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MEASUREMENT REPORT
FCC PART 15.247 / IC RSS-210 WLAN 802.11b/g/n

Applicant Name:
Motorola Mobility, Inc.
8000 West Sunrise Blvd.
Plantation, FL 33322
United States

Date of Testing:
05/22 - 05/29/2012
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0Y1205240721.IHD

FCC ID: **IHDT56NH5**

APPLICANT: **Motorola Mobility, Inc.**

Application Type: Certification
EUT Type: Portable Handset
FCC Classification: Digital Transmission System (DTS)
FCC Rule Part(s): Part 15.247
IC Specification(s): RSS-210 Issue 8
Test Procedure(s): ANSI C63.4-2003, KDB 558074

Mode	Tx Frequency (MHz)	Avg Conducted		Peak Conducted	
		Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
802.11b	2412 - 2462	76.913	18.86	127.938	21.07
802.11g	2412 - 2462	61.376	17.88	266.073	24.25
802.11n	2412 - 2462	55.590	17.45	261.216	24.17

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 ANSI C63.4-2003. 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.

PCTEST certifies that no party to this application has been subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Randy Ortanez
President

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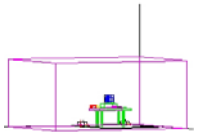

MEASUREMENT REPORT
FCC Part 15.247

§ 2.1033 General Information

APPLICANT:	Motorola Mobility, Inc.
APPLICANT ADDRESS:	8000 West Sunrise Blvd.
	Plantation, FL 33322, United States
TEST SITE:	PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS:	7185 Oakland Mills Road, Columbia, MD 21046 USA
FCC RULE PART(S):	Part 15.247
IC SPECIFICATION(S):	RSS-210 Issue 8
FCC ID:	IHDT56NH5
Test Device Serial No.:	TA657001XC, TA657001X8 ☐ Production ☒ Pre-Production ☐ Engineering
FCC CLASSIFICATION:	Digital Transmission System (DTS)
DATE(S) OF TEST:	05/22 - 05/29/2012
TEST REPORT S/N:	0Y1205240721.IHD

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21045, 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.

- 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 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 C63.4-2003 on February 15, 2012.

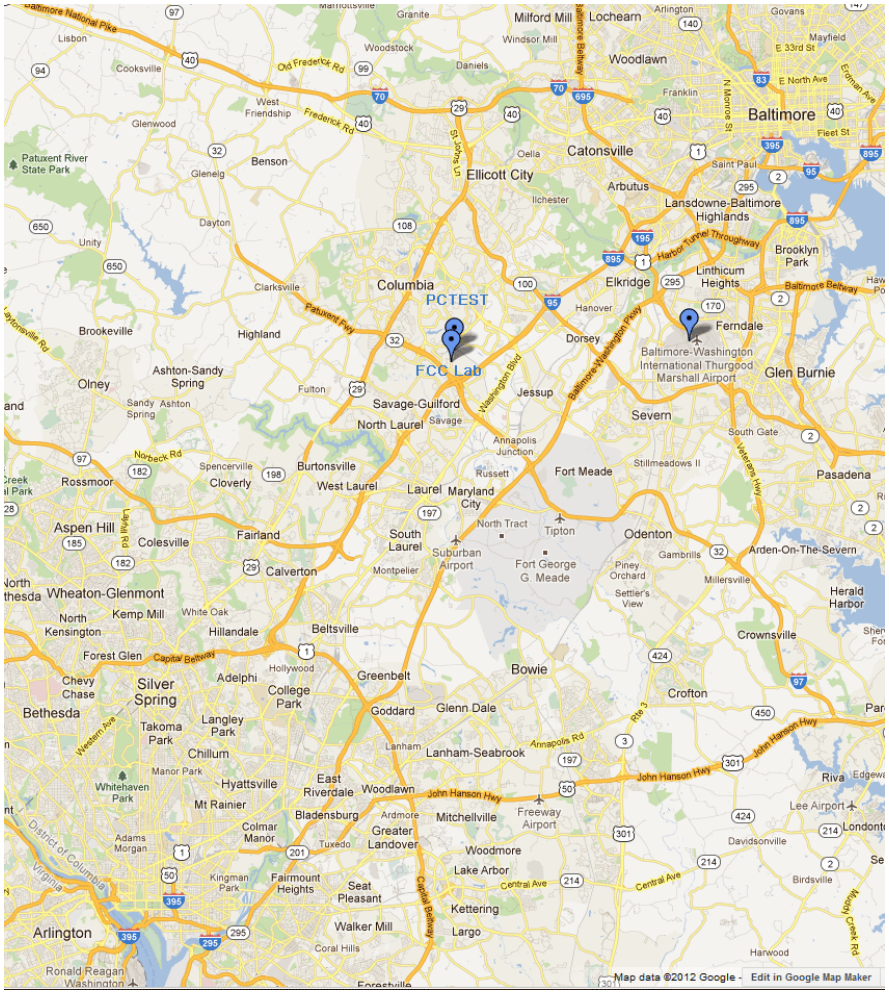

Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Motorola Portable Handset FCC ID: IHDT56NH5**. The test data contained in this report pertains only to the emissions due to the EUT's DTS transmitter.

2.2 Device Capabilities

This device contains the following capabilities:

802.11b/g/n WLAN, Bluetooth (1x,EDR, LE)

2.3 Test Configuration

The Motorola Portable Handset FCC ID: IHDT56NH5 was tested per the guidance of KDB 558074. See Sections 3.2, 3.3, and 6.1 of this test report for a description of the AC line conducted emissions, radiated emissions, and antenna port conducted emissions test setups, respectively.

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(b)(2).

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 Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2003) and the guidance provided in KDB 558074 were used in the measurement of the **Motorola Portable Handset FCC ID: IHDT56NH5.**

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 6.9. 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. 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 varying: the mode of operation or resolution, clock or data rate, scrolling H pattern to the EUT and/or support equipment, and changing the polarity of the receive antenna, whichever produced the worst-case emissions. To record the final measurements, the analyzer detector function was set to CISPR quasi-peak mode and the bandwidth of the spectrum analyzer was set to 120kHz for frequencies below 1GHz or 1MHz for frequencies above 1GHz. For average measurements above 1GHz, measurement procedure "RBAVG1" in Section 5.4.2.2.2.1 of KDB 558074 was used.

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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 antenna(s) of the Portable Handset are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The **Motorola Portable Handset FCC ID: IHDT56NH5** 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		

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)	6/7/2011	Annual	6/7/2012	N/A
-	WL25-1	Conducted Cable Set (25GHz)	2/13/2012	Annual	2/13/2013	N/A
-	RE2	Radiated Emissions Cable Set (VHF/UHF)	2/13/2012	Annual	2/13/2013	N/A
Agilent	8447D	Broadband Amplifier	5/8/2012	Annual	5/8/2013	2443A01900
Agilent	N9020A	MXA Signal Analyzer	10/10/2011	Annual	10/10/2012	US46470561
Anritsu	MA2411B	Pulse Sensor	10/13/2011	Annual	10/13/2012	1027293
Anritsu	ML2495A	Power Meter	10/13/2011	Annual	10/13/2012	1039008
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	5/10/2012	Annual	5/10/2013	121034
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	7/22/2011	Annual	7/22/2012	125518
ETS Lindgren	3160-09	18-26.5 GHz Standard Gain Horn	5/30/2012	Annual	5/30/2013	135427
Mini-Circuits	VHF-3100+	High Pass Filter	1/15/2012	Annual	1/15/2013	30841
Rohde & Schwarz	TS-PR18	1-18 GHz Pre-Amplifier	6/9/2011	Annual	6/9/2012	100071
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	5/30/2012	Annual	5/30/2013	100040
Rohde & Schwarz	ESU26	EMI Test Receiver	12/15/2011	Annual	12/15/2012	100342
Solar Electronics	8012-50-R-24-BNC	LISN	6/23/2011	Biennial	6/23/2013	310233
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	1/26/2012	Biennial	1/26/2014	A051107

Table 5-1. Annual Test Equipment Calibration Schedule

Note:

The 3160-09 horn antenna and TS-PR26 pre-amplifier were within their respective previous calibration cycles at the time of testing.

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6.0 TEST RESULTS

6.1 Summary

Company Name: Motorola Mobility, Inc.

FCC ID: IHDT56NH5

FCC Classification: Digital Transmission System (DTS)

Data Rate(s) Tested: 1Mbps, 2Mbps, 5.5Mbps, 11Mbps (b)

6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps (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)

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (TX)						
15.247(a)(2)	RSS-210 [A8.2]	6dB Bandwidth	> 500kHz	CONDUCTED	PASS	Section 6.2
15.247(b)(3)	RSS-210 [A8.4]	Transmitter Output Power	< 1 Watt		PASS	Section 6.3
15.247(e)	RSS-210 [A8.2]	Transmitter Power Spectral Density	< 8dBm / 3kHz Band		PASS	Section 6.4
15.247(d)	RSS-210 [A8.5]	Band Edge / Out-of-Band Emissions	< 20dBc (Peak)		PASS	Sections 6.5, 6.6
15.205 15.209	RSS-210 [A8.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-210 table 3 limits)	RADIATED	PASS	Sections 6.7, 6.8
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits or < RSS-Gen table 2 limits	LINE CONDUCTED	PASS	Section 6.9
RECEIVER MODE (RX) / DIGITAL EMISSIONS						
15.107	RSS-Gen [7.2.2]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.107 limits or < RSS-Gen table 2 limits	LINE CONDUCTED	PASS	Part 15B Test Report
15.109	RSS-Gen [7.2.3.2]	General Field Strength Limits (Restricted Bands and Radiated Emissions Limits)	< FCC 15.109 limits or < RSS-210 table 3 limits	RADIATED (30MHz-1GHz) (1-25 GHz)	PASS	Part 15B Test Report

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.

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6.2 6dB Bandwidth Measurement – 802.11b/g/n

§15.247(a)(2); RSS-210 [A8.2]

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6dB bandwidth is 500 kHz.

Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
2412	1	b	1	9.199	0.500	Pass
2437	6	b	1	9.201	0.500	Pass
2462	11	b	1	9.198	0.500	Pass
2412	1	g	6	15.920	0.500	Pass
2437	6	g	6	15.920	0.500	Pass
2462	11	g	6	15.960	0.500	Pass
2412	1	n	6.5/7.2 (MCS0)	17.270	0.500	Pass
2437	6	n	6.5/7.2 (MCS0)	17.220	0.500	Pass
2462	11	n	6.5/7.2 (MCS0)	17.160	0.500	Pass

