HCT CO.,LTD.

74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
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FCC / ISED DTS REPORT

Certification

Applicant Name:
LG Electronics Inc.

Address:
222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do,451-713, Korea

Date of Issue:
July 20, 2018
Test Site/Location:
HCT CO., LTD., 74,Seoicheon-ro 578beon-gil,Majang-myeo,Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
Report No.: HCT-RF-1807-FI011
ISED Registration Number: 5944A-6

FCC ID:	**BEJLGSBWAC92**
ISED:	**2703H-LGSBWAC92**
APPLICANT:	**LG Electronics Inc.**

Model: LGSBWAC92

EUT Type: RF Module

Peak Output Power:

Mode	Ant.0(SISO)	Ant.1(SISO)	Ant.0 & 1 (MIMO)
802.11b	23.63 dBm	23.70 dBm	26.68 dBm
802.11g	25.05 dBm	24.90 dBm	27.99 dBm
802.11n_HT20	24.88 dBm	24.90 dBm	27.83 dBm
802.11n_HT40	23.22 dBm	25.57 dBm	27.48 dBm

Frequency Range: 2412 MHz - 2472 MHz (2.4 GHz Band)

Modulation type: CCK/DSSS/OFDM

FCC Classification: Digital Transmission System(DTS)

FCC Rule Part(s): Part 15.247

ISED Rule Part(s): RSS-247 Issue 2 (February 2017), RSS-Gen Issue 5(April 2018)

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC / IC Rules under normal use and maintenance.

Report prepared by : Se Wook Park
Engineer of Telecommunication testing center

Approved by : Jong Seok Lee
Manager of Telecommunication testing center

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1807-FI011	July 20, 2018	- First Approval Report

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1. GENERAL INFORMATION

Applicant:	LG Electronics Inc.
Address:	222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do,451-713, Korea
FCC ID:	BEJLGSBWAC92
IC:	2703H-LGSBWAC92
EUT Type:	RF Module
Model:	LGSBWAC92
Date(s) of Tests:	May 11, 2018 ~ July 20, 2018
Place of Tests:	HCT Co., Ltd. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

2. EUT DESCRIPTION

Model	LGSBWAC92		
EUT Type	RF Module		
Power Supply	3.30 V		
Frequency Range	TX: 2412 MHz ~ 2472 MHz RX: 2412 MHz ~ 2472 MHz		
Max. RF Output Power	Peak	Ant. 0 (SISO)	Wi-Fi 802.11b (23.63 dBm) / Wi-Fi 802.11g (25.05 dBm) / Wi-Fi 802.11n_HT20 (24.88 dBm) Wi-Fi 802.11n_HT40 (23.22 dBm)
		Ant.1 (SISO)	Wi-Fi 802.11b (23.70 dBm) / Wi-Fi 802.11g (24.90 dBm) / Wi-Fi 802.11n_HT20 (24.90 dBm) Wi-Fi 802.11n_HT40 (25.57 dBm)
		Ant.0 & 1 (MIMO)	Wi-Fi 802.11b (26.68 dBm) / Wi-Fi 802.11g (27.99 dBm) / Wi-Fi 802.11n_HT20 (27.83 dBm) Wi-Fi 802.11n_HT40 (27.48 dBm)
	Average	Ant.0 (SISO)	Wi-Fi 802.11b (17.63 dBm) / Wi-Fi 802.11g (16.85 dBm) / Wi-Fi 802.11n_HT20 (16.57 dBm) Wi-Fi 802.11n_HT40 (15.04 dBm)
		Ant.1 (SISO)	Wi-Fi 802.11b (17.78 dBm) / Wi-Fi 802.11g (16.52 dBm) / Wi-Fi 802.11n_HT20 (16.43 dBm) Wi-Fi 802.11n_HT40 (15.96 dBm)
		Ant.0 & 1 (MIMO)	Wi-Fi 802.11b (20.66 dBm) / Wi-Fi 802.11g (19.68 dBm) / Wi-Fi 802.11n_HT20 (19.51 dBm) Wi-Fi 802.11n_HT40 (18.52 dBm)
Modulation Type	DSSS/CCK(802.11b), OFDM(802.11g, 802.11n)		
Antenna Specification	Manufacturer: LG Innotek Co., Ltd. Antenna type: Internal Antenna Peak Gain : cf. Section 6		

2.1 EUT OPERATING MODE

▣ Operating mode

Mode	Operating Mode	Operating Ant.
802.11b/g/n	SISO	Ant. 0
		Ant. 1
802.11b/g/n	MIMO	Ant. 0 & 1

Note : We have done all test case. Worst case is MIMO(CDD) for 802.11b/g/n_HT20, HT40 mode. So, we attached the result of MIMO for 802.11b/g/n mode.

3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v04 dated April 05, 2017 entitled “Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) and the measurement procedure described in ANSI C63.10(Version : 2013) ‘the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices’.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C/ RSS-Gen issue 5, RSS-247 issue 2.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

Conducted Antenna Terminal

See Section from 9.1 to 9.2.(KDB 558074 v04)

3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 07, 2015 (Registration Number: 90661)

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:

“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 this E.U.T are permanently attached.
*The E.U.T Complies with the requirement of §15.203

▣ Directional Gain Calculations

▪ **If any transmit signals are correlated with each other(802.11g/n_HT20),**

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

▣ Antenna Gain

2.4 GHz Band

Antenna Gain	802.11b/g/n	Ant 0	1.37 dBi
		Ant 1	1.49 dBi
Directional Antenna Gain	802.11g/n	Ant 0 & 1	4.44 dBi

7. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of *k* = 2 to indicate a 95 % level of confidence.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.71

8. SUMMARY TEST OF RESULTS

8.1 FCC Part

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	§15.247(a)(2)	> 500 kHz	CONDUCTED	PASS
Conducted Maximum Peak Output Power	§15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§15.247(e)	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	§15.247(d)	Conducted > 20 dBc		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 9.8		PASS
Radiated Spurious Emissions	§15.205, 15.209	cf. Section 9.7.1	RADIATED	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 9.7.2		PASS

8.2 ISED Part

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	RSS-247, 5.2	> 500 kHz	CONDUCTED	PASS
99% Bandwidth	RSS-GEN, 6.7	NA		NA
Conducted Maximum Peak Output Power And e.i.r.p.	RSS-247, 5.4.4	< 1 Watt <4 Watt(e.i.r.p.)		PASS
Power Spectral Density	RSS-247, 5.2	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	RSS-247, 5.5	Conducted > 20 dBc		PASS
AC Power line Conducted Emissions	RSS-GEN, 8.8	RSS-GEN section 8.8 table 4		PASS
Radiated Spurious Emissions	RSS-GEN, 8.9	RSS-GEN section 8.9 table 5, 6	RADIATED	PASS
Receiver Spurious Emissions	RSS-GEN, 5 RSS-GEN, 7.3	RSS-GEN section 7.3 table 3		PASS
Radiated Restricted Band Edge	RSS-GEN, 8.10	RSS-GEN section 8.10 table 7		PASS

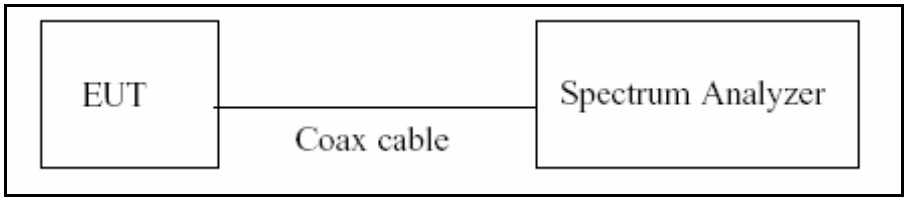
9. TEST RESULT

9.1 DUTY CYCLE

According to Section 6.0)b) in KDB 558074 v04

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested accroding to the zero-span measurement method, 6.0)b) in KDB 558074 v04

The largest availble value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if T ≤ 6.25 microseconds. (50/6.25 = 8)

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/*T*.

1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10*log(1/Duty Cycle)

▣ Duty Cycle Factor

Mode	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
b	-	-	-	-
g	-	-	-	-
n_HT20	-	-	-	-
n_HT40	-	-	-	-

Note : Duty Cycle Factor = 10*log(1/Duty Cycle). where, Duty Cycle = T_{on} / T_{total}

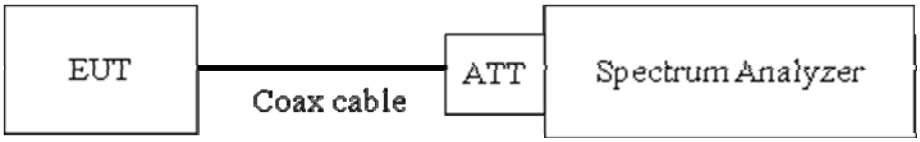
9.2 6dB BANDWIDTH

Test Requirements and limit, §15.247(a)(2) / RSS-247(Issue 1) Section 5.2.

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.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to (Procedure 8.1 in KDB 558074 v04)

RBW = 100 kHz

VBW ≥ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

Note : We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

▣ TEST RESULTS_Ant.0

Conducted 6dB Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	9.06	0.500	Pass
2437	6	9.05	0.500	Pass
2462	11	9.03	0.500	Pass
2467	12	9.068	0.500	Pass
2472	13	8.578	0.500	Pass

Conducted 6dB Bandwidth Measurements for 802.11g

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	16.36	0.500	Pass
2437	6	16.39	0.500	Pass
2462	11	16.34	0.500	Pass
2467	12	16.35	0.500	Pass
2472	13	16.37	0.500	Pass

Conducted 6dB Bandwidth Measurements for 802.11n_HT20

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	17.61	0.500	Pass
2437	6	17.61	0.500	Pass
2462	11	17.61	0.500	Pass
2467	12	17.61	0.500	Pass
2472	13	17.62	0.500	Pass

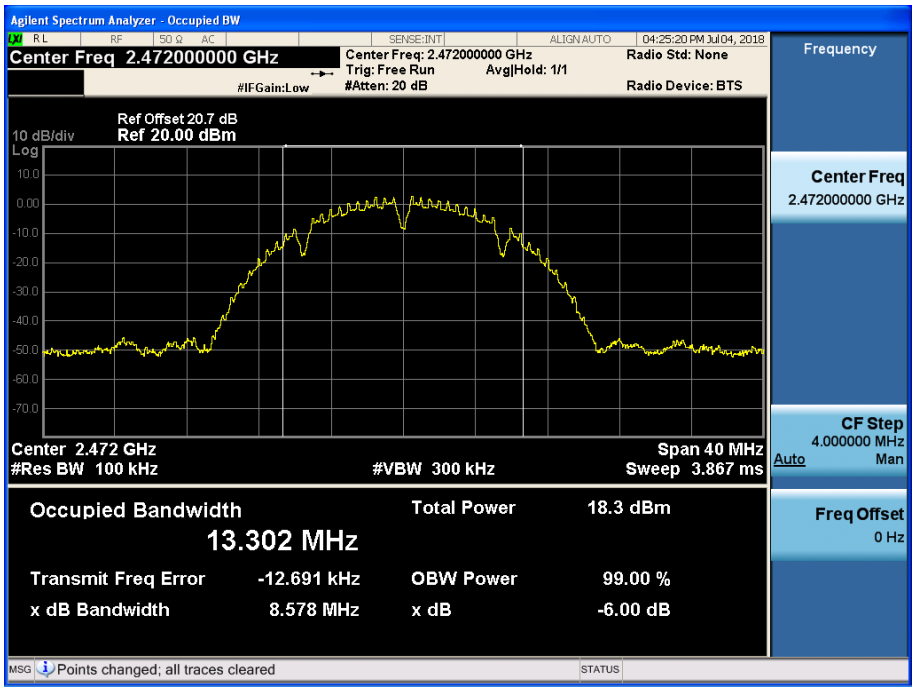
Conducted 6dB Bandwidth Measurements for 802.11n_HT40

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2422	3	36.39	0.500	Pass
2437	6	36.41	0.500	Pass
2452	9	36.38	0.500	Pass

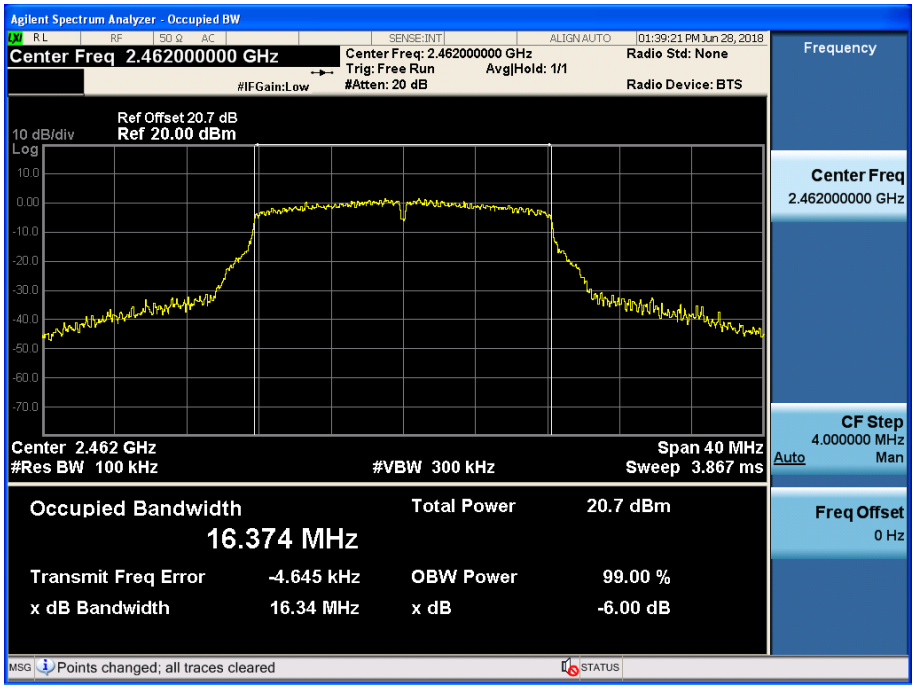
Note : In order to simplify the report, attached plots were only the most narrow 6 dB BW channel.

▣ RESULT PLOTS

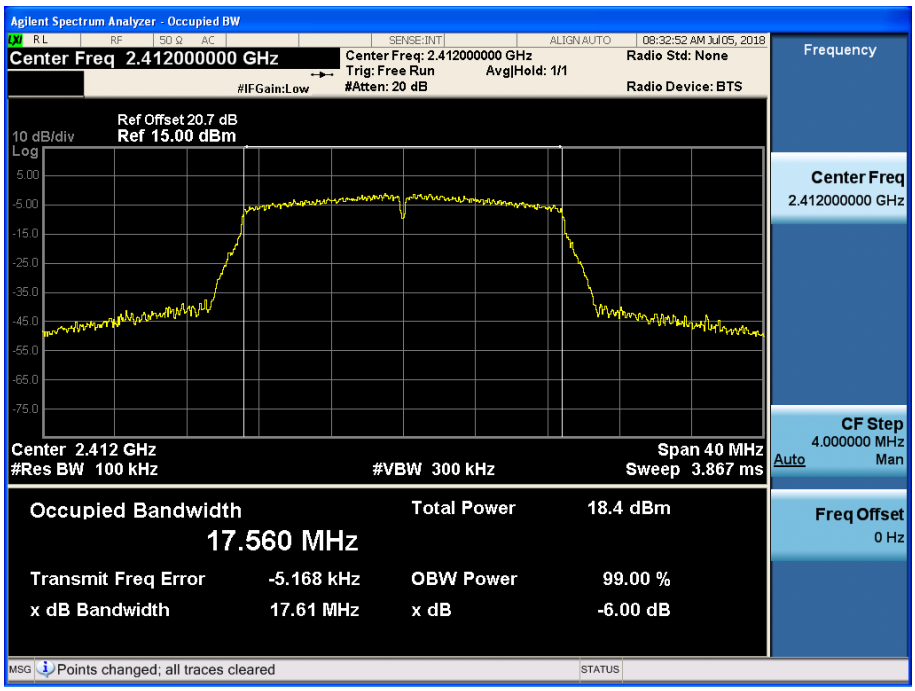
6dB Bandwidth plot (802.11b-CH 13)



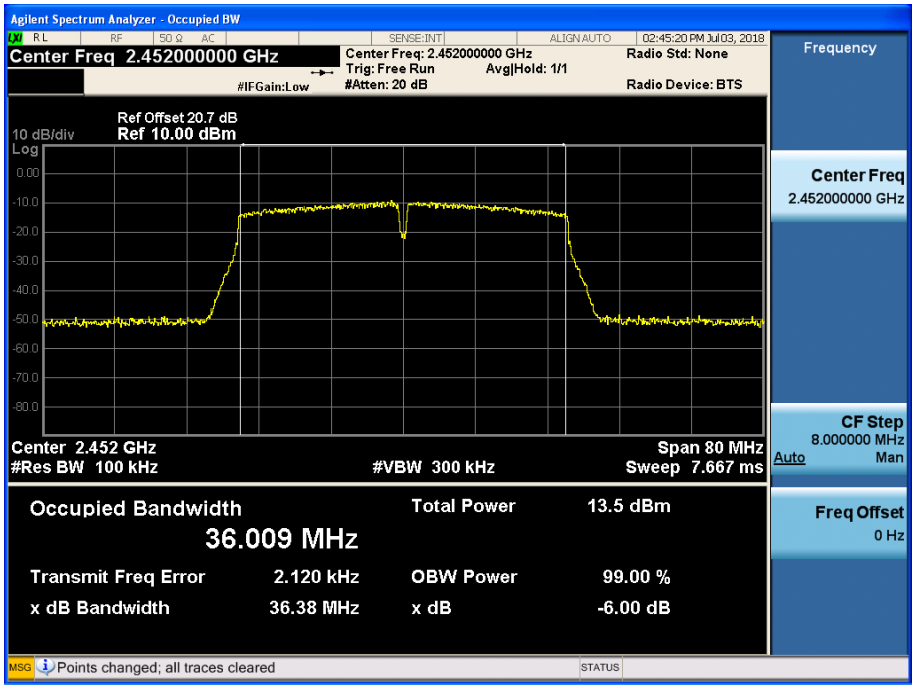
6dB Bandwidth plot (802.11g-CH 11)



6dB Bandwidth plot (802.11n_HT20-CH 1)



6dB Bandwidth plot (802.11n_HT40-CH 9)



▣ TEST RESULTS_Ant.1

Conducted 6dB Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	8.578	0.500	Pass
2437	6	9.054	0.500	Pass
2462	11	9.059	0.500	Pass
2467	12	9.068	0.500	Pass
2472	13	9.068	0.500	Pass

Conducted 6dB Bandwidth Measurements for 802.11g

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	16.37	0.500	Pass
2437	6	16.37	0.500	Pass
2462	11	16.36	0.500	Pass
2467	12	16.35	0.500	Pass
2472	13	16.38	0.500	Pass

Conducted 6dB Bandwidth Measurements for 802.11n_HT20

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2412	1	17.63	0.500	Pass
2437	6	17.62	0.500	Pass
2462	11	17.56	0.500	Pass
2467	12	17.60	0.500	Pass
2472	13	17.61	0.500	Pass

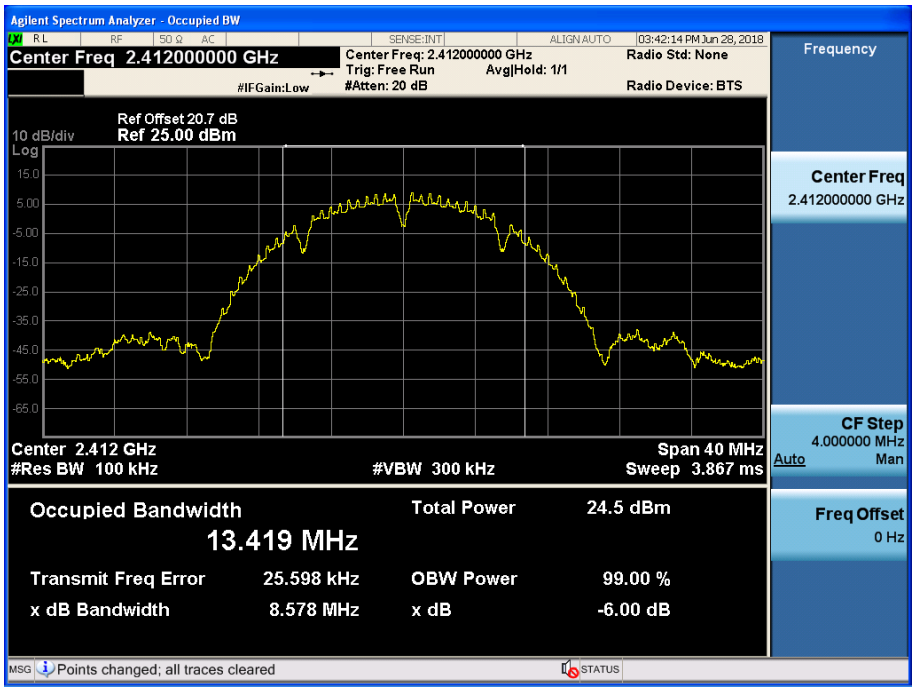
Conducted 6dB Bandwidth Measurements for 802.11n_HT40

802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
2422	3	36.42	0.500	Pass
2437	6	36.43	0.500	Pass
2452	9	36.41	0.500	Pass

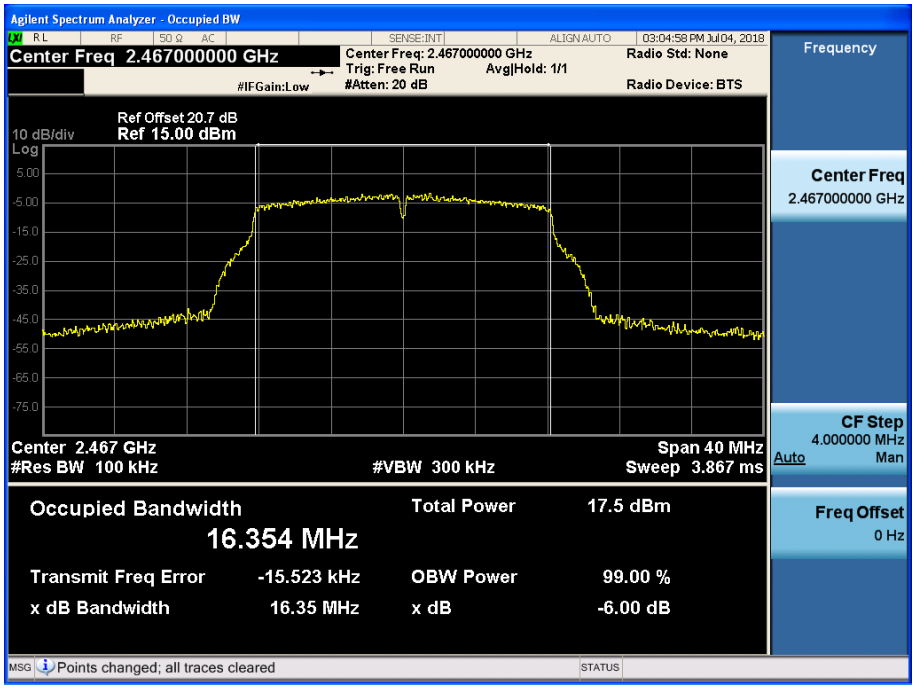
Note : In order to simplify the report, attached plots were only the most narrow 6 dB BW channel.

