Washington Laboratories, Ltd.
www.wll.com
7560 Lindbergh Drive · Gaithersburg, MD 20879
301.216.1500 · info@wll.com

FCC & Industry Canada Certification Test Report
For the
Cernium Corporation
Archerfish Solo

FCC ID: X86-AF3001001
IC: 9240A-AF300100

WLL JOB# **11533-01**
October 6, 2010

Prepared for:

Cernium Corporation
1925 Issac Newton Square - 3rd Fl.
Reston, VA, 20190 USA

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

ACLASS ACCREDITED TESTING

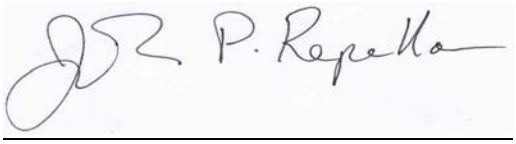
Testing Certificate AT-1448

FCC & Industry Canada Certification Test Report
for the
Cernium Corporation
Archerfish Solo
FCC ID: X86-AF3001001
IC: 9240A-AF300100

October 6, 2010

WLL JOB# **11533-01**

Prepared by:



John P. Repella
Compliance Engineer

Reviewed by:

Steven D. Koster
EMC Operations Manager

Abstract

This report has been prepared on behalf of Cernium Corporation to support the attached Application for Equipment Authorization. The test report and application are submitted for a Direct Sequence Spread Spectrum Transmitter under Part 15.247 (7/2008) of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Industry Canada. This Certification Test Report documents the test configuration and test results for the Cernium Corporation Archerfish Solo.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

The Cernium Corporation Archerfish Solo complies with the limits for a Direct Sequence Spread Spectrum Transmitter under FCC Part 15.247 and Industry Canada RSS-210.

Revision History	Description of Change	Date
Rev 0	Initial Release	October 6, 2010

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Compliance Statement

The Cernium Corporation Archerfish Solo complies with the limits for a Direct Sequence Spread Spectrum Transmitter device under FCC Part 15.247 (10/2009) and Industry Canada RSS-210.

1.2 Test Scope

Tests for radiated and conducted (at antenna terminal) emissions were performed. All measurements were performed in accordance with FCC Public Notice FCC97-114, Guidance on Measurements for Direct Sequence Spread Spectrum Systems & KDB558074: "Measurement of Digital Transmission Systems operating under Section 15.247." The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Cernium Corporation 1925 Issac Newton Square - 3rd Fl. Reston, VA, 20190 USA
Purchase Order Number:	694
Quotation Number:	65177B

1.4 Test Dates

Testing was performed on the following date(s):	07/09/2010-07/16/2010, 08/12/2010

1.5 Test and Support Personnel

Washington Laboratories, LTD	John P. Repella
Client Representative	Derek Ramcharran

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**ere**s**
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**c**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**d**eci**B**el
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga - prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo - prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega - prefix for 10^6 multiplier
m	**m**eter
µ	**m**icro - prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**umber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 Equipment Under Test

2.1 EUT Identification & Description

The Cernium Corporation Archerfish Solo is a networkable interactive wired/wireless monitor recording system.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Cernium, S/N:0021DF00061E
FCC ID:	X86-AF3001001
IC:	9240A-AF300100
Model:	Archerfish Solo
FCC Rule Parts:	§15.247
Industry Canada:	RSS210
Frequency Range:	2.412GHz – 2.462GHz
Maximum Output Power:	31.769mW (15.02dBm)
Modulation:	DSSS(CCK & OFDM)
Occupied Bandwidth:	802.11b, 11.163MHz/802.11g, 16.623MHz
Maximum Spurious TX:	333.5 uV/m @ 4874MHz (measured @ 3m)
Maximum Spurious RX:	33.1 uV/m @ 324MHz (measured @ 3m)
Emission Designator:	F1D11M1 (802.11b), F1D16M6(802.11g)
Keying:	Automatic, Manual
Type of Information:	Data
Number of Channels:	11
Power Output Level	Fixed
Antenna Connector	Internal
Antenna Type	2.1dBi Rufa 2.4GHz Surface Mount Antenna
Interface Cables:	Power & LAN
Power Source & Voltage:	Wall Wort, 12VDC

2.2 Test Configuration

The Cernium Corporation Archerfish Solo, Equipment Under Test (EUT), was operated from a 115/230Vac power supply providing 12VDC.

The Archerfish Solo was configured in a wireless mode transmitting continuously on the channels of interest for test.

2.3 Testing Algorithm

The Archerfish Solo was programmed for DSSS operation via customer supplied UniTest application.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and

Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

FCC Public Notice FCC97-114, Guidance on Measurements for Direct Sequence Spread Spectrum Systems

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 Methods of Measurement of Radio Noise from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

KDB558074: "Measurement of Digital Transmission Systems operating under Section 15.247."

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm\sqrt{\frac{a^2}{div_a{}^2} + \frac{b^2}{div_b{}^2} + \frac{c^2}{div_c{}^2} + ...}$$

Where u_c = standard uncertainty

a, b, c,.. = individual uncertainty elements

$Div_{a,\ b,\ c}$ = the individual uncertainty element divisor based on the probability distribution

Divisor = 1.732 for rectangular distribution

Divisor = 2 for normal distribution

Divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where U = expanded uncertainty

k = coverage factor

k ≤ 2 for 95% coverage (ANSI/NCSL Z540-2 Annex G)

u_c = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 2 below.

Table 2: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	2.63 dB
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	4.55 dB

3 Test Equipment

Table 3 shows a list of the test equipment used for measurements along with the calibration information.

Table 3: Test Equipment List

Test Name:	**Radiated Emissions, Bench Emissions**	Test Date:	**06/16/2010 7/19/2010**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
71	HP - 85685A	PRESELECTOR RF	6/28/2010
73	HP - 8568B	ANALYZER SPECTRUM	6/28/2010
69	HP - 85650A	ADAPTER QP	6/28/2010
382	SUNOL SCIENCES CORPORATION - JB1	ANTENNA BICONLOG	12/29/2010
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	2/6/2011
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	5/7/2011
732	MEGAPHASE - TM40 K1K5 36	RF CABLE 1M 2-9M TO 2-9M RA ONE END	5/13/2011
667	MEGAPHASE - EM18-S1NK5-600	TEST CABLE FOR OATS TESTING DC TO 18 GHZ SMA MALE	5/7/2011
477	HP - 8648C	GENERATOR RF SIGNAL	1/21/2011
7	ARA - LPB-2520	ANTENNA BICONILOG ANTENNA	6/17/2010
626	ARA - DRG-118/A	ANTENNA HORN	6/3/2011
4000	R&S - SMR 40	SIG GEN 1-40GHZ	3/15/2012
618	HP - 8563A	ANALYZER SPECTRUM	6/4/2011
597	TENNEY/T10RS1.5	TEMP & HUMIDITY CHAMBER	5/4/2011

4 Test Results

4.1 Test Summary

The Table Below shows the results of testing for compliance with a Direct Sequence Spread Spectrum System in accordance with FCC Part 15.247. Full results are shown in beginning in Section 4.2.

Table 4: Test Summary

TX Test Summary (Direct Sequence Spread Spectrum)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.247 (2)	RSS-210 [A8. 2]	6dB Bandwidth	Pass
15.247 (2)(b)(3)	RSS-210 [A8.4]	Transmit Output Power	Pass
15.247 (e)	RSS-210 [A8.2 (b)]	Power Spectral Density	Pass
15.247 (d)	RSS-210 [A8. 5]	Out-of-Band Emissions (Band Edge @ 20dB below)	Pass
15.205 15.209	RSS-210 Sect.2.2	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions	Pass
RX/Digital Test Summary (Direct Sequence Spread Spectrum)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions	Pass
15.209	RSS-210 sect 2.6	General Field Strength Limits	Pass

4.2 Occupied Bandwidth: (FCC Part §15.247 (2))

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer. The lowest and highest data rates for each modulation type were evaluated.

For Direct Sequence Spread Spectrum Systems, FCC Part 15.247 requires the minimum 6 dB bandwidth be greater than 500 kHz.

At full modulation, the occupied bandwidth was measured as shown:

