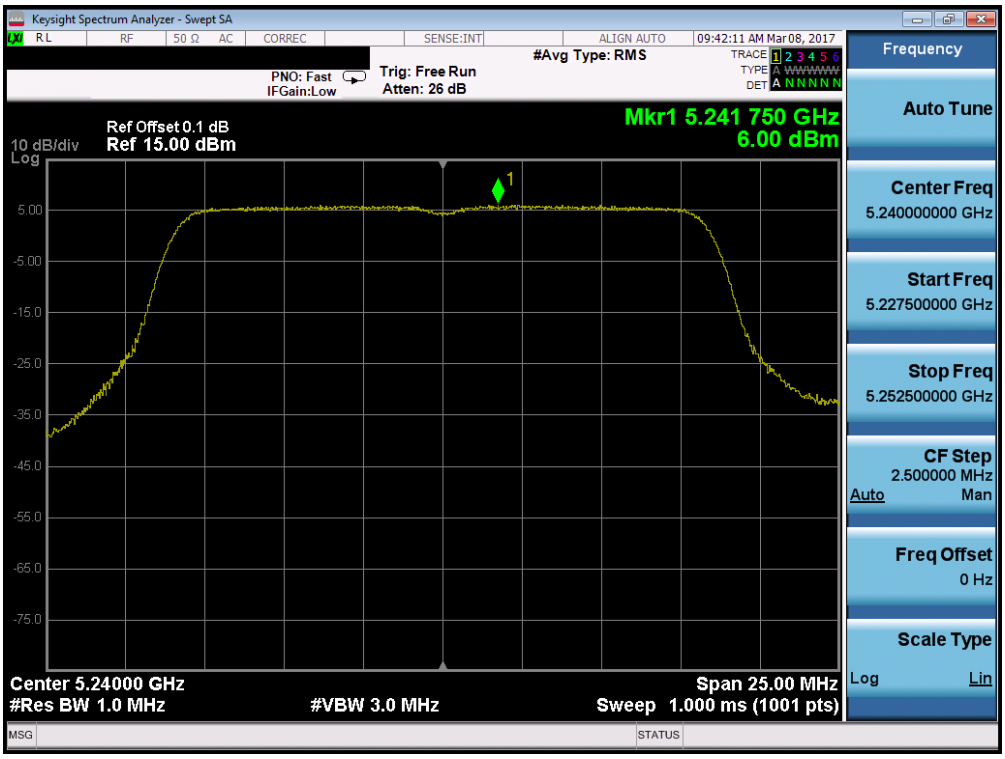
Table 7-17. Bands 1, 2A, 2C Conducted Power Spectral Density Measurements



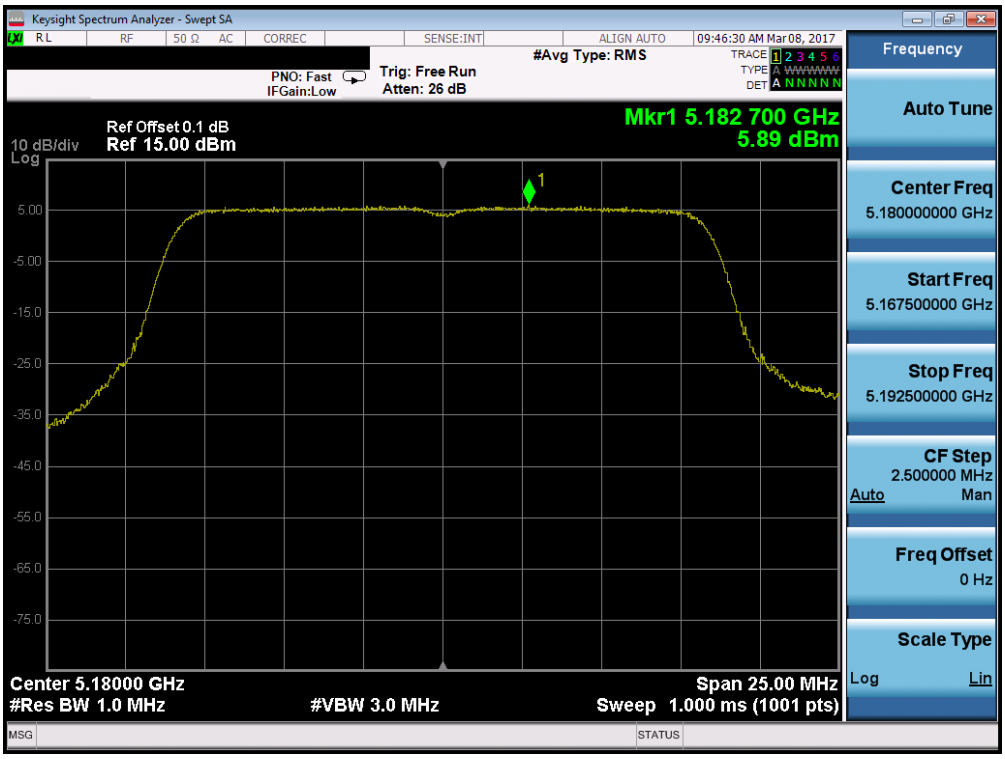
Plot 7-37. Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 36)



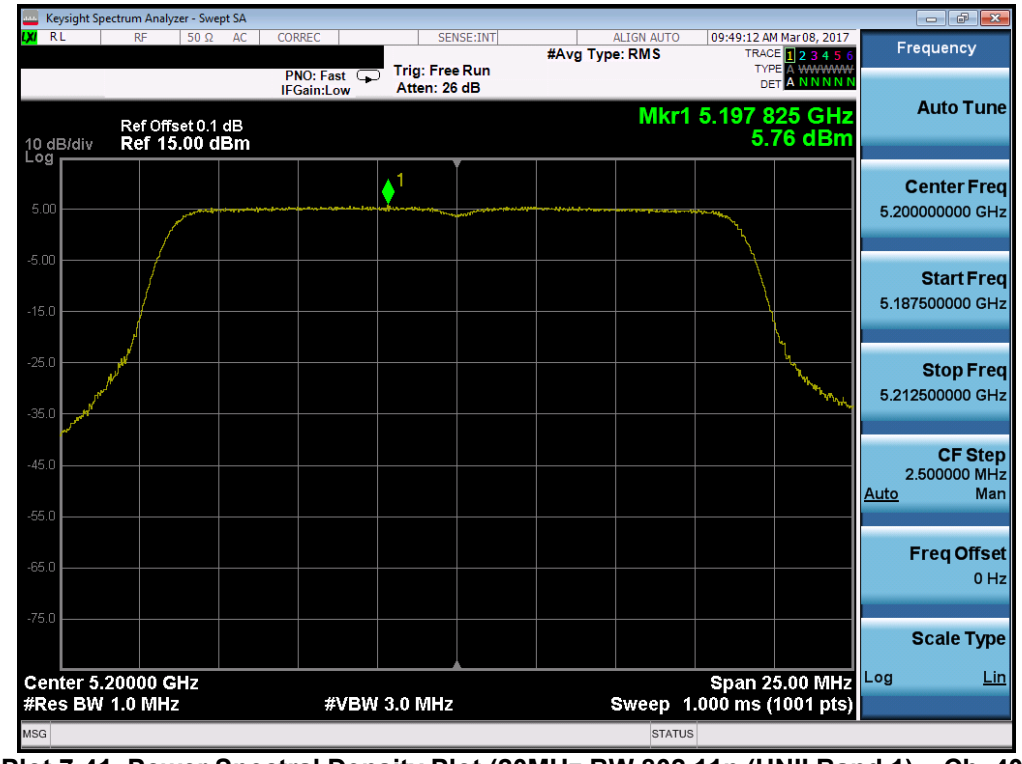
Plot 7-38. Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 40)



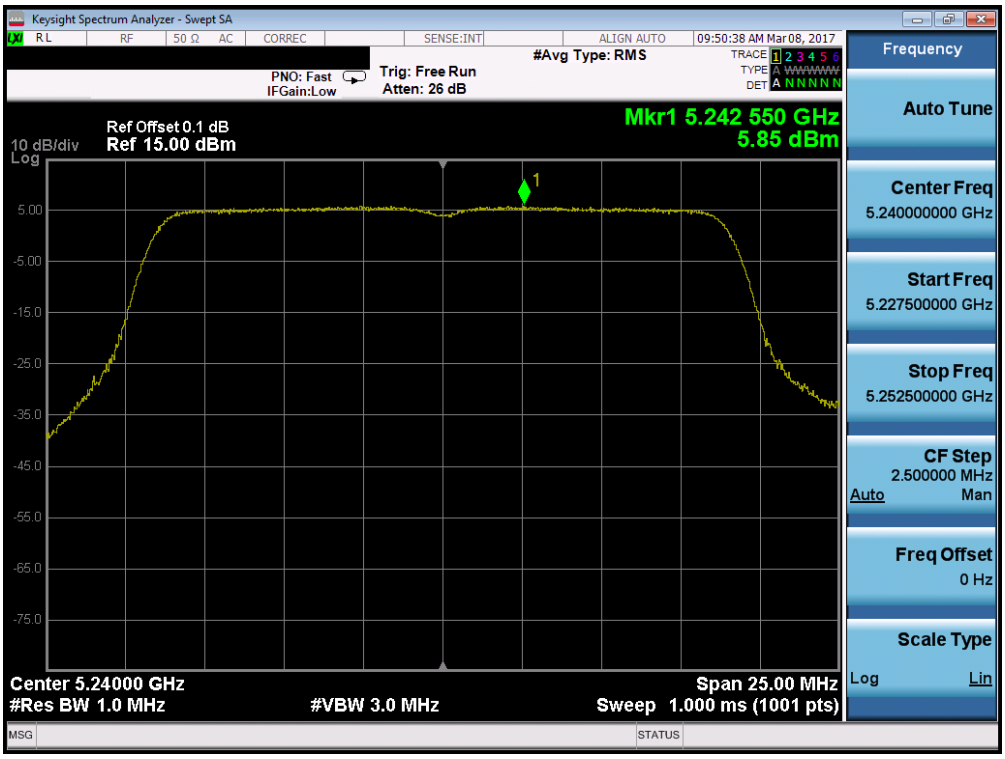
Plot 7-39. Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 48)



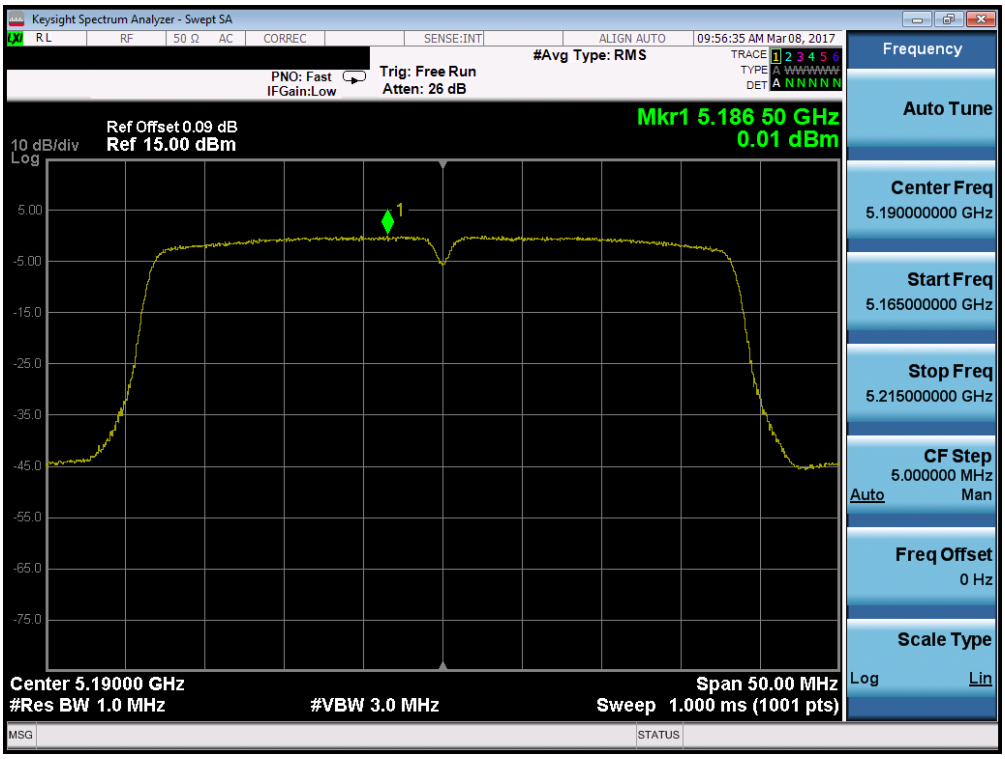
Plot 7-40. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 36)



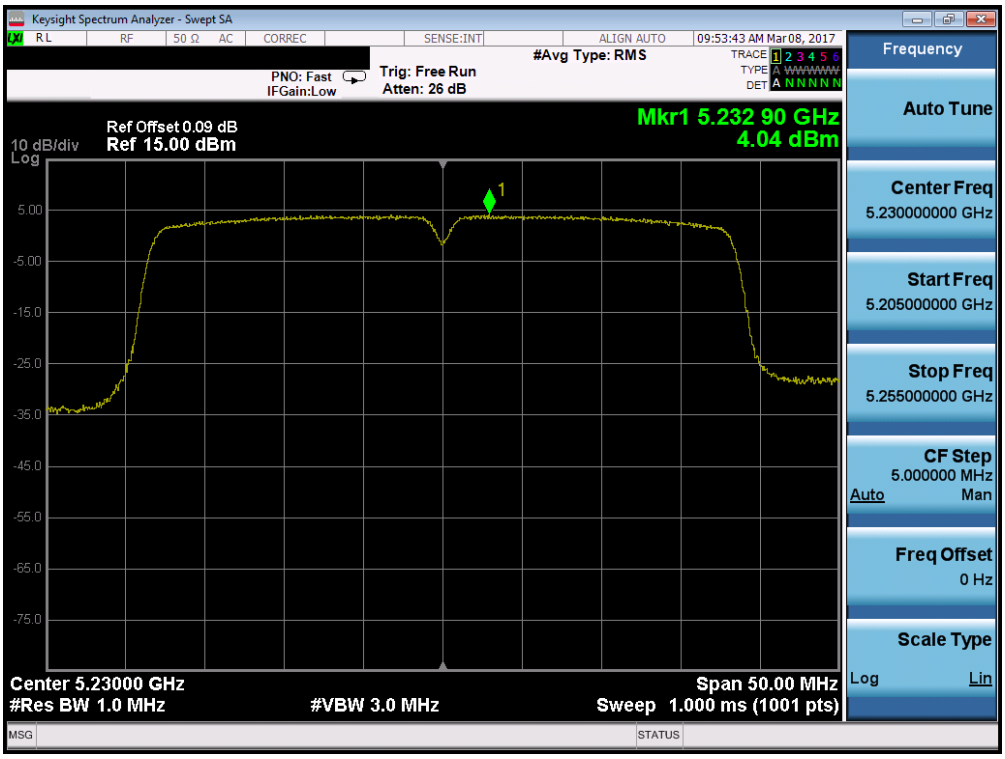
Plot 7-41. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 40)



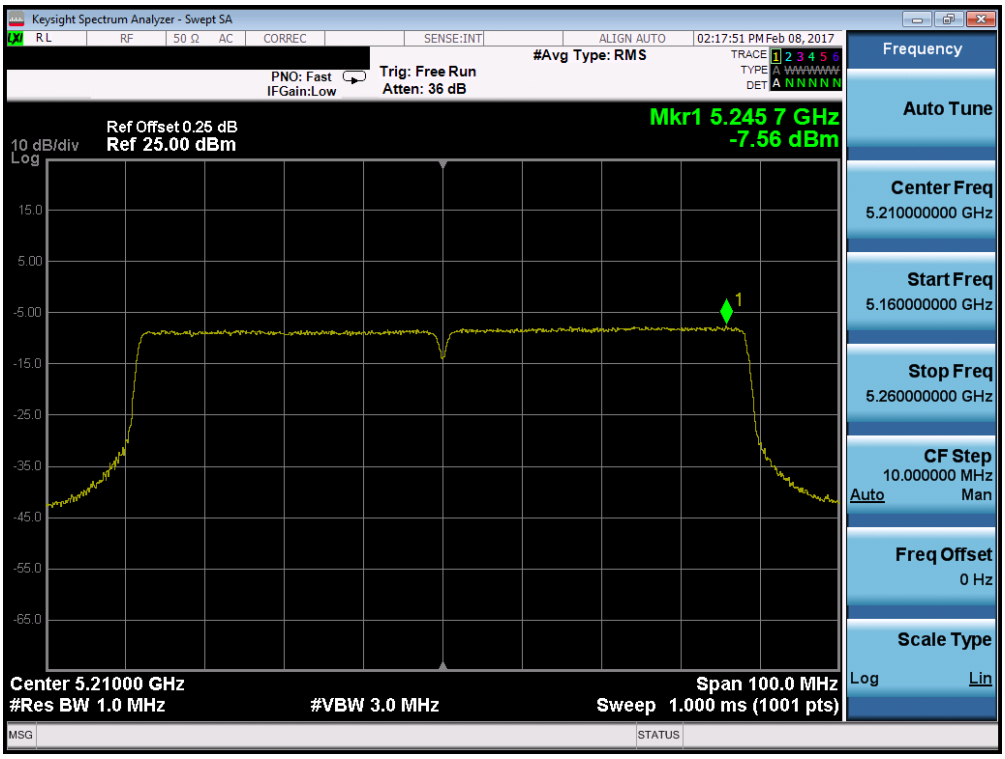
Plot 7-42. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 48)



Plot 7-43. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



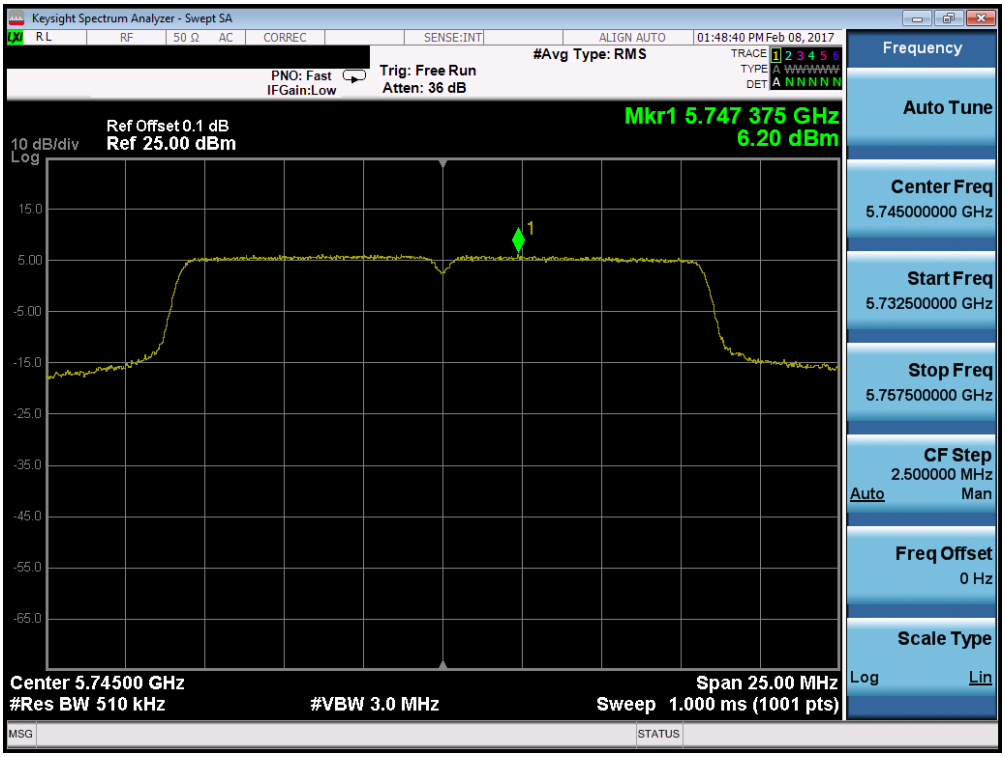
Plot 7-44. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 46)



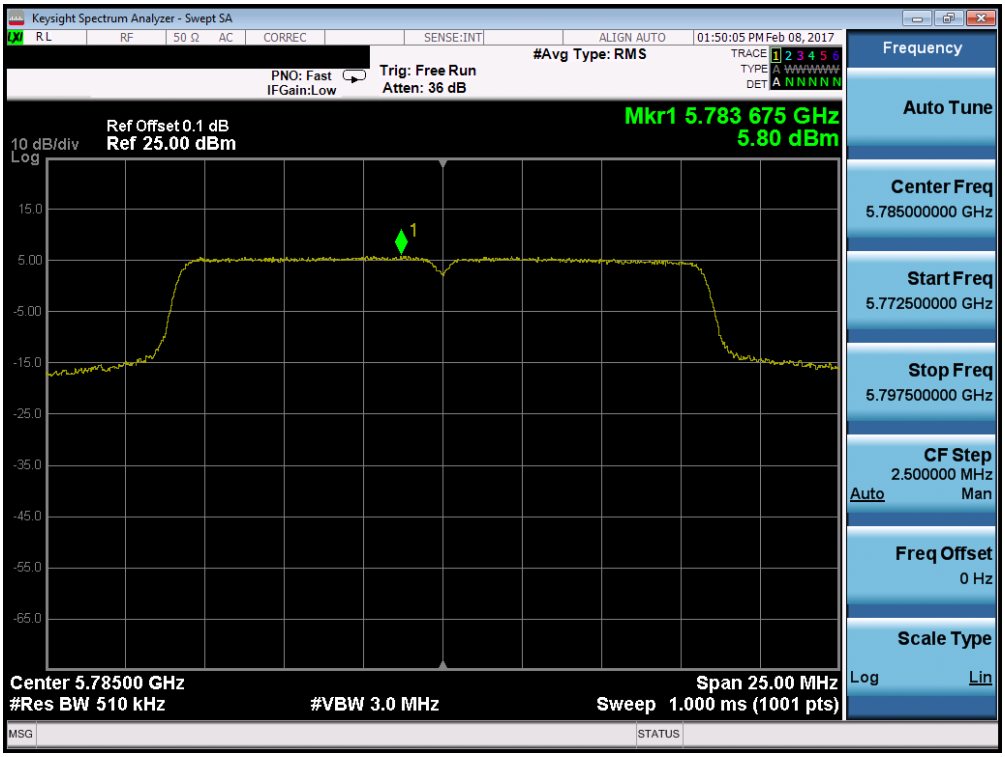
Plot 7-45. Power Spectral Density Plot (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)

	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	6.20	30.0	-23.80	Pass
	5785	157	a	6	5.80	30.0	-24.20	Pass
	5825	165	a	6	5.89	30.0	-24.11	Pass
	5745	149	n (20MHz)	6.5/7.2 (MCS0)	5.93	30.0	-24.07	Pass
	5785	157	n (20MHz)	6.5/7.2 (MCS0)	5.49	30.0	-24.51	Pass
	5825	165	n (20MHz)	6.5/7.2 (MCS0)	5.41	30.0	-24.59	Pass
	5755	151	n (40MHz)	13.5/15 (MCS0)	5.77	30.0	-24.23	Pass
	5795	159	n (40MHz)	13.5/15 (MCS0)	4.77	30.0	-25.23	Pass
	5775	155	ac (80MHz)	29.3/32.5 (MCS0)	1.80	30.0	-28.20	Pass

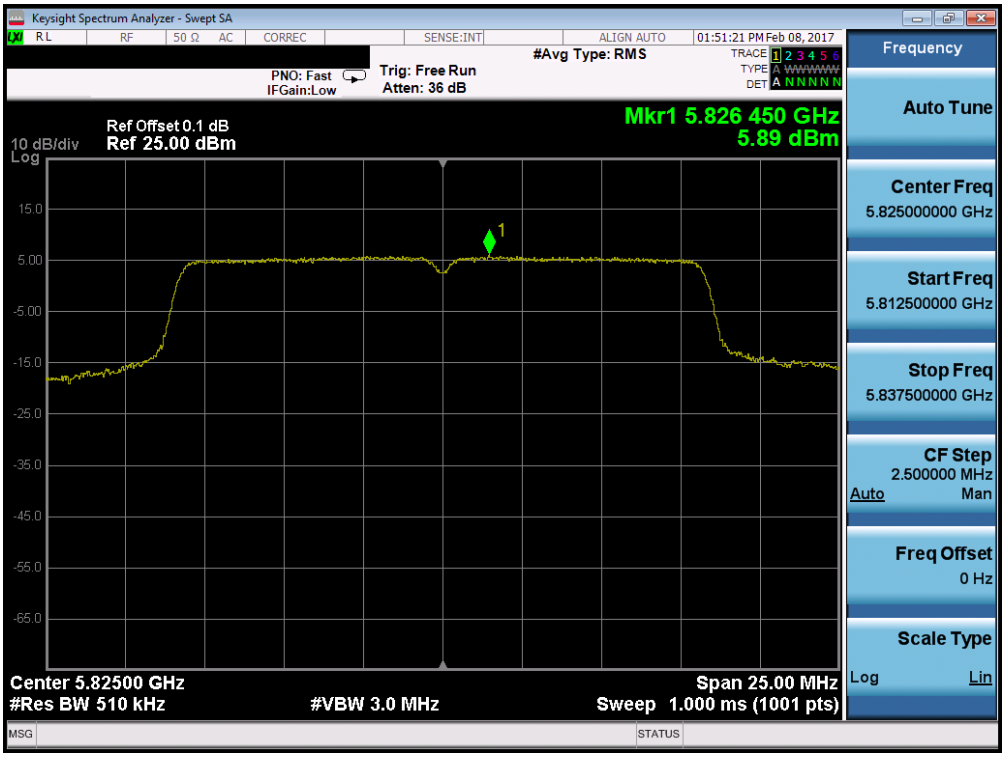
Table 7-18. Band 3 Conducted Power Spectral Density Measurements



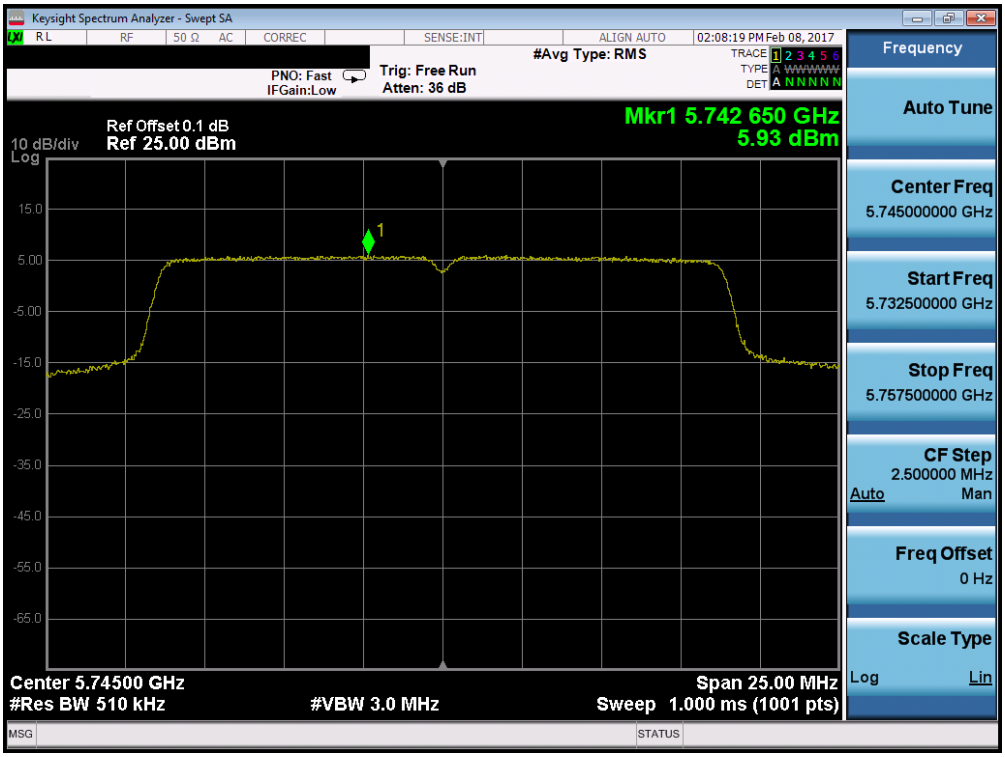
Plot 7-46. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 149)



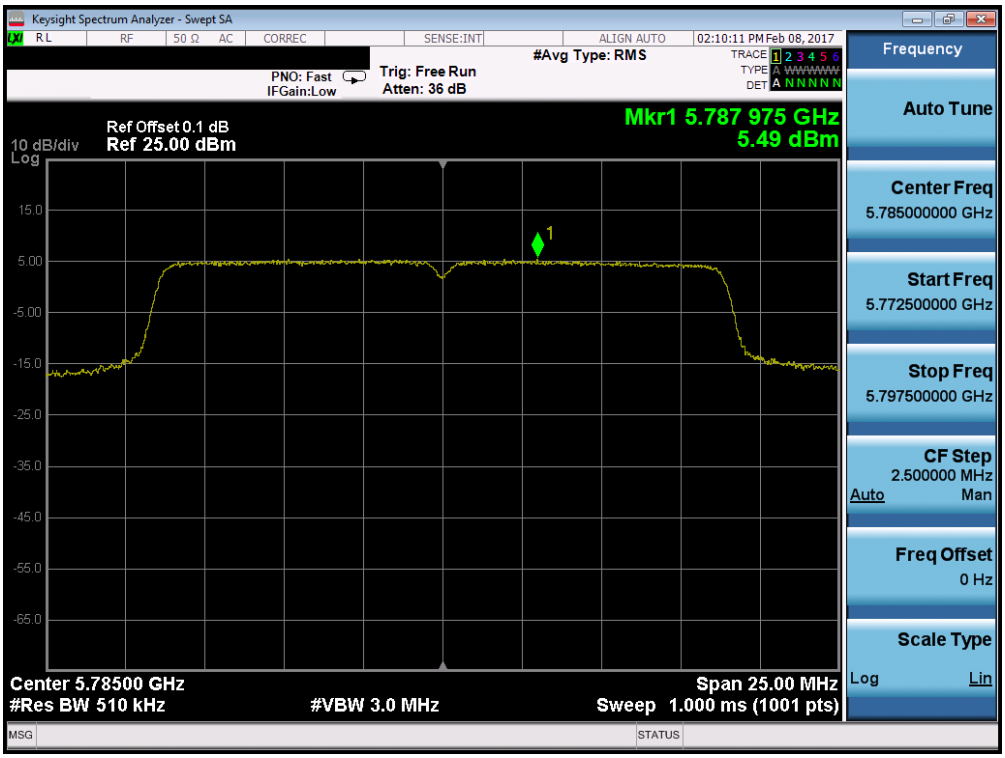
Plot 7-47. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 157)



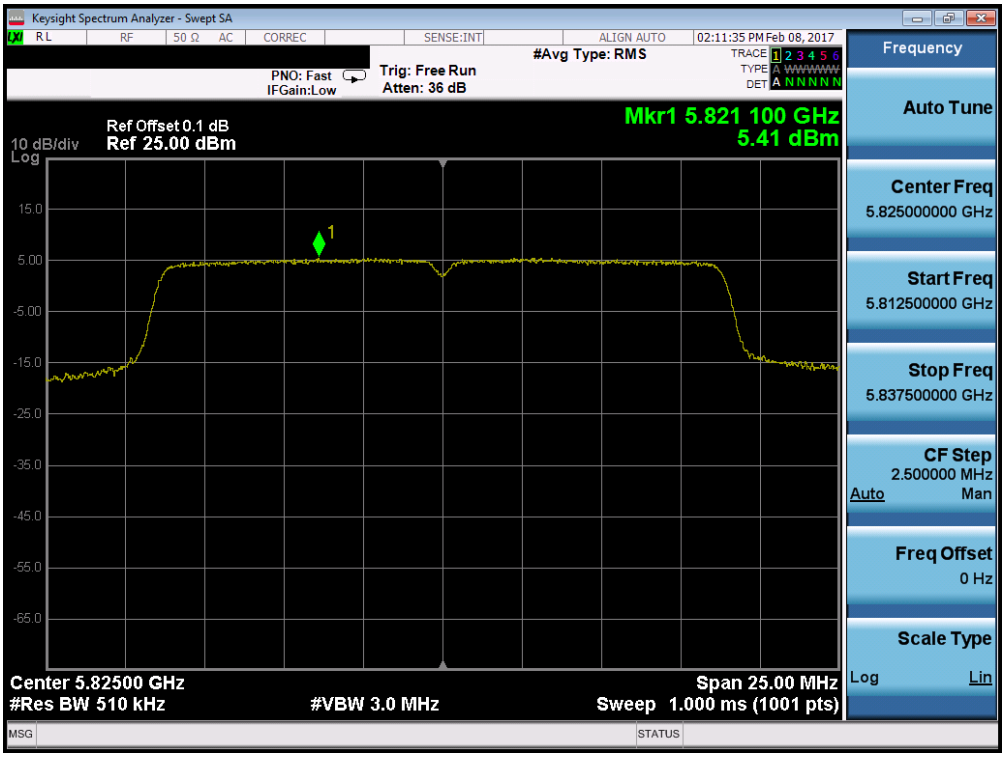
Plot 7-48. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 165)



Plot 7-49. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 149)



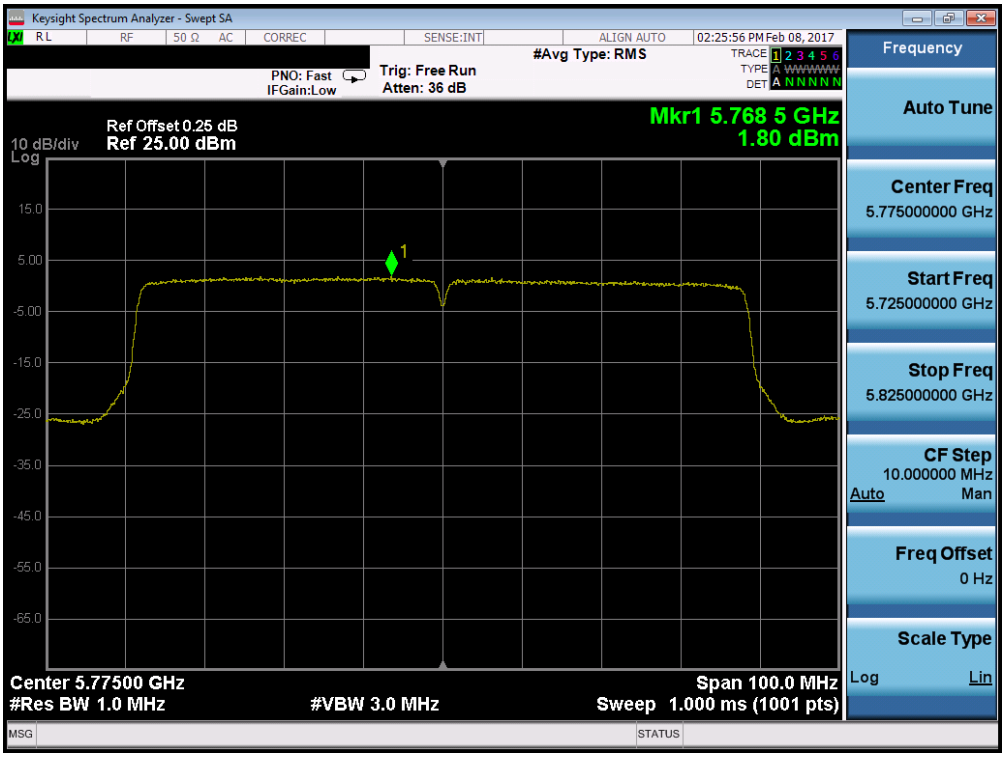
Plot 7-50. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 157)



Plot 7-51. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 165)

Plot 7-52. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 151)

Plot 7-53. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 159)

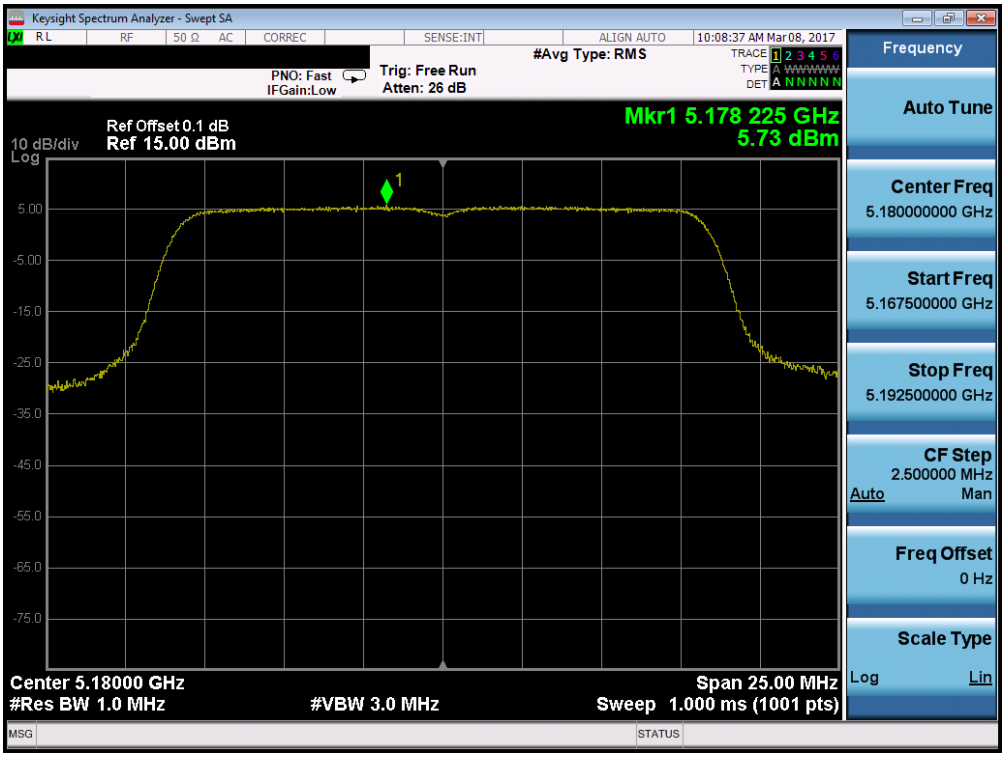


Plot 7-54. Power Spectral Density Plot (80MHz BW 802.11ac (UNII Band 3) – Ch. 155)

