Washington Laboratories, Ltd.

7560 Lindbergh Drive Gaithersburg, Maryland 20879 (301) 216-1500 Fax (301) 216-1590

FCC Certification Test Report

For the

Cervis Inc.

RFM307

FCC ID: LOBSRF307

WLL JOB# **10930**
June 3, 2009

Prepared for:

Cervis Inc.
170 Thorn Hill Road
Warrendale, PA 15086

Prepared By:

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

ACCREDITED
Testing Certificate 2675.01

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Prepared by:

Steven Dovell
Compliance Engineer

Reviewed by:

Steven D. Koster
EMC Laboratory Manager

Abstract

This report has been prepared on behalf of Cervis 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 (9/2007) 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 a Cervis Inc. RFM307.

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 Cervis Inc. RFM307 complies with the limits for a Direct Sequence Spread Spectrum Transmitter device under FCC Part 15.247.

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1 Introduction

1.1 Compliance Statement

The Cervis Inc. RFM307 complies with the limits for a Direct Sequence Spread Spectrum Transmitter device under FCC Part 15.247 and 15.212(7/2008).

1.2 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.

1.3 Contract Information

Customer:	Cervis Inc. 170 Thorn Hill Road Warrendale, PA 15086
Purchase Order Number:	50651
Quotation Number:	64861

1.4 Test Dates

Testing was performed on the following date(s):	5/6/09 - 5/8/09

1.5 Test and Support Personnel

Washington Laboratories, LTD	Steven Dovell
Client Representative	John Rose

1.6 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	**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 Cervis Inc. RFM307 is a Direct Sequence Spread Spectrum Split Module operating in the 2.405GHz – 2.480GHz Band.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Cervis Inc.
FCC ID:	LOBSRF307
Model:	RFM307
FCC Rule Parts:	§15.247
Frequency Range:	2.405GHz – 2.480GHz
Maximum Output Power:	1.929mW (2.8545dBm)
Modulation:	O-QPSK
Occupied Bandwidth:	1.546MHz
Keying:	Automatic, Manual
Type of Information:	Data
Number of Channels:	26
Power Output Level	Two settings - +3dBm & -17dBm
Antenna Connector	U.FL coaxial cable jack
Antenna Type	Strip line +2dBi, Dipole +2dBi
Interface Cables:	coax
Power Source & Voltage:	13.5VDC

2.2 Test Configuration

The RFM307 was test with the BU200 Cervis SmarRT Base unit as a host which was configured via a Laptop serial link. Power was supplied by a variable DC Lab power supply attached to the Base unit.

The RFM307 can be operated at two power levels, +3dBm and -17dBm. The +3dBm level is used for normal operation while the -17dBm is used to configure the remote to the base unit.

2.3 Testing Algorithm

The RFM307 was programmed for DSSS operation via HyperTerm running on a laptop. Transmit frequencies and power settings were controlled by serial communication commands.

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

2.5 Measurements

2.5.1 References

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

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

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. 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

Test Name:	**Radiated Emissions**	Test Date:	**05/08/2009**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
382	Sunol, JB1	Antenna, Biconlog	01/27/2010
68	HP, 85650A	Adapter, QP	07/07/2009
72	HP, 8568B	Analyzer, Spectrum	07/03/2009
70	HP, 85685A	Preselector, RF w/opt 8ZE	07/07/2009
528	Agilent, E4446A	Analyzer, Spectrum	05/30/2009
522	HP, 8449B	Pre-Amplifier, 1-26.5GHz	07/15/2009
626	ARA, DRG-118/A	Antenna, Horn	05/22/2009
667	MegaPhase, LLC EM18-S1NK5-600	Test cable for OATS testing DC to 18 GHz SMA male	04/23/2010
67	HP, 8564E	Analyzer, Spectrum	10/10/2009
641	HQ Power PS5005U	Variable Power supply	CNR

4 Test Summary

The Table Below shows the results of testing for compliance with a Digital Transmission System in accordance with FCC Part 15.247:2007 and RSS210e issue 7. Full results are shown in section 5.

Table 3: Test Summary Table

TX Test Summary (Direct Sequence Spread Spectrum)		
FCC Rule Part	**Description**	**Result**
15.247 (a)(1)(iii)	20dB Bandwidth	Pass
15.247 (b)(1)	Transmit Output Power	Pass
15.247 (d)	Occupied BW / Out-of-Band Emissions (Band Edge @ 20dB below)	Pass
15.247 (e)	Power Spectral Density	Pass
15.205 15.209	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	AC Conducted Emissions	N/A (Battery Operated)

5 Test Results

5.1 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. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system.

Table 4. RF Power Output +3dBm Setting

Frequency	Level	Limit	Pass/Fail
Low Channel: 2.405 GHz	2.701 dBm	30 dBm	Pass
Mid Channel: 2.445 GHz	2.536 dBm	30 dBm	Pass
High Channel: 2.480 GHz	2.854 dBm	30 dBm	Pass

Table 5. RF Power Output -17dBm Setting

Frequency	Level	Limit	Pass/Fail
Low Channel: 2.405 GHz	-17.58 dBm	30 dBm	Pass
Mid Channel: 2.445 GHz	-17.39 dBm	30 dBm	Pass
High Channel: 2.480 GHz	-17.12 dBm	30 dBm	Pass

