

RF TEST REPORT

Test item : CAR BLACK BOX
Model No. : Janus V3 HD
Order No. : DEMC1310-03035
Date of receipt : 2013-10-04
Test duration : 2013-12-11 ~ 2013-12-18
Date of issue : 2014-01-23
Use of report : FCC Original Grant

Applicant : Tibetsystem co., Ltd.
6F, Lotte IT Castle II, 550-1, Gasan-dong, Geumcheon-gu, Seoul, Korea

Test laboratory : Digital EMC Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification : FCC Part 15 Subpart C 247
KDB558074 v03r01

Test environment : See appended test report

Test result : ☒ Pass ☐ Fail

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DIGITAL EMC CO., LTD.

Tested by:

A handwritten signature in blue ink, appearing to be "J. Lee".

Engineer
JaeJin Lee

Reviewed by:

A handwritten signature in blue ink, appearing to be "G. Son".

Department Manager
GeunKi Son

Test Report Version

Test Report No.	Date	Description
DRTFCC1401-0078	Jan. 23, 2014	Initial issue

Table of Contents

1. GENERAL INFORMATION	4
2. EUT DESCRIPTION	4
3. SUMMARY OF TESTS	5
4. TEST METHODOLOGY	6
4.1 EUT CONFIGURATION	6
4.2 EUT EXERCISE	6
4.3 GENERAL TEST PROCEDURES	6
4.4 DESCRIPTION OF TEST MODES.....	6
5. INSTRUMENT CALIBRATION	7
6. FACILITIES AND ACCREDITATIONS.....	7
6.1 FACILITIES	7
6.2 EQUIPMENT	7
7. ANTENNA REQUIREMENTS.....	7
8. TEST RESULT	8
8.1 6dB Bandwidth	8
8.2 Maximum Peak Conducted Output Power	25
8.3 Maximum Power Spectral Density	28
8.4 Out of Band Emissions at the Band Edge / Conducted Spurious Emissions.....	45
8.5 Radiated Spurious Emissions.....	94
8.6 Power-line Conducted Emissions	104
8.7 Occupied Bandwidth	105
9. LIST OF TEST EQUIPMENT	106
APPENDIX I	107

1. GENERAL INFORMATION

Applicant : Tibetsystem co., Ltd.
Address : 6F, Lotte IT Castle II, 550-1, Gasan-dong, Geumcheon-gu, Seoul, Korea
FCC ID : 2ABMD-V3-HD
EUT : CAR BLACK BOX
Model : Janus V3 HD
Additional Model(s) : DEFFENDER
Data of Test : 2013-12-11 ~ 2013-12-18
Contact person : Jeon-gyu, Park

2. EUT DESCRIPTION

Product	CAR BLACK BOX
Model Name	Janus V3 HD, DEFFENDER ※ 2 models are same mechanical, electrical and functional. ※ The only difference is the model name, which are changed for marketing purpose.
Power Supply	DC 12~24 V
Frequency Range	2.4GHz Band ▪ 802.11b/g/n(20MHz): 2412 MHz ~ 2462 MHz ▪ 802.11n(40MHz): 2422 MHz ~ 2452 MHz
Max. RF Output Power	2.4GHz Band ▪ 802.11b: 15.94 dBm ▪ 802.11g: 20.52 dBm ▪ 802.11n (HT20): 21.64 dBm ▪ 802.11n (HT40): 21.47 dBm
Modulation Type	802.11b: DSSS/CCK 802.11g/n: OFDM
Antenna Specification	Dipole Antenna (1TX 1RX) ▪ 2.4GHz Band Max. peak gain: 2.4 dBi

Note. All tests were performed at the lowest (12 V) and highest voltage (24 V).

3. SUMMARY OF TESTS

FCC Part Section(s)	RSS Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)					
15.247(a)	RSS-210 [A8.2]	6 dB Bandwidth	> 500 kHz	Conducted	C
15.247(b)	RSS-210 [A8.4]	Transmitter Output Power	< 1Watt		C Note2
15.247(d)	RSS-210 [A8.5]	Out of Band Emissions / Band Edge	20dBc in any 100kHz BW		C
15.247(e)	RSS-210 [A8.2]	Transmitter Power Spectral Density	< 8dBm / 3kHz		C
-	RSS Gen [4.6.1]	Occupied Bandwidth (99%)	RSS-Gen(4.6.1)		NA
15.205 15.209	RSS-210 [A8.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	< FCC 15.209 limits	Radiated	C Note3
15.207	RSS-Gen [7.2.4]	AC Conducted Emissions	< FCC 15.207 limits	AC Line Conducted	NA Note4
15.203	-	Antenna Requirements	FCC 15.203	-	C
Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable Note 2: This test item was determined worse case data rate for each mode and channel. Note 3: This test item was performed in each axis and the worst case data was reported. Note 4: The supplying power of this device is DC 12~24 V from a Car Battery.					

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB558074 v03r1. And ANSI C63.10-2009 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing

4.1 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.

4.2 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.

4.3 GENERAL TEST PROCEDURES

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB 558074 v03r1. So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10.

The EUT is placed on the turntable, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15MHz and 30MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

Basically the radiated tests were performed with KDB 558074 v03r1. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10 as stated on section 12.1 of the KDB 558074 v03r1.

The EUT is placed on a turn table, which is 0.8 m above ground plane. 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 highest emission, the relative positions of the EUT were rotated through three orthogonal axis.

4.4 DESCRIPTION OF TEST MODES

The EUT has been tested with all modes of operating conditions to determine the worst case emission characteristics. A test program is used to control the EUT for staying in continuous transmitting mode.

5. 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.

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

The open area test site(OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 38, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number : 678747

6.2 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 peak, 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."

7. ANTENNA REQUIREMENTS

7.1 According to FCC 47 CFR §15.203& RSS-Gen [7.1.2]:

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 external antenna was used of unique connector. (SMA Reverse Polarity Type)

Therefore this E.U.T Complies with the requirement of §15.203

8. TEST RESULT

8.1 6dB Bandwidth

Test Requirements and limit, §15.247(a) & 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.

■ TEST CONFIGURATION

Refer to the APPENDIX I.

■ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB558074 v03r1**.

1. Set resolution bandwidth (RBW) = 100 KHz
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
(RBW:100KHz/VBW:300KHz)
3. Detector = **Peak**.
4. Trace mode = **max hold**.
5. Sweep = **auto couple**.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

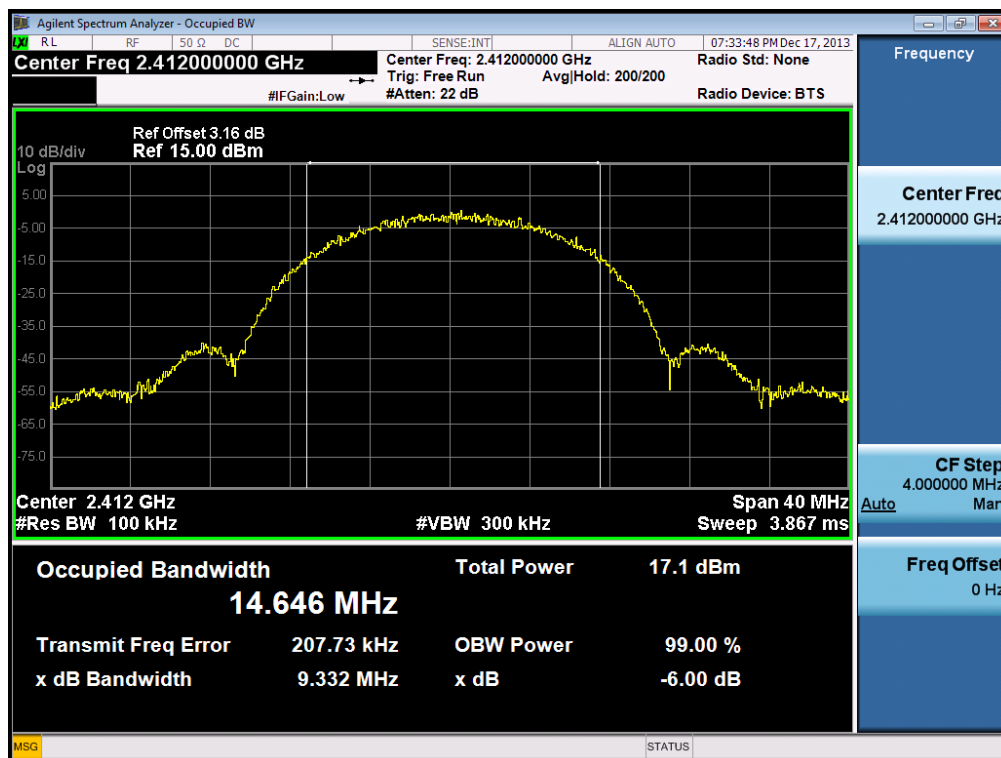
■ TEST RESULTS: **Comply**

Test Mode	Data Rate	Frequency [MHz]	Test Results[MHz]	
			DC 12 V	DC 24 V
802.11b	11 Mbps	2412	9.332	9.511
	11 Mbps	2437	9.848	9.661
	11 Mbps	2462	9.393	9.309
802.11g	54 Mbps	2412	16.440	16.390
	24 Mbps	2437	16.460	16.460
	54 Mbps	2462	16.480	16.390
802.11n (HT20)	MCS 7	2412	17.560	17.570
	MCS 4	2437	17.630	17.710
	MCS 7	2462	17.650	17.610
802.11n (HT40)	MCS 7	2422	35.420	35.250
	MCS 7	2437	35.540	35.260
	MCS 7	2452	36.270	35.710

