

RF TEST REPORT

Test item : 4G LTE CPE
Model No. : C773
Order No. : DEMC1306-02017
Date of receipt : 2013-06-26
Test duration : 2013-08-27 ~ 2013-09-09
Date of issue : 2013-09-13
Use of report : FCC Original Grant

Applicant : BIT & PULSE CO., LTD
2F Baegang B/D, 666-14 Sinsa-dong, Gangnam-gu, Seoul 135-897, Korea

Test laboratory : Digital EMC Co., Ltd.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 449-080, Korea

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:

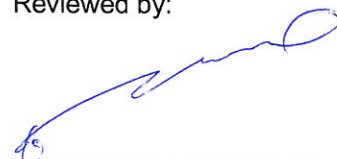
Witnessed by:

Reviewed by:

A handwritten signature in blue ink, appearing to read "S.H.S.", written over a horizontal line.

Engineer
HyunSu Son

N/A

A handwritten signature in blue ink, written over a horizontal line.

Deputy General Manager
WonJung Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1309-0882	Sep. 13, 2013	Initial issue

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1. GENERAL INFORMATION

Applicant : BIT & PULSE CO., LTD
Address : 2F Baegang B/D, 666-14 Sinsa-dong, Gangnam-gu, Seoul 135-897, Korea
FCC ID : CO3BPLC773
EUT : 4G LTE CPE
Model : C773
Additional Model(s) : N/A
Data of Test : 2013-08-27 ~ 2013-09-09
Contact person : WAN-yong Chung

2. EUT DESCRIPTION

Product	4G LTE CPE
Model Name	C773
Power Supply	DC 12V
Frequency Range	2.4GHz Band ▪ 802.11b/g/n(20MHz): 2412 ~ 2462 MHz ▪ 802.11n(40MHz): 2422~2452 MHz
Max. RF Output Power	2.4GHz Band ▪ 802.11b: 21.42dBm ▪ 802.11g: 24.01dBm ▪ 802.11n (HT20): 25.34dBm ▪ 802.11n (HT40): 25.29dBm
Modulation Type	802.11b: DSSS/CCK 802.11g/n: OFDM
Antenna Specification	Antenna type: InternalAntenna Antenna gain: Chain 0& 1 : 1.73dBi Antenna configuration ▪ 802.11b/g: 1TX/1RX(SISO: Chain 0) ▪ 802.11n(HT20)/(HT40): 2TX/2RX(MIMO)

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
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)		C
15.205 15.209	RSS-210 [A8.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	<FCC 15.209 limits	Radiated	C ^{Note2}
15.207	RSS-Gen [7.2.4]	AC Conducted Emissions	< FCC 15.207 limits	AC Line Conducted	C
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 performed in each axis and the worst case data was reported.					

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB558074 v03r1. And ANSI C63.10-2009 was used for EUT setup 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

According to 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 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

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 axes according to the requirements in Section 6.3 of ANSI C63.10.

4.4 DESCRIPTION OF TEST MODES

The EUT's output powers have been conducted with all data rates at each mode to determine the worst case mode. And all the tests were performed with the worst case data rate which generates the highest output power at each mode. 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 683-3, Yubang-Dong, Yongin-Si, Gyunggi-Do, 449-080, South Korea. 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

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 internal antenna of this E.U.T is permanently attached using the soldering.

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.

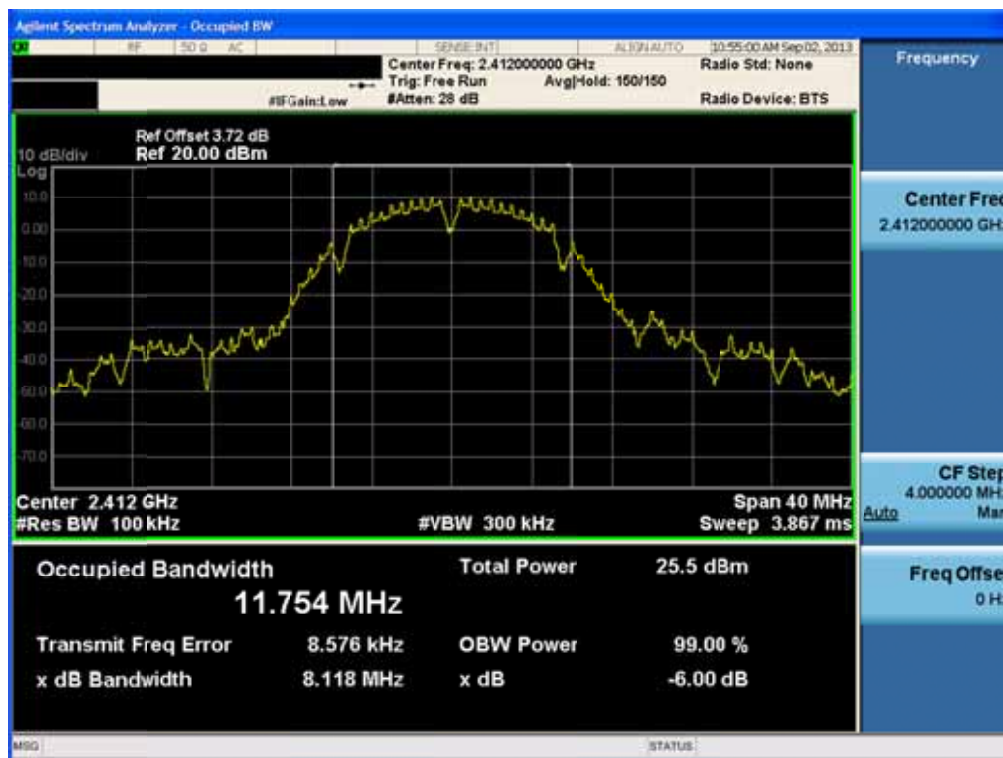
TEST RESULTS: **Comply**

Test Mode	Data Rate	Frequency [MHz]	Test Results[MHz]	
			Chain 0	Chain 1
802.11b	1Mbps	2412	8.118	N/A
		2437	8.106	N/A
		2462	8.093	N/A
802.11g	6Mbps	2412	16.400	N/A
		2437	16.400	N/A
		2462	16.410	N/A
802.11n (20MHz)	MCS 0	2412	17.320	17.090
		2437	17.570	16.860
		2462	17.300	16.960
802.11n (40MHz)	MCS 0	2422	35.490	35.480
		2437	36.040	35.690
		2452	35.760	35.550