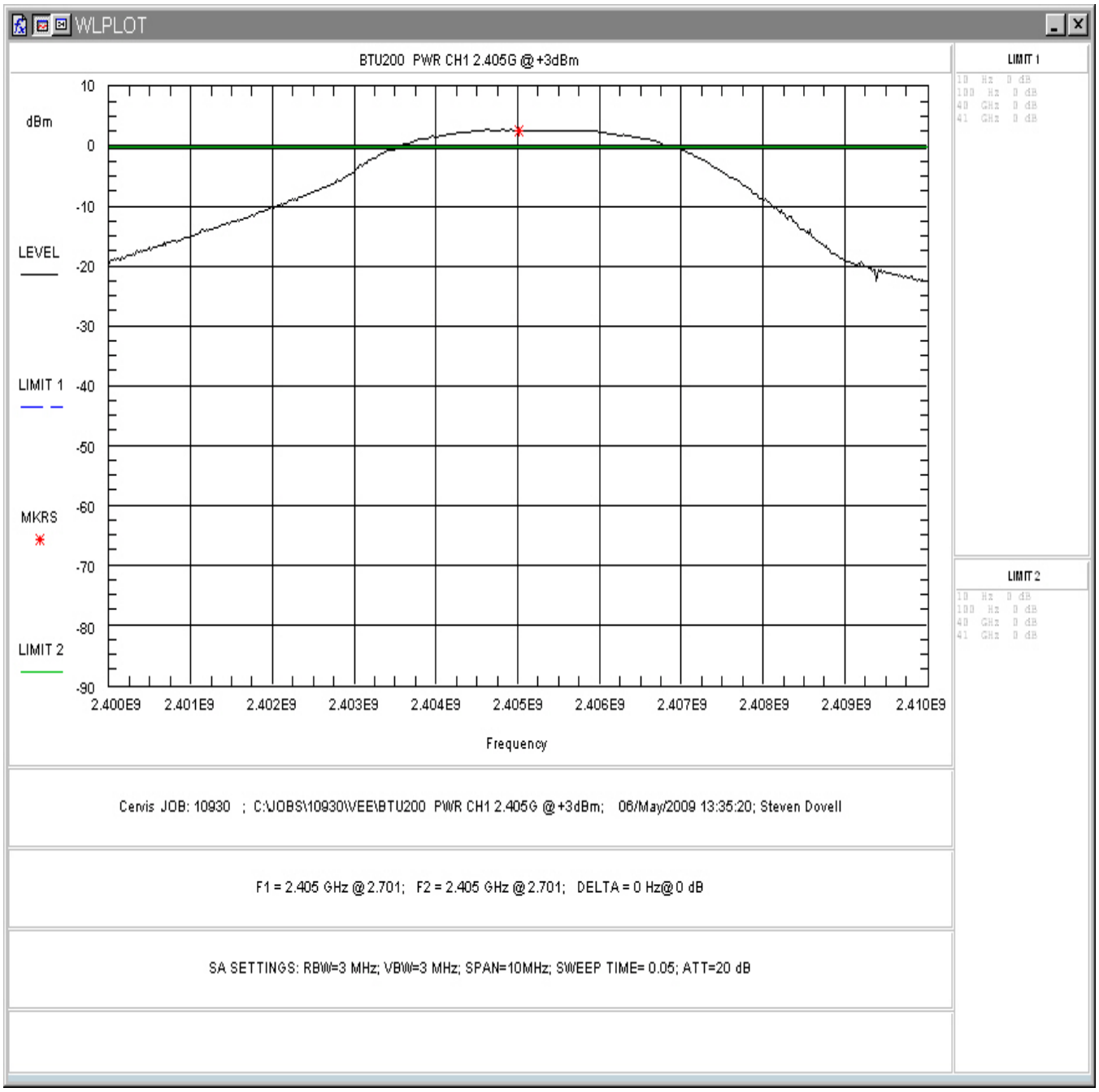

Figure 5-1. RF Peak Power, Low Channel +3dBm Setting

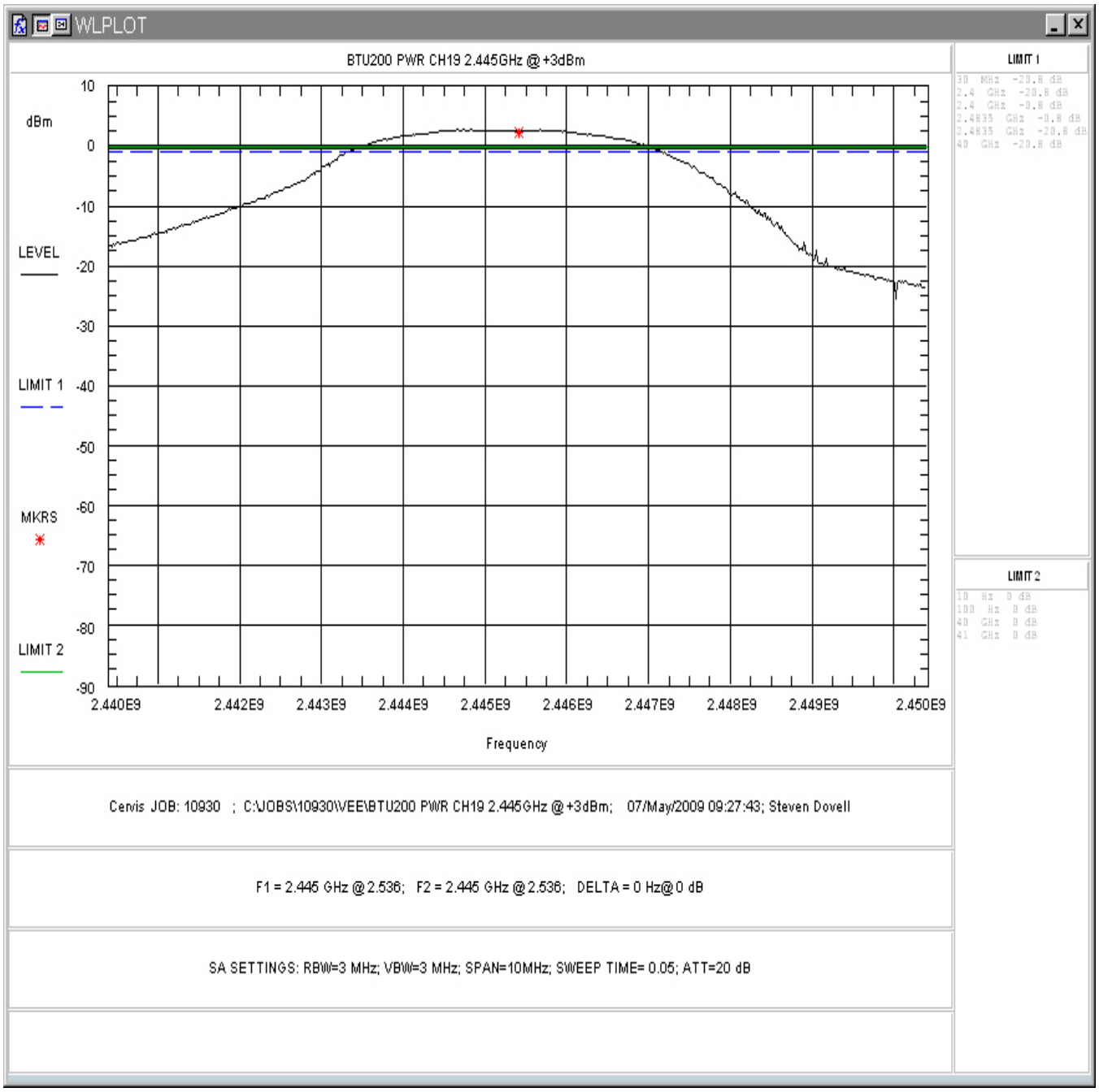

Figure 5-2. RF Peak Power, Mid Channel

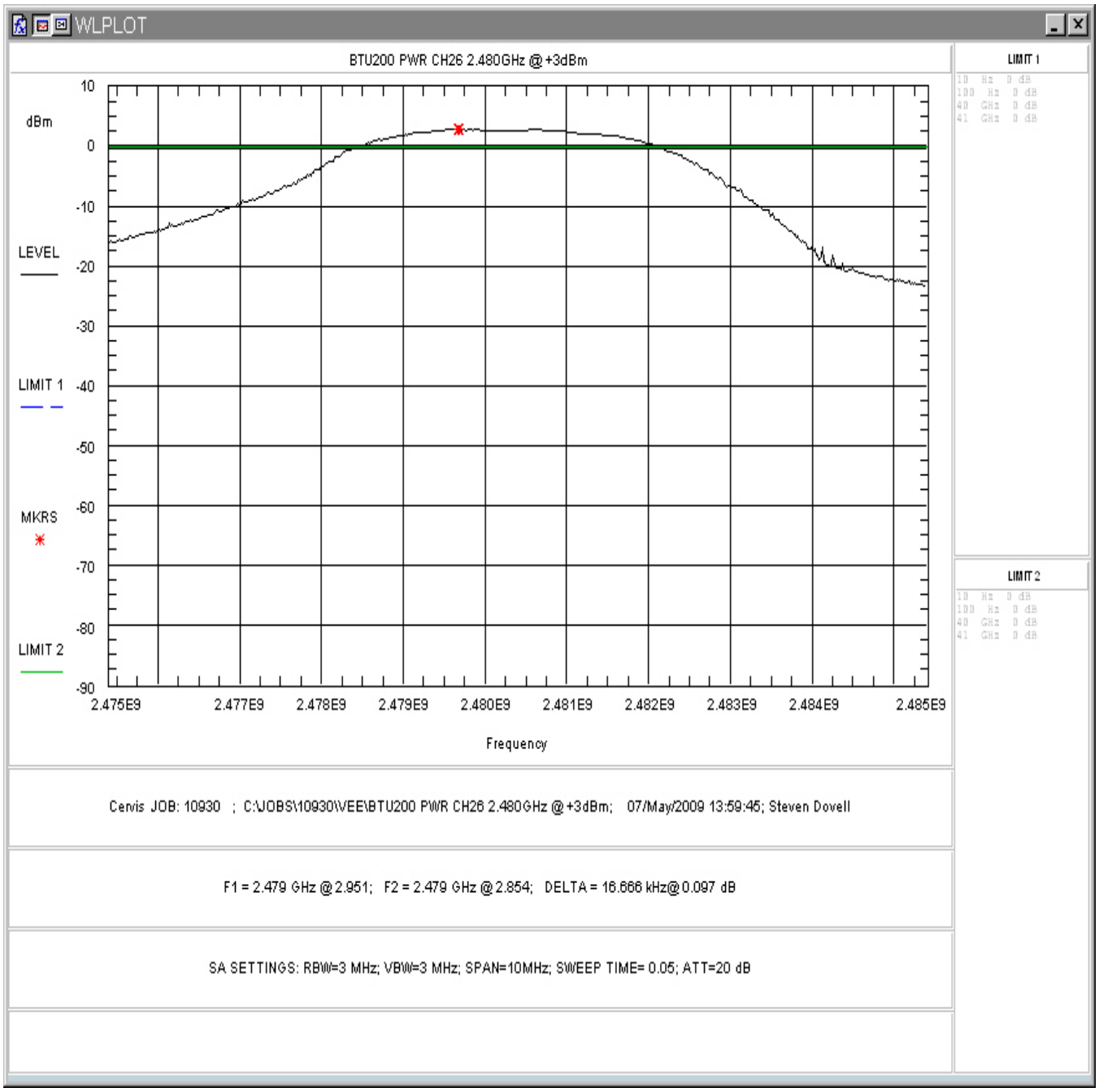

Figure 5-3. RF Peak Power, High Channel

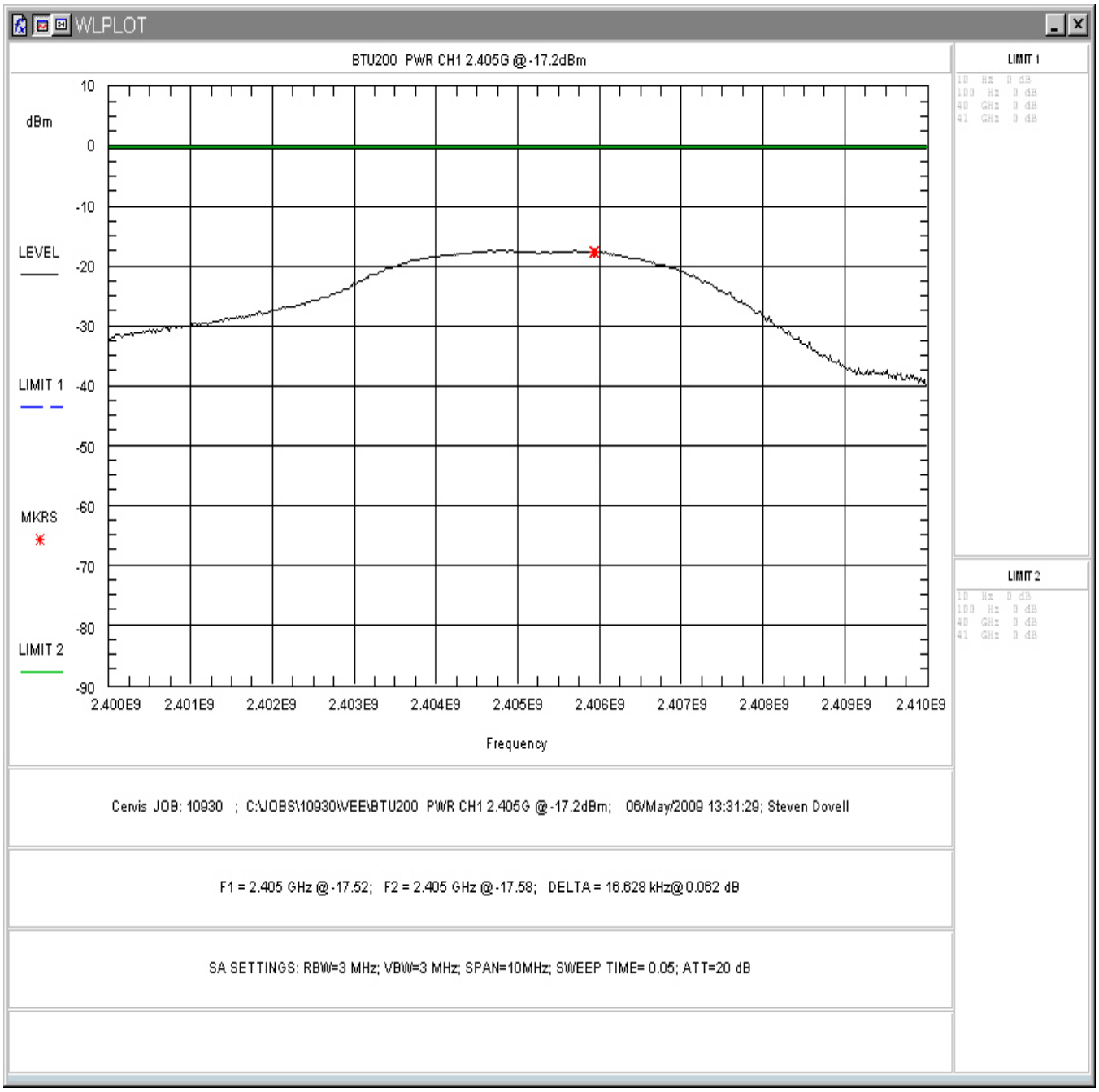

Figure 5-4. RF Peak Power, Low Channel -17dBm Setting

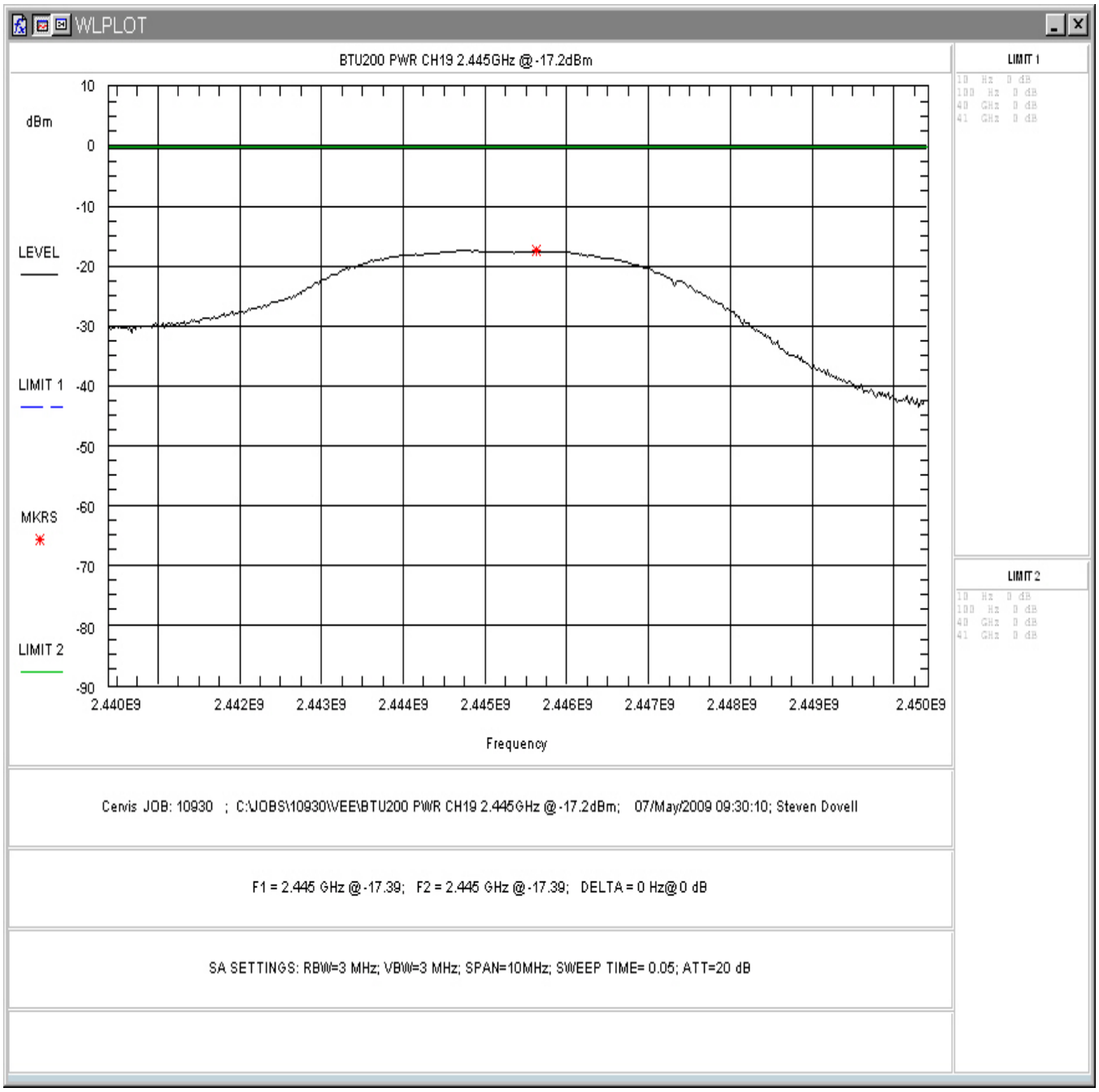

Figure 5-5. RF Peak Power, Center Channel -17dBm Setting

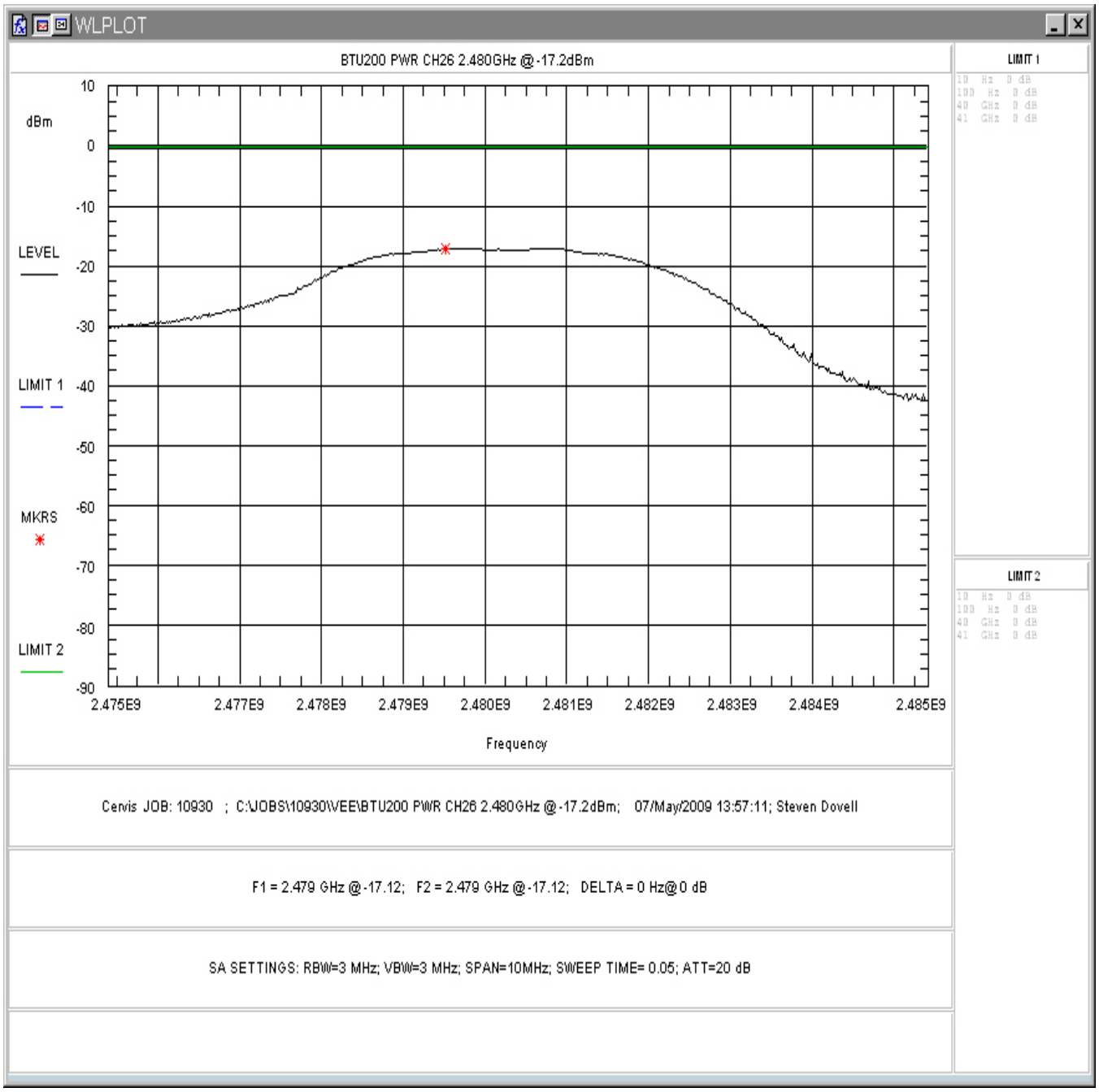

Figure 5-6. RF Peak Power, High Channel -17dBm Setting

5.2 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 Direct Sequence Spread Spectrum Systems, FCC Part 15.247 requires the minimum 6 dB bandwidth of 500 kHz.