Table 6-2. Conducted Bandwidth Measurements

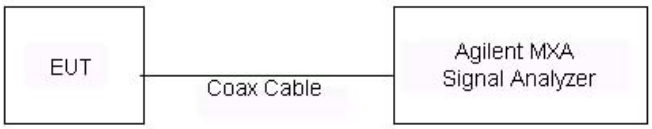

Figure 6-1. Test Instrument & Measurement Setup

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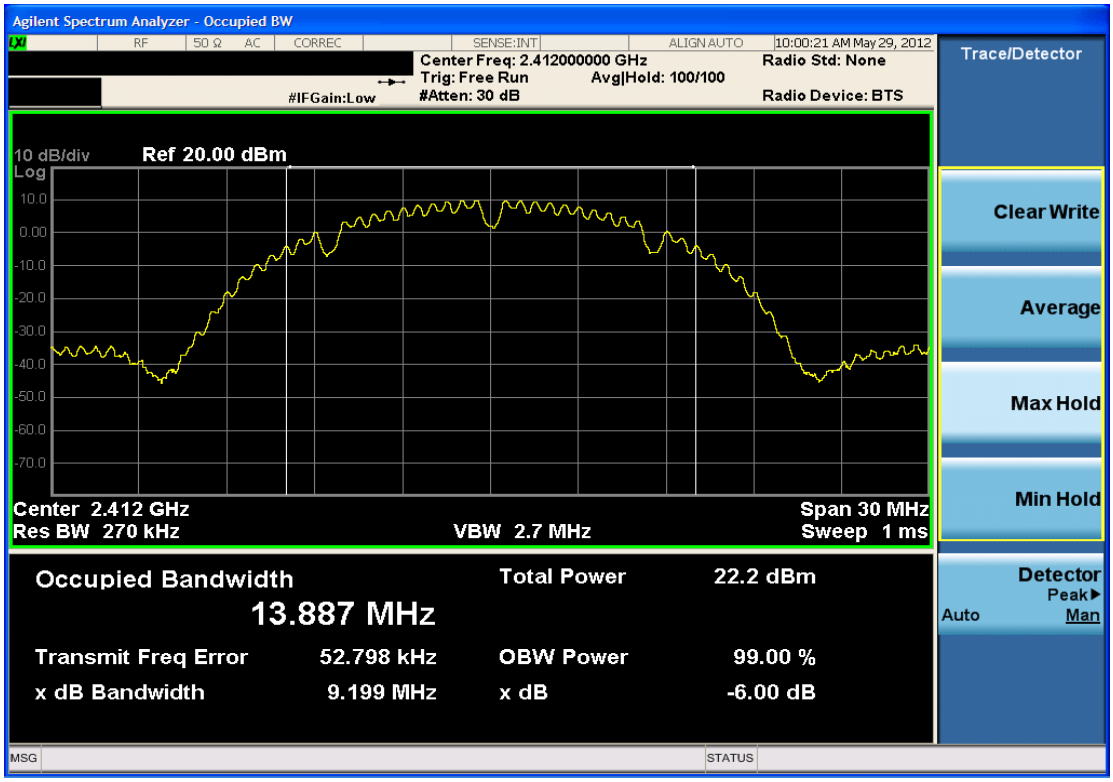
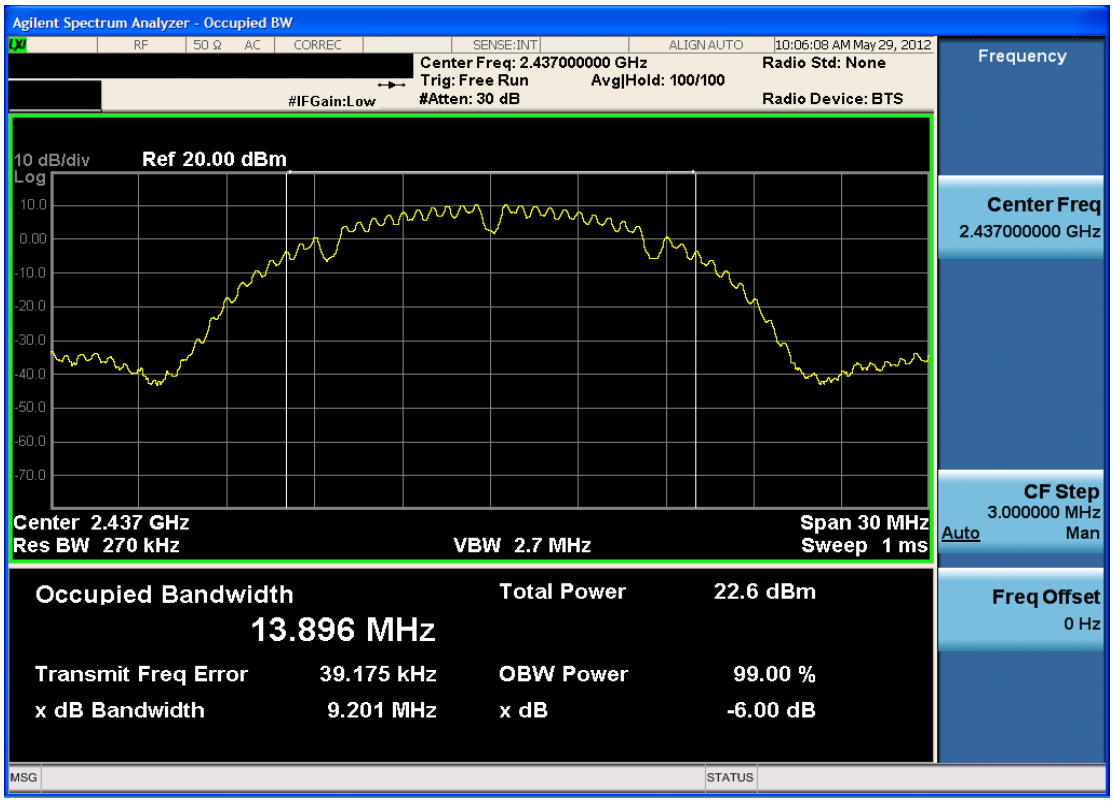


Plot 6-1. 6dB Bandwidth Plot (802.11b – Ch. 1)



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

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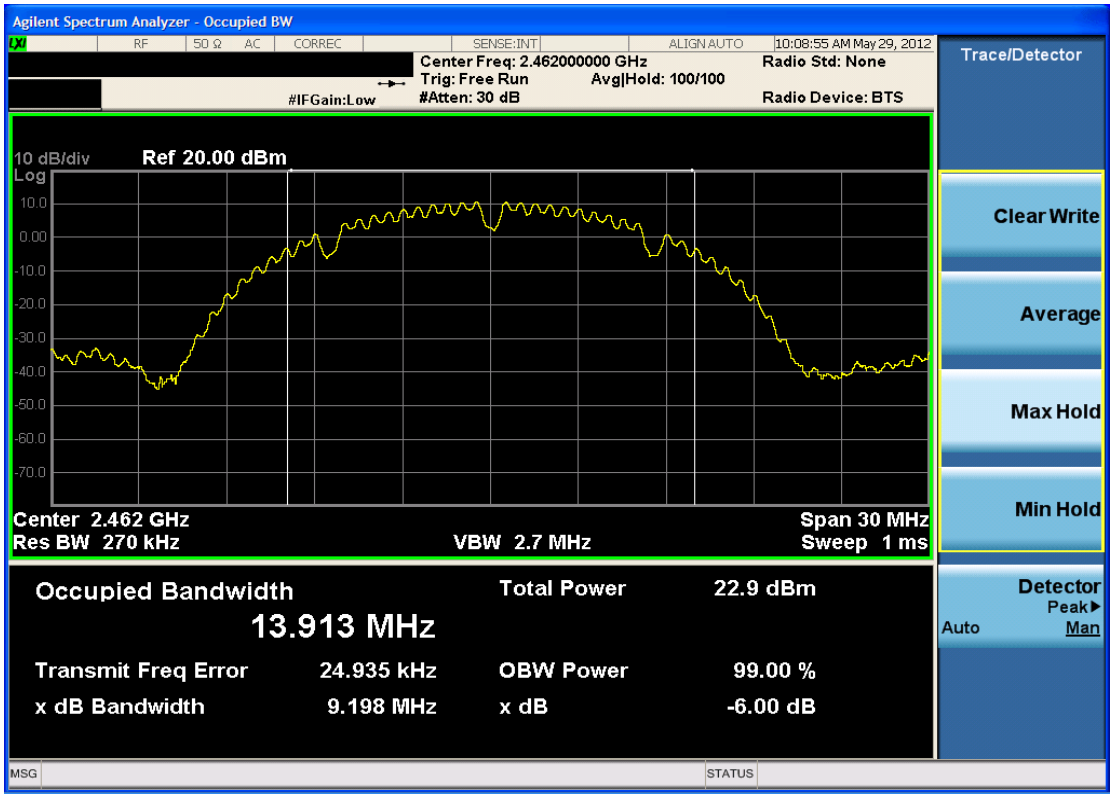
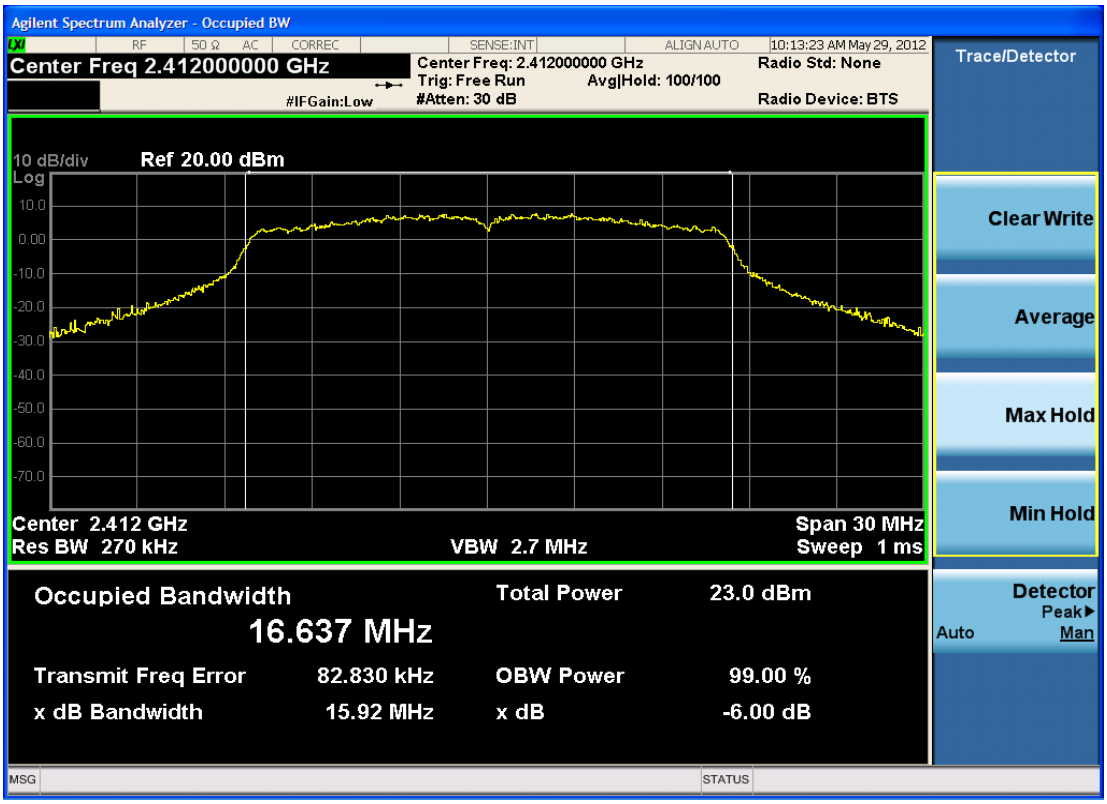


Plot 6-3. 6dB Bandwidth Plot (802.11b – Ch. 11)



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

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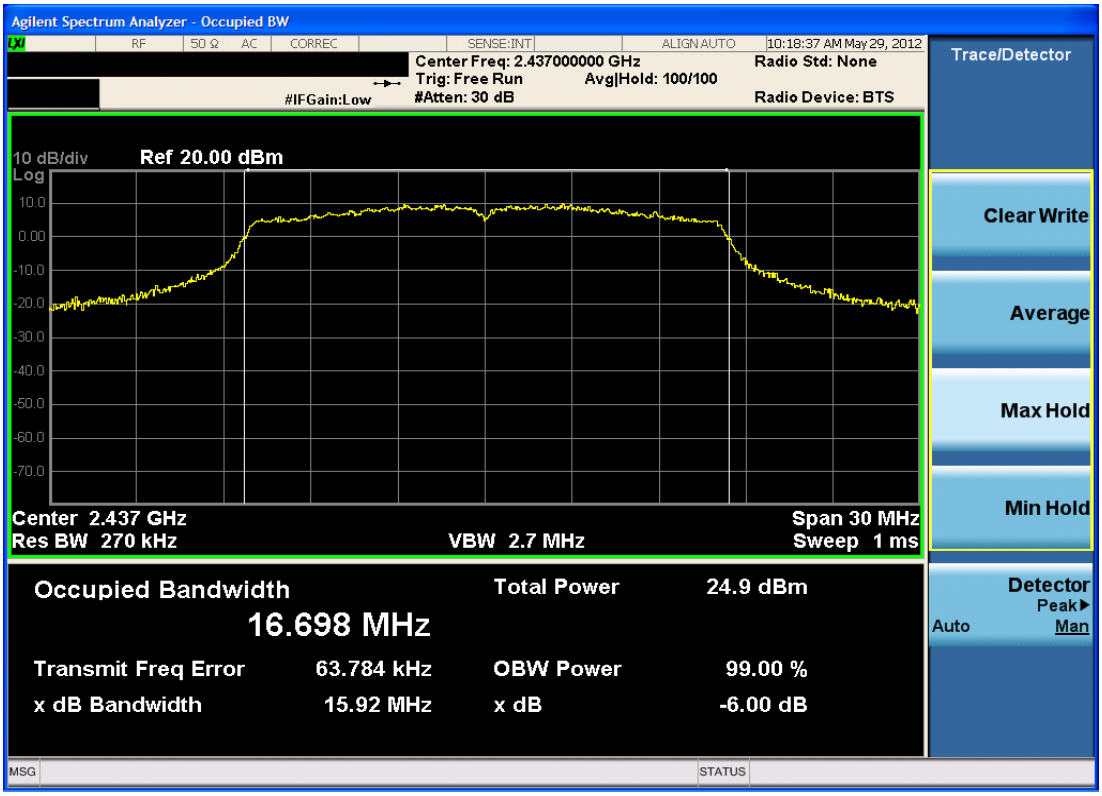
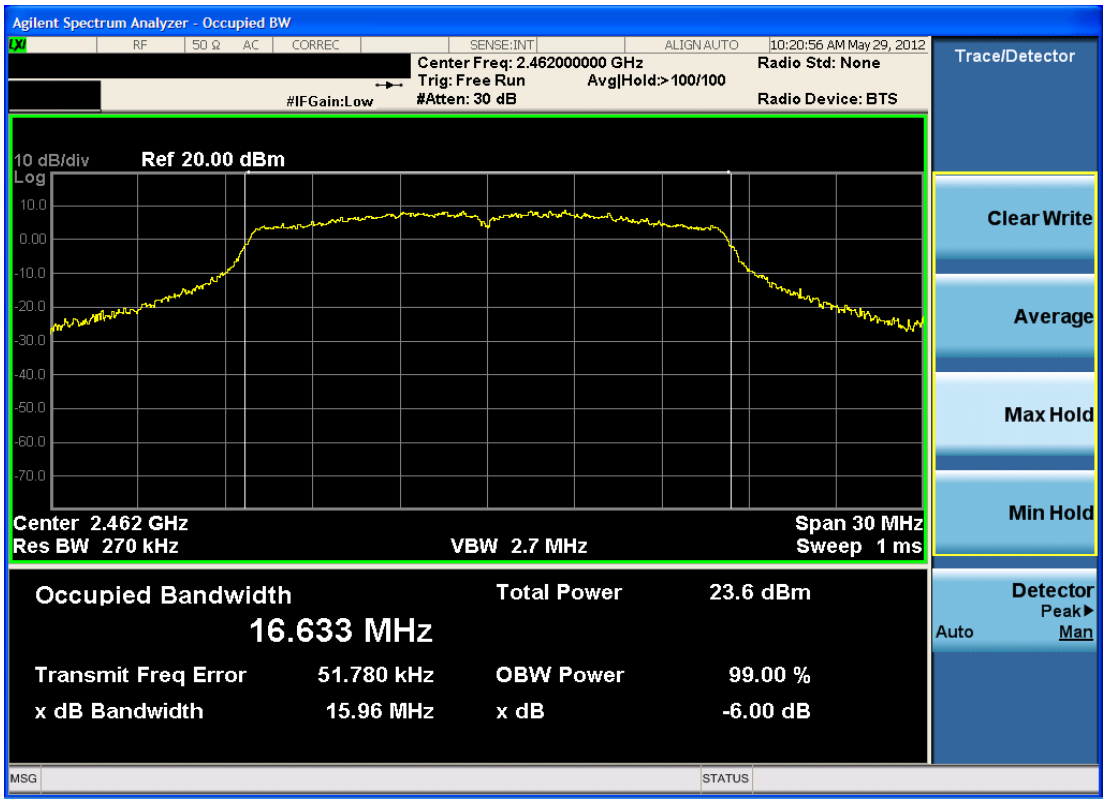


