Washington Laboratories, Ltd.

FCC Certification Test Report
For the
Etymotic Research, Inc.
ER88 Bluetooth Earphones

FCC ID: RWT-ER88

WLL JOB# **9319**
August 15, 2006

Prepared for:

Etymotic Research, Inc.
61 Martin Lane
Elk Grove Village, IL 60007

Prepared By:

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

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Prepared by: Brian J. Dettling
Documentation Specialist

Reviewed by: Gregory M. Snyder
Chief EMC Engineer

Abstract

This report has been prepared on behalf of Etymotic Research, Inc. to support the attached Application for Equipment Authorization. The test report and application are submitted for a Frequency Hopping Spread Spectrum Transmitter under Part 15.247 of the FCC Rules and Regulations. This Certification Test Report documents the test configuration and test results for an Etymotic Research, Inc. ER88 Bluetooth Earphones.

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 NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The Etymotic Research, Inc. ER88 Bluetooth Earphones complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247.

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1 Introduction

1.1 Compliance Statement

The Etymotic Research, Inc. ER88 Bluetooth Earphones complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247.

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 DA 00-705 and the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Etymotic Research, Inc. 61 Martin Lane Elk Grove Village, IL 60007
Quotation Number:	62997

1.4 Test Dates

Testing was performed on the following date(s):	August 1 through August 3, 2006

1.5 Test and Support Personnel

Washington Laboratories, LTD	Steve Dovell
Client Representative	Joe Adams

2 Equipment Under Test

2.1 EUT Identification & Description

The Etymotic Research, Inc. ER88 Bluetooth Earphones is an under-the-glass board designed for installation in an ECR-2400 meter. The node plugs into the meter and enables meters to automatically form a wireless mesh network.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Etymotic Research, Inc.
FCC ID:	RWT-ER88
Model:	ER88 Bluetooth Earphones
FCC Rule Parts:	§15.247
Frequency Range:	2402-2480MHz
Maximum Output Power:	0.66mW (-1.83dBm)
Occupied Bandwidth:	910kHz
Keying:	Automatic
Type of Information:	Digital Audio
Number of Channels:	79
Power Output Level	Fixed
Antenna Connector	Integral Antenna
Interface Cables:	None
Power Source & Voltage:	Battery (rechargeable via USB connection)

2.2 Test Configuration

The ER88 Bluetooth Earphones was configured as shown in Figure 1 below.

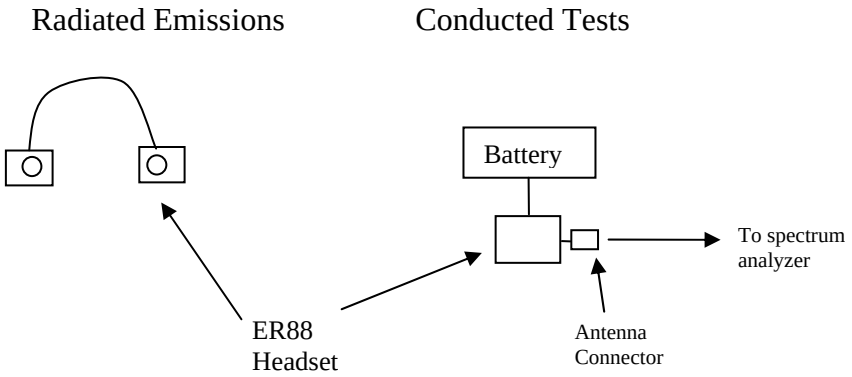

Figure 2-1: Test Configuration

2.3 Testing Algorithm

The ER88 Bluetooth Earphones was configured with software supplied by the radio chip manufacturer. It allowed for setting the device for continuous transmit mode with both the hopping and non-hopping modes along with channel selection. Additionally, as the device is portable, the emissions were checked in three orthogonal with the worst case being reported.

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 NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping 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

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

WLL Asset #	Manufacturer Model/Type	Function	Cal. Due
0073	HP 8568B	SPECTRUM ANALYZER	6/26/2007
0069	HP 85650A	QUASI-PEAK ADAPTER	6/26/2007
0125	SOLAR 8028-50-TS-BNC	LISN	1/31/2007
0126	SOLAR 8028-50-TS-BNC	LISN	1/31/2007
0557	SCHAFFNER CBL6141A	BICONILOG ANTENNA	12/01/2006
0522	HEWLETT-PACKARD 8449B	MICROWAVE PREAMP	5/4/2007
0004	ARA DRG118/A	MICROWAVE HORN ANTENNA	2/02/2007
0074	HEWLETT-PACKARD 8593A	SPECTRUM ANALYZER	10/4/2006
0425	ARA, DRG-118/A	MICROWAVE HORN ANTENNA	1/17/2007
0528	AGILENT 4446A	4446A SPECTRUM ANALYZER	6/20/2007
0280	ITC, 21C-3A1	WAVEGUIDE	2/7/2007
0281	ITC, 21A-3A1	WAVEGUIDE	2/7/2007
209	NARDA, V638	STANDARD GAIN ANTENNA	12/25/2008
210	NARDA, V637	STANDARD GAIN ANTENNA	12/25/2008

4 Test Results

4.1 Dwell Time

The EUT utilizes a qualified Bluetooth device (reference Parts List) and therefore in order to work properly with other Bluetooth devices and will therefore comply with the dwell time requirements. The following is taken from the FCC common theory of operation for Bluetooth devices.

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is a follows:

Dwell time = time slot length * hop rate / number of hopping channels *30s

Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = 625 µs * 1600 1/s / 79 * 30s = 0.3797s (in a 30s period)

For multi-slot packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots)
Dwell time = 5 * 625 µs * 1600 * 1/5 *1/s / 79 * 30s = 0.3797s (in a 30s period)

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore, all Bluetooth devices **comply** with the FCC dwell time requirement in the data mode. This was checked during the Bluetooth Qualification tests. The Dwell time in hybrid mode is approximately 2.6 mS (in a 12.8s period)

4.2 RF Power Output: (FCC Part §2.1046)

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 Spectrum Analyzer with a 2MHz resolution bandwidth and a 3MHz video bandwidth. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system and the detector was set to peak.

Table 3. RF Power Output

Frequency	Level	Limit	Pass/Fail
Low Channel 2402MHz	-1.83 dBm	30 dBm	Pass
Mid Channel 2441MHz	-2.66 dBm	30 dBm	Pass
High Channel 2480MHz	-3.66 dBm	30 dBm	Pass

4.3 Occupied Bandwidth: (FCC Part §2.1049)

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

For Frequency Hopping Spread Spectrum Systems, FCC Part 15.247 requires the Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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

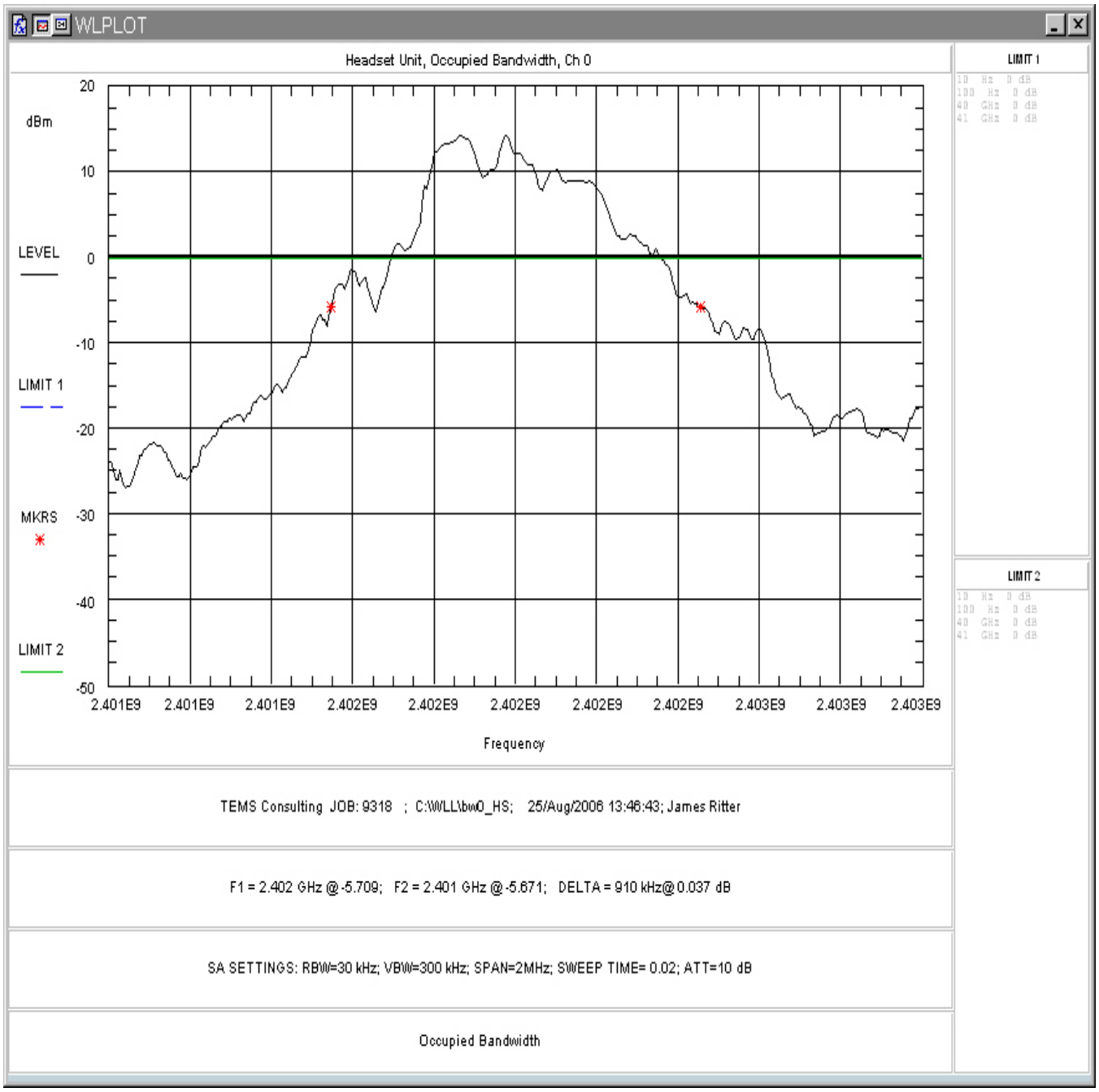

Figure 4-1. Occupied Bandwidth, Low Channel

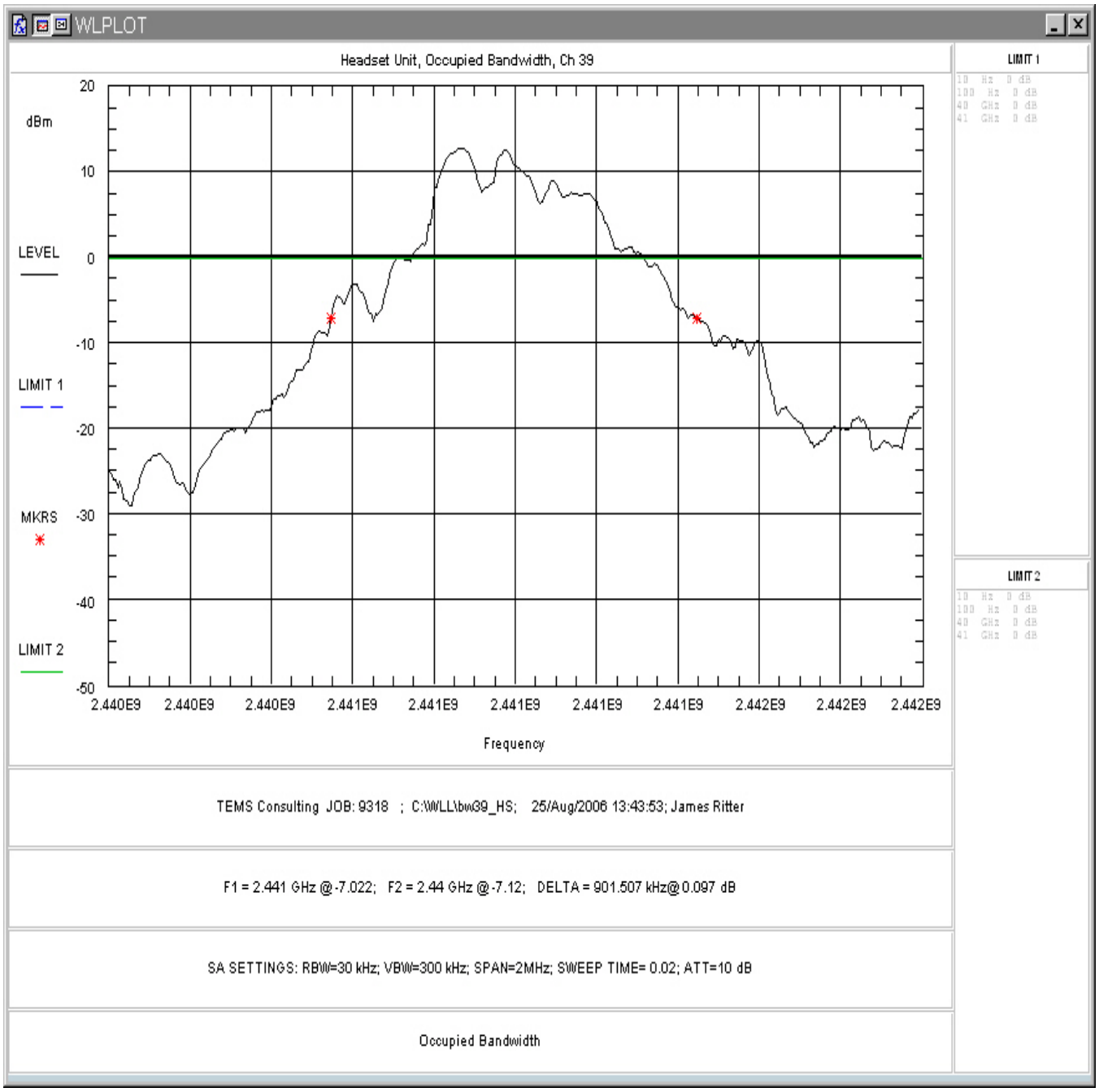

Figure 4-2. Occupied Bandwidth, Mid Channel

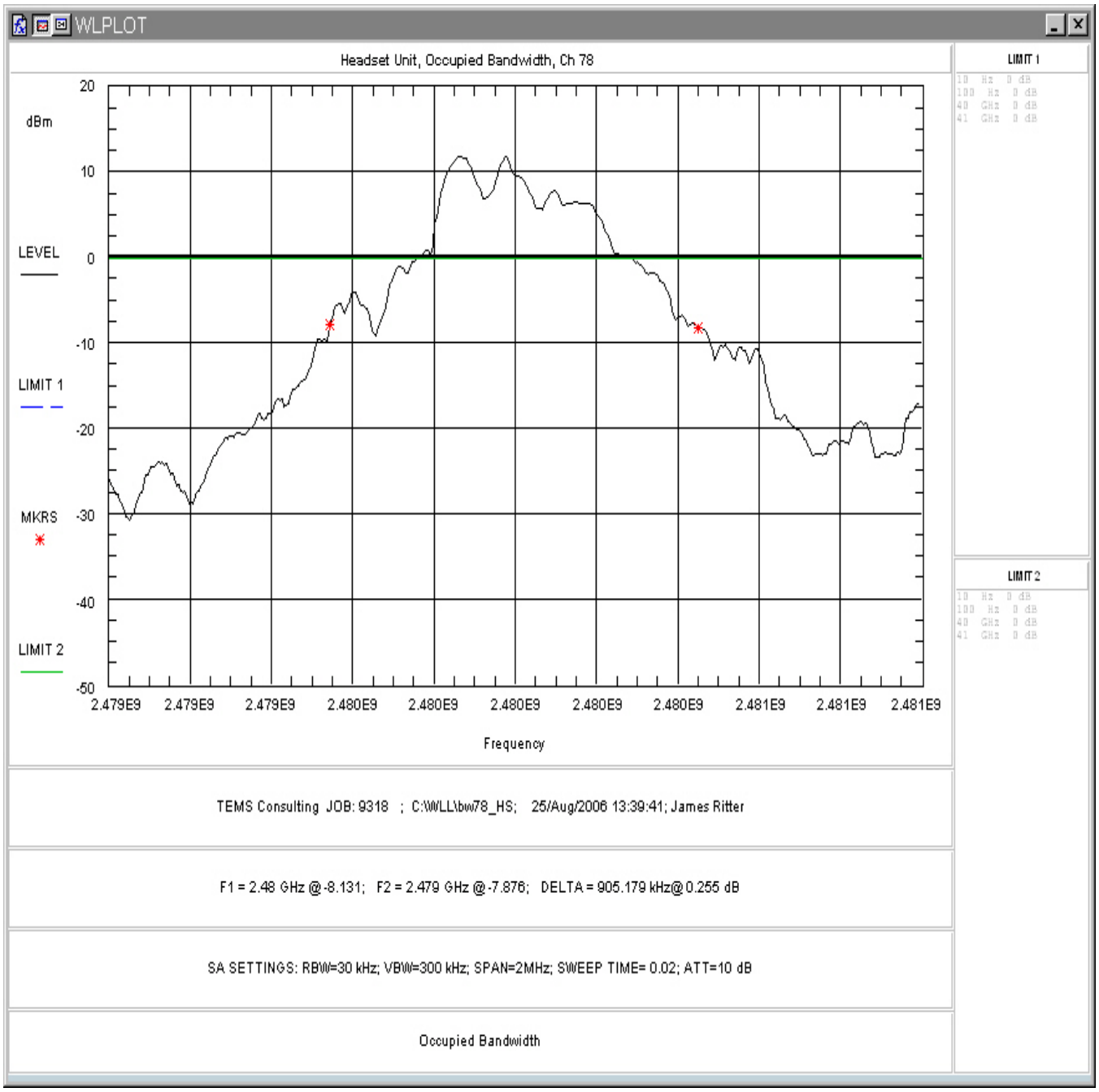

Figure 4-3. Occupied Bandwidth, High Channel

Table 4 provides a summary of the Occupied Bandwidth Results.

Table 4. Occupied Bandwidth Results

Frequency	Bandwidth
Low Channel 2402MHz	910kHz
Mid Channel 2441MHz	901.5kHz
High Channel 2480MHz	905.18kHz

4.4 RF Peak Power Spectral Density (§15.247(e) and RSS-210, Annex 8.2)

For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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

The highest peak within the transmission was located and measured for the upper and lower channels. Plots of the PSD were taken as shown in Figure 4-4 through Figure 4-6 below. Table 5 provides a summary of the data.