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

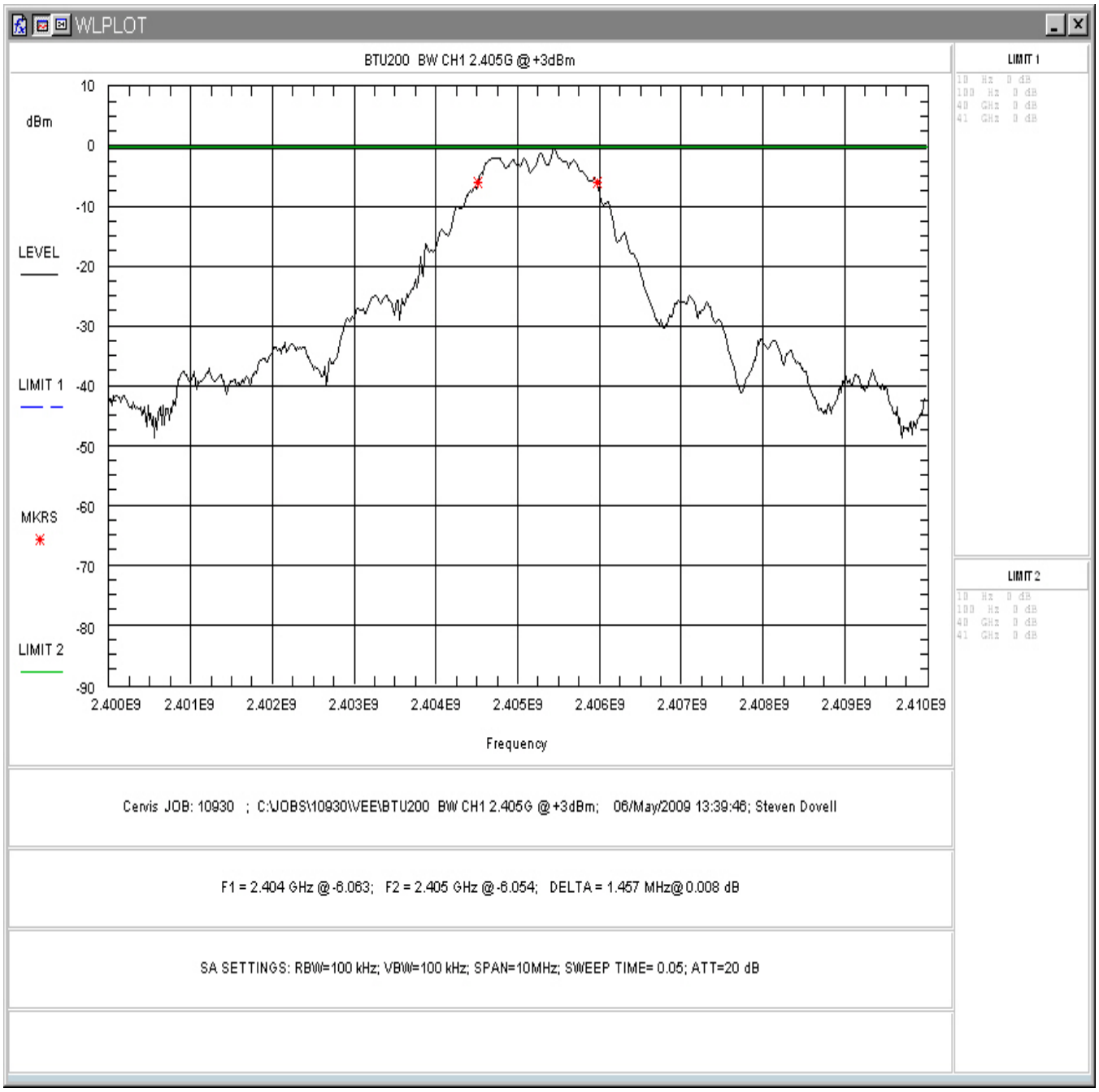

Figure 5-7. Occupied Bandwidth, Low Channel +3 dBm Setting

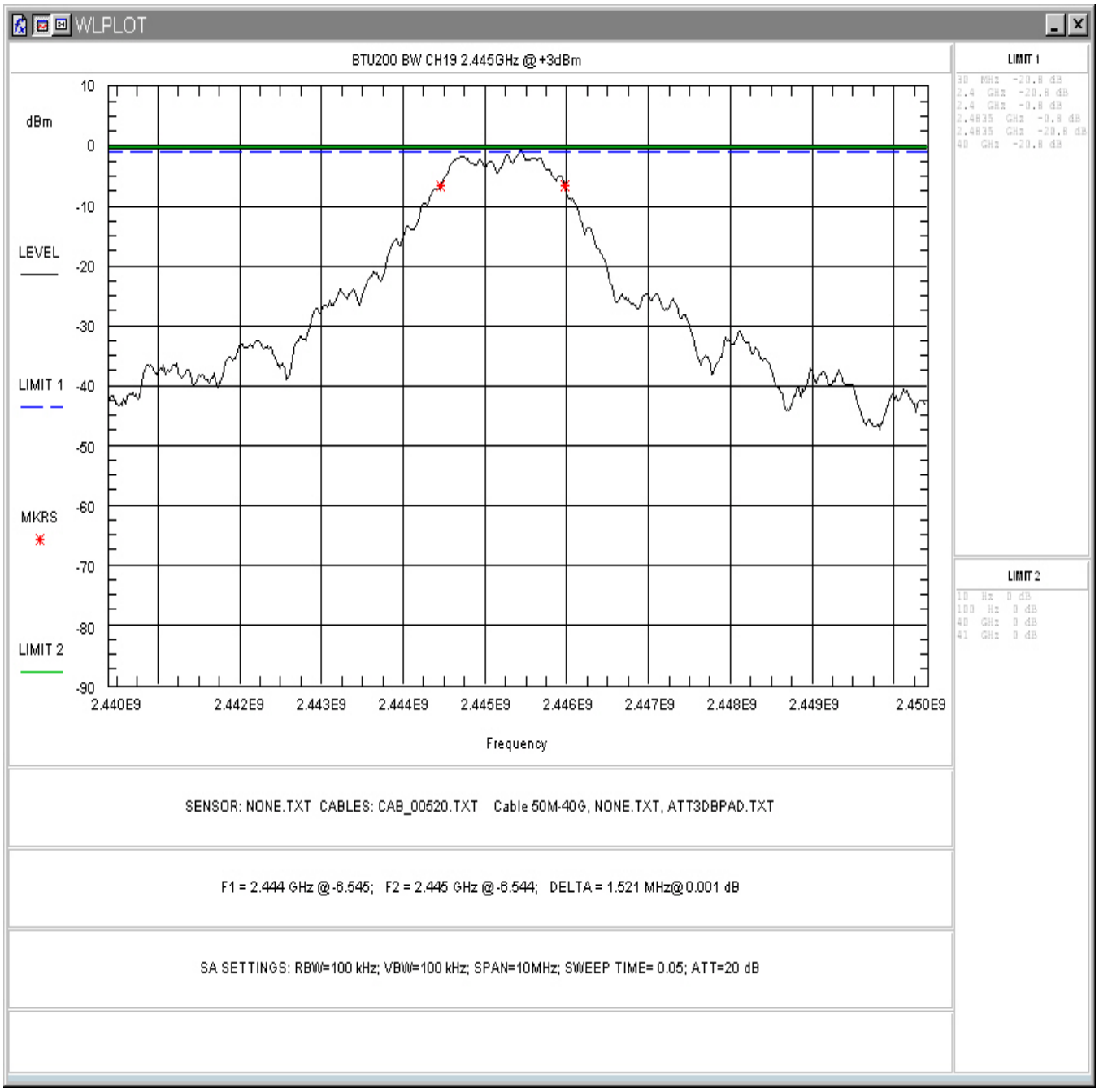

Figure 5-8. Occupied Bandwidth, Mid Channel +3 dBm Setting

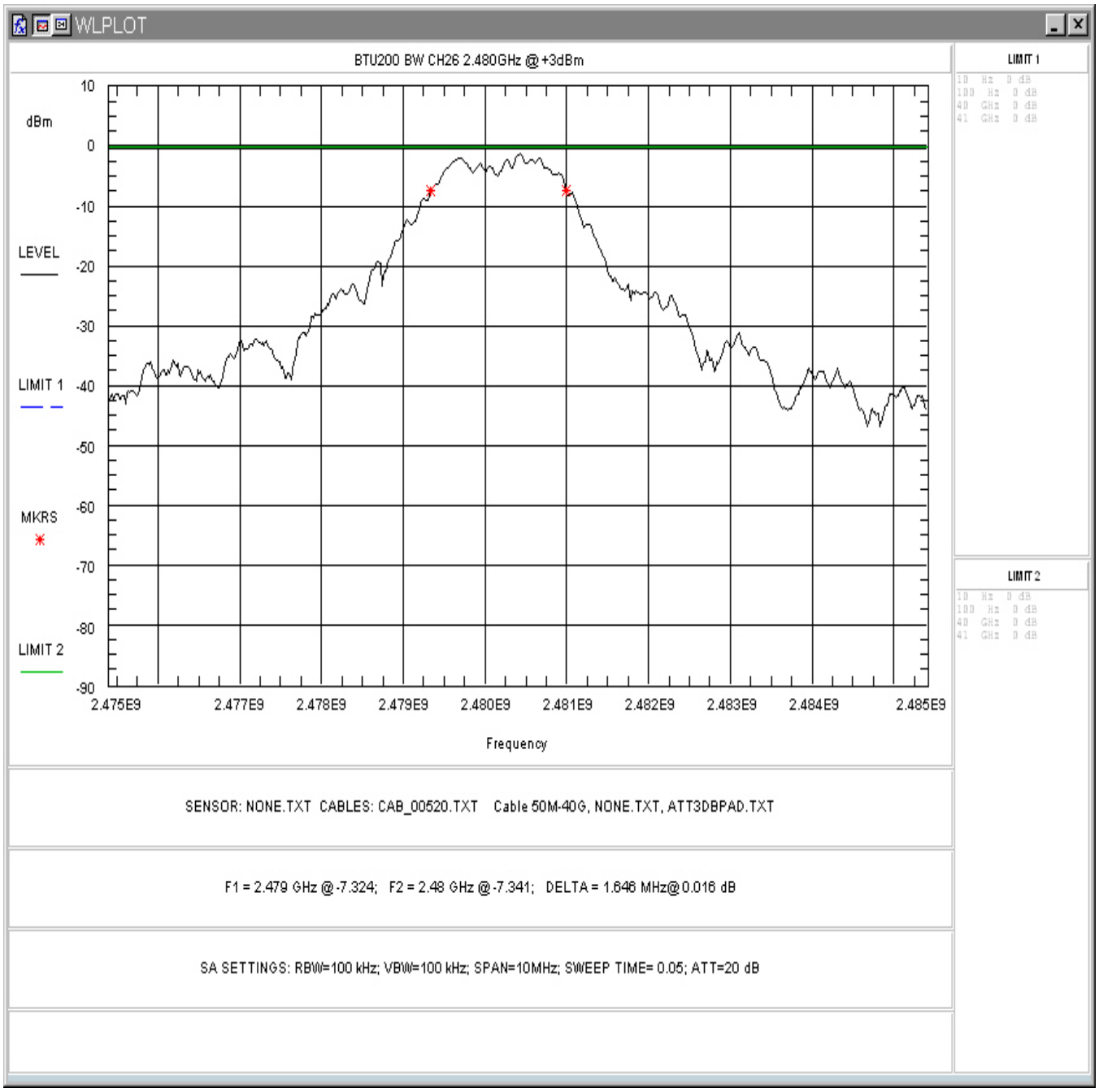

Figure 5-9. Occupied Bandwidth, High Channel +3 dBm Setting

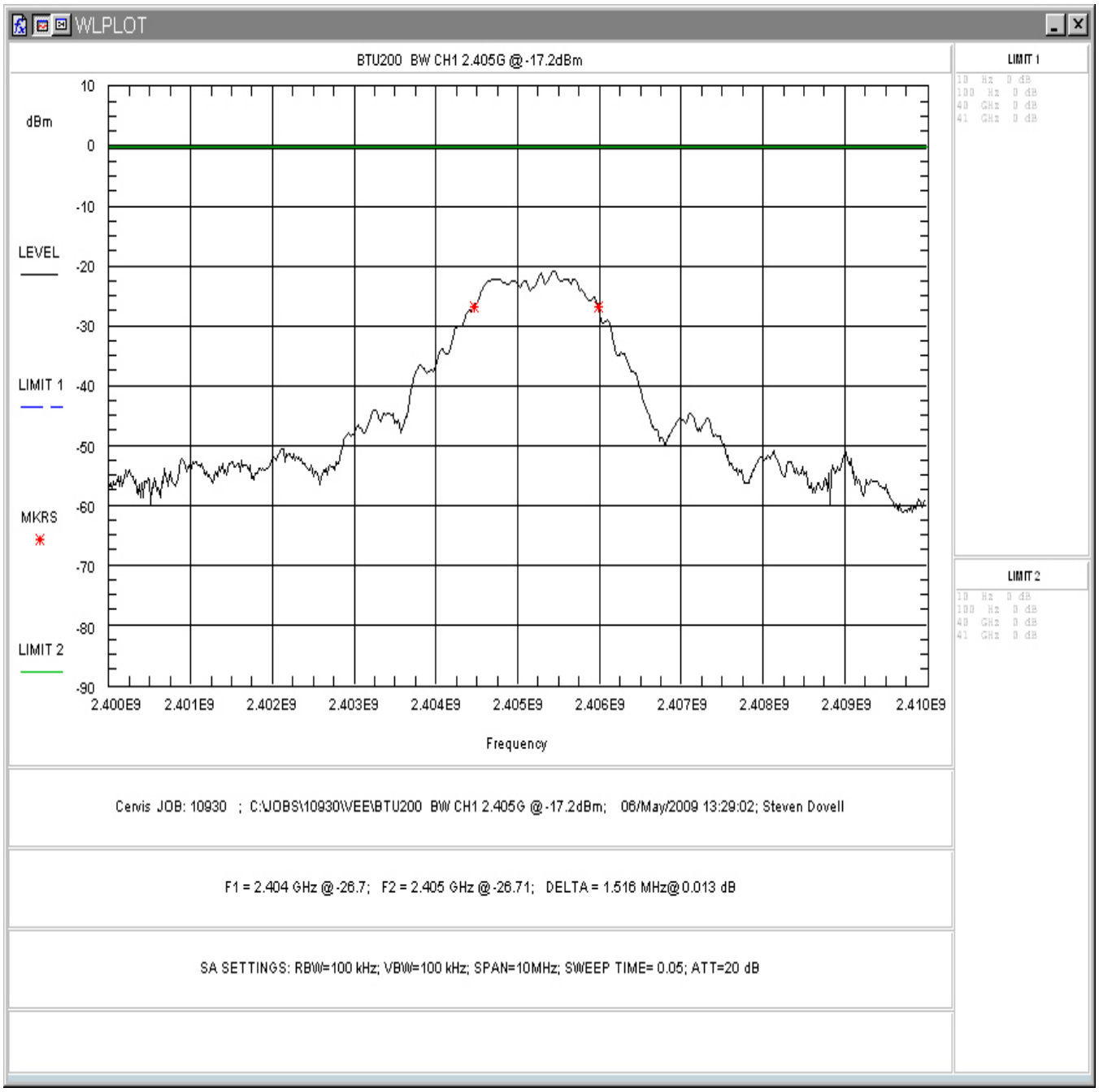

Figure 5-10. Occupied Bandwidth, Low Channel -17dBm Setting

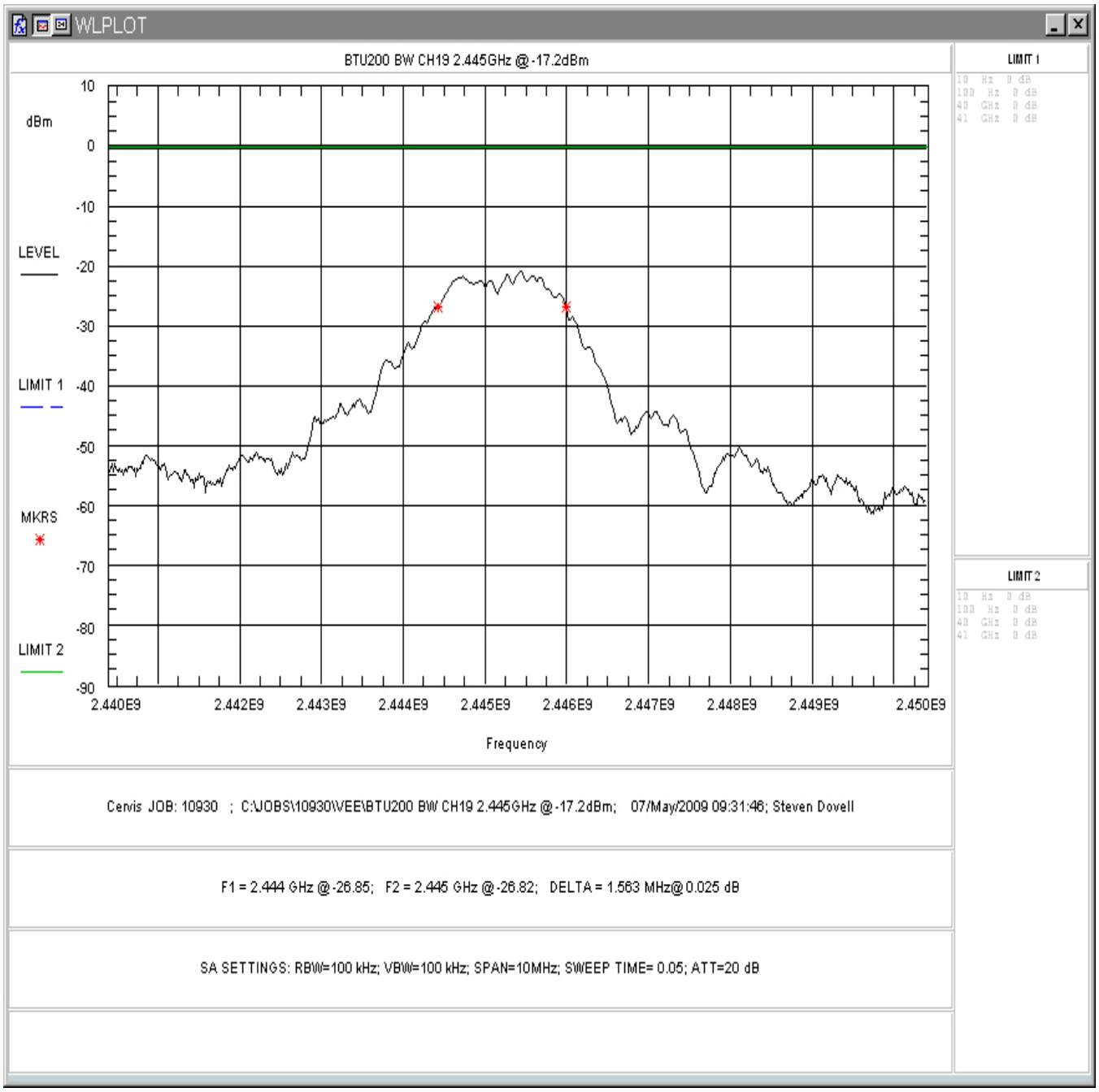

Figure 5-11. Occupied Bandwidth, Mid Channel -17dBm Setting

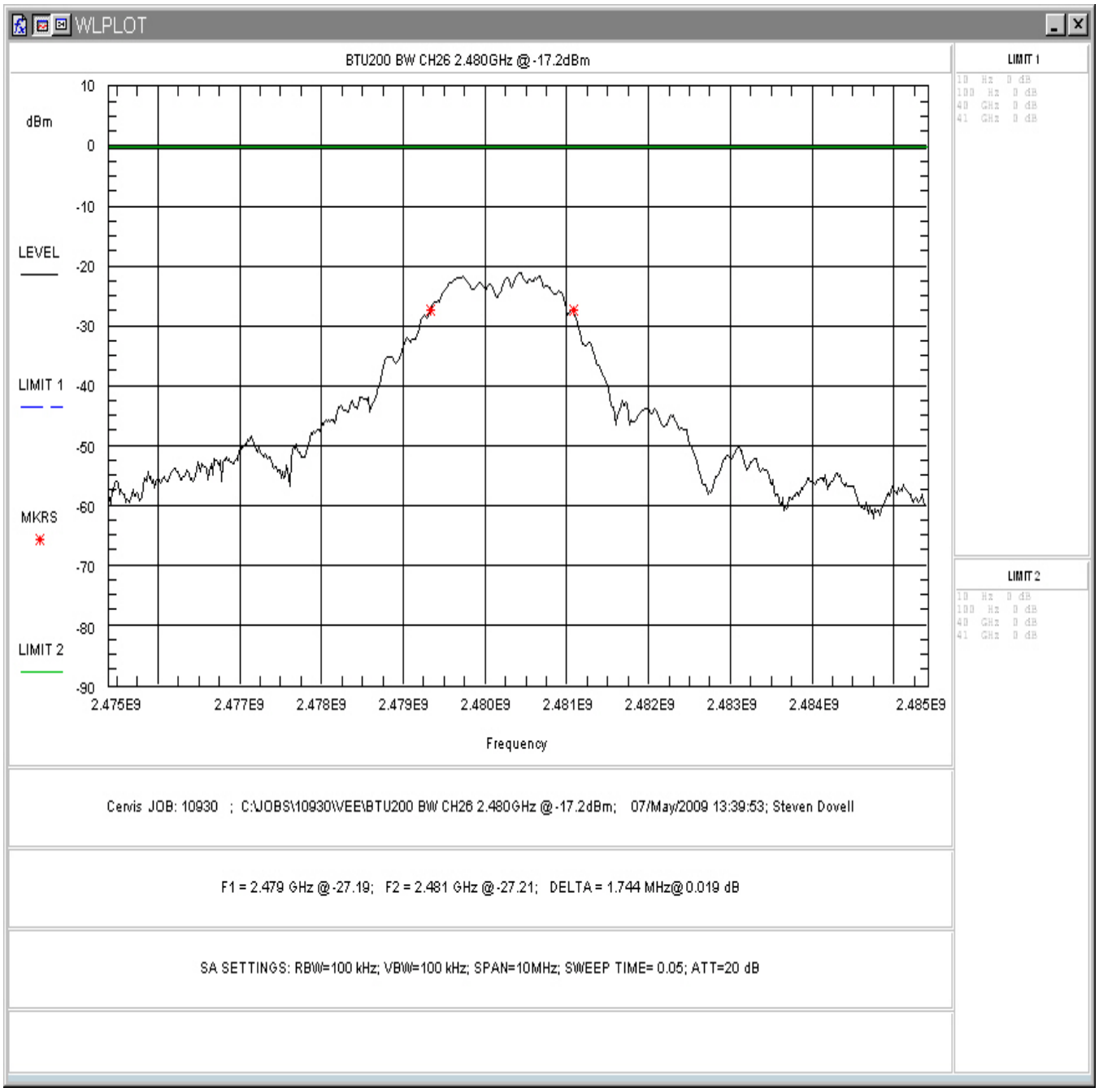

