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# MEASUREMENT REPORT
## FCC Part 15.247 WLAN 802.11a/b/g/n/ac

**Applicant Name:**
Samsung Electronics, Co. Ltd.
129, Samsung-ro, Maetan dong,
Yeongtong-gu, Suwon-si
Gyeonggi-do 443-742, Korea

**Date of Testing:**
7/23 - 8/1/2014
**Test Site/Location:**
PCTEST Lab, Columbia, MD, USA
**Test Report Serial No.:**
0Y1407181401.A3L

| | |
|---|---|
| **FCC ID:** | **A3LSMG850A** |
| **APPLICANT:** | **Samsung Electronics, Co. Ltd.** |

| | |
|---|---|
| **Application Type:** | Certification |
| **Model(s):** | SM-G850A |
| **EUT Type:** | Portable Handset |
| **FCC Classification:** | Digital Transmission System (DTS) |
| **FCC Rule Part(s):** | Part 15.247 |
| **Test Procedure(s):** | KDB 558074 v03r02, KDB 662911 v02r01 |

| Mode | Tx Frequency (MHz) | Conducted Power | | | | ANT2 | | | | MIMO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Avg Conducted | | Peak Conducted | | Avg Conducted | | Peak Conducted | | Avg Conducted | | Peak Conducted | |
| | | Max. Power (mW) | Max. Power (dBm) | Max. Power (mW) | Max. Power (dBm) | Max. Power (mW) | Max. Power (dBm) | Max. Power (mW) | Max. Power (dBm) | Max. Power (mW) | Max. Power (dBm) | Max. Power (mW) | Max. Power (dBm) |
| 802.11b | 2412 - 2462 | 55.081 | 17.41 | 119.950 | 20.79 | 55.847 | 17.47 | 108.393 | 20.35 | N/A | | | |
| 802.11g | 2412 - 2462 | 44.566 | 16.49 | 194.984 | 22.90 | 44.463 | 16.48 | 186.209 | 22.70 | | | | |
| 802.11n | 2412 - 2462 | 34.674 | 15.40 | 141.579 | 21.51 | 34.277 | 15.35 | 122.744 | 20.89 | 66.996 | 18.26 | 229.674 | 23.61 |
| 802.11a | 5745 - 5825 | 24.210 | 13.84 | 78.524 | 18.95 | 28.119 | 14.49 | 97.499 | 19.89 | N/A | | | |
| 802.11n (20MHz) | 5745 - 5825 | 23.768 | 13.76 | 80.168 | 19.04 | 28.054 | 14.48 | 94.406 | 19.75 | 50.737 | 17.05 | 165.128 | 22.18 |
| 802.11n (40MHz) | 5755 - 5795 | 17.298 | 12.38 | 62.230 | 17.94 | 16.749 | 12.24 | 72.611 | 18.61 | 32.294 | 15.09 | 121.084 | 20.83 |
| 802.11ac (80MHz) | 5775 | 12.050 | 10.81 | 42.170 | 16.25 | 14.028 | 11.47 | 51.880 | 17.15 | 25.159 | 14.01 | 91.417 | 19.61 |

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 558074 v03r02. 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 15.247

## § 2.1033 General Information

| | |
|---|---|
| **APPLICANT:** | Samsung Electronics, Co. Ltd. |
| **APPLICANT ADDRESS:** | 129, Samsung-ro, Maetan dong, |
| | Yeongtong-gu, Suwon-si, Gyeonggi-do 443-742, Korea |
| **TEST SITE:** | PCTEST ENGINEERING LABORATORY, INC. |
| **TEST SITE ADDRESS:** | 7185 Oakland Mills Road, Columbia, MD 21046 USA |
| **FCC RULE PART(S):** | Part 15.247 |
| **BASE MODEL:** | SM-G850A |
| **FCC ID:** | A3LSMG850A |
| **FCC CLASSIFICATION:** | Digital Transmission System (DTS) |
| **Test Device Serial No.:** | 18JULY-8, 18JULY-11 ☐ Production ☒ Pre-Production ☐ Engineering |
| **DATE(S) OF TEST:** | 7/23 - 8/1/2014 |
| **TEST REPORT S/N:** | 0Y1407181401.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.


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# 1.0 INTRODUCTION

## 1.1 Scope

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

## 1.2 PCTEST Test Location

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

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

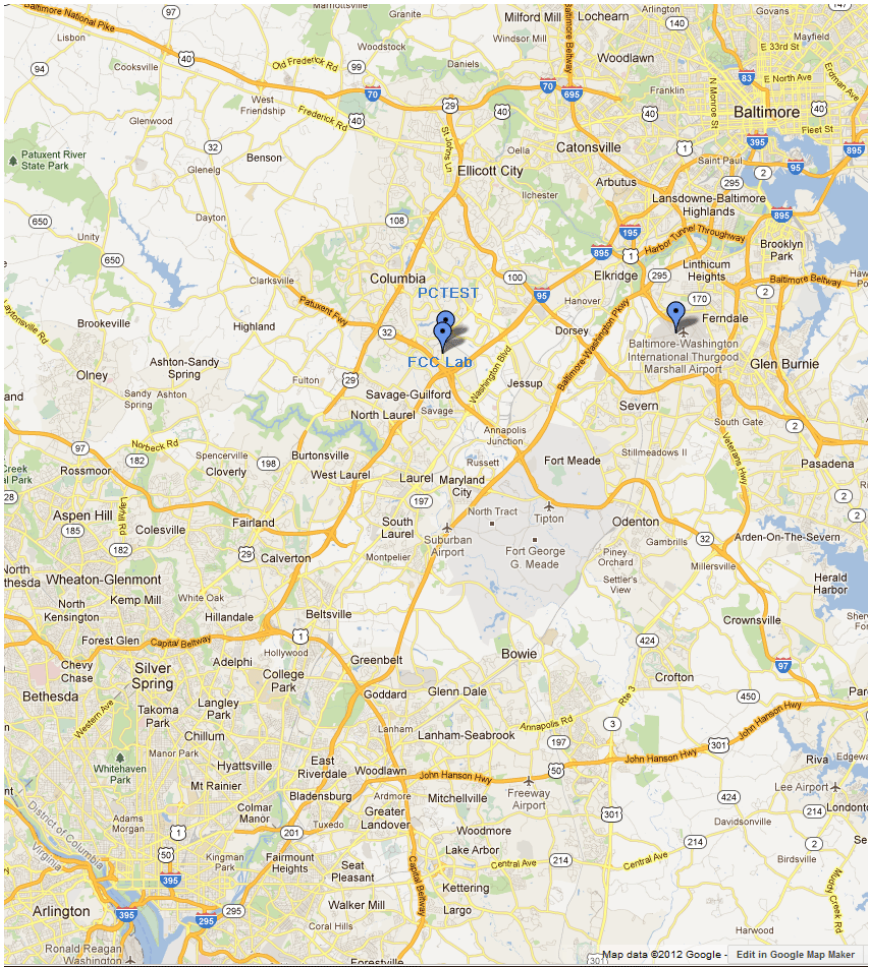


**Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area**


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# 2.0 PRODUCT INFORMATION

## 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMG850A**. The test data contained in this report pertains only to the emissions due to the EUT's WLAN (DTS) transmitter.

## 2.2 Device Capabilities

This device contains the following capabilities:

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

**Note:** 5GHz WLAN (DTS/NII) operation is possible in 20MHz, 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 6.0 b) of KDB 558074 v03r02. 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 |
| 2.4GHz | b | 99.82 | 99.88 | N/A |
| | g | 99.03 | 99.38 | N/A |
| | n | 99.12 | 99.12 | 98.81 |
| 5GHz | a | 98.80 | 98.90 | N/A |
| | n (HT20) | 98.80 | 98.90 | 98.83 |
| | n (HT40) | 98.40 | 98.60 | 98.31 |
| | ac (HT80) | 98.00 | 98.00 | 98.22 |

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

| WiFi Configurations | | SISO | | SDM | |
|---|---|---|---|---|---|
| | | ANT1 | ANT2 | ANT1 | ANT2 |
| 2.4GHz | 11b | ✓ | ✓ | × | × |
| | 11g | ✓ | ✓ | × | × |
| | 11n | ✓ | ✓ | ✓ | ✓ |
| 5GHz | 11a | ✓ | ✓ | × | × |
| | 11n (20MHz) | ✓ | ✓ | ✓ | ✓ |
| | 11n (40MHz) | ✓ | ✓ | ✓ | ✓ |
| | 11ac (80MHz) | ✓ | ✓ | ✓ | ✓ |

**Table 2-1. Frequency / Channel Operations**

✓= Support ; × = NOT Support
**SISO** = Single Input Single Output
**SDM** = Spatial Diversity Multiplexing – MIMO function


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## 2.3 Test Configuration

The Samsung Portable Handset FCC ID: A3LSMG850A was tested per the guidance of KDB 558074 v03r02. ANSI C63.10-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 6.2, 6.3, 6.4, 6.5, and 6.6 for antenna port conducted emissions test setups.

## 2.4 EMI Suppression Device(s)/Modifications

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

## 2.5 Labeling Requirements

Per 15.19; Docket 95-19

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


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# 3.0 DESCRIPTION OF TEST

## 3.1 Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2009), and the guidance provided in KDB 558074 v03r02 were used in the measurement of the **Samsung Portable Handset FCC ID: A3LSMG850A.**

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

## 3.2 AC Line Conducted Emissions

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

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

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

Line conducted emissions test results are shown in Section 6.11. Automated test software was used to perform the AC line conducted emissions testing. Automated measurement software utilized is Rohde & Schwarz EMC32, Version 8.51.0.


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## 3.3 Radiated Emissions

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

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

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


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# 4.0 ANTENNA REQUIREMENTS

**Excerpt from §15.203 of the FCC Rules/Regulations:**
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

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

**Conclusion:**

The **Samsung Portable Handset FCC ID: A3LSMG850A** unit complies with the requirement of §15.203.

| Ch. | Frequency (MHz) | Ch. | Frequency (MHz) |
|---|---|---|---|
| 1 | 2412 | 7 | 2442 |
| 2 | 2417 | 8 | 2447 |
| 3 | 2422 | 9 | 2452 |
| 4 | 2427 | 10 | 2457 |
| 5 | 2432 | 11 | 2462 |
| 6 | 2437 | | |

| Ch. | BW (MHz) | Frequency (MHz) |
|---|---|---|
| 149 | 20 | 5745 |
| 151 | 20 / 40 | 5755 |
| 153 | 20 | 5765 |
| 155 | 20 / 80 | 5775 |
| 157 | 20 | 5785 |

| Ch. | BW (MHz) | Frequency (MHz) |
|---|---|---|
| 159 | 20 / 40 | 5795 |
| 161 | 20 | 5805 |
| 163 | 20 | 5815 |
| 165 | 20 | 5825 |
| | | |

**Table 4-1. Frequency/ Channel Operations**


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# 5.0 TEST EQUIPMENT CALIBRATION DATA

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

| Manufacturer | Model | Description | Cal Date | Cal Interval | Cal Due | Serial Number |
|---|---|---|---|---|---|---|
| - | RE1 | Radiated Emissions Cable Set (UHF/EHF) | 5/29/2014 | Annual | 5/29/2015 | N/A |
| - | RE3 | Radiated Emissions Cable Set | 7/7/2014 | Annual | 7/7/2015 | N/A |
| - | WL25-1 | Conducted Cable Set (25GHz) | 1/29/2014 | Annual | 1/29/2015 | N/A |
| - | WL40-1 | Conducted Cable Set (40GHz) | 1/29/2014 | Annual | 1/29/2015 | N/A |
| Agilent | 8447D | Broadband Amplifier | 5/30/2014 | Annual | 5/30/2015 | 2443A01900 |
| Agilent | N9020A | MXA Signal Analyzer | 10/29/2013 | Annual | 10/29/2014 | US46470561 |
| Agilent | N9030A | PXA Signal Analyzer (44GHz) | 1/17/2014 | Annual | 1/17/2015 | MY52350166 |
| Anritsu | MA2411B | Pulse Sensor | 4/8/2014 | Annual | 4/8/2015 | 846215 |
| Anritsu | ML2495A | Power Meter | 10/31/2013 | Annual | 10/31/2014 | 941001 |
| Com-Power | AL-130 | 9kHz - 30MHz Loop Antenna | 6/26/2013 | Biennial | 6/26/2015 | 121034 |
| Emco | 3115 | Horn Antenna (1-18GHz) | 1/30/2014 | Biennial | 1/30/2016 | 9704-5182 |
| ETS Lindgren | 3117 | 1-18 GHz DRG Horn (Medium) | 4/8/2014 | Biennial | 4/8/2016 | 125518 |
| ETS Lindgren | 3160-09 | 18-26.5 GHz Standard Gain Horn | 6/17/2014 | Biennial | 6/17/2016 | 135427 |
| ETS Lindgren | 3160-10 | 26.5-40 GHz Standard Gain Horn | 6/17/2014 | Biennial | 6/17/2016 | 130993 |
| Huber+Suhner | Sucoflex 102A | 40GHz Radiated Cable | 1/30/2014 | Annual | 1/30/2015 | 251425001 |
| K & L | 11SH10-3075/U18000 | High Pass Filter | 5/2/2014 | Annual | 5/2/2015 | 2 |
| K & L | 11SH10-6000/T18000 | High Pass Filter | 2/7/2014 | Annual | 2/7/2015 | 1 |
| Pasternack | NMLC-1 | Line Conducted Emissions Cable (NM) | 1/28/2014 | Annual | 1/28/2015 | N/A |
| Rhode & Schwarz | TS-PR18 | Pre-Amplifier | 6/12/2014 | Annual | 6/12/2015 | 101622 |
| Rohde & Schwarz | ESU26 | EMI Test Receiver (26.5GHz) | 1/27/2014 | Annual | 1/27/2015 | 100342 |
| Rohde & Schwarz | ESU40 | EMI Test Receiver (40GHz) | 5/21/2014 | Annual | 5/21/2015 | 100348 |
| Rohde & Schwarz | TS-PR18 | 1-18 GHz Pre-Amplifier | 3/5/2014 | Annual | 3/5/2015 | 100071 |
| Rohde & Schwarz | TS-PR26 | 18-26.5 GHz Pre-Amplifier | 3/12/2014 | Annual | 3/12/2015 | 100040 |
| Rohde & Schwarz | TS-PR40 | 26.5-40 GHz Pre-Amplifier | 5/15/2014 | Annual | 5/15/2015 | 100037 |
| Seekonk | NC-100 | Torque Wrench 5/16", 8" lbs | 3/18/2014 | Biennial | 3/18/2016 | N/A |
| Solar Electronics | 8012-50-R-24-BNC | Line Impedance Stabilization Network | 6/20/2013 | Biennial | 6/20/2015 | 310233 |
| Sunol | JB5 | Bi-Log Antenna (30M - 5GHz) | 1/28/2014 | Biennial | 1/28/2016 | A051107 |

**Table 5-1. Annual Test Equipment Calibration Schedule**


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# 6.0 TEST RESULTS

## 6.1 Summary

Company Name: Samsung Electronics, Co. Ltd.
FCC ID: A3LSMG850A
FCC Classification: Digital Transmission System (DTS)
Data Rate(s) Tested: 1Mbps, 2Mbps, 5.5Mbps, 11Mbps (b)
6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps (a/g)
6.5/7.2Mbps, 13/14.4Mbps, 19.5/21.7Mbps, 26/28.9Mbps, 39/43.3Mbps, 52/57.8Mbps, 58.5/65Mbps, 65/72.2Mbps (n – 20MHz)
13.5/15Mbps, 27/30Mbps, 40.5/45Mbps, 54/60Mbps, 81/90Mbps, 108/120Mbps, 121.5/135Mbps, 135/150Mbps (n – 40MHz)
29.3/32.5Mbps, 58.5/65Mbps, 87.8/97.5Mbps, 117/130Mbps, 175.5/195Mbps, 234/260Mbps, 263.3/292.5Mbps, 292.5/325Mbps, 351/390Mbps, 390/433.3Mbps (ac – 80MHz BW)

| FCC Part Section(s) | Test Description | Test Limit | Test Condition | Test Result | Reference |
|---|---|---|---|---|---|
| **TRANSMITTER MODE (TX)** | | | | | |
| 15.247(a)(2) | 6dB Bandwidth | > 500kHz | CONDUCTED | PASS | Section 6.2 |
| 15.247(b)(3) | Transmitter Output Power | < 1 Watt | | PASS | Sections 6.3 |
| 15.247(e) | Transmitter Power Spectral Density | < 8dBm / 3kHz Band | | PASS | Section 0 |
| 15.247(d) | Band Edge / Out-of-Band Emissions | Conducted ≥ 20dBc | | PASS | Sections 6.5, 6.6 |
| 15.205 15.209 | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | Emissions in restricted bands must meet the radiated limits detailed in 15.209 | RADIATED | PASS | Sections 6.7, 6.8, 6.9, 6.10 |
| 15.207 | AC Conducted Emissions 150kHz – 30MHz | < FCC 15.207 limits | LINE CONDUCTED | PASS | Section 6.11 |

**Table 6-1. Summary of Test Results**

**Notes:**

1) All modes of operation and data rates were investigated. 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 "WLAN Automation", Version 2.7.


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## 6.2 6dB Bandwidth Measurement

**§15.247(a.2)**

**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 transmitter antenna terminal of the EUT while the EUT is operating at its maximum duty cycle (>98%), at maximum power, and at the appropriate frequencies. All data rates were investigated and the worst case configuration results are reported in this section.

***The minimum permissible 6dB bandwidth is 500 kHz.***

**Test Procedure Used**

KDB 558074 v03r02 – Section 8.2 Option 2

**Test Settings**

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 100kHz
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize

**Test Setup**

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

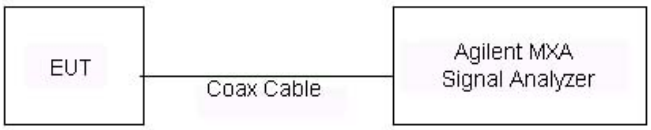


**Figure 6-1. Test Instrument & Measurement Setup**

**Test Notes**

None


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## Antenna-1 6 dB Bandwidth Measurements

| Frequency [MHz] | Channel No. | 802.11 Mode | Data Rate [Mbps] | Measured Bandwidth [MHz] | Minimum Bandwidth [MHz] | Pass / Fail |
|---|---|---|---|---|---|---|
| 2412 | 1 | b | 1 | 7.558 | 0.500 | Pass |
| 2437 | 6 | b | 1 | 8.049 | 0.500 | Pass |
| 2462 | 11 | b | 1 | 8.060 | 0.500 | Pass |
| 2412 | 1 | g | 6 | 16.40 | 0.500 | Pass |
| 2437 | 6 | g | 6 | 16.34 | 0.500 | Pass |
| 2462 | 11 | g | 6 | 16.39 | 0.500 | Pass |
| 2412 | 1 | n | 6.5/7.2 (MCS0) | 17.60 | 0.500 | Pass |
| 2437 | 6 | n | 6.5/7.2 (MCS0) | 17.57 | 0.500 | Pass |
| 2462 | 11 | n | 6.5/7.2 (MCS0) | 17.63 | 0.500 | Pass |
| 5745 | 149 | a | 6 | 16.37 | 0.500 | Pass |
| 5785 | 157 | a | 6 | 16.36 | 0.500 | Pass |
| 5825 | 165 | a | 6 | 16.35 | 0.500 | Pass |
| 5745 | 149 | n (20MHz) | 6.5/7.2 (MCS0) | 17.60 | 0.500 | Pass |
| 5785 | 157 | n (20MHz) | 6.5/7.2 (MCS0) | 17.59 | 0.500 | Pass |
| 5825 | 165 | n (20MHz) | 6.5/7.2 (MCS0) | 17.56 | 0.500 | Pass |
| 5755 | 151 | n (40MHz) | 13.5/15 (MCS0) | 36.01 | 0.500 | Pass |
| 5795 | 159 | n (40MHz) | 13.5/15 (MCS0) | 36.11 | 0.500 | Pass |
| 5775 | 155 | ac (80MHz) | 29.3/32.5 (MCS0) | 75.26 | 0.500 | Pass |

**Table 6-2. Conducted Bandwidth Measurements**


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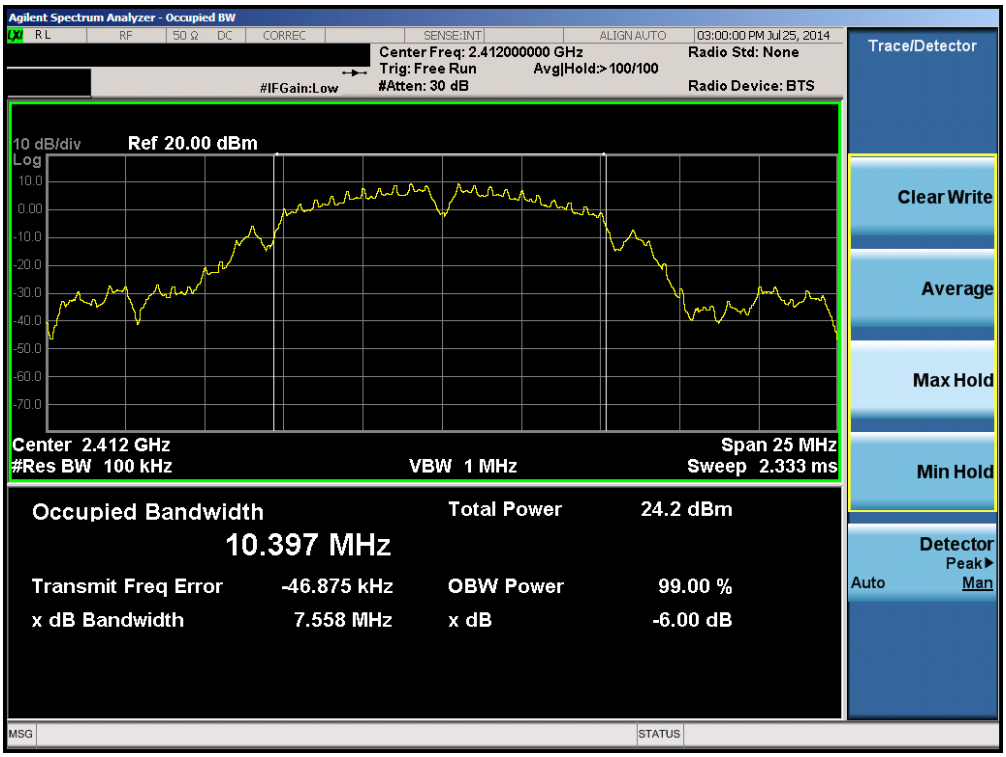
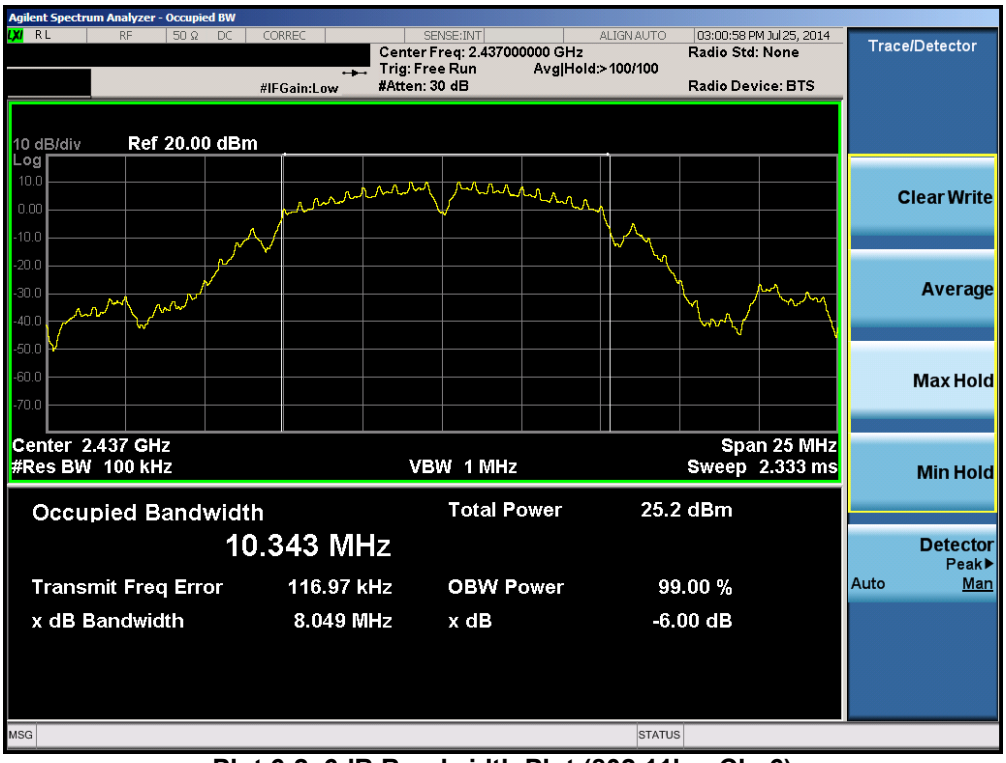