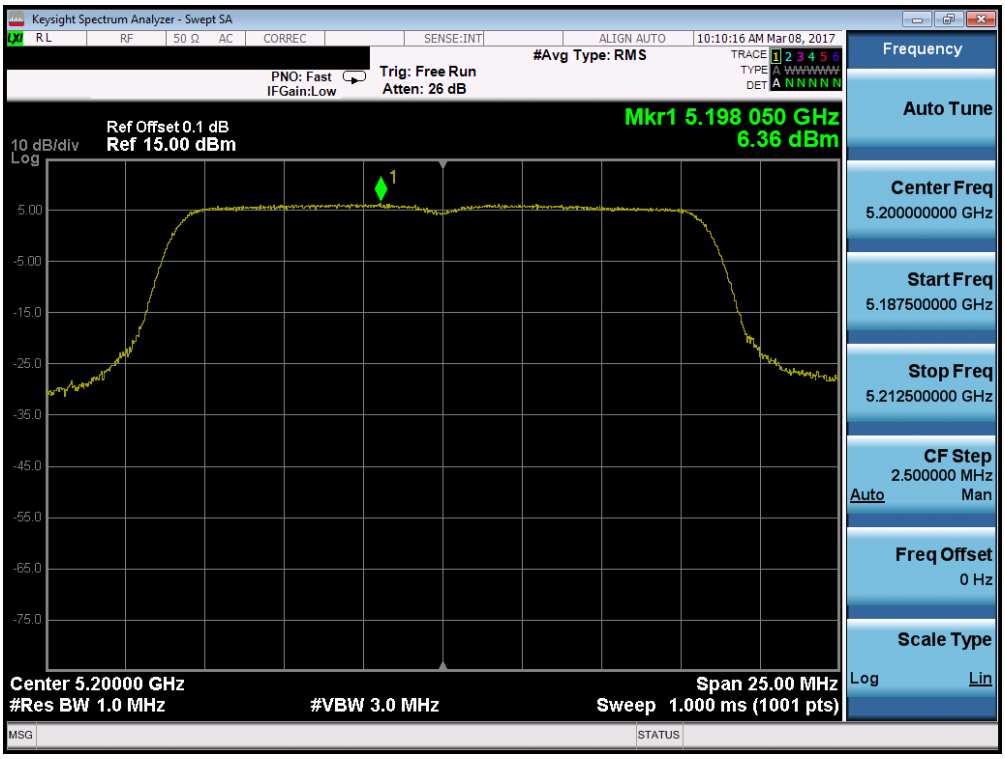
Antenna-2 Power Spectral Density Measurements

	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	4.76	17.0	-12.24	Pass
	5200	40	a	6	8.87	17.0	-8.13	Pass
	5240	48	a	6	8.46	17.0	-8.54	Pass
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	6.65	17.0	-10.35	Pass
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	8.76	17.0	-8.24	Pass
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	8.81	17.0	-8.19	Pass
	5190	38	n (40MHz)	13.5/15 (MCS0)	-0.41	17.0	-17.41	Pass
	5230	46	n (40MHz)	13.5/15 (MCS0)	4.64	17.0	-12.36	Pass
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	-7.28	17.0	-24.28	Pass

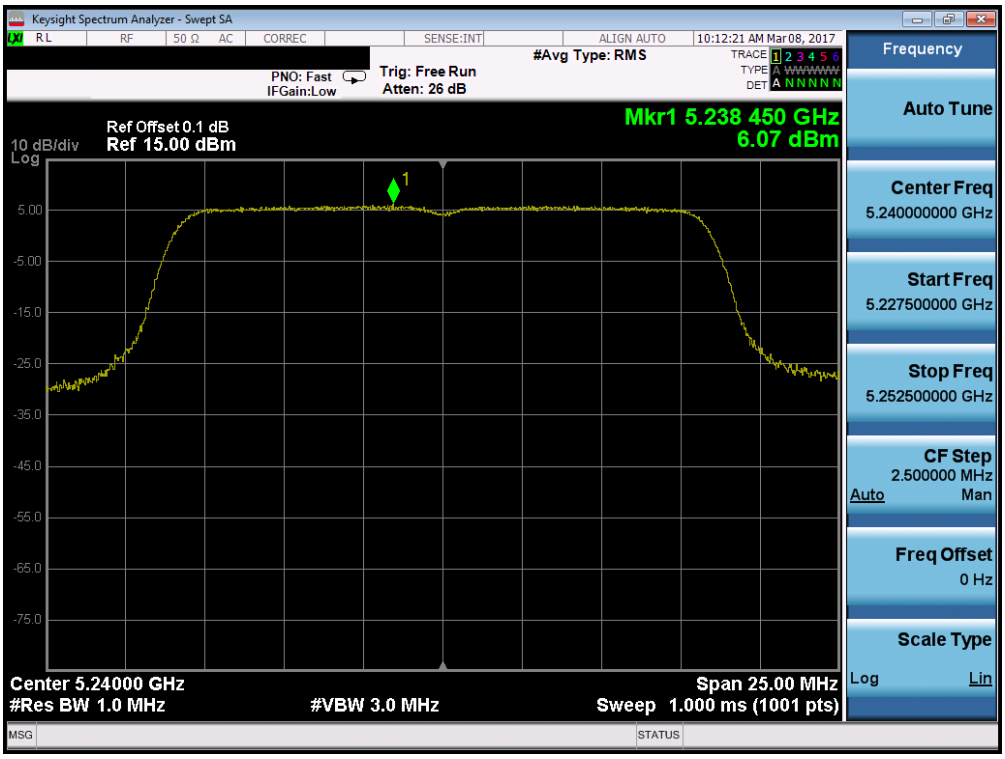
Table 7-19. Conducted Power Spectral Density Measurements



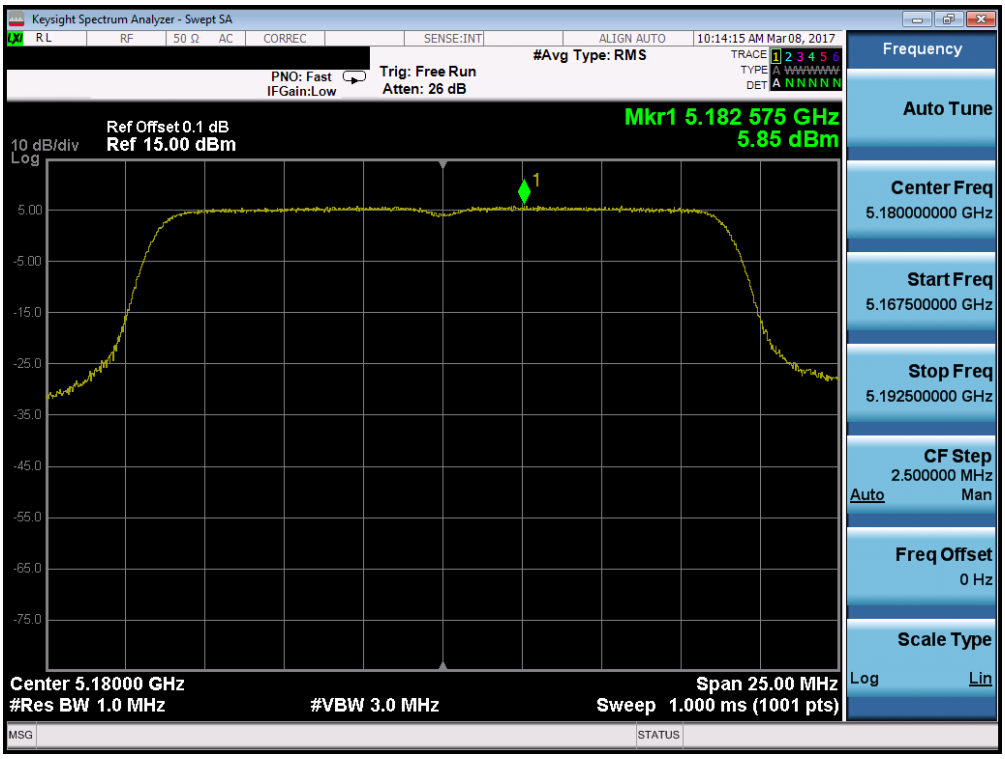
Plot 7-55. Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 36)



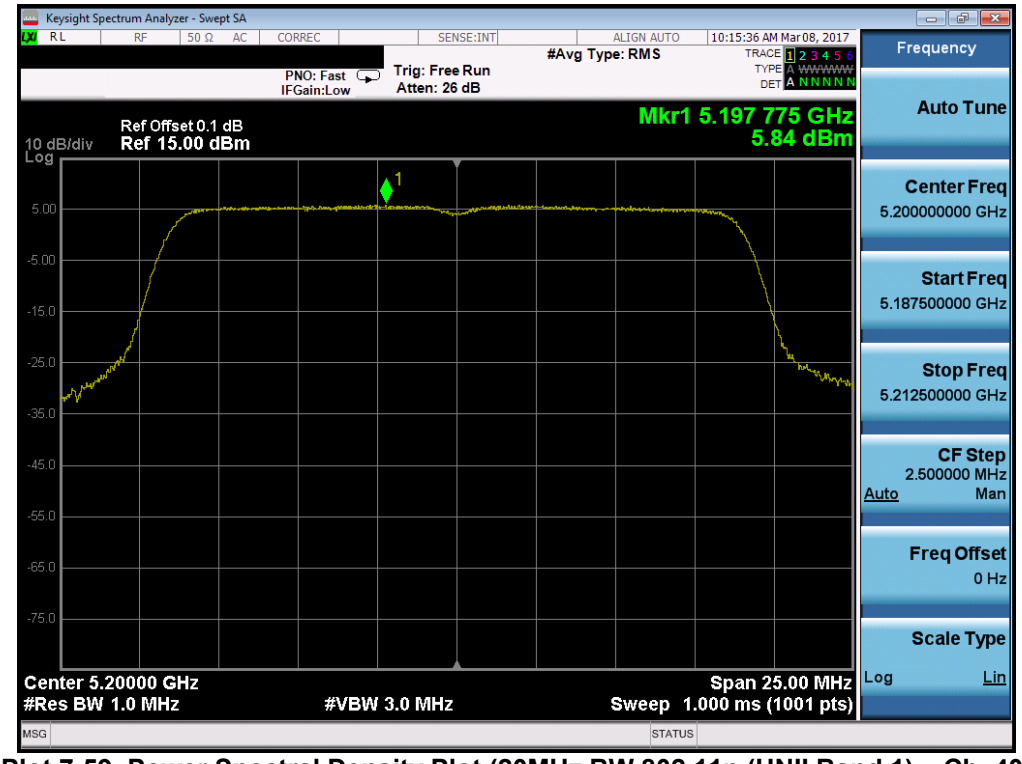
Plot 7-56. Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 40)



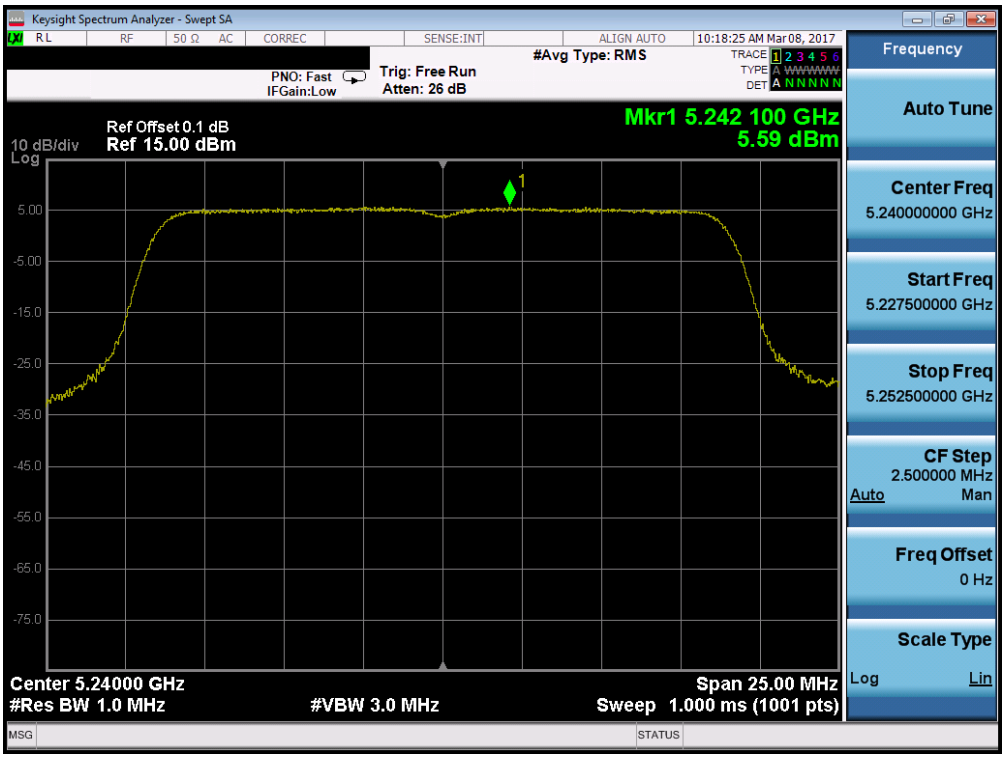
Plot 7-57. Power Spectral Density Plot (802.11a (UNII Band 1) – Ch. 48)



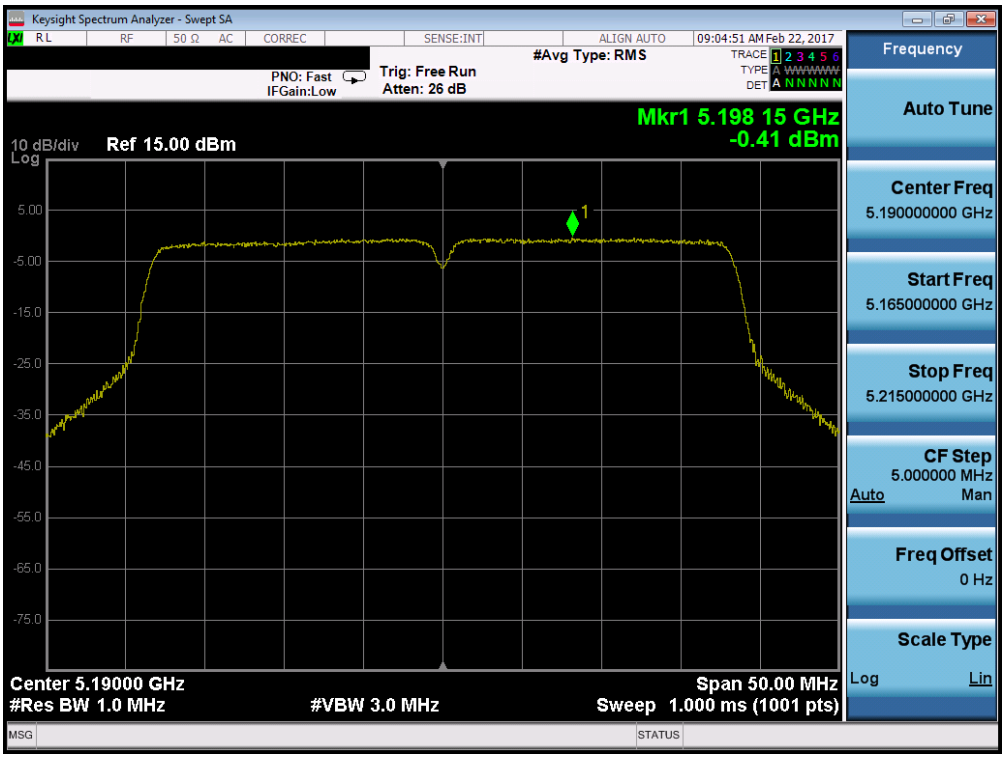
Plot 7-58. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 36)



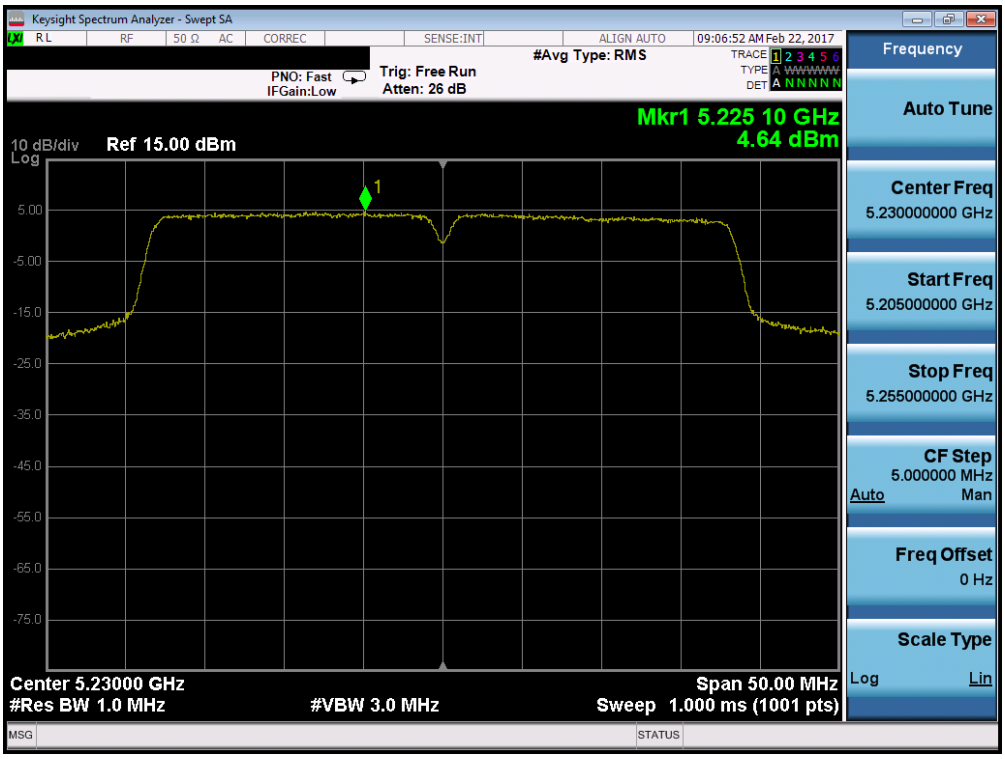
Plot 7-59. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 40)



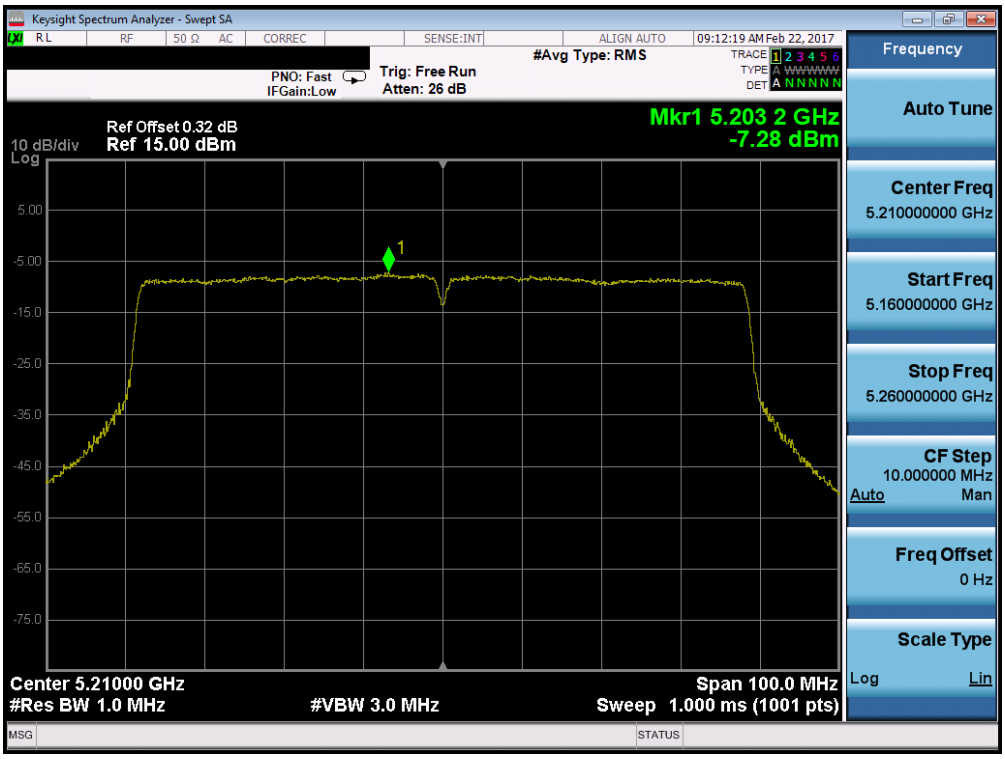
Plot 7-60. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 1) – Ch. 48)



Plot 7-61. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



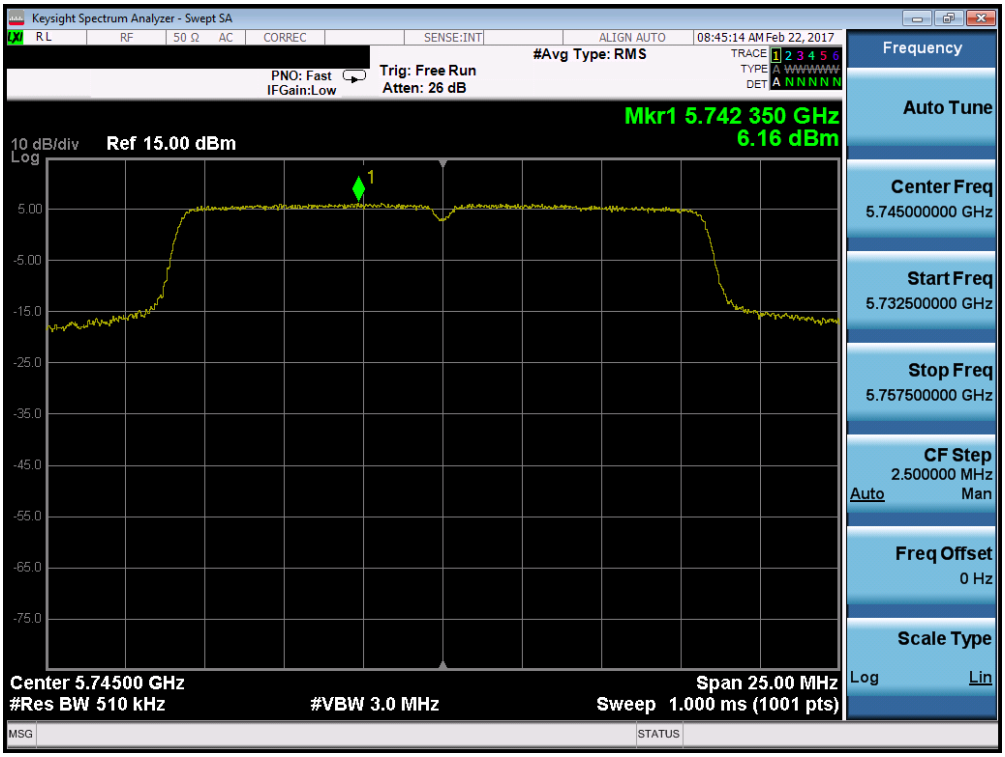
Plot 7-62. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 1) – Ch. 46)



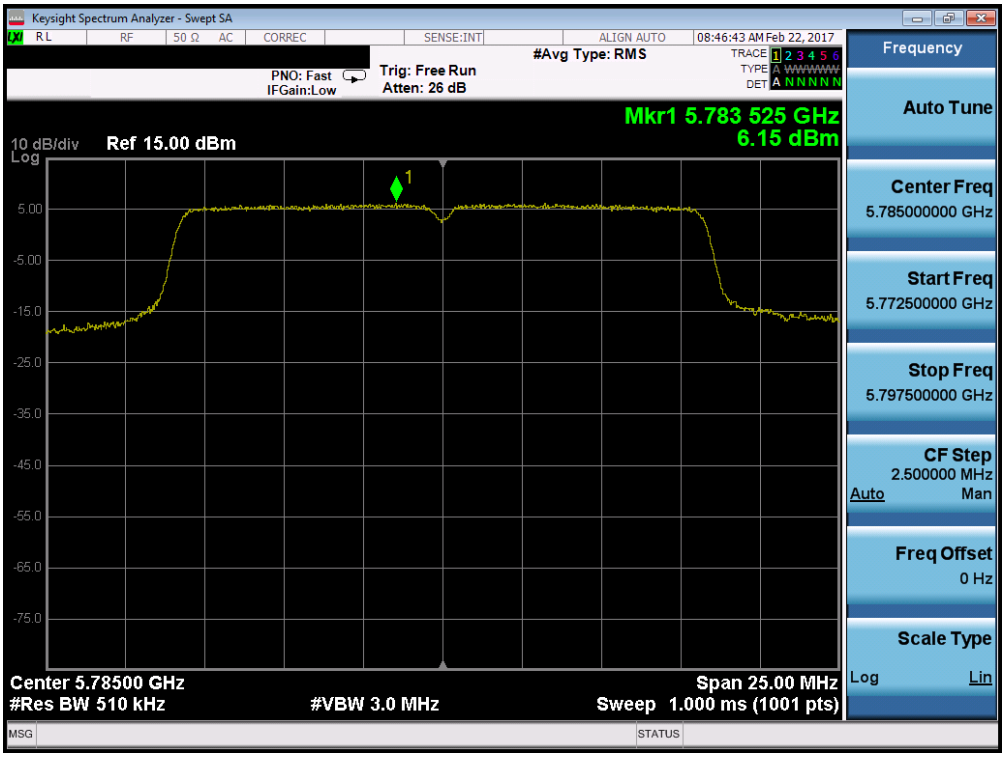
Plot 7-63. Power Spectral Density Plot (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)

	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	6.16	30.0	-23.84	Pass
	5785	157	a	6	6.15	30.0	-23.85	Pass
	5825	165	a	6	6.33	30.0	-23.67	Pass
	5745	149	n (20MHz)	6.5/7.2 (MCS0)	5.79	30.0	-24.21	Pass
	5785	157	n (20MHz)	6.5/7.2 (MCS0)	5.77	30.0	-24.23	Pass
	5825	165	n (20MHz)	6.5/7.2 (MCS0)	5.83	30.0	-24.17	Pass
	5755	151	n (40MHz)	13.5/15 (MCS0)	2.19	30.0	-27.81	Pass
	5795	159	n (40MHz)	13.5/15 (MCS0)	2.74	30.0	-27.26	Pass
	5775	155	ac (80MHz)	29.3/32.5 (MCS0)	-2.38	30.0	-32.38	Pass

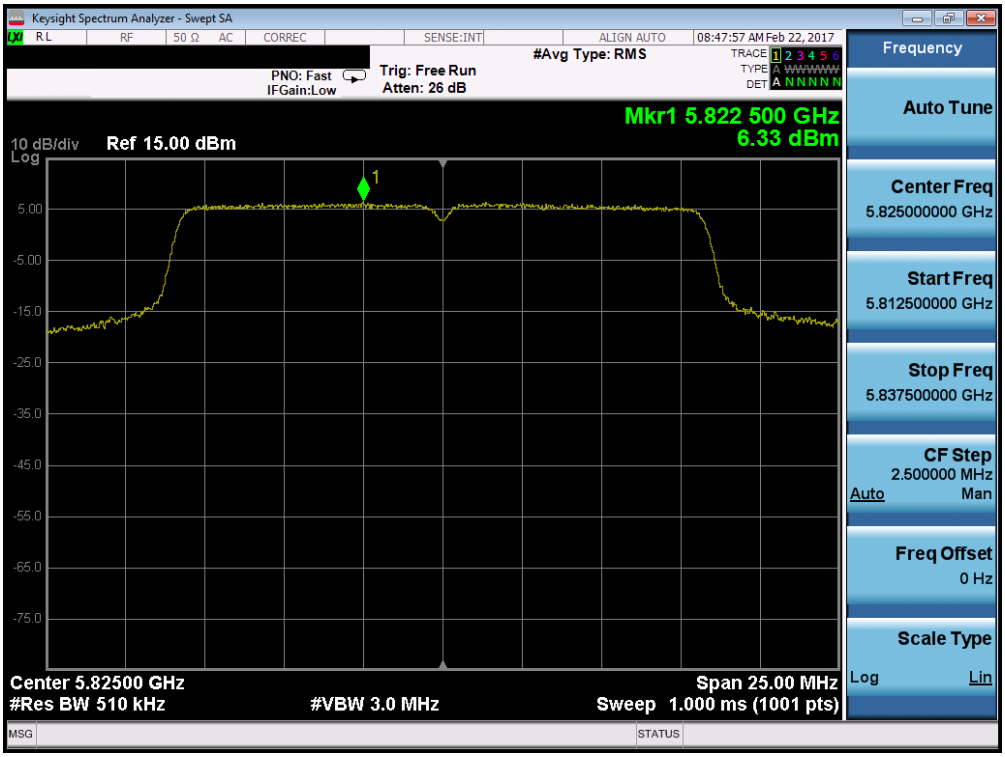
Table 7-20. Band 3 Conducted Power Spectral Density Measurements



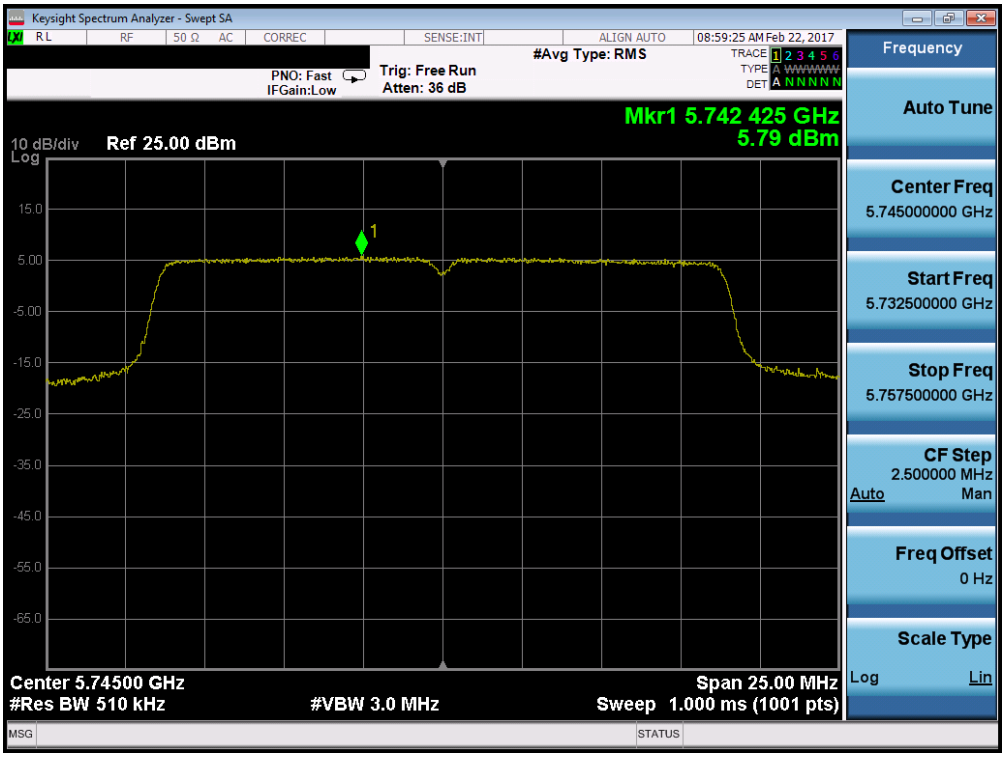
Plot 7-64. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 149)



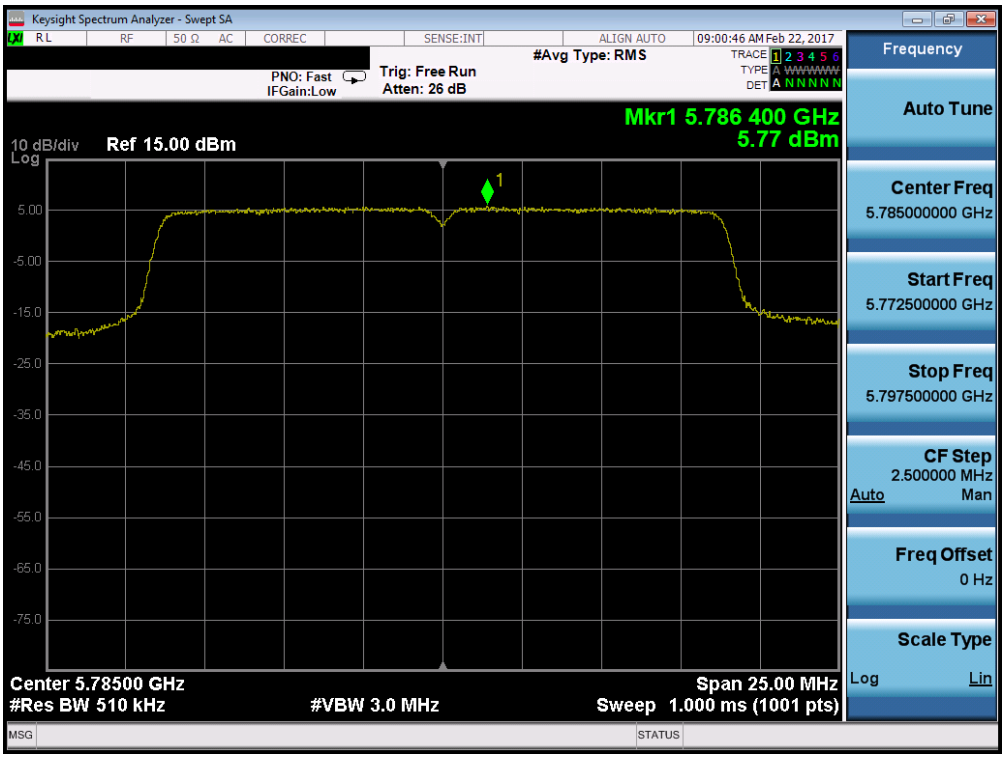
Plot 7-65. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 157)



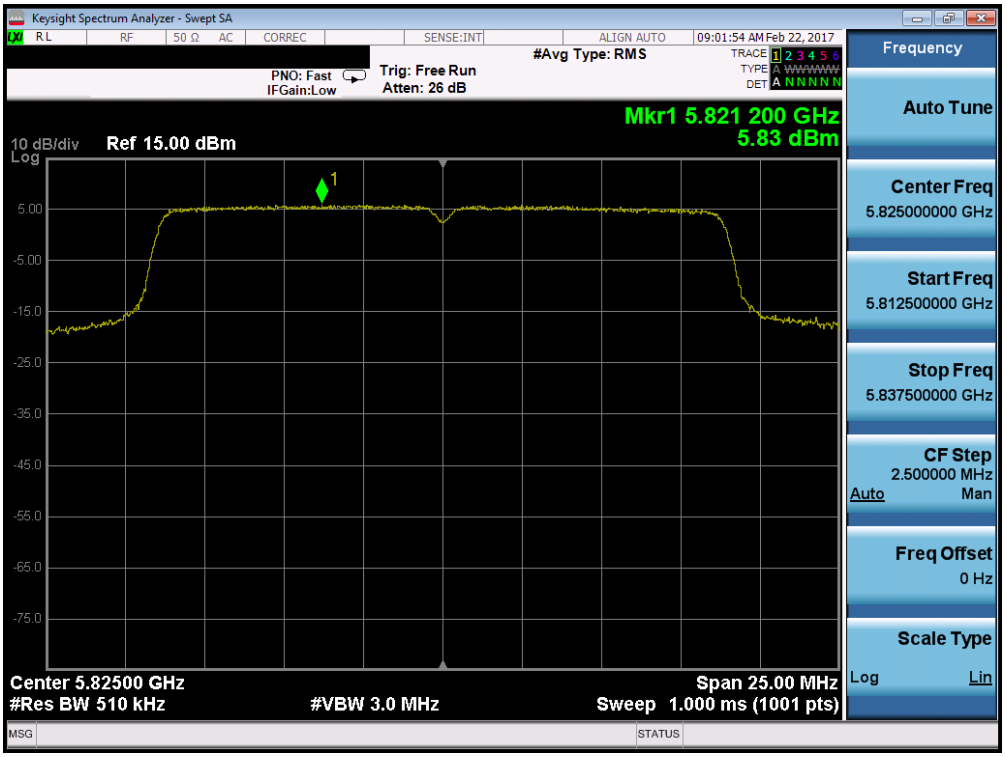
Plot 7-66. Power Spectral Density Plot (802.11a (UNII Band 3) – Ch. 165)



