Washington Laboratories, Ltd.

FCC & Industry Canada Certification Test Report
For the
Cervis, Inc.
SmaRT 206 Handheld Remote

FCC ID: LOBSHH200
IC ID: 7955A-SHH200

WLL JOB# **10276**
January 7, 2009

Prepared for:

Cervis, Inc.
170 Thorn Hill Road
Warrendale, PA 15086

Prepared By:

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

ACCREDITED

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Prepared by: James Ritter
Compliance Engineer

Reviewed by: Steven D. Koster
EMC Operations 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 Digital Transmission System under Part 15.247 (7/2008) of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Industry Canada. This Certification Test Report documents the test configuration and test results for a Cervis, Inc. SmaRT 206 Handheld Remote.

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. SmaRT 206 Handheld Remote complies with the limits for a Digital Transmission System under FCC Part 15.247 and Industry Canada RSS-210e issue 7.

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1 Introduction

1.1 Compliance Statement

The Cervis, Inc. SmaRT 206 Handheld Remote complies with the limits for a Digital Transmission System under FCC Part 15.247 (9/2007) and Industry Canada RSS-210e issue7.

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:	48457
Quotation Number:	64111

1.4 Test Dates

Testing was performed on the following date(s):	3/24/2008-4/2/2008

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	Anthony Di Tommaso

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	**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

2.1 EUT Identification & Description

The Cervis, Inc. SmaRT 206 Handheld Remote is a remote transceiver that transmits the status of 6 operator pushbuttons to a base unit and receives acknowledgements back from the base unit.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Cervis, Inc.
FCC ID:	LOBSHH200
IC:	7955A-SHH200
Model:	smaRT 206 Hand held Remote
FCC Rule Parts:	§15.247
Industry Canada:	RSS210
Frequency Range:	2405-2480MHz
Maximum Output Power:	2.37mW (3.75dBm)
Modulation:	DSSS (OQPSK)
Occupied Bandwidth:	1.74MHz
Keying:	Automatic, Manual
Type of Information:	Digital Data
Number of Channels:	16
Power Output Level	Fixed
Antenna Connector	Integral
Antenna Type	PCB Planar
Interface Cables:	None
Power Source & Voltage:	3 –AAA Batteries 4.5VDC

2.2 Test Configuration

The SmaRT 206 Handheld Remote was configured as a standalone unit. Two unit types were supplied, one with an Integral Antenna and a second with the antenna replaced by a SMA connector for conducted measurements. An additional unit was supplied that was constantly in receive-mode for receiver emissions.

2.3 Testing Algorithm

The SmaRT 206 Handheld Remote was programmed by the customer to repeatedly transmit at one of three channels, 2405MHz, 2440MHz, and 2480MHz. Two modes of operation were selectable, One mode was normal timing mode with one 8 byte packet of 2msec transmitted every 110msec. The second mode sent 128 Bytes of data every 5msec, this mode was used for radiated measurements for ease of testing. The Cervis, Inc. SmaRT 206 Remote Handheld Device, Equipment Under Test (EUT), was operated from a 4.5VDC (3 AAA batteries). A second unit was provided that was set to continuous receive mode.

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 Publication KDB 558074, New Guidance on Measurements for Digital Transmission Systems in Section 15.247.

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

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
00475	WILTRON, 75N50 DETECTOR	RF DETECTOR	2/16/2009
00461	TEKTRONIX, TDS-5104	OSCILLOSCOPE; 1GHZ, 4 CH, DPO	7/27/2008
00641	HQ POWER	0-50V 5AMP DC SUPPLY	CNR
00605	AGILENT, N1911A	WIDEBAND POWER METER	4/11/2008
00606	AGILENT,N1921A	WIDEBAND POWER SENSOR	4/11/2008
00618	HP 8563A	ANALYZER, SPECTRUM	3/7/2009
00069	HP, 85650A	ADAPTER, QP	7/6/2008
00071	HP, 85685A	PRESELECTOR, RF	7/6/2008
00073	HP, 8568B	ANALYZER, SPECTRUM	7/6/2008
00644	SUNOL SCIENCE JB1	BICONALOG ANTENNA	11/27/2009
00066	HP, 8449B	PRE-AMPLIFIER, RF. 1-26.5GHZ	8/2/2008
00626	ARA	DRG-118/A	5/22/2008
tracor 599 Rental	HP 8563E	ANALYZER, SPECTRUM	3/28/2010

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 (Digital Transmission Systems)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.247 (a)(2)	RSS-210 [A8. 2(a)]	6dB Bandwidth	Pass
15.247 (b)(3)	RSS-210 [A8.4 (4)]	Transmit Output Power	Pass
15.247 (e)	RSS-210 [A8.2 (b)]	Power Spectral Density	Pass
15.247 (d)	RSS-210 [A8. 5]	Out-of-Band Emissions (Band Edge @ 20dB below)	Pass
15.205 15.209	RSS-210 [A8. 5]	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions	Not Applicable- Battery powered
RX/Digital Test Summary (Digital Transmission Systems)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions	Not Applicable- Battery powered
15.209	RSS-Gen [7.2.3.2]	General Field Strength Limits (Restricted Bands & RE Limits)	Pass

5 Test Results

5.1 RF Power Output: (FCC Part 15.247(b)(3), RSS210 Annex 8.4 (4))

The output power was measured 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. The resolution bandwidth was set at 2MHz to encompass the 6dB bandwidth of the transmit signal.

Table 4. RF Power Output

Frequency	Level	Limit	Pass/Fail
Low Channel: 2405MHz	3.75 dBm	30 dBm	Pass
Mid Channel: 2440MHz	3.22 dBm	30 dBm	Pass
High Channel: 2480MHz	3.02 dBm	30 dBm	Pass

