Washington Laboratories, Ltd.

FCC Test Report
For the
Eastman Kodak Company
L153 Groucho Media Player

FCC ID: PA408002

WLL JOB# **10512-02**
August 14, 2008

Prepared for:

Eastman Kodak Company
2600 Manitou Rd.
Rochester, NY 14653

Prepared By:

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

ACCREDITED
Testing Certificate 2675.01

FCC Test Report
for the
Eastman Kodak Company
L153 Groucho Media Player

FCC ID: PA408002

August 12, 2008

WLL JOB# 10512-02

Prepared by:

Steven Dovell
Compliance Engineer

Reviewed by:

Steven D. Koster
EMC Operations Manager

Abstract

This report has been prepared on behalf of Eastman Kodak Company, Inc. 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 (9/2007) of the FCC Rules. This Certification Test Report documents the test configuration and test results for a Eastman Kodak Company, Inc. Media Player.

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 the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

The Eastman Kodak Company, Inc. Media Player complies with the limits for a Direct Sequence Spread Spectrum Transmitter device under FCC Part 15.247.

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1 Introduction

Compliance Statement

The Eastman Kodak Company, Inc. Media Player complies with the limits for a Direct Sequence Spread Spectrum Transmitter device under FCC Part 15.247 (9/2007)

Test Scope

Tests for radiated and conducted (at antenna terminal) emissions were performed. All measurements were performed in accordance Knowledge Data Base (KDB) publication number 558074 entitled "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.

Contract Information

Customer:	Eastman Kodak Company, Inc. 343 State St Rochester, NY 14660-0124
Purchase Order Number:	2008-07-090
Quotation Number:	64374A

Test Dates

Testing was performed on the following date(s):	July 16 – July 22, 2008

Test and Support Personnel

Washington Laboratories, LTD	John Repella, Steve Dovell
Client Representative	Roy Illingworth

Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**eres
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	**decibel**
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

EUT Identification & Description

The Eastman Kodak Company L153 Media Player is a device which allows a user to interface various media devices, such as a PC, USB stick, memory cards, etc to a HDTV. The PC can be connected via either a wired or wireless LAN connection. Control is via a handheld RF Remote pointing device. The device contains two radios. An 802.11 b/g/n Wireless LAN is used to transfer data and a 2.4HGz Direct Sequence Spread Spectrum Transmitter is used to communicate with the handheld remote.

Table 1. Device Summary (802.11 b/g/n)

ITEM	DESCRIPTION
Manufacturer:	Eastman Kodak Company, Inc.
FCC ID:	PA408002
Model:	Media Player
FCC Rule Parts:	§15.247
Frequency Range:	2400-2483.5 Channel Range: 2412 – 2462MHz
Maximum Output Power:	Channel 6 (2437 MHz) 19.24dBm, 83.9mW - 802.11n
Modulation:	DSSS
Occupied Bandwidth:	17.5531MHz
Keying:	Automatic, Manual
Type of Information:	Data
Number of Channels:	11
Power Output Level	Fixed
Antenna Connector	none
Antenna Type	Integral Chip (0.4dB)
Interface Cables:	none
Power Source & Voltage:	120VAC -12VDC external power supply

Test Configuration

The Media Player was configured with internal antennas and operated from 120VAC – 12VDC external power supply.

Testing Algorithm

The Media Player was programmed for DTS operation via control software.

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

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 the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

Measurements

2.1.1 References

FCC97114 Report & Order, Appendix C: Guidance on Measurements for Direct Sequence Spread Spectrum Systems

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

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions 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."

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 Equation1 and 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

$k \leq 2$ 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

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:	**Conducted Emissions Voltage**	**Test Date:**	**7/17/08**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00124	Solar, 8012-50-R-24-BNC	LISN	09/28/2008
00069	HP, 85650A	Adapter, QP	07/09/2009
00069	HP, 85650A	Adapter, QP	07/09/2009
00073	HP, 8568B	Analyzer, Spectrum	07/08/2009
Test Name:	**Radiated Emissions**	**Test Date:**	**7/16/08**
ASSET #	**Manufacturer/Model**	**Description**	**Cal. Due**
00644	Sunol Science JB1	BiConalog Antenna	11/27/2009
00069	HP, 85650A	Adapter, QP	07/09/2009
00071	HP, 85685A	Preselector, RF	07/09/2009
00073	HP, 8568B	Analyzer, Spectrum	07/08/2009
00667	MegaPhase, LLC EM18-S1NK5-600	Test cable DC to 18 GHz SMA male	03/17/2009
00004	ARA, DRG-118/A	Antenna, DRG, 1-18GHz	02/02/2009
00066	HP, 8449B	Pre-Amplifier, RF. 1-26.5GHz	07/15/2009
Test Name:	**Antenna Port Conducted Emissions**	Test Date:	**7/22/08**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00605	Agilent HP - N1911A	Power Meter	04/10/2009
00606	Agilent HP - N1921A	Power Sensor	04/11/2009
00528	Agilent, E4446A	Analyzer, Spectrum	02/15/2009

3 Test Results

Results Summary Part 15.247

Table 4: Test Summary (802.11 b/g/n)

TX Test Summary (Direct Sequence Spread Spectrum)			
FCC Rule Part	**Description**	**Limit**	**Result**
15.247 (a)(2)	6dB Bandwidth	> 500kHz	Pass
15.247 (b)(3)	Transmit Output Power	< 1Watt	Pass
15.247 (e)	Transmit, Power Spectral Density	< 8dBm/3kHz Band	Pass
15.247 (d)	Out-of-Band Emissions (Band Edge @ 20dB below fundamental)	Conducted < 20dBc	Pass
15.205 15.209	General Field Strength Limits (Restricted Bands & RE Limits)		Pass
15.207	AC Conducted Emissions		Pass
RX/Digital Test Summary (Direct Sequence Spread Spectrum)			
FCC Rule Part	**Description**		**Result**
15.207	AC Conducted Emissions		Pass
15.209	General Field Strength Limits (Restricted Bands & RE Limits)		Pass

RF Power Output:

To measure the output power the hopping sequence was stopped while the frequency dwelled on a low, high and middle channel. The output from the transmitter was connected to an attenuator and then to the input of the RF Power Meter.

Table 5: 802.11b, RF Power Output

Channel and/or Frequency	Peak Measured Level (dBm)	Peak Measured Level (Watts)	Rated (Watts)	Limit (Watts)
802.11b				
Channel 1 (2412 MHz)	9.59	0.0091	-	1
Channel 6 (2437 MHz)	9.62	0.0092	-	1
Channel 11 (2462 MHz)	8.21	0.0066	-	1

Table 6: 802.11g, RF Power Output

Channel and/or Frequency	Peak Measured Level (dBm)	Peak Measured Level (Watts)	Rated (Watts)	Limit (Watts)
802.11g				
Channel 1 (2412 MHz)	18.21	0.066	-	1
Channel 6 (2437 MHz)	18.75	0.075	-	1
Channel 11 (2462 MHz)	17.33	0.054	-	1

Table 7: 802.11n, RF Power Output

Channel and/or Frequency	Peak Measured Level (dBm)	Peak Measured Level (Watts)	Rated (Watts)	Limit (Watts)
802.11n				
Channel 1 (2412 MHz)	18.44	0.070	-	1
Channel 6 (2437 MHz)	19.24	0.084	-	1
Channel 11 (2462 MHz)	17.90	0.062	-	1

Power Spectral Density

For DSSS devices, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band.

The output from the transmitter was connected to an attenuator and then to the input of the Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system.

Table 8: 802.11b Power Spectral Density

Frequency	Level (dBm)	Limit (dBm)	Pass/Fail
Channel 1 2411 MHz	-27.9	8dBm	Pass
Channel 6 2437 MHz	-28	8dBm	Pass
Channel 11 2463 MHz	-30	8dBm	Pass

Table 9: 802.11g Power Spectral Density

Frequency	Level (dBm)	Limit (dBm)	Pass/Fail
Channel 1 2411 MHz	-28.7	8dBm	Pass
Channel 6 2437 MHz	-25.8	8dBm	Pass
Channel 11 2463 MHz	-28.7	8dBm	Pass

Table 10: 802.11n Power Spectral Density

Frequency	Level (dBm)	Limit (dBm)	Pass/Fail
Channel 1 2411 MHz	-23.9	8dBm	Pass
Channel 6 2437 MHz	-25.4	8dBm	Pass
Channel 11 2463 MHz	-26	8dBm	Pass