▣ RESULT PLOTS

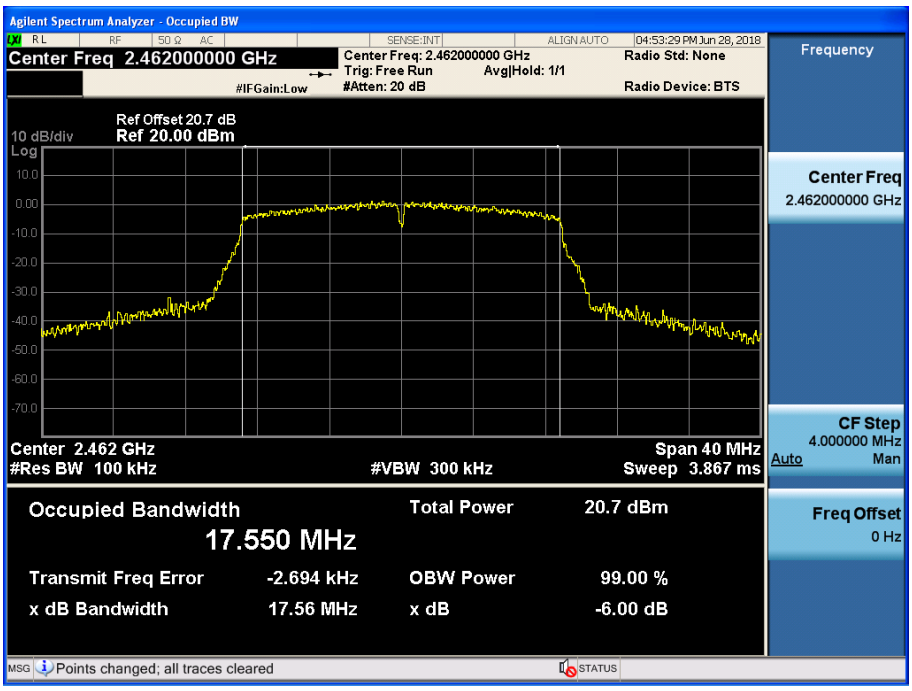
6dB Bandwidth plot (802.11b-CH 1)



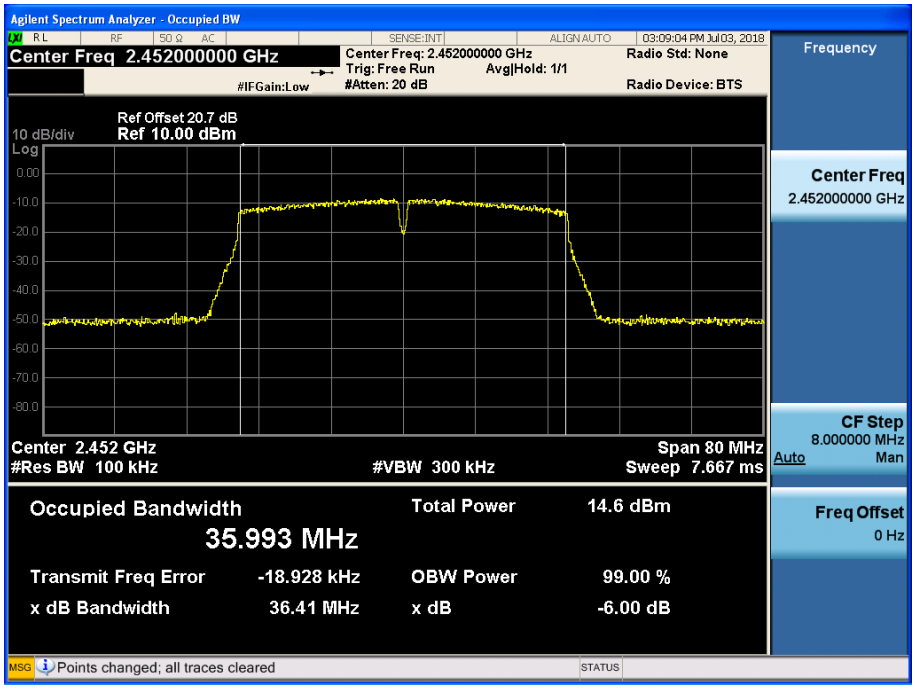
6dB Bandwidth plot (802.11g-CH 12)



6dB Bandwidth plot (802.11n_HT20-CH 11)



6dB Bandwidth plot (802.11n_HT40-CH 9)

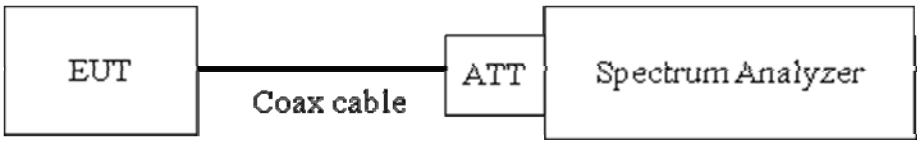


9.3 99% BANDWIDTH

Limit, RSS-Gen(Issue 5) Section 6.7

The 99 % bandwidth is used to determine the conducted power limits.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer.

RBW = 1% ~ 5% of the occupied bandwidth

VBW ≒ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

▣ TEST RESULTS_Ant.0

Conducted 99% Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	13.53	N/A
2437	6	13.55	N/A
2462	11	13.56	N/A
2467	12	13.36	N/A
2472	13	13.35	N/A

Conducted 99% Bandwidth Measurements for 802.11g

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.85	N/A
2437	6	16.97	N/A
2462	11	16.84	N/A
2467	12	16.80	N/A
2472	13	16.80	N/A

Conducted 99% Bandwidth Measurements for 802.11n_HT20

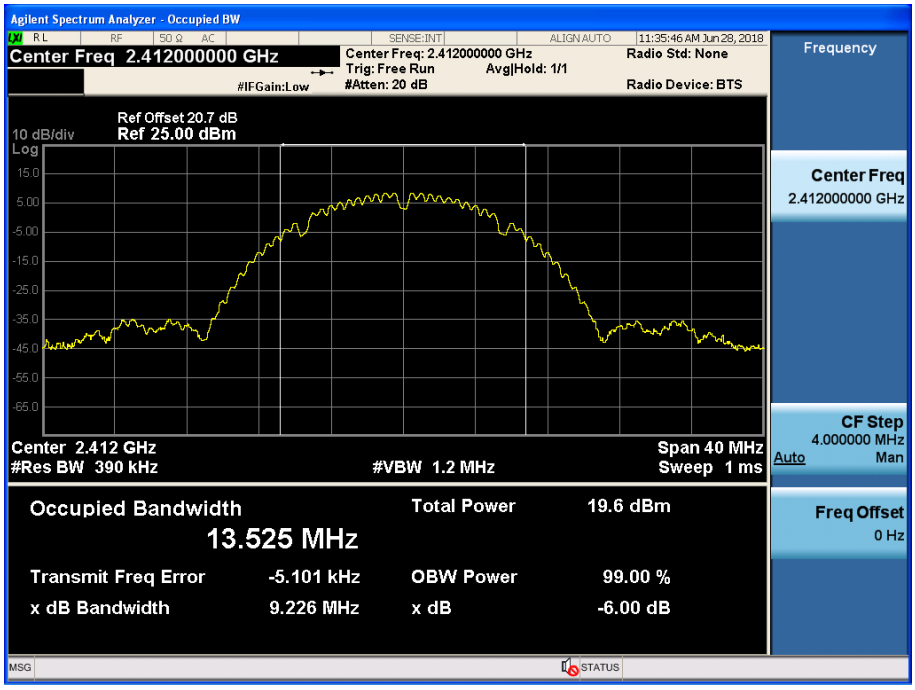
802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.80	N/A
2437	6	17.96	N/A
2462	11	17.86	N/A
2467	12	17.80	N/A
2472	13	17.83	N/A

Conducted 99% Bandwidth Measurements for 802.11n_HT40

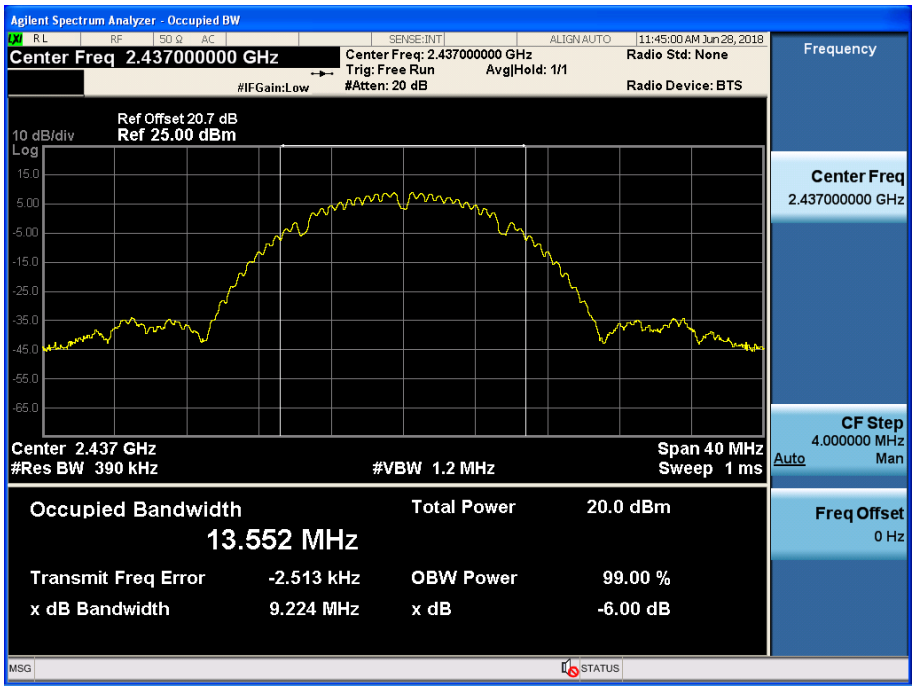
802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2422	3	36.53	N/A
2437	6	36.51	N/A
2452	9	36.45	N/A

▣ RESULT PLOTS_Ant.0

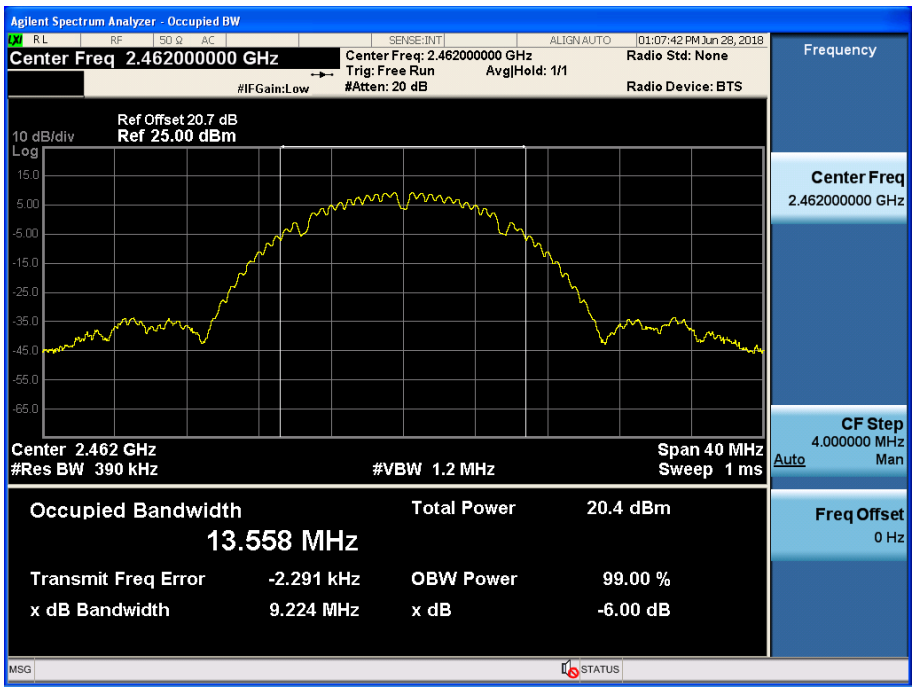
99% Bandwidth plot (802.11b - CH 1)



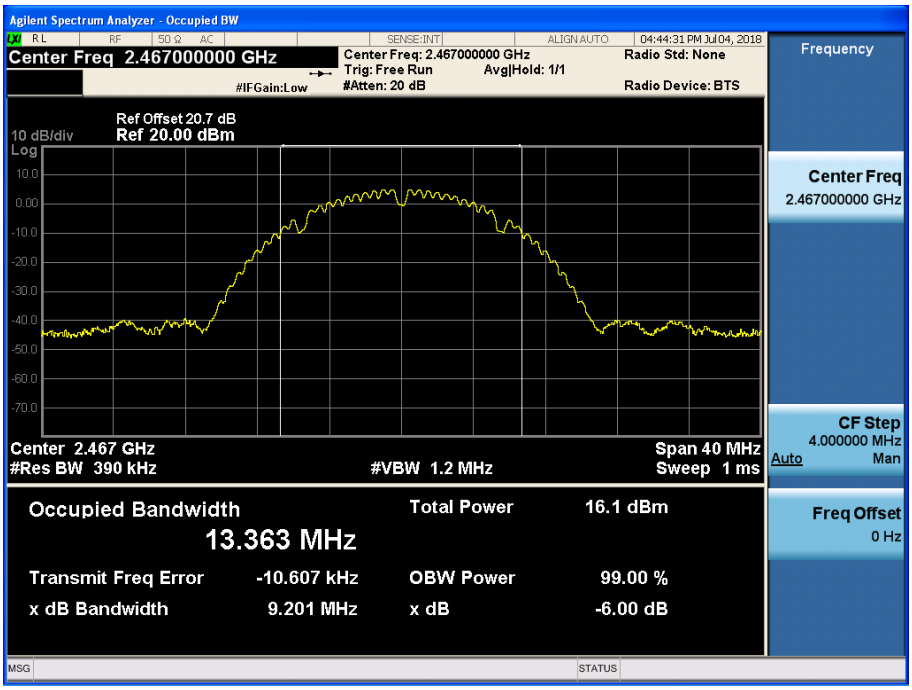
99% Bandwidth plot (802.11b - CH 6)



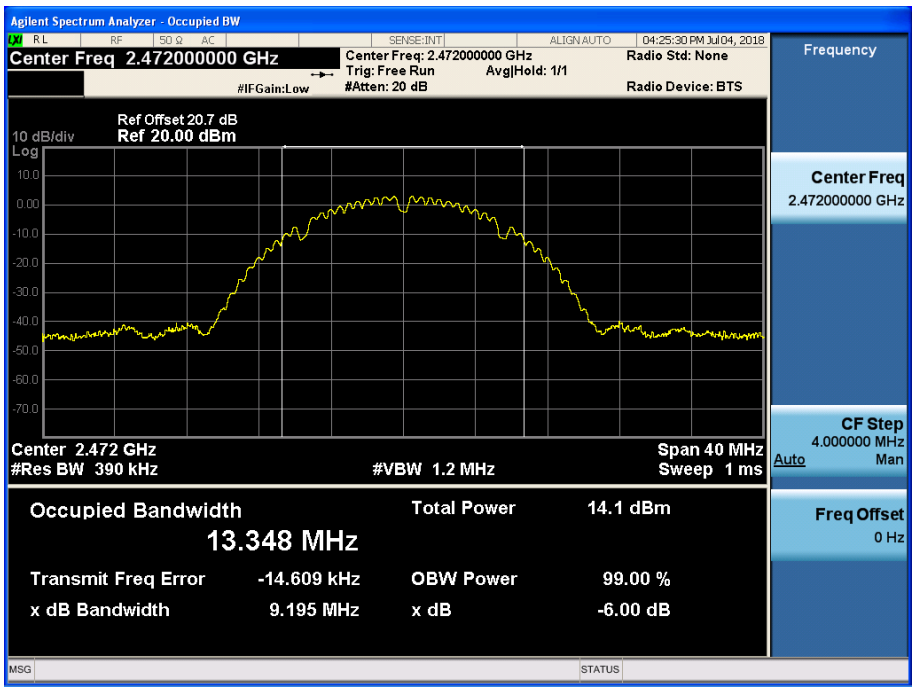
99% Bandwidth plot (802.11b - CH 11)



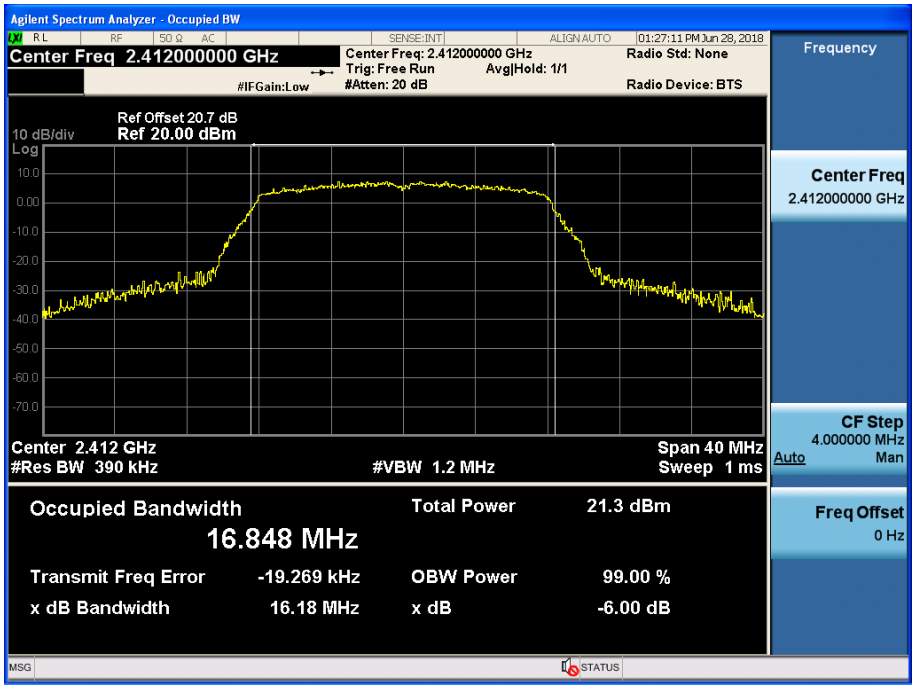
99% Bandwidth plot (802.11b - CH 12)



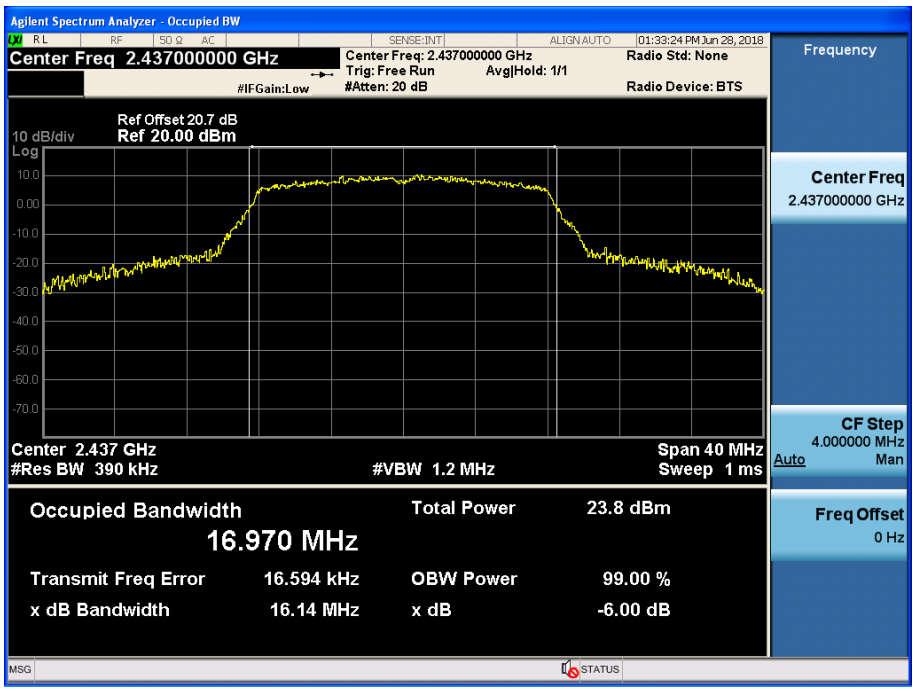
99% Bandwidth plot (802.11b - CH 13)



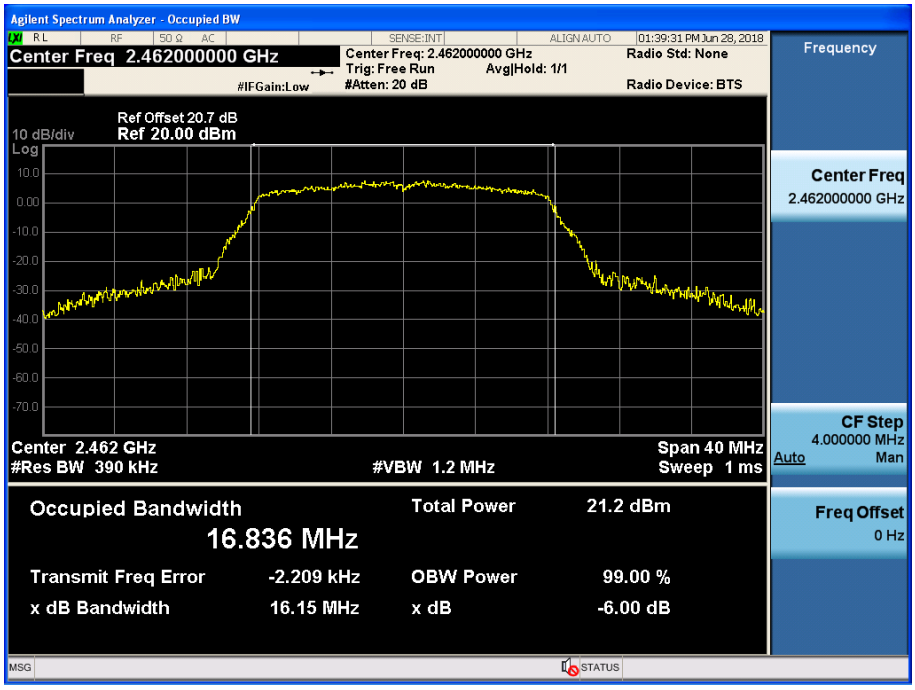
99% Bandwidth plot (802.11g - CH 1)



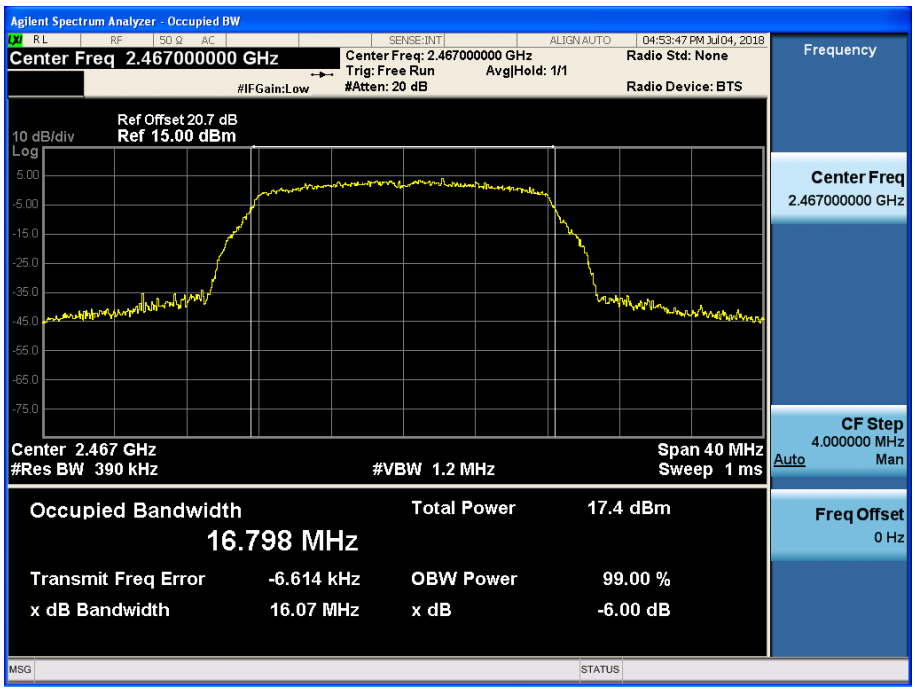
99% Bandwidth plot (802.11g - CH 6)



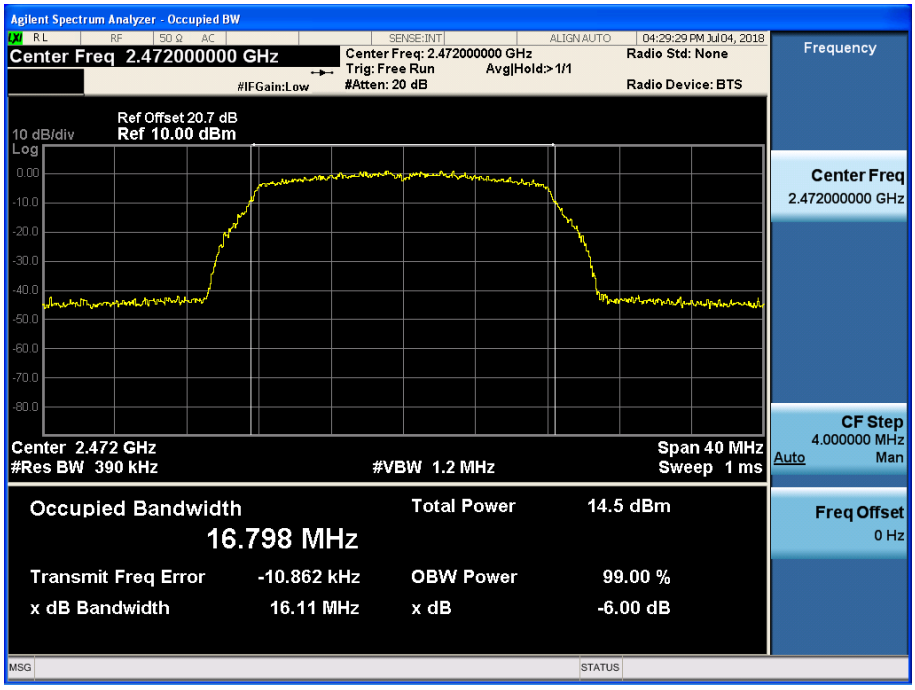
99% Bandwidth plot (802.11g - CH 11)