Plot 6-5. 6dB Bandwidth Plot (802.11g – Ch. 6)



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

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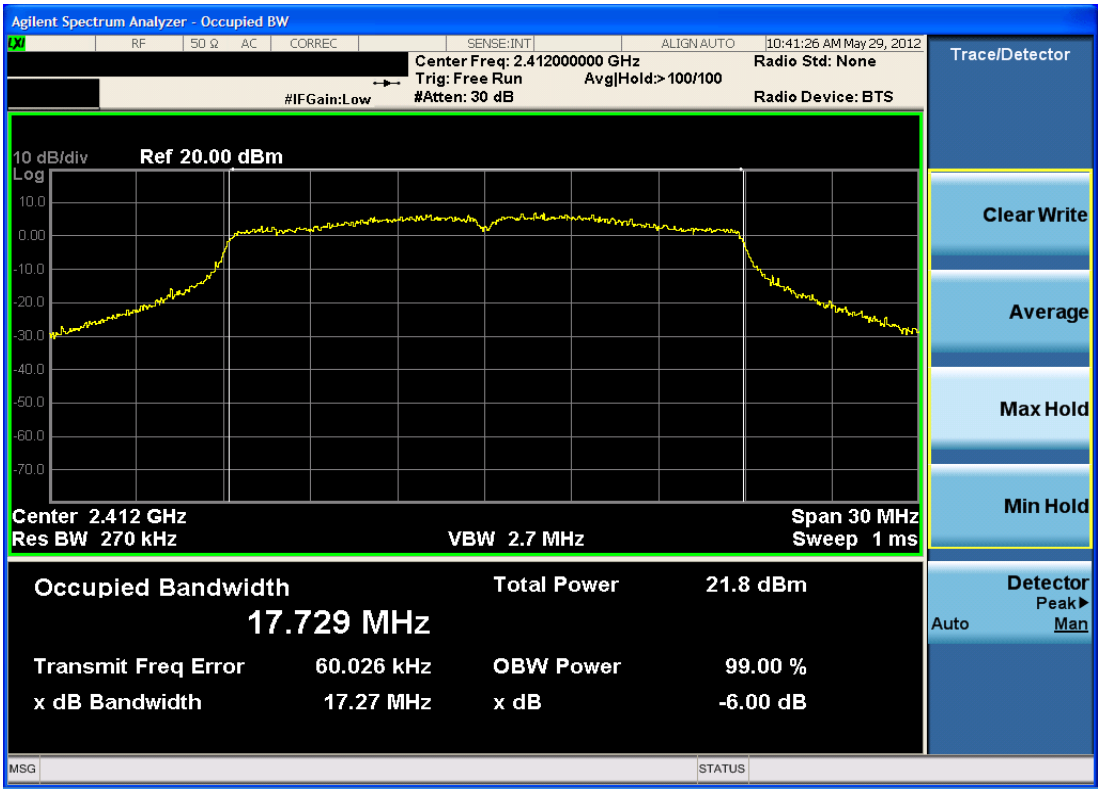
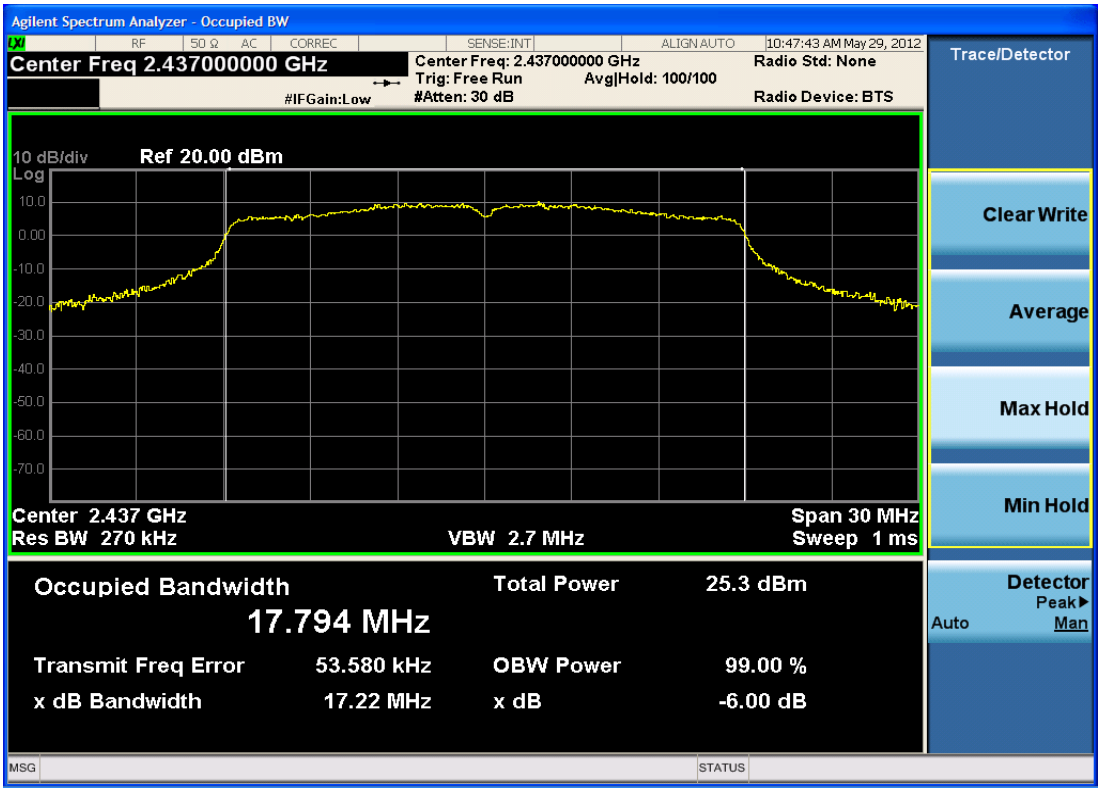


Plot 6-7. 6dB Bandwidth Plot (802.11n – Ch. 1)



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

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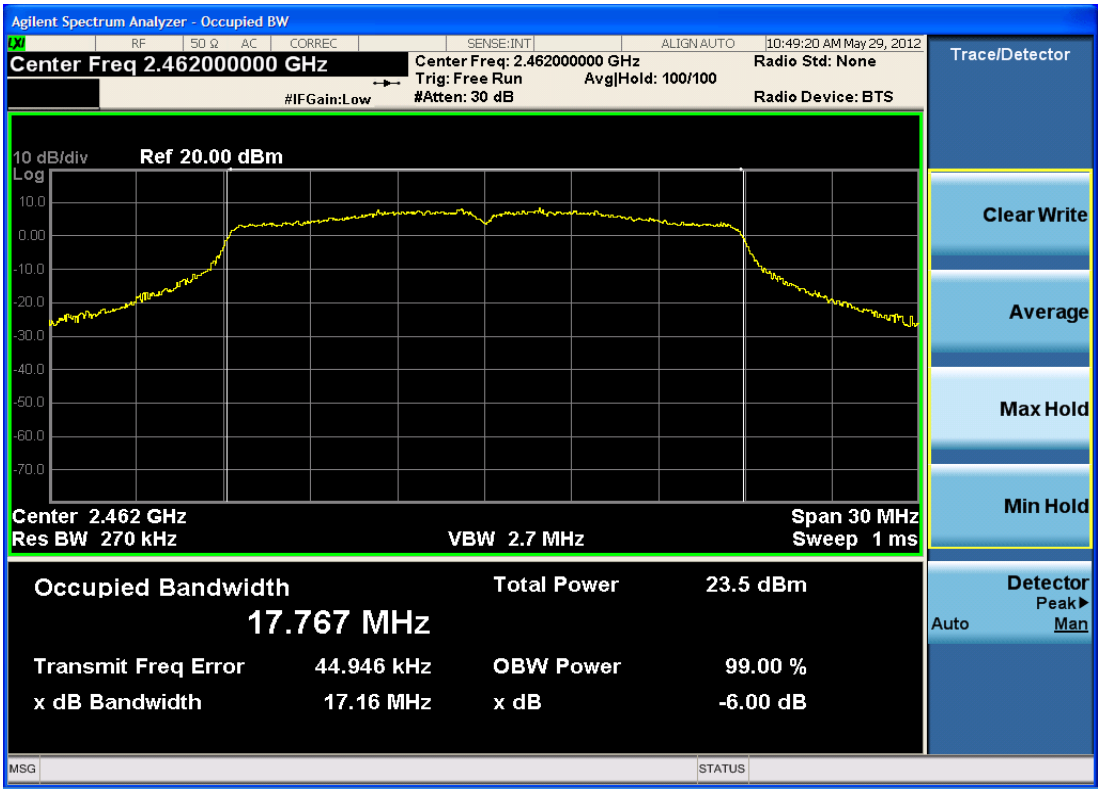

Plot 6-9. 6dB Bandwidth Plot (802.11n – Ch. 11)

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6.3 Output Power Measurement – 802.11b/g/n

§15.247(b)(3); RSS-210 [A8.4]

The transmit antenna terminal of the 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 power measurements while the EUT is operating in transmission mode at the appropriate frequencies. ***The maximum permissible conducted output power is 1 Watt.***

Mode	Freq [MHz]	Channel	Detector	802.11b Conducted Power [dBm] Data Rate [Mbps]			
				1	2	5.5	11
802.11b	2412	1	AVG	18.16	18.17	18.09	18.14
			PEAK	20.31	20.36	19.99	20.02
802.11b	2437	6	AVG	18.55	18.46	18.49	18.56
			PEAK	20.68	20.69	20.37	20.42
802.11b	2462	11	AVG	18.85	18.86	18.79	18.80
			PEAK	21.03	21.07	20.68	20.68

Table 6-3. Conducted Output Power Measurements (802.11b)

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	16.01	15.87	15.94	15.92	14.77	14.78	13.20	13.29
			PEAK	23.27	23.14	23.35	23.28	22.16	22.21	20.76	20.88
802.11g	2437	6	AVG	17.82	17.88	17.85	17.81	15.32	15.41	13.77	13.74
			PEAK	24.21	24.25	24.19	24.23	22.69	22.87	21.29	21.32
802.11g	2462	11	AVG	16.63	16.59	16.69	16.63	15.51	15.47	14.03	14.04
			PEAK	23.91	23.83	23.96	23.93	22.87	22.95	21.64	21.62

Table 6-4. 802.11g Conducted Output Power Measurements

Mode	Freq [MHz]	Channel	Detector	802.11n (2.4GHz - 400ns GI) Conducted Power [dBm] Data Rate [Mbps]							
				7.2	14.4	21.7	28.9	43.4	57.8	65.0	72.2
802.11n	2412	1	AVG	14.73	14.84	14.83	14.88	14.85	13.27	13.31	13.30
			PEAK	22.41	22.49	22.57	22.32	22.13	20.83	20.71	20.75
802.11n	2437	6	AVG	16.82	17.45	17.39	15.43	15.42	13.65	13.70	13.68
			PEAK	23.82	24.09	24.17	22.75	22.89	21.02	21.10	21.05
802.11n	2462	11	AVG	15.48	15.52	15.57	15.60	15.48	13.95	13.92	13.90
			PEAK	22.94	23.21	23.18	22.97	22.90	21.35	21.20	21.17

Table 6-5. 802.11n (2.4GHz – 400ns GI) Conducted Output Power Measurements

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Mode	Freq [MHz]	Channel	Detector	802.11n (2.4GHz - 800ns GI) Conducted Power [dBm] Data Rate [Mbps]							
				6.5	13.0	19.5	26.0	39.0	52.0	58.5	65.0
802.11n	2412	1	AVG	14.74	14.89	14.78	14.81	14.75	13.30	13.29	13.34
			PEAK	22.30	22.65	22.51	22.57	22.44	20.91	20.86	20.83
802.11n	2437	6	AVG	16.76	17.43	17.38	15.41	15.38	13.71	13.65	13.67
			PEAK	23.84	24.14	24.10	22.81	22.80	21.04	21.09	20.97
802.11n	2462	11	AVG	15.49	15.56	15.54	15.57	15.55	14.01	13.90	13.89
			PEAK	22.95	23.27	23.19	22.89	22.97	21.36	21.17	21.14

Table 6-6. 802.11n (2.4GHz – 800ns GI) Conducted Output Power Measurements

Note: The conducted powers for the outer channels (Channels 1 and 11) in 802.11g and 802.11n modes were reduced so that the EUT could comply with the radiated restricted band limits specified in 15.209 at the outer band edges. Radiated spurious band edge emissions were found to be compliant on Channels 2 and 10 while set to maximum power.