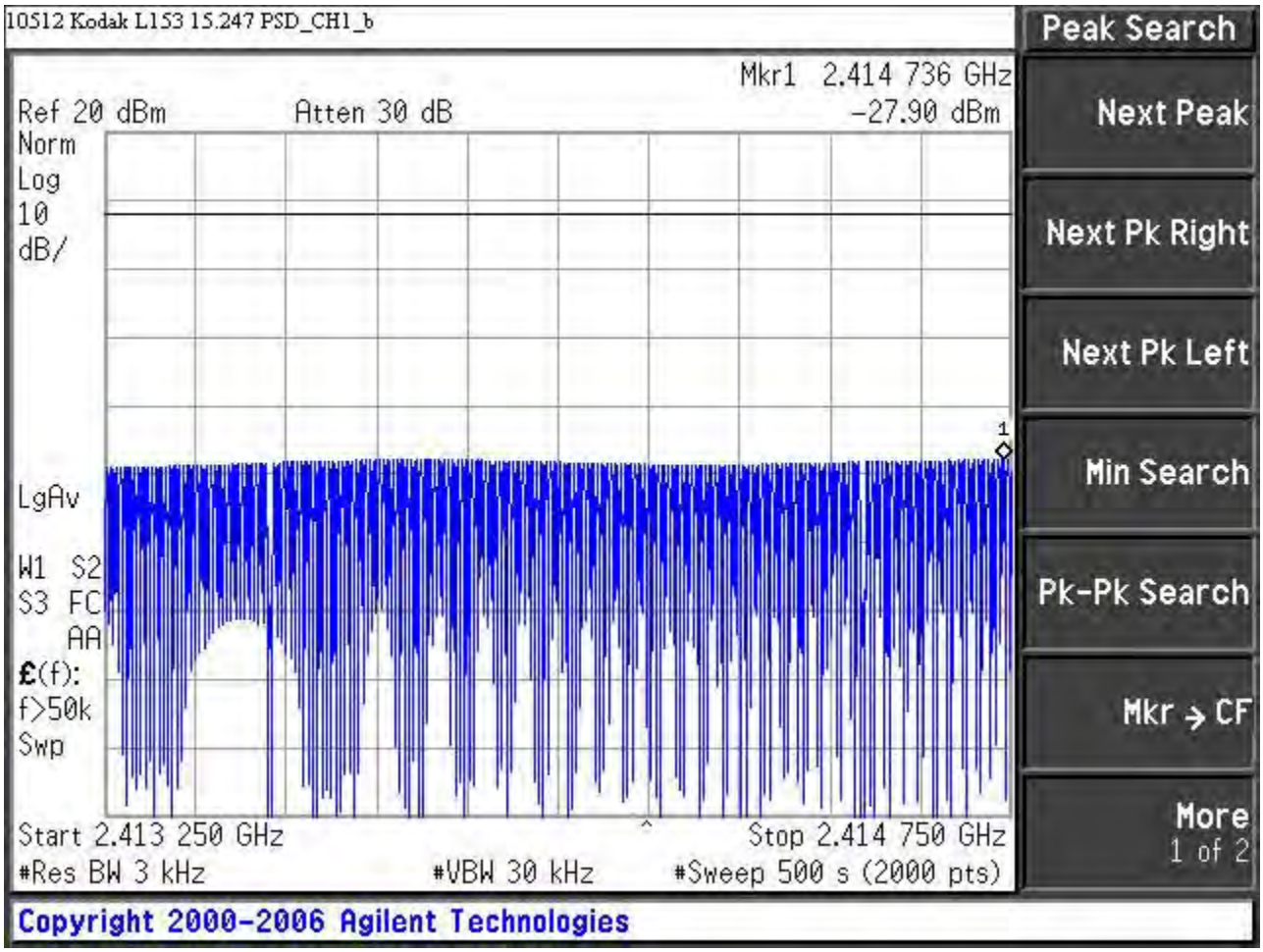

Figure 3-1: Power Spectral Density, 802.11b Channel 1 @ 2412MHz

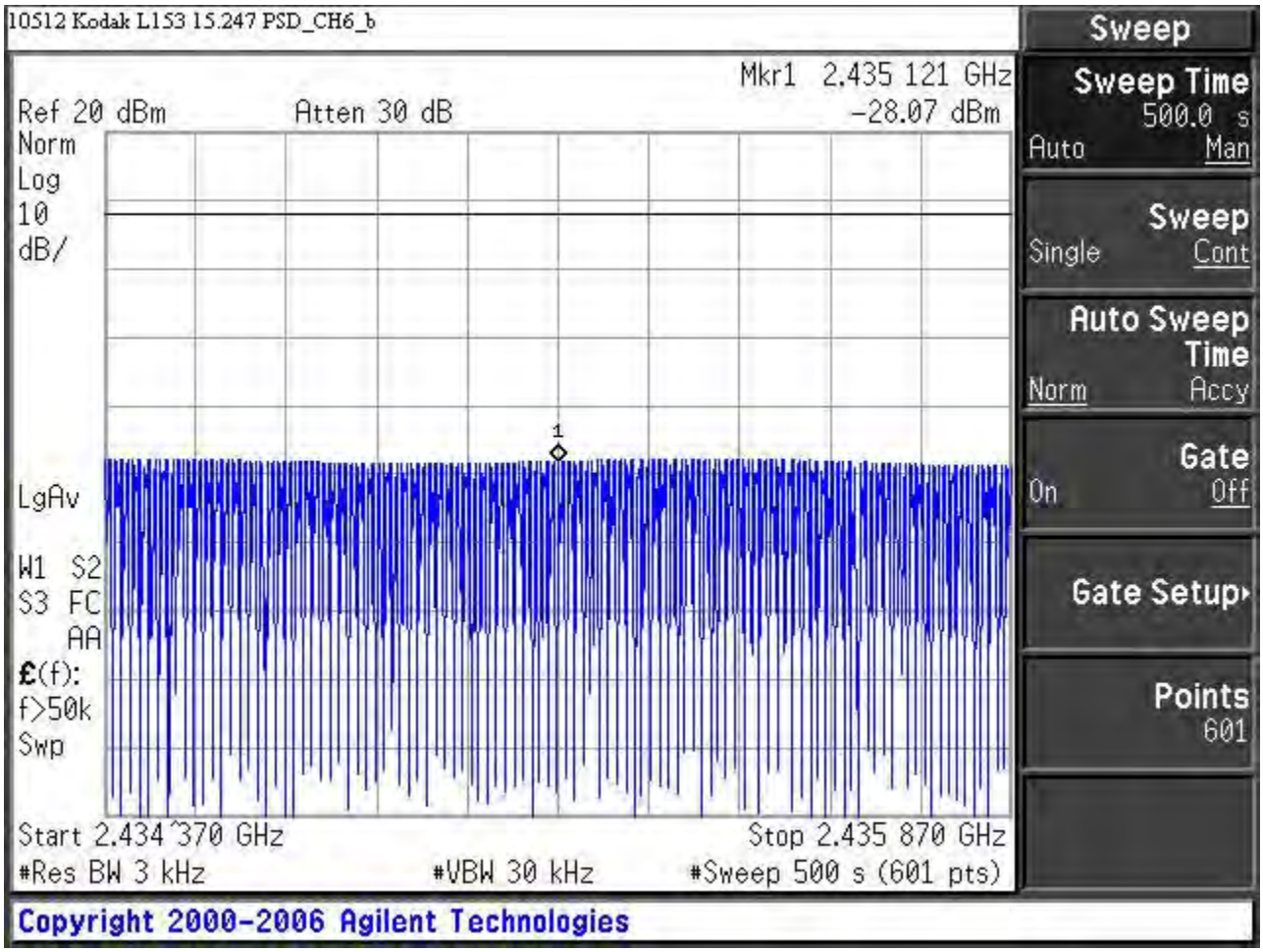

Figure 3-2: Power Spectral Density, 802.11b, Channel 6 @ 2437MHz

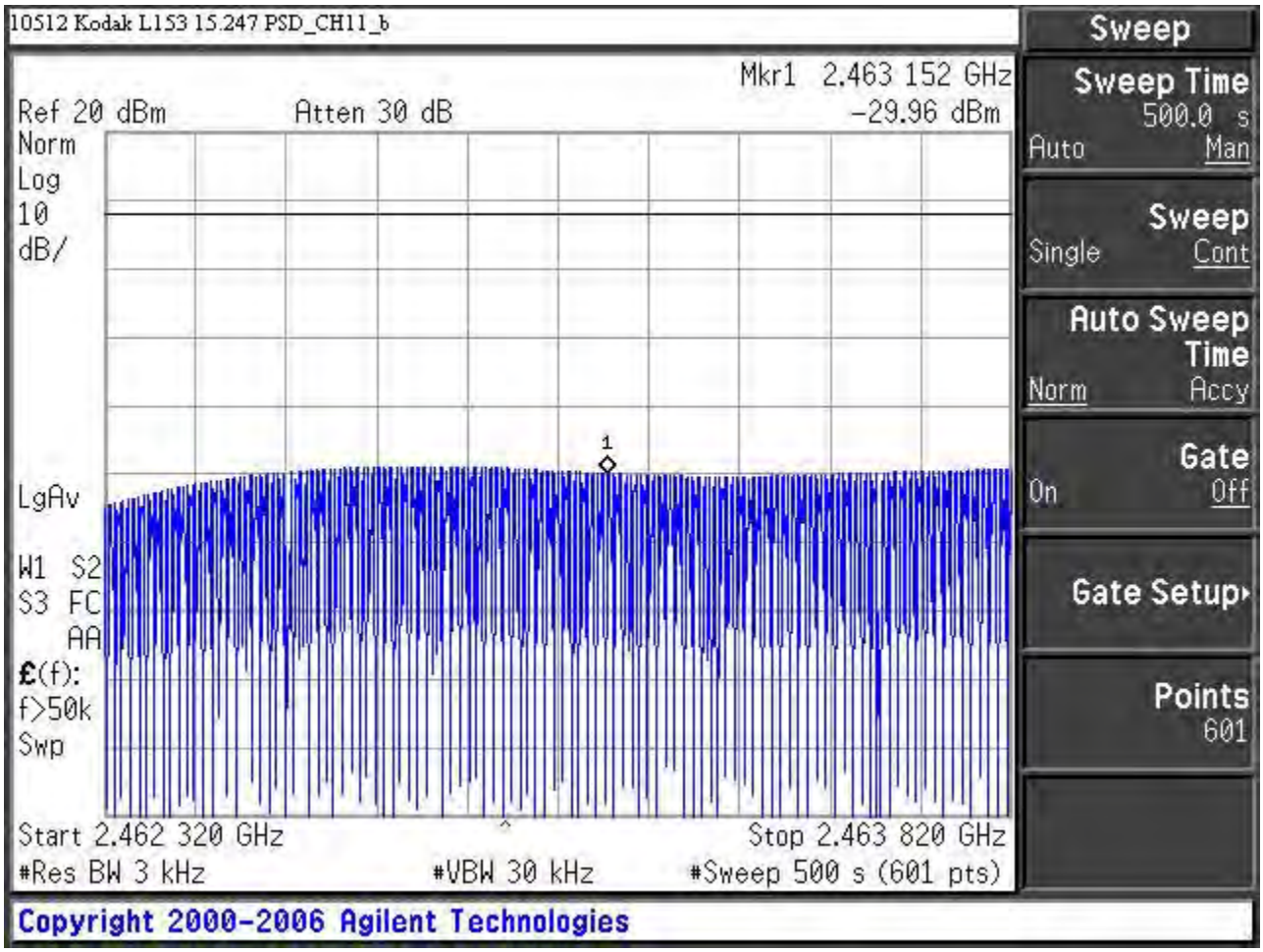

Figure 3-3: Power Spectral Density, 802.11b, Channel 11 @ 2462MHz

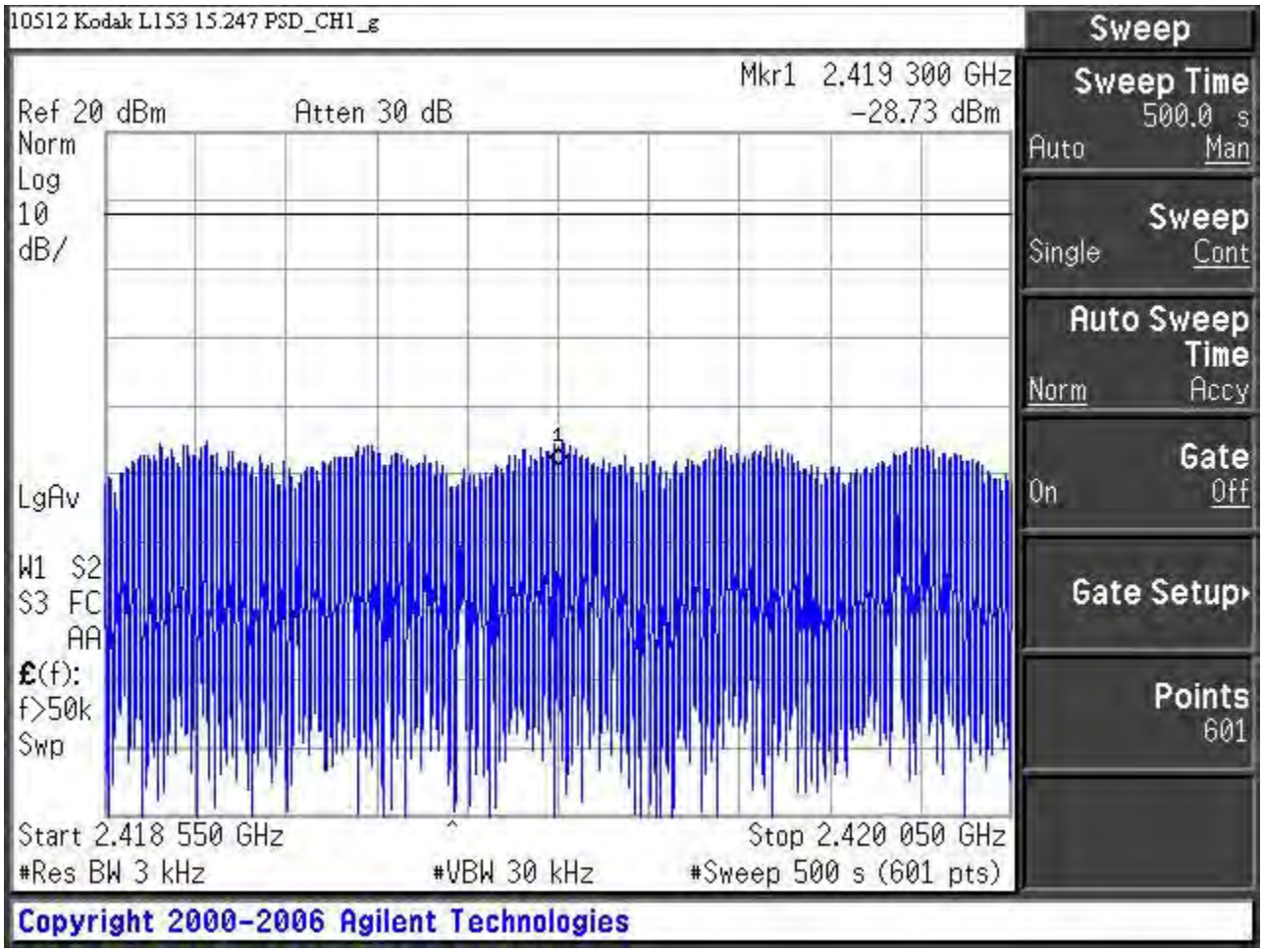

Figure 3-4: Power Spectral Density, 802.11g, Channel 1 @ 2412MHz

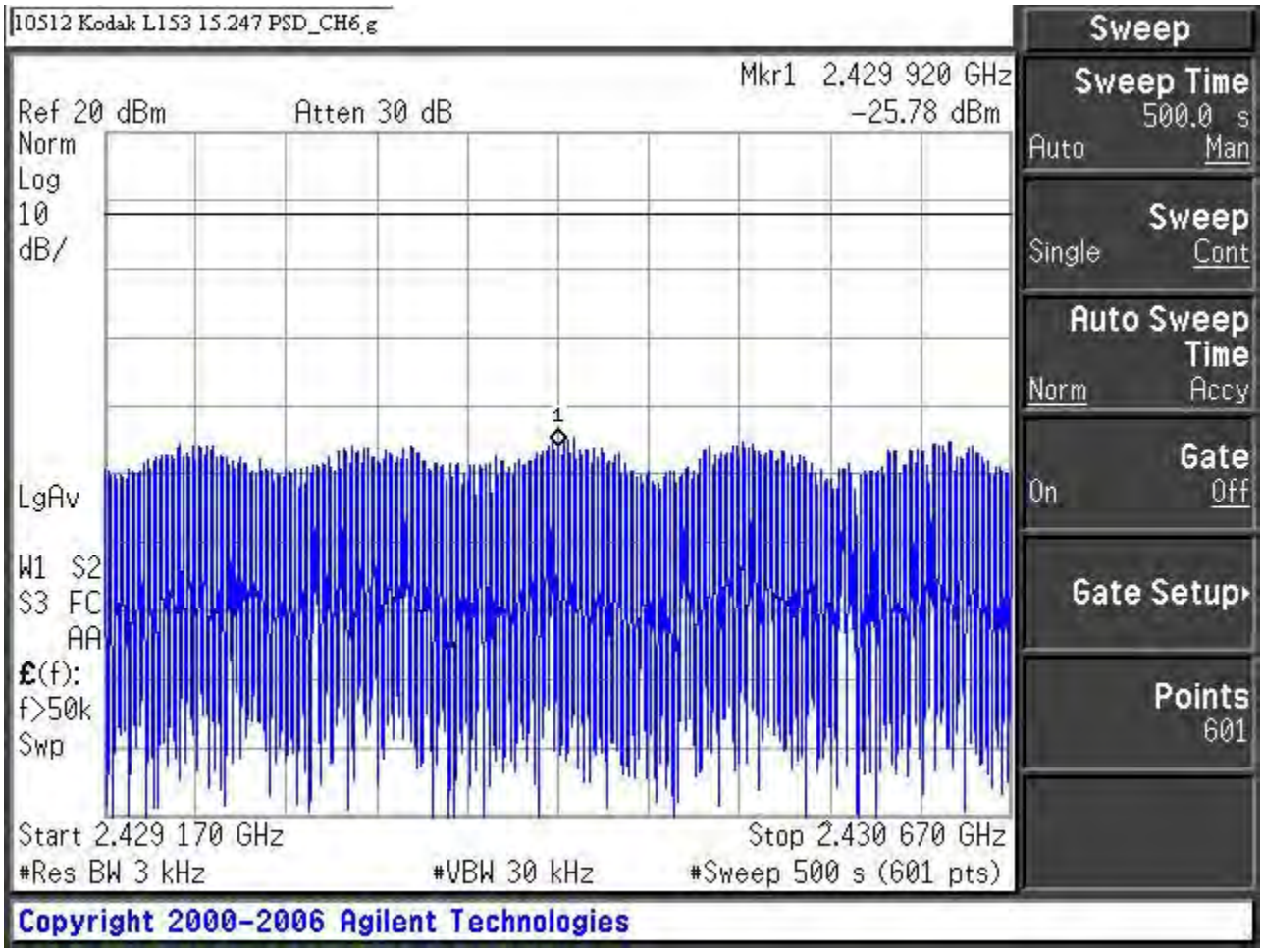

Figure 3-5: Power Spectral Density, 802.11g, Channel 6 @ 2437MHz

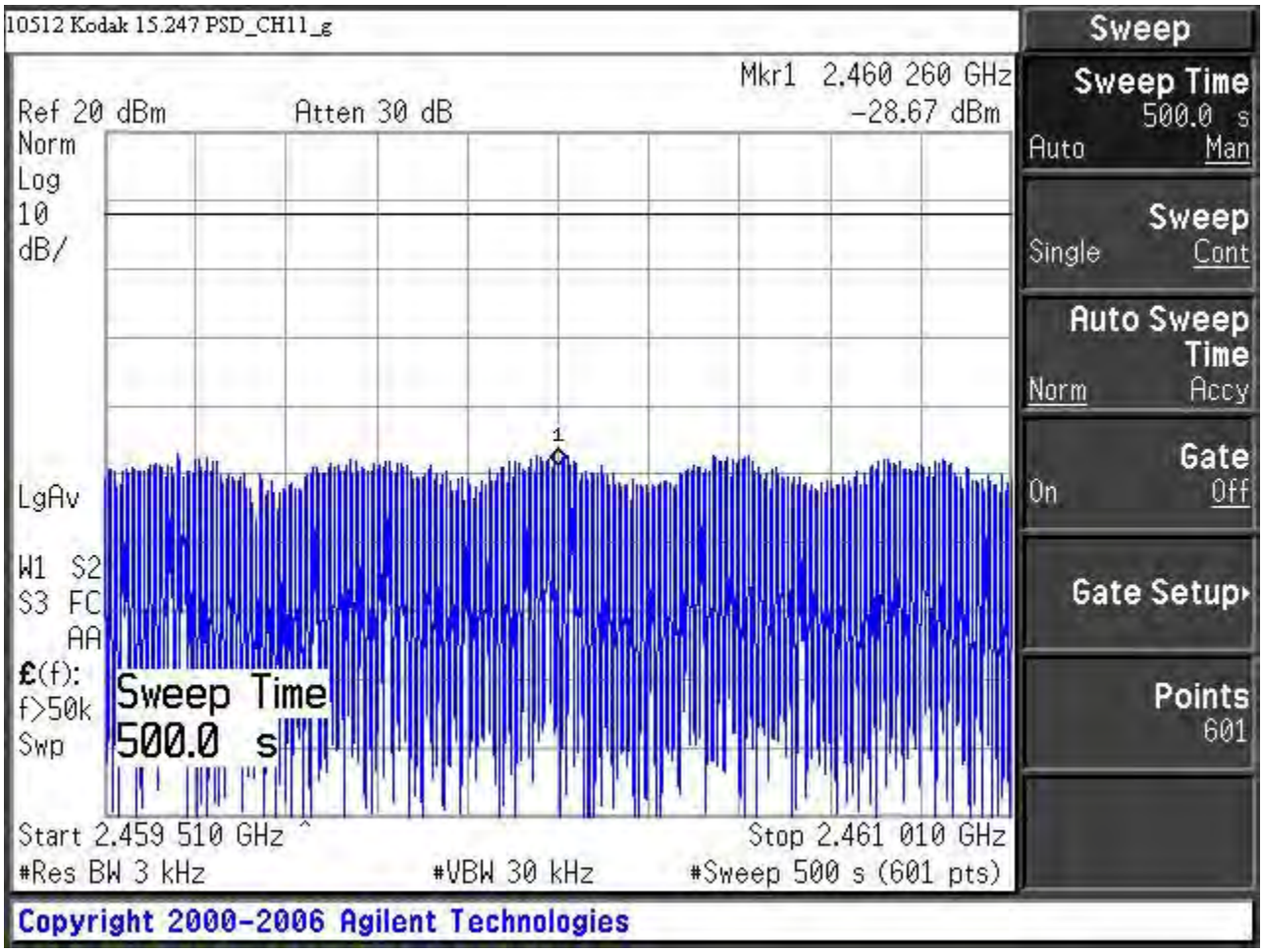

Figure 3-6: Power Spectral Density, 802.11g, Channel 11 @ 2462MHz

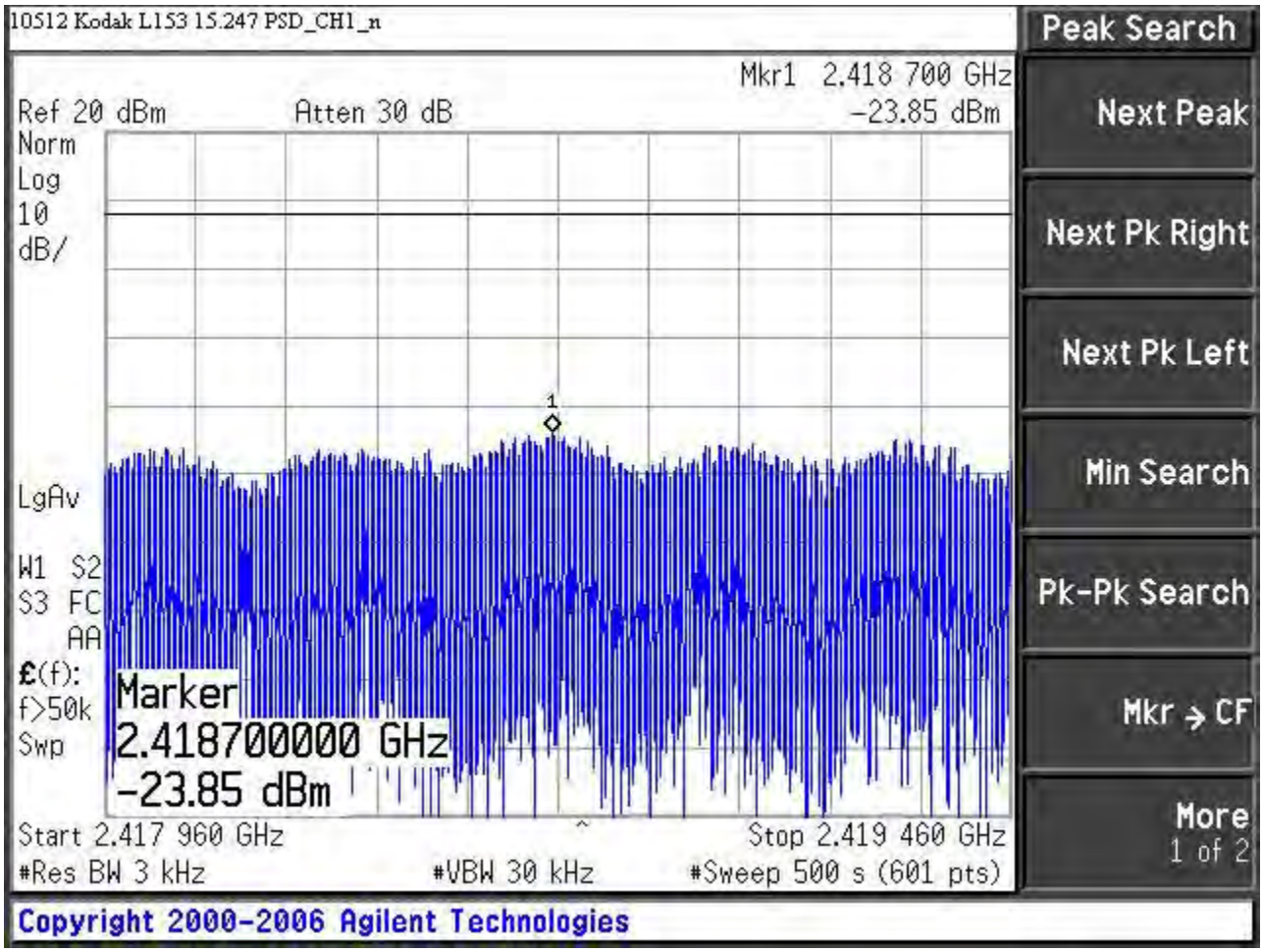

Figure 3-7: Power Spectral Density, 802.11n, Channel 1 @ 2412MHz

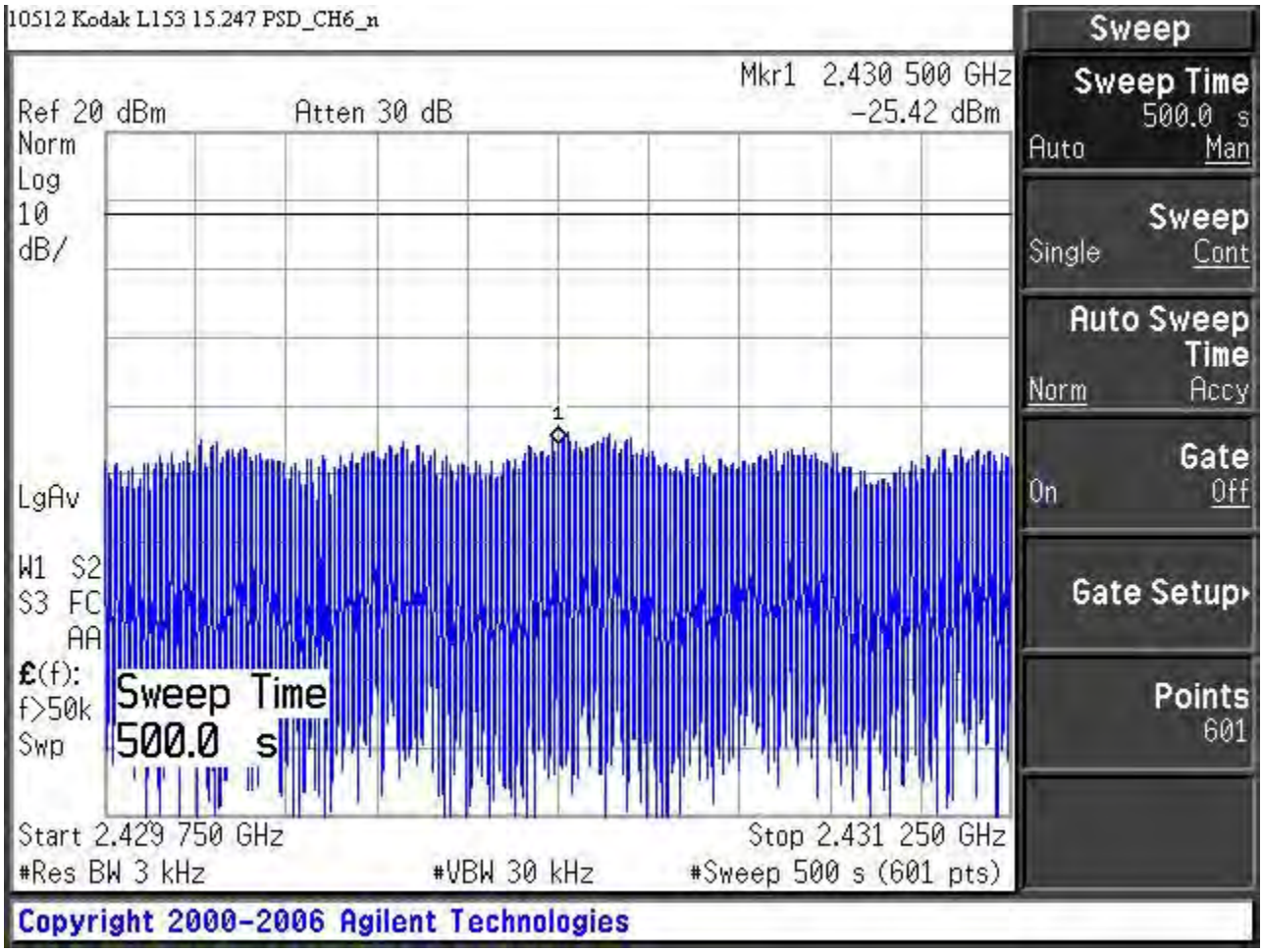

Figure 3-8: Power Spectral Density, 802.11n, Channel 6 @ 2437MHz

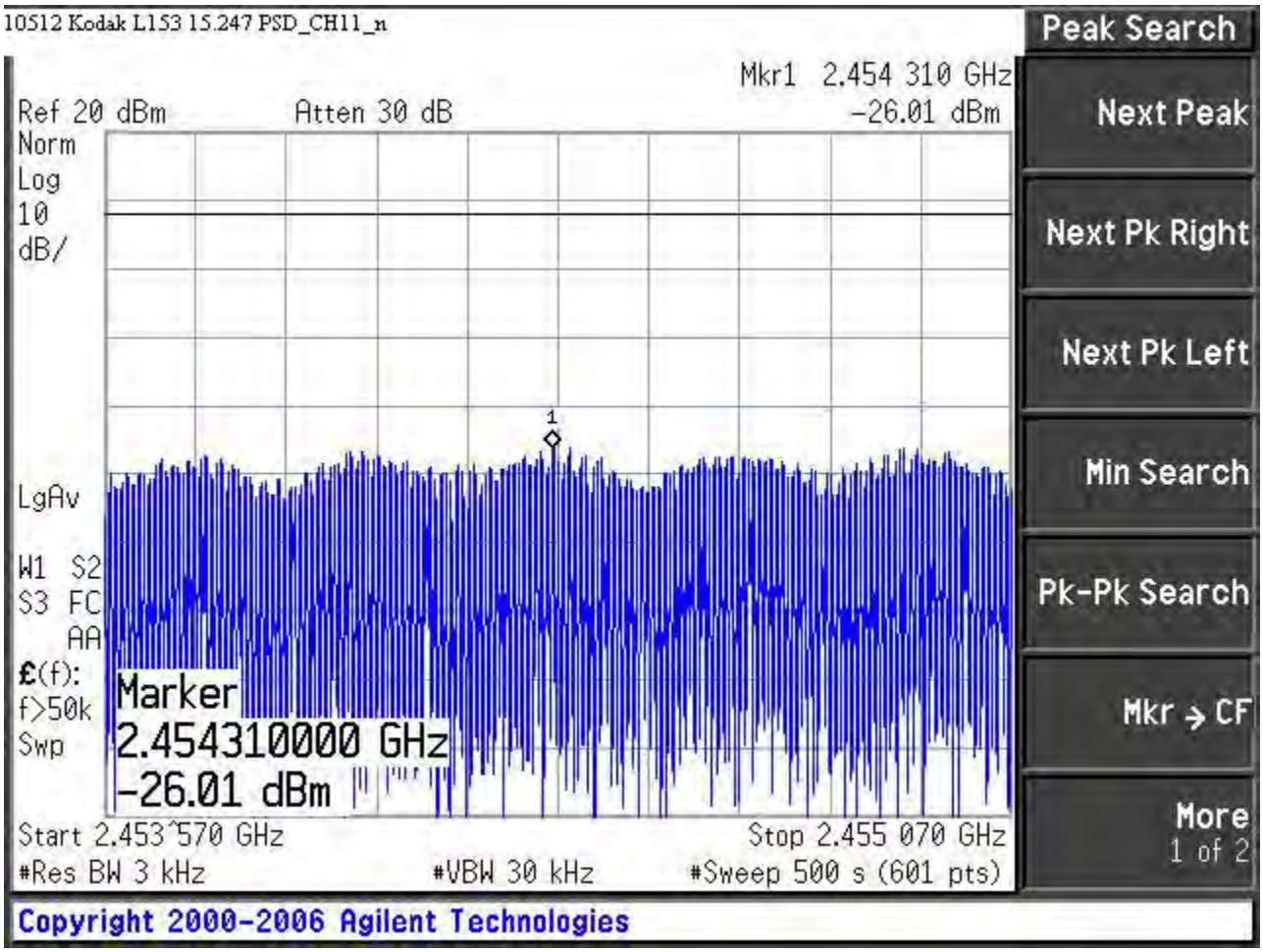

Figure 3-9: Power Spectral Density, 802.11n, Channel 11 @ 2462MHz

Occupied Bandwidth:

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

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

Table 11: 802.11b Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 2412MHz	15.2271MHz	>500 kHz	Pass
Mid Channel: 2437MHz	15.2203 MHz	>500 kHz	Pass
High Channel: 2462MHz	15.2620 MHz	>500 kHz	Pass

Table 12: 802.11g Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 2412MHz	16.4391 MHz	>500 kHz	Pass
Mid Channel: 2437MHz	16.4263 MHz	>500 kHz	Pass
High Channel: 2462MHz	16.4784 MHz	>500 kHz	Pass

Table 13: 802.11n Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 2412MHz	17.5521 MHz	>500 kHz	Pass
Mid Channel: 2437MHz	17.5520 MHz	>500 kHz	Pass
High Channel: 2462MHz	17.5531 MHz	>500 kHz	Pass