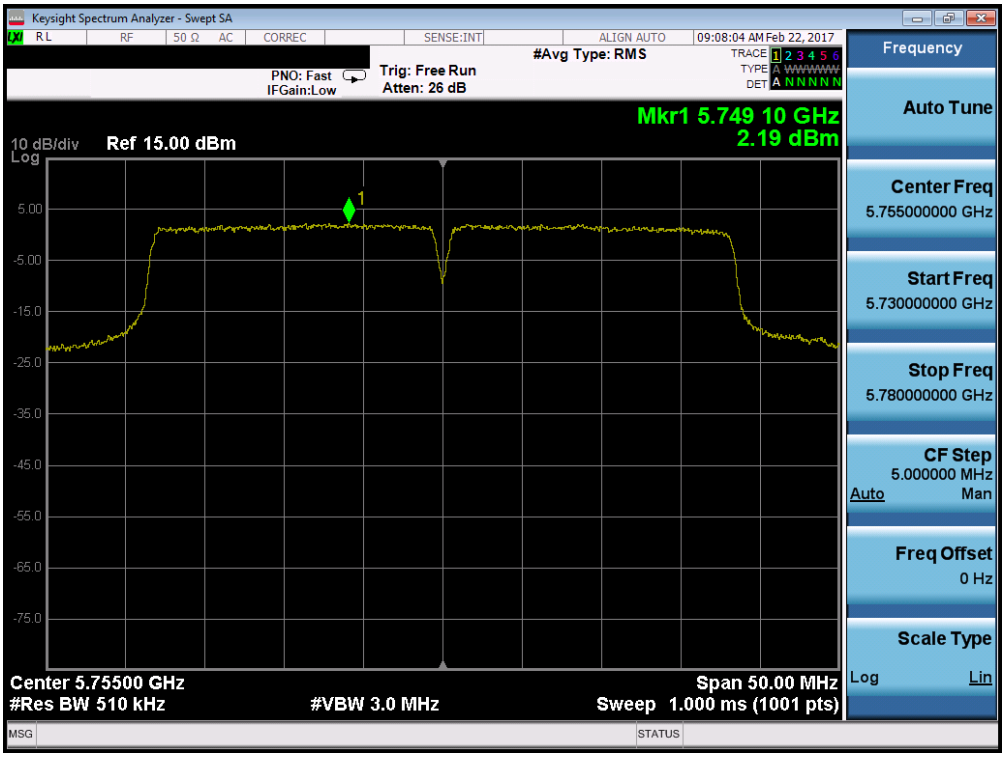
Plot 7-67. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 149)



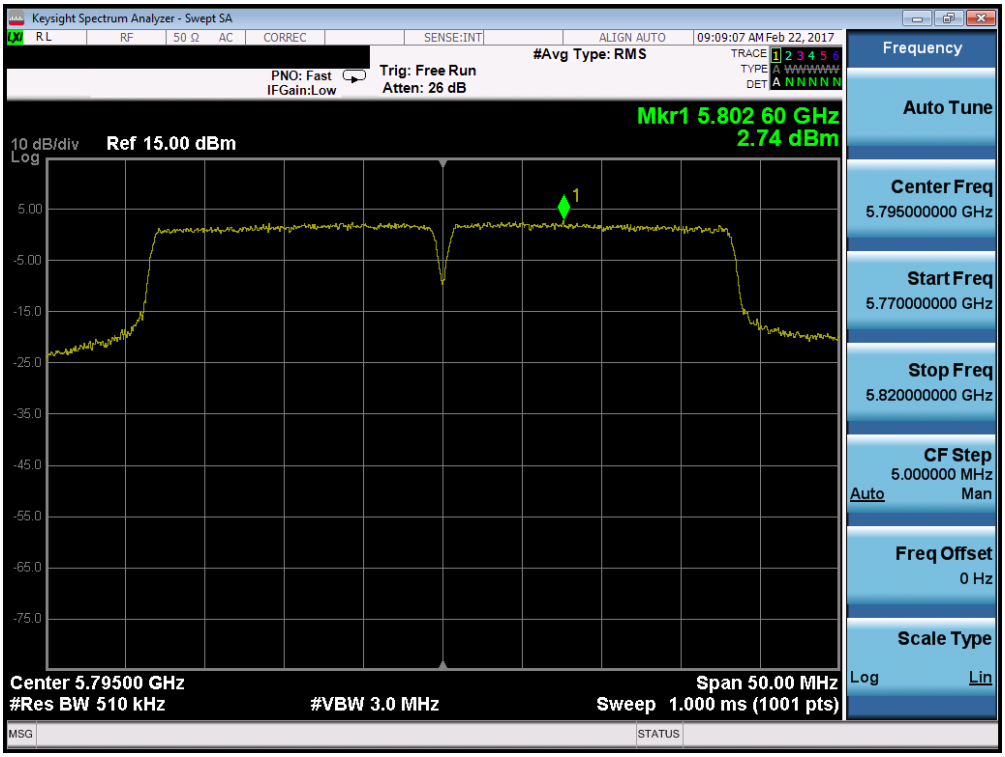
Plot 7-68. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 157)



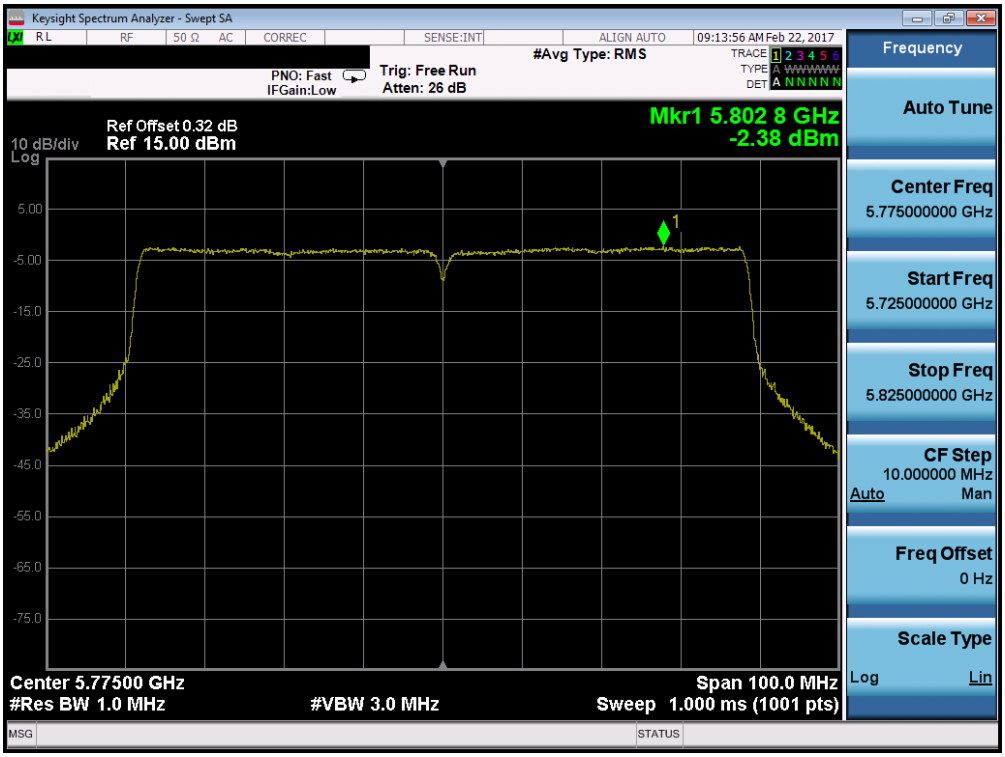
Plot 7-69. Power Spectral Density Plot (20MHz BW 802.11n (UNII Band 3) – Ch. 165)



Plot 7-70. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 151)



Plot 7-71. Power Spectral Density Plot (40MHz BW 802.11n (UNII Band 3) – Ch. 159)



Plot 7-72. Power Spectral Density Plot (80MHz BW 802.11ac (UNII Band 3) – Ch. 155)

Summed MIMO Power Spectral Density Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Directional Gain [dBi]	Antenna-1 Power Density [dBm]	Antenna-2 Power Density [dBm]	Summed MIMO Power Density [dBm]	Max Permissible Power Density	Adjusted Limit [dBm/MHz]	Margin [dB]	Pass / Fail
Band 1	5180	36	n (20MHz)	6.5/7.2 (MCS0)	6.31	4.09	6.65	8.57	17.0	16.69	-8.12	Pass
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	6.31	8.69	8.76	11.74	17.0	16.69	-4.95	Pass
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	6.31	8.30	8.81	11.57	17.0	16.69	-5.12	Pass
	5190	38	n (40MHz)	13.5/15 (MCS0)	6.31	5.55	-0.41	6.53	17.0	16.69	-10.16	Pass
	5230	46	n (40MHz)	13.5/15 (MCS0)	6.31	8.35	4.64	9.89	17.0	16.69	-6.80	Pass
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	6.31	-7.56	-7.28	-4.41	17.0	16.69	-21.10	Pass

Table 7-21. Band 1 MIMO Conducted Power Spectral Density Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Directional Gain [dBi]	Antenna-1 Power Density [dBm]	Antenna-2 Power Density [dBm]	Summed MIMO Power Density [dBm]	Max Permissible Power Density	Adjusted Limit [dBm/500kHz]	Margin [dB]	Pass / Fail
Band 3	5745	149	n (20MHz)	6.5/7.2 (MCS0)	6.06	5.93	5.79	8.87	30.0	29.9	-21.07	Pass
	5785	157	n (20MHz)	6.5/7.2 (MCS0)	6.06	5.49	5.77	8.64	30.0	29.9	-21.30	Pass
	5825	165	n (20MHz)	6.5/7.2 (MCS0)	6.06	5.41	5.83	8.63	30.0	29.9	-21.31	Pass
	5755	151	n (40MHz)	13.5/15 (MCS0)	6.06	5.77	2.19	7.35	30.0	29.9	-22.59	Pass
	5795	159	n (40MHz)	13.5/15 (MCS0)	6.06	4.77	2.74	6.88	30.0	29.9	-23.06	Pass
	5775	155	ac (80MHz)	29.3/32.5 (MCS0)	6.06	1.80	-2.38	3.20	30.0	29.9	-26.74	Pass

Table 7-22. Band 3 MIMO Conducted Power Spectral Density Measurements

Note:

Per KDB 662911 v02r01 Section E)2), the power spectral density at Antenna 1 and Antenna 2 were first measured separately as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Per KDB 662911 v02r01, Section F)2), the directional gain is calculated using the following formula, where Gn is the gain of the nth antenna and Nant, the total number of antennas used.

$$\text{Directional gain} = 10\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/N_{ANT}]\ \text{dBi}$$

The Power Density limits were then adjusted using the following formula:

Max permissible power density – [6-(Directional gain)]

Sample MIMO Calculation:

At 5180MHz in 802.11n (20MHz BW) mode, the average conducted power spectral density was measured to be 4.09 dBm for Antenna-1 and 6.65 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(4.09 dBm + 6.65 dBm) = (2.56 mW + 4.63 mW) = 7.19 mW = 8.57 dBm

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 -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:	5,180,000,000	Hz
CHANNEL:	36	
REFERENCE VOLTAGE:	120	VAC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	120.00	+ 20 (Ref)	5,180,000,056	56	0.00000108
100 %		- 30	5,179,999,978	-22	-0.00000042
100 %		- 20	5,180,000,028	28	0.00000054
100 %		- 10	5,179,999,861	-139	-0.00000268
100 %		0	5,180,000,171	171	0.00000330
100 %		+ 10	5,179,999,989	-11	-0.00000021
100 %		+ 20	5,179,999,821	-179	-0.00000346
100 %		+ 30	5,180,000,053	53	0.00000102
100 %		+ 40	5,180,000,240	240	0.00000463
100 %		+ 50	5,180,000,067	67	0.00000129
85 %	102.00	+ 20	5,179,999,975	-25	-0.00000048
115 %	138.00	+ 20	5,179,999,935	-65	-0.00000125

Table 7-23. 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.

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:	5,745,000,000	Hz
CHANNEL:	149	
REFERENCE VOLTAGE:	120	VAC

VOLTAGE (%)	POWER (VDC)	TEMP (ºC)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	120.00	+ 20 (Ref)	5,744,999,873	-127	-0.00000221
100 %		- 30	5,745,000,120	120	0.00000209
100 %		- 20	5,744,999,653	-347	-0.00000604
100 %		- 10	5,744,999,520	-480	-0.00000836
100 %		0	5,745,000,000	0	0.00000000
100 %		+ 10	5,745,000,017	17	0.00000030
100 %		+ 20	5,745,000,338	338	0.00000588
100 %		+ 30	5,744,999,930	-70	-0.00000122
100 %		+ 40	5,744,999,859	-141	-0.00000245
100 %		+ 50	5,744,999,818	-182	-0.00000317
85 %	102.00	+ 20	5,745,000,194	194	0.00000338
115 %	138.00	+ 20	5,744,999,908	-92	-0.00000160

Table 7-24. 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.

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 v01r04, 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 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 7-25 per Section 15.209.

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

Table 7-25. Radiated Limits

Test Procedures Used

KDB 789033 D02 v01r04 – Section G

Test Settings

Average Measurements above 1GHz (Method AD)

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

Peak Measurements above 1GHz

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

Peak Measurements below 1GHz

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.

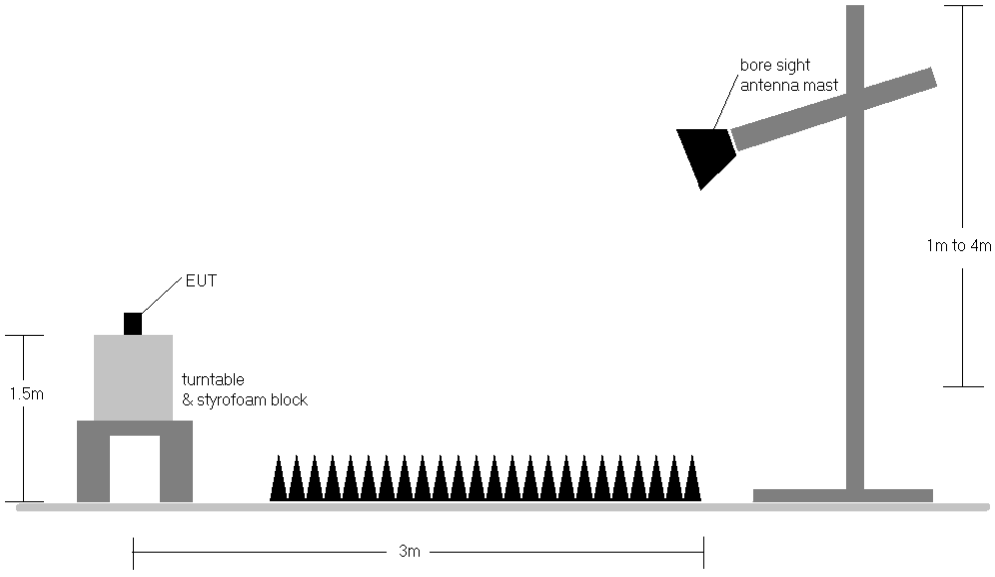


Figure 7-5. Test Instrument & Measurement Setup

Test Notes

1. All radiated spurious emissions levels were measured in a radiated test setup per the guidance of KDB 789033 D02 v01r04 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 7-25.
3. All spurious emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-25. 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 while powered by an DC power source.
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. All final emissions were measured at a 1 meter test distance with the application of a distance correction factor.
8. Radiated spurious emissions were investigated while operating in MIMO mode, however, it was determined that single antenna operation produced the worst case emissions. Since the emissions produced from MIMO operation were found to be more than 20dB below the limit, the MIMO emissions are not reported.
9. 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.
10. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Sample Calculations

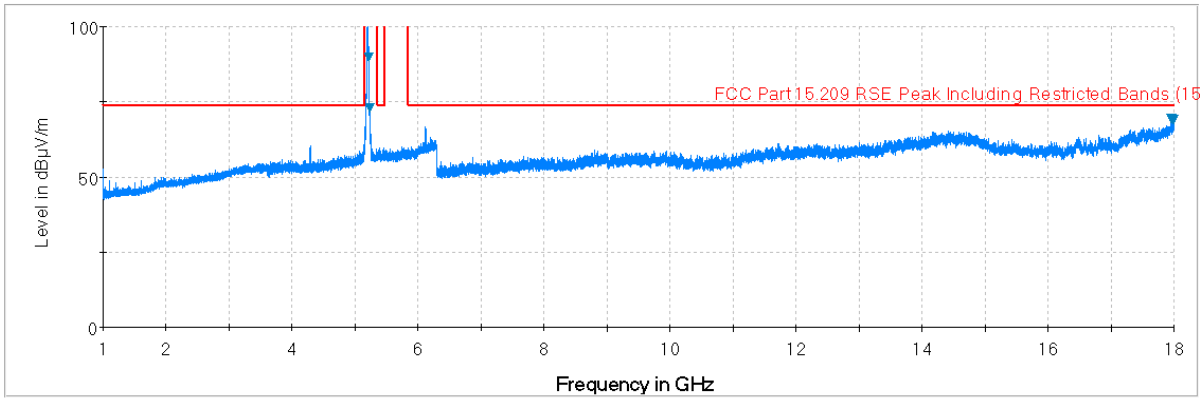
Determining Spurious Emissions Levels

- 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 $_{[dB\mu V/m]}$

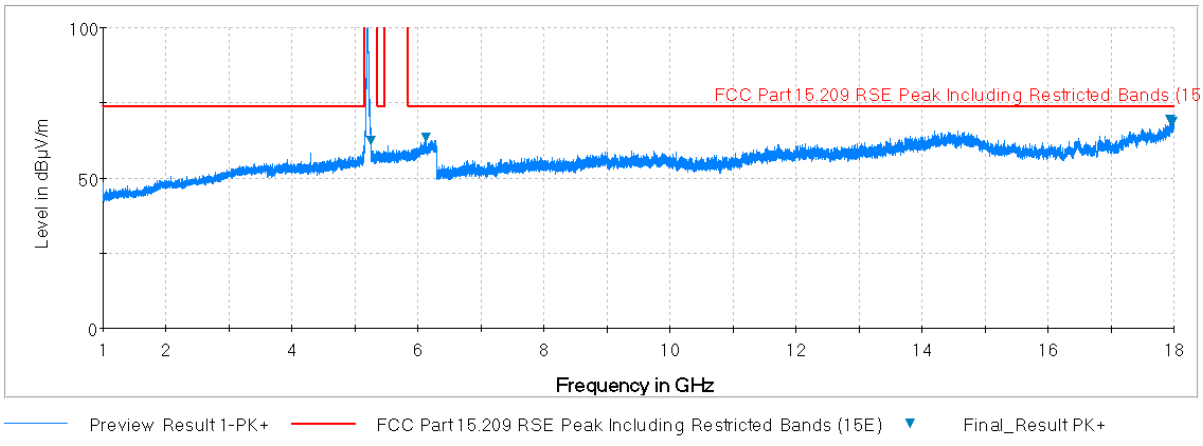
Radiated Band Edge Measurement Offset

- 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

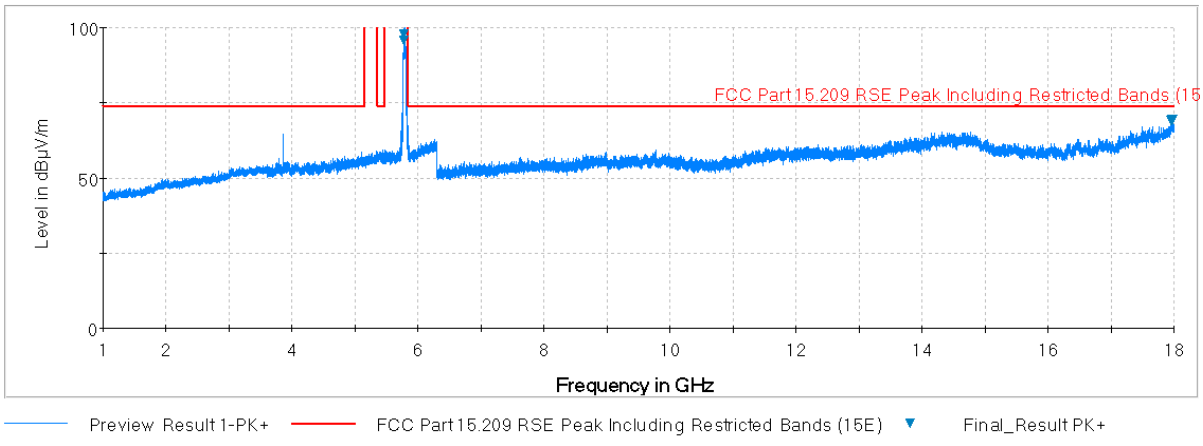
7.7.1 Antenna-1 Radiated Spurious Emission Measurements



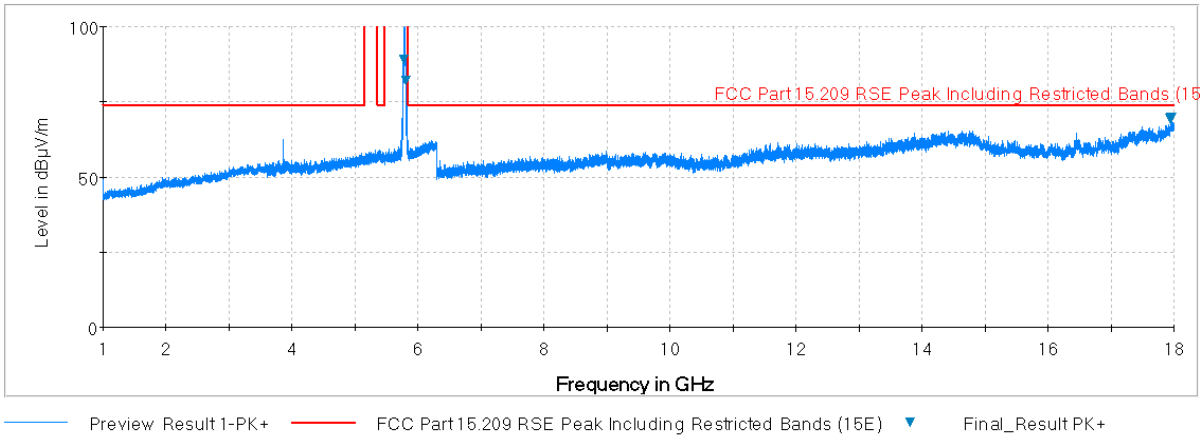
Plot 7-73. Radiated Spurious Plot above 1GHz (802.11a – U1 Ch. 40, Ant. Pol. H)



Plot 7-74. Radiated Spurious Plot above 1GHz (802.11a – U1 Ch. 40, Ant. Pol. V)



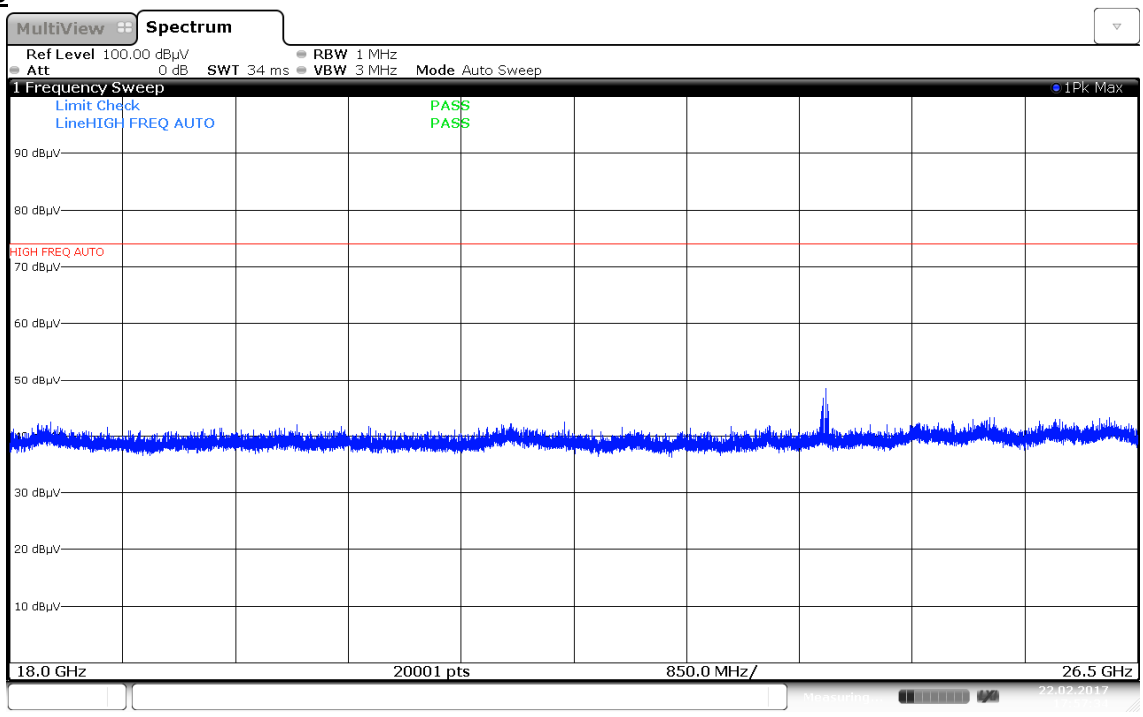
Plot 7-75. Radiated Spurious Plot above 1GHz (802.11a – U3 Ch. 157, Ant. Pol. H)



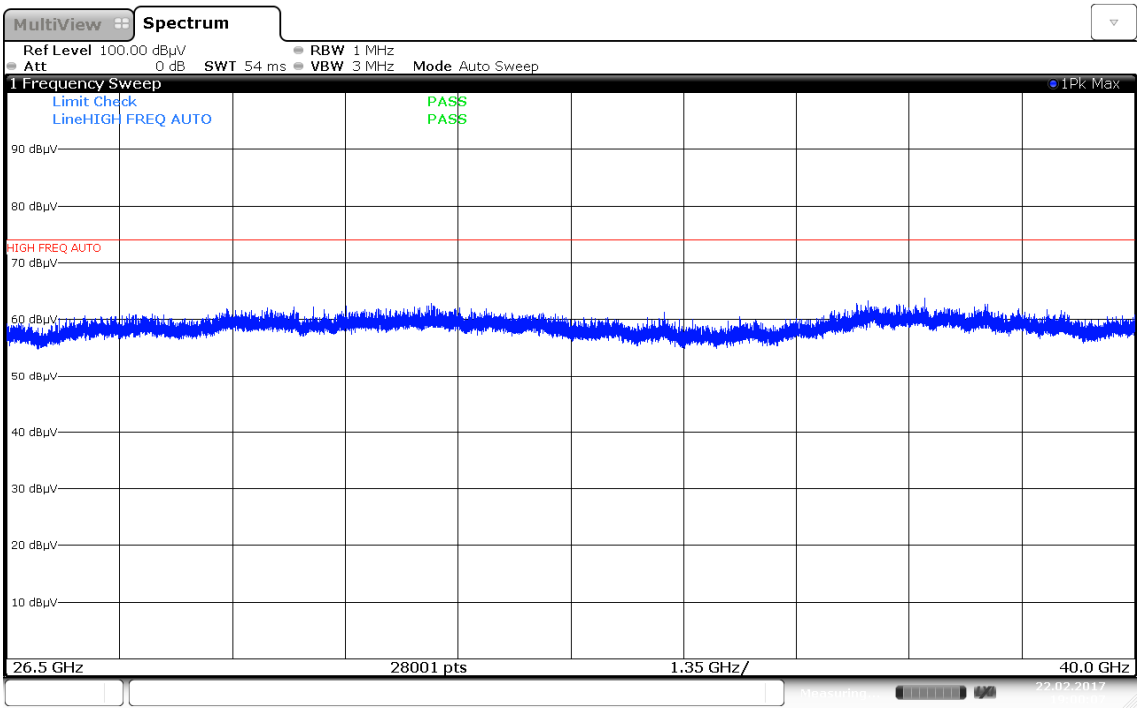
Plot 7-76. Radiated Spurious Plot above 1GHz (802.11a – U3 Ch. 157, Ant. Pol. V)

Antenna-1 Radiated Spurious Emissions Measurements (Above 18GHz)

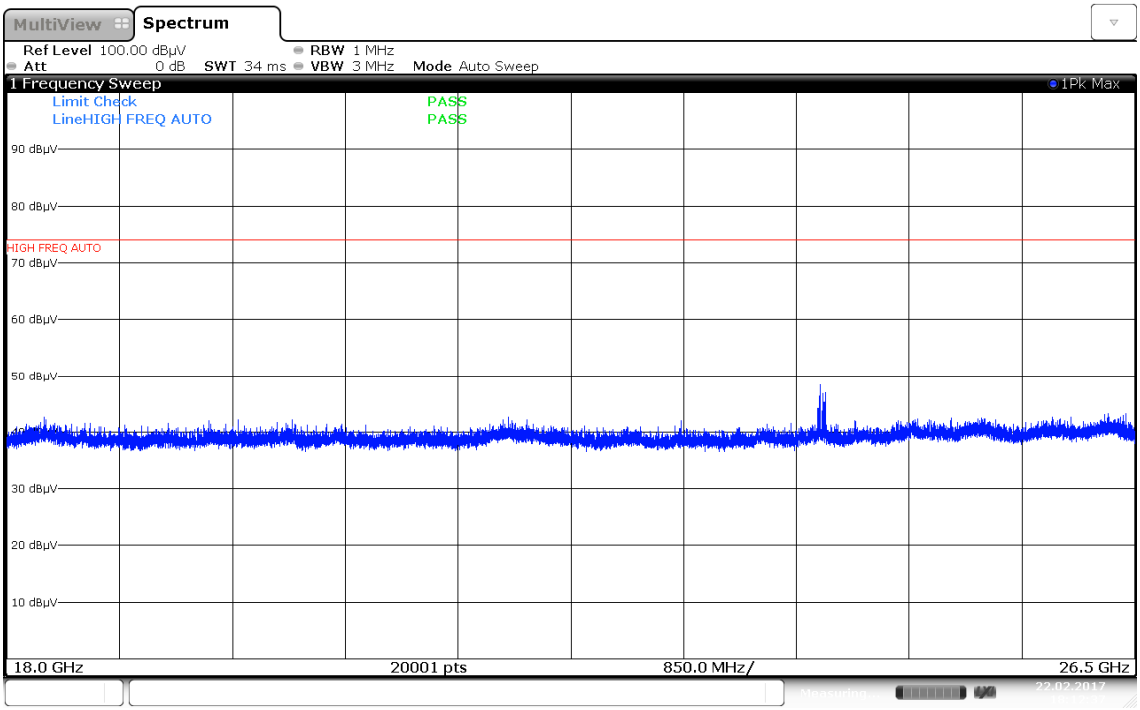
§15.209



Plot 7-77. Radiated Spurious Plot 18GHz - 26.5GHz (802.11a – Ant. Pol. H)



Plot 7-78. Radiated Spurious Plot 26.5GHz - 40GHz (802.11a – Ant. Pol. H)



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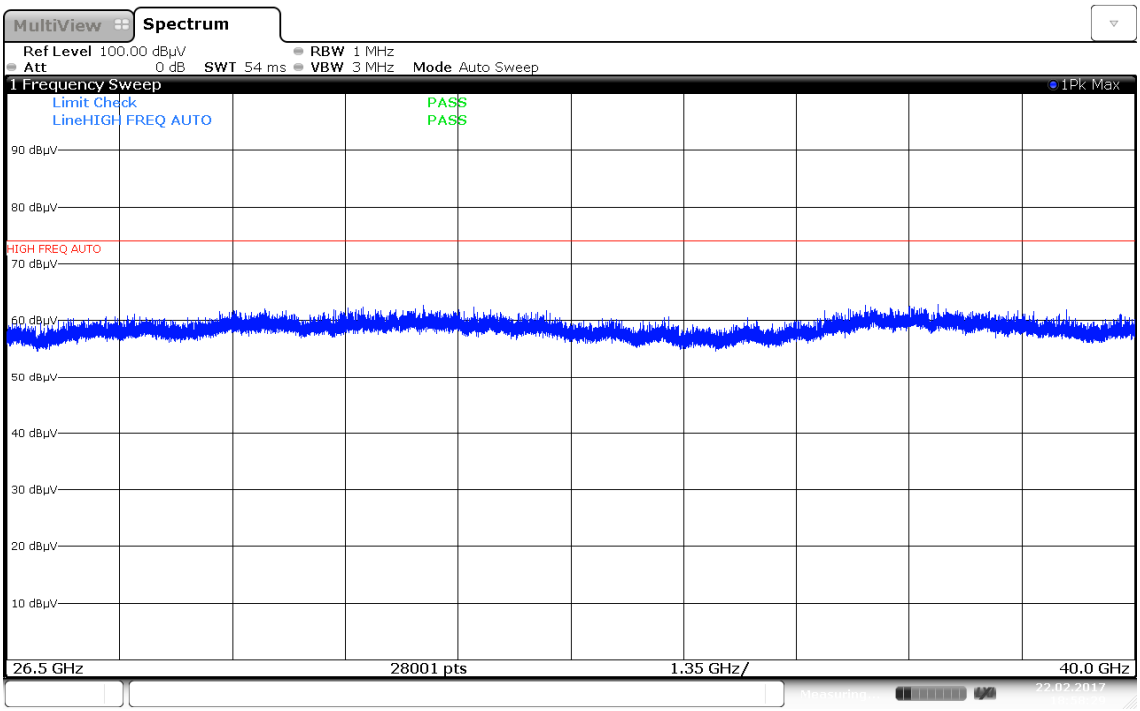
Plot 7-79. Radiated Spurious Plot above 18GHz - 26.5GHz (802.11a – Ant. Pol. V)



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Plot 7-80. Radiated Spurious Plot 26.5GHz - 40GHz (802.11a – Ant. Pol. V)

Antenna-1 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 Meter
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	100	164	-62.14	9.88	-9.54	45.20	68.20	-23.00
*	15540.00	Average	H	-	-	-73.07	12.76	-9.54	37.15	53.98	-16.83
*	15540.00	Peak	H	-	-	-63.02	12.76	-9.54	47.20	73.98	-26.78
*	20720.00	Average	H	-	-	-71.58	8.13	-9.54	34.01	53.98	-19.97
*	20720.00	Peak	H	-	-	-61.44	8.13	-9.54	44.15	73.98	-29.83
	25900.00	Peak	H	-	-	-58.10	8.50	-9.54	47.86	68.20	-20.34

Table 7-26. Radiated Measurements

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	1 Meter
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	100	168	-61.39	9.90	-9.54	45.97	68.20	-22.23
*	15600.00	Average	H	-	-	-73.48	13.11	-9.54	37.09	53.98	-16.89
*	15600.00	Peak	H	-	-	-63.89	13.11	-9.54	46.68	73.98	-27.30
*	20800.00	Average	H	-	-	-71.42	8.16	-9.54	34.19	53.98	-19.79
*	20800.00	Peak	H	-	-	-60.37	8.16	-9.54	45.24	73.98	-28.74
	26000.00	Peak	H	-	-	-58.11	8.52	-9.54	47.87	68.20	-20.33

Table 7-27. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 Meter
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	100	166	-61.88	10.24	-9.54	45.82	68.20	-22.38
*	15720.00	Average	H	-	-	-73.11	13.44	-9.54	37.79	53.98	-16.19
*	15720.00	Peak	H	-	-	-64.01	13.44	-9.54	46.89	73.98	-27.09
*	20960.00	Average	H	-	-	-70.76	8.12	-9.54	34.82	53.98	-19.16
*	20960.00	Peak	H	-	-	-59.90	8.12	-9.54	45.68	73.98	-28.30
	26200.00	Peak	H	-	-	-58.89	8.62	-9.54	47.19	68.20	-21.01

Table 7-28. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 Meter
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	100	167	-71.36	11.05	-9.54	37.15	53.98	-16.83
*	11490.00	Peak	H	100	167	-61.34	11.05	-9.54	47.17	73.98	-26.81
	17235.00	Peak	H	-	-	-61.46	17.22	-9.54	53.22	68.20	-14.98
*	22980.00	Average	H	100	187	-70.15	8.19	-9.54	35.50	53.98	-18.48
*	22980.00	Peak	H	100	187	-57.72	8.19	-9.54	47.93	73.98	-26.05
	28725.00	Peak	H	-	-	-44.70	-9.45	-9.54	43.31	68.20	-24.89

Table 7-29. Radiated Measurements

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	1 Meter
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	194	-70.69	10.87	-9.54	37.64	53.98	-16.34
*	11570.00	Peak	H	100	194	-60.63	10.87	-9.54	47.70	73.98	-26.28
	17355.00	Peak	H	-	-	-61.45	16.71	-9.54	52.72	68.20	-15.48
	23140.00	Peak	H	100	172	-59.13	8.47	-9.54	46.79	68.20	-21.41
	28925.00	Peak	H	-	-	-43.46	-9.71	-9.54	44.29	68.20	-23.91