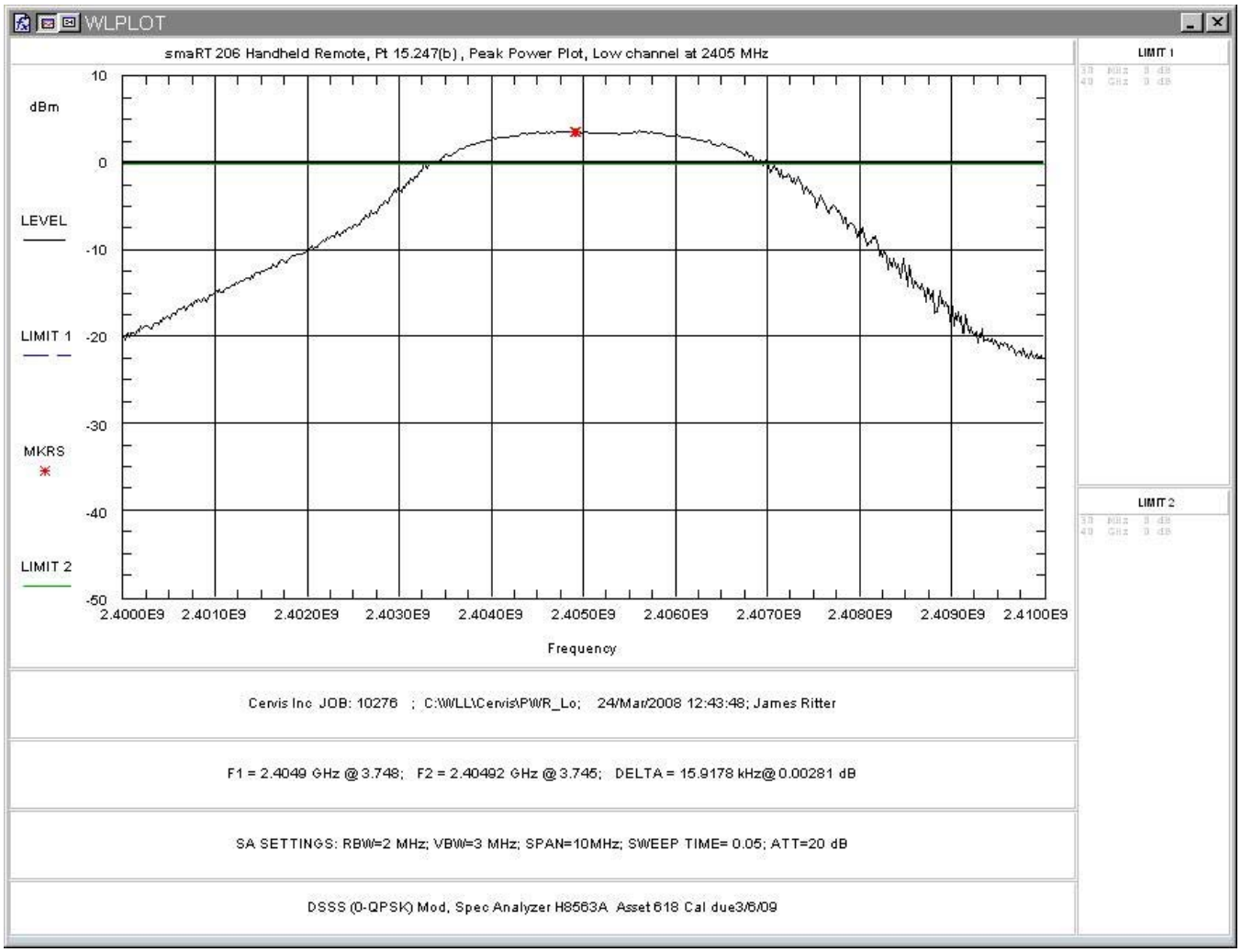

Figure 5-1. RF Peak Power, Low Channel

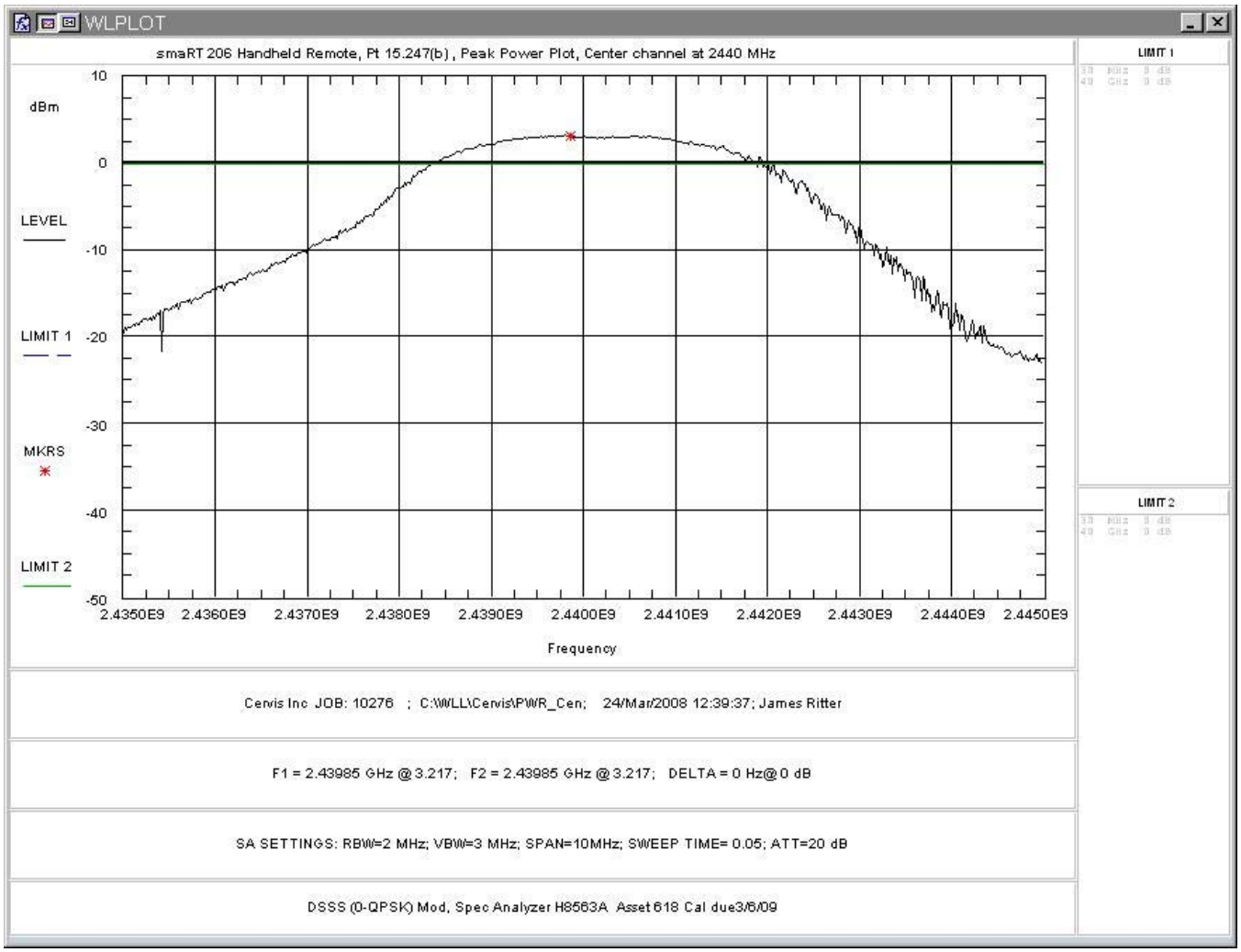

Figure 5-2. RF Peak Power, Mid Channel

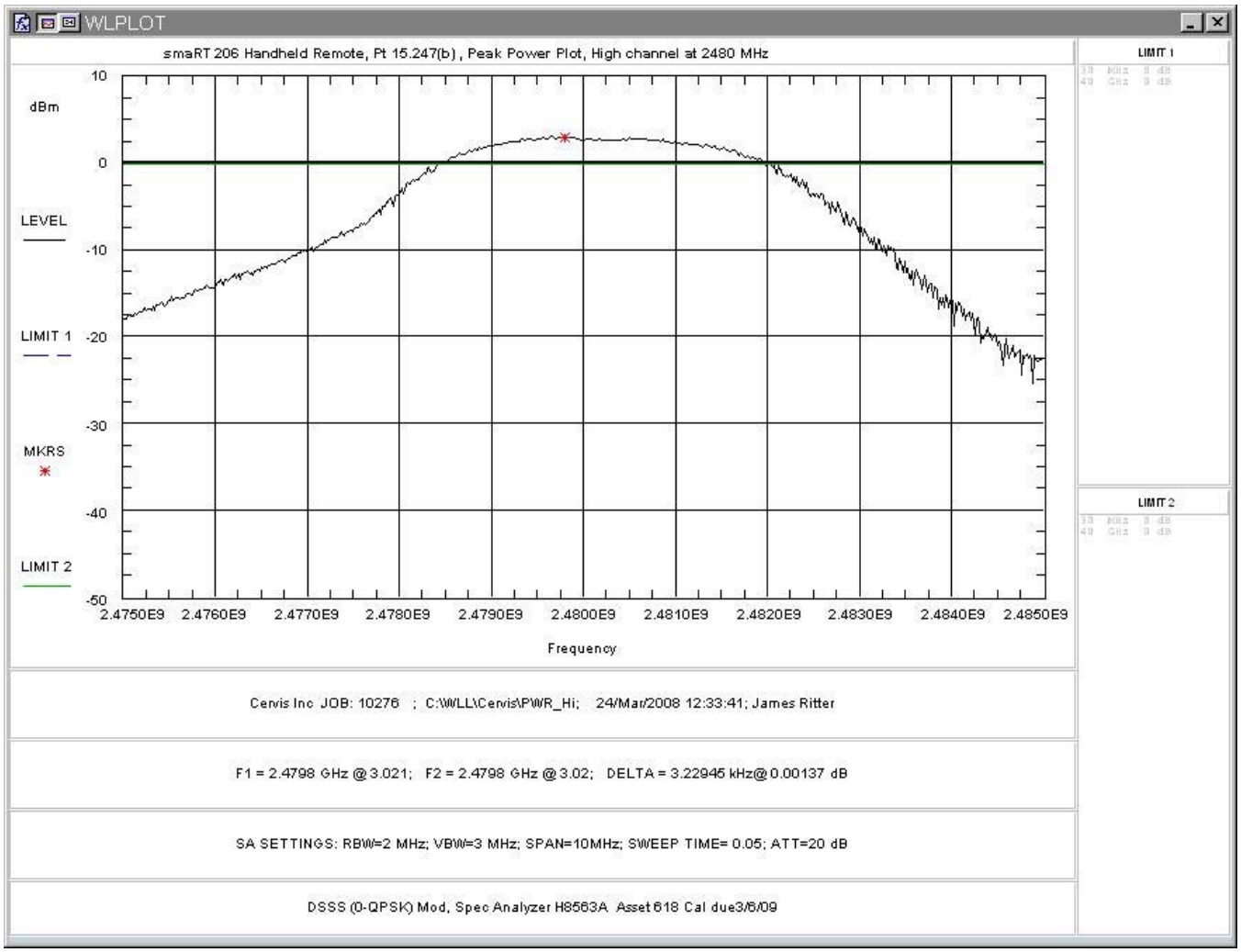

Figure 5-3. RF Peak Power, High Channel

5.2 Occupied Bandwidth: (FCC Part §15.247 (a)(2), RSS210 Annex 8.2 (a))

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

For Digital Systems, FCC Part 15.247 requires the maximum 6 dB bandwidth be at least 500kHz.