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

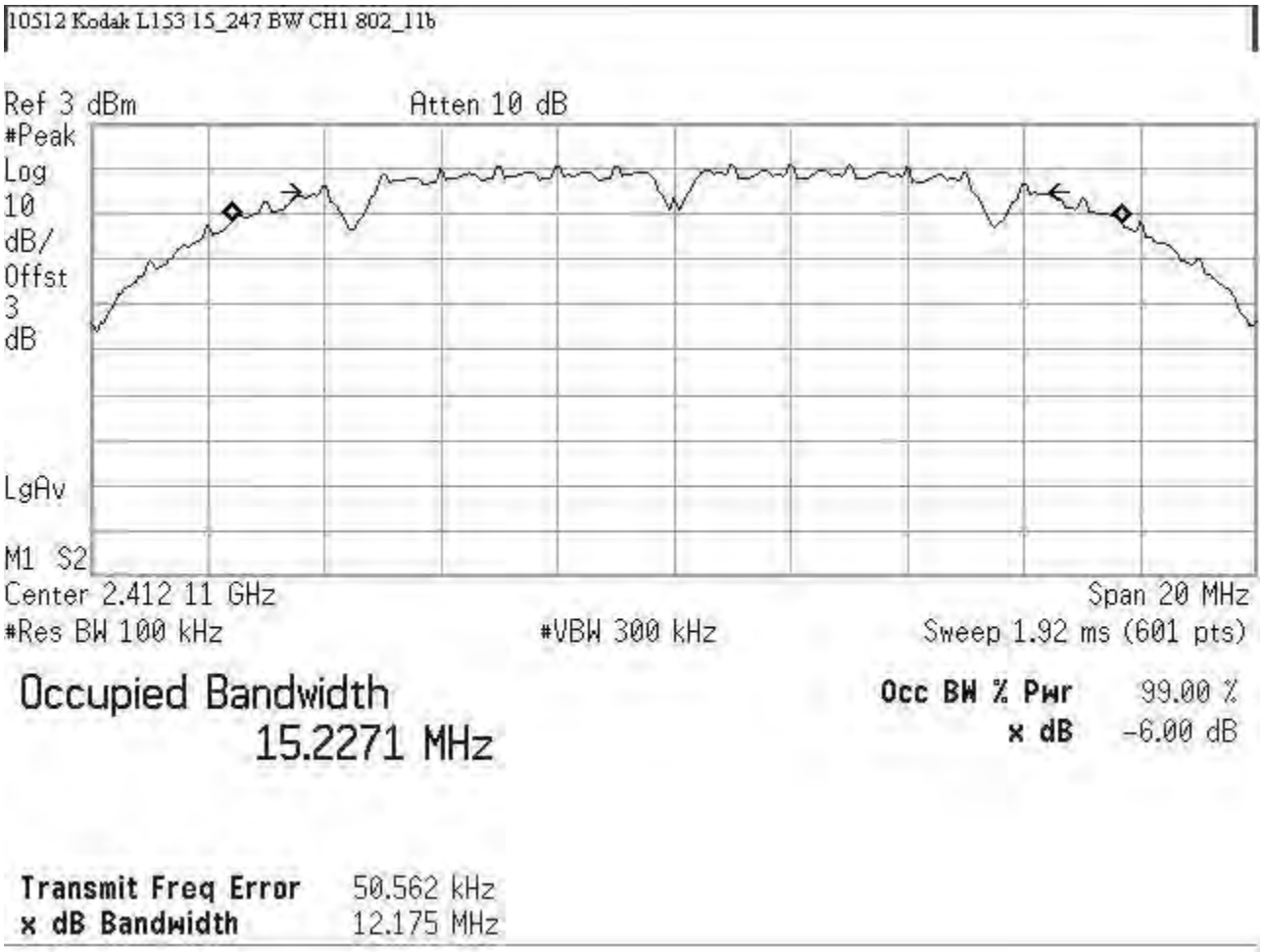

Figure 3-10: Occupied Bandwidth, 802.11b, Channel 1@ 2412MHz

Figure 3-11: Occupied Bandwidth, 802.11b, Channel 6 @ 2437MHz

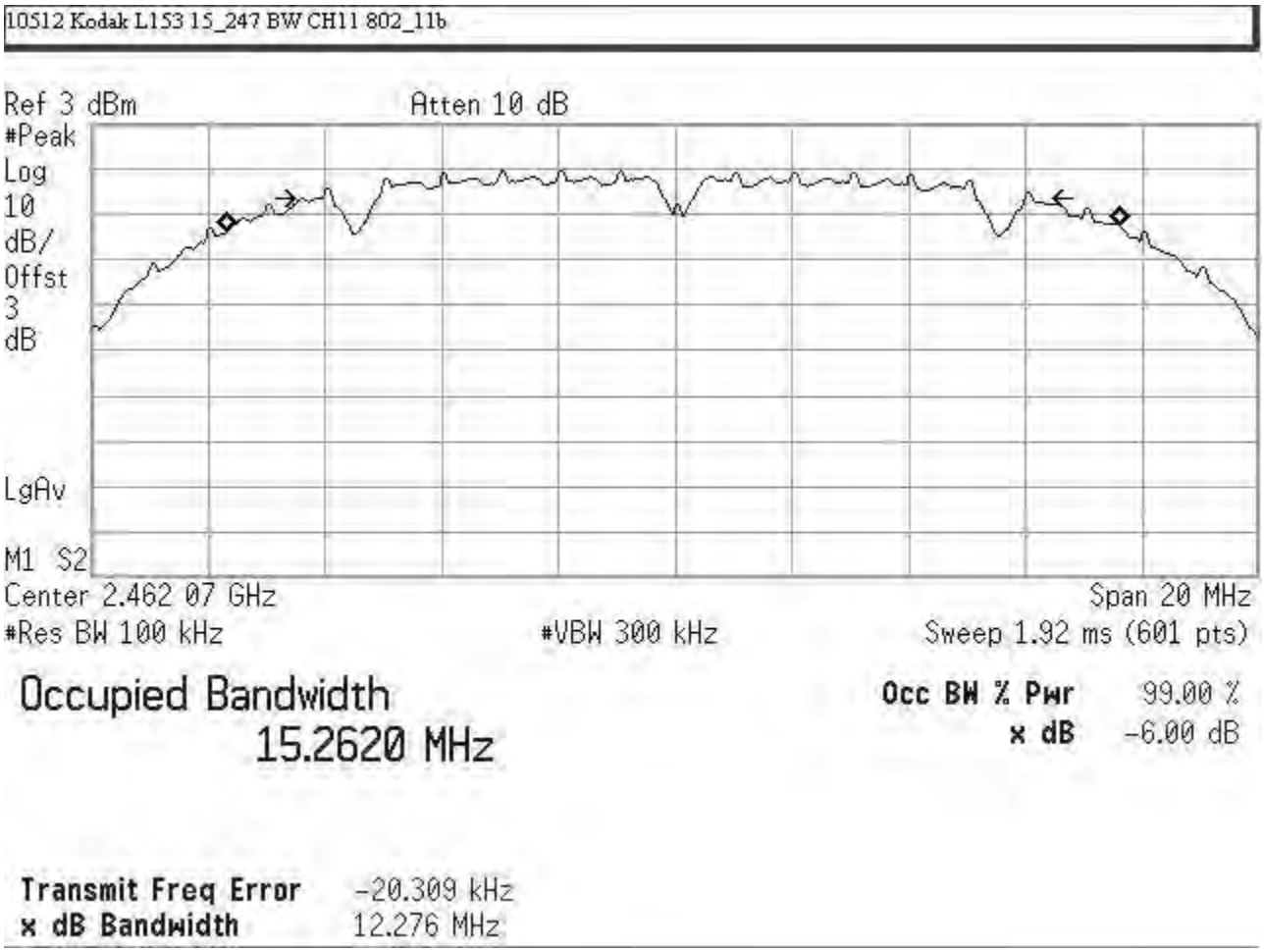

Figure 3-12: Occupied Bandwidth, 802.11b, Channel 11 @ 2462MHz

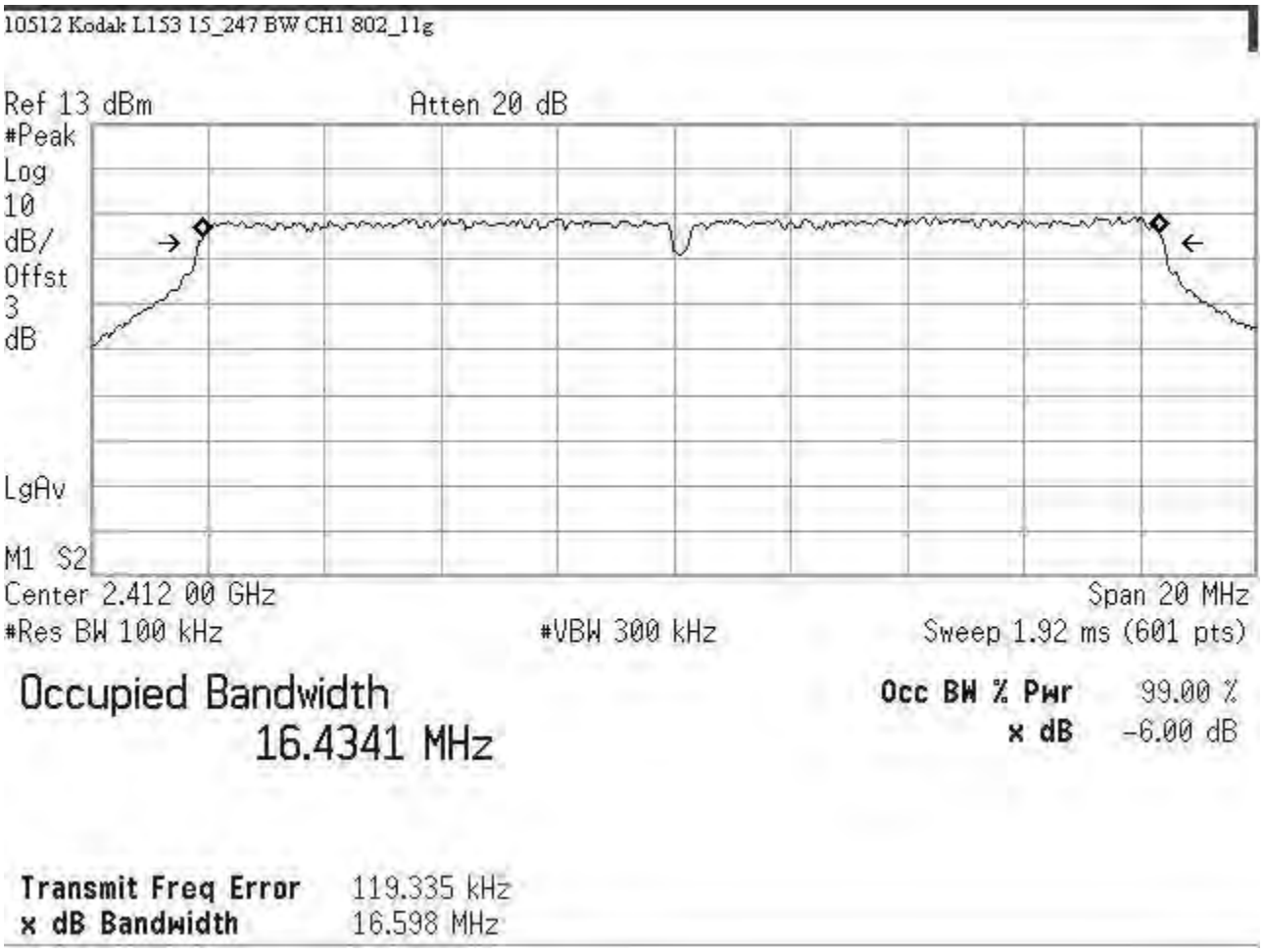

Figure 3-13: Occupied Bandwidth, 802.11g, Channel 1 @ 2412MHz

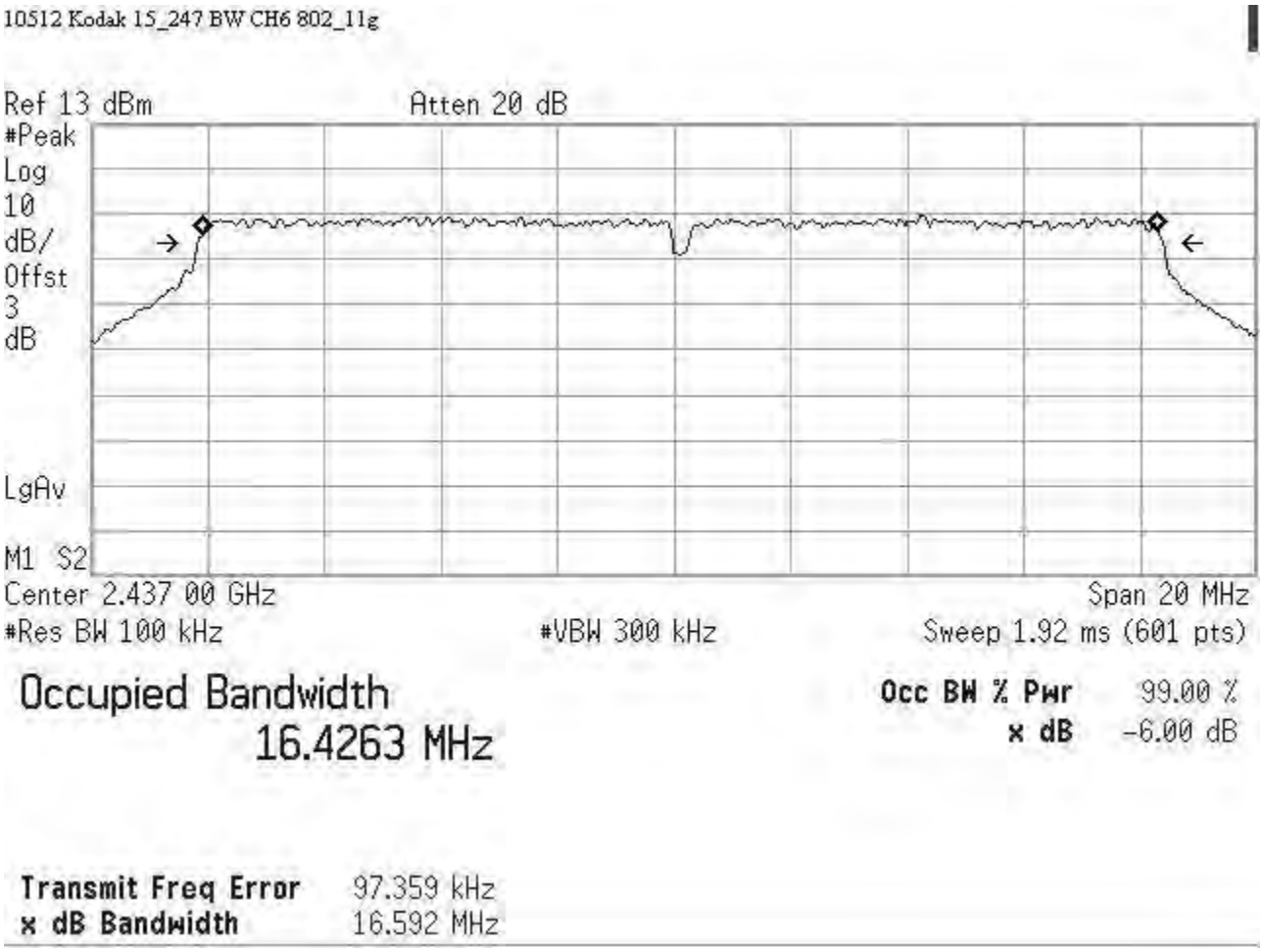

Figure 3-14: Occupied Bandwidth, 802.11g, Channel 6 @ 2437MHz

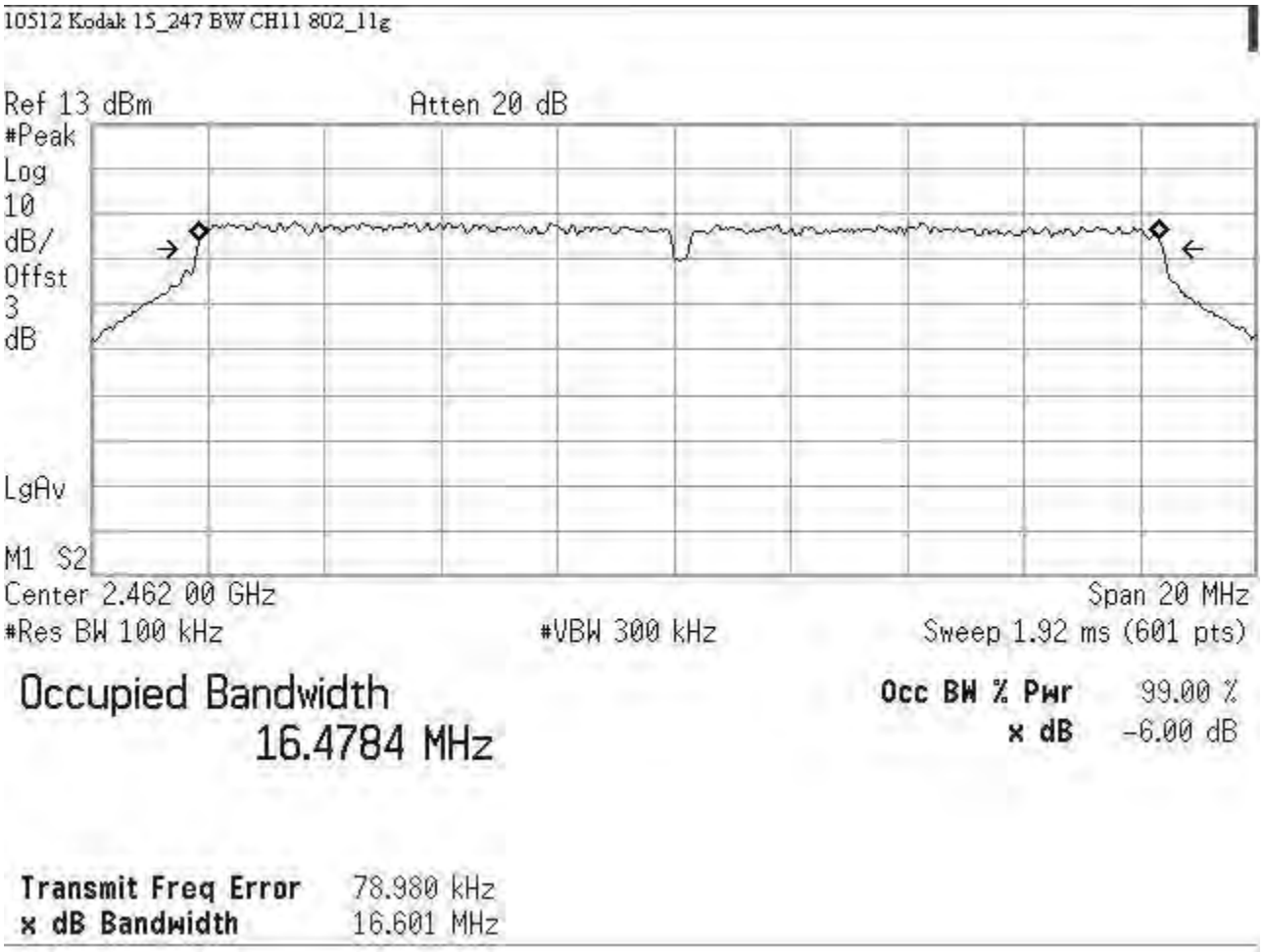

Figure 3-15: Occupied Bandwidth, 802.11g, Channel 11 @ 2462MHz

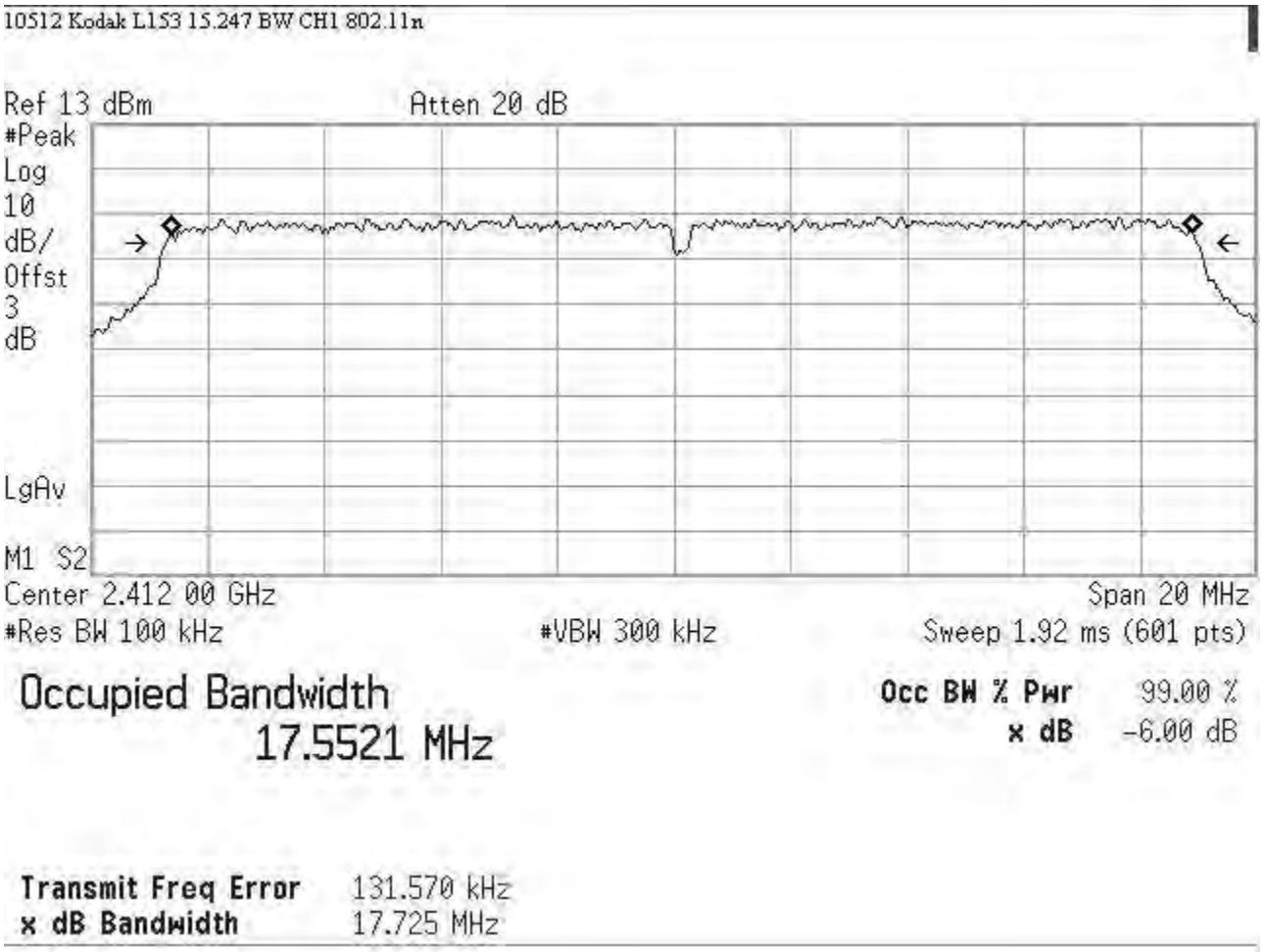

Figure 3-16: Occupied Bandwidth, 802.11n, Channel 1 @ 2412MHz

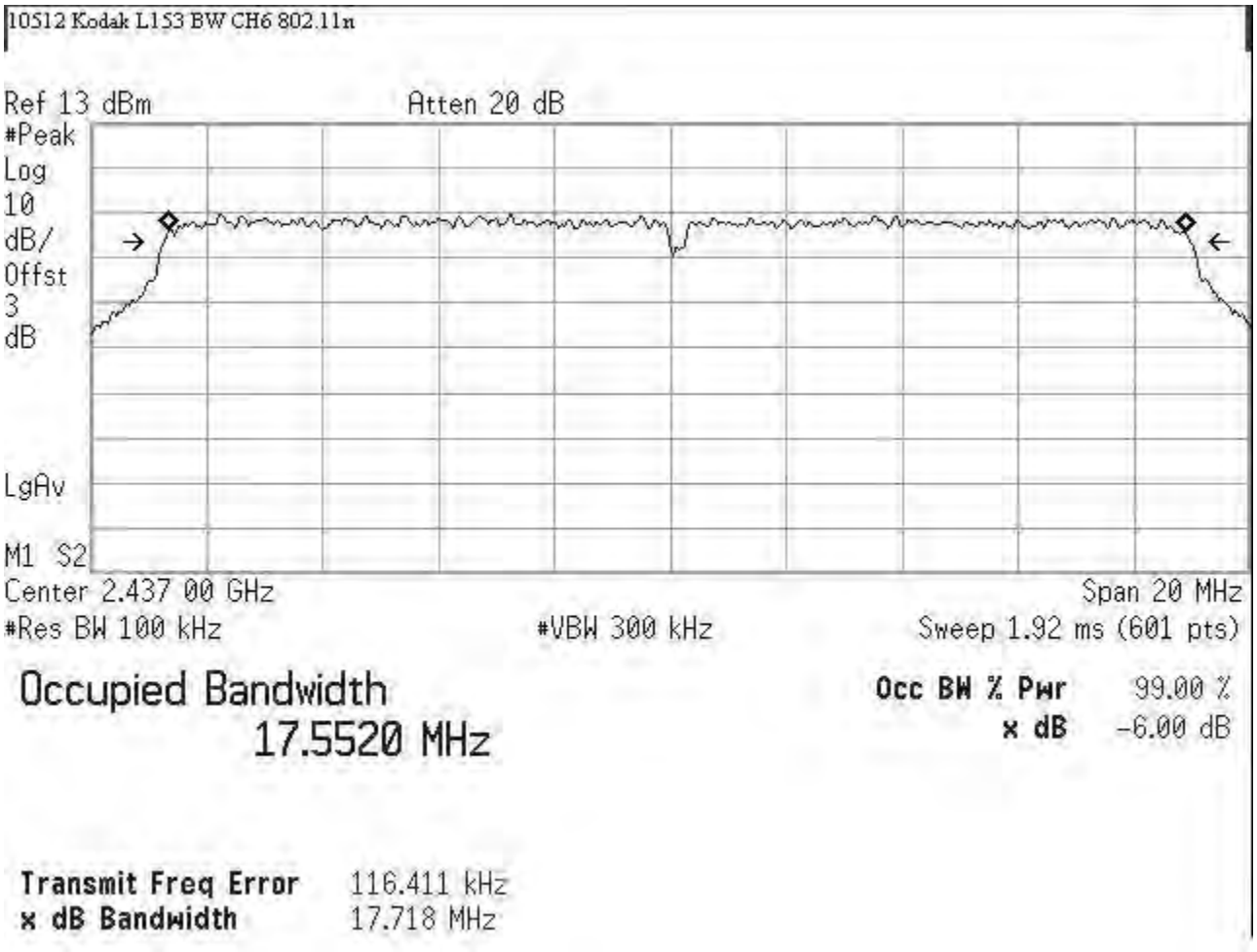

Figure 3-17: Occupied Bandwidth, 802.11n, Channel 6 @ 2437MHz

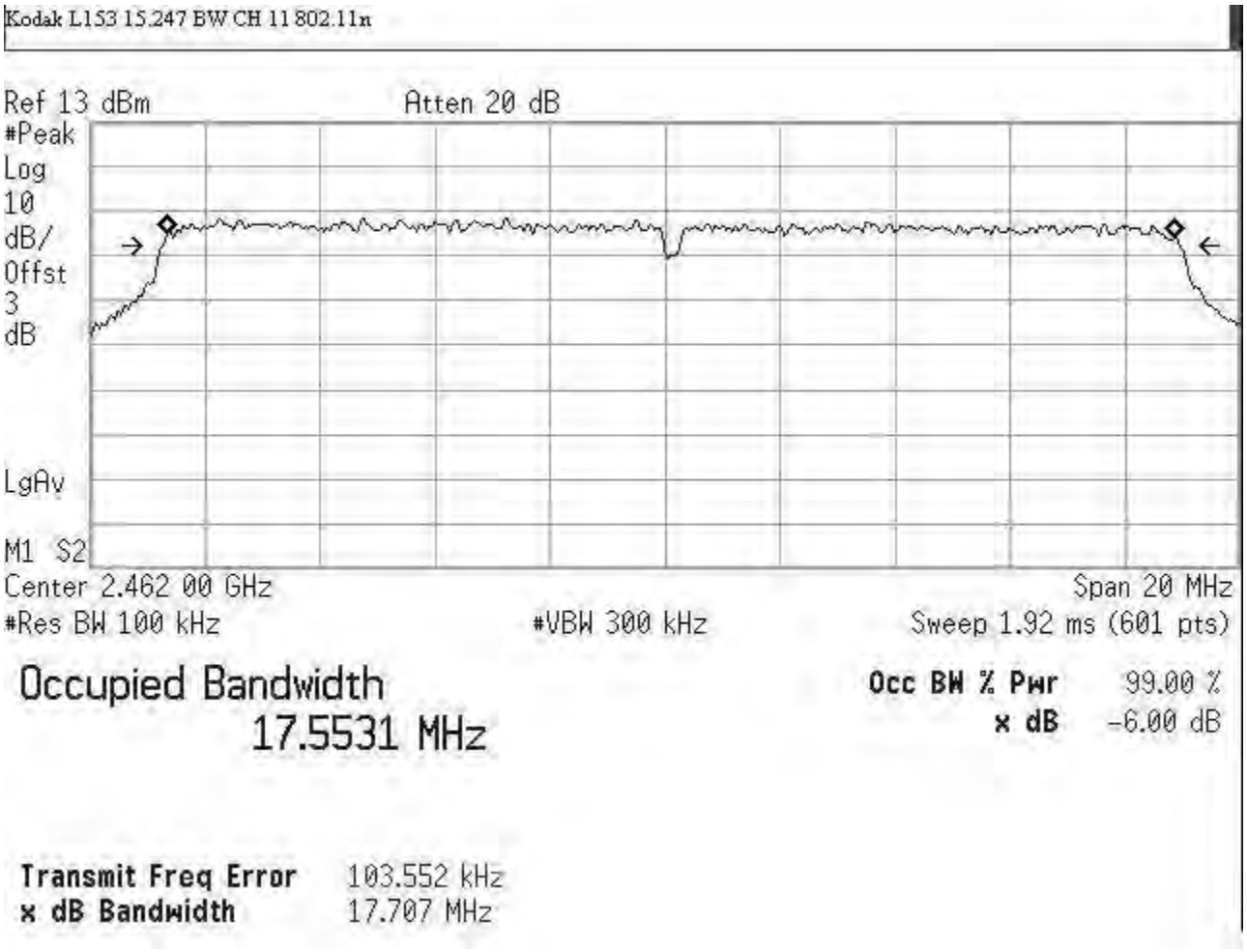

Figure 3-18: Occupied Bandwidth, 802.11n, Channel 11 @ 2462MHz

Conducted Spurious Emissions at Antenna Terminals

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.