RESULTPLOTS

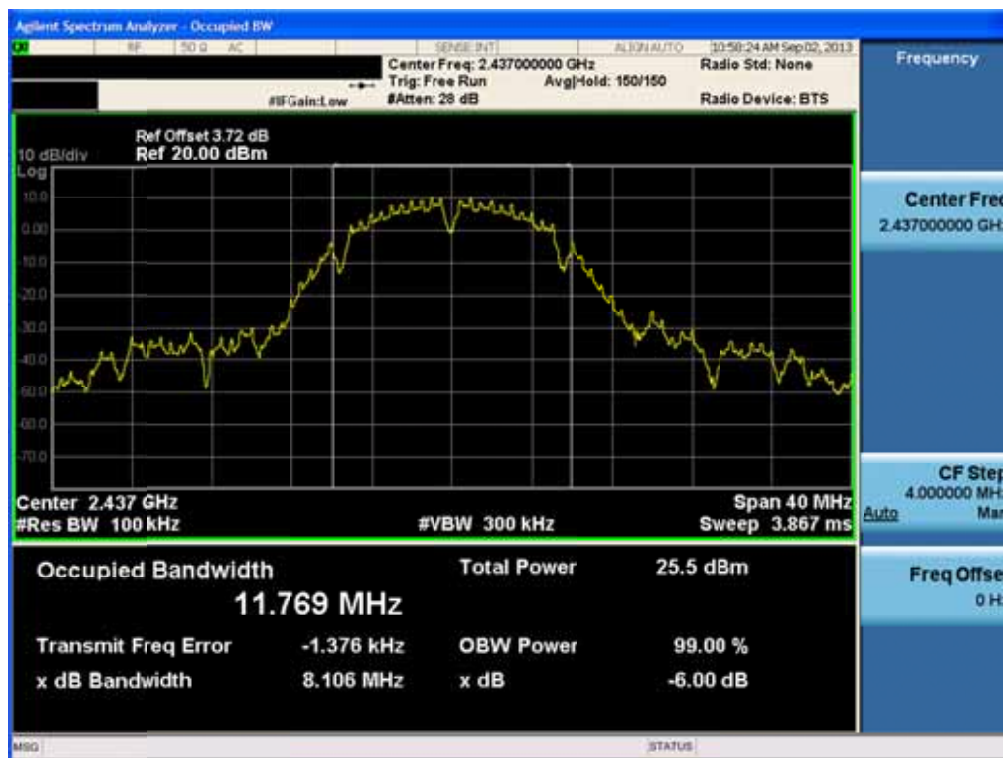
6 dB Bandwidth

Test Mode: Chain 0 & 802.11b & 1Mbps & 2412MHz



6 dB Bandwidth

Test Mode: Chain 0 & 802.11b & 1Mbps & 2437MHz

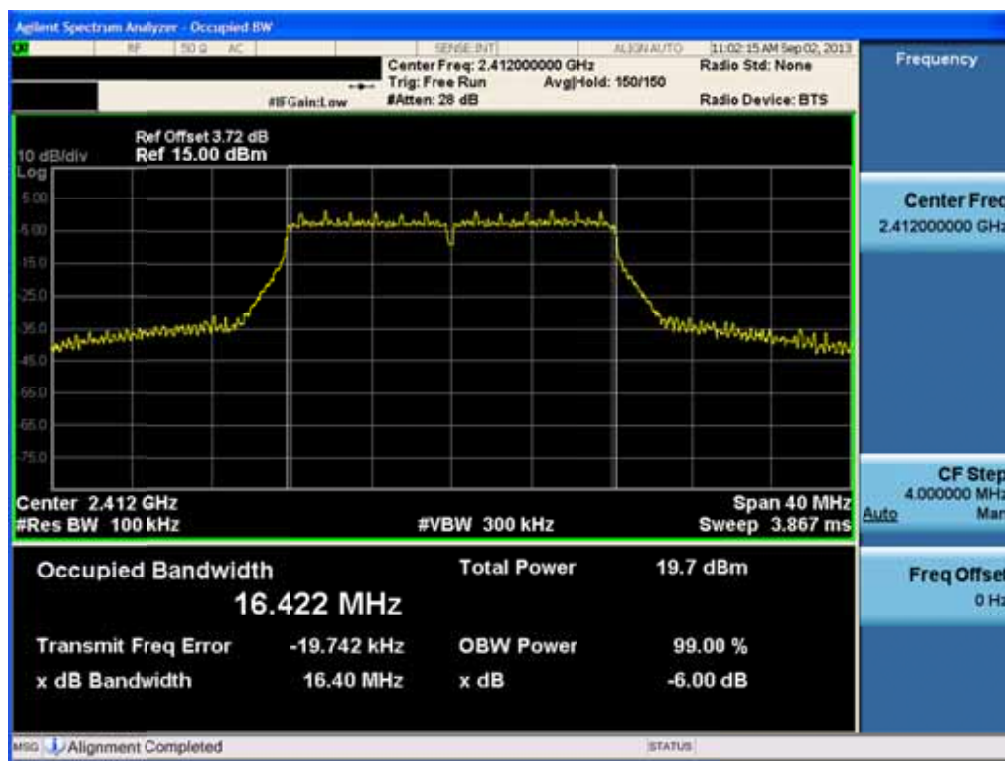


6 dB Bandwidth Test Mode: Chain 0 &802.11b & 1Mbps &2462MHz



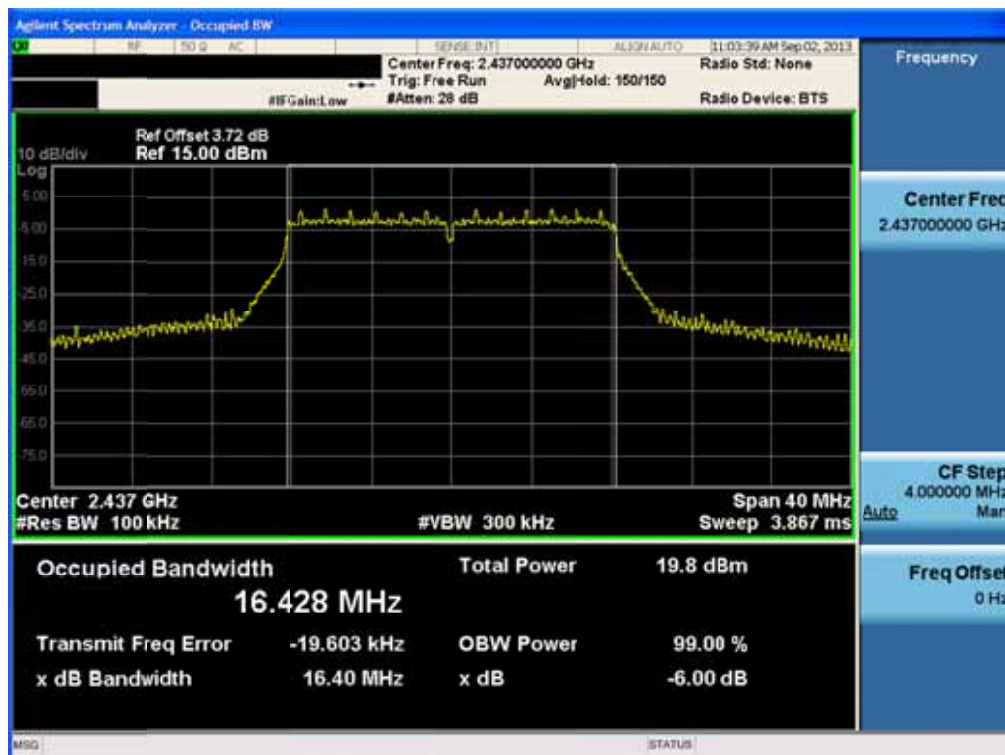
6 dB Bandwidth

Test Mode: Chain 0 & 802.11g & 6Mbps & 2412MHz



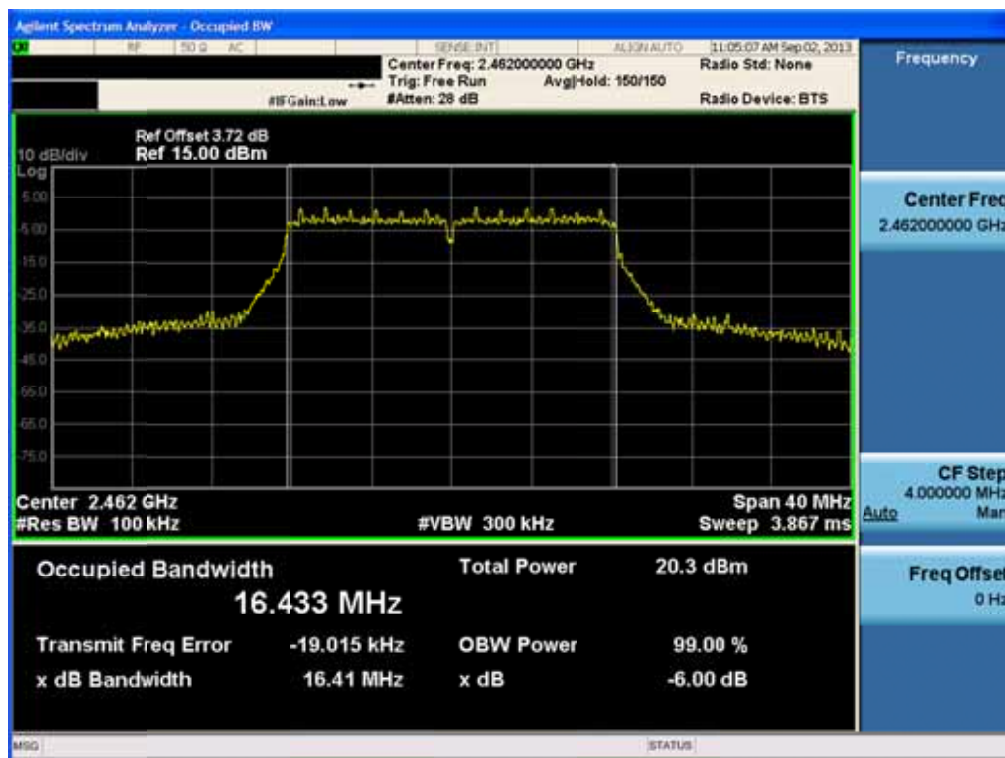
6 dB Bandwidth

Test Mode: Chain 0 & 802.11g & 6Mbps & 2437MHz



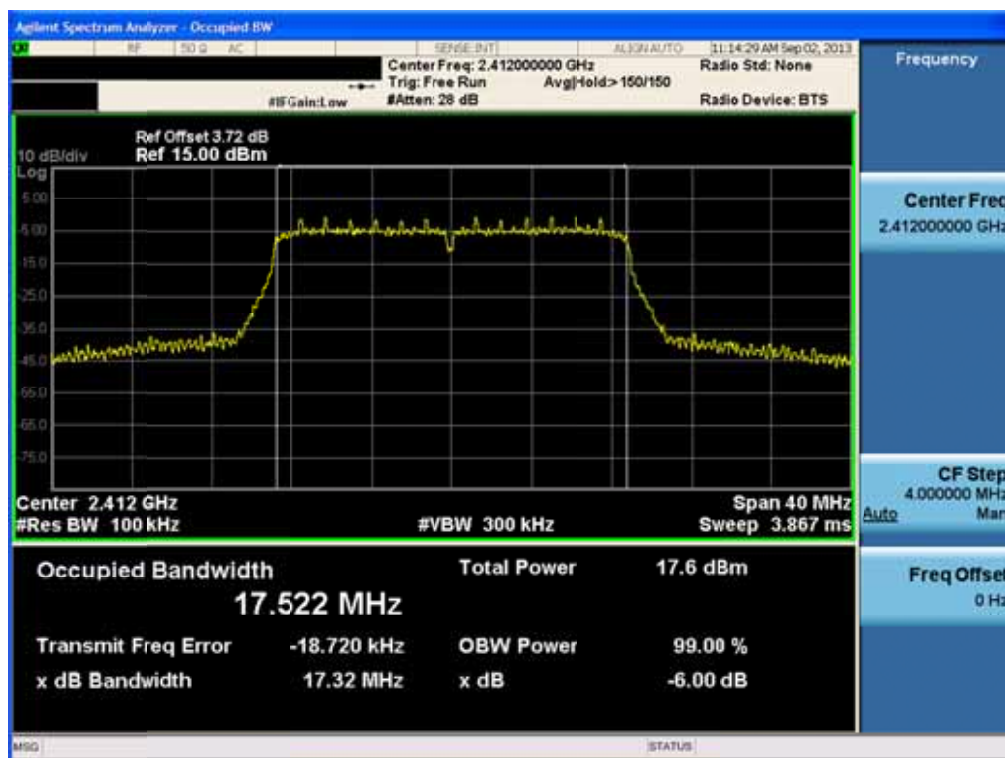
6 dB Bandwidth

Test Mode: Chain 0 & 802.11g & 6Mbps & 2462MHz



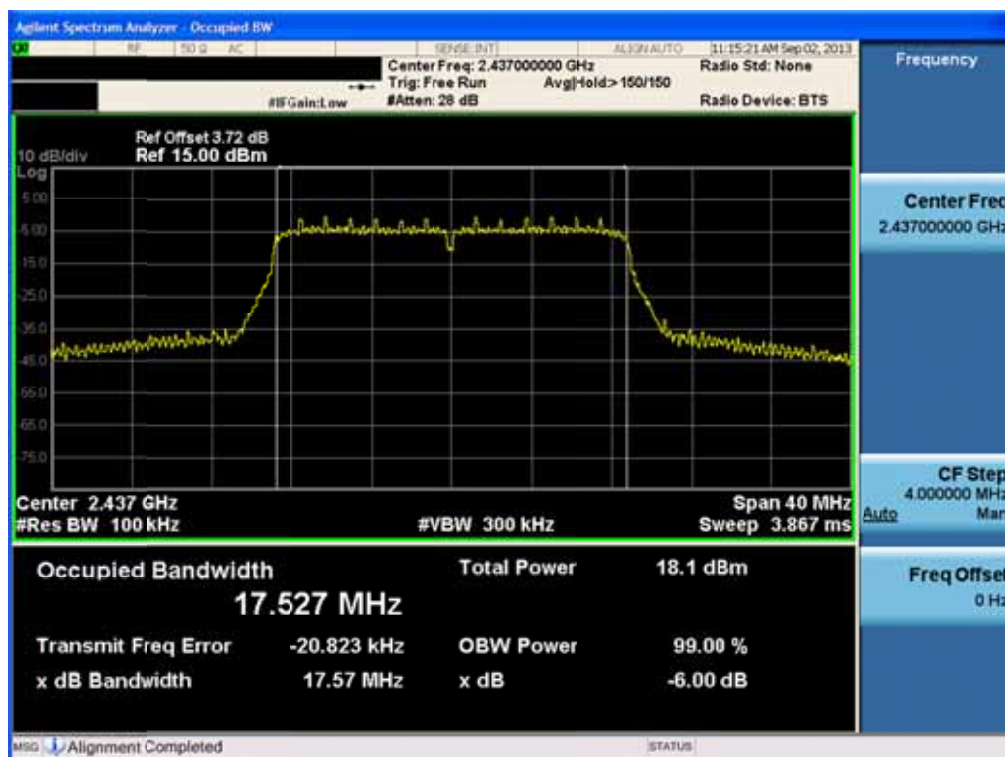
6 dB Bandwidth

Test Mode: Chain 0 & 802.11n HT20&MCS 0& 2412MHz



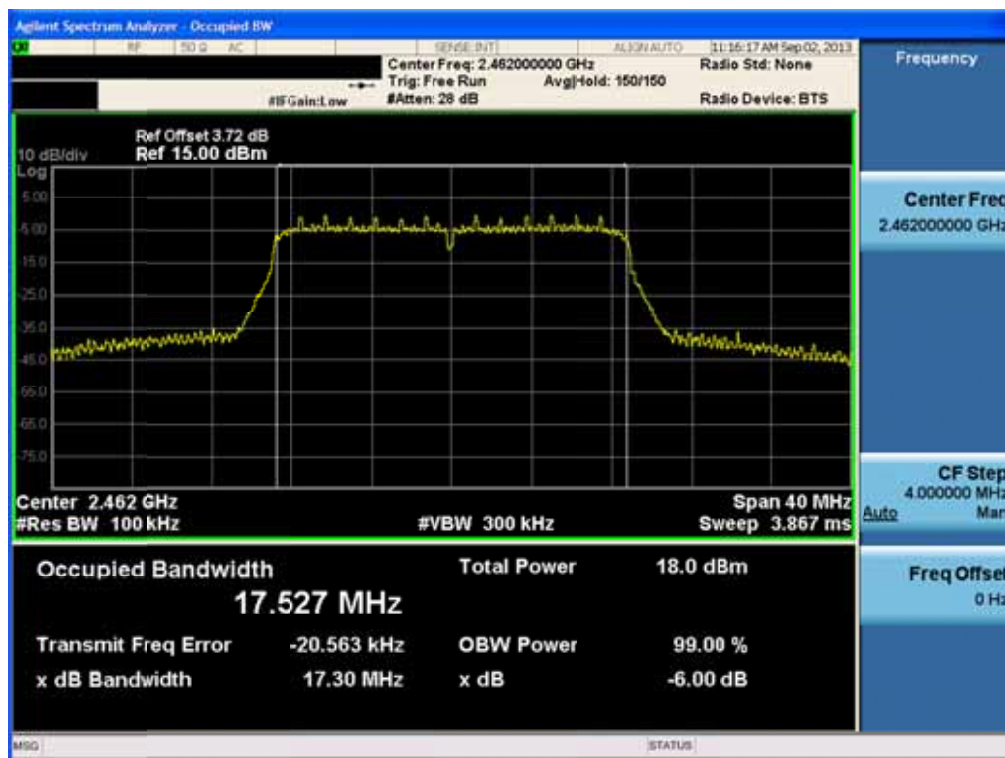
6 dB Bandwidth