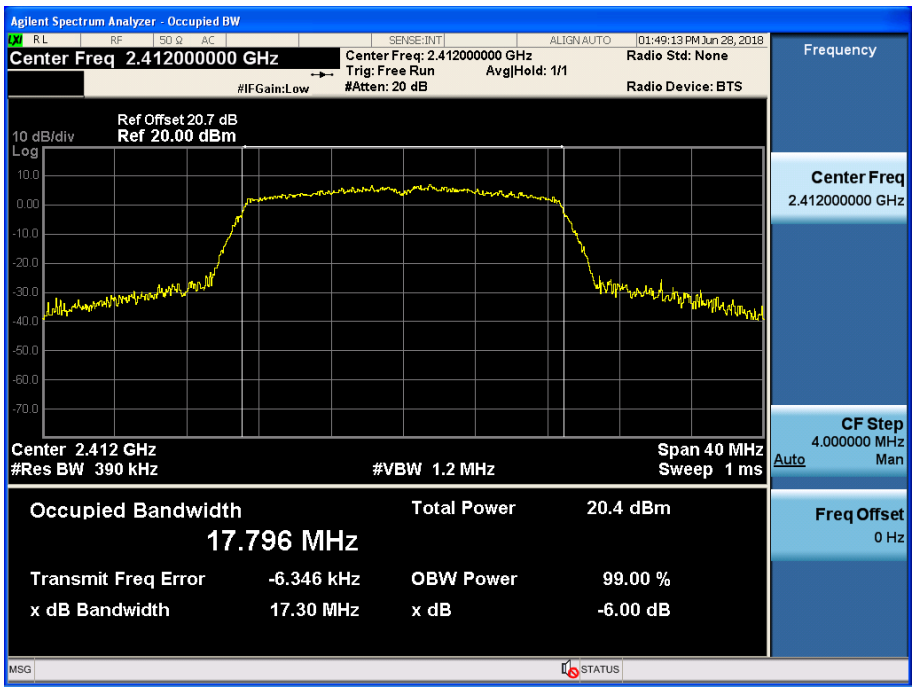
99% Bandwidth plot (802.11g - CH 12)



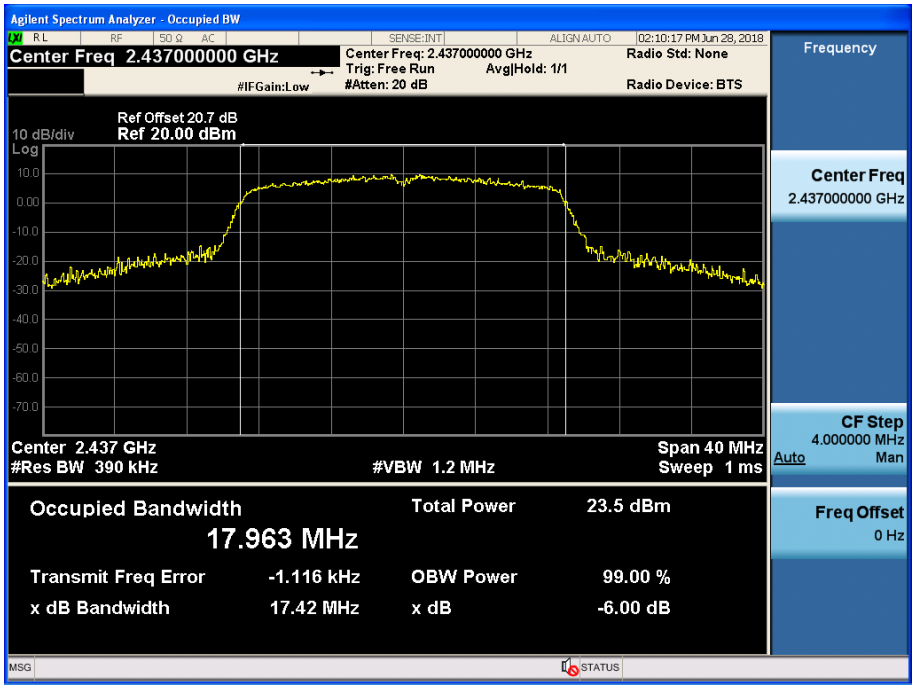
99% Bandwidth plot (802.11g - CH 13)



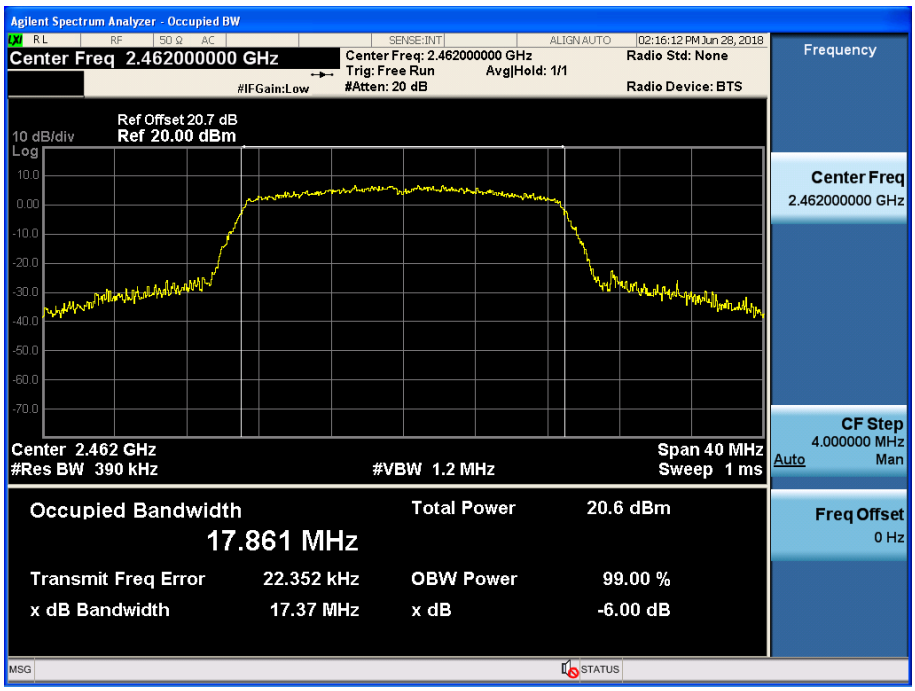
99% Bandwidth plot (802.11n_HT20 - CH 1)



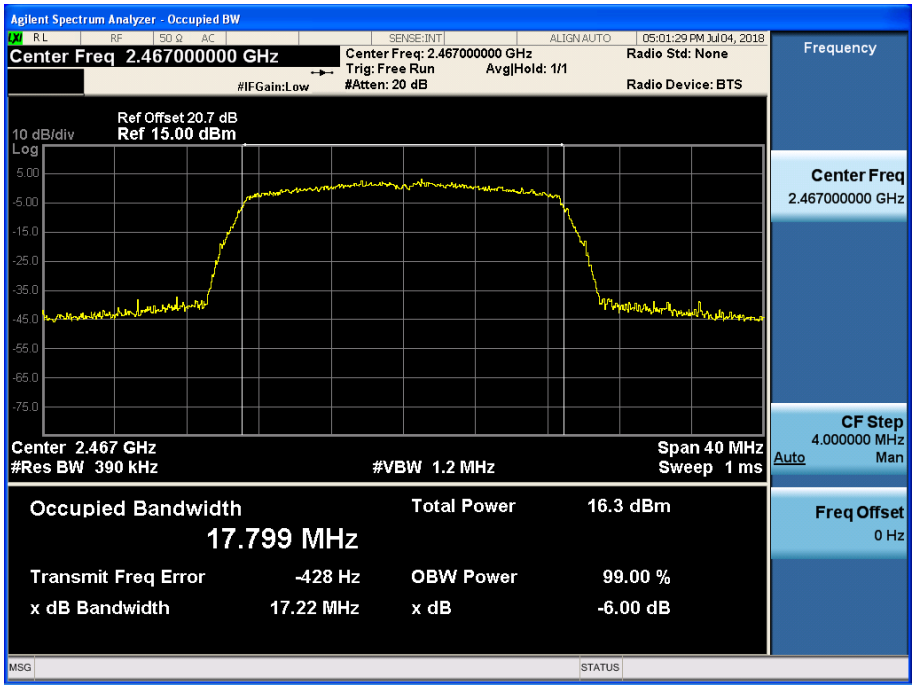
99% Bandwidth plot (802.11n_HT20 - CH 6)



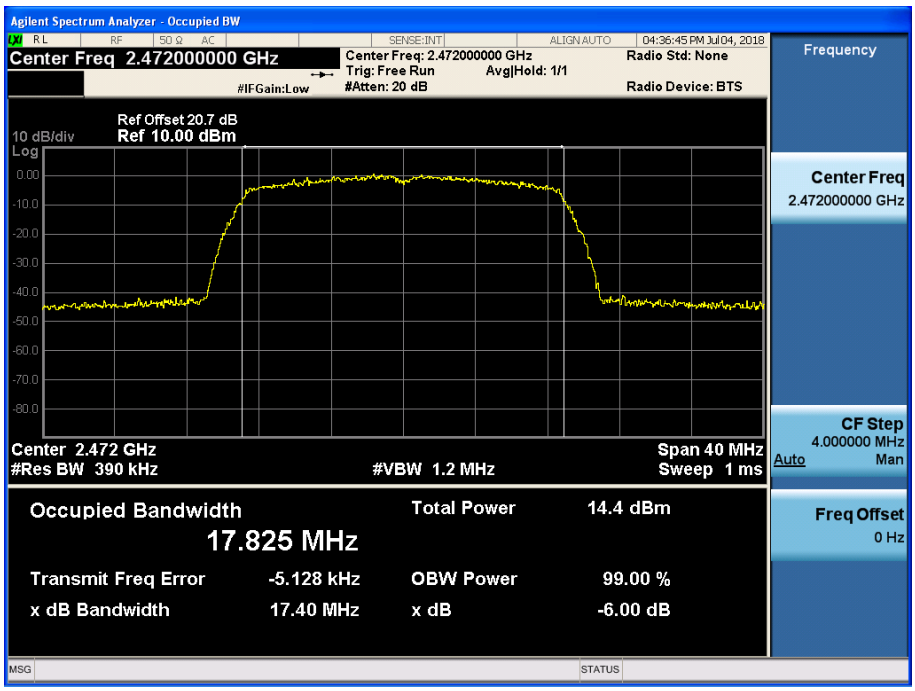
99% Bandwidth plot (802.11n_HT20 - CH 11)



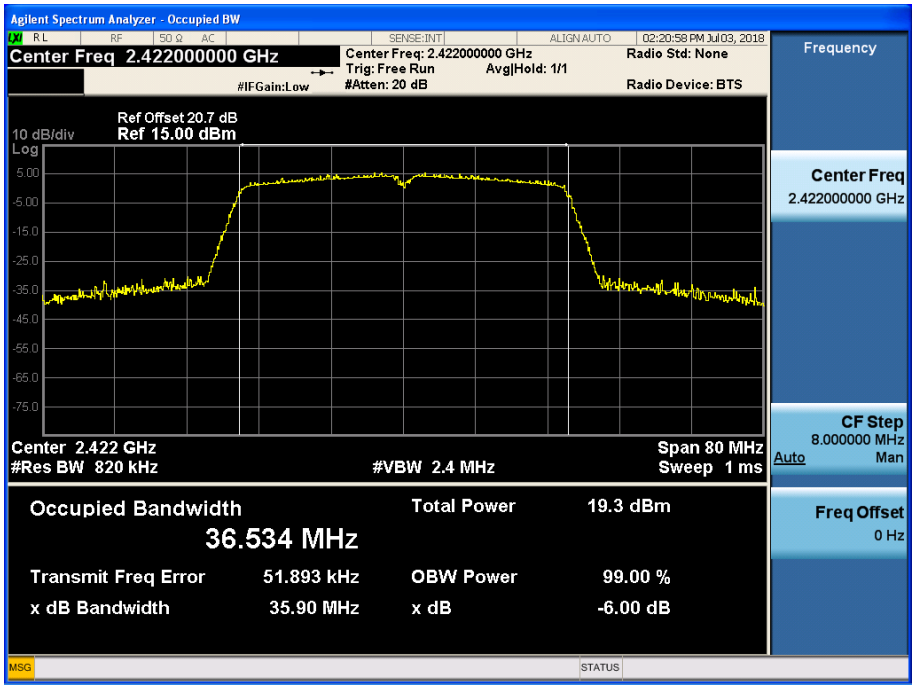
99% Bandwidth plot (802.11n_HT20 - CH 12)



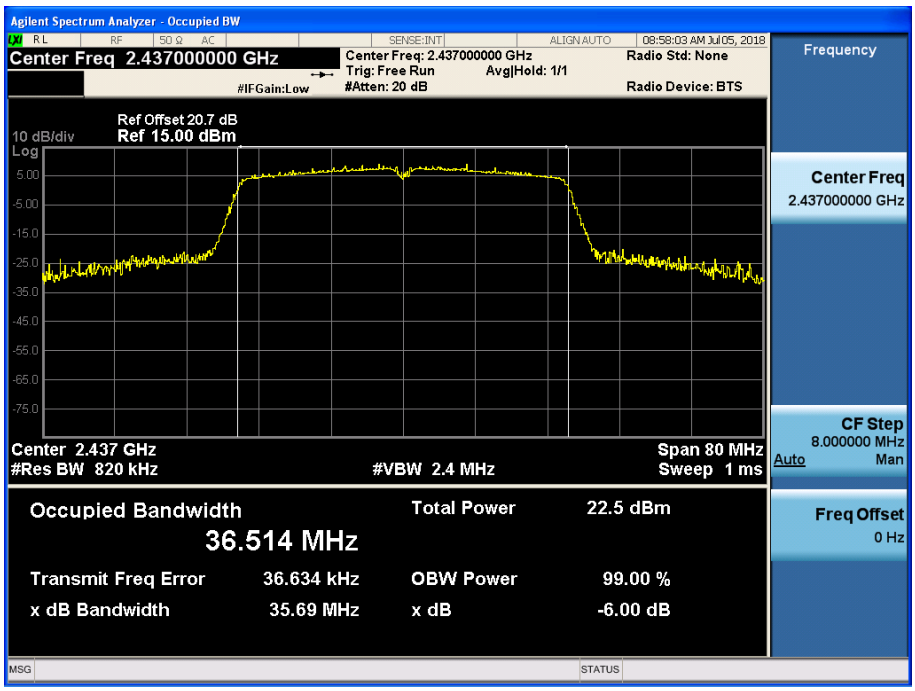
99% Bandwidth plot (802.11n_HT20 - CH 13)



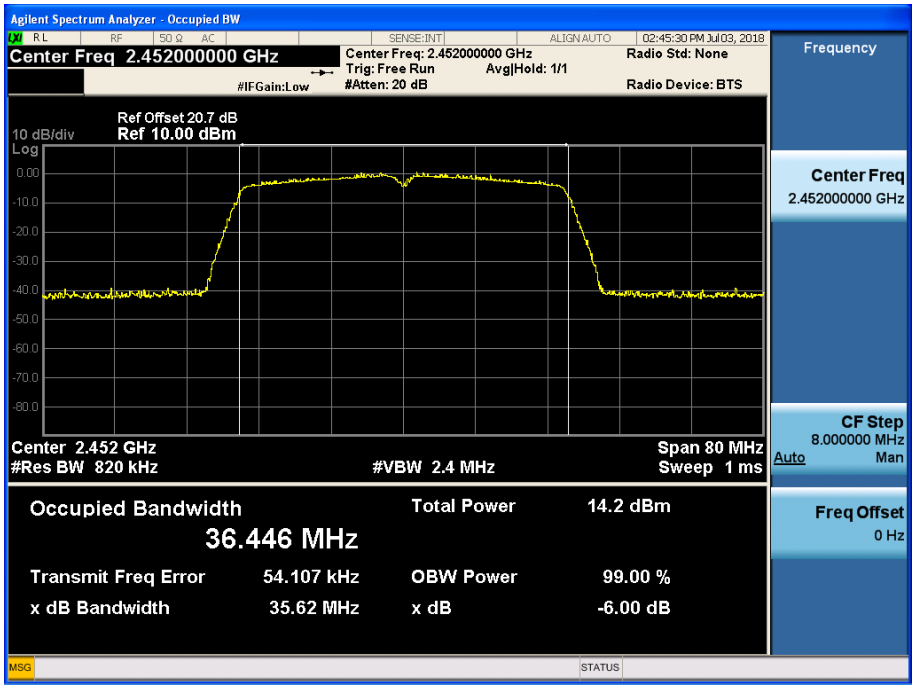
99% Bandwidth plot (802.11n_HT40 - CH 3)



99% Bandwidth plot (802.11n_HT40 - CH 6)



99% Bandwidth plot (802.11n_HT40 - CH 9)



▣ TEST RESULTS_Ant.1

Conducted 99% Bandwidth Measurements for 802.11b

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	13.41	N/A
2437	6	13.37	N/A
2462	11	13.48	N/A
2467	12	13.37	N/A
2472	13	13.32	N/A

Conducted 99% Bandwidth Measurements for 802.11g

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.83	N/A
2437	6	16.86	N/A
2462	11	16.79	N/A
2467	12	16.85	N/A
2472	13	16.84	N/A

Conducted 99% Bandwidth Measurements for 802.11n_HT20

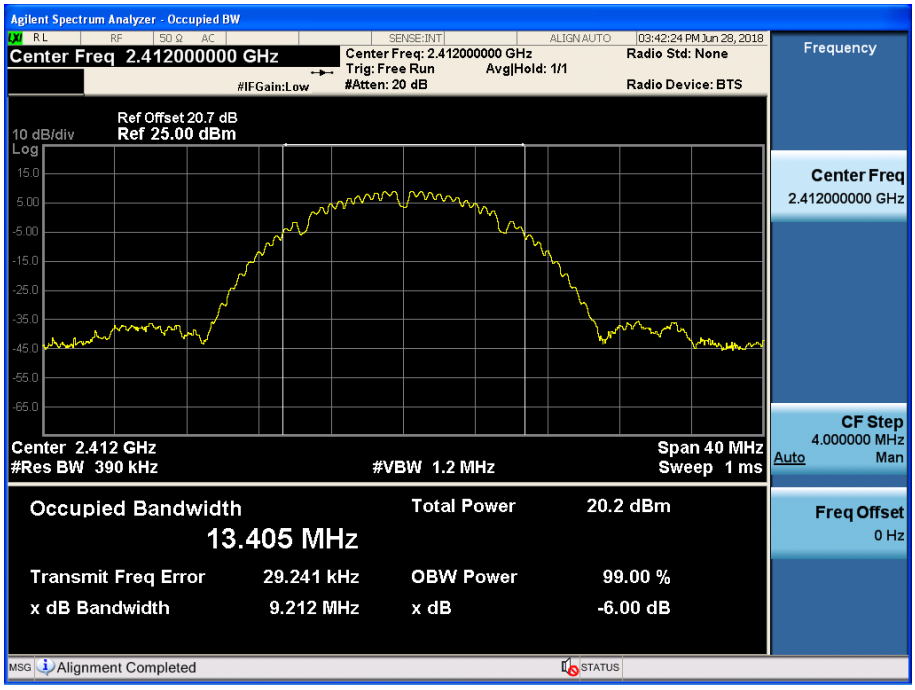
802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.82	N/A
2437	6	17.88	N/A
2462	11	17.79	N/A
2467	12	17.86	N/A
2472	13	17.78	N/A

Conducted 99% Bandwidth Measurements for 802.11n_HT40

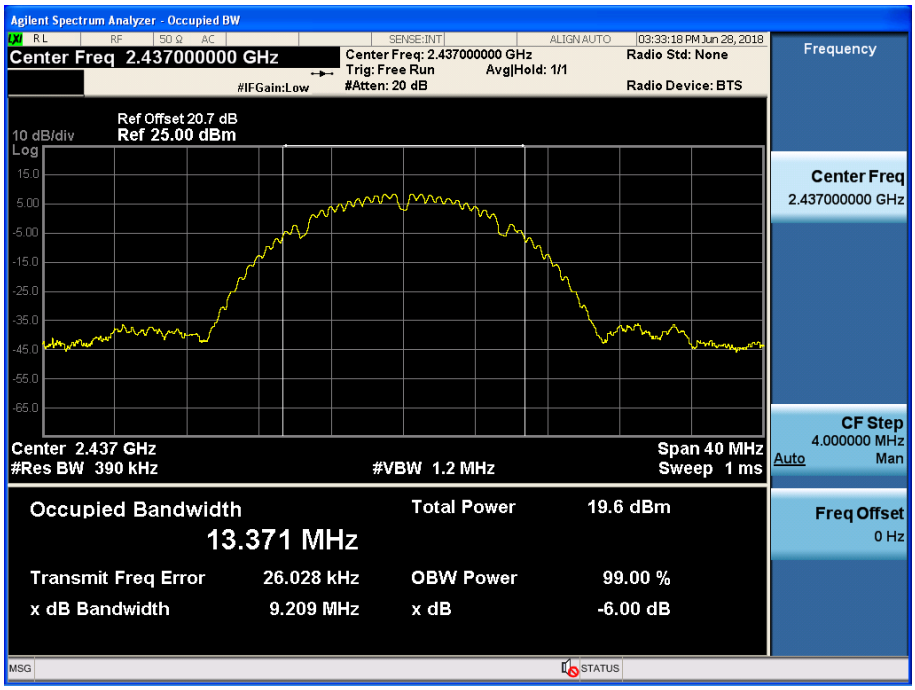
802.11n Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2422	3	36.44	N/A
2437	6	36.40	N/A
2452	9	36.40	N/A

▣ RESULT PLOTS)_Ant.1

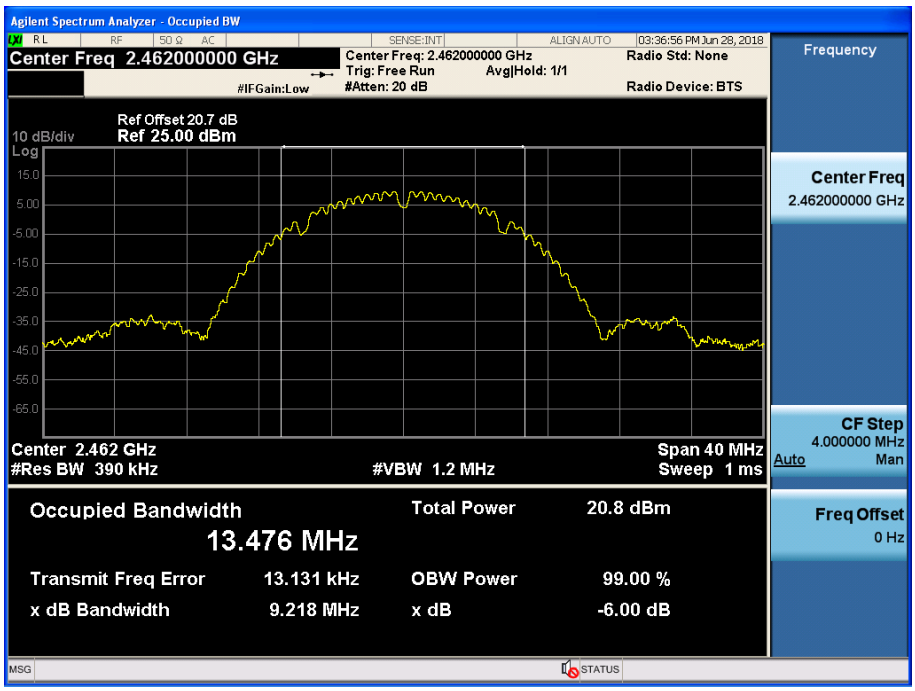
99% Bandwidth plot (802.11b - CH 1)