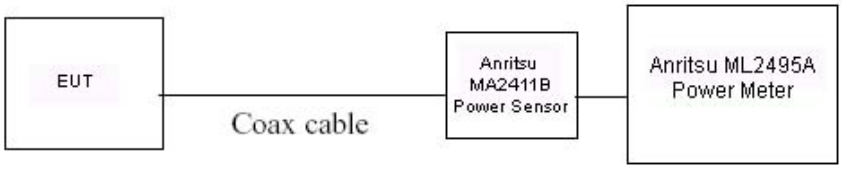

Figure 6-2. Test Instrument & Measurement Setup

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6.4 Power Spectral Density (802.11b/g/n)

§15.247(e); RSS-210 [A8.2]

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies. ***The maximum permissible power spectral density is 8 dBm in any 3 kHz band.***

Per the guidance on power spectral density measurements given in KDB 558074, the spectrum is measured with a 100kHz bandwidth using a peak detector. The measured spectrum is compared to the 8dBm/3kHz limit given in 15.247(e) by applying a bandwidth correction factor equal to 10log(3kHz/100kHz) = -15.23dB.

Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Power Spectral Density [dBm]	Bandwidth Correction Factor [dB]	Corrected Power Spectral Density [dBm]	Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]
2412	1	b	1	8.598	-15.23	-6.63	8.0	-14.63
2437	6	b	1	8.929	-15.23	-6.30	8.0	-14.30
2462	11	b	1	9.253	-15.23	-5.98	8.0	-13.98
2412	1	g	6	5.961	-15.23	-9.27	8.0	-17.27
2437	6	g	6	7.796	-15.23	-7.43	8.0	-15.43
2462	11	g	6	6.486	-15.23	-8.74	8.0	-16.74
2412	1	n	6.5/7.2 (MCS0)	4.698	-15.23	-10.53	8.0	-18.53
2437	6	n	6.5/7.2 (MCS0)	7.402	-15.23	-7.83	8.0	-15.83
2462	11	n	6.5/7.2 (MCS0)	5.500	-15.23	-9.73	8.0	-17.73

Table 6-7. Conducted Power Density Measurements

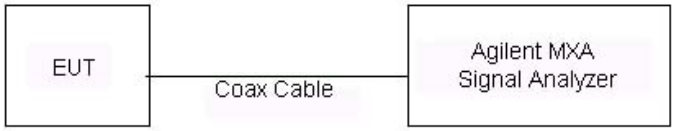

Figure 6-3. Test Instrument & Measurement Setup

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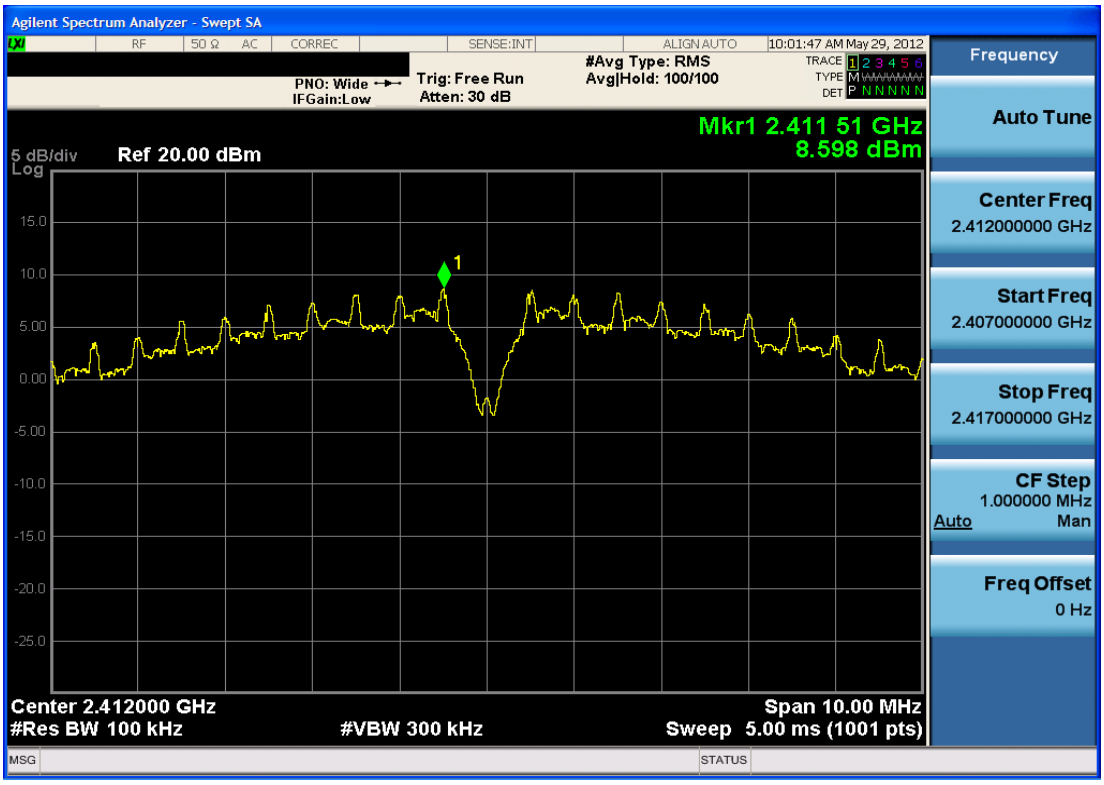
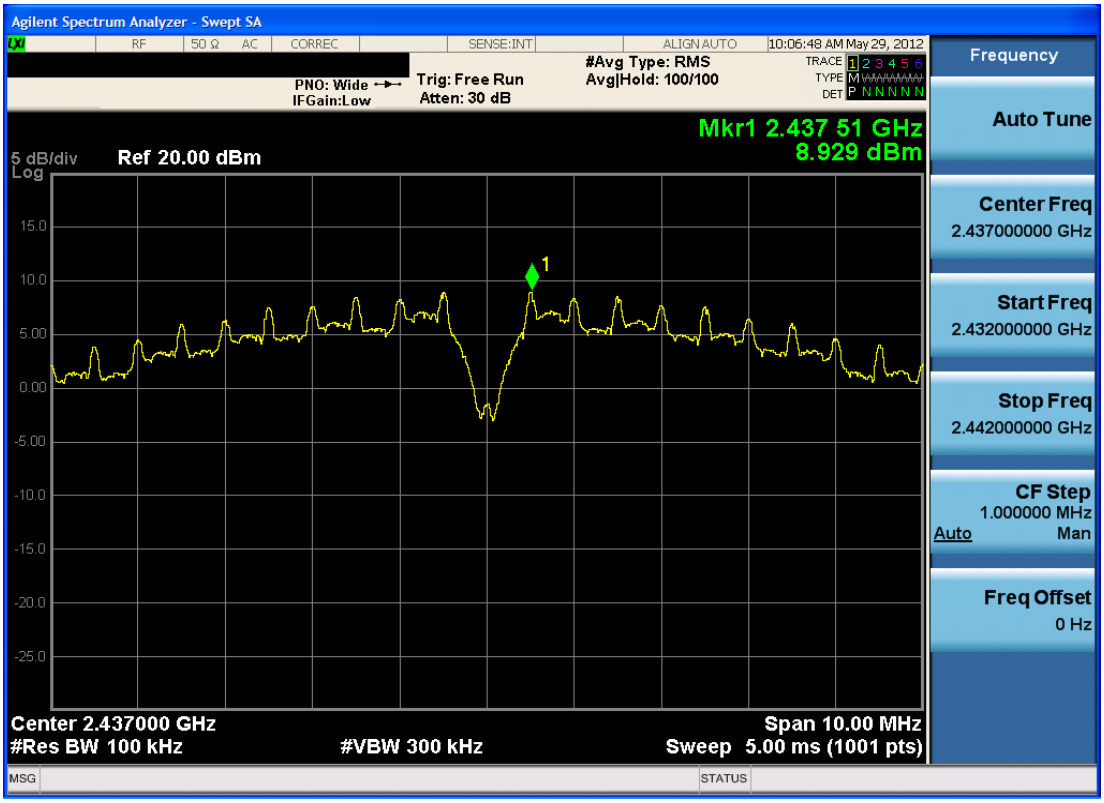


Plot 6-10. Power Spectral Density Plot (802.11b – Ch. 1)



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

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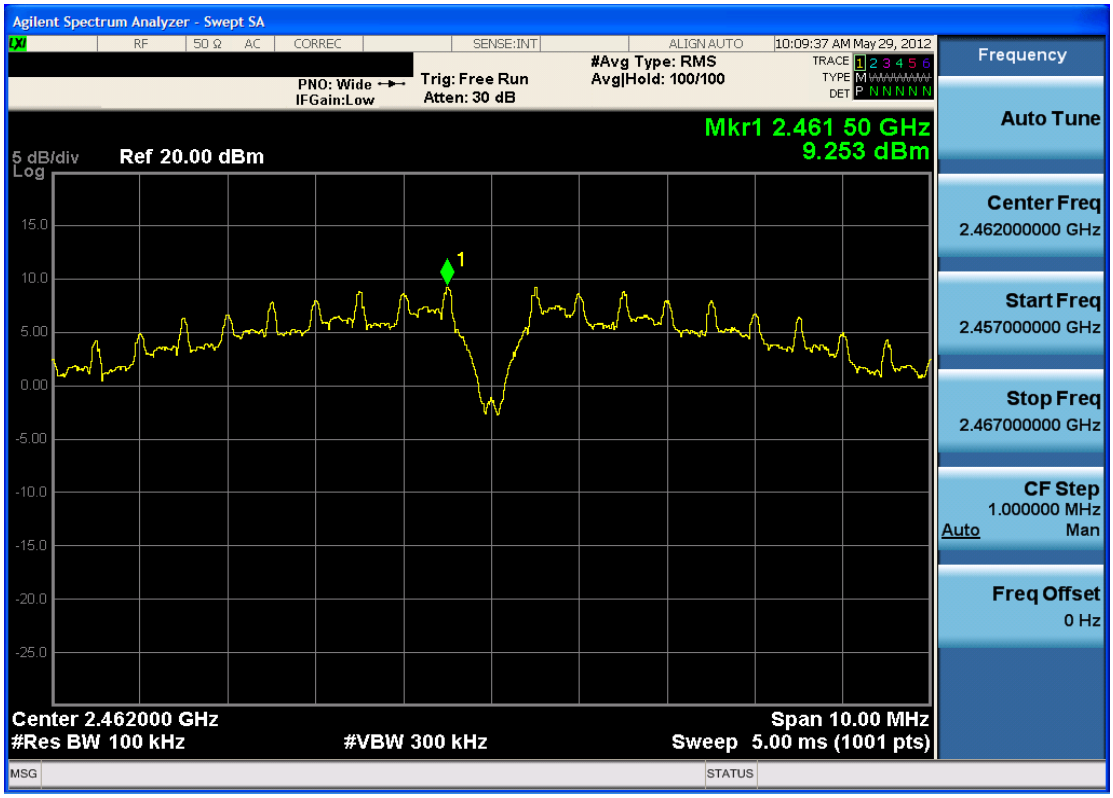
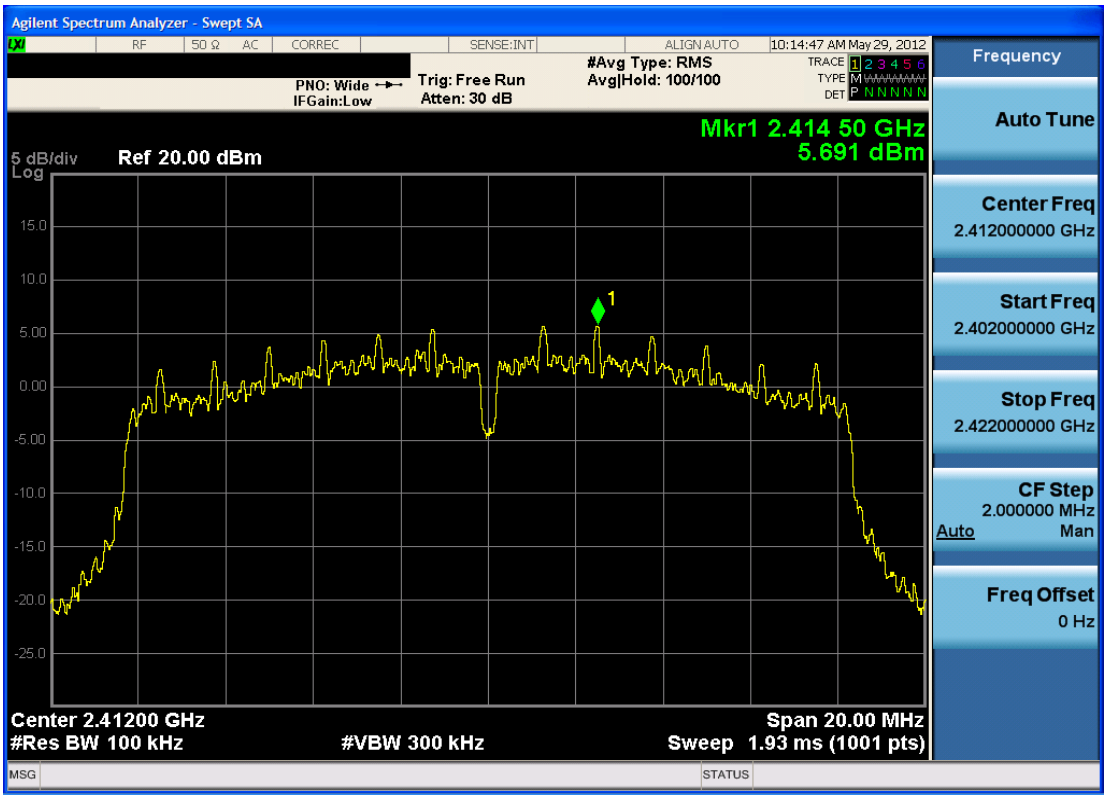