Test Mode: Chain 0 & 802.11n HT20&MCS 0& 2437MHz



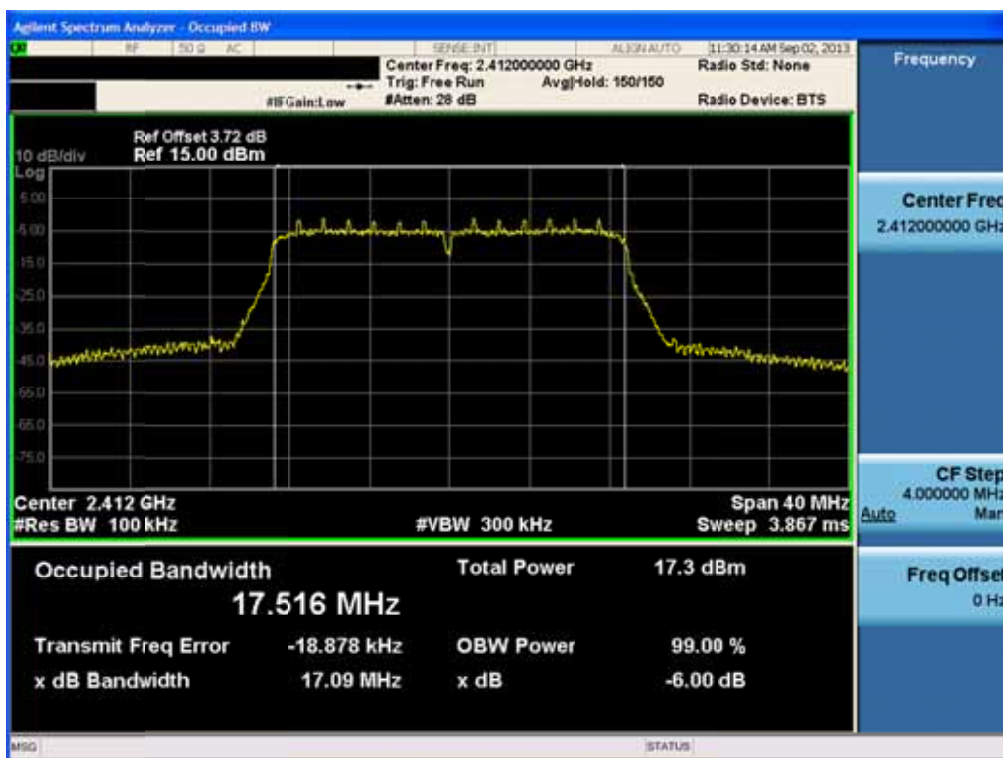
6 dB Bandwidth

Test Mode: Chain 0 & 802.11n HT20&MCS 0& 2462MHz



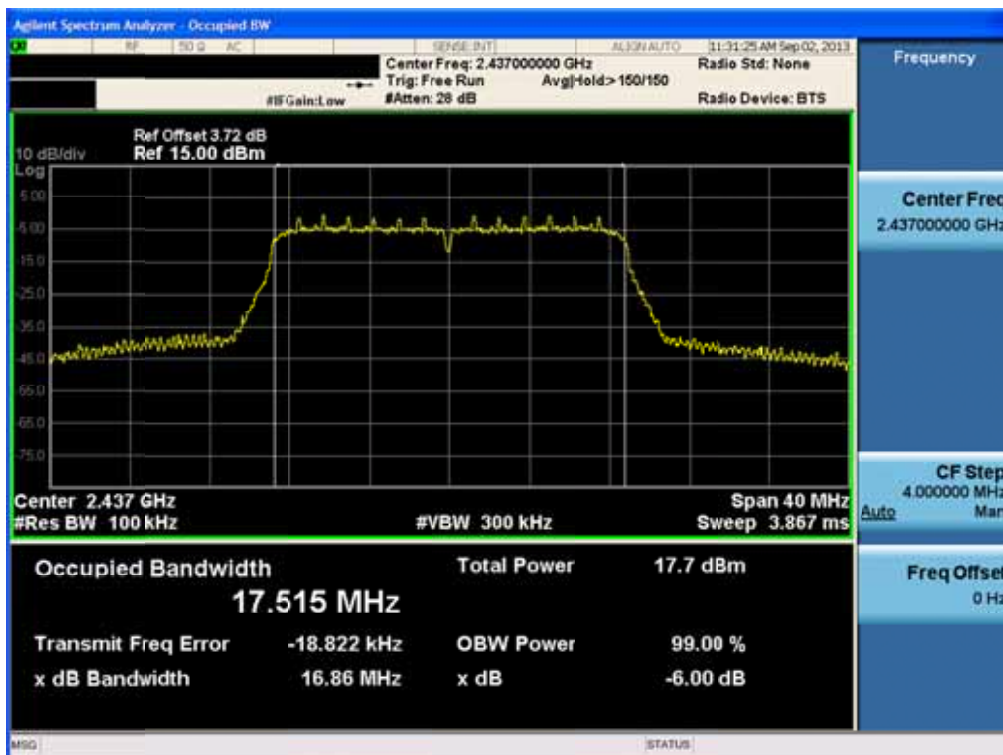
6 dB Bandwidth

Test Mode: Chain 1& 802.11n HT20&MCS 0& 2412MHz



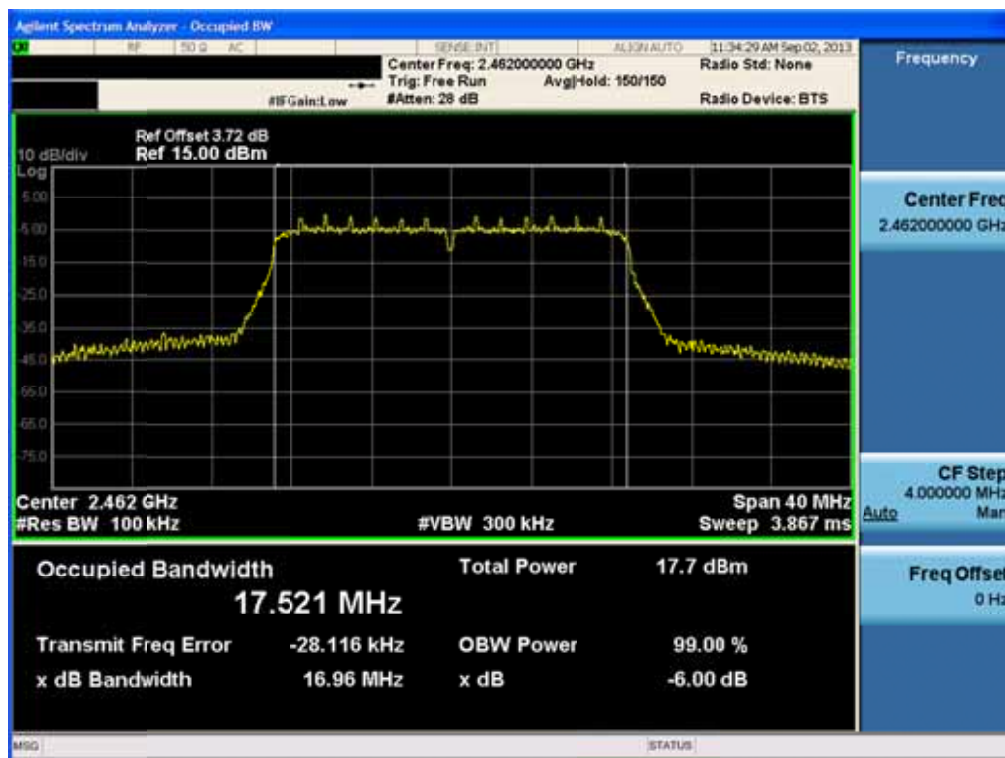
6 dB Bandwidth

Test Mode: Chain 1& 802.11n HT20&MCS 0& 2437MHz



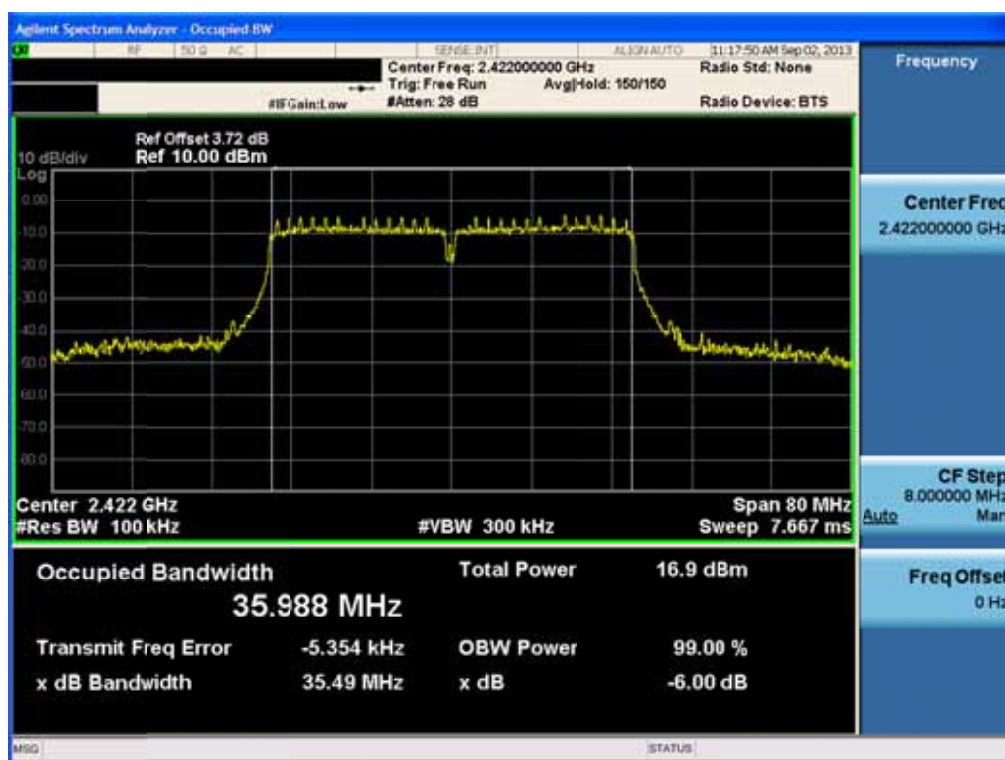
6 dB Bandwidth

Test Mode: Chain 1& 802.11n HT20&MCS 0& 2462MHz



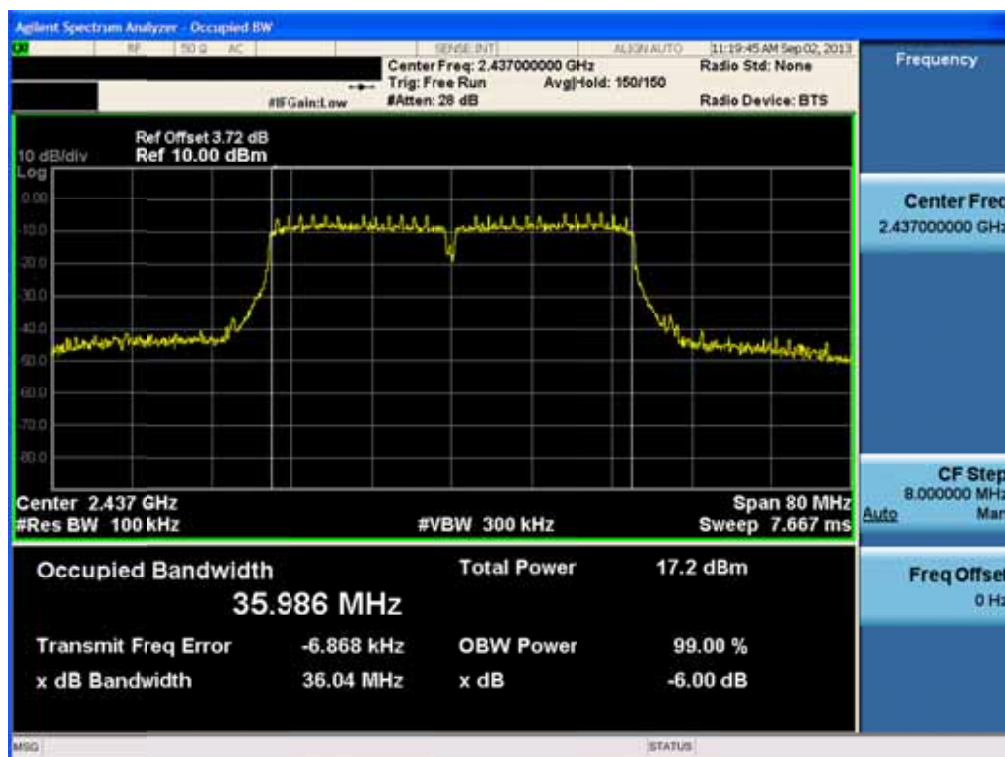
6 dB Bandwidth

Test Mode: Chain 0 & 802.11n HT40&MCS 0& 2422MHz



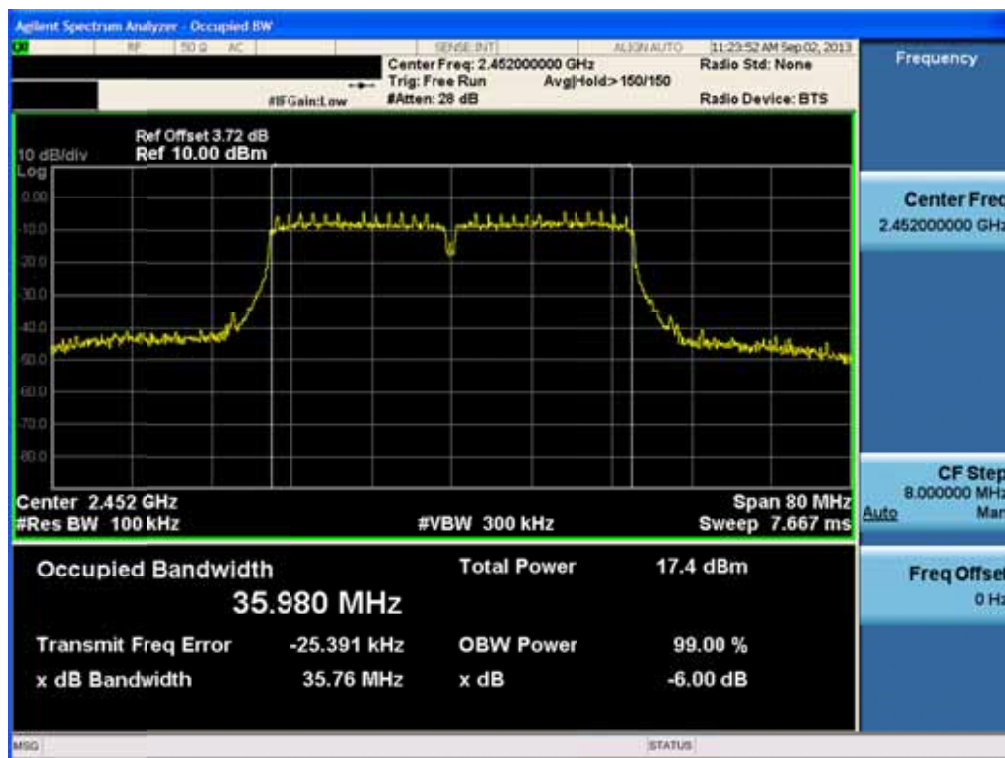
6 dB Bandwidth

Test Mode: Chain 0 & 802.11n HT40&MCS 0& 2437MHz



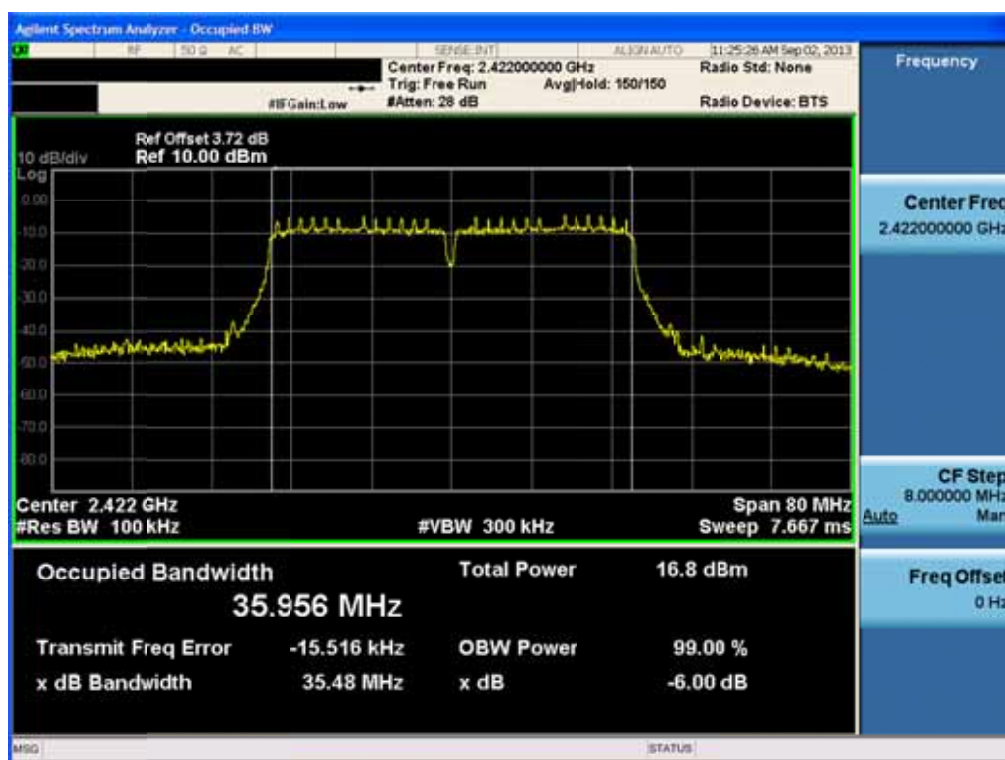
6 dB Bandwidth

Test Mode: Chain 0 & 802.11n HT40&MCS 0& 2452MHz