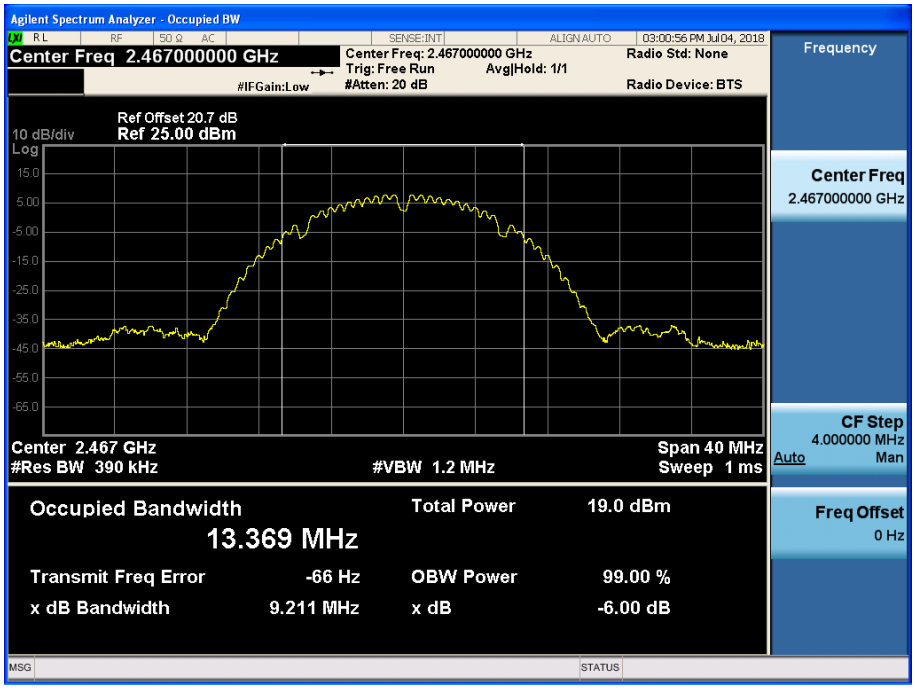
99% Bandwidth plot (802.11b - CH 6)



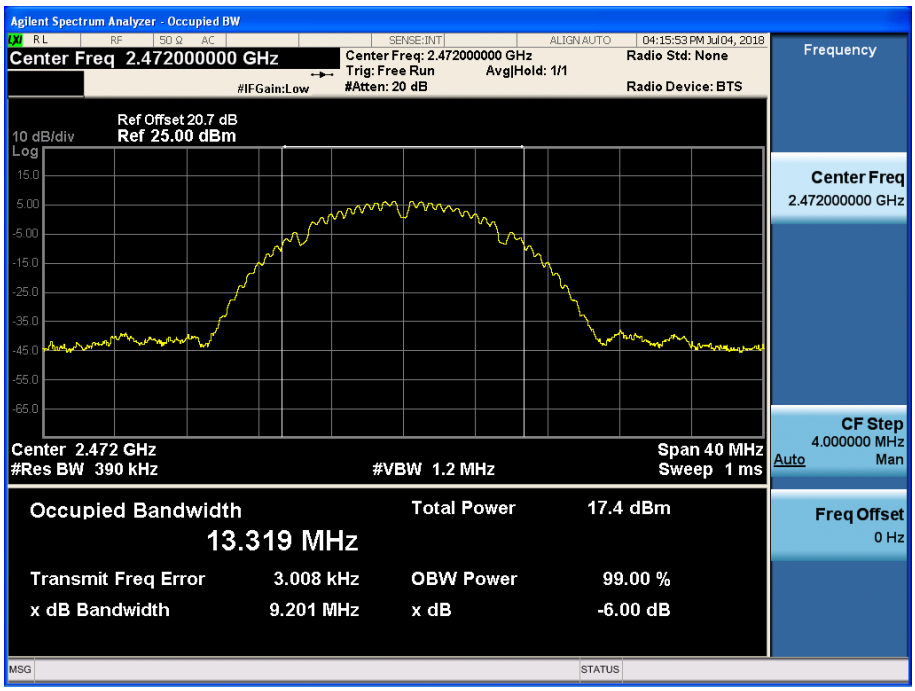
99% Bandwidth plot (802.11b - CH 11)



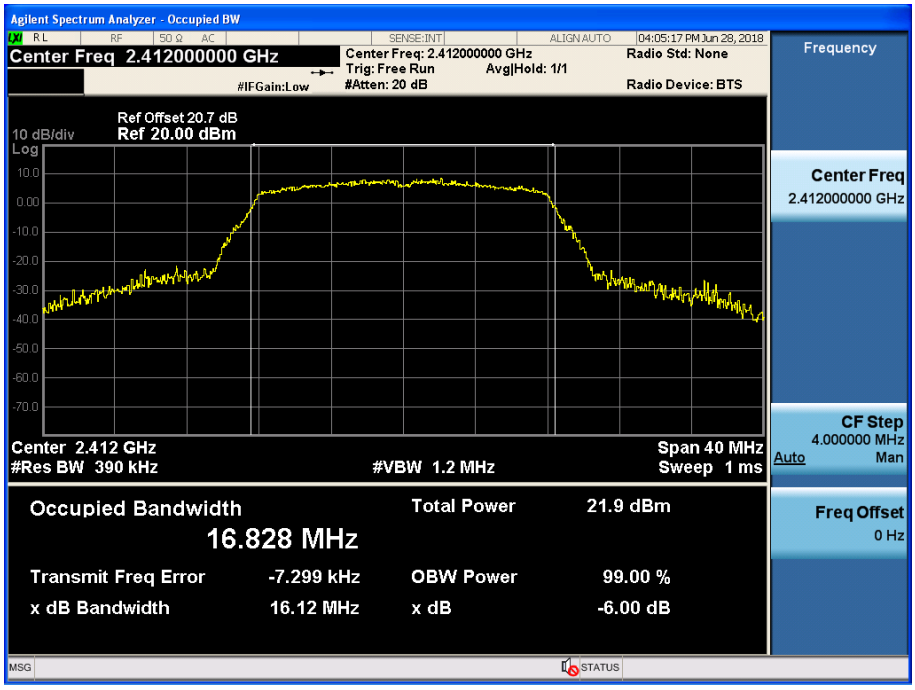
99% Bandwidth plot (802.11b - CH 12)



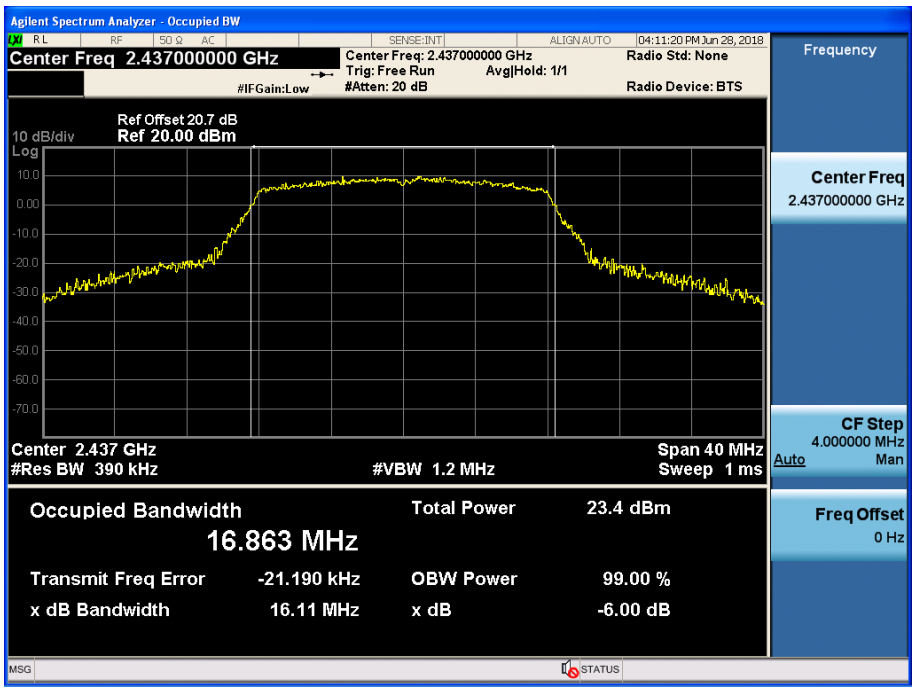
99% Bandwidth plot (802.11b - CH 13)



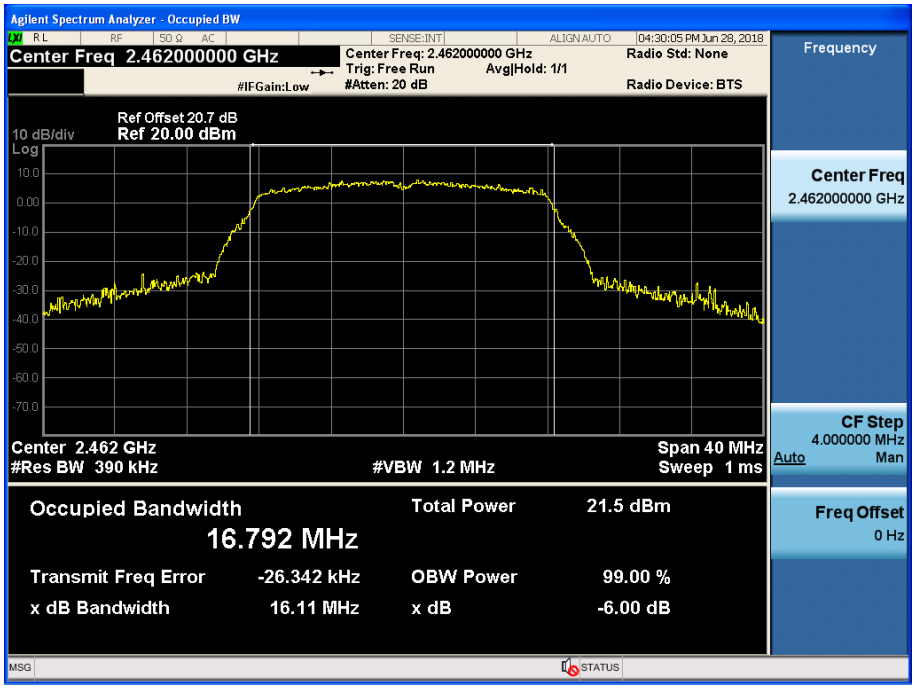
99% Bandwidth plot (802.11g - CH 1)



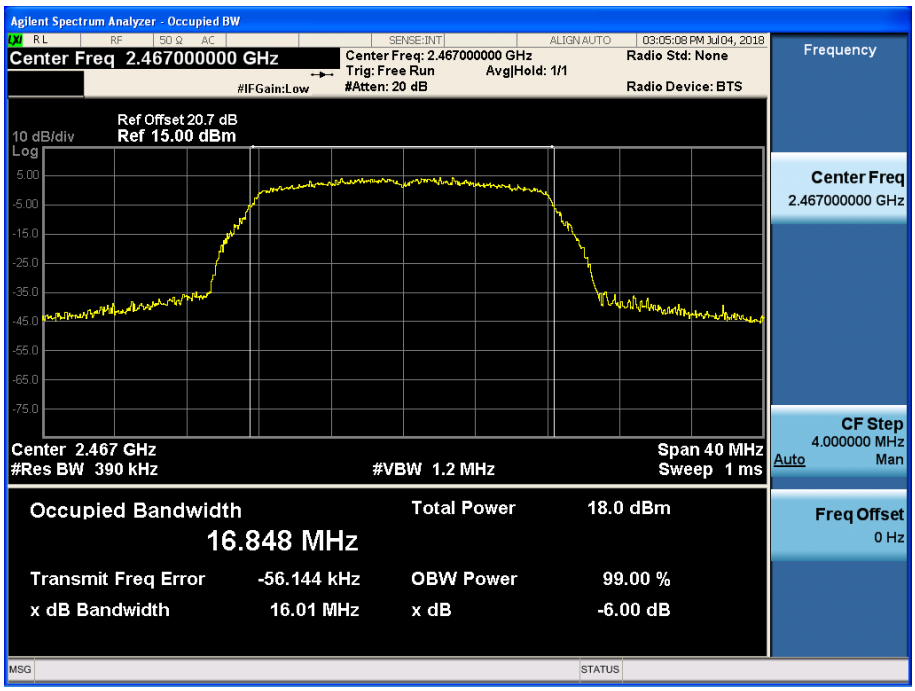
99% Bandwidth plot (802.11g - CH 6)



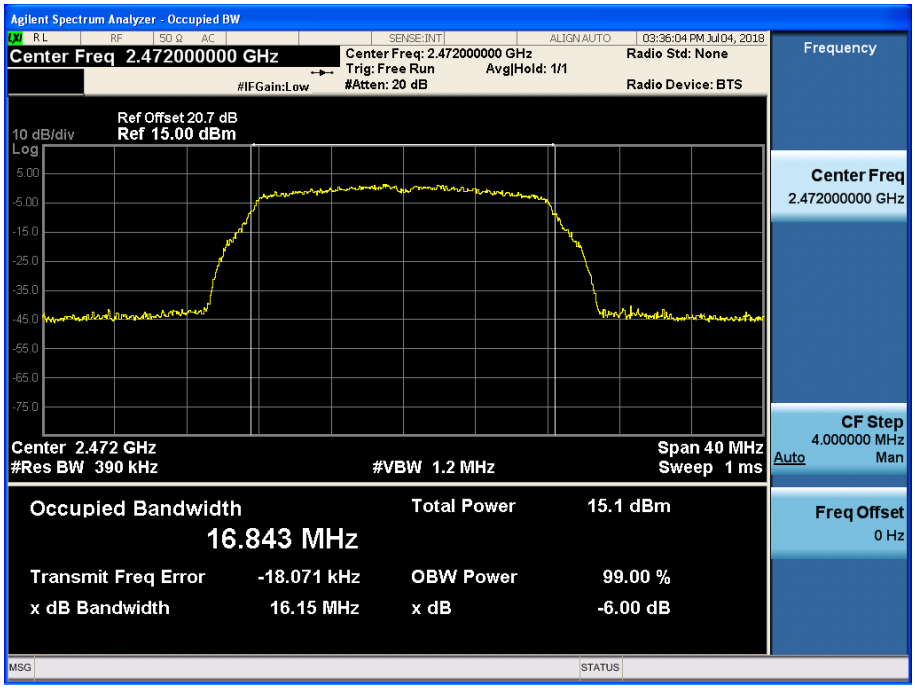
99% Bandwidth plot (802.11g - CH 11)



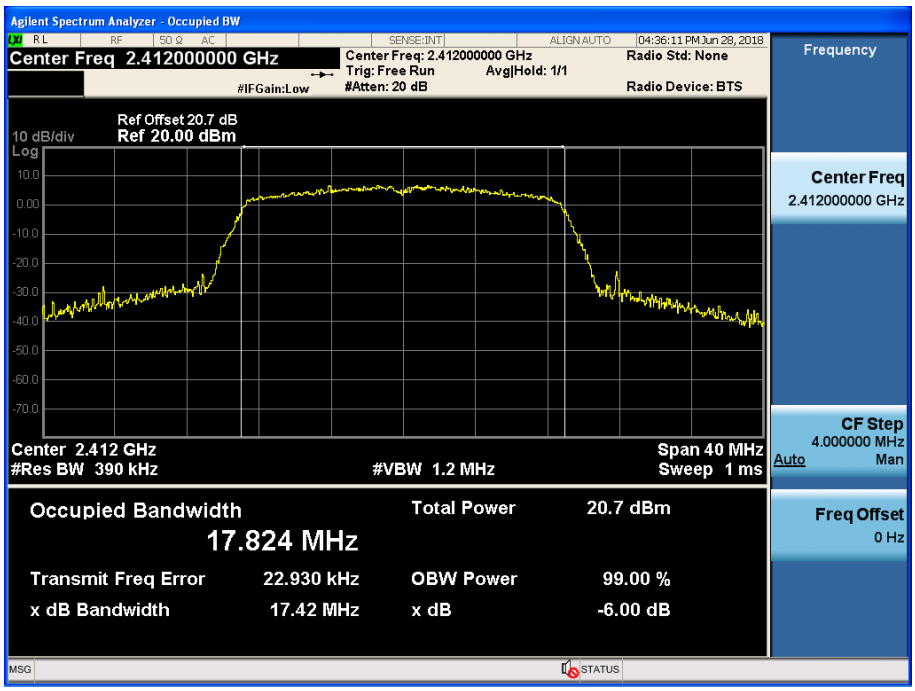
99% Bandwidth plot (802.11g - CH 12)



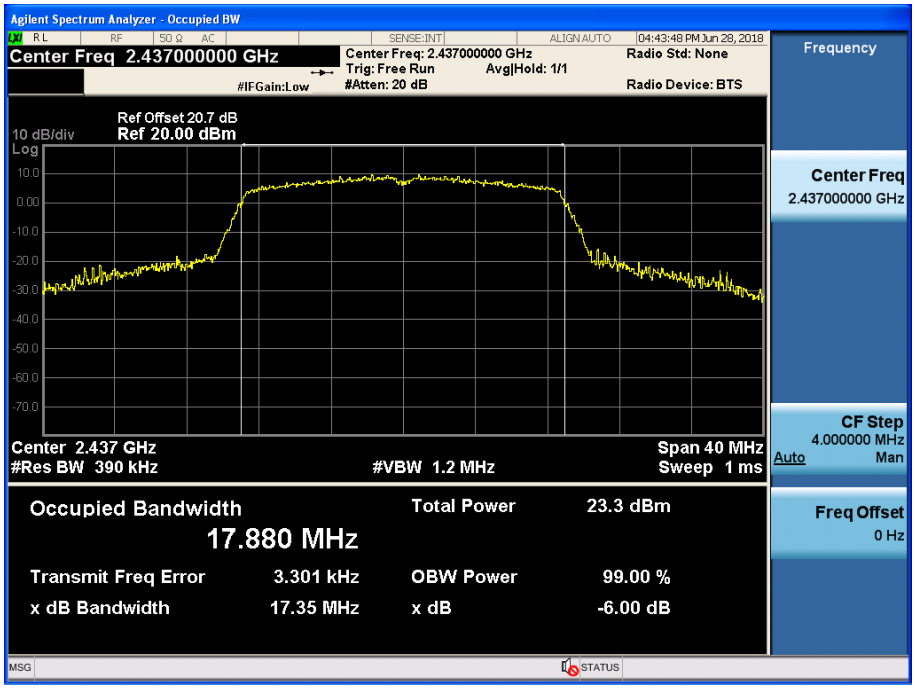
99% Bandwidth plot (802.11g - CH 13)



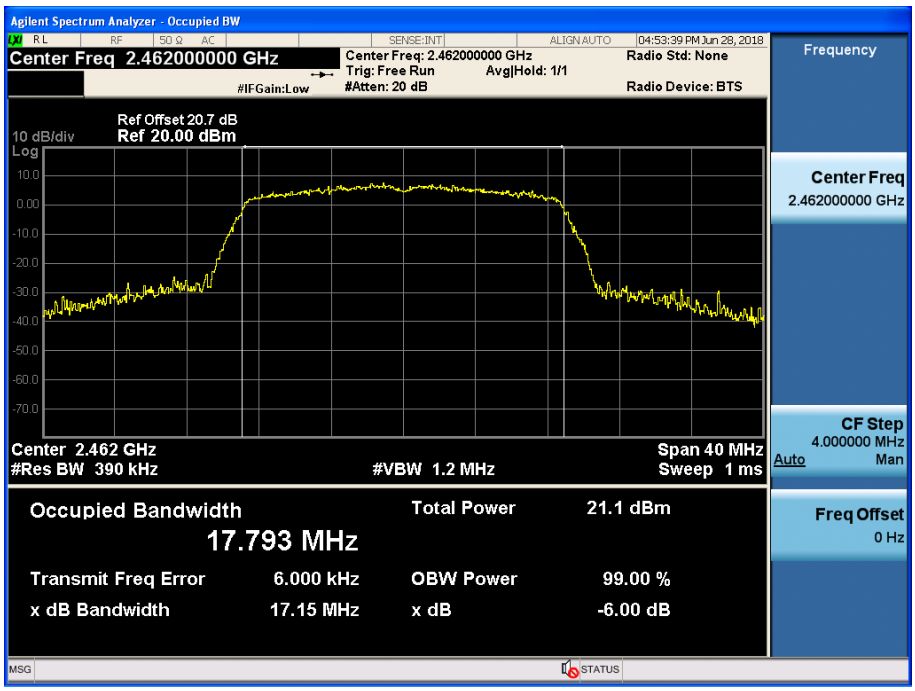
99% Bandwidth plot (802.11n_HT20 - CH 1)



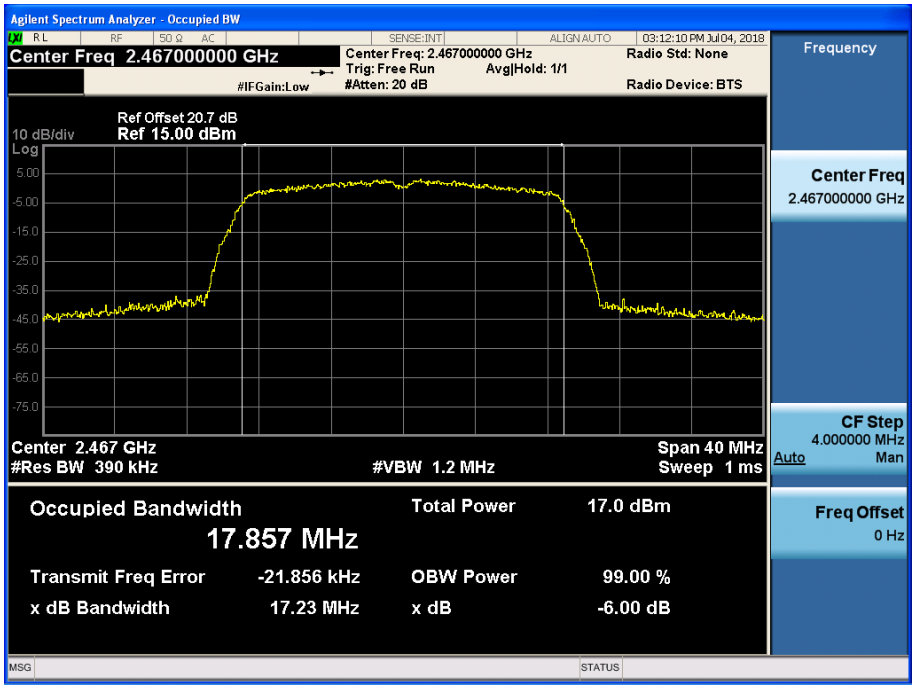
99% Bandwidth plot (802.11n_HT20 - CH 6)



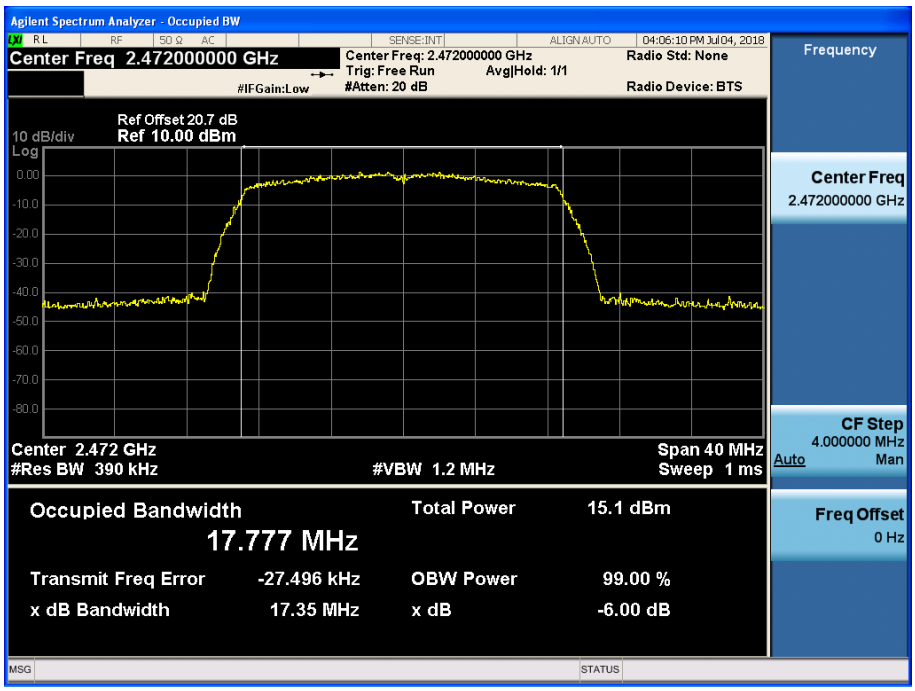
99% Bandwidth plot (802.11n_HT20 - CH 11)