Plot 6-12. Power Spectral Density Plot (802.11b – Ch. 11)



Plot 6-13. Power Spectral Density Plot (802.11g – Ch. 1)

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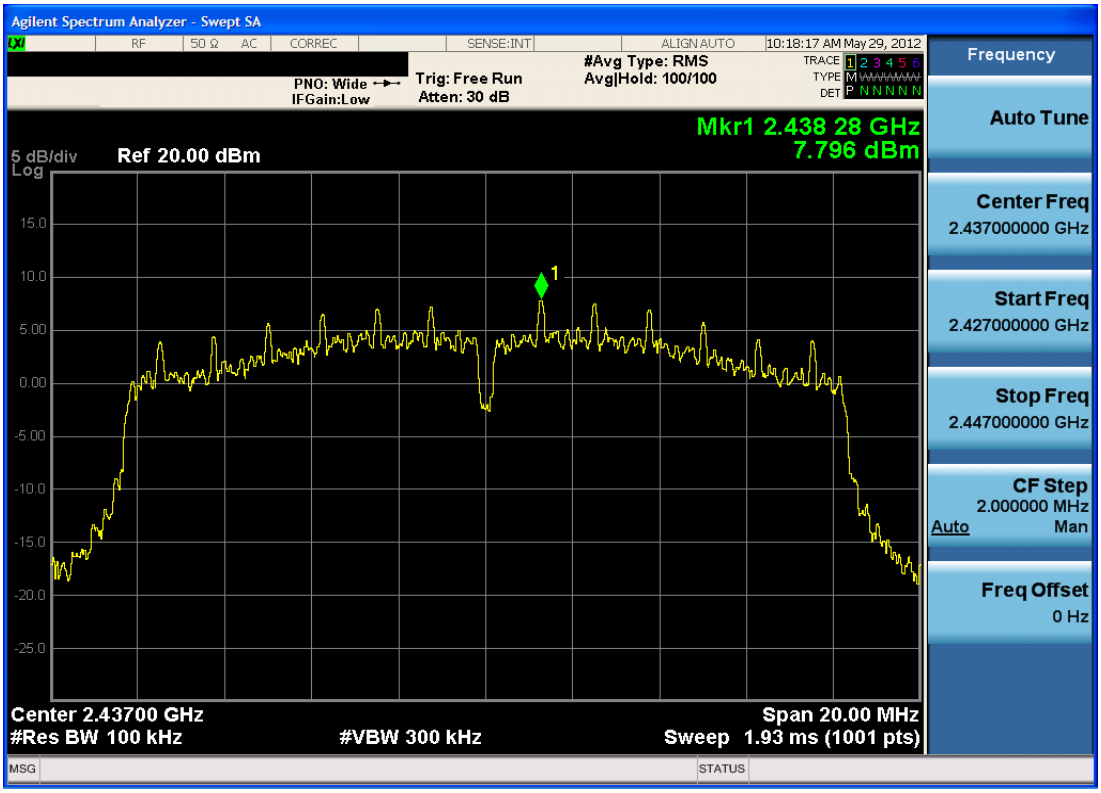
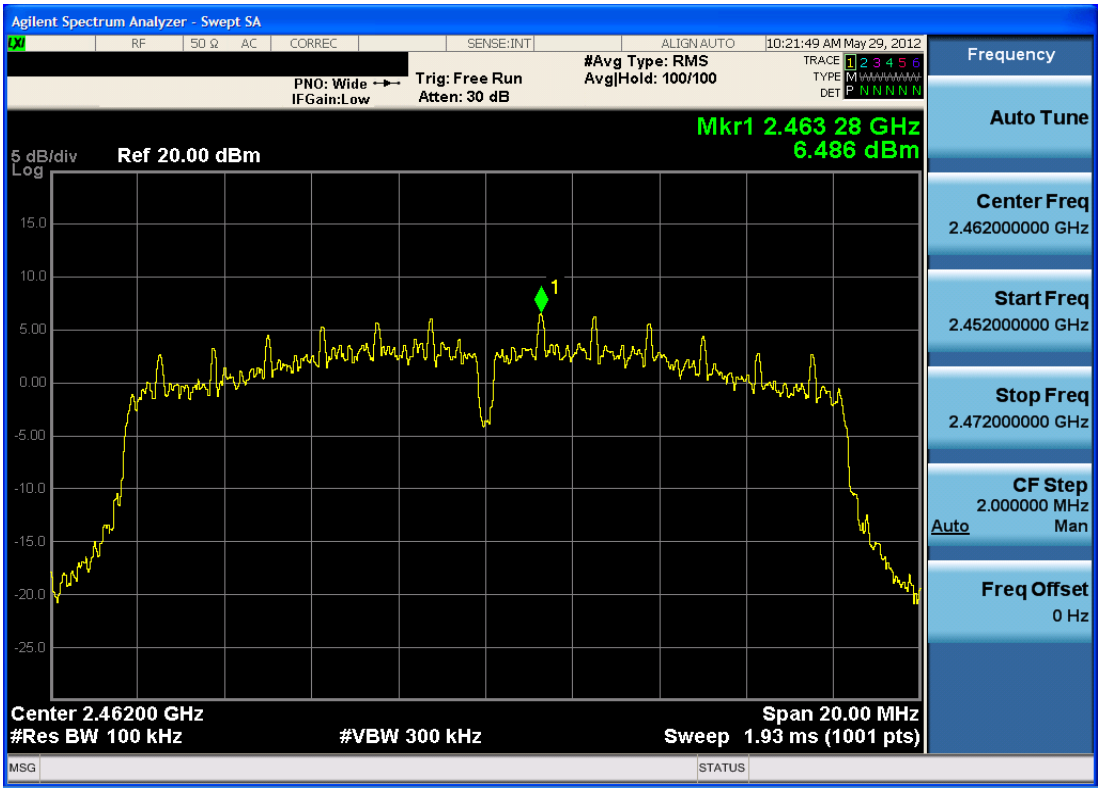


Plot 6-14. Power Spectral Density Plot (802.11g – Ch. 6)



Plot 6-15. Power Spectral Density Plot (802.11g – Ch. 11)

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Plot 6-16. Power Spectral Density Plot (802.11n – Ch. 1)

Plot 6-17. Power Spectral Density Plot (802.11n – Ch. 6)

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Plot 6-18. Power Spectral Density Plot (802.11n – Ch. 11)

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6.5 Conducted Emissions at the Band Edge

§15.247(d); RSS-210 [A8.5]

For the following out of band conducted spurious emissions plots at the band edge, the EUT was set at a data rate of 1Mbps for "b" mode, 6 Mbps for "g" mode and 6.5/7.2Mbps for "n" mode. These settings produced the worst-case emissions.

Per the guidance of KDB 558074, section 5.4.1.1, the reference level for out of band emissions is established from the plots of this section since the band edge emissions are measured with a RBW of 100kHz. This reference level is then used as the limit in subsequent plots for out of band spurious emissions shown in Section 6.6. The limit for out of band spurious emissions at the band edge is 20dB below the fundamental emission level measured in a 100kHz bandwidth.

Plot 6-19. Band Edge Plot (802.11b – Ch. 1)

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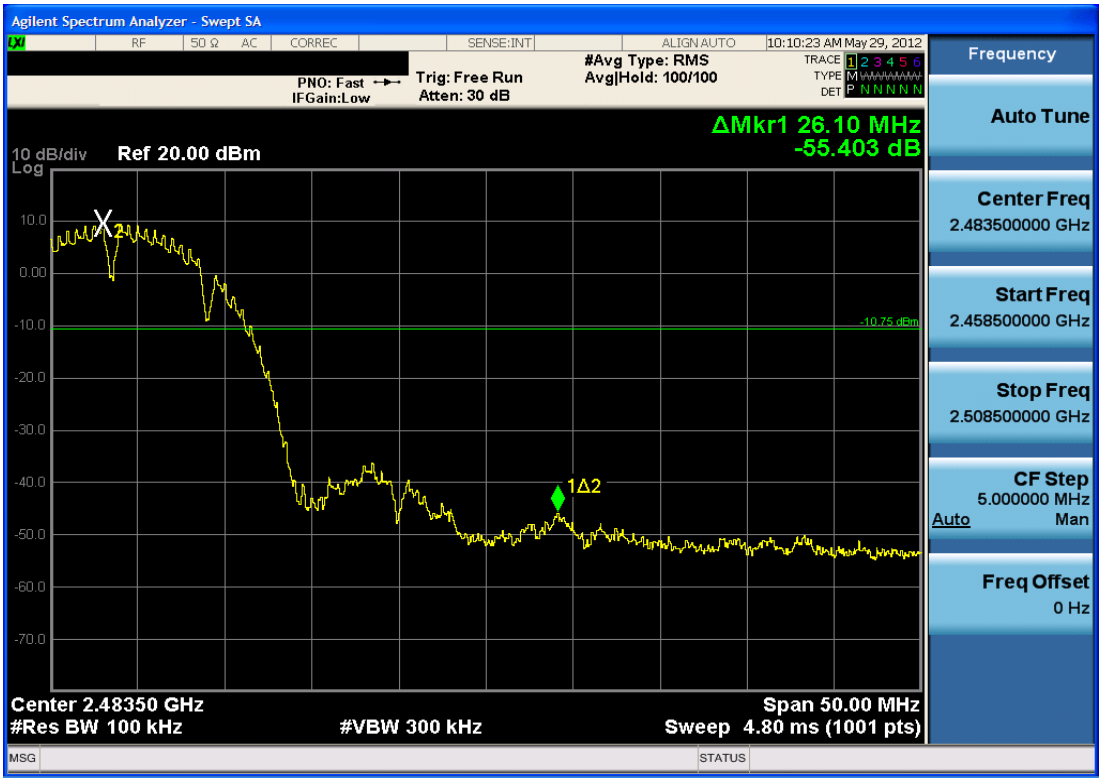
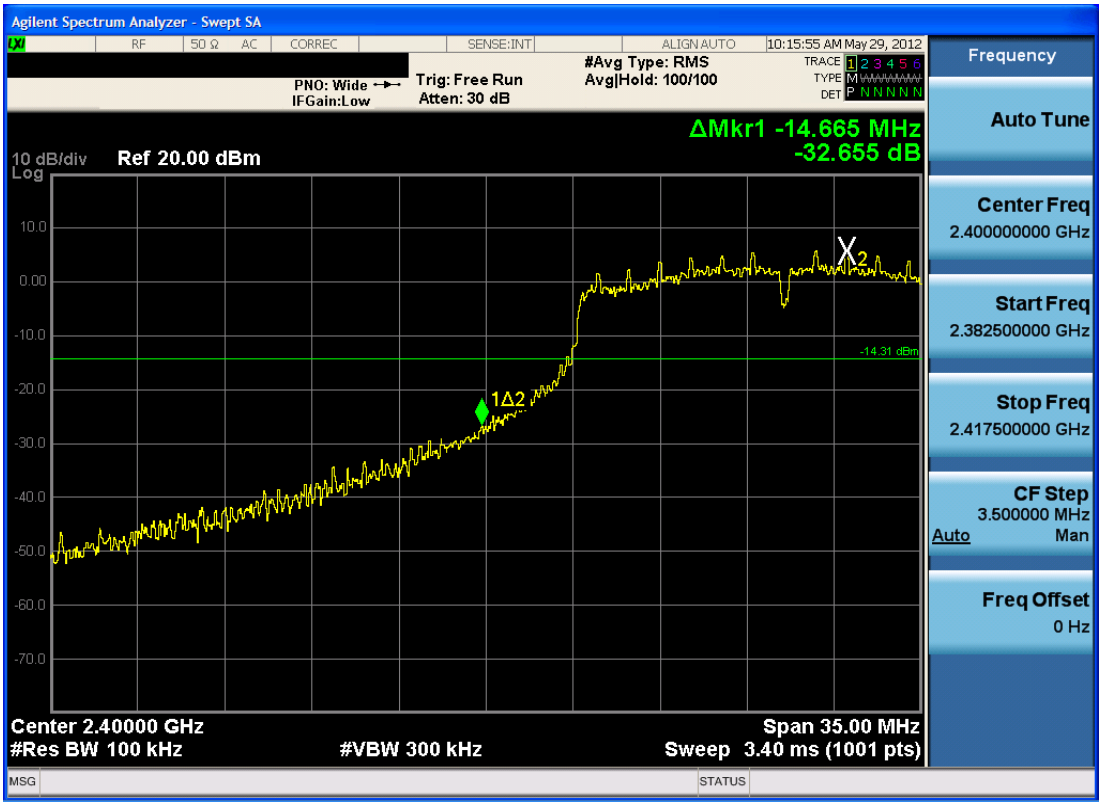


Plot 6-20. Band Edge Plot (802.11b – Ch. 11)



Plot 6-21. Band Edge Plot (802.11g – Ch. 1)