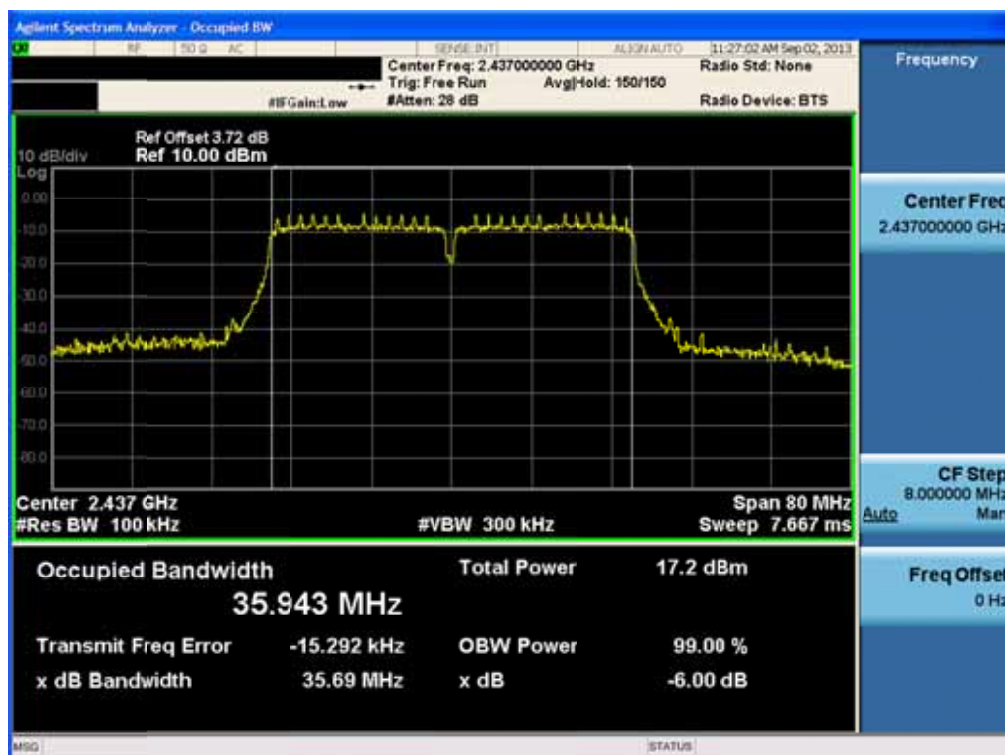
6 dB Bandwidth

Test Mode: Chain 1& 802.11n HT40&MCS 0& 2422MHz



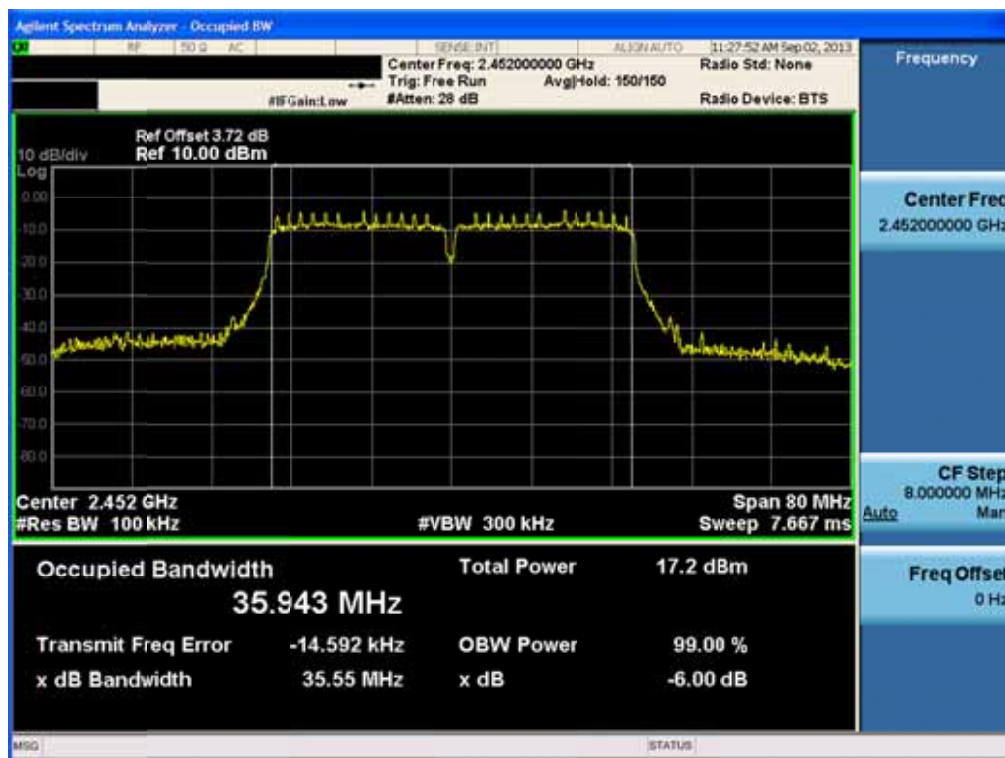
6 dB Bandwidth

Test Mode: Chain 1& 802.11n HT40&MCS 0& 2437MHz



6 dB Bandwidth

Test Mode: Chain 1& 802.11n HT40&MCS 0& 2452MHz

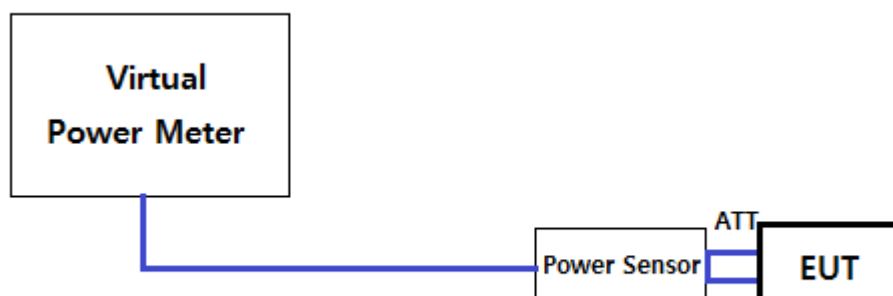


8.2 Maximum Peak Conducted Output Power

Test Requirements and limit, §15.247(b)& RSS-210 [A8.4]

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

TEST CONFIGURATION



TEST PROCEDURE

1. PKPM1 Peak power meter method of KDB558074 v03r1

The maximum conducted output powers were measured using a broadband peak RF power meter which has greater video bandwidth than DUT's DTS bandwidth and utilize a fast-responding diode detector.