■ RESULT PLOTS

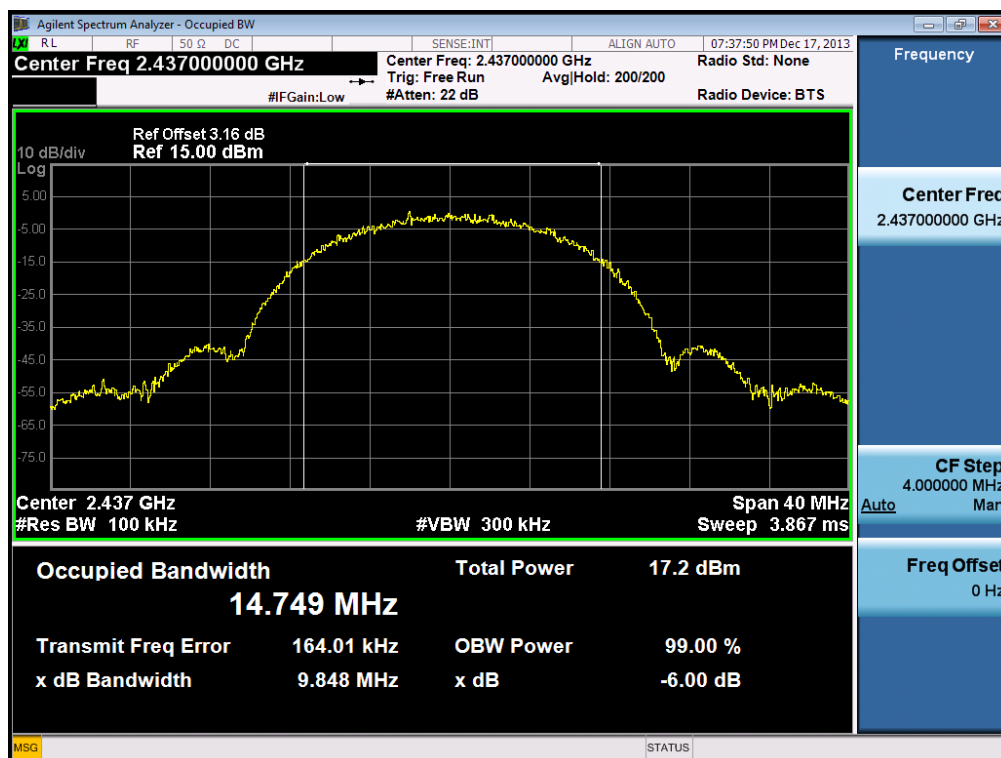
6 dB Bandwidth

Test Mode: DC 12 V & 802.11b & 11Mbps & 2412MHz

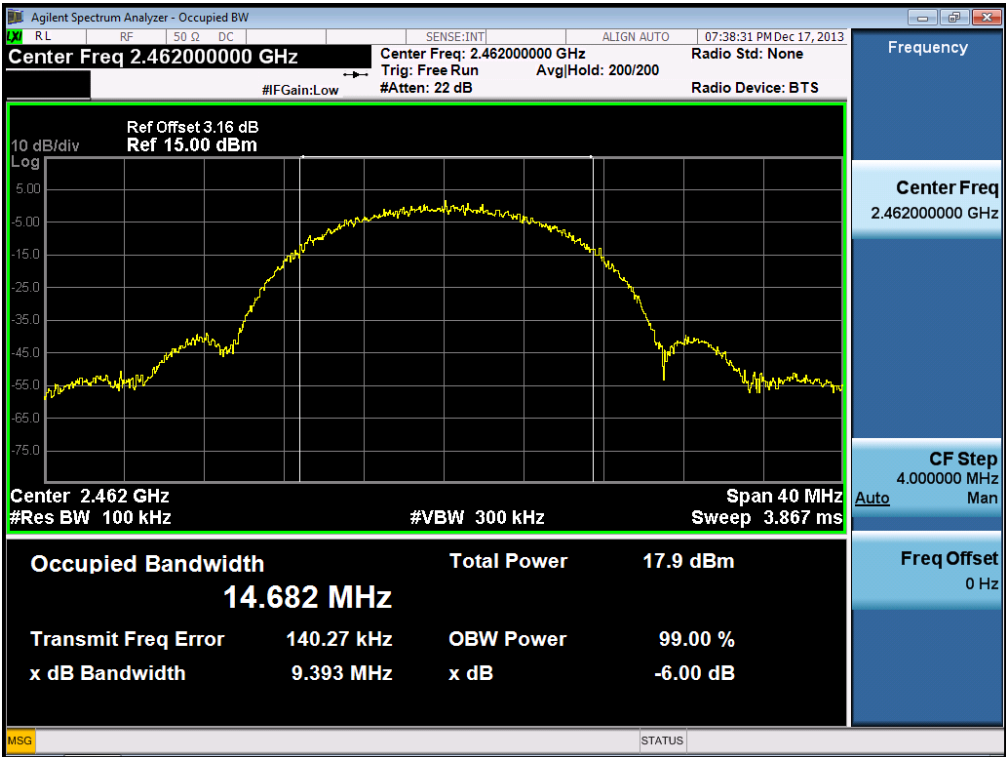


6 dB Bandwidth

Test Mode: DC 12 V & 802.11b & 11Mbps & 2437MHz

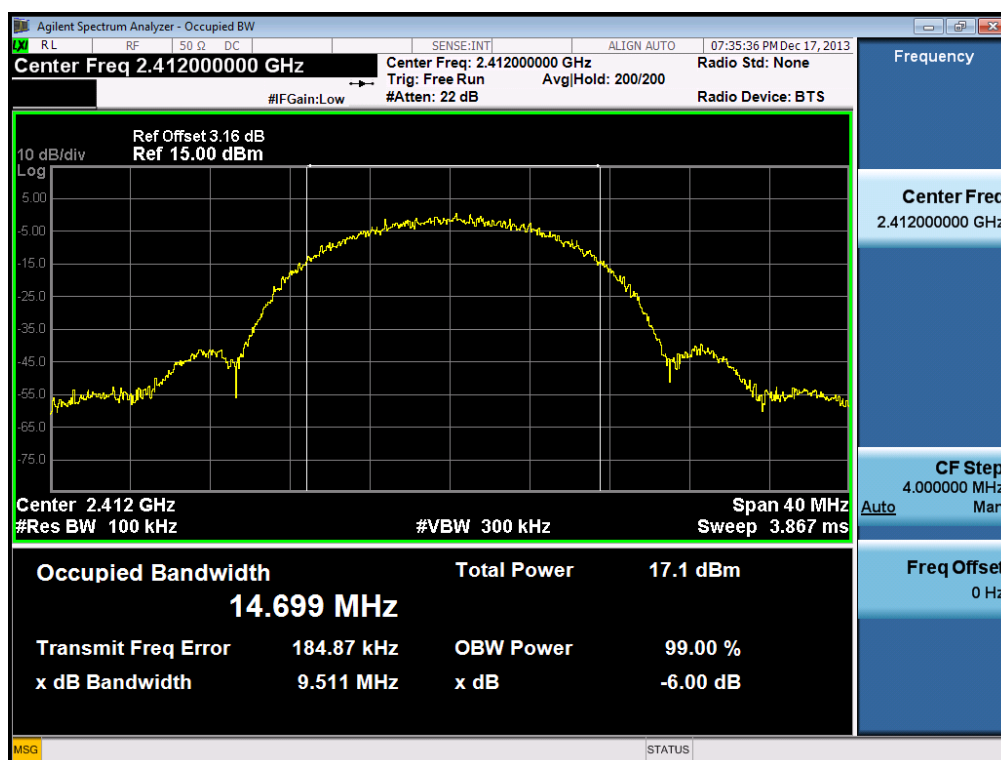


6 dB Bandwidth Test Mode: DC 12 V & 802.11b & 11Mbps & 2462MHz



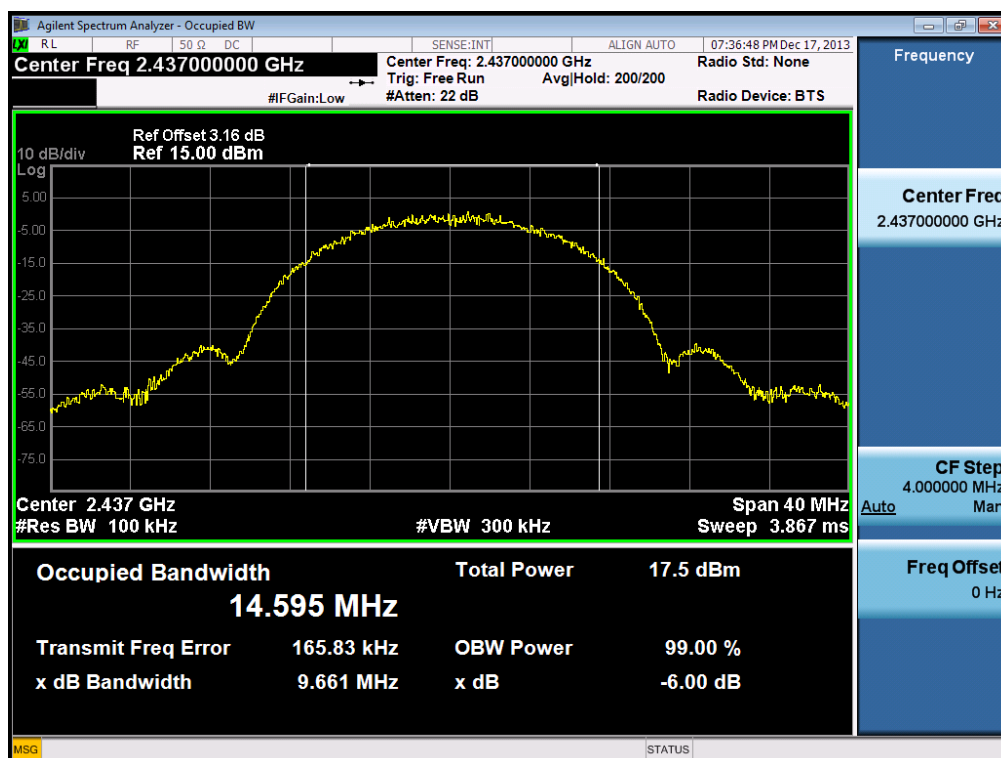