Figure 5-12. Occupied Bandwidth, High Channel -17dBm Setting

Table 6 provides a summary of the Occupied Bandwidth Results.

Table 6. Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 2.405 GHz	1.457 MHz	>500 kHz	Pass
Mid Channel: 2.445 GHz	1.521 MHz	> 500 kHz	Pass
High Channel: 2.480 GHz	1.546 MHz	> 500 kHz	Pass

5.3 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.

The following are plots of the conducted spurious emissions data.

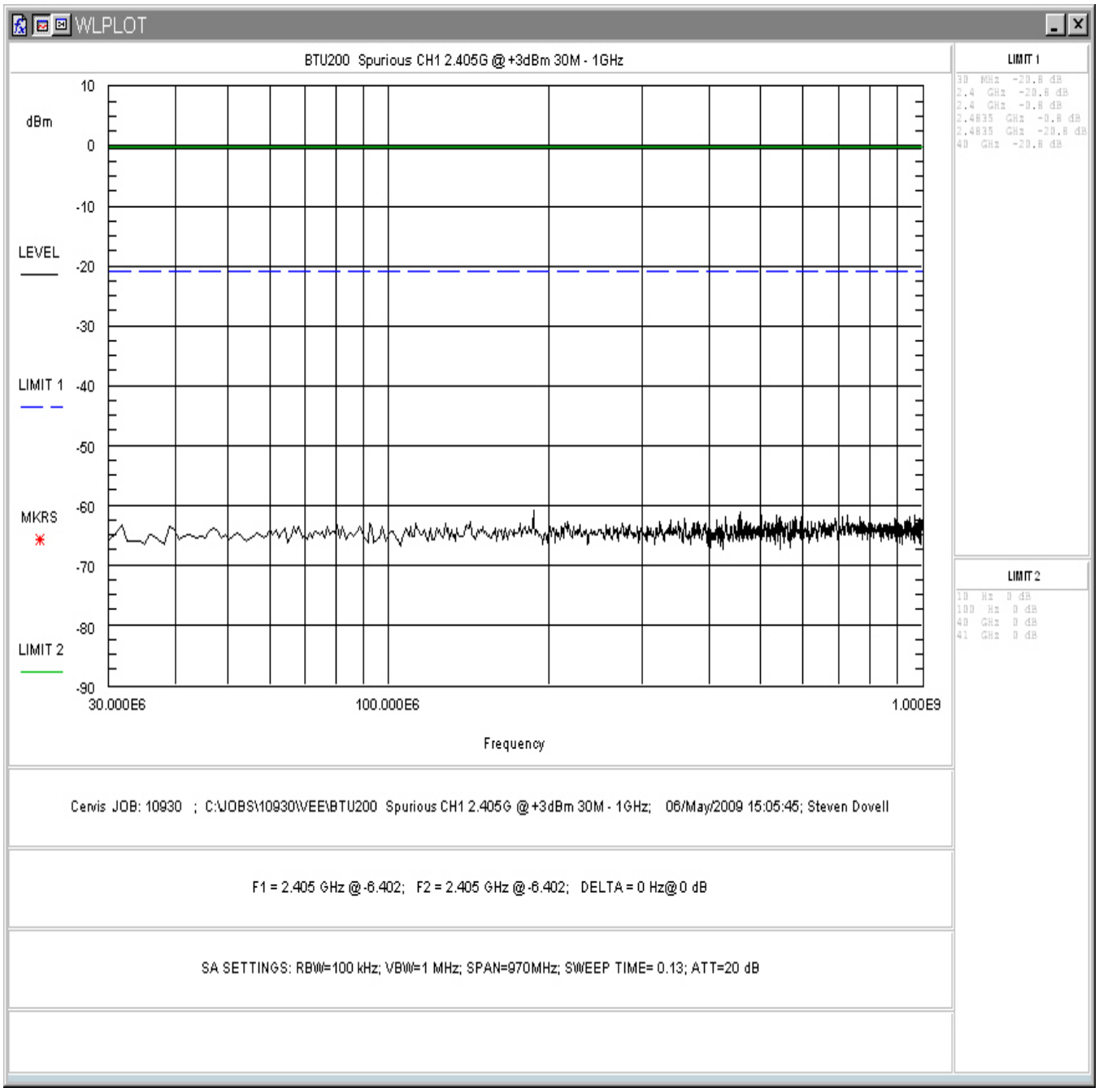

Figure 5-13. Conducted Spurious Emissions, Low Channel 30 - 1000MHz +3dBm Setting