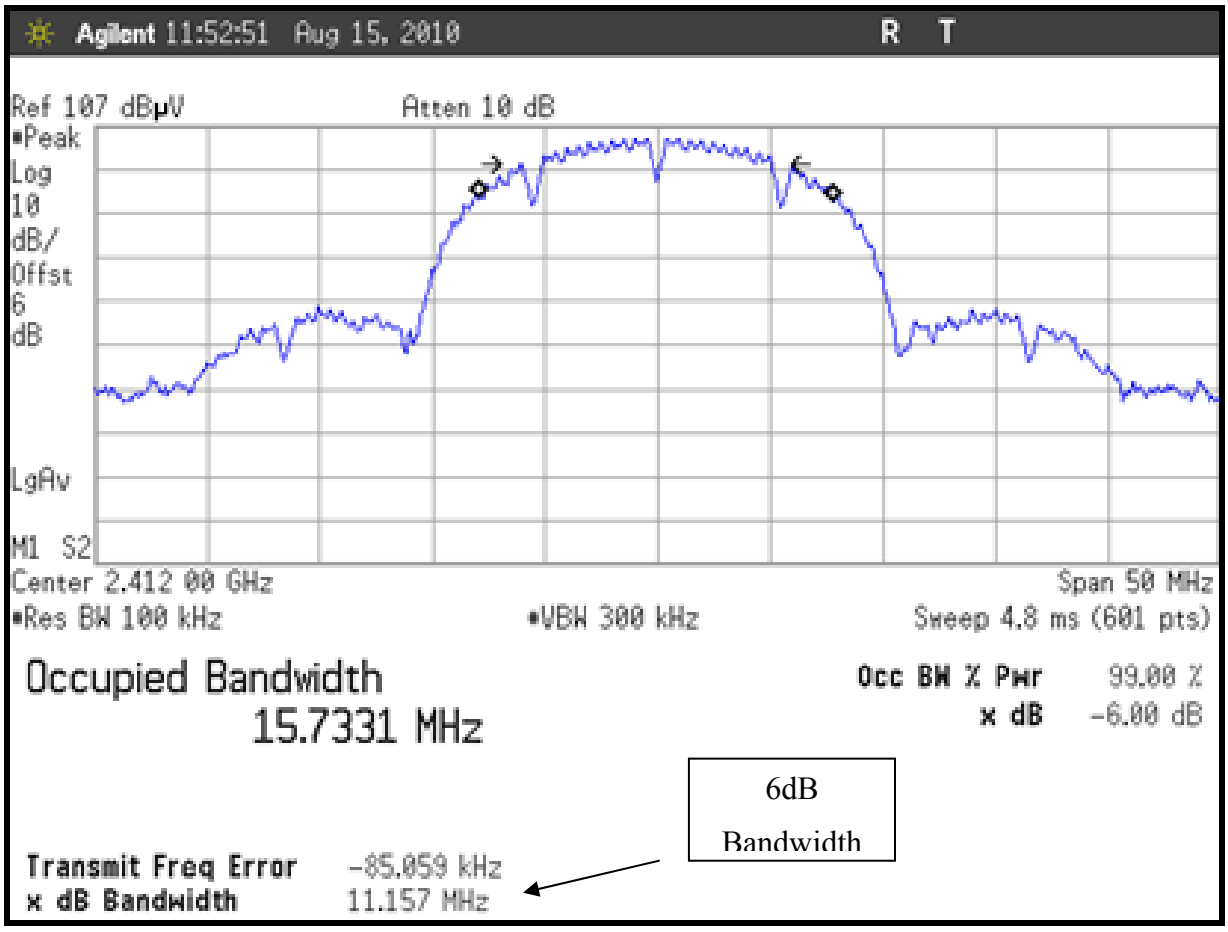


Figure 1: Occupied Bandwidth, 802.11b 1Mbps Low Channel

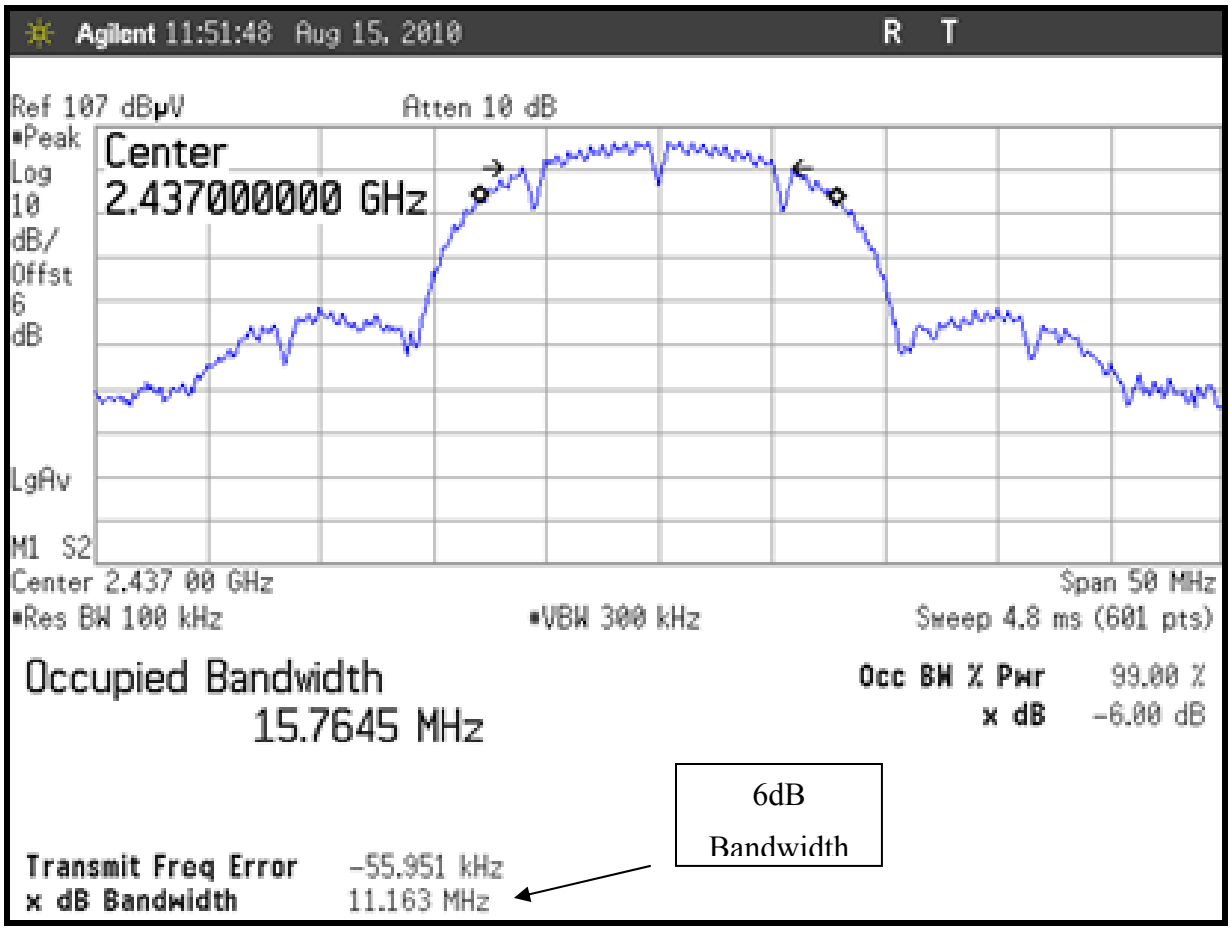


Figure 2: Occupied Bandwidth, 802.11b 1Mbps Mid Channel

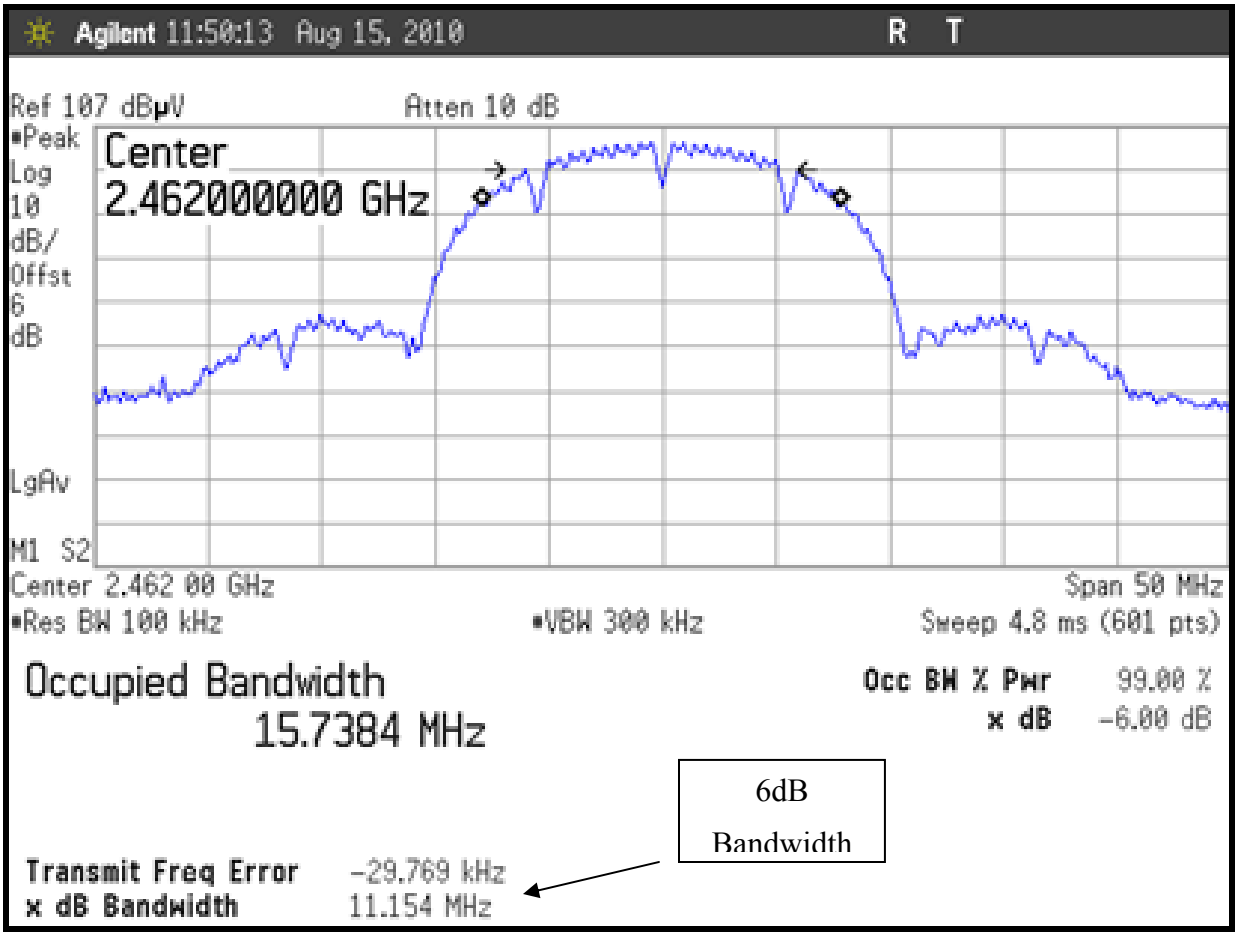


Figure 3: Occupied Bandwidth, 802.11b 1Mbps High Channel

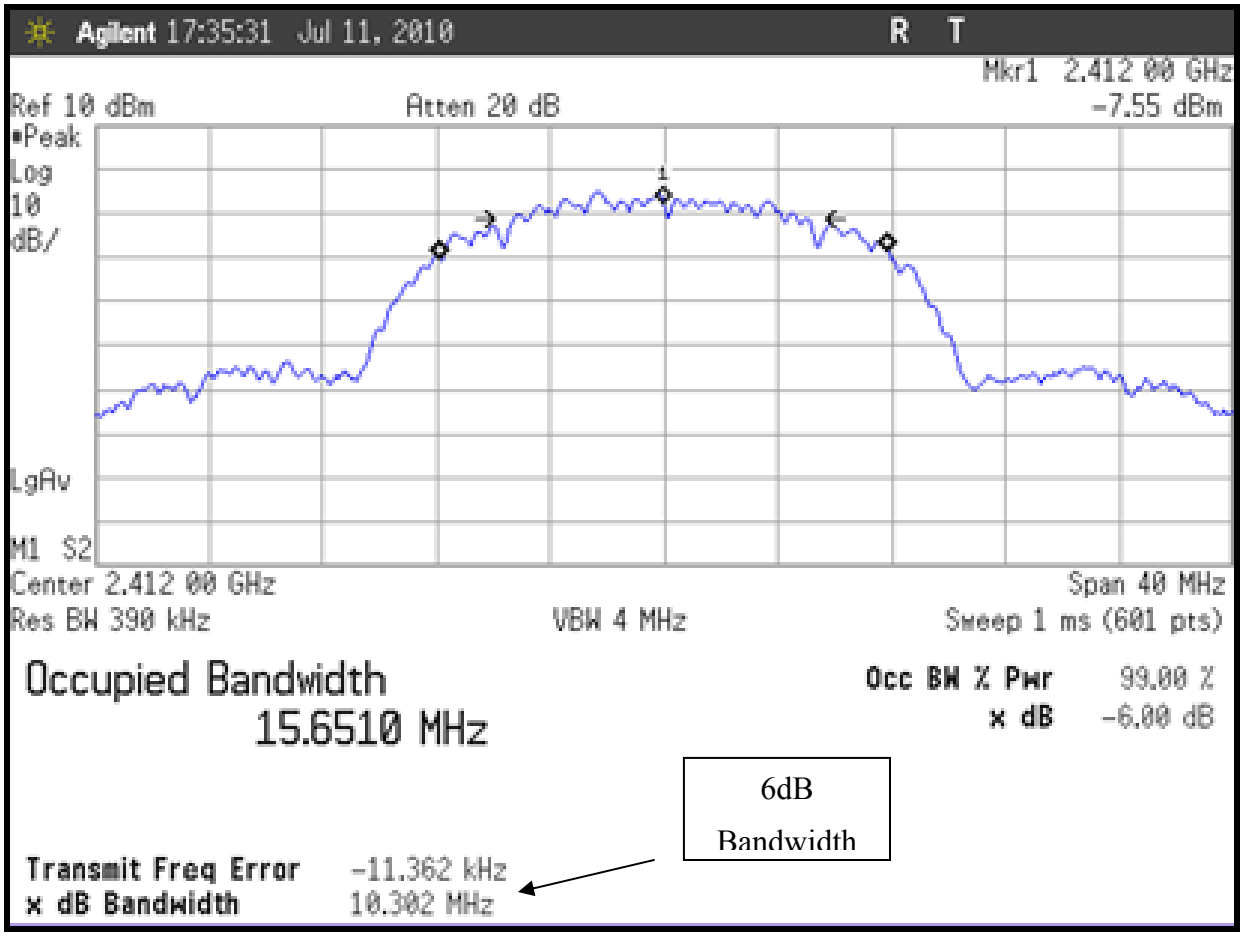


Figure 4: Occupied Bandwidth, 802.11b 11Mbps Low Channel

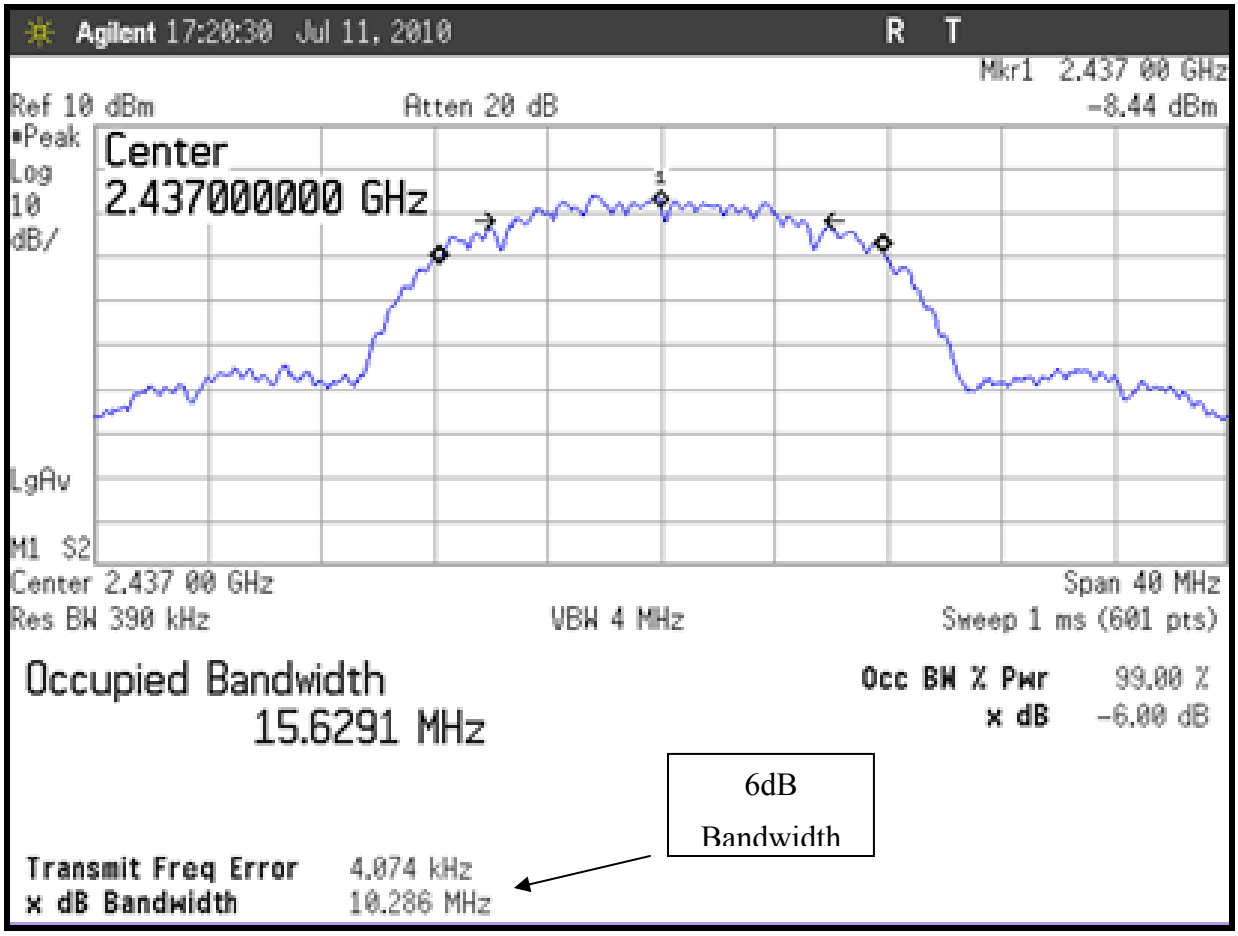


Figure 5: Occupied Bandwidth, 802.11b 11Mbps Mid Channel

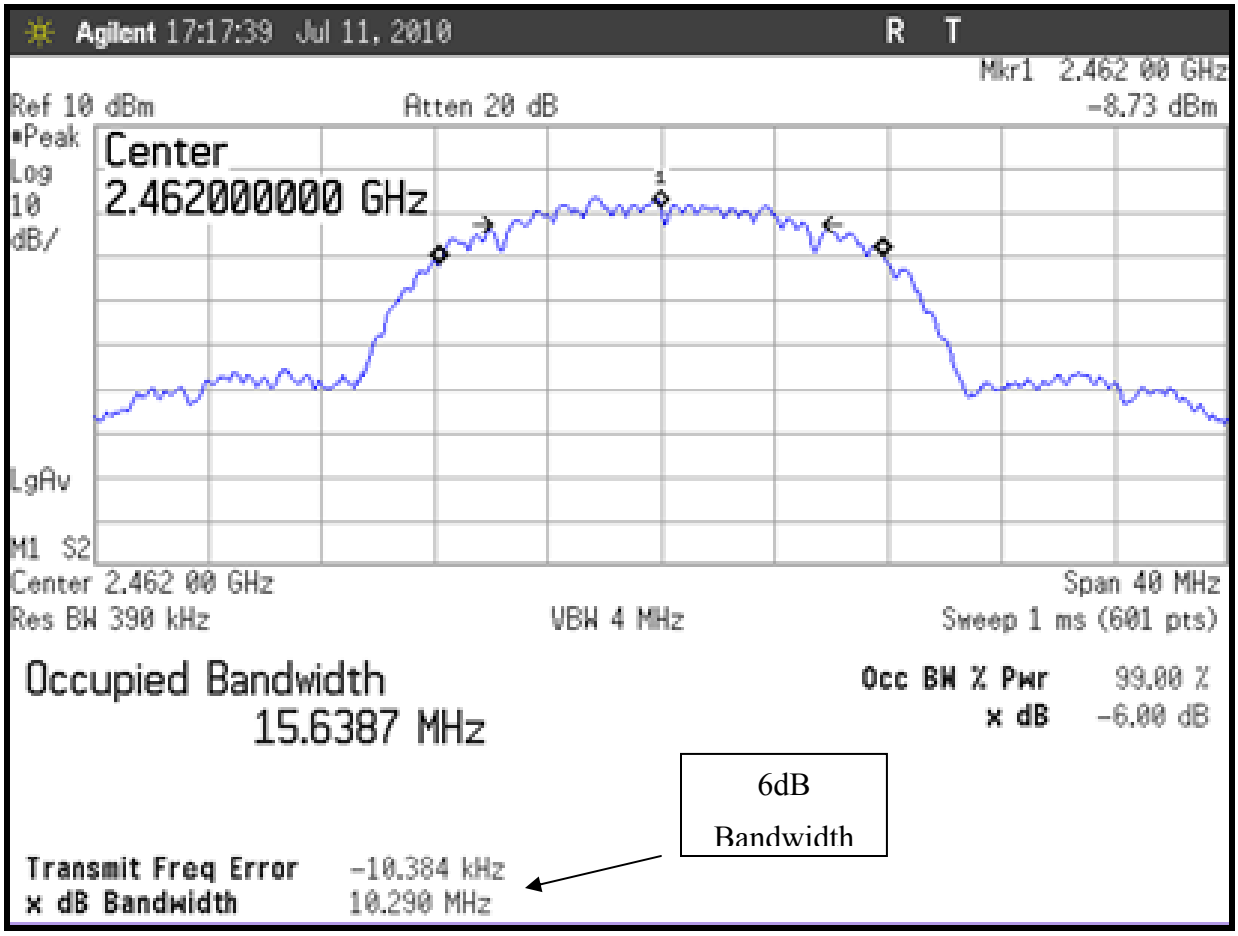


Figure 6: Occupied Bandwidth, 802.11b 11Mbps High Channel

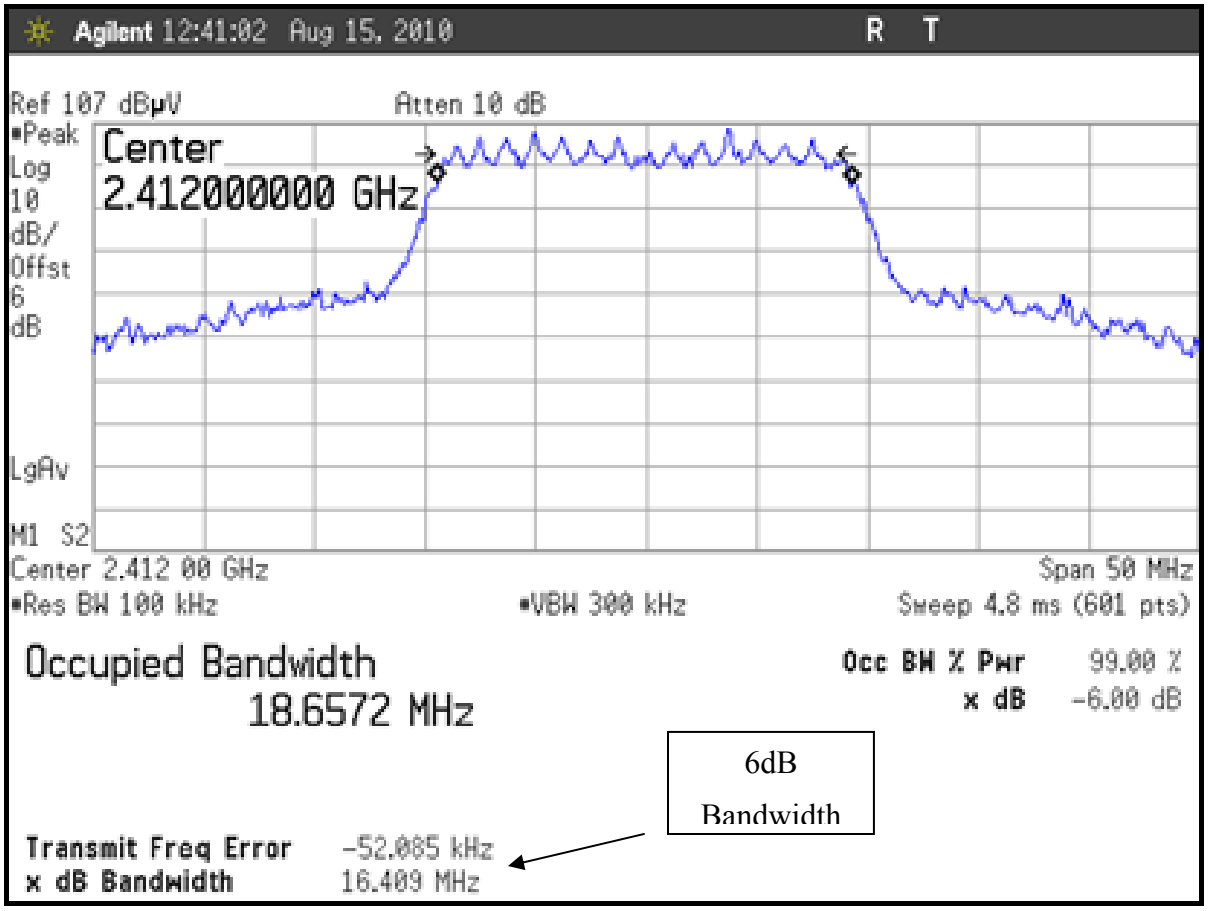