The directional antenna gains for MIMO with correlated signals.

Band	Chain 0 [dBi]	Chain 1 [dBi]	Directional Gain for correlated signals [dBi]
2.4GHz	1.73	1.73	4.74 < 6.00

Note : Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$ dBi for correlated signals

Calculation of limit

The limit shall be reduced by the amount in dB that the directional gain of the antenna of the antenna exceeds 6dBi.

TEST RESULTS: Comply

▪ Single transmitting data [PORT0]

Mode	Channel	Frequency [MHz]	Detector	DATA RATE [Mbps]							
				1	2	5.5	11	N/A	N/A	N/A	N/A
802.11b	1	2412	PK	21.12	21.09	21.06	21.04	-	-	-	-
	6	2437	PK	21.42	21.39	21.35	21.28	-	-	-	-
	11	2462	PK	21.33	21.28	21.22	21.16	-	-	-	-

Mode	Channel	Frequency [MHz]	Detector	DATA RATE [Mbps]							
				6	9	12	18	24	36	48	54
802.11g	1	2412	PK	23.05	22.82	22.75	22.63	22.56	22.53	22.36	22.29
	6	2437	PK	23.83	23.62	23.49	23.41	23.35	23.32	23.28	23.22
	11	2462	PK	24.01	23.79	23.65	23.51	23.42	23.32	23.25	23.17

▪ Multiple transmitting data

Mode	Channel	Frequency [MHz]	Port	Detector	Test Result [dBm]							
					0	1	2	3	4	5	6	7
802.11n (HT20)	1	2412	Port 0	PK	22.35	22.21	22.05	21.85	21.64	21.42	21.38	21.25
	6	2437		PK	22.22	22.21	22.05	21.96	21.71	21.63	21.57	21.44
	11	2462		PK	22.49	22.39	22.24	22.18	22.14	22.06	21.98	21.84
802.11n (HT20)	1	2412	Port 1	PK	22.11	22.02	21.89	21.73	21.65	21.62	21.58	21.47
	6	2437		PK	22.09	22.07	22.04	22.03	21.95	21.91	21.85	21.71
	11	2462		PK	22.17	22.13	22.05	21.95	21.91	21.89	21.81	21.76
802.11n (HT20)	1	2412	Port 0+1	PK	25.24	25.13	24.98	24.80	24.66	24.53	24.49	24.37
	6	2437		PK	25.16	25.15	25.06	25.01	24.84	24.78	24.72	24.59
	11	2462		PK	25.34	25.27	25.16	25.08	25.04	24.99	24.91	24.81

Mode	Channel	Frequency [MHz]	Port	Detector	Test Result [dBm]							
					0	1	2	3	4	5	6	7
802.11n (HT40)	3	2422	Port 0	PK	21.93	21.89	21.82	21.75	21.72	21.69	21.66	21.59
	6	2437		PK	22.20	22.16	22.08	21.98	21.90	21.85	21.81	21.72
	9	2452		PK	22.31	22.28	22.26	22.18	22.15	22.08	22.02	21.98
802.11n (HT40)	3	2422	Port 1	PK	21.81	21.79	21.74	21.71	21.68	21.64	21.60	21.58
	6	2437		PK	22.18	22.15	22.06	21.96	21.93	21.85	21.83	21.78
	9	2452		PK	22.25	22.17	22.15	22.03	21.98	21.92	21.86	21.77
802.11n (HT40)	3	2422	Port 0+1	PK	24.88	24.85	24.79	24.74	24.71	24.68	24.64	24.60
	6	2437		PK	25.20	25.17	25.08	24.98	24.93	24.86	24.83	24.76
	9	2452		PK	25.29	25.24	25.22	25.12	25.08	25.01	24.95	24.89

Note1: Aggregate PPSD = $10 \log \left(10^{\left(\frac{\text{chain0}}{10}\right)} + 10^{\left(\frac{\text{chain1}}{10}\right)} \right)$

8.3 Maximum Power Spectral Density

Test requirements and limit, §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.

Minimum Standard –specifies a conducted power spectral density (PSD) limit of 8 dBm in any 3 kHz band segment within the fundamental EBW during any time interval of continuous transmission.

TEST CONFIGURATION

Refer to the APPENDIX I.

TEST PROCEDURE:

Method PKPSD of KDB558074 v03r1 is used.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to **1.5 times** the DTS bandwidth.
3. Set the RBW to: **3 kHz ≤ RBW ≤ 100 kHz**.
4. Set the VBW **≥ 3 x RBW**.
5. Detector = **peak**.
6. Sweep time = **auto couple**.
7. Trace mode = **max hold**.
8. Allow trace to fully stabilize.
9. Use the **peak marker function** to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Calculation of limit

The limit shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

TEST RESULTS: Comply

▪ Single transmitting data

Mode	Data Rate	Frequency [MHz]	RBW	PPSD	
				Chain 0	Chain 1
				[dBm]	[dBm]
802.11b	1 Mbps	2412	3 kHz	-3.52	-
		2437	3 kHz	-4.45	-
		2462	3 kHz	-3.91	-
802.11g	6 Mbps	2412	3 kHz	-13.51	-
		2437	3 kHz	-13.06	-
		2462	3 kHz	-13.37	-

▪ Multiple transmitting data

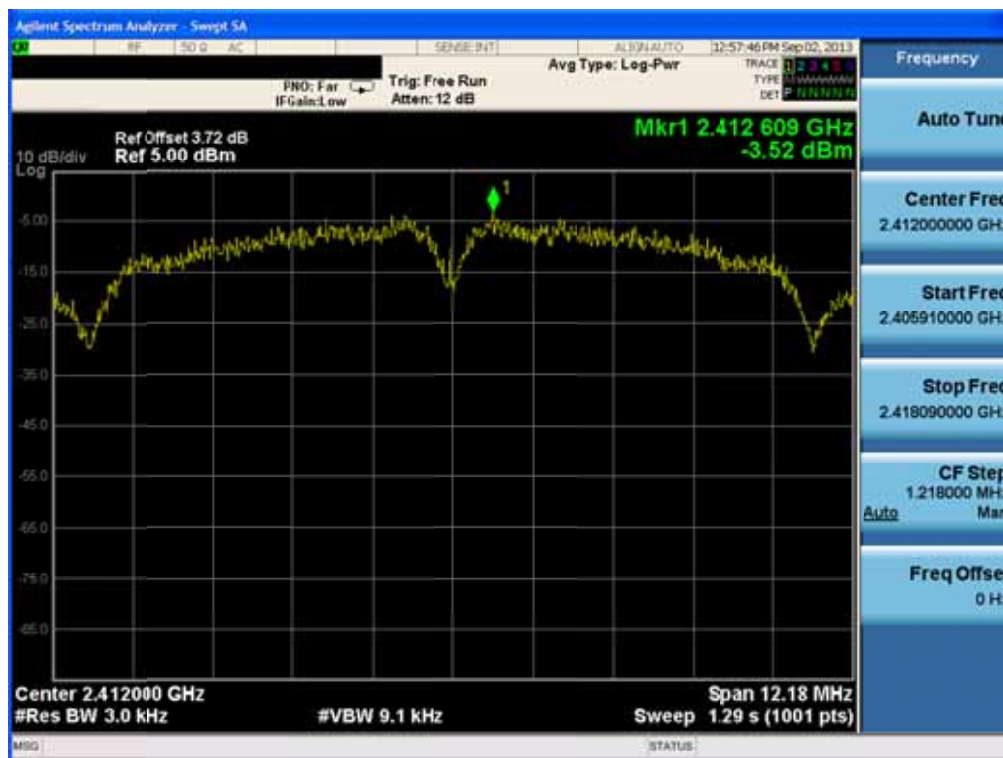
Mode	Data Rate	Frequency [MHz]	RBW	PPSD		
				Chain 0	Chain 1	Aggregate
				[dBm]	[dBm]	PPSD ^{Note1} [dBm]
802.11n HT20	MCS 0	2412	3 kHz	-15.55	-15.57	-12.55
		2437	3 kHz	-15.37	-15.39	-12.37
		2462	3 kHz	-15.14	-15.14	-12.13
802.11n HT40	MCS 0	2422	3 kHz	-18.66	-18.97	-15.80
		2437	3 kHz	-17.66	-18.16	-14.89
		2452	3 kHz	-17.66	-17.46	-14.55

Note1: $\text{AggregatePPSD} = 10 \log \left(10^{\left(\frac{\text{chain0}}{10}\right)} + 10^{\left(\frac{\text{chain1}}{10}\right)} \right)$