**Plot 6-1. 6dB Bandwidth Plot (802.11b – Ch. 1)**




**Plot 6-2. 6dB Bandwidth Plot (802.11b – Ch. 6)**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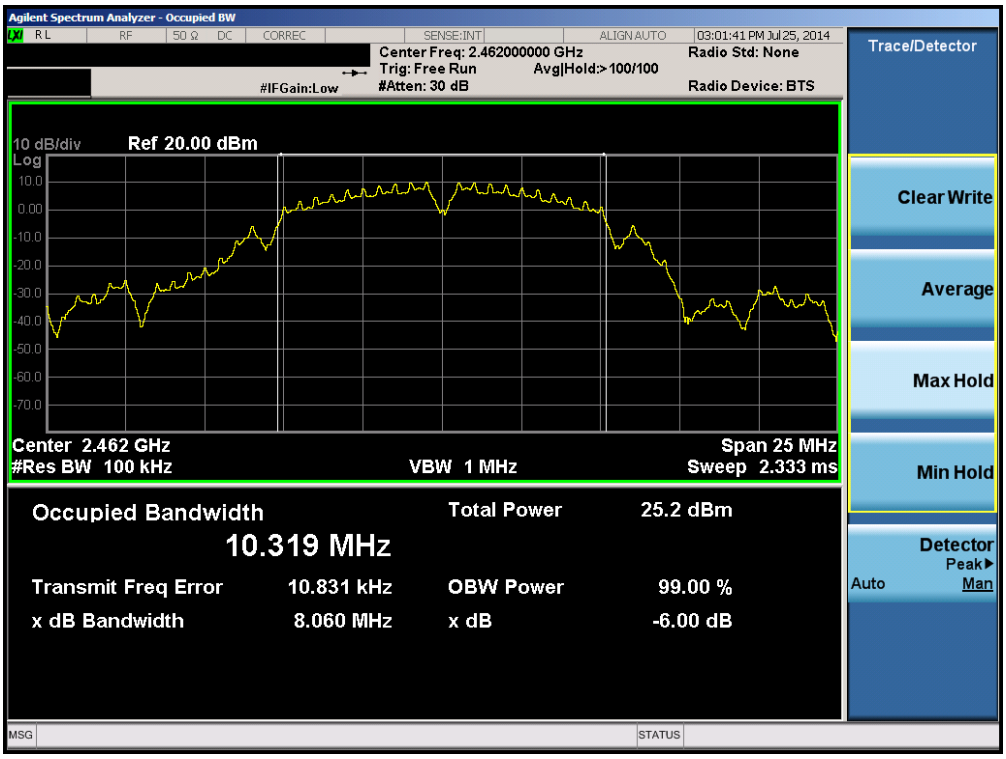
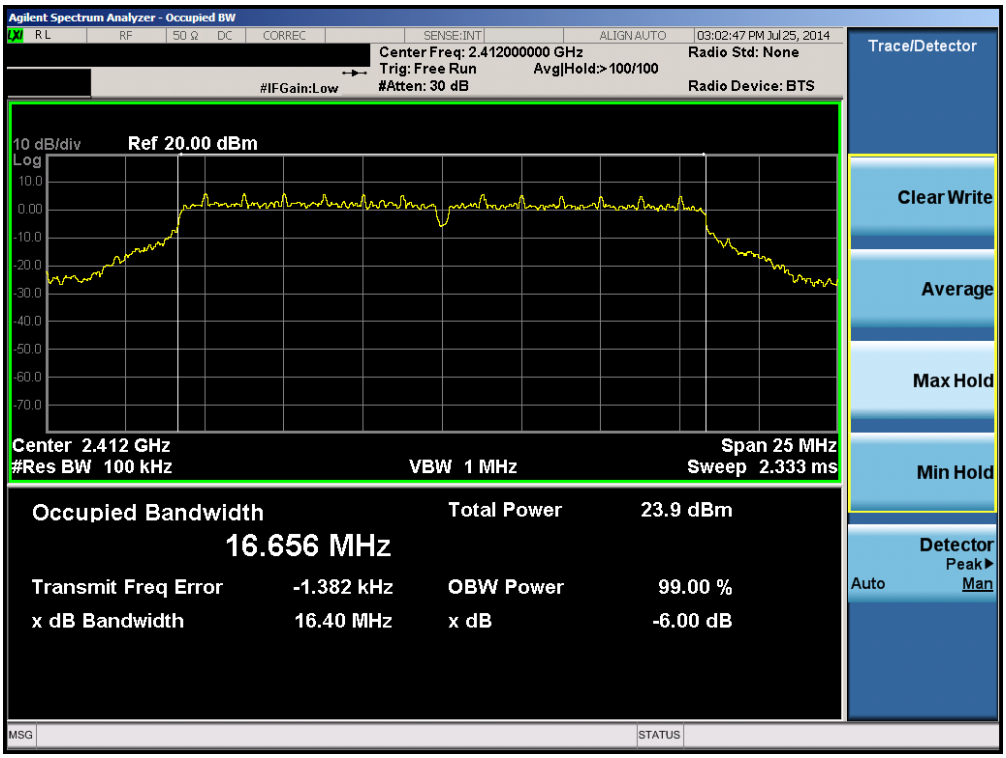



**Plot 6-3. 6dB Bandwidth Plot (802.11b – Ch. 11)**




**Plot 6-4. 6dB Bandwidth Plot (802.11g – Ch. 1)**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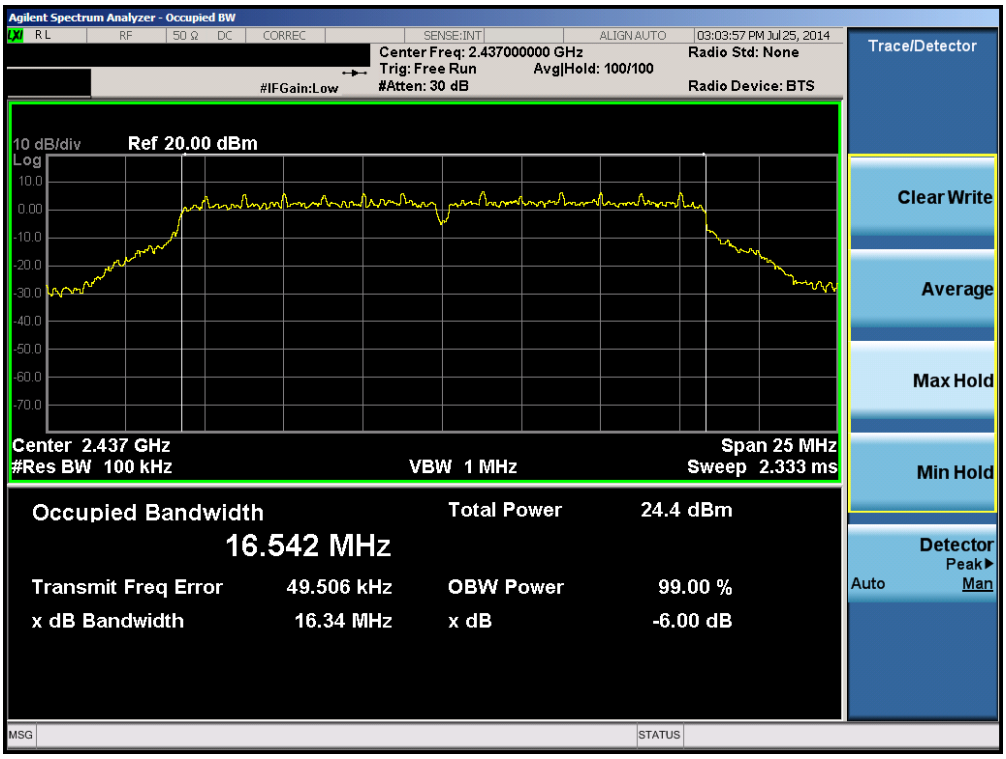
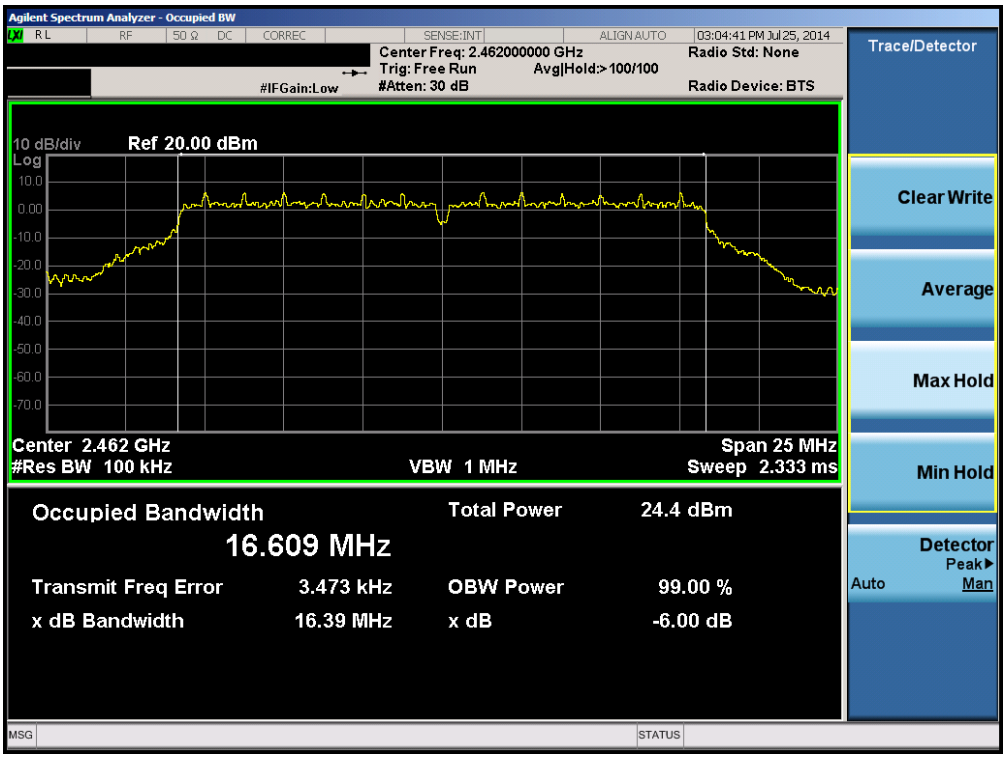



**Plot 6-5. 6dB Bandwidth Plot (802.11g – Ch. 6)**




**Plot 6-6. 6dB Bandwidth Plot (802.11g – Ch. 11)**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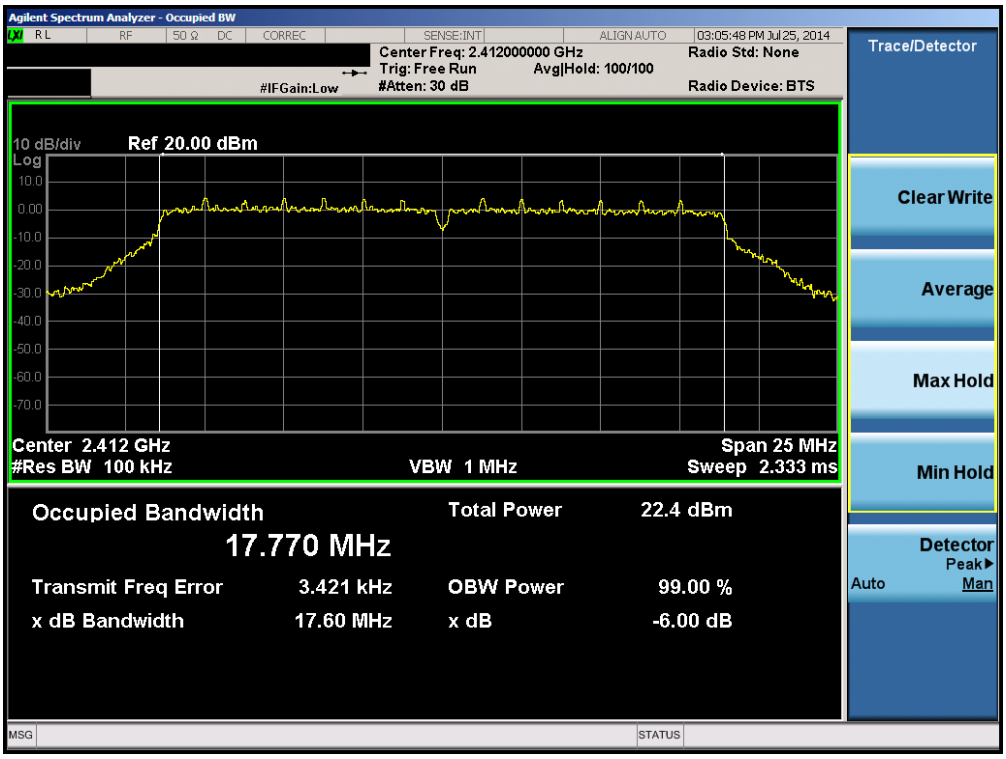
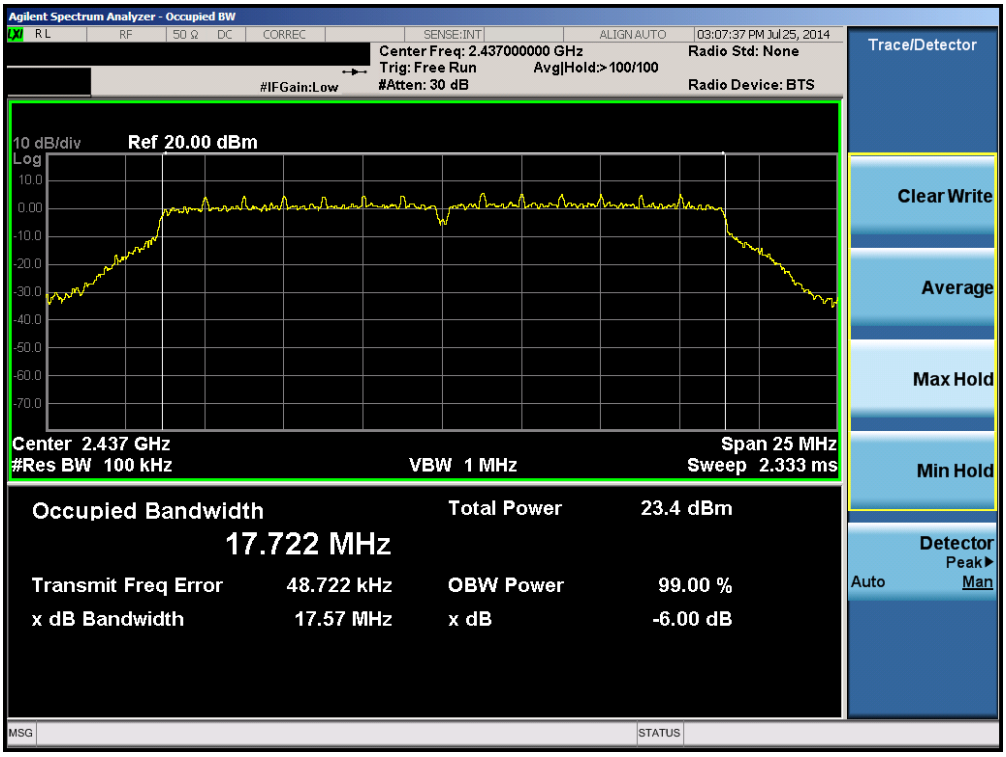



**Plot 6-7. 6dB Bandwidth Plot (802.11n (2.4GHz) – Ch. 1)**




**Plot 6-8. 6dB Bandwidth Plot (802.11n (2.4GHz) – Ch. 6)**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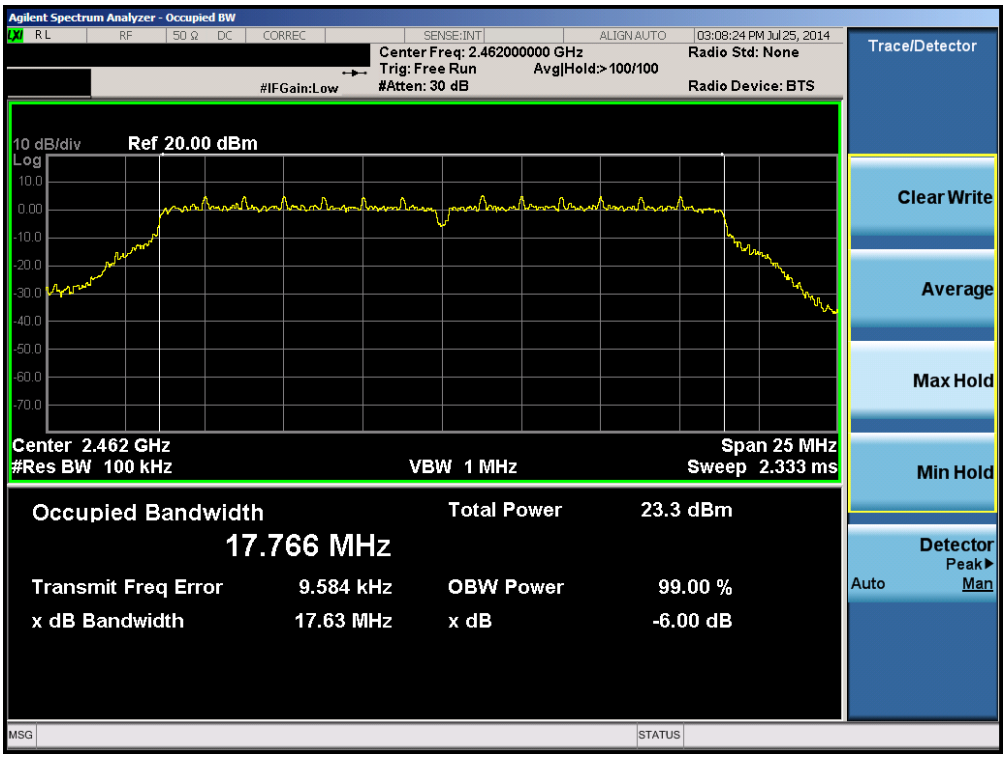
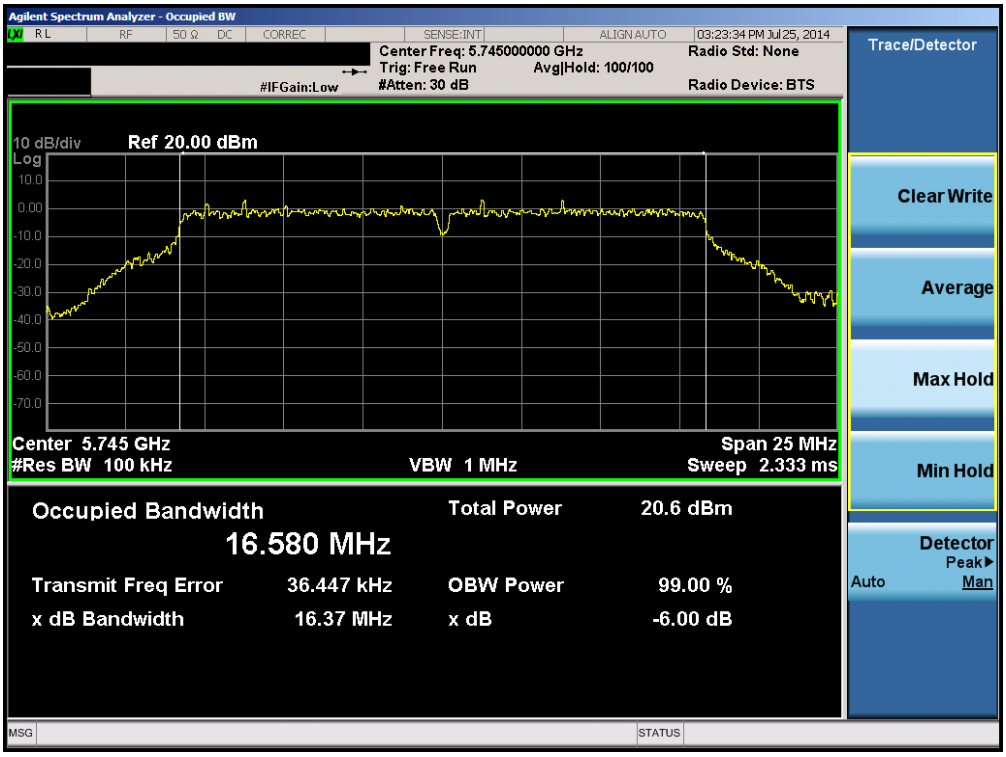