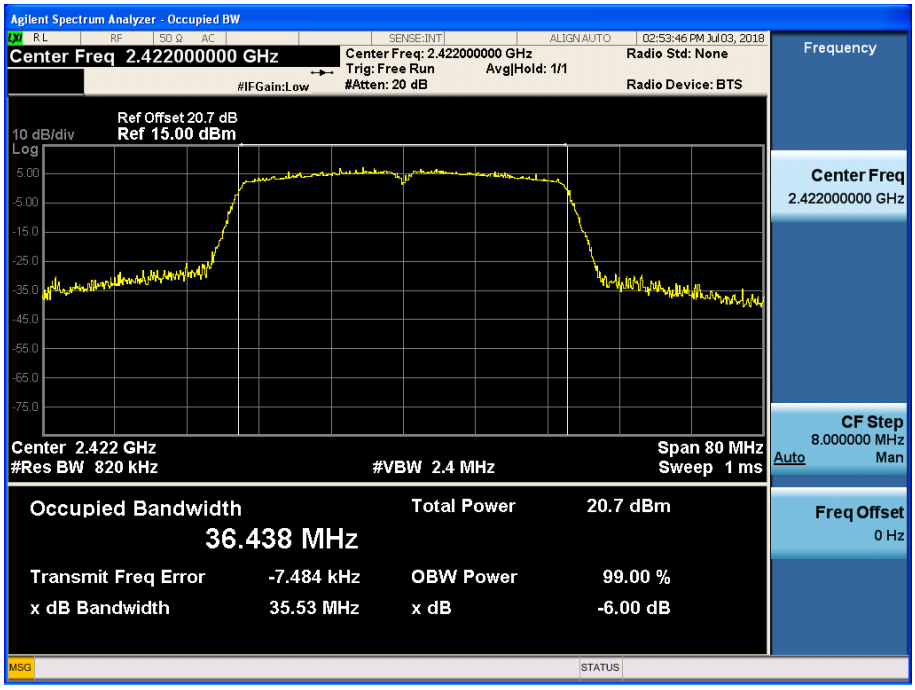
99% Bandwidth plot (802.11n_HT20 - CH 12)



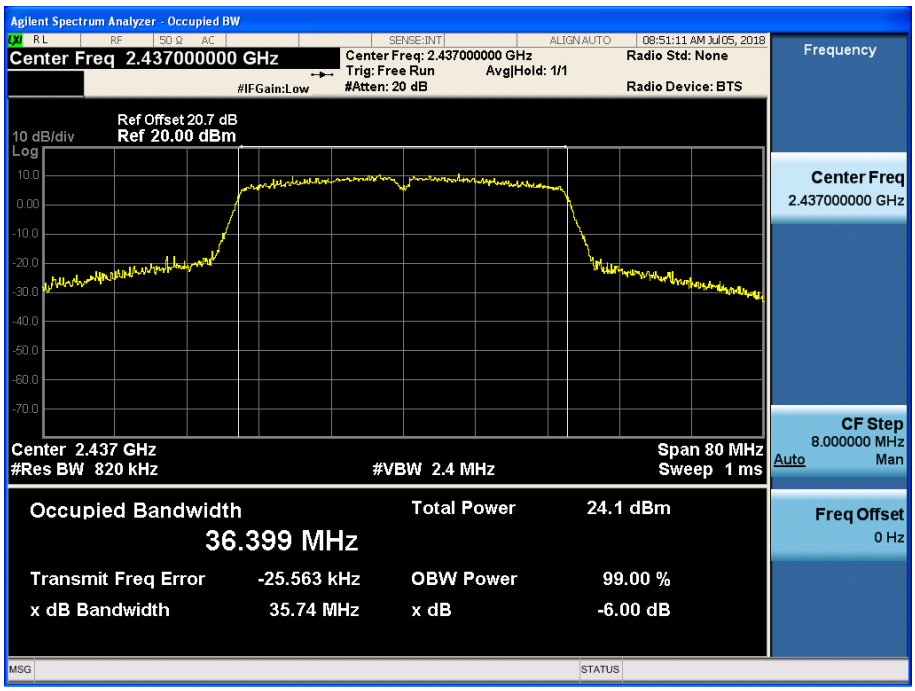
99% Bandwidth plot (802.11n_HT20 - CH 13)



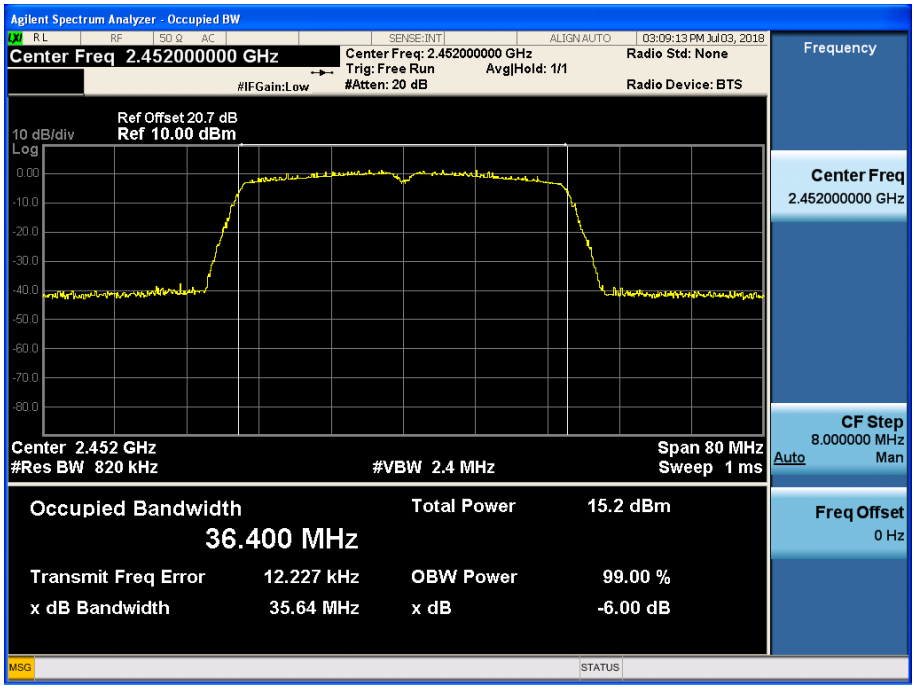
99% Bandwidth plot (802.11n_HT40 - CH 3)



99% Bandwidth plot (802.11n_HT40 - CH 6)



99% Bandwidth plot (802.11n_HT40 - CH 9)



9.4 OUTPUT POWER (802.11b/g/n)

Test Requirements and limit, §15.247(b)(3) / RSS-247(Issue 1) Section 5.4.4.

The transmitter output 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, at maximum power, and at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

▣ Limit(CDD)

Maximum Conducted Output Power

Operating Mode	Band	Mode	Ant. Port	Ant. Gain (dBi)	Limit (dBm)
SISO	2.4 GHz	802.11b/g/n	0	1.37	30.0
			1	1.49	30.0
MIMO(2 TX)		802.11g/n	0 & 1	4.44	30

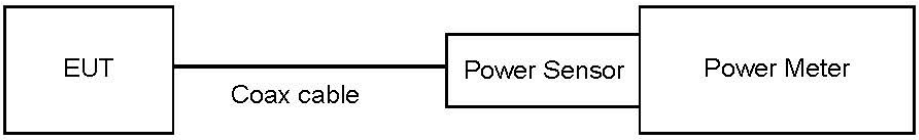
Note : 1. If antenna gains are not equal,

Directional gain = $10*\log[(10^{G1/20} + 10^{G2/20}+\ldots+10^{GN/20})^2/N]$ dBi (802.11g/n)

(according to KDB662911 D01 v02r01)

2. Limit is calculated by antenna gain.

▣ TEST CONFIGURATION(20 MHz BW)



▣ TEST PROCEDURE(20 MHz BW)

- Peak Power (Procedure 9.1.2 in KDB 558074 v04)
  1. Measure the peak power of the transmitter.
- Average Power (Procedure 9.2.3.1 in KDB 558074 v04)
  1. Measure the duty cycle.
  2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
  3. Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

Note :

1. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 20.7 dB is offset for 2.4 GHz Band.
   Actual value of loss for the attenuator and cable combination is below table.

Band	Frequency[MHz]	Loss[dB]
2.4 GHz	2412	20.7
	2437	20.7
	2462	20.7

(Actual value of loss for the attenuator and cable combination)

3. MIMO output power results are calculated by each antenna output power on MIMO operating mode.

▣ **TEST RESULTS-Peak**

▣ **TEST RESULTS-Ant.0**

Conducted Output Power Measurements (802.11b Mode)

802.11b Mode		Rate	Measured	Limit
Frequency[MHz]	Channel No.	(Mbps)	Power(dBm)	(dBm)
2412	1	1 Mbps	18.94	30
		2 Mbps	19.40	30
		5.5 Mbps	21.08	30
		11 Mbps	22.68	30
2437	6	1 Mbps	19.36	30
		2 Mbps	19.73	30
		5.5 Mbps	21.19	30
		11 Mbps	23.00	30
2462	11	1 Mbps	19.68	30
		2 Mbps	20.41	30
		5.5 Mbps	21.86	30
		11 Mbps	23.63	30
2467	12	1 Mbps	15.48	30
		2 Mbps	15.65	30
		5.5 Mbps	17.02	30
		11 Mbps	18.93	30
2472	13	1 Mbps	13.35	30
		2 Mbps	13.60	30
		5.5 Mbps	15.00	30
		11 Mbps	16.82	30

▣ TEST RESULTS-Ant.1

Conducted Output Power Measurements (802.11b Mode)

802.11b Mode		Rate	Measured	Limit
Frequency[MHz]	Channel No.	(Mbps)	Power(dBm)	(dBm)
2412	1	1 Mbps	19.46	30
		2 Mbps	19.88	30
		5.5 Mbps	21.32	30
		11 Mbps	23.16	30
2437	6	1 Mbps	18.90	30
		2 Mbps	19.57	30
		5.5 Mbps	20.97	30
		11 Mbps	22.48	30
2462	11	1 Mbps	20.12	30
		2 Mbps	20.69	30
		5.5 Mbps	21.91	30
		11 Mbps	23.70	30
2467	12	1 Mbps	18.40	30
		2 Mbps	18.80	30
		5.5 Mbps	20.20	30
		11 Mbps	22.02	30
2472	13	1 Mbps	16.73	30
		2 Mbps	17.06	30
		5.5 Mbps	18.39	30
		11 Mbps	20.21	30

▣ TEST RESULTS-_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11b MIMO Mode)

802.11b Mode		Rate	Measured	Limit
Frequency[MHz]	Channel No.	(Mbps)	Power(dBm)	(dBm)
2412	1	1 Mbps	22.21	30
		2 Mbps	22.65	30
		5.5 Mbps	24.21	30
		11 Mbps	25.93	30
2437	6	1 Mbps	22.14	30
		2 Mbps	22.66	30
		5.5 Mbps	24.09	30
		11 Mbps	25.75	30
2462	11	1 Mbps	22.91	30
		2 Mbps	23.56	30
		5.5 Mbps	24.90	30
		11 Mbps	26.68	30
2467	12	1 Mbps	20.07	30
		2 Mbps	20.38	30
		5.5 Mbps	21.77	30
		11 Mbps	23.62	30
2472	13	1 Mbps	18.21	30
		2 Mbps	18.51	30
		5.5 Mbps	19.87	30
		11 Mbps	21.69	30

▣ TEST RESULTS-Ant.0

Conducted Output Power Measurements (802.11g SISO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	21.94	30
		9 Mbps	22.39	30
		12 Mbps	22.33	30
		18 Mbps	22.24	30
		24 Mbps	22.80	30
		36 Mbps	23.08	30
		48 Mbps	20.95	30
		54 Mbps	20.99	30
2437	6	6 Mbps	24.49	30
		9 Mbps	24.74	30
		12 Mbps	24.58	30
		18 Mbps	24.39	30
		24 Mbps	24.96	30
		36 Mbps	25.05	30
		48 Mbps	23.17	30
		54 Mbps	22.94	30
2462	11	6 Mbps	21.80	30
		9 Mbps	22.07	30
		12 Mbps	21.93	30
		18 Mbps	21.98	30
		24 Mbps	22.55	30
		36 Mbps	22.57	30
		48 Mbps	20.42	30
		54 Mbps	20.55	30
2467	12	6 Mbps	18.08	30
		9 Mbps	18.17	30
		12 Mbps	18.05	30
		18 Mbps	18.12	30
		24 Mbps	18.66	30
		36 Mbps	18.20	30
		48 Mbps	16.36	30
		54 Mbps	16.47	30

2472	13	6 Mbps	15.26	30
		9 Mbps	15.32	30
		12 Mbps	15.23	30
		18 Mbps	15.23	30
		24 Mbps	15.86	30
		36 Mbps	15.25	30
		48 Mbps	13.36	30
		54 Mbps	13.38	30

▣ TEST RESULTS-Ant.1

Conducted Output Power Measurements (802.11g SISO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	22.56	30
		9 Mbps	22.83	30
		12 Mbps	22.82	30
		18 Mbps	22.79	30
		24 Mbps	23.32	30
		36 Mbps	23.23	30
		48 Mbps	21.09	30
		54 Mbps	21.11	30
2437	6	6 Mbps	24.01	30
		9 Mbps	24.32	30
		12 Mbps	24.24	30
		18 Mbps	24.26	30
		24 Mbps	24.88	30
		36 Mbps	24.90	30
		48 Mbps	22.87	30
		54 Mbps	22.87	30
2462	11	6 Mbps	22.14	30
		9 Mbps	22.37	30
		12 Mbps	22.24	30
		18 Mbps	22.32	30
		24 Mbps	22.82	30
		36 Mbps	23.01	30
		48 Mbps	20.94	30
		54 Mbps	20.67	30
2467	12	6 Mbps	18.72	30
		9 Mbps	18.81	30
		12 Mbps	18.77	30
		18 Mbps	18.77	30
		24 Mbps	19.38	30
		36 Mbps	18.75	30
		48 Mbps	16.83	30
		54 Mbps	16.87	30

2472	13	6 Mbps	15.79	30
		9 Mbps	15.82	30
		12 Mbps	15.82	30
		18 Mbps	15.74	30
		24 Mbps	16.40	30
		36 Mbps	15.67	30
		48 Mbps	13.66	30
		54 Mbps	13.70	30

▣ TEST RESULTS-_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11g MIMO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	25.27	30
		9 Mbps	25.62	30
		12 Mbps	25.59	30
		18 Mbps	25.53	30
		24 Mbps	26.07	30
		36 Mbps	26.17	30
		48 Mbps	24.03	30
		54 Mbps	24.06	30
2437	6	6 Mbps	27.26	30
		9 Mbps	27.54	30
		12 Mbps	27.42	30
		18 Mbps	27.34	30
		24 Mbps	27.93	30
		36 Mbps	27.99	30
		48 Mbps	26.03	30
		54 Mbps	25.92	30
2462	11	6 Mbps	24.98	30
		9 Mbps	25.23	30
		12 Mbps	25.10	30
		18 Mbps	25.16	30
		24 Mbps	25.70	30
		36 Mbps	25.80	30
		48 Mbps	23.69	30
		54 Mbps	23.62	30
2467	12	6 Mbps	21.42	30
		9 Mbps	21.51	30
		12 Mbps	21.43	30
		18 Mbps	21.46	30
		24 Mbps	22.04	30
		36 Mbps	21.49	30
		48 Mbps	19.61	30
		54 Mbps	19.68	30

2472	13	6 Mbps	18.54	30
		9 Mbps	18.58	30
		12 Mbps	18.54	30
		18 Mbps	18.50	30
		24 Mbps	19.14	30
		36 Mbps	18.47	30
		48 Mbps	16.52	30
		54 Mbps	16.55	30

▣ TEST RESULTS-Ant.0

Conducted Output Power Measurements (802.11n_HT20 SISO Mode)

802.11n_HT20 Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	21.22	30
		1	21.09	30
		2	21.18	30
		3	21.67	30
		4	21.75	30
		5	21.96	30
		6	19.70	30
		7	19.63	30
2437	6	0	24.26	30
		1	24.34	30
		2	24.38	30
		3	24.88	30
		4	24.80	30
		5	24.74	30
		6	22.90	30
		7	22.93	30
2462	11	0	21.35	30
		1	21.27	30
		2	21.34	30
		3	21.87	30
		4	21.89	30
		5	21.86	30
		6	20.00	30
		7	19.95	30
2467	12	0	17.09	30
		1	17.07	30
		2	17.02	30
		3	17.68	30
		4	17.16	30
		5	17.25	30
		6	15.33	30
		7	15.34	30

2472	13	0	15.23	30
		1	15.26	30
		2	15.16	30
		3	15.67	30
		4	15.18	30
		5	15.29	30
		6	13.34	30
		7	13.23	30

▣ TEST RESULTS-Ant.1

Conducted Output Power Measurements (802.11n_HT20 SISO Mode)

802.11n_HT20 Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	21.52	30
		1	21.49	30
		2	21.57	30
		3	22.10	30
		4	22.08	30
		5	22.20	30
		6	20.14	30
		7	20.12	30
2437	6	0	24.07	30
		1	24.26	30
		2	24.20	30
		3	24.73	30
		4	24.70	30
		5	24.90	30
		6	22.73	30
		7	22.73	30
2462	11	0	21.78	30
		1	21.74	30
		2	21.74	30
		3	22.13	30
		4	22.26	30
		5	22.37	30
		6	20.09	30
		7	20.08	30
2467	12	0	17.77	30
		1	17.78	30
		2	17.72	30
		3	18.30	30
		4	17.60	30
		5	17.68	30
		6	15.71	30
		7	15.75	30

2472	13	0	15.86	30
		1	15.83	30
		2	15.77	30
		3	16.32	30
		4	15.57	30
		5	15.64	30
		6	13.62	30
		7	13.61	30

▣ TEST RESULTS-_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11n_HT20 MIMO Mode)

802.11n_HT20 Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	24.38	30
		1	24.30	30
		2	24.39	30
		3	24.90	30
		4	24.93	30
		5	25.09	30
		6	22.93	30
		7	22.89	30
2437	6	0	27.18	30
		1	27.31	30
		2	27.30	30
		3	27.82	30
		4	27.76	30
		5	27.83	30
		6	25.83	30
		7	25.84	30
2462	11	0	24.58	30
		1	24.52	30
		2	24.55	30
		3	25.01	30
		4	25.09	30
		5	25.13	30
		6	23.06	30
		7	23.03	30
2467	12	0	20.45	30
		1	20.44	30
		2	20.39	30
		3	21.01	30
		4	20.39	30
		5	20.48	30
		6	18.53	30
		7	18.56	30

2472	13	0	18.56	30
		1	18.56	30
		2	18.48	30
		3	19.01	30
		4	18.39	30
		5	18.48	30
		6	16.49	30
		7	16.43	30

▣ TEST RESULTS-Ant.0

Conducted Output Power Measurements (802.11n_HT40 SISO Mode)

802.11n_HT40 Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2422	3	0	19.65	30
		1	19.50	30
		2	19.48	30
		3	19.93	30
		4	19.41	30
		5	19.55	30
		6	17.52	30
		7	17.54	30
2437	6	0	22.77	30
		1	22.71	30
		2	22.71	30
		3	23.22	30
		4	22.82	30
		5	22.94	30
		6	21.00	30
		7	21.10	30
2452	9	0	14.70	30
		1	14.64	30
		2	14.65	30
		3	15.21	30
		4	14.60	30
		5	14.70	30
		6	12.64	30
		7	12.67	30

▣ TEST RESULTS-Ant.1

Conducted Output Power Measurements (802.11n_HT40 SISO Mode)

802.11n_HT40 Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2422	3	0	21.09	30
		1	21.08	30
		2	21.04	30
		3	21.59	30
		4	20.96	30
		5	21.03	30
		6	19.31	30
		7	19.34	30
2437	6	0	25.12	30
		1	25.05	30
		2	25.06	30
		3	25.57	30
		4	25.21	30
		5	25.23	30
		6	23.51	30
		7	23.50	30
2452	9	0	15.63	30
		1	15.72	30
		2	15.62	30
		3	16.23	30
		4	15.47	30
		5	15.56	30
		6	13.52	30
		7	13.49	30

▣ TEST RESULTS-_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11n_HT40 MIMO Mode)

802.11n_HT40 Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2422	3	0	23.41	30
		1	23.34	30
		2	23.31	30
		3	23.81	30
		4	23.23	30
		5	23.33	30
		6	21.47	30
		7	21.50	30
2437	6	0	27.03	30
		1	26.97	30
		2	26.97	30
		3	27.48	30
		4	27.11	30
		5	27.17	30
		6	25.36	30
		7	25.39	30
2452	9	0	18.19	30
		1	18.21	30
		2	18.16	30
		3	18.75	30
		4	18.06	30
		5	18.15	30
		6	16.10	30
		7	16.10	30

▣ **TEST RESULTS-Average**

▣ **TEST RESULTS_Ant.0**

Conducted Output Power Measurements (802.11b Mode)

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1 Mbps	16.39	-	16.39	30
		2 Mbps	16.52	-	16.52	30
		5.5 Mbps	16.85	-	16.85	30
		11 Mbps	16.61	-	16.61	30
2437	6	1 Mbps	16.81	-	16.81	30
		2 Mbps	16.83	-	16.83	30
		5.5 Mbps	16.97	-	16.97	30
		11 Mbps	16.92	-	16.92	30
2462	11	1 Mbps	17.10	-	17.10	30
		2 Mbps	17.52	-	17.52	30
		5.5 Mbps	17.63	-	17.63	30
		11 Mbps	17.54	-	17.54	30
2467	12	1 Mbps	12.89	-	12.89	30
		2 Mbps	12.75	-	12.75	30
		5.5 Mbps	12.81	-	12.81	30
		11 Mbps	12.81	-	12.81	30
2472	13	1 Mbps	10.88	-	10.88	30
		2 Mbps	10.82	-	10.82	30
		5.5 Mbps	10.84	-	10.84	30
		11 Mbps	10.82	-	10.82	30

▣ TEST RESULTS_Ant.1

Conducted Output Power Measurements (802.11b Mode)

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1 Mbps	16.99	-	16.99	30
		2 Mbps	17.01	-	17.01	30
		5.5 Mbps	17.07	-	17.07	30
		11 Mbps	17.01	-	17.01	30
2437	6	1 Mbps	16.34	-	16.34	30
		2 Mbps	16.67	-	16.67	30
		5.5 Mbps	16.72	-	16.72	30
		11 Mbps	16.39	-	16.39	30
2462	11	1 Mbps	17.58	-	17.58	30
		2 Mbps	17.78	-	17.78	30
		5.5 Mbps	17.66	-	17.66	30
		11 Mbps	17.62	-	17.62	30
2467	12	1 Mbps	15.86	-	15.86	30
		2 Mbps	15.86	-	15.86	30
		5.5 Mbps	15.93	-	15.93	30
		11 Mbps	15.91	-	15.91	30
2472	13	1 Mbps	14.19	-	14.19	30
		2 Mbps	14.21	-	14.21	30
		5.5 Mbps	14.21	-	14.21	30
		11 Mbps	14.20	-	14.20	30

▣ TEST RESULTS-_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11b MIMO Mode)

802.11b Mode		Rate (Mbps)	Sum Power of Ant.0 & 1 (dBm)	Limit (dBm)
Frequency [MHz]	Channel No.			
2412	1	1 Mbps	19.71	30
		2 Mbps	19.78	30
		5.5 Mbps	19.97	30
		11 Mbps	19.82	30
2437	6	1 Mbps	19.59	30
		2 Mbps	19.76	30
		5.5 Mbps	19.86	30
		11 Mbps	19.67	30
2462	11	1 Mbps	20.35	30
		2 Mbps	20.66	30
		5.5 Mbps	20.66	30
		11 Mbps	20.59	30
2467	12	1 Mbps	17.51	30
		2 Mbps	17.45	30
		5.5 Mbps	17.52	30
		11 Mbps	17.51	30
2472	13	1 Mbps	15.70	30
		2 Mbps	15.69	30
		5.5 Mbps	15.70	30
		11 Mbps	15.68	30