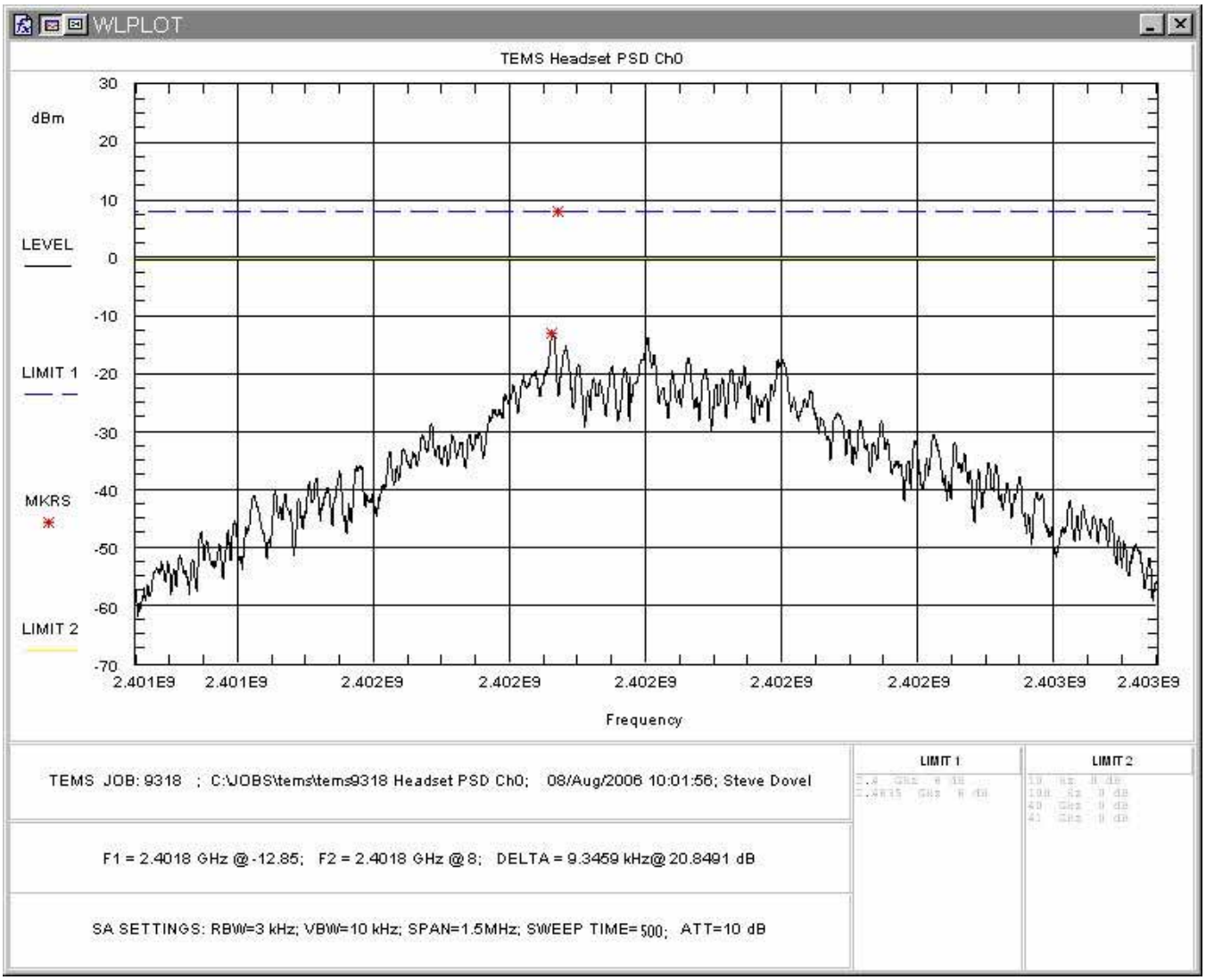

Figure 4-4. Power Spectral Density, Low Channel

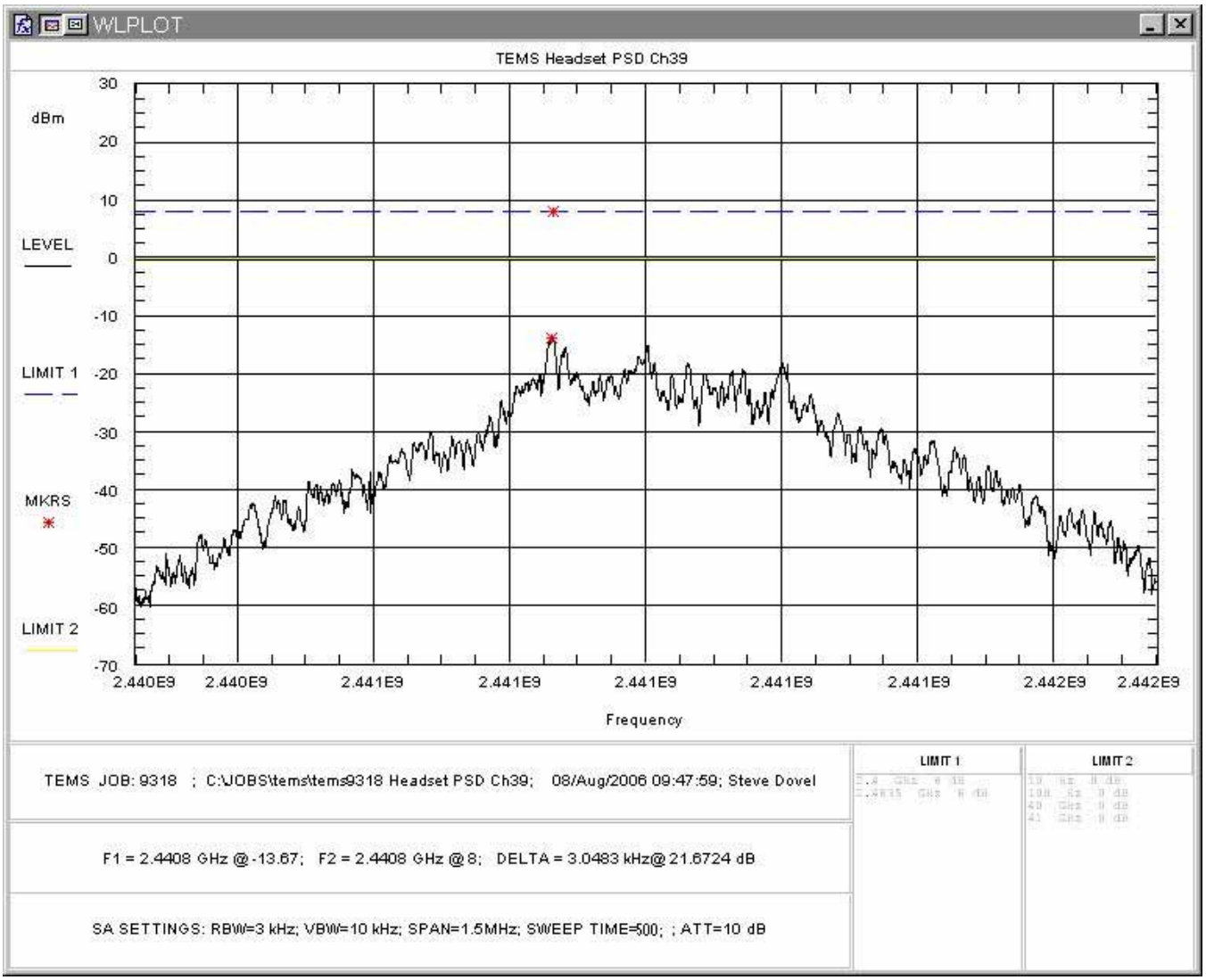

Figure 4-5. Power Spectral Density, Mid Channel

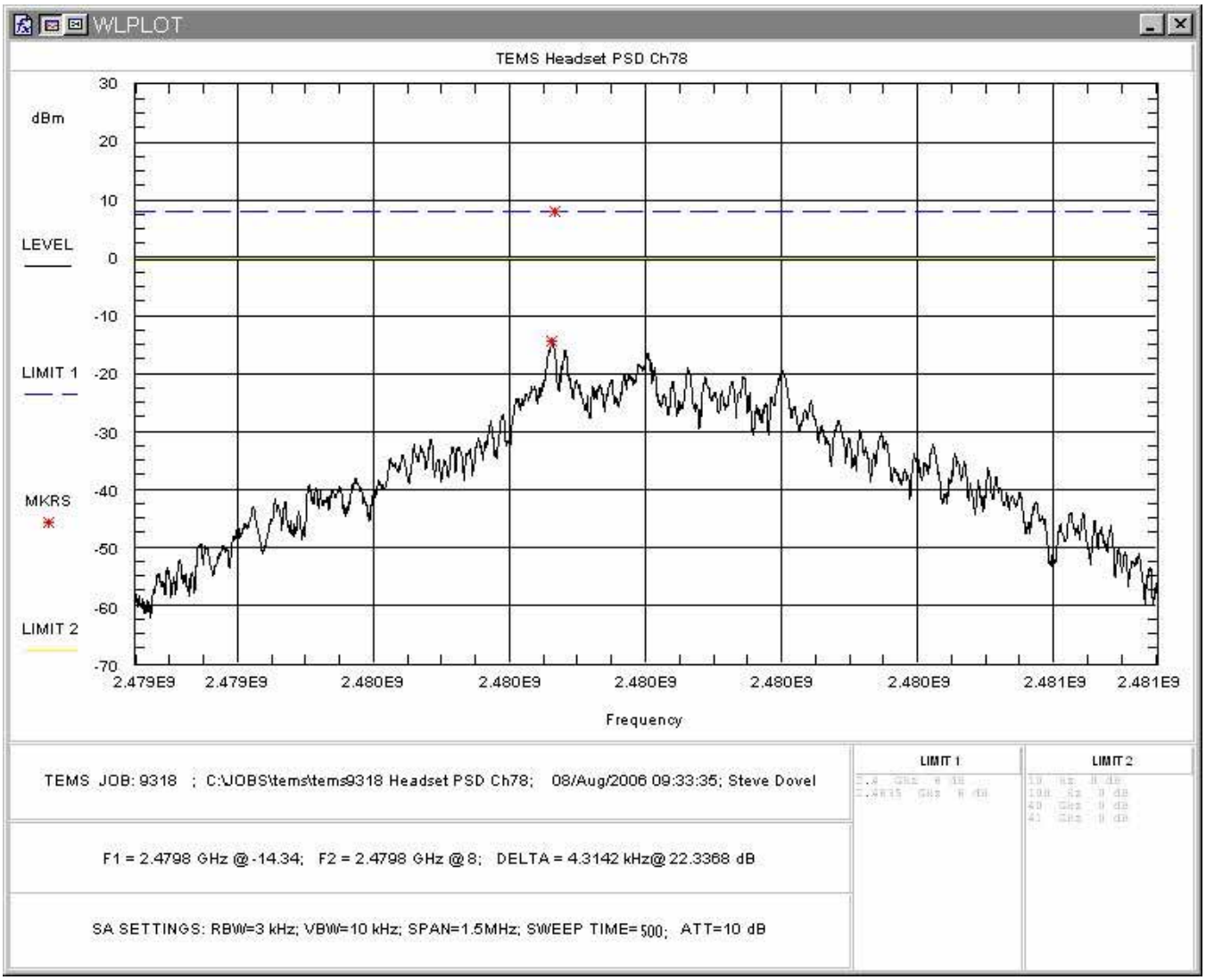

Figure 4-6. Power Spectral Density, High Channel

Table 5. RF Power Spectral Density

Frequency	Level (dBm)	Limit (dBm)	Pass/Fail
2402MHz	-12.85	8	Pass
2440MHz	-13.67	8	Pass
2480MHz	-14.34	8	Pass

4.5 Channel Spacing and Number of Hop Channels (FCC Part §15247(a)(1)

Per the FCC requirements, For Frequency Hopping Spread Spectrum Systems, FCC Part 15.247 requires the Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

The output of the ER88 is well under the limit 125 mW specification and therefore the channels must be separated by two-thirds of the 20dB bandwidth. The maximum 20dB bandwidth measured 910 kHz. Therefore the channel spacing must be at least 606.7 kHz.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10 dB attenuator. The spectrum analyzer resolution bandwidth was set to 300 kHz and the video bandwidth was set to 1MHz. The channel spacing of 2 adjacent channels was measured on the spectrum analyzer. The following are plots of the channel spacing and number of hopping channels data. The channel spacing was measured to be 1MHz and the number of channels used is 79.