Figure 7: Occupied Bandwidth, 802.11g 6Mbps Low Channel

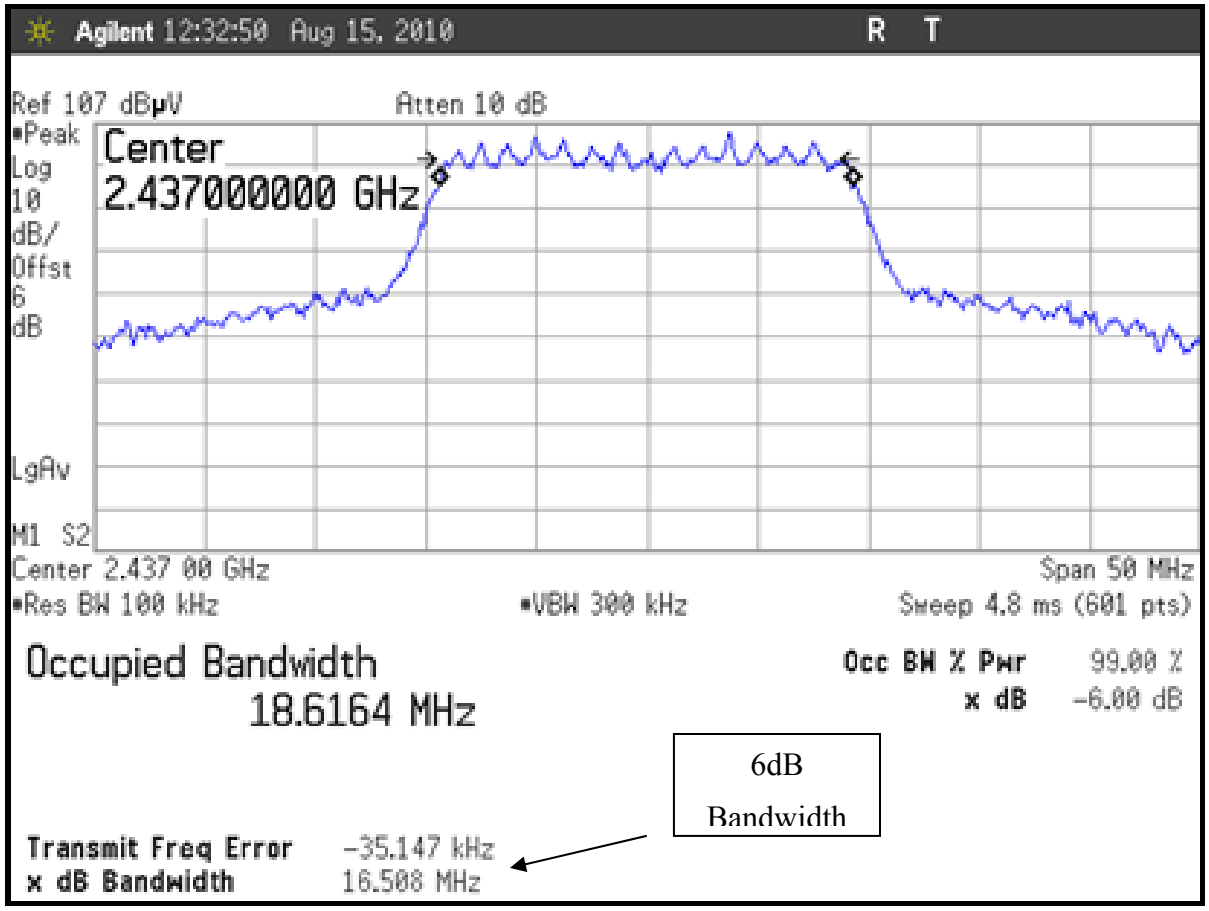


Figure 8: Occupied Bandwidth, 802.11g 6Mbps Mid Channel

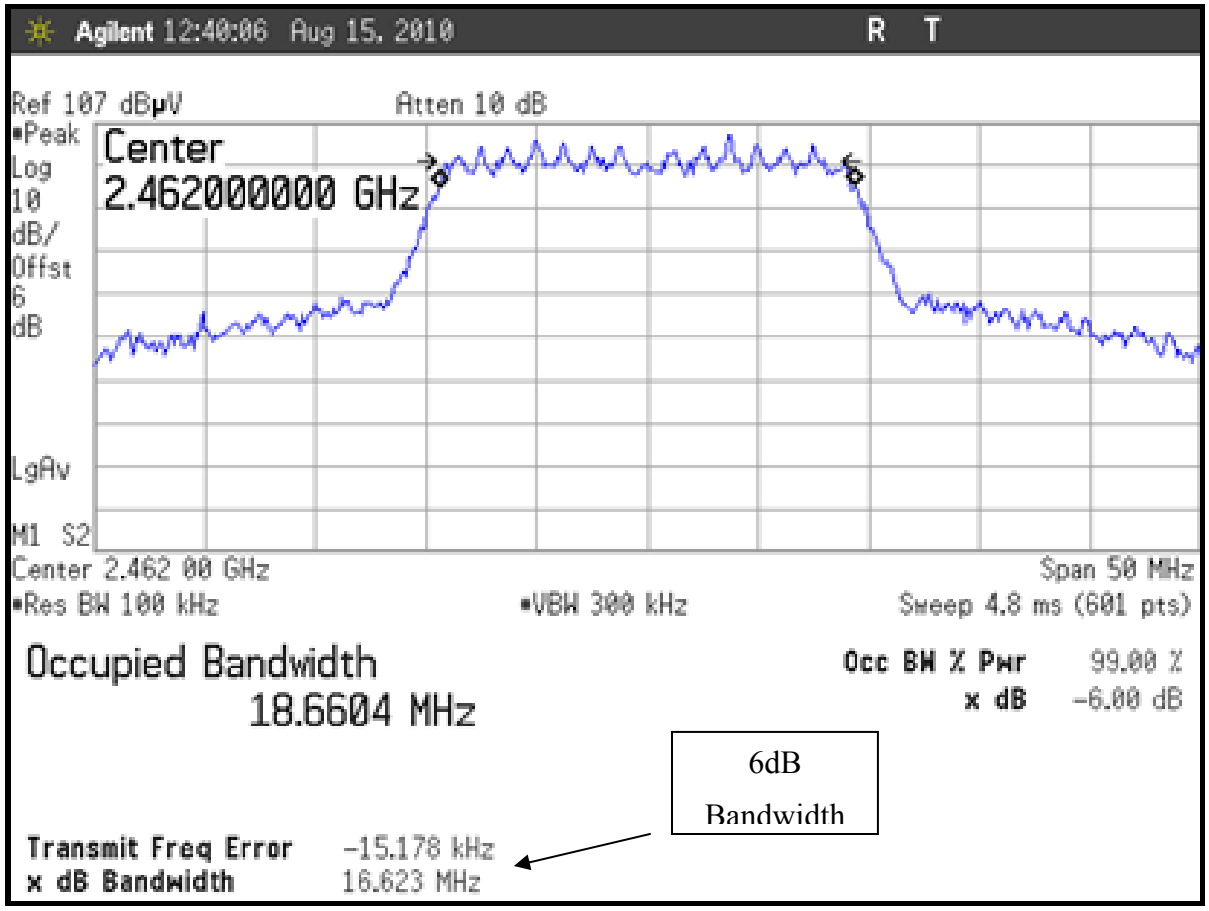


Figure 9: Occupied Bandwidth, 802.11g 6Mbps High Channel

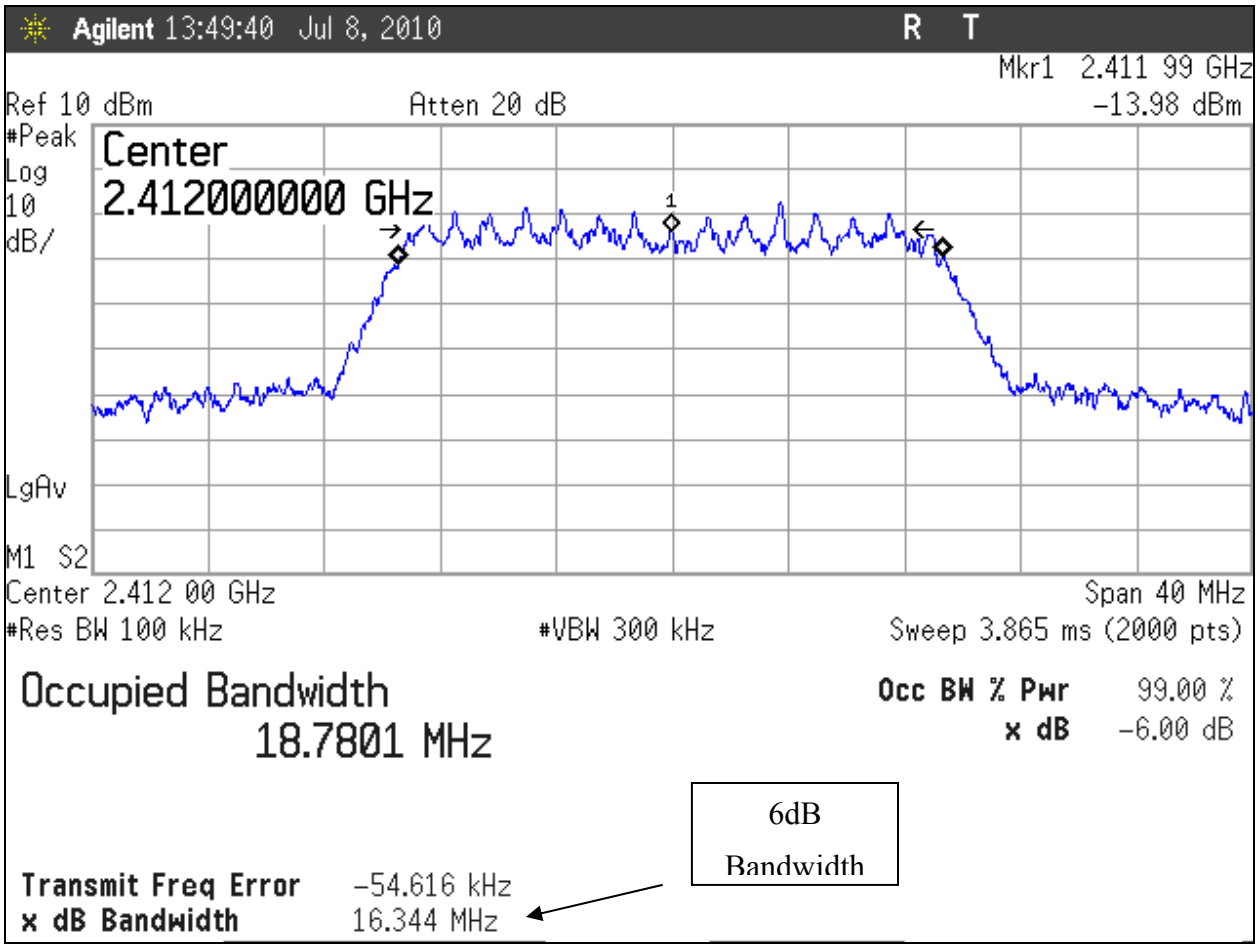


Figure 10: Occupied Bandwidth, 802.11g 54Mbps Low Channel

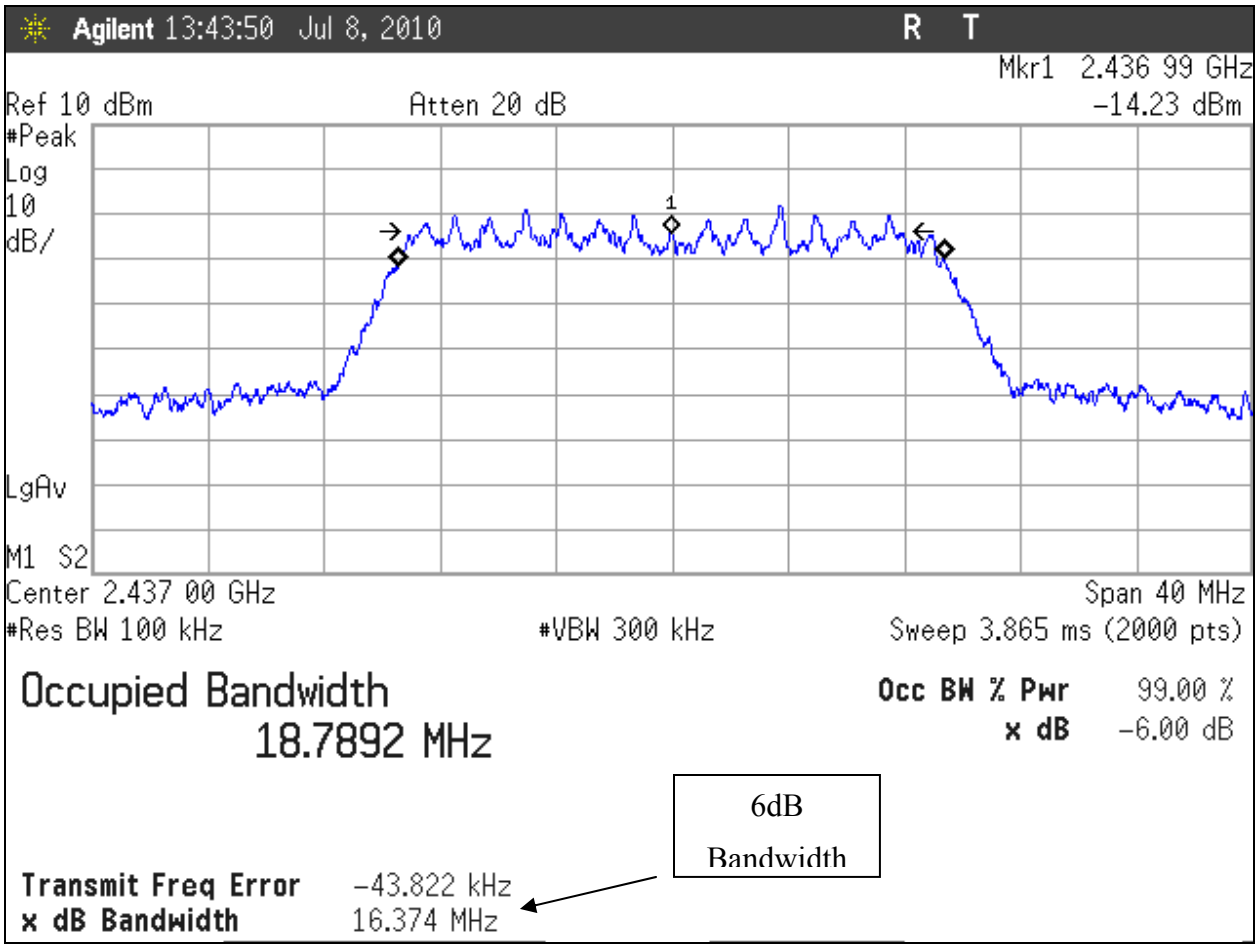


Figure 11: Occupied Bandwidth, 802.11g 54Mbps Mid Channel

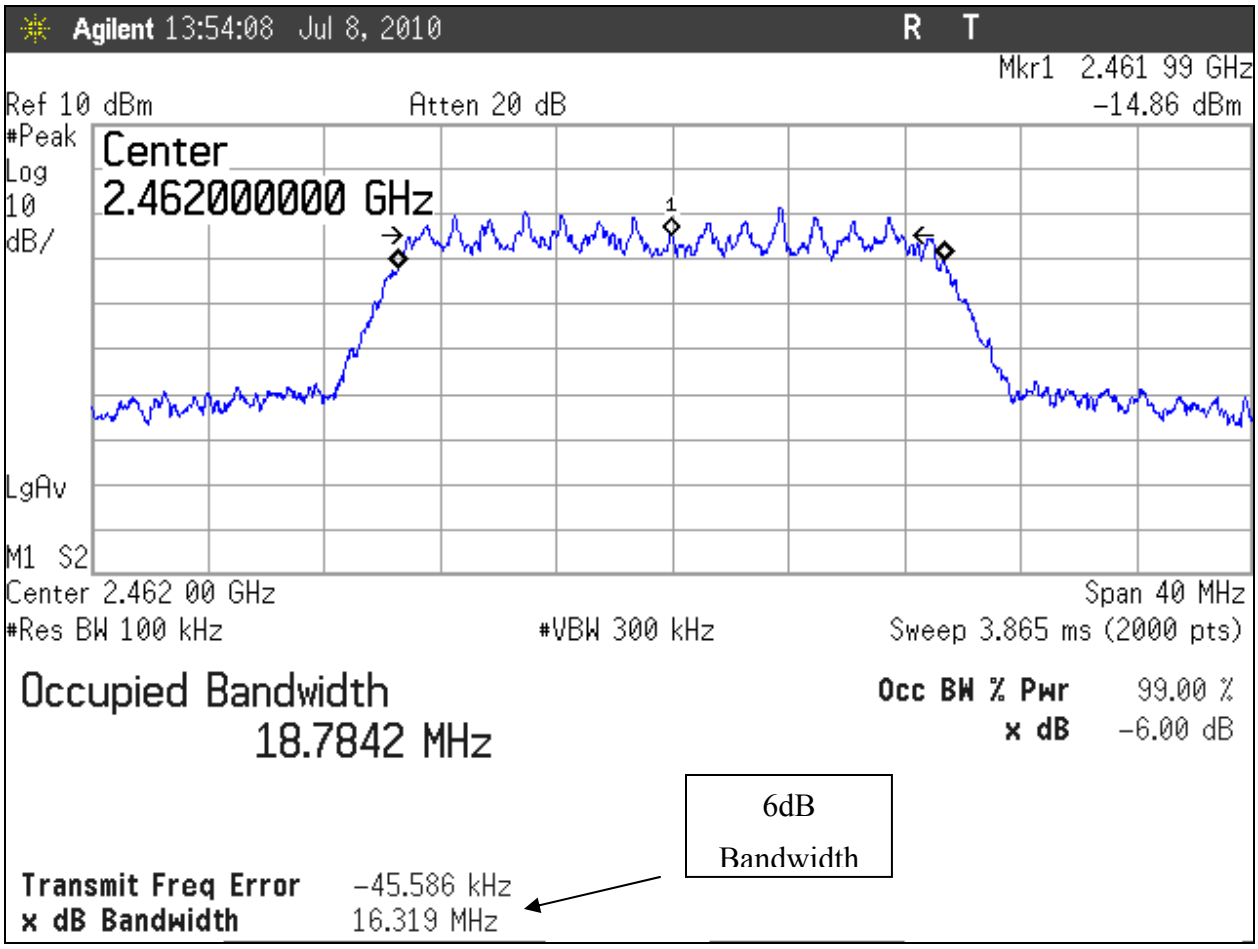


Figure 12: Occupied Bandwidth, 802.11g 54Mbps High Channel

Table 5 provides a summary of the Occupied Bandwidth Results.