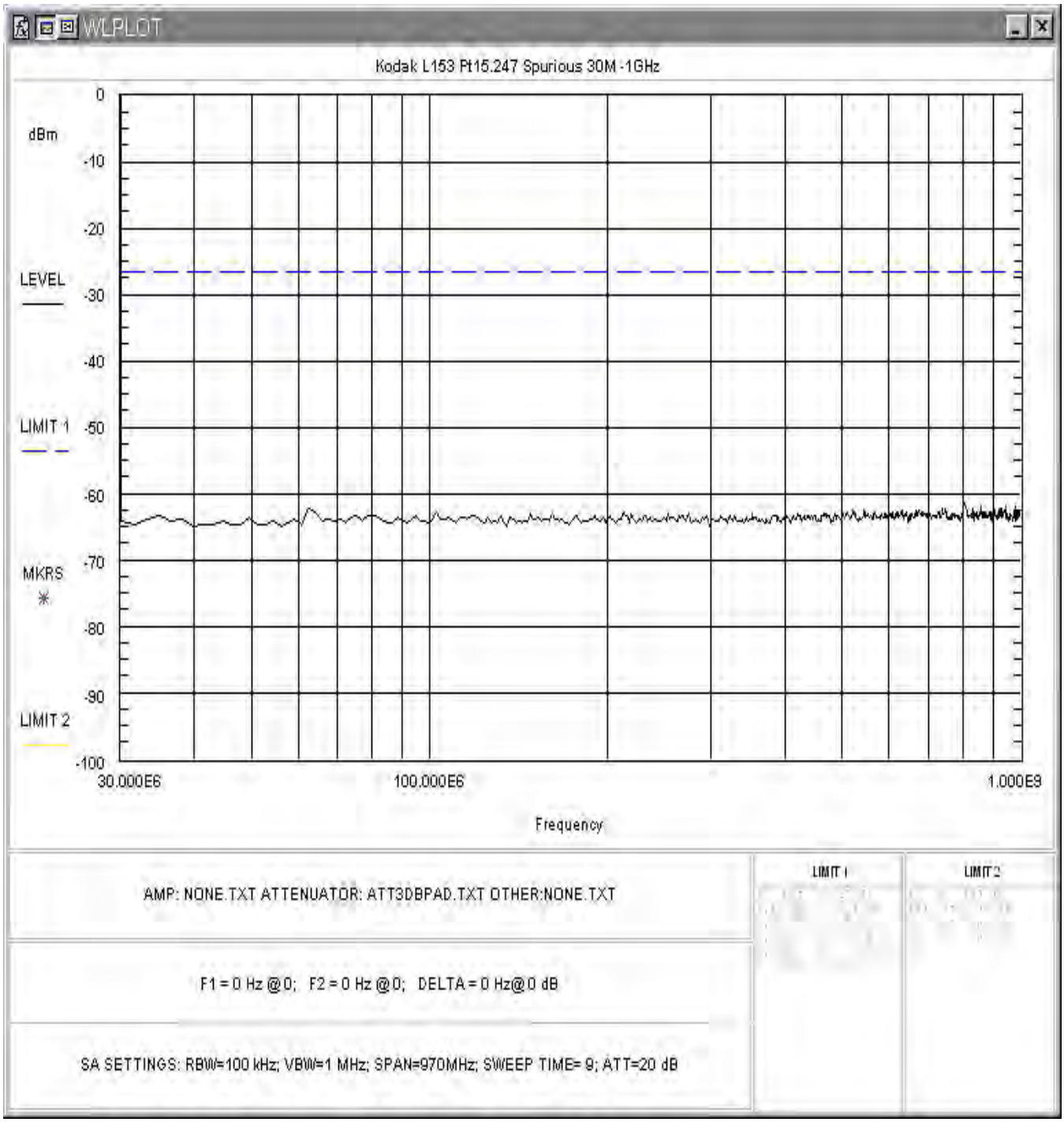

Figure 3-19: Conducted Spurious Emissions, Low Channel 30 - 1000MHz

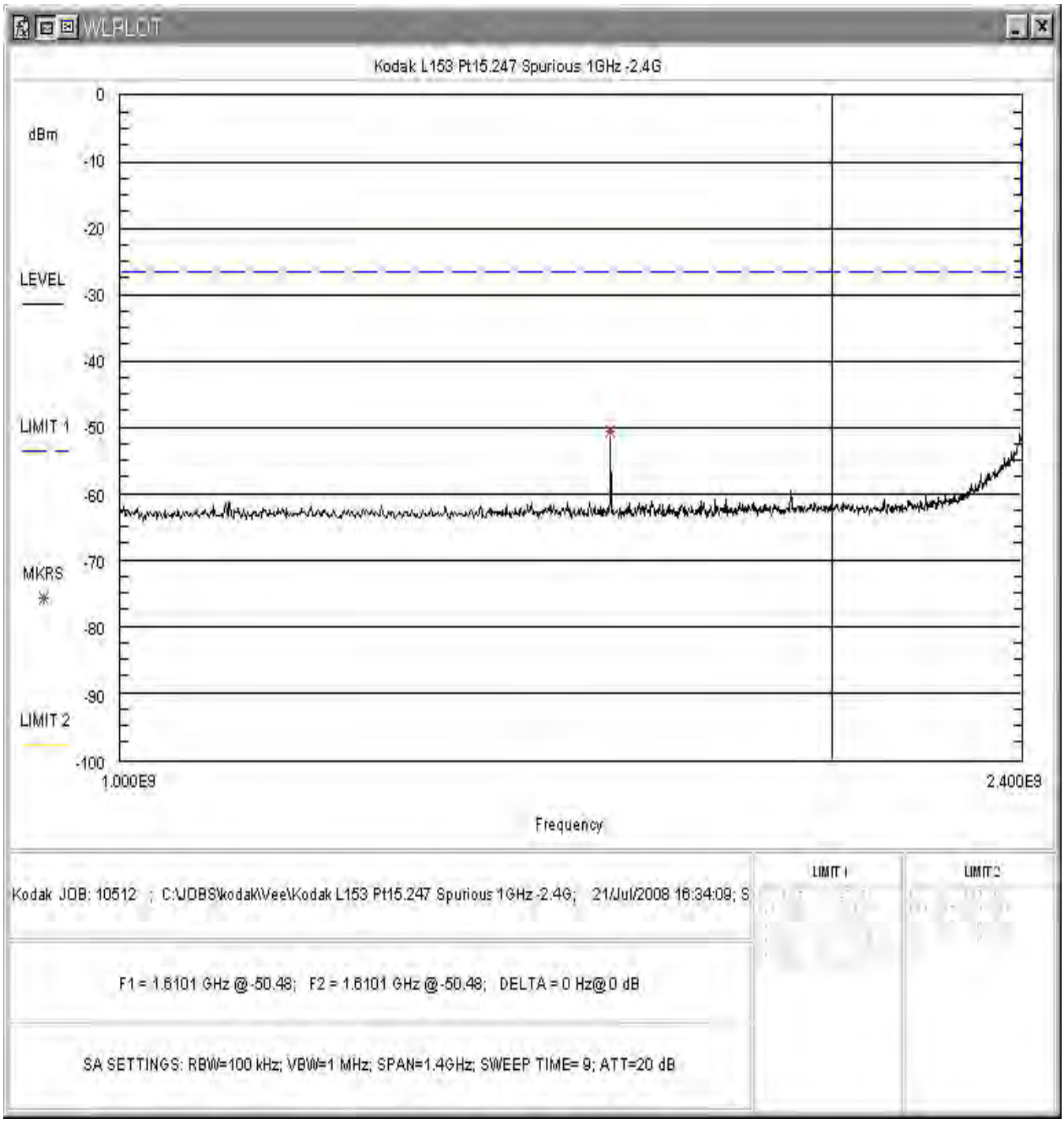

Figure 3-20: Conducted Spurious Emissions, Low Channel 1 – 2.4GHz

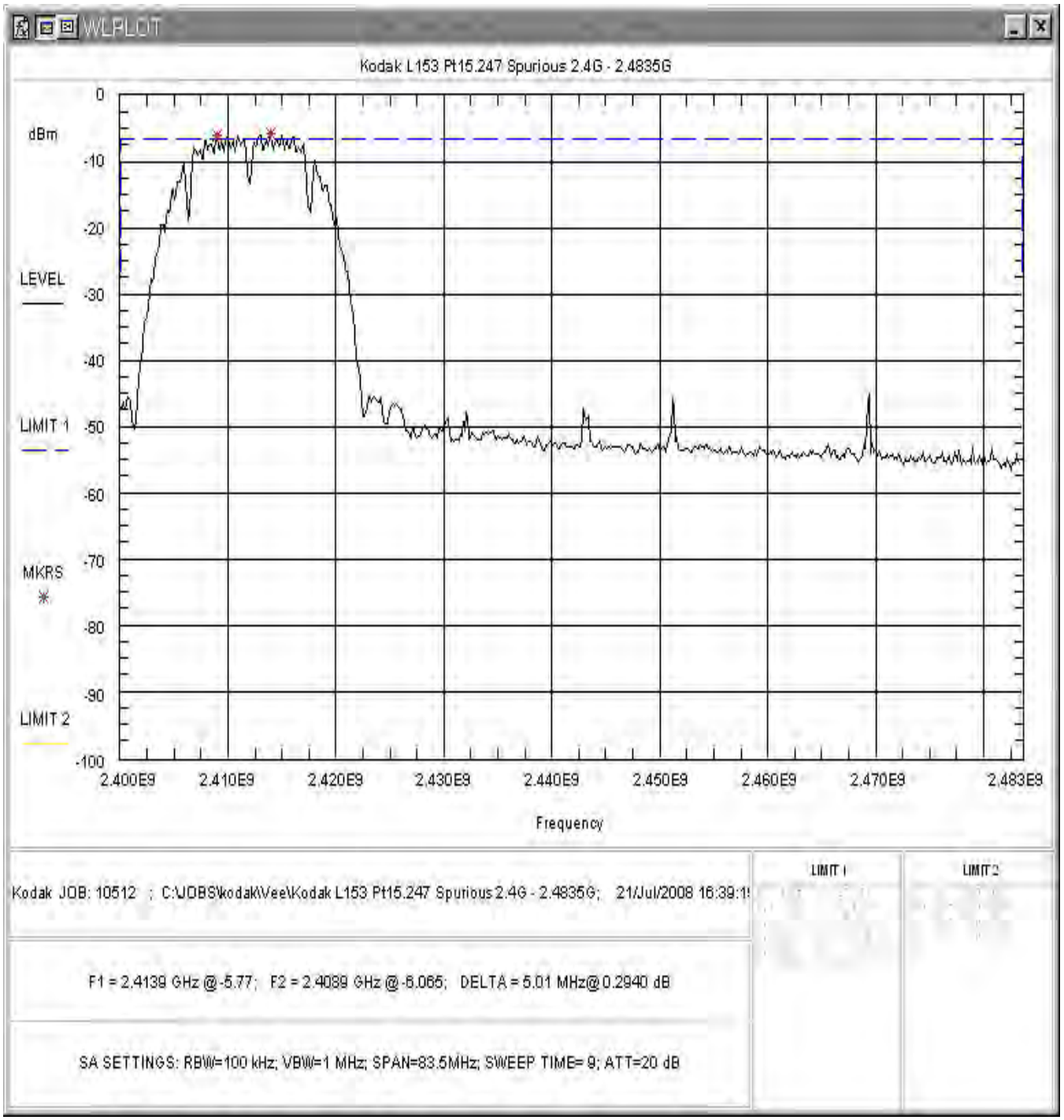

Figure 3-21: Conducted Spurious Emissions In-Band, Low Channel 2.4 – 2.4835GHz

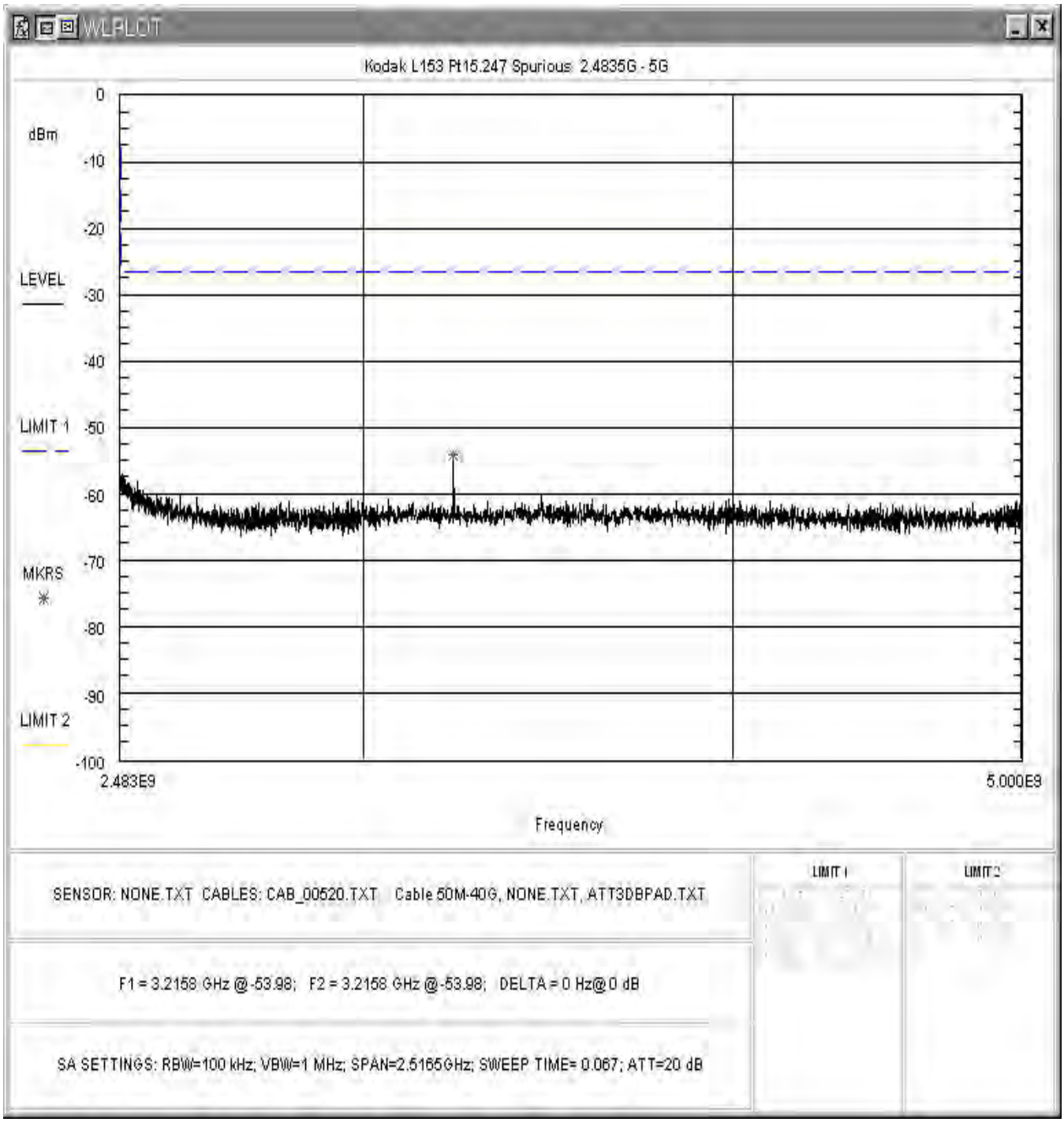

Figure 3-22: Conducted Spurious Emissions, Low Channel 2.4835 - 5GHz

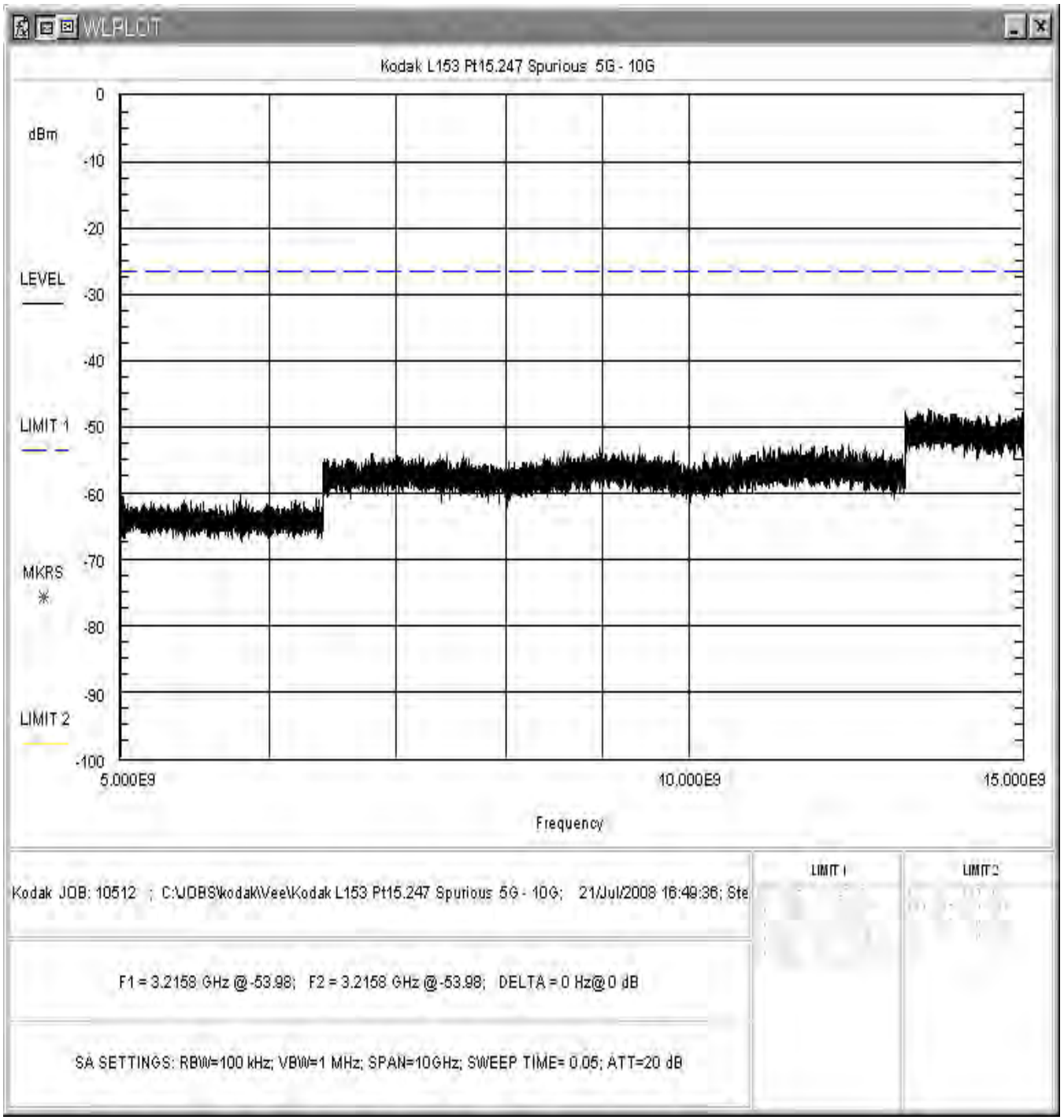

Figure 3-23: Conducted Spurious Emissions, Low Channel 5 - 15GHz

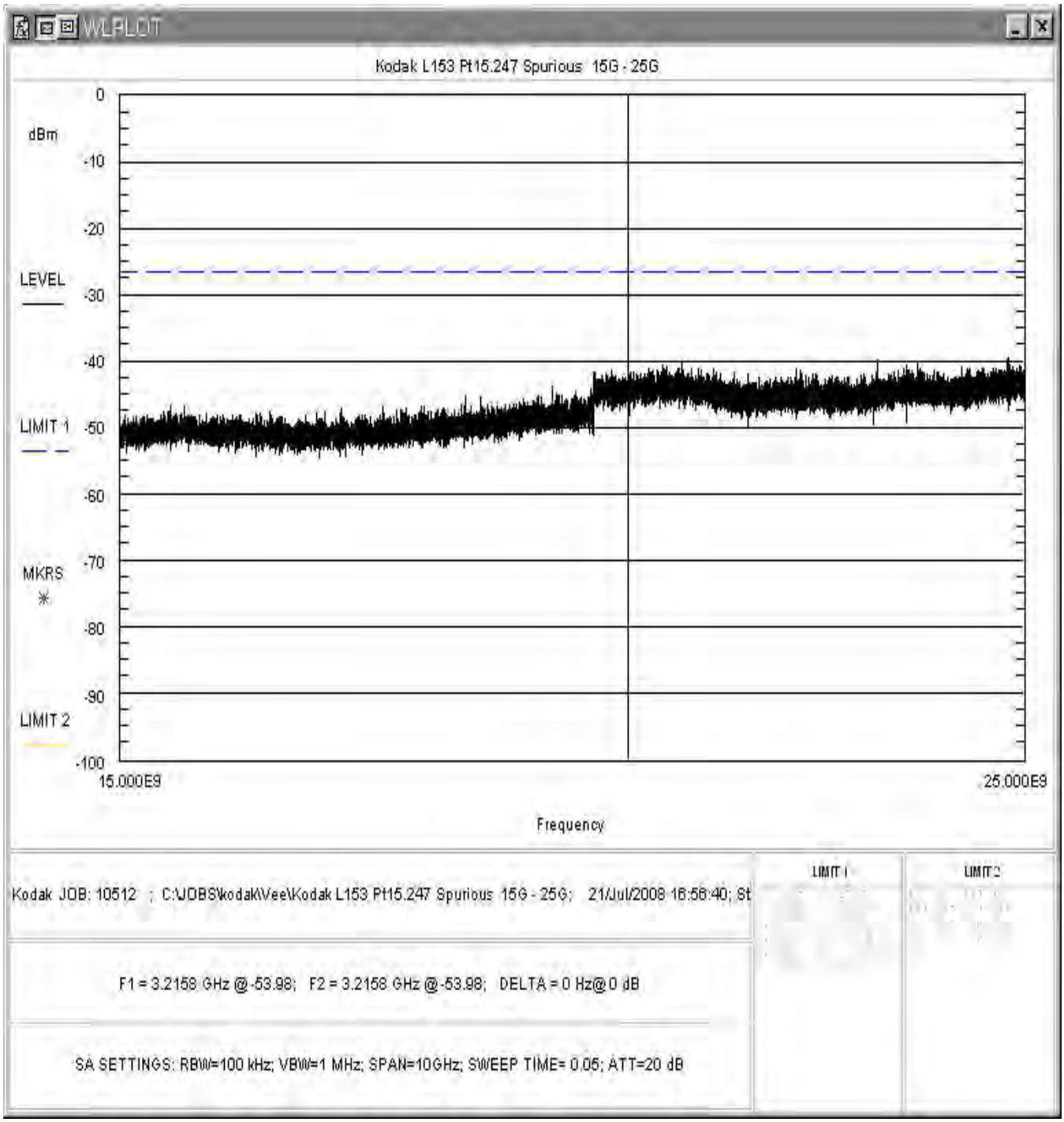

Figure 3-24: Conducted Spurious Emissions, Low Channel 15 - 25GHz

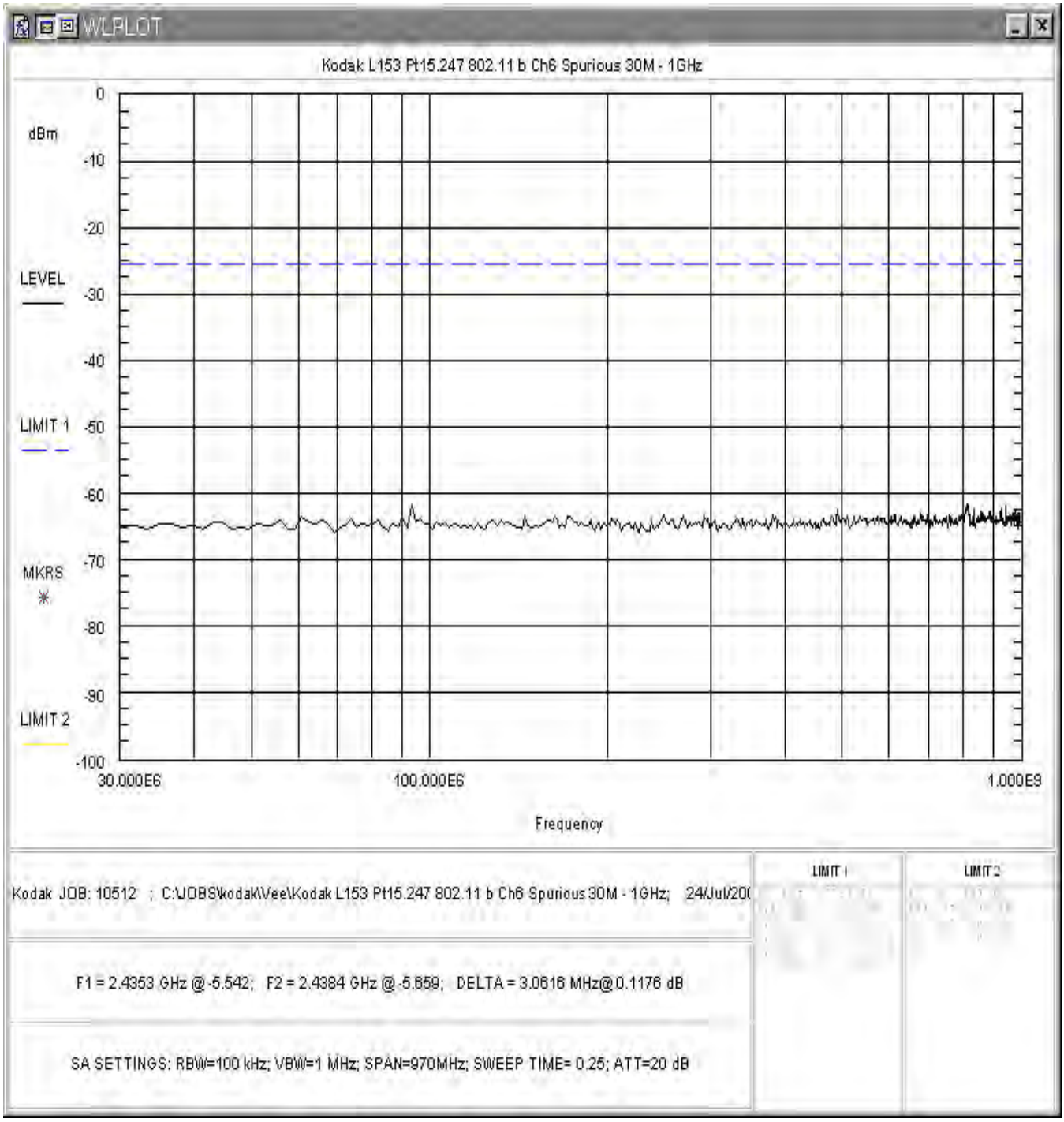

Figure 3-25: Conducted Spurious Emissions, Mid Channel 30 - 1000MHz

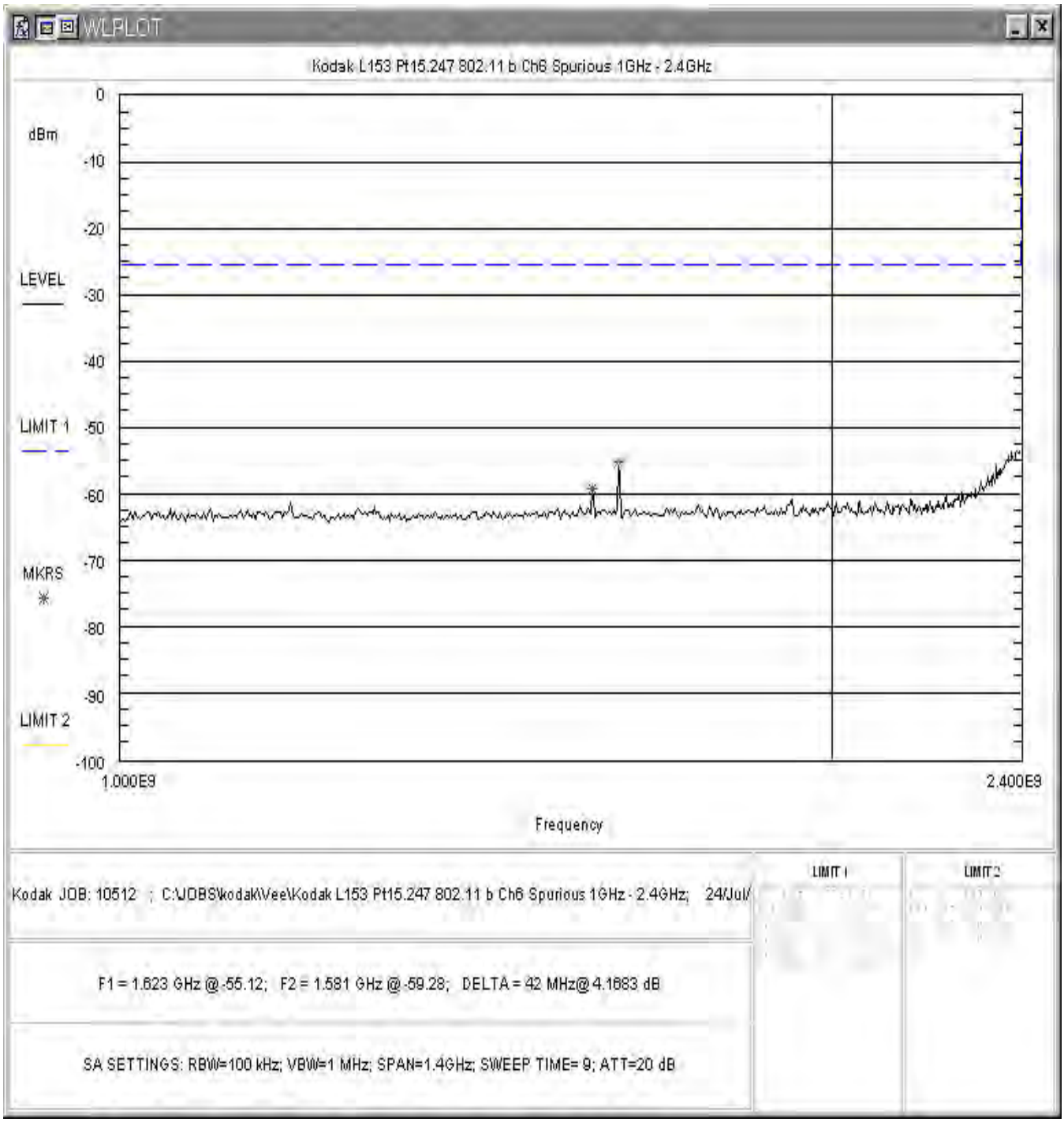

Figure 3-26: Conducted Spurious Emissions, Mid Channel 1 – 1 - 2.4GHz

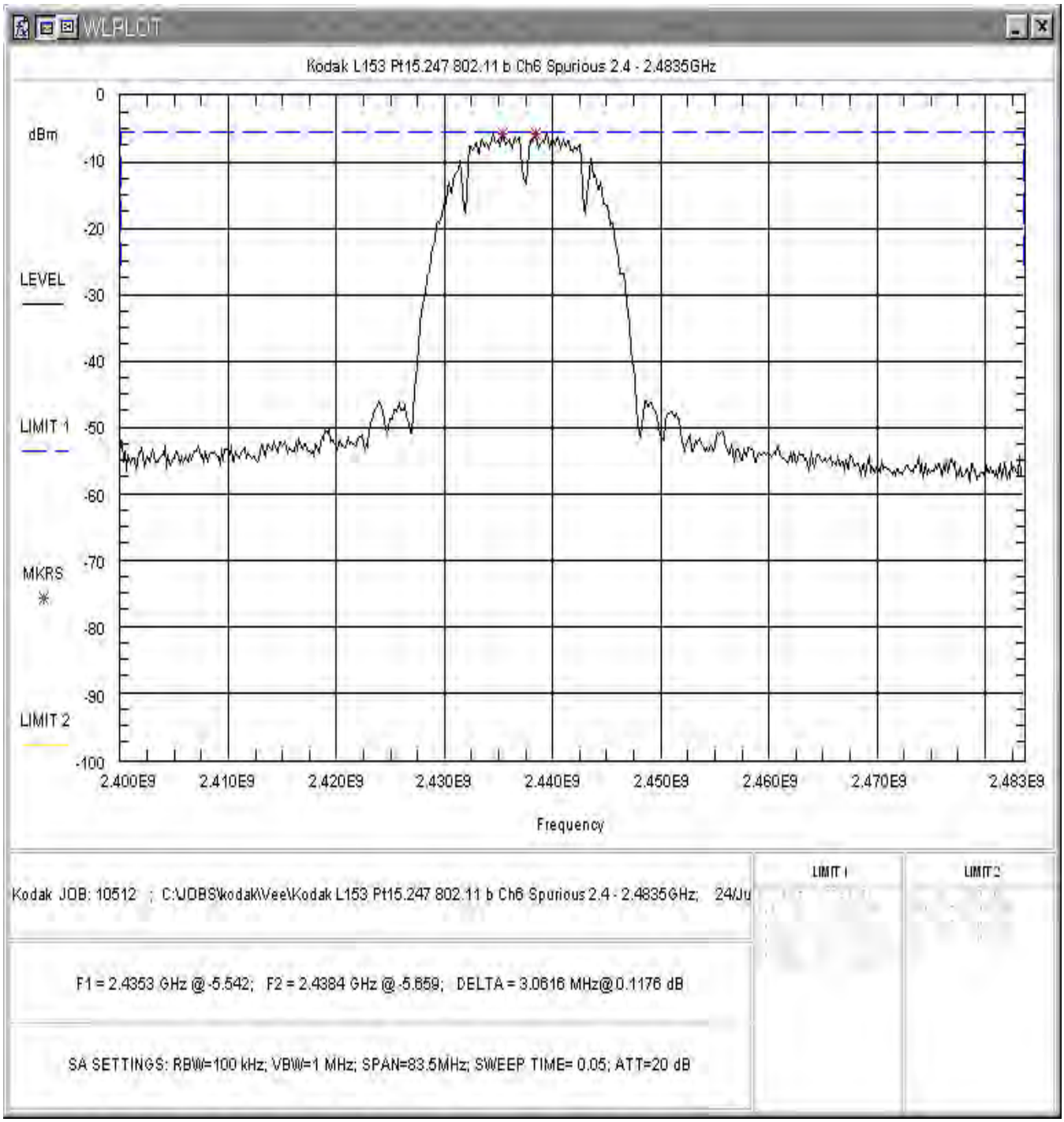

Figure 3-27: Conducted Spurious Emissions, Mid Channel 2.4 – 2.4835GHz

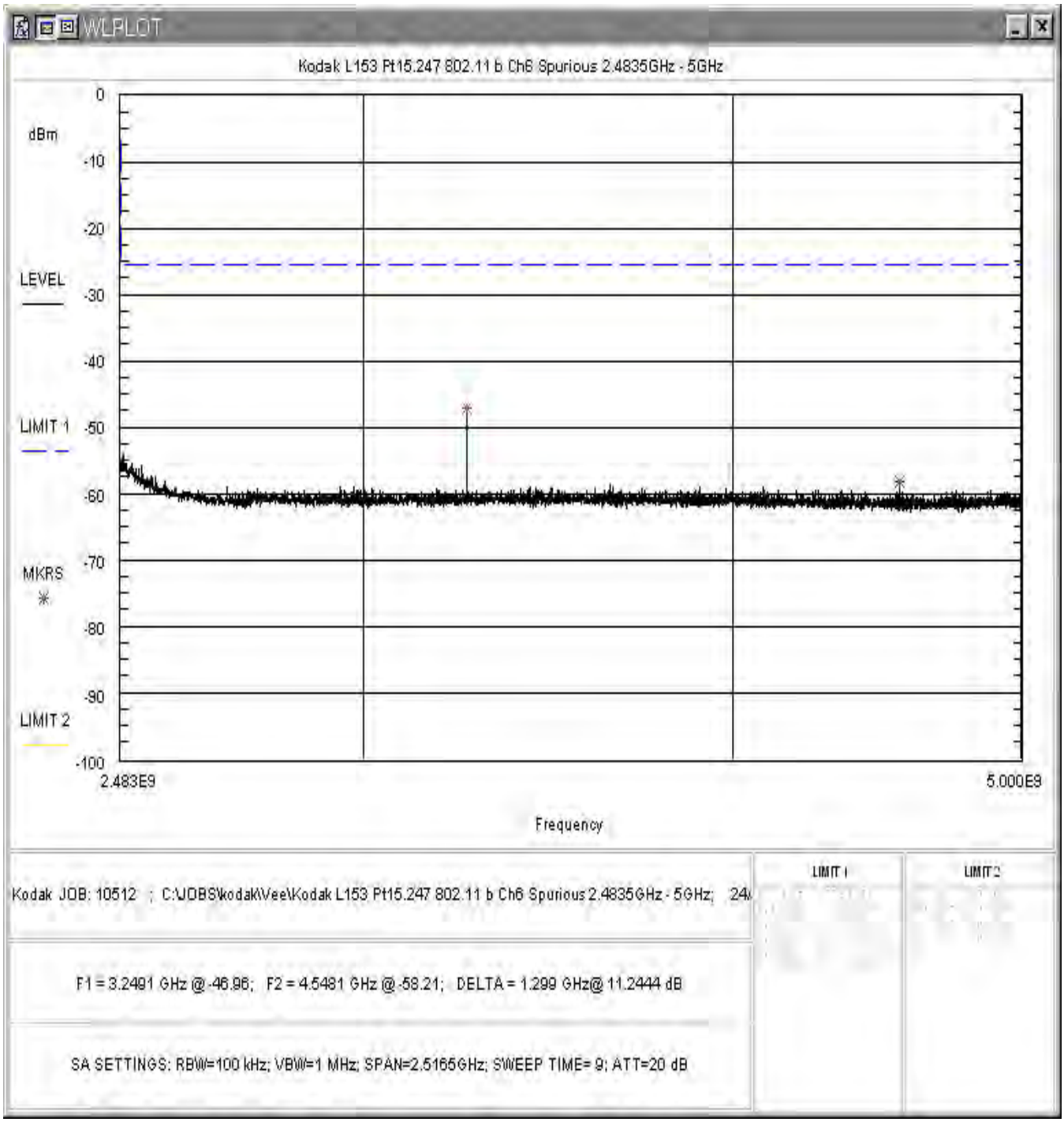

Figure 3-28: Conducted Spurious Emissions, Mid Channel 2.4835 - 5GHz

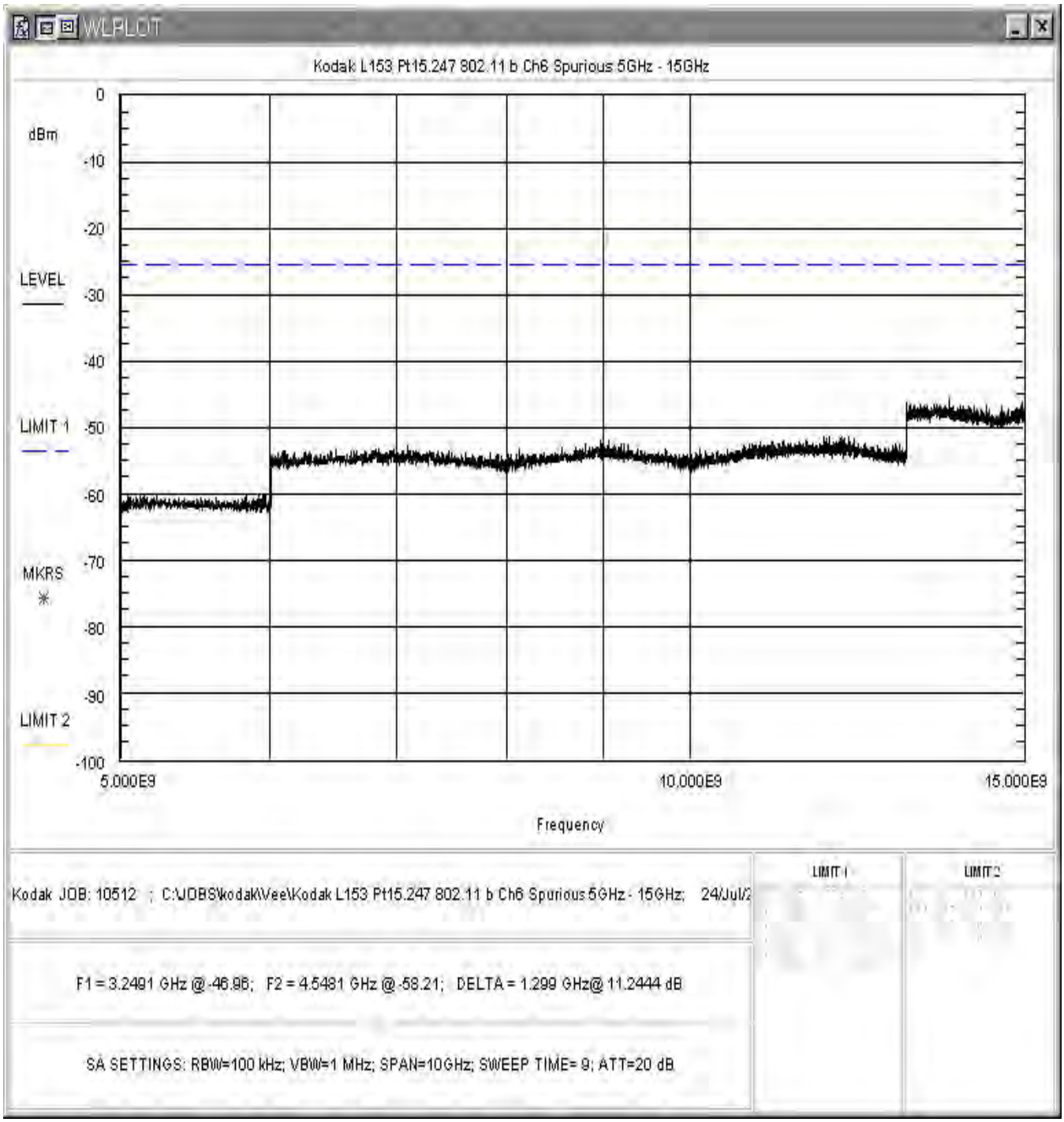

Figure 3-29: Conducted Spurious Emissions, Mid Channel 5 – 15GHz