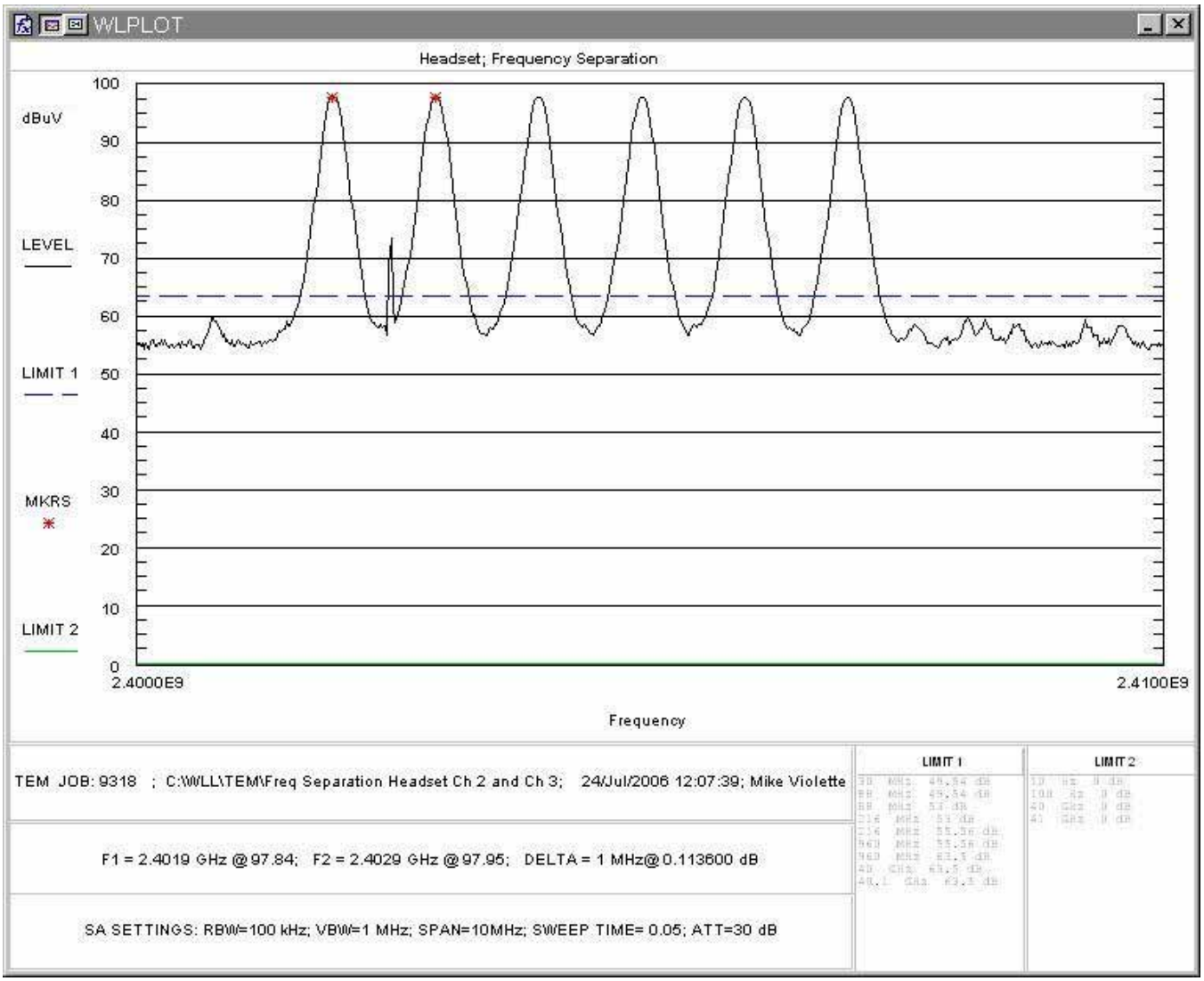

Figure 4-7. Channel Separation

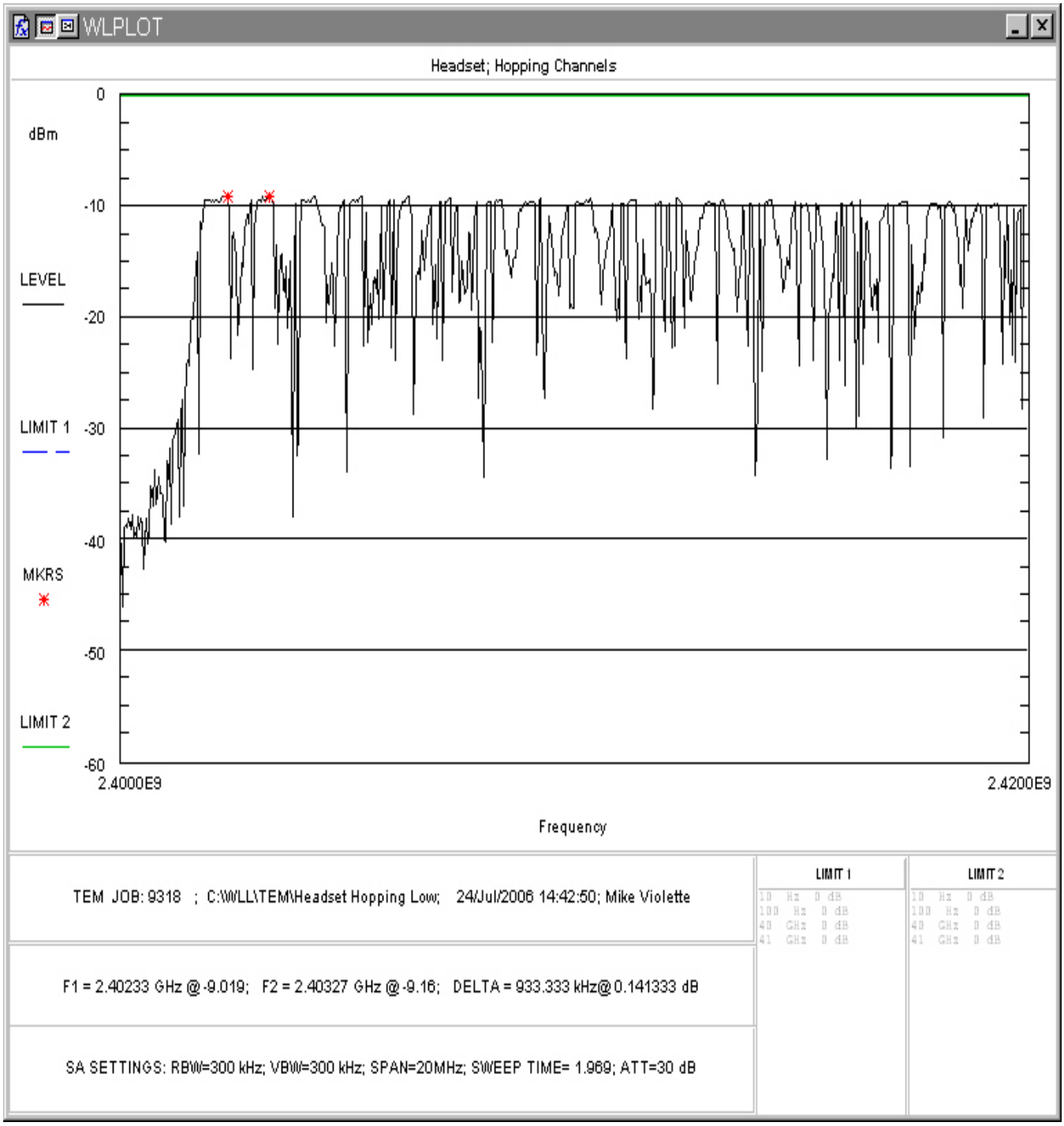

Figure 4-8. Number of Channels, Plot 1, Channels 1-19

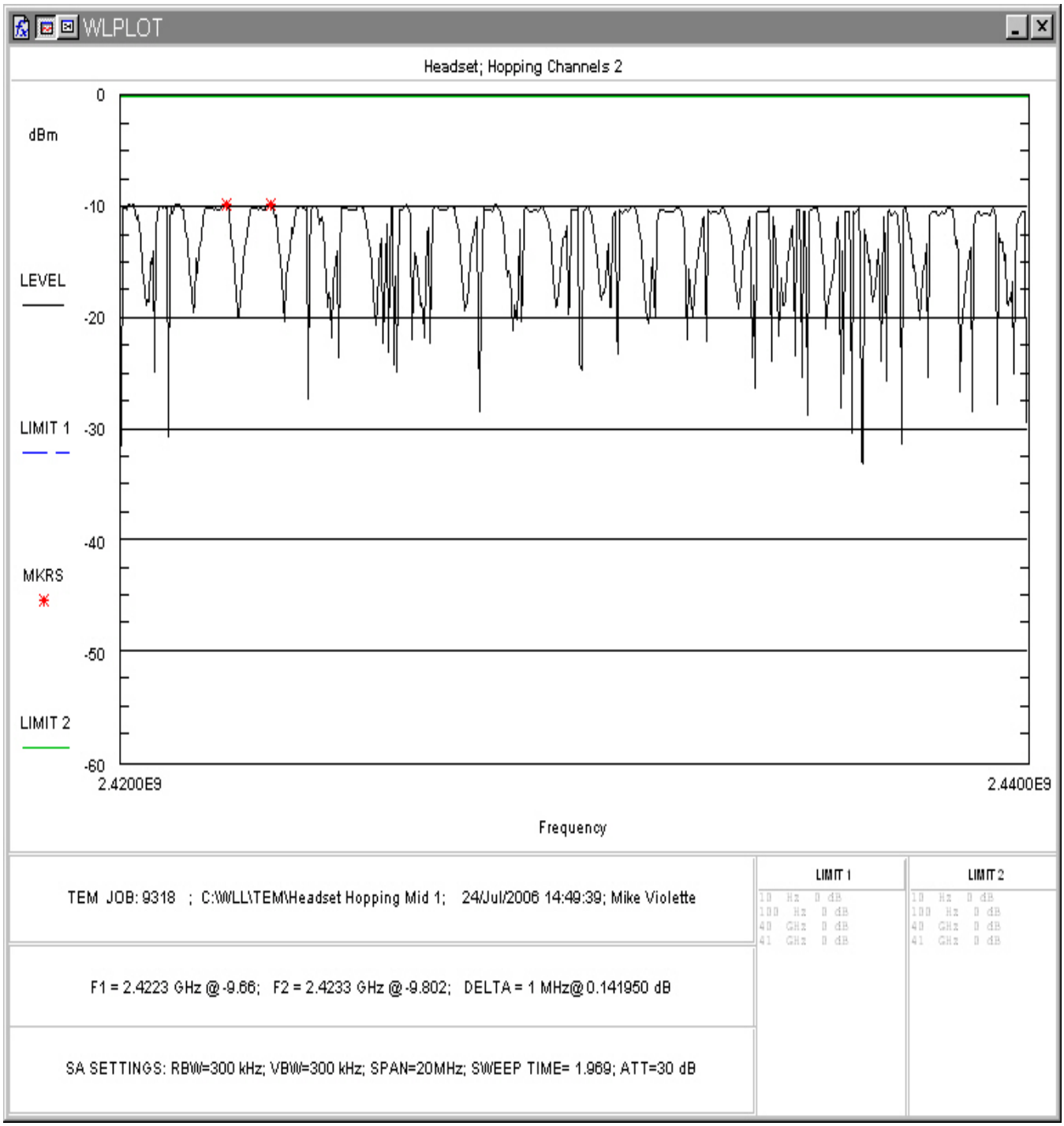

Figure 4-9. Number of Channels, Plot 2, Channels 19-39

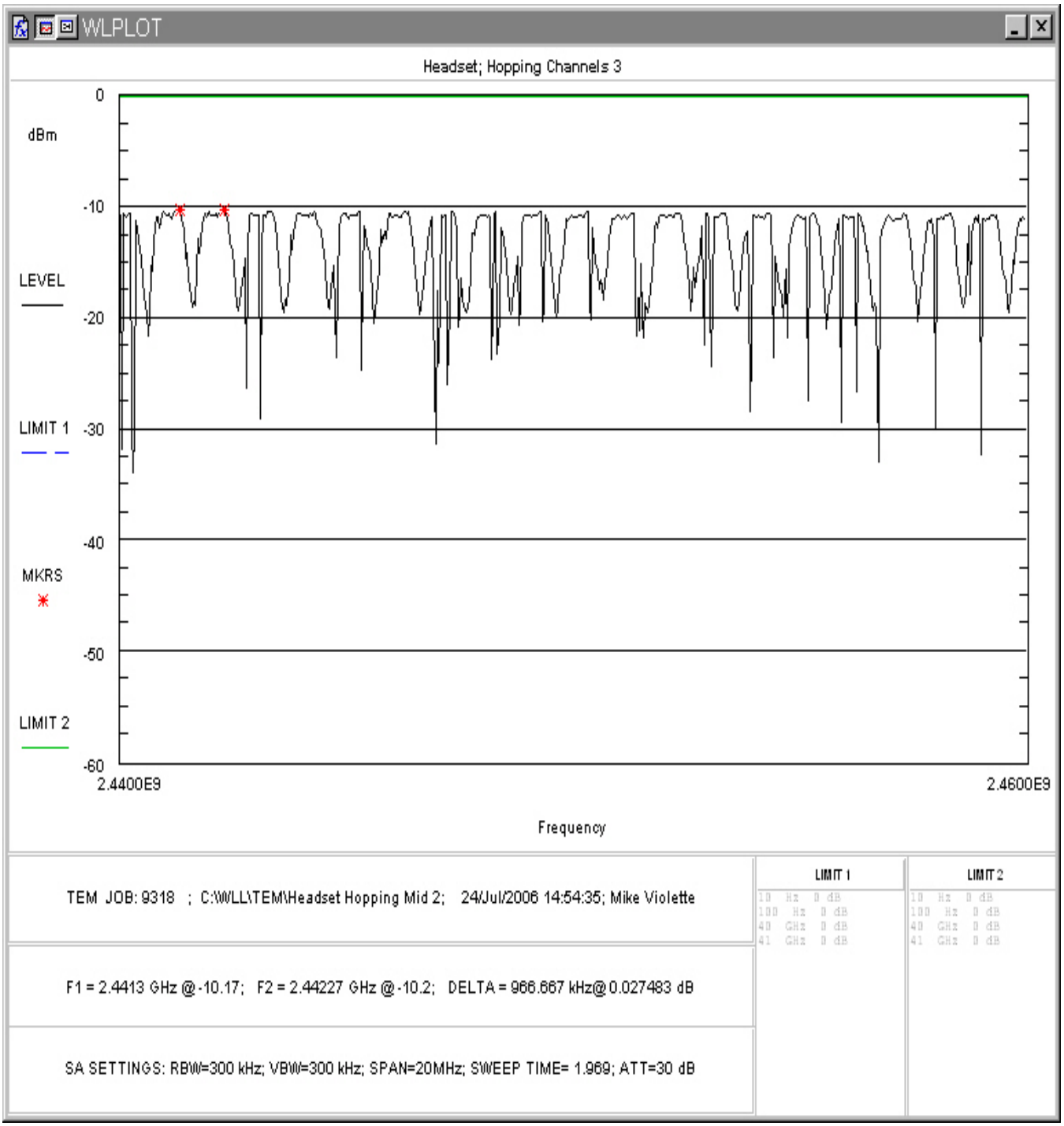

Figure 4-10. Number of Channels, Plot 3, Channels 39-59

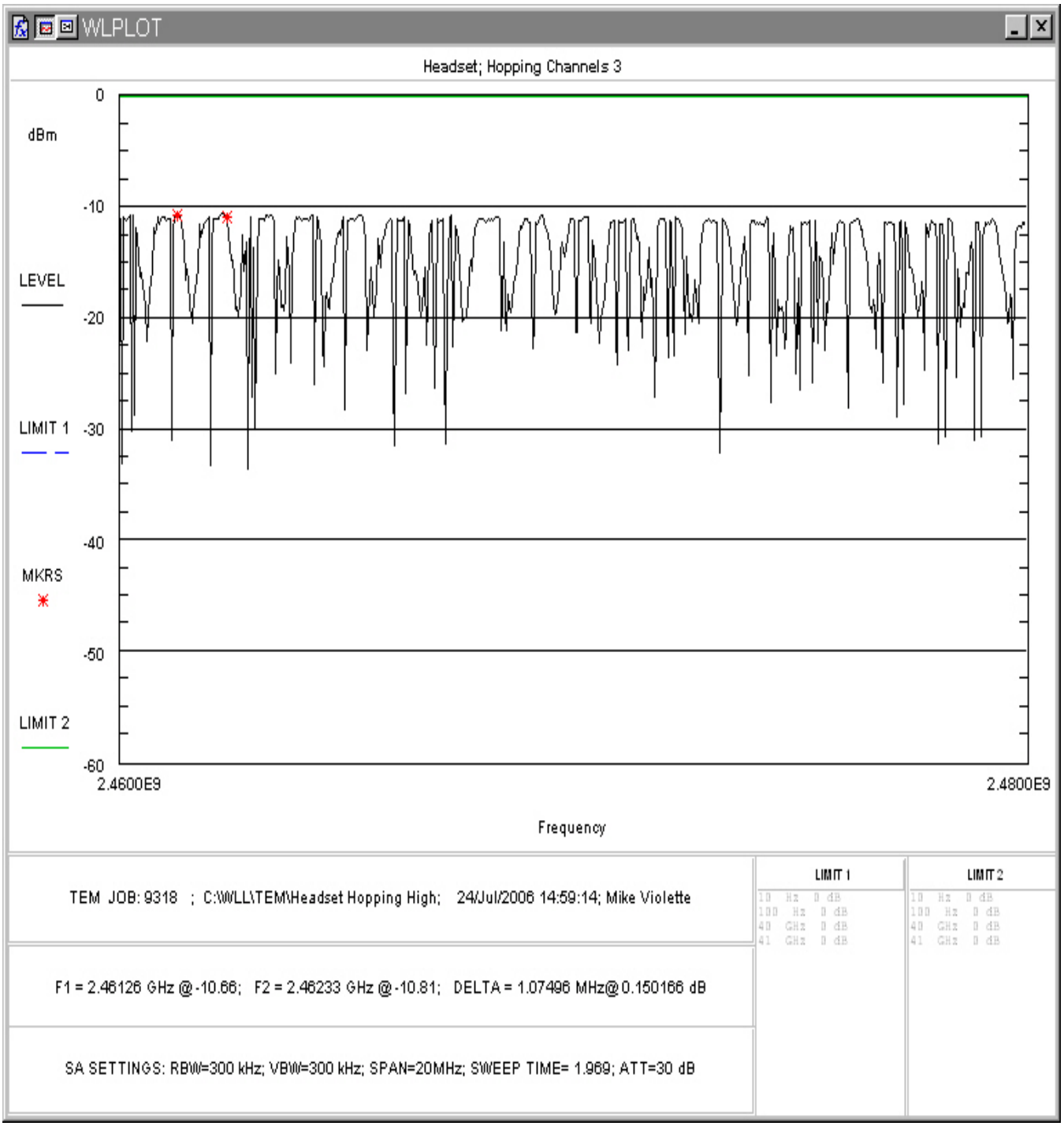

Figure 4-11. Number of Channels, Plot 4, Channels 59-79

4.6 Conducted Spurious Emissions at Antenna Terminals (FCC Part §2.1051)

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. Band edge conducted emissions testing was performed with both the hopping activated and while in non-hopping mode.

The following are plots of the conducted spurious emissions data. Bandedge plots are shown in Figure 4-36 through Figure 4-39.

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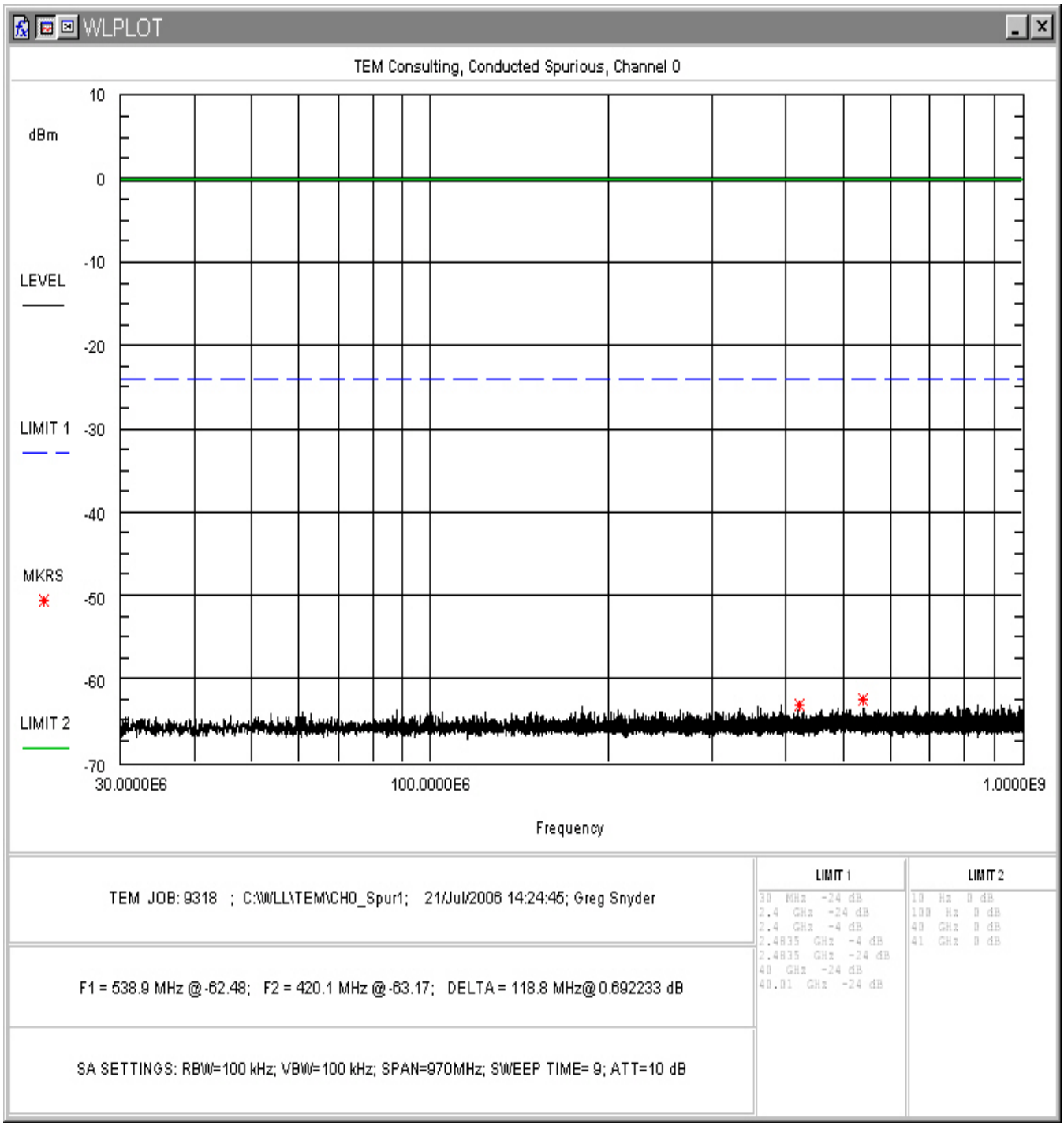