RESULT PLOTS

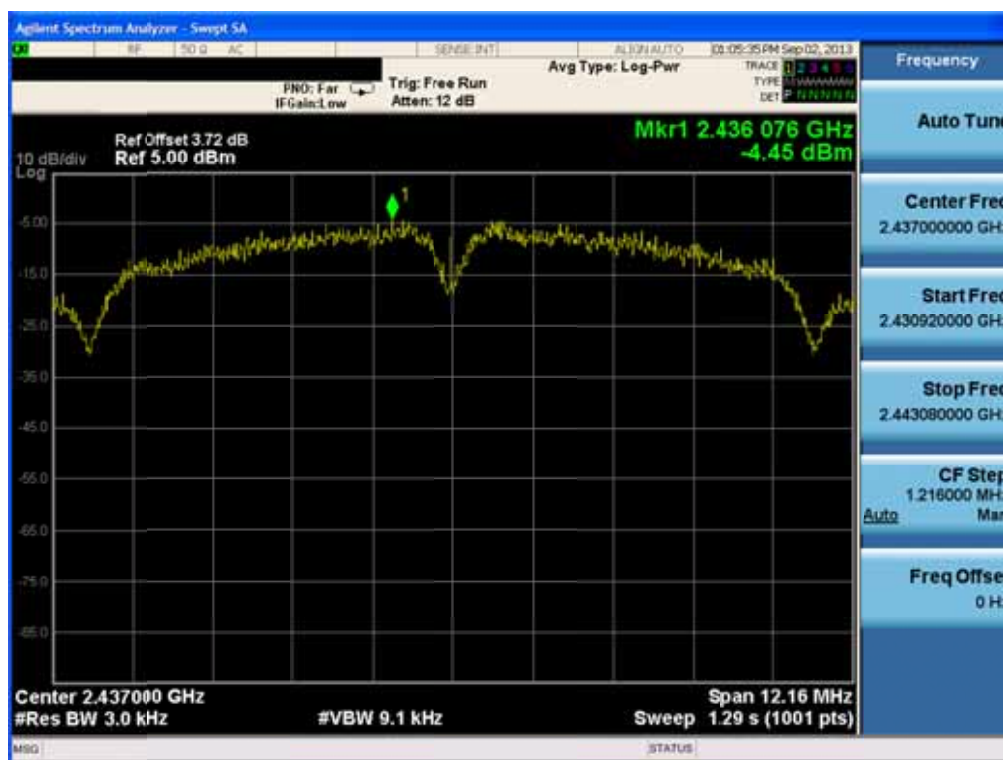
Maximum PPSD

Test Mode: Chain 0 & 802.11b & 1Mbps & 2412MHz



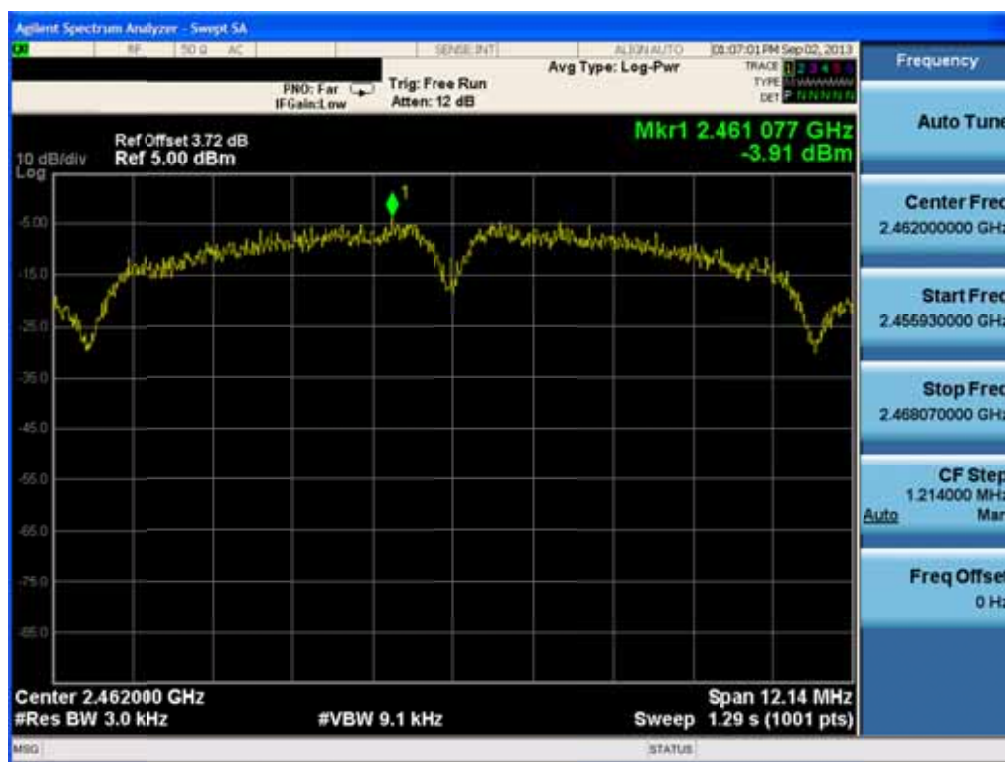
Maximum PPSD

Test Mode: Chain 0 & 802.11b & 1Mbps & 2437MHz



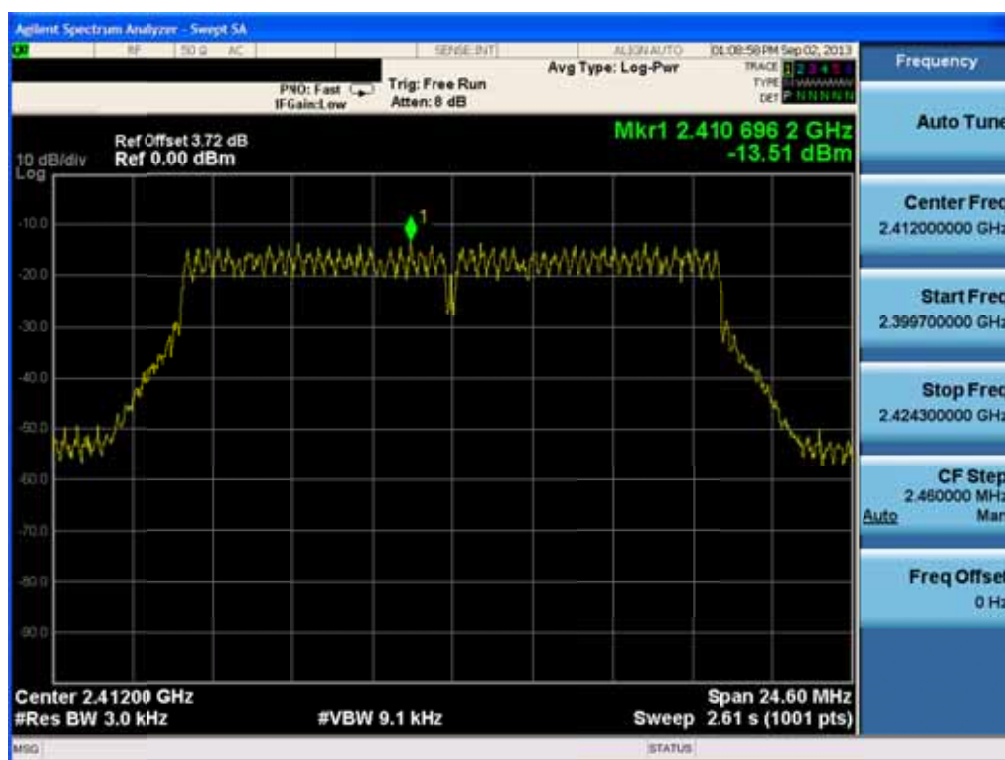
Maximum PPSD

Test Mode: Chain 0 &802.11b &1Mbps&2462MHz



Maximum PPSD

Test Mode: Chain 0 & 802.11g & 6Mbps & 2412MHz



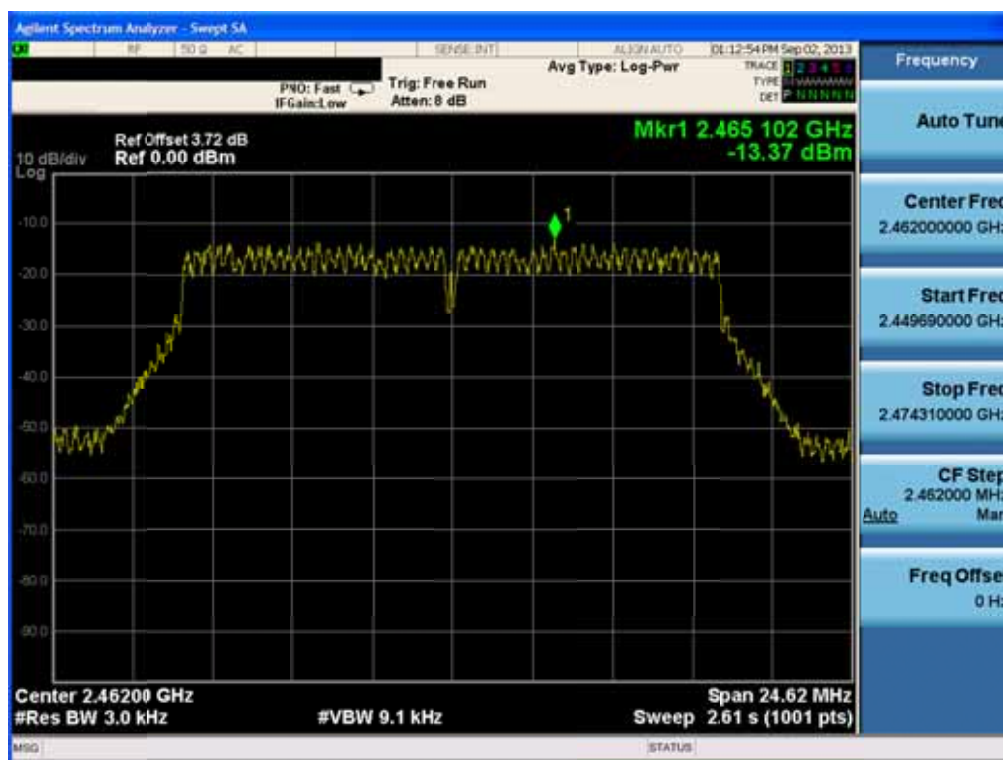
Maximum PPSD

Test Mode: Chain 0 & 802.11g & 6Mbps & 2437MHz



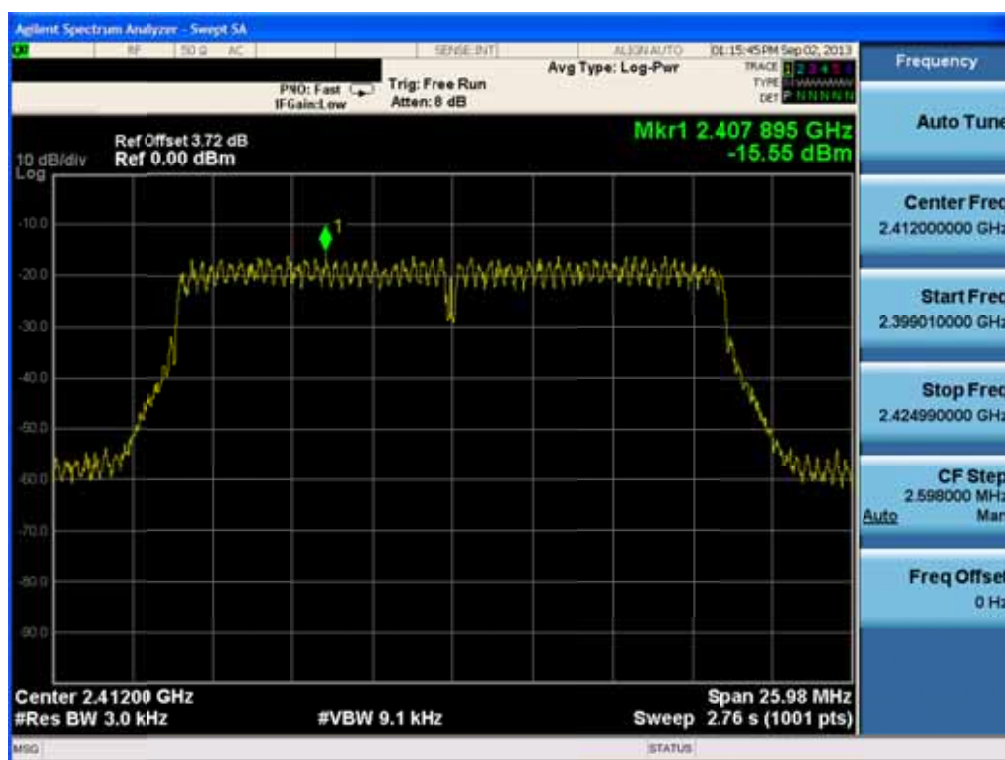
Maximum PPSD

Test Mode: Chain 0 & 802.11g & 6Mbps & 2462MHz