▣ TEST RESULTS_Ant.0

Conducted Output Power Measurements (802.11g SISO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6 Mbps	14.07	-	14.07	30
		9 Mbps	14.53	-	14.53	30
		12 Mbps	14.50	-	14.50	30
		18 Mbps	14.47	-	14.47	30
		24 Mbps	14.44	-	14.44	30
		36 Mbps	14.71	-	14.71	30
		48 Mbps	12.51	-	12.51	30
		54 Mbps	12.52	-	12.52	30
2437	6	6 Mbps	16.63	-	16.63	30
		9 Mbps	16.84	-	16.84	30
		12 Mbps	16.85	-	16.85	30
		18 Mbps	16.64	-	16.64	30
		24 Mbps	16.65	-	16.65	30
		36 Mbps	16.69	-	16.69	30
		48 Mbps	14.70	-	14.70	30
		54 Mbps	14.45	-	14.45	30
2462	11	6 Mbps	13.94	-	13.94	30
		9 Mbps	14.18	-	14.18	30
		12 Mbps	14.19	-	14.19	30
		18 Mbps	14.18	-	14.18	30
		24 Mbps	14.18	-	14.18	30
		36 Mbps	14.21	-	14.21	30
		48 Mbps	12.01	-	12.01	30
		54 Mbps	11.99	-	11.99	30
2467	12	6 Mbps	10.25	-	10.25	30
		9 Mbps	10.28	-	10.28	30
		12 Mbps	10.29	-	10.29	30
		18 Mbps	10.31	-	10.31	30
		24 Mbps	10.33	-	10.33	30
		36 Mbps	9.81	-	9.81	30
		48 Mbps	7.90	-	7.90	30
		54 Mbps	7.92	-	7.92	30

2472	13	6 Mbps	7.39	-	7.39	30
		9 Mbps	7.41	-	7.41	30
		12 Mbps	7.42	-	7.42	30
		18 Mbps	7.41	-	7.41	30
		24 Mbps	7.43	-	7.43	30
		36 Mbps	6.92	-	6.92	30
		48 Mbps	4.89	-	4.89	30
		54 Mbps	4.91	-	4.91	30

▣ TEST RESULTS_Ant.1

Conducted Output Power Measurements (802.11g SISO Mode)

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6 Mbps	14.73	-	14.73	30
		9 Mbps	14.93	-	14.93	30
		12 Mbps	14.94	-	14.94	30
		18 Mbps	14.93	-	14.93	30
		24 Mbps	14.92	-	14.92	30
		36 Mbps	14.85	-	14.85	30
		48 Mbps	12.59	-	12.59	30
		54 Mbps	12.60	-	12.60	30
2437	6	6 Mbps	16.21	-	16.21	30
		9 Mbps	16.45	-	16.45	30
		12 Mbps	16.49	-	16.49	30
		18 Mbps	16.49	-	16.49	30
		24 Mbps	16.52	-	16.52	30
		36 Mbps	16.52	-	16.52	30
		48 Mbps	14.36	-	14.36	30
		54 Mbps	14.39	-	14.39	30
2462	11	6 Mbps	14.27	-	14.27	30
		9 Mbps	14.49	-	14.49	30
		12 Mbps	14.48	-	14.48	30
		18 Mbps	14.49	-	14.49	30
		24 Mbps	14.43	-	14.43	30
		36 Mbps	14.60	-	14.60	30
		48 Mbps	12.39	-	12.39	30
		54 Mbps	12.14	-	12.14	30
2467	12	6 Mbps	10.87	-	10.87	30
		9 Mbps	10.94	-	10.94	30
		12 Mbps	10.97	-	10.97	30
		18 Mbps	10.95	-	10.95	30
		24 Mbps	10.94	-	10.94	30
		36 Mbps	10.31	-	10.31	30
		48 Mbps	8.31	-	8.31	30
		54 Mbps	8.34	-	8.34	30

2472	13	6 Mbps	7.93	-	7.93	30
		9 Mbps	7.93	-	7.93	30
		12 Mbps	7.93	-	7.93	30
		18 Mbps	7.94	-	7.94	30
		24 Mbps	7.96	-	7.96	30
		36 Mbps	7.22	-	7.22	30
		48 Mbps	5.17	-	5.17	30
		54 Mbps	5.17	-	5.17	30

▣ TEST RESULTS_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11g MIMO Mode)

802.11g Mode		Rate (Mbps)	Sum Power of Ant.0 & 1 (dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	17.42	30
		9 Mbps	17.74	30
		12 Mbps	17.73	30
		18 Mbps	17.71	30
		24 Mbps	17.69	30
		36 Mbps	17.79	30
		48 Mbps	15.56	30
		54 Mbps	15.57	30
2437	6	6 Mbps	19.43	30
		9 Mbps	19.66	30
		12 Mbps	19.68	30
		18 Mbps	19.58	30
		24 Mbps	19.60	30
		36 Mbps	19.62	30
		48 Mbps	17.54	30
		54 Mbps	17.43	30
2462	11	6 Mbps	17.12	30
		9 Mbps	17.35	30
		12 Mbps	17.35	30
		18 Mbps	17.35	30
		24 Mbps	17.32	30
		36 Mbps	17.42	30
		48 Mbps	15.21	30
		54 Mbps	15.08	30
2467	12	6 Mbps	13.58	30
		9 Mbps	13.63	30
		12 Mbps	13.65	30
		18 Mbps	13.65	30
		24 Mbps	13.65	30
		36 Mbps	13.07	30
		48 Mbps	11.12	30
		54 Mbps	11.14	30

2472	13	6 Mbps	10.67	30
		9 Mbps	10.68	30
		12 Mbps	10.69	30
		18 Mbps	10.69	30
		24 Mbps	10.71	30
		36 Mbps	10.08	30
		48 Mbps	8.04	30
		54 Mbps	8.05	30

▣ TEST RESULTS_Ant.0

Conducted Output Power Measurements (802.11n_HT20 SISO Mode)

802.11n_HT20 Mode		MCS Index	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	0	13.36	-	13.36	30
		1	13.33	-	13.33	30
		2	13.36	-	13.36	30
		3	13.33	-	13.33	30
		4	13.36	-	13.36	30
		5	13.43	-	13.43	30
		6	11.20	-	11.20	30
		7	11.19	-	11.19	30
2437	6	0	16.34	-	16.34	30
		1	16.56	-	16.56	30
		2	16.56	-	16.56	30
		3	16.57	-	16.57	30
		4	16.45	-	16.45	30
		5	16.42	-	16.42	30
		6	14.40	-	14.40	30
		7	14.43	-	14.43	30
2462	11	0	13.48	-	13.48	30
		1	13.52	-	13.52	30
		2	13.52	-	13.52	30
		3	13.52	-	13.52	30
		4	13.55	-	13.55	30
		5	13.33	-	13.33	30
		6	11.38	-	11.38	30
		7	11.41	-	11.41	30
2467	12	0	9.19	-	9.19	30
		1	9.21	-	9.21	30
		2	9.21	-	9.21	30
		3	9.24	-	9.24	30
		4	8.72	-	8.72	30
		5	8.75	-	8.75	30
		6	6.83	-	6.83	30
		7	6.83	-	6.83	30

2472	13	0	7.31	-	7.31	30
		1	7.31	-	7.31	30
		2	7.32	-	7.32	30
		3	7.31	-	7.31	30
		4	6.81	-	6.81	30
		5	6.80	-	6.80	30
		6	4.74	-	4.74	30
		7	4.75	-	4.75	30

▣ TEST RESULTS_Ant.1

Conducted Output Power Measurements (802.11n_HT20 SISO Mode)

802.11n_HT20 Mode		MCS Index	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	0	13.65	-	13.65	30
		1	13.69	-	13.69	30
		2	13.69	-	13.69	30
		3	13.69	-	13.69	30
		4	13.65	-	13.65	30
		5	13.70	-	13.70	30
		6	11.60	-	11.60	30
		7	11.59	-	11.59	30
2437	6	0	16.19	-	16.19	30
		1	16.43	-	16.43	30
		2	16.43	-	16.43	30
		3	16.42	-	16.42	30
		4	16.37	-	16.37	30
		5	16.37	-	16.37	30
		6	14.25	-	14.25	30
		7	14.27	-	14.27	30
2462	11	0	13.90	-	13.90	30
		1	13.93	-	13.93	30
		2	13.93	-	13.93	30
		3	13.96	-	13.96	30
		4	13.81	-	13.81	30
		5	13.84	-	13.84	30
		6	11.59	-	11.59	30
		7	11.59	-	11.59	30
2467	12	0	9.90	-	9.90	30
		1	9.91	-	9.91	30
		2	9.92	-	9.92	30
		3	9.90	-	9.90	30
		4	9.20	-	9.20	30
		5	9.21	-	9.21	30
		6	7.19	-	7.19	30
		7	7.19	-	7.19	30

2472	13	0	7.94	-	7.94	30
		1	7.94	-	7.94	30
		2	7.92	-	7.92	30
		3	7.91	-	7.91	30
		4	7.17	-	7.17	30
		5	7.17	-	7.17	30
		6	5.11	-	5.11	30
		7	5.09	-	5.09	30

▣ TEST RESULTS_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11n_HT20 MIMO Mode)

802.11n_HT20 Mode		MCS Index	Sum Power of Ant.0 & 1 (dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	16.52	30
		1	16.52	30
		2	16.54	30
		3	16.52	30
		4	16.52	30
		5	16.58	30
		6	14.41	30
		7	14.40	30
2437	6	0	19.28	30
		1	19.51	30
		2	19.51	30
		3	19.51	30
		4	19.42	30
		5	19.41	30
		6	17.34	30
		7	17.36	30
2462	11	0	16.70	30
		1	16.74	30
		2	16.74	30
		3	16.75	30
		4	16.69	30
		5	16.60	30
		6	14.50	30
		7	14.51	30
2467	12	0	12.56	30
		1	12.58	30
		2	12.58	30
		3	12.59	30
		4	11.97	30
		5	11.99	30
		6	10.02	30
		7	10.02	30

2472	13	0	10.64	30
		1	10.64	30
		2	10.64	30
		3	10.63	30
		4	10.00	30
		5	10.00	30
		6	7.94	30
		7	7.93	30

▣ TEST RESULTS_Ant.0

Conducted Output Power Measurements (802.11n_HT40 SISO Mode)

802.11n_HT40 Mode		MCS Index	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2422	3	0	11.65	-	11.65	30
		1	11.51	-	11.51	30
		2	11.51	-	11.51	30
		3	11.52	-	11.52	30
		4	10.97	-	10.97	30
		5	10.99	-	10.99	30
		6	8.93	-	8.93	30
		7	8.93	-	8.93	30
2437	6	0	14.96	-	14.96	30
		1	14.99	-	14.99	30
		2	14.99	-	14.99	30
		3	15.04	-	15.04	30
		4	14.59	-	14.59	30
		5	14.63	-	14.63	30
		6	12.69	-	12.69	30
		7	12.71	-	12.71	30
2452	9	0	6.71	-	6.71	30
		1	6.71	-	6.71	30
		2	6.72	-	6.72	30
		3	6.72	-	6.72	30
		4	6.14	-	6.14	30
		5	6.14	-	6.14	30
		6	4.06	-	4.06	30
		7	4.07	-	4.07	30

▣ TEST RESULTS_Ant.1

Conducted Output Power Measurements (802.11n_HT40 SISO Mode)

802.11n_HT40 Mode		MCS Index	Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency [MHz]	Channel No.					
2422	3	0	13.10	-	13.10	30
		1	13.07	-	13.07	30
		2	13.09	-	13.09	30
		3	13.11	-	13.11	30
		4	12.44	-	12.44	30
		5	12.45	-	12.45	30
		6	10.66	-	10.66	30
		7	10.69	-	10.69	30
2437	6	0	15.83	-	15.83	30
		1	15.94	-	15.94	30
		2	15.92	-	15.92	30
		3	15.96	-	15.96	30
		4	15.37	-	15.37	30
		5	15.36	-	15.36	30
		6	13.42	-	13.42	30
		7	13.38	-	13.38	30
2452	9	0	7.69	-	7.69	30
		1	7.70	-	7.70	30
		2	7.68	-	7.68	30
		3	7.71	-	7.71	30
		4	6.94	-	6.94	30
		5	6.93	-	6.93	30
		6	4.93	-	4.93	30
		7	4.92	-	4.92	30

▣ TEST RESULTS_Sum Data of Ant.0 and Ant.1

Conducted Output Power Measurements (802.11n_HT40 MIMO Mode)

802.11n_HT40 Mode		MCS Index	Sum Power of Ant.0 & 1 (dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2422	3	0	15.42	30
		1	15.34	30
		2	15.35	30
		3	15.36	30
		4	14.75	30
		5	14.76	30
		6	12.85	30
		7	12.86	30
2437	6	0	18.42	30
		1	18.49	30
		2	18.48	30
		3	18.52	30
		4	18.00	30
		5	18.01	30
		6	16.07	30
		7	16.06	30
2452	9	0	10.22	30
		1	10.23	30
		2	10.22	30
		3	10.24	30
		4	9.56	30
		5	9.55	30
		6	7.52	30
		7	7.52	30

9.5 POWER SPECTRAL DENSITY (802.11b/g/n)

Test Requirements and limit, §15.247(e) / RSS-247(Issue 1) Section 5.2.

The peak power spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

▣ Limit

Operating Mode	Band	Mode	Ant. Port	Ant. Gain (dBi)	Limit (dBm)
SISO	2.4 GHz	802.11b/g/n	0	1.37	8.0
			1	1.49	8.0
MIMO(2 TX)		802.11b/g/n	0 & 1	4.44	8.0

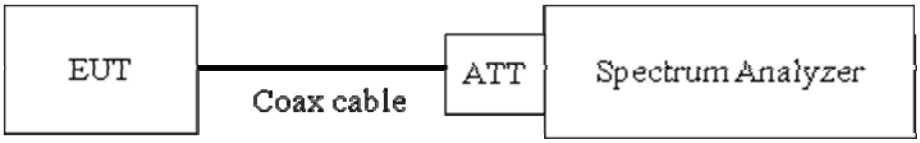
Note : 1. If antenna gains are not equal,

Directional gain = $10*\log[(10^{G1/20} + 10^{G2/20}+\ldots+10^{GN/20})^2/N]$ dBi (802.11g/n)

(according to KDB662911 D01 v02r01)

2. Limit is calculated by antenna gain.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

We tested according to Procedure 10.2 in KDB 558074 v04

The spectrum analyzer is set to :

Set analyzer center frequency to DTS channel center frequency.

Span = 1.5 times the DTS channel bandwidth.

RBW = 3 kHz ≤ RBW ≤ 100 kHz.

VBW ≥ 3 x RBW.

Sweep = auto couple

Detector = peak

Trace Mode = max hold

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

▣ SAMPLE CALCULATION

PSD = Reading Value + ATT loss + Cable loss(1 ea)

Note :

1. Spectrum reading values are not plot data. The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 20.7 dB is offset for 2.4 GHz Band.
   Actual value of loss for the attenuator and cable combination is below table.

Band	Frequency(MHz)	Loss(dB)
2.4 GHz	2412	20.7
	2437	20.7
	2462	20.7

(Actual value of loss for the attenuator and cable combination)

4. MIMO output power results are calculated by each antenna output power on MIMO operating mode.

▣ TEST RESULTS_Ant.0

Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Result		
			PSD (dBm)	Limit (dBm)	Pass/Fail
2412	1	802.11b	-5.861	8	Pass
2437	6		-5.830	8	Pass
2462	11		-4.635	8	Pass
2467	12		-9.565	8	Pass
2472	13		-11.912	8	Pass
2412	1	802.11g (SISO)	-8.657	8	Pass
2437	6		-7.487	8	Pass
2462	11		-9.449	8	Pass
2467	12		-13.835	8	Pass
2472	13		-16.497	8	Pass
2412	1	802.11n HT20 (SISO)	-11.434	8	Pass
2437	6		-7.993	8	Pass
2462	11		-10.882	8	Pass
2467	12		-14.198	8	Pass
2472	13		-17.130	8	Pass
2422	3	802.11n HT40 (SISO)	-15.696	8	Pass
2437	6		-12.461	8	Pass
2452	9		-21.207	8	Pass

▣ TEST RESULTS_Ant.1

Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Result		
			PSD (dBm)	Limit (dBm)	Pass/Fail
2412	1	802.11b	-4.923	8	Pass
2437	6		-4.969	8	Pass
2462	11		-5.186	8	Pass
2467	12		-5.325	8	Pass
2472	13		-7.468	8	Pass
2412	1	802.11g (SISO)	-9.969	8	Pass
2437	6		-8.415	8	Pass
2462	11		-8.726	8	Pass
2467	12		-13.167	8	Pass
2472	13		-15.026	8	Pass
2412	1	802.11n HT20 (SISO)	-8.833	8	Pass
2437	6		-8.132	8	Pass
2462	11		-10.935	8	Pass
2467	12		-14.625	8	Pass
2472	13		-16.534	8	Pass
2422	3	802.11n HT40 (SISO)	-13.253	8	Pass
2437	6		-11.795	8	Pass
2452	9		-20.258	8	Pass

▣ TEST RESULTS_Sum Data of Ant.0 and Ant.1

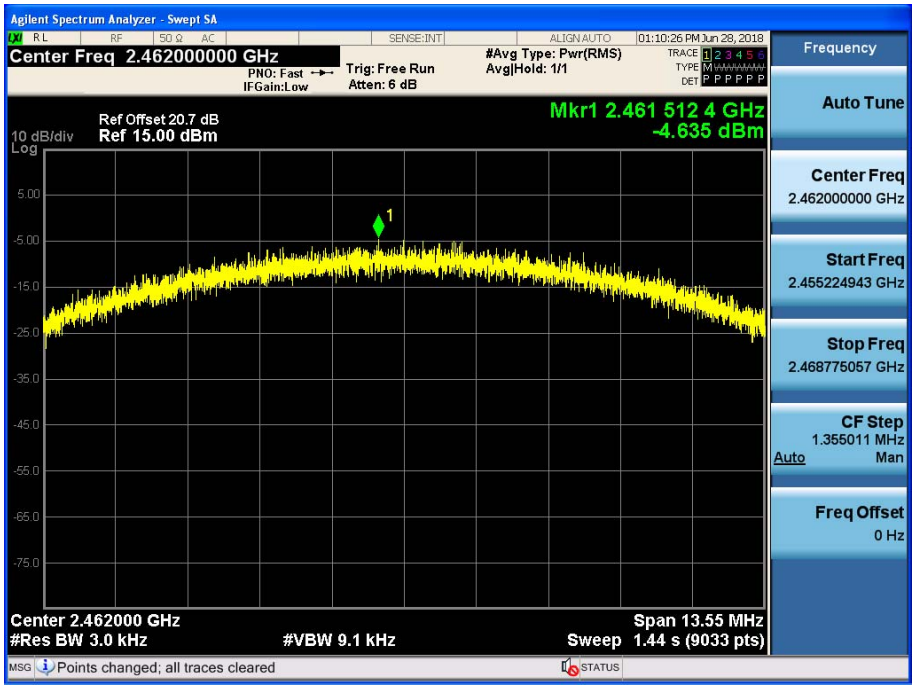
Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Result		
			PSD (dBm)	Limit (dBm)	Pass/Fail
2412	1	802.11b (MIMO)	-2.37	8	Pass
2437	6		-2.38		Pass
2462	11		-1.90		Pass
2467	12		-4.18		Pass
2472	13		-6.40		Pass
2412	1	802.11g (MIMO)	-6.28	8	Pass
2437	6		-4.93		Pass
2462	11		-6.07		Pass
2467	12		-10.48		Pass
2472	13		-12.72		Pass
2412	1	802.11n HT20 (MIMO)	-7.03	8	Pass
2437	6		-5.05		Pass
2462	11		-7.90		Pass
2467	12		-11.40		Pass
2472	13		-13.82		Pass
2422	3	802.11n HT40 (MIMO)	-11.38	8	Pass
2437	6		-9.11		Pass
2452	9		-17.71		Pass

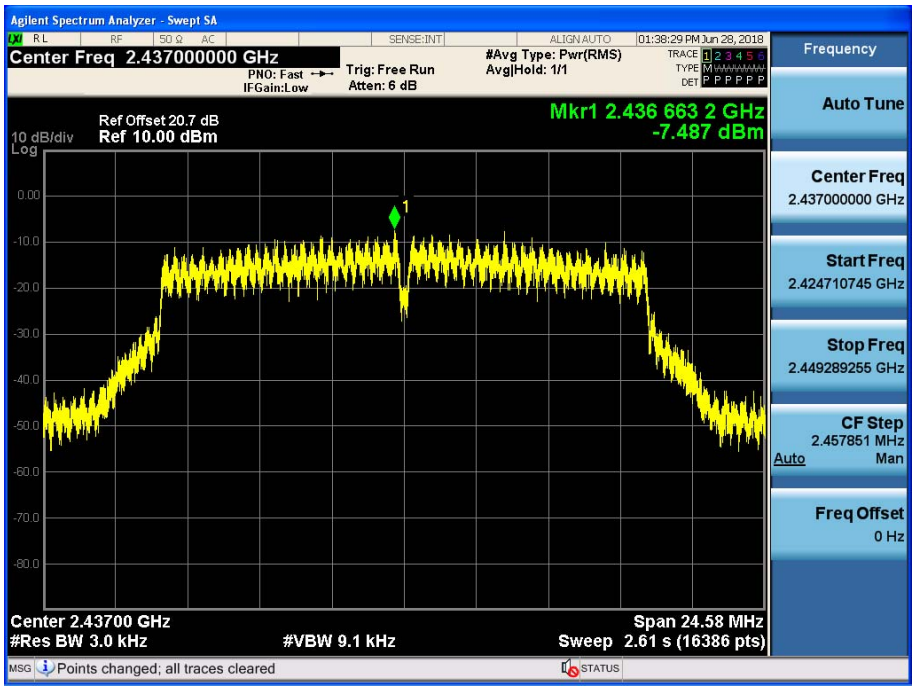
Note : In order to simplify the report, attached plots were only the highest PSD channel.