6 dB Bandwidth

Test Mode: DC 24 V & 802.11b & 11Mbps & 2412MHz

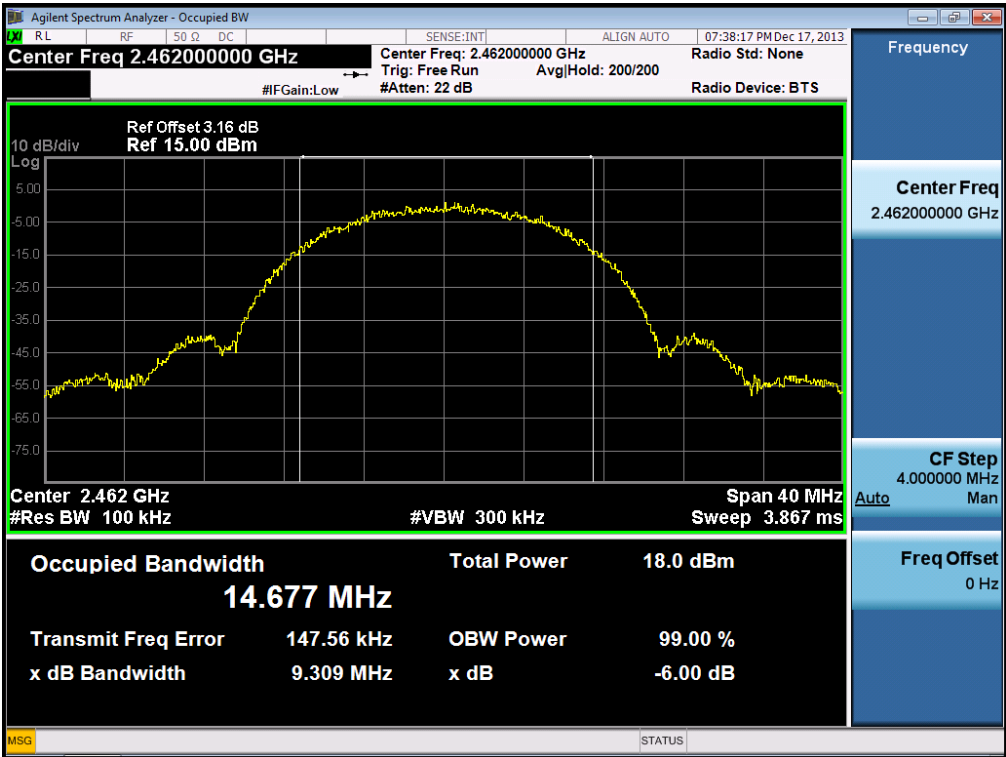


6 dB Bandwidth

Test Mode: DC 24 V & 802.11b & 11Mbps & 2437MHz

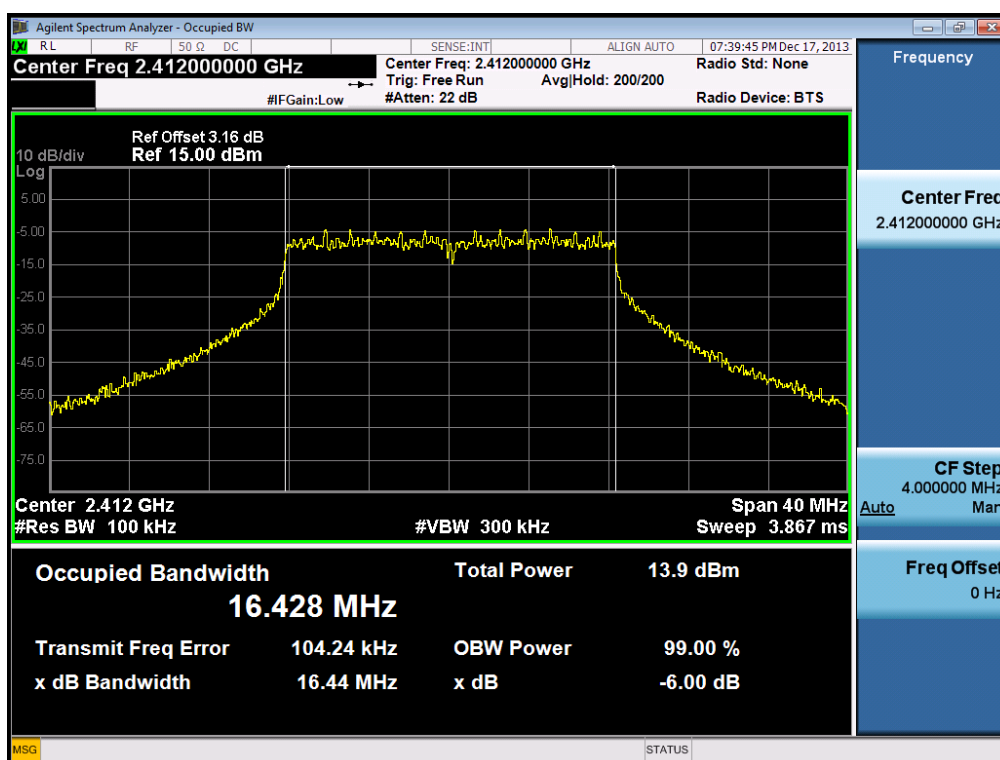


6 dB Bandwidth Test Mode: DC 24 V & 802.11b & 11Mbps & 2462MHz



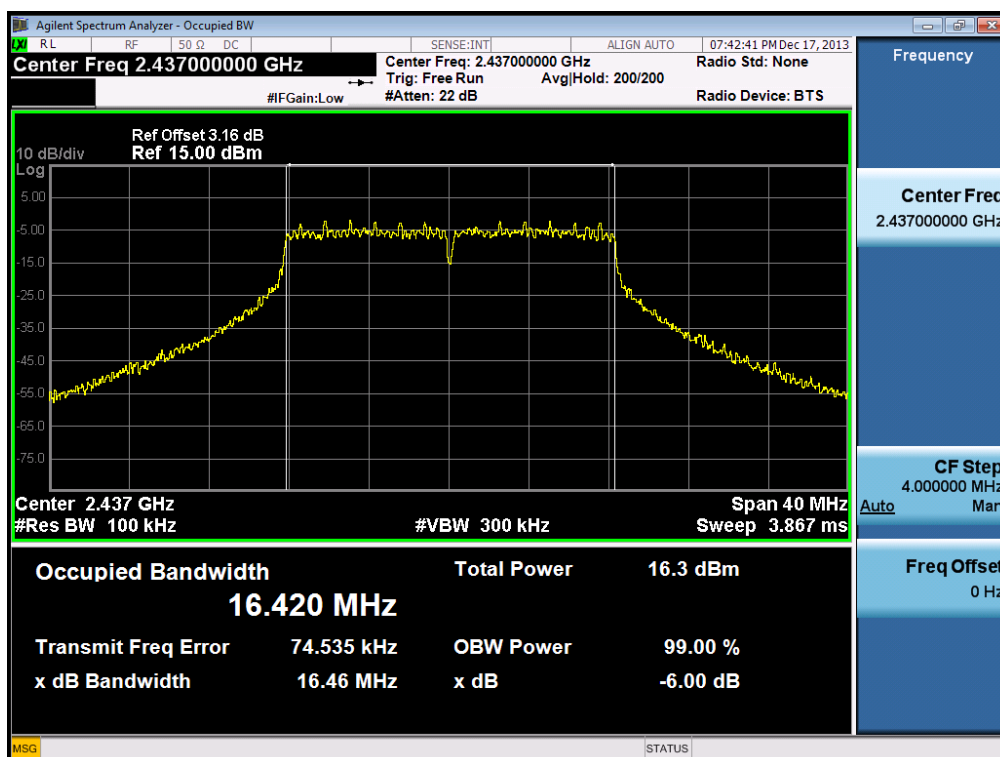
6 dB Bandwidth