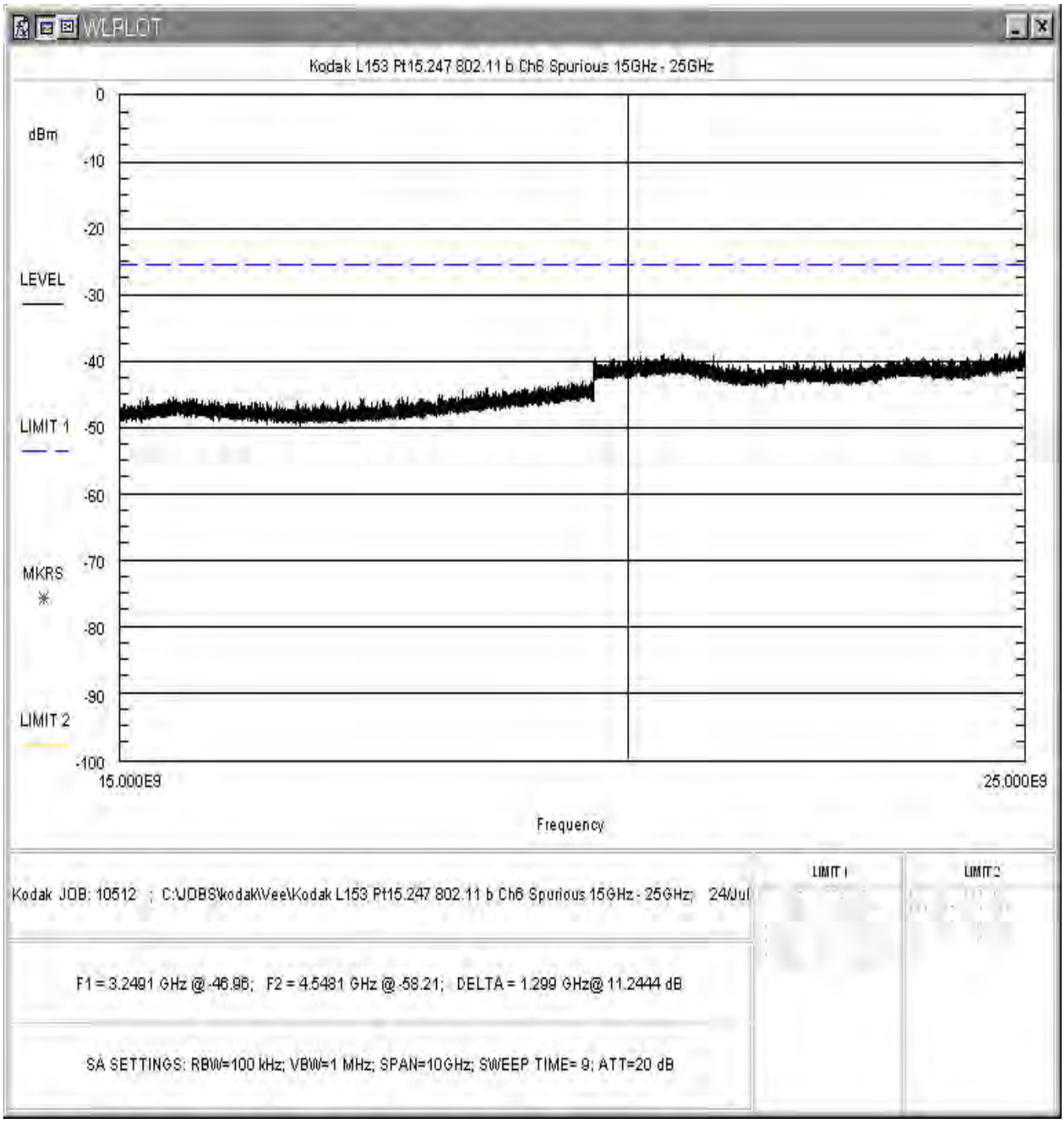

Figure 3-30: Conducted Spurious Emissions, Mid Channel 15 – 25GHz

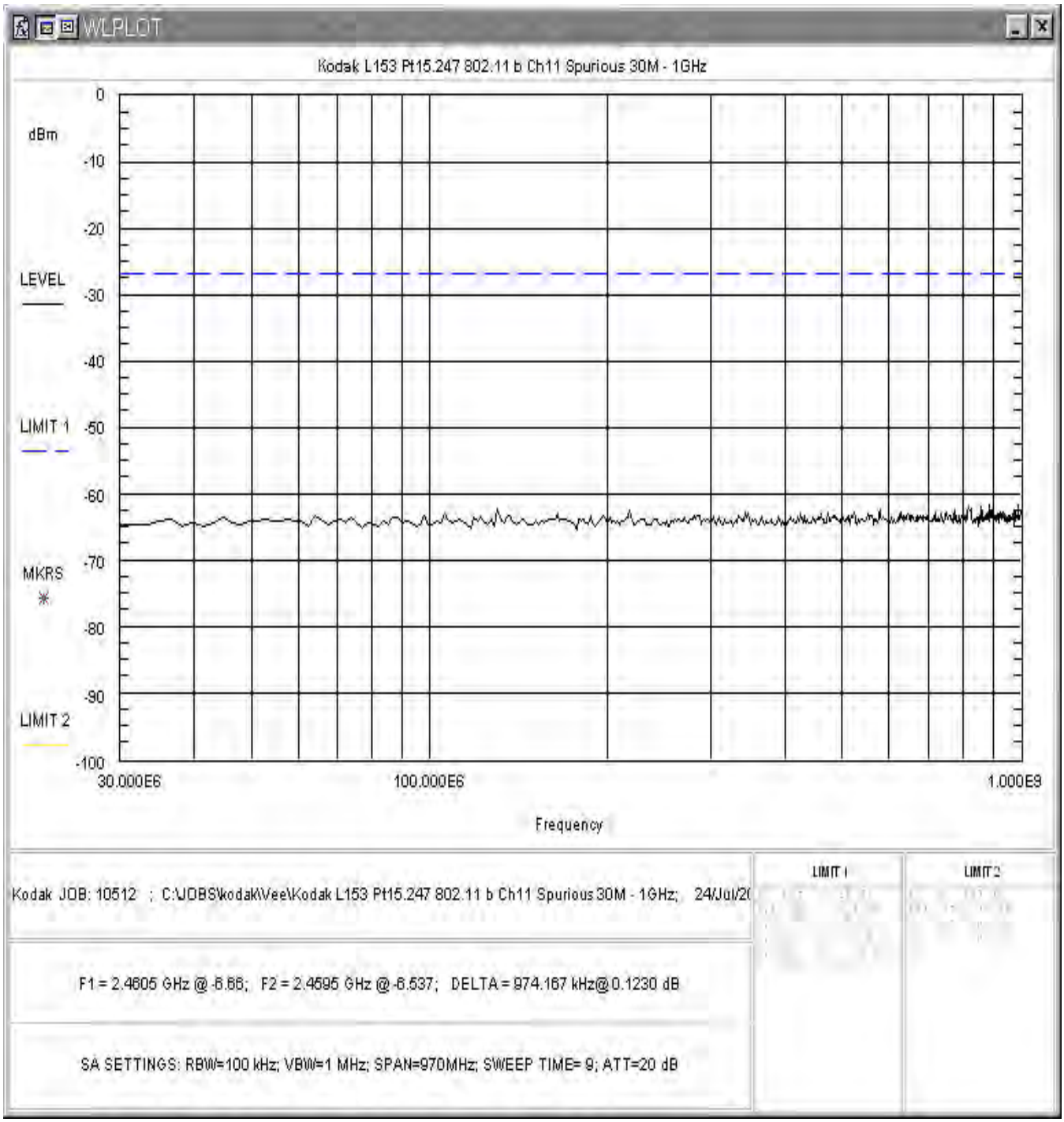

Figure 3-31: Conducted Spurious Emissions, High Channel 30MHz - 1GHz

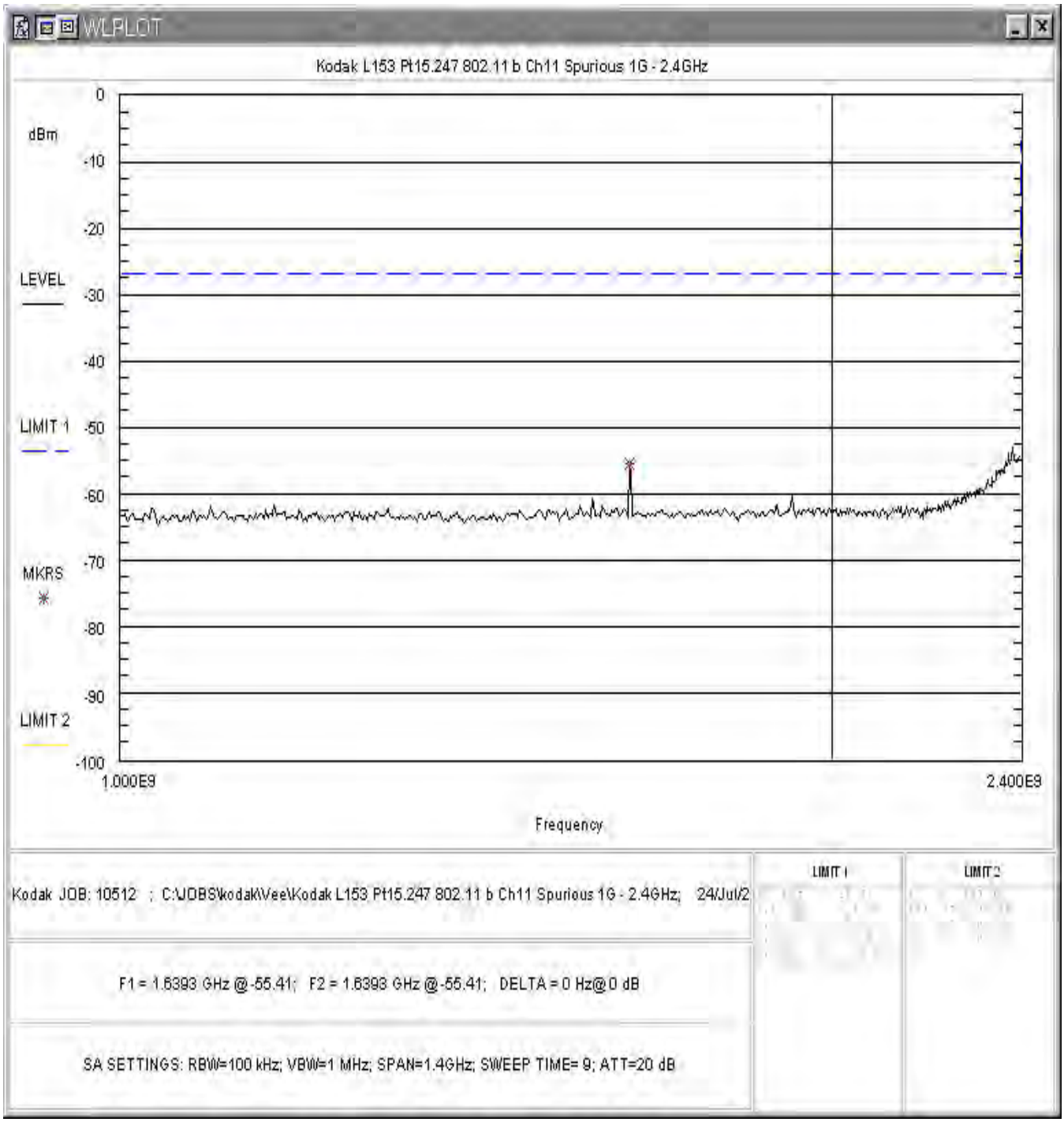

Figure 3-32: Conducted Spurious Emissions, High Channel 1– 2.4GHz

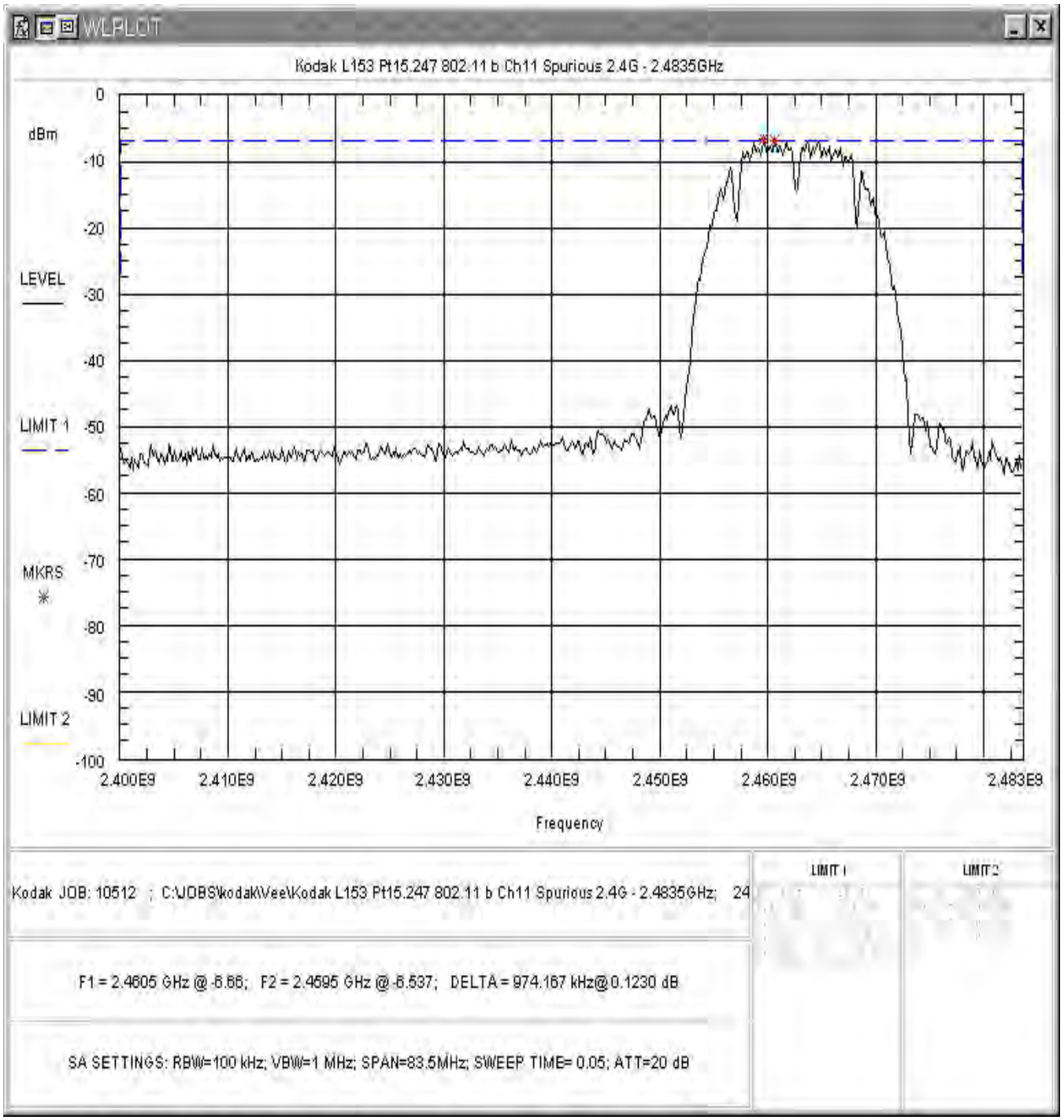

Figure 3-33: Conducted Spurious Emissions, In Band High Channel 2.4 – 2.4835GHz

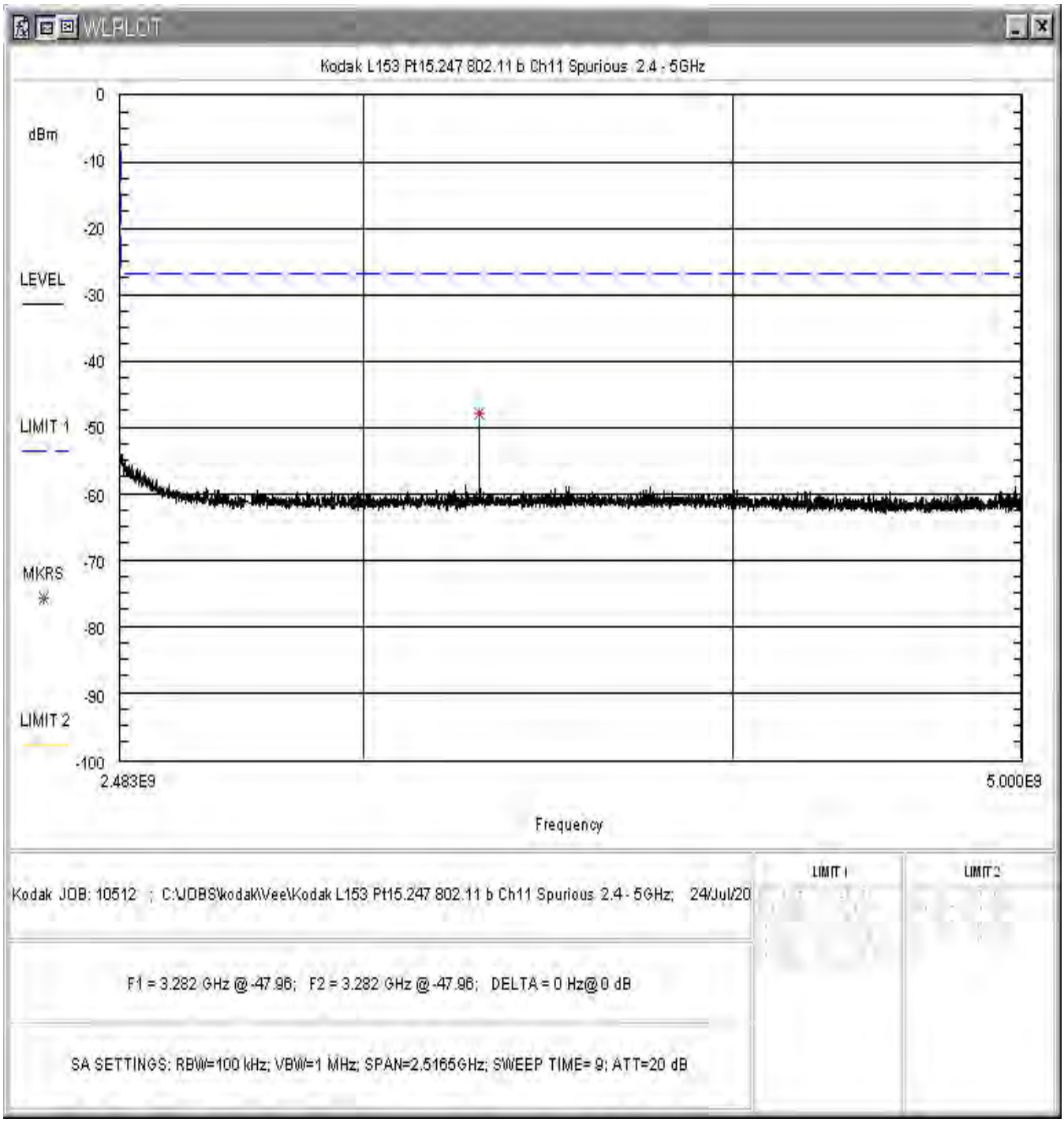

Figure 3-34: Conducted Spurious Emissions, High Channel 2.4385 - 5GHz

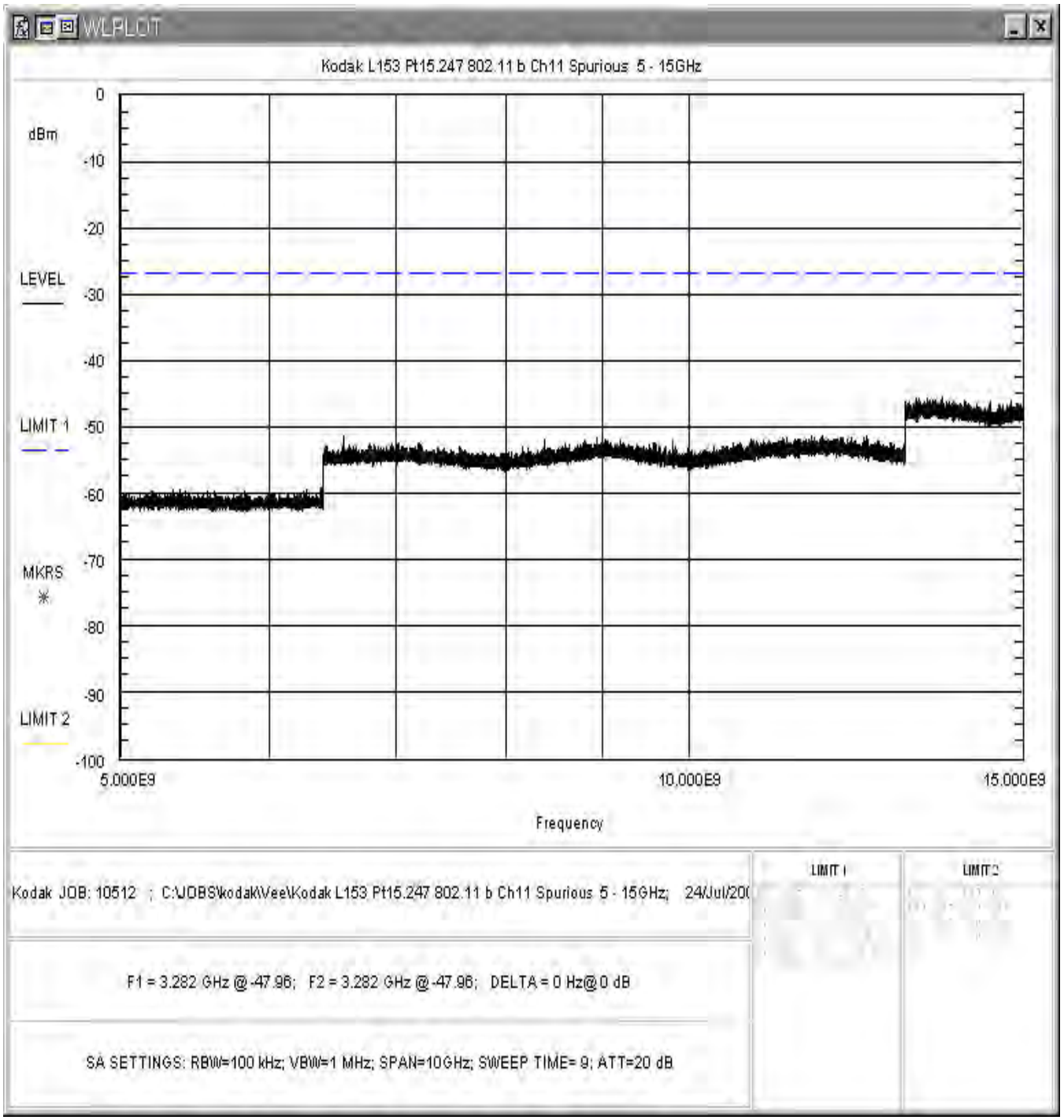

Figure 3-35: Conducted Spurious Emissions, High Channel 5- 15GHz

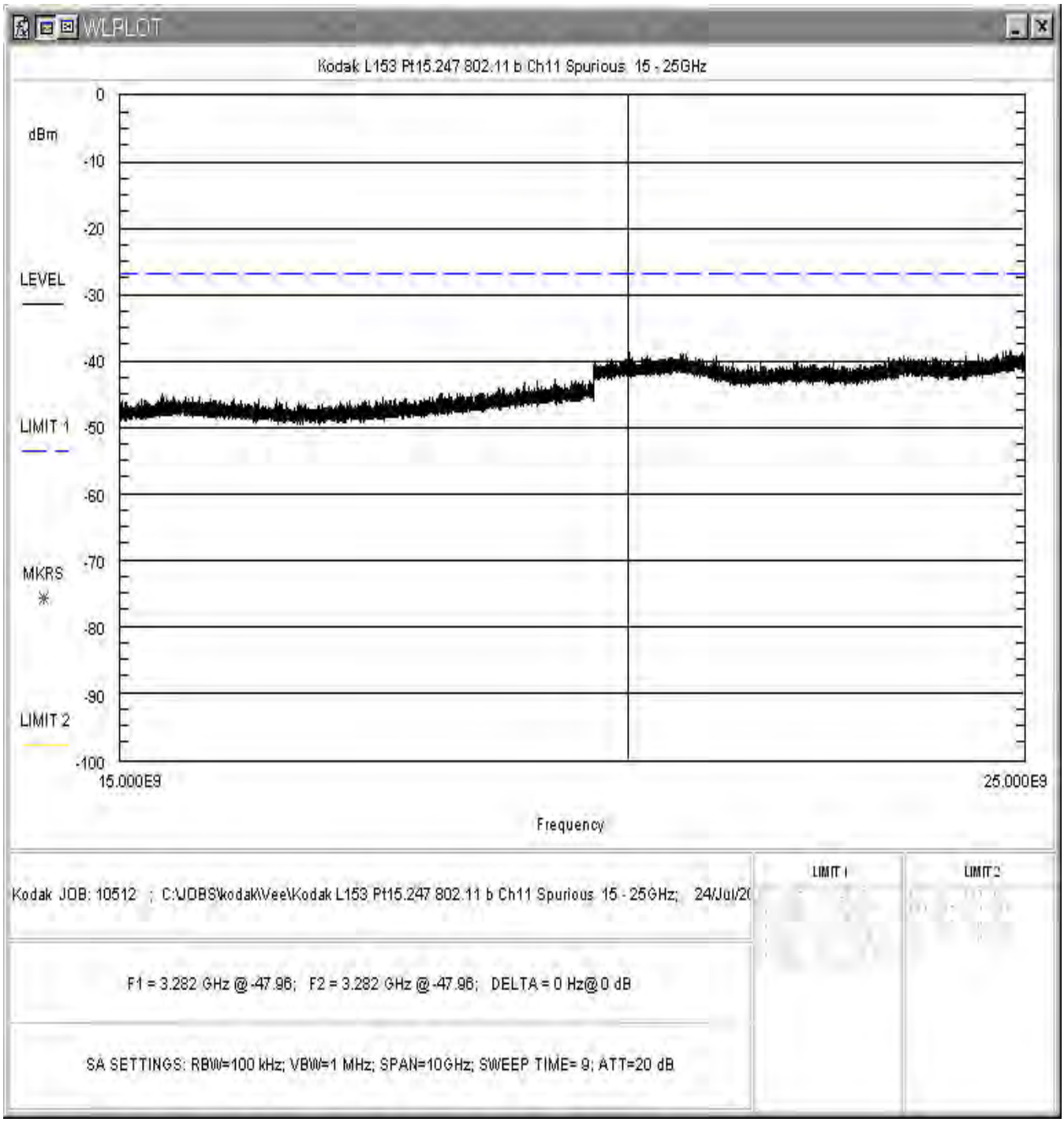

Figure 3-36: Conducted Spurious Emissions, High Channel 15 - 25GHz

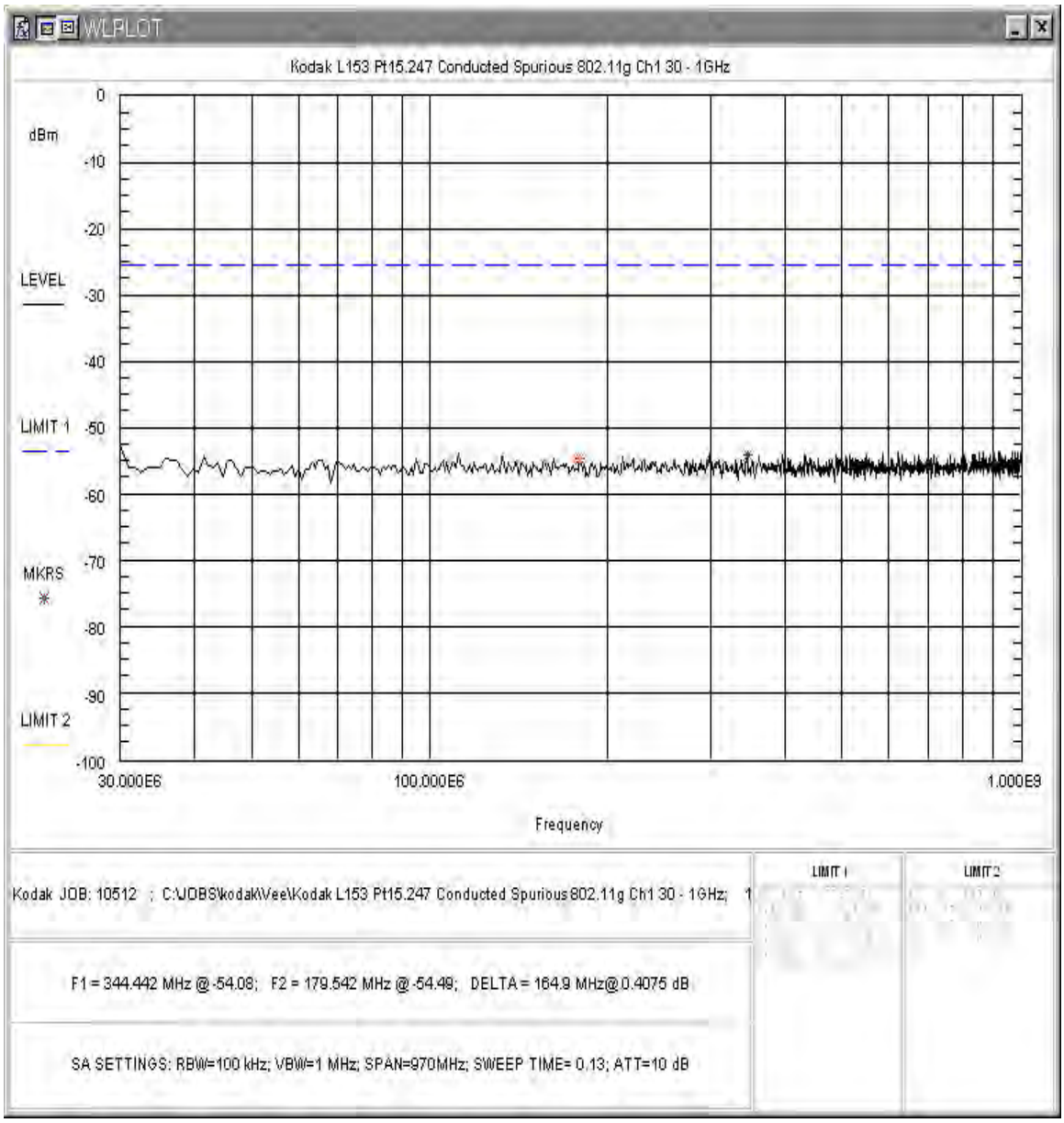

Figure 3- 37. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch1 30 - 1GHz

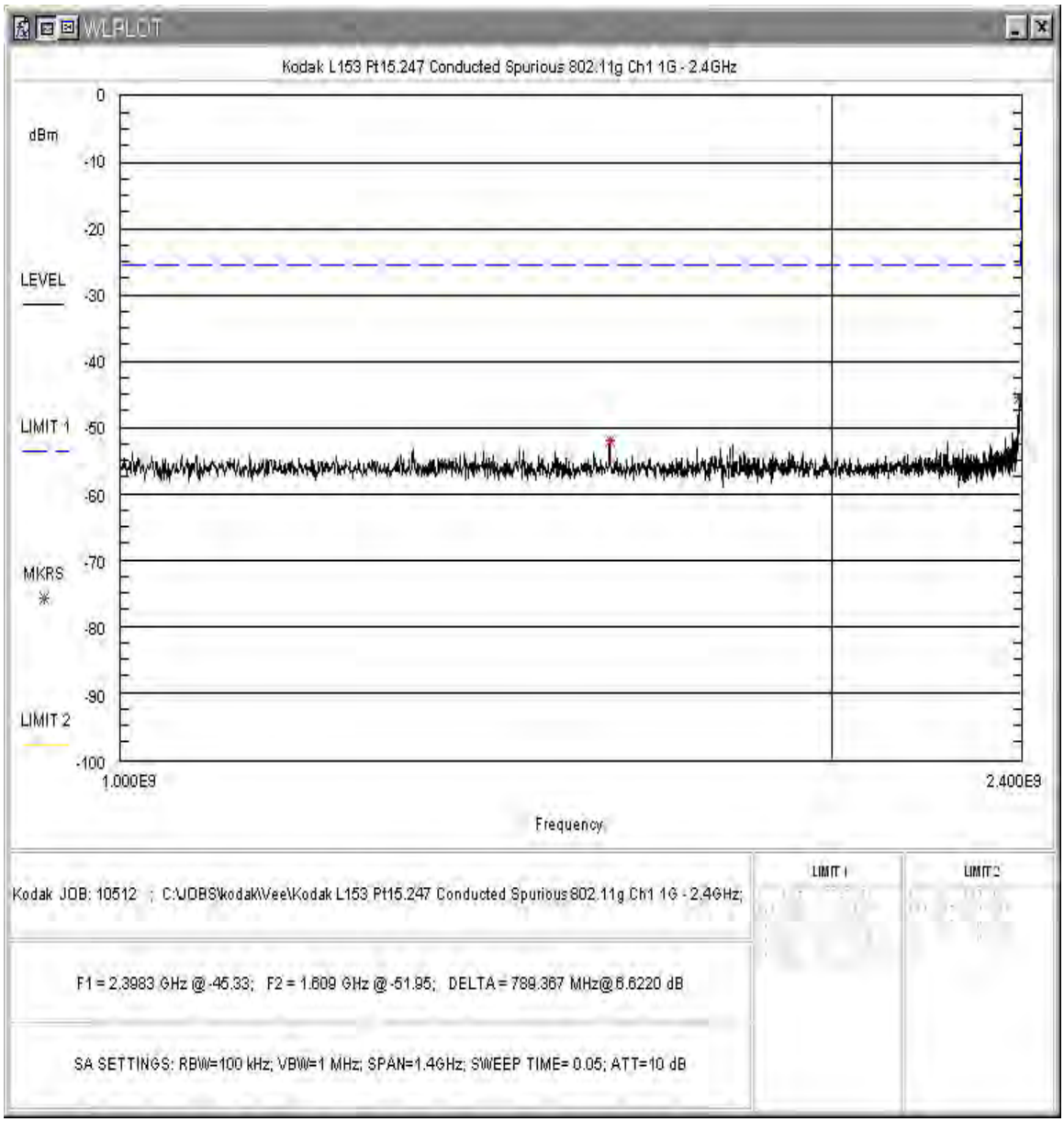

Figure 3- 38. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch1 1G - 2.4GHz

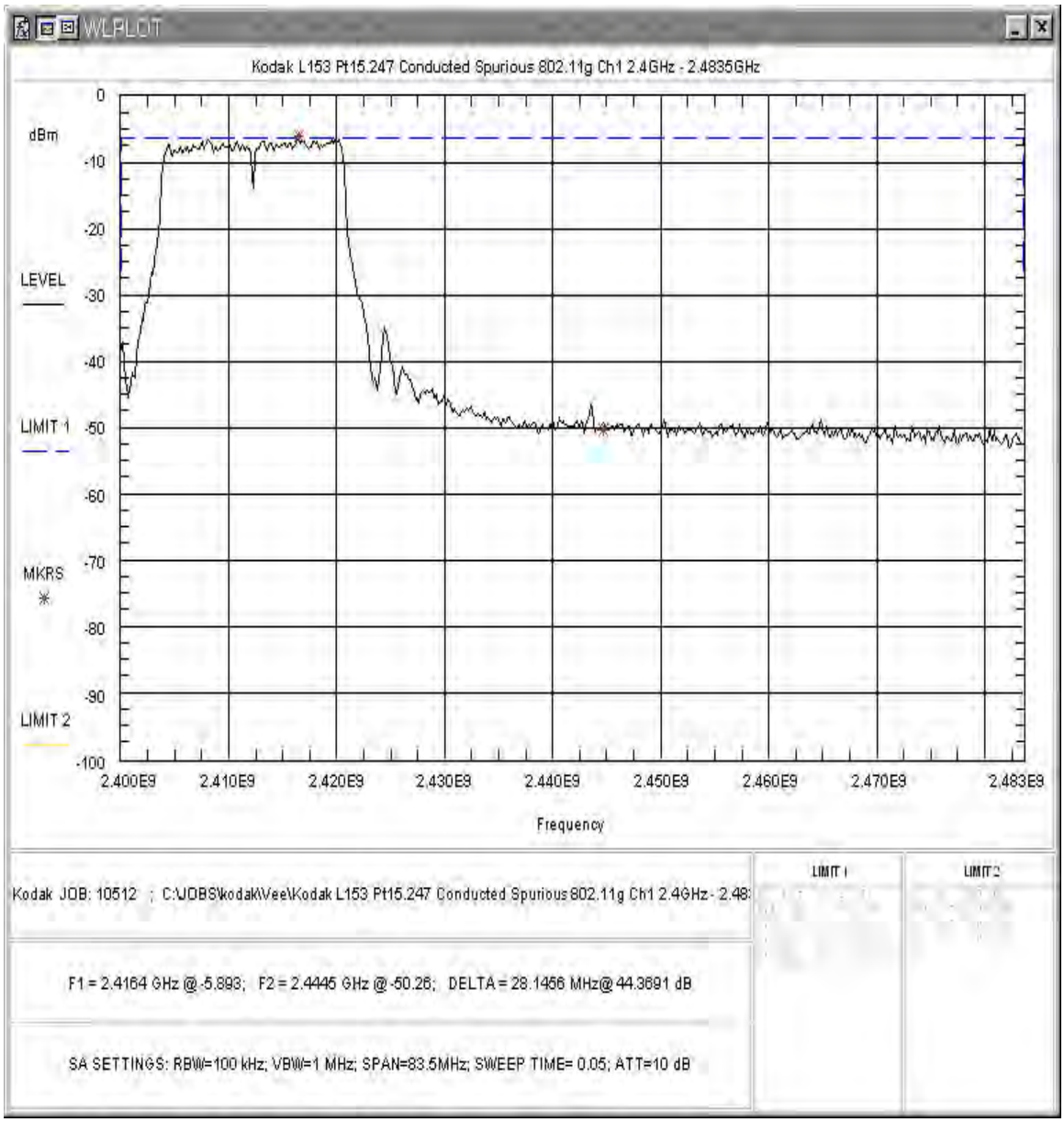

Figure 3- 39. Kodak L153 Pt15.247 Conducted Spurious In Band 802.11g Ch1 2.4GHz - 2.4835GHz