**Plot 6-9. 6dB Bandwidth Plot (802.11n (2.4GHz) – Ch. 11)**




**Plot 6-10. 6dB Bandwidth Plot (802.11a – Ch. 149)**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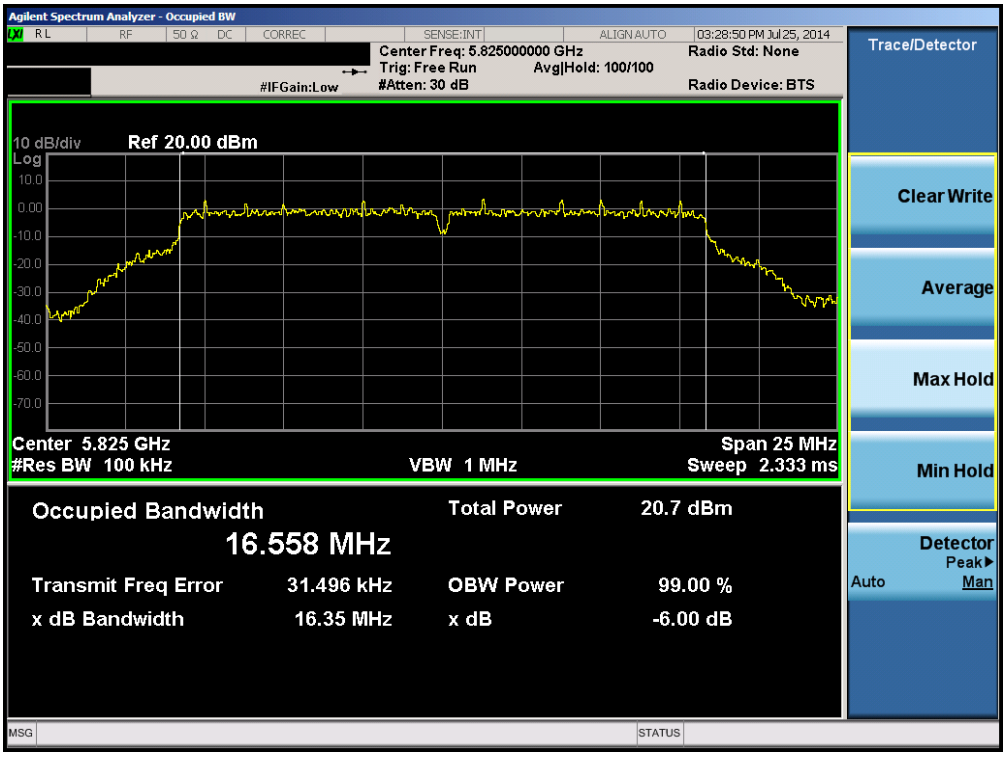
**Plot 6-11. 6dB Bandwidth Plot (802.11a – Ch. 157)**




**Plot 6-12. 6dB Bandwidth Plot (802.11a – Ch. 165)**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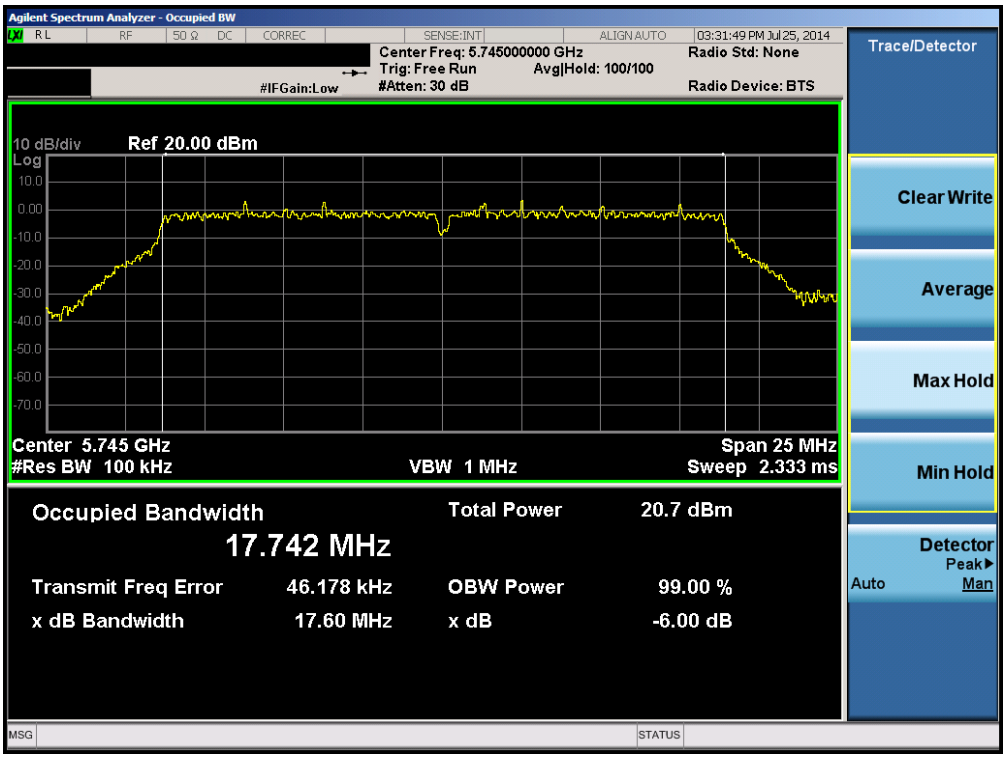
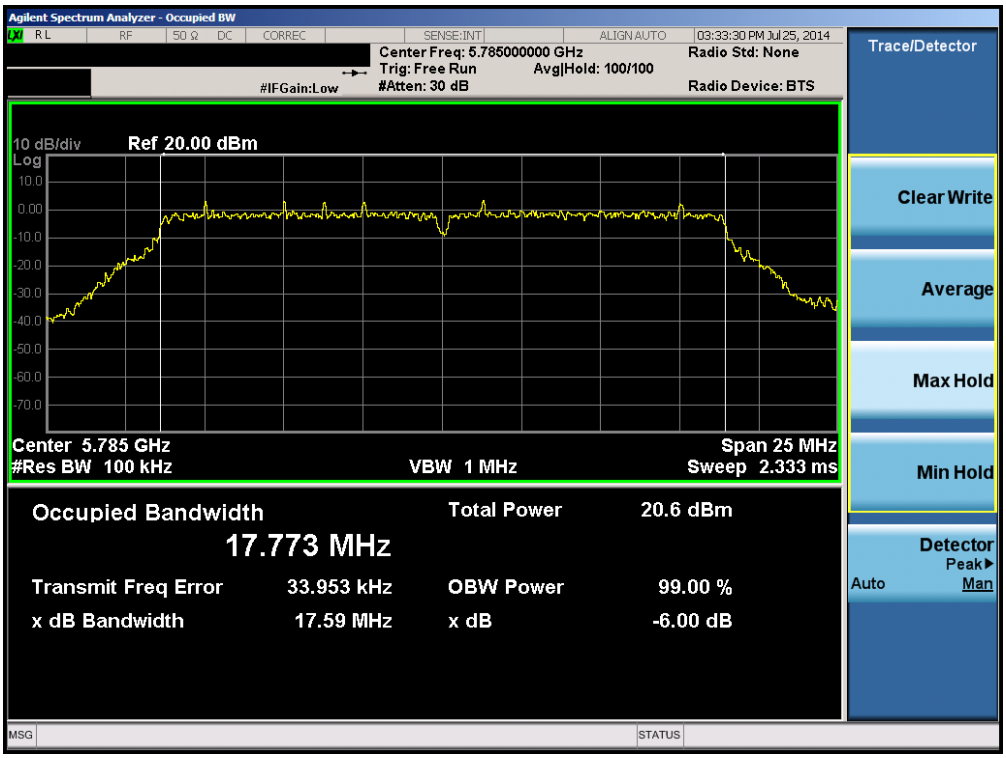



**Plot 6-13. 6dB Bandwidth Plot (20MHz BW 802.11n (5.8GHz) – Ch. 149)**




**Plot 6-14. 6dB Bandwidth Plot (20MHz BW 802.11n (5.8GHz) – Ch. 157)**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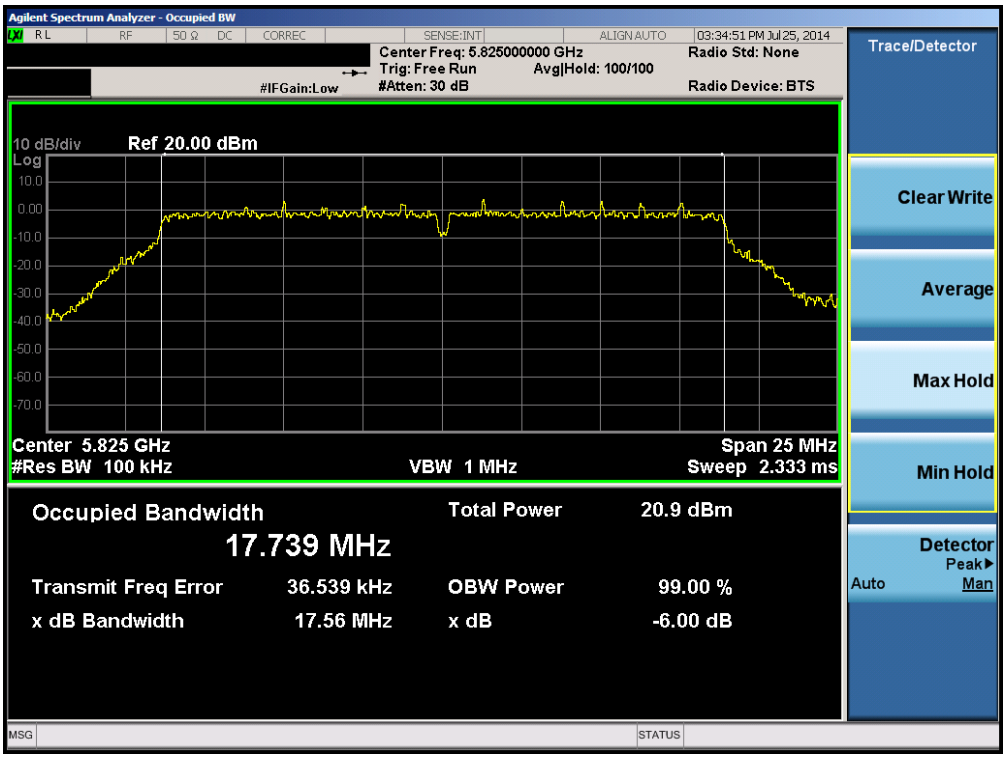
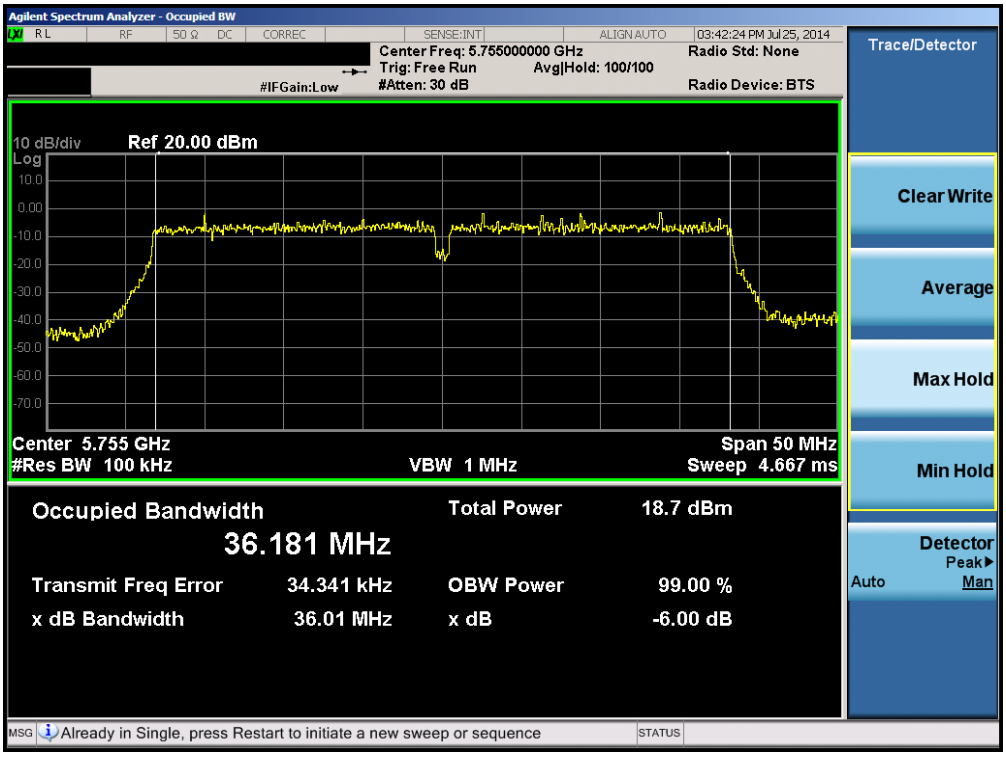



**Plot 6-15. 6dB Bandwidth Plot (20MHz BW 802.11n (5.8GHz) – Ch. 165)**




**Plot 6-16. 6dB Bandwidth Plot (40MHz BW 802.11n (5.8GHz) – Ch. 151)**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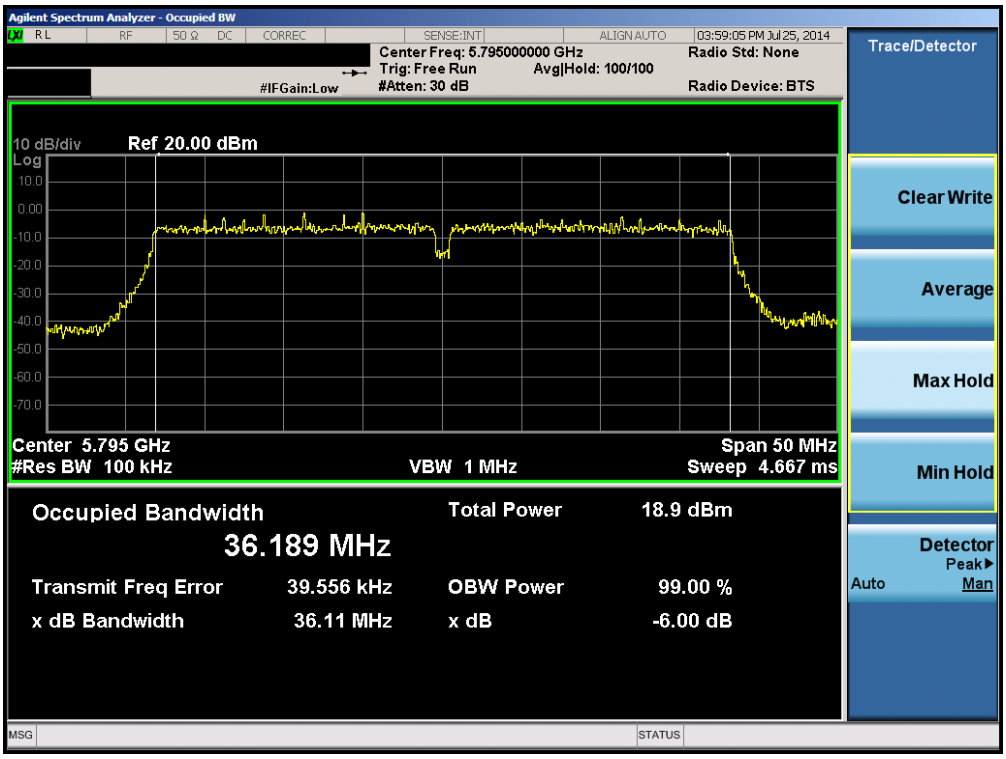
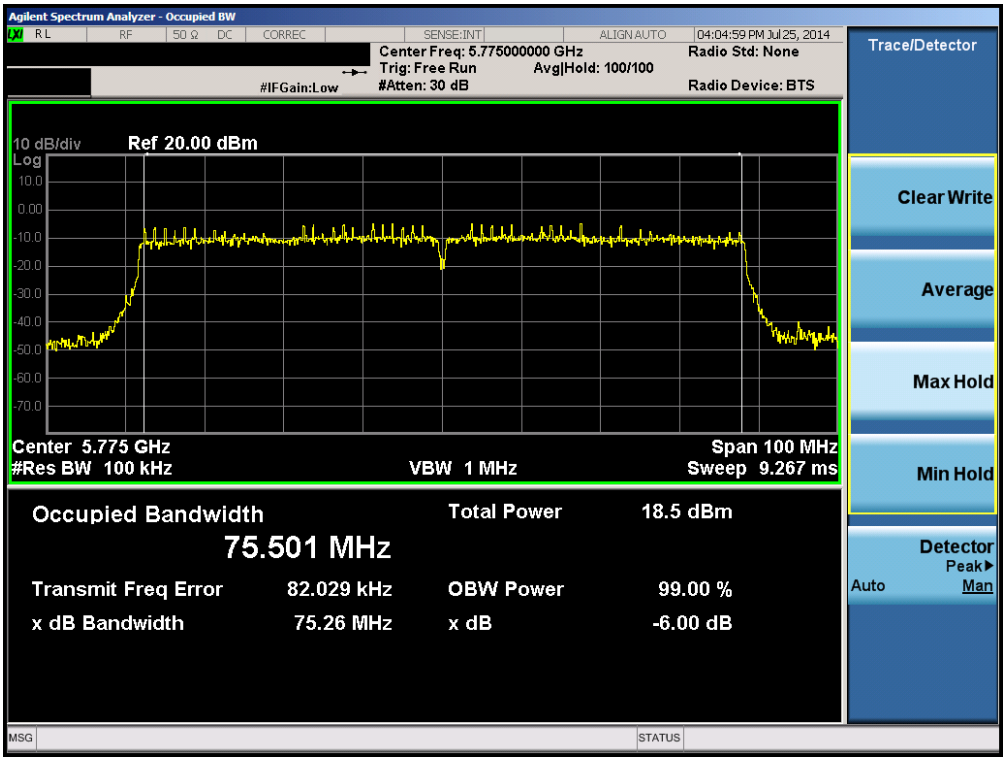



**Plot 6-17. 6dB Bandwidth Plot (40MHz BW 802.11n (5.8GHz) – Ch. 159)**




**Plot 6-18. 6dB Bandwidth Plot (80MHz BW 802.11ac (5.8GHz) – Ch. 155)**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## Antenna-2 6 dB Bandwidth Measurements

| Frequency [MHz] | Channel No. | 802.11 Mode | Data Rate [Mbps] | Measured Bandwidth [MHz] | Minimum Bandwidth [MHz] | Pass / Fail |
|---|---|---|---|---|---|---|
| 2412 | 1 | b | 1 | 8.074 | 0.500 | Pass |
| 2437 | 6 | b | 1 | 8.531 | 0.500 | Pass |
| 2462 | 11 | b | 1 | 8.568 | 0.500 | Pass |
| 2412 | 1 | g | 6 | 16.13 | 0.500 | Pass |
| 2437 | 6 | g | 6 | 15.99 | 0.500 | Pass |
| 2462 | 11 | g | 6 | 16.37 | 0.500 | Pass |
| 2412 | 1 | n | 6.5/7.2 (MCS0) | 17.31 | 0.500 | Pass |
| 2437 | 6 | n | 6.5/7.2 (MCS0) | 16.71 | 0.500 | Pass |
| 2462 | 11 | n | 6.5/7.2 (MCS0) | 17.60 | 0.500 | Pass |
| 5745 | 149 | a | 6 | 16.38 | 0.500 | Pass |
| 5785 | 157 | a | 6 | 16.36 | 0.500 | Pass |
| 5825 | 165 | a | 6 | 16.36 | 0.500 | Pass |
| 5745 | 149 | n (20MHz) | 6.5/7.2 (MCS0) | 17.57 | 0.500 | Pass |
| 5785 | 157 | n (20MHz) | 6.5/7.2 (MCS0) | 17.60 | 0.500 | Pass |
| 5825 | 165 | n (20MHz) | 6.5/7.2 (MCS0) | 17.62 | 0.500 | Pass |
| 5755 | 151 | n (40MHz) | 13.5/15 (MCS0) | 36.08 | 0.500 | Pass |
| 5795 | 159 | n (40MHz) | 13.5/15 (MCS0) | 36.08 | 0.500 | Pass |
| 5775 | 155 | ac (80MHz) | 29.3/32.5 (MCS0) | 75.24 | 0.500 | Pass |

**Table 6-3. Conducted Bandwidth Measurements**


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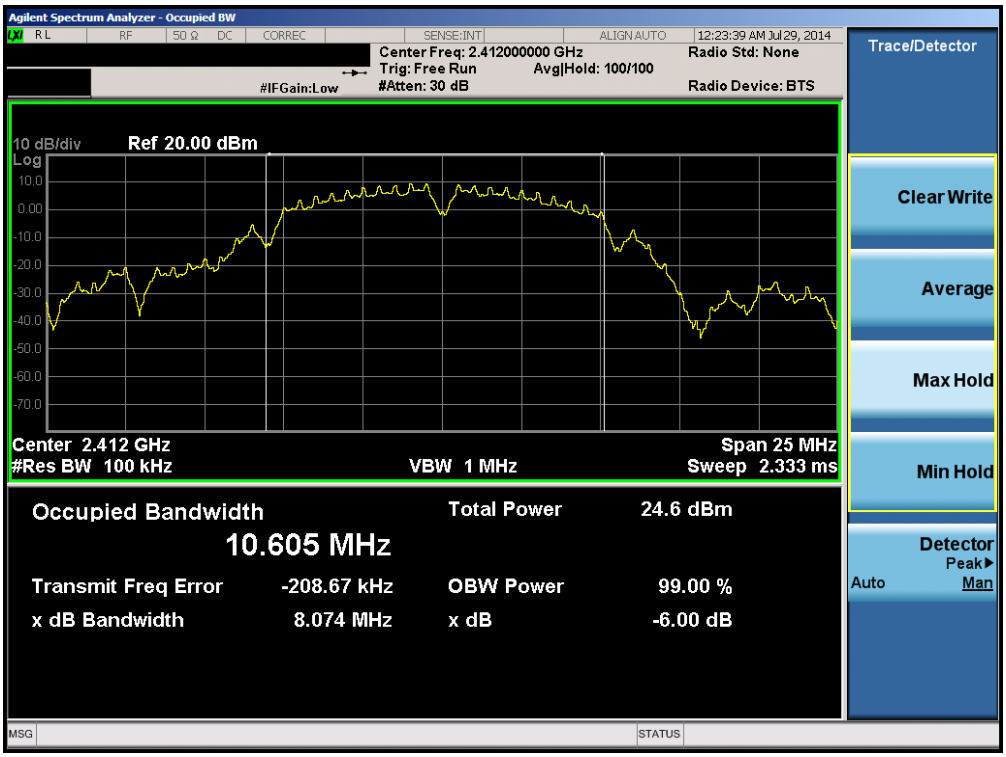
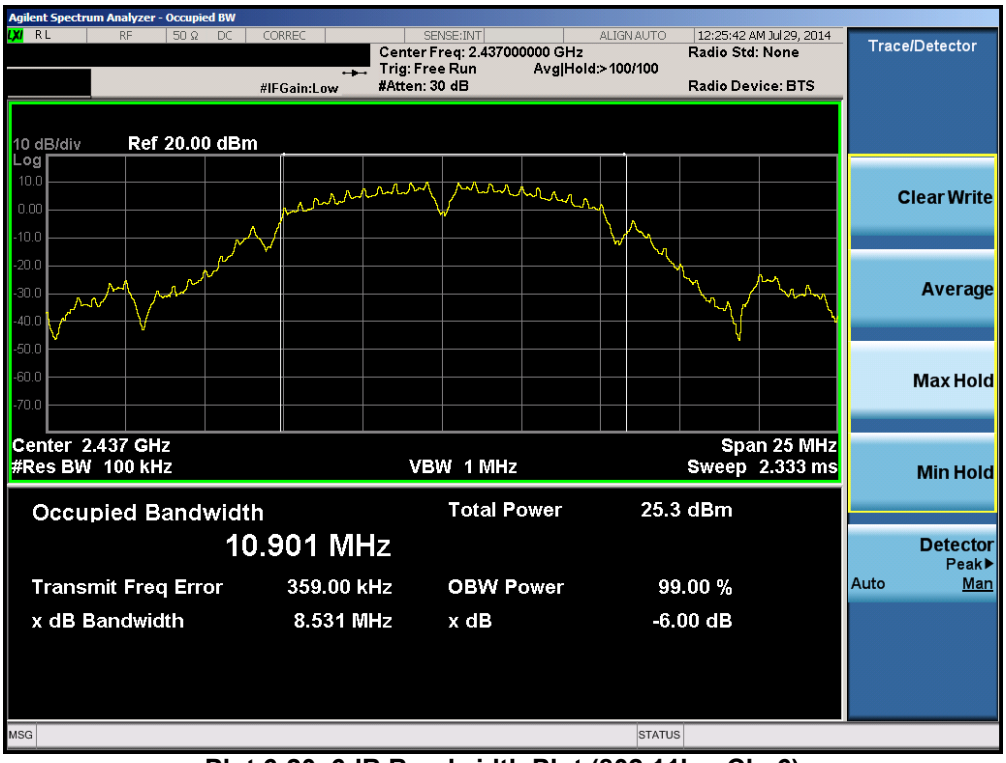