Figure 4-12. Conducted Spurious Emissions, Low Channel 30 - 1000MHz

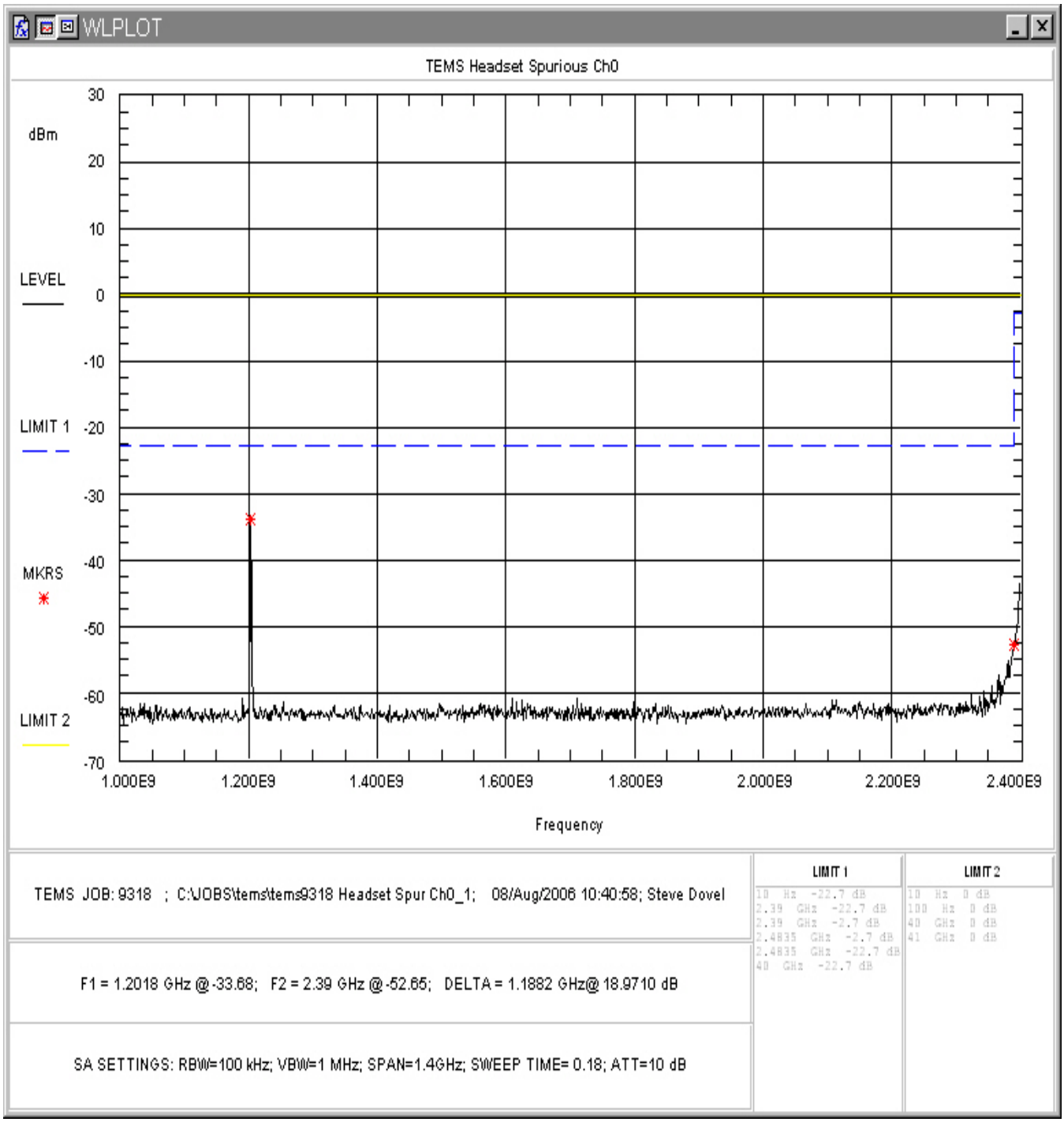

Figure 4-13. Conducted Spurious Emissions, Low Channel 1 – 2.4GHz

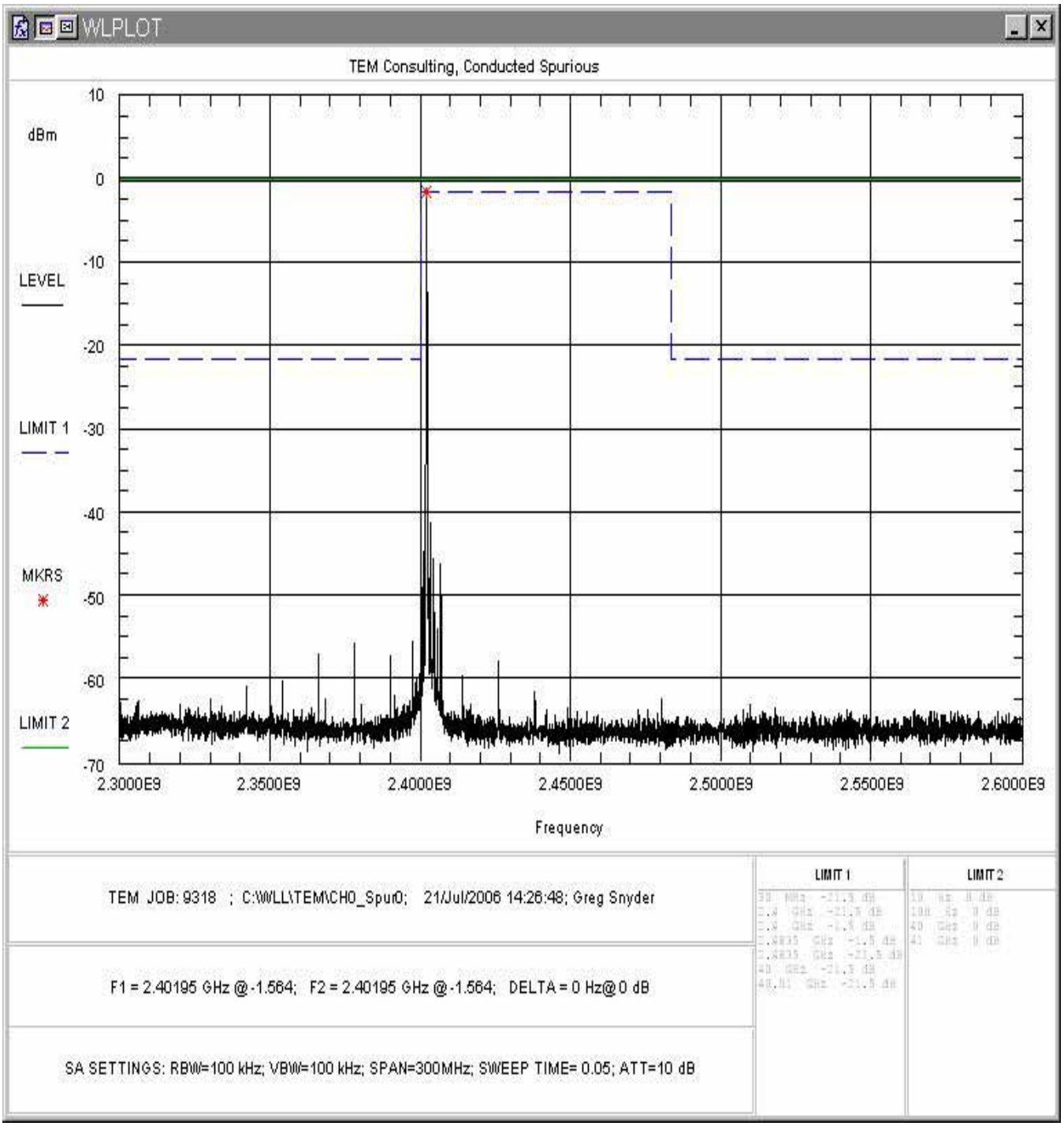

Figure 4-14. Conducted Spurious Emissions, Low Channel 2.3GHz – 2.6GHz

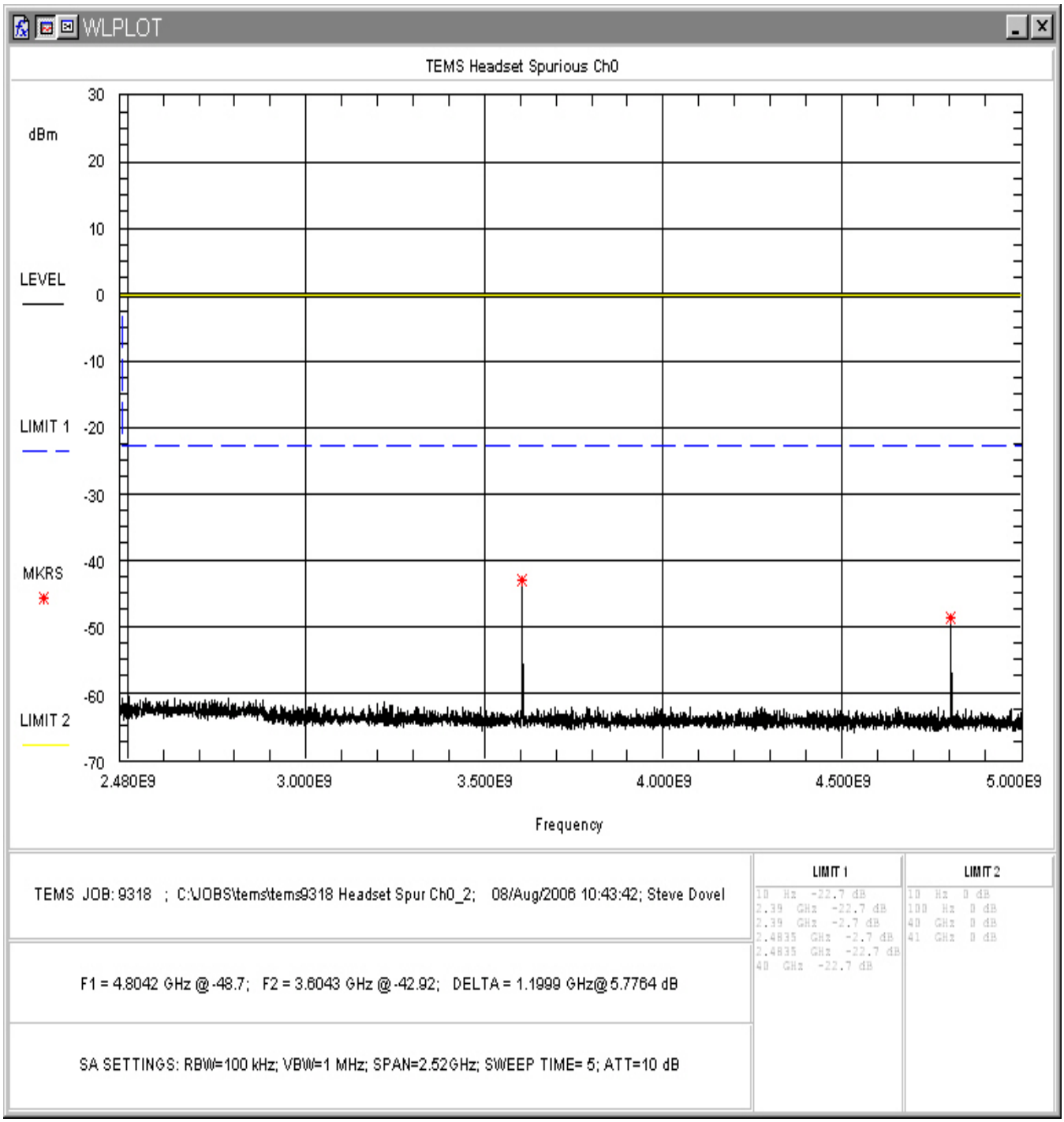

Figure 4-15. Conducted Spurious Emissions, Low Channel 2.4 – 5GHz

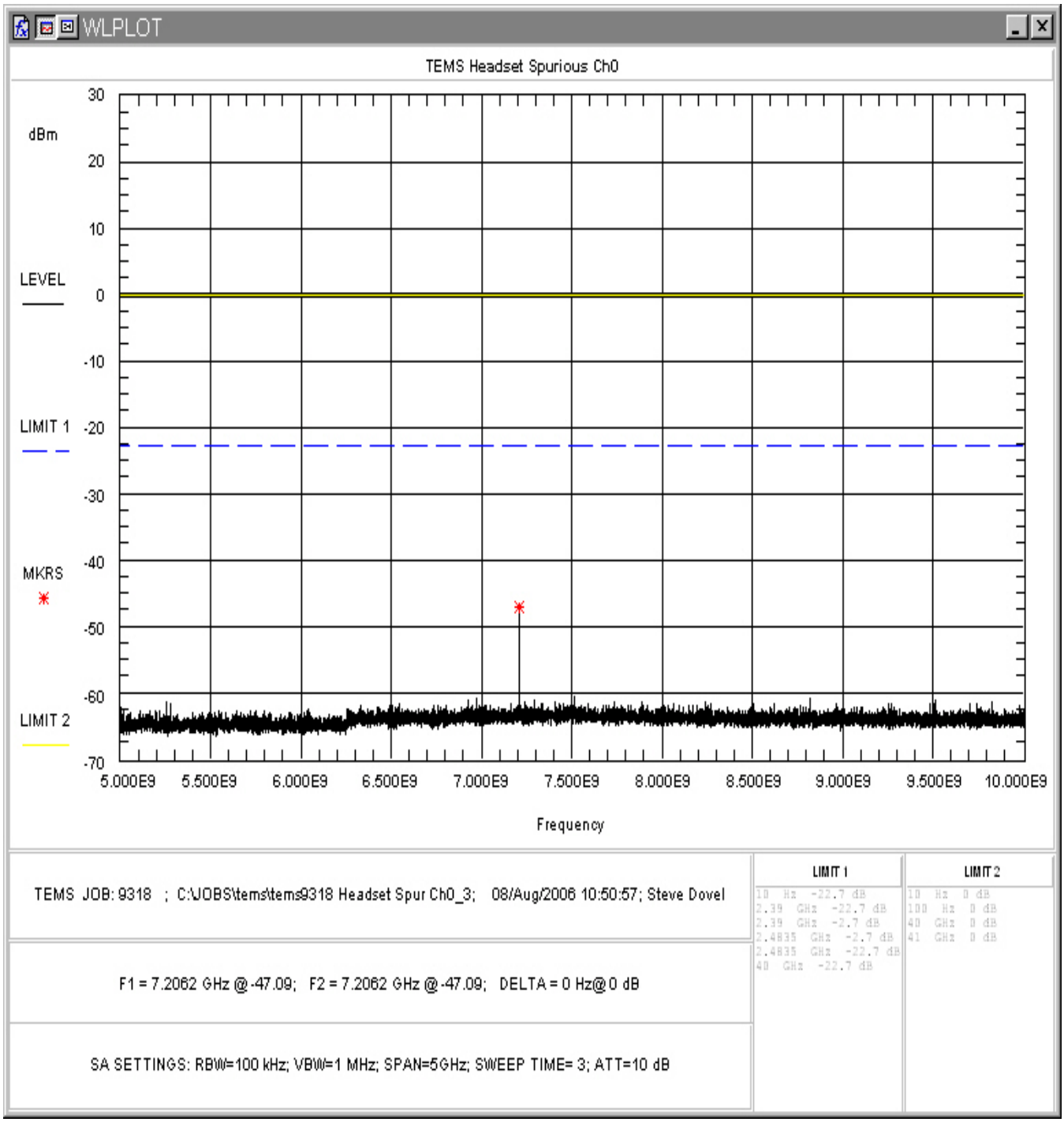

Figure 4-16. Conducted Spurious Emissions, Low Channel 5 – 10GHz

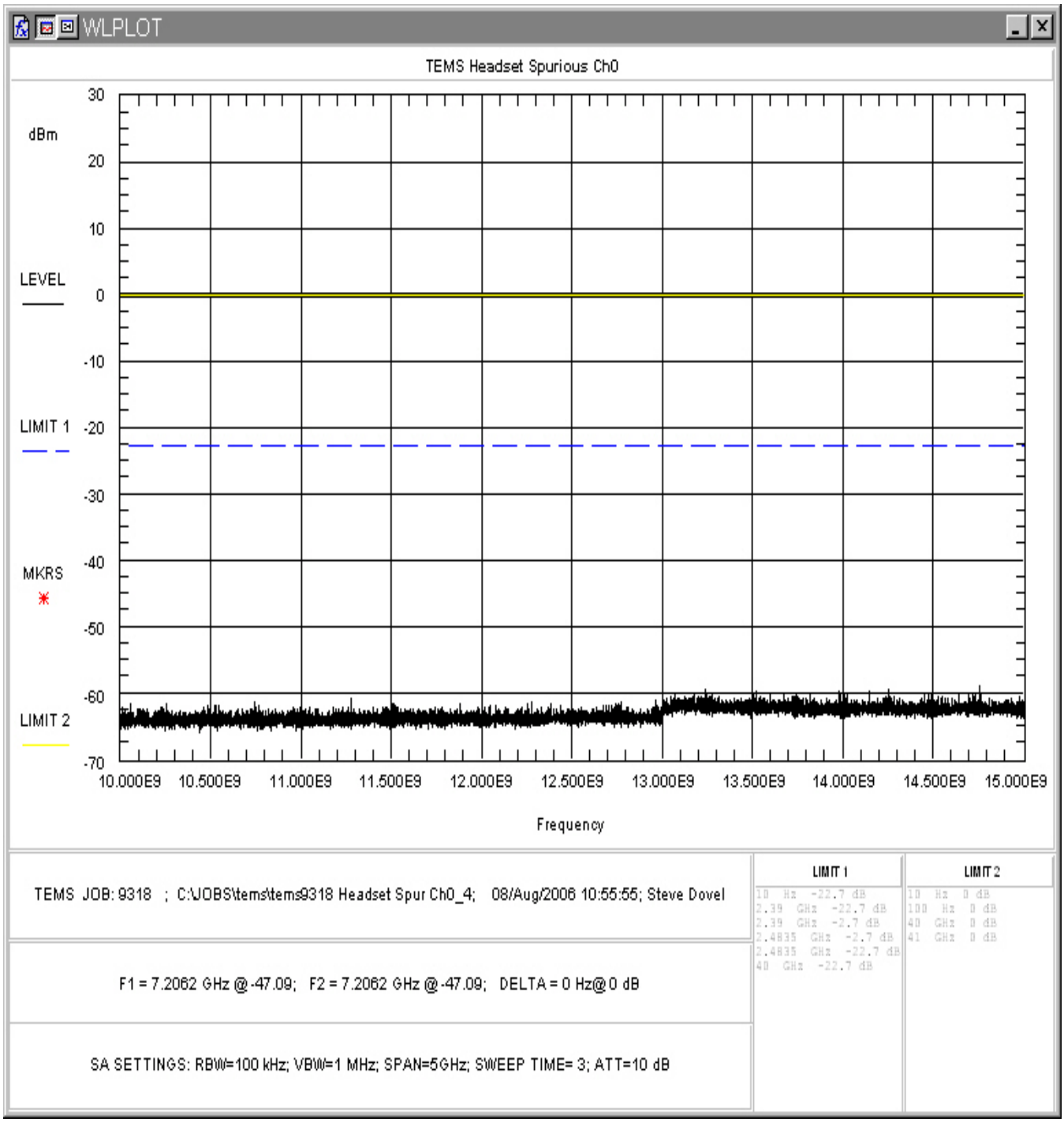

Figure 4-17. Conducted Spurious Emissions, Low Channel 10 - 15GHz

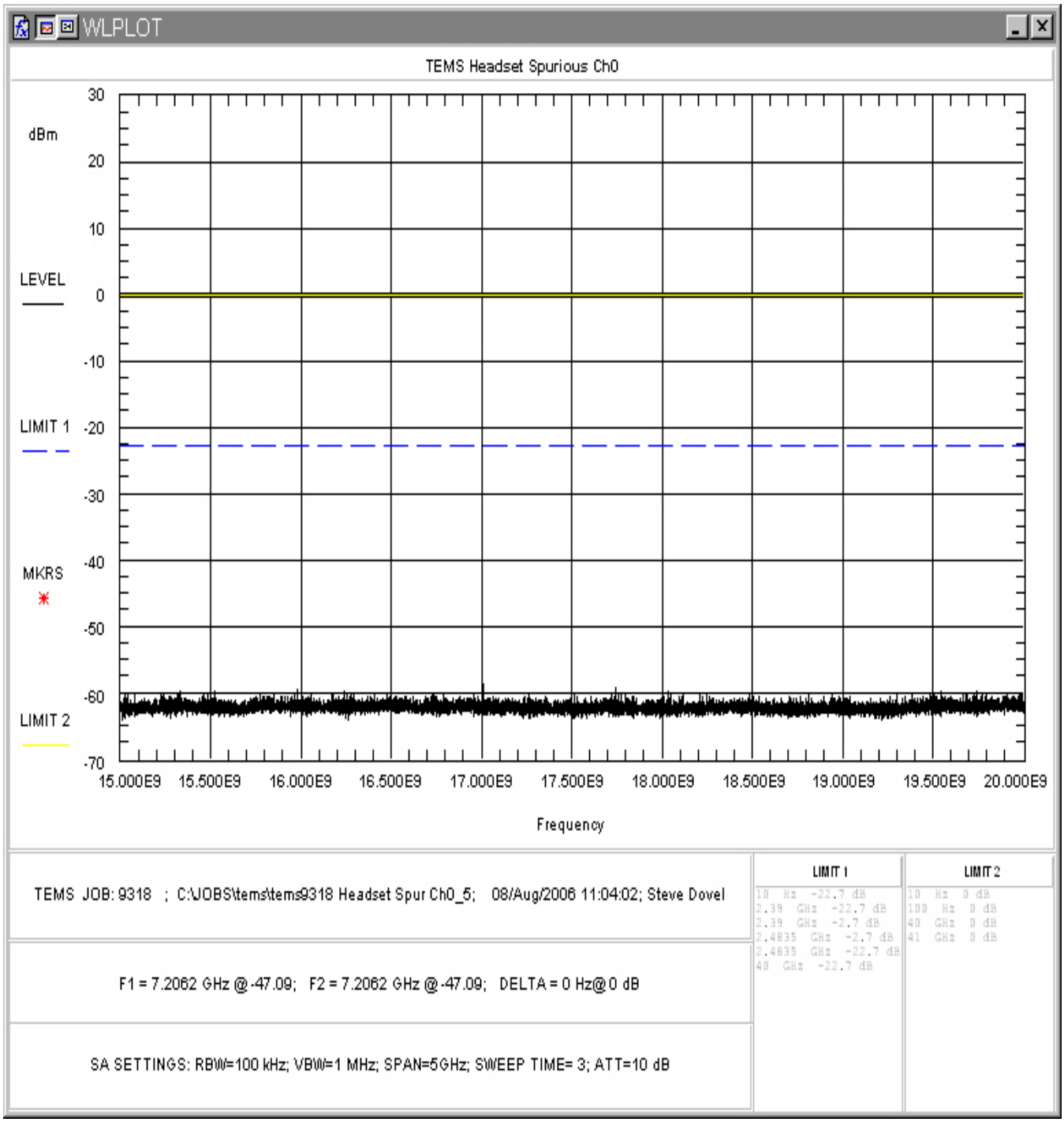

Figure 4-18. Conducted Spurious Emissions, Low Channel 15 - 20GHz

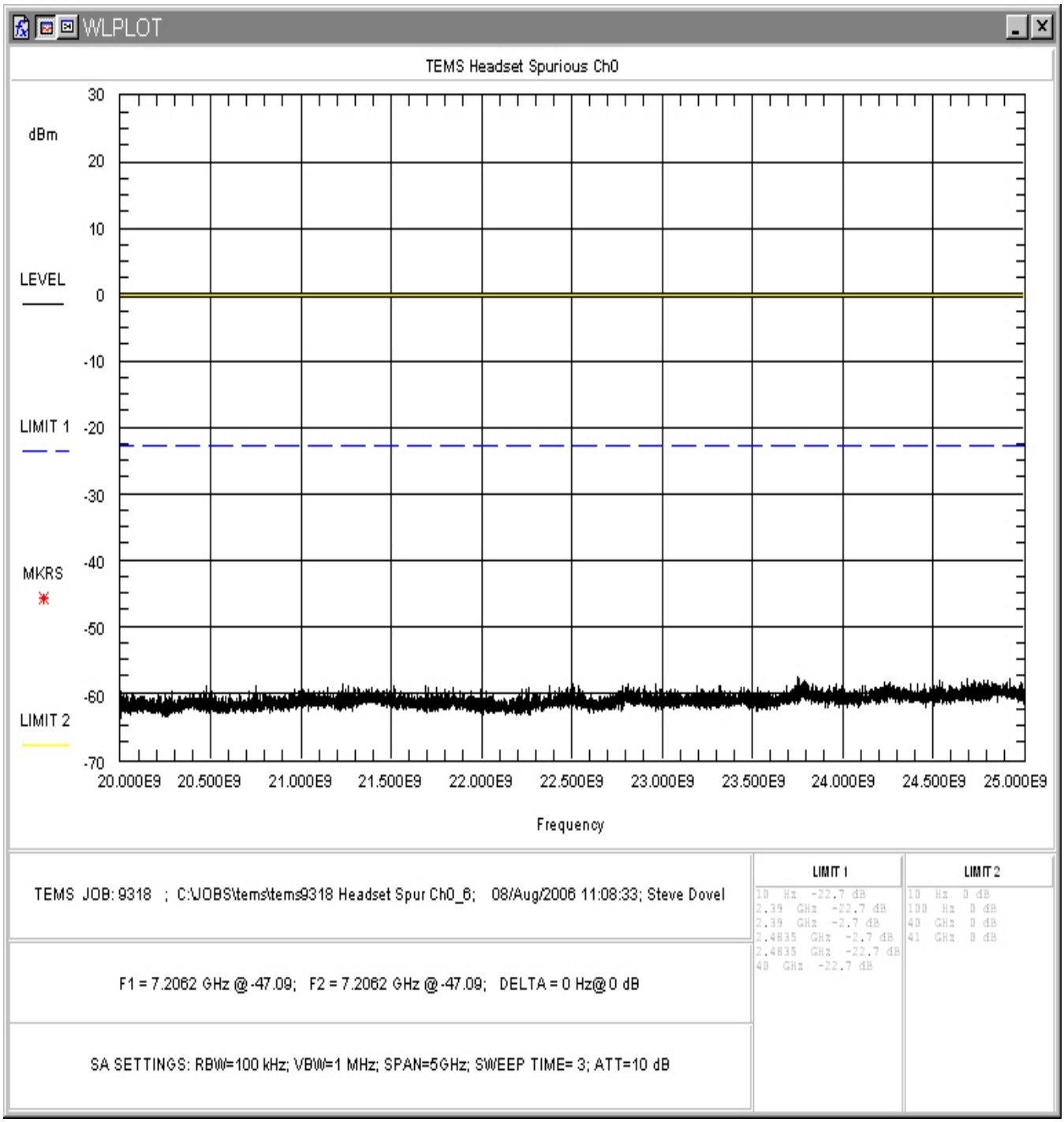

Figure 4-19. Conducted Spurious Emissions, Low Channel 20 - 25GHz

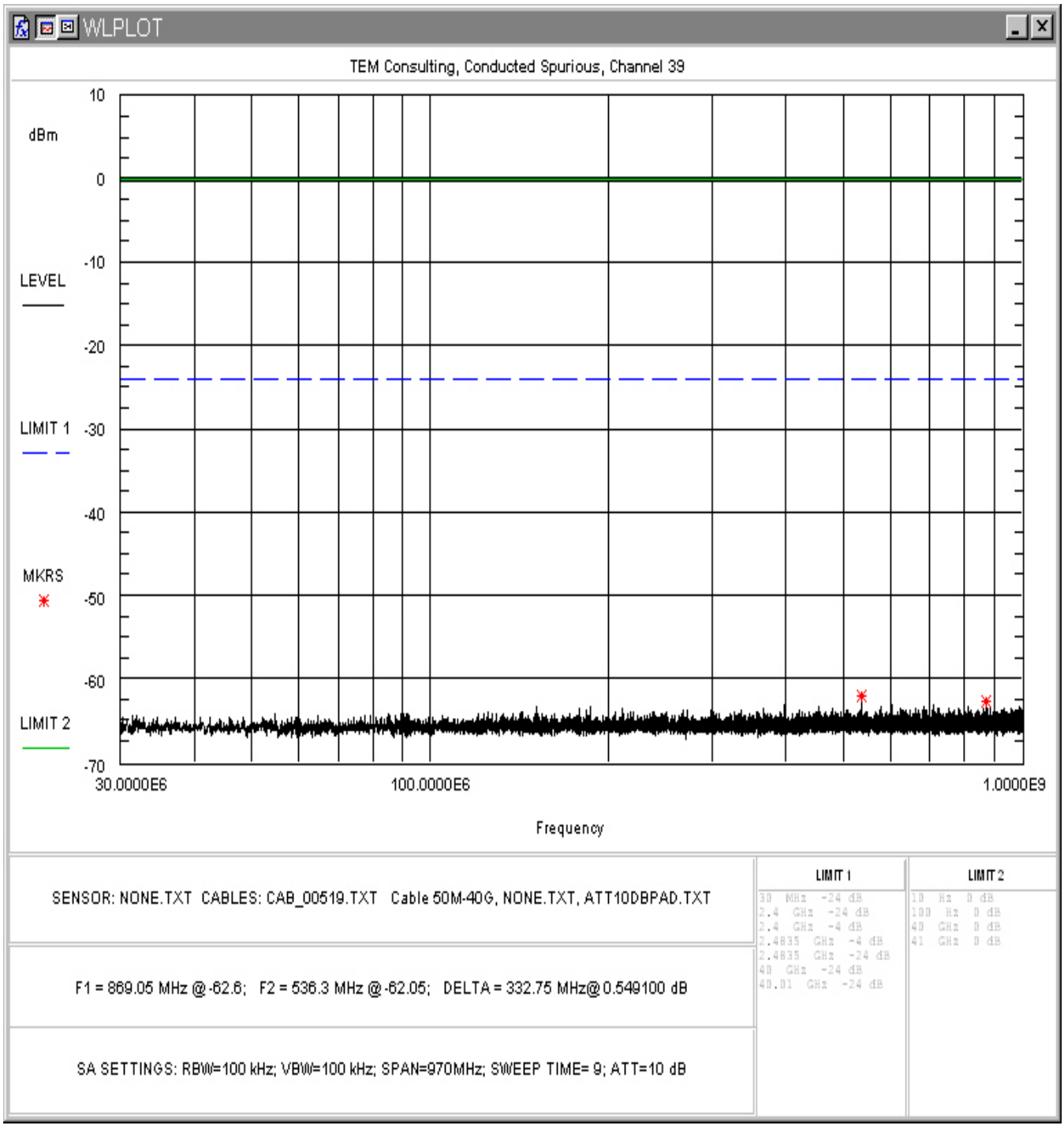

Figure 4-20. Conducted Spurious Emissions, Mid Channel 30 - 1000MHz

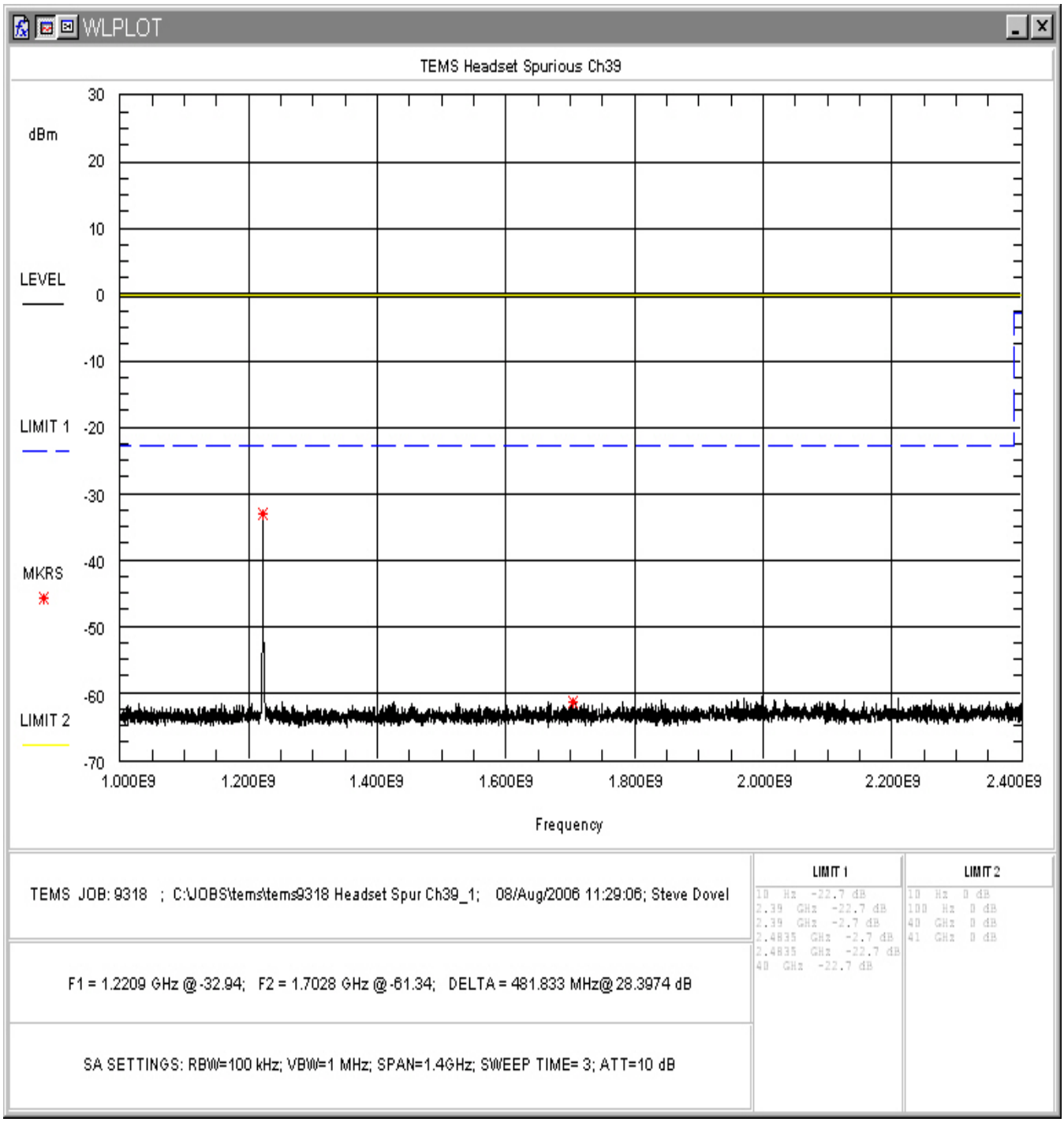

Figure 4-21. Conducted Spurious Emissions, Mid Channel 1 – 2.4GHz

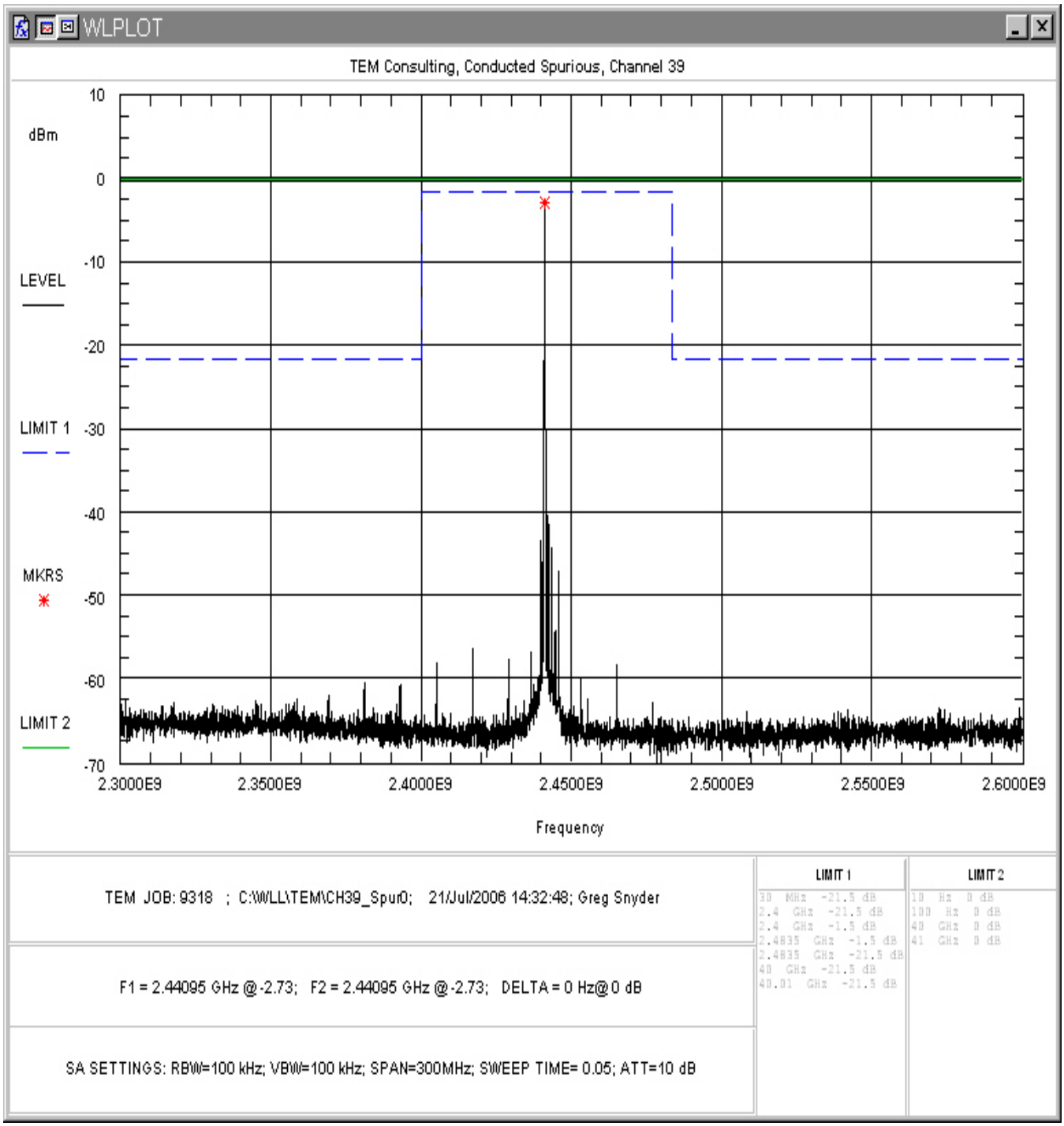

Figure 4-22. Conducted Spurious Emissions, Mid Channel In-band

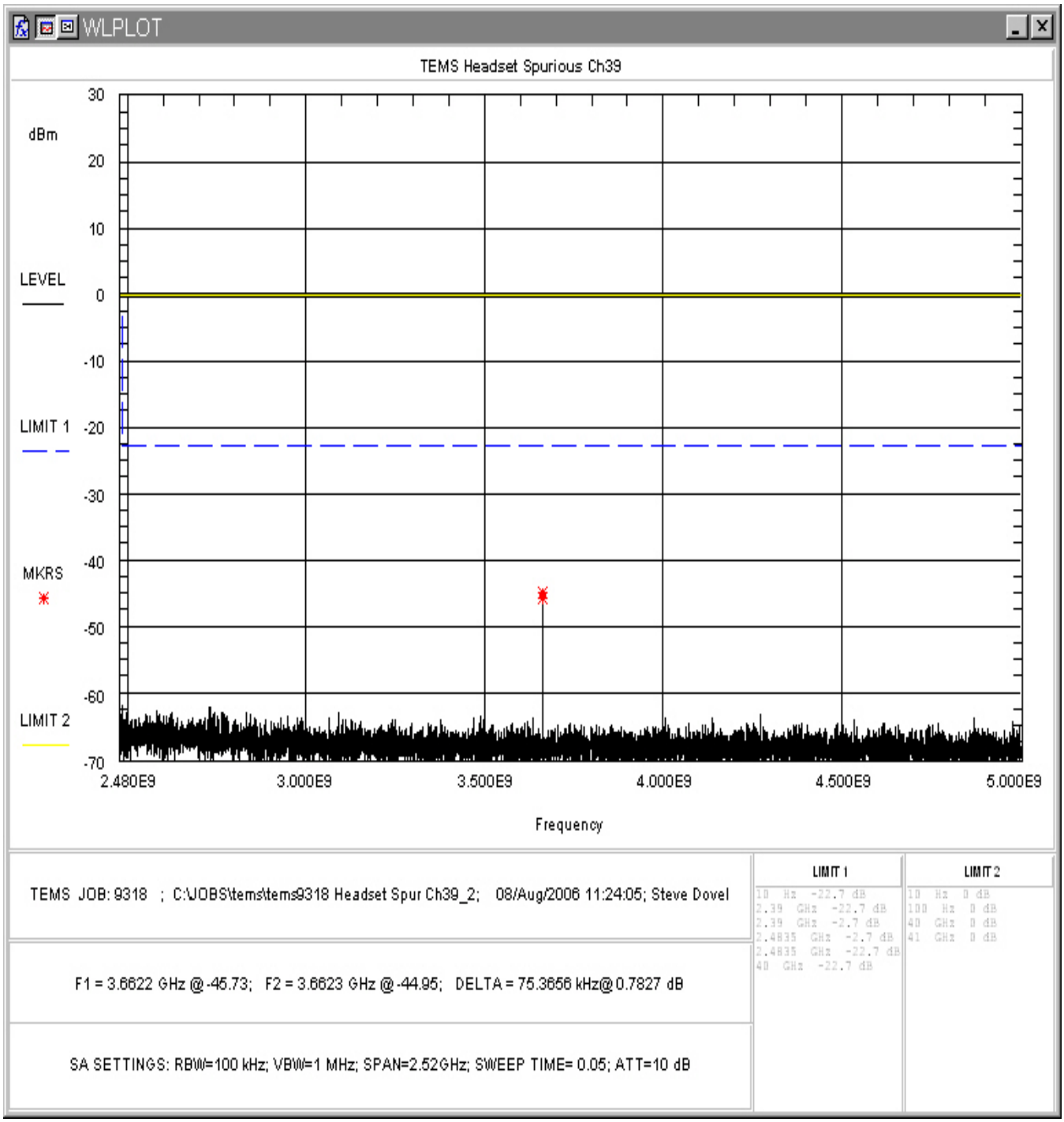

Figure 4-23. Conducted Spurious Emissions, Mid Channel 2.48 –5GHz

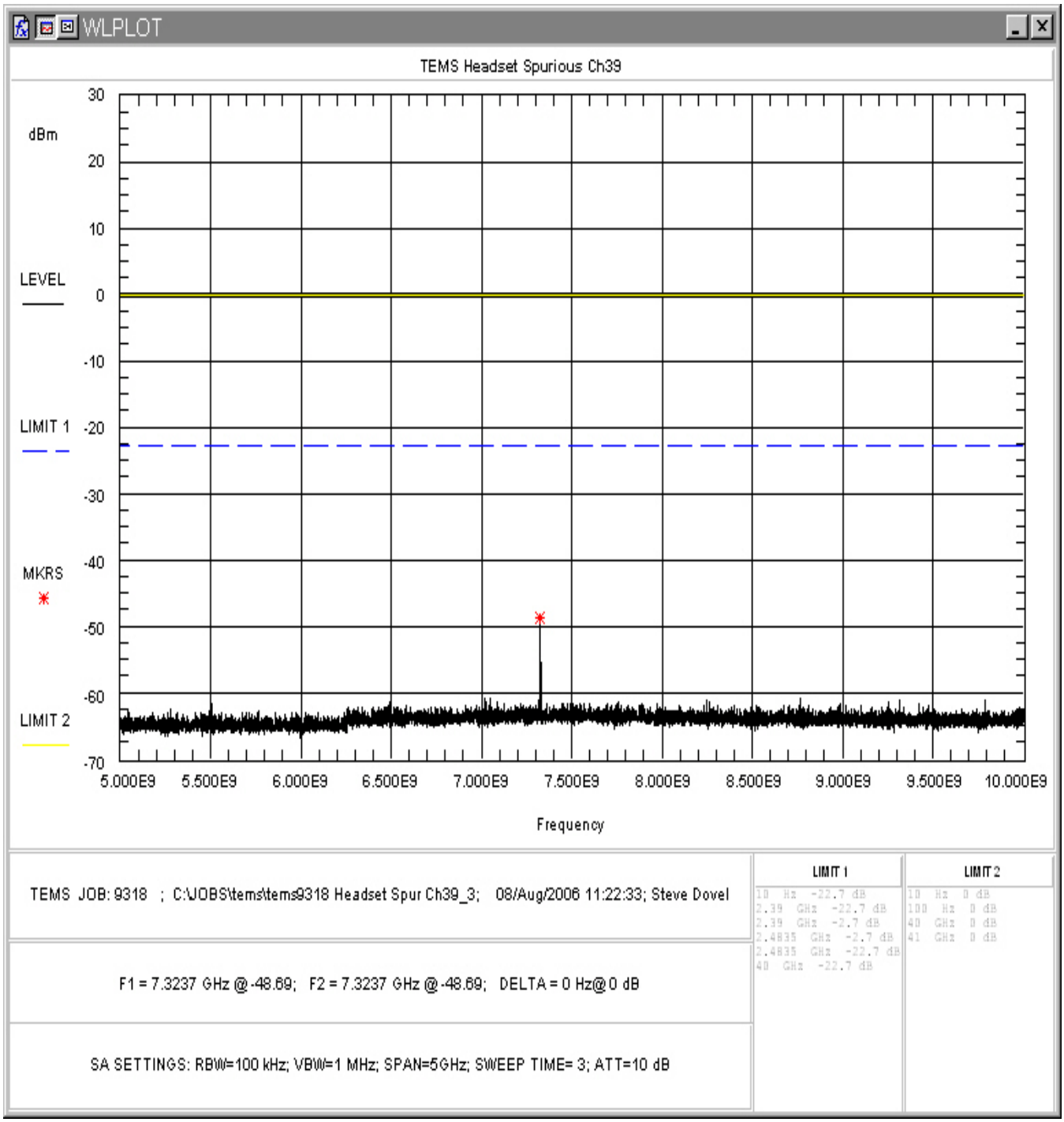

Figure 4-24. Conducted Spurious Emissions, Mid Channel 5 - 10GHz

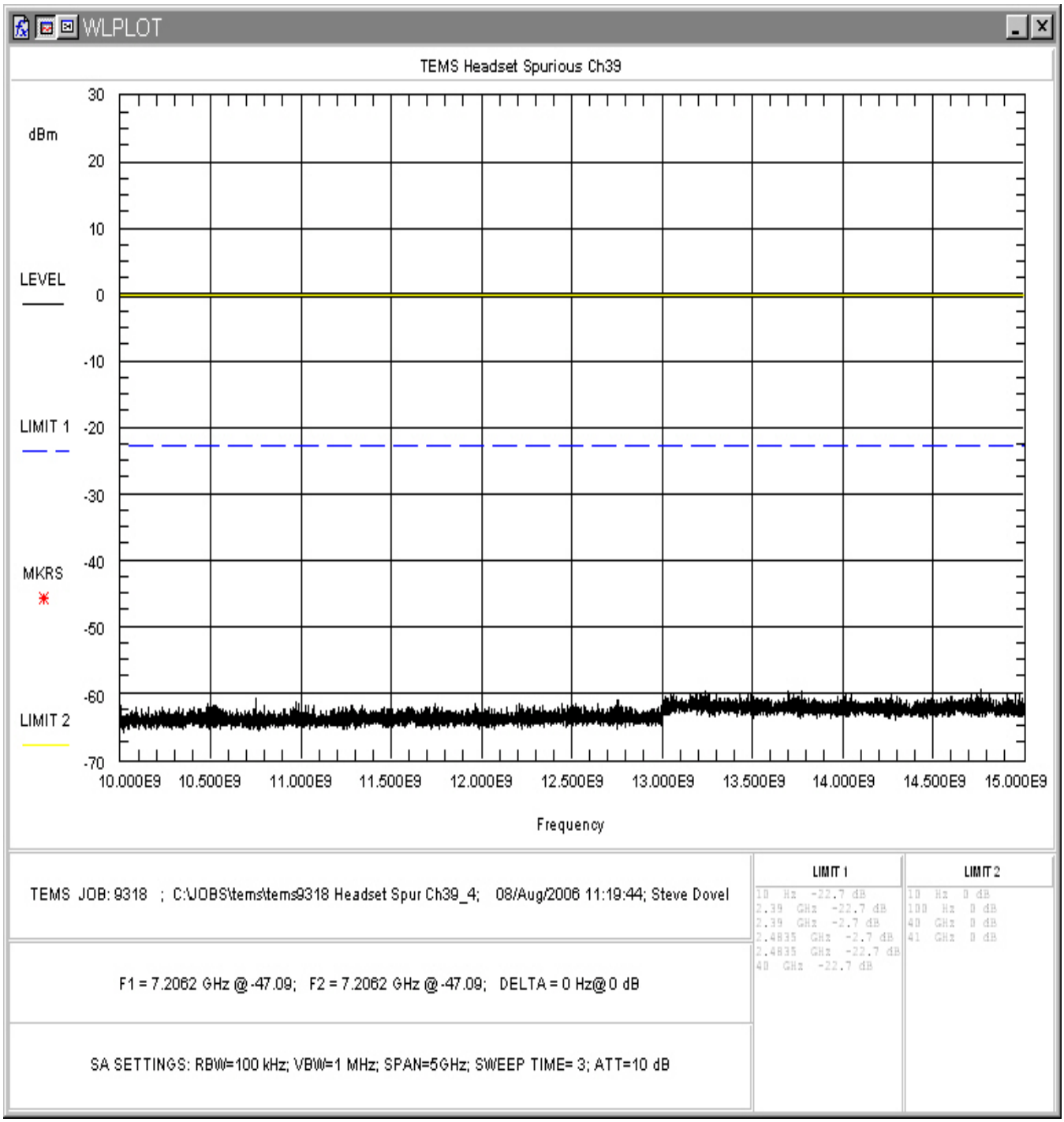

Figure 4-25. Conducted Spurious Emissions, Mid Channel 10 - 15GHz

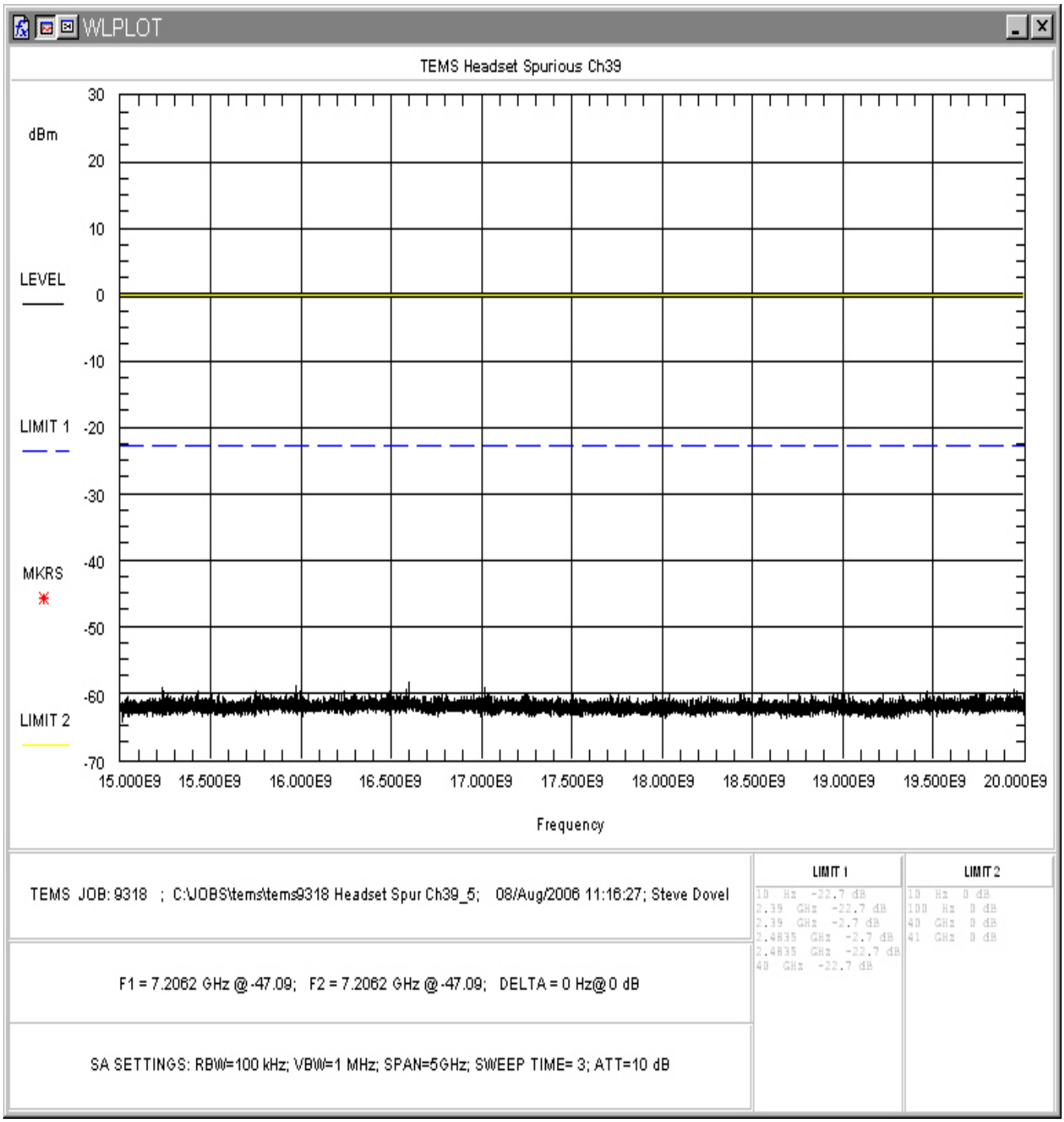

Figure 4-26. Conducted Spurious Emissions, Mid Channel 15 - 20GHz

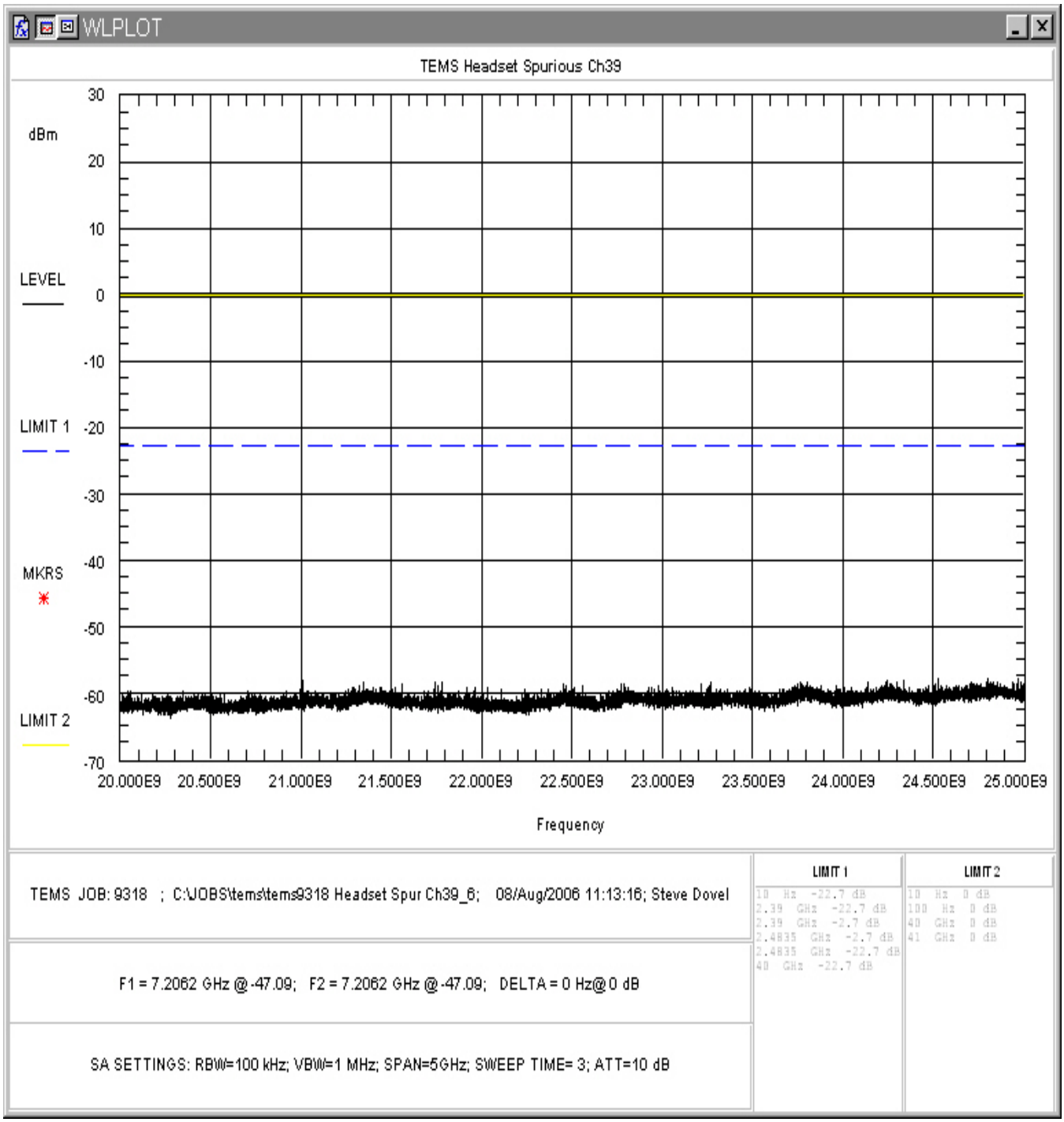

Figure 4-27. Conducted Spurious Emissions, Mid Channel 20 - 25GHz

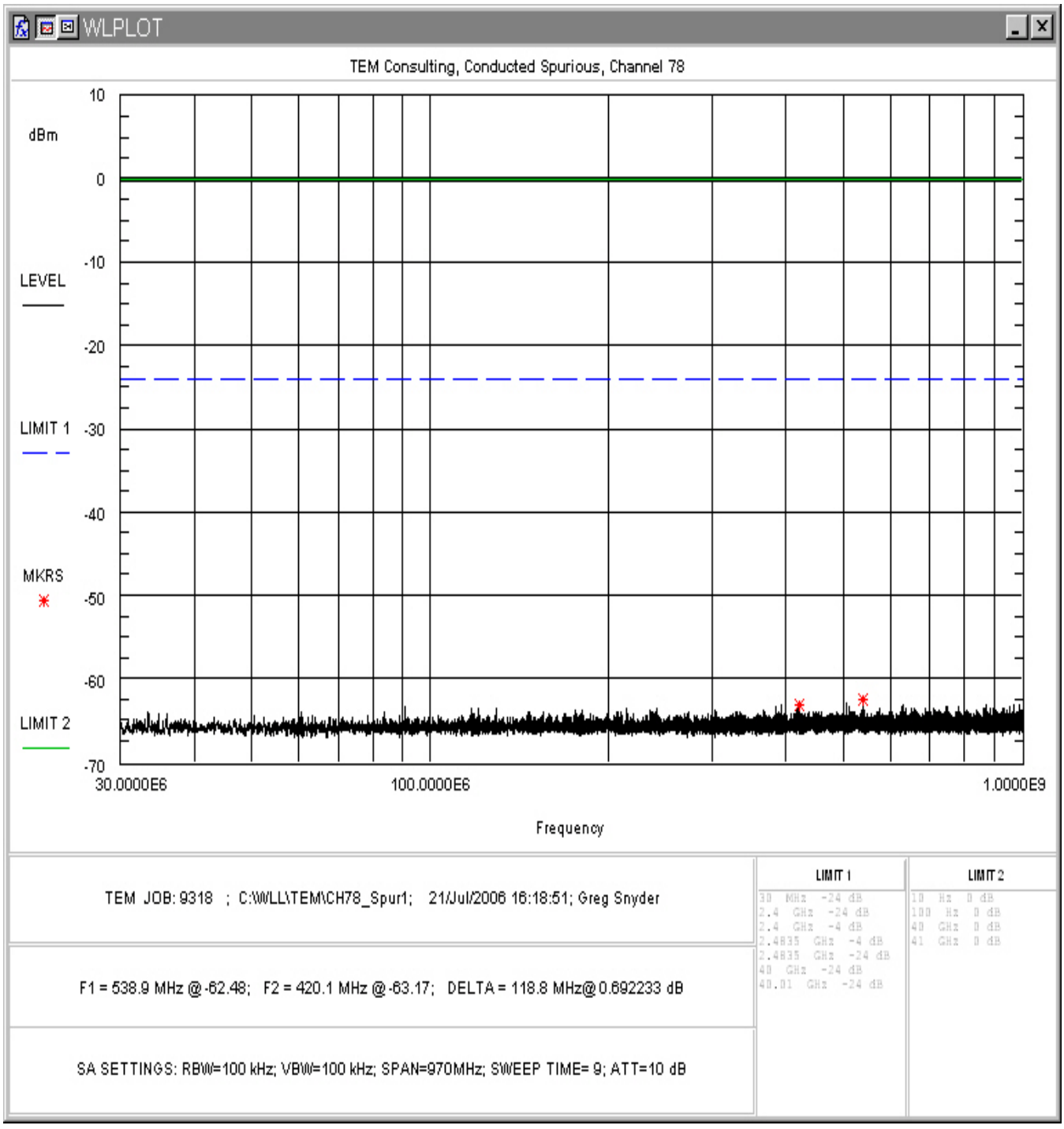

Figure 4-28. Conducted Spurious Emissions, High Channel 30 - 1000MHz

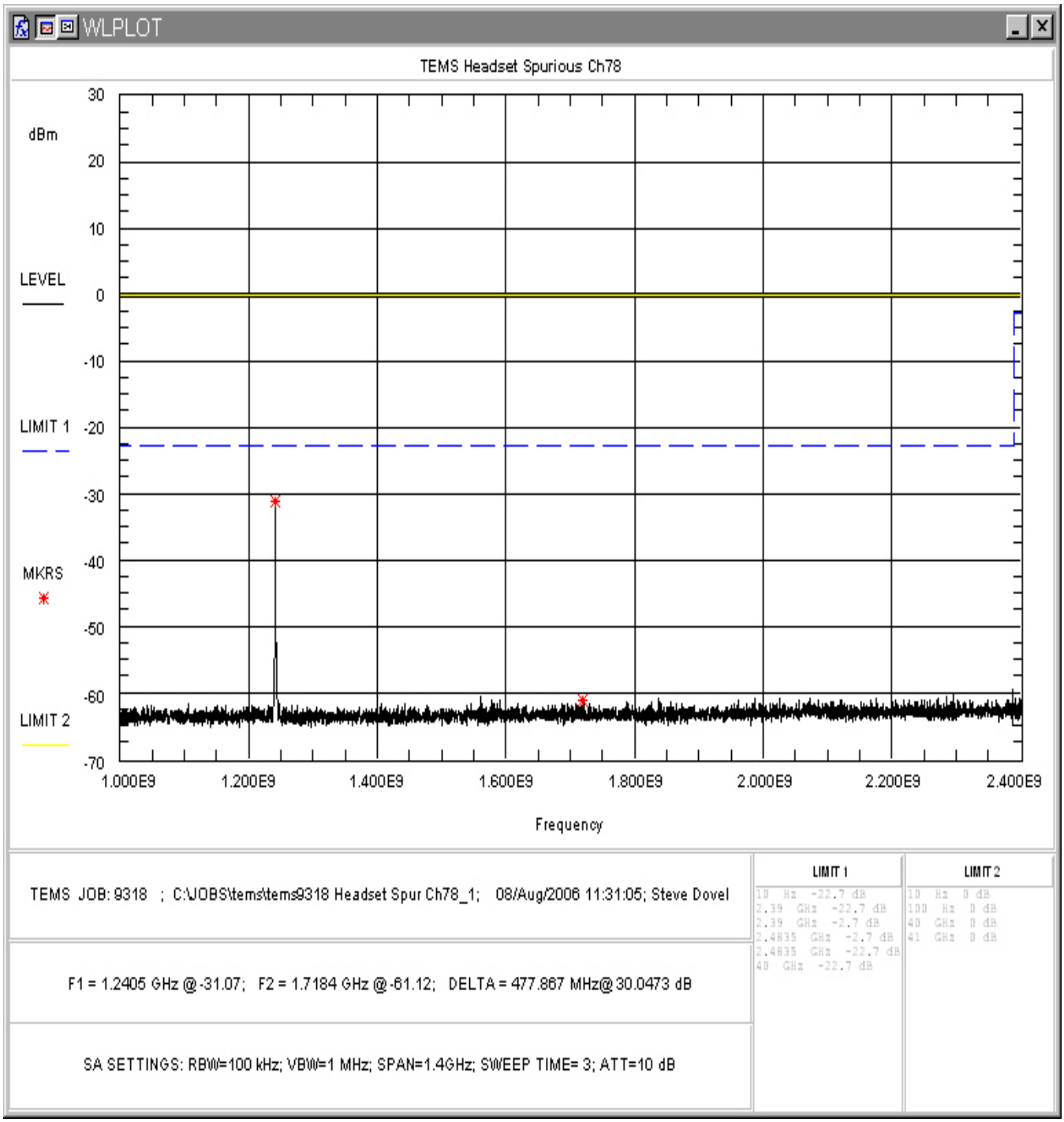

Figure 4-29. Conducted Spurious Emissions, High Channel 1 – 2.4GHz

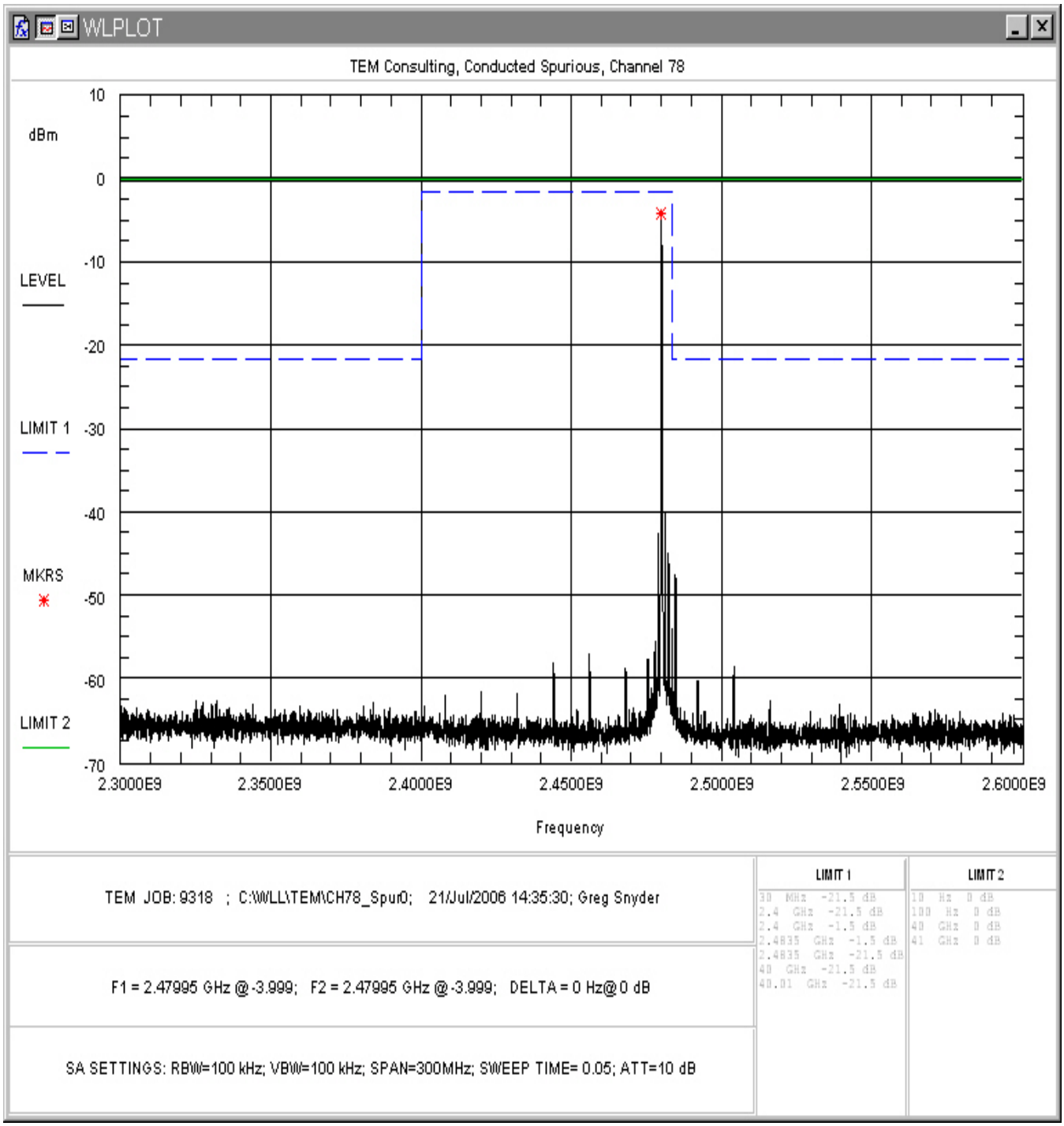