Table 5: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
802.11b 1Mbps			
Low Channel: 2412MHz	11.157MHz	>500kHz	Pass
Mid Channel: 2437MHz	11.163MHz	>500kHz	Pass
High Channel: 2462MHz	11.154MHz	>500kHz	Pass
802.11b 11Mbps			
Low Channel: 2412MHz	10.302MHz	>500kHz	Pass
Mid Channel: 2437MHz	10.286MHz	>500kHz	Pass
High Channel: 2462MHz	10.290MHz	>500kHz	Pass
802.11g 6Mbps			
Low Channel: 2412MHz	16.409MHz	>500kHz	Pass
Mid Channel: 2437MHz	16.508MHz	>500kHz	Pass
High Channel: 2462MHz	16.623MHz	>500kHz	Pass
802.11g 54Mbps			
Low Channel: 2412MHz	16.344MHz	>500kHz	Pass
Mid Channel: 2437MHz	16.374MHz	>500kHz	Pass
High Channel: 2462MHz	16.319MHz	>500kHz	Pass

4.3 RF Power Output: (FCC Part §15.247(b))

To measure the output power the modulation was started while the frequency dwelled on a low, middle and high channel. The output from the transmitter was connected to an attenuator and then to the input of the RF to a broadband power meter. The power meter offset was adjusted to compensate for the attenuator and other losses in the system.

Table 6: RF Power Output

Channel/Freq	Peak Power (dBm)	Power (mW)	Limit (W)	Pass/Fail
802.11b 1Mbps				
CH1: 2412	14.72	29.648	1W	Pass
CH 6: 2437	13.9	24.547	1W	Pass
CH 11: 2462	13.61	22.961	1W	Pass
Channel/Freq	Peak Power (dBm)	Power (mW)	Limit (W)	Pass/Fail
802.11b 11Mbps				
CH1: 2412	14.85	30.549	1W	Pass
CH 6: 2437	13.77	23.823	1W	Pass
CH 11: 2462	13.68	23.335	1W	Pass
Channel/Freq	Peak Power (dBm)	Power (mW)	Limit (W)	Pass/Fail
802.11g 6Mbps				
CH1: 2412	15.02	31.769	1W	Pass
CH 6: 2437	14.34	27.164	1W	Pass
CH 11: 2462	14.18	26.182	1W	Pass
Channel/Freq	Peak Power (dBm)	Power (mW)	Limit (W)	Pass/Fail
802.11g 54Mbps				
CH1: 2412	14.79	30.130	1W	Pass
CH 6: 2437	13.76	23.768	1W	Pass
CH 11: 2462	13.41	21.928	1W	Pass

4.4 Power Spectral Density (Section §15.247(e))

Measurements for power spectral density were taken in accordance with 15.247(e). The measurements were performed using PSD Option 1 of "Measurement of Digital Transmission Systems operating under 15.247" (March 23, 2005).

The spectrum analyzer was set to peak detect mode with a RBW of 3kHz and a VBW of 10kHz. The highest level detected across any 3kHz band for continuous transmission was then recorded and compared to the limit 8dBm. The following table and plots give the results for power spectral density testing.

Table 7: Power Spectral Density

Channel/Freq	Peak Power (dBm)	Limit (dBm)	Pass/Fail
802.11b 1Mbps			
CH1: 2412	-12.86	8	Pass
CH 6: 2437	-13.24	8	Pass
CH 11: 2462	-14.38	8	Pass
Channel/Freq	Peak Power (dBm)	Limit (dBm)	Pass/Fail
802.11b 11Mbps			
CH1: 2412	-12.54	8	Pass
CH 6: 2437	-13.32	8	Pass
CH 11: 2462	-14.3	8	Pass
Channel/Freq	Peak Power (dBm)	Limit (dBm)	Pass/Fail
802.11g 6Mbps			
CH1: 2412	-8.615	8	Pass
CH 6: 2437	-9.5909	8	Pass
CH 11: 2462	-10.757	8	Pass
Channel/Freq	Peak Power (dBm)	Limit (dBm)	Pass/Fail
802.11g 54Mbps			
CH1: 2412	-8.779	8	Pass
CH 6: 2437	-9.7609	8	Pass
CH 11: 2462	-10.59	8	Pass