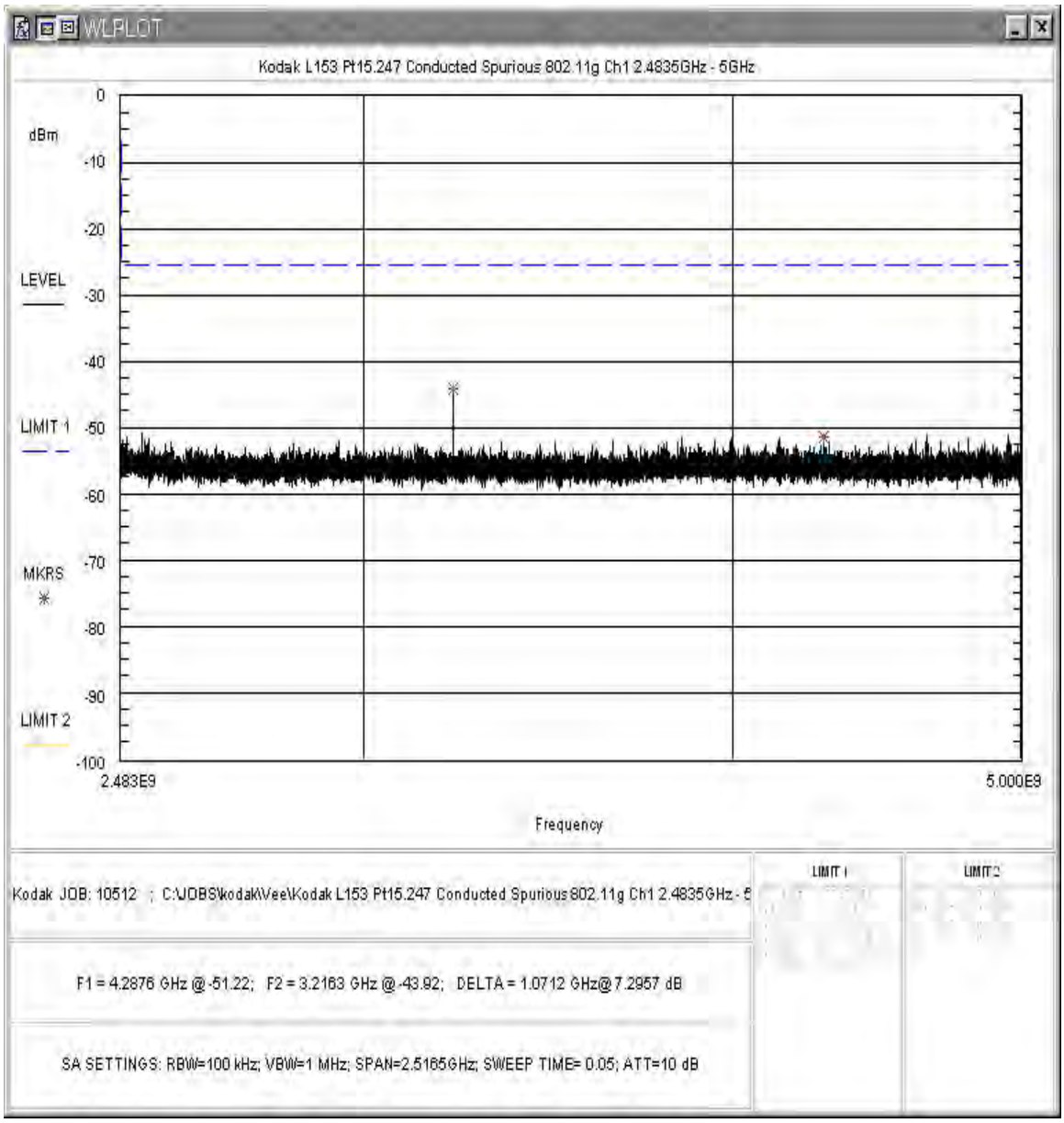

Figure 3- 40. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch1 2.4835GHz - 5GHz

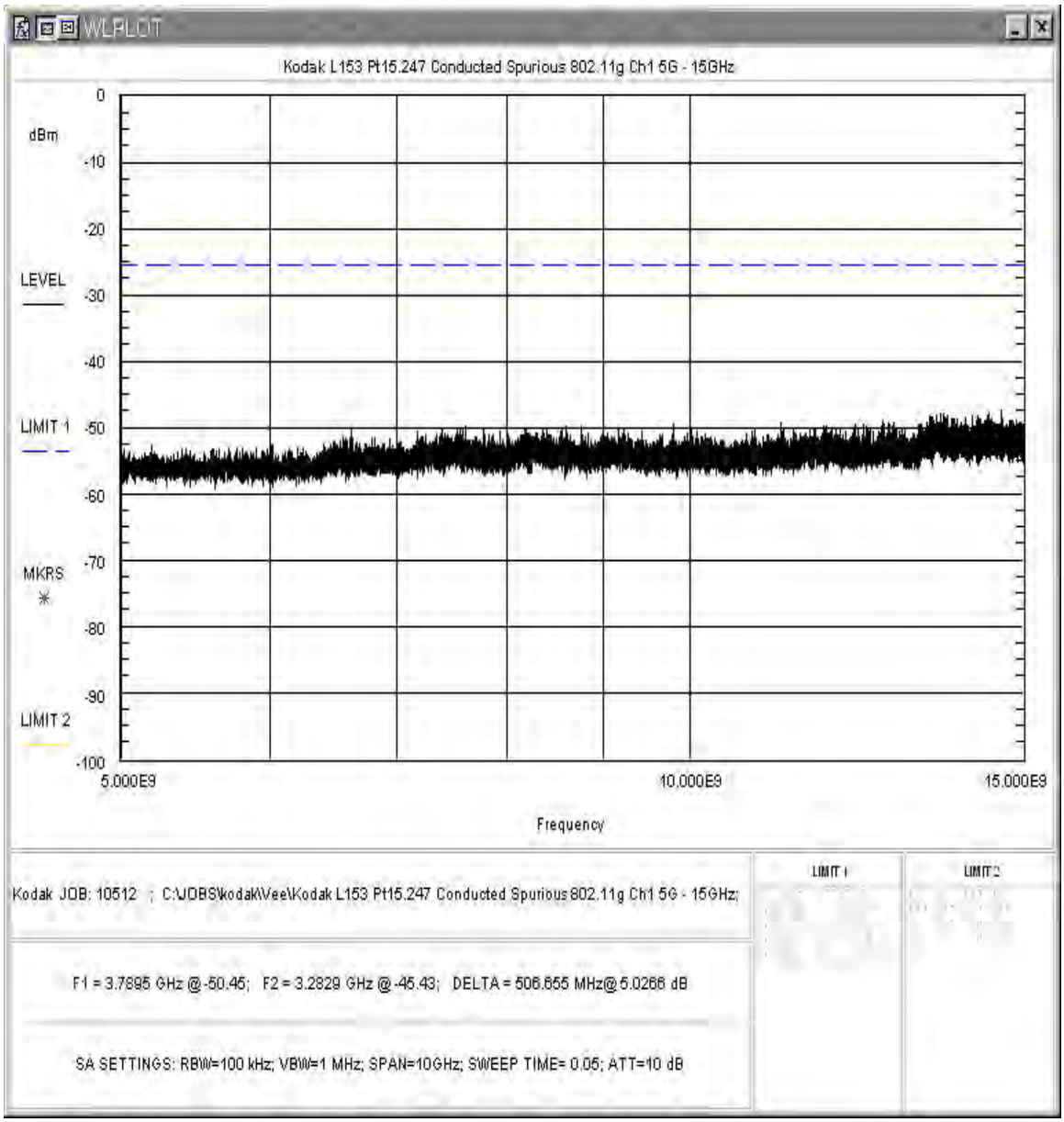

Figure 3- 41. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch1 5G - 15GHz

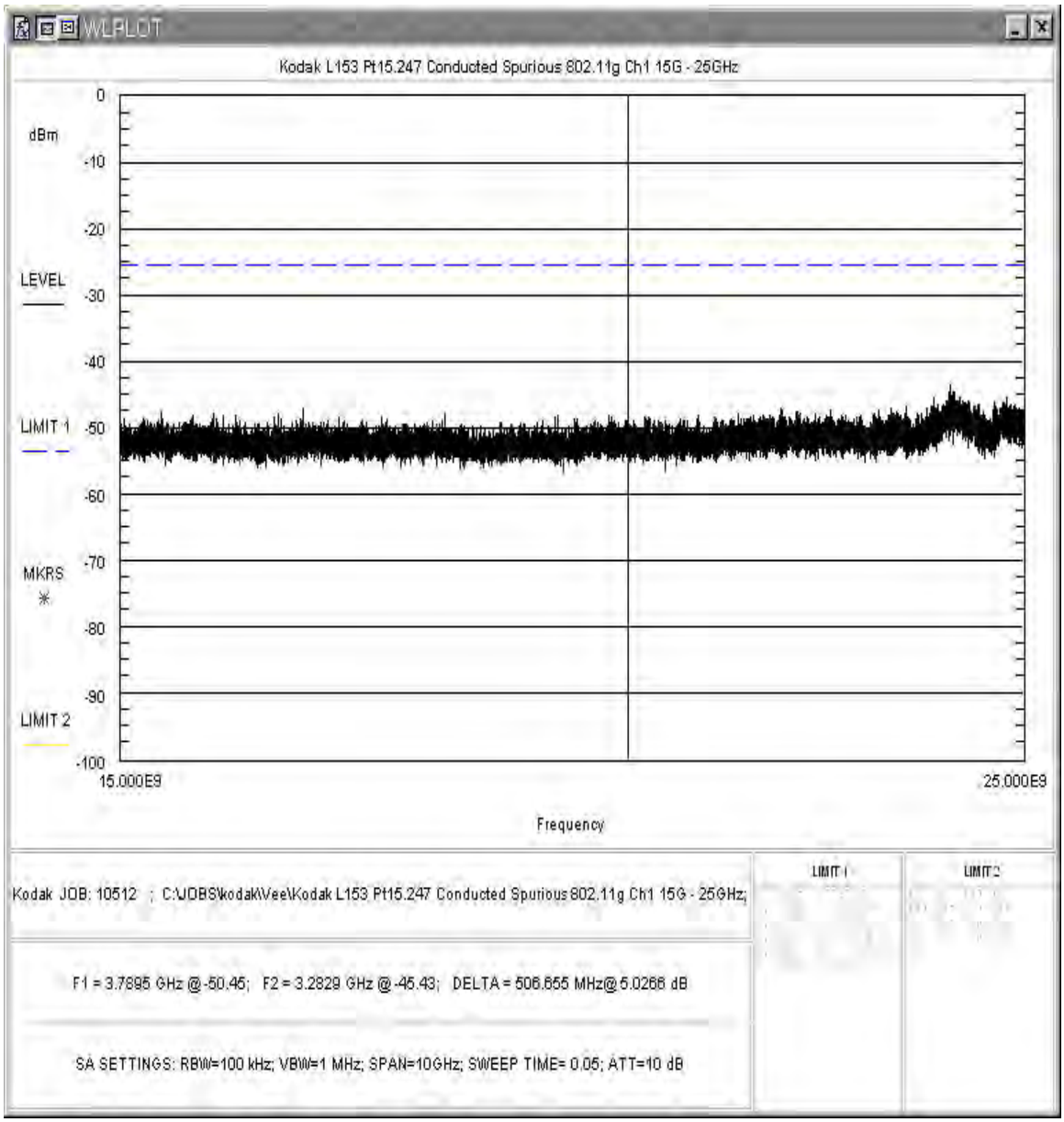

Figure 3- 42. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch1 15G - 25GHz

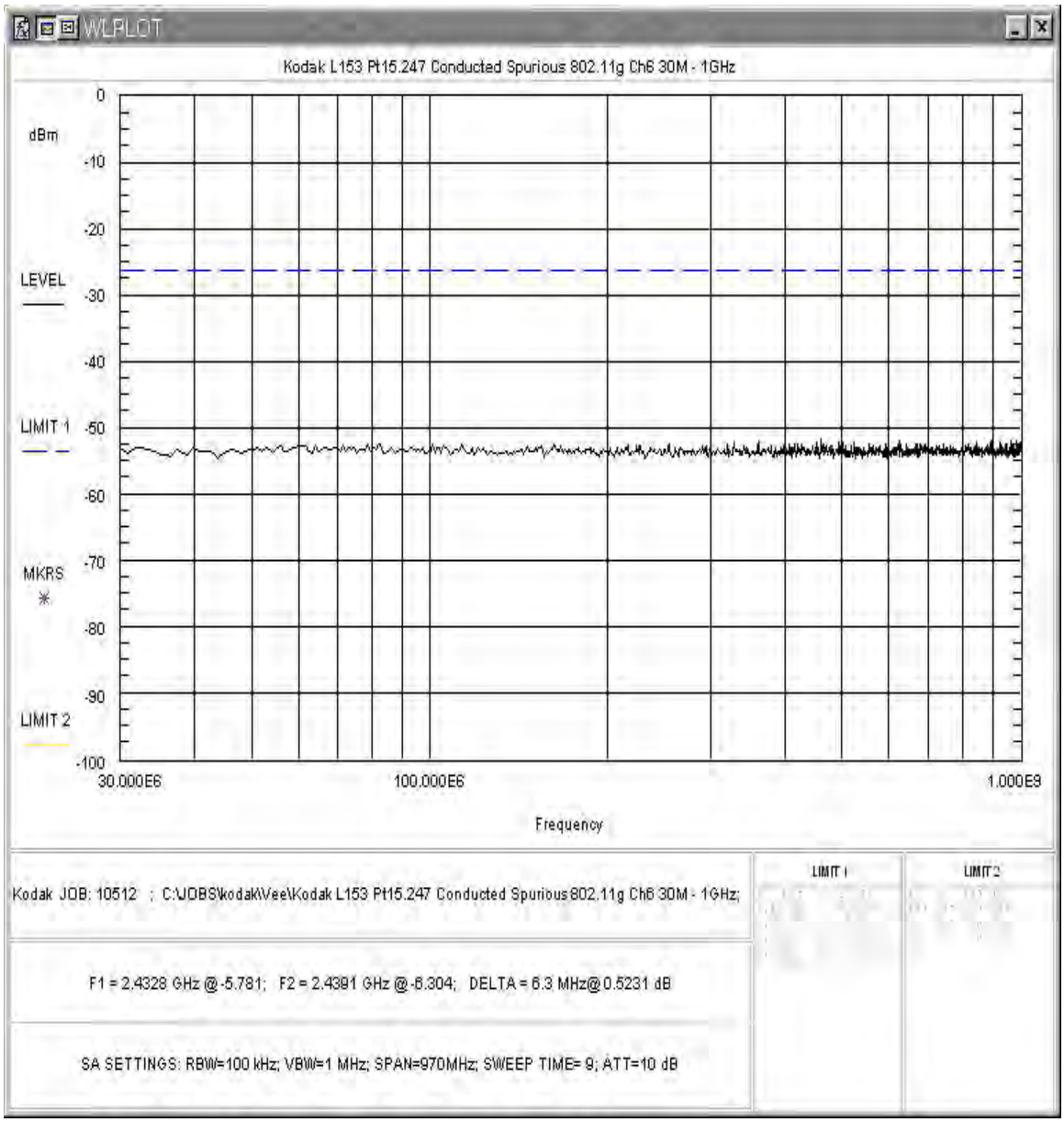

Figure 3- 43. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch6 30M - 1GHz

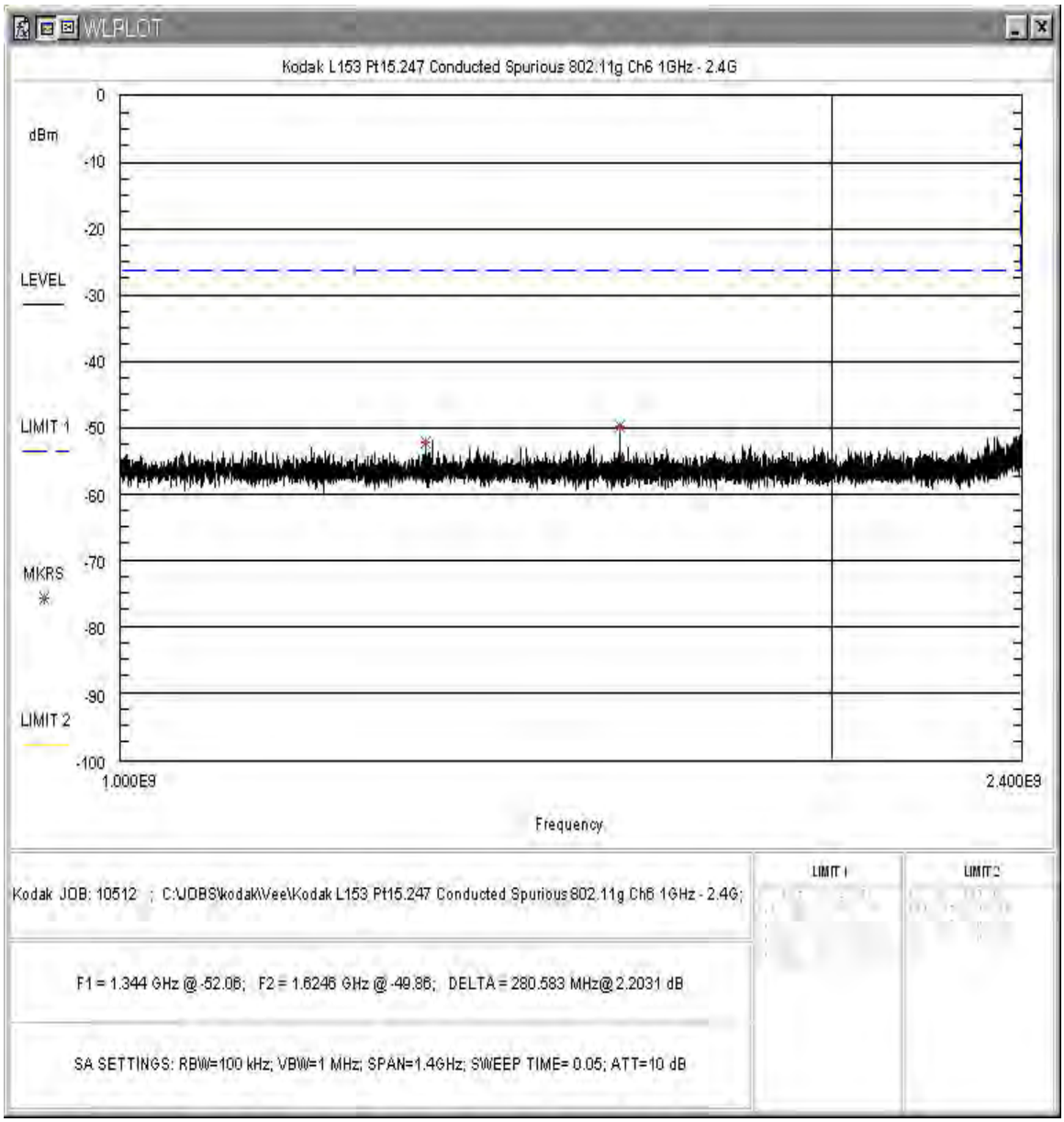

Figure 3- 44. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch6 1GHz - 2.4G

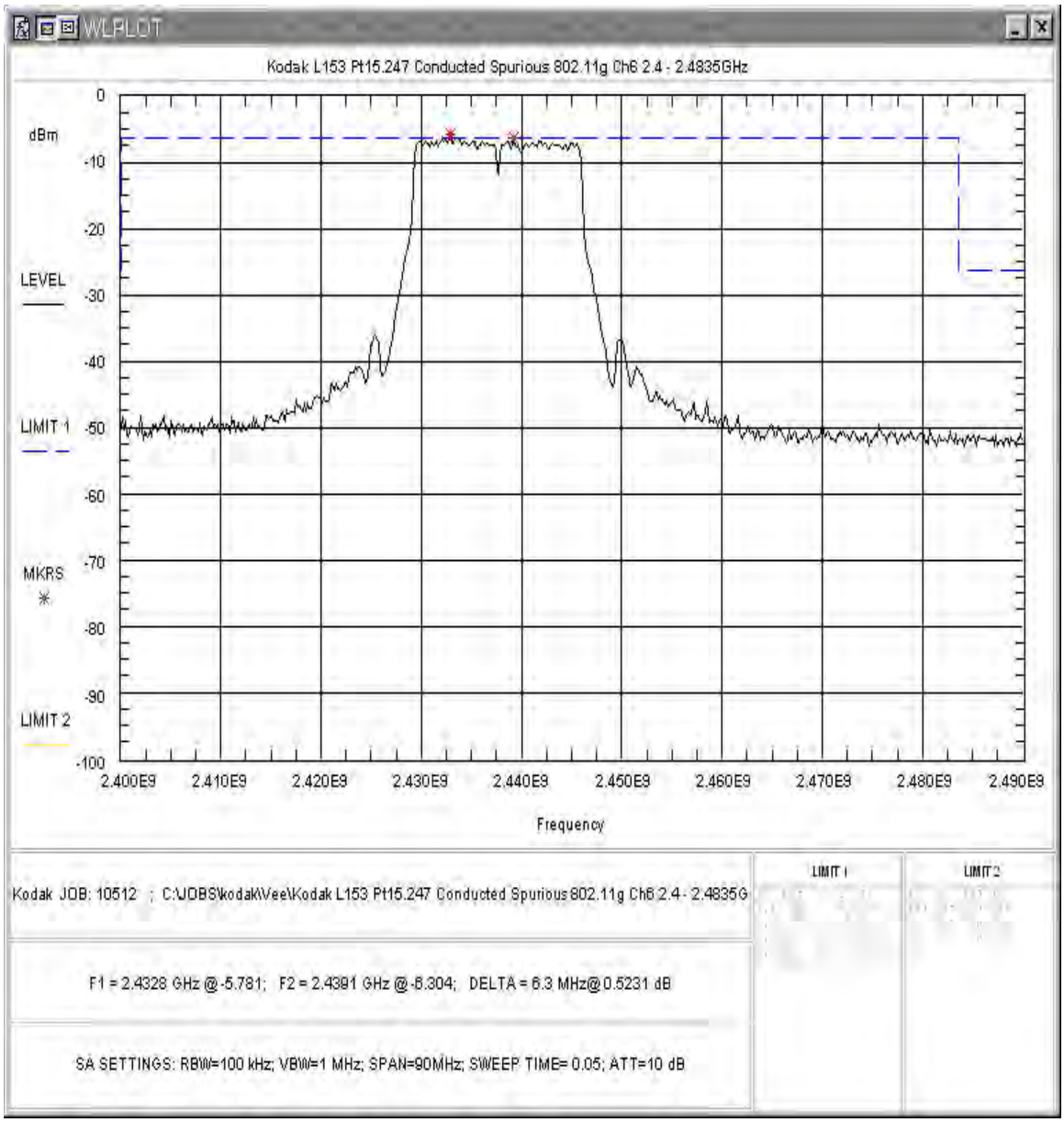

Figure 3- 45. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch6 2.4 - 2.4835GHz

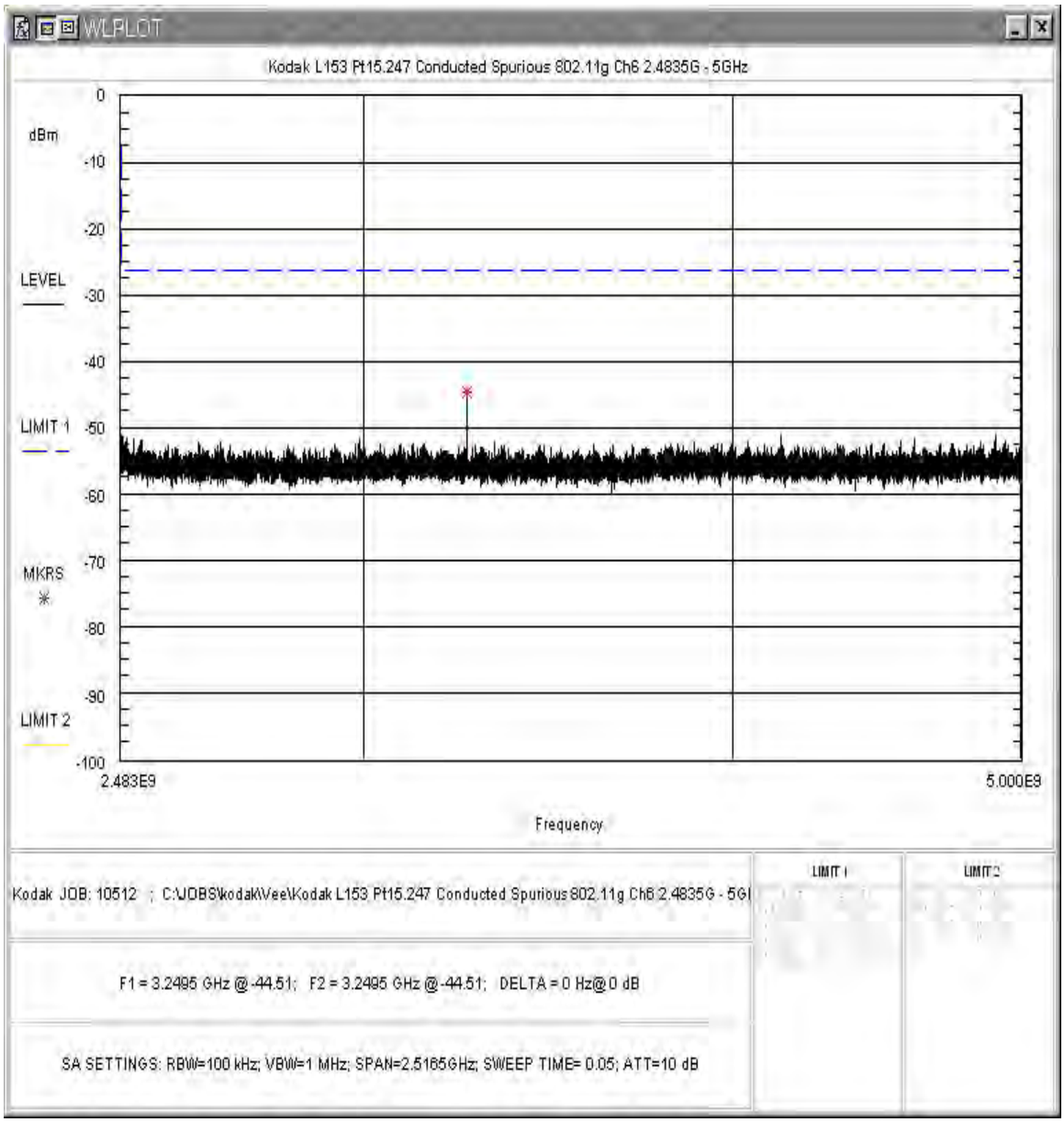

Figure 3- 46. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch6 2.4835G - 5GHz

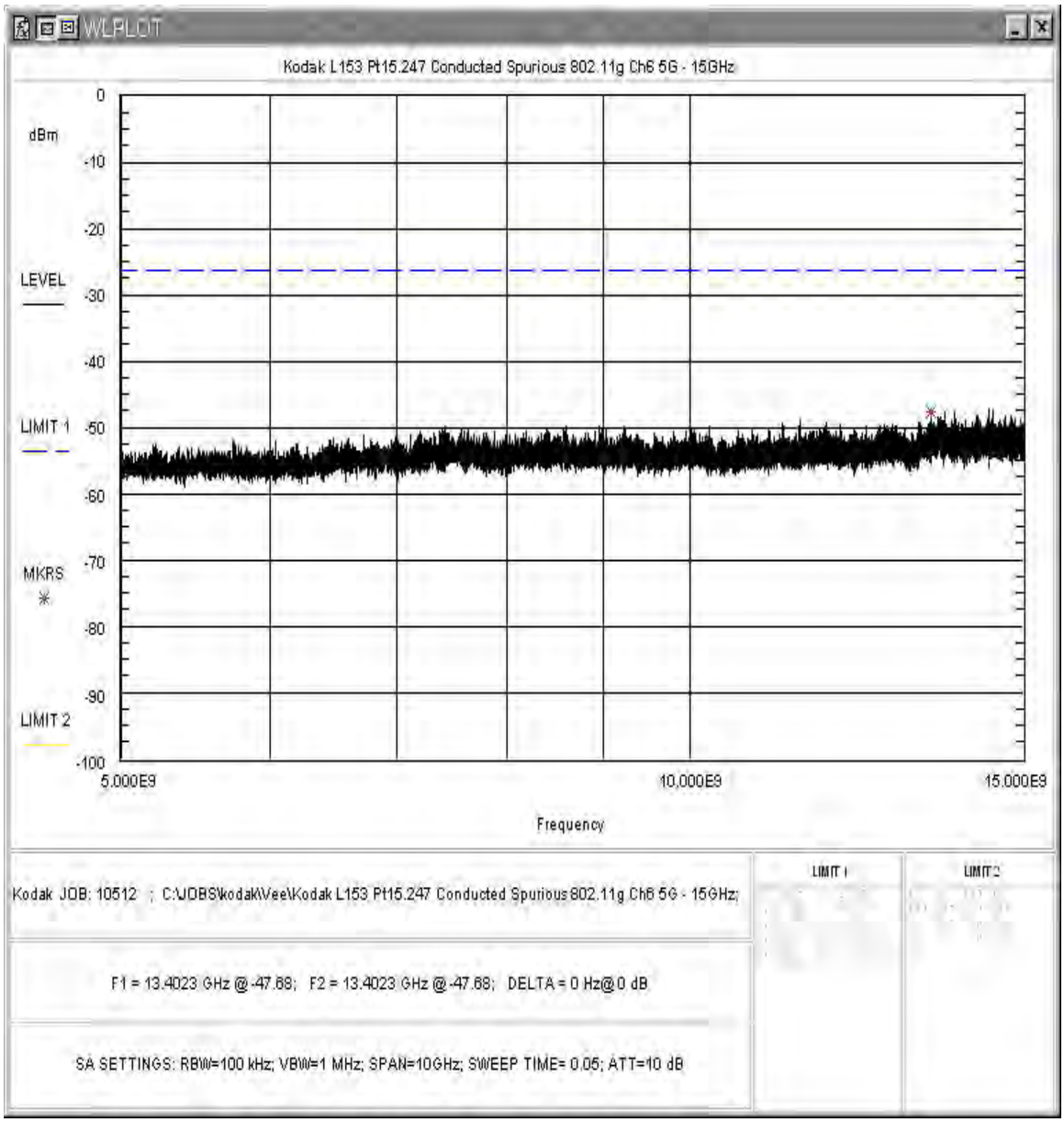

Figure 3- 47. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch6 5G - 15GHz

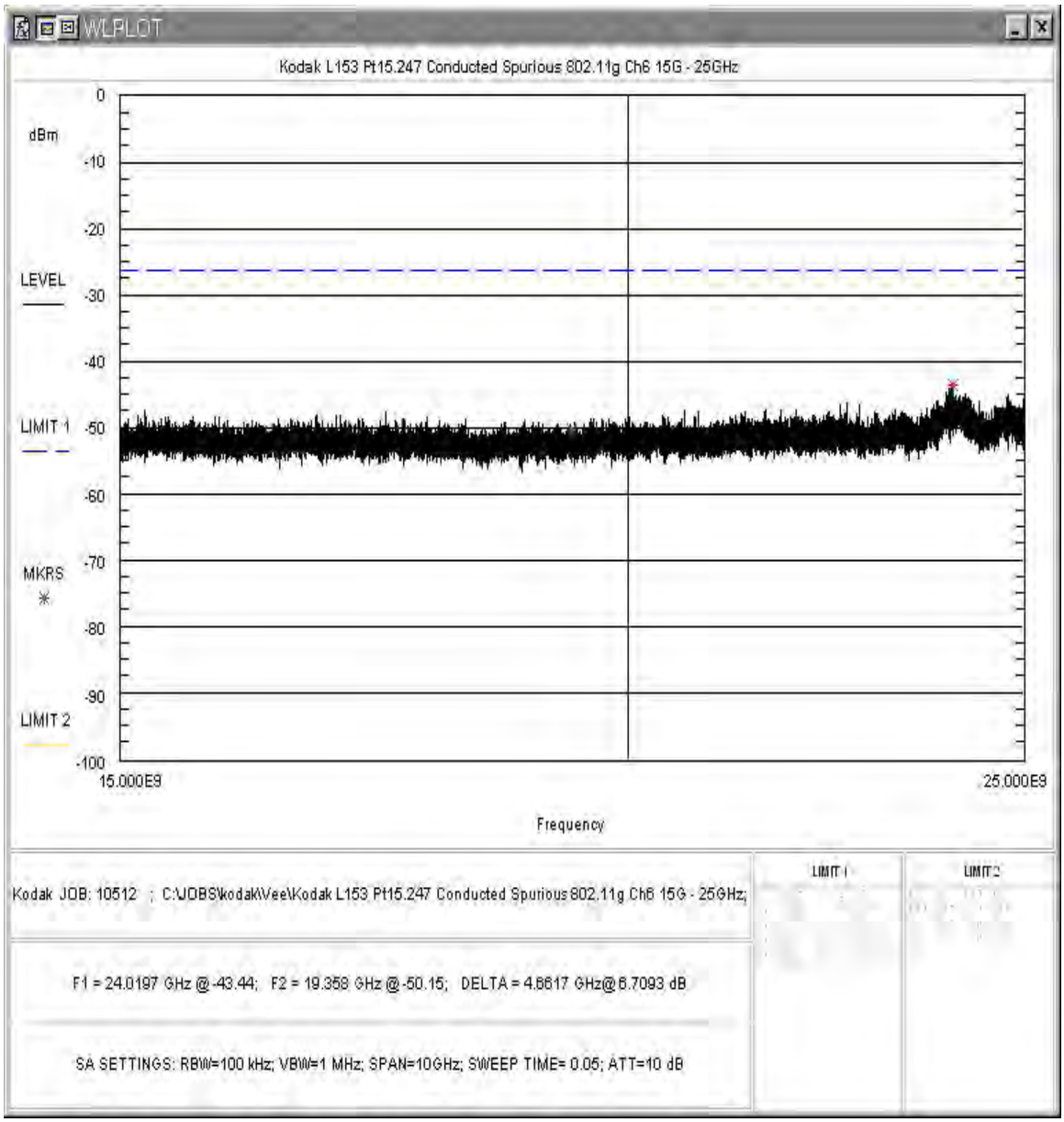

Figure 3- 48. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch6 15G - 25GHz