Figure 4-30. Conducted Spurious Emissions, High Channel In-band

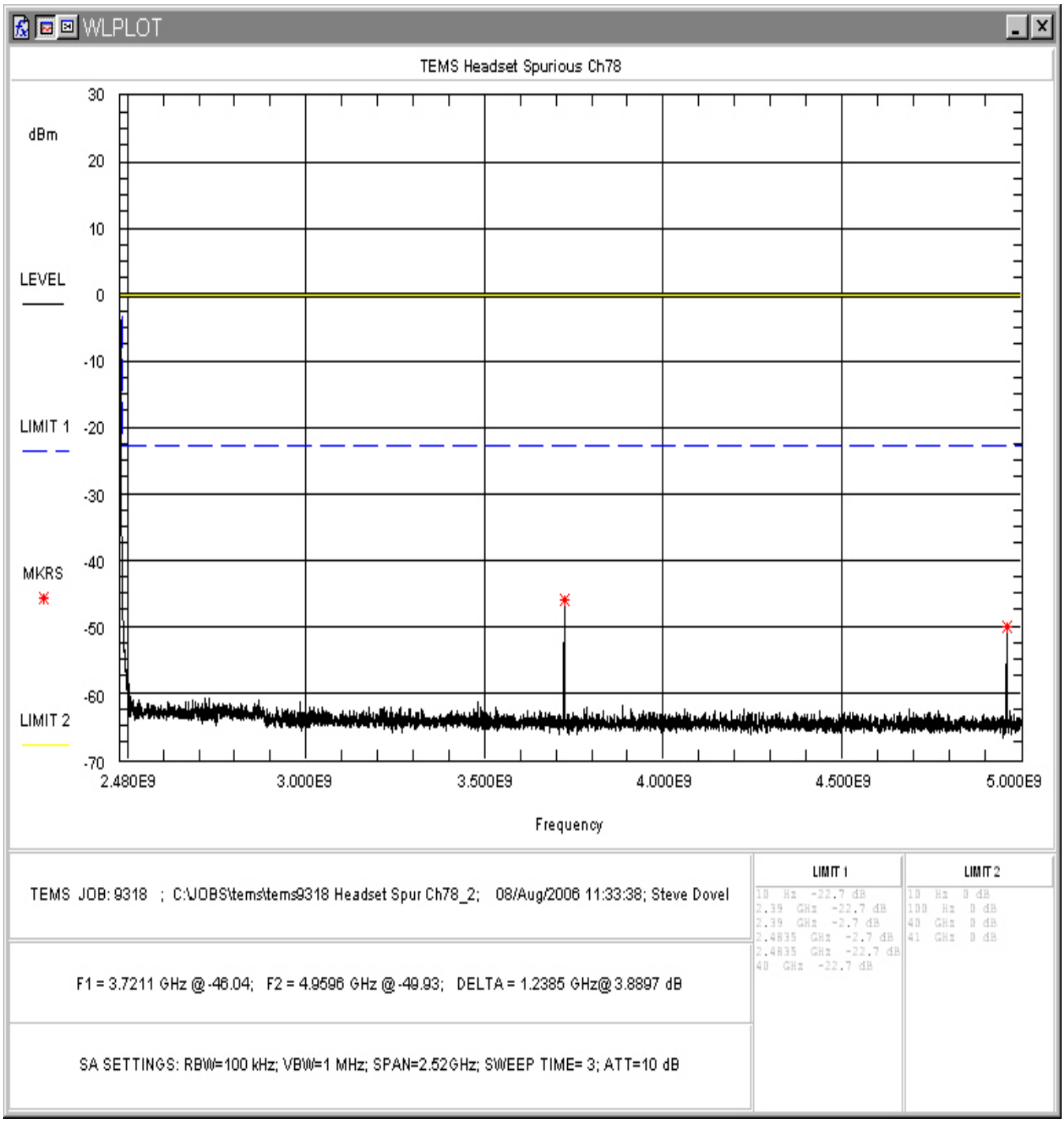

Figure 4-31. Conducted Spurious Emissions, High Channel 2.48 –5GHz

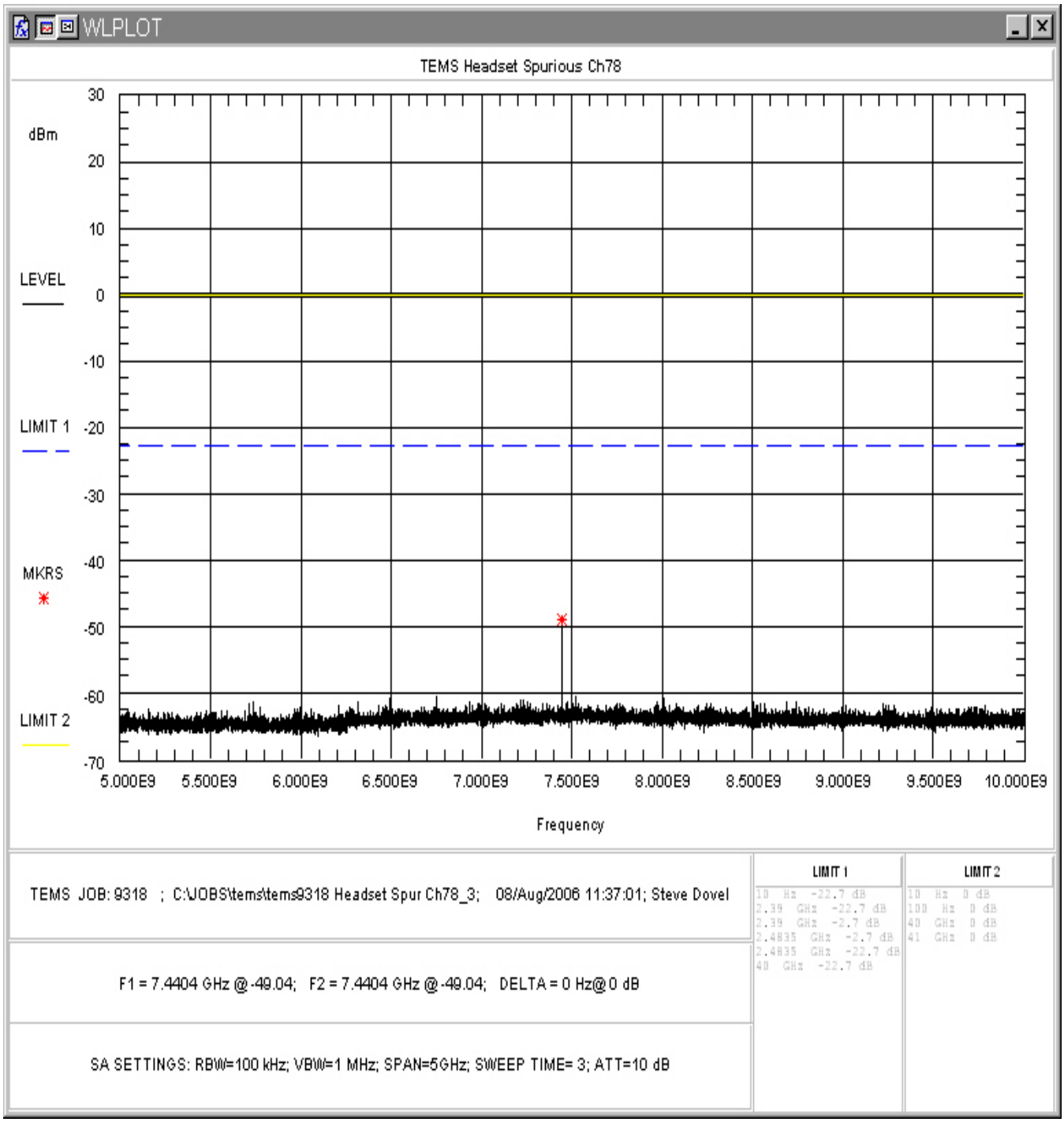

Figure 4-32. Conducted Spurious Emissions, High Channel 5 - 10GHz

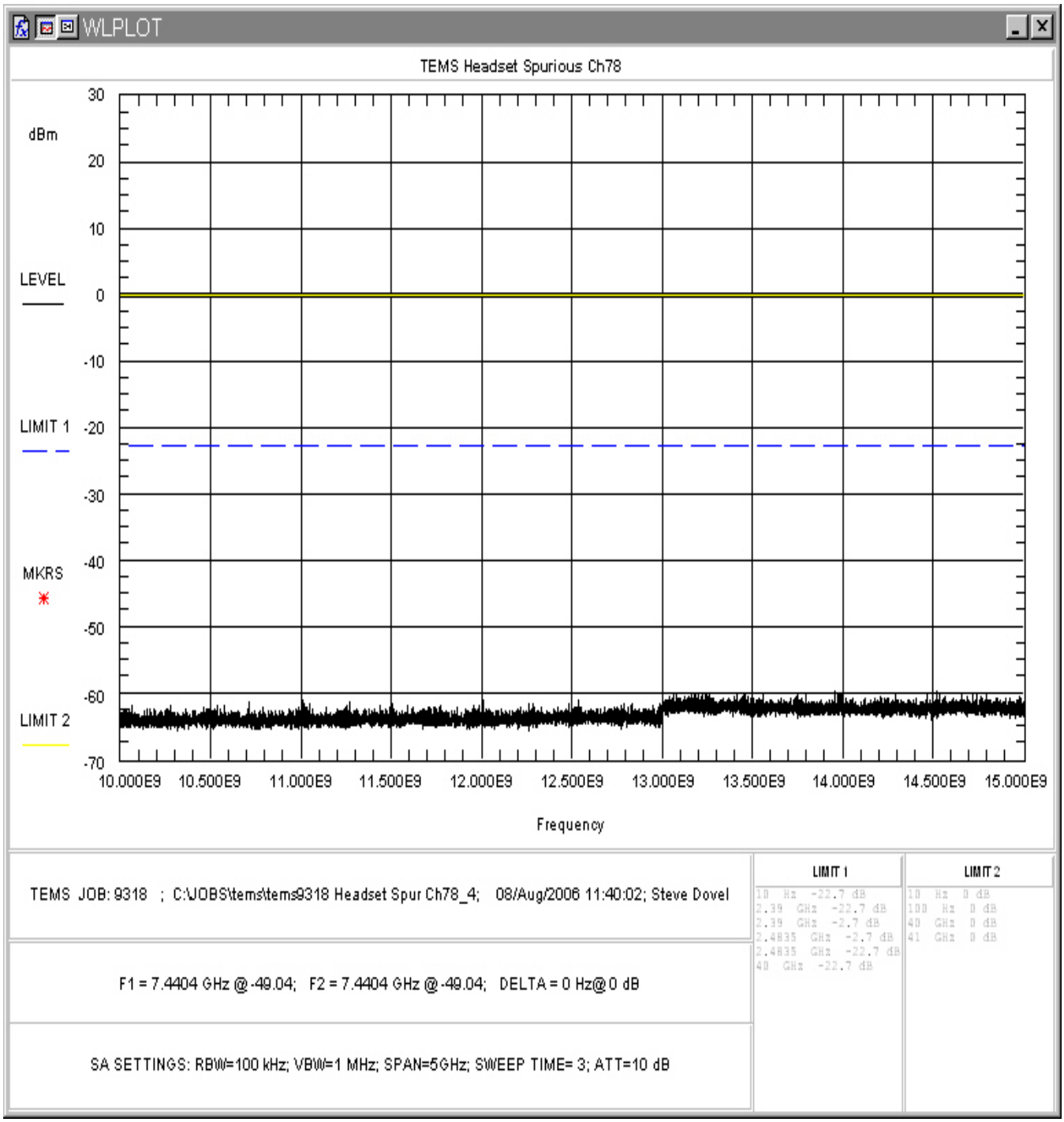

Figure 4-33. Conducted Spurious Emissions, High Channel 10 - 15GHz

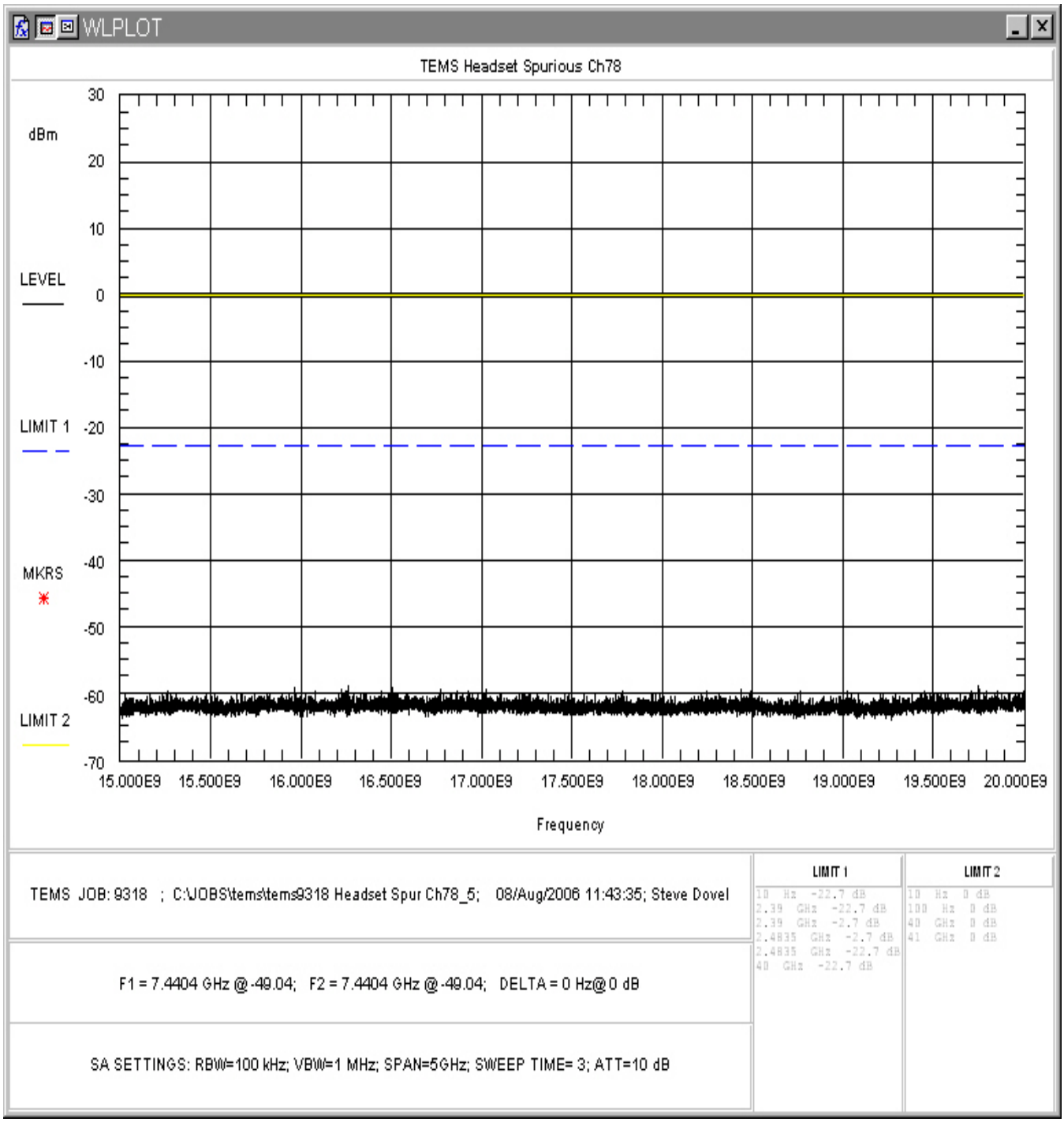

Figure 4-34. Conducted Spurious Emissions, High Channel 15 - 20GHz

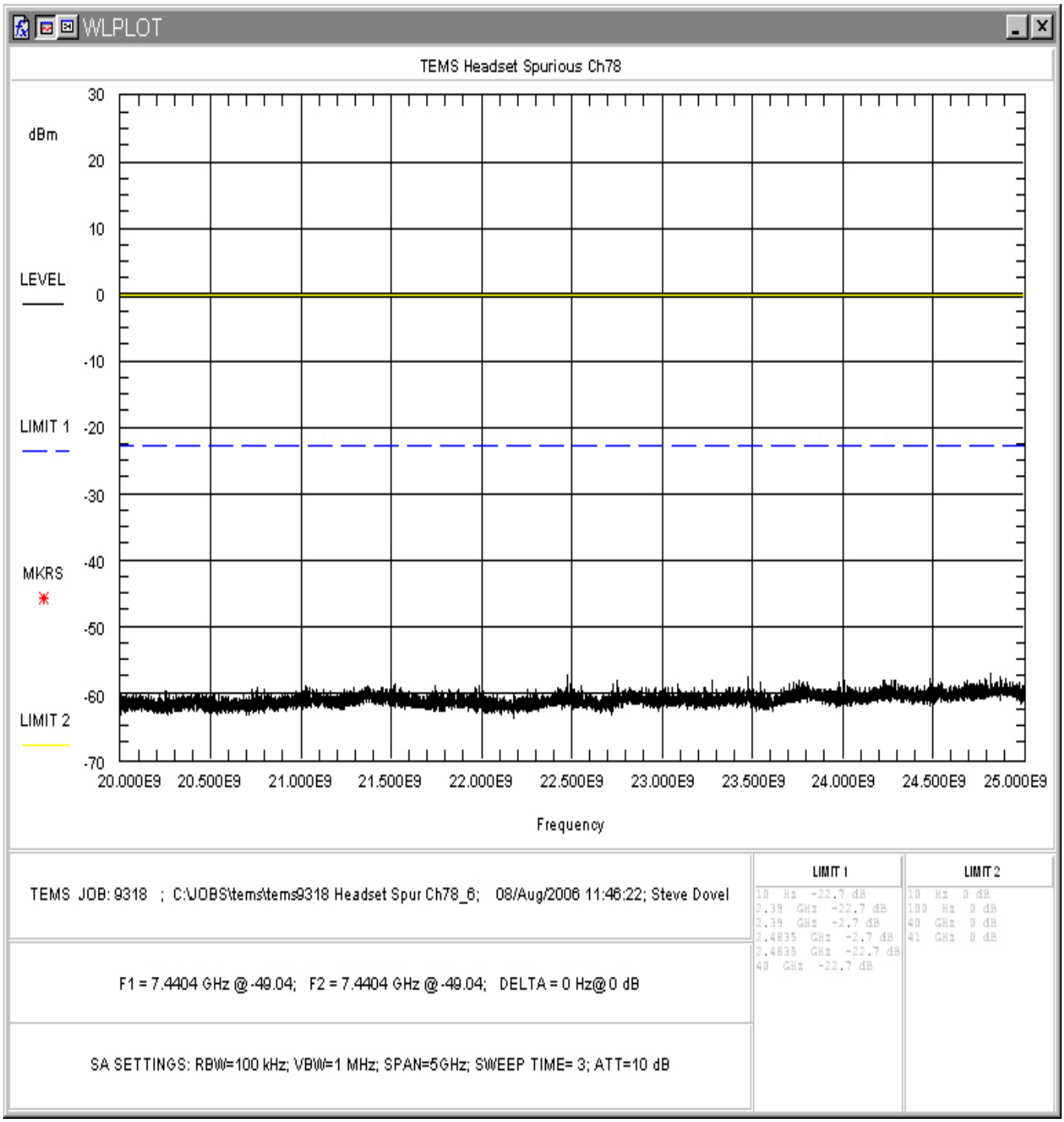

Figure 4-35. Conducted Spurious Emissions, High Channel 20 - 25GHz

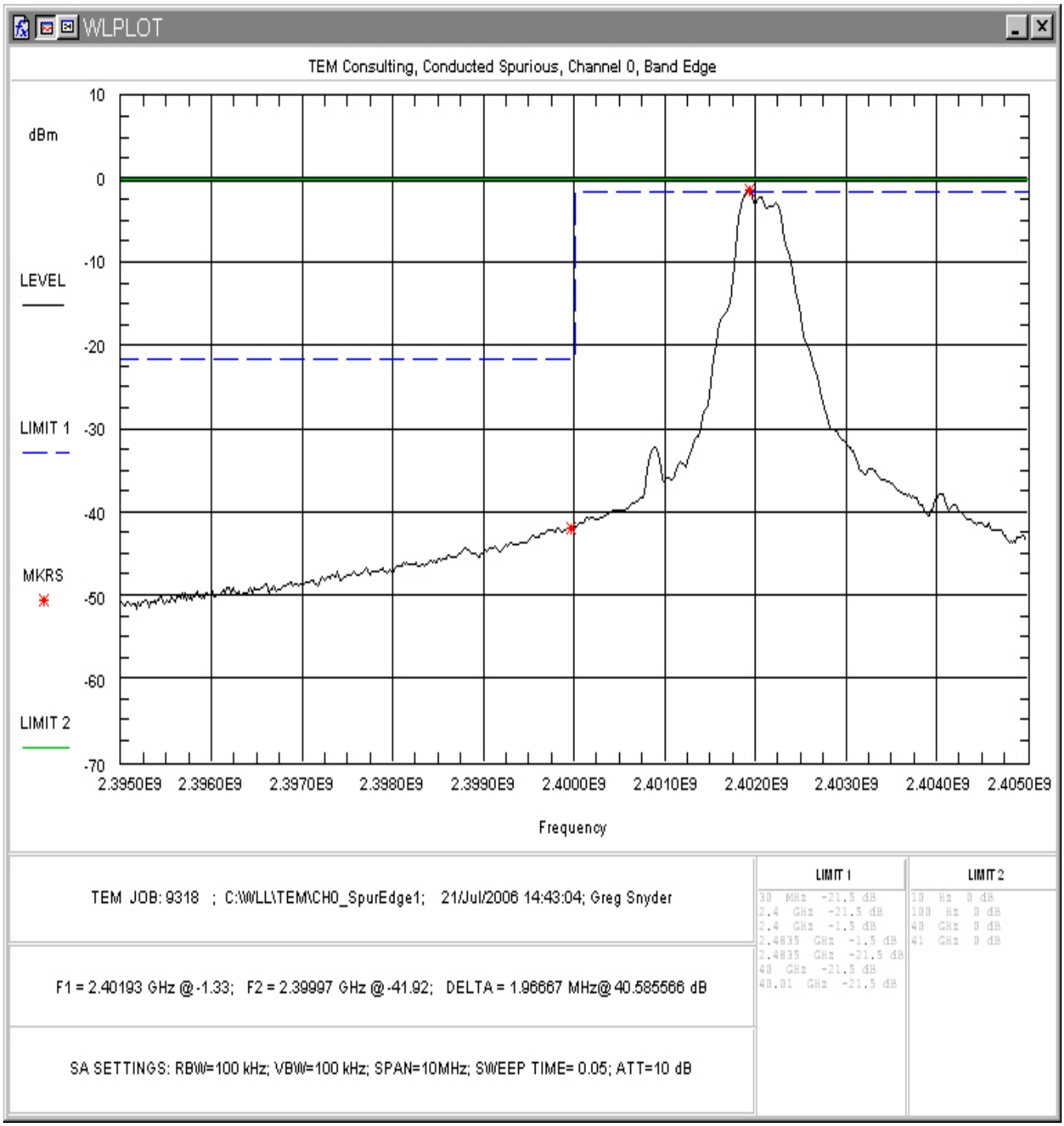

Figure 4-36. Conducted Spurious Emissions, Low Channel Band Edge, Non-hopping

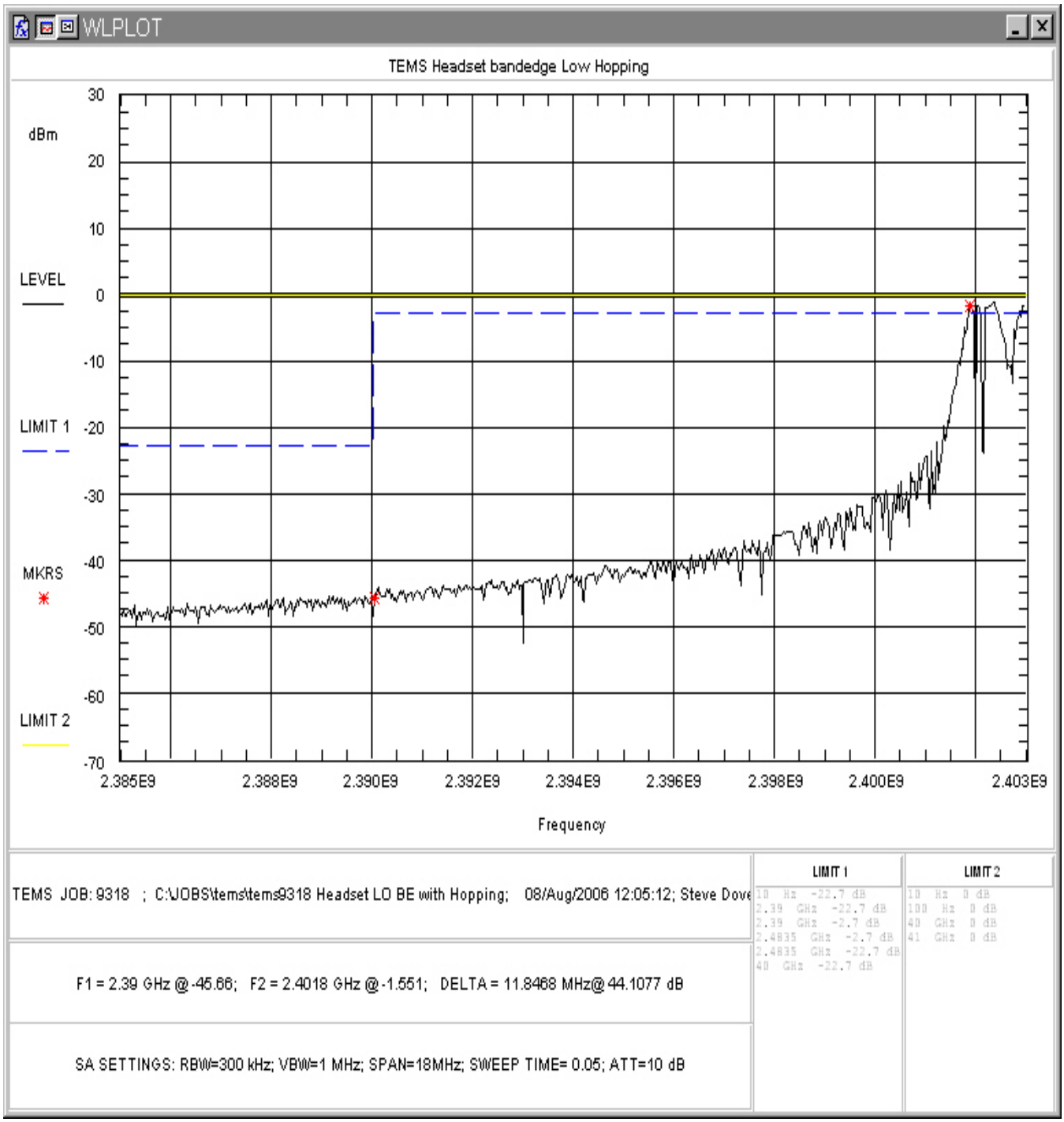

Figure 4-37. Conducted Spurious Emissions, Low Channel Band Edge, Hopping

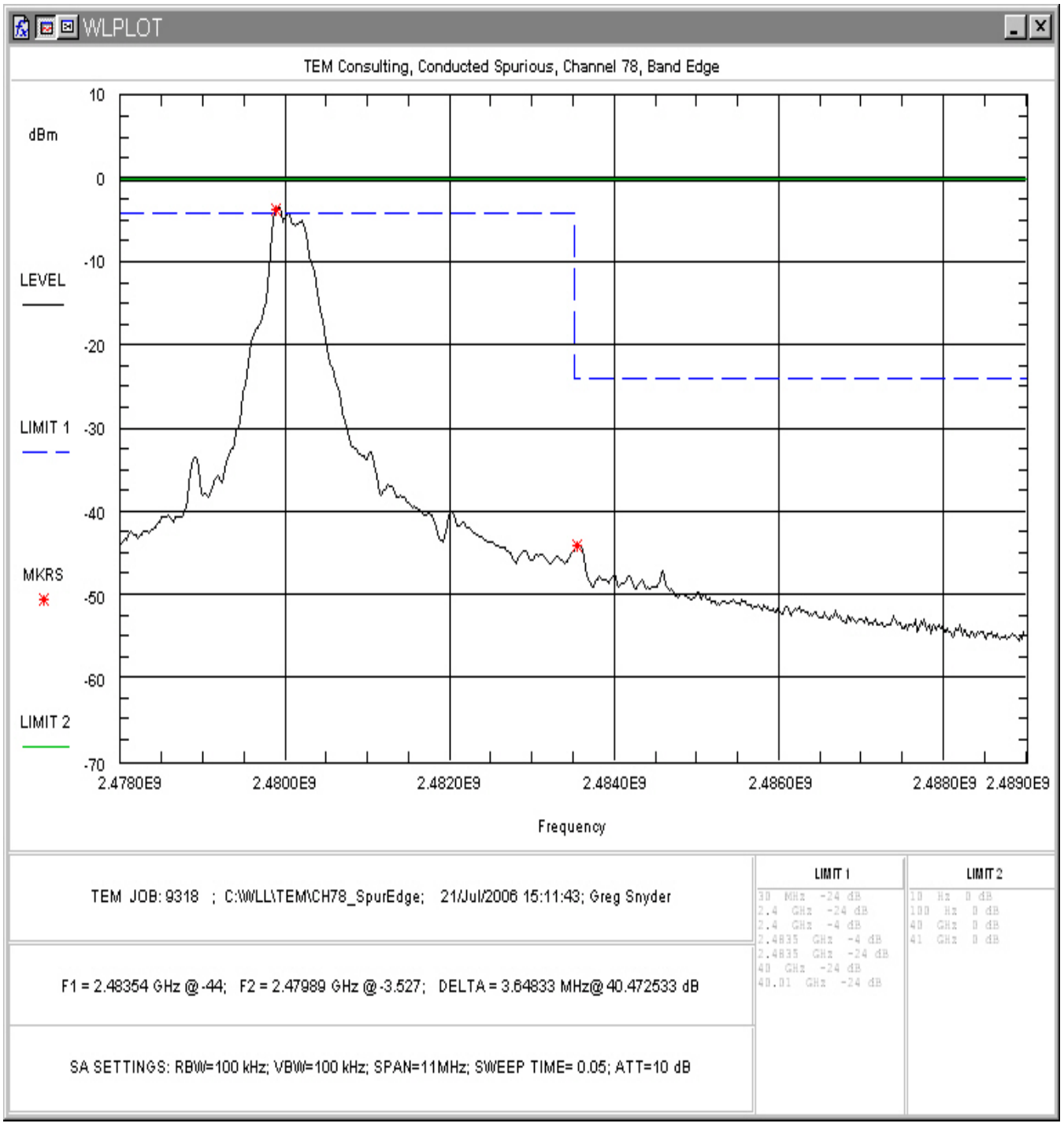

Figure 4-38. Conducted Spurious Emissions, High Channel Band Edge, Non-hopping

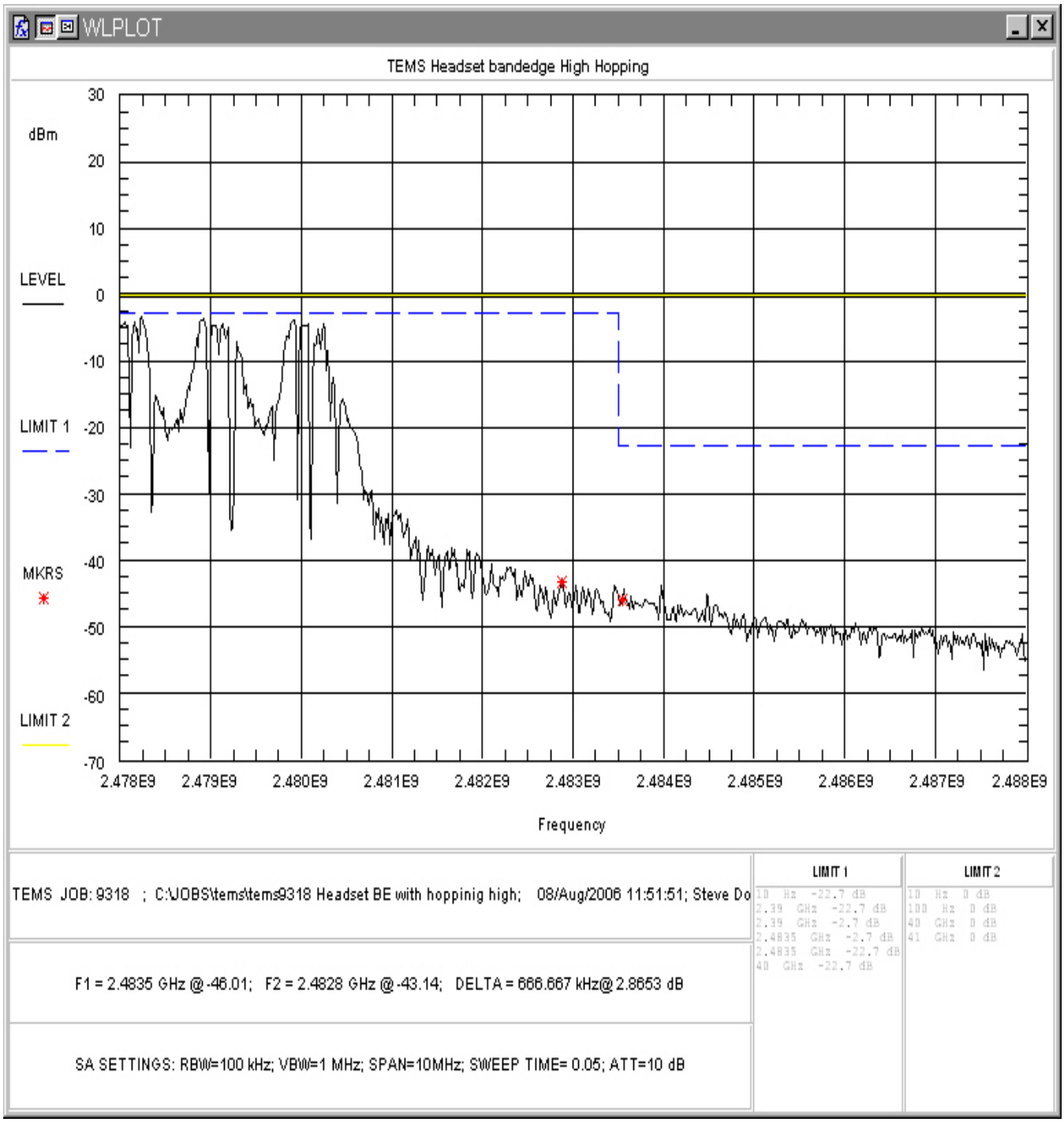

Figure 4-39. Conducted Spurious Emissions, High Channel Band Edge, Hopping

4.7 Radiated Spurious Emissions: (FCC Part §2.1053)

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.

4.7.1 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	>100 kHz
>1000 MHz	1 MHz	<30 Hz (Avg.) 1MHz (Peak)

Harmonic and Spurious emissions that were identified as coming from the EUT were checked in Peak and in Average Mode. It was verified that the peak-to-average ratio did not exceed 20dB.

Peak measurements and average measurements are made. All emissions were determined to have a peak-to-average ratio of less than 20 dB. Also, as described in FCC DA 00-705 if the dwell time per channel of the hopping signal is less than 100 ms then the average reading may be further adjusted by the duty cycle correction factor. No duty cycle correction was applied to the measurements

The following is a sample calculation used in the data tables for calculating the final field strength of spurious emissions and comparing these levels to the specified limits.