**Plot 6-19. 6dB Bandwidth Plot (802.11b – Ch. 1)**




**Plot 6-20. 6dB Bandwidth Plot (802.11b – Ch. 6)**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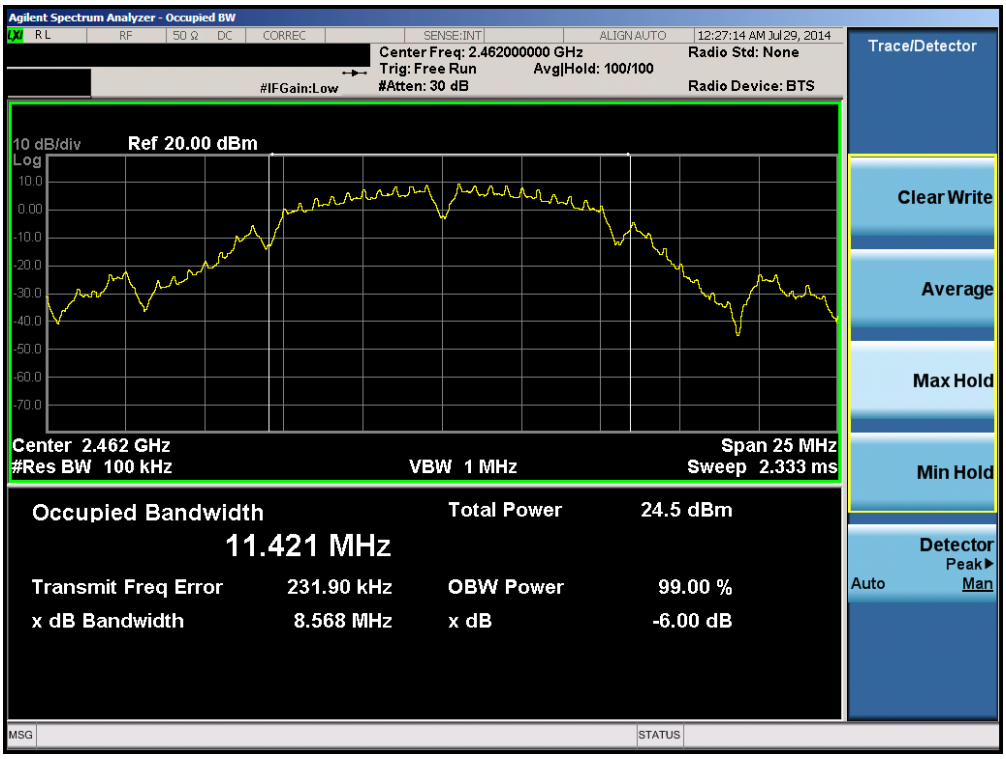
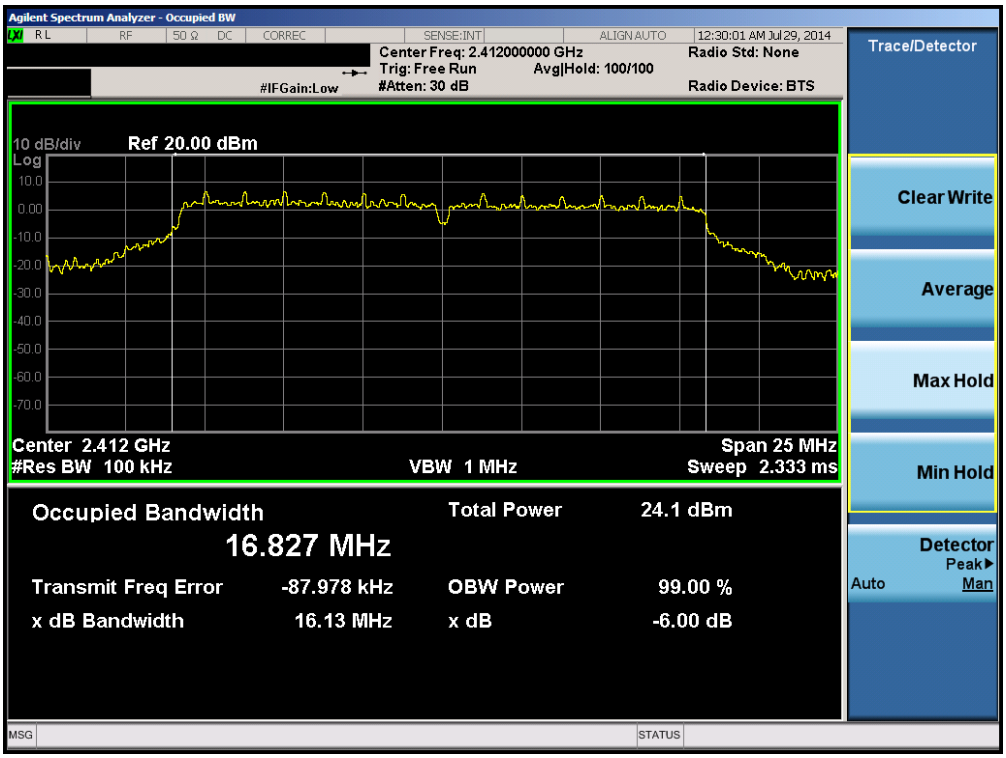



**Plot 6-21. 6dB Bandwidth Plot (802.11b – Ch. 11)**




**Plot 6-22. 6dB Bandwidth Plot (802.11g – Ch. 1)**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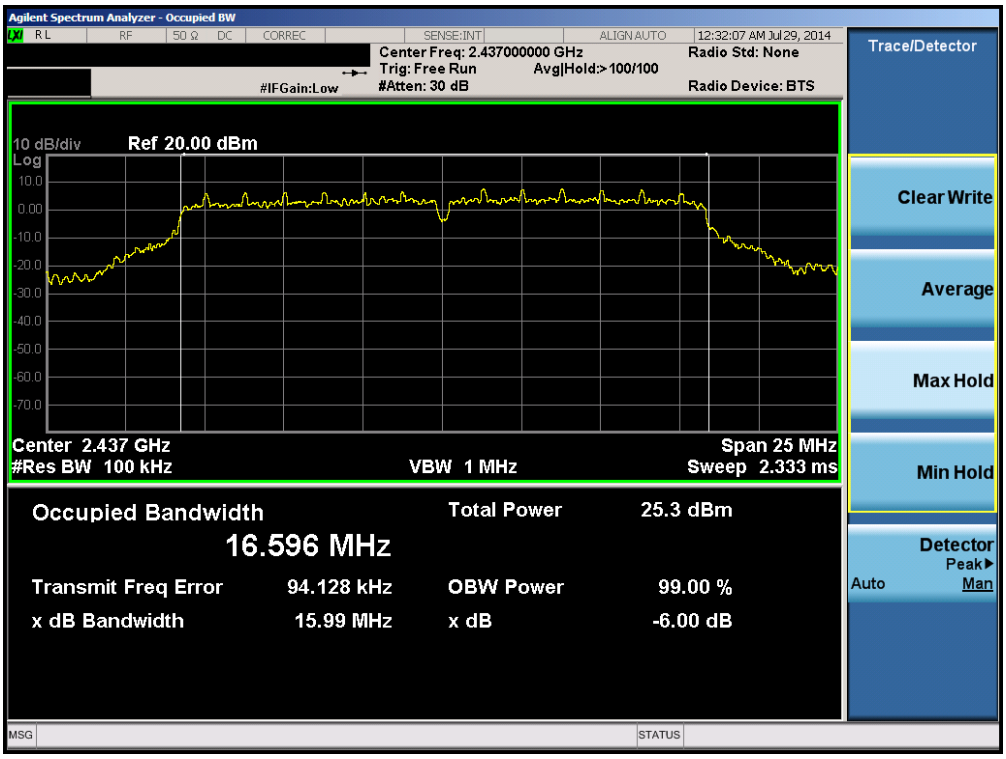
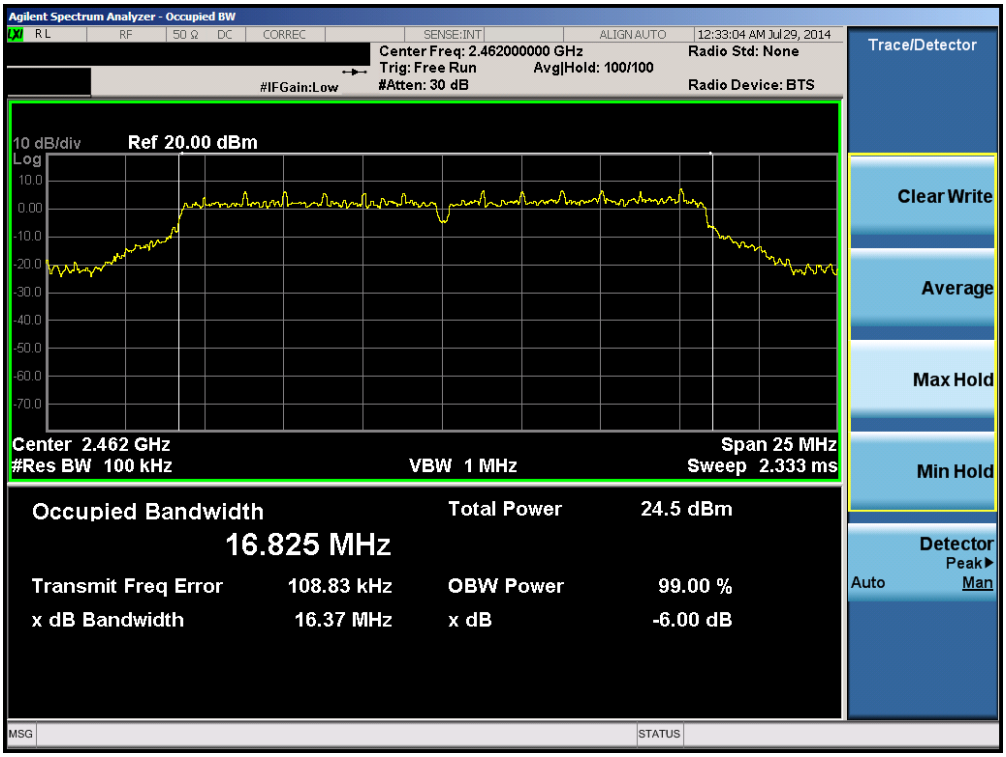



**Plot 6-23. 6dB Bandwidth Plot (802.11g – Ch. 6)**




**Plot 6-24. 6dB Bandwidth Plot (802.11g – Ch. 11)**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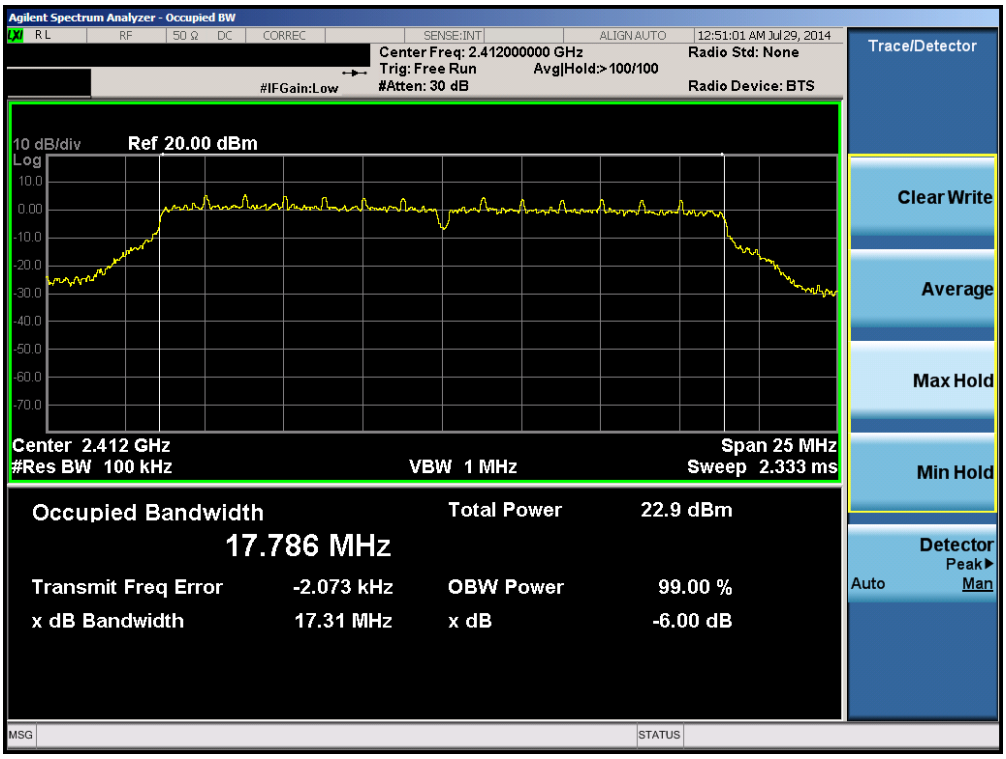
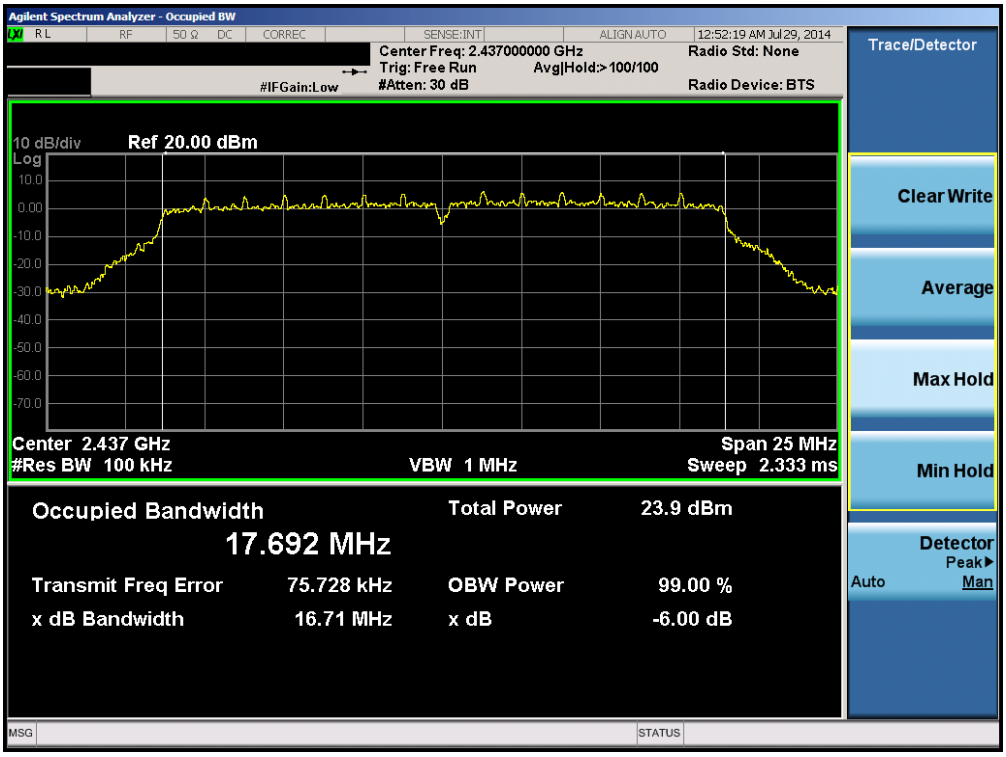



**Plot 6-25. 6dB Bandwidth Plot (802.11n (2.4GHz) – Ch. 1)**




**Plot 6-26. 6dB Bandwidth Plot (802.11n (2.4GHz) – Ch. 6)**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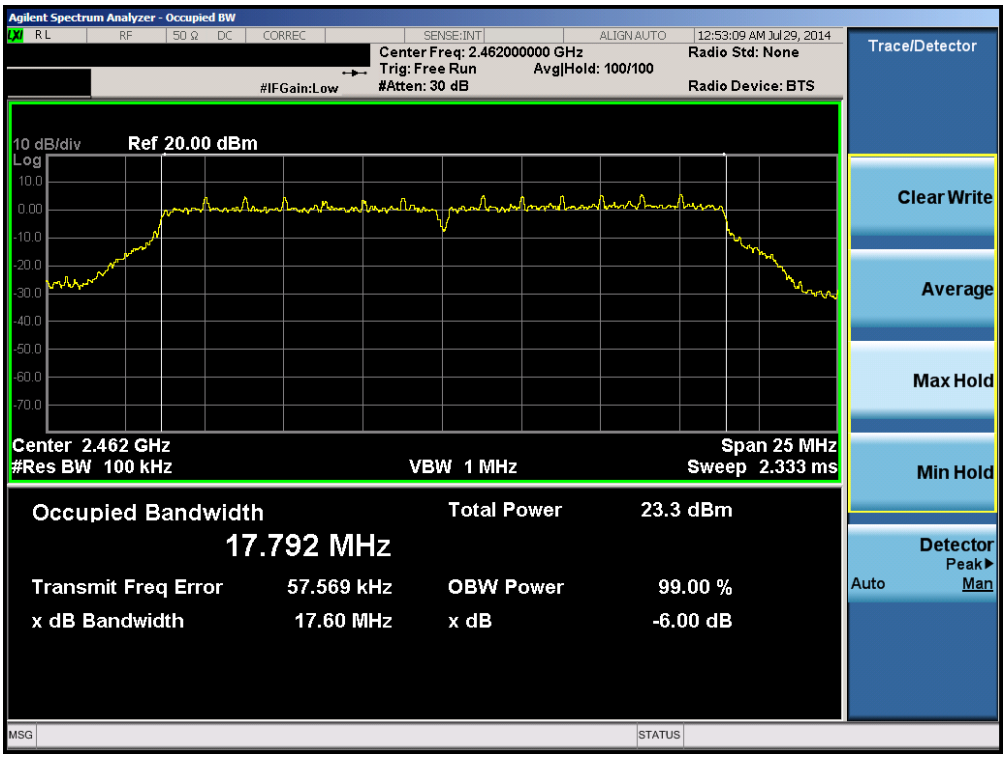
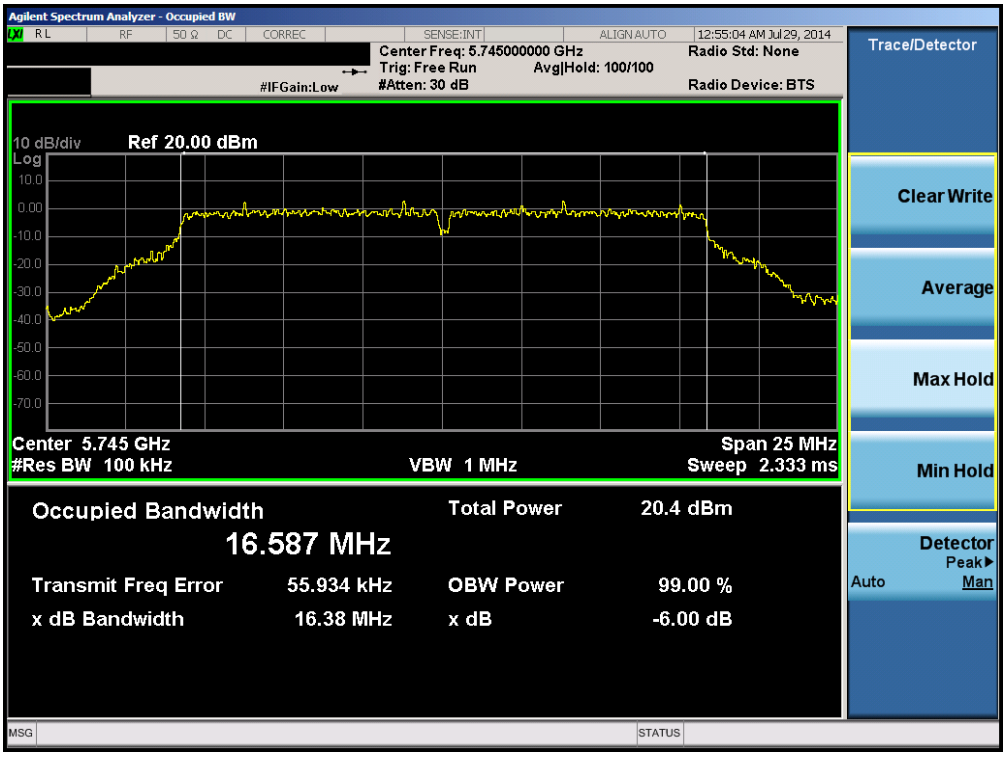