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

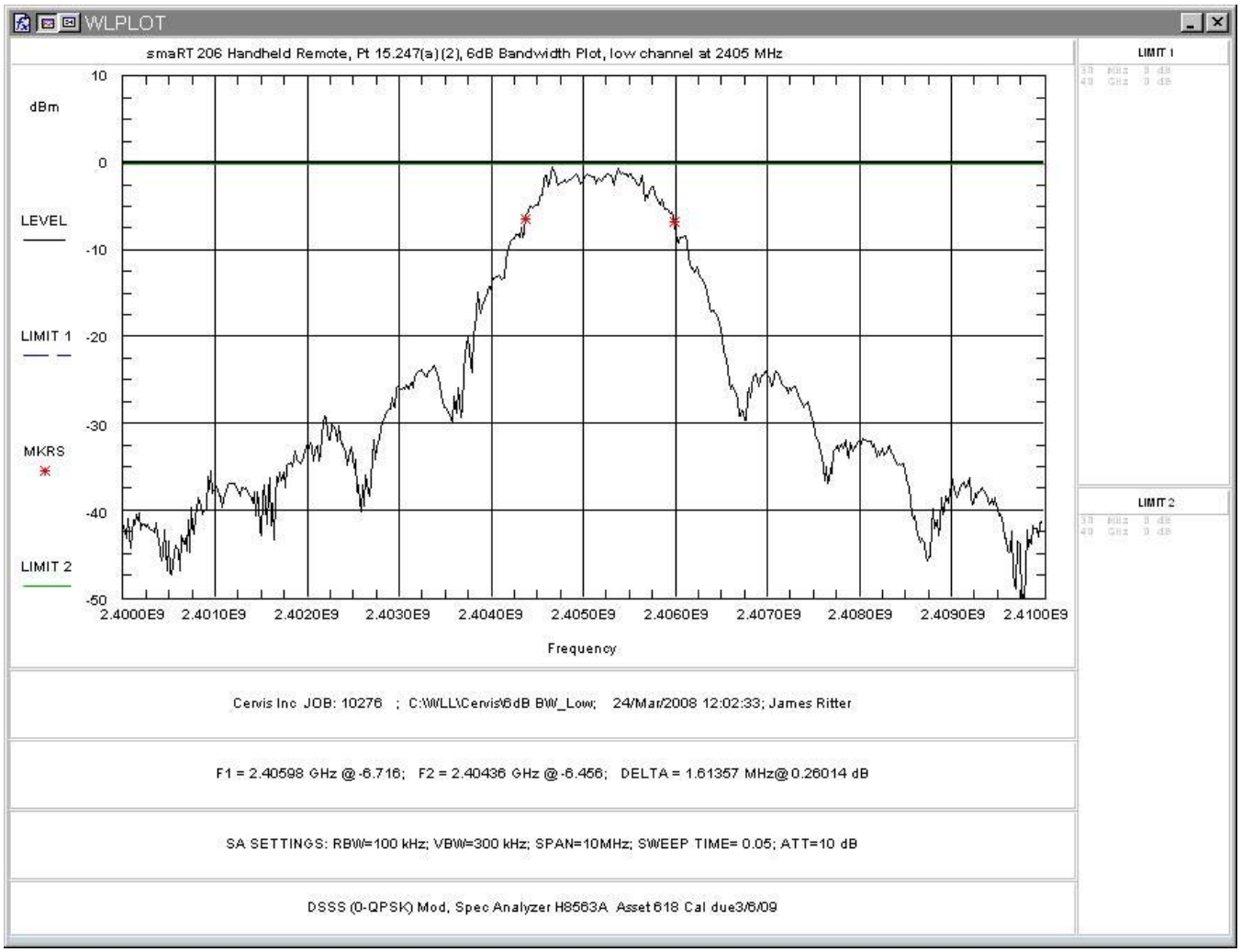

Figure 5-4. Occupied Bandwidth, Low Channel

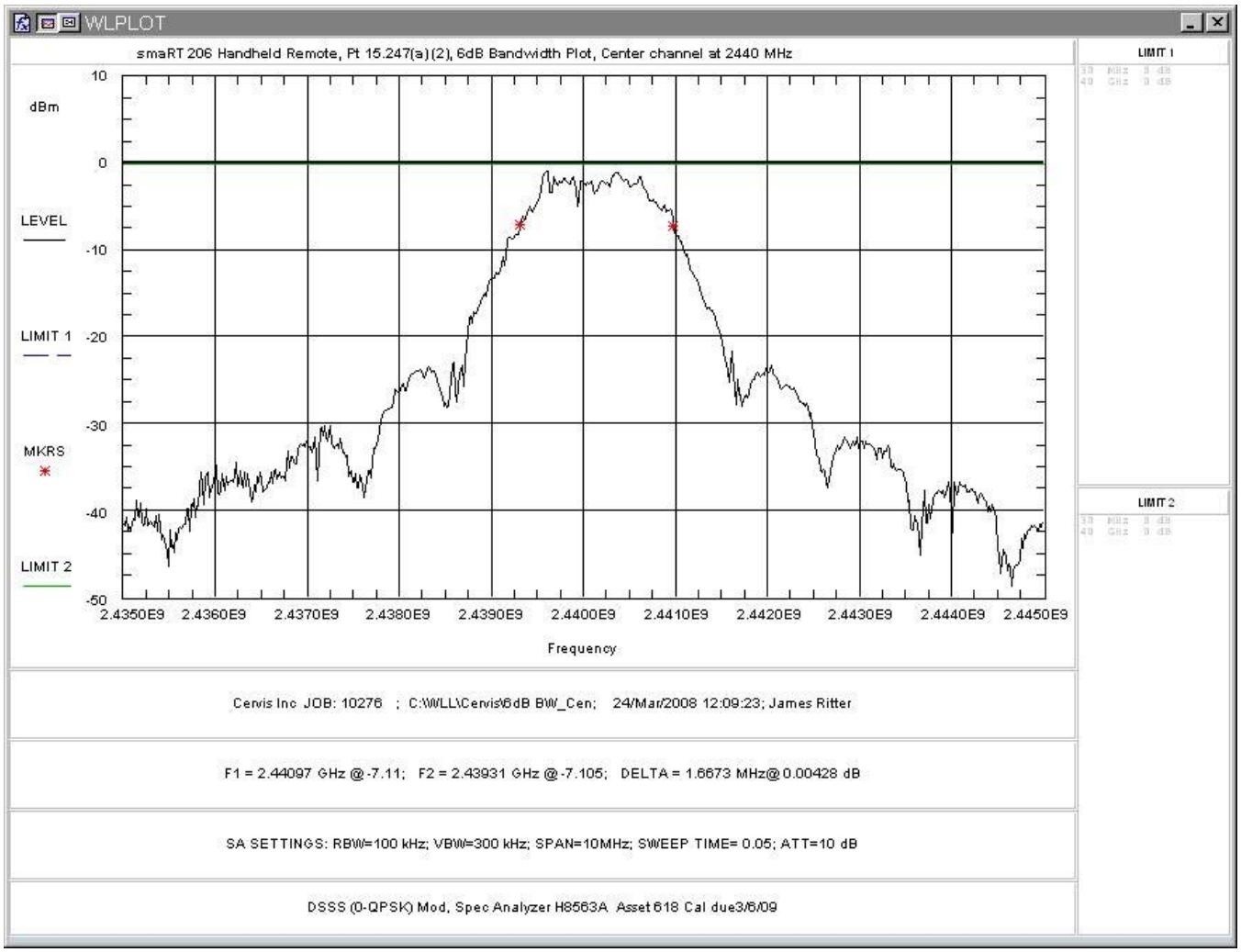

Figure 5-5. Occupied Bandwidth, Mid Channel

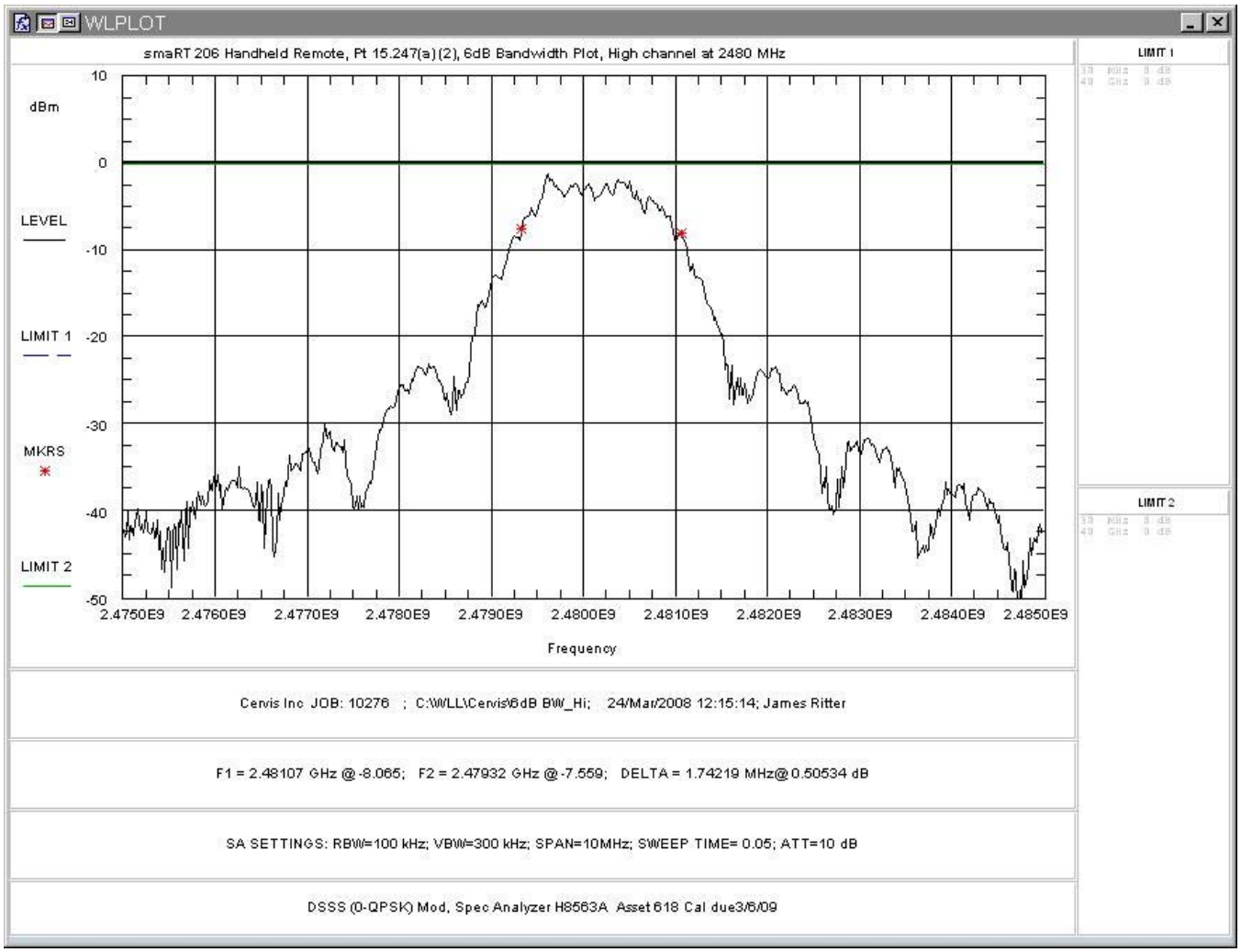

Figure 5-6. Occupied Bandwidth, High Channel

Table 5 provides a summary of the Occupied Bandwidth Results.

Table 5. Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 2405MHz	1.61MHz	500kHz minimum	Pass
Mid Channel: 2440MHz	1.67MHz	500kHz minimum	Pass
High Channel: 2480MHz	1.74MHz	500kHz minimum	Pass

5.3 RF Peak Power Spectral Density (FCC Part§15.247(e) , RSS-210, Annex 8.2 (b))

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, center and lower channels. Plots of the PSD were taken as shown in Figure 5-7 Through Figure 5-9 below.