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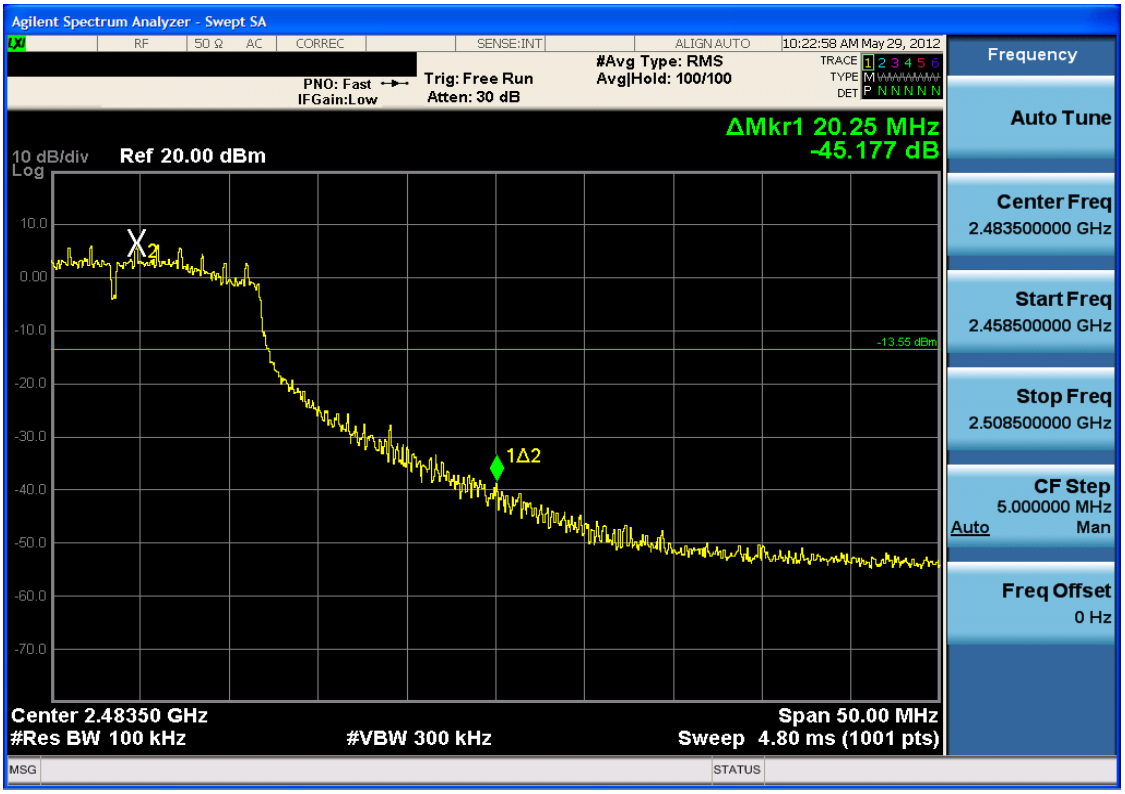
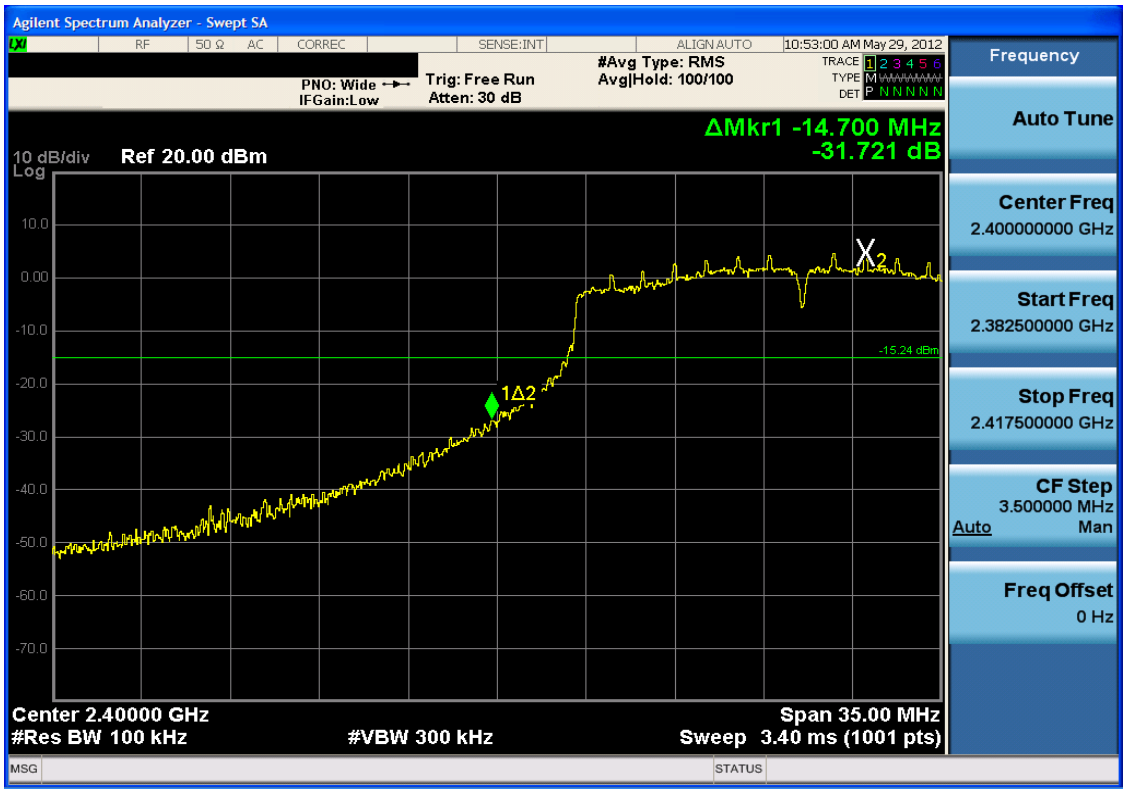


Plot 6-22. Band Edge Plot (802.11g – Ch. 11)



Plot 6-23. Band Edge Plot (802.11n – Ch. 1)

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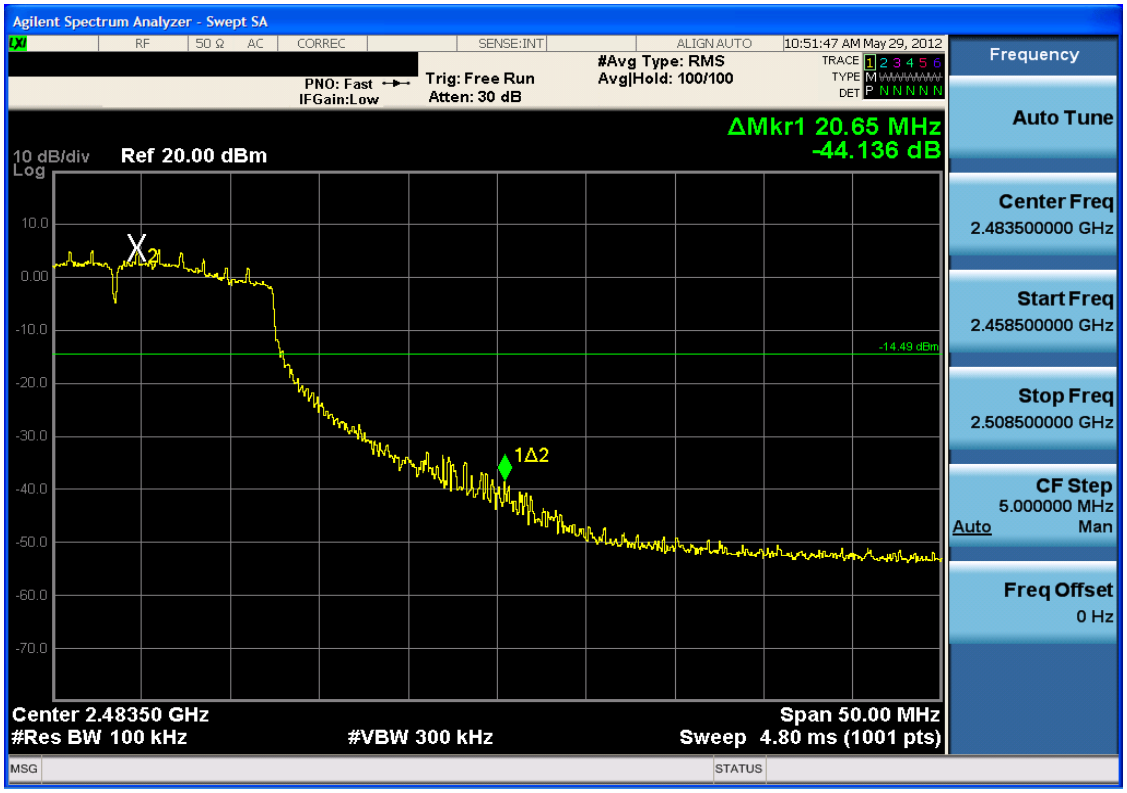

Plot 6-24. Band Edge Plot (802.11n – Ch. 11)

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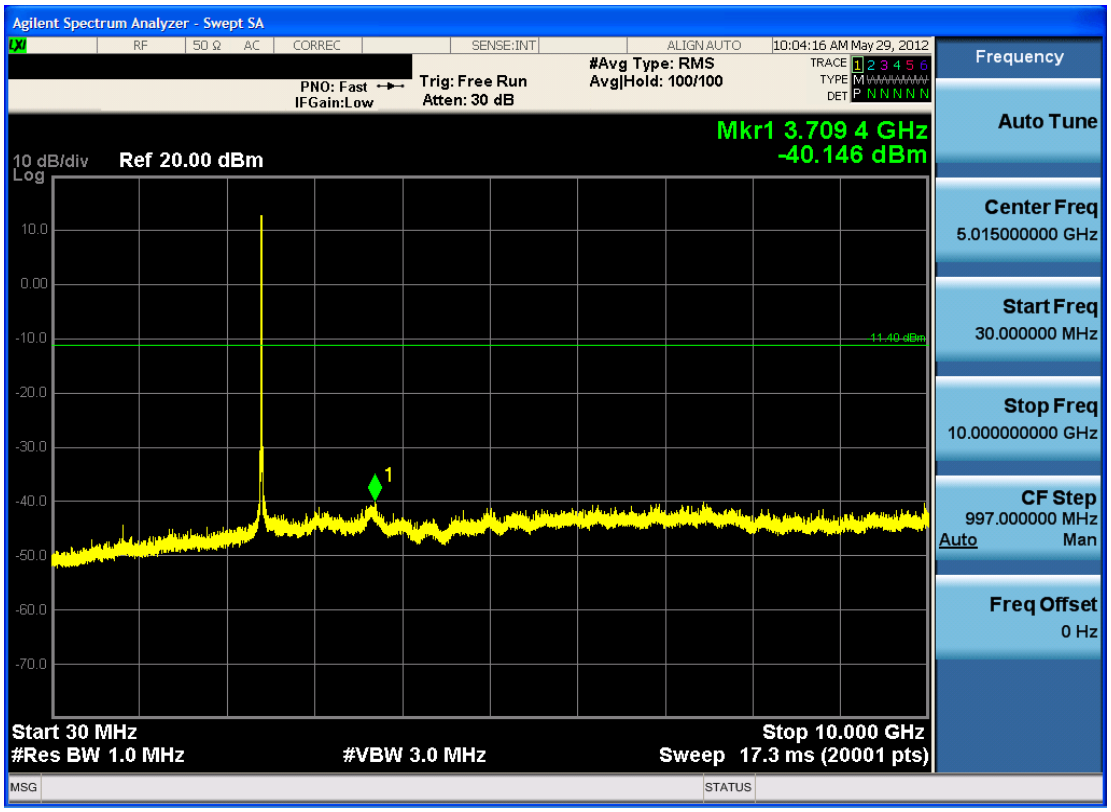
6.6 Conducted Spurious Emissions

§15.247(d); RSS-210 [A8.5]

For the following out of band conducted spurious emissions plots, the EUT was investigated in all available data rates for “b”, “g”, and “n” modes. The worst case spurious emissions were found while transmitting in “b” mode at 1 Mbps and are shown in the plots below.

The display line shown in the following plots denotes the limit at 20dB below the fundamental emission level measured in a 100kHz bandwidth, as determined in Section 6.5 of this report. However, since the traces in the following plots are measured with a 1MHz RBW, the display line may not necessarily appear to be 20dB below the level of the fundamental in a 1MHz bandwidth.