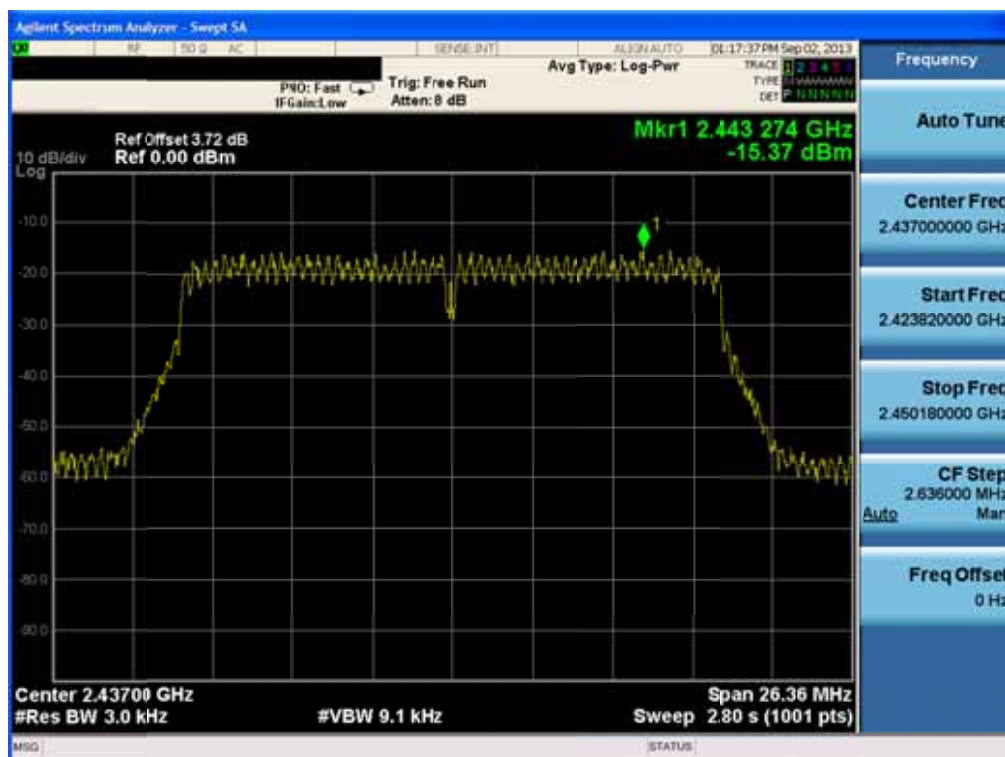
Maximum PPSD

Test Mode: Chain 0 & 802.11n HT20&MCS 0& 2412MHz



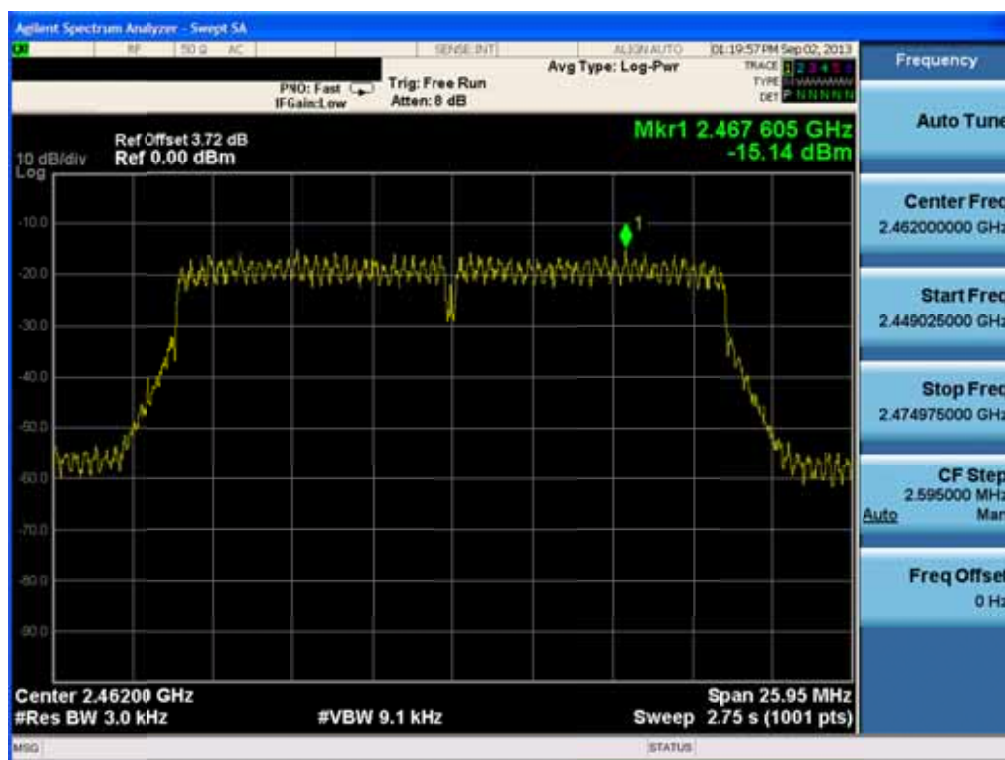
Maximum PPSD

Test Mode: Chain 0 & 802.11n HT20&MCS 0& 2437MHz



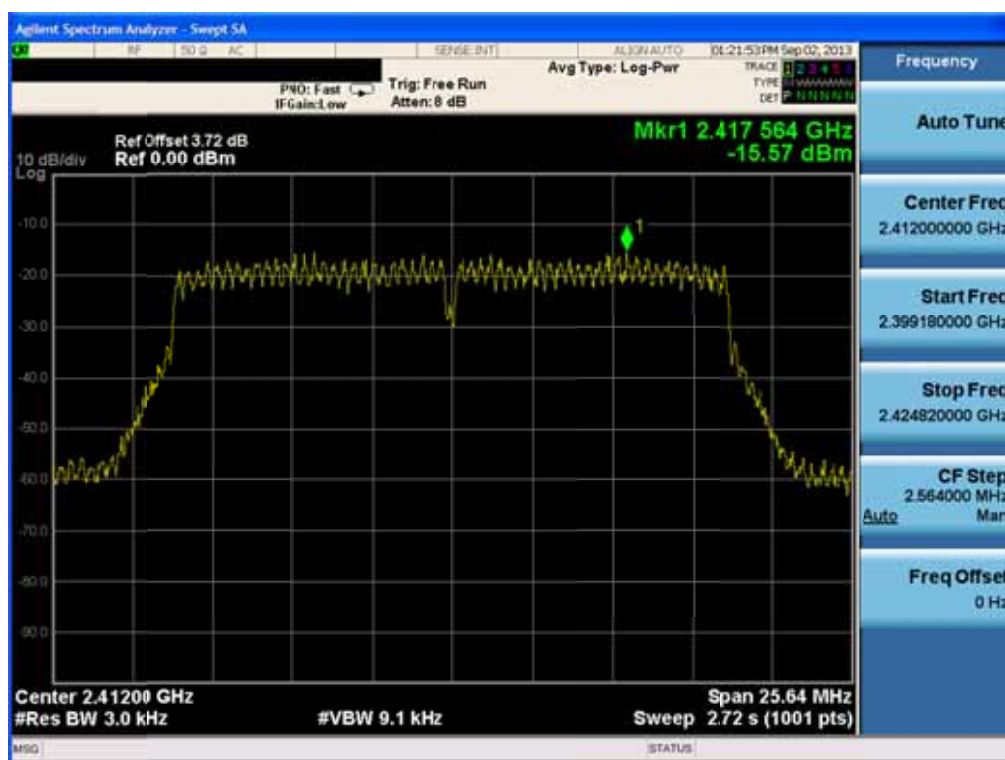
Maximum PPSD

Test Mode: Chain 0 & 802.11n HT20&MCS 0& 2462MHz



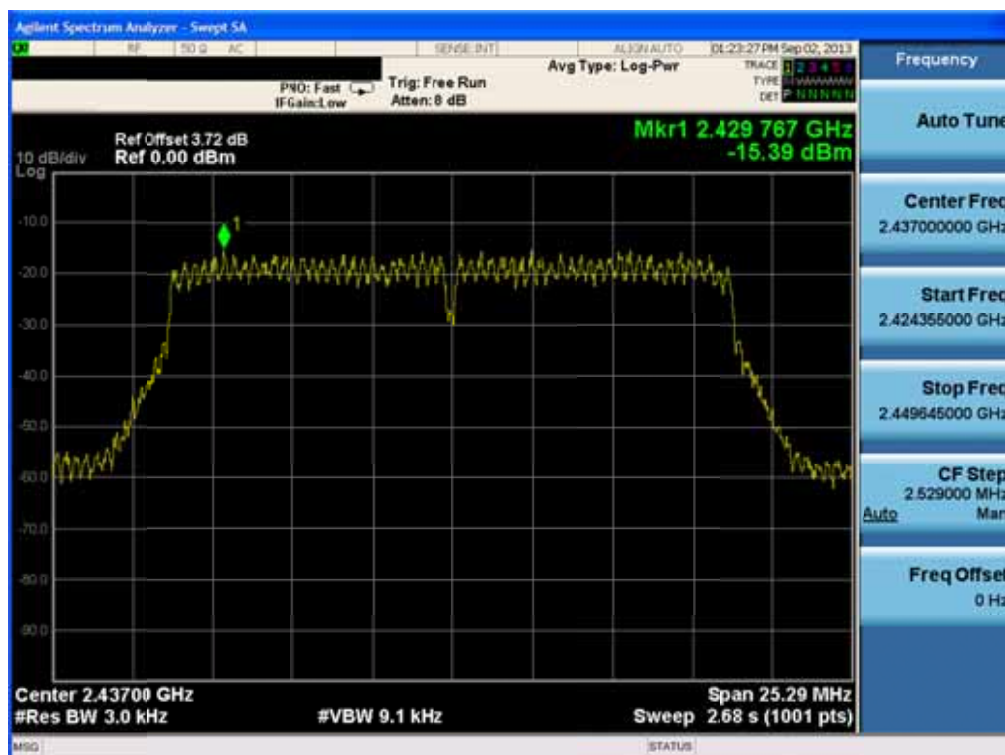
Maximum PPSD

Test Mode: Chain 1& 802.11n HT20&MCS 0& 2412MHz



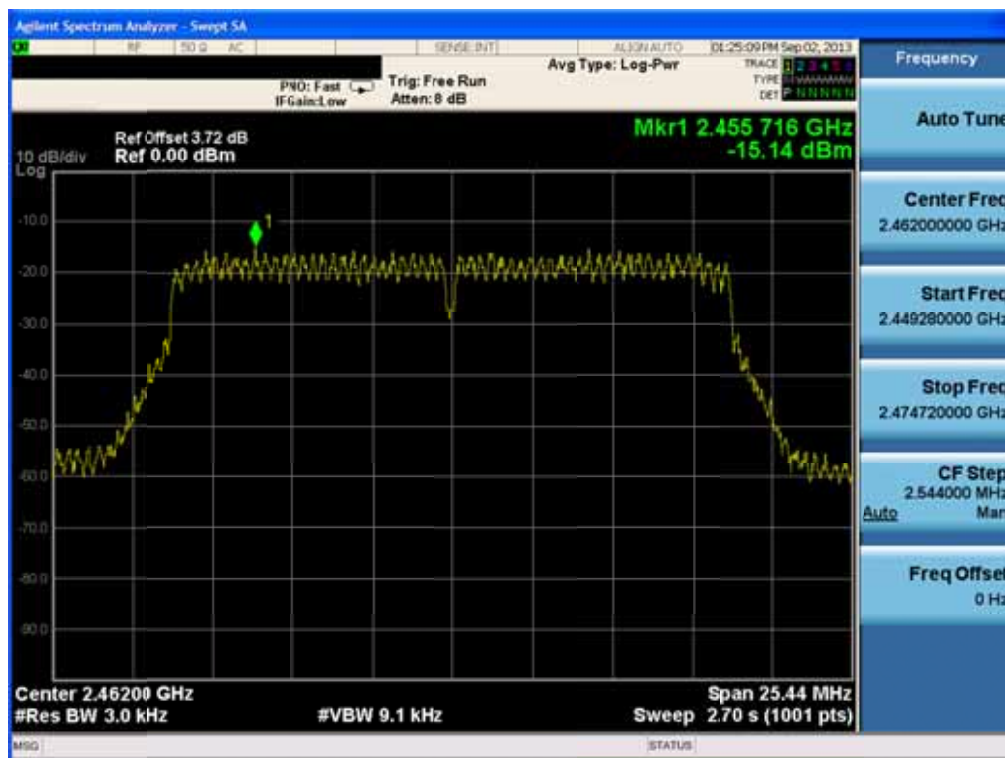
Maximum PPSD

Test Mode: Chain 1& 802.11n HT20&MCS 0& 2437MHz



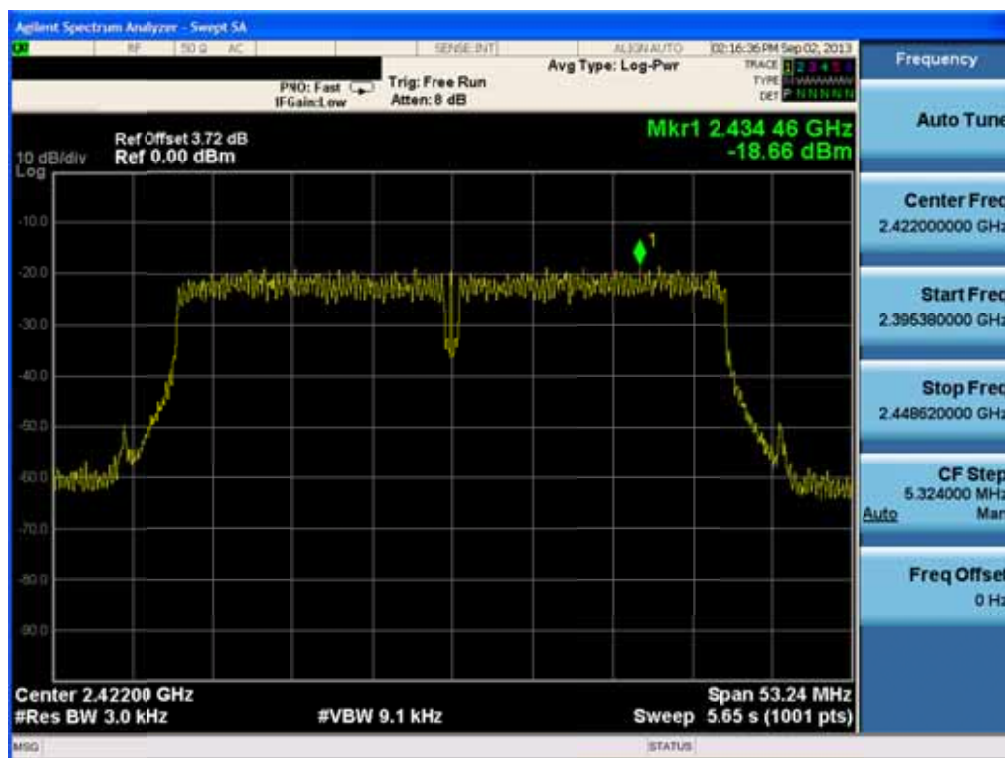
Maximum PPSD