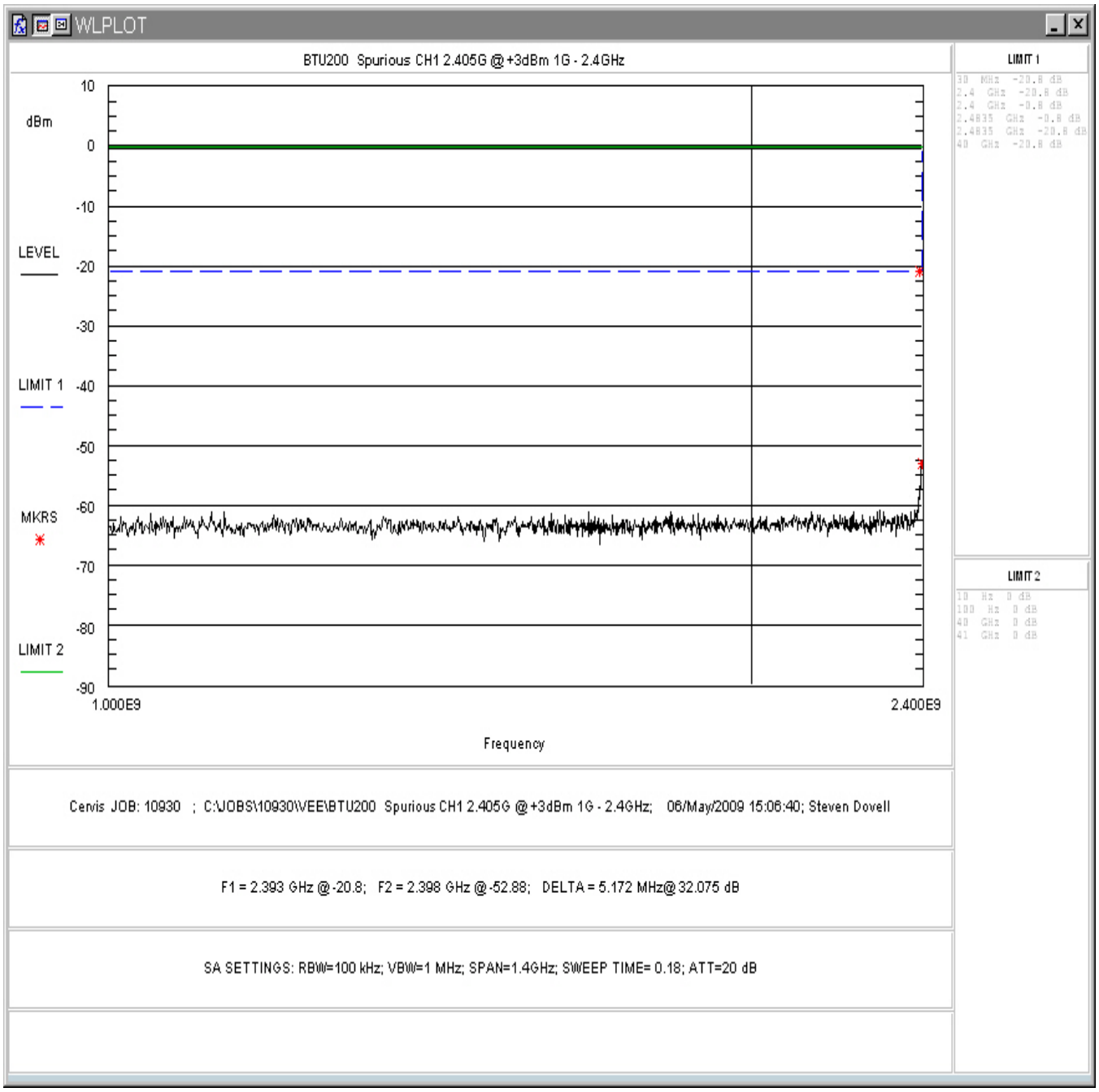

Figure 5-14. Conducted Spurious Emissions, Low Channel 1 – 2.4GHz +3dBm Setting

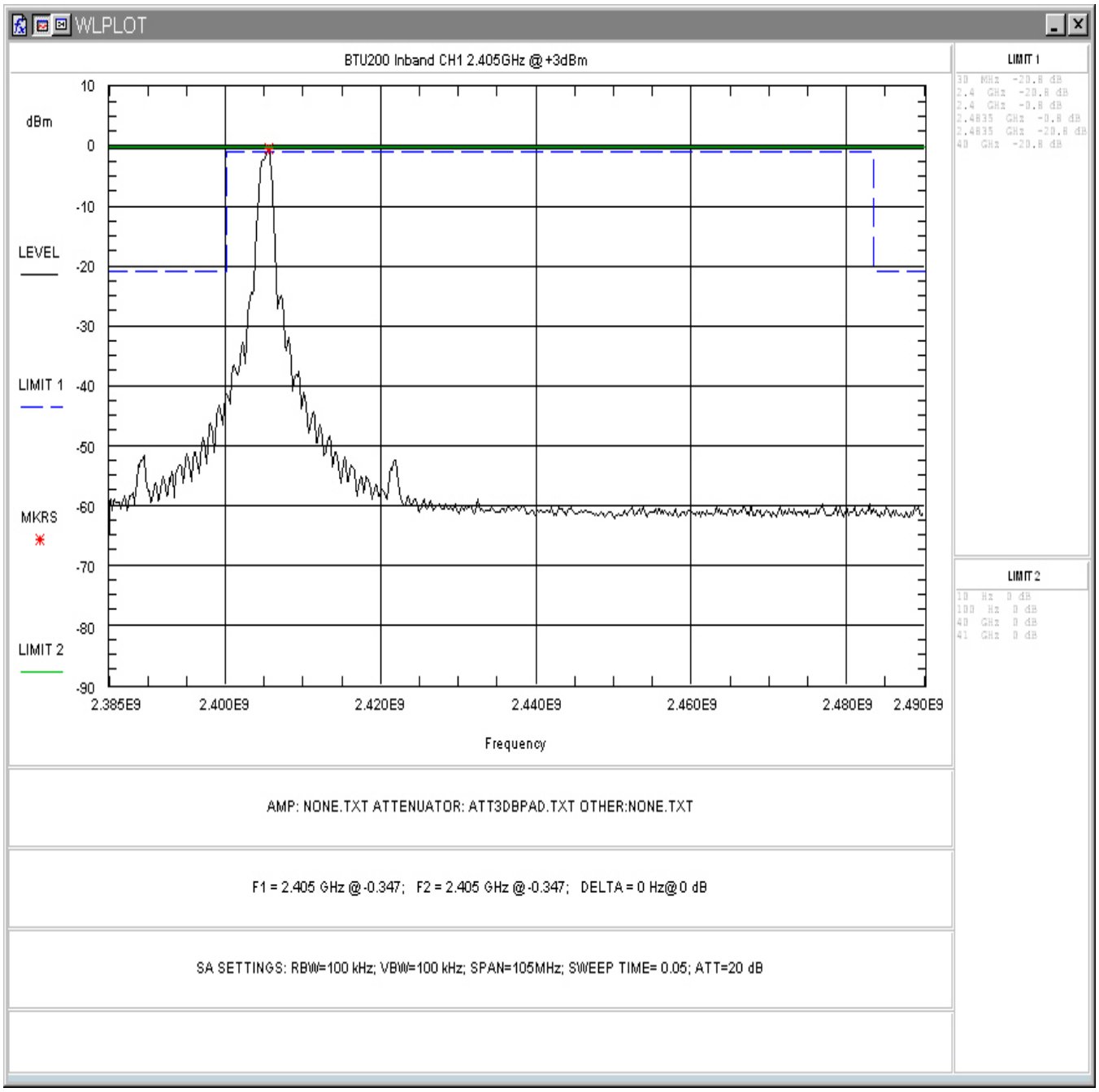

Figure 5-15. Conducted Spurious Emissions, Low Channel 2.4 – 2.5GHz +3dBm Setting