**Plot 6-27. 6dB Bandwidth Plot (802.11n (2.4GHz) – Ch. 11)**




**Plot 6-28. 6dB Bandwidth Plot (802.11a – Ch. 149)**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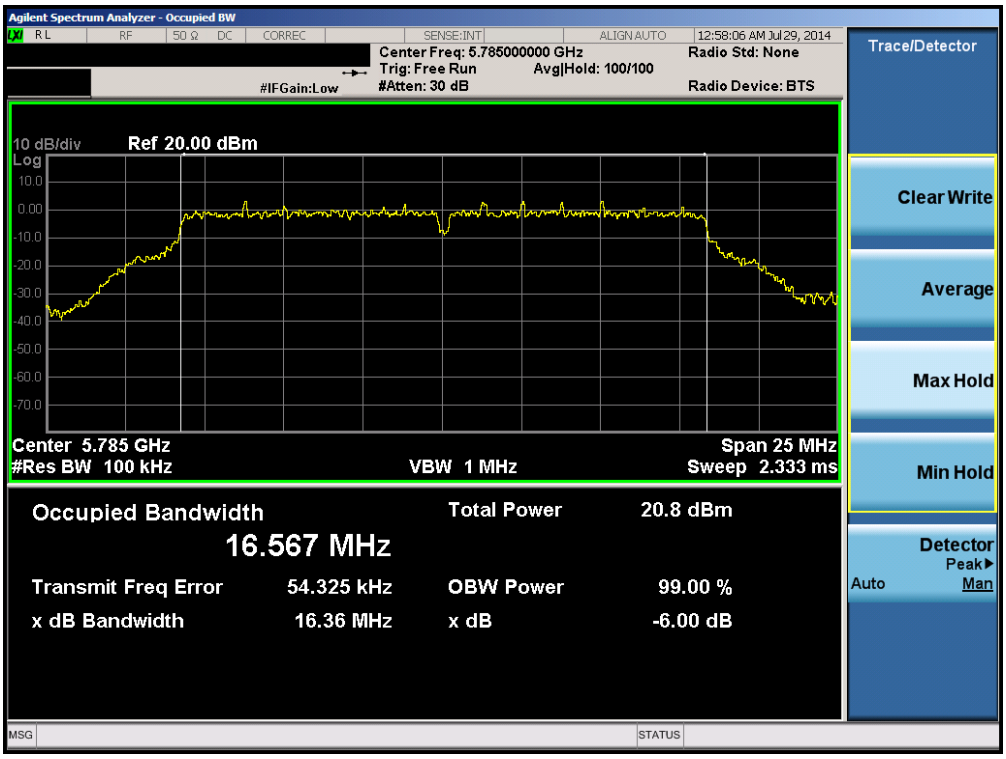
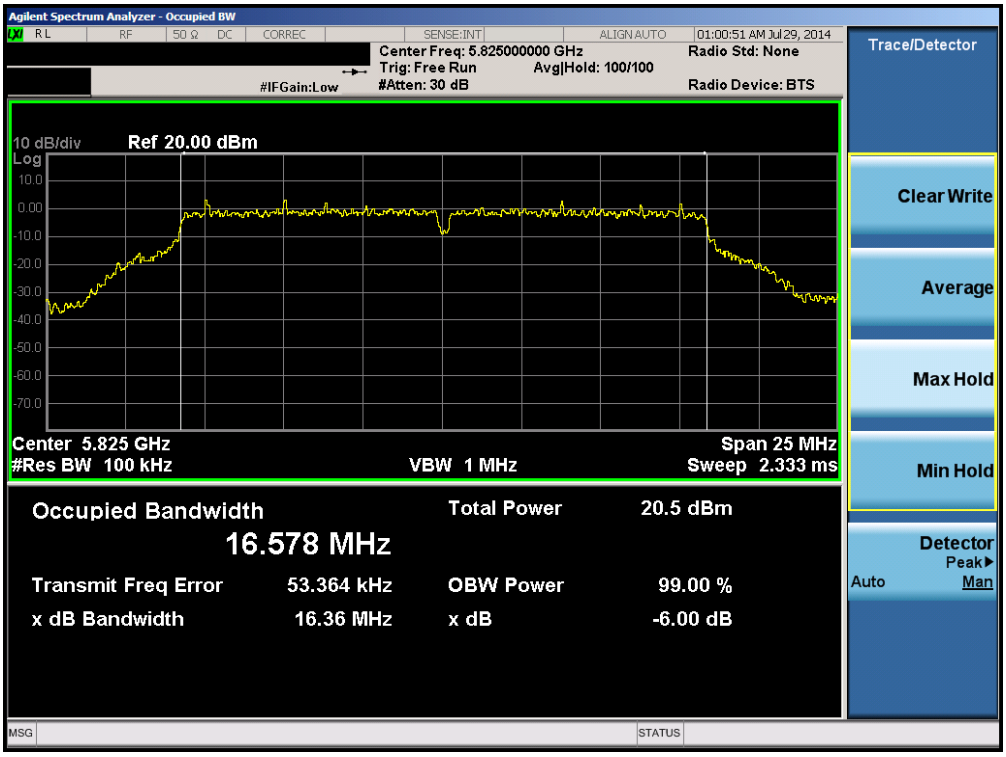



**Plot 6-29. 6dB Bandwidth Plot (802.11a – Ch. 157)**




**Plot 6-30. 6dB Bandwidth Plot (802.11a – Ch. 165)**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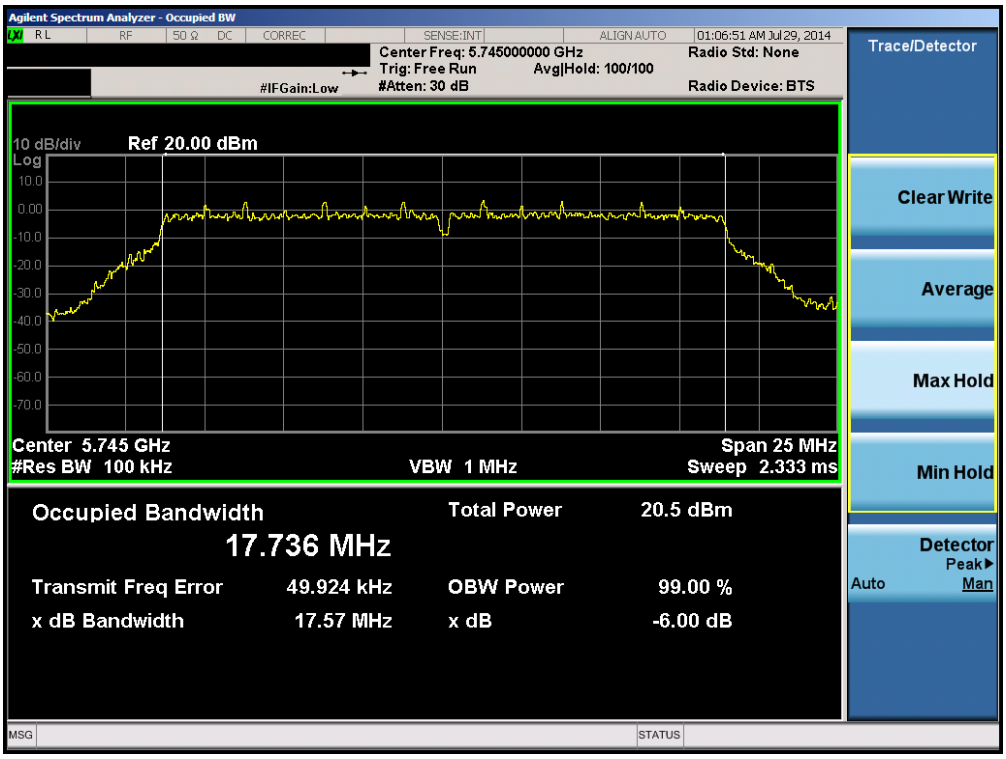
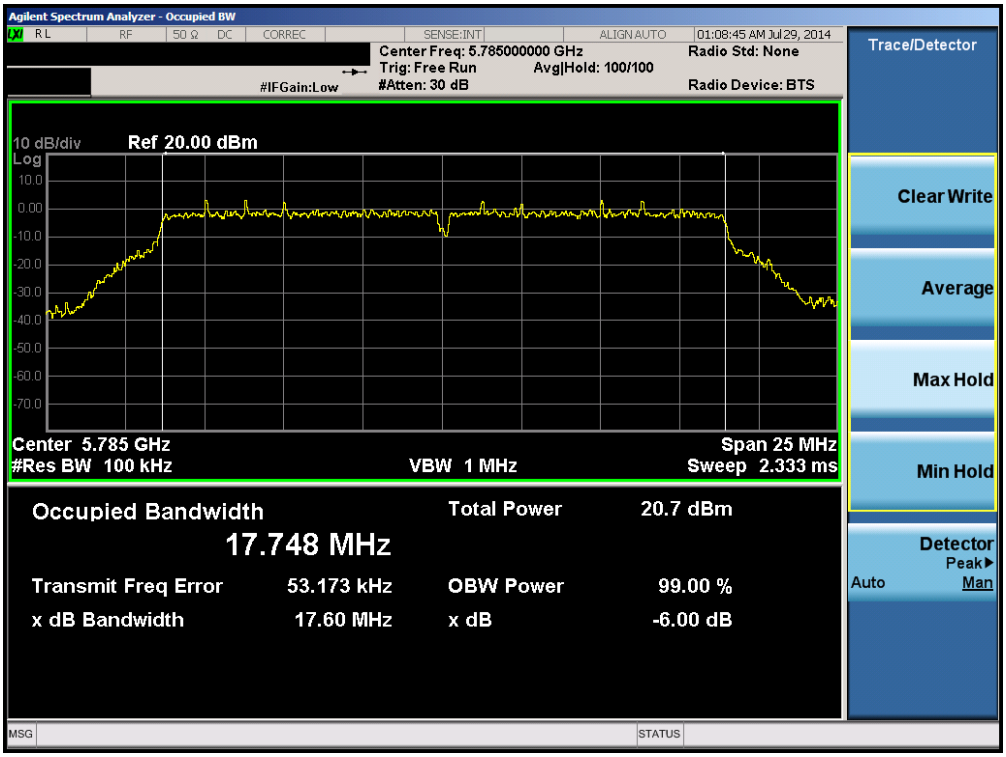



**Plot 6-31. 6dB Bandwidth Plot (20MHz BW 802.11n (5.8GHz) – Ch. 149)**




**Plot 6-32. 6dB Bandwidth Plot (20MHz BW 802.11n (5.8GHz) – Ch. 157)**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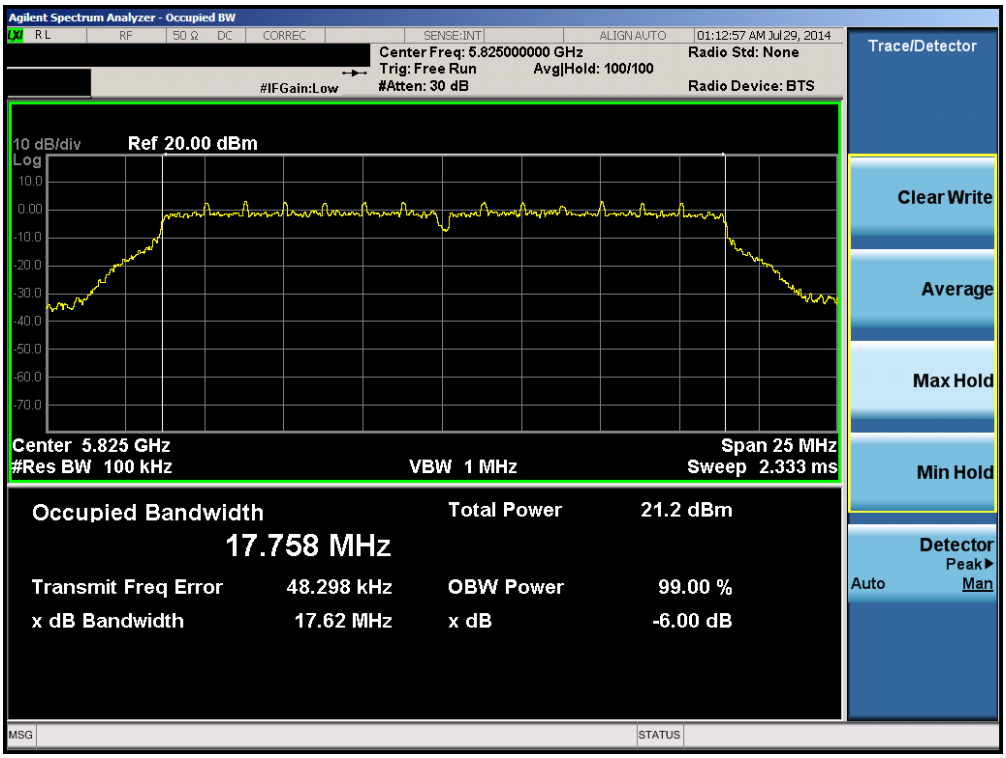
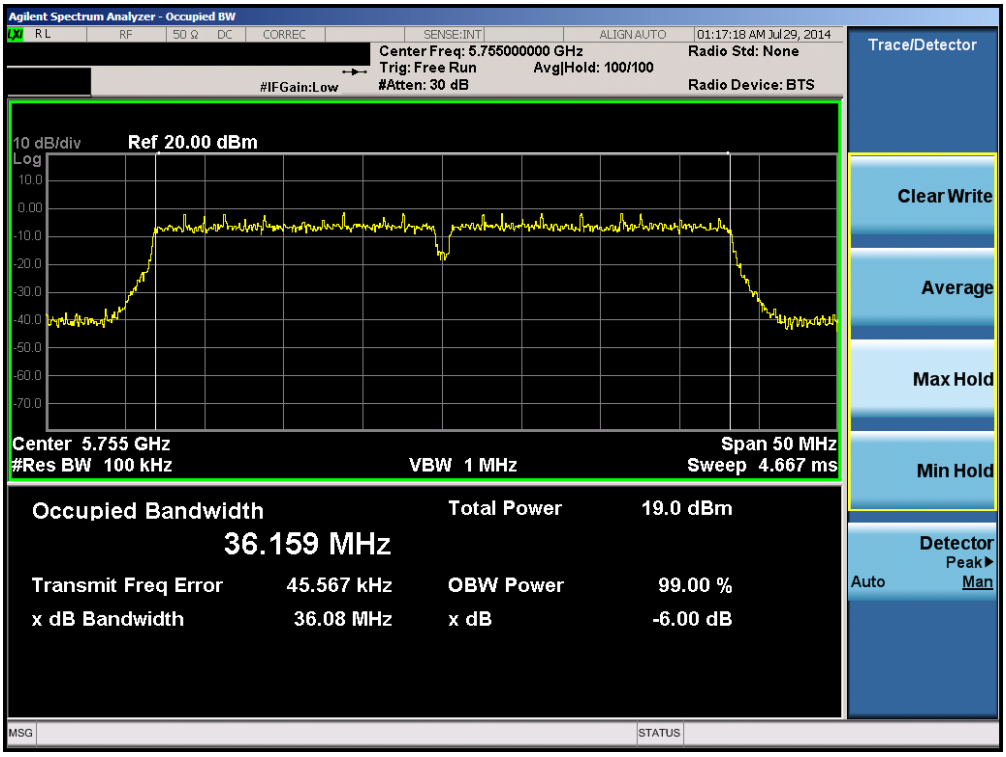



**Plot 6-33. 6dB Bandwidth Plot (20MHz BW 802.11n (5.8GHz) – Ch. 165)**




**Plot 6-34. 6dB Bandwidth Plot (40MHz BW 802.11n (5.8GHz) – Ch. 151)**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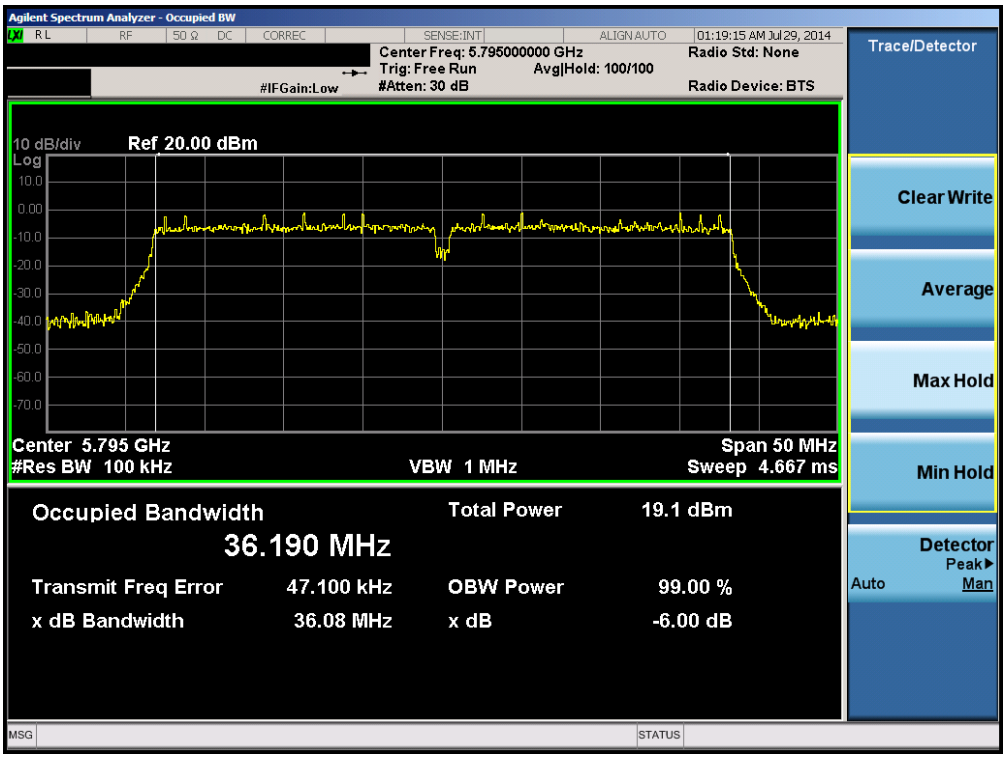
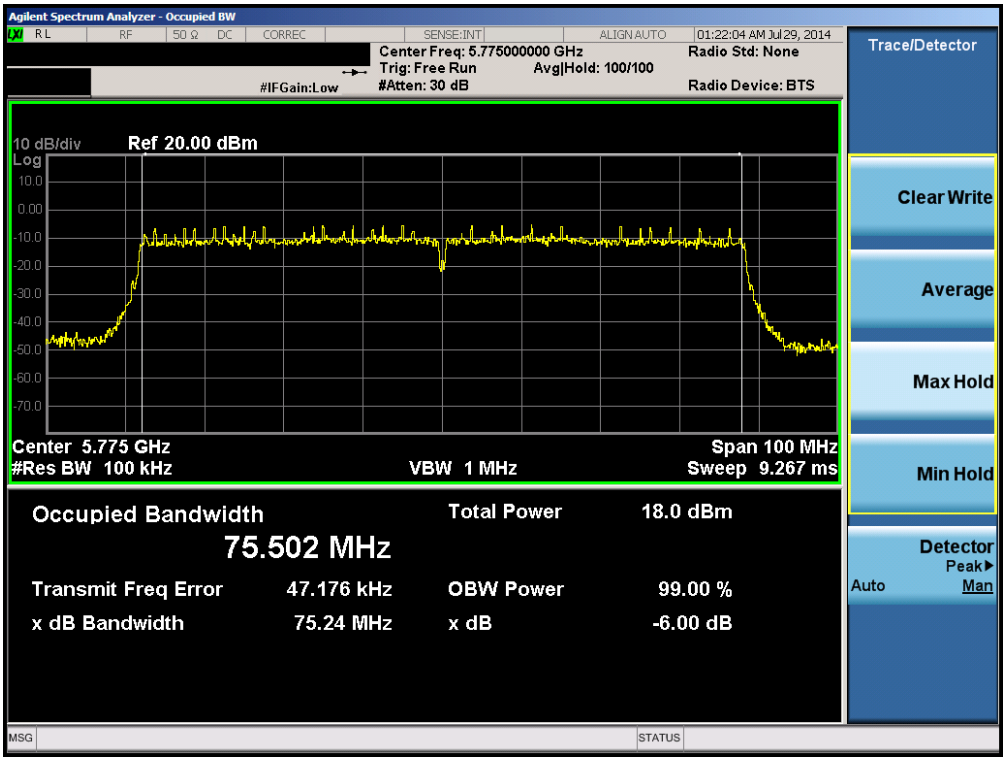



**Plot 6-35. 6dB Bandwidth Plot (40MHz BW 802.11n (5.8GHz) – Ch. 159)**




**Plot 6-36. 6dB Bandwidth Plot (80MHz BW 802.11ac (5.8GHz) – Ch. 155)**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## 6.3 Output Power Measurement

**§15.247(b.3)**

**Test Overview and Limits**

A transmitter antenna terminal of EUT is connected to the input of an RF power sensor. Measurement is made using a broadband power meter capable of making peak and average measurements while the EUT is operating at its maximum duty cycle (>98%), at maximum power, and at the appropriate frequencies.

***The maximum permissible conducted output power is 1 Watt.***

**Test Procedure Used**

KDB 558074 v03r02 – Section 9.1.2 PKPM1 Peak Power Method
KDB 558074 v03r02 – Section 9.2.3.2 Method AVGPM-G
KDB 662911 v02r01 – Section E)1) Measure-and-Sum Technique

**Test Settings**

**Method PKPM1 (Peak Power Measurement)**

Peak 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 pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

**Method AVGPM-G (Average Power Measurement)**

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 diagrams below.