Sample Calculation:

Spectrum Analyzer Voltage (SA Level):	V dBµV
Antenna Factor (Ant Corr):	AFdB/m
Cable Loss Correction (Cable Corr):	CCdB
Amplifier Gain:	GdB
Electric Field (Corr Level):	EdBµV/m = VdBµV + AFdB/m + CCdB - GdB
To convert to linear units:	EµV/m = antilog (EdBµV/m/20)

Data are supplied in the following tables. Testing was performed to 25GHz. No emissions were detected above the 3rd harmonic. Emissions below 1GHz are the same for all channels. All detected emissions are reported in the following tables. Both peak and average measurements are listed.

Table 6: Radiated Emission Test Data, Low Frequency Data (<1GHz)

Client:	TEM Cosulting	**Date:**	7/27/2006
Tester:	Steve Dovell	**Job #:**	9219
EUT Information:		**Test Requirements:**	
EUT:	BlueTooth Devices, Headset	TEST STANDARD:	FCC Part 15
Configuration:	Non-hopping Mode	DISTANCE:	3m
		CLASS:	B
Test Equipment (<1GHz):		**Test Equipment (>1GHz):**	
ANTENNA:	A_00557	ANTENNA:	A_00004
CABLE:	CSITE2_3m	CABLE:	CSITE2_HF
LIMIT:	LFCC_3m_Class_B	AMPLIFIER:	A_00066

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
32.740	V	180.0	1.0	2.0	22.5	1.3	25.8	19.6	100.0	-14.2
217.000	V	180.0	1.0	1.0	12.8	2.9	16.6	6.8	200.0	-29.4
276.500	V	180.0	1.0	6.0	13.1	3.2	22.3	13.1	200.0	-23.7
305.120	V	300.0	1.0	3.3	14.1	3.4	20.8	10.9	200.0	-25.2
314.680	V	120.0	1.0	1.0	14.2	3.4	18.6	8.5	200.0	-27.4
324.158	V	140.0	1.0	4.1	14.3	3.5	21.9	12.4	200.0	-24.2
276.500	H	180.0	1.0	3.0	13.1	3.2	19.3	9.3	200.0	-26.7
305.120	H	270.0	1.8	8.9	14.1	3.4	26.4	20.9	200.0	-19.6
314.680	H	270.0	1.3	6.5	14.2	3.4	24.1	16.1	200.0	-21.9
324.158	H	280.0	1.5	6.2	14.3	3.5	24.0	15.8	200.0	-22.1

Table 7: Radiated Emission Test Data, High Frequency Data (>1GHz)

Client: TEM Cosulting
Tester: Steve Dovell
EUT Information:
EUT: BlueTooth Devices
Configuration: Non-Hopping

Date: 8/4/2006
Job #: 9219
Test Requirements:
TEST STANDARD: FCC Part 15
DISTANCE: 3m
CLASS: B