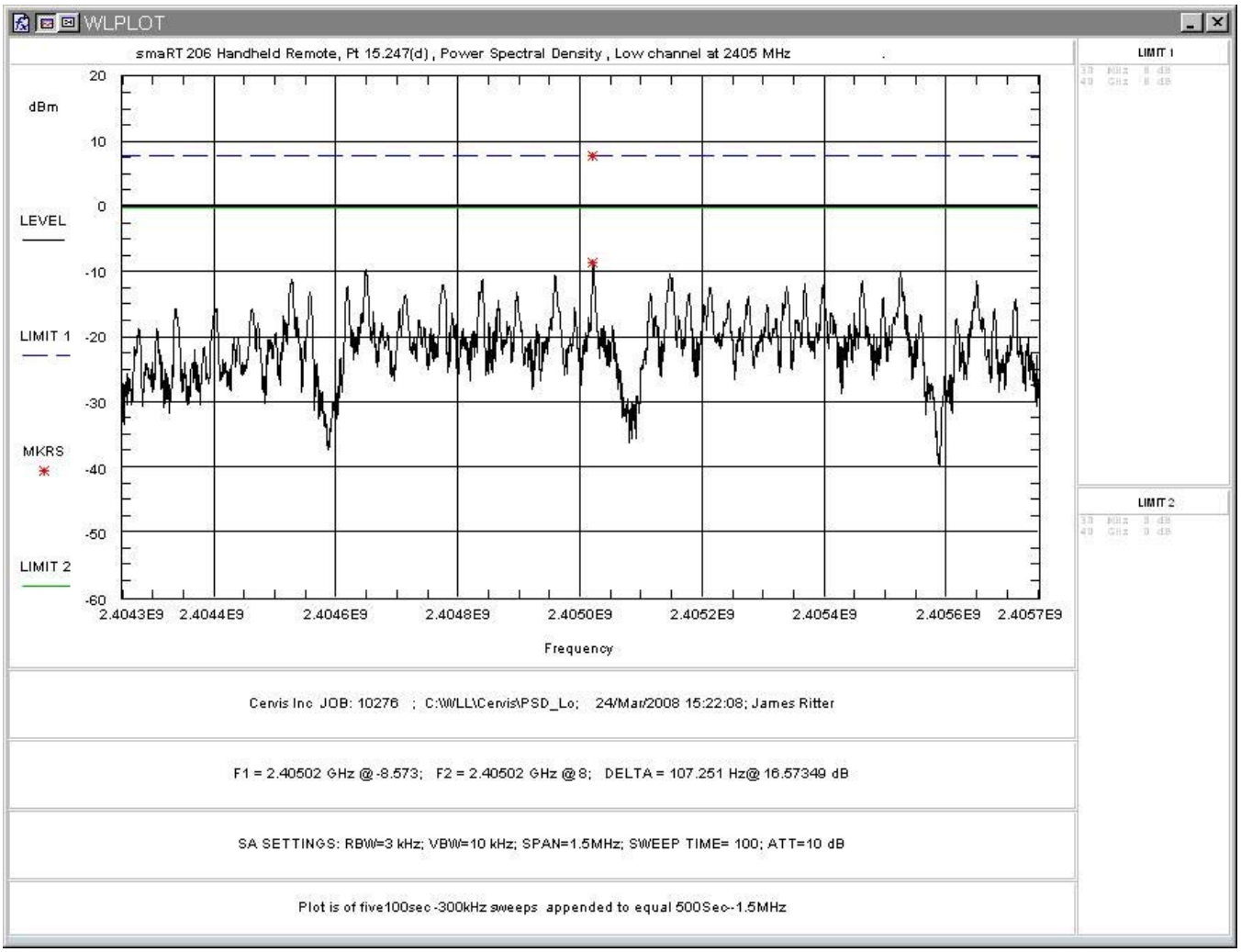

Figure 5-7. RF Peak Power Spectral Density, Low Channel

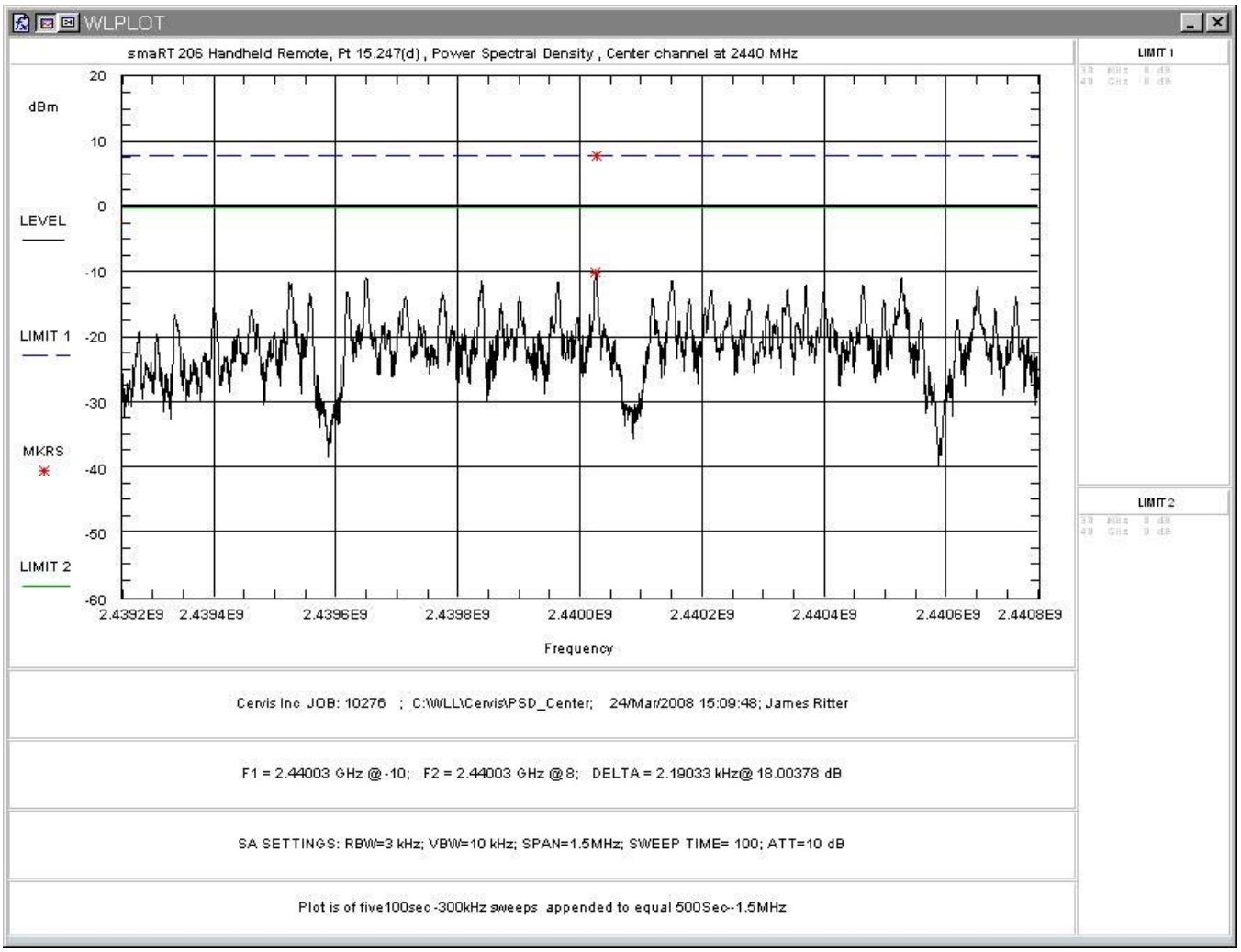

Figure 5-8. RF Peak Power Spectral Density, Center Channel

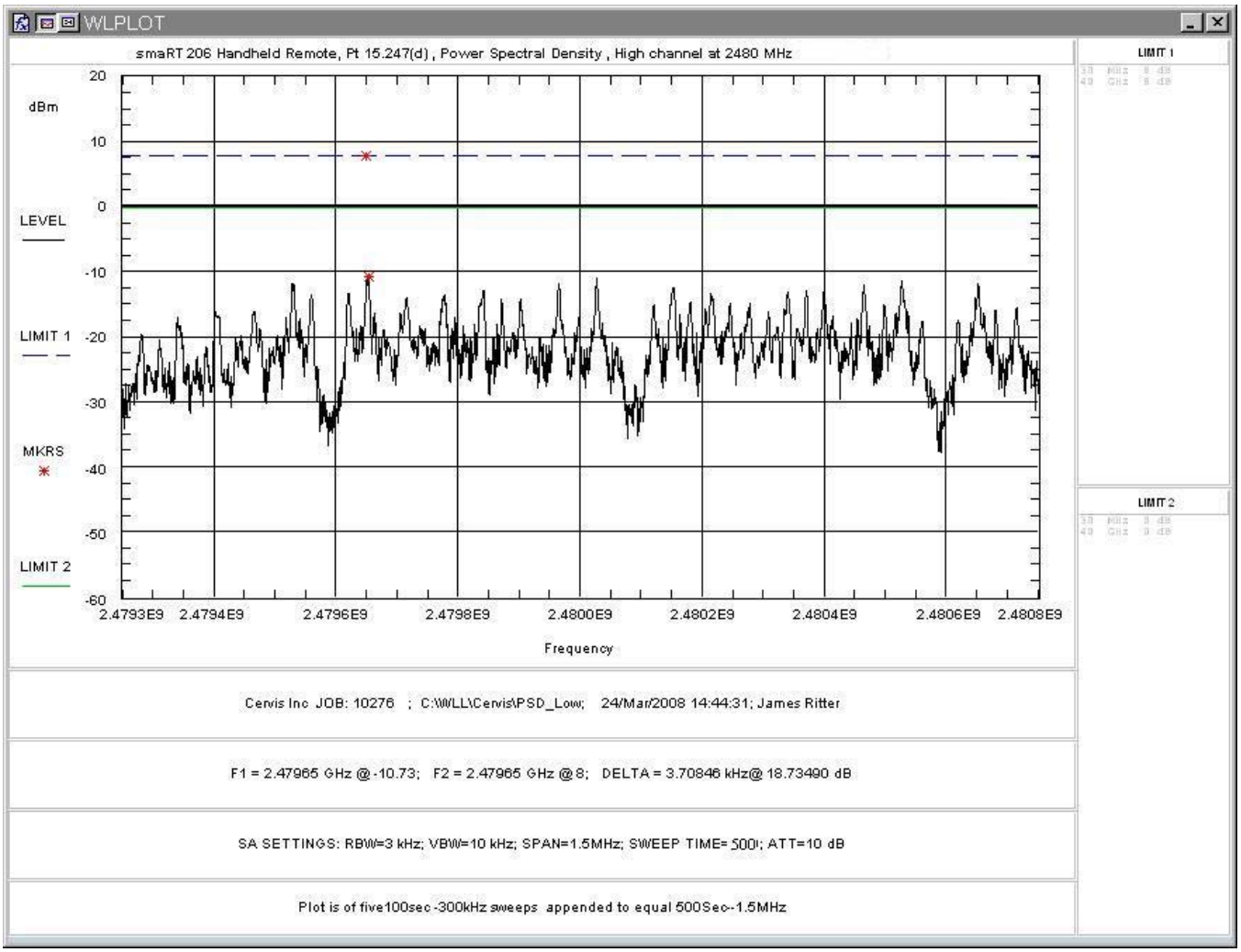

Figure 5-9. RF Peak Power Spectral Density, High Channel

5.4 Conducted Band Edge Measurements at Antenna Terminals

The following Plots show a close-up view of the signal at the lowest and highest channels in regards to the band edges to show compliance with the 20dBc requirement. Measurements were taken at the antenna terminal and coupled into a spectrum analyzer. All cable and attenuator losses were taken into account. A resolution bandwidth of 100kHz was used for these measurements.