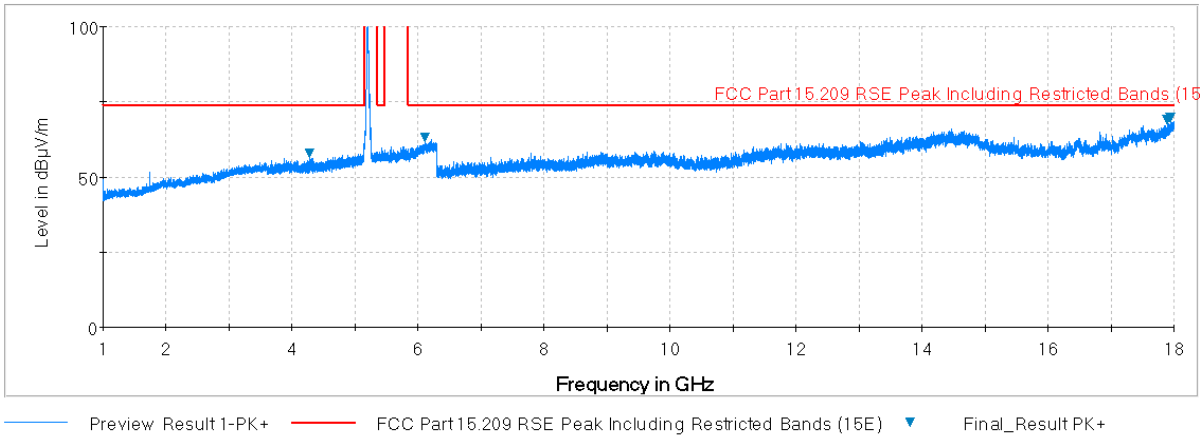
Table 7-30. Radiated Measurements

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

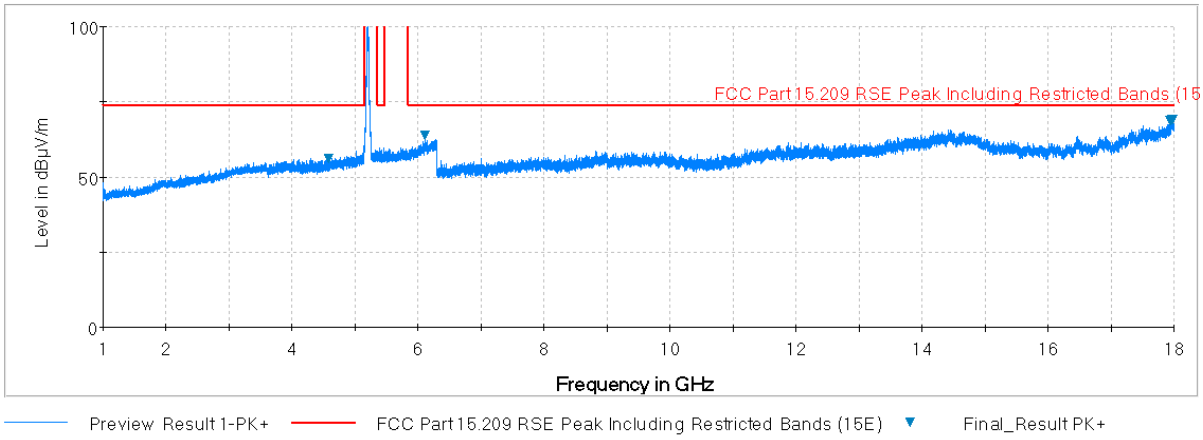
	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	11650.00	Average	H	100	173	-71.89	10.92	-9.54	36.49	53.98	-17.49
*	11650.00	Peak	H	100	173	-62.31	10.92	-9.54	46.07	73.98	-27.91
	17475.00	Peak	H	-	-	-61.11	15.82	-9.54	52.17	68.20	-16.03
	23300.00	Peak	H	100	177	-60.32	8.60	-9.54	45.74	68.20	-22.46
	29125.00	Peak	H	-	-	-45.03	-9.93	-9.54	42.50	68.20	-25.70

Table 7-31. Radiated Measurements

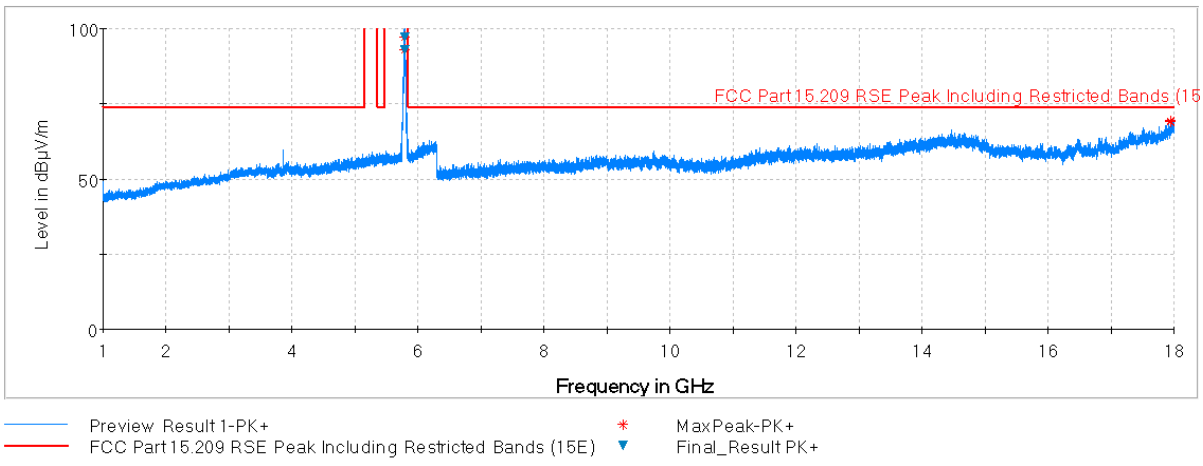
7.7.2 Antenna-2 Radiated Spurious Emission Measurements



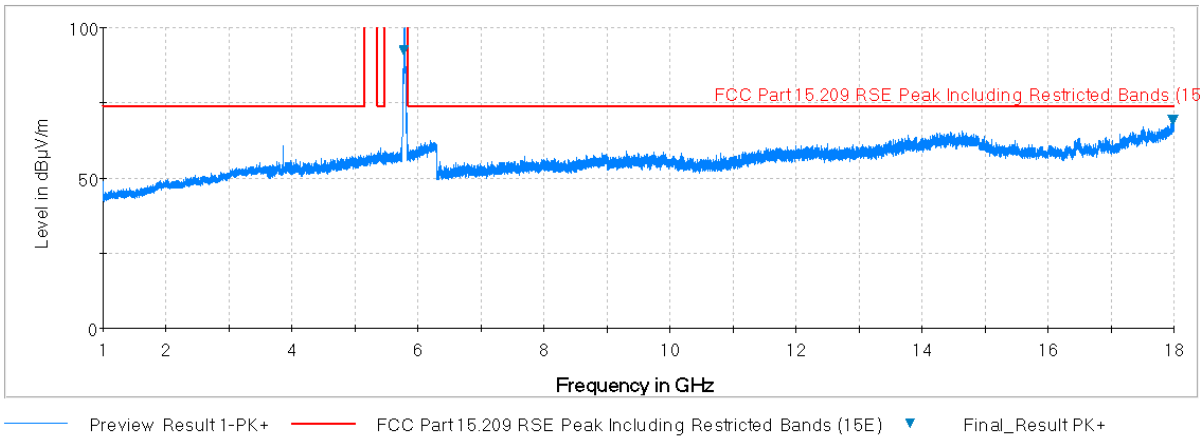
Plot 7-81. Radiated Spurious Plot above 1GHz (802.11a – U1 Ch. 40, Ant. Pol. H)



Plot 7-82. Radiated Spurious Plot above 1GHz (802.11a – U1 Ch. 40, Ant. Pol. V)



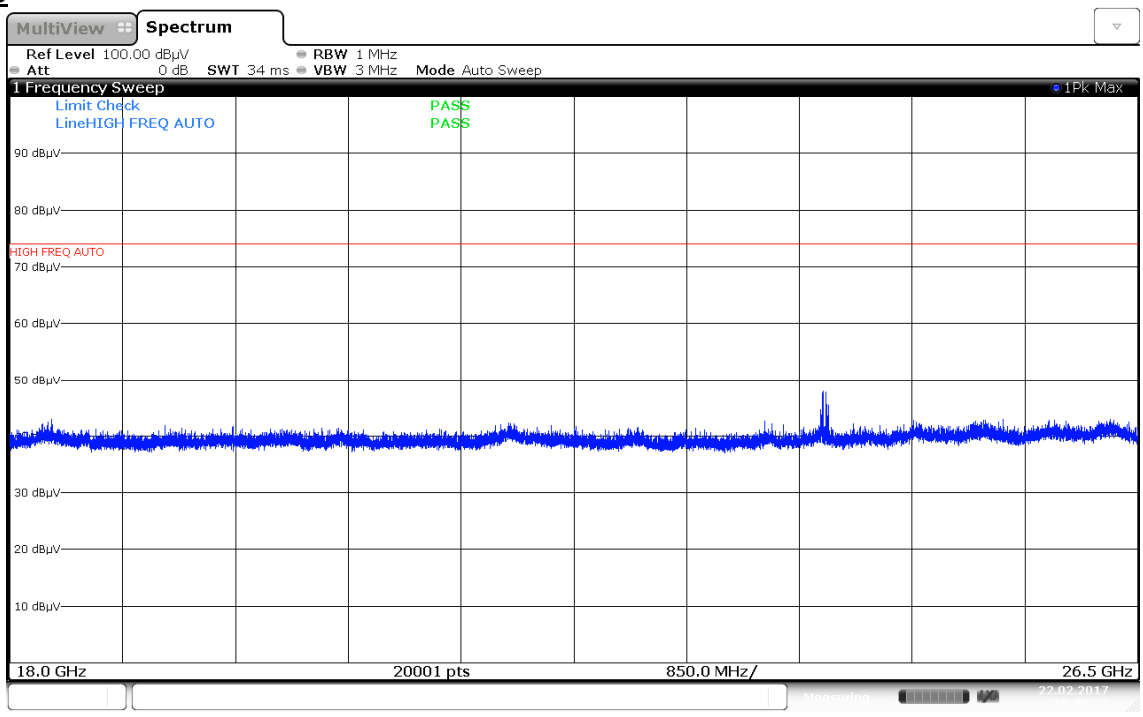
Plot 7-83. Radiated Spurious Plot above 1GHz (802.11a – U3 Ch. 157, Ant. Pol. H)



Plot 7-84. Radiated Spurious Plot above 1GHz (802.11a – U3 Ch. 157, Ant. Pol. V)

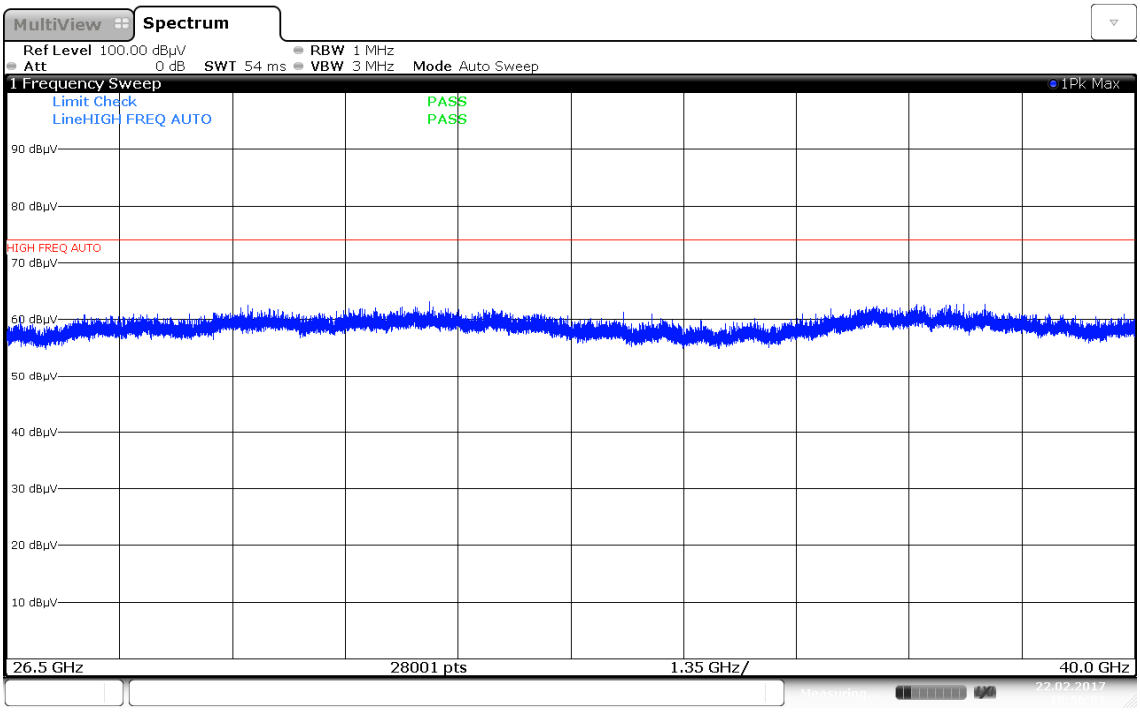
Antenna-2 Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209



18:39:25 22.02.2017

Plot 7-85. Radiated Spurious Plot above 18GHz - 26.5GHz (802.11a – Ant. Pol. H)

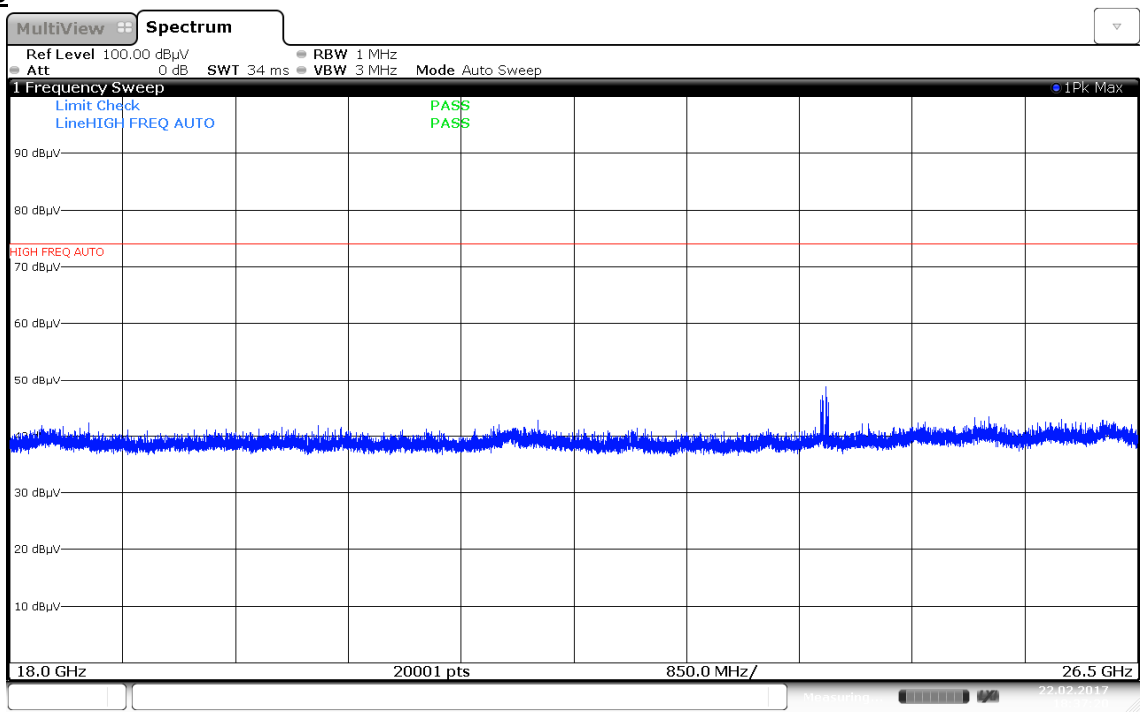


18:56:01 22.02.2017

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

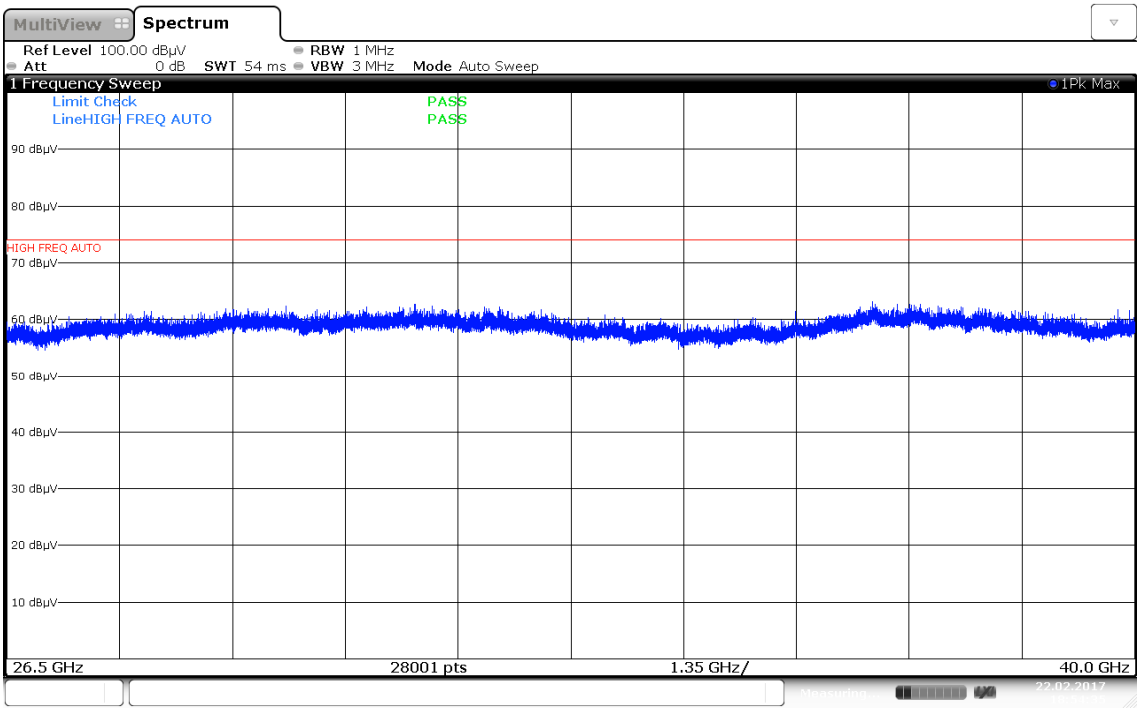
Antenna-2 Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209



18:37:21 22.02.2017

Plot 7-87. Radiated Spurious Plot 26.5GHz - 40GHz (802.11a – Ant. Pol. H)



18:54:36 22.02.2017

Plot 7-88. Radiated Spurious Plot above 26.5GHz - 40GHz (802.11a – Ant. Pol. V)

Antenna-2 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 Meter
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	100	172	-57.38	9.88	-9.54	49.96	68.20	-18.24
*	15540.00	Average	H	-	-	-77.49	12.76	-9.54	32.72	53.98	-21.26
*	15540.00	Peak	H	-	-	-67.20	12.76	-9.54	43.01	73.98	-30.97
*	20720.00	Average	H	-	-	-70.34	8.13	-9.54	35.25	53.98	-18.73
*	20720.00	Peak	H	-	-	-60.18	8.13	-9.54	45.41	73.98	-28.57
	25900.00	Peak	H	-	-	-58.15	8.50	-9.54	47.81	68.20	-20.39

Table 7-32. Radiated Measurements

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	1 Meter
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	100	168	-58.32	9.90	-9.54	49.04	68.20	-19.16
*	15600.00	Average	H	-	-	-73.51	13.11	-9.54	37.06	53.98	-16.92
*	15600.00	Peak	H	-	-	-63.79	13.11	-9.54	46.78	73.98	-27.20
*	20800.00	Average	H	-	-	-71.16	8.16	-9.54	34.45	53.98	-19.53
*	20800.00	Peak	H	-	-	-60.80	8.16	-9.54	44.81	73.98	-29.17
	26000.00	Peak	H	-	-	-58.40	8.52	-9.54	47.58	68.20	-20.62

Table 7-33. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 Meter
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	100	173	-58.49	10.24	-9.54	49.21	68.20	-18.99
*	15720.00	Average	H	-	-	-74.52	13.44	-9.54	36.38	53.98	-17.60
*	15720.00	Peak	H	-	-	-64.14	13.44	-9.54	46.76	73.98	-27.22
*	20960.00	Average	H	-	-	-71.56	8.12	-9.54	34.02	53.98	-19.96
*	20960.00	Peak	H	-	-	-60.36	8.12	-9.54	45.22	73.98	-28.76
	26200.00	Peak	H	-	-	-59.20	8.62	-9.54	46.88	68.20	-21.32

Table 7-34. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 Meter
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	100	181	-71.77	11.05	-9.54	36.74	53.98	-17.24
*	11490.00	Peak	H	100	181	-61.87	11.05	-9.54	46.64	73.98	-27.34
	17235.00	Peak	H	-	-	-61.91	17.22	-9.54	52.77	68.20	-15.43
*	22980.00	Average	H	100	185	-69.72	8.19	-9.54	35.93	53.98	-18.05
*	22980.00	Peak	H	100	185	-58.16	8.19	-9.54	47.49	73.98	-26.49
	28725.00	Peak	H	-	-	-44.36	-9.45	-9.54	43.65	68.20	-24.55

Table 7-35. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 Meter
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	185	-71.89	10.87	-9.54	36.44	53.98	-17.54
*	11570.00	Peak	H	100	185	-61.73	10.87	-9.54	46.60	73.98	-27.38
	17355.00	Peak	H	-	-	-61.45	16.71	-9.54	52.72	68.20	-15.48
	23140.00	Peak	H	100	181	-59.10	8.47	-9.54	46.82	68.20	-21.38
	28925.00	Peak	H	-	-	-44.99	-9.71	-9.54	42.76	68.20	-25.44

Table 7-36. Radiated Measurements

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6 Mbps
Distance of Measurements: 1 Meter
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	191	-71.36	10.92	-9.54	37.02	53.98	-16.96
*	11650.00	Peak	H	100	191	-61.41	10.92	-9.54	46.97	73.98	-27.01
	17475.00	Peak	H	-	-	-60.15	15.82	-9.54	53.13	68.20	-15.07
	23300.00	Peak	H	100	178	-59.29	8.60	-9.54	46.77	68.20	-21.43
	29125.00	Peak	H	-	-	-44.46	-9.93	-9.54	43.07	68.20	-25.13

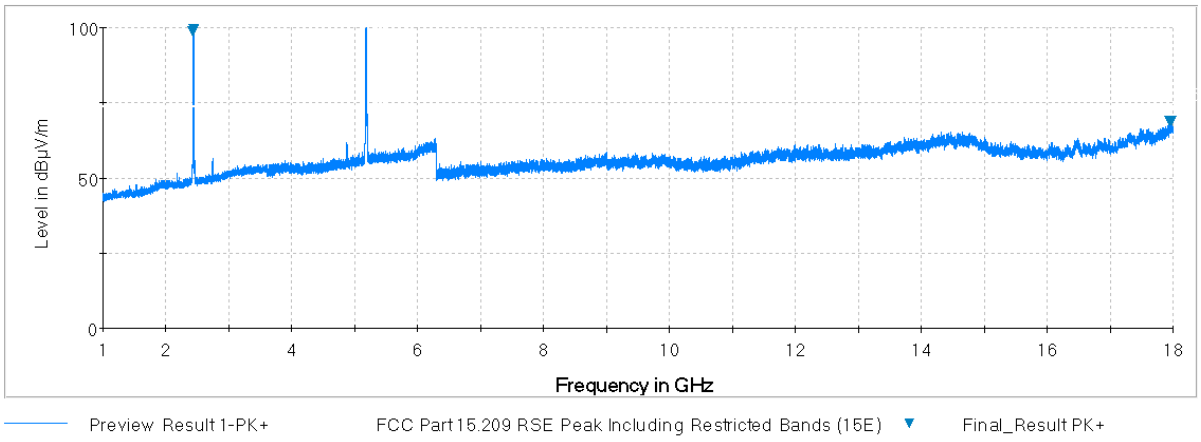
Table 7-37. Radiated Measurements

7.7.3 Simultaneous Tx Radiated Spurious Emissions Measurements

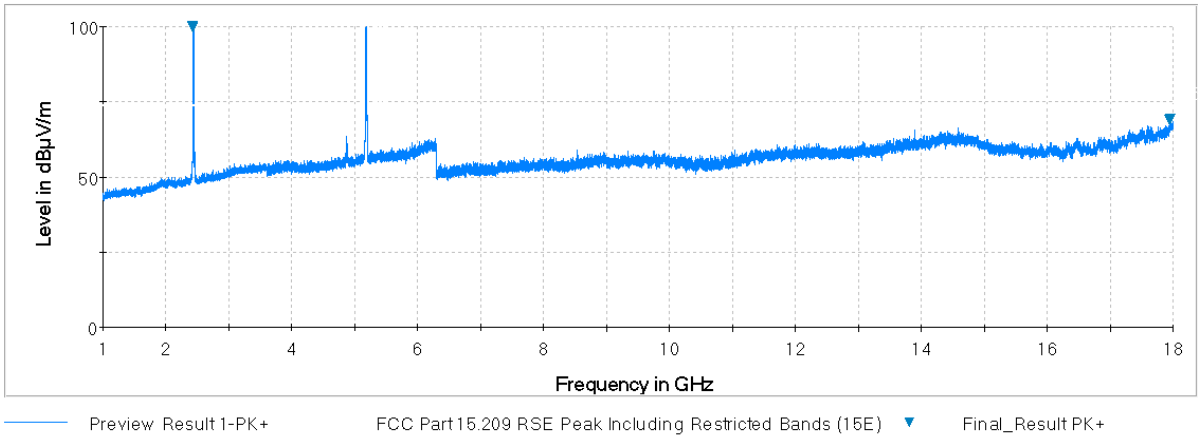
§15.247(d) §15.205 & §15.209

Description	2.4 GHz Emission	5 GHz Emisison
Antenna	ALL	ALL
Channel	6	36
Operating Frequency(MHz)	2437	5180
Data Rate (Mbps)	6	6
Band	WLAN	UNII 1
Mode	802.11g	802.11a

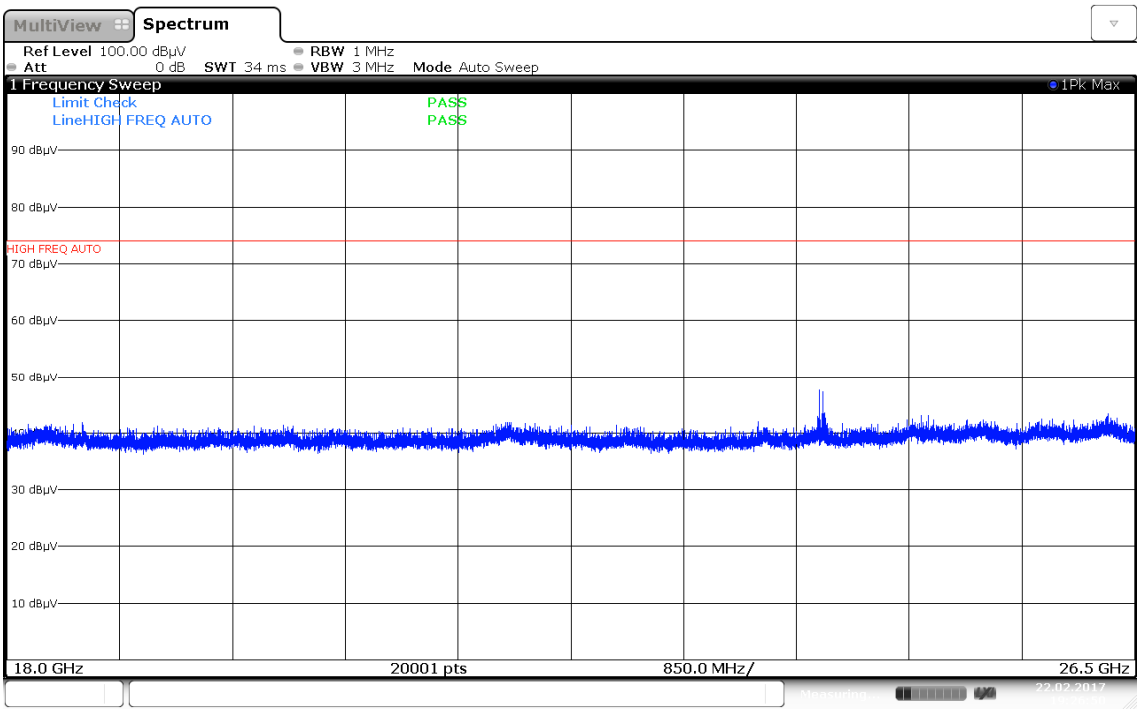
Table 7-38. Simultaneous Transmission Config-1



Plot 7-89. Radiated Spurious Plot above 1GHz (2.4GHz – 5GHz, Ant. Pol. H)

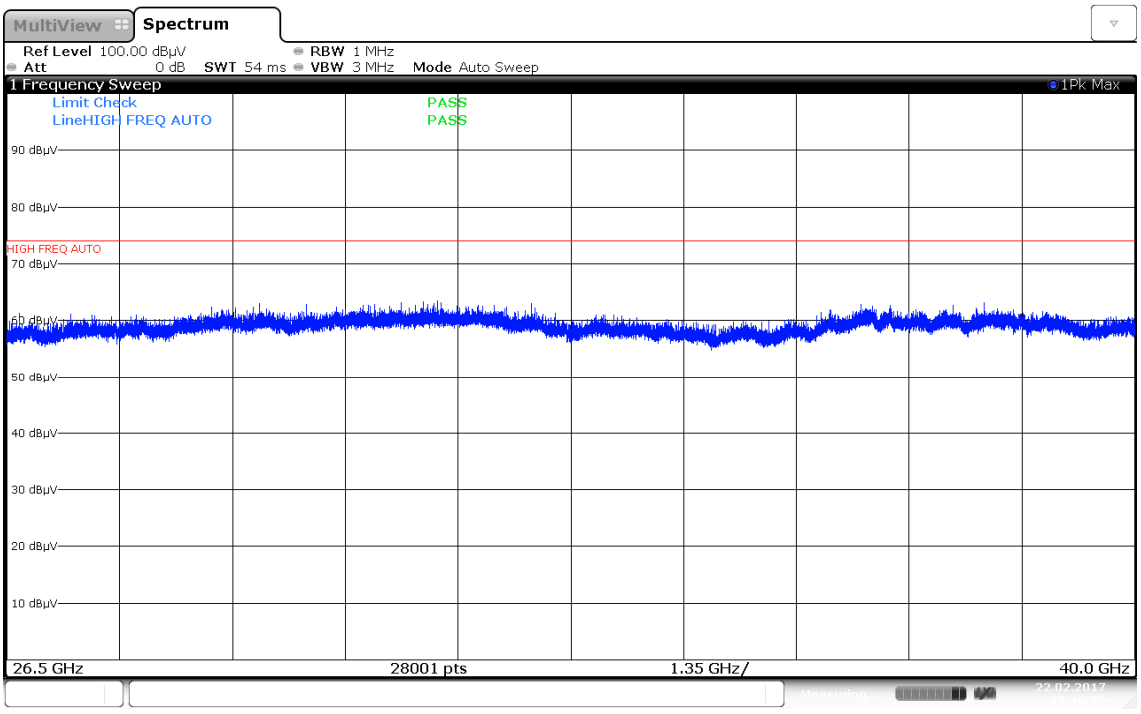


Plot 7-90. Radiated Spurious Plot above 1GHz (2.4GHz – 5GHz, Ant. Pol. V)



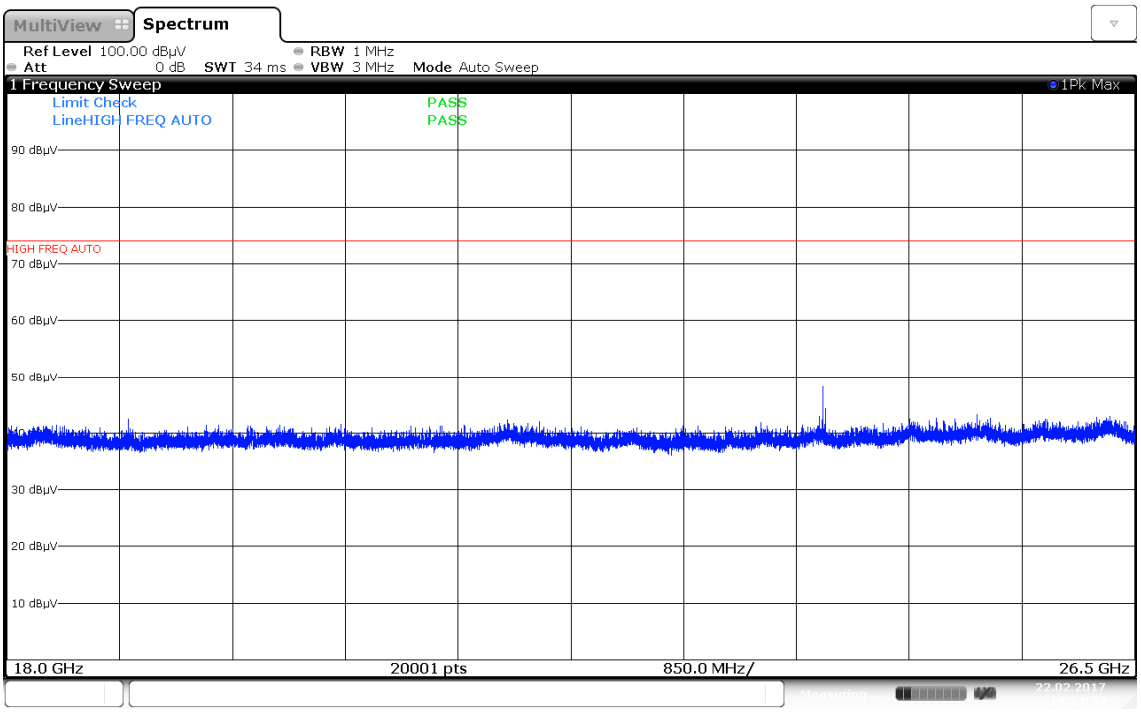
19:26:50 22.02.2017

Plot 7-91. Radiated Spurious Plot above 18GHz - 26.5GHz (802.11a – Ant. Pol. H)



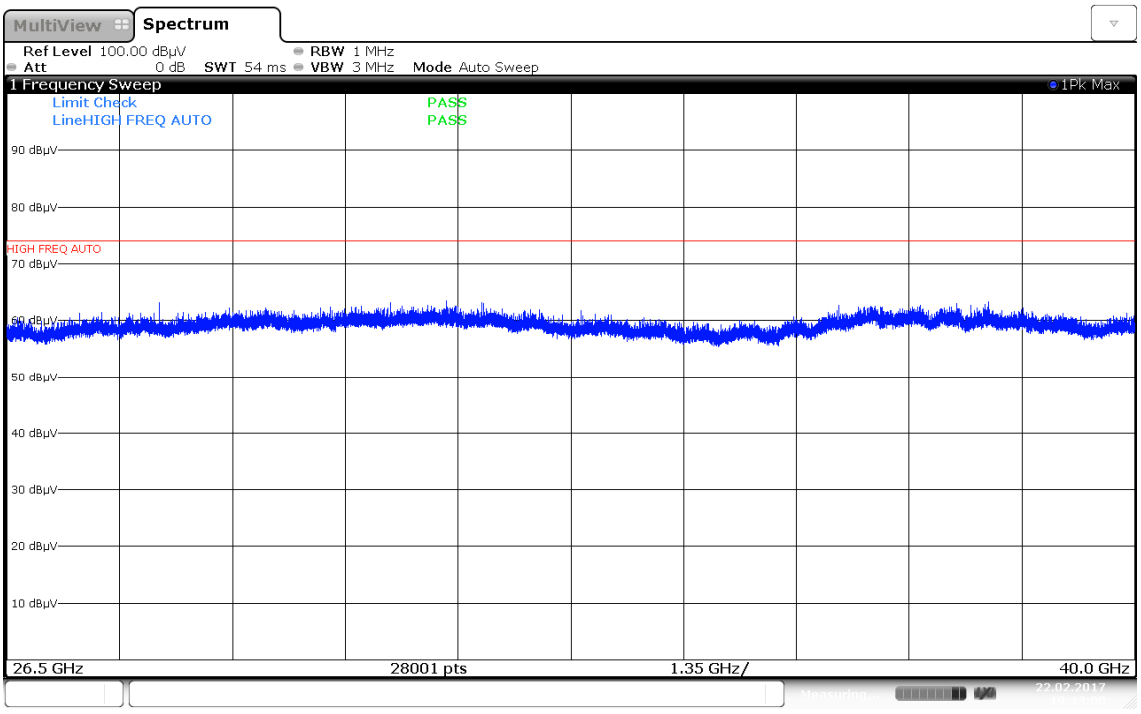
19:41:00 22.02.2017

Plot 7-92. Radiated Spurious Plot 26.5GHz - 40GHz (802.11a – Ant. Pol. H)



19:24:53 22.02.2017

Plot 7-93. Radiated Spurious Plot above 18GHz - 26.5GHz (802.11a – Ant. Pol. V)



19:43:09 22.02.2017

Plot 7-94. Radiated Spurious Plot 26.5GHz - 40GHz (802.11a – Ant. Pol. V)