Test Equipment (<1GHz):
ANTENNA: A_00557
CABLE: CSITE2_3m
LIMIT: LFCC_3m_Class_B

Test Equipment (>1GHz):
ANTENNA: A_00425
CABLE: C_00372
AMPLIFIER: A_00522

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)	Notes
CH 1 (2402)												
1201.600	H	22.5	1.0	52.7	25.4	2.2	39.0	41.3	116.1	500.0	-12.7	avg
1201.600	V	22.5	1.0	50.0	25.4	2.2	39.0	38.6	85.1	500.0	-15.4	avg
4804.000	H	0.0	1.0	39.8	32.8	3.2	37.2	38.7	85.7	500.0	-15.3	avg
4804.000	V	0.0	1.0	39.4	32.8	3.2	37.2	38.3	81.9	500.0	-15.7	avg
7205.000	H	180.0	1.0	36.8	36.8	4.0	37.5	40.0	100.4	500.0	-13.9	avg
7205.500	V	0.0	1.0	39.4	36.8	4.0	37.5	42.6	135.5	500.0	-11.3	avg
1201.600	H	22.5	1.0	56.2	25.4	2.2	39.0	44.8	173.7	5000.0	-29.2	Peak
1201.600	V	22.5	1.0	53.7	25.4	2.2	39.0	42.3	130.2	5000.0	-31.7	Peak
4804.000	H	0.0	1.0	41.9	32.8	3.2	37.2	40.8	109.2	5000.0	-33.2	Peak
4804.000	V	0.0	1.0	42.5	32.8	3.2	37.2	41.4	117.0	5000.0	-32.6	Peak
7205.000	H	180.0	1.0	45.0	36.8	4.0	37.5	48.2	258.2	5000.0	-25.7	Peak
7205.500	V	0.0	1.0	45.7	36.8	4.0	37.5	48.9	279.8	5000.0	-25.0	Peak
CH40 (2441)												
1201.600	H	180.0	1.0	58.7	25.4	2.2	39.0	47.3	231.6	500.0	-6.7	avg
1201.600	V	180.0	1.0	56.6	25.4	2.2	39.0	45.2	181.8	500.0	-8.8	avg
4882.000	H	180.0	1.0	41.0	33.0	3.3	37.2	40.1	101.5	500.0	-13.9	avg
4882.000	V	180.0	1.0	39.8	33.0	3.3	37.2	38.9	88.4	500.0	-15.1	avg
4882.000	H	180.0	1.0	44.7	33.0	3.3	37.2	43.8	155.4	5000.0	-30.2	Peak
4882.000	V	180.0	1.0	45.0	33.0	3.3	37.2	44.1	160.8	5000.0	-29.9	Peak
7322.600	H	180.0	1.0	46.8	36.9	4.0	37.6	50.1	320.2	5000.0	-23.9	Peak
7322.700	V	180.0	1.0	47.3	36.9	4.0	37.6	50.6	339.1	5000.0	-23.4	Peak
CH78 (2480)												
1201.600	H	0.0	1.0	56.0	25.4	3.6	39.0	46.0	239.9	500.0	-8.0	Avg

1201.600	V	0.0	1.0	52.8	25.4	3.6	39.0	42.8	239.9	500.0	-11.2	Avg
4960.000	H	90.0	1.0	42.1	33.2	3.6	37.2	41.7	239.9	500.0	-12.3	Avg
4960.000	V	90.0	1.0	37.0	33.2	3.6	37.2	36.6	239.9	500.0	-17.4	Avg
7439.500	H	0.0	1.0	38.0	37.0	3.6	37.6	41.0	239.9	500.0	-13.0	Avg
7439.000	V	0.0	1.0	38.8	37.0	3.6	37.6	41.8	239.9	500.0	-12.2	Avg