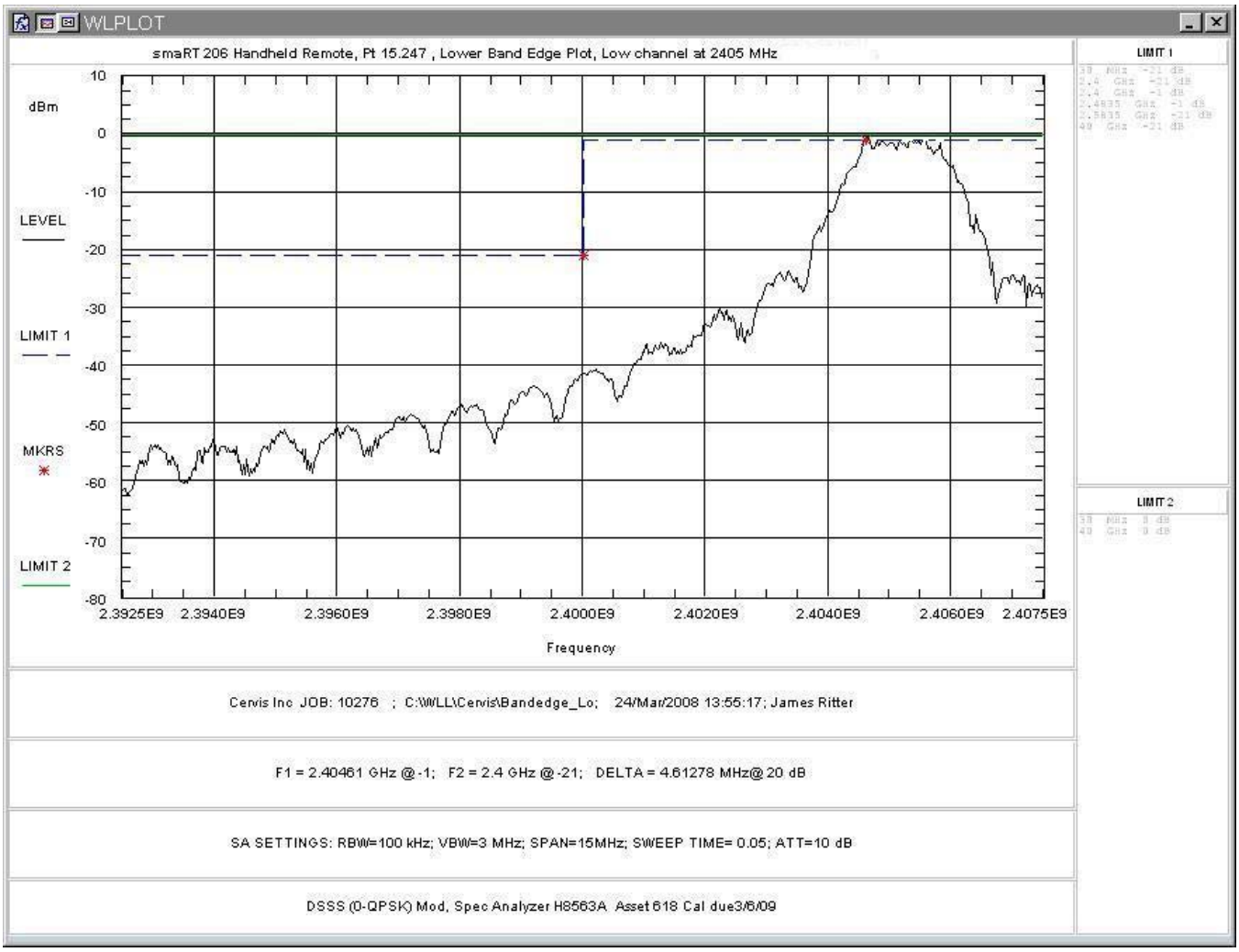

Figure 5-10. Conducted Band Edge, Low Channel

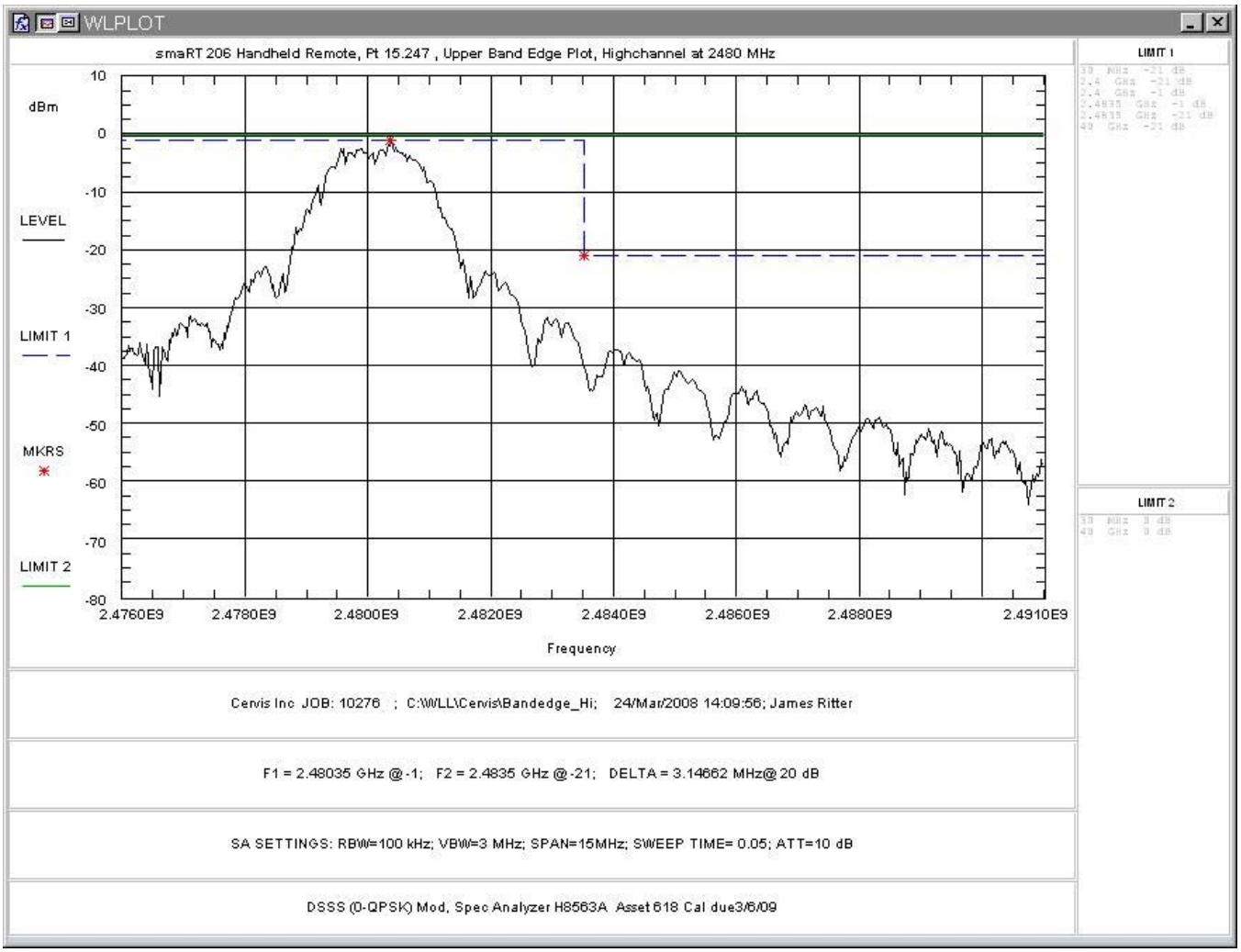

Figure 5-11. Conducted Band Edge, High Channel

5.5 Conducted Spurious Emissions at Antenna Terminals (FCC Part §15.247 (d), RSS210 Annex 8.5)

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 3 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.