Test Mode: DC 12 V & 802.11g & 54Mbps & 2412MHz



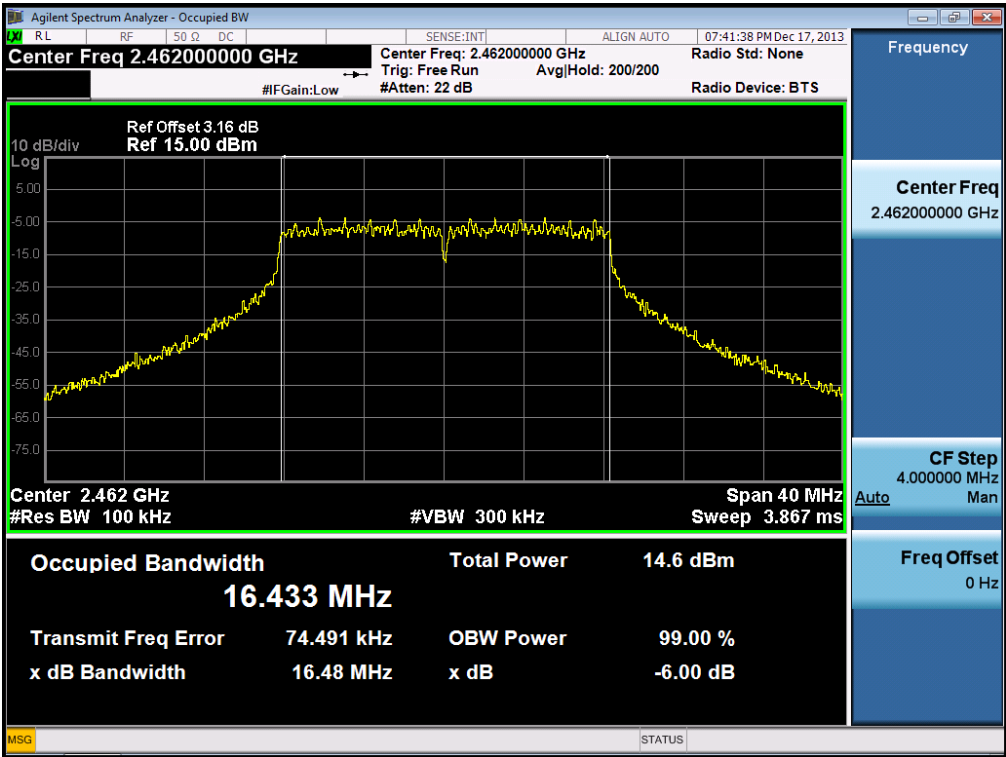
6 dB Bandwidth

Test Mode: DC 12 V & 802.11g & 24Mbps & 2437MHz



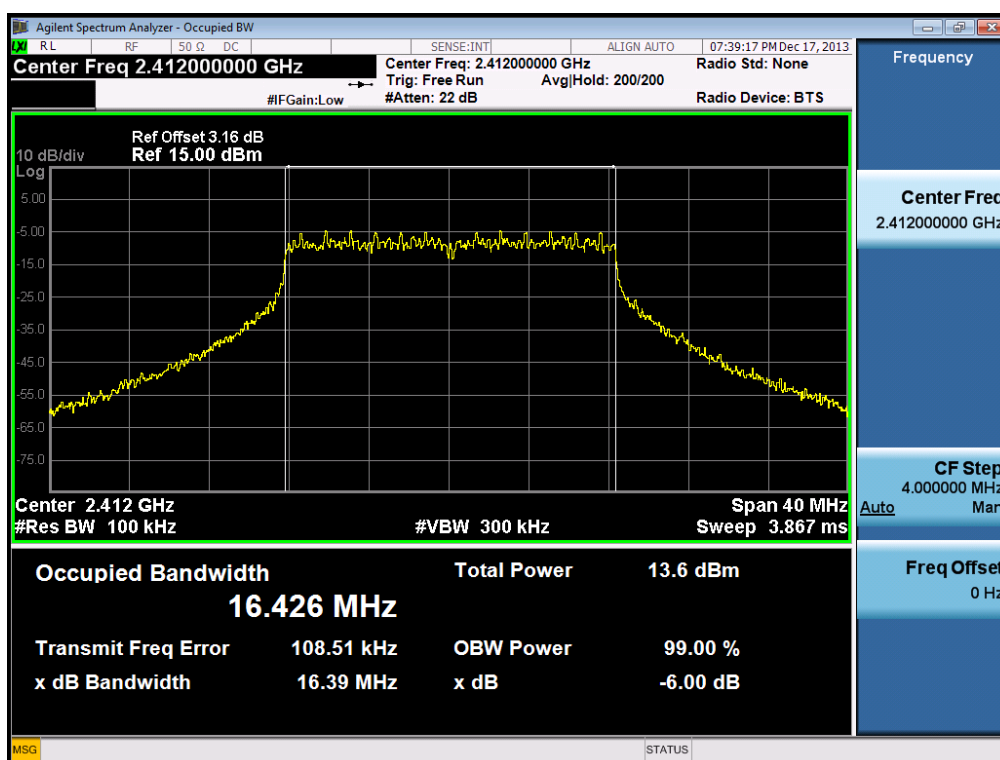
6 dB Bandwidth

Test Mode: DC 12 V & 802.11g & 54Mbps & 2462MHz



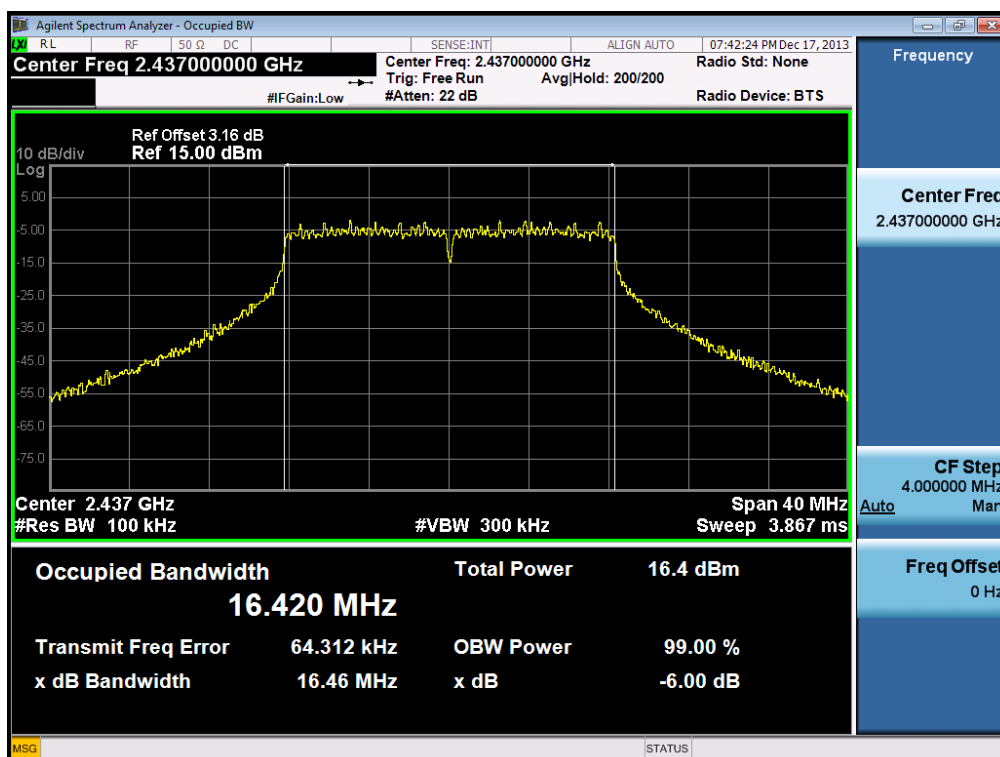
6 dB Bandwidth

Test Mode: DC 24 V & 802.11g & 54Mbps & 2412MHz