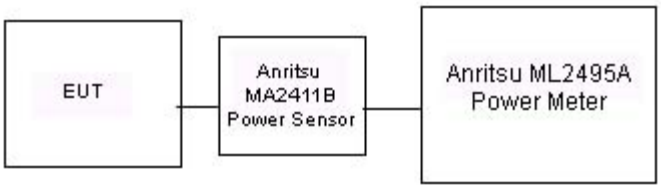


**Figure 6-2. Test Instrument & Measurement Setup for Power Meter Measurements**

**Test Notes**

None


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## Antenna-1 Output Power Measurement – 802.11b/g/n (2.4GHz)

| Mode | Freq [MHz] | Channel | Detector | 802.11b Conducted Power [dBm] | | | |
|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | |
| | | | | 1 | 2 | 5.5 | 11 |
| 802.11b | 2412 | 1 | AVG | 16.65 | 17.20 | 16.85 | 17.07 |
| | | | PEAK | 19.97 | 20.31 | 19.87 | 20.11 |
| 802.11b | 2437 | 6 | AVG | 17.26 | 16.34 | 16.31 | 16.28 |
| | | | PEAK | 20.31 | 19.43 | 19.47 | 19.40 |
| 802.11b | 2462 | 11 | AVG | 17.41 | 16.44 | 16.40 | 16.45 |
| | | | PEAK | 20.79 | 19.50 | 19.52 | 19.50 |

**Table 6-4. 802.11b Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 802.11g Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 |
| 802.11g | 2412 | 1 | AVG | 16.32 | 16.49 | 16.32 | 16.36 | 16.41 | 16.24 | 16.49 | 16.26 |
| | | | PEAK | 21.23 | 21.24 | 21.16 | 21.20 | 21.67 | 21.82 | 21.64 | 21.72 |
| 802.11g | 2437 | 6 | AVG | 15.97 | 16.12 | 15.91 | 16.00 | 16.06 | 15.82 | 16.07 | 15.92 |
| | | | PEAK | 22.17 | 22.21 | 22.07 | 22.18 | 22.62 | 22.90 | 22.67 | 22.74 |
| 802.11g | 2462 | 11 | AVG | 16.02 | 16.19 | 16.04 | 16.08 | 16.12 | 16.02 | 16.27 | 15.93 |
| | | | PEAK | 22.12 | 22.07 | 22.16 | 21.94 | 22.72 | 22.64 | 22.54 | 22.61 |

**Table 6-5. 802.11g Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 802.11n (2.4GHz) Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 6.5 | 13 | 19.5 | 26 | 39 | 52 | 58.5 | 65 |
| 802.11n | 2412 | 1 | AVG | 15.21 | 15.19 | 15.05 | 15.29 | 15.34 | 15.32 | 15.31 | 15.40 |
| | | | PEAK | 20.77 | 20.70 | 20.67 | 21.31 | 21.39 | 21.32 | 21.27 | 21.34 |
| 802.11n | 2437 | 6 | AVG | 14.84 | 14.91 | 14.64 | 14.99 | 14.97 | 15.04 | 14.93 | 15.06 |
| | | | PEAK | 20.82 | 20.79 | 20.63 | 21.43 | 21.42 | 21.48 | 21.37 | 21.51 |
| 802.11n | 2462 | 11 | AVG | 14.71 | 14.62 | 14.56 | 14.74 | 14.83 | 14.86 | 14.77 | 14.85 |
| | | | PEAK | 20.78 | 20.84 | 20.81 | 21.29 | 21.47 | 21.27 | 21.25 | 21.49 |

**Table 6-6. 20MHz BW 802.11n (2.4GHz) Conducted Output Power Measurements**


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## Antenna-1 Output Power Measurement – 802.11a/n/ac (5GHz)

| Mode | Freq [MHz] | Channel | Detector | 802.11a Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 |
| 802.11a | 5745 | 149 | AVG | 13.69 | 13.65 | 13.30 | 13.48 | 13.58 | 13.52 | 13.82 | 13.30 |
| | | | PEAK | 18.95 | 18.07 | 17.92 | 18.32 | 18.49 | 18.51 | 18.46 | 18.38 |
| 802.11a | 5765 | 153 | AVG | 13.63 | 13.61 | 13.15 | 13.35 | 13.49 | 13.45 | 13.81 | 13.33 |
| | | | PEAK | 18.80 | 17.92 | 17.91 | 18.01 | 18.44 | 18.49 | 18.30 | 18.08 |
| 802.11a | 5785 | 157 | AVG | 13.63 | 13.53 | 13.24 | 13.46 | 13.50 | 13.49 | 13.71 | 13.25 |
| | | | PEAK | 18.79 | 17.93 | 17.94 | 18.29 | 18.33 | 18.50 | 18.36 | 18.26 |
| 802.11a | 5805 | 161 | AVG | 13.72 | 13.63 | 13.32 | 13.55 | 13.61 | 13.54 | 13.84 | 13.34 |
| | | | PEAK | 18.93 | 18.19 | 17.90 | 18.16 | 18.47 | 18.41 | 18.46 | 18.33 |
| 802.11a | 5825 | 165 | AVG | 13.60 | 13.52 | 13.20 | 13.42 | 13.52 | 13.46 | 13.75 | 13.27 |
| | | | PEAK | 18.77 | 17.97 | 17.87 | 17.98 | 18.35 | 18.36 | 18.22 | 18.31 |

**Table 6-7. 802.11a Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 20MHz BW 802.11n (5GHz) Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 6.5 | 13 | 19.5 | 26 | 39 | 52 | 58.5 | 65 |
| 802.11n | 5745 | 149 | AVG | 13.47 | 13.29 | 13.39 | 13.49 | 13.42 | 13.52 | 13.51 | 13.56 |
| | | | PEAK | 18.85 | 18.51 | 18.51 | 18.91 | 18.87 | 18.95 | 18.92 | 18.97 |
| 802.11n | 5765 | 153 | AVG | 13.62 | 13.44 | 13.61 | 13.71 | 13.56 | 13.70 | 13.62 | 13.69 |
| | | | PEAK | 18.80 | 18.42 | 18.57 | 18.79 | 18.84 | 18.90 | 18.69 | 18.86 |
| 802.11n | 5785 | 157 | AVG | 13.58 | 13.31 | 13.53 | 13.57 | 13.60 | 13.65 | 13.56 | 13.61 |
| | | | PEAK | 18.77 | 18.32 | 18.58 | 18.81 | 18.87 | 18.81 | 18.87 | 19.01 |
| 802.11n | 5805 | 161 | AVG | 13.64 | 13.46 | 13.57 | 13.67 | 13.65 | 13.76 | 13.71 | 13.73 |
| | | | PEAK | 18.88 | 18.58 | 18.40 | 18.92 | 18.88 | 19.04 | 19.04 | 18.87 |
| 802.11n | 5825 | 165 | AVG | 13.63 | 13.52 | 13.52 | 13.66 | 13.58 | 13.72 | 13.70 | 13.75 |
| | | | PEAK | 18.82 | 18.46 | 18.54 | 18.93 | 18.81 | 18.85 | 18.81 | 19.04 |

**Table 6-8. 20MHz BW 802.11n (5GHz) Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 40MHz BW 802.11n (5GHz) Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 13.5 | 27 | 40.5 | 54 | 81 | 108 | 121.5 | 135 |
| 802.11n | 5755 | 151 | AVG | 12.17 | 12.15 | 12.19 | 12.38 | 12.27 | 12.37 | 12.08 | 12.08 |
| | | | PEAK | 17.75 | 17.40 | 17.45 | 17.86 | 17.82 | 17.84 | 17.88 | 17.82 |
| 802.11n | 5795 | 159 | AVG | 12.10 | 12.17 | 12.03 | 12.29 | 12.16 | 12.30 | 11.95 | 11.96 |
| | | | PEAK | 17.76 | 17.43 | 17.48 | 17.85 | 17.83 | 17.94 | 17.79 | 17.94 |

**Table 6-9. 40MHz BW 802.11n (5GHz) Conducted Output Power Measurements**


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| 20MHz BW 802.11ac (5GHz) Conducted Power [dBm] | | | | |
|---|---|---|---|---|
| Mode | Freq [MHz] | Channel | Detector | Data Rate |
| | | | | 6.5 Mbps |
| 802.11ac | 5745 | 149 | AVG | 13.35 |
| | | | PEAK | 18.57 |
| 802.11ac | 5785 | 157 | AVG | 13.40 |
| | | | PEAK | 18.60 |
| 802.11ac | 5825 | 165 | AVG | 13.42 |
| | | | PEAK | 18.51 |

**Table 6-10. 20MHz BW 802.11ac (5GHz) Conducted Output Power Measurements**

| 40MHz BW 802.11ac (5GHz) Conducted Power [dBm] | | | | |
|---|---|---|---|---|
| Mode | Freq [MHz] | Channel | Detector | Data Rate |
| | | | | 13.5 Mbps |
| 802.11ac | 5755 | 151 | AVG | 12.14 |
| | | | PEAK | 17.26 |
| 802.11ac | 5795 | 159 | AVG | 12.28 |
| | | | PEAK | 17.32 |

**Table 6-11. 40MHz BW 802.11ac (5GHz) Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 80MHz BW 802.11ac (5GHz) Conducted Power [dBm] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | | | |
| | | | | 29.3 | 58.5 | 87.8 | 117 | 175.5 | 234 | 263.3 | 292.5 | 351 | 390 |
| 802.11ac | 5775 | 155 | AVG | 10.60 | 10.74 | 10.64 | 10.67 | 10.76 | 10.81 | 10.68 | 10.57 | 10.65 | 10.75 |
| | | | PEAK | 15.97 | 16.25 | 16.18 | 16.22 | 16.20 | 16.19 | 16.17 | 16.14 | 16.10 | 16.21 |

**Table 6-12. 80MHz BW 802.11ac (5GHz) Conducted Output Power Measurements**


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## Antenna-2 Output Power Measurement – 802.11b/g/n (2.4GHz)

| Mode | Freq [MHz] | Channel | Detector | 802.11b Conducted Power [dBm] | | | |
|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | |
| | | | | 1 | 2 | 5.5 | 11 |
| 802.11b | 2412 | 1 | AVG | 16.86 | 16.97 | 17.07 | 17.08 |
| | | | PEAK | 19.67 | 19.89 | 19.90 | 19.88 |
| 802.11b | 2437 | 6 | AVG | 16.45 | 16.54 | 16.49 | 16.52 |
| | | | PEAK | 19.39 | 19.56 | 19.51 | 19.50 |
| 802.11b | 2462 | 11 | AVG | 17.24 | 17.47 | 17.39 | 17.45 |
| | | | PEAK | 19.93 | 20.35 | 20.26 | 20.29 |

**Table 6-13. 802.11b Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 802.11g Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 |
| 802.11g | 2412 | 1 | AVG | 15.27 | 15.24 | 15.29 | 15.42 | 15.38 | 15.42 | 15.37 | 15.45 |
| | | | PEAK | 20.39 | 20.47 | 20.43 | 20.21 | 20.87 | 20.77 | 20.82 | 21.02 |
| 802.11g | 2437 | 6 | AVG | 16.33 | 16.30 | 16.38 | 16.45 | 16.41 | 16.45 | 16.40 | 16.48 |
| | | | PEAK | 21.95 | 22.07 | 21.92 | 21.74 | 22.46 | 22.39 | 22.30 | 22.70 |
| 802.11g | 2462 | 11 | AVG | 15.67 | 15.63 | 15.68 | 15.87 | 15.82 | 15.86 | 15.77 | 15.85 |
| | | | PEAK | 21.32 | 21.44 | 21.36 | 21.13 | 21.75 | 21.69 | 21.68 | 21.99 |

**Table 6-14. 802.11g Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 802.11n (2.4GHz) Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 6.5 | 13 | 19.5 | 26 | 39 | 52 | 58.5 | 65 |
| 802.11n | 2412 | 1 | AVG | 15.29 | 15.12 | 15.14 | 15.27 | 15.35 | 15.32 | 15.34 | 15.30 |
| | | | PEAK | 20.29 | 20.26 | 20.10 | 20.88 | 20.80 | 20.76 | 20.81 | 20.72 |
| 802.11n | 2437 | 6 | AVG | 15.01 | 14.85 | 14.83 | 15.02 | 15.00 | 14.95 | 15.01 | 15.02 |
| | | | PEAK | 20.37 | 20.44 | 20.14 | 20.85 | 20.79 | 20.89 | 20.85 | 20.81 |
| 802.11n | 2462 | 11 | AVG | 14.67 | 14.57 | 14.50 | 14.65 | 14.75 | 14.66 | 14.72 | 14.70 |
| | | | PEAK | 20.08 | 20.01 | 19.94 | 20.72 | 20.65 | 20.44 | 20.72 | 20.45 |

**Table 6-15. 20MHz BW 802.11n (2.4GHz) Conducted Output Power Measurements**


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## Antenna-2 Output Power Measurement – 802.11a/n (5GHz)

| Mode | Freq [MHz] | Channel | Detector | 802.11a Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 |
| 802.11a | 5745 | 149 | AVG | 14.30 | 14.27 | 14.25 | 14.34 | 14.32 | 14.49 | 14.42 | 14.48 |
| | | | PEAK | 19.42 | 19.29 | 19.23 | 19.23 | 19.71 | 19.71 | 19.62 | 19.70 |
| 802.11a | 5765 | 153 | AVG | 14.27 | 14.22 | 14.27 | 14.27 | 14.38 | 14.43 | 14.38 | 14.47 |
| | | | PEAK | 19.45 | 19.28 | 19.09 | 19.20 | 19.89 | 19.64 | 19.51 | 19.66 |
| 802.11a | 5785 | 157 | AVG | 14.28 | 14.18 | 14.25 | 14.31 | 14.28 | 14.48 | 14.45 | 14.46 |
| | | | PEAK | 19.46 | 19.34 | 19.33 | 19.27 | 19.73 | 19.74 | 19.58 | 19.80 |
| 802.11a | 5805 | 161 | AVG | 14.34 | 14.32 | 14.24 | 14.38 | 14.35 | 14.45 | 14.40 | 14.41 |
| | | | PEAK | 19.48 | 19.48 | 19.28 | 19.27 | 19.80 | 19.89 | 19.71 | 19.84 |
| 802.11a | 5825 | 165 | AVG | 14.35 | 14.30 | 14.34 | 14.44 | 14.43 | 14.44 | 14.46 | 14.45 |
| | | | PEAK | 19.52 | 19.37 | 19.38 | 19.36 | 19.84 | 19.75 | 19.83 | 19.76 |

**Table 6-16. 802.11a Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 20MHz BW 802.11n (5GHz) Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 6.5 | 13 | 19.5 | 26 | 39 | 52 | 58.5 | 65 |
| 802.11n | 5745 | 149 | AVG | 14.22 | 14.27 | 14.20 | 14.38 | 14.41 | 14.28 | 14.42 | 14.37 |
| | | | PEAK | 19.35 | 19.12 | 19.10 | 19.54 | 19.50 | 19.55 | 19.51 | 19.52 |
| 802.11n | 5765 | 153 | AVG | 14.23 | 14.21 | 14.23 | 14.42 | 14.44 | 14.32 | 14.44 | 14.46 |
| | | | PEAK | 19.37 | 19.01 | 19.23 | 19.48 | 19.53 | 19.73 | 19.49 | 19.46 |
| 802.11n | 5785 | 157 | AVG | 14.21 | 14.22 | 14.25 | 14.45 | 14.42 | 14.25 | 14.38 | 14.39 |
| | | | PEAK | 19.35 | 19.18 | 18.96 | 19.71 | 19.37 | 19.53 | 19.58 | 19.45 |
| 802.11n | 5805 | 161 | AVG | 14.30 | 14.28 | 14.21 | 14.47 | 14.43 | 14.30 | 14.46 | 14.38 |
| | | | PEAK | 19.40 | 19.20 | 19.06 | 19.57 | 19.45 | 19.56 | 19.55 | 19.44 |
| 802.11n | 5825 | 165 | AVG | 14.42 | 14.48 | 14.46 | 14.46 | 14.48 | 14.40 | 14.43 | 14.46 |
| | | | PEAK | 19.49 | 19.38 | 19.08 | 19.64 | 19.72 | 19.75 | 19.71 | 19.66 |

**Table 6-17. 20MHz BW 802.11n (5GHz) Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 40MHz BW 802.11n (5GHz) Conducted Power [dBm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | |
| | | | | 13.5 | 27 | 40.5 | 54 | 81 | 108 | 121.5 | 135 |
| 802.11n | 5755 | 151 | AVG | 11.99 | 11.97 | 11.82 | 11.98 | 12.04 | 12.02 | 12.15 | 12.17 |
| | | | PEAK | 17.89 | 17.77 | 17.51 | 18.61 | 18.52 | 18.32 | 18.49 | 18.50 |
| 802.11n | 5795 | 159 | AVG | 12.02 | 11.98 | 11.94 | 12.06 | 12.14 | 12.04 | 12.14 | 12.24 |
| | | | PEAK | 17.82 | 17.83 | 17.49 | 18.55 | 18.48 | 18.33 | 18.37 | 18.44 |

**Table 6-18. 40MHz BW 802.11n (5GHz) Conducted Output Power Measurements**


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| 20MHz BW 802.11ac (5GHz) Conducted Power [dBm] | | | | |
|---|---|---|---|---|
| Mode | Freq [MHz] | Channel | Detector | Data Rate |
| | | | | 6.5 Mbps |
| 802.11ac | 5745 | 149 | AVG | 13.22 |
| | | | PEAK | 18.61 |
| 802.11ac | 5785 | 157 | AVG | 13.24 |
| | | | PEAK | 18.51 |
| 802.11ac | 5825 | 165 | AVG | 13.36 |
| | | | PEAK | 18.55 |

**Table 6-19. 20MHz BW 802.11ac (5GHz) Conducted Output Power Measurements**

| 40MHz BW 802.11ac (5GHz) Conducted Power [dBm] | | | | |
|---|---|---|---|---|
| Mode | Freq [MHz] | Channel | Detector | Data Rate |
| | | | | 13.5 Mbps |
| 802.11ac | 5755 | 151 | AVG | 11.81 |
| | | | PEAK | 17.70 |
| 802.11ac | 5795 | 159 | AVG | 11.72 |
| | | | PEAK | 17.56 |

**Table 6-20. 40MHz BW 802.11ac (5GHz) Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | 80MHz BW 802.11ac (5GHz) Conducted Power [dBm] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Data Rate [Mbps] | | | | | | | | | |
| | | | | 29.3 | 58.5 | 87.8 | 117 | 175.5 | 234 | 263.3 | 292.5 | 351 | 390 |
| 802.11ac | 5775 | 155 | AVG | 11.36 | 11.44 | 11.39 | 11.45 | 11.47 | 11.38 | 11.41 | 11.38 | 11.35 | 11.37 |
| | | | PEAK | 17.15 | 16.97 | 16.92 | 16.90 | 16.97 | 16.89 | 16.98 | 16.91 | 16.82 | 16.87 |

**Table 6-21. 80MHz BW 802.11ac (5GHz) Conducted Output Power Measurements**


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## MIMO Output Power Measurement – 802.11n (2.4GHz, 5GHz)

| Mode | Freq [MHz] | Channel | Detector | MCS8 | | |
|---|---|---|---|---|---|---|
| | | | | ANT1 | ANT2 | MIMO |
| 802.11n | 2412 | 1 | AVG | 15.21 | 15.29 | 18.26 |
| | | | PEAK | 20.77 | 20.29 | 23.55 |
| 802.11n | 2437 | 6 | AVG | 14.84 | 15.01 | 17.94 |
| | | | PEAK | 20.82 | 20.37 | 23.61 |
| 802.11n | 2462 | 11 | AVG | 14.71 | 14.67 | 17.70 |
| | | | PEAK | 20.78 | 20.08 | 23.45 |

**Table 6-22. 20MHz BW 802.11n (2.4GHz) Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | MCS8 | | |
|---|---|---|---|---|---|---|
| | | | | ANT1 | ANT2 | MIMO |
| 802.11n | 5745 | 149 | AVG | 13.47 | 14.22 | 16.87 |
| | | | PEAK | 18.85 | 19.35 | 22.12 |
| 802.11n | 5765 | 153 | AVG | 13.62 | 14.23 | 16.95 |
| | | | PEAK | 18.80 | 19.37 | 22.10 |
| 802.11n | 5785 | 157 | AVG | 13.58 | 14.21 | 16.92 |
| | | | PEAK | 18.77 | 19.35 | 22.08 |
| 802.11n | 5805 | 161 | AVG | 13.64 | 14.30 | 16.99 |
| | | | PEAK | 18.88 | 19.40 | 22.16 |
| 802.11n | 5825 | 165 | AVG | 13.63 | 14.42 | 17.05 |
| | | | PEAK | 18.82 | 19.49 | 22.18 |

**Table 6-23. 20MHz BW 802.11n (5GHz) Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | MCS8 | | |
|---|---|---|---|---|---|---|
| | | | | ANT1 | ANT2 | MIMO |
| 802.11n | 5755 | 151 | AVG | 12.17 | 11.99 | 15.09 |
| | | | PEAK | 17.75 | 17.89 | 20.83 |
| 802.11n | 5795 | 159 | AVG | 12.10 | 12.02 | 15.07 |
| | | | PEAK | 17.76 | 17.82 | 20.80 |

**Table 6-24. 40MHz BW 802.11n (5GHz) Conducted Output Power Measurements**


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| 20MHz BW 802.11ac (5GHz) Conducted Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| Mode | Freq [MHz] | Channel | Detector | MCS0 | | |
| | | | | ANT1 | ANT2 | MIMO |
| 802.11ac | 5745 | 149 | AVG | 13.35 | 13.22 | 16.30 |
| | | | PEAK | 18.57 | 18.61 | 21.60 |
| 802.11ac | 5785 | 157 | AVG | 13.40 | 13.24 | 16.33 |
| | | | PEAK | 18.60 | 18.51 | 21.57 |
| 802.11ac | 5825 | 165 | AVG | 13.42 | 13.36 | 16.40 |
| | | | PEAK | 18.51 | 18.55 | 21.54 |

**Table 6-25. 80MHz BW 802.11ac (5GHz) Conducted Output Power Measurements**

| 40MHz BW 802.11ac (5GHz) Conducted Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| Mode | Freq [MHz] | Channel | Detector | MCS0 | | |
| | | | | ANT1 | ANT2 | MIMO |
| 802.11ac | 5755 | 151 | AVG | 12.14 | 11.81 | 14.99 |
| | | | PEAK | 17.26 | 17.70 | 20.50 |
| 802.11ac | 5795 | 159 | AVG | 12.28 | 11.72 | 15.02 |
| | | | PEAK | 17.32 | 17.56 | 20.45 |

**Table 6-26. 80MHz BW 802.11ac (5GHz) Conducted Output Power Measurements**

| Mode | Freq [MHz] | Channel | Detector | MCS0 | | |
|---|---|---|---|---|---|---|
| | | | | ANT1 | ANT2 | MIMO |
| 802.11ac | 5775 | 155 | AVG | 10.60 | 11.36 | 14.01 |
| | | | PEAK | 15.97 | 17.15 | 19.61 |

**Table 6-27. 80MHz BW 802.11ac (5GHz) Conducted Output Power Measurements**

**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.

**Sample MIMO Calculation:**

At 2412MHz the average conducted output power was measured to be 15.21 dBm for Antenna-1 and 15.29 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(15.21 dBm + 15.29 dBm) = (33.19 mW + 33.81 mW) = 67.00 mW = 18.26 dBm


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## 6.4 Power Spectral Density

**§15.247(e)**

**Test Overview and Limit**

The peak power density is measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle (>98%), at maximum power, and at the appropriate frequencies. All data rates were investigated and the worst case configuration results are reported in this section.