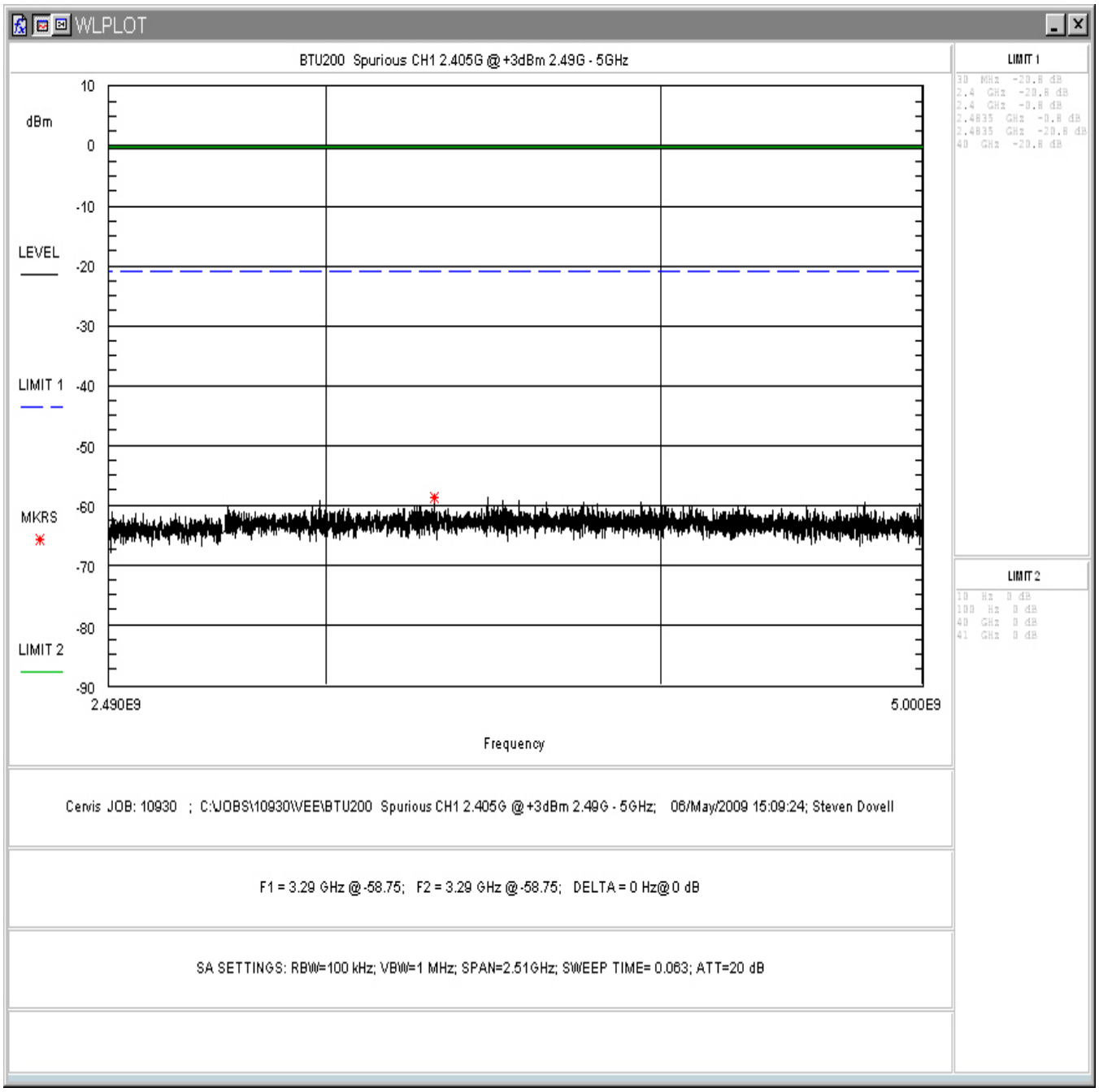

Figure 5-16. Conducted Spurious Emissions, Low Channel 2.5 - 5GHz +3dBm Setting

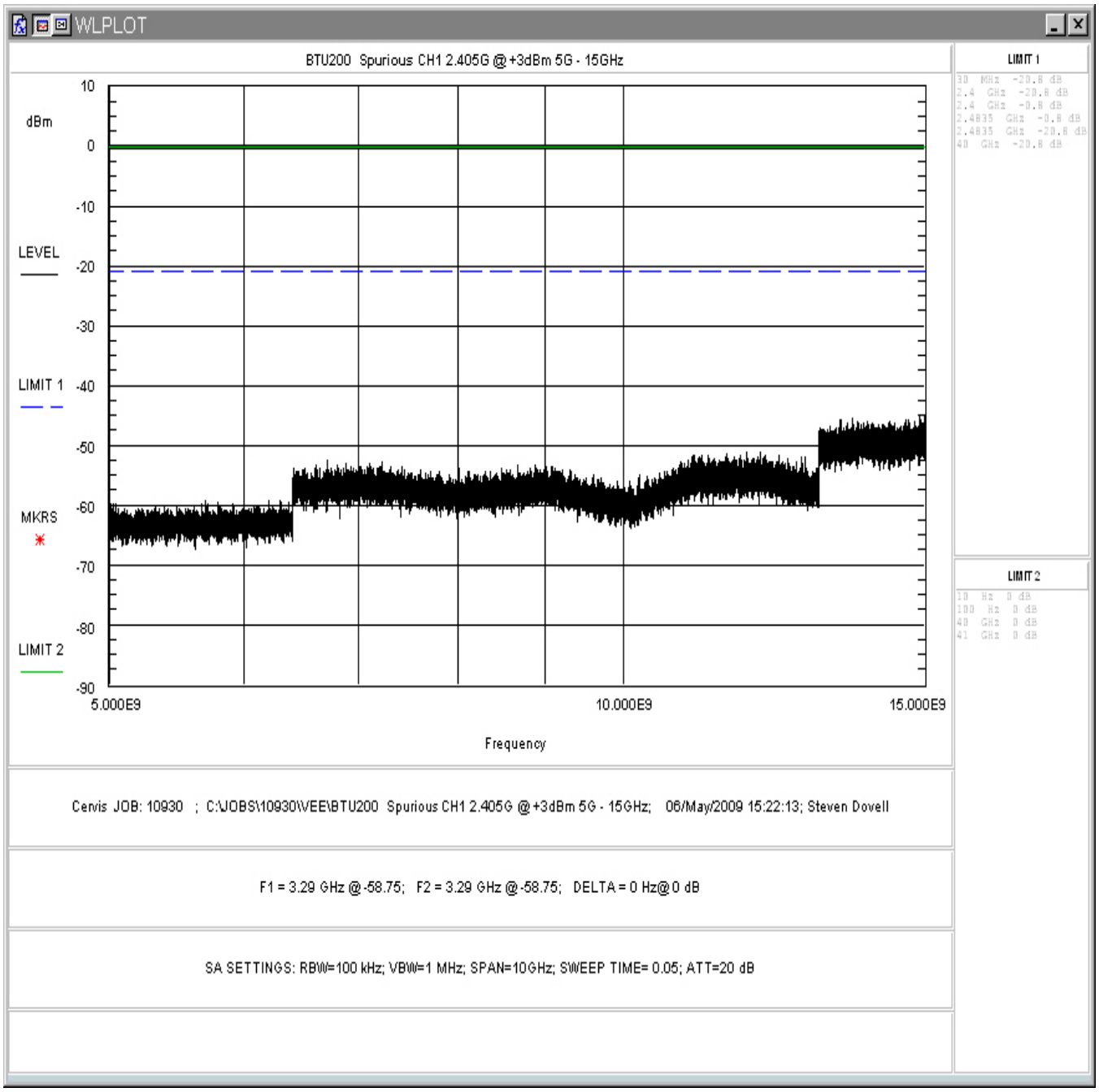

Figure 5-17. Conducted Spurious Emissions, Low Channel 5 - 15GHz +3dBm Setting

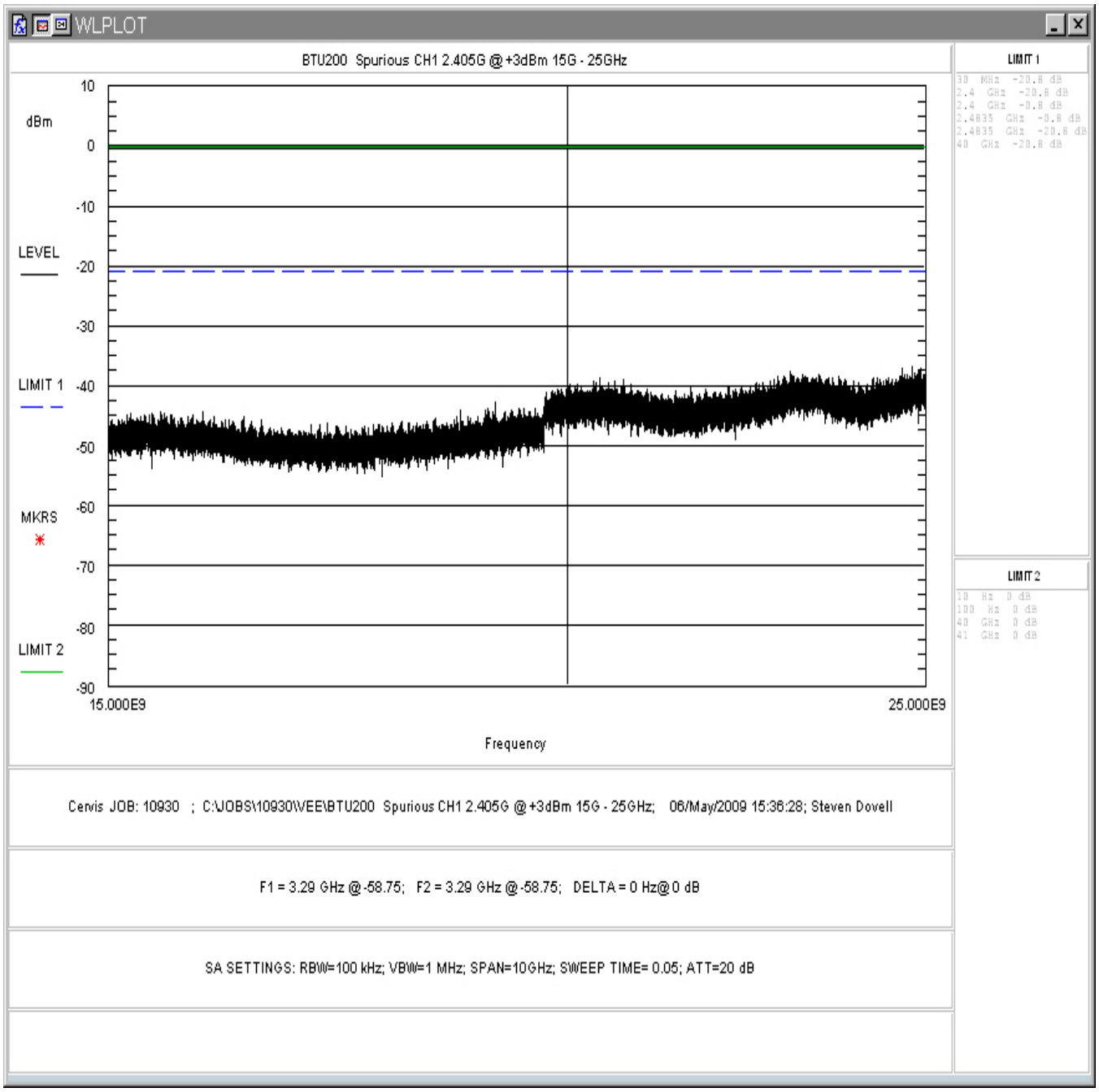

Figure 5-18. Conducted Spurious Emissions, Low Channel 15 - 25GHz +3dBm Setting

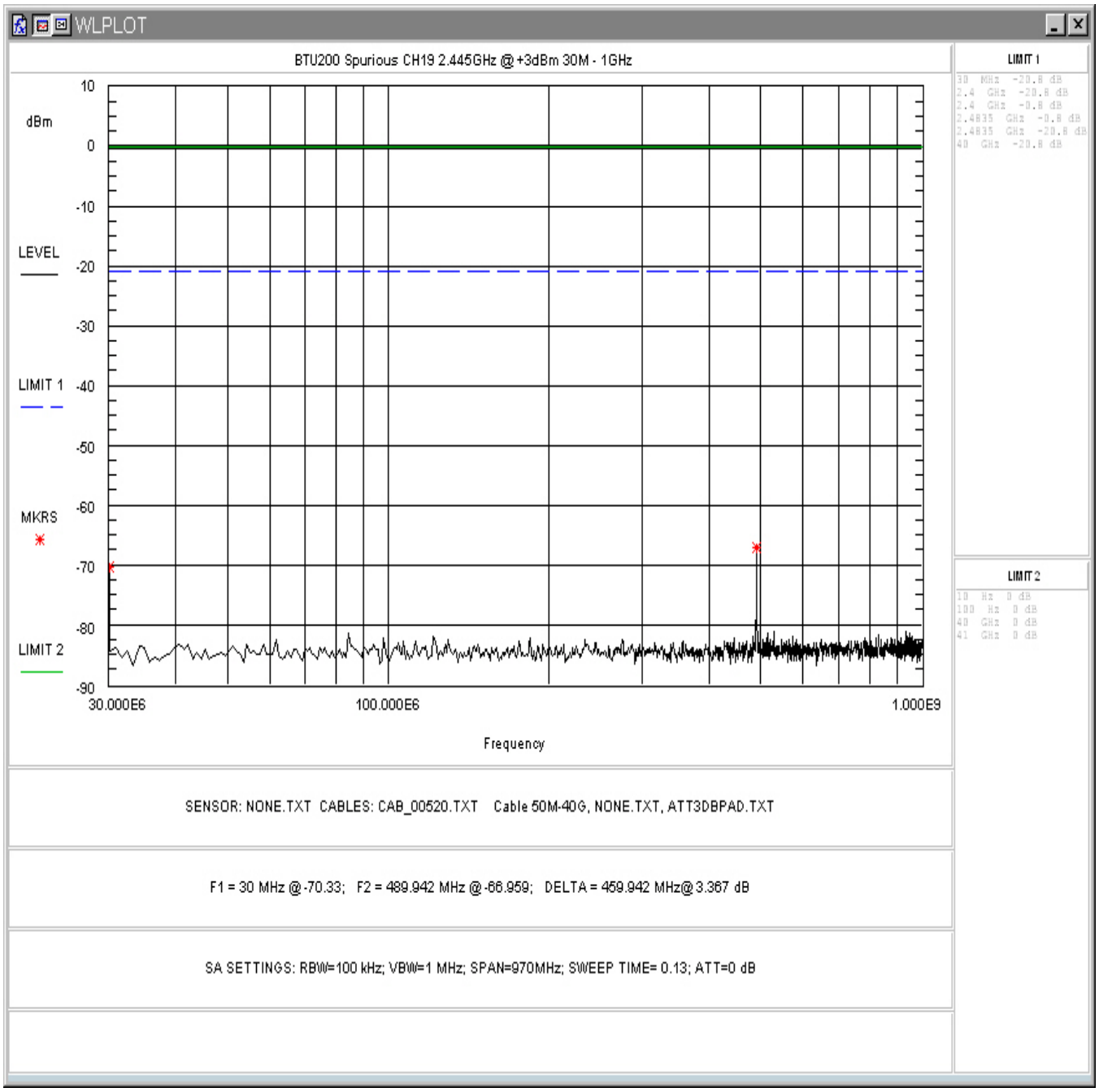

Figure 5-19. Conducted Spurious Emissions, Mid Channel 30 - 1000MHz +3dBm Setting

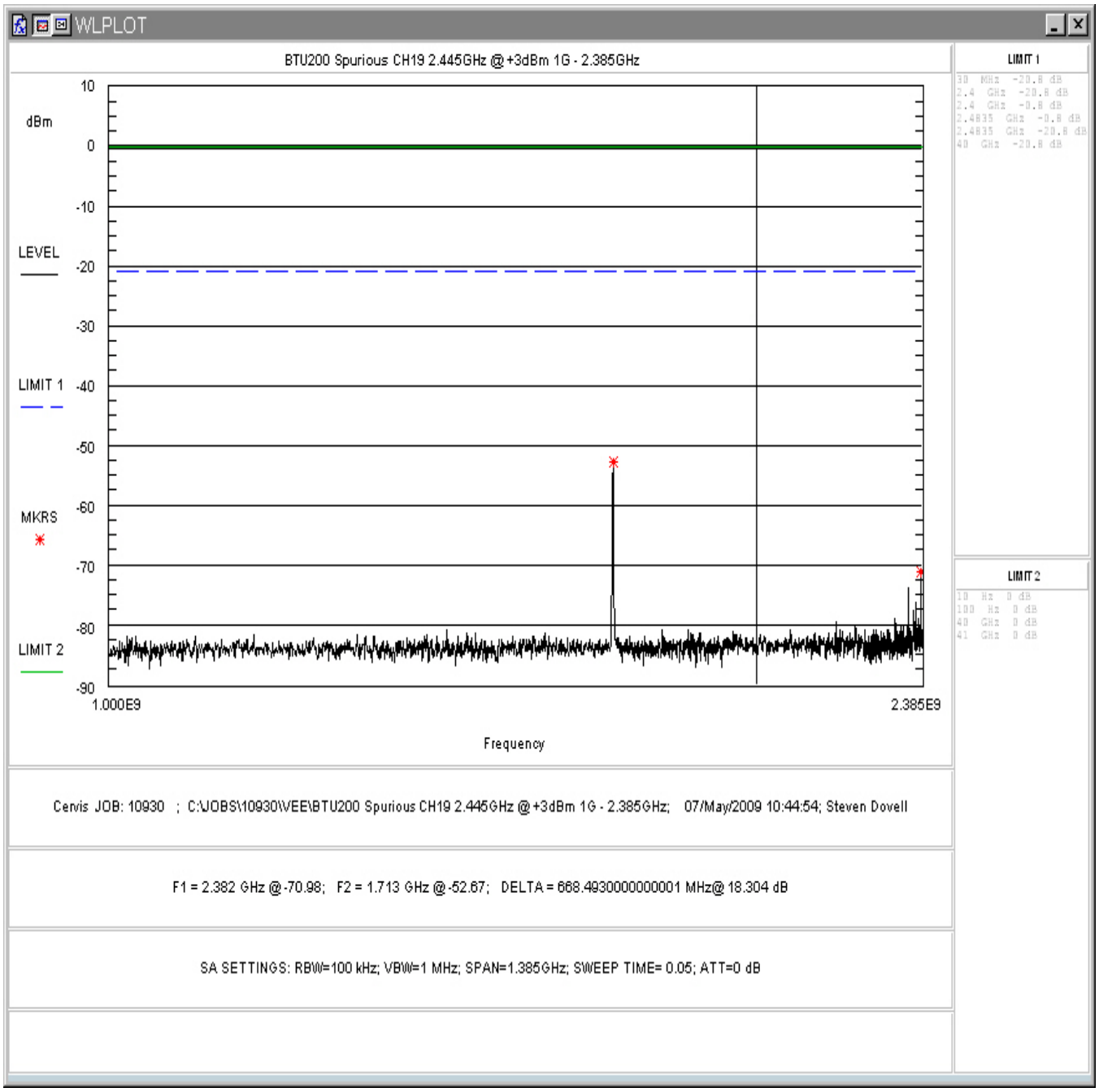

Figure 5-20. Conducted Spurious Emissions, Mid Channel 1 – 2.4GHz +3dBm Setting

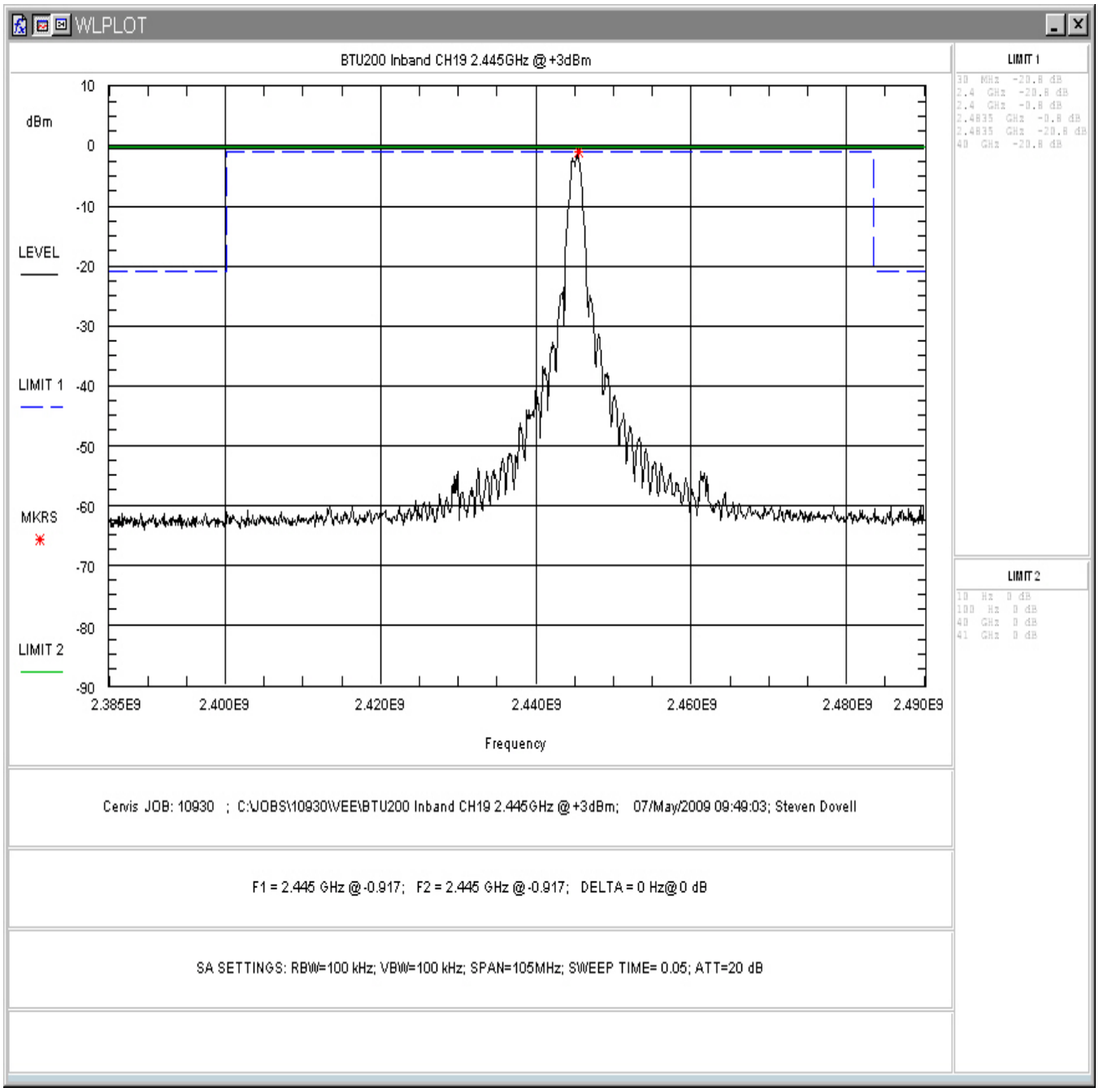

Figure 5-21. Conducted Spurious Emissions, Mid Channel 2.4 – 2.5GHz +3dBm Setting