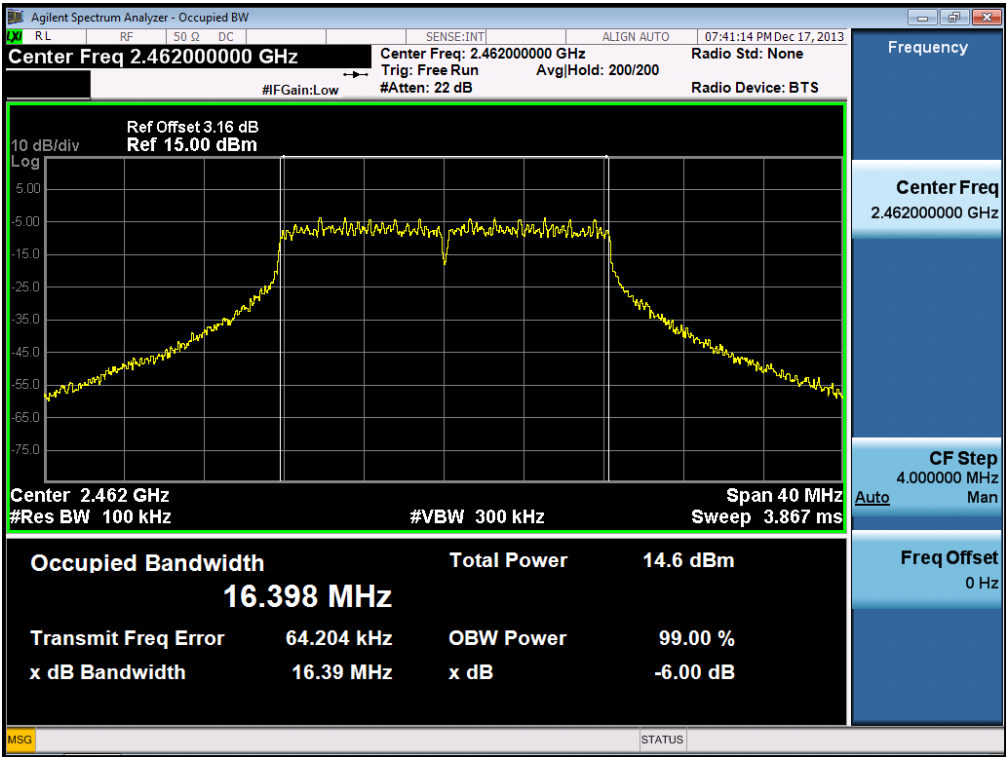
6 dB Bandwidth

Test Mode: DC 24 V & 802.11g & 24Mbps & 2437MHz



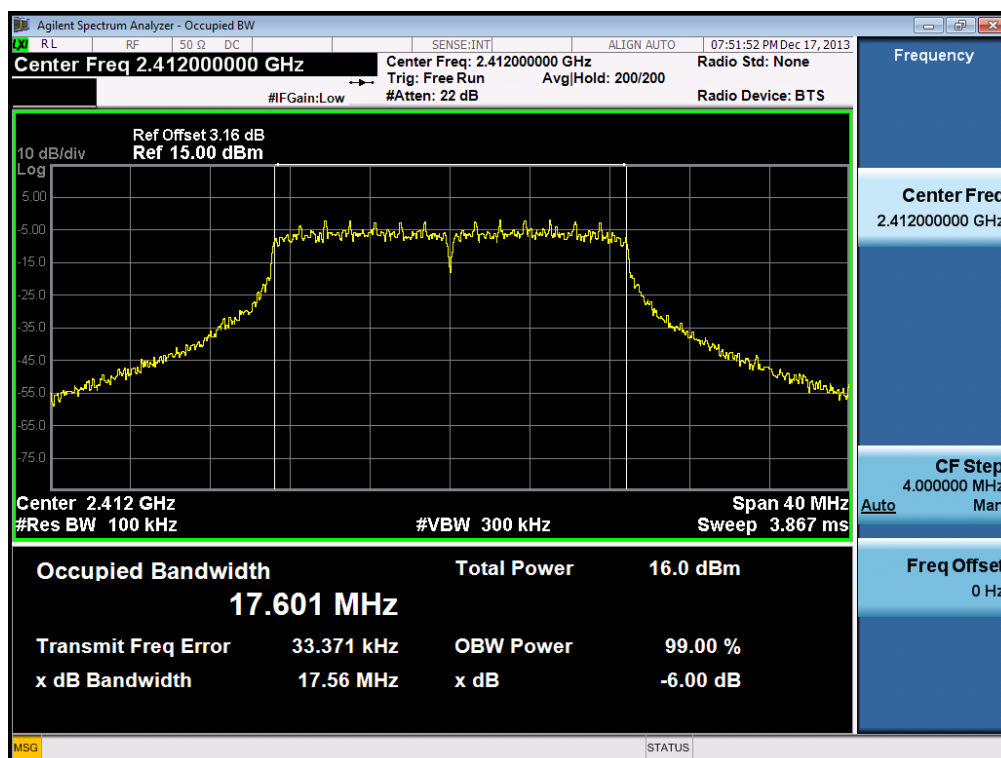
6 dB Bandwidth

Test Mode: DC 24 V & 802.11g & 54Mbps & 2462MHz



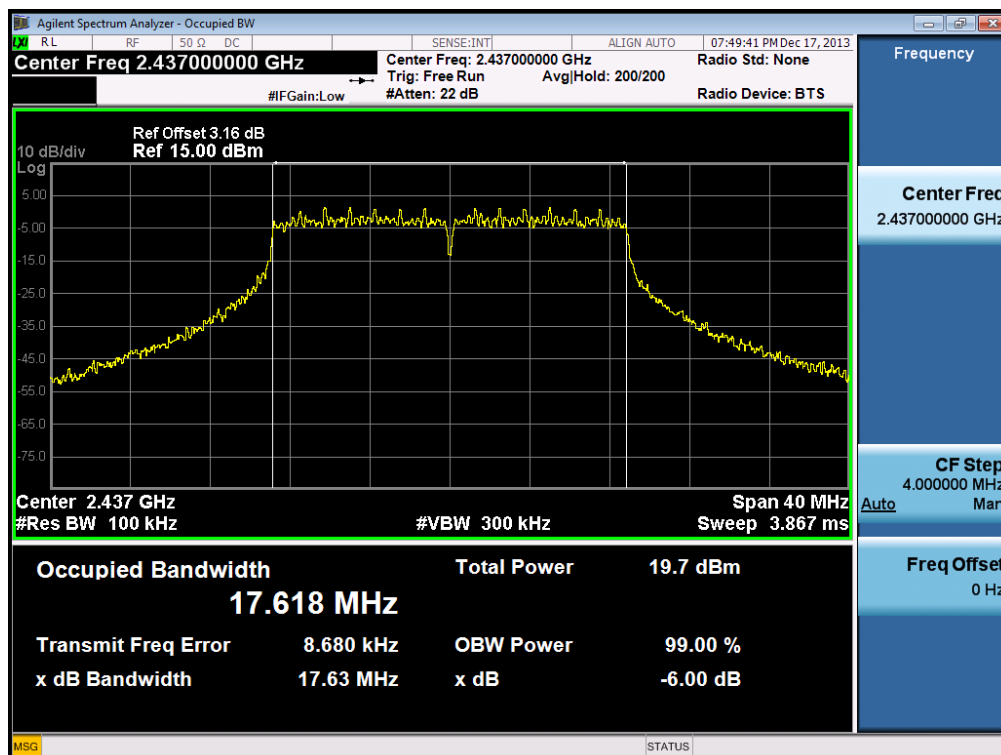
6 dB Bandwidth

Test Mode: DC 12 V & 802.11n HT20 & MCS 7 & 2412MHz

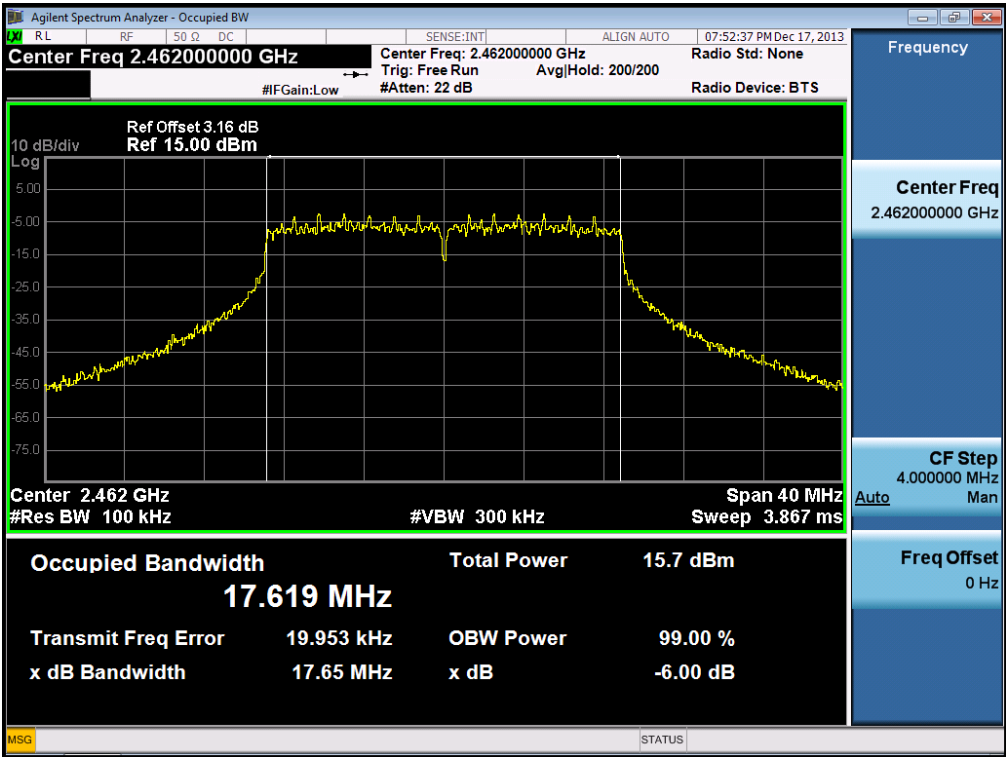