***The maximum permissible power spectral density is 8 dBm in any 3 kHz band.***

**Test Procedure Used**

KDB 558074 v03r02 – Section 10.2 Method PKPSD
KDB 662911 v02r01 – Section E)2) Measure-and-Sum Technique

**Test Settings**

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 10kHz
4. VBW = 1MHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

**Test Setup**

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

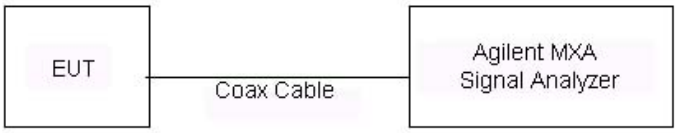


**Figure 6-3. Test Instrument & Measurement Setup**

**Test Notes**

None


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## Antenna-1 Power Spectral Density Measurements

| Frequency [MHz] | Channel No. | 802.11 Mode | Data Rate [Mbps] | Measured Power Spectral Density [dBm] | Maximum Permissible Power Density [dBm / 3kHz] | Margin [dB] | Pass / Fail |
|---|---|---|---|---|---|---|---|
| 2412 | 1 | b | 1 | 1.22 | 8.00 | -6.78 | Pass |
| 2437 | 6 | b | 1 | 0.98 | 8.00 | -7.02 | Pass |
| 2462 | 11 | b | 1 | 2.10 | 8.00 | -5.90 | Pass |
| 2412 | 1 | g | 6 | -3.49 | 8.00 | -11.49 | Pass |
| 2437 | 6 | g | 6 | -2.65 | 8.00 | -10.65 | Pass |
| 2462 | 11 | g | 6 | -2.42 | 8.00 | -10.42 | Pass |
| 2412 | 1 | n | 6.5/7.2 (MCS0) | -3.79 | 8.00 | -11.79 | Pass |
| 2437 | 6 | n | 6.5/7.2 (MCS0) | -2.77 | 8.00 | -10.77 | Pass |
| 2462 | 11 | n | 6.5/7.2 (MCS0) | -2.87 | 8.00 | -10.87 | Pass |
| 5745 | 149 | a | 6 | -5.36 | 8.00 | -13.36 | Pass |
| 5785 | 157 | a | 6 | -5.93 | 8.00 | -13.93 | Pass |
| 5825 | 165 | a | 6 | -5.98 | 8.00 | -13.98 | Pass |
| 5745 | 149 | n (20MHz) | 6.5/7.2 (MCS0) | -4.85 | 8.00 | -12.85 | Pass |
| 5785 | 157 | n (20MHz) | 6.5/7.2 (MCS0) | -5.70 | 8.00 | -13.70 | Pass |
| 5825 | 165 | n (20MHz) | 6.5/7.2 (MCS0) | -5.37 | 8.00 | -13.37 | Pass |
| 5755 | 151 | n (40MHz) | 13.5/15 (MCS0) | -8.32 | 8.00 | -16.32 | Pass |
| 5795 | 159 | n (40MHz) | 13.5/15 (MCS0) | -9.26 | 8.00 | -17.26 | Pass |
| 5775 | 155 | ac (80MHz) | 29.3/32.5 (MCS0) | -13.01 | 8.00 | -21.01 | Pass |

**Table 6-28. Conducted Power Density Measurements**


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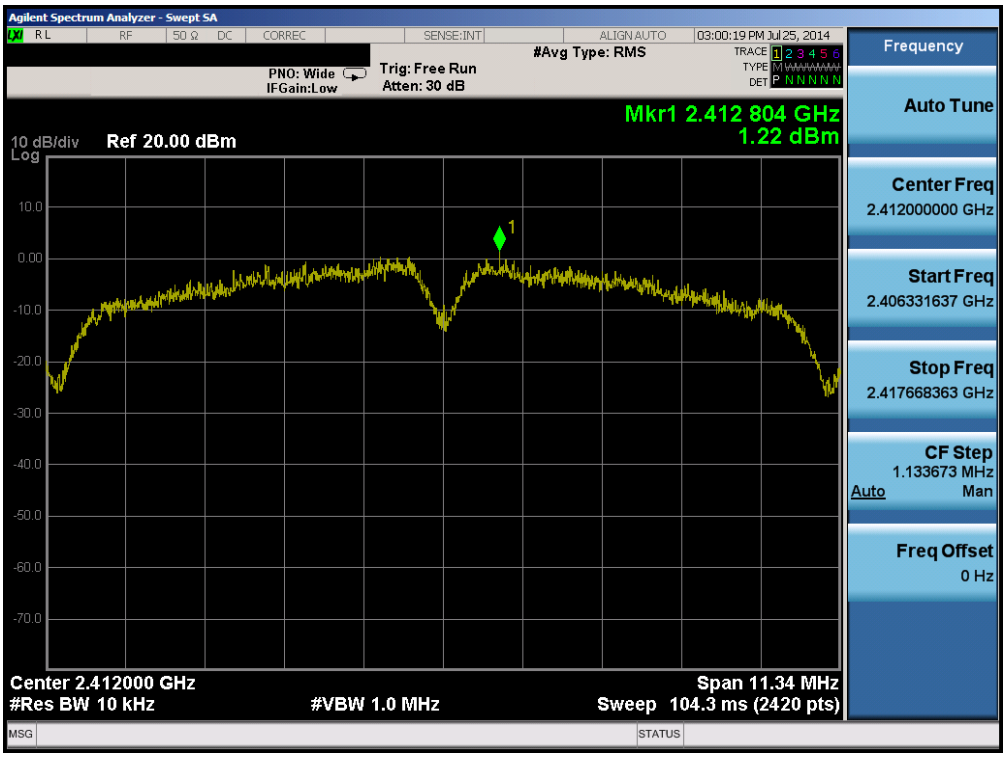
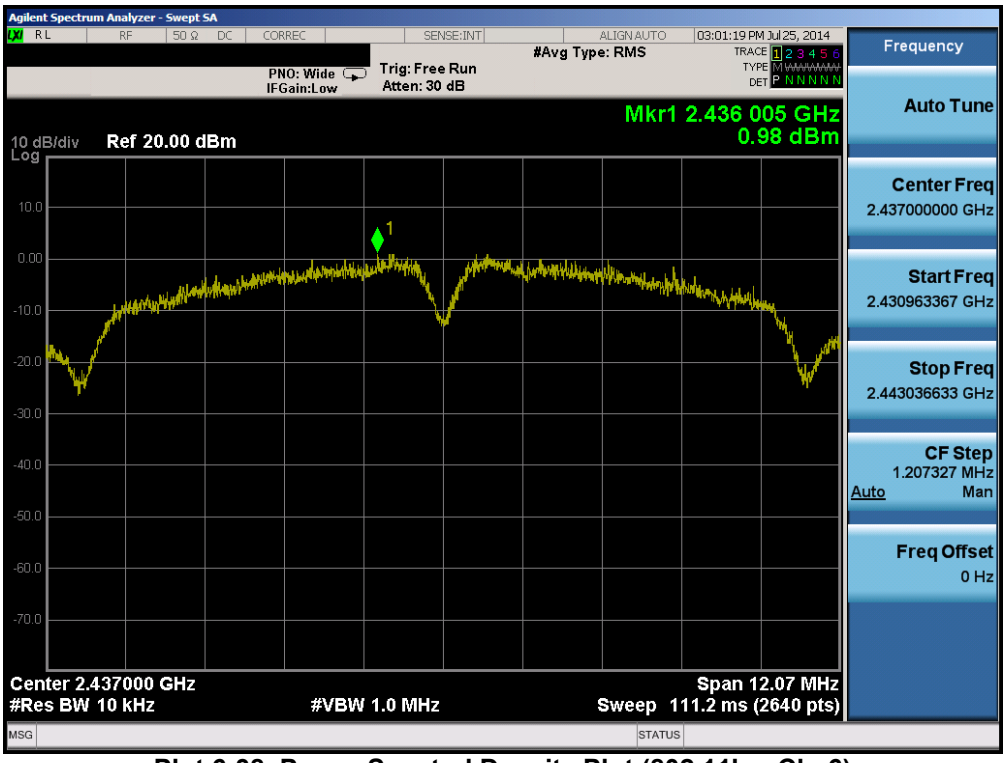



**Plot 6-37. Power Spectral Density Plot (802.11b – Ch. 1)**




**Plot 6-38. Power Spectral Density Plot (802.11b – Ch. 6)**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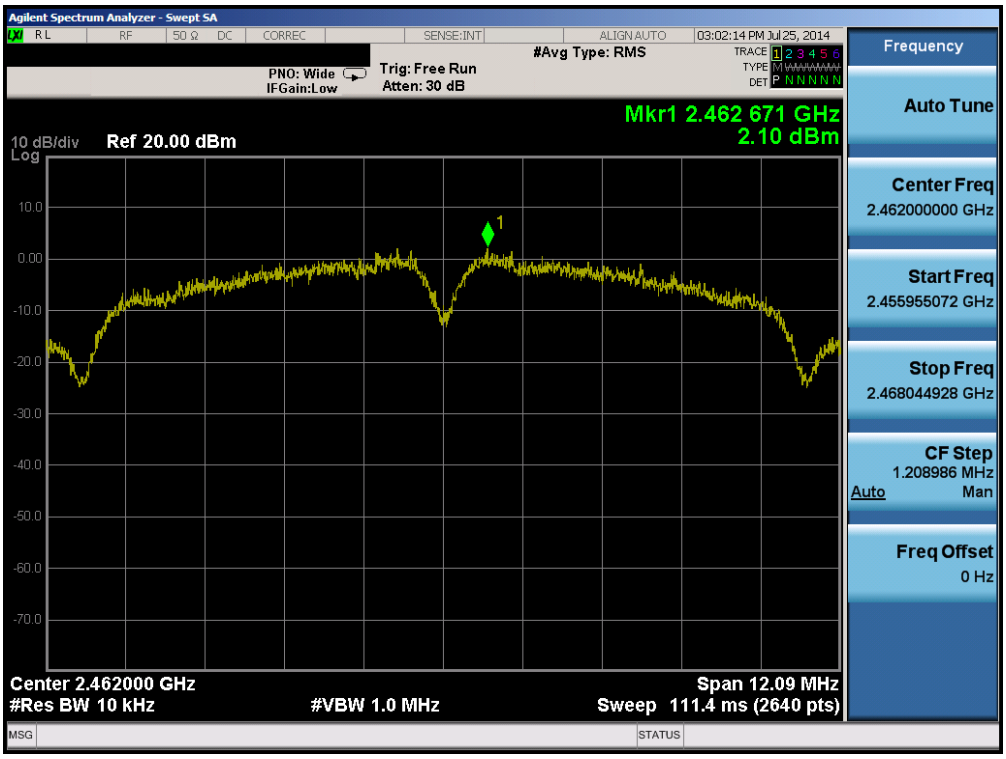
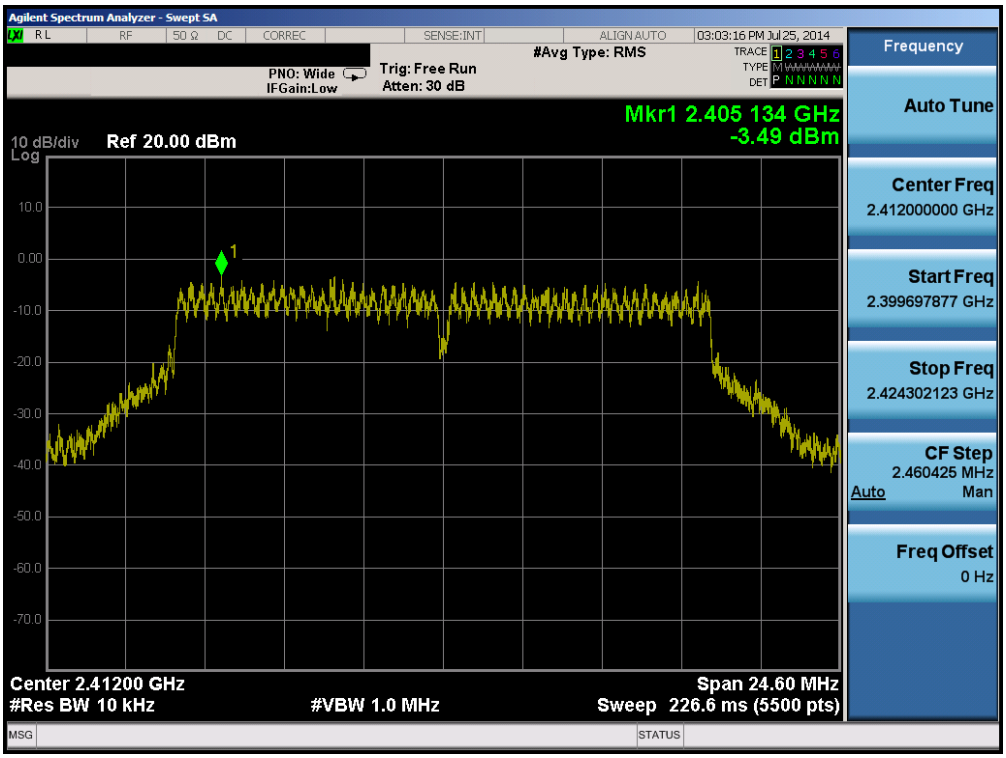



**Plot 6-39. Power Spectral Density Plot (802.11b – Ch. 11)**




**Plot 6-40. Power Spectral Density Plot (802.11g – Ch. 1)**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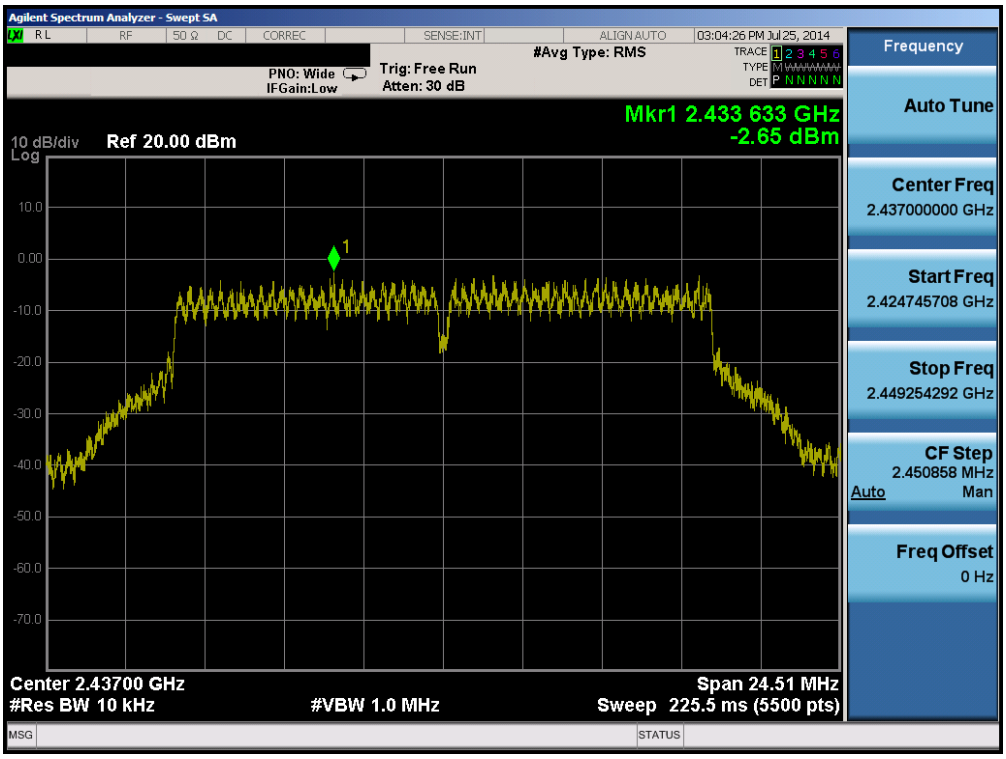
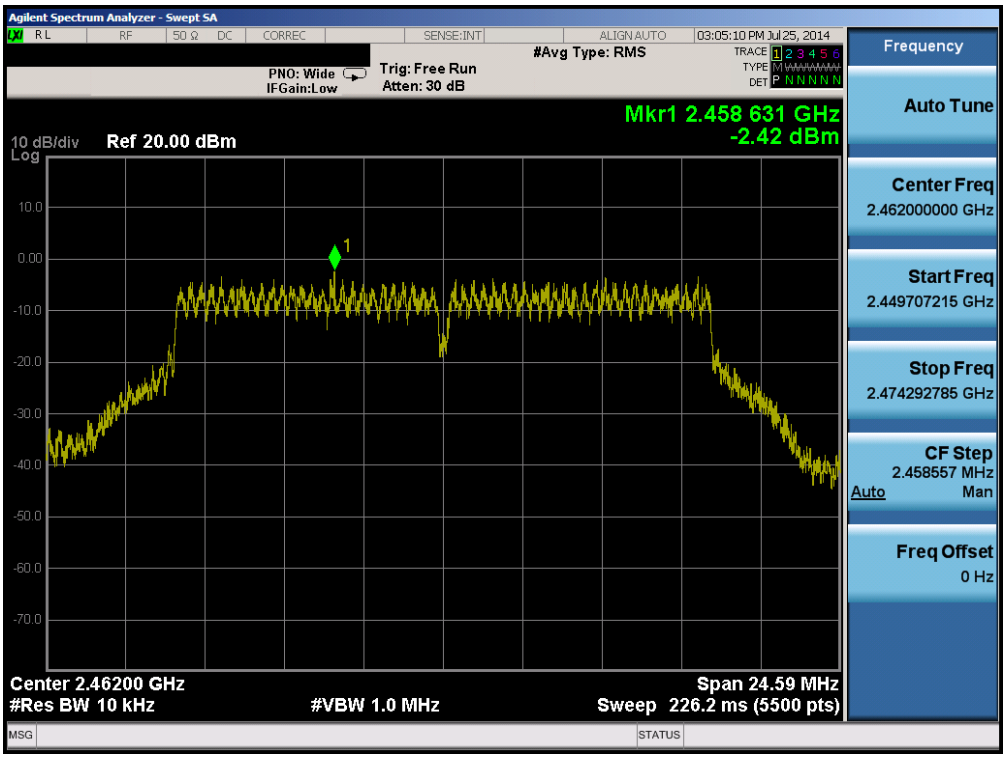



**Plot 6-41. Power Spectral Density Plot (802.11g – Ch. 6)**




**Plot 6-42. Power Spectral Density Plot (802.11g – Ch. 11)**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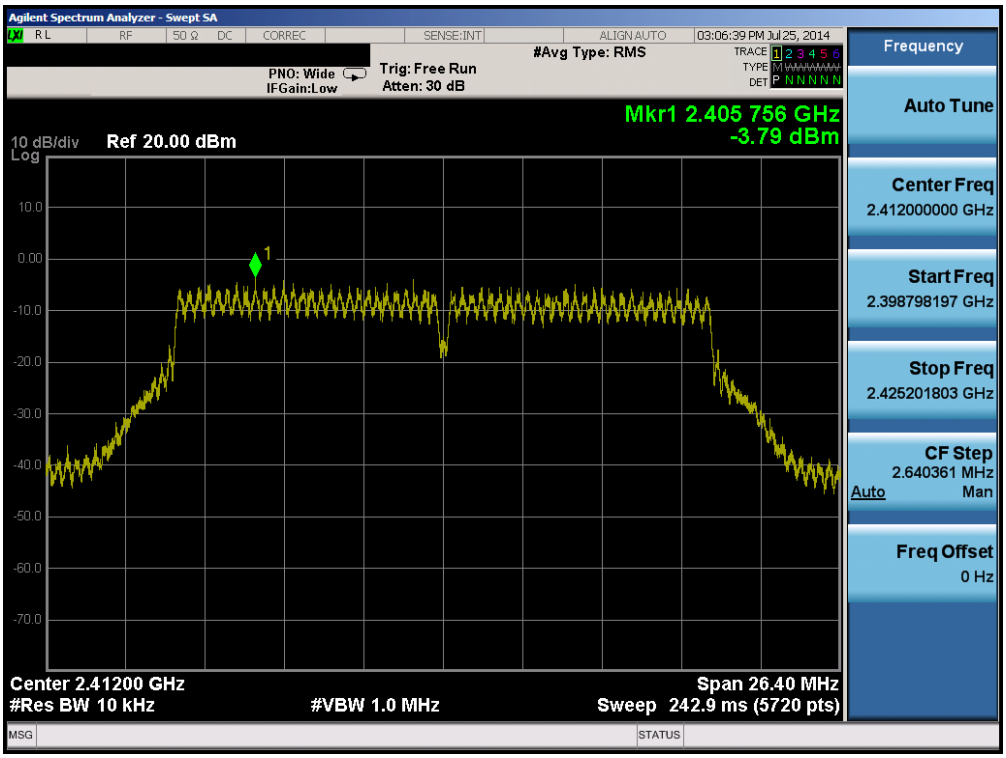
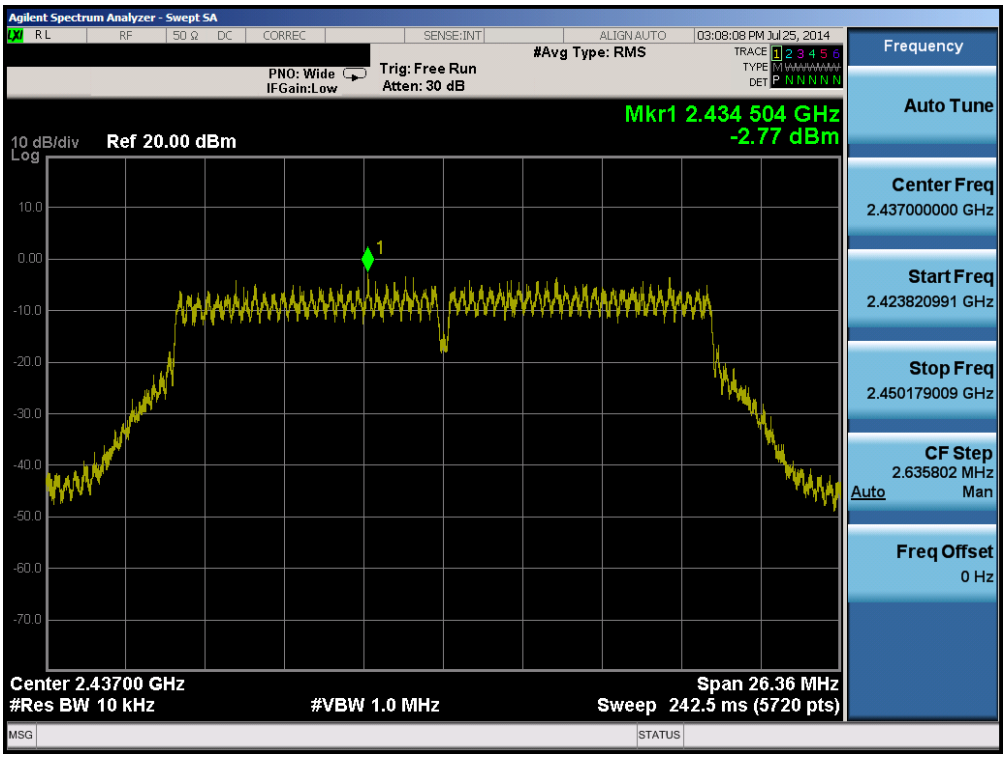



**Plot 6-43. Power Spectral Density Plot (802.11n (2.4GHz) – Ch. 1)**




**Plot 6-44. Power Spectral Density Plot (802.11n (2.4GHz) – Ch. 6)**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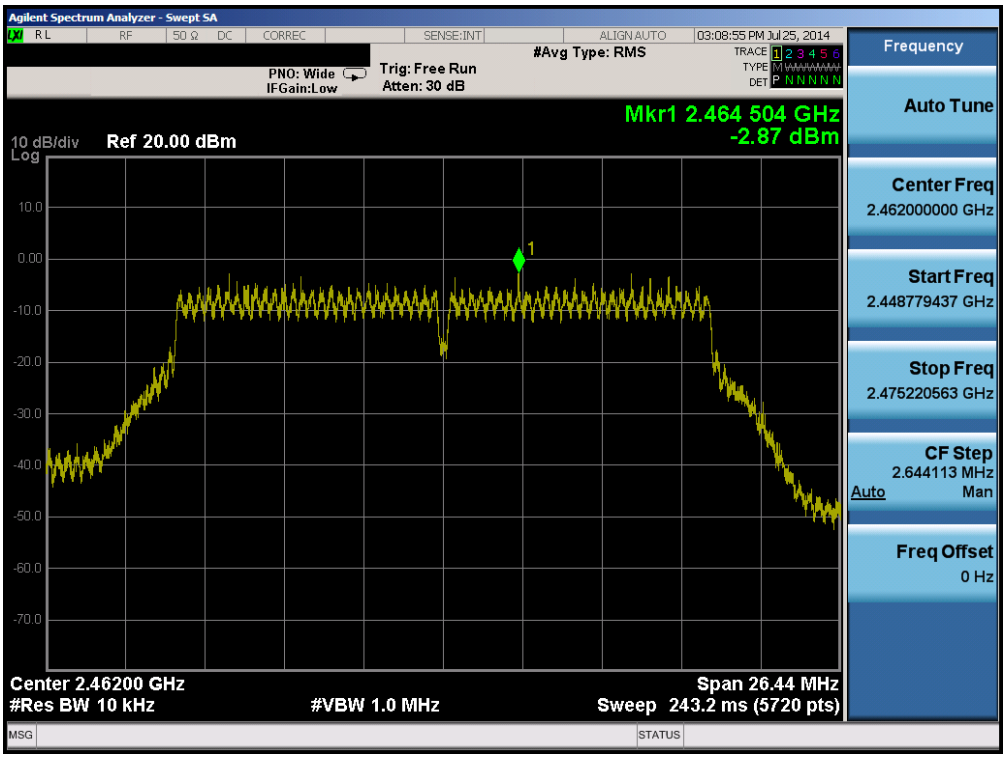
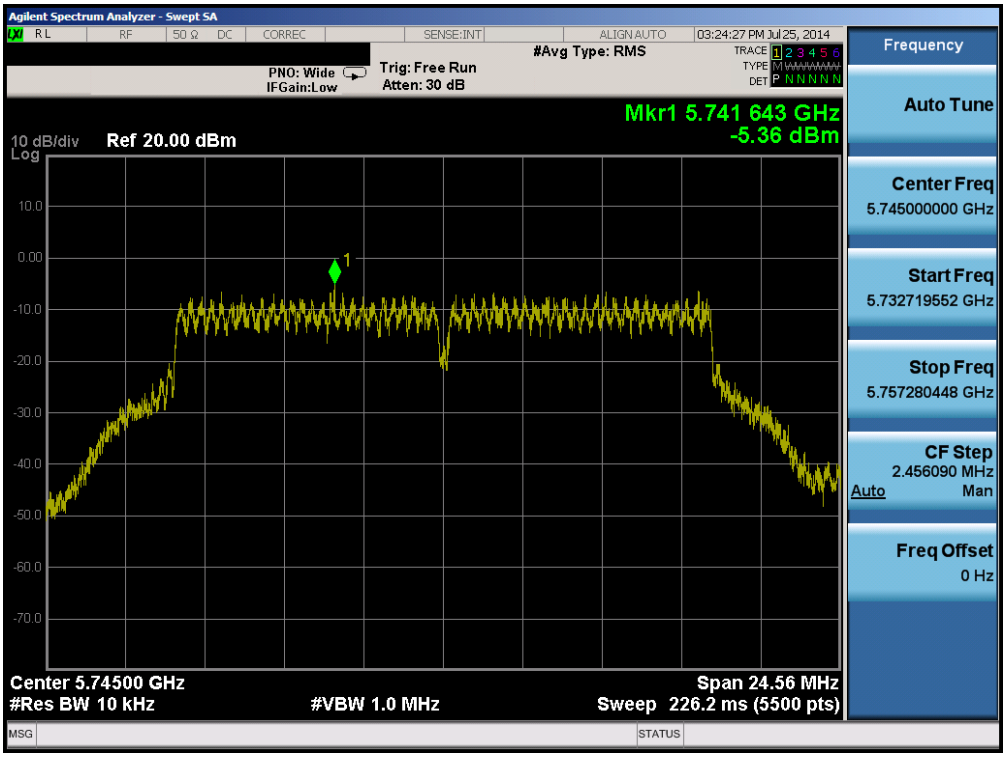