1201.600	H	0.0	1.0	57.5	25.4	3.6	39.0	47.5	239.9	5000.0	-26.5	Peak
1201.600	V	0.0	1.0	54.3	25.4	3.6	39.0	44.3	239.9	5000.0	-29.7	Peak
4960.000	V	90.0	1.0	45.7	33.2	1.5	37.2	43.3	1382.7	5000.0	-30.7	Peak
4960.000	H	90.0	1.0	41.9	33.2	1.5	37.2	39.5	1382.7	5000.0	-34.5	Peak
7439.000	V	0.0	1.0	47.7	37.0	1.5	37.6	48.6	403.4	5000.0	-25.4	Peak
7439.500	H	0.0	1.0	48.0	37.0	1.5	37.6	48.9	403.4	5000.0	-25.1	Peak

4.8 AC Powerline Conducted Emissions: (FCC Part §15.207 and RSS-GEN)

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 and data cables were moved about to obtain maximum emissions.

The 50Ω 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 peak measurements.

Data is recorded in the following table.

Table 8. AC Power line Conducted Emissions

LINE 1 - NEUTRAL

Frequency (MHz)	Level QP (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Limit QP (dBµV)	Level Corr (dBµV)	Margin QP dB)	Level AVG (dBµV)	Cable Loss (dB)	Level Corr (dBµV)	Limit AVG (dBµV)	Margin AVG (dB)
0.159	12.9	10.1	0.7	65.5	23.8	-41.8	-0.1	10.1	10.8	55.5	-44.8
0.205	7.9	10.2	0.5	63.4	18.6	-44.8	1.0	10.2	11.7	53.4	-41.7
5.250	7.9	10.8	0.8	60.0	19.6	-40.4	-6.0	10.8	5.7	50.0	-44.3
17.280	7.7	12.2	2.7	60.0	22.6	-37.4	-6.0	12.2	8.9	50.0	-41.1
28.150	7.9	12.7	5.0	60.0	25.6	-34.4	-5.5	12.7	12.2	50.0	-37.8
29.370	6.4	12.8	5.2	60.0	24.4	-35.6	-5.4	12.8	12.6	50.0	-37.4

LINE 2 - PHASE

Frequency (MHz)	Level QP (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Limit QP (dBµV)	Level Corr (dBµV)	Margin QP dB)	Level AVG (dBµV)	Cable Loss (dB)	Level Corr (dBµV)	Limit AVG (dBµV)	Margin AVG (dB)
0.151	38.4	10.1	0.4	66.0	48.9	-17.0	18.0	10.1	28.5	56.0	-27.4
0.218	36.8	10.2	0.3	62.9	47.2	-15.7	12.6	10.2	23.0	52.9	-29.9
0.358	23.8	10.2	0.2	58.8	34.2	-24.5	17.8	10.2	28.2	48.8	-20.5
10.600	20.7	11.7	1.8	60.0	34.1	-25.9	10.7	11.7	24.1	50.0	-25.9
16.540	14.0	12.1	3.4	60.0	29.6	-30.4	1.4	12.1	17.0	50.0	-33.0
29.520	7.5	12.8	6.2	60.0	26.5	-33.5	-4.6	12.8	14.4	50.0	-35.6