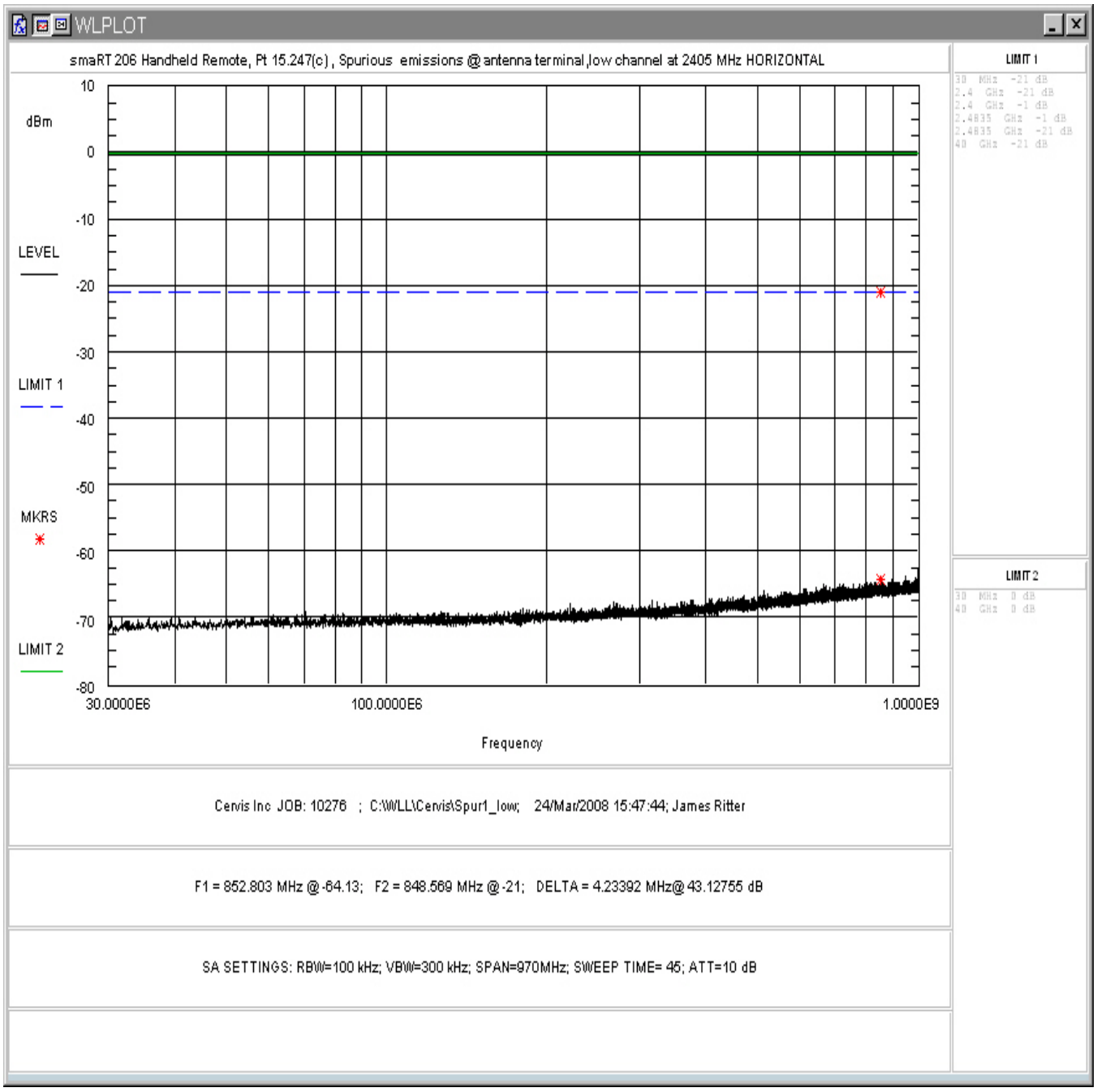

Figure 5-12. Conducted Spurious Emissions, Low Channel 30 - 1000MHz

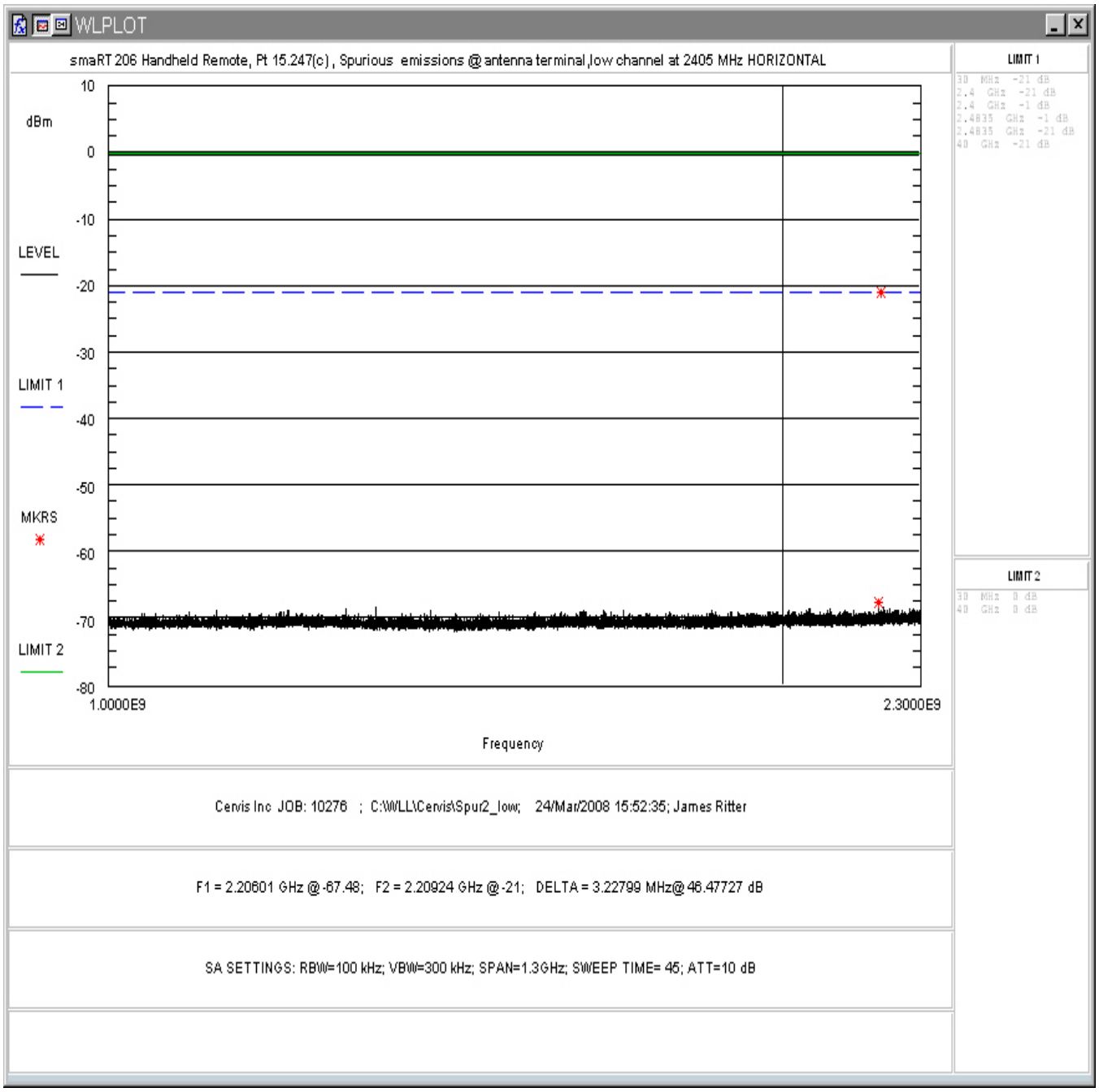

Figure 5-13. Conducted Spurious Emissions, Low Channel 1 – 2.3GHz

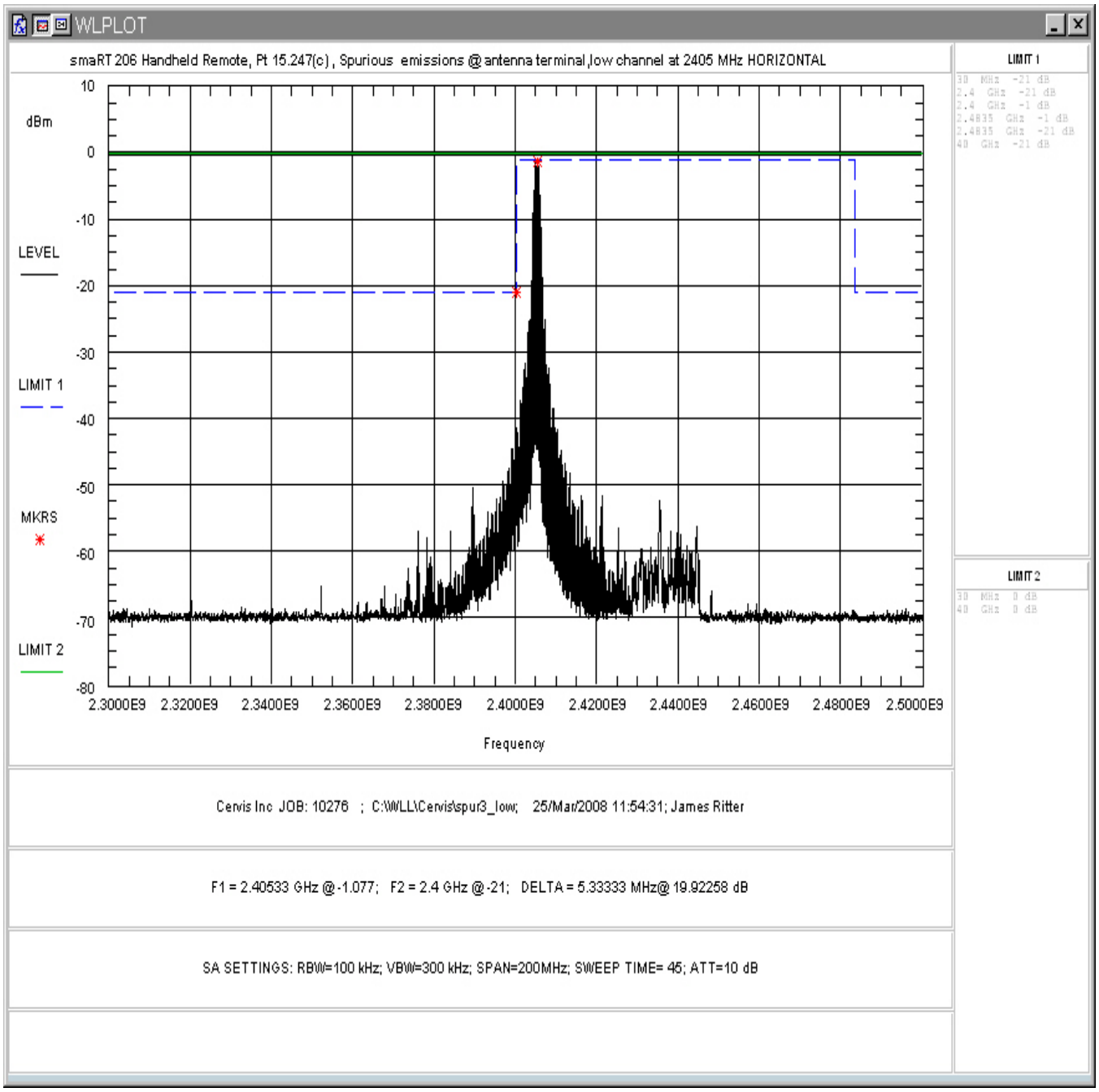

Figure 5-14. Conducted Spurious Emissions, Low Channel 2.3 – 2.5GHz

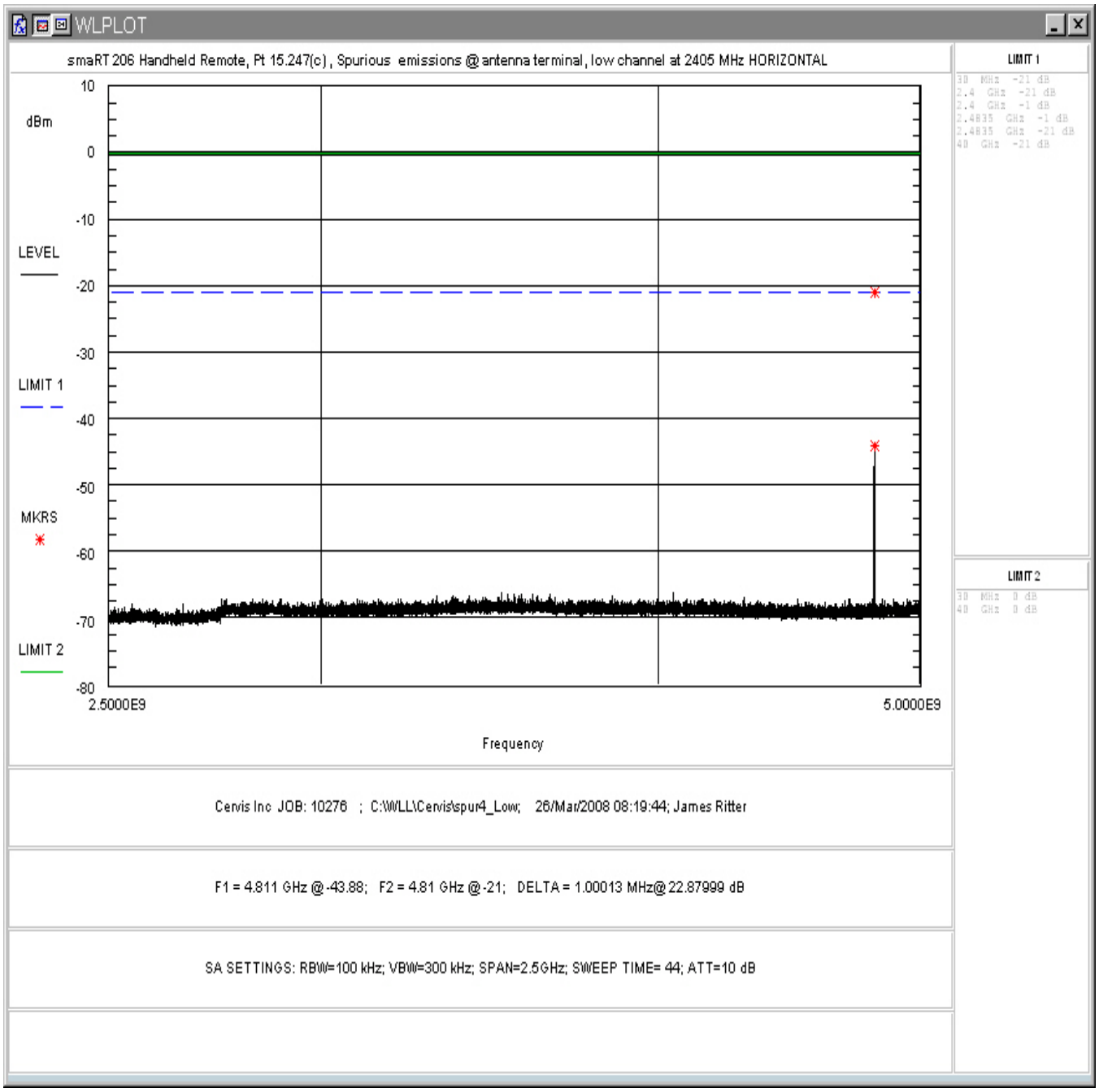