6 dB Bandwidth

Test Mode: DC 12 V & 802.11n HT20 & MCS 4 & 2437MHz

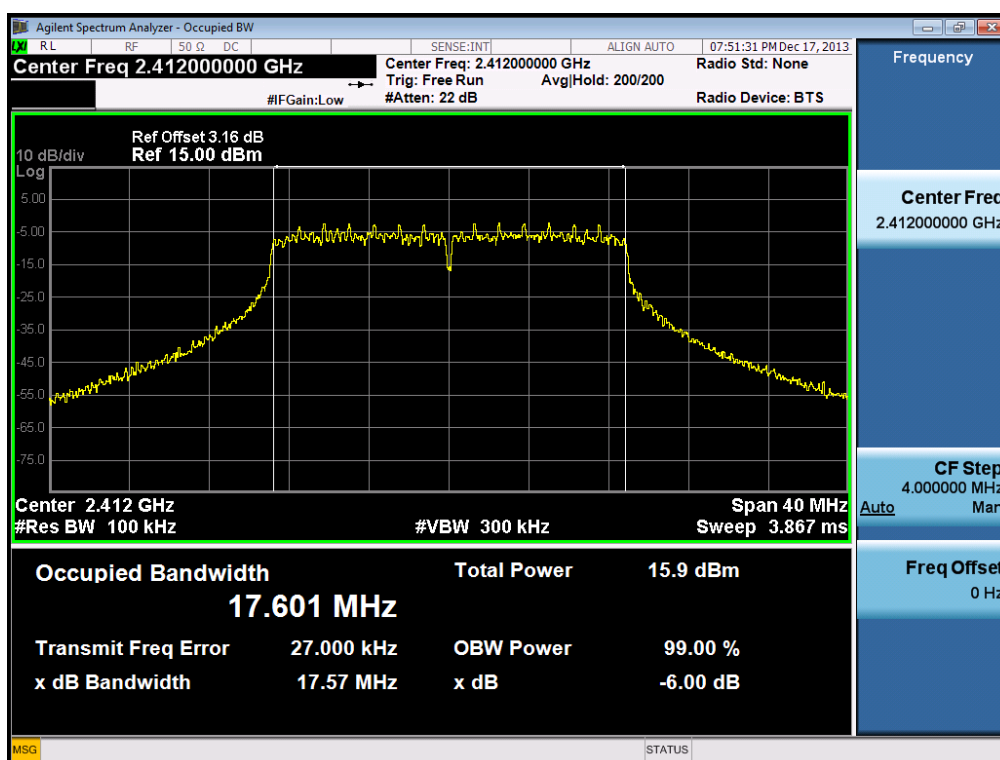


6 dB Bandwidth Test Mode: DC 12 V & 802.11n HT20 & MCS 7 & 2462MHz



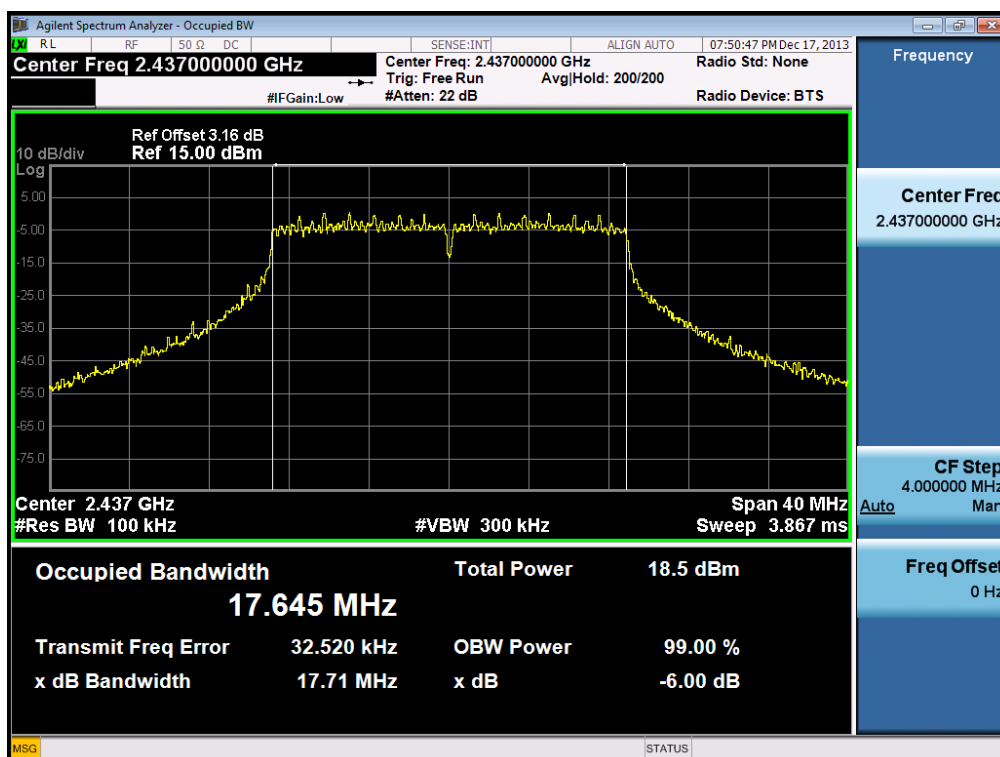
6 dB Bandwidth

Test Mode: DC 24 V & 802.11n HT20 & MCS 7 & 2412MHz

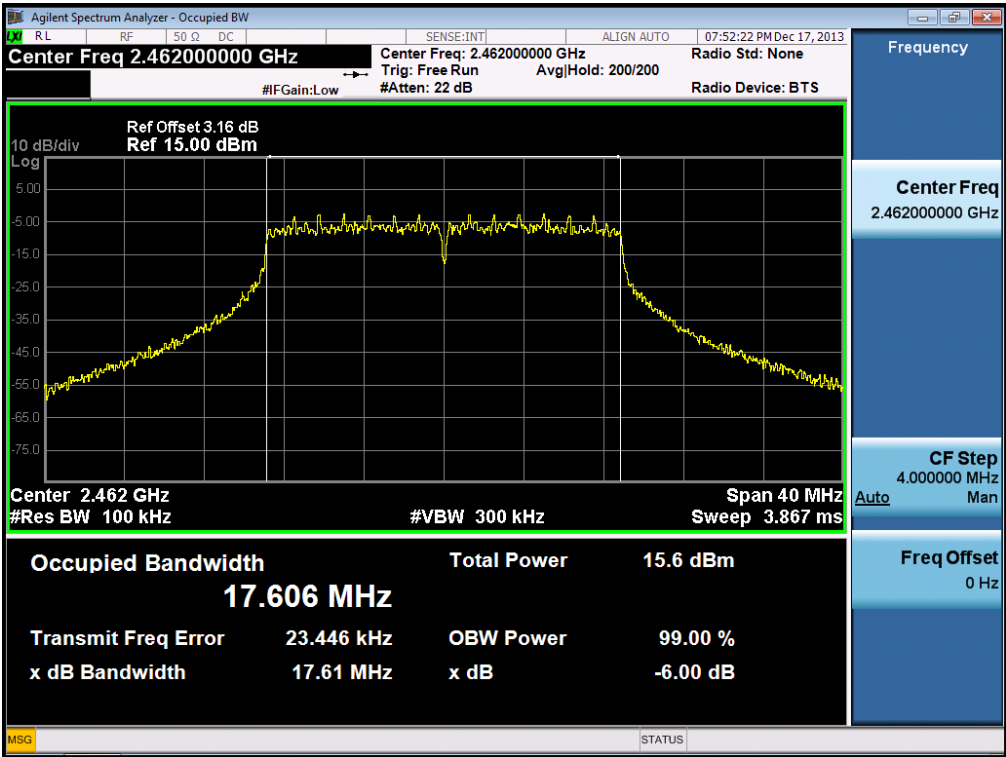


6 dB Bandwidth