	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	3028.00	Average	H	-	-	-68.28	-3.80	34.92	53.98	-19.06
	3028.00	Peak	H	-	-	-57.14	-3.80	46.06	73.98	-27.92
	5763.00	Average	H	-	-	-69.72	3.10	40.38	53.98	-13.60
	5763.00	Peak	H	-	-	-58.04	3.10	52.06	73.98	-21.92
	7912.00	Average	H	-	-	-69.93	-14.61	22.46	53.98	-31.52
	7912.00	Peak	H	-	-	-57.84	-14.61	34.55	73.98	-39.43
*	8498.00	Average	H	-	-	-70.34	-14.80	21.86	53.98	-32.12
*	8498.00	Peak	H	-	-	-59.32	-14.80	32.88	73.98	-41.10
*	10647.00	Peak	H	-	-	-70.41	-12.95	23.64	53.98	-30.34
*	10647.00	Average	H	-	-	-58.24	-12.95	35.81	73.98	-38.17

Table 7-39. Radiated Measurements (ANT1 2.4GHz – ANT2 5GHz, Ant. Pol. H)

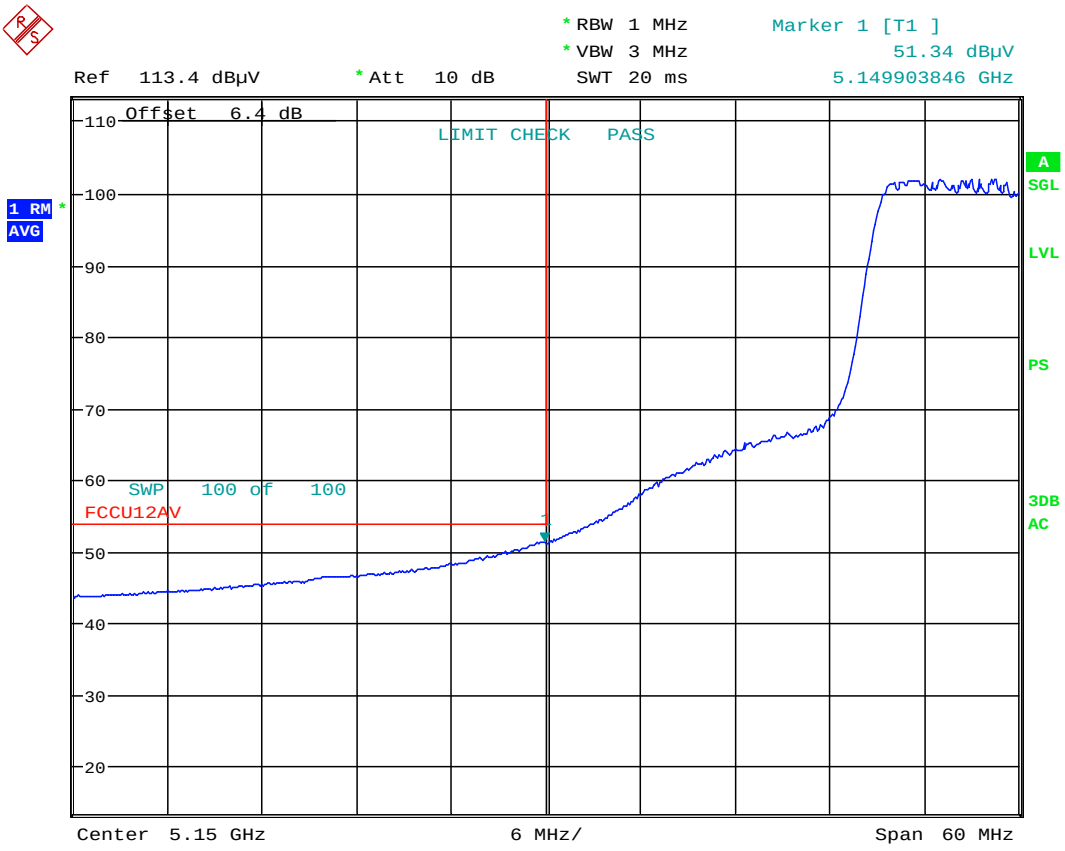
	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
	3028.00	Average	V	-	-	-68.49	-3.80	34.71	53.98	-19.27
	3028.00	Peak	V	-	-	-56.72	-3.80	46.48	73.98	-27.50
	5763.00	Average	V	-	-	-69.71	3.10	40.39	53.98	-13.59
	5763.00	Peak	V	-	-	-58.41	3.10	51.69	73.98	-22.29
	7912.00	Average	V	-	-	-69.62	-14.61	22.77	53.98	-31.21
	7912.00	Peak	V	-	-	-58.58	-14.61	33.81	73.98	-40.17
*	8498.00	Average	V	-	-	-70.63	-14.80	21.57	53.98	-32.41
*	8498.00	Peak	V	-	-	-59.20	-14.80	33.00	73.98	-40.98
*	10647.00	Average	V	-	-	-70.36	-12.95	23.69	53.98	-30.29
*	10647.00	Peak	V	-	-	-58.40	-12.95	35.65	73.98	-38.33

Table 7-40. Radiated Measurements (ANT1 2.4GHz – ANT2 5GHz, Ant. Pol. V)

7.7.4 Antenna-1 Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

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

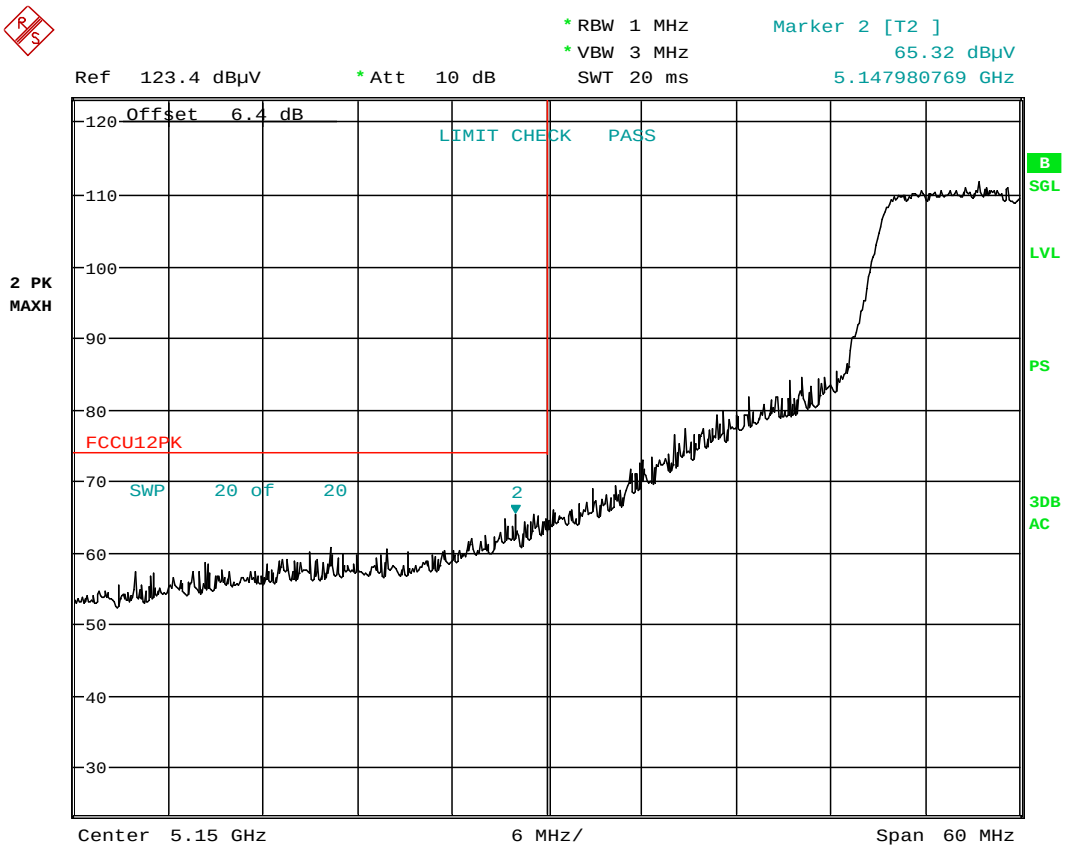


Date: 13.FEB.2017 08:57:08

Plot 7-95. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

Antenna-1 Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209



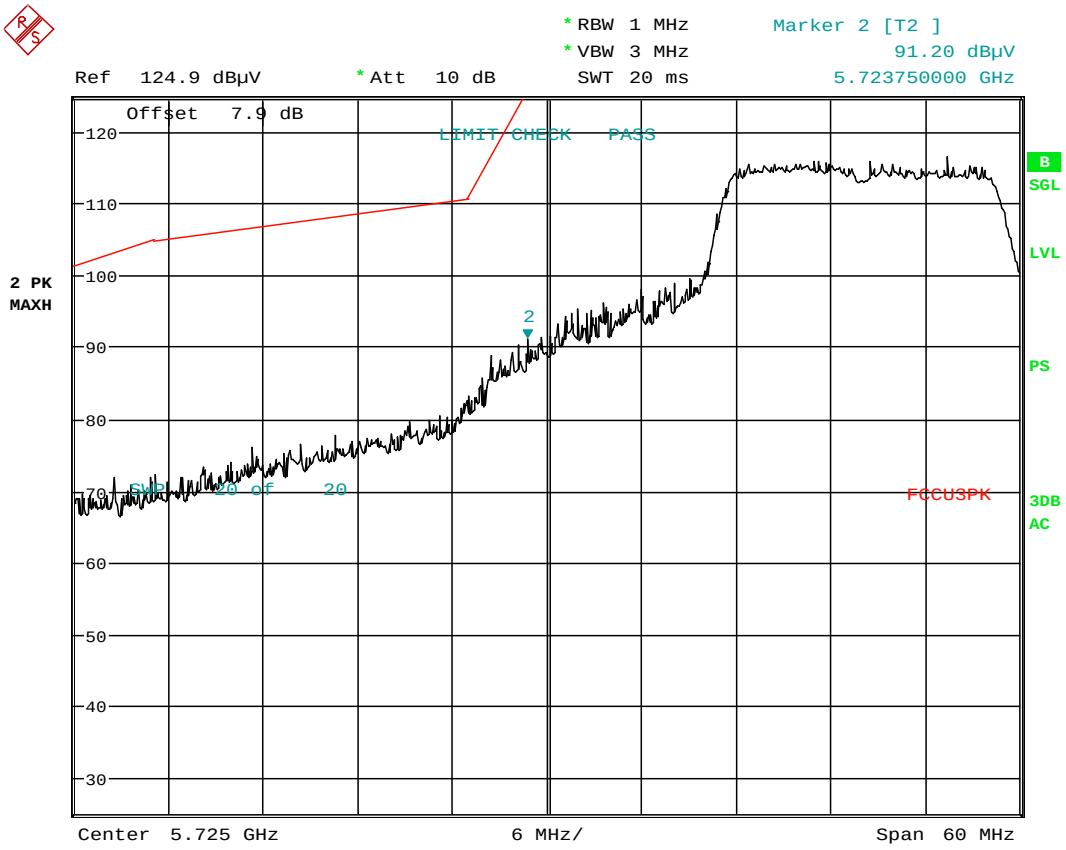
Date: 13.FEB.2017 08:57:56

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

Antenna-1 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



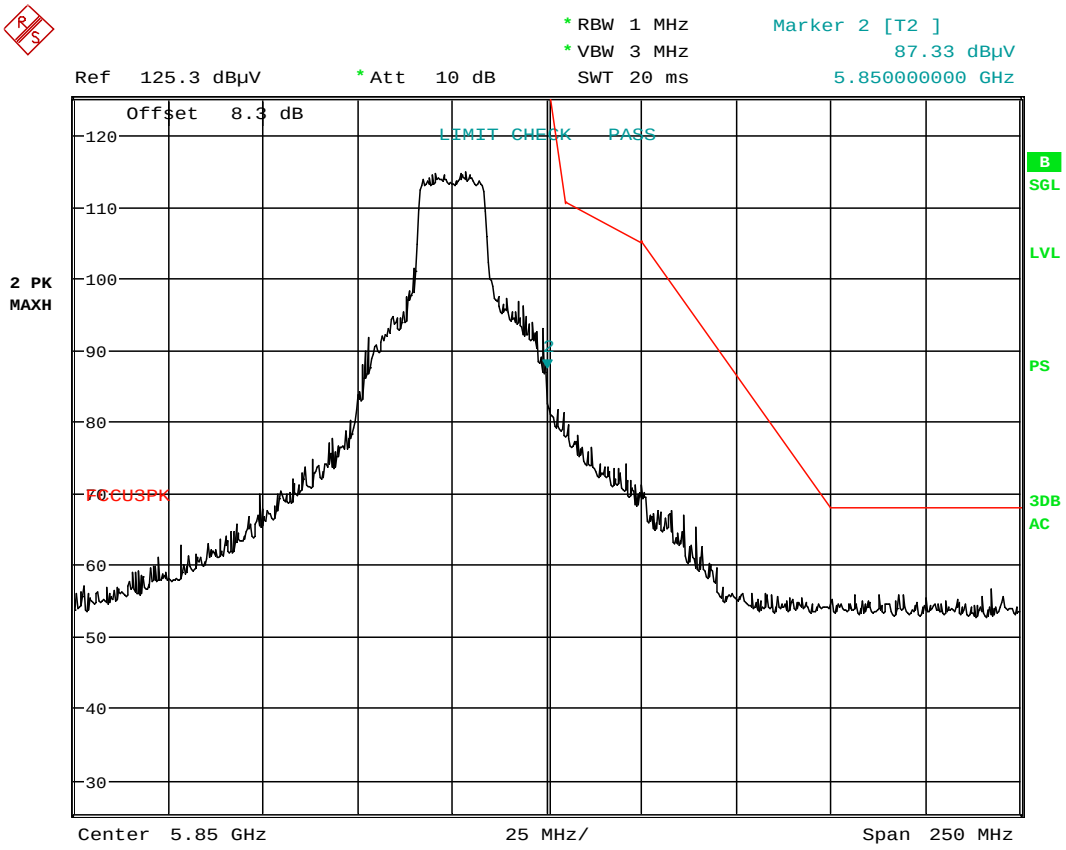
Date: 13.FEB.2017 09:12:23

Plot 7-97. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

Antenna-1 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: 13.FEB.2017 09:18:29

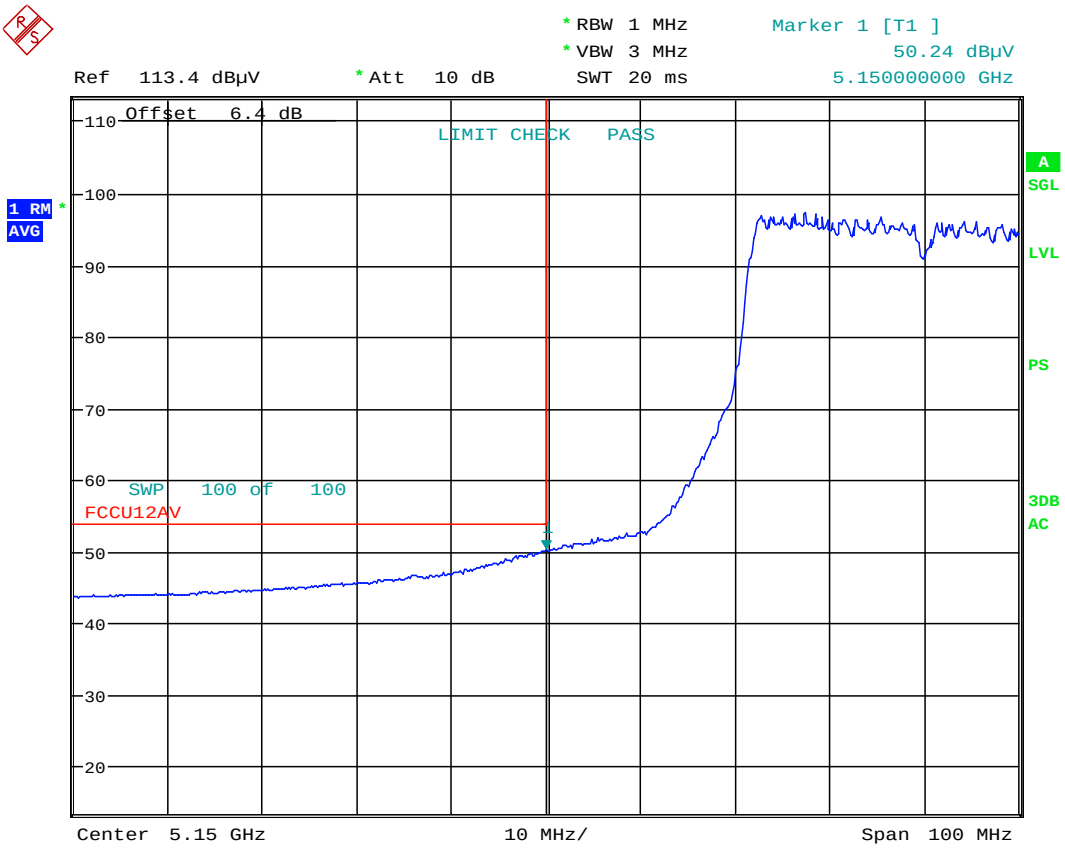
Plot 7-98. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

V 6.5
05/19/2017

7.7.5 Antenna-1 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



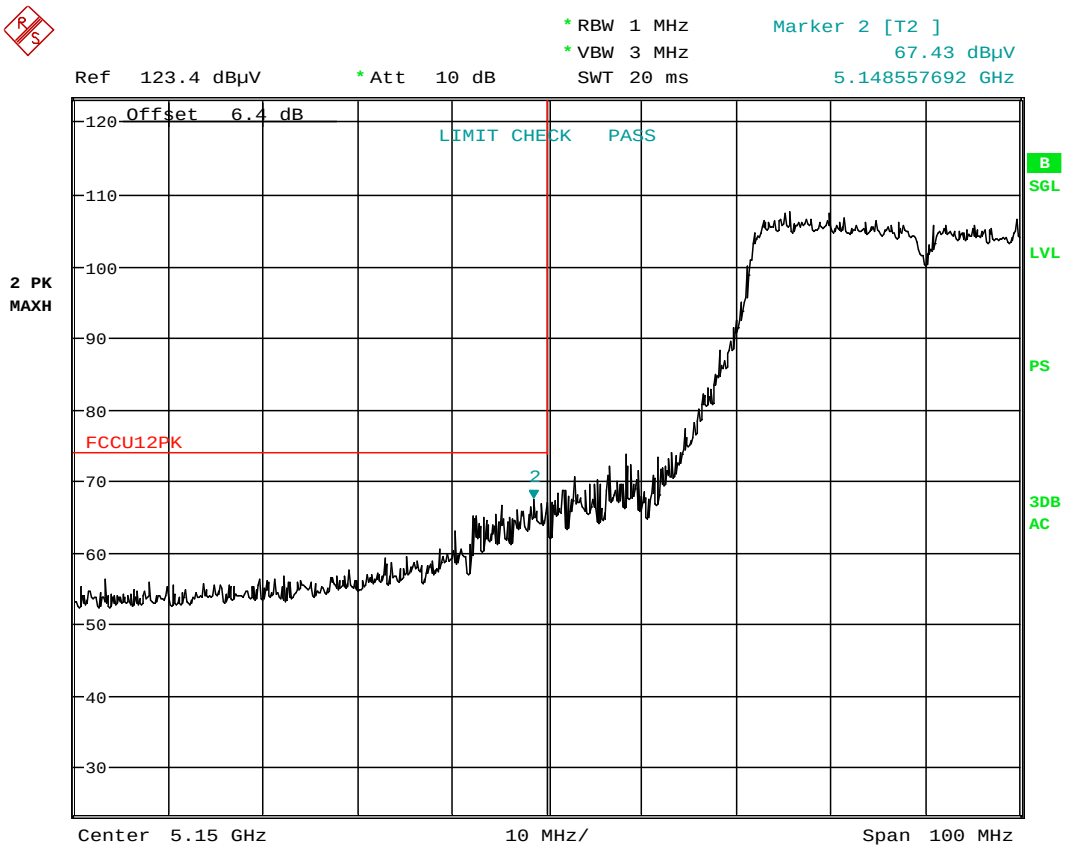
Date: 15.FEB.2017 08:33:22

Plot 7-99. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

V 6.5
05/19/2017

Antenna-1 Radiated Band Edge Measurements (40MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209



Date: 15.FEB.2017 08:33:58

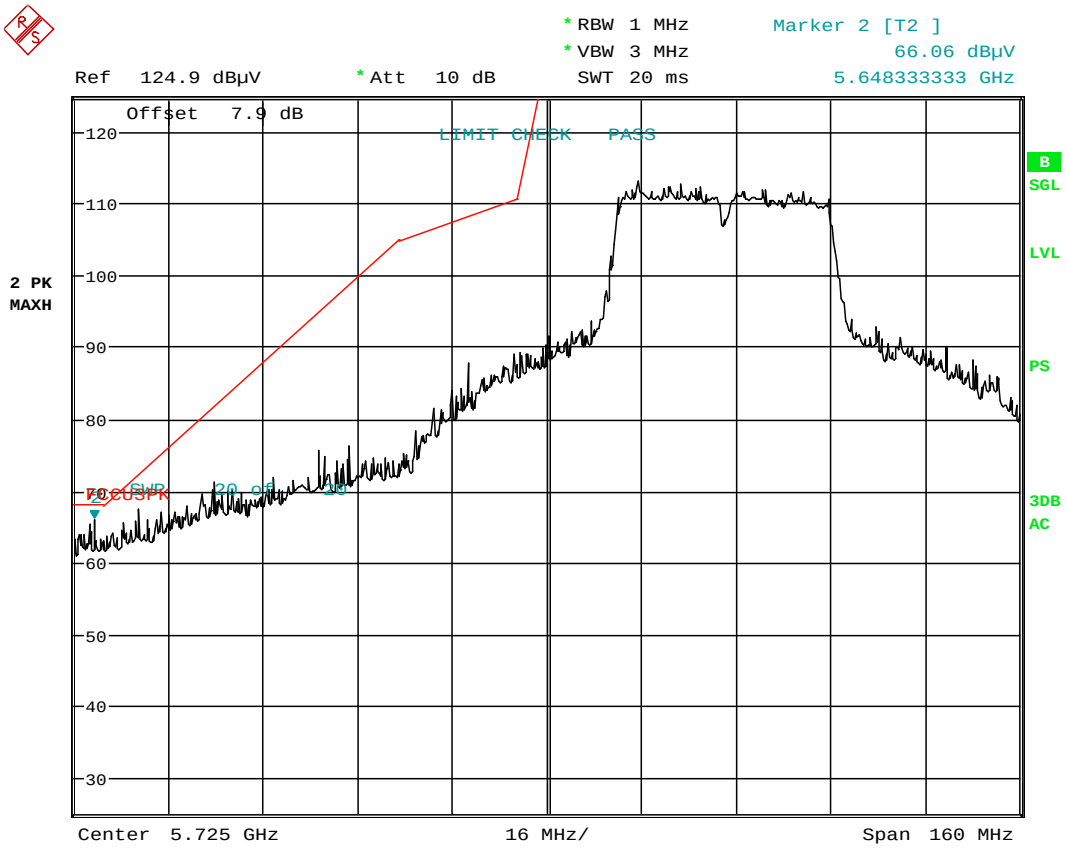
Plot 7-100. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

V 6.5
05/19/2017

Antenna-1 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



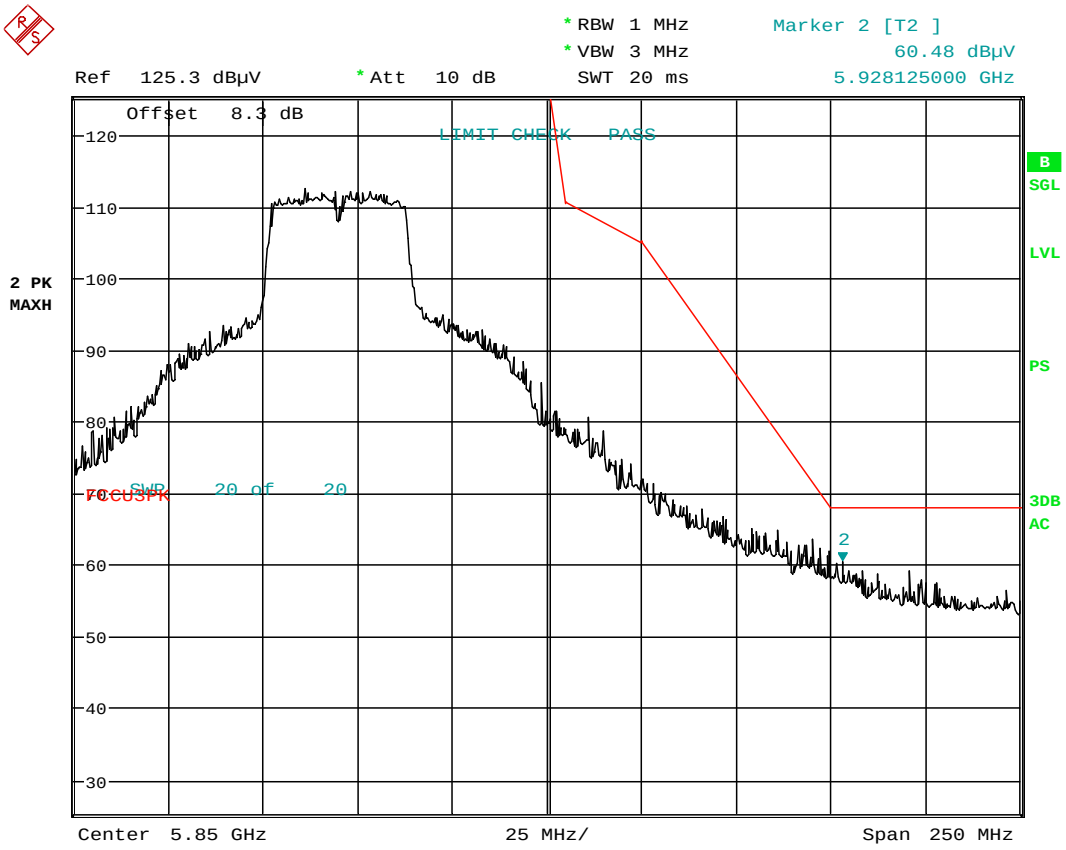
Date: 15.FEB.2017 08:54:05

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

Antenna-1 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



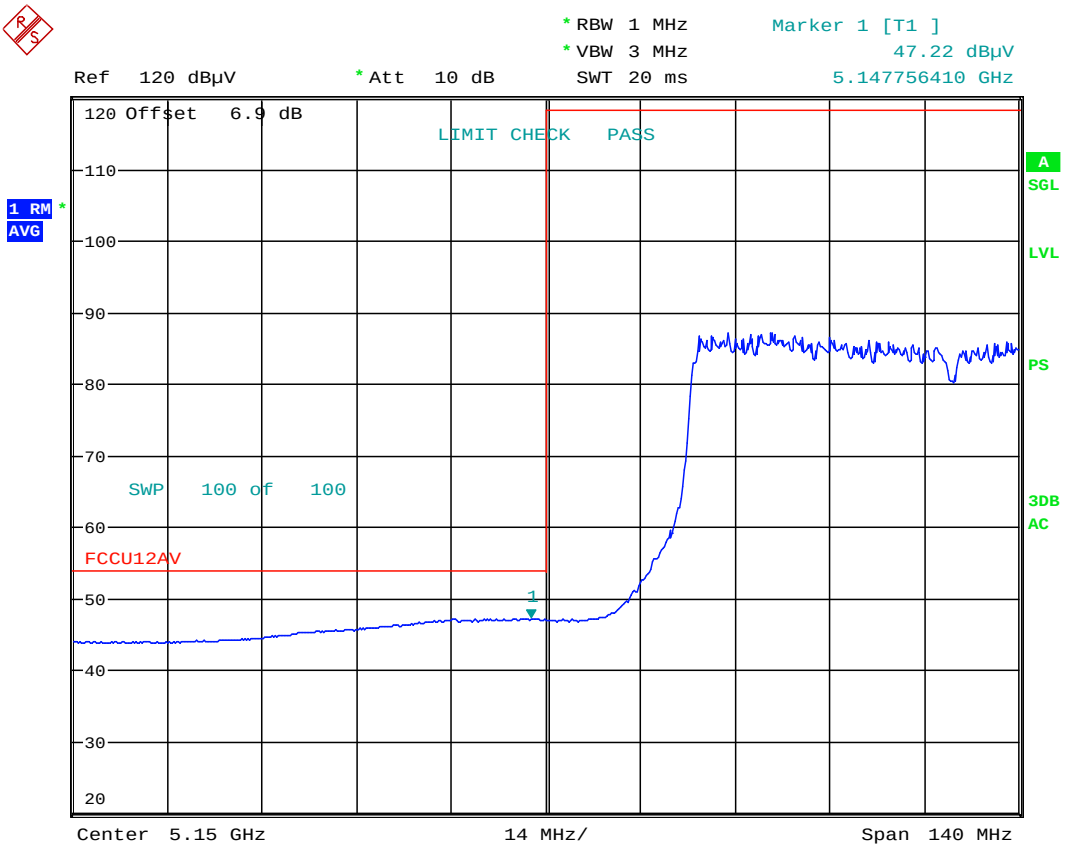
Date: 15.FEB.2017 09:03:46

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

7.7.6 Antenna-1 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:	5210MHz
Channel:	42

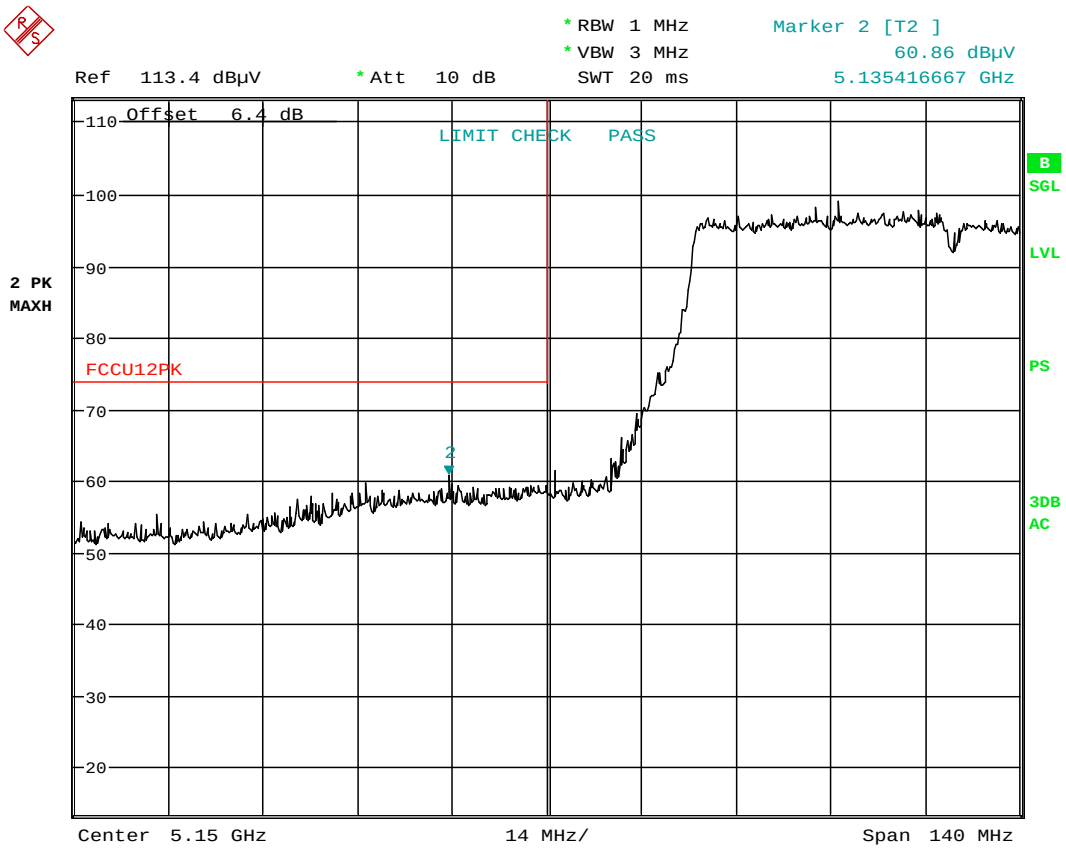


Date: 13.FEB.2017 09:28:14

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

Antenna-1 Radiated Band Edge Measurements (80MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209