Plot 6-25. Conducted Spurious Plot (802.11b – Ch. 1)

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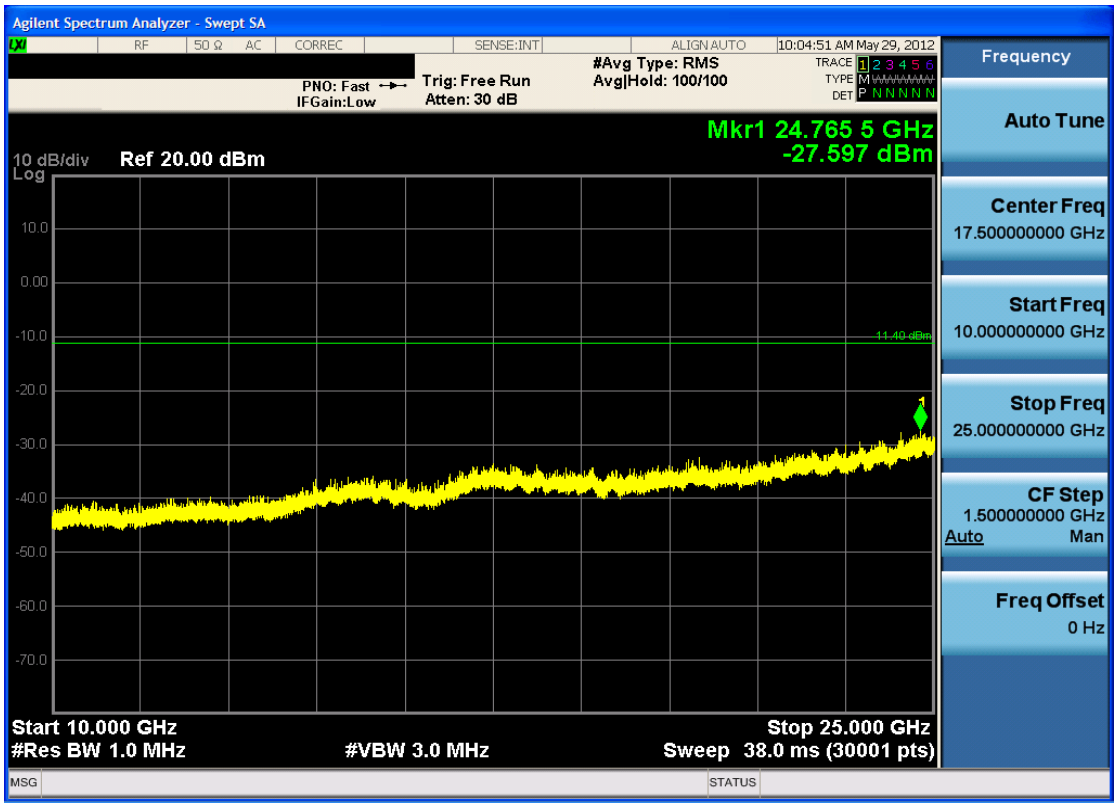
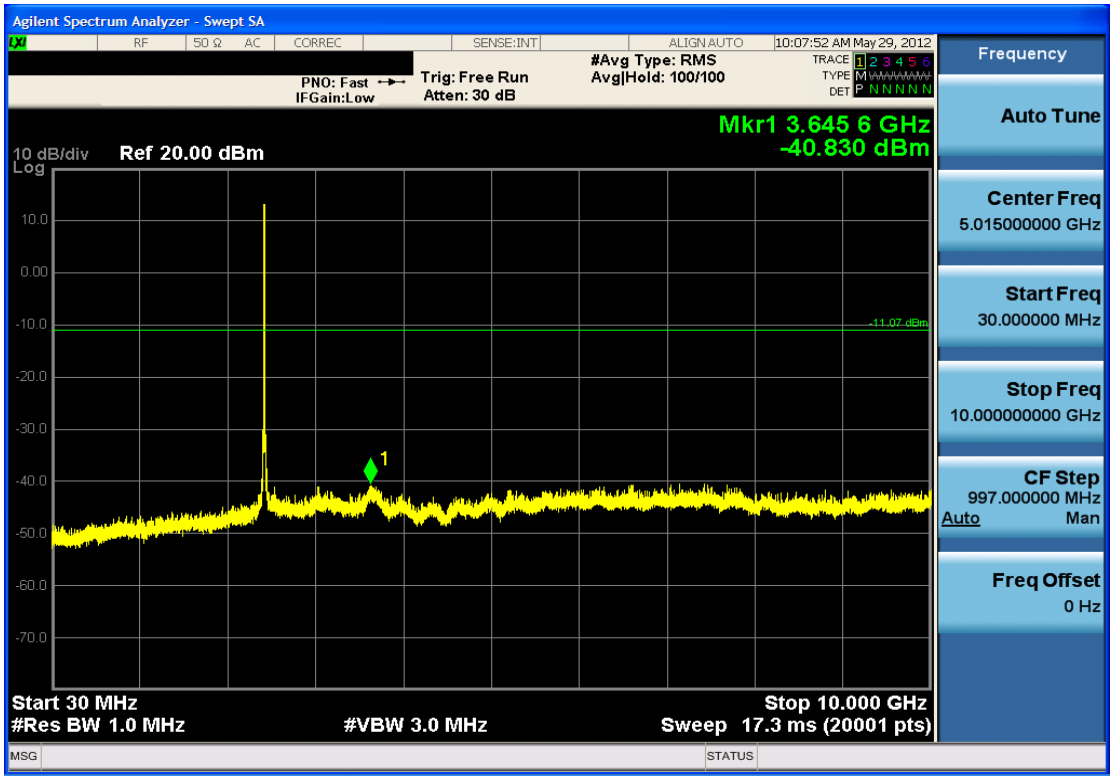


Plot 6-26. Conducted Spurious Plot (802.11b – Ch. 1)



Plot 6-27. Conducted Spurious Plot (802.11b – Ch. 6)

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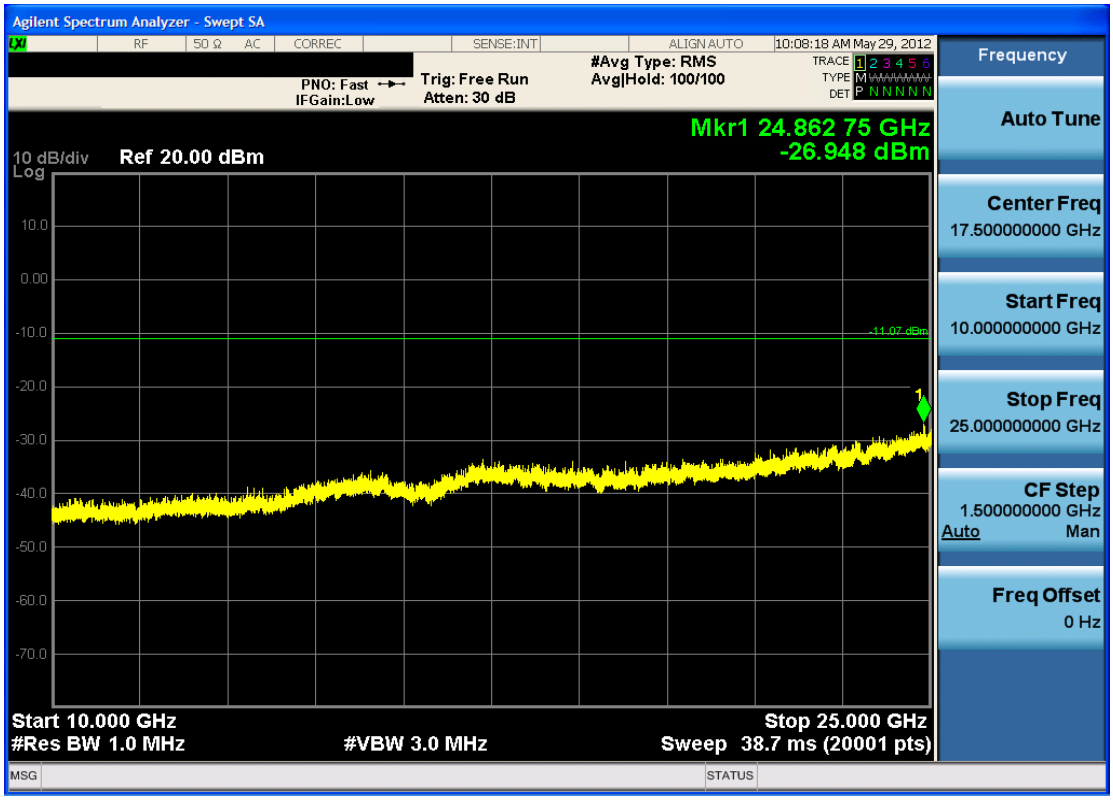
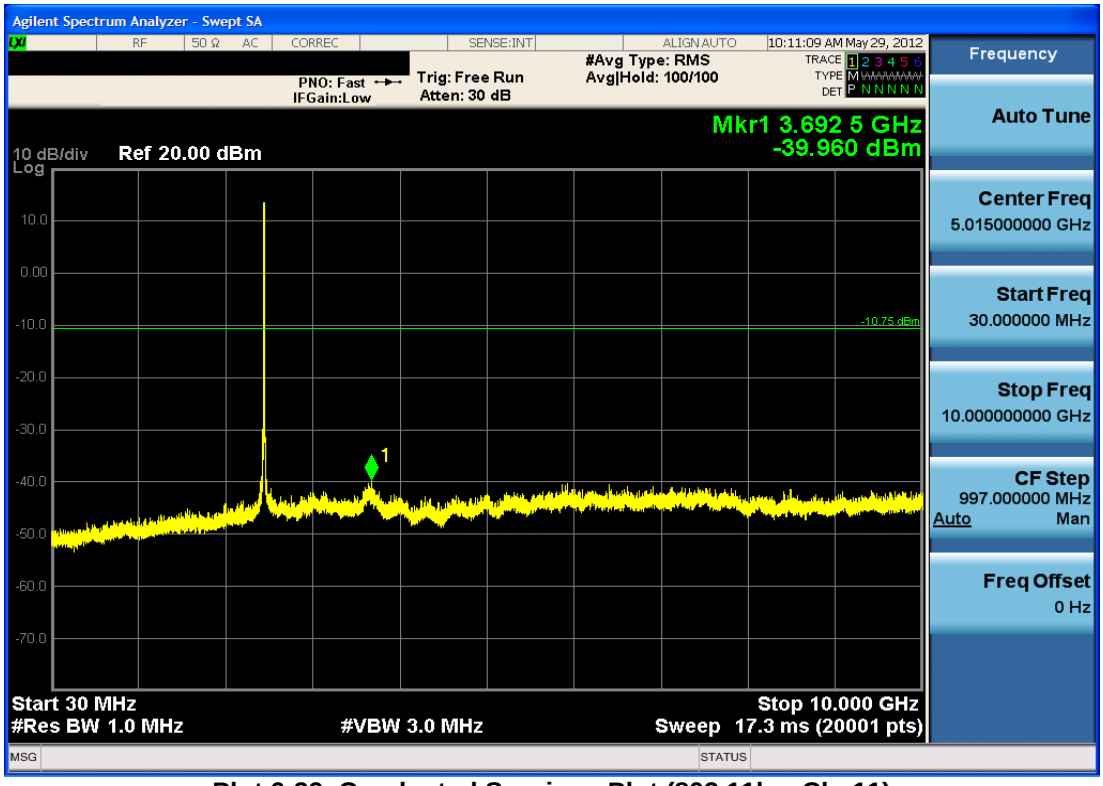


Plot 6-28. Conducted Spurious Plot (802.11b – Ch. 6)



Plot 6-29. Conducted Spurious Plot (802.11b – Ch. 11)

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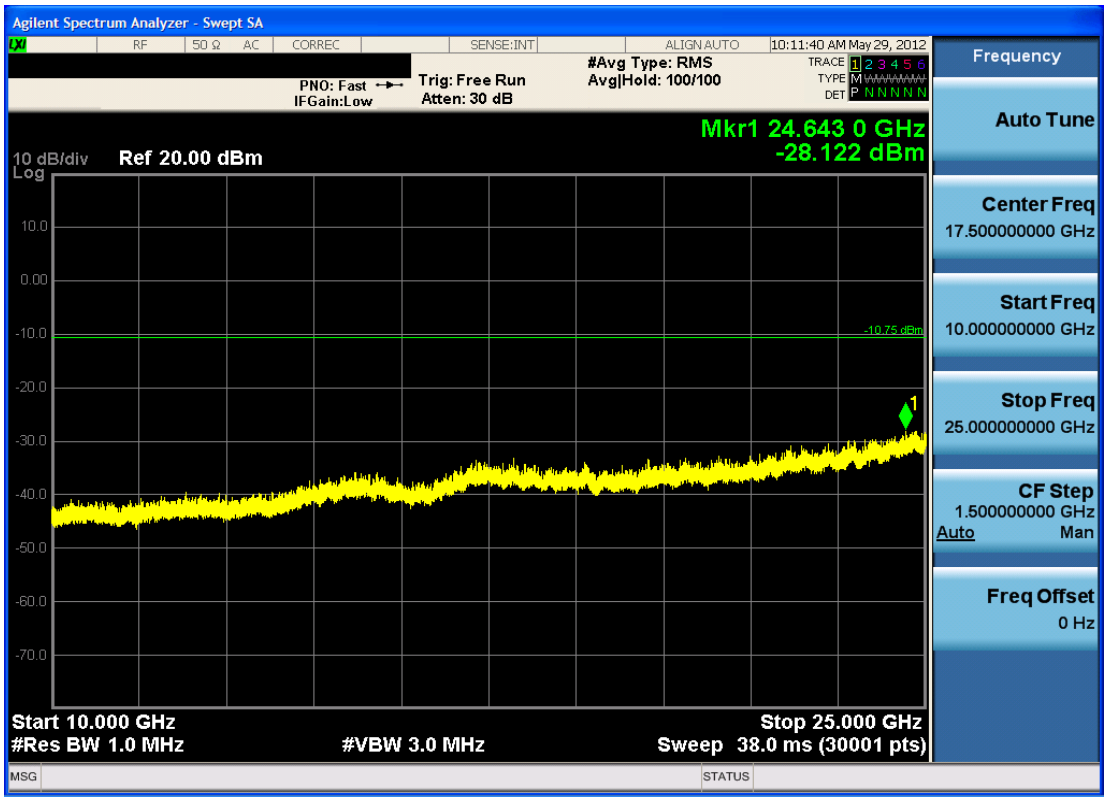

Plot 6-30. Conducted Spurious Plot (802.11b – Ch. 11)

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6.7 Radiated Spurious Emission Measurements

§15.205, §15.209, §15.247(d); RSS-210 [A8.5]

The EUT was tested from 9kHz up to the tenth 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. All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 6-8 per Section 15.209.