Test Mode: Chain 1& 802.11n HT20&MCS 0& 2462MHz



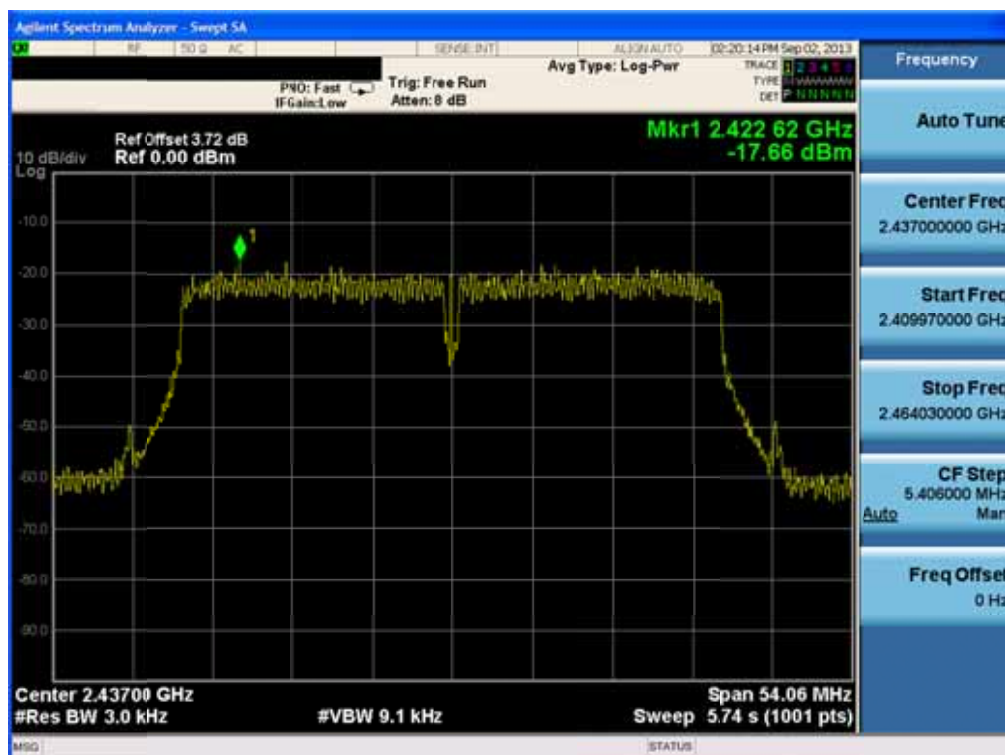
Maximum PPSD

Test Mode: Chain 0 & 802.11n HT40&MCS 0& 2422MHz



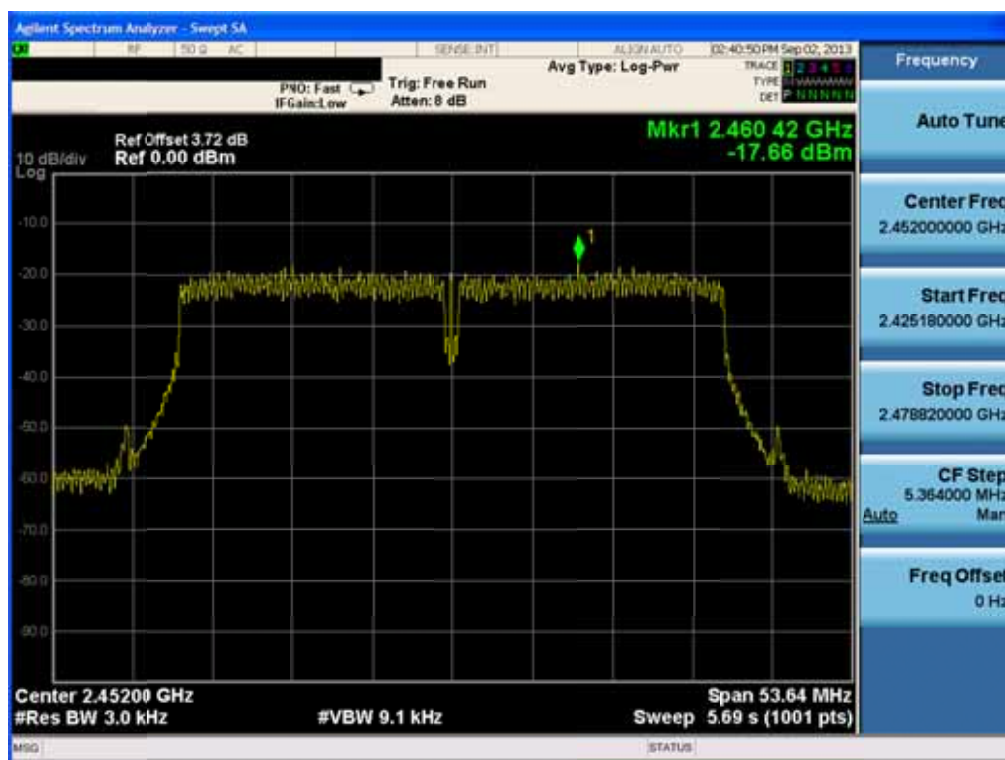
Maximum PPSD

Test Mode: Chain 0 & 802.11n HT40&MCS 0& 2437MHz



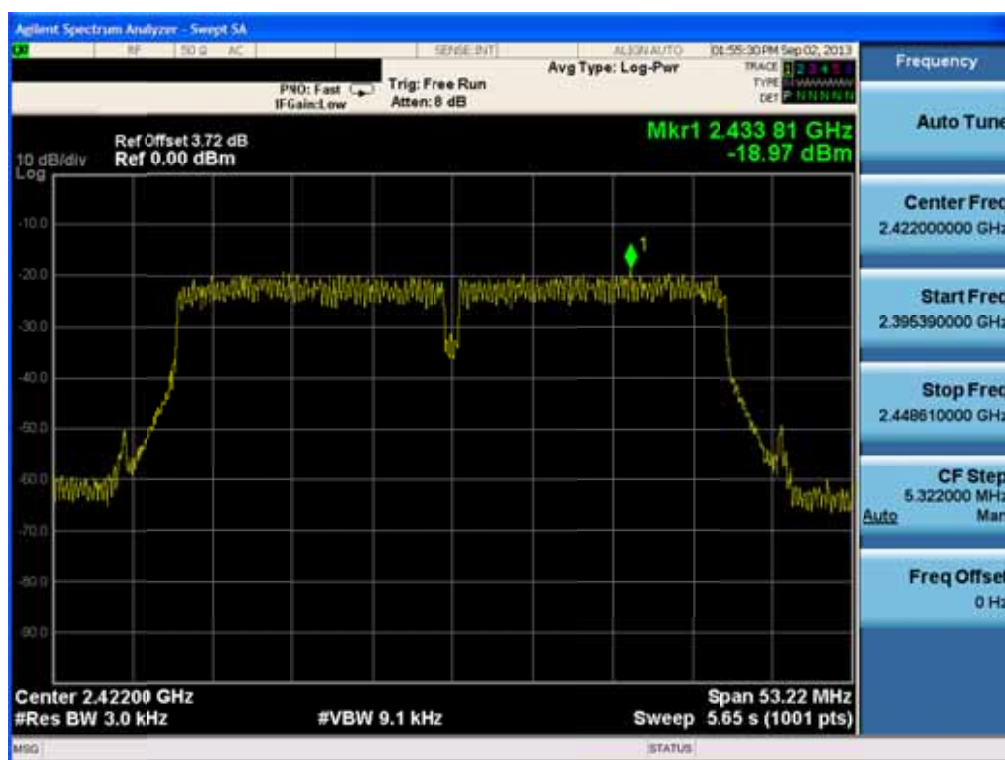
Maximum PPSD

Test Mode: Chain 0 & 802.11n HT40&MCS 0& 2452MHz



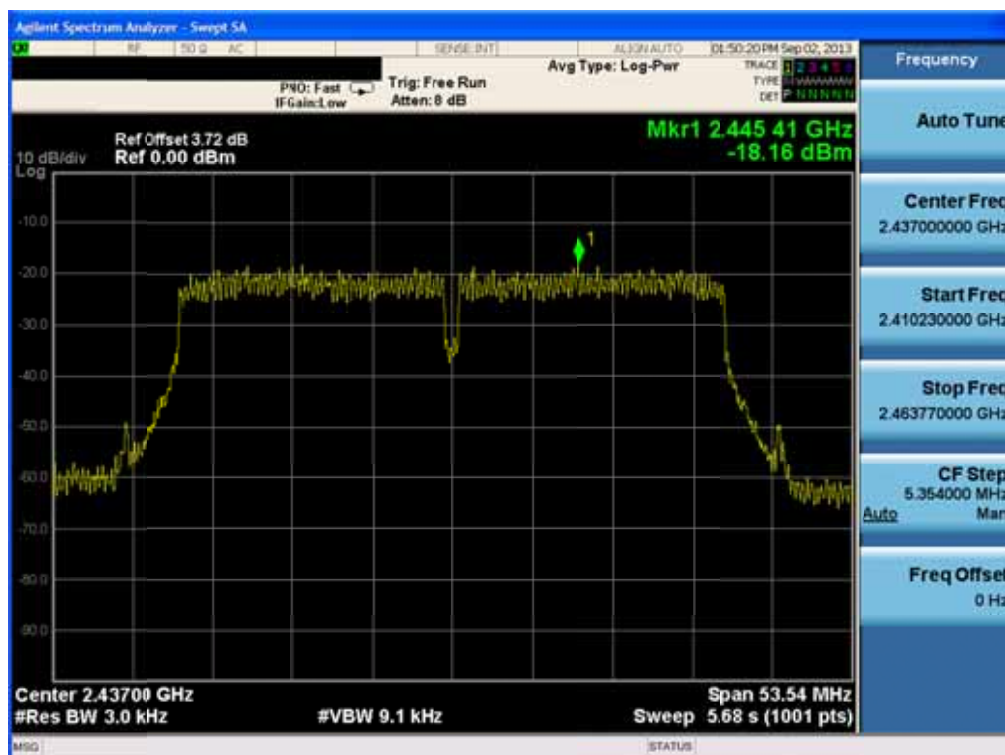
Maximum PPSD

Test Mode: Chain 1& 802.11n HT40&MCS 0& 2422MHz



Maximum PPSD

Test Mode: Chain 1& 802.11n HT40&MCS 0& 2437MHz



Maximum PPSD

Test Mode: Chain 1& 802.11n HT40&MCS 0& 2452MHz