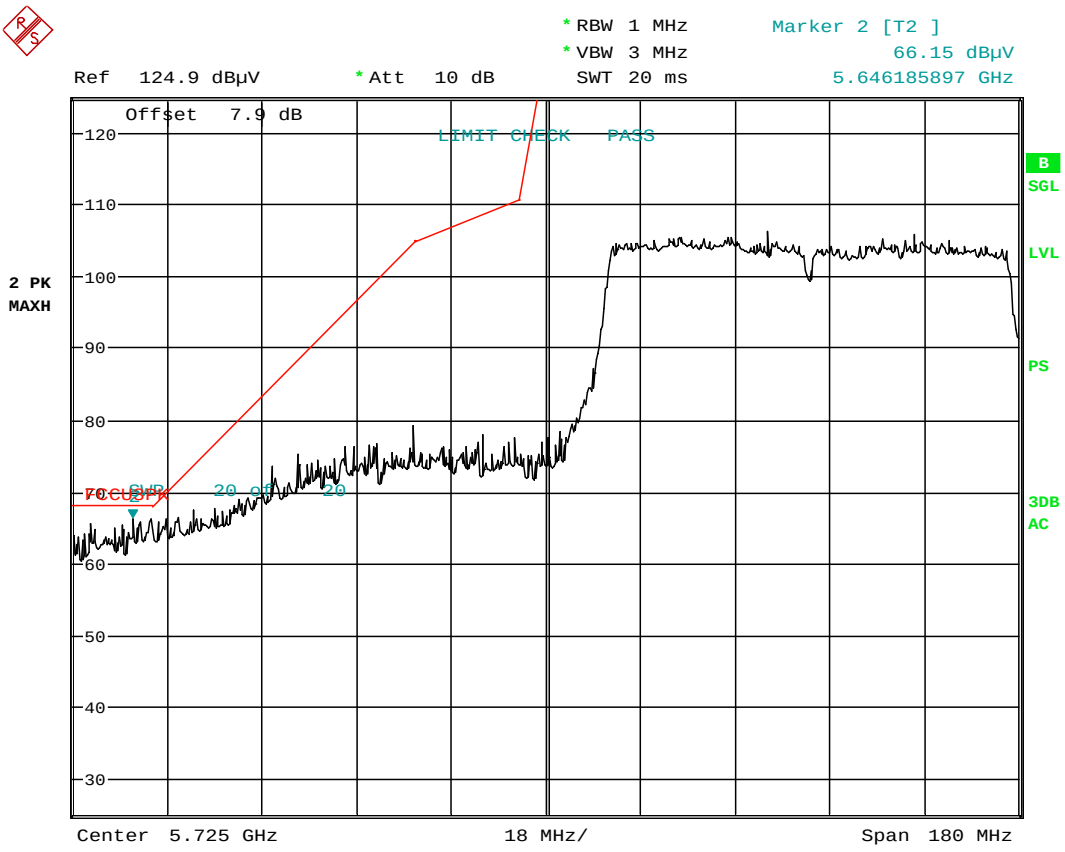
Date: 13.FEB.2017 11:16:18

Plot 7-104. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

Antenna-1 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



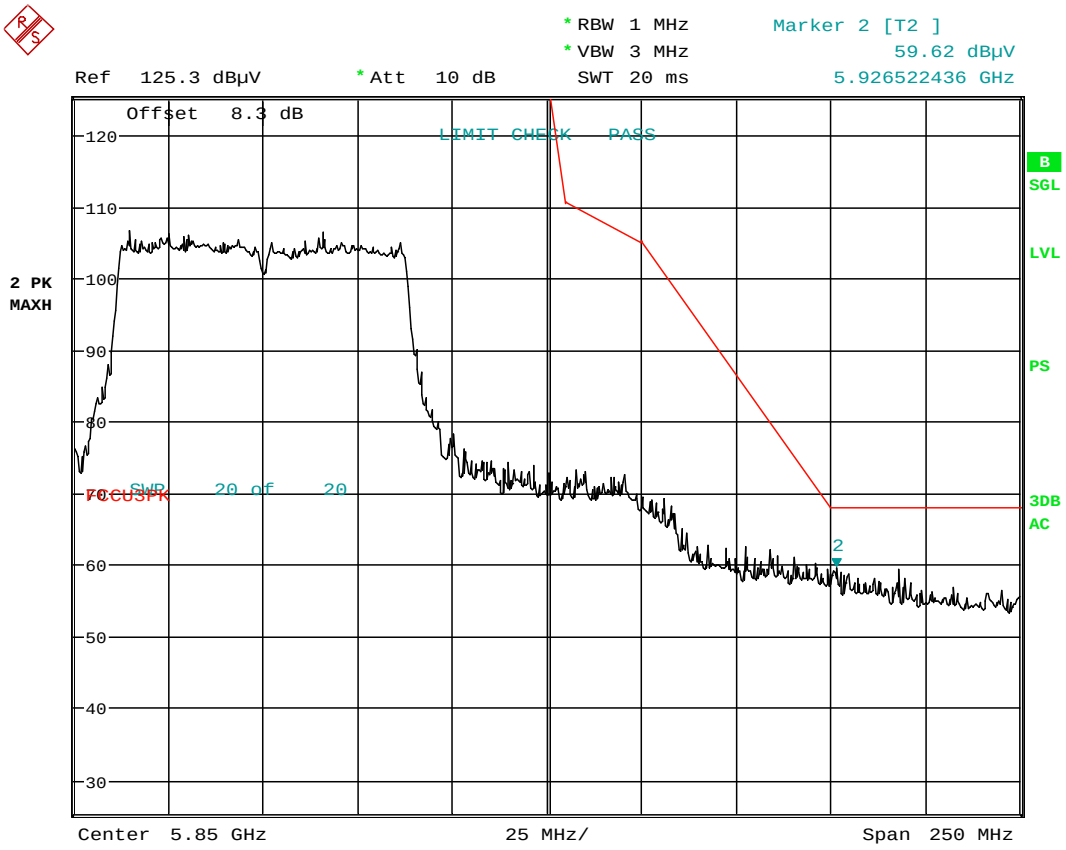
Date: 13.FEB.2017 10:05:43

Plot 7-105. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

Antenna-1 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



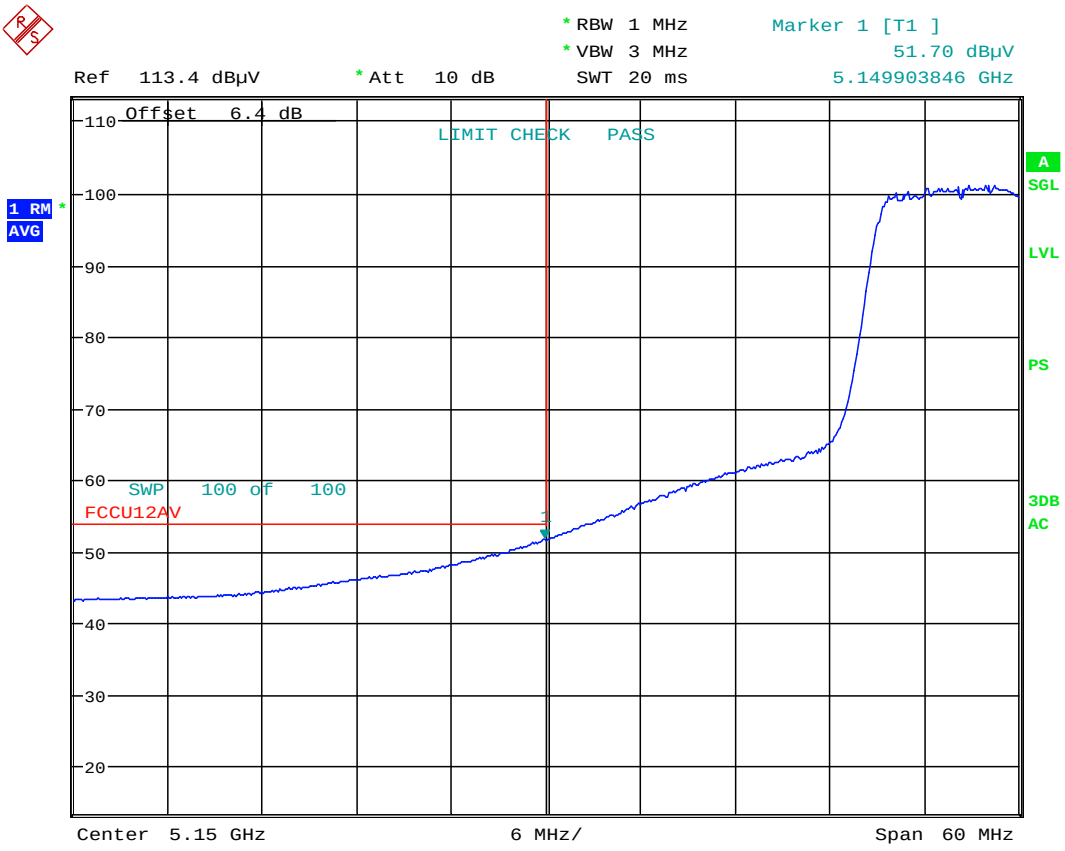
Date: 13.FEB.2017 10:07:15

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

7.7.7 Antenna-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

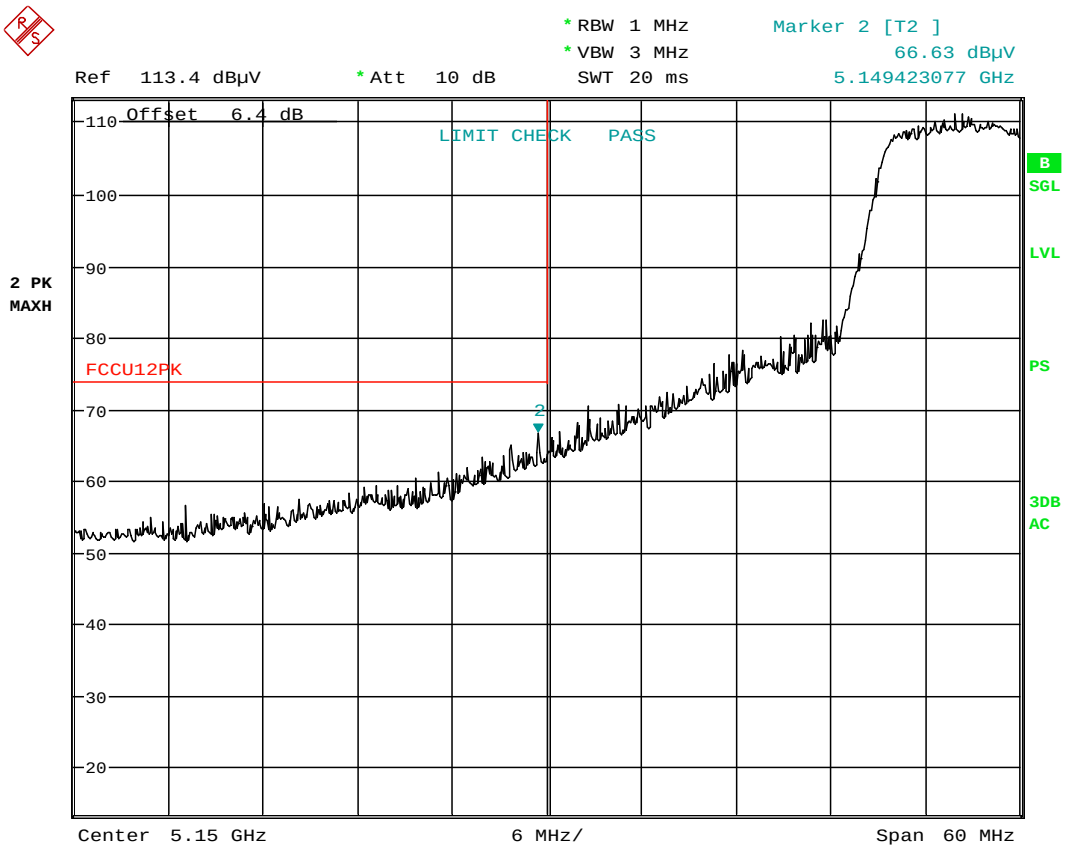


Date: 13.FEB.2017 10:33:04

Plot 7-107. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

Antenna-2 Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209



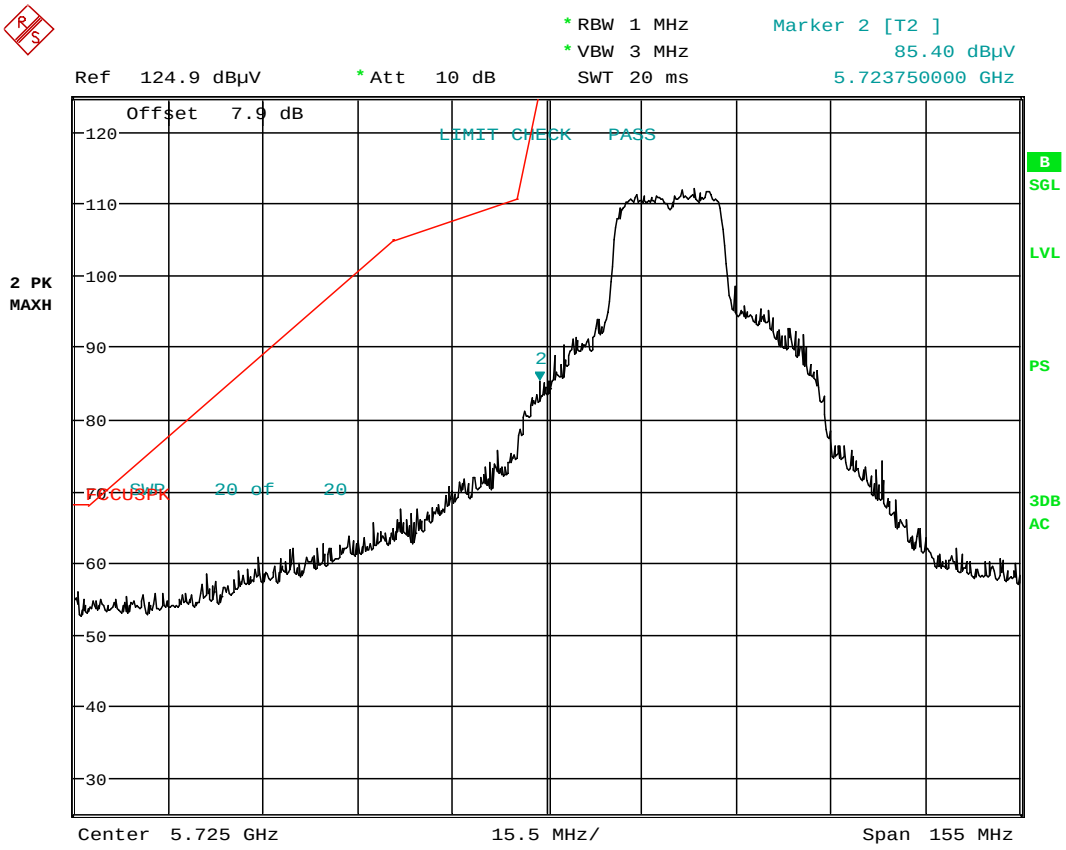
Date: 13.FEB.2017 10:33:28

Plot 7-108. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

Antenna-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:	5745MHz
Channel:	149



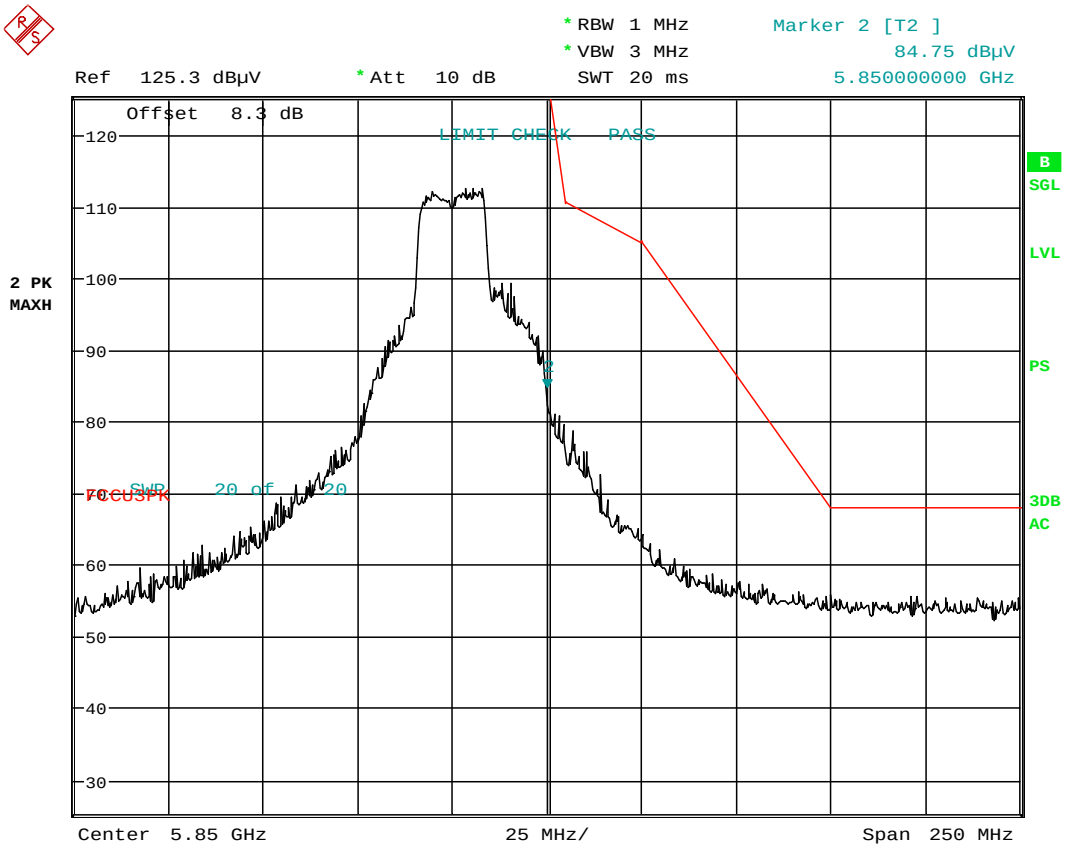
Date: 13.FEB.2017 10:42:02

Plot 7-109. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

Antenna-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:	5825MHz
Channel:	165



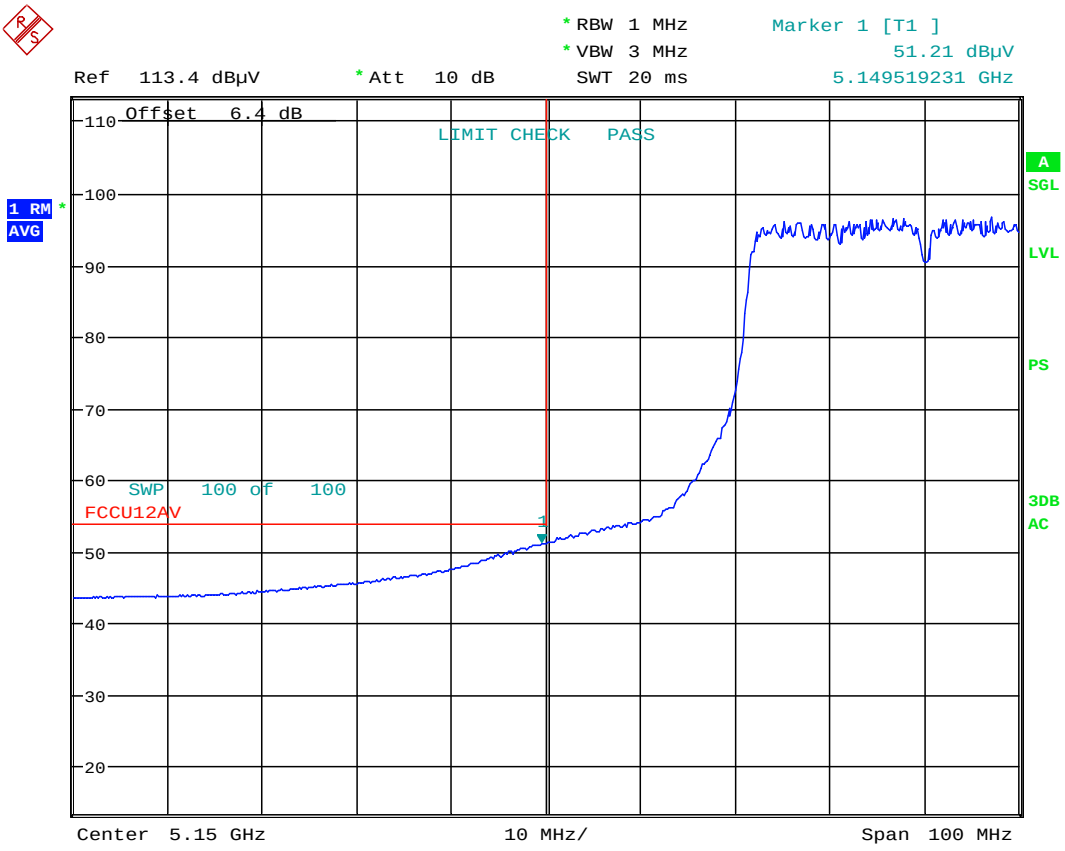
Date: 13.FEB.2017 10:47:41

Plot 7-110. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

7.7.8 Antenna-2 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

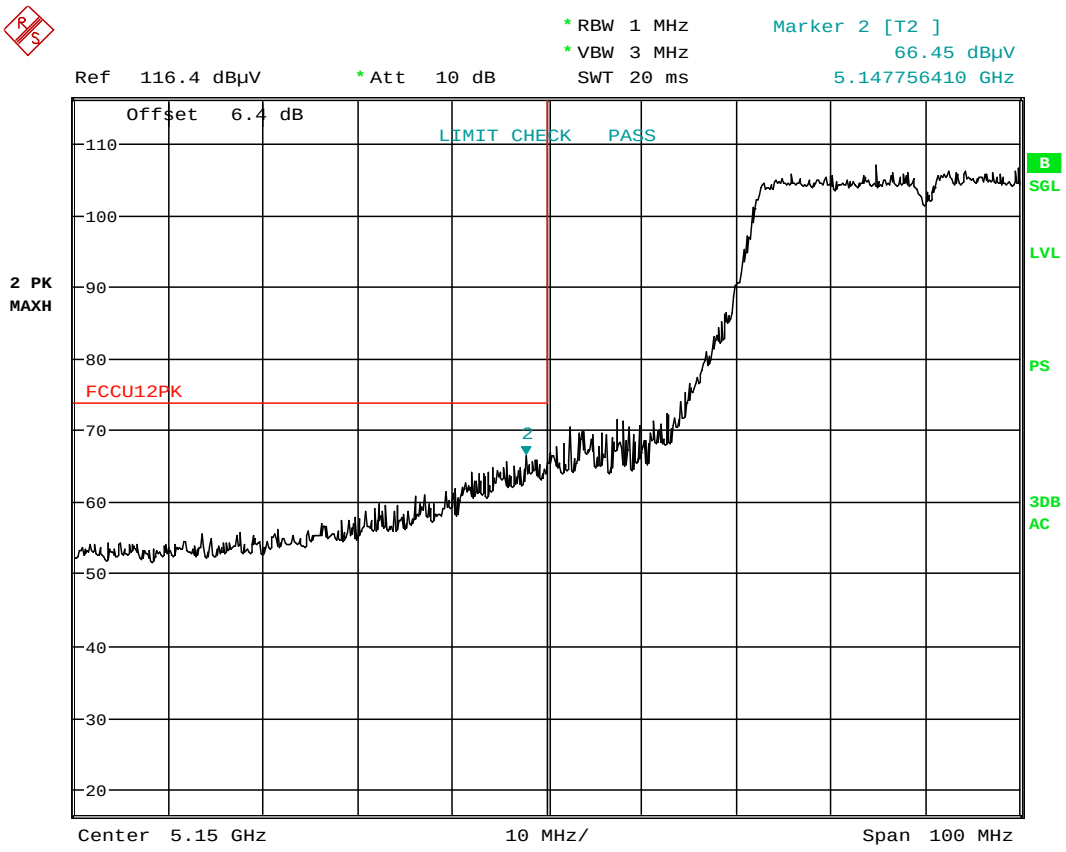


Date: 15.FEB.2017 09:28:33

Plot 7-111. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

Antenna-2 Radiated Band Edge Measurements (40MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

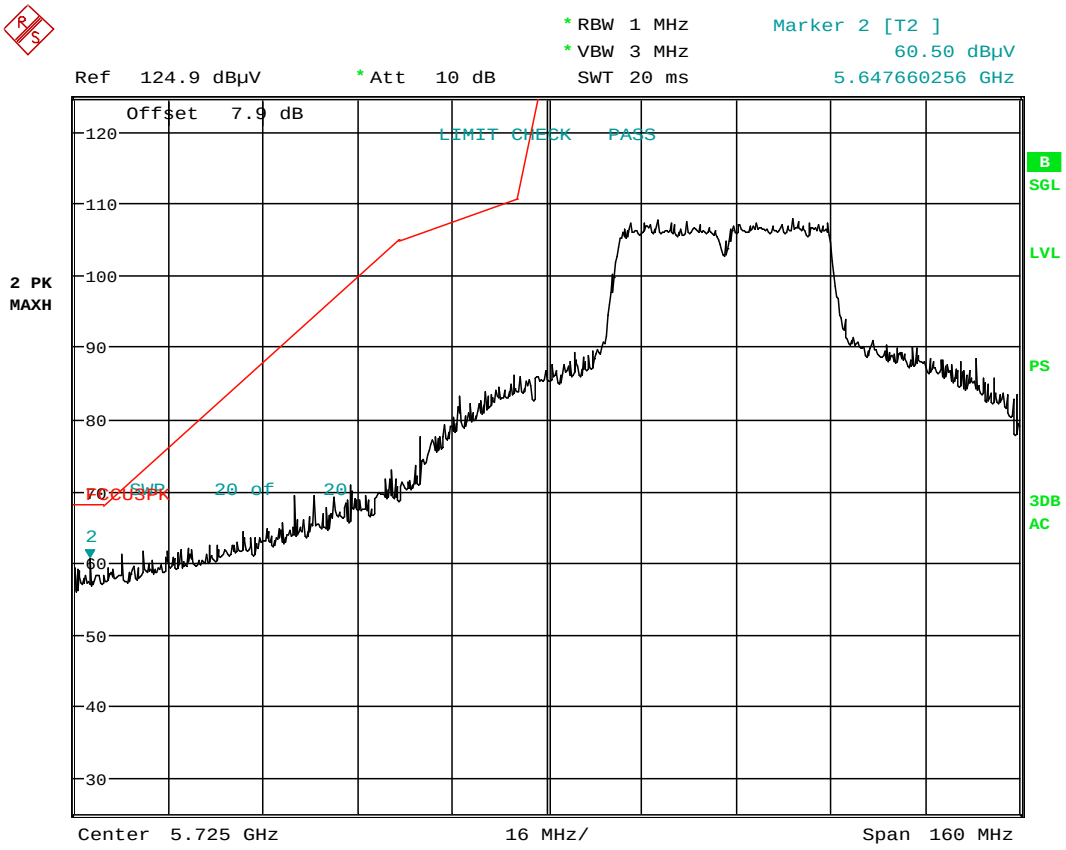


Plot 7-112. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

Antenna-2 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

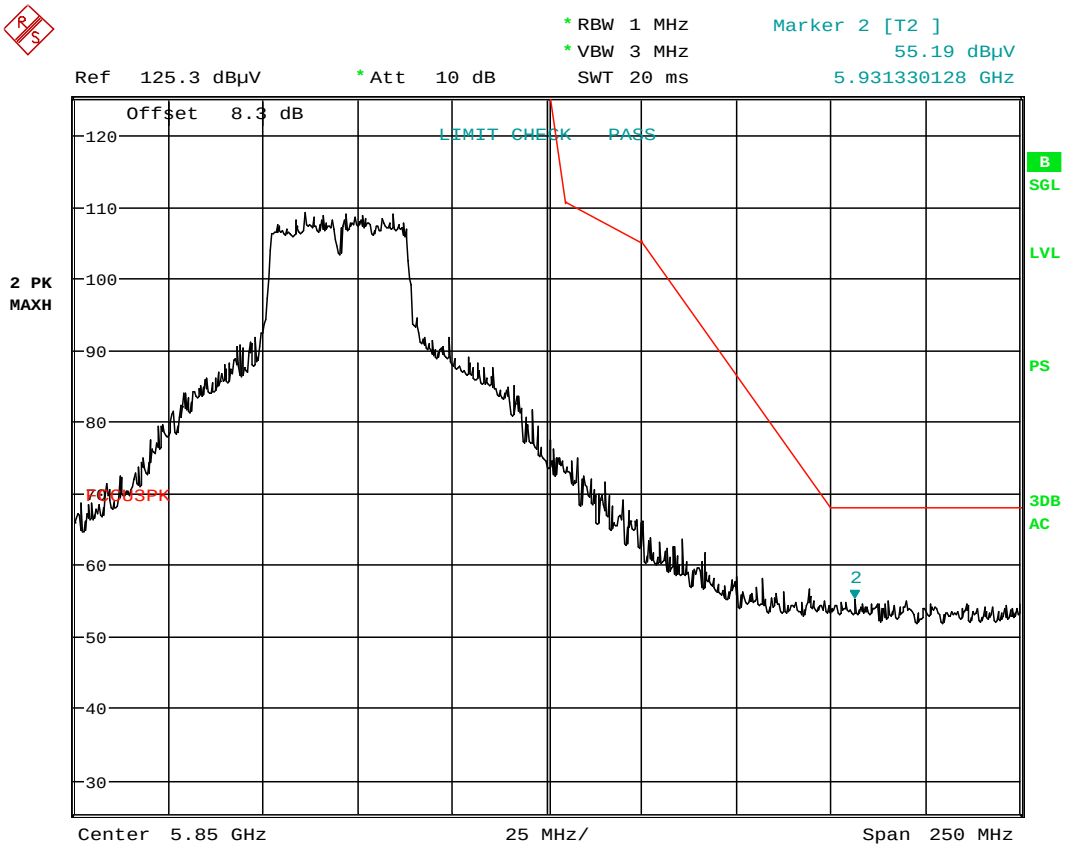


Plot 7-113. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

Antenna-2 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



Date: 15.FEB.2017 09:39:47

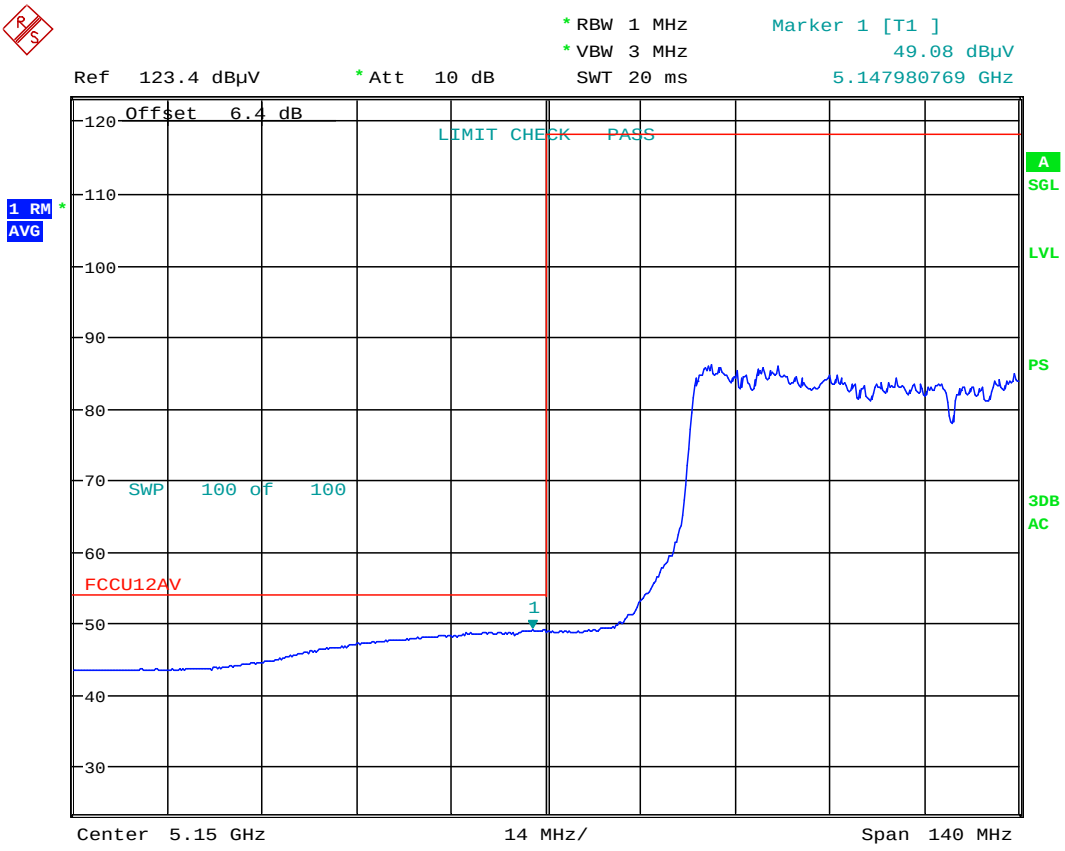
Plot 7-114. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

V 6.5
05/19/2017

7.7.9 Antenna-2 Radiated Band Edge Measurements (80MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

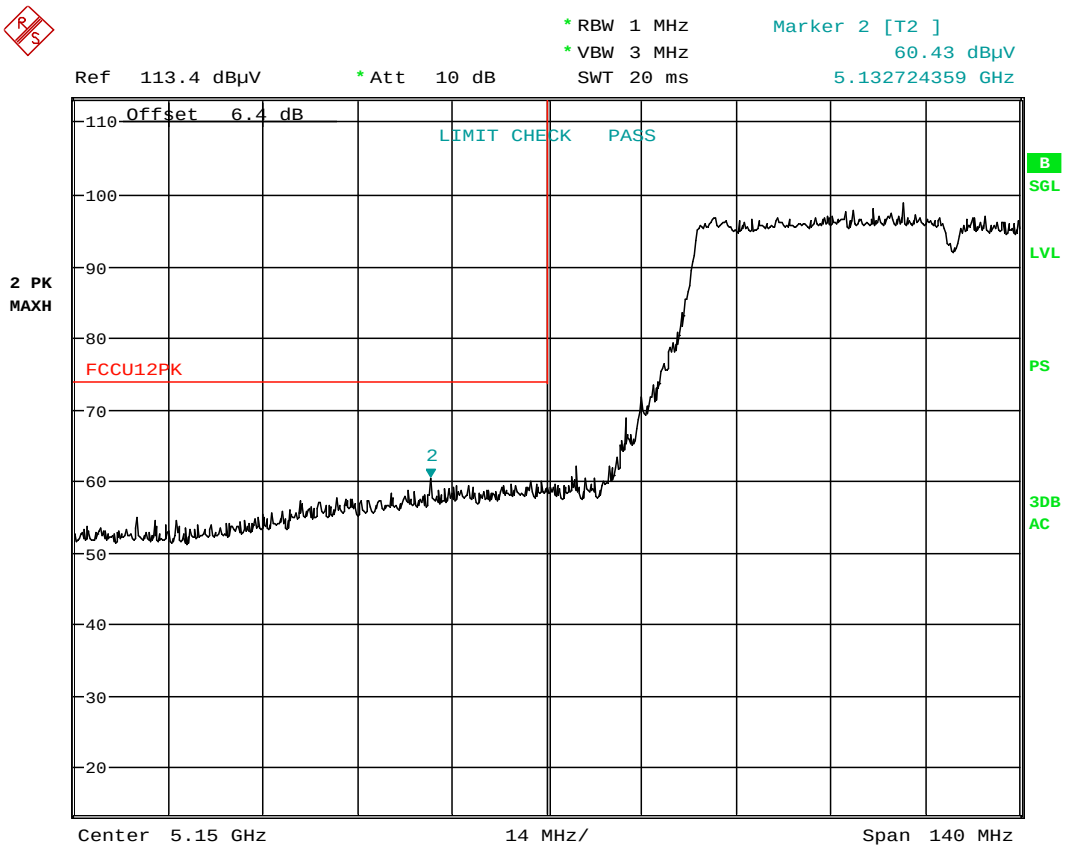
Worst Case Mode:	802.11n (80MHz)
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5210MHz
Channel:	42



Plot 7-115. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

Antenna-2 Radiated Band Edge Measurements (80MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209



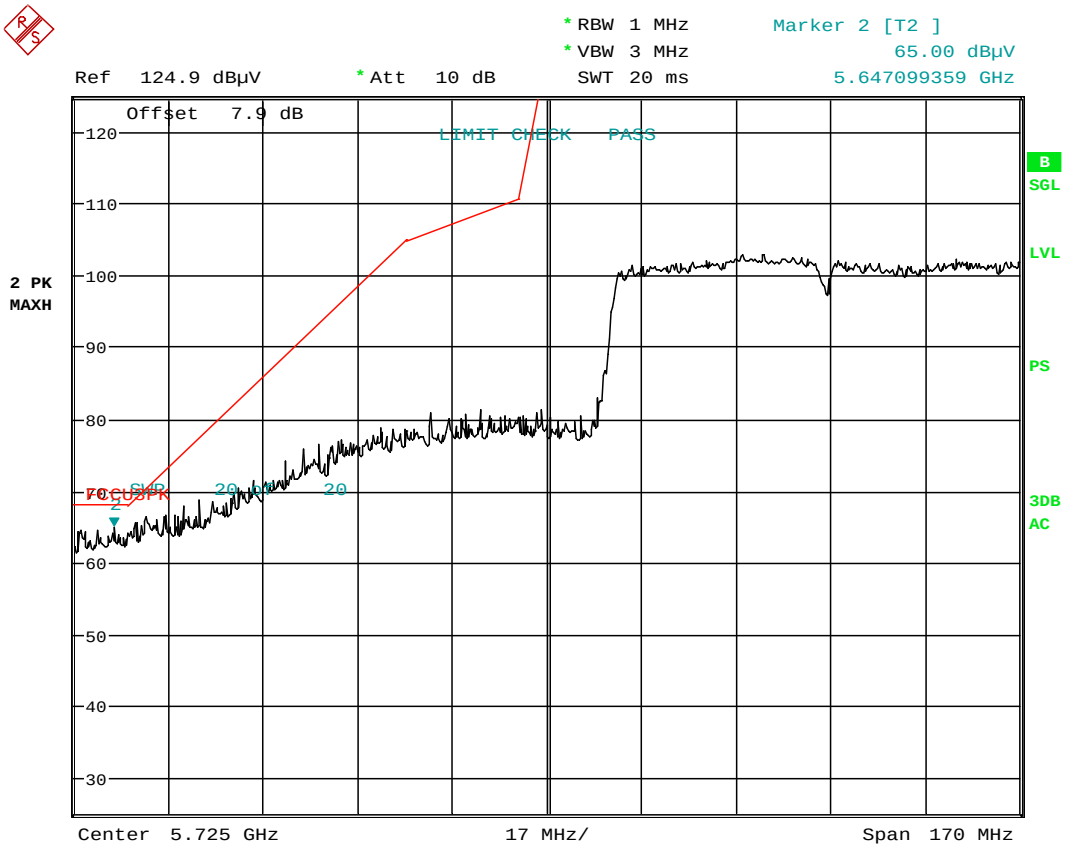
Date: 13.FEB.2017 11:17:52

Plot 7-116. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

Antenna-2 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

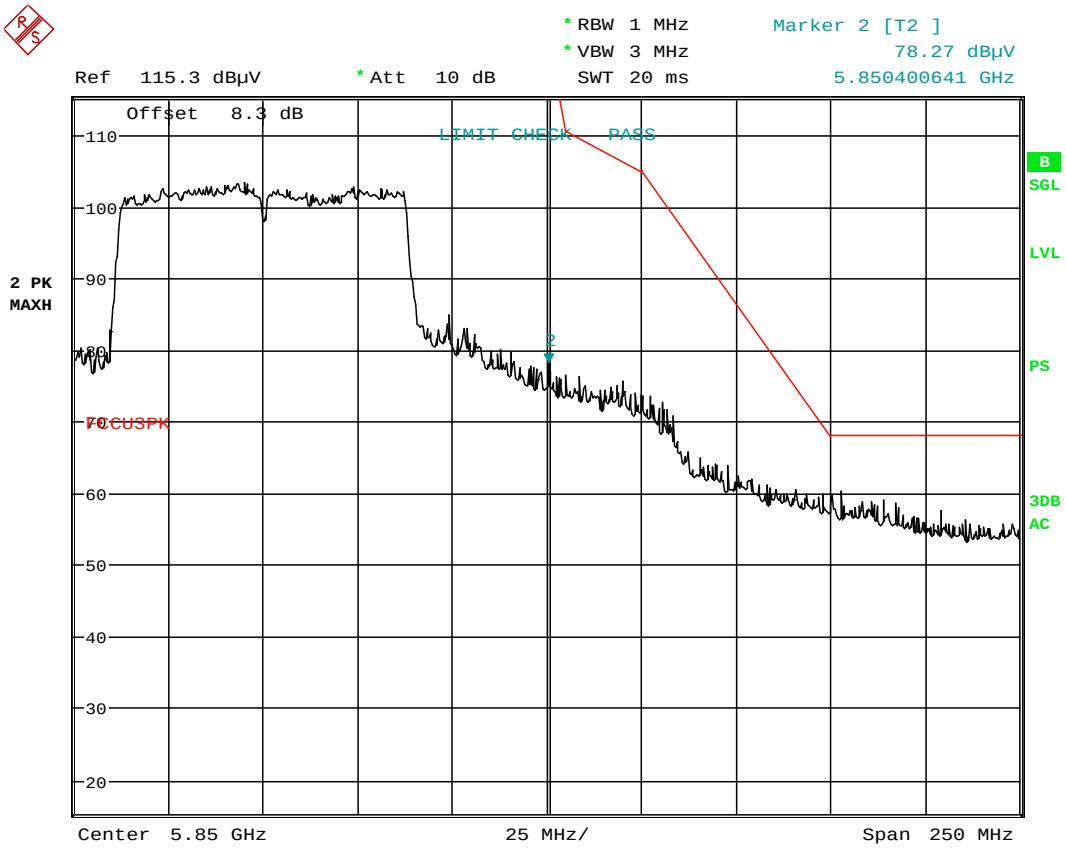


Plot 7-117. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

Antenna-2 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



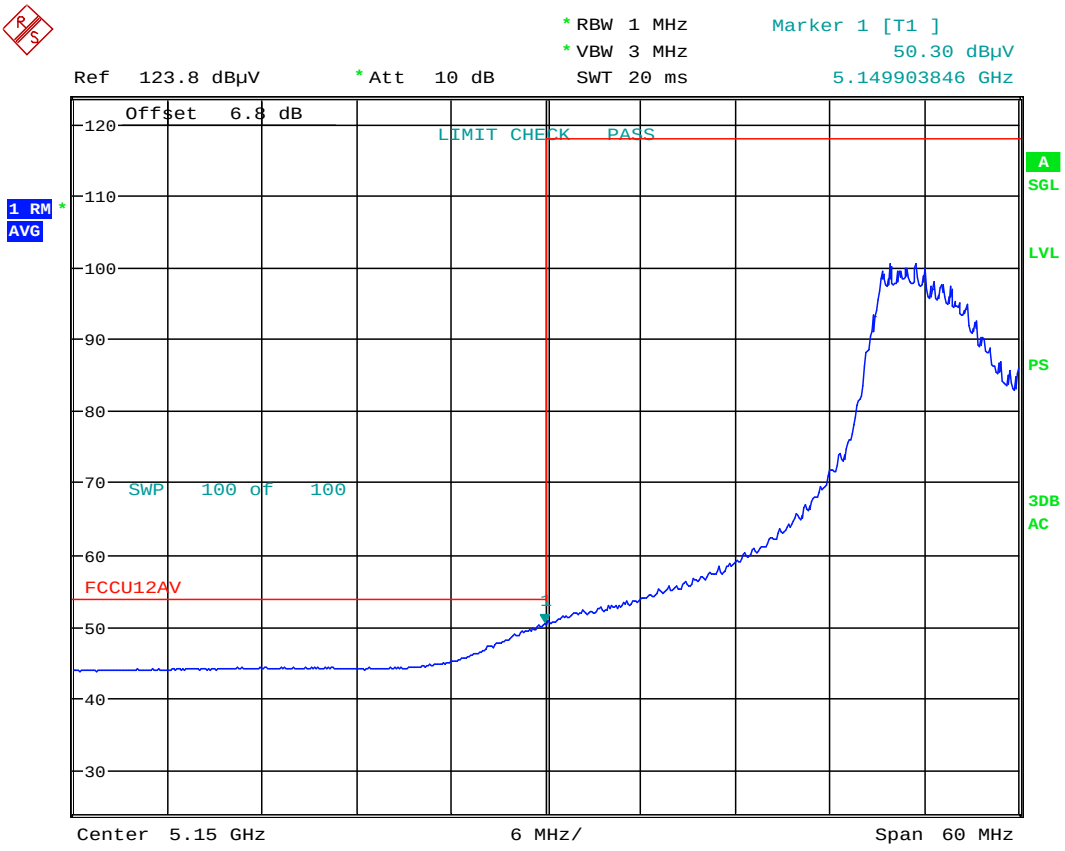
Date: 13.FEB.2017 10:59:59

Plot 7-118. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

7.7.10 MIMO Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11n (20MHz)
Worst Case Transfer Rate:	MCS8
Distance of Measurements:	3 Meters
Operating Frequency:	5180MHz
Channel:	36