**Plot 6-45. Power Spectral Density Plot (802.11n (2.4GHz) – Ch. 11)**




**Plot 6-46. Power Spectral Density Plot (802.11a – Ch. 149)**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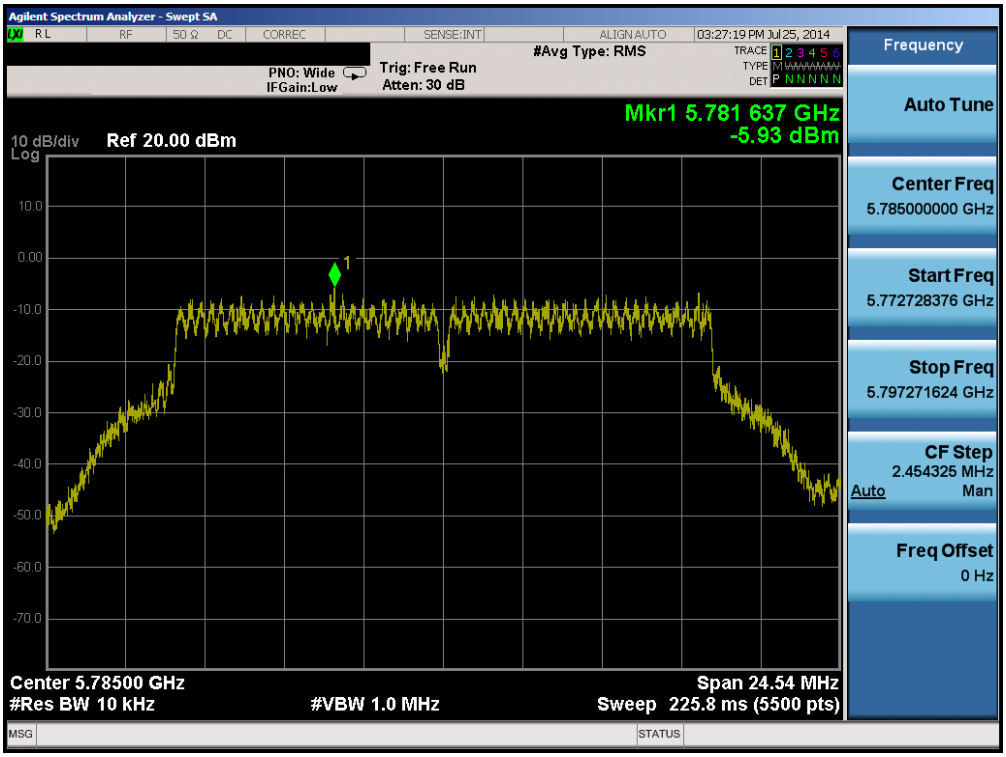
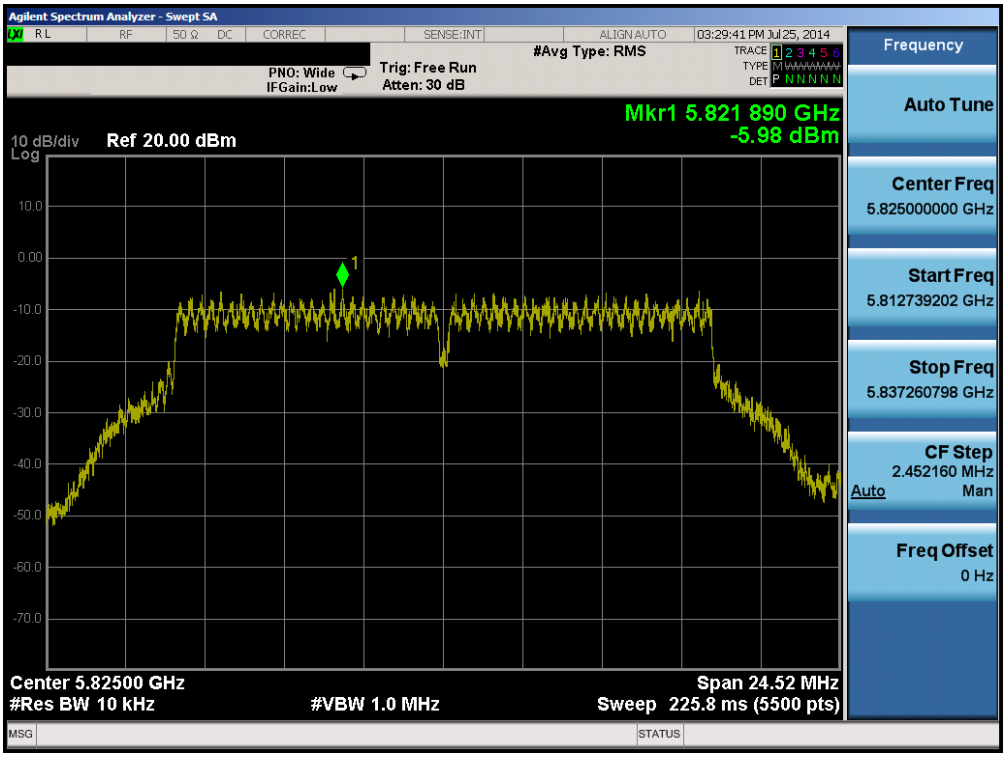



**Plot 6-47. Power Spectral Density Plot (802.11a – Ch. 157)**




**Plot 6-48. Power Spectral Density Plot (802.11a – Ch. 165)**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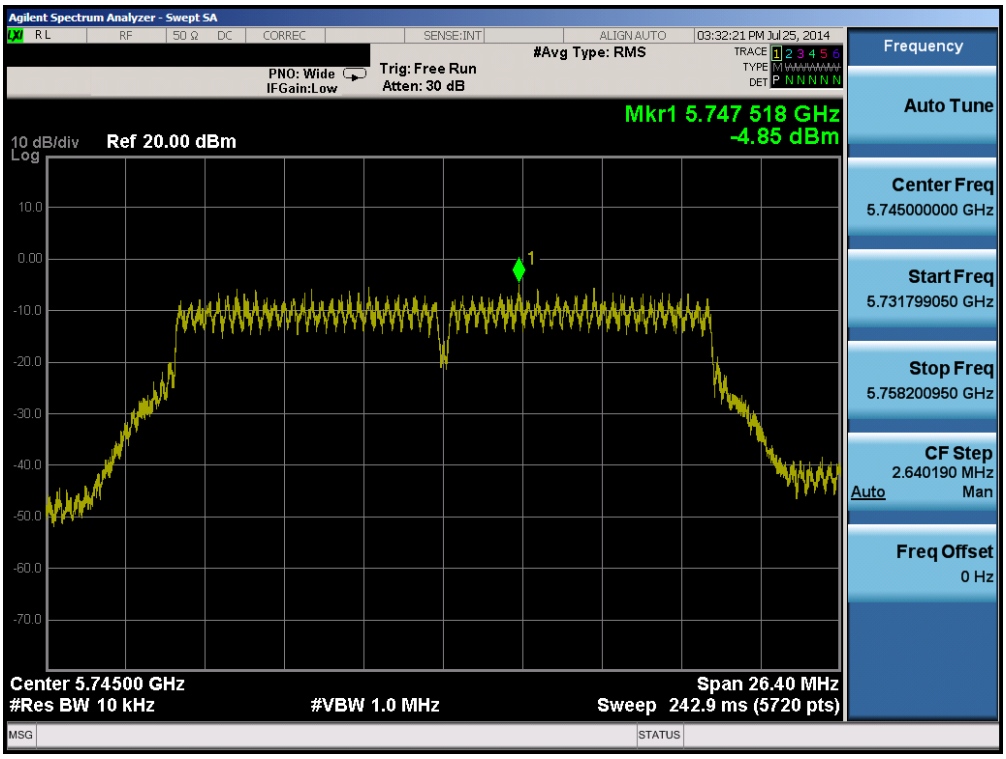
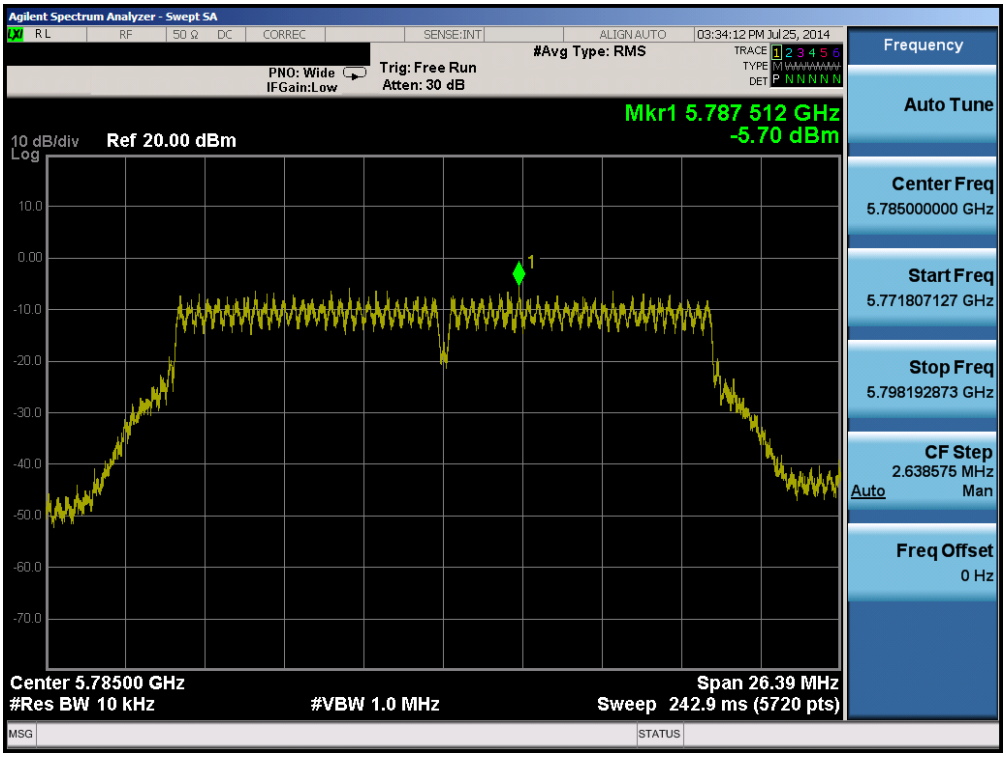



**Plot 6-49. Power Spectral Density Plot (20MHz BW 802.11n (5.8GHz) – Ch. 149)**




**Plot 6-50. Power Spectral Density Plot (20MHz BW 802.11n (5.8GHz) – Ch. 157)**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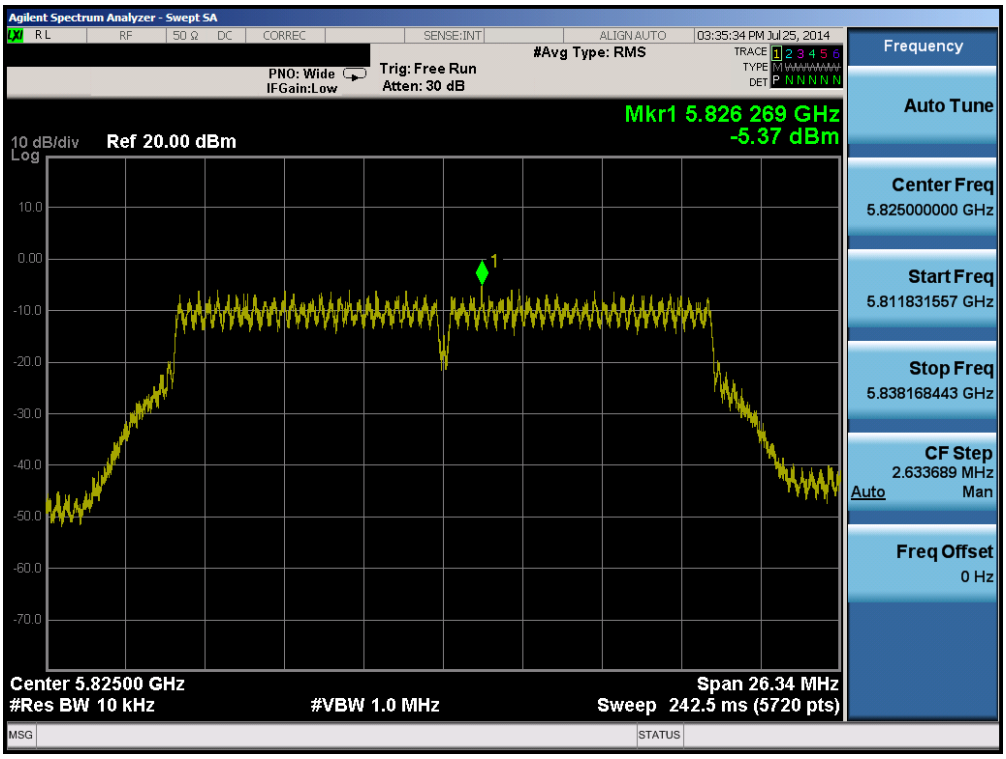
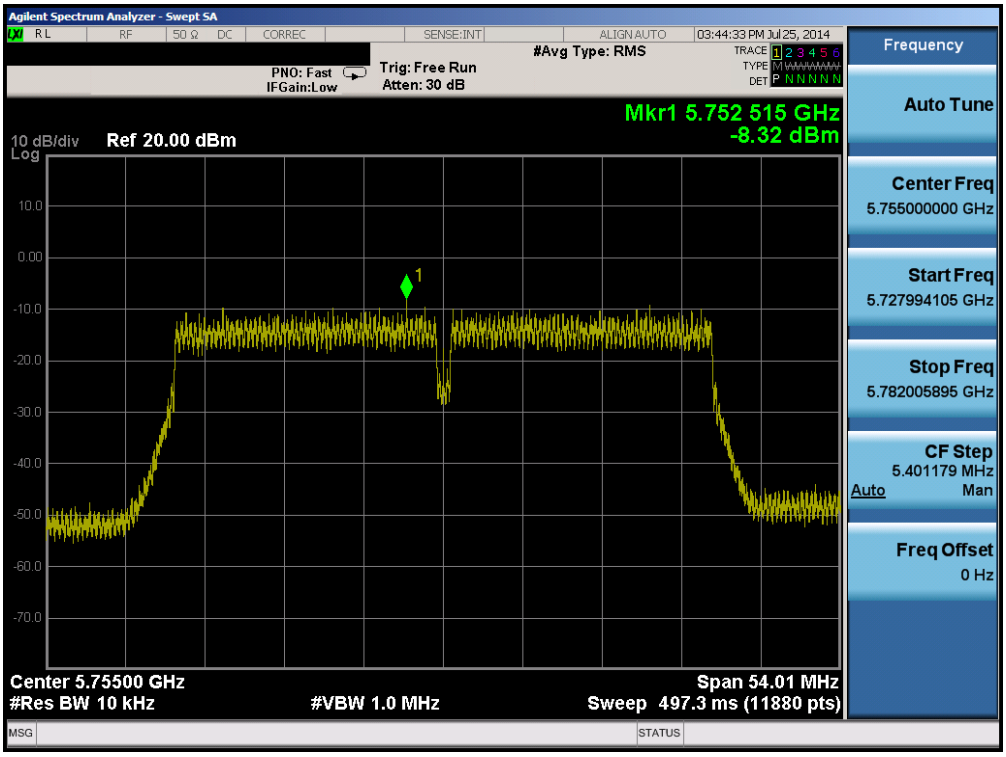



**Plot 6-51. Power Spectral Density Plot (20MHz BW 802.11n (5.8GHz) – Ch. 165)**




**Plot 6-52. Power Spectral Density Plot (40MHz BW 802.11n (5.8GHz) – Ch. 151)**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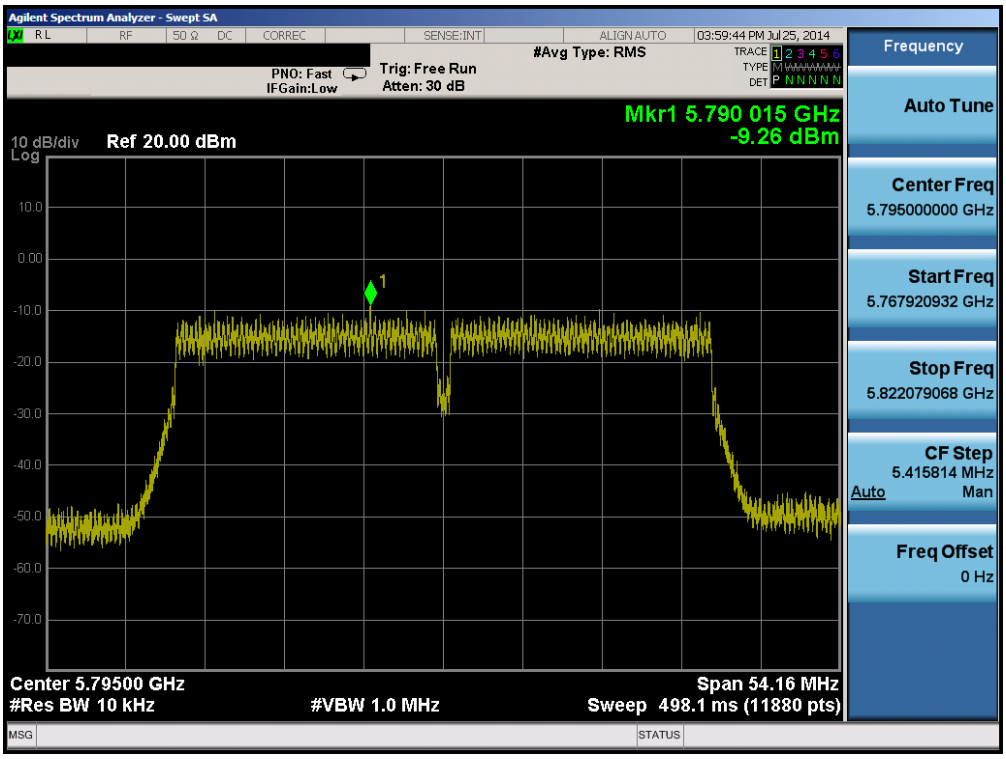
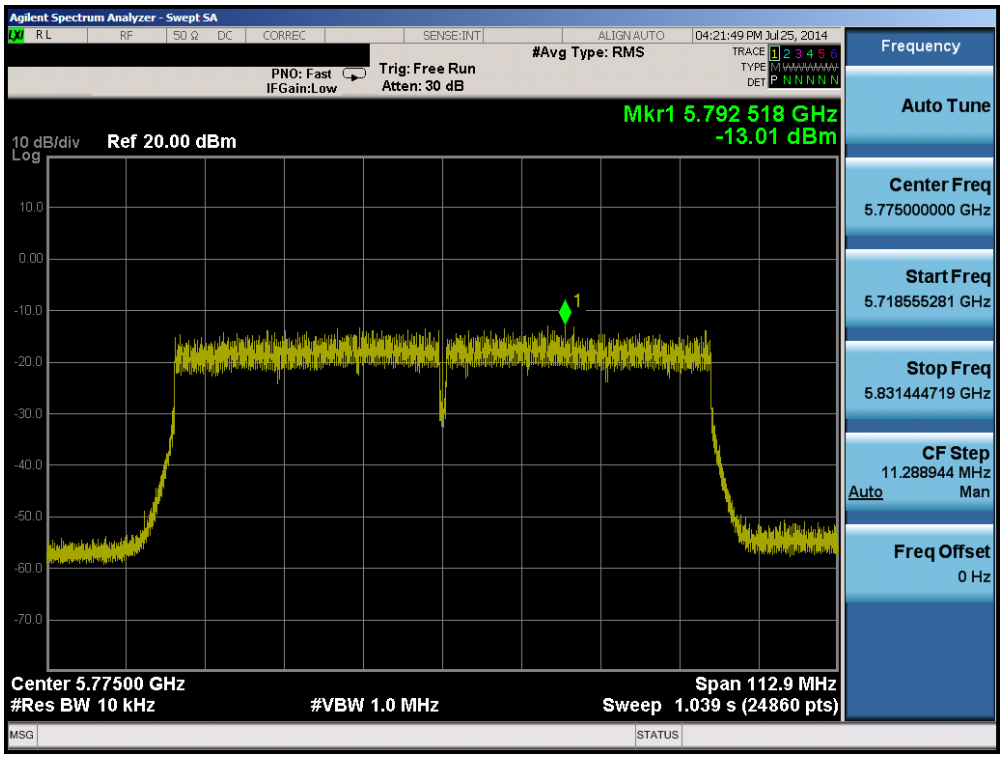



**Plot 6-53. Power Spectral Density Plot (40MHz BW 802.11n (5.8GHz) – Ch. 159)**




**Plot 6-54. Power Spectral Density Plot (80MHz BW 802.11ac (5.8GHz) – Ch. 155)**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