▣ RESULT PLOTS_Ant.0

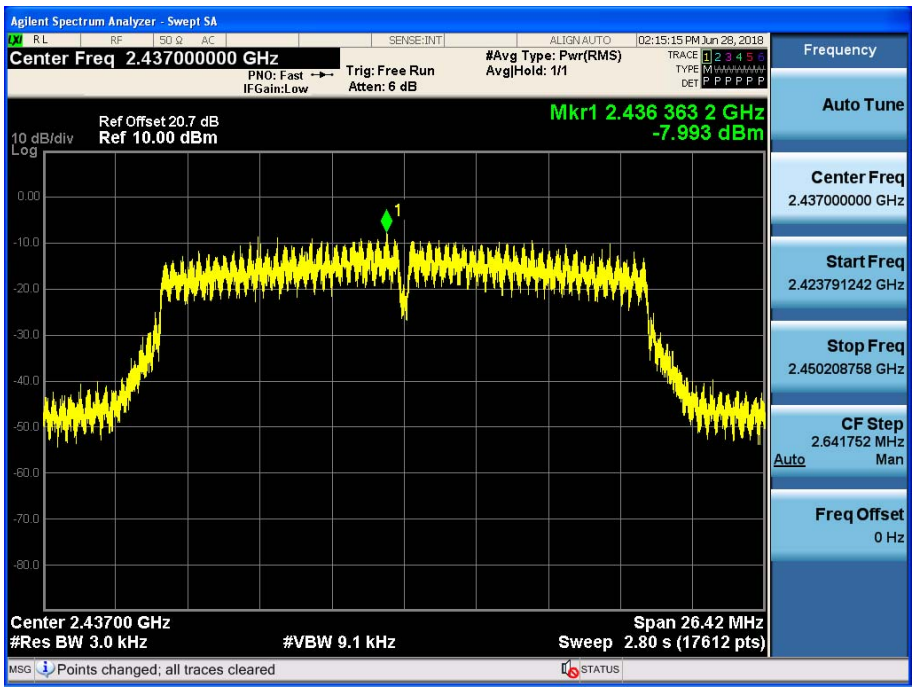
Power Spectral Density (802.11b-CH 11)



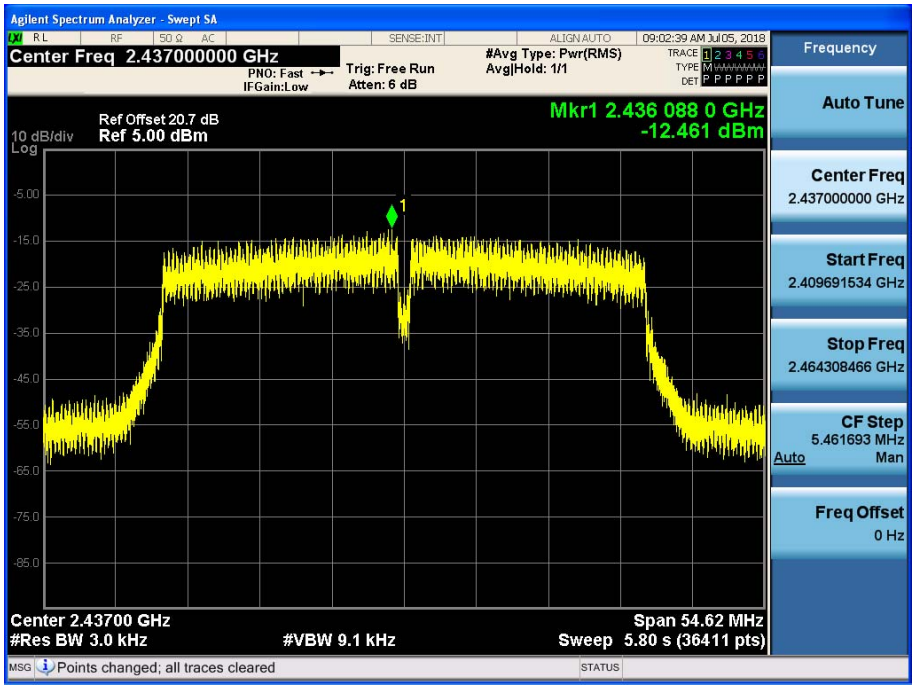
Power Spectral Density (802.11g-CH 6)



Power Spectral Density (802.11n_HT20 -CH 6)

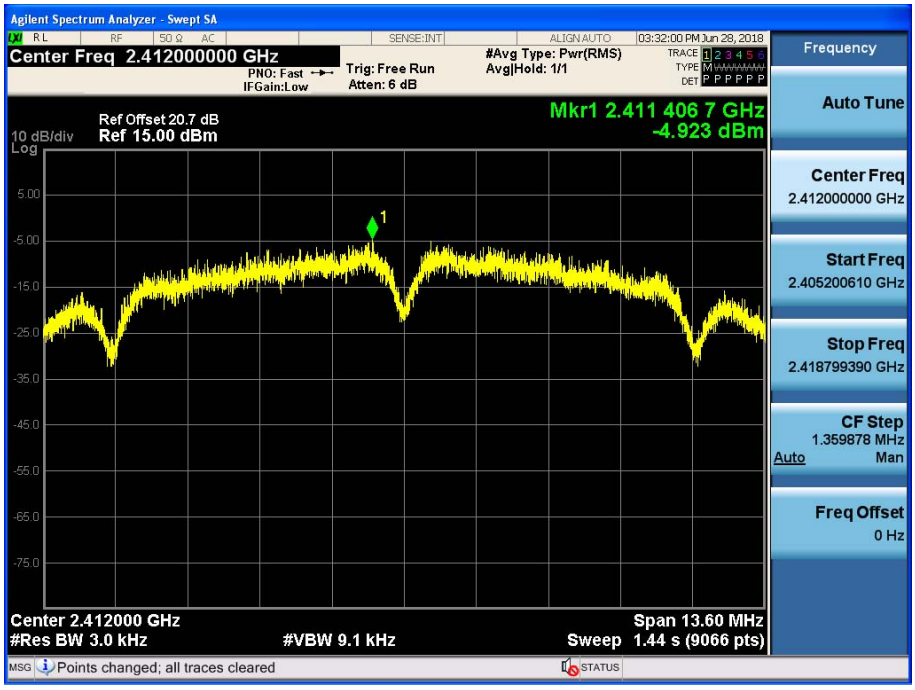


Power Spectral Density (802.11n_HT40 -CH 6)

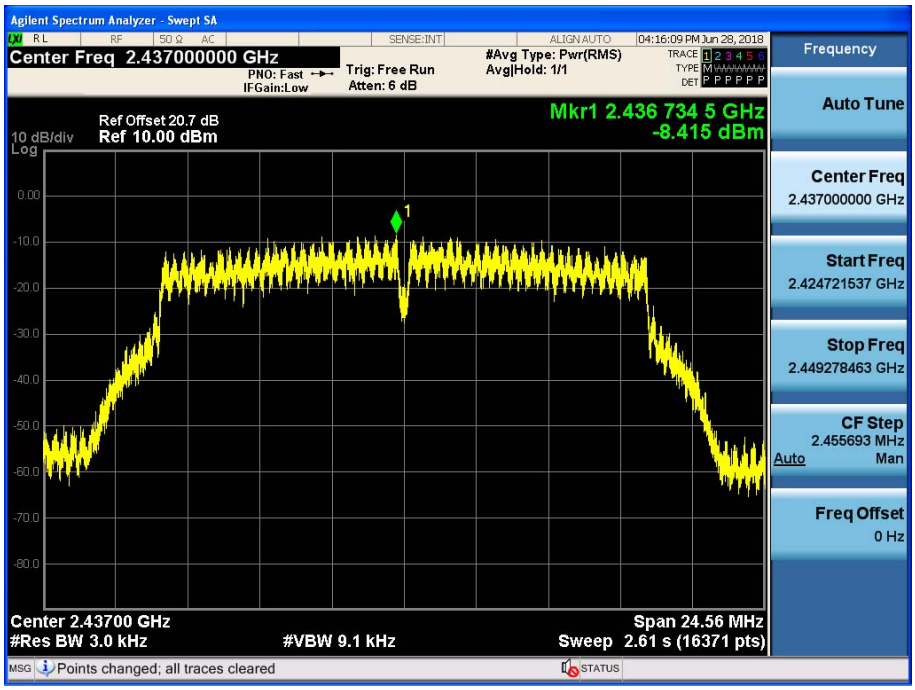


▣ RESULT PLOTS_Ant.1

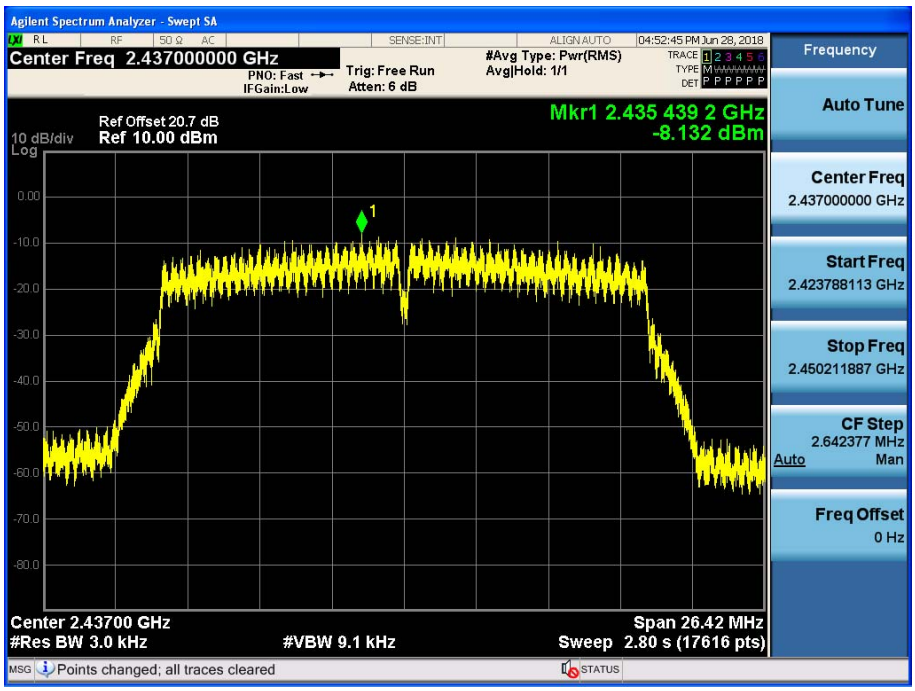
Power Spectral Density (802.11b-CH 1)



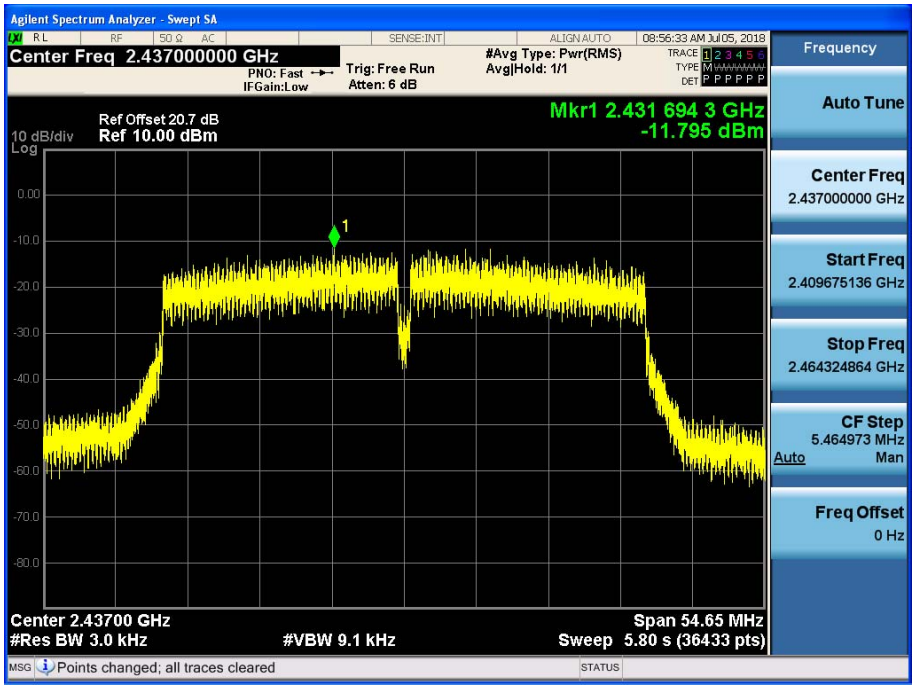
Power Spectral Density (802.11g-CH 6)



Power Spectral Density (802.11n_HT20 -CH 6)



Power Spectral Density (802.11n_HT40 -CH 6)



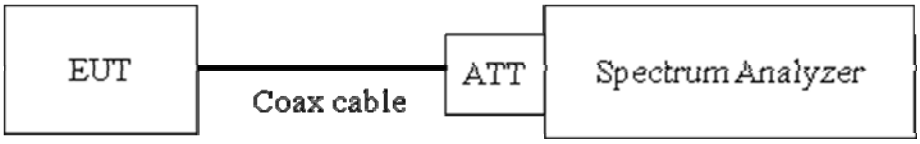
9.6 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

Test Requirements and limit, §15.247(d) / RSS-247(Issue 1) Section 5.5.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) / RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limit : 20 dBc

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. (Procedure 11.0 in KDB 558074 v04)

RBW = 100 kHz

VBW ≥ 3 x RBW

Set span to encompass the spectrum to be examined

Detector = Peak

Trace Mode = max hold

Sweep time = auto couple

Ensure that the number of measurement points ≥ Span/RBW

Allow trace to fully stabilize.

Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 10th harmonic range with the transmitter set to the lowest, middle, and highest channels.

Note :

1. The band edge results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 20.7 dB is offset for 2.4 GHz Band. Actual value of loss for the attenuator and cable combination is below table.

Band	Frequency(MHz)	Loss(dB)
2.4 GHz	2412	20.7
	2437	20.7
	2462	20.7

(Actual value of loss for the attenuator and cable combination)

4. In case of conducted spurious emissions test(not band edge), please check factors blow table.
5. In order to simplify the report, attached plots were only the worst case. (where, worst case is SISO mode and highest power channel)

▣ FACTORS FOR FREQUENCY

Freq(MHz)	Factor(dB)
30	21.30
100	19.83
200	20.19
300	20.13
400	20.23
500	20.25
600	20.32
700	20.35
800	20.35
900	20.34
1000	20.39
2000	20.64
2400*	20.65
2500*	20.70
3000	20.79
4000	20.89
5000	21.07
6000	21.06
7000	21.35
8000	21.32
9000	21.48
10000	21.56
11000	21.56
12000	21.68
13000	21.83
14000	21.90

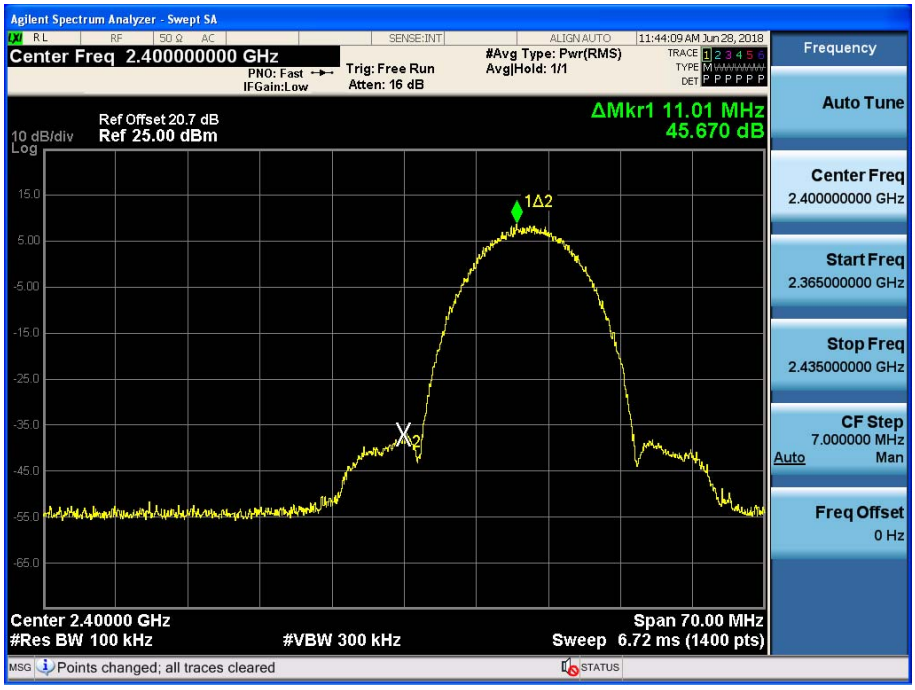
15000	21.98
16000	22.04
17000	22.02
18000	22.08
19000	22.07
20000	22.14
21000	22.17
22000	22.31
23000	22.60
24000	22.34
25000	22.53

Note : 1. '*' is fundamental frequency range.

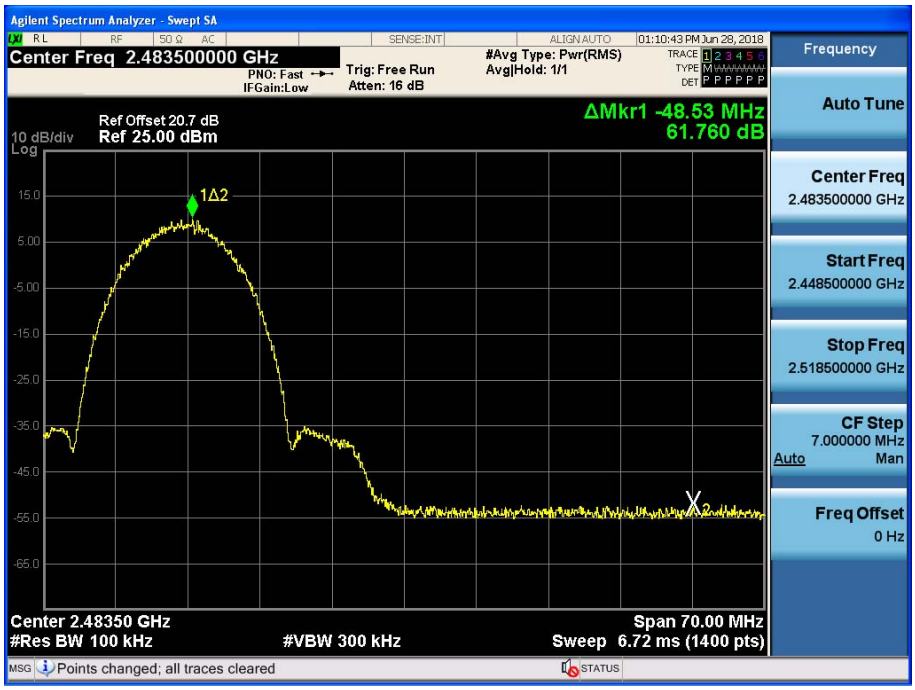
2. Factor = Cable loss + Attenuator loss

▣ RESULT PLOTS_Ant.0

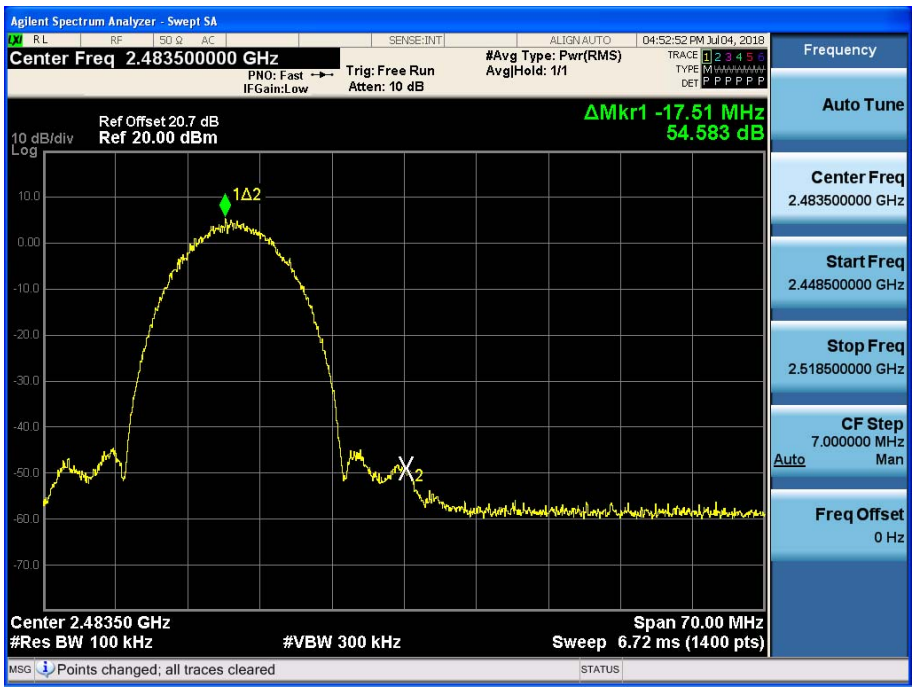
Band Edge (802.11b-CH1)



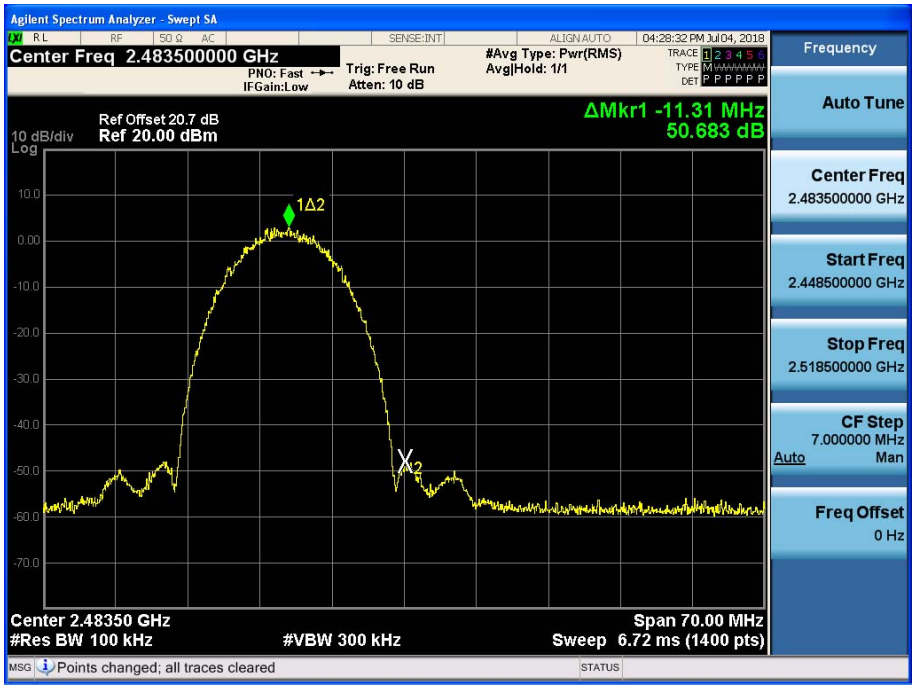
Band Edge (802.11b-CH11)



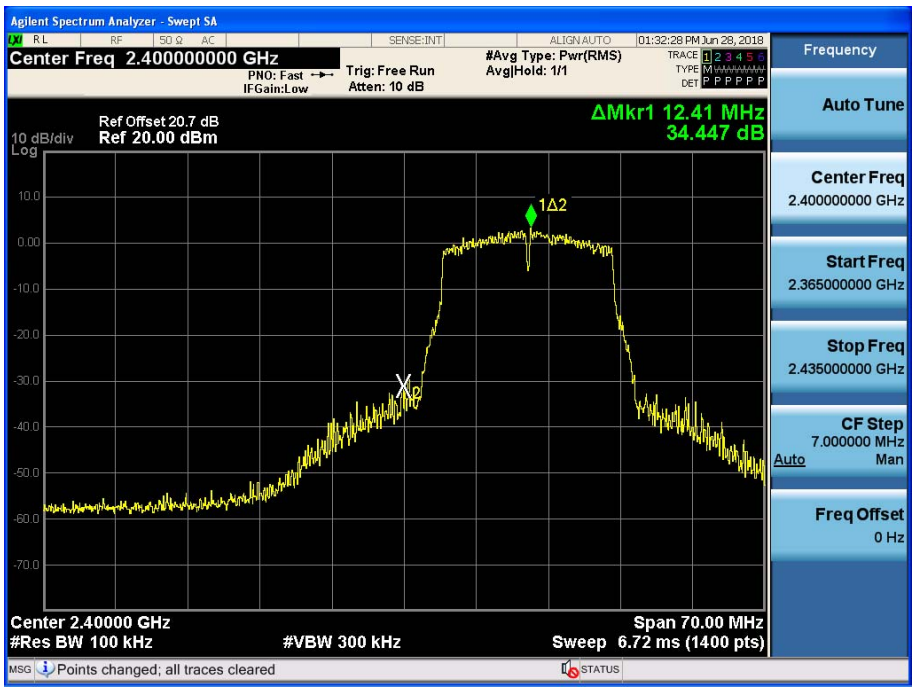
Band Edge (802.11b-CH12)



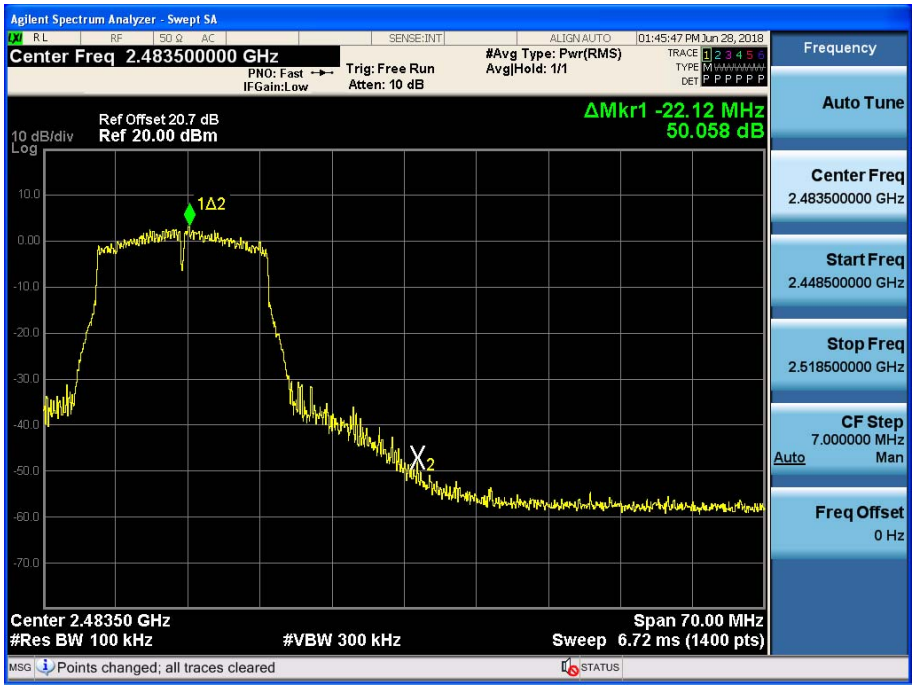
Band Edge (802.11b-CH13)