Test Mode: DC 24 V & 802.11n HT20 & MCS 4 & 2437MHz

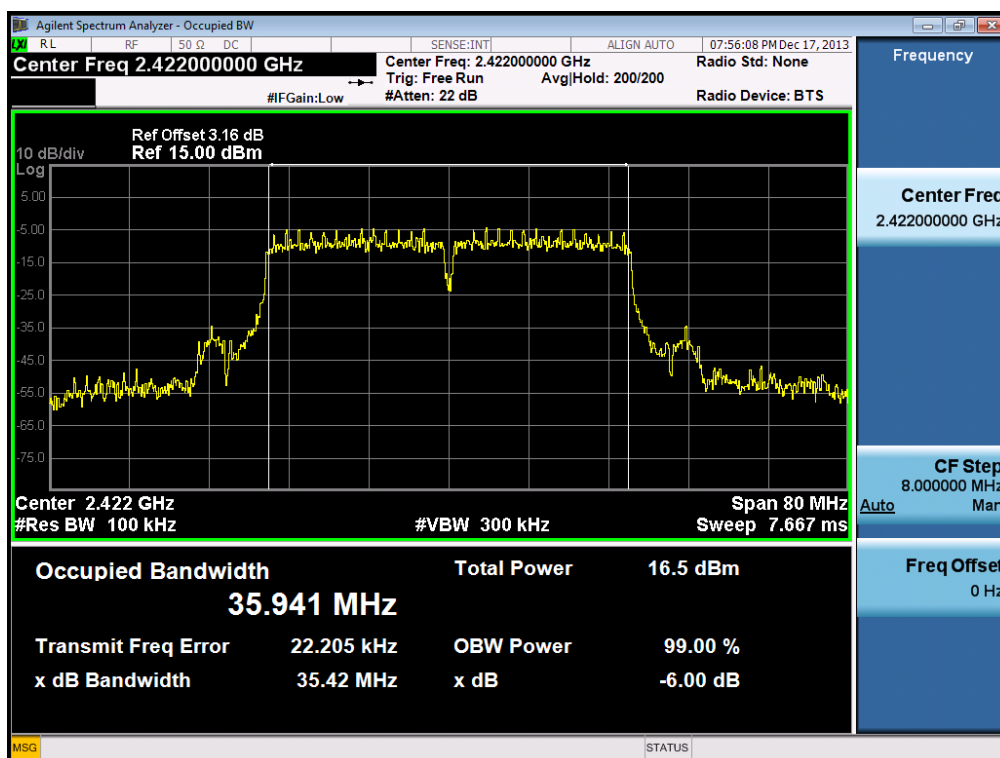


6 dB Bandwidth Test Mode: DC 24 V & 802.11n HT20 & MCS 7 & 2462MHz



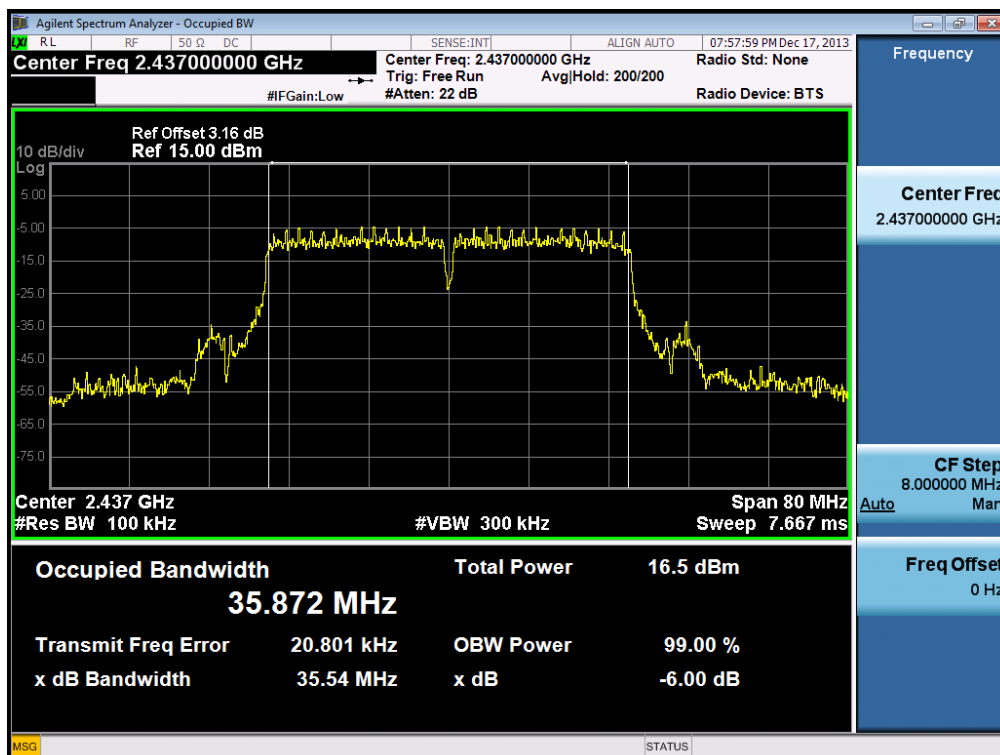
6 dB Bandwidth

Test Mode: DC 12 V & 802.11n HT40 & MCS 7 & 2422MHz

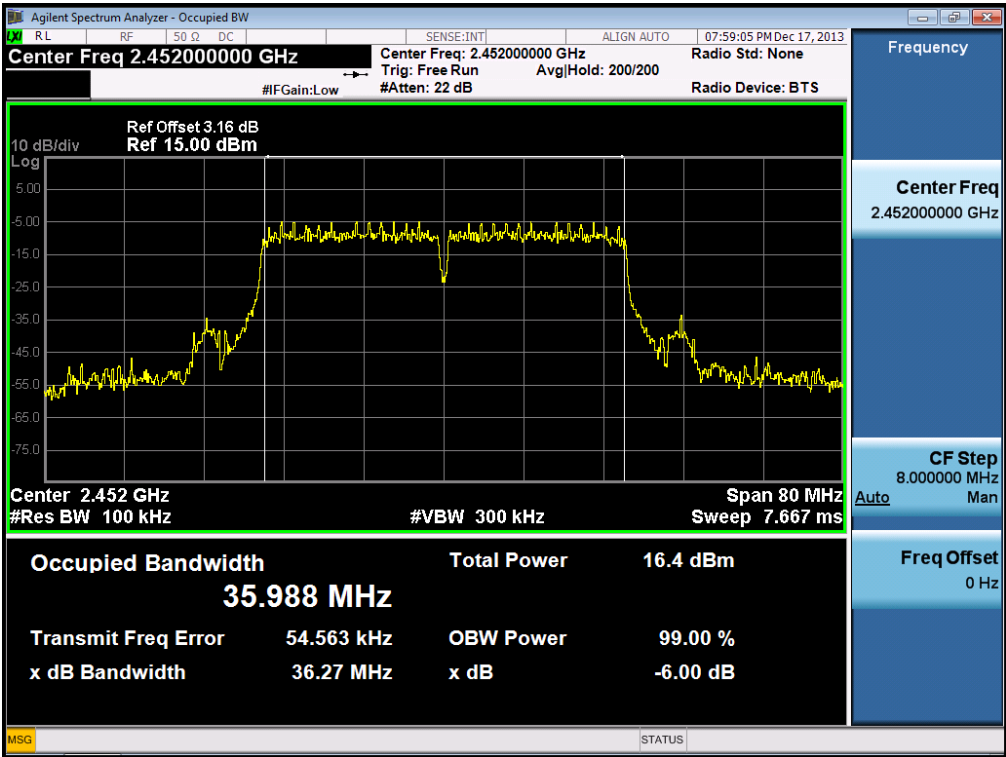


6 dB Bandwidth

Test Mode: DC 12 V & 802.11n HT40 & MCS 7 & 2437MHz