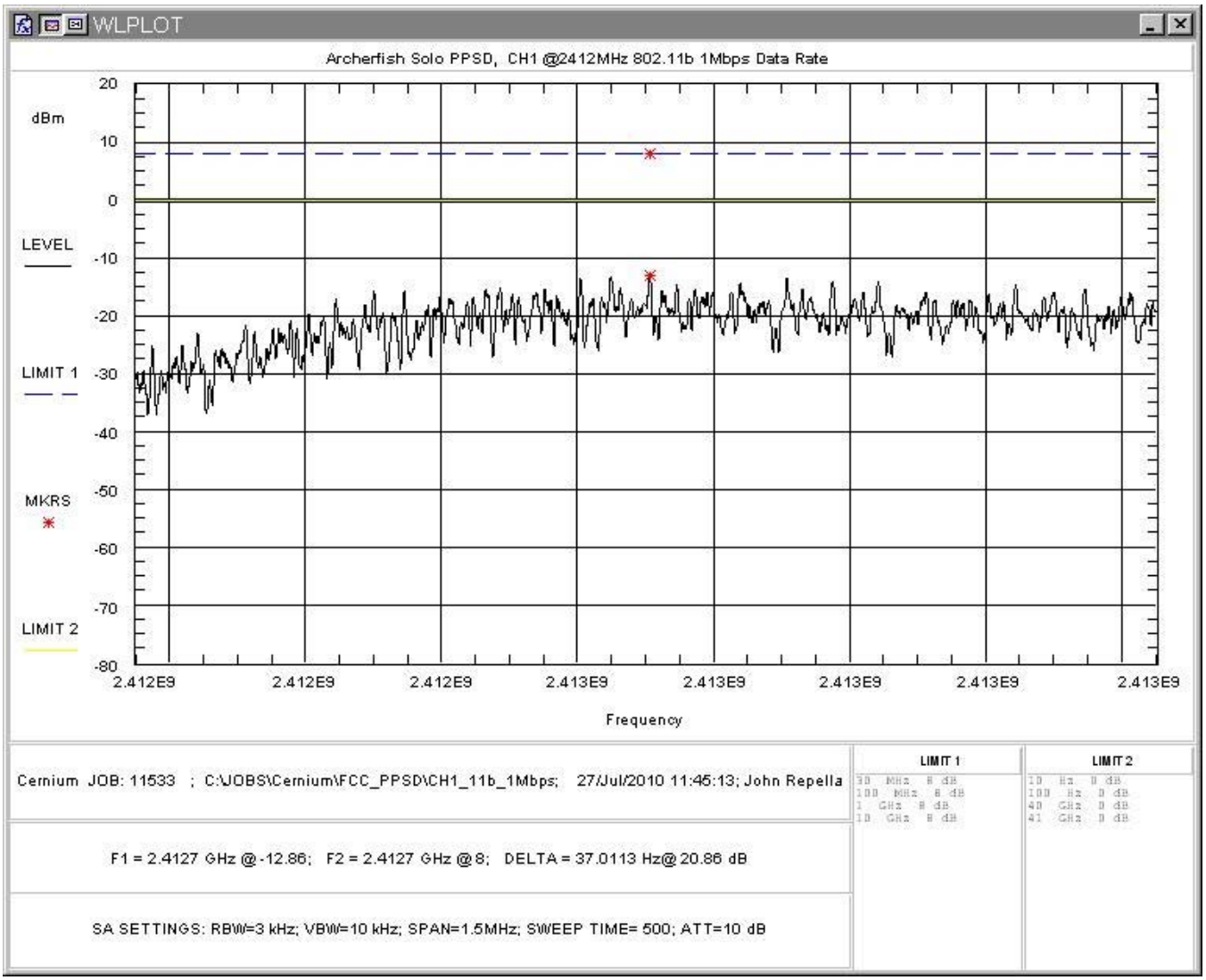


Figure 13: Power Spectral Density, 802.11b 1Mbps Low Channel

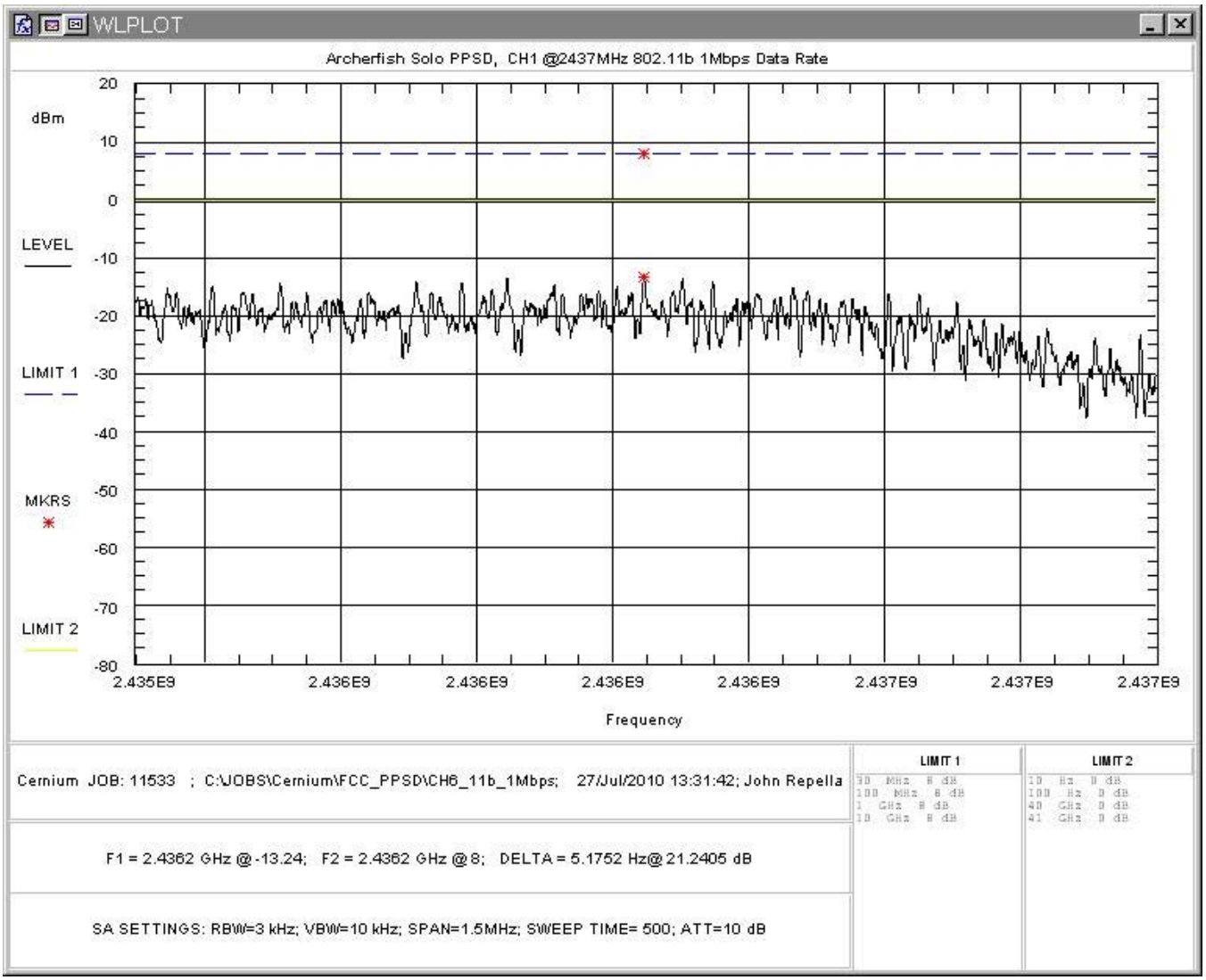


Figure 14: Power Spectral Density, 802.11b 1Mbps Mid Channel

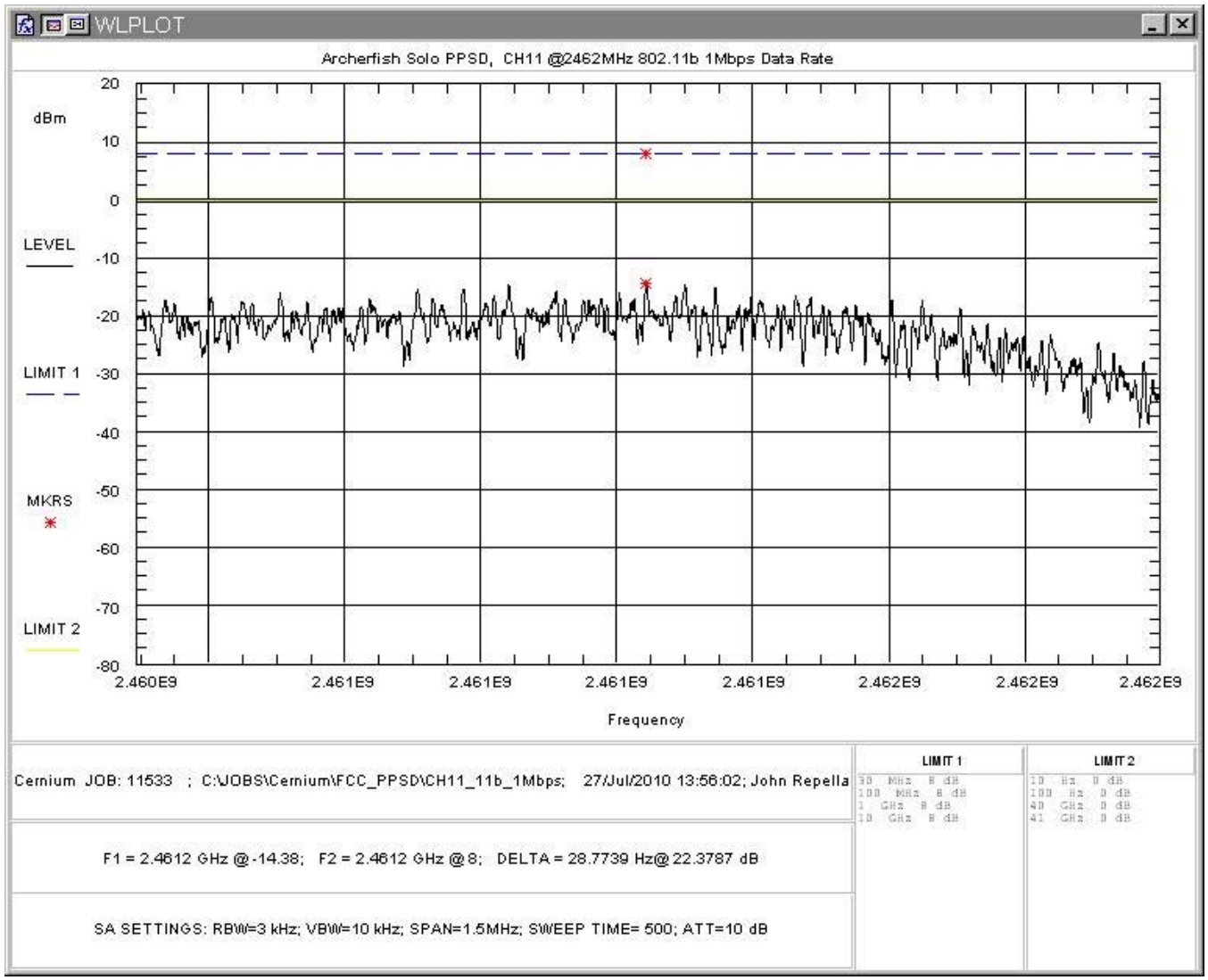


Figure 15: Power Spectral Density, 802.11b 1Mbps High Channel

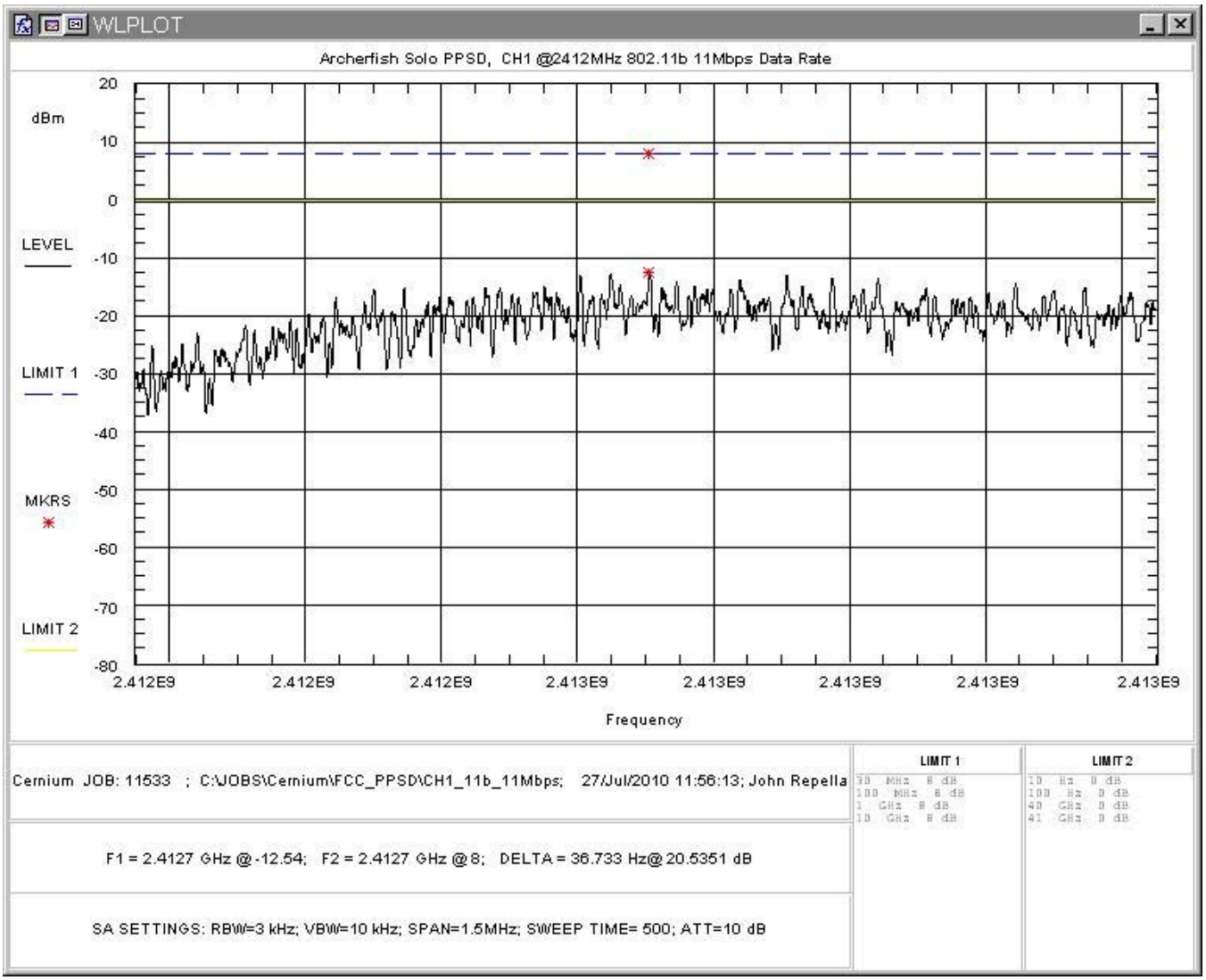


Figure 16: Power Spectral Density, 802.11b 11Mbps Low Channel

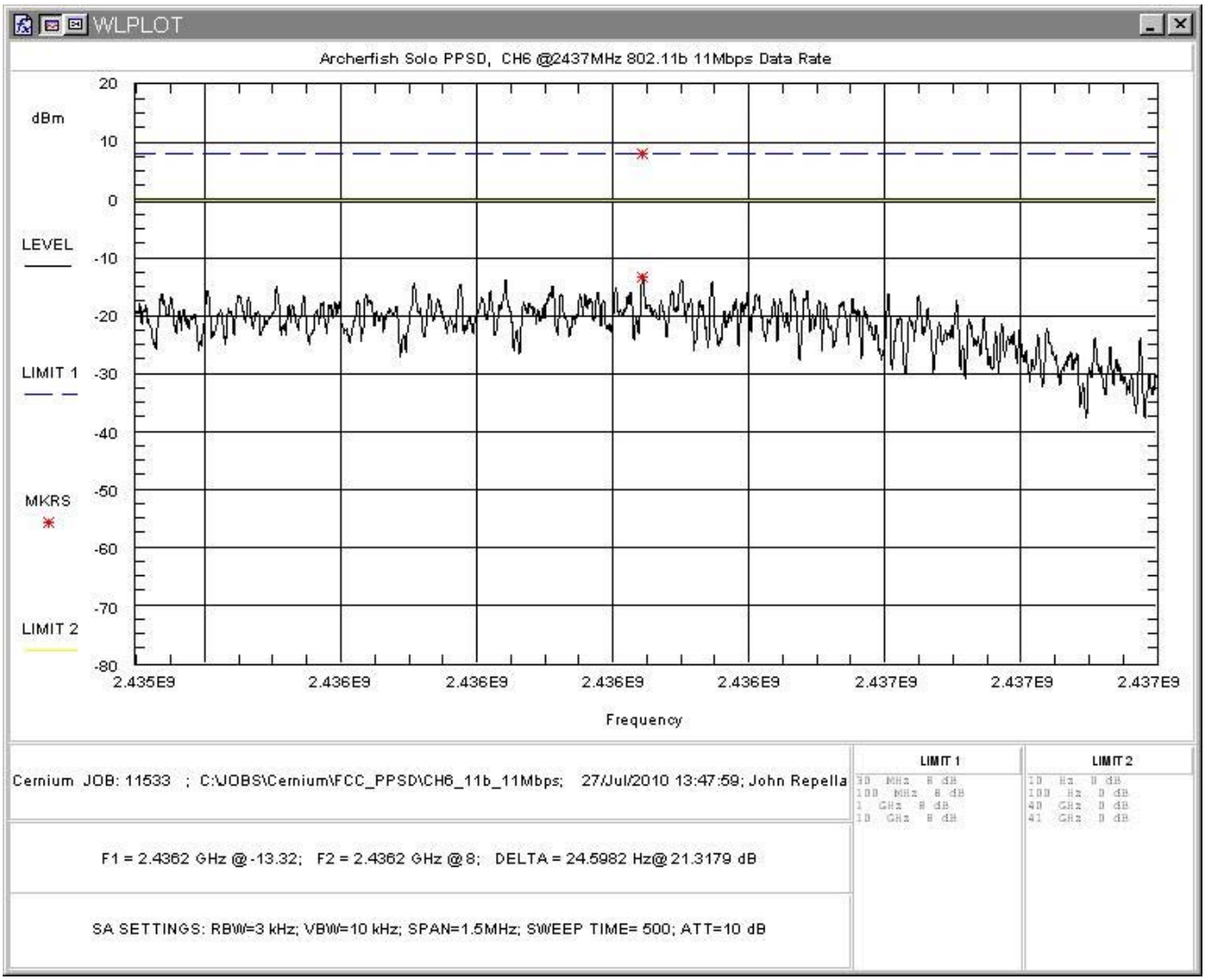


Figure 17: Power Spectral Density, 802.11b 11Mbps Mid Channel

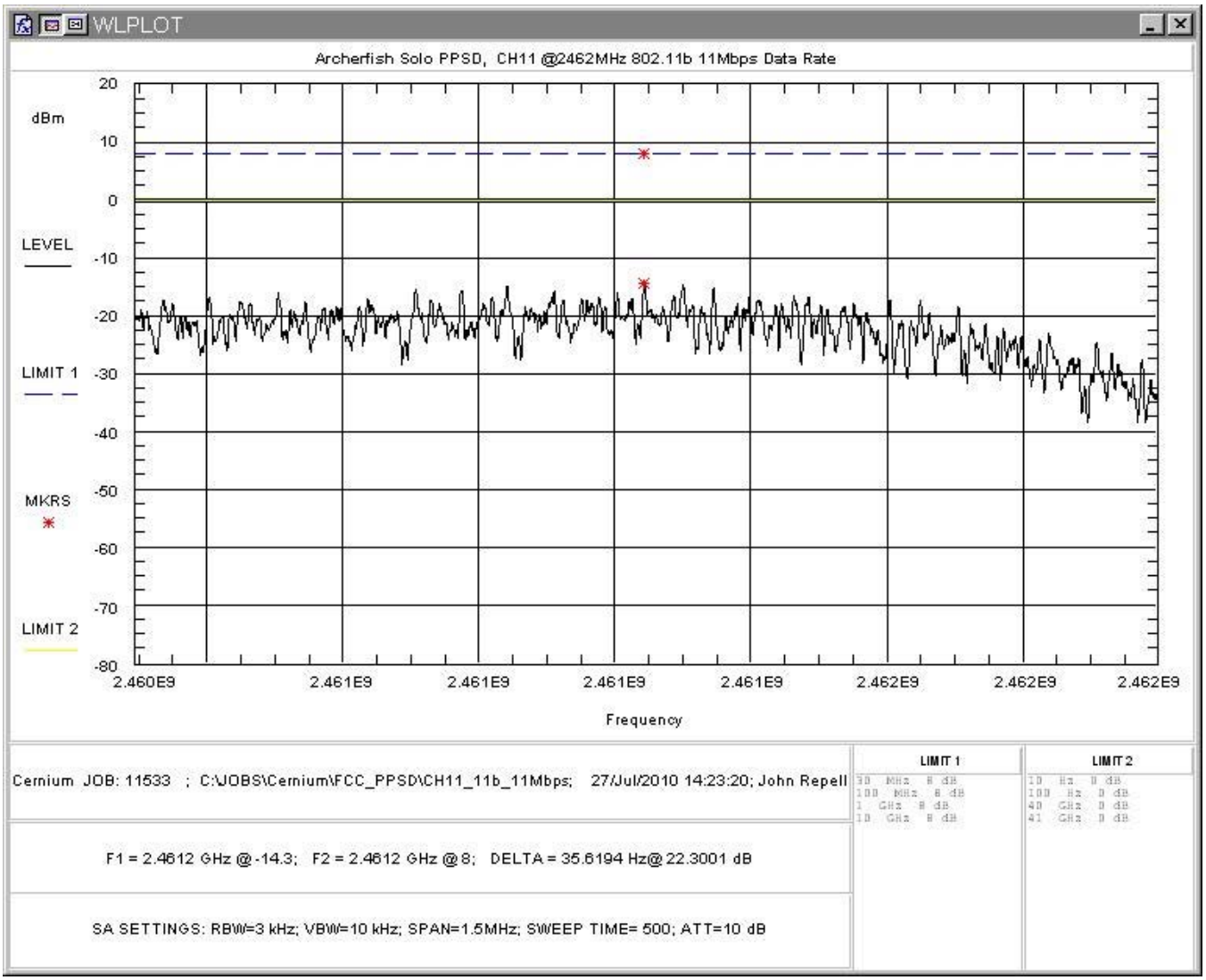


Figure 18: Power Spectral Density, 802.11b 11Mbps High Channel

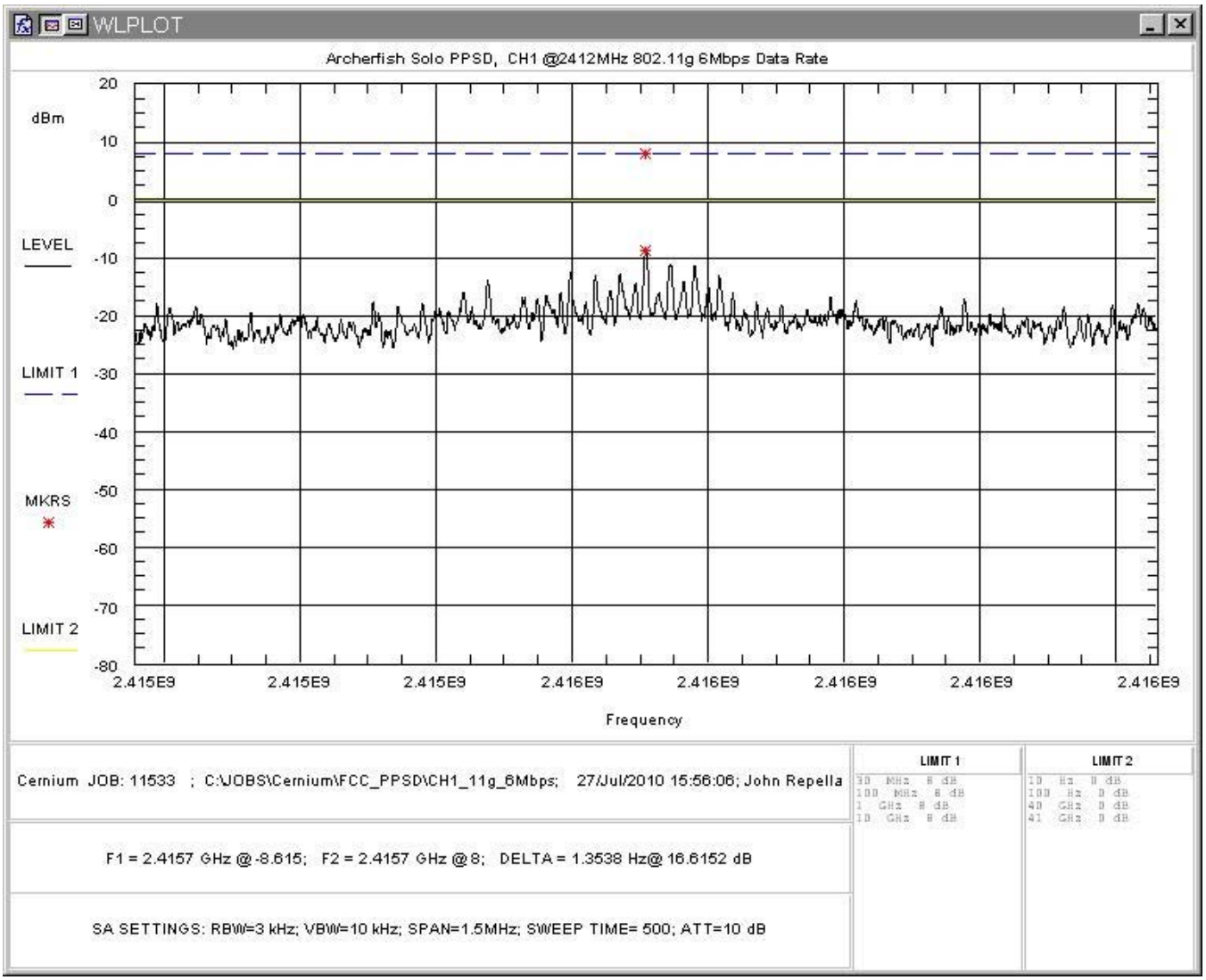


Figure 19: Power Spectral Density, 802.11g 6Mbps Low Channel

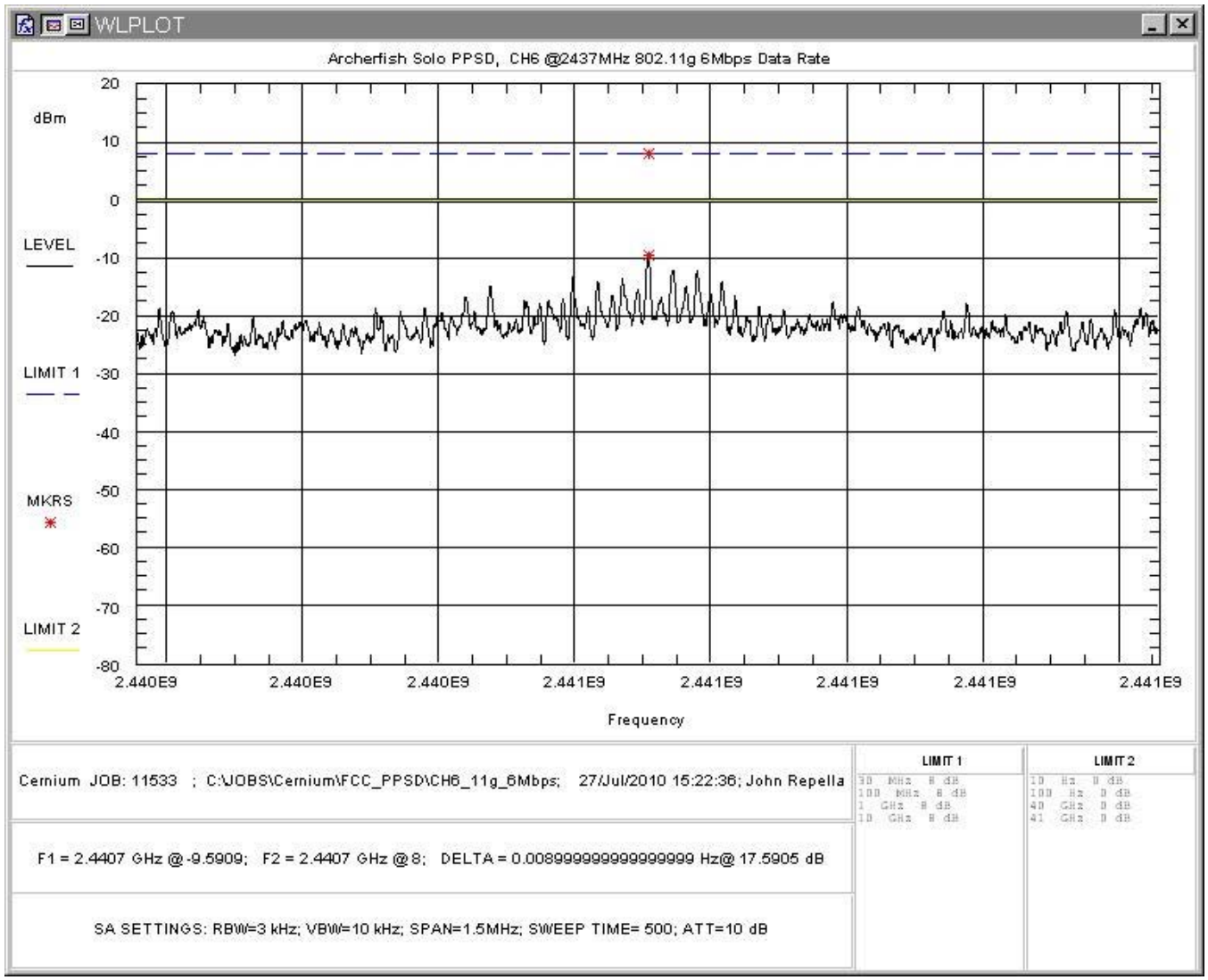


Figure 20: Power Spectral Density, 802.11g 6Mbps Mid Channel

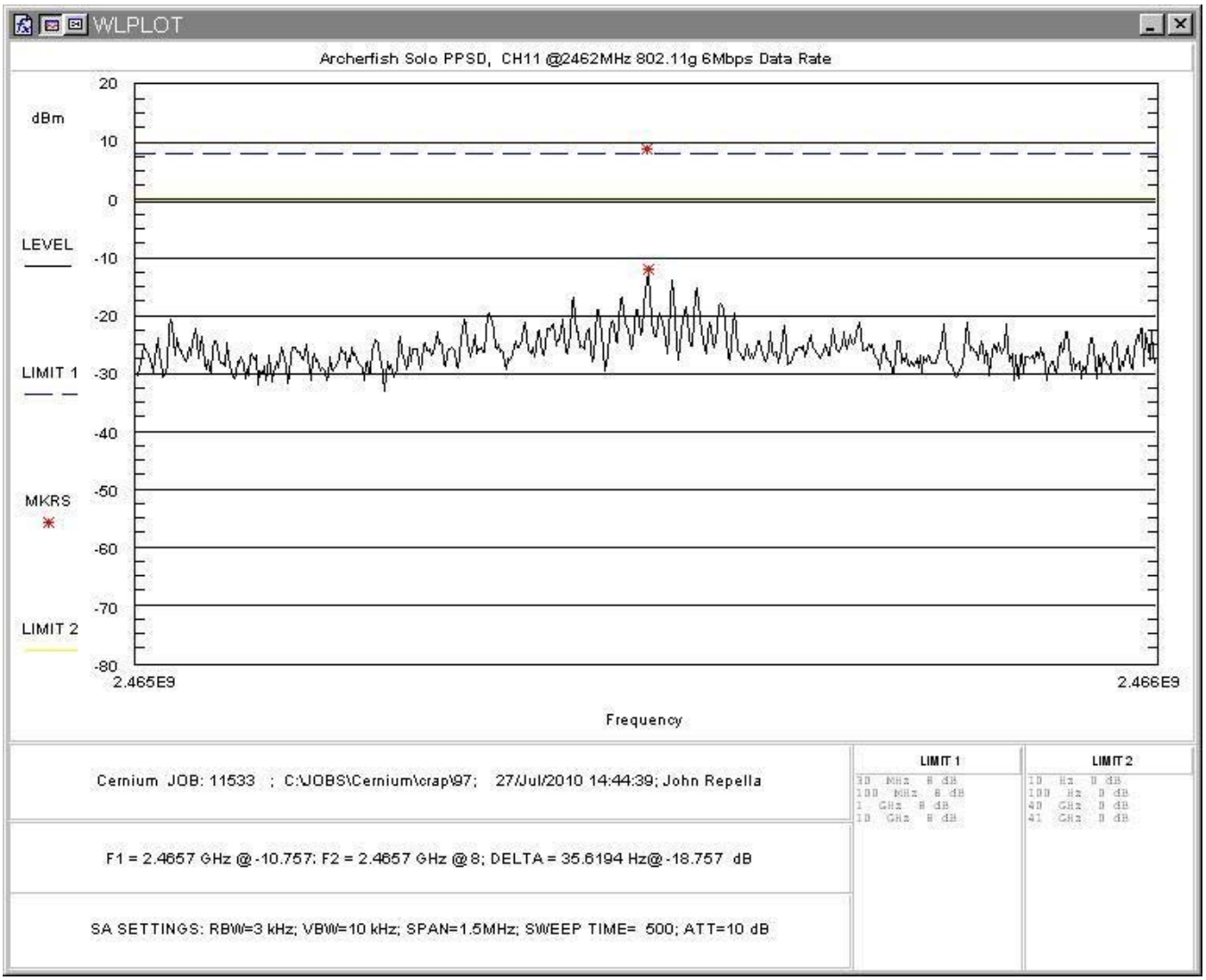


Figure 21: Power Spectral Density, 802.11g 6Mbps High Channel

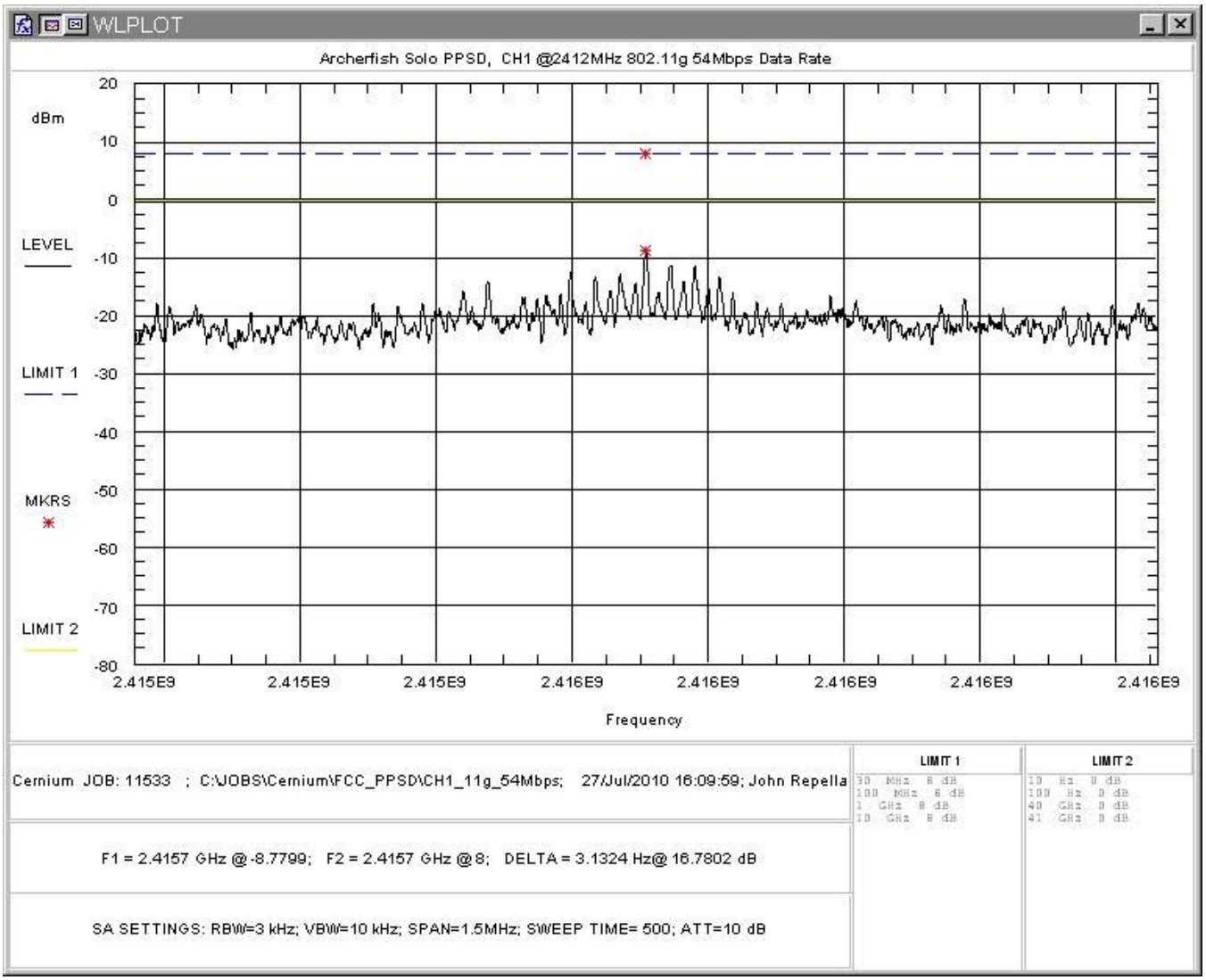


Figure 22: Power Spectral Density, 802.11g 54Mbps Low Channel

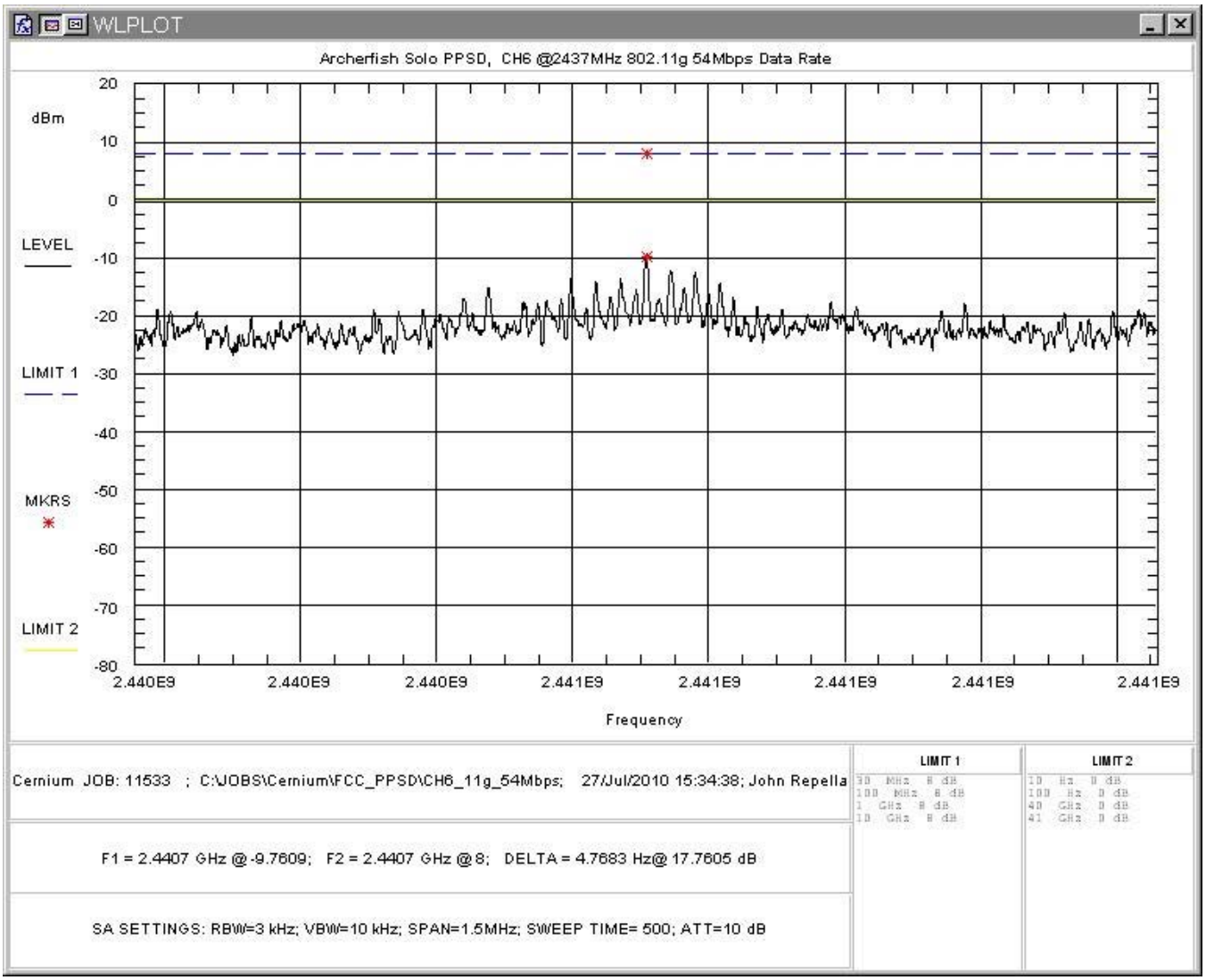