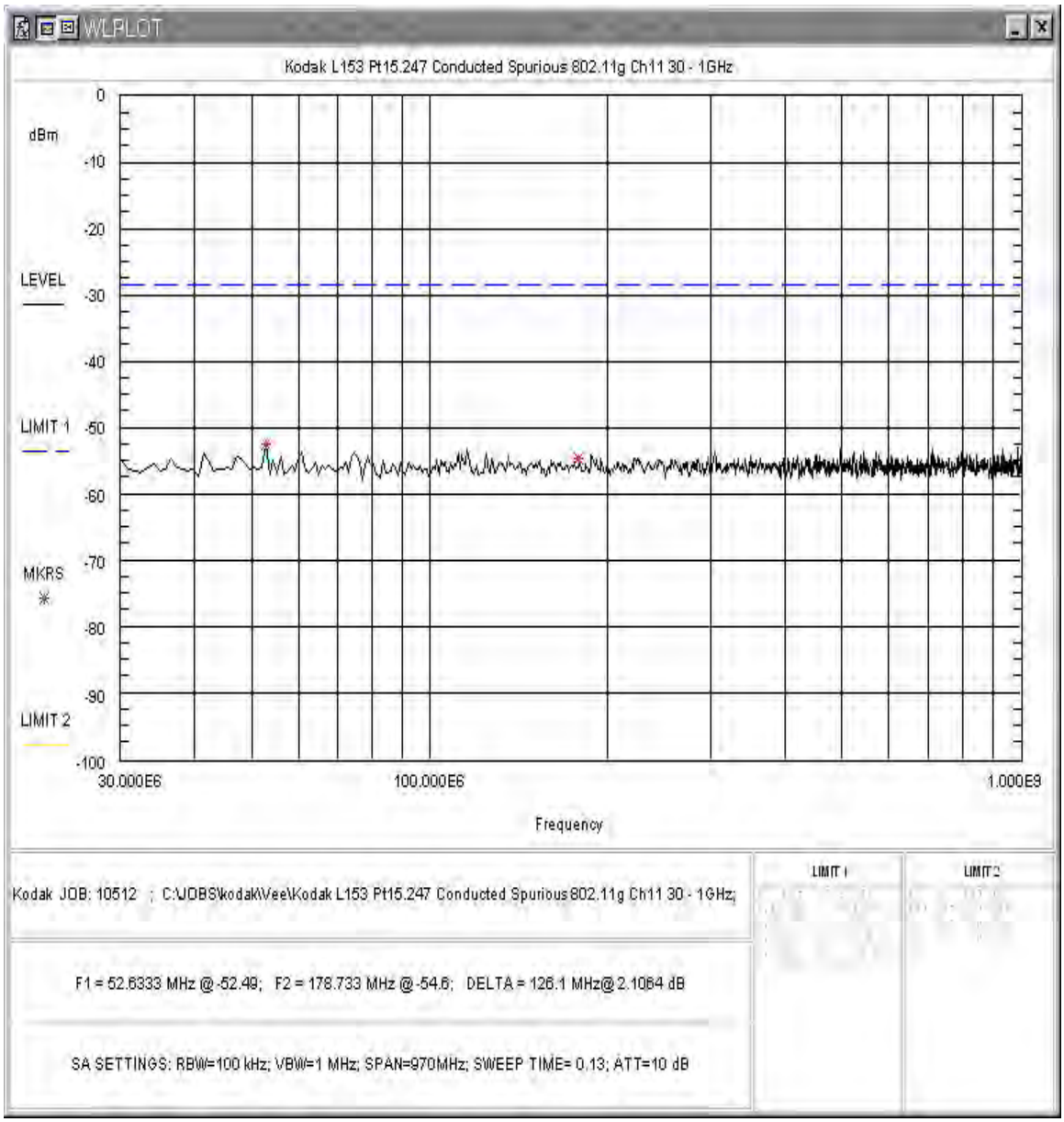

Figure 3- 49. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch11 30 - 1GHz

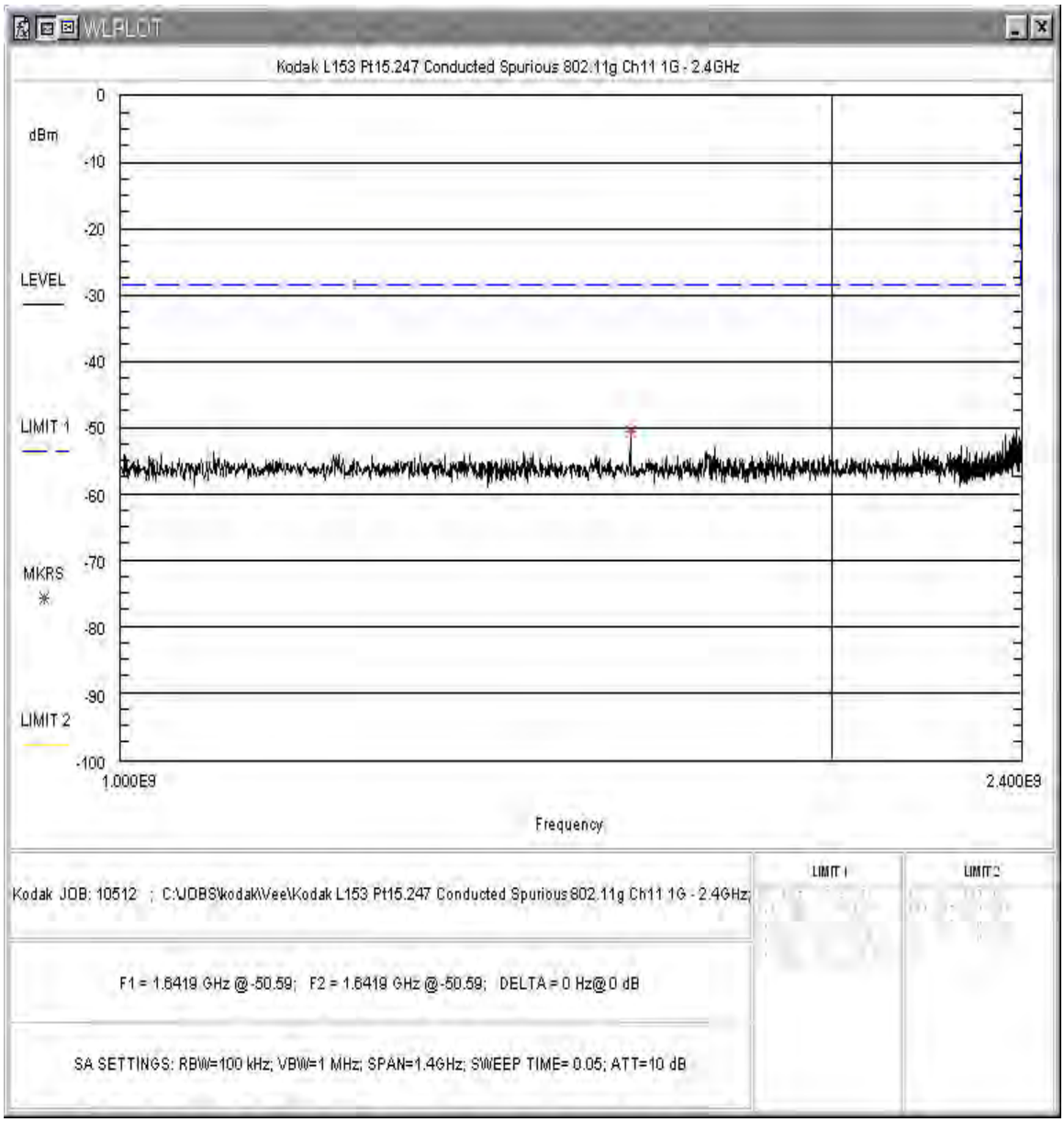

Figure 3- 50. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch11 1G - 2.4GHz

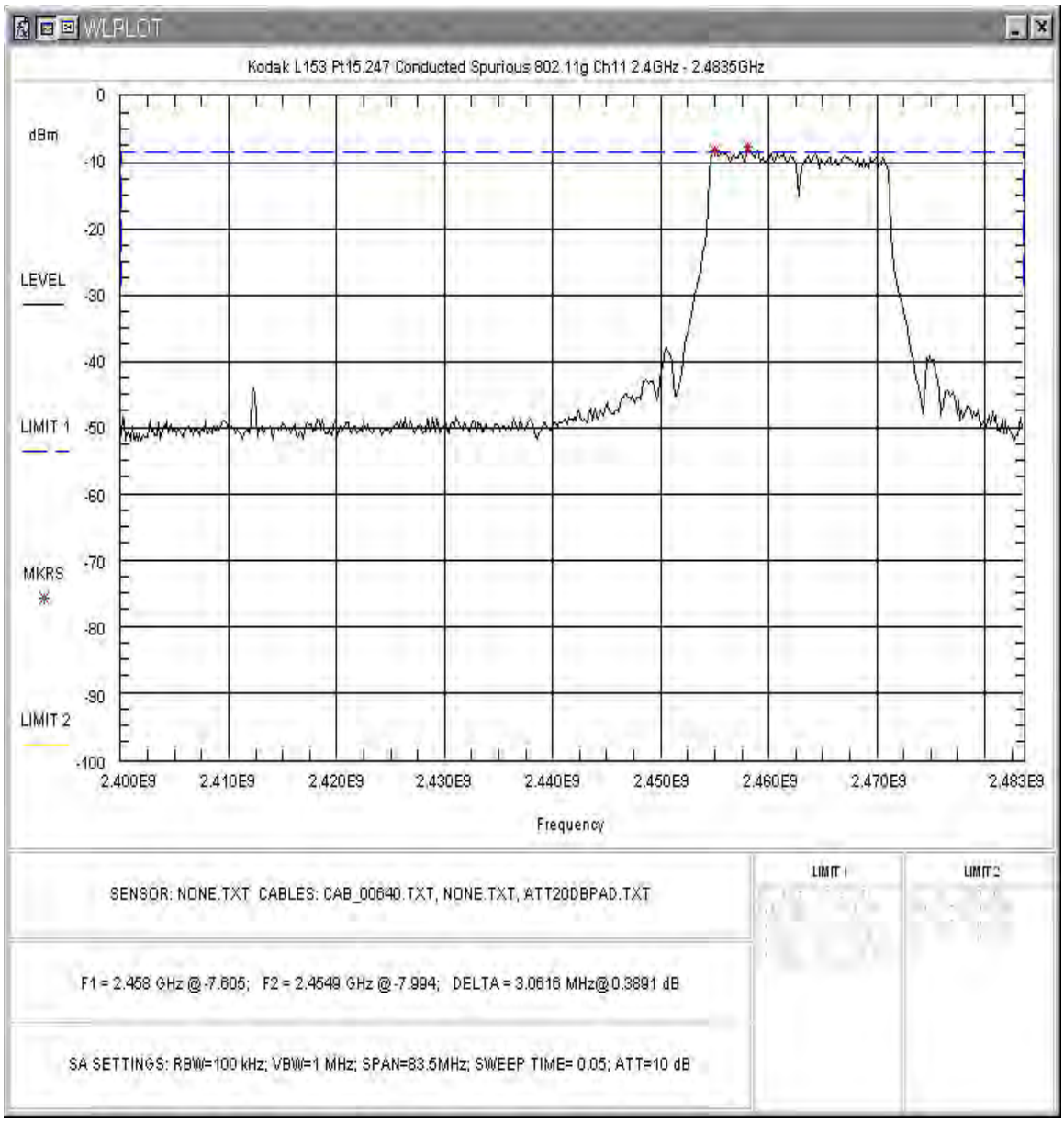

Figure 3- 51. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch11 2.4GHz - 2.4835GHz

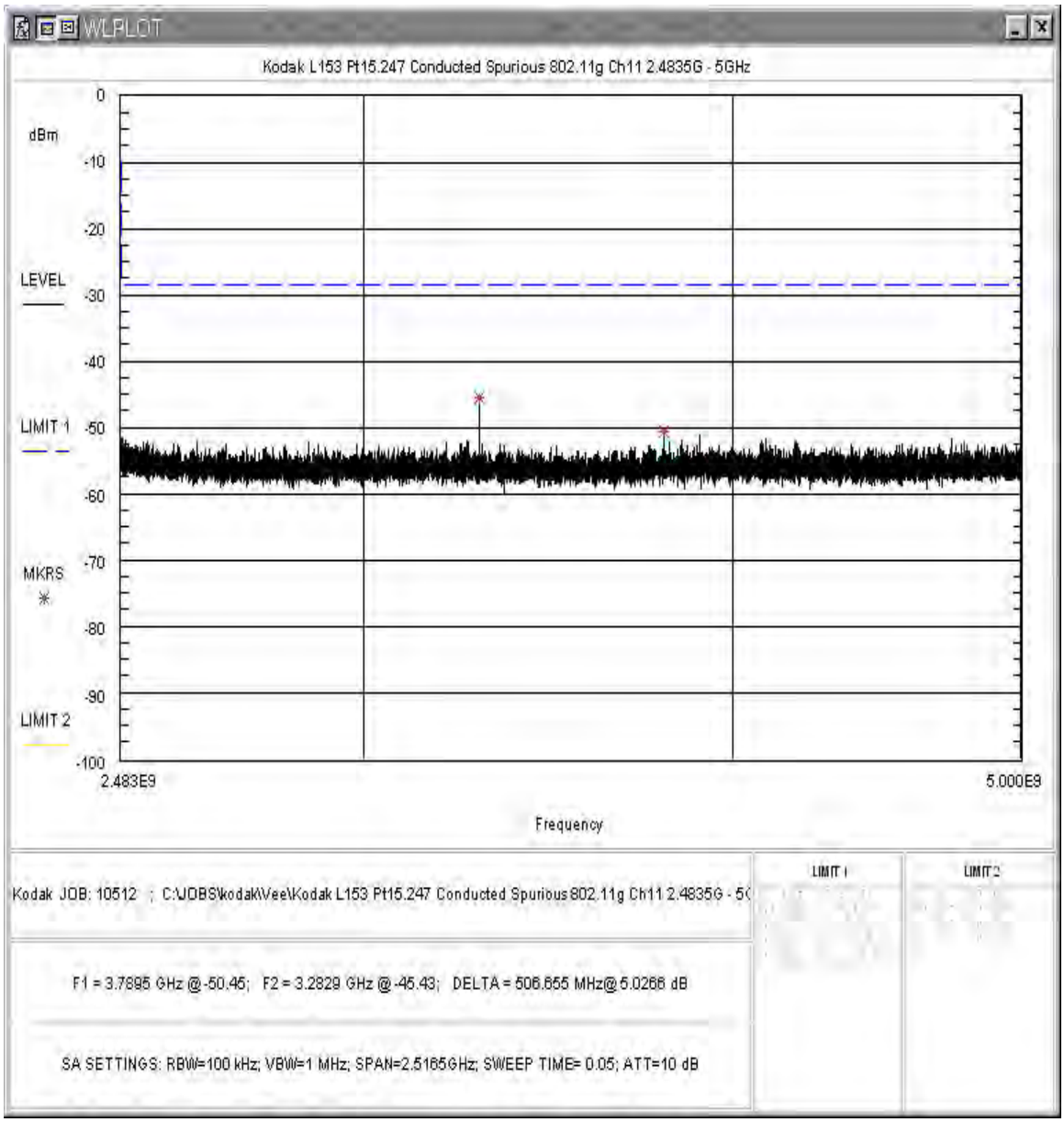

Figure 3- 52. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch11 2.4835G - 5GHz

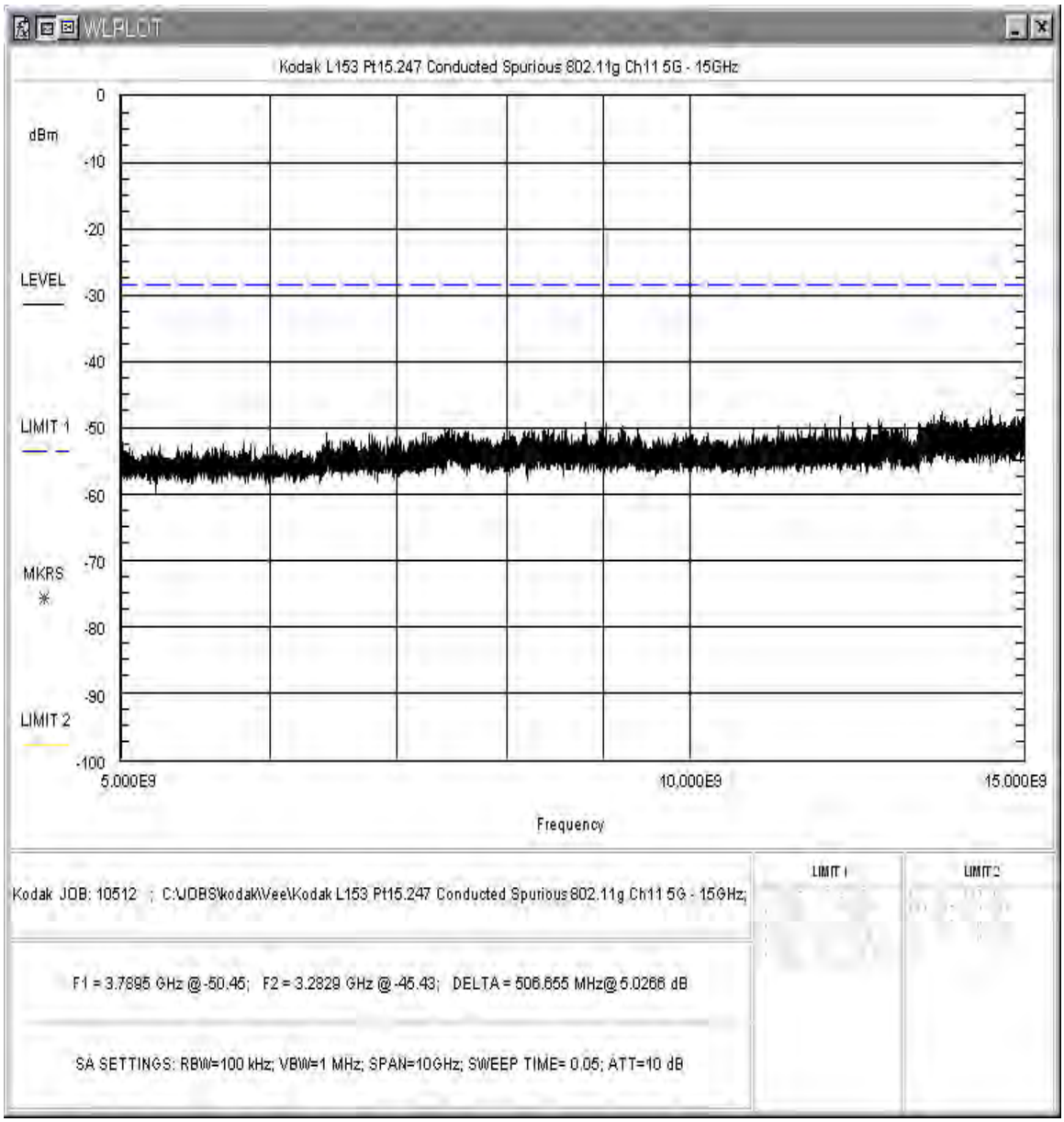

Figure 3- 53. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch11 5G - 15GHz