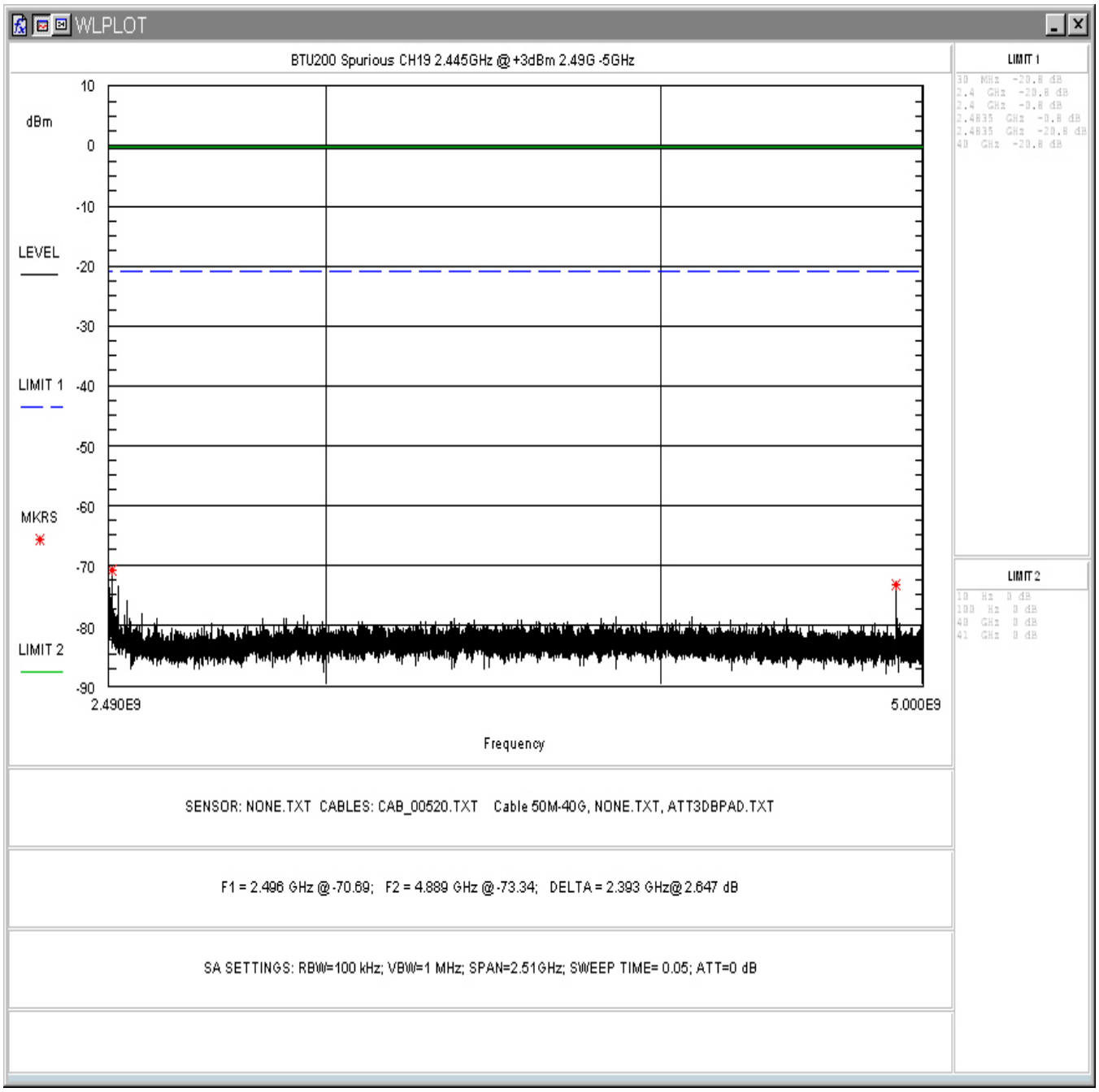

Figure 5-22. Conducted Spurious Emissions, Mid Channel 2.5 - 5GHz +3dBm Setting

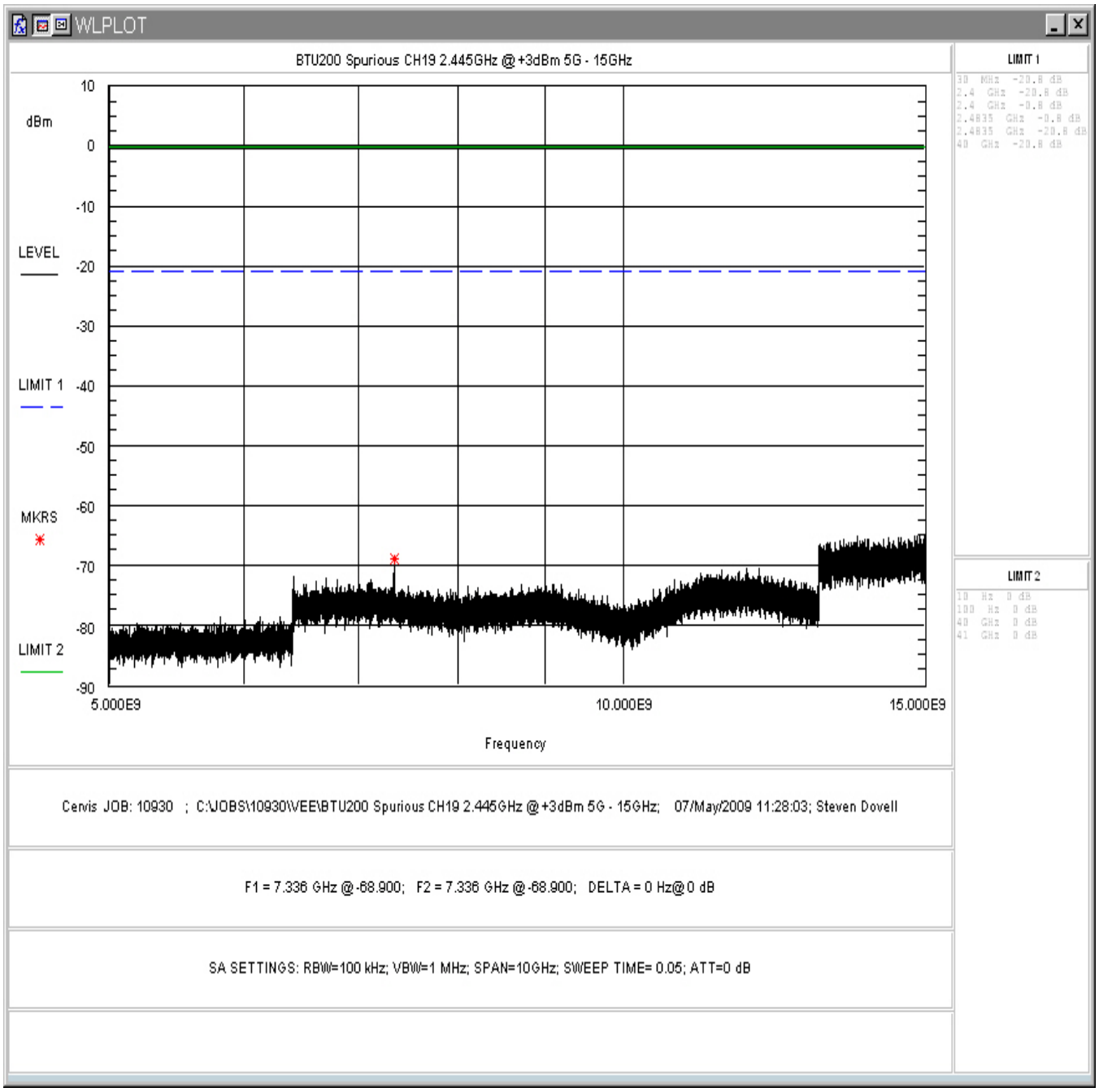

Figure 5-23. Conducted Spurious Emissions, Mid Channel 5 - 15GHz +3dBm Setting

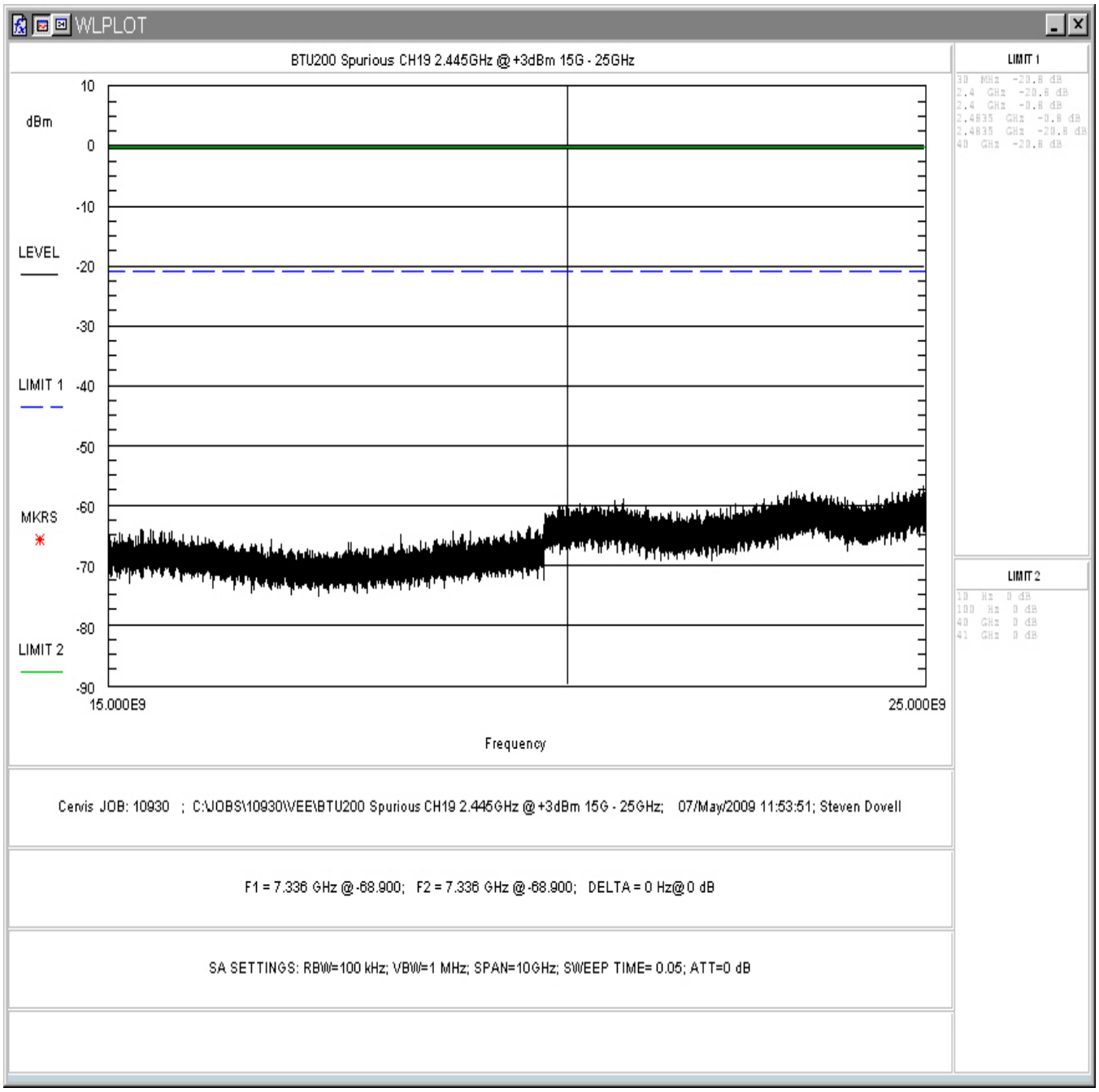

Figure 5-24. Conducted Spurious Emissions, Mid Channel 15 - 25GHz+3dBm Setting

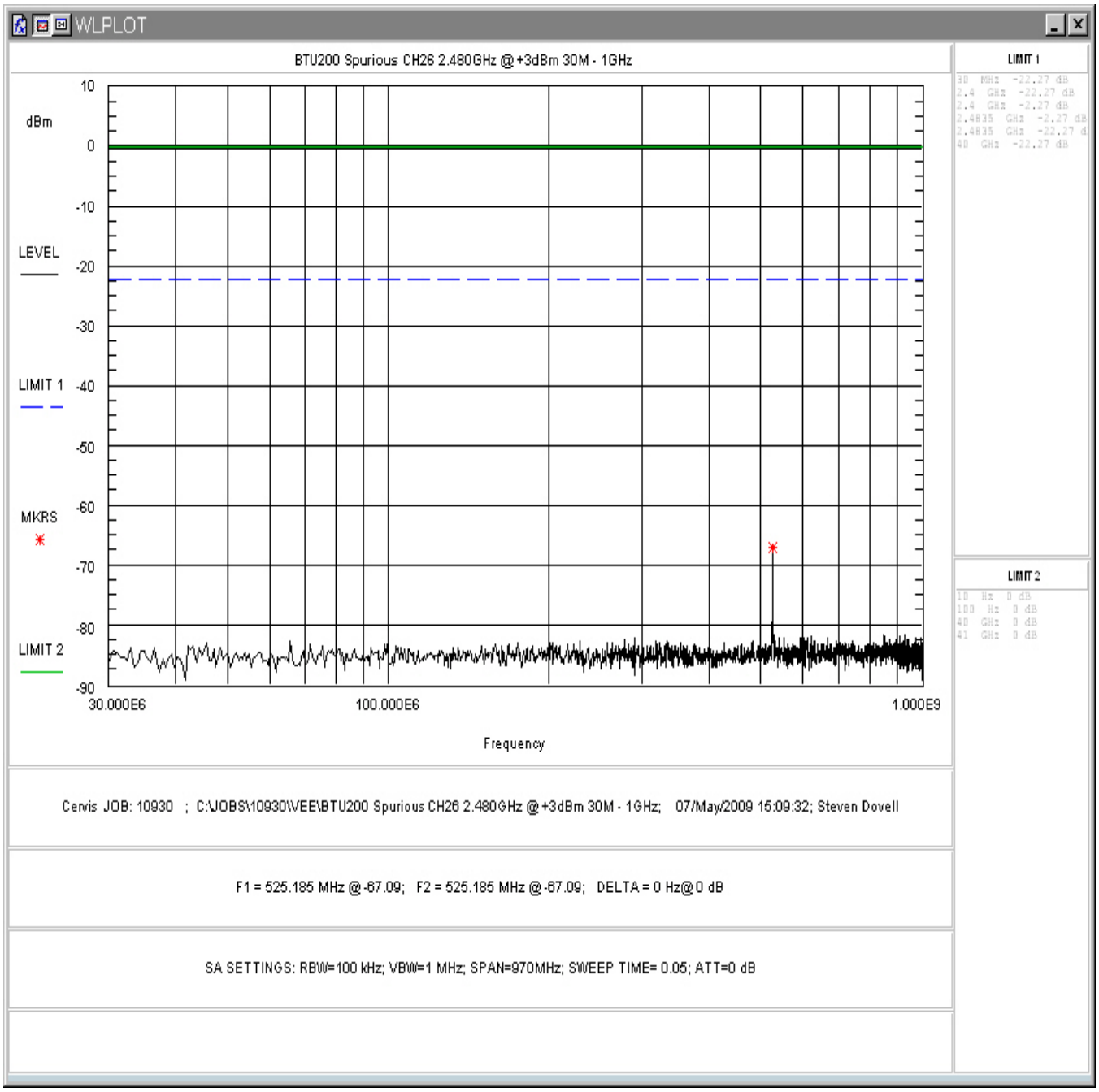

Figure 5-25. Conducted Spurious Emissions, High Channel 30 - 1000MHz +3dBm Setting