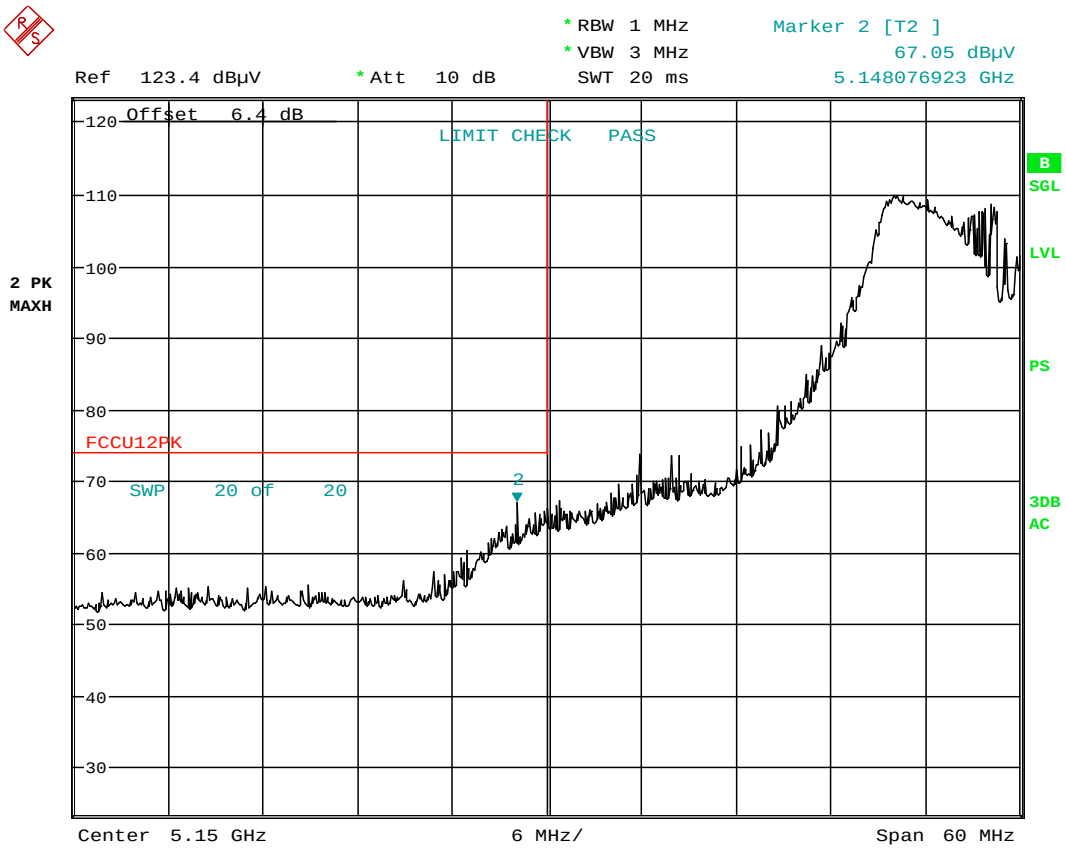
Date: 13.FEB.2017 11:34:17

Plot 7-119. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

V 6.5
05/19/2017

MIMO Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209



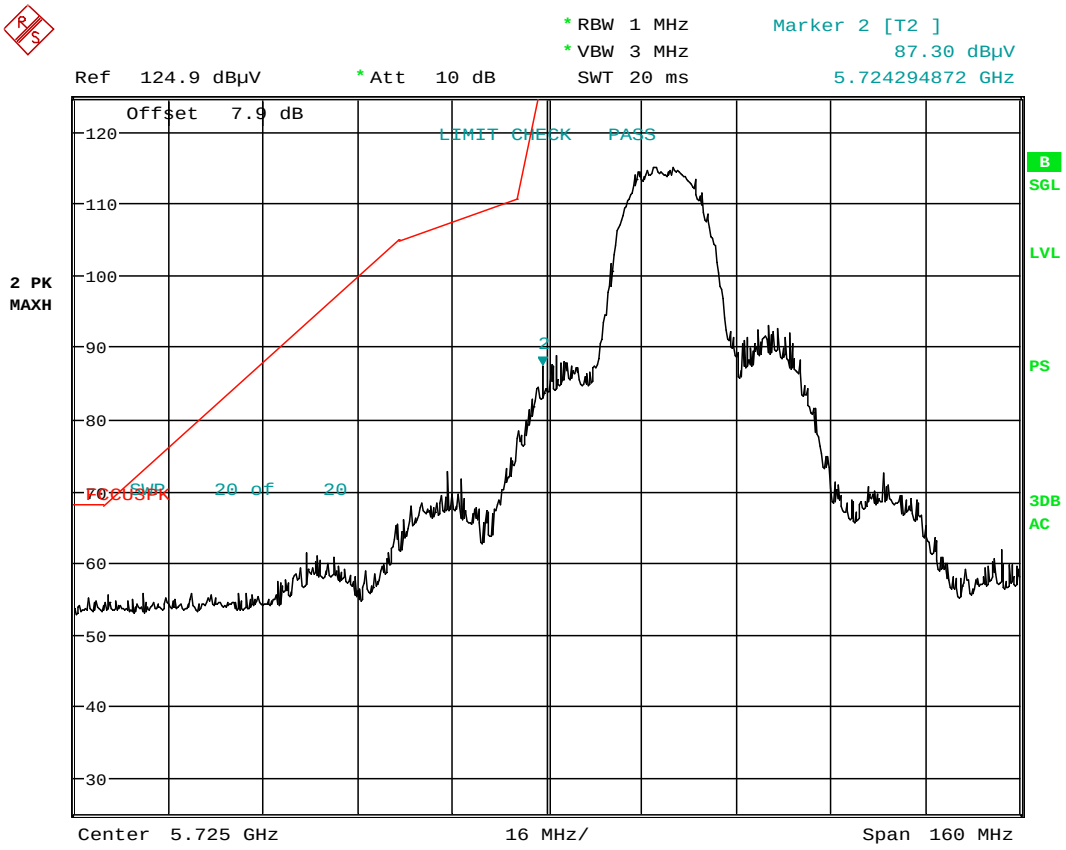
Date: 13.FEB.2017 11:33:38

Plot 7-120. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

MIMO Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11n (20MHz)
Worst Case Transfer Rate:	MCS8
Distance of Measurements:	3 Meters
Operating Frequency:	5745MHz
Channel:	149



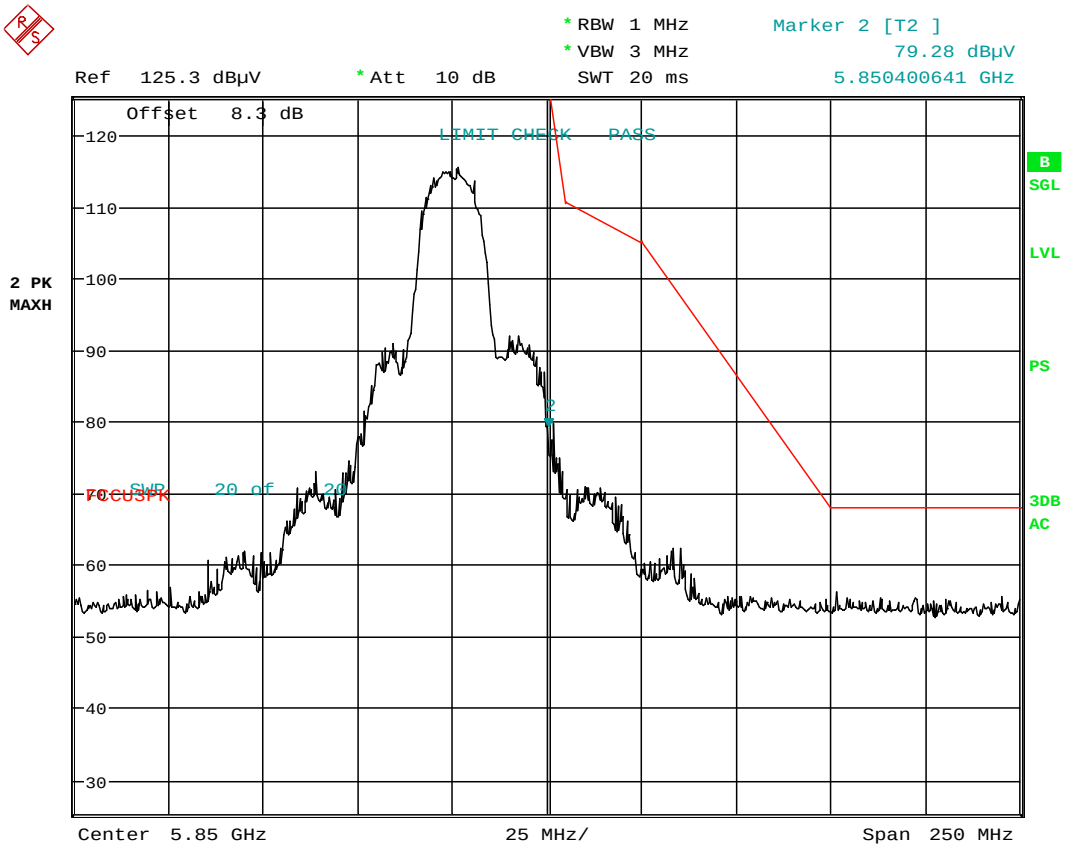
Date: 13.FEB.2017 11:40:52

Plot 7-121. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

MIMO Radiated Band Edge Measurements (20MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11n (20MHz)
Worst Case Transfer Rate:	MCS8
Distance of Measurements:	3 Meters
Operating Frequency:	5825MHz
Channel:	165



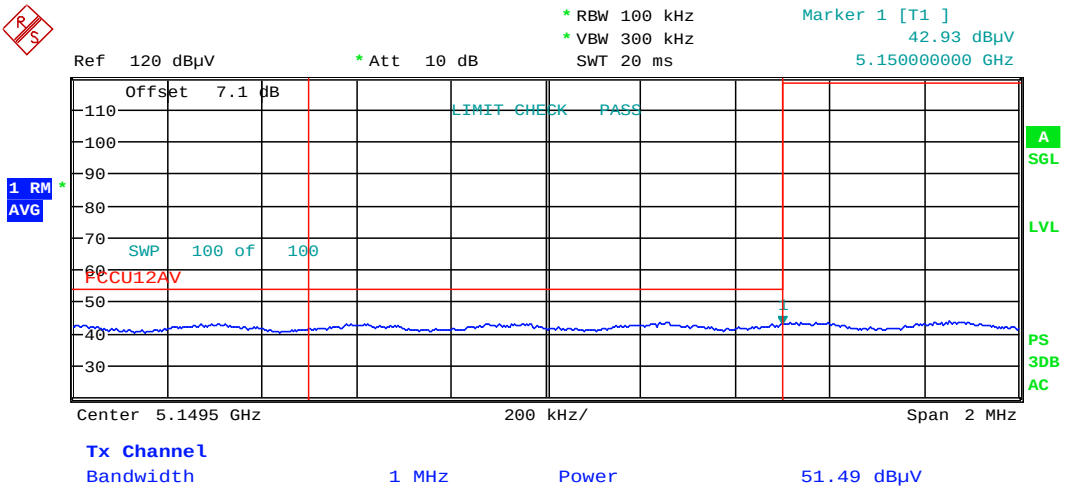
Date: 13.FEB.2017 11:45:00

Plot 7-122. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

7.7.11 MIMO 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:	MCS8
Distance of Measurements:	3 Meters
Operating Frequency:	5190MHz
Channel:	38

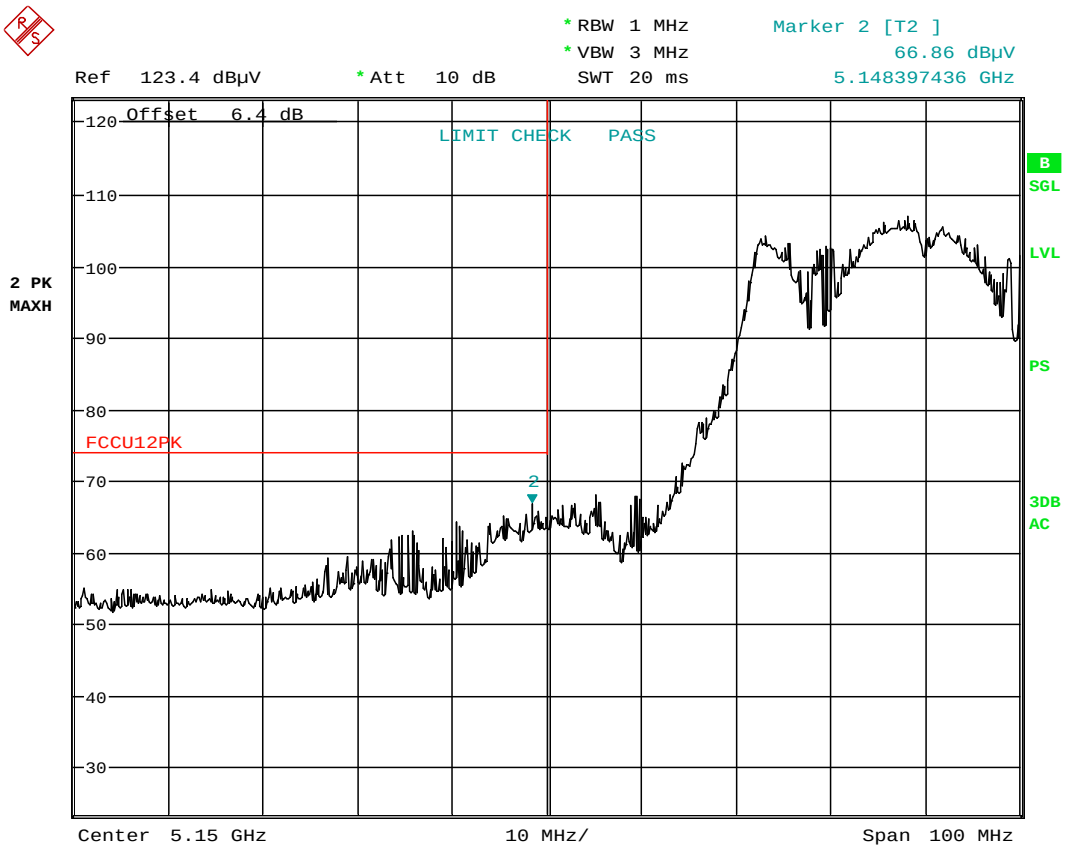


Date: 15.FEB.2017 10:03:41

Plot 7-123. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

MIMO Radiated Band Edge Measurements (40MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209



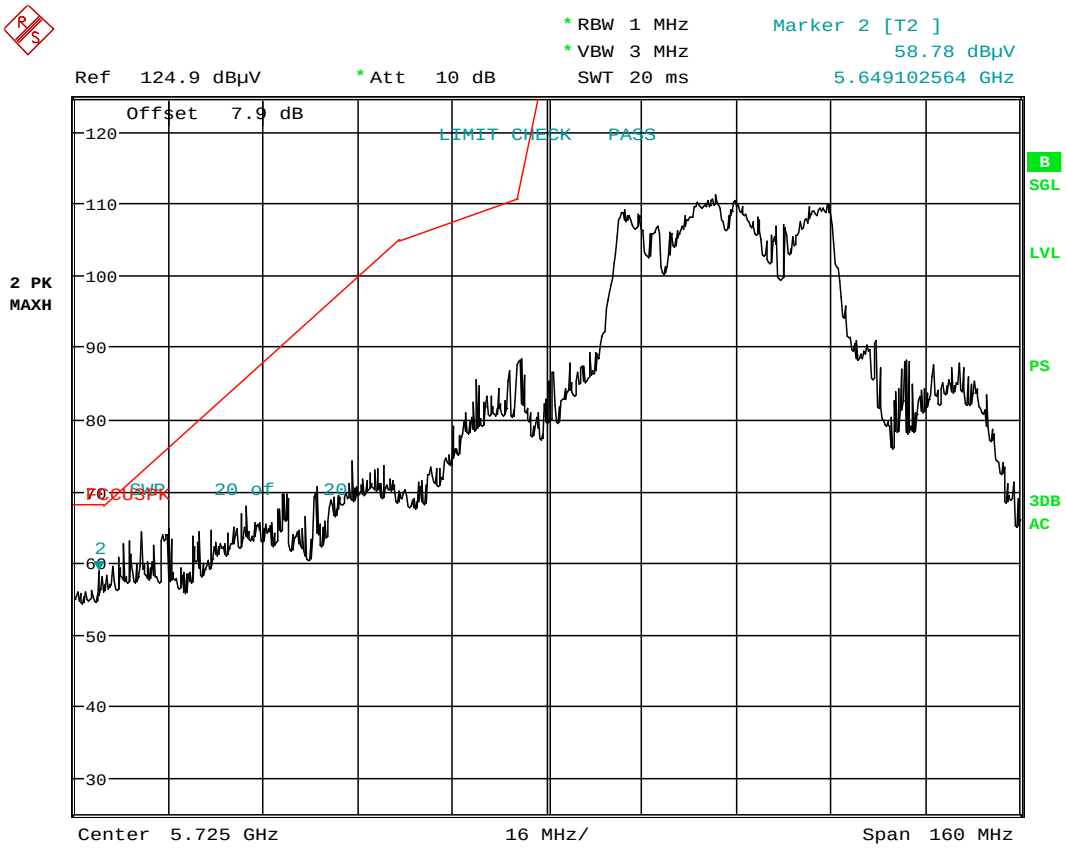
Date: 15.FEB.2017 10:05:34

Plot 7-124. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

MIMO 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:	MCS8
Distance of Measurements:	3 Meters
Operating Frequency:	5755MHz
Channel:	151



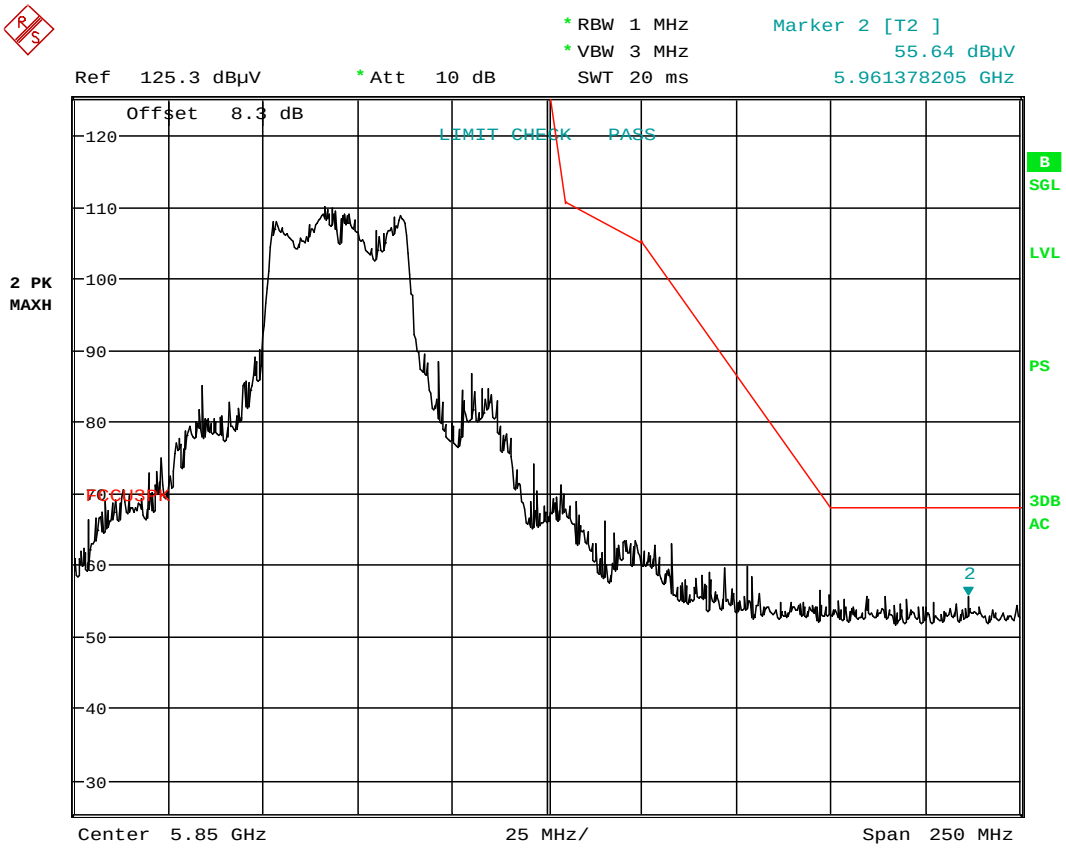
Date: 15.FEB.2017 10:10:00

Plot 7-125. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

MIMO 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:	MCS8
Distance of Measurements:	3 Meters
Operating Frequency:	5795MHz
Channel:	159



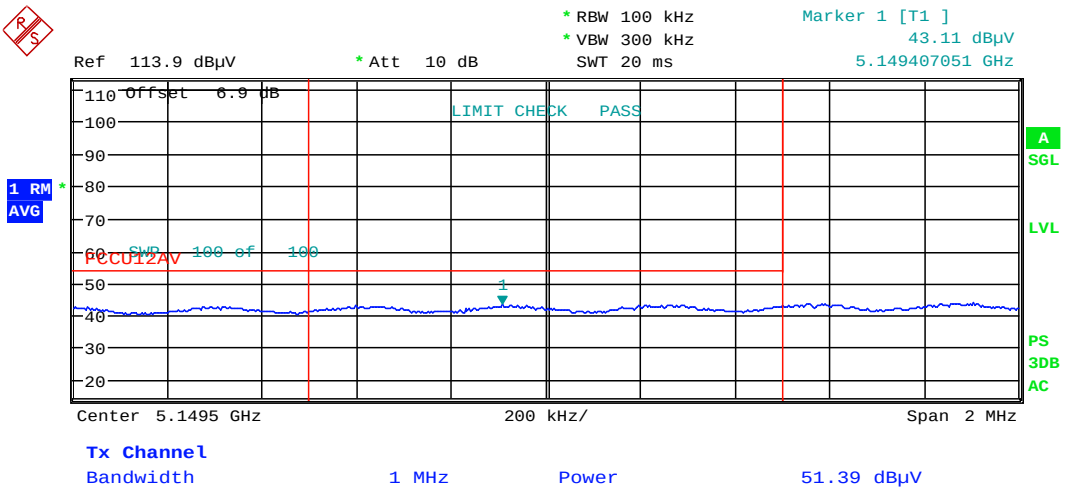
Date: 15.FEB.2017 10:14:10

Plot 7-126. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

7.7.12 MIMO 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:	5210MHz
Channel:	42

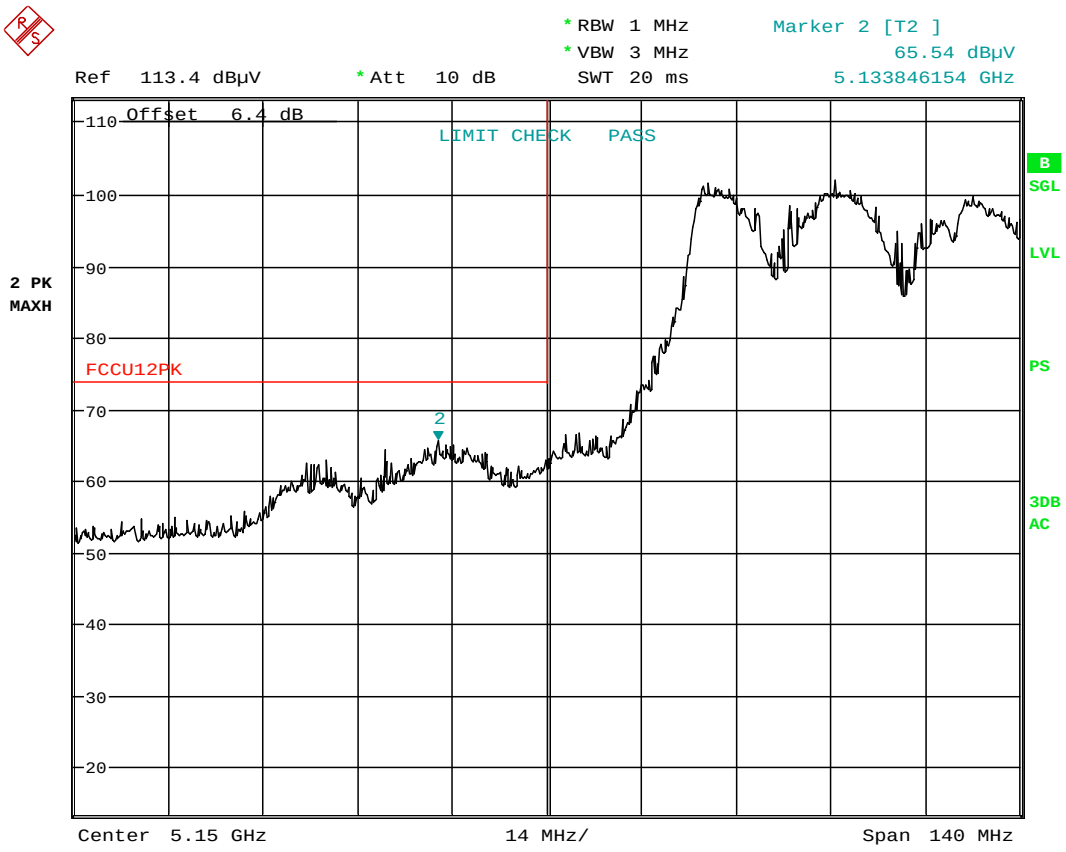


Date: 13.FEB.2017 11:58:02

Plot 7-127. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

MIMO Radiated Band Edge Measurements (80MHz BW)

§15.407(b.1)(b.2) §15.205 §15.209



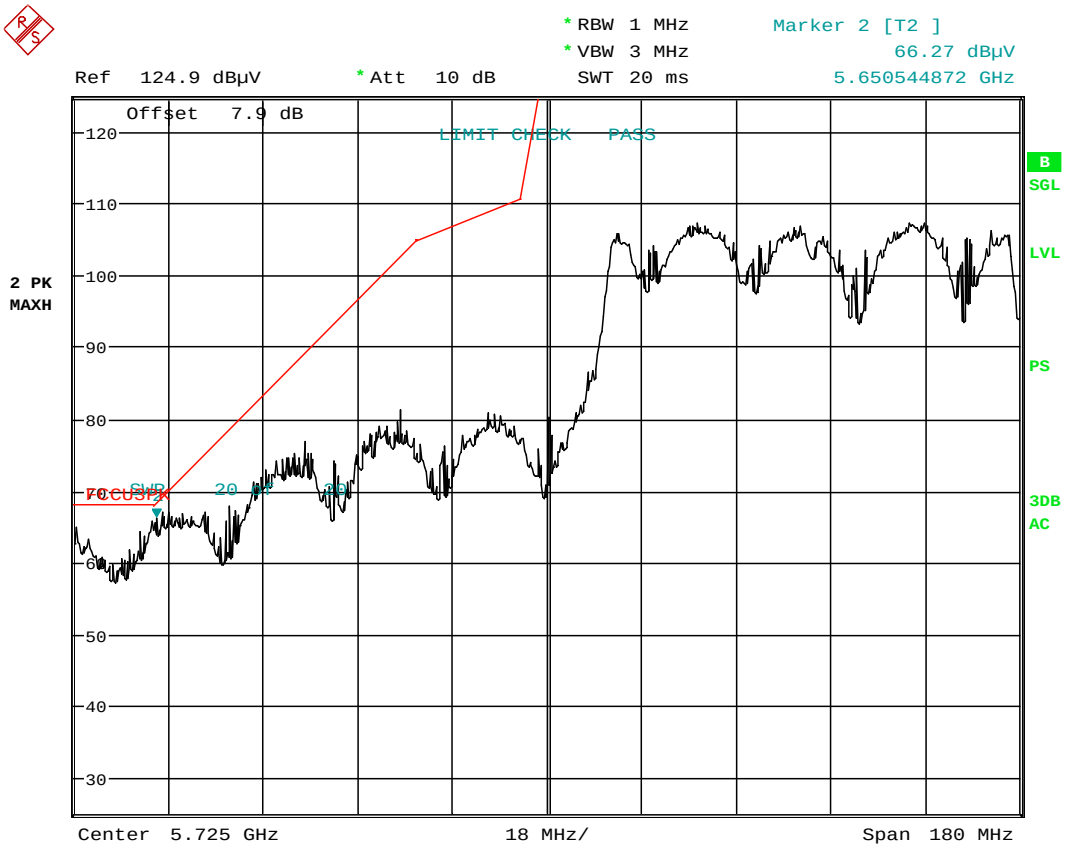
Date: 13.FEB.2017 11:58:49

Plot 7-128. Radiated Restricted Lower Band Edge Plot (Peak – UNII Band 1)

MIMO 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



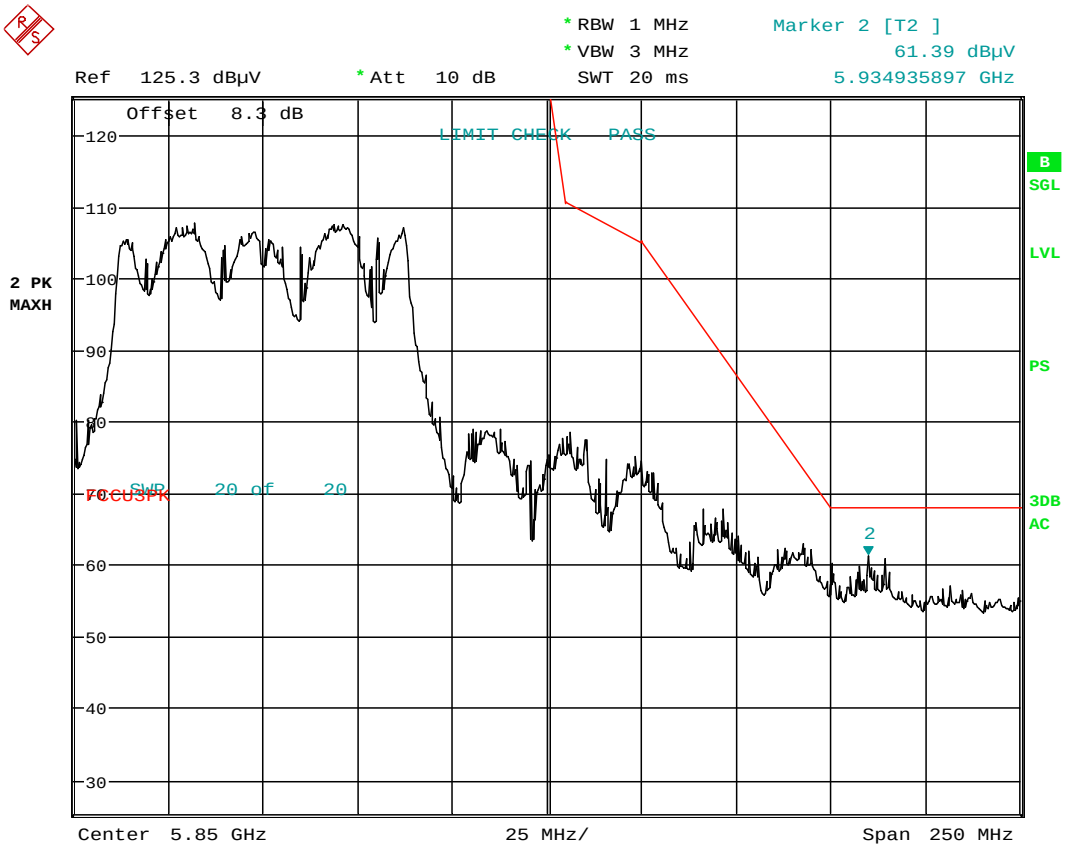
Date: 13.FEB.2017 12:03:31

Plot 7-129. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

MIMO 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



Plot 7-130. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

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 7-41 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 7-41. 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

Test Setup

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

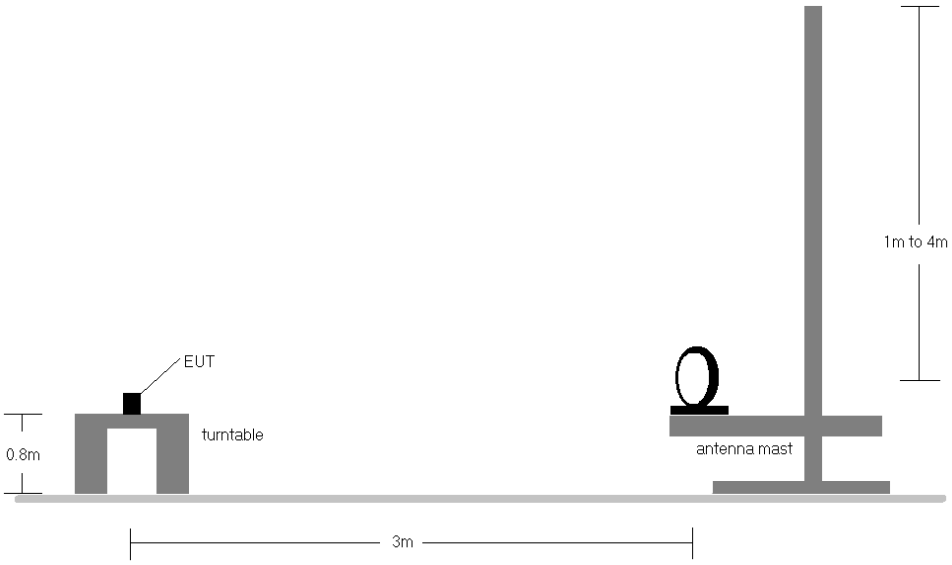


Figure 7-6. Radiated Test Setup < 30MHz

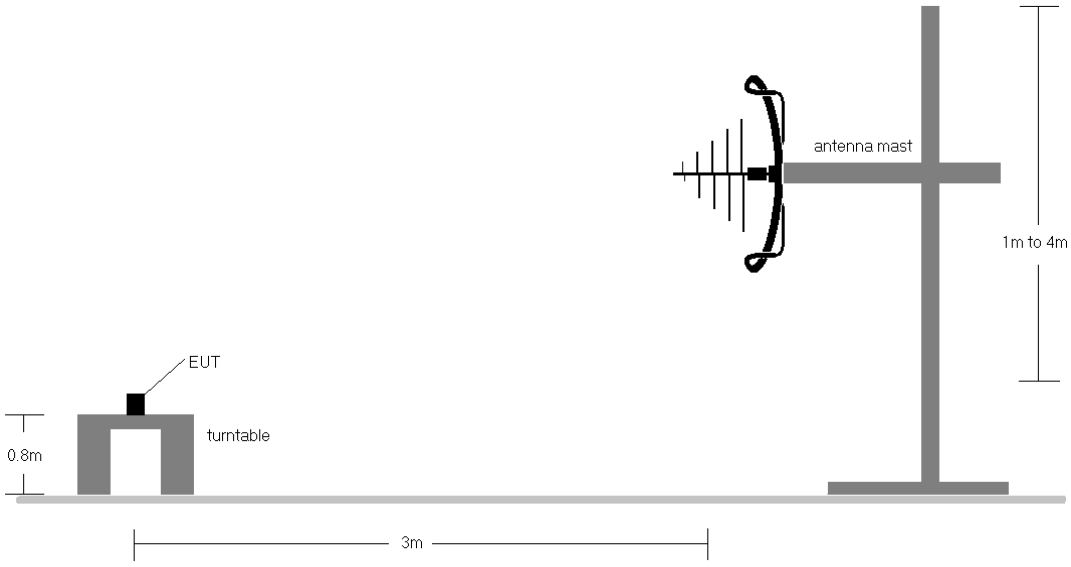


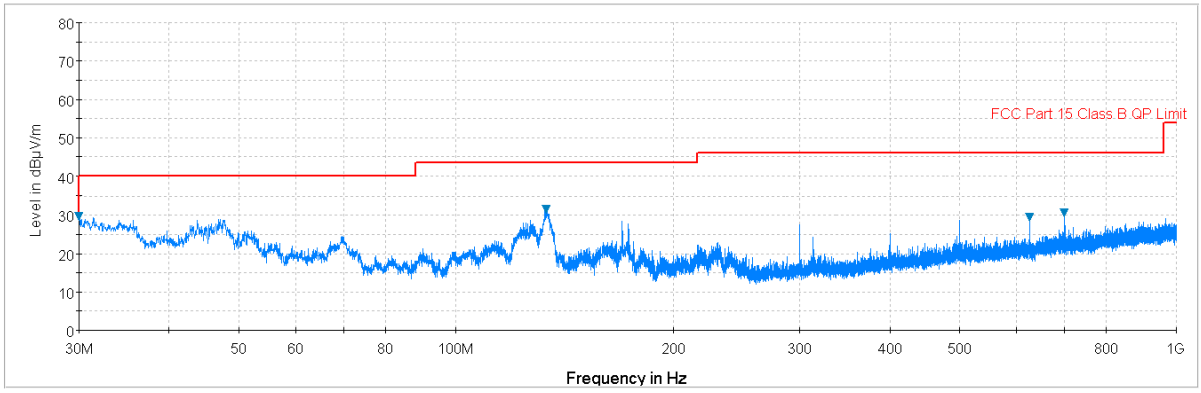
Figure 7-7. Radiated Test Setup < 1GHz

Test Notes

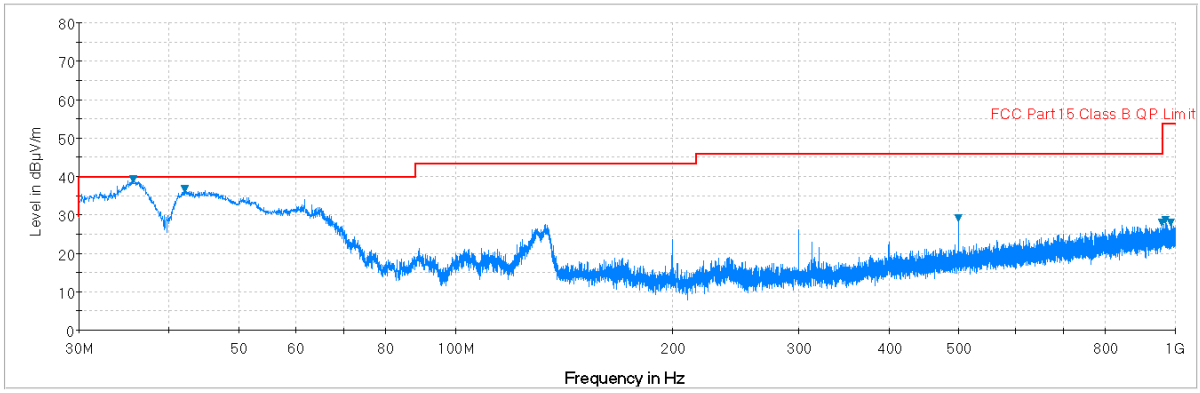
1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-41.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested while powered by an DC power source.
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.