Figure 23: Power Spectral Density, 802.11g 54Mbps Mid Channel

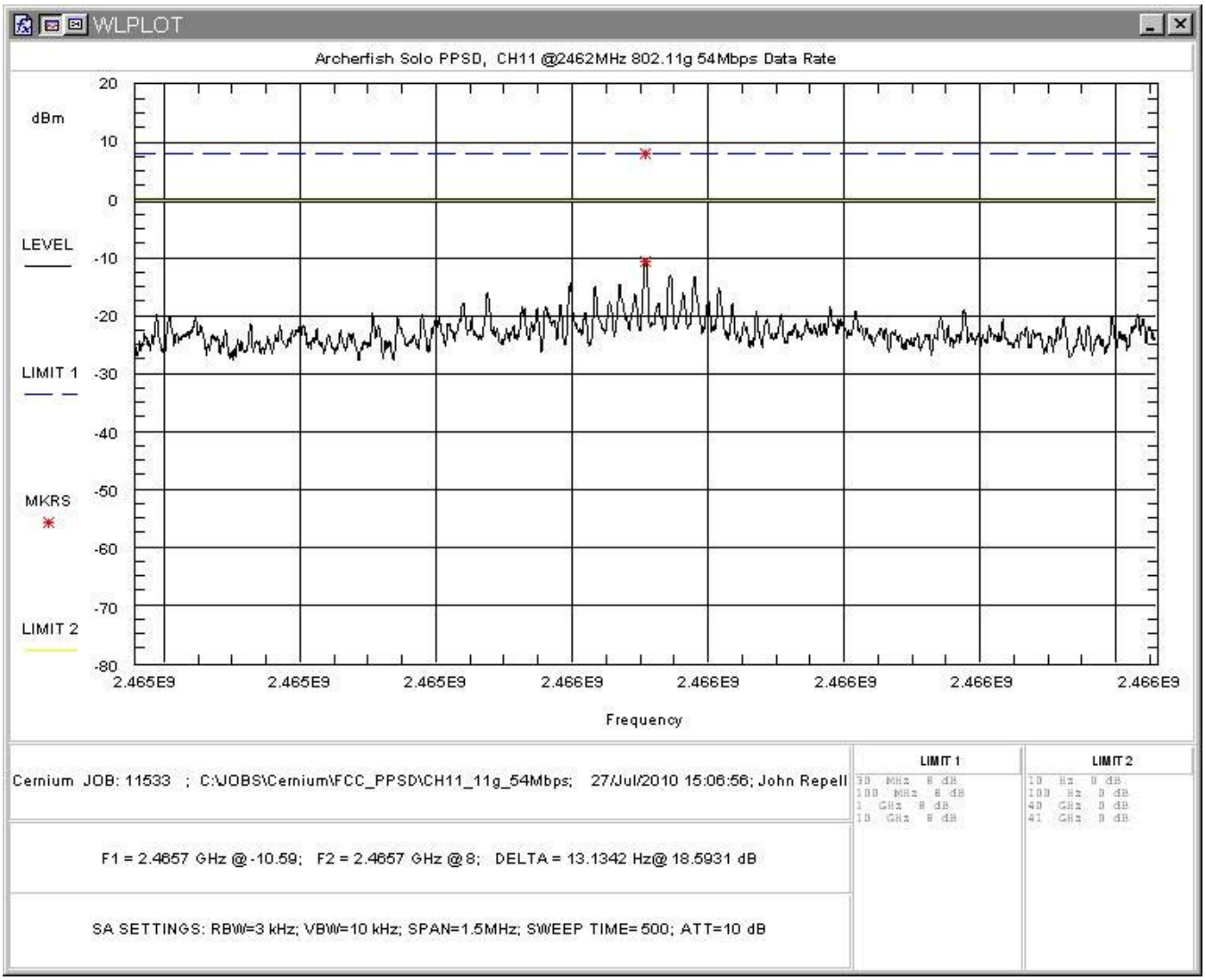


Figure 24: Power Spectral Density, 802.11g 54Mbps High Channel

4.5 Conducted Spurious Emissions at Antenna Terminals (FCC Part §15.247(c))

The EUT must comply with requirements for spurious emissions at antenna terminals. Per §15.247(c) all spurious emissions in any 100 kHz bandwidth outside the frequency band in which the spread spectrum device is operating shall be attenuated 20 dB below the highest power level in a 100 kHz bandwidth within the band containing the highest level of the desired power.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10 dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 100 kHz. The amplitude of the EUT carrier frequency was measured to determine

the emissions limit (20 dB below the carrier frequency amplitude). The emissions outside of the allocated frequency band were then scanned from 30 MHz up to the tenth harmonic of the carrier.

The following are plots of the conducted spurious emissions data.