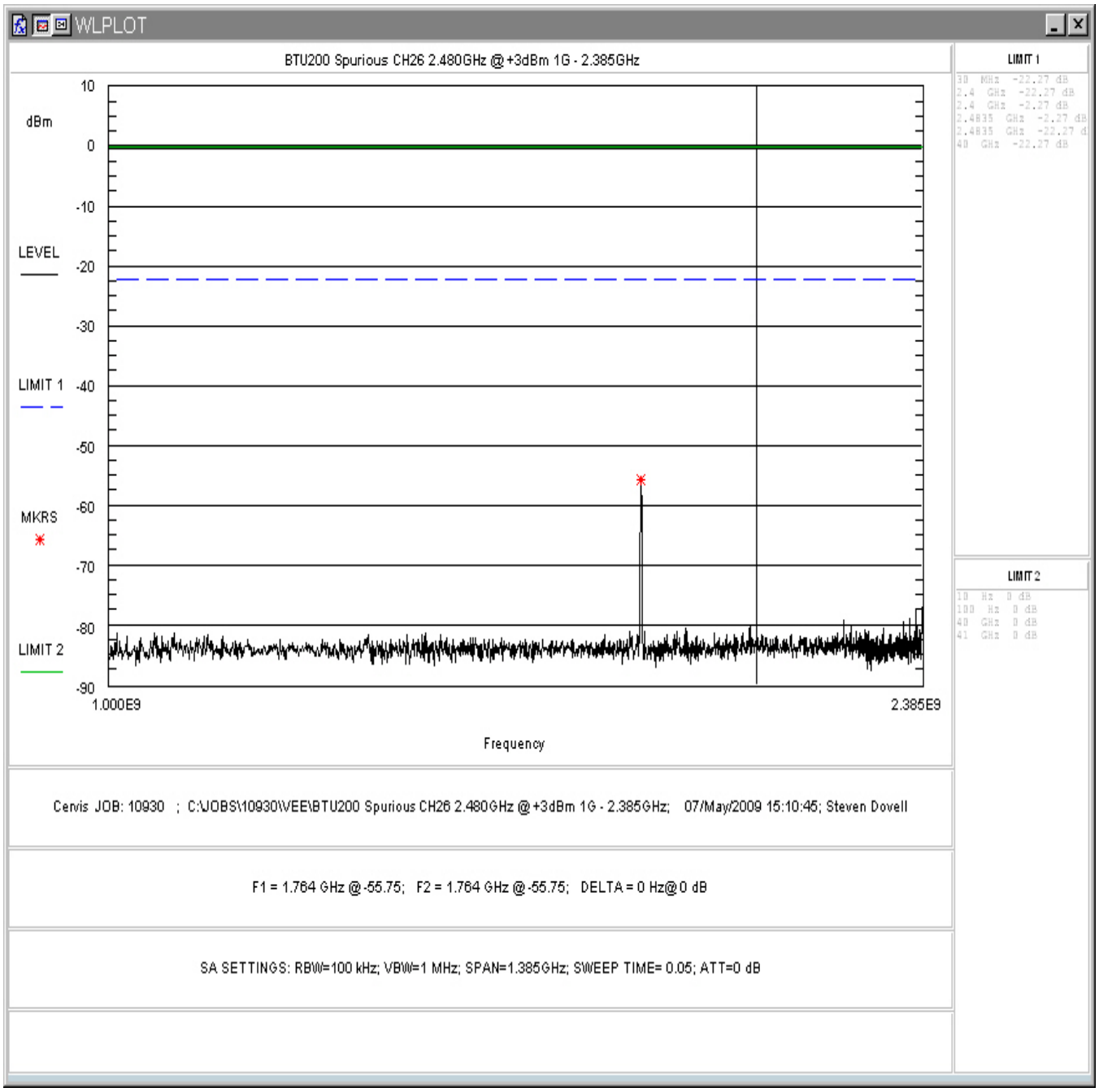

Figure 5-26. Conducted Spurious Emissions, High Channel 1 – 2.4GHz +3dBm Setting

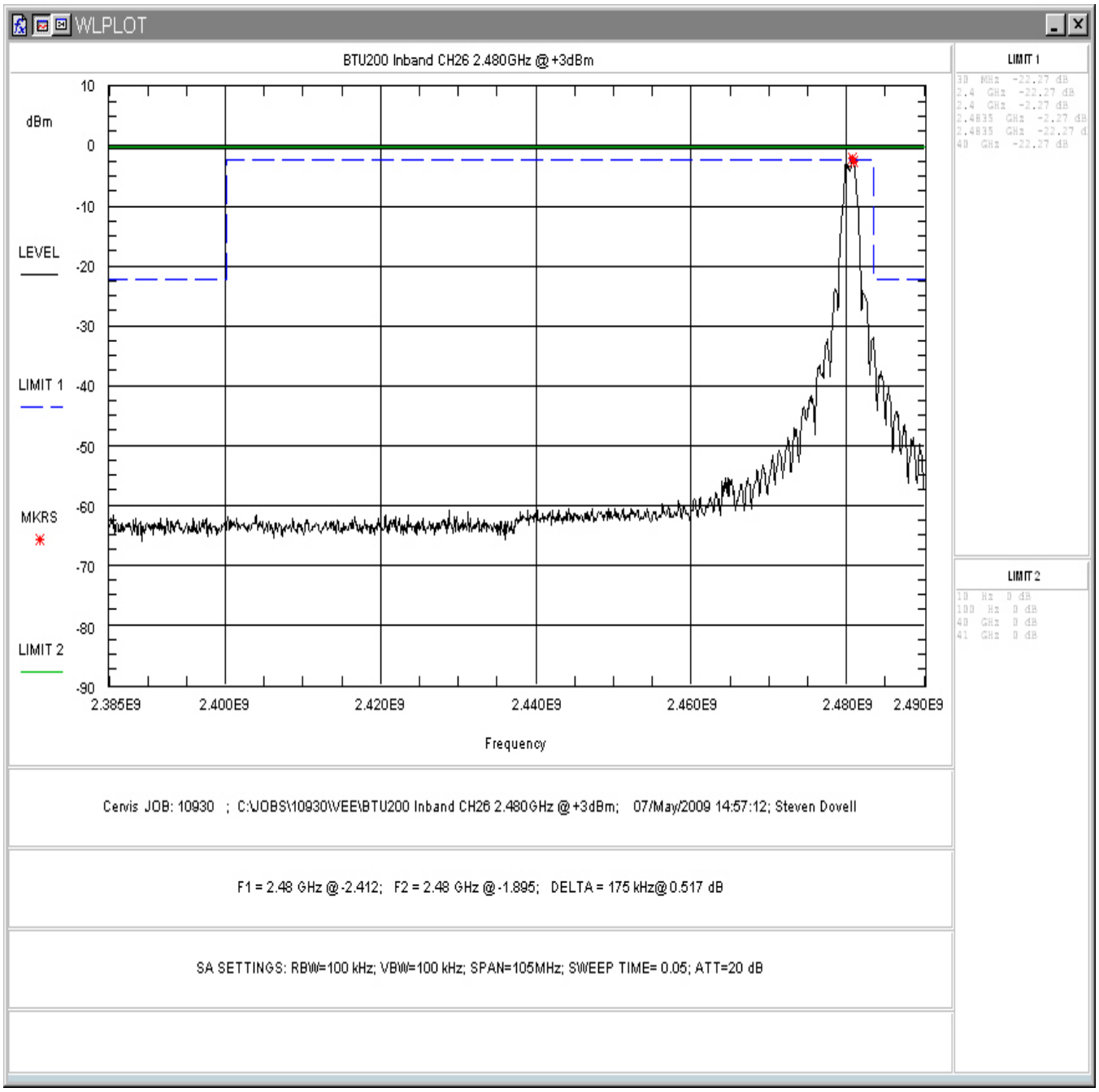

Figure 5-27. Conducted Spurious Emissions, High Channel 2.4 – 2.5GHz +3dBm Setting

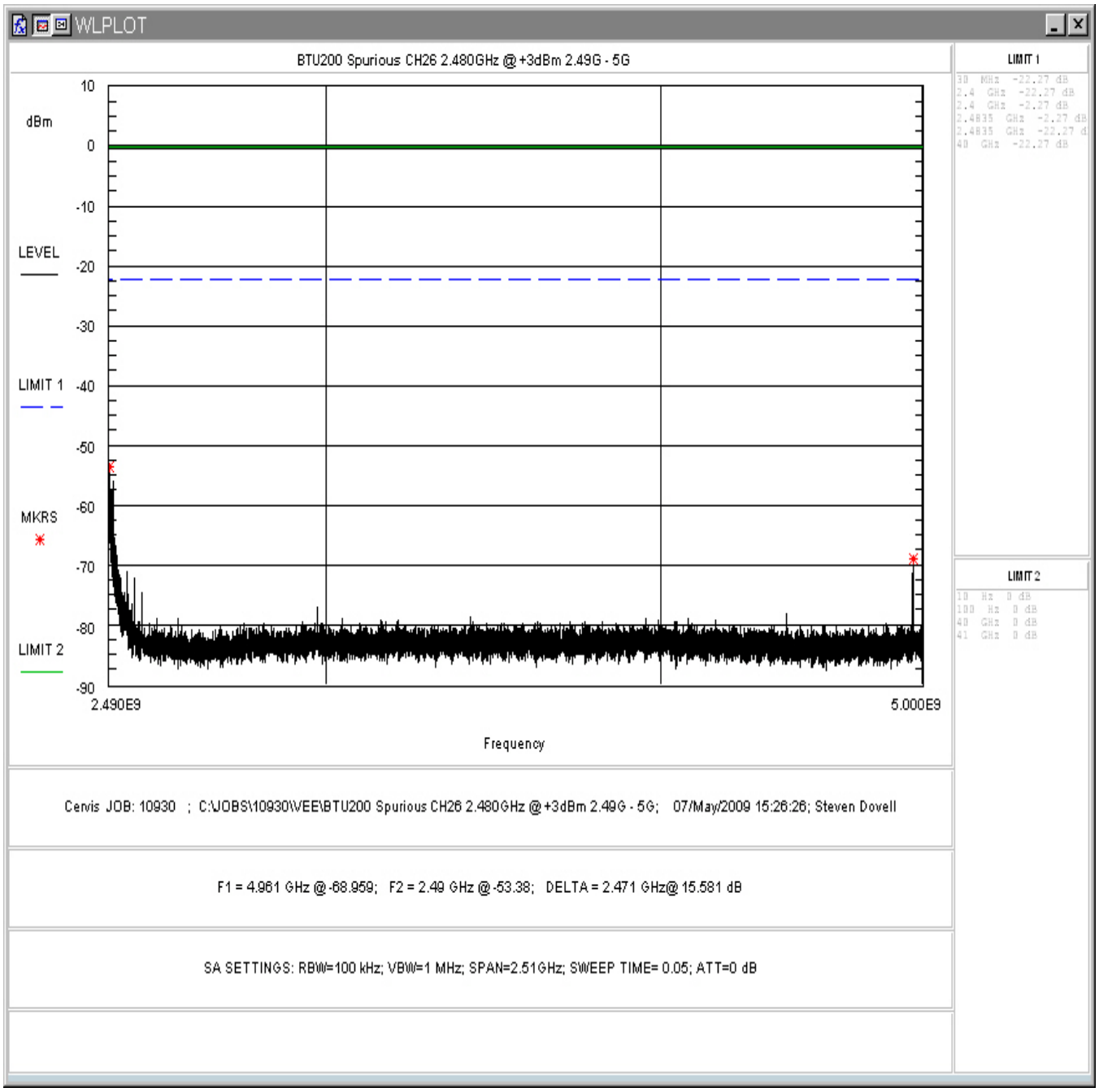

Figure 5-28. Conducted Spurious Emissions, High Channel 2.5 - 5GHz +3dBm Setting

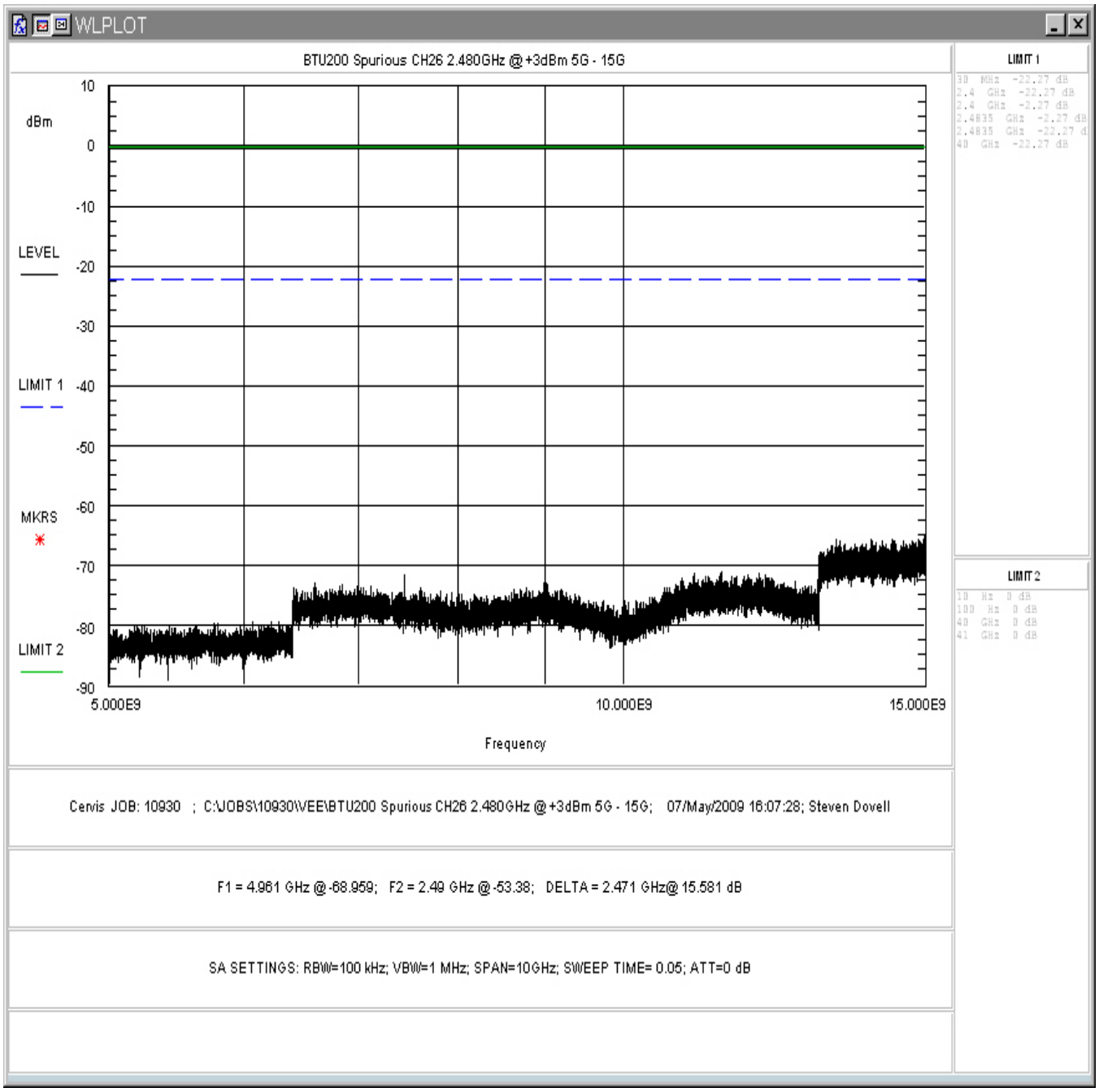

Figure 5-29. Conducted Spurious Emissions, High Channel 5 - 15GHz +3dBm Setting

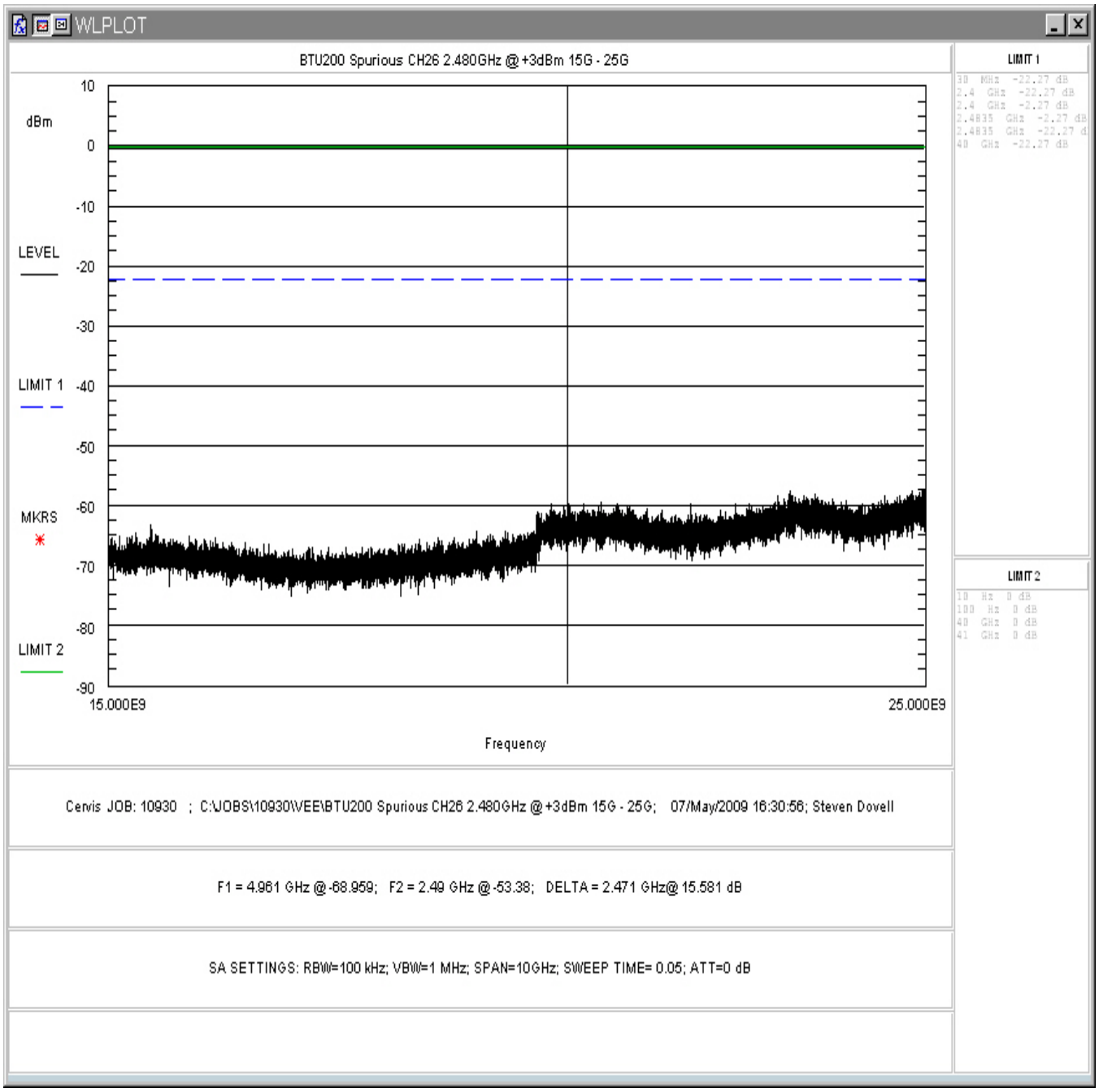

Figure 5-30. Conducted Spurious Emissions, High Channel 15 - 25GHz +3dBm Setting