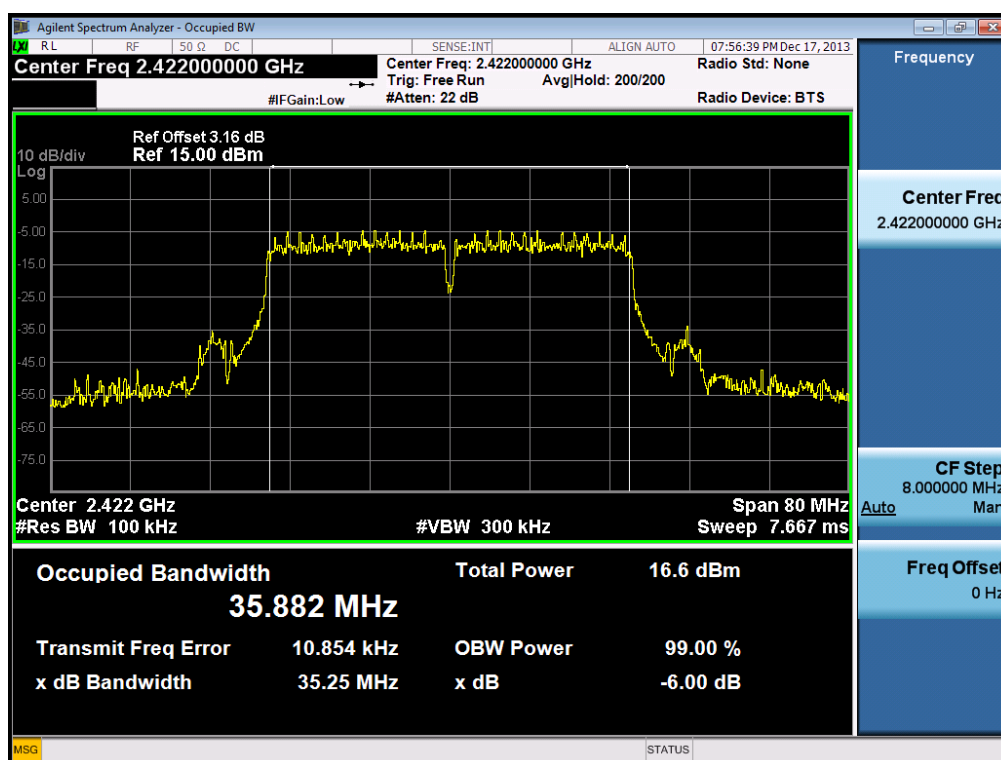


6 dB Bandwidth Test Mode: DC 12 V & 802.11n HT40 & MCS 7 & 2452MHz



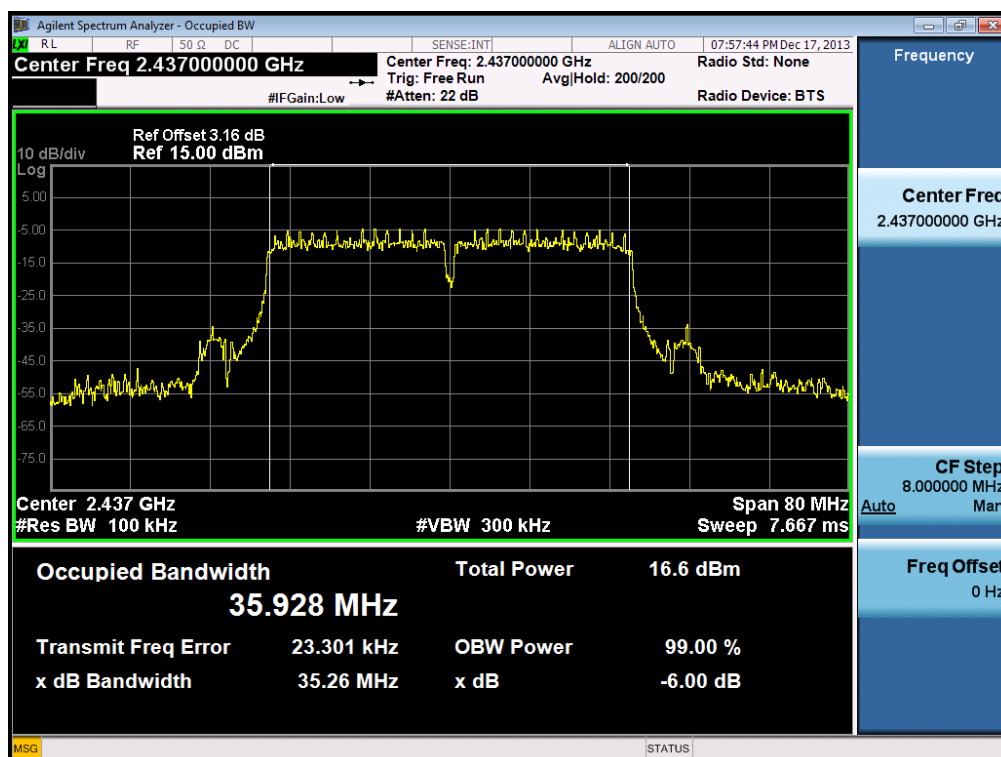
6 dB Bandwidth

Test Mode: DC 24 V & 802.11n HT40 & MCS 7 & 2422MHz



6 dB Bandwidth

Test Mode: DC 24 V & 802.11n HT40 & MCS 7 & 2437MHz



6 dB Bandwidth Test Mode: DC 24 V & 802.11n HT40 & MCS 7 & 2452MHz