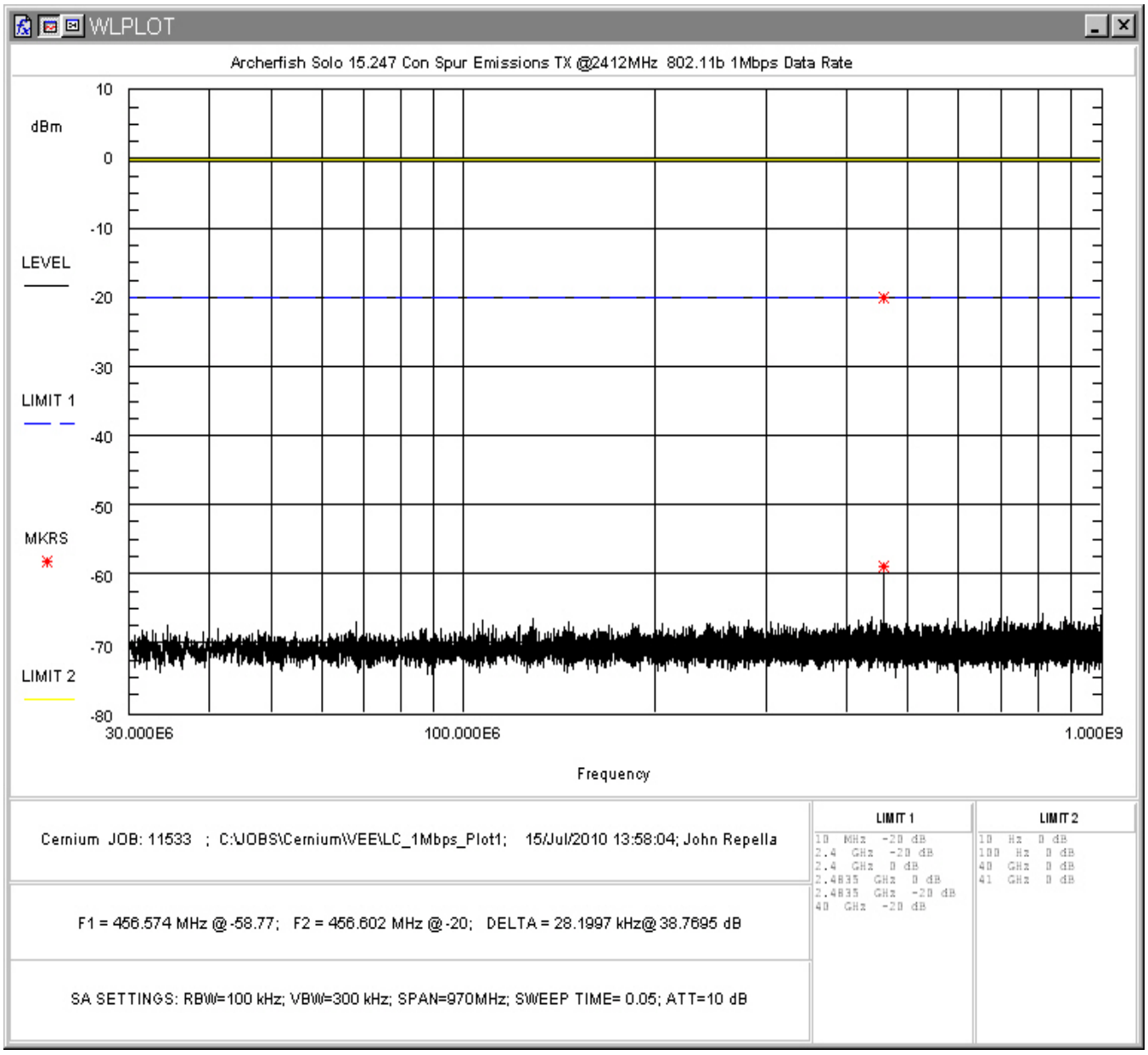


Figure 25: Conducted Spurious Emissions, 802.11b 1Mbps Low Channel, 30 - 1000MHz

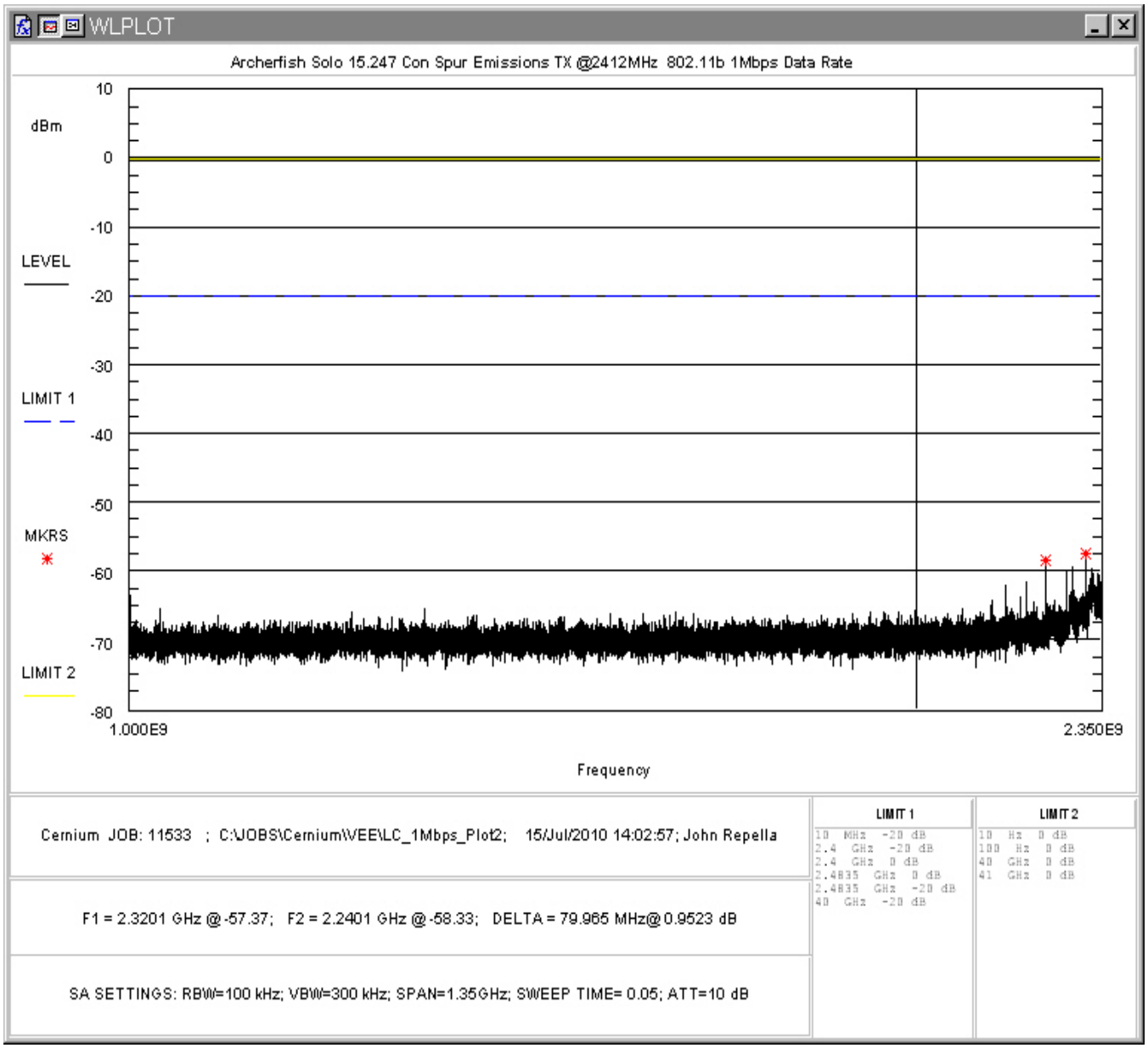


Figure 26: Conducted Spurious Emissions, 802.11b 1Mbps Low Channel, 1 – 2.35GHz

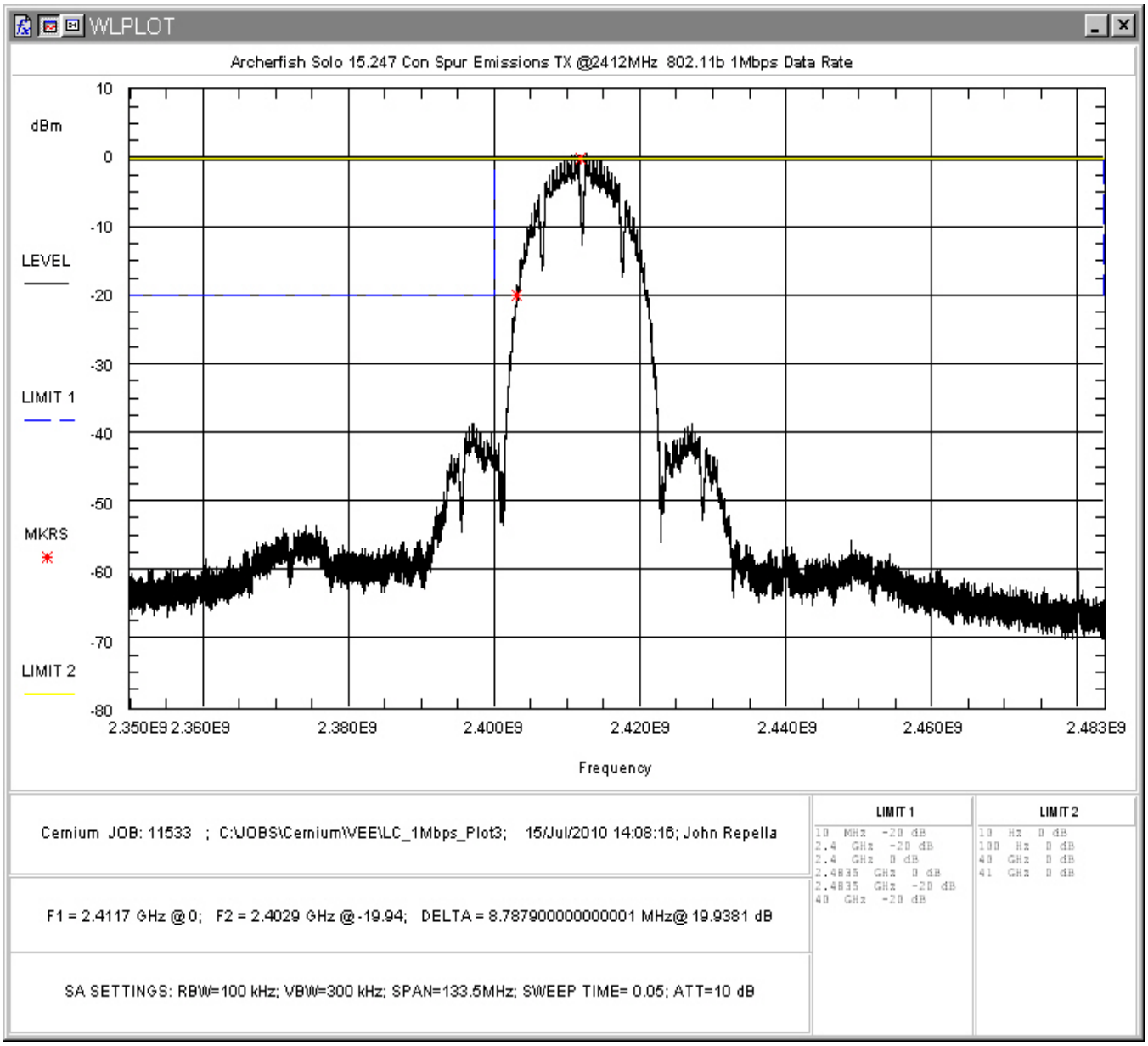


Figure 27: Conducted Spurious Emissions, 802.11b 1Mbps Low Channel, 2.35 – 2.483GHz