Figure 5-15. Conducted Spurious Emissions, Low Channel 2.5 - 5GHz

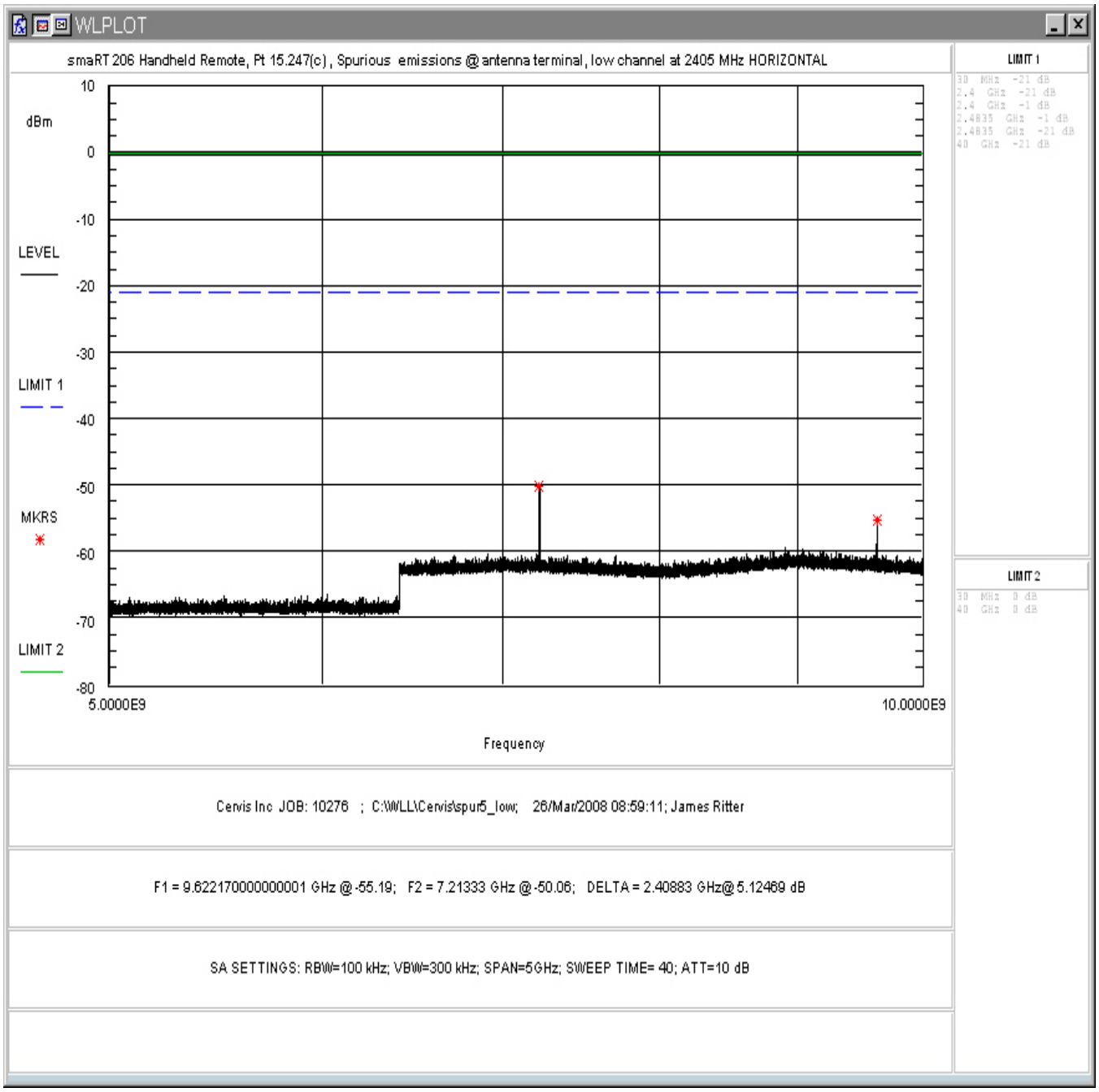

Figure 5-16. Conducted Spurious Emissions, Low Channel 5 - 10GHz

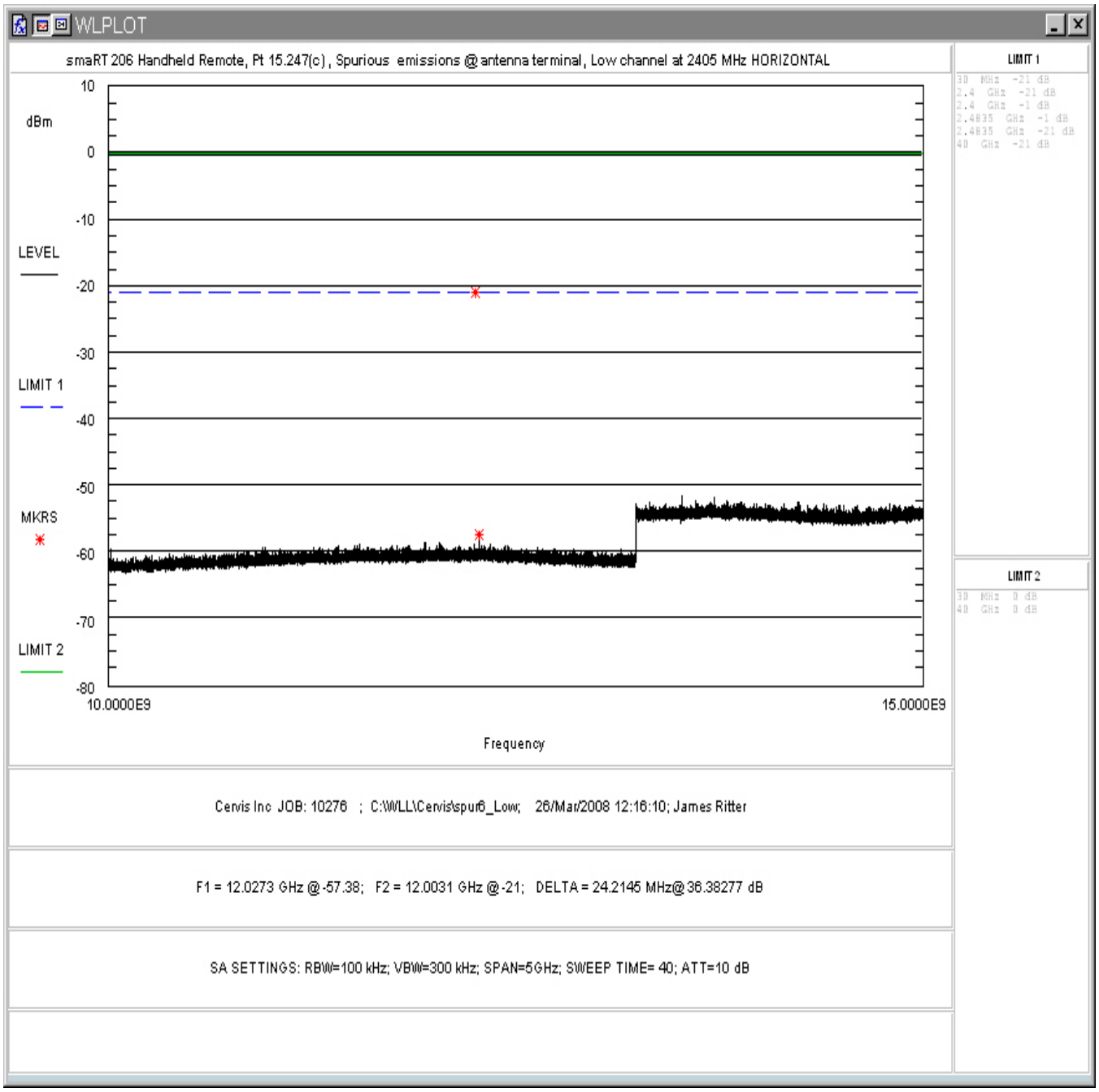

Figure 5-17. Conducted Spurious Emissions, Low Channel 10 - 15GHz

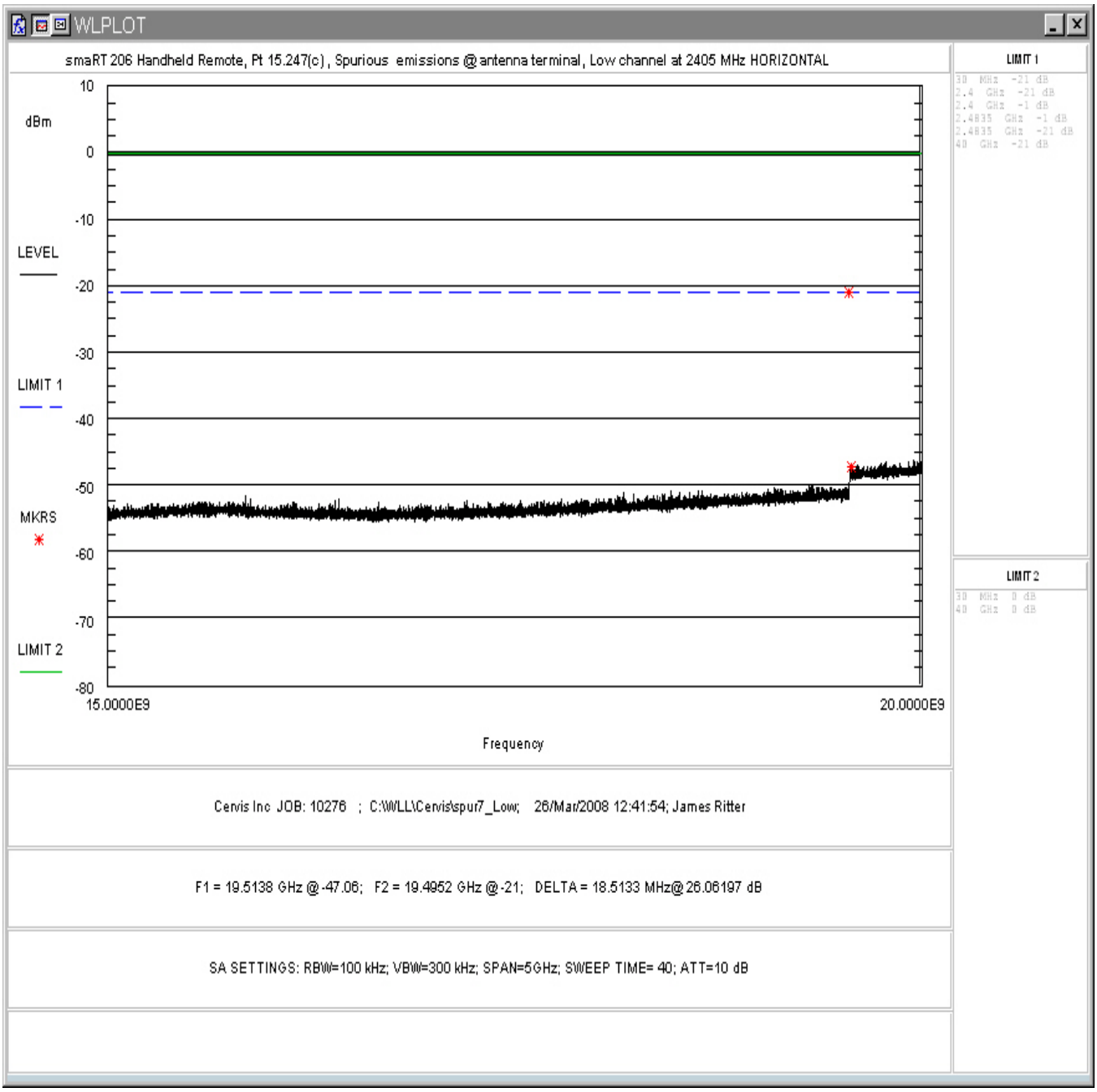

Figure 5-18. Conducted Spurious Emissions, Low Channel 15 -20GHz

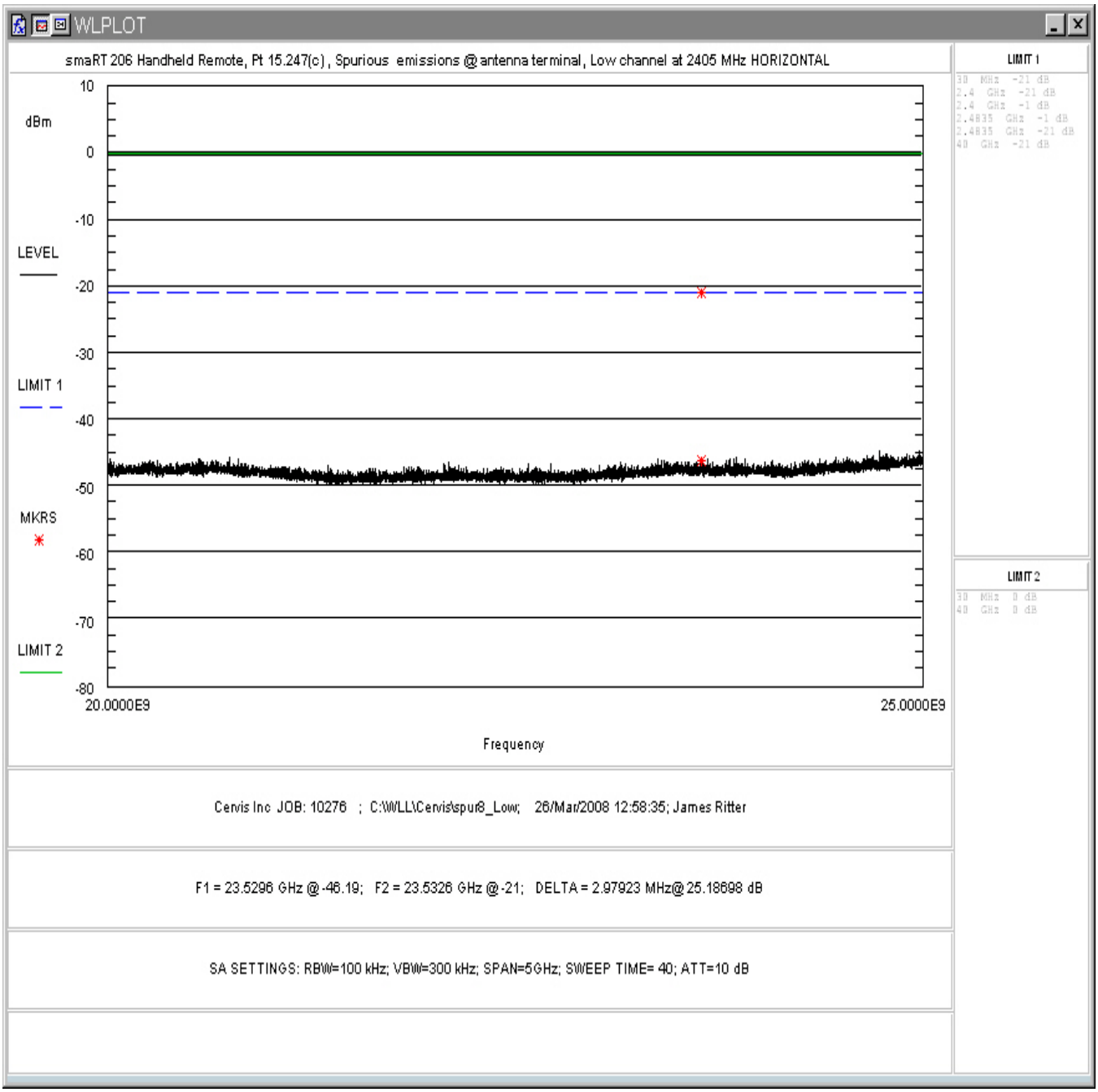