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 measurements shown in this section were obtained using traditional radiated test methods. The optional test procedures for antenna port conducted measurements of unwanted emissions per the guidance of KDB 558074 were not used to evaluate this device.

Note: Radiated spurious band edge emissions were found to be compliant when the EUT was set to Channels 2 and 10 at the maximum power.

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

Table 6-8. Radiated Limits

Sample Calculations

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

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Radiated Spurious Emission Measurements (Cont'd)
§15.205, §15.209, §15.247(d); RSS-210 [A8.5]

Worst Case Mode: 802.11b

Worst Case Transfer Rate: 1 Mbps

Distance of Measurements: 3 Meters

Operating Frequency: 2412MHz

Channel: 01

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4824.00	-108.70	Avg	H	39.43	37.73	53.98	-16.25
4824.00	-99.73	Peak	H	39.43	46.70	73.98	-27.28
12060.00	-135.00	Avg	H	49.66	21.66	53.98	-32.32
12060.00	-125.00	Peak	H	49.66	31.66	73.98	-42.32

Table 6-9. Radiated Measurements @ 3 meters

NOTES:

1. All emissions shown lie in the restricted bands specified in §15.205 and RSS-210 section 2.7, Table 1 and are below the limit shown in Table 6-8.
2. For frequencies > 1GHz, average measurements are recorded using the RBAVG1 measurement procedure of KDB 558074. Peak measurements are recorded using RBW = 1MHz, VBW = 3MHz.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
7. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

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Radiated Spurious Emission Measurements (Cont'd)

§15.205, §15.209, §15.247(d); RSS-210 [A8.5]

Worst Case Mode: 802.11b

Worst Case Transfer Rate: 1 Mbps

Distance of Measurements: 3 Meters

Operating Frequency: 2437MHz

Channel: 06

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4874.00	-104.00	Avg	H	39.48	42.49	53.98	-11.49
4874.00	-96.87	Peak	H	39.48	49.62	73.98	-24.36
7311.00	-135.00	Avg	H	47.90	19.90	53.98	-34.08
7311.00	-125.00	Peak	H	47.90	29.90	73.98	-44.08
12185.00	-135.00	Avg	H	50.32	22.32	53.98	-31.66
12185.00	-125.00	Peak	H	50.32	32.32	73.98	-41.66

Table 6-10. Radiated Measurements @ 3 meters

NOTES:

1. All emissions shown lie in the restricted bands specified in §15.205 and RSS-210 section 2.7, Table 1 and are below the limit shown in Table 6-8.
2. For frequencies > 1GHz, average measurements are recorded using the RBAVG1 measurement procedure of KDB 558074. Peak measurements are recorded using RBW = 1MHz, VBW = 3MHz.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
7. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

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Radiated Spurious Emission Measurements (Cont'd)
§15.205, §15.209, §15.247(d); RSS-210 [A8.5]

Worst Case Mode: 802.11b

Worst Case Transfer Rate: 1 Mbps

Distance of Measurements: 3 Meters

Operating Frequency: 2462MHz

Channel: 11

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4924.00	-106.48	Avg	H	39.54	40.06	53.98	-13.92
4924.00	-98.79	Peak	H	39.54	47.75	73.98	-26.23
7386.00	-135.00	Avg	H	48.89	20.89	53.98	-33.09
7386.00	-125.00	Peak	H	48.89	30.89	73.98	-43.09
12310.00	-135.00	Avg	H	50.98	22.98	53.98	-31.00
12310.00	-125.00	Peak	H	50.98	32.98	73.98	-41.00

Table 6-11. Radiated Measurements @ 3 meters

NOTES:

1. All emissions shown lie in the restricted bands specified in §15.205 and RSS-210 section 2.7, Table 1 and are below the limit shown in Table 6-8.
2. For frequencies > 1GHz, average measurements are recorded using the RBAVG1 measurement procedure of KDB 558074. Peak measurements are recorded using RBW = 1MHz, VBW = 3MHz.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
7. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

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6.8 Radiated Restricted Band Edge Measurements

§15.205, §15.209, §15.247(d); RSS-210 [A8.5]

Worst Case Mode: 802.11g

Worst Case Transfer Rate: 6 Mbps

Distance of Measurements: 3 Meters

Operating Frequency: 2412MHz

Channel: 1

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
2388.33	-92.13	Avg	H	35.48	50.35	53.98	-3.63
2388.33	-70.75	Peak	H	35.48	71.73	73.98	-2.25
2389.01	-90.68	Avg	H	35.48	51.80	53.98	-2.18
2389.01	-70.31	Peak	H	35.48	72.17	73.98	-1.81
2390.00	-89.48	Avg	H	35.49	53.02	53.98	-0.96
2390.00	-70.28	Peak	H	35.49	72.22	73.98	-1.76

Table 6-12. Radiated Restricted Band Edge Measurements (2310 – 2390MHz)

NOTES:

1. All emissions shown lie in the restricted bands specified in §15.205 and RSS-210 section 2.7, Table 1 and are below the limit shown in Table 6-8.
2. For frequencies > 1GHz, average measurements are recorded using the RBAVG1 measurement procedure of KDB 558074. Peak measurements are recorded using RBW = 1MHz, VBW = 3MHz.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
7. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

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Radiated Restricted Band Edge Measurements (Cont'd)
§15.205, §15.209, §15.247(d); RSS-210 [A8.5]

Worst Case Mode: 802.11g

Worst Case Transfer Rate: 6 Mbps

Distance of Measurements: 3 Meters

Operating Frequency: 2462MHz

Channel: 11

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
2483.50	-90.96	Avg	H	36.44	52.48	53.98	-1.50
2483.50	-71.65	Peak	H	36.44	71.79	73.98	-2.19
2484.29	-90.50	Avg	H	36.45	52.95	53.98	-1.03
2484.29	-72.20	Peak	H	36.45	71.25	73.98	-2.73
2484.45	-91.06	Avg	H	36.45	52.39	53.98	-1.59
2484.45	-73.04	Peak	H	36.45	70.41	73.98	-3.57

Table 6-13. Radiated Restricted Band Edge Measurements (2483.5 – 2500MHz)

NOTES:

1. All emissions shown lie in the restricted bands specified in §15.205 and RSS-210 section 2.7, Table 1 and are below the limit shown in Table 6-8.
2. For frequencies > 1GHz, average measurements are recorded using the RBAVG1 measurement procedure of KDB 558074. Peak measurements are recorded using RBW = 1MHz, VBW = 3MHz.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
7. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

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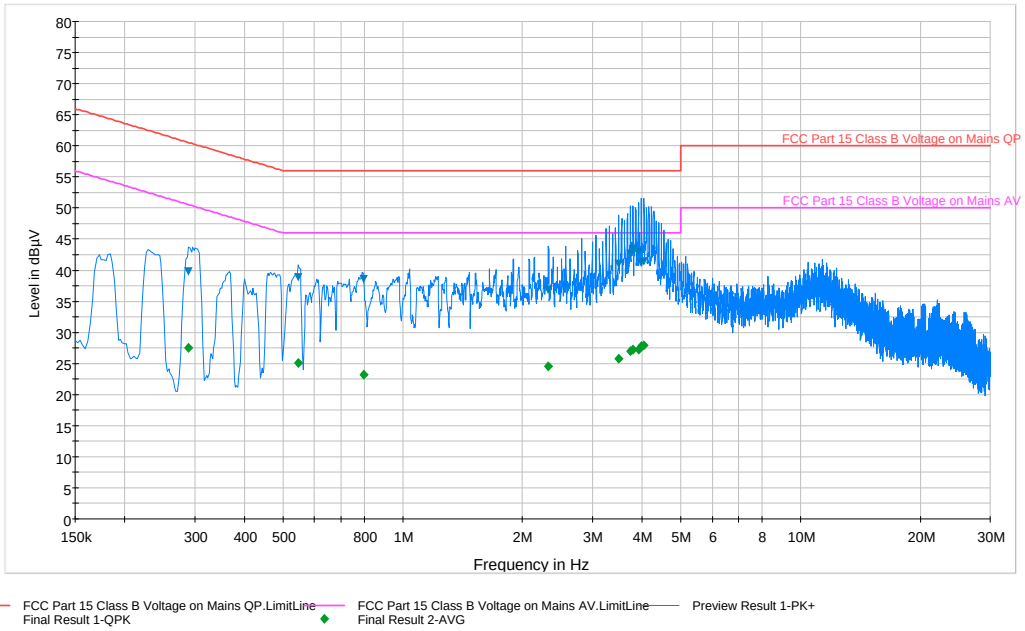
6.9 Line-Conducted Test Data

§15.207; RSS-Gen [7.2.2]



Plot 6-31. Line Conducted Plot with 802.11a (L1)

Frequency MHz	Line	Corr. dB	QuasiPeak dBµV	Limit dBµV	Margin dB	Average dBµV	Limit dBµV	Margin dB
0.290	L1	0.1	39.90	60.50	20.60	27.50	50.50	23.00
0.546	L1	0.1	38.80	56.00	17.20	25.10	46.00	20.90
0.796	L1	0.1	38.60	56.00	17.40	23.20	46.00	22.80
2.326	L1	0.2	36.90	56.00	19.10	24.60	46.00	21.40
3.489	L1	0.2	41.10	56.00	14.90	25.70	46.00	20.30
3.732	L1	0.2	42.60	56.00	13.40	27.00	46.00	19.00
3.793	L1	0.2	43.40	56.00	12.60	27.20	46.00	18.80
3.914	L1	0.2	42.90	56.00	13.10	27.30	46.00	18.70
3.982	L1	0.2	41.20	56.00	14.80	27.80	46.00	18.20
4.043	L1	0.2	41.40	56.00	14.60	28.00	46.00	18.00

Table 6-14. Line Conducted Data with 802.11a (L1)

Notes:

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

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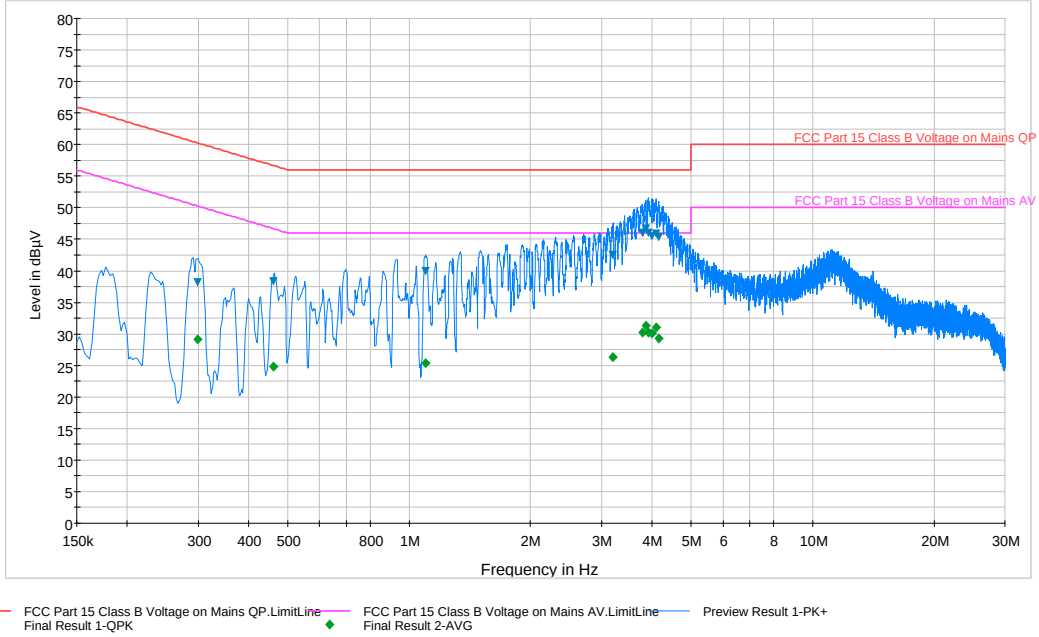
Line-Conducted Test Data (Cont'd)

§15.207; RSS-Gen [7.2.2]



Plot 6-32. Line Conducted Plot with 802.11a (N)

Frequency MHz	Line	Corr. dB	QuasiPeak dBµV	Limit dBµV	Margin dB	Average dBµV	Limit dBµV	Margin dB
0.299	N	0.2	38.10	60.30	22.20	29.20	50.30	21.10
0.461	N	0.1	38.30	56.70	18.40	24.90	46.70	21.80
1.097	N	0.2	39.90	56.00	16.10	25.40	46.00	20.60
3.203	N	0.2	42.40	56.00	13.60	26.20	46.00	19.80
3.784	N	0.2	46.00	56.00	10.00	30.20	46.00	15.80
3.860	N	0.2	46.70	56.00	9.30	31.30	46.00	14.70
3.921	N	0.2	46.00	56.00	10.00	30.20	46.00	15.80
4.004	N	0.2	45.50	56.00	10.50	30.10	46.00	15.90
4.103	N	0.2	45.90	56.00	10.10	31.10	46.00	14.90
4.157	N	0.2	45.30	56.00	10.70	29.20	46.00	16.80

Table 6-15. Line Conducted Data with 802.11a (N)

Notes:

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

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7.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Motorola Portable Handset FCC ID: IHDT56NH5** is in compliance with Part 15C of the FCC Rules and RSS-210 of the Industry Canada Rules.

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