Antenna-1 Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



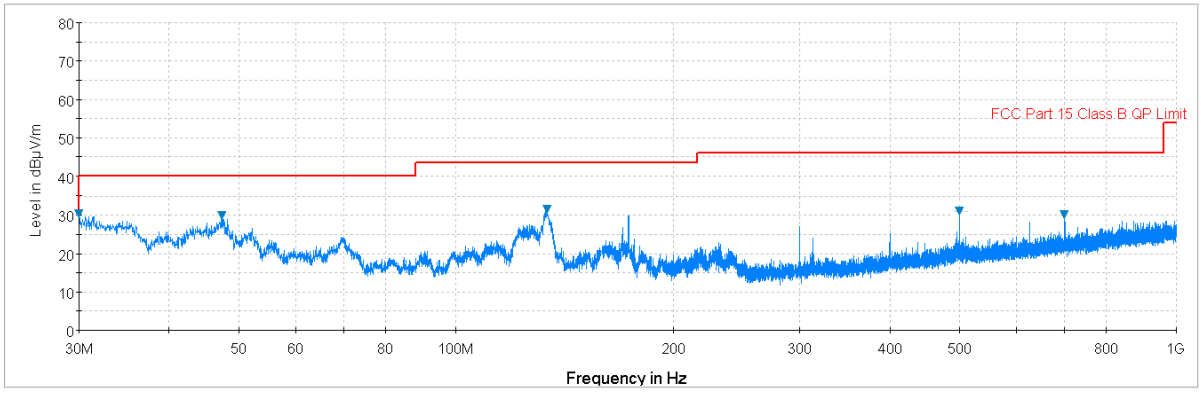
Plot 7-131. Radiated Spurious Plot below 1GHz (802.11a – U3 Ch. 157, Ant. Pol. H)



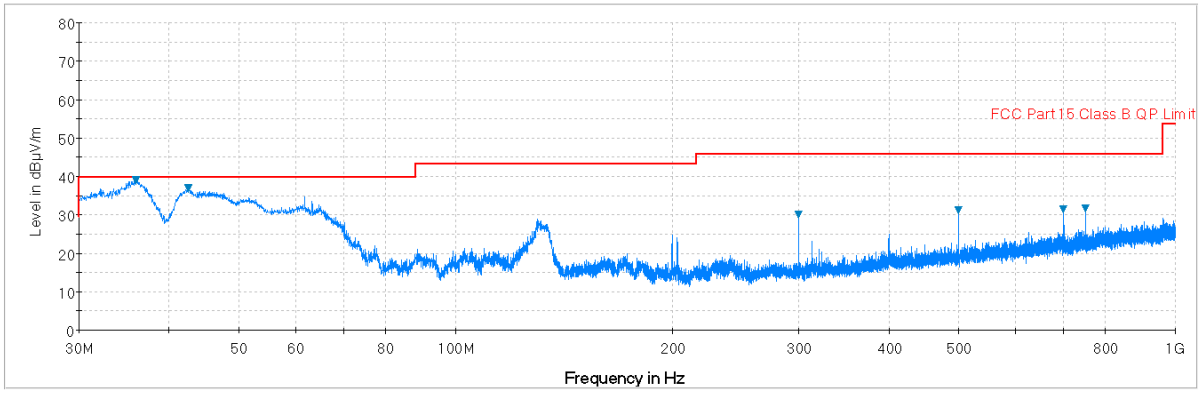
Plot 7-132. Radiated Spurious Plot below 1GHz (802.11a – U3 Ch. 157, Ant. Pol. V)

Antenna-2 Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



Plot 7-133. Radiated Spurious Plot below 1GHz (802.11a – U3 Ch. 157, Ant. Pol. H)



Plot 7-134. Radiated Spurious Plot below 1GHz (802.11a – U3 Ch. 157, Ant. Pol. V)

Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
36.01	Quasi-Peak	V	100	0	-57.50	-12.73	36.77	40.00	-3.23
42.56	Quasi-Peak	V	100	0	-52.81	-17.49	36.70	40.00	-3.30

Table 7-42. Radiated Spurious Emissions below 1GHz

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 7-43. 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

Test Setup

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

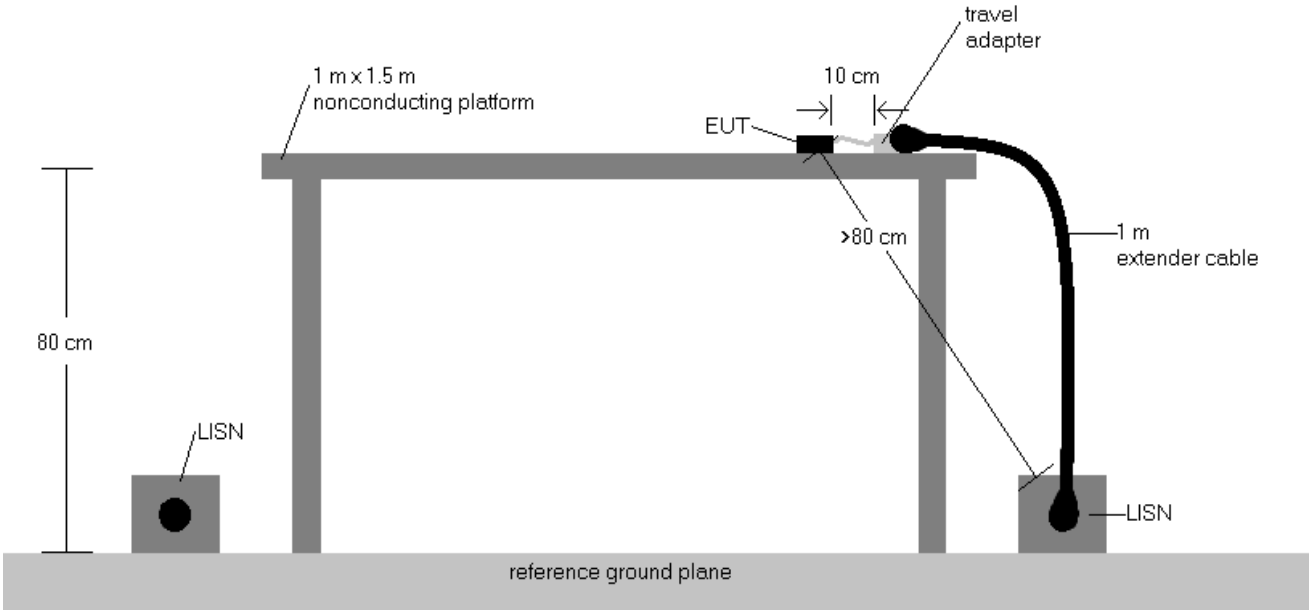


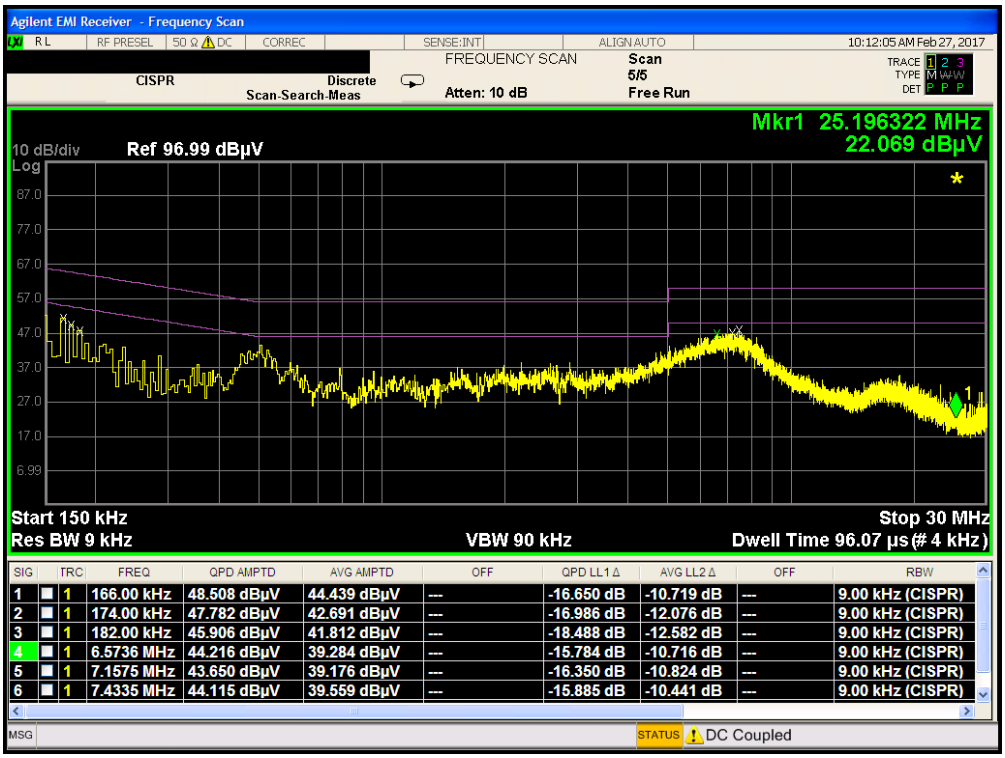
Figure 7-8. Test Instrument & Measurement Setup

Test Notes

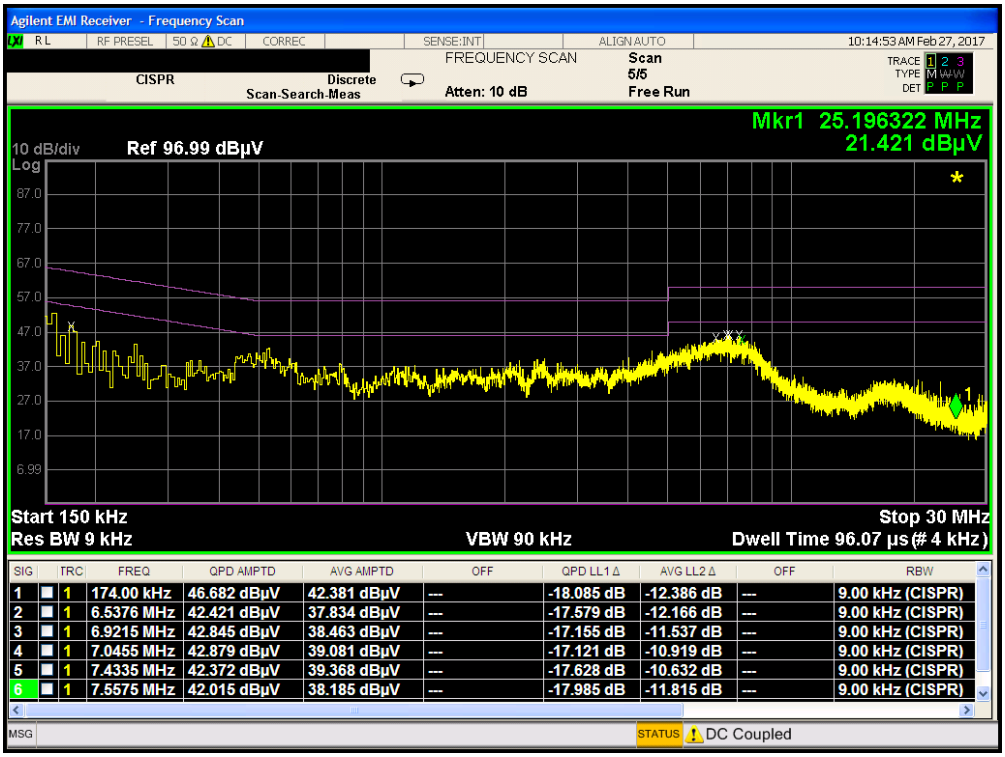
1. All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
2. The limit for an intentional radiator from 150kHz to 30MHz are specified in 15.207.
3. Corr. (dB) = Cable loss (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.

Line-Conducted Test Data

§15.407



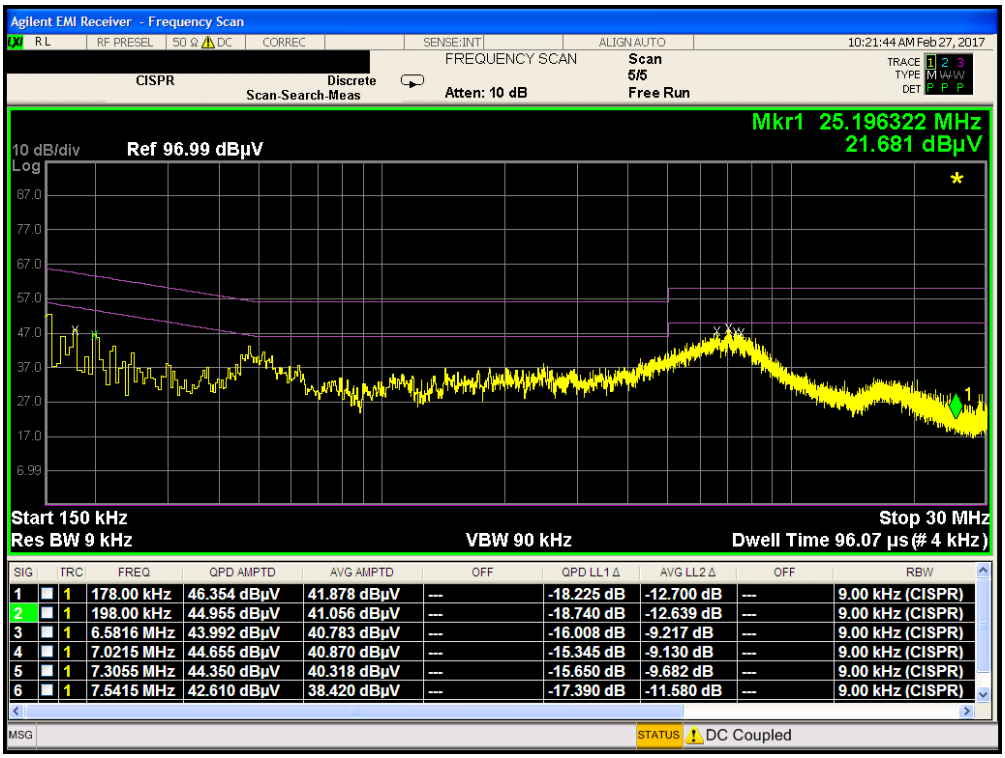
Plot 7-135. Line Conducted Plot with 802.11a UNII Band 1 (L1)



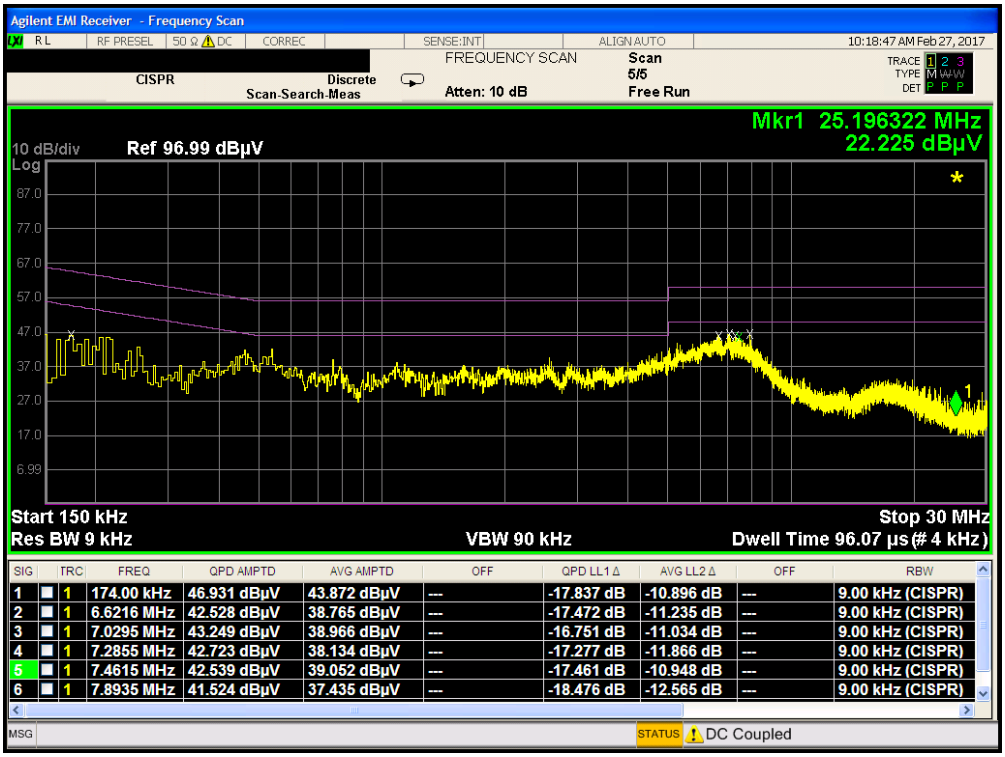
Plot 7-136. Line Conducted Plot with 802.11a UNII Band 1 (N)

Line-Conducted Test Data

§15.407



Plot 7-137. Line Conducted Plot with 802.11a UNII Band 3 (L1)



Plot 7-138. Line Conducted Plot with 802.11a UNII Band 3 (N)

8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Samsung Indoor Access Point FCC ID: A3LETWV521** is in compliance with Part 15E of the FCC Rules.

APPENDIX A. 802.11A DUAL TX

A.1 Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (TX)					
15.407 (a.1)	Maximum Conducted Output Power	Maximum conducted powers must meet limits detailed in 15.407(a)	CONDUCTED	PASS	Section A.2
15.407 (a.1), (5)	Maximum Power Spectral Density	Maximum power spectral density must meet the limits detailed in 15.407(a)		PASS	Section A.3
15.205, 15.407(b.1),(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 A.4

Table A.1-1. Summary of Test Results

Notes:

1. This device employs dual transmission in 802.11a and 802.11g modes using Cyclic Delay Diversity. For all test cases, the device was set to transmit from four antennas simultaneously. The data in this section demonstrates compliance to the dual-transmission requirements specified in KDB 662911 v02r01.
2. All data found in this section is compiled from plots found in the main body of this test report.
3. Since this device is able to transmit the same data through four of its antennas in a given symbol period, then, by the definition specified in KDB 662911 v02r01 Section F)1), the transmission symbols are correlated.
4. For CDD operation where Nss = 1, the array gain for power density measurements is equal to $10\log(N_{ANT}/N_{SS})$ dB and the array gain for power measurements is 0dB.

A.2 Output Power Measurement

§15.247(b.3)

Test Overview

Using the "Measure and Sum" technique, the measured conducted power values were summed in linear power units then converted back to dBm. Original measured values are found in Section 7.4 of this report.

Freq [MHz]	Channel	Detector	Directional Gain [dBi]	5GHz (20MHz) Conducted Power [dBm]			Max Permissible Conducted Power [dBm]	Adjusted Limit [dBm]	Margin [dB]
				IEEE Transmission Mode					
				ANT1	ANT2	CDD			
5180	36	AVG	6.31	16.27	16.44	19.37	30.00	29.69	-10.32
5200	40	AVG	6.31	17.12	17.41	20.28	30.00	29.69	-9.41
5220	44	AVG	6.31	17.23	17.41	20.33	30.00	29.69	-9.36
5240	48	AVG	6.31	17.36	17.44	20.41	30.00	29.69	-9.28
5745	149	AVG	6.06	18.11	17.63	20.89	30.00	29.94	-9.05
5785	157	AVG	6.06	18.00	17.66	20.84	30.00	29.94	-9.10
5825	165	AVG	6.06	17.71	17.56	20.65	30.00	29.94	-9.29

Table A.2-1. Dual Tx 802.11a-mode Conducted Output Power Measurements

A.3 Power Spectral Density

§15.247(e)

Test Overview

Using the "Measure and Sum" technique, the measured conducted power density values were summed in linear power units then converted back to dBm. Original measured values are found in Section 7.5 of this report.

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Directional Gain [dBi]	Antenna-1 Power Density [dBm]	Antenna-2 Power Density [dBm]	Summed CDD Power Density [dBm]	Max Permissible Power Density	Adjusted Limit [dBm/MHz]	Margin [dB]	Pass / Fail
Band 1	5180	36	a	6.5/7.2 (MCS0)	6.31	4.53	4.76	7.66	17.0	16.69	-9.34	Pass
	5200	40	a	6.5/7.2 (MCS0)	6.31	9.00	8.87	11.95	17.0	16.69	-5.05	Pass
	5240	48	a	6.5/7.2 (MCS0)	6.31	9.43	8.46	11.98	17.0	16.69	-5.02	Pass

Table A.3-1.802.11a Dual Tx Conducted Power Density Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Directional Gain [dBi]	Antenna-1 Power Density [dBm]	Antenna-2 Power Density [dBm]	Summed CDD Power Density [dBm]	Max Permissible Power Density	Adjusted Limit [dBm/500kHz]	Margin [dB]	Pass / Fail
Band 3	5745	149	a	6.5/7.2 (MCS0)	6.06	6.20	6.16	9.19	30.0	29.9	-20.81	Pass
	5785	157	a	6.5/7.2 (MCS0)	6.06	5.80	6.15	8.99	30.0	29.9	-21.01	Pass
	5825	165	a	6.5/7.2 (MCS0)	6.06	5.89	6.33	9.12	30.0	29.9	-20.88	Pass

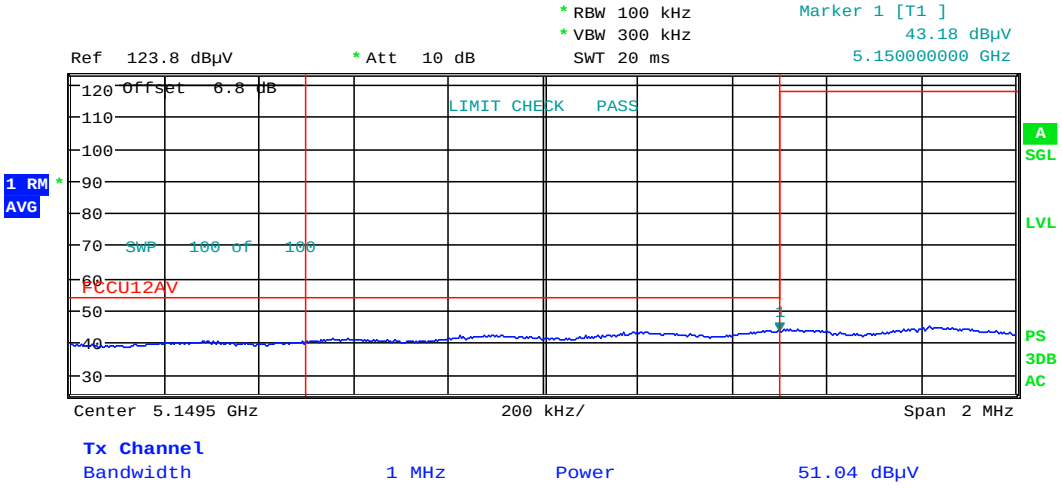
Table A.3-2.802.11a Dual Tx Conducted Power Density Measurements

A.4 Dual Tx Radiated Restricted Band Edge Measurements

§15.205 §15.209

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting on both outputs in 802.11a mode.

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

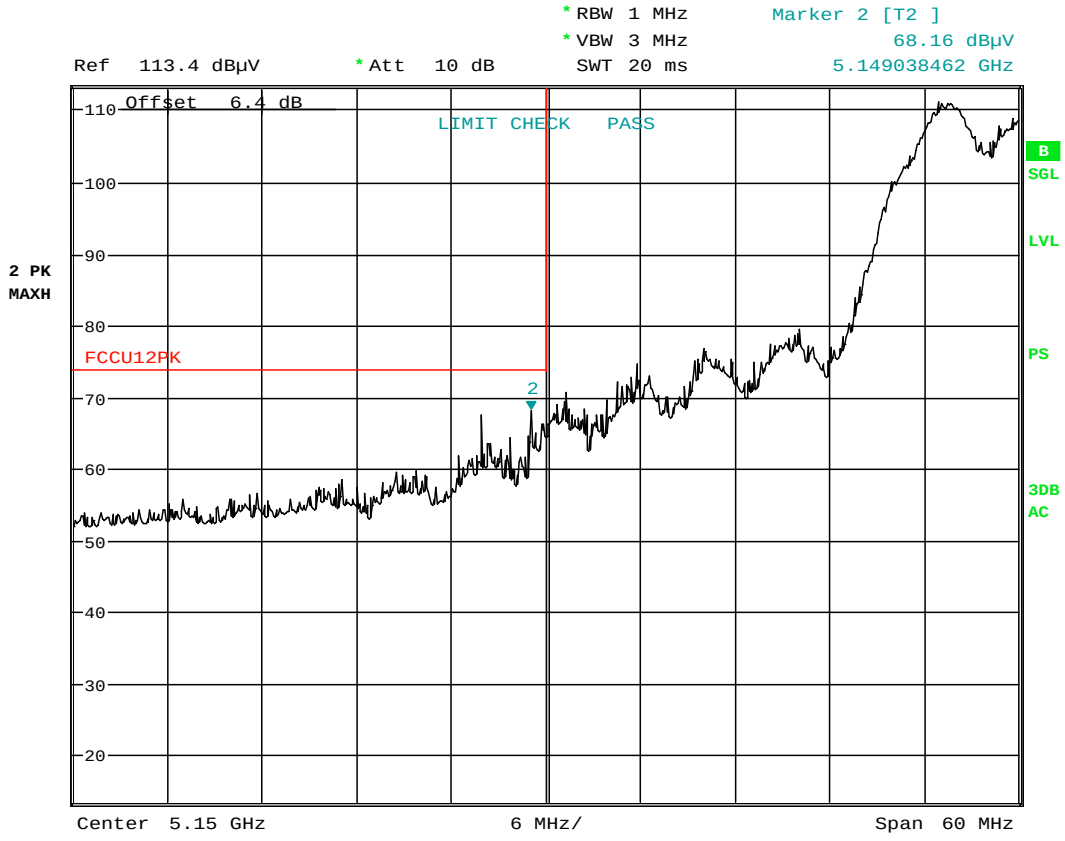


Date: 17.FEB.2017 11:30:02

Plot A.4-1. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

Dual Tx Radiated Restricted Band Edge Measurements

§15.407(b.1)(b.2) §15.205 §15.209



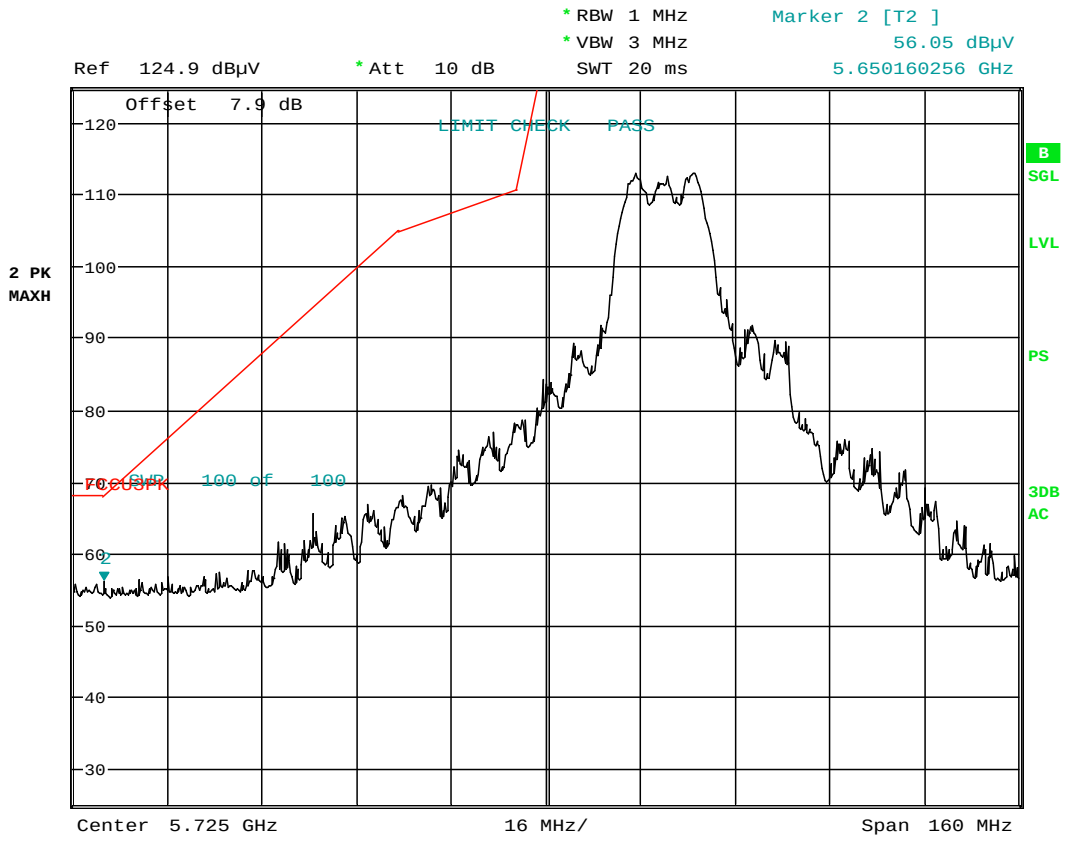
Date: 17.FEB.2017 11:27:25

Plot A.4-2. Radiated Restricted Lower Band Edge Plot (Average – UNII Band 1)

Dual Tx Radiated Restricted Band Edge Measurements

§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: 17.FEB.2017 11:37:07

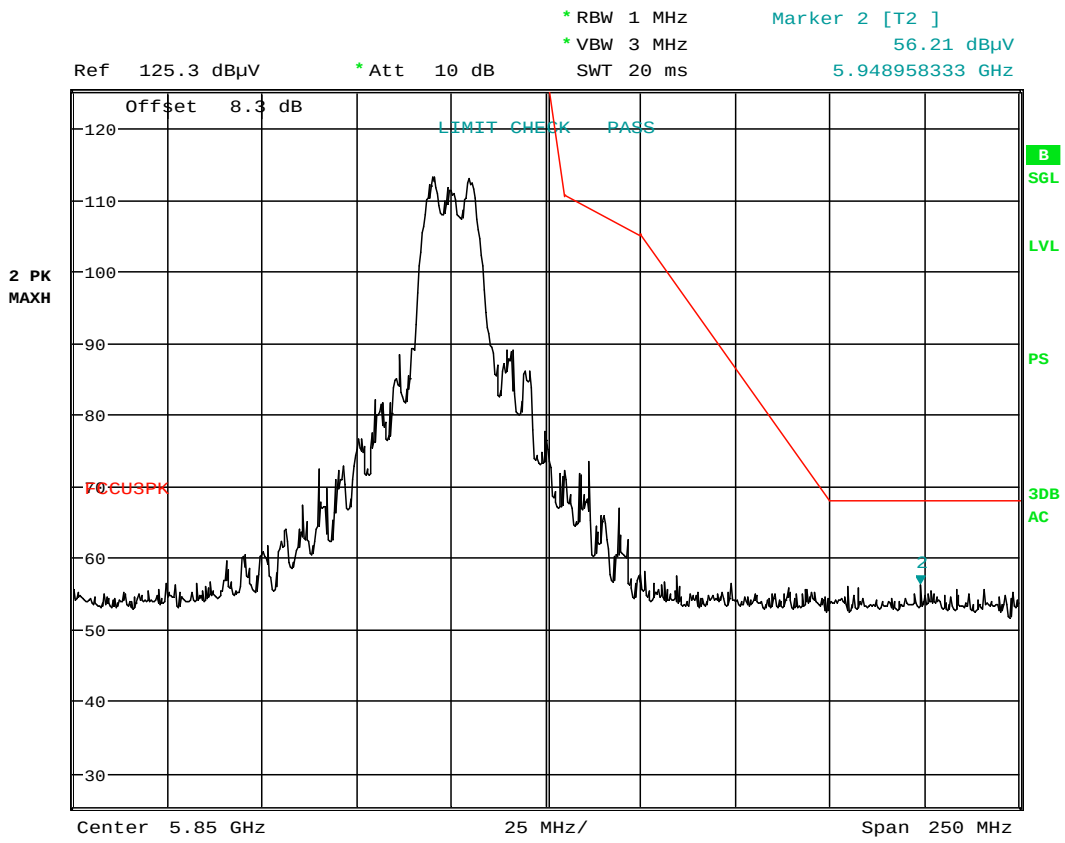
Plot A.4-3. Radiated Lower Band Edge Plot (Peak – UNII Band 3)

V 6.5
05/19/2017

Dual Tx Radiated Restricted Band Edge Measurements

§15.407(b.1)(b.2) §15.205 §15.209

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



Date: 17.FEB.2017 11:41:39

Plot A.4-4. Radiated Upper Band Edge Plot (Peak – UNII Band 3)

V 6.5
05/19/2017