Figure 5-19. Conducted Spurious Emissions, Low Channel 20- 25GHz

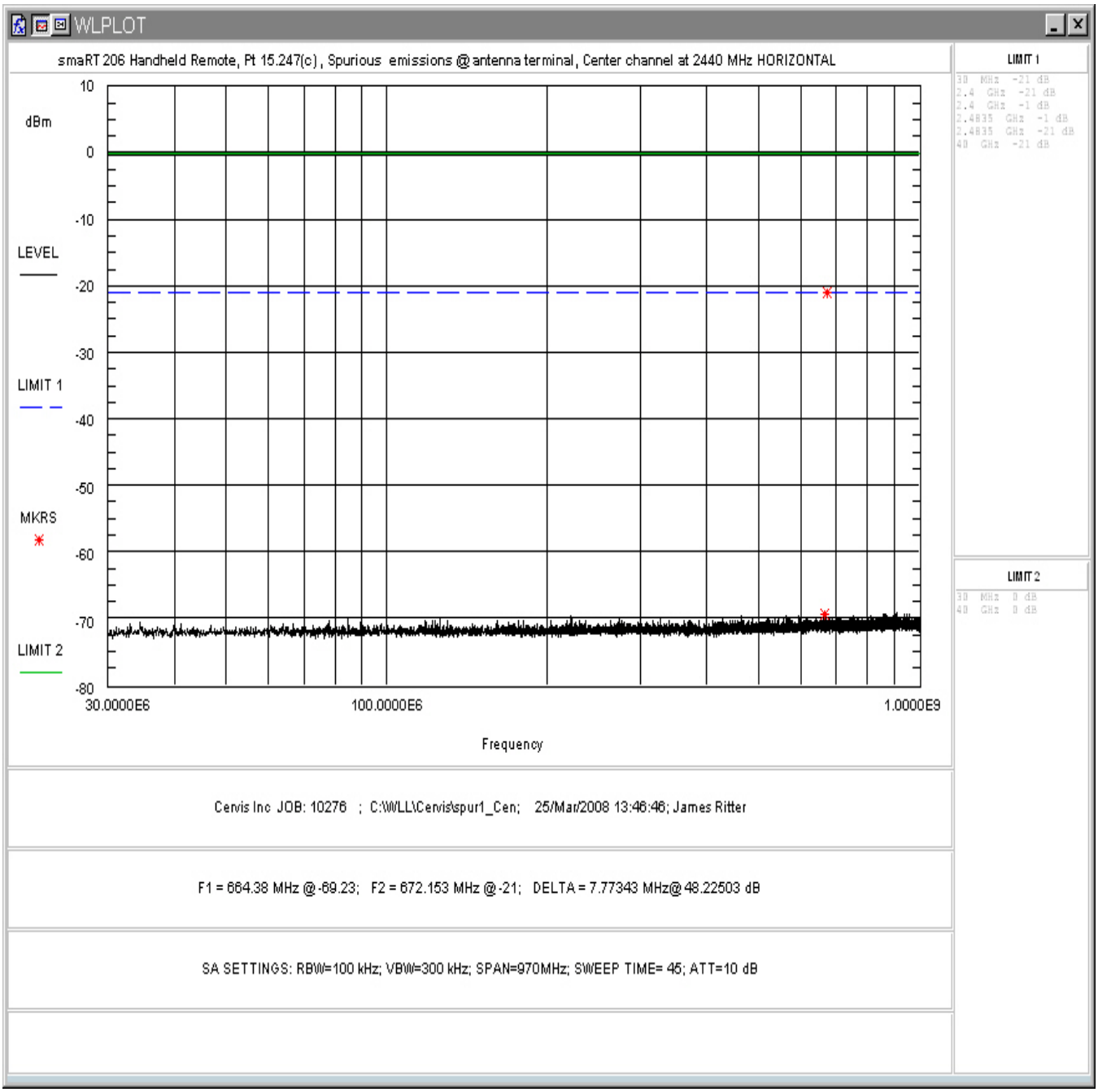

Figure 5-20. Conducted Spurious Emissions, Mid Channel 30 - 1000MHz

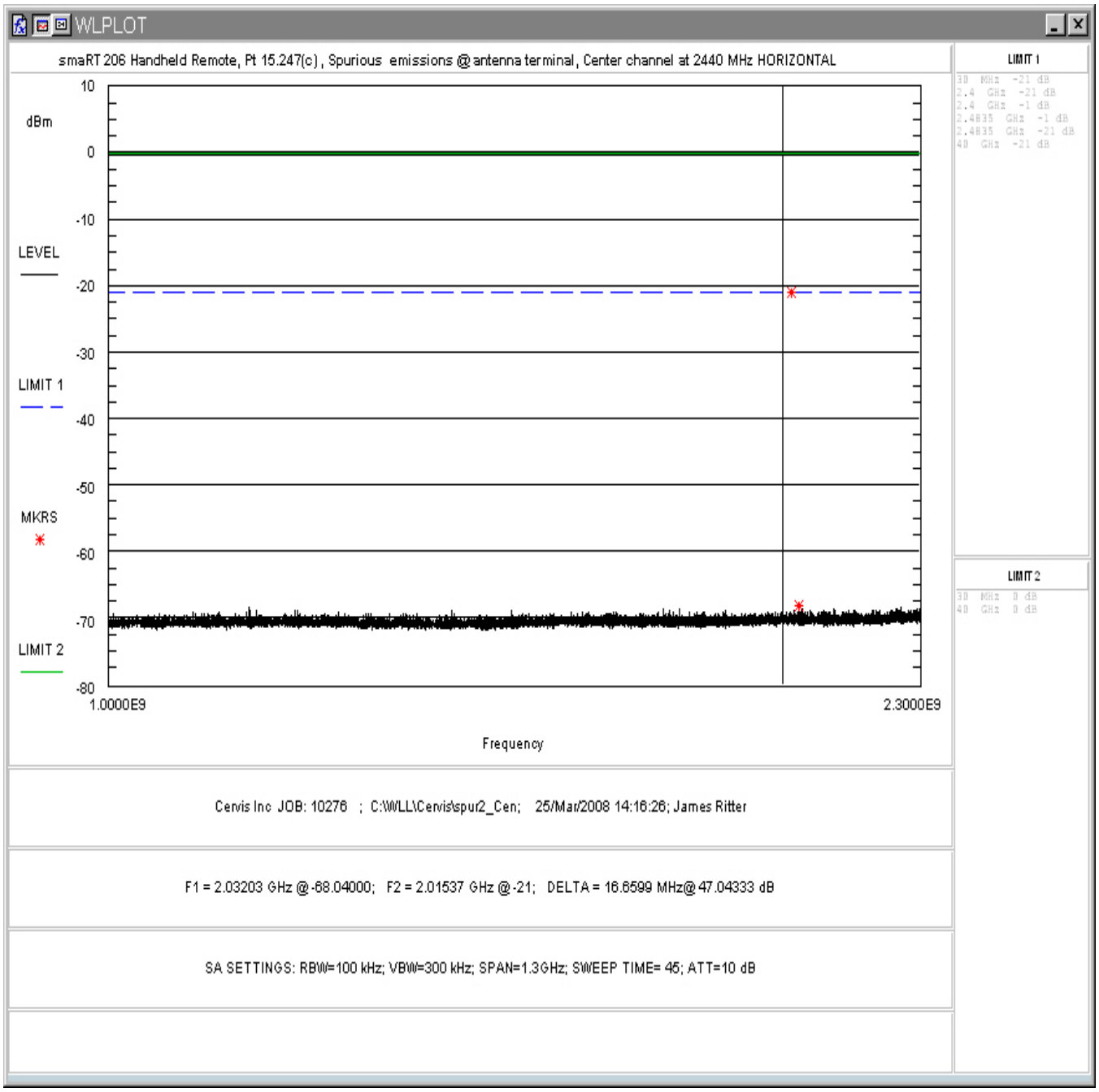

Figure 5-21. Conducted Spurious Emissions, Mid Channel 1 – 2.3GHz

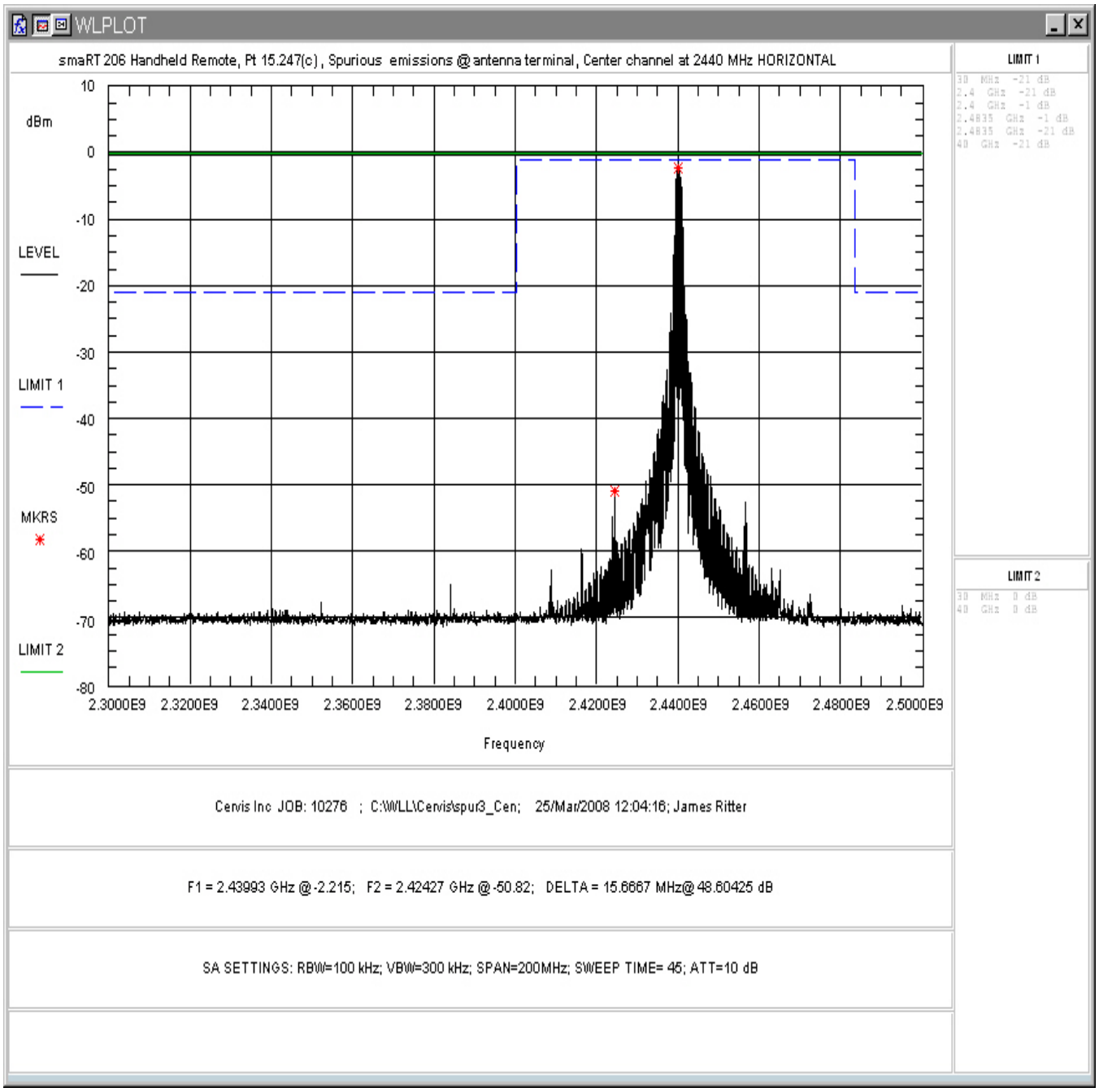

Figure 5-22. Conducted Spurious Emissions, Mid Channel 2.3 – 2.5GHz