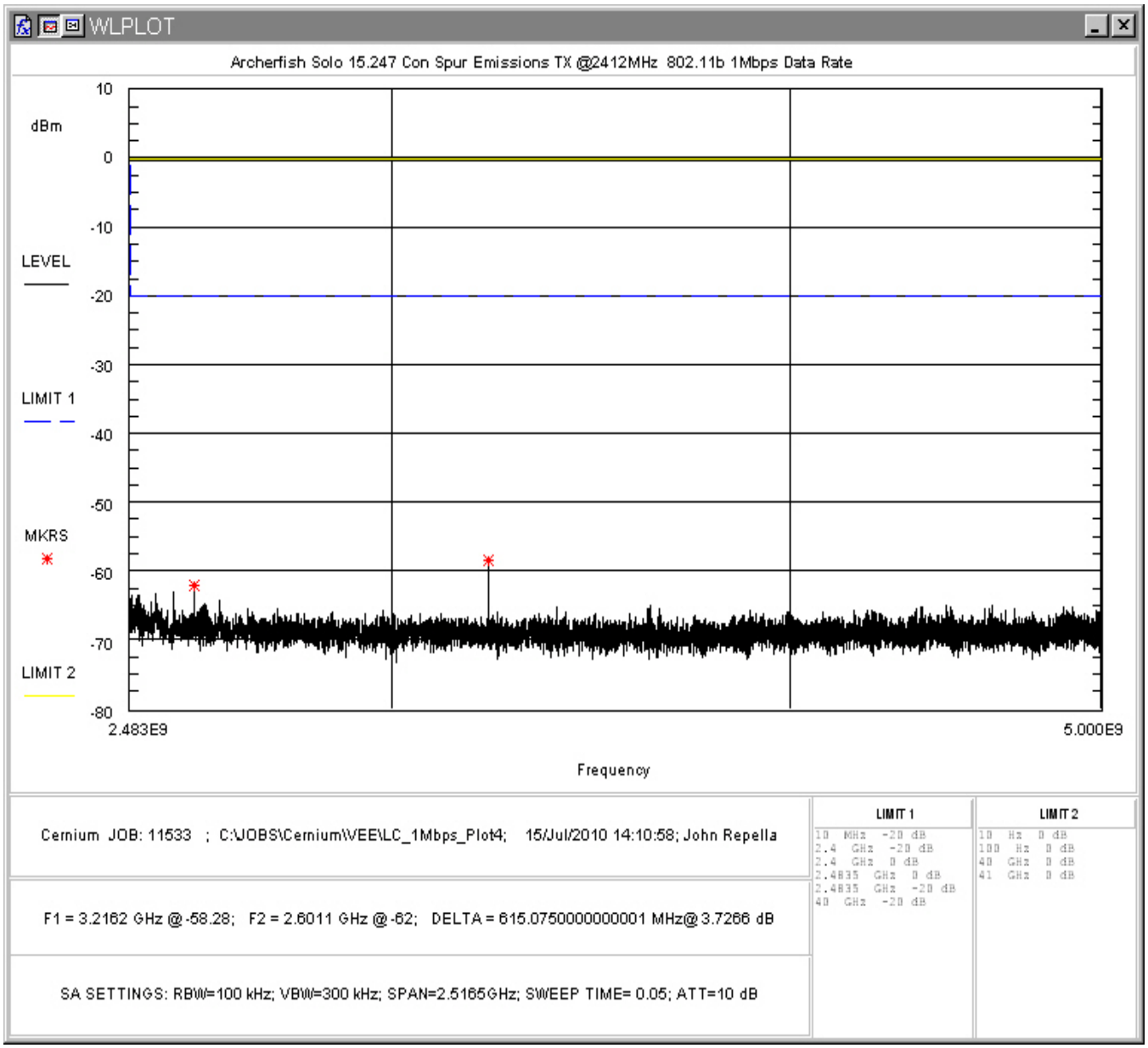


Figure 28: Conducted Spurious Emissions, 802.11b 1Mbps Low Channel, 2.483 - 5GHz

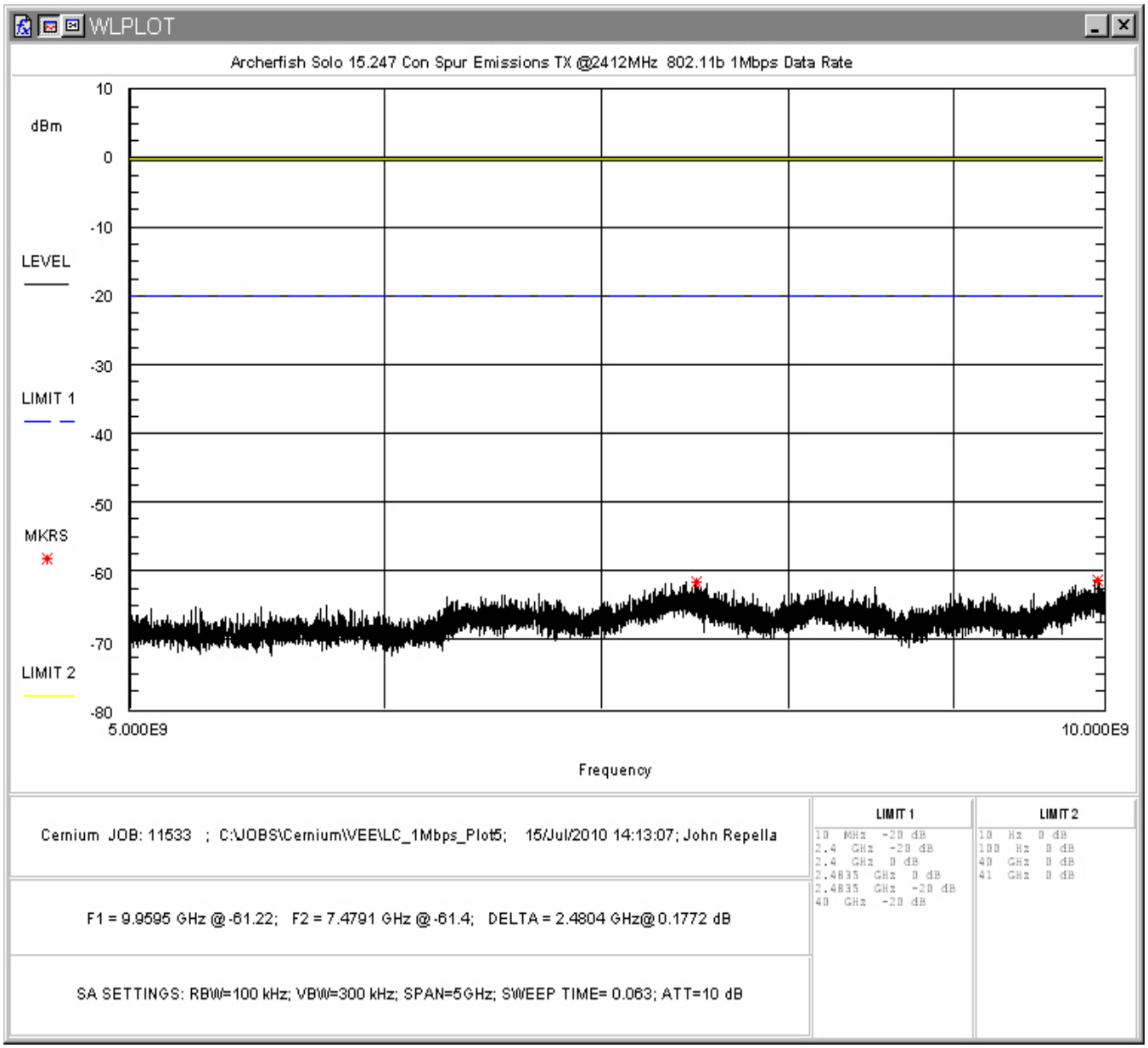


Figure 29: Conducted Spurious Emissions, 802.11b 1Mbps Low Channel, 5 - 10GHz

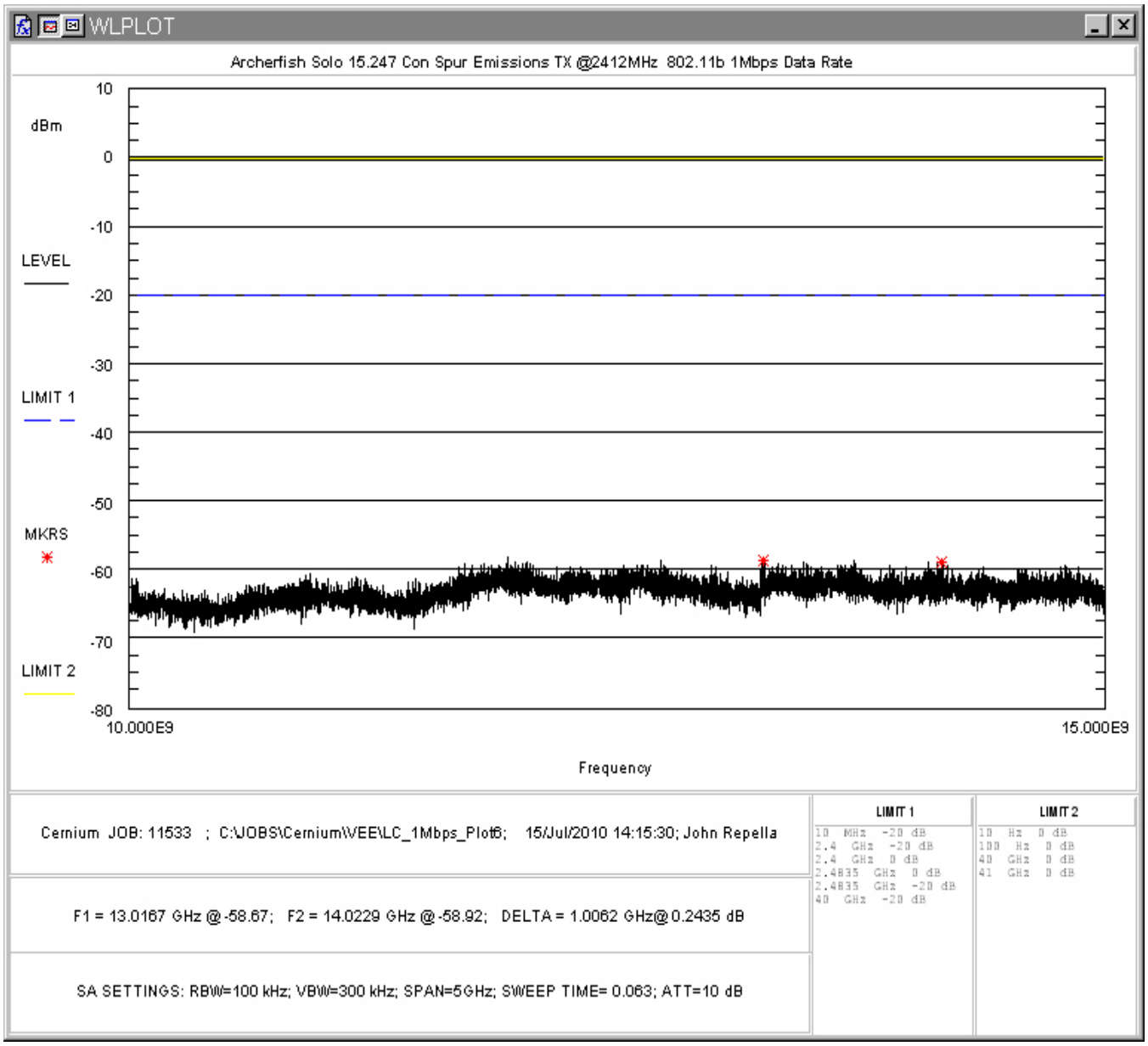


Figure 30: Conducted Spurious Emissions, 802.11b 1Mbps Low Channel, 10 - 15GHz

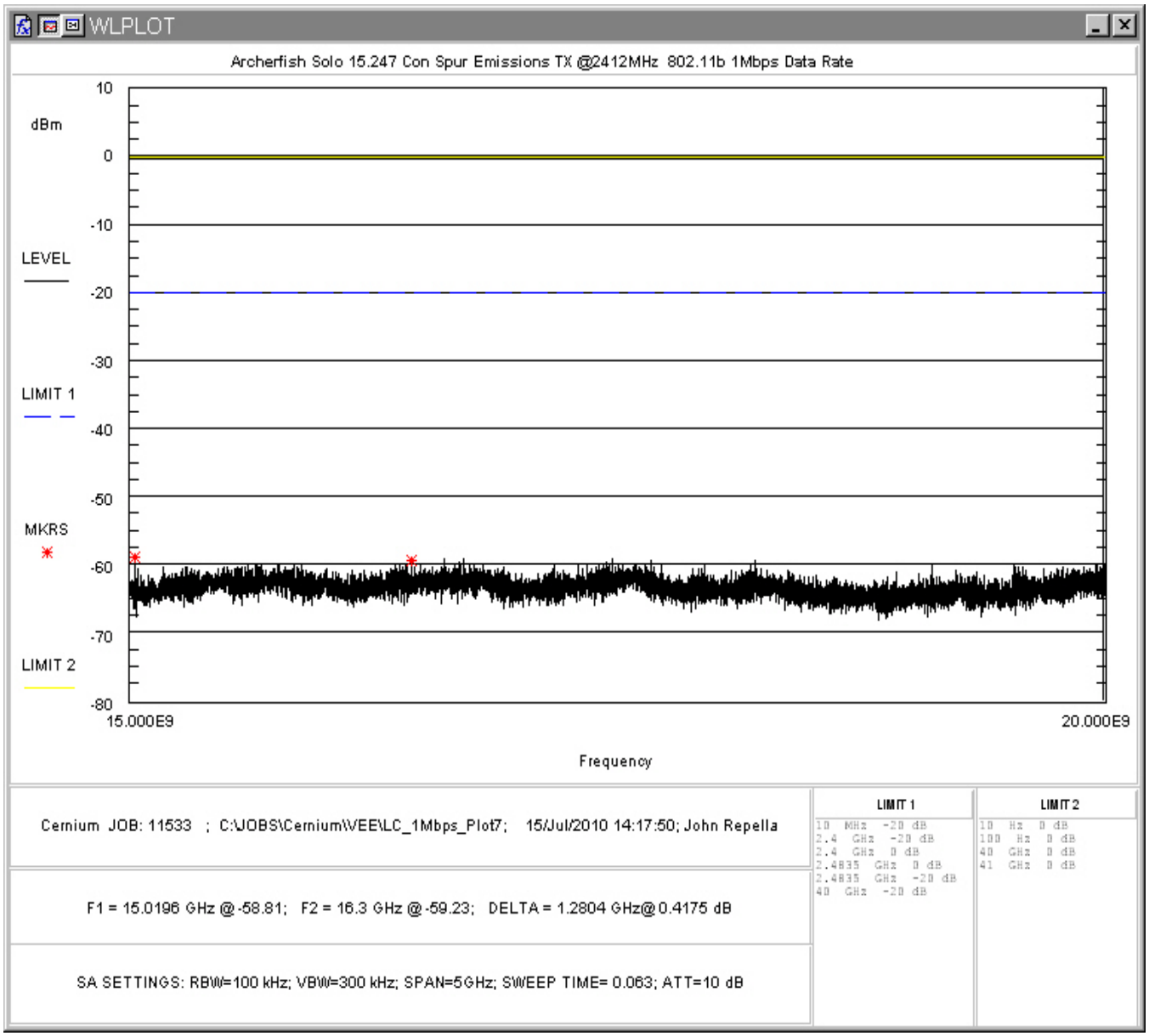


Figure 31: Conducted Spurious Emissions, 802.11b 1Mbps Low Channel, 15 - 20GHz

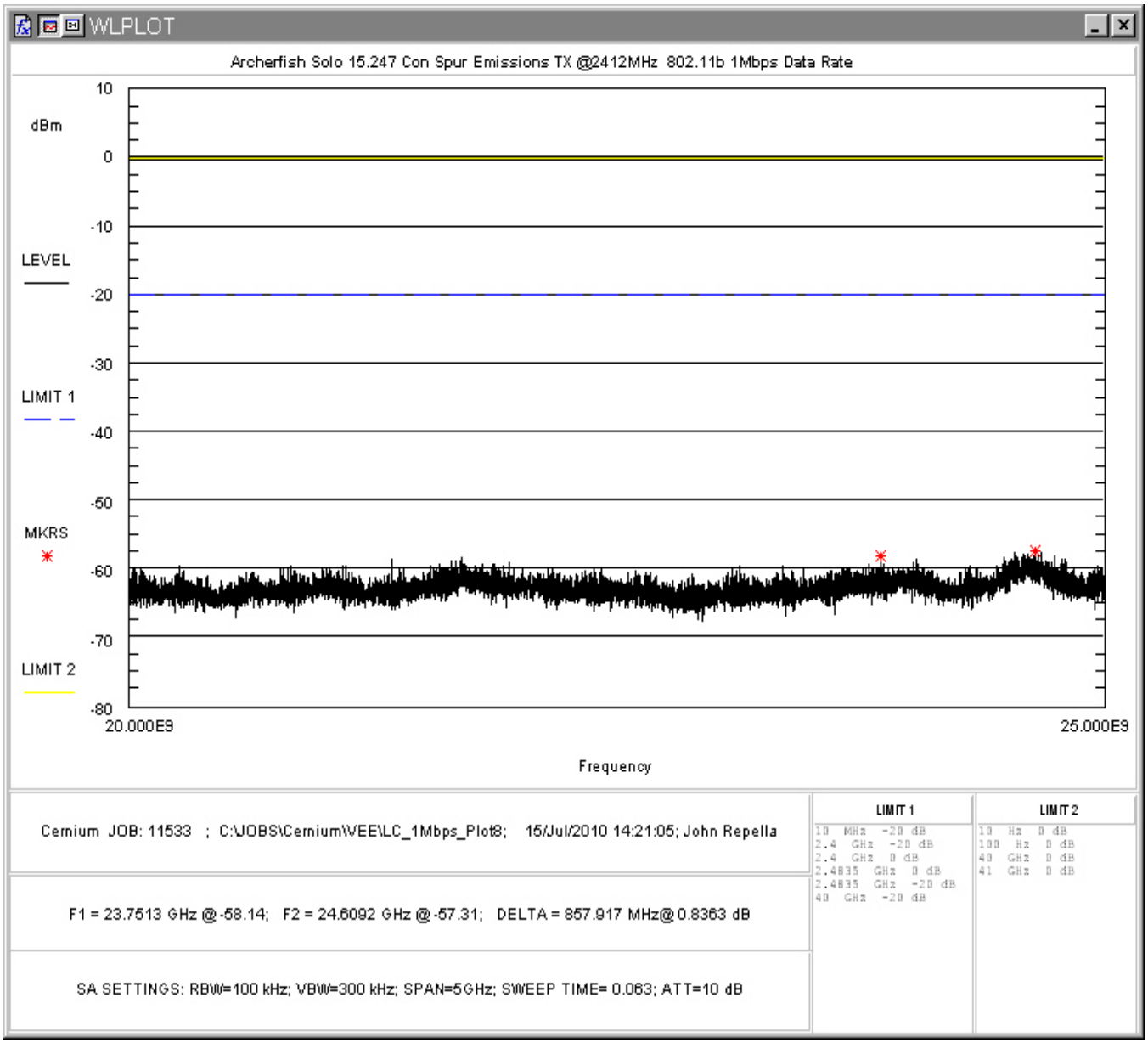


Figure 32: Conducted Spurious Emissions, 802.11b 1Mbps Low Channel, 20 - 25GHz

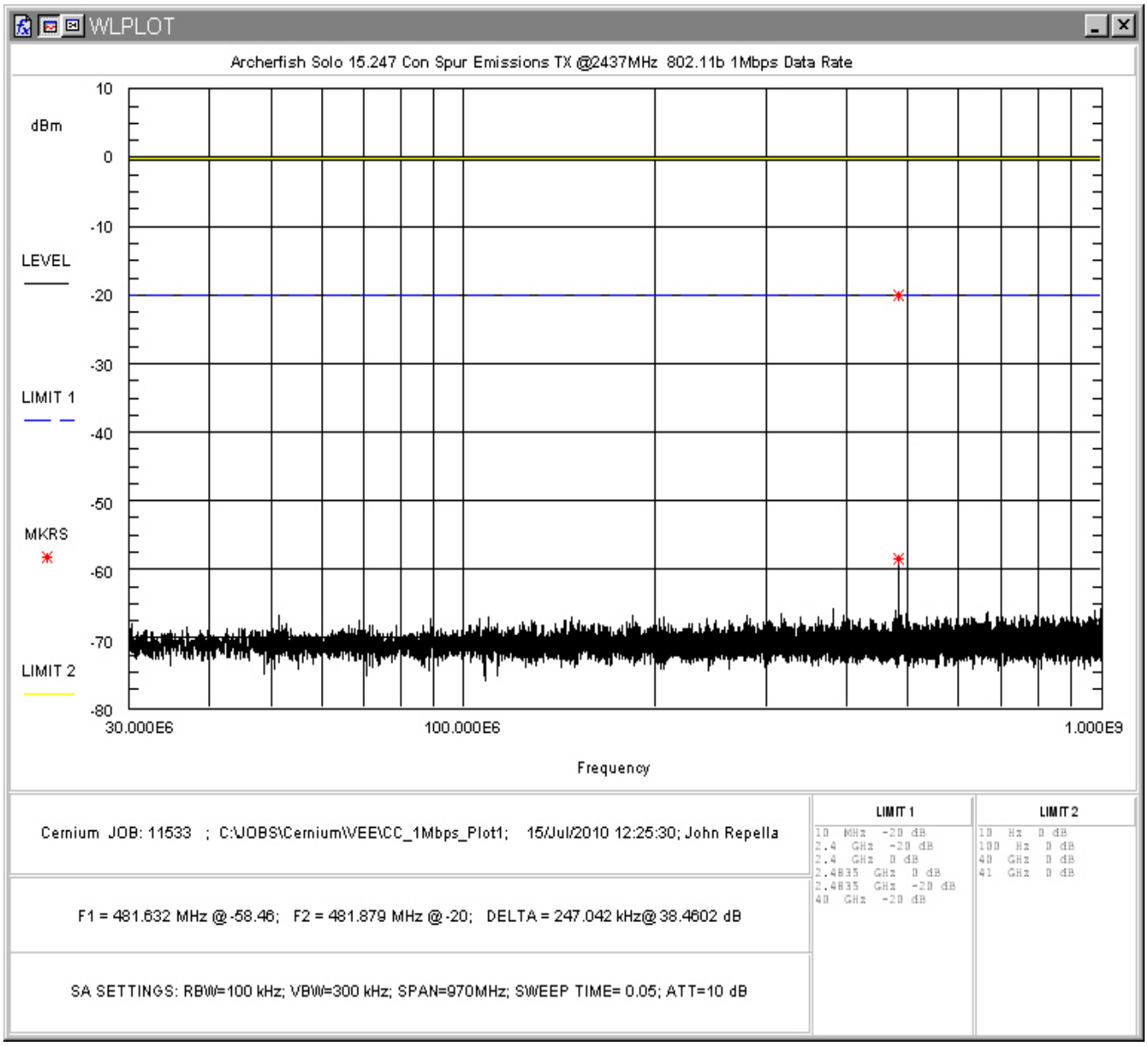


Figure 33: Conducted Spurious Emissions, 802.11b 1Mbps, Mid Channel 30 - 1000MHz