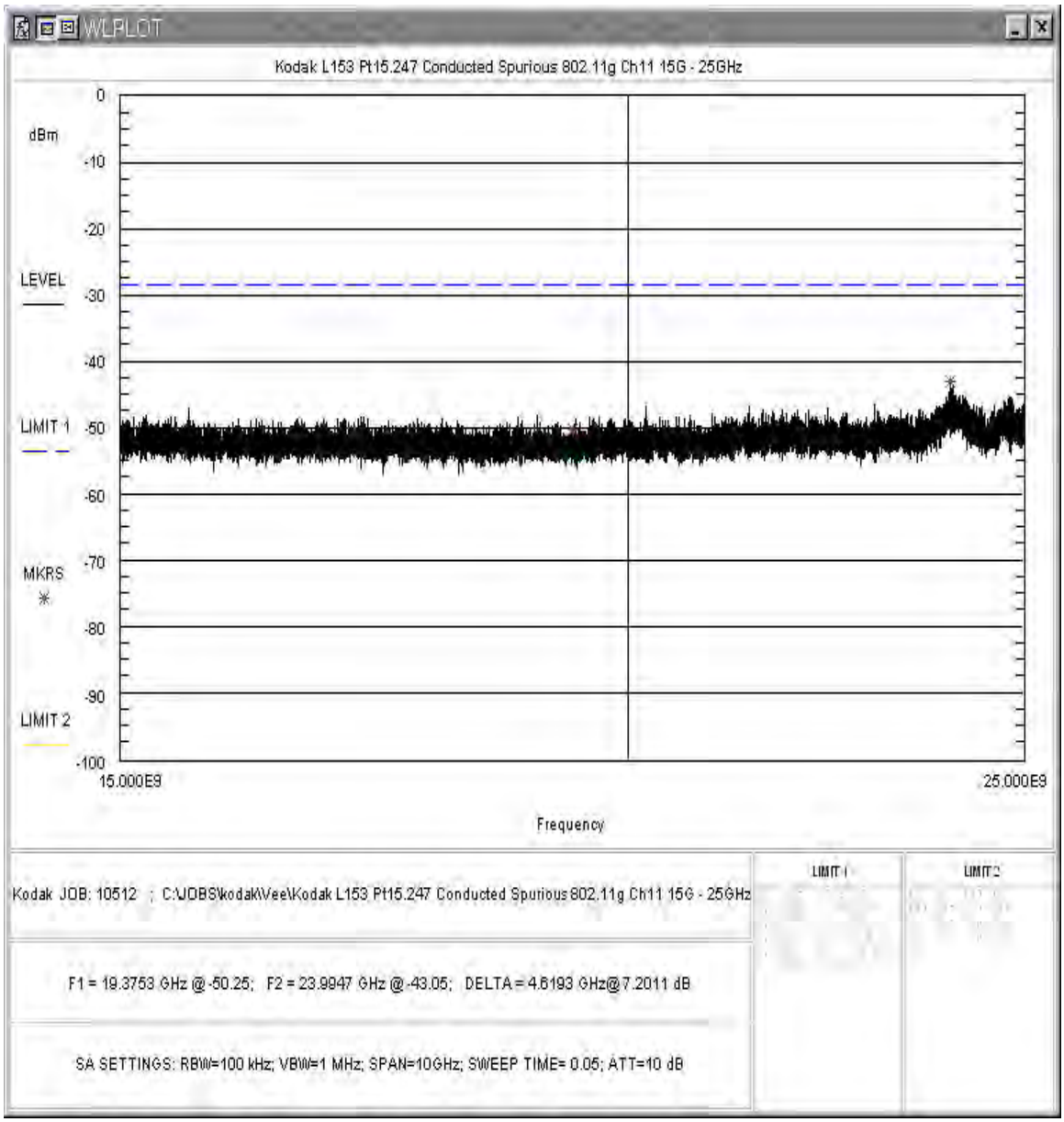

Figure 3- 54. Kodak L153 Pt15.247 Conducted Spurious 802.11g Ch11 15G - 25GHz

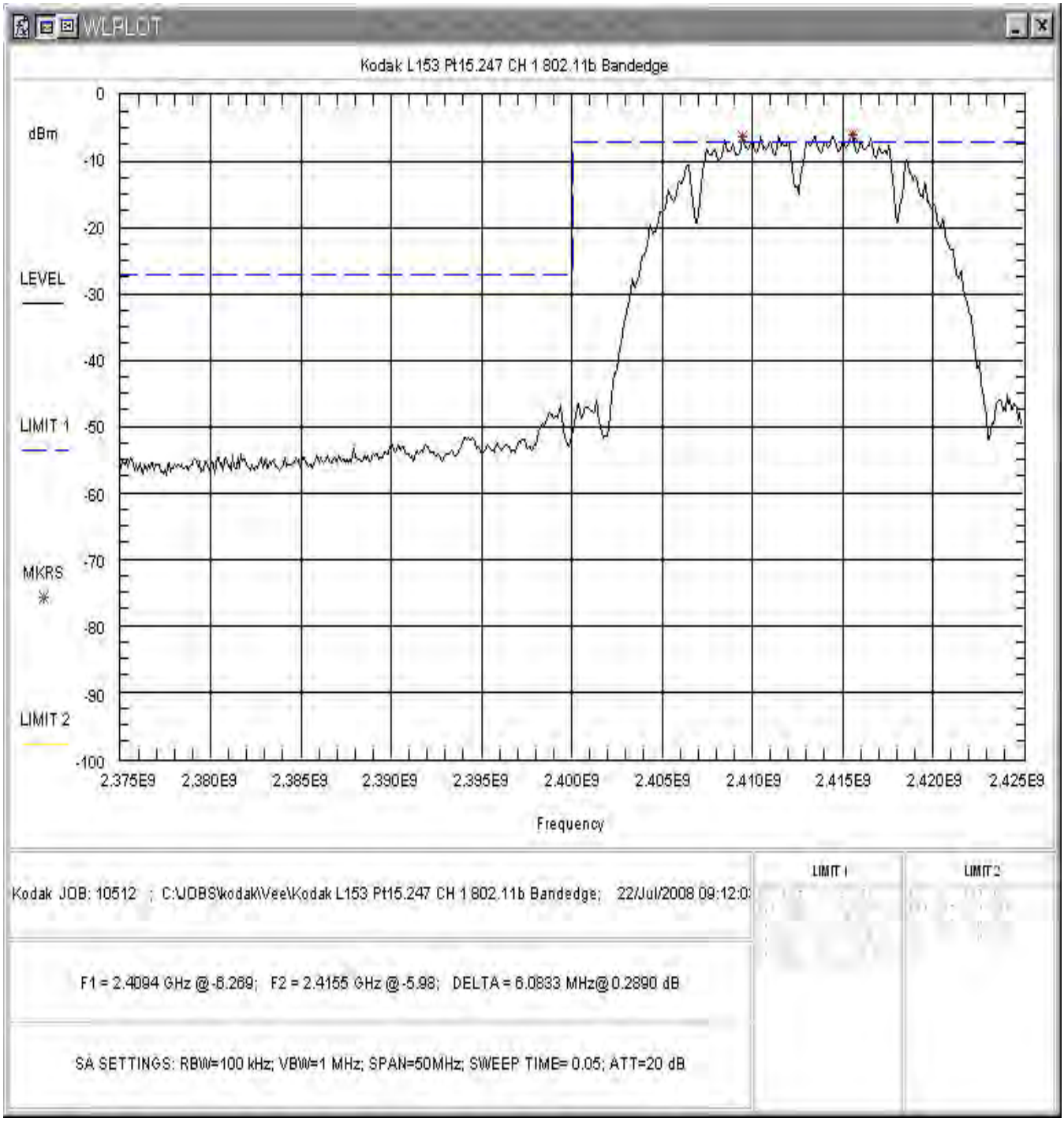

Figure 3-55: Band edge – 802.11b, 2.400GHz

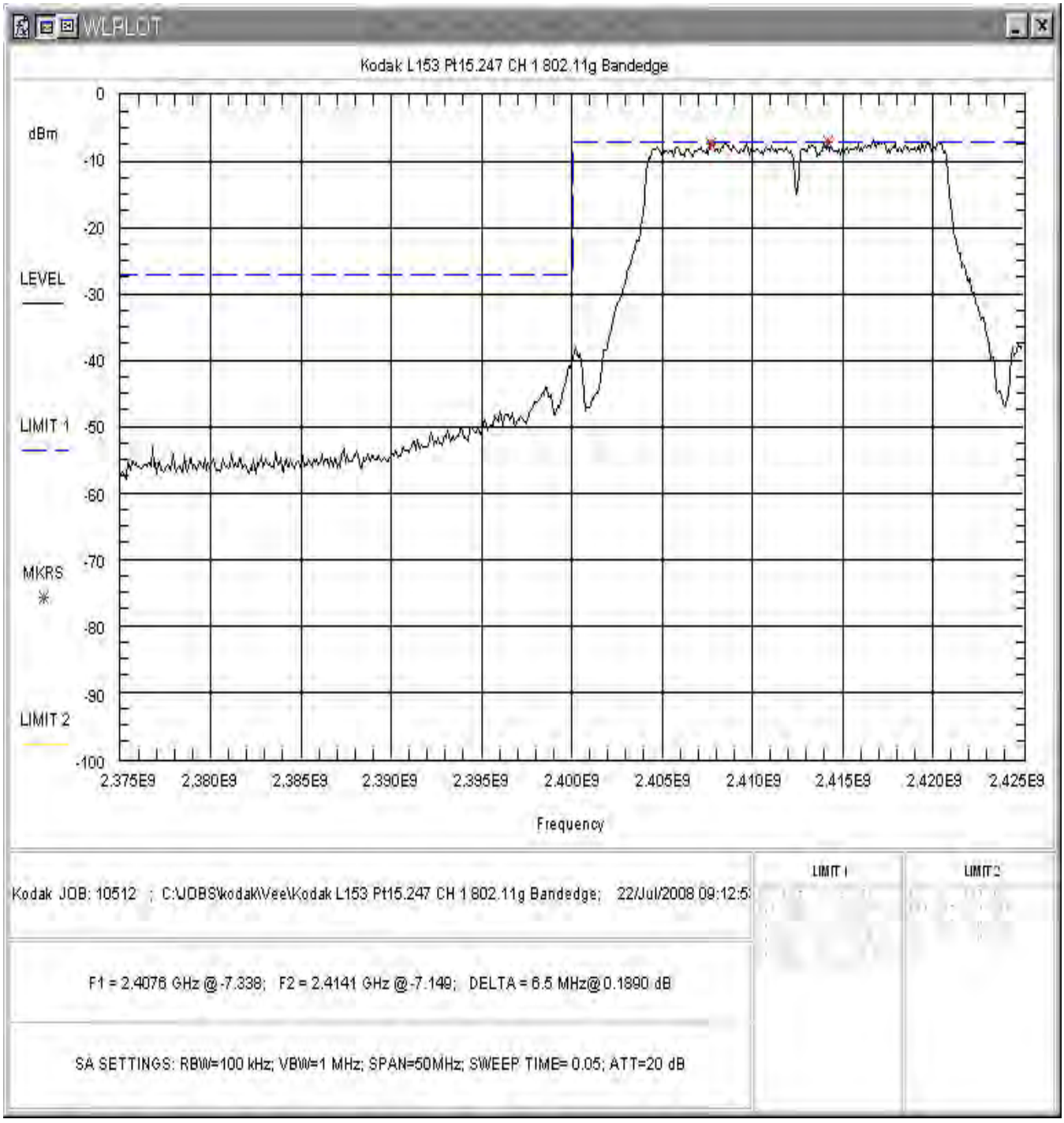

Figure 3-56: Band edge – 802.11g, 2.400GHz

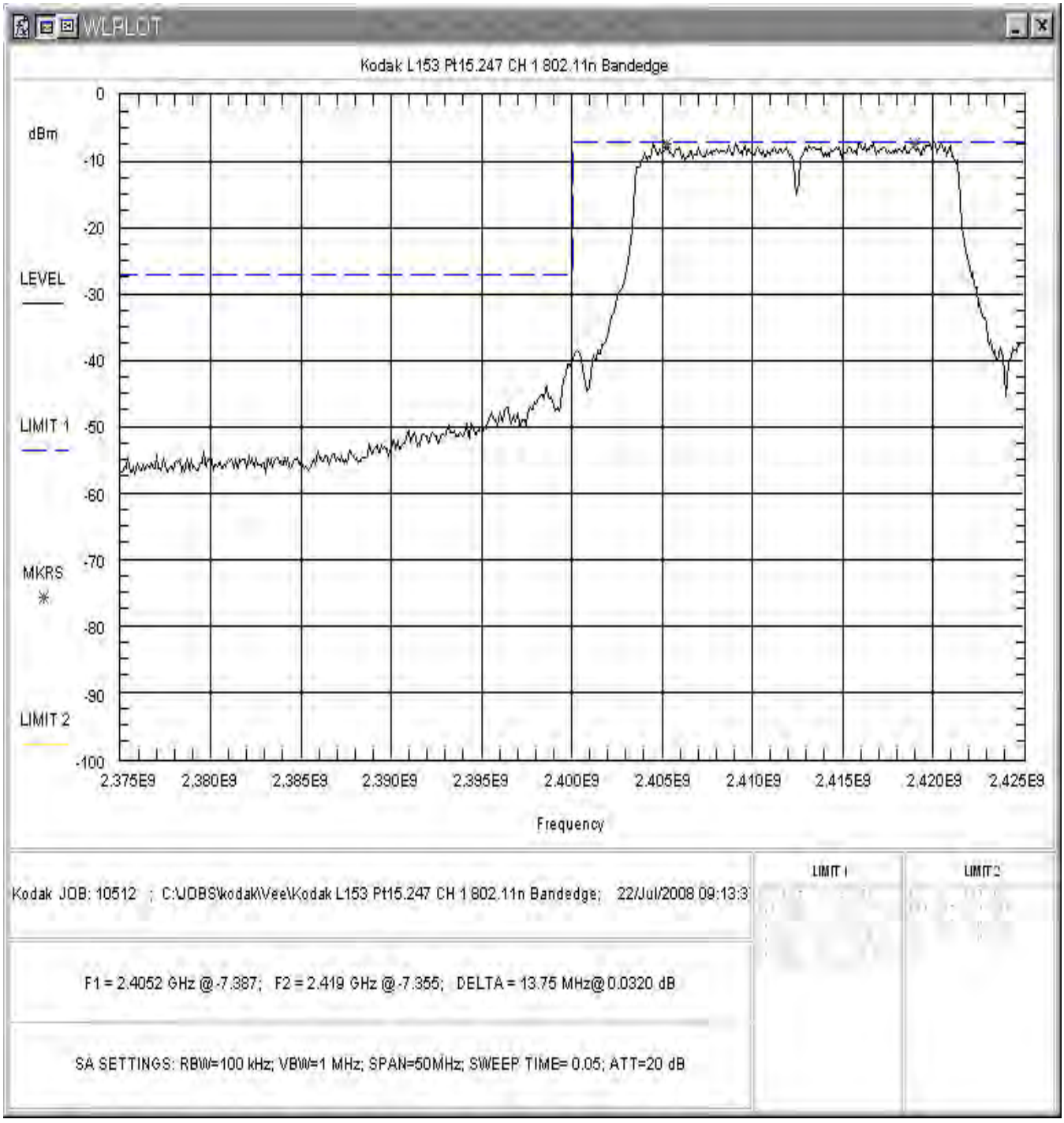

Figure 3-57: Band edge – 802.11n, 2.400GHz

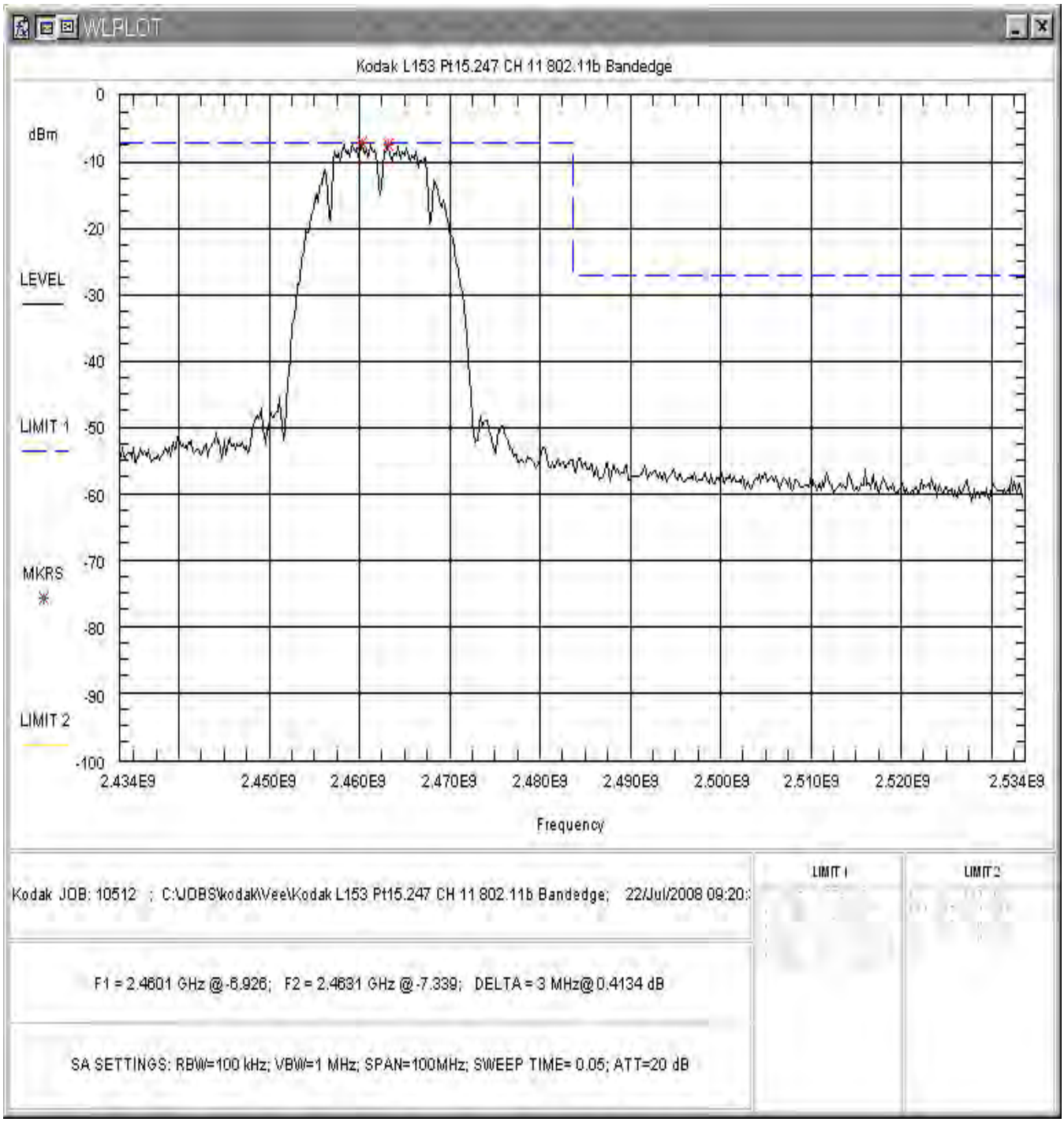

Figure 3-58: Band edge – 802.11b, 2.4835GHz

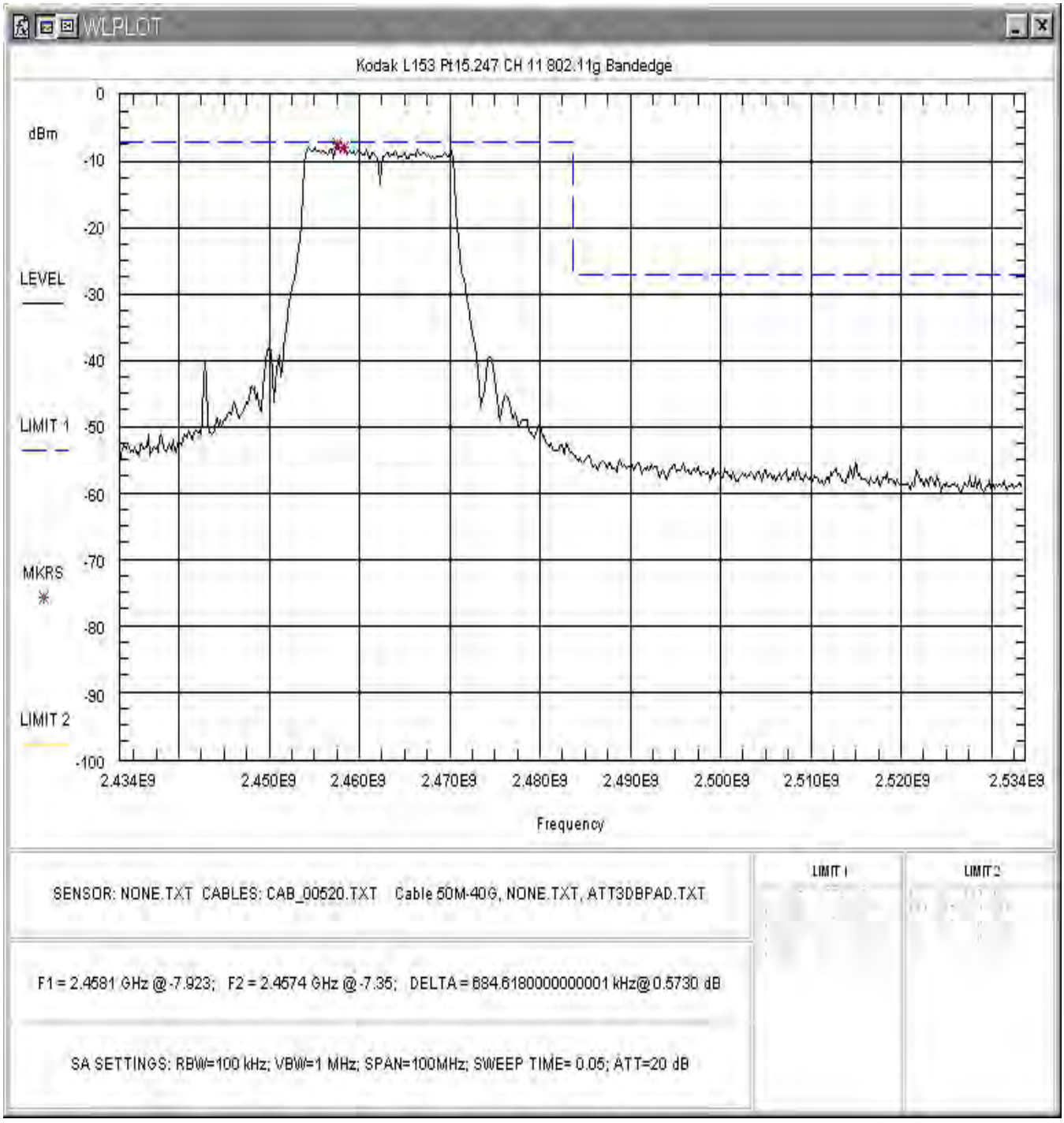

Figure 3-59: Band edge – 802.11g, 2.4835GHz

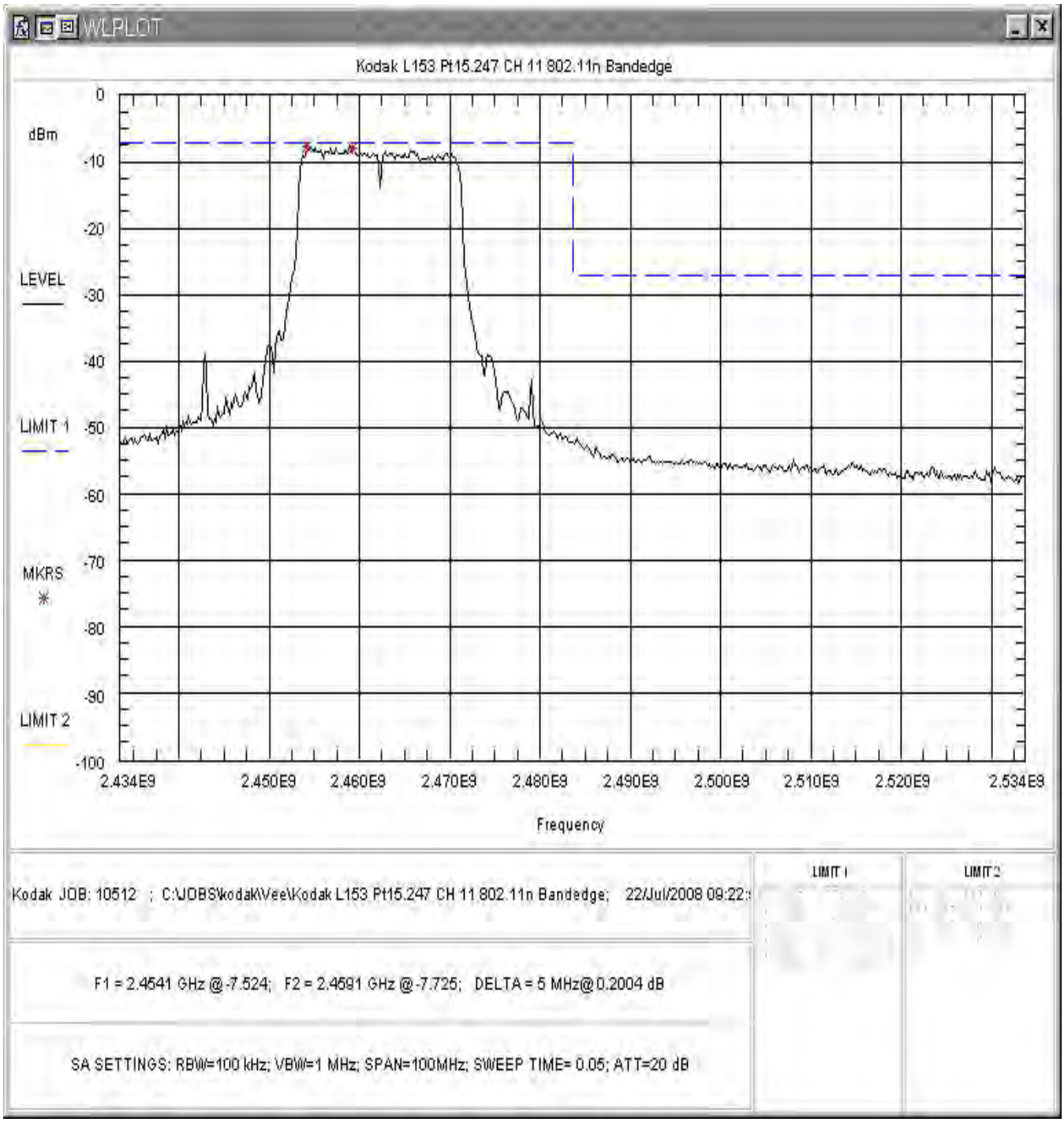

Figure 3-60: Band edge – 802.11n, 2.4835GHz

Radiated Spurious Emissions:

The EUT must comply with the requirements for radiated spurious emissions that fall within the restricted bands. These emissions must meet the limits specified in §15.209 and §15.35(b) for peak measurements.

3.1.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	1MHz
>1000 MHz	1 MHz	10Hz (Ave) 1MHz (Peak)

There were no transmitter related emissions below 1GHz observed.

Table 14: Radiated Emission Test Data (>1GHz) Harmonics

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Duty Cycle Corr	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)	Notes
802.11 B													
2412.00													
4824.00	H	180.0	3.4	41.0	32.5	5.0	35.7	0.0	42.9	138.9	5000.0	-31.1	Peak
4824.00	H	180.0	3.4	29.1	32.5	5.0	35.7	0.0	31.0	35.3	500.0	-23.0	Avg
7236.00	H	270.0	3.4	41.5	37.1	6.5	35.6	0.0	49.5	297.4	5000.0	-24.5	Peak
7236.00	H	270.0	3.4	28.7	37.1	6.5	35.6	0.0	36.7	68.5	500.0	-17.3	Avg
4824.00	V	270.0	3.2	44.2	32.5	5.0	35.7	0.0	46.1	200.8	5000.0	-27.9	Peak
4824.00	V	270.0	3.2	36.6	32.5	5.0	35.7	0.0	38.5	83.7	500.0	-15.5	Avg
7236.00	V	270.0	3.2	38.2	37.1	6.5	35.6	0.0	46.2	204.4	5000.0	-27.8	Peak
7236.00	V	270.0	3.2	28.8	37.1	6.5	35.6	0.0	36.8	69.2	500.0	-17.2	Avg
2437.00													
4874.00	V	270.0	3.3	43.3	32.6	5.1	35.7	0.0	45.2	182.5	5000.0	-28.8	Peak
4874.00	V	270.0	3.3	37.1	32.6	5.1	35.7	0.0	39.0	89.4	500.0	-15.0	Avg
7311.00	V	270.0	3.3	40.2	37.1	6.4	35.6	0.0	48.1	255.5	5000.0	-25.8	Peak
7311.00	V	270.0	3.3	28.0	37.1	6.4	35.6	0.0	36.0	62.9	500.0	-18.0	Avg
4874.00	H	90.0	2.4	43.0	32.6	5.1	35.7	0.0	44.9	176.3	5000.0	-29.1	Peak

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Duty Cycle Corr	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)	Notes
4874.00	H	90.0	2.4	36.8	32.6	5.1	35.7	0.0	38.7	86.4	500.0	-15.3	Avg
7311.00	H	90.0	2.4	37.0	37.1	6.4	35.6	0.0	44.9	176.8	5000.0	-29.0	Peak
7311.00	H	90.0	2.4	28.0	37.1	6.4	35.6	0.0	35.9	62.7	500.0	-18.0	Avg
2462.00													
4924.00	V	0.0	3.1	41.7	32.7	5.1	35.8	0.0	43.7	153.0	5000.0	-30.3	Peak
4924.00	V	0.0	3.1	31.3	32.7	5.1	35.8	0.0	33.3	46.2	500.0	-20.7	Avg
7386.00	V	0.0	3.1	36.8	37.1	6.4	35.6	0.0	44.7	171.6	5000.0	-29.3	Peak
7386.00	V	0.0	3.1	28.5	37.1	6.4	35.6	0.0	36.4	66.0	500.0	-17.6	Avg
4924.00	H	90.0	2.3	44.4	32.7	5.1	35.8	0.0	46.4	208.8	5000.0	-27.6	Peak
4924.00	H	90.0	2.3	38.9	32.7	5.1	35.8	0.0	40.9	110.9	500.0	-13.1	Avg
7386.00	H	90.0	2.3	36.4	37.1	6.4	35.6	0.0	44.3	163.8	5000.0	-29.7	Peak
7386.00	H	90.0	2.3	27.8	37.1	6.4	35.6	0.0	35.7	60.9	500.0	-18.3	Avg
802.11g													
2412.00													
4824.00	V	0.0	3.0	42.4	32.5	5.0	35.7	0.0	44.3	163.2	5000.0	-29.7	Peak
4824.00	V	0.0	3.0	31.7	32.5	5.0	35.7	0.0	33.6	47.6	500.0	-20.4	Avg
7236.00	V	0.0	3.0	34.9	37.1	6.5	35.6	0.0	42.9	139.8	5000.0	-31.1	Peak
7236.00	V	0.0	3.0	28.5	37.1	6.5	35.6	0.0	36.5	66.9	500.0	-17.5	Avg
4824.00	H	90.0	2.3	46.5	32.5	5.0	35.7	0.0	48.4	261.7	5000.0	-25.6	Peak
4824.00	H	90.0	2.3	36.1	32.5	5.0	35.7	0.0	37.9	78.6	500.0	-16.1	Avg
7236.00	H	90.0	2.3	37.6	37.1	6.5	35.6	0.0	45.6	189.8	5000.0	-28.4	Peak
7236.00	H	90.0	2.3	28.7	37.1	6.5	35.6	0.0	36.7	68.5	500.0	-17.3	Avg
2437.00													
4874.00	V	270.0	2.5	42.0	32.6	5.1	35.7	0.0	43.9	157.5	5000.0	-30.0	Peak
4874.00	V	270.0	2.5	30.0	32.6	5.1	35.7	0.0	31.9	39.5	500.0	-22.1	Avg
7311.00	V	270.0	2.5	36.4	37.1	6.4	35.6	0.0	44.3	165.0	5000.0	-29.6	Peak
7311.00	V	270.0	2.5	28.0	37.1	6.4	35.6	0.0	35.9	62.7	500.0	-18.0	Avg
4874.00	H	0.0	2.4	44.9	32.6	5.1	35.7	0.0	46.8	219.4	5000.0	-27.2	Peak
4874.00	H	0.0	2.4	31.0	32.6	5.1	35.7	0.0	33.0	44.4	500.0	-21.0	Avg
7311.00	H	0.0	2.4	36.6	37.1	6.4	35.6	0.0	44.5	168.8	5000.0	-29.4	Peak
7311.00	H	0.0	2.4	27.9	37.1	6.4	35.6	0.0	35.8	62.0	500.0	-18.1	Avg
2462.00													
4924.00	V	0.0	3.1	38.3	32.7	5.1	35.8	0.0	40.3	103.1	5000.0	-33.7	Peak
4924.00	V	0.0	3.1	28.5	32.7	5.1	35.8	0.0	30.4	33.3	500.0	-23.5	Avg
7386.00	V	0.0	3.1	36.8	37.1	6.4	35.6	0.0	44.7	171.6	5000.0	-29.3	Peak
7386.00	V	0.0	3.1	27.5	37.1	6.4	35.6	0.0	35.4	58.8	500.0	-18.6	Avg
4924.00	H	90.0	2.3	39.5	32.7	5.1	35.8	0.0	41.5	118.8	5000.0	-32.5	Peak
4924.00	H	90.0	2.3	29.5	32.7	5.1	35.8	0.0	31.5	37.6	500.0	-22.5	Avg
7386.00	H	90.0	2.3	36.8	37.1	6.4	35.6	0.0	44.7	171.6	5000.0	-29.3	Peak
7386.00	H	90.0	2.3	27.3	37.1	6.4	35.6	0.0	35.2	57.5	500.0	-18.8	Avg
802.11 n													
2412.00													

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Duty Cycle Corr	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)	Notes
4824.00	V	270.0	2.6	44.4	32.5	5.0	35.7	0.0	46.3	205.5	5000.0	-27.7	Peak
4824.00	V	270.0	2.6	32.7	32.5	5.0	35.7	0.0	34.6	53.4	500.0	-19.4	Avg
7236.00	V	270.0	2.6	38.2	37.1	6.5	35.6	0.0	46.2	204.4	5000.0	-27.8	Peak
7236.00	V	270.0	2.6	30.3	37.1	6.5	35.6	0.0	38.3	82.3	500.0	-15.7	Avg
4824.00	H	0.0	2.1	40.6	32.5	5.0	35.7	0.0	42.5	132.7	5000.0	-31.5	Peak
4824.00	H	0.0	2.1	27.2	32.5	5.0	35.7	0.0	29.1	28.4	500.0	-24.9	Avg
7236.00	H	0.0	2.1	39.2	37.1	6.5	35.6	0.0	47.2	229.3	5000.0	-26.8	Peak
7236.00	H	0.0	2.1	27.0	37.1	6.5	35.6	0.0	35.0	56.3	500.0	-19.0	Avg
2437.00													
4874.00	V	270.0	2.5	40.7	32.6	5.1	35.7	0.0	42.6	134.5	5000.0	-31.4	Peak
4874.00	V	270.0	2.5	29.3	32.6	5.1	35.7	0.0	31.2	36.2	500.0	-22.8	Avg
7311.00	V	270.0	2.5	36.4	37.1	6.4	35.6	0.0	44.3	165.0	5000.0	-29.6	Peak
7311.00	V	270.0	2.5	28.0	37.1	6.4	35.6	0.0	35.9	62.7	500.0	-18.0	Avg
4874.00	H	0.0	2.4	41.0	32.6	5.1	35.7	0.0	42.9	140.1	5000.0	-31.1	Peak
4874.00	H	0.0	2.4	29.0	32.6	5.1	35.7	0.0	30.9	35.2	500.0	-23.1	Avg
7311.00	H	0.0	2.4	36.6	37.1	6.4	35.6	0.0	44.5	168.8	5000.0	-29.4	Peak
7311.00	H	0.0	2.4	27.9	37.1	6.4	35.6	0.0	35.8	62.0	500.0	-18.1	Avg
2462.00													
4924.00	V	0.0	3.1	41.2	32.7	5.1	35.8	0.0	43.2	144.5	5000.0	-30.8	Peak
4924.00	V	0.0	3.1	31.2	32.7	5.1	35.8	0.0	33.2	45.7	500.0	-20.8	Avg
7386.00	V	0.0	3.1	28.4	37.1	6.4	35.6	0.0	36.3	65.2	5000.0	-37.7	Peak
7386.00	V	0.0	3.1	28.6	37.1	6.4	35.6	0.0	36.5	66.7	500.0	-17.5	Avg
4924.00	H	90.0	2.3	40.3	32.7	5.1	35.8	0.0	42.3	130.2	5000.0	-31.7	Peak
4924.00	H	90.0	2.3	30.1	32.7	5.1	35.8	0.0	32.1	40.3	500.0	-21.9	Avg
7386.00	H	90.0	2.3	34.3	37.1	6.4	35.6	0.0	42.2	128.7	5000.0	-31.8	Peak
7386.00	H	90.0	2.3	29.2	37.1	6.4	35.6	0.0	37.1	71.5	500.0	-16.9	Avg

Conducted Emissions

3.1.2 Requirements

Test Arrangement: Table Top

Compliance Standard: FCC Part 15.207

FCC Compliance Limits		
Frequency	**Quasi-peak**	**Average**
0.15-0.5MHz	66 to 56dBµV	56 to 46dBµV
0.5 to 5MHz	56dBµV	46dBµV
0.5-30MHz	60dBµV	50dBµV

3.1.3 Test Equipment

Test Name:	**Conducted Emissions Voltage**	Test Date:	**7/17/08**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00124	Solar, 8012-50-R-24-BNC	LISN	09/28/2008
00069	HP, 85650A	Adapter, QP	07/09/2009
00069	HP, 85650A	Adapter, QP	07/09/2009
00073	HP, 8568B	Analyzer, Spectrum	07/08/2009

3.1.4 Test Procedure

The EUT was placed on an 80 cm high 1 X 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω/50 µH Line Impedance Stabilization Network bonded to a 3 X 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power was supplied to the peripherals through a second LISN. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak, peak, or average as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth. For average measurements the post-detector filter was set to 10 Hz.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed.

3.1.5 Test Data

The EUT complied with the Conducted Emissions requirements. Table 2 provides the test results for phase and neutral line power line conducted emissions.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed. The Conducted emissions level to be compared to the FCC limit is calculated as shown in the following example.

Example:

Spectrum Analyzer Voltage: VdBµV

LISN Correction Factor: LISN dB

Cable Correction Factor: CF dB

Electric Field: EdBµV = V dBµV + LISN dB + CF dB

Table 15: Conducted Emission Test Data

LINE 1 - NEUTRAL

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.199	36.9	23.0	10.3	0.3	47.5	33.6	63.7	53.7	-16.2	-20.1
0.454	31.6	20.1	10.5	0.2	42.3	30.8	56.8	46.8	-14.5	-16.0
1.196	29.8	19.1	10.6	0.4	40.7	30.0	56.0	46.0	-15.3	-16.0
4.630	31.9	19.1	11.2	0.5	43.6	30.8	56.0	46.0	-12.4	-15.2
13.430	34.6	20.0	11.4	1.2	47.2	32.6	60.0	50.0	-12.8	-17.4
15.730	29.8	15.9	11.3	1.4	42.5	28.6	60.0	50.0	-17.5	-21.4

LINE 1 - Phase

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.150	40.6	29.1	10.2	0.2	51.0	39.5	66.0	56.0	-15.0	-16.5
0.448	32.4	23.5	10.5	0.7	43.6	34.7	56.9	46.9	-13.3	-12.2
1.194	28.0	17.7	10.6	0.6	39.2	28.9	56.0	46.0	-16.8	-17.1
13.220	37.0	25.3	11.4	1.4	49.8	38.1	60.0	50.0	-10.2	-11.9
15.790	30.1	18.6	11.3	1.5	42.9	31.4	60.0	50.0	-17.1	-18.6
27.970	14.1	1.3	12.5	1.9	28.6	15.8	60.0	50.0	-31.4	-34.2

Test Engineer(s): Steven Dovell

Test Date(s): 7/17/08