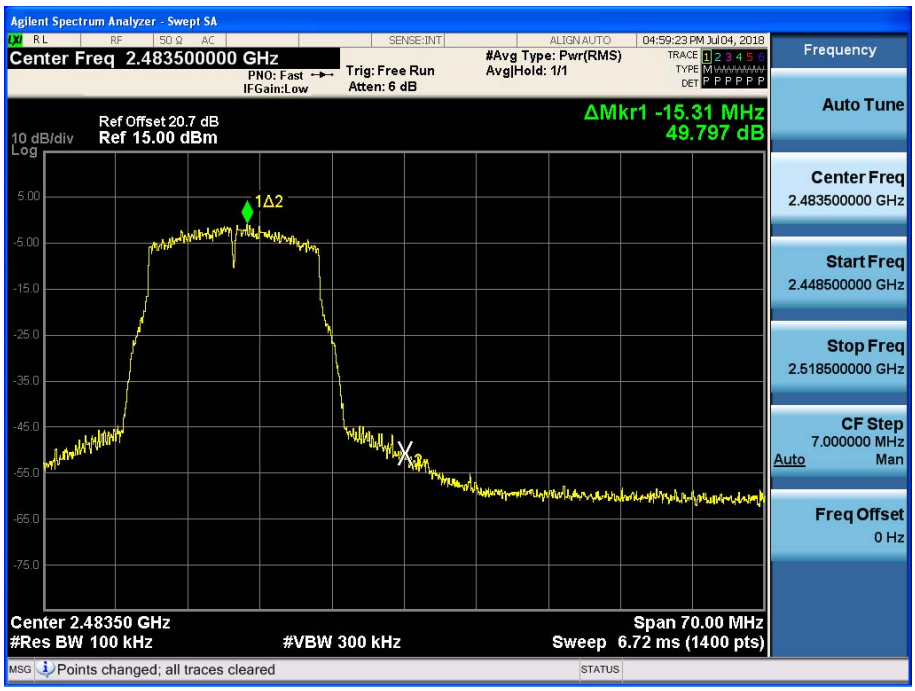
Band Edge (802.11g-CH1)



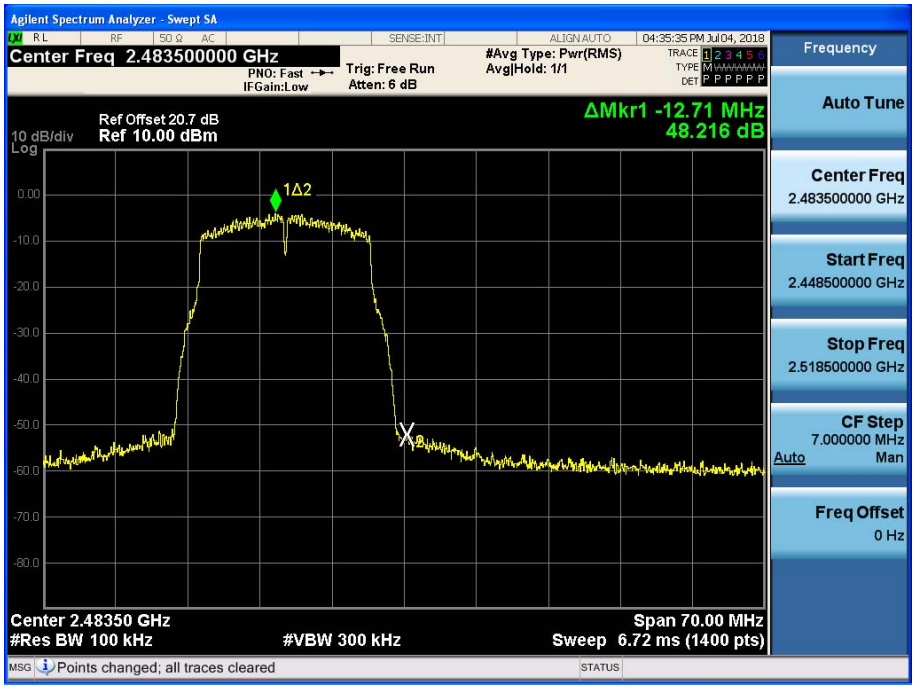
Band Edge (802.11g-CH11)



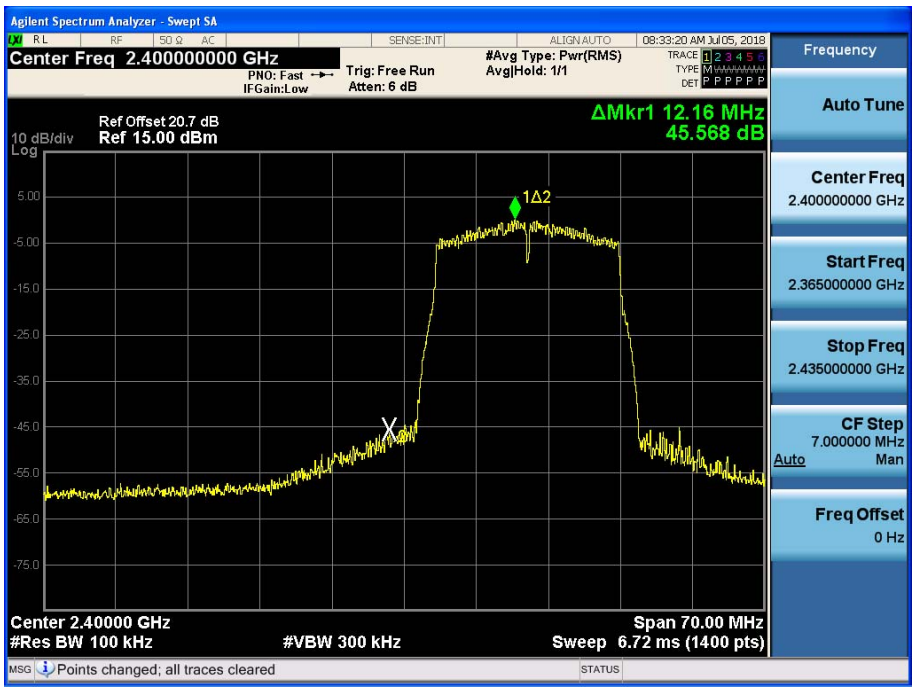
Band Edge (802.11g-CH12)



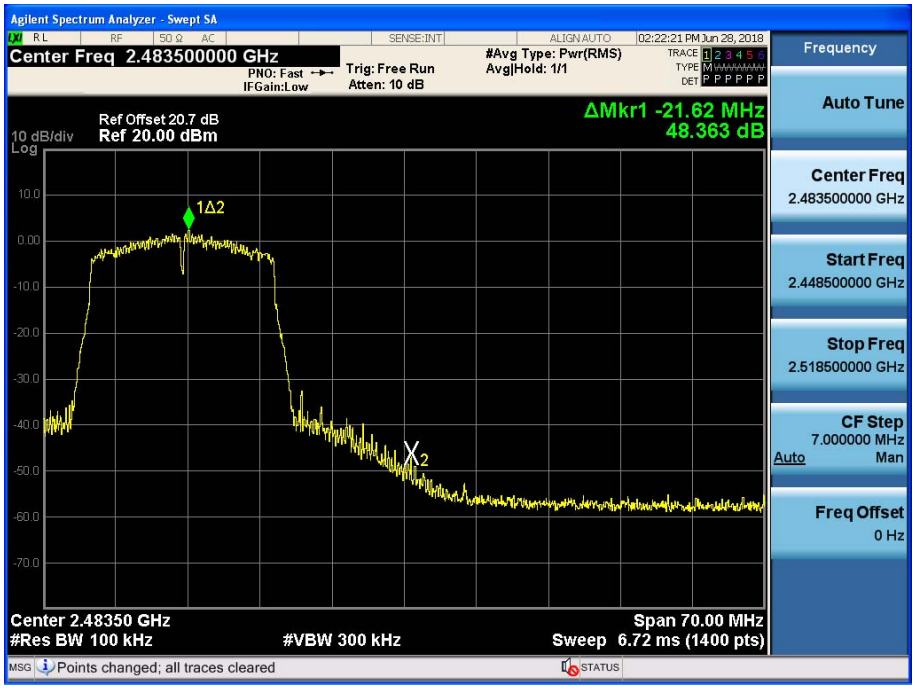
Band Edge (802.11g-CH13)



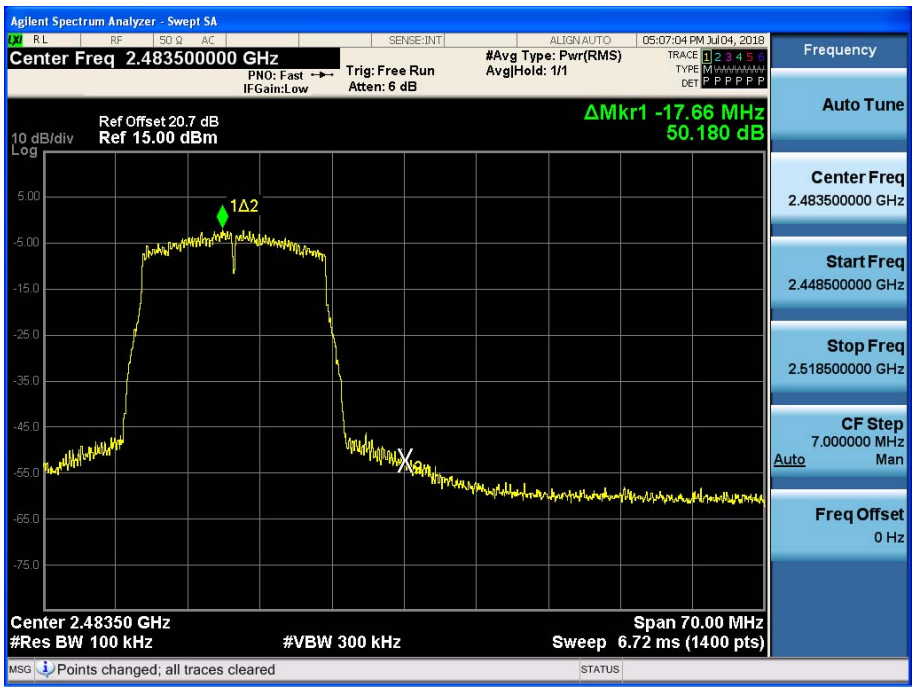
Band Edge (802.11n_HT20-CH1)



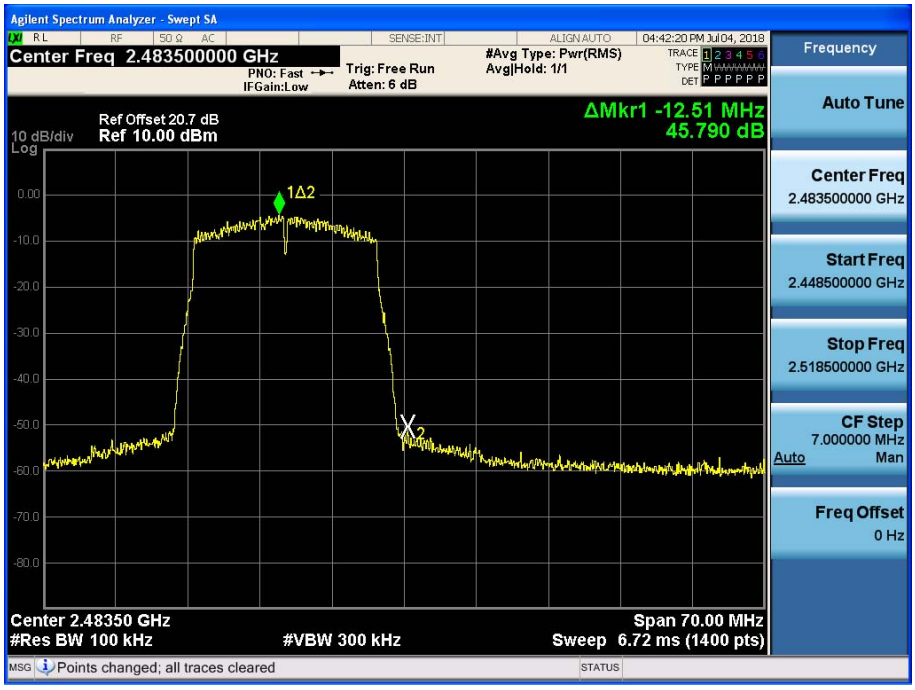
Band Edge (802.11n_HT20-CH11)



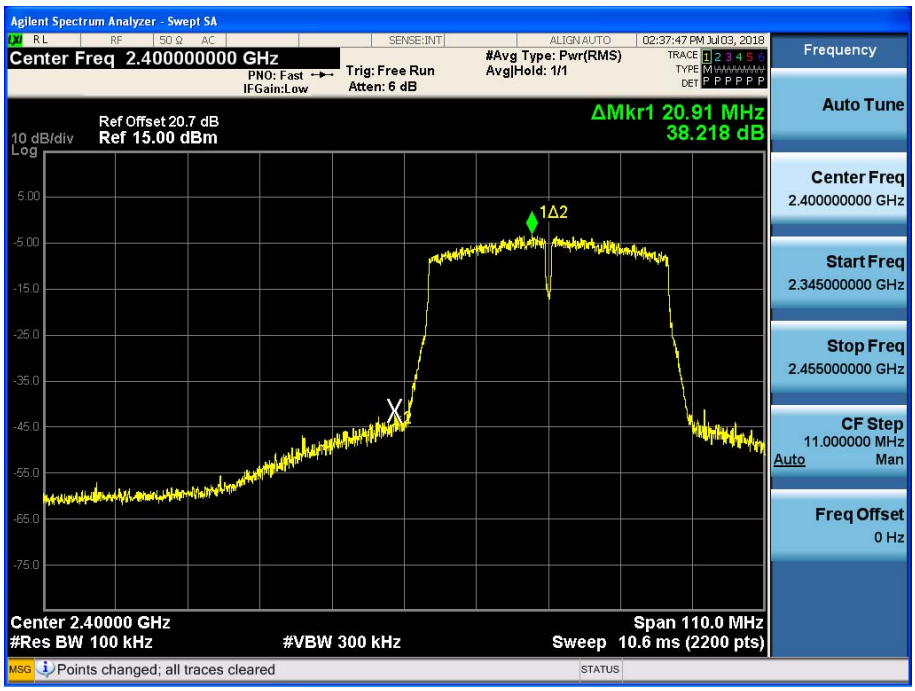
Band Edge (802.11n_HT20-CH12)



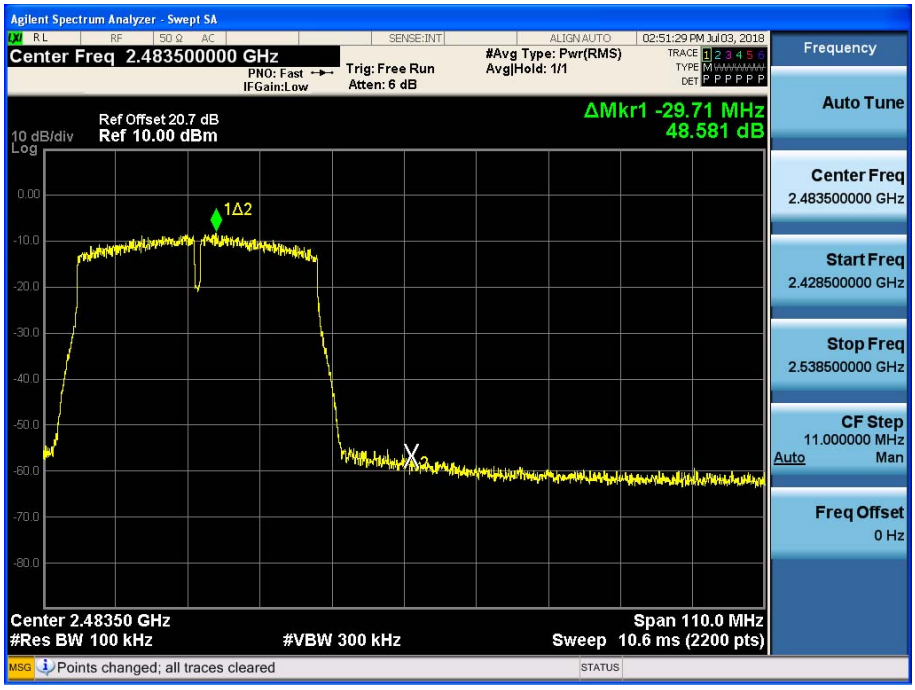
Band Edge (802.11n_HT20-CH13)



Band Edge (802.11n_HT40-CH3)

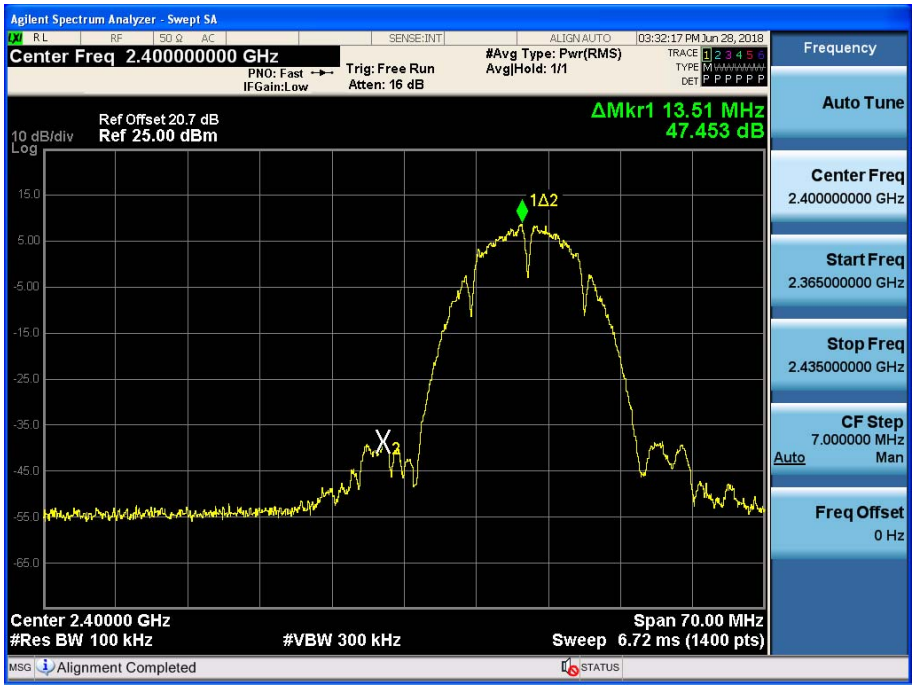


Band Edge (802.11n_HT40-CH9)

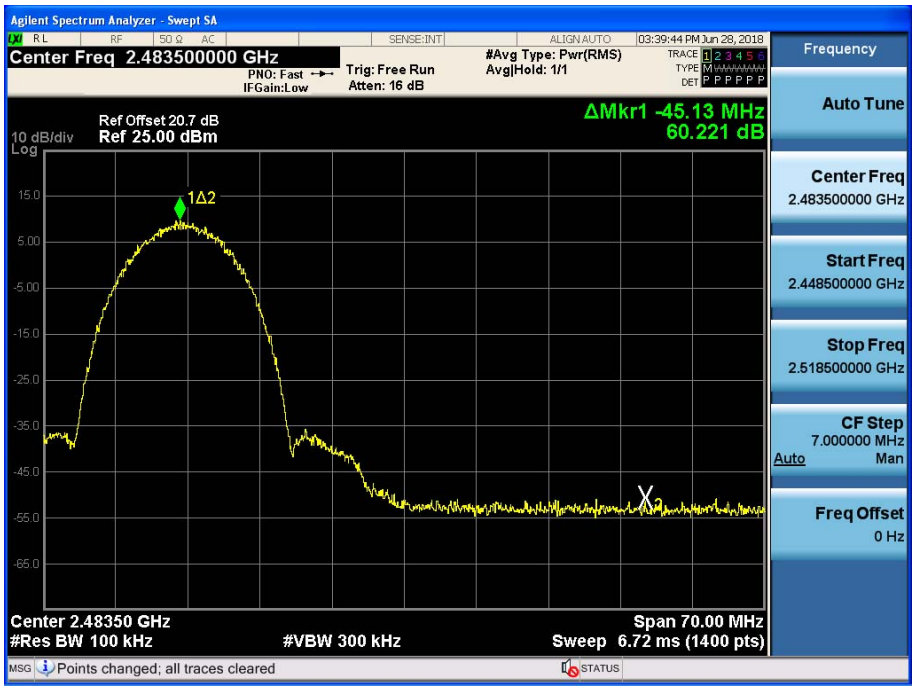


▣ RESULT PLOTS_Ant.1

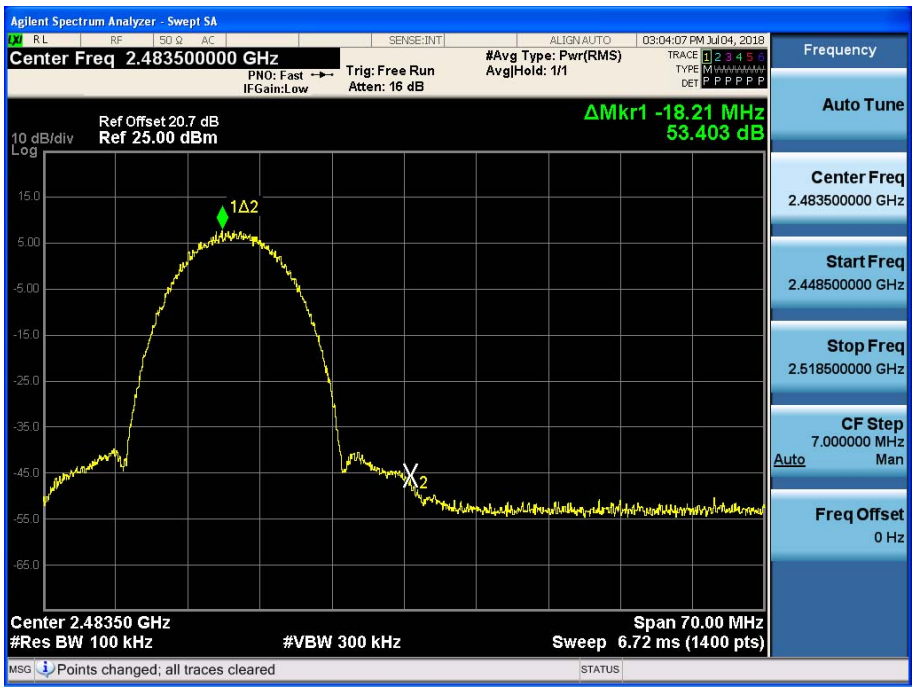
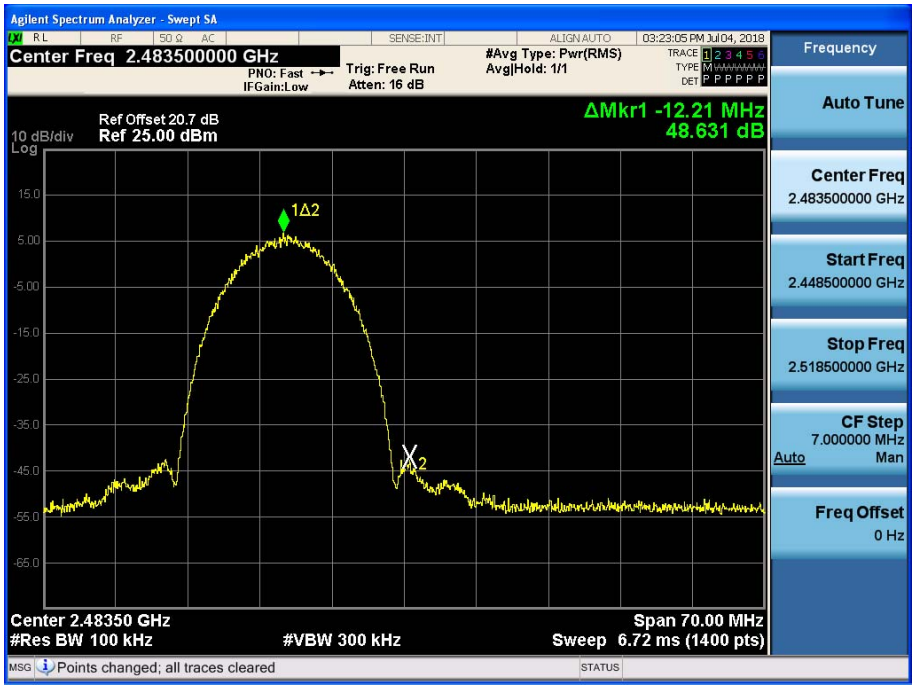
Band Edge (802.11b-CH1)



Band Edge (802.11b-CH11)



Band Edge (802.11b-CH12)



Band Edge (802.11b-CH13)